Second Annual Coal Combustion Residuals Groundwater Monitoring and Corrective Action Report 2018

Prepared for:
Marquette Board of Light & Power
Shiras Steam Plant

Project No. 180827
January 23, 2019

Fishbeck, Thompson, Carr & Huber, Inc.
engineers | scientists | architects | constructors

ftc&h

Groundwater Monitoring System Certification

Certification Statement 40 CFR 257.93 (f)(6) – Statistical Approach for Evaluation of Groundwater Monitoring Data for CCR Management Area

CCR: MBLP: Shiras Steam Plant; Holding Pond

I, Stephen J. MacDonald, a professional engineer licensed in the State of Michigan, hereby certify, to the best of my knowledge, information, and belief that the information contained in this certification is prepared in accordance with the accepted practice in engineering.

The Shiras Steam Plant CCR unit is located adjacent to the northern border of the Shiras Steam plant. The CCR rule groundwater monitoring system requirement is addressed by a single unit system consisting of two upgradient (background) and three downgradient monitoring wells. To my best knowledge, the location and depth of these wells yield groundwater samples that accurately represent: the quality of the background groundwater that has not been affected by leakage from the CCR unit; and groundwater passing the waste boundary of the CCR unit and monitoring all potential contaminant pathways.

Through this document, I certify that the groundwater monitoring system designed and constructed in 2017 for the above CCR unit and redeveloped in 2018 (as described in the Second Annual CCR Groundwater Monitoring and Corrective Action Report 2018), meets the requirements of CFR 257.91.

Stephen J. MacDonald

Stephen J. MacDonald, PE

Senior Environmental Engineer

Date: January 23, 2019

Statistical Methods Certification

Certification Statement 40 CFR 257.93 (f)(6) – Statistical Approach for Evaluation of Groundwater Monitoring Data for CCR Management Area

CCR: MBLP: Shiras Steam Plant; Holding Pond

I, Stephen J. MacDonald, a professional engineer licensed in the State of Michigan, hereby certify, to the best of my knowledge, information, and belief that the information contained in this certification is prepared in accordance with the accepted practice in engineering. I certify, for the above CCR unit, that the statistical approach selected for the groundwater monitoring system, as described in this document, is appropriate and in accordance with CFR 40 257.93(f), as found in the federal regulation CFR 40 257, subpart D - Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. The statistical method selected to evaluate the groundwater monitoring data for the Shiras Steam Plant is described below, and it complies with the CFR 40 257.93(f)(3), that is, prediction limits were determined from the distribution of the background data and the level of each constituent in each compliance well was compared to the upper tolerance or prediction limit.

STEPHEN J. MacDONALD

Stephen J. MacDonald

Stephen J. MacDonald, PE

Senior Environmental Engineer

Date: January 23, 2019

Statistical Analysis Approach

The selection of a statistical method to evaluate groundwater monitoring data for each specified constituent is required by the United States Code of Federal regulations (CFR), Chapter 40, part 257, subpart D - Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments (the Federal CCR Rule – Section 93 (f).

On behalf of the Shiras Steam Plant, FTCH recommended the following statistical method to be used for the evaluation of the groundwater monitoring data for each specified constituent: 257.93 (f)(3) " A tolerance or prediction interval procedure, in which an interval for each constituent is established from the distribution of the background data and the level of each constituent in each compliance well is compared to the upper tolerance or prediction limit."

All statistical analysis was made using recognized and generally accepted methods and the EPA software ProUCL 5.1. (USEPA, 2016) and following USEPA CCR rule, USEPA (2009) and ASTM D6312-17 groundwater statistics guidance.

For that, the statistical analysis process included the following steps:

- Background (upgradient) wells and downgradient wells were determined/confirmed
- The statistical database for the background data was updated
- Detection frequencies in upgradient and downgradient wells were computed
- A Dixon's test was performed to identify potential outliers with a 0.99 confidential level.
- Normality and lognormality tests were performed for the background data (Shapiro-Wilk).
- Based on detection frequency and tests of statistical distribution (normal or lognormal) the prediction limits were calculated.
    - For detection frequency ≥ 50%, and data Normal in distribution, compute a Normal prediction limit
    - For detection frequency ≥ 50%, and data Lognormal in distribution, compute a Lognormal prediction limit
    - For detection frequency ≥ 50%, and data neither Normal or Lognormal in distribution, compute a nonparametric prediction limit
    - For detection frequency >0% and < 50%, compute a nonparametric prediction limit
    - For detection frequency equal to zero (=0%), compute lab specific prediction limit equal to quantitation limit (= QL)
- Upgradient prediction limits and downgradient wells data were compared and plots were generated.
- Observe any wells which exceed the prediction limits:
    - An initial statistically significant increase (SSI) would be noted if downgradient is greater than background. In that case, the well would be resampled.
        - If the resample would not to exceed the prediction limit, detection monitoring would be resumed
        - If the resample would to exceed the prediction limit, an alternate source demonstration (ASD) would be conducted
- Mann-Kendall Trend Test Analysis was performed for the monitoring wells
- False positive and false negative rates for current upgradient vs downgradient monitoring program was calculated

References

USEPA, 2016. ProUCL Version 5.1 User Guide - Statistical Software for Environmental Applications for Data Sets with and without Non-detect Observations. https://www.epa.gov/sites/production/files/2016-05/documents/proucl_5.1_user-guide.pdf. Accessed in October 2018.

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ASTM D6312-17, 2017. Standard Guide for Developing Appropriate Statistical Approaches for Groundwater Detection Monitoring Programs at Waste Disposal Facilities, 15 p.

Second Annual Coal Combustion Residuals Groundwater Monitoring and Corrective Action Report 2018

Prepared For:
Marquette Board of Light & Power
Shiras Steam Plant
2200 Wright Street, Marquette, Michigan

January 23, 2019
Project No. 180827

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List of Abbreviations/Acronyms

ASD	Alternative Source Demonstration
bgs	Below Ground Surface
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
FTCH	Fishbeck, Thompson, Carr & Huber, Inc
GWMS	Ground Water Monitoring System
GWPS	Groundwater Protections Standards
IGLD85	International Great Lakes Datum of 1985
MBLP	Marquette Board of Light & Power
MCL	Maximum Contaminant Level
NPDES	National Pollutant Discharge Elimination System
SDWA	Safe Drinking Water Act
SSI	Statistically Significant Increase
UPL	Upper Prediction Limit

1.0 Introduction

Fishbeck, Thompson, Carr & Huber, Inc. (FTCH), on behalf of Marquette Board of Light & Power (MBLP), has prepared this document to report the groundwater monitoring and corrective action activities conducted in 2018 for the Shiras Steam Plant generating station located at 400 East Hampton Street, Marquette, Michigan; Ash Impoundment WDS ID 478988 (Shiras Steam Plant). This report has been prepared in accordance with 40 Code of Federal Regulations (CFR) Part 257, Disposal of Coal Combustion Residuals (CCR) from Electric Utilities (CCR rule) published in April 17, 2015.

1.1 Regulatory Background

The CCR rule 40 CFR Part 257.90 established standards for the disposal of CCR in landfills and surface impoundments (CCR units). According to this rule, MBLP must prepare an Annual Groundwater Monitoring and Corrective Action Report for the Shiras Steam Plant due by the end of January of each year. The report must document the status of the groundwater monitoring and corrective action program for each CCR unit, summarize key actions completed in the previous year, and project key activities for the upcoming year. As per Part 257.105(h)(1), the prepared annual document must be placed in the facility's operating record. According to Part 257.910 (e), at a minimum, the annual groundwater monitoring and corrective action report must contain:

- A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient identified monitoring wells that are part of the groundwater monitoring program.
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken.
- In addition to all the monitoring data obtained under §§ 257.90 through 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs.
- A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring, in addition to identifying the constituent(s) detected at a statistically significant increase over background levels).
- Other information required to be included in the annual report as specified in §§ 257.90 through 257.98.

The following sections of this annual report cover these requirements for the calendar year 2018.

1.2 Facility Location and Operational History

The Shiras Steam Plant was built in 1967 and it is located at 400 East Hampton Street, in Marquette, Michigan, along the shoreline of Lake Superior. The plant has one CCR surface impoundment (aka, holding pond), which is located north of the generating station. It was originally built in 1981 and improvements were completed in 1990 and 2013. The plant and holding pond locations are shown on Figure 1. Presently, the plant has three coal-fired, power-generating units:

- Unit 1 – Built in 1967, capability of 10 megawatts, currently out-of-service with no plans to re-commission.
- Unit 2 – Built in 1972, capability of 21 megawatts, currently off-line.
- Unit 3 – Built in 1983, capability of 44 megawatts, currently in cold standby.

1.3 CCR Unit Description

The holding pond is composed of five cells, which are enclosed by steel sheet pile walls. The south and west boundaries are formed by the shoreline of Lake Superior, while the east and north boundaries are formed by sheet pile walls which were constructed in 1981. The walls for the inner cells 1, 2, and 3 were constructed in 1990. An additional wall was constructed in the north boundary to replace the existing wall in 2013. The new wall was placed inside of the existing north wall, which remains in place but does not provide control. There are also some other abandoned sheet pile walls in place from previous configurations. The holding pond is operated as a zero-discharge facility during normal conditions meaning water does not typically discharge to Lake Superior. All process water and precipitation were discharged to the pond by sluicing. Water was pumped from the pond to a reuse storage tank or recirculated to the plant. No water was discharged to Lake Superior during 2018.

The normal operating level of the holding pond varies but is approximately 606.0 feet International Great Lakes Datum of 1985 (IGLD85). The ordinary high-water surface elevation of Lake Superior is 603.1 feet. During emergency situations, an overflow of 607.4 feet, which is regulated via a NPDES permitted outfall (#004A), discharges water from the holding pond through the east wall directly into Lake Superior. The north and east perimeter sheet pile walls have a top elevation of 609 feet.

1.4 Physical Setting and Geology

The site is located in the Peshekee Highlands portion of the Superior Bedrock Uplands physiographic province. The region is described by the Michigan Geological Survey (MGS) as of high elevation, largely bedrock-controlled landscapes, which have been modified by glacial scour and deposition with areas of high hills and low mountains formed on bedrock (Bedrock-controlled landscape of high relief and irregular topography and glacially-eroded bedrock knobs and drift-filled valleys). Peshekee Highlands are the highest elevation area in Michigan (MGS, 2013). According to the Bedrock geologic map available at the Natural Features and Resource Maps of the Marquette County, the bedrock in this region is characterized as Archean volcanic and sedimentary, of the Precambrian age (Marquette County, 2013). As described in last year's annual report (Marquette Board of Light and Power, 2017), the depth to bedrock around the site is variable and can be seen as outcrops in some areas, while in other areas depth to bedrock is estimated to be 100 to 150 feet below ground surface (bgs). At the site, this bedrock is located at approximately 40 feet bgs.

The surficial soils in the region are generally well-drained. Shallow soils are present in uplands while poorly drained soils and Histosols are present in lowlands. Many upland soils have a thin loess cap and most parent materials are sandy. The hydrology of the region is Major Upland of the Western Upper Peninsula, forming regional drainage dividing many lakes and few through-flowing streams. The region accumulates heavy snow in the winter. Pre-settlement vegetation is primarily sugar maple-hemlock forest on uplands and conifer swamp in lowlands. The use of the land in the region is mostly forest with patches of open land. Two large iron mines are in operation in the southeast part of the Peshekee Highlands region (MGS, 2013).

2.0 Groundwater Monitoring and Corrective Action Process Overview

The groundwater monitoring and corrective action process is described in Parts 257.90 through 257.98 of the CCR rule. This annual CCR Groundwater Monitoring and Corrective Actions Report is developed as required by section 257.90 (e).

Groundwater monitoring is performed using a network of monitoring wells (groundwater monitoring system) that includes wells monitoring background (non-impacted area by the CCR unit) and wells downgradient boundary of the CCR unit. The first phase of groundwater monitoring is the Detection Monitoring phase, which focuses on a set of constituents (listed in Appendix III of the CCR rule) that are the more mobile components of CCR and represent indicators of possible impacts from CCR in groundwater.

According to CCR 257.94(e) and 257.93(h), if a facility determines there is a statistically significant increase (SSI) over background levels for one or more constituents within 90 days of detecting an SSI, the facility will establish an Assessment Monitoring Program (second phase) and/or demonstrate an alternative explanation for the exceedance. Alternate explanations could include the existence of a source other than the CCR Unit that could have caused the SSI; the SSI resulted from errors in sampling, analysis, or statistical evaluation; and natural variation in groundwater quality. The owner/operator of the CCR must complete and produce a written document (Alternative Source Demonstration [ASD]) that must be certified by a qualified professional engineer, and the CCR unit may continue with detection monitoring. The facility must also include the ASD in the annual groundwater monitoring and corrective action report required by CCR 257.90(e), in addition to certification by a qualified professional engineer. If the SSI is identified and cannot be attributed to an ASD, the facility must begin assessment monitoring for the CCR Unit. Per the CCR Rule, assessment monitoring must begin within 90 days of identification of an SSI that is not attributed to an alternative source and include the Appendix IV constituents in accordance to CCR 257.95(b).

The second phase of groundwater monitoring focuses on the constituents listed in Appendix IV of the CCR rule. The Appendix IV constituents generally are less mobile and occur at lower concentrations in groundwater than the Appendix III constituents. Concentrations of Appendix IV constituents in downgradient wells are compared to the higher of either the federal Safe Drinking Water Act (SDWA) maximum contaminant level (MCL) or the background concentration for each constituent.

The monitoring process counts on appropriate sampling locations (wells), baseline data, and statistical methods to establish local background concentrations of the constituents in both Appendices III and IV and to compare the concentrations in downgradient wells to background and/or MCLs.

If exceedances are determined to be occurring in the downgradient boundary wells at statistically significant levels, and no alternative sources for the exceedances can be demonstrated, then both additional groundwater characterization and Assessment of Corrective Actions are initiated. According to the CCR rule, groundwater corrective action will continue until compliance with the Groundwater Protections Standards (GWPS) has been attained in all impacted wells and sustained for a period of 3 consecutive years.

3.0 Groundwater Activities in 2018

In January 2018, the MBLP completed the first Annual Groundwater Monitoring and Corrective Action Report for the 2017 activities. The data in this report showed an SSI in the Appendix III parameter pH at MW-2 and MW-3 over the background (Marquette Board of Light and Power, 2017). According to CCR 257.94 (e)(2), “The owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.” To address the observed SSI for pH, MBLP completed an ASD after the redevelopment of all five wells belonging to the groundwater monitoring system on May 30, 2018. Also, as required by 257.90 (e), monitoring data was collected in May and September 2018 for the annual CCR Groundwater Monitoring and Corrective Actions Report developed for the year 2018.

This report summarizes the activities completed in 2018, including reporting of the ASD study and the analytical results and statistical analysis of the semi-annual sampling events executed at the groundwater well system of the MBLP holding pond shown on Figure 2. These activities were completed in support of the CCR rule and are described below.

3.1 Monitoring Wells Redevelopment and Alternative Source Demonstration

The monitoring well network, installed in 2017, meets the requirement for a groundwater monitoring system in the CCR rule 40 CFR Part 257.91. The network includes the minimum required three downgradient monitoring wells because of the small size of the CCR unit. Although all monitoring wells were reported to be in excellent condition on October 2017, the detection of an SSI for pH during the annual report raised questions on whether the well conditions could be interfering with the pH, in which case it would possibly explain the SSI for pH observed during the monitoring event of 2017.

The redevelopment activities were originally scheduled to begin in April 2018; however, ice present surrounding the downgradient wells located in Lake Superior prevented safe access to complete the work. The MDEQ agreed with postponing sampling until the wells could be accessed safely.

The redevelopment of the holding pond well system occurred on May 30, 2018, and it was executed by FTCH staff. Prior to redevelopment activities, static water levels were collected from monitoring wells MW-1 through MW-5 and the data was used to calculate groundwater elevations. During redevelopment, pH values were monitored for stabilization. The pH data obtained during redevelopment of the wells and at the semi-annual groundwater sampling event 24 hours after the redevelopment, were added to the existing pH database and used to develop the ASD study.

The ASD study was submitted on September 5, 2018, and a copy of the document is included in Appendix A. Details on the process and results obtained in the redevelopment and ASD study are summarized in Section 4.0 below.

3.2 Groundwater Monitoring Events for 2018

The semi-annual groundwater monitoring events for the reporting period of 2018 included groundwater level measurements and sample collection for all five wells on May 31, 2018, and September 20, 2018. Equipment calibration, monitoring well water level measurement, monitoring well purging and sampling documentation are provided in Appendix B. Laboratory data reports and data validation reports for both the May and September 2018 monitoring events are provided in Appendix C. The sampling, analysis, and results of these sampling events are summarized in section 5.0 below.

4.0 Alternative Source Demonstration Investigation

To address the SSI for pH observed in 2017, the MBLP holding pond well system was redeveloped on May 30, 2018, by FTCH staff. These included monitoring wells MW-1, MW-2, and MW-3, located downgradient of the holding pond, as well as monitoring wells MW-4 and MW-5, installed upgradient of the holding pond. The first semi-annual monitoring event occurred on May 31, 2018, and that data was also used to verify the success of the monitoring well redevelopment activities for the ASD investigation.

The groundwater elevation data, collected prior to redevelopment activities, were contoured and are shown on Figure 3 of Appendix A. As depicted on the figure, groundwater flows toward the east and Lake Superior with groundwater elevations ranging from approximately 609 feet, IGLD85 on the upgradient (southwest) side to approximately 605 feet, IGLD85 on the downgradient (northeast) side of the holding pond. These conditions are consistent with those anticipated for long-term monitoring of the CCR unit and with the assignment of background and downgradient monitoring locations.

The pH data, obtained during the semi-annual monitoring event 24 hours after redevelopment, were added to the existing pH database and used in combination with the baseline data collected in 2017 for statistical analyses of the ASD.

Historical downgradient data for pH (MW-1, MW-2, and MW-3) were compared with the prediction limit calculated for the updated background data (6.782-8.303). All three monitor wells measured following the redevelopment (on May 31, 2018), were within the acceptable limits calculated for background (MW-1 = 7.62, MW-2 = 7.88, and MW-3 = 8.07). Thus, at that time, previous well conditions seemed to explain the SSI for pH observed during the monitoring event of 2017. Because no other Appendix III constituent exhibited an SSI in the 2017 monitoring event, the variation in pH data was considered to some extent a potential indicator of natural variation.

Overall, the ASD document re-assessed the potential SSI of pH for the downgradient wells MW-2 and MW-3 at the Shiras Steam Plant. Based on the statistical study executed after the redevelopment of the wells, previous well conditions explained the SSI. As no SSI was noted after redeveloping the wells, it was established that the 2018 monitoring program report was only required to cover Appendix III parameters in both sampling events. The complete ASD document is attached in Appendix A.

5.0 Groundwater Sampling and Analysis for 2018

On both May 31, 2018, and September 20, 2018, all five monitoring wells from the holding pond were sampled for the Detection Monitoring Program (Appendix III, CCR Rule) parameters (Boron, Calcium, Chloride, Fluoride, pH, Sulfate, and Total Dissolved Solids). The upgradient wells were opened to allow for equilibration and an electronic water level meter was used to collect depth to water measurements to the nearest tenth of a foot prior to well purging. The measured water levels were used to calculate groundwater elevations at each monitoring well. The groundwater elevation data were contoured and are shown on Figure 3. The groundwater flow direction is toward the east and Lake Superior, consistent with previous monitoring events.

Groundwater sampling was completed at each well using low-flow procedures using a peristaltic pump. New polyethylene and silicone tubing were used at each sampling location. Wells were purged at a low-flow rate (100-300mL/min). Purge water was collected into 5-gallon buckets and transferred to the holding pond for disposal. A YSI Inc. Pro Plus handheld instrument with an in-line, flow-through cell was used to measure field parameters including pH, temperature, specific conductivity, oxidation reduction potential (ORP), and dissolved oxygen (DO). Turbidity was measured using a LaMotte 2020we turbidimeter. Readings were recorded on low-flow sampling forms. Groundwater sample documentation is provided in Appendix B.

Once the groundwater quality parameters had stabilized (+/- 0.1 SU over 3 consecutive readings), groundwater samples were collected. The tubing was disconnected from the flow-through cell, and the samples were collected directly from the sample tubing into pre-preserved laboratory containers. Bottles were labeled with the site name, sample identification, analysis type, preservation method, and date and time of collection before being placed immediately into a cooler of ice. Groundwater samples were transferred, under chain of custody procedures, to TestAmerica Laboratories (North Canton, OH), a certified laboratory for analysis of Appendix III constituents. Laboratory analytical and data validation reports for the May and September 2018 sampling events are provided in Appendix C. Cumulative analytical results are summarized in Table 1.

Please note that samples were also collected and analyzed for Appendix IV parameters on May 31, 2018, to provide additional data for the assessment in the event that the statistical analysis demonstrated any Appendix

III exceedance. Since statistical analyses of Appendix III data did not demonstrate any such exceedance, the Appendix IV data was not utilized in the statistical evaluation. This analytical data is provided in Appendix C (Laboratory Analytical and Data Validation Reports).

6.0 Statistical Analysis

Statistical analyses were completed using the latest version of ProUCL 5.1 software developed by the USEPA (USEPA, 2016) and following USEPA CCR rule, USEPA (2009) and ASTM D6312-17 groundwater statistics guidance. All analyses for the background and downgradient groundwater results are presented in Appendix D.

Initially, the detection frequencies for all wells were computed (Table 1 of Appendix D). A Dixon's test was performed to identify potential outliers with a 0.99 confidence level. Regarding the new and historical data for the background, the Total Dissolved Solids value of 2,300 mg/L for background data (MW-5 sample from 9/28/2017) was identified as potential outlier. Still, this value was kept in the data set because its potential to be an outlier was not confirmed. Table 2 of Appendix D presents the Shapiro-Wilk test of normality for the background data. Field pH background data was classified as normal, total calcium was classified as lognormal and all other parameters from Appendix III were classified as nonparametric. Following that, upper prediction limits were calculated for each parameter based on the shape of the distribution of the background data (MW-4 and MW-5) and lower prediction limit was calculated for pH only (Table 3 of Appendix D).

Historical downgradient data for pH (MW-1, MW-2, and MW-3) were compared with the prediction limits calculated for the updated background data. Although some historical values were in exceedance when compared to the prediction limits calculated for 2018, when the background upper limits were compared the most recent concentrations (2018) of the compliance wells (MW-1, MW-2, and MW-3), no SSI above background occurred.

Time series plots of the Appendix III parameters were created for all monitoring wells (Attachment B of Appendix D). Overall, significant variability (either increase or decrease) was observed both upgradient (MW-4 and MW-5) and downgradient (MW-1, MW-2, and MW-3) for calcium, chloride, pH-field, sulfate, and total dissolved solids. This variability in both upgradient and downgradient wells signals a natural variation in groundwater. Upgradient vs. downgradient prediction limit comparison plots (Attachment C of Appendix D) were also generated and they showed that currently there are no SSIs for wells MW-1, MW-2, and MW-3 for any of the Appendix III parameters.

7.0 Anticipated Future Activities

Based on the analytical results and statistical analysis of the 2018 data, the following actions are anticipated:

- It is FTCH's understanding that the plant has ceased power generation activities and has since placed Unit 3 into Long Term Cold Storage. Therefore, FTCH recommends the following:
    - Prepare and submit a Surface Impoundment Closure Plan for the closure of the CCR surface impoundment. The closure plan is required under Title 40, Code of Federal Regulations (40 CFR) Part 257.101 and detailed in 40 CFR Part 257.102.
    - Implement the closure plan.
- In the event that the CCR material is closed in-place, a post closure plan including groundwater monitoring for a period of 30 years may be needed (40 CFR 257.104).

8.0 References

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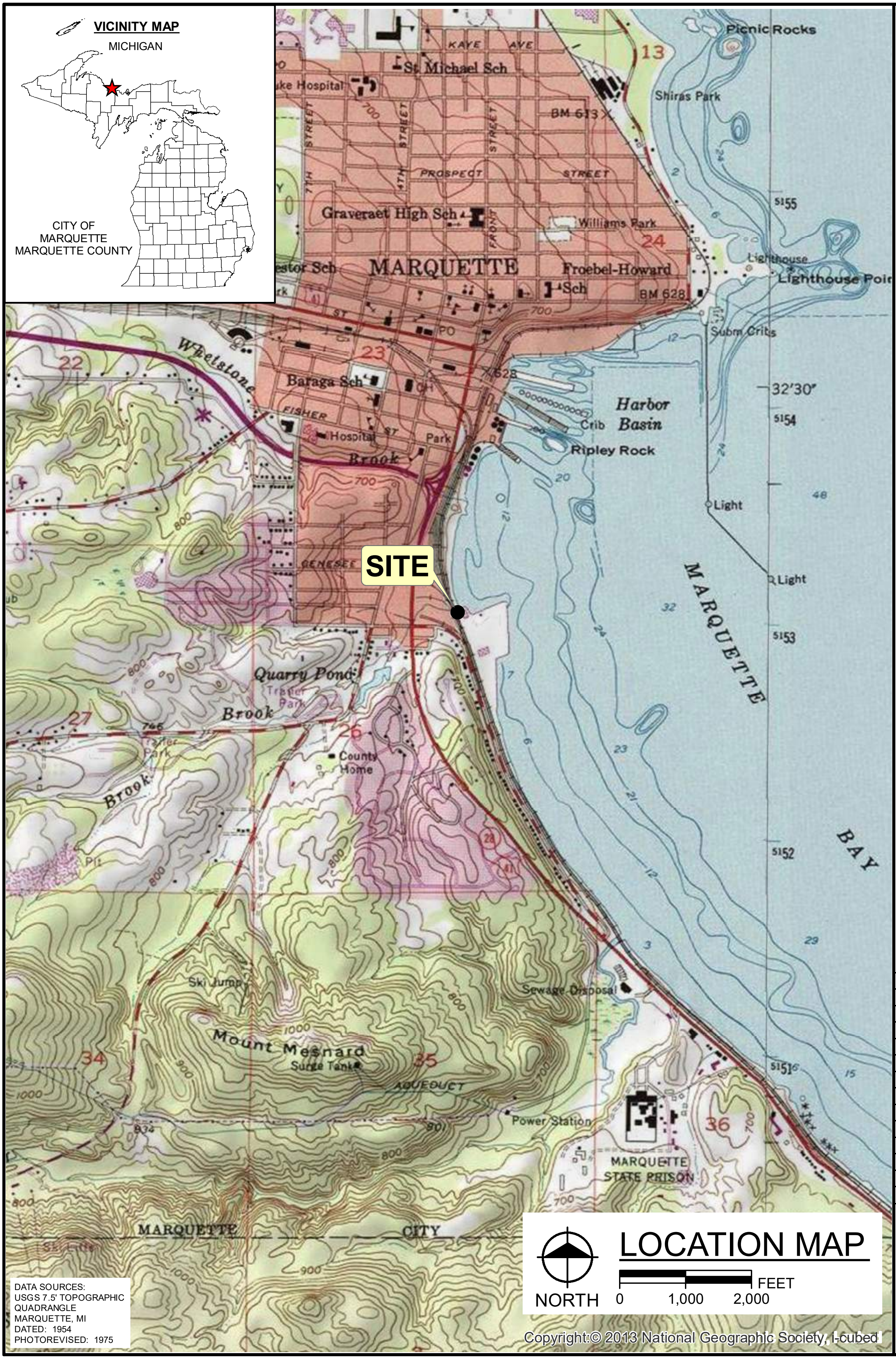
ASTM D6312-17, 2017. Standard Guide for Developing Appropriate Statistical Approaches for Groundwater Detection Monitoring Programs at Waste Disposal Facilities, 15 p.

9.0 Certification

See attached Groundwater Monitoring System and Statistical Methods Certifications at the beginning of this report.

Figures



LOCATION MAP

DATA SOURCES:
USGS 7.5' TOPOGRAPHIC QUADRANGLE
MARQUETTE, MI
DATED: 1954
PHOTOREVISED: 1975

Copyright:© 2013 National Geographic Society, i-cubed

PLOT INFO: Z:\2018\180827\CAD\GIS\MAPDOC\FIG01_LOCATION MAP.mxd Date: 8/3/2018 2:09:15 PM User: ACS

ftc&h

engineers
scientists
architects
constructors

fishbeck, thompson, carr & huber, inc.

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Marquette Board of Light and Power

Shiras Steam Plant, Marquette, Michigan

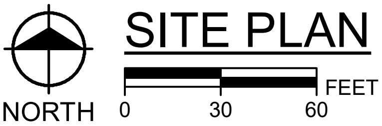
2018 Annual CCR Groundwater Monitoring and Corrective Action Report

PROJECT NO.
180827

FIGURE NO.
1

LEGEND

⌖ Monitoring Well



SITE PLAN

ftc&h

engineers

scientists

architects

constructors

fishbeck, thompson, carr & huber, inc.

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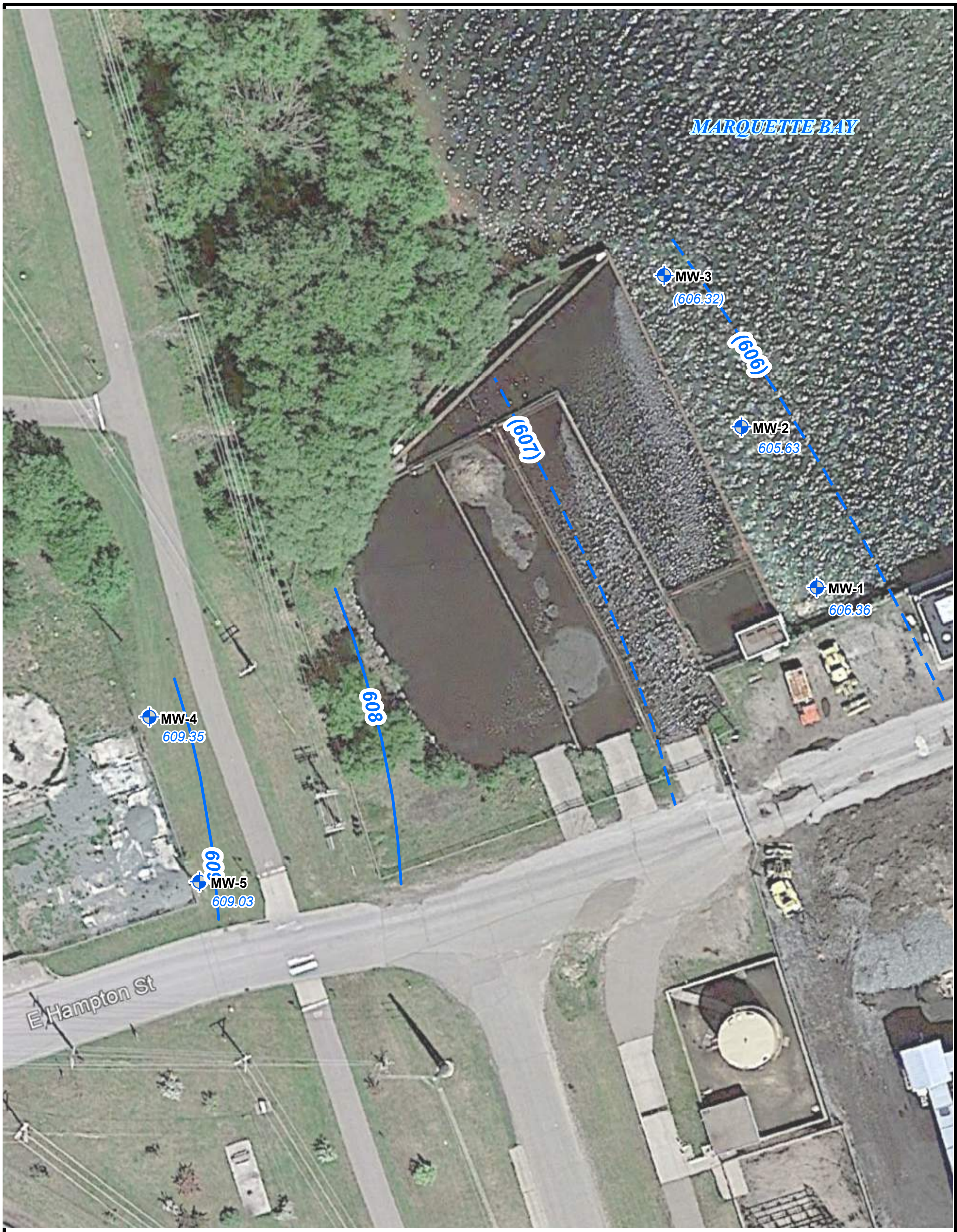
Marquette Board of Light and Power

Shiras Steam Plant, Marquette, Michigan

2018 Annual CCR Groundwater Monitoring and Corrective Action Report

PROJECT NO.
180827

FIGURE NO.
2



LEGEND

⊕ Monitoring Well

— Groundwater Contour (feet)-September 20, 2018

– – Groundwater Contour (feet) Inferred

608.92 Groundwater Elevation (feet)-May 30, 2018

*(606.76)** SWL = (+0.30') Artesian Conditions (Not used in contour)

NORTH

FEET 0 30 60

GROUNDWATER CONTOUR MAP SEPTEMBER 20, 2018

ftc&h

engineers
scientists
architects
constructors

fishbeck, thompson, carr & huber, inc.

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Marquette Board of Light and Power
Shiras Steam Plant, Marquette, Michigan
2018 Annual CCR Groundwater Monitoring and Corrective Action Report

PROJECT NO.
180827

FIGURE NO.
3

PLOT INFO: Z:\2018\180827\CAD\GIS\MAPDOC\FIG03_SEPT2018-GW CONTOUR MAP.mxd Date: 11/5/2018 4:15:58 PM User: ACS

Tables

Table 1 - Cumulative Analytical Data Summary
Marquette Board of Light and Power
Shiras Steam Plant
September 2018

Lab Suite:				CCR Appendix III							CCR Appendix IV																
Parameter:				Boron	Calcium	Chloride	Fluoride	Sulfate	Total Dissolved Solids (TDS)	pH (lab)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Fluoride	Lead	Lithium	Mercury	Molybdenum	Radium 226 & 228 Combined	Radium 226	Radium 228	Selenium	Thallium
Units:				µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	SU	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	pCi/L	pCi/L	µg/L	µg/L
U.S. EPA MCL:				*NE*	*NE*	*NE*	*4.0*	*NE*	*NE*	*NE*	*6.0*	*10*	*2.0*	*4.0*	*5.0*	*100*	*NE*	*4.0*	*15*	*NE*	*2.0*	*NE*	*5.0*	*NE*	*NE*	*50*	*2.0*
Location	Well ID	Collection Date	Duplicate																								
Downgradient	MW-1	07/19/17		300 U	100,000	230	0.38 U	19	700	7.58	2.0 U	6.6	0.21	1.0 U	1.0 U	10 U	20 U	--	17	10 U	0.20 U	50 U	2.33	1.00 U	2.33	5.0 U	2.0 U
		07/24/17		300 U	110,000	230	0.38 U	20	800	7.45	2.0 U	5.0 U	0.15	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.43	1.00 U	1.43	5.0 U	2.0 U
		08/23/17		300 U	120,000	260	0.10 U	21	800	7.54	2.0 U	5.0 U	0.14	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/29/17		300 U	130,000	270	0.10 U	20	960	6.56	2.0 U	5.0 U	0.13	1.0 U	1.0 U	18	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17		300 U	130,000	270	0.10 U	21	930	7.56	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/14/17		300 U	110,000	290	0.10 U	22	980	7.60	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17		530	120,000	270	0.10 U	20	920	7.58	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17	X	300 U	120,000	270	0.10 U	21	990	7.58	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.16	1.00 U	1.16	5.0 U	2.0 U
		10/05/17		300 U	130,000	280	0.10 U	21	820	7.55	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		10/05/17	X	300 U	120,000	270	0.10 U	21	880	7.55	2.0 U	5.0 U	0.14	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		05/31/18		66 J	110,000	310	0.046 J	25	770	7.8	2.0 U	5.0 U	0.15	1.0 U	1.0 U	2.1	0.77 J	0.042 J	1.0 U	12	0.20 UJ	1.6 J	0.516	0.409	0.107 U	5.0 U	1.0 U
		09/20/18		67 J	120,000	300	0.044 J	24	740	7.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	MW-2	07/19/17		300 U	51,000	60	0.38 U	22	220	8.41	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		07/24/17		300 U	63,000	59	0.38 U	21	350	8.09	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.56	1.00 U	1.56	5.0 U	2.0 U
		08/23/17		300 U	51,000	62	0.10 U	26	190	8.13	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	240	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/29/17		300 U	52,000	61	0.10 U	22	350	7.03	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	2.00	1.00 U	2.00	5.0 U	2.0 U
		08/29/17	X	300 U	53,000	61	0.10 U	22	320	7.03	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17		300 U	53,000	60	0.10 U	21	310	8.15	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/14/17		300 U	52,000	64	0.10 U	23	300	8.13	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17		300 U	58,000	65	0.10 U	21	350	8.07	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		10/05/17		300 U	61,000	65	0.10 U	21	310	7.99	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		05/31/18		74 J	68,000	86	0.056	31	330	8.0	2.0 U	0.84 J	0.073	1.0 U	1.0 U	2.2	0.38 J	0.055	1.0 U	5.9 J	0.20 U	1.1 J	0.519	0.204 U	0.315 U	5.0 U	1.0 U
		05/31/18	X	75 J	70,000	86	0.057	31	330	8.0	2.0 U	1.0 J	0.072	1.0 U	1.0 U	1.7 J	0.38 J	0.055	1.0 U	6.0 J	0.20 U	5.0 U	0.299 U	0.193	0.106 U	5.0 U	1.0 U
		09/20/18		55 J	64,000	85	0.058	29	310	8.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	MW-3	07/19/17		300 U	68,000	98	0.38 U	49	360	8.00	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		07/24/17		300 U	69,000	89	0.38 U	36	440	7.86	2.0 U	5.0 U	0.23	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/23/17		300 U	75,000	95	0.10 U	44	300	7.81	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/29/17		300 U	62,000	86	0.10 U	28	390	6.32	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17		300 U	62,000	85	0.10 U	26	380	7.77	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.05	1.00 U	1.05	5.0 U	2.0 U
		09/14/17		300 U	57,000	83	0.10 U	25	380	7.85	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.17	1.00 U	1.17	5.0 U	2.0 U
		09/14/17	X	300 U	56,000	84	0.10 U	24	380	7.85	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17		300 U	67,000	89	0.10 U	20	440	8.09	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		10/05/17		300 U	69,000	87	0.10 U	21	350	8.10	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		05/31/18		45 J	55,000	67	0.067	20	290	8.2	2.0 U	1.5 J	0.066	1.0 U	1.0 U	2.4	0.32 J	0.065	1.0 U	4.9 J	0.20 U	1.2 J	0.128 U	0.199 U	-0.0711 U	5.0 U	1.0 U
		09/20/18		41 J	70,000	92	0.055	22	340	8.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	MW-4	07/19/17		300 U	93,000	260	0.38 U	19	700	7.92	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.07	1.00 U	1.07	5.0 U	2.0 U
		07/24/17		300 U	89,000	220	0.38 U	18	730	7.86	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		07/24/17	X	300 U	89,000	230	0.38 U	19	710	7.86	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/23/17		300 U	100,000	300	0.10 U	24	830	7.93	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/29/17		300 U	120,000	340	0.10 U	47	1,000	7.32	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17		300 U	110,000	340	0.20	53	1,000	7.75	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/14/17		300 U	100,000	360	0.18	49	1,000	7.77	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17		300 U	160,000	370	0.12	46	1,200	7.74	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.1 U	13	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		10/05/17		300 U	120,000	380	0.10	43	1,100	7.70	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	11	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		05/31/18		120	130,000	450	0.23	42	1,000	7.8	1.0 J	1.4 J	0.11	1.0 U	0.24 J	1.2 J	0.48 J	0.23	0.50 J	9.8	0.20 U	16	0.639	0.400	0.240 U	5.0 U	1.0 U
		09/20/18		110	130,000	450	0.23	42	970	7.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		09/20/18	X	110	130,000	450	0.23	42	1,000	7.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Upgradient	MW-5	07/19/17		300 U	100,000	200	0.38 U	25	640	7.36	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.51	1.00 U	1.51	5.0 U	2.0 U
		07/19/17	X	300 U	100,000	190	0.38 U	24	530	7.36	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		07/24/17		300 U	100,000	190	0.38 U	21	730	7.17	2.0 U	5.0 U	0.16	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/23/17		300 U	110,000	210	0.10 U	19	590	7.41	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.44	1.00 U	1.44	5.0 U	2.0 U
		08/23/17	X	300 U	110,000	190	0.10 U	19	620	7.41	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/29/17		300 U	110,000	190	0.10 U	18	750	6.76	2.0 U	5.0 U	0.12	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17		300 U	100,000	190	0.10 U	18	660	7.43	2.0 U	5.0 U	0.11	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17	X	300 U	100,000	190	0.10 U	18	730	7.43	2.0 U	5.0 U	0.11	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/14/17		300 U	96,000	200	0.10 U	19	720	7.51	2.0 U	5.0 U	0.11	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17		300 U	120,000	190	0.10 U	18	2,300	7.54	2.0 U	5.0 U	0.11	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		10/05/17		300 U	120,000	190	0.10 U	18	700	7.45	2.0 U	5.0 U	0.12	1.0 U	1.0 U	10 U	20 U	--	3.0 U	13	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		05/31/18		42 J	100,000	210	0.043 J	19	640	7.6	2.0 U	5.0 U	0.095	1.0 U	1.0 U	1.5 J	0.25 J	0.046 J	1.0 U	7.6 J	0.20 U	7.1	0.470	0.272	0.198 U	5.0 U	1.0 U
		09/20/18		39 J	120,000	220	0.031 J	22	630	7.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 1 - Cumulative Analytical Data Summary
Marquette Board of Light and Power
Shiras Steam Plant
September 2018

Lab Suite:				CCR Appendix III							CCR Appendix IV															
Parameter:				Boron	Calcium	Chloride	Fluoride	Sulfate	Total Dissolved Solids (TDS)	pH (lab)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Fluoride	Lead	Lithium	Mercury	Molybdenum	Radium 226 & 228 Combined	Radium 226	Radium 228	Selenium	Thallium
Units:				µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	SU	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	pCi/L	pCi/L	µg/L	µg/L
U.S. EPA MCL:				*NE*	*NE*	*NE*	*4.0*	*NE*	*NE*	*NE*	*6.0*	*10*	*2.0*	*4.0*	*5.0*	*100*	*NE*	*4.0*	*15*	*NE*	*2.0*	*NE*	*5.0*	*NE*	*NE*	*50*	*2.0*
Location	Well ID	Collection Date	Duplicate																								
QC	Equipment Blank	07/20/17		300 U	1,000 U	10 U	0.38 U	2.5 U	10 U	8.05	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.24	1.00 U	1.24	5.0 U	2.0 U
		07/24/17		300 U	1,000 U	10 U	0.38 U	2.5 U	10 U	7.94	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.03	1.00 U	1.03	5.0 U	2.0 U
		08/29/17		300 U	1,000 U	10 U	0.10 U	1 U	10 U	NA	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17		300 U	1,000 U	10 U	0.10 U	1 U	10	NA	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/14/17		300 U	1,000 U	10 U	0.10 U	1 U	10 U	NA	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17		300 U	1,000 U	10 U	0.10 U	1 U	10	NA	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		10/05/17		300 U	1,000 U	10 U	0.10 U	1 U	18	NA	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U

Bolded values exceed an applicable criterion.

Data Qualifiers:
U - Not detected

Footnotes/Abbreviations:
MCL - maximum contaminant limit
NA - Not Analyzed
NE - Value has not been established

Appendix A

Monitoring Well Development
Alternative Source Demonstration

Marquette Board of Light and Power
400 East Hampton Street, Marquette, Michigan

Project No. 180827
September 5, 2018

Fishbeck, Thompson, Carr & Huber, Inc.
engineers | scientists | architects | constructors

Monitoring Well Development
Alternative Source Demonstration

Prepared For:
Marquette Board of Light & Power
400 East Hampton Street, Marquette, Michigan

September 5, 2018
Project No. 180827

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List of Abbreviations/Acronyms

ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
FTCH	Fishbeck, Thompson, Carr & Huber, Inc
GOF	good of fitness
MBLP	Marquette Board of Light & Power
SSI	statistically significant increase
UPL	upper prediction limit

1.0 Introduction

Fishbeck, Thompson, Carr & Huber, Inc. (FTCH) on behalf of Marquette Board of Light & Power (MBLP) has prepared this Alternative Source Demonstration (ASD) for the Shiras Steam Plant generating station located at 400 East Hampton Street, Marquette, Michigan; Ash Impoundment WDS ID 478988 (Shiras Steam Plant). This document provides a description of the redevelopment of the five monitoring wells located at the Shiras Steam Plant, pH data collected during and after well redevelopment, and the statistical analysis used to determine if the statistically significant increase (SSI) in pH for monitoring wells MW-2 and MW-3 (reported in the 2017 annual monitoring report) may be a result of a source(s) other than the Coal Combustion Residuals (CCR) unit. This report has been prepared in accordance with 40 Code of Federal Regulations (CFR) Part 257, Disposal of Coal Combustion Residuals from Electric Utilities (CCR rule) published in April 17, 2015.

2.0 Summary of Previous Investigations and Regulations Background

The Shiras Steam Plant is located at 400 East Hampton Street, in Marquette, Michigan, along the shoreline of Lake Superior, as shown on Figure 1. The Shiras Steam Plant has one CCR surface impoundment (aka holding pond) located north of the generating station. In January 2018, the MBLP completed the Annual Groundwater Monitoring and Corrective Action Report, which documented the 2017 activities in accordance with the CCR 257.90(e), including data from monitoring wells shown on Figure 2. According to the report, the Shiras Steam Plant Site data showed an SSI in the Appendix III parameter pH at MW-2 and MW-3 over the background (Marquette Board of Light and Power, 2017).

According to CCR 257.94(e) and 257.93(h), if a facility determines there is an SSI over background levels for one or more constituents within 90 days of detecting an SSI, the facility will establish an Assessment Monitoring Program and/or demonstrate an alternative explanation for the exceedance. Alternate explanations could include the existence of a source other than the CCR Unit that could have caused the SSI; the SSI resulted from errors in sampling, analysis, or statistical evaluation; and natural variation in groundwater quality. The owner/operator of the CCR must complete and produce a written document (ASD) that must be certified by a qualified professional engineer, and the CCR unit may continue with detection monitoring. The facility must also include the ASD in the annual groundwater monitoring and corrective action report required by CCR 257.90(e), in addition to certification by a qualified professional engineer.

If the SSI is identified and cannot be attributed to an ASD, the facility must begin assessment monitoring for the CCR Unit. Per the CCR Rule, assessment monitoring must begin within 90 days of identification of an SSI that is not attributed to an alternative source and also include the Appendix IV constituents in accordance to CCR 257.95(b).

3.0 Objective

To support collection of high quality data to address CCR 257.94 (e)(2), redevelopment of the existing five monitoring wells (MW-1 through MW-5) for pH was proposed. The objective of this report is to document the redevelopment of these wells and determine if an alternative source other than the CCR unit, previous well conditions, errors, or natural variation in groundwater quality can explain the SSI in pH for MW-2 and MW-3 over the background. According to CCR 257.94 (e)(2), "The owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality." The current ASD investigated the following lines of evidence:

- Well conditions may affect pH readings. Redeveloping the wells could improve sampling conditions for more representative field parameters measurements.
- There is inherent error present in the equipment used to measure pH in the field.
- There is natural variation within pH ranges from both background wells (MW-4 and MW-5) and downgradient monitoring wells (MW-1, MW-2 and MW-3).

4.0 Alternative Source Demonstration Investigation

4.1 Well Redevelopment and Re-Evaluation of the Data

Redevelopment activities were originally scheduled to occur during April 2018; however, ice present in the area of the wells prevented safe access to complete the work. The delay in access to the monitoring wells was communicated to the Michigan Department of Environmental Quality (MDEQ) in an email from Mr. John Schultz (MBLP) on April 16, 2018. Ms. Margie Ring, MDEQ State Solid Waste Engineering Coordinator, responded via email that the MDEQ was in agreement with postponing sampling until the wells could be accessed safely. Ms. Ring recommended documenting the delay in the monitoring report if the samples were not collected by April 30, 2018.

Monitoring well redevelopment activities were executed on May 30, 2018, at all five wells within the monitoring network. Prior to redevelopment activities, static water levels were collected from monitoring wells MW-1 through MW-5 and the data was used to calculate groundwater elevations. The groundwater elevation data was then contoured and is shown on Figure 3. As depicted on Figure 3, groundwater flows toward the east and Lake Superior. During redevelopment, pH values were monitored for stabilization (+/- 0.1 SU over 3 consecutive readings) using a YSI Inc. Pro Plus handheld instrument containing a pH meter probe. The pH values were recorded on field documentation forms provided in Appendix A. Statistical analysis was completed on background and downgradient groundwater pH data. As established in the 2017 annual groundwater report, an inter-well approach was considered appropriate for statistical analysis, as the groundwater monitoring system for the WDS ID 478988 unit contains two upgradient (MW-4 and MW-5) and three downgradient wells (MW-1, MW-2, and MW-3 in Lake Superior), which were installed in the uppermost aquifer.

The pH data, obtained during redevelopment of the wells and 24 hours after redevelopment, were added to the existing pH database. The new pH data, except for pH data collected during redevelopment, were used in combination with the baseline data collected in 2017 for statistical analyses of the ASD. The redevelopment pH data was not used because this data is not representative of undisturbed steady-state conditions. All statistical evaluations were completed using the latest version of ProUCL 5.1 software developed by the USEPA (USEPA, 2016).

Initially, the detection frequencies for all wells were computed (Table 1). To establish the prediction limit, historical data and pH measurements collected 24 hours after the redevelopment for MW-4 and MW-5 were used for background calculations. To check for outliers, background data was plotted on a box plot, histogram, and Q-Q plot for a visual assessment of potential outliers followed by the calculations of the Dixon's outlier test (Appendix B). No outliers were detected with a one percent significance level. A good of fitness (GOF) test was used to determine the statistical distribution of the background data; to verify whether the dataset is normal, gamma, lognormal or nonparametrically distributed. The background dataset was identified to be normally distributed (Appendix C). The upper and lower prediction limit were calculated based on normal distribution and results are shown on Table 2 (additional calculations executed by ProUCL regarding prediction limits are shown on Appendix D).

Historical downgradient data for pH (MW-1, MW-2, and MW-3) were compared with the prediction limit calculated for the updated background data (6.782-8.303) and are shown on Table 3. Among the data tested, only one measurement at MW-2 exceeded the updated prediction limit. This measurement was from the first sampling event on July of 2017 (pH = 8.41), which should not be a concern since many other measurements were taken afterwards. As discussed above, the redevelopment pH data was not used for statistical analysis due to the nature of redeveloping wells, which include mixing solutions, solids, and minerals to clean up the well. These unstable conditions, noticeable by the variability in values observed on each well throughout the redevelopment event, are not representative of undisturbed steady-state conditions. For that reason, the pH measurement collected 24 hours following redevelopment better represents the parameter in these wells. All three monitor wells' measurements, following the redevelopment (on May 31, 2018), were within the acceptable limits calculated for background (MW-1 = 7.62, MW-2 = 7.88 and MW-3 = 8.07). Thus, at this time, previous well conditions seem to explain the SSI for pH observed during the monitoring event of 2017. Figures 4, 5, and 6 display the Upgradient vs. Downgradient analysis for MW-1, MW-2, and MW-3.

4.2 Evaluation of Inherent Error

The potential of errors due to the calibration of the measurement instrument and the inherent error present due to accuracy limits of the instrument were also evaluated. An investigation of the field forms was conducted to verify if the calibration drifted throughout the course of the sampling event, if adequate amount of groundwater was withdrawn to obtain a representative sample from each monitoring well, and if pH readings were allowed to stabilize prior to sample collection. Additionally, the accuracy limitations of the instrument used to measure pH was assessed and compared to the baseline upper prediction limit (UPL) to ascertain if the margin of error for the pH measurements in questions is below UPL.

Investigation of the field notes/calibration forms showed little drift in pH value (7.06, 7.02 and 7.04 over the course of the day) and reported an adequate amount of water was used to obtain representative pH measurements; thus, these lines of evidence would not be able to explain the SSI for pH in MW-2 and MW-3. Regarding accuracy limitations of the instrument used to measure pH, the instrument manual reports an accuracy of ±0.2 (YSI, 2011). By accounting for the equipment accuracy, all pH values measured using this instrument during redevelopment and 24h after the redevelopment event would be actually ±0.2 S.U.

4.3 Evaluation of Natural Variation

Because no other Appendix III constituent exhibited an SSI in the 2017 monitoring event, the variation in pH data may be indicative of natural variation. Trend analysis of pH was executed using the Mann-Kendall test on ProUCL and results are shown on Appendix E. The purpose of the Mann-Kendall (MK) test (Mann 1945, Kendall 1975, Gilbert 1987) is to statistically assess if there is a monotonic upward or downward trend of the variable of interest over time. Similar to background, both MW-2 and MW-3 had insufficient evidence to identify a significant trend at the 0.01 level of significance (confidence coefficient 0.99).

5.0 Conclusions and Recommendations

- 24 hours after redevelopment of the wells, values greater than the prediction limit, set based on current background data, were not observed in MW-2 and MW-3.
- Based on the data, previous well conditions explain the evidence of SSI for pH previously reported.

- There is insufficient evidence to identify a significant increasing trend for pH at MW-2 and MW-3, this indicates that, to some extent, any difference between background field pH and downgradient may be naturally-occurring.

This ASD documents the re-assessment of the potential SSI of pH for the downgradient wells MW-2 and MW-3 at the Shiras Steam Plant. Based on all above, especially the statistical study executed after the redevelopment of the wells, previous well conditions explain the SSI. As no SSI was noted after redeveloping the wells, the 2018 monitoring program report will cover Appendix III parameters exclusively.

6.0 Monitoring Schedule

Following the ASD study, two monitoring events are expected for the 2018 annual report. The first monitoring event occurred in May 31, 2018 (only pH data shown in this document) and the second sampling event is expected to occur in September 2018. The annual report will be submitted in January 2019 and, based on this ASD, the report will only include Appendix III parameters.

7.0 References

Marquette Board of Light and Power, 2017. First Annual CCR Groundwater Monitoring and Corrective Action Report 2017.

YSI, 2011. Professional Plus Water Quality Instrument – Specifications

USEPA, 2016. ProUCL Version 5.1 User Guide - Statistical Software for Environmental Applications for Data Sets with and without Non-detect Observations. https://www.epa.gov/sites/production/files/2016-05/documents/proucl_5.1_user-guide.pdf, accessed in July 2018.

8.0 Certification

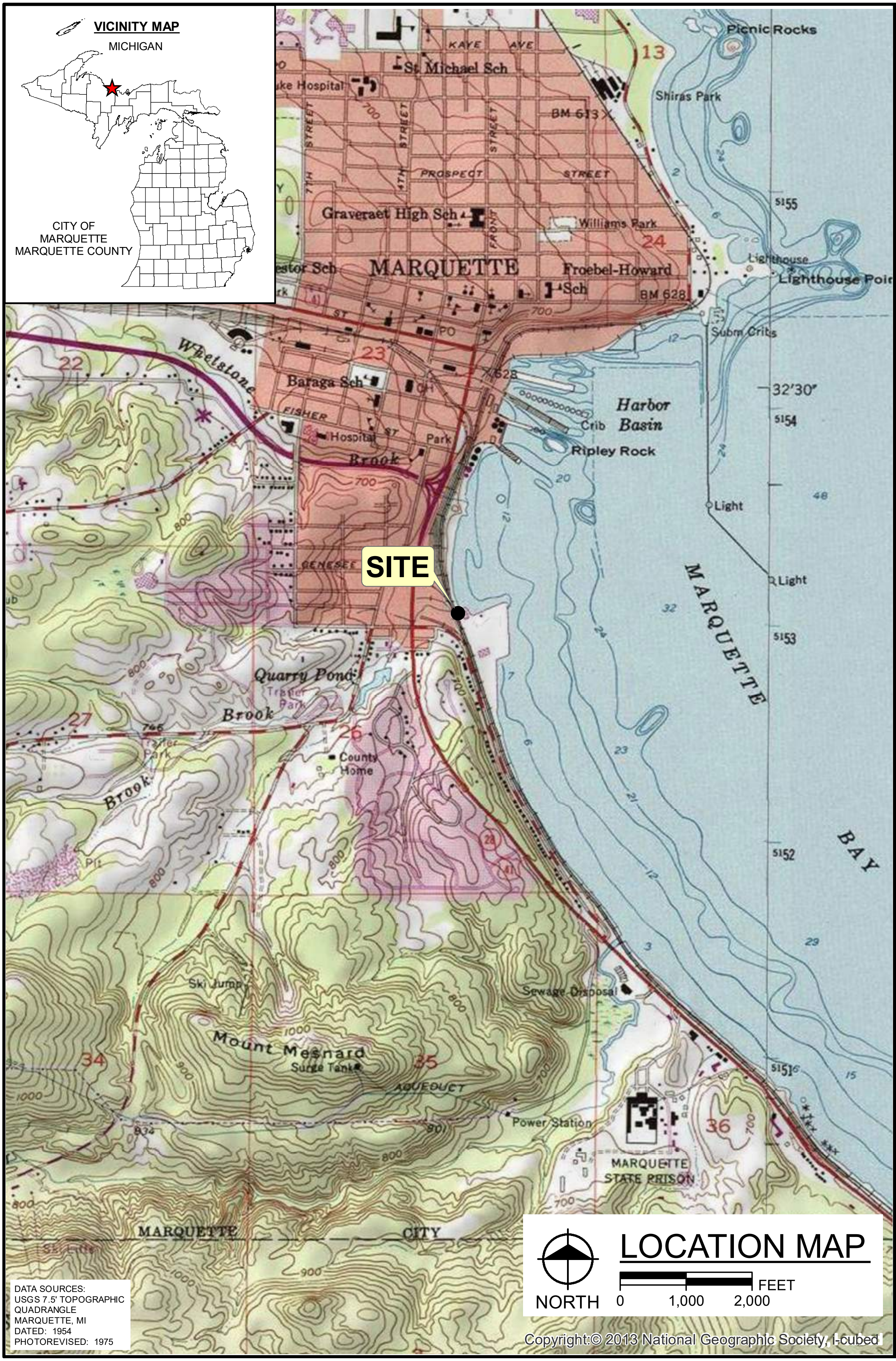
I, Stephen J. MacDonald, a qualified professional engineer, certify that the selected statistical method is appropriate for evaluating the groundwater monitoring data for the CCR ash Impoundment WDS ID 478988 at the Shiras Steam Plant.

STATE OF MICHIGAN
STEPHEN J. MacDONALD
ENGINEER
No. 40569
LICENSED PROFESSIONAL ENGINEER

Stephen J. MacDonald

Stephen J. MacDonald, PE License Number 40569
Senior Environmental Engineer
Date: September 5, 2018

Figures



LOCATION MAP

DATA SOURCES:
USGS 7.5' TOPOGRAPHIC QUADRANGLE
MARQUETTE, MI
DATED: 1954
PHOTOREVISED: 1975

PLOT INFO: Z:\2018\180827\CAD\GIS\MAPDOC\FIG01_LOCATION MAP.mxd Date: 5/25/2018 8:35:25 AM User: ACS

ftc&h

engineers
scientists
architects
constructors

fishbeck, thompson, carr & huber, inc.

Hard copy is intended to be 8.5"x11" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

Marquette Board of Light and Power

Shiras Steam Plant, Marquette, Michigan

Alternative Source Demonstration

PROJECT NO.
180827

FIGURE NO.
1

LEGEND

⊕ Monitoring Well

NORTH

SITE PLAN

0 30 60 FEET

fтс&h

engineers

scientists

architects

constructors

fishbeck, thompson, carr & huber, inc.

Hard copy is intended to be 8.5"x11" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

Marquette Board of Light and Power

Shiras Steam Plant, Marquette, Michigan

Alternative Source Demonstration

PROJECT NO.
180827

FIGURE NO.
2

PLOT INFO: Z:\2018\180827\CAD\GIS\MAPDOC\FIG02_SITE MAP.mxd Date: 6/18/2018 4:05:55 PM User: ACS

LEGEND

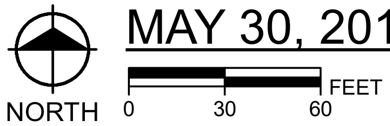
⌖ Monitoring Well

— Groundwater Contour (feet)-May 30, 2018

– – Groundwater Contour (feet) Inferred

608.92 Groundwater Elevation (feet)-May 30, 2018

(606.76)* SWL = (+0.30') Artesian Conditions (Not used in contour)



GROUNDWATER CONTOUR MAP MAY 30, 2018

ftc&h

engineers
scientists
architects
constructors

fishbeck, thompson, carr & huber, inc.

Hard copy is intended to be 8.5"x11" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

Marquette Board of Light and Power
Shiras Steam Plant, Marquette, Michigan

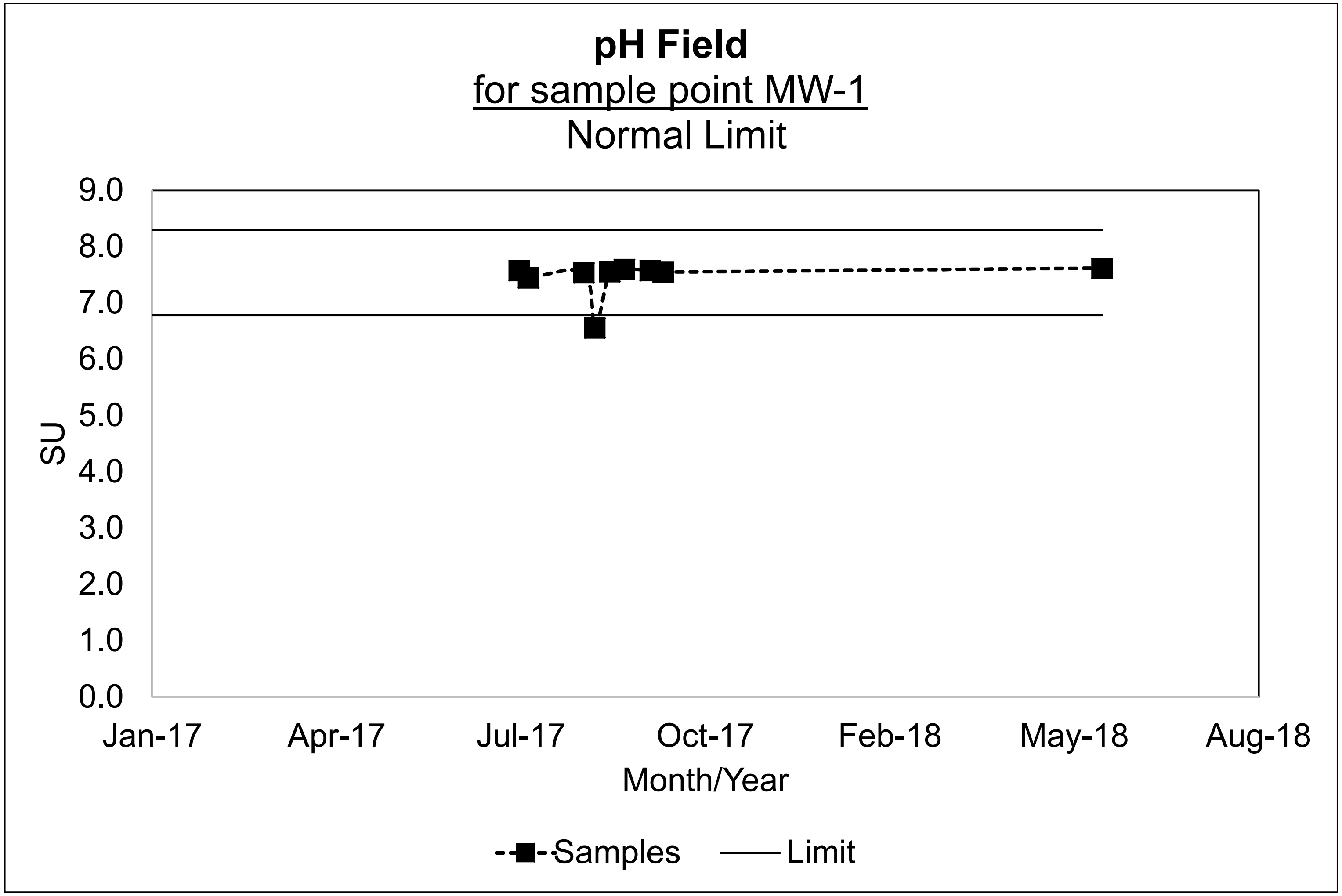
Alternative Source Demonstration

PROJECT NO.
180827

FIGURE NO.
3

PLOT INFO: Z:\2018\180827\CADD\GIS\MAPDOC\FIG03_MAY2018-GW CONTOUR MAP.mxd Date: 6/20/2018 10:22:23 AM User: ACS

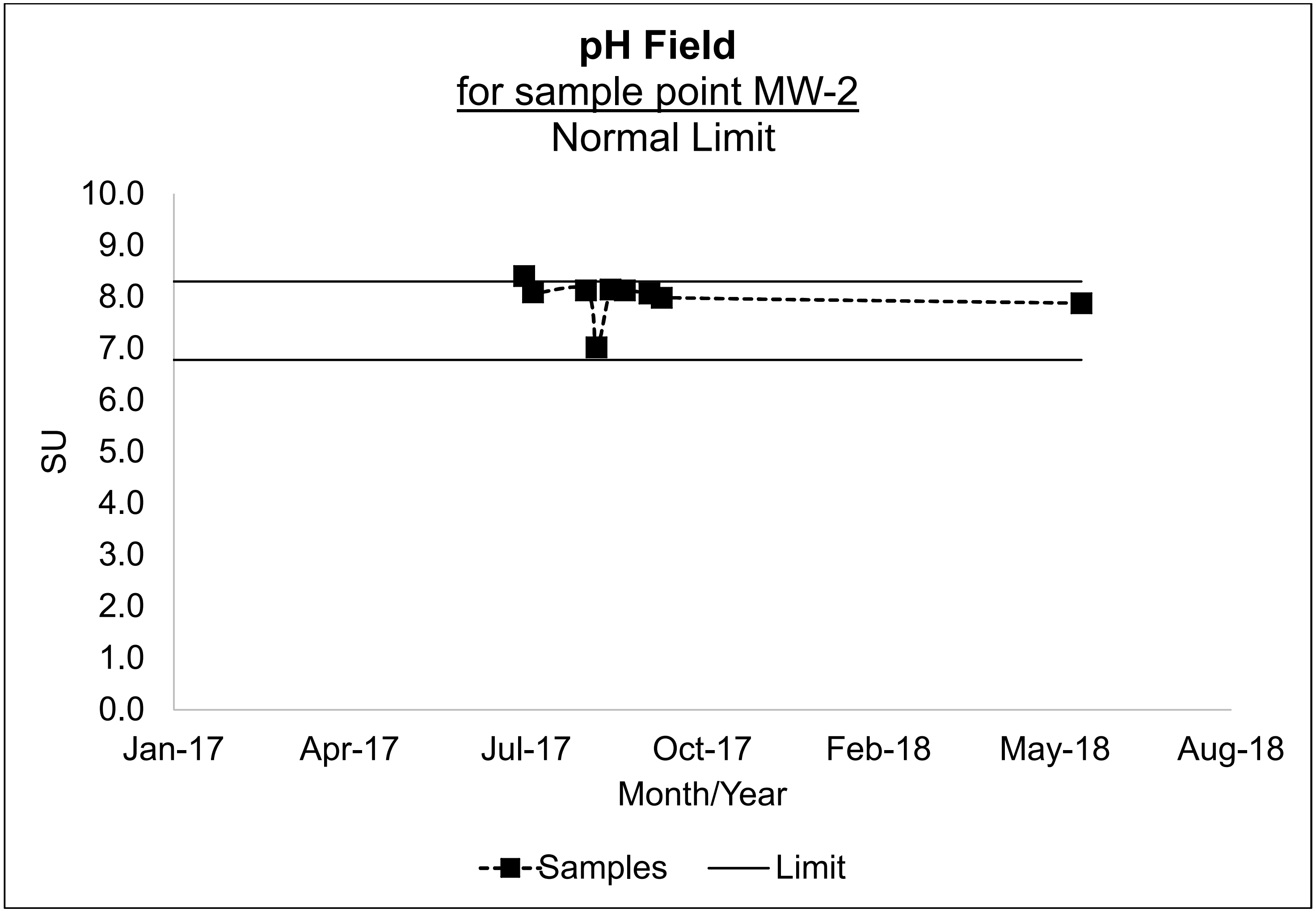
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 1

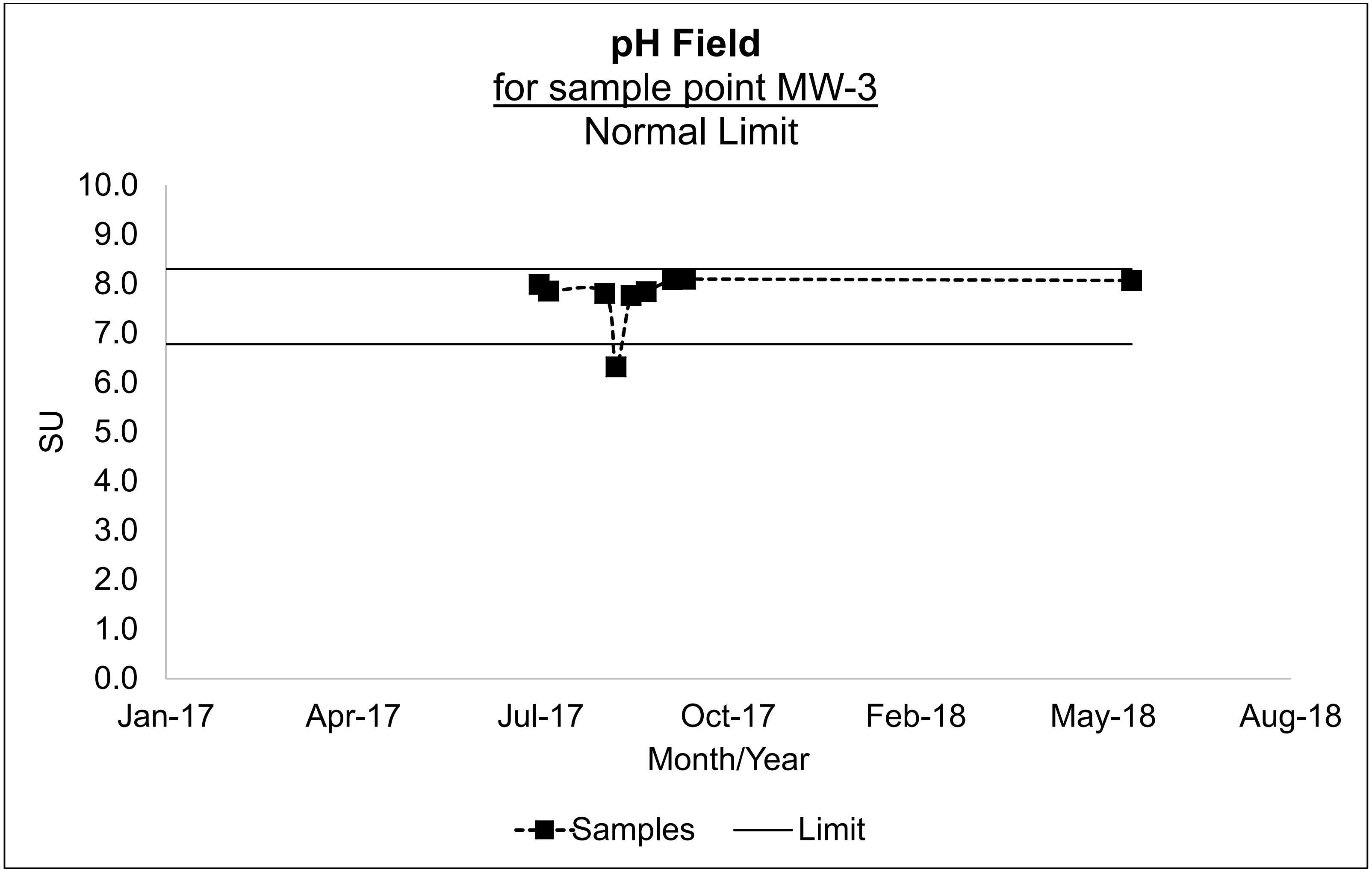
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 2

Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 3

Tables

Table 1 - Summary of Detection Frequencies for Appendix III Parameter of pH

Marquette Board of Light and Power
Shiras Steam Plant

Parameter	Detection Frequency	MW-1	MW-2	MW-3	MW-4	MW-5
pH	n	9	9	9	9	9
	ND	0	0	0	0	0
	%ND	0%	0%	0%	0%	0%

Notes:
n - sample size
ND - count of nondetect values in sample
%ND - percentage of nondetects in sample

Table 2 - Summary Statistics and Prediction Limits

Marquette Board of Light and Power

Shiras Steam Plant

Parameter	Unit	Model Type	Sample Size	Detect	Mean	Standard Deviation	Student's T test critical value (.99 confidence)	Upper Prediction Limit	Lower Prediction Limit
pH	SU	Normal	18	18	7.541	0.289	2.567	8.303	6.782

Table 3 - Historical Downgradient Data for pH which Failed the Current Statistical Evaluation

Marquette Board of Power and Light
Shiras Steam Plant

Parameter	Unit	Well	Date	Result	Prediction Limit	SSI
pH	SU	MW-1	7/19/2017	7.58	6.861-8.211	
pH	SU	MW-1	7/24/2017	7.45	6.861-8.211	
pH	SU	MW-1	8/23/2017	7.54	6.861-8.211	
pH	SU	MW-1	8/29/2017	6.56	6.861-8.211	
pH	SU	MW-1	9/6/2017	7.56	6.861-8.211	
pH	SU	MW-1	9/14/2017	7.6	6.861-8.211	
pH	SU	MW-1	9/28/2017	7.58	6.861-8.211	
pH	SU	MW-1	10/5/2017	7.55	6.861-8.211	
pH*	SU	MW-1	5/30/2018	7.56	6.861-8.211	
pH*	SU	MW-1	5/30/2018	8.11	6.861-8.211	
pH*	SU	MW-1	5/30/2018	7.77	6.861-8.211	
pH*	SU	MW-1	5/30/2018	9.54	6.861-8.211	
pH	SU	MW-1	5/31/2018	7.62	6.861-8.211	
pH	SU	MW-2	7/19/2017	8.41	6.861-8.211	>PL
pH	SU	MW-2	7/24/2017	8.09	6.861-8.211	
pH	SU	MW-2	8/23/2017	8.13	6.861-8.211	
pH	SU	MW-2	8/29/2017	7.03	6.861-8.211	
pH	SU	MW-2	9/6/2017	8.15	6.861-8.211	
pH	SU	MW-2	9/14/2017	8.13	6.861-8.211	
pH	SU	MW-2	9/28/2017	8.07	6.861-8.211	
pH	SU	MW-2	10/5/2017	7.99	6.861-8.211	
pH*	SU	MW-2	5/30/2018	8.01	6.861-8.211	
pH*	SU	MW-2	5/30/2018	7.89	6.861-8.211	
pH*	SU	MW-2	5/30/2018	8.28	6.861-8.211	
pH	SU	MW-2	5/31/2018	7.88	6.861-8.211	
pH	SU	MW-3	7/19/2017	8	6.861-8.211	
pH	SU	MW-3	7/24/2017	7.86	6.861-8.211	
pH	SU	MW-3	8/23/2017	7.81	6.861-8.211	
pH	SU	MW-3	8/29/2017	6.32	6.861-8.211	
pH	SU	MW-3	9/6/2017	7.77	6.861-8.211	
pH	SU	MW-3	9/14/2017	7.85	6.861-8.211	
pH	SU	MW-3	9/28/2017	8.09	6.861-8.211	
pH	SU	MW-3	10/5/2017	8.1	6.861-8.211	
pH*	SU	MW-3	5/30/2018	8.61	6.861-8.211	
pH*	SU	MW-3	5/30/2018	6.95	6.861-8.211	
pH*	SU	MW-3	5/30/2018	7.82	6.861-8.211	
pH	SU	MW-3	5/31/2018	8.07	6.861-8.211	

*Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because this data is not representative of undisturbed steady-state conditions

Notes:

>PL - results exceeds prediction limit; significantly increased over background

Appendix A

FIELD NOTES

Project Name: MBLP/Shiras ASD & GW Monitoring
Project Number: 180827
Site Location: Marquette, MI
Date: 5/30/18

P 1 of 2

Weather Conditions: 62°, overcast

Purpose: MW development

8:20: AD + APS onsite, calibrating
8:30: Tom (MBLP) onsite to provide keys/observe
9:20: MW-5 developed, ~17 gallons purged
9:45: MW-4 purged dry at ~5 gal, ~~turbidity~~ AD turbidity and pH
comparable to MW-5, will return tomorrow to sample
10:30: launch boat at Cinder Pond Marina
11:20: begin developing MW-3 - purged dry at ~5 gallons
will let well recover and return after other 2 wells
on the water - boat taking on water, used bilge pump
1145: begin development of MW-2, purged dry at ~5 gallons
boat taking on water seemingly quicker, plug is in, sealed well
continue to intermittently use bilge pump
will return after allowing time for MW-2 to recover
1219: MW-1 purged dry at ~6 gal
1225: midday pH cal check - 7.02 s.u.
1258: MW-3 has recovered to ~~~9~~ AD 8.4' below TOC, pumping again
1305 - MW-1 purged dry second
time, after 4 gallons purged (9 gallons purged total)), move to
MW-2

Completed by: A J (signature)
5/30/18 (date)

FIELD NOTES

Project Name: MBLP/Shiras ASD & GW Monitoring
Project Number: 180827
Site Location: Marquette, MI
Date: 5/30/18

2 of 2

Weather Conditions:

Purpose: MW development

1319 - MW-2 has ~~[illegible]~~ recovered to 5.55' below TOC, restarting purge

1322. MW-2 purged dry after 3 gallons - 8 gallons purged total
will move to MW-1. boat filling with substantial amounts of water regularly - use bilge pump

1337 MW-1 recovered to 2.3' below TOC, will purge again

NOTE: MW-1, MW-2, MW-3 did not recover fully due to boat issues (leaks) and nearby thunderstorms

1342: MW-1 purged dry after 4 gallons on second attempt, 10 gal purged total
Leave for marina

1446: restart purge at MW-4, SWL:

1449: MW-4 purged dry a second time, 3 additional gallons (8.5 gallons total)
next task is repairing boat if needed (Dockside Marina)

1530: Leaving Dockside Marina. They are keeping the boat for the night. Livewell was not plumbed allowing water into the boat through livewell drain. AD, APS done for the day

Completed by: (signature)
5/30/18 (date)

Fishbeck, Thompson, Carr & Huber, Inc.

MBLP/Shiras ASD & GW Monitoring.

Marquette, MI

Project No. 180827

Retention ponds, facing NNW.

Retention ponds, facing W.

Well development (MW-4)

Well development (MW-4)

Equipment decon between locations.

Dumping of development water.

Offshore wells (MW-3)

Development of offshore locations (MW-3)

Low flow sampling offshore location
(MW-3)

Low flow sampling offshore location
(MW-1)

EQUIPMENT CALIBRATION FORM

Project Name: MBLP/Shiras ASD & GW Monitoring
Project Number: 180827
Date/Time: 5/30/18 8:40
Initials: AD

NA = Not Applicable

Parameter	Standard	Lot Number	Units	Measured Value	Measurement Temperature (°C)	Calibration Verification Acceptance Window	Instrument Model/ID Number
pH	4.00	4612941-011117	S.U.	4.06	21.1	3.9 - 4.1	YSI PP #513
	7.00	4709695-110817	S.U.	7.06		6.9 - 7.1	
	10.00	462804-011117	S.U.	9.99		9.9 - 10.1	
Specific Conductance	147		µmhos/cm			132 - 162	
	1412		µmhos/cm			1342 - 1484	
	2765		µmhos/cm			2628 - 2905	
Eh	Zobell's solution		mV				
Dissolved Oxygen	NA	NA	mg/L			±10% Theoretical:	
Turbidity	10 NTU	A6272	NTU	9.41	—	9 - 11	LaMotte 2020we #410

Notes:

EQUIPMENT CALIBRATION VERIFICATION FORM

Project Name: MBLP/Shiras ASD & GW Monitoring

Project Number: 180827

Date/Time: 5/30/18 1225

Initials: AD

NA = Not Applicable

Parameter	Standard	Lot Number	Units	Measured Value	Measurement Temperature (°C)	Calibration Verification Acceptance Window	Instrument Model/ ID Number
pH	7.00	4709C45-110817	S.U.	7.02	23.2	6.9 - 7.1	YSI Pro
Specific Conductance	1412		µmhos/cm			1342 - 1484	
Eh	Zobell's solution		mV				
Dissolved Oxygen	NA	NA	mg/L			±10% Theoretical:	
Turbidity	10 NTU		NTU		NA	9 - 11	

Notes:

EQUIPMENT CALIBRATION VERIFICATION FORM

Project Name: MBLP/Shiras ASD & GW Monitoring

Project Number: 180827

Date/Time: 5/30/18 1500

Initials: AES

NA = Not Applicable

Parameter	Standard	Lot Number	Units	Measured Value	Measurement Temperature (°C)	Calibration Verification Acceptance Window	Instrument Model/ ID Number
pH	7.00	4709C95-110817	S.U.	7.04	21.3	6.9 - 7.1	YSI P.P. # ~~545~~ 513
Specific Conductance	1412		µmhos/cm			1342 - 1484	
Eh	Zobell's solution		mV				
Dissolved Oxygen	NA	NA	mg/L			±10% Theoretical:	
Turbidity	10 NTU	A6272	NTU	9.22	NA	9 - 11	1-2020 we #4510

Notes:

EQUIPMENT CALIBRATION FORM

Project Name: MBLP/Shiras ASD & GW Monitoring

Project Number: 180827

Date/Time: 5/31/18 1000

Initials: APS

NA = Not Applicable

Parameter	Standard	Lot Number	Units	Measured Value	Measurement Temperature (°C)	Calibration Verification Acceptance Window	Instrument Model/ID Number
pH	4.00	4612941-011117	S.U.	3.98	185	3.9 - 4.1	YSI P.P. #429
	7.00	4709095-110317	S.U.	7.04		6.9 - 7.1	
	10.00	4612804-011117	S.U.	10.00		9.9 - 10.1	
Specific Conductance	147	SC180208-1C	µmhos/cm	161	18.7	132 - 162	
	1412	SC180208-2A	µmhos/cm	1410		1342 - 1484	
	2765	SC180103-3C	µmhos/cm	2802		2628 - 2905	
Eh	Zobell's solution	20B2645-1	mV	429.5	18.8	425.8-445.8	
Dissolved Oxygen	NA	NA	mg/L	9.20	19.8	±10% Theoretical: 9.09	
Turbidity	10 NTU	A6272	NTU	9.75	-	9 - 11	L.2020 we

Notes:

GROUNDWATER SAMPLE COLLECTION FORM - STANDARD

Project Name:	MBLP/Shiras ASD & GW Monitoring	**Monitoring Location:**	MW-1
Project Number:	180827	**Sample ID:**	NA
Site Location:	Marquette, MI	**Well Type:**	2" galvanized
Weather/Temp.:	74°, some clouds	**Key Number:**	0356

INSPECTION

Label on well?	YES / [✓ NO] / REMEDIED	Is cement pad in good repair?	YES / NO / REMEDIED N/A
Is reference mark visible?	YES / [✓ NO] / REMEDIED	Is protective casing locked and in good repair?	[✓ YES] / NO / REMEDIED
Standing water present?	[✓ YES] / NO / REMEDIED	Is inner cap in place and properly sealing well?	[✓ YES] / NO / REMEDIED
Indication of surface runoff in well?	~~YES~~ / [✓ NO] / REMEDIED	Is well casing in visibly good repair?	[✓ YES] / NO / REMEDIED

Repair Notes:

STATIC WATER LEVEL

DATE: 5/30/18 **TIME:** 1209

Top of Casing Elevation:	NM ft	Measured with:	[✓ Electronic tape] / Chalked tape / Other:
Depth to Water:	+0.30 ft	Well depth verified?	[✓ YES] / NO
Elevation of Water:	— ft		

WELL PURGING

DATE: 5/30/18 **TIME:** 12:12

CALCULATION OF 3 CASING VOLUMES

Depth of well from TOC	29.44 ft
Depth to water	+(0.30 ft
Height of water column	= 29.74 ft
Conversion factor	X(0.49)
3 Water volumes	= 14.57 gallons
Actual volume purged:	~10 gallons

PURGE METHOD:

Bailer / Grundfos / Peristaltic / Bladder / Other: whale

Equipment #: 603

Conversion Factors (gallons/ft)	
1.25" well - 0.20	4" well - 1.96
2" well - 0.49	8" well - 7.83

WATER QUALITY STABILIZATION (If required)

Time	Volume Purged	pH	Spec Cond	Dissolved O_2	Temperature	Eh	Turbidity	
12:12	←start purge	(S.U.)	(µmhos/cm)	(mg/L)	(°C)	(mV)	(NTU)	
12:15	3	7.56	NA	NA	~~NA~~ 11.0	NA	~~NA~~ 201	
12:19	6	8.11	NA	NA	~~NA~~ 13.4	NA	~~NA~~ 118	purged dry at ~6 gal
1339	restart purge		~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	
1341	8	7.77	NA	NA	~~NA~~ 9.4	NA	~~NA~~ 1267	
1342	10	9.54	NA	NA	~~NA~~ 9.6	NA	~~NA~~ 951	purged dry at 10 gal total - second attempt
			NA	NA	NA	NA	NA	

FIELD ANALYSES

DATE: **TIME:**

Temperature:	NA	°C	Carbon Dioxide:	NA	mg/L	HACH CA-DT (RL = 10mg/L)
pH:		S.U.	Sulfide:	NA	mg/L	HACH HS-WR (RL = 0.05mg/L)
Specific Conductance:	NA	µmhos/cm	Ferrous Iron (Fe^{+2}):	NA	mg/L	HACH IR-18C (RL = 0.2mg/L)
Eh:	NA	mV				
Dissolved O_2:	NA	mg/L				
Turbidity:	NA	NTU				

SAMPLE COLLECTION

DATE: — **TIME:** —

Sample appearance:

Collection method: Bailer / Grundfos / Peristaltic / Bladder / Other:

Equipment #:

Filter used: 0.45 µm (8100) / 0.45 µm (8200) / NONE

Duplicate sample collected? YES / NO

MS/MSD sample collected? YES / NO

Chain of Custody Number:

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	250 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

Not Applicable

SAMPLING PERSONNEL

Name (SIGNATURE):

Name (SIGNATURE):

GROUNDWATER SAMPLE COLLECTION FORM - STANDARD

Project Name: MBLP/Shiras ASD & GW Monitoring
Monitoring Location: MW-1
Project Number: 180827
Sample ID: NA
Site Location: Marquette, MI
Well Type: 2" Galvanized
Weather/Temp.: 70°, sunny
Key Number: 0356

INSPECTION

Label on well?	YES / [✓ NO] / REMEDIED	Is cement pad in good repair?	YES / NO / REMEDIED NA
Is reference mark visible?	YES / [✓ NO] / REMEDIED	Is protective casing locked and in good repair?	[✓ YES] / NO / REMEDIED
Standing water present?	[✓ YES] / NO / REMEDIED	Is inner cap in place and properly sealing well?	[✓ YES] / NO / REMEDIED
Indication of surface runoff in well?	YES / [✓ NO] / REMEDIED	Is well casing in visibly good repair?	[✓ YES] / NO / REMEDIED

Repair Notes:

STATIC WATER LEVEL

DATE: 5/30/18
TIME: 11.43

Top of Casing Elevation: NM ft
Measured with: [✓ Electronic tape] / Chalked tape / Other:
Depth to Water: 0.70 ft
Well depth verified? [✓ YES] / NO
Elevation of Water: — ft

WELL PURGING

DATE: 5/30/18
TIME: 1145

CALCULATION OF 3 CASING VOLUMES

Depth of well from TOC 28.92 ft
Depth to water −(0.70 ft
Height of water column = 28.22 ✓ ft
Conversion factor X (0.49)
3 Water volumes = 13.83 ✓ gallons
Actual volume purged: 8 (5+3) gallons

PURGE METHOD:

Bailer / Grundfos / Peristaltic / Bladder / Other: whale
Equipment #: 603

Conversion Factors (gallons/ft)	
1.25" well - 0.20	4" well - 1.96
2" well - 0.49	8" well - 7.83

WATER QUALITY STABILIZATION (If required)

Time	Volume Purged	pH	Spec Cond	Dissolved O_2	Temperature	Eh	Turbidity	
1145	←start purge	(S.U.)	(μmhos/cm)	(mg/L)	[illegible] (°C)	(mV)	[illegible] (NTU)	
1149	5	8.01	NA	NA	~~NA~~ 12.9	NA	~~NA~~ 707 AU	purged dry at ~5 gal
1320	restart purge	—	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	
1321	6	7.59	NA	NA	~~NA~~ 10.0	NA	~~NA~~ 2504 AU	
1322	8	8.28	NA	NA	~~NA~~ 10.1	NA	~~NA~~ 1055 AU	purged dry at 8 gallons total - second time
			NA	NA	NA	NA	NA	
			NA	NA	NA	NA	NA	

FIELD ANALYSES

DATE:
TIME:

Temperature: NA °C
pH: S.U.
Specific Conductance: NA μmhos/cm
Eh: NA mV
Dissolved O_2: NA mg/L
Turbidity: NA NTU

Carbon Dioxide: NA mg/L HACH CA-DT (RL = 10mg/L)
Sulfide: NA mg/L HACH HS-WR (RL = 0.05mg/L)
Ferrous Iron (Fe^{+2}): NA mg/L HACH IR-18C (RL = 0.2mg/L)

SAMPLE COLLECTION

DATE: —
TIME: —

Sample appearance:
Collection method: Bailer / Grundfos / Peristaltic / Bladder / Other:
Equipment #:
Filter used: 0.45 μm (8100) / 0.45 μm (8200) / NONE

Duplicate sample collected? YES / NO
MS/MSD sample collected? YES / NO
Chain of Custody Number:

Not Applicable

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	250 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

SAMPLING PERSONNEL

Name (SIGNATURE):
Name (SIGNATURE):

GROUNDWATER SAMPLE COLLECTION FORM - STANDARD

Project Name: MBLP/Shiras ASD & GW Monitoring
Project Number: 180827
Site Location: Marquette, MI
Weather/Temp.:

Monitoring Location: MW-3
Sample ID: N/A
Well Type: 2" galvanized
Key Number: 0356

INSPECTION

Label on well? YES / [✓ NO] / REMEDIED
Is reference mark visible? YES / [✓ NO] / REMEDIED
Standing water present? [✓ YES] / NO / REMEDIED
Indication of surface runoff in well? YES / [✓ NO] / REMEDIED
Is cement pad in good repair? YES / NO / REMEDIED N/A
Is protective casing locked and in good repair? [✓ YES] / NO / REMEDIED
Is inner cap in place and properly sealing well? [✓ YES] / NO / REMEDIED
Is well casing in visibly good repair? [✓ YES] / NO / REMEDIED
Repair Notes:

STATIC WATER LEVEL

DATE: 5/30/18 TIME: 11:10

Top of Casing Elevation: NM ft
Depth to Water: 0.9 ft
Elevation of Water: — ft
Measured with: [✓ Electronic tape] / Chalked tape / Other:
Well depth verified? [✓ YES] / NO

WELL PURGING

DATE: 5/30/18 TIME: 1120

CALCULATION OF 3 CASING VOLUMES
Depth of well from TOC 29.01 ft
Depth to water −(0.90 ft
Height of water column = 28.11 ✓ ft
Conversion factor X(0.49)
3 Water volumes = 13.77 ✓ gallons
Actual volume purged: 5 9 gallons total

PURGE METHOD:
Bailer / Grundfos / Peristaltic / Bladder / Other: whale
Equipment #: 603

Conversion Factors (gallons/ft)	
1.25" well - 0.20	4" well - 1.96
2" well - 0.49	8" well - 7.83

WATER QUALITY STABILIZATION (if required)

Time	Volume Purged	pH	Spec Cond	Dissolved O_2	Temperature	Eh	Turbidity	
		(S.U.)	(µmhos/cm)	(mg/L)	(°C)	(mV)	(NTU) AU	
1120	←start purge							
1124	5	8.61	NA	NA	~~NA~~ 11.6	NA	~~NA~~ 3627	purged dry @ 5 gal
1303 ←	restart purge	—	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	
1304	6	6.95	NA	NA	~~NA~~ 11.2	NA	~~NA~~ 1493 AU	
1305	8	7.82	NA	NA	~~NA~~ 8.7	NA	~~NA~~ 98 NTU	purged dry at 9 gal (4 gal purged second time)
			NA	NA	NA	NA	NA	
			NA	NA	NA	NA	NA	

FIELD ANALYSES

DATE: TIME:

Temperature: NA °C
pH: S.U.
Specific Conductance: NA µmhos/cm
Eh: NA mV
Dissolved O_2: NA mg/L
Turbidity: NA NTU
Carbon Dioxide: NA mg/L HACH CA-DT (RL = 10mg/L)
Sulfide: NA mg/L HACH HS-WR (RL = 0.05mg/L)
Ferrous Iron (Fe^{+2}): NA mg/L HACH IR-18C (RL = 0.2mg/L)

SAMPLE COLLECTION

DATE: — TIME: —

Sample appearance:
Collection method: Bailer / Grundfos / Peristaltic / Bladder / Other:
Equipment #:
Filter used: 0.45 µm (8100) / 0.45 µm (8200) / NONE
Duplicate sample collected? YES / NO
MS/MSD sample collected? YES / NO
Chain of Custody Number:

Not Applicable

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	250 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

SAMPLING PERSONNEL

Name (SIGNATURE):
Name (SIGNATURE):

GROUNDWATER SAMPLE COLLECTION FORM - STANDARD

Project Name:	MBLP/Shiras ASD & GW Monitoring	Monitoring Location:	MW-4
Project Number:	180827	Sample ID:	N/A
Site Location:	Marquette, MI	Well Type:	2" PVC FM
Weather/Temp.:	64°, overcast	Key Number:	N/A

INSPECTION

Label on well?	[✓ YES] / NO / REMEDIED	Is cement pad in good repair?	[✓ YES] / NO / REMEDIED
Is reference mark visible?	[✓ YES] / NO / REMEDIED	Is protective casing locked and in good repair?	[✓ YES] / NO / REMEDIED
Standing water present?	YES / [✓ NO] / REMEDIED	Is inner cap in place and properly sealing well?	[✓ YES] / NO / REMEDIED
Indication of surface runoff in well?	YES / [✓ NO] / REMEDIED	Is well casing in visibly good repair?	[✓ YES] / NO / REMEDIED

Repair Notes:

STATIC WATER LEVEL

DATE: 5/30/18 TIME: 9:28

Top of Casing Elevation:	NM ft	Measured with:	[✓ Electronic tape] / Chalked tape / Other:
Depth to Water:	15.35 ft	Well depth verified?	[✓ YES] / NO
Elevation of Water:	— ft		

WELL PURGING

DATE: 5/30/18 TIME: ~~930~~ 0940 AS

CALCULATION OF 3 CASING VOLUMES

Depth of well from TOC 46.73 ft

Depth to water -(15.35 ft ✓

Height of water column = 31.38 ft

Conversion factor X(0.49)

3 Water volumes = 15.38 ✓ gallons

Actual volume purged: 8.5(5.5 + 3) gallons

PURGE METHOD:

Bailer / Grundfos / Peristaltic / Bladder / Other: whale

Equipment #: 603

Conversion Factors (gallons/ft)	
1.25" well - 0.20	4" well - 1.96
2" well - 0.49	8" well - 7.83

* 14:49 - purged dry a second time at 8.5 gal total (3 additional gallons purged)

WATER QUALITY STABILIZATION (if required)

AS

Time	Volume Purged	pH	Spec Cond	Dissolved O_2	Temperature	Eh	Turbidity	
0940 ~~930~~	←start purge	(S.U.)	(μmhos/cm)	(mg/L)	AS (°C)	(mV)	AS (NTU)	
* 0946	5.5	7.46	NA	NA	~~NA~~ 11.6	NA	~~NA~~ 23.6	* PURGED DRY @ 5.5 gal.
~~NA~~	~~4~~	NM	NA	NA	~~NA~~	NA	~~NA~~	WILL LET RECHARGE AND
~~NA~~	~~4.5~~	NM	NA	NA	~~NA~~	NA	~~NA~~	SAMPLE 5/31.
1446	restart purge		~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	** RETURNED TO PURGE
1447	7	7.80	NA	NA	NA 9.9	NA	~~NA~~ 40.1	DRY A SECOND TIME
1448	8	7.70	NA	NA	NA 9.7	NA	NA 30.2	SWL = 22.33

FIELD ANALYSES

DATE: — TIME: —

Temperature:	NA °C	Carbon Dioxide:	NA	mg/L	HACH CA-DT (RL = 10mg/L)
pH:	NM S.U.	Sulfide:	NA	mg/L	HACH HS-WR (RL = 0.05mg/L)
Specific Conductance:	NA μmhos/cm	Ferrous Iron (Fe^{+2}):	NA	mg/L	HACH IR-18C (RL = 0.2mg/L)
Eh:	NA mV				
Dissolved O_2:	NA mg/L				
Turbidity:	NA NTU				

SAMPLE COLLECTION

DATE: — TIME: —

Sample appearance:

Collection method: Bailer / Grundfos / Peristaltic / Bladder / Other:

Equipment #:

Filter used: 0.45 μm (8100) / 0.45 μm (8200) / NONE

Duplicate sample collected? YES / NO

MS/MSD sample collected? YES / NO

Chain of Custody Number:

Not Applicable

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	250 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

SAMPLING PERSONNEL

Name (SIGNATURE):

Name (SIGNATURE):

GROUNDWATER SAMPLE COLLECTION FORM - STANDARD

Project Name:	MBLP/Shiras ASD & GW Monitoring	**Monitoring Location:**	MW-5
Project Number:	180827	**Sample ID:**	N/A
Site Location:	Marquette, MI	**Well Type:**	2" PVC
Weather/Temp.:	63°, overcast	**Key Number:**	N/A

INSPECTION

Label on well?	YES / [✓ NO] / [✓ REMEDIED]	Is cement pad in good repair?	[✓ YES] / NO / REMEDIED
Is reference mark visible?	[✓ YES] / NO / REMEDIED	Is protective casing locked and in good repair?	[✓ YES] / NO / REMEDIED
Standing water present?	YES / [✓ NO] / REMEDIED	Is inner cap in place and properly sealing well?	[✓ YES] / NO / REMEDIED
Indication of surface runoff in well?	YES / [✓ NO] / REMEDIED	Is well casing in visibly good repair?	[✓ YES] / NO / REMEDIED

Repair Notes:

STATIC WATER LEVEL

DATE: 5/30/18 TIME: 8:50

Top of Casing Elevation:	– ft	Measured with:	[✓ Electronic tape] / Chalked tape / Other:
Depth to Water:	14.79 ft	Well depth verified?	[✓ YES] / NO
Elevation of Water:	– ft		

WELL PURGING

DATE: 5/30/18 TIME: 8:59

CALCULATION OF 3 CASING VOLUMES

Depth of well from TOC	44.75 ft
Depth to water	-(14.79) ft
Height of water column	= 29.96 ✓ ft
Conversion factor	X(0.49) ✓
3 Water volumes	= 14.68 ✓ gallons
Actual volume purged:	17.0 gallons

PURGE METHOD:

Bailer / Grundfos / Peristaltic / Bladder / Other: WHALE

Equipment #: # 603

Conversion Factors (gallons/ft)	
1.25" well - 0.20	4" well - 1.96
2" well - 0.49	8" well - 7.83

WATER QUALITY STABILIZATION (if required)

Time	Volume Purged	pH (S.U.)	Spec Cond (µmhos/cm)	Dissolved O_2 (mg/L)	Temperature (°C)	Eh (mV)	Turbidity (NTU)	
8:59	←start purge							
0904	5	7.28	NA	NA	NA	NA	NA	TURBIDITY: 70BAN, TEMP: 11.1°C
0908	10	7.48	NA	NA	NA	NA	NA	TURBIDITY: 199 NTU TEMP 11.0°C
0915	15	7.42	NA	NA	NA	NA	NA	TUR. : 11.5 NTU TEMP: 6.7°C
			NA	NA	NA	NA	NA	
			NA	NA	NA	NA	NA	
			NA	NA	NA	NA	NA	

FIELD ANALYSES

DATE: 5/30/18 TIME: 0917

Temperature:	10.2 ~~NA~~	°C
pH:	7.46	S.U.
Specific Conductance:	NA	µmhos/cm
Eh:	NA	mV
Dissolved O_2:	NA	mg/L
Turbidity:	12.8 ~~NA~~	NTU

Carbon Dioxide:	NA	mg/L	HACH CA-DT (RL = 10mg/L)
Sulfide:	NA	mg/L	HACH HS-WR (RL = 0.05mg/L)
Ferrous Iron (Fe^{+2}):	NA	mg/L	HACH IR-18C (RL = 0.2mg/L)

SAMPLE COLLECTION

DATE: TIME:

Sample appearance:

Collection method: Bailer / Grundfos / Peristaltic / Bladder / Other:

Equipment #:

Filter used: 0.45 µm (8100) / 0.45 µm (8200) / NONE

Duplicate sample collected? YES / NO

MS/MSD sample collected? YES / NO

Chain of Custody Number:

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	250 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

Not Applicable

SAMPLING PERSONNEL

Name (SIGNATURE):

Name (SIGNATURE):

GROUNDWATER SAMPLE COLLECTION FORM - LOW FLOW

Project Name: MBLP/Shiras ASD & GW Monitoring
Monitoring Location: MW-1
Project Number: 180827
Sample ID: MBLPS-18-0S-MW-1(I/MS/MSD)
Site Location: Marquette, MI
Well Type: 2" galvanized
Weather/Temp: 75, sunny, some clouds
Key Number: 0356

INSPECTION

Label on well? YES / [✓ NO] / REMEDIED
Is reference mark visible? YES / [✓ NO] / REMEDIED
Standing water present? [✓ YES] / NO / REMEDIED
Indication of surface runoff in well? YES / [✓ NO] / REMEDIED
Is cement pad in good repair? YES / NO / REMEDIED NA
Is protective casing locked and in good repair? [✓ YES] / NO / REMEDIED
Is inner cap in place and properly sealing well? [✓ YES] / NO / REMEDIED
Is well casing in visibly good repair? [✓ YES] / NO / REMEDIED
Repair Notes: casing full of water to top, bailed out, ADDED 12" OF M.F.

STATIC WATER LEVEL

DATE: 5/31/18 TIME: 1553
Top of Casing Elevation: NM ft
Depth to Water: 0.04 ft
Elevation of Water: — ft
Measured with: [✓ Electronic tape] / Chalked tape / Other:
Well depth verified? YES / [✓ NO]

*PURGED @ HIGH RATE FOR 10 MINS TO ATTEMPT TO STABILIZE H2O LEVEL.

WELL PURGING

DATE: 5/31/18 TIME: 1555
Purge Method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:
Pump intake @ 2.5 ft from ____ TOC or ✓ bottom
Equipment No.: 552
Measured well depth: 29.44 ft
Screen length: 5 ft
Depth to screen midpoint: 26.94 ft

Time	Water Level (feet)	Drawdown (feet)	Pumping Rate (mL/min)	pH (S.U.)	Temp (°C)	Spec Cond (µmhos/cm)	Turbidity (NTU)	Eh (mV)	D.O. (mg/L)
1618	6.14	6.10	140	7.64	14.3	1357	14.0	472	0.29
1621	6.15	6.11	140	7.63	14.9	1361	21.0	471	0.30
1624	6.15	6.11	140	7.62	14.9	1378	21.2	471	0.30
1627	6.15	6.11	140	7.62	14.8	1370	20.0	470	0.29
Volume: 2.1	(Gallons)		Stabilization Criteria:	±0.1	±3%	±3%	±10% for values >20	±10 mV	±10%

✓

FIELD ANALYSES

DATE: 5/31/18 TIME: 1628
Temperature: 14.9 °C
pH: 7.62 S.U.
Specific Conductance: 1367 µmhos/cm
Eh: 469 mV
Dissolved Oxygen: 0.29 mg/L
Turbidity: 14.5 NTU
Carbon Dioxide: NA mg/L HACH CA-DT (RL = 10 mg/L)
Sulfide (S^{-2}): NA mg/L HACH HS-WR (RL = 0.05 mg/L)
Ferrous Iron (Fe^{+2}): NA mg/L HACH IR-18C (RL = 0.2 mg/L)

SAMPLE COLLECTION

DATE: 5/31/18 TIME: 1629 ✓
Sample appearance: clear
Collection method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:
Equipment No.: 552
Filter used: 0.45 µm (8100) / 0.45 µm (8200) / [✓ NONE]
Duplicate sample collected? YES / [✓ NO]
MS/MSD sample collected? [✓ YES] / NO
Chain of Custody Number: Appx III *G042036 ✓
Chain of Custody Number: Appx IV G042060 (Radium only) ✓
✓ *Designated MS/MSD location*

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	125 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	G041501
3	500 mL	Plastic	No	None	Fl ✓
3	500 mL	Plastic	No	None	Boron, Calcium ✓ *
3	500 mL	Plastic	No	HNO_3	Cl, Fl, pH, TDS, SO_4 ✓ *
3	500 mL	Plastic	No	HNO_3	Sb, As, Ba, Be, Cd, Cr, Co, Pb, Hg, Mo, Se, Tl, Li ✓
9	1000 mL	Plastic	No	HNO_3	Radium 226, Radium 228 ✓
	1000 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

SAMPLING PERSONNEL

Name (SIGNATURE):
Name (SIGNATURE):

Appendix B

Outlier Tests for Selected Uncensored Variables

User Selected Options

Date/Time of Computation	ProUCL 5.17/27/2018 2:26:36 PM
From File	WorkSheet_a.xls
Full Precision	OFF

Dixon's Outlier Test for Background

Number of Observations = 18
10% critical value: 0.424
5% critical value: 0.475
1% critical value: 0.561

1. Observation Value 7.93 is a Potential Outlier (Upper Tail)?

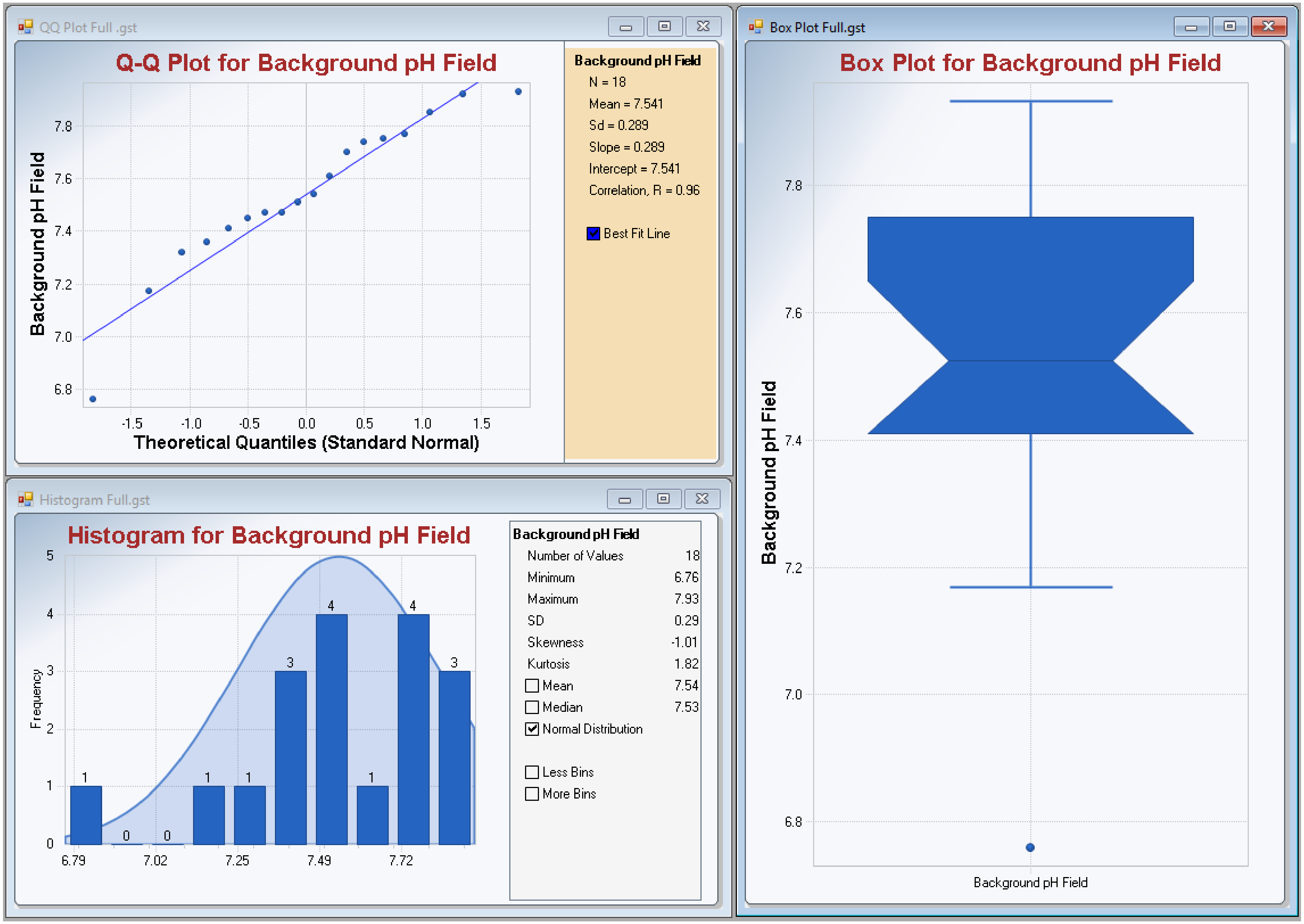
Test Statistic: 0.131

For 10% significance level, 7.93 is not an outlier.
For 5% significance level, 7.93 is not an outlier.
For 1% significance level, 7.93 is not an outlier.

2. Observation Value 6.76 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.514

For 10% significance level, 6.76 is an outlier.
For 5% significance level, 6.76 is an outlier.
For 1% significance level, 6.76 is not an outlier.



Background pH Field
N = 18
Mean = 7.541
Sd = 0.289
Slope = 0.289
Intercept = 7.541
Correlation, R = 0.96

☑ Best Fit Line

Background pH Field	
Number of Values	18
Minimum	6.76
Maximum	7.93
SD	0.29
Skewness	-1.01
Kurtosis	1.82
☐ Mean	7.54
☐ Median	7.53
☑ Normal Distribution	
☐ Less Bins	
☐ More Bins	

Data Visualization for detection of Potential Outliers

Appendix C

Goodness-of-Fit Test Statistics for Uncensored Full Data Sets without Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.17/27/2018 3:27:19 PM
From File	WorkSheet_a.xls
Full Precision	OFF
Confidence Coefficient	0.99

Background

Raw Statistics

Number of Valid Observations	18
Number of Distinct Observations	17
Minimum	6.76
Maximum	7.93
Mean of Raw Data	7.541
Standard Deviation of Raw Data	0.289
Khat	701.7
Theta hat	0.0107
Kstar	584.8
Theta star	0.0129
Mean of Log Transformed Data	2.02
Standard Deviation of Log Transformed Data	0.0391

Normal GOF Test Results

Correlation Coefficient R	0.96
Shapiro Wilk Test Statistic	0.929
Shapiro Wilk Critical (0.01) Value	0.858
Approximate Shapiro Wilk P Value	0.182
Lilliefors Test Statistic	0.112
Lilliefors Critical (0.01) Value	0.235

Data appear Normal at (0.01) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.958
A-D Test Statistic	0.387
A-D Critical (0.01) Value	1.006
K-S Test Statistic	0.11
K-S Critical(0.01) Value	0.236

Data appear Gamma Distributed at (0.01) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.953
Shapiro Wilk Test Statistic	0.917
Shapiro Wilk Critical (0.01) Value	0.858
Approximate Shapiro Wilk P Value	0.109
Lilliefors Test Statistic	0.118
Lilliefors Critical (0.01) Value	0.235

Data appear Lognormal at (0.01) Significance Level

Appendix D

```
Normal Background Statistics for Uncensored Full Data Sets

User Selected Options
Date/Time of Computation      ProUCL 5.17/27/2018 2:58:33 PM
From File                     WorkSheet_a.xls
Full Precision                OFF
Confidence Coefficient            99%
Coverage                          99%
New or Future K Observations        1

Background

General Statistics
Total Number of Observations                      18  Number of Distinct Observations                  17
Minimum                                         6.76  First Quartile                                 7.42
Second Largest                                  7.92  Median                                        7.525
Maximum                                         7.93  Third Quartile                                7.748
Mean                                           7.541  SD                                            0.289
Coefficient of Variation                      0.0384  Skewness                                     -1.012
Mean of logged Data                             2.02  SD of logged Data                            0.0391

Critical Values for Background Threshold Values (BTVs)
Tolerance Factor K (For UTL)                    3.96  d2max (for USL)                               2.821

Normal GOF Test
Shapiro Wilk Test Statistic                    0.929  Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value                 0.897  Data appear Normal at 5% Significance Level
Lilliefors Test Statistic                      0.112  Lilliefors GOF Test
5% Lilliefors Critical Value                   0.202  Data appear Normal at 5% Significance Level
Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution
  99% UTL with   99% Coverage                  8.686  90% Percentile (z)                            7.911
  99% UPL (t)                                  8.303  95% Percentile (z)                            8.016
  99% USL                                      8.356  99% Percentile (z)                            8.213

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set  free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV


One Sample t-Test for Uncensored Full Data Sets without NDs

User Selected Options
Date/Time of Computation      ProUCL 5.17/27/2018 3:08:00 PM
From File                     WorkSheet_a.xls
Full Precision                OFF
Confidence Coefficient            99%
Substantial Difference              0
Action Level                        0
Selected Null Hypothesis      Mean <= Action Level (Form 1)
Alternative Hypothesis        Mean > the Action Level
```

```
Background

One Sample t-Test

Raw Statistics
Number of Valid Observations                  18
Number of Distinct Observations               17
Minimum                                     6.76
Maximum                                     7.93
Mean                                       7.541
Median                                     7.525
SD                                         0.289
SE of Mean                                0.0682

H0: Sample Mean <= 0   (Form 1)

Test Value                                 110.6
Degrees of Freedom                            17
Critical Value (0.01)                      2.567
P-Value                                 4.88E-26

Conclusion with Alpha = 0.01
  Reject H0, Conclude Mean > 0
  P-Value < Alpha (0.01)
```

Appendix E

```
                                  Mann-Kendall Trend Test Analysis
User Selected Options
Date/Time of Computation          ProUCL 5.17/27/2018 3:40:33 PM
From File                         WorkSheet_a.xls
Full Precision                    OFF
Confidence Coefficient                 0.99
Level of Significance                  0.01

pH-mw-1

General Statistics
Number of Events Reported (m)                   9
Number of Missing Events                        0
Number or Reported Events Used                  9
Number Values Reported (n)                      9
Minimum                                      6.56
Maximum                                      7.62
Mean                                        7.449
Geometric Mean                              7.442
Median                                       7.56
Standard Deviation                          0.337
Coefficient of Variation                   0.0452

Mann-Kendall Test
M-K Test Value (S)                             13
Tabulated p-value                            0.13
Standard Deviation of S                     9.539
Standardized Value of S                     1.258
Approximate p-value                         0.104

Insufficient evidence to identify a significant
 trend at the specified level of significance.

pH-mw-2

General Statistics
Number of Events Reported (m)                   9
Number of Missing Events                        0
Number or Reported Events Used                  9
Number Values Reported (n)                      9
Minimum                                      7.03
Maximum                                      8.41
Mean                                        7.987
Geometric Mean                              7.978
Median                                       8.09
Standard Deviation                          0.386
Coefficient of Variation                   0.0483
```

Mann-Kendall Test

M-K Test Value (S)	-17
Tabulated p-value	0.06
Standard Deviation of S	9.539
Standardized Value of S	-1.677
Approximate p-value	0.0467

Insufficient evidence to identify a significant trend at the specified level of significance.

pH-mw-3

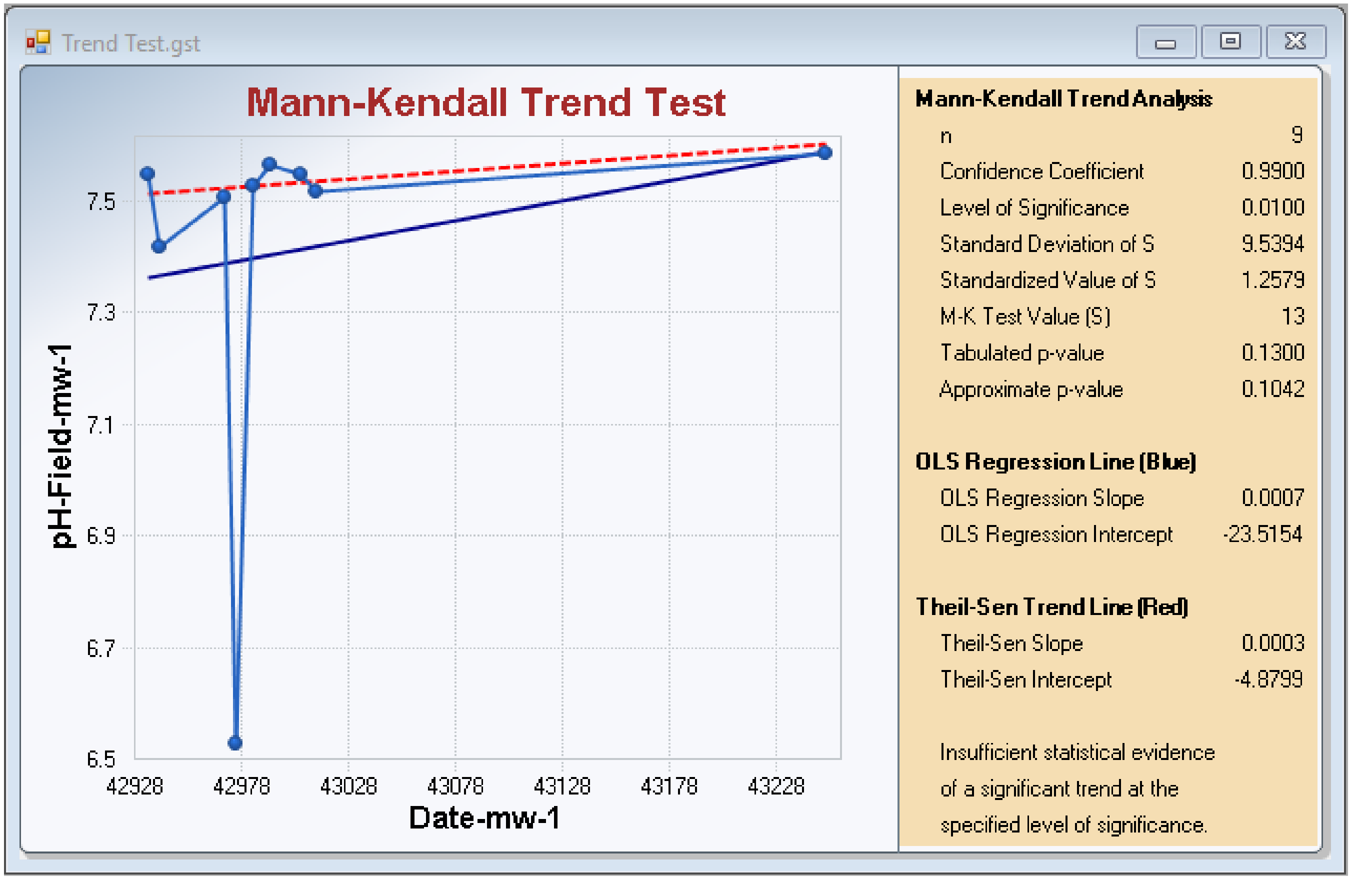
General Statistics

Number of Events Reported (m)	9
Number of Missing Events	0
Number or Reported Events Used	9
Number Values Reported (n)	9
Minimum	6.32
Maximum	8.1
Mean	7.763
Geometric Mean	7.744
Median	7.86
Standard Deviation	0.556
Coefficient of Variation	0.0716

Mann-Kendall Test

M-K Test Value (S)	10
Tabulated p-value	0.179
Standard Deviation of S	9.592
Standardized Value of S	0.938
Approximate p-value	0.174

Insufficient evidence to identify a significant trend at the specified level of significance.



Mann-Kendall Trend Analysis

n	9
Confidence Coefficient	0.9900
Level of Significance	0.0100
Standard Deviation of S	9.5394
Standardized Value of S	1.2579
M-K Test Value (S)	13
Tabulated p-value	0.1300
Approximate p-value	0.1042

OLS Regression Line (Blue)

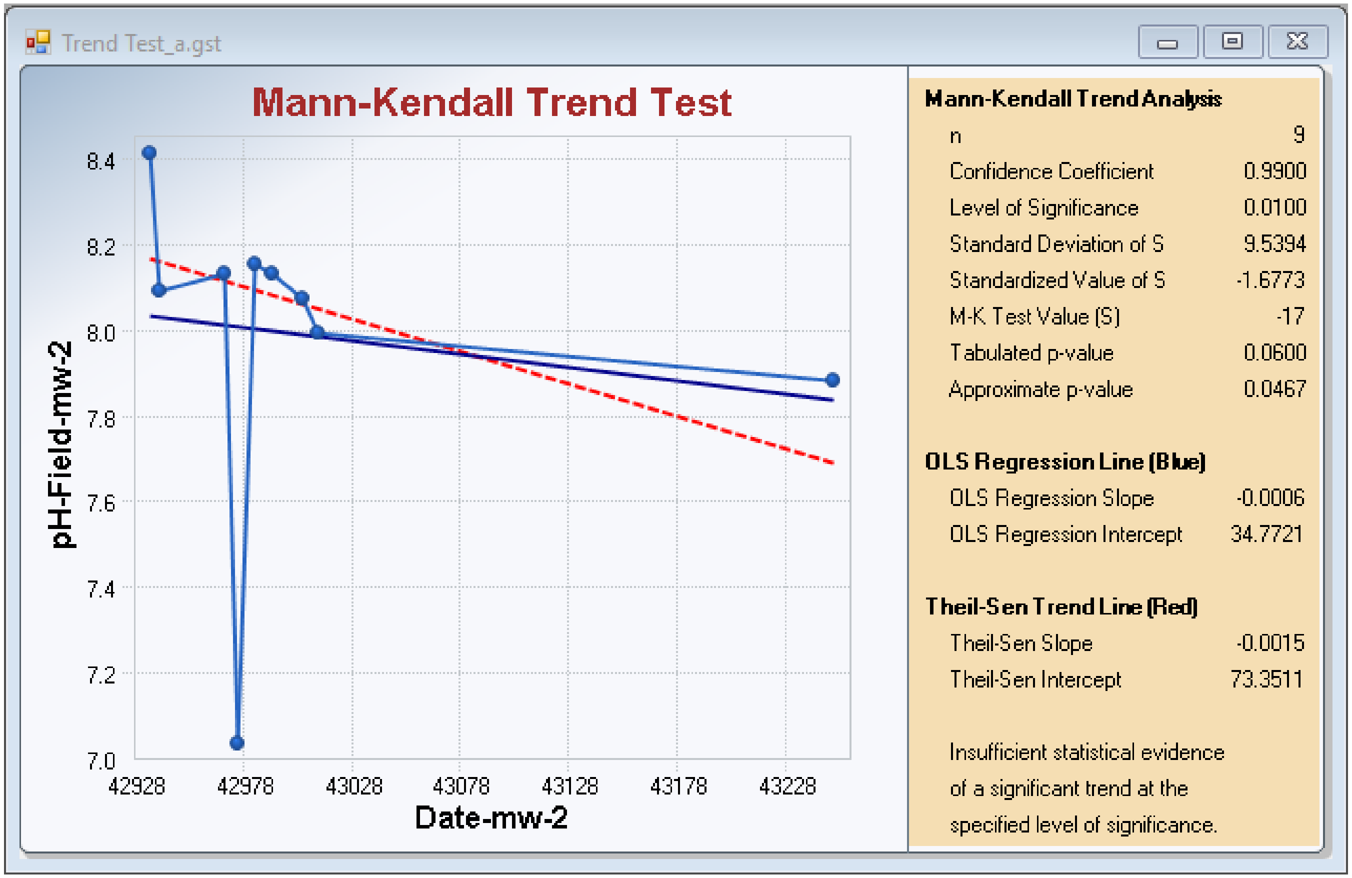
OLS Regression Slope	0.0007
OLS Regression Intercept	-23.5154

Theil-Sen Trend Line (Red)

Theil-Sen Slope	0.0003
Theil-Sen Intercept	-4.8799

Insufficient statistical evidence of a significant trend at the specified level of significance.

Trend Analysis for MW-1



Mann-Kendall Trend Analysis

n	9
Confidence Coefficient	0.9900
Level of Significance	0.0100
Standard Deviation of S	9.5394
Standardized Value of S	-1.6773
M-K Test Value (S)	-17
Tabulated p-value	0.0600
Approximate p-value	0.0467

OLS Regression Line (Blue)

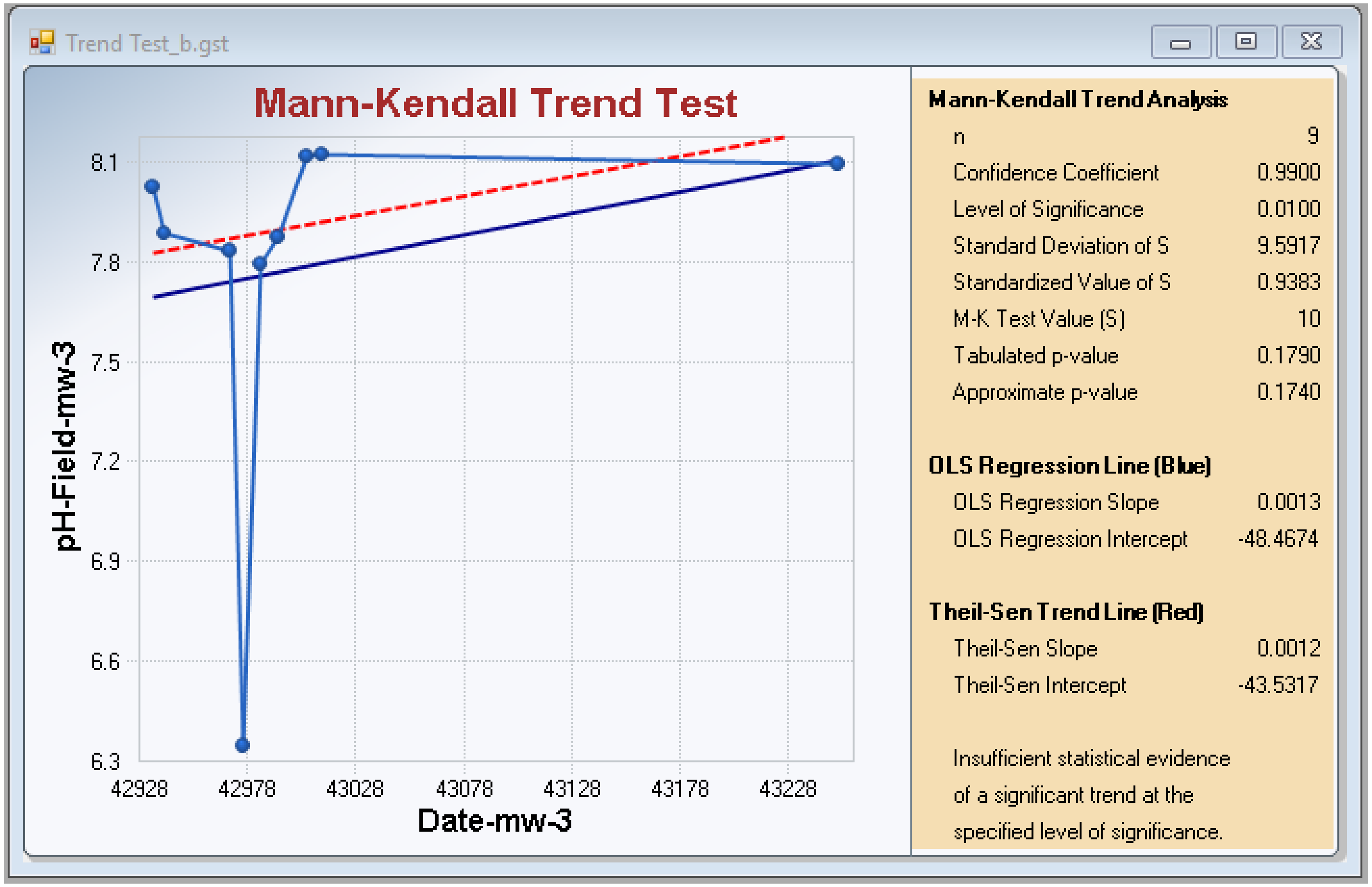
OLS Regression Slope	-0.0006
OLS Regression Intercept	34.7721

Theil-Sen Trend Line (Red)

Theil-Sen Slope	-0.0015
Theil-Sen Intercept	73.3511

Insufficient statistical evidence of a significant trend at the specified level of significance.

Trend Analysis for MW-1



Mann-Kendall Trend Analysis

n	9
Confidence Coefficient	0.9900
Level of Significance	0.0100
Standard Deviation of S	9.5917
Standardized Value of S	0.9383
M-K Test Value (S)	10
Tabulated p-value	0.1790
Approximate p-value	0.1740

OLS Regression Line (Blue)

OLS Regression Slope	0.0013
OLS Regression Intercept	-48.4674

Theil-Sen Trend Line (Red)

Theil-Sen Slope	0.0012
Theil-Sen Intercept	-43.5317

Insufficient statistical evidence of a significant trend at the specified level of significance.

Trend Analysis for MW-1

Appendix B

Fishbeck, Thompson, Carr & Huber, Inc.

MBLP/Shiras ASD & GW Monitoring.

Marquette, MI

ftc&h

Project No. 180827

Retention ponds, facing NNW.

Retention ponds, facing W.

Well development (MW-4)

Well development (MW-4)

Equipment decon between locations.

Dumping of development water.

ftc&h **Project No.:** 180827 **Date:** 5/31/2018 **Project Name:** MBLP/Shiras ASD & GW Monitoring.

Offshore wells (MW-3)

Development of offshore locations (MW-3)

Low flow sampling offshore location (MW-3)

Low flow sampling offshore location (MW-1)

EQUIPMENT CALIBRATION FORM

Project Name: MBLP/Shiras ASD & GW Monitoring

Project Number: 180827

Date/Time: 5/30/18 8:40

Initials: AD

NA = Not Applicable

Parameter	Standard	Lot Number	Units	Measured Value	Measurement Temperature (°C)	Calibration Verification Acceptance Window	Instrument Model/ID Number
pH	4.00	4612941-011117	S.U.	4.06	21.1	3.9 - 4.1	YSI PP #513
	7.00	4709695-110817	S.U.	7.06		6.9 - 7.1	
	10.00	462804-011117	S.U.	9.99		9.9 - 10.1	
Specific Conductance	147		µmhos/cm			132 - 162	
	1412		µmhos/cm			1342 - 1484	
	2765		µmhos/cm			2628 - 2905	
Eh	Zobell's solution		mV				
Dissolved Oxygen	NA	NA	mg/L			±10% Theoretical:	
Turbidity	10 NTU	A6272	NTU	9.41	—	9 - 11	LaMotte 2020we #410

Notes:

EQUIPMENT CALIBRATION VERIFICATION FORM

Project Name: MBLP/Shiras ASD & GW Monitoring
Project Number: 180827
Date/Time: 5/30/18 1225
Initials: AD

NA = Not Applicable

Parameter	Standard	Lot Number	Units	Measured Value	Measurement Temperature (°C)	Calibration Verification Acceptance Window	Instrument Model/ ID Number
pH	7.00	4709C45-110817	S.U.	7.02	23.2	6.9 - 7.1	YSI Pro
Specific Conductance	1412		µmhos/cm			1342 - 1484	
Eh	Zobell's solution		mV				
Dissolved Oxygen	NA	NA	mg/L			±10% Theoretical:	
Turbidity	10 NTU		NTU		NA	9 - 11	

Notes:

EQUIPMENT CALIBRATION VERIFICATION FORM

Project Name: MBLP/Shiras ASD & GW Monitoring

Project Number: 180827

Date/Time: 5/30/18 1500

Initials: AFS

NA = Not Applicable

Parameter	Standard	Lot Number	Units	Measured Value	Measurement Temperature (°C)	Calibration Verification Acceptance Window	Instrument Model/ ID Number
pH	7.00	4709C95-110817	S.U.	7.04	21.3	6.9 - 7.1	YSI P.P. #~~345~~ 513
Specific Conductance	1412		µmhos/cm			1342 - 1484	
Eh	Zobell's solution		mV				
Dissolved Oxygen	NA	NA	mg/L			±10% Theoretical:	
Turbidity	10 NTU	A6272	NTU	9.22	NA	9 - 11	1-2020 we #4510

Notes:

EQUIPMENT CALIBRATION FORM

Project Name: MBLP/Shiras ASD & GW Monitoring

Project Number: 180827

Date/Time: 5/31/18 1000

Initials: APS

NA = Not Applicable

Parameter	Standard	Lot Number	Units	Measured Value	Measurement Temperature (°C)	Calibration Verification Acceptance Window	Instrument Model/ID Number
pH	4.00	4612941-011117	S.U.	3.98	18.5	3.9 - 4.1	YSI P.P. #429
	7.00	4709095-110317	S.U.	7.04		6.9 - 7.1	
	10.00	4612804-011117	S.U.	10.00		9.9 - 10.1	
Specific Conductance	147	SC180208-1C	µmhos/cm	161	18.7	132 - 162	↓
	1412	SC180208-2A	µmhos/cm	1410		1342 - 1484	
	2765	SC180103-3C	µmhos/cm	2802		2628 - 2905	
Eh	Zobell's solution	20B2045-1	mV	429.5	18.8	425.8-445.8	
Dissolved Oxygen	NA	NA	mg/L	9.20	19.8	±10% Theoretical: 9.09	
Turbidity	10 NTU	A6272	NTU	9.75	–	9 - 11	L.2020we

Notes:

EQUIPMENT CALIBRATION VERIFICATION FORM

Project Name: MBLP/Shiras ASD & GW Monitoring

Project Number: 180827

Date/Time: 5/31/18 1130

Initials: APS

NA = Not Applicable

Parameter	Standard	Lot Number	Units	Measured Value	Measurement Temperature (°C)	Calibration Verification Acceptance Window	Instrument Model/ ID Number
pH	7.00	SAME AS INITIAL	S.U.	7.07	19.8	6.9 - 7.1	YSI P.P. #428
Specific Conductance	1412	CAL.	µmhos/cm	1370	19.9	1342 - 1484	
Eh	Zobell's solution		mV	427.8	19.8	424.5-444.5	
Dissolved Oxygen	NA	NA	mg/L	9.93	15.8	±10% Theoretical: 9.87	
Turbidity	10 NTU		NTU	10.67	NA	9 - 11	L.2020we #6

Notes:

EQUIPMENT CALIBRATION FORM

Project Name: MBLP/Shiras ASD & GW Monitoring

Project Number: 180827

Date/Time: 5/31/18 10:20

Initials: AD

NA = Not Applicable

Parameter	Standard	Lot Number	Units	Measured Value	Measurement Temperature (°C)	Calibration Verification Acceptance Window	Instrument Model/ID Number
pH	4.00	4612941-01117	S.U.	3.98	19.4	3.9 - 4.1	YSI pp #513
	7.00	4709C95-110817	S.U.	7.01		6.9 - 7.1	
	10.00	4612804-01117	S.U.	9.97		9.9 - 10.1	
Specific Conductance	147	SC180208-1D	µmhos/cm	157.6	19.2	132 - 162	↓
	1412	SC180208-2B	µmhos/cm	1371		1342 - 1484	
	2765	SC180103-3D	µmhos/cm	2663		2628 - 2905	
Eh	Zobell's solution	ZOB21045-1	mV	427.5	19.5	424.5-444.5	
Dissolved Oxygen	NA	NA	mg/L	9.50	19.0	±10% Theoretical: 9.28	
Turbidity	10 NTU	A6272	NTU	9.52	—	9 - 11	LaMotte 2020we #410

Notes:

EQUIPMENT CALIBRATION VERIFICATION FORM

Project Name: MBLP/Shiras ASD & GW Monitoring
Project Number: 180827
Date/Time: 5/31/18 1345
Initials: AD

NA = Not Applicable

Parameter	Standard	Lot Number	Units	Measured Value	Measurement Temperature (°C)	Calibration Verification Acceptance Window	Instrument Model/ ID Number
pH	7.00	Same as	S.U.	7.08	25.7	6.9 - 7.1	YSI PP 513
Specific Conductance	1412	initial cal.	µmhos/cm	1420	25.1	1342 - 1484	
Eh	Zobell's solution		mV	424.0	21.7	421.9 - 441.9	
Dissolved Oxygen	NA	NA	mg/L	9.07	16	±10% Theoretical: 9.87	
Turbidity	10 NTU		NTU	10.6	NA	9 - 11	LaMotte 2020we #410

Notes:

EQUIPMENT CALIBRATION VERIFICATION FORM

Project Name: MBLP/Shiras ASD & GW Monitoring
Project Number: 180827
Date/Time: 5/31/18 1635
Initials: AD

NA = Not Applicable

Parameter	Standard	Lot Number	Units	Measured Value	Measurement Temperature (°C)	Calibration Verification Acceptance Window	Instrument Model/ ID Number
pH	7.00	Same as initial	S.U.	7.08	28.8	6.9 - 7.1	YSI PP #513
Specific Conductance	1412	cal.	µmhos/cm	1478	21.4	1342 - 1484	
Eh	Zobell's solution		mV	427.3	17.6	427.1 - 447.1	
Dissolved Oxygen	NA	NA	mg/L	9.04	16.6	±10% Theoretical: 9.67	
Turbidity	10 NTU		NTU	4.7	NA	9 - 11	L-2020 we #410

Notes:

GROUNDWATER SAMPLE COLLECTION FORM - STANDARD

Project Name:	MBLP/Shiras ASD & GW Monitoring	**Monitoring Location:**	MW-1
Project Number:	180827	**Sample ID:**	NA
Site Location:	Marquette, MI	**Well Type:**	2" galvanized
Weather/Temp.:	74°, some clouds	**Key Number:**	0356

INSPECTION

Label on well?	YES / [✓ NO] / REMEDIED	Is cement pad in good repair?	YES / NO / REMEDIED N/A
Is reference mark visible?	YES / [✓ NO] / REMEDIED	Is protective casing locked and in good repair?	[✓ YES] / NO / REMEDIED
Standing water present?	[✓ YES] / NO / REMEDIED	Is inner cap in place and properly sealing well?	[✓ YES] / NO / REMEDIED
Indication of surface runoff in well?	[✓ NA] ~~YES~~ / [✓ NO] / REMEDIED	Is well casing in visibly good repair?	[✓ YES] / NO / REMEDIED

Repair Notes:

STATIC WATER LEVEL

DATE: 5/30/18 TIME: 1209

Top of Casing Elevation:	NM ft	Measured with:	[✓ Electronic tape] / Chalked tape / Other:
Depth to Water:	+0.30 ft	Well depth verified?	[✓ YES] / NO
Elevation of Water:	— ft		

WELL PURGING

DATE: 5/30/18 TIME: 12:12

CALCULATION OF 3 CASING VOLUMES

Depth of well from TOC	29.44 ft
Depth to water	+(0.30 ft
Height of water column	= 29.74 ft
Conversion factor	X(0.49)
3 Water volumes	= 14.57 gallons
Actual volume purged:	~10 gallons

PURGE METHOD:

Bailer / Grundfos / Peristaltic / Bladder / Other: whale

Equipment #: 603

Conversion Factors (gallons/ft)	
1.25" well - 0.20	4" well - 1.96
2" well - 0.49	8" well - 7.83

WATER QUALITY STABILIZATION (If required)

Time	Volume Purged	pH	Spec Cond	Dissolved O_2	Temperature	Eh	Turbidity	
12:12	←start purge	(S.U.)	(µmhos/cm)	(mg/L)	(°C)	(mV)	(NTU)	
12:15	3	7.56	NA	NA	~~NA~~ 11.0	NA	~~NA~~ 201	
12:19	6	8.11	NA	NA	~~NA~~ 13.4	NA	~~NA~~ 118	purged dry at ~6 gal
1339	restart purge		~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	
1341	8	7.77	NA	NA	~~NA~~ 9.4	NA	~~NA~~ 1267	
1342	10	9.54	NA	NA	~~NA~~ 9.6	NA	~~NA~~ 951	purged dry at 10 gal total - second attempt
			NA	NA	NA	NA	NA	

FIELD ANALYSES

DATE: TIME:

Temperature:	NA	°C	Carbon Dioxide:	NA	mg/L	HACH CA-DT (RL = 10mg/L)
pH:		S.U.	Sulfide:	NA	mg/L	HACH HS-WR (RL = 0.05mg/L)
Specific Conductance:	NA	µmhos/cm	Ferrous Iron (Fe^{+2}):	NA	mg/L	HACH IR-18C (RL = 0.2mg/L)
Eh:	NA	mV				
Dissolved O_2:	NA	mg/L				
Turbidity:	NA	NTU				

SAMPLE COLLECTION

DATE: — TIME: —

Sample appearance:

Collection method: Bailer / Grundfos / Peristaltic / Bladder / Other:

Equipment #:

Filter used: 0.45 µm (8100) / 0.45 µm (8200) / NONE

Duplicate sample collected? YES / NO

MS/MSD sample collected? YES / NO

Chain of Custody Number:

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	250 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

Not Applicable

SAMPLING PERSONNEL

Name (SIGNATURE):

Name (SIGNATURE):

GROUNDWATER SAMPLE COLLECTION FORM - STANDARD

Project Name: MBLP/Shiras ASD & GW Monitoring
Monitoring Location: MW-2
Project Number: 180827
Sample ID: NA
Site Location: Marquette, MI
Well Type: 2" Galvanized
Weather/Temp.: 70°, sunny
Key Number: 0356

INSPECTION

Label on well? YES [✓ NO] / REMEDIED
Is reference mark visible? YES / [✓ NO] / REMEDIED
Standing water present? [✓ YES] / NO / REMEDIED
Indication of surface runoff in well? YES [✓ NO] / REMEDIED
Is cement pad in good repair? YES / NO / REMEDIED NA
Is protective casing locked and in good repair? [✓ YES] / NO / REMEDIED
Is inner cap in place and properly sealing well? [✓ YES] / NO / REMEDIED
Is well casing in visibly good repair? [✓ YES] / NO / REMEDIED
Repair Notes:

STATIC WATER LEVEL

DATE: 5/30/18
TIME: 11.43
Top of Casing Elevation: NM ft
Measured with: [✓ Electronic tape] / Chalked tape / Other:
Depth to Water: 0.70 ft
Well depth verified? [✓ YES] / NO
Elevation of Water: — ft

WELL PURGING

DATE: 5/30/18
TIME: 1145

CALCULATION OF 3 CASING VOLUMES

Depth of well from TOC 28.92 ft
Depth to water −(0.70 ft
Height of water column = 28.22 ✓ ft
Conversion factor X (0.49)
3 Water volumes = 13.83 ✓ gallons
Actual volume purged: 8 (5+3) gallons

PURGE METHOD:
Bailer / Grundfos / Peristaltic / Bladder / Other: whale
Equipment #: 607

Conversion Factors (gallons/ft)	
1.25" well - 0.20	4" well - 1.96
2" well - 0.49	8" well - 7.83

WATER QUALITY STABILIZATION (If required)

Time	Volume Purged	pH	Spec Cond	Dissolved O_2	Temperature	Eh	Turbidity	
1145	←start purge	(S.U.)	(µmhos/cm)	(mg/L)	(°C)	(mV)	(NTU)	
1149	5	8.01	NA	NA	~~NA~~ 12.9	NA	~~NA~~ 707 AU	pursed dry at ~5 gal
1320	restart purge	—	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	
1321	6	7.59	NA	NA	~~NA~~ 10.0	NA	~~NA~~ 2504 AU	
1322	8	8.28	NA	NA	~~NA~~ 10.1	NA	~~NA~~ 1055 AU	purged dry at 8 gallons total - second time
			NA	NA	NA	NA	NA	
			NA	NA	NA	NA	NA	

FIELD ANALYSES

DATE:
TIME:
Temperature: NA °C
pH: S.U.
Specific Conductance: NA µmhos/cm
Eh: NA mV
Dissolved O_2: NA mg/L
Turbidity: NA NTU
Carbon Dioxide: NA mg/L HACH CA-DT (RL = 10mg/L)
Sulfide: NA mg/L HACH HS-WR (RL = 0.05mg/L)
Ferrous Iron (Fe^{+2}): NA mg/L HACH IR-18C (RL = 0.2mg/L)

SAMPLE COLLECTION

DATE: –
TIME: –
Sample appearance:
Collection method: Bailer / Grundfos / Peristaltic / Bladder / Other:
Equipment #:
Filter used: 0.45 µm (8100) / 0.45 µm (8200) / NONE
Duplicate sample collected? YES / NO
MS/MSD sample collected? YES / NO
Chain of Custody Number:

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	250 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

Not Applicable

SAMPLING PERSONNEL

Name (SIGNATURE):
Name (SIGNATURE):

GROUNDWATER SAMPLE COLLECTION FORM - STANDARD

Project Name: MBLP/Shiras ASD & GW Monitoring
Monitoring Location: MW-3
Project Number: 180827
Sample ID: N/A
Site Location: Marquette, MI
Well Type: 2" galvanized
Weather/Temp.:
Key Number: 0356

INSPECTION

Label on well? YES / [✓ NO] / REMEDIED
Is cement pad in good repair? YES / NO / REMEDIED N/A
Is reference mark visible? YES / [✓ NO] / REMEDIED
Is protective casing locked and in good repair? [✓ YES] / NO / REMEDIED
Standing water present? [✓ YES] / NO / REMEDIED
Is inner cap in place and properly sealing well? [✓ YES] / NO / REMEDIED
Indication of surface runoff in well? YES / [✓ NO] / REMEDIED
Is well casing in visibly good repair? [✓ YES] / NO / REMEDIED
Repair Notes:

STATIC WATER LEVEL

DATE: 5/30/18 TIME: 11:10

Top of Casing Elevation: NM ft
Measured with: [✓ Electronic tape] / Chalked tape / Other:
Depth to Water: 0.9 ft
Well depth verified? [✓ YES] / NO
Elevation of Water: — ft

WELL PURGING

DATE: 5/30/18 TIME: 1120

CALCULATION OF 3 CASING VOLUMES

Depth of well from TOC 24.01 ft
Depth to water −(0.90 ft
Height of water column = 28.11 ✓ ft
Conversion factor X(0.49)
3 Water volumes = 13.77 ✓ gallons
Actual volume purged: 5 ~~10~~ 9 gallons total

PURGE METHOD:
Bailer / Grundfos / Peristaltic / Bladder / Other: whale
Equipment #: 603

Conversion Factors (gallons/ft)	
1.25" well - 0.20	4" well - 1.96
2" well - 0.49	8" well - 7.83

WATER QUALITY STABILIZATION (If required)

Time	Volume Purged	pH	Spec Cond	Dissolved O_2	Temperature	Eh	Turbidity	
		(S.U.)	(µmhos/cm)	(mg/L)	ND (°C)	(mV)	ND (NTU)	AU
1120	←start purge							
1124	5	8.61	NA	NA	~~NA~~ 11.6	NA	~~NA~~ 3677	purged dry @ 5 gal
1303 ←	restart purge	—	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	
1304	6	6.95	NA	NA	~~NA~~ 11.2	NA	~~NA~~ 1493	AU
1305	8	7.82	NA	NA	~~NA~~ 8.7	NA	~~NA~~ 98 NTU	purged dry at 9 gal (4 gal purged second time)
			NA	NA	NA	NA	NA	
			NA	NA	NA	NA	NA	

FIELD ANALYSES

DATE: TIME:

Temperature: NA °C
pH: S.U.
Specific Conductance: NA µmhos/cm
Eh: NA mV
Dissolved O_2: NA mg/L
Turbidity: NA NTU

Carbon Dioxide: NA mg/L HACH CA-DT (RL = 10mg/L)
Sulfide: NA mg/L HACH HS-WR (RL = 0.05mg/L)
Ferrous Iron (Fe^{+2}): NA mg/L HACH IR-18C (RL = 0.2mg/L)

SAMPLE COLLECTION

DATE: — TIME: —

Sample appearance:
Duplicate sample collected? YES / NO
Collection method: Bailer / Grundfos / Peristaltic / Bladder / Other:
MS/MSD sample collected? YES / NO
Equipment #:
Chain of Custody Number:
Filter used: 0.45 µm (8100) / 0.45 µm (8200) / NONE

Not Applicable

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	250 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

SAMPLING PERSONNEL

Name (SIGNATURE):
Name (SIGNATURE):

GROUNDWATER SAMPLE COLLECTION FORM - STANDARD

Project Name: MBLP/Shiras ASD & GW Monitoring
Monitoring Location: MW-4
Project Number: 180827
Sample ID: N/A
Site Location: Marquette, MI
Well Type: 2" PVC FM
Weather/Temp.: 64°, overcast
Key Number: N/A

INSPECTION

Label on well? [✓ YES] / NO / REMEDIED
Is reference mark visible? [✓ YES] / NO / REMEDIED
Standing water present? YES / [✓ NO] / REMEDIED
Indication of surface runoff in well? YES / [✓ NO] / REMEDIED
Is cement pad in good repair? [✓ YES] / NO / REMEDIED
Is protective casing locked and in good repair? [✓ YES] / NO / REMEDIED
Is inner cap in place and properly sealing well? [✓ YES] / NO / REMEDIED
Is well casing in visibly good repair? [✓ YES] / NO / REMEDIED
Repair Notes:

STATIC WATER LEVEL

DATE: 5/30/18 TIME: 9:28

Top of Casing Elevation: NM ft
Depth to Water: 15.35 ft
Elevation of Water: — ft
Measured with: [✓ Electronic tape] / Chalked tape / Other:
Well depth verified? [✓ YES] / NO

WELL PURGING

DATE: 5/30/18 TIME: ~~430~~ 0940 (ABS)

CALCULATION OF 3 CASING VOLUMES
Depth of well from TOC 46.73 ft
Depth to water −(15.35 ft
Height of water column = 31.38 ft ✓
Conversion factor X(0.49)
3 Water volumes = 15.37 ✓ gallons
Actual volume purged: 8.5(5.5+3) gallons

PURGE METHOD:
Bailer / Grundfos / Peristaltic / Bladder / Other: whale
Equipment #: 603

Conversion Factors (gallons/ft)	
1.25" well - 0.20	4" well - 1.96
2" well - 0.49	8" well - 7.83

* 14:49 - purged dry a second time at 8.5 gal total (3 additional gallons purged)

WATER QUALITY STABILIZATION (if required)

(ABS)

Time	Volume Purged	pH	Spec Cond	Dissolved O_2	Temperature	Eh	Turbidity	
0940 ~~430~~	←start purge	(S.U.)	(µmhos/cm)	(mg/L)	(ABS) (°C)	(mV)	(ABS) (NTU)	
* 0946	5.5	7.46	NA	NA	~~NA~~ 11.6	NA	~~NA~~ 23.6	* PURGED DRY @ 5.5 gal.
~~NA~~	~~"~~	NM	NA	NA	~~NA~~	NA	~~NA~~	WILL LET RECHARGE AND
~~NA~~	~~4 or 5~~	NM	NA	NA	~~NA~~	NA	~~NA~~	SAMPLE 5/31.
1446	restart purge		~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	** RETURNED TO PURGE
1447	7	7.80	NA	NA	NA 9.9	NA	~~NA~~ 40.1	DRY A SECOND TIME.
1448	8	7.70	NA	NA	NA 9.7	NA	NA 30.2	SWL = 22.33

FIELD ANALYSES

DATE: — TIME: —

Temperature: NA °C
pH: NM S.U.
Specific Conductance: NA µmhos/cm
Eh: NA mV
Dissolved O_2: NA mg/L
Turbidity: NA NTU
Carbon Dioxide: NA mg/L HACH CA-DT (RL = 10mg/L)
Sulfide: NA mg/L HACH HS-WR (RL = 0.05mg/L)
Ferrous Iron (Fe^{+2}): NA mg/L HACH IR-18C (RL = 0.2mg/L)

SAMPLE COLLECTION

DATE: — TIME: —

Sample appearance:
Collection method: Bailer / Grundfos / Peristaltic / Bladder / Other:
Equipment #:
Filter used: 0.45 µm (8100) / 0.45 µm (8200) / NONE
Duplicate sample collected? YES / NO
MS/MSD sample collected? YES / NO
Chain of Custody Number:

Not Applicable

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	250 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

SAMPLING PERSONNEL

Name (SIGNATURE):
Name (SIGNATURE):

GROUNDWATER SAMPLE COLLECTION FORM - STANDARD

Project Name: MBLP/Shiras ASD & GW Monitoring

Project Number: 180827

Site Location: Marquette, MI

Weather/Temp.: 63°, overcast

Monitoring Location: MW-5

Sample ID: N/A

Well Type: 2" PVC

Key Number: N/A

INSPECTION

Label on well? YES / ~~NO~~ / [✓ REMEDIED]

Is reference mark visible? [✓ YES] / NO / REMEDIED

Standing water present? YES / [✓ NO] / REMEDIED

Indication of surface runoff in well? YES / [✓ NO] / REMEDIED

Is cement pad in good repair? [✓ YES] / NO / REMEDIED

Is protective casing locked and in good repair? [✓ YES] / NO / REMEDIED

Is inner cap in place and properly sealing well? [✓ YES] / NO / REMEDIED

Is well casing in visibly good repair? [✓ YES] / NO / REMEDIED

Repair Notes:

STATIC WATER LEVEL

DATE: 5/30/18 TIME: 8:50

Top of Casing Elevation: – ft

Depth to Water: 14.79 ft

Elevation of Water: – ft

Measured with: [✓ Electronic tape] / Chalked tape / Other:

Well depth verified? [✓ YES] / NO

WELL PURGING

DATE: 5/30/18 TIME: 8:59

CALCULATION OF 3 CASING VOLUMES

Depth of well from TOC 44.75 ft

Depth to water –(14.79 ft

Height of water column = 29.96 ✓ ft

Conversion factor X(0.49)

3 Water volumes = 14.68 ✓ gallons

Actual volume purged: 17.0 gallons

PURGE METHOD:

Bailer / Grundfos / Peristaltic / Bladder / Other: WHALE

Equipment #: # 603

Conversion Factors (gallons/ft)	
1.25" well - 0.20	4" well - 1.96
2" well - 0.49	8" well - 7.83

WATER QUALITY STABILIZATION (if required)

Time	Volume Purged	pH	Spec Cond	Dissolved O_2	Temperature	Eh	Turbidity	
8:59	←start purge	(S.U.)	(µmhos/cm)	(mg/L)	(°C)	(mV)	(NTU)	
0904	5	7.28	NA	NA	NA	NA	NA	TURBIDITY: 70BAN, TEMP: 11.1°C
0908	10	7.48	NA	NA	NA	NA	NA	TURBIDITY: 199 NTU TEMP 11.0°C
0915	15	7.42	NA	NA	NA	NA	NA	TUR.: 11.5 NTU TEMP: 6.7°C
			NA	NA	NA	NA	NA	
			NA	NA	NA	NA	NA	
			NA	NA	NA	NA	NA	

FIELD ANALYSES

DATE: 5/30/18 TIME: 0917

Temperature: 10.2 ~~NA~~ °C

pH: 7.46 S.U.

Specific Conductance: NA µmhos/cm

Eh: NA mV

Dissolved O_2: NA mg/L

Turbidity: 12.8 ~~NA~~ NTU

Carbon Dioxide: NA mg/L HACH CA-DT (RL = 10mg/L)

Sulfide: NA mg/L HACH HS-WR (RL = 0.05mg/L)

Ferrous Iron (Fe^{+2}): NA mg/L HACH IR-18C (RL = 0.2mg/L)

SAMPLE COLLECTION

DATE: TIME:

Sample appearance:

Collection method: Bailer / Grundfos / Peristaltic / Bladder / Other:

Equipment #:

Filter used: 0.45 µm (8100) / 0.45 µm (8200) / NONE

Duplicate sample collected? YES / NO

MS/MSD sample collected? YES / NO

Chain of Custody Number:

Not Applicable

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	250 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

SAMPLING PERSONNEL

Name (SIGNATURE):

Name (SIGNATURE):

GROUNDWATER SAMPLE COLLECTION FORM - LOW FLOW

Project Name: MBLP/Shiras ASD & GW Monitoring
Monitoring Location: MW-1
Project Number: 180827
Sample ID: MBLPS-18-0S-MW-1(I/MS/MSD)
Site Location: Marquette, MI
Well Type: 2" galvanized
Weather/Temp: 75, sunny, some clouds
Key Number: 0356

INSPECTION

Label on well? YES / [✓ NO] / REMEDIED
Is reference mark visible? YES / [✓ NO] / REMEDIED
Standing water present? [✓ YES] / NO / REMEDIED
Indication of surface runoff in well? YES / [✓ NO] / REMEDIED
Is cement pad in good repair? YES / NO / REMEDIED NA
Is protective casing locked and in good repair? [✓ YES] / NO / REMEDIED
Is inner cap in place and properly sealing well? [✓ YES] / NO / REMEDIED
Is well casing in visibly good repair? [✓ YES] / NO / REMEDIED
Repair Notes: casing full of water to top, bailed out, ADDED 12" OF M.F.

STATIC WATER LEVEL

DATE: 5/31/18 TIME: 1553
Top of Casing Elevation: NM ft
Depth to Water: 0.04 ft
Elevation of Water: — ft
Measured with: [✓ Electronic tape] / Chalked tape / Other:
Well depth verified? YES / [✓ NO]

*PURGED @ HIGH RATE FOR 10 MINS TO ATTEMPT TO STABILIZE H2O LEVEL.

WELL PURGING

DATE: 5/31/18 TIME: 1555
Purge Method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:
Pump intake @ 2.5 ft from ____ TOC or ✓ bottom
Equipment No.: 552
Measured well depth: 29.44 ft
Screen length: 5 ft
Depth to screen midpoint: 26.94 ft

Time	Water Level (feet)	Drawdown (feet)	Pumping Rate (mL/min)	pH (S.U.)	Temp (°C)	Spec Cond (µmhos/cm)	Turbidity (NTU)	Eh (mV)	D.O. (mg/L)
1618	6.14	6.10	140	7.64	14.3	1357	14.0	472	0.29
1621	6.15	6.11	140	7.63	14.9	1361	21.0	471	0.30
1624	6.15	6.11	140	7.62	14.9	1378	21.2	471	0.30
1627	6.15	6.11	140	7.62	14.8	1370	20.0	470	0.29
Volume:	2.1	(Gallons)	Stabilization Criteria:	±0.1	±3%	±3%	±10% for values >20	±10 mV	±10% ✓

FIELD ANALYSES

DATE: 5/31/18 TIME: 1628
Temperature: 14.9 °C
pH: 7.62 S.U.
Specific Conductance: 1367 µmhos/cm
Eh: 469 mV
Dissolved Oxygen: 0.29 mg/L
Turbidity: 14.5 NTU
Carbon Dioxide: NA mg/L HACH CA-DT (RL = 10 mg/L)
Sulfide (S^{-2}): NA mg/L HACH HS-WR (RL = 0.05 mg/L)
Ferrous Iron (Fe^{+2}): NA mg/L HACH IR-18C (RL = 0.2 mg/L)

SAMPLE COLLECTION

DATE: 5/31/18 TIME: 1629 ✓
Sample appearance: clear
Collection method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:
Equipment No.: 552
Filter used: 0.45 µm (8100) / 0.45 µm (8200) / [✓ NONE]
Duplicate sample collected? YES / [✓ NO]
MS/MSD sample collected? [✓ YES] / NO
Chain of Custody Number: Appx III *G042036 ✓
Chain of Custody Number: Appx IV G042060 (Radium only) ✓
✓ Designated MS/MSD location

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	125 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	G041501
3	500 mL	Plastic	No	None	Fl ✓
3	500 mL	Plastic	No	None	Boron, Calcium ✓ *
3	500 mL	Plastic	No	HNO_3	Cl, Fl, pH, TDS, SO_4 ✓ *
3	500 mL	Plastic	No	HNO_3	Sb, As, Ba, Be, Cd, Cr, Co, Pb, Hg, Mo, Se, Tl, Li ✓
9	1000 mL	Plastic	No	HNO_3	Radium 226, Radium 228 ✓
	1000 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

SAMPLING PERSONNEL

Name (SIGNATURE):
Name (SIGNATURE):

GROUNDWATER SAMPLE COLLECTION FORM - LOW FLOW

Project Name: MBLP/Shiras ASD & GW Monitoring
Monitoring Location: MW-2
Project Number: 180827
Sample ID: MBLPS-18-05-MW-2(I) & (D)
Site Location: Marquette, MI
Well Type: 2" galvanized
Weather/Temp: 76°, some clouds
Key Number: 0356

INSPECTION

Label on well? YES / [✓ NO] / REMEDIED
Is reference mark visible? YES / [✓ NO] / REMEDIED
Standing water present? Ⓝ ~~YES~~ / [✓ NO] / REMEDIED
Indication of surface runoff in well? YES / [✓ NO] / REMEDIED
Is cement pad in good repair? YES / NO / REMEDIED N/A
Is protective casing locked and in good repair? [✓ YES] / NO / REMEDIED
Is inner cap in place and properly sealing well? [✓ YES] / NO / REMEDIED
Is well casing in visibly good repair? [✓ YES] / NO / REMEDIED
Repair Notes: added 1' MasterFlex

STATIC WATER LEVEL

DATE: 5/31/18 TIME: 1421
Top of Casing Elevation: NM ft
Measured with: [✓ Electronic tape] / Chalked tape / Other:
Depth to Water: 1.09 ft
Well depth verified? YES / [✓ NO]
Elevation of Water: — ft

* purged at high rate for 5 minutes to try to stabilize H2O level

WELL PURGING

DATE: 5/31/18 TIME: 1423
Purge Method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:
Pump intake @ 2.5 ft from ___ TOC or ✓ bottom
Equipment No.: 552
Measured well depth: 28.92 ft
Screen length: 5 ft
Depth to screen midpoint: 26.42 ft

Time	Water Level (feet)	*Drawdown (feet)	Pumping Rate (mL/min)	pH (S.U.)	Temp (°C)	Spec Cond (µmhos/cm)	*Turbidity (NTU)	Eh (mV)	D.O. (mg/L)
1447	5.61	4.52	160	7.88	12.0	578	28.3 ~~493~~ (AD)	~~28.~~493	0.26
1450	5.81	4.72	100	7.88	12.3	574	17.8	492	0.26
1453	5.85	4.76	100	7.88	13.3	571	18.2	491	0.26
1456	5.89	4.80	100	7.88	13.6	576	19.7	490	0.26
1459	5.90	4.81	100	7.88	14.0	575	20.8	489	0.27
1502	5.94	4.85	100	7.89	13.9	577	23.1	488	0.26
1505	5.97	4.88	100	7.89	14.1	575	26.0	487	0.25
Volume: 1.9	(Gallons)		Stabilization Criteria:	±0.1	±3%	±3%	±10% for values >20	±10 mV	±10% ✓

FIELD ANALYSES

DATE: 5/31/18 TIME: 1506
Temperature: 14.1 °C
pH: 7.88 S.U.
Specific Conductance: 575 µmhos/cm
Eh: 487 mV
Dissolved Oxygen: 0.24 mg/L
Turbidity: 24.4 NTU

Carbon Dioxide: NA mg/L HACH CA-DT (RL = 10 mg/L)
Sulfide (S^{-2}): NA mg/L HACH HS-WR (RL = 0.05 mg/L)
Ferrous Iron (Fe^{+2}): NA mg/L HACH IR-18C (RL = 0.2 mg/L)

* Drawdown and turbidity did not stabilize in 45 minutes

SAMPLE COLLECTION

DATE: 5/31/18 TIME: 1507 ✓
Sample appearance: clear
Collection method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:
Equipment No.: 552
Filter used: 0.45 µm (8100) / 0.45 µm (8200) / [✓ NONE]
Duplicate sample collected? [✓ YES] NO
MS/MSD sample collected? YES [✓ NO]
* Chain of Custody Number: Appx III 6042036 ✓
Chain of Custody Number: Appx IV 6042060 ✓
✓ ***Designated duplicate location***

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	125 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
2	500 mL	Plastic	No	None	Fl ✓
2	500 mL	Plastic	No	None	Boron, Calcium ✓ *
2	500 mL	Plastic	No	HNO_3	Cl, Fl, pH, TDS, SO_4 ✓ *
2	500 mL	Plastic	No	HNO_3	Sb, As, Ba, Be, Cd, Cr, Co, Pb, Hg, Mo, Se, Tl, Li ✓
6	1000 mL	Plastic	No	HNO_3	Radium 226, Radium 228 ✓
	1000 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

SAMPLING PERSONNEL

Name (SIGNATURE):
Name (SIGNATURE):

GROUNDWATER SAMPLE COLLECTION FORM - LOW FLOW

Project Name: MBLP/Shiras ASD & GW Monitoring
Monitoring Location: MW-3
Project Number: 180827
Sample ID: MBLPS-18-05-MW-3(I)
Site Location: Marquette, MI
Well Type: 2" BK AD galvanized
Weather/Temp: 70°, cloudy
Key Number: 0356

INSPECTION

Label on well? YES / [✓ NO] / REMEDIED
Is reference mark visible? YES / [✓ NO] / REMEDIED
Standing water present? AD ~~YES~~ / [✓ NO] / REMEDIED
Indication of surface runoff in well? YES / [✓ NO] / REMEDIED
Is cement pad in good repair? YES / NO / REMEDIED NA
Is protective casing locked and in good repair? [✓ YES] / NO / REMEDIED
Is inner cap in place and properly sealing well? [✓ YES] / NO / REMEDIED
Is well casing in visibly good repair? [✓ YES] / NO / REMEDIED
Repair Notes:

STATIC WATER LEVEL

DATE: 5/31/18 TIME: 1250

Top of Casing Elevation: NM ft
Measured with: [✓ Electronic tape] / Chalked tape / Other:
Depth to Water: 0.25 ft
Well depth verified? YES / [✓ NO]
Elevation of Water: — ft

*PURGED @ HIGH RATE FOR 5 MINS TO TRY TO STABILIZE H2O LEVEL.

WELL PURGING

DATE: 5/31/18 TIME: 12:54

Purge Method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:
Pump intake @ 2.5 ft from ____ TOC or ✓ bottom
Equipment No.: 552
Measured well depth: 29.01 ft
Screen length: 5 ft
Depth to screen midpoint: 26.51 ft

Time	Water Level (feet)	Drawdown (feet) *	Pumping Rate (mL/min)	pH (S.U.)	Temp (°C)	Spec Cond (µmhos/cm)	Turbidity (NTU) *	Eh (mV)	D.O. (mg/L)
1323	5.68	5.43	100	8.08	14.5	489	20.0	550	0.66
1326	5.96	5.71	100	8.08	14.5	493	16.7	547	0.66
1329	6.31	6.06	100	8.08	14.9	488	18.6	542	0.66
1332	6.45	6.20	100	8.07	15.1	490	18.1	539	0.65
1335	6.62	6.37	100	8.08	14.6	496	20.6	538	0.65
1338	6.78	6.	100	8.07	14.9	490	16.6	535	0.63
Volume: 1.5	(Gallons)		Stabilization Criteria:	±0.1	±3%	±3%	±10% for values >20	±10 mV	±10%

FIELD ANALYSES

DATE: 5/31/18 TIME: 13:40

Temperature: 14.9 °C
pH: 8.07 S.U.
Specific Conductance: 491 µmhos/cm
Eh: 535 mV
Dissolved Oxygen: 0.62 mg/L
Turbidity: 19.0 NTU

Carbon Dioxide: NA mg/L HACH CA-DT (RL = 10 mg/L)
Sulfide (S^{-2}): NA mg/L HACH HS-WR (RL = 0.05 mg/L)
Ferrous Iron (Fe^{+2}): NA mg/L HACH IR-18C (RL = 0.2 mg/L)

*DID NOT STABILIZE IN 45 MINS.

SAMPLE COLLECTION

DATE: 5/31/18 TIME: 1341 ✓

Sample appearance: clear
Collection method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:
Equipment No.: 552
Filter used: 0.45 µm (8100) / 0.45 µm (8200) / [✓ NONE]
Duplicate sample collected? YES / [✓ NO]
MS/MSD sample collected? YES / [✓ NO]
*Chain of Custody Number: Appx III G042036 ✓
Chain of Custody Number: Appx IV G042059 ✓

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	125 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
1	500 mL	Plastic	No	None	Fl ✓
1	500 mL	Plastic	No	None	Boron, Calcium ✓ *
1	500 mL	Plastic	No	HNO_3	Cl, Fl, pH, TDS, SO_4 ✓ *
1	500 mL	Plastic	No	HNO_3	Sb, As, Ba, Be, Cd, Cr, Co, Pb, Hg, Mo, Se, Tl, Li ✓
3	1000 mL	Plastic	No	HNO_3	Radium 226, Radium 228 ✓
	1000 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

SAMPLING PERSONNEL

Name (SIGNATURE):
Name (SIGNATURE):

GROUNDWATER SAMPLE COLLECTION FORM - LOW FLOW

Project Name: MBLP/Shiras ASD & GW Monitoring
Monitoring Location: MW-4
Project Number: 180827
Sample ID: MBLPS-18-05-MW-4(I)
Site Location: Marquette, MI
Well Type: 2" PVC FM
Weather/Temp: SUN, 65°
Key Number: NONE

INSPECTION

Label on well? [✓ YES] / NO / REMEDIED
Is reference mark visible? [✓ YES] / NO / REMEDIED
Standing water present? YES / [✓ NO] / REMEDIED
Indication of surface runoff in well? YES / [✓ NO] / REMEDIED
Is cement pad in good repair? [✓ YES] / NO / REMEDIED
Is protective casing locked and in good repair? [✓ YES] / NO / REMEDIED
Is inner cap in place and properly sealing well? [✓ YES] / NO / REMEDIED
Is well casing in visibly good repair? [✓ YES] / NO / REMEDIED
Repair Notes:

STATIC WATER LEVEL DATE: 5/31/18 TIME: 1021

Top of Casing Elevation: – ft
Depth to Water: 15.10 ft
Elevation of Water: – ft
Measured with: [✓ Electronic tape] / Chalked tape / Other:
Well depth verified? YES / [✓ NO]

WELL PURGING DATE: 5/31/18 TIME: 1022

Purge Method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:
Pump intake @ 2.5 ft from ____ TOC or ✓ bottom
Equipment No.: 397
Measured well depth: ____ ft
Screen length: ____ ft
Depth to screen midpoint: ____ ft

Time	Water Level (feet)	Drawdown (feet) *	Pumping Rate (mL/min)	pH (S.U.)	Temp (°C)	Spec Cond (μmhos/cm)	Turbidity (NTU)	Eh (mV)	D.O. (mg/L)
1100	24.58	9.48	100	7.61	11.3	1735	13.5	143	0.87
1103	24.80	9.70	100	7.61	11.5	1735	12.5	144	0.84
1106	25.12	10.02	100	7.61	11.4	1728	~~11.4~~ 12.4	143	0.83
Volume: 1.6	(Gallons)		Stabilization Criteria:	±0.1	±3%	±3%	±10% for values >20	±10 mV	±10% ✓

FIELD ANALYSES DATE: 5/31/18 TIME: 1107

Temperature: 11.4 °C
pH: 7.61 S.U.
Specific Conductance: 1739 μmhos/cm
Eh: 144 mV
Dissolved Oxygen: 0.84 mg/L
Turbidity: 11.4 NTU
Carbon Dioxide: NA mg/L HACH CA-DT (RL = 10 mg/L)
Sulfide (S^{-2}): NA mg/L HACH HS-WR (RL = 0.05 mg/L)
Ferrous Iron (Fe^{+2}): NA mg/L HACH IR-18C (RL = 0.2 mg/L)

*DRAWDOWN DID NOT STABILIZE IN 45 MINS.

SAMPLE COLLECTION DATE: 5/31/18 TIME: 1108 ✓

Sample appearance: CLEAR
Collection method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:
Equipment No.: 397
Filter used: 0.45 μm (8100) / 0.45 μm (8200) / [✓ NONE]
Duplicate sample collected? YES / [✓ NO]
MS/MSD sample collected? YES / [✓ NO]
*Chain of Custody Number: Appx III 6042036 ✓
Chain of Custody Number: Appx IV 6042059 ✓

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	125 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
1	500 mL	Plastic	No	None	Fl ✓
1	500 mL	Plastic	No	None	Boron, Calcium ✓
1	500 mL	Plastic	No	HNO_3	Cl, Fl, pH, TDS, SO_4 ✓
1	500 mL	Plastic	No	HNO_3	Sb, As, Ba, Be, Cd, Cr, Co, Pb, Hg, Mo, Se, Tl, Li ✓
3	1000 mL	Plastic	No	HNO_3	Radium 226, Radium 228 ✓
	1000 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

SAMPLING PERSONNEL

Name (SIGNATURE):
Name (SIGNATURE):

GROUNDWATER SAMPLE COLLECTION FORM - LOW FLOW

Project Name:	MBLP/Shiras ASD & GW Monitoring	**Monitoring Location:**	MW-5
Project Number:	180827	**Sample ID:**	MBLP5-18-05-MW-5(I)
Site Location:	Marquette, MI	**Well Type:**	2" PVC
Weather/Temp:	65°, cloudy	**Key Number:**	

INSPECTION

Label on well? [✓ YES] / NO / REMEDIED

Is reference mark visible? [✓ YES] / NO / REMEDIED

Standing water present? YES / [✓ NO] / REMEDIED

Indication of surface runoff in well? YES / [✓ NO] / REMEDIED

Is cement pad in good repair? [✓ YES] / NO / REMEDIED

Is protective casing locked and in good repair? [✓ YES] / NO / REMEDIED

Is inner cap in place and properly sealing well? [✓ YES] / NO / REMEDIED

Is well casing in visibly good repair? [✓ YES] / NO / REMEDIED

Repair Notes:

STATIC WATER LEVEL **DATE:** 5/31/18 **TIME:** 10:23

Top of Casing Elevation: NM ft

Depth to Water: 14.78 ft

Elevation of Water: – ft

Measured with: [✓ Electronic tape] / Chalked tape / Other:

Well depth verified? YES / [✓ NO]

WELL PURGING **DATE:** 5/31/18 **TIME:** 1033

Purge Method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:

Pump intake @ 2.5' ft from ____ TOC or ✓ bottom

Equipment No.: 552

Measured well depth: 44.75 ft

Screen length: 5 ft

Depth to screen midpoint: 42.25 ft

Time	Water Level (feet)	Drawdown (feet)	Pumping Rate (mL/min)	pH (S.U.)	Temp (°C)	Spec Cond (μmhos/cm)	Turbidity (NTU)	Eh (mV)	D.O. (mg/L)
1109	16.37	1.59	220	7.47	11.0	1102	8.79	489.5	3.16
1112	16.37	1.59	220	7.47	11.0	1102	8.17	491.6	3.18
1115	16.37	1.59	220	7.47	11.1	1103	6.91	493.2	3.17
1118	16.37	1.59	220	7.47	11.1	1103	7.45	494.9	3.19
Volume: 2.5	(Gallons)		Stabilization Criteria:	±0.1	±3%	±3%	±10% for values >20	±10 mV	±10%

✓

FIELD ANALYSES **DATE:** 5/31/18 **TIME:** 1119

Temperature: 11.0 °C

pH: 7.47 S.U.

Specific Conductance: 1103 μmhos/cm

Eh: 4955 mV

Dissolved Oxygen: 3.19 mg/L

Turbidity: 6.76 NTU

Carbon Dioxide: NA mg/L HACH CA-DT (RL = 10 mg/L)

Sulfide (S^{-2}): NA mg/L HACH HS-WR (RL = 0.05 mg/L)

Ferrous Iron (Fe^{+2}): NA mg/L HACH IR-18C (RL = 0.2 mg/L)

SAMPLE COLLECTION **DATE:** 5/31/18 **TIME:** 1120 ✓

Sample appearance: clear

Collection method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:

Equipment No.: 552

Filter used: 0.45 μm (8100) / 0.45 μm (8200) / [✓ NONE]

Duplicate sample collected? YES / [✓ NO]

MS/MSD sample collected? YES / [✓ NO]

* Chain of Custody Number: Appx III 6042036 ✓

Chain of Custody Number: Appx IV 6042059 ✓

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	125 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
1	500 mL	Plastic	No	None	Fl ✓
1	500 mL	Plastic	No	None	Boron, Calcium ✓
1	500 mL	Plastic	No	HNO_3	Cl, Fl, pH, TDS, SO_4 ✓
1	500 mL	Plastic	No	HNO_3	Sb, As, Ba, Be, Cd, Cr, Co, Pb, Hg, Mo, Se, Tl, Li ✓
3	1000 mL	Plastic	No	HNO_3	Radium 226, Radium 228 ✓
	1000 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

III

IV

SAMPLING PERSONNEL

Name (SIGNATURE):

Name (SIGNATURE):

EQUIPMENT CALIBRATION FORM

Project Name: MBLP/Shiras ASD & GW Monitoring

Project Number: 180827

Date/Time: 9/20/18 0740

Initials: APS

NA = Not Applicable

Parameter	Standard	Lot Number	Units	Measured Value	Measurement Temperature (°C)	Calibration Verification Acceptance Window	Instrument Model/ID Number
pH	4.00	4B05H52-062018	S.U.	3.98	16.3	3.9 - 4.1	YSI P.P. #573
	7.00	4708L95-110817	S.U.	7.08		6.9 - 7.1	
	10.00	4G7B04-011117	S.U.	10.10		9.9 - 10.1	
Specific Conductance	147	SC180713-1C	µmhos/cm	149	15.8	132 - 162	↓
	1412	SC180103-2D	µmhos/cm	1413		1342 - 1484	
	2765	SC180713-3D	µmhos/cm	2756		2628 - 2905	
Eh	Zobell's solution	20B26882-2	mV	435.3	14.9	431.0 - 451.0	↓
Dissolved Oxygen	NA	NA	mg/L	10.00	14.5	±10% Theoretical: 10.08	↓
Turbidity	10 NTU	A6272	NTU	10.28	—	9 - 11	L.2020we #6

Notes:

EQUIPMENT CALIBRATION VERIFICATION FORM

Project Name: MBLP/Shiras ASD & GW Monitoring
Project Number: 180827
Date/Time: 9/20/18 11:53
Initials: AO

NA = Not Applicable

Parameter	Standard	Lot Number	Units	Measured Value	Measurement Temperature (°C)	Calibration Verification Acceptance Window	Instrument Model/ ID Number
pH	7.00	same as initial cal.	S.U.	7.10	15.8	6.9 - 7.1	YSI PP #513
Specific Conductance	1412	↑	µmhos/cm	1408	15.4	1342 - 1484	↓
Eh	Zobell's solution		mV	434.3	15.2	431.0 - 451.0	
Dissolved Oxygen	NA	NA	mg/L	9.47	14.7	±10% Theoretical: 10.08	
Turbidity	10 NTU	↓	NTU	10.00	NA	9 - 11	L.M.H 2020we #6

Notes:

Z:\2018\180827\WORK\FieldNotes\Forms\EquipCalVer-Water.xlsx

9/10/2018

EQUIPMENT CALIBRATION VERIFICATION FORM

Project Name: MBLP/Shiras ASD & GW Monitoring

Project Number: 180827

Date/Time: 9/20/18 1425

Initials: APS

NA = Not Applicable

Parameter	Standard	Lot Number	Units	Measured Value	Measurement Temperature (°C)	Calibration Verification Acceptance Window	Instrument Model/ ID Number
pH	7.00	SAME AS INITIAL CAL	S.U.	7.10	15.9	6.9 - 7.1	YSI P.P. #513
Specific Conductance	1412		µmhos/cm	1406	15.3	1342 - 1484	
Eh	Zobell's solution		mV	430.3	15.9	429.7-449.7	
Dissolved Oxygen	NA	NA	mg/L	9.70	13.1	±10% Theoretical: 10.54	
Turbidity	10 NTU		NTU	9.89	NA	9 - 11	L-2020 we #6

Notes:

GROUNDWATER SAMPLE COLLECTION FORM - LOW FLOW

Project Name:	MBLP/Shiras ASD & GW Monitoring	**Monitoring Location:**	MW-1
Project Number:	180827	**Sample ID:**	MBLPS-18-09-MW-1~~(I/MS/MSD)~~ (I) AD
Site Location:	Marquette, MI	**Well Type:**	2" Galv
Weather/Temp:	57°, cloudy	**Key Number:**	3S6

INSPECTION

Label on well?	YES / [✓ NO] / REMEDIED	Is cement pad in good repair?	YES / NO / REMEDIED NA
Is reference mark visible?	YES / [✓ NO] / REMEDIED	Is protective casing locked and in good repair?	[✓ YES] / NO / REMEDIED
Standing water present?	[✓ YES] / NO / REMEDIED	Is inner cap in place and properly sealing well?	[✓ YES] / NO / REMEDIED
Indication of surface runoff in well?	YES / [✓ NO] / REMEDIED	Is well casing in visibly good repair?	[✓ YES] / NO / REMEDIED

Repair Notes:

STATIC WATER LEVEL DATE: 9/20/18 TIME: 11:04

Top of Casing Elevation: NM ft

Depth to Water: 0.10 ft

Elevation of Water: — ft

Measured with: [✓ Electronic tape] / Chalked tape / Other:

Well depth verified? YES / [✓ NO]

WELL PURGING DATE: 9/20/18 TIME: 11:06

Purge Method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:

Pump intake @ 5 ft from ____ TOC or ✓ bottom

Equipment No.: 397

Measured well depth: 29.44 ft

Screen length: 5 ft

Depth to screen midpoint: 26.94 ft

Time	Water Level (feet)	Drawdown (feet)	Pumping Rate (mL/min)	pH (S.U.)	Temp (°C)	Spec Cond (µmhos/cm)	Turbidity (NTU)	Eh (mV)	D.O. (mg/L)
11:28	2.26	2.16	100	7.80	13.8	1358	~~430~~ 23.4	430	0.15
11:31	2.38	2.28	100	7.79	13.8	1358	18.5	430	0.16
11:34	2.51	2.41	100	7.79	13.7	1359	17.7	430	0.16
11:37	2.57	2.47	100	7.79	13.7	1358	12.4	430	0.16
11:40	2.67	2.57	100	7.77	13.7	1358	12.9	430	0.16
11:43	2.76	2.66	100	7.79	13.7	1358	13.8	430	0.17
11:46	2.80	2.70	100	7.79	13.8	1356	11.7	430	0.17
11:49	2.87	2.77	100	7.77	13.7	1357	9.8	430	0.17
Volume:	1.0 (Gallons)		Stabilization Criteria:	±0.1	±3%	±3%	±10% for values >20	±10 mV	±10%

✓

FIELD ANALYSES DATE: 9/20/18 TIME: 1150

Temperature:	13.8 °C	Carbon Dioxide:	NA mg/L	HACH CA-DT (RL = 10 mg/L)
pH:	7.77 S.U.	Sulfide (S^{-2}):	NA mg/L	HACH HS-WR (RL = 0.05 mg/L)
Specific Conductance:	1356 µmhos/cm	Ferrous Iron (Fe^{+2}):	NA mg/L	HACH IR-18C (RL = 0.2 mg/L)
Eh:	430 mV			
Dissolved Oxygen:	0.17 mg/L			
Turbidity:	9.8 NTU			

SAMPLE COLLECTION DATE: 9/20/18 TIME: 1151 ✓

Sample appearance: clear

Collection method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:

Equipment No.: 397

Filter used: 0.45 µm (8100) / 0.45 µm (8200) / [✓ NONE]

Duplicate sample collected? YES / [✓ NO]

MS/MSD sample collected? YES / [✓ NO]

Chain of Custody Number: Appx III 6042172 ✓

~~Chain of Custody Number: Appx IV~~ AD moved MS/MSD

~~Designated MS/MSD location~~ to MW-5

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	125 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	250 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
~~3~~ 1 AD	250 mL	Plastic	No	HNO_3	Total; B, Ca ✓
~~3~~ 1	500 mL	Plastic	No	None	Cl, Fl, pH, TDS, SO_4 ✓
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

SAMPLING PERSONNEL

Name (SIGNATURE):

Name (SIGNATURE): AJ

GROUNDWATER SAMPLE COLLECTION FORM - LOW FLOW

Project Name: MBLP/Shiras ASD & GW Monitoring
Project Number: 180827
Site Location: Marquette, MI
Weather/Temp: 57°, cloudy

Monitoring Location: MW-2
Sample ID: MBLPS-18-09-MW-2(I) ~~& (D)~~ ASD
Well Type: 2" Galv
Key Number: 356

INSPECTION

Label on well? YES / [✓ NO] / REMEDIED
Is reference mark visible? YES / [✓ NO] / REMEDIED
Standing water present? YES / [✓ NO] / REMEDIED
Indication of surface runoff in well? YES / [✓ NO] / REMEDIED
Is cement pad in good repair? YES / NO / REMEDIED N/A
Is protective casing locked and in good repair? [✓ YES] / NO / REMEDIED
Is inner cap in place and properly sealing well? [✓ YES] / NO / REMEDIED
Is well casing in visibly good repair? [✓ YES] / NO / REMEDIED
Repair Notes:

STATIC WATER LEVEL

DATE: 9/20/18 TIME: 10:12

Top of Casing Elevation: NM ft
Depth to Water: 0.03 ft
Elevation of Water: — ft
Measured with: [✓ Electronic tape] / Chalked tape / Other:
Well depth verified? YES / [✓ NO]

WELL PURGING

DATE: 9/20/18 TIME: 10:13

Purge Method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:
Pump intake @ 2.5 ft from ___ TOC or ✓ bottom
Equipment No.: 397
Measured well depth: 28.42 ft
Screen length: 5 ft
Depth to screen midpoint: 26.42 ft

Time	Water Level (feet)	* Drawdown (feet)	Pumping Rate (mL/min)	pH (S.U.)	Temp (°C)	Spec Cond (µmhos/cm)	Turbidity (NTU)	Eh (mV)	** D.O. (mg/L)
* 10:23	1.21	1.18	100	7.95	13.4	563	5.7	424	0.17
10:37	1.79	1.76	100	7.95	13.5	560	4.2	428	0.15
10:40	2.02	1.99	100	7.95	13.5	563	3.1	428	0.14
10:43	2.26	2.23	100	7.95	13.1	561	2.5	429	0.11
10:46	2.50	2.47	100	7.95	13.1	560	2.3	429	0.11
10:49	2.69	6.66	100	7.95	13.1	560	1.7	430	0.11
10:52	2.96	ASD ~~6.6~~ 2.93	100	7.95	13.0	560	1.7	431	0.09
Volume: 1.1	(Gallons)		Stabilization Criteria:	±0.1	±3%	±3%	±10% for values >20	±10 mV	±10% ✓

FIELD ANALYSES

DATE: 9/20/18 TIME: 10:53

Temperature: 13.1 °C
pH: 7.95 S.U.
Specific Conductance: 559 µmhos/cm
Eh: 431 mV
Dissolved Oxygen: 0.1 mg/L
Turbidity: 1.6 NTU

Carbon Dioxide: NA mg/L HACH CA-DT (RL = 10 mg/L)
Sulfide (S^{-2}): NA mg/L HACH HS-WR (RL = 0.05 mg/L)
Ferrous Iron (Fe^{+2}): NA mg/L HACH IR-18C (RL = 0.2 mg/L)

* Hiatus in readings for drawdown stabilization
** Drawdown & D.O. did not stabilize @ 100 mL/min in 45 min.

SAMPLE COLLECTION

DATE: 9/20/18 TIME: 10:54 ✓

Sample appearance: clear
Collection method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:
Equipment No.: 397
Filter used: 0.45 µm (8100) / 0.45 µm (8200) / [✓ NONE]

Duplicate sample collected? YES / [✓ NO]
MS/MSD sample collected? YES / [✓ NO]
Chain of Custody Number: Appx III 6042193 ✓
~~Chain of Custody Number: Appx IV~~ ASD
~~Designated duplicate location~~ moved dup. to MW-4

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	125 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	250 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
~~2~~ 1 ASD	250 mL	Plastic	No	HNO_3	Total; B, Ca ✓
~~2~~ 1	500 mL	Plastic	No	None	Cl, Fl, pH, TDS, SO_4 ✓
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

SAMPLING PERSONNEL

Name (SIGNATURE):
Name (SIGNATURE):

GROUNDWATER SAMPLE COLLECTION FORM - LOW FLOW

Project Name:	MBLP/Shiras ASD & GW Monitoring	**Monitoring Location:**	MW-3
Project Number:	180827	**Sample ID:**	MBLPS-18-09-MW-3(I)
Site Location:	Marquette, MI	**Well Type:**	2" Galv
Weather/Temp:	55°, cloudy	**Key Number:**	3S6

INSPECTION

Label on well?	YES / [✓ NO] / REMEDIED	Is cement pad in good repair?	YES / NO / REMEDIED N/A
Is reference mark visible?	YES / [✓ NO] / REMEDIED	Is protective casing locked and in good repair?	[✓ YES] / NO / REMEDIED
Standing water present?	YES / [✓ NO] / REMEDIED	Is inner cap in place and properly sealing well?	[✓ YES] / NO / REMEDIED
Indication of surface runoff in well?	YES / [✓ NO] / REMEDIED	Is well casing in visibly good repair?	[✓ YES] / NO / REMEDIED

Repair Notes:

STATIC WATER LEVEL DATE: 9/20/18 TIME: 9:00

Top of Casing Elevation: NM ft

Measured with: [✓ Electronic tape] / Chalked tape / Other:

Depth to Water: 0.1 ft

Well depth verified? YES / [✓ NO]

Elevation of Water: — ft

WELL PURGING DATE: 9/20/18 TIME: 9:01

Purge Method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:

Pump intake @ 2.5 ft from ____ TOC or ✓ bottom

Equipment No.: 397

Measured well depth: 29.01 ft Screen length: 5 ft Depth to screen midpoint: 26.51 ft

Time	Water Level (feet)	**Drawdown (feet)	Pumping Rate (mL/min)	pH (S.U.)	Temp (°C)	Spec Cond (µmhos/cm)	Turbidity (NTU)	Eh (mV)	D.O. (mg/L)
9:21	2.69	2.59	100	8.15	13.2	616	3.0	440	0.39
9:24	2.94	2.84	100	8.16	13.1	615	1.9	439	0.37
9:28	3.34	3.24	100	8.17	13.1	608	2.2	440	0.34
9:31	3.55	3.45	100	8.17	13.2	604	2.3	440	0.33
9:53	3.57	3.47	100	8.17	11.5	640	11.4	437	0.38
9:56	3.76	3.66	100	8.17	12.4	629	11.1	437	0.41
9:59	3.97	3.87	100	8.18	12.9	621	9.7	437	0.39
Volume: 0.9 (Gallons)			Stabilization Criteria:	±0.1	±3%	±3%	±10% for values >20	±10 mV	±10%

* hiatus in readings; dead pump battery ✓

FIELD ANALYSES DATE: 9/20/18 TIME: 10:00

Temperature:	13.0 °C	Carbon Dioxide:	NA mg/L	HACH CA-DT (RL = 10 mg/L)
pH:	8.18 S.U.	Sulfide (S^{-2}):	NA mg/L	HACH HS-WR (RL = 0.0S mg/L)
Specific Conductance:	620 µmhos/cm	Ferrous Iron (Fe^{+2}):	NA mg/L	HACH IR-18C (RL = 0.2 mg/L)
Eh:	437 mV			
Dissolved Oxygen:	0.38 mg/L			
Turbidity:	9.1 NTU			

** drawdown did not stabilize @ 100 mL/min in 45 min.

SAMPLE COLLECTION DATE: 9/20/18 TIME: 10:01 ✓

Sample appearance: clear

Duplicate sample collected? YES / [✓ NO]

Collection method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:

MS/MSD sample collected? YES / [✓ NO]

Equipment No.: 397

Chain of Custody Number: Appx III 604272 ✓

Filter used: 0.4S µm (8100) / 0.4S µm (8200) / [✓ NONE]

~~Chain of Custody Number: Appx IV~~

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	12S mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	2S0 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
1	2S0 mL	Plastic	No	HNO_3	Total; B, Ca ✓
1	S00 mL	Plastic	No	None	Cl, Fl, pH, TDS, SO_4 ✓
	S00 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

SAMPLING PERSONNEL

Name (SIGNATURE): Name (SIGNATURE):

GROUNDWATER SAMPLE COLLECTION FORM - LOW FLOW

Project Name: MBLP/Shiras ASD & GW Monitoring
Monitoring Location: MW-4
Project Number: 180827
Sample ID: MBLPS-18-09-MW-4(I) - (D)
Site Location: Marquette, MI
Well Type: 2" PVC FM
Weather/Temp: 60°, showers
Key Number: NA

INSPECTION

Label on well? [✓ YES] / NO / REMEDIED
Is cement pad in good repair? [✓ YES] / NO / REMEDIED
Is reference mark visible? [✓ YES] / NO / REMEDIED
Is protective casing locked and in good repair? [✓ YES] / NO / REMEDIED
Standing water present? YES / [✓ NO] / REMEDIED
Is inner cap in place and properly sealing well? [✓ YES] / NO / REMEDIED
Indication of surface runoff in well? YES / [✓ NO] / REMEDIED
Is well casing in visibly good repair? [✓ YES] / NO / REMEDIED
Repair Notes:

STATIC WATER LEVEL DATE: 9/20/18 TIME: 1302

Top of Casing Elevation: – ft
Measured with: [✓ Electronic tape] / Chalked tape / Other:
Depth to Water: 14.92 ft
Well depth verified? [✓ YES] / NO
Elevation of Water: – ft

WELL PURGING DATE: 9/20/18 TIME: 1330

Purge Method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:
Pump intake @ 2.5 ft from ____ TOC or ✓ bottom
Equipment No.: 397
Measured well depth: 46.65 ft
Screen length: 5 ft
Depth to screen midpoint: 44.15 ft

Time	Water Level (feet)	Drawdown (feet)	Pumping Rate (mL/min)	pH (S.U.)	Temp (°C)	Spec Cond (µmhos/cm)	Turbidity (NTU)	Eh (mV)	D.O. (mg/L)
1353	19.04	4.12	100	7.72	12.2	1875	11.6	78	0.16
1356	19.31	4.39	100	7.71	12.3	1871	7.22	77.3	0.14
1359	19.79	4.87	100	7.69	12.3	1865	7.26	77.6	0.15
1402	20.17	5.26	100	7.67	12.1	1849	7.35	74.0	0.16
1405	20.55	5.64	100	7.66	12.1	1837	7.67	78.8	0.14
1408	20.91	6.00	100	7.65	12.3	1828	9.49	78.3	0.13
1411	21.20		100	7.64	12.3	1830	8.18	77.7	0.13
Volume: 1.1	(Gallons)		Stabilization Criteria:	±0.1	±3%	±3%	±10% for values >20	±10 mV	±10%

✓

FIELD ANALYSES DATE: 9/20/18 TIME: 1412

Temperature: 12.3 °C
Carbon Dioxide: NA mg/L HACH CA-DT (RL = 10 mg/L)
pH: 7.65 S.U.
Sulfide (S^{-2}): NA mg/L HACH HS-WR (RL = 0.05 mg/L)
Specific Conductance: 1830 µmhos/cm
Ferrous Iron (Fe^{+2}): NA mg/L HACH IR-18C (RL = 0.2 mg/L)
Eh: 77.5 mV
Dissolved Oxygen: 0.13 mg/L
Turbidity: 6.23 NTU

SAMPLE COLLECTION DATE: 9/20/18 TIME: 1413 ✓

Sample appearance: clear
Duplicate sample collected? [✓ YES] / NO
Collection method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:
MS/MSD sample collected? YES / [✓ NO]
Equipment No.: 397
Chain of Custody Number: Appx III G042192 ✓
Filter used: 0.45 µm (8100) / 0.45 µm (8200) / [✓ NONE]
~~Chain of Custody Number: Appx IV~~
Duplicate. ✓

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	125 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	250 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
AO x 2	250 mL	Plastic	No	HNO_3	Total; B, Ca ✓
1 2	500 mL	Plastic	No	None	Cl, Fl, pH, TDS, SO_4 ✓
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

SAMPLING PERSONNEL

Name (SIGNATURE):
Name (SIGNATURE):

GROUNDWATER SAMPLE COLLECTION FORM - LOW FLOW

Project Name:	MBLP/Shiras ASD & GW Monitoring	**Monitoring Location:**	MW-5
Project Number:	180827	**Sample ID:**	MBLPS-18-09-MW-5~~0~~ (1/MS/MSD)
Site Location:	Marquette, MI	**Well Type:**	2" PVC
Weather/Temp:	58°, cloudy	**Key Number:**	NA

INSPECTION

Label on well?	[✓ YES] / NO / REMEDIED	Is cement pad in good repair?	[✓ YES] / NO / REMEDIED
Is reference mark visible?	[✓ YES] / ~~NO~~ / REMEDIED	Is protective casing locked and in good repair?	[✓ YES] / NO / REMEDIED
Standing water present?	YES / [✓ NO] / REMEDIED	Is inner cap in place and properly sealing well?	[✓ YES] / NO / REMEDIED
Indication of surface runoff in well?	YES / [✓ NO] / REMEDIED	Is well casing in visibly good repair?	[✓ YES] / NO / REMEDIED

Repair Notes: REPLACED 6" OF M.F.

STATIC WATER LEVEL DATE: 9/20/18 TIME: 1235

Top of Casing Elevation: NM ft

Depth to Water: 14.84 ft

Elevation of Water: — ft

Measured with: [✓ Electronic tape] / Chalked tape / Other:

Well depth verified? YES / [✓ NO]

WELL PURGING DATE: 9/20/18 TIME: 1237

Purge Method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:

Pump intake @ 2.5' ft from ____ TOC or ✓ bottom

Equipment No.: 397

Measured well depth: 44.75 ft

Screen length: 5 ft

Depth to screen midpoint: 42.25 ft

Time	Water Level (feet)	Drawdown (feet)	Pumping Rate (mL/min)	pH (S.U.)	Temp (°C)	Spec Cond (μmhos/cm)	Turbidity (NTU)	Eh (mV)	D.O. (mg/L)
1255	16.50	~~2.~~ 1.66	220	7.47	11.6	1137	2.3	413	2.15
* 1258	16.50	1.66	220	7.47	11.6	1138	1.3	416	2.11
1301	16.50	1.66	220	7.47	11.6	1133	1.0	417	1.51
1304	16.50	1.66	220	7.47	11.6	1133	1.2	419	1.46
1307	16.50	1.66	220	7.48	11.6	1133	1.1	419	1.38
Volume: 1.5	(Gallons)		Stabilization Criteria:	±0.1	±3%	±3%	±10% for values >20	±10 mV	±10% ✓

FIELD ANALYSES DATE: 9/20/18 TIME: 1308

Temperature:	11.6 °C	Carbon Dioxide:	NA mg/L	HACH CA-DT (RL = 10 mg/L)
pH:	7.48 S.U.	Sulfide (S^{-2}):	NA mg/L	HACH HS-WR (RL = 0.05 mg/L)
Specific Conductance:	1134 μmhos/cm	Ferrous Iron (Fe^{+2}):	NA mg/L	HACH IR-18C (RL = 0.2 mg/L)
Eh:	419 mV			
Dissolved Oxygen:	1.38 mg/L			
Turbidity:	0.97 NTU			

* BUBBLE ON D.O. PROBE.

SAMPLE COLLECTION DATE: 9/20/18 TIME: 1309 ✓

Sample appearance: CLEAR

Collection method: [✓ PERISTALTIC] / BLADDER / MICRO BLADDER / OTHER:

Equipment No.: 337

Filter used: 0.45 μm (8100) / 0.45 μm (8200) / [✓ NONE]

Duplicate sample collected? YES / [✓ NO]

MS/MSD sample collected? [✓ YES] NO

Chain of Custody Number: Appx III 4042192 ✓

~~Chain of Custody Number: Appx IV~~

MS/MSD ✓

Quantity	Size	Type	Filtered	Preservative	Parameters
	40 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	125 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	250 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
~~1~~ 3 AO	250 mL	Plastic	No	HNO_3	Total; B, Ca ✓
~~1~~ 3	500 mL	Plastic	No	None	Cl, Fl, pH, TDS, SO_4 ✓
	500 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Plastic	Yes No	None HCl HNO_3 H_2SO_4 NaOH	
	1000 mL	Glass	Yes No	None HCl HNO_3 H_2SO_4 NaOH	

SAMPLING PERSONNEL

Name (SIGNATURE):

Name (SIGNATURE):

Appendix C

Analytical Data Validation Report
June 2018

Shiras Steam Plant
Marquette, Michigan

Prepared For:
Marquette Board of Light and Power
2200 Wright Street Marquette, Michigan 49855

July 2018
Project No. 180827

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List of Abbreviations/Acronyms

%R	percent recovery
°C	degrees Celsius
FTCH	Fishbeck, Thompson, Carr & Huber, Inc.
ICP-AES	inductively coupled plasma-atomic emission spectroscopy
ICP-MS	inductively coupled plasma-mass spectrometry
LCS	laboratory control sample
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
mg/L	milligram per liter
QC	quality control
RL	reporting limit
RPD	relative percent difference
USEPA	U.S. Environmental Protection Agency
µg/L	micrograms per liter

1.0 Project Information

Site name:	Shiras Steam Plant	
Project name:	Marquette Board of Light and Power/Shiras	
Sample collection dates:	05/31/18	
Sample matrix:	Groundwater	
Analytical parameters/methods:	Metals	6010C, 6020A, 7470A
	General Chemistry	9040B, 9056A, SM2540C
	Radiological	9315, 9320, Ra226+Ra228
Laboratory:	TestAmerica	
Sample Delivery Group(s):	240-96519-1, 240-96523-1, 240-96523-2, 240-96524-1, 240-96524-2	

Sample Index:

Field ID	Lab ID
MBLPS-18-05-MW-1(I)	240-96519-6
	240-96519-7
	240-96524-3
MBLPS-18-05-MW-2(I)	240-96519-4
	240-96524-1
	240-96524-1
MBLPS-18-05-MW-2(D)	240-96519-5
	240-96524-2
	240-96524-2

Field ID	Lab ID
MBLPS-18-05-MW-3(I)	240-96519-3
	240-96523-3
	240-96523-3
MBLPS-18-05-MW-4(I)	240-96519-1
	240-96523-1
	240-96523-1
MBLPS-18-05-MW-5(I)	240-96519-2
	240-96523-2
	240-96523-2

The laboratory data package was evaluated for compliance with reference to *National Functional Guidelines for Inorganic Superfund Methods Data Review (January, 2017) and Evaluation of Radiochemical Data Usability (April, 1997)*. These guidelines were modified to accommodate the non-CLP methodologies. The following USEPA Region V data qualifier codes may be utilized in this report:

U	The analyte was analyzed for, but not detected above the MDL.
J	Analyte present. Reported value may not be accurate or precise.
R	Result is rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria.

2.0 Metals Fraction

The laboratory data summary report is provided in Appendix 1. The metals data are summarized in Table 1.

2.1 ICP-AES/ICP-MS Metals

2.1.1 Technical Holding Time and Sample Preservation

ICP-AES or ICP-MS samples were preserved with nitric acid to pH ≤ 2.	Yes ☒ No ☐ NA ☐
ICP-AES or ICP-MS metals were analyzed within the 180-day holding time.	Yes ☒ No ☐ NA ☐

Exceptions:
None.

2.1.2 Blanks

A method blank was prepared and analyzed as part of each QC batch.	Yes ☒ No ☐
The target analytes were detected in the method blanks at concentrations above the RL.	Yes ☐ No ☒
The target analytes were detected in the method blanks at concentrations above the MDL but below the RL.	Yes ☐ No ☒

Exceptions:
None

2.1.3 Laboratory Control Samples

LCS were prepared and analyzed as part of each analytical batch.	Yes ☒ No ☐
The LCS were spiked with the target analytes at the same concentration as the matrix spike samples.	Yes ☒ No ☐
LCS recoveries were within the specified QC limits.	Yes ☒ No ☐

Exceptions:
None.

2.1.4 Matrix Spike/Matrix Spike Duplicate Analysis

MS/MSD samples were analyzed at the required frequency.	Yes ☒ No ☐
Samples identified as field blanks or equipment blanks were used for spiked sample analysis.	Yes ☐ No ☒
MS/MSD recoveries are within the established QC limits.	Yes ☒ No ☐
The RPD of the concentrations measured for the MS/MSD pairs is within the established QC limits.	Yes ☒ No ☐

Exceptions:
None.

2.2 Mercury

The laboratory data summary report is provided in Appendix 1. The mercury data are summarized in Table 1.

2.2.1 Technical Holding Time and Sample Preservation

Samples were preserved with nitric acid to pH ≤ 2.	Yes ☒ No ☐ NA ☐
Preserved samples were analyzed within 28 days of collection.	Yes ☒ No ☐ NA ☐

Exceptions:
None.

2.2.2 Blanks

2.2.2.1 Method Blanks

A method blank was prepared and analyzed as part of each QC batch.	Yes ☒ No ☐
Mercury was detected in the method blanks at concentrations above the RL.	Yes ☐ No ☒
Mercury was detected in the method blanks at concentrations above the MDL but below the RL.	Yes ☐ No ☒

Exceptions:
None.

2.2.2.2 Field Blanks

A field blank was included in each mercury sample shipment.	Yes ☐ No ☐ NA ☒
Mercury was detected in the field blank at a concentration >MDL but <RL.	Yes ☐ No ☐ NA ☒
Mercury was detected in the field blank at a concentration >RL.	Yes ☐ No ☐ NA ☒

2.2.3 Laboratory Control Samples

LCS were prepared and analyzed as part of each analytical batch.	Yes ☒ No ☐
The LCS was spiked with mercury at the same concentration as the matrix spike samples.	Yes ☐ No ☒
LCS recoveries were within the specified QC limits.	Yes ☒ No ☐

Exceptions:
LCS samples were spiked at 5.0 µg/L and matrix spike samples were spiked at 1.0 µg/L.

Data Qualification:
None.

2.2.4 Matrix Spike/Matrix Spike Duplicate Analysis

MS/MSD samples were analyzed at the required frequency.	Yes ☒ No ☐
Samples identified as field blanks or equipment blanks were used for spiked sample analysis.	Yes ☐ No ☒
MS/MSD recoveries are within the established QC limits.	Yes ☐ No ☒
The RPD of the concentrations measured for the MS/MSD pairs is within the established QC limits.	Yes ☐ No ☒

Validation Guidelines:

If MS/MSD recoveries were outside control limits high, detected results were qualified as estimated (J); non-detects were not qualified.

If MS/MSD recoveries were outside control limits low, detected results were qualified as estimated (J); non-detects were qualified as estimated (UJ).

When the original sample concentration was ≥ 4X the spike amount, data was reported unflagged, even if the %R did not meet acceptance criteria.

Exceptions:

Sample	Analyte	MS %R	MSD %R	MS Control Limits	RPD	RPD Control Limits
MW-1	Mercury	95	76	80 -1 20	23	20

Data Qualification:

Analyte	Sample ID	Lab Result (µg/L)	Qualified Result (µg/L)
Mercury	MW-1	0.13 U	0.13 UJ

3.0 General Chemistry Fraction

The laboratory data summary report is provided in Appendix 1. The general chemistry data are summarized in Table 1.

3.1 Technical Holding Time and Sample Preservation

Samples were received by the laboratory in proper condition with shipping container temperatures at ≤ 6°C (but not frozen) upon receipt.	Yes ☒	No ☐	NA ☐
Samples were properly preserved for the requested analyses.	Yes ☒	No ☐	NA ☐
Samples were analyzed within the analyte-specific holding times.	Yes ☒	No ☐	NA ☐

Exceptions:
pH is a field parameter with a holding time of 15 minutes. Laboratory analysis performed outside of the 15 minute holding time to allow for shipping of samples.

Data Qualification:
None.

3.2 Blanks

A method blank was prepared and analyzed as part of each QC batch.	Yes ☒	No ☐
The target analytes were detected in the method blanks at concentrations above the RL.	Yes ☐	No ☒
The target analytes were detected in the method blanks at concentrations above the MDL but below the RL.	Yes ☐	No ☒

Exceptions:
None.

3.3 Laboratory Control Samples

LCS were prepared and analyzed as part of each analytical batch.	Yes ☒	No ☐
The LCS were spiked with the target analytes at the same concentration as the matrix spike samples.	Yes ☐	No ☒
LCS recoveries were within the specified QC limits.	Yes ☒	No ☐

Exceptions:
LCS samples for Chloride and Sulfate were spiked at 50.0 mg/L and matrix spike samples were spiked at 250 mg/L.

Data Qualification:
None.

3.4 Matrix Spike/Matrix Spike Duplicate Analysis

MS/MSD samples were analyzed at the required frequency.	Yes ☒ No ☐
Samples identified as field blanks or equipment blanks were used for spiked sample analysis.	Yes ☐ No ☒
MS/MSD recoveries are within the established QC limits.	Yes ☒ No ☐
The RPD of the concentrations measured for the MS/MSD pairs is within the established QC limits.	Yes ☒ No ☐

Exceptions:
None.

4.0 Radiological

The laboratory data summary report is provided in Appendix 1. The radiological data are summarized in Table 1.

4.1 Technical Holding Time and Sample Preservation

Samples were received by the laboratory in proper condition with shipping container temperatures at ≤ 6°C (but not frozen) upon receipt.	Yes ☒ No ☐ NA ☐
Samples were preserved with nitric acid to pH ≤ 2.	Yes ☒ No ☐ NA ☐
Samples were analyzed within the 6-month holding time.	Yes ☒ No ☐ NA ☐

Exceptions:
None.

4.2 Blanks

A method blank was prepared and analyzed as part of each QC batch.	Yes ☒ No ☐
The target compounds were detected in the method blanks at concentrations above the RL.	Yes ☐ No ☒
The target compounds were detected in the method blanks at concentrations above the MDL but below the RL.	Yes ☐ No ☒

Method Blank Exceptions:
None.

4.3 Laboratory Control Samples

LCS were prepared and analyzed as part of each analytical batch.	Yes ☒ No ☐
LCS recoveries were within the specified QC limits.	Yes ☒ No ☒

Validation Guidelines:

The LCS is the primary demonstration of the laboratory's ability to analyze samples with qualitative and quantitative accuracy. When recovery of the LCS compounds was outside QC limits high, detected results were qualified as estimated (J), biased high; non-detects were not qualified.

When recovery of the LCS compounds was outside QC limits low, results for detected results qualified as estimated (J), biased low; non-detects were rejected (R).

LCS Exceptions:

LCS ID	Compound	%R	%R Control Limits
160-369905/1-A	Radium-228	160	56 - 140

Data Qualification:
Data qualification is not required as Radium-228 was not detected in any of the associated samples.

4.4 Matrix Spike/Matrix Spike Duplicate Analysis

MS/MSD samples were analyzed at the required frequency.	Yes ☒ No ☐
Samples identified as field blanks or equipment blanks were used for spiked sample analysis.	Yes ☐ No ☒
MS/MSD recoveries are within the established QC limits.	Yes ☒ No ☐
The RPD of the concentrations measured for the MS/MSD pairs is within the established QC limits.	Yes ☒ No ☐

Exceptions:
None.

5.0 Reconciliation with Data Quality Objectives

5.1 Overall Precision and Sample Representativeness

RPD for field duplicates is within the project control limits (± 30%) for at least 75% of the analyses. Yes ☒ No ☐

Sample	Analyte	Units	Field Sample	Field Duplicate	RPD	RPD Control Limits
MW-2	Boron	µg/L	74 J	75J	1.3	30
	Calcium	µg/L	68,000	70,000	2.9	30
	Chloride	mg/L	86	86	0.0	30
	Fluoride	mg/L	0.056	0.057	1.8	30
	Sulfate	mg/L	31	31	0.0	30
	TDS	mg/L	330	330	0.0	30
MW-2	pH (lab)	SU	8.0	8.0	0.0	30
	Antimony	µg/L	ND	ND		
	Arsenic	µg/L	0.84 J	1.0 J	17.4	30
	Barium	µg/L	0.073	0.072	1.4	30
	Beryllium	µg/L	ND	ND		
	Cadmium	µg/L	ND	ND		
	Chromium	µg/L	2.2	1.7 J	26	30
	Cobalt	µg/L	0.38 J	0.38 J	0.0	30
	Fluoride	mg/L	0.055	0.055	0.0	30
	Lead	µg/L	ND	ND		
	Lithium	µg/L	5.9 J	6.0 J	1.7	30
	Mercury	µg/L	ND	ND		
	Molybdenum	µg/L	1.1 J	ND		
	Rad226 & Rad228	pCi/L	0.519	ND		
	Radium 226	pCi/L	ND	0.193		
	Radium 228	pCi/L	ND	ND		
	Selenium	µg/L	ND	ND		
	Thallium	µg/L	ND	ND		

5.2 Overall Accuracy/Bias

LCS recoveries were met for all samples. Yes ☐ No ☒

MS/MSD recoveries were met for 75% of the samples. Yes ☒ No ☐

96% of the LCS recoveries, and 96% of the MS/MSD recoveries acceptable.

5.3 Overall Completeness

Total data points generated	120
Data points available for use	120
At least 90% of the data are determined to be valid.	Yes ☒ No ☐

The completeness objective for the task was met and sufficient data are available to support decision-making.

5.4 Data Limitations and Actions

U-qualified results may not be usable when greater than a screening level.

UJ-qualified results are usable as non-detects with the understanding that the quantitation limit is estimated and may be higher; caution should be used when evaluating against screening levels.

J-qualified data are usable as detects at the reported concentration with the understanding that the result is estimated.

Tables

Table 1 - Cumulative Analytical Data Summary
Marquette Board of Light and Power
Shiras Steam Plant
September 2018

Lab Suite:				CCR Appendix III							CCR Appendix IV																
Parameter:				Boron	Calcium	Chloride	Fluoride	Sulfate	Total Dissolved Solids (TDS)	pH (lab)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Fluoride	Lead	Lithium	Mercury	Molybdenum	Radium 226 & 228 Combined	Radium 226	Radium 228	Selenium	Thallium
Units:				µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	SU	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	pCi/L	pCi/L	µg/L	µg/L
U.S. EPA MCL:				*NE*	*NE*	*NE*	*4.0*	*NE*	*NE*	*NE*	*6.0*	*10*	*2.0*	*4.0*	*5.0*	*100*	*NE*	*4.0*	*15*	*NE*	*2.0*	*NE*	*5.0*	*NE*	*NE*	*50*	*2.0*
Location	Well ID	Collection Date	Duplicate																								
Downgradient	MW-1	07/19/17		300 U	100,000	230	0.38 U	19	700	7.58	2.0 U	6.6	0.21	1.0 U	1.0 U	10 U	20 U	--	17	10 U	0.20 U	50 U	2.33	1.00 U	2.33	5.0 U	2.0 U
		07/24/17		300 U	110,000	230	0.38 U	20	800	7.45	2.0 U	5.0 U	0.15	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.43	1.00 U	1.43	5.0 U	2.0 U
		08/23/17		300 U	120,000	260	0.10 U	21	800	7.54	2.0 U	5.0 U	0.14	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/29/17		300 U	130,000	270	0.10 U	20	960	6.56	2.0 U	5.0 U	0.13	1.0 U	1.0 U	18	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17		300 U	130,000	270	0.10 U	21	930	7.56	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/14/17		300 U	110,000	290	0.10 U	22	980	7.60	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17		530	120,000	270	0.10 U	20	920	7.58	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17	X	300 U	120,000	270	0.10 U	21	990	7.58	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.16	1.00 U	1.16	5.0 U	2.0 U
		10/05/17		300 U	130,000	280	0.10 U	21	820	7.55	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		10/05/17	X	300 U	120,000	270	0.10 U	21	880	7.55	2.0 U	5.0 U	0.14	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		05/31/18		66 J	110,000	310	0.046 J	25	770	7.8	2.0 U	5.0 U	0.15	1.0 U	1.0 U	2.1	0.77 J	0.042 J	1.0 U	12	0.20 UJ	1.6 J	0.516	0.409	0.107 U	5.0 U	1.0 U
		09/20/18		67 J	120,000	300	0.044 J	24	740	7.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	MW-2	07/19/17		300 U	51,000	60	0.38 U	22	220	8.41	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		07/24/17		300 U	63,000	59	0.38 U	21	350	8.09	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.56	1.00 U	1.56	5.0 U	2.0 U
		08/23/17		300 U	51,000	62	0.10 U	26	190	8.13	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	240	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/29/17		300 U	52,000	61	0.10 U	22	350	7.03	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	2.00	1.00 U	2.00	5.0 U	2.0 U
		08/29/17	X	300 U	53,000	61	0.10 U	22	320	7.03	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17		300 U	53,000	60	0.10 U	21	310	8.15	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/14/17		300 U	52,000	64	0.10 U	23	300	8.13	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17		300 U	58,000	65	0.10 U	21	350	8.07	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		10/05/17		300 U	61,000	65	0.10 U	21	310	7.99	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		05/31/18		74 J	68,000	86	0.056	31	330	8.0	2.0 U	0.84 J	0.073	1.0 U	1.0 U	2.2	0.38 J	0.055	1.0 U	5.9 J	0.20 U	1.1 J	0.519	0.204 U	0.315 U	5.0 U	1.0 U
		05/31/18	X	75 J	70,000	86	0.057	31	330	8.0	2.0 U	1.0 J	0.072	1.0 U	1.0 U	1.7 J	0.38 J	0.055	1.0 U	6.0 J	0.20 U	5.0 U	0.299 U	0.193	0.106 U	5.0 U	1.0 U
		09/20/18		55 J	64,000	85	0.058	29	310	8.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	MW-3	07/19/17		300 U	68,000	98	0.38 U	49	360	8.00	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		07/24/17		300 U	69,000	89	0.38 U	36	440	7.86	2.0 U	5.0 U	0.23	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/23/17		300 U	75,000	95	0.10 U	44	300	7.81	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/29/17		300 U	62,000	86	0.10 U	28	390	6.32	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17		300 U	62,000	85	0.10 U	26	380	7.77	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.05	1.00 U	1.05	5.0 U	2.0 U
		09/14/17		300 U	57,000	83	0.10 U	25	380	7.85	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.17	1.00 U	1.17	5.0 U	2.0 U
		09/14/17	X	300 U	56,000	84	0.10 U	24	380	7.85	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17		300 U	67,000	89	0.10 U	20	440	8.09	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		10/05/17		300 U	69,000	87	0.10 U	21	350	8.10	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		05/31/18		45 J	55,000	67	0.067	20	290	8.2	2.0 U	1.5 J	0.066	1.0 U	1.0 U	2.4	0.32 J	0.065	1.0 U	4.9 J	0.20 U	1.2 J	0.128 U	0.199 U	-0.0711 U	5.0 U	1.0 U
		09/20/18		41 J	70,000	92	0.055	22	340	8.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	MW-4	07/19/17		300 U	93,000	260	0.38 U	19	700	7.92	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.07	1.00 U	1.07	5.0 U	2.0 U
		07/24/17		300 U	89,000	220	0.38 U	18	730	7.86	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		07/24/17	X	300 U	89,000	230	0.38 U	19	710	7.86	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/23/17		300 U	100,000	300	0.10 U	24	830	7.93	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/29/17		300 U	120,000	340	0.10 U	47	1,000	7.32	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17		300 U	110,000	340	0.20	53	1,000	7.75	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/14/17		300 U	100,000	360	0.18	49	1,000	7.77	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17		300 U	160,000	370	0.12	46	1,200	7.74	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.1 U	13	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		10/05/17		300 U	120,000	380	0.10	43	1,100	7.70	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	11	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		05/31/18		120	130,000	450	0.23	42	1,000	7.8	1.0 J	1.4 J	0.11	1.0 U	0.24 J	1.2 J	0.48 J	0.23	0.50 J	9.8	0.20 U	16	0.639	0.400	0.240 U	5.0 U	1.0 U
		09/20/18		110	130,000	450	0.23	42	970	7.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		09/20/18	X	110	130,000	450	0.23	42	1,000	7.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Upgradient	MW-5	07/19/17		300 U	100,000	200	0.38 U	25	640	7.36	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.51	1.00 U	1.51	5.0 U	2.0 U
		07/19/17	X	300 U	100,000	190	0.38 U	24	530	7.36	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		07/24/17		300 U	100,000	190	0.38 U	21	730	7.17	2.0 U	5.0 U	0.16	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/23/17		300 U	110,000	210	0.10 U	19	590	7.41	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.44	1.00 U	1.44	5.0 U	2.0 U
		08/23/17	X	300 U	110,000	190	0.10 U	19	620	7.41	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/29/17		300 U	110,000	190	0.10 U	18	750	6.76	2.0 U	5.0 U	0.12	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17		300 U	100,000	190	0.10 U	18	660	7.43	2.0 U	5.0 U	0.11	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17	X	300 U	100,000	190	0.10 U	18	730	7.43	2.0 U	5.0 U	0.11	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/14/17		300 U	96,000	200	0.10 U	19	720	7.51	2.0 U	5.0 U	0.11	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17		300 U	120,000	190	0.10 U	18	2,300	7.54	2.0 U	5.0 U	0.11	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		10/05/17		300 U	120,000	190	0.10 U	18	700	7.45	2.0 U	5.0 U	0.12	1.0 U	1.0 U	10 U	20 U	--	3.0 U	13	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		05/31/18		42 J	100,000	210	0.043 J	19	640	7.6	2.0 U	5.0 U	0.095	1.0 U	1.0 U	1.5 J	0.25 J	0.046 J	1.0 U	7.6 J	0.20 U	7.1	0.470	0.272	0.198 U	5.0 U	1.0 U
		09/20/18		39 J	120,000	220	0.031 J	22	630	7.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 1 - Cumulative Analytical Data Summary
Marquette Board of Light and Power
Shiras Steam Plant
September 2018

Lab Suite:				CCR Appendix III							CCR Appendix IV																
Parameter:				Boron	Calcium	Chloride	Fluoride	Sulfate	Total Dissolved Solids (TDS)	pH (lab)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Fluoride	Lead	Lithium	Mercury	Molybdenum	Radium 226 & 228 Combined	Radium 226	Radium 228	Selenium	Thallium
Units:				µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	SU	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	pCi/L	pCi/L	µg/L	µg/L
U.S. EPA MCL:				*NE*	*NE*	*NE*	*4.0*	*NE*	*NE*	*NE*	*6.0*	*10*	*2.0*	*4.0*	*5.0*	*100*	*NE*	*4.0*	*15*	*NE*	*2.0*	*NE*	*5.0*	*NE*	*NE*	*50*	*2.0*
Location	Well ID	Collection Date	Duplicate																								
QC	Equipment Blank	07/20/17		300 U	1,000 U	10 U	0.38 U	2.5 U	10 U	8.05	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.24	1.00 U	1.24	5.0 U	2.0 U
		07/24/17		300 U	1,000 U	10 U	0.38 U	2.5 U	10 U	7.94	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.03	1.00 U	1.03	5.0 U	2.0 U
		08/29/17		300 U	1,000 U	10 U	0.10 U	1 U	10 U	NA	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17		300 U	1,000 U	10 U	0.10 U	1 U	10	NA	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/14/17		300 U	1,000 U	10 U	0.10 U	1 U	10 U	NA	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17		300 U	1,000 U	10 U	0.10 U	1 U	10	NA	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		10/05/17		300 U	1,000 U	10 U	0.10 U	1 U	18	NA	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U

Bolded values exceed an applicable criterion.

Data Qualifiers:
U - Not detected

Footnotes/Abbreviations:
MCL - maximum contaminant limit
NA - Not Analyzed
NE - Value has not been established

Appendix 1

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Canton
4101 Shuffel Street NW
North Canton, OH 44720
Tel: (330)497-9396

TestAmerica Job ID: 240-96519-1
Client Project/Site: CCR-MBLP Shiras Steam Plant

For:
Fishbeck Thompson Carr & Huber Inc
1515 Arboretum Drive SE
Grand Rapids, Michigan 49546

Attn: Penni Mahler

Kris Brooks

Authorized for release by:
6/19/2018 4:48:46 PM

Kris Brooks, Project Manager II
(330)966-9790
kris.brooks@testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Definitions/Glossary

Qualifiers

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
F1	MS and/or MSD Recovery is outside acceptance limits.
F2	MS/MSD RPD exceeds control limits
U	Indicates the analyte was analyzed for but not detected.

General Chemistry

Qualifier	Qualifier Description
HF	Field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U	Indicates the analyte was analyzed for but not detected.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 240-96519-1

Laboratory: TestAmerica Canton

Narrative

CASE NARRATIVE

Client: Fishbeck Thompson Carr & Huber Inc

Project: CCR-MBLP Shiras Steam Plant

Report Number: 240-96519-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica Canton attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica’s operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header.

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT
The samples were received on 6/5/2018 9:30 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 4.3º C.

TOTAL RECOVERABLE METALS (ICP)
Samples MBLPS-18-05-MW-4 (I) (240-96519-1), MBLPS-18-05-MW-5 (I) (240-96519-2), MBLPS-18-05-MW-3 (I) (240-96519-3), MBLPS-18-05-MW-2 (I) (240-96519-4), MBLPS-18-05-MW-2 (D) (240-96519-5) and MBLPS-18-05-MW-1 (I) (240-96519-6) were analyzed for total recoverable metals (ICP) in accordance with EPA SW-846 Method 6010C. The samples were prepared on 06/05/2018 and analyzed on 06/06/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TOTAL RECOVERABLE METALS (ICPMS)
Sample MBLPS-18-05-MW-1 (I) (240-96519-7) was analyzed for total recoverable metals (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 06/05/2018 and analyzed on 06/06/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Job ID: 240-96519-1 (Continued)

Laboratory: TestAmerica Canton (Continued)

TOTAL MERCURY

Sample MBLPS-18-05-MW-1 (I) (240-96519-7) was analyzed for total mercury in accordance with EPA SW-846 Methods 7470A. The samples were prepared on 06/05/2018 and analyzed on 06/06/2018.

Mercury failed the recovery criteria low for the MSD of sample MBLPS-18-05-MW-1 (I)MSD (240-96519-7) in batch 240-330440. Mercury exceeded the RPD limit. Refer to the QC report for details.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TOTAL DISSOLVED SOLIDS

Samples MBLPS-18-05-MW-4 (I) (240-96519-1), MBLPS-18-05-MW-5 (I) (240-96519-2), MBLPS-18-05-MW-3 (I) (240-96519-3), MBLPS-18-05-MW-2 (I) (240-96519-4), MBLPS-18-05-MW-2 (D) (240-96519-5) and MBLPS-18-05-MW-1 (I) (240-96519-6) were analyzed for total dissolved solids in accordance with SM 2540C. The samples were analyzed on 06/07/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

PH

Samples MBLPS-18-05-MW-4 (I) (240-96519-1), MBLPS-18-05-MW-5 (I) (240-96519-2), MBLPS-18-05-MW-3 (I) (240-96519-3), MBLPS-18-05-MW-2 (I) (240-96519-4), MBLPS-18-05-MW-2 (D) (240-96519-5) and MBLPS-18-05-MW-1 (I) (240-96519-6) were analyzed for pH in accordance with EPA SW-846 Method 9040B. The samples were analyzed on 06/05/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

ANIONS

Samples MBLPS-18-05-MW-4 (I) (240-96519-1), MBLPS-18-05-MW-5 (I) (240-96519-2), MBLPS-18-05-MW-3 (I) (240-96519-3), MBLPS-18-05-MW-2 (I) (240-96519-4), MBLPS-18-05-MW-2 (D) (240-96519-5), MBLPS-18-05-MW-1 (I) (240-96519-6) and MBLPS-18-05-MW-1 (I) (240-96519-7) were analyzed for anions in accordance with EPA SW-846 Method 9056A. The samples were analyzed on 06/15/2018 and 06/18/2018.

Samples MBLPS-18-05-MW-4 (I) (240-96519-1)[10X], MBLPS-18-05-MW-5 (I) (240-96519-2)[5X] and MBLPS-18-05-MW-1 (I) (240-96519-6)[5X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Method Summary

Method	Method Description	Protocol	Laboratory
6010C	Metals (ICP)	SW846	TAL CAN
6020A	Metals (ICP/MS)	SW846	TAL CAN
7470A	Mercury (CVAA)	SW846	TAL CAN
9040B	pH	SW846	TAL CAN
9056A	Anions, Ion Chromatography	SW846	TAL CAN
SM 2540C	Solids, Total Dissolved (TDS)	SM	TAL CAN
3005A	Preparation, Total Recoverable or Dissolved Metals	SW846	TAL CAN
7470A	Preparation, Mercury	SW846	TAL CAN

Protocol References:

SM = "Standard Methods For The Examination Of Water And Wastewater"

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL CAN = TestAmerica Canton, 4101 Shuffel Street NW, North Canton, OH 44720, TEL (330)497-9396

Sample Summary

Client: Fishbeck Thompson Carr & Huber Inc
Project/Site: CCR-MBLP Shiras Steam Plant

TestAmerica Job ID: 240-96519-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
240-96519-1	MBLPS-18-05-MW-4 (I)	Water	05/31/18 11:08	06/05/18 09:30
240-96519-2	MBLPS-18-05-MW-5 (I)	Water	05/31/18 11:20	06/05/18 09:30
240-96519-3	MBLPS-18-05-MW-3 (I)	Water	05/31/18 13:41	06/05/18 09:30
240-96519-4	MBLPS-18-05-MW-2 (I)	Water	05/31/18 15:07	06/05/18 09:30
240-96519-5	MBLPS-18-05-MW-2 (D)	Water	05/31/18 15:07	06/05/18 09:30
240-96519-6	MBLPS-18-05-MW-1 (I)	Water	05/31/18 16:29	06/05/18 09:30
240-96519-7	MBLPS-18-05-MW-1 (I)	Water	05/31/18 16:29	06/05/18 09:30

Detection Summary

Client Sample ID: MBLPS-18-05-MW-4 (I) — Lab Sample ID: 240-96519-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Boron	120		100	23	ug/L	1		6010C	Total Recoverable
Calcium	130000		5000	310	ug/L	1		6010C	Total Recoverable
pH	7.8	HF	0.1	0.1	SU	1		9040B	Total/NA
Chloride	450		10	2.8	mg/L	10		9056A	Total/NA
Fluoride	0.23		0.050	0.024	mg/L	1		9056A	Total/NA
Sulfate	42		1.0	0.35	mg/L	1		9056A	Total/NA
Total Dissolved Solids	1000		20	16	mg/L	1		SM 2540C	Total/NA

Client Sample ID: MBLPS-18-05-MW-5 (I) — Lab Sample ID: 240-96519-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Boron	42	J	100	23	ug/L	1		6010C	Total Recoverable
Calcium	100000		5000	310	ug/L	1		6010C	Total Recoverable
pH	7.6	HF	0.1	0.1	SU	1		9040B	Total/NA
Chloride	210		5.0	1.4	mg/L	5		9056A	Total/NA
Fluoride	0.043	J	0.050	0.024	mg/L	1		9056A	Total/NA
Sulfate	19		1.0	0.35	mg/L	1		9056A	Total/NA
Total Dissolved Solids	640		10	7.8	mg/L	1		SM 2540C	Total/NA

Client Sample ID: MBLPS-18-05-MW-3 (I) — Lab Sample ID: 240-96519-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Boron	45	J	100	23	ug/L	1		6010C	Total Recoverable
Calcium	55000		5000	310	ug/L	1		6010C	Total Recoverable
pH	8.2	HF	0.1	0.1	SU	1		9040B	Total/NA
Chloride	67		1.0	0.28	mg/L	1		9056A	Total/NA
Fluoride	0.067		0.050	0.024	mg/L	1		9056A	Total/NA
Sulfate	20		1.0	0.35	mg/L	1		9056A	Total/NA
Total Dissolved Solids	290		10	7.8	mg/L	1		SM 2540C	Total/NA

Client Sample ID: MBLPS-18-05-MW-2 (I) — Lab Sample ID: 240-96519-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Boron	74	J	100	23	ug/L	1		6010C	Total Recoverable
Calcium	68000		5000	310	ug/L	1		6010C	Total Recoverable
pH	8.0	HF	0.1	0.1	SU	1		9040B	Total/NA
Chloride	86		1.0	0.28	mg/L	1		9056A	Total/NA
Fluoride	0.056		0.050	0.024	mg/L	1		9056A	Total/NA
Sulfate	31		1.0	0.35	mg/L	1		9056A	Total/NA
Total Dissolved Solids	330		10	7.8	mg/L	1		SM 2540C	Total/NA

Client Sample ID: MBLPS-18-05-MW-2 (D) — Lab Sample ID: 240-96519-5

This Detection Summary does not include radiochemical test results.

Client Sample ID: MBLPS-18-05-MW-2 (D) (Continued) Lab Sample ID: 240-96519-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Boron	75	J	100	23	ug/L	1		6010C	Total Recoverable
Calcium	70000		5000	310	ug/L	1		6010C	Total Recoverable
pH	8.0	HF	0.1	0.1	SU	1		9040B	Total/NA
Chloride	86		1.0	0.28	mg/L	1		9056A	Total/NA
Fluoride	0.057		0.050	0.024	mg/L	1		9056A	Total/NA
Sulfate	31		1.0	0.35	mg/L	1		9056A	Total/NA
Total Dissolved Solids	330		10	7.8	mg/L	1		SM 2540C	Total/NA

Client Sample ID: MBLPS-18-05-MW-1 (I) Lab Sample ID: 240-96519-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Boron	66	J	100	23	ug/L	1		6010C	Total Recoverable
Calcium	110000		5000	310	ug/L	1		6010C	Total Recoverable
pH	7.8	HF	0.1	0.1	SU	1		9040B	Total/NA
Chloride	310		5.0	1.4	mg/L	5		9056A	Total/NA
Fluoride	0.046	J	0.050	0.024	mg/L	1		9056A	Total/NA
Sulfate	25		5.0	1.7	mg/L	5		9056A	Total/NA
Total Dissolved Solids	770		10	7.8	mg/L	1		SM 2540C	Total/NA

Client Sample ID: MBLPS-18-05-MW-1 (I) Lab Sample ID: 240-96519-7

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Barium	150		5.0	2.2	ug/L	1		6020A	Total Recoverable
Cobalt	0.77	J	1.0	0.19	ug/L	1		6020A	Total Recoverable
Chromium	2.1		2.0	0.98	ug/L	1		6020A	Total Recoverable
Molybdenum	1.6	J	5.0	1.1	ug/L	1		6020A	Total Recoverable
Lithium	12		8.0	1.7	ug/L	1		6020A	Total Recoverable
Fluoride	0.042	J	0.050	0.024	mg/L	1		9056A	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client Sample ID: MBLPS-18-05-MW-4 (I)

Lab Sample ID: 240-96519-1

Date Collected: 05/31/18 11:08
Matrix: Water
Date Received: 06/05/18 09:30

Method: 6010C - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	**120**		100	23	ug/L		06/05/18 15:00	06/06/18 22:15	1
Calcium	**130000**		5000	310	ug/L		06/05/18 15:00	06/06/18 22:15	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.8**	**HF**	0.1	0.1	SU			06/05/18 14:37	1
Chloride	**450**		10	2.8	mg/L			06/18/18 10:35	10
Fluoride	**0.23**		0.050	0.024	mg/L			06/18/18 10:15	1
Sulfate	**42**		1.0	0.35	mg/L			06/18/18 10:15	1
Total Dissolved Solids	**1000**		20	16	mg/L			06/07/18 10:44	1

Client Sample ID: MBLPS-18-05-MW-5 (I)

Lab Sample ID: 240-96519-2

Date Collected: 05/31/18 11:20

Matrix: Water

Date Received: 06/05/18 09:30

Method: 6010C - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	**42**	**J**	100	23	ug/L		06/05/18 15:00	06/06/18 22:20	1
Calcium	**100000**		5000	310	ug/L		06/05/18 15:00	06/06/18 22:20	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.6**	**HF**	0.1	0.1	SU			06/05/18 14:43	1
Chloride	**210**		5.0	1.4	mg/L			06/18/18 11:17	5
Fluoride	**0.043**	**J**	0.050	0.024	mg/L			06/18/18 10:56	1
Sulfate	**19**		1.0	0.35	mg/L			06/18/18 10:56	1
Total Dissolved Solids	**640**		10	7.8	mg/L			06/07/18 10:44	1

Client Sample ID: MBLPS-18-05-MW-3 (I)

Lab Sample ID: 240-96519-3

Date Collected: 05/31/18 13:41

Matrix: Water

Date Received: 06/05/18 09:30

Method: 6010C - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	45	J	100	23	ug/L		06/05/18 15:00	06/06/18 22:26	1
Calcium	55000		5000	310	ug/L		06/05/18 15:00	06/06/18 22:26	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	8.2	HF	0.1	0.1	SU			06/05/18 14:49	1
Chloride	67		1.0	0.28	mg/L			06/15/18 21:54	1
Fluoride	0.067		0.050	0.024	mg/L			06/15/18 21:54	1
Sulfate	20		1.0	0.35	mg/L			06/15/18 21:54	1
Total Dissolved Solids	290		10	7.8	mg/L			06/07/18 10:44	1

Client Sample ID: MBLPS-18-05-MW-2 (I)

Lab Sample ID: 240-96519-4

Date Collected: 05/31/18 15:07
Date Received: 06/05/18 09:30

Matrix: Water

Method: 6010C - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	**74**	**J**	100	23	ug/L		06/05/18 15:00	06/06/18 22:31	1
Calcium	**68000**		5000	310	ug/L		06/05/18 15:00	06/06/18 22:31	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**8.0**	**HF**	0.1	0.1	SU			06/05/18 14:55	1
Chloride	**86**		1.0	0.28	mg/L			06/15/18 22:15	1
Fluoride	**0.056**		0.050	0.024	mg/L			06/15/18 22:15	1
Sulfate	**31**		1.0	0.35	mg/L			06/15/18 22:15	1
Total Dissolved Solids	**330**		10	7.8	mg/L			06/07/18 10:44	1

Client Sample ID: MBLPS-18-05-MW-2 (D)

Lab Sample ID: 240-96519-5

Date Collected: 05/31/18 15:07
Matrix: Water
Date Received: 06/05/18 09:30

Method: 6010C - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	**75**	**J**	100	23	ug/L		06/05/18 15:00	06/06/18 22:36	1
Calcium	**70000**		5000	310	ug/L		06/05/18 15:00	06/06/18 22:36	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**8.0**	**HF**	0.1	0.1	SU			06/05/18 15:00	1
Chloride	**86**		1.0	0.28	mg/L			06/15/18 22:36	1
Fluoride	**0.057**		0.050	0.024	mg/L			06/15/18 22:36	1
Sulfate	**31**		1.0	0.35	mg/L			06/15/18 22:36	1
Total Dissolved Solids	**330**		10	7.8	mg/L			06/07/18 10:44	1

Client Sample ID: MBLPS-18-05-MW-1 (I)

Lab Sample ID: 240-96519-6

Date Collected: 05/31/18 16:29

Matrix: Water

Date Received: 06/05/18 09:30

Method: 6010C - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	66	J	100	23	ug/L		06/05/18 15:00	06/06/18 21:41	1
Calcium	110000		5000	310	ug/L		06/05/18 15:00	06/06/18 21:41	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.8	HF	0.1	0.1	SU			06/05/18 15:06	1
Chloride	310		5.0	1.4	mg/L			06/15/18 22:56	5
Fluoride	0.046	J	0.050	0.024	mg/L			06/18/18 12:19	1
Sulfate	25		5.0	1.7	mg/L			06/15/18 22:56	5
Total Dissolved Solids	770		10	7.8	mg/L			06/07/18 10:44	1

Client Sample ID: MBLPS-18-05-MW-1 (I)

Date Collected: 05/31/18 16:29
Date Received: 06/05/18 09:30

Lab Sample ID: 240-96519-7

Matrix: Water

Method: 6020A - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.75	U	5.0	0.75	ug/L		06/05/18 15:00	06/06/18 15:40	1
Barium	**150**		5.0	2.2	ug/L		06/05/18 15:00	06/06/18 15:40	1
Beryllium	0.31	U	1.0	0.31	ug/L		06/05/18 15:00	06/06/18 15:40	1
Cadmium	0.21	U	1.0	0.21	ug/L		06/05/18 15:00	06/06/18 15:40	1
Cobalt	**0.77**	**J**	1.0	0.19	ug/L		06/05/18 15:00	06/06/18 15:40	1
Chromium	**2.1**		2.0	0.98	ug/L		06/05/18 15:00	06/06/18 15:40	1
Molybdenum	**1.6**	**J**	5.0	1.1	ug/L		06/05/18 15:00	06/06/18 15:40	1
Lead	0.45	U	1.0	0.45	ug/L		06/05/18 15:00	06/06/18 15:40	1
Antimony	0.57	U	2.0	0.57	ug/L		06/05/18 15:00	06/06/18 15:40	1
Selenium	0.89	U	5.0	0.89	ug/L		06/05/18 15:00	06/06/18 15:40	1
Lithium	**12**		8.0	1.7	ug/L		06/05/18 15:00	06/06/18 15:40	1
Thallium	0.20	U	1.0	0.20	ug/L		06/05/18 15:00	06/06/18 15:40	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.13	U F1 F2	0.20	0.13	ug/L		06/05/18 15:00	06/06/18 15:02	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	**0.042**	**J**	0.050	0.024	mg/L			06/15/18 23:59	1

QC Sample Results

Method: 6010C - Metals (ICP)

Lab Sample ID: MB 240-330141/1-A
Matrix: Water
Analysis Batch: 330488

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 330141

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	23	U	100	23	ug/L		06/05/18 15:00	06/06/18 21:31	1
Calcium	310	U	5000	310	ug/L		06/05/18 15:00	06/06/18 21:31	1

Lab Sample ID: LCS 240-330141/2-A
Matrix: Water
Analysis Batch: 330488

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 330141

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Boron			1000	1050		ug/L		105	80 - 120		
Calcium			50000	49200		ug/L		98	80 - 120		

Lab Sample ID: 240-96519-6 MS
Matrix: Water
Analysis Batch: 330488

Client Sample ID: MBLPS-18-05-MW-1 (I)
Prep Type: Total Recoverable
Prep Batch: 330141

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Boron	66	J	1000	1100		ug/L		103	75 - 125		
Calcium	110000		50000	159000		ug/L		94	75 - 125		

Lab Sample ID: 240-96519-6 MSD
Matrix: Water
Analysis Batch: 330488

Client Sample ID: MBLPS-18-05-MW-1 (I)
Prep Type: Total Recoverable
Prep Batch: 330141

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Boron	66	J	1000	1100		ug/L		104	75 - 125	0	20
Calcium	110000		50000	157000		ug/L		89	75 - 125	1	20

Method: 6020A - Metals (ICP/MS)

Lab Sample ID: MB 240-330141/1-A
Matrix: Water
Analysis Batch: 330498

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 330141

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.75	U	5.0	0.75	ug/L		06/05/18 15:00	06/06/18 15:31	1
Barium	2.2	U	5.0	2.2	ug/L		06/05/18 15:00	06/06/18 15:31	1
Beryllium	0.31	U	1.0	0.31	ug/L		06/05/18 15:00	06/06/18 15:31	1
Cadmium	0.21	U	1.0	0.21	ug/L		06/05/18 15:00	06/06/18 15:31	1
Cobalt	0.19	U	1.0	0.19	ug/L		06/05/18 15:00	06/06/18 15:31	1
Chromium	0.98	U	2.0	0.98	ug/L		06/05/18 15:00	06/06/18 15:31	1
Molybdenum	1.1	U	5.0	1.1	ug/L		06/05/18 15:00	06/06/18 15:31	1
Lead	0.45	U	1.0	0.45	ug/L		06/05/18 15:00	06/06/18 15:31	1
Antimony	0.57	U	2.0	0.57	ug/L		06/05/18 15:00	06/06/18 15:31	1
Selenium	0.89	U	5.0	0.89	ug/L		06/05/18 15:00	06/06/18 15:31	1
Lithium	1.7	U	8.0	1.7	ug/L		06/05/18 15:00	06/06/18 15:31	1
Thallium	0.20	U	1.0	0.20	ug/L		06/05/18 15:00	06/06/18 15:31	1

Method: 6020A - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 240-330141/3-A
Matrix: Water
Analysis Batch: 330498

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 330141

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Arsenic			1000	947		ug/L		95	80 - 120		
Barium			1000	969		ug/L		97	80 - 120		
Beryllium			1000	961		ug/L		96	80 - 120		
Cadmium			1000	1060		ug/L		106	80 - 120		
Cobalt			1000	979		ug/L		98	80 - 120		
Chromium			1000	964		ug/L		96	80 - 120		
Molybdenum			100	94.4		ug/L		94	80 - 120		
Lead			1000	1060		ug/L		106	80 - 120		
Antimony			100	93.0		ug/L		93	80 - 120		
Selenium			1000	947		ug/L		95	80 - 120		
Thallium			250	263		ug/L		105	80 - 120		

Lab Sample ID: 240-96519-7 MS
Matrix: Water
Analysis Batch: 330498

Client Sample ID: MBLPS-18-05-MW-1 (I)
Prep Type: Total Recoverable
Prep Batch: 330141

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Arsenic	0.75	U	1000	1030		ug/L		103	75 - 125		
Barium	150		1000	1130		ug/L		98	75 - 125		
Beryllium	0.31	U	1000	1000		ug/L		100	75 - 125		
Cadmium	0.21	U	1000	1060		ug/L		106	75 - 125		
Cobalt	0.77	J	1000	952		ug/L		95	75 - 125		
Chromium	2.1		1000	968		ug/L		97	75 - 125		
Molybdenum	1.6	J	100	103		ug/L		102	75 - 125		
Lead	0.45	U	1000	1040		ug/L		104	75 - 125		
Antimony	0.57	U	100	97.9		ug/L		98	75 - 125		
Selenium	0.89	U	1000	984		ug/L		98	75 - 125		
Thallium	0.20	U	250	253		ug/L		101	75 - 125		

Lab Sample ID: 240-96519-7 MSD
Matrix: Water
Analysis Batch: 330498

Client Sample ID: MBLPS-18-05-MW-1 (I)
Prep Type: Total Recoverable
Prep Batch: 330141

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	0.75	U	1000	1030		ug/L		103	75 - 125	0	20
Barium	150		1000	1160		ug/L		101	75 - 125	3	20
Beryllium	0.31	U	1000	1030		ug/L		103	75 - 125	3	20
Cadmium	0.21	U	1000	1080		ug/L		108	75 - 125	1	20
Cobalt	0.77	J	1000	969		ug/L		97	75 - 125	2	20
Chromium	2.1		1000	973		ug/L		97	75 - 125	1	20
Molybdenum	1.6	J	100	103		ug/L		102	75 - 125	0	20
Lead	0.45	U	1000	1050		ug/L		105	75 - 125	1	20
Antimony	0.57	U	100	99.4		ug/L		99	75 - 125	2	20
Selenium	0.89	U	1000	984		ug/L		98	75 - 125	0	20
Thallium	0.20	U	250	255		ug/L		102	75 - 125	1	20

Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 240-330150/1-A
Matrix: Water
Analysis Batch: 330440

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 330150

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.13	U	0.20	0.13	ug/L		06/05/18 15:00	06/06/18 15:23	1

Lab Sample ID: LCS 240-330150/2-A
Matrix: Water
Analysis Batch: 330440

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 330150

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	5.00	4.35		ug/L		87	80 - 120

Lab Sample ID: 240-96519-7 MS
Matrix: Water
Analysis Batch: 330440

Client Sample ID: MBLPS-18-05-MW-1 (I)
Prep Type: Total/NA
Prep Batch: 330150

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.13	U F1 F2	1.00	0.954		ug/L		95	80 - 120

Lab Sample ID: 240-96519-7 MSD
Matrix: Water
Analysis Batch: 330440

Client Sample ID: MBLPS-18-05-MW-1 (I)
Prep Type: Total/NA
Prep Batch: 330150

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	0.13	U F1 F2	1.00	0.757	F1 F2	ug/L		76	80 - 120	23	20

Method: 9040B - pH

Lab Sample ID: LCS 240-330127/2
Matrix: Water
Analysis Batch: 330127

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
pH	9.19	9.2		SU		100	97 - 103

Lab Sample ID: 240-96519-6 DU
Matrix: Water
Analysis Batch: 330127

Client Sample ID: MBLPS-18-05-MW-1 (I)
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
pH	7.8	HF	7.8	HF	SU		0.1	20

Method: 9056A - Anions, Ion Chromatography

Lab Sample ID: MB 240-331676/3
Matrix: Water
Analysis Batch: 331676

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	0.28	U	1.0	0.28	mg/L			06/18/18 00:34	1
Fluoride	0.024	U	0.050	0.024	mg/L			06/18/18 00:34	1
Sulfate	0.35	U	1.0	0.35	mg/L			06/18/18 00:34	1

QC Sample Results

Lab Sample ID: LCS 240-331676/4
Matrix: Water
Analysis Batch: 331676

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Chloride			50.0	51.4		mg/L		103	90 - 110		
Fluoride			2.50	2.64		mg/L		106	90 - 110		
Sulfate			50.0	51.5		mg/L		103	90 - 110		

Lab Sample ID: 240-96519-6 MS
Matrix: Water
Analysis Batch: 331676

Client Sample ID: MBLPS-18-05-MW-1 (I)
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Fluoride	0.046	J	2.50	2.79		mg/L		110	80 - 120		

Lab Sample ID: 240-96519-6 MSD
Matrix: Water
Analysis Batch: 331676

Client Sample ID: MBLPS-18-05-MW-1 (I)
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Fluoride	0.046	J	2.50	2.74		mg/L		108	80 - 120	2	15

Lab Sample ID: MB 240-331714/3
Matrix: Water
Analysis Batch: 331714

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	0.28	U	1.0	0.28	mg/L			06/15/18 21:13	1
Fluoride	0.024	U	0.050	0.024	mg/L			06/15/18 21:13	1
Sulfate	0.35	U	1.0	0.35	mg/L			06/15/18 21:13	1

Lab Sample ID: LCS 240-331714/4
Matrix: Water
Analysis Batch: 331714

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Chloride			50.0	51.4		mg/L		103	90 - 110		
Fluoride			2.50	2.64		mg/L		106	90 - 110		
Sulfate			50.0	51.4		mg/L		103	90 - 110		

Lab Sample ID: 240-96519-6 MS
Matrix: Water
Analysis Batch: 331714

Client Sample ID: MBLPS-18-05-MW-1 (I)
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Chloride	310		250	542		mg/L		93	80 - 120		
Sulfate	25		250	278		mg/L		101	80 - 120		

Lab Sample ID: 240-96519-6 MSD
Matrix: Water
Analysis Batch: 331714

Client Sample ID: MBLPS-18-05-MW-1 (I)
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chloride	310		250	537		mg/L		91	80 - 120	1	15
Sulfate	25		250	278		mg/L		101	80 - 120	0	15

Method: 9056A - Anions, Ion Chromatography (Continued)

Lab Sample ID: 240-96519-7 MS
Matrix: Water
Analysis Batch: 331714

Client Sample ID: MBLPS-18-05-MW-1 (I)
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Fluoride	0.042	J	2.50	2.74		mg/L		108	80 - 120

Lab Sample ID: 240-96519-7 MSD
Matrix: Water
Analysis Batch: 331714

Client Sample ID: MBLPS-18-05-MW-1 (I)
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Fluoride	0.042	J	2.50	2.75		mg/L		108	80 - 120	0	15

Method: SM 2540C - Solids, Total Dissolved (TDS)

Lab Sample ID: MB 240-330503/1
Matrix: Water
Analysis Batch: 330503

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	7.8	U	10	7.8	mg/L			06/07/18 10:44	1

Lab Sample ID: LCS 240-330503/2
Matrix: Water
Analysis Batch: 330503

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Dissolved Solids	626	627		mg/L		100	80 - 120

Lab Sample ID: 240-96519-6 DU
Matrix: Water
Analysis Batch: 330503

Client Sample ID: MBLPS-18-05-MW-1 (I)
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Total Dissolved Solids	770		760		mg/L		1	20

QC Association Summary

Client: Fishbeck Thompson Carr & Huber Inc
Project/Site: CCR-MBLP Shiras Steam Plant

TestAmerica Job ID: 240-96519-1

Metals

Prep Batch: 330141

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96519-1	MBLPS-18-05-MW-4 (I)	Total Recoverable	Water	3005A	
240-96519-2	MBLPS-18-05-MW-5 (I)	Total Recoverable	Water	3005A	
240-96519-3	MBLPS-18-05-MW-3 (I)	Total Recoverable	Water	3005A	
240-96519-4	MBLPS-18-05-MW-2 (I)	Total Recoverable	Water	3005A	
240-96519-5	MBLPS-18-05-MW-2 (D)	Total Recoverable	Water	3005A	
240-96519-6	MBLPS-18-05-MW-1 (I)	Total Recoverable	Water	3005A	
240-96519-7	MBLPS-18-05-MW-1 (I)	Total Recoverable	Water	3005A	
MB 240-330141/1-A	Method Blank	Total Recoverable	Water	3005A	
LCS 240-330141/2-A	Lab Control Sample	Total Recoverable	Water	3005A	
LCS 240-330141/3-A	Lab Control Sample	Total Recoverable	Water	3005A	
240-96519-6 MS	MBLPS-18-05-MW-1 (I)	Total Recoverable	Water	3005A	
240-96519-6 MSD	MBLPS-18-05-MW-1 (I)	Total Recoverable	Water	3005A	
240-96519-7 MS	MBLPS-18-05-MW-1 (I)	Total Recoverable	Water	3005A	
240-96519-7 MSD	MBLPS-18-05-MW-1 (I)	Total Recoverable	Water	3005A	

Prep Batch: 330150

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96519-7	MBLPS-18-05-MW-1 (I)	Total/NA	Water	7470A	
MB 240-330150/1-A	Method Blank	Total/NA	Water	7470A	
LCS 240-330150/2-A	Lab Control Sample	Total/NA	Water	7470A	
240-96519-7 MS	MBLPS-18-05-MW-1 (I)	Total/NA	Water	7470A	
240-96519-7 MSD	MBLPS-18-05-MW-1 (I)	Total/NA	Water	7470A	

Analysis Batch: 330440

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96519-7	MBLPS-18-05-MW-1 (I)	Total/NA	Water	7470A	330150
MB 240-330150/1-A	Method Blank	Total/NA	Water	7470A	330150
LCS 240-330150/2-A	Lab Control Sample	Total/NA	Water	7470A	330150
240-96519-7 MS	MBLPS-18-05-MW-1 (I)	Total/NA	Water	7470A	330150
240-96519-7 MSD	MBLPS-18-05-MW-1 (I)	Total/NA	Water	7470A	330150

Analysis Batch: 330488

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96519-1	MBLPS-18-05-MW-4 (I)	Total Recoverable	Water	6010C	330141
240-96519-2	MBLPS-18-05-MW-5 (I)	Total Recoverable	Water	6010C	330141
240-96519-3	MBLPS-18-05-MW-3 (I)	Total Recoverable	Water	6010C	330141
240-96519-4	MBLPS-18-05-MW-2 (I)	Total Recoverable	Water	6010C	330141
240-96519-5	MBLPS-18-05-MW-2 (D)	Total Recoverable	Water	6010C	330141
240-96519-6	MBLPS-18-05-MW-1 (I)	Total Recoverable	Water	6010C	330141
MB 240-330141/1-A	Method Blank	Total Recoverable	Water	6010C	330141
LCS 240-330141/2-A	Lab Control Sample	Total Recoverable	Water	6010C	330141
240-96519-6 MS	MBLPS-18-05-MW-1 (I)	Total Recoverable	Water	6010C	330141
240-96519-6 MSD	MBLPS-18-05-MW-1 (I)	Total Recoverable	Water	6010C	330141

Analysis Batch: 330498

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96519-7	MBLPS-18-05-MW-1 (I)	Total Recoverable	Water	6020A	330141
MB 240-330141/1-A	Method Blank	Total Recoverable	Water	6020A	330141
LCS 240-330141/3-A	Lab Control Sample	Total Recoverable	Water	6020A	330141
240-96519-7 MS	MBLPS-18-05-MW-1 (I)	Total Recoverable	Water	6020A	330141
240-96519-7 MSD	MBLPS-18-05-MW-1 (I)	Total Recoverable	Water	6020A	330141

QC Association Summary

General Chemistry

Analysis Batch: 330127

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96519-1	MBLPS-18-05-MW-4 (I)	Total/NA	Water	9040B	
240-96519-2	MBLPS-18-05-MW-5 (I)	Total/NA	Water	9040B	
240-96519-3	MBLPS-18-05-MW-3 (I)	Total/NA	Water	9040B	
240-96519-4	MBLPS-18-05-MW-2 (I)	Total/NA	Water	9040B	
240-96519-5	MBLPS-18-05-MW-2 (D)	Total/NA	Water	9040B	
240-96519-6	MBLPS-18-05-MW-1 (I)	Total/NA	Water	9040B	
LCS 240-330127/2	Lab Control Sample	Total/NA	Water	9040B	
240-96519-6 DU	MBLPS-18-05-MW-1 (I)	Total/NA	Water	9040B	

Analysis Batch: 330503

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96519-1	MBLPS-18-05-MW-4 (I)	Total/NA	Water	SM 2540C	
240-96519-2	MBLPS-18-05-MW-5 (I)	Total/NA	Water	SM 2540C	
240-96519-3	MBLPS-18-05-MW-3 (I)	Total/NA	Water	SM 2540C	
240-96519-4	MBLPS-18-05-MW-2 (I)	Total/NA	Water	SM 2540C	
240-96519-5	MBLPS-18-05-MW-2 (D)	Total/NA	Water	SM 2540C	
240-96519-6	MBLPS-18-05-MW-1 (I)	Total/NA	Water	SM 2540C	
MB 240-330503/1	Method Blank	Total/NA	Water	SM 2540C	
LCS 240-330503/2	Lab Control Sample	Total/NA	Water	SM 2540C	
240-96519-6 DU	MBLPS-18-05-MW-1 (I)	Total/NA	Water	SM 2540C	

Analysis Batch: 331676

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96519-1	MBLPS-18-05-MW-4 (I)	Total/NA	Water	9056A	
240-96519-1	MBLPS-18-05-MW-4 (I)	Total/NA	Water	9056A	
240-96519-2	MBLPS-18-05-MW-5 (I)	Total/NA	Water	9056A	
240-96519-2	MBLPS-18-05-MW-5 (I)	Total/NA	Water	9056A	
240-96519-6	MBLPS-18-05-MW-1 (I)	Total/NA	Water	9056A	
MB 240-331676/3	Method Blank	Total/NA	Water	9056A	
LCS 240-331676/4	Lab Control Sample	Total/NA	Water	9056A	
240-96519-6 MS	MBLPS-18-05-MW-1 (I)	Total/NA	Water	9056A	
240-96519-6 MSD	MBLPS-18-05-MW-1 (I)	Total/NA	Water	9056A	

Analysis Batch: 331714

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96519-3	MBLPS-18-05-MW-3 (I)	Total/NA	Water	9056A	
240-96519-4	MBLPS-18-05-MW-2 (I)	Total/NA	Water	9056A	
240-96519-5	MBLPS-18-05-MW-2 (D)	Total/NA	Water	9056A	
240-96519-6	MBLPS-18-05-MW-1 (I)	Total/NA	Water	9056A	
240-96519-7	MBLPS-18-05-MW-1 (I)	Total/NA	Water	9056A	
MB 240-331714/3	Method Blank	Total/NA	Water	9056A	
LCS 240-331714/4	Lab Control Sample	Total/NA	Water	9056A	
240-96519-6 MS	MBLPS-18-05-MW-1 (I)	Total/NA	Water	9056A	
240-96519-6 MSD	MBLPS-18-05-MW-1 (I)	Total/NA	Water	9056A	
240-96519-7 MS	MBLPS-18-05-MW-1 (I)	Total/NA	Water	9056A	
240-96519-7 MSD	MBLPS-18-05-MW-1 (I)	Total/NA	Water	9056A	

Lab Chronicle

Client: Fishbeck Thompson Carr & Huber Inc
Project/Site: CCR-MBLP Shiras Steam Plant

TestAmerica Job ID: 240-96519-1

Client Sample ID: MBLPS-18-05-MW-4 (I)

Lab Sample ID: 240-96519-1
Date Collected: 05/31/18 11:08
Matrix: Water
Date Received: 06/05/18 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			330141	06/05/18 15:00	MBB	TAL CAN
Total Recoverable	Analysis	6010C		1	330488	06/06/18 22:15	KLC	TAL CAN
Total/NA	Analysis	9040B		1	330127	06/05/18 14:37	BLW	TAL CAN
Total/NA	Analysis	9056A		1	331676	06/18/18 10:15	LKG	TAL CAN
Total/NA	Analysis	9056A		10	331676	06/18/18 10:35	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	330503	06/07/18 10:44	MMM	TAL CAN

Client Sample ID: MBLPS-18-05-MW-5 (I)

Lab Sample ID: 240-96519-2
Date Collected: 05/31/18 11:20
Matrix: Water
Date Received: 06/05/18 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			330141	06/05/18 15:00	MBB	TAL CAN
Total Recoverable	Analysis	6010C		1	330488	06/06/18 22:20	KLC	TAL CAN
Total/NA	Analysis	9040B		1	330127	06/05/18 14:43	BLW	TAL CAN
Total/NA	Analysis	9056A		1	331676	06/18/18 10:56	LKG	TAL CAN
Total/NA	Analysis	9056A		5	331676	06/18/18 11:17	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	330503	06/07/18 10:44	MMM	TAL CAN

Client Sample ID: MBLPS-18-05-MW-3 (I)

Lab Sample ID: 240-96519-3
Date Collected: 05/31/18 13:41
Matrix: Water
Date Received: 06/05/18 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			330141	06/05/18 15:00	MBB	TAL CAN
Total Recoverable	Analysis	6010C		1	330488	06/06/18 22:26	KLC	TAL CAN
Total/NA	Analysis	9040B		1	330127	06/05/18 14:49	BLW	TAL CAN
Total/NA	Analysis	9056A		1	331714	06/15/18 21:54	JWW	TAL CAN
Total/NA	Analysis	SM 2540C		1	330503	06/07/18 10:44	MMM	TAL CAN

Client Sample ID: MBLPS-18-05-MW-2 (I)

Lab Sample ID: 240-96519-4
Date Collected: 05/31/18 15:07
Matrix: Water
Date Received: 06/05/18 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			330141	06/05/18 15:00	MBB	TAL CAN
Total Recoverable	Analysis	6010C		1	330488	06/06/18 22:31	KLC	TAL CAN
Total/NA	Analysis	9040B		1	330127	06/05/18 14:55	BLW	TAL CAN
Total/NA	Analysis	9056A		1	331714	06/15/18 22:15	JWW	TAL CAN
Total/NA	Analysis	SM 2540C		1	330503	06/07/18 10:44	MMM	TAL CAN

Client Sample ID: MBLPS-18-05-MW-2 (D)

Lab Sample ID: 240-96519-5

Date Collected: 05/31/18 15:07
Date Received: 06/05/18 09:30

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			330141	06/05/18 15:00	MBB	TAL CAN
Total Recoverable	Analysis	6010C		1	330488	06/06/18 22:36	KLC	TAL CAN
Total/NA	Analysis	9040B		1	330127	06/05/18 15:00	BLW	TAL CAN
Total/NA	Analysis	9056A		1	331714	06/15/18 22:36	JWW	TAL CAN
Total/NA	Analysis	SM 2540C		1	330503	06/07/18 10:44	MMM	TAL CAN

Client Sample ID: MBLPS-18-05-MW-1 (I)

Lab Sample ID: 240-96519-6

Date Collected: 05/31/18 16:29
Date Received: 06/05/18 09:30

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			330141	06/05/18 15:00	MBB	TAL CAN
Total Recoverable	Analysis	6010C		1	330488	06/06/18 21:41	KLC	TAL CAN
Total/NA	Analysis	9040B		1	330127	06/05/18 15:06	BLW	TAL CAN
Total/NA	Analysis	9056A		5	331714	06/15/18 22:56	JWW	TAL CAN
Total/NA	Analysis	9056A		1	331676	06/18/18 12:19	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	330503	06/07/18 10:44	MMM	TAL CAN

Client Sample ID: MBLPS-18-05-MW-1 (I)

Lab Sample ID: 240-96519-7

Date Collected: 05/31/18 16:29
Date Received: 06/05/18 09:30

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			330141	06/05/18 15:00	MBB	TAL CAN
Total Recoverable	Analysis	6020A		1	330498	06/06/18 15:40	DSH	TAL CAN
Total/NA	Prep	7470A			330150	06/05/18 15:00	MBB	TAL CAN
Total/NA	Analysis	7470A		1	330440	06/06/18 15:02	AJC	TAL CAN
Total/NA	Analysis	9056A		1	331714	06/15/18 23:59	JWW	TAL CAN

Laboratory References:

TAL CAN = TestAmerica Canton, 4101 Shuffel Street NW, North Canton, OH 44720, TEL (330)497-9396

Accreditation/Certification Summary

Laboratory: TestAmerica Canton

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
California	State Program	9	2927	02-23-19
Connecticut	State Program	1	PH-0590	12-31-19
Florida	NELAP	4	E87225	06-30-18 *
Illinois	NELAP	5	200004	07-31-18 *
Kansas	NELAP	7	E-10336	01-31-19
Kentucky (UST)	State Program	4	58	02-23-19
Kentucky (WW)	State Program	4	98016	12-31-18
Minnesota	NELAP	5	039-999-348	12-31-18
Minnesota (Petrofund)	State Program	1	3506	07-31-18 *
Nevada	State Program	9	OH-000482008A	07-31-18 *
New Jersey	NELAP	2	OH001	06-30-18 *
New York	NELAP	2	10975	03-31-19
Ohio VAP	State Program	5	CL0024	09-06-19
Oregon	NELAP	10	4062	02-23-19
Pennsylvania	NELAP	3	68-00340	08-31-18 *
Texas	NELAP	6	T104704517-17-9	08-31-18 *
USDA	Federal		P330-16-00404	12-28-19
Virginia	NELAP	3	460175	09-14-18 *
Washington	State Program	10	C971	01-12-19
West Virginia DEP	State Program	3	210	12-31-18

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

4.2/4.3

ftch CHAIN OF CUSTODY RECORD

Fishbeck, Thompson, Carr & Huber, Inc
Address 1515 Arboretum Dr SE
Grand Rapids, MI 49546
Phone 616. 575. 3824

Report to Penni Mahler
Email pdmahler@ftch.com
Copy to
Email

Invoice to Payable
Email @ftch.com
Lab Quote
Reference 24019987

PROJECT NAME MB&P/SHIRAS ASD+Lcw	PROJECT NO 180827	PAGE 1	OF 1
PROJECT LOCATION Marquette, MI	SAMPLER(S) NAME APS - AD	STD TAT ☒	
PROJECT MANAGER Todd Campbell	PHONE 269-544-6948	RUSH TAT ☐	
	EMAIL tccampbell@ftch.com	DATE DUE	
ADDITIONAL INFORMATION			

MATRIX TYPE

REQUIRED ANALYSES

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	AQUEOUS (WATER)	SOLID/SEMI-SOLID	AIR	NONAQUEOUS LIQUID	Boron; Calcium	Cl, F, pH, TDS, SO4	REMARKS
PRESERVATIVE							—	HNO3	
NUMBER OF CONTAINERS SUBMITTED									
5/31/18	1108	MBLPS-18-05-MW-4(E)	X				1	1	
	1120	MBLPS-18-05-MW-5(E)	X				1	1	
	1341	MBLPS-18-05-MW 3(E)	X				1	1	
	1507	MBLPS-18-05-MW-2(E)	X				1	1	
	↓	MBLPS-18-05-MW-2(D)	X				1	1	
	1629	MBLPS-18-05-MW-1(E/MS/MSD)	X				3	3	

240-96519 Chain of Custody

RELINQUISHED BY	DATE 6/1/18	TIME 1600	RELINQUISHED BY	DATE	TIME 16:30 6/4/18	RELINQUISHED BY	DATE	TIME	METHOD OF SHIPMENT/BILL OF LADING FedEx# 7115-7198-7937		
To storage											
RECEIVED BY From Storage	DATE 6/4/18	TIME 16:30	RECEIVED BY	DATE	TIME	RECEIVED BY	DATE	TIME	RECEIVED FOR LAB	DATE 6/5/18	TIME 930

WHITE Copy — Return with data package
YELLOW Copy — field File / Project Documentation

G 042036

CHAIN OF CUSTODY RECORD

Fishbeck, Thompson, Carr & Huber, Inc.

1515 Arboretum Drive, SE
Grand Rapids, MI 49546
(616) 575-3824

5913 Executive Dr., Ste. 100
Lansing, MI 48911
(517) 882-0383

4775 Campus Drive
Kalamazoo, MI 49008
(269) 375-3824

39500 MacKenzie Drive, Suite 100
Novi, MI 48377
(248) 324-2090

11353 Reed Hartman Hwy., Ste. 500
Cincinnati, OH 45241
(513) 469-2370

PROJECT NAME: MBLP/SHEAS ASC: GW
PROJECT NO: 180827
PROJECT LOCATION: MARQUETTE, MI
SAMPLER(S) NAME: APS AND AD
PROJECT MANAGER: TCC
PHONE: 269.544.6948
EMAIL: tcampbell@ftch.COM
ADDITIONAL INFORMATION:

PAGE 2 OF 2

STD TAT ☒
RUSH TAT ☐
DATE DUE ____________

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	MATRIX TYPE: AQUEOUS (WATER)	SOLID/SEMI-SOLID	AIR	NONAQUEOUS LIQUID	REQUIRED ANALYSES: F1	*METALS										REMARKS
							PRESERVATIVE: –	HNO3										
							NUMBER OF CONTAINERS SUBMITTED											
5/24/18	1629	MBLPS-18-05-MW-1(MS/MSD)	X				3	3										METALS = Sb, As, Ba, Be,
																		Cd, Cr, Co, Pb, Hg, Mo,
																		Se, Tl, Li

RELINQUISHED BY	DATE	TIME	RELINQUISHED BY	DATE	TIME	RELINQUISHED BY	DATE	TIME	METHOD OF SHIPMENT/BILL OF LADING
	5/11/18	1000		6/4/18	16:30				FedEx # 7115-7198-7937
To Storage									

RECEIVED BY	DATE	TIME	RECEIVED BY	DATE	TIME	RECEIVED BY	DATE	TIME	RECEIVED FOR LAB	DATE	TIME
From Storage	6/4/18	16:30								6/5/18	930

WHITE Copy — Return with data package. YELLOW Copy — Forward to laboratory PINK Copy — field File / Project Documentation

G 041501

TestAmerica Canton Sample Receipt Form/Narrative **Login # :** 96519
Canton Facility

Client FTCH Site Name ____ Cooler unpacked by:
Cooler Received on 6/5/18 Opened on 6/5/18
FedEx: 1st Grd [✓ Exp] UPS FAS Clipper Client Drop Off TestAmerica Courier Other ____

Receipt After-hours: Drop-off Date/Time ____ Storage Location ____

TestAmerica Cooler # TA Foam Box Client Cooler Box Other ____
Packing material used: Bubble Wrap Foam [✓ Plastic Bag] None Other ____
COOLANT: [✓ Wet Ice] Blue Ice Dry Ice Water None

1. Cooler temperature upon receipt ☐ See Multiple Cooler Form
IR GUN# IR-8 (CF +0.1 °C) Observed Cooler Temp. 4.2 °C Corrected Cooler Temp. 4.3 °C
IR GUN #36 (CF +0.3°C) Observed Cooler Temp. ____ °C Corrected Cooler Temp. ____ °C
~~IR GUN # 627 (CF -1.3°C) Observed Cooler Temp. ____ °C Corrected Cooler Temp. ____ °C~~

2. Were tamper/custody seals on the outside of the cooler(s)? If Yes Quantity 1 [✓ Yes] No
-Were the seals on the outside of the cooler(s) signed & dated? [✓ Yes] No NA
-Were tamper/custody seals on the bottle(s) or bottle kits (LLHg/MeHg)? Yes [✓ No]
-Were tamper/custody seals intact and uncompromised? [✓ Yes] No NA
3. Shippers' packing slip attached to the cooler(s)? [✓ Yes] No
4. Did custody papers accompany the sample(s)? [✓ Yes] No
5. Were the custody papers relinquished & signed in the appropriate place? [✓ Yes] No
6. Was/were the person(s) who collected the samples clearly identified on the COC? [✓ Yes] No
7. Did all bottles arrive in good condition (Unbroken)? [✓ Yes] No
8. Could all bottle labels be reconciled with the COC? [✓ Yes] No
9. Were correct bottle(s) used for the test(s) indicated? [✓ Yes] No
10. Sufficient quantity received to perform indicated analyses? [✓ Yes] No
11. Are these work share samples? Yes [✓ No]
If yes, Questions 12-16 have been checked at the originating laboratory.
12. Were all preserved sample(s) at the correct pH upon receipt? [✓ Yes] No ~~[✓ NA]~~ pH Strip Lot# **HC740840**
13. Were VOAs on the COC? Yes [✓ No]
14. Were air bubbles >6 mm in any VOA vials? ● ⬅ Larger than this. Yes No [✓ NA]
15. Was a VOA trip blank present in the cooler(s)? Trip Blank Lot # ____ Yes [✓ No]
16. Was a LL Hg or Me Hg trip blank present? ____ Yes [✓ No]

Tests that are not checked for pH by Receiving:

VOAs
Oil and Grease
TOC

Contacted PM ____ Date ____ by ____ via Verbal Voice Mail Other

Concerning ____

17. CHAIN OF CUSTODY & SAMPLE DISCREPANCIES

Samples processed by: JR

18. SAMPLE CONDITION

Sample(s) ____ were received after the recommended holding time had expired.
Sample(s) ____ were received in a broken container.
Sample(s) ____ were received with bubble >6 mm in diameter. (Notify PM)

19. SAMPLE PRESERVATION

Sample(s) ____ were further preserved in the laboratory.
Time preserved: ____ Preservative(s) added/Lot number(s): ____.

WI-NC-099

6/5/2018

Login Container Summary Report

240-96519

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Temperature readings. ______________________________

Client Sample ID	Lab ID	Container Type	Container pH	Preservative Added (mls)	Lot #
MBLPS-18-05-MW-4 (I)	240-96519-B-1	Plastic 500ml - with Nitric Acid	<2		
MBLPS-18-05-MW-5 (I)	240-96519-B-2	Plastic 500ml - with Nitric Acid	<2		
MBLPS-18-05-MW-3 (I)	240-96519-B-3	Plastic 500ml - with Nitric Acid	<2		
MBLPS-18-05-MW-2 (I)	240-96519-B-4	Plastic 500ml - with Nitric Acid	<2		
MBLPS-18-05-MW-2 (D)	240-96519-B-5	Plastic 500ml - with Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96519-D-6	Plastic 500ml - with Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96519-E-6	Plastic 500ml - with Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96519-F-6	Plastic 500ml - with Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96519-D-7	Plastic 500ml - with Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96519-E-7	Plastic 500ml - with Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96519-F-7	Plastic 500ml - with Nitric Acid	<2		

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

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ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Canton
4101 Shuffel Street NW
North Canton, OH 44720
Tel: (330)497-9396

TestAmerica Job ID: 240-96523-2
Client Project/Site: CCR-MBLP Shiras Steam Plant

For:
Fishbeck Thompson Carr & Huber Inc
1515 Arboretum Drive SE
Grand Rapids, Michigan 49546

Attn: Penni Mahler

Patrick O'Meara

Authorized for release by:
7/9/2018 3:36:40 PM
Patrick O'Meara, Manager of Project Management
(330)966-5725
patrick.omeara@testamericainc.com

Designee for

Kris Brooks, Project Manager II
(330)966-9790
kris.brooks@testamericainc.com

LINKS

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Have a Question? Ask The Expert

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Table of Contents

Definitions/Glossary

Qualifiers

Rad

Qualifier	Qualifier Description
*	LCS or LCSD is outside acceptance limits.
U	Result is less than the sample detection limit.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 240-96523-2

Laboratory: TestAmerica Canton

Narrative

CASE NARRATIVE

Client: Fishbeck Thompson Carr & Huber Inc

Project: CCR-MBLP Shiras Steam Plant

Report Number: 240-96523-2

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica Canton attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The 9315 Radium-226, 9320 Radium-228, and Ra226Ra228 Combined Radium-226 and Radium-228 analyses were performed at the TestAmerica St. Louis laboratory.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT
The samples were received on 6/5/2018 9:30 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 3.5º C.

RADIUM-226
Samples MBLPS-18-05-MW-4 (I) (240-96523-1), MBLPS-18-05-MW-5 (I) (240-96523-2) and MBLPS-18-05-MW-3 (I) (240-96523-3) were analyzed for Radium-226 in accordance with SW846 Method 9315. The samples were prepared on 06/11/2018 and analyzed on 07/03/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

RADIUM-228 (GFPC)
Samples MBLPS-18-05-MW-4 (I) (240-96523-1), MBLPS-18-05-MW-5 (I) (240-96523-2) and MBLPS-18-05-MW-3 (I) (240-96523-3) were analyzed for Radium-228 (GFPC) in accordance with SW846 Method 9320. The samples were prepared on 06/11/2018 and analyzed on 07/02/2018.

The laboratory control sample (LCS) recovery (160%) associated with the following samples is outside the upper QC limit of 140% indicating a potential positive bias for that analyte. This analyte was not observed above the RL in the associated samples; therefore the

Job ID: 240-96523-2 (Continued)

Laboratory: TestAmerica Canton (Continued)

sample data is not adversely affected by this excursion. The data have been reported with this narrative.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

COMBINED RADIUM 226 AND RADIUM 228

Samples MBLPS-18-05-MW-4 (I) (240-96523-1), MBLPS-18-05-MW-5 (I) (240-96523-2) and MBLPS-18-05-MW-3 (I) (240-96523-3) were analyzed for Combined Radium 226 and Radium 228 in accordance with Ra226_Ra228. The samples were analyzed on 07/08/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Method Summary

Method	Method Description	Protocol	Laboratory
9315	Radium-226 (GFPC)	SW846	TAL SL
9320	Radium-228 (GFPC)	SW846	TAL SL
Ra226_Ra228	Combined Radium-226 and Radium-228	TAL-STL	TAL SL
PrecSep_0	Preparation, Precipitate Separation	None	TAL SL
PrecSep-21	Preparation, Precipitate Separation (21-Day In-Growth)	None	TAL SL

Protocol References:

None = None

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

TAL-STL = TestAmerica Laboratories, St. Louis, Facility Standard Operating Procedure.

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Fishbeck Thompson Carr & Huber Inc
Project/Site: CCR-MBLP Shiras Steam Plant

TestAmerica Job ID: 240-96523-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
240-96523-1	MBLPS-18-05-MW-4 (I)	Water	05/31/18 11:08	06/05/18 09:30
240-96523-2	MBLPS-18-05-MW-5 (I)	Water	05/31/18 11:20	06/05/18 09:30
240-96523-3	MBLPS-18-05-MW-3 (I)	Water	05/31/18 13:41	06/05/18 09:30

Detection Summary

Client: Fishbeck Thompson Carr & Huber Inc
Project/Site: CCR-MBLP Shiras Steam Plant

TestAmerica Job ID: 240-96523-2

Client Sample ID: MBLPS-18-05-MW-4 (I) Lab Sample ID: 240-96523-1

No Detections.

Client Sample ID: MBLPS-18-05-MW-5 (I) Lab Sample ID: 240-96523-2

No Detections.

Client Sample ID: MBLPS-18-05-MW-3 (I) Lab Sample ID: 240-96523-3

No Detections.

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client Sample ID: MBLPS-18-05-MW-4 (I)

Lab Sample ID: 240-96523-1

Date Collected: 05/31/18 11:08

Matrix: Water

Date Received: 06/05/18 09:30

Method: 9315 - Radium-226 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	**0.400**		0.206	0.209	1.00	0.245	pCi/L	06/11/18 13:02	07/03/18 06:00	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*88.8*		*40 - 110*	*06/11/18 13:02*	*07/03/18 06:00*	*1*

Method: 9320 - Radium-228 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-228	0.240	U *	0.246	0.247	1.00	0.400	pCi/L	06/11/18 13:56	07/02/18 14:36	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*88.8*		*40 - 110*	*06/11/18 13:56*	*07/02/18 14:36*	*1*
Y Carrier	*91.2*		*40 - 110*	*06/11/18 13:56*	*07/02/18 14:36*	*1*

Method: Ra226_Ra228 - Combined Radium-226 and Radium-228

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Combined Radium 226 + 228	**0.639**		0.321	0.324	5.00	0.400	pCi/L		07/08/18 16:47	1

Client Sample ID: MBLPS-18-05-MW-5 (I)

Date Collected: 05/31/18 11:20
Date Received: 06/05/18 09:30

Lab Sample ID: 240-96523-2

Matrix: Water

Method: 9315 - Radium-226 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	**0.272**		0.174	0.176	1.00	0.223	pCi/L	06/11/18 13:02	07/03/18 06:00	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*86.4*		*40 - 110*	*06/11/18 13:02*	*07/03/18 06:00*	*1*

Method: 9320 - Radium-228 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-228	0.198	U *	0.234	0.234	1.00	0.385	pCi/L	06/11/18 13:56	07/02/18 14:36	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*86.4*		*40 - 110*	*06/11/18 13:56*	*07/02/18 14:36*	*1*
Y Carrier	*90.5*		*40 - 110*	*06/11/18 13:56*	*07/02/18 14:36*	*1*

Method: Ra226_Ra228 - Combined Radium-226 and Radium-228

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Combined Radium 226 + 228	**0.470**		0.292	0.293	5.00	0.385	pCi/L		07/08/18 16:47	1

Client Sample ID: MBLPS-18-05-MW-3 (I)

Lab Sample ID: 240-96523-3

Date Collected: 05/31/18 13:41

Matrix: Water

Date Received: 06/05/18 09:30

Method: 9315 - Radium-226 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.199	U	0.160	0.161	1.00	0.234	pCi/L	06/11/18 13:02	07/03/18 06:01	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*92.9*		*40 - 110*	*06/11/18 13:02*	*07/03/18 06:01*	*1*

Method: 9320 - Radium-228 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-228	-0.0711	U *	0.196	0.196	1.00	0.367	pCi/L	06/11/18 13:56	07/02/18 14:37	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*92.9*		*40 - 110*	*06/11/18 13:56*	*07/02/18 14:37*	*1*
Y Carrier	*91.2*		*40 - 110*	*06/11/18 13:56*	*07/02/18 14:37*	*1*

Method: Ra226_Ra228 - Combined Radium-226 and Radium-228

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Combined Radium 226 + 228	0.128	U	0.253	0.254	5.00	0.367	pCi/L		07/08/18 16:47	1

Tracer/Carrier Summary

Method: 9315 - Radium-226 (GFPC)

Matrix: Water **Prep Type: Total/NA**

Percent Yield (Acceptance Limits)

Lab Sample ID	Client Sample ID	Ba Carrier (40-110)
240-96523-1	MBLPS-18-05-MW-4 (I)	88.8
240-96523-2	MBLPS-18-05-MW-5 (I)	86.4
240-96523-3	MBLPS-18-05-MW-3 (I)	92.9
LCS 160-369900/1-A	Lab Control Sample	88.8
MB 160-369900/23-A	Method Blank	92.6

Tracer/Carrier Legend

Ba Carrier = Ba Carrier

Method: 9320 - Radium-228 (GFPC)

Matrix: Water **Prep Type: Total/NA**

Percent Yield (Acceptance Limits)

Lab Sample ID	Client Sample ID	Ba Carrier (40-110)	Y Carrier (40-110)
240-96523-1	MBLPS-18-05-MW-4 (I)	88.8	91.2
240-96523-2	MBLPS-18-05-MW-5 (I)	86.4	90.5
240-96523-3	MBLPS-18-05-MW-3 (I)	92.9	91.2
LCS 160-369905/1-A	Lab Control Sample	88.8	92.7
MB 160-369905/23-A	Method Blank	92.6	92.0

Tracer/Carrier Legend

Ba Carrier = Ba Carrier
Y Carrier = Y Carrier

QC Sample Results

Method: 9315 - Radium-226 (GFPC)

Lab Sample ID: MB 160-369900/23-A
Matrix: Water
Analysis Batch: 373831

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 369900

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	-0.006681	U	0.0929	0.0929	1.00	0.207	pCi/L	06/11/18 13:02	07/03/18 09:43	1

Carrier	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*92.6*		*40 - 110*	*06/11/18 13:02*	*07/03/18 09:43*	*1*

Lab Sample ID: LCS 160-369900/1-A
Matrix: Water
Analysis Batch: 373830

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 369900

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Radium-226			11.8	12.31		1.46	1.00	0.231	pCi/L	104	68 - 137		

Carrier	*LCS %Yield*	*LCS Qualifier*	*Limits*
Ba Carrier	*88.8*		*40 - 110*

Method: 9320 - Radium-228 (GFPC)

Lab Sample ID: MB 160-369905/23-A
Matrix: Water
Analysis Batch: 373662

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 369905

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-228	-0.07828	U	0.198	0.198	1.00	0.372	pCi/L	06/11/18 13:56	07/02/18 14:40	1

Carrier	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*92.6*		*40 - 110*	*06/11/18 13:56*	*07/02/18 14:40*	*1*
Y Carrier	*92.0*		*40 - 110*	*06/11/18 13:56*	*07/02/18 14:40*	*1*

Lab Sample ID: LCS 160-369905/1-A
Matrix: Water
Analysis Batch: 373489

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 369905

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Radium-228			8.18	13.10	*	1.44	1.00	0.418	pCi/L	160	56 - 140		

Carrier	*LCS %Yield*	*LCS Qualifier*	*Limits*
Ba Carrier	*88.8*		*40 - 110*
Y Carrier	*92.7*		*40 - 110*

QC Association Summary

Rad

Prep Batch: 369900

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96523-1	MBLPS-18-05-MW-4 (I)	Total/NA	Water	PrecSep-21	
240-96523-2	MBLPS-18-05-MW-5 (I)	Total/NA	Water	PrecSep-21	
240-96523-3	MBLPS-18-05-MW-3 (I)	Total/NA	Water	PrecSep-21	
MB 160-369900/23-A	Method Blank	Total/NA	Water	PrecSep-21	
LCS 160-369900/1-A	Lab Control Sample	Total/NA	Water	PrecSep-21	

Prep Batch: 369905

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96523-1	MBLPS-18-05-MW-4 (I)	Total/NA	Water	PrecSep_0	
240-96523-2	MBLPS-18-05-MW-5 (I)	Total/NA	Water	PrecSep_0	
240-96523-3	MBLPS-18-05-MW-3 (I)	Total/NA	Water	PrecSep_0	
MB 160-369905/23-A	Method Blank	Total/NA	Water	PrecSep_0	
LCS 160-369905/1-A	Lab Control Sample	Total/NA	Water	PrecSep_0	

Lab Chronicle

Client: Fishbeck Thompson Carr & Huber Inc
Project/Site: CCR-MBLP Shiras Steam Plant

TestAmerica Job ID: 240-96523-2

Client Sample ID: MBLPS-18-05-MW-4 (I)

Lab Sample ID: 240-96523-1

Date Collected: 05/31/18 11:08
Date Received: 06/05/18 09:30
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	PrecSep-21			369900	06/11/18 13:02	JLC	TAL SL
Total/NA	Analysis	9315		1	373831	07/03/18 06:00	RTM	TAL SL
Total/NA	Prep	PrecSep_0			369905	06/11/18 13:56	JLC	TAL SL
Total/NA	Analysis	9320		1	373488	07/02/18 14:36	CDR	TAL SL
Total/NA	Analysis	Ra226_Ra228		1	374405	07/08/18 16:47	RTM	TAL SL

Client Sample ID: MBLPS-18-05-MW-5 (I)

Lab Sample ID: 240-96523-2

Date Collected: 05/31/18 11:20
Date Received: 06/05/18 09:30
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	PrecSep-21			369900	06/11/18 13:02	JLC	TAL SL
Total/NA	Analysis	9315		1	373831	07/03/18 06:00	RTM	TAL SL
Total/NA	Prep	PrecSep_0			369905	06/11/18 13:56	JLC	TAL SL
Total/NA	Analysis	9320		1	373488	07/02/18 14:36	CDR	TAL SL
Total/NA	Analysis	Ra226_Ra228		1	374405	07/08/18 16:47	RTM	TAL SL

Client Sample ID: MBLPS-18-05-MW-3 (I)

Lab Sample ID: 240-96523-3

Date Collected: 05/31/18 13:41
Date Received: 06/05/18 09:30
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	PrecSep-21			369900	06/11/18 13:02	JLC	TAL SL
Total/NA	Analysis	9315		1	373831	07/03/18 06:01	RTM	TAL SL
Total/NA	Prep	PrecSep_0			369905	06/11/18 13:56	JLC	TAL SL
Total/NA	Analysis	9320		1	373488	07/02/18 14:37	CDR	TAL SL
Total/NA	Analysis	Ra226_Ra228		1	374405	07/08/18 16:47	RTM	TAL SL

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Accreditation/Certification Summary

Laboratory: TestAmerica Canton

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
California	State Program	9	2927	02-23-19
Connecticut	State Program	1	PH-0590	12-31-19
Florida	NELAP	4	E87225	06-30-19
Illinois	NELAP	5	200004	07-31-18 *
Kansas	NELAP	7	E-10336	01-31-19
Kentucky (UST)	State Program	4	58	02-23-19
Kentucky (WW)	State Program	4	98016	12-31-18
Minnesota	NELAP	5	039-999-348	12-31-18
Minnesota (Petrofund)	State Program	1	3506	07-31-18 *
Nevada	State Program	9	OH-000482008A	07-31-18 *
New Jersey	NELAP	2	OH001	06-30-19
New York	NELAP	2	10975	03-31-19
Ohio VAP	State Program	5	CL0024	09-06-19
Oregon	NELAP	10	4062	02-23-19
Pennsylvania	NELAP	3	68-00340	08-31-18 *
Texas	NELAP	6	T104704517-17-9	08-31-18 *
USDA	Federal		P330-16-00404	12-28-19
Virginia	NELAP	3	460175	09-14-18 *
Washington	State Program	10	C971	01-12-19
West Virginia DEP	State Program	3	210	12-31-18

Laboratory: TestAmerica St. Louis

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
Alaska	State Program	10	MO00054	06-30-18 *
ANAB	DoD ELAP		L2305	04-06-19
Arizona	State Program	9	AZ0813	12-08-18
California	State Program	9	2886	06-30-19
Connecticut	State Program	1	PH-0241	03-31-19
Florida	NELAP	4	E87689	06-30-19
Illinois	NELAP	5	200023	11-30-18
Iowa	State Program	7	373	12-01-18
Kansas	NELAP	7	E-10236	10-31-18
Kentucky (DW)	State Program	4	90125	12-31-18
Louisiana	NELAP	6	04080	06-30-19
Louisiana (DW)	NELAP	6	LA180017	12-31-18
Maryland	State Program	3	310	09-30-18
Michigan	State Program	5	9005	06-30-18 *
Missouri	State Program	7	780	06-30-18 *
Nevada	State Program	9	MO000542018-1	07-31-18 *
New Jersey	NELAP	2	MO002	06-30-19
New York	NELAP	2	11616	03-31-19
North Dakota	State Program	8	R207	06-30-18 *
NRC	NRC		24-24817-01	12-31-22
Oklahoma	State Program	6	9997	08-31-18 *
Pennsylvania	NELAP	3	68-00540	02-28-19
South Carolina	State Program	4	85002001	06-30-18 *
Texas	NELAP	6	T104704193-17-11	07-31-18
US Fish & Wildlife	Federal		058448	07-31-18

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Accreditation/Certification Summary

Laboratory: TestAmerica St. Louis (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
USDA	Federal		P330-17-0028	02-02-20
Utah	NELAP	8	MO000542016-8	07-31-18 *
Virginia	NELAP	3	460230	06-14-19
Washington	State Program	10	C592	08-30-18
West Virginia DEP	State Program	3	381	08-31-18 *

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

34135

CHAIN OF CUSTODY RECORD

Fishbeck, Thompson, Carr & Huber, Inc.
Address 1515 Arboretum Dr SE
Grand Rapids, MI 49546
Phone 616-575-3824

Report to Penni Maier
Email pdmaier@ftch.com
Copy to
Email

Invoice to Accounts Payable
Email acpay@ftch.com
Lab Quote Reference 24013587

240-96523 Chain of Custody

PROJECT NAME MBLP/Shiras Ash Lab
PROJECT NO. 180827
PROJECT LOCATION Marquette MI
SAMPLER(S) NAME ABS & AD
PROJECT MANAGER TCC
PHONE 269-544-1848
EMAIL tccampbell@ftch.com
ADDITIONAL INFORMATION

PAGE 1 OF 1

STD TAT ☒
RUSH TAT ☐
DATE DUE

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	AQUEOUS (WATER)	SOLID/SEMI-SOLID	AIR	NONAQUEOUS LIQUID	F-	*METALS	RADIUM 226 RADIUM 228								REMARKS
PRESERVATIVE							—	HNO3	HNO3								
NUMBER OF CONTAINERS SUBMITTED																	
5/31/18	1108	MBLPS-18-05-MW-4 (E)	X				1	1	3								* METALS = Sb, As, Ba, Be,
↓	1170	MBLPS-18-05-MW-5 (E)	X				1	1	3								Cd, Cr, Co, Pb, Hg, Mo, Se,
↓	1341	MBLPS-18-05-MW-3 (I)	X				1	1	3								Tl, Li

RELINQUISHED BY	DATE	TIME	RELINQUISHED BY	DATE	TIME	RELINQUISHED BY	DATE	TIME	METHOD OF SHIPMENT/BILL OF LADING
To Storage	6/1/18	1600			16:30				FedEx# 7115-7198-7926

RECEIVED BY	DATE	TIME	RECEIVED BY	DATE	TIME	RECEIVED BY	DATE	TIME	RECEIVED FOR LAB	DATE	TIME
From Storage	6/4/18	16:30								6/5/18	930

WHITE Copy — Return with data package. YELLOW Copy — field File / Project Documentation.

G 042059

TestAmerica Canton Sample Receipt Form/Narrative **Login # :** 96528
Canton Facility

Client FTC&H Site Name ____ Cooler unpacked by:
Cooler Received on 6/5/18 Opened on 6/5/18
FedEx: 1st Grd [✓ Exp] UPS FAS Clipper Client Drop Off TestAmerica Courier Other

Receipt After-hours: Drop-off Date/Time ____ Storage Location ____

TestAmerica Cooler # TA Foam Box Client Cooler Box Other ____
Packing material used: Bubble Wrap Foam [✓ Plastic Bag] None Other ____
COOLANT: [✓ Wet Ice] Blue Ice Dry Ice Water None

1. Cooler temperature upon receipt ☐ See Multiple Cooler Form
IR GUN# IR-8 (CF +0.1 °C) Observed Cooler Temp. 3.4 °C Corrected Cooler Temp. 3.5 °C
IR GUN #36 (CF +0.3°C) Observed Cooler Temp. ____ °C Corrected Cooler Temp. ____ °C
~~IR GUN # 627 (CF -1.3°C) Observed Cooler Temp. ____ °C Corrected Cooler Temp. ____ °C~~

2. Were tamper/custody seals on the outside of the cooler(s)? If Yes Quantity 1 [✓ Yes] No
-Were the seals on the outside of the cooler(s) signed & dated? [✓ Yes] No NA
-Were tamper/custody seals on the bottle(s) or bottle kits (LLHg/MeHg)? Yes [✓ No]
-Were tamper/custody seals intact and uncompromised? [✓ Yes] No NA
3. Shippers' packing slip attached to the cooler(s)? [✓ Yes] No
4. Did custody papers accompany the sample(s)? [✓ Yes] No
5. Were the custody papers relinquished & signed in the appropriate place? [✓ Yes] No
6. Was/were the person(s) who collected the samples clearly identified on the COC? [✓ Yes] No
7. Did all bottles arrive in good condition (Unbroken)? [✓ Yes] No
8. Could all bottle labels be reconciled with the COC? [✓ Yes] No
9. Were correct bottle(s) used for the test(s) indicated? [✓ Yes] No
10. Sufficient quantity received to perform indicated analyses? [✓ Yes] No
11. Are these work share samples? Yes [✓ No]
If yes, Questions 12-16 have been checked at the originating laboratory.
12. Were all preserved sample(s) at the correct pH upon receipt? [✓ Yes] No NA pH Strip Lot# **HC740840**
13. Were VOAs on the COC? Yes [✓ No]
14. Were air bubbles >6 mm in any VOA vials? ● ⇐ Larger than this. Yes No [✓ NA]
15. Was a VOA trip blank present in the cooler(s)? Trip Blank Lot # ____ Yes [✓ No]
16. Was a LL Hg or Me Hg trip blank present? ____ Yes [✓ No]

Tests that are not checked for pH by Receiving:

VOAs
Oil and Grease
TOC

Contacted PM ____ Date ____ by ____ via Verbal Voice Mail Other

Concerning ____

17. CHAIN OF CUSTODY & SAMPLE DISCREPANCIES

Samples processed by: JR

18. SAMPLE CONDITION

Sample(s) ____ were received after the recommended holding time had expired.
Sample(s) ____ were received in a broken container.
Sample(s) ____ were received with bubble >6 mm in diameter. (Notify PM)

19. SAMPLE PRESERVATION

Sample(s) ____ were further preserved in the laboratory.
Time preserved: ____ Preservative(s) added/Lot number(s): ____

WI-NC-099

Login Container Summary Report

Temperature readings: ________________

Client Sample ID	Lab ID	Container Type	Container pH	Preservative Added (mls)	Lot #
	240-96523-B-1	Plastic 500ml - with Nitric Acid	<2		
	240-96523-C-1	Plastic 1 liter - Nitric Acid	<2		
	240-96523-D-1	Plastic 1 liter - Nitric Acid	<2		
	240-96523-E-1	Plastic 1 liter - Nitric Acid	<2		
	240-96523-B-2	Plastic 500ml - with Nitric Acid	<2		
	240-96523-C-2	Plastic 1 liter - Nitric Acid	<2		
	240-96523-D-2	Plastic 1 liter - Nitric Acid	<2		
	240-96523-E-2	Plastic 1 liter - Nitric Acid	<2		
	240-96523-B-3	Plastic 500ml - with Nitric Acid	<2		
	240-96523-C-3	Plastic 1 liter - Nitric Acid	<2		
	240-96523-D-3	Plastic 1 liter - Nitric Acid	<2		
	240-96523-E-3	Plastic 1 liter - Nitric Acid	<2		

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TestAmerica Canton
4101 Shuffel Street NW
North Canton, OH 44720
Phone (330) 497-9396 Fax (330) 497-0772

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information (Sub Contract Lab)
Client Contact: Shipping/Receiving
Company: TestAmerica Laboratories, Inc.
Address: 13715 Rider Trail North,
City: Earth City
State, Zip: MO, 63045
Phone: 314-298-8566(Tel) 314-298-8757(Fax)
Email:
Project Name: CCR-MBLP Shiras Steam Plant
Site:

Sampler:
Phone:
Due Date Requested: 6/7/2018
TAT Requested (days):
PO #:
WO #:
Project #: 24020283
SSOW#:

Lab PM: Brooks, Kris M
E-Mail: kris.brooks@testamericainc.com
Carrier Tracking No(s):
State of Origin: Michigan
Accreditations Required (See note):

COC No: 240-87735.1
Page: Page 1 of 1
Job #: 240-96523-1

Preservation Codes:
A - HCL
B - NaOH
C - Zn Acetate
D - Nitric Acid
E - NaHSO4
F - MeOH
G - Amchlor
H - Ascorbic Acid
I - Ice
J - DI Water
K - EDTA
L - EDA
M - Hexane
N - None
O - AsNaO2
P - Na2O4S
Q - Na2SO3
R - Na2S2O3
S - H2SO4
T - TSP Dodecahydrate
U - Acetone
V - MCAA
W - pH 4-5
Z - other (specify)
Other:

Analysis Requested

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	9315_Ra226/PrecSep_21 Radium-226 (GFPC) - 21 day decay	9320_Ra228/PrecSep_0 Radium-228 (GFPC)	Ra226Ra228_GFPC	Total Number of containers	Special Instructions/Note:
			Preservation Code:								
MBLPS-18-05-MW-4 (I) (240-96523-1)	5/31/18	11:08 Eastern		Water			X	X	X	3	
MBLPS-18-05-MW-5 (I) (240-96523-2)	5/31/18	11:20 Eastern		Water			X	X	X	3	
MBLPS-18-05-MW-3 (I) (240-96523-3)	5/31/18	13:41 Eastern		Water			X	X	X	3	

Note: Since laboratory accreditations are subject to change, TestAmerica Laboratories, Inc. places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to TestAmerica Laboratories, Inc. attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said complicance to TestAmerica Laboratories, Inc.

Possible Hazard Identification
Unconfirmed
Deliverable Requested: I, II, III, IV, Other (specify)
Primary Deliverable Rank: 2

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ______ *Months*
Special Instructions/QC Requirements:

Empty Kit Relinquished by:
Date:
Time:
Method of Shipment:

Relinquished by: Charles Gantt	Date/Time: 6-5-18 15:19	Company: 240	Received by: Nicholas Prom	Date/Time: 6-6-18/0910	Company: TASL
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks:

Ver: 09/20/2016

Login Sample Receipt Checklist

Client: Fishbeck Thompson Carr & Huber Inc

Job Number: 240-96523-2

Login Number: 96523
List Number: 2
Creator: Press, Nicholas B

List Source: TestAmerica St. Louis
List Creation: 06/06/18 02:01 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.		
The cooler's custody seal, if present, is intact.		
Sample custody seals, if present, are intact.		
The cooler or samples do not appear to have been compromised or tampered with.		
Samples were received on ice.		
Cooler Temperature is acceptable.		
Cooler Temperature is recorded.		
COC is present.		
COC is filled out in ink and legible.		
COC is filled out with all pertinent information.		
Is the Field Sampler's name present on COC?		
There are no discrepancies between the containers received and the COC.		
Samples are received within Holding Time (excluding tests with immediate HTs)		
Sample containers have legible labels.		
Containers are not broken or leaking.		
Sample collection date/times are provided.		
Appropriate sample containers are used.		
Sample bottles are completely filled.		
Sample Preservation Verified.		
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs		
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").		
Multiphasic samples are not present.		
Samples do not require splitting or compositing.		
Residual Chlorine Checked.		

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TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Canton
4101 Shuffel Street NW
North Canton, OH 44720
Tel: (330)497-9396

TestAmerica Job ID: 240-96523-1
Client Project/Site: CCR-MBLP Shiras Steam Plant

For:
Fishbeck Thompson Carr & Huber Inc
1515 Arboretum Drive SE
Grand Rapids, Michigan 49546

Attn: Penni Mahler

Kris Brooks

Authorized for release by:
6/19/2018 4:42:40 PM

Kris Brooks, Project Manager II
(330)966-9790
kris.brooks@testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Definitions/Glossary

Qualifiers

Metals

Qualifier	Qualifier Description
U	Indicates the analyte was analyzed for but not detected.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

General Chemistry

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U	Indicates the analyte was analyzed for but not detected.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 240-96523-1

Laboratory: TestAmerica Canton

Narrative

CASE NARRATIVE

Client: Fishbeck Thompson Carr & Huber Inc

Project: CCR-MBLP Shiras Steam Plant

Report Number: 240-96523-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica Canton attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header.

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT
The samples were received on 6/5/2018 9:30 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 3.5º C.

TOTAL RECOVERABLE METALS (ICPMS)
Samples MBLPS-18-05-MW-4 (I) (240-96523-1), MBLPS-18-05-MW-5 (I) (240-96523-2) and MBLPS-18-05-MW-3 (I) (240-96523-3) were analyzed for total recoverable metals (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 06/05/2018 and analyzed on 06/06/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TOTAL MERCURY
Samples MBLPS-18-05-MW-4 (I) (240-96523-1), MBLPS-18-05-MW-5 (I) (240-96523-2) and MBLPS-18-05-MW-3 (I) (240-96523-3) were analyzed for total mercury in accordance with EPA SW-846 Methods 7470A. The samples were prepared on 06/05/2018 and analyzed on 06/06/2018.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Job ID: 240-96523-1 (Continued)

Laboratory: TestAmerica Canton (Continued)

ANIONS

Samples MBLPS-18-05-MW-4 (I) (240-96523-1), MBLPS-18-05-MW-5 (I) (240-96523-2) and MBLPS-18-05-MW-3 (I) (240-96523-3) were analyzed for anions in accordance with EPA SW-846 Method 9056A. The samples were analyzed on 06/16/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Method Summary

Client: Fishbeck Thompson Carr & Huber Inc
Project/Site: CCR-MBLP Shiras Steam Plant

TestAmerica Job ID: 240-96523-1

Method	Method Description	Protocol	Laboratory
6020A	Metals (ICP/MS)	SW846	TAL CAN
7470A	Mercury (CVAA)	SW846	TAL CAN
9056A	Anions, Ion Chromatography	SW846	TAL CAN
3005A	Preparation, Total Recoverable or Dissolved Metals	SW846	TAL CAN
7470A	Preparation, Mercury	SW846	TAL CAN

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL CAN = TestAmerica Canton, 4101 Shuffel Street NW, North Canton, OH 44720, TEL (330)497-9396

Sample Summary

Client: Fishbeck Thompson Carr & Huber Inc
Project/Site: CCR-MBLP Shiras Steam Plant

TestAmerica Job ID: 240-96523-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
240-96523-1	MBLPS-18-05-MW-4 (I)	Water	05/31/18 11:08	06/05/18 09:30
240-96523-2	MBLPS-18-05-MW-5 (I)	Water	05/31/18 11:20	06/05/18 09:30
240-96523-3	MBLPS-18-05-MW-3 (I)	Water	05/31/18 13:41	06/05/18 09:30

Detection Summary

Client: Fishbeck Thompson Carr & Huber Inc
Project/Site: CCR-MBLP Shiras Steam Plant

TestAmerica Job ID: 240-96523-1

Client Sample ID: MBLPS-18-05-MW-4 (I) Lab Sample ID: 240-96523-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	1.4	J	5.0	0.75	ug/L	1		6020A	Total Recoverable
Barium	110		5.0	2.2	ug/L	1		6020A	Total Recoverable
Cadmium	0.24	J	1.0	0.21	ug/L	1		6020A	Total Recoverable
Cobalt	0.48	J	1.0	0.19	ug/L	1		6020A	Total Recoverable
Chromium	1.2	J	2.0	0.98	ug/L	1		6020A	Total Recoverable
Molybdenum	16		5.0	1.1	ug/L	1		6020A	Total Recoverable
Lead	0.50	J	1.0	0.45	ug/L	1		6020A	Total Recoverable
Antimony	1.0	J	2.0	0.57	ug/L	1		6020A	Total Recoverable
Lithium	9.8		8.0	1.7	ug/L	1		6020A	Total Recoverable
Fluoride	0.23		0.050	0.024	mg/L	1		9056A	Total/NA

Client Sample ID: MBLPS-18-05-MW-5 (I) Lab Sample ID: 240-96523-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Barium	95		5.0	2.2	ug/L	1		6020A	Total Recoverable
Cobalt	0.25	J	1.0	0.19	ug/L	1		6020A	Total Recoverable
Chromium	1.5	J	2.0	0.98	ug/L	1		6020A	Total Recoverable
Molybdenum	7.1		5.0	1.1	ug/L	1		6020A	Total Recoverable
Lithium	7.6	J	8.0	1.7	ug/L	1		6020A	Total Recoverable
Fluoride	0.046	J	0.050	0.024	mg/L	1		9056A	Total/NA

Client Sample ID: MBLPS-18-05-MW-3 (I) Lab Sample ID: 240-96523-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	1.5	J	5.0	0.75	ug/L	1		6020A	Total Recoverable
Barium	66		5.0	2.2	ug/L	1		6020A	Total Recoverable
Cobalt	0.32	J	1.0	0.19	ug/L	1		6020A	Total Recoverable
Chromium	2.4		2.0	0.98	ug/L	1		6020A	Total Recoverable
Molybdenum	1.2	J	5.0	1.1	ug/L	1		6020A	Total Recoverable
Lithium	4.9	J	8.0	1.7	ug/L	1		6020A	Total Recoverable
Fluoride	0.065		0.050	0.024	mg/L	1		9056A	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: MBLPS-18-05-MW-4 (I)

Lab Sample ID: 240-96523-1

Date Collected: 05/31/18 11:08
Matrix: Water
Date Received: 06/05/18 09:30

Method: 6020A - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**1.4**	**J**	5.0	0.75	ug/L		06/05/18 15:00	06/06/18 16:02	1
Barium	**110**		5.0	2.2	ug/L		06/05/18 15:00	06/06/18 16:02	1
Beryllium	0.31	U	1.0	0.31	ug/L		06/05/18 15:00	06/06/18 16:02	1
Cadmium	**0.24**	**J**	1.0	0.21	ug/L		06/05/18 15:00	06/06/18 16:02	1
Cobalt	**0.48**	**J**	1.0	0.19	ug/L		06/05/18 15:00	06/06/18 16:02	1
Chromium	**1.2**	**J**	2.0	0.98	ug/L		06/05/18 15:00	06/06/18 16:02	1
Molybdenum	**16**		5.0	1.1	ug/L		06/05/18 15:00	06/06/18 16:02	1
Lead	**0.50**	**J**	1.0	0.45	ug/L		06/05/18 15:00	06/06/18 16:02	1
Antimony	**1.0**	**J**	2.0	0.57	ug/L		06/05/18 15:00	06/06/18 16:02	1
Selenium	0.89	U	5.0	0.89	ug/L		06/05/18 15:00	06/06/18 16:02	1
Lithium	**9.8**		8.0	1.7	ug/L		06/05/18 15:00	06/06/18 16:02	1
Thallium	0.20	U	1.0	0.20	ug/L		06/05/18 15:00	06/06/18 16:02	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.13	U	0.20	0.13	ug/L		06/05/18 15:00	06/06/18 15:13	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	**0.23**		0.050	0.024	mg/L			06/16/18 01:42	1

1
2
3
4
5
6
7
8
9
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11
12
13

Client Sample Results

Client Sample ID: MBLPS-18-05-MW-5 (I)

Lab Sample ID: 240-96523-2

Date Collected: 05/31/18 11:20
Matrix: Water
Date Received: 06/05/18 09:30

Method: 6020A - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.75	U	5.0	0.75	ug/L		06/05/18 15:00	06/06/18 16:07	1
Barium	**95**		5.0	2.2	ug/L		06/05/18 15:00	06/06/18 16:07	1
Beryllium	0.31	U	1.0	0.31	ug/L		06/05/18 15:00	06/06/18 16:07	1
Cadmium	0.21	U	1.0	0.21	ug/L		06/05/18 15:00	06/06/18 16:07	1
Cobalt	**0.25**	**J**	1.0	0.19	ug/L		06/05/18 15:00	06/06/18 16:07	1
Chromium	**1.5**	**J**	2.0	0.98	ug/L		06/05/18 15:00	06/06/18 16:07	1
Molybdenum	**7.1**		5.0	1.1	ug/L		06/05/18 15:00	06/06/18 16:07	1
Lead	0.45	U	1.0	0.45	ug/L		06/05/18 15:00	06/06/18 16:07	1
Antimony	0.57	U	2.0	0.57	ug/L		06/05/18 15:00	06/06/18 16:07	1
Selenium	0.89	U	5.0	0.89	ug/L		06/05/18 15:00	06/06/18 16:07	1
Lithium	**7.6**	**J**	8.0	1.7	ug/L		06/05/18 15:00	06/06/18 16:07	1
Thallium	0.20	U	1.0	0.20	ug/L		06/05/18 15:00	06/06/18 16:07	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.13	U	0.20	0.13	ug/L		06/05/18 15:00	06/06/18 15:15	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	**0.046**	**J**	0.050	0.024	mg/L			06/16/18 02:03	1

Client Sample Results

Client Sample ID: MBLPS-18-05-MW-3 (I)

Lab Sample ID: 240-96523-3

Date Collected: 05/31/18 13:41

Matrix: Water

Date Received: 06/05/18 09:30

Method: 6020A - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**1.5**	**J**	5.0	0.75	ug/L		06/05/18 15:00	06/06/18 16:20	1
Barium	**66**		5.0	2.2	ug/L		06/05/18 15:00	06/06/18 16:20	1
Beryllium	0.31	U	1.0	0.31	ug/L		06/05/18 15:00	06/06/18 16:20	1
Cadmium	0.21	U	1.0	0.21	ug/L		06/05/18 15:00	06/06/18 16:20	1
Cobalt	**0.32**	**J**	1.0	0.19	ug/L		06/05/18 15:00	06/06/18 16:20	1
Chromium	**2.4**		2.0	0.98	ug/L		06/05/18 15:00	06/06/18 16:20	1
Molybdenum	**1.2**	**J**	5.0	1.1	ug/L		06/05/18 15:00	06/06/18 16:20	1
Lead	0.45	U	1.0	0.45	ug/L		06/05/18 15:00	06/06/18 16:20	1
Antimony	0.57	U	2.0	0.57	ug/L		06/05/18 15:00	06/06/18 16:20	1
Selenium	0.89	U	5.0	0.89	ug/L		06/05/18 15:00	06/06/18 16:20	1
Lithium	**4.9**	**J**	8.0	1.7	ug/L		06/05/18 15:00	06/06/18 16:20	1
Thallium	0.20	U	1.0	0.20	ug/L		06/05/18 15:00	06/06/18 16:20	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.13	U	0.20	0.13	ug/L		06/05/18 15:00	06/06/18 15:17	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	**0.065**		0.050	0.024	mg/L			06/16/18 02:24	1

Method: 6020A - Metals (ICP/MS)

Lab Sample ID: MB 240-330141/1-A
Matrix: Water
Analysis Batch: 330498

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 330141

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.75	U	5.0	0.75	ug/L		06/05/18 15:00	06/06/18 15:31	1
Barium	2.2	U	5.0	2.2	ug/L		06/05/18 15:00	06/06/18 15:31	1
Beryllium	0.31	U	1.0	0.31	ug/L		06/05/18 15:00	06/06/18 15:31	1
Cadmium	0.21	U	1.0	0.21	ug/L		06/05/18 15:00	06/06/18 15:31	1
Cobalt	0.19	U	1.0	0.19	ug/L		06/05/18 15:00	06/06/18 15:31	1
Chromium	0.98	U	2.0	0.98	ug/L		06/05/18 15:00	06/06/18 15:31	1
Molybdenum	1.1	U	5.0	1.1	ug/L		06/05/18 15:00	06/06/18 15:31	1
Lead	0.45	U	1.0	0.45	ug/L		06/05/18 15:00	06/06/18 15:31	1
Antimony	0.57	U	2.0	0.57	ug/L		06/05/18 15:00	06/06/18 15:31	1
Selenium	0.89	U	5.0	0.89	ug/L		06/05/18 15:00	06/06/18 15:31	1
Lithium	1.7	U	8.0	1.7	ug/L		06/05/18 15:00	06/06/18 15:31	1
Thallium	0.20	U	1.0	0.20	ug/L		06/05/18 15:00	06/06/18 15:31	1

Lab Sample ID: LCS 240-330141/3-A
Matrix: Water
Analysis Batch: 330498

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 330141

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	1000	947		ug/L		95	80 - 120
Barium	1000	969		ug/L		97	80 - 120
Beryllium	1000	961		ug/L		96	80 - 120
Cadmium	1000	1060		ug/L		106	80 - 120
Cobalt	1000	979		ug/L		98	80 - 120
Chromium	1000	964		ug/L		96	80 - 120
Molybdenum	100	94.4		ug/L		94	80 - 120
Lead	1000	1060		ug/L		106	80 - 120
Antimony	100	93.0		ug/L		93	80 - 120
Selenium	1000	947		ug/L		95	80 - 120
Thallium	250	263		ug/L		105	80 - 120

Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 240-330150/1-A
Matrix: Water
Analysis Batch: 330440

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 330150

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.13	U	0.20	0.13	ug/L		06/05/18 15:00	06/06/18 15:23	1

Lab Sample ID: LCS 240-330150/2-A
Matrix: Water
Analysis Batch: 330440

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 330150

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	5.00	4.35		ug/L		87	80 - 120

Method: 9056A - Anions, Ion Chromatography

Lab Sample ID: MB 240-331714/3
Matrix: Water
Analysis Batch: 331714

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	0.024	U	0.050	0.024	mg/L			06/15/18 21:13	1

Lab Sample ID: LCS 240-331714/4
Matrix: Water
Analysis Batch: 331714

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Fluoride	2.50	2.64		mg/L		106	90 - 110

QC Association Summary

Metals

Prep Batch: 330141

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96523-1	MBLPS-18-05-MW-4 (I)	Total Recoverable	Water	3005A	
240-96523-2	MBLPS-18-05-MW-5 (I)	Total Recoverable	Water	3005A	
240-96523-3	MBLPS-18-05-MW-3 (I)	Total Recoverable	Water	3005A	
MB 240-330141/1-A	Method Blank	Total Recoverable	Water	3005A	
LCS 240-330141/3-A	Lab Control Sample	Total Recoverable	Water	3005A	

Prep Batch: 330150

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96523-1	MBLPS-18-05-MW-4 (I)	Total/NA	Water	7470A	
240-96523-2	MBLPS-18-05-MW-5 (I)	Total/NA	Water	7470A	
240-96523-3	MBLPS-18-05-MW-3 (I)	Total/NA	Water	7470A	
MB 240-330150/1-A	Method Blank	Total/NA	Water	7470A	
LCS 240-330150/2-A	Lab Control Sample	Total/NA	Water	7470A	

Analysis Batch: 330440

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96523-1	MBLPS-18-05-MW-4 (I)	Total/NA	Water	7470A	330150
240-96523-2	MBLPS-18-05-MW-5 (I)	Total/NA	Water	7470A	330150
240-96523-3	MBLPS-18-05-MW-3 (I)	Total/NA	Water	7470A	330150
MB 240-330150/1-A	Method Blank	Total/NA	Water	7470A	330150
LCS 240-330150/2-A	Lab Control Sample	Total/NA	Water	7470A	330150

Analysis Batch: 330498

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96523-1	MBLPS-18-05-MW-4 (I)	Total Recoverable	Water	6020A	330141
240-96523-2	MBLPS-18-05-MW-5 (I)	Total Recoverable	Water	6020A	330141
240-96523-3	MBLPS-18-05-MW-3 (I)	Total Recoverable	Water	6020A	330141
MB 240-330141/1-A	Method Blank	Total Recoverable	Water	6020A	330141
LCS 240-330141/3-A	Lab Control Sample	Total Recoverable	Water	6020A	330141

General Chemistry

Analysis Batch: 331714

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96523-1	MBLPS-18-05-MW-4 (I)	Total/NA	Water	9056A	
240-96523-2	MBLPS-18-05-MW-5 (I)	Total/NA	Water	9056A	
240-96523-3	MBLPS-18-05-MW-3 (I)	Total/NA	Water	9056A	
MB 240-331714/3	Method Blank	Total/NA	Water	9056A	
LCS 240-331714/4	Lab Control Sample	Total/NA	Water	9056A	

Lab Chronicle

Client Sample ID: MBLPS-18-05-MW-4 (I)

Lab Sample ID: 240-96523-1

Date Collected: 05/31/18 11:08
Matrix: Water
Date Received: 06/05/18 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			330141	06/05/18 15:00	MBB	TAL CAN
Total Recoverable	Analysis	6020A		1	330498	06/06/18 16:02	DSH	TAL CAN
Total/NA	Prep	7470A			330150	06/05/18 15:00	MBB	TAL CAN
Total/NA	Analysis	7470A		1	330440	06/06/18 15:13	AJC	TAL CAN
Total/NA	Analysis	9056A		1	331714	06/16/18 01:42	JWW	TAL CAN

Client Sample ID: MBLPS-18-05-MW-5 (I)

Lab Sample ID: 240-96523-2

Date Collected: 05/31/18 11:20
Matrix: Water
Date Received: 06/05/18 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			330141	06/05/18 15:00	MBB	TAL CAN
Total Recoverable	Analysis	6020A		1	330498	06/06/18 16:07	DSH	TAL CAN
Total/NA	Prep	7470A			330150	06/05/18 15:00	MBB	TAL CAN
Total/NA	Analysis	7470A		1	330440	06/06/18 15:15	AJC	TAL CAN
Total/NA	Analysis	9056A		1	331714	06/16/18 02:03	JWW	TAL CAN

Client Sample ID: MBLPS-18-05-MW-3 (I)

Lab Sample ID: 240-96523-3

Date Collected: 05/31/18 13:41
Matrix: Water
Date Received: 06/05/18 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			330141	06/05/18 15:00	MBB	TAL CAN
Total Recoverable	Analysis	6020A		1	330498	06/06/18 16:20	DSH	TAL CAN
Total/NA	Prep	7470A			330150	06/05/18 15:00	MBB	TAL CAN
Total/NA	Analysis	7470A		1	330440	06/06/18 15:17	AJC	TAL CAN
Total/NA	Analysis	9056A		1	331714	06/16/18 02:24	JWW	TAL CAN

Laboratory References:

TAL CAN = TestAmerica Canton, 4101 Shuffel Street NW, North Canton, OH 44720, TEL (330)497-9396

Accreditation/Certification Summary

Client: Fishbeck Thompson Carr & Huber Inc
Project/Site: CCR-MBLP Shiras Steam Plant

TestAmerica Job ID: 240-96523-1

Laboratory: TestAmerica Canton

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
California	State Program	9	2927	02-23-19
Connecticut	State Program	1	PH-0590	12-31-19
Florida	NELAP	4	E87225	06-30-18 *
Illinois	NELAP	5	200004	07-31-18 *
Kansas	NELAP	7	E-10336	01-31-19
Kentucky (UST)	State Program	4	58	02-23-19
Kentucky (WW)	State Program	4	98016	12-31-18
Minnesota	NELAP	5	039-999-348	12-31-18
Minnesota (Petrofund)	State Program	1	3506	07-31-18 *
Nevada	State Program	9	OH-000482008A	07-31-18 *
New Jersey	NELAP	2	OH001	06-30-18 *
New York	NELAP	2	10975	03-31-19
Ohio VAP	State Program	5	CL0024	09-06-19
Oregon	NELAP	10	4062	02-23-19
Pennsylvania	NELAP	3	68-00340	08-31-18 *
Texas	NELAP	6	T104704517-17-9	08-31-18 *
USDA	Federal		P330-16-00404	12-28-19
Virginia	NELAP	3	460175	09-14-18 *
Washington	State Program	10	C971	01-12-19
West Virginia DEP	State Program	3	210	12-31-18

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

34135

CHAIN OF CUSTODY RECORD

Fishbeck, Thompson, Carr & Huber, Inc.
Address 1515 Arboretum Dr SE
Grand Rapids, MI 49546
Phone 616-575-3824

Report to Penni Maier
Email pdmaier@ftch.com
Copy to
Email

Invoice to Accounts Payable
Email acpay@ftch.com
Lab Quote
Reference 24013587

PROJECT NAME MBLP/Shiras Add'l GW
PROJECT NO. 180827
PROJECT LOCATION Marquette MI
SAMPLER(S) NAME ABS & AD
PROJECT MANAGER TCC
PHONE 269-544-1848
EMAIL tccampbell@ftch.com
ADDITIONAL INFORMATION

PAGE 1 OF 1
STD TAT ☒
RUSH TAT ☐
DATE DUE

240-96523 Chain of Custody

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	MATRIX TYPE: AQUEOUS (WATER)	SOLID/SEMI-SOLID	AIR	NONAQUEOUS LIQUID	REQUIRED ANALYSES: F⁻	*METALS	Radium 226, Radium 228									REMARKS
		PRESERVATIVE					—	HNO3	HNO3									
		NUMBER OF CONTAINERS SUBMITTED																
5/31/18	1108	MBLPS-18-05-MW-4(E)	X				1	1	3									* METALS = Sb, As, Ba, Be,
↓	1120	MBLPS-18-05-MW-5(E)	X				1	1	3									Cd, Cr, Co, Pb, Hg, Mo, Se,
↓	1341	MBLPS-18-05-MW-3(I)	X				1	1	3									Tl, Li.

RELINQUISHED BY	DATE	TIME	RELINQUISHED BY	DATE	TIME	RELINQUISHED BY	DATE	TIME	METHOD OF SHIPMENT/BILL OF LADING
to storage	6/1/18	1600		6/4/18	16:30				FedEx# 7115-7198-7926
RECEIVED BY	**DATE**	**TIME**	**RECEIVED BY**	**DATE**	**TIME**	**RECEIVED BY**	**DATE**	**TIME**	**RECEIVED FOR LAB / DATE / TIME**
From Storage	6/4/18	16:30							6/5/18 930

WHITE Copy — Return with data package.
YELLOW Copy — field File / Project Documentation.

G 042059

TestAmerica Canton Sample Receipt Form/Narrative **Login # :** 96528
Canton Facility

Client FTC&H Site Name
Cooler Received on 6/5/18 Opened on 6/5/18
FedEx: 1st Grd [✓ Exp] UPS FAS Clipper Client Drop Off TestAmerica Courier Other

Cooler unpacked by:

Receipt After-hours: Drop-off Date/Time Storage Location

TestAmerica Cooler # TA Foam Box Client Cooler Box Other
Packing material used: Bubble Wrap Foam [✓ Plastic Bag] None Other
COOLANT: [✓ Wet Ice] Blue Ice Dry Ice Water None

1. Cooler temperature upon receipt ☐ See Multiple Cooler Form
IR GUN# IR-8 (CF +0.1 °C) Observed Cooler Temp. 3.4 °C Corrected Cooler Temp. 3.5 °C
IR GUN #36 (CF +0.3°C) Observed Cooler Temp. ____ °C Corrected Cooler Temp. ____ °C
~~IR GUN # 627 (CF -1.3°C) Observed Cooler Temp. ____ °C Corrected Cooler Temp. ____ °C~~

2. Were tamper/custody seals on the outside of the cooler(s)? If Yes Quantity 1 [✓ Yes] No
-Were the seals on the outside of the cooler(s) signed & dated? [✓ Yes] No NA
-Were tamper/custody seals on the bottle(s) or bottle kits (LLHg/MeHg)? Yes [✓ No]
-Were tamper/custody seals intact and uncompromised? [✓ Yes] No NA
3. Shippers' packing slip attached to the cooler(s)? [✓ Yes] No
4. Did custody papers accompany the sample(s)? [✓ Yes] No
5. Were the custody papers relinquished & signed in the appropriate place? [✓ Yes] No
6. Was/were the person(s) who collected the samples clearly identified on the COC? [✓ Yes] No
7. Did all bottles arrive in good condition (Unbroken)? [✓ Yes] No
8. Could all bottle labels be reconciled with the COC? [✓ Yes] No
9. Were correct bottle(s) used for the test(s) indicated? [✓ Yes] No
10. Sufficient quantity received to perform indicated analyses? [✓ Yes] No
11. Are these work share samples? Yes [✓ No]
If yes, Questions 12-16 have been checked at the originating laboratory.
12. Were all preserved sample(s) at the correct pH upon receipt? [✓ Yes] No NA pH Strip Lot# **HC740840**
13. Were VOAs on the COC? Yes [✓ No]
14. Were air bubbles >6 mm in any VOA vials? ● ◀ Larger than this. Yes No [✓ NA]
15. Was a VOA trip blank present in the cooler(s)? Trip Blank Lot # ____ Yes [✓ No]
16. Was a LL Hg or Me Hg trip blank present? Yes [✓ No]

Tests that are not checked for pH by Receiving:

VOAs
Oil and Grease
TOC

Contacted PM ____ Date ____ by ____ via Verbal Voice Mail Other

Concerning ____

17. CHAIN OF CUSTODY & SAMPLE DISCREPANCIES

Samples processed by: JR

18. SAMPLE CONDITION

Sample(s) ____ were received after the recommended holding time had expired.
Sample(s) ____ were received in a broken container.
Sample(s) ____ were received with bubble >6 mm in diameter. (Notify PM)

19. SAMPLE PRESERVATION

Sample(s) ____ were further preserved in the laboratory.
Time preserved: ____ Preservative(s) added/Lot number(s): ____

WI-NC-099

Login Container Summary Report

240-96523

Temperature readings: ______________________________

Client Sample ID	Lab ID	Container Type	Container pH	Preservative Added (mls)	Lot #
	240-96523-B-1	Plastic 500ml - with Nitric Acid	<2		
	240-96523-C-1	Plastic 1 liter - Nitric Acid	<2		
	240-96523-D-1	Plastic 1 liter - Nitric Acid	<2		
	240-96523-E-1	Plastic 1 liter - Nitric Acid	<2		
	240-96523-B-2	Plastic 500ml - with Nitric Acid	<2		
	240-96523-C-2	Plastic 1 liter - Nitric Acid	<2		
	240-96523-D-2	Plastic 1 liter - Nitric Acid	<2		
	240-96523-E-2	Plastic 1 liter - Nitric Acid	<2		
	240-96523-B-3	Plastic 500ml - with Nitric Acid	<2		
	240-96523-C-3	Plastic 1 liter - Nitric Acid	<2		
	240-96523-D-3	Plastic 1 liter - Nitric Acid	<2		
	240-96523-E-3	Plastic 1 liter - Nitric Acid	<2		

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Canton
4101 Shuffel Street NW
North Canton, OH 44720
Tel: (330)497-9396

TestAmerica Job ID: 240-96524-2
Client Project/Site: CCR-MBLP Shiras Steam Plant

For:
Fishbeck Thompson Carr & Huber Inc
1515 Arboretum Drive SE
Grand Rapids, Michigan 49546

Attn: Penni Mahler

Patrick O'Meara

Authorized for release by:
7/9/2018 3:39:00 PM
Patrick O'Meara, Manager of Project Management
(330)966-5725
patrick.omeara@testamericainc.com

Designee for

Kris Brooks, Project Manager II
(330)966-9790
kris.brooks@testamericainc.com

LINKS

Review your project results through
TotalAccess

Have a Question?
Ask The Expert

Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Definitions/Glossary

Qualifiers

Rad

Qualifier	Qualifier Description
*	LCS or LCSD is outside acceptance limits.
U	Result is less than the sample detection limit.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 240-96524-2

Laboratory: TestAmerica Canton

Narrative

CASE NARRATIVE

Client: Fishbeck Thompson Carr & Huber Inc

Project: CCR-MBLP Shiras Steam Plant

Report Number: 240-96524-2

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica Canton attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The 9315 Radium-226, 9320 Radium-228, and Ra226Ra228 Combined Radium-226 and Radium-228 analyses were performed at the TestAmerica St. Louis laboratory.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 6/5/2018 9:30 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 3.5º C.

RADIUM-226

Samples MBLPS-18-05-MW-2 (I) (240-96524-1), MBLPS-18-05-MW-2 (D) (240-96524-2) and MBLPS-18-05-MW-1 (I) (240-96524-3) were analyzed for Radium-226 in accordance with SW846 Method 9315. The samples were prepared on 06/11/2018 and analyzed on 07/03/2018.

Method PrecSep-21: Radium 226 Prep Batch 160-369900: Sample aliquots reduced due to potential matrix interference. Samples were brown, murky, and contained sediment.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

RADIUM-228 (GFPC)

Samples MBLPS-18-05-MW-2 (I) (240-96524-1), MBLPS-18-05-MW-2 (D) (240-96524-2) and MBLPS-18-05-MW-1 (I) (240-96524-3) were analyzed for Radium-228 (GFPC) in accordance with SW846 Method 9320. The samples were prepared on 06/11/2018 and analyzed on 07/02/2018.

Job ID: 240-96524-2 (Continued)

Laboratory: TestAmerica Canton (Continued)

The laboratory control sample (LCS) recovery (160%) associated with the following samples is outside the upper QC limit of 140% indicating a potential positive bias for that analyte. This analyte was not observed above the RL in the associated samples; therefore the sample data is not adversely affected by this excursion. The data have been reported with this narrative.

Method PrecSep_0: Radium 228 Prep Batch 160-369905: Sample aliquots reduced due to potential matrix interference. Samples were brown, murky, and contained sediment.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

COMBINED RADIUM 226 AND RADIUM 228

Samples MBLPS-18-05-MW-2 (I) (240-96524-1), MBLPS-18-05-MW-2 (D) (240-96524-2) and MBLPS-18-05-MW-1 (I) (240-96524-3) were analyzed for Combined Radium 226 and Radium 228 in accordance with Ra226_Ra228. The samples were analyzed on 07/08/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Method Summary

Method	Method Description	Protocol	Laboratory
9315	Radium-226 (GFPC)	SW846	TAL SL
9320	Radium-228 (GFPC)	SW846	TAL SL
Ra226_Ra228	Combined Radium-226 and Radium-228	TAL-STL	TAL SL
PrecSep_0	Preparation, Precipitate Separation	None	TAL SL
PrecSep-21	Preparation, Precipitate Separation (21-Day In-Growth)	None	TAL SL

Protocol References:

None = None

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

TAL-STL = TestAmerica Laboratories, St. Louis, Facility Standard Operating Procedure.

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Fishbeck Thompson Carr & Huber Inc
Project/Site: CCR-MBLP Shiras Steam Plant

TestAmerica Job ID: 240-96524-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
240-96524-1	MBLPS-18-05-MW-2 (I)	Water	05/31/18 15:07	06/05/18 09:30
240-96524-2	MBLPS-18-05-MW-2 (D)	Water	05/31/18 15:07	06/05/18 09:30
240-96524-3	MBLPS-18-05-MW-1 (I)	Water	05/31/18 16:29	06/05/18 09:30

Detection Summary

Client: Fishbeck Thompson Carr & Huber Inc
Project/Site: CCR-MBLP Shiras Steam Plant

TestAmerica Job ID: 240-96524-2

Client Sample ID: MBLPS-18-05-MW-2 (I) — Lab Sample ID: 240-96524-1

No Detections.

Client Sample ID: MBLPS-18-05-MW-2 (D) — Lab Sample ID: 240-96524-2

No Detections.

Client Sample ID: MBLPS-18-05-MW-1 (I) — Lab Sample ID: 240-96524-3

No Detections.

This Detection Summary does not include radiochemical test results.

Client Sample ID: MBLPS-18-05-MW-2 (I)

Date Collected: 05/31/18 15:07
Date Received: 06/05/18 09:30

Lab Sample ID: 240-96524-1
Matrix: Water

Method: 9315 - Radium-226 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.204	U	0.154	0.155	1.00	0.212	pCi/L	06/11/18 13:02	07/03/18 06:02	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*92.6*		*40 - 110*	*06/11/18 13:02*	*07/03/18 06:02*	*1*

Method: 9320 - Radium-228 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-228	0.315	U *	0.219	0.221	1.00	0.337	pCi/L	06/11/18 13:56	07/02/18 14:37	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*92.6*		*40 - 110*	*06/11/18 13:56*	*07/02/18 14:37*	*1*
Y Carrier	*92.3*		*40 - 110*	*06/11/18 13:56*	*07/02/18 14:37*	*1*

Method: Ra226_Ra228 - Combined Radium-226 and Radium-228

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Combined Radium 226 + 228	**0.519**		0.268	0.270	5.00	0.337	pCi/L		07/08/18 16:47	1

Client Sample ID: MBLPS-18-05-MW-2 (D)

Lab Sample ID: 240-96524-2

Date Collected: 05/31/18 15:07
Date Received: 06/05/18 09:30

Matrix: Water

Method: 9315 - Radium-226 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	**0.193**		0.144	0.145	1.00	0.189	pCi/L	06/11/18 13:02	07/03/18 06:02	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*91.2*		*40 - 110*	*06/11/18 13:02*	*07/03/18 06:02*	*1*

Method: 9320 - Radium-228 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-228	0.106	U *	0.209	0.209	1.00	0.357	pCi/L	06/11/18 13:56	07/02/18 14:37	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*91.2*		*40 - 110*	*06/11/18 13:56*	*07/02/18 14:37*	*1*
Y Carrier	*96.1*		*40 - 110*	*06/11/18 13:56*	*07/02/18 14:37*	*1*

Method: Ra226_Ra228 - Combined Radium-226 and Radium-228

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Combined Radium 226 + 228	0.299	U	0.254	0.254	5.00	0.357	pCi/L		07/08/18 16:47	1

Client Sample ID: MBLPS-18-05-MW-1 (I)

Lab Sample ID: 240-96524-3

Date Collected: 05/31/18 16:29
Matrix: Water
Date Received: 06/05/18 09:30

Method: 9315 - Radium-226 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	**0.409**		0.224	0.227	1.00	0.264	pCi/L	06/11/18 13:02	07/03/18 09:40	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*91.7*		*40 - 110*	*06/11/18 13:02*	*07/03/18 09:40*	*1*

Method: 9320 - Radium-228 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-228	0.107	U *	0.265	0.265	1.00	0.458	pCi/L	06/11/18 13:56	07/02/18 14:37	1

Carrier	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*91.7*		*40 - 110*	*06/11/18 13:56*	*07/02/18 14:37*	*1*
Y Carrier	*94.6*		*40 - 110*	*06/11/18 13:56*	*07/02/18 14:37*	*1*

Method: Ra226_Ra228 - Combined Radium-226 and Radium-228

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Combined Radium 226 + 228	**0.516**		0.347	0.349	5.00	0.458	pCi/L		07/08/18 16:47	1

Tracer/Carrier Summary

Method: 9315 - Radium-226 (GFPC)

Matrix: Water **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)
Lab Sample ID	**Client Sample ID**	**Ba Carrier (40-110)**
240-96524-1	MBLPS-18-05-MW-2 (I)	92.6
240-96524-2	MBLPS-18-05-MW-2 (D)	91.2
240-96524-3	MBLPS-18-05-MW-1 (I)	91.7
240-96524-3 MS	MBLPS-18-05-MW-1 (I)	89.4
240-96524-3 MSD	MBLPS-18-05-MW-1 (I)	88.2
LCS 160-369900/1-A	Lab Control Sample	88.8
MB 160-369900/23-A	Method Blank	92.6

Tracer/Carrier Legend

Ba Carrier = Ba Carrier

Method: 9320 - Radium-228 (GFPC)

Matrix: Water **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)	
Lab Sample ID	**Client Sample ID**	**Ba Carrier (40-110)**	**Y Carrier (40-110)**
240-96524-1	MBLPS-18-05-MW-2 (I)	92.6	92.3
240-96524-2	MBLPS-18-05-MW-2 (D)	91.2	96.1
240-96524-3	MBLPS-18-05-MW-1 (I)	91.7	94.6
240-96524-3 MS	MBLPS-18-05-MW-1 (I)	89.4	90.8
240-96524-3 MSD	MBLPS-18-05-MW-1 (I)	88.2	91.2
LCS 160-369905/1-A	Lab Control Sample	88.8	92.7
MB 160-369905/23-A	Method Blank	92.6	92.0

Tracer/Carrier Legend

Ba Carrier = Ba Carrier
Y Carrier = Y Carrier

QC Sample Results

Method: 9315 - Radium-226 (GFPC)

Lab Sample ID: MB 160-369900/23-A
Matrix: Water
Analysis Batch: 373831

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 369900

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	-0.006681	U	0.0929	0.0929	1.00	0.207	pCi/L	06/11/18 13:02	07/03/18 09:43	1

Carrier	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*92.6*		*40 - 110*	*06/11/18 13:02*	*07/03/18 09:43*	*1*

Lab Sample ID: LCS 160-369900/1-A
Matrix: Water
Analysis Batch: 373830

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 369900

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Radium-226			11.8	12.31		1.46	1.00	0.231	pCi/L	104	68 - 137		

Carrier	*LCS %Yield*	*LCS Qualifier*	*Limits*
Ba Carrier	*88.8*		*40 - 110*

Lab Sample ID: 240-96524-3 MS
Matrix: Water
Analysis Batch: 373831

Client Sample ID: MBLPS-18-05-MW-1 (I)
Prep Type: Total/NA
Prep Batch: 369900

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Radium-226	0.409		15.7	14.46		1.74	1.00	0.248	pCi/L	89	75 - 138		

Carrier	*MS %Yield*	*MS Qualifier*	*Limits*
Ba Carrier	*89.4*		*40 - 110*

Lab Sample ID: 240-96524-3 MSD
Matrix: Water
Analysis Batch: 373831

Client Sample ID: MBLPS-18-05-MW-1 (I)
Prep Type: Total/NA
Prep Batch: 369900

Analyte	Sample Result	Sample Qual	Spike Added	MSD Result	MSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Radium-226	0.409		15.7	14.73		1.78	1.00	0.259	pCi/L	91	75 - 138	0.08	1

Carrier	*MSD %Yield*	*MSD Qualifier*	*Limits*
Ba Carrier	*88.2*		*40 - 110*

QC Sample Results

Method: 9320 - Radium-228 (GFPC)

Lab Sample ID: MB 160-369905/23-A
Matrix: Water
Analysis Batch: 373662

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 369905

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-228	-0.07828	U	0.198	0.198	1.00	0.372	pCi/L	06/11/18 13:56	07/02/18 14:40	1

Carrier	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Ba Carrier	*92.6*		*40 - 110*	*06/11/18 13:56*	*07/02/18 14:40*	*1*
Y Carrier	*92.0*		*40 - 110*	*06/11/18 13:56*	*07/02/18 14:40*	*1*

Lab Sample ID: LCS 160-369905/1-A
Matrix: Water
Analysis Batch: 373489

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 369905

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Radium-228			8.18	13.10	*	1.44	1.00	0.418	pCi/L	160	56 - 140		

Carrier	*LCS %Yield*	*LCS Qualifier*	*Limits*
Ba Carrier	*88.8*		*40 - 110*
Y Carrier	*92.7*		*40 - 110*

Lab Sample ID: 240-96524-3 MS
Matrix: Water
Analysis Batch: 373488

Client Sample ID: MBLPS-18-05-MW-1 (I)
Prep Type: Total/NA
Prep Batch: 369905

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Radium-228	0.107	U *	10.9	10.50		1.28	1.00	0.457	pCi/L	95	45 - 150		

Carrier	*MS %Yield*	*MS Qualifier*	*Limits*
Ba Carrier	*89.4*		*40 - 110*
Y Carrier	*90.8*		*40 - 110*

Lab Sample ID: 240-96524-3 MSD
Matrix: Water
Analysis Batch: 373488

Client Sample ID: MBLPS-18-05-MW-1 (I)
Prep Type: Total/NA
Prep Batch: 369905

Analyte	Sample Result	Sample Qual	Spike Added	MSD Result	MSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Radium-228	0.107	U *	10.9	12.07		1.44	1.00	0.549	pCi/L	110	45 - 150	0.58	1

Carrier	*MSD %Yield*	*MSD Qualifier*	*Limits*
Ba Carrier	*88.2*		*40 - 110*
Y Carrier	*91.2*		*40 - 110*

Rad

Prep Batch: 369900

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96524-1	MBLPS-18-05-MW-2 (I)	Total/NA	Water	PrecSep-21	
240-96524-2	MBLPS-18-05-MW-2 (D)	Total/NA	Water	PrecSep-21	
240-96524-3	MBLPS-18-05-MW-1 (I)	Total/NA	Water	PrecSep-21	
MB 160-369900/23-A	Method Blank	Total/NA	Water	PrecSep-21	
LCS 160-369900/1-A	Lab Control Sample	Total/NA	Water	PrecSep-21	
240-96524-3 MS	MBLPS-18-05-MW-1 (I)	Total/NA	Water	PrecSep-21	
240-96524-3 MSD	MBLPS-18-05-MW-1 (I)	Total/NA	Water	PrecSep-21	

Prep Batch: 369905

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96524-1	MBLPS-18-05-MW-2 (I)	Total/NA	Water	PrecSep_0	
240-96524-2	MBLPS-18-05-MW-2 (D)	Total/NA	Water	PrecSep_0	
240-96524-3	MBLPS-18-05-MW-1 (I)	Total/NA	Water	PrecSep_0	
MB 160-369905/23-A	Method Blank	Total/NA	Water	PrecSep_0	
LCS 160-369905/1-A	Lab Control Sample	Total/NA	Water	PrecSep_0	
240-96524-3 MS	MBLPS-18-05-MW-1 (I)	Total/NA	Water	PrecSep_0	
240-96524-3 MSD	MBLPS-18-05-MW-1 (I)	Total/NA	Water	PrecSep_0	

Client Sample ID: MBLPS-18-05-MW-2 (I)

Lab Sample ID: 240-96524-1

Date Collected: 05/31/18 15:07

Matrix: Water

Date Received: 06/05/18 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	PrecSep-21			369900	06/11/18 13:02	JLC	TAL SL
Total/NA	Analysis	9315		1	373831	07/03/18 06:02	RTM	TAL SL
Total/NA	Prep	PrecSep_0			369905	06/11/18 13:56	JLC	TAL SL
Total/NA	Analysis	9320		1	373488	07/02/18 14:37	CDR	TAL SL
Total/NA	Analysis	Ra226_Ra228		1	374405	07/08/18 16:47	RTM	TAL SL

Client Sample ID: MBLPS-18-05-MW-2 (D)

Lab Sample ID: 240-96524-2

Date Collected: 05/31/18 15:07

Matrix: Water

Date Received: 06/05/18 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	PrecSep-21			369900	06/11/18 13:02	JLC	TAL SL
Total/NA	Analysis	9315		1	373831	07/03/18 06:02	RTM	TAL SL
Total/NA	Prep	PrecSep_0			369905	06/11/18 13:56	JLC	TAL SL
Total/NA	Analysis	9320		1	373488	07/02/18 14:37	CDR	TAL SL
Total/NA	Analysis	Ra226_Ra228		1	374405	07/08/18 16:47	RTM	TAL SL

Client Sample ID: MBLPS-18-05-MW-1 (I)

Lab Sample ID: 240-96524-3

Date Collected: 05/31/18 16:29

Matrix: Water

Date Received: 06/05/18 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	PrecSep-21			369900	06/11/18 13:02	JLC	TAL SL
Total/NA	Analysis	9315		1	373831	07/03/18 09:40	RTM	TAL SL
Total/NA	Prep	PrecSep_0			369905	06/11/18 13:56	JLC	TAL SL
Total/NA	Analysis	9320		1	373488	07/02/18 14:37	CDR	TAL SL
Total/NA	Analysis	Ra226_Ra228		1	374405	07/08/18 16:47	RTM	TAL SL

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Accreditation/Certification Summary

Laboratory: TestAmerica Canton

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
California	State Program	9	2927	02-23-19
Connecticut	State Program	1	PH-0590	12-31-19
Florida	NELAP	4	E87225	06-30-19
Illinois	NELAP	5	200004	07-31-18 *
Kansas	NELAP	7	E-10336	01-31-19
Kentucky (UST)	State Program	4	58	02-23-19
Kentucky (WW)	State Program	4	98016	12-31-18
Minnesota	NELAP	5	039-999-348	12-31-18
Minnesota (Petrofund)	State Program	1	3506	07-31-18 *
Nevada	State Program	9	OH-000482008A	07-31-18 *
New Jersey	NELAP	2	OH001	06-30-19
New York	NELAP	2	10975	03-31-19
Ohio VAP	State Program	5	CL0024	09-06-19
Oregon	NELAP	10	4062	02-23-19
Pennsylvania	NELAP	3	68-00340	08-31-18 *
Texas	NELAP	6	T104704517-17-9	08-31-18 *
USDA	Federal		P330-16-00404	12-28-19
Virginia	NELAP	3	460175	09-14-18 *
Washington	State Program	10	C971	01-12-19
West Virginia DEP	State Program	3	210	12-31-18

Laboratory: TestAmerica St. Louis

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
Alaska	State Program	10	MO00054	06-30-18 *
ANAB	DoD ELAP		L2305	04-06-19
Arizona	State Program	9	AZ0813	12-08-18
California	State Program	9	2886	06-30-19
Connecticut	State Program	1	PH-0241	03-31-19
Florida	NELAP	4	E87689	06-30-19
Illinois	NELAP	5	200023	11-30-18
Iowa	State Program	7	373	12-01-18
Kansas	NELAP	7	E-10236	10-31-18
Kentucky (DW)	State Program	4	90125	12-31-18
Louisiana	NELAP	6	04080	06-30-19
Louisiana (DW)	NELAP	6	LA180017	12-31-18
Maryland	State Program	3	310	09-30-18
Michigan	State Program	5	9005	06-30-18 *
Missouri	State Program	7	780	06-30-18 *
Nevada	State Program	9	MO000542018-1	07-31-18 *
New Jersey	NELAP	2	MO002	06-30-19
New York	NELAP	2	11616	03-31-19
North Dakota	State Program	8	R207	06-30-18 *
NRC	NRC		24-24817-01	12-31-22
Oklahoma	State Program	6	9997	08-31-18 *
Pennsylvania	NELAP	3	68-00540	02-28-19
South Carolina	State Program	4	85002001	06-30-18 *
Texas	NELAP	6	T104704193-17-11	07-31-18
US Fish & Wildlife	Federal		058448	07-31-18

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Laboratory: TestAmerica St. Louis (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
USDA	Federal		P330-17-0028	02-02-20
Utah	NELAP	8	MO000542016-8	07-31-18 *
Virginia	NELAP	3	460230	06-14-19
Washington	State Program	10	C592	08-30-18
West Virginia DEP	State Program	3	381	08-31-18 *

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

3.4/3.5

ftc&h CHAIN OF CUSTODY RECORD

Fishbeck, Thompson, Carr & Huber, Inc.
Address 1515 Arboretum Dr SE
Grand Rapids, MI 49546
Phone 616-575-3824

Report to Penni Mahler
Email pdmahler@ftch.com
Copy to
Email

Invoice to Accounts Payable
Email acpay@ftch.com
Lab Quote
Reference

PROJECT NAME: MBLP/Shires ASD + GW
PROJECT NO.: 180827
PROJECT LOCATION:
SAMPLER(S) NAME: APS, AD
PROJECT MANAGER: TCC
PHONE: 218 544 1848
EMAIL: tccampbell@ftch.com
ADDITIONAL INFORMATION:

PAGE 1 OF 1
STD TAT ☑
RUSH TAT ☐
DATE DUE:

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	AQUEOUS (WATER)	SOLID/SEMI-SOLID	AIR	NONAQUEOUS LIQUID	F1	*Metals	Radium 226 Radium 228									REMARKS
PRESERVATIVE							–	HNO3	HNO3									
5/31/18	1507	MBLPS-18-05-MW-2 (I)	X				1	1	3									*Metals: Sb, As, Ba, Be
↓	↓	MBLPS-18-05-MW-2 (D)	X				1	1	3									Cd, Cr, Co, Pb, Hg, Mo,
↓	1629	MBLPS-18-05-MW-1 (I/MS/MSD)	X						4									Se, Ti, Li

NUMBER OF CONTAINERS SUBMITTED

240-96524 Chain of Custody

RELINQUISHED BY	DATE	TIME	RELINQUISHED BY	DATE	TIME	RELINQUISHED BY	DATE	TIME	METHOD OF SHIPMENT/BILL OF LADING
To storage	6/1/18	1400		6/4/18	16:30				FedEx# 7115-7198-7948

RECEIVED BY	DATE	TIME	RECEIVED BY	DATE	TIME	RECEIVED BY	DATE	TIME	RECEIVED FOR LAB	DATE	TIME
From Storage	6/4/18	1630								6/5/18	930

WHITE Copy — Return with data package. YELLOW Copy — field File / Project Documentation.

G 042060

TestAmerica Canton Sample Receipt Form/Narrative **Login # :** 96524
Canton Facility

Client STC H Site Name ______ Cooler unpacked by:
Cooler Received on 6/5/18 Opened on 6/5/18
FedEx: 1st Grd [✓ Exp] UPS FAS Clipper Client Drop Off TestAmerica Courier Other

Receipt After-hours: Drop-off Date/Time Storage Location

TestAmerica Cooler # TA Foam Box Client Cooler Box Other ______
Packing material used: Bubble Wrap Foam [✓ Plastic Bag] None Other ______
COOLANT: [✓ Wet Ice] Blue Ice Dry Ice Water None

1. Cooler temperature upon receipt ☐ See Multiple Cooler Form
IR GUN# IR-8 (CF +0.1 °C) Observed Cooler Temp. 3.4 °C Corrected Cooler Temp. 3.5 °C
IR GUN #36 (CF +0.3°C) Observed Cooler Temp. ______ °C Corrected Cooler Temp. ______ °C
~~IR GUN # 627 (CF -1.3°C) Observed Cooler Temp. ______ °C Corrected Cooler Temp. ______ °C~~

2. Were tamper/custody seals on the outside of the cooler(s)? If Yes Quantity 1 [✓ Yes] No
-Were the seals on the outside of the cooler(s) signed & dated? [✓ Yes] No NA
-Were tamper/custody seals on the bottle(s) or bottle kits (LLHg/MeHg)? Yes [✓ No]
-Were tamper/custody seals intact and uncompromised? [✓ Yes] No NA
3. Shippers' packing slip attached to the cooler(s)? [✓ Yes] No
4. Did custody papers accompany the sample(s)? [✓ Yes] No
5. Were the custody papers relinquished & signed in the appropriate place? [✓ Yes] No
6. Was/were the person(s) who collected the samples clearly identified on the COC? [✓ Yes] No
7. Did all bottles arrive in good condition (Unbroken)? [✓ Yes] No
8. Could all bottle labels be reconciled with the COC? [✓ Yes] No
9. Were correct bottle(s) used for the test(s) indicated? [✓ Yes] No
10. Sufficient quantity received to perform indicated analyses? [✓ Yes] No
11. Are these work share samples? Yes [✓ No]
If yes, Questions 12-16 have been checked at the originating laboratory.
12. Were all preserved sample(s) at the correct pH upon receipt? [✓ Yes] No NA pH Strip Lot# **HC740840**
13. Were VOAs on the COC? Yes [✓ No]
14. Were air bubbles >6 mm in any VOA vials? ● Larger than this. Yes No [✓ NA]
15. Was a VOA trip blank present in the cooler(s)? Trip Blank Lot # ______ Yes [✓ No]
16. Was a LL Hg or Me Hg trip blank present? ______ Yes [✓ No]

Tests that are not checked for pH by Receiving:

VOAs
Oil and Grease
TOC

Contacted PM ______ Date ______ by ______ via Verbal Voice Mail Other

Concerning ______

17. CHAIN OF CUSTODY & SAMPLE DISCREPANCIES

Samples processed by: JR

18. SAMPLE CONDITION

Sample(s) ______ were received after the recommended holding time had expired.
Sample(s) ______ were received in a broken container.
Sample(s) ______ were received with bubble >6 mm in diameter. (Notify PM)

19. SAMPLE PRESERVATION

Sample(s) ______ were further preserved in the laboratory.
Time preserved: ______ Preservative(s) added/Lot number(s): ______

WI-NC-099

6/5/2018

Login Container Summary Report

240-96524

Temperature readings: ______________________________

Client Sample ID	Lab ID	Container Type	Container pH	Preservative Added (mls)	Lot #
MBLPS-18-05-MW-2 (I)	240-96524-B-1	Plastic 500ml - with Nitric Acid	<2		
MBLPS-18-05-MW-2 (I)	240-96524-C-1	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-2 (I)	240-96524-D-1	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-2 (I)	240-96524-E-1	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-2 (D)	240-96524-B-2	Plastic 500ml - with Nitric Acid	<2		
MBLPS-18-05-MW-2 (D)	240-96524-C-2	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-2 (D)	240-96524-D-2	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-2 (D)	240-96524-E-2	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96524-A-3	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96524-B-3	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96524-C-3	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96524-D-3	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96524-E-3	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96524-F-3	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96524-G-3	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96524-H-3	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96524-I-3	Plastic 1 liter - Nitric Acid	<2		

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

TestAmerica Canton
4101 Shuffel Street NW
North Canton, OH 44720
Phone (330) 497-9396 Fax (330) 497-0772

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Brooks, Kris M	Carrier Tracking No(s):	COC No: 240-87735.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: kris.brooks@testamericainc.com	State of Origin: Michigan	Page: Page 1 of 1
Company: TestAmerica Laboratories, Inc.		Accreditations Required (See note):		Job #: 240-96524-1
Address: 13715 Rider Trail North,	Due Date Requested: 6/7/2018			
City: Earth City	TAT Requested (days):			
State, Zip: MO, 63045				
Phone: 314-298-8566(Tel) 314-298-8757(Fax)	PO #:			
Email:	WO #:			
Project Name: CCR-MBLP Shiras Steam Plant	Project #: 24020283			
Site:	SSOW#:			

Analysis Requested

Preservation Codes:
A - HCL
B - NaOH
C - Zn Acetate
D - Nitric Acid
E - NaHSO4
F - MeOH
G - Amchlor
H - Ascorbic Acid
I - Ice
J - DI Water
K - EDTA
L - EDA
M - Hexane
N - None
O - AsNaO2
P - Na2O4S
Q - Na2SO3
R - Na2S2O3
S - H2SO4
T - TSP Dodecahydrate
U - Acetone
V - MCAA
W - pH 4-5
Z - other (specify)
Other:

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	9315_Ra226/PrecSep_21 Radium-226 (GFPC) - 21 day decay	9320_Ra228/PrecSep_0 Radium-228 (GFPC)	Ra226Ra228_GFPC	Total Number of containers	Special Instructions/Note:
			Preservation Code:								
MBLPS-18-05-MW-2 (I) (240-96524-1)	5/31/18	15:07 Eastern		Water			X	X	X	3	
MBLPS-18-05-MW-2 (D) (240-96524-2)	5/31/18	15:07 Eastern		Water			X	X	X	3	
MBLPS-18-05-MW-1 (I) (240-96524-3)	5/31/18	16:29 Eastern		Water			X	X	X	9	

Note: Since laboratory accreditations are subject to change, TestAmerica Laboratories, Inc. places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to TestAmerica Laboratories, Inc. attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said compliance to TestAmerica Laboratories, Inc.

Possible Hazard Identification
Unconfirmed

Deliverable Requested: I, II, III, IV, Other (specify)
Primary Deliverable Rank: 2

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ______ *Months*

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by: Charles Dantt	Date/Time: 6-5-18 15:19	Company: 240	Received by: Nicholas Palm	Date/Time: 6-6-18/0910	Company: TASTL
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks:

Ver: 09.20.2016

TestAmerica Canton
4101 Shuffel Street NW
North Canton, OH 44720
Phone (330) 497-9396 Fax (330) 497-0772

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information (Sub Contract Lab)

Client Contact: Shipping/Receiving
Company: TestAmerica Laboratories, Inc.
Address: 13715 Rider Trail North,
City: Earth City
State, Zip: MO, 63045
Phone: 314-298-8566(Tel) 314-298-8757(Fax)
Email:
Project Name: CCR-MBLP Shiras Steam Plant
Site:

Sampler:
Phone:
Due Date Requested: 6/7/2018
TAT Requested (days):
PO #:
WO #:
Project #: 24020283
SSOW#:

Lab PM: Brooks, Kris M
E-Mail: kris.brooks@testamericainc.com
Accreditations Required (See note):

Carrier Tracking No(s):
State of Origin: Michigan

COC No: 240-87736.1
Page: Page 1 of 1
Job #: 240-96524-1

Preservation Codes:
A - HCL
B - NaOH
C - Zn Acetate
D - Nitric Acid
E - NaHSO4
F - MeOH
G - Amchlor
H - Ascorbic Acid
I - Ice
J - DI Water
K - EDTA
L - EDA
M - Hexane
N - None
O - AsNaO2
P - Na2O4S
Q - Na2SO3
R - Na2S2O3
S - H2SO4
T - TSP Dodecahydrate
U - Acetone
V - MCAA
W - pH 4-5
Z - other (specify)
Other:

Analysis Requested

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	9315_Ra226/PrecSep_21 Radium-226 (GFPC) - 21 day decay	9320_Ra228/PrecSep_0 Radium-228 (GFPC)	Ra226Ra228_GFPC	Total Number of containers	Special Instructions/Note:
			Preservation Code:								
MBLPS-18-05-MW-1 (I) (240-96524-3MS)	5/31/18	16:29 Eastern	MS	Water			X	X	X	1	
MBLPS-18-05-MW-1 (I) (240-96524-3MSD)	5/31/18	16:29 Eastern	MSD	Water			X	X	X	1	

Note: Since laboratory accreditations are subject to change, TestAmerica Laboratories, Inc. places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to TestAmerica Laboratories, Inc. attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said compliance to TestAmerica Laboratories, Inc.

Possible Hazard Identification
Unconfirmed

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ____ *Months*

Deliverable Requested: I, II, III, IV, Other (specify)
Primary Deliverable Rank: 2
Special Instructions/QC Requirements:

Empty Kit Relinquished by:
Date:
Time:
Method of Shipment:

Relinquished by:
Date/Time: 6-5-18 15:19
Company: 240
Received by:
Date/Time: 6-6-18/0910
Company: TASTL

Relinquished by:
Date/Time:
Company:
Received by:
Date/Time:
Company:

Relinquished by:
Date/Time:
Company:
Received by:
Date/Time:
Company:

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks:

Ver: 09/20/2016

Login Sample Receipt Checklist

Client: Fishbeck Thompson Carr & Huber Inc

Job Number: 240-96524-2

Login Number: 96524
List Number: 2
Creator: Press, Nicholas B

List Source: TestAmerica St. Louis
List Creation: 06/06/18 02:01 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.		
The cooler's custody seal, if present, is intact.		
Sample custody seals, if present, are intact.		
The cooler or samples do not appear to have been compromised or tampered with.		
Samples were received on ice.		
Cooler Temperature is acceptable.		
Cooler Temperature is recorded.		
COC is present.		
COC is filled out in ink and legible.		
COC is filled out with all pertinent information.		
Is the Field Sampler's name present on COC?		
There are no discrepancies between the containers received and the COC.		
Samples are received within Holding Time (excluding tests with immediate HTs)		
Sample containers have legible labels.		
Containers are not broken or leaking.		
Sample collection date/times are provided.		
Appropriate sample containers are used.		
Sample bottles are completely filled.		
Sample Preservation Verified.		
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs		
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").		
Multiphasic samples are not present.		
Samples do not require splitting or compositing.		
Residual Chlorine Checked.		

Login Sample Receipt Checklist

Client: Fishbeck Thompson Carr & Huber Inc

Job Number: 240-96524-2

Login Number: 96524
List Number: 3
Creator: McKinney, Gerrod E

List Source: TestAmerica St. Louis
List Creation: 06/09/18 12:45 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.		
The cooler's custody seal, if present, is intact.		
Sample custody seals, if present, are intact.		
The cooler or samples do not appear to have been compromised or tampered with.		
Samples were received on ice.		
Cooler Temperature is acceptable.		
Cooler Temperature is recorded.		
COC is present.		
COC is filled out in ink and legible.		
COC is filled out with all pertinent information.		
Is the Field Sampler's name present on COC?		
There are no discrepancies between the containers received and the COC.		
Samples are received within Holding Time (excluding tests with immediate HTs)		
Sample containers have legible labels.		
Containers are not broken or leaking.		
Sample collection date/times are provided.		
Appropriate sample containers are used.		
Sample bottles are completely filled.		
Sample Preservation Verified.		
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs		
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").		
Multiphasic samples are not present.		
Samples do not require splitting or compositing.		
Residual Chlorine Checked.		

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TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

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ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Canton
4101 Shuffel Street NW
North Canton, OH 44720
Tel: (330)497-9396

TestAmerica Job ID: 240-96524-1
Client Project/Site: CCR-MBLP Shiras Steam Plant

For:
Fishbeck Thompson Carr & Huber Inc
1515 Arboretum Drive SE
Grand Rapids, Michigan 49546

Attn: Penni Mahler

Kris Brooks

Authorized for release by:
6/19/2018 4:46:03 PM

Kris Brooks, Project Manager II
(330)966-9790
kris.brooks@testamericainc.com

Table of Contents

Qualifiers

Metals

Qualifier	Qualifier Description
U	Indicates the analyte was analyzed for but not detected.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

General Chemistry

Qualifier	Qualifier Description
U	Indicates the analyte was analyzed for but not detected.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 240-96524-1

Laboratory: TestAmerica Canton

Narrative

CASE NARRATIVE

Client: Fishbeck Thompson Carr & Huber Inc

Project: CCR-MBLP Shiras Steam Plant

Report Number: 240-96524-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica Canton attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header.

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT
The samples were received on 6/5/2018 9:30 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 3.5º C.

TOTAL RECOVERABLE METALS (ICPMS)
Samples MBLPS-18-05-MW-2 (I) (240-96524-1) and MBLPS-18-05-MW-2 (D) (240-96524-2) were analyzed for total recoverable metals (ICPMS) in accordance with EPA SW-846 Method 6020A. The samples were prepared on 06/05/2018 and analyzed on 06/06/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TOTAL MERCURY
Samples MBLPS-18-05-MW-2 (I) (240-96524-1) and MBLPS-18-05-MW-2 (D) (240-96524-2) were analyzed for total mercury in accordance with EPA SW-846 Methods 7470A. The samples were prepared on 06/05/2018 and analyzed on 06/06/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

ANIONS
Samples MBLPS-18-05-MW-2 (I) (240-96524-1) and MBLPS-18-05-MW-2 (D) (240-96524-2) were analyzed for anions in accordance with

Job ID: 240-96524-1 (Continued)

Laboratory: TestAmerica Canton (Continued)

EPA SW-846 Method 9056A. The samples were analyzed on 06/16/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Method Summary

Method	Method Description	Protocol	Laboratory
6020A	Metals (ICP/MS)	SW846	TAL CAN
7470A	Mercury (CVAA)	SW846	TAL CAN
9056A	Anions, Ion Chromatography	SW846	TAL CAN
3005A	Preparation, Total Recoverable or Dissolved Metals	SW846	TAL CAN
7470A	Preparation, Mercury	SW846	TAL CAN

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL CAN = TestAmerica Canton, 4101 Shuffel Street NW, North Canton, OH 44720, TEL (330)497-9396

Sample Summary

Client: Fishbeck Thompson Carr & Huber Inc
Project/Site: CCR-MBLP Shiras Steam Plant

TestAmerica Job ID: 240-96524-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
240-96524-1	MBLPS-18-05-MW-2 (I)	Water	05/31/18 15:07	06/05/18 09:30
240-96524-2	MBLPS-18-05-MW-2 (D)	Water	05/31/18 15:07	06/05/18 09:30

Detection Summary

Client: Fishbeck Thompson Carr & Huber Inc
Project/Site: CCR-MBLP Shiras Steam Plant

TestAmerica Job ID: 240-96524-1

Client Sample ID: MBLPS-18-05-MW-2 (I)

Lab Sample ID: 240-96524-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.84	J	5.0	0.75	ug/L	1		6020A	Total Recoverable
Barium	73		5.0	2.2	ug/L	1		6020A	Total Recoverable
Cobalt	0.38	J	1.0	0.19	ug/L	1		6020A	Total Recoverable
Chromium	2.2		2.0	0.98	ug/L	1		6020A	Total Recoverable
Molybdenum	1.1	J	5.0	1.1	ug/L	1		6020A	Total Recoverable
Lithium	5.9	J	8.0	1.7	ug/L	1		6020A	Total Recoverable
Fluoride	0.055		0.050	0.024	mg/L	1		9056A	Total/NA

Client Sample ID: MBLPS-18-05-MW-2 (D)

Lab Sample ID: 240-96524-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	1.0	J	5.0	0.75	ug/L	1		6020A	Total Recoverable
Barium	72		5.0	2.2	ug/L	1		6020A	Total Recoverable
Cobalt	0.38	J	1.0	0.19	ug/L	1		6020A	Total Recoverable
Chromium	1.7	J	2.0	0.98	ug/L	1		6020A	Total Recoverable
Lithium	6.0	J	8.0	1.7	ug/L	1		6020A	Total Recoverable
Fluoride	0.055		0.050	0.024	mg/L	1		9056A	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: Fishbeck Thompson Carr & Huber Inc
Project/Site: CCR-MBLP Shiras Steam Plant

TestAmerica Job ID: 240-96524-1

Client Sample ID: MBLPS-18-05-MW-2 (I)

Date Collected: 05/31/18 15:07
Date Received: 06/05/18 09:30

Lab Sample ID: 240-96524-1

Matrix: Water

Method: 6020A - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.84**	**J**	5.0	0.75	ug/L		06/05/18 15:00	06/06/18 16:24	1
Barium	**73**		5.0	2.2	ug/L		06/05/18 15:00	06/06/18 16:24	1
Beryllium	0.31	U	1.0	0.31	ug/L		06/05/18 15:00	06/06/18 16:24	1
Cadmium	0.21	U	1.0	0.21	ug/L		06/05/18 15:00	06/06/18 16:24	1
Cobalt	**0.38**	**J**	1.0	0.19	ug/L		06/05/18 15:00	06/06/18 16:24	1
Chromium	**2.2**		2.0	0.98	ug/L		06/05/18 15:00	06/06/18 16:24	1
Molybdenum	**1.1**	**J**	5.0	1.1	ug/L		06/05/18 15:00	06/06/18 16:24	1
Lead	0.45	U	1.0	0.45	ug/L		06/05/18 15:00	06/06/18 16:24	1
Antimony	0.57	U	2.0	0.57	ug/L		06/05/18 15:00	06/06/18 16:24	1
Selenium	0.89	U	5.0	0.89	ug/L		06/05/18 15:00	06/06/18 16:24	1
Lithium	**5.9**	**J**	8.0	1.7	ug/L		06/05/18 15:00	06/06/18 16:24	1
Thallium	0.20	U	1.0	0.20	ug/L		06/05/18 15:00	06/06/18 16:24	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.13	U	0.20	0.13	ug/L		06/05/18 15:00	06/06/18 15:19	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	**0.055**		0.050	0.024	mg/L			06/16/18 02:44	1

Client Sample ID: MBLPS-18-05-MW-2 (D)

Date Collected: 05/31/18 15:07
Date Received: 06/05/18 09:30

Lab Sample ID: 240-96524-2
Matrix: Water

Method: 6020A - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**1.0**	**J**	5.0	0.75	ug/L		06/05/18 15:00	06/06/18 16:29	1
Barium	**72**		5.0	2.2	ug/L		06/05/18 15:00	06/06/18 16:29	1
Beryllium	0.31	U	1.0	0.31	ug/L		06/05/18 15:00	06/06/18 16:29	1
Cadmium	0.21	U	1.0	0.21	ug/L		06/05/18 15:00	06/06/18 16:29	1
Cobalt	**0.38**	**J**	1.0	0.19	ug/L		06/05/18 15:00	06/06/18 16:29	1
Chromium	**1.7**	**J**	2.0	0.98	ug/L		06/05/18 15:00	06/06/18 16:29	1
Molybdenum	1.1	U	5.0	1.1	ug/L		06/05/18 15:00	06/06/18 16:29	1
Lead	0.45	U	1.0	0.45	ug/L		06/05/18 15:00	06/06/18 16:29	1
Antimony	0.57	U	2.0	0.57	ug/L		06/05/18 15:00	06/06/18 16:29	1
Selenium	0.89	U	5.0	0.89	ug/L		06/05/18 15:00	06/06/18 16:29	1
Lithium	**6.0**	**J**	8.0	1.7	ug/L		06/05/18 15:00	06/06/18 16:29	1
Thallium	0.20	U	1.0	0.20	ug/L		06/05/18 15:00	06/06/18 16:29	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.13	U	0.20	0.13	ug/L		06/05/18 15:00	06/06/18 15:21	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	**0.055**		0.050	0.024	mg/L			06/16/18 03:05	1

1 2 3 4 5 6 7 8 9 10 11 12 13

Method: 6020A - Metals (ICP/MS)

Lab Sample ID: MB 240-330141/1-A
Matrix: Water
Analysis Batch: 330498

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 330141

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.75	U	5.0	0.75	ug/L		06/05/18 15:00	06/06/18 15:31	1
Barium	2.2	U	5.0	2.2	ug/L		06/05/18 15:00	06/06/18 15:31	1
Beryllium	0.31	U	1.0	0.31	ug/L		06/05/18 15:00	06/06/18 15:31	1
Cadmium	0.21	U	1.0	0.21	ug/L		06/05/18 15:00	06/06/18 15:31	1
Cobalt	0.19	U	1.0	0.19	ug/L		06/05/18 15:00	06/06/18 15:31	1
Chromium	0.98	U	2.0	0.98	ug/L		06/05/18 15:00	06/06/18 15:31	1
Molybdenum	1.1	U	5.0	1.1	ug/L		06/05/18 15:00	06/06/18 15:31	1
Lead	0.45	U	1.0	0.45	ug/L		06/05/18 15:00	06/06/18 15:31	1
Antimony	0.57	U	2.0	0.57	ug/L		06/05/18 15:00	06/06/18 15:31	1
Selenium	0.89	U	5.0	0.89	ug/L		06/05/18 15:00	06/06/18 15:31	1
Lithium	1.7	U	8.0	1.7	ug/L		06/05/18 15:00	06/06/18 15:31	1
Thallium	0.20	U	1.0	0.20	ug/L		06/05/18 15:00	06/06/18 15:31	1

Lab Sample ID: LCS 240-330141/3-A
Matrix: Water
Analysis Batch: 330498

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 330141

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	1000	947		ug/L		95	80 - 120
Barium	1000	969		ug/L		97	80 - 120
Beryllium	1000	961		ug/L		96	80 - 120
Cadmium	1000	1060		ug/L		106	80 - 120
Cobalt	1000	979		ug/L		98	80 - 120
Chromium	1000	964		ug/L		96	80 - 120
Molybdenum	100	94.4		ug/L		94	80 - 120
Lead	1000	1060		ug/L		106	80 - 120
Antimony	100	93.0		ug/L		93	80 - 120
Selenium	1000	947		ug/L		95	80 - 120
Thallium	250	263		ug/L		105	80 - 120

Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 240-330150/1-A
Matrix: Water
Analysis Batch: 330440

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 330150

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.13	U	0.20	0.13	ug/L		06/05/18 15:00	06/06/18 15:23	1

Lab Sample ID: LCS 240-330150/2-A
Matrix: Water
Analysis Batch: 330440

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 330150

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	5.00	4.35		ug/L		87	80 - 120

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Method: 9056A - Anions, Ion Chromatography

Lab Sample ID: MB 240-331714/3
Matrix: Water
Analysis Batch: 331714

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	0.024	U	0.050	0.024	mg/L			06/15/18 21:13	1

Lab Sample ID: LCS 240-331714/4
Matrix: Water
Analysis Batch: 331714

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Fluoride	2.50	2.64		mg/L		106	90 - 110

Metals

Prep Batch: 330141

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96524-1	MBLPS-18-05-MW-2 (I)	Total Recoverable	Water	3005A	
240-96524-2	MBLPS-18-05-MW-2 (D)	Total Recoverable	Water	3005A	
MB 240-330141/1-A	Method Blank	Total Recoverable	Water	3005A	
LCS 240-330141/3-A	Lab Control Sample	Total Recoverable	Water	3005A	

Prep Batch: 330150

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96524-1	MBLPS-18-05-MW-2 (I)	Total/NA	Water	7470A	
240-96524-2	MBLPS-18-05-MW-2 (D)	Total/NA	Water	7470A	
MB 240-330150/1-A	Method Blank	Total/NA	Water	7470A	
LCS 240-330150/2-A	Lab Control Sample	Total/NA	Water	7470A	

Analysis Batch: 330440

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96524-1	MBLPS-18-05-MW-2 (I)	Total/NA	Water	7470A	330150
240-96524-2	MBLPS-18-05-MW-2 (D)	Total/NA	Water	7470A	330150
MB 240-330150/1-A	Method Blank	Total/NA	Water	7470A	330150
LCS 240-330150/2-A	Lab Control Sample	Total/NA	Water	7470A	330150

Analysis Batch: 330498

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96524-1	MBLPS-18-05-MW-2 (I)	Total Recoverable	Water	6020A	330141
240-96524-2	MBLPS-18-05-MW-2 (D)	Total Recoverable	Water	6020A	330141
MB 240-330141/1-A	Method Blank	Total Recoverable	Water	6020A	330141
LCS 240-330141/3-A	Lab Control Sample	Total Recoverable	Water	6020A	330141

General Chemistry

Analysis Batch: 331714

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-96524-1	MBLPS-18-05-MW-2 (I)	Total/NA	Water	9056A	
240-96524-2	MBLPS-18-05-MW-2 (D)	Total/NA	Water	9056A	
MB 240-331714/3	Method Blank	Total/NA	Water	9056A	
LCS 240-331714/4	Lab Control Sample	Total/NA	Water	9056A	

Lab Chronicle

Client Sample ID: MBLPS-18-05-MW-2 (I)

Lab Sample ID: 240-96524-1

Date Collected: 05/31/18 15:07
Matrix: Water
Date Received: 06/05/18 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			330141	06/05/18 15:00	MBB	TAL CAN
Total Recoverable	Analysis	6020A		1	330498	06/06/18 16:24	DSH	TAL CAN
Total/NA	Prep	7470A			330150	06/05/18 15:00	MBB	TAL CAN
Total/NA	Analysis	7470A		1	330440	06/06/18 15:19	AJC	TAL CAN
Total/NA	Analysis	9056A		1	331714	06/16/18 02:44	JWW	TAL CAN

Client Sample ID: MBLPS-18-05-MW-2 (D)

Lab Sample ID: 240-96524-2

Date Collected: 05/31/18 15:07
Matrix: Water
Date Received: 06/05/18 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			330141	06/05/18 15:00	MBB	TAL CAN
Total Recoverable	Analysis	6020A		1	330498	06/06/18 16:29	DSH	TAL CAN
Total/NA	Prep	7470A			330150	06/05/18 15:00	MBB	TAL CAN
Total/NA	Analysis	7470A		1	330440	06/06/18 15:21	AJC	TAL CAN
Total/NA	Analysis	9056A		1	331714	06/16/18 03:05	JWW	TAL CAN

Laboratory References:

TAL CAN = TestAmerica Canton, 4101 Shuffel Street NW, North Canton, OH 44720, TEL (330)497-9396

Accreditation/Certification Summary

Laboratory: TestAmerica Canton

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
California	State Program	9	2927	02-23-19
Connecticut	State Program	1	PH-0590	12-31-19
Florida	NELAP	4	E87225	06-30-18 *
Illinois	NELAP	5	200004	07-31-18 *
Kansas	NELAP	7	E-10336	01-31-19
Kentucky (UST)	State Program	4	58	02-23-19
Kentucky (WW)	State Program	4	98016	12-31-18
Minnesota	NELAP	5	039-999-348	12-31-18
Minnesota (Petrofund)	State Program	1	3506	07-31-18 *
Nevada	State Program	9	OH-000482008A	07-31-18 *
New Jersey	NELAP	2	OH001	06-30-18 *
New York	NELAP	2	10975	03-31-19
Ohio VAP	State Program	5	CL0024	09-06-19
Oregon	NELAP	10	4062	02-23-19
Pennsylvania	NELAP	3	68-00340	08-31-18 *
Texas	NELAP	6	T104704517-17-9	08-31-18 *
USDA	Federal		P330-16-00404	12-28-19
Virginia	NELAP	3	460175	09-14-18 *
Washington	State Program	10	C971	01-12-19
West Virginia DEP	State Program	3	210	12-31-18

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

3.4/3.5

CHAIN OF CUSTODY RECORD

Fishbeck, Thompson, Carr & Huber, Inc.
Address 1515 Arboretum Dr SE
Grand Rapids, MI 49546
Phone 616-575-3824

Report to Penni Mahler
Email pdmahler@ftch.com
Copy to
Email

Invoice to Accounts Payable
Email acpay@ftch.com
Lab Quote
Reference

PROJECT NAME: MBLP/Shires ASD + GW
PROJECT NO.: 180827
PROJECT LOCATION:
SAMPLER(S) NAME: APS, AD
PROJECT MANAGER: TCC
PHONE: 218-514-1848
EMAIL: tccampbell@ftch.com
ADDITIONAL INFORMATION:

PAGE 1 OF 1
STD TAT ☑
RUSH TAT ☐
DATE DUE

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	AQUEOUS (WATER)	SOLID/SEMI-SOLID	AIR	NONAQUEOUS LIQUID	F1	*Metals	Radium 22 Radium 22	REMARKS
PRESERVATIVE							-	HNO3	HNO3	
NUMBER OF CONTAINERS SUBMITTED										
5/31/18	1507	MBLPS-18-05-MW-2 (I)	X				1	1	3	*Metals: Sb, As, Ba, Be, Cd, Cr, Co, Pb, Hg, Mo, Se, Ti, Li
↓	↓	MBLPS-18-05-MW-2 (D)	X				1	1	3	
↓	1629	MBLPS-18-05-MW-1 (I/MS/MSD)	X						4	

240-96524 Chain of Custody

RELINQUISHED BY	DATE	TIME	RELINQUISHED BY	DATE	TIME	RELINQUISHED BY	DATE	TIME	METHOD OF SHIPMENT/BILL OF LADING
To storage	6/1/18	1400		6/4/18	1630				FedEx 7115-7198-7948
RECEIVED BY	**DATE**	**TIME**	**RECEIVED BY**	**DATE**	**TIME**	**RECEIVED BY**	**DATE**	**TIME**	**RECEIVED FOR LAB** / **DATE** / **TIME**
FTCH Storage	6/4/18	1630							6/5/18 930

WHITE Copy — Return with data package. YELLOW Copy — field File / Project Documentation.

G 042060

TestAmerica Canton Sample Receipt Form/Narrative **Login # :** 96524
Canton Facility

Client STL H Site Name

Cooler unpacked by:

Cooler Received on 6/5/18 Opened on 6/5/18

FedEx: 1st Grd [✓ Exp] UPS FAS Clipper Client Drop Off TestAmerica Courier Other

Receipt After-hours: Drop-off Date/Time Storage Location

TestAmerica Cooler # TA Foam Box Client Cooler Box Other

Packing material used: Bubble Wrap Foam [✓ Plastic Bag] None Other

COOLANT: [✓ Wet Ice] Blue Ice Dry Ice Water None

1. Cooler temperature upon receipt ☐ See Multiple Cooler Form

IR GUN# IR-8 (CF +0.1 °C) Observed Cooler Temp. 3.4 °C Corrected Cooler Temp. 3.5 °C

IR GUN #36 (CF +0.3°C) Observed Cooler Temp. ______ °C Corrected Cooler Temp. ______ °C

~~IR GUN # 627 (CF -1.3°C) Observed Cooler Temp. ______ °C Corrected Cooler Temp. ______ °C~~

2.	Were tamper/custody seals on the outside of the cooler(s)? If Yes Quantity 1	[✓ Yes] No
	-Were the seals on the outside of the cooler(s) signed & dated?	[✓ Yes] No NA
	-Were tamper/custody seals on the bottle(s) or bottle kits (LLHg/MeHg)?	Yes [✓ No]
	-Were tamper/custody seals intact and uncompromised?	[✓ Yes] No NA
3.	Shippers' packing slip attached to the cooler(s)?	[✓ Yes] No
4.	Did custody papers accompany the sample(s)?	[✓ Yes] No
5.	Were the custody papers relinquished & signed in the appropriate place?	[✓ Yes] No
6.	Was/were the person(s) who collected the samples clearly identified on the COC?	[✓ Yes] No
7.	Did all bottles arrive in good condition (Unbroken)?	[✓ Yes] No
8.	Could all bottle labels be reconciled with the COC?	[✓ Yes] No
9.	Were correct bottle(s) used for the test(s) indicated?	[✓ Yes] No
10.	Sufficient quantity received to perform indicated analyses?	[✓ Yes] No
11.	Are these work share samples?	Yes [✓ No]
	If yes, Questions 12-16 have been checked at the originating laboratory.	
12.	Were all preserved sample(s) at the correct pH upon receipt?	[✓ Yes] No NA pH Strip Lot# **HC740840**
13.	Were VOAs on the COC?	Yes [✓ No]
14.	Were air bubbles >6 mm in any VOA vials? ● ← Larger than this.	Yes No [✓ NA]
15.	Was a VOA trip blank present in the cooler(s)? Trip Blank Lot # ______	Yes [✓ No]
16.	Was a LL Hg or Me Hg trip blank present?	Yes [✓ No]

Tests that are not checked for pH by Receiving:

VOAs
Oil and Grease
TOC

Contacted PM ______ Date ______ by ______ via Verbal Voice Mail Other

Concerning ______

17. CHAIN OF CUSTODY & SAMPLE DISCREPANCIES

Samples processed by: JR

18. SAMPLE CONDITION

Sample(s) ______ were received after the recommended holding time had expired.

Sample(s) ______ were received in a broken container.

Sample(s) ______ were received with bubble >6 mm in diameter. (Notify PM)

19. SAMPLE PRESERVATION

Sample(s) ______ were further preserved in the laboratory.

Time preserved: ______ Preservative(s) added/Lot number(s): ______

WI-NC-099

6/5/2018

Login Container Summary Report

240-96524

Temperature readings: ____________________

Client Sample ID	Lab ID	Container Type	Container pH	Preservative Added (mls)	Lot #
MBLPS-18-05-MW-2 (I)	240-96524-B-1	Plastic 500ml - with Nitric Acid	<2		
MBLPS-18-05-MW-2 (I)	240-96524-C-1	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-2 (I)	240-96524-D-1	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-2 (I)	240-96524-E-1	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-2 (D)	240-96524-B-2	Plastic 500ml - with Nitric Acid	<2		
MBLPS-18-05-MW-2 (D)	240-96524-C-2	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-2 (D)	240-96524-D-2	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-2 (D)	240-96524-E-2	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96524-A-3	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96524-B-3	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96524-C-3	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96524-D-3	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96524-E-3	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96524-F-3	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96524-G-3	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96524-H-3	Plastic 1 liter - Nitric Acid	<2		
MBLPS-18-05-MW-1 (I)	240-96524-I-3	Plastic 1 liter - Nitric Acid	<2		

1 2 3 4 5 6 7 8 9 10 11 12 13

Analytical Data Validation Report
September 2018

Shiras Steam Plant
Marquette, Michigan

Prepared For:
Marquette Board of Light and Power
2200 Wright Street Marquette, Michigan 49855

October 2018
Project No. 180827

Table of Contents

List of Tables

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Table of Contents

List of Abbreviations/Acronyms

%R	percent recovery
°C	degrees Celsius
FTCH	Fishbeck, Thompson, Carr & Huber, Inc.
ICP-AES	inductively coupled plasma-atomic emission spectroscopy
ICP-MS	inductively coupled plasma-mass spectrometry
LCS	laboratory control sample
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
mg/L	milligram per liter
QC	quality control
RL	reporting limit
RPD	relative percent difference
USEPA	U.S. Environmental Protection Agency
µg/L	micrograms per liter

1.0 Project Information

Site name:	Shiras Steam Plant	
Project name:	Marquette Board of Light and Power/Shiras	
Sample collection dates:	09/20/18	
Sample matrix:	Groundwater	
Analytical parameters/methods:	Metals	6010C
	General Chemistry	9040B, 9056A, SM2540C
Laboratory:	TestAmerica	
Sample Delivery Group(s):	240-101698-1	

Sample Index:

Field ID	Lab ID
MBLPS-18-09-MW-1(I)	240-101698-3
MBLPS-18-09-MW-2(I)	240-101698-2
MBLPS-18-09-MW-3(I)	240-101698-1

Field ID	Lab ID
MBLPS-18-09-MW-4(I)	240-101698-5
MBLPS-18-09-MW-4(D)	240-101698-6
MBLPS-18-09-MW-5(I)	240-101698-4

The laboratory data package was evaluated for compliance with reference to *National Functional Guidelines for Inorganic Superfund Methods Data Review (January, 2017) and Evaluation of Radiochemical Data Usability (April, 1997)*. These guidelines were modified to accommodate the non-CLP methodologies. The following USEPA Region V data qualifier codes may be utilized in this report:

U The analyte was analyzed for, but not detected above the MDL.

J Analyte present. Reported value may not be accurate or precise.

R Result is rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria.

2.0 Metals Fraction

The laboratory data summary report is provided in Appendix 1. The metals data are summarized in Table 1.

2.1 ICP-AES/ICP-MS Metals

2.1.1 Technical Holding Time and Sample Preservation

ICP-AES or ICP-MS samples were preserved with nitric acid to pH ≤ 2.	Yes ☒ No ☐ NA ☐
ICP-AES or ICP-MS metals were analyzed within the 180-day holding time.	Yes ☒ No ☐ NA ☐

Exceptions:
None.

2.1.2 Blanks

A method blank was prepared and analyzed as part of each QC batch.	Yes ☒ No ☐
The target analytes were detected in the method blanks at concentrations above the RL.	Yes ☐ No ☒
The target analytes were detected in the method blanks at concentrations above the MDL but below the RL.	Yes ☐ No ☒

Exceptions:
None

2.1.3 Laboratory Control Samples

LCS were prepared and analyzed as part of each analytical batch.	Yes ☒ No ☐
The LCS were spiked with the target analytes at the same concentration as the matrix spike samples.	Yes ☒ No ☐
LCS recoveries were within the specified QC limits.	Yes ☒ No ☐

Exceptions:
None.

2.1.4 Matrix Spike/Matrix Spike Duplicate Analysis

MS/MSD samples were analyzed at the required frequency.	Yes ☒ No ☐
Samples identified as field blanks or equipment blanks were used for spiked sample analysis.	Yes ☐ No ☒
MS/MSD recoveries are within the established QC limits.	Yes ☒ No ☐
The RPD of the concentrations measured for the MS/MSD pairs is within the established QC limits.	Yes ☒ No ☐

Exceptions:
None.

3.0 General Chemistry Fraction

The laboratory data summary report is provided in Appendix 1. The general chemistry data are summarized in Table 1.

3.1 Technical Holding Time and Sample Preservation

Samples were received by the laboratory in proper condition with shipping container temperatures at ≤ 6°C (but not frozen) upon receipt.	Yes ☒ No ☐ NA ☐
Samples were properly preserved for the requested analyses.	Yes ☒ No ☐ NA ☐
Samples were analyzed within the analyte-specific holding times.	Yes ☒ No ☐ NA ☐

Exceptions:
pH is a field parameter with a holding time of 15 minutes. Laboratory analysis performed outside of the 15-minute holding time to allow for shipping of samples.

Data Qualification:
None.

3.2 Blanks

A method blank was prepared and analyzed as part of each QC batch.	Yes ☒ No ☐
The target analytes were detected in the method blanks at concentrations above the RL.	Yes ☐ No ☒
The target analytes were detected in the method blanks at concentrations above the MDL but below the RL.	Yes ☐ No ☒

Exceptions:
None.

3.3 Laboratory Control Samples

LCS were prepared and analyzed as part of each analytical batch.	Yes ☒ No ☐
The LCS were spiked with the target analytes at the same concentration as the matrix spike samples.	Yes ☐ No ☒
LCS recoveries were within the specified QC limits.	Yes ☒ No ☐

Exceptions:
LCS sample for Chloride was spiked at 50.0 mg/L and matrix spike samples were spiked at 250 mg/L.

Data Qualification:
None.

3.4 Matrix Spike/Matrix Spike Duplicate Analysis

MS/MSD samples were analyzed at the required frequency.	Yes ☒ No ☐
Samples identified as field blanks or equipment blanks were used for spiked sample analysis.	Yes ☐ No ☒
MS/MSD recoveries are within the established QC limits.	Yes ☒ No ☐
The RPD of the concentrations measured for the MS/MSD pairs is within the established QC limits.	Yes ☒ No ☐

Exceptions:
None.

4.0 Reconciliation with Data Quality Objectives

4.1 Overall Precision and Sample Representativeness

RPD for field duplicates is within the project control limits (± 30%) for at least 75% of the analyses. Yes ☒ No ☐

Sample	Analyte	Units	Field Sample	Field Duplicate	RPD	RPD Control Limits
MW-4	Boron	µg/L	110	110	0.0	30
	Calcium	µg/L	130,000	130,000	0.0	30
	Chloride	mg/L	450	450	0.0	30
	Fluoride	mg/L	0.23	0.23	0.0	30
	Sulfate	mg/L	42	42	0.0	30
	TDS	mg/L	970	1,000	3.0	30
	pH (lab)	SU	7.7	7.7	0.0	30

4.2 Overall Accuracy/Bias

LCS recoveries were met for all samples. Yes ☐ No ☒

MS/MSD recoveries were met for 75% of the samples. Yes ☒ No ☐

100% of the LCS recoveries, and 100% of the MS/MSD recoveries acceptable.

4.3 Overall Completeness

Total data points generated	42
Data points available for use	42

At least 90% of the data are determined to be valid. Yes ☒ No ☐

The completeness objective for the task was met and sufficient data are available to support decision-making.

4.4 Data Limitations and Actions

U-qualified results may not be usable when greater than a screening level.

Tables

Table 1 - Cumulative Analytical Data Summary
Marquette Board of Light and Power
Shiras Steam Plant
September 2018

Lab Suite:				CCR Appendix III							CCR Appendix IV																
Parameter:				Boron	Calcium	Chloride	Fluoride	Sulfate	Total Dissolved Solids (TDS)	pH (lab)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Fluoride	Lead	Lithium	Mercury	Molybdenum	Radium 226 & 228 Combined	Radium 226	Radium 228	Selenium	Thallium
Units:				µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	SU	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	pCi/L	pCi/L	µg/L	µg/L
U.S. EPA MCL:				*NE*	*NE*	*NE*	*4.0*	*NE*	*NE*	*NE*	*6.0*	*10*	*2.0*	*4.0*	*5.0*	*100*	*NE*	*4.0*	*15*	*NE*	*2.0*	*NE*	*5.0*	*NE*	*NE*	*50*	*2.0*
Location	Well ID	Collection Date	Duplicate																								
Downgradient	MW-1	07/19/17		300 U	100,000	230	0.38 U	19	700	7.58	2.0 U	6.6	0.21	1.0 U	1.0 U	10 U	20 U	--	17	10 U	0.20 U	50 U	2.33	1.00 U	2.33	5.0 U	2.0 U
		07/24/17		300 U	110,000	230	0.38 U	20	800	7.45	2.0 U	5.0 U	0.15	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.43	1.00 U	1.43	5.0 U	2.0 U
		08/23/17		300 U	120,000	260	0.10 U	21	800	7.54	2.0 U	5.0 U	0.14	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/29/17		300 U	130,000	270	0.10 U	20	960	6.56	2.0 U	5.0 U	0.13	1.0 U	1.0 U	18	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17		300 U	130,000	270	0.10 U	21	930	7.56	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/14/17		300 U	110,000	290	0.10 U	22	980	7.60	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17		530	120,000	270	0.10 U	20	920	7.58	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17	X	300 U	120,000	270	0.10 U	21	990	7.58	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.16	1.00 U	1.16	5.0 U	2.0 U
		10/05/17		300 U	130,000	280	0.10 U	21	820	7.55	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		10/05/17	X	300 U	120,000	270	0.10 U	21	880	7.55	2.0 U	5.0 U	0.14	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		05/31/18		66 J	110,000	310	0.046 J	25	770	7.8	2.0 U	5.0 U	0.15	1.0 U	1.0 U	2.1	0.77 J	0.042 J	1.0 U	12	0.20 UJ	1.6 J	0.516	0.409	0.107 U	5.0 U	1.0 U
		09/20/18		67 J	120,000	300	0.044 J	24	740	7.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	MW-2	07/19/17		300 U	51,000	60	0.38 U	22	220	8.41	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		07/24/17		300 U	63,000	59	0.38 U	21	350	8.09	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.56	1.00 U	1.56	5.0 U	2.0 U
		08/23/17		300 U	51,000	62	0.10 U	26	190	8.13	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	240	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/29/17		300 U	52,000	61	0.10 U	22	350	7.03	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	2.00	1.00 U	2.00	5.0 U	2.0 U
		08/29/17	X	300 U	53,000	61	0.10 U	22	320	7.03	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17		300 U	53,000	60	0.10 U	21	310	8.15	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/14/17		300 U	52,000	64	0.10 U	23	300	8.13	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17		300 U	58,000	65	0.10 U	21	350	8.07	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		10/05/17		300 U	61,000	65	0.10 U	21	310	7.99	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		05/31/18		74 J	68,000	86	0.056	31	330	8.0	2.0 U	0.84 J	0.073	1.0 U	1.0 U	2.2	0.38 J	0.055	1.0 U	5.9 J	0.20 U	1.1 J	0.519	0.204 U	0.315 U	5.0 U	1.0 U
		05/31/18	X	75 J	70,000	86	0.057	31	330	8.0	2.0 U	1.0 J	0.072	1.0 U	1.0 U	1.7 J	0.38 J	0.055	1.0 U	6.0 J	0.20 U	5.0 U	0.299 U	0.193	0.106 U	5.0 U	1.0 U
		09/20/18		55 J	64,000	85	0.058	29	310	8.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	MW-3	07/19/17		300 U	68,000	98	0.38 U	49	360	8.00	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		07/24/17		300 U	69,000	89	0.38 U	36	440	7.86	2.0 U	5.0 U	0.23	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/23/17		300 U	75,000	95	0.10 U	44	300	7.81	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/29/17		300 U	62,000	86	0.10 U	28	390	6.32	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17		300 U	62,000	85	0.10 U	26	380	7.77	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.05	1.00 U	1.05	5.0 U	2.0 U
		09/14/17		300 U	57,000	83	0.10 U	25	380	7.85	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.17	1.00 U	1.17	5.0 U	2.0 U
		09/14/17	X	300 U	56,000	84	0.10 U	24	380	7.85	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17		300 U	67,000	89	0.10 U	20	440	8.09	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		10/05/17		300 U	69,000	87	0.10 U	21	350	8.10	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		05/31/18		45 J	55,000	67	0.067	20	290	8.2	2.0 U	1.5 J	0.066	1.0 U	1.0 U	2.4	0.32 J	0.065	1.0 U	4.9 J	0.20 U	1.2 J	0.128 U	0.199 U	-0.0711 U	5.0 U	1.0 U
		09/20/18		41 J	70,000	92	0.055	22	340	8.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	MW-4	07/19/17		300 U	93,000	260	0.38 U	19	700	7.92	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.07	1.00 U	1.07	5.0 U	2.0 U
		07/24/17		300 U	89,000	220	0.38 U	18	730	7.86	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		07/24/17	X	300 U	89,000	230	0.38 U	19	710	7.86	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/23/17		300 U	100,000	300	0.10 U	24	830	7.93	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/29/17		300 U	120,000	340	0.10 U	47	1,000	7.32	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17		300 U	110,000	340	0.20	53	1,000	7.75	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/14/17		300 U	100,000	360	0.18	49	1,000	7.77	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17		300 U	160,000	370	0.12	46	1,200	7.74	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.1 U	13	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		10/05/17		300 U	120,000	380	0.10	43	1,100	7.70	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	11	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		05/31/18		120	130,000	450	0.23	42	1,000	7.8	1.0 J	1.4 J	0.11	1.0 U	0.24 J	1.2 J	0.48 J	0.23	0.50 J	9.8	0.20 U	16	0.639	0.400	0.240 U	5.0 U	1.0 U
		09/20/18		110	130,000	450	0.23	42	970	7.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		09/20/18	X	110	130,000	450	0.23	42	1,000	7.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Upgradient	MW-5	07/19/17		300 U	100,000	200	0.38 U	25	640	7.36	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.51	1.00 U	1.51	5.0 U	2.0 U
		07/19/17	X	300 U	100,000	190	0.38 U	24	530	7.36	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		07/24/17		300 U	100,000	190	0.38 U	21	730	7.17	2.0 U	5.0 U	0.16	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/23/17		300 U	110,000	210	0.10 U	19	590	7.41	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.44	1.00 U	1.44	5.0 U	2.0 U
		08/23/17	X	300 U	110,000	190	0.10 U	19	620	7.41	2.0 U	5.0 U	0.13	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		08/29/17		300 U	110,000	190	0.10 U	18	750	6.76	2.0 U	5.0 U	0.12	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17		300 U	100,000	190	0.10 U	18	660	7.43	2.0 U	5.0 U	0.11	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17	X	300 U	100,000	190	0.10 U	18	730	7.43	2.0 U	5.0 U	0.11	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/14/17		300 U	96,000	200	0.10 U	19	720	7.51	2.0 U	5.0 U	0.11	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17		300 U	120,000	190	0.10 U	18	2,300	7.54	2.0 U	5.0 U	0.11	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		10/05/17		300 U	120,000	190	0.10 U	18	700	7.45	2.0 U	5.0 U	0.12	1.0 U	1.0 U	10 U	20 U	--	3.0 U	13	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		05/31/18		42 J	100,000	210	0.043 J	19	640	7.6	2.0 U	5.0 U	0.095	1.0 U	1.0 U	1.5 J	0.25 J	0.046 J	1.0 U	7.6 J	0.20 U	7.1	0.470	0.272	0.198 U	5.0 U	1.0 U
		09/20/18		39 J	120,000	220	0.031 J	22	630	7.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 1 - Cumulative Analytical Data Summary
Marquette Board of Light and Power
Shiras Steam Plant
September 2018

Lab Suite:				CCR Appendix III							CCR Appendix IV																
Parameter:				Boron	Calcium	Chloride	Fluoride	Sulfate	Total Dissolved Solids (TDS)	pH (lab)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Fluoride	Lead	Lithium	Mercury	Molybdenum	Radium 226 & 228 Combined	Radium 226	Radium 228	Selenium	Thallium
Units:				µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	SU	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	pCi/L	pCi/L	µg/L	µg/L
U.S. EPA MCL:				*NE*	*NE*	*NE*	*4.0*	*NE*	*NE*	*NE*	*6.0*	*10*	*2.0*	*4.0*	*5.0*	*100*	*NE*	*4.0*	*15*	*NE*	*2.0*	*NE*	*5.0*	*NE*	*NE*	*50*	*2.0*
Location	Well ID	Collection Date	Duplicate																								
QC	Equipment Blank	07/20/17		300 U	1,000 U	10 U	0.38 U	2.5 U	10 U	8.05	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.24	1.00 U	1.24	5.0 U	2.0 U
		07/24/17		300 U	1,000 U	10 U	0.38 U	2.5 U	10 U	7.94	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.03	1.00 U	1.03	5.0 U	2.0 U
		08/29/17		300 U	1,000 U	10 U	0.10 U	1 U	10 U	NA	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/06/17		300 U	1,000 U	10 U	0.10 U	1 U	10	NA	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/14/17		300 U	1,000 U	10 U	0.10 U	1 U	10 U	NA	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		09/28/17		300 U	1,000 U	10 U	0.10 U	1 U	10	NA	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U
		10/05/17		300 U	1,000 U	10 U	0.10 U	1 U	18	NA	2.0 U	5.0 U	0.10 U	1.0 U	1.0 U	10 U	20 U	--	3.0 U	10 U	0.20 U	50 U	1.00 U	1.00 U	1.00 U	5.0 U	2.0 U

Bolded values exceed an applicable criterion.

Data Qualifiers:
U - Not detected

Footnotes/Abbreviations:
MCL - maximum contaminant limit
NA - Not Analyzed
NE - Value has not been established

Appendix 1

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Canton
4101 Shuffel Street NW
North Canton, OH 44720
Tel: (330)497-9396

TestAmerica Job ID: 240-101698-1
Client Project/Site: CCR-MBLP Shiras Steam Plant

For:
Fishbeck Thompson Carr & Huber Inc
1515 Arboretum Drive SE
Grand Rapids, Michigan 49546

Attn: Penni Mahler

Kris Brooks

Authorized for release by:
10/5/2018 8:13:25 PM

Kris Brooks, Project Manager II
(330)966-9790
kris.brooks@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Qualifiers

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U	Indicates the analyte was analyzed for but not detected.

General Chemistry

Qualifier	Qualifier Description
HF	Field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U	Indicates the analyte was analyzed for but not detected.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 240-101698-1

Laboratory: TestAmerica Canton

Narrative

CASE NARRATIVE

Client: Fishbeck Thompson Carr & Huber Inc

Project: CCR-MBLP Shiras Steam Plant

Report Number: 240-101698-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica Canton attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header.

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT
The samples were received on 9/22/2018 10:00 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 2.9º C.

TOTAL RECOVERABLE METALS (ICP)
Samples MBLPS-18-09-MW-3 (I) (240-101698-1), MBLPS-18-09-MW-2 (I) (240-101698-2), MBLPS-18-09-MW-1 (I) (240-101698-3), MBLPS-18-09-MW-5 (240-101698-4), MBLPS-18-09-MW-4 (I) (240-101698-5) and MBLPS-18-09-MW-4 (D) (240-101698-6) were analyzed for total recoverable metals (ICP) in accordance with EPA SW-846 Method 6010C. The samples were prepared on 09/24/2018 and analyzed on 09/25/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TOTAL DISSOLVED SOLIDS
Samples MBLPS-18-09-MW-3 (I) (240-101698-1), MBLPS-18-09-MW-2 (I) (240-101698-2), MBLPS-18-09-MW-1 (I) (240-101698-3), MBLPS-18-09-MW-5 (240-101698-4), MBLPS-18-09-MW-4 (I) (240-101698-5) and MBLPS-18-09-MW-4 (D) (240-101698-6) were analyzed for total dissolved solids in accordance with SM 2540C. The samples were analyzed on 09/27/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Job ID: 240-101698-1 (Continued)

Laboratory: TestAmerica Canton (Continued)

PH
Samples MBLPS-18-09-MW-3 (I) (240-101698-1), MBLPS-18-09-MW-2 (I) (240-101698-2), MBLPS-18-09-MW-1 (I) (240-101698-3), MBLPS-18-09-MW-5 (240-101698-4), MBLPS-18-09-MW-4 (I) (240-101698-5) and MBLPS-18-09-MW-4 (D) (240-101698-6) were analyzed for pH in accordance with EPA SW-846 Method 9040B. The samples were analyzed on 09/22/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

ANIONS
Samples MBLPS-18-09-MW-3 (I) (240-101698-1), MBLPS-18-09-MW-2 (I) (240-101698-2), MBLPS-18-09-MW-1 (I) (240-101698-3), MBLPS-18-09-MW-5 (240-101698-4), MBLPS-18-09-MW-4 (I) (240-101698-5) and MBLPS-18-09-MW-4 (D) (240-101698-6) were analyzed for anions in accordance with EPA SW-846 Method 9056A. The samples were analyzed on 09/26/2018.

Samples MBLPS-18-09-MW-1 (I) (240-101698-3)[5X], MBLPS-18-09-MW-5 (240-101698-4)[5X], MBLPS-18-09-MW-4 (I) (240-101698-5) [10X] and MBLPS-18-09-MW-4 (D) (240-101698-6)[10X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Method Summary

Method	Method Description	Protocol	Laboratory
6010C	Metals (ICP)	SW846	TAL CAN
9040B	pH	SW846	TAL CAN
9056A	Anions, Ion Chromatography	SW846	TAL CAN
SM 2540C	Solids, Total Dissolved (TDS)	SM	TAL CAN
3005A	Preparation, Total Recoverable or Dissolved Metals	SW846	TAL CAN

Protocol References:

SM = "Standard Methods For The Examination Of Water And Wastewater"

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL CAN = TestAmerica Canton, 4101 Shuffel Street NW, North Canton, OH 44720, TEL (330)497-9396

Sample Summary

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
240-101698-1	MBLPS-18-09-MW-3 (I)	Water	09/20/18 10:01	09/22/18 10:00
240-101698-2	MBLPS-18-09-MW-2 (I)	Water	09/20/18 10:54	09/22/18 10:00
240-101698-3	MBLPS-18-09-MW-1 (I)	Water	09/20/18 11:51	09/22/18 10:00
240-101698-4	MBLPS-18-09-MW-5	Water	09/20/18 13:09	09/22/18 10:00
240-101698-5	MBLPS-18-09-MW-4 (I)	Water	09/20/18 14:13	09/22/18 10:00
240-101698-6	MBLPS-18-09-MW-4 (D)	Water	09/20/18 14:13	09/22/18 10:00

Detection Summary

Client Sample ID: MBLPS-18-09-MW-3 (I) — Lab Sample ID: 240-101698-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Boron	41	J	100	23	ug/L	1		6010C	Total Recoverable
Calcium	70000		5000	310	ug/L	1		6010C	Total Recoverable
pH	8.1	HF	0.1	0.1	SU	1		9040B	Total/NA
Chloride	92		1.0	0.28	mg/L	1		9056A	Total/NA
Fluoride	0.055		0.050	0.024	mg/L	1		9056A	Total/NA
Sulfate	22		1.0	0.35	mg/L	1		9056A	Total/NA
Total Dissolved Solids	340		10	7.8	mg/L	1		SM 2540C	Total/NA

Client Sample ID: MBLPS-18-09-MW-2 (I) — Lab Sample ID: 240-101698-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Boron	55	J	100	23	ug/L	1		6010C	Total Recoverable
Calcium	64000		5000	310	ug/L	1		6010C	Total Recoverable
pH	8.0	HF	0.1	0.1	SU	1		9040B	Total/NA
Chloride	85		1.0	0.28	mg/L	1		9056A	Total/NA
Fluoride	0.058		0.050	0.024	mg/L	1		9056A	Total/NA
Sulfate	29		1.0	0.35	mg/L	1		9056A	Total/NA
Total Dissolved Solids	310		10	7.8	mg/L	1		SM 2540C	Total/NA

Client Sample ID: MBLPS-18-09-MW-1 (I) — Lab Sample ID: 240-101698-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Boron	67	J	100	23	ug/L	1		6010C	Total Recoverable
Calcium	120000		5000	310	ug/L	1		6010C	Total Recoverable
pH	7.9	HF	0.1	0.1	SU	1		9040B	Total/NA
Chloride	300		5.0	1.4	mg/L	5		9056A	Total/NA
Fluoride	0.044	J	0.050	0.024	mg/L	1		9056A	Total/NA
Sulfate	24		1.0	0.35	mg/L	1		9056A	Total/NA
Total Dissolved Solids	740		10	7.8	mg/L	1		SM 2540C	Total/NA

Client Sample ID: MBLPS-18-09-MW-5 — Lab Sample ID: 240-101698-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Boron	39	J	100	23	ug/L	1		6010C	Total Recoverable
Calcium	120000		5000	310	ug/L	1		6010C	Total Recoverable
pH	7.6	HF	0.1	0.1	SU	1		9040B	Total/NA
Chloride	220		5.0	1.4	mg/L	5		9056A	Total/NA
Fluoride	0.031	J	0.050	0.024	mg/L	1		9056A	Total/NA
Sulfate	22		1.0	0.35	mg/L	1		9056A	Total/NA
Total Dissolved Solids	630		10	7.8	mg/L	1		SM 2540C	Total/NA

Client Sample ID: MBLPS-18-09-MW-4 (I) — Lab Sample ID: 240-101698-5

This Detection Summary does not include radiochemical test results.

Client Sample ID: MBLPS-18-09-MW-4 (I) (Continued) Lab Sample ID: 240-101698-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Boron	110		100	23	ug/L	1		6010C	Total Recoverable
Calcium	130000		5000	310	ug/L	1		6010C	Total Recoverable
pH	7.7	HF	0.1	0.1	SU	1		9040B	Total/NA
Chloride	450		10	2.8	mg/L	10		9056A	Total/NA
Fluoride	0.23		0.050	0.024	mg/L	1		9056A	Total/NA
Sulfate	42		1.0	0.35	mg/L	1		9056A	Total/NA
Total Dissolved Solids	970		20	16	mg/L	1		SM 2540C	Total/NA

Client Sample ID: MBLPS-18-09-MW-4 (D) Lab Sample ID: 240-101698-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Boron	110		100	23	ug/L	1		6010C	Total Recoverable
Calcium	130000		5000	310	ug/L	1		6010C	Total Recoverable
pH	7.7	HF	0.1	0.1	SU	1		9040B	Total/NA
Chloride	450		10	2.8	mg/L	10		9056A	Total/NA
Fluoride	0.23		0.050	0.024	mg/L	1		9056A	Total/NA
Sulfate	42		1.0	0.35	mg/L	1		9056A	Total/NA
Total Dissolved Solids	1000		20	16	mg/L	1		SM 2540C	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: MBLPS-18-09-MW-3 (I) Lab Sample ID: 240-101698-1

Date Collected: 09/20/18 10:01 **Matrix: Water**
Date Received: 09/22/18 10:00

Method: 6010C - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	41	J	100	23	ug/L		09/24/18 14:00	09/25/18 10:07	1
Calcium	70000		5000	310	ug/L		09/24/18 14:00	09/25/18 10:07	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	8.1	HF	0.1	0.1	SU			09/22/18 14:32	1
Chloride	92		1.0	0.28	mg/L			09/26/18 09:32	1
Fluoride	0.055		0.050	0.024	mg/L			09/26/18 09:32	1
Sulfate	22		1.0	0.35	mg/L			09/26/18 09:32	1
Total Dissolved Solids	340		10	7.8	mg/L			09/27/18 13:55	1

Client Sample ID: MBLPS-18-09-MW-2 (I)

Lab Sample ID: 240-101698-2

Date Collected: 09/20/18 10:54
Matrix: Water
Date Received: 09/22/18 10:00

Method: 6010C - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	**55**	**J**	100	23	ug/L		09/24/18 14:00	09/25/18 10:12	1
Calcium	**64000**		5000	310	ug/L		09/24/18 14:00	09/25/18 10:12	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**8.0**	**HF**	0.1	0.1	SU			09/22/18 14:38	1
Chloride	**85**		1.0	0.28	mg/L			09/26/18 09:53	1
Fluoride	**0.058**		0.050	0.024	mg/L			09/26/18 09:53	1
Sulfate	**29**		1.0	0.35	mg/L			09/26/18 09:53	1
Total Dissolved Solids	**310**		10	7.8	mg/L			09/27/18 13:55	1

Client Sample ID: MBLPS-18-09-MW-1 (I)

Lab Sample ID: 240-101698-3

Date Collected: 09/20/18 11:51
Matrix: Water
Date Received: 09/22/18 10:00

Method: 6010C - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	67	J	100	23	ug/L		09/24/18 14:00	09/25/18 10:17	1
Calcium	120000		5000	310	ug/L		09/24/18 14:00	09/25/18 10:17	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.9	HF	0.1	0.1	SU			09/22/18 14:43	1
Chloride	300		5.0	1.4	mg/L			09/26/18 11:16	5
Fluoride	0.044	J	0.050	0.024	mg/L			09/26/18 10:55	1
Sulfate	24		1.0	0.35	mg/L			09/26/18 10:55	1
Total Dissolved Solids	740		10	7.8	mg/L			09/27/18 13:55	1

Client Sample ID: MBLPS-18-09-MW-5

Lab Sample ID: 240-101698-4

Date Collected: 09/20/18 13:09

Matrix: Water

Date Received: 09/22/18 10:00

Method: 6010C - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	**39**	**J**	100	23	ug/L		09/24/18 14:00	09/25/18 09:45	1
Calcium	**120000**		5000	310	ug/L		09/24/18 14:00	09/25/18 09:45	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.6**	**HF**	0.1	0.1	SU			09/22/18 14:54	1
Chloride	**220**		5.0	1.4	mg/L			09/26/18 12:39	5
Fluoride	**0.031**	**J**	0.050	0.024	mg/L			09/26/18 11:37	1
Sulfate	**22**		1.0	0.35	mg/L			09/26/18 11:37	1
Total Dissolved Solids	**630**		10	7.8	mg/L			09/27/18 13:55	1

Client Sample Results

Client Sample ID: MBLPS-18-09-MW-4 (I)

Lab Sample ID: 240-101698-5

Date Collected: 09/20/18 14:13
Date Received: 09/22/18 10:00
Matrix: Water

Method: 6010C - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	**110**		100	23	ug/L		09/24/18 14:00	09/25/18 10:21	1
Calcium	**130000**		5000	310	ug/L		09/24/18 14:00	09/25/18 10:21	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.7**	**HF**	0.1	0.1	SU			09/22/18 14:59	1
Chloride	**450**		10	2.8	mg/L			09/26/18 14:01	10
Fluoride	**0.23**		0.050	0.024	mg/L			09/26/18 13:41	1
Sulfate	**42**		1.0	0.35	mg/L			09/26/18 13:41	1
Total Dissolved Solids	**970**		20	16	mg/L			09/27/18 13:55	1

Client Sample Results

Client: Fishbeck Thompson Carr & Huber Inc
Project/Site: CCR-MBLP Shiras Steam Plant

TestAmerica Job ID: 240-101698-1

Client Sample ID: MBLPS-18-09-MW-4 (D)

Lab Sample ID: 240-101698-6

Date Collected: 09/20/18 14:13
Date Received: 09/22/18 10:00

Matrix: Water

Method: 6010C - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	**110**		100	23	ug/L		09/24/18 14:00	09/25/18 10:26	1
Calcium	**130000**		5000	310	ug/L		09/24/18 14:00	09/25/18 10:26	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.7**	**HF**	0.1	0.1	SU			09/22/18 15:10	1
Chloride	**450**		10	2.8	mg/L			09/26/18 18:52	10
Fluoride	**0.23**		0.050	0.024	mg/L			09/26/18 18:31	1
Sulfate	**42**		1.0	0.35	mg/L			09/26/18 18:31	1
Total Dissolved Solids	**1000**		20	16	mg/L			09/27/18 13:55	1

Method: 6010C - Metals (ICP)

Lab Sample ID: MB 240-346908/1-A
Matrix: Water
Analysis Batch: 347083

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 346908

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	23	U	100	23	ug/L		09/24/18 14:00	09/25/18 09:09	1
Calcium	310	U	5000	310	ug/L		09/24/18 14:00	09/25/18 09:09	1

Lab Sample ID: LCS 240-346908/2-A
Matrix: Water
Analysis Batch: 347083

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 346908

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Boron	1000	1110		ug/L		111	80 - 120
Calcium	50000	51300		ug/L		103	80 - 120

Lab Sample ID: 240-101698-4 MS
Matrix: Water
Analysis Batch: 347083

Client Sample ID: MBLPS-18-09-MW-5
Prep Type: Total Recoverable
Prep Batch: 346908

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Boron	39	J	1000	1120		ug/L		108	75 - 125
Calcium	120000		50000	169000		ug/L		105	75 - 125

Lab Sample ID: 240-101698-4 MSD
Matrix: Water
Analysis Batch: 347083

Client Sample ID: MBLPS-18-09-MW-5
Prep Type: Total Recoverable
Prep Batch: 346908

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Boron	39	J	1000	1080		ug/L		104	75 - 125	4	20
Calcium	120000		50000	158000		ug/L		82	75 - 125	7	20

Method: 9040B - pH

Lab Sample ID: LCS 240-346711/2
Matrix: Water
Analysis Batch: 346711

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
pH	6.29	6.2		SU		99	97 - 103

Lab Sample ID: LCS 240-346711/29
Matrix: Water
Analysis Batch: 346711

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
pH	6.29	6.3		SU		100	97 - 103

Lab Sample ID: 240-101698-4 DU
Matrix: Water
Analysis Batch: 346711

Client Sample ID: MBLPS-18-09-MW-5
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
pH	7.6	HF	7.6	HF	SU		0.1	20

Method: 9056A - Anions, Ion Chromatography

Lab Sample ID: MB 240-347183/3
Matrix: Water
Analysis Batch: 347183

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	0.28	U	1.0	0.28	mg/L			09/25/18 22:30	1
Fluoride	0.024	U	0.050	0.024	mg/L			09/25/18 22:30	1
Sulfate	0.35	U	1.0	0.35	mg/L			09/25/18 22:30	1

Lab Sample ID: LCS 240-347183/4
Matrix: Water
Analysis Batch: 347183

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Chloride			50.0	52.0		mg/L		104	90 - 110		
Fluoride			2.50	2.64		mg/L		105	90 - 110		
Sulfate			50.0	52.4		mg/L		105	90 - 110		

Lab Sample ID: 240-101698-4 MS
Matrix: Water
Analysis Batch: 347183

Client Sample ID: MBLPS-18-09-MW-5
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Fluoride	0.031	J	2.50	2.75		mg/L		109	80 - 120		
Sulfate	22		50.0	74.3		mg/L		105	80 - 120		

Lab Sample ID: 240-101698-4 MS
Matrix: Water
Analysis Batch: 347183

Client Sample ID: MBLPS-18-09-MW-5
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Chloride	220		250	452		mg/L		94	80 - 120		

Lab Sample ID: 240-101698-4 MSD
Matrix: Water
Analysis Batch: 347183

Client Sample ID: MBLPS-18-09-MW-5
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Fluoride	0.031	J	2.50	2.75		mg/L		109	80 - 120	0	15
Sulfate	22		50.0	74.4		mg/L		105	80 - 120	0	15

Lab Sample ID: 240-101698-4 MSD
Matrix: Water
Analysis Batch: 347183

Client Sample ID: MBLPS-18-09-MW-5
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chloride	220		250	450		mg/L		94	80 - 120	0	15

Lab Sample ID: MB 240-347361/3
Matrix: Water
Analysis Batch: 347361

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	0.28	U	1.0	0.28	mg/L			09/26/18 15:45	1

QC Sample Results

Client: Fishbeck Thompson Carr & Huber Inc
Project/Site: CCR-MBLP Shiras Steam Plant

TestAmerica Job ID: 240-101698-1

Method: 9056A - Anions, Ion Chromatography (Continued)

Lab Sample ID: MB 240-347361/3
Matrix: Water
Analysis Batch: 347361

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	0.024	U	0.050	0.024	mg/L			09/26/18 15:45	1
Sulfate	0.35	U	1.0	0.35	mg/L			09/26/18 15:45	1

Lab Sample ID: LCS 240-347361/4
Matrix: Water
Analysis Batch: 347361

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Chloride			50.0	52.0		mg/L		104	90 - 110		
Fluoride			2.50	2.65		mg/L		106	90 - 110		
Sulfate			50.0	52.4		mg/L		105	90 - 110		

Method: SM 2540C - Solids, Total Dissolved (TDS)

Lab Sample ID: MB 240-347570/1
Matrix: Water
Analysis Batch: 347570

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	7.8	U	10	7.8	mg/L			09/27/18 13:55	1

Lab Sample ID: LCS 240-347570/2
Matrix: Water
Analysis Batch: 347570

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Total Dissolved Solids			494	484		mg/L		98	80 - 120		

Lab Sample ID: 240-101698-4 DU
Matrix: Water
Analysis Batch: 347570

Client Sample ID: MBLPS-18-09-MW-5
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Total Dissolved Solids	630			628		mg/L				0.2	20

Metals

Prep Batch: 346908

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-101698-1	MBLPS-18-09-MW-3 (I)	Total Recoverable	Water	3005A	
240-101698-2	MBLPS-18-09-MW-2 (I)	Total Recoverable	Water	3005A	
240-101698-3	MBLPS-18-09-MW-1 (I)	Total Recoverable	Water	3005A	
240-101698-4	MBLPS-18-09-MW-5	Total Recoverable	Water	3005A	
240-101698-5	MBLPS-18-09-MW-4 (I)	Total Recoverable	Water	3005A	
240-101698-6	MBLPS-18-09-MW-4 (D)	Total Recoverable	Water	3005A	
MB 240-346908/1-A	Method Blank	Total Recoverable	Water	3005A	
LCS 240-346908/2-A	Lab Control Sample	Total Recoverable	Water	3005A	
240-101698-4 MS	MBLPS-18-09-MW-5	Total Recoverable	Water	3005A	
240-101698-4 MSD	MBLPS-18-09-MW-5	Total Recoverable	Water	3005A	

Analysis Batch: 347083

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-101698-1	MBLPS-18-09-MW-3 (I)	Total Recoverable	Water	6010C	346908
240-101698-2	MBLPS-18-09-MW-2 (I)	Total Recoverable	Water	6010C	346908
240-101698-3	MBLPS-18-09-MW-1 (I)	Total Recoverable	Water	6010C	346908
240-101698-4	MBLPS-18-09-MW-5	Total Recoverable	Water	6010C	346908
240-101698-5	MBLPS-18-09-MW-4 (I)	Total Recoverable	Water	6010C	346908
240-101698-6	MBLPS-18-09-MW-4 (D)	Total Recoverable	Water	6010C	346908
MB 240-346908/1-A	Method Blank	Total Recoverable	Water	6010C	346908
LCS 240-346908/2-A	Lab Control Sample	Total Recoverable	Water	6010C	346908
240-101698-4 MS	MBLPS-18-09-MW-5	Total Recoverable	Water	6010C	346908
240-101698-4 MSD	MBLPS-18-09-MW-5	Total Recoverable	Water	6010C	346908

General Chemistry

Analysis Batch: 346711

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-101698-1	MBLPS-18-09-MW-3 (I)	Total/NA	Water	9040B	
240-101698-2	MBLPS-18-09-MW-2 (I)	Total/NA	Water	9040B	
240-101698-3	MBLPS-18-09-MW-1 (I)	Total/NA	Water	9040B	
240-101698-4	MBLPS-18-09-MW-5	Total/NA	Water	9040B	
240-101698-5	MBLPS-18-09-MW-4 (I)	Total/NA	Water	9040B	
240-101698-6	MBLPS-18-09-MW-4 (D)	Total/NA	Water	9040B	
LCS 240-346711/2	Lab Control Sample	Total/NA	Water	9040B	
LCS 240-346711/29	Lab Control Sample	Total/NA	Water	9040B	
240-101698-4 DU	MBLPS-18-09-MW-5	Total/NA	Water	9040B	

Analysis Batch: 347183

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-101698-1	MBLPS-18-09-MW-3 (I)	Total/NA	Water	9056A	
240-101698-2	MBLPS-18-09-MW-2 (I)	Total/NA	Water	9056A	
240-101698-3	MBLPS-18-09-MW-1 (I)	Total/NA	Water	9056A	
240-101698-3	MBLPS-18-09-MW-1 (I)	Total/NA	Water	9056A	
240-101698-4	MBLPS-18-09-MW-5	Total/NA	Water	9056A	
240-101698-4	MBLPS-18-09-MW-5	Total/NA	Water	9056A	
240-101698-5	MBLPS-18-09-MW-4 (I)	Total/NA	Water	9056A	
240-101698-5	MBLPS-18-09-MW-4 (I)	Total/NA	Water	9056A	
MB 240-347183/3	Method Blank	Total/NA	Water	9056A	
LCS 240-347183/4	Lab Control Sample	Total/NA	Water	9056A	

General Chemistry (Continued)

Analysis Batch: 347183 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-101698-4 MS	MBLPS-18-09-MW-5	Total/NA	Water	9056A	
240-101698-4 MS	MBLPS-18-09-MW-5	Total/NA	Water	9056A	
240-101698-4 MSD	MBLPS-18-09-MW-5	Total/NA	Water	9056A	
240-101698-4 MSD	MBLPS-18-09-MW-5	Total/NA	Water	9056A	

Analysis Batch: 347361

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-101698-6	MBLPS-18-09-MW-4 (D)	Total/NA	Water	9056A	
240-101698-6	MBLPS-18-09-MW-4 (D)	Total/NA	Water	9056A	
MB 240-347361/3	Method Blank	Total/NA	Water	9056A	
LCS 240-347361/4	Lab Control Sample	Total/NA	Water	9056A	

Analysis Batch: 347570

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-101698-1	MBLPS-18-09-MW-3 (I)	Total/NA	Water	SM 2540C	
240-101698-2	MBLPS-18-09-MW-2 (I)	Total/NA	Water	SM 2540C	
240-101698-3	MBLPS-18-09-MW-1 (I)	Total/NA	Water	SM 2540C	
240-101698-4	MBLPS-18-09-MW-5	Total/NA	Water	SM 2540C	
240-101698-5	MBLPS-18-09-MW-4 (I)	Total/NA	Water	SM 2540C	
240-101698-6	MBLPS-18-09-MW-4 (D)	Total/NA	Water	SM 2540C	
MB 240-347570/1	Method Blank	Total/NA	Water	SM 2540C	
LCS 240-347570/2	Lab Control Sample	Total/NA	Water	SM 2540C	
240-101698-4 DU	MBLPS-18-09-MW-5	Total/NA	Water	SM 2540C	

Lab Chronicle

Client: Fishbeck Thompson Carr & Huber Inc
Project/Site: CCR-MBLP Shiras Steam Plant

TestAmerica Job ID: 240-101698-1

Client Sample ID: MBLPS-18-09-MW-3 (I)

Lab Sample ID: 240-101698-1

Date Collected: 09/20/18 10:01

Matrix: Water

Date Received: 09/22/18 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			346908	09/24/18 14:00	MBB	TAL CAN
Total Recoverable	Analysis	6010C		1	347083	09/25/18 10:07	WKD	TAL CAN
Total/NA	Analysis	9040B		1	346711	09/22/18 14:32	MMM	TAL CAN
Total/NA	Analysis	9056A		1	347183	09/26/18 09:32	JWW	TAL CAN
Total/NA	Analysis	SM 2540C		1	347570	09/27/18 13:55	ACR	TAL CAN

Client Sample ID: MBLPS-18-09-MW-2 (I)

Lab Sample ID: 240-101698-2

Date Collected: 09/20/18 10:54

Matrix: Water

Date Received: 09/22/18 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			346908	09/24/18 14:00	MBB	TAL CAN
Total Recoverable	Analysis	6010C		1	347083	09/25/18 10:12	WKD	TAL CAN
Total/NA	Analysis	9040B		1	346711	09/22/18 14:38	MMM	TAL CAN
Total/NA	Analysis	9056A		1	347183	09/26/18 09:53	JWW	TAL CAN
Total/NA	Analysis	SM 2540C		1	347570	09/27/18 13:55	ACR	TAL CAN

Client Sample ID: MBLPS-18-09-MW-1 (I)

Lab Sample ID: 240-101698-3

Date Collected: 09/20/18 11:51

Matrix: Water

Date Received: 09/22/18 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			346908	09/24/18 14:00	MBB	TAL CAN
Total Recoverable	Analysis	6010C		1	347083	09/25/18 10:17	WKD	TAL CAN
Total/NA	Analysis	9040B		1	346711	09/22/18 14:43	MMM	TAL CAN
Total/NA	Analysis	9056A		1	347183	09/26/18 10:55	JWW	TAL CAN
Total/NA	Analysis	9056A		5	347183	09/26/18 11:16	JWW	TAL CAN
Total/NA	Analysis	SM 2540C		1	347570	09/27/18 13:55	ACR	TAL CAN

Client Sample ID: MBLPS-18-09-MW-5

Lab Sample ID: 240-101698-4

Date Collected: 09/20/18 13:09

Matrix: Water

Date Received: 09/22/18 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			346908	09/24/18 14:00	MBB	TAL CAN
Total Recoverable	Analysis	6010C		1	347083	09/25/18 09:45	WKD	TAL CAN
Total/NA	Analysis	9040B		1	346711	09/22/18 14:54	MMM	TAL CAN
Total/NA	Analysis	9056A		1	347183	09/26/18 11:37	JWW	TAL CAN
Total/NA	Analysis	9056A		5	347183	09/26/18 12:39	JWW	TAL CAN
Total/NA	Analysis	SM 2540C		1	347570	09/27/18 13:55	ACR	TAL CAN

Client Sample ID: MBLPS-18-09-MW-4 (I)

Lab Sample ID: 240-101698-5

Date Collected: 09/20/18 14:13

Matrix: Water

Date Received: 09/22/18 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			346908	09/24/18 14:00	MBB	TAL CAN
Total Recoverable	Analysis	6010C		1	347083	09/25/18 10:21	WKD	TAL CAN
Total/NA	Analysis	9040B		1	346711	09/22/18 14:59	MMM	TAL CAN
Total/NA	Analysis	9056A		1	347183	09/26/18 13:41	JWW	TAL CAN
Total/NA	Analysis	9056A		10	347183	09/26/18 14:01	JWW	TAL CAN
Total/NA	Analysis	SM 2540C		1	347570	09/27/18 13:55	ACR	TAL CAN

Client Sample ID: MBLPS-18-09-MW-4 (D)

Lab Sample ID: 240-101698-6

Date Collected: 09/20/18 14:13

Matrix: Water

Date Received: 09/22/18 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			346908	09/24/18 14:00	MBB	TAL CAN
Total Recoverable	Analysis	6010C		1	347083	09/25/18 10:26	WKD	TAL CAN
Total/NA	Analysis	9040B		1	346711	09/22/18 15:10	MMM	TAL CAN
Total/NA	Analysis	9056A		1	347361	09/26/18 18:31	JMB	TAL CAN
Total/NA	Analysis	9056A		10	347361	09/26/18 18:52	JMB	TAL CAN
Total/NA	Analysis	SM 2540C		1	347570	09/27/18 13:55	ACR	TAL CAN

Laboratory References:

TAL CAN = TestAmerica Canton, 4101 Shuffel Street NW, North Canton, OH 44720, TEL (330)497-9396

Accreditation/Certification Summary

Laboratory: TestAmerica Canton

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
California	State Program	9	2927	02-23-19
Connecticut	State Program	1	PH-0590	12-31-19
Florida	NELAP	4	E87225	06-30-19
Illinois	NELAP	5	200004	07-31-19
Kansas	NELAP	7	E-10336	01-31-19
Kentucky (UST)	State Program	4	58	02-23-19
Kentucky (WW)	State Program	4	98016	12-31-18 *
Minnesota	NELAP	5	039-999-348	12-31-18 *
Minnesota (Petrofund)	State Program	1	3506	07-31-19
Nevada	State Program	9	OH00048	07-31-19
New Jersey	NELAP	2	OH001	06-30-19
New York	NELAP	2	10975	03-31-19
Ohio VAP	State Program	5	CL0024	09-06-19
Oregon	NELAP	10	4062	02-23-19
Pennsylvania	NELAP	3	68-00340	08-31-19 *
Texas	NELAP	6	T104704517-17-9	08-31-19
USDA	Federal		P330-16-00404	12-28-19
Virginia	NELAP	3	460175	09-14-19
Washington	State Program	10	C971	01-12-19
West Virginia DEP	State Program	3	210	12-31-18 *

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

2.01C2.9

CHAIN OF CUSTODY RECORD

ftc&h

Fishbeck, Thompson, Carr & Huber, Inc.
Address
Phone

Report to PENNI MAHLER
Email plmahler@ftch.com
Copy to
Email

Invoice to
Email
Lab Quote
Reference 240202 83

PROJECT NAME: MBLP/SHIRAS ASD 1/4 ly MON.
PROJECT NO. 180827
PROJECT LOCATION: MARQUETTE, MI
SAMPLER(S) NAME: APS + AD.
PROJECT MANAGER: TCL
PHONE
EMAIL
ADDITIONAL INFORMATION

PAGE 1 OF 1
STD TAT ☑
RUSH TAT ☐
DATE DUE:

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	MATRIX TYPE: AQUEOUS (WATER)	SOLID/SEMI-SOLID	AIR	NONAQUEOUS LIQUID	REQUIRED ANALYSES: TOTAL B, Ca PRESERVATIVE: HNO3	Cl, Fl, pH, TDS, SO4 PRESERVATIVE: -										REMARKS
9/20/18	1001	MBLPS-18-09-MW-3 (I)	X				1	1									
	1054	MBLPS-18-09-MW-2 (I)	X				1	1									*MOVED DUP. TO MW-4*
	1151	MBLPS-18-09-MW-1 (I)	X				1	1									*MOVED 1/MS/MSD TO MW-5*
	1309	MBLPS-18-09-MW-5(I/MS/MSD)	X				3	3									
	1413	MBLPS-1809-MW-5(I)	X				1	1									
↓	↓	MBLPS-18-09-MW-5(D)	X				1	1									

NUMBER OF CONTAINERS SUBMITTED

240-101698 Chain of Custody

RELINQUISHED BY	DATE	TIME	RELINQUISHED BY	DATE	TIME	RELINQUISHED BY	DATE	TIME	METHOD OF SHIPMENT/BILL OF LADING		
	9/21/18	1520		9-21-18	3:20		9-21-18	3:20	Fed Ex		
RECEIVED BY	DATE	TIME	RECEIVED BY	DATE	TIME	RECEIVED BY	DATE	TIME	RECEIVED FOR LAB	DATE	TIME
	9-21-18	3:20	PoP	9-22-18	1000						

WHITE Copy — Return with data package. YELLOW Copy — field File / Project Documentation.

G 042192

TestAmerica Canton Sample Receipt Form/Narrative **Login # :** 141698
Canton Facility

Client FTC+H Site Name —

Cooler Received on 9-22-18 Opened on 9-22-18

Cooler unpacked by: POP

FedEx: 1st Grd [✓ Exp] UPS FAS Clipper Client Drop Off TestAmerica Courier Other

Receipt After-hours: Drop-off Date/Time Storage Location

TestAmerica Cooler # TA Foam Box Client Cooler Box Other

Packing material used: Bubble Wrap Foam [✓ Plastic Bag] None Other

COOLANT: [✓ Wet Ice] Blue Ice Dry Ice Water None

1. Cooler temperature upon receipt ☐ See Multiple Cooler Form
   IR GUN# IR-8 (CF +0.9 °C) Observed Cooler Temp. 2.0 °C Corrected Cooler Temp. 2.9 °C
   IR GUN #36 (CF +0.6°C) Observed Cooler Temp. ____ °C Corrected Cooler Temp. ____ °C
2. Were tamper/custody seals on the outside of the cooler(s)? If Yes Quantity 1 [✓ Yes] No
   -Were the seals on the outside of the cooler(s) signed & dated? [✓ Yes] No NA
   -Were tamper/custody seals on the bottle(s) or bottle kits (LLHg/MeHg)? Yes [✓ No]
   -Were tamper/custody seals intact and uncompromised? [✓ Yes] No NA
3. Shippers' packing slip attached to the cooler(s)? [✓ Yes] No
4. Did custody papers accompany the sample(s)? [✓ Yes] No
5. Were the custody papers relinquished & signed in the appropriate place? [✓ Yes] No
6. Was/were the person(s) who collected the samples clearly identified on the COC? Yes [✓ No]
7. Did all bottles arrive in good condition (Unbroken)? [✓ Yes] No
8. Could all bottle labels be reconciled with the COC? [✓ Yes] No
9. Were correct bottle(s) used for the test(s) indicated? [✓ Yes] No
10. Sufficient quantity received to perform indicated analyses? [✓ Yes] No
11. Are these work share samples? Yes [✓ No]
    If yes, Questions 12-16 have been checked at the originating laboratory.
12. Were all preserved sample(s) at the correct pH upon receipt? [✓ Yes] No NA pH Strip Lot# **HC849161**
13. Were VOAs on the COC? Yes [✓ No]
14. Were air bubbles >6 mm in any VOA vials? ● Larger than this. Yes No [✓ NA]
15. Was a VOA trip blank present in the cooler(s)? Trip Blank Lot # ____ Yes [✓ No]
16. Was a LL Hg or Me Hg trip blank present? ____ Yes [✓ No]

Tests that are not checked for pH by Receiving:

VOAs
Oil and Grease
TOC

Contacted PM ____ Date ____ by ____ via Verbal Voice Mail Other

Concerning ____

17. CHAIN OF CUSTODY & SAMPLE DISCREPANCIES

Samples processed by: POP

18. SAMPLE CONDITION

Sample(s) ____ were received after the recommended holding time had expired.
Sample(s) ____ were received in a broken container.
Sample(s) ____ were received with bubble >6 mm in diameter. (Notify PM)

19. SAMPLE PRESERVATION

Sample(s) ____ were further preserved in the laboratory.
Time preserved: ____ Preservative(s) added/Lot number(s): ____

WI-NC-099

1 2 3 4 5 6 7 8 9 10 11 12 13

9/22/2018

Login Container Summary Report

240-101698

Temperature readings: ____________________

Client Sample ID	Lab ID	Container Type	Container pH	Preservative Added (mls)	Lot #
MBLPS-18-09-MW-3 (I)	240-101698-A-1	Plastic 250ml - with Nitric Acid	<2		
MBLPS-18-09-MW-2 (I)	240-101698-A-2	Plastic 250ml - with Nitric Acid	<2		
MBLPS-18-09-MW-1 (I)	240-101698-A-3	Plastic 250ml - with Nitric Acid	<2		
MBLPS-18-09-MW-5	240-101698-A-4	Plastic 250ml - with Nitric Acid	<2		
MBLPS-18-09-MW-5	240-101698-B-4	Plastic 250ml - with Nitric Acid	<2		
MBLPS-18-09-MW-5	240-101698-C-4	Plastic 250ml - with Nitric Acid	<2		
MBLPS-18-09-MW-5 (I)	240-101698-A-5	Plastic 250ml - with Nitric Acid	<2		
MBLPS-18-09-MW-5 (P)	240-101698-A-6	Plastic 250ml - with Nitric Acid	<2		

Appendix D

MEMO

TO: Marquette Board of Light and Power

FROM: Stephen J. MacDonald, PE

DATE: January 21, 2019 **PROJECT NO.:** 180827

RE: Groundwater Statistics 2018 – Shiras Steam Plant

As part of meeting the requirements of the USEPA Coal Combustion Residuals (CCR) Rule, statistical analyses were completed on background and downgradient groundwater data related to the CCR surface impoundment at the Marquette Board of Light and Power (MBLP) Shiras Steam Plant. The statistical analysis process included the following:

1. Review of site specific information
2. Selection/confirmation of the upgradient (or background) wells and downgradient wells
3. Updating of the statistical database for the background data
4. Computation of detection frequencies in upgradient and downgradient wells to date
5. Test for potential outliers on background data
6. Computation of tests of normality and lognormality
7. Based on detection frequency and tests of statistical distribution (normal or lognormal) perform the computation prediction limits utilizing up-to-date database:
    a. Detection frequency ≥ 50%, and data Normal in distribution: compute a Normal prediction limit
    b. Detection frequency ≥ 50%, and data Lognormal in distribution: compute a Lognormal prediction limit
    c. Detection frequency ≥ 50%, and data neither Normal or Lognormal in distribution: compute a nonparametric prediction limit
    d. Detection frequency >0% and < 50%: compute a nonparametric prediction limit
    e. Detection frequency equal to zero (=0%): compute lab specific prediction limit equal to quantitation limit
8. Compute false positive and false negative rates for entire monitoring program based on observed conditions
    a. If the false positive rate is greater than 5% (> 5%), increase the number of background samples or change verification resampling plan (i.e., Pass 1 of 3 resamples versus Pass 1 of 2)
9. Comparison of upgradient versus downgradient wells using the background data
    a. Note any wells which exceed the prediction limits
        - Note an initial statistically significant increase (SSI) if downgradient is greater than background
    b. For downgradient wells which exceed prediction limit, resample well
        - If the resample does not exceed the prediction limit, resume detection monitoring
        - If the resample exceeds the prediction limit, conduct an alternate source demonstration (ASD)

The statistical methodology used in this study is consistent with USEPA regulation 40 CFR 264.97(h), 40 CFR 257.93 (§257.93(d), §257.93(e), §257.93(f) and §257.93(g)), USEPA (2009) and ASTM D6312-17 guidance. Statistical analyses were completed using the latest version of ProUCL 5.1 software developed by the USEPA (USEPA, 2016).

Site data was reviewed to confirm upgradient and downgradient monitoring wells. Wells MW-4 and MW-5 have been previously identified as upgradient background wells based on static groundwater data collected from these wells, and as of September 2018, this continues to be the case. Wells MW-1, MW-2, and MW-3 have been identified as downgradient wells. For the semi-annual sampling events, groundwater data was collected on May 31, 2018 (following re-development of the wells) and September 20, 2018 and added to the existing database of data containing results from the eight sampling events that occurred in 2017. In 2018, the monitoring wells were sampled for Appendix III and Appendix IV parameters in May and Appendix III parameters only in September. Since statistical analyses of Appendix III data did not demonstrate any exceedance in the downgradient boundary wells, the Appendix IV data from the May 2018 sampling event were not statistically analyzed.

Detection frequencies for each well and each parameter were tabulated. Table 1 presents a summary of detection frequencies for Appendix III parameters for all monitoring wells sample results.

Monitoring results were loaded into ProUCL and the following tests/calculations were performed:

- Check the data for outliers using Dixon's test
- Test the data for normality (normal and lognormal distribution) using Shapiro-Wilk test
- Based on results of normality test, compute either a normal, lognormal or nonparametric prediction limit

All ProUCL outputs are presented in Attachment A.

Dixon's Test

The USEPA Unified Guidance (USEPA, 2009) recommends that outliers tests should be performed on background data, but they generally not to be removed unless some basis for a likely error or discrepancy can be identified. Possible identifiable errors or discrepancies could include data recording errors, unusual sampling and laboratory procedures or conditions, inconsistent sample turbidity, and values significantly outside the historical ranges of background data. Regarding the new and historical data for the background, the Total Dissolved Solids value of 2300 mg/L for background data (MW-5 sample from September 28, 2017) was identified as potential outlier with 0.99 confidence level. Still, this value was kept in the data set because its potential to be an outlier was not confirmed. That is, the basis to classify the identified potential outlier as an error or discrepancy (as suggested by the USEPA unified guidance) does not exist at this time.

Shapiro-Wilk Normal and Lognormal Test

Table 2 presents the results of Shapiro-Wilk test of normality for the background data for the Appendix III parameters. Based on the analysis, the normal prediction limit was computed for field pH; the lognormal prediction limit was calculated for total calcium; and nonparametric prediction limits were computed for total boron, chloride, fluoride, sulfate, and total dissolved solids.

Upper Prediction Limit

Table 3 presents summary statistics and prediction limits based on background data from background wells (MW-4 and MW-5). All downgradient data for parameter-well combinations were compared to the prediction limits.

Upgradient vs. Downgradient Comparison

Table 4 presents the historical downgradient data for parameter-well combinations, which failed the current statistical comparisons for Appendix III parameters. For historical monitoring data, a prediction limit exceedance for boron in well MW-1 (sampled on September 28, 2017). This was the only detection of boron in all 10 sample events. All sampling events after this, including both 2018 events, were non-detect and invalidates the initial exceedance. Regarding historical data of fluoride, wells MW-1, MW-2, and MW-3 presented values above prediction limit in samples from July 2017, but all these potential exceedances were qualified as non-detects, thus invalidating the exceedance. For 2018, no exceedances in fluoride were observed. Wells MW-2 historical monitoring results indicate a prediction limit exceedance for field pH from a sample collected on July 19, 2017. All sampling events after this, including both 2018 events did not exceed the prediction limit and invalidates the initial exceedance. The ASD study performed after redevelopment of the wells explained previously reported SSI and stated that sample results may also indicate a natural variation in groundwater.

When the background upper limits were compared the most recent concentrations (2018) of the compliance wells (MW-1, MW-2, and MW-3), no SSI above background occurred.

Time series plots of the Appendix III parameters were created for all monitoring wells (Attachment B) together with a Mann-Kendall trend test that was performed on ProUCL. Overall, significant variability (either increase or decrease) was observed both upgradient (MW-4 and MW-5) and downgradient (MW-1, MW-2, and MW-3) for several parameters from Appendix III. A significant increase in calcium was observed in MW-4 and MW-2; a significant increase in chloride was observed in MW-4, MW-2, and MW-1; and a decrease in pH-field was observed for MW-4, while an increase was observed for MW-5 and MW-1. For sulfate, a significant decrease was observed for MW-3 while an increase was observed for MW-1. For total dissolved solids, a significant increase was observed for MW-4. This variability in both upgradient and downgradient wells signposts a natural variation in groundwater.

The upgradient vs. downgradient prediction limit comparison was plotted and show that currently there are no statistically significant increase for wells MW-1, MW-2 and MW-3 for any of the Appendix III parameters (Attachment C).

Summary

Statistical analyses were completed following USEPA CCR rule and USEPA (2009) and ASTM D6312-17 groundwater statistics guidance. ProUCL, a statistical analysis program developed by the USEPA, was used to analyze background and downgradient groundwater results. Parametric and nonparametric prediction limits were selected in comparing downgradient groundwater concentrations to upgradient background for Appendix III parameters.

Based on the statistical analysis and discussion executed during this study, no SSI above background was observed for any Appendix III parameters. Few statistically significant trends were noted in the background data collected through time series plots. Overall, significant variability (either increase or decrease) was observed both upgradient (MW-4 and MW-5) and downgradient (MW-1, MW-2, and MW-3) for calcium, chloride, pH-field, sulfate, and total dissolved solids. This variability in both upgradient and downgradient wells signposts a natural variation in groundwater. Up vs. Down prediction limits comparison shows that currently there are no SSI for wells MW-1, MW-2, and MW-3 for any of the Appendix III parameters.

Recommendations

- It is FTCH's understanding that the plant has discontinued power generation activities in preparation of permanent plan closure; therefore, FTCH recommends the following:
    - Prepare and submit a Surface Impoundment Closure Plan for the closure of the CCR surface impoundment. The closure plan is required under Title 40, Code of Federal Regulations (40 CFR) Part 257.101 and detailed in 40 CFR Part 257.102.
    - Implement the closure plan.
- In the event that the CCR material is closed in-place, a post closure plan including groundwater monitoring for a period of 30 years may be needed (40 CFR 257.104).

References

United States Environmental Protection Agency (USEPA), 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities - Unified Guidance. https://nepis.epa.gov/Exe/ZyPDF.cgi/P10055GQ.PDF?Dockey=P10055GQ.PDF. Accessed on October 2018.

ASTM D6312-17, 2017. Standard Guide for Developing Appropriate Statistical Approaches for Groundwater Detection Monitoring Programs at Waste Disposal Facilities, 15 p.

USEPA, 2016. ProUCL Version 5.1 User Guide - Statistical Software for Environmental Applications for Data Sets with and without Non-detect Observations. https://www.epa.gov/sites/production/files/2016-05/documents/proucl_5.1_user-guide.pdf. Accessed in October 2018.

Table 1 – Summary of Detection Frequencies for Appendix III Parameters
Table 2 – Shapiro-Wilk Test of Normality for Background
Table 3 – Summary Statistics and Upper Prediction Limits
Table 4 – Historical Downgradient Data for Constituent-Well Combinations Which Failed the Current Statistical Evaluation

ATTACHMENT A – ProUCL Outputs for Marquette Board of Light and Power Shiras Steam Plant
ATTACHMENT B – Time Series Graphs and Mann-Kendall trend tests for Appendix III Parameters
ATTACHMENT C – Up vs. Down Prediction Limits Graphs for Appendix III Parameters
ATTACHMENT D – False Positive and False Negative Rates for Current Upgradient vs Downgradient Monitoring Program

Tables

Table 1 - Summary of Detection Frequencies for Appendix III Parameters
Marquette Board of Light and Power
Shiras Steam Plant

Parameter	**Detection frequency**	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**MW-5**
Boron, Total	n	10	10	10	10	10
	ND	8	10	10	8	10
	%ND	80%	100%	100%	80%	100%
Calcium, Total	n	10	10	10	10	10
	ND	0	0	0	0	0
	%ND	0%	0%	0%	0%	0%
Chloride	n	10	10	10	10	10
	ND	0	0	0	0	0
	%ND	0%	0%	0%	0%	0%
Fluoride	n	10	10	10	10	10
	ND	10	8	8	5	10
	%ND	100%	80%	80%	50%	100%
pH, Field	n	10	10	10	10	10
	ND	0	0	0	0	0
	%ND	0%	0%	0%	0%	0%
Sulfate	n	10	10	10	10	10
	ND	0	0	0	0	0
	%ND	0%	0%	0%	0%	0%
Total Dissolved Solids (TDS)	n	10	10	10	10	10
	ND	0	0	0	0	0
	%ND	0%	0%	0%	0%	0%

Notes:
n - sample size
ND - count of nondetect values in sample
%ND - percentage of nondetects in sample

Table 2 - Shapiro-Wilk Test of Normality for Background
Marquette Board of Light and Power
Shiras Steam Plant

Parameter	N (detects)	Detection Frequency	Test Value (W)	Log Test Value (Log_W)	Critical Value (0.05)	Limit Type
Boron, Total	2	0.100	-		-	Nonparametric
Calcium, Total	20	1.000	0.882	0.921	0.905	Lognormal
Chloride	20	1.000	0.825	0.839	0.905	Nonparametric
Fluoride	5	0.250	-	-	-	Nonparametric
pH, Field	20	1.000	0.927	0.914	0.905	Normal
Sulfate	20	1.000	0.770	0.786	0.905	Nonparametric
Total Dissolved Solids (TDS)	20	1.000	0.657	0.832	0.905	Nonparametric

Notes:
If detection frequency is < 0.500, nonparametric limit is used
If W< critical value, normal distribution is rejected
If Log_W< critical value, lognormal distribution is rejected

Table 3 - Summary Statistics and Upper Prediction Limits
Marquette Board of Light and Power
Shiras Steam Plant

Parameter	Units	Model Type	n	Detect	X	s	Prediction Limit	[1] Confidence Level
Boron, Total	ug/L	Nonparametric	20	2	-	-	300	0.99
Calcium, Total	ug/L	Lognormal	20	20	11.61	0.141	159381	
Chloride	mg/L	Nonparametric	20	20	273	91.66	450	0.99
Fluoride	mg/L	Nonparametric	20	5	0.192	0.455	0.23	0.99
pH, Field	SU	Normal	20	20	7.543	0.275	6.82-8.26	
Sulfate	mg/L	Nonparametric	20	20	29.1	13.09	53	0.99
Total Dissolved Solids (TDS)	mg/L	Nonparametric	20	20	900	373.3	2300	0.99

Notes:

When the number of detect values was too low for statistical calculations, the lab specific detection limit was used as upper prediction limit for the paramete

[1]- Confidence level for passing initial test or one verification resample at all downgradient wells for a single parameter (nonparametric test only)

Model type refers to type of prediction limit

For lognormal test, mean and standard deviation are in lognormal units and prediction limit in original units

All sample sizes and statistics are based on outlier free data

For nonparametric limits, median reporting limits are substituted for extreme reporting limit values.

Table 4 - Historical Downgraduent Data for Constituent-Well Combinations which Failed the Current Statistical Evaluation
Marquette Board of Light and Power
Shiras Steam Plant

Parameter	Units	Sample Point	Date	Qualifier	Result	Prediction Limit	SSI
Boron	ug/L	MW-1	9/28/2017		530	300	>PL
Fluoride	mg/L	MW-1	7/19/2017	ND	0.38	0.23	>PL
Fluoride	mg/L	MW-1	7/24/2017	ND	0.38	0.23	>PL
Fluoride	mg/L	MW-2	7/19/2017	ND	0.38	0.23	>PL
Fluoride	mg/L	MW-2	7/24/2017	ND	0.38	0.23	>PL
pH-field	S.U.	MW-2	7/19/2017		8.41	8.259	>PL
Fluoride	mg/L	MW-3	7/19/2017	ND	0.38	0.23	>PL
Fluoride	mg/L	MW-3	7/24/2017	ND	0.38	0.23	>PL

Notes:

>PL - results exceeds prediction limit; significantly increased over background

ND = not detected, result = detection limit

Attachment A

```
                                          Outlier Tests for Selected Uncensored Variables
                         User Selected Options
          Date/Time of Computation    ProUCL 5.110/25/2018 11:37:44 AM
                               From File    WorkSheet.xls
                           Full Precision    OFF


                         Dixon's Outlier Test for Bckgd-Result (calcium)

Number of Observations = 20
10% critical value: 0.401
5% critical value: 0.45
1% critical value: 0.535

1.  Observation Value 160000 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.469

For 10% significance level, 160000 is an outlier.
For 5% significance level, 160000 is an outlier.
For 1% significance level, 160000 is not an outlier.

2. Observation Value 89000 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.171

For 10% significance level, 89000 is not an outlier.
For 5% significance level, 89000 is not an outlier.
For 1% significance level, 89000 is not an outlier.


                         Dixon's Outlier Test for Bckgd-Result (chloride)

Number of Observations = 20
10% critical value: 0.401
5% critical value: 0.45
1% critical value: 0.535

1.  Observation Value 450 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.269

For 10% significance level, 450 is not an outlier.
For 5% significance level, 450 is not an outlier.
For 1% significance level, 450 is not an outlier.
```

2. Observation Value 190 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 190 is not an outlier.
For 5% significance level, 190 is not an outlier.
For 1% significance level, 190 is not an outlier.

Dixon's Outlier Test for Bckgd-Result (fluoride)

Number of Observations = 5
10% critical value: 0.557
5% critical value: 0.642
1% critical value: 0.78

1. Observation Value 0.23 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.000

For 10% significance level, 0.23 is not an outlier.
For 5% significance level, 0.23 is not an outlier.
For 1% significance level, 0.23 is not an outlier.

2. Observation Value 0.12 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.545

For 10% significance level, 0.12 is not an outlier.
For 5% significance level, 0.12 is not an outlier.
For 1% significance level, 0.12 is not an outlier.

Dixon's Outlier Test for Bckgd-Result (ph-field)

Number of Observations = 20
10% critical value: 0.401
5% critical value: 0.45
1% critical value: 0.535

1. Observation Value 7.93 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.131

For 10% significance level, 7.93 is not an outlier.
For 5% significance level, 7.93 is not an outlier.
For 1% significance level, 7.93 is not an outlier.

2. Observation Value 6.76 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.514

For 10% significance level, 6.76 is an outlier.
For 5% significance level, 6.76 is an outlier.
For 1% significance level, 6.76 is not an outlier.

Dixon's Outlier Test for Bckgd-Result (sulfate)

Number of Observations = 20
10% critical value: 0.401
5% critical value: 0.45
1% critical value: 0.535

1. Observation Value 53 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.171

For 10% significance level, 53 is not an outlier.
For 5% significance level, 53 is not an outlier.
For 1% significance level, 53 is not an outlier.

2. Observation Value 18 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 18 is not an outlier.
For 5% significance level, 18 is not an outlier.
For 1% significance level, 18 is not an outlier.

Dixon's Outlier Test for Bckgd-Result (total dissolved solids)

Number of Observations = 20
10% critical value: 0.401
5% critical value: 0.45
1% critical value: 0.535

1. Observation Value 2300 is a Potential Outlier (Upper Tail)?

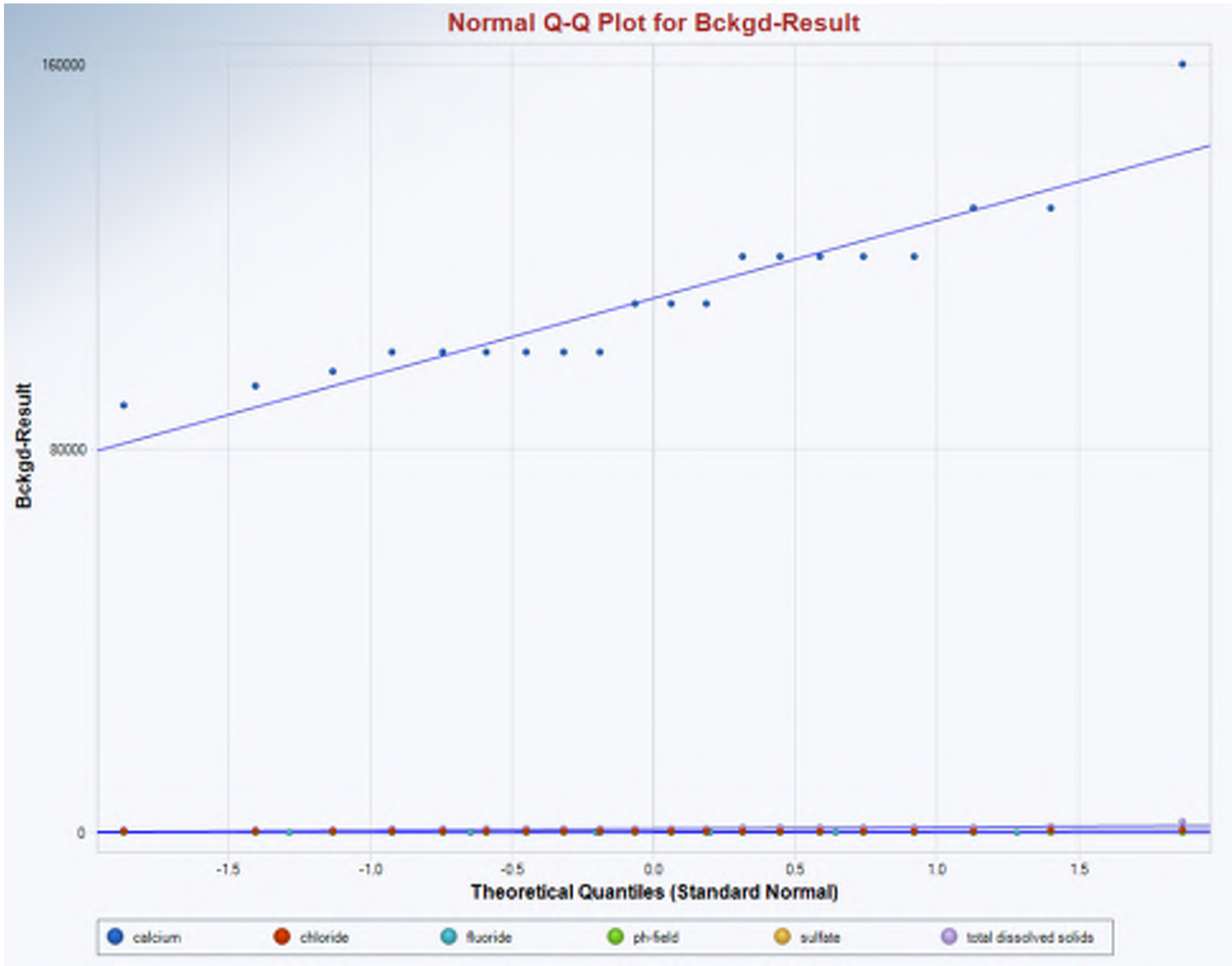
Test Statistic: 0.723

For 10% significance level, 2300 is an outlier.
For 5% significance level, 2300 is an outlier.
For 1% significance level, 2300 is an outlier.

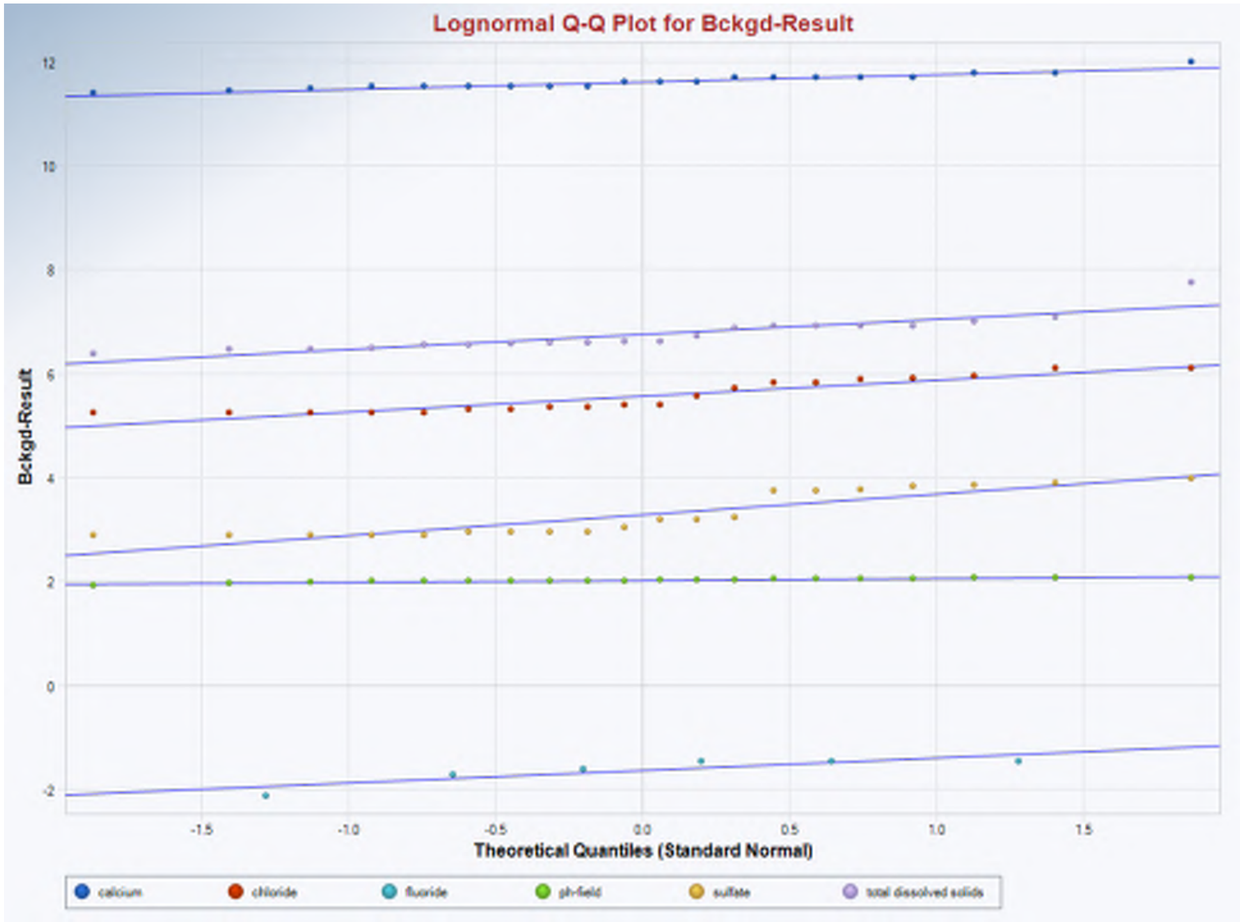
2. Observation Value 590 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.098

For 10% significance level, 590 is not an outlier.
For 5% significance level, 590 is not an outlier.
For 1% significance level, 590 is not an outlier.



Parameter	n	Mean	SD	Slope	Intercept	Correlation, R	Shapiro-Wilk test exact test statistic	Criticla value (0.05)	p-Value	Data Appear Normal?
Calcium	20	111400	16681	16168	111400	0.934	0.882	0.905	0.0184	NO
Chloride	20	273	91.66	87.32	273	0.918	0.825	0.905	0.00176	NO
Fluoride	5	0.192	0.0455	0.0472	0.192	0.939	0.805	0.762	N/A	YES
pH-field	20	7.543	0.275	0.274	7.543	0.958	0.927	0.905	0.135	YES
Sulfate	20	29.1	13.09	12.07	29.1	0.888	0.770	0.905	1.9303E-4	NO
Total Dissolved Solids	20	900	373.3	308.1	900	0.795	0.657	0.905	2.8432E-6	NO



Parameter	n	Mean	SD	Slope	Intercept	Correlation, R	Shapiro-Wilk test exact test statistic	Criticla value (0.05)	p-Value	Data Appear Lognormal?
Calcium	20	11.61	0.141	0.14	11.61	0.956	0.921	0.905	0.108	YES
Chloride	20	5.56	0.318	0.306	5.56	0.928	0.839	0.905	0.00334	NO
Fluoride	5	-1.677	0.269	0.271	-1.677	0.915	0.838	0.762	N/A	YES
pH-field	20	2.02	0.0372	0.0367	2.02	0.95	0.914	0.905	0.0745	YES
Sulfate	20	3.281	0.424	0.396	3.281	0.899	0.786	0.905	3.7159E-4	NO
Total Dissolved Solids	20	6.748	0.311	0.292	6.748	0.904	0.832	0.905	0.00202	NO

```
                              Background Statistics for Uncensored Full Data Sets
                 User Selected Options
      Date/Time of Computation   ProUCL 5.110/25/2018 10:55:10 AM
                     From File   WorkSheet.xls
                Full Precision   OFF
        Confidence Coefficient   99%
                      Coverage   99%
   New or Future K Observations  1
 Number of Bootstrap Operations  2000

Bckgd-Result (calcium)

General Statistics
                  Total Number of Observations     20                       Number of Distinct Observations     8
                                       Minimum  89000                                        First Quartile  100000
                                Second Largest  130000                                               Median  110000
                                       Maximum  160000                                        Third Quartile  120000
                                          Mean  111400                                                   SD   16681
                      Coefficient of Variation    0.15                                             Skewness    1.27
                           Mean of logged Data   11.61                                   SD of logged Data    0.141

                             Critical Values for Background Threshold Values (BTVs)
                     Tolerance Factor K (For UTL)   3.832                                  d2max (for USL)    2.884

                                          Normal GOF Test
                    Shapiro Wilk Test Statistic   0.882                     Shapiro Wilk GOF Test
                 5% Shapiro Wilk Critical Value   0.905         Data Not Normal at 5% Significance Level
                       Lilliefors Test Statistic  0.203                     Lilliefors GOF Test
                    5% Lilliefors Critical Value  0.192         Data Not Normal at 5% Significance Level
                                Data Not Normal at 5% Significance Level

                              Background Statistics Assuming Normal Distribution
                  99% UTL with   99% Coverage  175321                                 90% Percentile (z)  132777
                                  99% UPL (t)  154807                                 95% Percentile (z)  138838
                                     99% USL   159505                                 99% Percentile (z)  150206

                                          Gamma GOF Test
                            A-D Test Statistic   0.698               Anderson-Darling Gamma GOF Test
                          5% A-D Critical Value  0.739    Detected data appear Gamma Distributed at 5% Significance Level
                            K-S Test Statistic   0.211               Kolmogorov-Smirnov Gamma GOF Test
                          5% K-S Critical Value  0.193       Data Not Gamma Distributed at 5% Significance Level
                         Detected data follow Appr. Gamma Distribution at 5% Significance Level

                                          Gamma Statistics
                                   k hat (MLE)   50.98                        k star (bias corrected MLE)    43.37
                               Theta hat (MLE)  2185                      Theta star (bias corrected MLE)   2569
                                  nu hat (MLE)  2039                             nu star (bias corrected)   1735
                     MLE Mean (bias corrected)  111400                             MLE Sd (bias corrected)  16917
```

Background Statistics Assuming Gamma Distribution

99% Wilson Hilferty (WH) Approx. Gamma UPL	157525	90% Percentile	133555
99% Hawkins Wixley (HW) Approx. Gamma UPL	157953	95% Percentile	140607
99% WH Approx. Gamma UTL with 99% Coverage	183648	99% Percentile	154484
99% HW Approx. Gamma UTL with 99% Coverage	185003		
99% WH USL	163273	99% HW USL	163866

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.921	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.905	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.192	Data Not Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

99% UTL with 99% Coverage	189657	90% Percentile (z)	132228
99% UPL (t)	159381	95% Percentile (z)	139199
99% USL	165857	99% Percentile (z)	153283

Nonparametric Distribution Free Background Statistics

Data appear Approximate Gamma Distribution at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	20	99% UTL with 99% Coverage	160000
Approx, f used to compute achieved CC	0.202	Approximate Actual Confidence Coefficient achieved by UTL	0.182
		Approximate Sample Size needed to achieve specified CC	461
99% Percentile Bootstrap UTL with 99% Coverage	160000	99% BCA Bootstrap UTL with 99% Coverage	160000
99% UPL	160000	90% Percentile	130000
90% Chebyshev UPL	162679	95% Percentile	131500
95% Chebyshev UPL	185906	99% Percentile	154300
99% USL	160000		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Bckgd-Result (chloride)

General Statistics

Total Number of Observations	20	Number of Distinct Observations	11
Minimum	190	First Quartile	197.5
Second Largest	450	Median	220
Maximum	450	Third Quartile	345
Mean	273	SD	91.66
Coefficient of Variation	0.336	Skewness	0.765
Mean of logged Data	5.56	SD of logged Data	0.318

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.832	d2max (for USL)	2.884

Normal GOF Test

Shapiro Wilk Test Statistic	0.825	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.268	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

99% UTL with 99% Coverage	624.2	90% Percentile (z)	390.5
99% UPL (t)	511.5	95% Percentile (z)	423.8
99% USL	537.3	99% Percentile (z)	486.2

Gamma GOF Test

A-D Test Statistic	1.366	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.742	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.262	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.194	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	10.21	k star (bias corrected MLE)	8.71
Theta hat (MLE)	26.74	Theta star (bias corrected MLE)	31.34
nu hat (MLE)	408.3	nu star (bias corrected)	348.4
MLE Mean (bias corrected)	273	MLE Sd (bias corrected)	92.5

Background Statistics Assuming Gamma Distribution

99% Wilson Hilferty (WH) Approx. Gamma UPL	556.2	90% Percentile	396.2
99% Hawkins Wixley (HW) Approx. Gamma UPL	564.2	95% Percentile	440.8
99% WH Approx. Gamma UTL with 99% Coverage	748.3	99% Percentile	532.8
99% HW Approx. Gamma UTL with 99% Coverage	773.7		
99% WH USL	596.9	99% HW USL	607.9

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.839	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.905	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.249	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.192	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

99% UTL with 99% Coverage	877.4	90% Percentile (z)	390.3
99% UPL (t)	593.7	95% Percentile (z)	438
99% USL	649.2	99% Percentile (z)	543.9

Nonparametric Distribution Free Background Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	20	99% UTL with 99% Coverage	450
Approx, f used to compute achieved CC	0.202	Approximate Actual Confidence Coefficient achieved by UTL	0.182
		Approximate Sample Size needed to achieve specified CC	461
99% Percentile Bootstrap UTL with 99% Coverage	450	99% BCA Bootstrap UTL with 99% Coverage	450
99% UPL	450	90% Percentile	387
90% Chebyshev UPL	554.8	95% Percentile	450
95% Chebyshev UPL	682.4	99% Percentile	450
99% USL	450		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Bckgd-Result (fluoride)

General Statistics

Total Number of Observations	5	Number of Distinct Observations	4
Minimum	0.12	First Quartile	0.18
Second Largest	0.23	Median	0.2
Maximum	0.23	Third Quartile	0.23
Mean	0.192	SD	0.0455
Coefficient of Variation	0.237	Skewness	-1.171
Mean of logged Data	-1.677	SD of logged Data	0.269

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	4.203	d2max (for USL)	1.671

Normal GOF Test

Shapiro Wilk Test Statistic	0.876	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.202	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

99% UTL with 99% Coverage	0.383	90% Percentile (z)	0.25
99% UPL (t)	0.298	95% Percentile (z)	0.267
99% USL	0.268	99% Percentile (z)	0.298

Gamma GOF Test

A-D Test Statistic	0.452	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.679	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.22	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	19.03	k star (bias corrected MLE)	7.744
Theta hat (MLE)	0.0101	Theta star (bias corrected MLE)	0.0248
nu hat (MLE)	190.3	nu star (bias corrected)	77.44
MLE Mean (bias corrected)	0.192	MLE Sd (bias corrected)	0.069

Background Statistics Assuming Gamma Distribution

99% Wilson Hilferty (WH) Approx. Gamma UPL	0.327	90% Percentile	0.284
99% Hawkins Wixley (HW) Approx. Gamma UPL	0.332	95% Percentile	0.318
99% WH Approx. Gamma UTL with 99% Coverage	0.476	99% Percentile	0.388
99% HW Approx. Gamma UTL with 99% Coverage	0.496		
99% WH USL	0.282	99% HW USL	0.285

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.838	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.244	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

99% UTL with 99% Coverage	0.578	90% Percentile (z)	0.264
99% UPL (t)	0.35	95% Percentile (z)	0.291
99% USL	0.293	99% Percentile (z)	0.349

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	5	99% UTL with 99% Coverage	0.23
Approx, f used to compute achieved CC	0.263	Approximate Actual Confidence Coefficient achieved by UTL	0.226
		Approximate Sample Size needed to achieve specified CC	59
99% Percentile Bootstrap UTL with 99% Coverage	0.23	99% BCA Bootstrap UTL with 99% Coverage	0.23
99% UPL	0.23	90% Percentile	0.23
90% Chebyshev UPL	0.342	95% Percentile	0.23
95% Chebyshev UPL	0.409	99% Percentile	0.23
99% USL	0.23		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Bckgd-Result (ph-field)

General Statistics

Total Number of Observations	20	Number of Distinct Observations	19
Minimum	6.76	First Quartile	7.44
Second Largest	7.92	Median	7.525
Maximum	7.93	Third Quartile	7.743
Mean	7.543	SD	0.275
Coefficient of Variation	0.0365	Skewness	-1.066
Mean of logged Data	2.02	SD of logged Data	0.0372

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.832	d2max (for USL)	2.884

Normal GOF Test

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.118	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

99% UTL with 99% Coverage	8.597	90% Percentile (z)	7.895
99% UPL (t)	8.259	95% Percentile (z)	7.995
99% USL	8.336	99% Percentile (z)	8.183

Gamma GOF Test

A-D Test Statistic	0.418	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.74	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.12	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.193	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	771.5	k star (bias corrected MLE)	655.8
Theta hat (MLE)	0.00978	Theta star (bias corrected MLE)	0.0115
nu hat (MLE)	30861	nu star (bias corrected)	26233
MLE Mean (bias corrected)	7.543	MLE Sd (bias corrected)	0.295

Background Statistics Assuming Gamma Distribution

99% Wilson Hilferty (WH) Approx. Gamma UPL	8.288	90% Percentile	7.923
99% Hawkins Wixley (HW) Approx. Gamma UPL	8.292	95% Percentile	8.034
99% WH Approx. Gamma UTL with 99% Coverage	8.658	99% Percentile	8.245
99% HW Approx. Gamma UTL with 99% Coverage	8.667		
99% WH USL	8.372	99% HW USL	8.377

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.914	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.905	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.126	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.192	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

99% UTL with 99% Coverage	8.693	90% Percentile (z)	7.906
99% UPL (t)	8.304	95% Percentile (z)	8.014
99% USL	8.392	99% Percentile (z)	8.219

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	20	99% UTL with 99% Coverage	7.93
Approx, f used to compute achieved CC	0.202	Approximate Actual Confidence Coefficient achieved by UTL	0.182
		Approximate Sample Size needed to achieve specified CC	461
99% Percentile Bootstrap UTL with 99% Coverage	7.93	99% BCA Bootstrap UTL with 99% Coverage	7.93
99% UPL	7.93	90% Percentile	7.857
90% Chebyshev UPL	8.389	95% Percentile	7.921
95% Chebyshev UPL	8.772	99% Percentile	7.928
99% USL	7.93		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

LPL is not calculated at ProUCL, but utilizing the equivalent formula for 99% UPL (t), the 99% LPL (t) 6.819642

Predicition limit Formula: $\bar{X}_n \pm T_a s_n \sqrt{1 + (1/n)}$

Bckgd-Result (sulfate)

General Statistics

Total Number of Observations	20	Number of Distinct Observations	11
Minimum	18	First Quartile	18.75
Second Largest	49	Median	22.5
Maximum	53	Third Quartile	42.25
Mean	29.1	SD	13.09
Coefficient of Variation	0.45	Skewness	0.71
Mean of logged Data	3.281	SD of logged Data	0.424

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.832	d2max (for USL)	2.884

Normal GOF Test

Shapiro Wilk Test Statistic	0.77	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.273	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

99% UTL with 99% Coverage	79.28	90% Percentile (z)	45.88
99% UPL (t)	63.17	95% Percentile (z)	50.64
99% USL	66.86	99% Percentile (z)	59.56

Gamma GOF Test

A-D Test Statistic	1.985	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.241	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.194	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.754	k star (bias corrected MLE)	4.924
Theta hat (MLE)	5.058	Theta star (bias corrected MLE)	5.91
nu hat (MLE)	230.1	nu star (bias corrected)	197
MLE Mean (bias corrected)	29.1	MLE Sd (bias corrected)	13.11

Background Statistics Assuming Gamma Distribution

99% Wilson Hilferty (WH) Approx. Gamma UPL	71.89	90% Percentile	46.66
99% Hawkins Wixley (HW) Approx. Gamma UPL	73.6	95% Percentile	53.48
99% WH Approx. Gamma UTL with 99% Coverage	103.7	99% Percentile	67.89
99% HW Approx. Gamma UTL with 99% Coverage	109.4		
99% WH USL	78.51	99% HW USL	80.87

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.786	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.905	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.237	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.192	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

99% UTL with 99% Coverage	135.1	90% Percentile (z)	45.82
99% UPL (t)	80.22	95% Percentile (z)	53.46
99% USL	90.4	99% Percentile (z)	71.37

Nonparametric Distribution Free Background Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	20	99% UTL with 99% Coverage	53
Approx, f used to compute achieved CC	0.202	Approximate Actual Confidence Coefficient achieved by UTL	0.182
		Approximate Sample Size needed to achieve specified CC	461
99% Percentile Bootstrap UTL with 99% Coverage	53	99% BCA Bootstrap UTL with 99% Coverage	53
99% UPL	53	90% Percentile	47.2
90% Chebyshev UPL	69.35	95% Percentile	49.2
95% Chebyshev UPL	87.59	99% Percentile	52.24
99% USL	53		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Bckgd-Result (total dissolved solids)

General Statistics

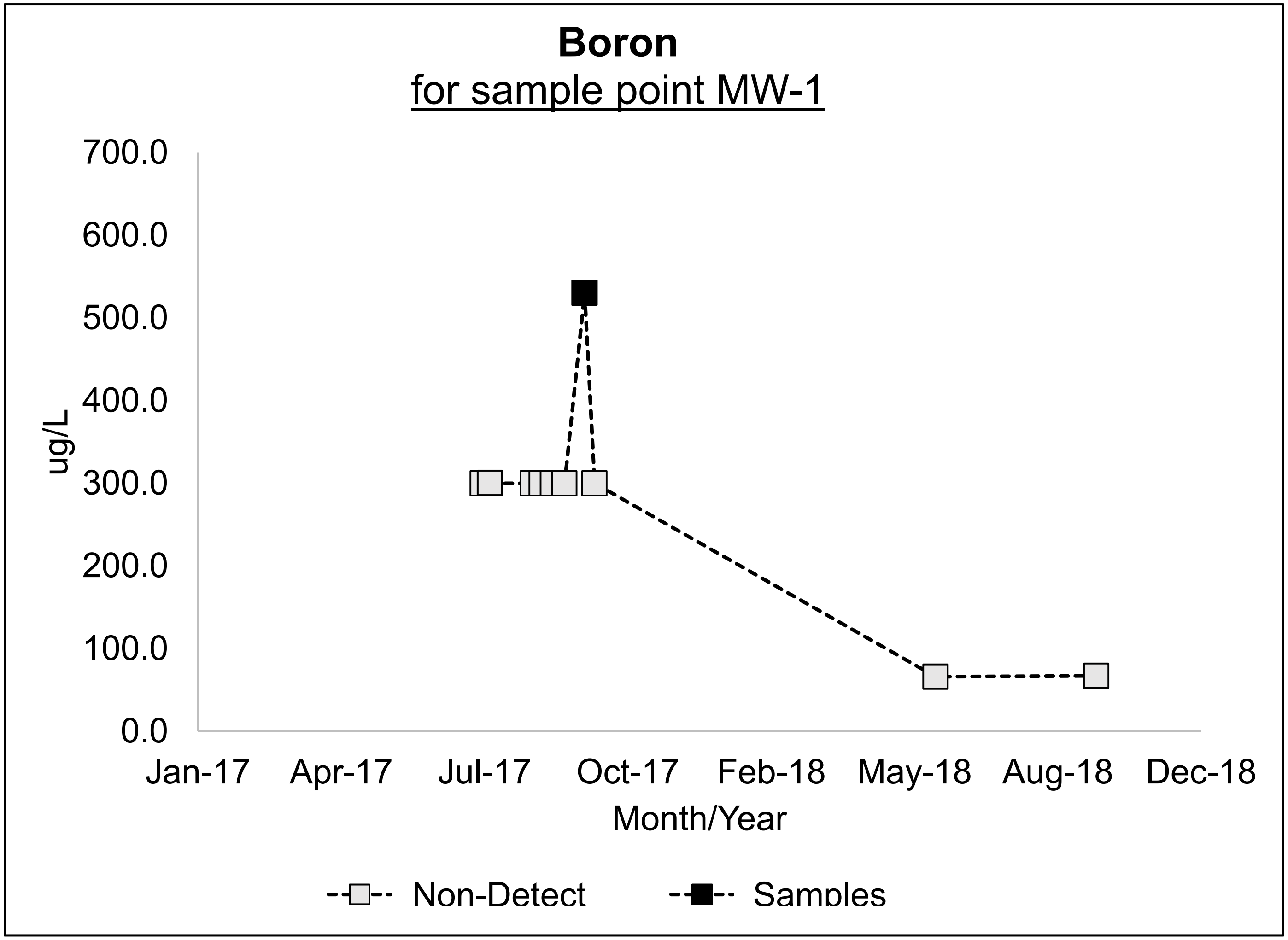
Total Number of Observations	20	Number of Distinct Observations	14
Minimum	590	First Quartile	700
Second Largest	1200	Median	745
Maximum	2300	Third Quartile	1000
Mean	900	SD	373.3
Coefficient of Variation	0.415	Skewness	2.997
Mean of logged Data	6.748	SD of logged Data	0.311

```
                    Critical Values for Background Threshold Values (BTVs)
          Tolerance Factor K (For UTL)    3.832                              d2max (for USL)    2.884

                                      Normal GOF Test
            Shapiro Wilk Test Statistic    0.657                   Shapiro Wilk GOF Test
         5% Shapiro Wilk Critical Value    0.905          Data Not Normal at 5% Significance Level
               Lilliefors Test Statistic   0.244                     Lilliefors GOF Test
            5% Lilliefors Critical Value   0.192          Data Not Normal at 5% Significance Level
                          Data Not Normal at 5% Significance Level

                      Background Statistics Assuming Normal Distribution
          99% UTL with   99% Coverage   2330                           90% Percentile (z)   1378
                             99% UPL (t)   1871                           95% Percentile (z)   1514
                                 99% USL   1976                           99% Percentile (z)   1768

                                      Gamma GOF Test
                       A-D Test Statistic   1.272            Anderson-Darling Gamma GOF Test
                     5% A-D Critical Value   0.742    Data Not Gamma Distributed at 5% Significance Level
                       K-S Test Statistic   0.216           Kolmogorov-Smirnov Gamma GOF Test
                     5% K-S Critical Value   0.194    Data Not Gamma Distributed at 5% Significance Level
                        Data Not Gamma Distributed at 5% Significance Level

                                      Gamma Statistics
                             k hat (MLE)   9.297                    k star (bias corrected MLE)    7.936
                         Theta hat (MLE)   96.8                 Theta star (bias corrected MLE)   113.4
                            nu hat (MLE)   371.9                        nu star (bias corrected)   317.4
                 MLE Mean (bias corrected)   900                           MLE Sd (bias corrected)   319.5

                      Background Statistics Assuming Gamma Distribution
      99% Wilson Hilferty (WH) Approx. Gamma UPL   1879                          90% Percentile   1326
      99% Hawkins Wixley (HW) Approx. Gamma UPL   1886                          95% Percentile   1482
  99% WH Approx. Gamma UTL with   99% Coverage   2554                          99% Percentile   1804
  99% HW Approx. Gamma UTL with   99% Coverage   2604
                               99% WH USL   2022                                 99% HW USL   2035

                                     Lognormal GOF Test
            Shapiro Wilk Test Statistic    0.832              Shapiro Wilk Lognormal GOF Test
         5% Shapiro Wilk Critical Value    0.905        Data Not Lognormal at 5% Significance Level
               Lilliefors Test Statistic   0.209                Lilliefors Lognormal GOF Test
            5% Lilliefors Critical Value   0.192        Data Not Lognormal at 5% Significance Level
                         Data Not Lognormal at 5% Significance Level
```

```
                                   Background Statistics assuming Lognormal Distribution
                 99% UTL with   99% Coverage   2810                                          90% Percentile (z)   1270
                                   99% UPL (t)   1916                                          95% Percentile (z)   1422
                                       99% USL   2092                                          99% Percentile (z)   1758

                                   Nonparametric Distribution Free Background Statistics
                                     Data do not follow a Discernible Distribution (0.05)

                                 Nonparametric Upper Limits for Background Threshold Values
                                  Order of Statistic, r     20                                 99% UTL with   99% Coverage   2300
                 Approx, f used to compute achieved CC      0.202   Approximate Actual Confidence Coefficient achieved by UTL     0.182
                                                                      Approximate Sample Size needed to achieve specified CC    461
99% Percentile Bootstrap UTL with   99% Coverage   2300                     99% BCA Bootstrap UTL with   99% Coverage   2300
                                        99% UPL   2300                                                90% Percentile   1110
                             90% Chebyshev UPL   2047                                                95% Percentile   1255
                             95% Chebyshev UPL   2567                                                99% Percentile   2091
                                       99% USL   2300

      Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
      Therefore, one may use USL to estimate a BTV only when the data set represents a background data set  free of outliers
                               and consists of observations collected from clean unimpacted locations.
              The use of USL tends to provide a balance between false positives and false negatives provided the data
           represents a background data set and when many onsite observations need to be compared with the BTV.
```

Attachment B

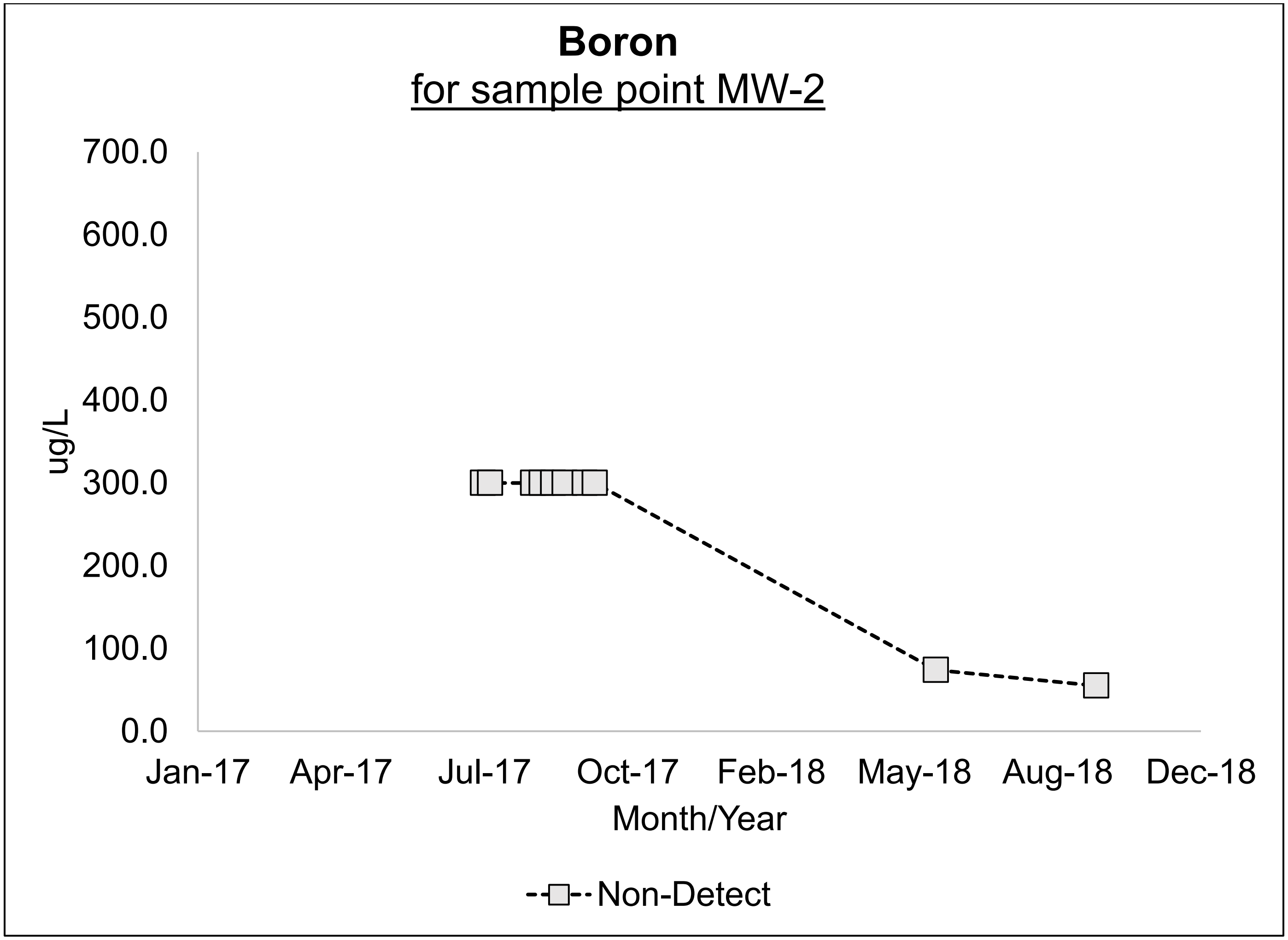
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 1

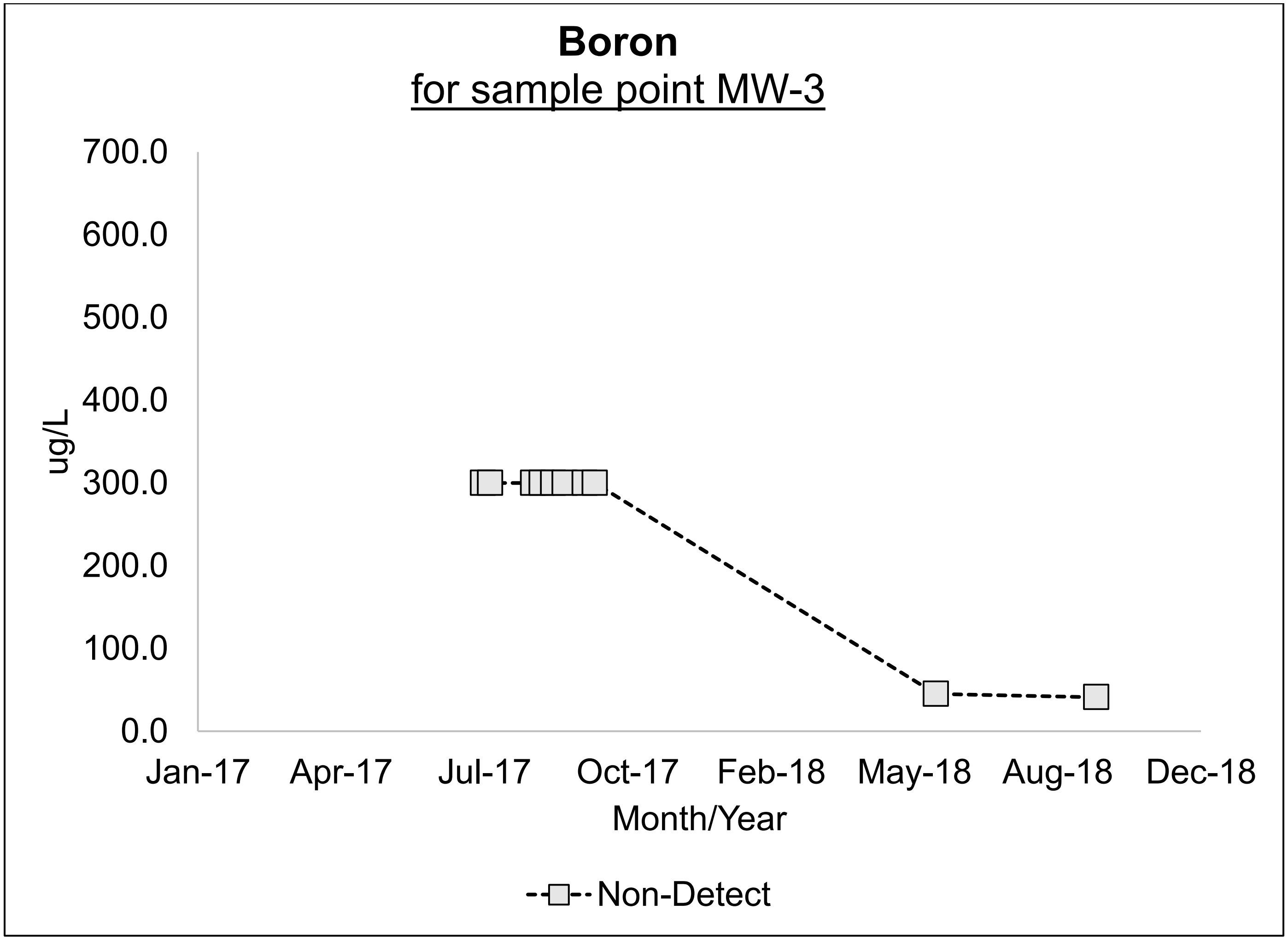
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 2

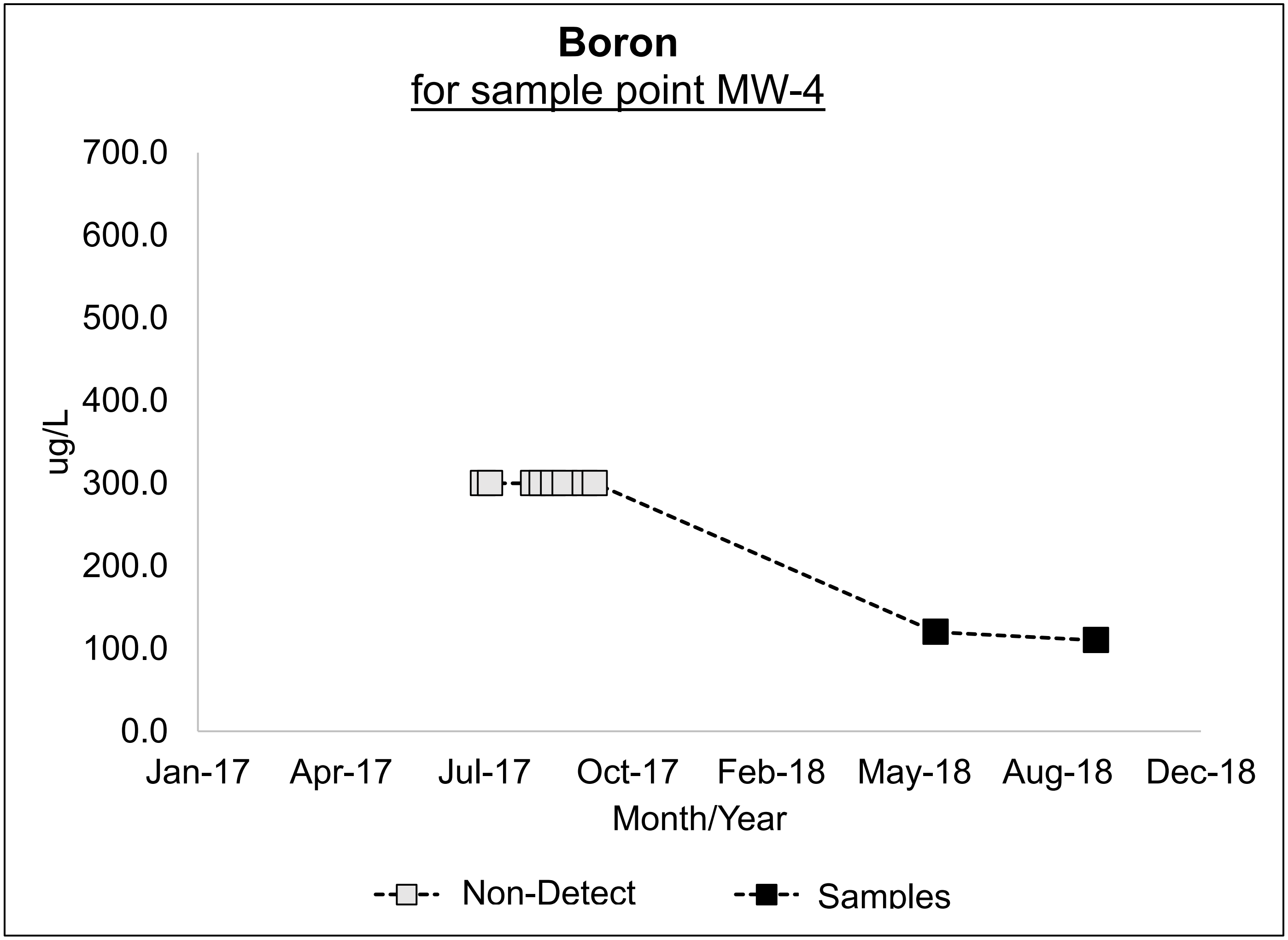
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 3

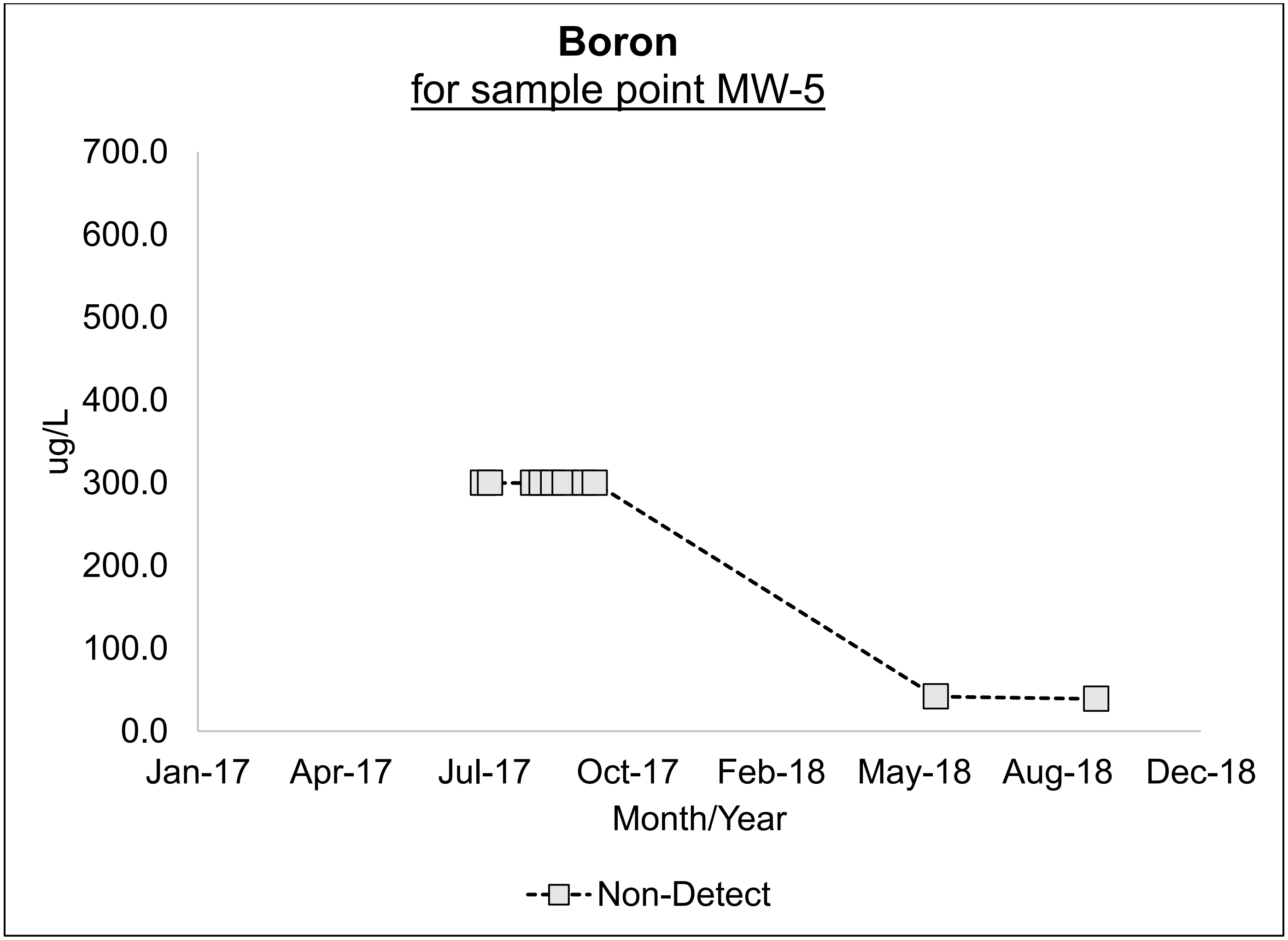
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 4

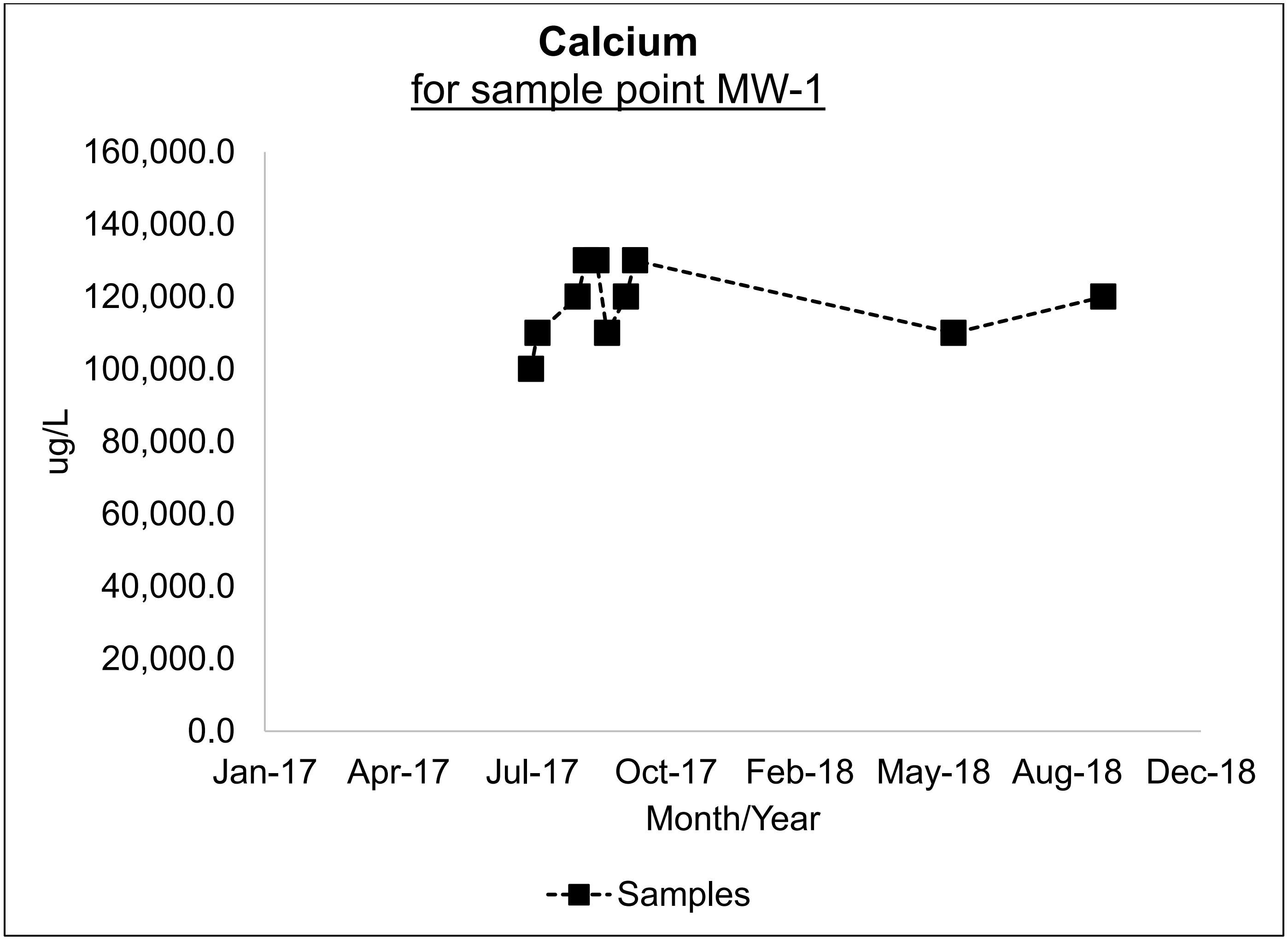
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 5

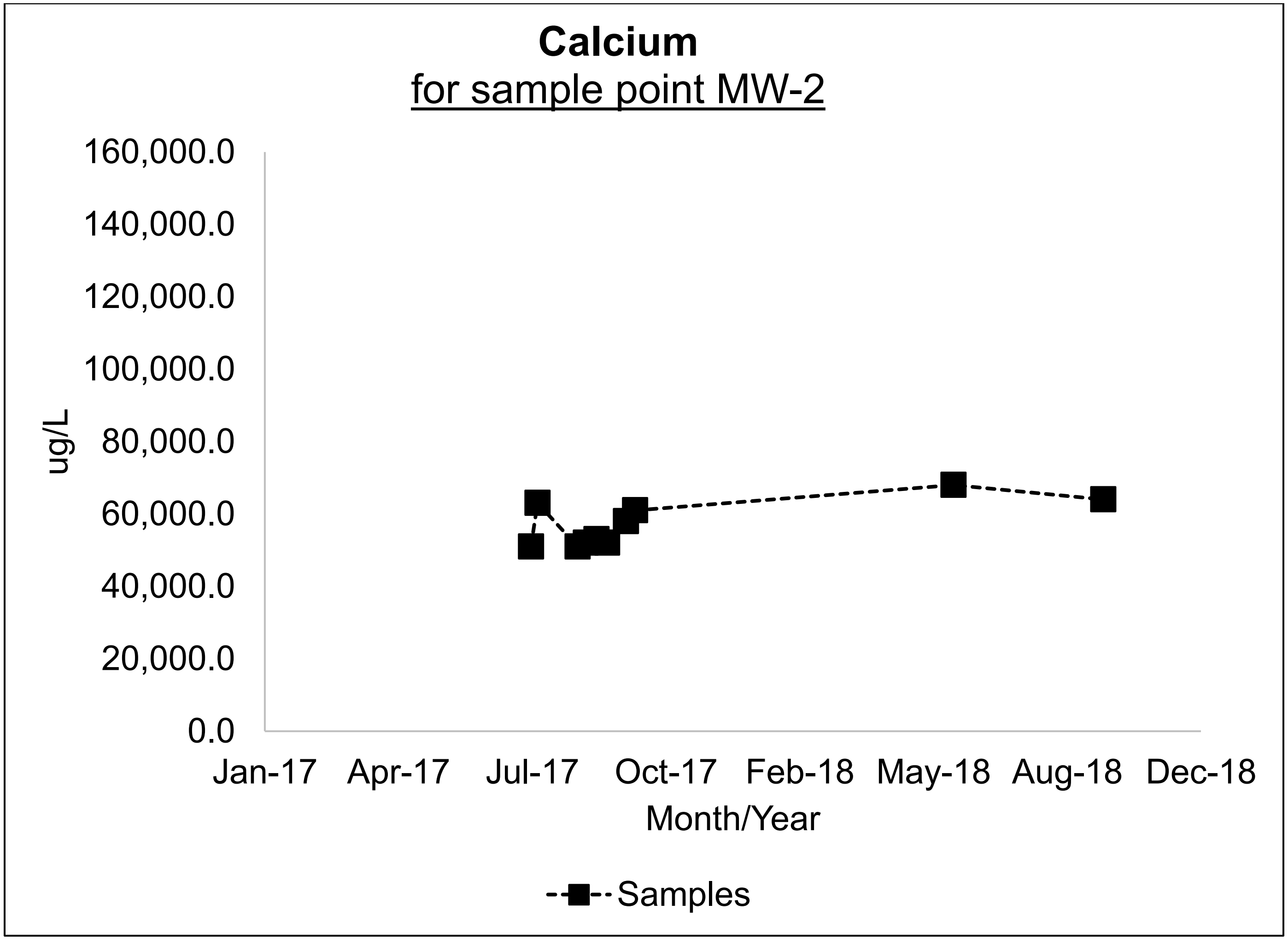
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 6

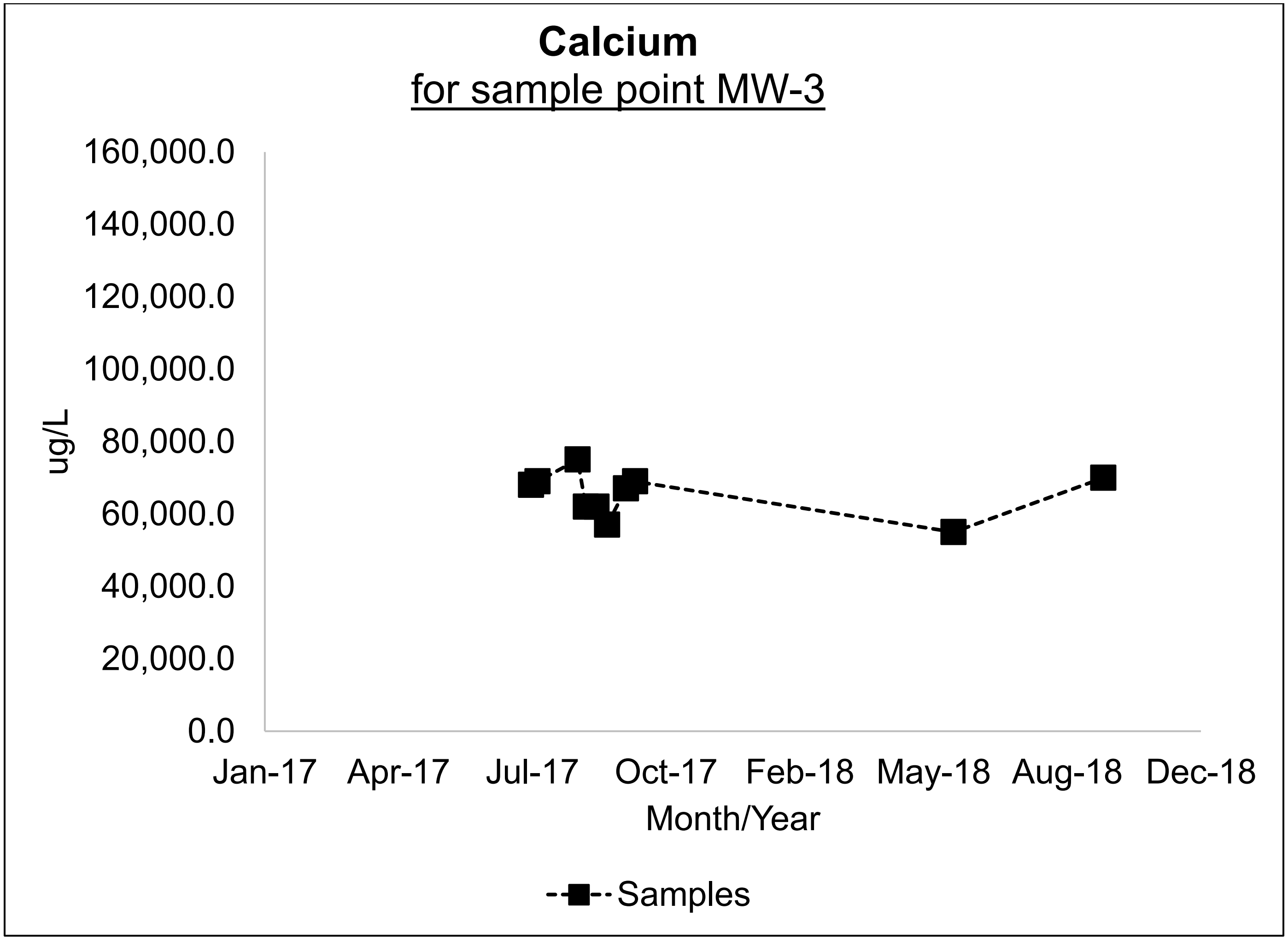
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 7

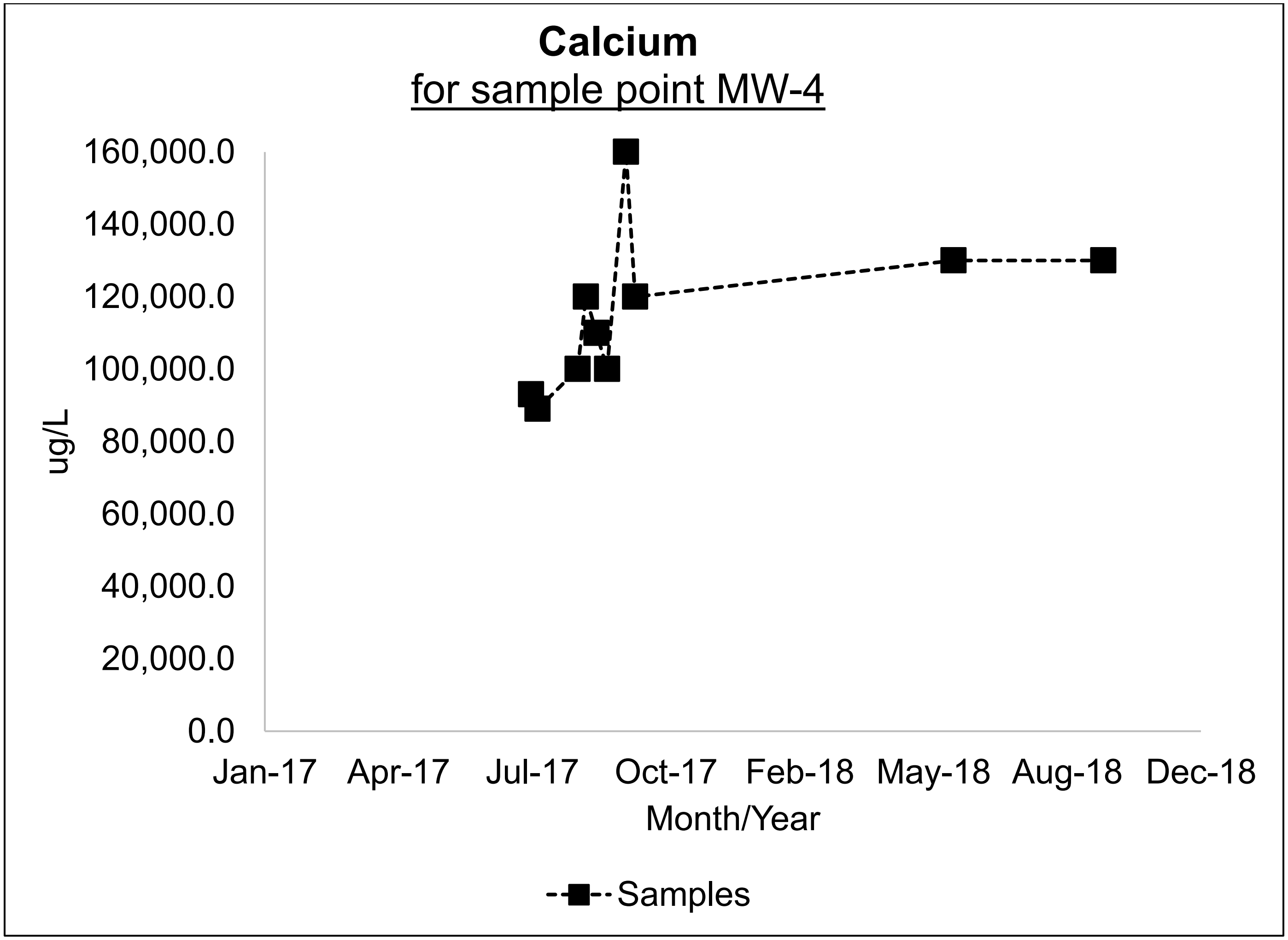
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 8

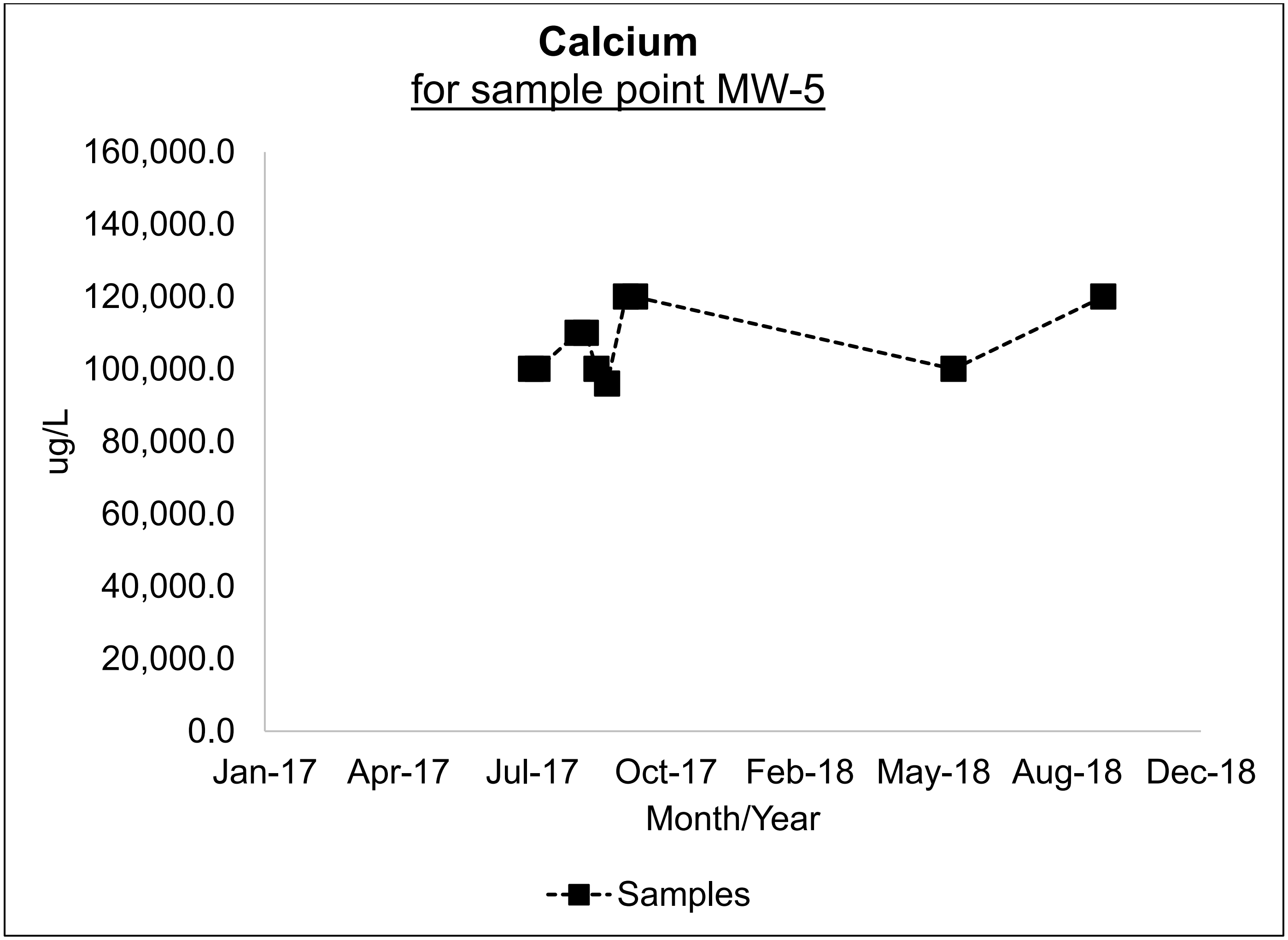
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 9

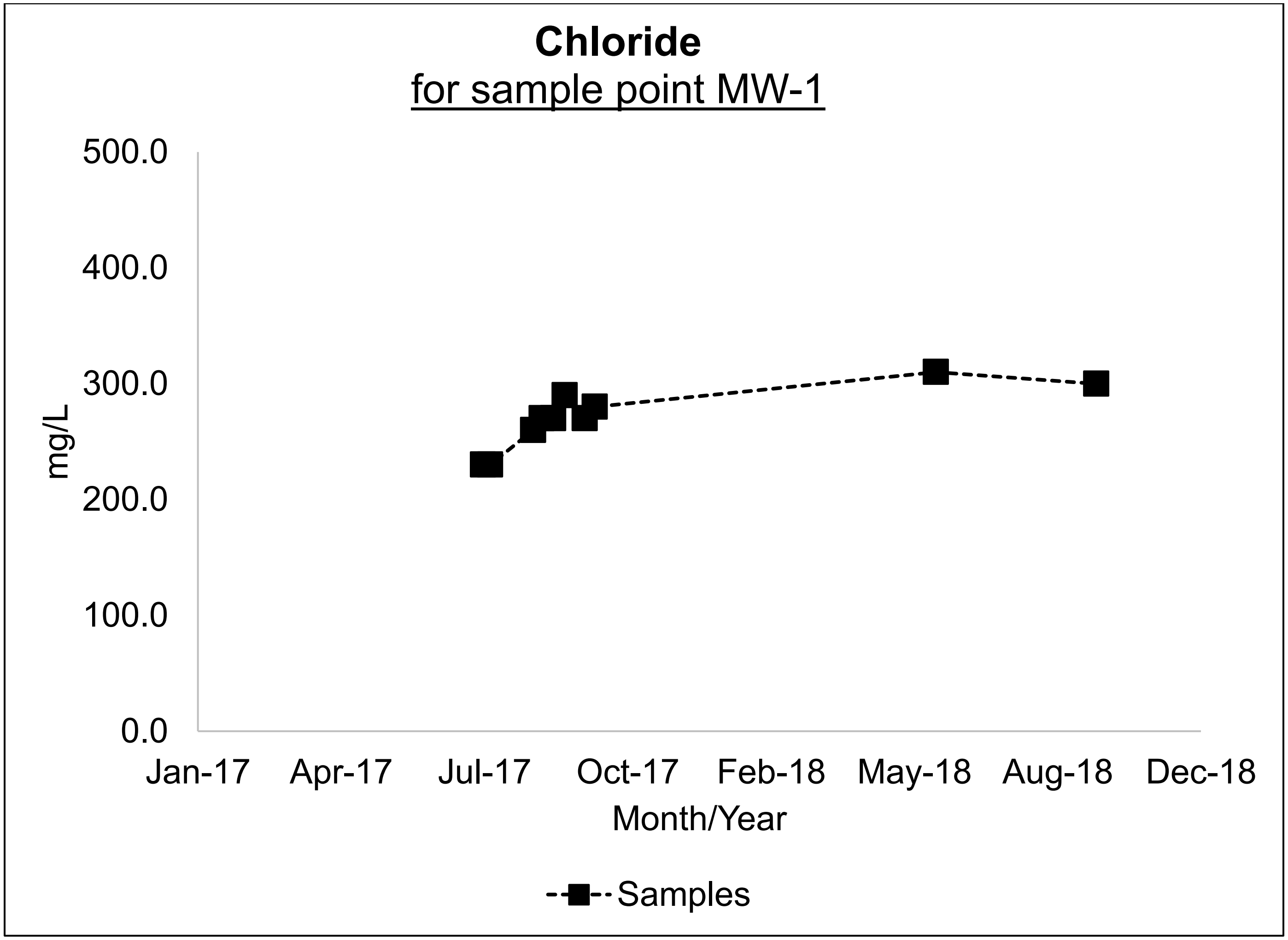
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 10

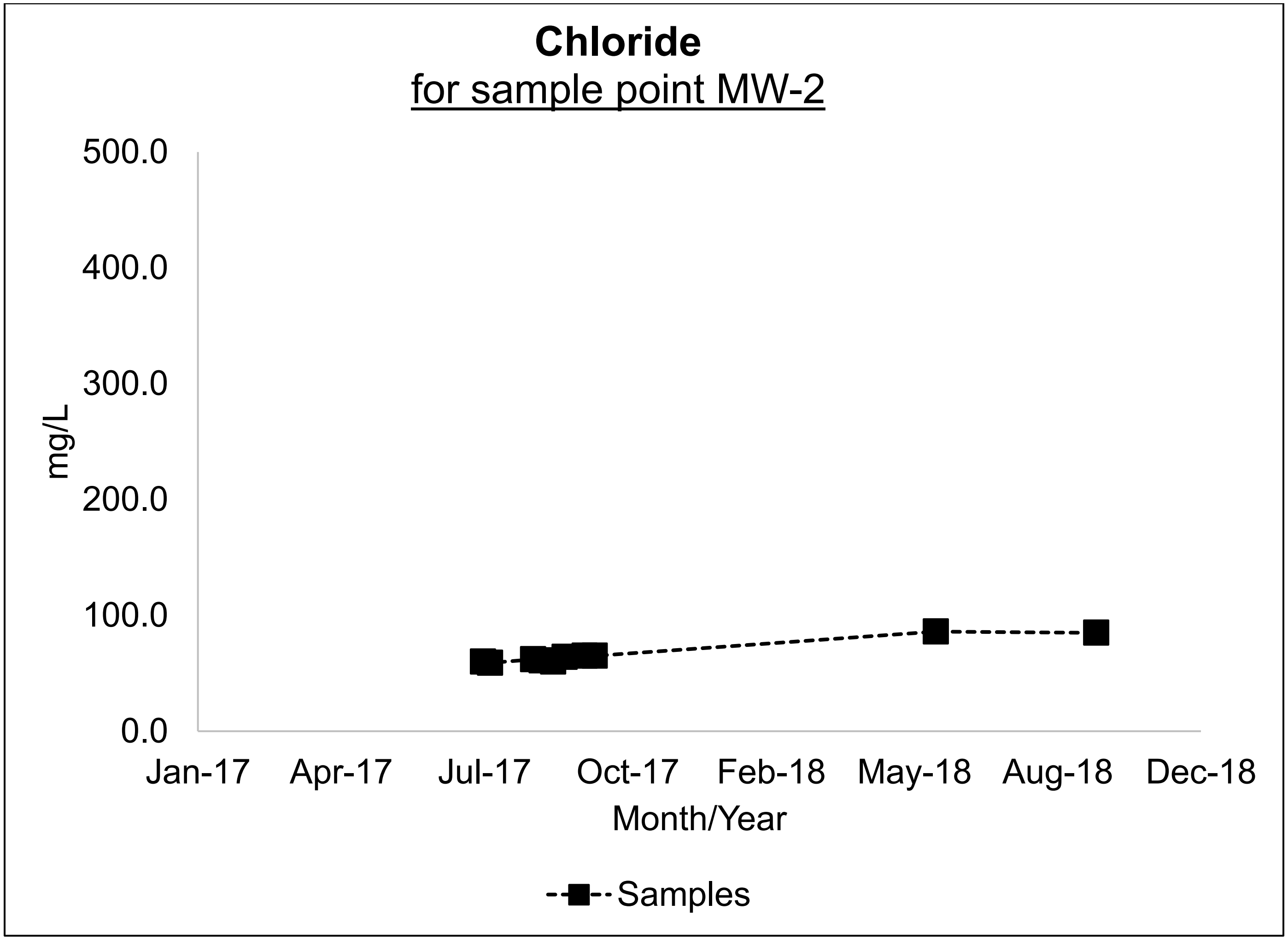
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 11

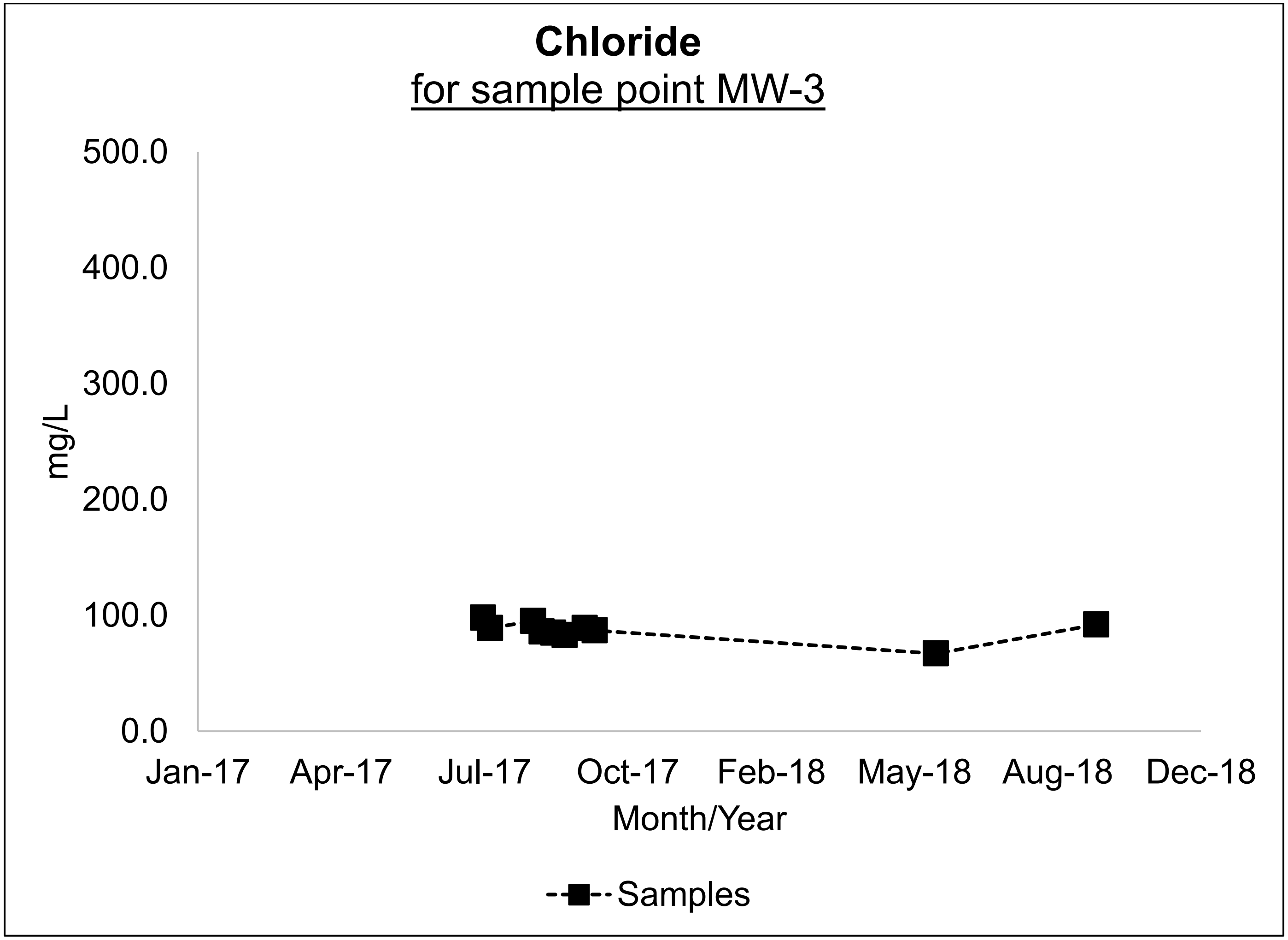
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 12

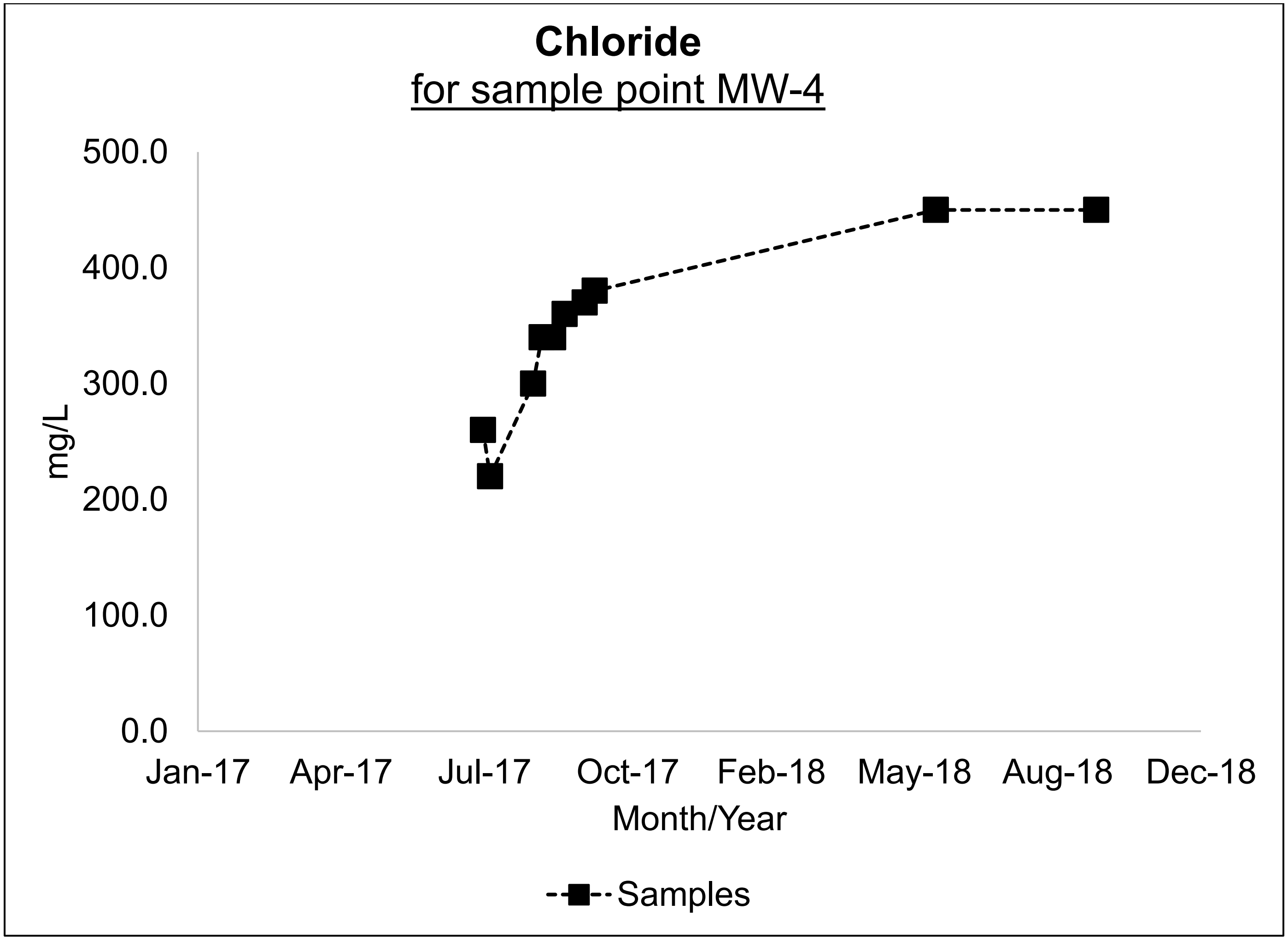
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 13

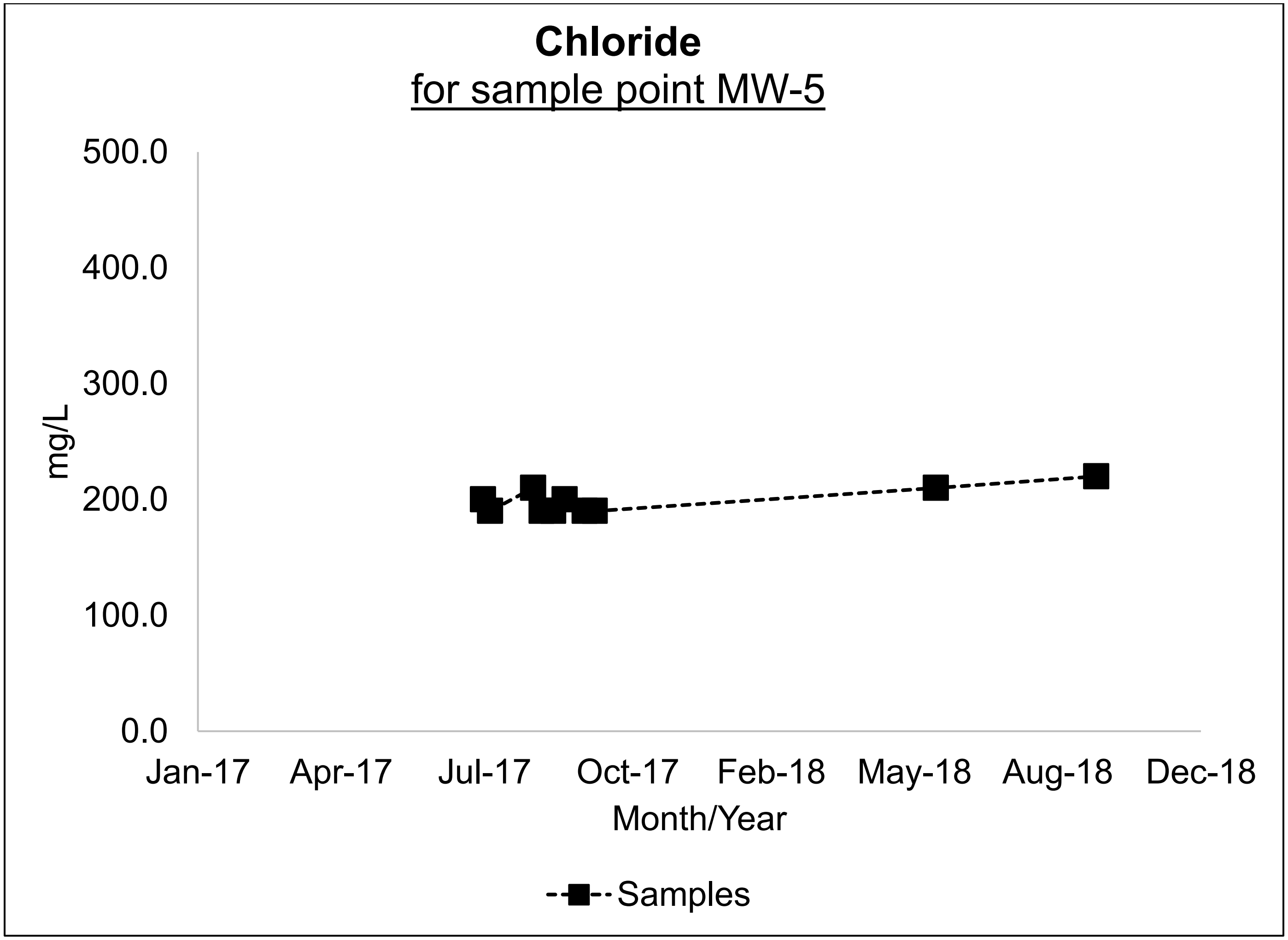
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 14

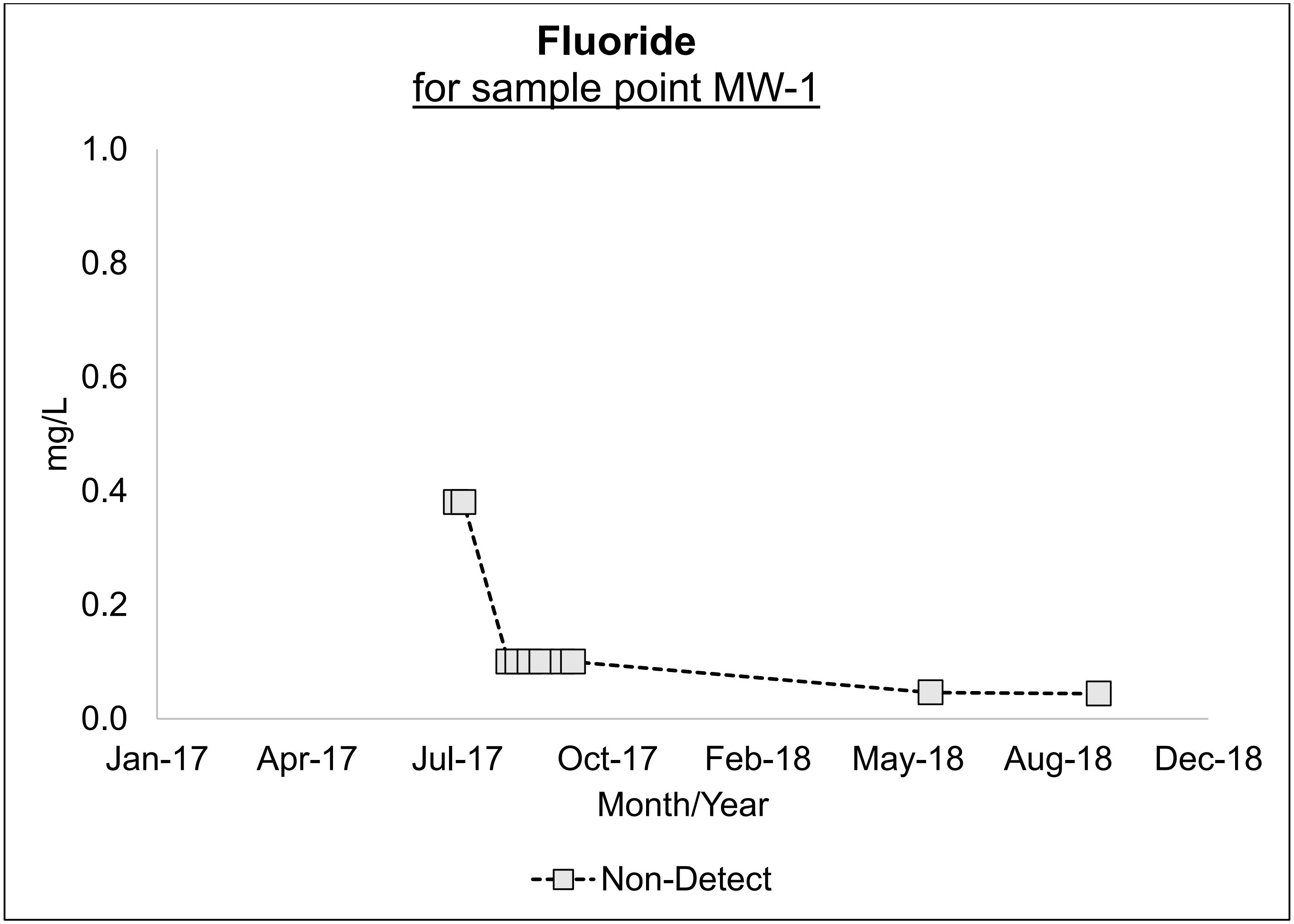
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 15

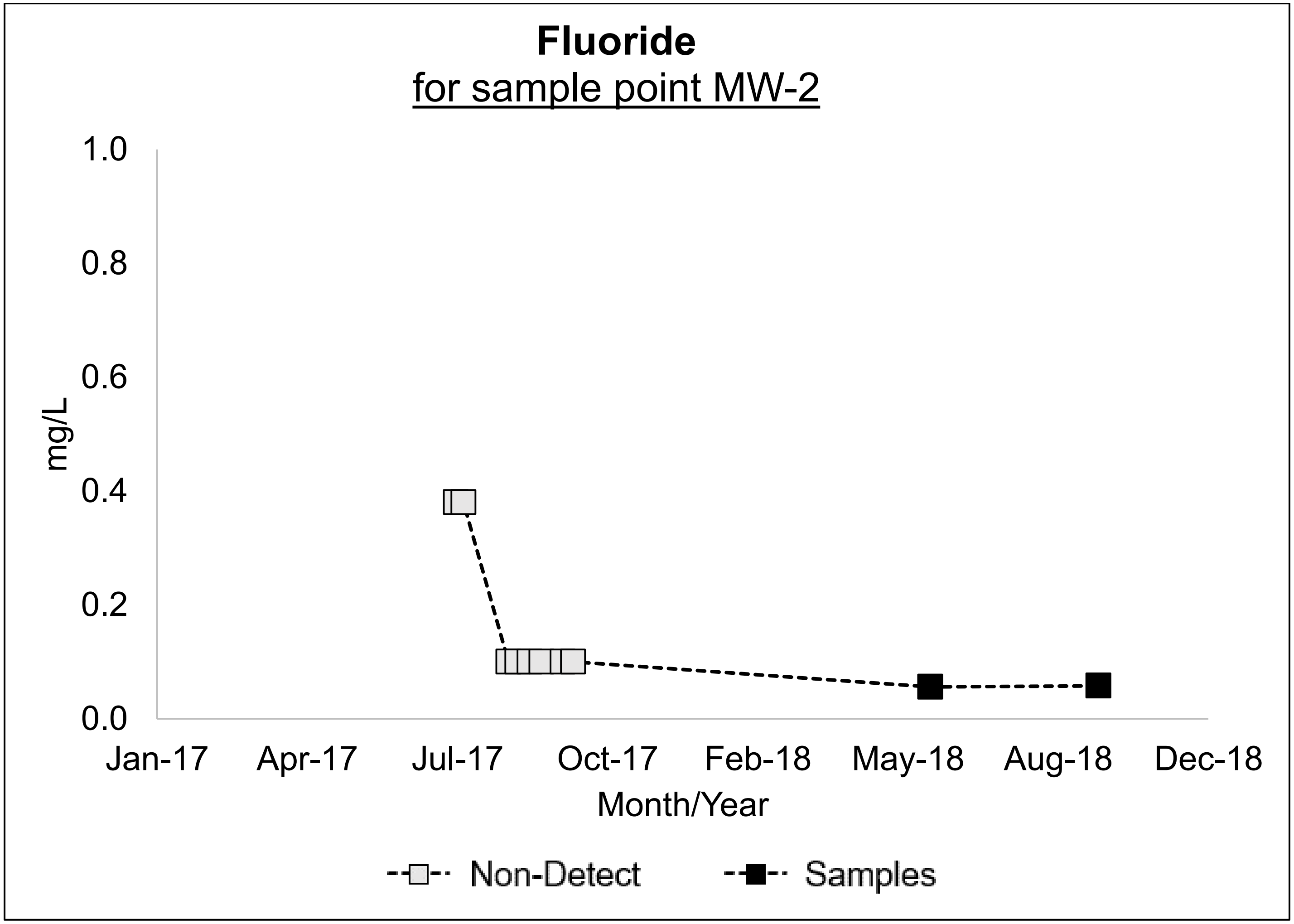
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 16

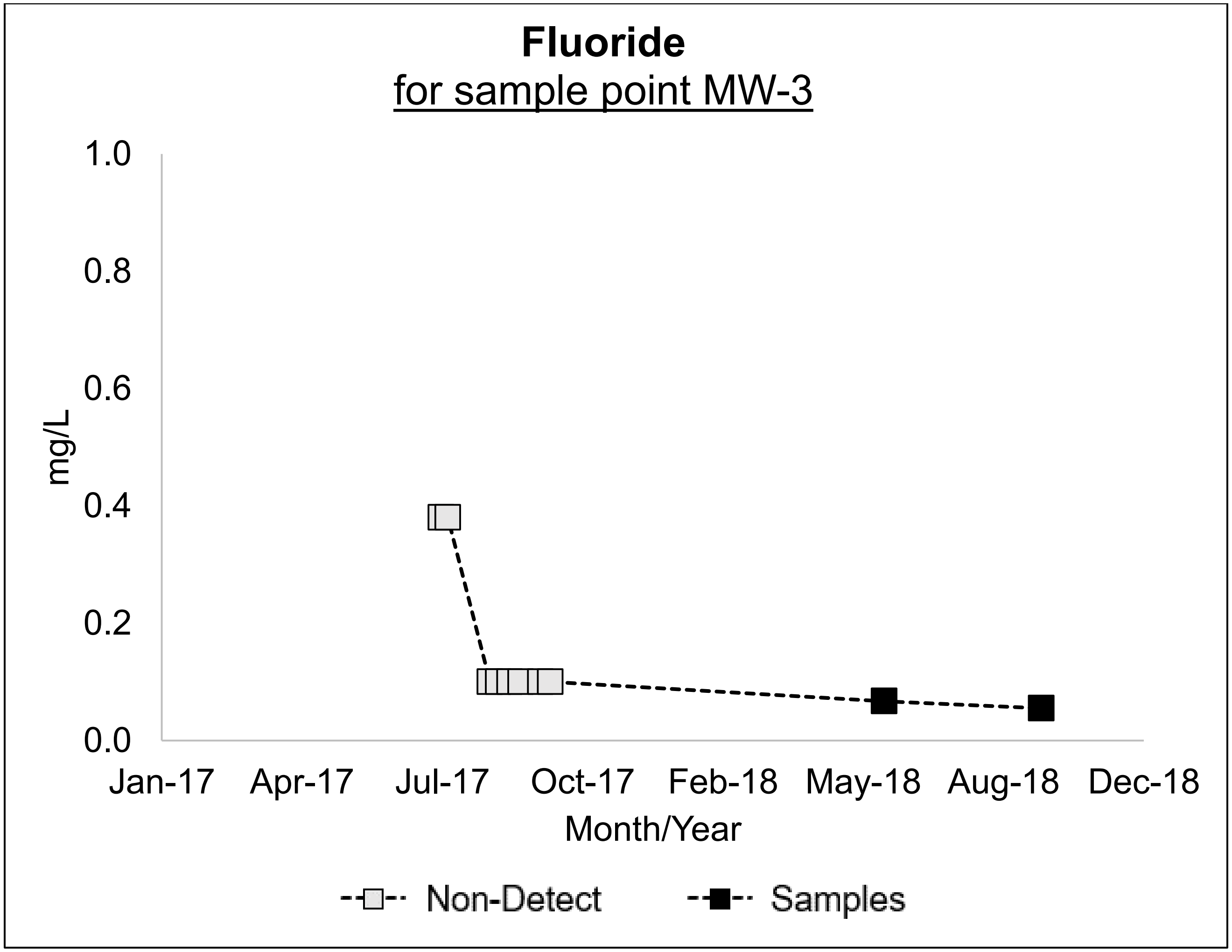
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 17

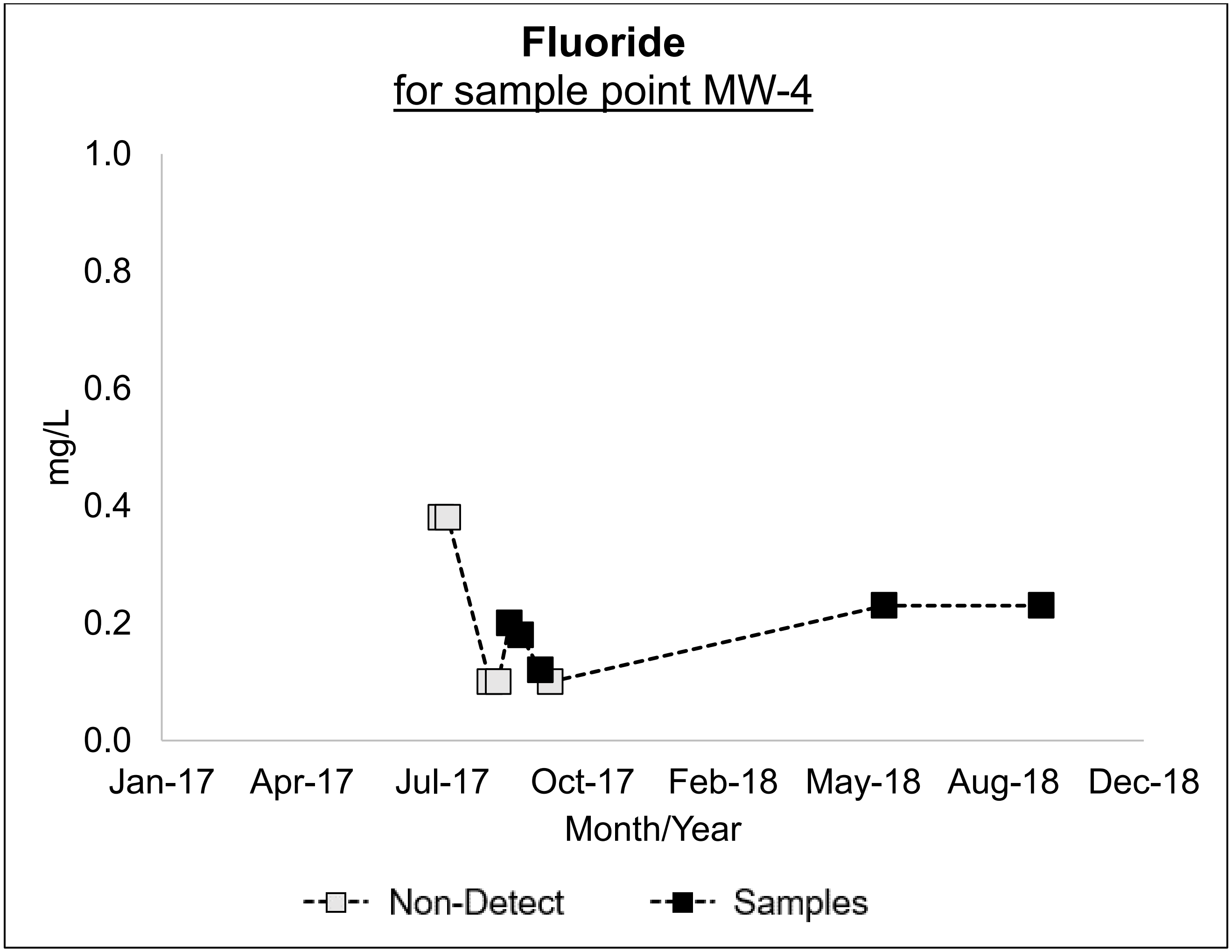
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 18

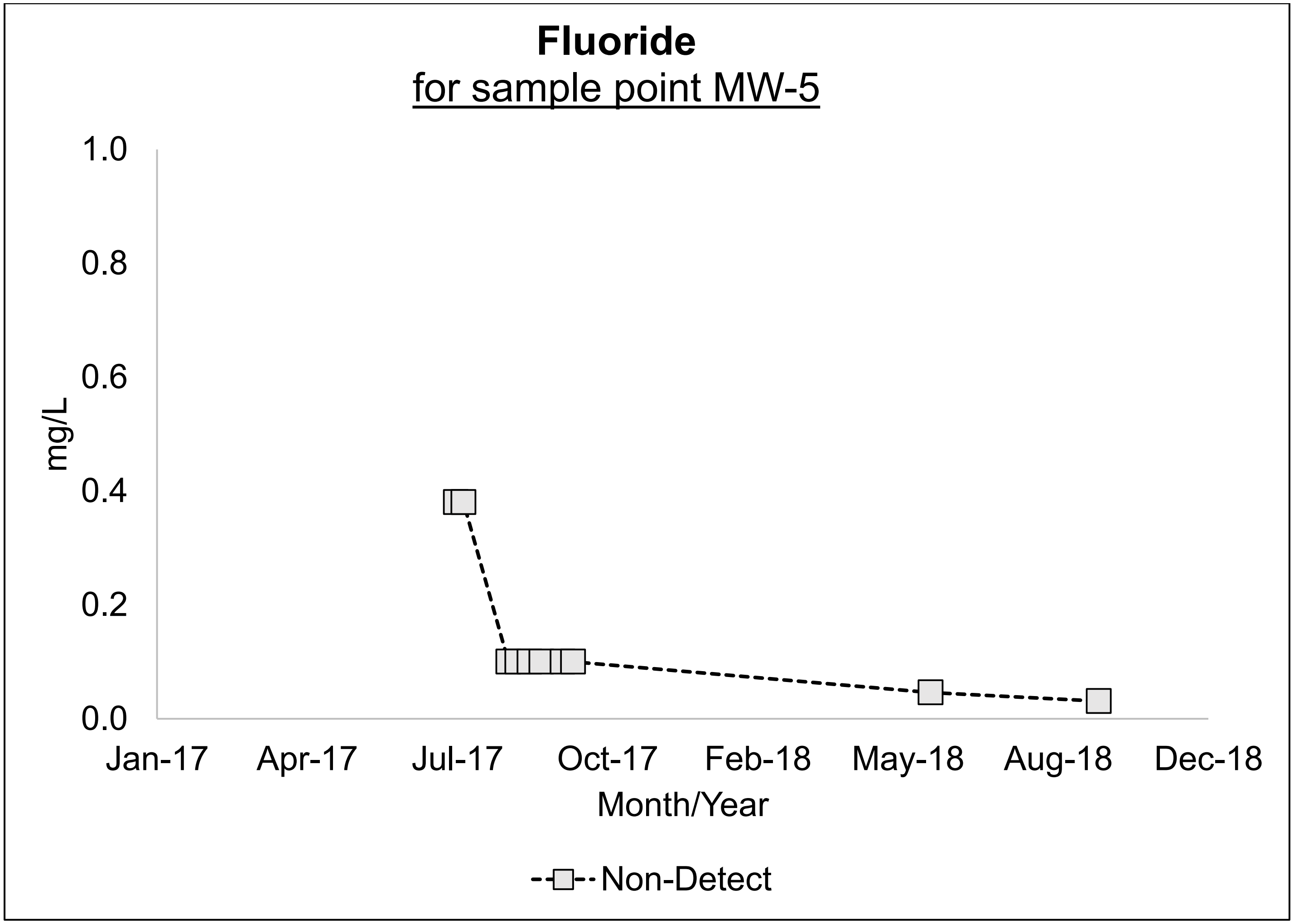
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 19

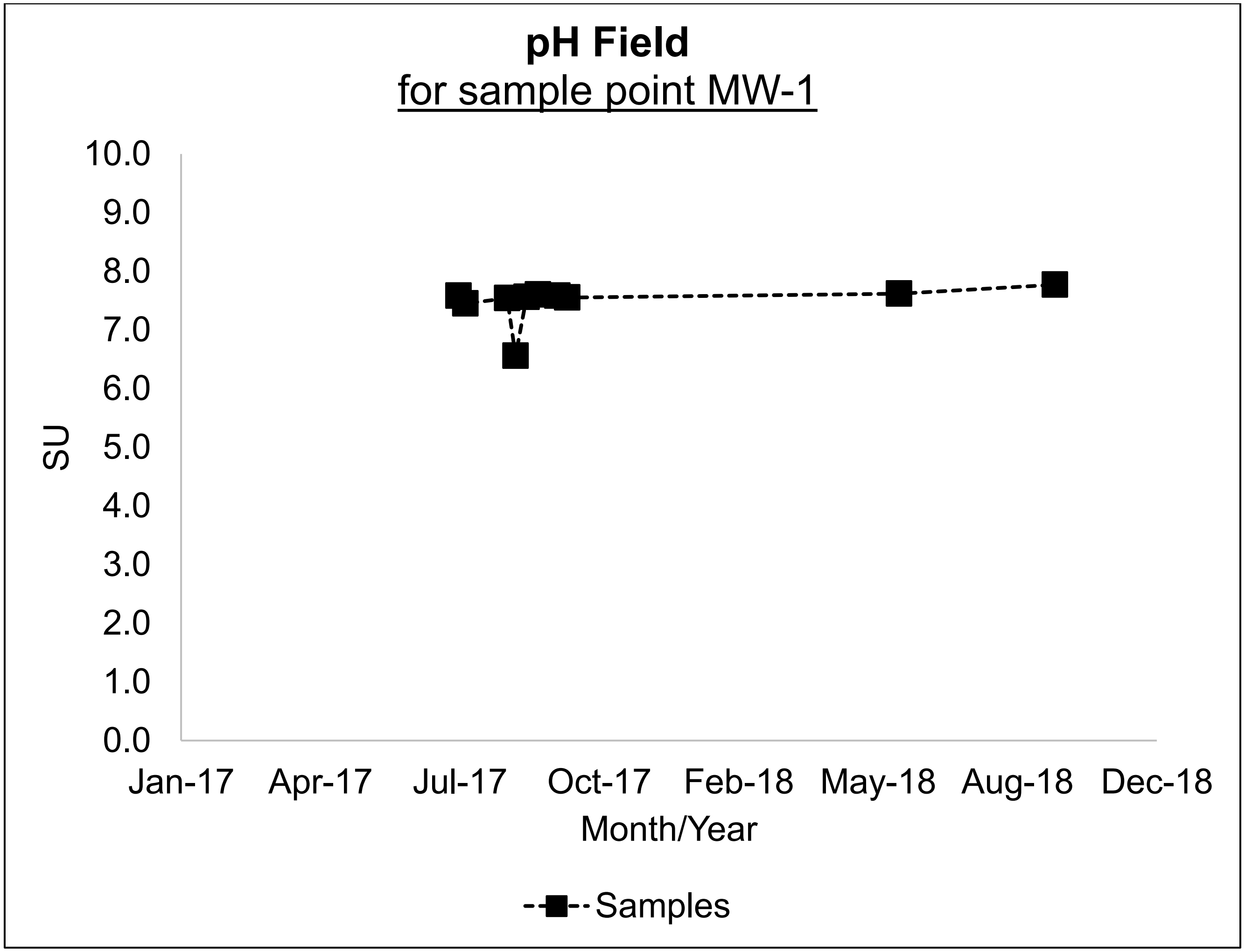
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 20

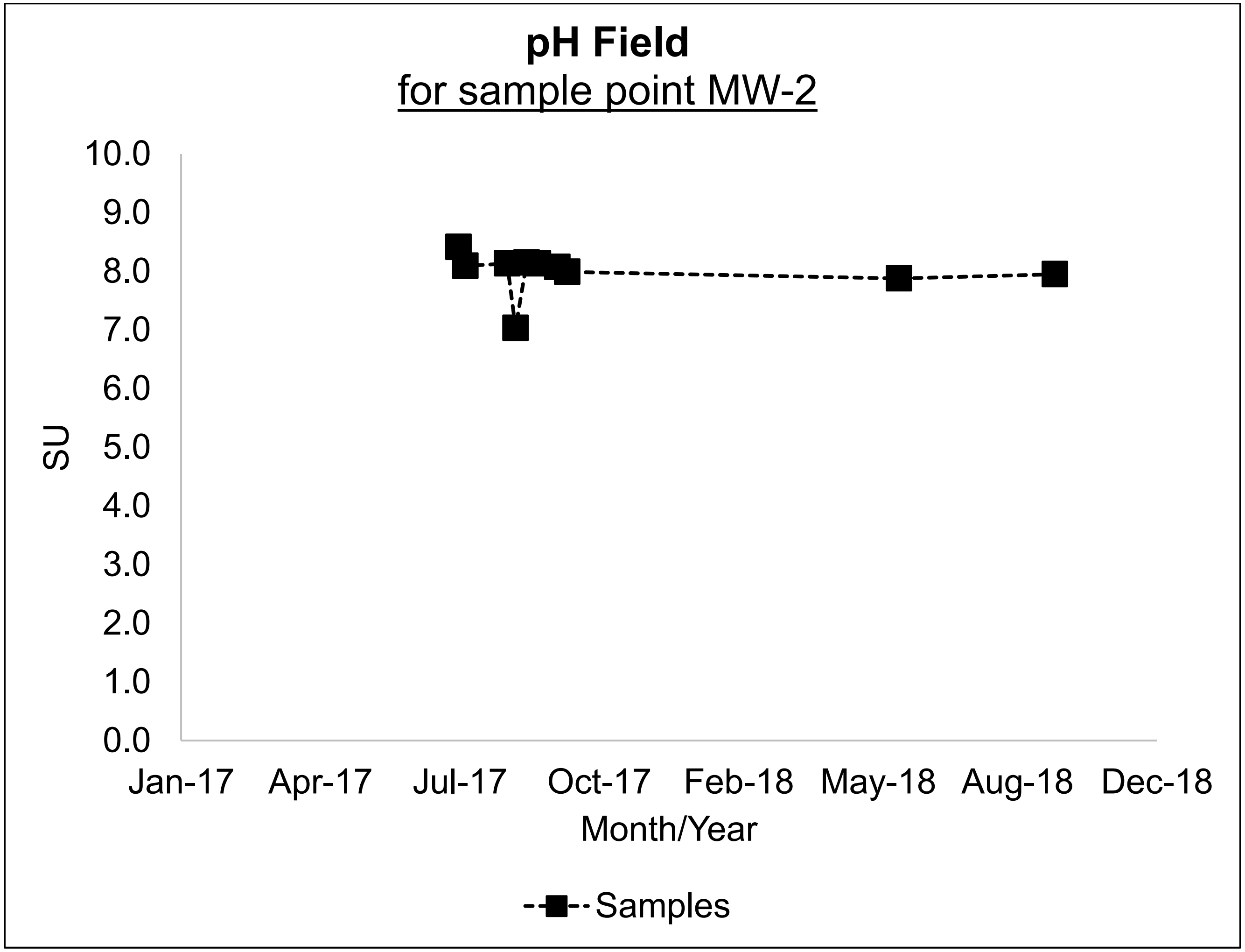
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 21

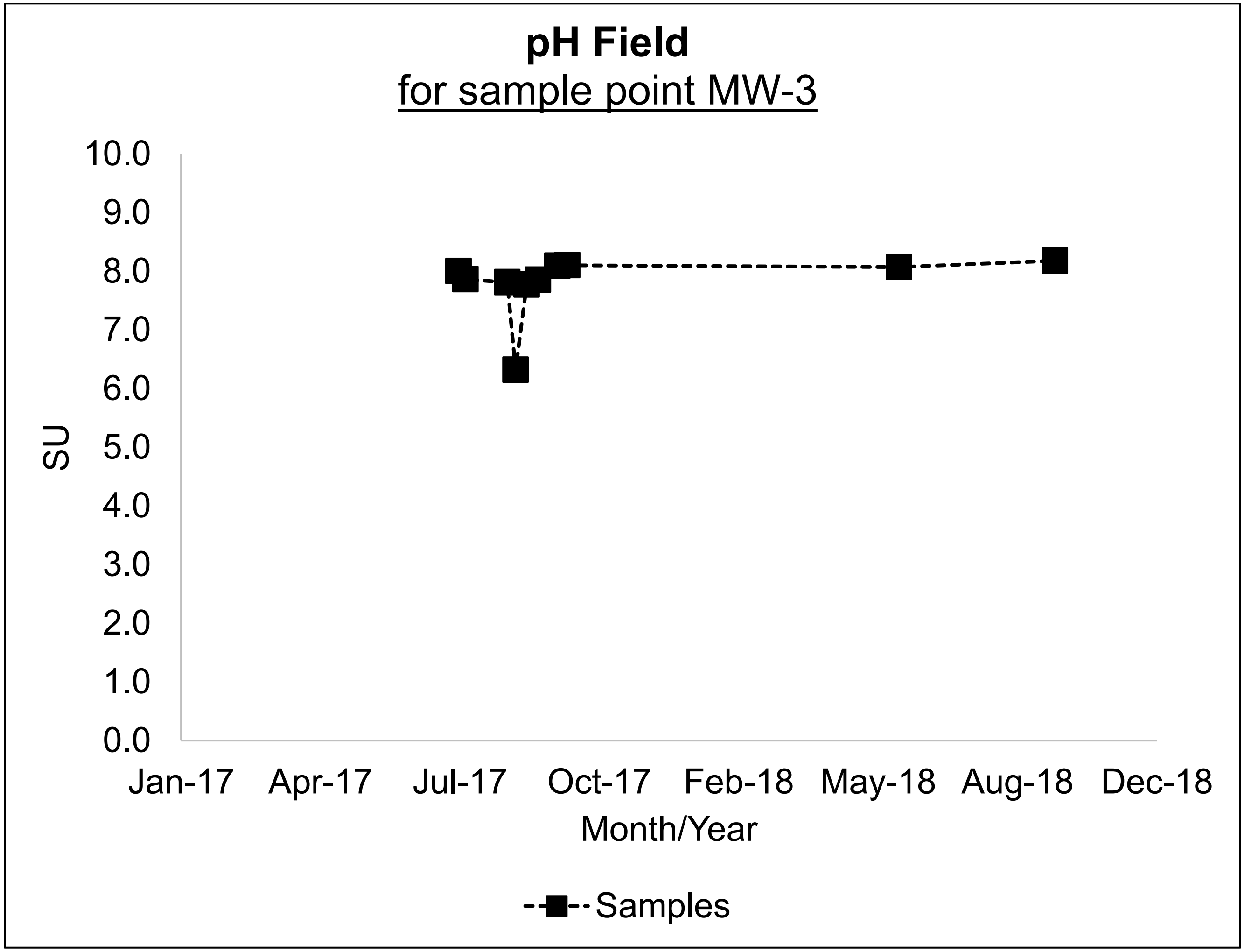
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 22

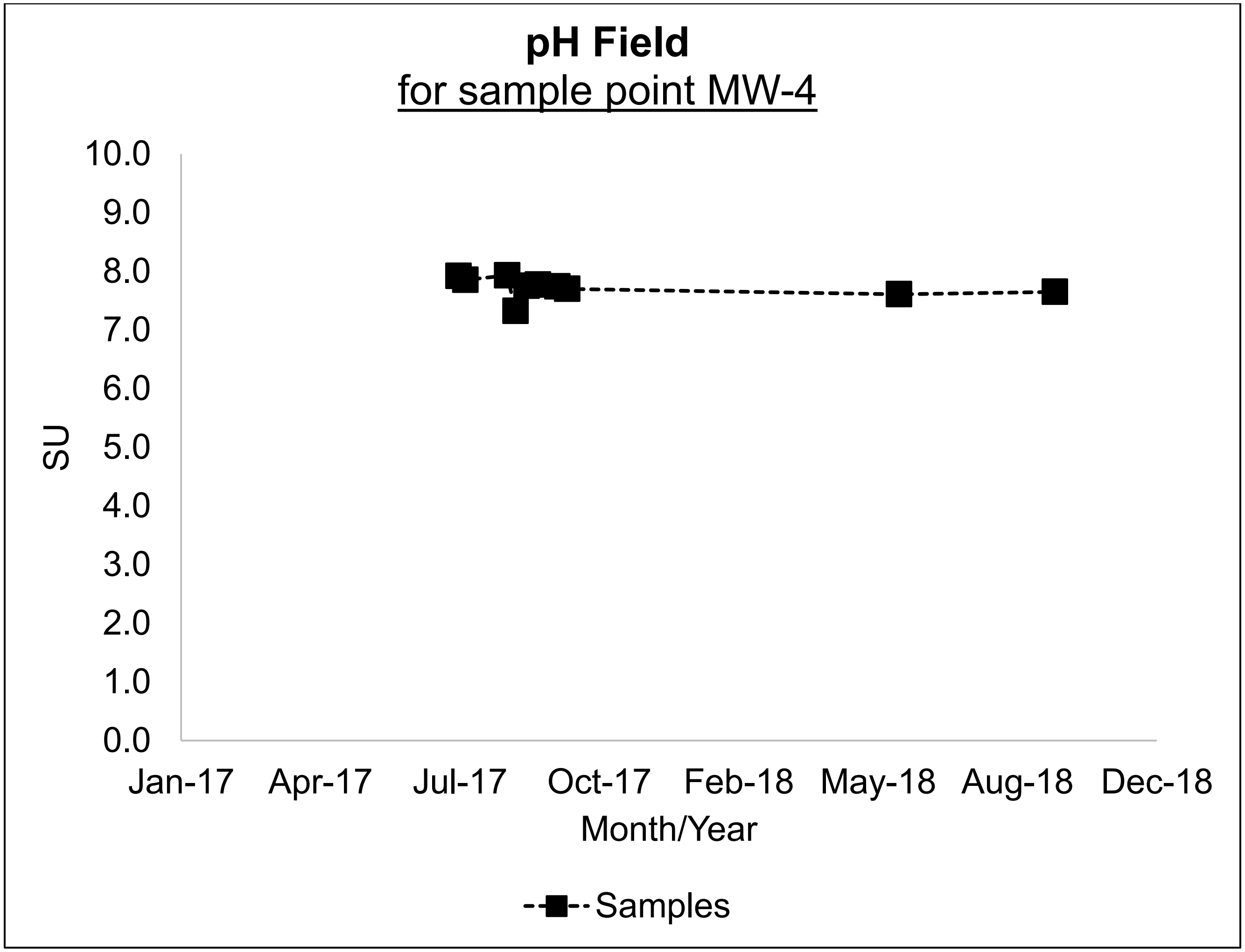
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 23

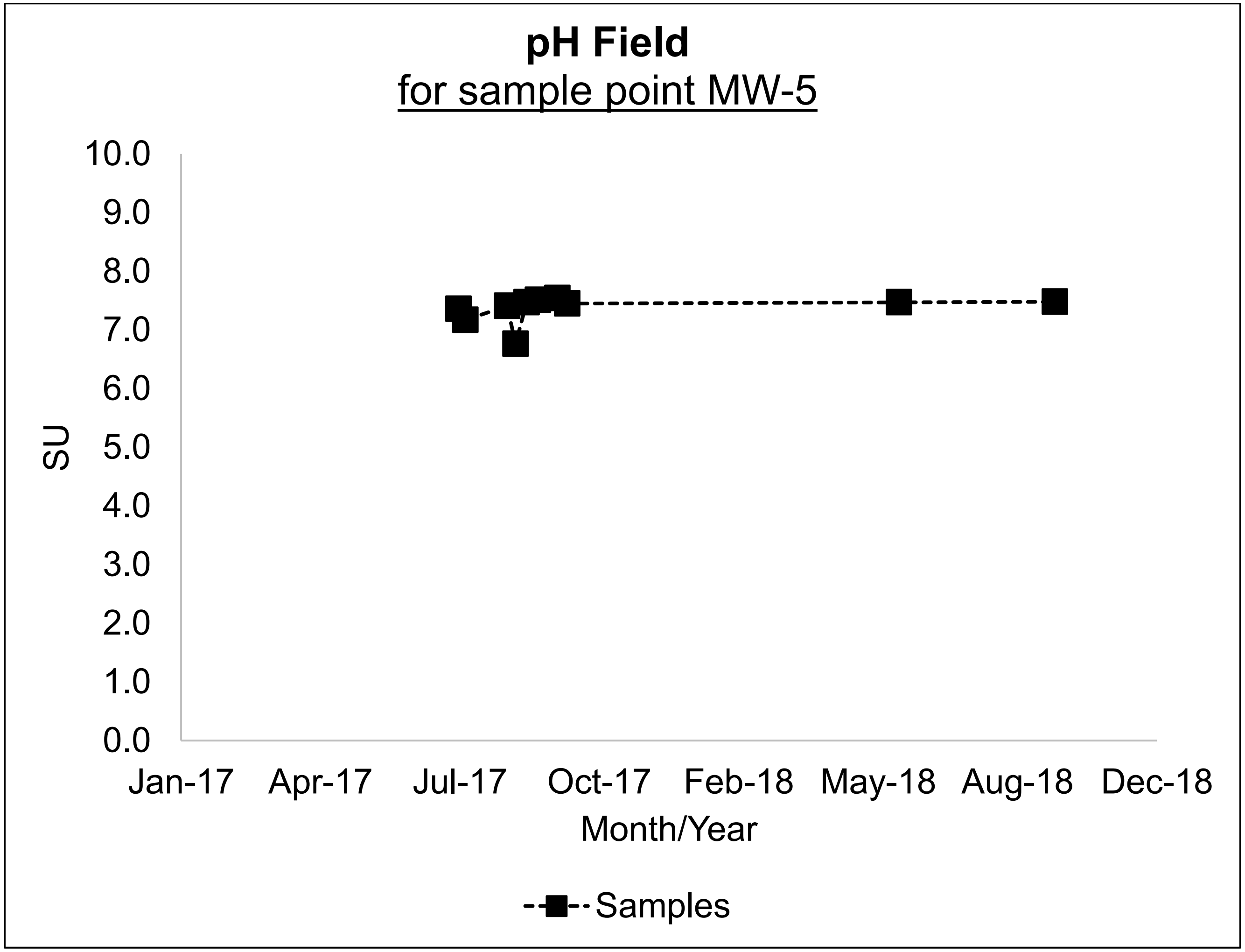
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 24

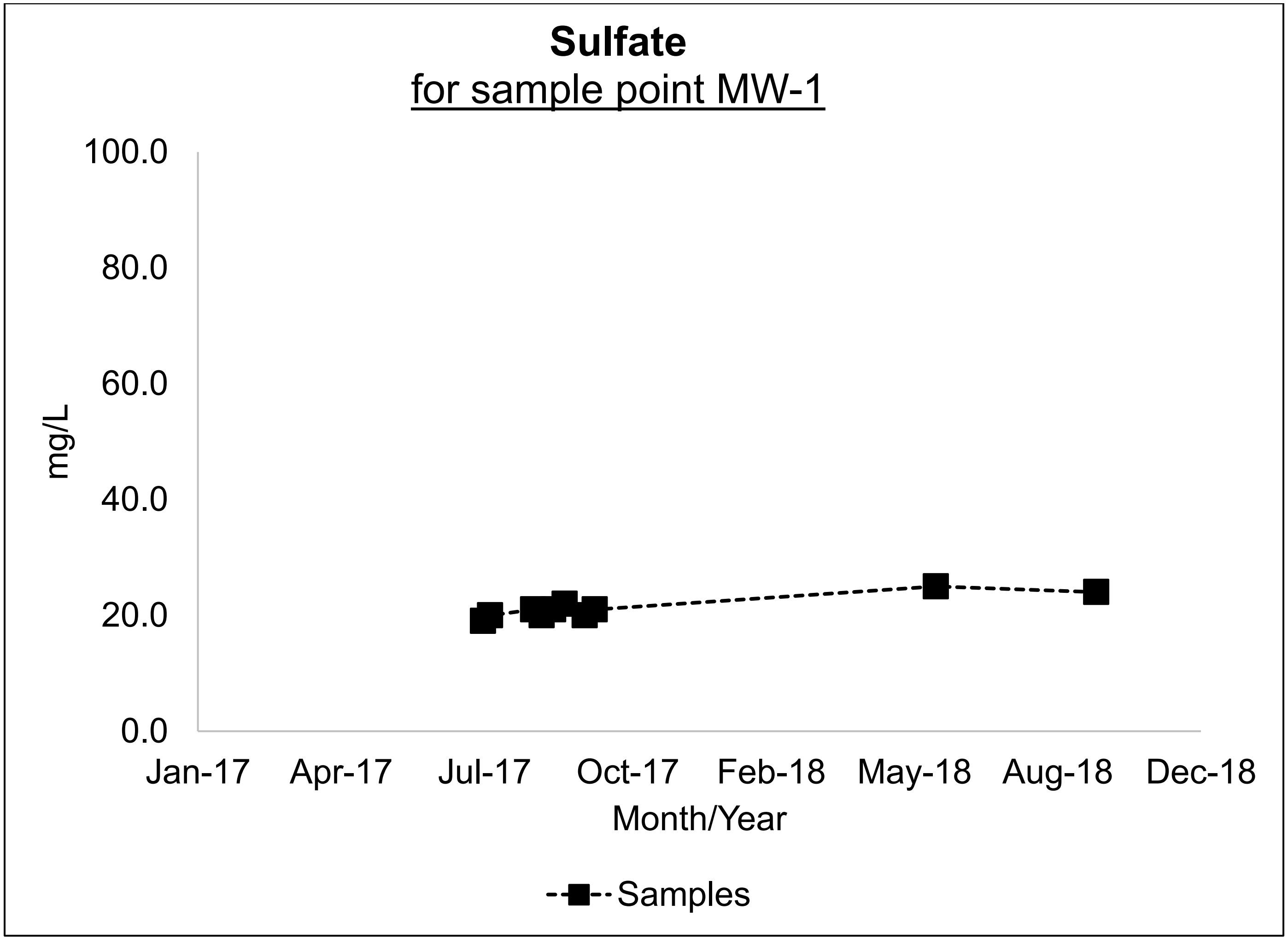
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 25

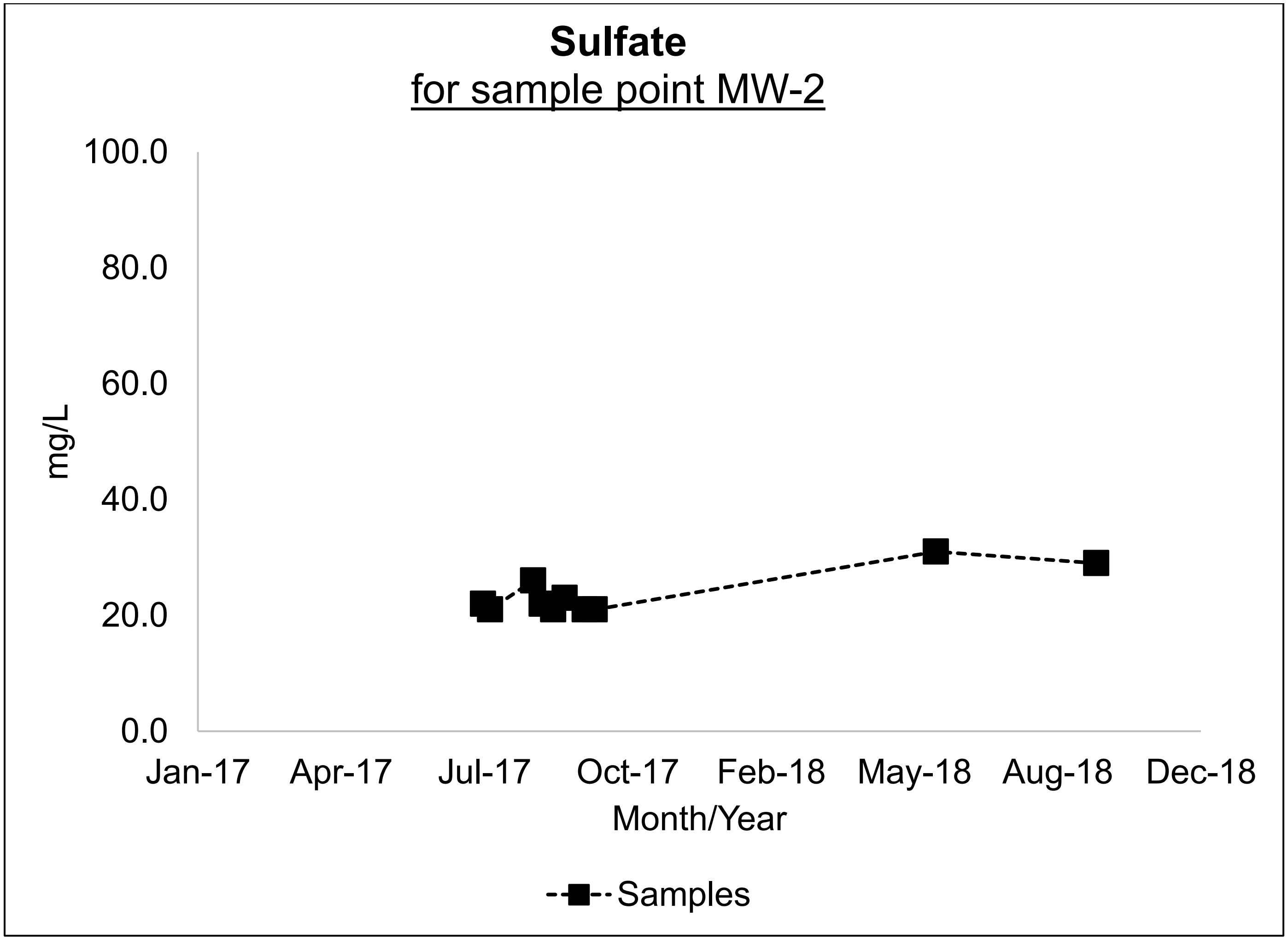
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 26

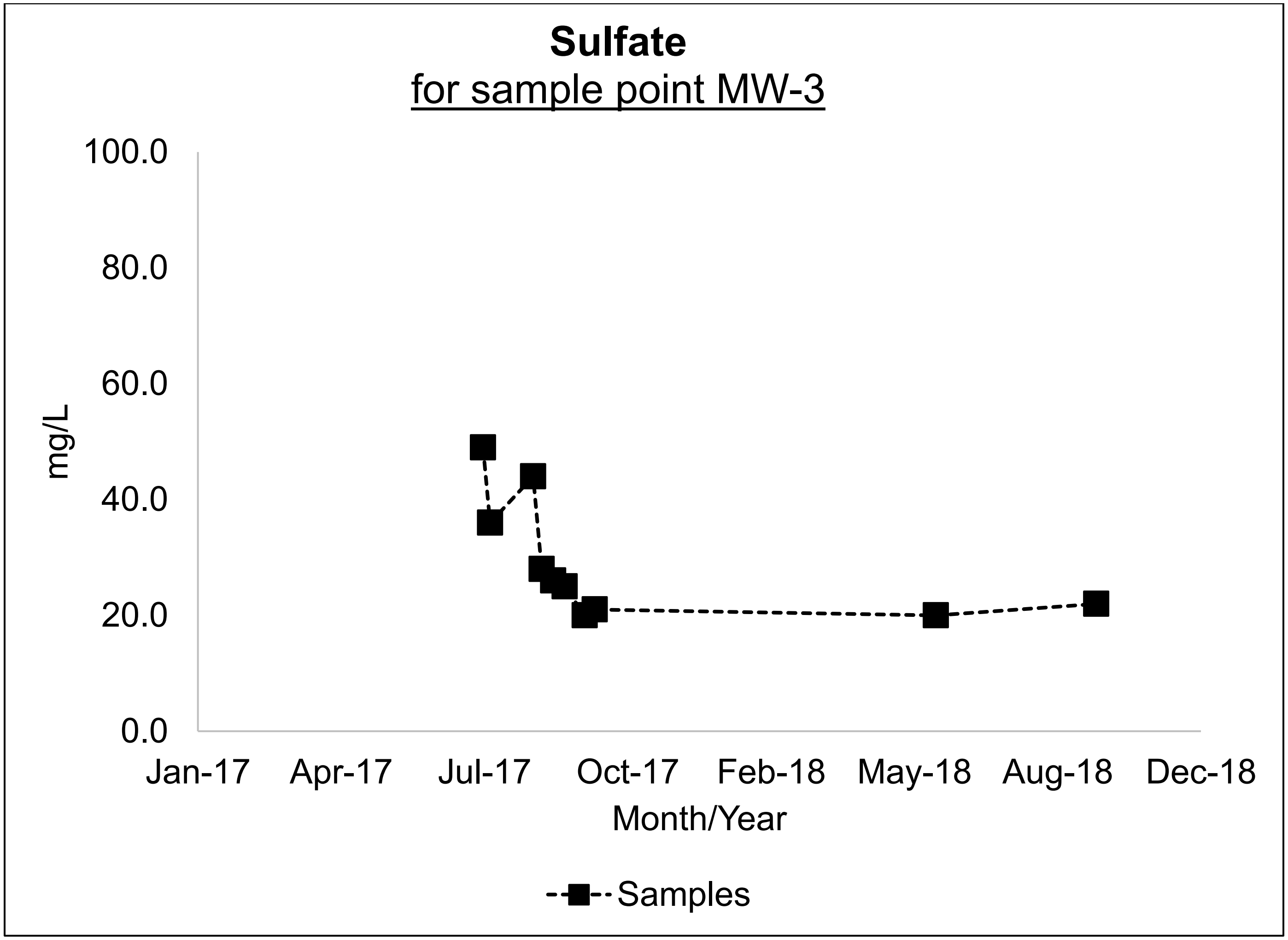
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 27

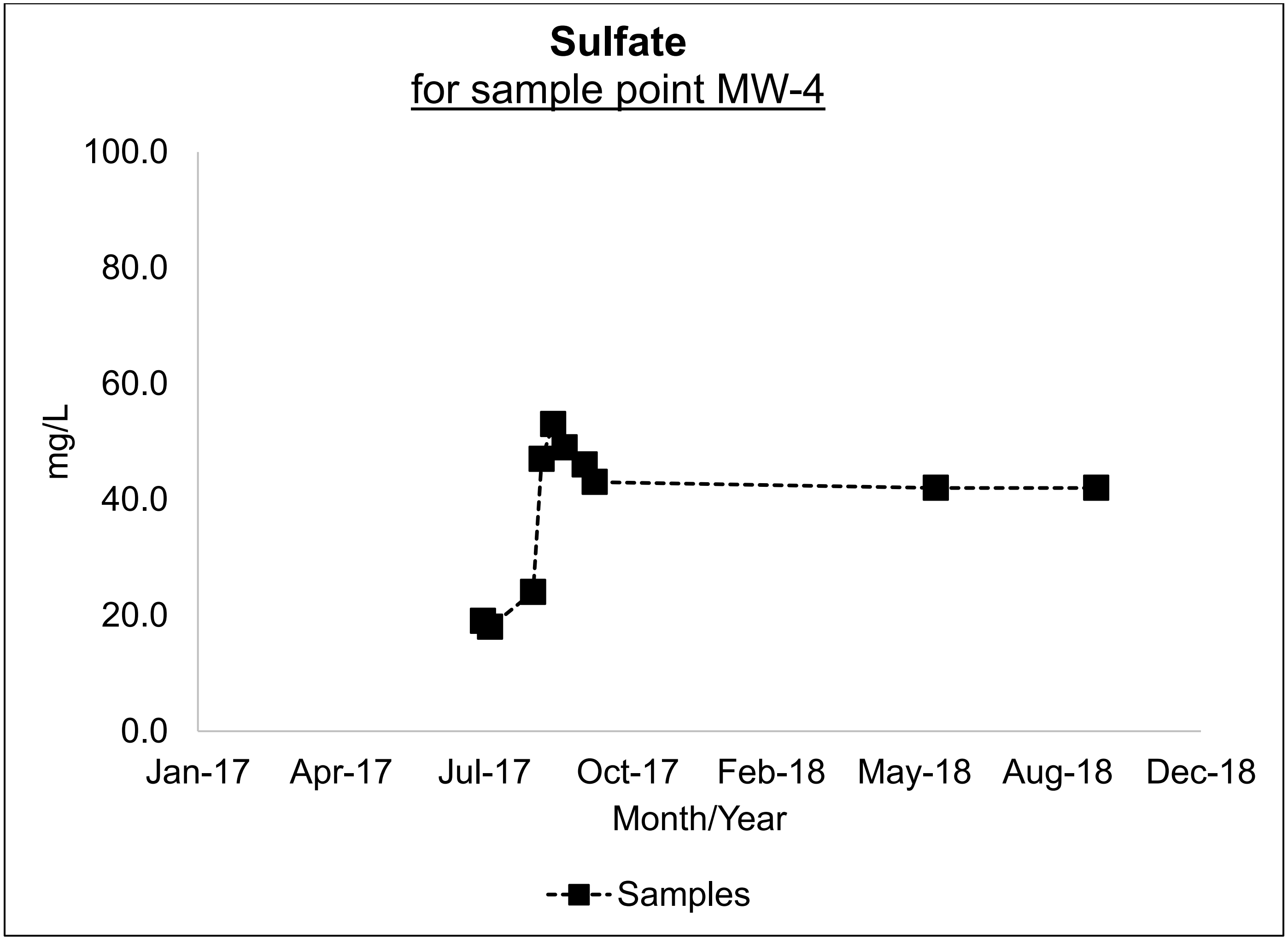
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 28

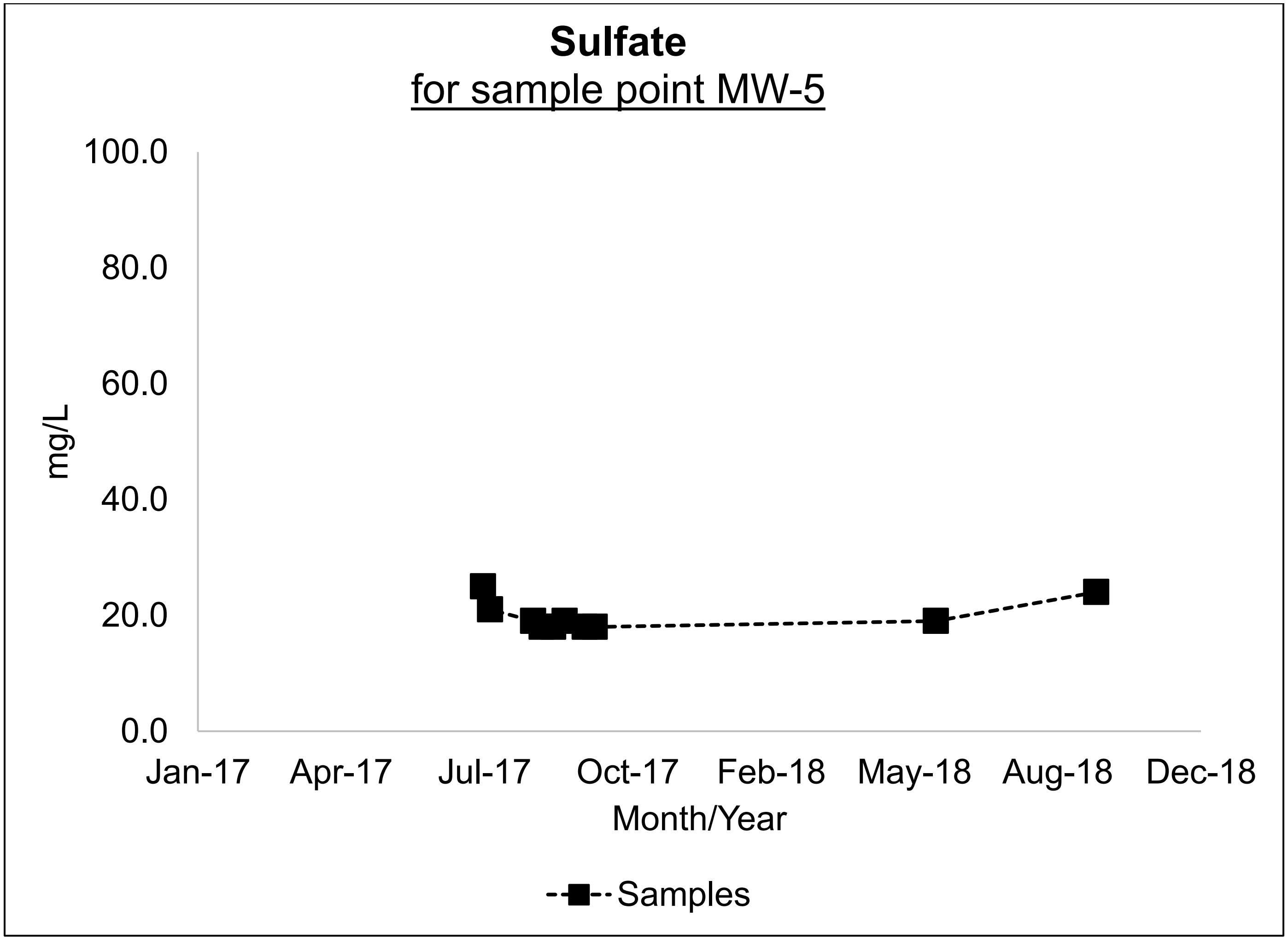
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 29

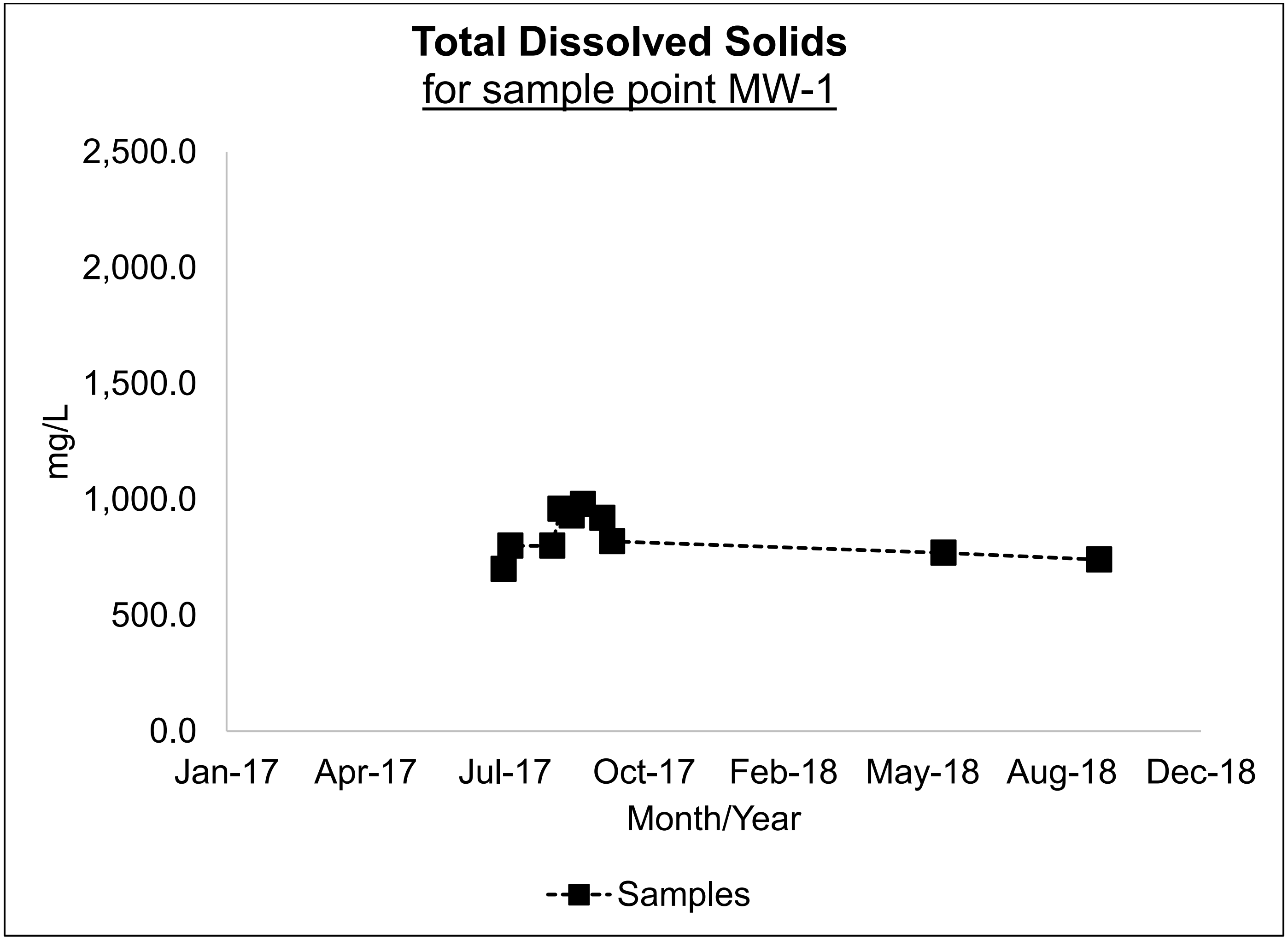
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 30

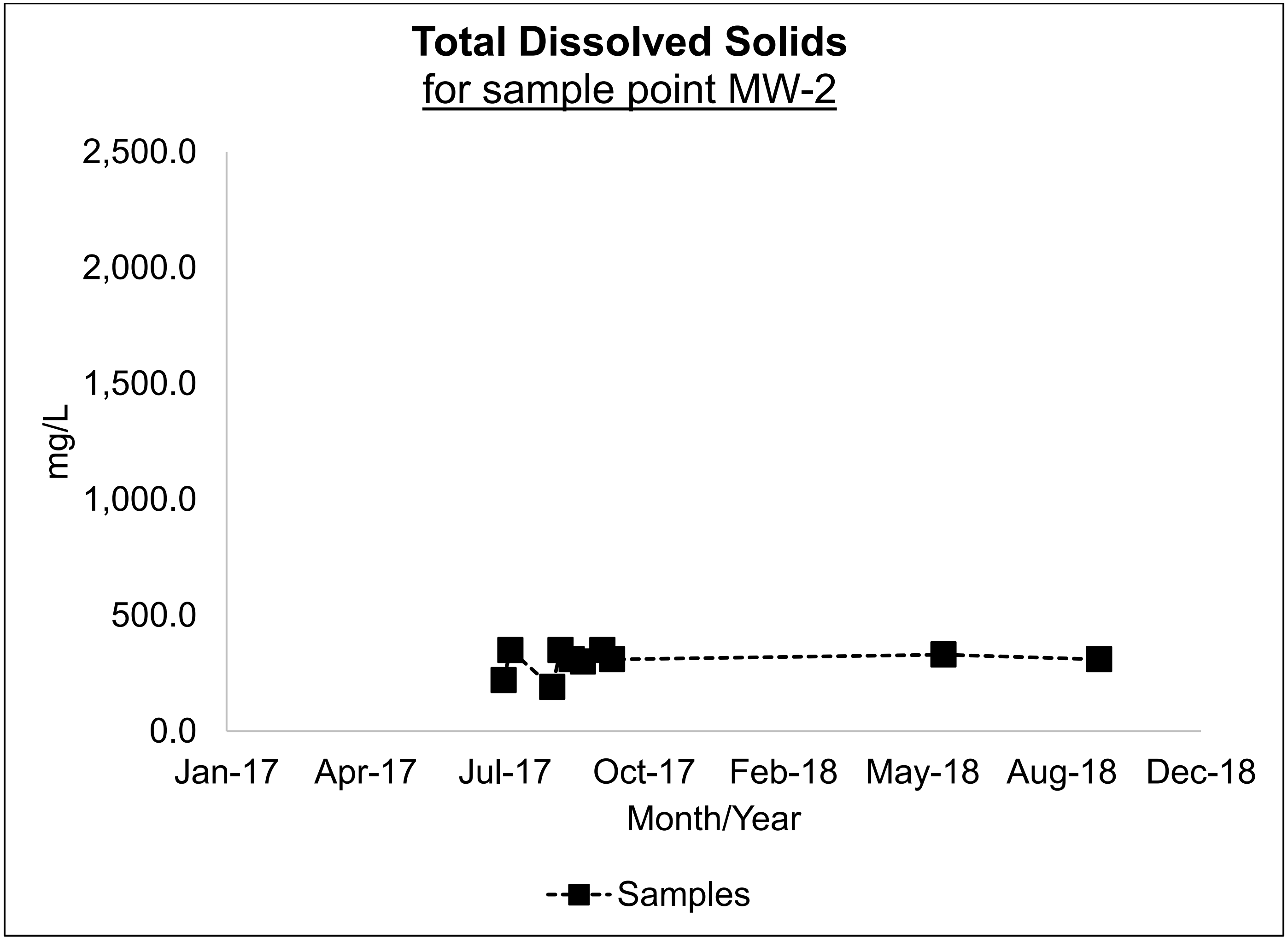
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 31

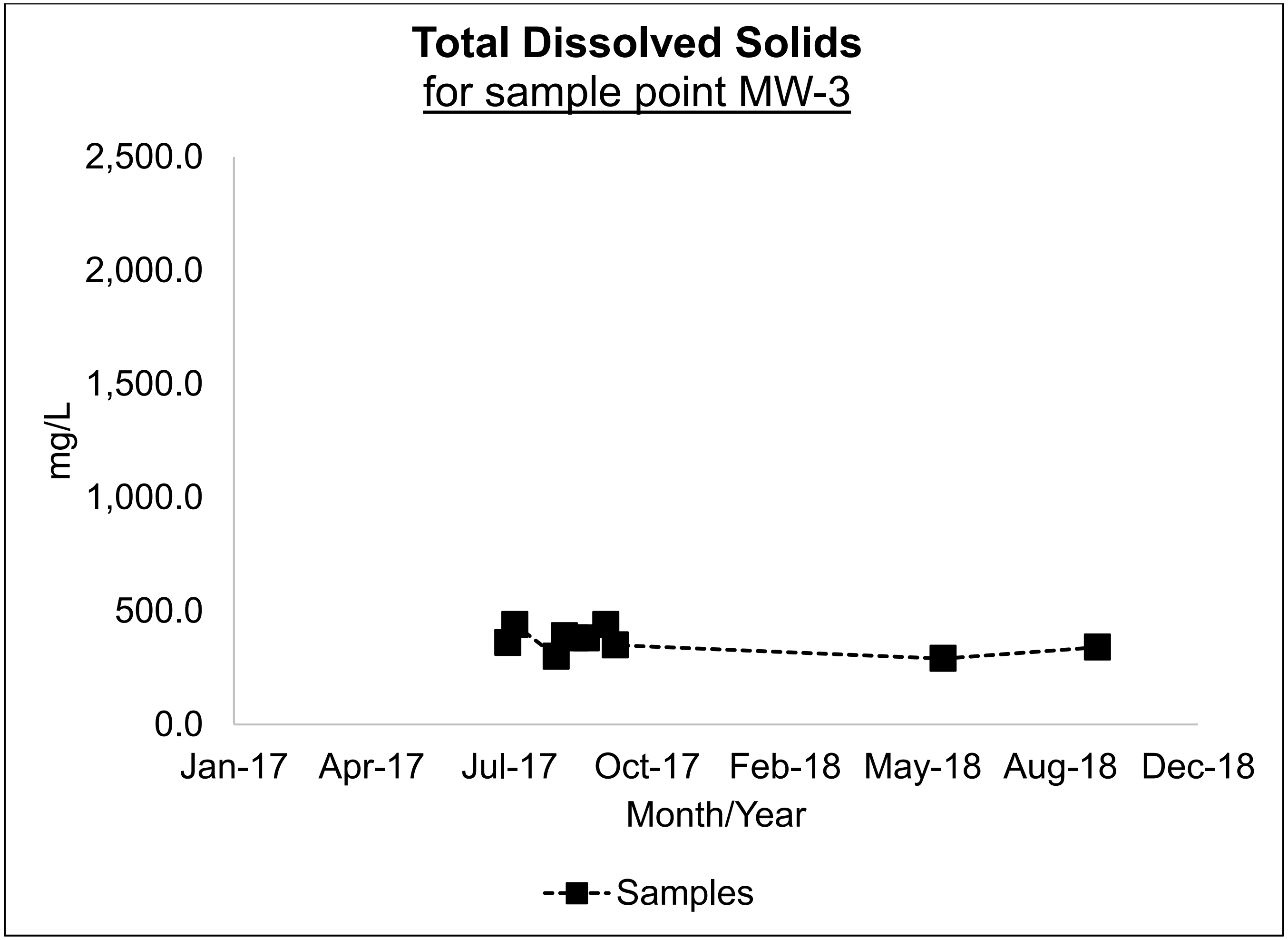
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 32

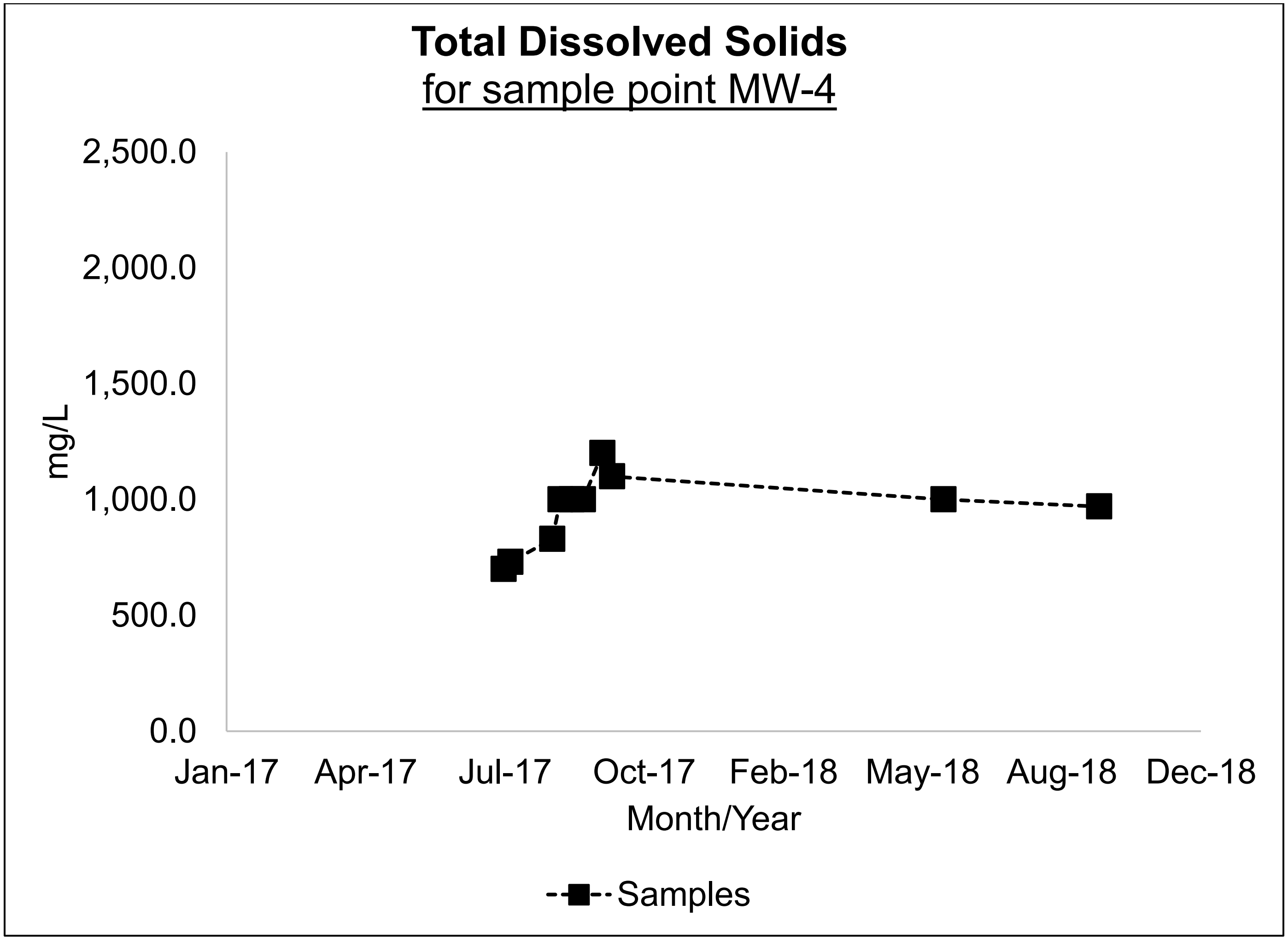
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 33

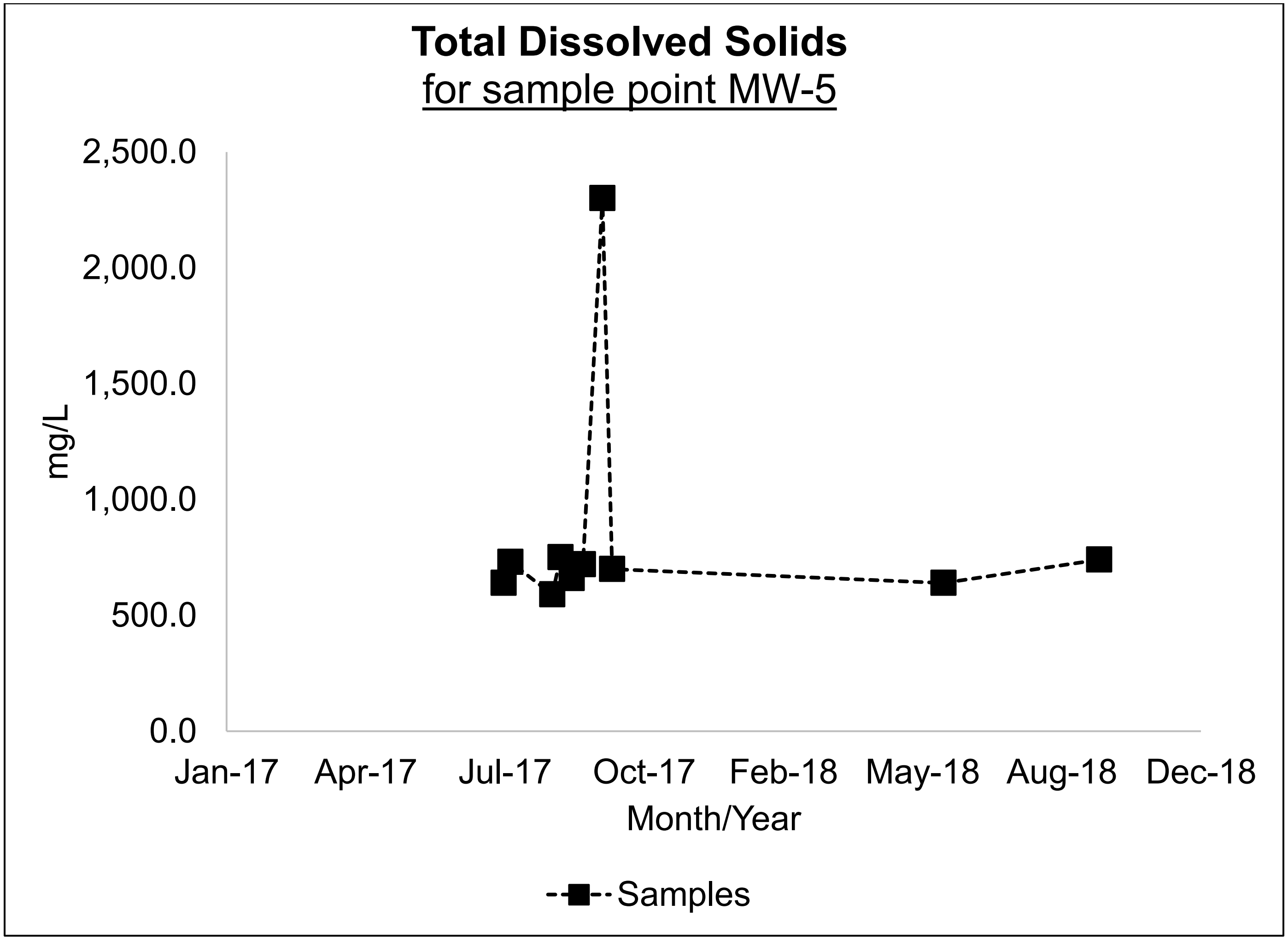
Time Series



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 34

Time Series

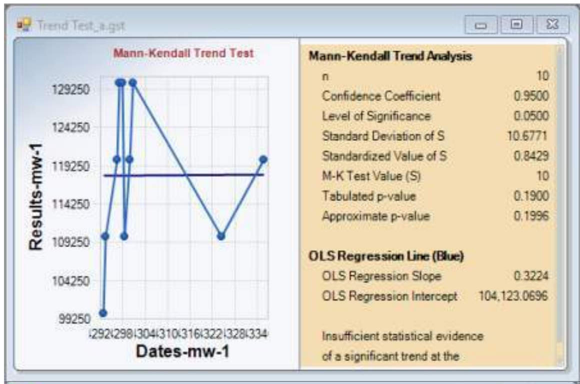


**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 35

Mann-Kendall Trend Test

Calcium



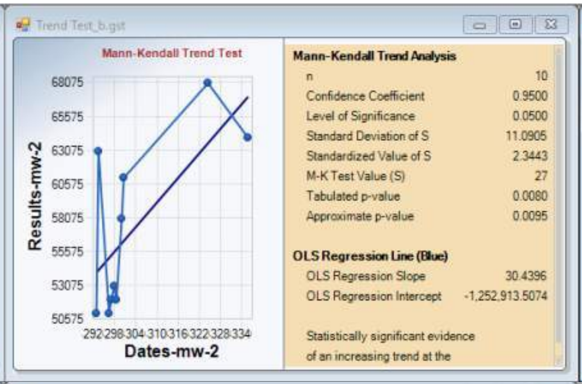
Mann-Kendall Trend Analysis

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	10.6771
Standardized Value of S	0.8429
M-K Test Value (S)	10
Tabulated p-value	0.1900
Approximate p-value	0.1996

OLS Regression Line (Blue)

OLS Regression Slope	0.3224
OLS Regression Intercept	104,123.0696

Insufficient statistical evidence
of a significant trend at the



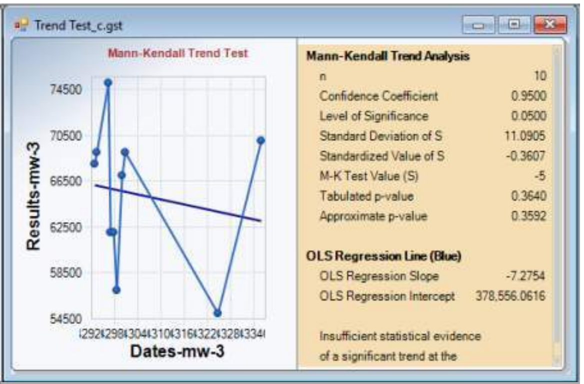
Mann-Kendall Trend Analysis

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	11.0905
Standardized Value of S	2.3443
M-K Test Value (S)	27
Tabulated p-value	0.0080
Approximate p-value	0.0095

OLS Regression Line (Blue)

OLS Regression Slope	30.4396
OLS Regression Intercept	-1,252,913.5074

Statistically significant evidence
of an increasing trend at the



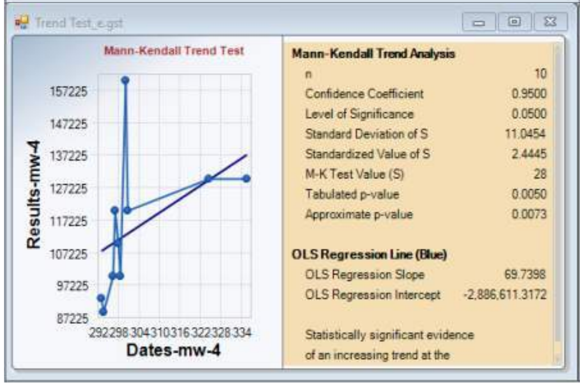
Mann-Kendall Trend Analysis

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	11.0905
Standardized Value of S	-0.3607
M-K Test Value (S)	-5
Tabulated p-value	0.3640
Approximate p-value	0.3592

OLS Regression Line (Blue)

OLS Regression Slope	-7.2754
OLS Regression Intercept	378,556.0616

Insufficient statistical evidence
of a significant trend at the



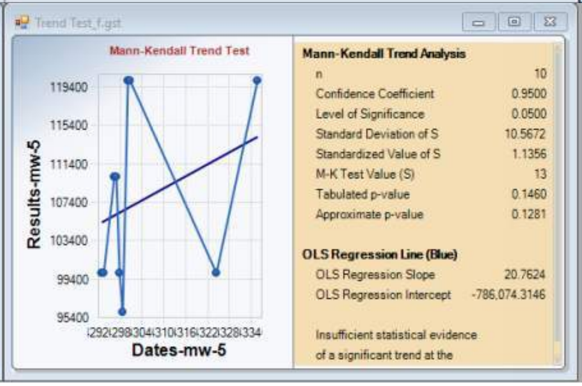
Mann-Kendall Trend Analysis

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	11.0454
Standardized Value of S	2.4445
M-K Test Value (S)	28
Tabulated p-value	0.0050
Approximate p-value	0.0073

OLS Regression Line (Blue)

OLS Regression Slope	69.7398
OLS Regression Intercept	-2,886,611.3172

Statistically significant evidence
of an increasing trend at the



Mann-Kendall Trend Analysis

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	10.5672
Standardized Value of S	1.1356
M-K Test Value (S)	13
Tabulated p-value	0.1460
Approximate p-value	0.1281

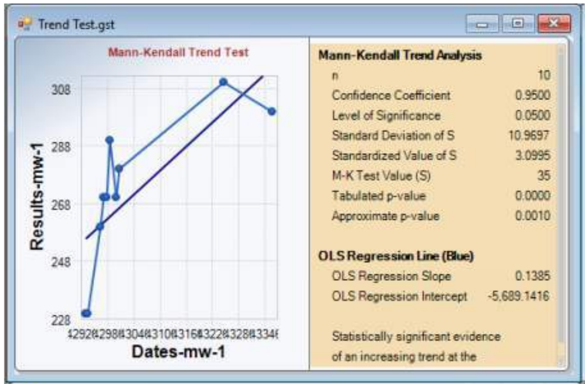
OLS Regression Line (Blue)

OLS Regression Slope	20.7624
OLS Regression Intercept	-786,074.3146

Insufficient statistical evidence
of a significant trend at the

Mann-Kendall Trend Test

Chloride



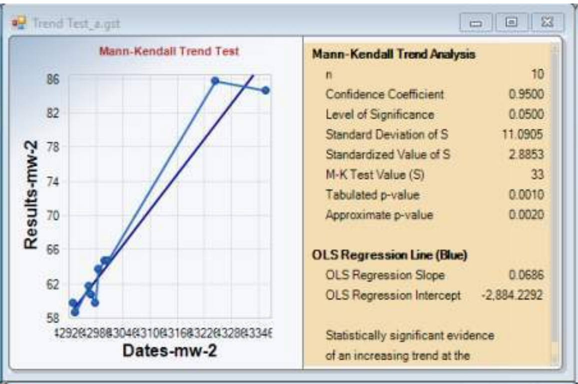
Mann-Kendall Trend Analysis

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	10.9697
Standardized Value of S	3.0995
M-K Test Value (S)	35
Tabulated p-value	0.0000
Approximate p-value	0.0010

OLS Regression Line (Blue)

OLS Regression Slope	0.1385
OLS Regression Intercept	-5,689.1416

Statistically significant evidence
of an increasing trend at the



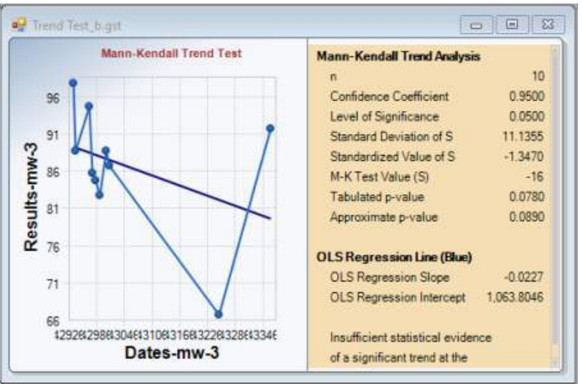
Mann-Kendall Trend Analysis

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	11.0905
Standardized Value of S	2.8853
M-K Test Value (S)	33
Tabulated p-value	0.0010
Approximate p-value	0.0020

OLS Regression Line (Blue)

OLS Regression Slope	0.0686
OLS Regression Intercept	-2,884.2292

Statistically significant evidence
of an increasing trend at the



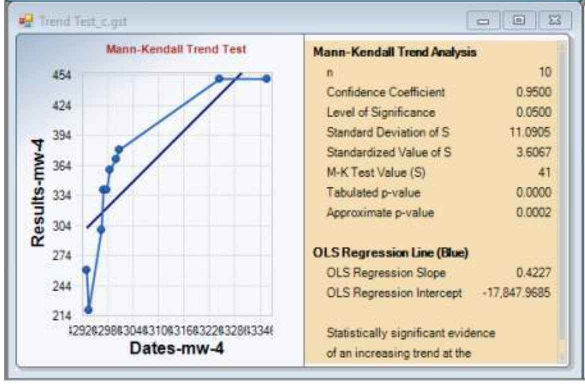
Mann-Kendall Trend Analysis

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	11.1355
Standardized Value of S	-1.3470
M-K Test Value (S)	-16
Tabulated p-value	0.0780
Approximate p-value	0.0890

OLS Regression Line (Blue)

OLS Regression Slope	-0.0227
OLS Regression Intercept	1,063.8046

Insufficient statistical evidence
of a significant trend at the



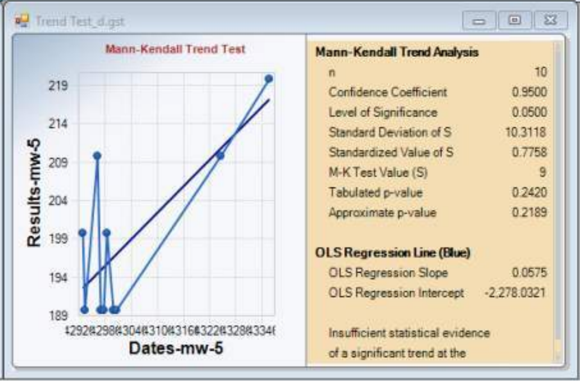
Mann-Kendall Trend Analysis

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	11.0905
Standardized Value of S	3.6067
M-K Test Value (S)	41
Tabulated p-value	0.0000
Approximate p-value	0.0002

OLS Regression Line (Blue)

OLS Regression Slope	0.4227
OLS Regression Intercept	-17,847.9685

Statistically significant evidence
of an increasing trend at the



Mann-Kendall Trend Analysis

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	10.3118
Standardized Value of S	0.7758
M-K Test Value (S)	9
Tabulated p-value	0.2420
Approximate p-value	0.2189

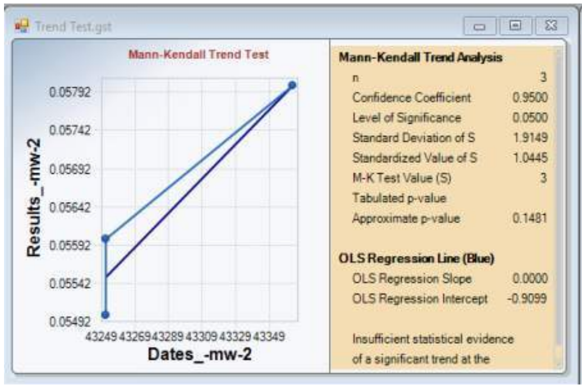
OLS Regression Line (Blue)

OLS Regression Slope	0.0575
OLS Regression Intercept	-2,278.0321

Insufficient statistical evidence
of a significant trend at the

Mann-Kendall Trend Test

Fluoride



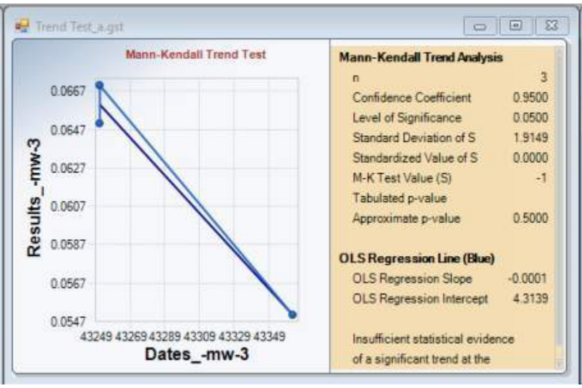
Mann-Kendall Trend Analysis

n	3
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	1.9149
Standardized Value of S	1.0445
M-K Test Value (S)	3
Tabulated p-value	
Approximate p-value	0.1481

OLS Regression Line (Blue)

OLS Regression Slope	0.0000
OLS Regression Intercept	-0.9099

Insufficient statistical evidence of a significant trend at the



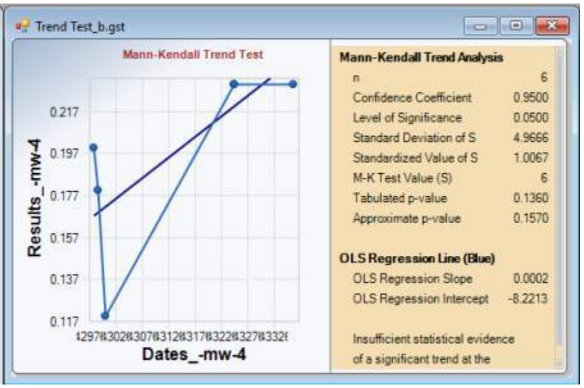
Mann-Kendall Trend Analysis

n	3
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	1.9149
Standardized Value of S	0.0000
M-K Test Value (S)	-1
Tabulated p-value	
Approximate p-value	0.5000

OLS Regression Line (Blue)

OLS Regression Slope	-0.0001
OLS Regression Intercept	4.3139

Insufficient statistical evidence of a significant trend at the



Mann-Kendall Trend Analysis

n	6
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	4.9666
Standardized Value of S	1.0067
M-K Test Value (S)	6
Tabulated p-value	0.1360
Approximate p-value	0.1570

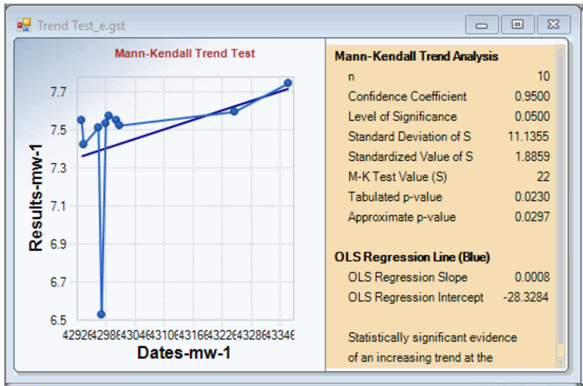
OLS Regression Line (Blue)

OLS Regression Slope	0.0002
OLS Regression Intercept	-8.2213

Insufficient statistical evidence of a significant trend at the

Mann-Kendall Trend Test

pH-Field



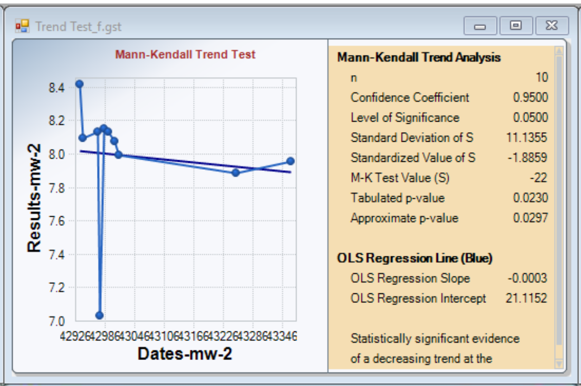
Mann-Kendall Trend Analysis

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	11.1355
Standardized Value of S	1.8859
M-K Test Value (S)	22
Tabulated p-value	0.0230
Approximate p-value	0.0297

OLS Regression Line (Blue)

OLS Regression Slope	0.0008
OLS Regression Intercept	-28.3284

Statistically significant evidence
of an increasing trend at the



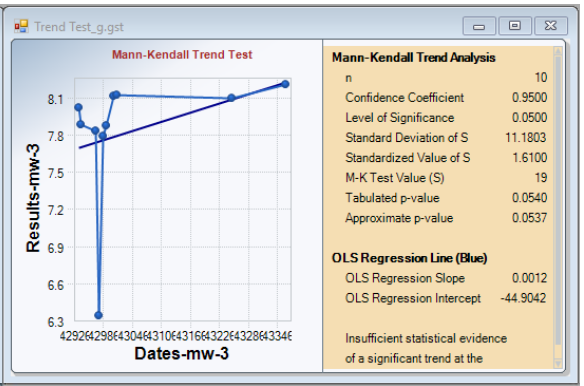
Mann-Kendall Trend Analysis

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	11.1355
Standardized Value of S	-1.8859
M-K Test Value (S)	-22
Tabulated p-value	0.0230
Approximate p-value	0.0297

OLS Regression Line (Blue)

OLS Regression Slope	-0.0003
OLS Regression Intercept	21.1152

Statistically significant evidence
of a decreasing trend at the



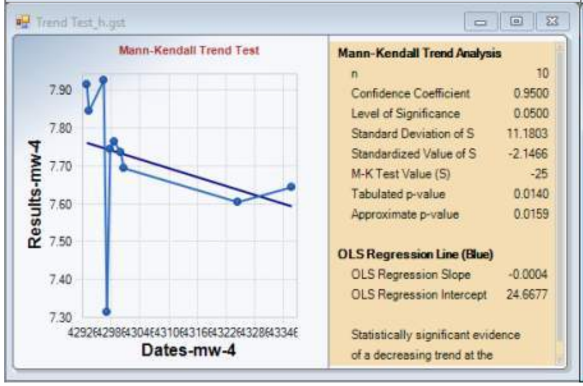
Mann-Kendall Trend Analysis

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	11.1803
Standardized Value of S	1.6100
M-K Test Value (S)	19
Tabulated p-value	0.0540
Approximate p-value	0.0537

OLS Regression Line (Blue)

OLS Regression Slope	0.0012
OLS Regression Intercept	-44.9042

Insufficient statistical evidence
of a significant trend at the



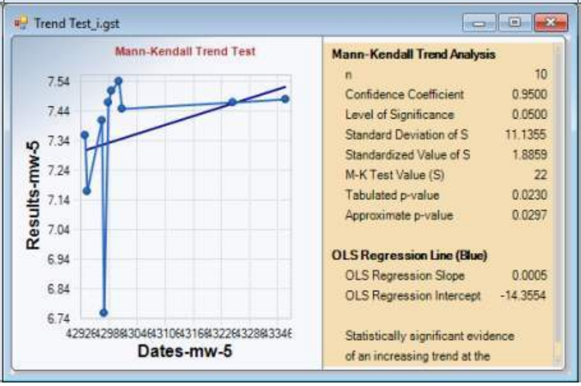
Mann-Kendall Trend Analysis

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	11.1803
Standardized Value of S	-2.1466
M-K Test Value (S)	-25
Tabulated p-value	0.0140
Approximate p-value	0.0159

OLS Regression Line (Blue)

OLS Regression Slope	-0.0004
OLS Regression Intercept	24.6677

Statistically significant evidence
of a decreasing trend at the



Mann-Kendall Trend Analysis

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	11.1355
Standardized Value of S	1.8859
M-K Test Value (S)	22
Tabulated p-value	0.0230
Approximate p-value	0.0297

OLS Regression Line (Blue)

OLS Regression Slope	0.0005
OLS Regression Intercept	-14.3554

Statistically significant evidence
of an increasing trend at the

Mann-Kendall Trend Test

Sulfate

Mann-Kendall Trend Analysis (Trend Test.gst)

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	10.8474
Standardized Value of S	2.3969
M-K Test Value (S)	27
Tabulated p-value	0.0080
Approximate p-value	0.0083

OLS Regression Line (Blue)

OLS Regression Slope	0.0116
OLS Regression Intercept	-479.1946

Statistically significant evidence
of an increasing trend at the

Mann-Kendall Trend Analysis (Trend Test_a.gst)

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	10.7393
Standardized Value of S	0.6518
M-K Test Value (S)	8
Tabulated p-value	0.2420
Approximate p-value	0.2573

OLS Regression Line (Blue)

OLS Regression Slope	0.0215
OLS Regression Intercept	-900.9661

Insufficient statistical evidence
of a significant trend at the

Mann-Kendall Trend Analysis (Trend Test_b.gst)

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	11.1355
Standardized Value of S	-2.9635
M-K Test Value (S)	-34
Tabulated p-value	0.0000
Approximate p-value	0.0015

OLS Regression Line (Blue)

OLS Regression Slope	-0.0380
OLS Regression Intercept	1,663.5711

Statistically significant evidence
of a decreasing trend at the

Mann-Kendall Trend Analysis (Trend Test_c.gst)

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	11.1355
Standardized Value of S	0.4490
M-K Test Value (S)	6
Tabulated p-value	0.3000
Approximate p-value	0.3267

OLS Regression Line (Blue)

OLS Regression Slope	0.0255
OLS Regression Intercept	-1,060.5216

Insufficient statistical evidence
of a significant trend at the

Mann-Kendall Trend Analysis (Trend Test_d.gst)

n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	10.6145
Standardized Value of S	-0.6595
M-K Test Value (S)	-8
Tabulated p-value	0.2420
Approximate p-value	0.2548

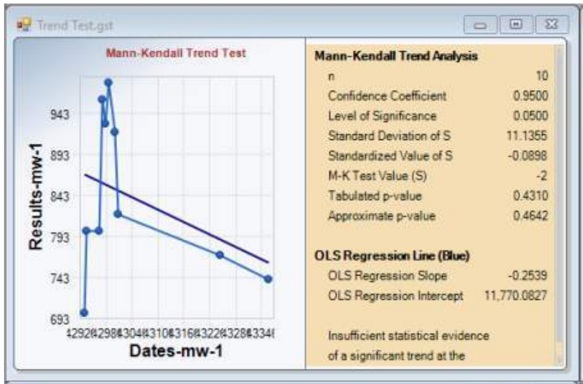
OLS Regression Line (Blue)

OLS Regression Slope	0.0050
OLS Regression Intercept	-197.2740

Insufficient statistical evidence
of a significant trend at the

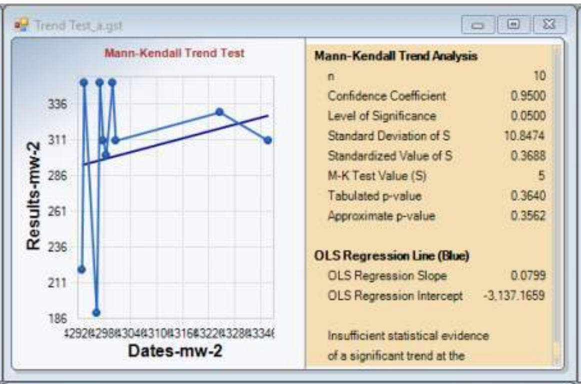
Mann-Kendall Trend Test

Total Dissolved Solids



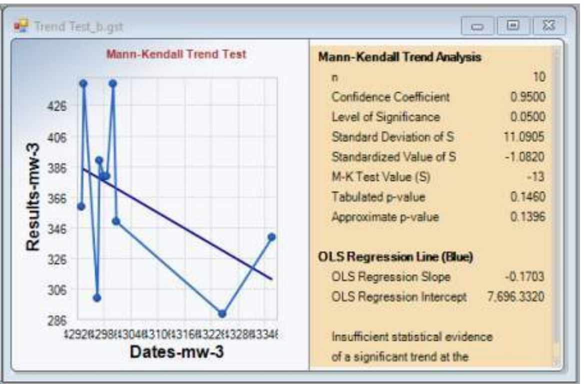
Mann-Kendall Trend Analysis	
n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	11.1355
Standardized Value of S	-0.0898
M-K Test Value (S)	-2
Tabulated p-value	0.4310
Approximate p-value	0.4642
OLS Regression Line (Blue)	
OLS Regression Slope	-0.2539
OLS Regression Intercept	11,770.0827

Insufficient statistical evidence of a significant trend at the



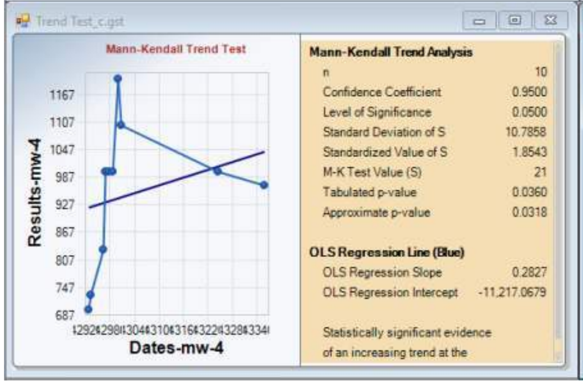
Mann-Kendall Trend Analysis	
n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	10.8474
Standardized Value of S	0.3688
M-K Test Value (S)	5
Tabulated p-value	0.3640
Approximate p-value	0.3562
OLS Regression Line (Blue)	
OLS Regression Slope	0.0799
OLS Regression Intercept	-3,137.1659

Insufficient statistical evidence of a significant trend at the



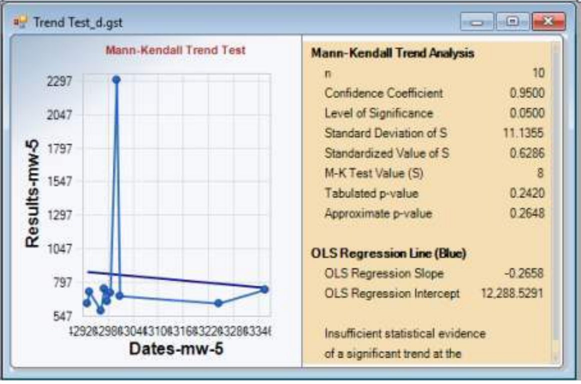
Mann-Kendall Trend Analysis	
n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	11.0905
Standardized Value of S	-1.0820
M-K Test Value (S)	-13
Tabulated p-value	0.1460
Approximate p-value	0.1396
OLS Regression Line (Blue)	
OLS Regression Slope	-0.1703
OLS Regression Intercept	7,696.3320

Insufficient statistical evidence of a significant trend at the



Mann-Kendall Trend Analysis	
n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	10.7858
Standardized Value of S	1.8543
M-K Test Value (S)	21
Tabulated p-value	0.0360
Approximate p-value	0.0318
OLS Regression Line (Blue)	
OLS Regression Slope	0.2827
OLS Regression Intercept	-11,217.0679

Statistically significant evidence of an increasing trend at the



Mann-Kendall Trend Analysis	
n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	11.1355
Standardized Value of S	0.6286
M-K Test Value (S)	8
Tabulated p-value	0.2420
Approximate p-value	0.2648
OLS Regression Line (Blue)	
OLS Regression Slope	-0.2658
OLS Regression Intercept	12,288.5291

Insufficient statistical evidence of a significant trend at the

```
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        Level of Significance   0.05

                Results-mw-1

              General Statistics
         Number of Events Reported (m)     10
              Number of Missing Events      0
        Number or Reported Events Used     10
           Number Values Reported (n)      10
                               Minimum  100000
                               Maximum  130000
                                  Mean  118000
                        Geometric Mean  117586
                                Median  120000
                    Standard Deviation   10328
              Coefficient of Variation     0.0875

              Mann-Kendall Test
                   M-K Test Value (S)      10
                    Tabulated p-value       0.19
                Standard Deviation of S    10.68
               Standardized Value of S      0.843
                   Approximate p-value      0.2

Insufficient evidence to identify a significant
 trend at the specified level of significance.
                Results-mw-2

              General Statistics
         Number of Events Reported (m)     10
              Number of Missing Events      0
        Number or Reported Events Used     10
           Number Values Reported (n)      10
                               Minimum   51000
                               Maximum   68000
                                  Mean   57300
                        Geometric Mean   56993
                                Median   55500
                    Standard Deviation    6325
              Coefficient of Variation      0.11
```

Mann-Kendall Test

M-K Test Value (S)	27
Tabulated p-value	0.008
Standard Deviation of S	11.09
Standardized Value of S	2.344
Approximate p-value	0.00953

Statistically significant evidence of an increasing trend at the specified level of significance.

Results-mw-3

General Statistics

Number of Events Reported (m)	10
Number of Missing Events	0
Number or Reported Events Used	10
Number Values Reported (n)	10
Minimum	55000
Maximum	75000
Mean	65400
Geometric Mean	65125
Median	67500
Standard Deviation	6240
Coefficient of Variation	0.0954

Mann-Kendall Test

M-K Test Value (S)	-5
Tabulated p-value	0.364
Standard Deviation of S	11.09
Standardized Value of S	-0.361
Approximate p-value	0.359

Insufficient evidence to identify a significant trend at the specified level of significance.

Results-mw-4

General Statistics

Number of Events Reported (m)	10
Number of Missing Events	0
Number or Reported Events Used	10
Number Values Reported (n)	10
Minimum	89000
Maximum	160000
Mean	115200
Geometric Mean	113492
Median	115000
Standard Deviation	21498
Coefficient of Variation	0.187

Mann-Kendall Test

M-K Test Value (S)	28
Tabulated p-value	0.005
Standard Deviation of S	11.05
Standardized Value of S	2.444
Approximate p-value	0.00725

Statistically significant evidence of an increasing trend at the specified level of significance.

Results-mw-5

General Statistics

Number of Events Reported (m)	10
Number of Missing Events	0
Number or Reported Events Used	10
Number Values Reported (n)	10
Minimum	96000
Maximum	120000
Mean	107600
Geometric Mean	107216
Median	105000
Standard Deviation	9652
Coefficient of Variation	0.0897

Mann-Kendall Test

M-K Test Value (S)	13
Tabulated p-value	0.146
Standard Deviation of S	10.57
Standardized Value of S	1.136
Approximate p-value	0.128

Insufficient evidence to identify a significant trend at the specified level of significance.

```
                           Mann-Kendall Trend Test Analysis
       User Selected Options
  Date/Time of Computation  ProUCL 5.110/29/2018 3:30:39 PM
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            Full Precision  OFF
    Confidence Coefficient  0.95
     Level of Significance  0.05

              Results-mw-1

            General Statistics
       Number of Events Reported (m)    10
           Number of Missing Events      0
     Number or Reported Events Used     10
         Number Values Reported (n)     10
                            Minimum   230
                            Maximum   310
                               Mean   271
                     Geometric Mean   269.8
                             Median   270
                 Standard Deviation    26.44
           Coefficient of Variation    0.0976

            Mann-Kendall Test
                   M-K Test Value (S)    35
                   Tabulated p-value      0
               Standard Deviation of S   10.97
              Standardized Value of S     3.099
                Approximate p-value  9.6937E-4

Statistically significant evidence of an increasing
trend at the specified level of significance.
              Results-mw-2

            General Statistics
       Number of Events Reported (m)    10
           Number of Missing Events      0
     Number or Reported Events Used     10
         Number Values Reported (n)     10
                            Minimum     59
                            Maximum     86
                               Mean     66.7
                     Geometric Mean     66.08
                             Median     63
                 Standard Deviation     10.13
           Coefficient of Variation      0.152
```

Mann-Kendall Test

M-K Test Value (S)	33
Tabulated p-value	0.001
Standard Deviation of S	11.09
Standardized Value of S	2.885
Approximate p-value	0.00195

Statistically significant evidence of an increasing trend at the specified level of significance.

Results-mw-3

General Statistics

Number of Events Reported (m)	10
Number of Missing Events	0
Number or Reported Events Used	10
Number Values Reported (n)	10
Minimum	67
Maximum	98
Mean	87.1
Geometric Mean	86.7
Median	88
Standard Deviation	8.425
Coefficient of Variation	0.0967

Mann-Kendall Test

M-K Test Value (S)	-16
Tabulated p-value	0.078
Standard Deviation of S	11.14
Standardized Value of S	-1.347
Approximate p-value	0.089

Insufficient evidence to identify a significant trend at the specified level of significance.

Results-mw-4

General Statistics

Number of Events Reported (m)	10
Number of Missing Events	0
Number or Reported Events Used	10
Number Values Reported (n)	10
Minimum	220
Maximum	450
Mean	347
Geometric Mean	339.5
Median	350
Standard Deviation	73.79
Coefficient of Variation	0.213

```
               Mann-Kendall Test
                    M-K Test Value (S)    41
                     Tabulated p-value     0
                 Standard Deviation of S  11.09
                Standardized Value of S    3.607
                    Approximate p-value 1.5507E-4

Statistically significant evidence of an increasing
trend at the specified level of significance.
                 Results-mw-5

               General Statistics
         Number of Events Reported (m)    10
                Number of Missing Events   0
      Number or Reported Events Used      10
         Number Values Reported (n)       10
                              Minimum   190
                              Maximum   220
                                 Mean   199
                       Geometric Mean   198.7
                               Median   195
                   Standard Deviation    11.01
              Coefficient of Variation    0.0553

               Mann-Kendall Test
                    M-K Test Value (S)     9
                     Tabulated p-value     0.242
                 Standard Deviation of S  10.31
                Standardized Value of S    0.776
                    Approximate p-value    0.219

Insufficient evidence to identify a significant
 trend at the specified level of significance.
```

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	ProUCL 5.110/29/2018 3:36:00 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Results_-mw-2

General Statistics

Number of Events Reported (m)	3
Number of Missing Events	0
Number or Reported Events Used	3
Number Values Reported (n)	3
Minimum	0.055
Maximum	0.058
Mean	0.0563
Geometric Mean	0.0563
Median	0.056
Standard Deviation	0.00153
Coefficient of Variation	0.0271

Mann-Kendall Test

M-K Test Value (S)	3
Tabulated p-value	N/A
Standard Deviation of S	1.915
Standardized Value of S	1.044
Approximate p-value	0.148

Insufficient evidence to identify a significant trend at the specified level of significance.

Results_-mw-3

General Statistics

Number of Events Reported (m)	3
Number of Missing Events	0
Number or Reported Events Used	3
Number Values Reported (n)	3
Minimum	0.055
Maximum	0.067
Mean	0.0623
Geometric Mean	0.0621
Median	0.065
Standard Deviation	0.00643
Coefficient of Variation	0.103

Mann-Kendall Test

M-K Test Value (S)	-1
Tabulated p-value	N/A
Standard Deviation of S	1.915
Standardized Value of S	0
Approximate p-value	0.5

Insufficient evidence to identify a significant trend at the specified level of significance.

Results_-mw-4

General Statistics

Number of Events Reported (m)	6
Number of Missing Events	0
Number or Reported Events Used	6
Number Values Reported (n)	6
Minimum	0.12
Maximum	0.23
Mean	0.198
Geometric Mean	0.194
Median	0.215
Standard Deviation	0.0436
Coefficient of Variation	0.22

Mann-Kendall Test

M-K Test Value (S)	6
Tabulated p-value	0.136
Standard Deviation of S	4.967
Standardized Value of S	1.007
Approximate p-value	0.157

Insufficient evidence to identify a significant trend at the specified level of significance.

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	ProUCL 5.110/29/2018 3:42:57 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Results-mw-1

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	10
Number Values Reported (n)	10
Minimum	6.56
Maximum	7.77
Mean	7.481
Geometric Mean	7.474
Median	7.57
Standard Deviation	0.333
Coefficient of Variation	0.0446

Mann-Kendall Test

M-K Test Value (S)	22
Tabulated p-value	0.023
Standard Deviation of S	11.14
Standardized Value of S	1.886
Approximate p-value	0.0297

Statistically significant evidence of an increasing trend at the specified level of significance.

Results-mw-2

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	10
Number Values Reported (n)	10
Minimum	7.03
Maximum	8.41
Mean	7.983
Geometric Mean	7.975
Median	8.08
Standard Deviation	0.364
Coefficient of Variation	0.0456

Mann-Kendall Test

M-K Test Value (S)	-10
Tabulated p-value	0.19
Standard Deviation of S	11.14
Standardized Value of S	-0.808
Approximate p-value	0.209

Insufficient evidence to identify a significant trend at the specified level of significance.

Results-mw-3

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	10
Number Values Reported (n)	10
Minimum	6.32
Maximum	8.18
Mean	7.805
Geometric Mean	7.786
Median	7.93
Standard Deviation	0.54
Coefficient of Variation	0.0692

Mann-Kendall Test

M-K Test Value (S)	11
Tabulated p-value	0.19
Standard Deviation of S	11.18
Standardized Value of S	0.894
Approximate p-value	0.186

Insufficient evidence to identify a significant trend at the specified level of significance.

Results-mw-4

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	10
Number Values Reported (n)	10
Minimum	7.32
Maximum	7.93
Mean	7.724
Geometric Mean	7.722
Median	7.745
Standard Deviation	0.177
Coefficient of Variation	0.0229

Mann-Kendall Test

M-K Test Value (S)	-25
Tabulated p-value	0.014
Standard Deviation of S	11.18
Standardized Value of S	-2.147
Approximate p-value	0.0159

Statistically significant evidence of a decreasing trend at the specified level of significance.

Results-mw-5

General Statistics

Number or Reported Events Not Used	0
Number of Generated Events	10
Number Values Reported (n)	10
Minimum	6.76
Maximum	7.54
Mean	7.362
Geometric Mean	7.358
Median	7.46
Standard Deviation	0.236
Coefficient of Variation	0.032

Mann-Kendall Test

M-K Test Value (S)	22
Tabulated p-value	0.023
Standard Deviation of S	11.14
Standardized Value of S	1.886
Approximate p-value	0.0297

Statistically significant evidence of an increasing trend at the specified level of significance.

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	ProUCL 5.110/29/2018 3:48:37 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Results-mw-1

General Statistics

Number of Events Reported (m)	10
Number of Missing Events	0
Number or Reported Events Used	10
Number Values Reported (n)	10
Minimum	19
Maximum	25
Mean	21.3
Geometric Mean	21.23
Median	21
Standard Deviation	1.889
Coefficient of Variation	0.0887

Mann-Kendall Test

M-K Test Value (S)	27
Tabulated p-value	0.008
Standard Deviation of S	10.85
Standardized Value of S	2.397
Approximate p-value	0.00827

Statistically significant evidence of an increasing trend at the specified level of significance.

Results-mw-2

General Statistics

Number of Events Reported (m)	10
Number of Missing Events	0
Number or Reported Events Used	10
Number Values Reported (n)	10
Minimum	21
Maximum	31
Mean	23.7
Geometric Mean	23.46
Median	22
Standard Deviation	3.683
Coefficient of Variation	0.155

Mann-Kendall Test

M-K Test Value (S)	8
Tabulated p-value	0.242
Standard Deviation of S	10.74
Standardized Value of S	0.652
Approximate p-value	0.257

Insufficient evidence to identify a significant trend at the specified level of significance.

Results-mw-3

General Statistics

Number of Events Reported (m)	10
Number of Missing Events	0
Number or Reported Events Used	10
Number Values Reported (n)	10
Minimum	20
Maximum	49
Mean	29.1
Geometric Mean	27.65
Median	25.5
Standard Deviation	10.41
Coefficient of Variation	0.358

Mann-Kendall Test

M-K Test Value (S)	-34
Tabulated p-value	0
Standard Deviation of S	11.14
Standardized Value of S	-2.963
Approximate p-value	0.00152

Statistically significant evidence of a decreasing trend at the specified level of significance.

Results-mw-4

General Statistics

Number of Events Reported (m)	10
Number of Missing Events	0
Number or Reported Events Used	10
Number Values Reported (n)	10
Minimum	18
Maximum	53
Mean	38.3
Geometric Mean	35.84
Median	42.5
Standard Deviation	12.93
Coefficient of Variation	0.338

Mann-Kendall Test

M-K Test Value (S)	6
Tabulated p-value	0.3
Standard Deviation of S	11.14
Standardized Value of S	0.449
Approximate p-value	0.327

Insufficient evidence to identify a significant trend at the specified level of significance.

Results-mw-5

General Statistics

Number of Events Reported (m)	10
Number of Missing Events	0
Number or Reported Events Used	10
Number Values Reported (n)	10
Minimum	18
Maximum	25
Mean	19.9
Geometric Mean	19.76
Median	19
Standard Deviation	2.601
Coefficient of Variation	0.131

Mann-Kendall Test

M-K Test Value (S)	-8
Tabulated p-value	0.242
Standard Deviation of S	10.61
Standardized Value of S	-0.659
Approximate p-value	0.255

Insufficient evidence to identify a significant trend at the specified level of significance.

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	ProUCL 5.110/29/2018 3:52:23 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Results-mw-1

General Statistics

Number of Events Reported (m)	10
Number of Missing Events	0
Number or Reported Events Used	10
Number Values Reported (n)	10
Minimum	700
Maximum	980
Mean	842
Geometric Mean	836.9
Median	810
Standard Deviation	98.07
Coefficient of Variation	0.116

Mann-Kendall Test

M-K Test Value (S)	-2
Tabulated p-value	0.431
Standard Deviation of S	11.14
Standardized Value of S	-0.0898
Approximate p-value	0.464

Insufficient evidence to identify a significant trend at the specified level of significance.

Results-mw-2

General Statistics

Number of Events Reported (m)	10
Number of Missing Events	0
Number or Reported Events Used	10
Number Values Reported (n)	10
Minimum	190
Maximum	350
Mean	302
Geometric Mean	296.7
Median	310
Standard Deviation	54.93
Coefficient of Variation	0.182

Mann-Kendall Test

M-K Test Value (S)	5
Tabulated p-value	0.364
Standard Deviation of S	10.85
Standardized Value of S	0.369
Approximate p-value	0.356

Insufficient evidence to identify a significant trend at the specified level of significance.

Results-mw-3

General Statistics

Number of Events Reported (m)	10
Number of Missing Events	0
Number or Reported Events Used	10
Number Values Reported (n)	10
Minimum	290
Maximum	440
Mean	367
Geometric Mean	363.8
Median	370
Standard Deviation	50.56
Coefficient of Variation	0.138

Mann-Kendall Test

M-K Test Value (S)	-13
Tabulated p-value	0.146
Standard Deviation of S	11.09
Standardized Value of S	-1.082
Approximate p-value	0.14

Insufficient evidence to identify a significant trend at the specified level of significance.

Results-mw-4

General Statistics

Number of Events Reported (m)	10
Number of Missing Events	0
Number or Reported Events Used	10
Number Values Reported (n)	10
Minimum	700
Maximum	1200
Mean	953
Geometric Mean	940.8
Median	1000
Standard Deviation	156.6
Coefficient of Variation	0.164

Mann-Kendall Test

M-K Test Value (S)	21
Tabulated p-value	0.036
Standard Deviation of S	10.79
Standardized Value of S	1.854
Approximate p-value	0.0318

Statistically significant evidence of an increasing trend at the specified level of significance.

Results-mw-5

General Statistics

Number of Events Reported (m)	10
Number of Missing Events	0
Number or Reported Events Used	10
Number Values Reported (n)	10
Minimum	590
Maximum	2300
Mean	847
Geometric Mean	771.7
Median	710
Standard Deviation	513.2
Coefficient of Variation	0.606

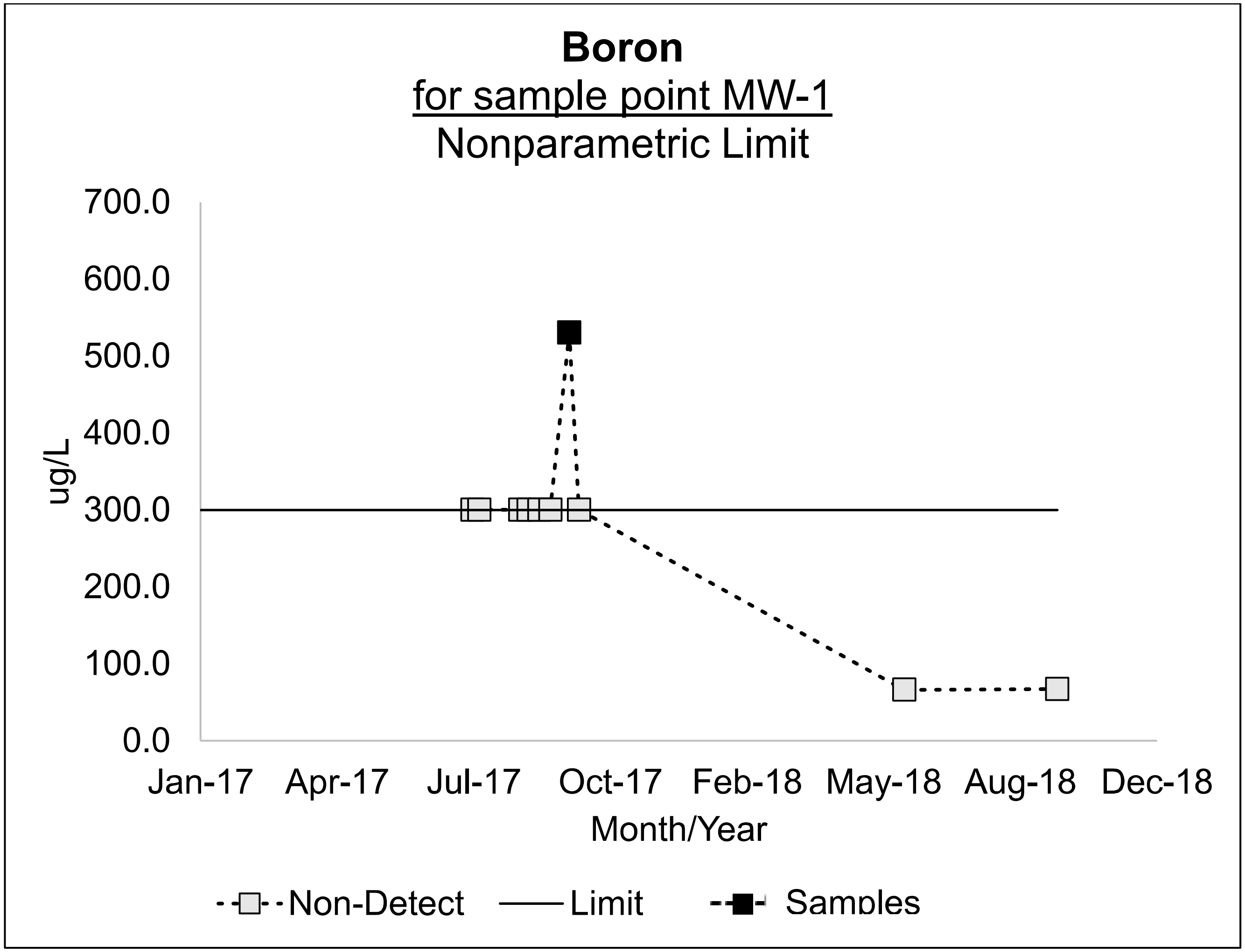
Mann-Kendall Test

M-K Test Value (S)	8
Tabulated p-value	0.242
Standard Deviation of S	11.14
Standardized Value of S	0.629
Approximate p-value	0.265

Insufficient evidence to identify a significant trend at the specified level of significance.

Attachment C

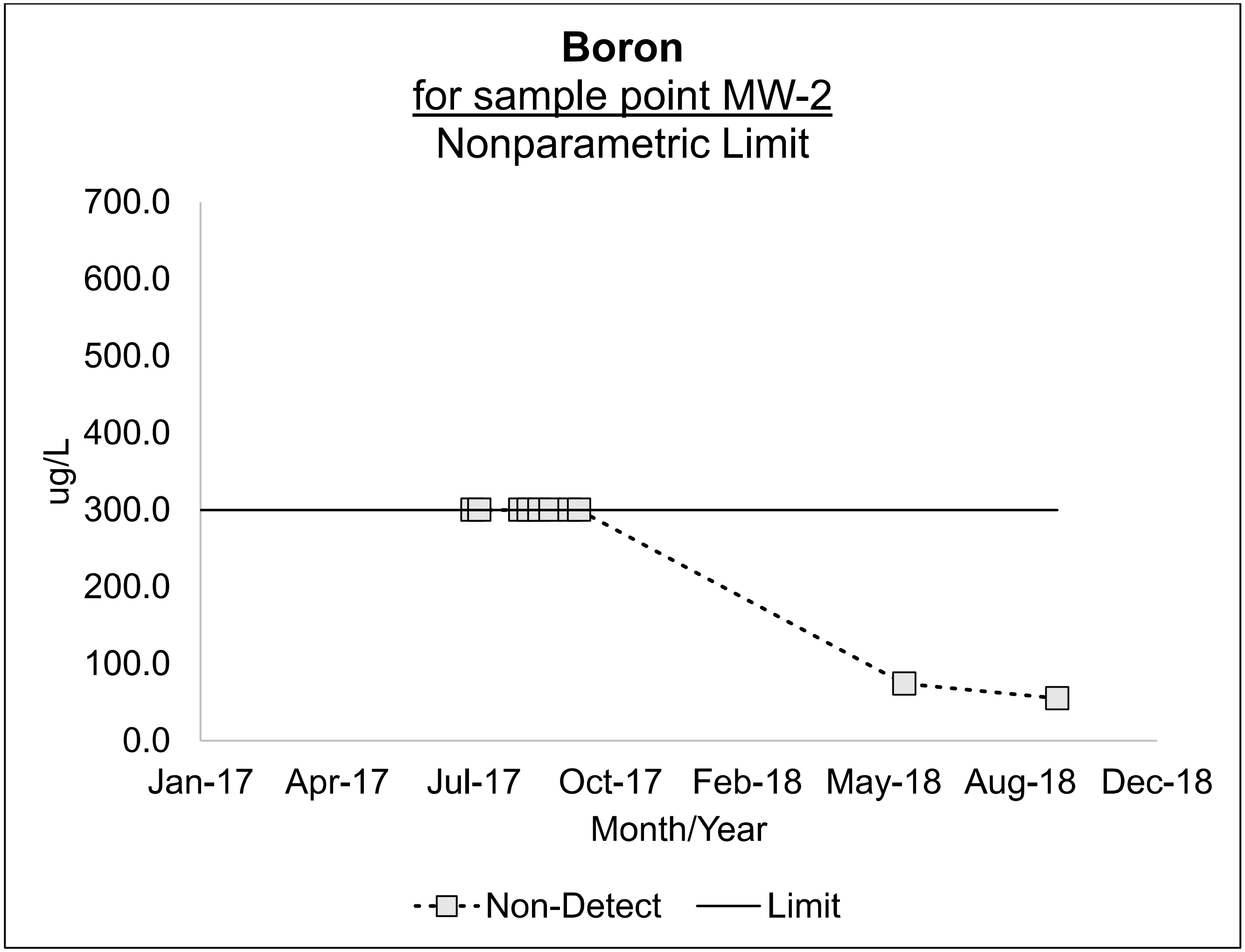
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 1

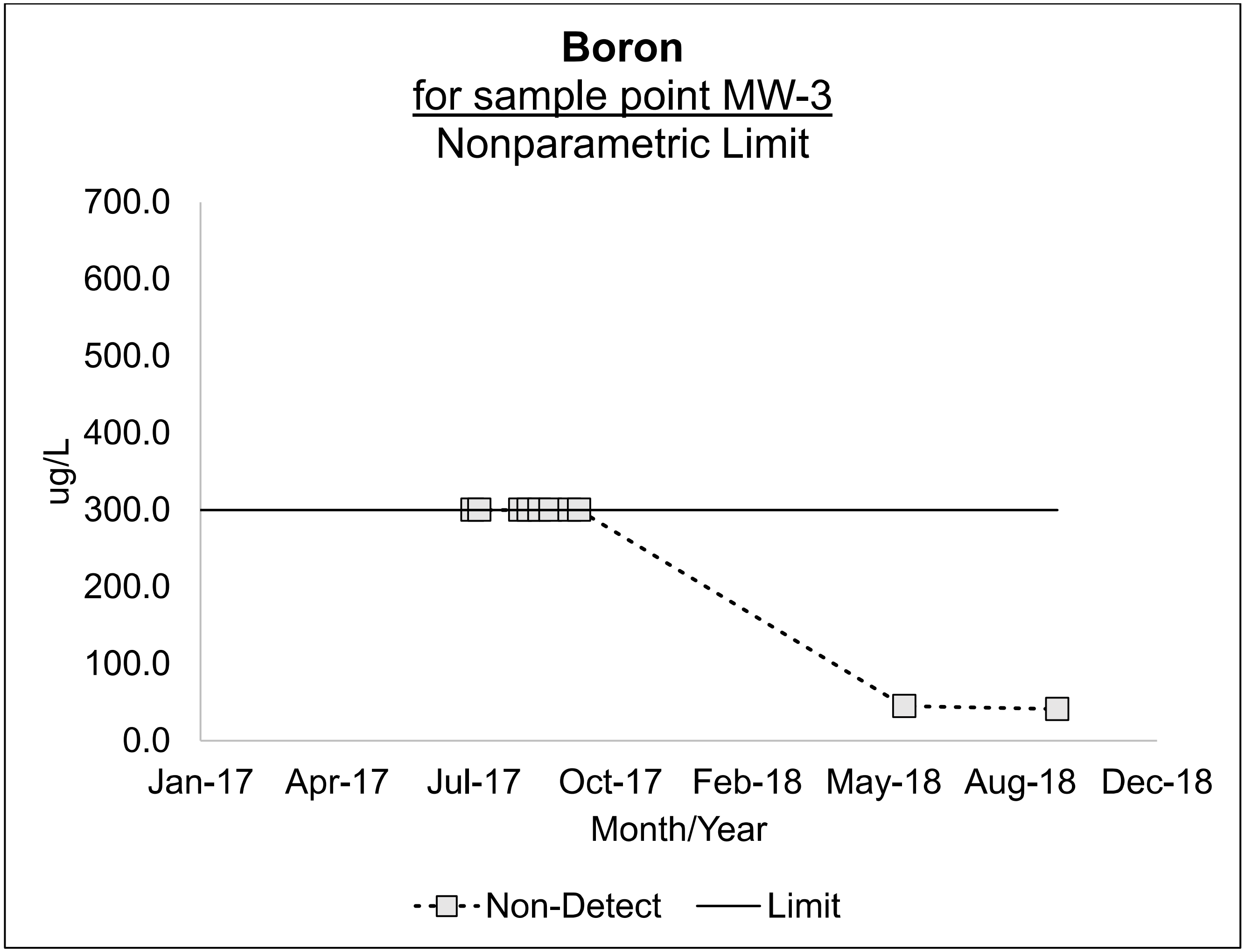
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 2

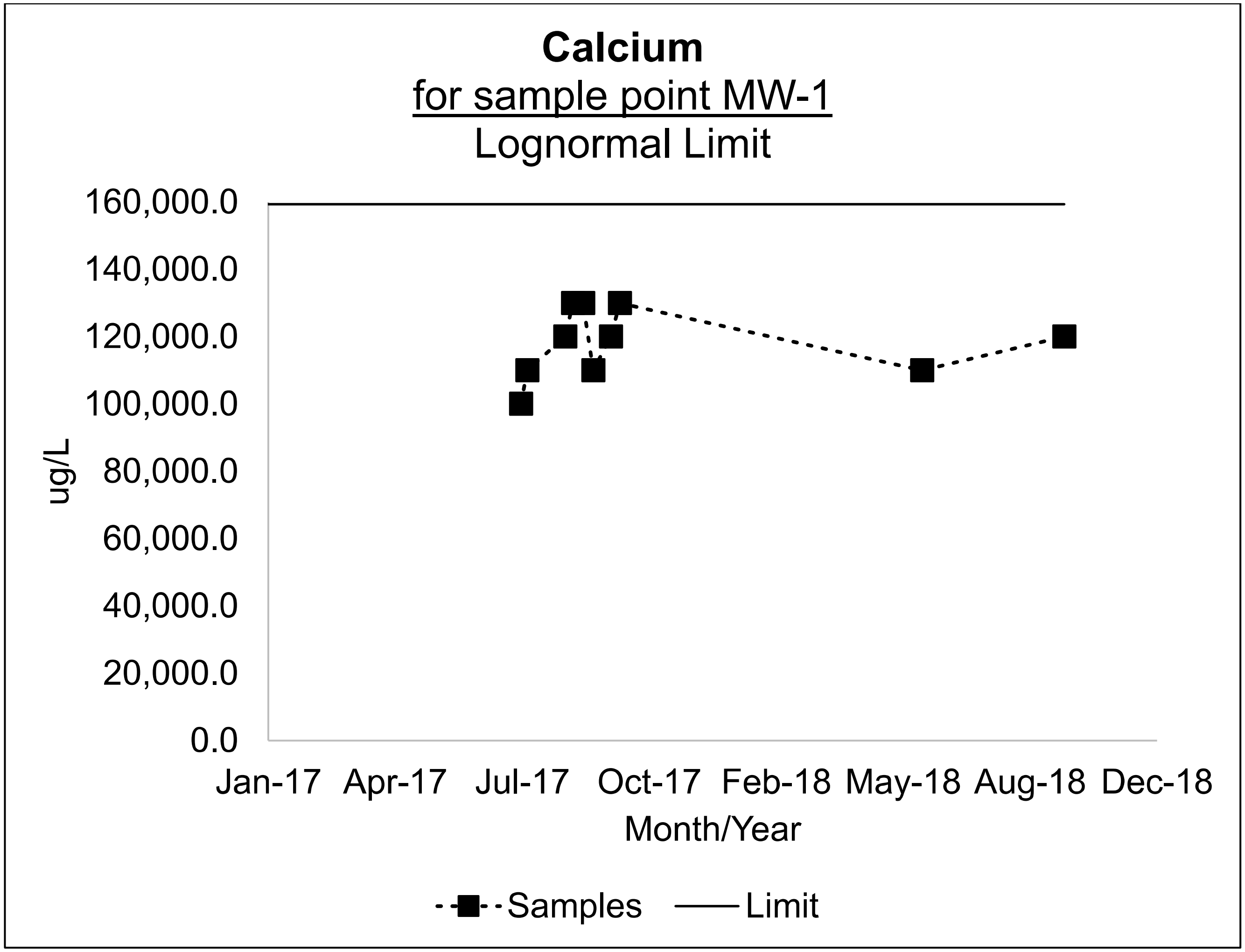
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 3

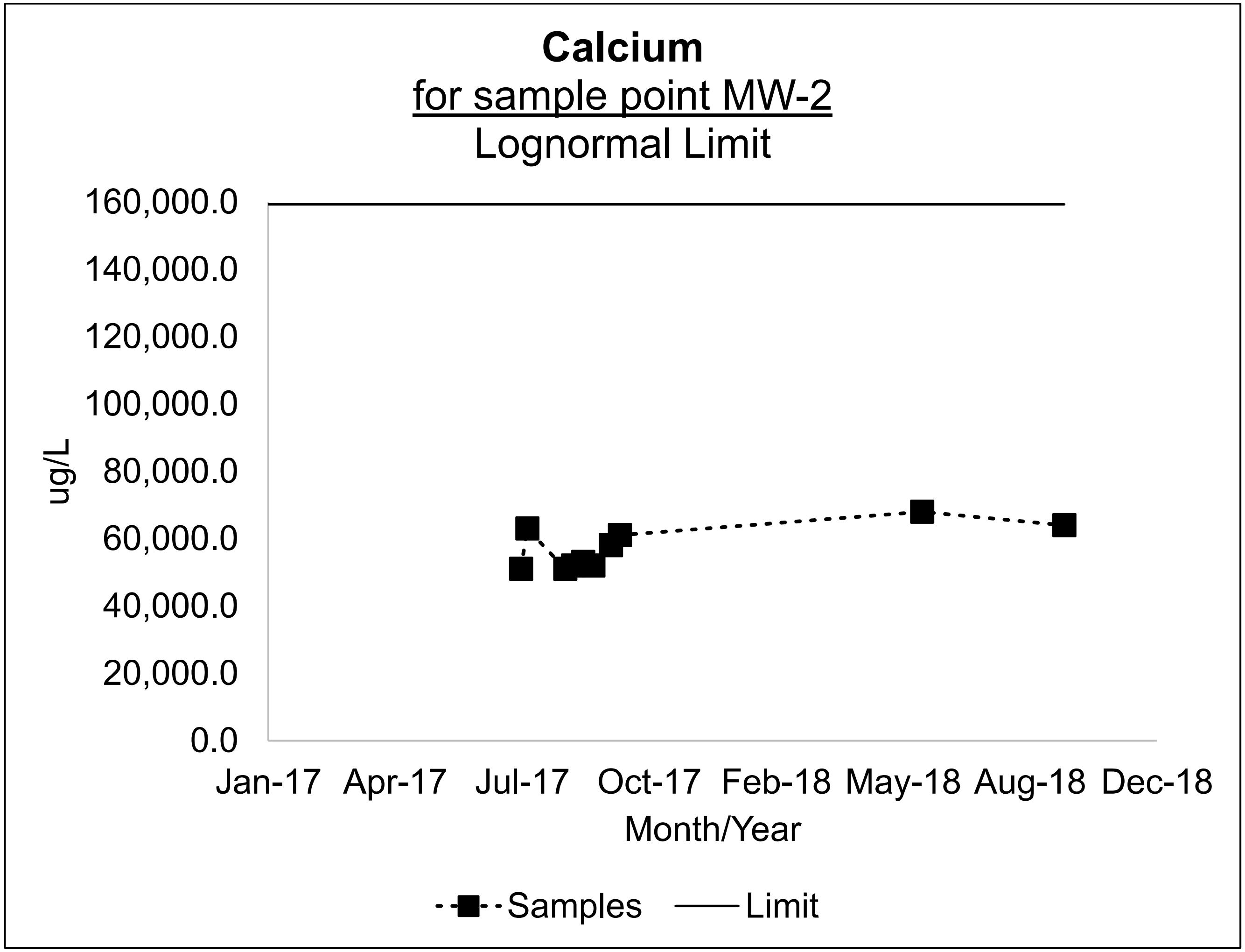
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 4

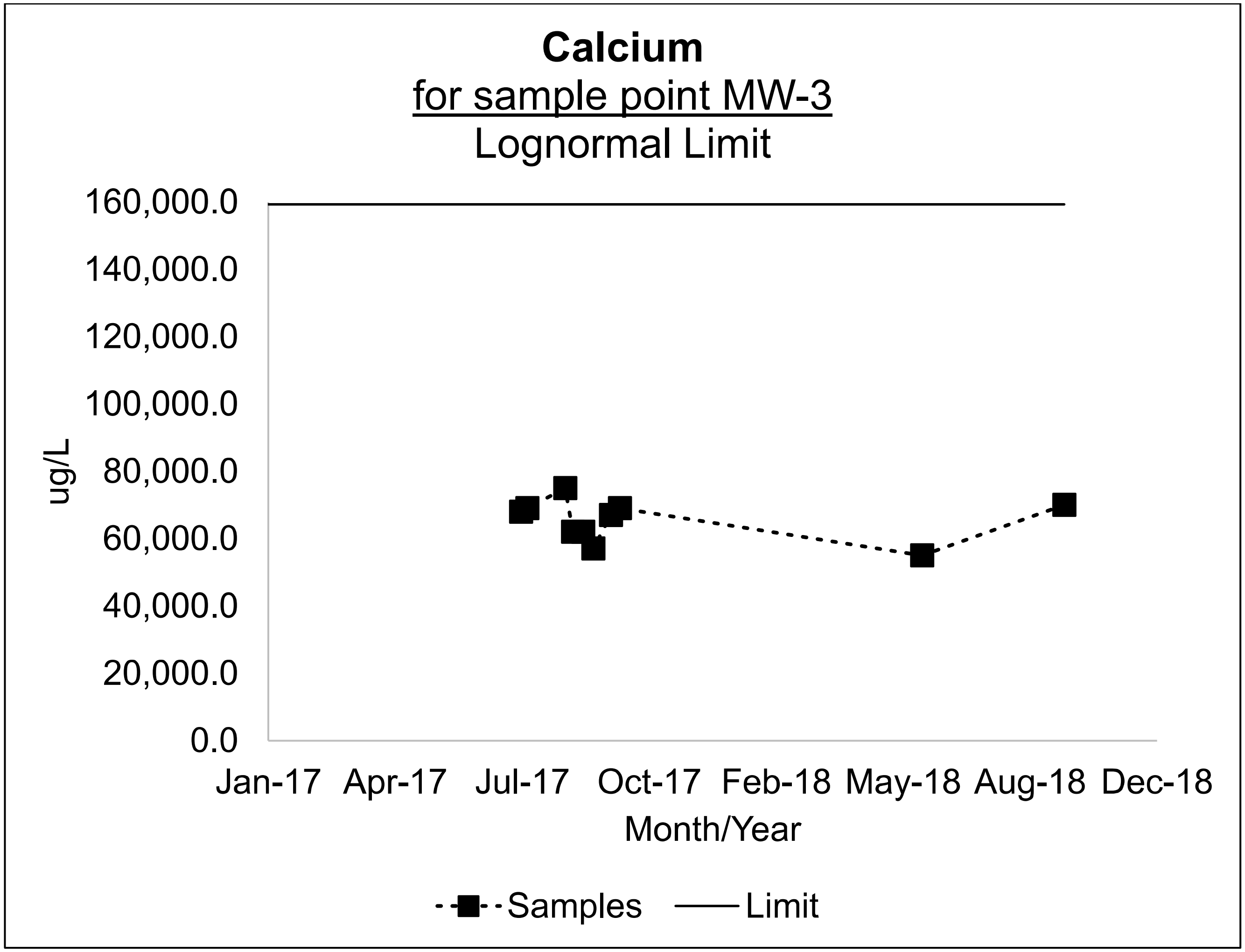
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 5

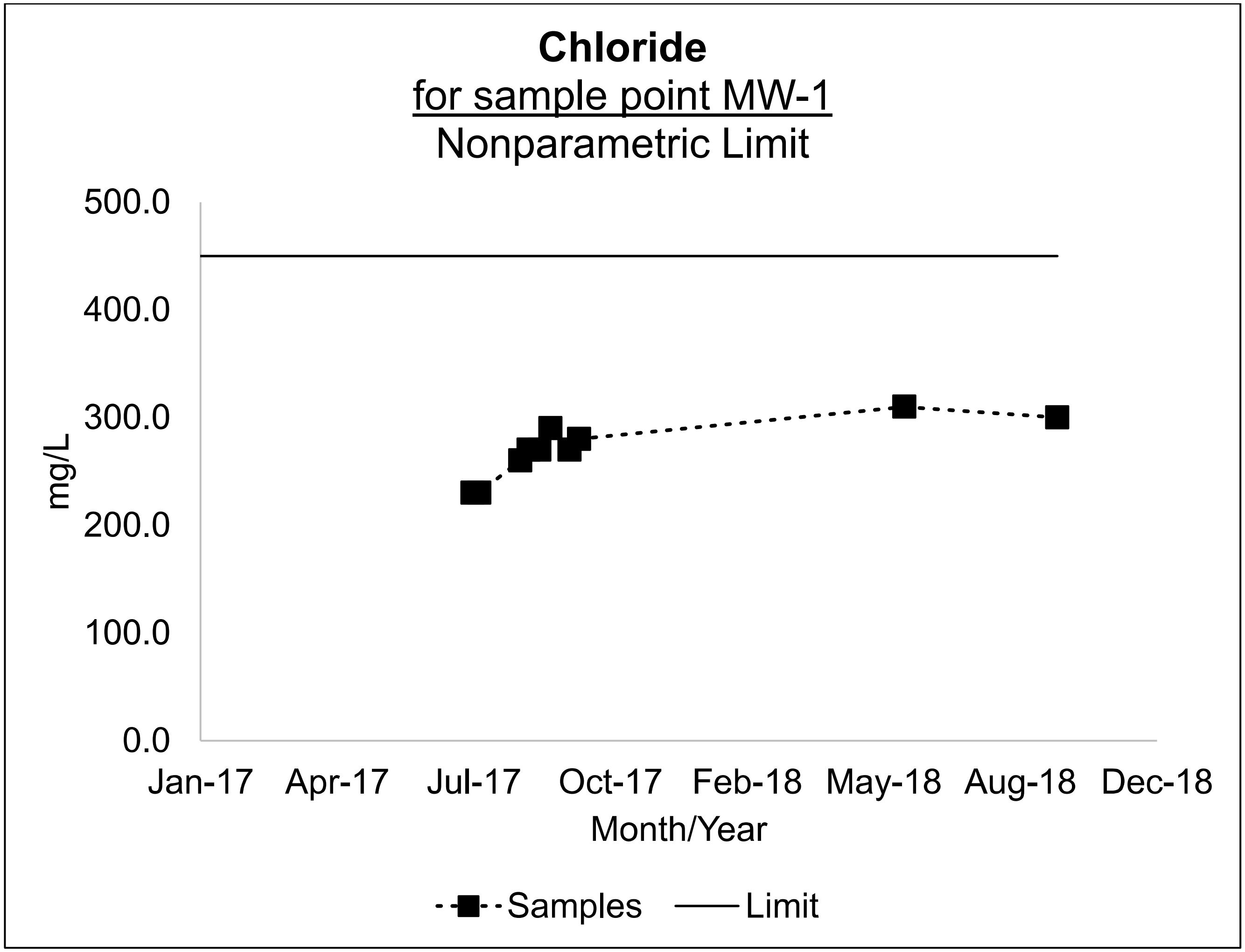
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 6

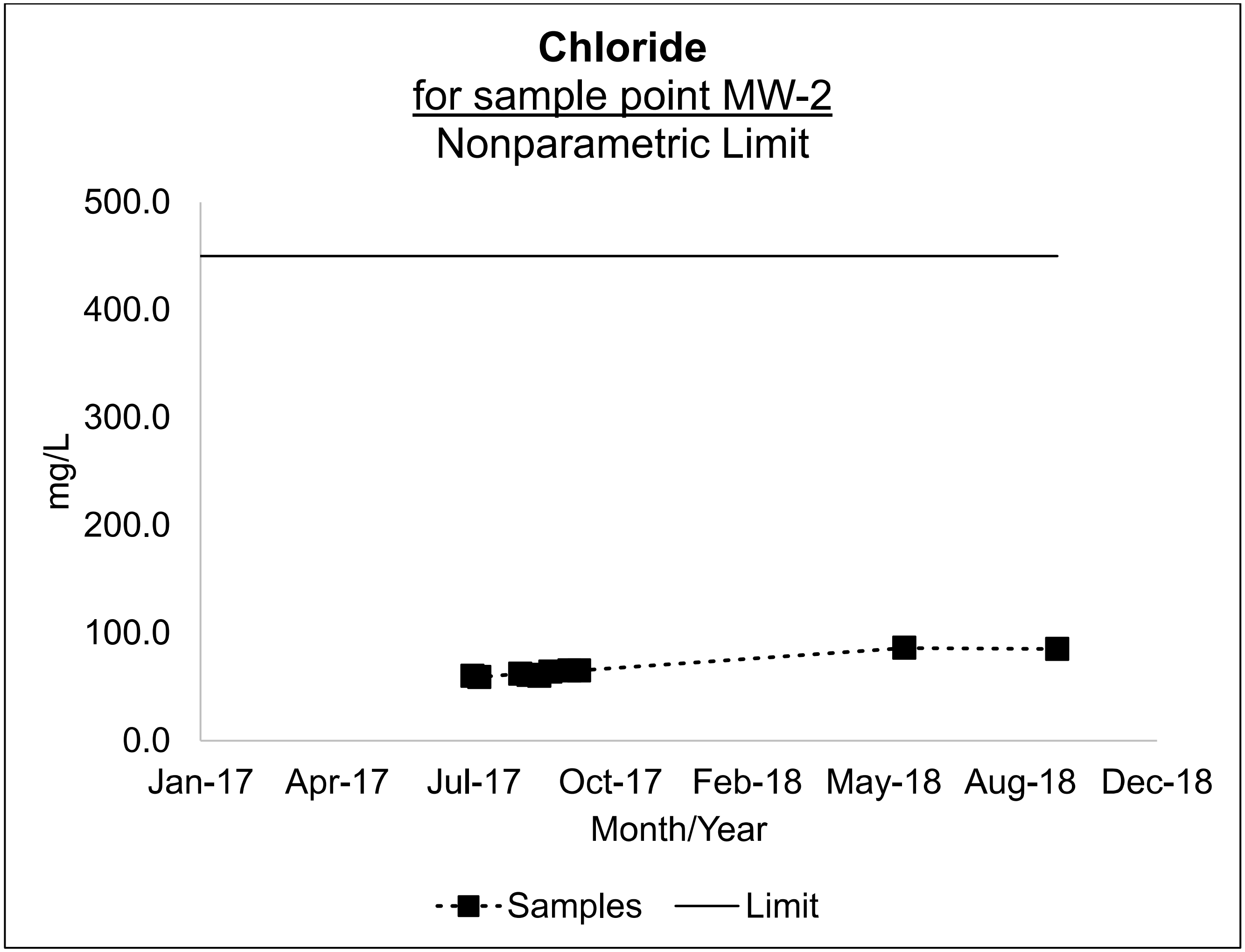
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 7

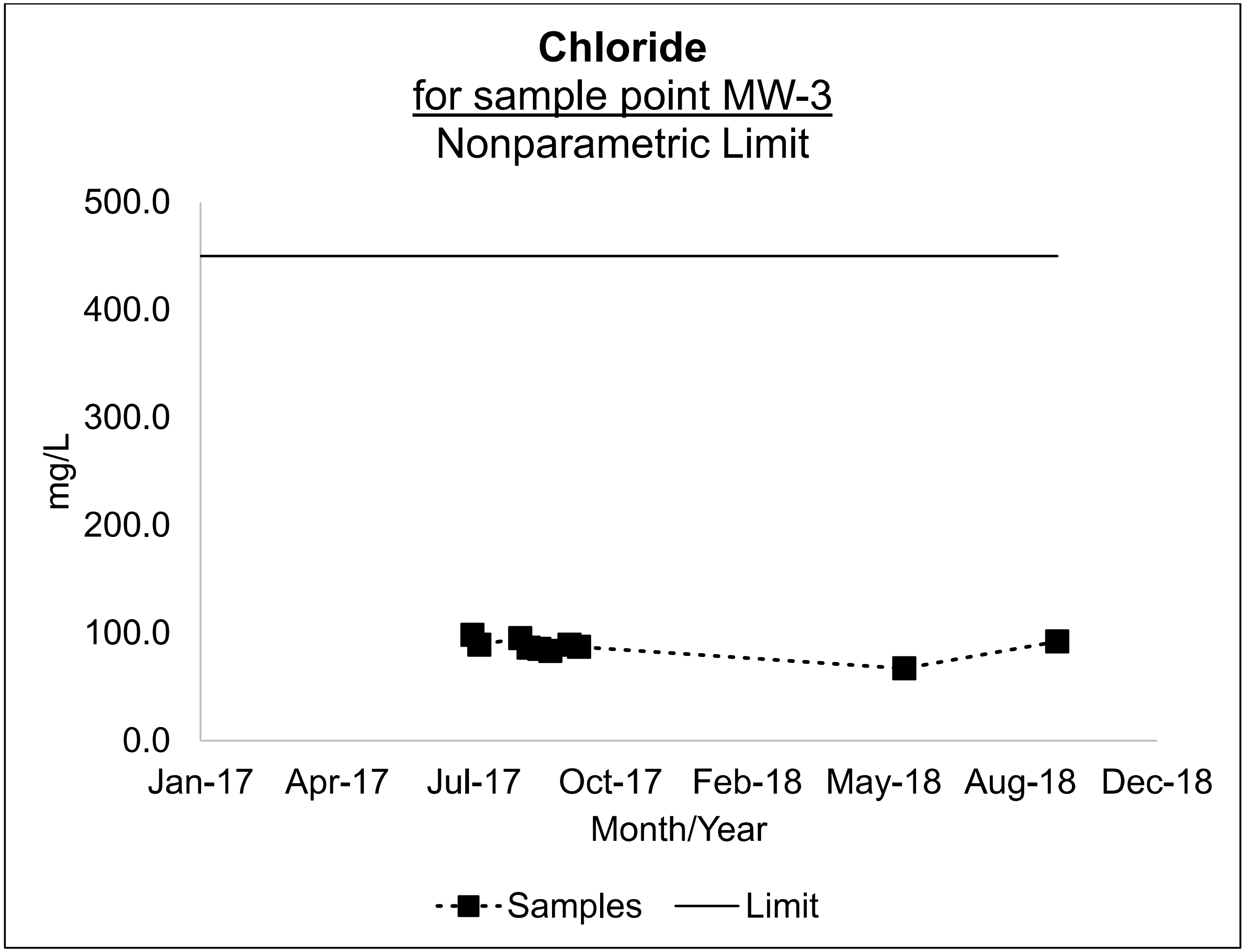
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 8

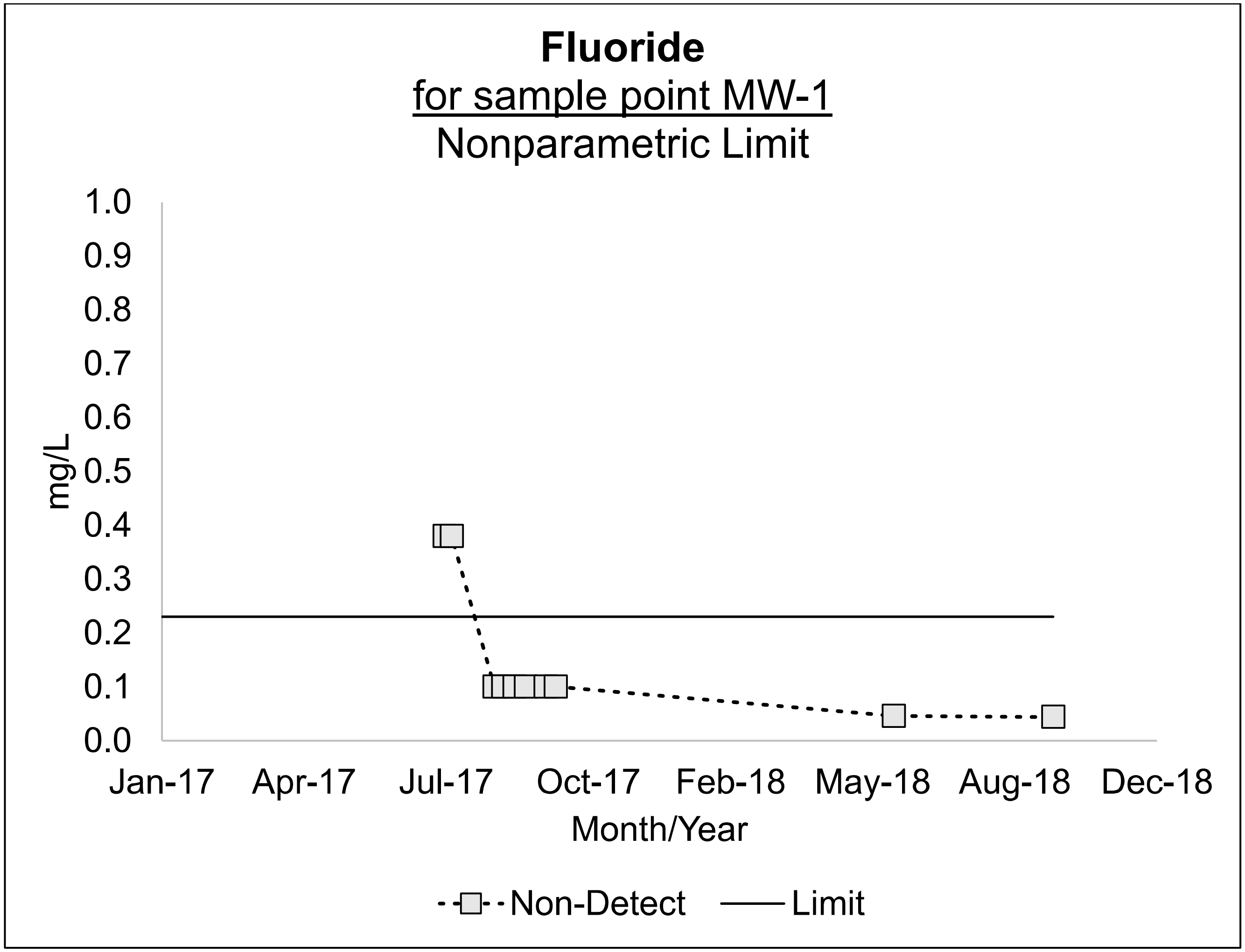
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 9

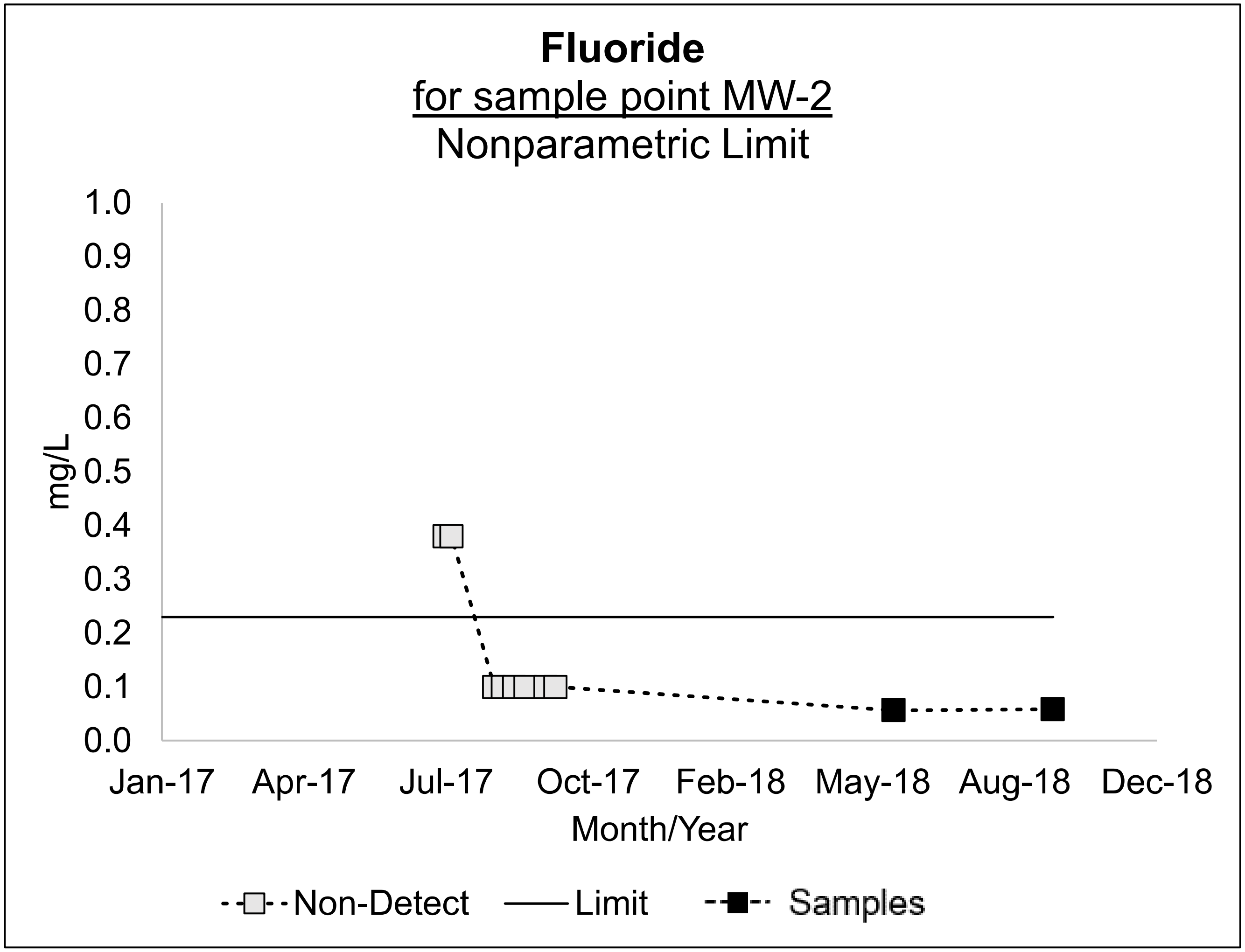
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 10

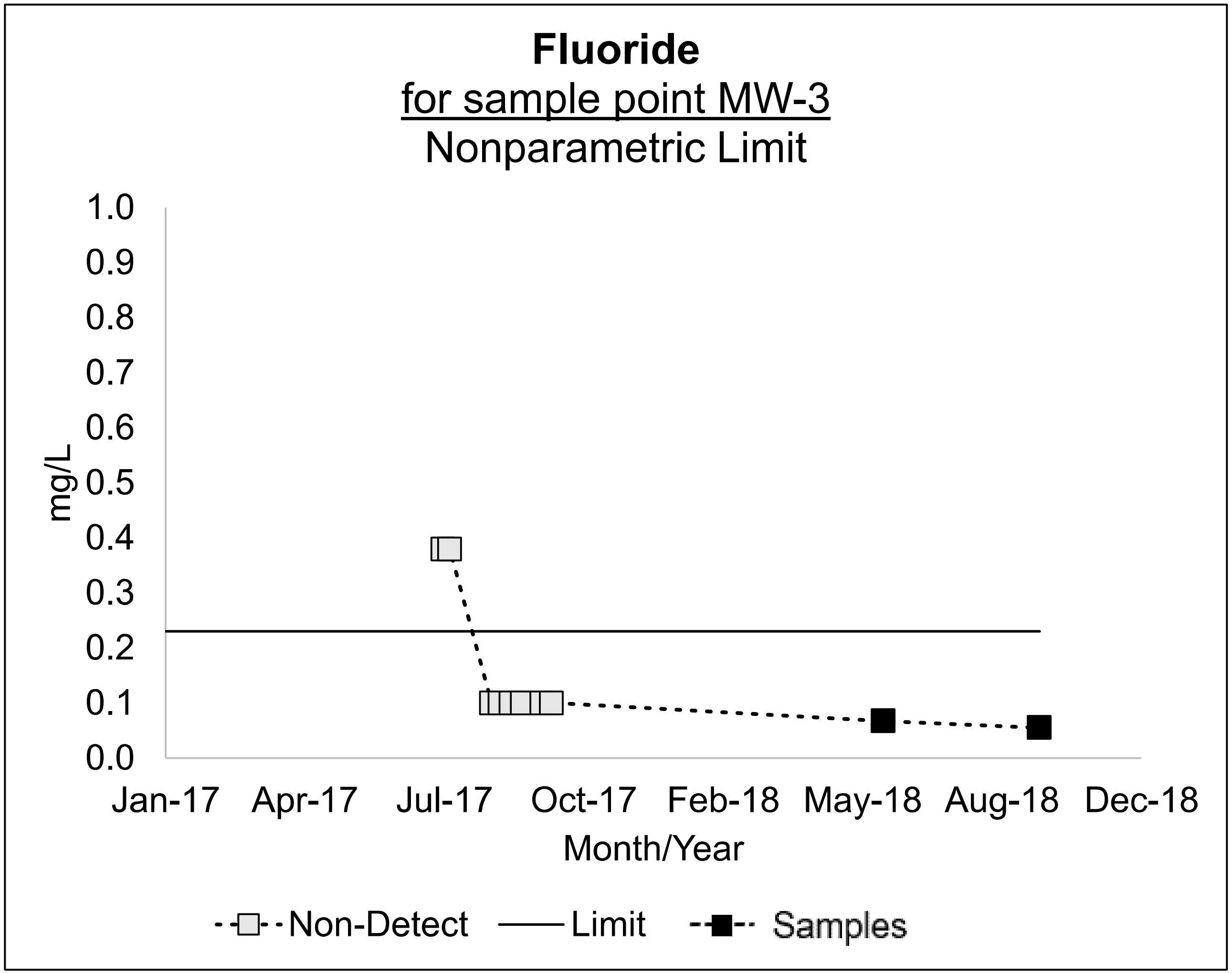
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 11

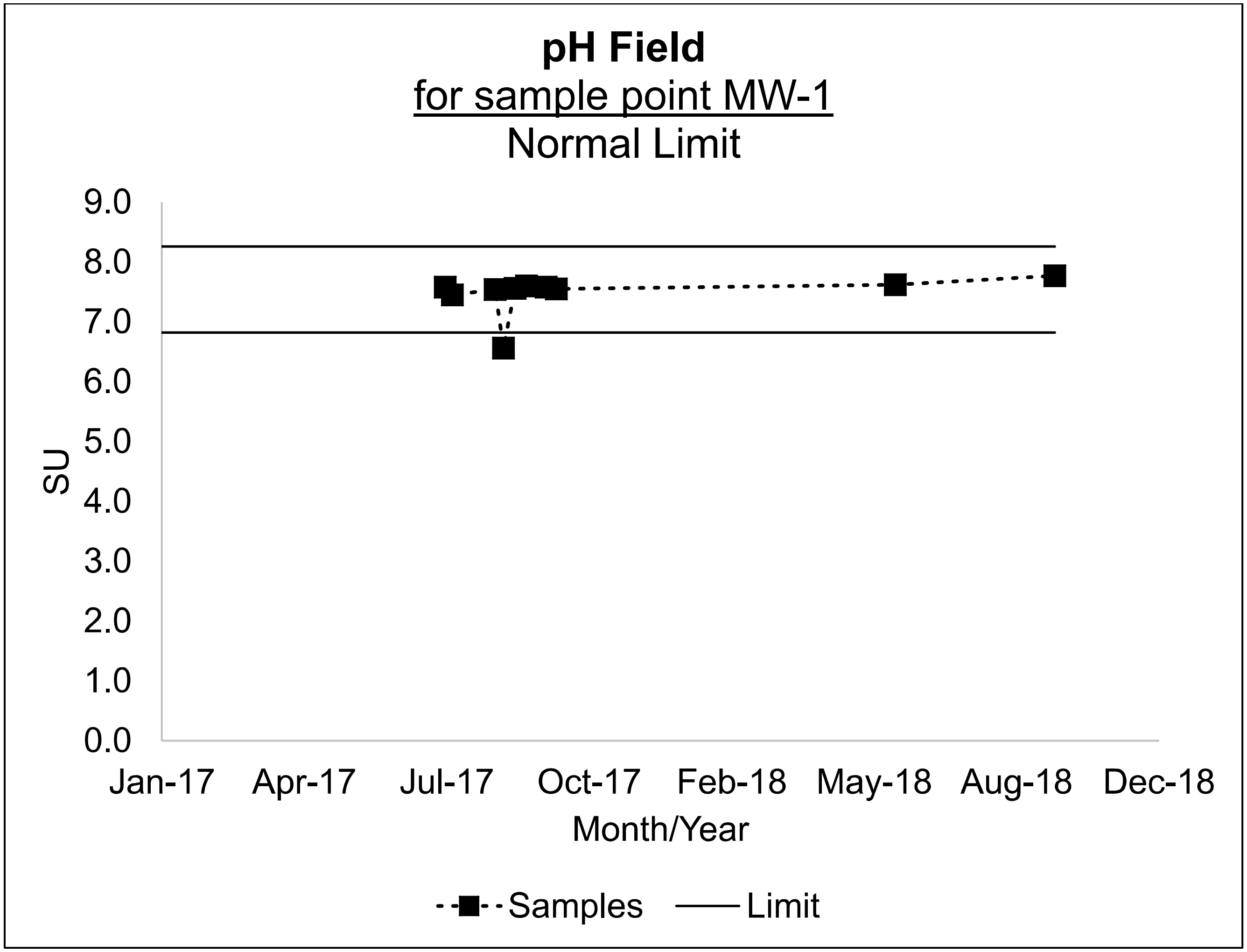
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 12

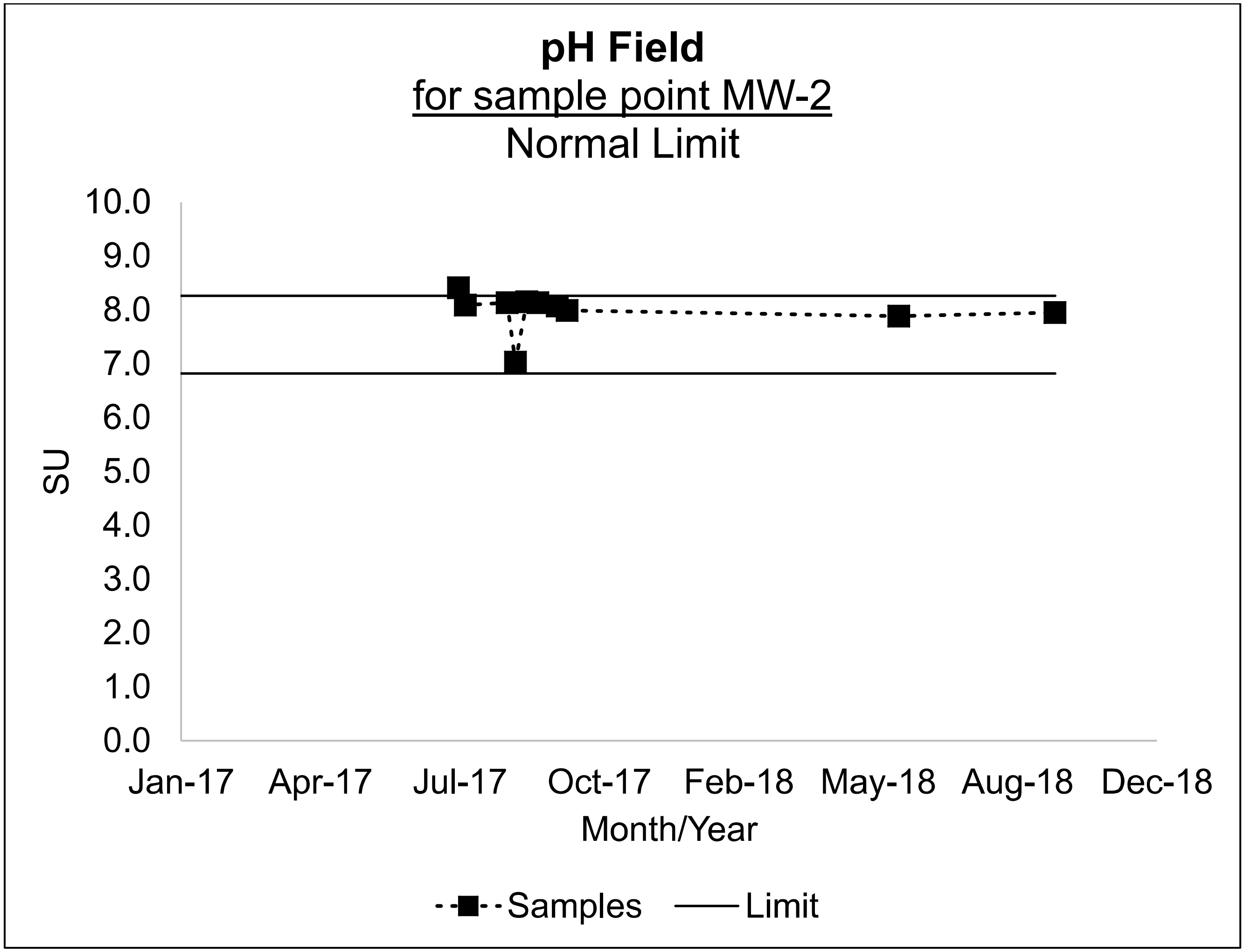
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 13

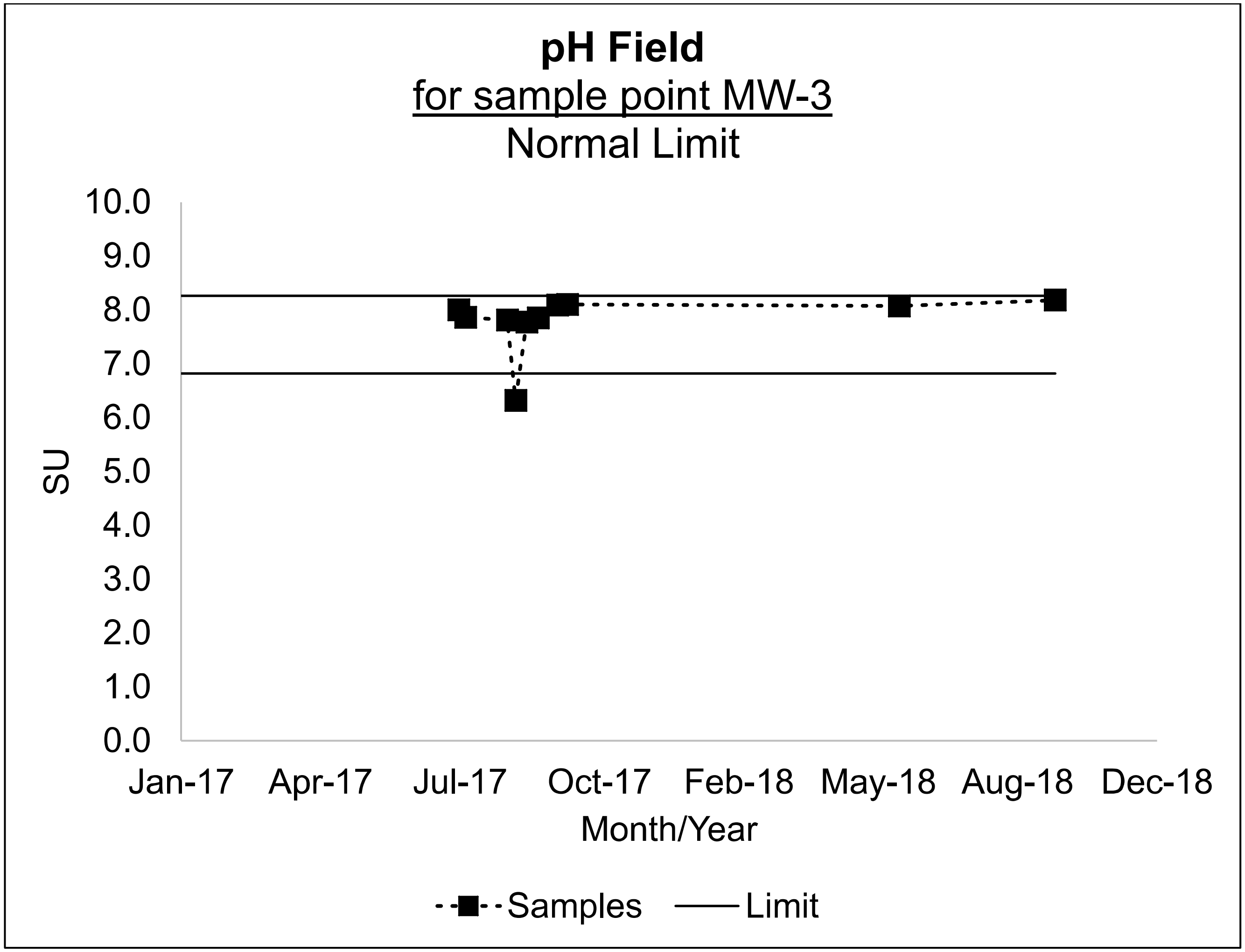
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 14

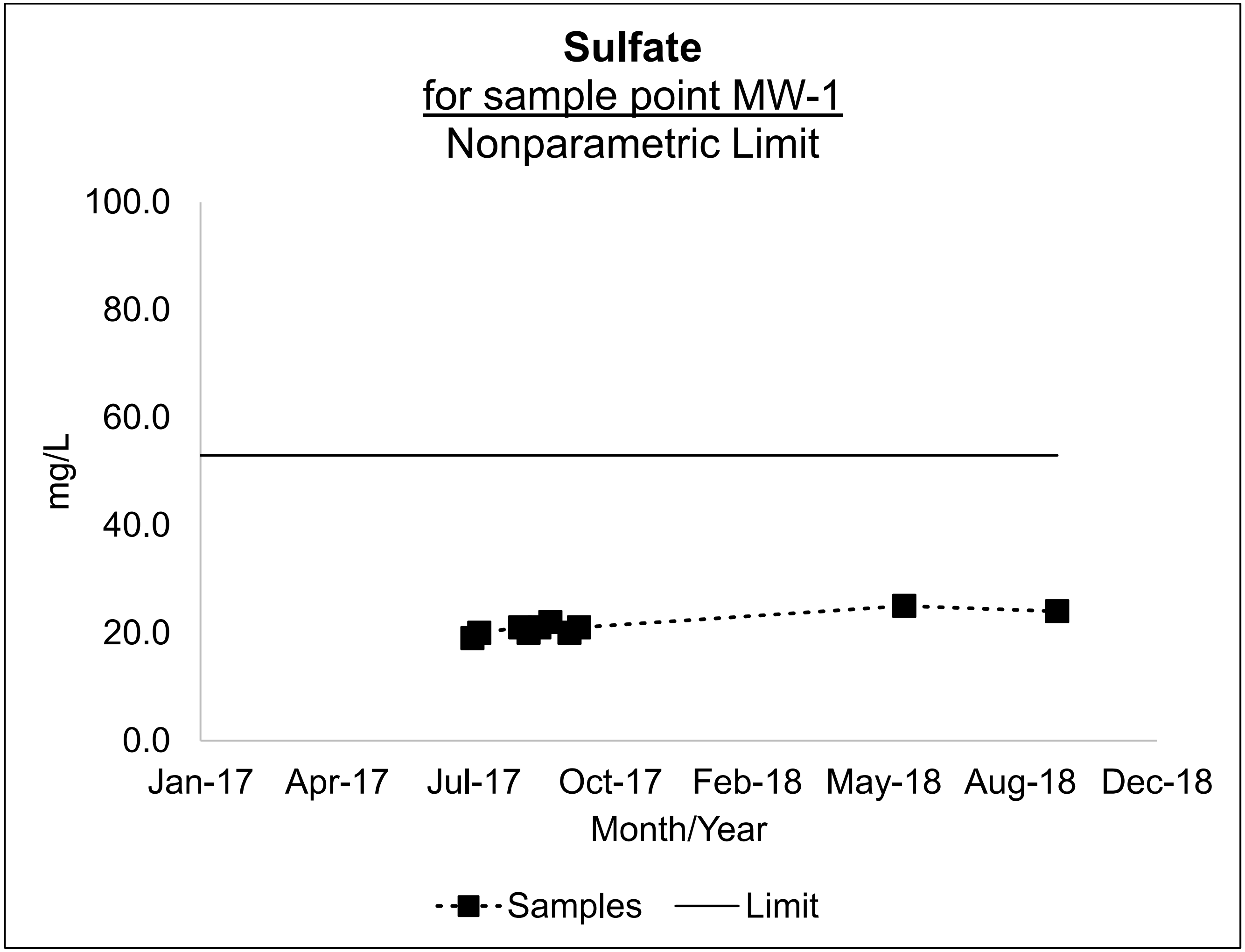
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 15

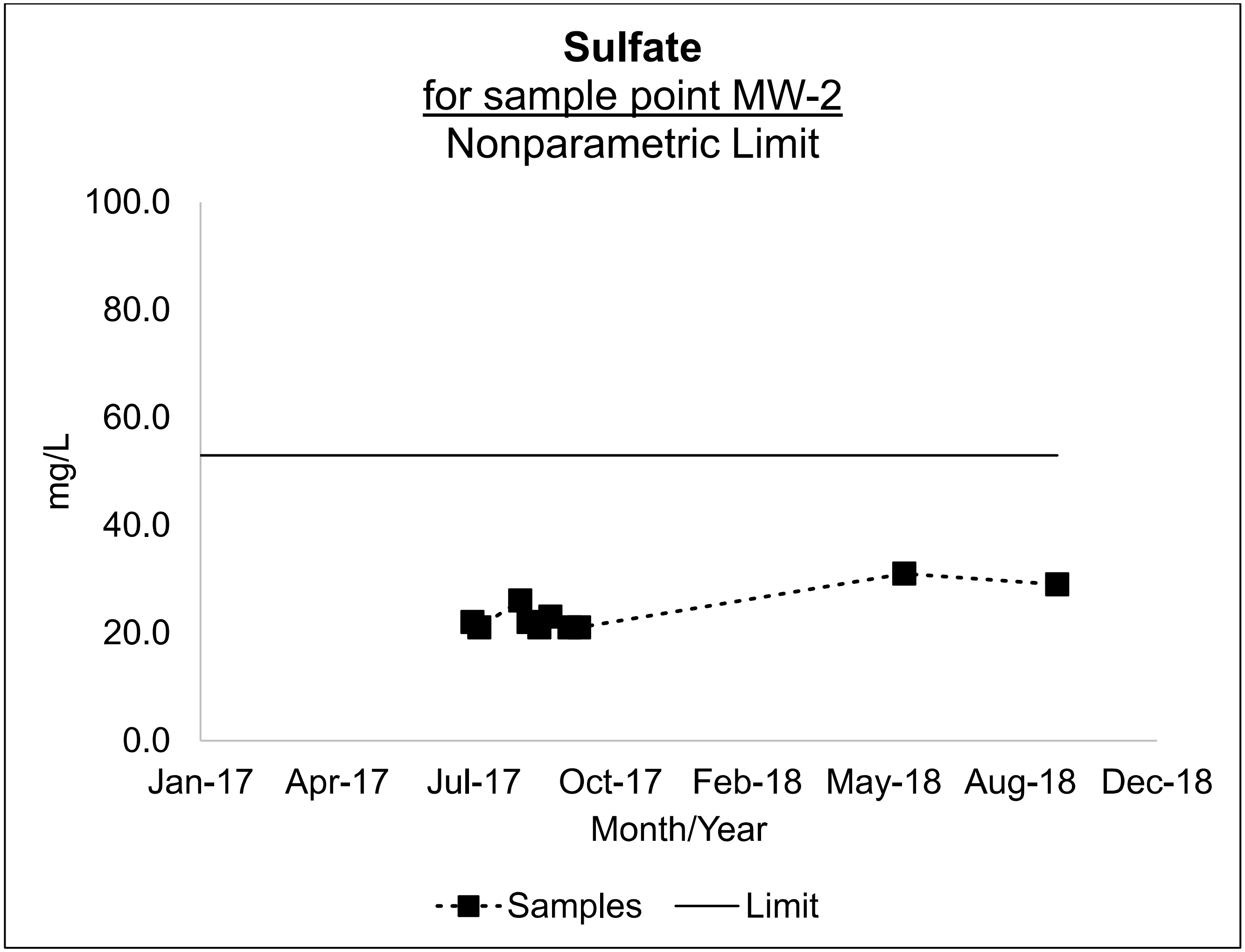
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 16

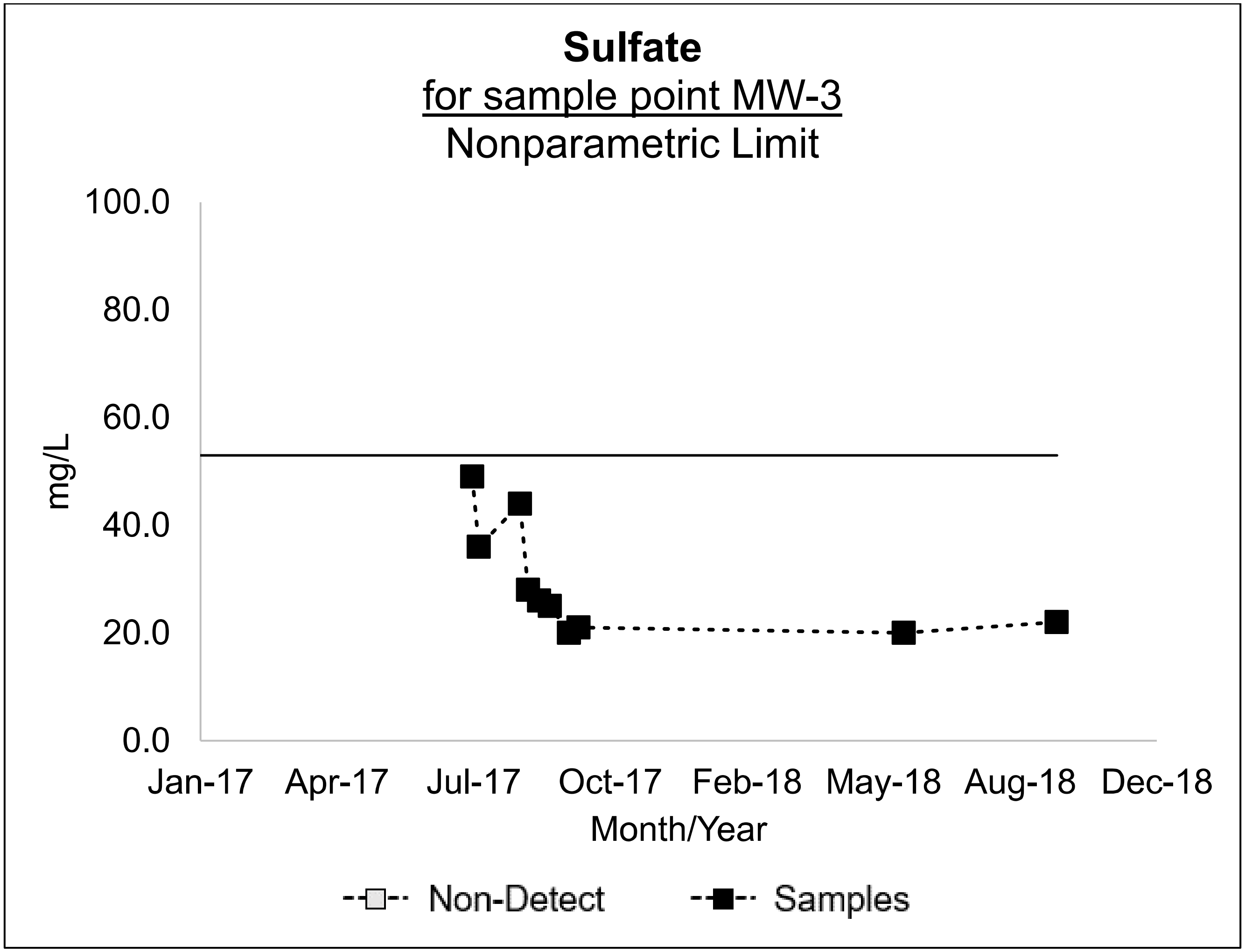
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 17

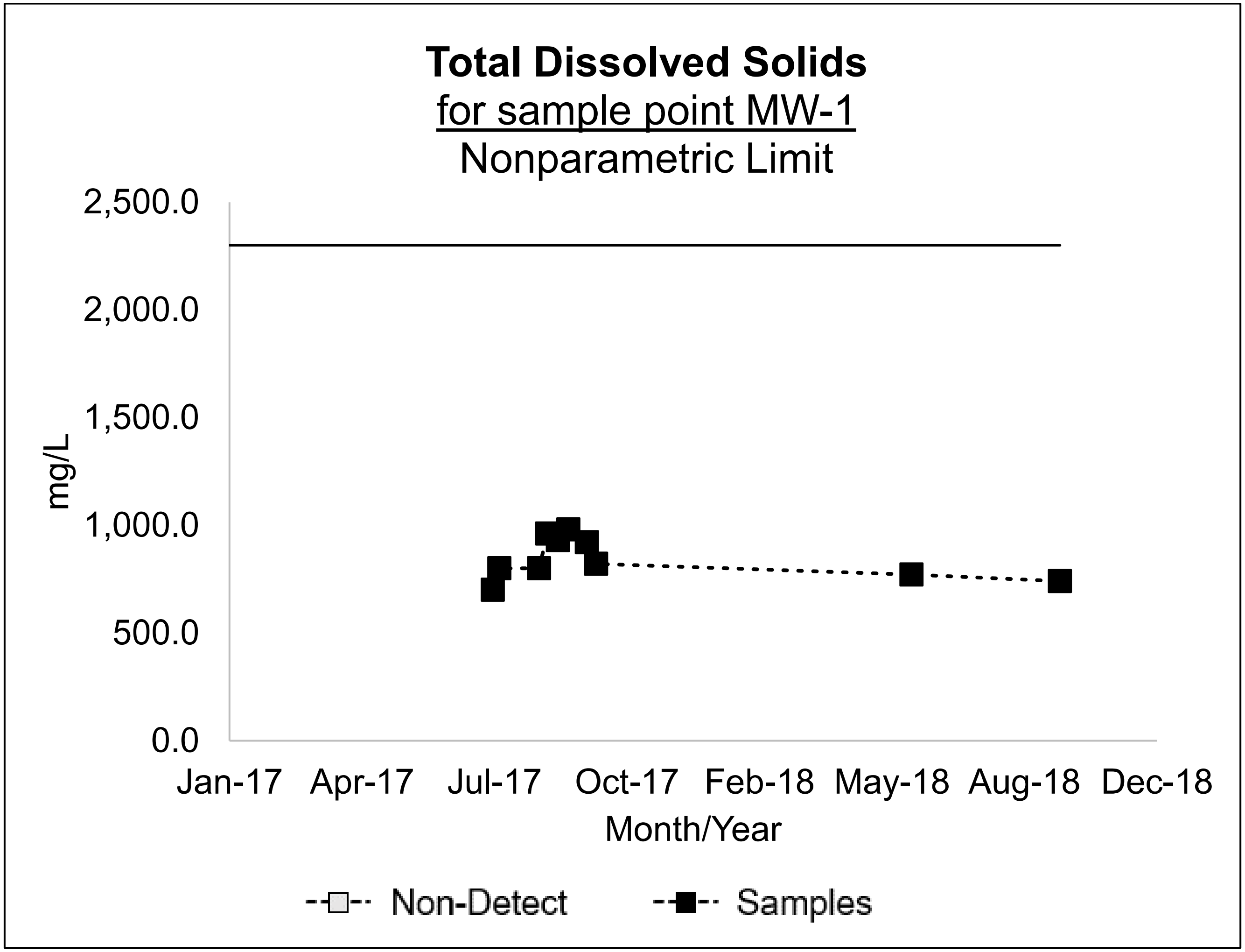
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 18

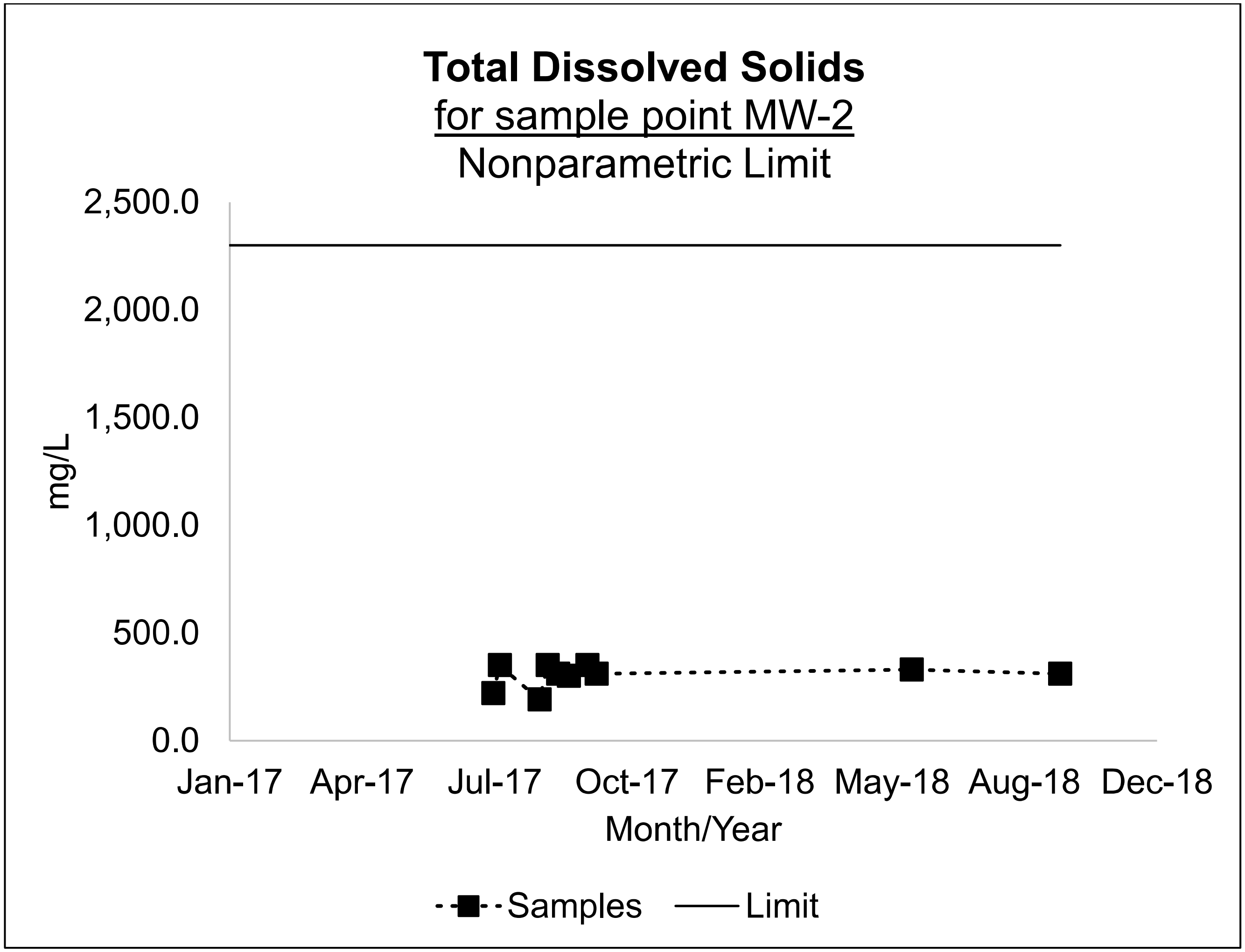
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 19

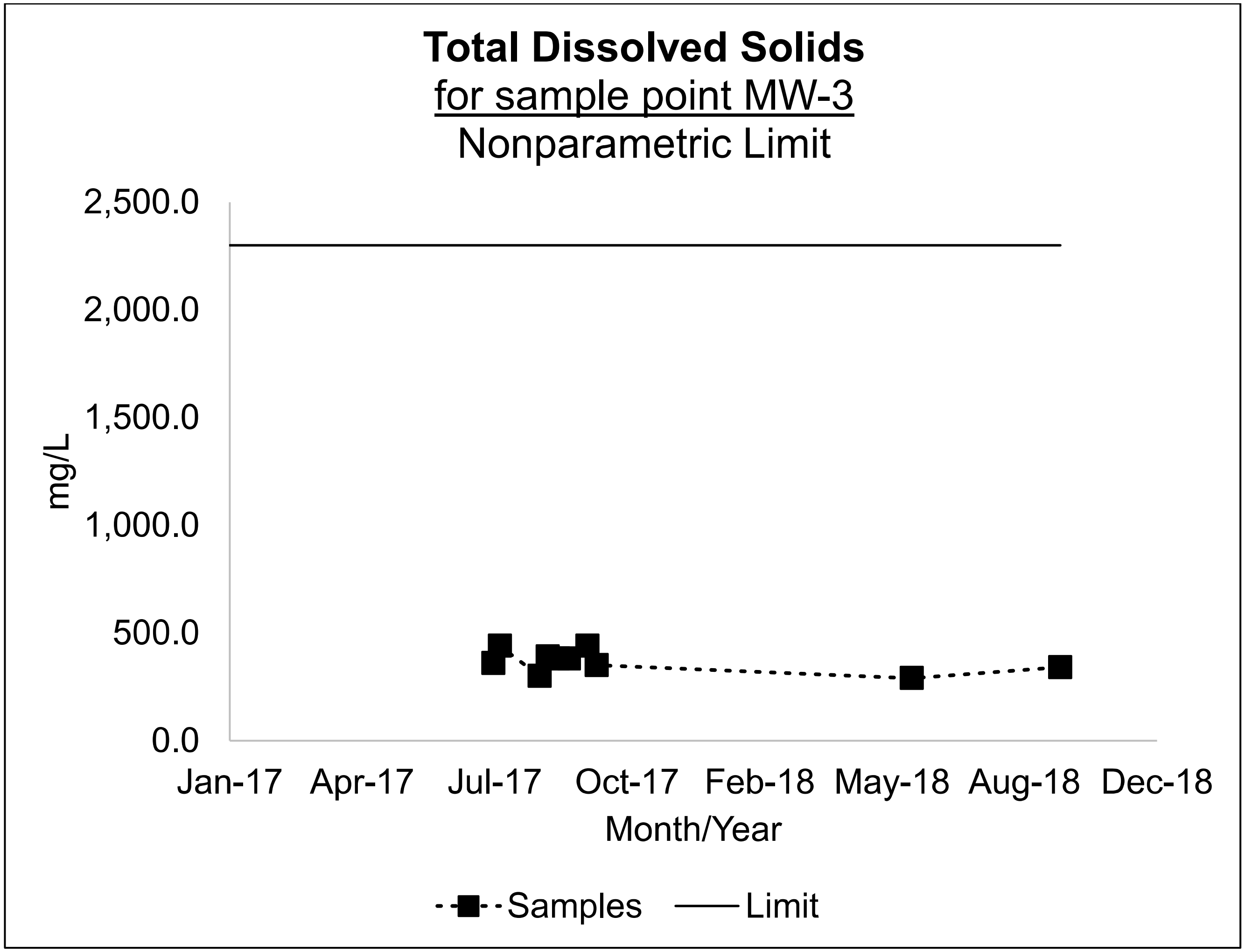
Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 20

Up vs. Down Prediction Limits



**Measurements obtained during redevelopment of the wells on 5/30/2018 were not used in the statistical analysis because they are not representative of undisturbed steady-state conditions*

Graph 21

Attachment D

False positive and false negative rates for current upgradient vs downgradient monitoring program