FRESH WATER MONITORING PROGRAM
ANNUAL REPORT

WATER YEAR 2019

(October 1, 2018, through September 30, 2019)

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EXECUTIVE SUMMARY

This annual report has been prepared by the Hecla Greens Creek Mining Company (HGCMC) in accordance with the Fresh Water Monitoring Program (FWMP) contained in the mine's General Plan of Operations Appendix 1: Integrated Monitoring Plan (IMP). Monitoring interpretative data reports are presented for thirteen surface water and four groundwater monitoring sites.

Each site's interpretative report summarizes the annual dataset with respect to several goals and objectives outlined in the FWMP. Each report contains a list of any exceptions, omissions, or errors that occurred during data collection. The report lists a comparison of each site's annual dataset to all appropriate applicable Alaska Water Quality Standards (AWQS). Finally, a series of summary tables and X-Y graphs have been generated to meet the specific statistical goals for each site.

All required sampling was accomplished as specified in the monitoring schedule, and for each site, the specified analytic suite (P or Q) was performed on the collected samples. Applicable holding times were achieved for all analytes, and no data points were qualified as outliers.

No exceedances of Alaska Water Quality Standards (AWQS) occurred along Greens Creek at the four monitoring points (Site 48 (background), Site 6, Site 54, and Site 62) or the one floodplain monitoring site (Site 61) during Water Year 2019.

Site 13 was in exceedance, twice each, for dissolved cadmium and dissolved zinc. HGCMC removed 11,200 bank cubic yards of material from the 1350 during the 2014 summer season. It was after this disturbance that the exceedances started to occur. This has been seen before with other reclamation projects, and with those, the increased concentrations were short-lived.
In 2015 HGCMC removed additional material at the 1350 from the access to the raised bore ventilation shafts. Late in August 2016, a collection system was installed at the base of the remaining material to be reclaimed. A reduction in zinc and cadmium concentrations in 2018 is attributed to the installation of the collection system and natural attenuation of the stored metal load in the reclaimed area. HGCMC will continue to monitor the area as it stabilizes and matures.

No exceedances of AWQS were recorded for Bruin Creek, during Water Year 2019; monitored at the up-gradient Site 49 (background) and downgradient Site 46. There were no exceedances recorded at the background Site 57, located upgradient from the mine operations near the waste rock facility Site 23.

Exceedances in the tailings area were noted for low pH and low alkalinity. The shallow wells (Site 27, Site 29, and Site 32) continued to express the natural condition of low pH and low alkalinity that characterize these sites located in organic-rich peat sediments. One exceedance was recorded for lead at Site 29.

Site 60 had exceedances for low alkalinity, low pH, and elevated mercury. Dissolution of tailings dust particles, which contain small amounts of mercury, and atmospheric deposition of mercury from natural (e.g., volcanoes) and anthropogenic sources (e.g., coal-fired power plants in Asia) are potential sources of this metal in the drainage area. Three of the four samples collected during the current water year were within AWQS. The other sample (0.0128 µg/L) was slightly

above the AWQS of 0.012 µg/L. Sampling in adjacent drainages during the Water Year 2009 and Water Year 2013 showed that this issue was isolated to only the Site 60 watershed.

Site 9 on Tributary Creek south of the facility had exceedances for low alkalinity, low pH, and elevated levels of lead. Low alkalinity and pH values are expected given the naturally occurring acidic muskeg conditions in the headwaters near Site 27 and Site 29. Site 9 had two samples that were slightly above the hardness based AWQS for lead. Site 609 had a single exceedance, out of the four samples taken, for total sulfate (272 mg/L).

Graphical and non-parametric analyses for trends in the data were performed for all sites when sufficient data were available. Statistically significant trends were identified as follows: Site 57, an increasing trend in total alkalinity; Site 13, a decreasing trend in conductivity and total sulfate; Site 29, an decreasing trend in conductivity and dissolved zinc, with an increasing trend in total sulfate; Site 60, an upward trend in total sulfate; Site 27, an upward trend in total alkalinity and conductivity; Site 32, an upward trend in conductivity, pH, and alkalinity with a decrease in dissolved zinc; Site 9, a decreasing trend in pH.

A non-parametric comparison of medians was performed for all the appropriately paired surface sites (48-6, 6-54, 54-62). Significant differences were noted for the paired datasets from Greens Creek (48-6) for total sulfate, and dissolved zinc. These differences have been observed in previous annual reports and do not appear to be increasing in magnitude. Paired sites 6-54 showed significant differences for conductivity. Also, significant differences were observed between the paired Greens Creeks sites 54-62 for conductivity, pH, and total sulfate.

With the reduction in the sampling frequency for the Bruin Creek sites (49 and 46), a statistical analysis of median values cannot be calculated. Instead, the data from Site 46 is analyzed on an intra-site basis using the combined Shewhart-CUSUM control charts. An analysis using these charts reached the same conclusion as in previous reports that HGCMC is not having a measurable effect on Site 46.

Site 27, Site 29, and Site 32 are analyzed using the combined Shewhart-CUSUM control charts. From this evaluation, it is recognized that Site 27 has experienced changes over time. Primarily the specific conductance and total sulfate charts begin to go out of control in early 2008. This was attributed to the building of the rock-fill pad east of Pond 7. Both parameters are trending towards pre-pad disturbance levels; however, with the construction of the tailings expansion (2015-2018) occurring immediately upgradient of the monitoring site, some fluctuation in the water chemistry is occurring. It is expected that once the area has stabilized that the variations in water chemistry will stabilize. The other control chart for dissolved zinc first went out of control during the Water Year 2007, a high fugitive dust year. Twice since zinc concentrations have been above the control limits, also associated with fugitive dust loading. However, after each of these events, the values return to the historical range. Control charts for Site 32 indicate conductivity and alkalinity went out of control in the 2017 water year, but are trending towards established baseline conditions. The driver for this fluctuation is likely a result of construction activity near the well.

INTRODUCTION

This annual report for Water Year 2019 (October 1, 2018, through September 30, 2019, provides the information required by the Fresh Water Monitoring Program (FWMP). It is separated into several sections, the first of which provides general information applicable to the entire program, followed by a comprehensive analysis of the data for each specific site.

Data values reported by the laboratory as being below the Method Detection Limit (MDL) are assigned a value of zero for plotting purposes. This is done so that the values below MDL are visually distinct and thus can be properly interpreted. On several of the graphs presented, changes have occurred in MDL over the period shown. This leads to the visual impression that an upward trend exists when, in fact, the older analysis had MDL greater than ambient background levels. For the current Water Year's data, the actual MDLs for non-detect values are listed in each site's table of results in the interpretative discussion of this report. For prior Water Year's historic MDLs please refer to GPO Appendix 1, Table 8-2.

The monitoring schedule varies from site to site, and different sites are monitored for different analytes on different months of the year. Occasionally, sites scheduled for sampling may not be available due to weather or more rarely operational reasons. A copy of the Water Year 2019 sampling log is included in this section, and any variations from scheduled sampling events are noted on each site's table of results presented in the interpretive section.

The following table outlines the Statistical Information Goals for each site sampled during the Water Year 2019.

		Trend			
Site	AWQS Comparison	Visual	Calc	Median Comparison	Control Chart
48	x	x	x		
6	x	x	x	6 vs 48	
54	x	x	x	54 vs 6	
62	x	x	x	62 vs 54	
46	x	x	x		x
49	x	x	x		
61	x	x	x		
13	x	x	x		
57	x	x	x		
27	x	x	x		x
29	x	x	x		x
32	x	x	x		x
9	x	x	x		
60	x	x	x		
609	x	x	x		
711	x	x	x		
712	x	x	x		

Comparison to Alaska Water Quality Standards (AWQS) is required for all sites. In Appendix A the specific water quality criteria used for each comparison are summarized. Trend analysis is carried out by two different methods. The first method is a visual trend analysis for each analyte. For each site sampled, a series of time-concentration graphs are constructed for the previous five years of data collected. The second method is a non-parametric statistical method, Mann-Kendall seasonal trend analysis that is routinely done for conductivity, pH, alkalinity, and dissolved zinc. These are the key parameters, along with sulfate that can be strongly affected by Acid Mine Drainage (AMD). Sulfate was added back into the required list of analytes in the 2002 Water Year. Median calculations are shown in the annual table of results for each site. Finally, for all downgradient sites that are paired with an upgradient reference site, which are monitored with a frequency greater than four (4) times per year, a comparison of medians is presented for each specific site. These down gradient sites (upgradient site in parenthesis) include Site 6 (Site 48), Site 54 (Site 6), and Site 62 (Site 54). For each of these sites, a comparison of medians was performed for total alkalinity, pH, conductivity, total sulfate, and dissolved zinc. The statistical test utilized is a non-parametric, Wilcoxon signed-rank test. A brief summary of the two main statistical procedures, the Wilcoxon-Mann-Whitney rank-sum test and the Mann-Kendall seasonal trend, are given below.

With the approved decrease in the sampling frequency at Site 46 and Site 49, the statistical procedures previously discussed are no longer useable. More recently, the analysis of data for Site 46 has been conducted using intra-site methodologies instead of an inter-site comparison. In the interpretive section of Site 46 is a discussion of this methodology. This technique was also applied to Site 27, Site 29, and Site 32. Much of the development and understanding of the technique used has come from the Resource Conservation and Recovery Act (RCRA) documents concerning groundwater monitoring at waste sites.

Statistical Tests

The Mann-Kendall seasonal trend test is a non-parametric test for zero slope of a linear regression of time-ordered data verse time. Briefly, the test consists of tabulating the Mann-Kendall statistic S_k (k=1 to 12, for each month) and its variance VAR(S) for data from each season (month). The S_k statistic is simply the sum of the number of positive differences minus the number of negative differences for time-ordered data pairs. Any seasonal trend is removed by only considering data pairs taken within the same month. The individual monthly Mann-Kendall statistics (S_k) are tested for homogeneity of trend, which is used to determine if it is reasonable to combine the monthly S_k statistics into an overall annual statistic (ΣS_k). If the test for monthly homogeneity is rejected, the annualize statistic is not meaningful. However, the individual monthly Mann-Kendall statistics can still be tested for trend, and a Sen's slope estimator can be calculated for each month (noted as Q_m in the interpretive section) with a significant trend.

The advantages of the Seasonal Kendall trend test is that it is a rank-based procedure especially suitable for non-normally distributed data, censored data, data containing outliers, and non-linear trends. The null hypothesis (H_0) states that the data(x_1, ., x_n) are a sample of n independent and identically distributed random variables. The trend test statistic Z is used as a measure of trend magnitude, or of its significance. A positive Z value indicates an upward trend, while a negative value indicates a downward trend. However, the Z statistic is not a direct quantification of trend magnitude. For trends of significant magnitude a separate statistic, Sen's slope estimator is

calculated by computing the seasonally adjusted (monthly) median value for the slope. For datasets that fail the homogeneity test, individual monthly S_k statistics are compared to a theoretical probability distribution of S derived by Mann and Kendall (Table A18 in Gilbert, 1987). Statistically significant trends ($\alpha/2 = 2.5\%$) are noted for p-values >=0.975 or <=0.025. Further guidance and background on these statistical methods can be found in Gilbert (1987) or Helsel and Hirsch (1992).

The Wilcoxon signed-rank test is used to determine if the median difference between paired data points is equal to zero. In general terms, the signed-rank is used to determine if a set of paired data observations, x's and y's, come from the same population (i.e., have the same median) or as the alternative hypothesis differ only in the location of the central value (median). If the data are from the same population, then the differences of the paired data should be equally distributed around 0, or about half the differences should be greater than 0, and half should be less than 0. Computationally the test is straight forward. First, the differences $D_i=x_i-y_i$, i=1…N are computed for each pair. The absolute values of the differences $|D_i|$, i=1…N are ranked from smallest to largest, and data pairs that are tied, thus having differences of zero, are ignored. The ranks of the absolute differences are assigned the sign of the actual differences. For example, negative differences have negative-signed ranks, and positive differences have positive-signed ranks; thus the term "signed-rank" in the method name. The test statistic W^+ is the sum of all positively signed ranks. The statistic W^+ is then compared to tabled values that vary based on N. The one-tailed version of the signed-rank test has been applied to the key indicator analytes of conductivity, pH, total alkalinity, sulfate, and dissolved zinc as listed in the table below. For a significant difference to be noted, the difference must be in the direction indicated in the table and at a significance level of α=0.05 (p-value less than or equal to 0.05).

Analyte	Rationale	median |D|	Tail	Reject H_0 if:
Specific Conductance	Conductivity, as a proxy for total dissolved solids, **increases** due to sulfide oxidation.	<0	X's < Y's	$W^+(calc)<W(table)_{\alpha,n}$
Field-pH	pH **decreases** though the addition of H^+ generated by pyrite oxidation.	>0	X's > Y's	$W^+(calc)>W(table)_{\alpha,n}$
Total Alkalinity	Total alkalinity **decreases** by consumption of buffing capacity due to H^+ produced by pyrite oxidation associated with waste rock.	>0	X's > Y's	$W^+(calc)>W(table)_{\alpha,n}$
Total Alkalinity	Total alkalinity **increase** by the weathering of carbonate mineralogy, associated with tailings	<0	X's < Y's	$W^+(calc)<W(table)_{\alpha,n}$
Total Sulfate	Total sulfate **increases** due to oxidation of sulfides	<0	X's < Y's	$W^+(calc)<W(table)_{\alpha,n}$
Dissolved Zinc	Dissolved zinc **increases** due to sulfide oxidation and is more readily soluble at neutral pH than other metals.	<0	X's < Y's	$W^+(calc)<W(table)_{\alpha,n}$

X: Upgradient Site

Y: Downgradient Site

Further guidance and background on the statistical methods utilized in this report can be found in one of the following references: Helsel and Hirsch (1992), Gilbert (1987), or Section 3.3.3.1 of the EPA document "Guidance for Data Quality Assessment" EPA/600/R-96/084.

Qualified Data by QA Reviewer - QA reports provide a summary for each site section of data limitations found in the monthly QA reviews. They list all data for that site that was qualified by

the QA Reviewer for Water Year 2019 along with the reason for qualification. These data are included in the data analyses unless identified as an outlier in the Qualified Data Summary.

INTERVENTIONS

This section identifies any procedural changes, natural phenomena, mine operational changes, or other interventions that could have affected data during Water Year 2019. Results of any visual data analyses to detect the effects of these interventions are also indicated.

Prior interventions (and negotiated mid-year program modifications such as changes to laboratories, methods, detection limits, and reporting limits), and anything else which may affect data comparability and quality which occurred during previous Water Years, are documented in the "General History" section of the FWMP and in previous annual reports.

- All required sampling was accomplished during the 2019 Water Year as specified in the monitoring schedule.

MID-YEAR MODIFICATIONS

There were no mid-year modifications.

GENERAL HISTORY

There has been an error in the graphical labeling found in the 2004-2009 annual reports. It was noticed, a few years ago, that on most of the graphs, the line indicating the AWQS is labeled as 'total.' Most of the analytes in this report are dissolved, and HGCMC is held to the dissolved AWQS. All analyses have been dissolved during this timeframe, so the graphs were mislabeled and should read 'dissolved.' After reviewing the yearly files, it appears that HGCMC was using total standards prior to 2003 when the change was made to using the dissolved standards. This change resulted in modifying the limits and also the graph labels, both of which were correctly done in 2003. Unfortunately, in 2004-2009 both of these modifications were not carried forward. This error in labeling was first corrected in the 2010 FWMP Report.

It was noted, during the annual meeting in 2012, that the units on the conductivity graphs were expressed as 'NTU' and not 'µS/cm.' This error was corrected in the 2012 FWMP Report.

A number of modifications were made to the FWMP with regards to sample sites and frequency. These modifications were discussed during the 2012 annual meeting, and the discussion was followed up with two formal request letters in January 2013 and October 2013. Approval for these changes was granted in late October 2013. See the 2013 FWMP report for a thorough analysis of these changes.

During the 2014 Water Year, sampling at Site 61 was increased to monthly beginning in June 2014. This modification was initiated because of the exceedances recorded with the first sampling. After conducting this additional sampling for over a year, and with no further exceedances, the frequency of sampling was changed back to quarterly, as called for in the FWMP.

While compiling the 2018 Water Year report, it was noted that reports for the 2016 and 2017 Water Years did not include comparison graphs for the Greens Creek monitoring points.

FWMP SAMPLE LOG

2019 Water Year October 2018 Through September 2019

Annual Water Quality Monitoring Schedule-Laboratory Samples

Site Number	Sample Identifier	Site Name	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
6	006FMS	Middle Greens Creek	P	P	Q	P	Q	P	P	P	P	P	P	P
9	009FMS	Tributary Creek-Lower		Q						Q		Q		Q
13	013FMS	Mine Adit Discharge East		Q						Q			Q	
27	027FMG	Monitoring Well 2S		Q						Q		Q		Q
29	029FMG	Monitoring Well 3S		Q						Q		Q		Q
32	032FMG	Monitoring Well 5S		Q						Q		Q		Q
46	046FMS	Lower Bruin Creek		Q			Q			P			P	
48	048FMS	Upper Greens Creek	P	P	Q	P	Q	P	P	P	P	P	P	P
49	049FMS	Control Site Upper Bruin Creek		Q			Q			P			P	
54	054FMS	Greens Creek below D-Pond	P	P	Q	P	Q	P	P	P	P	P	P	P
57	057FMG	Monitoring Well -23-00-03		Q			Q			Q			Q	
60	060FMS	Althea Creek - Lower		Q						Q		Q		Q
61	061FMS	Greens Creek Floodplain		Q			Q			P			P	
62	062FMS	Greens Creek Lower Than 54	P	P	Q	P	Q	P	P	P	P	P	P	P
609	609FMS	Further Creek Lower		Q						Q		Q		Q
711	711FMS	Greens Creek Above Site E									Q			P
712	712FMS	Greens Creek Below Site E									Q			P
1913	1913	Greens Creek Floodplain		Q			Q			P			P	
1914	1914	Greens Creek Floodplain		Q			Q			P			P	
1067	1067	TRIP BLANK		Q						Q				Q
1068	1068	FIELD BLANK @ SITE	**54**	**46**	**6**	**48**	**49**	**54**	**6**	**60**	**712**	**32**	**57**	**9**

SAMPLE SUITES

Suite P
(Surface water only)

Conductivity
pH
Temperature
Hardness
Sulfate
Total Alkalinity
Dissolved Arsenic
Dissolved Cadmium
Dissolved Copper
Dissolved Lead
Dissolved Mercury
Dissolved Zinc

Suite Q
(Groundwater and surface water)

Conductivity
pH
Temperature
Hardness
Sulfate
Total Alkalinity
Dissolved Arsenic
Dissolved Barium
Dissolved Cadmium
Dissolved Chromium
Dissolved Copper
Dissolved Lead
Dissolved Mercury
Dissolved Nickel
Dissolved Selenium
Dissolved Silver
Dissolved Zinc

PERSONNEL INVOLVED

USFS

Basia Trout, Monument Ranger Matt Reece
Richard Dudek

HGCMC

Keith Malone, General Manager
Brian Erickson, General Manager

Christopher Wallace, Environmental Manager
Cameron Sell, Environmental Engineer
David Landes, Environmental Engineer

Douglas Maller, Environmental Specialist
Gunnar Fredheim, Environmental Specialist

Biomonitoring (Fish and Game)

Kate Kanouse
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Laboratory Analysis

David Wetzel, Project Manager
Admiralty Environmental

Nicholas Ward, Project Coordinator
Battelle Marine Sciences Laboratory

Sue Webber, Project Manager ACZ

SITE COORDINATES

Site	Site Name	Latitude	Longitude
6	Greens Creek – Middle	58°04’47.424” N	134°38’25.849” W
9	Tributary Creek - Lower	58°06’22.040” N	134°44’44.100” W
13	East Mine Drainage Upper	58°04’47.685” N	134°37’39.951” W
27	Monitoring Well-2S	58°06’48.546” N	134°44’38.365” W
29	Monitoring Well-3S	58°06’59.860” N	134°44’51.821” W
32	Monitoring Well-5S	58°06’57.732” N	134°44’51.225’ W
46	Bruin Creek – Lower	58°04’46.450” N	134°38’32.580” W
48	Greens Creek – Upper	58°05’01.350” N	134°37’33.590” W
49	Bruin Creek – Upper	58°05’04.070” N	134°38’30.410” W
54	Greens Creek - Lower	58°04’41.681” N	134°38’46.529” W
57	Monitoring Well-23-00-03	58°04’59.933” N	134°38’39.881” W
60	Althea Creek - Lower	58°04’41.770” N	134°45’08.432” W
61	Greens Creek Floodplain	58°04’43.480” N	134°38’52.910” W
62	Greens Creek Lower Than 54	58°04’38.650” N	134°39’06.000” W
609	Further Creek – Lower	58°07’05.707” N	134°45’06.332” W
711	Greens Creek Above Site E	58°04’08.425” N	134°43’27.181” W
712	Greens Creek Below Site E	58°04’13.858” N	134°43’42.438” W

PROPOSED PROGRAM MODIFICATIONS

In 2020 HGCMC will adopt the new sampling and reporting schedule as approved with the renewal of the Waste Management Permit No. 2020DB0001.

BIBLIOGRAPHY

Environmental Protection Agency (1998). *EPA Guidance for Data Quality Assessment.* EPA QA/G-9, EPA/600-R-96/084. U.S. Environmental Protection Agency, Office of Research and Development, Washington, D.C. 219 pp.

Gilbert, Richard O. (1987). *Statistical Methods for Environmental Pollution Monitoring.* Van Nostrand Reinhold, New York. 320 pp.

Helsel, D.R., and Hirsch, R.M. (1992). *Statistical methods in water resource.* Elsevier Publishers, Amsterdam. 510 pp.

INTERPRETIVE REPORT
SITE 48

The data collected during the current water year are listed in the following "Table of Results for Water Year 2019" report. The table includes all the required FWMP analyte data (field and laboratory) collected for the current water year and a series of flags keyed to the summary report "Qualified Data by QA Reviewer." The QA report lists any associated data limitations found during the monthly QA reviews of laboratory data for this site. Median values for all analytes have been calculated and are shown in the right-most column of the table of results. Any value reported as less than MDL has been replaced with a value of one-half of the MDL for the purpose of median calculation.

All data collected at this site for the past six years are included in the data analyses, with the exception of the outliers shown in the table below. During the current year, no data points were flagged as outliers after reviewing by HGCMC.

Sample Date	Parameter	Value	Qualifier	Notes
No outliers, in the past six years, have been identified by HGCMC.				

The data have been compared to the strictest freshwater quality criterion for each applicable analyte. No results exceeded these criteria.

Table of Exceedance for Water Year 2019

			Limits		
Sample Date	Parameter	Value	Lower	Upper	Hardness
No exceedances have been identified by HGCMC for the period of October 2018 through September 2019.					

X-Y plots have been generated to graphically present the data for each of the analytes requested in the Statistical Information Goals for this site. These plots have been visually analyzed for the appearance of trends in concentration. There were no apparent visual trends.

A non-parametric statistical analysis for trend was performed for specific conductivity, field pH, total alkalinity, total sulfate, and dissolved zinc. Calculation details of the Seasonal Kendall analyses are presented in detail on the pages following this interpretive section. The following table summarizes the results of the data collected between Oct-13 and Sep-19 (WY2014-WY2019).

Site 48 - Table of Summary Statistics for Trend Analysis

	Mann-Kendall test statistics			Sen's slope estimate	
Parameter	**n***	**p****	**Trend**	**Q**	**Q(%)**
Conductivity Field	6	0.65			
pH Field	6	0.13			
Alkalinity, Total	6	0.95			
Sulfate, Total	6	0.85			
Zinc, Dissolved	6	0.08			

* Number of Years ** Significance level

For datasets with a statistically significant trend ($\alpha/2$=2.5%), a Seasonal-Sen's Slope estimate statistic has also been calculated. No significant trends were found.

Table of Results for Water Year 2019

Site 048FMS - 'Upper Greens Creek'

Sample Date/Parameter	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019	**Median**
Water Temp (°C)	5.6	3.5	0.60	0	0.00	0.7	2	3.8	7.8	10.7	11.4	9.8	3.65
Conductivity-Field(µmho)	104.4	117.5	109.8	115.1	149.1	163.6	110.5	91.6	96.4	150.9	148.8	125.5	116.3
Conductivity-Lab (µmho)	103	117	111	139	152	169	113	91	97	144	134	121	119
pH Lab (standard units)	6.65	6.22	6.72	6.36	6.59	6.9	6.5	6.5	6.77	6.47	6.75	6.59	6.59
pH Field (standard units)	7.38	7.73	7.91	7.89	7.94	7.86	7.9	7.79	7.77	7.87	7.83	7.83	7.85
Total Alkalinity (mg/L)	38.6	43.3	40.6	49.8	55	59.9	43.9	35.1	39.2	59.6	58.7	58.7	46.9
Total Sulfate (mg/L)	10	13.7	13.6	17.8	21.2	26.8	12.2	9.5	10.4	20.2	16.6	13.8	13.8
Hardness (mg/L)	48.4	58.4	54.8	65.9	73.6	80.9	53.7	43.1	46.9	74.6	70.9	62.8	60.6
Dissolved As (ug/L)	0.222	0.2	0.201	0.173	0.189	0.195	0.214	0.187	0.202	0.232	0.248	0.245	0.202
Dissolved Ba (ug/L)			26.2		30								28.1
Dissolved Cd (ug/L)	0.0301	0.0329	0.0332	0.0361	0.0357	0.0392	0.025	0.0295	0.0293	0.0376	0.0388	0.0345	0.0339
Dissolved Cr (ug/L)			0.1		0.071								0.086
Dissolved Cu (ug/L)	0.518	0.499	0.598	0.388	0.294	0.231	0.376	0.466	0.243	0.308	0.376	0.56	0.382
Dissolved Pb (ug/L)	0.0078	0.0056	0.0251	0.0033	0.0015	0.0054	0.0015	0.0071	0.0047	0.004	0.0118	0.0066	0.0055
Dissolved Ni (ug/L)			0.307		0.253								0.280
Dissolved Ag (ug/L)			0.002		0.002								0.002
Dissolved Zn (ug/L)	2.4	3.27	3.66	3.62	4.1	4.23	2.31	2.55	3.3	2.63	2.42	2.44	2.95
Dissolved Se (ug/L)			0.692		1.11								0.901
Dissolved Hg (ug/L)	0.000947	0.00105	0.00162	0.0006	0.000489	0.000416	0.000616	0.00101	0.000395	0.000445	0.000525	0.000831	0.000608

For individual sample/analyte qualifier descriptions see "Qualified Data by QA Reviewer" table.

Values reported as less than MDL are replaced by 1/2 MDL for median calculation purposes.

Shaded data has been qualified as an outlier by HGCMC and removed from any further analysis and is not included into the calculation of the median

Qualified Data by QA Reviewer

Date Range: 10/01/2018 to 09/30/2019

Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
048FMS	16-Oct-18	Diss. Pb-ICP/MS	0.00781	µg/L	J	Below Quantitative Range
	12-Nov-18	Diss. Ba-ICP/MS	0.03	µg/L	U	Field Blank Contamination
		Diss. Pb-ICP/MS	0.00559	µg/L	U	Field Blank Contamination
		Diss. Tl-ICP/MS	0.00295	µg/L	J	Below Quantitative Range
	11-Dec-18	Diss. Cr-ICP/MS	0.1	µg/L	J	Below Quantitative Range
		Diss. Ni-ICP/MS	0.3	µg/L	U	Field Blank Contamination
		Diss. Tl-ICP/MS	0.00478	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	3.66	µg/L	U	Field Blank Contamination
	8-Jan-19	Diss. Pb-ICP/MS	0.00325	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	3.62	µg/L	U	Field Blank Contamination
	11-Feb-19	Diss. Cr-ICP/MS	0.07	µg/L	J	Below Quantitative Range
		Diss. Ni-ICP/MS	0.25	µg/L	U	Field Blank Contamination
		Diss. Zn-ICP/MS	4.1	µg/L	U	Field Blank Contamination
	11-Mar-19	Diss. Pb-ICP/MS	0.00543	µg/L	J	Below Quantitative Range
	2-Apr-19	Diss. Zn-ICP/MS	2.31	µg/L	U	Field Blank Contamination
	6-May-19	Diss. Pb-ICP/MS	0.00712	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	2.55	µg/L	U	Field Blank Contamination
	11-Jun-19	Diss. Pb-ICP/MS	0.00472	µg/L	J	Below Quantitative Range
	15-Jul-19	Diss. Pb-ICP/MS	0.00403	µg/L	U	Field Blank contamination
		Diss. Zn-ICP/MS	2.63	µg/L	U	Field Blank contamination

Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

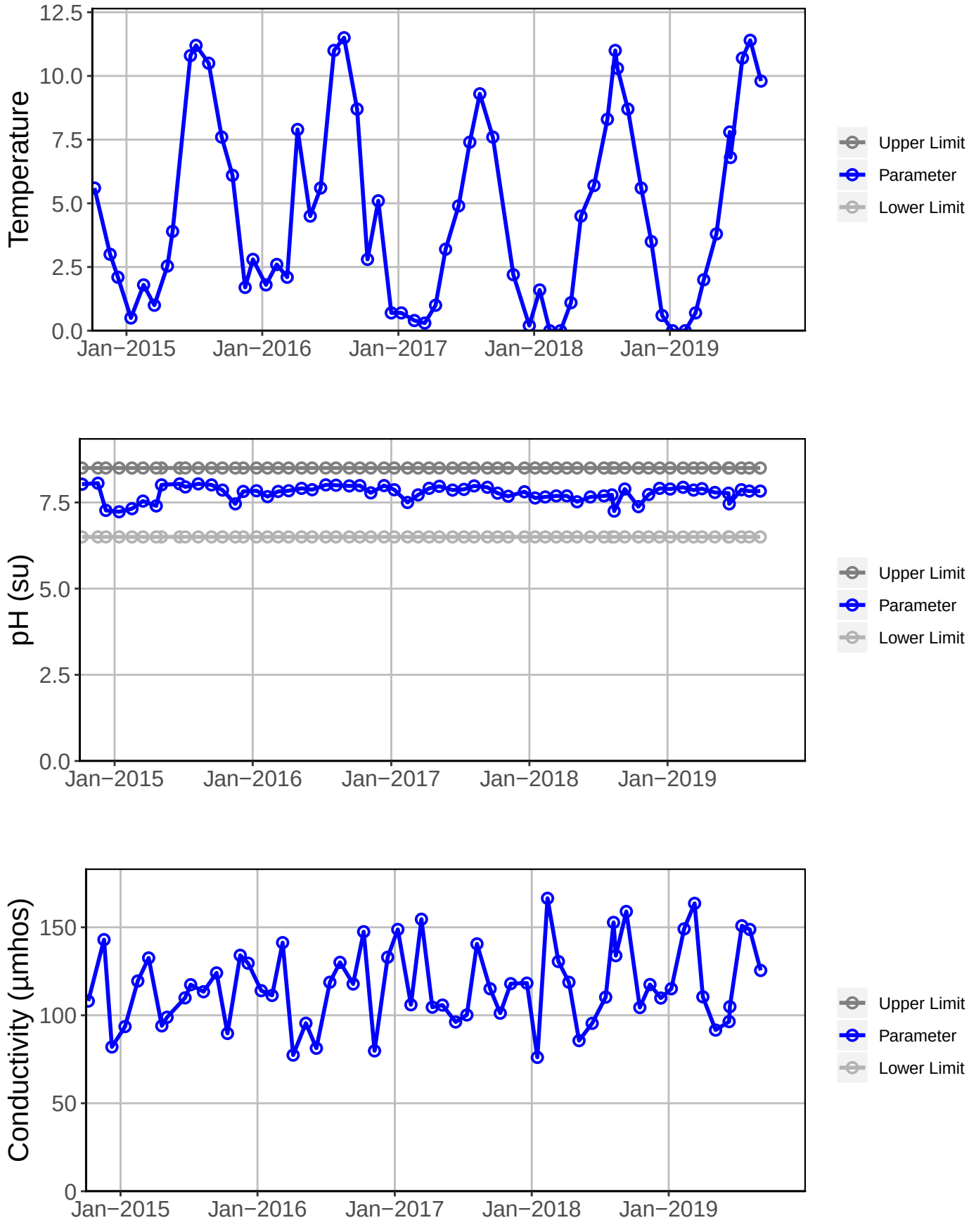
Qualified Data by QA Reviewer

Date Range: 10/01/2018 to 09/30/2019

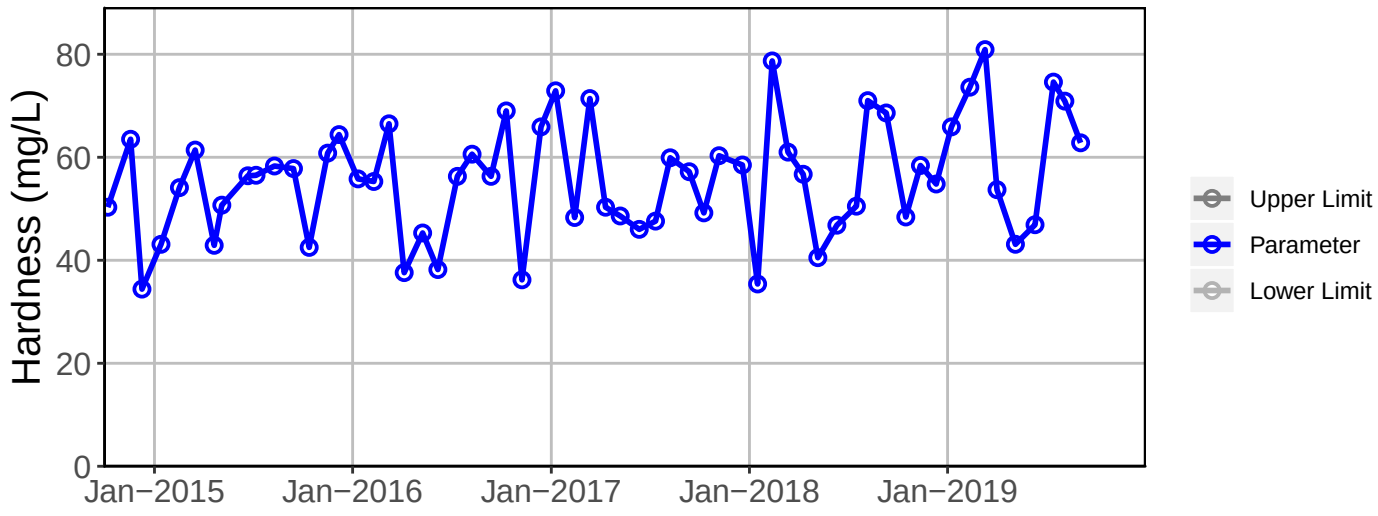
Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
048FMS	5-Aug-19	Diss. Cu-ICP/MS	0.37	µg/L	U	Field Blank Contamination
		Diss. Pb-ICP/MS	0.01	µg/L	U	Field Blank Contamination
		Diss. Zn-ICP/MS	2.42	µg/L	U	Field Blank Contamination
		Total Sulfate	16.60	µg/L	J	Sample Receipt Temperature
	3-Sep-19	Diss. Pb-ICP/MS	0.00656	µg/L	U	Field Blank Contamination
		Total Sulfate	13.80	µg/L	J	Sample Receipt Temperature

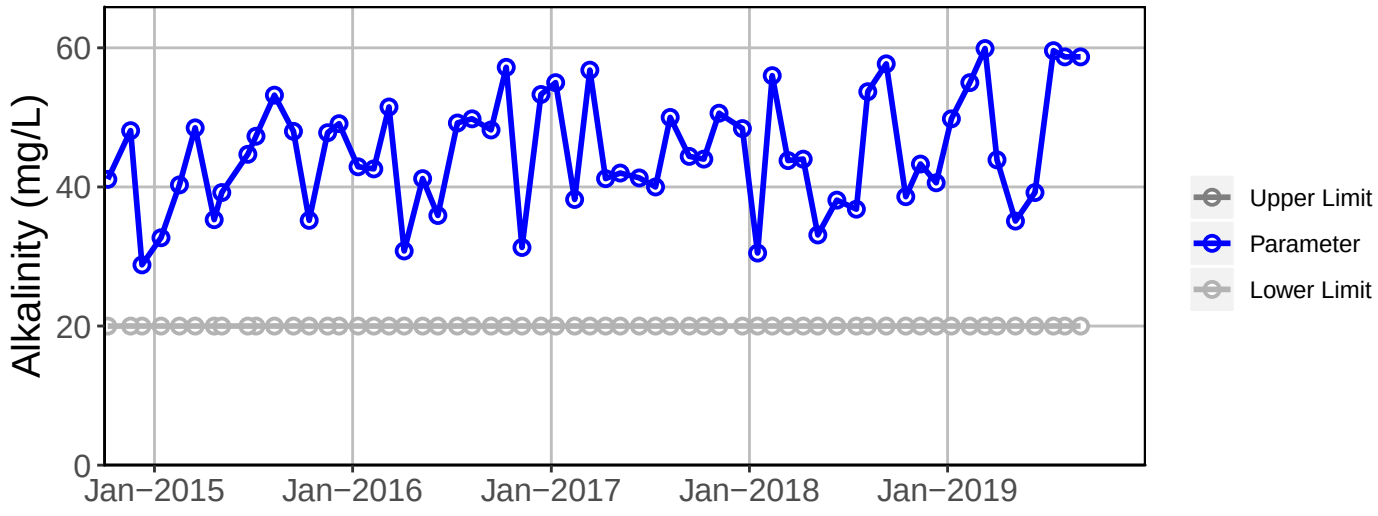
Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

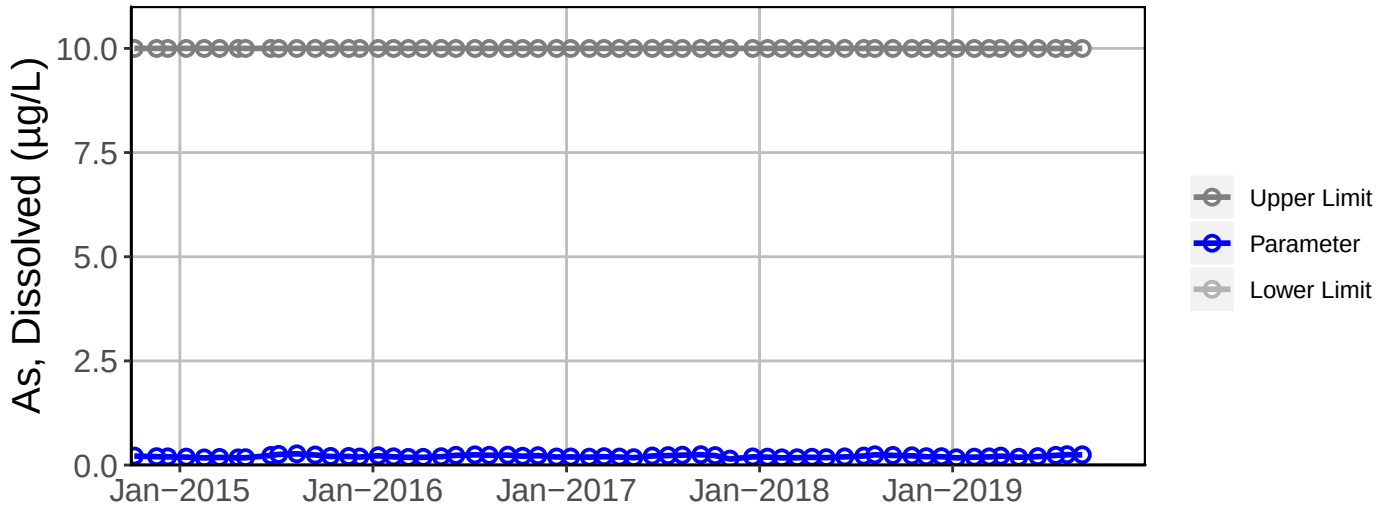
Site 48 Analyte Charts



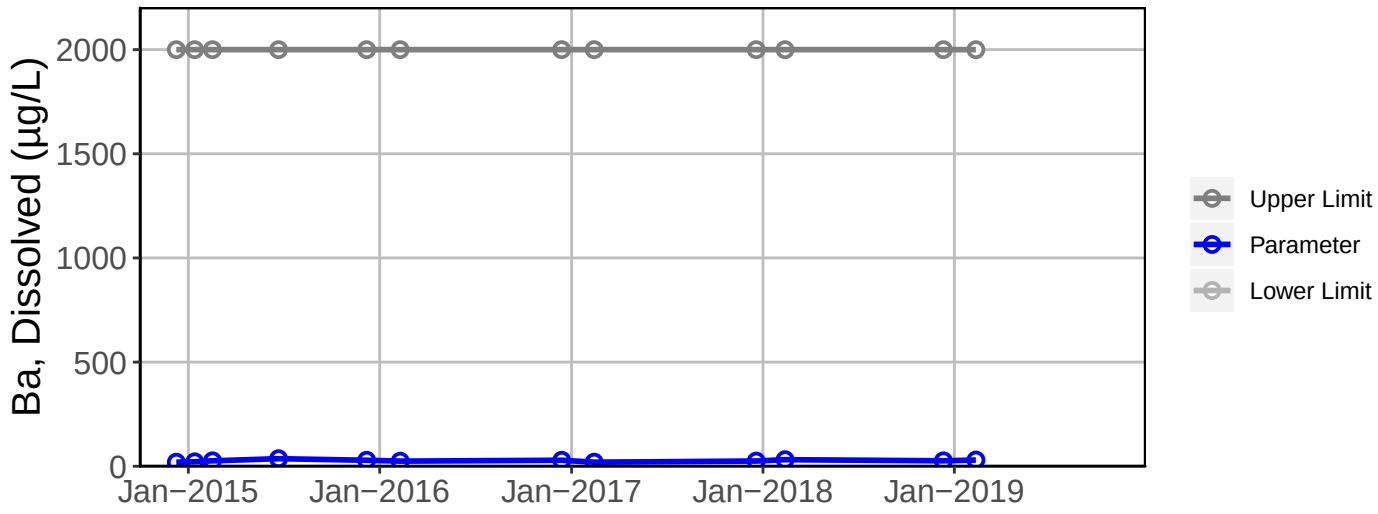
Site 48 Analyte Charts

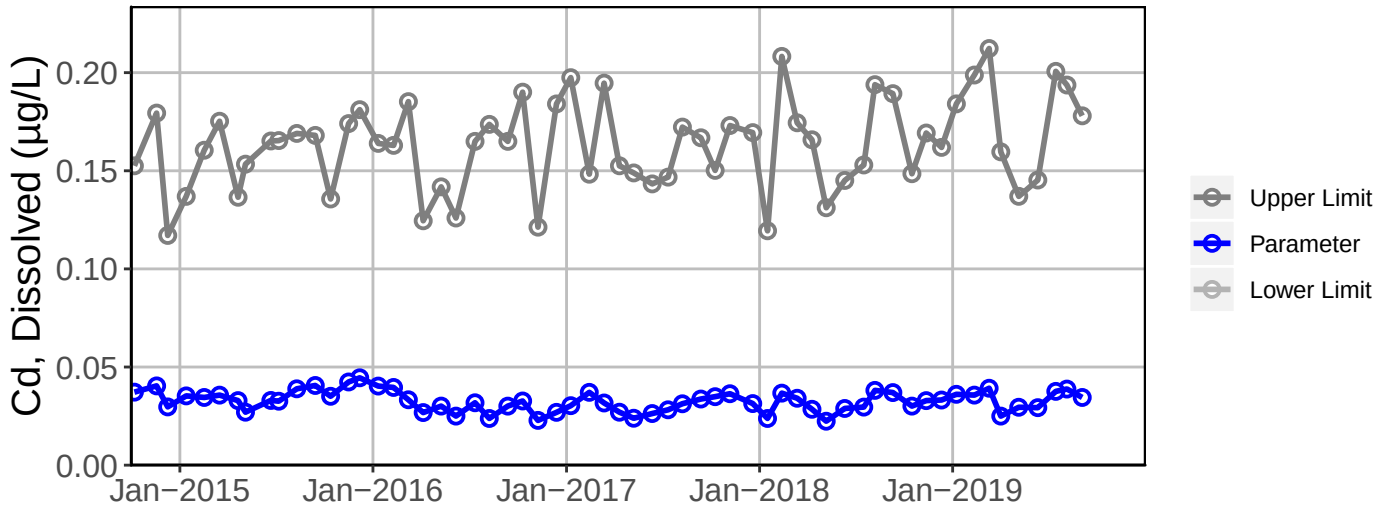


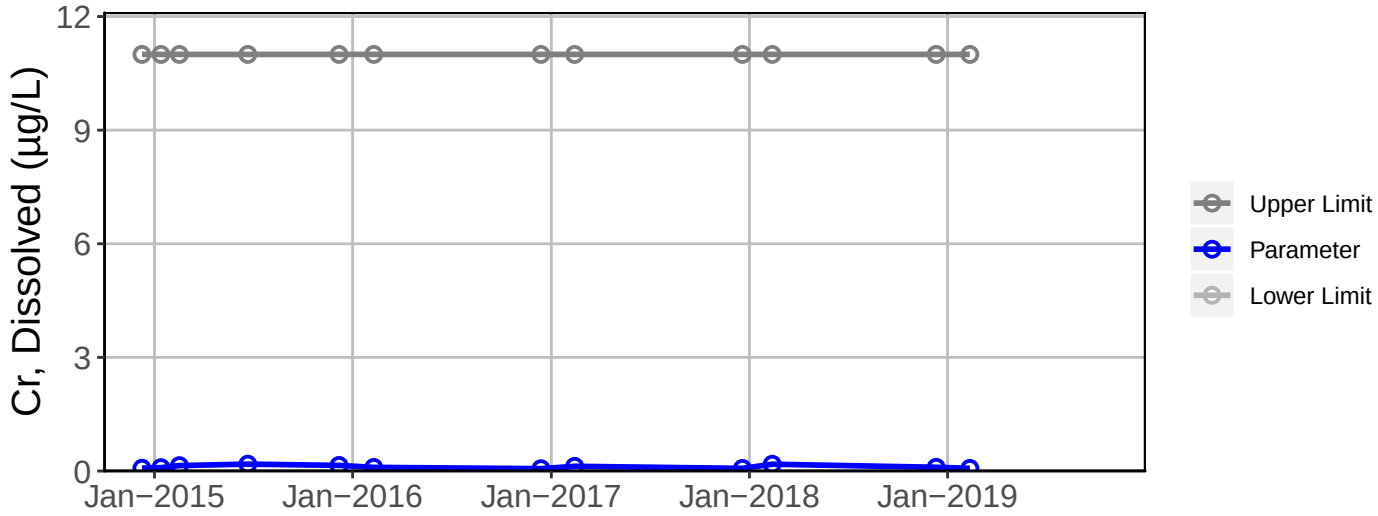




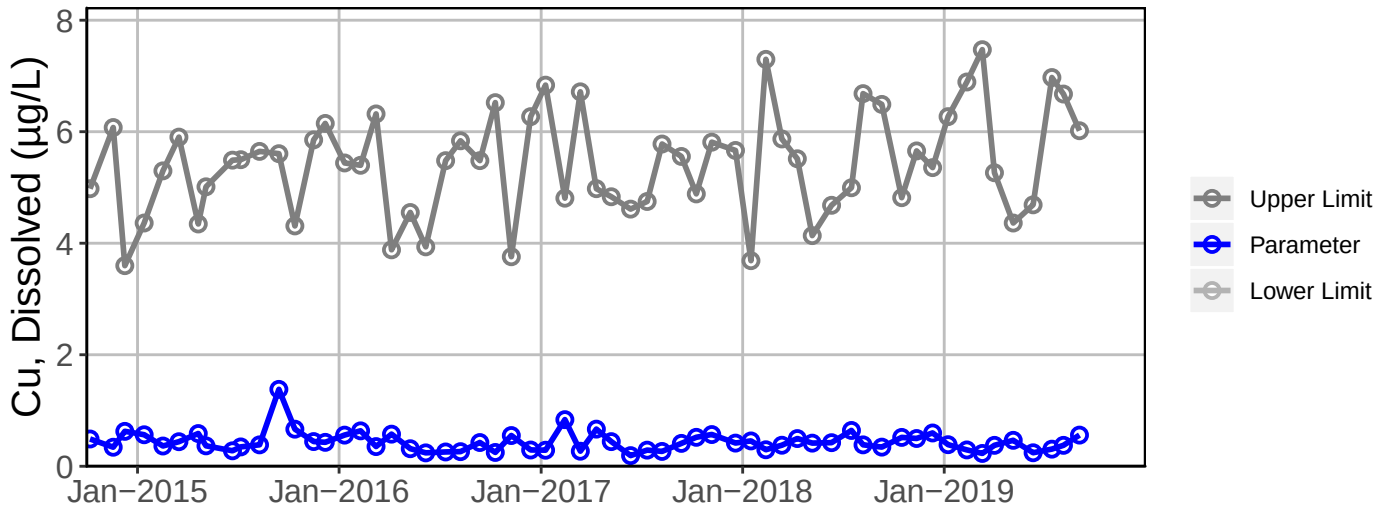
Site 48 Analyte Charts

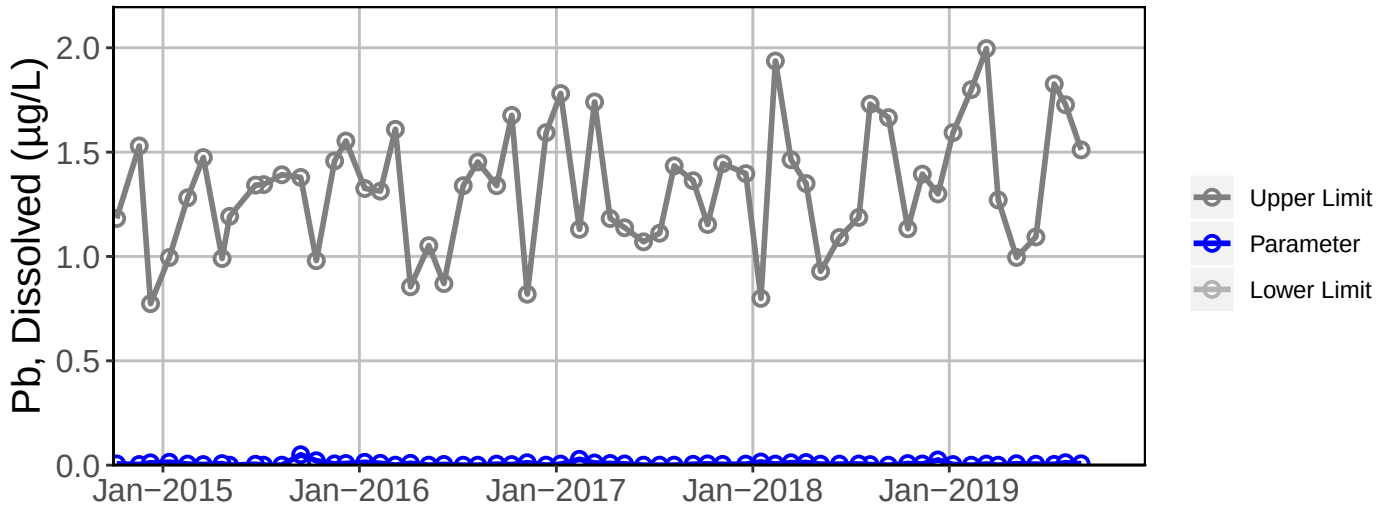


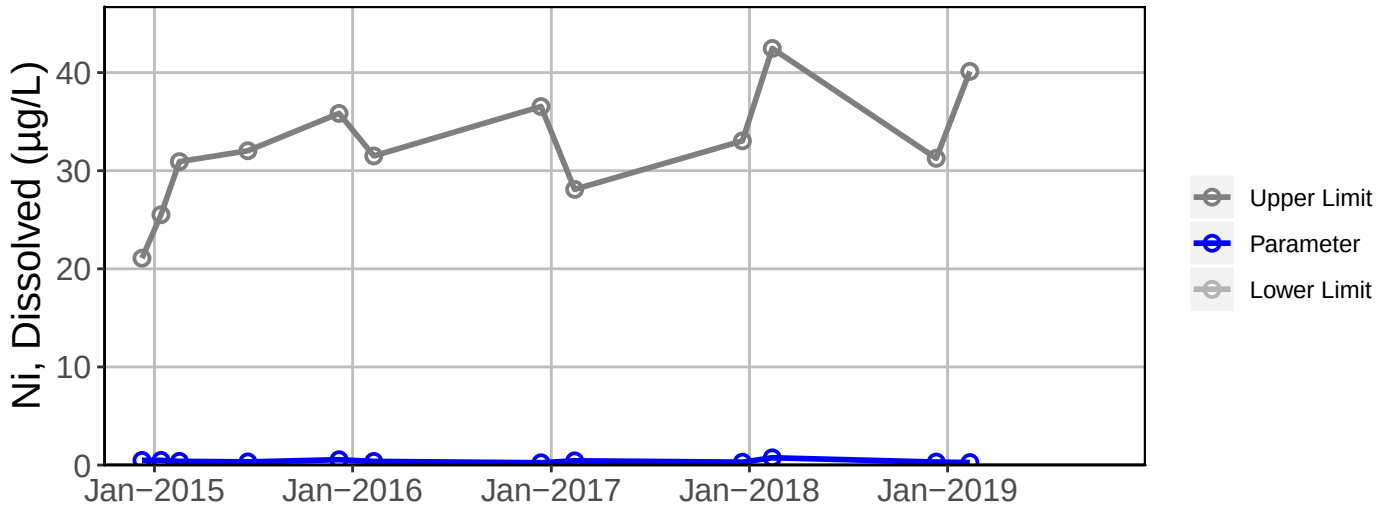




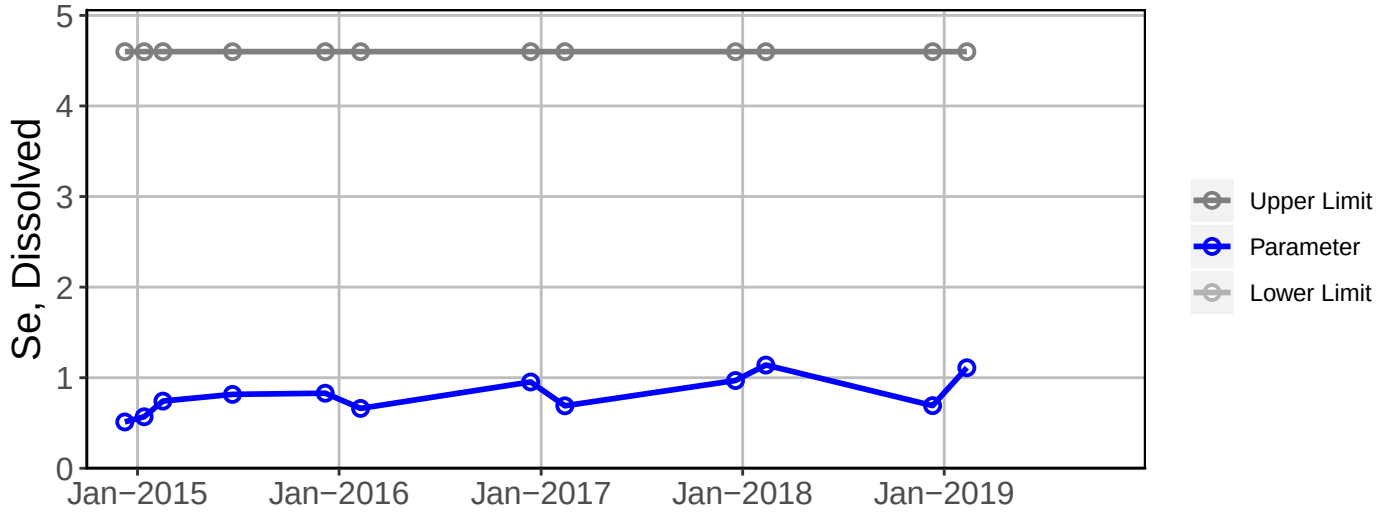
Site 48 Analyte Charts

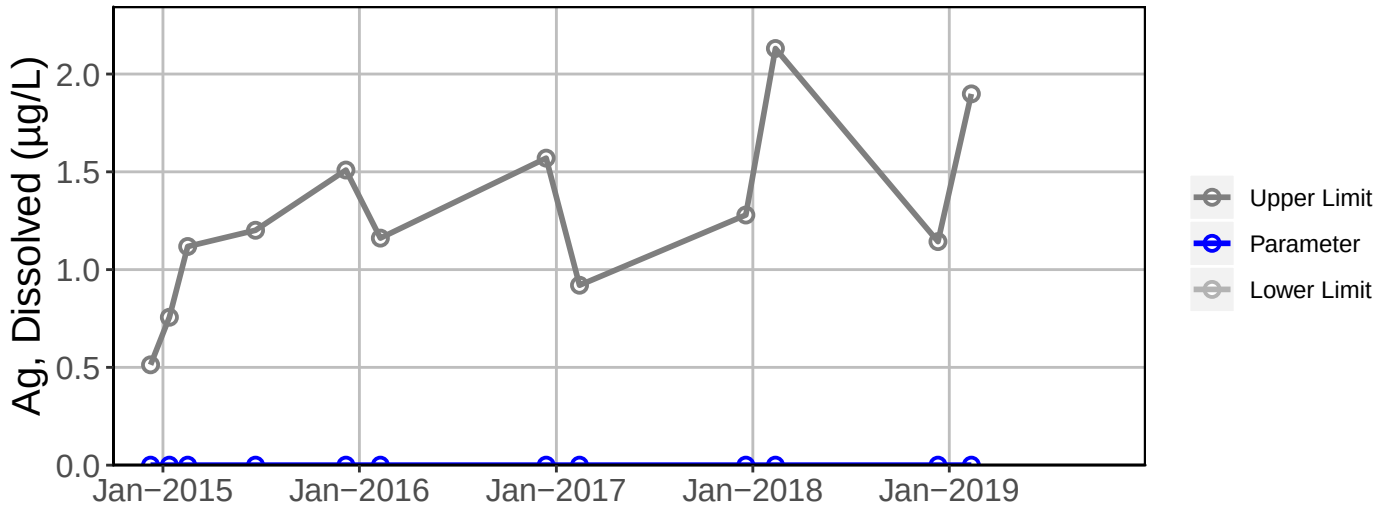


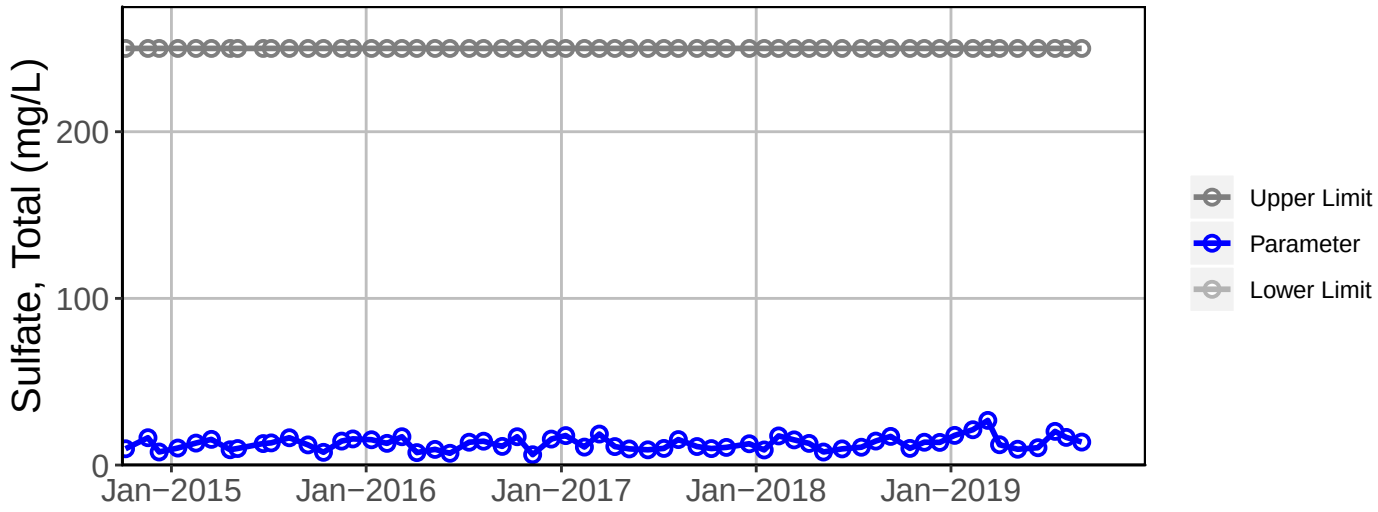




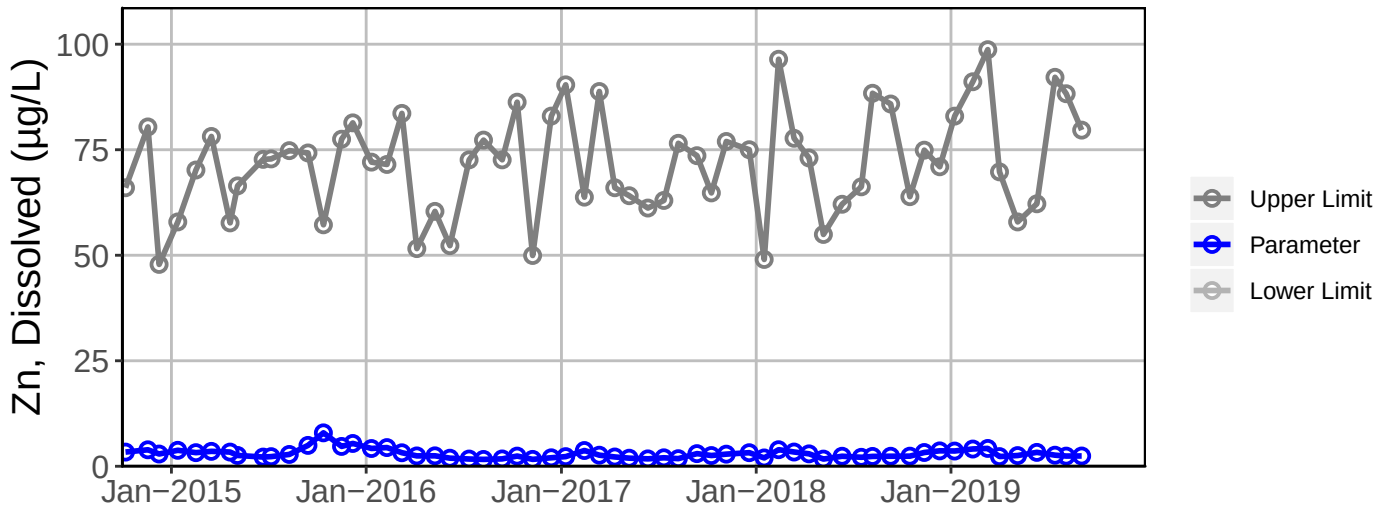
Site 48 Analyte Charts







Site 48 Analyte Charts



Site #48 Seasonal Kendall analysis for Specific Conductance, Field (µS/cm)

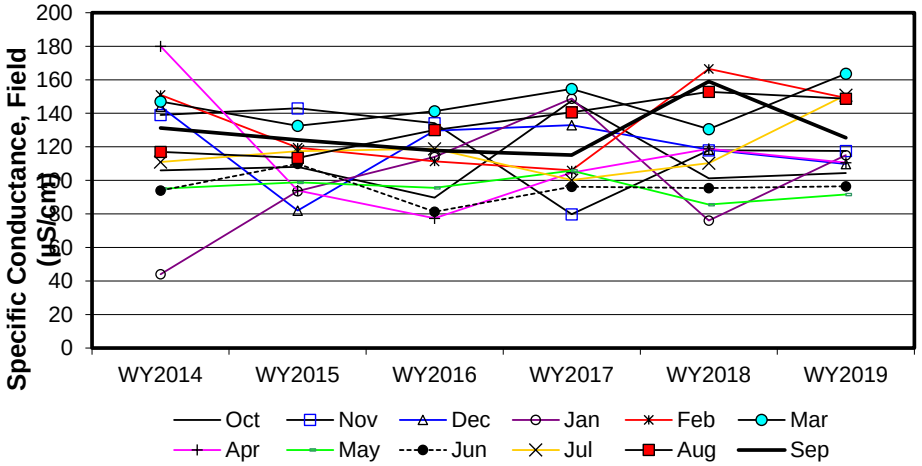
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	106.0	139.0	144.0	44.0	151.0	147.0	180.0	95.0	94.0	111.0	117.0	131.2
b	**WY2015**	108.1	143.0	82.0	93.6	119.5	132.6	94.0	98.9	109.9	117.4	113.4	124.1
c	**WY2016**	89.7	134.1	129.6	114.0	111.3	141.3	77.4	95.5	81.3	118.8	130.1	117.8
d	**WY2017**	147.5	79.8	133.0	148.8	106.0	154.6	104.6	105.8	96.2	100.2	140.6	115.1
e	**WY2018**	101.2	118.0	118.3	76.1	166.5	130.6	118.8	85.6	95.4	110.3	152.8	159.0
f	**WY2019**	104.4	117.5	109.8	115.1	149.1	163.6	110.5	91.6	96.4	150.9	148.8	125.5
	n	6	6	6	6	6	6	6	6	6	6	6	6
	t_1	6	6	6	6	6	6	6	6	6	6	6	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	1	1	-1	1	-1	-1	-1	1	1	1	-1	-1
	c-a	-1	-1	-1	1	-1	-1	-1	1	-1	1	1	-1
	d-a	1	-1	-1	1	-1	1	-1	1	1	-1	1	-1
	e-a	-1	-1	-1	1	1	-1	-1	-1	1	-1	1	1
	f-a	-1	-1	-1	1	-1	1	-1	-1	1	1	1	-1
	c-b	-1	-1	1	1	-1	1	-1	-1	-1	1	1	-1
	d-b	1	-1	1	1	-1	1	1	1	-1	-1	1	-1
	e-b	-1	-1	1	-1	1	-1	1	-1	-1	-1	1	1
	f-b	-1	-1	1	1	1	1	1	-1	-1	1	1	1
	d-c	1	-1	1	1	-1	1	1	1	1	-1	1	-1
	e-c	1	-1	-1	-1	1	-1	1	-1	1	-1	1	1
	f-c	1	-1	-1	1	1	1	1	-1	1	1	1	1
	e-d	-1	1	-1	-1	1	-1	1	-1	-1	1	1	1
	f-d	-1	1	-1	-1	1	1	1	-1	1	1	1	1
	f-e	1	-1	-1	1	-1	1	-1	1	1	1	-1	-1
	S_k	-1	-9	-5	7	-1	3	1	-3	3	3	11	-1
	σ^2_S=	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33
	$Z_k = S_k/\sigma_S$	-0.19	-1.69	-0.94	1.32	-0.19	0.56	0.19	-0.56	0.56	0.56	2.07	-0.19
	Z^2_k	0.04	2.86	0.88	1.73	0.04	0.32	0.04	0.32	0.32	0.32	4.27	0.04

ΣZ_k= 1.50
ΣZ^2_k= 11.15
Z-bar=$\Sigma Z_k/K$= 0.13

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	72	0	0	0	0

Σn 72
ΣS_k 8

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	10.96		@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
	p	**0.446**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	0.38	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
340.00	**p**	**0.648**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-3.08		4.68
0.050	-1.90	**0.36**	3.88
0.100	-1.10		3.39
0.200	-0.63		2.56

Site #48 Seasonal Kendall analysis for pH, Field, Standard Units

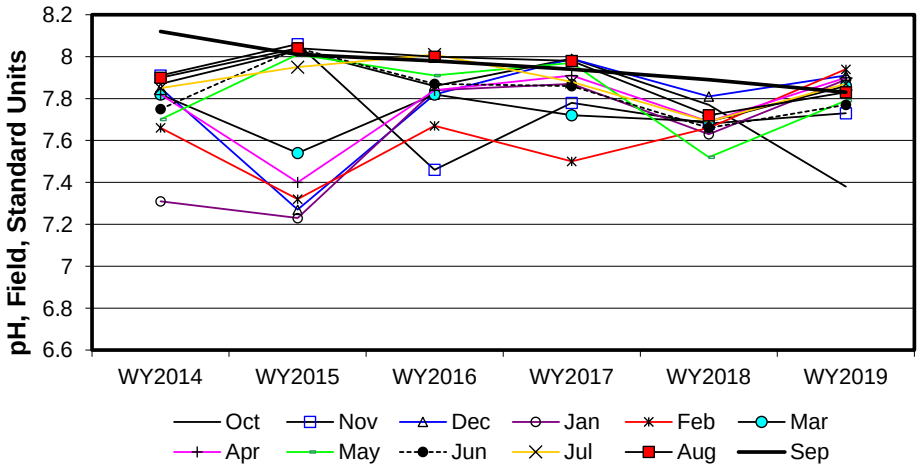
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	7.9	7.9	7.9	7.3	7.7	7.8	7.8	7.7	7.8	7.9	7.9	8.1
b	**WY2015**	8.0	8.1	7.3	7.2	7.3	7.5	7.4	8.0	8.0	8.0	8.0	8.0
c	**WY2016**	7.9	7.5	7.8	7.8	7.7	7.8	7.8	7.9	7.9	8.0	8.0	8.0
d	**WY2017**	8.0	7.8	8.0	7.9	7.5	7.7	7.9	8.0	7.9	7.9	8.0	7.9
e	**WY2018**	7.8	7.7	7.8	7.6	7.7	7.7	7.7	7.5	7.7	7.7	7.7	7.9
f	**WY2019**	7.4	7.7	7.9	7.9	7.9	7.9	7.9	7.8	7.8	7.9	7.8	7.8
	n	6	6	6	6	6	6	6	6	6	6	6	6
	t_1	6	6	6	6	4	4	6	6	6	6	6	6
	t_2	0	0	0	0	1	1	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	1	1	-1	-1	-1	-1	-1	1	1	1	1	-1
	c-a	-1	-1	-1	1	1	0	1	1	1	1	1	-1
	d-a	1	-1	1	1	-1	-1	1	1	1	1	1	-1
	e-a	-1	-1	-1	1	0	-1	-1	-1	-1	-1	-1	-1
	f-a	-1	-1	1	1	1	1	1	1	1	1	-1	-1
	c-b	-1	-1	1	1	1	1	1	-1	-1	1	-1	-1
	d-b	-1	-1	1	1	1	1	1	-1	-1	-1	-1	-1
	e-b	-1	-1	1	1	1	1	1	-1	-1	-1	-1	-1
	f-b	-1	-1	1	1	1	1	1	-1	-1	-1	-1	-1
	d-c	1	1	1	1	-1	-1	1	1	-1	-1	-1	-1
	e-c	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
	f-c	-1	1	1	1	1	1	1	-1	-1	-1	-1	-1
	e-d	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1
	f-d	-1	-1	-1	1	1	1	-1	-1	-1	-1	-1	-1
	f-e	-1	1	1	1	1	1	1	1	1	1	1	-1
	S_k	-9	-5	3	9	6	2	5	-3	-5	-3	-7	-15
	σ^2_S=	28.33	28.33	28.33	28.33	27.33	27.33	28.33	28.33	28.33	28.33	28.33	28.33
	$Z_k = S_k/\sigma_S$	-1.69	-0.94	0.56	1.69	1.15	0.38	0.94	-0.56	-0.94	-0.56	-1.32	-2.82
	Z^2_k	2.86	0.88	0.32	2.86	1.32	0.15	0.88	0.32	0.88	0.32	1.73	7.94

ΣZ_k= -4.11
ΣZ^2_k= 20.45
Z-bar=$\Sigma Z_k/K$= -0.34

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	68	2	0	0	0

Σn 72
ΣS_k -22

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	19.05	@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
p	**0.060**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc} -1.14	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
338.00	**p** **0.127**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.04	**-0.02**	0.01
0.050	-0.04		0.01
0.100	-0.03		0.00
0.200	-0.03		0.00

Site #48 Seasonal Kendall analysis for Total Alk, (mg/l)

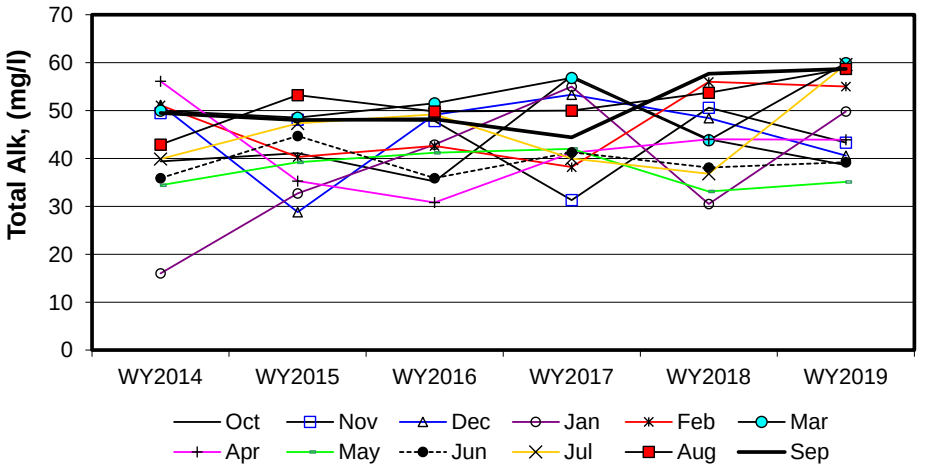
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	39.4	49.5	51.2	16.0	51.1	50.0	56.1	34.4	35.9	39.9	42.9	49.5
b	**WY2015**	41.1	48.1	28.8	32.7	40.3	48.5	35.3	39.2	44.7	47.3	53.2	48.0
c	**WY2016**	35.2	47.8	49.1	42.9	42.6	51.5	30.8	41.2	35.9	49.2	49.8	48.2
d	**WY2017**	57.2	31.3	53.3	55.0	38.2	56.8	41.2	42.0	41.3	40.0	50.0	44.4
e	**WY2018**	44.0	50.6	48.4	30.5	56.0	43.8	44.0	33.1	38.1	36.8	53.7	57.7
f	**WY2019**	38.6	43.3	40.6	49.8	55.0	59.9	43.9	35.1	39.2	59.6	58.7	58.7
	n	6	6	6	6	6	6	6	6	6	6	6	6
	t_1	6	6	6	6	6	6	6	6	4	6	6	6
	t_2	0	0	0	0	0	0	0	0	1	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	1	-1	-1	1	-1	-1	-1	1	1	1	1	-1
	c-a	-1	-1	-1	1	-1	1	-1	1	0	1	1	-1
	d-a	1	-1	1	1	-1	1	-1	1	1	1	1	-1
	e-a	1	1	-1	1	1	-1	-1	-1	1	-1	1	1
	f-a	-1	-1	-1	1	1	1	-1	1	1	1	1	1
	c-b	-1	-1	1	1	1	1	-1	1	-1	1	-1	1
	d-b	1	-1	1	1	-1	1	1	1	-1	-1	-1	-1
	e-b	1	1	1	-1	1	-1	1	-1	-1	-1	1	1
	f-b	-1	-1	1	1	1	1	1	-1	-1	1	1	1
	d-c	1	-1	1	1	-1	1	1	1	1	-1	1	-1
	e-c	1	1	-1	-1	1	-1	1	-1	1	-1	1	1
	f-c	1	-1	-1	1	1	1	1	-1	1	1	1	1
	e-d	-1	1	-1	-1	1	-1	1	-1	-1	-1	1	1
	f-d	-1	1	-1	-1	1	1	1	-1	-1	1	1	1
	f-e	-1	-1	-1	1	-1	1	-1	1	1	1	1	1
	S_k	1	-5	-3	7	3	5	1	1	2	3	11	5
	σ^2_S=	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	27.33	28.33	28.33	28.33
	$Z_k = S_k/\sigma_S$	0.19	-0.94	-0.56	1.32	0.56	0.94	0.19	0.19	0.38	0.56	2.07	0.94
	Z^2_k	0.04	0.88	0.32	1.73	0.32	0.88	0.04	0.04	0.15	0.32	4.27	0.88

ΣZ_k= 5.83
ΣZ^2_k= 9.85
Z-bar=$\Sigma Z_k/K$= 0.49

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	70	1	0	0	0

Σn 72
ΣS_k 31

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	7.02	@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
p	**0.798**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc} 1.63	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
339.00	**p** **0.948**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.64		2.20
0.050	-0.01	**1.05**	1.91
0.100	0.17		1.67
0.200	0.58		1.37

Site #48 Seasonal Kendall analysis for Sulfate, Total (mg/l)

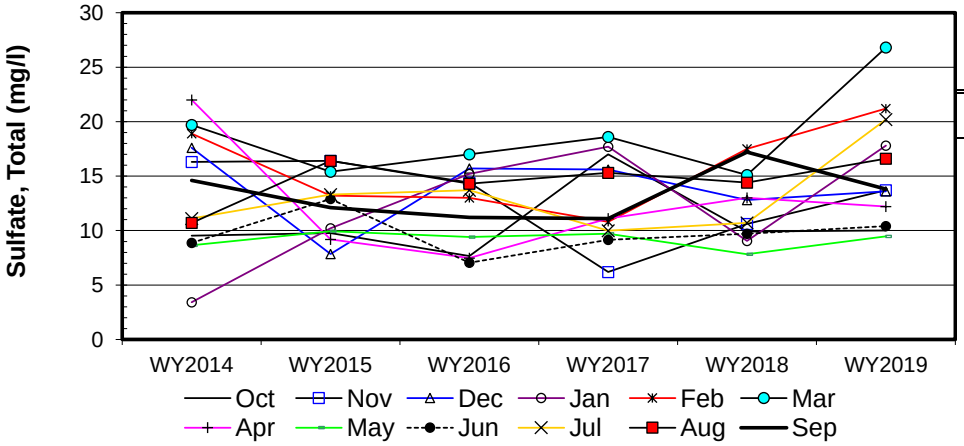
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	9.5	16.3	17.6	3.4	18.9	19.7	22.0	8.7	8.9	11.1	10.7	14.6
b	**WY2015**	9.8	16.4	7.9	10.2	13.2	15.4	9.2	9.9	12.9	13.3	16.4	12.1
c	**WY2016**	7.7	14.4	15.7	15.2	13.0	17.0	7.5	9.4	7.1	13.7	14.3	11.2
d	**WY2017**	17.0	6.2	15.6	17.7	10.8	18.6	11.1	9.7	9.2	10.0	15.3	11.1
e	**WY2018**	9.9	10.6	12.8	9.1	17.5	15.1	13.0	7.8	9.7	10.7	14.4	17.2
f	**WY2019**	10.0	13.7	13.6	17.8	21.2	26.8	12.2	9.5	10.4	20.2	16.6	13.8
	n	6	6	6	6	6	6	6	6	6	6	6	6
	t_1	6	6	6	6	6	6	6	6	6	6	6	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	1	1	-1	1	-1	-1	-1	1	1	1	1	-1
	c-a	-1	-1	-1	1	-1	-1	-1	1	-1	1	1	-1
	d-a	1	-1	-1	1	-1	-1	-1	1	1	-1	1	-1
	e-a	1	-1	-1	1	-1	-1	-1	-1	1	-1	1	1
	f-a	1	-1	-1	1	1	1	-1	1	1	1	1	-1
	c-b	-1	-1	1	1	-1	1	-1	-1	-1	1	-1	-1
	d-b	1	-1	1	1	-1	1	1	-1	-1	-1	-1	-1
	e-b	1	-1	1	-1	1	-1	1	-1	-1	-1	-1	1
	f-b	1	-1	1	1	1	1	1	-1	-1	1	1	1
	d-c	1	-1	-1	1	-1	1	1	1	1	-1	1	-1
	e-c	1	-1	-1	-1	1	-1	1	-1	1	-1	1	1
	f-c	1	-1	-1	1	1	1	1	1	1	1	1	1
	e-d	-1	1	-1	-1	1	-1	1	-1	1	1	-1	1
	f-d	-1	1	-1	1	1	1	1	-1	1	1	1	1
	f-e	1	1	1	1	1	1	-1	1	1	1	1	-1
	S_k	7	-7	-5	9	1	1	1	-1	5	3	7	-1
σ^2_S=		28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33
$Z_k = S_k/\sigma_S$		1.32	-1.32	-0.94	1.69	0.19	0.19	0.19	-0.19	0.94	0.56	1.32	-0.19
Z^2_k		1.73	1.73	0.88	2.86	0.04	0.04	0.04	0.04	0.88	0.32	1.73	0.04

ΣZ_k= 3.76
ΣZ^2_k= 10.31
Z-bar=$\Sigma Z_k/K$= 0.31

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	72	0	0	0	0

Σn 72
ΣS_k 20

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	9.13		@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
	p	**0.610**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	1.03	@α=2.5% **Z**=	1.96	**H_0** (No trend) ACCEPT
340.00	**p**	**0.849**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.36	**0.10**	0.79
0.050	-0.12		0.65
0.100	-0.10		0.53
0.200	0.04		0.37

Site #48 Seasonal Kendall analysis for Zinc, Dissolved (ug/l)

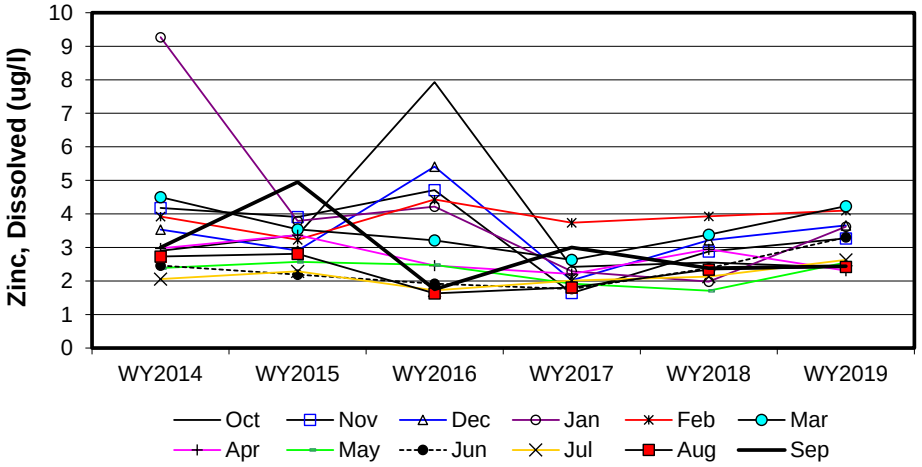
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	2.9	4.2	3.5	9.3	3.9	4.5	3.0	2.4	2.5	2.1	2.7	3.0
b	**WY2015**	3.4	3.9	2.9	3.8	3.2	3.5	3.4	2.6	2.2	2.3	2.8	5.0
c	**WY2016**	7.9	4.7	5.4	4.2	4.4	3.2	2.5	2.5	1.9	1.7	1.6	1.8
d	**WY2017**	2.4	1.6	2.0	2.3	3.7	2.6	2.2	1.9	1.8	2.0	1.8	3.0
e	**WY2018**	2.6	2.9	3.2	2.0	3.9	3.4	3.0	1.7	2.4	2.1	2.3	2.4
f	**WY2019**	2.4	3.3	3.7	3.6	4.1	4.2	2.3	2.6	3.3	2.6	2.4	2.4
	n	6	6	6	6	6	6	6	6	6	6	6	6
	t_1	6	6	6	6	6	6	6	6	6	6	6	4
	t_2	0	0	0	0	0	0	0	0	0	0	0	1
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	1	-1	-1	-1	-1	-1	1	1	-1	1	1	1
	c-a	1	1	1	-1	1	-1	-1	1	-1	-1	-1	-1
	d-a	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
	e-a	-1	-1	-1	-1	1	-1	-1	-1	-1	1	-1	-1
	f-a	-1	-1	1	-1	1	-1	-1	1	1	1	-1	-1
	c-b	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1
	d-b	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1
	e-b	-1	-1	1	-1	1	-1	-1	-1	1	-1	-1	-1
	f-b	-1	-1	1	-1	1	1	-1	-1	1	1	-1	-1
	d-c	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1
	e-c	-1	-1	-1	-1	-1	1	1	-1	1	1	1	1
	f-c	-1	-1	-1	-1	-1	1	-1	1	1	1	1	1
	e-d	1	1	1	-1	1	1	1	-1	1	1	1	-1
	f-d	-1	1	1	1	1	1	1	1	1	1	1	-1
	f-e	-1	1	1	1	1	1	-1	1	1	1	1	1
	S_k	-7	-5	1	-9	5	-3	-7	-3	1	5	-1	-4
	σ^2_S=	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	27.33
	$Z_k = S_k/\sigma_S$	-1.32	-0.94	0.19	-1.69	0.94	-0.56	-1.32	-0.56	0.19	0.94	-0.19	-0.77
	Z^2_k	1.73	0.88	0.04	2.86	0.88	0.32	1.73	0.32	0.04	0.88	0.04	0.59

ΣZ_k= -5.09
ΣZ^2_k= 10.29
Z-bar=$\Sigma Z_k/K$= -0.42

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	70	1	0	0	0

Σn 72
ΣS_k -27

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	8.14	@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
p	**0.701**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc} -1.41	@α/2=2.5% **Z**=	1.96	**H_0** (No trend) ACCEPT
339.00	**p** **0.079**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.21		0.05
0.050	-0.16	**-0.08**	0.00
0.100	-0.16		-0.01
0.200	-0.14		-0.04

INTERPRETIVE REPORT
SITE 6

The data collected during the current water year are listed in the following "Table of Results for Water Year 2019" report. The table includes all the required FWMP analyte data (field and laboratory) collected for the current water year and a series of flags keyed to the summary report "Qualified Data by QA Reviewer." The QA report lists any associated data limitations found during the monthly QA reviews of laboratory data for this site. Median values for all analytes have been calculated and are shown in the right-most column of the table of results. Any value reported as less than MDL has been replaced with a value of one-half of the MDL for the purpose of median calculation.

All data collected at this site for the past six years are included in the data analyses, with the exception of the outliers shown in the table below. During the current year, no data points were flagged as outliers after reviewing by HGCMC.

Sample Date	Parameter	Value	Qualifier	Notes
No outliers, in the past six years, have been identified by HGCMC.				

The data have been compared to the strictest freshwater quality criterion for each applicable analyte. No results exceeded these criteria.

Table of Exceedance for Water Year 2019

			Limits		
Sample Date	Parameter	Value	Lower	Upper	Hardness
No exceedances have been identified by HGCMC for the period of October 2018 through September 2019.					

X-Y plots have been generated to graphically present the data for each of the analytes requested in the Statistical Information Goals for this site. These plots have been visually analyzed for the appearance of any trend in concentration. There were no visually obvious trends.

A non-parametric statistical analysis for trend was performed for specific conductivity, field pH, total alkalinity, total sulfate, and dissolved zinc. Calculation details of the Seasonal Kendall analyses are presented in detail on the pages following this interpretive section. The following table summarizes the results of the data collected between Oct-13 and Sep-19 (WY2014-WY2019).

Site 6 - Table of Summary Statistics for Trend Analysis

	Mann-Kendall test statistics			Sen's slope estimate	
Parameter	**n***	**p****	**Trend**	**Q**	**Q(%)**
Conductivity Field	6	0.61			
pH Field	6	0.26			
Alkalinity, Total	6	0.95			
Sulfate, Total	6	0.69			
Zinc, Dissolved	6	0.28			

* Number of Years ** Significance level

For datasets with a statistically significant trend ($\alpha/2$=2.5%), a Seasonal-Sen's Slope estimate statistic has also been calculated. There were no statistically significant trends identified.

A comparison of median values for alkalinity, laboratory pH, lab conductivity, total sulfate, and dissolved zinc between Site 6 and Site 48 has been conducted as specified in the Statistical Information Goals for Site 6. Additionally, X-Y plots have been generated for total alkalinity, field pH, specific conductance, total sulfate, and dissolved zinc that coplot data from Site 6 and Site 48, the upstream control site, to aid in the comparison between those sites. Calculation details of the non-parametric signed-rank tests are presented in detail on the pages following this interpretive section. The table below summarizes the results of the signed-rank test as performed on the Water Year 2019 dataset.

Table of Summary Statistics for Median Analysis

Site 6 vs Site 48

Parameter	**Signed Ranks p-value**	**Site 48 median**	**Site 6 median**	**Median Differences**
Conductivity Field	0.076	116.30	117.80	-4.15
pH Field	0.289	7.85	7.89	-0.02
Alkalinity, Total	0.032	52.40	53.30	-0.85
Sulfate, Total	<0.01	13.80	15.10	-1.30
Zinc, Dissolved	<0.01	2.95	6.50	-3.47

The significant median differences between the sites for Total Sulfate and Dissolved Zinc indicates that the values increase going downstream. Though signed-rank test results for prior datasets for Water Years 2000 – 2018 showed similar statistically significant differences. These differences have been relatively consistent over several years and appear not to be increasing. Also, the magnitude of the relative differences is small, and concentrations are well below the applicable AWQS. Taking into consideration the small magnitude of the differences that are measurable between the two sites, the current FWMP program is sufficient to monitor for water quality changes in this section of Greens Creek. Thus, if an upward trend in total sulfate or

dissolved zinc at Site 6 is occurring, the current program is sufficient for identifying the change before any water quality values are impaired.

Table of Results for Water Year 2019

Site 006FMS - 'Greens Creek Middle'

Sample Date/Parameter	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019	**Median**
Water Temp (°C)	5.7	3.5	0.8	0.1	0.0	0.8	1.8	3.3	7.7	10.9	11.1	9.8	3.4
Conductivity-Field(μmho)	110.6	120.3	113.4	103.2	144.1	168.8	115.2	93.5	99.3	155.6	153.7	130.7	117.8
Conductivity-Lab (μmho)	107	120	116	146	158	175	117	93	94	146	139	126	123
pH Lab (standard units)	6.71	6.3	6.57	6.4	6.97	6.87	6.62	6.48	6.71	6.86	6.8	6.59	6.67
pH Field (standard units)	7.41	7.6	7.93	7.9	7.94	7.9	7.84	7.74	7.91	7.92	7.84	7.87	7.89
Total Alkalinity (mg/L)	39.5	43.6	41.4	50.9	55.7	59.3	44.9	35.6	38.1	60.8	59.9	60.2	47.9
Total Sulfate (mg/L)	11.1	15.1	15	19.8	22.7	26.6	13.4	10	11.1	21.7	18.1	14.9	15.1
Hardness (mg/L)	51	59.4	58.2	68.3	75.3	83.6	56.1	44.1	45.1	78.6	73.9	65.3	62.4
Dissolved As (ug/L)	0.21	0.182	0.2	0.17	0.163	0.176	0.194	0.177	0.215	0.212	0.219	0.24	0.197
Dissolved Ba (ug/L)			25.2		29.4								27.3
Dissolved Cd (ug/L)	0.0547	0.0557	0.0577	0.0591	0.0552	0.0463	0.0354	0.0377	0.0267	0.0437	0.0416	0.043	0.0450
Dissolved Cr (ug/L)			0.106		0.063								0.085
Dissolved Cu (ug/L)	0.711	0.612	0.668	0.519	0.332	0.468	0.541	0.54	0.242	0.343	0.43	0.562	0.530
Dissolved Pb (ug/L)	0.0205	0.0114	0.0341	0.0167	0.0056	0.0302	0.016	0.0115	0.0015	0.007	0.0064	0.0089	0.0115
Dissolved Ni (ug/L)			0.367		0.33								0.349
Dissolved Ag (ug/L)			0.002		0.002								0.002
Dissolved Zn (ug/L)	7.57	8.98	9.94	10.7	9.93	8.05	5.43	4.69	1.64	3.81	4.24	4.74	6.50
Dissolved Se (ug/L)			0.776		1.2								0.988
Dissolved Hg (ug/L)	0.000976	0.00113	0.00168	0.000695	0.000548	0.000436	0.000661	0.00112	0.000374	0.000498	0.00052	0.000871	0.000678

For individual sample/analyte qualifier descriptions see "Qualified Data by QA Reviewer" table.

Values reported as less than MDL are replaced by 1/2 MDL for median calculation purposes.

Shaded data has been qualified as an outlier by HGCMC and removed from any further analysis and is not included into the calculation of the median

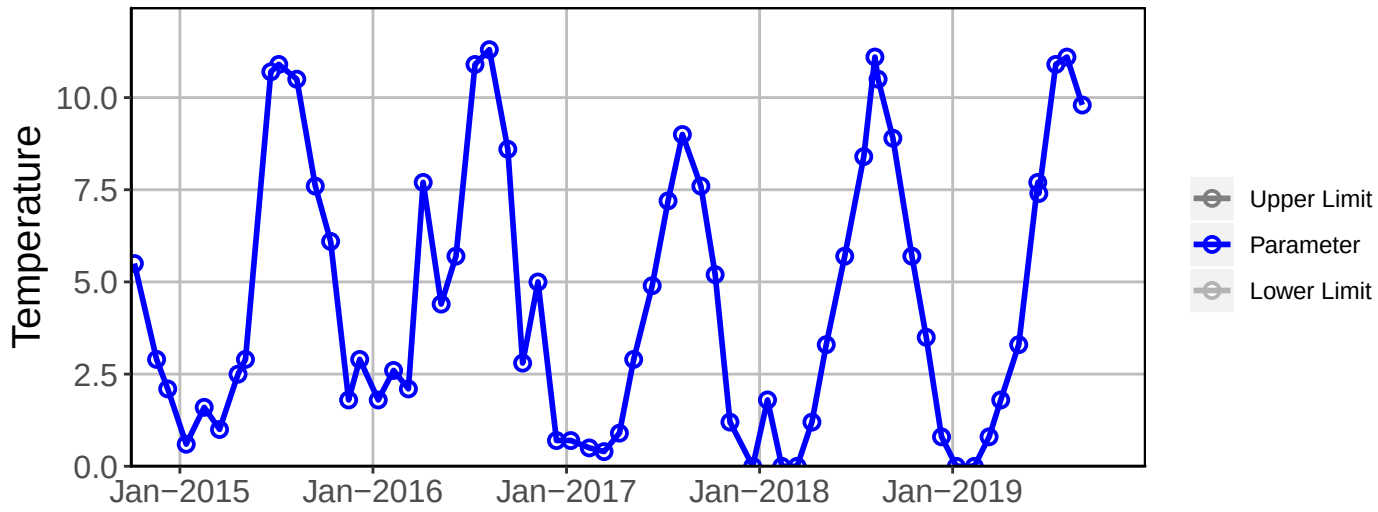
Qualified Data by QA Reviewer

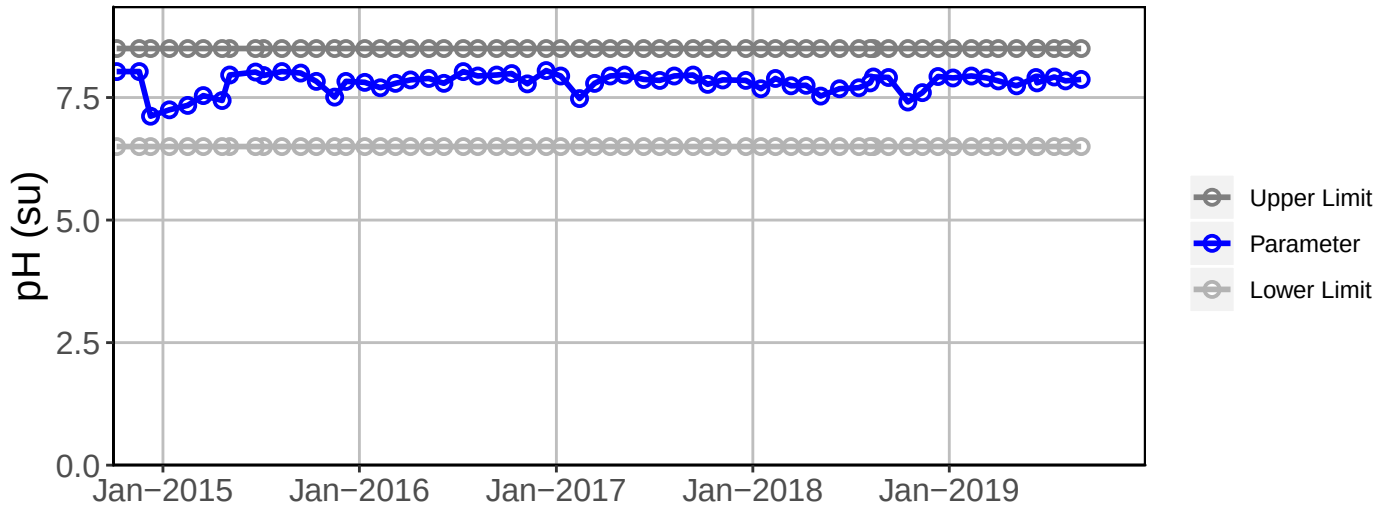
Date Range: 10/01/2018 to 09/30/2019

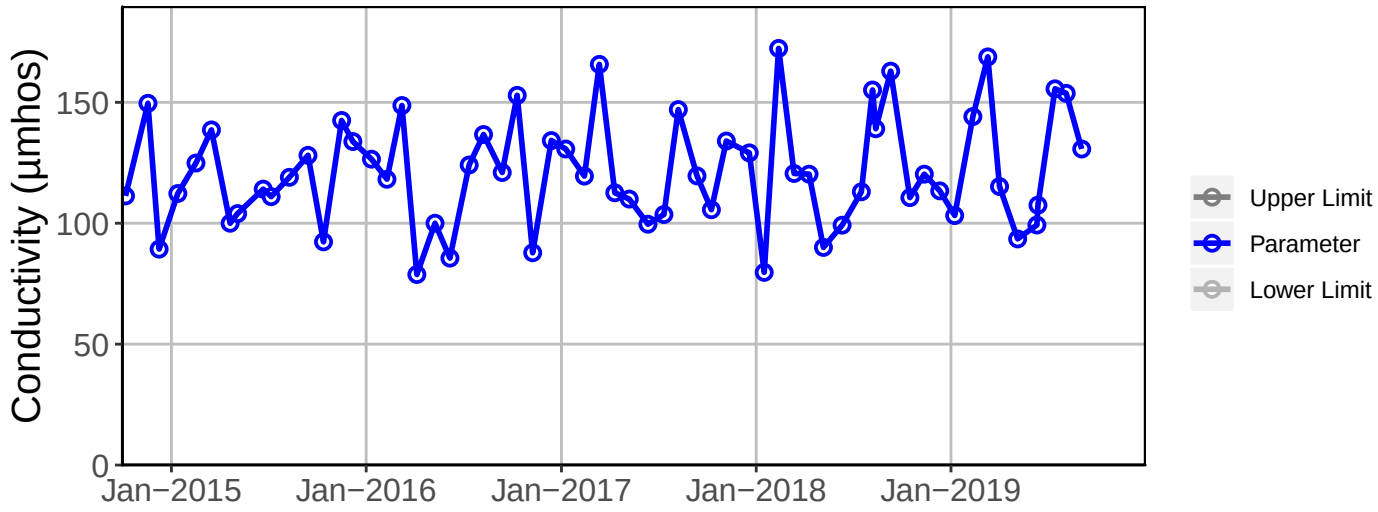
Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
006FMS	16-Oct-18	Diss. Tl-ICP/MS	0.00463	µg/L	J	Below Quantitative Range
	12-Nov-18	Diss. Pb-ICP/MS	0.01	µg/L	U	Field Blank Contamination
		Diss. Tl-ICP/MS	0.00421	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	8.98	µg/L	U	Field Blank Contamination
	11-Dec-18	Diss. Cr-ICP/MS	0.1	µg/L	J	Below Quantitative Range
		Diss. Ni-ICP/MS	0.36	µg/L	U	Field Blank Contamination
		Diss. Tl-ICP/MS	0.00426	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	9.94	µg/L	U	Field Blank Contamination
	8-Jan-19	Diss. Zn-ICP/MS	10.70	µg/L	U	Field Blank Contamination
	11-Feb-19	Diss. Cr-ICP/MS	0.06	µg/L	J	Below Quantitative Range
		Diss. Pb-ICP/MS	0.00555	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	9.93	µg/L	U	Field Blank Contamination
	2-Apr-19	Diss. Zn-ICP/MS	5.43	µg/L	U	Field Blank Contamination
	6-May-19	Diss. Zn-ICP/MS	4.69	µg/L	U	Field Blank Contamination
	15-Jul-19	Diss. Pb-ICP/MS	0.00703	µg/L	U	Field Blank contamination
		Diss. Zn-ICP/MS	3.81	µg/L	U	Field Blank contamination
	5-Aug-19	Diss. Cu-ICP/MS	0.43	µg/L	U	Field Blank Contamination
		Diss. Pb-ICP/MS	0.00637	µg/L	U	Field Blank Contamination
		Diss. Zn-ICP/MS	4.24	µg/L	U	Field Blank Contamination
		Total Sulfate	18.10	µg/L	J	Sample Receipt Temperature
	3-Sep-19	Diss. Pb-ICP/MS	0.00888	µg/L	U	Field Blank Contamination
		Total Sulfate	14.90	µg/L	J	Sample Receipt Temperature

Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

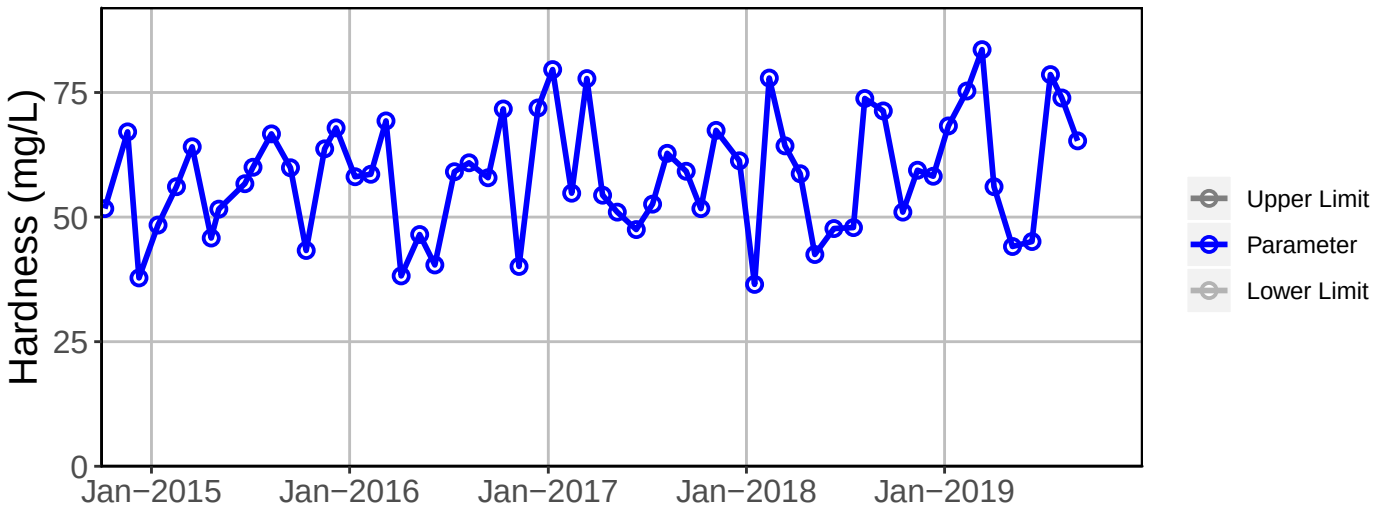
Site 6 Analyte Charts

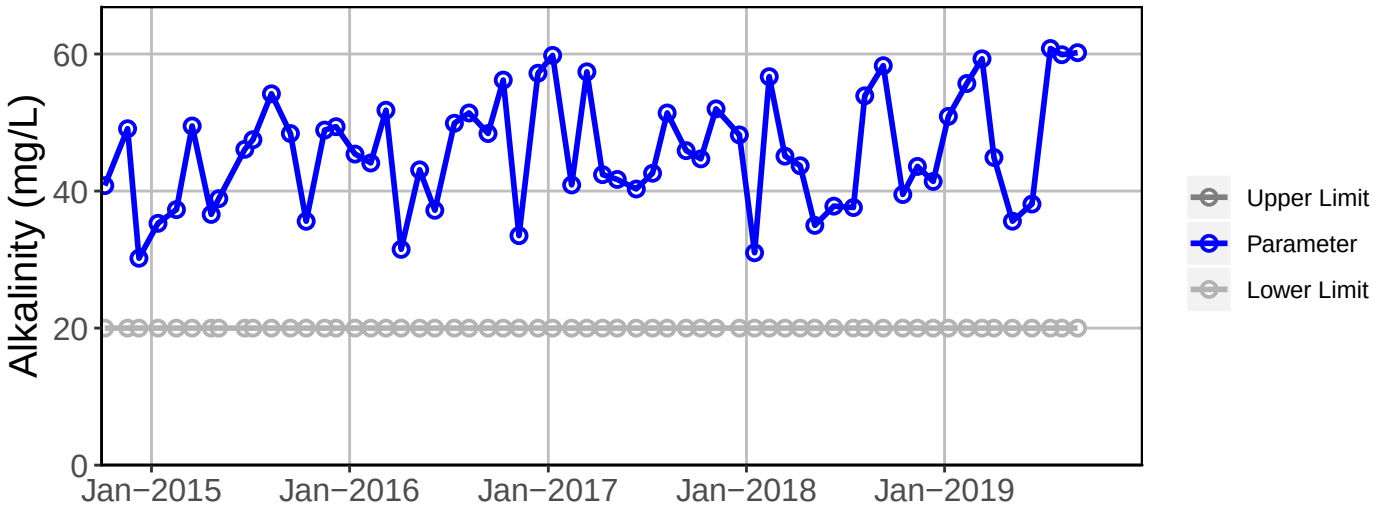


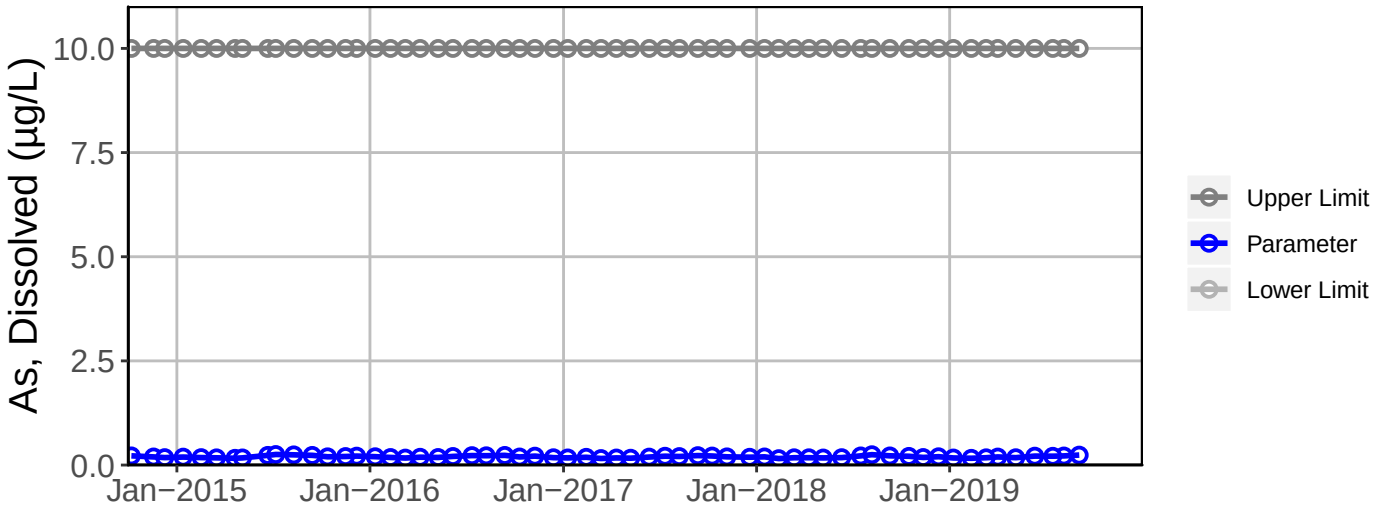




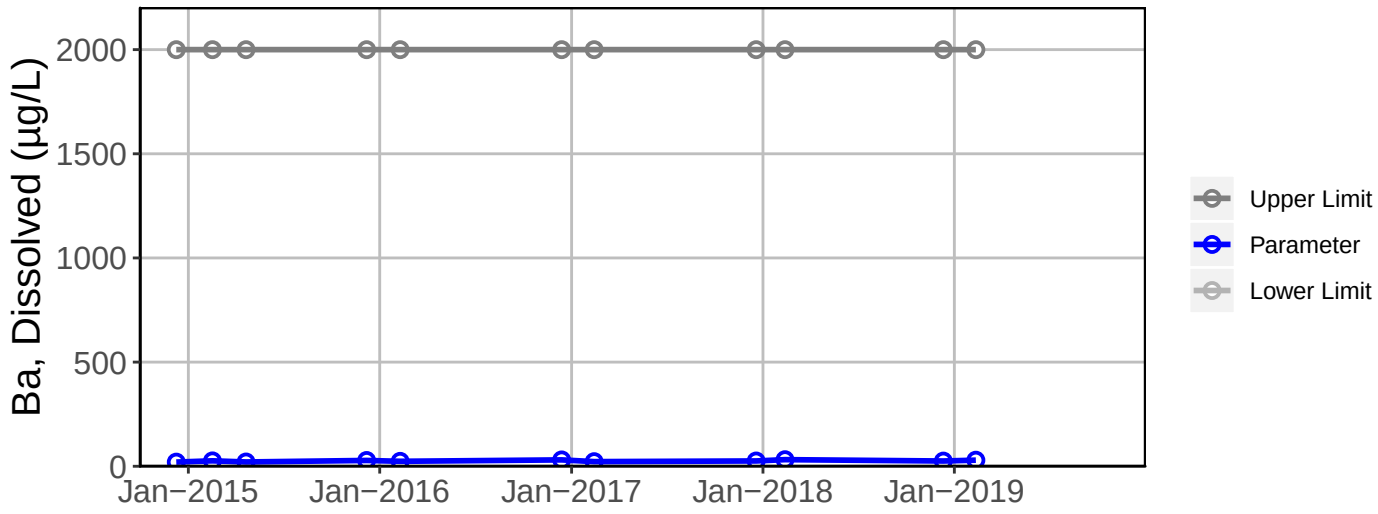
Site 6 Analyte Charts

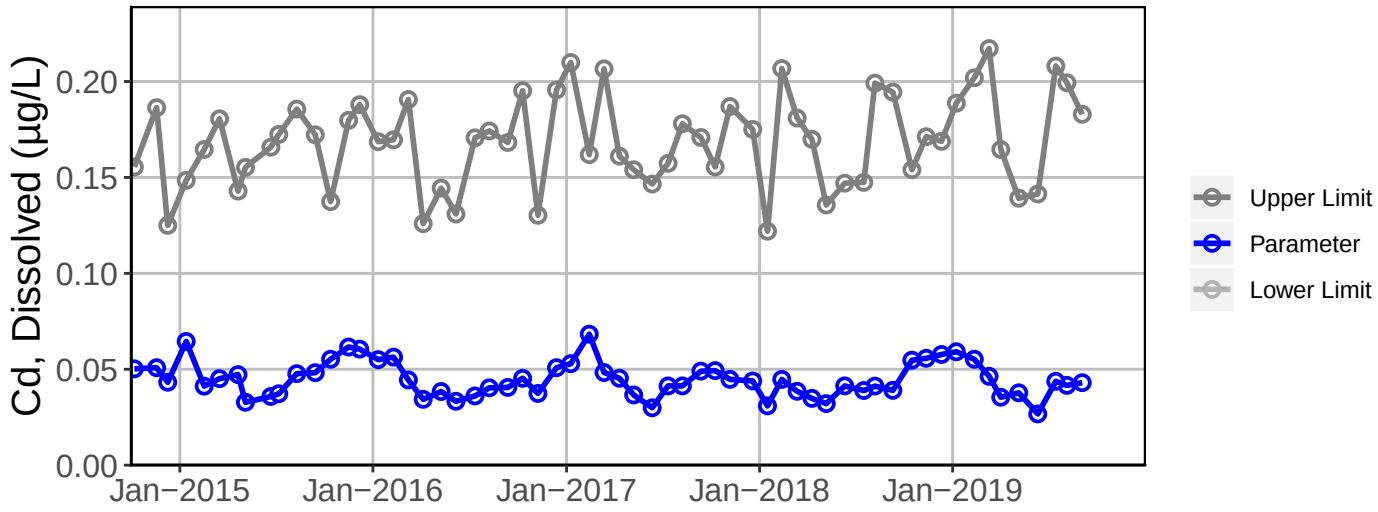


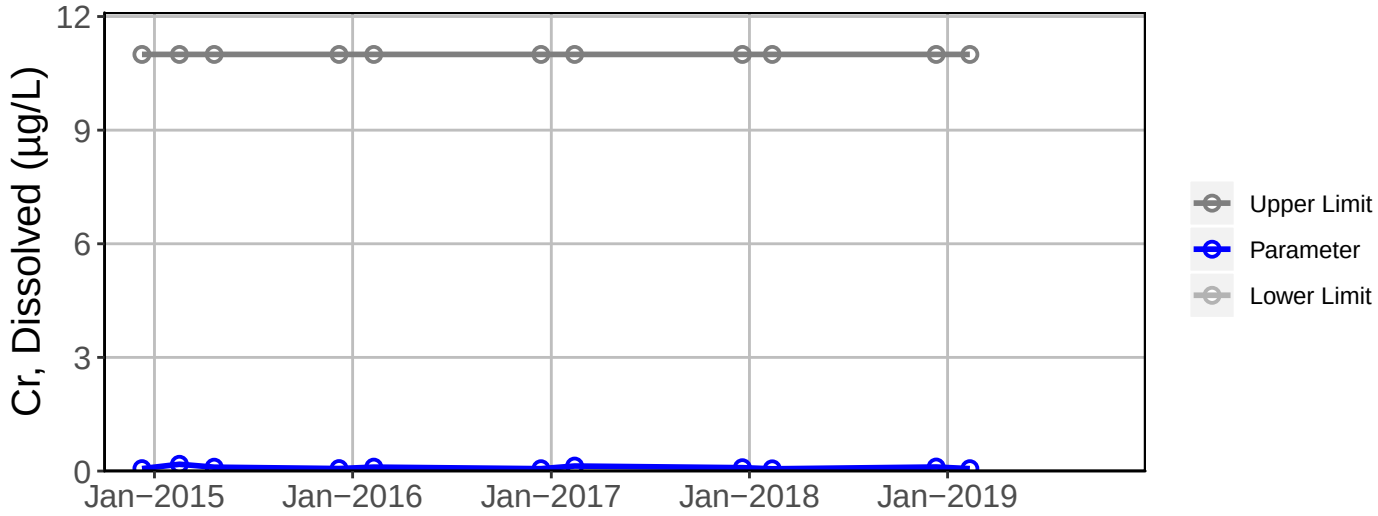




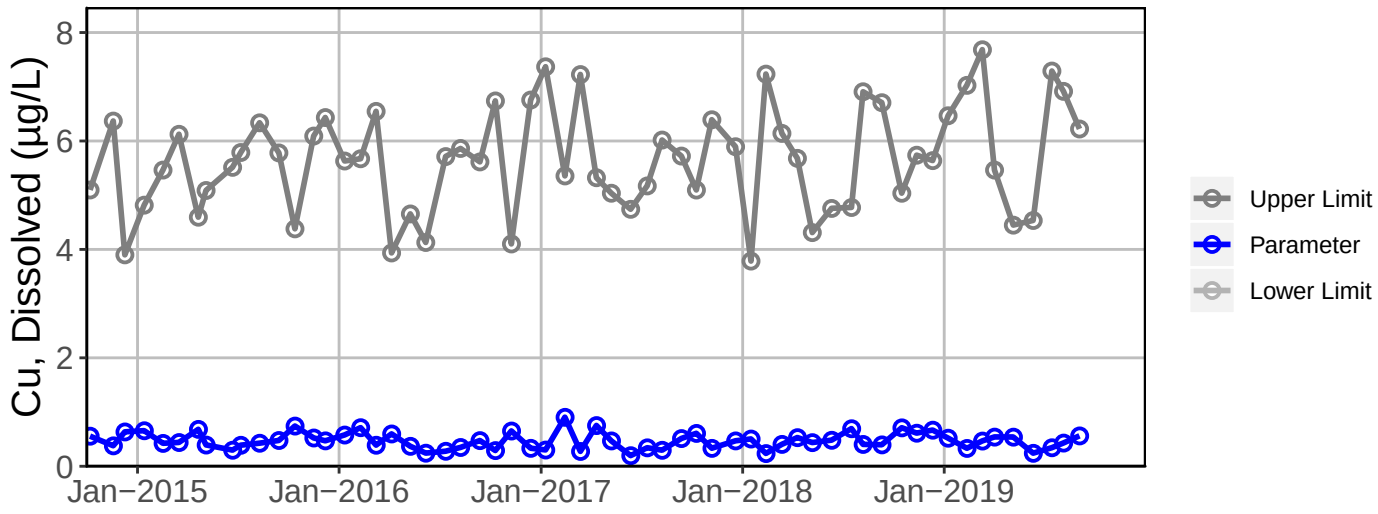
Site 6 Analyte Charts

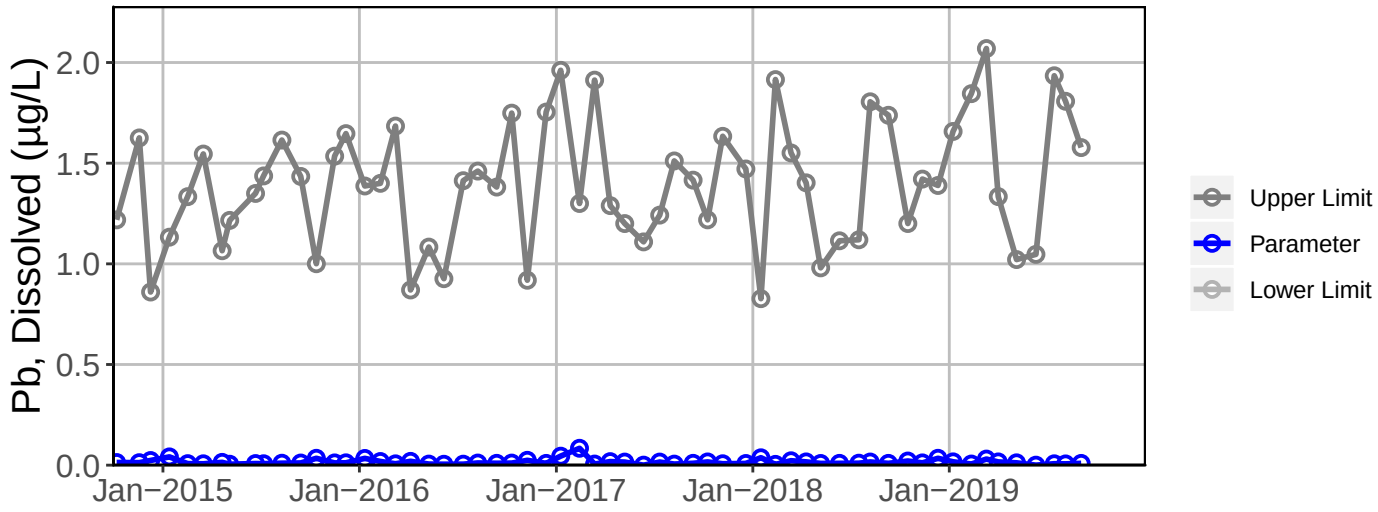


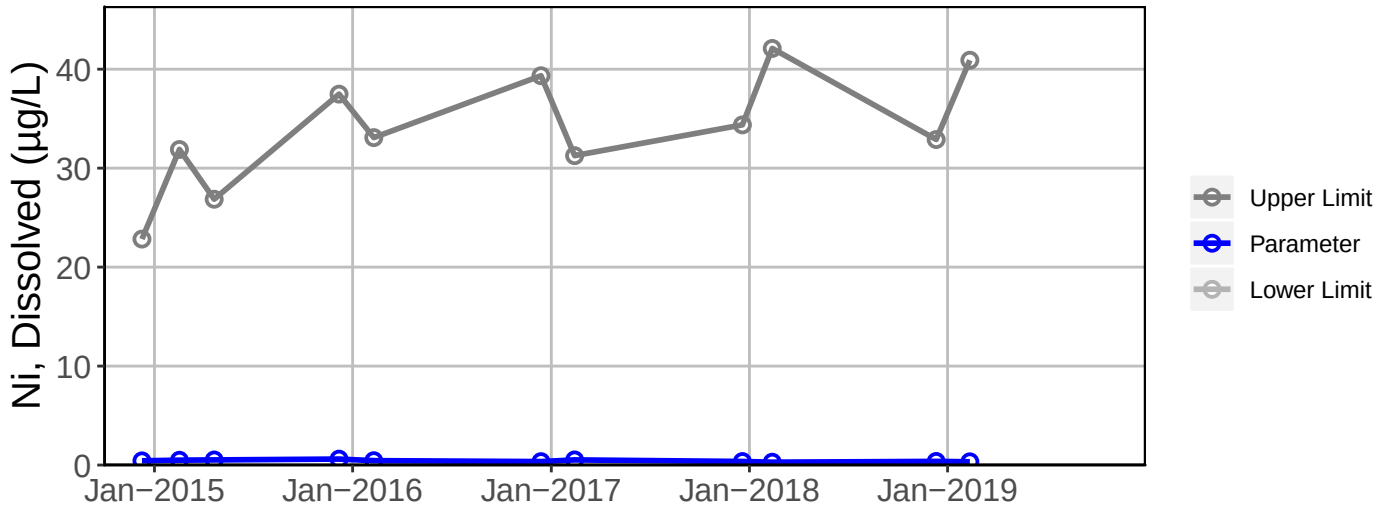




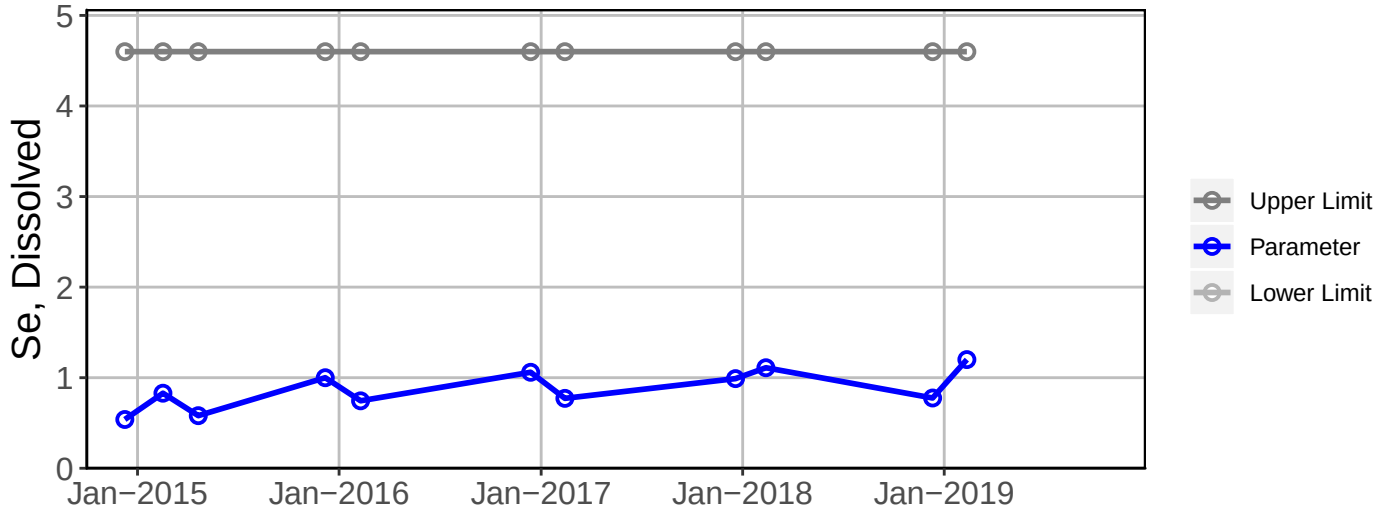
Site 6 Analyte Charts

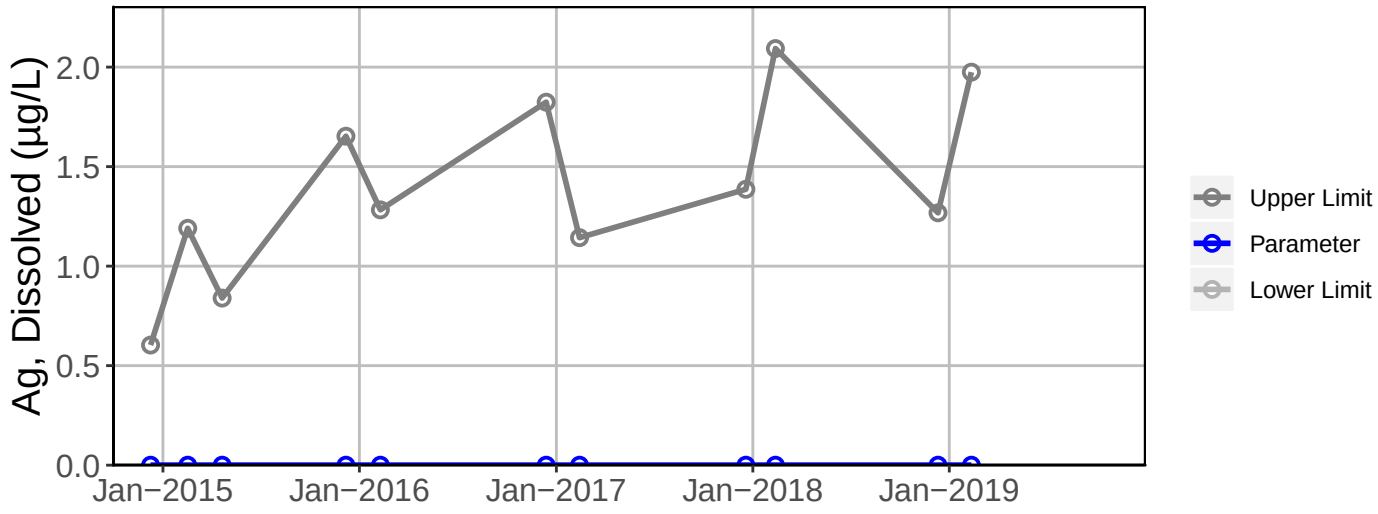


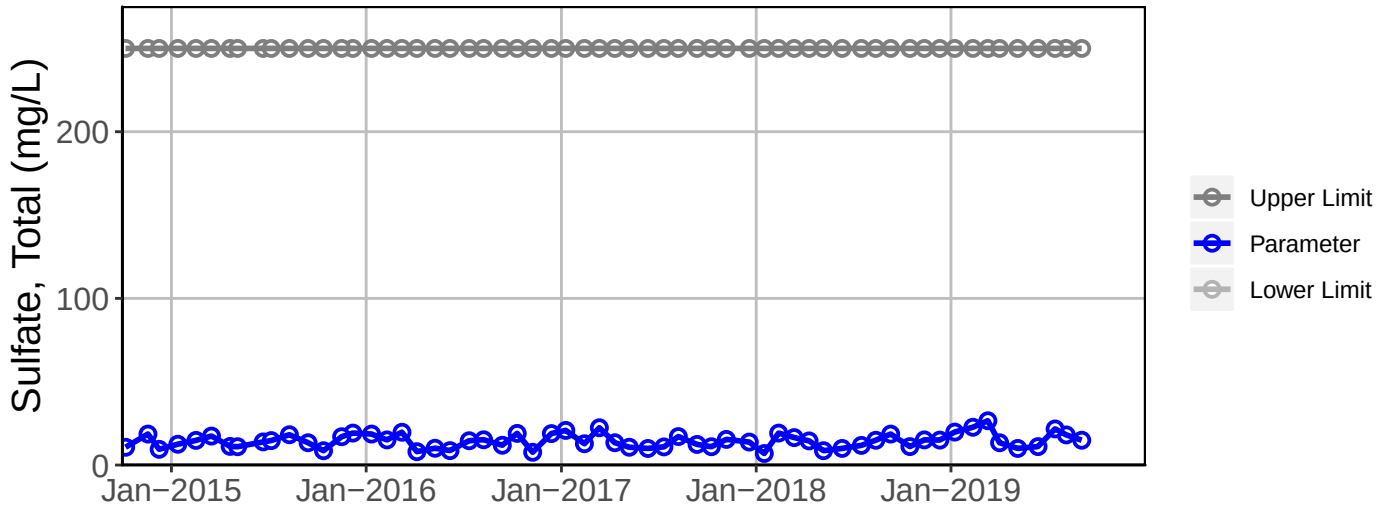




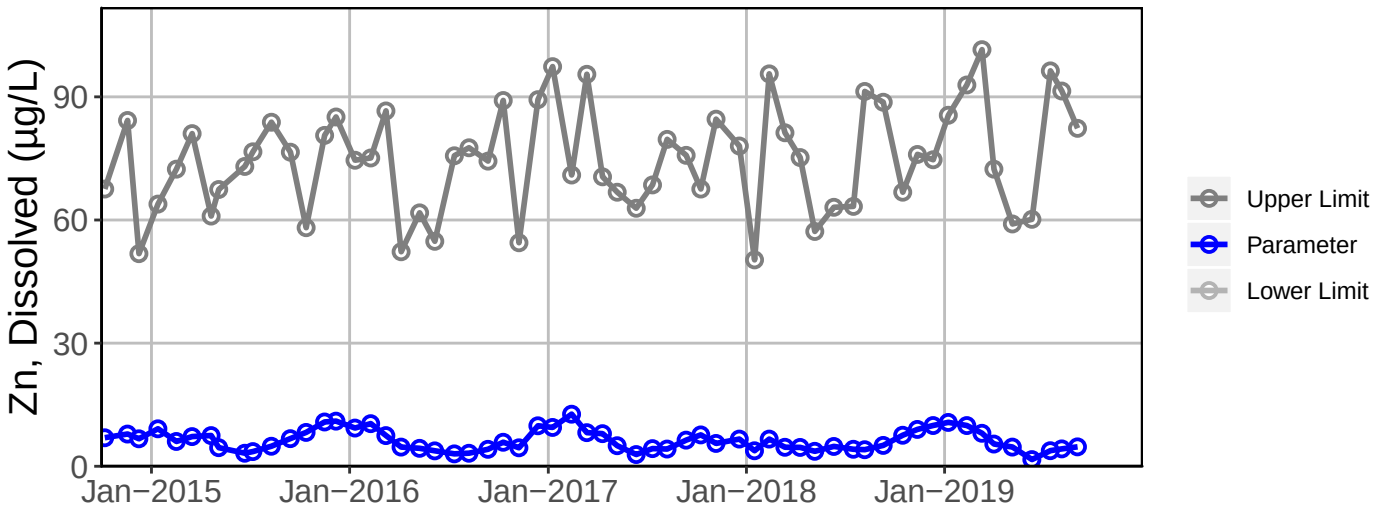
Site 6 Analyte Charts



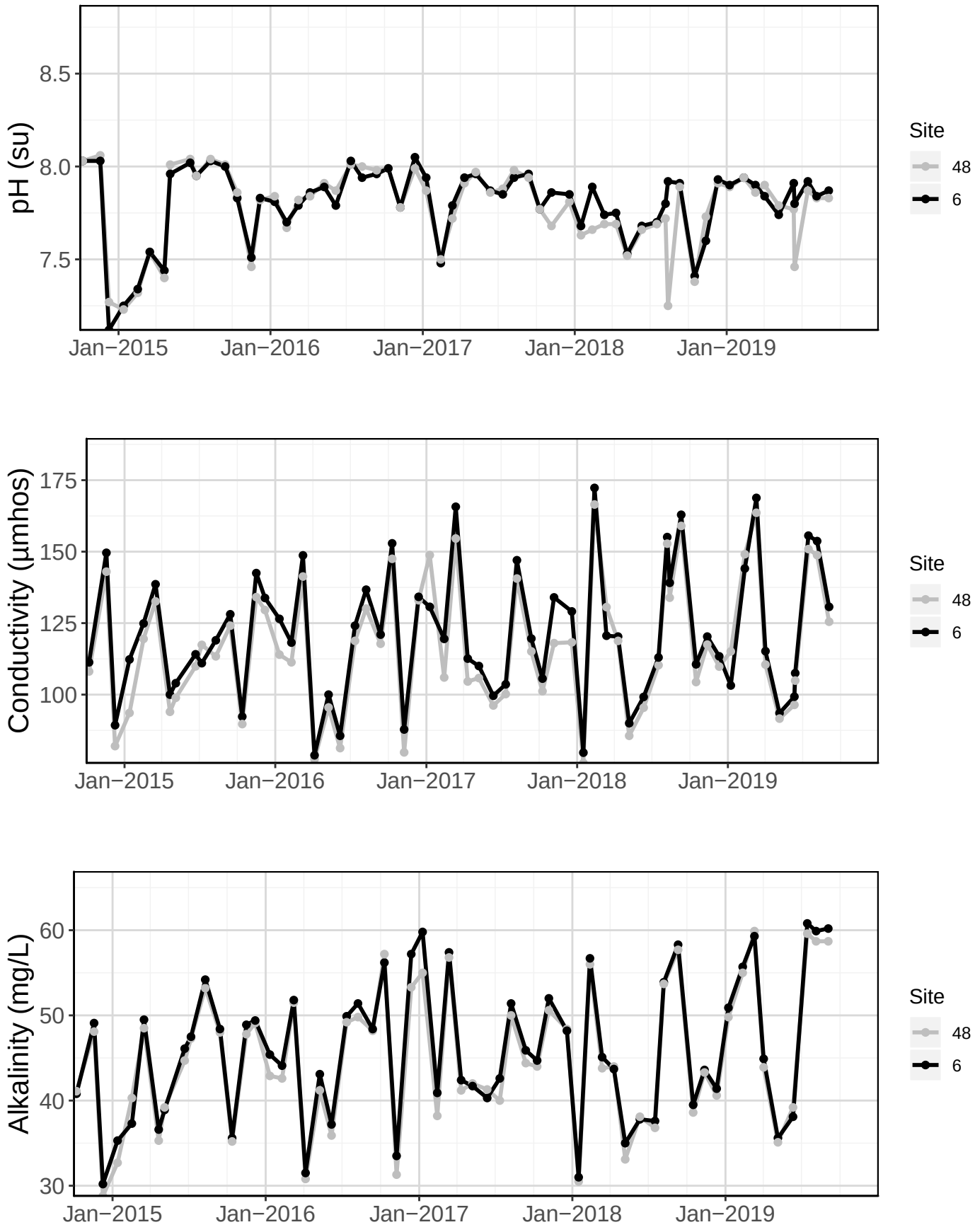




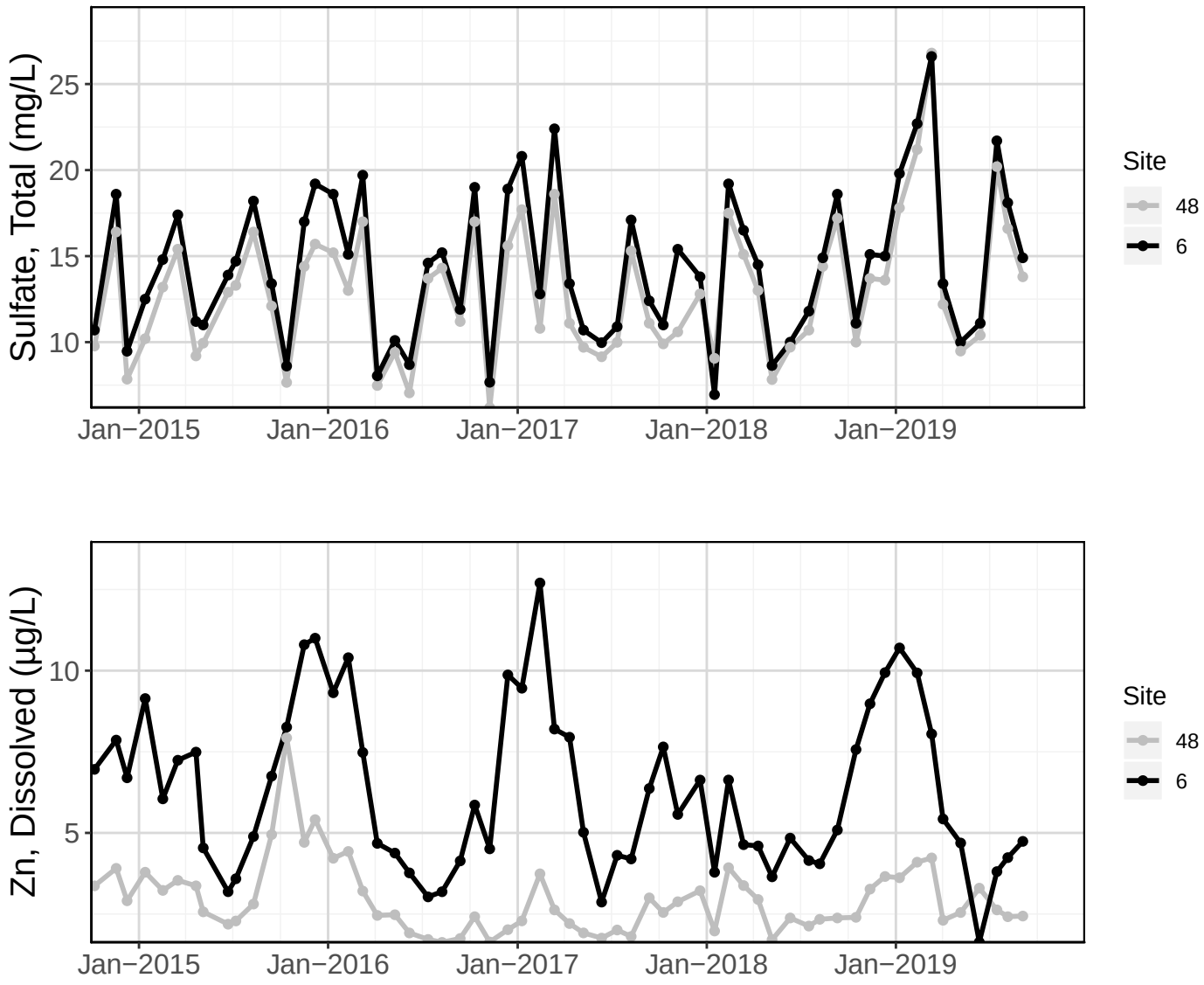
Site 6 Analyte Charts



Comparison of Site 6 to Site 48



Comparison of Site 6 to Site 48



Site #6 Seasonal Kendall analysis for Specific Conductance, Field (µS/cm)

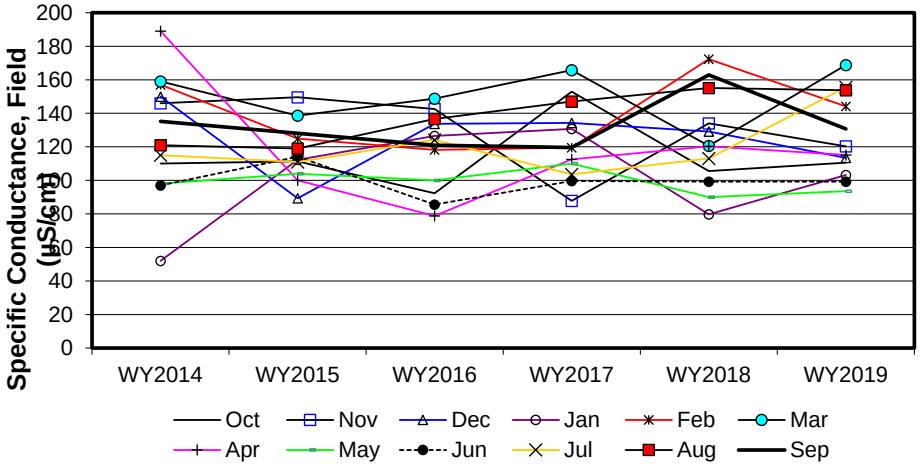
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	110.0	146.0	150.0	52.0	157.0	159.0	189.0	98.0	97.0	115.0	121.0	135.2
b	**WY2015**	111.3	149.6	89.3	112.3	124.9	138.6	100.0	104.0	114.1	111.0	119.0	128.1
c	**WY2016**	92.3	142.5	133.8	126.5	118.2	148.7	78.8	100.0	85.6	124.1	136.7	121.0
d	**WY2017**	152.9	87.8	134.2	130.7	119.5	165.7	112.6	110.0	99.6	103.6	147.0	119.6
e	**WY2018**	105.6	134.0	129.1	79.7	172.3	120.6	120.3	90.0	99.2	113.0	155.1	162.9
f	**WY2019**	110.6	120.3	113.4	103.2	144.1	168.8	115.2	93.5	99.3	155.6	153.7	130.7
	n	6	6	6	6	6	6	6	6	6	6	6	6
	t_1	6	6	6	6	6	6	6	6	6	6	6	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	1	1	-1	1	-1	-1	-1	1	1	-1	-1	-1
	c-a	-1	-1	-1	1	-1	-1	-1	1	-1	1	1	-1
	d-a	1	-1	-1	1	-1	1	-1	1	1	-1	1	-1
	e-a	-1	-1	-1	1	1	-1	-1	-1	1	-1	1	1
	f-a	1	-1	-1	1	-1	1	-1	-1	1	1	1	-1
	c-b	-1	-1	1	1	-1	1	-1	-1	-1	1	1	-1
	d-b	1	-1	1	1	-1	1	1	1	-1	-1	1	-1
	e-b	-1	-1	1	-1	1	-1	1	-1	-1	1	1	1
	f-b	-1	-1	1	-1	1	1	1	-1	-1	1	1	1
	d-c	1	-1	1	1	1	1	1	1	1	-1	1	-1
	e-c	1	-1	-1	-1	1	-1	1	-1	1	-1	1	1
	f-c	1	-1	-1	-1	1	1	1	-1	1	1	1	1
	e-d	-1	1	-1	-1	1	-1	1	-1	-1	1	1	1
	f-d	-1	1	-1	-1	1	1	1	-1	-1	1	1	1
	f-e	1	-1	-1	1	-1	1	-1	1	1	1	-1	-1
	S_k	1	-9	-5	3	1	3	1	-3	1	3	11	-1
	σ^2_S=	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33
	$Z_k = S_k/\sigma_S$	0.19	-1.69	-0.94	0.56	0.19	0.56	0.19	-0.56	0.19	0.56	2.07	-0.19
	Z^2_k	0.04	2.86	0.88	0.32	0.04	0.32	0.04	0.32	0.04	0.32	4.27	0.04

ΣZ_k= 1.13
ΣZ^2_k= 9.46
Z-bar=$\Sigma Z_k/K$= 0.09

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	72	0	0	0	0

Σn 72
ΣS_k 6

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	9.35	@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
p	**0.589**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc} 0.27	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
340.00	**p** **0.607**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-2.83	**0.43**	4.36
0.050	-2.03		3.38
0.100	-1.69		2.18
0.200	-0.90		1.30

Site #6 Seasonal Kendall analysis for pH, Field, Standard Units

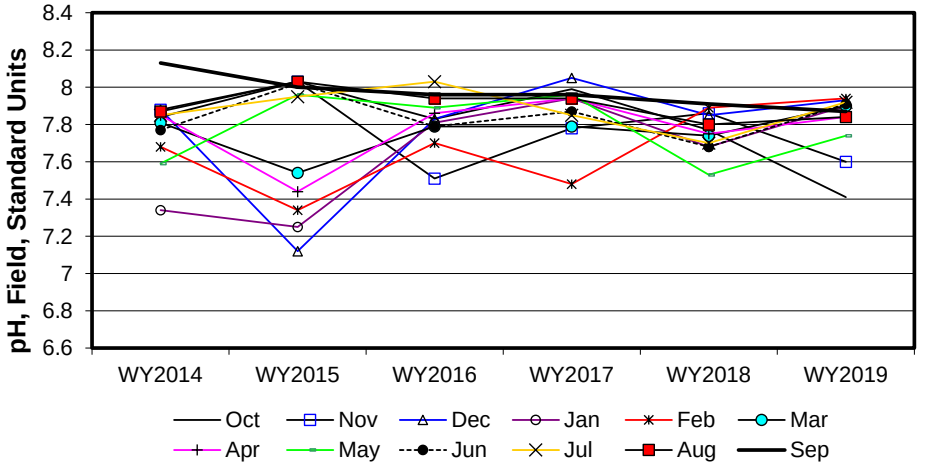
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	7.8	7.9	7.9	7.3	7.7	7.8	7.9	7.6	7.8	7.9	7.9	8.1
b	**WY2015**	8.0	8.0	7.1	7.3	7.3	7.5	7.4	8.0	8.0	8.0	8.0	8.0
c	**WY2016**	7.8	7.5	7.8	7.8	7.7	7.8	7.9	7.9	7.8	8.0	7.9	8.0
d	**WY2017**	8.0	7.8	8.1	7.9	7.5	7.8	7.9	8.0	7.9	7.9	7.9	8.0
e	**WY2018**	7.8	7.9	7.9	7.7	7.9	7.7	7.8	7.5	7.7	7.7	7.8	7.9
f	**WY2019**	7.4	7.6	7.9	7.9	7.9	7.9	7.8	7.7	7.9	7.9	7.8	7.9
	n	6	6	6	6	6	6	6	6	6	6	6	6
	t_1	6	6	6	6	6	4	6	4	6	4	4	4
	t_2	0	0	0	0	0	1	0	1	0	1	1	1
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	1	1	-1	-1	-1	-1	-1	1	1	1	1	-1
	c-a	-1	-1	-1	1	1	-1	1	1	1	1	1	-1
	d-a	1	-1	1	1	-1	-1	1	1	1	0	1	-1
	e-a	-1	-1	-1	1	1	-1	-1	-1	-1	-1	-1	-1
	f-a	-1	-1	1	1	1	1	-1	1	1	1	-1	-1
	c-b	-1	-1	1	1	1	1	1	-1	-1	1	-1	-1
	d-b	-1	-1	1	1	1	1	1	0	-1	-1	-1	-1
	e-b	-1	-1	1	1	1	1	1	-1	-1	-1	-1	-1
	f-b	-1	-1	1	1	1	1	1	-1	-1	-1	-1	-1
	d-c	1	1	1	1	-1	0	1	1	1	-1	0	0
	e-c	-1	1	1	-1	1	-1	-1	-1	-1	-1	-1	-1
	f-c	-1	1	1	1	1	1	-1	-1	1	-1	-1	-1
	e-d	-1	1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1
	f-d	-1	-1	-1	-1	1	1	-1	-1	1	1	-1	-1
	f-e	-1	-1	1	1	1	1	1	1	1	1	1	-1
	S_k	-9	-5	5	7	9	2	1	-2	1	-2	-6	-14
	σ^2_S=	28.33	28.33	28.33	28.33	28.33	27.33	28.33	27.33	28.33	27.33	27.33	27.33
	$Z_k = S_k/\sigma_S$	-1.69	-0.94	0.94	1.32	1.69	0.38	0.19	-0.38	0.19	-0.38	-1.15	-2.68
	Z^2_k	2.86	0.88	0.88	1.73	2.86	0.15	0.04	0.15	0.04	0.15	1.32	7.17

ΣZ_k= -2.52
ΣZ^2_k= 18.21
Z-bar=$\Sigma Z_k/K$= -0.21

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	62	5	0	0	0

Σn 72
ΣS_k -13

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	17.68		@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
p	**0.089**				$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	-0.66	@α/2=2.5% **Z**=	1.96	**H_0** (No trend) ACCEPT
335.00	**p**	**0.256**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.03		0.03
0.050	-0.02	**-0.01**	0.01
0.100	-0.02		0.01
0.200	-0.02		0.00

Site #6 Seasonal Kendall analysis for Total Alk, (mg/l)

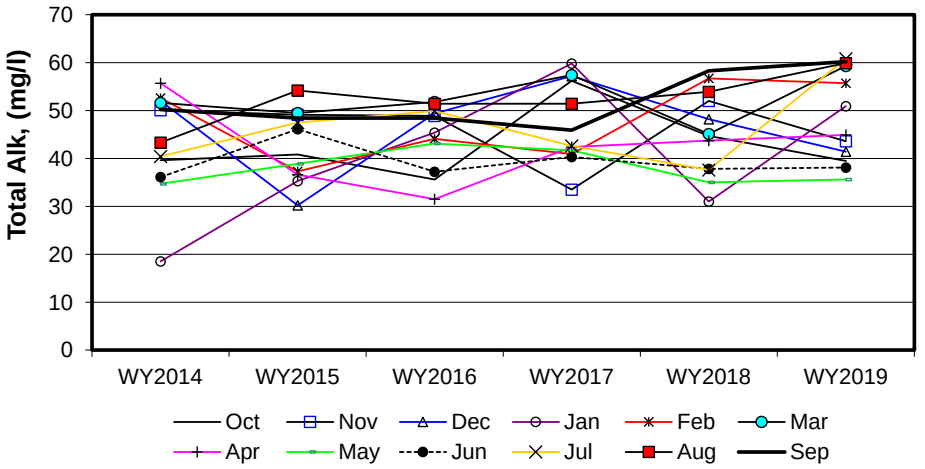
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	39.6	50.1	52.0	18.5	52.6	51.6	55.7	34.7	36.1	40.4	43.3	50.2
b	**WY2015**	40.8	49.1	30.2	35.3	37.3	49.5	36.6	38.9	46.1	47.5	54.2	48.4
c	**WY2016**	35.6	48.9	49.4	45.4	44.1	51.8	31.5	43.1	37.2	49.9	51.4	48.4
d	**WY2017**	56.2	33.5	57.2	59.8	40.9	57.4	42.4	41.7	40.3	42.6	51.4	45.9
e	**WY2018**	44.7	52.0	48.2	31.0	56.7	45.1	43.7	35.0	37.8	37.6	53.9	58.3
f	**WY2019**	39.5	43.6	41.4	50.9	55.7	59.3	44.9	35.6	38.1	60.8	59.9	60.2
	n	6	6	6	6	6	6	6	6	6	6	6	6
	t_1	6	6	6	6	6	6	6	6	6	6	4	4
	t_2	0	0	0	0	0	0	0	0	0	0	1	1
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	1	-1	-1	1	-1	-1	-1	1	1	1	1	-1
	c-a	-1	-1	-1	1	-1	1	-1	1	1	1	1	-1
	d-a	1	-1	1	1	-1	1	-1	1	1	1	1	-1
	e-a	1	1	-1	1	1	-1	-1	1	1	-1	1	1
	f-a	-1	-1	-1	1	1	1	-1	1	1	1	1	1
	c-b	-1	-1	1	1	1	1	-1	1	-1	1	-1	0
	d-b	1	-1	1	1	1	1	1	1	-1	-1	-1	-1
	e-b	1	1	1	-1	1	-1	1	-1	-1	-1	-1	1
	f-b	-1	-1	1	1	1	1	1	-1	-1	1	1	1
	d-c	1	-1	1	1	-1	1	1	-1	1	-1	0	-1
	e-c	1	1	-1	-1	1	-1	1	-1	1	-1	1	1
	f-c	1	-1	-1	1	1	1	1	-1	1	1	1	1
	e-d	-1	1	-1	-1	1	-1	1	-1	-1	-1	1	1
	f-d	-1	1	-1	-1	1	1	1	-1	-1	1	1	1
	f-e	-1	-1	-1	1	-1	1	1	1	1	1	1	1
	S_k	1	-5	-3	7	5	5	3	1	3	3	8	4
	σ^2_S=	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	27.33	27.33
	$Z_k = S_k/\sigma_S$	0.19	-0.94	-0.56	1.32	0.94	0.94	0.56	0.19	0.56	0.56	1.53	0.77
	Z^2_k	0.04	0.88	0.32	1.73	0.88	0.88	0.32	0.04	0.32	0.32	2.34	0.59

ΣZ_k= 6.05
ΣZ^2_k= 8.64
Z-bar=$\Sigma Z_k/K$= 0.50

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	68	2	0	0	0

Σn 72
ΣS_k 32

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	5.59		@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
	p	**0.899**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
$\Sigma VAR(S_k)$	Z_{calc}	1.69	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
338.00	**p**	**0.954**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.60		2.04
0.050	0.00	**1.00**	1.74
0.100	0.21		1.42
0.200	0.41		1.30

Site #6

Seasonal Kendall analysis for Sulfate, Total (mg/l)

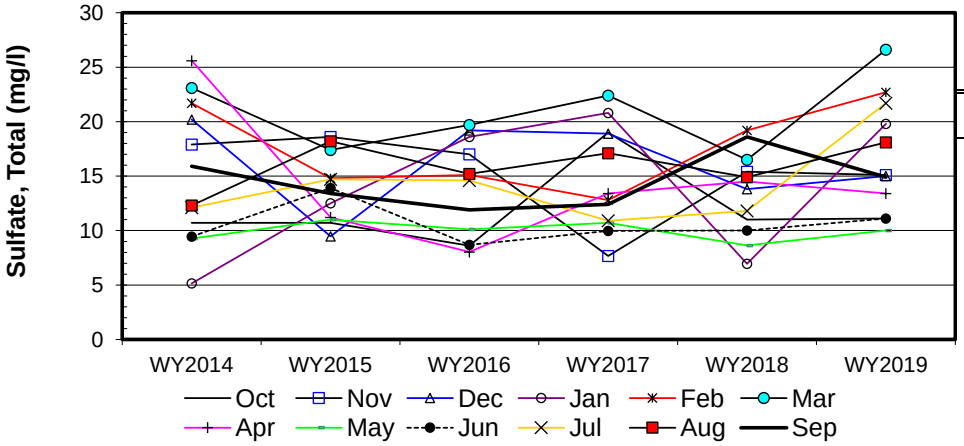
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	10.7	17.9	20.2	5.2	21.7	23.1	25.6	9.3	9.5	12.1	12.3	15.9
b	**WY2015**	10.7	18.6	9.5	12.5	14.8	17.4	11.2	11.0	13.9	14.7	18.2	13.4
c	**WY2016**	8.6	17.0	19.2	18.6	15.1	19.7	8.0	10.1	8.7	14.6	15.2	11.9
d	**WY2017**	19.0	7.7	18.9	20.8	12.8	22.4	13.4	10.7	10.0	10.9	17.1	12.4
e	**WY2018**	11.0	15.4	13.8	7.0	19.2	16.5	14.5	8.6	10.0	11.8	14.9	18.6
f	**WY2019**	11.1	15.1	15.0	19.8	22.7	26.6	13.4	10.0	11.1	21.7	18.1	14.9
	n	6	6	6	6	6	6	6	6	6	6	6	6
	t_1	4	6	6	6	6	6	4	6	6	6	6	6
	t_2	1	0	0	0	0	0	1	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	0	1	-1	1	-1	-1	-1	1	1	1	1	-1
	c-a	-1	-1	-1	1	-1	-1	-1	1	-1	1	1	-1
	d-a	1	-1	-1	1	-1	-1	-1	1	1	-1	1	-1
	e-a	1	-1	-1	1	-1	-1	-1	-1	1	-1	1	1
	f-a	1	-1	-1	1	1	1	-1	1	1	1	1	-1
	c-b	-1	-1	1	1	1	1	-1	-1	-1	-1	-1	-1
	d-b	1	-1	1	1	-1	1	1	-1	-1	-1	-1	-1
	e-b	1	-1	1	-1	1	-1	1	-1	-1	-1	-1	1
	f-b	1	-1	1	1	1	1	1	-1	-1	1	-1	1
	d-c	1	-1	-1	1	-1	1	1	1	1	-1	1	1
	e-c	1	-1	-1	-1	1	-1	1	-1	1	-1	-1	1
	f-c	1	-1	-1	1	1	1	1	-1	1	1	1	1
	e-d	-1	1	-1	-1	1	-1	1	-1	1	1	-1	1
	f-d	-1	1	-1	-1	1	1	0	-1	1	1	1	1
	f-e	1	-1	1	1	1	1	-1	1	1	1	1	-1
	S_k	6	-9	-5	7	3	1	0	-3	5	1	3	1
	σ^2_S=	27.33	28.33	28.33	28.33	28.33	28.33	27.33	28.33	28.33	28.33	28.33	28.33
	$Z_k = S_k/\sigma_S$	1.15	-1.69	-0.94	1.32	0.56	0.19	0.00	-0.56	0.94	0.19	0.56	0.19
	Z^2_k	1.32	2.86	0.88	1.73	0.32	0.04	0.00	0.32	0.88	0.04	0.32	0.04

ΣZ_k= 1.90
ΣZ^2_k= 8.73
Z-bar=$\Sigma Z_k/K$= 0.16

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	68	2	0	0	0

Σn 72
ΣS_k 10

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	8.43		@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
	p	**0.675**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	0.49	@α=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
338.00	**p**	**0.688**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.41	**0.10**	0.68
0.050	-0.26		0.51
0.100	-0.16		0.44
0.200	-0.06		0.32

Site #6 Seasonal Kendall analysis for Zinc, Dissolved (ug/l)

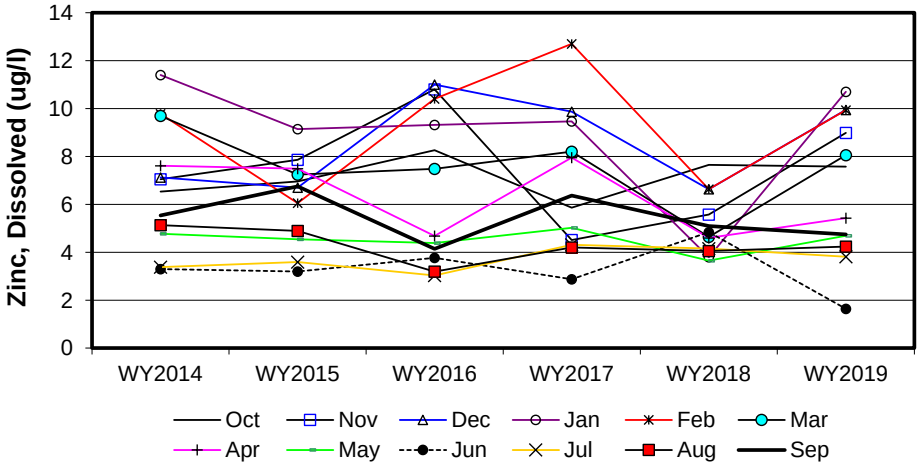
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	6.5	7.1	7.1	11.4	9.8	9.7	7.6	4.8	3.3	3.4	5.1	5.5
b	**WY2015**	7.0	7.9	6.7	9.1	6.1	7.2	7.5	4.5	3.2	3.6	4.9	6.8
c	**WY2016**	8.3	10.8	11.0	9.3	10.4	7.5	4.7	4.4	3.8	3.0	3.2	4.1
d	**WY2017**	5.9	4.5	9.9	9.5	12.7	8.2	8.0	5.0	2.9	4.3	4.2	6.4
e	**WY2018**	7.7	5.6	6.6	3.8	6.6	4.6	4.6	3.7	4.8	4.2	4.1	5.1
f	**WY2019**	7.6	9.0	9.9	10.7	9.9	8.1	5.4	4.7	1.6	3.8	4.2	4.7
	n	6	6	6	6	6	6	6	6	6	6	6	6
	t_1	6	6	6	6	6	6	6	6	6	6	6	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	1	1	-1	-1	-1	-1	-1	-1	-1	1	-1	1
	c-a	1	1	1	-1	1	-1	-1	-1	1	-1	-1	-1
	d-a	-1	-1	1	-1	1	-1	1	1	-1	1	-1	1
	e-a	1	-1	-1	-1	-1	-1	-1	-1	1	1	-1	-1
	f-a	1	1	1	-1	1	-1	-1	-1	-1	1	-1	-1
	c-b	1	1	1	1	1	1	-1	-1	1	-1	-1	-1
	d-b	-1	-1	1	1	1	1	1	1	-1	1	-1	-1
	e-b	1	-1	-1	-1	1	-1	-1	-1	1	1	-1	-1
	f-b	1	1	1	1	1	1	-1	1	-1	1	-1	-1
	d-c	-1	-1	-1	1	1	1	1	1	-1	1	1	1
	e-c	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1
	f-c	-1	-1	-1	1	-1	1	1	1	-1	1	1	1
	e-d	1	1	-1	-1	-1	-1	-1	-1	1	-1	-1	-1
	f-d	1	1	1	1	-1	-1	-1	-1	-1	-1	1	-1
	f-e	-1	1	1	1	1	1	1	1	-1	-1	1	-1
	S_k	3	1	1	-1	3	-3	-5	-3	-3	5	-5	-5
	σ^2_S=	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33
	$Z_k = S_k/\sigma_S$	0.56	0.19	0.19	-0.19	0.56	-0.56	-0.94	-0.56	-0.56	0.94	-0.94	-0.94
	Z^2_k	0.32	0.04	0.04	0.04	0.32	0.32	0.88	0.32	0.32	0.88	0.88	0.88

ΣZ_k= -2.25
ΣZ^2_k= 5.22
Z-bar=$\Sigma Z_k/K$= -0.19

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	72	0	0	0	0

Σn 72
ΣS_k -12

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	4.80		@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
p	**0.940**				$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
$\Sigma VAR(S_k)$	Z_{calc} -0.60		@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
340.00	**p** **0.275**				**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.26		0.19
0.050	-0.19	**-0.11**	0.12
0.100	-0.16		0.08
0.200	-0.16		0.03

Wilcoxon-signed-ranks test

Exact Form

Variable: **Specific Conductance, Field (µS/cm)**

	X	**Y**			
Site	#48	#6	Differences		
Year	WY2019	WY2019	**D**	**|D|**	**Rank**
Oct	104.40	110.60	-6.20	6.20	-11
Nov	117.50	120.30	-2.80	2.80	-2
Dec	109.80	113.40	-3.60	3.60	-4
Jan	115.10	103.20	11.90	11.90	12
Feb	149.10	144.10	5.00	5.00	8
Mar	163.60	168.80	-5.20	5.20	-10
Apr	110.50	115.20	-4.70	4.70	-5.5
May	91.60	93.53	-1.93	1.93	-1
Jun	96.42	99.28	-2.86	2.86	-3
Jul	150.90	155.60	-4.70	4.70	-5.5
Aug	148.80	153.70	-4.90	4.90	-7
Sep	125.50	130.70	-5.20	5.20	-9
Median	116.30	117.75	-4.15	4.80	

n	**m**
12	12

N= 12

ΣR= -38

α
0.05
W'α,n
17

W^+=
20
p-test
0.076

H_0	median [D]=0	ACCEPT
H_1	median [D]<0	

Wilcoxon-signed-ranks test

Exact Form

Variable: **pH, Field, Standard Units**

	X	**Y**			
Site	#48	#6	Differences		
Year	WY2019	WY2019	**D**	**|D|**	**Rank**
Oct	7.38	7.41	-0.03	0.03	-4
Nov	7.73	7.60	0.13	0.13	10
Dec	7.91	7.93	-0.02	0.02	-3
Jan	7.89	7.90	-0.01	0.01	-2
Feb	7.94	7.94	0.00		
Mar	7.86	7.90	-0.04	0.04	-5.5
Apr	7.90	7.84	0.06	0.06	9
May	7.79	7.74	0.05	0.05	7
Jun	7.77	7.91	-0.14	0.14	-11
Jul	7.87	7.92	-0.05	0.05	-8
Aug	7.83	7.84	-0.01	0.01	-1
Sep	7.83	7.87	-0.04	0.04	-5.5
Median	7.85	7.89	-0.02	0.04	

n	**m**
12	11

N= 11

ΣR= -14

α
0.05
W'α,n
13

W^+=
26
p-test
0.289

H_0	median [D]=0	ACCEPT
H_1	median [D]<0	

Wilcoxon-signed-ranks test

Exact Form

Variable: **Total Alk, (mg/l)**

	X	**Y**			
Site	#48	#6	Differences		
Year	WY2019	WY2019	**D**	**|D|**	**Rank**
Oct	38.60	39.50	-0.90	0.90	-6
Nov	43.30	43.60	-0.30	0.30	-1
Dec	40.60	41.40	-0.80	0.80	-5
Jan	49.80	50.90	-1.10	1.10	-8.5
Feb	55.00	55.70	-0.70	0.70	-4
Mar	59.90	59.30	0.60	0.60	3
Apr	43.90	44.90	-1.00	1.00	-7
May	35.10	35.60	-0.50	0.50	-2
Jun	39.20	38.10	1.10	1.10	8.5
Jul	59.60	60.80	-1.20	1.20	-10.5
Aug	58.70	59.90	-1.20	1.20	-10.5
Sep	58.70	60.20	-1.50	1.50	-12
Median	46.85	47.90	-0.85	0.95	

n	**m**
12	12

N= 12

ΣR= -55

α
0.05
W'α,n
17

W^+=
11.5
p-test
0.013

H_0	median [D]=0	**REJECT**
H_1	median [D]<0	**ACCEPT**

Wilcoxon-signed-ranks test

Exact Form

Variable: **Sulfate, Total (mg/l)**

	X	**Y**			
Site	#48	#6	Differences		
Year	WY2019	WY2019	**D**	**|D|**	**Rank**
Oct	10.0	11.1	-1.1	1.1	-4.5
Nov	13.7	15.1	-1.4	1.4	-7.5
Dec	13.6	15.0	-1.4	1.4	-7.5
Jan	17.8	19.8	-2.0	2.0	-12
Feb	21.2	22.7	-1.5	1.5	-10
Mar	26.8	26.6	0.2	0.2	1
Apr	12.2	13.4	-1.2	1.2	-6
May	9.5	10.0	-0.5	0.5	-2
Jun	10.4	11.1	-0.7	0.7	-3
Jul	20.2	21.7	-1.5	1.5	-10
Aug	16.6	18.1	-1.5	1.5	-10
Sep	13.8	14.9	-1.1	1.1	-4.5
Median	13.8	15.1	-1.3	1.3	

n	**m**
12	12

N= 12

ΣR= -76

α
0.05
W'α,n
17

W^+=
1
p-test
0.000

H_0	median [D]=0	**REJECT**
H_1	median [D]<0	**ACCEPT**

Wilcoxon-signed-ranks test
Exact Form

Variable: **Zinc, Dissolved (ug/l)**

	X	**Y**			
Site	#48	#6	Differences		
Year	WY2019	WY2019	**D**	**|D|**	**Rank**
Oct	2.40	7.57	-5.17	5.17	-8
Nov	3.27	8.98	-5.71	5.71	-9
Dec	3.66	9.94	-6.28	6.28	-11
Jan	3.62	10.70	-7.08	7.08	-12
Feb	4.10	9.93	-5.83	5.83	-10
Mar	4.23	8.05	-3.82	3.82	-7
Apr	2.31	5.43	-3.12	3.12	-6
May	2.55	4.69	-2.14	2.14	-4
Jun	3.30	1.64	1.66	1.66	2
Jul	2.63	3.81	-1.18	1.18	-1
Aug	2.42	4.24	-1.82	1.82	-3
Sep	2.44	4.74	-2.30	2.30	-5
Median	2.95	6.50	-3.47	3.47	

n	**m**
12	12

N= 12

ΣR= -74

α
0.05
W'α,n
17

W^+=
2
p-test
0.001

H_0	median [D]=0	**REJECT**
H_1	median [D]<0	**ACCEPT**

INTERPRETIVE REPORT
SITE 54

The data collected during the current water year are listed in the following "Table of Results for Water Year 2019" report. The table includes all the required FWMP analyte data (field and laboratory) collected for the current water year and a series of flags keyed to the summary report "Qualified Data by QA Reviewer." The QA report lists any associated data limitations found during the monthly QA reviews of laboratory data for this site. Median values for all analytes have been calculated and are shown in the right-most column of the table of results. Any value reported as less than MDL has been replaced with a value of one-half of the MDL for the purpose of median calculation.

All data collected at this site for the past six years are included in the data analyses, with the exception of the outliers shown in the table below. During the current year, no data points were flagged as outliers after reviewing by HGCMC.

Sample Date	Parameter	Value	Qualifier	Notes
No outliers, in the past six years, have been identified by HGCMC.				

The data have been compared to the strictest freshwater quality criterion for each applicable analyte. No results exceeded these criteria.

Table of Exceedance for Water Year 2019

			Limits		
Sample Date	Parameter	Value	Lower	Upper	Hardness
No exceedances have been identified by HGCMC for the period of October 2018 through September 2019.					

X-Y plots have been generated to graphically present the data for each of the analytes requested in the Statistical Information Goals for this site. These plots have been visually analyzed for the appearance of any trend in concentration. There were no visually obvious trends.

A non-parametric statistical analysis for trend was performed for specific conductivity, field pH, total alkalinity, total sulfate, and dissolved zinc. Calculation details of the Seasonal Kendall analyses are presented in detail on the pages following this interpretive section. The following table summarizes the results of the data collected between Oct-13 and Sep-19 (WY2014-WY2019).

Site 54 - Table of Summary Statistics for Trend Analysis

	Mann-Kendall test statistics			Sen's slope estimate	
Parameter	**n***	**p****	**Trend**	**Q**	**Q(%)**
Conductivity Field	6	0.48			
pH Field	6	0.48			
Alkalinity, Total	6	0.76			
Sulfate, Total	6	0.74			
Zinc, Dissolved	6	0.29			

* Number of Years ** Significance level

For datasets with a statistically significant trend ($\alpha/2$=2.5%), a Seasonal-Sen's Slope estimate statistic has also been calculated. There were no statistically significant trends identified.

A comparison of median values for total alkalinity, field pH, field conductivity, total sulfate, and dissolved zinc between Site 54 and Site 6 has been conducted as specified in the Statistical Information Goals for Site 54. Additionally, X-Y plots have been generated for total alkalinity, field pH, specific conductance, total sulfate, and dissolved zinc that coplot data from Site 54 and Site 6, the upstream control site, to aid in the comparison between those sites. Calculation details of the non-parametric signed-rank tests are presented in detail on the pages following this interpretive section. The table below summarizes the results of the signed-rank test as performed on the Water Year 2019 dataset.

Table of Summary Statistics for Median Analysis

Site 54 vs Site 6

Parameter	**Signed Ranks p-value**	**Site 6 median**	**Site 54 median**	**Median Differences**
Conductivity Field	<0.01	117.80	123.70	-1.40
pH Field	0.117	7.89	7.83	0.03
Alkalinity, Total	<0.01	53.30	54.20	-1.00
Sulfate, Total	0.278	15.10	16.60	-0.10
Zinc, Dissolved	0.013	6.50	5.85	0.36

A significant difference in field conductivity was observed though this is consistent with prior years. The sensitivity of the FWMP program is adequate to measure and quantify future changes that may occur between Site 6 and Site 54.

Table of Results for Water Year 2019

Site 054FMS - 'Greens Creek Below D-Pond'

Sample Date/Parameter	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019	**Median**
Water Temp (°C)	5.6	3.5	1.1	0.1	0.0	0.8	1.8	3.3	7.6	10.9	11.1	9.8	3.4
Conductivity-Field(μmho)	111	123.1	114.8	124.2	144.6	169.7	115.3	93.5	101.6	157	155.4	132.9	123.7
Conductivity-Lab (μmho)	112	122	117	148	159	176	118	94	98	151	141	128	125
pH Lab (standard units)	6.51	6.84	6.38	6.43	6.52	6.18	6.54	6.57	6.8	7.84	6.78	6.56	6.55
pH Field (standard units)	7.21	7.74	7.94	7.88	7.91	7.94	7.8	7.77	7.82	7.88	7.78	7.84	7.83
Total Alkalinity (mg/L)	39.9	44.6	42.4	51.9	56.4	60.4	45.1	35.9	40.1	62.8	60.4	62	48.5
Total Sulfate (mg/L)	11.3	15	19.7	19	22.8	26.4	13.2	10	11.1	22.1	18.2	15	16.6
Hardness (mg/L)	51	60	58.8	69.8	76.1	85	56	45.2	47.3	76.1	73.6	66.2	63.1
Dissolved As (ug/L)	0.21	0.192	0.194	0.155	0.161	0.169	0.193	0.176	0.206	0.208	0.217	0.232	0.194
Dissolved Ba (ug/L)			26		29.6								27.8
Dissolved Cd (ug/L)	0.0515	0.0536	0.0564	0.0544	0.0517	0.0442	0.0331	0.0378	0.0276	0.0411	0.0446	0.0412	0.0444
Dissolved Cr (ug/L)			0.113		0.068								0.091
Dissolved Cu (ug/L)	0.648	0.614	0.745	0.426	0.335	0.273	0.44	0.544	0.247	0.331	0.405	0.545	0.433
Dissolved Pb (ug/L)	0.0193	0.0123	0.0777	0.0103	0.0047	0.0071	0.008	0.0136	0.0041	0.0061	0.0059	0.0103	0.0092
Dissolved Ni (ug/L)			0.405		0.325								0.365
Dissolved Ag (ug/L)			0.002		0.002								0.002
Dissolved Zn (ug/L)	7.17	8.28	9.54	9.27	8.93	6.58	5.12	4.64	2.5	3.59	3.92	4.9	5.85
Dissolved Se (ug/L)			0.771		1.21								0.991
Dissolved Hg (ug/L)	0.001	0.00116	0.00197	0.000649	0.000568	0.000405	0.000675	0.00113	0.000401	0.000453	0.000553	0.000914	0.000662

For individual sample/analyte qualifier descriptions see "Qualified Data by QA Reviewer" table.

Values reported as less than MDL are replaced by 1/2 MDL for median calculation purposes.

Shaded data has been qualified as an outlier by HGCMC and removed from any further analysis and is not included into the calculation of the median

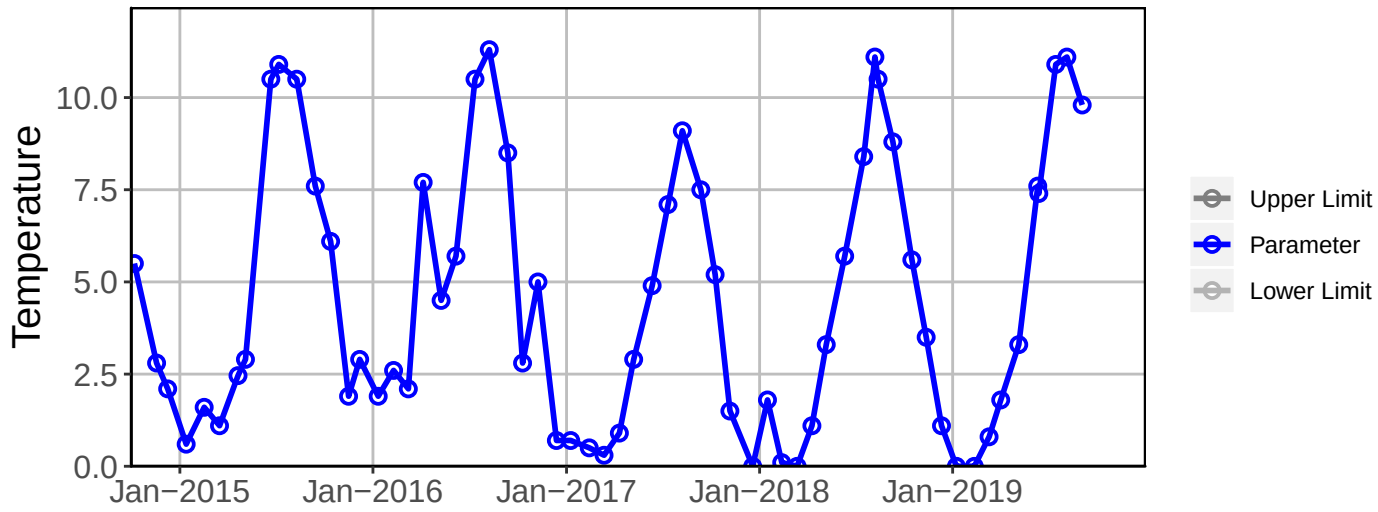
Qualified Data by QA Reviewer

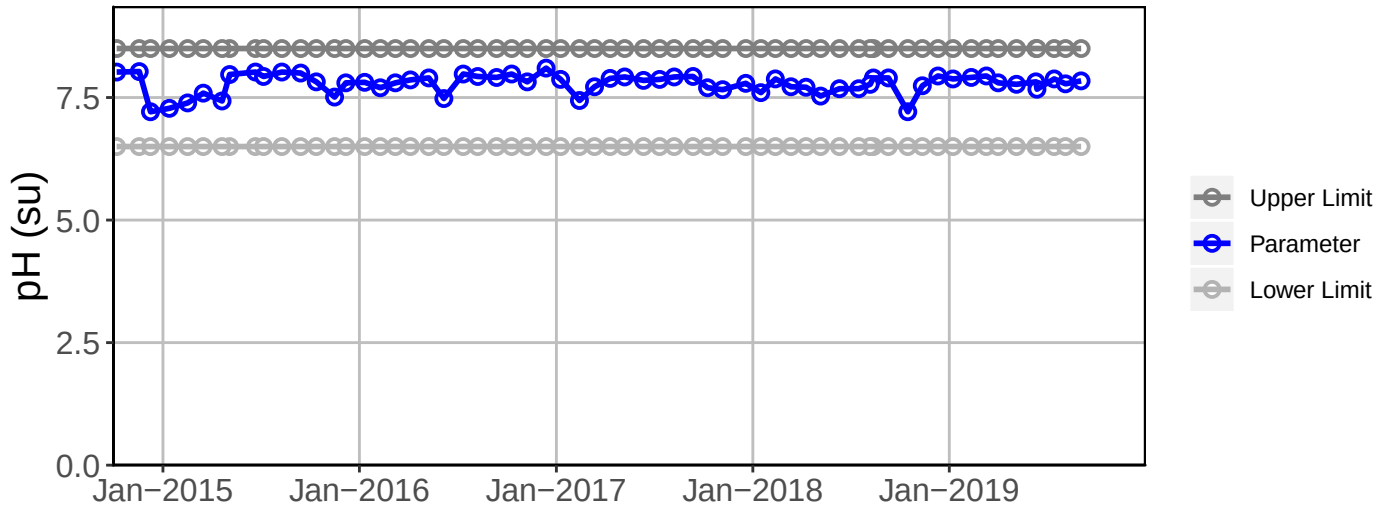
Date Range: 10/01/2018 to 09/30/2019

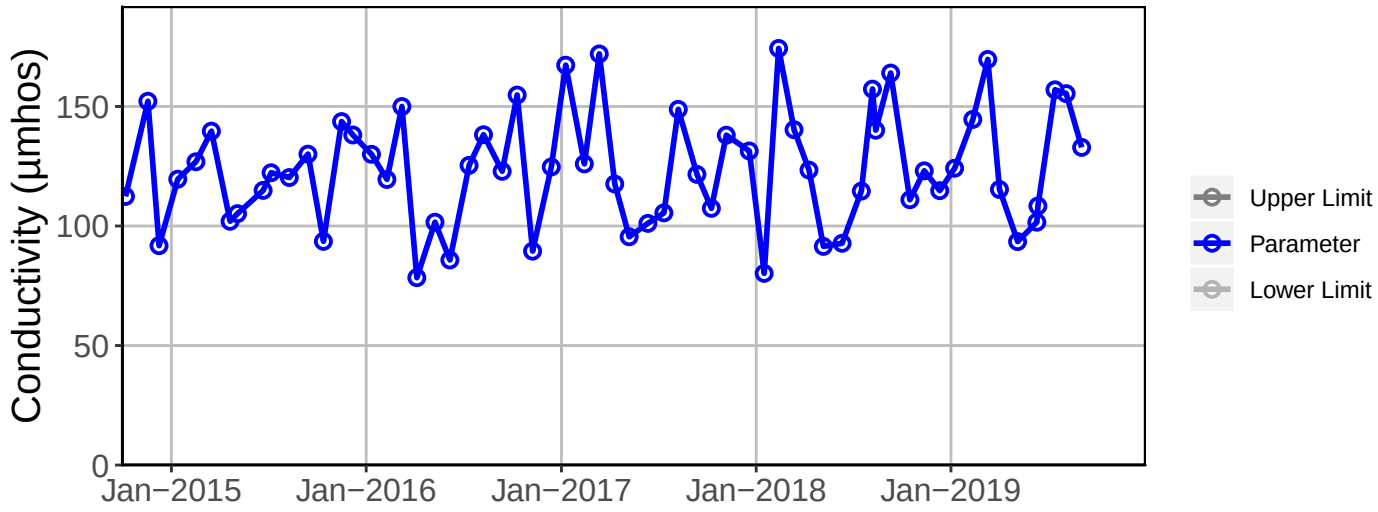
Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
054FMS	16-Oct-18	Diss. Tl-ICP/MS	0.00478	µg/L	J	Below Quantitative Range
	12-Nov-18	Diss. Pb-ICP/MS	0.01	µg/L	U	Field Blank Contamination
		Diss. Tl-ICP/MS	0.00485	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	8.28	µg/L	U	Field Blank Contamination
	11-Dec-18	Diss. Cr-ICP/MS	0.11	µg/L	J	Below Quantitative Range
		Diss. Ni-ICP/MS	0.4	µg/L	U	Field Blank Contamination
		Diss. Zn-ICP/MS	9.54	µg/L	U	Field Blank Contamination
	8-Jan-19	Diss. Zn-ICP/MS	9.27	µg/L	U	Field Blank Contamination
	11-Feb-19	Diss. Cr-ICP/MS	0.06	µg/L	J	Below Quantitative Range
		Diss. Pb-ICP/MS	0.00472	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	8.93	µg/L	U	Field Blank Contamination
	11-Mar-19	Diss. Pb-ICP/MS	0.00711	µg/L	J	Below Quantitative Range
	2-Apr-19	Diss. Pb-ICP/MS	0.00798	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	5.12	µg/L	U	Field Blank Contamination
	6-May-19	Diss. Zn-ICP/MS	4.64	µg/L	U	Field Blank Contamination
	11-Jun-19	Diss. Pb-ICP/MS	0.00412	µg/L	J	Below Quantitative Range
	15-Jul-19	Diss. Pb-ICP/MS	0.00612	µg/L	U	Field Blank contamination
		Diss. Zn-ICP/MS	3.59	µg/L	U	Field Blank contamination

Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

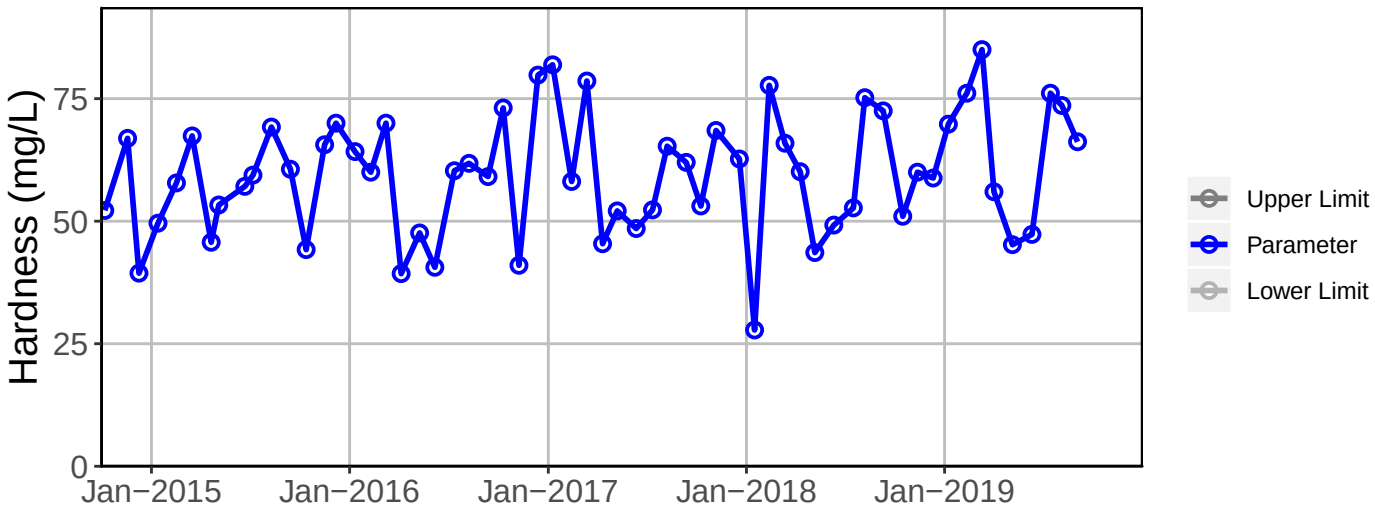
Site 54 Analyte Charts

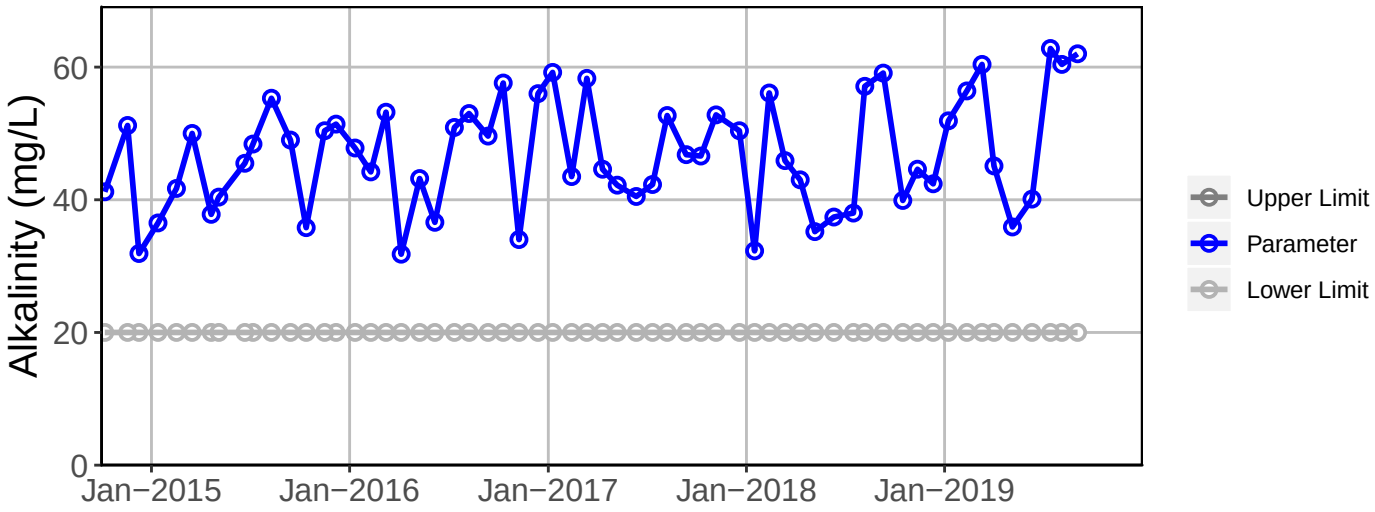


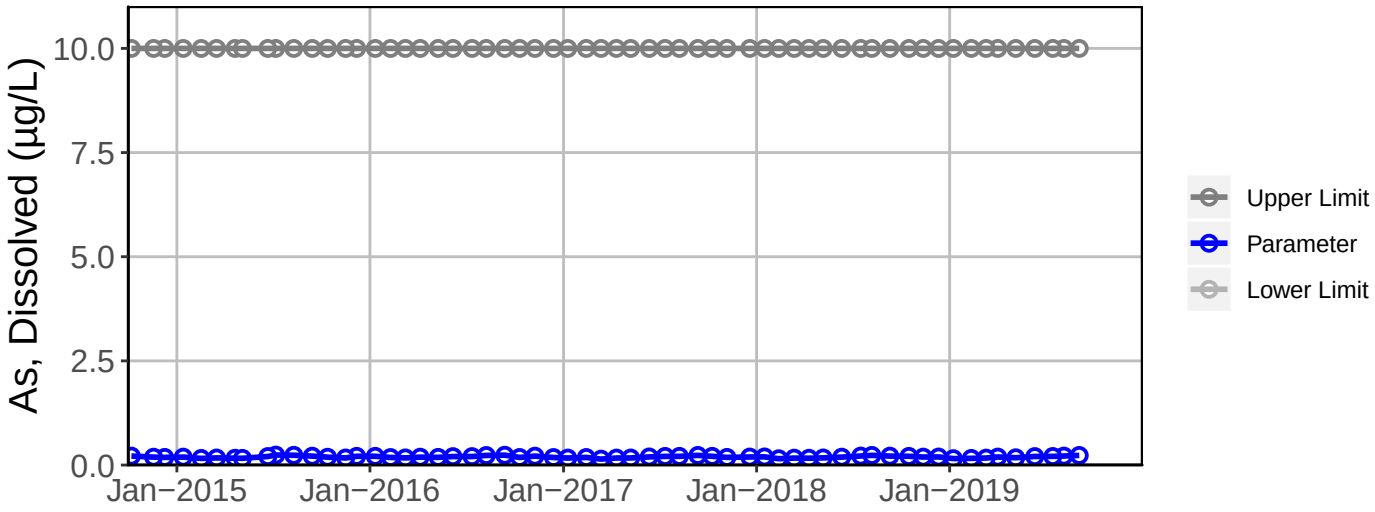




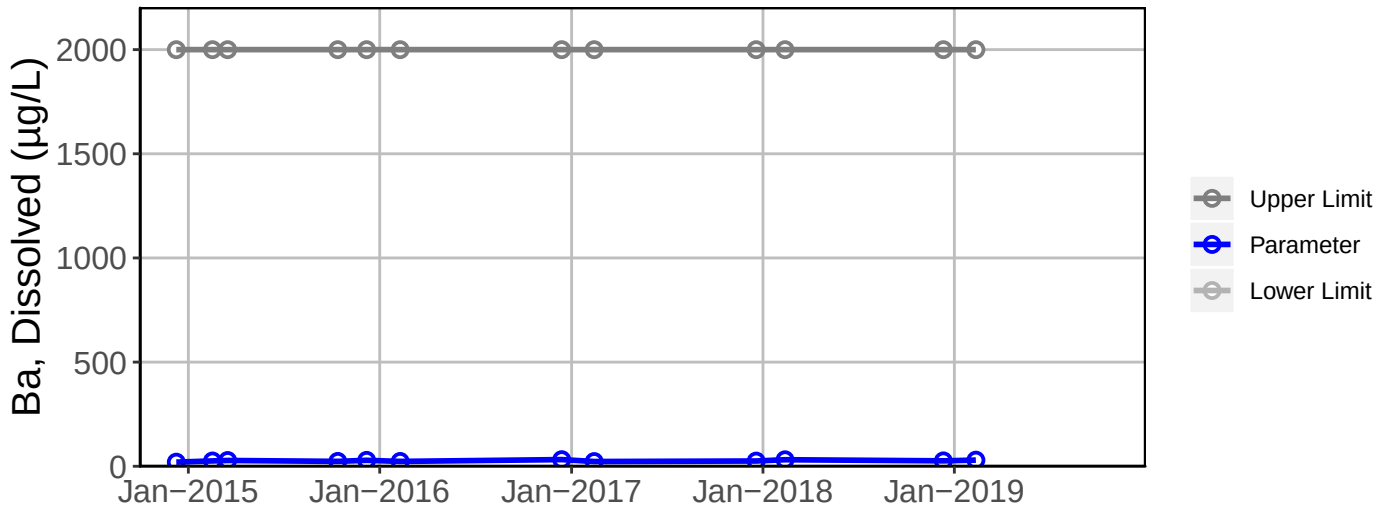
Site 54 Analyte Charts

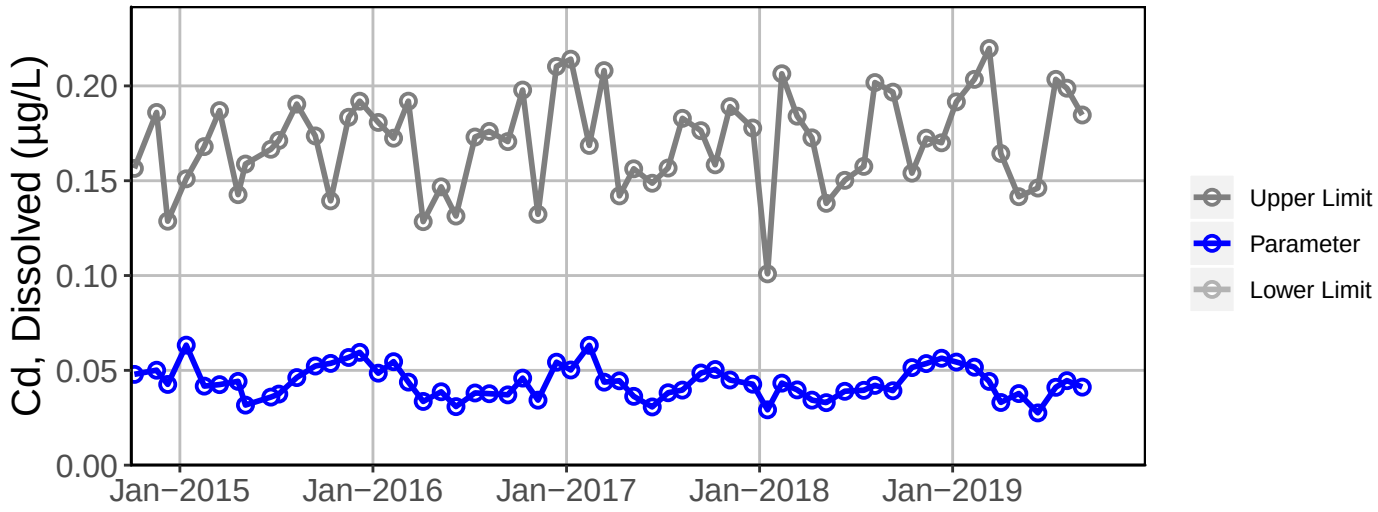


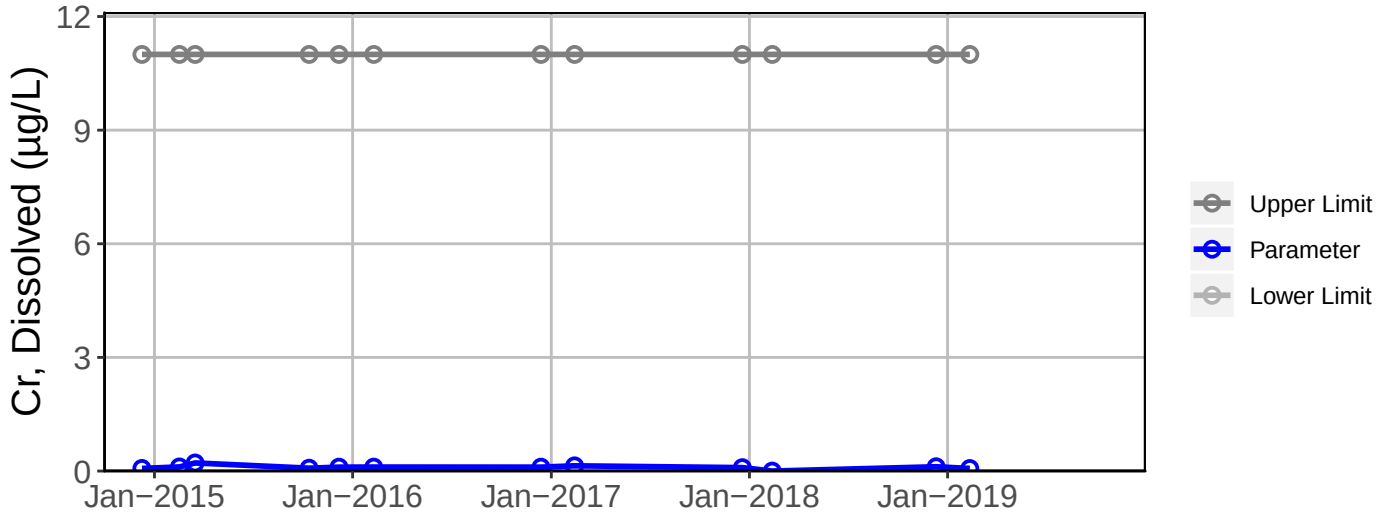




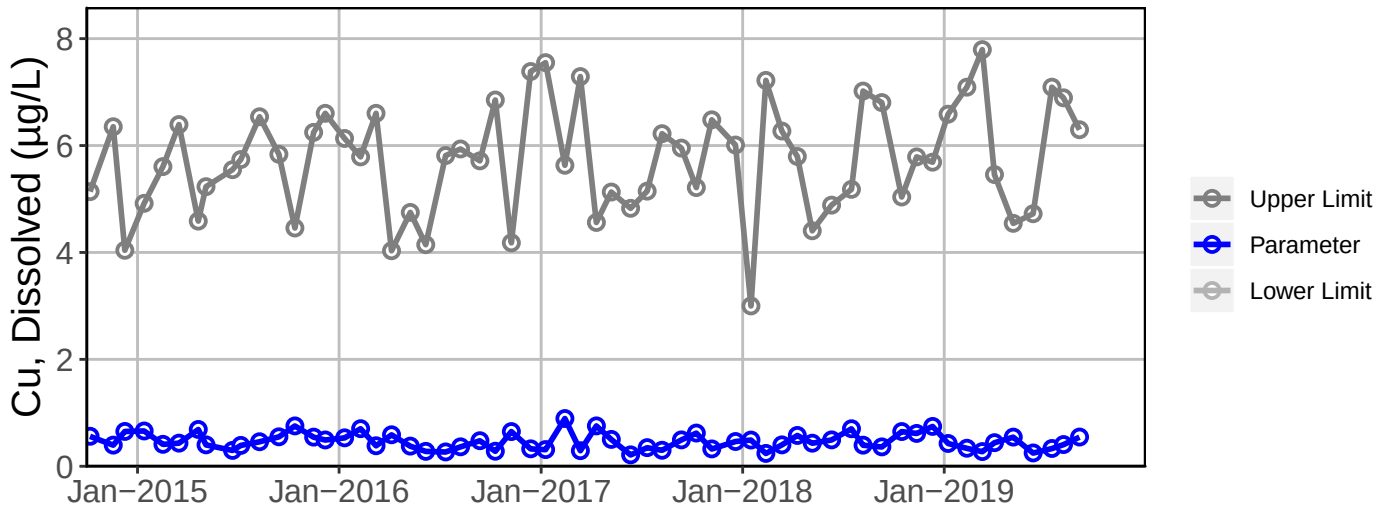
Site 54 Analyte Charts

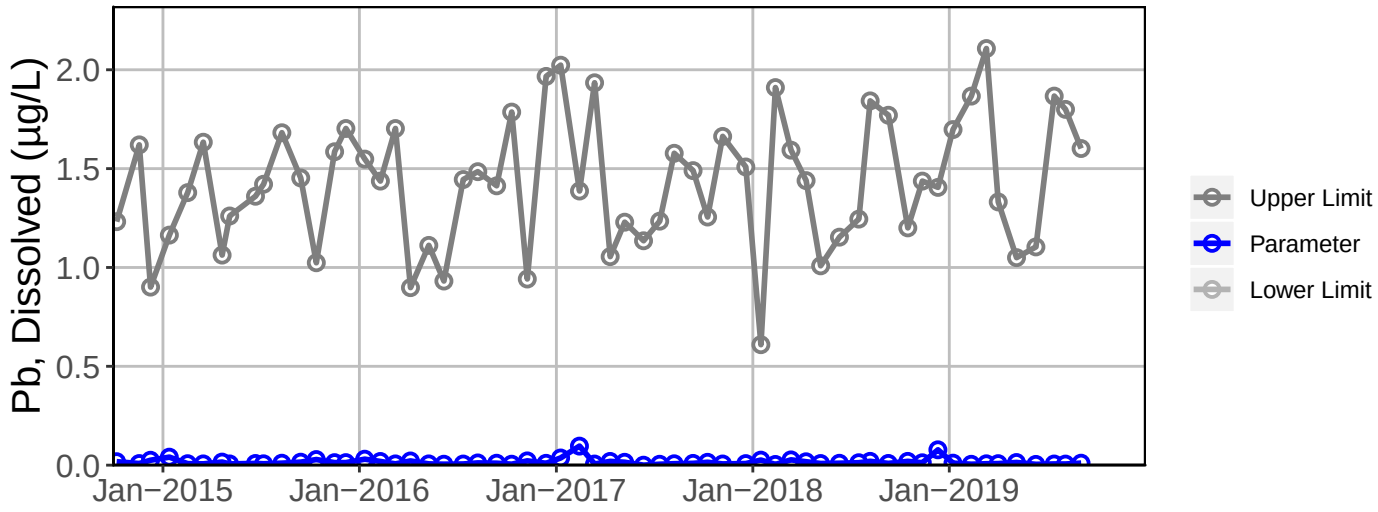


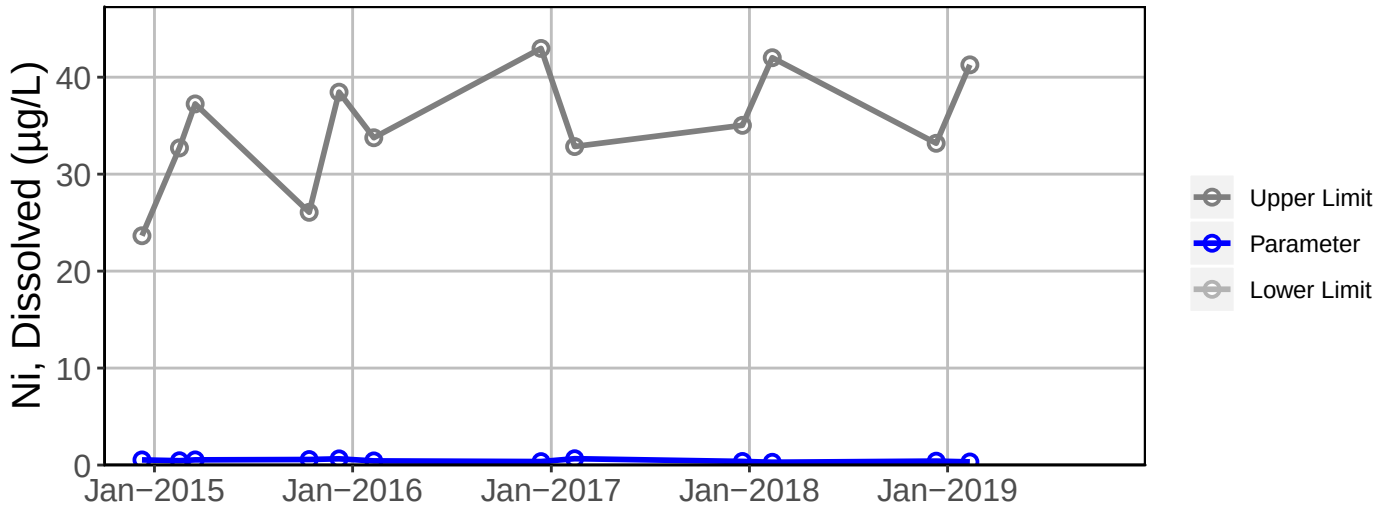




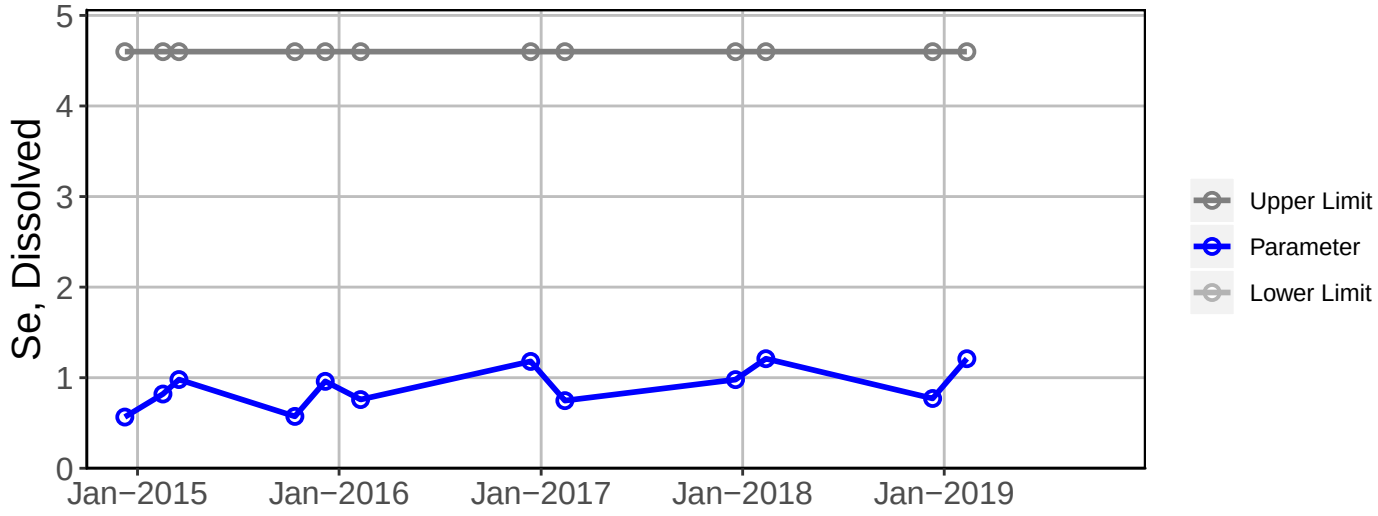
Site 54 Analyte Charts

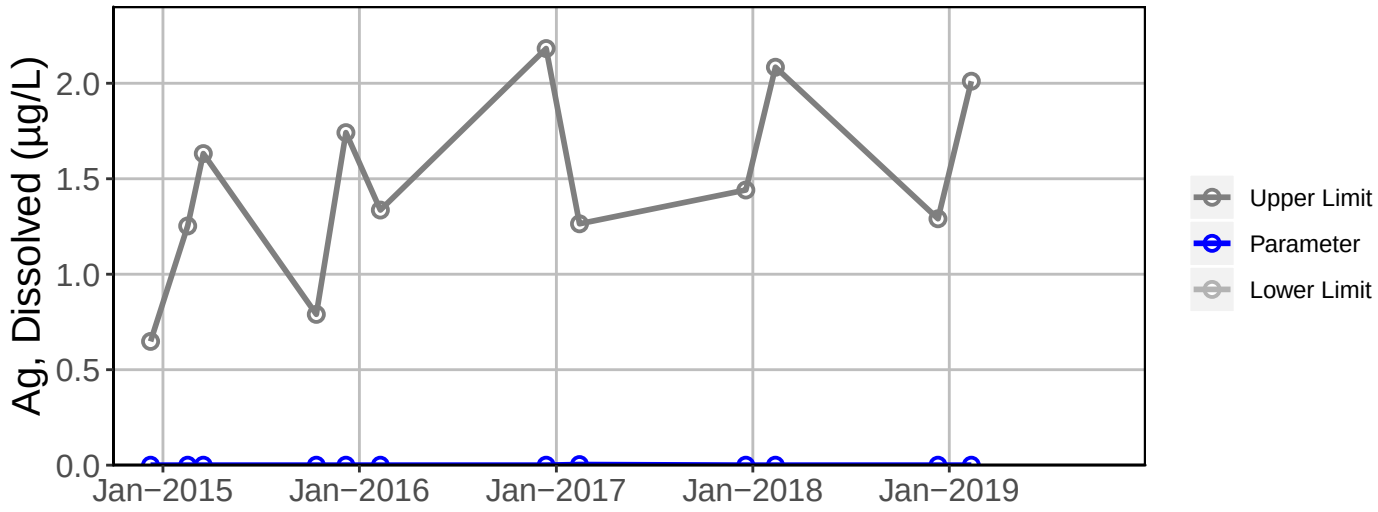


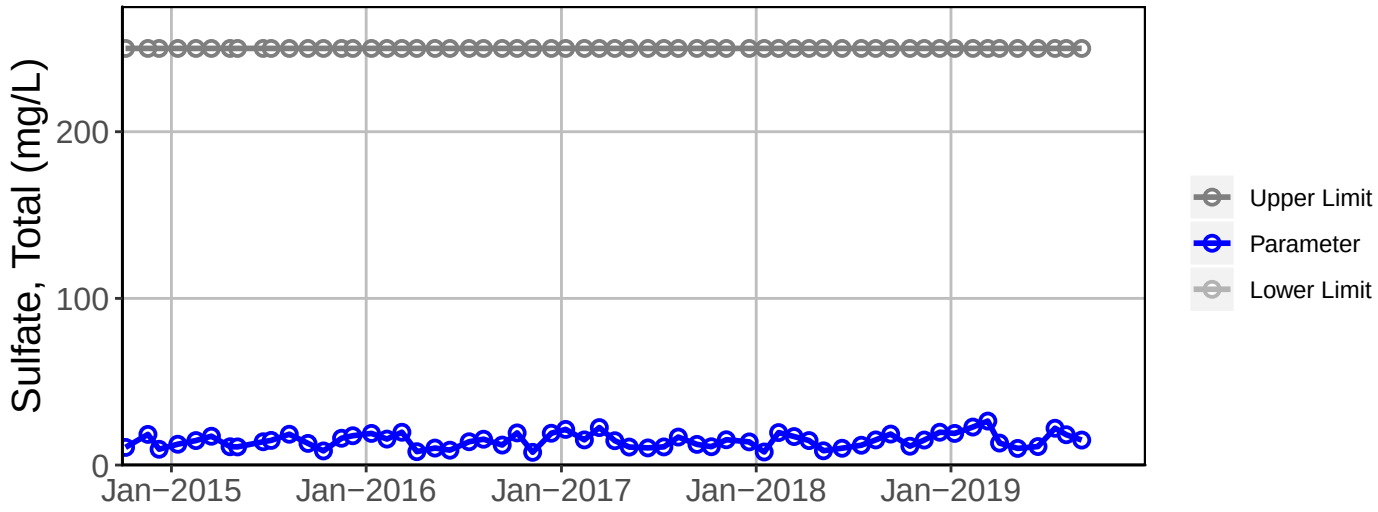




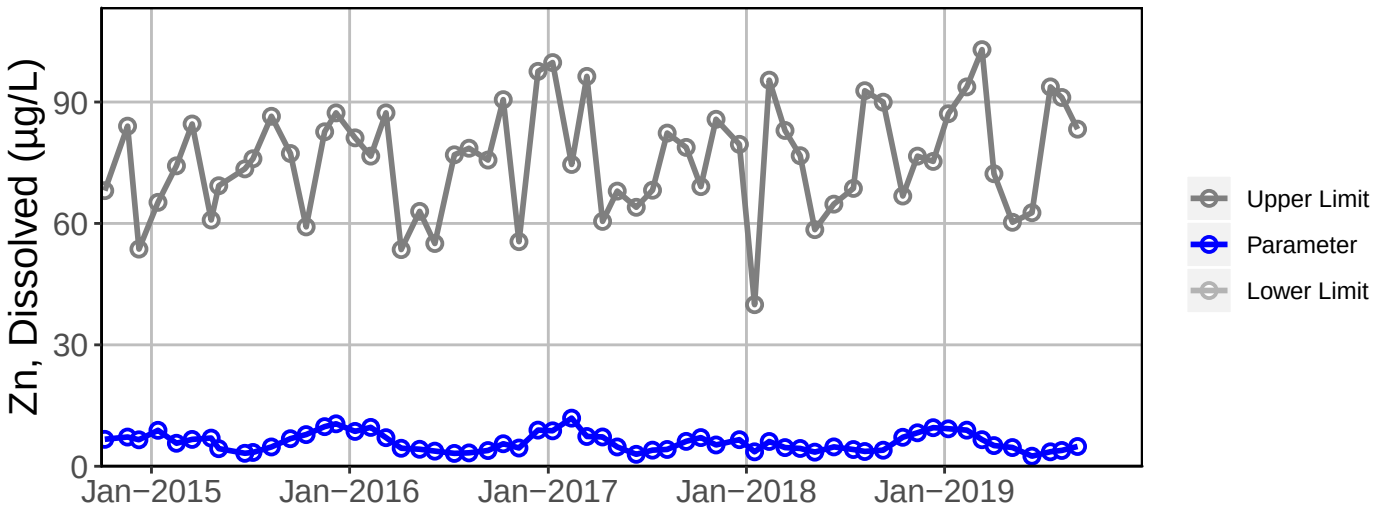
Site 54 Analyte Charts



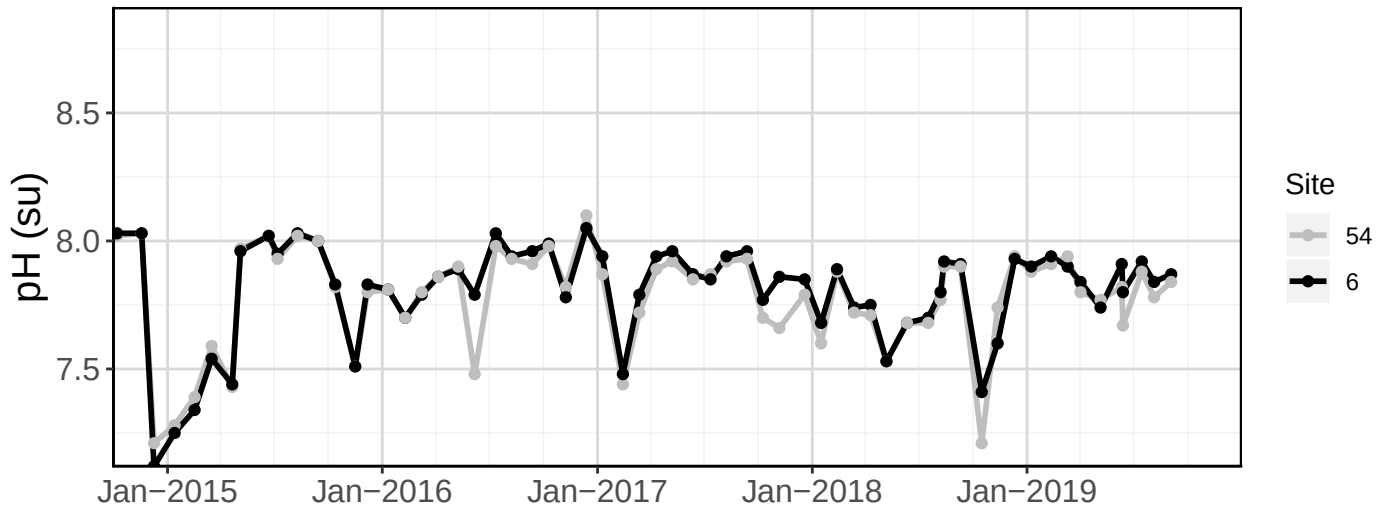


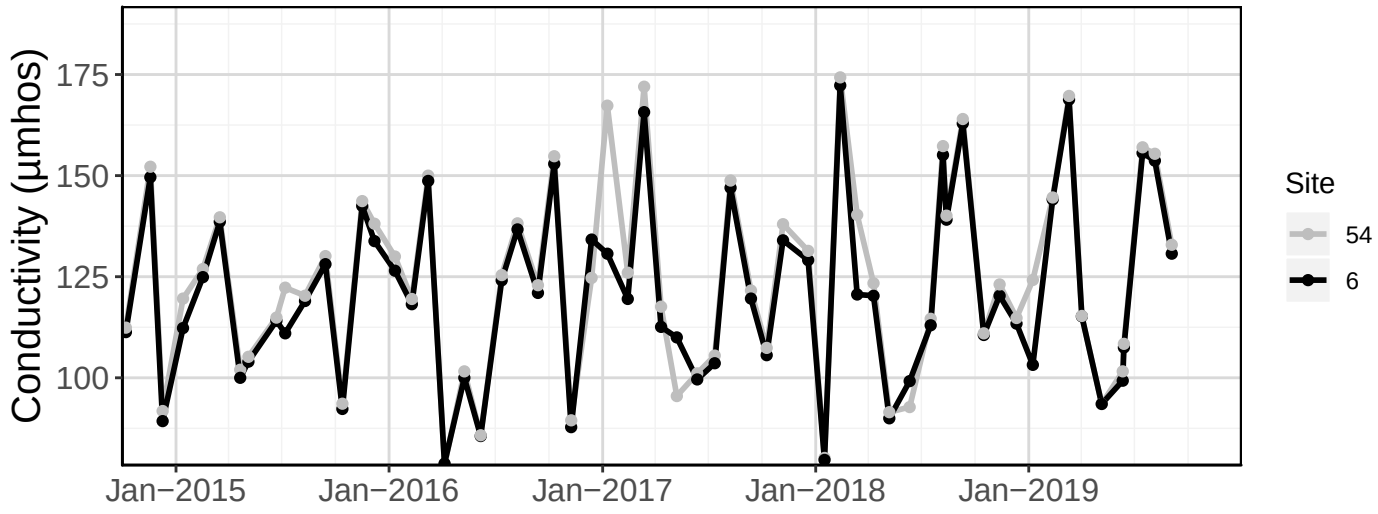


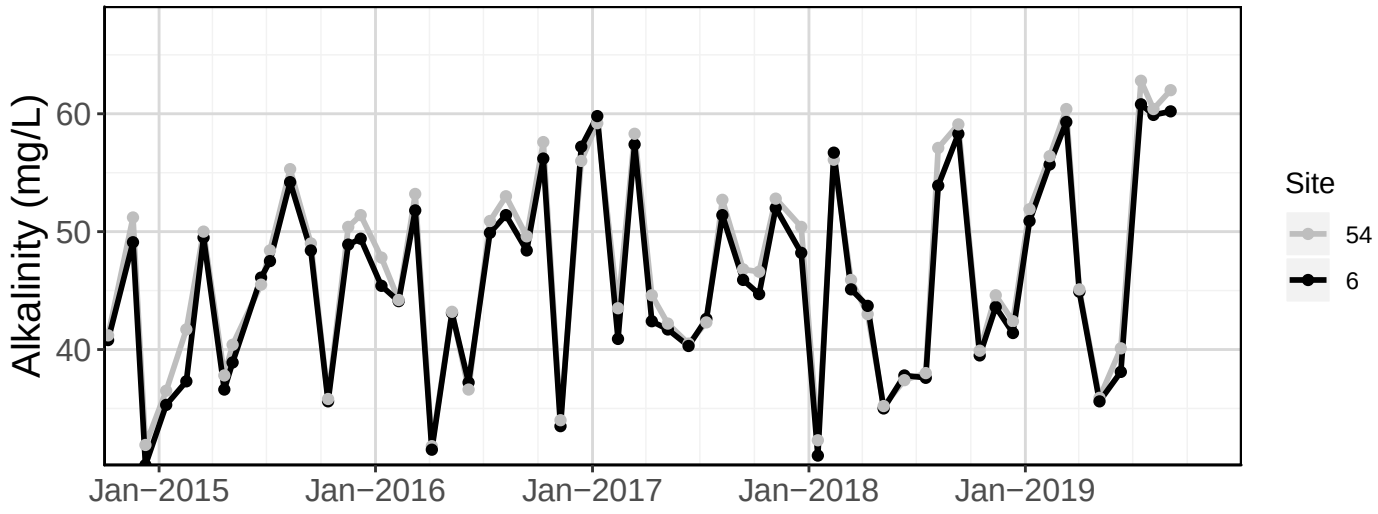
Site 54 Analyte Charts



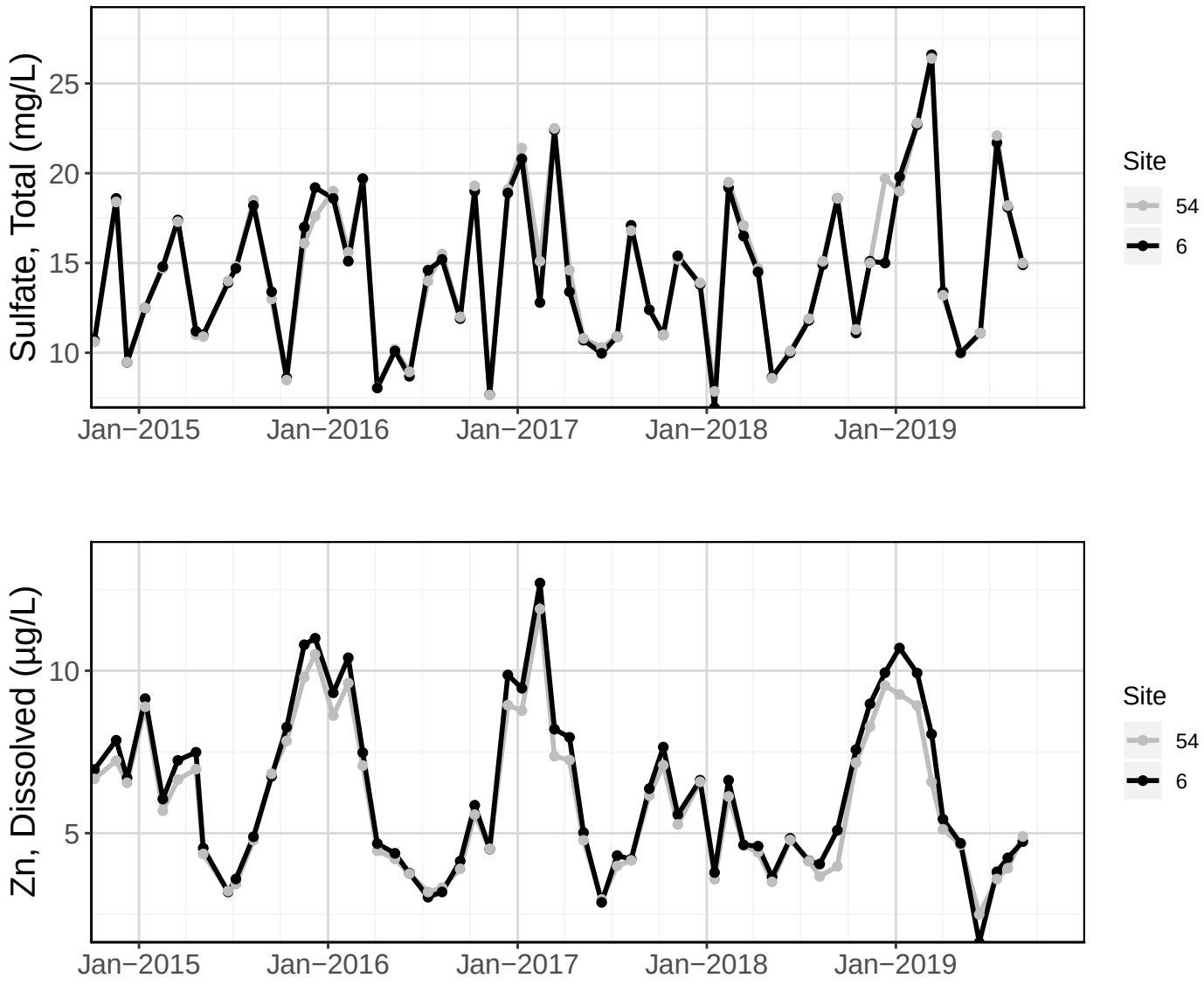
Comparison of Site 54 to Site 6







Comparison of Site 54 to Site 6



Qualified Data by QA Reviewer

Date Range: 10/01/2018 to 09/30/2019

Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
054FMS	5-Aug-19	Diss. Cu-ICP/MS	0.4	µg/L	U	Field Blank Contamination
		Diss. Pb-ICP/MS	0.00586	µg/L	U	Field Blank Contamination
		Diss. Zn-ICP/MS	3.92	µg/L	U	Field Blank Contamination
		Total Sulfate	18.20	µg/L	J	Sample Receipt Temperature
	3-Sep-19	Diss. Pb-ICP/MS	0.01	µg/L	U	Field Blank Contamination
		Total Sulfate	15	µg/L	J	Sample Receipt Temperature

Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

Site #54 Seasonal Kendall analysis for Specific Conductance, Field (µS/cm)

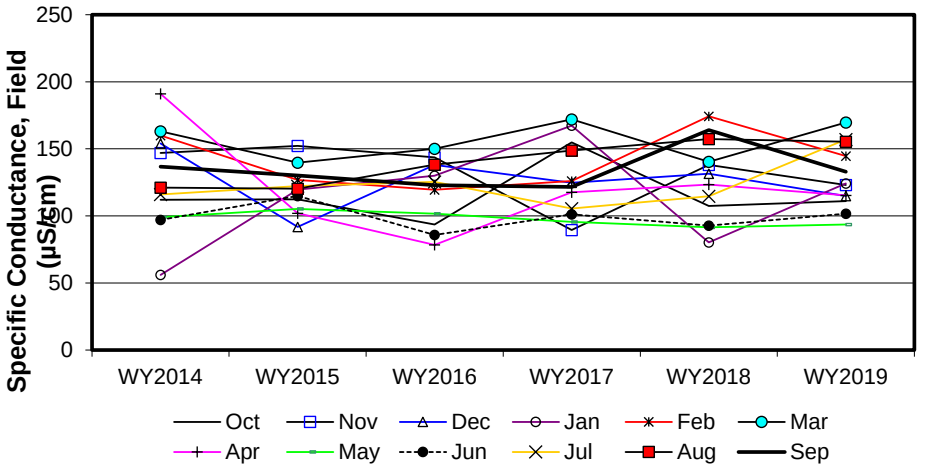
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	112.0	147.0	154.0	56.0	160.0	163.0	191.0	99.0	97.0	116.0	121.0	136.8
b	**WY2015**	112.4	152.2	91.8	119.6	126.9	139.7	102.0	105.2	114.9	122.3	120.3	130.1
c	**WY2016**	93.6	143.7	138.1	130.0	119.5	150.0	78.4	101.6	85.8	125.4	138.2	122.9
d	**WY2017**	154.8	89.5	124.7	167.3	126.0	172.0	117.6	95.5	101.1	105.5	148.8	121.6
e	**WY2018**	107.4	138.0	131.4	80.2	174.3	140.3	123.4	91.5	92.8	114.6	157.3	164.0
f	**WY2019**	111.0	123.1	114.8	124.2	144.6	169.7	115.3	93.5	101.6	157.0	155.4	132.9
	n	6	6	6	6	6	6	6	6	6	6	6	6
	t_1	6	6	6	6	6	6	6	6	6	6	6	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	1	1	-1	1	-1	-1	-1	1	1	1	-1	-1
	c-a	-1	-1	-1	1	-1	-1	-1	1	-1	1	1	-1
	d-a	1	-1	-1	1	-1	1	-1	-1	1	-1	1	-1
	e-a	-1	-1	-1	1	1	-1	-1	-1	-1	-1	1	1
	f-a	-1	-1	-1	1	-1	1	-1	-1	1	1	1	-1
	c-b	-1	-1	1	1	-1	1	-1	-1	-1	1	1	-1
	d-b	1	-1	1	1	-1	1	1	-1	-1	-1	1	-1
	e-b	-1	-1	1	-1	1	1	1	-1	-1	-1	1	1
	f-b	-1	-1	1	1	1	1	1	-1	-1	1	1	1
	d-c	1	-1	-1	1	1	1	1	-1	1	-1	1	-1
	e-c	1	-1	-1	-1	1	-1	1	-1	1	-1	1	1
	f-c	1	-1	-1	-1	1	1	1	-1	1	1	1	1
	e-d	-1	1	1	-1	1	-1	1	-1	-1	1	1	1
	f-d	-1	1	-1	-1	1	-1	-1	-1	1	1	1	1
	f-e	1	-1	-1	1	-1	1	-1	1	1	1	-1	-1
	S_k	-1	-9	-5	5	1	3	-1	-9	1	3	11	-1
σ^2_S=		28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33
$Z_k = S_k/\sigma_S$		-0.19	-1.69	-0.94	0.94	0.19	0.56	-0.19	-1.69	0.19	0.56	2.07	-0.19
Z^2_k		0.04	2.86	0.88	0.88	0.04	0.32	0.04	2.86	0.04	0.32	4.27	0.04

ΣZ_k= -0.38
ΣZ^2_k= 12.56
Z-bar=$\Sigma Z_k/K$= -0.03

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	72	0	0	0	0

Σn 72
ΣS_k -2

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	12.55	@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity	
p	**0.324**			$\chi^2_h<\chi^2_{(K-1)}$	ACCEPT
ΣVAR(S_k)	Z_{calc} -0.05	@α/2=2.5% **Z**=	1.96	**H_0** (No trend)	ACCEPT
340.00	**p** **0.478**			**H_A** (± trend)	REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-2.88		4.92
0.050	-1.88	**-0.28**	3.33
0.100	-1.28		2.82
0.200	-1.14		1.26

Site #54 Seasonal Kendall analysis for pH, Field, Standard Units

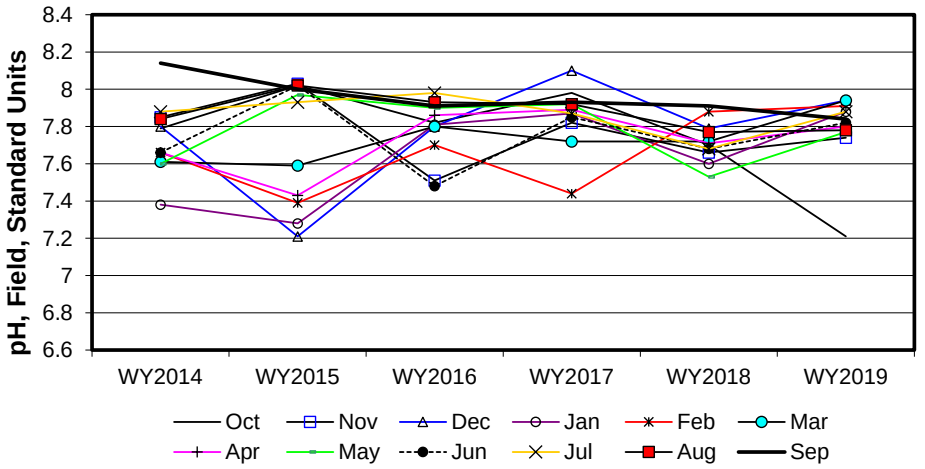
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	7.8	7.9	7.8	7.4	7.7	7.6	7.7	7.6	7.7	7.9	7.8	8.1
b	**WY2015**	8.0	8.0	7.2	7.3	7.4	7.6	7.4	8.0	8.0	7.9	8.0	8.0
c	**WY2016**	7.8	7.5	7.8	7.8	7.7	7.8	7.9	7.9	7.5	8.0	7.9	7.9
d	**WY2017**	8.0	7.8	8.1	7.9	7.4	7.7	7.9	7.9	7.9	7.9	7.9	7.9
e	**WY2018**	7.7	7.7	7.8	7.6	7.9	7.7	7.7	7.5	7.7	7.7	7.8	7.9
f	**WY2019**	7.2	7.7	7.9	7.9	7.9	7.9	7.8	7.8	7.8	7.9	7.8	7.8
	n	6	6	6	6	6	6	6	6	6	6	6	6
	t_1	6	6	4	6	6	4	6	6	6	4	6	4
	t_2	0	0	1	0	0	1	0	0	0	1	0	1
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	1	1	-1	-1	-1	-1	-1	1	1	1	1	-1
	c-a	1	-1	0	1	1	1	1	1	-1	1	1	-1
	d-a	1	-1	1	1	-1	1	1	1	1	-1	1	-1
	e-a	-1	-1	-1	1	1	1	1	-1	1	-1	-1	-1
	f-a	-1	-1	1	1	1	1	1	1	1	0	-1	-1
	c-b	-1	-1	1	1	1	1	1	-1	-1	1	-1	-1
	d-b	-1	-1	1	1	1	1	1	-1	-1	-1	-1	-1
	e-b	-1	-1	1	1	1	1	1	-1	-1	-1	-1	-1
	f-b	-1	-1	1	1	1	1	1	-1	-1	-1	-1	-1
	d-c	1	1	1	1	-1	-1	1	1	1	-1	-1	1
	e-c	-1	1	-1	-1	1	-1	-1	-1	1	-1	-1	0
	f-c	-1	1	1	1	1	1	-1	-1	1	-1	-1	-1
	e-d	-1	-1	-1	-1	1	0	-1	-1	-1	-1	-1	-1
	f-d	-1	-1	-1	1	1	1	-1	-1	-1	1	-1	-1
	f-e	-1	1	1	1	1	1	1	1	1	1	1	-1
	S_k	-7	-5	4	9	9	8	5	-3	1	-4	-7	-12
	Qm												0.0
	σ^2_S=	28.33	28.33	27.33	28.33	28.33	27.33	28.33	28.33	28.33	27.33	28.33	27.33
	$Z_k = S_k/\sigma_S$	-1.32	-0.94	0.77	1.69	1.69	1.53	0.94	-0.56	0.19	-0.77	-1.32	-2.30
	Z^2_k	1.73	0.88	0.59	2.86	2.86	2.34	0.88	0.32	0.04	0.59	1.73	5.27

ΣZ_k= -0.39
ΣZ^2_k= 20.07
Z-bar=$\Sigma Z_k/K$= -0.03

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	64	4	0	0	0

Σn 72
ΣS_k -2

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	20.06	@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
p	**0.044**			$\chi^2_h<\chi^2_{(K-1)}$ **REJECT**
ΣVAR(S_k)	Z_{calc} -0.05	@α/2=2.5% **Z**=	1.96	**H_0** (No trend) NA
336.00	**p** **0.478**			**H_A** (± trend) NA



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.03	**0.00**	0.03
0.050	-0.02		0.03
0.100	-0.02		0.02
0.200	-0.01		0.01

Site #54 Seasonal Kendall analysis for Total Alk, (mg/l)

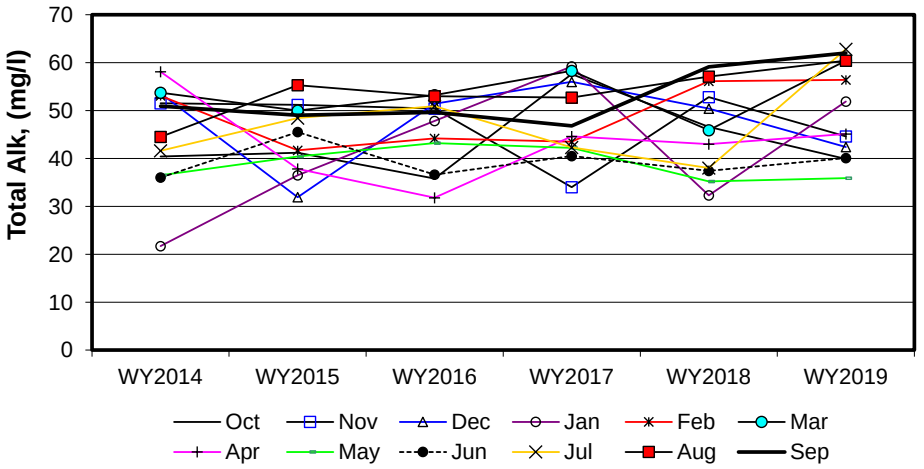
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	40.4	51.5	53.6	21.7	53.1	53.7	58.1	36.5	36.0	41.6	44.5	50.9
b	**WY2015**	41.2	51.2	31.9	36.5	41.7	50.0	37.8	40.4	45.5	48.4	55.3	49.0
c	**WY2016**	35.8	50.4	51.4	47.8	44.2	53.2	31.8	43.2	36.6	50.9	53.0	49.6
d	**WY2017**	57.6	34.0	56.0	59.2	43.5	58.3	44.6	42.2	40.5	42.3	52.7	46.8
e	**WY2018**	46.6	52.8	50.4	32.3	56.1	45.9	43.0	35.2	37.4	38.0	57.1	59.1
f	**WY2019**	39.9	44.6	42.4	51.9	56.4	60.4	45.1	35.9	40.1	62.8	60.4	62.0
	n	6	6	6	6	6	6	6	6	6	6	6	6
	t_1	6	6	6	6	6	6	6	6	6	6	6	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	1	-1	-1	1	-1	-1	-1	1	1	1	1	-1
	c-a	-1	-1	-1	1	-1	-1	-1	1	1	1	1	-1
	d-a	1	-1	1	1	-1	1	-1	1	1	1	1	-1
	e-a	1	1	-1	1	1	-1	-1	-1	1	-1	1	1
	f-a	-1	-1	-1	1	1	1	-1	-1	1	1	1	1
	c-b	-1	-1	1	1	1	1	-1	1	-1	1	-1	1
	d-b	1	-1	1	1	1	1	1	1	-1	-1	-1	-1
	e-b	1	1	1	-1	1	-1	1	-1	-1	-1	1	1
	f-b	-1	-1	1	1	1	1	1	-1	-1	1	1	1
	d-c	1	-1	1	1	-1	1	1	-1	1	-1	-1	-1
	e-c	1	1	-1	-1	1	-1	1	-1	1	-1	1	1
	f-c	1	-1	-1	1	1	1	1	-1	1	1	1	1
	e-d	-1	1	-1	-1	1	-1	-1	-1	-1	-1	1	1
	f-d	-1	1	-1	-1	1	1	1	-1	-1	1	1	1
	f-e	-1	-1	-1	1	1	1	1	1	1	1	1	1
	S_k	1	-5	-3	7	7	3	1	-3	3	3	9	5
	σ^2_S=	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33
	$Z_k = S_k/\sigma_S$	0.19	-0.94	-0.56	1.32	1.32	0.56	0.19	-0.56	0.56	0.56	1.69	0.94
	Z^2_k	0.04	0.88	0.32	1.73	1.73	0.32	0.04	0.32	0.32	0.32	2.86	0.88

ΣZ_k= 5.26
ΣZ^2_k= 9.74
Z-bar=$\Sigma Z_k/K$= 0.44

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	72	0	0	0	0

Σn 72
ΣS_k 28

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	7.44		@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
p	**0.763**				$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
$\Sigma VAR(S_k)$	Z_{calc} 1.46		@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
340.00	**p**	**0.928**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.40		2.15
0.050	-0.13	**0.80**	1.74
0.100	0.26		1.48
0.200	0.36		1.26

Site #54 Seasonal Kendall analysis for Sulfate, Total (mg/l)

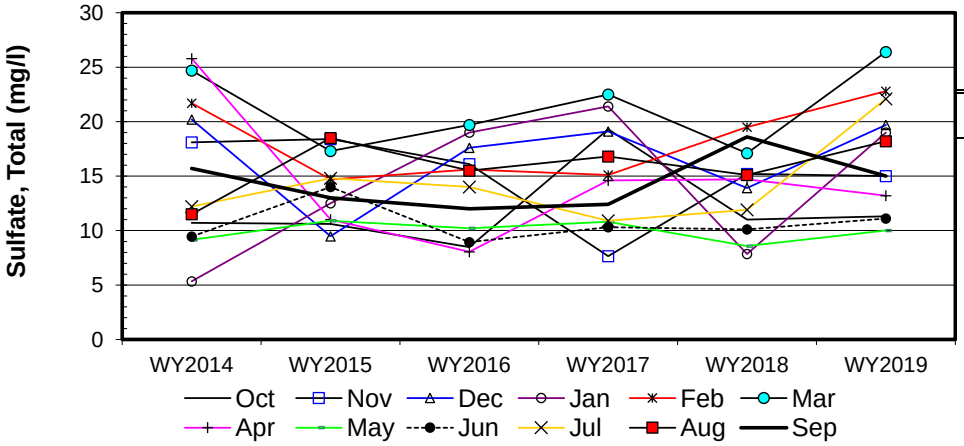
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	10.7	18.1	20.2	5.3	21.7	24.7	25.8	9.2	9.5	12.2	11.5	15.7
b	**WY2015**	10.6	18.4	9.5	12.5	14.7	17.3	11.0	10.9	14.0	14.8	18.5	13.0
c	**WY2016**	8.5	16.1	17.6	19.0	15.6	19.7	8.1	10.2	8.9	14.0	15.5	12.0
d	**WY2017**	19.3	7.7	19.1	21.4	15.1	22.5	14.6	10.8	10.3	10.9	16.8	12.4
e	**WY2018**	11.0	15.2	13.9	7.9	19.5	17.1	14.7	8.6	10.1	11.9	15.1	18.6
f	**WY2019**	11.3	15.0	19.7	19.0	22.8	26.4	13.2	10.0	11.1	22.1	18.2	15.0
	n	6	6	6	6	6	6	6	6	6	6	6	6
	t_1	6	6	6	4	6	6	6	6	6	6	6	6
	t_2	0	0	0	1	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	-1	1	-1	1	-1	-1	-1	1	1	1	1	-1
	c-a	-1	-1	-1	1	-1	-1	-1	1	-1	1	1	-1
	d-a	1	-1	-1	1	-1	-1	-1	1	1	-1	1	-1
	e-a	1	-1	-1	1	-1	-1	-1	-1	1	-1	1	1
	f-a	1	-1	-1	1	1	1	-1	1	1	1	1	-1
	c-b	-1	-1	1	1	1	1	-1	-1	-1	-1	-1	-1
	d-b	1	-1	1	1	1	1	1	-1	-1	-1	-1	-1
	e-b	1	-1	1	-1	1	-1	1	-1	-1	-1	-1	1
	f-b	1	-1	1	1	1	1	1	-1	-1	1	-1	1
	d-c	1	-1	1	1	-1	1	1	1	1	-1	1	1
	e-c	1	-1	-1	-1	1	-1	1	-1	1	-1	-1	1
	f-c	1	-1	1	0	1	1	1	-1	1	1	1	1
	e-d	-1	1	-1	-1	1	-1	1	-1	-1	1	-1	1
	f-d	-1	1	1	-1	1	1	-1	-1	1	1	1	1
	f-e	1	-1	1	1	1	1	-1	1	1	1	1	-1
	S_k	5	-9	1	6	5	1	-1	-3	3	1	3	1
	σ^2_S=	28.33	28.33	28.33	27.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33
	$Z_k = S_k/\sigma_S$	0.94	-1.69	0.19	1.15	0.94	0.19	-0.19	-0.56	0.56	0.19	0.56	0.19
	Z^2_k	0.88	2.86	0.04	1.32	0.88	0.04	0.04	0.32	0.32	0.04	0.32	0.04

ΣZ_k= 2.46
ΣZ^2_k= 7.07
Z-bar=$\Sigma Z_k/K$= 0.21

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	70	1	0	0	0

Σn 72
ΣS_k 13

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	6.56	@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
	p **0.833**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc} 0.65	@α=2.5% **Z**=	1.96	**H_0** (No trend) ACCEPT
339.00	**p** **0.743**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.33	**0.17**	0.72
0.050	-0.15		0.55
0.100	-0.09		0.48
0.200	-0.06		0.32

Site #54 Seasonal Kendall analysis for Zinc, Dissolved (ug/l)

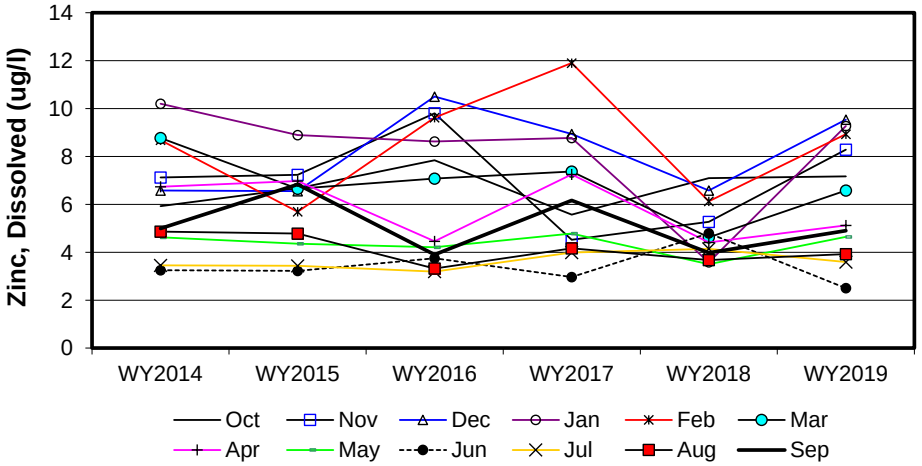
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	5.9	7.1	6.6	10.2	8.7	8.8	6.7	4.6	3.3	3.5	4.9	5.0
b	**WY2015**	6.7	7.2	6.6	8.9	5.7	6.7	7.0	4.4	3.2	3.4	4.8	6.8
c	**WY2016**	7.8	9.8	10.5	8.6	9.6	7.1	4.5	4.2	3.8	3.2	3.3	3.9
d	**WY2017**	5.6	4.5	8.9	8.8	11.9	7.4	7.3	4.8	3.0	4.0	4.2	6.2
e	**WY2018**	7.1	5.3	6.6	3.6	6.1	4.6	4.4	3.5	4.8	4.1	3.7	4.0
f	**WY2019**	7.2	8.3	9.5	9.3	8.9	6.6	5.1	4.6	2.5	3.6	3.9	4.9
	n	6	6	6	6	6	6	6	6	6	6	6	6
	t_1	6	6	4	6	6	6	6	6	6	6	6	6
	t_2	0	0	1	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	1	1	-1	-1	-1	-1	1	-1	-1	-1	-1	1
	c-a	1	1	1	-1	1	-1	-1	-1	1	-1	-1	-1
	d-a	-1	-1	1	-1	1	-1	1	1	-1	1	-1	1
	e-a	1	-1	0	-1	-1	-1	-1	-1	1	1	-1	-1
	f-a	1	1	1	-1	1	-1	-1	1	-1	1	-1	-1
	c-b	1	1	1	-1	1	1	-1	-1	1	-1	-1	-1
	d-b	-1	-1	1	-1	1	1	1	1	-1	1	-1	-1
	e-b	1	-1	1	-1	1	-1	-1	-1	1	1	-1	-1
	f-b	1	1	1	1	1	-1	-1	1	-1	1	-1	-1
	d-c	-1	-1	-1	1	1	1	1	1	-1	1	1	1
	e-c	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1
	f-c	-1	-1	-1	1	-1	-1	1	1	-1	1	1	1
	e-d	1	1	-1	-1	-1	-1	-1	-1	1	1	-1	-1
	f-d	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1
	f-e	1	1	1	1	1	1	1	1	-1	-1	1	1
	S_k	5	1	4	-5	3	-7	-3	-1	-3	5	-7	-3
	σ^2_S=	28.33	28.33	27.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33
	$Z_k = S_k/\sigma_S$	0.94	0.19	0.77	-0.94	0.56	-1.32	-0.56	-0.19	-0.56	0.94	-1.32	-0.56
	Z^2_k	0.88	0.04	0.59	0.88	0.32	1.73	0.32	0.04	0.32	0.88	1.73	0.32

ΣZ_k= -2.05
ΣZ^2_k= 8.03
Z-bar=$\Sigma Z_k/K$= -0.17

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	70	1	0	0	0

Σn 72
ΣS_k -11

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	7.68	@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
p	**0.742**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc} -0.54	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
339.00	**p** **0.294**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.24		0.14
0.050	-0.20	**-0.03**	0.08
0.100	-0.18		0.05
0.200	-0.13		0.01

Wilcoxon-signed-ranks test

Exact Form

Variable: **Specific Conductance, Field (µS/cm)**

	X	**Y**			
Site	#6	#54	Differences		
Year	WY2019	WY2019	**D**	**|D|**	**Rank**
Oct	110.60	111.00	-0.40	0.40	-3
Nov	120.30	123.10	-2.80	2.80	-11
Dec	113.40	114.80	-1.40	1.40	-6
Jan	103.20	124.20	-21.00	21.00	-12
Feb	144.10	144.60	-0.50	0.50	-4
Mar	168.80	169.70	-0.90	0.90	-5
Apr	115.20	115.30	-0.10	0.10	-2
May	93.53	93.51	0.02	0.02	1
Jun	99.28	101.60	-2.32	2.32	-10
Jul	155.60	157.00	-1.40	1.40	-7
Aug	153.70	155.40	-1.70	1.70	-8
Sep	130.70	132.90	-2.20	2.20	-9
Median	117.75	123.65	-1.40	1.40	

n	**m**
12	12

N= 12

ΣR= -76

α
0.05
W'α,n
17

W^+=
1
p-test
0.000

H_0	median [D]=0	**REJECT**
H_1	median [D]<0	**ACCEPT**

Wilcoxon-signed-ranks test

Exact Form

Variable: **pH, Field, Standard Units**

	X	**Y**			
Site	#6	#54	Differences		
Year	WY2019	WY2019	**D**	**|D|**	**Rank**
Oct	7.41	7.21	0.20	0.20	12
Nov	7.60	7.74	-0.14	0.14	-11
Dec	7.93	7.94	-0.01	0.01	-1
Jan	7.90	7.88	0.02	0.02	2
Feb	7.94	7.91	0.03	0.03	4
Mar	7.90	7.94	-0.04	0.04	-7
Apr	7.84	7.80	0.04	0.04	7
May	7.74	7.77	-0.03	0.03	-4
Jun	7.91	7.82	0.09	0.09	10
Jul	7.92	7.88	0.04	0.04	7
Aug	7.84	7.78	0.06	0.06	9
Sep	7.87	7.84	0.03	0.03	4
Median	7.89	7.83	0.03	0.04	

n	**m**
12	12

N= 12

ΣR= 32

α
0.05
W'α,n
17

W^+=
23
p-test
0.117

H_0	median [D]=0	ACCEPT
H_1	median [D]<0	

Wilcoxon-signed-ranks test

Exact Form

Variable: **Total Alk, (mg/l)**

	X	**Y**			
Site	#6	#54	Differences		
Year	WY2019	WY2019	**D**	**|D|**	**Rank**
Oct	39.50	39.90	-0.40	0.40	-3
Nov	43.60	44.60	-1.00	1.00	-7
Dec	41.40	42.40	-1.00	1.00	-7
Jan	50.90	51.90	-1.00	1.00	-7
Feb	55.70	56.40	-0.70	0.70	-5
Mar	59.30	60.40	-1.10	1.10	-9
Apr	44.90	45.10	-0.20	0.20	-1
May	35.60	35.90	-0.30	0.30	-2
Jun	38.10	40.10	-2.00	2.00	-11.5
Jul	60.80	62.80	-2.00	2.00	-11.5
Aug	59.90	60.40	-0.50	0.50	-4
Sep	60.20	62.00	-1.80	1.80	-10
Median	47.90	48.50	-1.00	1.00	

n	**m**
12	12

N= 12

ΣR= -78

α
0.05
W'α,n
17

W^+=
0
p-test
0.000

H_0	median [D]=0	**REJECT**
H_1	median [D]<0	**ACCEPT**

Wilcoxon-signed-ranks test

Exact Form

Variable: **Sulfate, Total (mg/l)**

	X	**Y**			
Site	#6	#54	Differences		
Year	WY2019	WY2019	**D**	**|D|**	**Rank**
Oct	11.1	11.3	-0.2	0.2	-7
Nov	15.1	15.0	0.1	0.1	1
Dec	15.0	19.7	-4.7	4.7	-10
Jan	19.8	19.0	0.8	0.8	9
Feb	22.7	22.8	-0.1	0.1	-4
Mar	26.6	26.4	0.2	0.2	5.5
Apr	13.4	13.2	0.2	0.2	5.5
May	10.0	10.0	0.0		
Jun	11.1	11.1	0.0		
Jul	21.7	22.1	-0.4	0.4	-8
Aug	18.1	18.2	-0.1	0.1	-2.5
Sep	14.9	15.0	-0.1	0.1	-2.5
Median	15.1	16.6	-0.1	0.2	

n	**m**
12	10

N= 10

ΣR= -13

α
0.05
W'α,n
10

W^+=
21
p-test
0.278

H_0	median [D]=0	ACCEPT
H_1	median [D]<0	

Wilcoxon-signed-ranks test
Exact Form

Variable: **Zinc, Dissolved (ug/l)**

	X	**Y**			
Site	#6	#54	Differences		
Year	WY2019	WY2019	**D**	**|D|**	**Rank**
Oct	7.57	7.17	0.40	0.40	6.5
Nov	8.98	8.28	0.70	0.70	8
Dec	9.94	9.54	0.40	0.40	6.5
Jan	10.70	9.27	1.43	1.43	11
Feb	9.93	8.93	1.00	1.00	10
Mar	8.05	6.58	1.47	1.47	12
Apr	5.43	5.12	0.31	0.31	4
May	4.69	4.64	0.05	0.05	1
Jun	1.64	2.50	-0.86	0.86	-9
Jul	3.81	3.59	0.22	0.22	3
Aug	4.24	3.92	0.32	0.32	5
Sep	4.74	4.90	-0.16	0.16	-2
Median	6.50	5.85	0.36	0.40	

n	**m**
12	12

N= 12
ΣR= 56

α
0.05
W'α,n
17

W^+=
11
p-test
0.013

H_0	median [D]=0	**REJECT**
H_1	median [D]<0	**ACCEPT**

INTERPRETIVE REPORT
SITE 62

Sampling at this site was initiated during the spring of the Water Year 2013. Site 62 is located approximately 1,000 feet downstream from Site 54, and therefore is downstream of Site 23 and Inactive Site D. Sampling is on a monthly basis in conjunction with the other routine monthly sampling along Greens Creek.

The data collected during the current water year are listed in the following "Table of Results for Water Year 2019" report. The table includes all the required FWMP analyte data (field and laboratory) collected for the current water year and a series of flags keyed to the summary report "Qualified Data by QA Reviewer." The QA report lists any associated data limitations found during the monthly QA reviews of laboratory data for this site. Median values for all analytes have been calculated and are shown in the right-most column of the table of results. Any value reported as less than MDL has been replaced with a value of one-half of the MDL for the purpose of median calculation.

All data collected at this site for the past year is included in the report. As shown in the table below, there were no data outliers.

Sample Date	Parameter	Value	Qualifier	Notes
No outliers, in the past six years, have been identified by HGCMC.				

The data have been compared to the strictest freshwater quality criterion for each applicable analyte. No results exceeded these criteria.

Table of Exceedance for Water Year 2019

			Limits		
Sample Date	Parameter	Value	Lower	Upper	Hardness
No exceedances have been identified by HGCMC for the period of October 2018 through September 2019.					

X-Y plots have been generated to graphically present the data for each of the analytes requested in the Statistical Information Goals for this site. These plots have been visually analyzed for the appearance of any trend in concentration. There were no visually obvious trends.

A non-parametric statistical analysis for trend was performed for specific conductivity, field pH, total alkalinity, total sulfate, and dissolved zinc. Calculation details of the Seasonal Kendall analyses are presented in detail on the pages following this interpretive section. The following table summarizes the results of the data collected between Oct-13 and Sep-19 (WY2014-WY2019).

Site 62 - Table of Summary Statistics for Trend Analysis

	Mann-Kendall test statistics			Sen's slope estimate	
Parameter	**n***	**p****	**Trend**	**Q**	**Q(%)**
Conductivity Field	6	0.59			
pH Field	6	0.37			
Alkalinity, Total	6	0.93			
Sulfate, Total	6	0.93			
Zinc, Dissolved	6	0.39			

* Number of Years ** Significance level

For datasets with a statistically significant trend ($\alpha/2$=2.5%), a Seasonal-Sen's Slope estimate statistic has also been calculated. There were no statistically significant trends identified.

A comparison of median values for total alkalinity, field pH, field conductivity, total sulfate, and dissolved zinc between Site 62 and Site 54 has been conducted. Additionally, X-Y plots have been generated for total alkalinity, field pH, specific conductance, total sulfate, and dissolved zinc that coplot data from Site 62 and Site 54, the upstream control site, to aid in the comparison between those sites. Calculation details of the non-parametric signed-rank tests are presented in detail on the pages following this interpretive section. The table below summarizes the results of the signed-rank test as performed on the Water Year 2019 dataset.

Table of Summary Statistics for Median Analysis

Site 62 vs Site 54

Parameter	**Signed Ranks p-value**	**Site 54 median**	**Site 62 median**	**Median Differences**
Conductivity Field	0.01	123.70	135.70	-7.25
pH Field	<0.01	7.83	7.53	0.28
Alkalinity, Total	<0.01	54.20	58.40	-3.85
Sulfate, Total	<0.01	16.60	17.70	-1.10
Zinc, Dissolved	0.170	5.85	5.70	0.14

A number of the five parameters compared between Site 54 and Site 62, had statistically significant median differences. Similar results (concentration and magnitude) to these have been obtained in previous years and are similar to the other paired (48-6 and 6-54) sites along Greens Creek. HGCMC feels the current FWMP program is adequate to measure and quantify potential changes between Site 54 and Site 62.

Table of Results for Water Year 2019

Site 062FMS - 'Greens Creek Below Site 54'

Sample Date/Parameter	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019	**Median**
Water Temp (°C)	5.6	3.2	1.5	0.1	0.1	1	1.8	3.1	7.6	10.7	10.8	9.9	3.2
Conductivity-Field(μmho)	115.6	132.7	124	146.5	168.3	160.3	121.5	101.6	101.5	163.4	164.1	138.7	135.7
Conductivity-Lab (μmho)	119	133	128	159	171	185	124	103	103	154	153	134	134
pH Lab (standard units)	6.43	6.96	7.1	6.45	6.71	7.03	6.51	7.57	6.75	7.91	6.59	7.36	6.86
pH Field (standard units)	7.14	7.41	7.34	7.51	7.56	7.52	7.4	7.53	7.91	7.73	7.71	7.93	7.53
Total Alkalinity (mg/L)	41.2	48.3	46.1	56.3	60.4	64.6	47.1	41.7	41.2	66.5	61.9	71.8	52.3
Total Sulfate (mg/L)	12.3	16.2	19.3	22.9	23.9	28.2	14.3	11.4	11.5	22.8	19.1	16	17.7
Hardness (mg/L)	56.8	65.6	64.1	75	80.4	88.7	60.4	49.2	50.4	81.4	77.6	71.1	68.4
Dissolved As (ug/L)	0.205	0.196	0.197	0.167	0.168	0.174	0.192	0.174	0.189	0.208	0.216	0.245	0.194
Dissolved Ba (ug/L)			25.8		30.5								28.2
Dissolved Cd (ug/L)	0.0495	0.0563	0.0553	0.058	0.0558	0.0501	0.0362	0.0356	0.0283	0.0456	0.0466	0.0309	0.0481
Dissolved Cr (ug/L)			0.109		0.101								0.105
Dissolved Cu (ug/L)	0.592	0.599	0.646	0.411	0.334	0.268	0.407	0.504	0.259	0.325	0.387	0.433	0.409
Dissolved Pb (ug/L)	0.0214	0.0141	0.0895	0.0083	0.006	0.0071	0.0054	0.0171	0.005	0.0108	0.0072	0.0072	0.0078
Dissolved Ni (ug/L)			0.374		0.355								0.365
Dissolved Ag (ug/L)			0.002		0.002								0.002
Dissolved Zn (ug/L)	6.48	8.26	8.66	9.3	8.71	6.42	4.98	4.49	2.97	3.88	4.32	3.36	5.70
Dissolved Se (ug/L)			0.831		1.25								1.041
Dissolved Hg (ug/L)	0.000974	0.00111	0.00163	0.000658	0.000544	0.000384	0.000647	0.00107	0.000443	0.000446	0.000527	0.00086	0.000653

For individual sample/analyte qualifier descriptions see "Qualified Data by QA Reviewer" table.

Values reported as less than MDL are replaced by 1/2 MDL for median calculation purposes.

Shaded data has been qualified as an outlier by HGCMC and removed from any further analysis and is not included into the calculation of the median

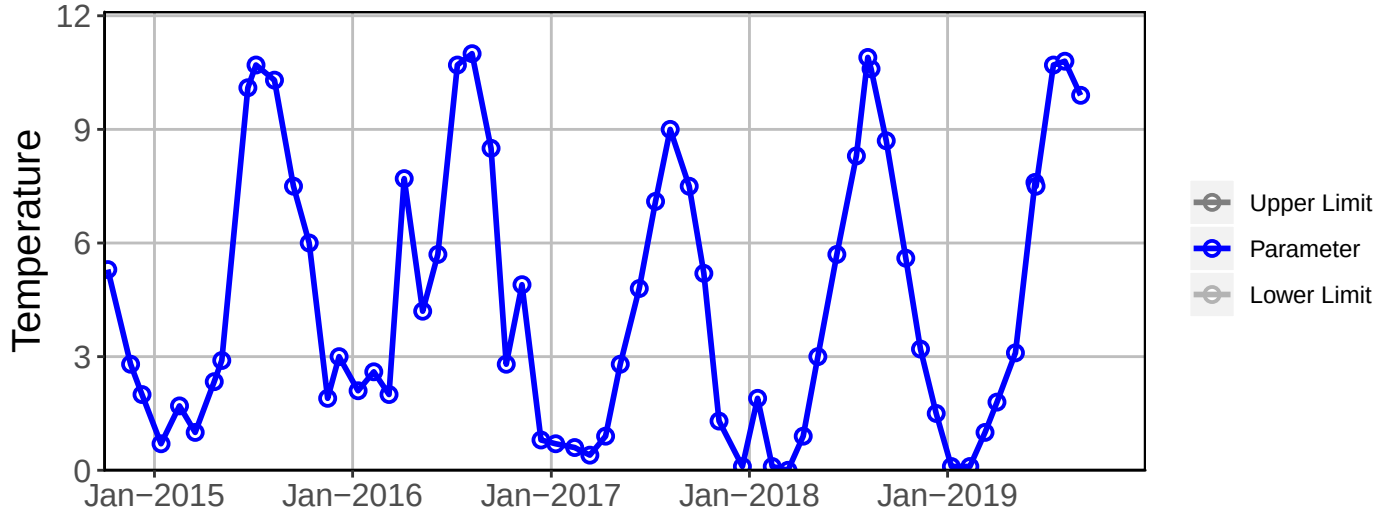
Qualified Data by QA Reviewer

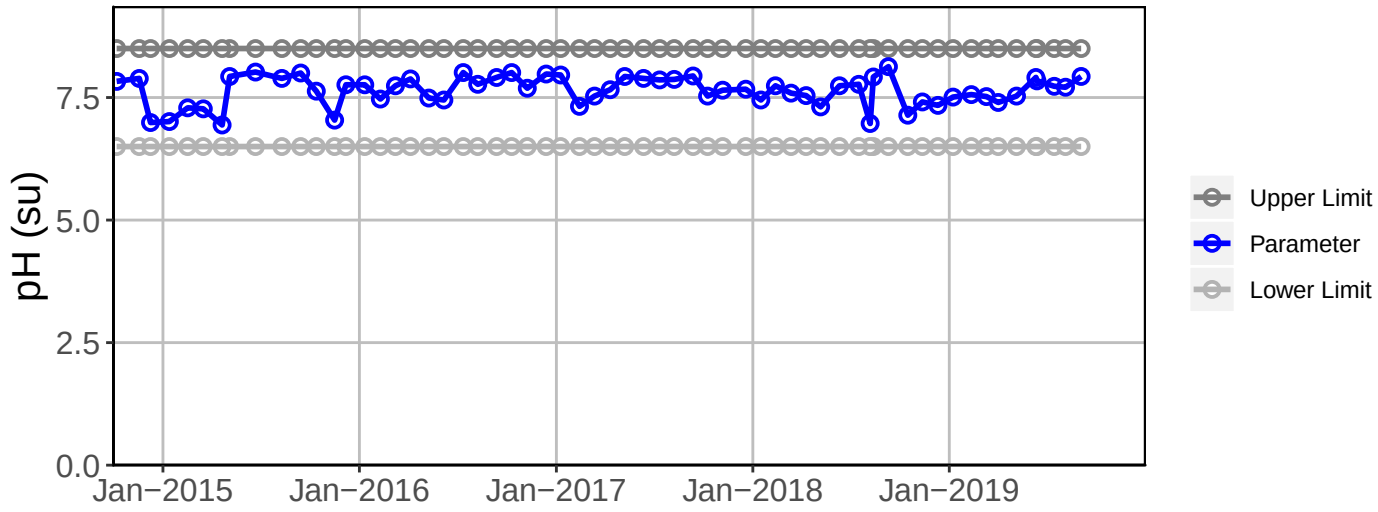
Date Range: 10/01/2018 to 09/30/2019

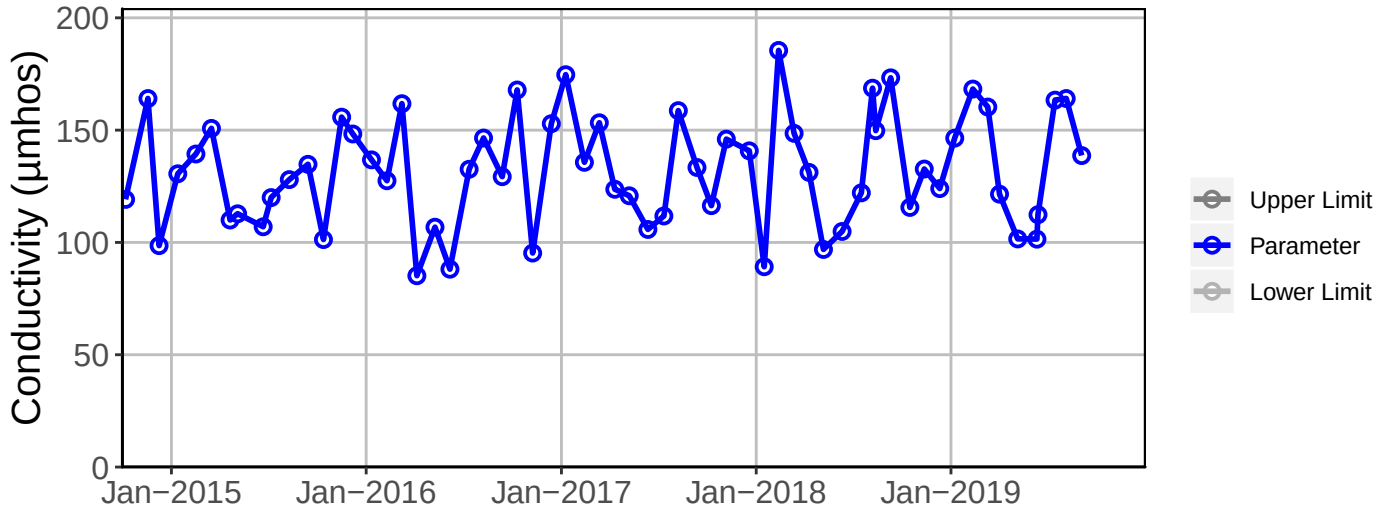
Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
062FMS	12-Nov-18	Diss. Pb-ICP/MS	0.01	µg/L	U	Field Blank Contamination
		Diss. Zn-ICP/MS	8.26	µg/L	U	Field Blank Contamination
	11-Dec-18	Diss. Cr-ICP/MS	0.1	µg/L	J	Below Quantitative Range
		Diss. Ni-ICP/MS	0.37	µg/L	U	Field Blank Contamination
		Diss. Zn-ICP/MS	8.66	µg/L	U	Field Blank Contamination
	8-Jan-19	Diss. Pb-ICP/MS	0.00833	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	9.3	µg/L	U	Field Blank Contamination
	11-Feb-19	Diss. Cr-ICP/MS	0.1	µg/L	J	Below Quantitative Range
		Diss. Pb-ICP/MS	0.00604	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	8.71	µg/L	U	Field Blank Contamination
	11-Mar-19	Diss. Pb-ICP/MS	0.00713	µg/L	J	Below Quantitative Range
	2-Apr-19	Diss. Pb-ICP/MS	0.00536	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	4.98	µg/L	U	Field Blank Contamination
	6-May-19	Diss. Zn-ICP/MS	4.49	µg/L	U	Field Blank Contamination
	11-Jun-19	Diss. Pb-ICP/MS	0.00499	µg/L	J	Below Quantitative Range
	15-Jul-19	Diss. Pb-ICP/MS	0.01	µg/L	U	Field Blank contamination
		Diss. Zn-ICP/MS	3.88	µg/L	U	Field Blank contamination
	5-Aug-19	Diss. Cu-ICP/MS	0.38	µg/L	U	Field Blank Contamination
		Diss. Pb-ICP/MS	0.00717	µg/L	U	Field Blank Contamination
		Diss. Zn-ICP/MS	4.32	µg/L	U	Field Blank Contamination
		Total Sulfate	19.10	µg/L	J	Sample Receipt Temperature
	3-Sep-19	Diss. Pb-ICP/MS	0.0072	µg/L	U	Field Blank Contamination
		Total Sulfate	16	µg/L	J	Sample Receipt Temperature

Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

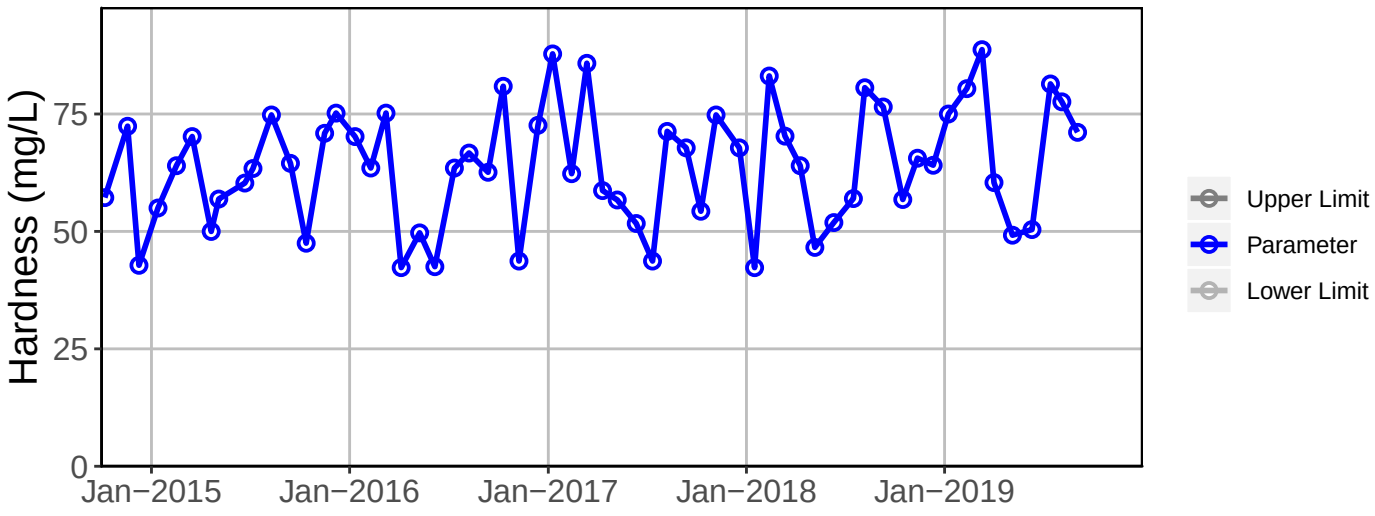
Site 62 Analyte Charts

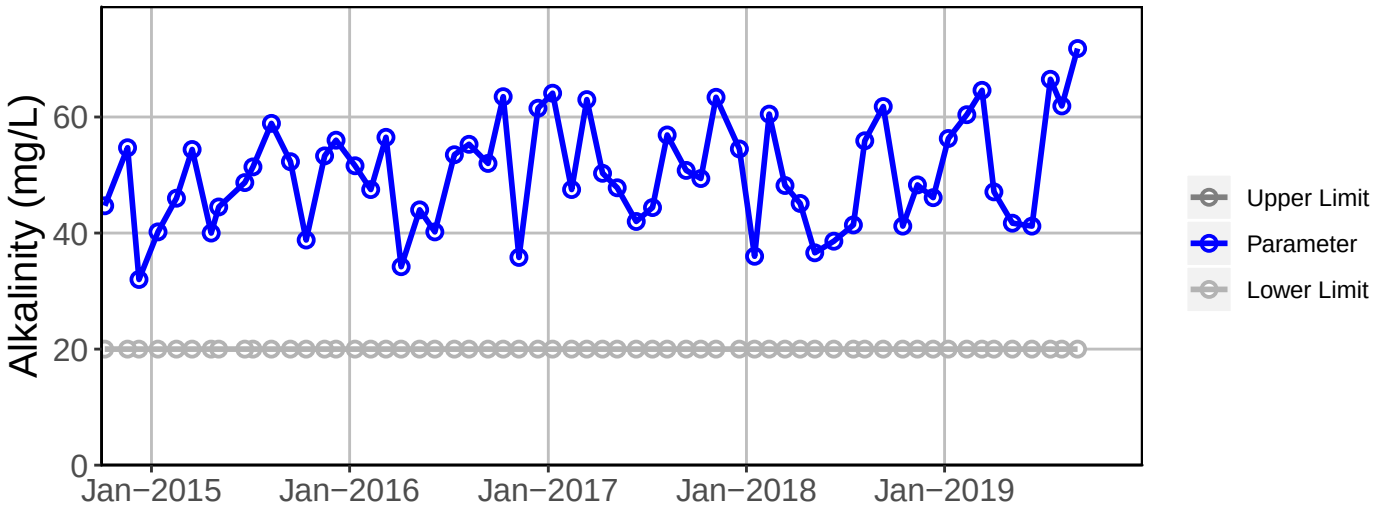


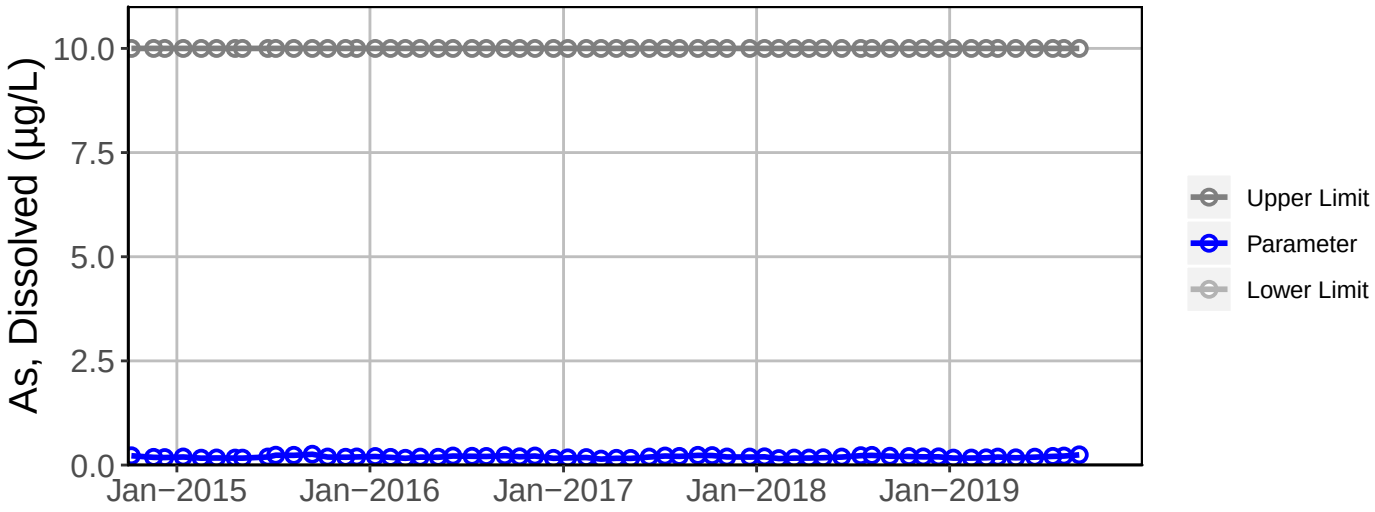




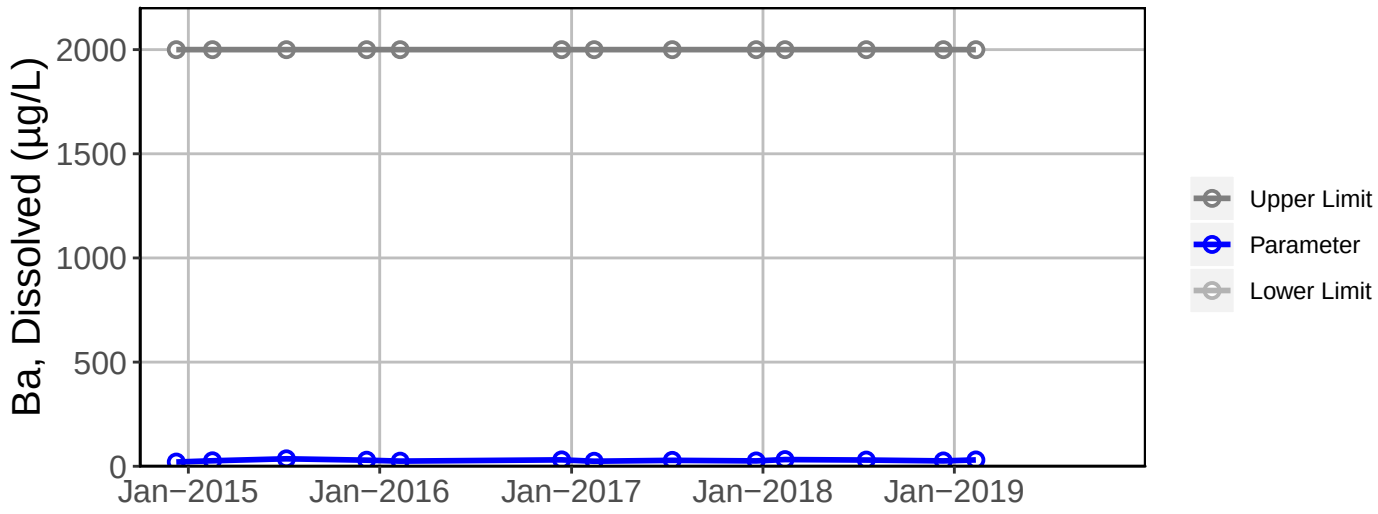
Site 62 Analyte Charts

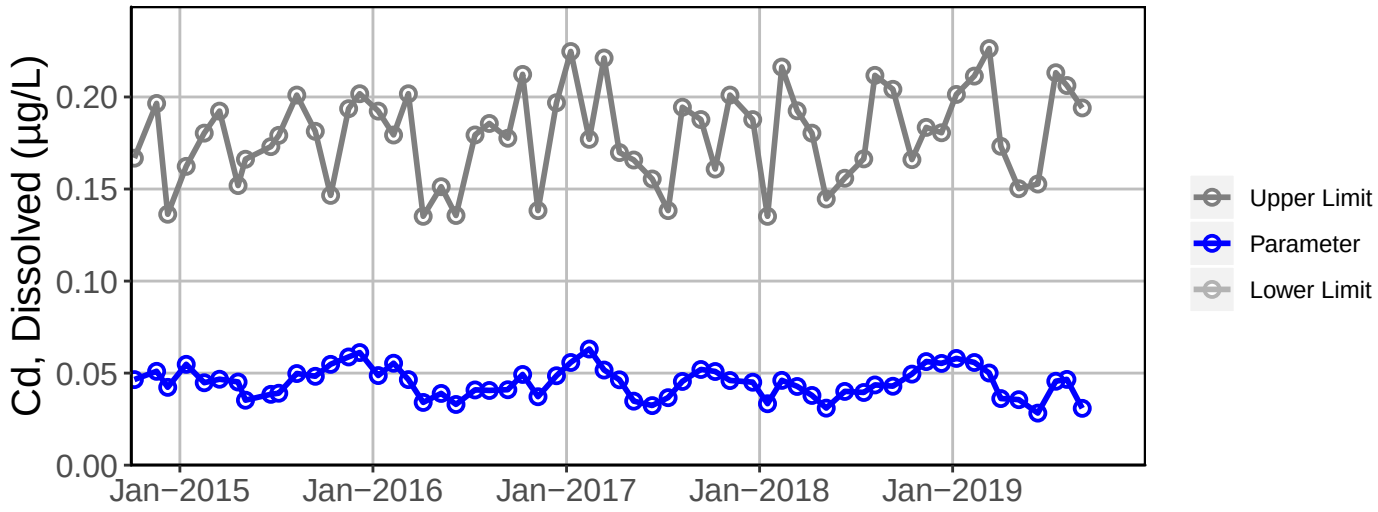


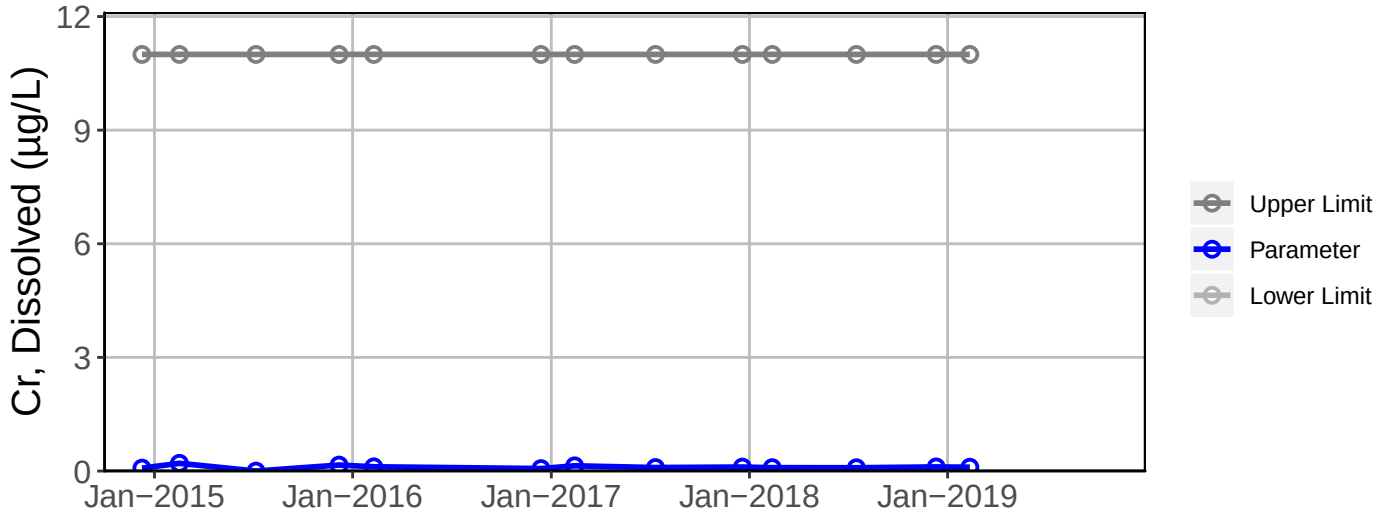




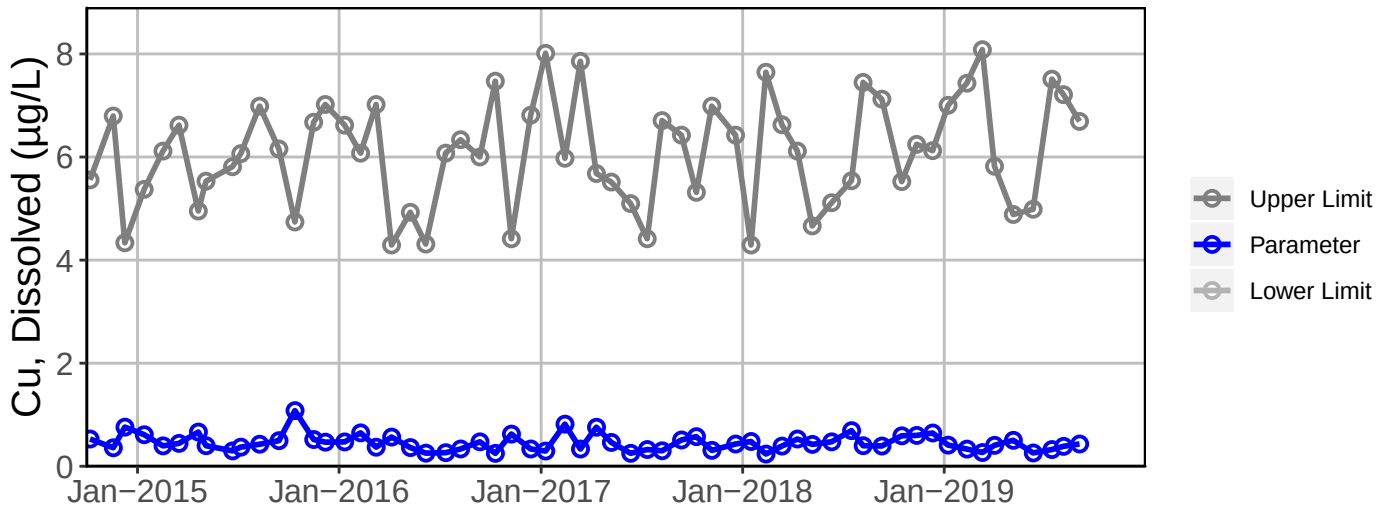
Site 62 Analyte Charts

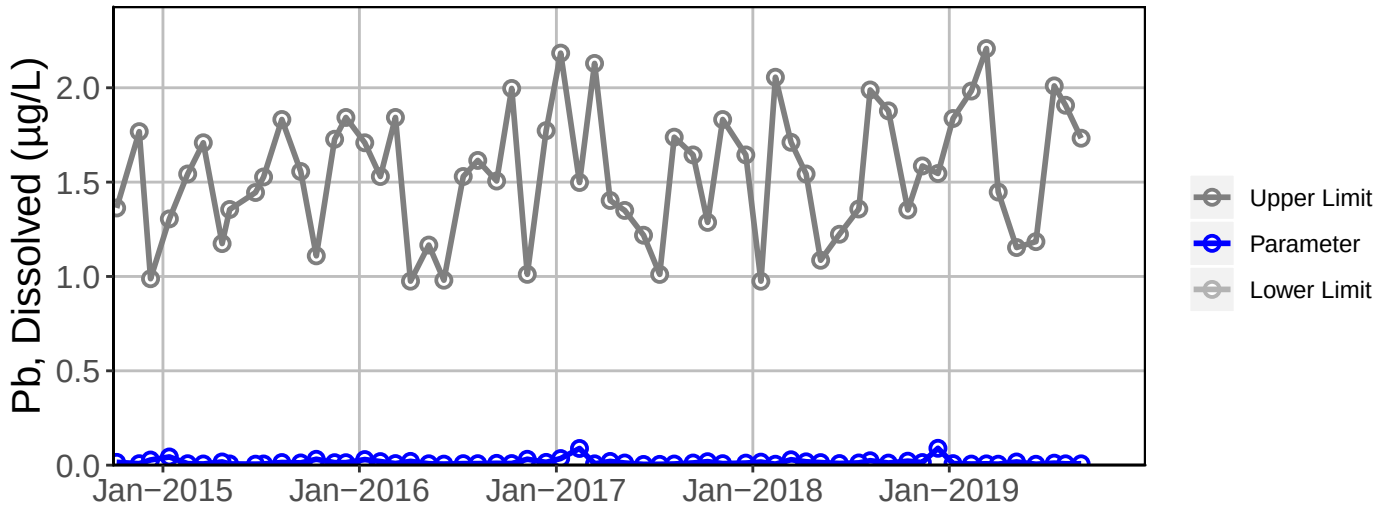


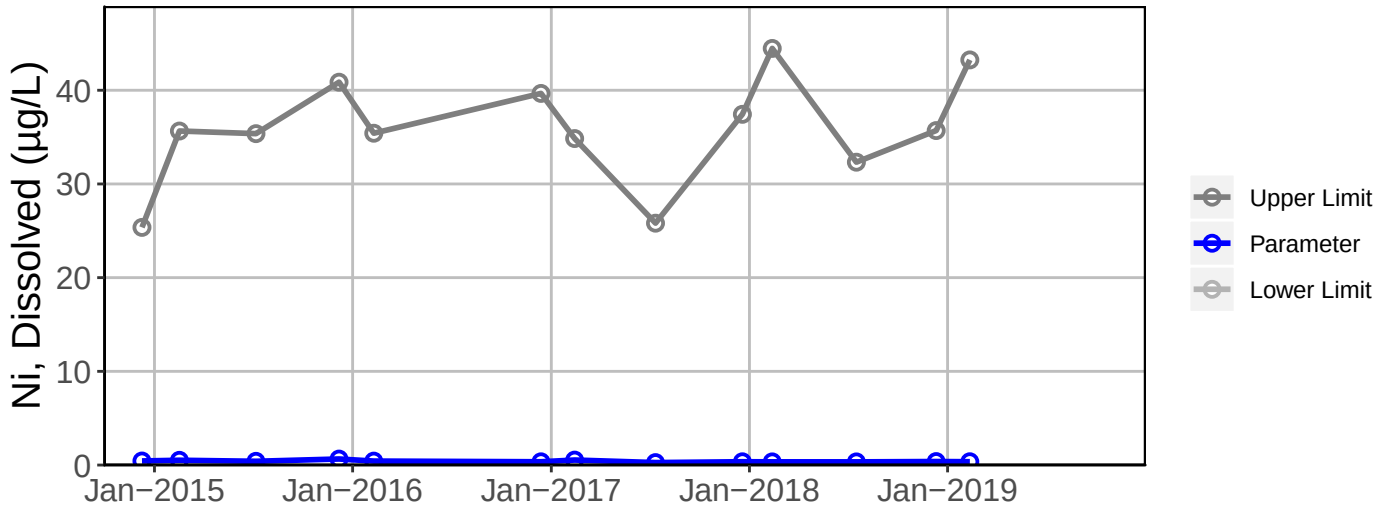




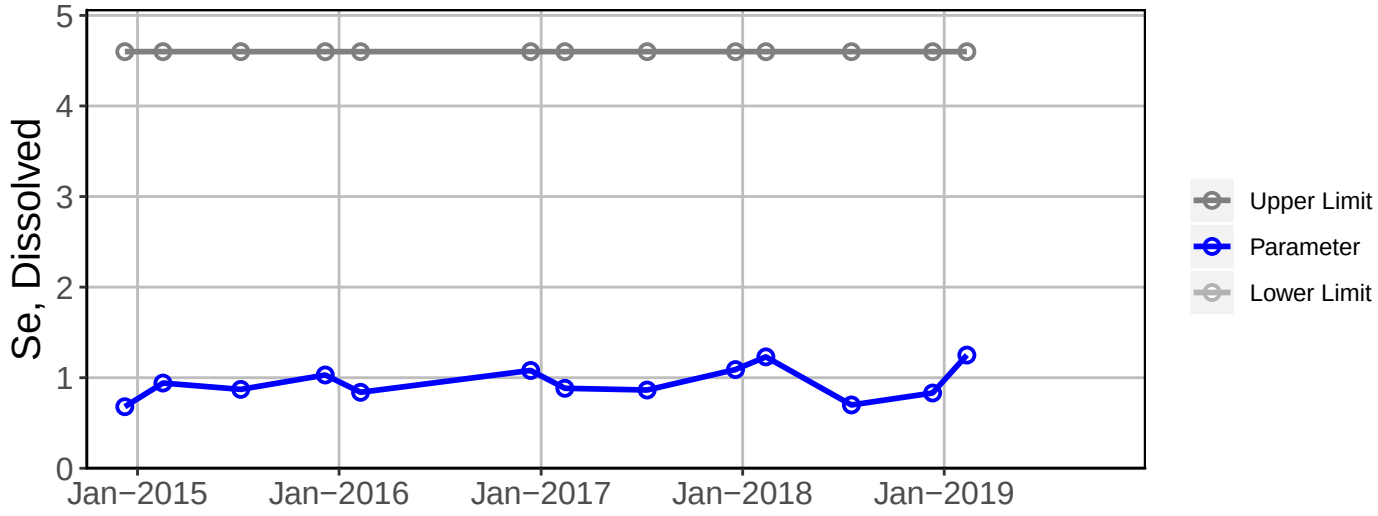
Site 62 Analyte Charts

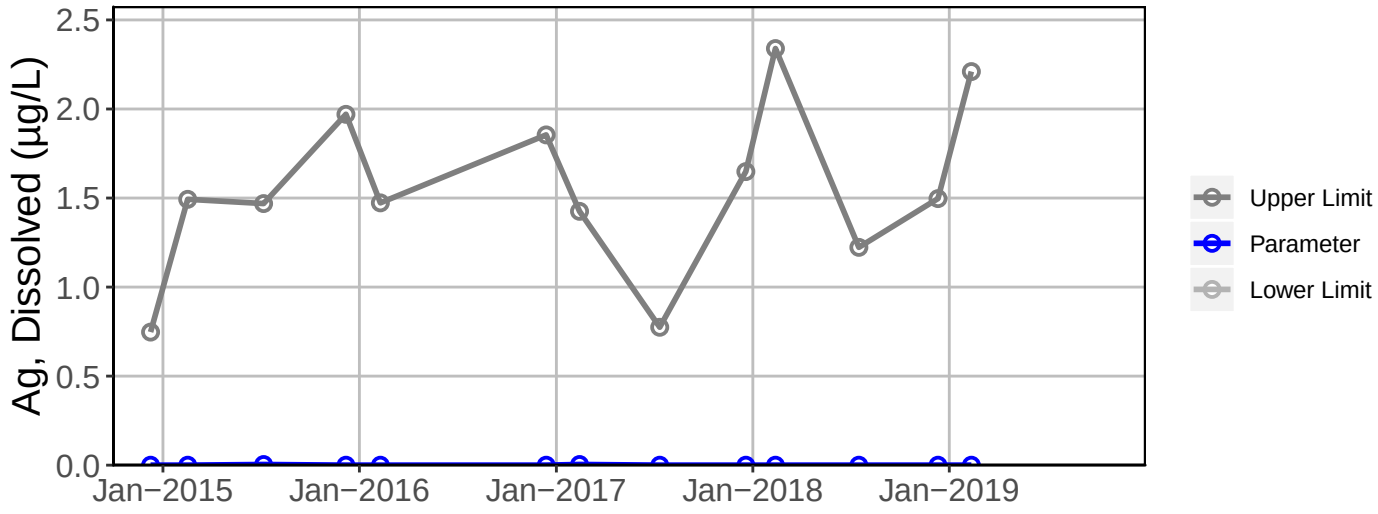


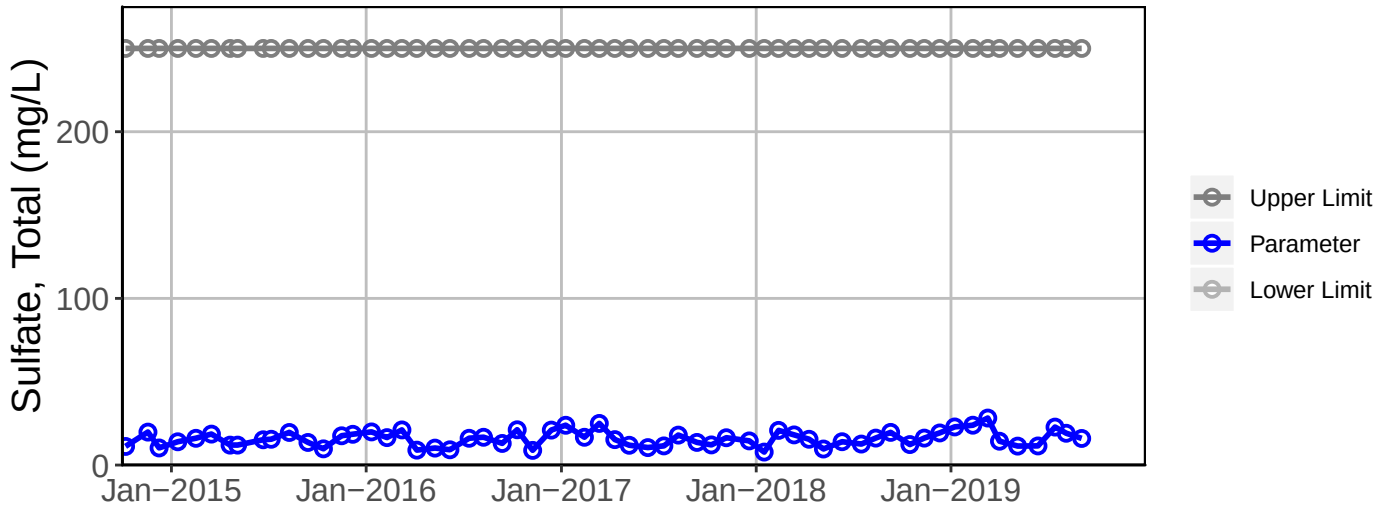




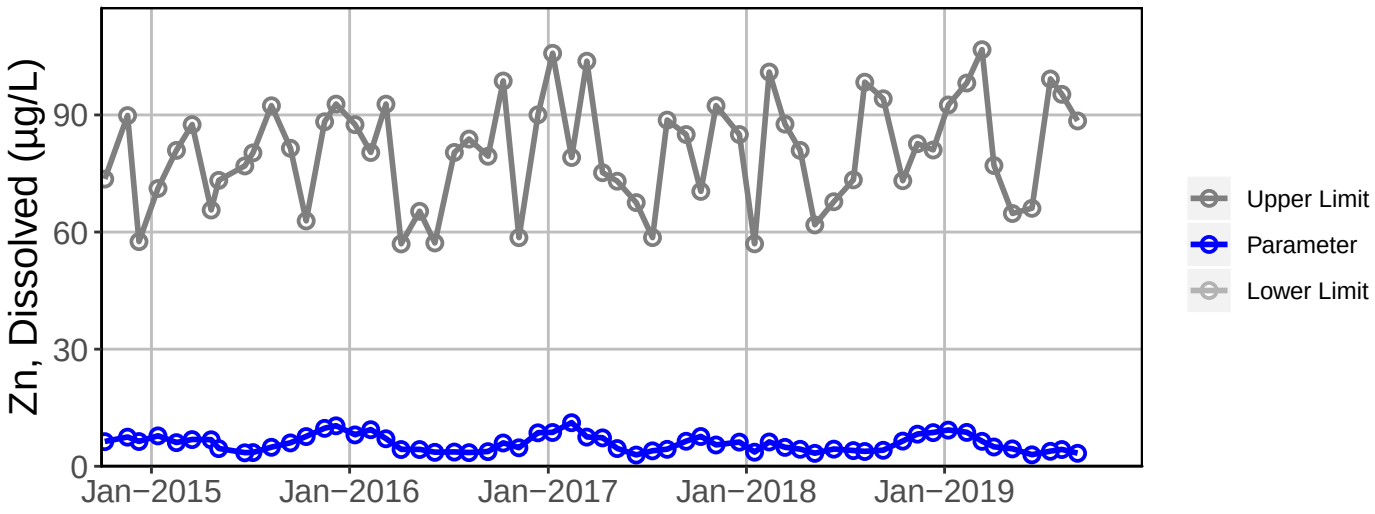
Site 62 Analyte Charts



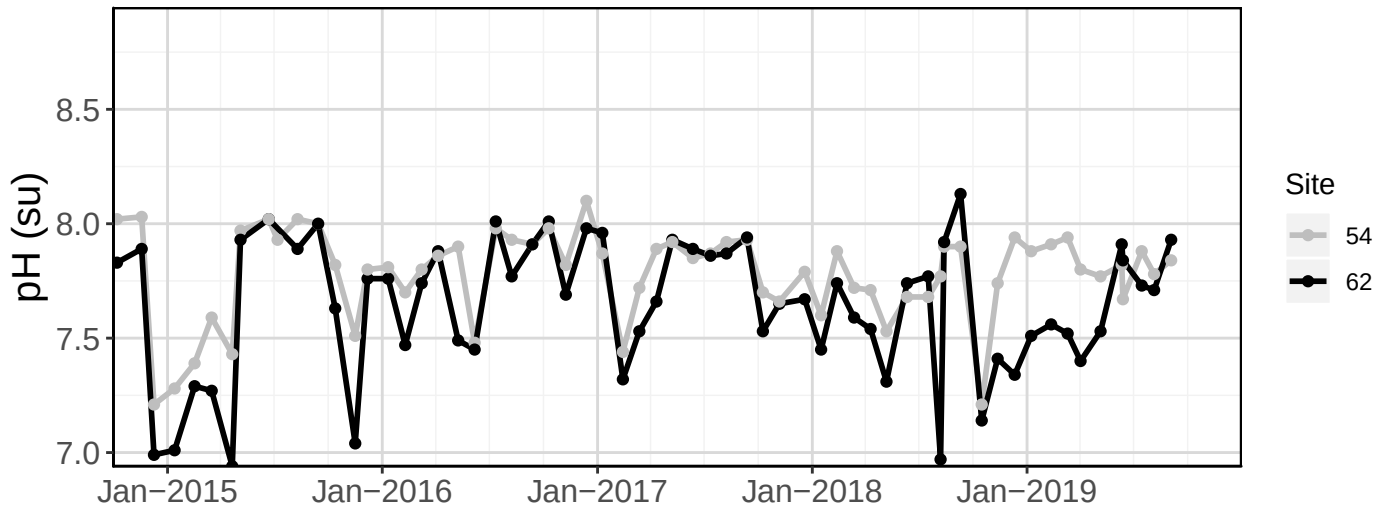


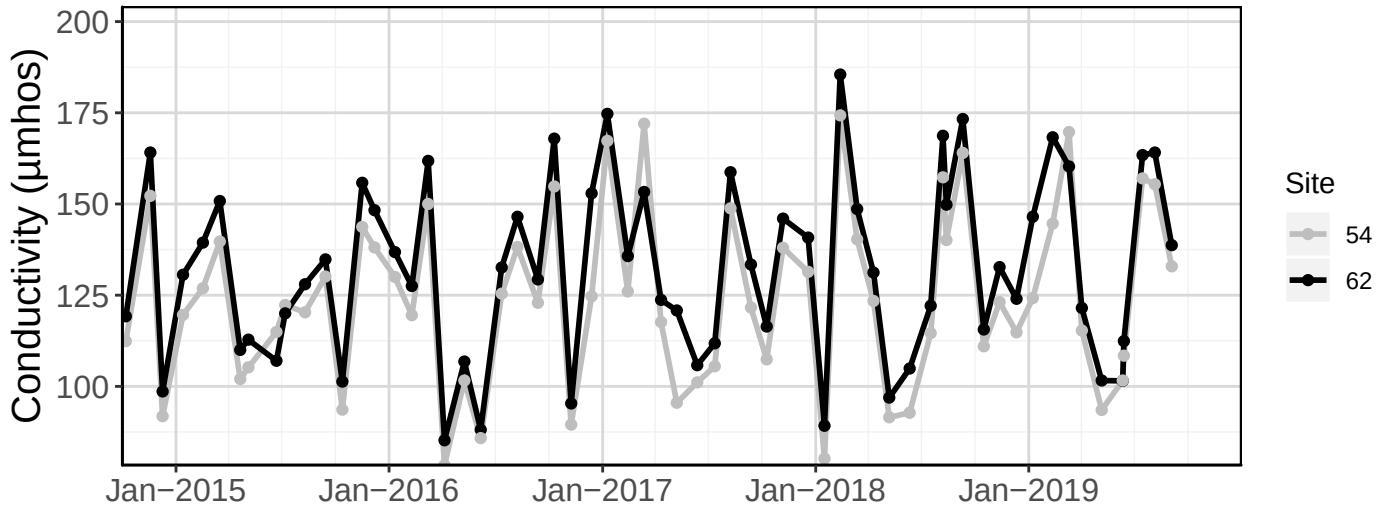


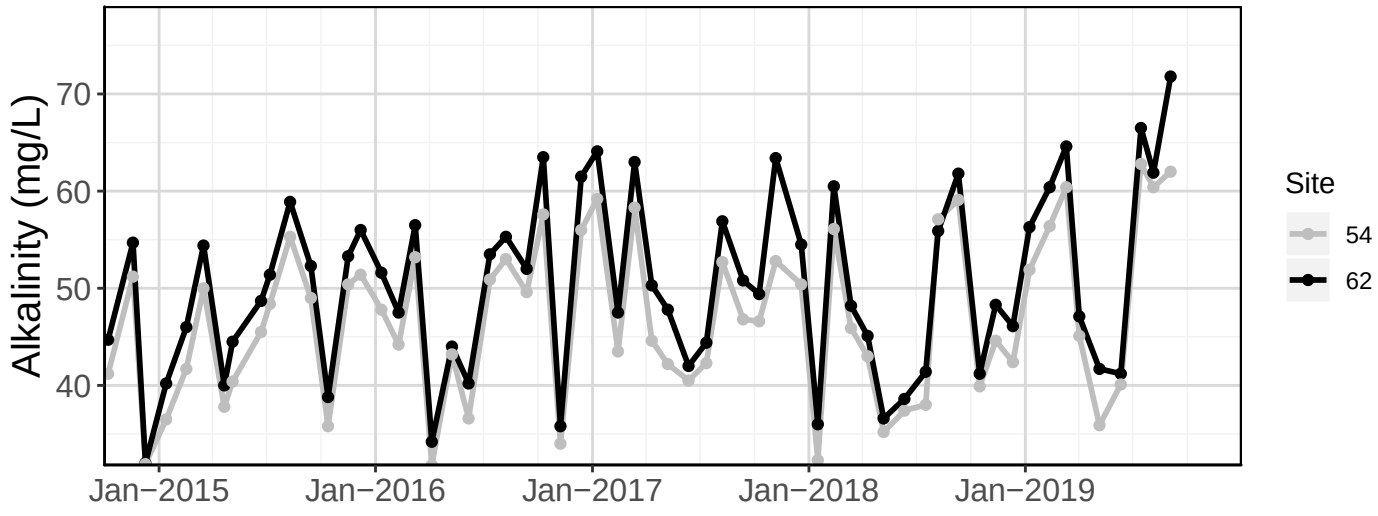
Site 62 Analyte Charts



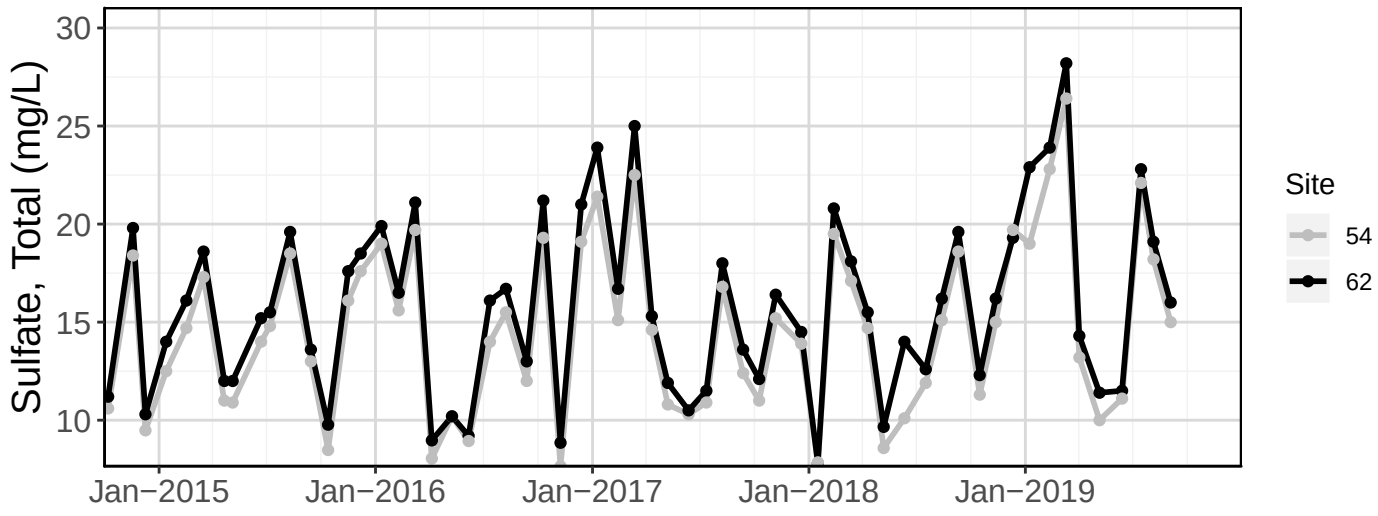
Comparison of Site 62 to Site 54

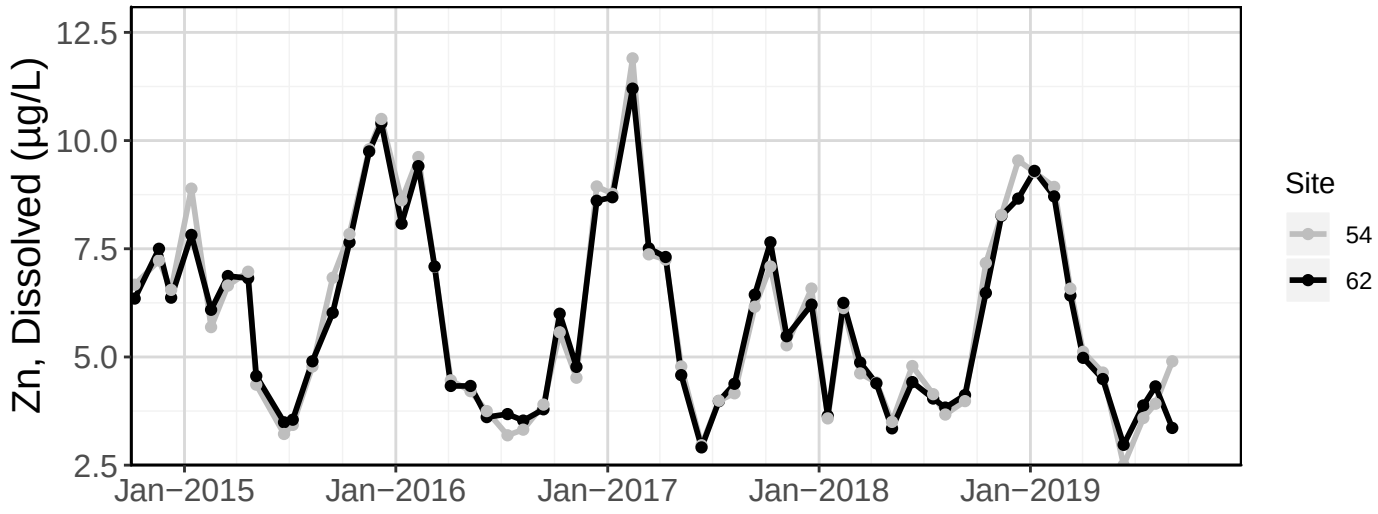






Comparison of Site 62 to Site 54





Site #62 Seasonal Kendall analysis for Total Alk, (mg/l)

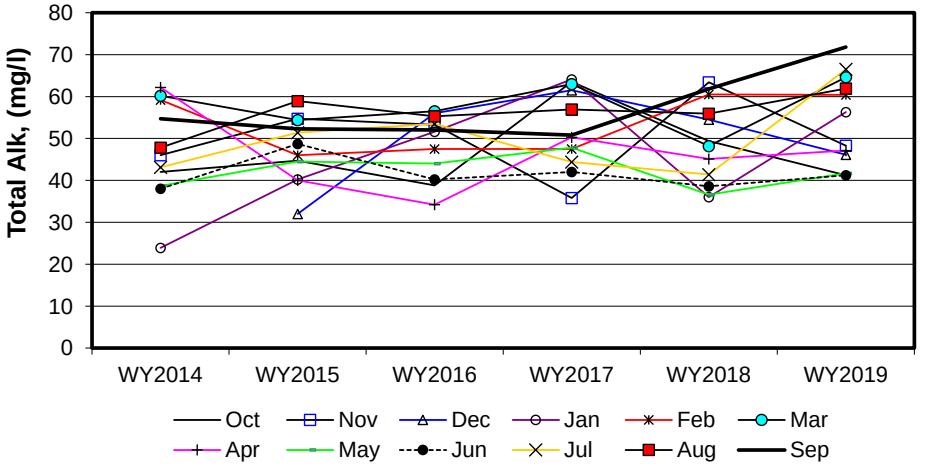
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	42.0	46.0		23.9	59.2	60.2	62.2	38.7	38.0	43.1	47.8	54.7
b	**WY2015**	44.7	54.7	32.0	40.2	46.0	54.4	40.0	44.5	48.7	51.4	58.9	52.3
c	**WY2016**	38.8	53.3	56.0	51.6	47.5	56.5	34.2	44.0	40.2	53.5	55.3	52.0
d	**WY2017**	63.5	35.8	61.5	64.1	47.5	63.0	50.3	47.8	42.0	44.4	56.9	50.8
e	**WY2018**	49.4	63.4	54.5	36.0	60.5	48.2	45.1	36.6	38.6	41.4	55.9	61.8
f	**WY2019**	41.2	48.3	46.1	56.3	60.4	64.6	47.1	41.7	41.2	66.5	61.9	71.8
	n	6	6	5	6	6	6	6	6	6	6	6	6
	t_1	6	6	5	6	4	6	6	6	6	6	6	6
	t_2	0	0	0	0	1	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	1	1		1	-1	-1	-1	1	1	1	1	-1
	c-a	-1	1		1	-1	-1	-1	1	1	1	1	-1
	d-a	1	-1		1	-1	1	-1	1	1	1	1	-1
	e-a	1	1		1	1	-1	-1	-1	1	-1	1	1
	f-a	-1	1		1	1	1	-1	1	1	1	1	1
	c-b	-1	-1	1	1	1	1	-1	-1	-1	1	-1	-1
	d-b	1	-1	1	1	1	1	1	1	-1	-1	-1	-1
	e-b	1	1	1	-1	1	-1	1	-1	-1	-1	-1	1
	f-b	-1	-1	1	1	1	1	1	-1	-1	1	1	1
	d-c	1	-1	1	1	0	1	1	1	1	-1	1	-1
	e-c	1	1	-1	-1	1	-1	1	-1	-1	-1	1	1
	f-c	1	-1	-1	1	1	1	1	-1	1	1	1	1
	e-d	-1	1	-1	-1	1	-1	-1	-1	-1	-1	-1	1
	f-d	-1	1	-1	-1	1	1	-1	-1	-1	1	1	1
	f-e	-1	-1	-1	1	-1	1	1	1	1	1	1	1
	S_k	1	1	0	7	6	3	-1	-1	1	3	7	3
	σ^2_S=	28.33	28.33	16.67	28.33	27.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33
	$Z_k = S_k/\sigma_S$	0.19	0.19	0.00	1.32	1.15	0.56	-0.19	-0.19	0.19	0.56	1.32	0.56
	Z^2_k	0.04	0.04	0.00	1.73	1.32	0.32	0.04	0.04	0.04	0.32	1.73	0.32

ΣZ_k= 5.66
ΣZ^2_k= 5.91
Z-bar=$\Sigma Z_k/K$= 0.47

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	69	1	0	0	0

Σn 71
ΣS_k 30

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	3.24	@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
p	**0.987**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
$\Sigma VAR(S_k)$	Z_{calc} 1.60	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
327.33	**p** **0.946**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.51	**0.93**	2.63
0.050	-0.04		2.05
0.100	0.29		1.80
0.200	0.46		1.66

Site #62 Seasonal Kendall analysis for pH, Field, Standard Units

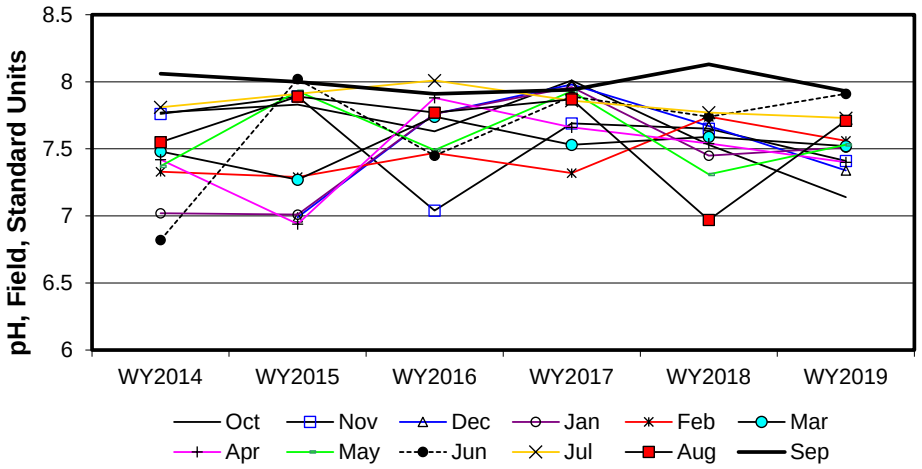
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	7.8	7.8		7.0	7.3	7.5	7.4	7.4	6.8	7.8	7.6	8.1
b	**WY2015**	7.8	7.9	7.0	7.0	7.3	7.3	6.9	7.9	8.0		7.9	8.0
c	**WY2016**	7.6	7.0	7.8	7.8	7.5	7.7	7.9	7.5	7.5	8.0	7.8	7.9
d	**WY2017**	8.0	7.7	8.0	8.0	7.3	7.5	7.7	7.9	7.9	7.9	7.9	7.9
e	**WY2018**	7.5	7.7	7.7	7.5	7.7	7.6	7.5	7.3	7.7	7.8	7.0	8.1
f	**WY2019**	7.1	7.4	7.3	7.5	7.6	7.5	7.4	7.5	7.9	7.7	7.7	7.9
	n	6	6	5	6	6	6	6	6	6	5	6	6
	t_1	6	6	5	6	6	6	6	4	6	5	6	6
	t_2	0	0	0	0	0	0	0	1	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	1	1		-1	-1	-1	-1	1	1		1	-1
	c-a	-1	-1		1	1	1	1	1	1	1	1	-1
	d-a	1	-1		1	-1	1	1	1	1	1	1	-1
	e-a	-1	-1		1	1	1	1	-1	1	-1	-1	1
	f-a	-1	-1		1	1	1	-1	1	1	-1	1	-1
	c-b	-1	-1	1	1	1	1	1	-1	-1		-1	-1
	d-b	1	-1	1	1	1	1	1	0	-1		-1	-1
	e-b	-1	-1	1	1	1	1	1	-1	-1		-1	1
	f-b	-1	-1	1	1	1	1	1	-1	-1		-1	-1
	d-c	1	1	1	1	-1	-1	-1	1	1	-1	1	1
	e-c	-1	1	-1	-1	1	-1	-1	-1	1	-1	-1	1
	f-c	-1	1	-1	-1	1	-1	-1	1	1	-1	-1	1
	e-d	-1	-1	-1	-1	1	1	-1	-1	-1	-1	-1	1
	f-d	-1	-1	-1	-1	1	-1	-1	-1	1	-1	-1	-1
	f-e	-1	-1	-1	1	-1	-1	-1	1	1	-1	1	-1
	S_k	-7	-7	0	5	7	3	-1	0	5	-6	-3	-3
	σ^2_S=	28.33	28.33	16.67	28.33	28.33	28.33	28.33	27.33	28.33	16.67	28.33	28.33
	$Z_k = S_k/\sigma_S$	-1.32	-1.32	0.00	0.94	1.32	0.56	-0.19	0.00	0.94	-1.47	-0.56	-0.56
	Z^2_k	1.73	1.73	0.00	0.88	1.73	0.32	0.04	0.00	0.88	2.16	0.32	0.32

ΣZ_k= -1.66
ΣZ^2_k= 10.10
Z-bar=$\Sigma Z_k/K$= -0.14

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	68	1	0	0	0

Σn 70
ΣS_k -7

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	9.87	@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
p	**0.542**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc} -0.34	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
315.67	**p** **0.368**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.06		0.06
0.050	-0.04	**-0.01**	0.03
0.100	-0.03		0.02
0.200	-0.02		0.01

Site #62 Seasonal Kendall analysis for Specific Conductance, Field (µS/cm)

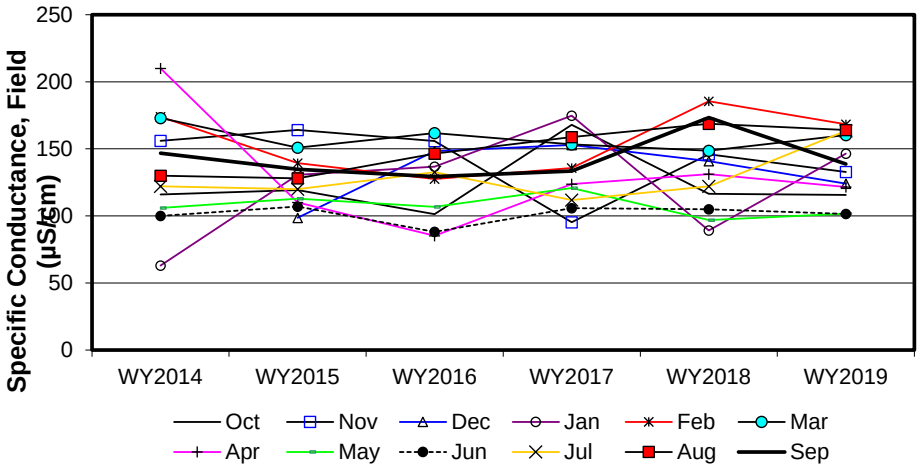
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	116.0	156.0		63.0	174.0	173.0	210.0	106.0	100.0	122.0	130.0	146.7
b	**WY2015**	119.2	164.1	98.6	130.6	139.4	150.8	110.0	112.8	107.0	120.0	128.0	134.8
c	**WY2016**	101.3	155.8	148.3	136.8	127.5	161.8	85.2	106.8	88.1	132.6	146.5	129.3
d	**WY2017**	167.9	95.3	152.9	174.7	135.7	153.3	123.7	120.8	105.8	111.8	158.7	133.4
e	**WY2018**	116.4	146.0	140.8	89.2	185.5	148.6	131.2	96.9	104.9	122.1	168.7	173.3
f	**WY2019**	115.6	132.7	124.0	146.5	168.3	160.3	121.5	101.6	101.5	163.4	164.1	138.7
	n	6	6	5	6	6	6	6	6	6	6	6	6
	t_1	6	6	5	6	6	6	6	6	6	6	6	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	1	1		1	-1	-1	-1	1	1	-1	-1	-1
	c-a	-1	-1		1	-1	-1	-1	1	-1	1	1	-1
	d-a	1	-1		1	-1	-1	-1	1	1	-1	1	-1
	e-a	1	-1		1	1	-1	-1	-1	1	1	1	1
	f-a	-1	-1		1	-1	-1	-1	-1	1	1	1	-1
	c-b	-1	-1	1	1	-1	1	-1	-1	-1	1	1	-1
	d-b	1	-1	1	1	-1	1	1	1	-1	-1	1	-1
	e-b	-1	-1	1	-1	1	-1	1	-1	-1	1	1	1
	f-b	-1	-1	1	1	1	1	1	-1	-1	1	1	1
	d-c	1	-1	1	1	1	-1	1	1	1	-1	1	1
	e-c	1	-1	-1	-1	1	-1	1	-1	1	-1	1	1
	f-c	1	-1	-1	1	1	-1	1	-1	1	1	1	1
	e-d	-1	1	-1	-1	1	-1	1	-1	-1	1	1	1
	f-d	-1	1	-1	-1	1	1	-1	-1	-1	1	1	1
	f-e	-1	-1	-1	1	-1	1	-1	1	-1	1	-1	-1
	S_k	-1	-9	0	7	1	-5	-1	-3	-1	5	11	1
σ^2_S=		28.33	28.33	16.67	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33
$Z_k = S_k/\sigma_S$		-0.19	-1.69	0.00	1.32	0.19	-0.94	-0.19	-0.56	-0.19	0.94	2.07	0.19
Z^2_k		0.04	2.86	0.00	1.73	0.04	0.88	0.04	0.32	0.04	0.88	4.27	0.04

ΣZ_k= 0.94
ΣZ^2_k= 11.12
Z-bar=$\Sigma Z_k/K$= 0.08

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	71	0	0	0	0

Σn 71
ΣS_k 5

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	11.04	@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
p	**0.440**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc} 0.22	@α/2=2.5% **Z**=	1.96	**H_0** (No trend) ACCEPT
328.33	**p** **0.587**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-2.00		4.66
0.050	-1.12	**0.30**	3.34
0.100	-0.90		2.90
0.200	-0.70		2.41

Site #62

Seasonal Kendall analysis for Sulfate, Total (mg/l)

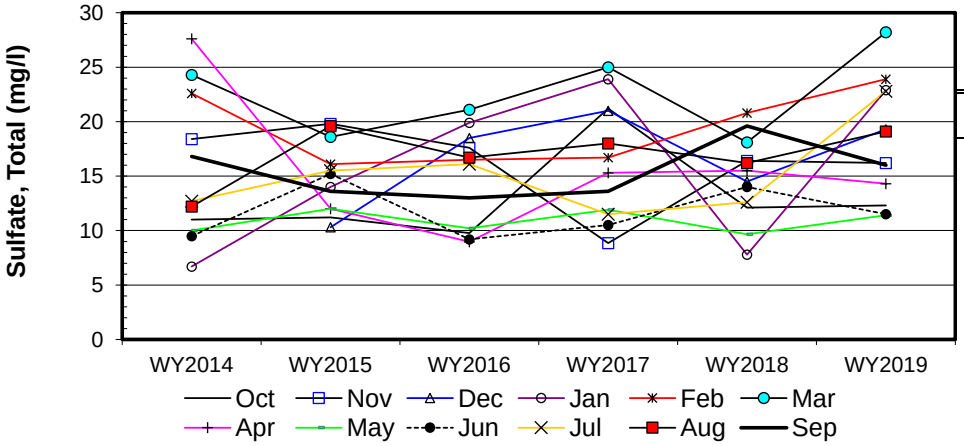
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	11.0	18.4		6.7	22.6	24.3	27.6	10.0	9.5	12.7	12.2	16.8
b	**WY2015**	11.2	19.8	10.3	14.0	16.1	18.6	12.0	12.0	15.2	15.5	19.6	13.6
c	**WY2016**	9.8	17.6	18.5	19.9	16.5	21.1	9.0	10.2	9.2	16.1	16.7	13.0
d	**WY2017**	21.2	8.9	21.0	23.9	16.7	25.0	15.3	11.9	10.5	11.5	18.0	13.6
e	**WY2018**	12.1	16.4	14.5	7.8	20.8	18.1	15.5	9.7	14.0	12.6	16.2	19.6
f	**WY2019**	12.3	16.2	19.3	22.9	23.9	28.2	14.3	11.4	11.5	22.8	19.1	16.0
	n	6	6	5	6	6	6	6	6	6	6	6	6
	t_1	6	6	5	6	6	6	6	6	6	6	6	4
	t_2	0	0	0	0	0	0	0	0	0	0	0	1
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	1	1		1	-1	-1	-1	1	1	1	1	-1
	c-a	-1	-1		1	-1	-1	-1	1	-1	1	1	-1
	d-a	1	-1		1	-1	1	-1	1	1	-1	1	-1
	e-a	1	-1		1	-1	-1	-1	-1	1	-1	1	1
	f-a	1	-1		1	1	1	-1	1	1	1	1	-1
	c-b	-1	-1	1	1	1	1	-1	-1	-1	1	-1	-1
	d-b	1	-1	1	1	1	1	1	-1	-1	-1	-1	0
	e-b	1	-1	1	-1	1	-1	1	-1	-1	-1	-1	1
	f-b	1	-1	1	1	1	1	1	-1	-1	1	-1	1
	d-c	1	-1	1	1	1	1	1	1	1	-1	1	1
	e-c	1	-1	-1	-1	1	-1	1	-1	1	-1	-1	1
	f-c	1	-1	1	1	1	1	1	1	1	1	1	1
	e-d	-1	1	-1	-1	1	-1	1	-1	1	1	-1	1
	f-d	-1	1	-1	-1	1	1	-1	-1	1	1	1	1
	f-e	1	-1	1	1	1	1	-1	1	-1	1	1	-1
	S_k	7	-9	4	7	7	3	-1	-1	3	3	3	2
	σ^2_S=	28.33	28.33	16.67	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	27.33
	$Z_k = S_k/\sigma_S$	1.32	-1.69	0.98	1.32	1.32	0.56	-0.19	-0.19	0.56	0.56	0.56	0.38
	Z^2_k	1.73	2.86	0.96	1.73	1.73	0.32	0.04	0.04	0.32	0.32	0.32	0.15

ΣZ_k= 5.50
ΣZ^2_k= 10.49
Z-bar=$\Sigma Z_k/K$= 0.46

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	69	1	0	0	0

Σn 71
ΣS_k 28

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	7.98		@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
	p	**0.715**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	1.49	@α=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
327.33	**p**	**0.932**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.16	**0.30**	1.05
0.050	-0.03		0.77
0.100	0.19		0.60
0.200	0.23		0.55

Site #62 Seasonal Kendall analysis for Zinc, Dissolved (ug/l)

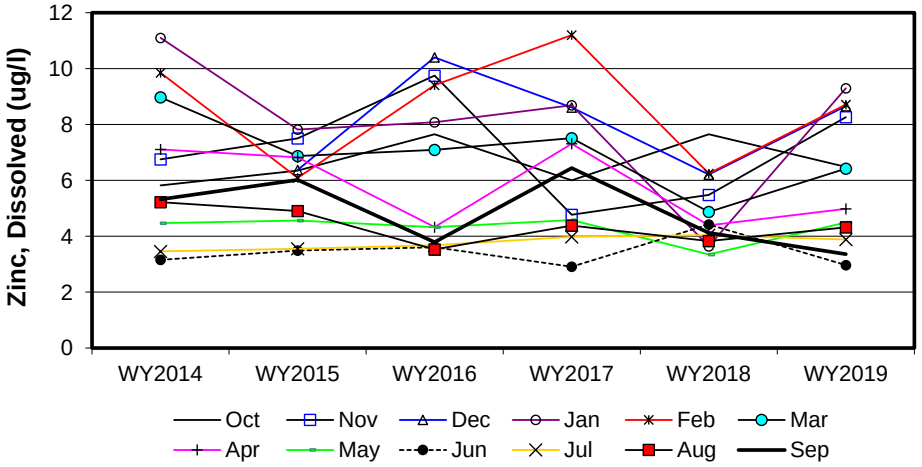
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**	5.8	6.8		11.1	9.9	9.0	7.1	4.5	3.2	3.5	5.2	5.3
b	**WY2015**	6.4	7.5	6.4	7.8	6.1	6.9	6.8	4.6	3.5	3.6	4.9	6.0
c	**WY2016**	7.7	9.8	10.4	8.1	9.4	7.1	4.3	4.3	3.6	3.7	3.5	3.8
d	**WY2017**	6.0	4.8	8.6	8.7	11.2	7.5	7.3	4.6	2.9	4.0	4.4	6.4
e	**WY2018**	7.7	5.5	6.2	3.6	6.3	4.9	4.4	3.4	4.4	4.0	3.8	4.1
f	**WY2019**	6.5	8.3	8.7	9.3	8.7	6.4	5.0	4.5	3.0	3.9	4.3	3.4
	n	6	6	5	6	6	6	6	6	6	6	6	6
	t_1	4	6	5	6	6	6	6	6	6	6	6	6
	t_2	1	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a	1	1		-1	-1	-1	-1	1	1	1	-1	1
	c-a	1	1		-1	-1	-1	-1	-1	1	1	-1	-1
	d-a	1	-1		-1	1	-1	1	1	-1	1	-1	1
	e-a	1	-1		-1	-1	-1	-1	-1	1	1	-1	-1
	f-a	1	1		-1	-1	-1	-1	1	-1	1	-1	-1
	c-b	1	1	1	1	1	1	-1	-1	1	1	-1	-1
	d-b	-1	-1	1	1	1	1	1	1	-1	1	-1	1
	e-b	1	-1	-1	-1	1	-1	-1	-1	1	1	-1	-1
	f-b	1	1	1	1	1	-1	-1	-1	-1	1	-1	-1
	d-c	-1	-1	-1	1	1	1	1	1	-1	1	1	1
	e-c	0	-1	-1	-1	-1	-1	1	-1	1	1	1	1
	f-c	-1	-1	-1	1	-1	-1	1	1	-1	1	1	-1
	e-d	1	1	-1	-1	-1	-1	-1	-1	1	1	-1	-1
	f-d	1	1	1	1	-1	-1	-1	-1	1	-1	-1	-1
	f-e	-1	1	1	1	1	1	1	1	-1	-1	1	-1
	S_k	6	1	0	-1	-1	-7	-3	-1	1	11	-7	-5
	σ^2_S=	27.33	28.33	16.67	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33
	$Z_k = S_k/\sigma_S$	1.15	0.19	0.00	-0.19	-0.19	-1.32	-0.56	-0.19	0.19	2.07	-1.32	-0.94
	Z^2_k	1.32	0.04	0.00	0.04	0.04	1.73	0.32	0.04	0.04	4.27	1.73	0.88

ΣZ_k= -1.11
ΣZ^2_k= 10.42
Z-bar=$\Sigma Z_k/K$= -0.09

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	69	1	0	0	0

Σn 71
ΣS_k -6

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	10.32	@α=5% $\chi^2_{(K-1)}$=	19.68	Test for station homogeneity
p	**0.502**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc} -0.28	@α/2=2.5% **Z**=	1.96	**H_0** (No trend) ACCEPT
327.33	**p** **0.391**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.29		0.10
0.050	-0.23	**-0.04**	0.06
0.100	-0.18		0.05
0.200	-0.14		0.03

Wilcoxon-signed-ranks test

Exact Form

Variable: **Specific Conductance, Field (µS/cm)**

	X	**Y**			
Site	#54	#62	Differences		
Year	WY2019	WY2019	**D**	**|D|**	**Rank**
Oct	111.00	115.60	-4.60	4.60	-2
Nov	123.10	132.70	-9.60	9.60	-10
Dec	114.80	124.00	-9.20	9.20	-8
Jan	124.20	146.50	-22.30	22.30	-11
Feb	144.60	168.30	-23.70	23.70	-12
Mar	169.70	160.30	9.40	9.40	9
Apr	115.30	121.50	-6.20	6.20	-4
May	93.51	101.60	-8.09	8.09	-6
Jun	101.60	101.50	0.10	0.10	1
Jul	157.00	163.40	-6.40	6.40	-5
Aug	155.40	164.10	-8.70	8.70	-7
Sep	132.90	138.70	-5.80	5.80	-3
Median	123.65	135.70	-7.25	8.40	

n	**m**
12	12

N= 12

ΣR= -58

α
0.05
W'α,n
17

W^+=
10
p-test
0.010

H_0	median [D]=0	**REJECT**
H_1	median [D]<0	**ACCEPT**

Wilcoxon-signed-ranks test

Exact Form

Variable: **pH, Field, Standard Units**

	X	**Y**			
Site	#54	#62	Differences		
Year	WY2019	WY2019	**D**	**|D|**	**Rank**
Oct	7.21	7.14	0.07	0.07	1.5
Nov	7.74	7.41	0.33	0.33	7
Dec	7.94	7.34	0.60	0.60	12
Jan	7.88	7.51	0.37	0.37	9
Feb	7.91	7.56	0.35	0.35	8
Mar	7.94	7.52	0.42	0.42	11
Apr	7.80	7.40	0.40	0.40	10
May	7.77	7.53	0.24	0.24	6
Jun	7.82	7.91	-0.09	0.09	-3.5
Jul	7.88	7.73	0.15	0.15	5
Aug	7.78	7.71	0.07	0.07	1.5
Sep	7.84	7.93	-0.09	0.09	-3.5
Median	7.83	7.53	0.28	0.28	

n	**m**
12	12

N= 12

ΣR= 64

α
0.05
W'α,n
17

W^+=
7
p-test
0.005

H_0	median [D]=0	**REJECT**
H_1	median [D]<0	**ACCEPT**

Wilcoxon-signed-ranks test

Exact Form

Variable: **Total Alk, (mg/l)**

	X	**Y**			
Site	#54	#62	Differences		
Year	WY2019	WY2019	**D**	**|D|**	**Rank**
Oct	39.90	41.20	-1.30	1.30	-2
Nov	44.60	48.30	-3.70	3.70	-6
Dec	42.40	46.10	-3.70	3.70	-6
Jan	51.90	56.30	-4.40	4.40	-10
Feb	56.40	60.40	-4.00	4.00	-8
Mar	60.40	64.60	-4.20	4.20	-9
Apr	45.10	47.10	-2.00	2.00	-4
May	35.90	41.70	-5.80	5.80	-11
Jun	40.10	41.20	-1.10	1.10	-1
Jul	62.80	66.50	-3.70	3.70	-6
Aug	60.40	61.90	-1.50	1.50	-3
Sep	62.00	71.80	-9.80	9.80	-12
Median	48.50	52.30	-3.70	3.70	

n	**m**
12	12

N= 12

ΣR= -78

α
0.05
W'α,n
17

W^+=
0
p-test
0.000

H_0	median [D]=0	**REJECT**
H_1	median [D]<0	**ACCEPT**

Wilcoxon-signed-ranks test

Exact Form

Variable: **Sulfate, Total (mg/l)**

	X	**Y**			
Site	#54	#62	Differences		
Year	WY2019	WY2019	**D**	**|D|**	**Rank**
Oct	11.3	12.3	-1.0	1.0	-5.5
Nov	15.0	16.2	-1.2	1.2	-9
Dec	19.7	19.3	0.4	0.4	1
Jan	19.0	22.9	-3.9	3.9	-12
Feb	22.8	23.9	-1.1	1.1	-7.5
Mar	26.4	28.2	-1.8	1.8	-11
Apr	13.2	14.3	-1.1	1.1	-7.5
May	10.0	11.4	-1.4	1.4	-10
Jun	11.1	11.5	-0.4	0.4	-2
Jul	22.1	22.8	-0.7	0.7	-3
Aug	18.2	19.1	-0.9	0.9	-4
Sep	15.0	16.0	-1.0	1.0	-5.5
Median	16.6	17.7	-1.1	1.1	

n	**m**
12	12

N= 12

ΣR= -76

α
0.05
W'α,n
17

W^+=
1
p-test
0.000

H_0	median [D]=0	**REJECT**
H_1	median [D]<0	**ACCEPT**

Wilcoxon-signed-ranks test
Exact Form

Variable: **Zinc, Dissolved (ug/l)**

	X	**Y**			
Site	#54	#62	Differences		
Year	WY2019	WY2019	**D**	**|D|**	**Rank**
Oct	7.17	6.48	0.69	0.69	10
Nov	8.28	8.26	0.02	0.02	1
Dec	9.54	8.66	0.88	0.88	11
Jan	9.27	9.30	-0.03	0.03	-2
Feb	8.93	8.71	0.22	0.22	6
Mar	6.58	6.42	0.16	0.16	5
Apr	5.12	4.98	0.14	0.14	3
May	4.64	4.49	0.15	0.15	4
Jun	2.50	2.97	-0.47	0.47	-9
Jul	3.59	3.88	-0.29	0.29	-7
Aug	3.92	4.32	-0.40	0.40	-8
Sep	4.90	3.36	1.54	1.54	12
Median	5.85	5.70	0.14	0.25	

n	**m**
12	12

N= 12

ΣR= 26

α
0.05
W'α,n
17

W^+=
26
p-test
0.170

H_0	median [D]=0	ACCEPT
H_1	median [D]<0	

INTERPRETIVE REPORT
SITE 61

The quarterly sampling of Site 61was initiated spring of Water Year 2013. This site was added to the FWMP at the request of the state and federal regulators. Site 61 is located in a floodplain of Greens Creek, approximately 250 feet downgradient of D Pond. The sampling location is just past the confluence of two drainages, one of which originates from the north and the other from the east.

The data collected during the current water year are listed in the following "Table of Results for Water Year 2019" report. The table includes all the required FWMP analyte data (field and laboratory) collected for the current water year and a series of flags keyed to the summary report "Qualified Data by QA Reviewer." The QA report lists any associated data limitations found during the monthly QA reviews of laboratory data for this site. Median values for all analytes have been calculated and are shown in the right-most column of the table of results. Any value reported as less than MDL has been replaced with a value of one-half of the MDL for the purpose of median calculation.

All data collected at this site for the past year is included in the report. As shown in the table below, there were no data outliers.

Sample Date	Parameter	Value	Qualifier	Notes
No outliers, in the past six years, have been identified by HGCMC.				

The data have been compared to the strictest freshwater quality criterion for each applicable analyte. No results exceeded these criteria.

Table of Exceedance for Water Year 2019

			Limits		
Sample Date	Parameter	Value	Lower	Upper	Hardness
No exceedances have been identified by HGCMC for the period of October 2018 through September 2019.					

X-Y plots have been generated to graphically present the data for each of the analytes requested in the Statistical Information Goals for this site. These plots have been visually analyzed for the appearance of any trend in concentration; no obvious trends were noted.

Table of Results for Water Year 2019

Site 061FMS - 'Greens Creek Floodplain'

Sample Date/Parameter	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019	**Median**
Water Temp (°C)		4						6.2			8.4		6.2
Conductivity-Field(μmho)		549.9						582.8			441.2		549.9
Conductivity-Lab (μmho)		519						531			389		519
pH Lab (standard units)		6.87						6.94			6.88		6.88
pH Field (standard units)		7.16						7.35			7.33		7.33
Total Alkalinity (mg/L)		116						117			129		117.0
Total Sulfate (mg/L)		162						177			90.5		162.0
Hardness (mg/L)		275						296			221		275.0
Dissolved As (ug/L)		0.156						0.2			0.184		0.184
Dissolved Ba (ug/L)		50.9											50.9
Dissolved Cd (ug/L)		0.414						0.336			0.306		0.3360
Dissolved Cr (ug/L)		0.137											0.137
Dissolved Cu (ug/L)		0.377						0.499			0.275		0.377
Dissolved Pb (ug/L)		0.0169						0.028			0.0142		0.0169
Dissolved Ni (ug/L)		2.15											2.150
Dissolved Ag (ug/L)		0.002											0.002
Dissolved Zn (ug/L)		125						98.6			81.9		98.60
Dissolved Se (ug/L)		1.62											1.620
Dissolved Hg (ug/L)		0.00031						0.000444			0.000213		0.000310

For individual sample/analyte qualifier descriptions see "Qualified Data by QA Reviewer" table.

Values reported as less than MDL are replaced by 1/2 MDL for median calculation purposes.

Shaded data has been qualified as an outlier by HGCMC and removed from any further analysis and is not included into the calculation of the median

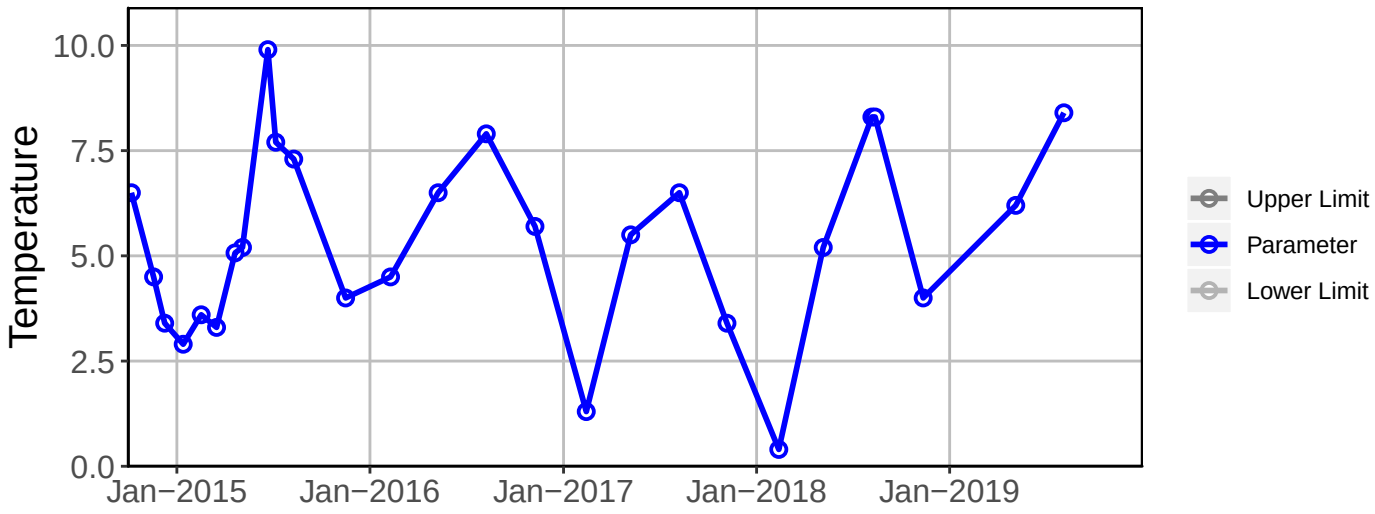
Qualified Data by QA Reviewer

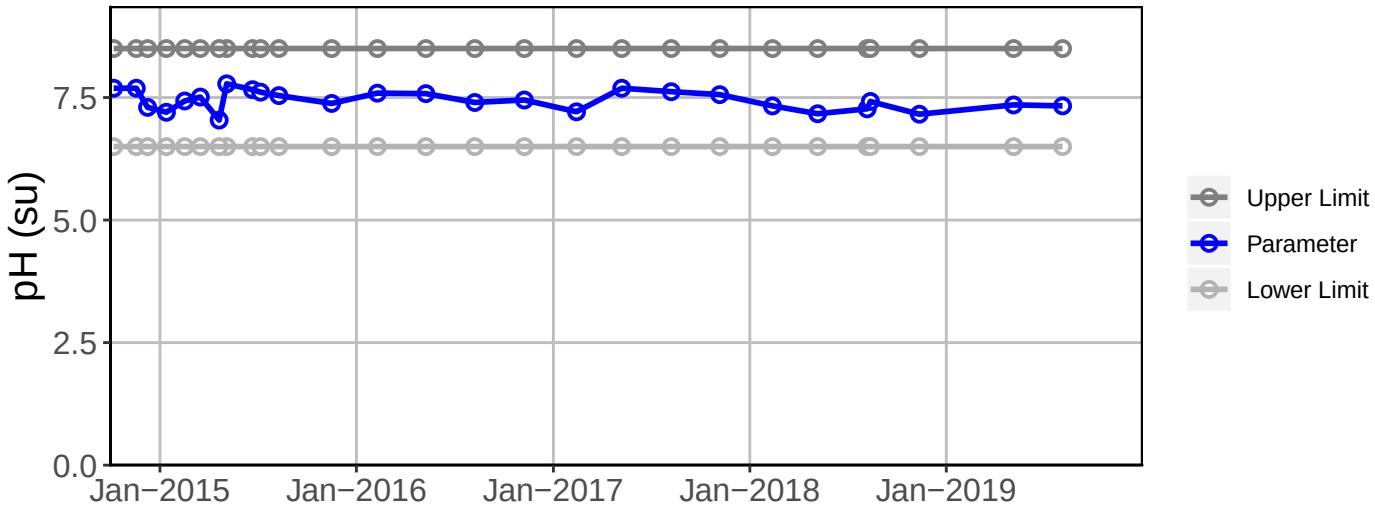
Date Range: 10/01/2018 to 09/30/2019

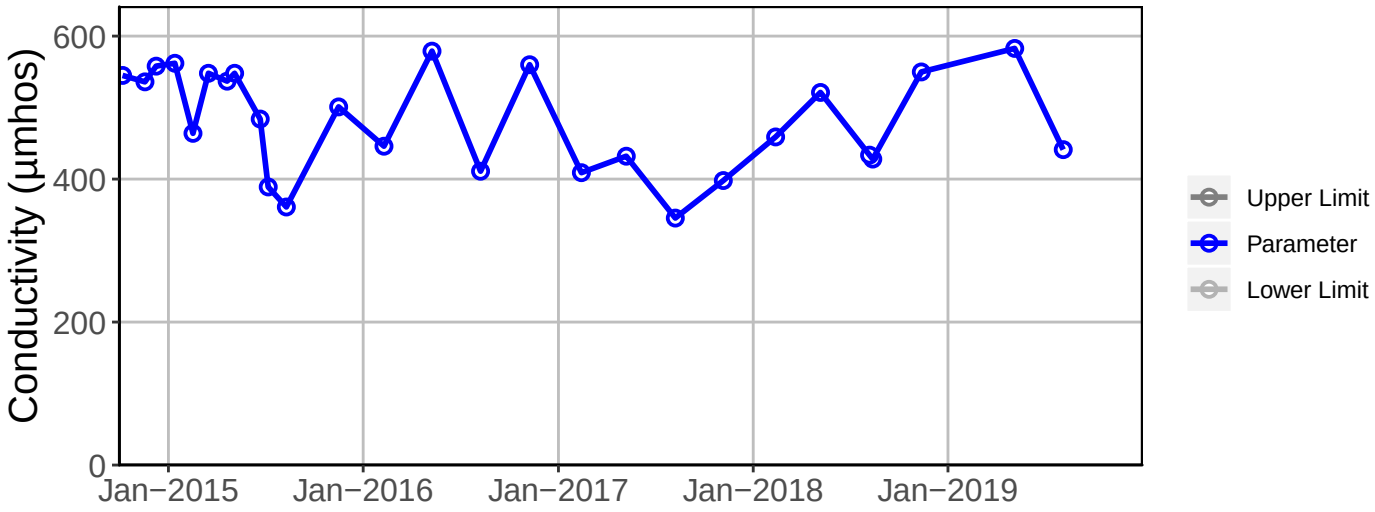
Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
061FMS	12-Nov-18	Diss. Cr-ICP/MS	0.13	µg/L	J	Below Quantitative Range
		Diss. Pb-ICP/MS	0.01	µg/L	U	Field Blank Contamination
	5-Aug-19	Diss. Cu-ICP/MS	0.27	µg/L	U	Field Blank Contamination
		Diss. Hg-CVAF	0.000213	µg/L	J	Below Quantitative Range
		Diss. Pb-ICP/MS	0.01	µg/L	U	Field Blank Contamination
		Total Sulfate	90.50	µg/L	J	Sample Receipt Temperature

Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

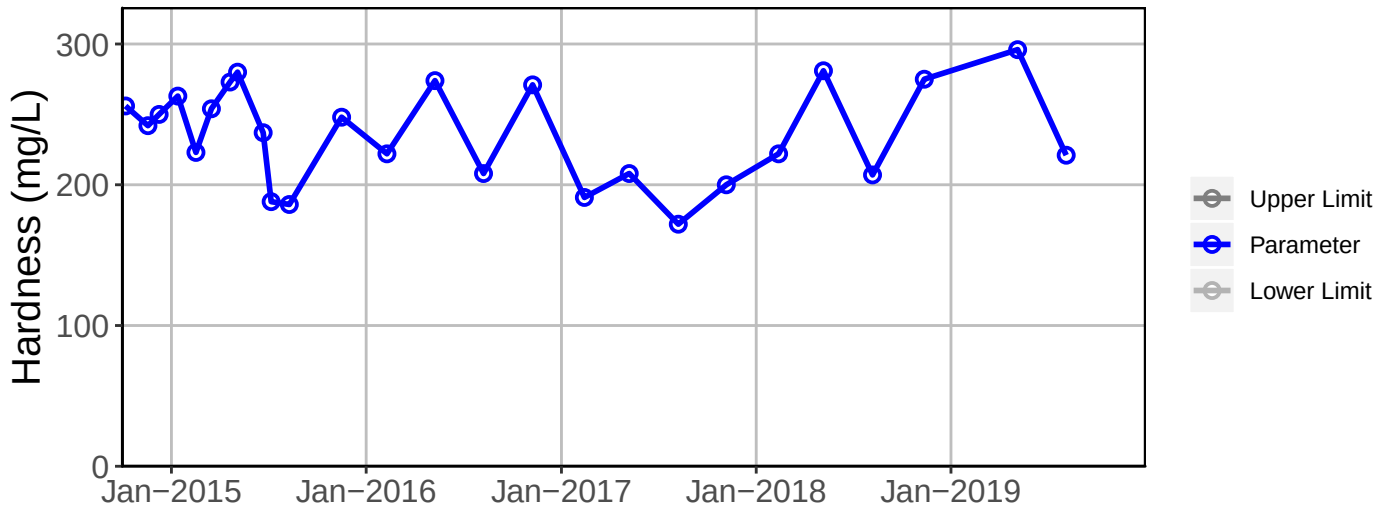
Site 61 Analyte Charts

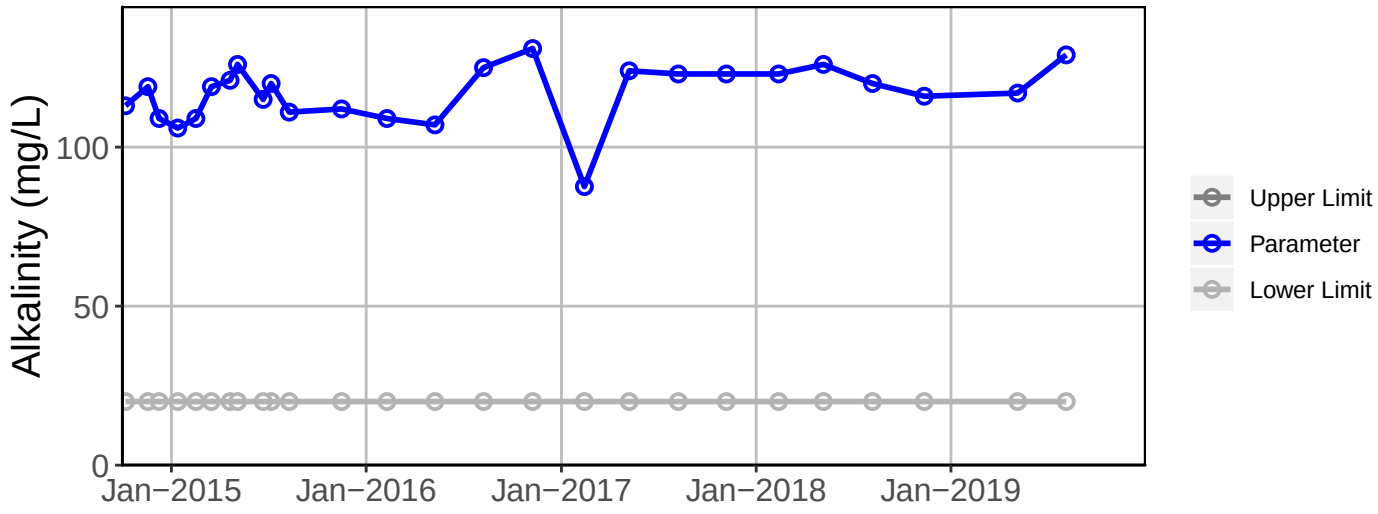


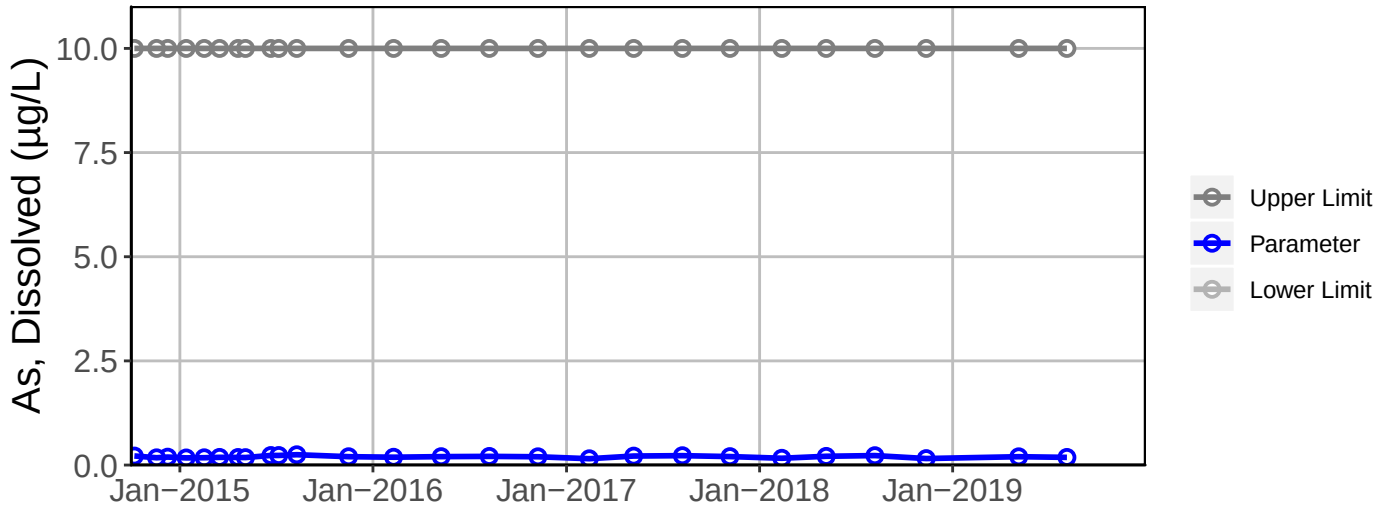




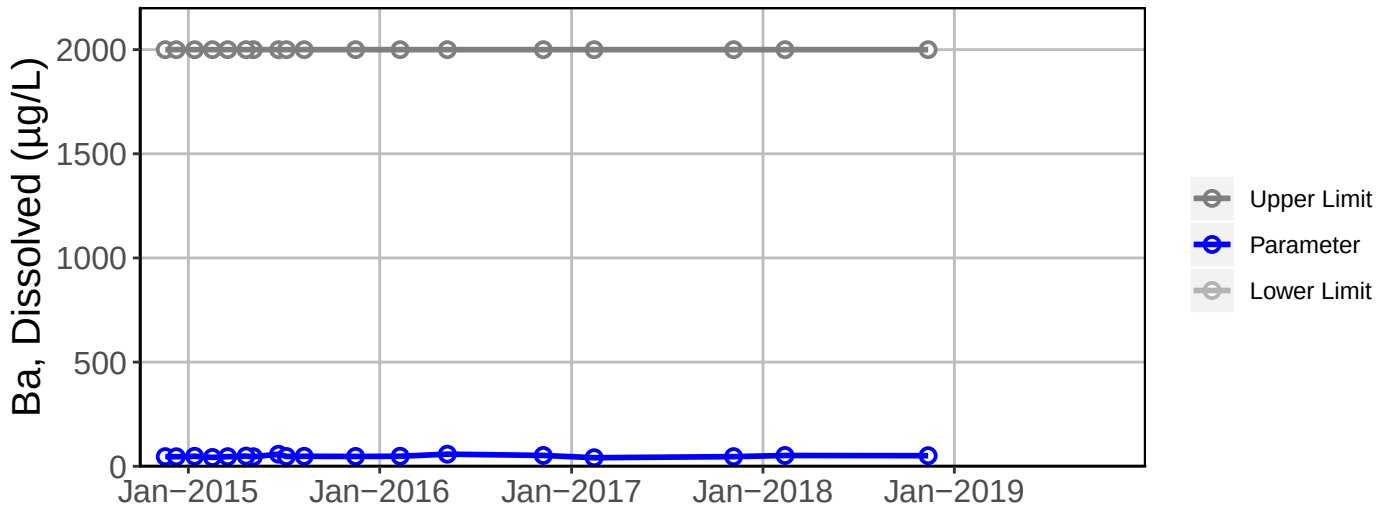
Site 61 Analyte Charts

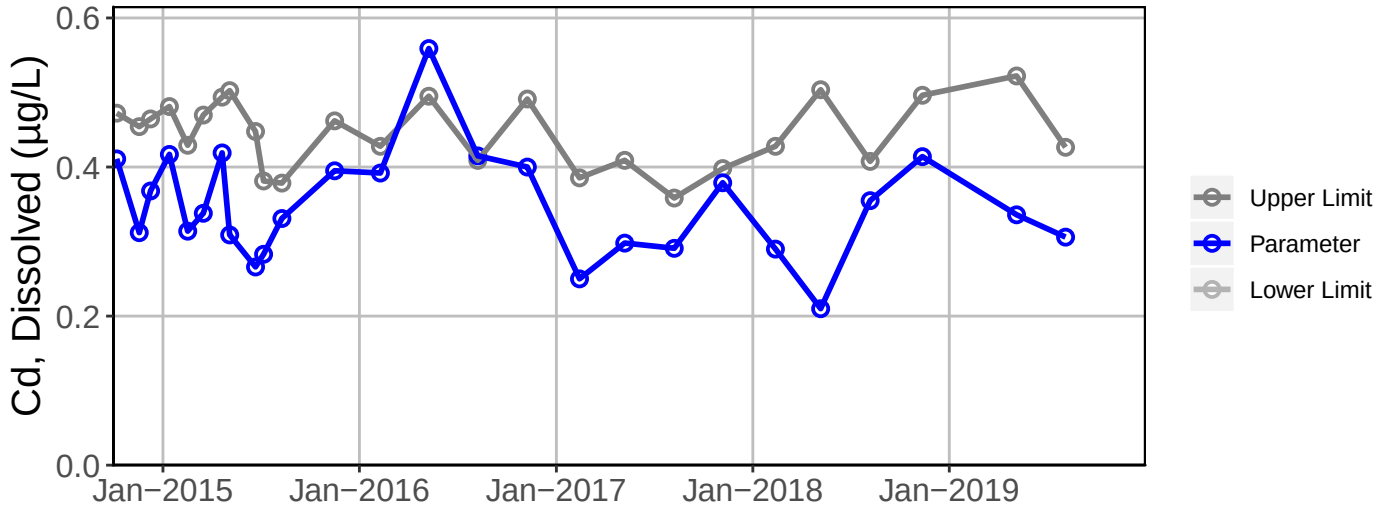


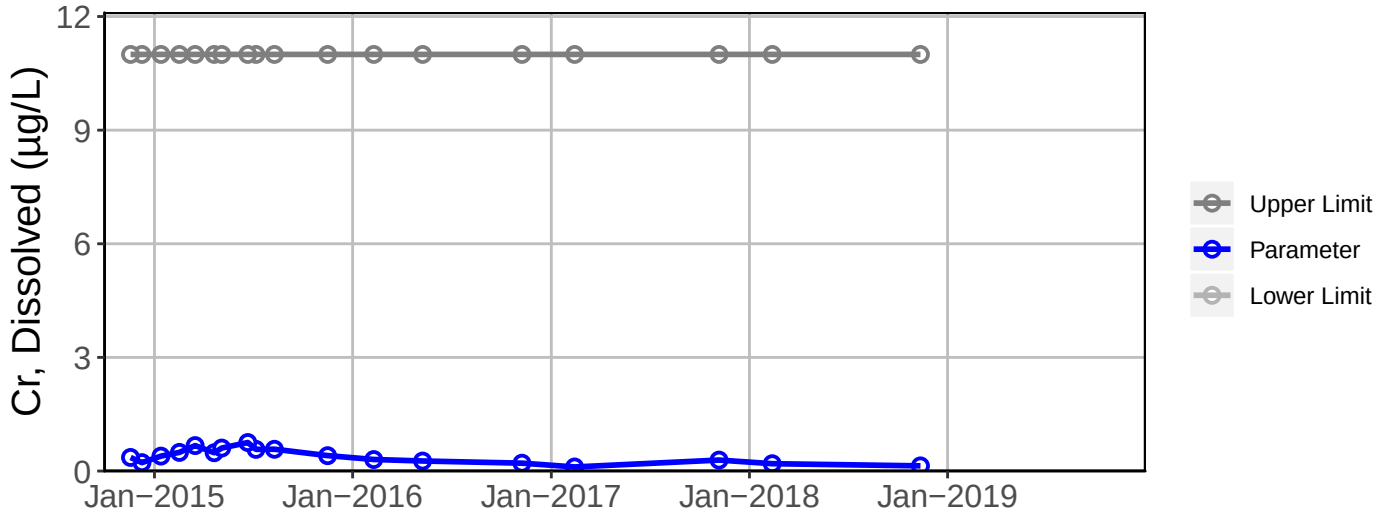




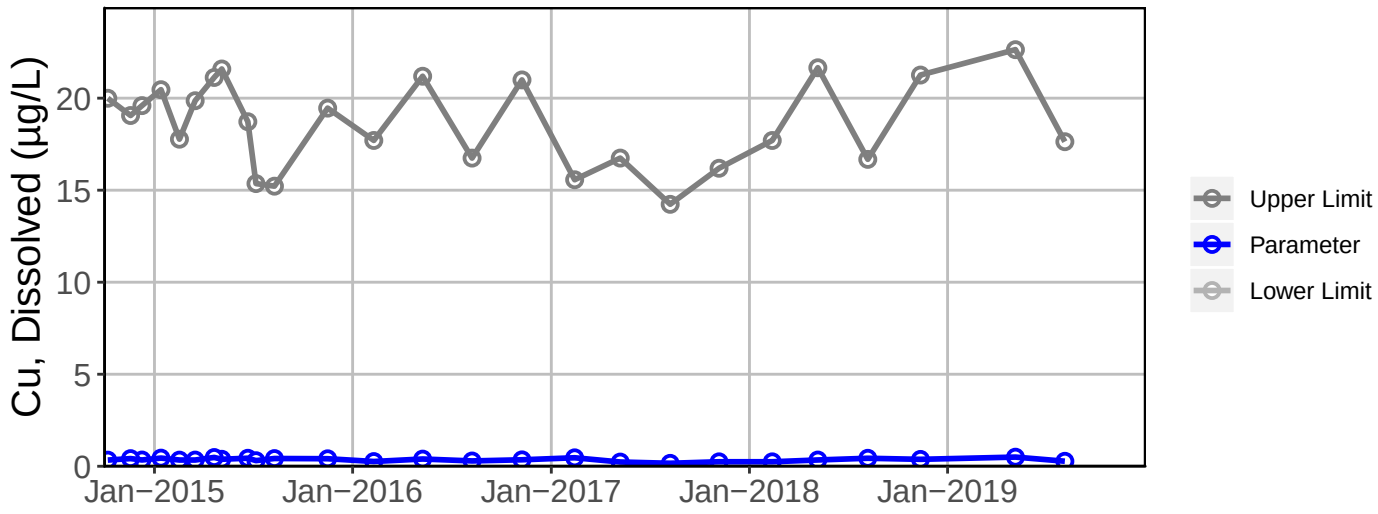
Site 61 Analyte Charts

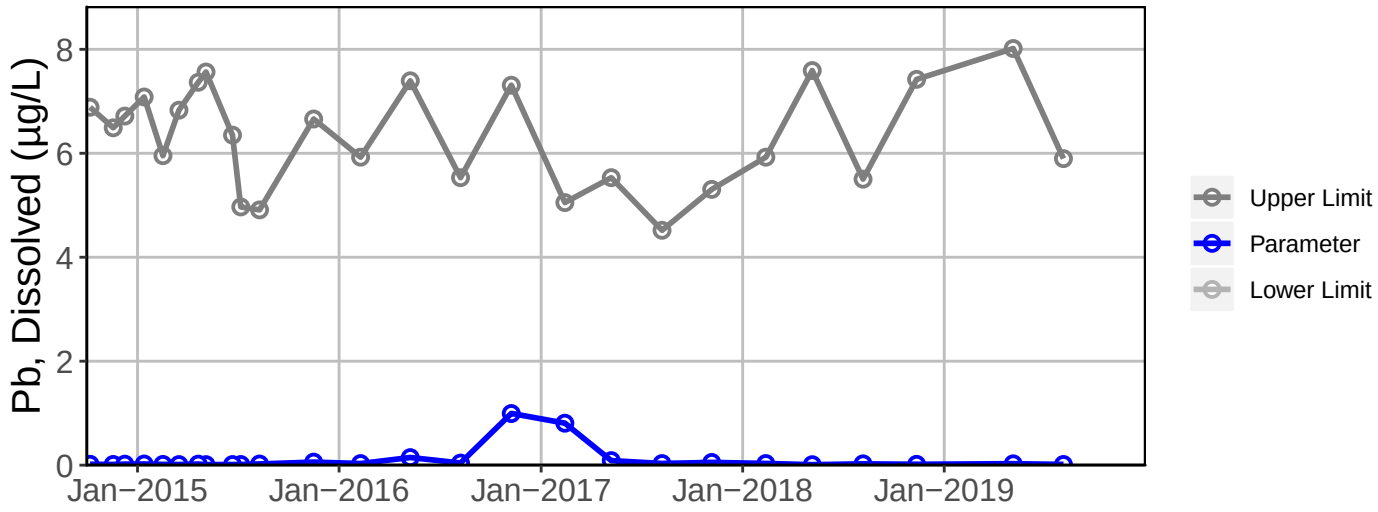


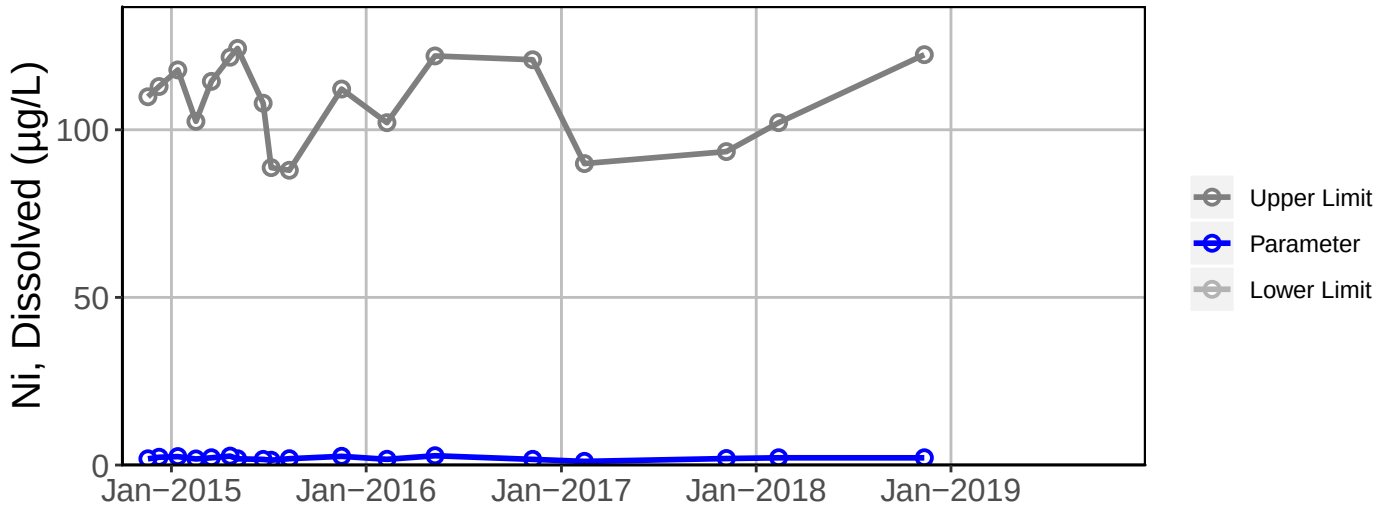




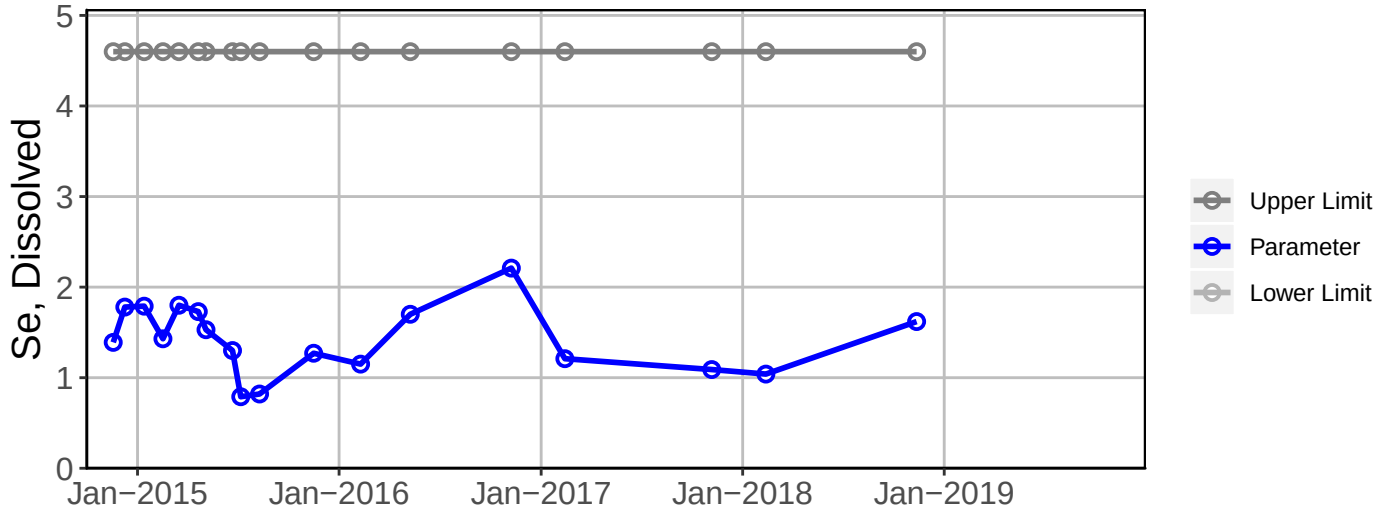
Site 61 Analyte Charts

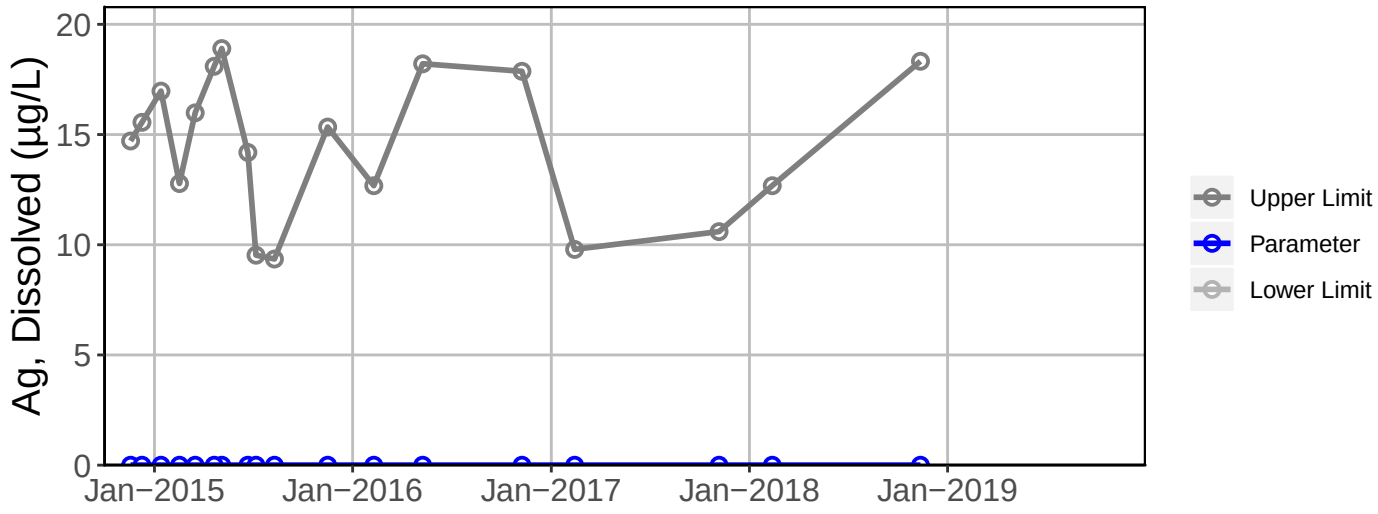


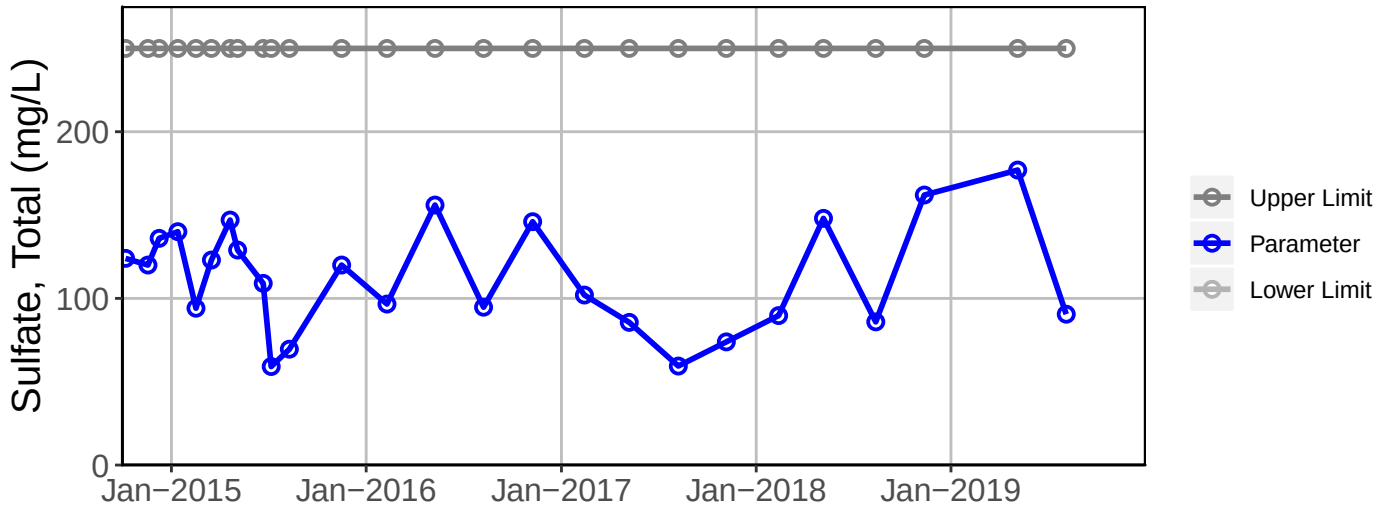




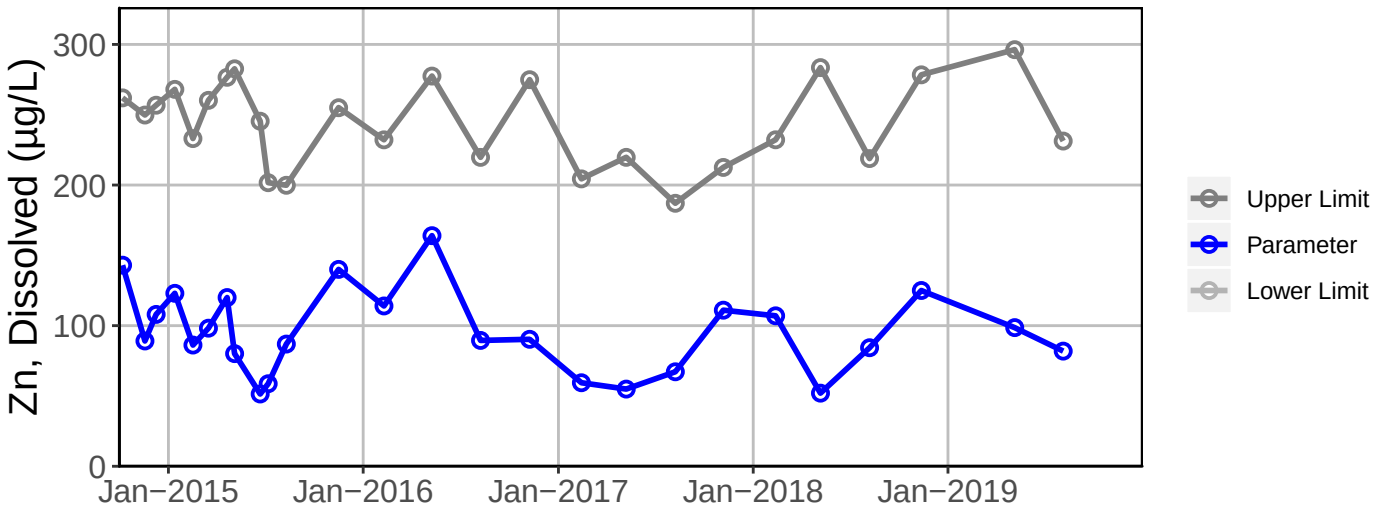
Site 61 Analyte Charts







Site 61 Analyte Charts



INTERPRETIVE REPORT
SITE 49

The data collected during the current water year are listed in the following "Table of Results for Water Year 2019" report. The table includes all the required FWMP analyte data (field and laboratory) collected for the current water year and a series of flags keyed to the summary report "Qualified Data by QA Reviewer." The QA report lists any associated data limitations found during the monthly QA reviews of laboratory data for this site. Median values for all analytes have been calculated and are shown in the right-most column of the table of results. Any value reported as less than MDL has been replaced with a value of one-half of the MDL for the purpose of median calculation.

All data collected at this site for the past six years are included in the data analyses. As shown in the table below, there were no data outliers.

Sample Date	Parameter	Value	Qualifier	Notes
No outliers, in the past six years, have been identified by HGCMC.				

The data have been compared to the strictest freshwater quality criterion for each applicable analyte. No results exceeding these criteria have been identified, as listed in the table below.

Table of Exceedance for Water Year 2019

			Limits		
Sample Date	**Parameter**	**Value**	**Lower**	**Upper**	**Hardness**
No exceedances have been identified by HGCMC for the period of October 2018 through September 2019.					

X-Y plots have been generated to graphically present the data for each of the analytes requested in the Statistical Information Goals for this site. These plots have been visually analyzed for the appearance of any trend in concentration; no obvious trends were identified.

A non-parametric statistical analysis for trend was performed for specific conductivity, field pH, total alkalinity, total sulfate, and dissolved zinc. Calculation details of the Seasonal Kendall analyses are presented in detail on the pages following this interpretive section. The below table summarizes the results of the data collected between Oct-13 and Sep-19 (WY2014-WY2019).

Site 49 - Table of Summary Statistics for Trend Analysis

	Mann-Kendall test statistics			Sen's slope estimate	
Parameter	**n***	**p****	**Trend**	**Q**	**Q(%)**
Conductivity Field	6	0.54			
pH Field	6	0.20			
Alkalinity, Total	6	0.80			
Sulfate, Total	6	0.72			
Zinc, Dissolved	6	0.26			

* Number of Years ** Significance level

For datasets with a statistically significant trend ($\alpha/2$=2.5%), a Seasonal-Sen's Slope estimate statistic has also been calculated. There were no statistically significant trends identified at Site 49 during the reporting period.

Table of Results for Water Year 2019

Site 049FMS - 'Upper Bruin Creek'

Sample Date/Parameter	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019	**Median**
Water Temp (°C)		3.8			0.5			3.8			11.4		3.8
Conductivity-Field(μmho)		139			174.2			106			191.6		156.6
Conductivity-Lab (μmho)		139			177			107			176		158
pH Lab (standard units)		6.82			7			6.75			7.46		6.91
pH Field (standard units)		7.87			8			7.89			7.92		7.91
Total Alkalinity (mg/L)		56.7			74.4			46.1			86.2		65.6
Total Sulfate (mg/L)		11.2			16.4			7.7			16.5		13.8
Hardness (mg/L)		75			89.6			52.7			98.1		82.3
Dissolved As (ug/L)		0.169			0.154			0.143			0.194		0.162
Dissolved Ba (ug/L)		9			10.8								9.9
Dissolved Cd (ug/L)		0.026			0.0248			0.0248			0.0288		0.0254
Dissolved Cr (ug/L)		0.204			0.192								0.198
Dissolved Cu (ug/L)		0.579			0.374			0.494			0.502		0.498
Dissolved Pb (ug/L)		0.0059			0.0051			0.0055			0.0042		0.0053
Dissolved Ni (ug/L)		0.775			0.939								0.857
Dissolved Ag (ug/L)		0.002			0.002								0.002
Dissolved Zn (ug/L)		2.19			1.7			1.81			1.84		1.83
Dissolved Se (ug/L)		0.431			0.637								0.534
Dissolved Hg (ug/L)		0.0018			0.000866			0.0015			0.00118		0.001340

For individual sample/analyte qualifier descriptions see "Qualified Data by QA Reviewer" table.

Values reported as less than MDL are replaced by 1/2 MDL for median calculation purposes.

Shaded data has been qualified as an outlier by HGCMC and removed from any further analysis and is not included into the calculation of the median

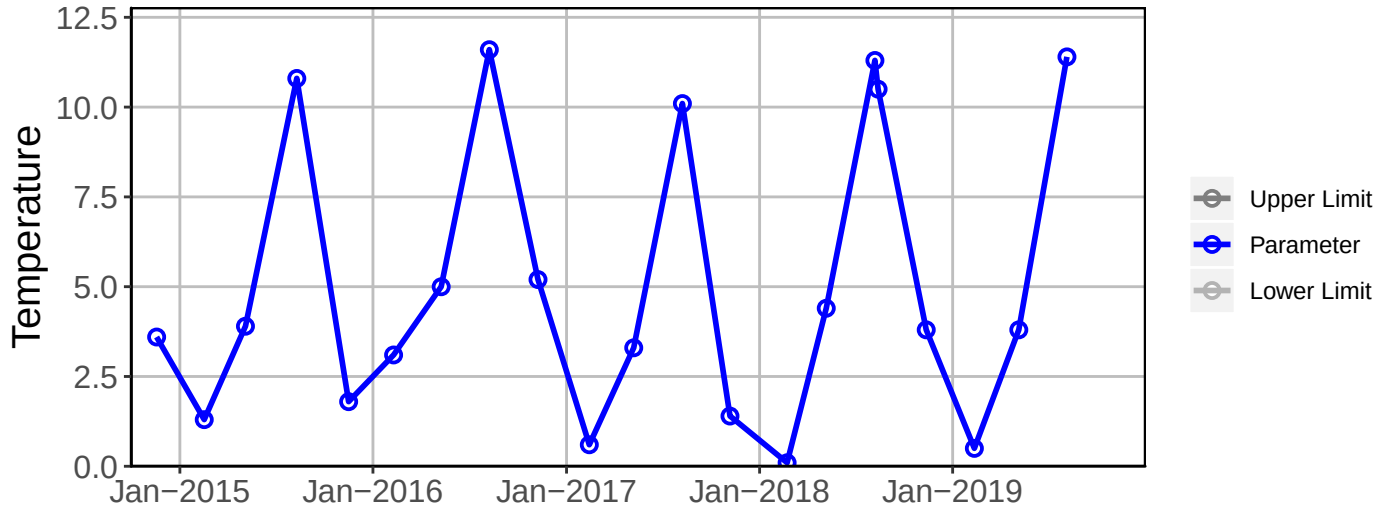
Qualified Data by QA Reviewer

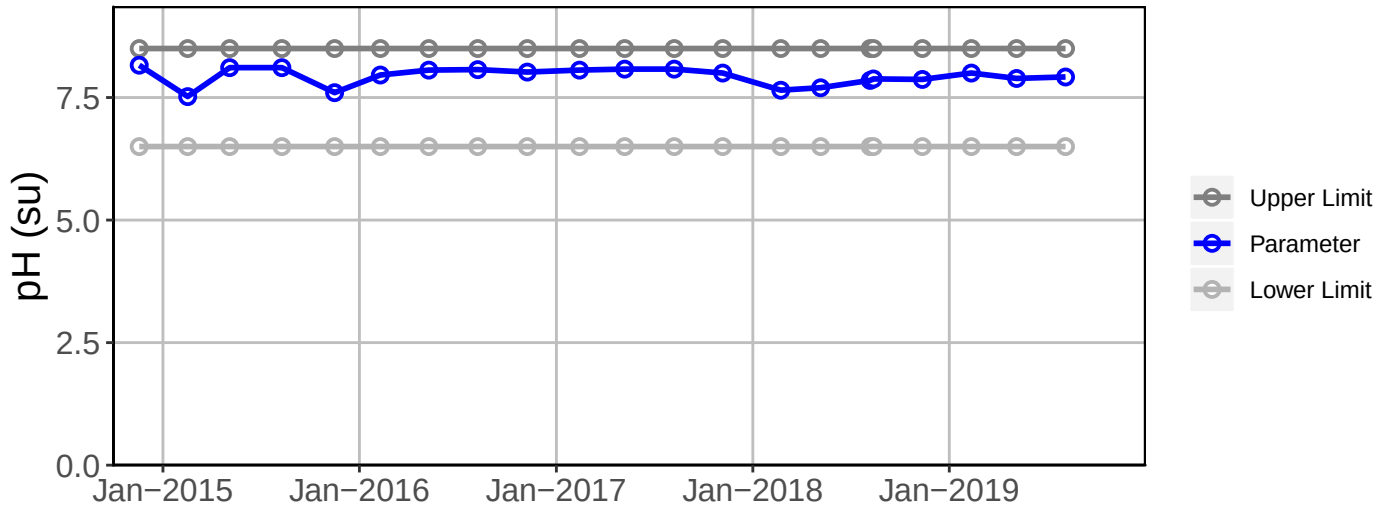
Date Range: 10/01/2018 to 09/30/2019

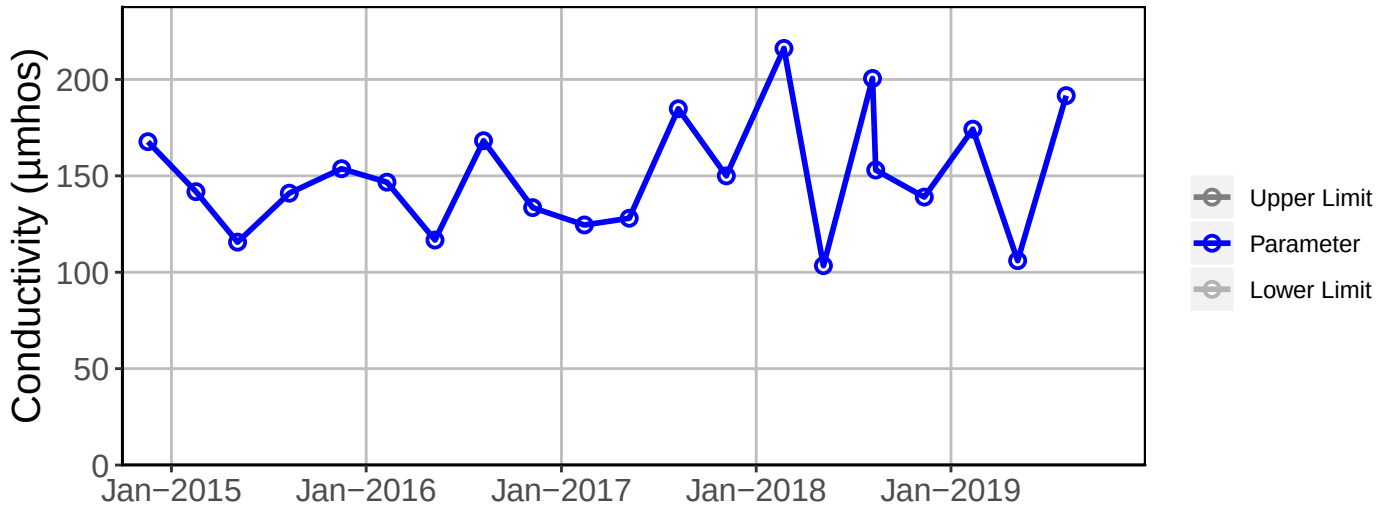
Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
049FMS	12-Nov-18	Diss. Ni-ICP/MS	0.77	µg/L	U	Field Blank Contamination
		Diss. Pb-ICP/MS	0.00593	µg/L	U	Field Blank Contamination
		Diss. Tl-ICP/MS	0.00549	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	2.19	µg/L	U	Field Blank Contamination
	11-Feb-19	Diss. Pb-ICP/MS	0.00512	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	1.7	µg/L	U	Field Blank Contamination
	6-May-19	Diss. Pb-ICP/MS	0.00552	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	1.81	µg/L	U	Field Blank Contamination
	5-Aug-19	Diss. Cd-ICP/MS	0.02	µg/L	U	Field Blank Contamination
		Diss. Cu-ICP/MS	0.5	µg/L	U	Field Blank Contamination
		Diss. Pb-ICP/MS	0.00424	µg/L	U	Field Blank Contamination
		Diss. Zn-ICP/MS	1.84	µg/L	U	Field Blank Contamination
		Total Sulfate	16.50	µg/L	J	Sample Receipt Temperature

Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

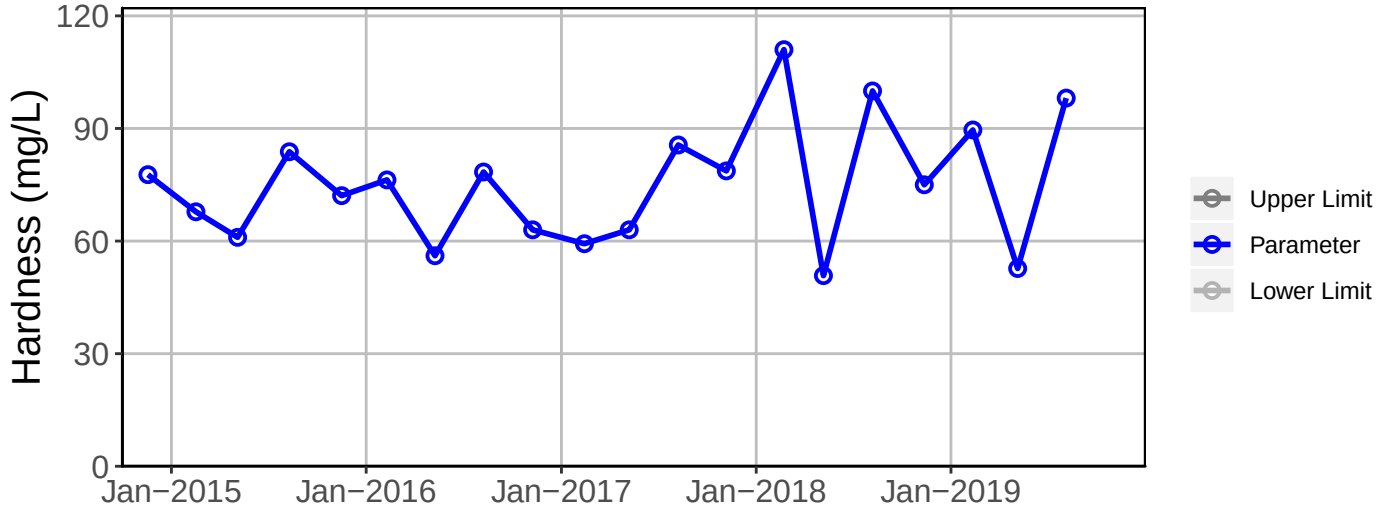
Site 49 Analyte Charts

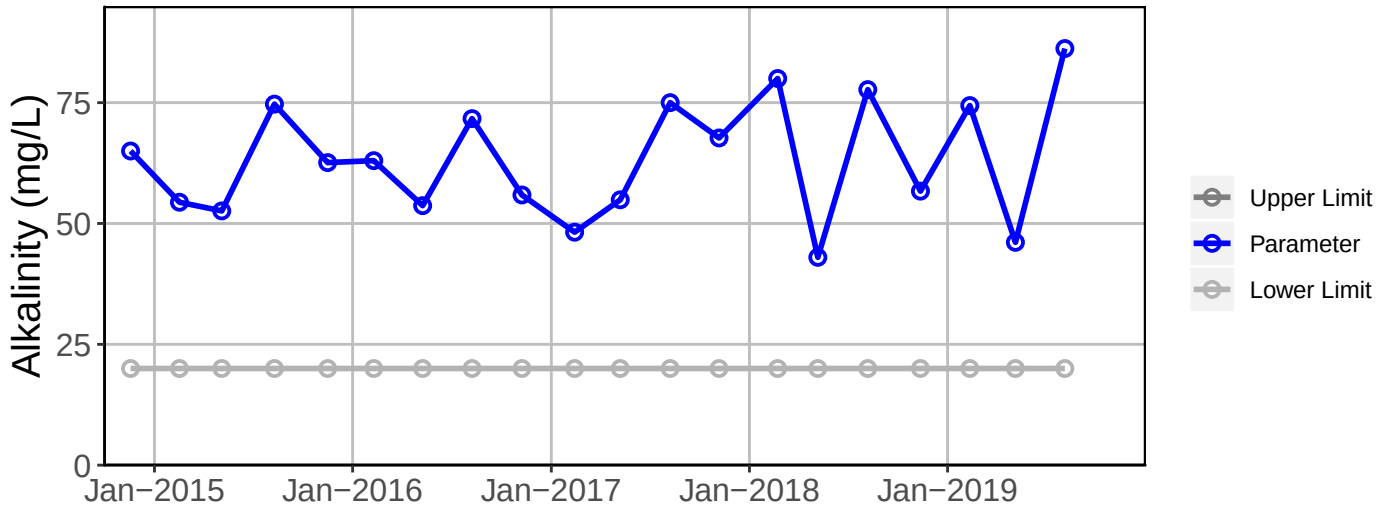


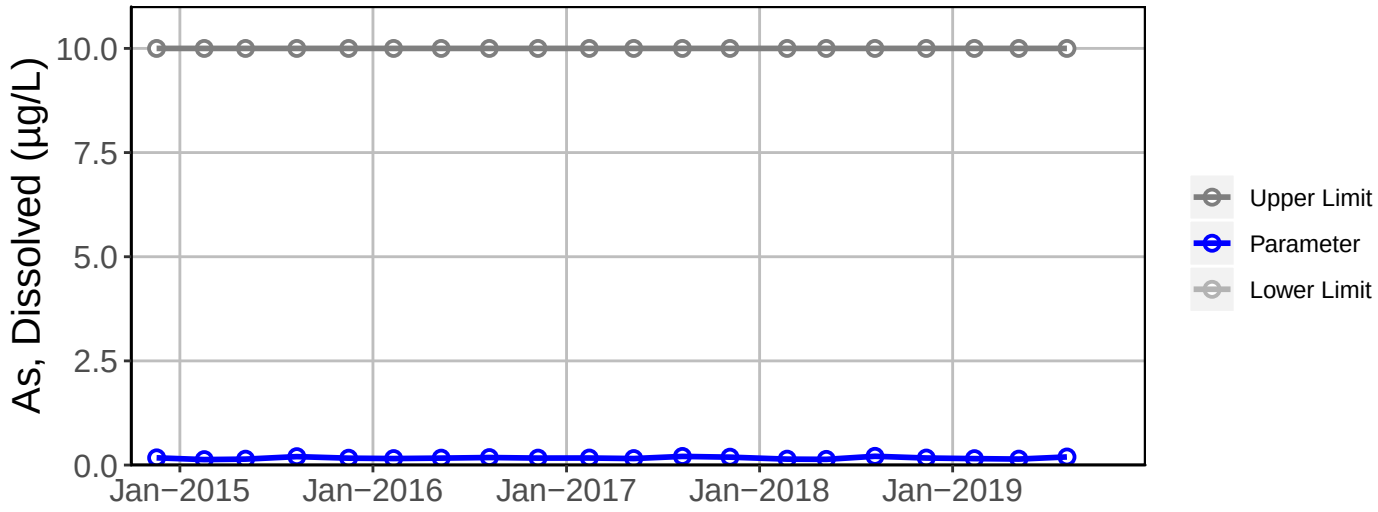




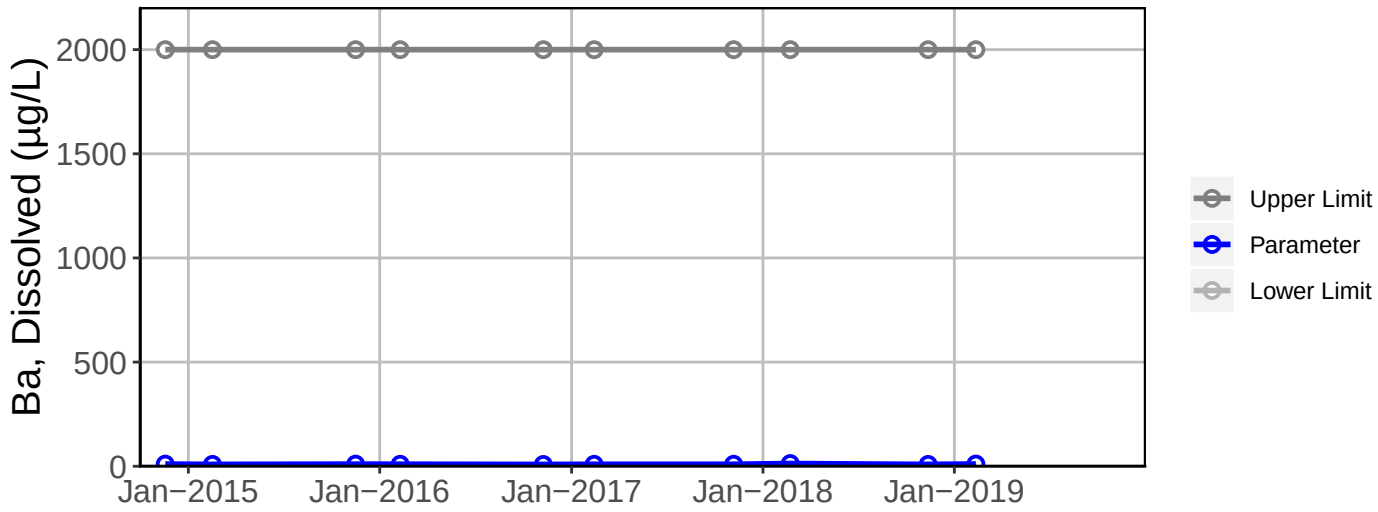
Site 49 Analyte Charts

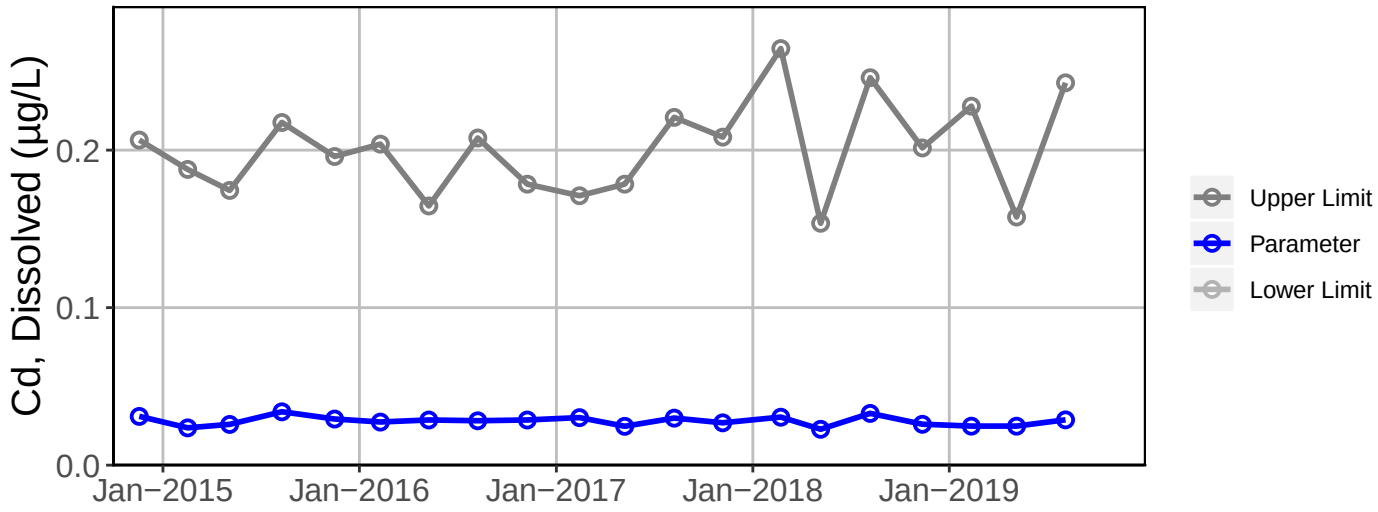


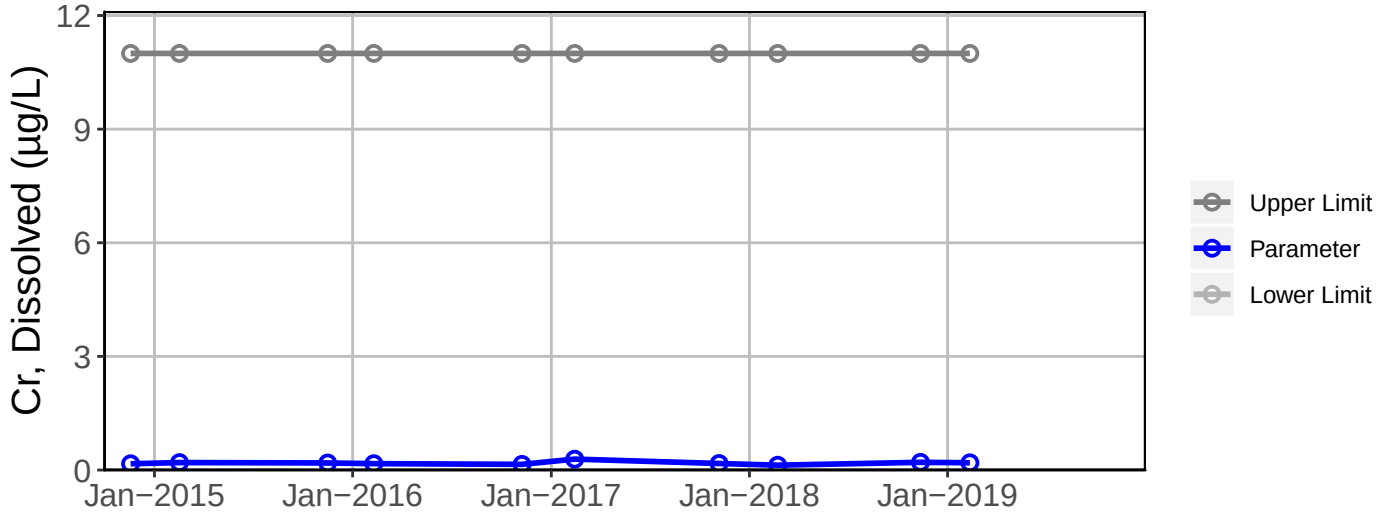




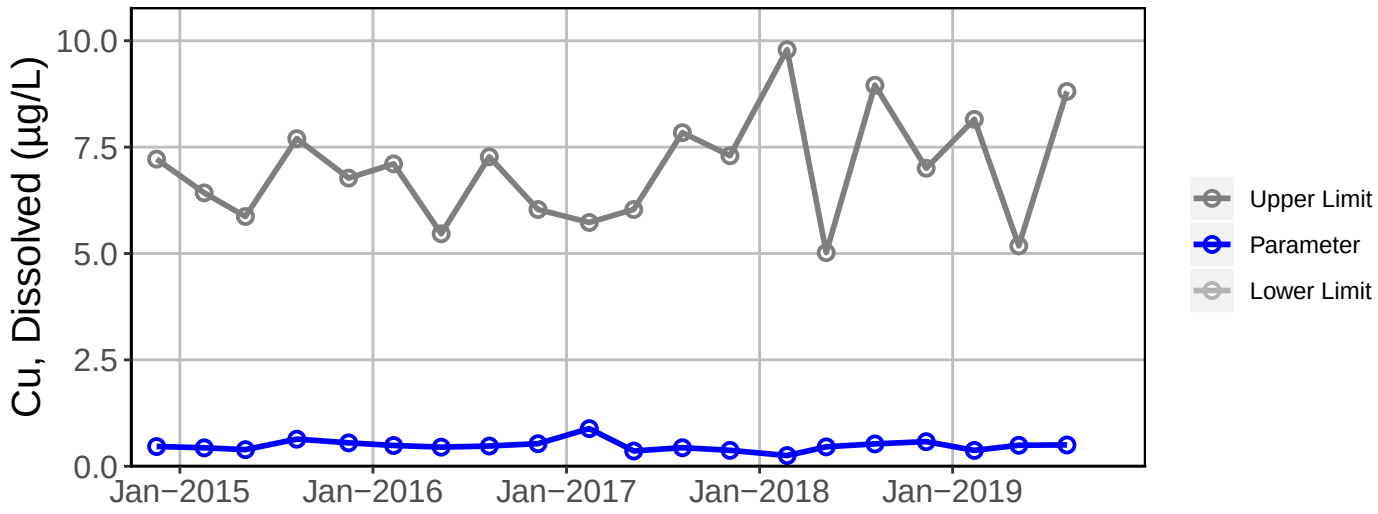
Site 49 Analyte Charts

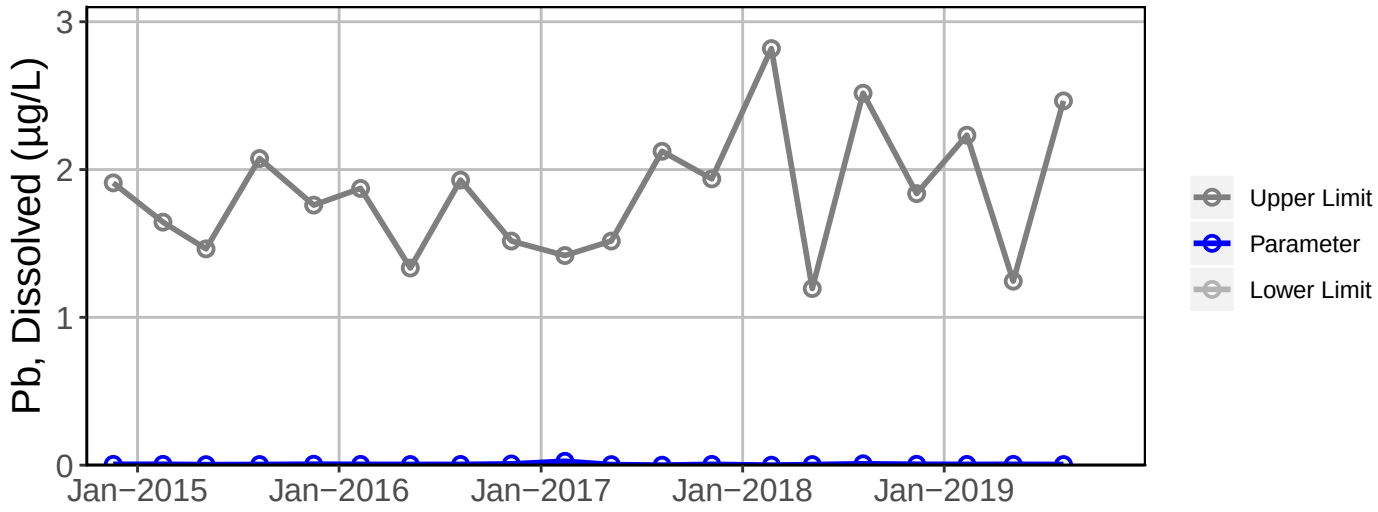


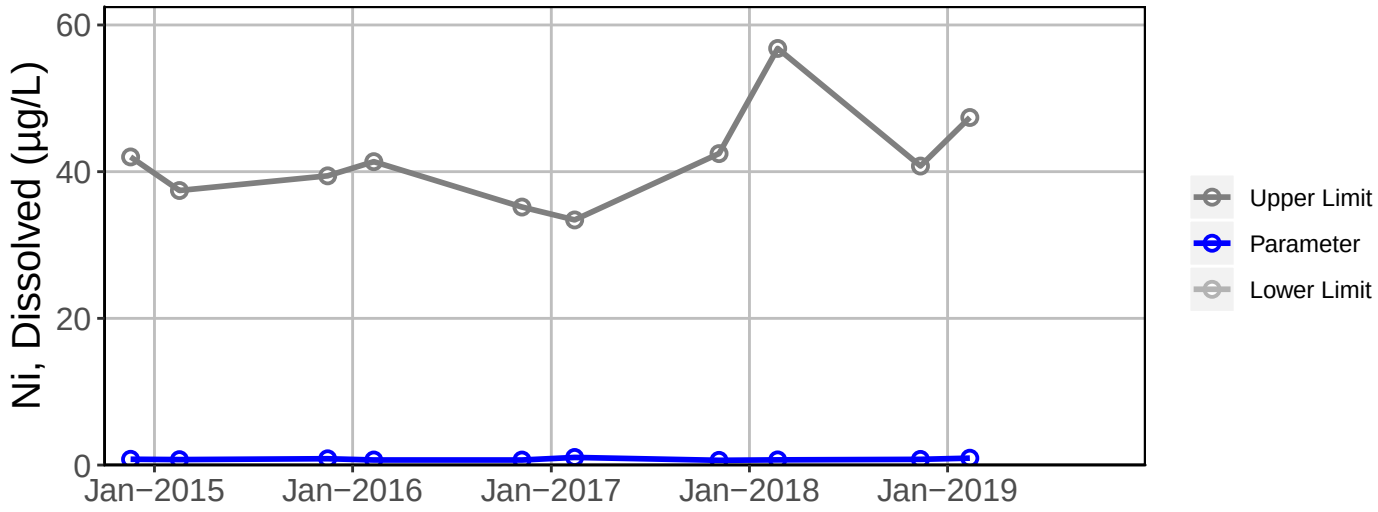




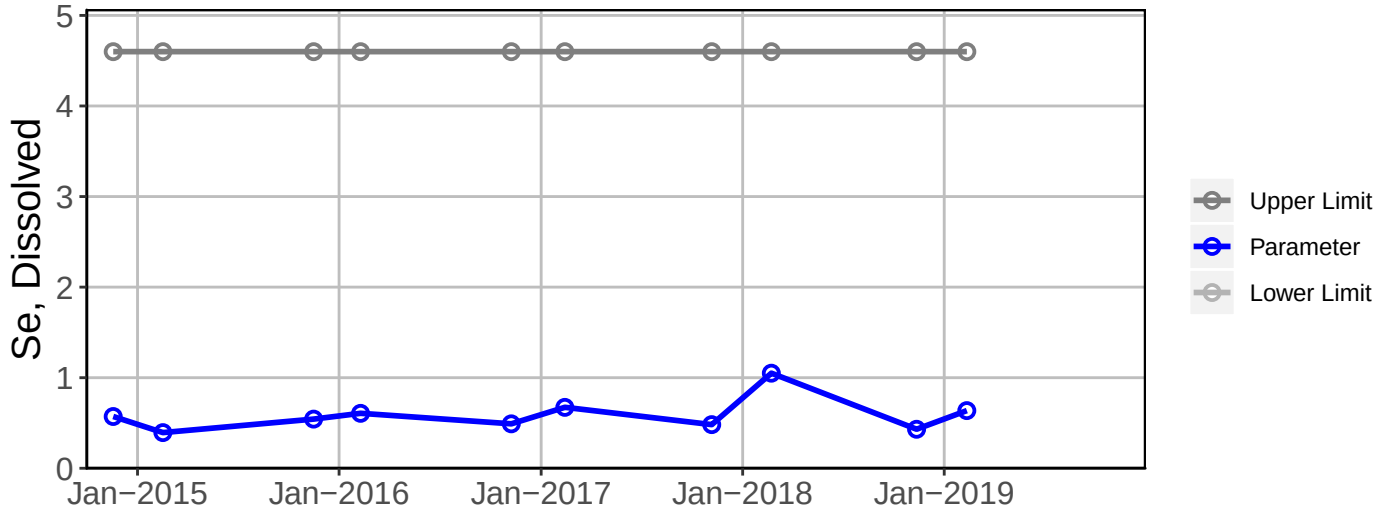
Site 49 Analyte Charts

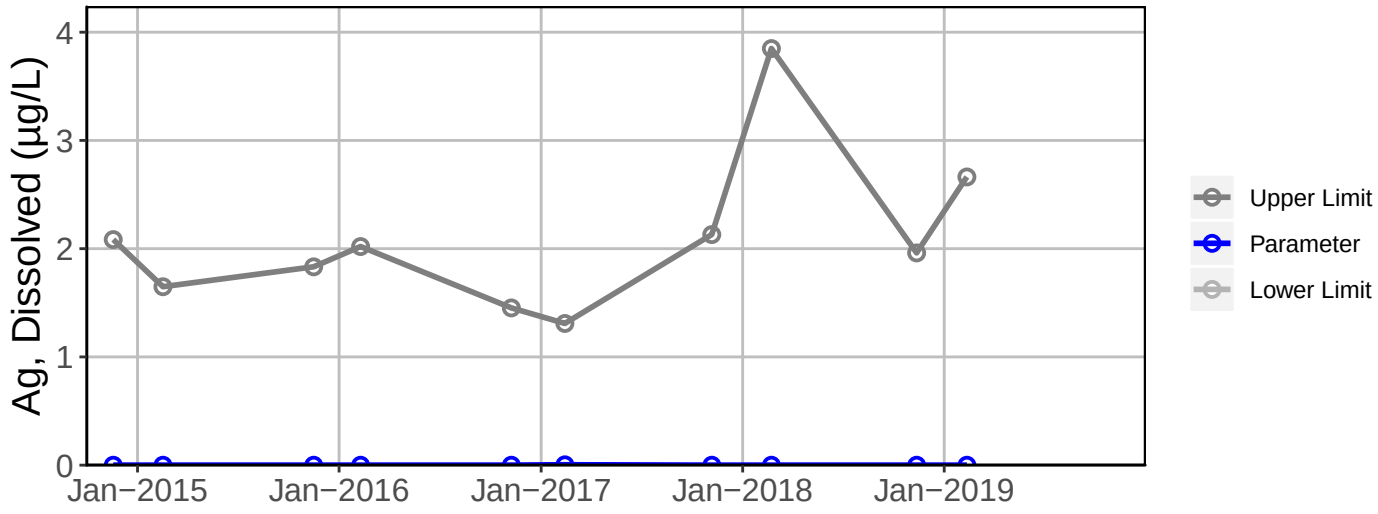


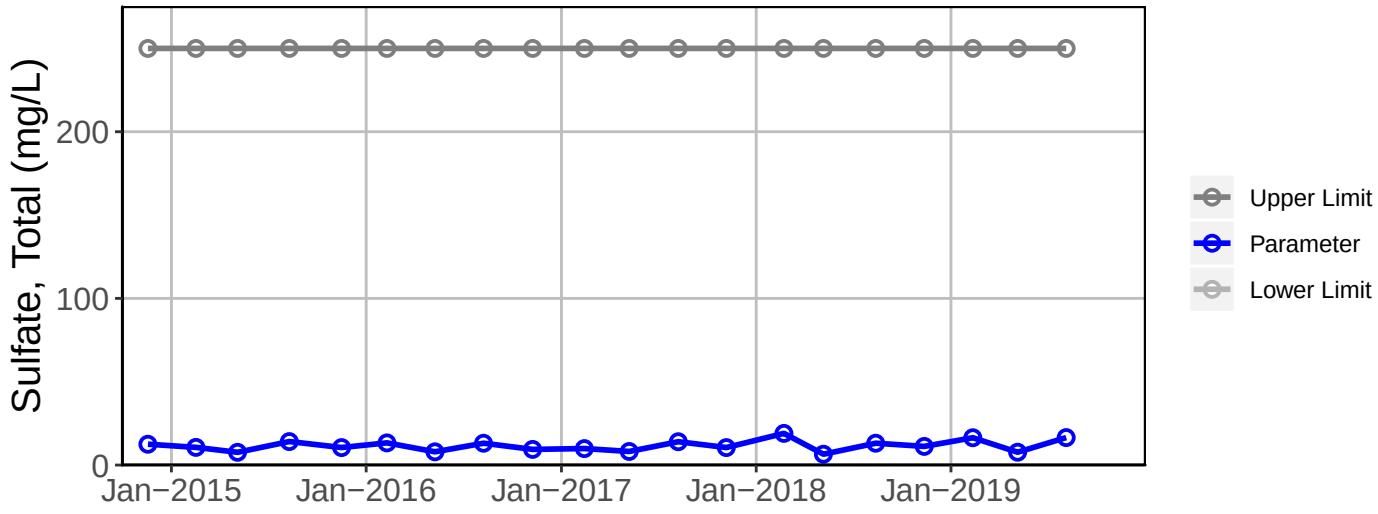




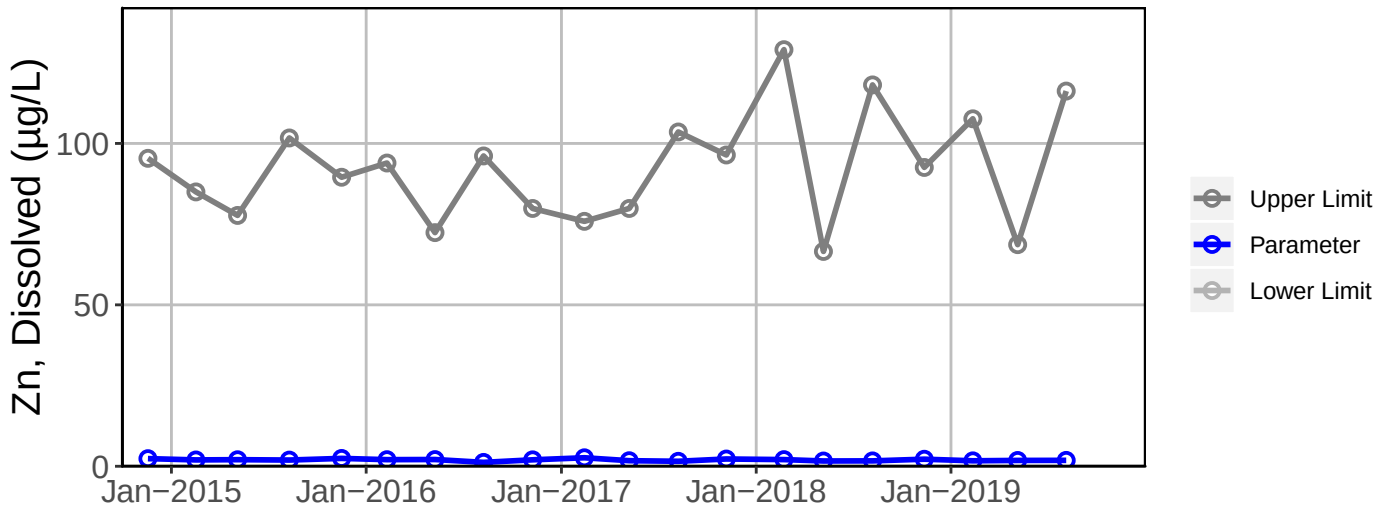
Site 49 Analyte Charts







Site 49 Analyte Charts



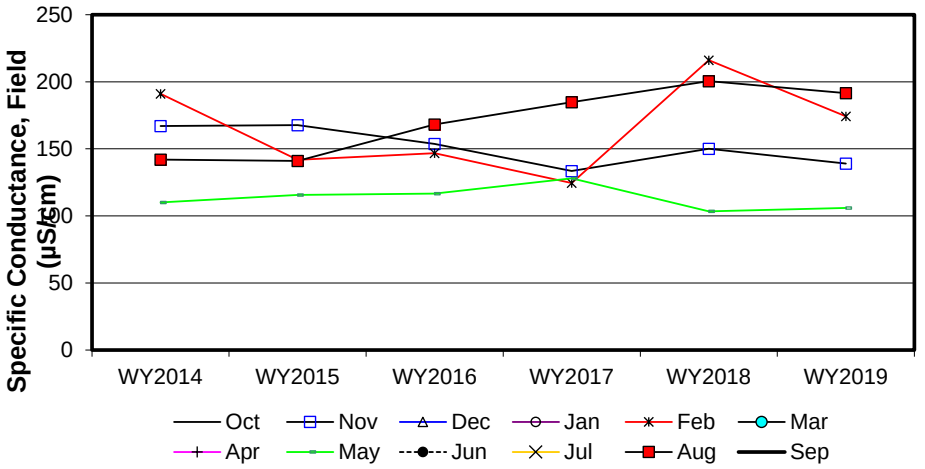
Site #49 Seasonal Kendall analysis for Specific Conductance, Field (µS/cm)

Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		167.0			191.0			110.0			142.0	
b	**WY2015**		167.7			141.8			115.6			141.0	
c	**WY2016**		153.7			146.7			116.7			168.2	
d	**WY2017**		133.5			124.5			128.0			184.8	
e	**WY2018**		150.0			216.1			103.4			200.5	
f	**WY2019**		139.0			174.2			106.0			191.6	
	n	0	6	0	0	6	0	0	6	0	0	6	0
	t_1	0	6	0	0	6	0	0	6	0	0	6	0
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		1			-1			1			-1	
	c-a		-1			-1			1			1	
	d-a		-1			-1			1			1	
	e-a		-1			1			-1			1	
	f-a		-1			-1			-1			1	
	c-b		-1			1			1			1	
	d-b		-1			-1			1			1	
	e-b		-1			1			-1			1	
	f-b		-1			1			-1			1	
	d-c		-1			-1			1			1	
	e-c		-1			1			-1			1	
	f-c		-1			1			-1			1	
	e-d		1			1			-1			1	
	f-d		1			1			-1			1	
	f-e		-1			-1			1			-1	
	S_k	0	-9	0	0	1	0	0	-1	0	0	11	0
	σ^2_S=		28.33			28.33			28.33			28.33	
	$Z_k = S_k/\sigma_S$		-1.69			0.19			-0.19			2.07	
	Z^2_k		2.86			0.04			0.04			4.27	

ΣZ_k=	0.38	Tie Extent	t_1	t_2	t_3	t_4	t_5
ΣZ^2_k=	7.20	Count	24	0	0	0	0
Z-bar=ΣZ_k/K=	0.09						

Σn	24				
ΣS_k	2				

$\chi^2_h = \Sigma Z^2_k - K(\text{Z-bar})^2$=	7.16	@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity	
	p **0.067**			$\chi^2_h < \chi^2_{(K-1)}$	ACCEPT
ΣVAR(S_k)	Z_{calc} 0.09	@α/2=2.5% Z=	1.96	**H_0** (No trend)	ACCEPT
113.33	**p** **0.537**			**H_A** (± trend)	REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-6.19	**0.90**	8.51
0.050	-4.21		6.15
0.100	-3.53		5.48
0.200	-2.11		3.37

Site #49 Seasonal Kendall analysis for pH, Field, Standard Units

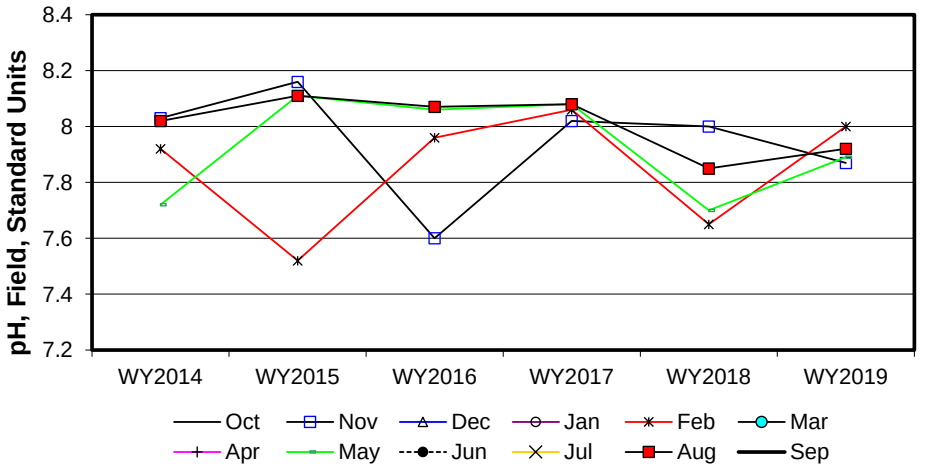
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		8.0			7.9			7.7			8.0	
b	**WY2015**		8.2			7.5			8.1			8.1	
c	**WY2016**		7.6			8.0			8.1			8.1	
d	**WY2017**		8.0			8.1			8.1			8.1	
e	**WY2018**		8.0			7.7			7.7			7.9	
f	**WY2019**		7.9			8.0			7.9			7.9	
	n	0	6	0	0	6	0	0	6	0	0	6	0
	t_1	0	6	0	0	6	0	0	6	0	0	6	0
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		1			-1			1			1	
	c-a		-1			1			1			1	
	d-a		-1			1			1			1	
	e-a		-1			-1			-1			-1	
	f-a		-1			1			1			-1	
	c-b		-1			1			-1			-1	
	d-b		-1			1			-1			-1	
	e-b		-1			1			-1			-1	
	f-b		-1			1			-1			-1	
	d-c		1			1			1			1	
	e-c		1			-1			-1			-1	
	f-c		1			1			-1			-1	
	e-d		-1			-1			-1			-1	
	f-d		-1			-1			-1			-1	
	f-e		-1			1			1			1	
	S_k	0	-7	0	0	5	0	0	-3	0	0	-5	0
	σ^2_S=		28.33			28.33			28.33			28.33	
	$Z_k = S_k/\sigma_S$		-1.32			0.94			-0.56			-0.94	
	Z^2_k		1.73			0.88			0.32			0.88	

ΣZ_k= -1.88
ΣZ^2_k= 3.81
Z-bar=$\Sigma Z_k/K$= -0.47

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	24	0	0	0	0

Σn 24
ΣS_k -10

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	2.93		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.403**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	-0.85	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
113.33	**p**	**0.199**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.07	**-0.02**	0.03
0.050	-0.05		0.02
0.100	-0.05		0.01
0.200	-0.04		0.00

Site #49 Seasonal Kendall analysis for Total Alk, (mg/l)

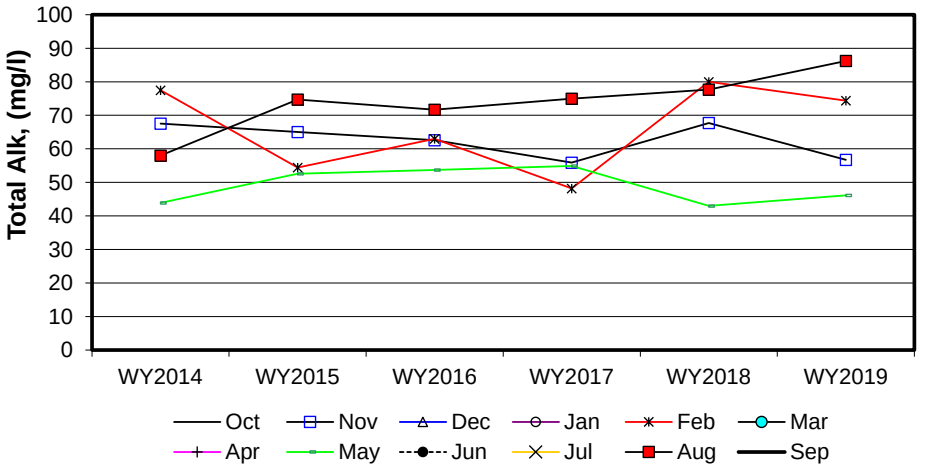
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		67.5			77.5			43.9			58.0	
b	**WY2015**		65.0			54.4			52.6			74.7	
c	**WY2016**		62.6			63.0			53.7			71.7	
d	**WY2017**		55.9			48.2			54.9			75.0	
e	**WY2018**		67.7			80.0			43.0			77.7	
f	**WY2019**		56.7			74.4			46.1			86.2	
	n	0	6	0	0	6	0	0	6	0	0	6	0
	t_1	0	6	0	0	6	0	0	6	0	0	6	0
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1			-1			1			1	
	c-a		-1			-1			1			1	
	d-a		-1			-1			1			1	
	e-a		1			1			-1			1	
	f-a		-1			-1			1			1	
	c-b		-1			1			1			-1	
	d-b		-1			-1			1			1	
	e-b		1			1			-1			1	
	f-b		-1			1			-1			1	
	d-c		-1			-1			1			1	
	e-c		1			1			-1			1	
	f-c		-1			1			-1			1	
	e-d		1			1			-1			1	
	f-d		1			1			-1			1	
	f-e		-1			-1			1			1	
	S_k	0	-5	0	0	1	0	0	1	0	0	13	0
	σ^2_S=		28.33			28.33			28.33			28.33	
	$Z_k = S_k/\sigma_S$		-0.94			0.19			0.19			2.44	
	Z^2_k		0.88			0.04			0.04			5.96	

ΣZ_k= 1.88
ΣZ^2_k= 6.92
Z-bar=$\Sigma Z_k/K$= 0.47

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	24	0	0	0	0

Σn 24
ΣS_k 10

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	6.04	@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity	
p	**0.110**			$\chi^2_h<\chi^2_{(K-1)}$	ACCEPT
$\Sigma VAR(S_k)$	Z_{calc} 0.85	@α/2=2.5% Z=	1.96	**H_0** (No trend)	ACCEPT
113.33	**p** **0.801**			**H_A** (± trend)	REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-2.47	**0.76**	3.72
0.050	-2.05		2.97
0.100	-1.45		2.67
0.200	-0.08		1.17

Site #49 Seasonal Kendall analysis for Sulfate, Total (mg/l)

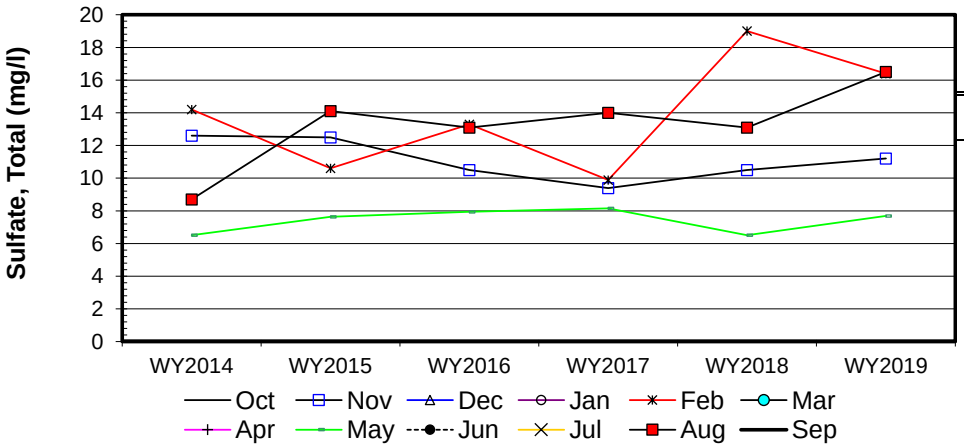
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		12.6			14.2			6.5			8.7	
b	**WY2015**		12.5			10.6			7.6			14.1	
c	**WY2016**		10.5			13.3			7.9			13.1	
d	**WY2017**		9.4			9.9			8.2			14.0	
e	**WY2018**		10.5			19.0			6.5			13.1	
f	**WY2019**		11.2			16.4			7.7			16.5	
	n	0	6	0	0	6	0	0	6	0	0	6	0
	t_1	0	4	0	0	6	0	0	4	0	0	4	0
	t_2	0	1	0	0	0	0	0	1	0	0	1	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1			-1			1			1	
	c-a		-1			-1			1			1	
	d-a		-1			-1			1			1	
	e-a		-1			1			0			1	
	f-a		-1			1			1			1	
	c-b		-1			1			1			-1	
	d-b		-1			-1			1			-1	
	e-b		-1			1			-1			-1	
	f-b		-1			1			1			1	
	d-c		-1			-1			1			1	
	e-c		0			1			-1			0	
	f-c		1			1			-1			1	
	e-d		1			1			-1			-1	
	f-d		1			1			-1			1	
	f-e		1			-1			1			1	
	S_k	0	-6	0	0	3	0	0	4	0	0	6	0
	σ^2_S=		27.33			28.33			27.33			27.33	
	$Z_k = S_k/\sigma_S$		-1.15			0.56			0.77			1.15	
	Z^2_k		1.32			0.32			0.59			1.32	

ΣZ_k=	1.33
ΣZ^2_k=	3.54
Z-bar=$\Sigma Z_k/K$=	0.33

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	18	3	0	0	0

Σn	24
ΣS_k	7

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	3.10	@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity	
	p **0.377**			$\chi^2_h<\chi^2_{(K-1)}$	ACCEPT
$\Sigma VAR(S_k)$	Z_{calc} 0.57	@α=2.5% Z=	1.96	**H_0** (No trend)	ACCEPT
110.33	**p** **0.716**			**H_A** (± trend)	REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.36	**0.22**	1.05
0.050	-0.26		0.71
0.100	-0.10		0.59
0.200	-0.02		0.36

Site #49 Seasonal Kendall analysis for Zinc, Dissolved (ug/l)

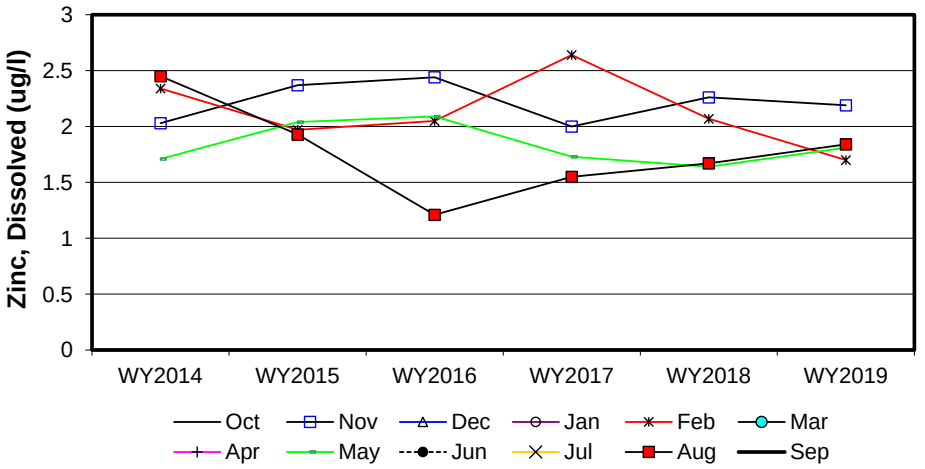
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		2.0			2.3			1.7			2.5	
b	**WY2015**		2.4			2.0			2.0			1.9	
c	**WY2016**		2.4			2.1			2.1			1.2	
d	**WY2017**		2.0			2.6			1.7			1.6	
e	**WY2018**		2.3			2.1			1.6			1.7	
f	**WY2019**		2.2			1.7			1.8			1.8	
	n	0	6	0	0	6	0	0	6	0	0	6	0
	t_1	0	6	0	0	6	0	0	6	0	0	6	0
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		1			-1			1			-1	
	c-a		1			-1			1			-1	
	d-a		-1			1			1			-1	
	e-a		1			-1			-1			-1	
	f-a		1			-1			1			-1	
	c-b		1			1			1			-1	
	d-b		-1			1			-1			-1	
	e-b		-1			1			-1			-1	
	f-b		-1			-1			-1			-1	
	d-c		-1			1			-1			1	
	e-c		-1			1			-1			1	
	f-c		-1			-1			-1			1	
	e-d		1			-1			-1			1	
	f-d		1			-1			1			1	
	f-e		-1			-1			1			1	
	S_k	0	-1	0	0	-3	0	0	-1	0	0	-3	0
	σ^2_S=		28.33			28.33			28.33			28.33	
	$Z_k = S_k/\sigma_S$		-0.19			-0.56			-0.19			-0.56	
	Z^2_k		0.04			0.32			0.04			0.32	

ΣZ_k= -1.50
ΣZ^2_k= 0.71
Z-bar=$\Sigma Z_k/K$= -0.38

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	24	0	0	0	0

Σn 24
ΣS_k -8

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	0.14		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.986**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	-0.66	@α/2=2.5% **Z**=	1.96	**H_0** (No trend) ACCEPT
113.33	**p**	**0.255**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.13	**-0.04**	0.06
0.050	-0.09		0.03
0.100	-0.09		0.02
0.200	-0.08		0.00

INTERPRETIVE REPORT
SITE 46

The data collected during the current water year are listed in the following "Table of Results for Water Year 2019" report. The table includes all the required FWMP analyte data (field and laboratory) collected for the current water year and a series of flags keyed to the summary report "Qualified Data by QA Reviewer." The QA report lists any associated data limitations found during the monthly QA reviews of laboratory data for this site. Median values for all analytes have been calculated and are shown in the right-most column of the table of results. Any value reported as less than MDL has been replaced with a value of one-half of the MDL for the purpose of median calculation.

All data collected at this site for the past six years are included in the data analyses. As shown in the table below, there were no data outliers.

Sample Date	Parameter	Value	Qualifier	Notes
No outliers, in the past six years, have been identified by HGCMC.				

The data have been compared to the strictest freshwater quality criterion for each applicable analyte. No results exceeding these criteria have been identified, as listed in the table below.

Table of Exceedance for Water Year 2019

			Limits		
Sample Date	Parameter	Value	Lower	Upper	Hardness
No exceedances have been identified by HGCMC for the period of October 2018 through September 2019.					

X-Y plots have been generated to graphically present the data for each of the analytes requested in the Statistical Information Goals for this site. These plots have been visually analyzed for the appearance of any trend in concentration. No visually obvious trends were identified.

A non-parametric statistical analysis for trend was performed for field conductivity, field pH, total alkalinity, total sulfate, and dissolved zinc. Calculation details of the Seasonal Kendall analyses are presented on the pages following this interpretive section. The following table summarizes the results of the data collected between Oct-13 and Sep-19 (WY2014-WY2019).

Site 46 - Table of Summary Statistics for Trend Analysis

	Mann-Kendall test statistics			Sen's slope estimate	
Parameter	**n***	**p****	**Trend**	**Q**	**Q(%)**
Conductivity Field	6	0.37			
pH Field	6	0.19			
Alkalinity, Total	6	0.72			
Sulfate, Total	6	0.67			
Zinc, Dissolved	6	0.78			

* Number of Years ** Significance level

For datasets with a statistically significant trend ($\alpha/2$=2.5%), a Seasonal-Sen's Slope estimate statistic has also been calculated. There were no statistically significant trends identified at Site 46 during the reporting period.

Analytical results from Site 46 were analyzed using combined Shewhart-CUSUM charts. The Shewhart-CUSUM is a sequential analysis technique to determine changes in a variable. For a detailed explanation of the Shewhart-CUSUM calculations, see the corresponding section in the 2015 FWMP report.

For this year's FWMP report, the combined Shewhart-CUSUM control chart statistical analysis was carried out on the specific conductance, dissolved zinc, and total sulfate data from Site 46. In order to use the analysis, background values were calculated for each of the analytes. The first several years of sampling were chosen for these calculations, summarized in Table 1.

The visual representations of these calculations are graphed in Figure 1. All three of the analytes have previously reached the lowest control limit (SCL=2). Each of the sites were below the EPA recommend control limit of SCL=4.5. None of the analyses exceed the established limit of h=5 (dotted red lines). In order for a process to be considered 'out of control,' both metrics (Shewhart & CUSUM) need to be 'out of control.' Note (Figure 1) that none of the analytes went out of control during the monitoring period. This supports the conclusion drawn in the previous FWMP reports that HGCMC activities in the Site23 / D Pile area are not having a measurable effect on Bruin Creek.

Table 1. **Specific Conductance, Dissolved Zinc, and Total Sulfate Baseline Periods, Summary Statistics and Various Control Limits**

	Site 46 Conductivity (µS/cm)	Site 46 Diss. Zinc (µg/L)	Site 46 Total Sulfate (mg/L)
Baseline Statistics			
Baseline Period	1/12/00–12/14/05	1/12/00–12/14/05	11/12/02–12/14/05
Number of Samples	58	58	33
Mean (x)	135.5	2.3	10.0
Standard Deviation	22.9	1.6	2.86
Shewhart-CUSUM Control Limits (SCL)			
Control Limit (mean x+ 2s)	181.4	5.6	15.7
Control Limit (mean x + 3s)	204.4	7.3	18.6
Control Limit (mean x + 4s)	227.3	8.9	21.5
Control Limit (mean x + 4.5s)	238.8	9.7	22.9
CUSUM Control Limits			
Cumulative increase (h)	5	5	5

Figure 1. **Observed Measurements for Specific Conductance, Dissolved Zinc, and Total Sulfate from Site 46 Compared to the Shewhart-CUSUM Control Limits From Table 2**

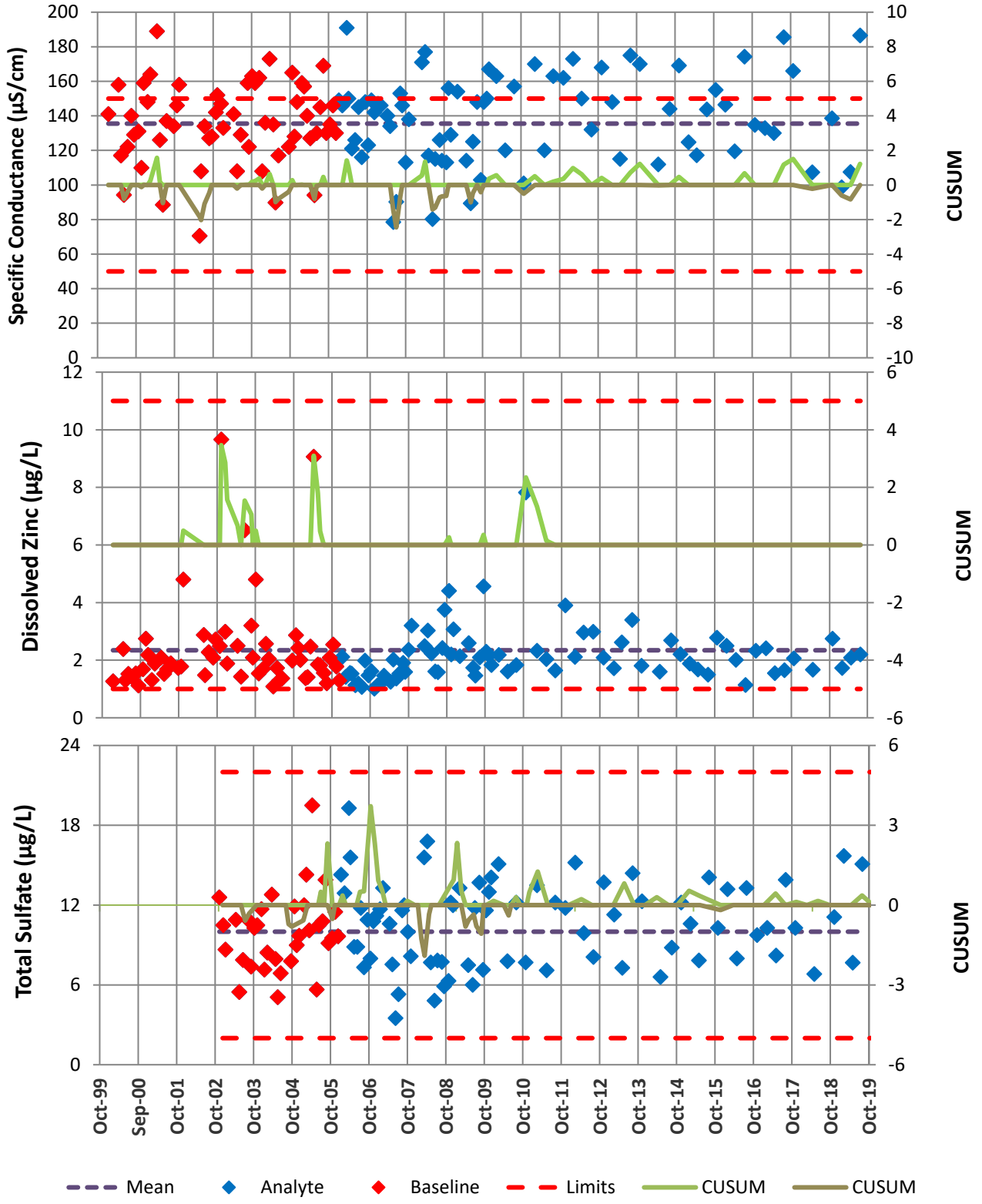


Table of Results for Water Year 2019

Site 046FMS - 'Lower Bruin Creek'

Sample Date/Parameter	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019	**Median**
Water Temp (°C)		3.8			0.2			3.9			10.6		3.9
Conductivity-Field(μmho)		138.6			98.6			107.5			186.5		123.1
Conductivity-Lab (μmho)		138			176			109			167		153
pH Lab (standard units)		6.65			6.79			6.62			6.57		6.64
pH Field (standard units)		7.8			7.95			7.9			7.27		7.85
Total Alkalinity (mg/L)		57.3			74.4			46.3			92.8		65.9
Total Sulfate (mg/L)		11.1			15.7			7.7			15.1		13.1
Hardness (mg/L)		70.8			87			53.5			92.8		78.9
Dissolved As (ug/L)		0.229			0.231			0.167			0.153		0.198
Dissolved Ba (ug/L)		10.7			11.9								11.3
Dissolved Cd (ug/L)		0.0271			0.0216			0.0208			0.04		0.0244
Dissolved Cr (ug/L)		0.21			0.238								0.224
Dissolved Cu (ug/L)		0.672			0.387			0.61			0.508		0.559
Dissolved Pb (ug/L)		0.0241			0.0041			0.0227			0.0015		0.0134
Dissolved Ni (ug/L)		0.709			0.82								0.765
Dissolved Ag (ug/L)		0.002			0.002								0.002
Dissolved Zn (ug/L)		2.75			1.73			2.09			2.2		2.15
Dissolved Se (ug/L)		0.443			0.654								0.549
Dissolved Hg (ug/L)		0.00204			0.000979			0.00162			0.000757		0.001300

For individual sample/analyte qualifier descriptions see "Qualified Data by QA Reviewer" table.

Values reported as less than MDL are replaced by 1/2 MDL for median calculation purposes.

Shaded data has been qualified as an outlier by HGCMC and removed from any further analysis and is not included into the calculation of the median

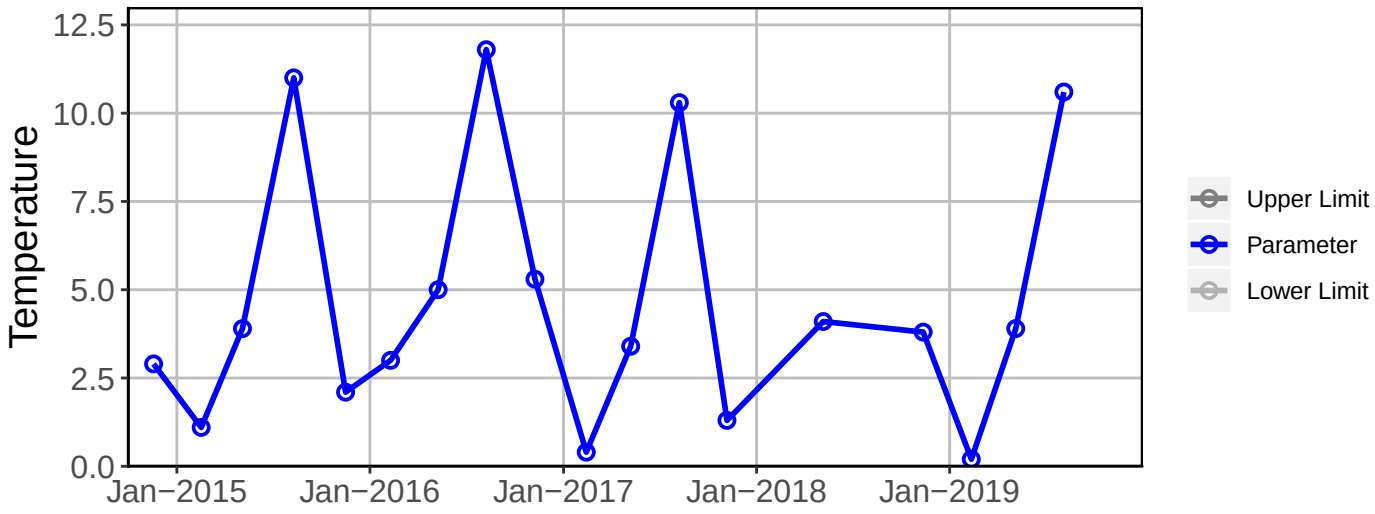
Qualified Data by QA Reviewer

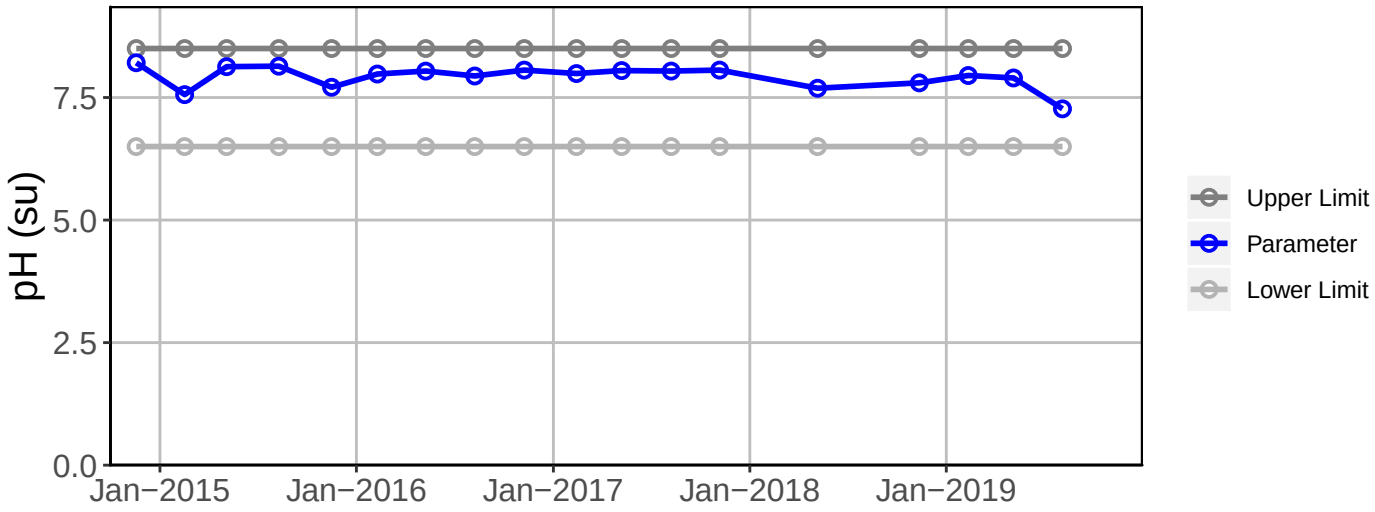
Date Range: 10/01/2018 to 09/30/2019

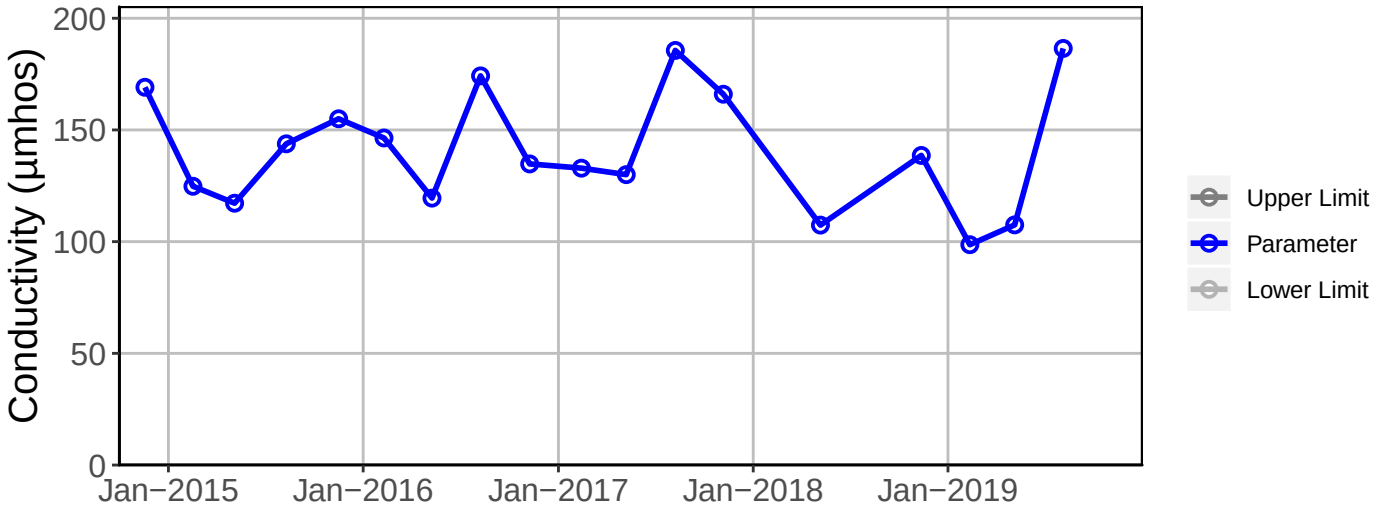
Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
046FMS	12-Nov-18	Diss. Ni-ICP/MS	0.7	µg/L	U	Field Blank Contamination
		Diss. Tl-ICP/MS	0.00577	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	2.75	µg/L	U	Field Blank Contamination
	11-Feb-19	Diss. Pb-ICP/MS	0.00411	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	1.73	µg/L	U	Field Blank Contamination
	6-May-19	Diss. Zn-ICP/MS	2.09	µg/L	U	Field Blank Contamination
	5-Aug-19	Diss. Cu-ICP/MS	0.5	µg/L	U	Field Blank Contamination
		Diss. Pb-ICP/MS	-0.0030	µg/L	U	Field Blank Contamination
		Diss. Zn-ICP/MS	2.2	µg/L	U	Field Blank Contamination
		Total Sulfate	15.10	µg/L	J	Sample Receipt Temperature

Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

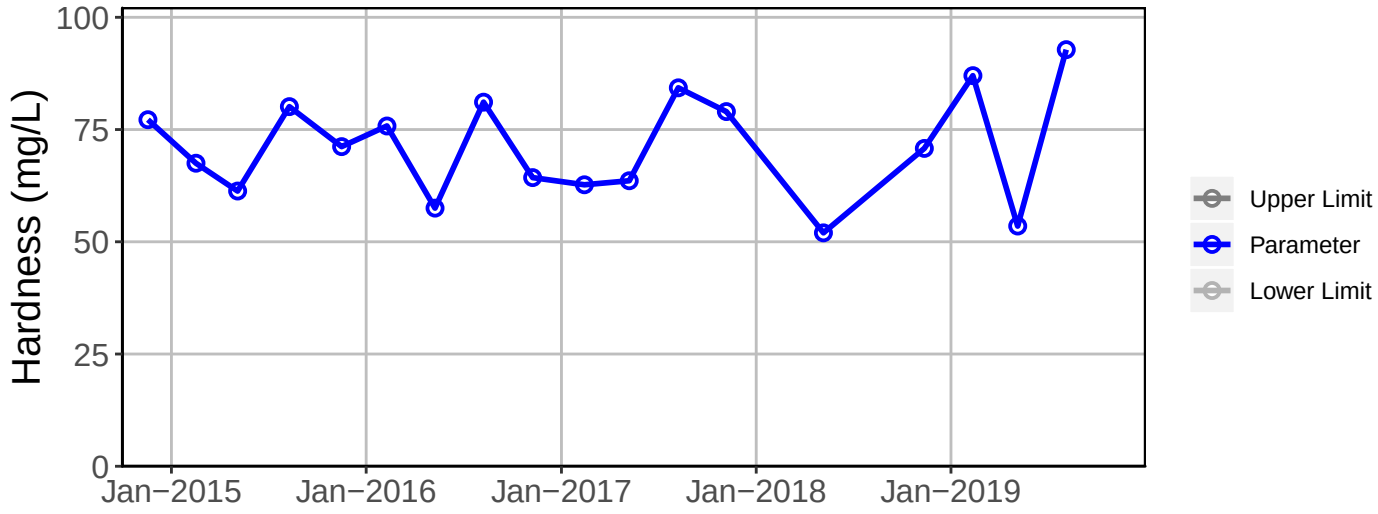
Site 46 Analyte Charts

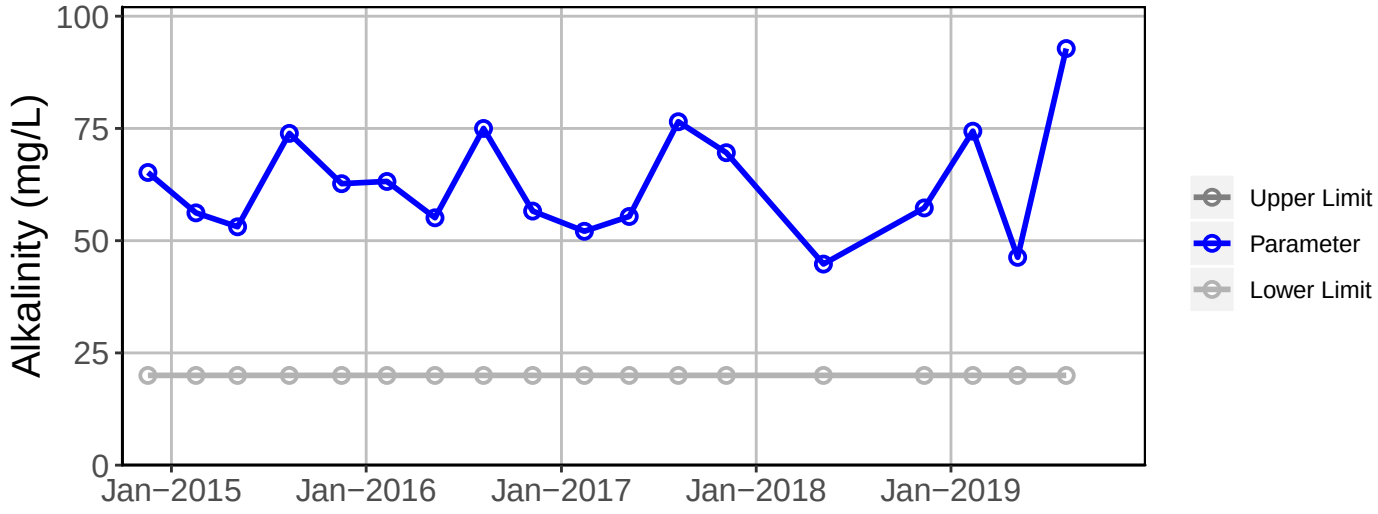


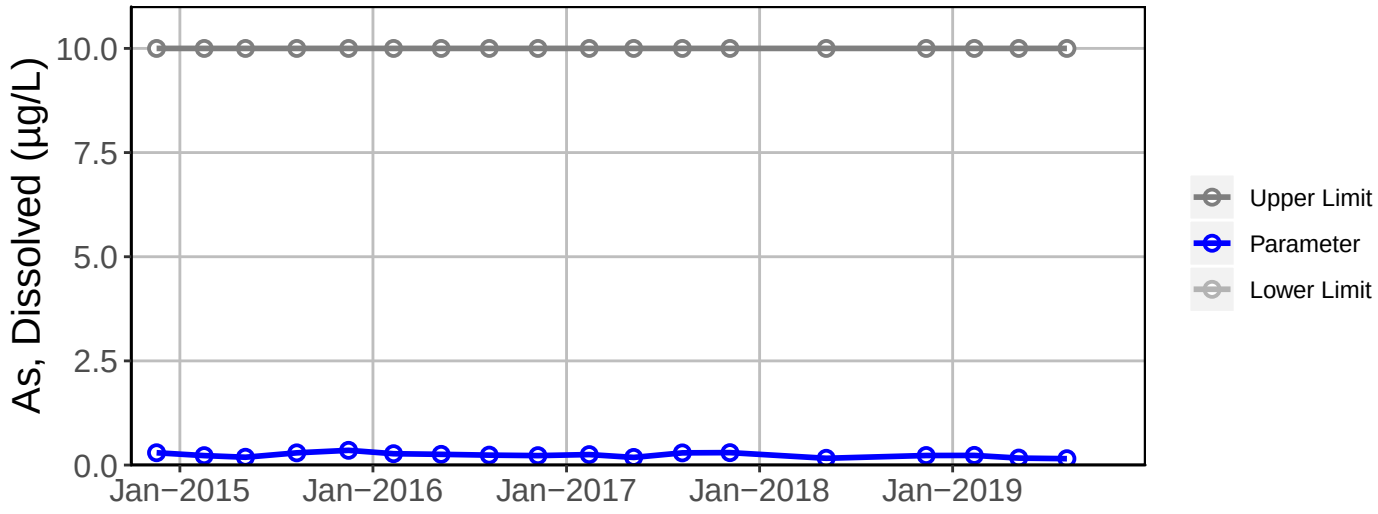




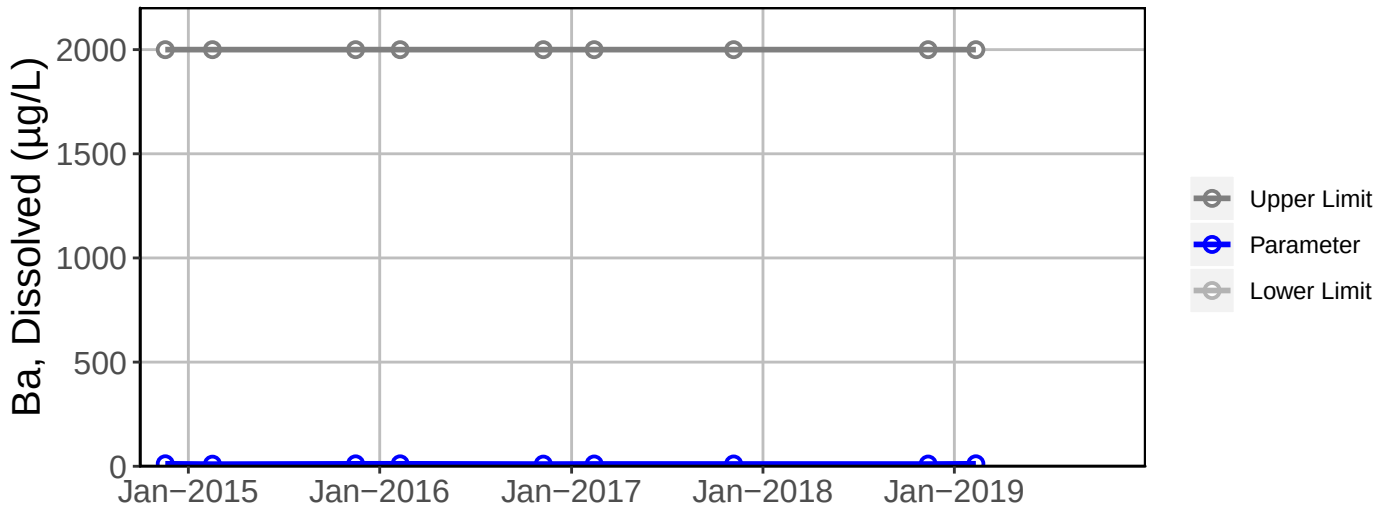
Site 46 Analyte Charts

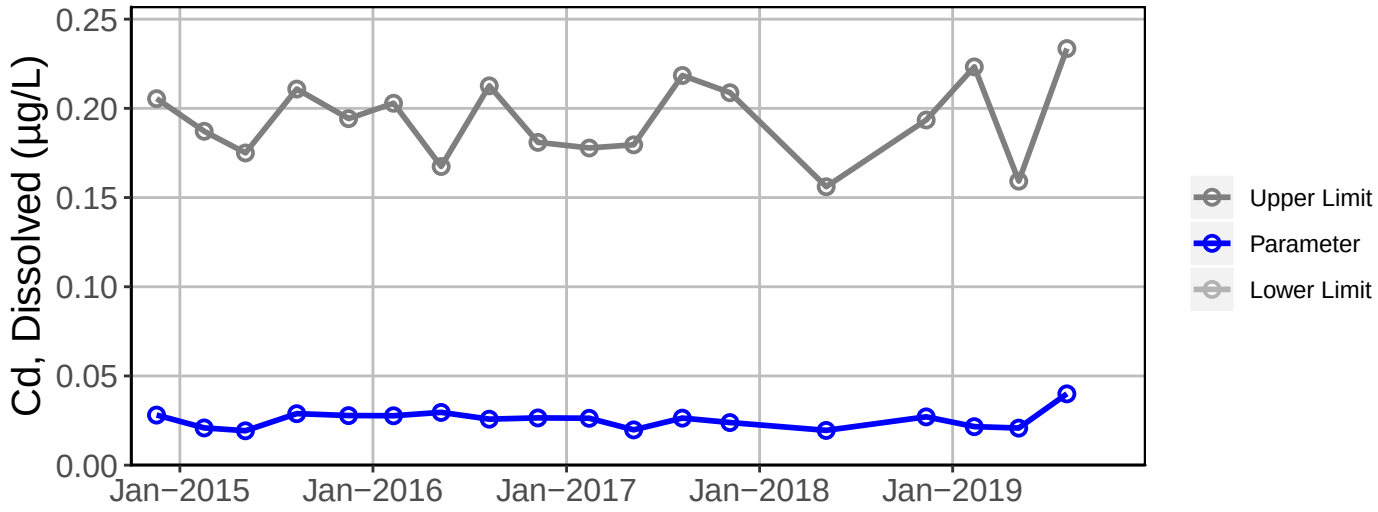


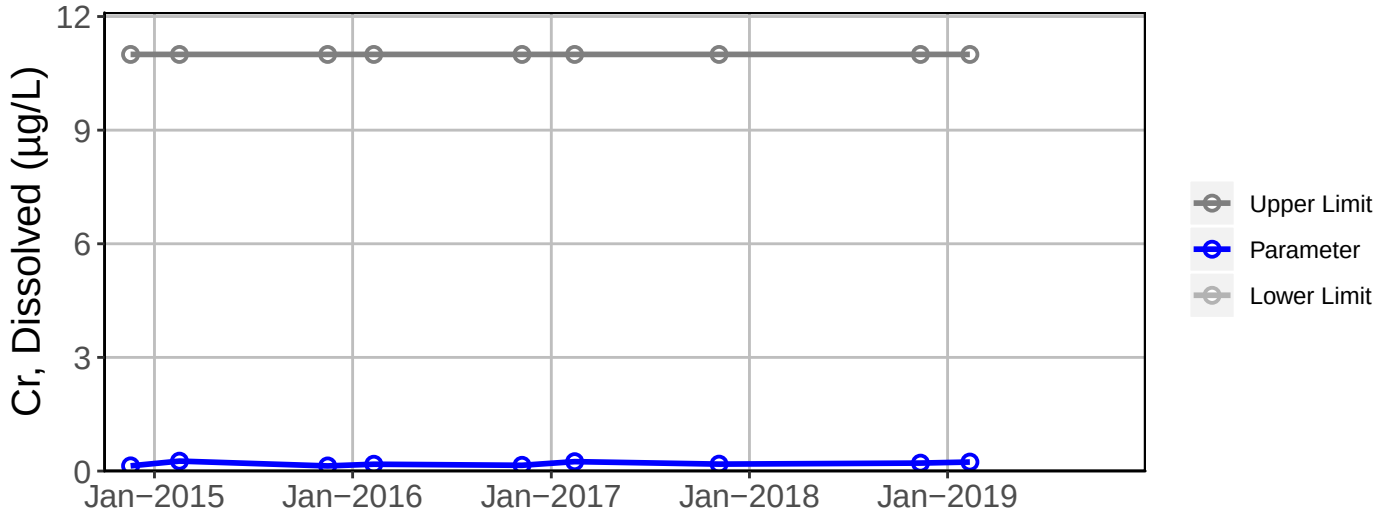




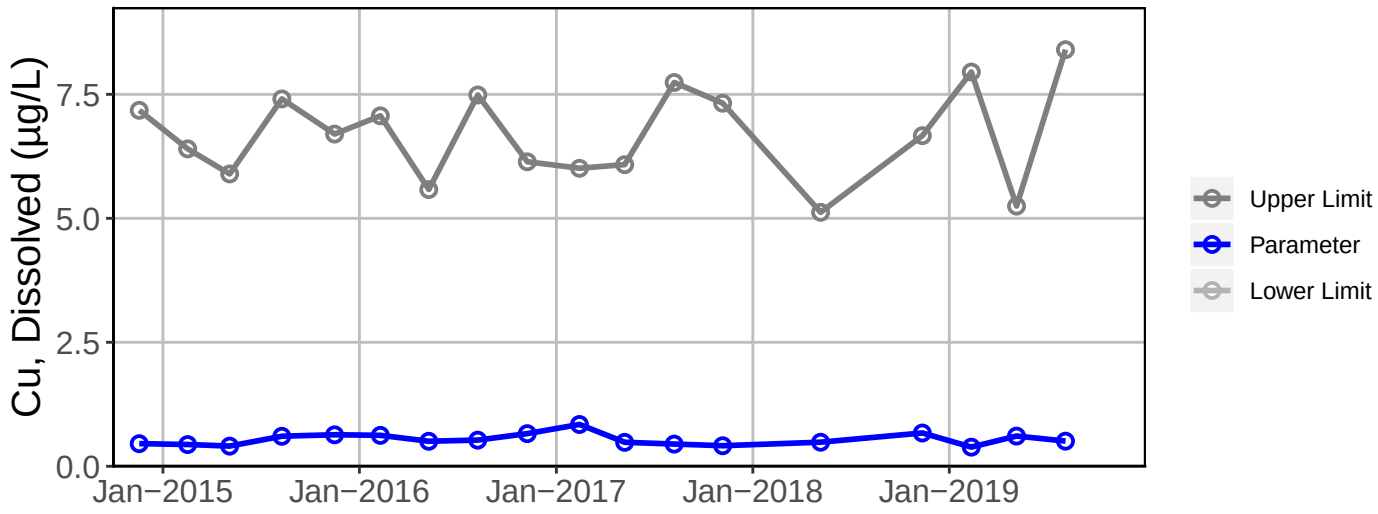
Site 46 Analyte Charts

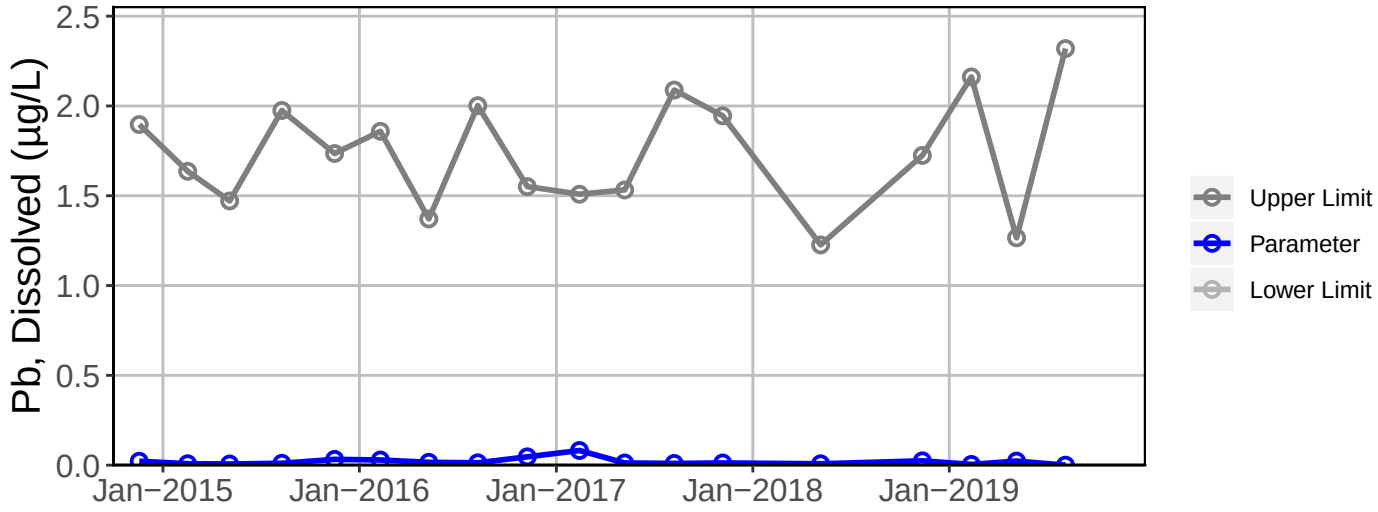


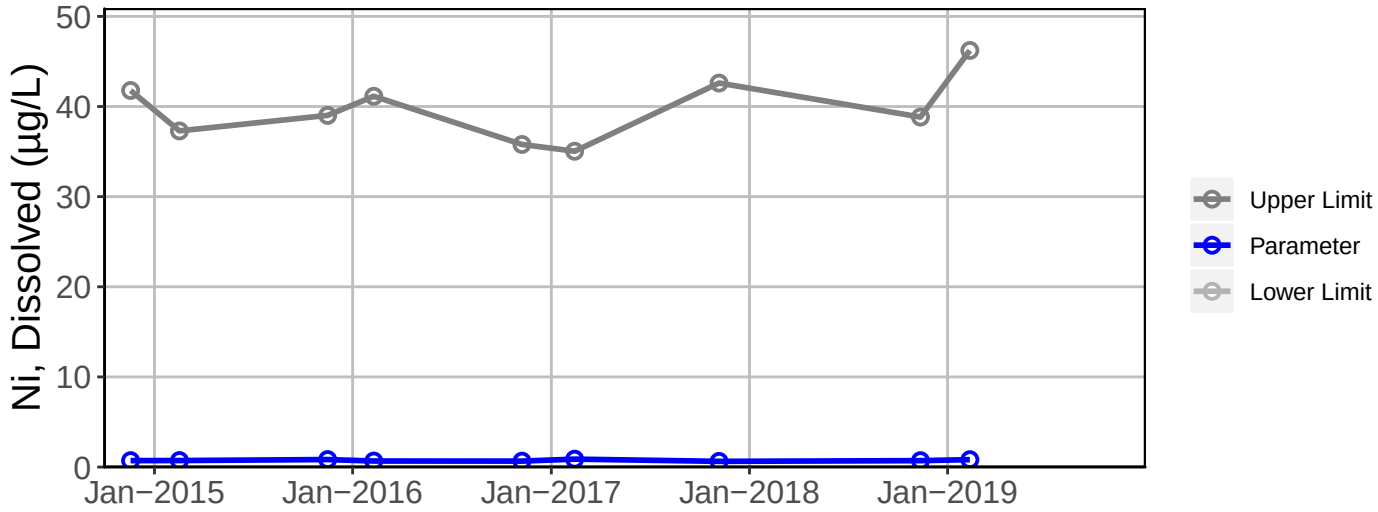




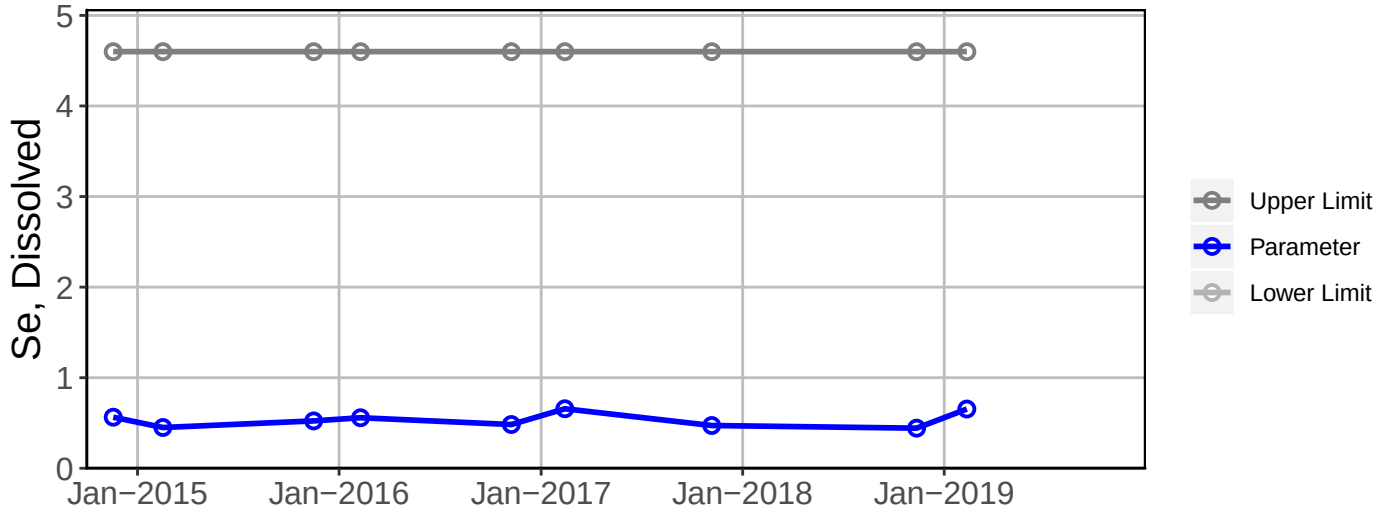
Site 46 Analyte Charts

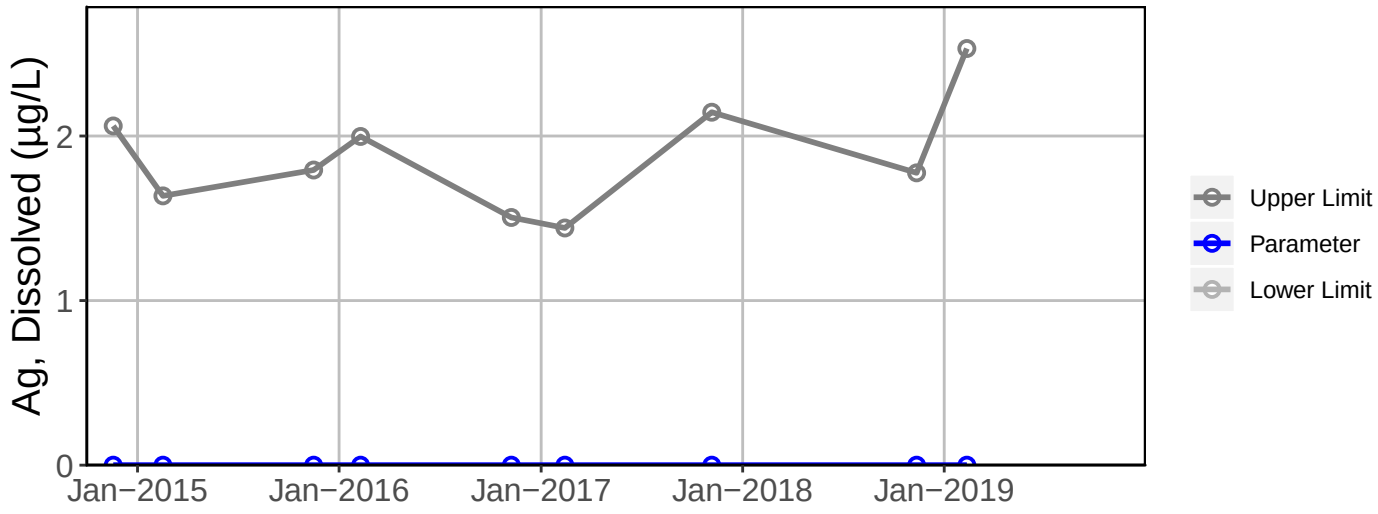


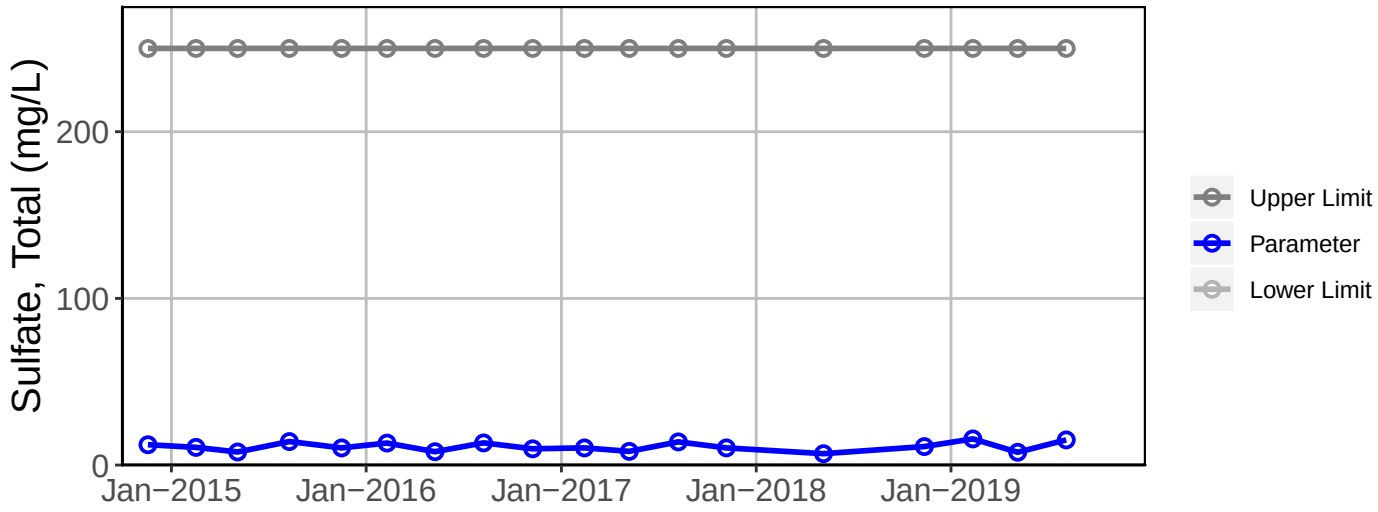




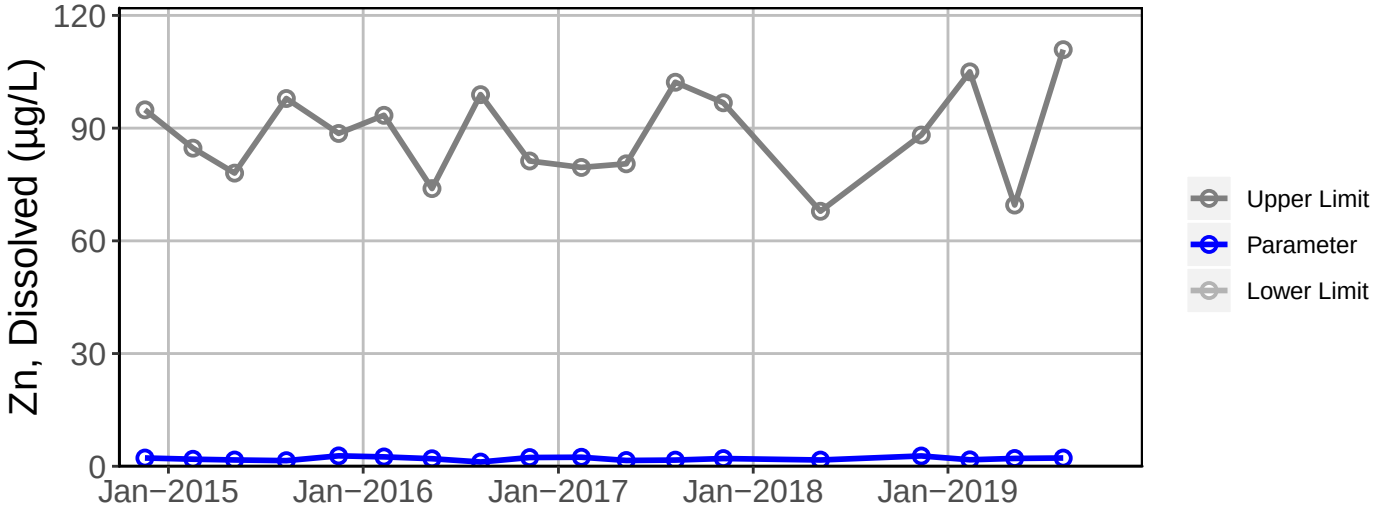
Site 46 Analyte Charts







Site 46 Analyte Charts



Site #46 Seasonal Kendall analysis for Specific Conductance, Field (µS/cm)

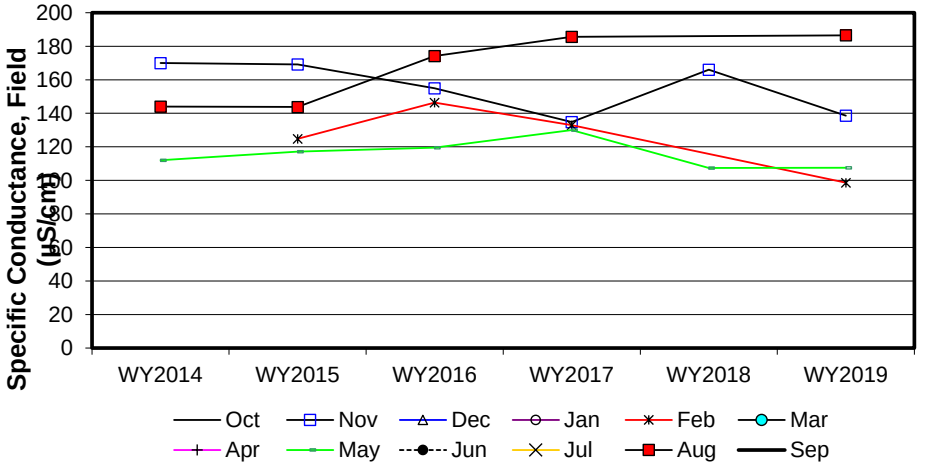
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		170.0						112.0			144.0	
b	**WY2015**		169.1			124.8			117.2			143.8	
c	**WY2016**		155.0			146.4			119.5			174.2	
d	**WY2017**		134.8			132.9			130.0			185.6	
e	**WY2018**		166.0						107.4				
f	**WY2019**		138.6			98.6			107.5			186.5	
	n	0	6	0	0	4	0	0	6	0	0	5	0
	t_1	0	6	0	0	4	0	0	6	0	0	5	0
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						1			-1	
	c-a		-1						1			1	
	d-a		-1						1			1	
	e-a		-1						-1				
	f-a		-1						-1			1	
	c-b		-1			1			1			1	
	d-b		-1			1			1			1	
	e-b		-1						-1				
	f-b		-1			-1			-1			1	
	d-c		-1			-1			1			1	
	e-c		1						-1				
	f-c		-1			-1			-1			1	
	e-d		1						-1				
	f-d		1			-1			-1			1	
	f-e		-1						1				
	S_k	0	-9	0	0	-2	0	0	-1	0	0	8	0
	σ^2_S=		28.33			8.67			28.33			16.67	
	$Z_k = S_k/\sigma_S$		-1.69			-0.68			-0.19			1.96	
	Z^2_k		2.86			0.46			0.04			3.84	

ΣZ_k= -0.60
ΣZ^2_k= 7.20
Z-bar=$\Sigma Z_k/K$= -0.15

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	21	0	0	0	0

Σn 21
ΣS_k -4

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	7.11	@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
p	**0.069**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc} -0.33	@α/2=2.5% **Z**=	1.96	**H_0** (No trend) ACCEPT
82.00	**p** **0.370**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

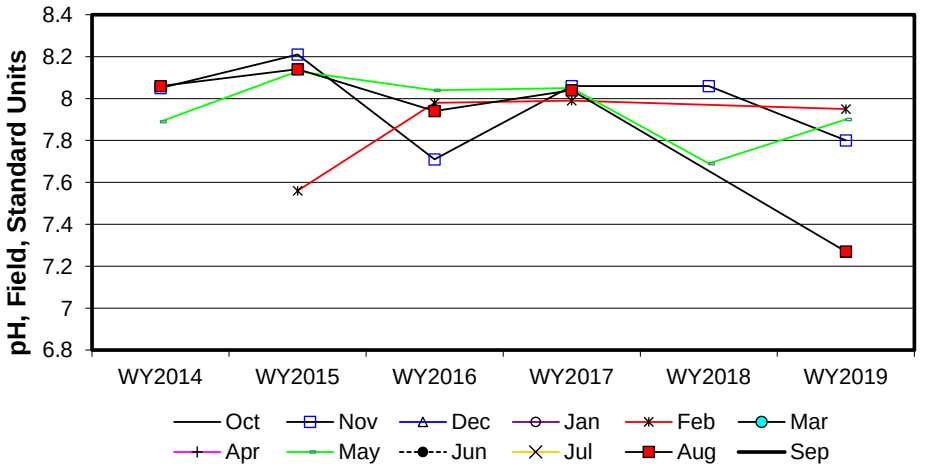
α	Lower Limit	Sen's Slope	Upper Limit
0.010	-7.05	**-0.90**	5.36
0.050	-5.73		3.88
0.100	-3.86		2.22
0.200	-2.18		0.38

Site #46 Seasonal Kendall analysis for pH, Field, Standard Units

Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		8.1						7.9			8.1	
b	**WY2015**		8.2			7.6			8.1			8.1	
c	**WY2016**		7.7			8.0			8.0			7.9	
d	**WY2017**		8.1			8.0			8.1			8.0	
e	**WY2018**		8.1						7.7				
f	**WY2019**		7.8			8.0			7.9			7.3	
	n	0	6	0	0	4	0	0	6	0	0	5	0
	t_1	0	4	0	0	4	0	0	6	0	0	5	0
	t_2	0	1	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		1						1			1	
	c-a		-1						1			-1	
	d-a		1						1			-1	
	e-a		1						-1				
	f-a		-1						1			-1	
	c-b		-1			1			-1			-1	
	d-b		-1			1			-1			-1	
	e-b		-1						-1				
	f-b		-1			1			-1			-1	
	d-c		1			1			1			1	
	e-c		1						-1				
	f-c		1			-1			-1			-1	
	e-d		0						-1				
	f-d		-1			-1			-1			-1	
	f-e		-1						1				
	S_k	0	-2	0	0	2	0	0	-3	0	0	-6	0
	σ^2_S=		27.33			8.67			28.33			16.67	
	$Z_k = S_k/\sigma_S$		-0.38			0.68			-0.56			-1.47	
	Z^2_k		0.15			0.46			0.32			2.16	

ΣZ_k=	-1.74	Tie Extent	t_1	t_2	t_3	t_4	t_5	Σn	21
ΣZ^2_k=	3.09	Count	19	1	0	0	0	ΣS_k	-9
Z-bar=ΣZ_k/K=	-0.43								

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	2.33	@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity	
p	**0.506**			$\chi^2_h<\chi^2_{(K-1)}$	ACCEPT
$\Sigma VAR(S_k)$	Z_{calc} -0.89	@α/2=2.5% **Z**=	1.96	**H_0** (No trend)	ACCEPT
81.00	**p** **0.187**			**H_A** (± trend)	REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.12	**-0.04**	0.02
0.050	-0.08		0.00
0.100	-0.06		0.00
0.200	-0.05		-0.01

Site #46 Seasonal Kendall analysis for Total Alk, (mg/l)

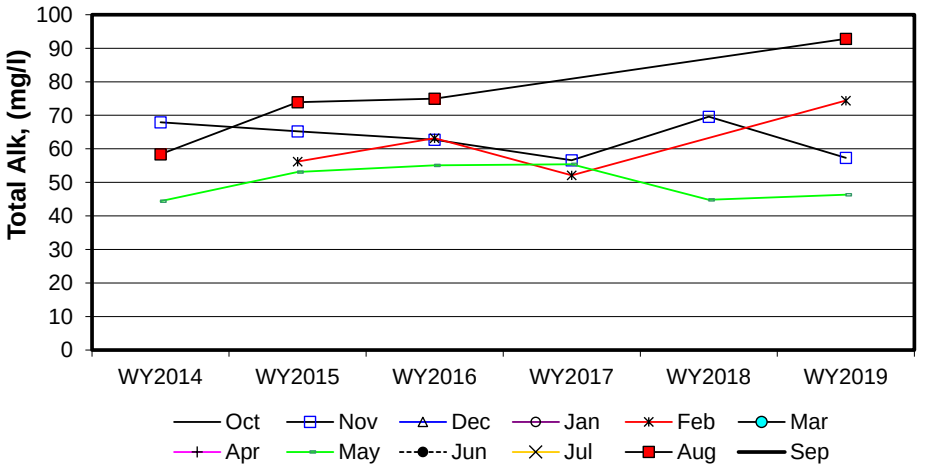
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		67.9						44.4			58.4	
b	**WY2015**		65.2			56.2			53.1			73.9	
c	**WY2016**		62.7			63.2			55.1			75.0	
d	**WY2017**		56.6			52.1			55.4				
e	**WY2018**		69.6						44.8				
f	**WY2019**		57.3			74.4			46.3			92.8	
	n	0	6	0	0	4	0	0	6	0	0	4	0
	t_1	0	6	0	0	4	0	0	6	0	0	4	0
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						1			1	
	c-a		-1						1			1	
	d-a		-1						1				
	e-a		1						1				
	f-a		-1						1			1	
	c-b		-1			1			1			1	
	d-b		-1			-1			1				
	e-b		1						-1				
	f-b		-1			1			-1			1	
	d-c		-1			-1			1				
	e-c		1						-1				
	f-c		-1			1			-1			1	
	e-d		1						-1				
	f-d		1			1			-1				
	f-e		-1						1				
	S_k	0	-5	0	0	2	0	0	3	0	0	6	0
	σ^2_S=		28.33			8.67			28.33			8.67	
	$Z_k = S_k/\sigma_S$		-0.94			0.68			0.56			2.04	
	Z^2_k		0.88			0.46			0.32			4.15	

ΣZ_k= 2.34
ΣZ^2_k= 5.82
Z-bar=$\Sigma Z_k/K$= 0.59

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	20	0	0	0	0

Σn 20
ΣS_k 6

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	4.44		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.217**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
$\Sigma VAR(S_k)$	Z_{calc}	0.58	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
74.00	**p**	**0.719**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-2.70	**0.36**	3.74
0.050	-2.15		2.11
0.100	-2.01		1.48
0.200	-1.76		1.13

Site #46 Seasonal Kendall analysis for Sulfate, Total (mg/l)

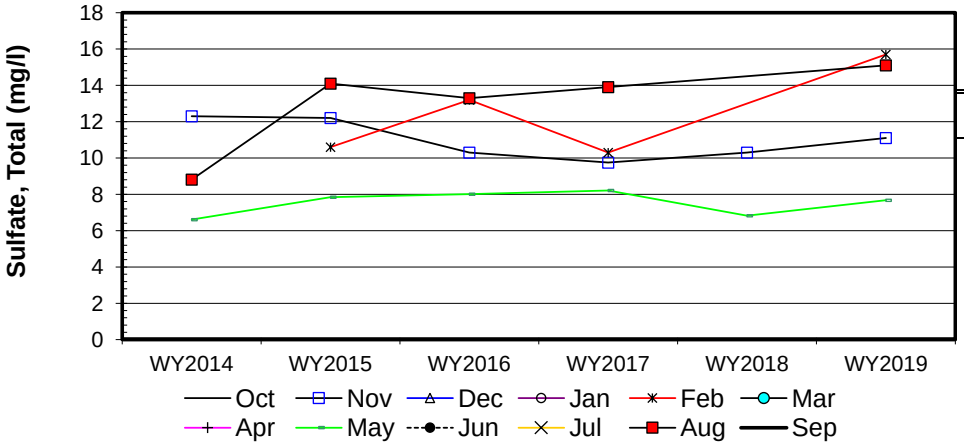
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		12.3						6.6			8.8	
b	**WY2015**		12.2			10.6			7.8			14.1	
c	**WY2016**		10.3			13.2			8.0			13.3	
d	**WY2017**		9.8			10.3			8.2			13.9	
e	**WY2018**		10.3						6.8				
f	**WY2019**		11.1			15.7			7.7			15.1	
	n	0	6	0	0	4	0	0	6	0	0	5	0
	t_1	0	4	0	0	4	0	0	6	0	0	5	0
	t_2	0	1	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						1			1	
	c-a		-1						1			1	
	d-a		-1						1			1	
	e-a		-1						1				
	f-a		-1						1			1	
	c-b		-1			1			1			-1	
	d-b		-1			-1			1			-1	
	e-b		-1						-1				
	f-b		-1			1			-1			1	
	d-c		-1			-1			1			1	
	e-c		0						-1				
	f-c		1			1			-1			1	
	e-d		1						-1				
	f-d		1			1			-1			1	
	f-e		1						1				
	S_k	0	-6	0	0	2	0	0	3	0	0	6	0
	σ^2_S=		27.33			8.67			28.33			16.67	
	$Z_k = S_k/\sigma_S$		-1.15			0.68			0.56			1.47	
	Z^2_k		1.32			0.46			0.32			2.16	

ΣZ_k=	1.57
ΣZ^2_k=	4.26
Z-bar=$\Sigma Z_k/K$=	0.39

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	19	1	0	0	0

Σn	21
ΣS_k	5

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	3.64	@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity	
	p **0.303**			$\chi^2_h<\chi^2_{(K-1)}$	ACCEPT
ΣVAR(S_k)	Z_{calc} 0.44	@α=2.5% Z=	1.96	**H_0** (No trend)	ACCEPT
81.00	**p** **0.672**			**H_A** (± trend)	REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.30	**0.18**	0.64
0.050	-0.19		0.57
0.100	-0.11		0.47
0.200	-0.09		0.24

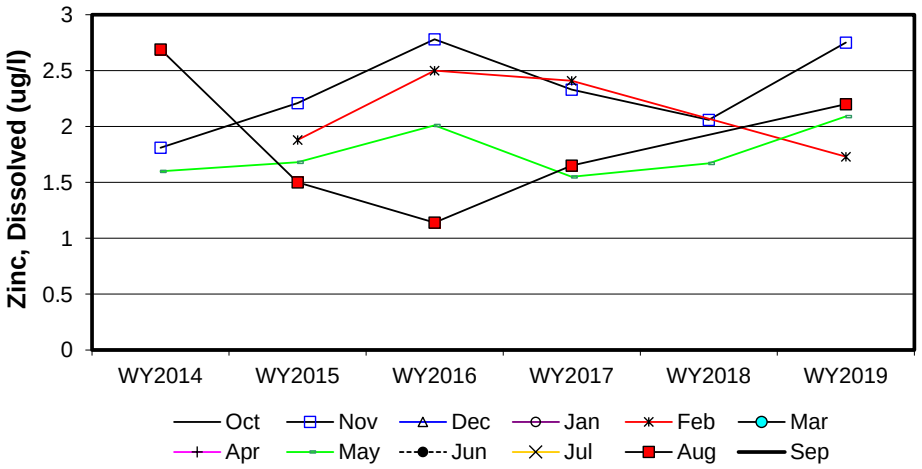
Site #46 Seasonal Kendall analysis for Zinc, Dissolved (ug/l)

Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		1.8						1.6			2.7	
b	**WY2015**		2.2			1.9			1.7			1.5	
c	**WY2016**		2.8			2.5			2.0			1.1	
d	**WY2017**		2.3			2.4			1.6			1.7	
e	**WY2018**		2.1						1.7				
f	**WY2019**		2.8			1.7			2.1			2.2	
	n	0	6	0	0	4	0	0	6	0	0	5	0
	t_1	0	6	0	0	4	0	0	6	0	0	5	0
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		1						1			-1	
	c-a		1						1			-1	
	d-a		1						-1			-1	
	e-a		1						1				
	f-a		1						1			-1	
	c-b		1			1			1			-1	
	d-b		1			1			-1			1	
	e-b		-1						-1				
	f-b		1			-1			1			1	
	d-c		-1			-1			-1			1	
	e-c		-1						-1				
	f-c		-1			-1			1			1	
	e-d		-1						1				
	f-d		1			-1			1			1	
	f-e		1						1				
	S_k	0	5	0	0	-2	0	0	5	0	0	0	0
	σ^2_S=		28.33			8.67			28.33			16.67	
	$Z_k = S_k/\sigma_S$		0.94			-0.68			0.94			0.00	
	Z^2_k		0.88			0.46			0.88			0.00	

ΣZ_k=	1.20	Tie Extent	t_1	t_2	t_3	t_4	t_5
ΣZ^2_k=	2.23	Count	21	0	0	0	0
Z-bar=ΣZ_k/K=	0.30						

Σn	21				
ΣS_k	8				

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	1.87	@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity	
p	**0.601**			$\chi^2_h<\chi^2_{(K-1)}$	ACCEPT
ΣVAR(S_k)	Z_{calc} 0.77	@α/2=2.5% **Z**=	1.96	**H_0** (No trend)	ACCEPT
82.00	**p** **0.780**			**H_A** (± trend)	REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.09	**0.07**	0.21
0.050	-0.04		0.17
0.100	-0.02		0.13
0.200	0.00		0.10

INTERPRETIVE REPORT
SITE 57

The data collected during the current water year are listed in the following "Table of Results for Water Year 2019" report. The table includes all the required FWMP analyte data (field and laboratory) collected for the current water year and a series of flags keyed to the summary report "Qualified Data by QA Reviewer." The QA report lists any associated data limitations found during the monthly QA reviews of laboratory data for this site. Median values for all analytes have been calculated and are shown in the right-most column of the table of results. Any value reported as less than MDL has been replaced with a value of one-half of the MDL for the purpose of median calculation.

All data collected at this site for the past six years are included in the data analyses. As shown in the table below, there were no data outliers.

Sample Date	Parameter	Value	Qualifier	Notes
No outliers, in the past six years, have been identified by HGCMC.				

The data have been compared to the strictest freshwater quality criterion for each applicable analyte. No results exceeding these criteria were identified in the current water year.

Table of Exceedance for Water Year 2019

			Limits		
Sample Date	Parameter	Value	Lower	Upper	Hardness
No exceedances have been identified by HGCMC for the period of October 2018 through September 2019.					

X-Y plots have been generated to graphically present the data for each of the analytes requested in the Statistical Information Goals for this site. These plots have been visually analyzed for the appearance of any trend in concentration. No visually obvious trends were identified.

A non-parametric statistical analysis for trend was performed for specific conductivity, field pH, total alkalinity, total sulfate, and dissolved zinc. Calculation details of the Seasonal Kendall analyses are presented on the pages following this interpretive section. The following table summarizes the results of the data collected between Oct-13 and Sep-19 (WY2014-WY2019).

Site 57 - Table of Summary Statistics for Trend Analysis

	Mann-Kendall test statistics			Sen's slope estimate	
Parameter	**n***	**p****	**Trend**	**Q**	**Q(%)**
Conductivity Field	6	0.92			
pH Field	6	0.08			
Alkalinity, Total	6	1.00	+	7.00	4.9
Sulfate, Total	6	0.96			
Zinc, Dissolved	6	0.04			

* Number of Years ** Significance level

For datasets with a statistically significant trend ($\alpha/2$=2.5%), a Seasonal-Sen's Slope estimate statistic has also been calculated. There was a statistically significant increasing trend (7.00 mg/L/yr) in alkalinity and is similar to the value calculated for the last water year

Table of Results for Water Year 2019

Site 057FMG - 'Monitoring Well -23-00-03'

Sample Date/Parameter	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019	**Median**
Water Temp (°C)		5			3.1			6.1			6.6		5.6
Conductivity-Field(μmho)		374.1			395.4			316.2			448.5		384.8
Conductivity-Lab (μmho)		386			381			394			386		386
pH Lab (standard units)		6.95			7.01			7.39			7.25		7.13
pH Field (standard units)		7.35			7.7			7.64			7.42		7.53
Total Alkalinity (mg/L)		155			153			161			166		158.0
Total Sulfate (mg/L)		48.3			52.2			59.1			62		55.7
Hardness (mg/L)		204			196			215			231		209.5
Dissolved As (ug/L)		0.822			1.14			0.577			0.563		0.700
Dissolved Ba (ug/L)		28.2			30.1			32			31.7		30.9
Dissolved Cd (ug/L)		0.102			0.0824			0.208			0.207		0.1545
Dissolved Cr (ug/L)		0.257			0.261			0.324			0.375		0.293
Dissolved Cu (ug/L)		0.055			0.201			1.94			1.93		1.066
Dissolved Pb (ug/L)		0.0015			0.177			0.362			0.132		0.1545
Dissolved Ni (ug/L)		0.193			0.497			0.727			0.618		0.558
Dissolved Ag (ug/L)		0.002			0.002			0.002			0.002		0.002
Dissolved Zn (ug/L)		1.45			30.3			51.7			19.6		24.95
Dissolved Se (ug/L)		0.55			0.559			0.485			0.497		0.524
Dissolved Hg (ug/L)		0.000101			0.000234			0.000261			0.000144		0.000189

For individual sample/analyte qualifier descriptions see "Qualified Data by QA Reviewer" table.

Values reported as less than MDL are replaced by 1/2 MDL for median calculation purposes.

Shaded data has been qualified as an outlier by HGCMC and removed from any further analysis and is not included into the calculation of the median

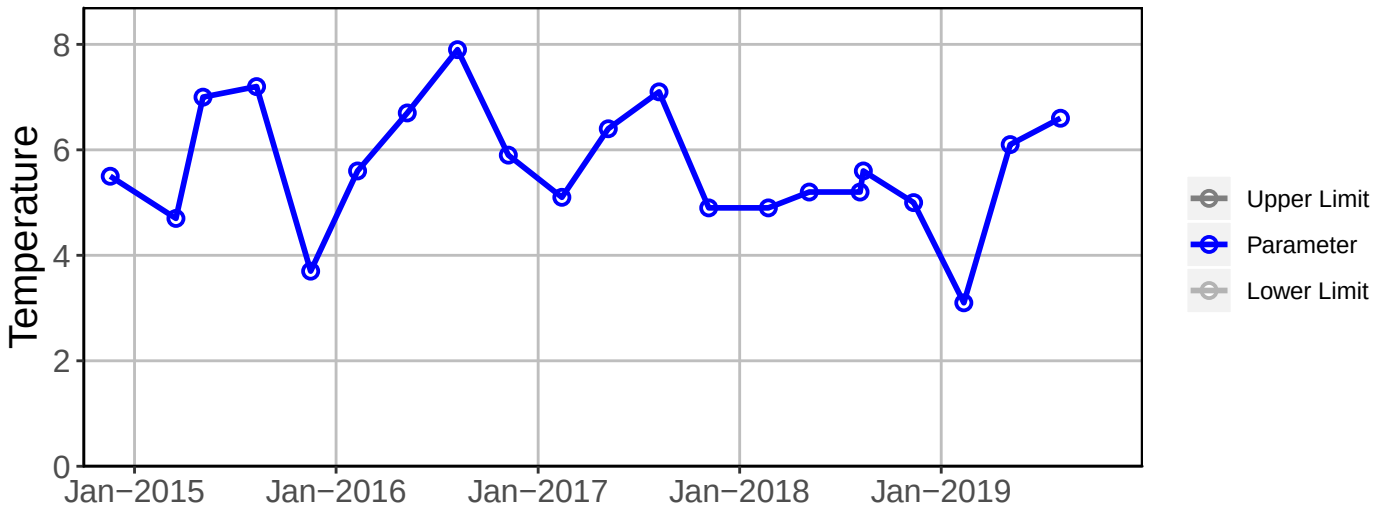
Qualified Data by QA Reviewer

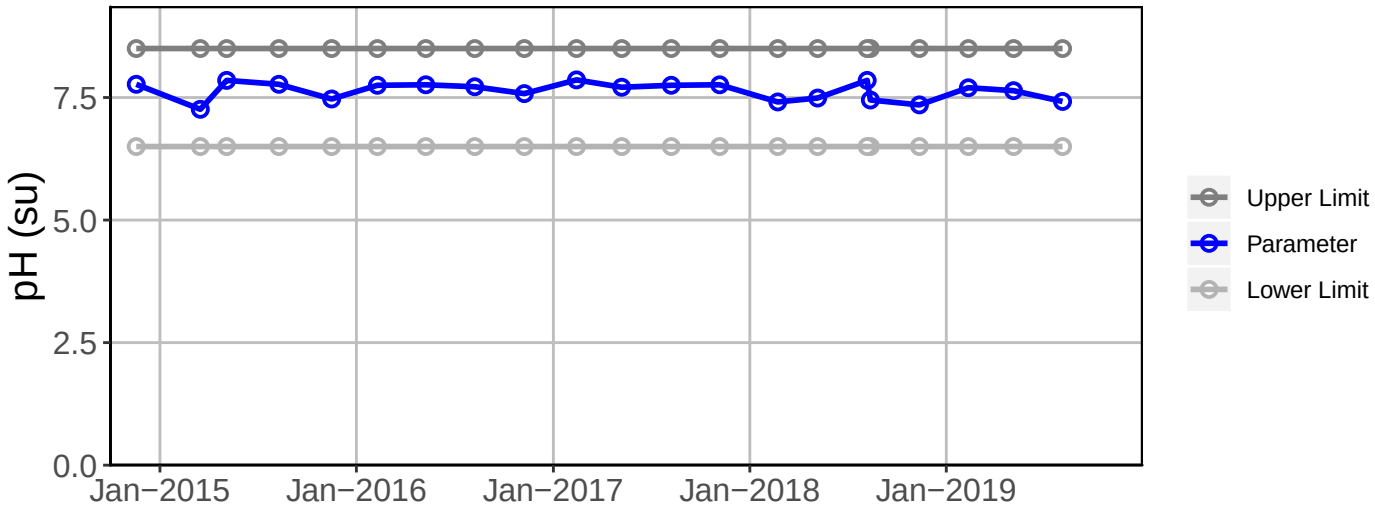
Date Range: 10/01/2018 to 09/30/2019

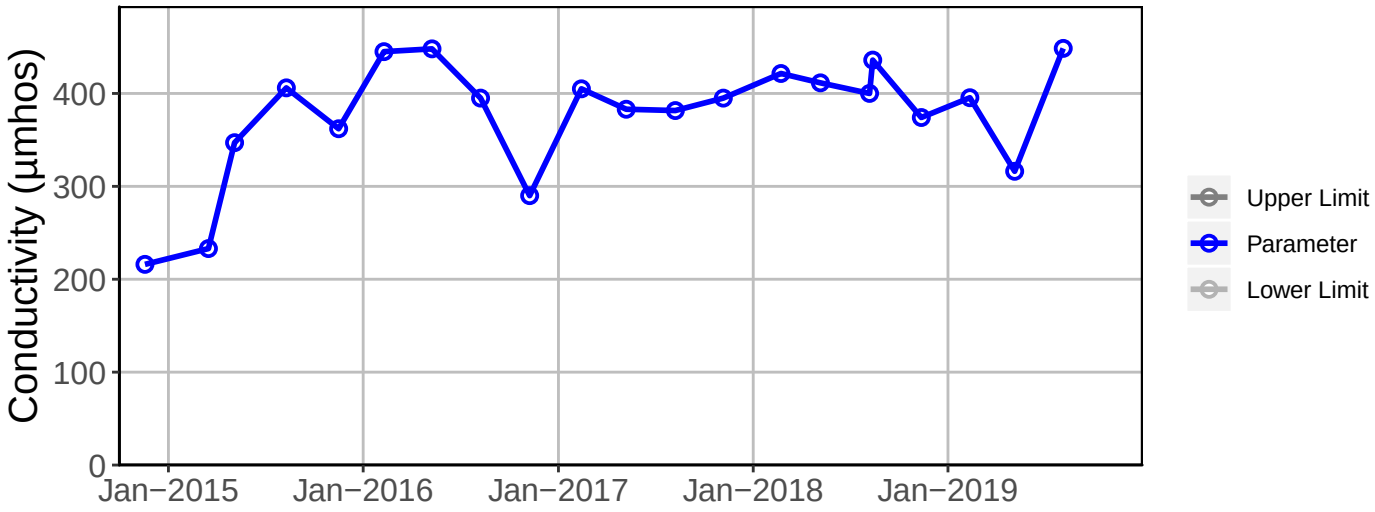
Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
057FMG	12-Nov-18	Diss. Cu-ICP/MS	0.05	µg/L	U	Field Blank Contamination
		Diss. Hg-CVAF	0.000101	µg/L	J	Below Quantitative Range
		Diss. Ni-ICP/MS	0.19	µg/L	U	Field Blank Contamination
		Diss. Pb-ICP/MS	-0.0030	µg/L	U	Field Blank Contamination
		Diss. Tl-ICP/MS	0.00267	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	1.45	µg/L	U	Field Blank Contamination
	11-Feb-19	Diss. Hg-CVAF	0.000234	µg/L	J	Below Quantitative Range
	6-May-19	Diss. Hg-CVAF	0.000261	µg/L	J	Below Quantitative Range
	5-Aug-19	Diss. Hg-CVAF	0.000144	µg/L	J	Below Quantitative Range
		Diss. Ni-ICP/MS	0.61	µg/L	U	Field Blank Contamination
		Diss. Pb-ICP/MS	0.13	µg/L	U	Field Blank Contamination
		Diss. Zn-ICP/MS	19.60	µg/L	U	Field Blank Contamination
		Total Sulfate	62	µg/L	J	Sample Receipt Temperature

Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

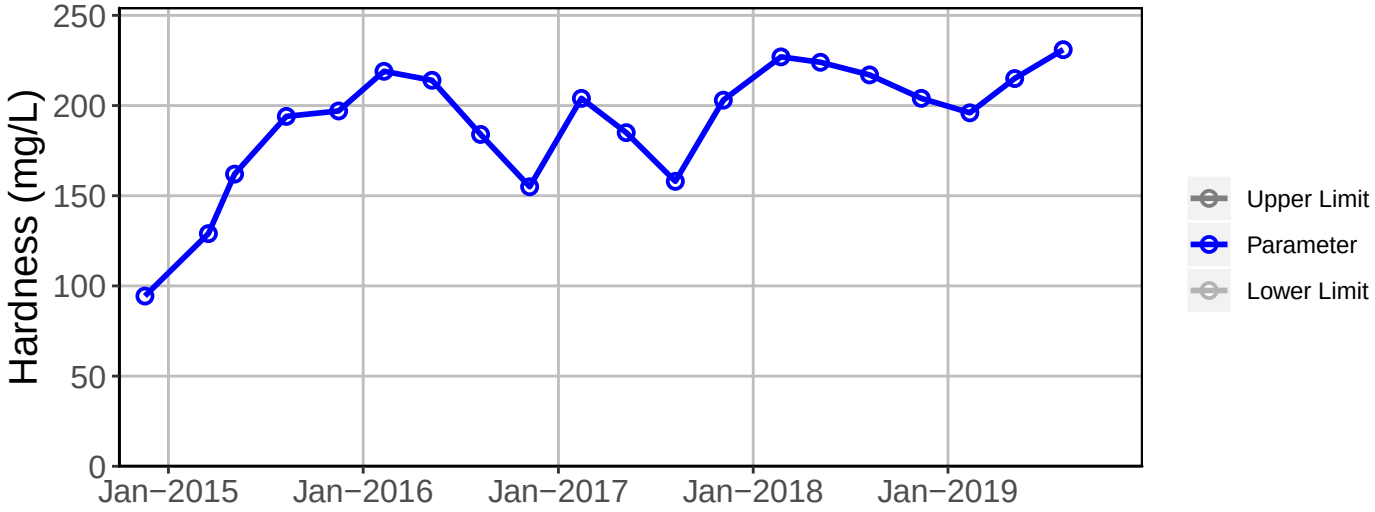
Site 57 Analyte Charts

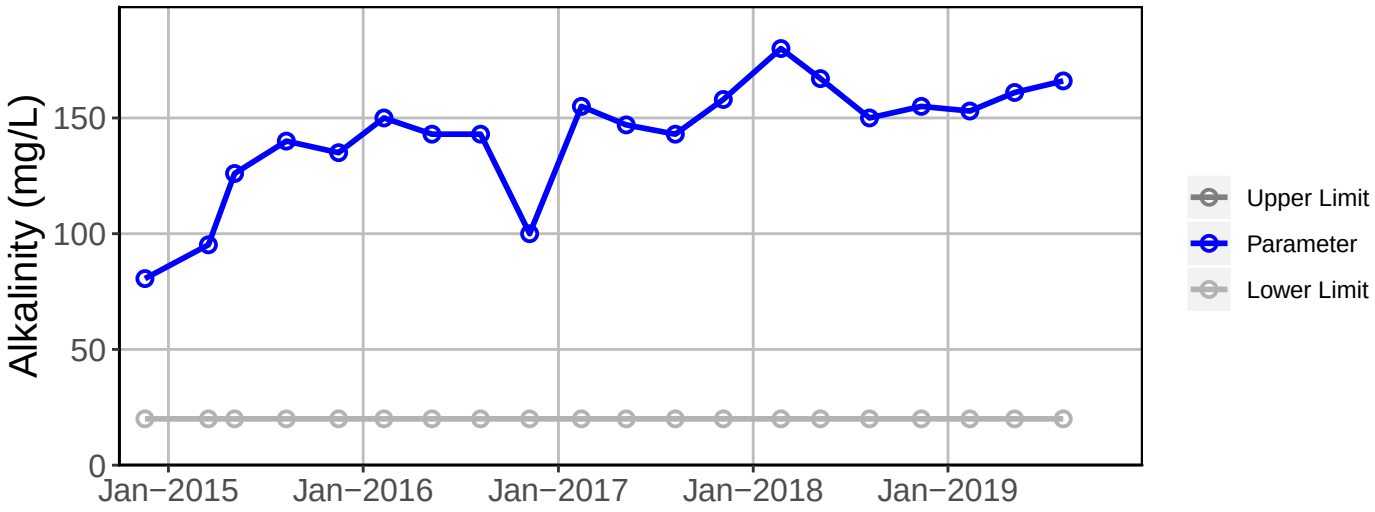


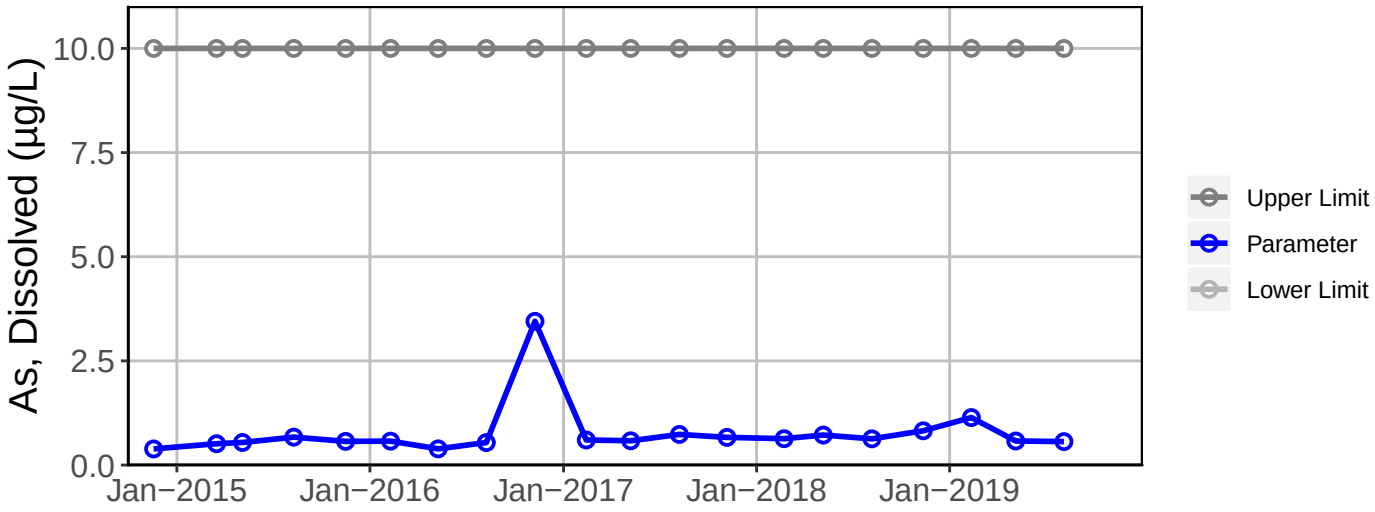




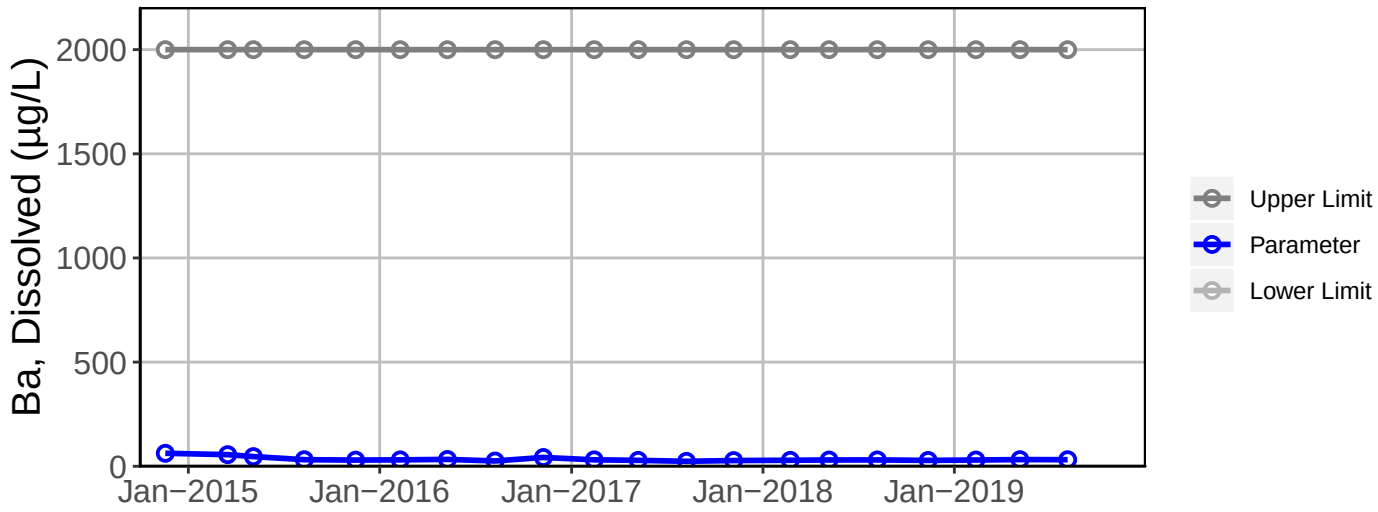
Site 57 Analyte Charts

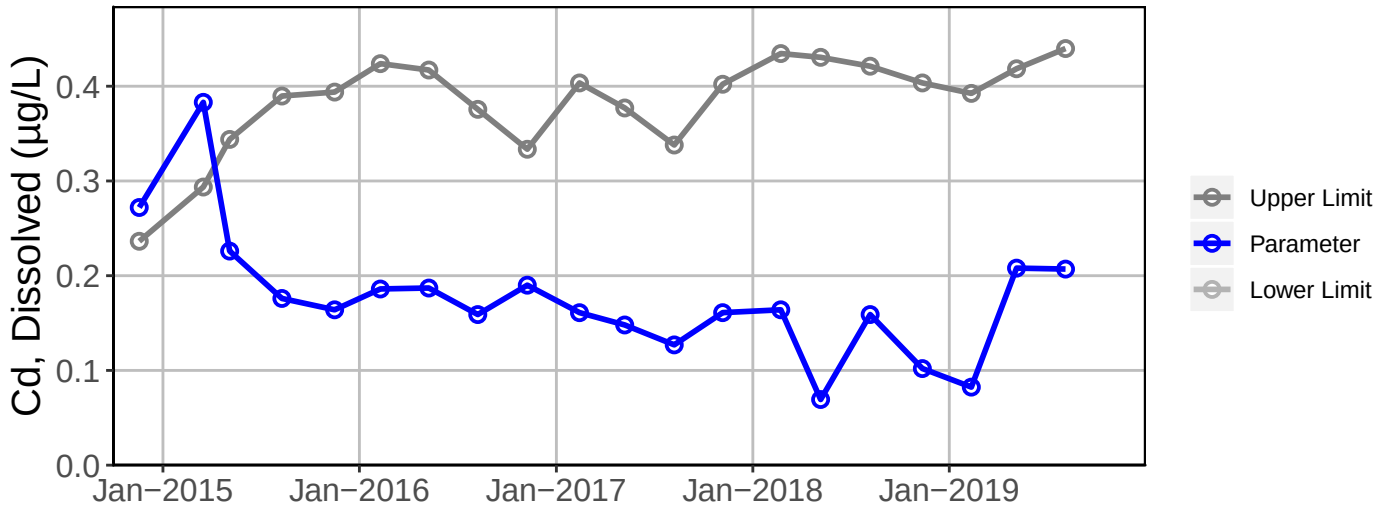


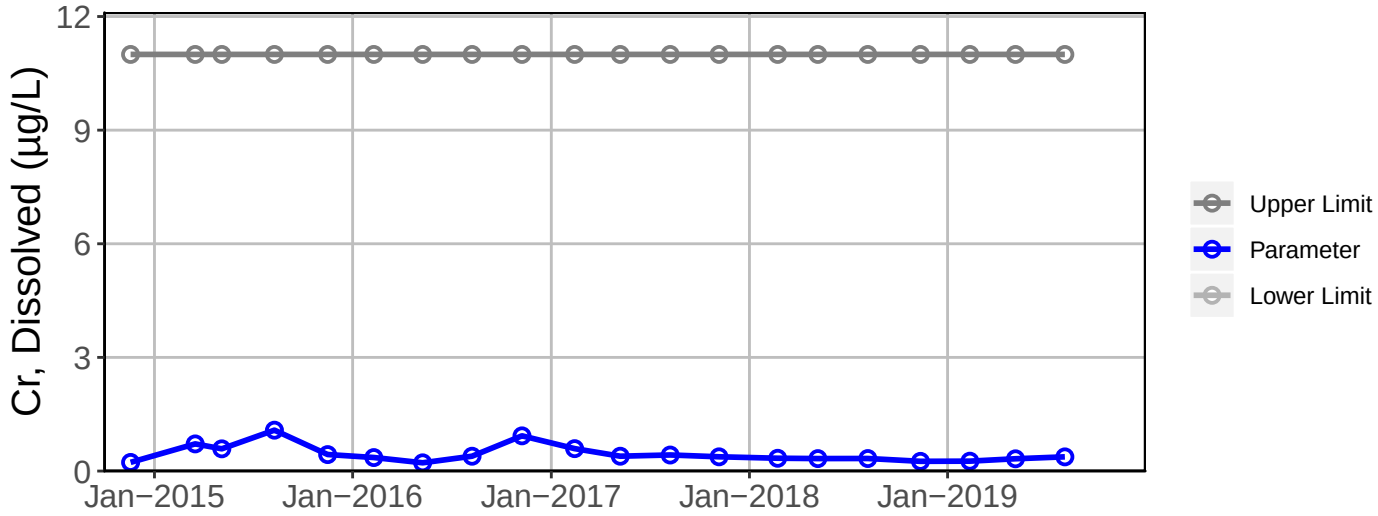




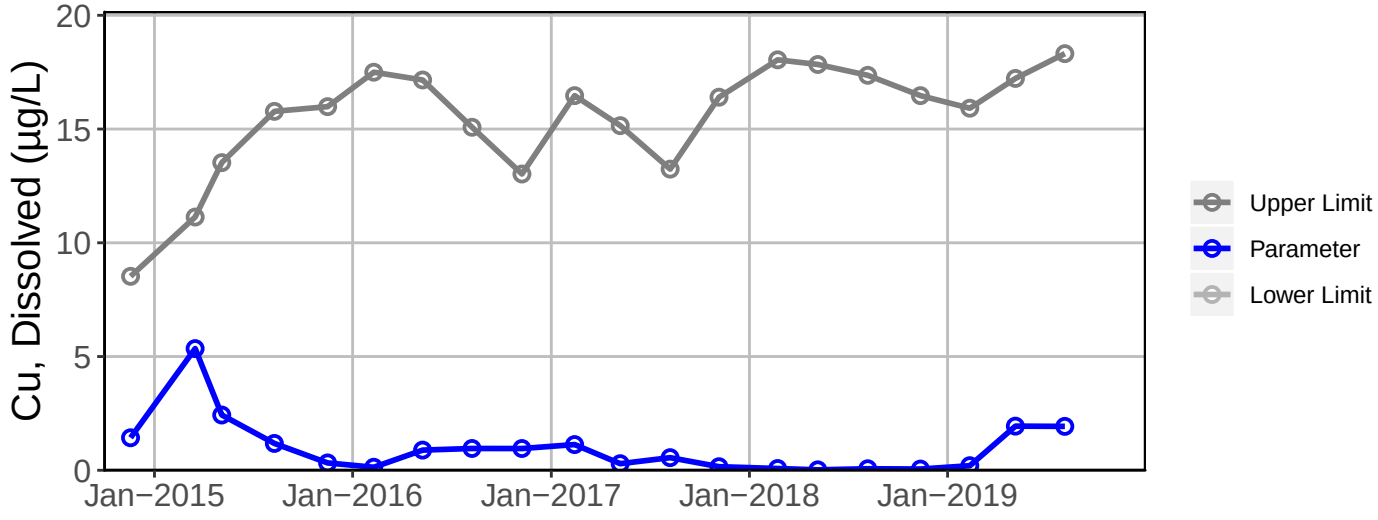
Site 57 Analyte Charts

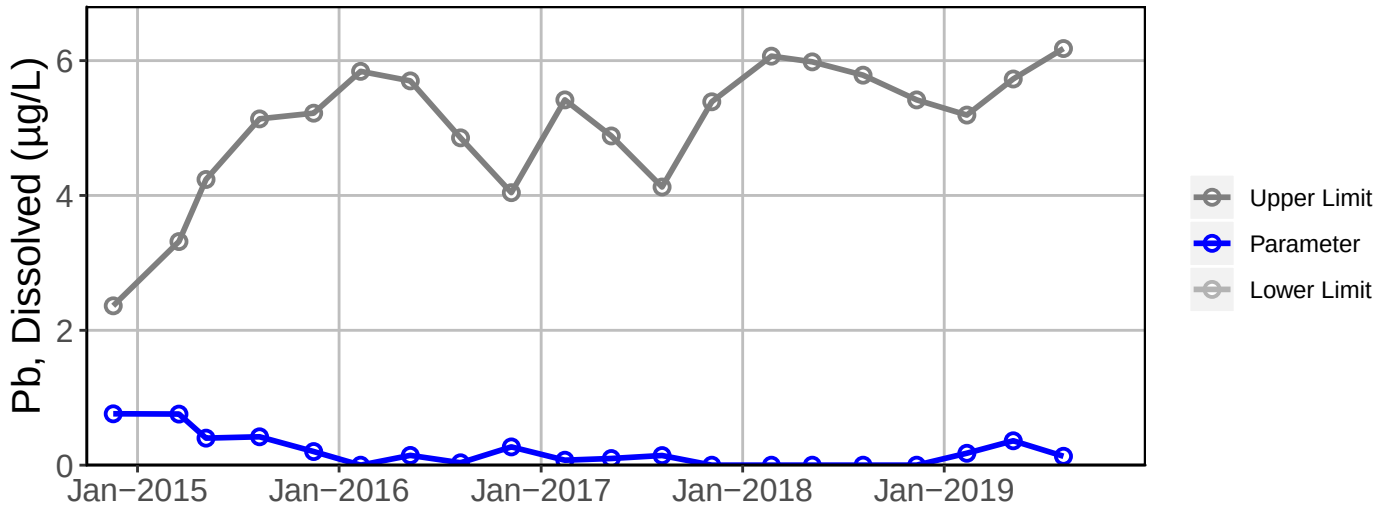


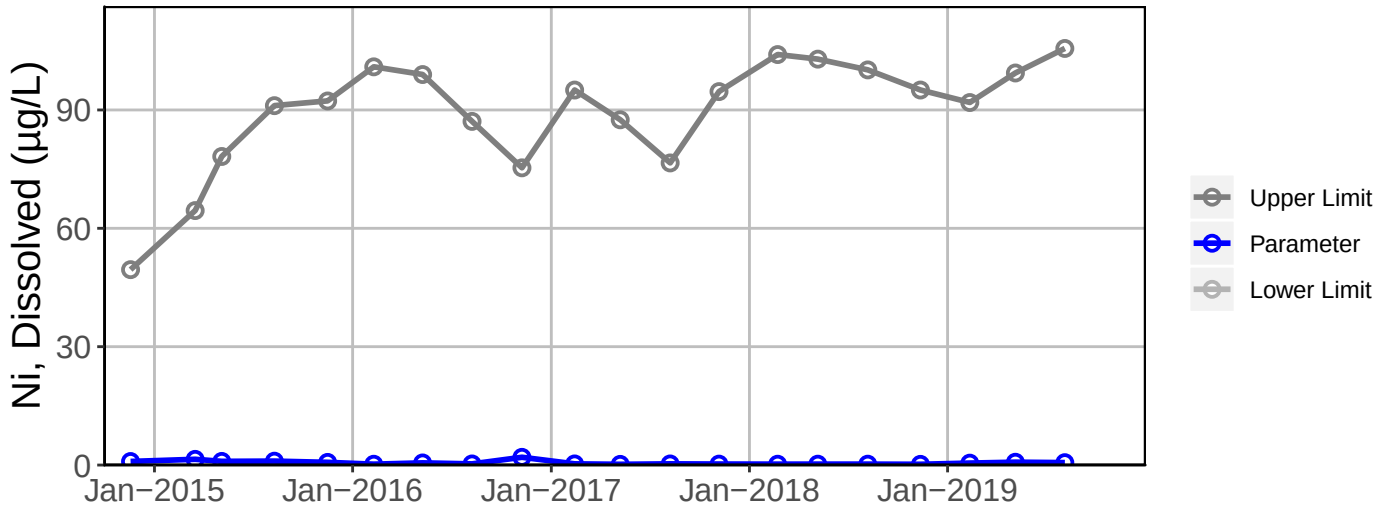




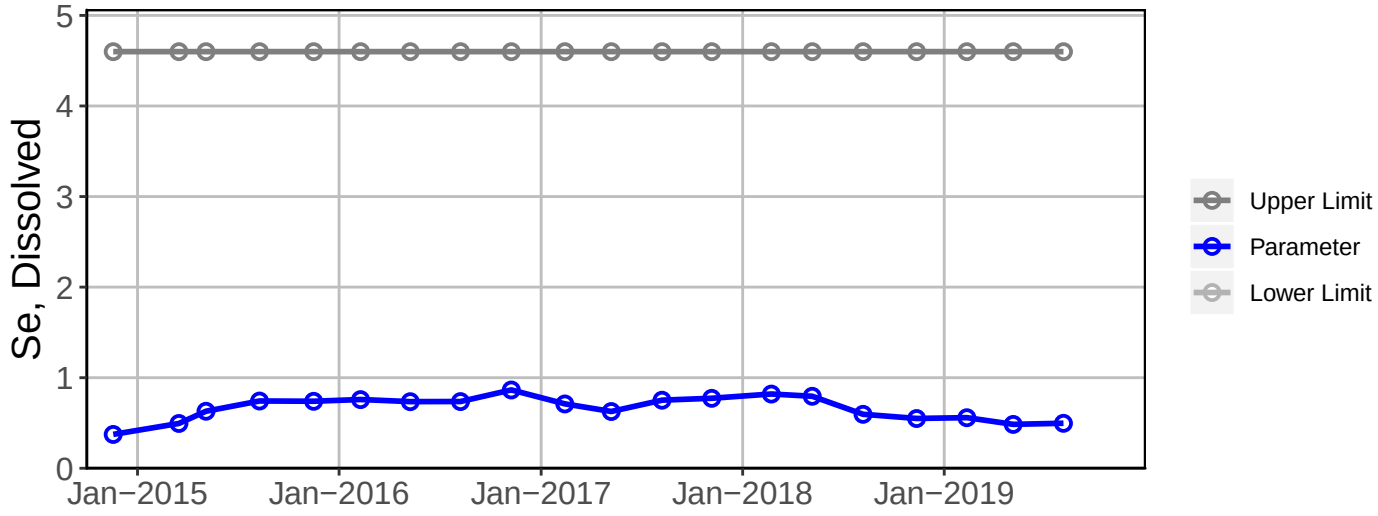
Site 57 Analyte Charts

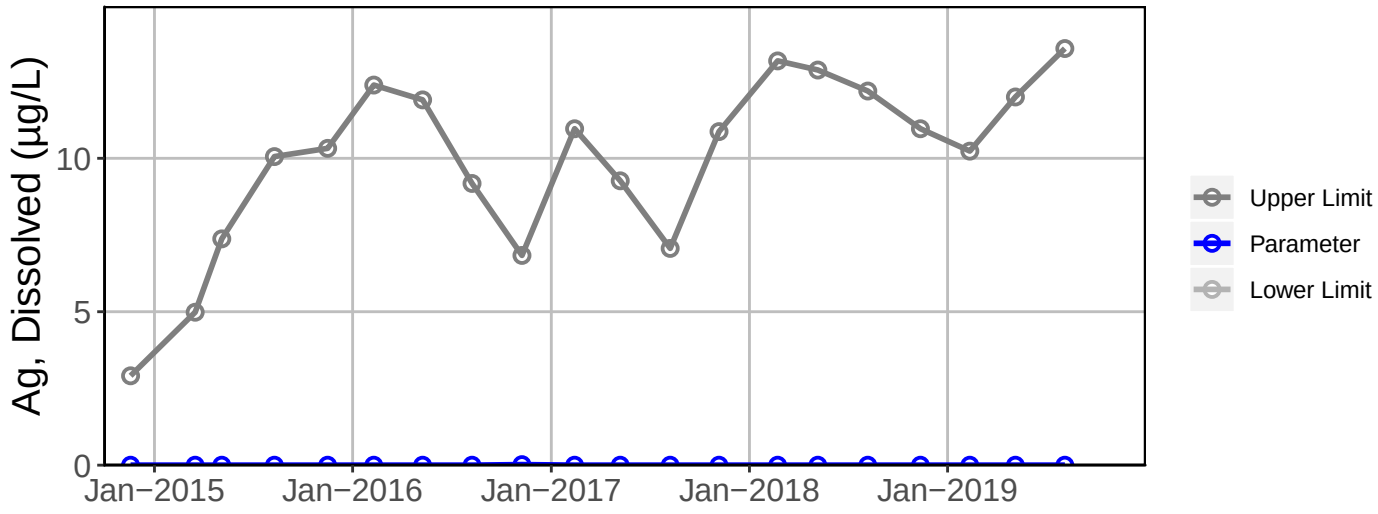


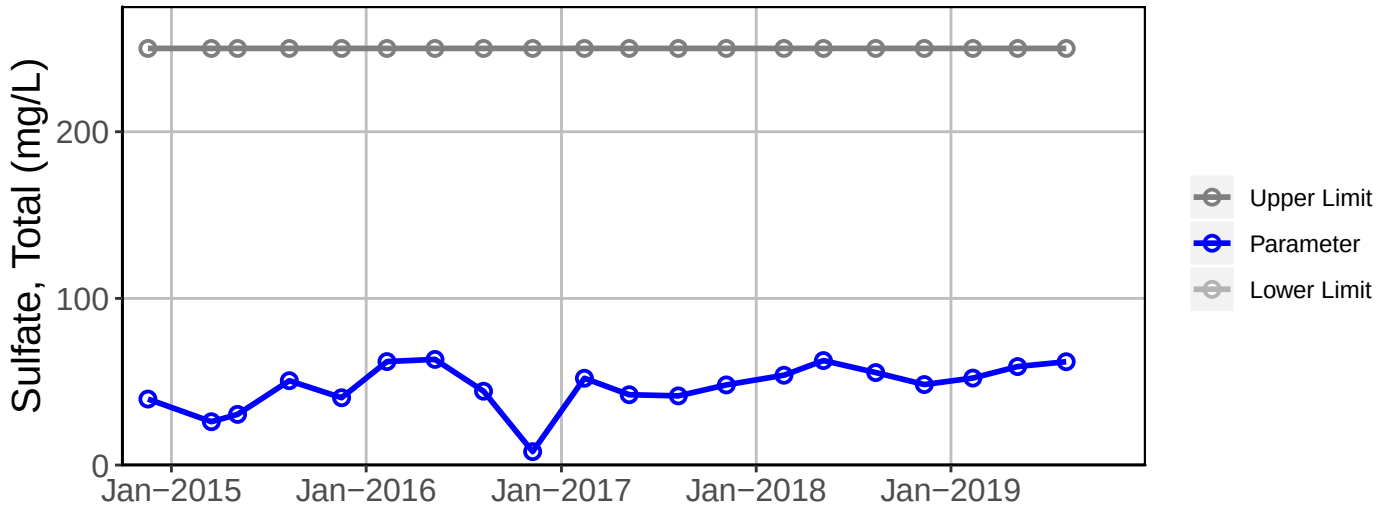




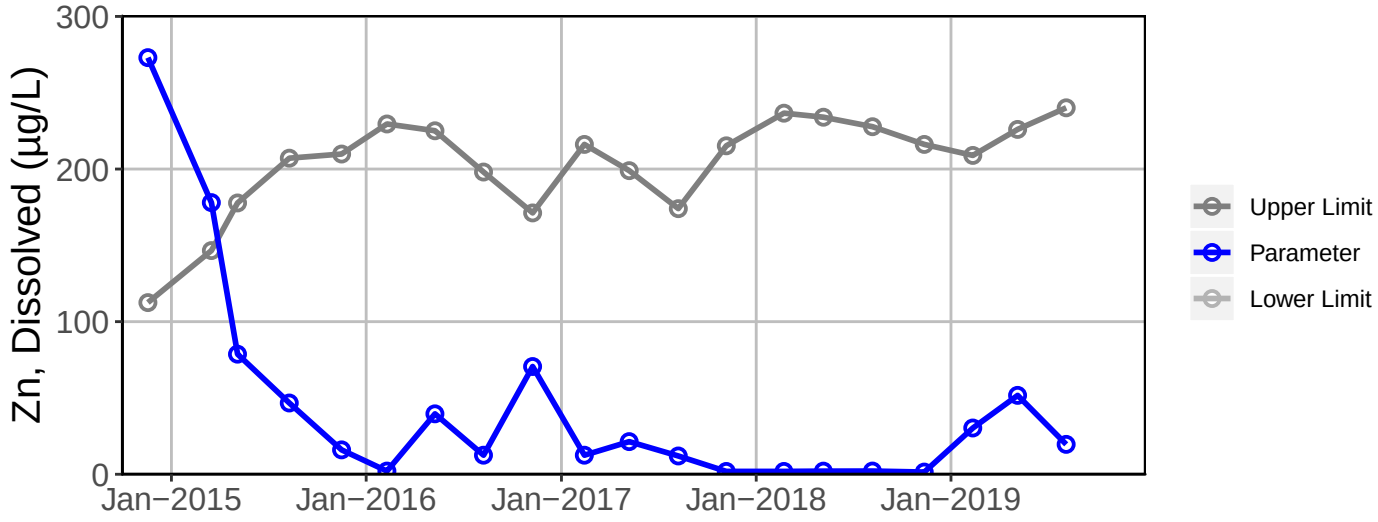
Site 57 Analyte Charts







Site 57 Analyte Charts



Site #57 Seasonal Kendall analysis for Specific Conductance, Field (µS/cm)

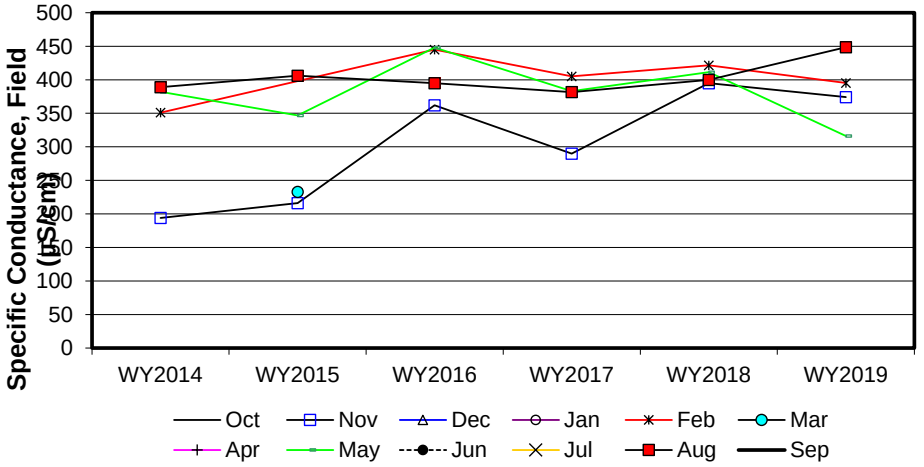
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		194.0			351.0			382.0			389.0	
b	**WY2015**		216.0				233.0		347.0			406.0	
c	**WY2016**		362.0			445.0			448.0			395.0	
d	**WY2017**		290.0			405.0			383.0			381.6	
e	**WY2018**		395.0			421.5			411.4			400.0	
f	**WY2019**		374.1			395.4			316.2			448.5	
	n	0	6	0	0	5	1	0	6	0	0	6	0
	t_1	0	6	0	0	5	1	0	6	0	0	6	0
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		1						-1			1	
	c-a		1			1			1			1	
	d-a		1			1			1			-1	
	e-a		1			1			1			1	
	f-a		1			1			-1			1	
	c-b		1						1			-1	
	d-b		1						1			-1	
	e-b		1						1			-1	
	f-b		1						-1			1	
	d-c		-1			-1			-1			-1	
	e-c		1			-1			-1			1	
	f-c		1			-1			-1			1	
	e-d		1			1			1			1	
	f-d		1			-1			-1			1	
	f-e		-1			-1			-1			1	
	S_k	0	11	0	0	0	0	0	-1	0	0	5	0
	σ^2_S=		28.33			16.67			28.33			28.33	
	$Z_k = S_k/\sigma_S$		2.07			0.00			-0.19			0.94	
	Z^2_k		4.27			0.00			0.04			0.88	

ΣZ_k= 2.82
ΣZ^2_k= 5.19
Z-bar=$\Sigma Z_k/K$= 0.70

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	24	0	0	0	0

Σn 24
ΣS_k 15

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	3.20		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.361**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	1.39	@α/2=2.5% **Z**=	1.96	**H_0** (No trend) ACCEPT
101.67	**p**	**0.918**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-11.17	**10.63**	23.46
0.050	-2.37		18.00
0.100	0.42		17.83
0.200	2.81		16.87

Site #57 Seasonal Kendall analysis for pH, Field, Standard Units

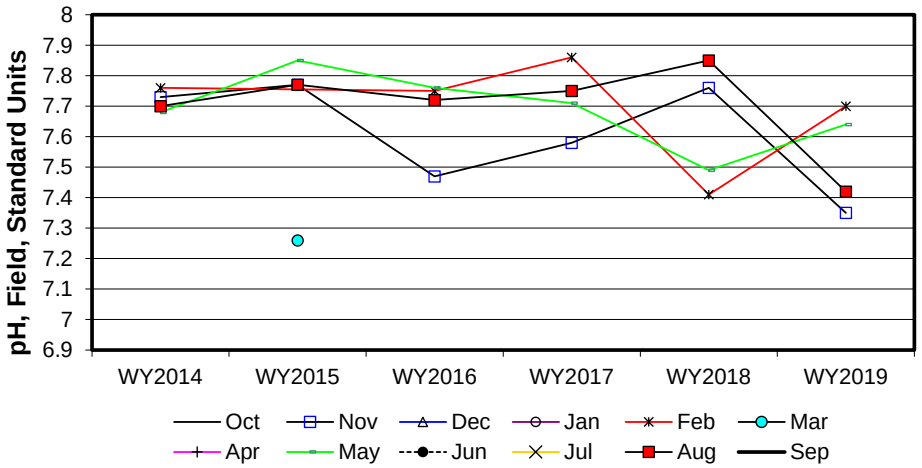
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		7.7			7.8			7.7			7.7	
b	**WY2015**		7.8				7.3		7.9			7.8	
c	**WY2016**		7.5			7.8			7.8			7.7	
d	**WY2017**		7.6			7.9			7.7			7.8	
e	**WY2018**		7.8			7.4			7.5			7.9	
f	**WY2019**		7.4			7.7			7.6			7.4	
	n	0	6	0	0	5	1	0	6	0	0	6	0
	t_1	0	6	0	0	5	1	0	6	0	0	6	0
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		1						1			1	
	c-a		-1			-1			1			1	
	d-a		-1			1			1			1	
	e-a		1			-1			-1			1	
	f-a		-1			-1			-1			-1	
	c-b		-1						-1			-1	
	d-b		-1						-1			-1	
	e-b		-1						-1			1	
	f-b		-1						-1			-1	
	d-c		1			1			-1			1	
	e-c		1			-1			-1			1	
	f-c		-1			-1			-1			-1	
	e-d		1			-1			-1			1	
	f-d		-1			-1			-1			-1	
	f-e		-1			1			1			-1	
	S_k	0	-5	0	0	-4	0	0	-7	0	0	1	0
	σ^2_S=		28.33			16.67			28.33			28.33	
	$Z_k = S_k/\sigma_S$		-0.94			-0.98			-1.32			0.19	
	Z^2_k		0.88			0.96			1.73			0.04	

ΣZ_k= -3.05
ΣZ^2_k= 3.61
Z-bar=$\Sigma Z_k/K$= -0.76

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	24	0	0	0	0

Σn 24
ΣS_k -15

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	1.29	@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity	
p	**0.732**			$\chi^2_h<\chi^2_{(K-1)}$	ACCEPT
$\Sigma VAR(S_k)$	Z_{calc} -1.39	@α/2=2.5% Z=	1.96	**H_0** (No trend)	ACCEPT
101.67	**p** **0.082**			**H_A** (± trend)	REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.09	**-0.04**	0.02
0.050	-0.07		0.01
0.100	-0.06		-0.01
0.200	-0.05		-0.01

Site #57 Seasonal Kendall analysis for Total Alk, (mg/l)

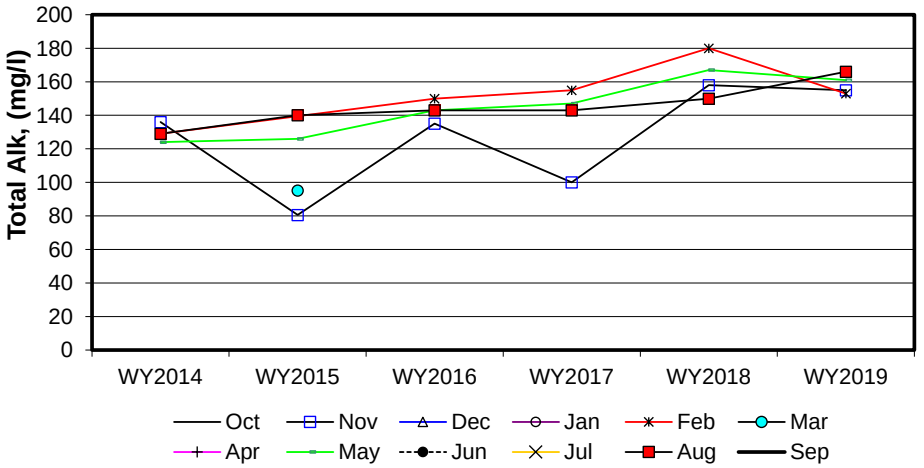
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		136.0			129.0			124.0			129.0	
b	**WY2015**		80.6				95.2		126.0			140.0	
c	**WY2016**		135.0			150.0			143.0			143.0	
d	**WY2017**		100.0			155.0			147.0			143.0	
e	**WY2018**		158.0			180.0			167.0			150.0	
f	**WY2019**		155.0			153.0			161.0			166.0	
	n	0	6	0	0	5	1	0	6	0	0	6	0
	t_1	0	6	0	0	5	1	0	6	0	0	4	0
	t_2	0	0	0	0	0	0	0	0	0	0	1	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						1			1	
	c-a		-1			1			1			1	
	d-a		-1			1			1			1	
	e-a		1			1			1			1	
	f-a		1			1			1			1	
	c-b		1						1			1	
	d-b		1						1			1	
	e-b		1						1			1	
	f-b		1						1			1	
	d-c		-1			1			1			0	
	e-c		1			1			1			1	
	f-c		1			1			1			1	
	e-d		1			1			1			1	
	f-d		1			-1			1			1	
	f-e		-1			-1			-1			1	
	S_k	0	5	0	0	6	0	0	13	0	0	14	0
	σ^2_S=		28.33			16.67			28.33			27.33	
	$Z_k = S_k/\sigma_S$		0.94			1.47			2.44			2.68	
	Z^2_k		0.88			2.16			5.96			7.17	

ΣZ_k= 7.53
ΣZ^2_k= 16.18
Z-bar=$\Sigma Z_k/K$= 1.88

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	22	1	0	0	0

Σn 24
ΣS_k 38

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	2.01	@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity	
p	**0.571**			$\chi^2_h<\chi^2_{(K-1)}$	ACCEPT
$\Sigma VAR(S_k)$	Z_{calc} 3.69	@α/2=2.5% Z=	1.96	**H_0** (No trend)	REJECT
100.67	**p** **1.000**			**H_A** (± trend)	ACCEPT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	3.75		10.79
0.050	4.85	**7.00**	9.65
0.100	5.27		8.74
0.200	6.14		7.67

4.9%

Site #57 Seasonal Kendall analysis for Sulfate, Total (mg/l)

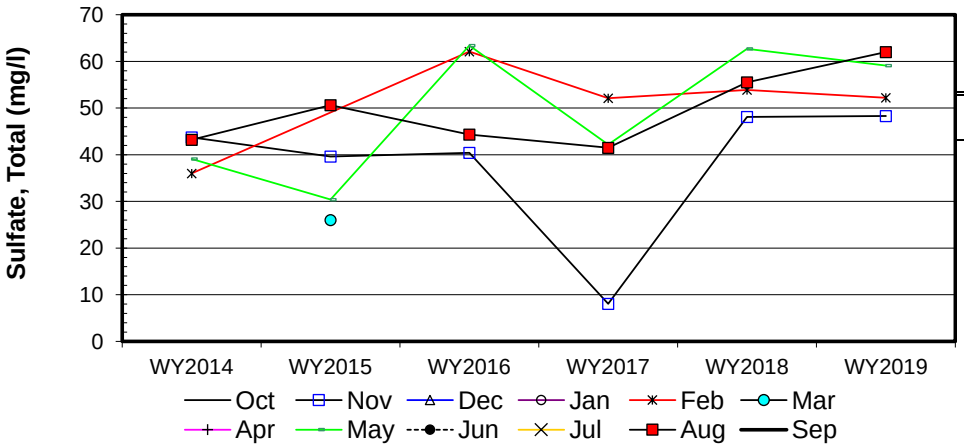
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		43.7			36.0			39.1			43.2	
b	**WY2015**		39.6				26.0		30.4			50.6	
c	**WY2016**		40.4			62.1			63.4			44.3	
d	**WY2017**		8.1			52.1			42.2			41.5	
e	**WY2018**		48.1			53.9			62.7			55.5	
f	**WY2019**		48.3			52.2			59.1			62.0	
	n	0	6	0	0	5	1	0	6	0	0	6	0
	t_1	0	6	0	0	5	1	0	6	0	0	6	0
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						-1			1	
	c-a		-1			1			1			1	
	d-a		-1			1			1			-1	
	e-a		1			1			1			1	
	f-a		1			1			1			1	
	c-b		1						1			-1	
	d-b		-1						1			-1	
	e-b		1						1			1	
	f-b		1						1			1	
	d-c		-1			-1			-1			-1	
	e-c		1			-1			-1			1	
	f-c		1			-1			-1			1	
	e-d		1			1			1			1	
	f-d		1			1			1			1	
	f-e		1			-1			-1			1	
	S_k	0	5	0	0	2	0	0	5	0	0	7	0
	σ^2_S=		28.33			16.67			28.33			28.33	
	$Z_k = S_k/\sigma_S$		0.94			0.49			0.94			1.32	
	Z^2_k		0.88			0.24			0.88			1.73	

ΣZ_k=	3.68
ΣZ^2_k=	3.73
Z-bar=$\Sigma Z_k/K$=	0.92

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	24	0	0	0	0

Σn	24
ΣS_k	19

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	0.34	@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity	
	p **0.952**			$\chi^2_h<\chi^2_{(K-1)}$	ACCEPT
ΣVAR(S_k)	Z_{calc} 1.79	@α=2.5% Z=	1.96	**H_0** (No trend)	ACCEPT
101.67	**p** **0.963**			**H_A** (± trend)	REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-1.48	**2.18**	5.67
0.050	0.08		3.97
0.100	0.56		3.74
0.200	0.95		3.02

Site #57 Seasonal Kendall analysis for Zinc, Dissolved (ug/l)

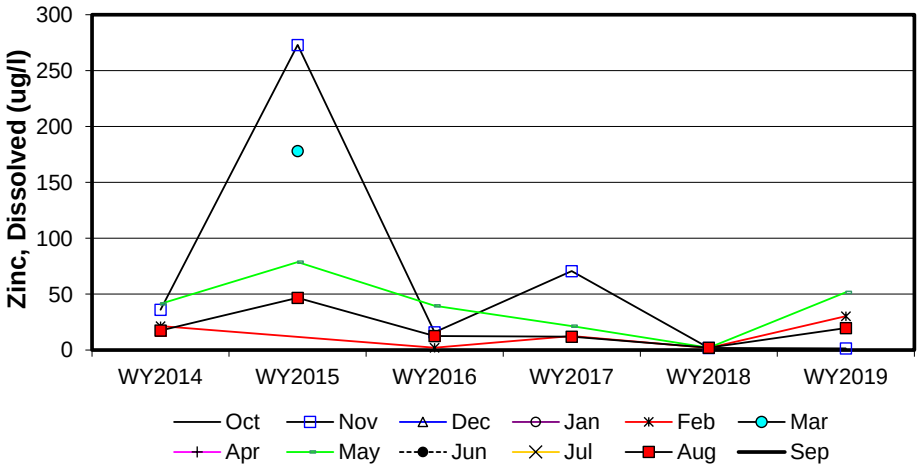
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		36.0			21.4			41.3			17.5	
b	**WY2015**		273.0				178.0		78.7			46.7	
c	**WY2016**		16.0			2.1			39.6			12.5	
d	**WY2017**		70.6			12.5			21.4			12.0	
e	**WY2018**		1.9			1.9			2.1			2.1	
f	**WY2019**		1.5			30.3			51.7			19.6	
	n	0	6	0	0	5	1	0	6	0	0	6	0
	t_1	0	6	0	0	5	1	0	6	0	0	6	0
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		1						1			1	
	c-a		-1			-1			-1			-1	
	d-a		1			-1			-1			-1	
	e-a		-1			-1			-1			-1	
	f-a		-1			1			1			1	
	c-b		-1						-1			-1	
	d-b		-1						-1			-1	
	e-b		-1						-1			-1	
	f-b		-1						-1			-1	
	d-c		1			1			-1			-1	
	e-c		-1			-1			-1			-1	
	f-c		-1			1			1			1	
	e-d		-1			-1			-1			-1	
	f-d		-1			1			1			1	
	f-e		-1			1			1			1	
	S_k	0	-9	0	0	0	0	0	-5	0	0	-5	0
	σ^2_S=		28.33			16.67			28.33			28.33	
	$Z_k = S_k/\sigma_S$		-1.69			0.00			-0.94			-0.94	
	Z^2_k		2.86			0.00			0.88			0.88	

ΣZ_k= -3.57
ΣZ^2_k= 4.62
Z-bar=$\Sigma Z_k/K$= -0.89

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	24	0	0	0	0

Σn 24
ΣS_k -19

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	1.44		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.697**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	-1.79	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
101.67	**p**	**0.037**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-11.59		1.85
0.050	-9.78	**-4.88**	-0.44
0.100	-8.48		-0.89
0.200	-6.88		-2.62

INTERPRETIVE REPORT
SITE 13

The data collected during the current water year are listed in the following "Table of Results for Water Year 2019" report. The table includes all the required FWMP analyte data (field and laboratory) collected for the current water year and a series of flags keyed to the summary report "Qualified Data by QA Reviewer." The QA report lists any associated data limitations found during the monthly QA reviews of laboratory data for this site. Median values for all analytes have been calculated and are shown in the right-most column of the table of results. Any value reported as less than MDL has been replaced with a value of one-half of the MDL for the purpose of median calculation.

All data collected at this site for the past six years are included in the data analyses. As shown in the table below, there were no data outliers.

Sample Date	Parameter	Value	Qualifier	Notes
No outliers, in the past six years, have been identified by HGCMC.				

The data have been compared to the strictest freshwater quality criterion for each applicable analyte. Four results exceeding these criteria have been identified, as listed in the table below.

Table of Exceedance for Water Year 2019

			Limits		
Sample Date	Parameter	Value	Lower	Upper	Hardness
6-May-19	Cadmium, Dissolved	0.58 µg/L		0.21	80.2 mg/L
6-May-19	Zinc, Dissolved	409.00 µg/L		98.0	80.2 mg/L
5-Aug-19	Cadmium, Dissolved	0.41 µg/L		0.27	112 mg/L
5-Aug-19	Zinc, Dissolved	229.00 µg/L		130.0	112 mg/L

Waste rock removal near the 1350 adit took place over several years. It was not until 2011 that any material was removed from the Eastern Lobe, the area that contributes to the Site 13 drainage. However, the material removed was not in the direct flow path for Site 13. HGCMC removed most of the remaining material in 2014. Only the material in the road access was left, and it will be removed during final reclamation.

X-Y plots have been generated to graphically present the data for each of the analytes requested in the Statistical Information Goals for this site. Cadmium, lead, and zinc all sharply increased at Site 13 after waste rock material was removed in 2014. Lead levels were well below the AWQS by Water Year 2016. However, dissolved zinc and dissolved cadmium continued to have measurements above the respective AWQS. As seen with other reclamation projects (e.g., the 960), there is usually an initial increase in metals concentration. HGCMC had expected to see

these elevated levels attenuate throughout, as they had appeared to be doing in the 2015 Water Year. Though HGCMC expects these elevated concentrations will attenuate with time, a collection system was installed in late August 2016 at the toe of the material left in place. Monitoring conducted has shown a substantial improvement in water quality following the installation of the collection system, particularly with lower sulfate, cadmium, and zinc concentrations. Despite these improvements, cadmium and zinc were still marginally above the AWQS during the reporting period.

A non-parametric statistical analysis for trend was performed for specific conductivity, field pH, total alkalinity, total sulfate, and dissolved zinc. Calculation details of the Seasonal Kendall analyses are presented in detail on the pages following this interpretive section. The following table summarizes the results of the data collected between Oct-13 and Sep-19 (WY2014-WY2019).

Site 13 - Table of Summary Statistics for Trend Analysis

	Mann-Kendall test statistics			Sen's slope estimate	
Parameter	**n***	**p****	**Trend**	**Q**	**Q(%)**
Conductivity Field	6	<0.01	-	-61.1	-20.6
pH Field	6	0.13			
Alkalinity, Total	6	0.05			
Sulfate, Total	6	<0.01	-	-23.4	-27.9
Zinc, Dissolved	6	0.31			

* Number of Years ** Significance level

For datasets with a statistically significant trend, a Seasonal-Sen's Slope estimate statistic has also been calculated. There is a statistically significant (α/2=2.5%) decreasing trends for field conductivity (-61.1 µS/cm/yr), and total sulfate (-23.4µg/L/yr). These changes are a result of material removal and installation of the collection system. HGCMC feels the current FWMP program is sufficient to monitor changes at Site 13 before water quality values are impaired long term.

Table of Results for Water Year 2019

Site 013FMS - '1350 East Drainage'

Sample Date/Parameter	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019	**Median**
Water Temp (°C)		3.5						7.6			12.1		7.6
Conductivity-Field(μmho)		136.1						163.6			225.8		163.6
Conductivity-Lab (μmho)		134						166			201		166
pH Lab (standard units)		7.12						6.39			6.69		6.69
pH Field (standard units)		7.58						7.54			7.63		7.58
Total Alkalinity (mg/L)		23.2						27.1			66.9		27.1
Total Sulfate (mg/L)		38.1						53			44.4		44.4
Hardness (mg/L)		65.7						80.2			112		80.2
Dissolved As (ug/L)		0.116						0.124			0.198		0.124
Dissolved Ba (ug/L)		5.6						8.3			9.8		8.3
Dissolved Cd (ug/L)		0.1						0.6			0.4		0.4
Dissolved Cr (ug/L)		0.088						0.074			0.12		0.088
Dissolved Cu (ug/L)		0.8						0.91			1.07		0.91
Dissolved Pb (ug/L)		0.021						0.017			0.016		0.017
Dissolved Ni (ug/L)		0.5						1.4			1.1		1.1
Dissolved Ag (ug/L)		0.002						0.002			0.002		0.002
Dissolved Zn (ug/L)		77						409			229		229
Dissolved Se (ug/L)		0.057						0.057			0.187		0.057
Dissolved Hg (ug/L)		0.00108						0.000947			0.0012		0.001080

For individual sample/analyte qualifier descriptions see "Qualified Data by QA Reviewer" table.

Values reported as less than MDL are replaced by 1/2 MDL for median calculation purposes.

Shaded data has been qualified as an outlier by HGCMC and removed from any further analysis and is not included into the calculation of the median

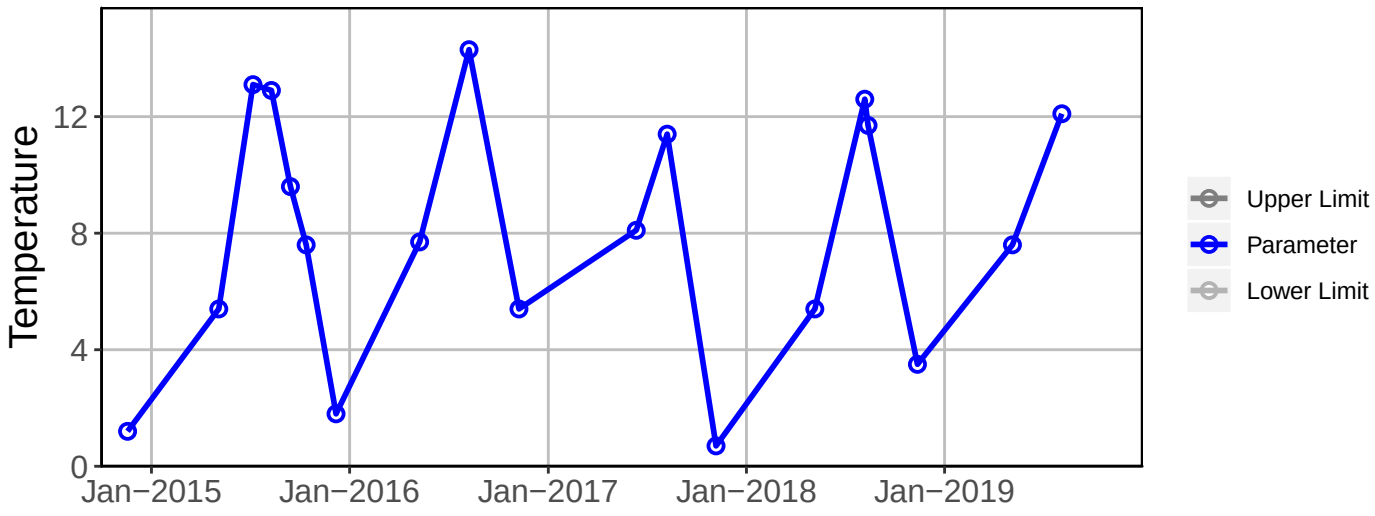
Qualified Data by QA Reviewer

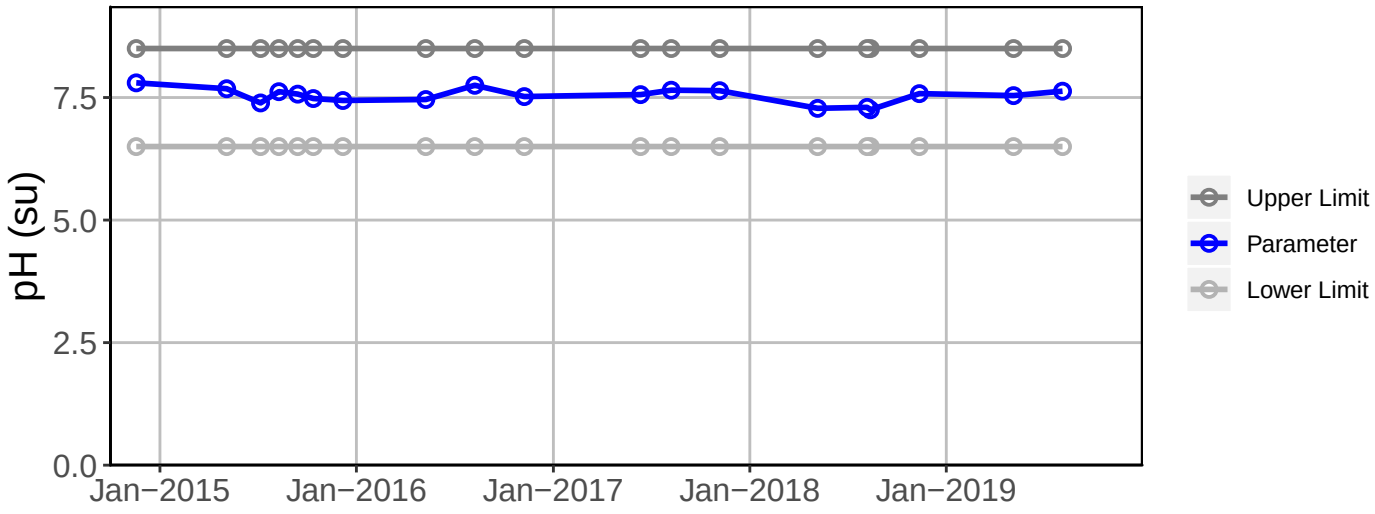
Date Range: 10/01/2018 to 09/30/2019

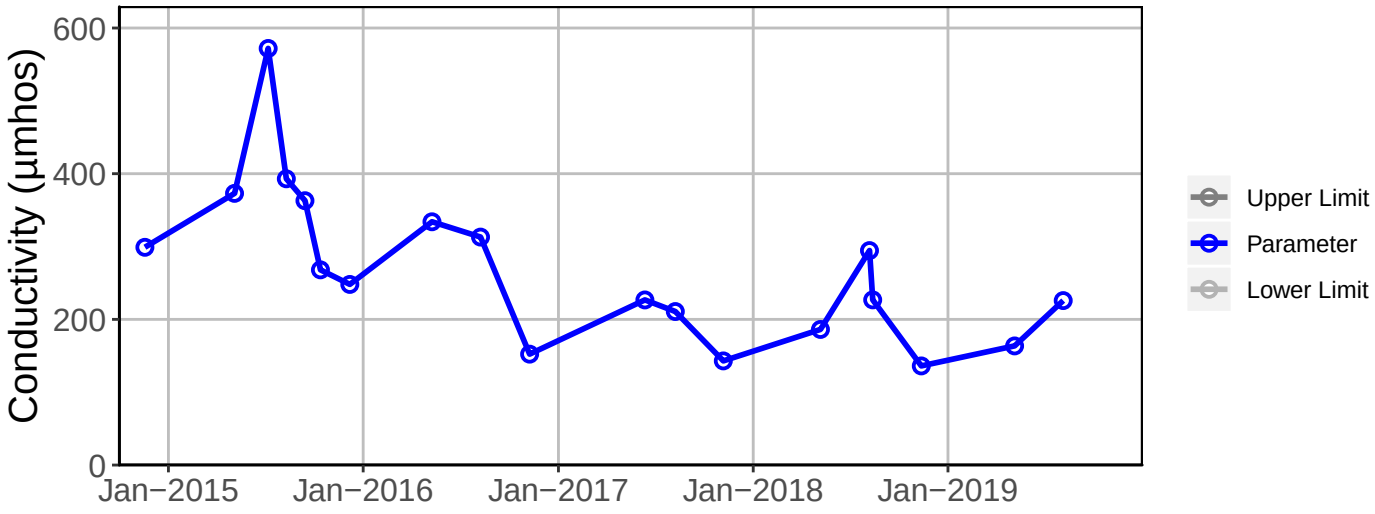
Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
013FMS	12-Nov-18	Diss. Cr-ICP/MS	0.08	µg/L	J	Below Quantitative Range
		Diss. Ni-ICP/MS	0.53	µg/L	U	Field Blank Contamination
		Diss. Pb-ICP/MS	0.02	µg/L	U	Field Blank Contamination
	6-May-19	Diss. Cr-ICP/MS	0.07	µg/L	J	Below Quantitative Range
	5-Aug-19	Diss. Cr-ICP/MS	0.12	µg/L	J	Below Quantitative Range
		Diss. Ni-ICP/MS	1.11	µg/L	U	Field Blank Contamination
		Diss. Pb-ICP/MS	0.01	µg/L	U	Field Blank Contamination
		Diss. Se-ICP/MS	0.18	µg/L	J	Below Quantitative Range
		Total Sulfate	44.40	µg/L	J	Sample Receipt Temperature

Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

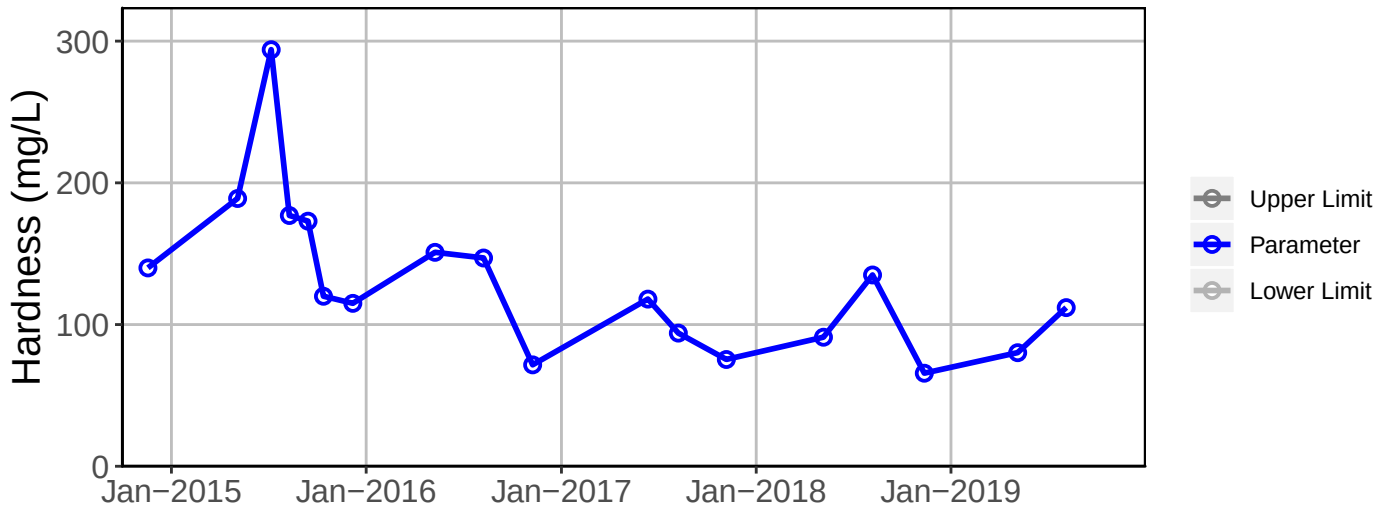
Site 13 Analyte Charts

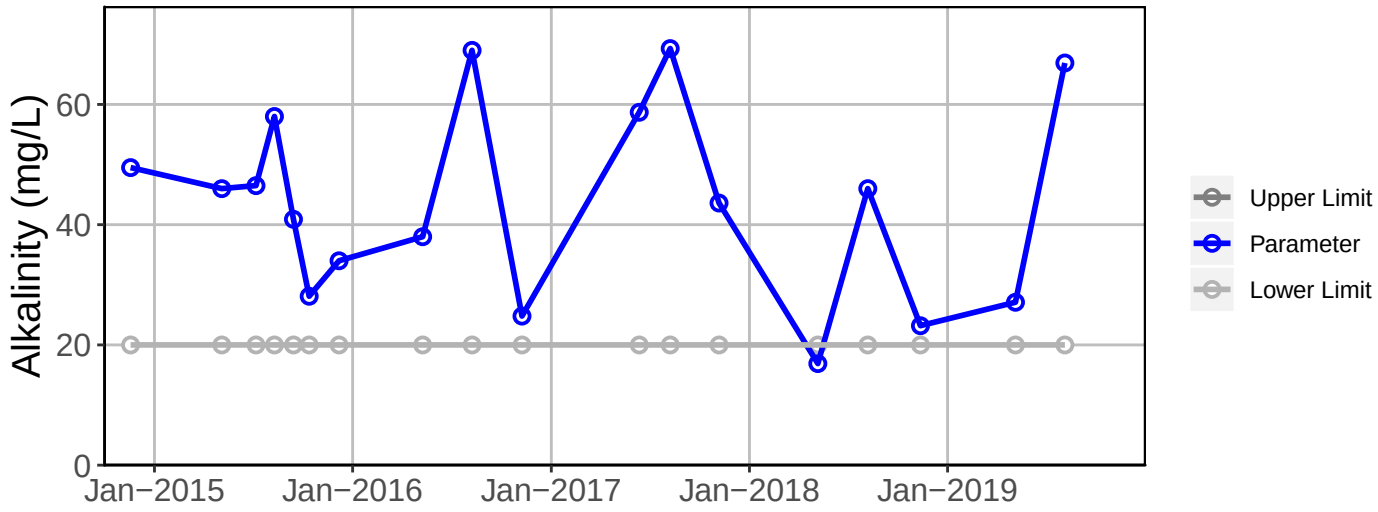


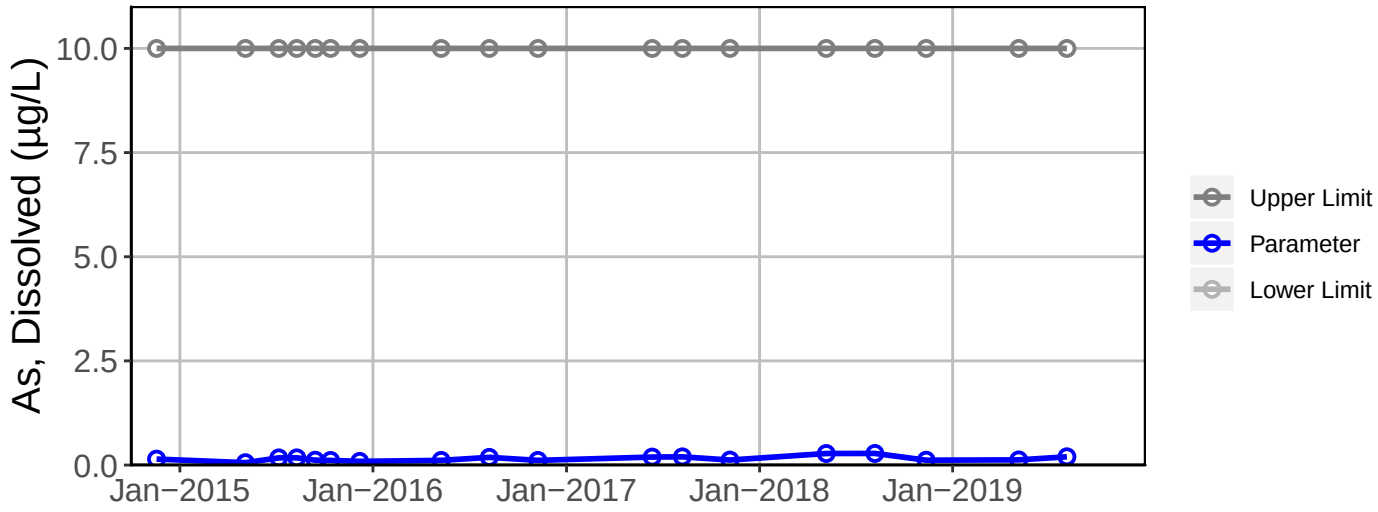




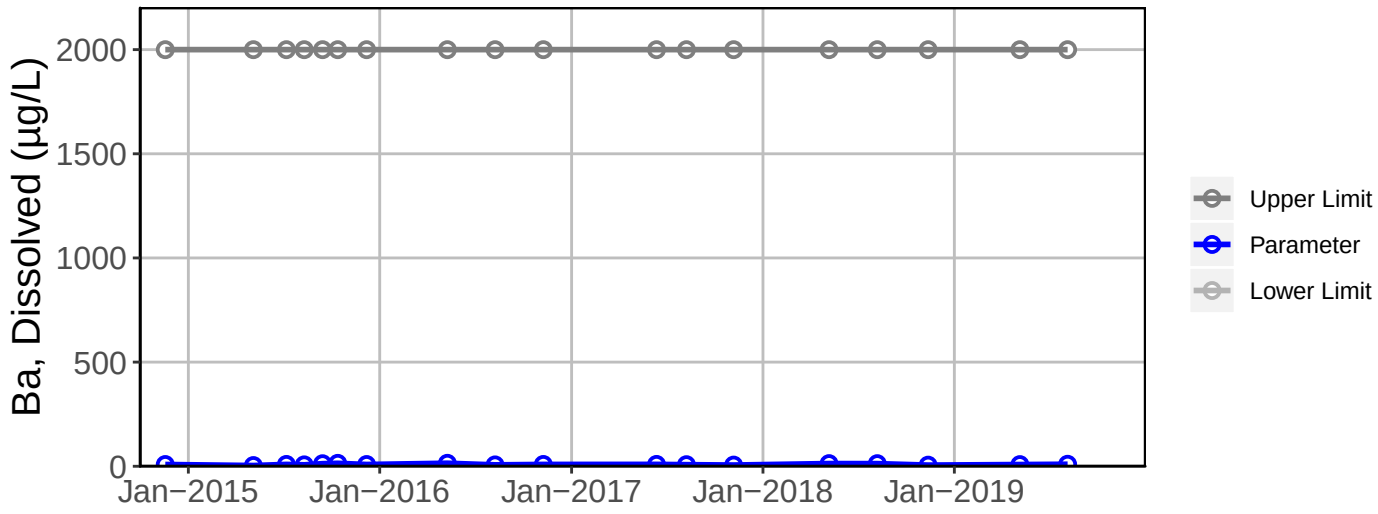
Site 13 Analyte Charts

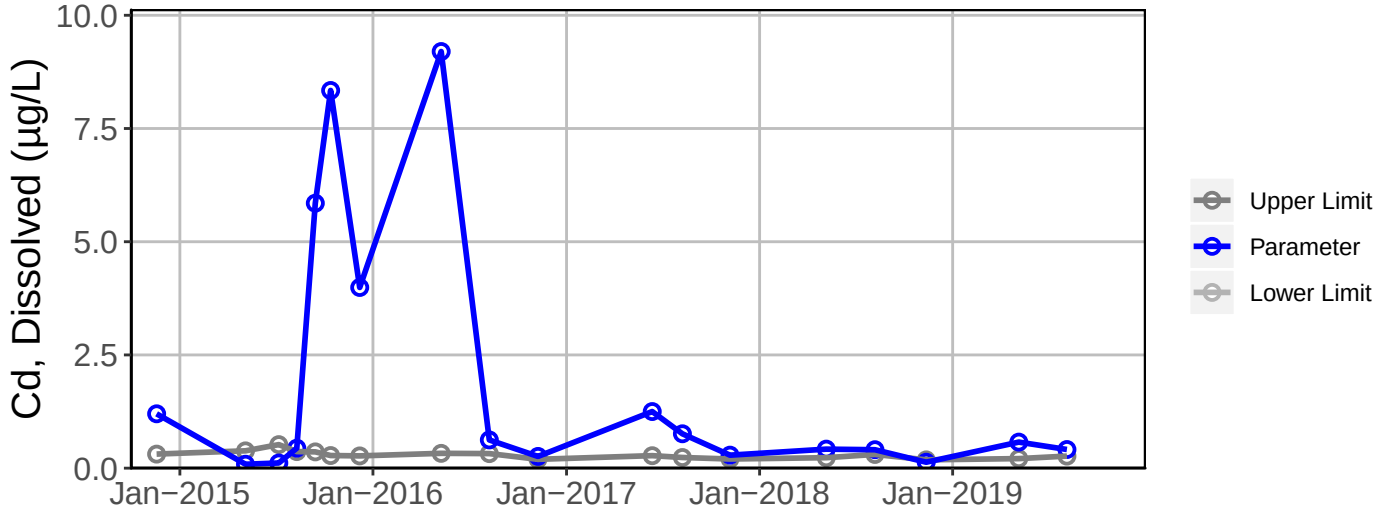


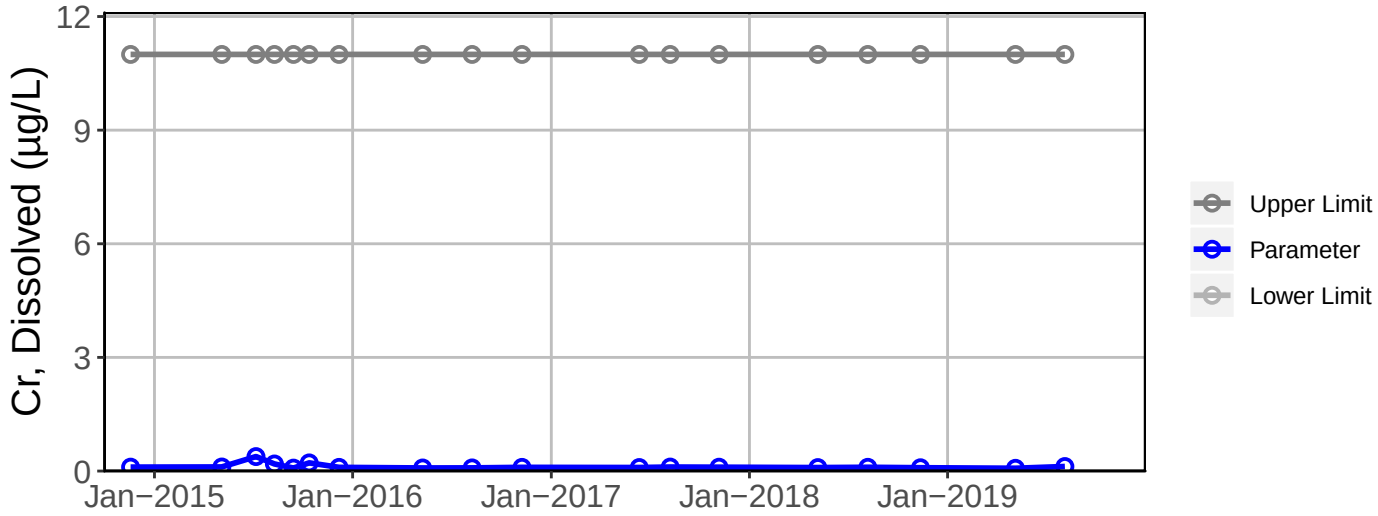




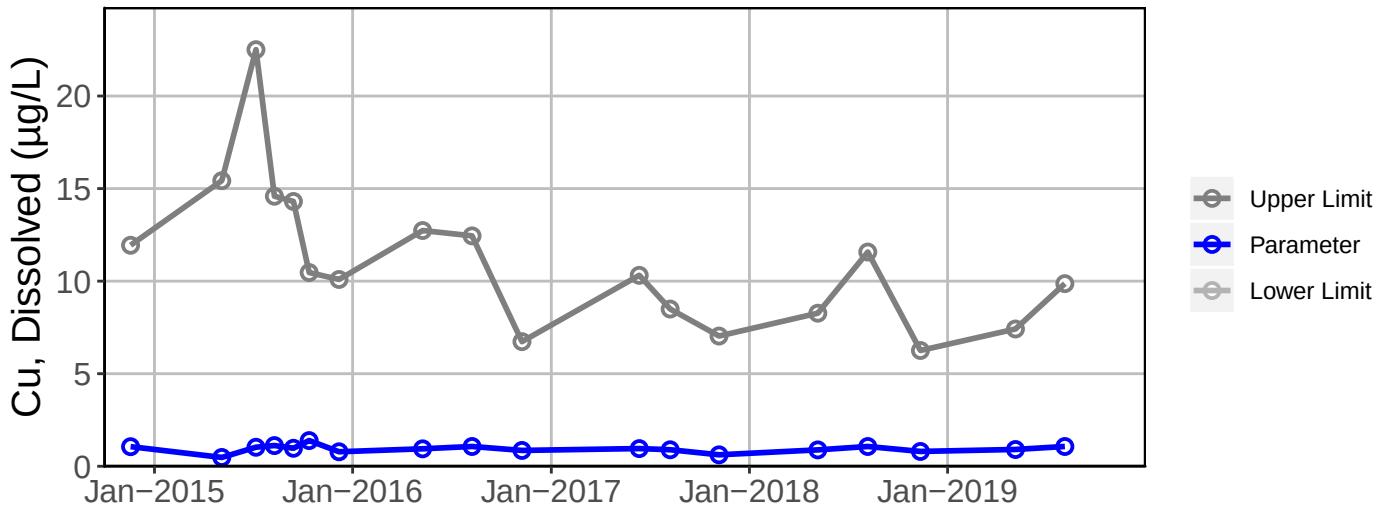
Site 13 Analyte Charts

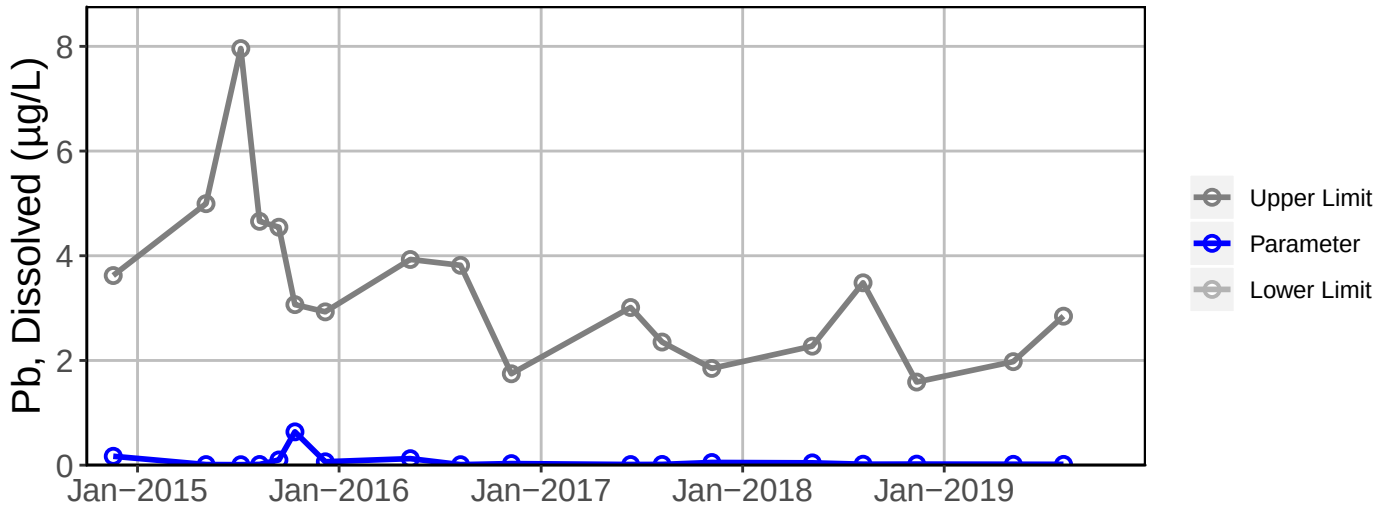


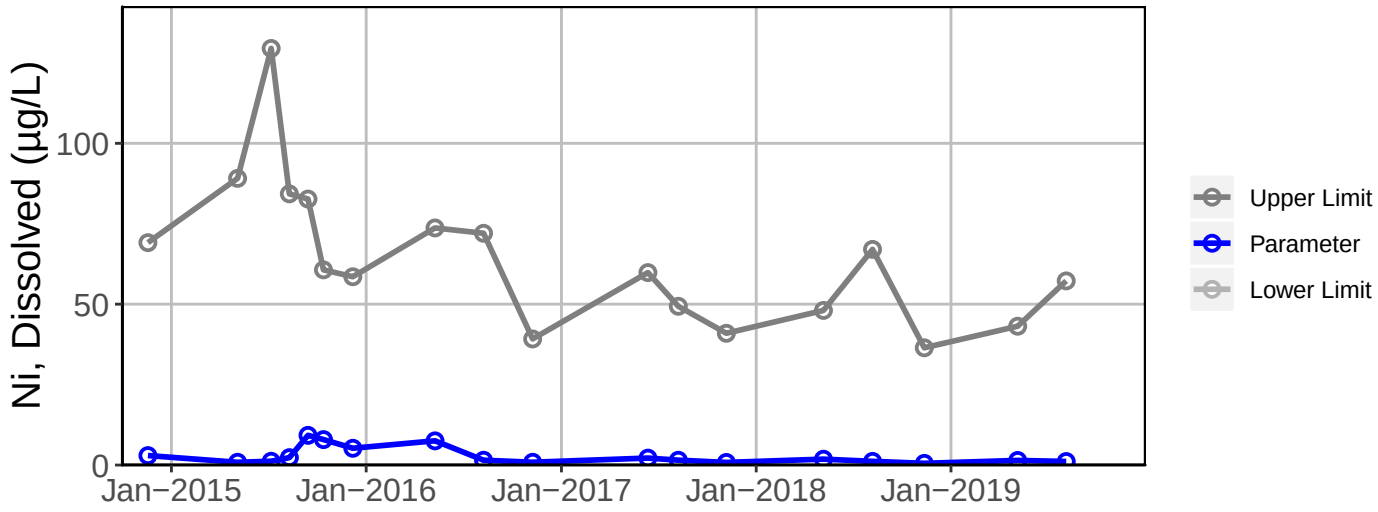




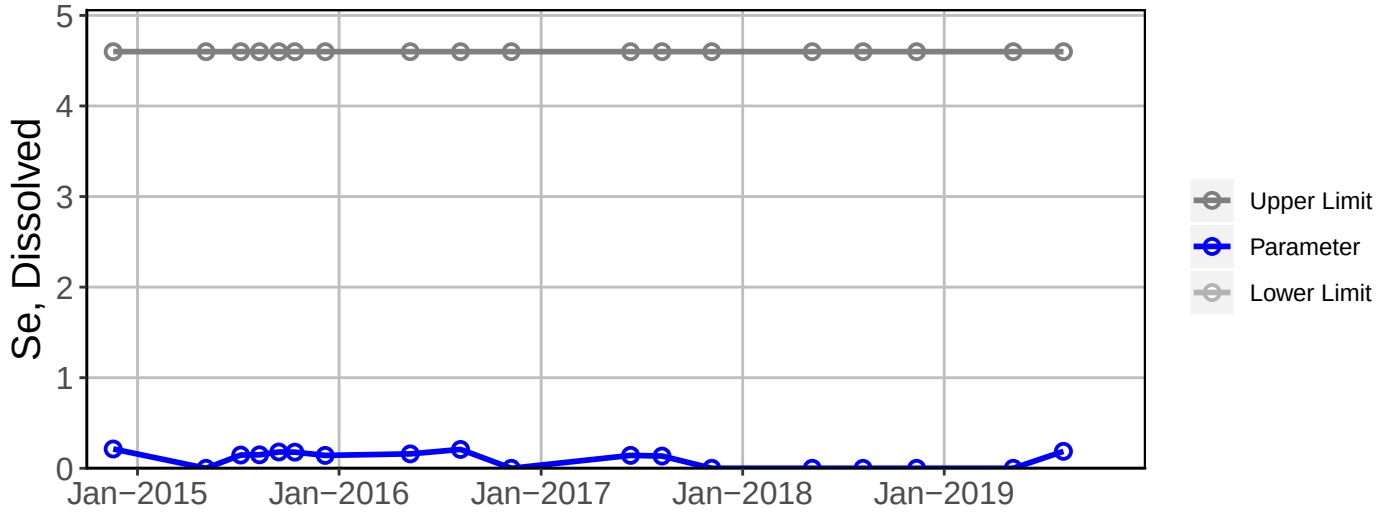
Site 13 Analyte Charts

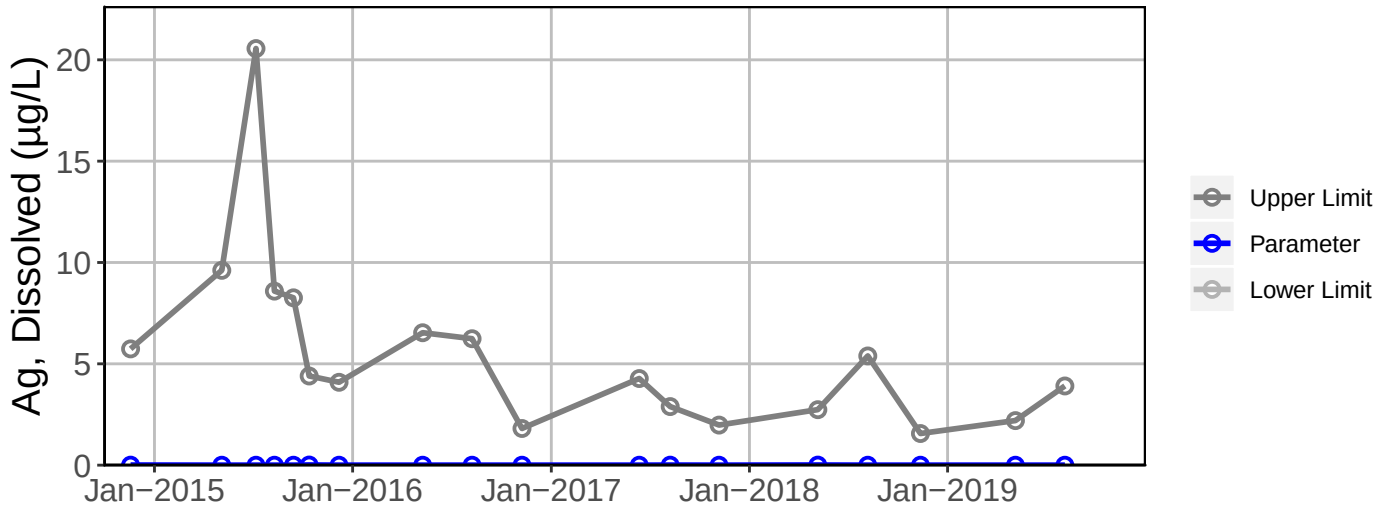


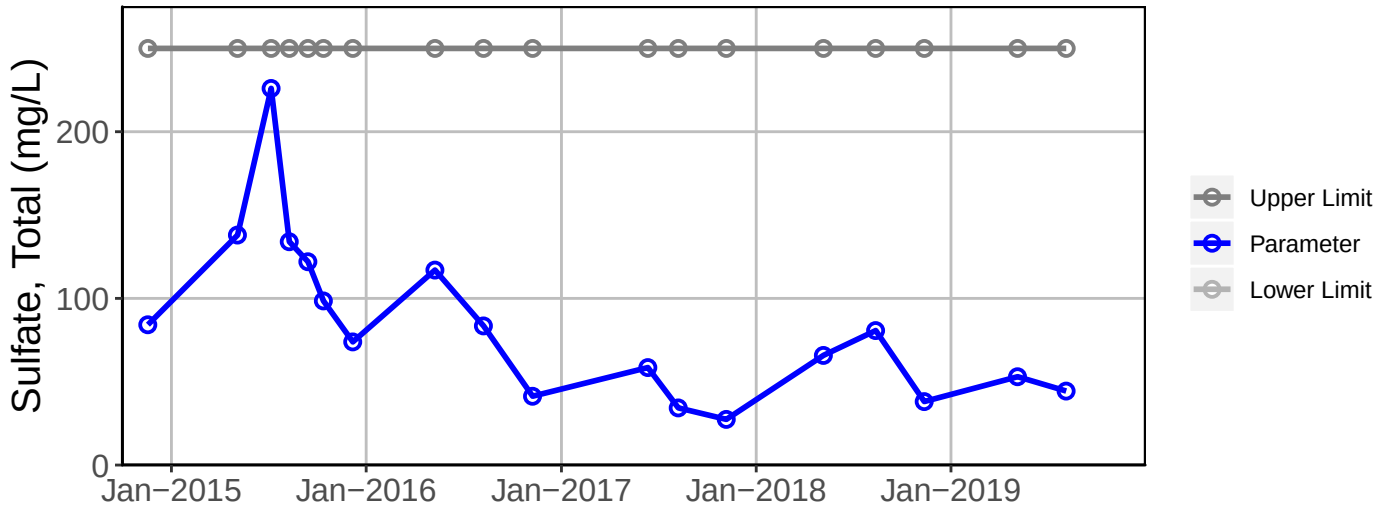




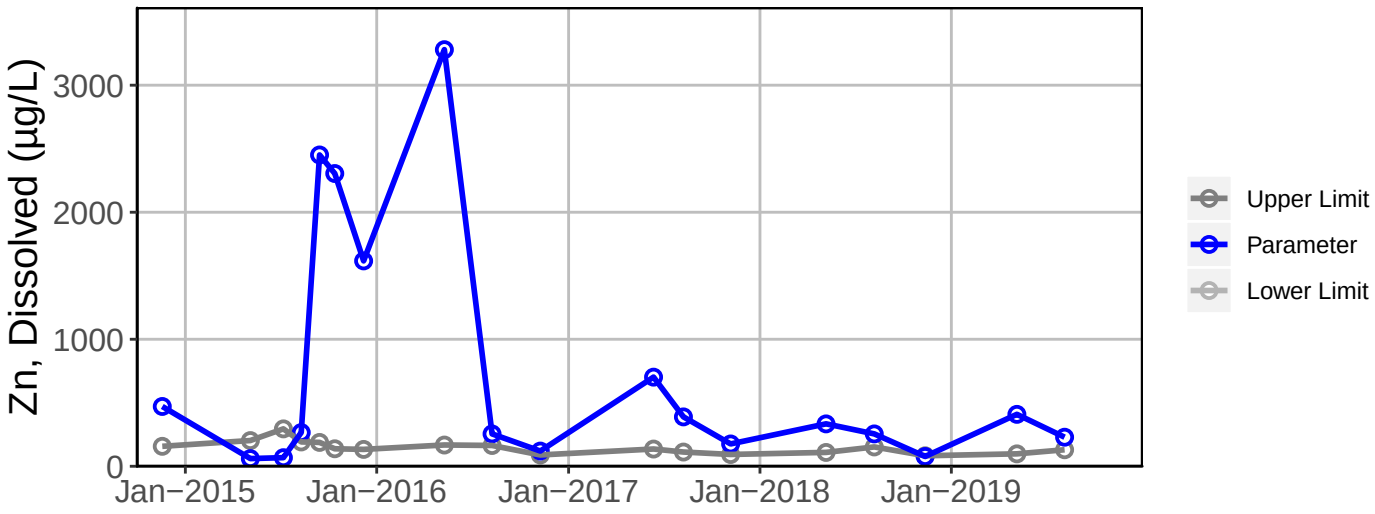
Site 13 Analyte Charts







Site 13 Analyte Charts



Site #13 Seasonal Kendall analysis for Specific Conductance, Field (µS/cm)

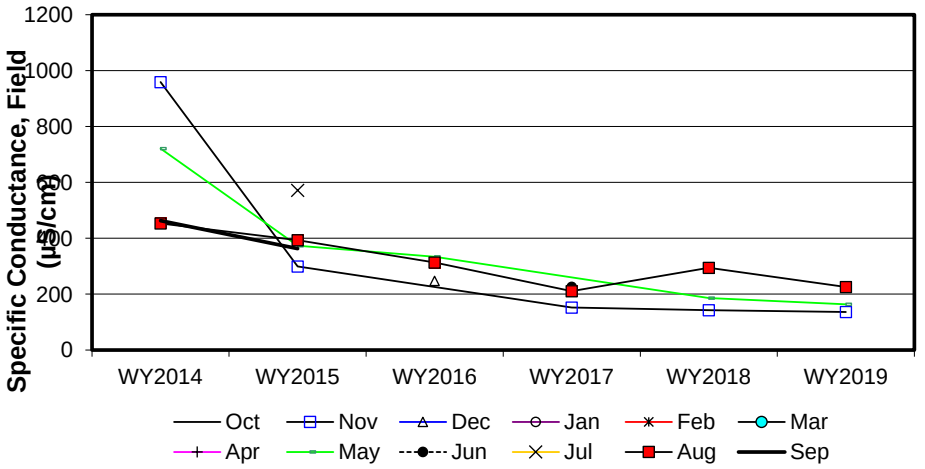
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		959.0						721.0			453.0	463.0
b	**WY2015**		299.0						373.0		572.0	393.0	363.0
c	**WY2016**	268.0		248.0					334.0			313.0	
d	**WY2017**		152.3							226.7		210.8	
e	**WY2018**		143.0						186.2			294.5	
f	**WY2019**		136.1						163.6			225.8	
	n	1	5	1	0	0	0	0	5	1	1	6	2
	t_1	1	5	1	0	0	0	0	5	1	1	6	2
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						-1			-1	-1
	c-a								-1			-1	
	d-a		-1									-1	
	e-a		-1						-1			-1	
	f-a		-1						-1			-1	
	c-b								-1			-1	
	d-b		-1									-1	
	e-b		-1						-1			-1	
	f-b		-1						-1			-1	
	d-c											-1	
	e-c								-1			-1	
	f-c								-1			-1	
	e-d		-1									1	
	f-d		-1									1	
	f-e		-1						-1			-1	
	S_k	0	-10	0	0	0	0	0	-10	0	0	-11	-1
	σ^2_S=		16.67						16.67			28.33	1.00
	$Z_k = S_k/\sigma_S$		-2.45						-2.45			-2.07	-1.00
	Z^2_k		6.00						6.00			4.27	1.00

ΣZ_k= -7.97
ΣZ^2_k= 17.27
Z-bar=$\Sigma Z_k/K$= -1.99

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	22	0	0	0	0

Σn 22
ΣS_k -32

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	1.41		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p **0.704**				$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc} -3.92		@α/2=2.5% Z=	1.96	**H_0** (No trend) REJECT
62.67	**p** **0.000**				**H_A** (± trend) ACCEPT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-104.13		-37.72
0.050	-86.03	**-61.13**	-41.25
0.100	-80.05		-45.18
0.200	-73.53		-52.23

-20.6%

Site #13 Seasonal Kendall analysis for pH, Field, Standard Units

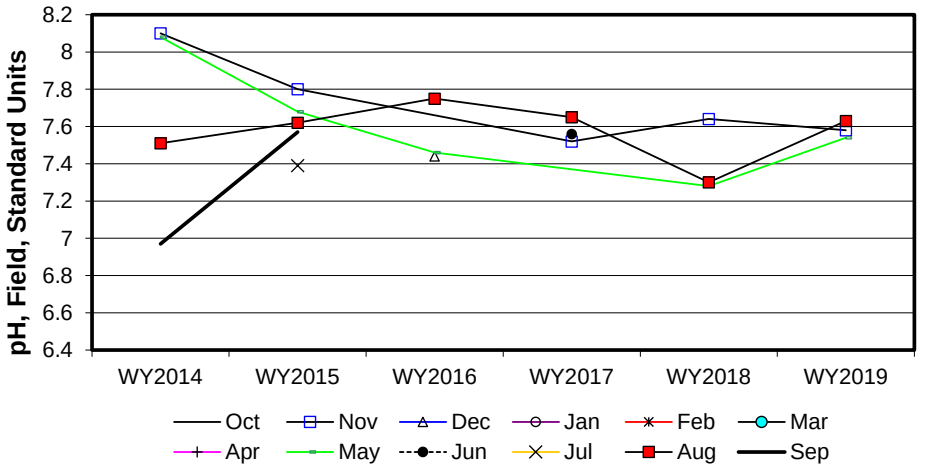
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		8.1						8.1			7.5	7.0
b	**WY2015**		7.8						7.7		7.4	7.6	7.6
c	**WY2016**	7.5		7.4					7.5			7.8	
d	**WY2017**		7.5							7.6		7.7	
e	**WY2018**		7.6						7.3			7.3	
f	**WY2019**		7.6						7.5			7.6	
	n	1	5	1	0	0	0	0	5	1	1	6	2
	t_1	1	5	1	0	0	0	0	5	1	1	6	2
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						-1			1	1
	c-a								-1			1	
	d-a		-1									1	
	e-a		-1						-1			-1	
	f-a		-1						-1			1	
	c-b								-1			1	
	d-b		-1									1	
	e-b		-1						-1			-1	
	f-b		-1						-1			1	
	d-c											-1	
	e-c								-1			-1	
	f-c								1			-1	
	e-d		1									-1	
	f-d		1									-1	
	f-e		-1						1			1	
	S_k	0	-6	0	0	0	0	0	-6	0	0	1	1
	σ^2_S=		16.67						16.67			28.33	1.00
	$Z_k = S_k/\sigma_S$		-1.47						-1.47			0.19	1.00
	Z^2_k		2.16						2.16			0.04	1.00

ΣZ_k= -1.75
ΣZ^2_k= 5.36
Z-bar=$\Sigma Z_k/K$= -0.44

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	22	0	0	0	0

Σn 22
ΣS_k -10

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	4.59		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
p	**0.205**				$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
$\Sigma VAR(S_k)$	Z_{calc} -1.14		@α/2=2.5% **Z**=	1.96	**H_0** (No trend) ACCEPT
62.67	**p** **0.128**				**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.15		0.03
0.050	-0.11	**-0.05**	0.01
0.100	-0.11		-0.01
0.200	-0.10		-0.04

Site #13 Seasonal Kendall analysis for Total Alk, (mg/l)

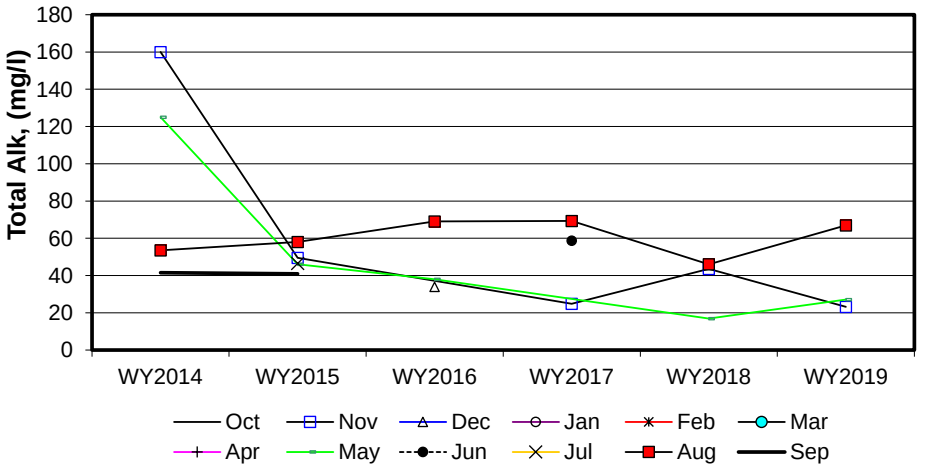
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		160.0						125.0			53.5	41.5
b	**WY2015**		49.5						46.0		46.5	58.0	40.9
c	**WY2016**	28.1		34.0					38.0			69.0	
d	**WY2017**		24.8							58.7		69.3	
e	**WY2018**		43.6						16.9			46.0	
f	**WY2019**		23.2						27.1			66.9	
	n	1	5	1	0	0	0	0	5	1	1	6	2
	t_1	1	5	1	0	0	0	0	5	1	1	6	2
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						-1			1	-1
	c-a								-1			1	
	d-a		-1									1	
	e-a		-1						-1			-1	
	f-a		-1						-1			1	
	c-b								-1			1	
	d-b		-1									1	
	e-b		-1						-1			-1	
	f-b		-1						-1			1	
	d-c											1	
	e-c								-1			-1	
	f-c								-1			-1	
	e-d		1									-1	
	f-d		-1									-1	
	f-e		-1						1			1	
	S_k	0	-8	0	0	0	0	0	-8	0	0	3	-1
	σ^2_S=		16.67						16.67			28.33	1.00
	$Z_k = S_k/\sigma_S$		-1.96						-1.96			0.56	-1.00
	Z^2_k		3.84						3.84			0.32	1.00

ΣZ_k=	-4.36
ΣZ^2_k=	9.00
Z-bar=ΣZ_k/K=	-1.09

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	22	0	0	0	0

Σn	22
ΣS_k	-14

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	4.25	@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity	
p	**0.235**			$\chi^2_h<\chi^2_{(K-1)}$	ACCEPT
ΣVAR(S_k)	Z_{calc} -1.64	@α/2=2.5% Z=	1.96	**H_0** (No trend)	ACCEPT
62.67	**p** **0.050**			**H_A** (± trend)	REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-21.00	**-3.82**	2.32
0.050	-11.93		-0.65
0.100	-10.62		-0.79
0.200	-8.56		-1.65

Site #13

Seasonal Kendall analysis for Sulfate, Total (mg/l)

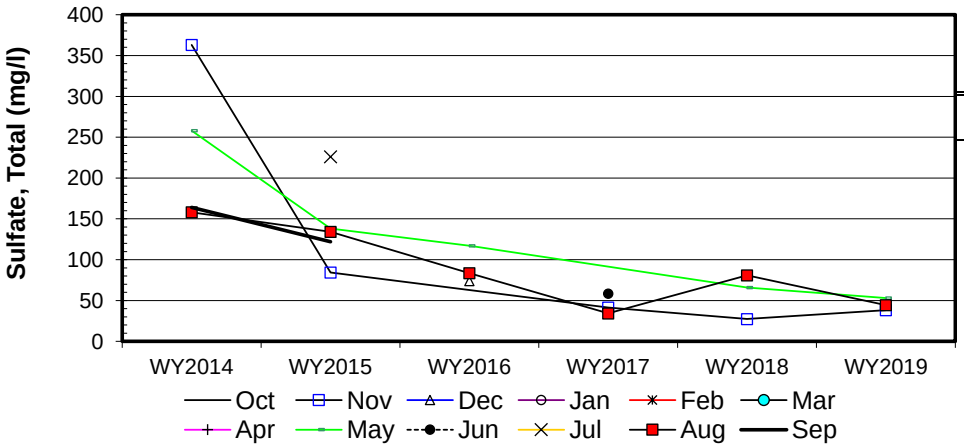
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		363.0						258.0			158.0	164.0
b	**WY2015**		84.2						138.0		226.0	134.0	122.0
c	**WY2016**	98.5		73.9					117.0			83.5	
d	**WY2017**		41.3							58.5		34.3	
e	**WY2018**		27.4						65.8			80.7	
f	**WY2019**		38.1						53.0			44.4	
	n	1	5	1	0	0	0	0	5	1	1	6	2
	t_1	1	5	1	0	0	0	0	5	1	1	6	2
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						-1			-1	-1
	c-a								-1			-1	
	d-a		-1									-1	
	e-a		-1						-1			-1	
	f-a		-1						-1			-1	
	c-b								-1			-1	
	d-b		-1									-1	
	e-b		-1						-1			-1	
	f-b		-1						-1			-1	
	d-c											-1	
	e-c								-1			-1	
	f-c								-1			-1	
	e-d		-1									1	
	f-d		-1									1	
	f-e		1						-1			-1	
	S_k	0	-8	0	0	0	0	0	-10	0	0	-11	-1
	σ^2_S=		16.67						16.67			28.33	1.00
	$Z_k = S_k/\sigma_S$		-1.96						-2.45			-2.07	-1.00
	Z^2_k		3.84						6.00			4.27	1.00

ΣZ_k=	-7.48
ΣZ^2_k=	15.11
Z-bar=$\Sigma Z_k/K$=	-1.87

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	22	0	0	0	0

Σn	22
ΣS_k	-30

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	1.14		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.768**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
$\Sigma VAR(S_k)$	Z_{calc}	-3.66	@α=2.5% Z=	1.96	**H_0** (No trend) REJECT
62.67	**p**	**0.000**			**H_A** (± trend) ACCEPT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-49.34		-16.96
0.050	-41.62	**-23.36**	-20.14
0.100	-41.02		-21.23
0.200	-36.61		-21.41

-27.9%

Site #13 Seasonal Kendall analysis for Zinc, Dissolved (ug/l)

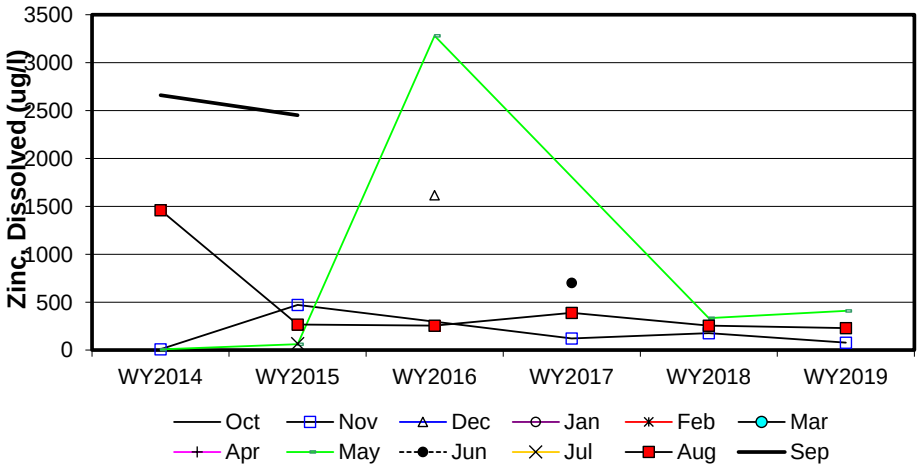
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		8.5						7.0			1460.0	2660.0
b	**WY2015**		471.0						60.5		67.9	266.0	2451.0
c	**WY2016**	2305.0		1617.0					3280.0			255.0	
d	**WY2017**		120.0							702.0		389.0	
e	**WY2018**		176.0						334.0			255.0	
f	**WY2019**		77.2						409.0			229.0	
	n	1	5	1	0	0	0	0	5	1	1	6	2
	t_1	1	5	1	0	0	0	0	5	1	1	4	2
	t_2	0	0	0	0	0	0	0	0	0	0	1	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		1						1			-1	-1
	c-a								1			-1	
	d-a		1									-1	
	e-a		1						1			-1	
	f-a		1						1			-1	
	c-b								1			-1	
	d-b		-1									1	
	e-b		-1						1			-1	
	f-b		-1						1			-1	
	d-c											1	
	e-c								-1			0	
	f-c								-1			-1	
	e-d		1									-1	
	f-d		-1									-1	
	f-e		-1						1			-1	
	S_k	0	0	0	0	0	0	0	6	0	0	-10	-1
	σ^2_S=		16.67						16.67			27.33	1.00
	$Z_k = S_k/\sigma_S$		0.00						1.47			-1.91	-1.00
	Z^2_k		0.00						2.16			3.66	1.00

ΣZ_k= -1.44
ΣZ^2_k= 6.82
Z-bar=$\Sigma Z_k/K$= -0.36

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	20	1	0	0	0

Σn 22
ΣS_k -5

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	6.30		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.098**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	-0.51	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
61.67	**p**	**0.305**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-180.00		63.31
0.050	-98.61	**-8.96**	47.22
0.100	-98.34		37.32
0.200	-42.45		4.19

INTERPRETIVE REPORT
SITE 27

The data collected during the current water year are listed in the following "Table of Results for Water Year 2019" report. The table includes all the required FWMP analyte data (field and laboratory) collected for the current water year and a series of flags keyed to the summary report "Qualified Data by QA Reviewer." The QA report lists any associated data limitations found during the monthly QA reviews of laboratory data for this site. Median values for all analytes have been calculated and are shown in the right-most column of the table of results. Any value reported as less than MDL has been replaced with a value of one-half of the MDL for the purpose of median calculation.

All data collected at this site for the past six years are included in the data analyses. As shown in the table below, there were no data outliers.

Sample Date	Parameter	Value	Qualifier	Notes
No outliers, in the past six years, have been identified by HGCMC.				

The data have been compared to the strictest freshwater quality criterion for each applicable analyte. Three samples exceeding these criteria have been identified, as listed in the table below. The exceedances were for field pH values, which are below the lower limit of 6.5 su listed in the AWQS. Values for field pH from other wells completed into organic-rich peat sediments similar to Site 27 have historically resulted in pH values ranging from 5 to 6 su (e.g., Sites 29 and 32). All other analytes were within AWQS for the current water year.

Table of Exceedance for Water Year 2019

			Limits		
Sample Date	Parameter	Value	Lower	Upper	Hardness
13-Nov-18	pH	6.34 su	6.5	8.5	42.2 mg/L
15-Jul-19	pH	6.41 su	6.5	8.5	41.3 mg/L
2-Sep-19	pH	6.32 su	6.5	8.5	43.8 mg/L

X-Y plots have been generated to graphically present the data for each of the analytes requested in the Statistical Information Goals for this site. These plots have been visually analyzed for the appearance of any trend in concentration. No visually obvious trends were identified.

Non-parametric statistical analyses were performed for specific conductivity, field pH, total alkalinity, total sulfate, and dissolved zinc. Calculation details of the Seasonal Kendall analyses are presented in detail on the pages following this interpretive section. The below table summarizes the results of the data collected between Oct-13 and Sep-19 (WY2014-WY2019).

Site 27 - Table of Summary Statistics for Trend Analysis

	Mann-Kendall test statistics			Sen's slope estimate	
Parameter	**n***	**p****	**Trend**	**Q**	**Q(%)**
Conductivity Field	6	0.92			
pH Field	6	0.95			
Alkalinity, Total	6	0.92			
Sulfate, Total	6	0.16			
Zinc, Dissolved	6	0.09			

* Number of Years ** Significance level

For datasets with a statistically significant trend ($\alpha/2$=2.5%), a Seasonal-Sen's Slope estimate statistic has also been calculated. There were no statistically significant trends determined from the data analysis.

An intra-well analysis was performed using combined Shewhart-CUSUM charts for conductivity, dissolved zinc, and total sulfate. Table 1 contains a summary of the baseline statistics, along with the control limits used.

Table 1. Specific Conductance, Dissolved Zinc, and Total Sulfate Baseline Periods, Summary Statistics and Various Control Limits

	Site 27 Conductivity (µS/cm)	Site 27 Diss. Zinc (µg/L)	Site 27 Total Sulfate (mg/L)
Baseline Statistics			
Baseline Period	09/18/01-05/18/04	09/18/01-05/18/04	09/17/02-09/21/04
Number of Samples	6	6	5
Mean (x)	95.88	2.78	1.56
Standard Deviation	6.43	1.42	0.43
Shewhart-CUSUM Control Limits (SCL)			
Control Limit (mean x+ 2s)	108.6	5.6	2.4
Control Limit (mean x + 3s)	115.5	7.0	2.8
Control Limit (mean x + 4s)	122.3	8.4	3.3
Control Limit (mean x + 4.5s)	125.7	9.2	3.5
CUSUM Control Limits			
Cumulative increase (h)	5	5	5

Figure 1 shows the three analytes examined eventually went out of control. Total sulfate went out of control during the Water Year 2008. This has been discussed in previous reports and is related to the material that was placed to the east of Pond 7 to form a pad. The fill material originated from the northern expansion of the tailings facility, and from the figure, it appears that there was some easily weathered sulfide mineralogy in the freshly blasted material. Total sulfate concentrations were initially decreasing through Water Year 2015. However, there was an

increase in late 2016 and early 2017 likely caused by the recent disturbance (tailings expansion) in the vicinity of the monitoring well. The median concentration decreased to near-baseline level in 2017 with a slight increase in Water Year 2019. Though increased over the median value, the average value in Wate Year 2019 was less than 4% of the AWQS.

Specific conductance also went out of control in Water Year 2008 as would be expected with the increase in dissolved constituents driving the increase in conductivity. Specific conductivity increased during late 2015 and remained elevated during the 2018 Water Year. This correlates with the excavation and construction of the Stage 3 Phase 1 tailings expansion that began in May 2015. Now that the construction (disturbance) is completed, the conductivity values are expected to drop as the area stabilizes.

Dissolved zinc went out of control, beginning in Water Year 2007. After the first increase in Water Year 2007, concentrations returned to near baseline levels resulting in the flattening of the CUSUM values. Then water years 2010 and 2011 each had dissolved zinc concentrations that further increased the CUSUM value. Since the fall of 2011, the CUSUM measurement has been trending downward, indicating that the concentrations are around the baseline mean.

Figure 1. **Observed Measurements for Specific Conductance, Dissolved Zinc, and Total Sulfate from Site 27 Compared to the Shewhart-CUSUM Control Limits From Table 1**

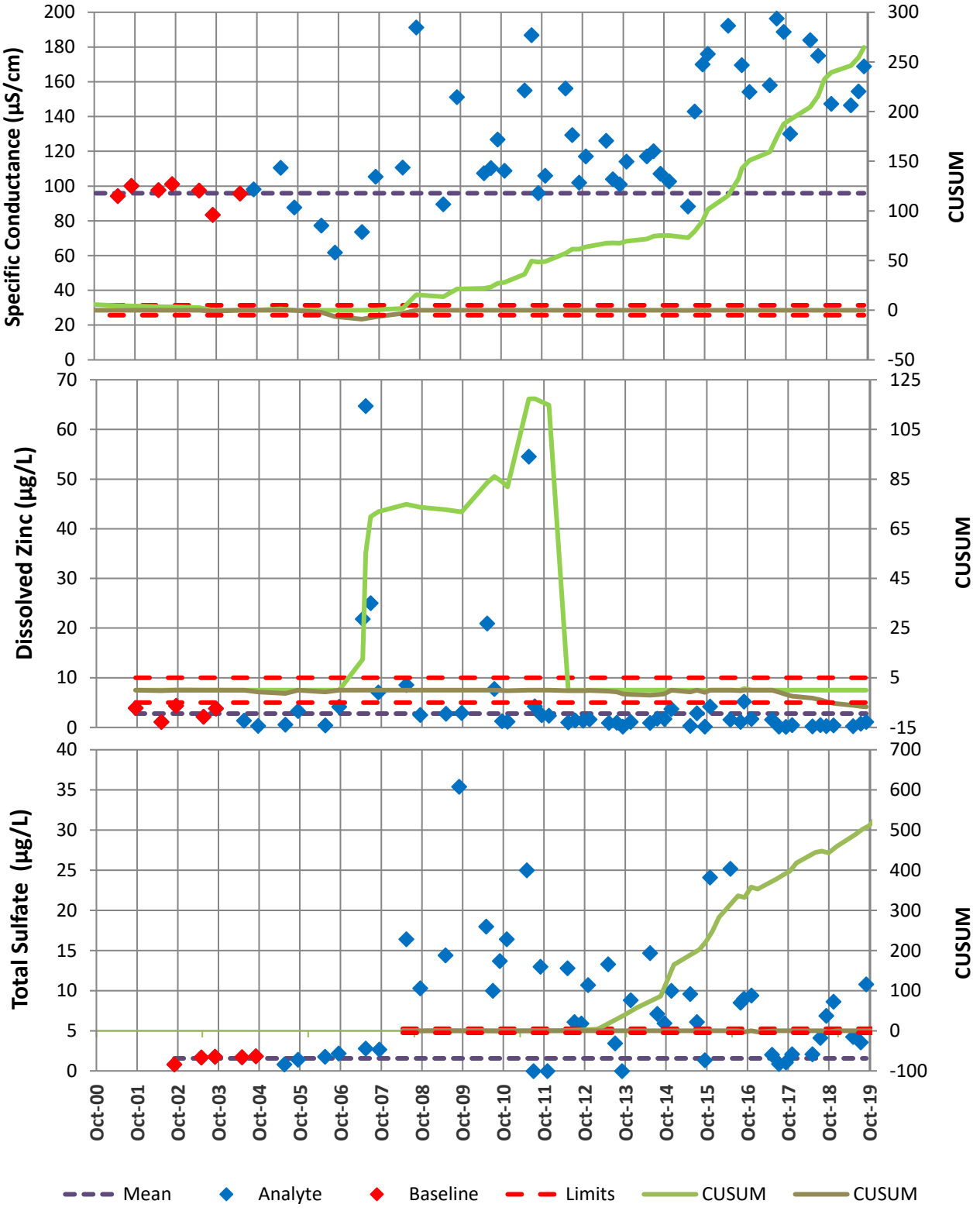


Table of Results for Water Year 2019

Site 027FMG - 'Monitoring Well - 2S'

Sample Date/Parameter	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019	**Median**
Water Temp (°C)		6						4.4		10.2		9.2	7.6
Conductivity-Field(μmho)		147.3						146.4		154.5		168.9	150.9
Conductivity-Lab (μmho)		131						122		122		127	125
pH Lab (standard units)		5.93						5.98		6.12		5.98	5.98
pH Field (standard units)		6.34						6.64		6.41		6.32	6.38
Total Alkalinity (mg/L)		51.3						52.2		61.7		54	53.1
Total Sulfate (mg/L)		8.6						4.2		3.6		10.8	6.4
Hardness (mg/L)		42.2						31.9		41.3		43.8	41.8
Dissolved As (ug/L)		0.57						0.615		0.716		0.721	0.666
Dissolved Ba (ug/L)		49.8						38.2		46.3		46.9	46.6
Dissolved Cd (ug/L)		0.0018						0.0018		0.0018		0.0018	0.0018
Dissolved Cr (ug/L)		0.347						0.337		0.607		0.44	0.394
Dissolved Cu (ug/L)		0.034						0.066		0.079		0.088	0.073
Dissolved Pb (ug/L)		0.0059						0.0154		0.011		0.0195	0.0132
Dissolved Ni (ug/L)		0.136						0.186		0.349		0.255	0.221
Dissolved Ag (ug/L)		0.002						0.002		0.002		0.002	0.002
Dissolved Zn (ug/L)		0.4						0.25		0.78		1.11	0.59
Dissolved Se (ug/L)		0.057						0.057		0.057		0.199	0.057
Dissolved Hg (ug/L)		0.000229						0.00041		0.000415		0.000384	0.000397

For individual sample/analyte qualifier descriptions see "Qualified Data by QA Reviewer" table.

Values reported as less than MDL are replaced by 1/2 MDL for median calculation purposes.

Shaded data has been qualified as an outlier by HGCMC and removed from any further analysis and is not included into the calculation of the median

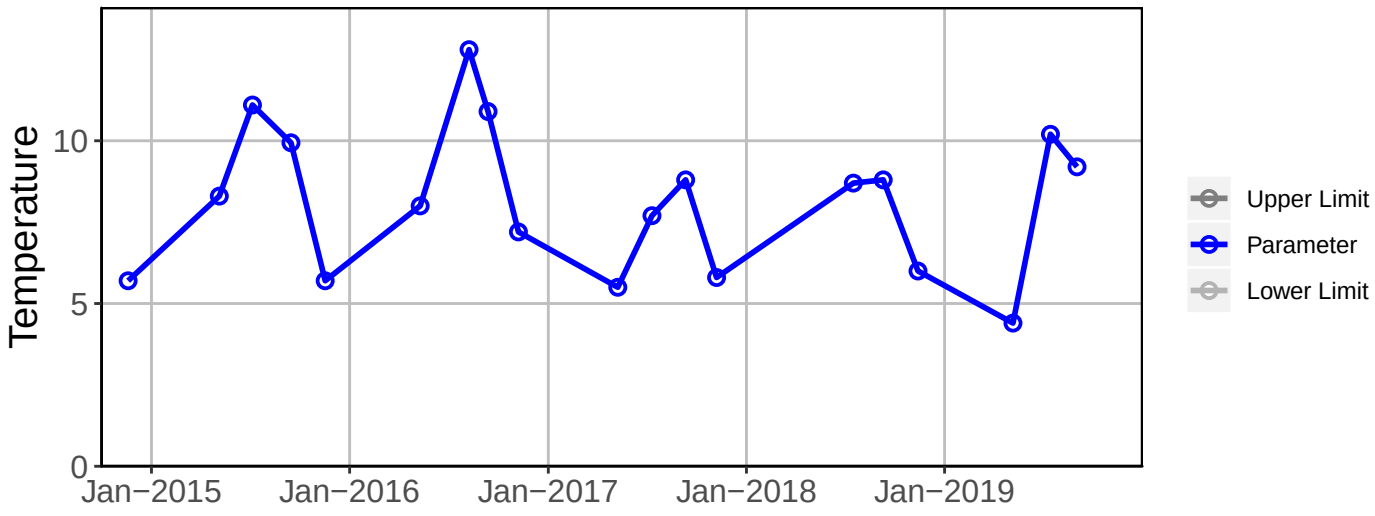
Qualified Data by QA Reviewer

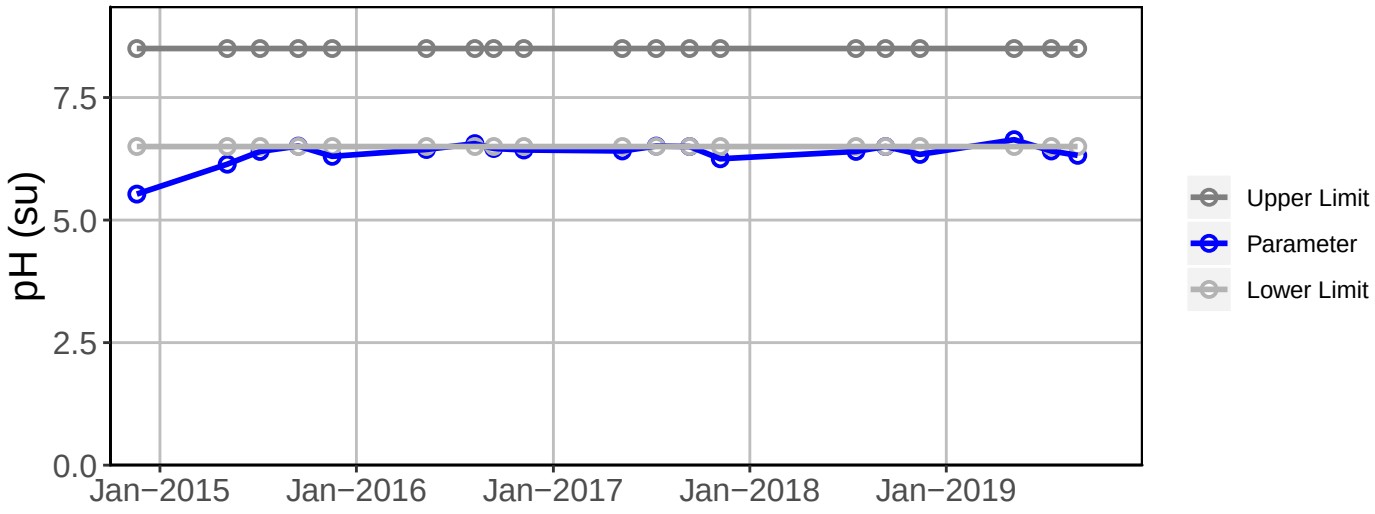
Date Range: 10/01/2018 to 09/30/2019

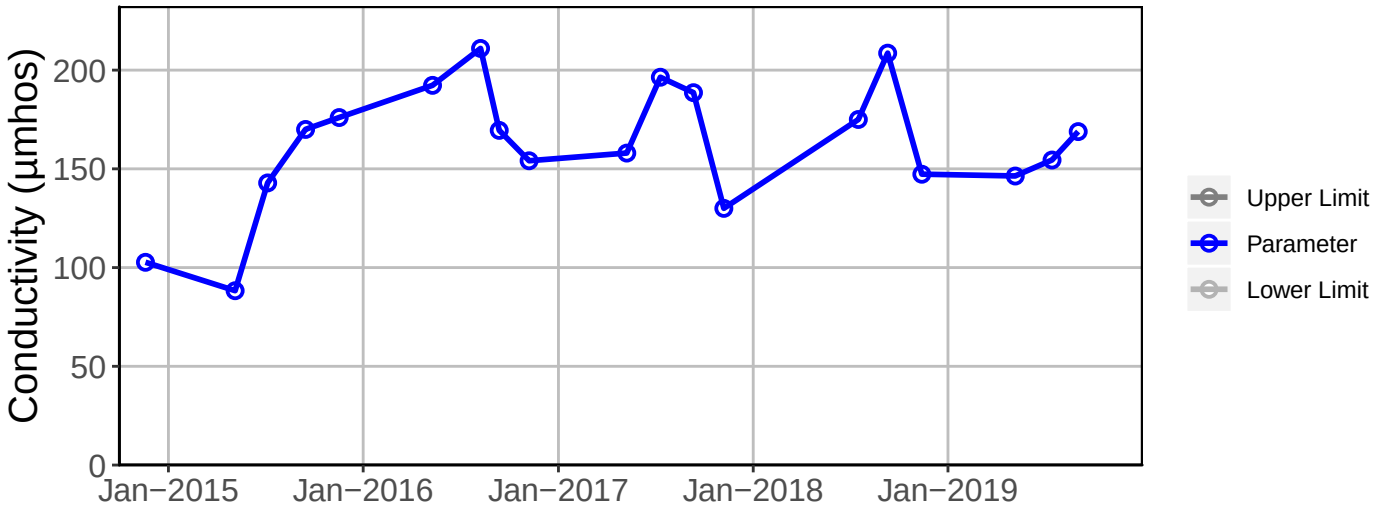
Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
027FMG	13-Nov-18	Diss. Cu-ICP/MS	0.03	µg/L	U	Field Blank Contamination
		Diss. Hg-CVAF	0.000229	µg/L	J	Below Quantitative Range
		Diss. Ni-ICP/MS	0.13	µg/L	U	Field Blank Contamination
		Diss. Pb-ICP/MS	0.00592	µg/L	U	Field Blank Contamination
		Diss. Zn-ICP/MS	0.4	µg/L	U	Field Blank Contamination
	7-May-19	Diss. Zn-ICP/MS	0.25	µg/L	U	Field Blank Contamination
	15-Jul-19	Diss. Cu-ICP/MS	0.07	µg/L	U	Field Blank Contamination
		Diss. Ni-ICP/MS	0.34	µg/L	U	Field Blank contamination
		Diss. Pb-ICP/MS	0.01	µg/L	U	Field Blank contamination
		Diss. Zn-ICP/MS	0.77	µg/L	U	Field Blank contamination
	2-Sep-19	Diss. Cr-ICP/MS	0.44	µg/L	U	Field Blank Contamination
		Diss. Cu-ICP/MS	0.08	µg/L	U	Field Blank Contamination
		Diss. Ni-ICP/MS	0.25	µg/L	U	Field Blank Contamination
		Diss. Pb-ICP/MS	0.01	µg/L	U	Field Blank Contamination
		Diss. Se-ICP/MS	0.19	µg/L	U	Method Blank Contamination
		Diss. Zn-ICP/MS	1.11	µg/L	U	Field Blank Contamination
		Total Sulfate	10.80	µg/L	J	Sample Receipt Temperature

Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

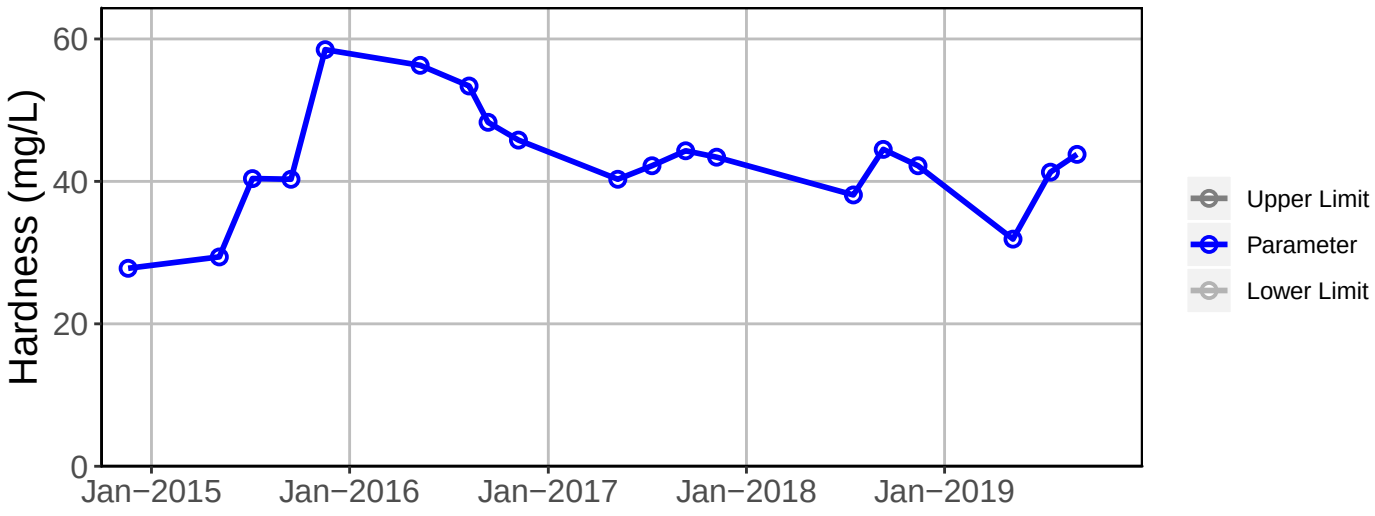
Site 27 Analyte Charts

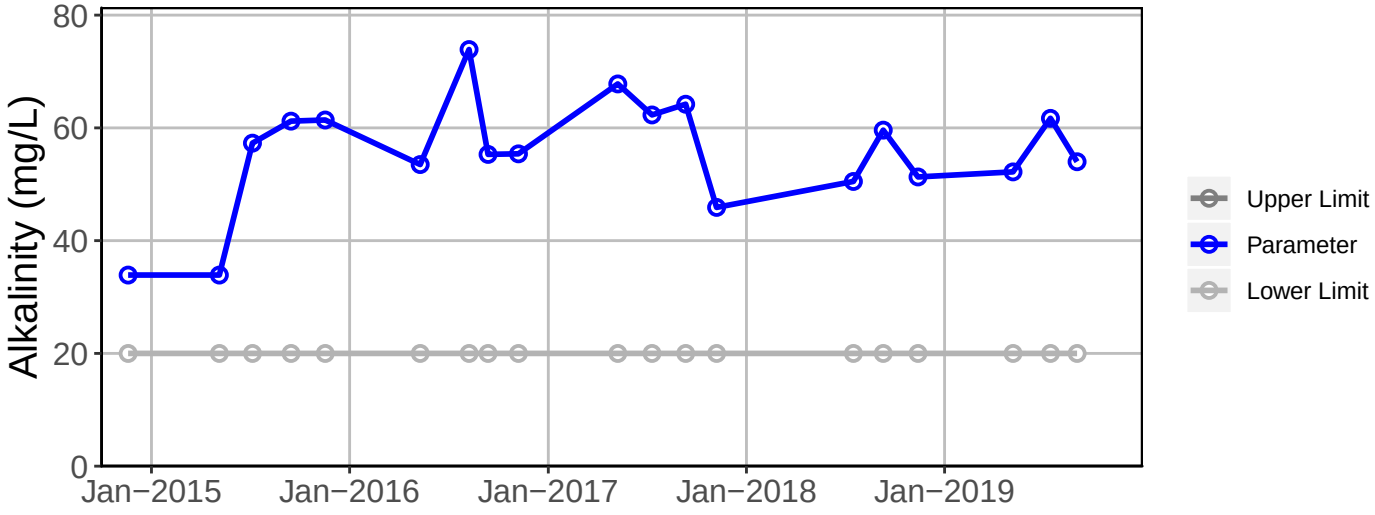


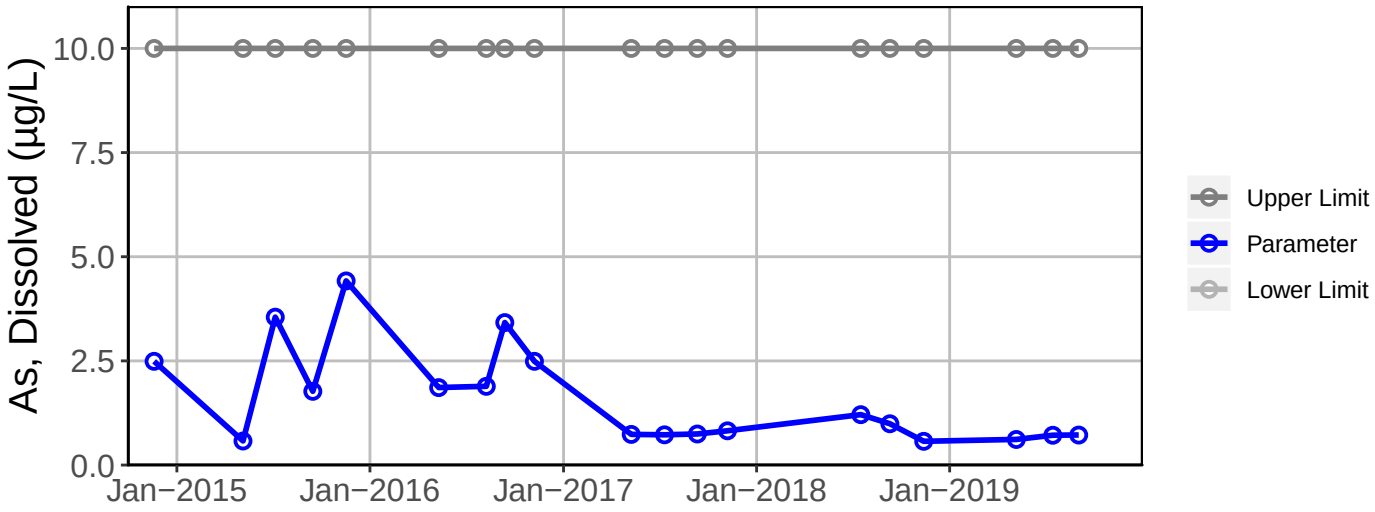




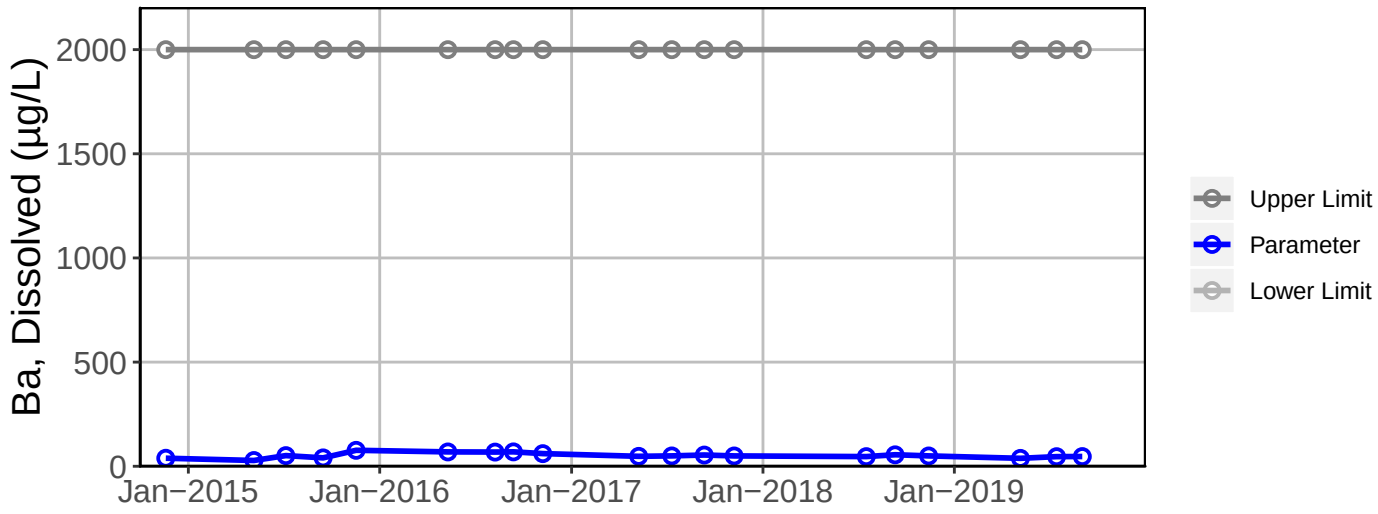
Site 27 Analyte Charts

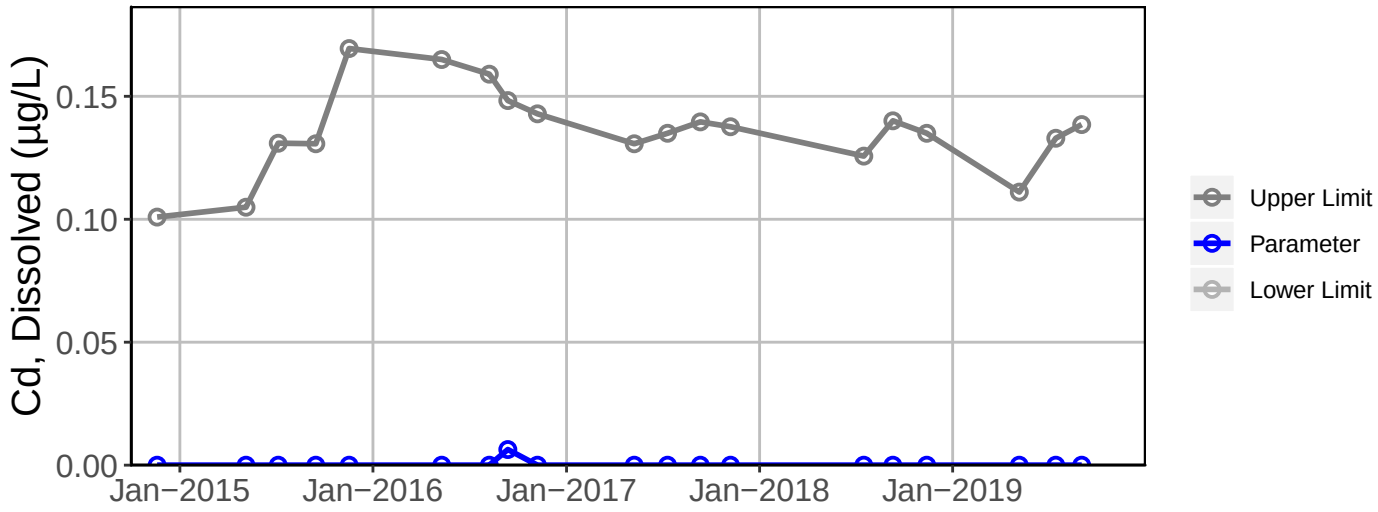


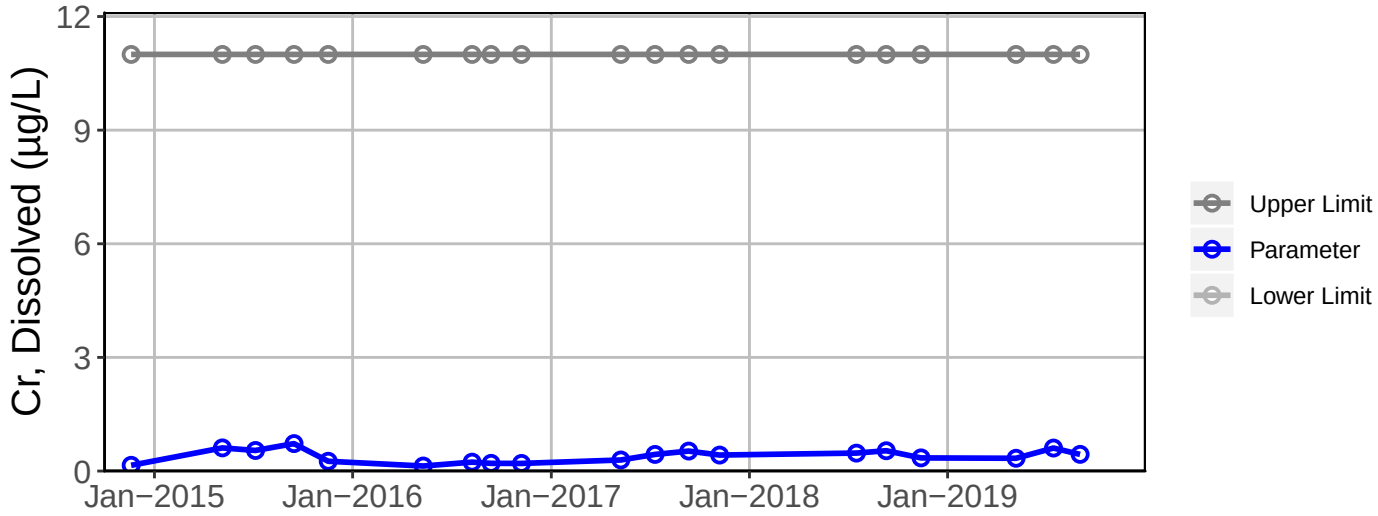




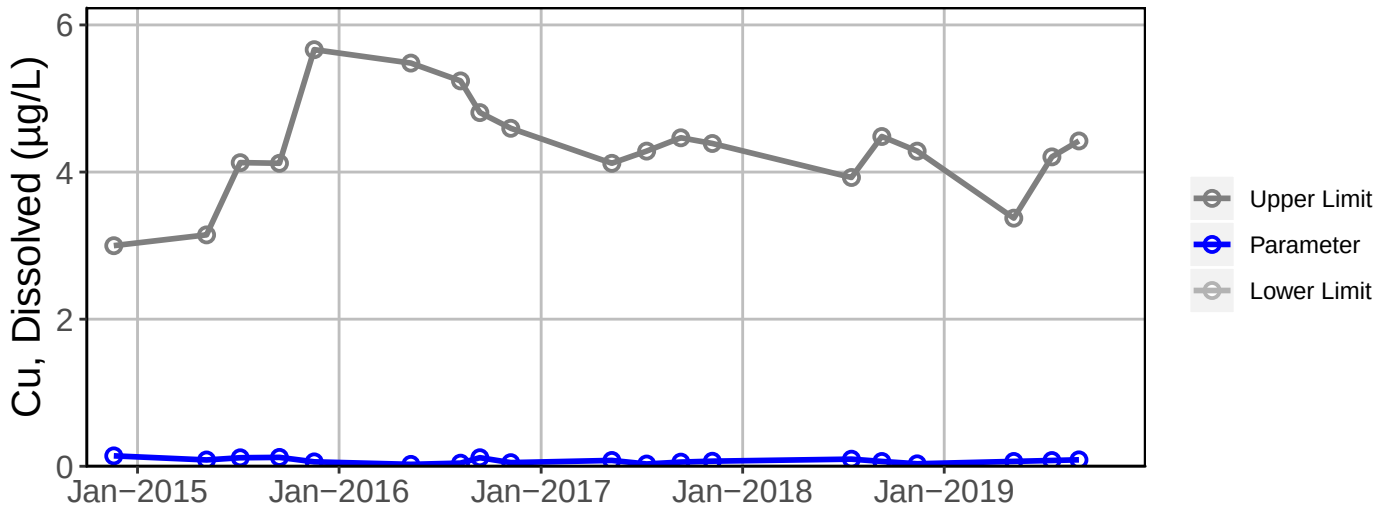
Site 27 Analyte Charts

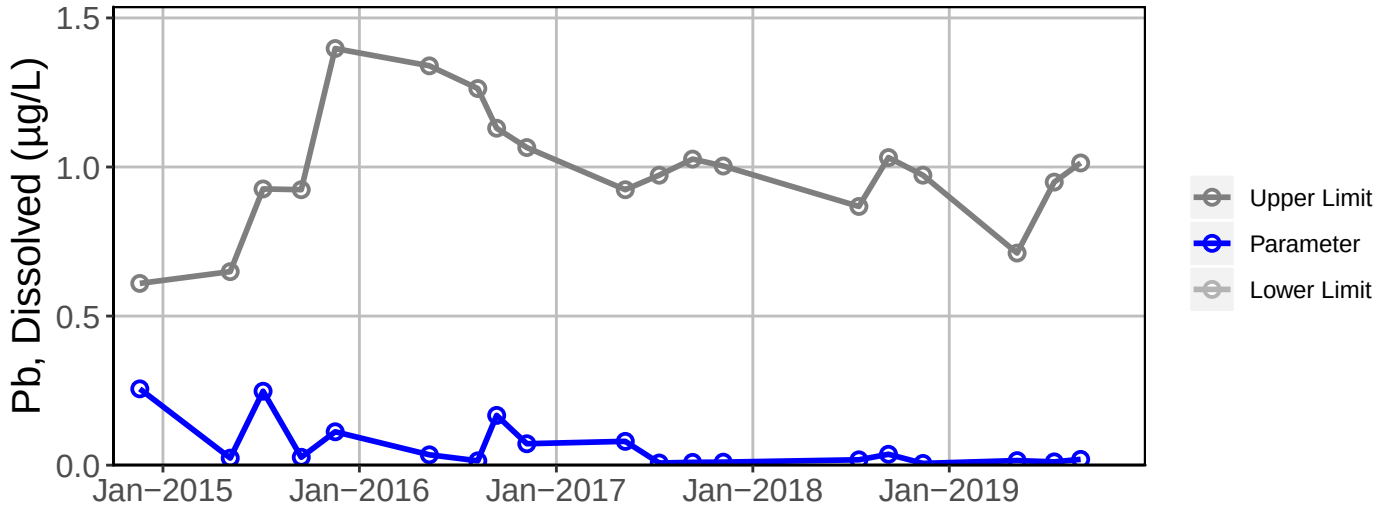


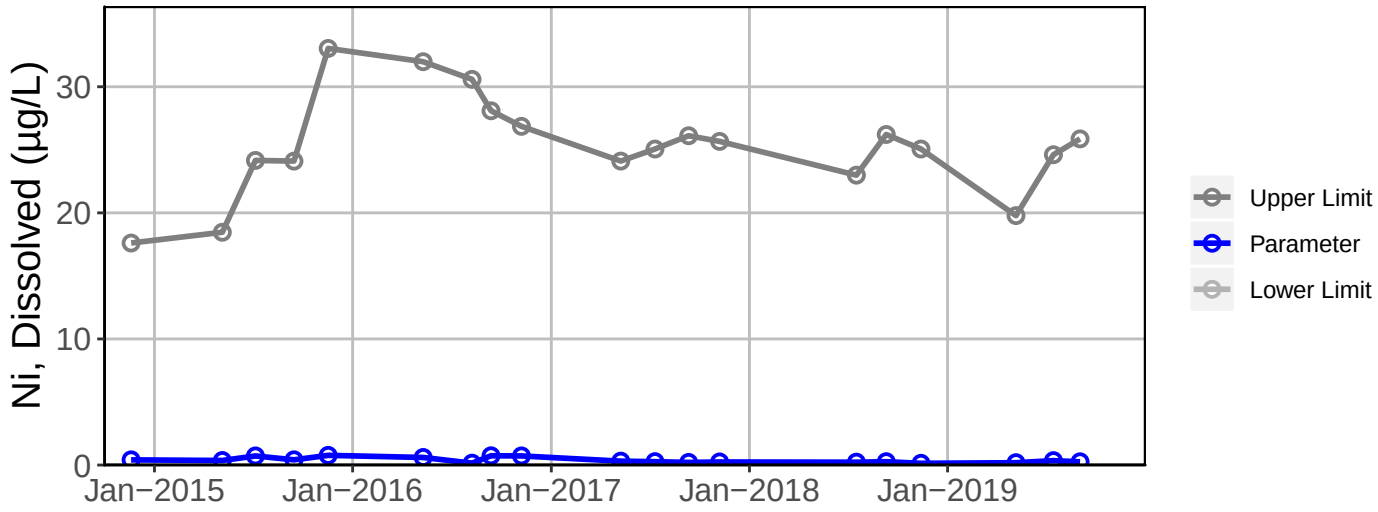




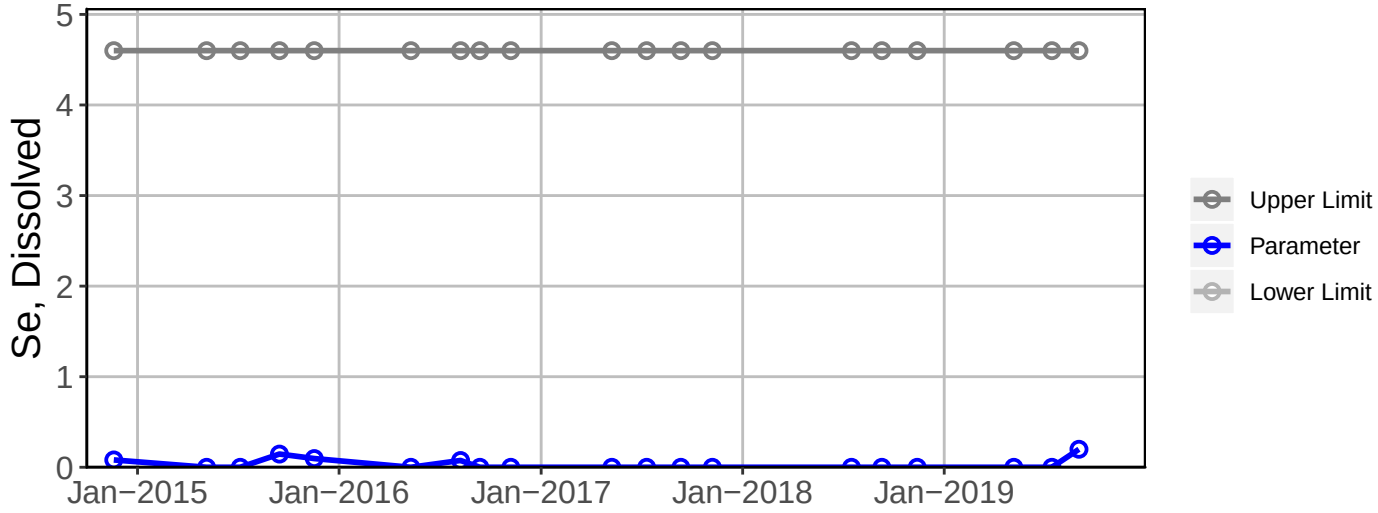
Site 27 Analyte Charts

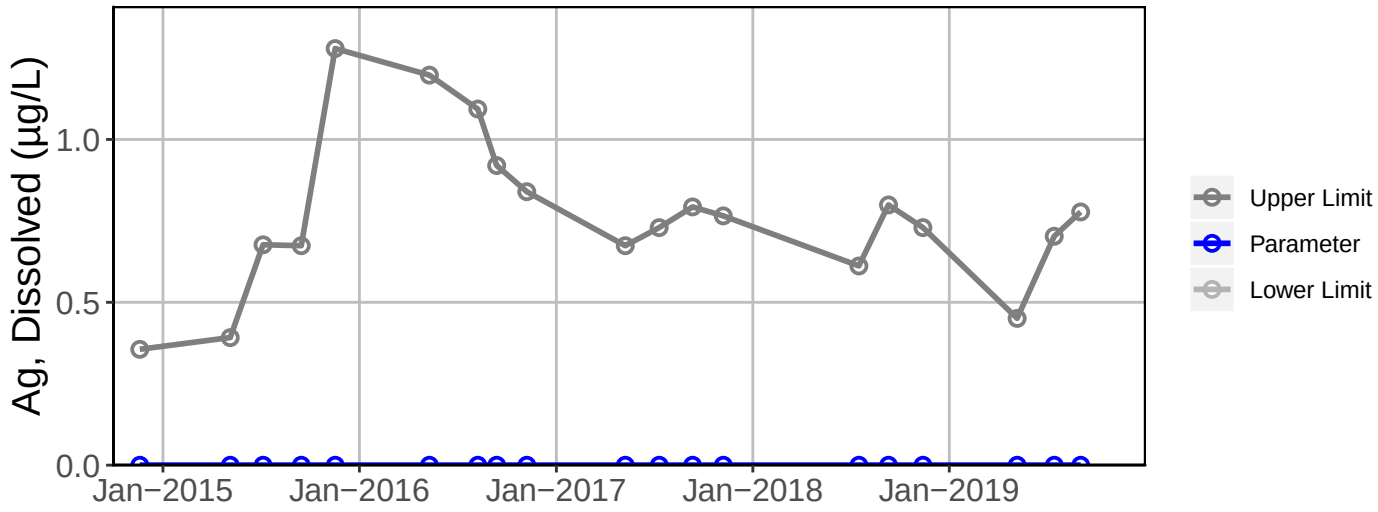


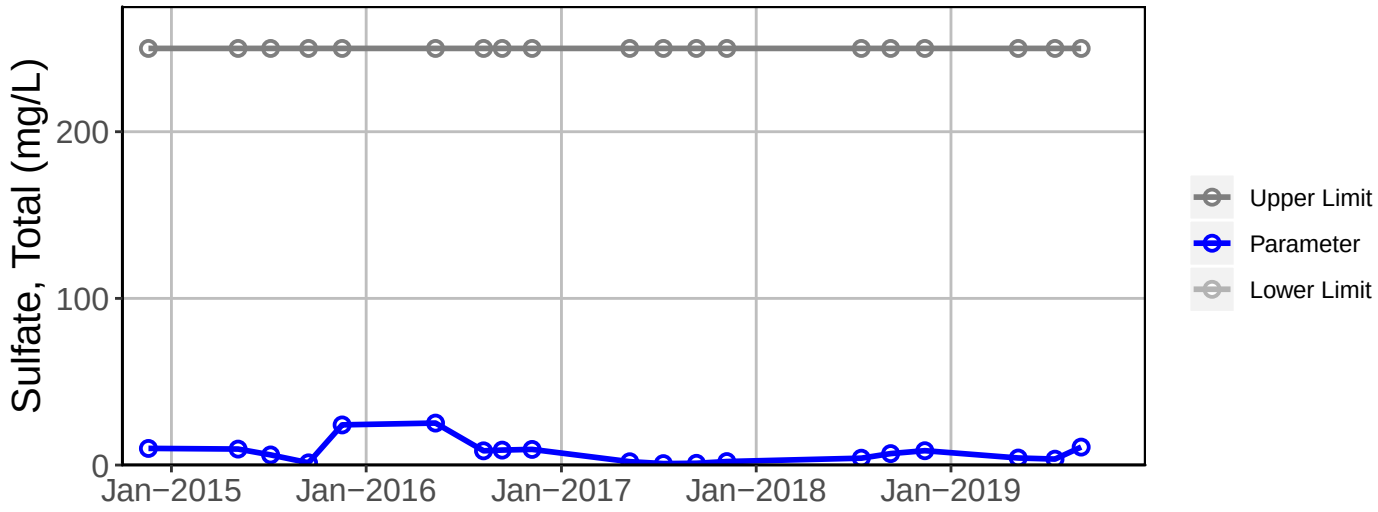




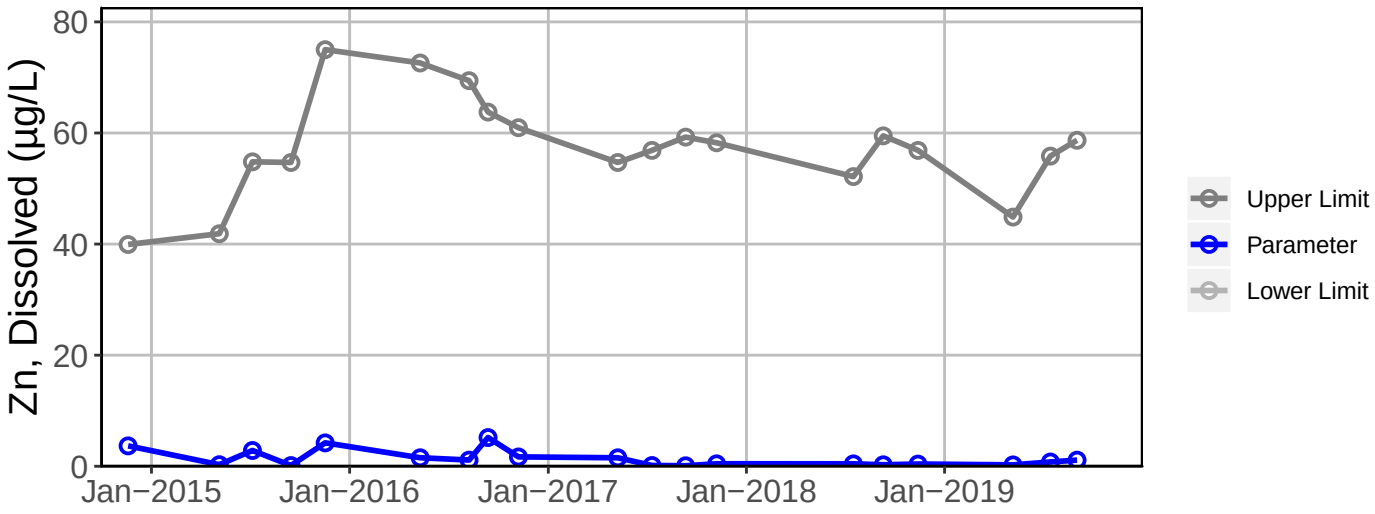
Site 27 Analyte Charts







Site 27 Analyte Charts



Site #27 Seasonal Kendall analysis for Specific Conductance, Field (µS/cm)

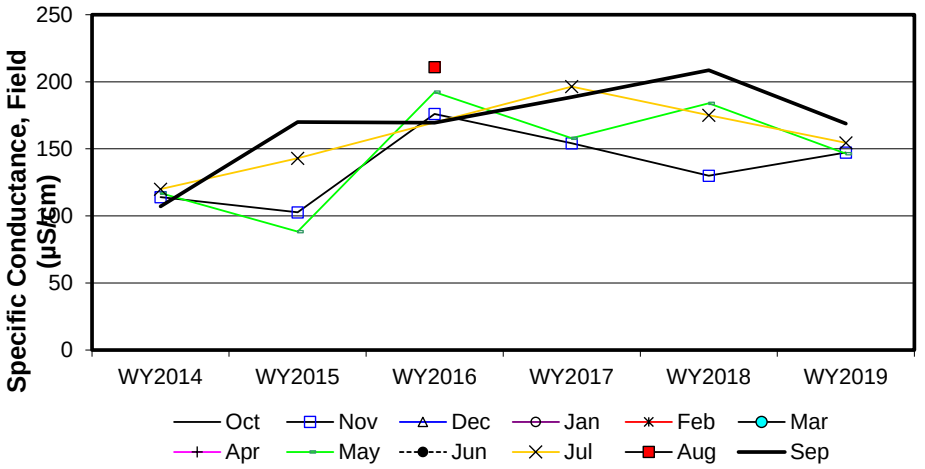
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		114.0						117.0		120.0		107.1
b	**WY2015**		102.7						88.3		142.9		170.0
c	**WY2016**		176.0						192.3			211.0	169.5
d	**WY2017**		154.1						158.0		196.4		188.6
e	**WY2018**		130.0						183.9		175.0		208.6
f	**WY2019**		147.3						146.4		154.5		168.9
	n	0	6	0	0	0	0	0	6	0	5	1	6
	t_1	0	6	0	0	0	0	0	6	0	5	1	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						-1		1		1
	c-a		1						1				1
	d-a		1						1		1		1
	e-a		1						1		1		1
	f-a		1						1		1		1
	c-b		1						1				-1
	d-b		1						1		1		1
	e-b		1						1		1		1
	f-b		1						1		1		-1
	d-c		-1						-1				1
	e-c		-1						-1				1
	f-c		-1						-1				-1
	e-d		-1						1		-1		1
	f-d		-1						-1		-1		-1
	f-e		1						-1		-1		-1
	S_k	0	3	0	0	0	0	0	3	0	4	0	5
	σ^2_S=		28.33						28.33		16.67		28.33
	$Z_k = S_k/\sigma_S$		0.56						0.56		0.98		0.94
	Z^2_k		0.32						0.32		0.96		0.88

ΣZ_k= 3.05
ΣZ^2_k= 2.48
Z-bar=$\Sigma Z_k/K$= 0.76

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	24	0	0	0	0

Σn 24
ΣS_k 15

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	0.16		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.984**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	1.39	@α/2=2.5% **Z**=	1.96	**H_0** (No trend) ACCEPT
101.67	**p**	**0.918**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-4.57	**10.70**	19.65
0.050	-0.26		16.27
0.100	2.94		13.75
0.200	6.08		13.24

Site #27 Seasonal Kendall analysis for pH, Field, Standard Units

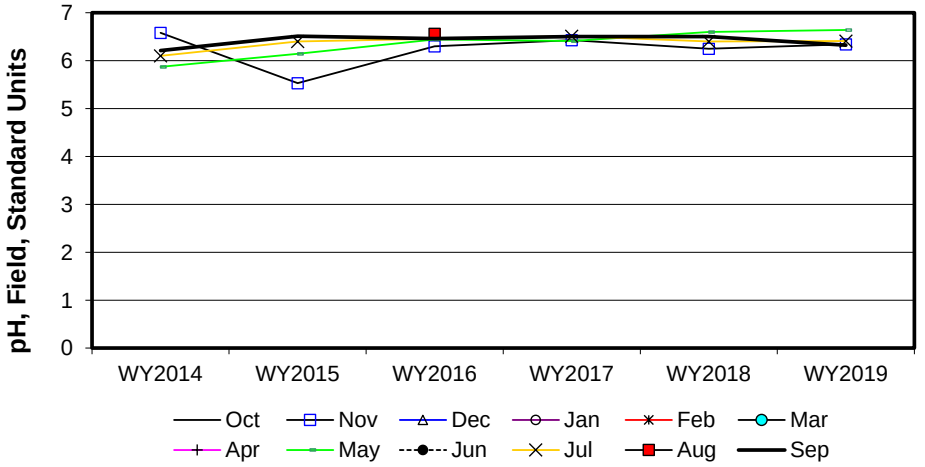
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		6.6						5.9		6.1		6.2
b	**WY2015**		5.5						6.1		6.4		6.5
c	**WY2016**		6.3						6.4			6.6	6.5
d	**WY2017**		6.4						6.4		6.5		6.5
e	**WY2018**		6.3						6.6		6.4		6.5
f	**WY2019**		6.3						6.6		6.4		6.3
	n	0	6	0	0	0	0	0	6	0	5	1	6
	t_1	0	6	0	0	0	0	0	6	0	3	1	4
	t_2	0	0	0	0	0	0	0	0	0	1	0	1
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						1		1		1
	c-a		-1						1				1
	d-a		-1						1		1		1
	e-a		-1						1		1		1
	f-a		-1						1		1		1
	c-b		1						1				-1
	d-b		1						1		1		-1
	e-b		1						1		0		-1
	f-b		1						1		1		-1
	d-c		1						-1				1
	e-c		-1						1				1
	f-c		1						1				-1
	e-d		-1						1		-1		0
	f-d		-1						1		-1		-1
	f-e		1						1		1		-1
	S_k	0	-1	0	0	0	0	0	13	0	5	0	0
	σ^2_S=		28.33						28.33		15.67		27.33
	$Z_k = S_k/\sigma_S$		-0.19						2.44		1.26		0.00
	Z^2_k		0.04						5.96		1.60		0.00

ΣZ_k= 3.52
ΣZ^2_k= 7.60
Z-bar=$\Sigma Z_k/K$= 0.88

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	20	2	0	0	0

Σn 24
ΣS_k 17

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	4.50		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.212**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	1.60	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
99.67	**p**	**0.945**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.03	**0.05**	0.13
0.050	0.00		0.11
0.100	0.00		0.09
0.200	0.02		0.07

Site #27 Seasonal Kendall analysis for Total Alk, (mg/l)

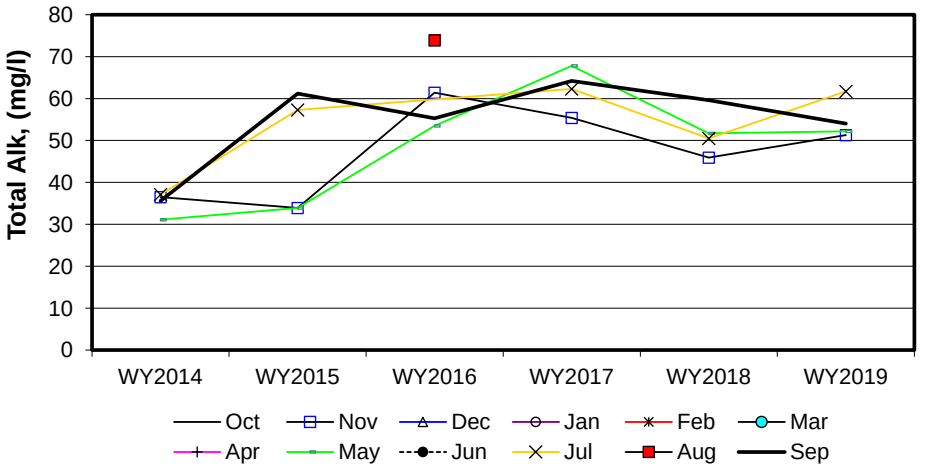
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		36.5						31.1		37.1		35.6
b	**WY2015**		33.9						33.9		57.3		61.2
c	**WY2016**		61.4						53.5			73.9	55.3
d	**WY2017**		55.4						67.8		62.3		64.2
e	**WY2018**		45.9						51.7		50.5		59.6
f	**WY2019**		51.3						52.2		61.7		54.0
	n	0	6	0	0	0	0	0	6	0	5	1	6
	t_1	0	6	0	0	0	0	0	6	0	5	1	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						1		1		1
	c-a		1						1				1
	d-a		1						1		1		1
	e-a		1						1		1		1
	f-a		1						1		1		1
	c-b		1						1				-1
	d-b		1						1		1		1
	e-b		1						1		-1		-1
	f-b		1						1		1		-1
	d-c		-1						1				1
	e-c		-1						-1				1
	f-c		-1						-1				-1
	e-d		-1						-1		-1		-1
	f-d		-1						-1		-1		-1
	f-e		1						1		1		-1
	S_k	0	3	0	0	0	0	0	7	0	4	0	1
	σ^2_S=		28.33						28.33		16.67		28.33
	$Z_k = S_k/\sigma_S$		0.56						1.32		0.98		0.19
	Z^2_k		0.32						1.73		0.96		0.04

ΣZ_k= 3.05
ΣZ^2_k= 3.04
Z-bar=$\Sigma Z_k/K$= 0.76

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	24	0	0	0	0

Σn 24
ΣS_k 15

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	0.72		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.868**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	1.39	@α/2=2.5% **Z**=	1.96	**H_0** (No trend) ACCEPT
101.67	**p**	**0.918**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-1.11	**2.96**	6.07
0.050	-0.41		5.10
0.100	0.52		4.57
0.200	1.67		4.16

Site #27 Seasonal Kendall analysis for Sulfate, Total (mg/l)

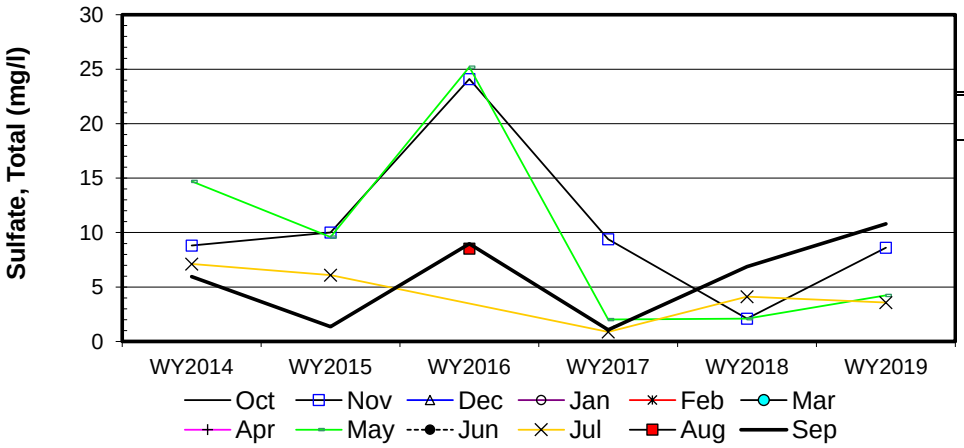
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		8.8						14.7		7.1		6.0
b	**WY2015**		10.0						9.6		6.1		1.4
c	**WY2016**		24.1						25.2			8.5	9.0
d	**WY2017**		9.4						2.0		0.9		1.1
e	**WY2018**		2.1						2.1		4.1		6.9
f	**WY2019**		8.6						4.2		3.6		10.8
	n	0	6	0	0	0	0	0	6	0	5	1	6
	t_1	0	6	0	0	0	0	0	6	0	5	1	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		1						-1		-1		-1
	c-a		1						1				1
	d-a		1						-1		-1		-1
	e-a		-1						-1		-1		1
	f-a		-1						-1		-1		1
	c-b		1						1				1
	d-b		-1						-1		-1		-1
	e-b		-1						-1		-1		1
	f-b		-1						-1		-1		1
	d-c		-1						-1				-1
	e-c		-1						-1				-1
	f-c		-1						-1				1
	e-d		-1						1		1		1
	f-d		-1						1		1		1
	f-e		1						1		-1		1
	S_k	0	-5	0	0	0	0	0	-5	0	-6	0	5
	σ^2_S=		28.33						28.33		16.67		28.33
	$Z_k = S_k/\sigma_S$		-0.94						-0.94		-1.47		0.94
	Z^2_k		0.88						0.88		2.16		0.88

ΣZ_k= -2.41
ΣZ^2_k= 4.81
Z-bar=$\Sigma Z_k/K$= -0.60

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	24	0	0	0	0

Σn 24
ΣS_k -11

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	3.36		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p **0.340**				$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc} -0.99		@α=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
101.67	**p** **0.161**				**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-2.52	**-0.55**	1.13
0.050	-1.67		0.22
0.100	-1.33		0.07
0.200	-0.96		-0.18

Site #27 Seasonal Kendall analysis for Zinc, Dissolved (ug/l)

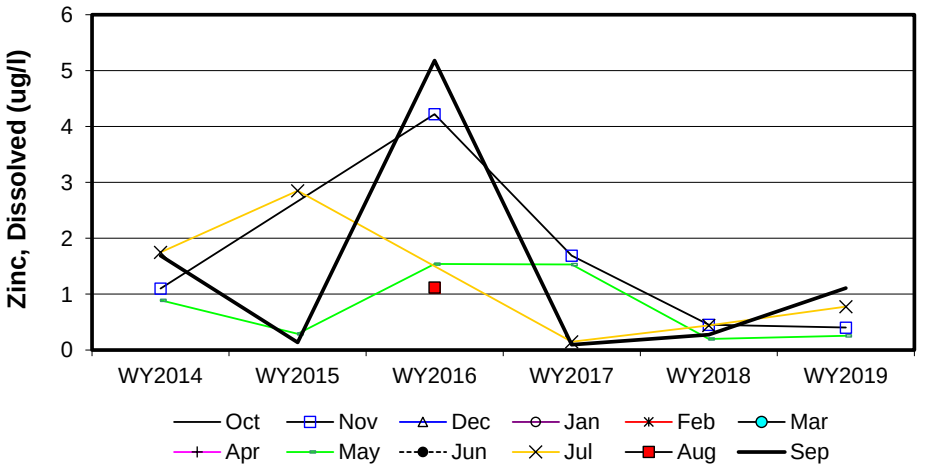
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		1.1						0.9		1.8		1.7
b	**WY2015**								0.3		2.9		0.1
c	**WY2016**		4.2						1.5			1.1	5.2
d	**WY2017**		1.7						1.5		0.1		0.1
e	**WY2018**		0.5						0.2		0.4		0.3
f	**WY2019**		0.4						0.3		0.8		1.1
	n	0	5	0	0	0	0	0	6	0	5	1	6
	t_1	0	5	0	0	0	0	0	6	0	5	1	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a								-1		1		-1
	c-a		1						1				1
	d-a		1						1		-1		-1
	e-a		-1						-1		-1		-1
	f-a		-1						-1		-1		-1
	c-b								1				1
	d-b								1		-1		-1
	e-b								-1		-1		1
	f-b								-1		-1		1
	d-c		-1						-1				-1
	e-c		-1						-1				-1
	f-c		-1						-1				-1
	e-d		-1						-1		1		1
	f-d		-1						-1		1		1
	f-e		-1						1		1		1
	S_k	0	-6	0	0	0	0	0	-5	0	-2	0	-1
	σ^2_S=		16.67						28.33		16.67		28.33
	$Z_k = S_k/\sigma_S$		-1.47						-0.94		-0.49		-0.19
	Z^2_k		2.16						0.88		0.24		0.04

ΣZ_k= -3.09
ΣZ^2_k= 3.32
Z-bar=$\Sigma Z_k/K$= -0.77

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	23	0	0	0	0

Σn 23
ΣS_k -14

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	0.94		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.817**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	-1.37	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
90.00	**p**	**0.085**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.64	**-0.13**	0.20
0.050	-0.53		0.03
0.100	-0.44		-0.01
0.200	-0.33		-0.03

INTERPRETIVE REPORT
SITE 29

The data collected during the current water year are listed in the following "Table of Results for Water Year 2019" report. The table includes all the required FWMP analyte data (field and laboratory) collected for the current water year and a series of flags keyed to the summary report "Qualified Data by QA Reviewer." The QA report lists any associated data limitations found during the monthly QA reviews of laboratory data for this site. Median values for all analytes have been calculated and are shown in the right-most column of the table of results. Any value reported as less than MDL has been replaced with a value of one-half of the MDL for the purpose of median calculation.

All data collected at this site for the past six years are included in the data analyses. As shown in the table below, there were no data outliers.

Sample Date	Parameter	Value	Qualifier	Notes
No outliers, in the past six years, have been identified by HGCMC.				

The results for the current water year has been compared to the strictest freshwater quality criterion for each applicable analyte. Several results exceeding these criteria have been identified, as listed in the table below.

Table of Exceedance for Water Year 2019

			Limits		
Sample Date	Parameter	Value	Lower	Upper	Hardness
13-Nov-18	Alkalinity, Total	14.3 mg/L	20		22.2 mg/L
13-Nov-18	pH	5.3 su	6.5	8.5	22.2 mg/L
7-May-19	pH	5.3 su	6.5	8.5	17.6 mg/L
15-Jul-19	Alkalinity, Total	10.8 mg/L	20		11.5 mg/L
15-Jul-19	Lead, Dissolved	0.46 µg/L		0.2	11.5 mg/L
15-Jul-19	pH	5.1 su	6.5	8.5	11.5 mg/L
2-Sep-19	Alkalinity, Total	12.30 mg/L	20		17.8 mg/L
2-Sep-19	pH	5.1 su	6.5	8.5	17.8 mg/L

Four of these records are for field pH with values below the lower limit of 6.5 su listed in AWQS. Field pH values from other wells completed in organic-rich peat sediments similar to Site 29 have historically resulted in pH values ranging from 5 to 6 su (e.g., Site 27 and 32). Three exceedances were for total alkalinity below the lower limit of 20 mg/L, though the results were in the historical range. There was a single exceedance for lead during the current water year, the first in over two years.

X-Y plots have been generated to graphically present the data for each of the analytes requested in the Statistical Information Goals for this site. These plots have been visually analyzed for the appearance of any trend in concentration. There appear to be no obvious visual trends.

A non-parametric statistical analysis for trend was performed for specific conductivity, field pH, total alkalinity, total sulfate, and dissolved zinc. Calculation details of the Seasonal Kendall analyses are presented in detail on the pages following this interpretive section. The following table summarizes the results of the data collected between Oct-13 and Sep-19 (WY2014-WY2019).

Site 29 - Table of Summary Statistics for Trend Analysis

	Mann-Kendall test statistics			Sen's slope estimate	
Parameter	**n***	**p****	**Trend**	**Q**	**Q(%)**
Conductivity Field	6	0.02	-	-2.69	-6.0
pH Field	6	0.29			
Alkalinity, Total	6	0.11			
Sulfate, Total	6	0.98	+	0.05	0.25
Zinc, Dissolved	6	0.02	-	-0.36	-12.6

* Number of Years ** Significance level

Three statistically significant trends were found with the trend analysis. Field conductivity and dissolved zinc both had slightly decreasing trends, and total sulfate a slightly increasing trend. Concentrations of total sulfate and dissolved zinc are well below AWQS.

Intra-well analysis was performed using combined Shewhart-CUSUM charts for conductivity, dissolved zinc, and alkalinity. Table 1 contains a summary of the baseline statistics, along with the control limits used.

Site 29 was installed in 1988 and has an extensive sampling history. However, establishing a baseline has been difficult. Since the installation of the well, a few of the monitored parameters (i.e., alkalinity, specific conductance, and total sulfate) have been in constant flux. Because the CUSUM process compares the mean and standard deviation of the chosen baseline to the collected data, it is possible to detect continual changes in the analytes without having a background data set. After reviewing the data for the three parameters, data periods were chosen based upon the data having a period of minimal flux. This period was then used for the calculation of the baseline statistics.

All three of the parameters examined (Figure 1) eventually went out of control with respect to the chosen baseline data statistics. If the pore/contact water from inside the tailings facility was not contained, the well water would have high conductivity, high dissolved zinc, and high alkalinity. Two of the three charts in Figure 1 have long term decreasing trends; it is dissolved zinc that has periodically had higher values. As previously discussed, it is hypothesized that the increase in dissolved zinc results from the accumulation of fugitive dust in the snowpack during

the winter. In the spring, when the snowpack melts, this material is released as a pulse. Most years, the deposited material is not present by the fall sampling. With the implementation of additional best management practices, HGCMC expects to decrease the amount of fugitive dust leaving the tailings disposal facility.

Table 1. Specific Conductance, Dissolved Zinc, and Total Sulfate Baseline Periods, Summary Statistics and Various Control Limits

	Site 29 Conductivity (µS/cm)	Site 29 Diss. Zinc (µg/L)	Site 29 Alkalinity (mg/L)
Baseline Statistics			
Baseline Period	05/11/00-09/15/05	05/11/00-09/15/05	04/27/95-09/13/00
Number of Samples	12	12	5
Mean (x)	122.27	3.60	1.56
Standard Deviation	24.8	1.35	0.43
Shewhart-CUSUM Control Limits (SCL)			
Control Limit (mean x+ 2s)	171.9	6.3	2.4
Control Limit (mean x + 3s)	196.7	7.6	2.8
Control Limit (mean x + 4s)	221.4	9.0	3.3
Control Limit (mean x + 4.5s)	233.8	9.7	3.5
CUSUM Control Limits			
Cumulative increase (h)	5	5	5

The long term decreasing trends in specific conductance and alkalinity are potentially the result of the weathering of the rock originally used to build the access roads and embankments for the tailings facility. In recent years HGCMC has reported on water chemistry changes directly related to construction activities in the tailings facility. As previously discussed in the report, with regards to Site 27, there was an increase in total sulfate and conductivity after the pad was built east of Pond 7. Similar results were recorded at Site 60 after the construction of Pond 7. Until the groundwater collection system was brought online, there were substantial increases for specific conductivity and alkalinity at Site 60. These are two examples of where the placement of construction rock has resulted in changes to the water chemistry. Therefore, the decreasing trends in alkalinity and specific conductance seen at Site 29 are potentially the results of weathering of the initial rock placed for the construction of the tailings facility.

Figure 1. **Observed Measurements for Specific Conductance, Dissolved Zinc, and Alkalinity from Site 29 Compared to the Shewhart-CUSUM Control Limits From Table 1**

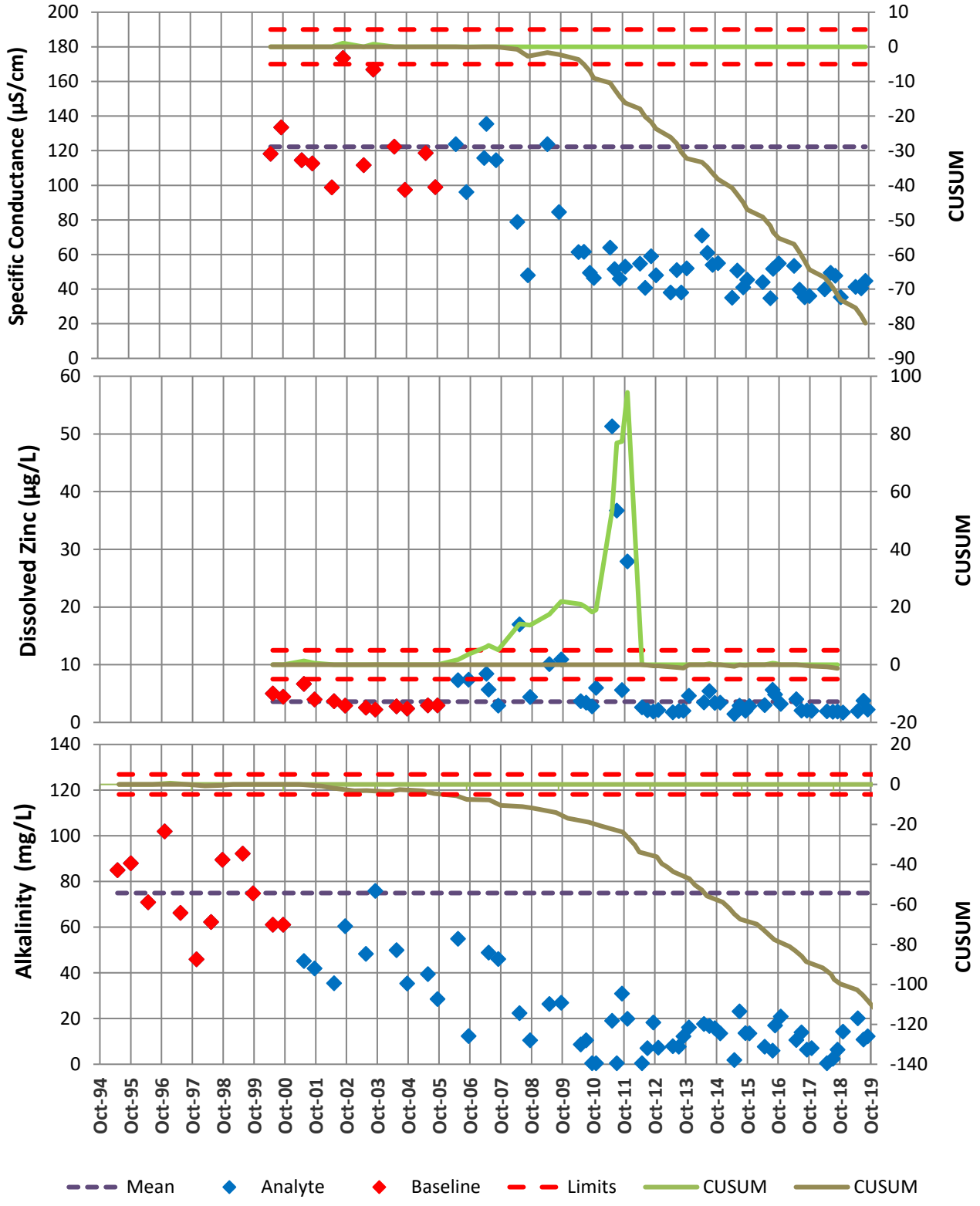


Table of Results for Water Year 2019

Site 029FMG - 'Monitoring Well - 3S'

Sample Date/Parameter	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019	**Median**
Water Temp (°C)		6.7						6.1		9.6		8.3	7.5
Conductivity-Field(μmho)		35.3						41.3		40.5		44.8	40.9
Conductivity-Lab (μmho)		42						52		32		38	40
pH Lab (standard units)		5.1						5.13		4.96		4.98	5.04
pH Field (standard units)		5.27						5.26		5.05		5.13	5.20
Total Alkalinity (mg/L)		14.3						20.1		10.8		12.3	13.3
Total Sulfate (mg/L)		0.2						0.2		0.2		0.2	0.2
Hardness (mg/L)		22.2						17.6		11.5		17.8	17.7
Dissolved As (ug/L)		7.22						6.45		4.76		6.63	6.540
Dissolved Ba (ug/L)		5.7						5.4		7		5.6	5.7
Dissolved Cd (ug/L)		0.0018						0.0018		0.0037		0.0018	0.0018
Dissolved Cr (ug/L)		0.56						0.597		0.579		0.629	0.588
Dissolved Cu (ug/L)		0.108						0.135		0.311		0.159	0.147
Dissolved Pb (ug/L)		0.0851						0.134		0.464		0.159	0.1465
Dissolved Ni (ug/L)		0.918						0.995		1.02		1.08	1.008
Dissolved Ag (ug/L)		0.002						0.002		0.002		0.002	0.002
Dissolved Zn (ug/L)		1.7						1.95		3.78		2.24	2.10
Dissolved Se (ug/L)		0.057						0.057		0.057		0.189	0.057
Dissolved Hg (ug/L)		0.000836						0.00115		0.00084		0.000792	0.000838

For individual sample/analyte qualifier descriptions see "Qualified Data by QA Reviewer" table.

Values reported as less than MDL are replaced by 1/2 MDL for median calculation purposes.

Shaded data has been qualified as an outlier by HGCMC and removed from any further analysis and is not included into the calculation of the median

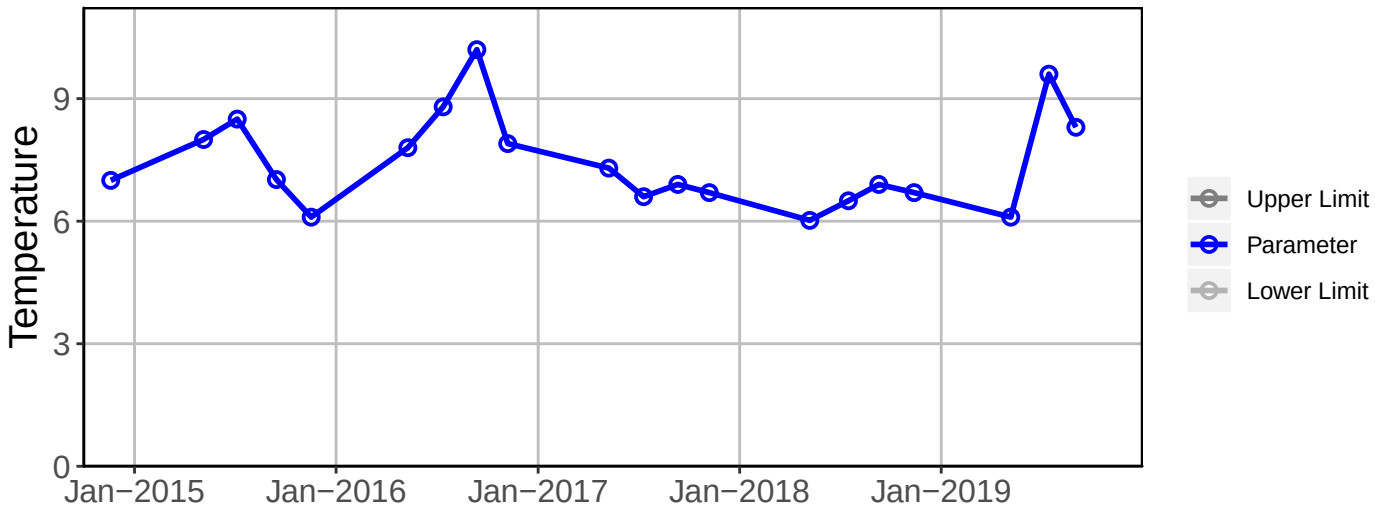
Qualified Data by QA Reviewer

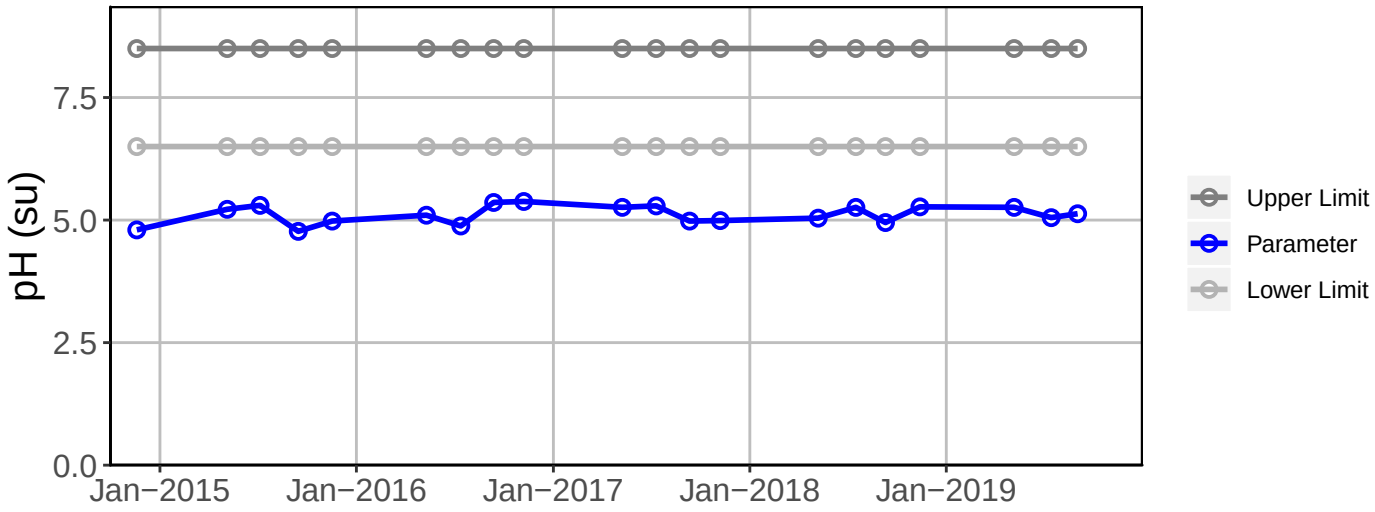
Date Range: 10/01/2018 to 09/30/2019

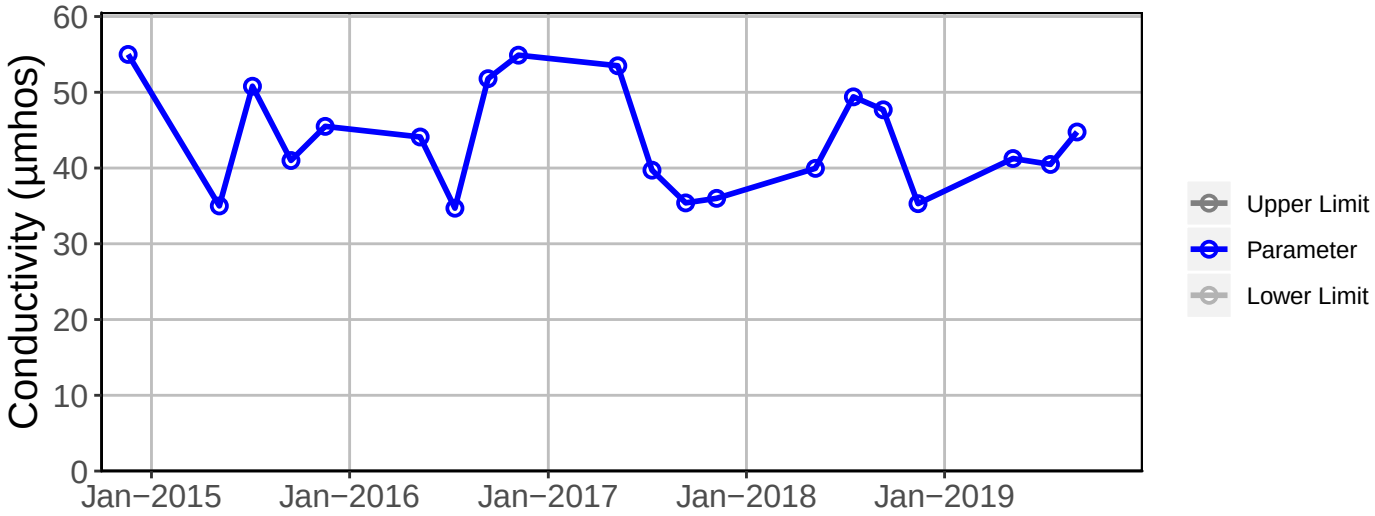
Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
029FMG	13-Nov-18	Diss. Cu-ICP/MS	0.1	µg/L	U	Field Blank Contamination
		Diss. Zn-ICP/MS	1.7	µg/L	U	Field Blank Contamination
	7-May-19	Diss. Cu-ICP/MS	0.13	µg/L	U	Trip Blank Contamination
		Diss. Zn-ICP/MS	1.95	µg/L	U	Field Blank Contamination
	15-Jul-19	Diss. Cd-ICP/MS	0.0037	µg/L	J	Below Quantitative Range
		Diss. Ni-ICP/MS	1.02	µg/L	U	Field Blank contamination
		Diss. Zn-ICP/MS	3.78	µg/L	U	Field Blank contamination
	2-Sep-19	Diss. Cr-ICP/MS	0.62	µg/L	U	Field Blank Contamination
		Diss. Cu-ICP/MS	0.15	µg/L	U	Field Blank Contamination
		Diss. Ni-ICP/MS	1.08	µg/L	U	Field Blank Contamination
		Diss. Pb-ICP/MS	0.15	µg/L	U	Field Blank Contamination
		Diss. Se-ICP/MS	0.18	µg/L	U	Method Blank Contamination
		Total Sulfate	-0.40	µg/L	J	Sample Receipt Temperature

Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

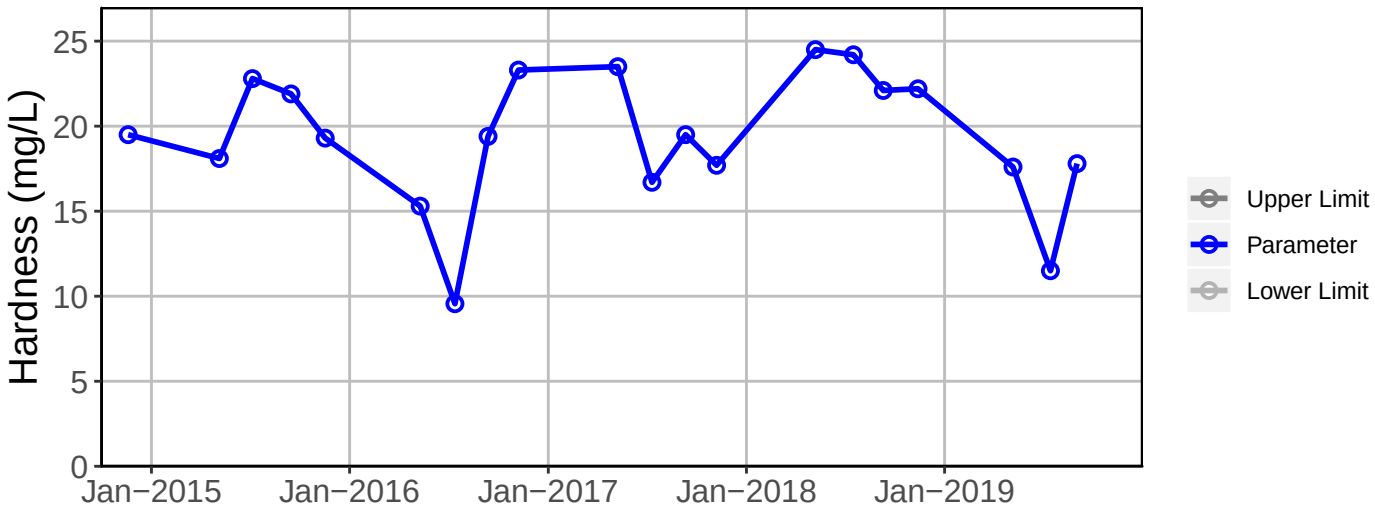
Site 29 Analyte Charts

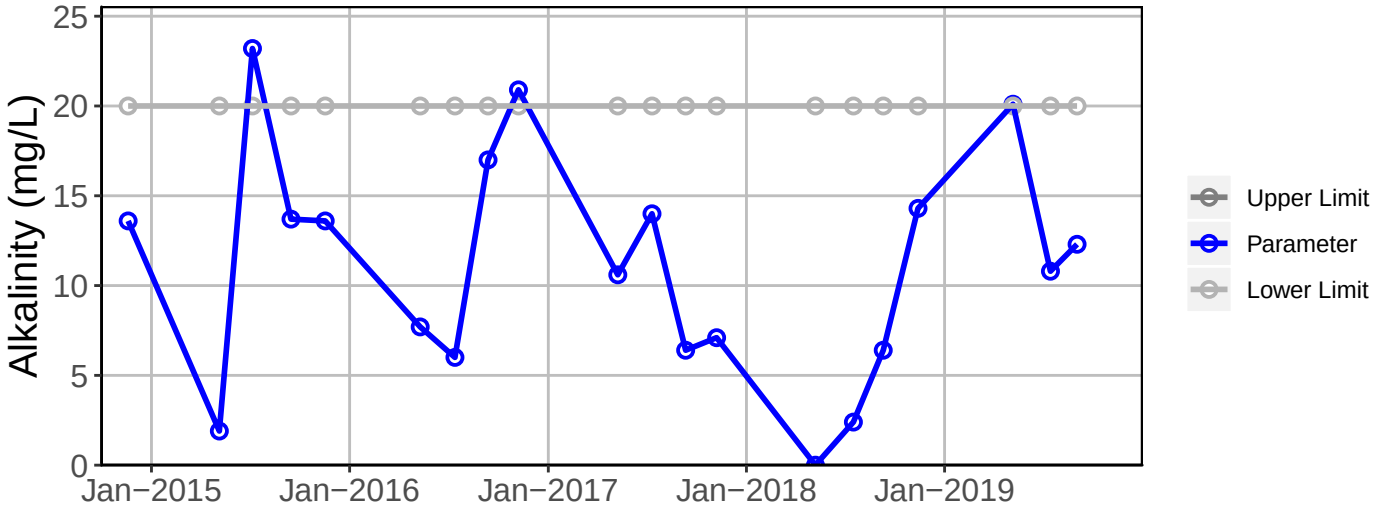


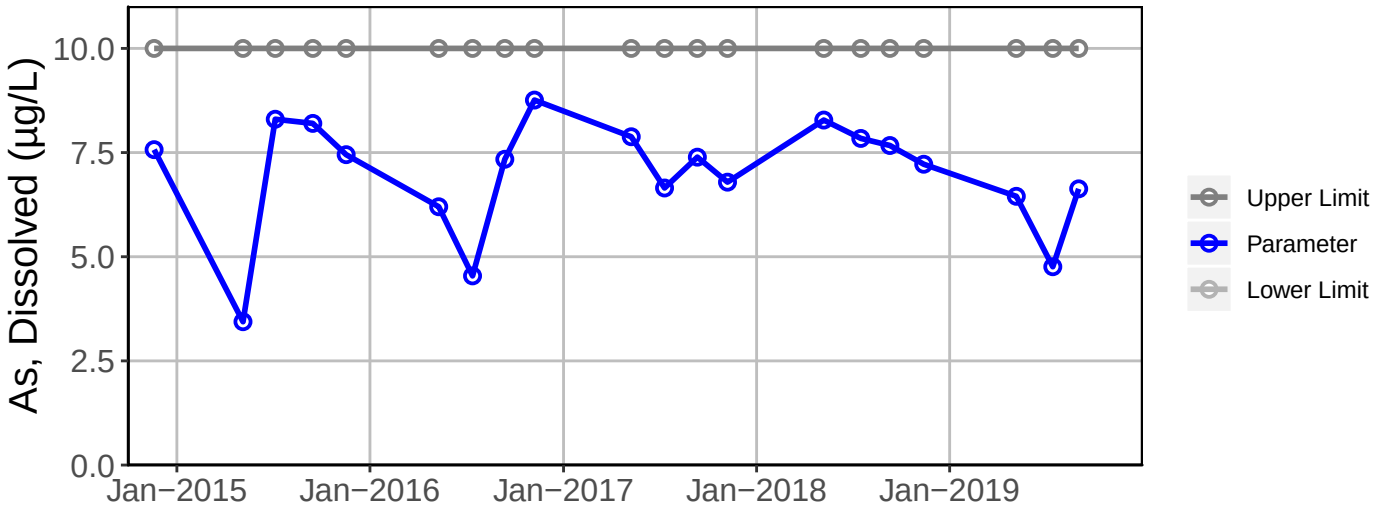




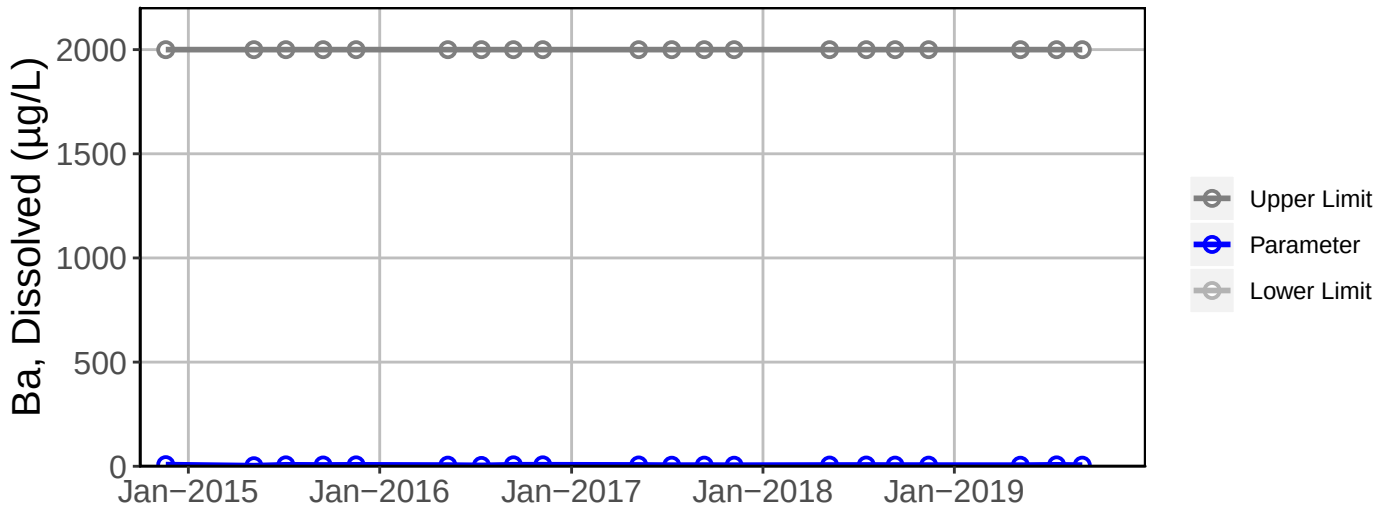
Site 29 Analyte Charts

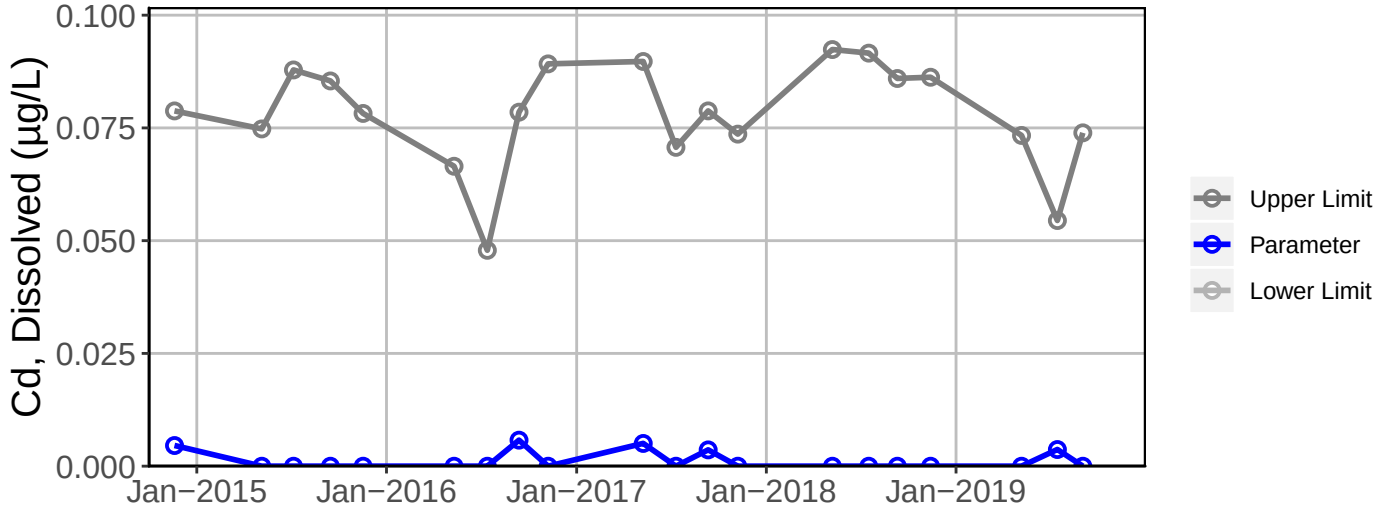


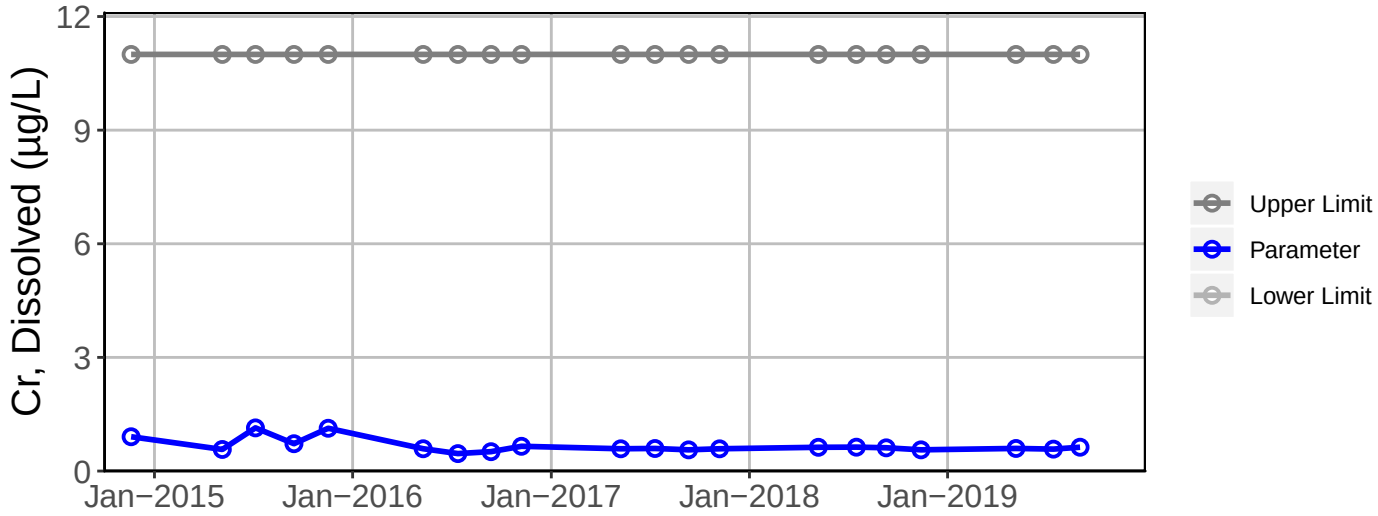




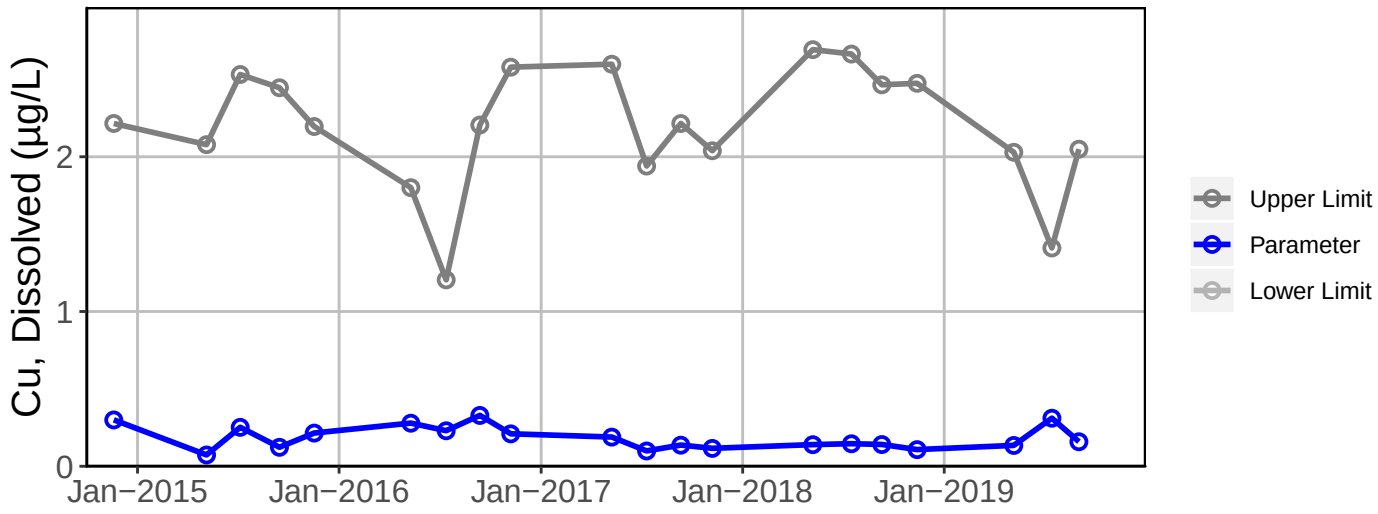
Site 29 Analyte Charts

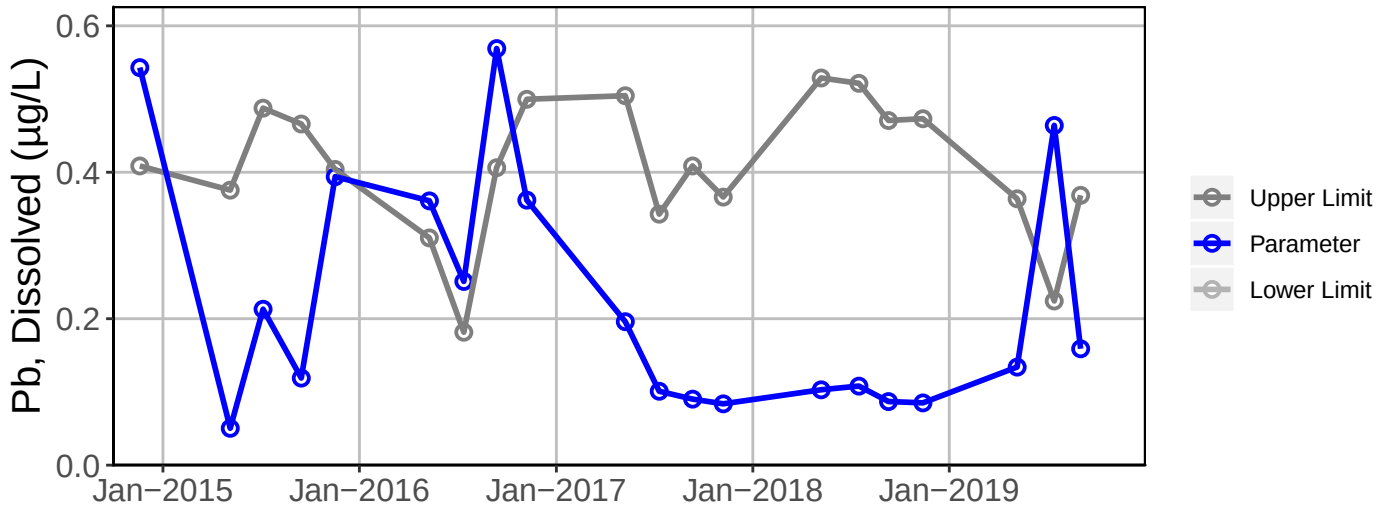


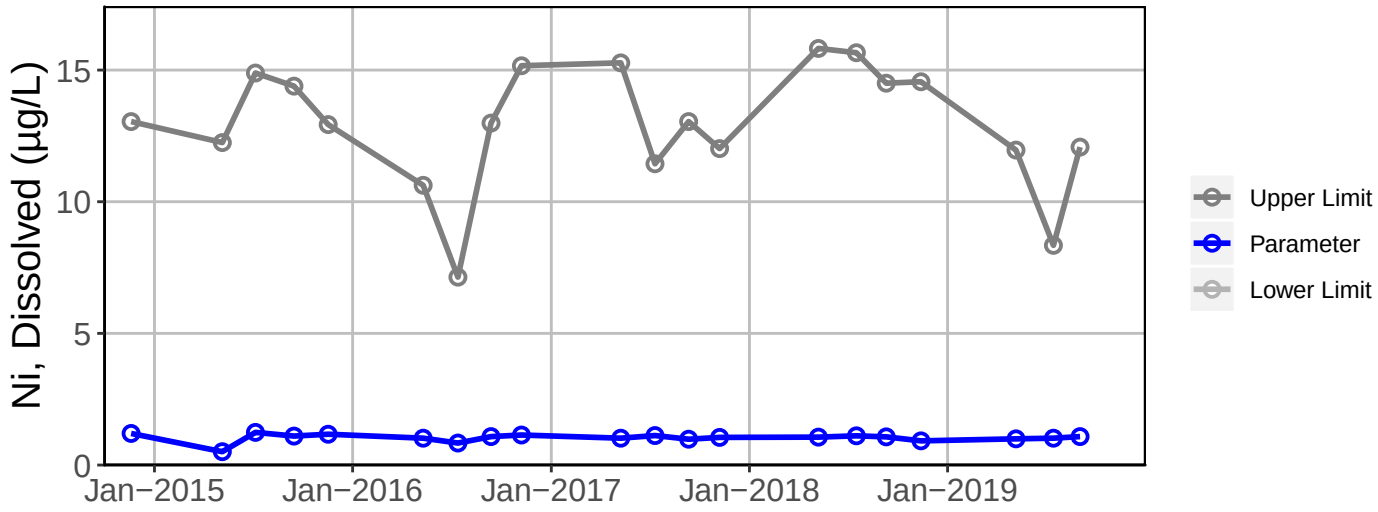




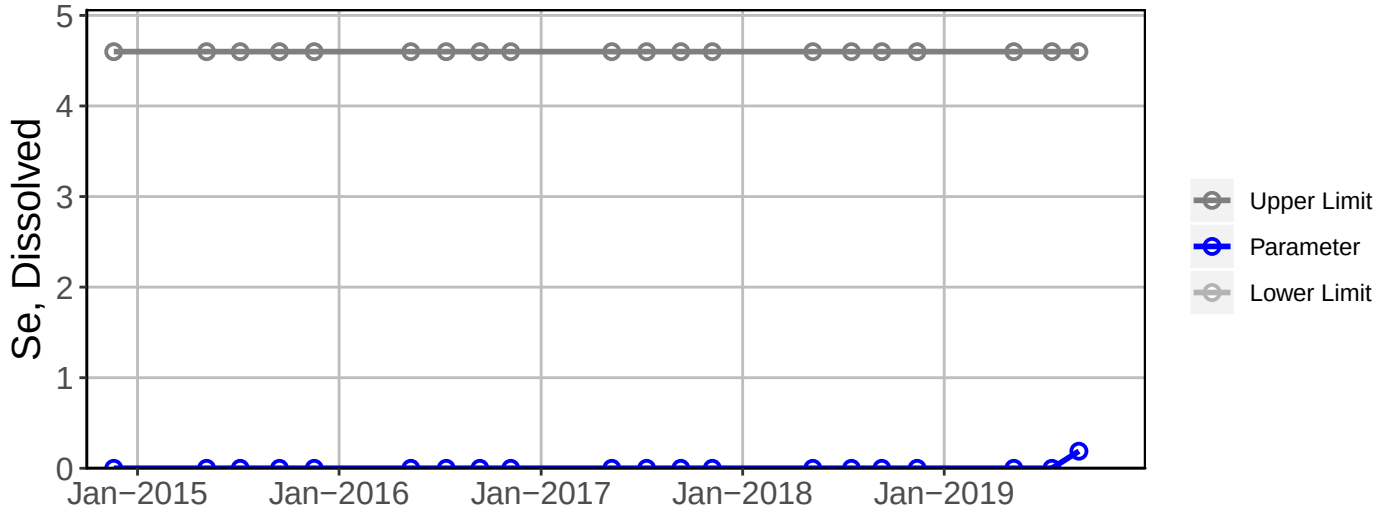
Site 29 Analyte Charts

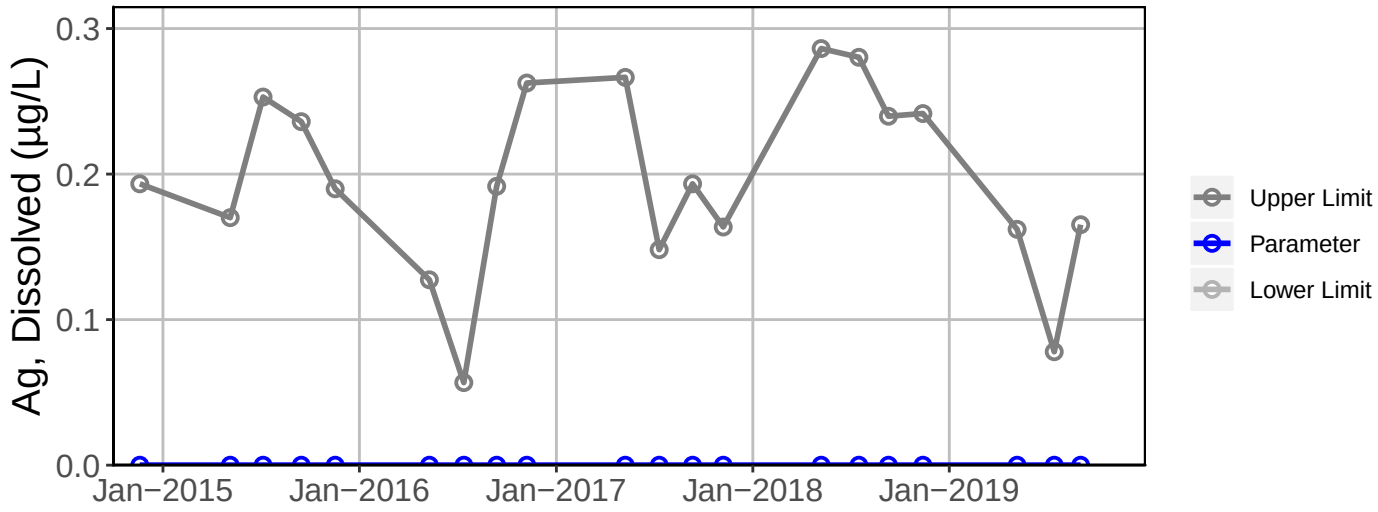


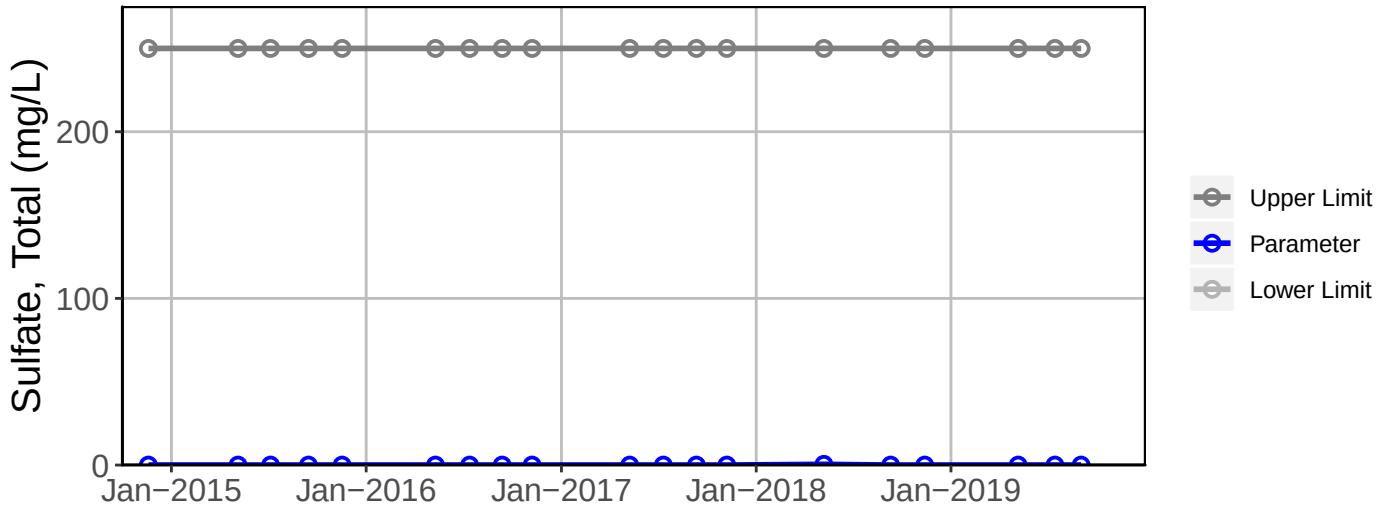




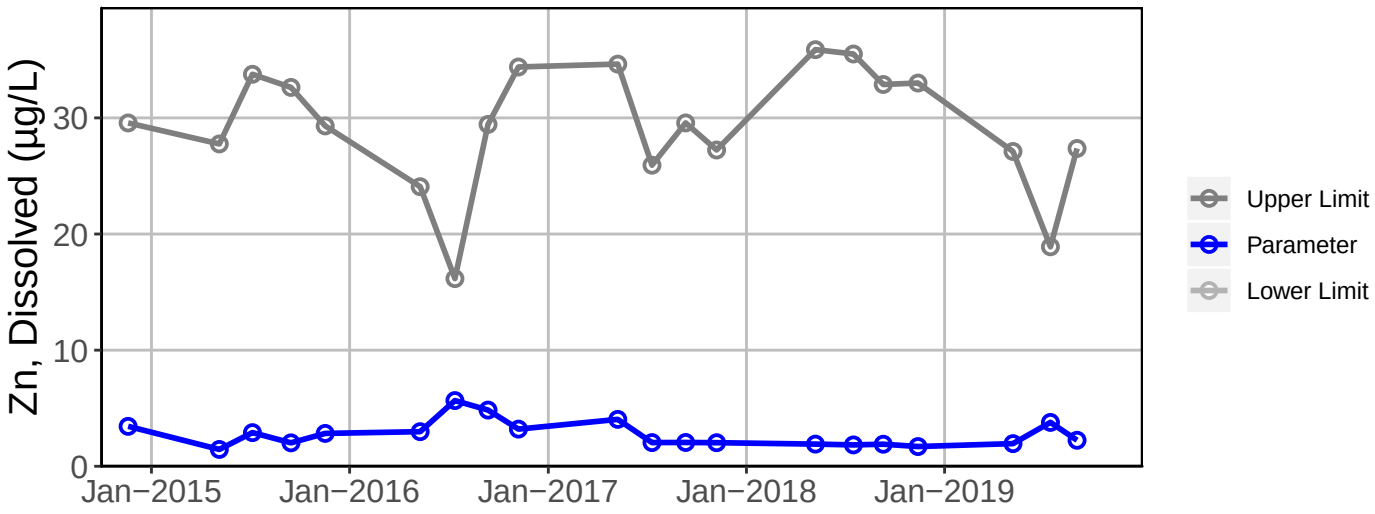
Site 29 Analyte Charts







Site 29 Analyte Charts



Site #29 Seasonal Kendall analysis for Specific Conductance, Field (µS/cm)

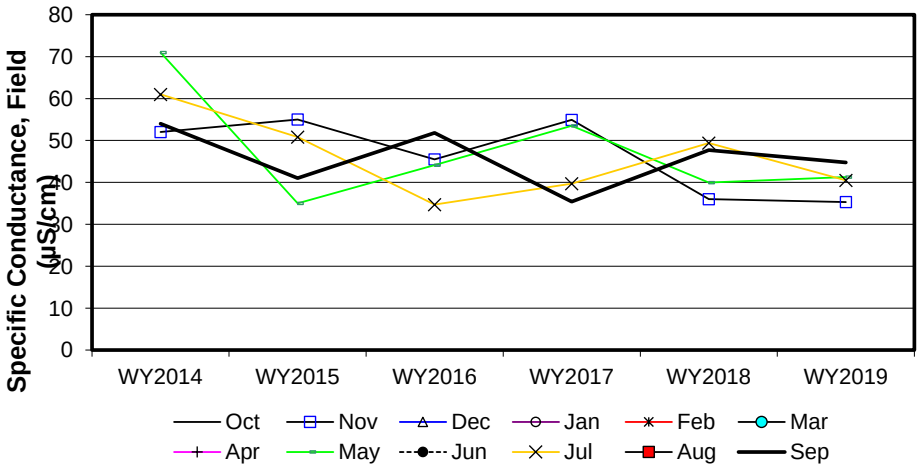
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		52.0						71.0		61.0		54.0
b	**WY2015**		55.0						35.0		50.8		41.0
c	**WY2016**		45.5						44.1		34.7		51.8
d	**WY2017**		54.9						53.5		39.7		35.4
e	**WY2018**		36.0						40.0		49.4		47.7
f	**WY2019**		35.3						41.3		40.5		44.8
	n	0	6	0	0	0	0	0	6	0	6	0	6
	t_1	0	6	0	0	0	0	0	6	0	6	0	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		1						-1		-1		-1
	c-a		-1						-1		-1		-1
	d-a		1						-1		-1		-1
	e-a		-1						-1		-1		-1
	f-a		-1						-1		-1		-1
	c-b		-1						1		-1		1
	d-b		-1						1		-1		-1
	e-b		-1						1		-1		1
	f-b		-1						1		-1		1
	d-c		1						1		1		-1
	e-c		-1						-1		1		-1
	f-c		-1						-1		1		-1
	e-d		-1						-1		1		1
	f-d		-1						-1		1		1
	f-e		-1						1		-1		-1
	S_k	0	-9	0	0	0	0	0	-3	0	-5	0	-5
	σ^2_S=		28.33						28.33		28.33		28.33
	$Z_k = S_k/\sigma_S$		-1.69						-0.56		-0.94		-0.94
	Z^2_k		2.86						0.32		0.88		0.88

ΣZ_k=	-4.13
ΣZ^2_k=	4.94
Z-bar=$\Sigma Z_k/K$=	-1.03

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	24	0	0	0	0

Σn	24
ΣS_k	-22

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	0.67	@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity	
	p **0.880**			$\chi^2_h<\chi^2_{(K-1)}$	ACCEPT
ΣVAR(S_k)	Z_{calc} -1.97	@α/2=2.5% Z=	1.96	**H_0** (No trend)	REJECT
113.33	**p** **0.024**			**H_A** (± trend)	ACCEPT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-6.01		0.59
0.050	-4.88	**-2.69**	-0.76
0.100	-4.09		-1.19
0.200	-3.37		-1.96

-6.0%

Site #29 Seasonal Kendall analysis for pH, Field, Standard Units

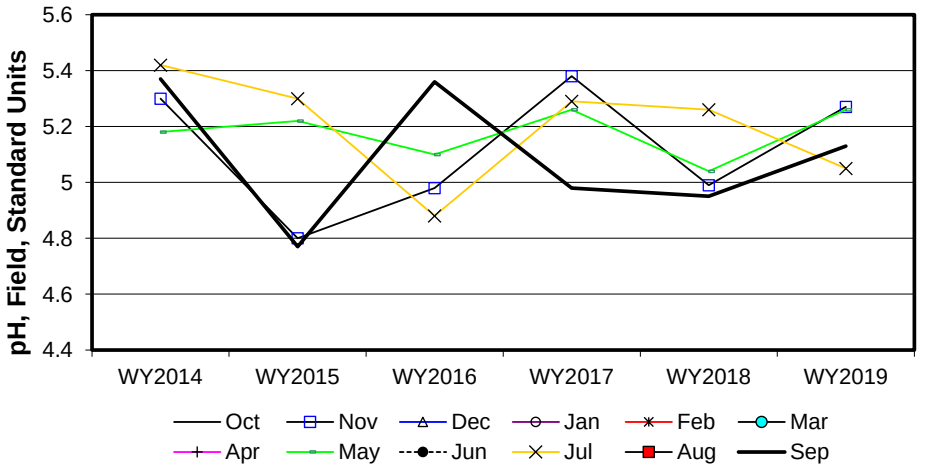
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		5.3						5.2		5.4		5.4
b	**WY2015**		4.8						5.2		5.3		4.8
c	**WY2016**		5.0						5.1		4.9		5.4
d	**WY2017**		5.4						5.3		5.3		5.0
e	**WY2018**		5.0						5.0		5.3		5.0
f	**WY2019**		5.3						5.3		5.1		5.1
	n	0	6	0	0	0	0	0	6	0	6	0	6
	t_1	0	6	0	0	0	0	0	4	0	6	0	6
	t_2	0	0	0	0	0	0	0	1	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						1		-1		-1
	c-a		-1						-1		-1		-1
	d-a		1						1		-1		-1
	e-a		-1						-1		-1		-1
	f-a		-1						1		-1		-1
	c-b		1						-1		-1		1
	d-b		1						1		-1		1
	e-b		1						-1		-1		1
	f-b		1						1		-1		1
	d-c		1						1		1		-1
	e-c		1						-1		1		-1
	f-c		1						1		1		-1
	e-d		-1						-1		-1		-1
	f-d		-1						0		-1		1
	f-e		1						1		-1		1
	S_k	0	3	0	0	0	0	0	2	0	-9	0	-3
	σ^2_S=		28.33						27.33		28.33		28.33
	$Z_k = S_k/\sigma_S$		0.56						0.38		-1.69		-0.56
	Z^2_k		0.32						0.15		2.86		0.32

ΣZ_k=	-1.31
ΣZ^2_k=	3.64
Z-bar=$\Sigma Z_k/K$=	-0.33

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	22	1	0	0	0

Σn	24
ΣS_k	-7

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	3.21	@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity	
	p **0.360**			$\chi^2_h<\chi^2_{(K-1)}$	ACCEPT
ΣVAR(S_k)	Z_{calc} -0.57	@α/2=2.5% Z=	1.96	**H_0** (No trend)	ACCEPT
112.33	**p** **0.286**			**H_A** (± trend)	REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.07		0.05
0.050	-0.05	**-0.01**	0.02
0.100	-0.04		0.01
0.200	-0.04		0.00

Site #29 Seasonal Kendall analysis for Total Alk, (mg/l)

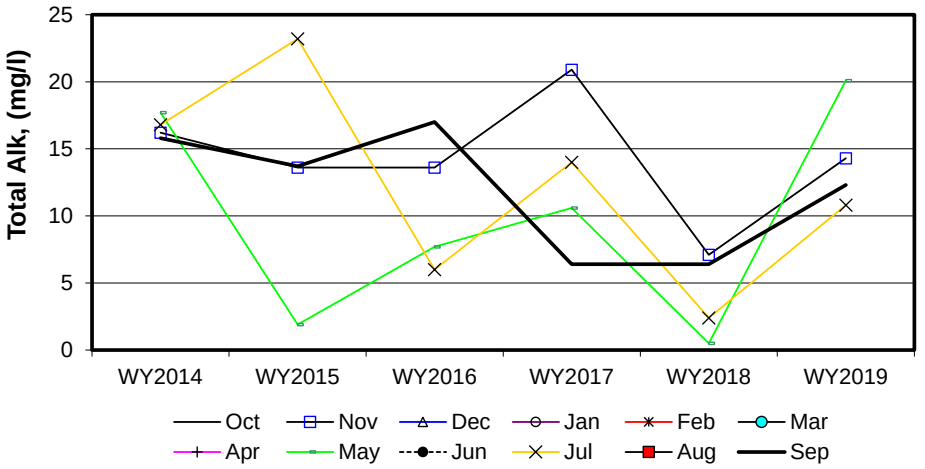
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		16.2						17.7		16.8		15.8
b	**WY2015**		13.6						1.9		23.2		13.7
c	**WY2016**		13.6						7.7		6.0		17.0
d	**WY2017**		20.9						10.6		14.0		6.4
e	**WY2018**		7.1						0.5		2.4		6.4
f	**WY2019**		14.3						20.1		10.8		12.3
	n	0	6	0	0	0	0	0	6	0	6	0	6
	t_1	0	4	0	0	0	0	0	6	0	6	0	4
	t_2	0	1	0	0	0	0	0	0	0	0	0	1
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						-1		1		-1
	c-a		-1						-1		-1		1
	d-a		1						-1		-1		-1
	e-a		-1						-1		-1		-1
	f-a		-1						1		-1		-1
	c-b		0						1		-1		1
	d-b		1						1		-1		-1
	e-b		-1						-1		-1		-1
	f-b		1						1		-1		-1
	d-c		1						1		1		-1
	e-c		-1						-1		-1		-1
	f-c		1						1		1		-1
	e-d		-1						-1		-1		0
	f-d		-1						1		-1		1
	f-e		1						1		1		1
	S_k	0	-2	0	0	0	0	0	1	0	-7	0	-6
	σ^2_S=		27.33						28.33		28.33		27.33
	$Z_k = S_k/\sigma_S$		-0.38						0.19		-1.32		-1.15
	Z^2_k		0.15						0.04		1.73		1.32

ΣZ_k= -2.66
ΣZ^2_k= 3.23
Z-bar=$\Sigma Z_k/K$= -0.66

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	20	2	0	0	0

Σn 24
ΣS_k -14

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	1.46		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.691**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	-1.23	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
111.33	**p**	**0.109**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-3.17	**-1.25**	0.86
0.050	-2.41		0.12
0.100	-2.33		-0.08
0.200	-2.13		-0.43

Site #29 Seasonal Kendall analysis for Zinc, Dissolved (ug/l)

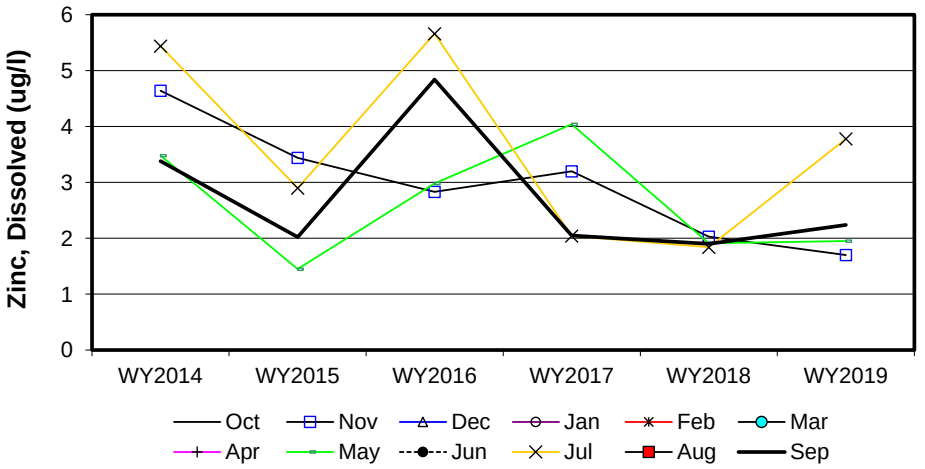
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		4.6						3.5		5.4		3.4
b	**WY2015**		3.4						1.5		2.9		2.0
c	**WY2016**		2.8						3.0		5.7		4.8
d	**WY2017**		3.2						4.0		2.0		2.1
e	**WY2018**		2.0						1.9		1.8		1.9
f	**WY2019**		1.7						2.0		3.8		2.2
	n	0	6	0	0	0	0	0	6	0	6	0	6
	t_1	0	6	0	0	0	0	0	6	0	6	0	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						-1		-1		-1
	c-a		-1						-1		1		1
	d-a		-1						1		-1		-1
	e-a		-1						-1		-1		-1
	f-a		-1						-1		-1		-1
	c-b		-1						1		1		1
	d-b		-1						1		-1		1
	e-b		-1						1		-1		-1
	f-b		-1						1		1		1
	d-c		1						1		-1		-1
	e-c		-1						-1		-1		-1
	f-c		-1						-1		-1		-1
	e-d		-1						-1		-1		-1
	f-d		-1						-1		1		1
	f-e		-1						1		1		1
	S_k	0	-13	0	0	0	0	0	-1	0	-5	0	-3
	σ^2_S=		28.33						28.33		28.33		28.33
	$Z_k = S_k/\sigma_S$		-2.44						-0.19		-0.94		-0.56
	Z^2_k		5.96						0.04		0.88		0.32

ΣZ_k= -4.13
ΣZ^2_k= 7.20
Z-bar=$\Sigma Z_k/K$= -1.03

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	24	0	0	0	0

Σn 24
ΣS_k -22

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	2.93		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.403**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	-1.97	@α/2=2.5% Z=	1.96	**H_0** (No trend) REJECT
113.33	**p**	**0.024**			**H_A** (± trend) ACCEPT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.64		0.02
0.050	-0.52	**-0.36**	-0.16
0.100	-0.47		-0.23
0.200	-0.43		-0.32

-12.6%

INTERPRETIVE REPORT
SITE 32

The data collected during the current water year are listed in the following "Table of Results for Water Year 2019" report. The table includes all the required FWMP analyte data (field and laboratory) collected for the current water year and a series of flags keyed to the summary report "Qualified Data by QA Reviewer." The QA report lists any associated data limitations found during the monthly QA reviews of laboratory data for this site. Median values for all analytes have been calculated and are shown in the right-most column of the table of results. Values reported as less than MDL have been replaced with a value of one-half of the MDL for the purpose of median calculation.

All data collected at this site for the past six years are included in the data analyses. As shown in the table below, there were no data outliers.

Sample Date	Parameter	Value	Qualifier	Notes
No outliers, in the past six years, have been identified by HGCMC.				

The results for the current water year have been compared to the strictest freshwater quality criterion for each applicable analyte. Four results exceeding these criteria have been identified, as listed in the table below.

Table of Exceedance for Water Year 2019

			Limits		
Sample Date	Parameter	Value	Lower	Upper	Hardness
13-Nov-18	pH	5.8 su	6.5	8.5	36.3 mg/L
7-May-19	pH	5.57 su	6.5	8.5	23.2 mg/L
15-Jul-19	pH	5.37 su	6.5	8.5	21.7 mg/L
2-Sep-19	pH	5.56 su	6.5	8.5	24.7 mg/L

All four of the annual sampling events for field pH were in exceedance. Monitoring well completion in organic-rich peat, as discussed for Sites 27 and 29, is a reasonable explanation for the low pH values.

X-Y plots have been generated to graphically present the data for each of the analytes requested in the Statistical Information Goals for this site. These plots have been visually analyzed for the appearance of any trend in concentration. There were noticeable changes in conductivity, alkalinity, and hardness during the current water year.

A non-parametric statistical analysis for trend was performed for specific conductivity. Calculation details of the Seasonal Kendall analyses are presented in detail on the pages

following this interpretive section. The adjacent table summarizes the results of the data collected between Oct-13 and Sep-19 (WY2014-WY2019).

Site 32 - Table of Summary Statistics for Trend Analysis

	Mann-Kendall test statistics			Sen's slope estimate	
Parameter	**n***	**p****	**Trend**	**Q**	**Q(%)**
Conductivity Field	6	0.99	+	12.57	18.5
pH Field	6	0.99	+	0.14	2.7
Alkalinity, Total	6	0.97			
Sulfate, Total	6	1.00	+	0.09	40.7
Zinc, Dissolved	6	<0.01	-	-1.2	-18.3

* Number of Years ** Significance level

Statistically significant trends in field conductivity (12.57 µS/cm/yr), field pH (0.14 su/yr), total sulfate (0.09 µg/L/yr), and dissolved zinc (-1.2 µg/L/yr) were identified at Site 32 for the six-year period.

Intra-well analysis was performed using combined Shewhart-CUSUM charts for conductivity, dissolved zinc, and alkalinity. Table 1 contains a summary of the baseline statistics, along with the control limits used.

Site 32 was installed in 1988 and has an extensive sampling history. However, establishing a baseline was difficult. Since the installation of the well several the monitored parameters (i.e., alkalinity, specific conductance, and total sulfate) have been in constant flux. Because the CUSUM process compares the mean and standard deviation of the chosen baseline to the collected data, it is possible to detect continual changes in the analytes without having a background data set. After reviewing the data for the three parameters, data periods were chosen based upon the data having a period of minimal flux. This period was then used for the calculation of the baseline statistics.

Table 1. Specific Conductance, Dissolved Zinc, and Total Sulfate Baseline Periods, Summary Statistics and Various Control Limits

	Site 32 Conductivity (µS/cm)	Site 32 Diss. Zinc (µg/L)	Site 32 Alkalinity (mg/L)
Baseline Statistics			
Baseline Period	09/18/95-09/10/03	05/11/00-09/15/05	04/27/95-09/13/00
Number of Samples	12	12	12
Mean (x)	57.5	9.17	18.7
Standard Deviation	2.86	3.72	2.02
Shewhart-CUSUM Control Limits (SCL)			
Control Limit (mean x+ 2s)	63.3	16.6	22.1
Control Limit (mean x + 3s)	66.1	20.3	24.1
Control Limit (mean x + 4s)	69.0	24.0	26.1
Control Limit (mean x + 4.5s)	70.4	25.9	27.1
CUSUM Control Limits			
Cumulative increase (h)	5	5	5

The construction-related influences on near-surface hydrology discussed previously caused specific conductance and alkalinity to go out of control during the 2017 water year. A gradual stabilization of values is expected over the coming years. Dissolved zinc has periodically had higher values than the mean. As previously discussed, it is hypothesized that the increase in dissolved zinc results from the accumulation of fugitive dust in the snowpack during the winter. In the spring, when the snowpack melts, this material is released as a pulse. Most years, the deposited material is not present by the fall sampling. With the implementation of additional best management practices, HGCMC expects to decrease the amount of fugitive dust leaving the tailings disposal facility.

Figure 1. **Observed Measurements for Specific Conductance, Dissolved Zinc, and Alkalinity from Site 32 Compared to the Shewhart-CUSUM Control Limits From Table 1**

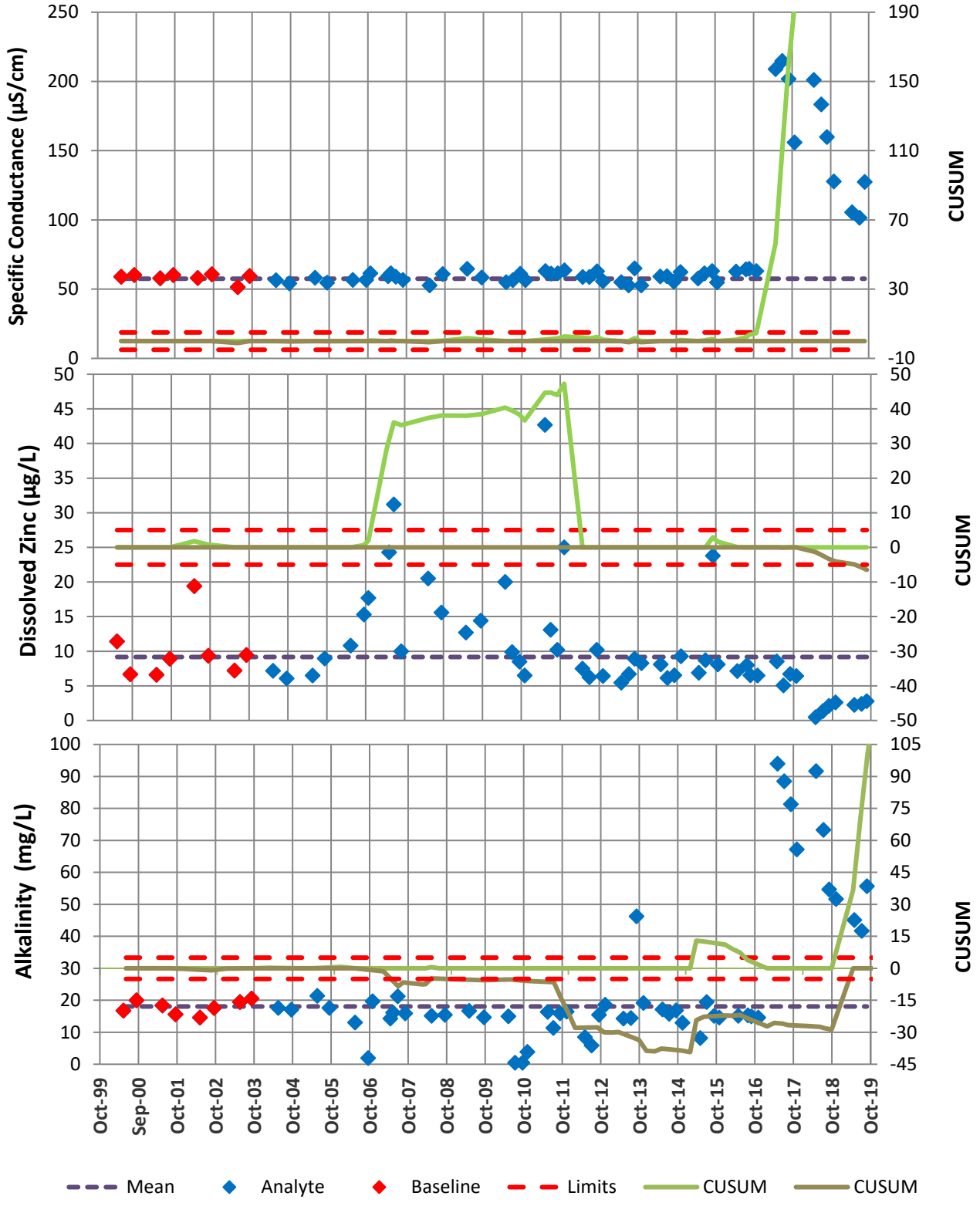


Table of Results for Water Year 2019

Site 032FMG - 'Monitoring Well - 5S'

Sample Date/Parameter	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019	**Median**
Water Temp (°C)		7.4						6.2		10.1		8.7	8.1
Conductivity-Field(μmho)		127.7						105.5		101.5		127.5	116.5
Conductivity-Lab (μmho)		113						103		91		109	106
pH Lab (standard units)		5.72						5.46		5.76		5.51	5.62
pH Field (standard units)		5.83						5.57		5.37		5.56	5.57
Total Alkalinity (mg/L)		51.7						45.1		41.7		55.7	48.4
Total Sulfate (mg/L)		0.4						0.7		0.2		2.6	0.6
Hardness (mg/L)		36.3						23.2		21.7		24.7	24.0
Dissolved As (ug/L)		2.05						3.03		2.77		2.44	2.605
Dissolved Ba (ug/L)		35.6						26		25		27.5	26.8
Dissolved Cd (ug/L)		0.0018						0.0018		0.0018		0.0018	0.0018
Dissolved Cr (ug/L)		0.753						1.07		1.11		0.867	0.969
Dissolved Cu (ug/L)		0.197						0.405		0.459		0.325	0.365
Dissolved Pb (ug/L)		0.177						0.228		0.188		0.176	0.1825
Dissolved Ni (ug/L)		2.46						2.92		2.94		2.93	2.925
Dissolved Ag (ug/L)		0.002						0.002		0.002		0.003	0.002
Dissolved Zn (ug/L)		2.62						2.25		2.4		2.77	2.51
Dissolved Se (ug/L)		0.057						0.057		0.149		0.29	0.103
Dissolved Hg (ug/L)		0.000506						0.000981		0.000788		0.000649	0.000719

For individual sample/analyte qualifier descriptions see "Qualified Data by QA Reviewer" table.

Values reported as less than MDL are replaced by 1/2 MDL for median calculation purposes.

Shaded data has been qualified as an outlier by HGCMC and removed from any further analysis and is not included into the calculation of the median

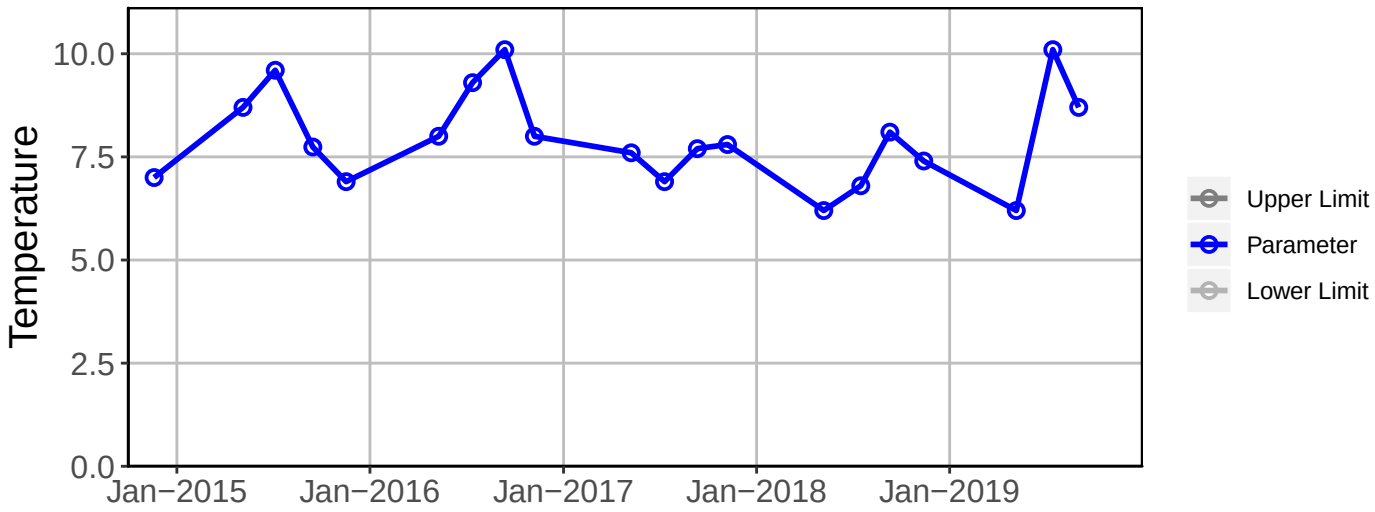
Qualified Data by QA Reviewer

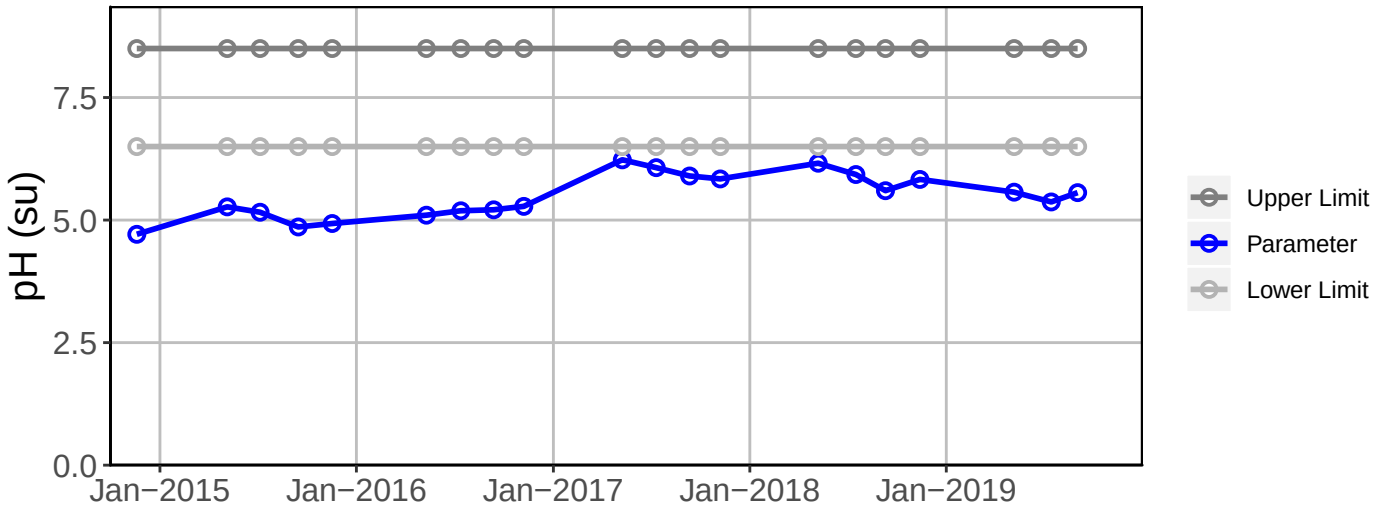
Date Range: 10/01/2018 to 09/30/2019

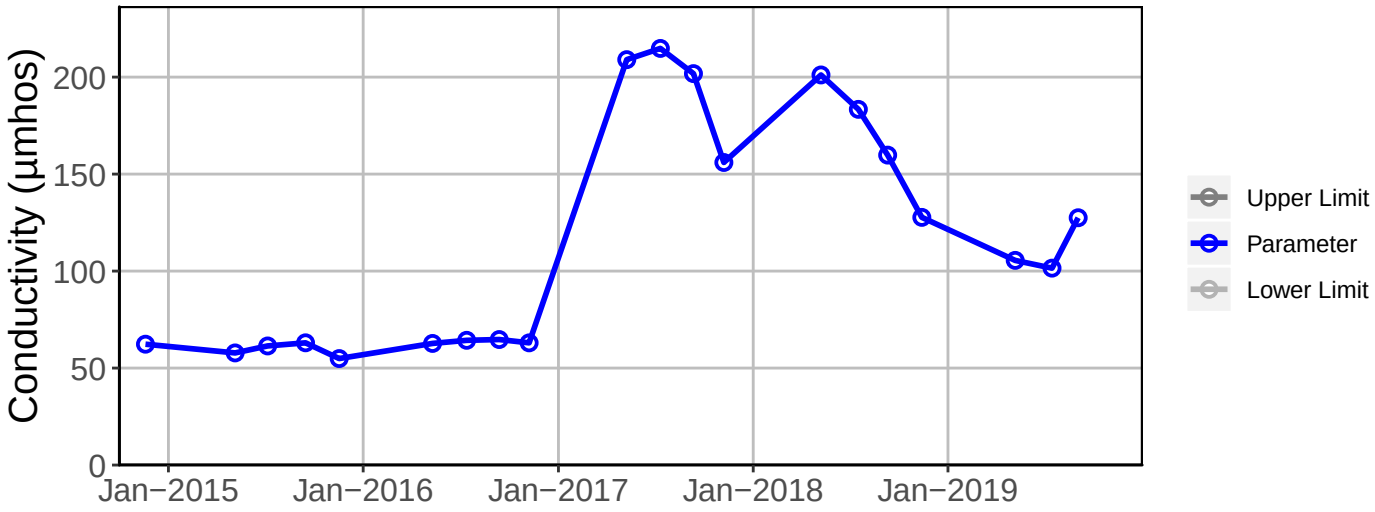
Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
032FMG	13-Nov-18	Diss. Zn-ICP/MS	2.62	µg/L	U	Field Blank Contamination
	7-May-19	Diss. Cu-ICP/MS	0.4	µg/L	U	Trip Blank Contamination
		Diss. Zn-ICP/MS	2.25	µg/L	U	Field Blank Contamination
		Total Sulfate	0.66	µg/L	J	Below Quantitative Range
	15-Jul-19	Diss. Se-ICP/MS	0.14	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	2.4	µg/L	U	Field Blank contamination
	2-Sep-19	Diss. Ag-ICP/MS	0.00325	µg/L	J	Below Quantitative Range
		Diss. Cr-ICP/MS	0.86	µg/L	U	Field Blank Contamination
		Diss. Ni-ICP/MS	2.93	µg/L	U	Field Blank Contamination
		Diss. Pb-ICP/MS	0.17	µg/L	U	Field Blank Contamination
		Diss. Se-ICP/MS	0.29	µg/L	U	Method Blank Contamination
		Total Sulfate	2.64	µg/L	J	Sample Receipt Temperature

Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

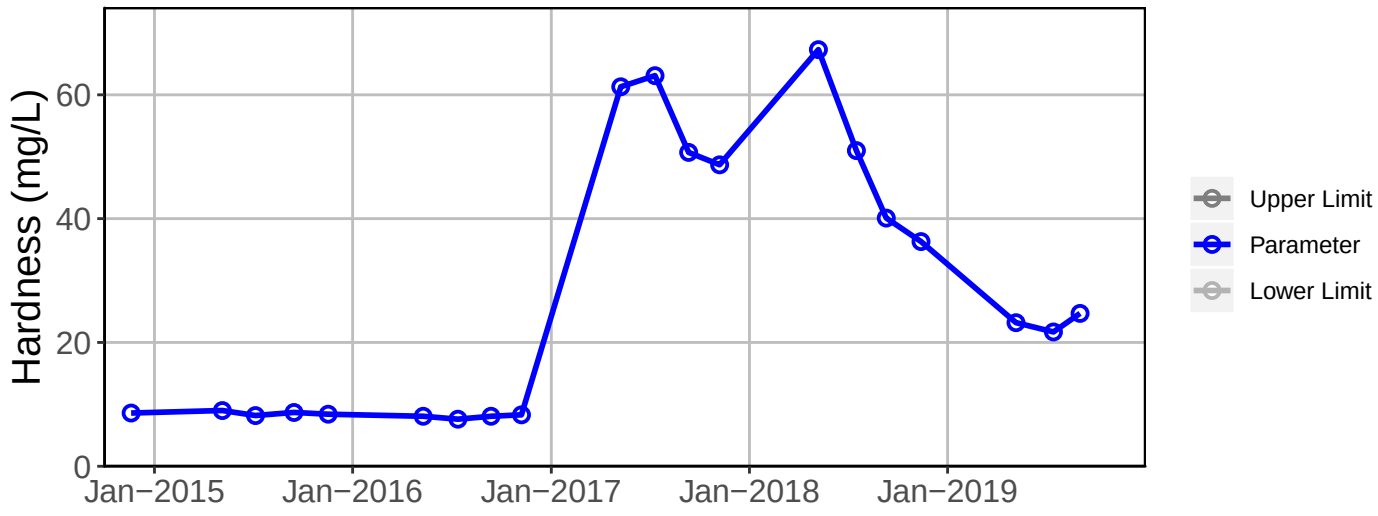
Site 32 Analyte Charts

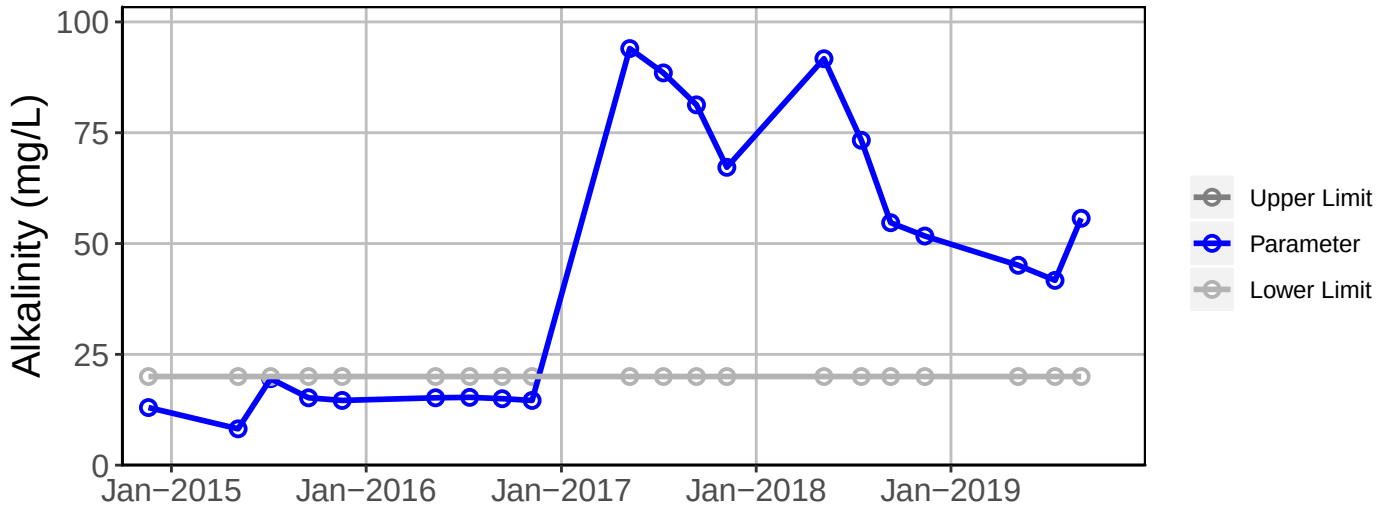


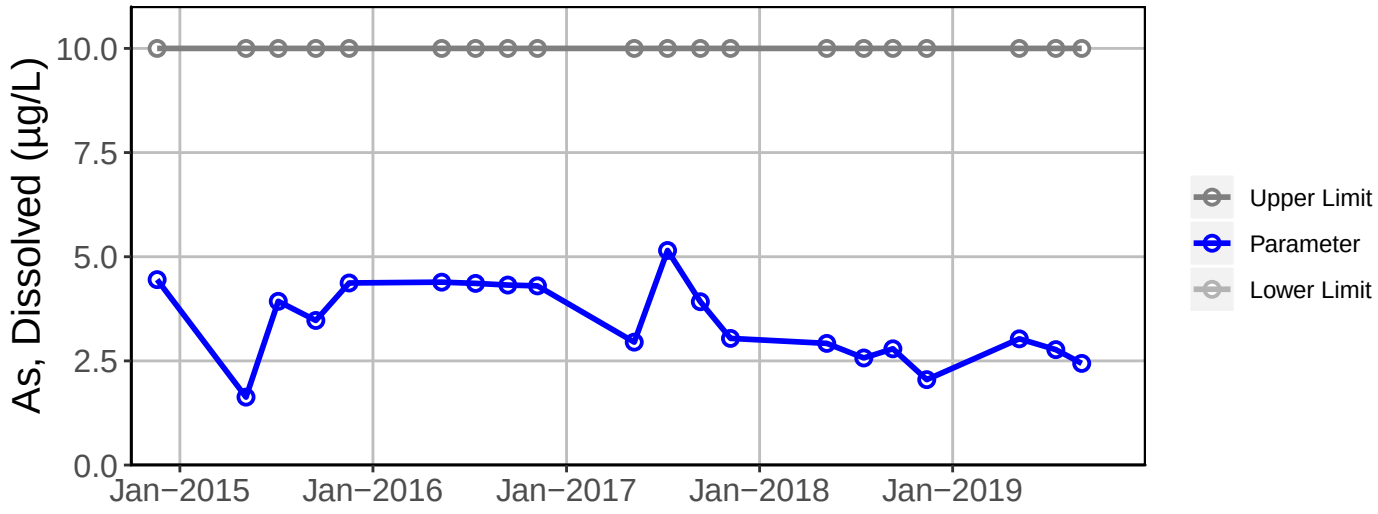




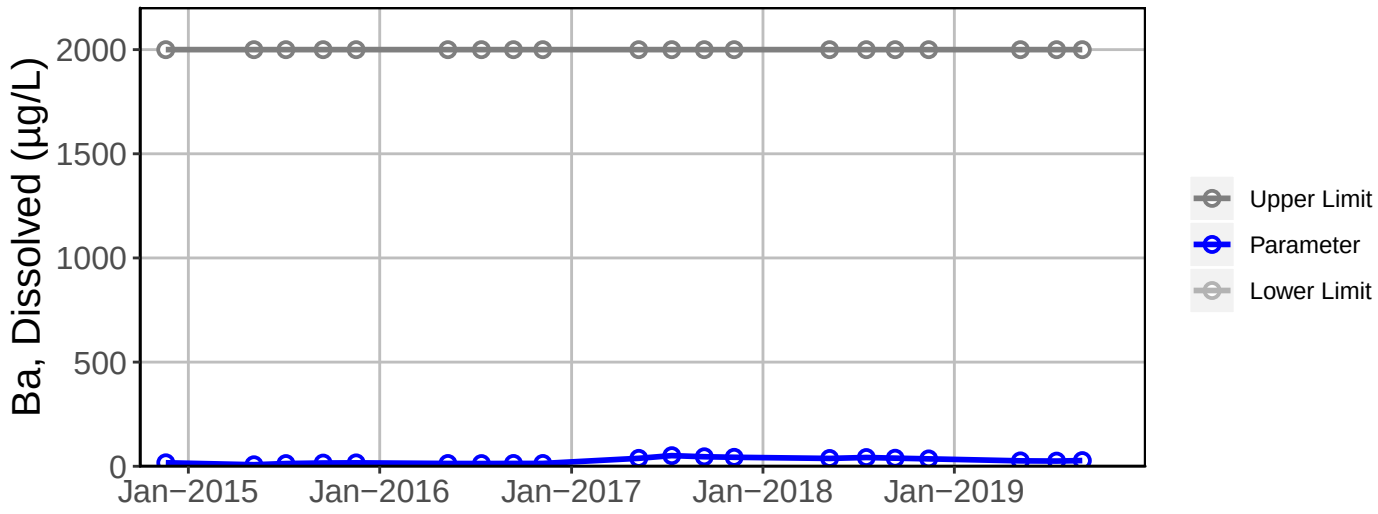
Site 32 Analyte Charts

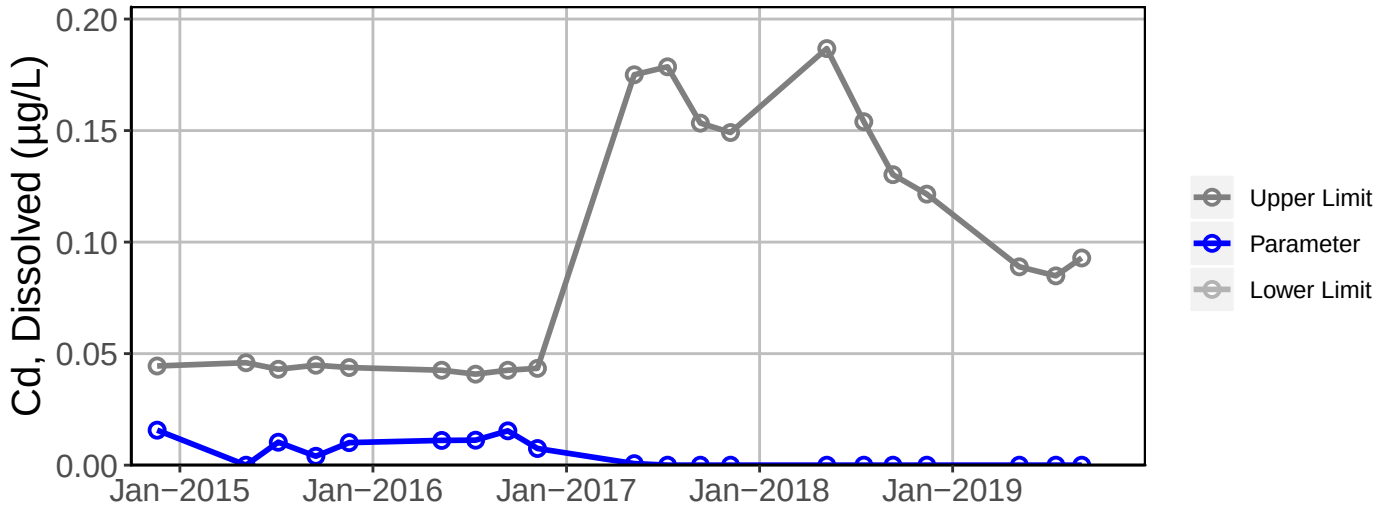


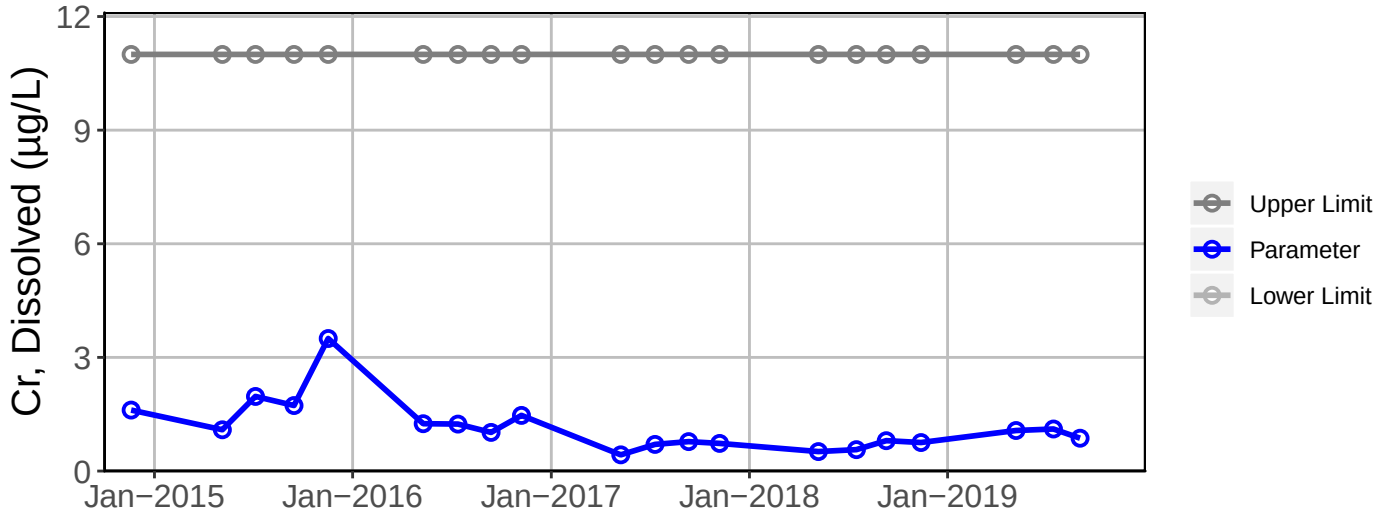




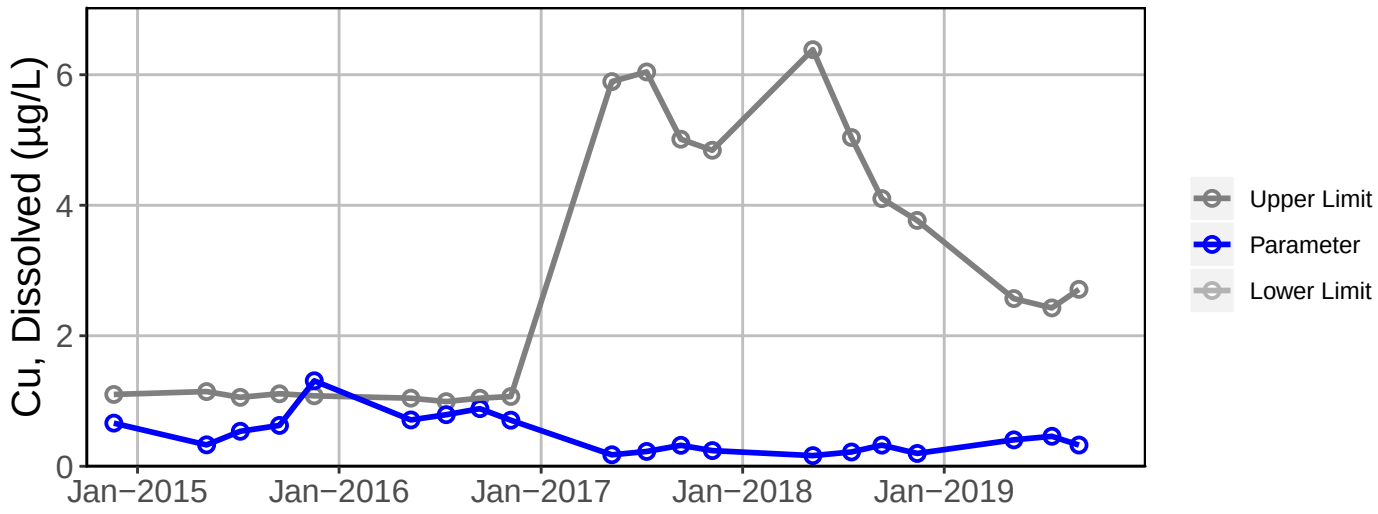
Site 32 Analyte Charts

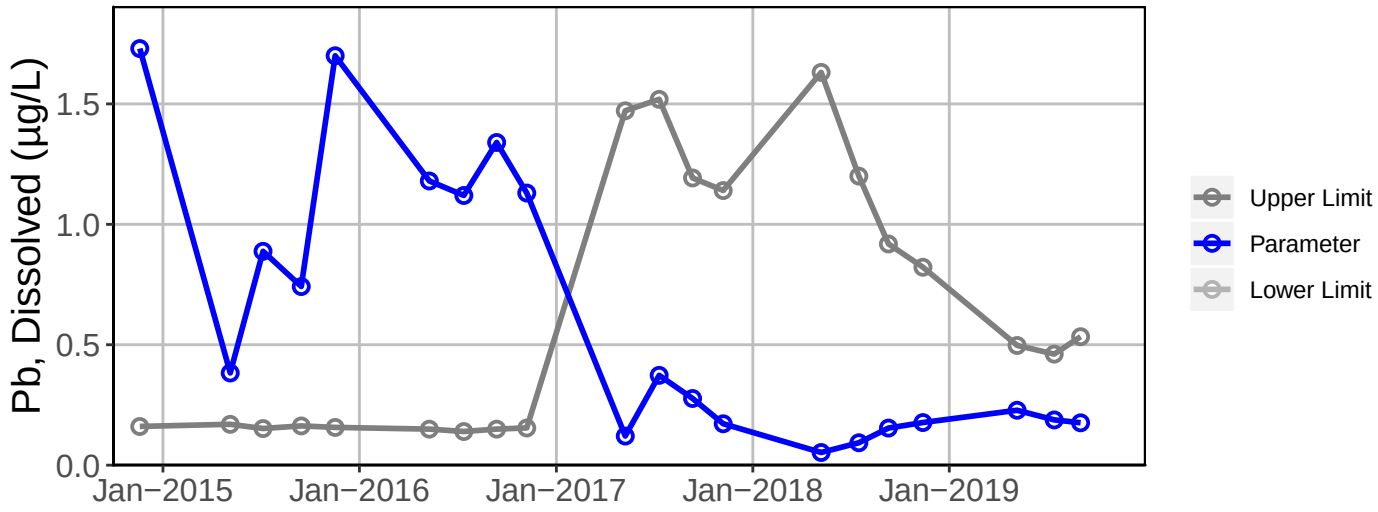


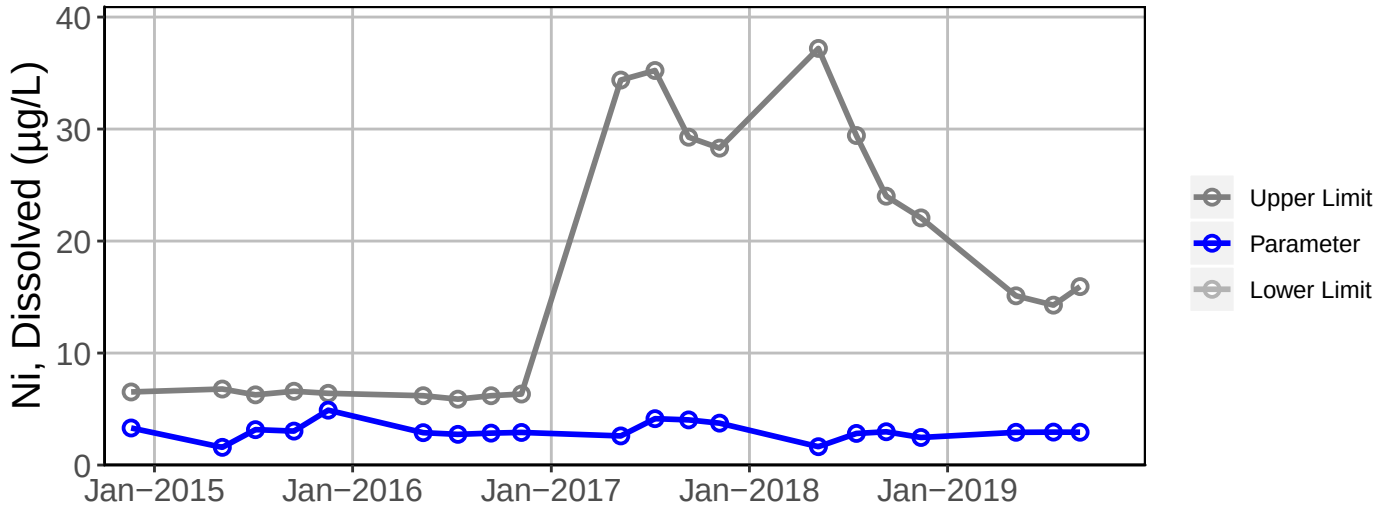




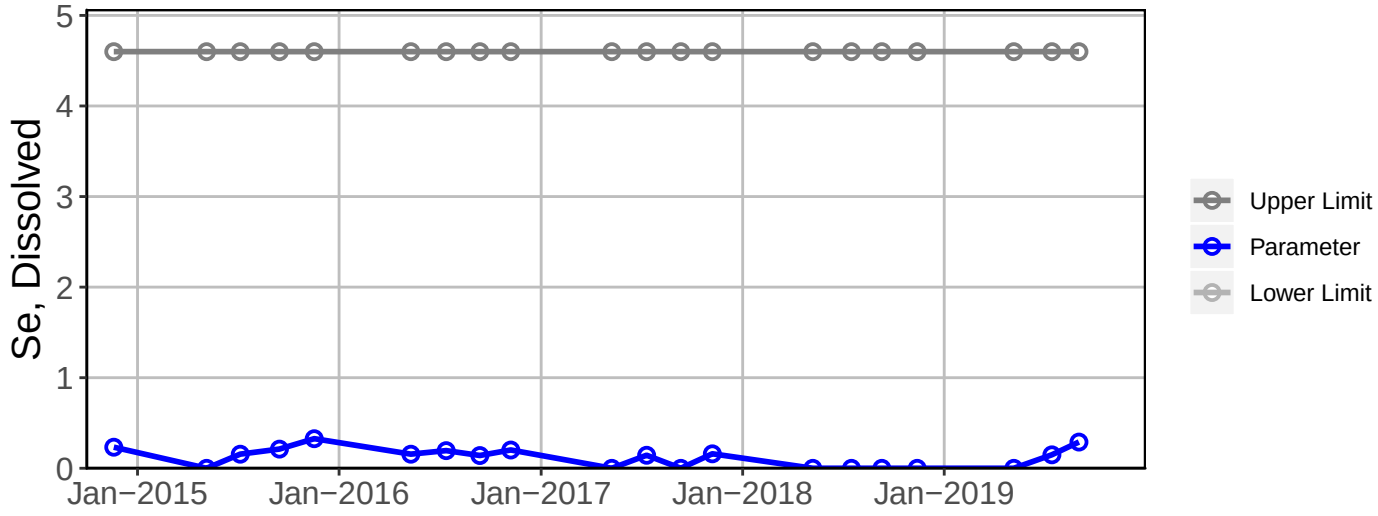
Site 32 Analyte Charts

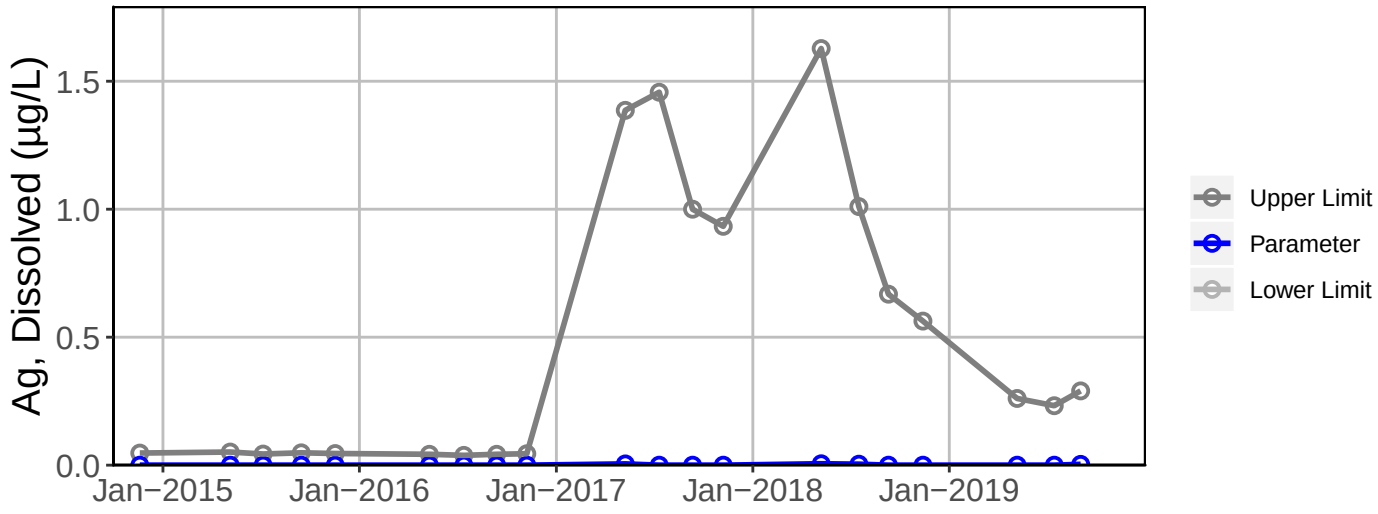


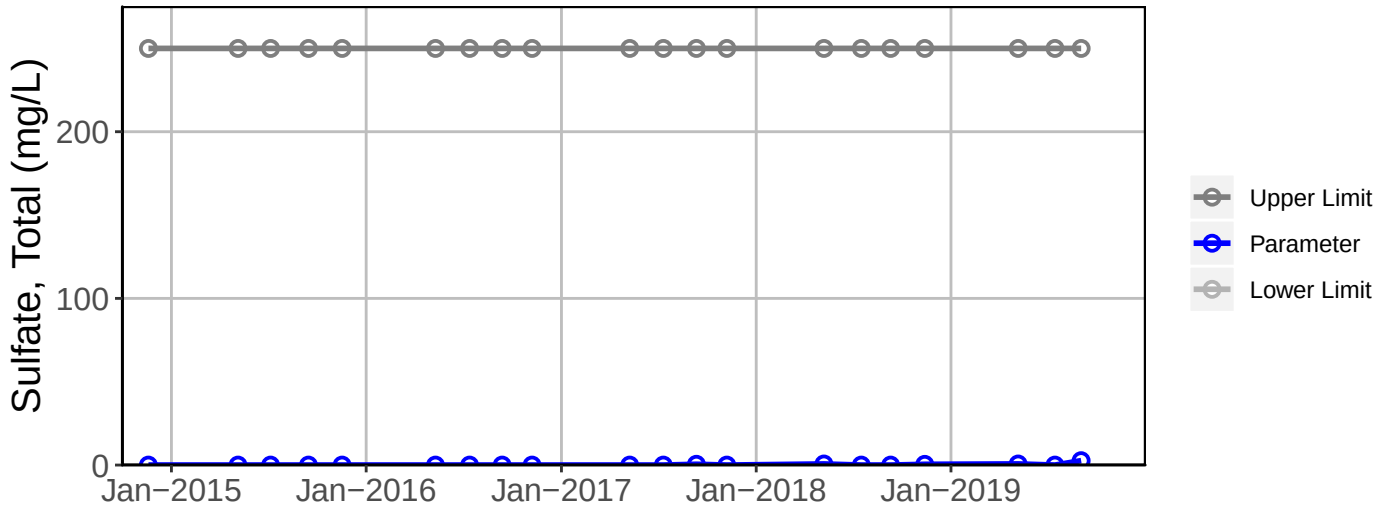




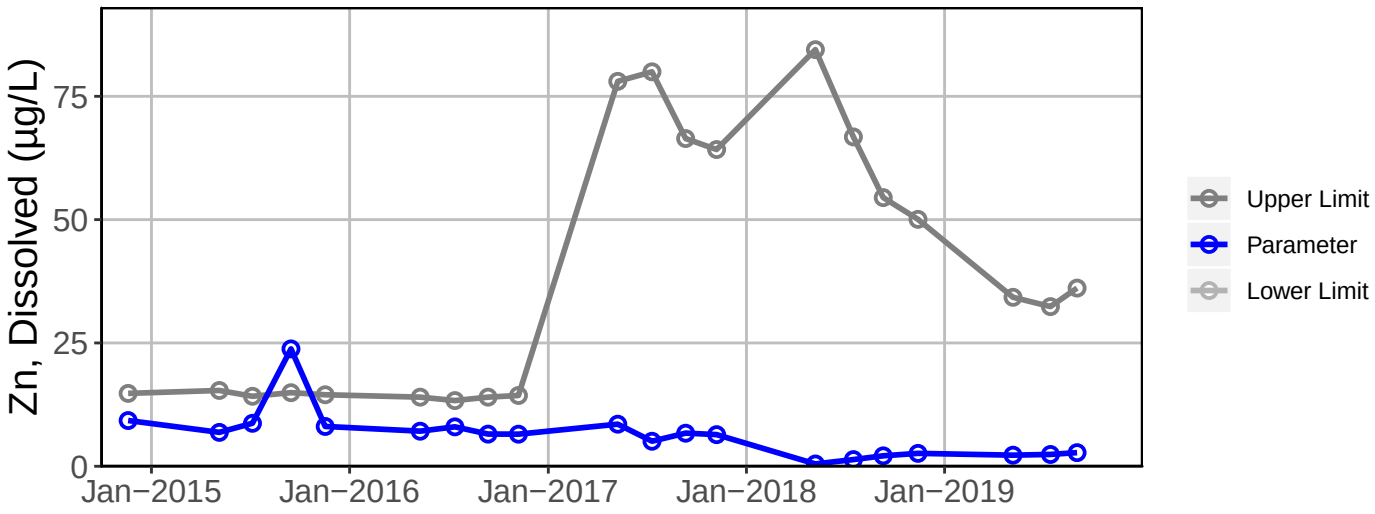
Site 32 Analyte Charts







Site 32 Analyte Charts



Site #32 Seasonal Kendall analysis for Specific Conductance, Field (µS/cm)

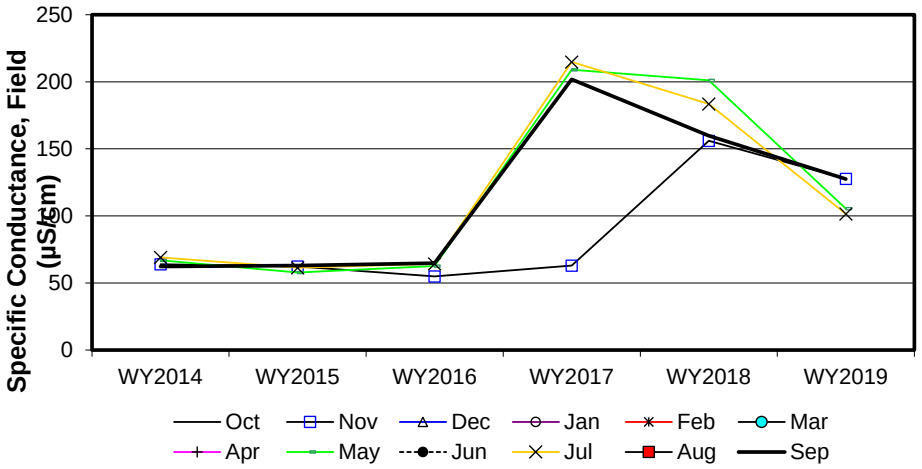
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		64.0						67.0		69.0		62.3
b	**WY2015**		62.3						57.8		61.4		63.0
c	**WY2016**		54.9						62.7		64.3		64.7
d	**WY2017**		63.0						209.0		214.8		201.8
e	**WY2018**		156.0						201.1		183.5		159.8
f	**WY2019**		127.7						105.5		101.5		127.5
	n	0	6	0	0	0	0	0	6	0	6	0	6
	t_1	0	6	0	0	0	0	0	6	0	6	0	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						-1		-1		1
	c-a		-1						-1		-1		1
	d-a		-1						1		1		1
	e-a		1						1		1		1
	f-a		1						1		1		1
	c-b		-1						1		1		1
	d-b		1						1		1		1
	e-b		1						1		1		1
	f-b		1						1		1		1
	d-c		1						1		1		1
	e-c		1						1		1		1
	f-c		1						1		1		1
	e-d		1						-1		-1		-1
	f-d		1						-1		-1		-1
	f-e		-1						-1		-1		-1
	S_k	0	5	0	0	0	0	0	5	0	5	0	9
	σ^2_S=		28.33						28.33		28.33		28.33
	$Z_k = S_k/\sigma_S$		0.94						0.94		0.94		1.69
	Z^2_k		0.88						0.88		0.88		2.86

ΣZ_k= 4.51
ΣZ^2_k= 5.51
Z-bar=$\Sigma Z_k/K$= 1.13

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	24	0	0	0	0

Σn 24
ΣS_k 24

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	0.42		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.935**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	**Z_{calc}**	2.16	@α/2=2.5% **Z**=	1.96	**H_0** (No trend) REJECT
113.33	**p**	**0.985**			**H_A** (± trend) ACCEPT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.86		32.30
0.050	1.32	**12.57**	24.35
0.100	3.26		22.63
0.200	7.12		16.23

18.5%

Site #32 Seasonal Kendall analysis for pH, Field, Standard Units

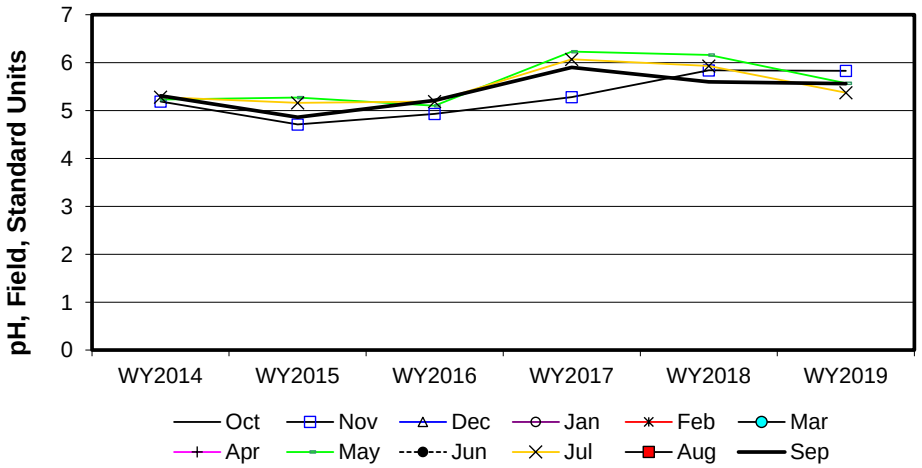
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		5.2						5.2		5.3		5.3
b	**WY2015**		4.7						5.3		5.2		4.9
c	**WY2016**		4.9						5.1		5.2		5.2
d	**WY2017**		5.3						6.2		6.1		5.9
e	**WY2018**		5.8						6.2		5.9		5.6
f	**WY2019**		5.8						5.6		5.4		5.6
	n	0	6	0	0	0	0	0	6	0	6	0	6
	t_1	0	6	0	0	0	0	0	6	0	6	0	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						1		-1		-1
	c-a		-1						-1		-1		-1
	d-a		1						1		1		1
	e-a		1						1		1		1
	f-a		1						1		1		1
	c-b		1						-1		1		1
	d-b		1						1		1		1
	e-b		1						1		1		1
	f-b		1						1		1		1
	d-c		1						1		1		1
	e-c		1						1		1		1
	f-c		1						1		1		1
	e-d		1						-1		-1		-1
	f-d		1						-1		-1		-1
	f-e		-1						-1		-1		-1
	S_k	0	9	0	0	0	0	0	5	0	5	0	5
	σ^2_S=		28.33						28.33		28.33		28.33
	$Z_k = S_k/\sigma_S$		1.69						0.94		0.94		0.94
	Z^2_k		2.86						0.88		0.88		0.88

ΣZ_k= 4.51
ΣZ^2_k= 5.51
Z-bar=$\Sigma Z_k/K$= 1.13

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	24	0	0	0	0

Σn 24
ΣS_k 24

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	0.42		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p **0.935**				$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc} 2.16		@α/2=2.5% Z=	1.96	**H_0** (No trend) REJECT
113.33	**p** **0.985**				**H_A** (± trend) ACCEPT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.02		0.28
0.050	0.03	**0.14**	0.24
0.100	0.05		0.22
0.200	0.06		0.18

2.7%

Site #32 Seasonal Kendall analysis for Total Alk, (mg/l)

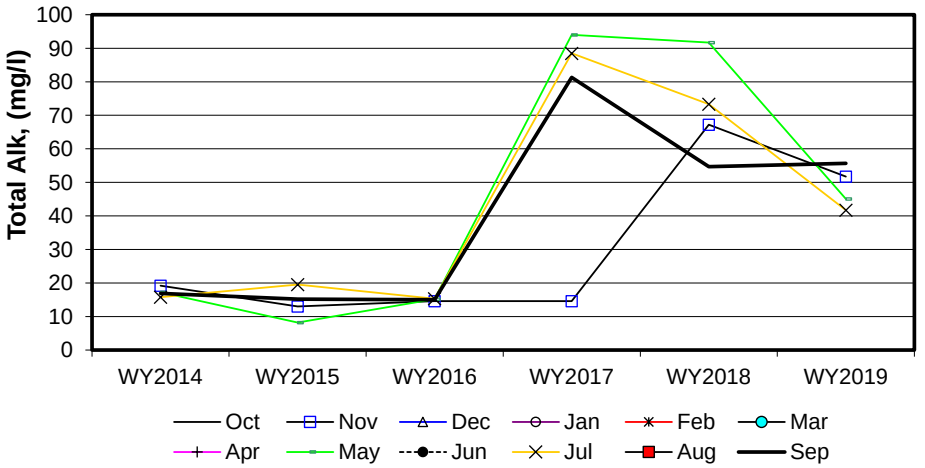
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		19.2						17.2		15.8		16.9
b	**WY2015**		13.0						8.2		19.5		15.2
c	**WY2016**		14.6						15.2		15.3		15.0
d	**WY2017**		14.6						94.0		88.5		81.3
e	**WY2018**		67.2						91.7		73.3		54.7
f	**WY2019**		51.7						45.1		41.7		55.7
	n	0	6	0	0	0	0	0	6	0	6	0	6
	t_1	0	4	0	0	0	0	0	6	0	6	0	6
	t_2	0	1	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						-1		1		-1
	c-a		-1						-1		-1		-1
	d-a		-1						1		1		1
	e-a		1						1		1		1
	f-a		1						1		1		1
	c-b		1						1		-1		-1
	d-b		1						1		1		1
	e-b		1						1		1		1
	f-b		1						1		1		1
	d-c		0						1		1		1
	e-c		1						1		1		1
	f-c		1						1		1		1
	e-d		1						-1		-1		-1
	f-d		1						-1		-1		-1
	f-e		-1						-1		-1		1
	S_k	0	6	0	0	0	0	0	5	0	5	0	5
	σ^2_S=		27.33						28.33		28.33		28.33
	$Z_k = S_k/\sigma_S$		1.15						0.94		0.94		0.94
	Z^2_k		1.32						0.88		0.88		0.88

ΣZ_k= 3.97
ΣZ^2_k= 3.96
Z-bar=$\Sigma Z_k/K$= 0.99

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	22	1	0	0	0

Σn 24
ΣS_k 21

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	0.03		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.998**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	1.89	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
112.33	**p**	**0.970**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.48	**8.28**	17.98
0.050	0.86		12.94
0.100	2.04		11.61
0.200	5.38		9.81

Site #32 Seasonal Kendall analysis for Zinc, Dissolved (ug/l)

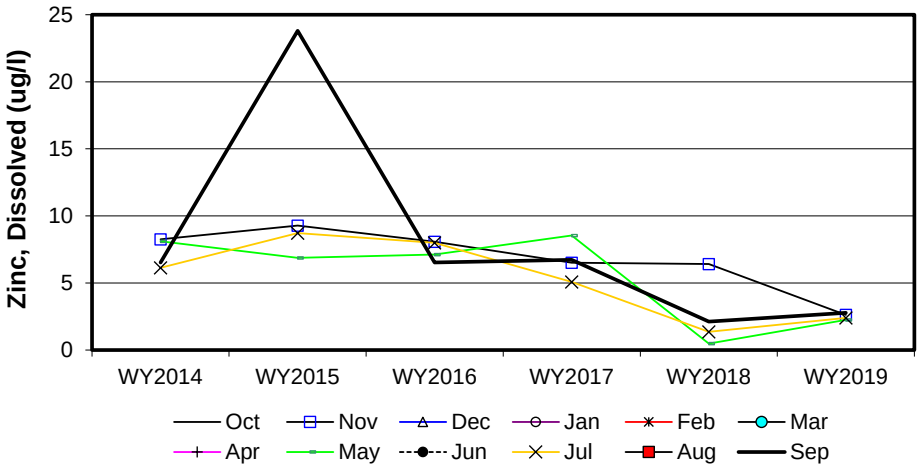
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		8.3						8.1		6.1		6.5
b	**WY2015**		9.3						6.9		8.7		23.8
c	**WY2016**		8.1						7.1		8.0		6.5
d	**WY2017**		6.5						8.5		5.1		6.7
e	**WY2018**		6.4						0.5		1.4		2.1
f	**WY2019**		2.6						2.3		2.4		2.8
	n	0	6	0	0	0	0	0	6	0	6	0	6
	t_1	0	6	0	0	0	0	0	6	0	6	0	4
	t_2	0	0	0	0	0	0	0	0	0	0	0	1
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		1						-1		1		1
	c-a		-1						-1		1		0
	d-a		-1						1		-1		1
	e-a		-1						-1		-1		-1
	f-a		-1						-1		-1		-1
	c-b		-1						1		-1		-1
	d-b		-1						1		-1		-1
	e-b		-1						-1		-1		-1
	f-b		-1						-1		-1		-1
	d-c		-1						1		-1		1
	e-c		-1						-1		-1		-1
	f-c		-1						-1		-1		-1
	e-d		-1						-1		-1		-1
	f-d		-1						-1		-1		-1
	f-e		-1						1		1		1
	S_k	0	-13	0	0	0	0	0	-5	0	-9	0	-6
	σ^2_S=		28.33						28.33		28.33		27.33
	$Z_k = S_k/\sigma_S$		-2.44						-0.94		-1.69		-1.15
	Z^2_k		5.96						0.88		2.86		1.32

ΣZ_k= -6.22
ΣZ^2_k= 11.02
Z-bar=$\Sigma Z_k/K$= -1.56

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	22	1	0	0	0

Σn 24
ΣS_k -33

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	1.35		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.717**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	-3.02	@α/2=2.5% Z=	1.96	**H_0** (No trend) REJECT
112.33	**p**	**0.001**			**H_A** (± trend) ACCEPT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-1.92		-0.48
0.050	-1.78	**-1.20**	-0.75
0.100	-1.61		-0.86
0.200	-1.47		-1.12

-18.3%

INTERPRETIVE REPORT
SITE 9

The Tributary Creek site was initially chosen to monitor the effects on water quality caused by the originally planned, larger slurry tailings impoundment. It is approximately one mile downstream from the present dry stack tailings site. The site was monitored from 1981 – 1993 when it was temporarily suspended by administrative agreement with the USFS. The site was re-activated in 2001 as a biological monitoring site for the Tailings Pile. HGCMC recommenced the collection of water chemistry samples after receiving a suggestion to do so from ADNR-Office of Habitat Management and Permitting personnel. It was noted that should the required annual biomonitoring show significant changes, an understanding of any related water chemistry variations would enhance the interpretation of those results.

The data collected during the current water year are listed in the following "Table of Results for Water Year 2019" report. The table includes all the FWMP analyte data (field and laboratory) collected for the current water year and a series of flags keyed to the summary report "Qualified Data by QA Reviewer." The QA report lists any associated data limitations found during the monthly QA reviews of laboratory data for this site. Median values for all analytes have been calculated and are shown in the right-most column of the table of results. Any value reported as less than MDL has been replaced with a value of one-half of the MDL for the purpose of median calculation.

Routine water chemistry data collection was reinstated in May 2006. All data collected at the site since then are included in the data analyses. As shown in the table below, there were no data outliers.

Sample Date	Parameter	Value	Qualifier	Notes
No outliers, in the past six years, have been identified by HGCMC.				

The results for the current water year have been compared to the strictest freshwater quality criterion for each applicable analyte. Four results exceeding these criteria have been identified and are listed in the table below.

Table of Exceedance for Water Year 2019

			Limits		
Sample Date	Parameter	Value	Lower	Upper	Hardness
13-Nov-18	Alkalinity, Total	11.2 mg/L	20		26.5 mg/L
7-May-19	Alkalinity, Total	9.83 mg/L	20		19.9 mg/L
7-May-19	Lead, Dissolved	0.53 µg/L		0.42	19.9 mg/L
15-Jul-19	Lead, Dissolved	1.85 µg/L		1.0	44.3 mg/L

Two samples were below the lower limit for alkalinity. Alkalinity concentrations below AWQS routinely occur at Site 9 and are expected because Tributary Creek drains peat muskeg that produces dilute low-alkalinity water. Two samples were above the AWQS for lead. As noted in the interpretive section for Site 29, fugitive tailings dust may be contributing to the elevated lead levels monitored at Site 9.

X-Y plots have been generated to graphically present the data for each of the analytes that are listed in Suite Q. No obvious visual trends were observed for the reporting period.

A non-parametric statistical analysis for trend was performed for specific conductivity, field pH, total alkalinity, total sulfate, and dissolved zinc. Calculation details of the Seasonal Kendall analyses are presented in detail on the pages following this interpretive section. The following table summarizes the results of the data collected between Oct-13 and Sep-19 (WY2014-WY2019).

Site 9 - Table of Summary Statistics for Trend Analysis

	Mann-Kendall test statistics			Sen's slope estimate	
Parameter	**n***	**p****	**Trend**	**Q**	**Q(%)**
Conductivity Field	6	0.26			
pH Field	6	<0.01	-	-0.06	-90
Alkalinity, Total	6	0.88			
Sulfate, Total	6	0.13			
Zinc, Dissolved	6	0.46			

* Number of Years ** Significance level

A statistically significant (α/2=2.5%) decreasing trend for pH was observed during the current water year. The above sampling, coupled with the annual biomonitoring, has been sufficient to adequately characterize the water quality parameters while addressing safety concerns associated with winter access and the increased potential for bear encounters during salmon spawning season.

Table of Results for Water Year 2019

Site 009FMS - 'Lower Tributary Creek'

Sample Date/Parameter	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019	**Median**
Water Temp (°C)		4.2						5.7		15		11.6	8.7
Conductivity-Field(μmho)		61.1						45.9		94.8		85.2	73.2
Conductivity-Lab (μmho)		62						48		92		84	73
pH Lab (standard units)		6.08						6.04		7.08		6.13	6.11
pH Field (standard units)		6.88						6.64		6.8		6.61	6.72
Total Alkalinity (mg/L)		11.2						9.8		38.3		20.3	15.8
Total Sulfate (mg/L)		10						7.1		4.8		13.8	8.6
Hardness (mg/L)		26.5						19.9		44.3		36.6	31.6
Dissolved As (ug/L)		0.686						0.906		2.56		1.33	1.118
Dissolved Ba (ug/L)		30.9						25.9		47.4		40	35.5
Dissolved Cd (ug/L)		0.0261						0.0262		0.0576		0.0271	0.0267
Dissolved Cr (ug/L)		0.523						0.561		0.844		0.71	0.636
Dissolved Cu (ug/L)		1.66						1.97		2.05		1.68	1.825
Dissolved Pb (ug/L)		0.428						0.526		1.85		0.514	0.520
Dissolved Ni (ug/L)		1.94						1.8		3.68		2.68	2.310
Dissolved Ag (ug/L)		0.007						0.007		0.022		0.011	0.009
Dissolved Zn (ug/L)		4.56						4.96		5.19		3.42	4.76
Dissolved Se (ug/L)		0.135						0.057		0.181		0.225	0.158
Dissolved Hg (ug/L)		0.0049						0.0068		0.0057		0.0042	0.0053

For individual sample/analyte qualifier descriptions see "Qualified Data by QA Reviewer" table.

Values reported as less than MDL are replaced by 1/2 MDL for median calculation purposes.

Shaded data has been qualified as an outlier by HGCMC and removed from any further analysis and is not included into the calculation of the median

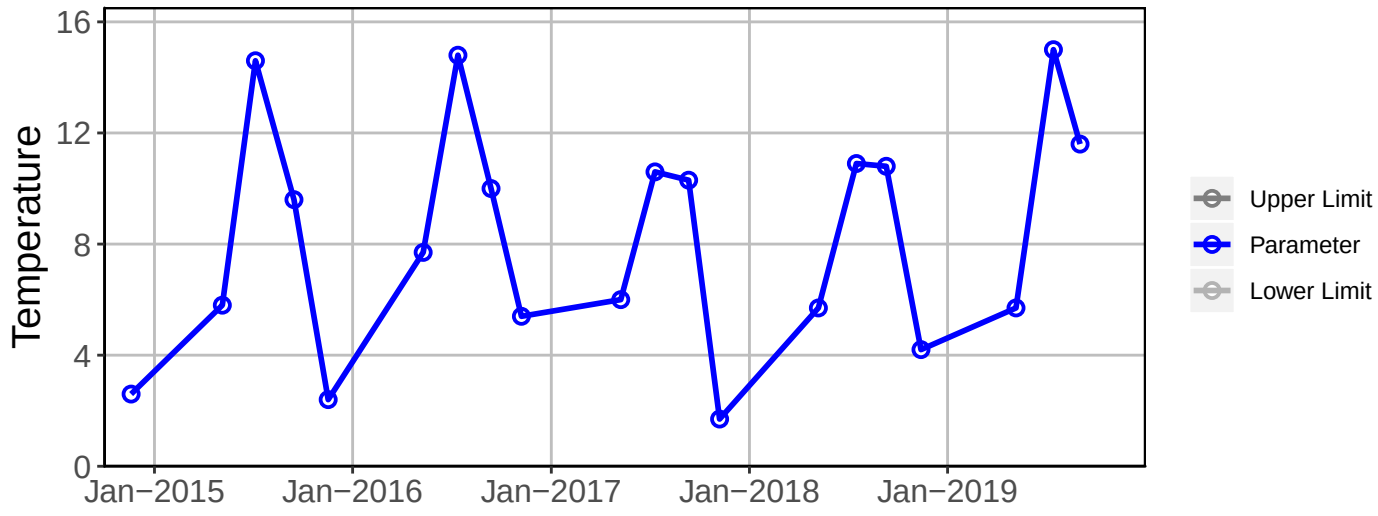
Qualified Data by QA Reviewer

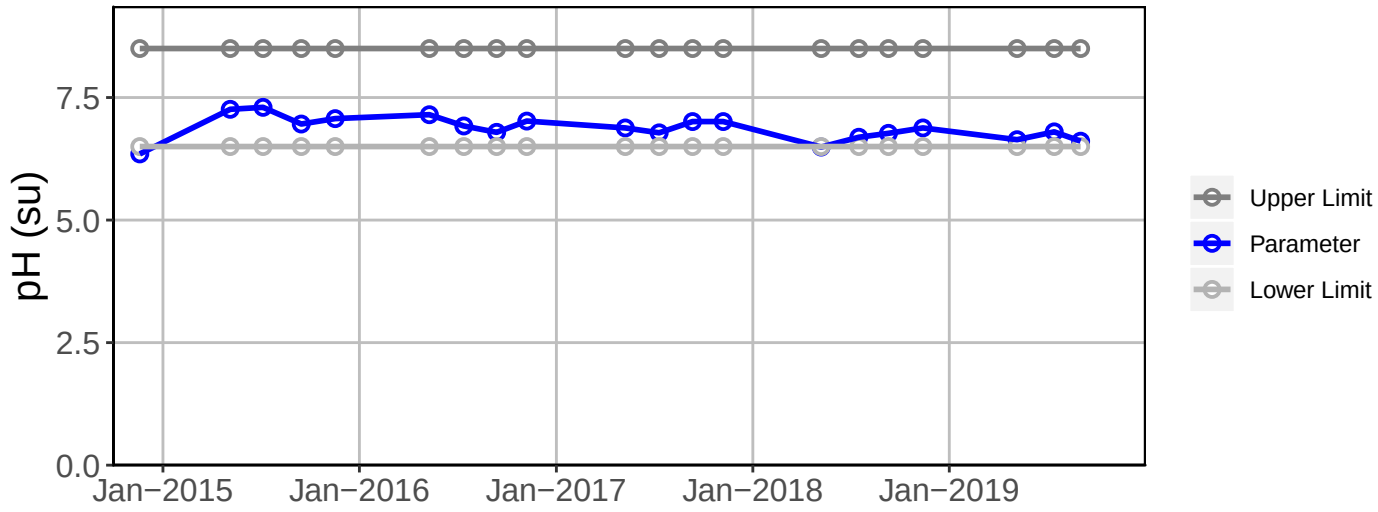
Date Range: 10/01/2018 to 09/30/2019

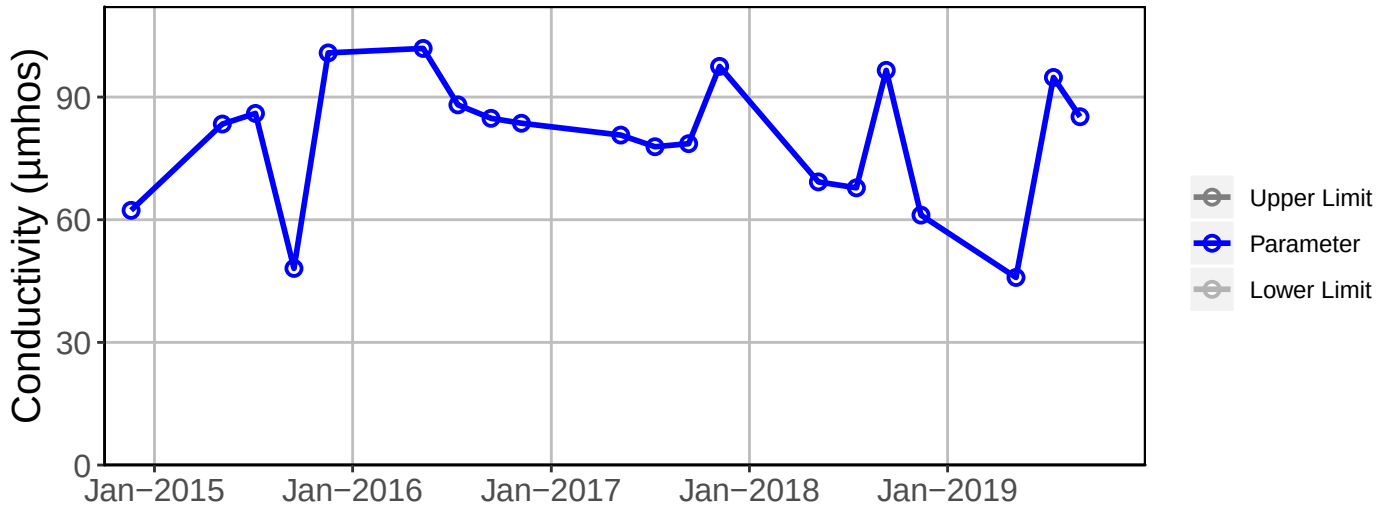
Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
009FMS	13-Nov-18	Diss. Ag-ICP/MS	0.0067	µg/L	J	Below Quantitative Range
		Diss. Se-ICP/MS	0.13	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	4.56	µg/L	U	Field Blank Contamination
	7-May-19	Diss. Ag-ICP/MS	0.00662	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	4.96	µg/L	U	Field Blank Contamination
	15-Jul-19	Diss. Se-ICP/MS	0.18	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	5.19	µg/L	U	Field Blank contamination
	2-Sep-19	Diss. Cr-ICP/MS	0.71	µg/L	U	Field Blank Contamination
		Diss. Ni-ICP/MS	2.68	µg/L	U	Field Blank Contamination
		Diss. Se-ICP/MS	0.22	µg/L	U	Method Blank Contamination
		Total Sulfate	13.80	µg/L	J	Sample Receipt Temperature

Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

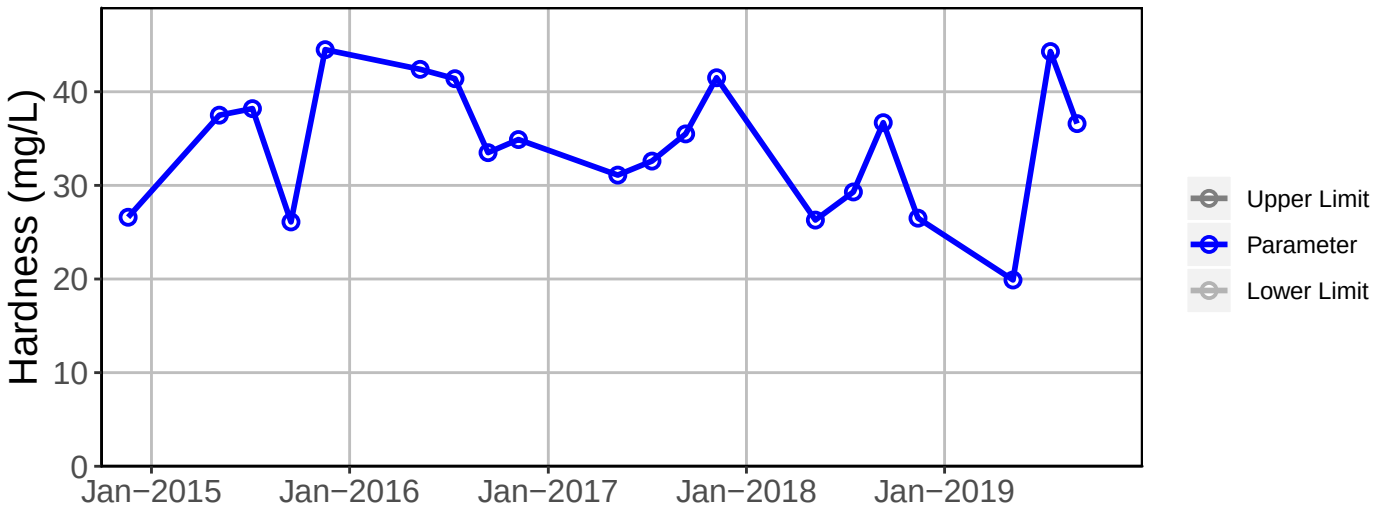
Site 9 Analyte Charts

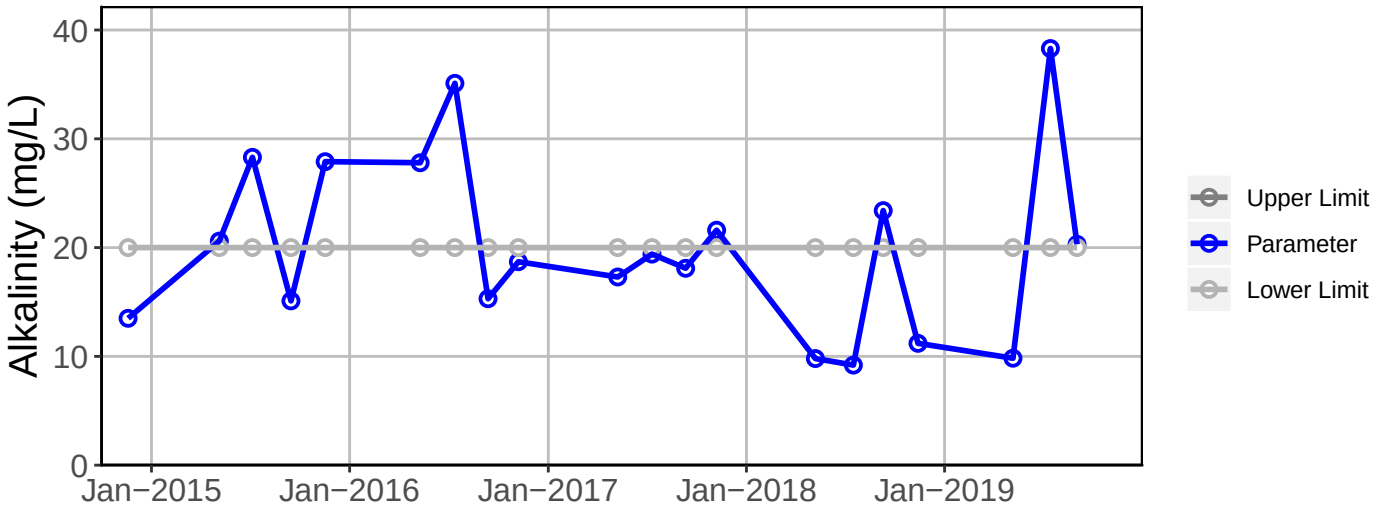


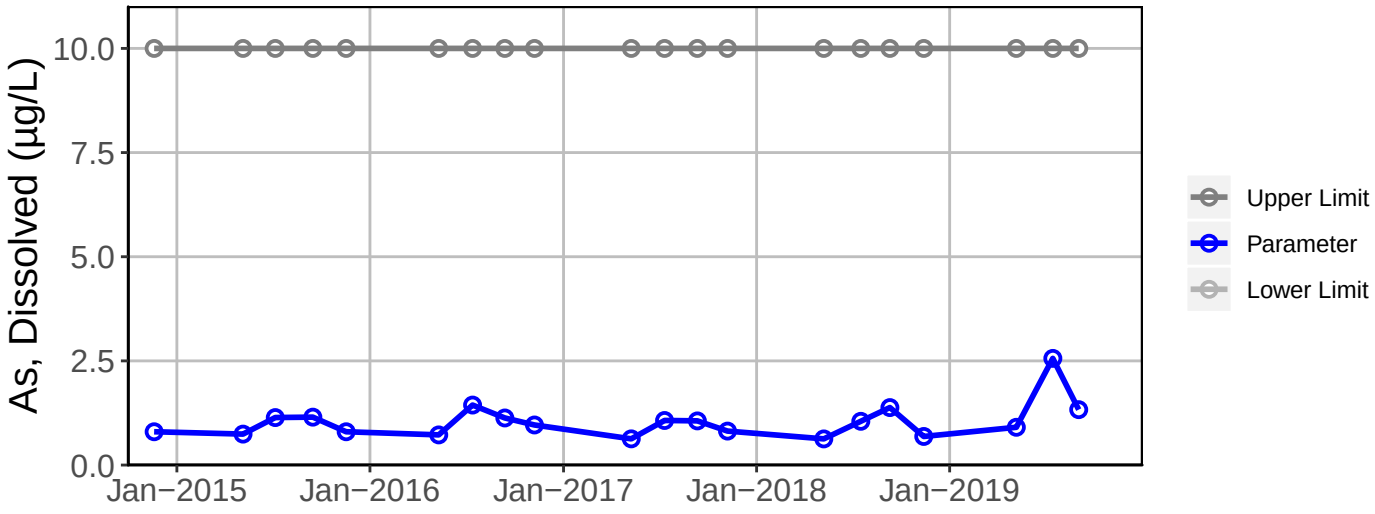




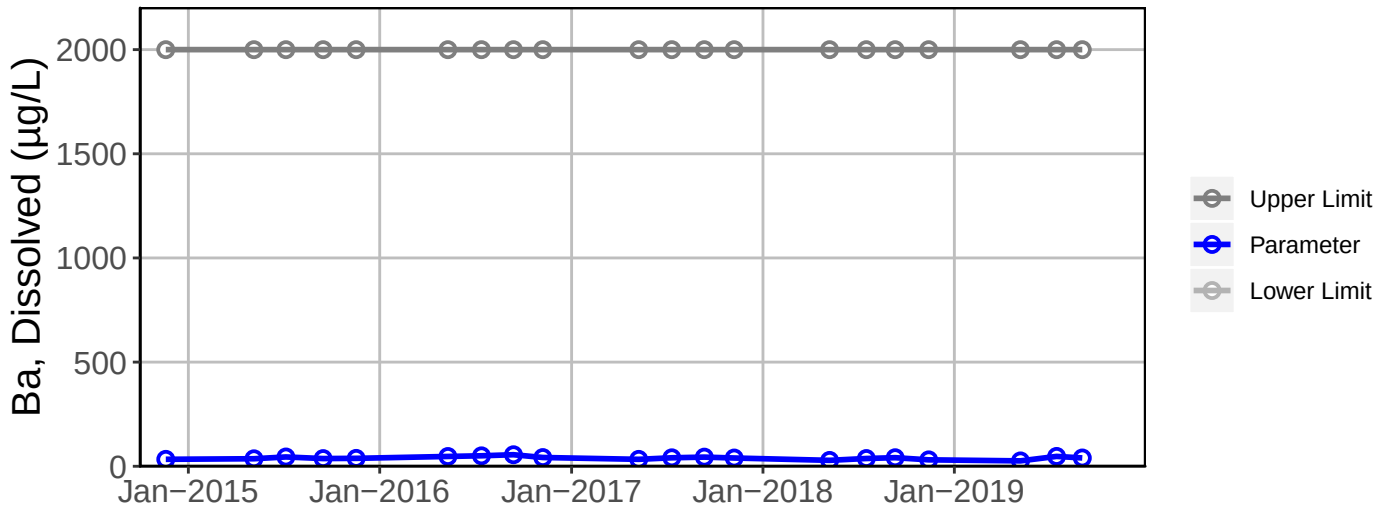
Site 9 Analyte Charts

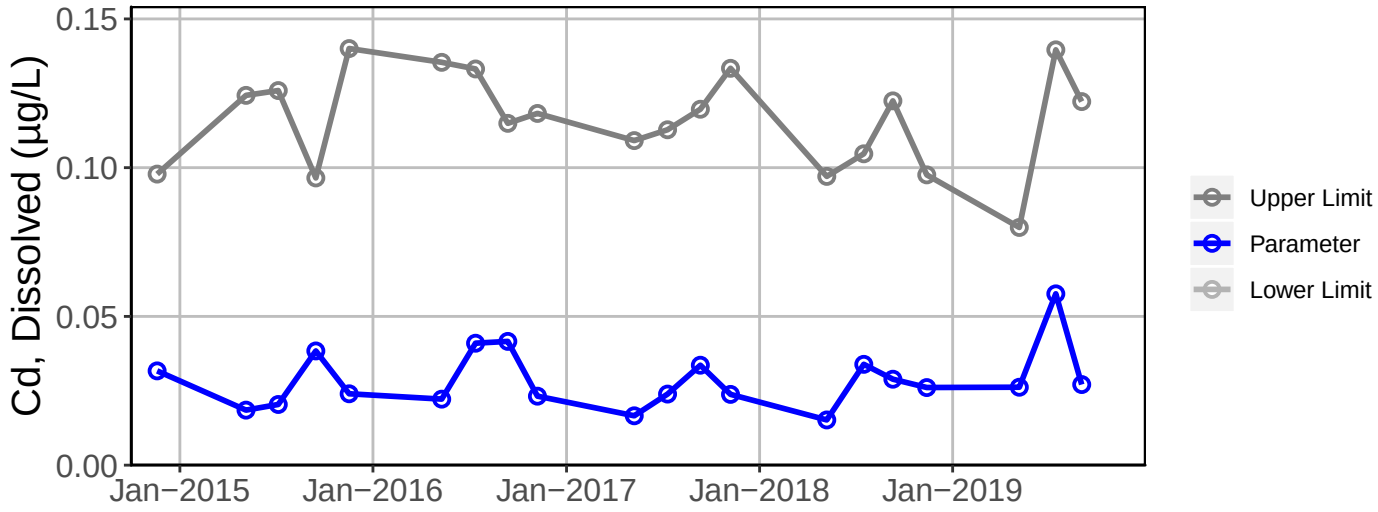


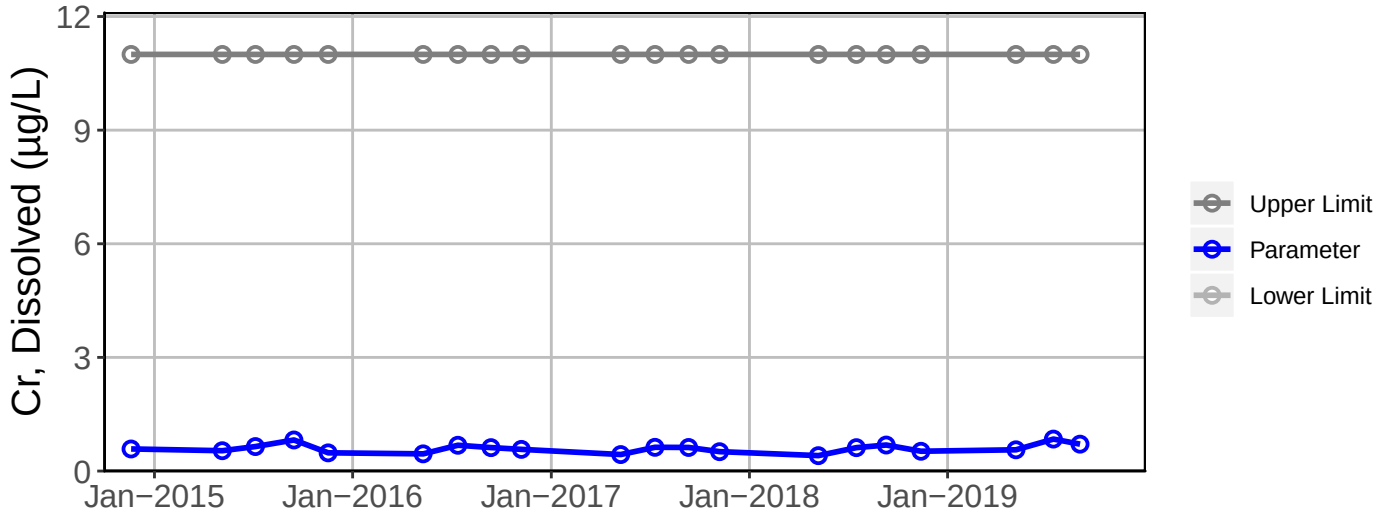




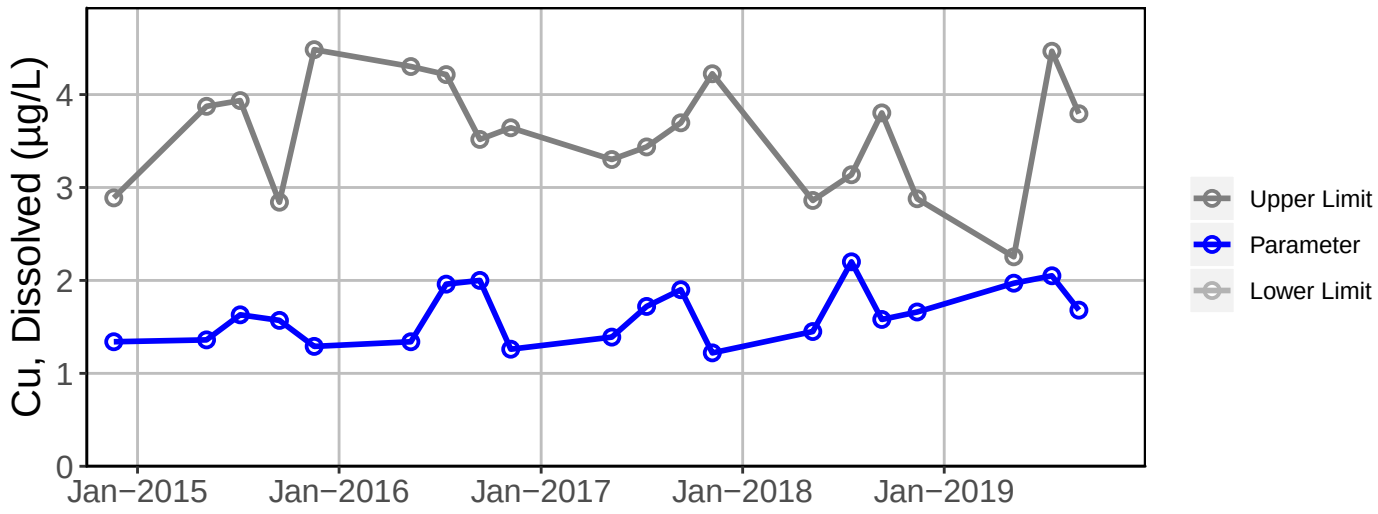
Site 9 Analyte Charts

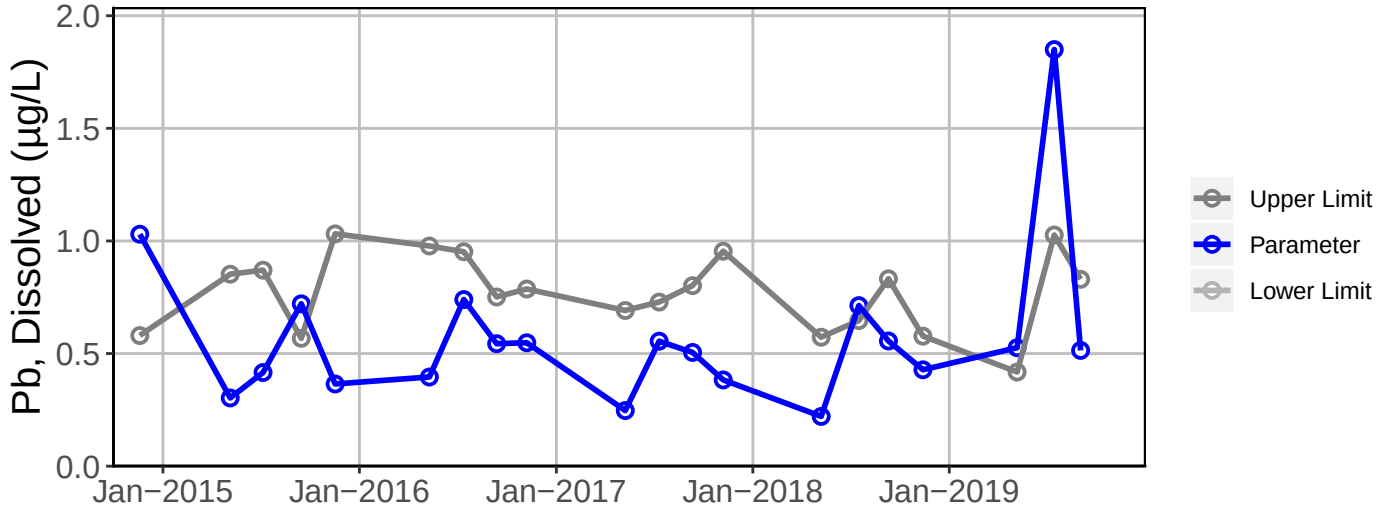


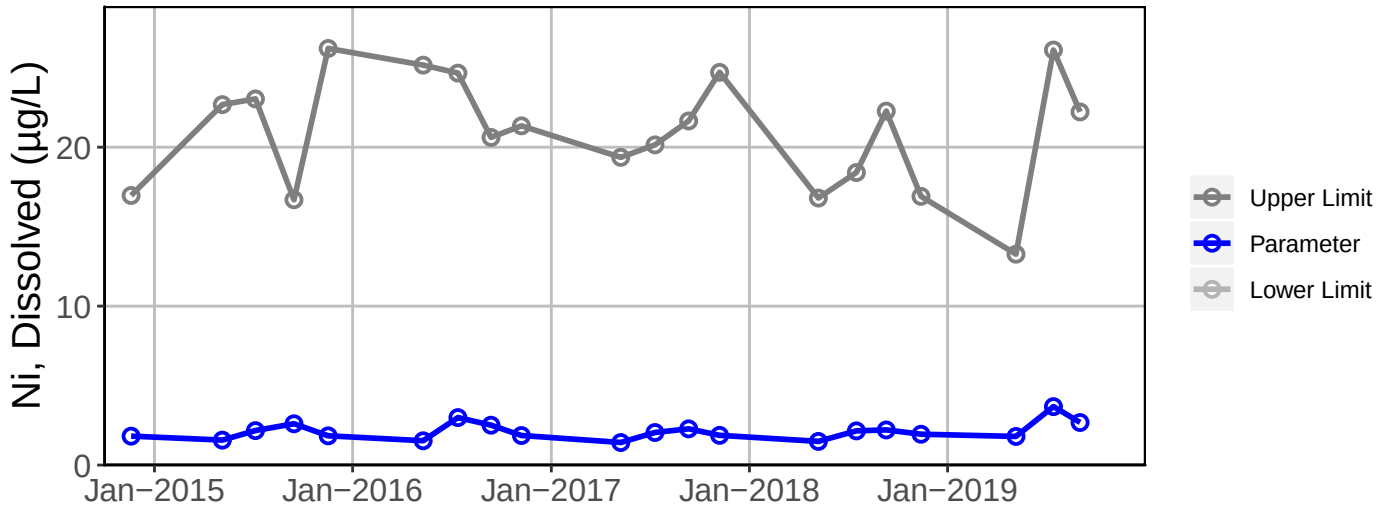




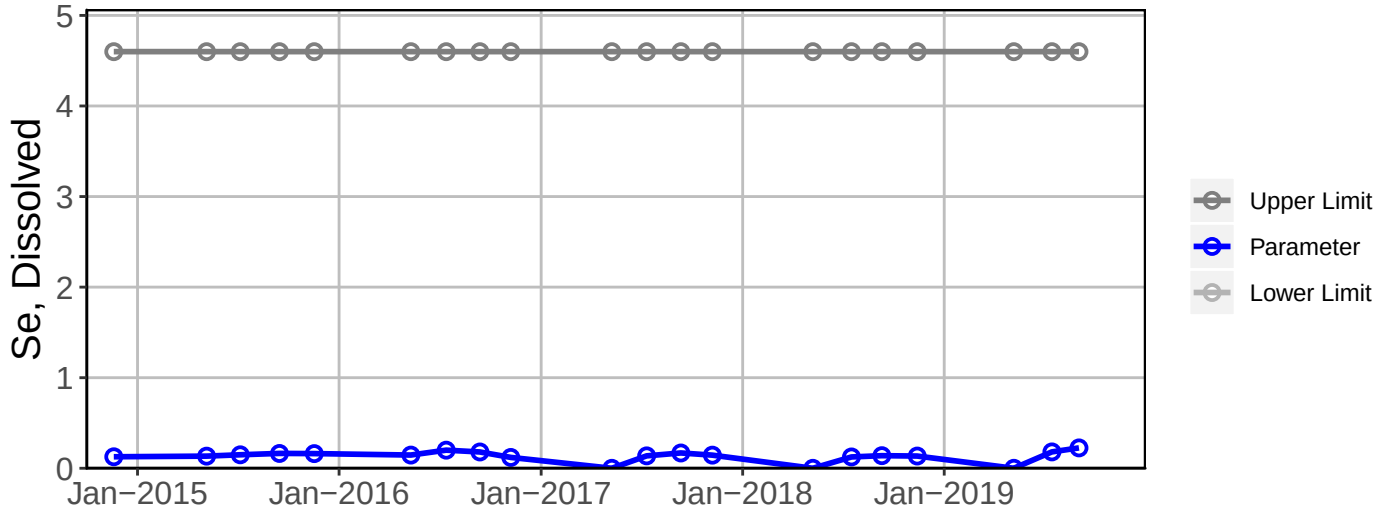
Site 9 Analyte Charts

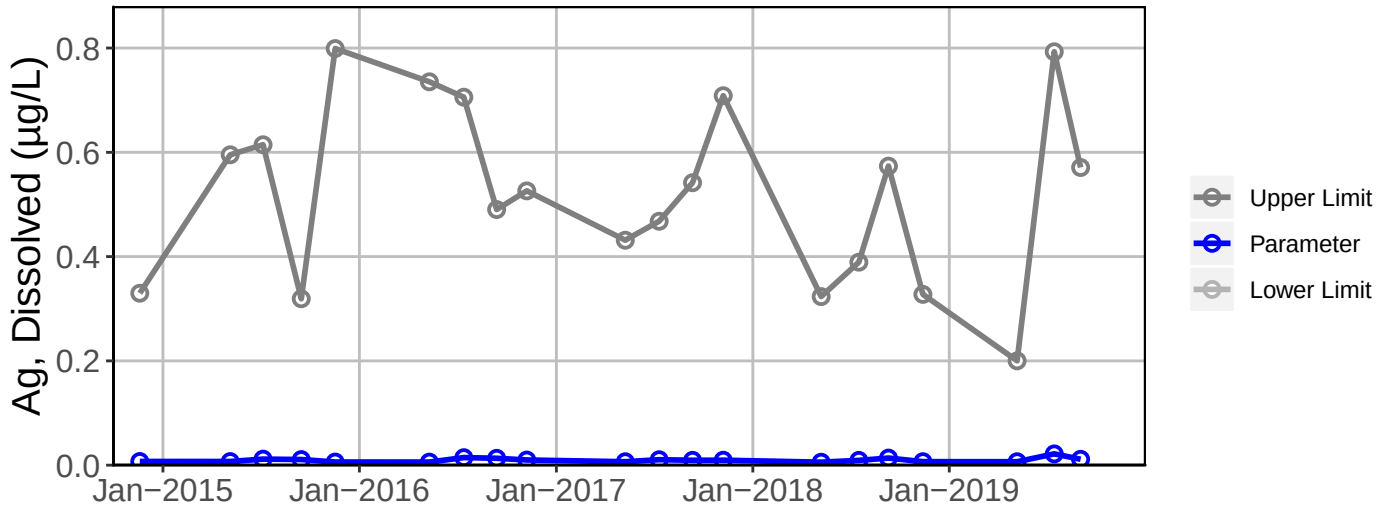


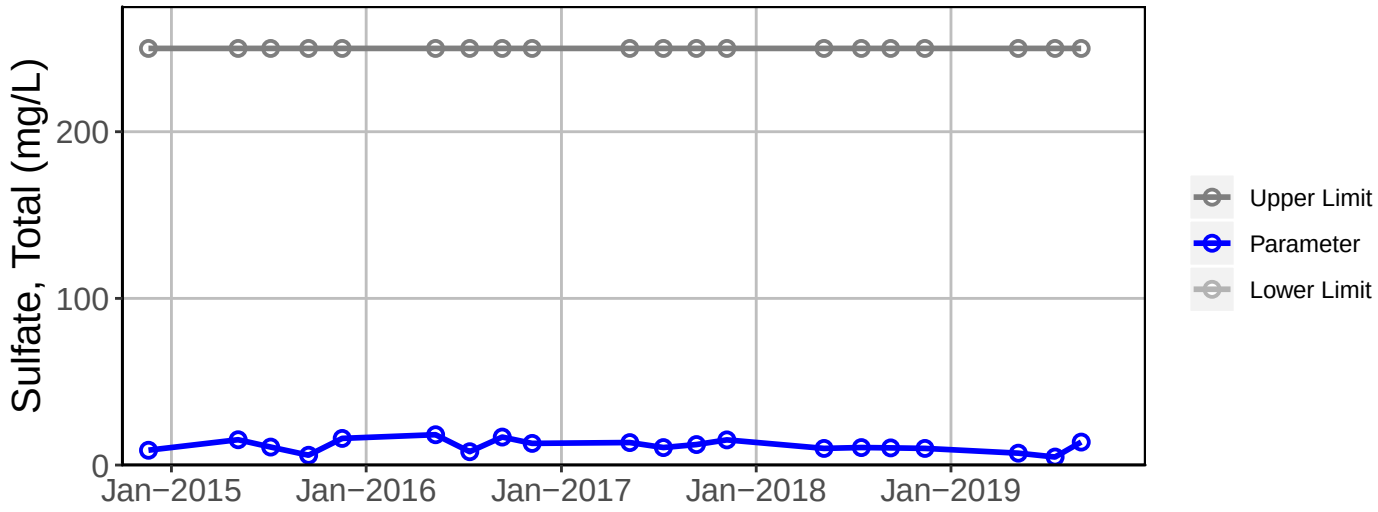




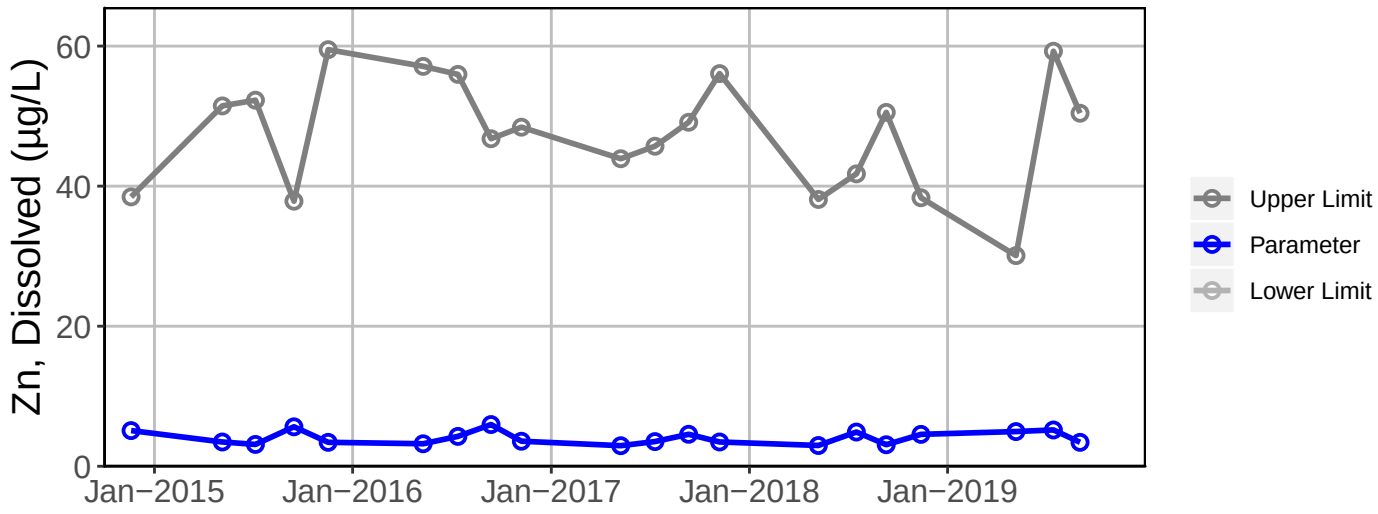
Site 9 Analyte Charts







Site 9 Analyte Charts



Site #9 Seasonal Kendall analysis for Specific Conductance, Field (µS/cm)

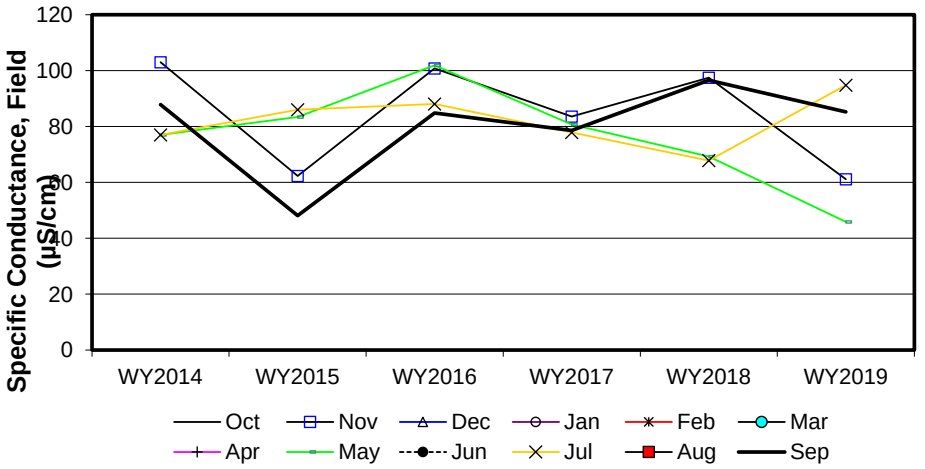
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		103.0						77.0		77.0		87.8
b	**WY2015**		62.3						83.4		86.0		48.1
c	**WY2016**		100.8						101.9		88.1		84.8
d	**WY2017**		83.6						80.7		77.9		78.6
e	**WY2018**		97.5						69.3		67.8		96.5
f	**WY2019**		61.1						45.9		94.8		85.2
	n	0	6	0	0	0	0	0	6	0	6	0	6
	t_1	0	6	0	0	0	0	0	6	0	6	0	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						1		1		-1
	c-a		-1						1		1		-1
	d-a		-1						1		1		-1
	e-a		-1						-1		-1		1
	f-a		-1						-1		1		-1
	c-b		1						1		1		1
	d-b		1						-1		-1		1
	e-b		1						-1		-1		1
	f-b		-1						-1		1		1
	d-c		-1						-1		-1		-1
	e-c		-1						-1		-1		1
	f-c		-1						-1		1		1
	e-d		1						-1		-1		1
	f-d		-1						-1		1		1
	f-e		-1						-1		1		-1
	S_k	0	-7	0	0	0	0	0	-7	0	3	0	3
	σ^2_S=		28.33						28.33		28.33		28.33
	$Z_k = S_k/\sigma_S$		-1.32						-1.32		0.56		0.56
	Z^2_k		1.73						1.73		0.32		0.32

ΣZ_k= -1.50
ΣZ^2_k= 4.09
Z-bar=$\Sigma Z_k/K$= -0.38

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	24	0	0	0	0

Σn 24
ΣS_k -8

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	3.53		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
p	**0.317**				$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc} -0.66		@α/2=2.5% **Z**=	1.96	**H_0** (No trend) ACCEPT
113.33	**p** **0.255**				**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-8.76	**-1.36**	3.40
0.050	-6.17		2.16
0.100	-4.60		1.06
0.200	-2.67		-0.09

Site #9 Seasonal Kendall analysis for pH, Field, Standard Units

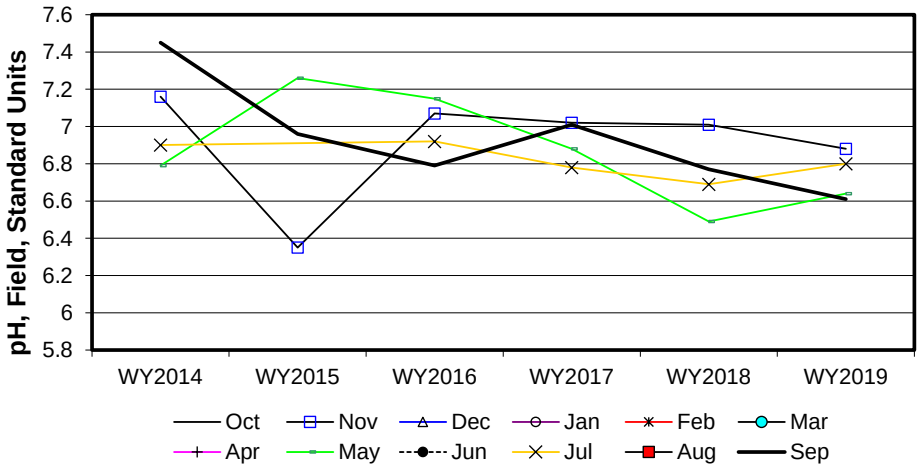
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		7.2						6.8		6.9		7.5
b	**WY2015**		6.4						7.3				7.0
c	**WY2016**		7.1						7.2		6.9		6.8
d	**WY2017**		7.0						6.9		6.8		7.0
e	**WY2018**		7.0						6.5		6.7		6.8
f	**WY2019**		6.9						6.6		6.8		6.6
	n	0	6	0	0	0	0	0	6	0	5	0	6
	t_1	0	6	0	0	0	0	0	6	0	5	0	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						1				-1
	c-a		-1						1		1		-1
	d-a		-1						1		-1		-1
	e-a		-1						-1		-1		-1
	f-a		-1						-1		-1		-1
	c-b		1						-1				-1
	d-b		1						-1				1
	e-b		1						-1				-1
	f-b		1						-1				-1
	d-c		-1						-1		-1		1
	e-c		-1						-1		-1		-1
	f-c		-1						-1		-1		-1
	e-d		-1						-1		-1		-1
	f-d		-1						-1		1		-1
	f-e		-1						1		1		-1
	S_k	0	-7	0	0	0	0	0	-7	0	-4	0	-11
	σ^2_S=		28.33						28.33		16.67		28.33
	$Z_k = S_k/\sigma_S$		-1.32						-1.32		-0.98		-2.07
	Z^2_k		1.73						1.73		0.96		4.27

ΣZ_k= -5.68
ΣZ^2_k= 8.69
Z-bar=$\Sigma Z_k/K$= -1.42

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	23	0	0	0	0

Σn 23
ΣS_k -29

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	0.63	@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
p	**0.889**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
$\Sigma VAR(S_k)$	Z_{calc} -2.78	@α/2=2.5% Z=	1.96	**H_0** (No trend) REJECT
101.67	**p** **0.003**			**H_A** (± trend) ACCEPT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.16		-0.03
0.050	-0.13	**-0.06**	-0.04
0.100	-0.11		-0.05
0.200	-0.09		-0.05

-0.9%

Site #9 Seasonal Kendall analysis for Total Alk, (mg/l)

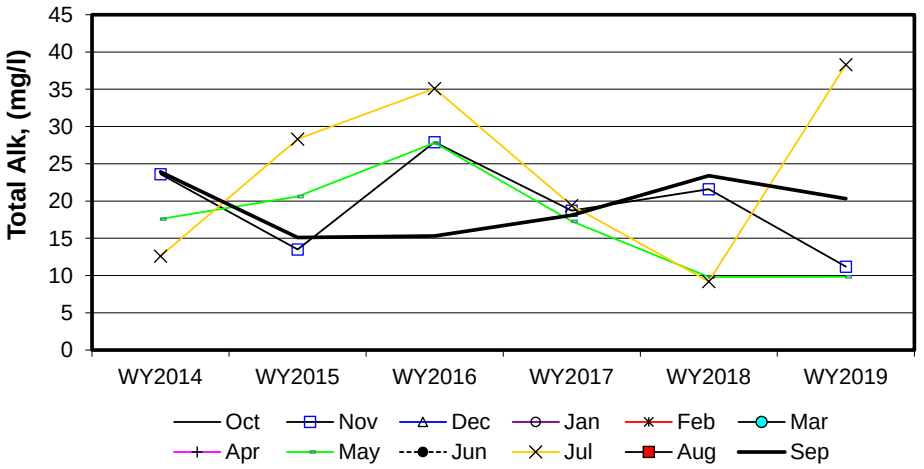
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		23.6						17.6		12.6		23.9
b	**WY2015**		13.5						20.6		28.3		15.1
c	**WY2016**		27.9						27.8		35.1		15.3
d	**WY2017**		18.7						17.3		19.4		18.1
e	**WY2018**		21.6						9.8		9.2		23.4
f	**WY2019**		11.2						9.8		38.3		20.3
	n	0	6	0	0	0	0	0	6	0	6	0	6
	t_1	0	6	0	0	0	0	0	6	0	6	0	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						1		1		-1
	c-a		1						1		1		-1
	d-a		-1						-1		1		-1
	e-a		-1						-1		-1		-1
	f-a		-1						-1		1		-1
	c-b		1						1		1		1
	d-b		1						-1		-1		1
	e-b		1						-1		-1		1
	f-b		-1						-1		1		1
	d-c		-1						-1		-1		1
	e-c		-1						-1		-1		1
	f-c		-1						-1		1		1
	e-d		1						-1		-1		1
	f-d		-1						-1		1		1
	f-e		-1						1		1		-1
	S_k	0	-5	0	0	0	0	0	-7	0	3	0	3
	σ^2_S=		28.33						28.33		28.33		28.33
	$Z_k = S_k/\sigma_S$		-0.94						-1.32		0.56		0.56
	Z^2_k		0.88						1.73		0.32		0.32

ΣZ_k= -1.13
ΣZ^2_k= 3.25
Z-bar=$\Sigma Z_k/K$= -0.28

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	24	0	0	0	0

Σn 24
ΣS_k -6

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	2.93	@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity	
	p **0.403**			$\chi^2_h<\chi^2_{(K-1)}$	ACCEPT
ΣVAR(S_k)	Z_{calc} -0.47	@α/2=2.5% Z=	1.96	**H_0** (No trend)	ACCEPT
113.33	**p** **0.319**			**H_A** (± trend)	REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-3.65	**-0.54**	2.36
0.050	-2.64		1.45
0.100	-1.95		1.09
0.200	-1.64		0.11

Site #9 Seasonal Kendall analysis for Sulfate, Total (mg/l)

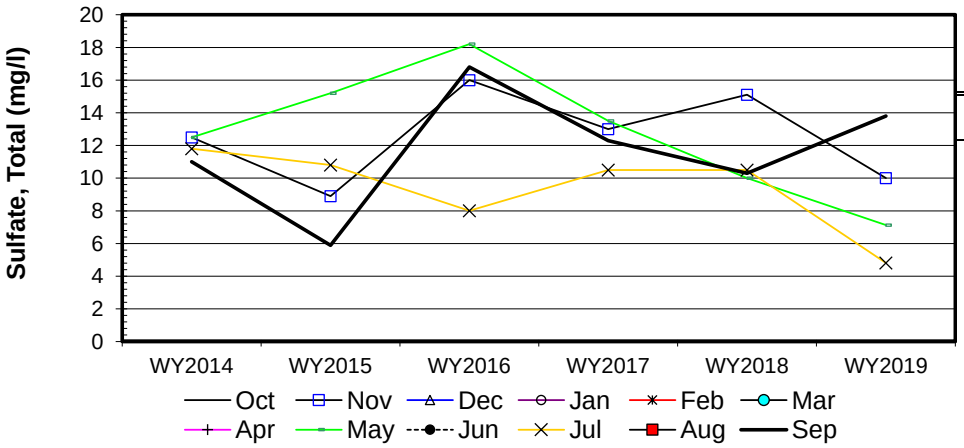
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		12.5						12.5		11.8		11.0
b	**WY2015**		8.9						15.2		10.8		5.9
c	**WY2016**		16.0						18.2		8.0		16.8
d	**WY2017**		13.0						13.5		10.5		12.3
e	**WY2018**		15.1						10.0		10.5		10.3
f	**WY2019**		10.0						7.1		4.8		13.8
	n	0	6	0	0	0	0	0	6	0	6	0	6
	t_1	0	6	0	0	0	0	0	6	0	4	0	6
	t_2	0	0	0	0	0	0	0	0	0	1	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						1		-1		-1
	c-a		1						1		-1		1
	d-a		1						1		-1		1
	e-a		1						-1		-1		-1
	f-a		-1						-1		-1		1
	c-b		1						1		-1		1
	d-b		1						-1		-1		1
	e-b		1						-1		-1		1
	f-b		1						-1		-1		1
	d-c		-1						-1		1		-1
	e-c		-1						-1		1		-1
	f-c		-1						-1		-1		-1
	e-d		1						-1		0		-1
	f-d		-1						-1		-1		1
	f-e		-1						-1		-1		1
	S_k	0	1	0	0	0	0	0	-7	0	-10	0	3
	σ^2_S=		28.33						28.33		27.33		28.33
	$Z_k = S_k/\sigma_S$		0.19						-1.32		-1.91		0.56
	Z^2_k		0.04						1.73		3.66		0.32

ΣZ_k= -2.48
ΣZ^2_k= 5.74
Z-bar=$\Sigma Z_k/K$= -0.62

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	22	1	0	0	0

Σn 24
ΣS_k -13

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	4.21	@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p **0.240**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
$\Sigma VAR(S_k)$	Z_{calc} -1.13	@α=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
112.33	**p** **0.129**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-2.00	**-0.48**	0.59
0.050	-1.50		0.24
0.100	-1.33		-0.02
0.200	-1.03		-0.16

Site #9 Seasonal Kendall analysis for Zinc, Dissolved (ug/l)

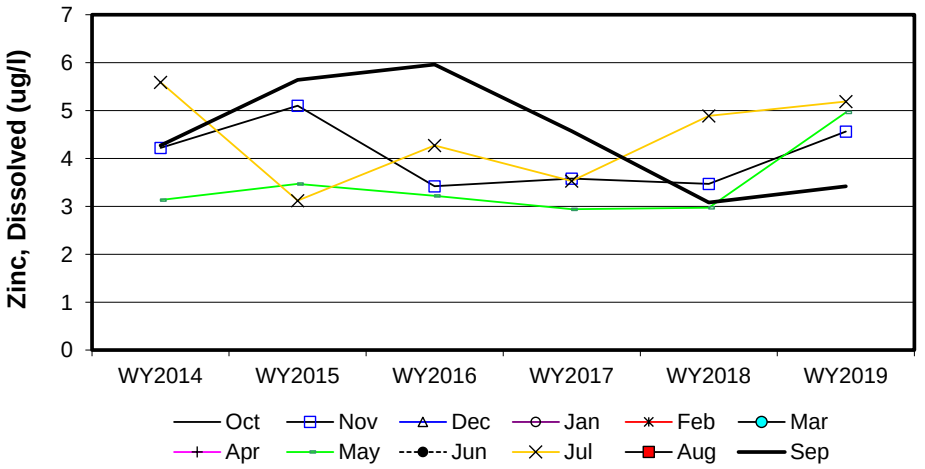
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		4.2						3.1		5.6		4.3
b	**WY2015**		5.1						3.5		3.1		5.6
c	**WY2016**		3.4						3.2		4.3		6.0
d	**WY2017**		3.6						2.9		3.5		4.6
e	**WY2018**		3.5						3.0		4.9		3.1
f	**WY2019**		4.6						5.0		5.2		3.4
	n	0	6	0	0	0	0	0	6	0	6	0	6
	t_1	0	6	0	0	0	0	0	6	0	6	0	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		1						1		-1		1
	c-a		-1						1		-1		1
	d-a		-1						-1		-1		1
	e-a		-1						-1		-1		-1
	f-a		1						1		-1		-1
	c-b		-1						-1		1		1
	d-b		-1						-1		1		-1
	e-b		-1						-1		1		-1
	f-b		-1						1		1		-1
	d-c		1						-1		-1		-1
	e-c		1						-1		1		-1
	f-c		1						1		1		-1
	e-d		-1						1		1		-1
	f-d		1						1		1		-1
	f-e		1						1		1		1
	S_k	0	-1	0	0	0	0	0	1	0	3	0	-5
	σ^2_S=		28.33						28.33		28.33		28.33
	$Z_k = S_k/\sigma_S$		-0.19						0.19		0.56		-0.94
	Z^2_k		0.04						0.04		0.32		0.88

ΣZ_k= -0.38
ΣZ^2_k= 1.27
Z-bar=$\Sigma Z_k/K$= -0.09

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	24	0	0	0	0

Σn 24
ΣS_k -2

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	1.24		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.745**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	-0.09	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
113.33	**p**	**0.463**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.29	**-0.05**	0.33
0.050	-0.21		0.28
0.100	-0.17		0.15
0.200	-0.15		0.06

INTERPRETIVE REPORT
SITE 60

Sampling at this site was initiated during background investigations conducted by HGCMC for the Stage II Tailings EIS. Both ADEC and the USFS requested during the WY2006 annual meeting that an additional monitoring point be added to monitor potential impacts from Pond 7 on the western downgradient drainage. Greens Creek proposed the current site, and after review by ADEC and USFS during a site visit (June 2, 2007 – USFS Inspection #259), the new site was added to the routine monitoring schedule.

The data collected during the current water year are listed in the following "Table of Results for Water Year 2019" report. The table includes all the required FWMP analyte data (field and laboratory) collected for the current water year and a series of flags keyed to the summary report "Qualified Data by QA Reviewer." The QA report lists any associated data limitations found during the monthly QA reviews of laboratory data for this site. Median values for all analytes have been calculated and are shown in the right-most column of the table of results. Any value reported as less than MDL has been replaced with a value of one-half of the MDL for the purpose of median calculation.

As shown in the table below, there were no data outliers.

Sample Date	Parameter	Value	Qualifier	Notes
No outliers, in the past six years, have been identified by HGCMC.				

The results for the current water year have been compared to the strictest freshwater quality criterion for each applicable analyte. Nine results exceeding these criteria have been identified, as listed in the table below. Two samples for field pH and three for total alkalinity were below the lower limits. These values are similar to those recorded prior to disturbance activities. The remaining exceedance was for dissolved mercury and is discussed below.

Table of Exceedance for Water Year 2019

			Limits		
Sample Date	Parameter	Value	Lower	Upper	Hardness
13-Nov-18	Alkalinity, Total	7.5 mg/L	20		28.2 mg/L
7-May-19	Alkalinity, Total	5.8 mg/L	20		17.7 mg/L
7-May-19	Mercury, Dissolved	0.013 µg/L		0.012	17.7 mg/L
7-May-19	pH	6.3 su	6.5	8.5	17.7 mg/L
2-Sep-19	Alkalinity, Total	10.7 mg/L	20		25.7 mg/L
2-Sep-19	pH	6.1 su	6.5	8.5	25.7 mg/L

X-Y plots have been generated to graphically present the data for each of the analytes requested in the Statistical Information Goals for this site. Site 60 was added to the FWMP as a monitoring

point for potential impacts from Pond 7. Hardness, conductivity, and sulfate appear to have increased in the past two years.

Dissolved mercury levels have been elevated slightly above the AWQS of 0.012 µg/L, intermittently for the past several years. Dissolution of tailings dust particles, which contain small amounts of mercury, and atmospheric deposition of mercury from natural (e.g., volcanoes) and anthropogenic sources (e.g., coal-fired power plants in Asia) are potential sources of this metal in the drainage area. Additional sampling in adjacent drainages during Water Year 2009 and Water Year 2012 showed that this issue was isolated to only the Site 60 watershed.

A non-parametric statistical analysis for trend was performed for specific conductivity, field pH, total alkalinity, total sulfate, and dissolved zinc. Calculation details of the Seasonal Kendall analyses are presented in detail on the pages following this interpretive section. The following table summarizes the results of the data collected between Oct-13 and Sep-19 (WY2014-WY2019).

Site 60 - Table of Summary Statistics for Trend Analysis

	Mann-Kendall test statistics			Sen's slope estimate	
Parameter	**n***	**p****	**Trend**	**Q**	**Q(%)**
Conductivity Field	6	0.88			
pH Field	6	0.10			
Alkalinity, Total	6	0.08			
Sulfate, Total	6	1.00	+	1.06	19.3
Zinc, Dissolved	6	0.42			

* Number of Years ** Significance level

A statistically significant (α/2=2.5%) trend was identified for sulfate for the current water year. A Sen's slope estimate of 1.06 mg/L/yr was estimated. Sulfate values were approximately 4% of the AWQS.

Table of Results for Water Year 2019

Site 060FMS - 'Lower Althea creek'

Sample Date/Parameter	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019	**Median**
Water Temp (°C)		5						5.5				10.9	5.5
Conductivity-Field(μmho)		63.4						41.6				50.2	50.2
Conductivity-Lab (μmho)		63						42				52	52
pH Lab (standard units)		5.8						5.68				5.82	5.80
pH Field (standard units)		7						6.27				6.09	6.27
Total Alkalinity (mg/L)		7.5						5.8				10.7	7.5
Total Sulfate (mg/L)		9.8						4.9				7.4	7.4
Hardness (mg/L)		28.2						17.7				25.7	25.7
Dissolved As (ug/L)		2.69						2.34				1.76	2.340
Dissolved Ba (ug/L)		29.5						21.1				25.1	25.1
Dissolved Cd (ug/L)		0.018						0.0159				0.0143	0.0159
Dissolved Cr (ug/L)		0.949						0.894				1.64	0.949
Dissolved Cu (ug/L)		1.27						1.51				1.14	1.270
Dissolved Pb (ug/L)		0.31						0.309				0.192	0.3090
Dissolved Ni (ug/L)		0.958						1				1.21	1.000
Dissolved Ag (ug/L)		0.009						0.007				0.008	0.008
Dissolved Zn (ug/L)		7.78						6.45				6.08	6.45
Dissolved Se (ug/L)		0.117						0.057				0.232	0.117
Dissolved Hg (ug/L)		0.012						0.0128				0.0105	0.012000

For individual sample/analyte qualifier descriptions see "Qualified Data by QA Reviewer" table.

Values reported as less than MDL are replaced by 1/2 MDL for median calculation purposes.

Shaded data has been qualified as an outlier by HGCMC and removed from any further analysis and is not included into the calculation of the median

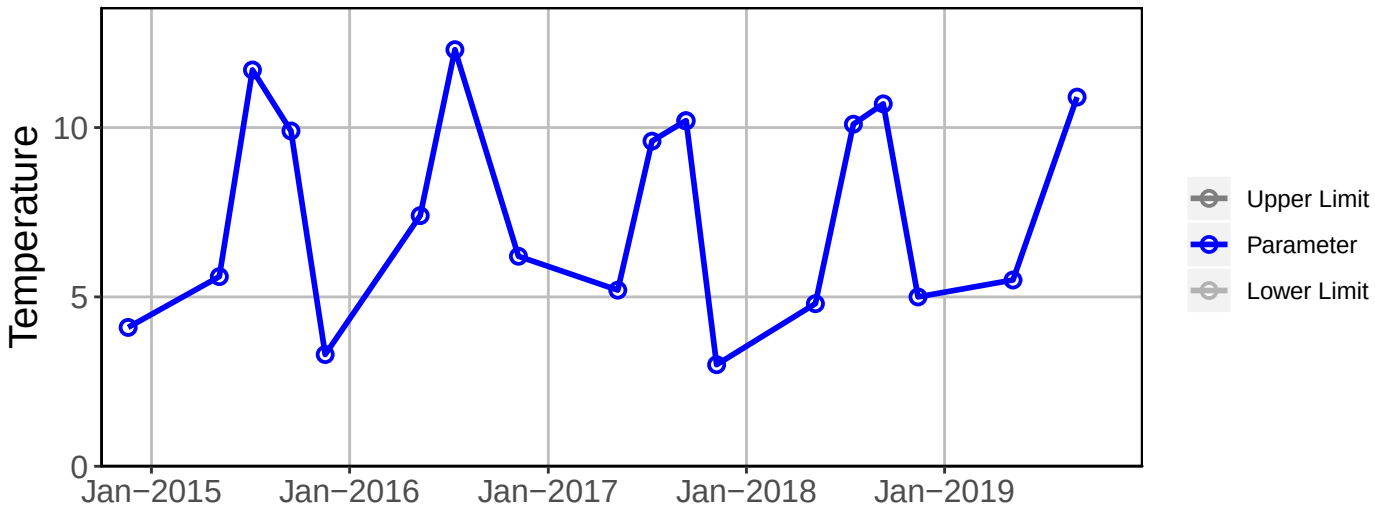
Qualified Data by QA Reviewer

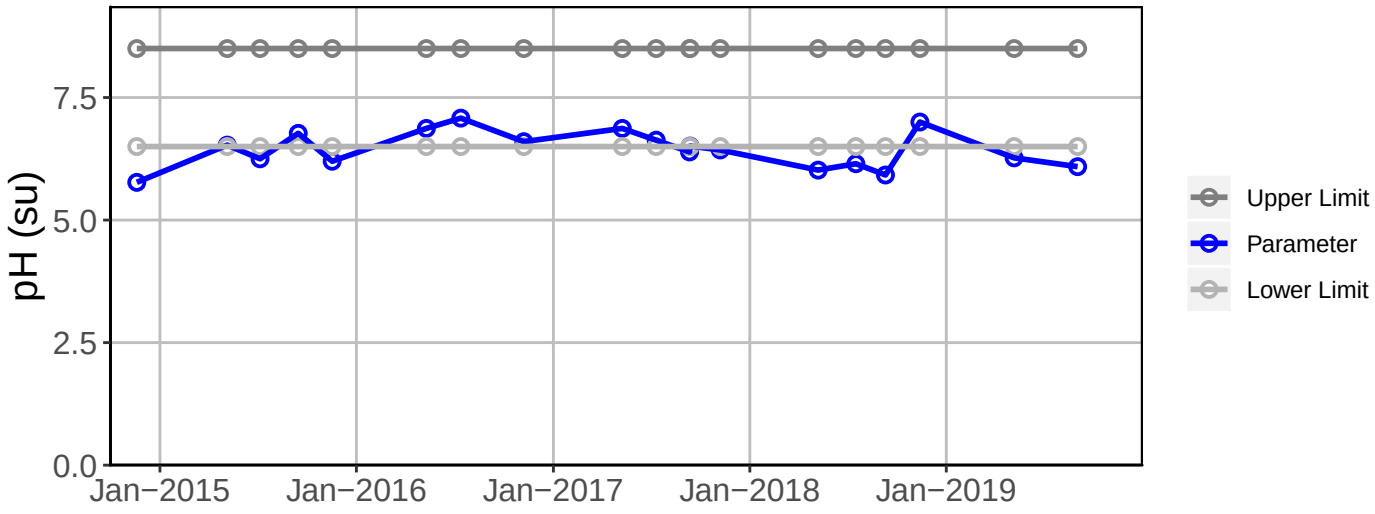
Date Range: 10/01/2018 to 09/30/2019

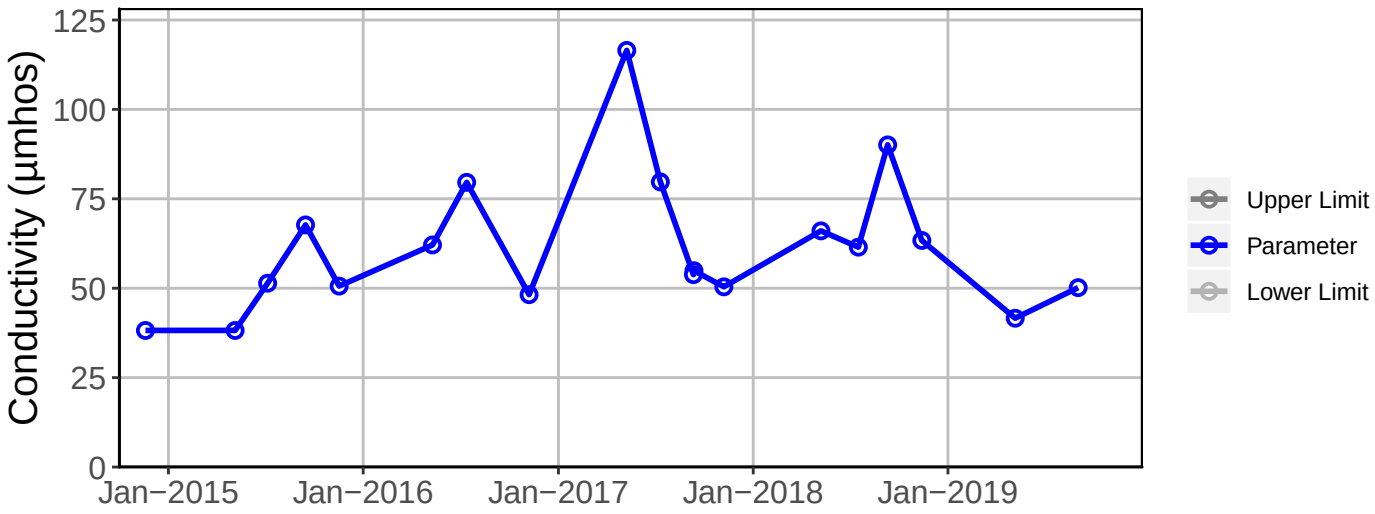
Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
060FMS	13-Nov-18	Diss. Ag-ICP/MS	0.00915	µg/L	J	Below Quantitative Range
		Diss. Se-ICP/MS	0.11	µg/L	J	Below Quantitative Range
		Diss. Zn-ICP/MS	7.78	µg/L	U	Field Blank Contamination
	7-May-19	Diss. Ag-ICP/MS	0.00731	µg/L	J	Below Quantitative Range
	2-Sep-19	Diss. Ag-ICP/MS	0.00762	µg/L	J	Below Quantitative Range
		Diss. Cr-ICP/MS	1.64	µg/L	U	Field Blank Contamination
		Diss. Ni-ICP/MS	1.21	µg/L	U	Field Blank Contamination
		Diss. Pb-ICP/MS	0.19	µg/L	U	Field Blank Contamination
		Diss. Se-ICP/MS	0.23	µg/L	U	Method Blank Contamination
		Total Sulfate	7.37	µg/L	J	Sample Receipt Temperature

Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

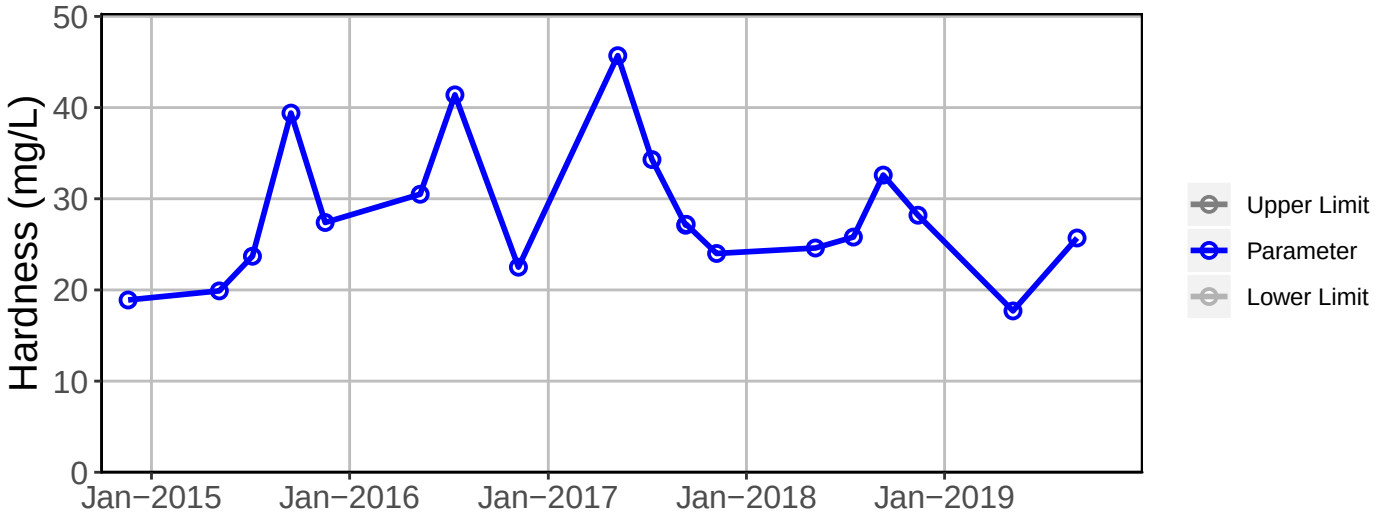
Site 60 Analyte Charts

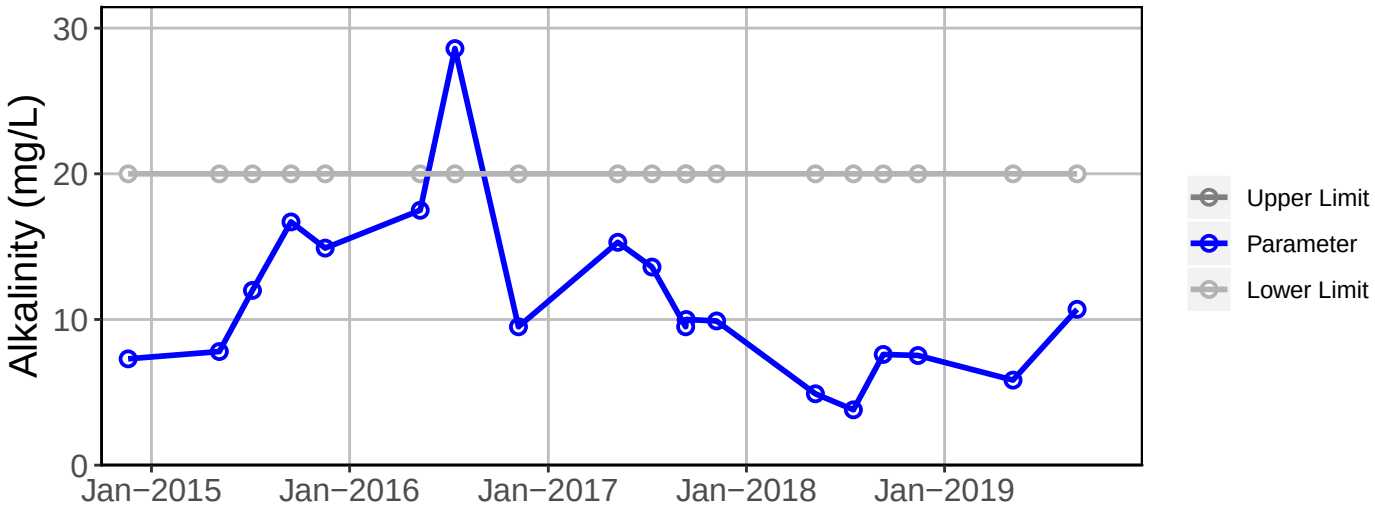


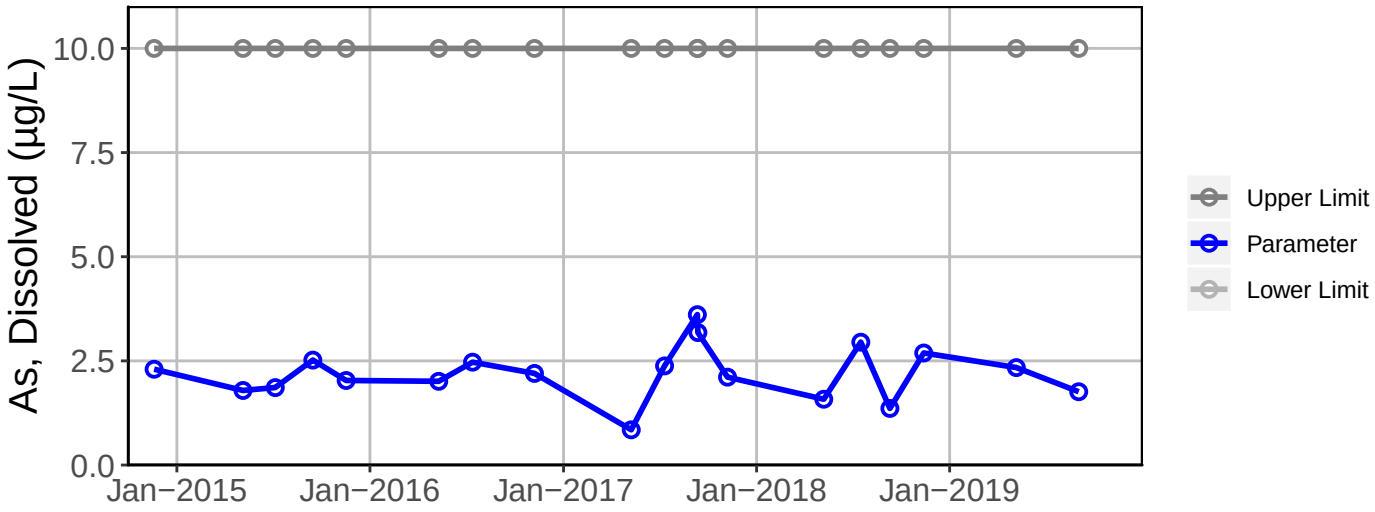




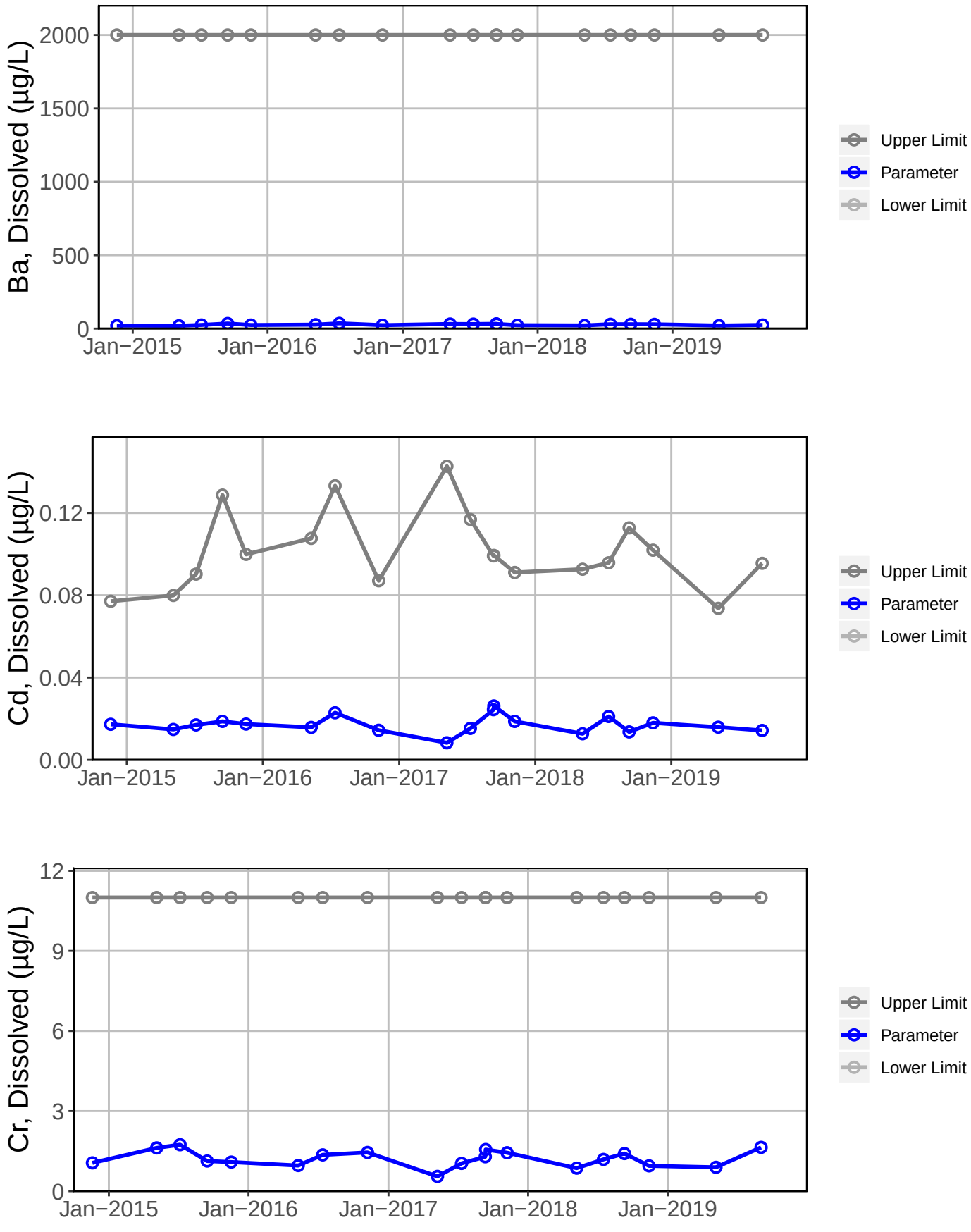
Site 60 Analyte Charts







Site 60 Analyte Charts



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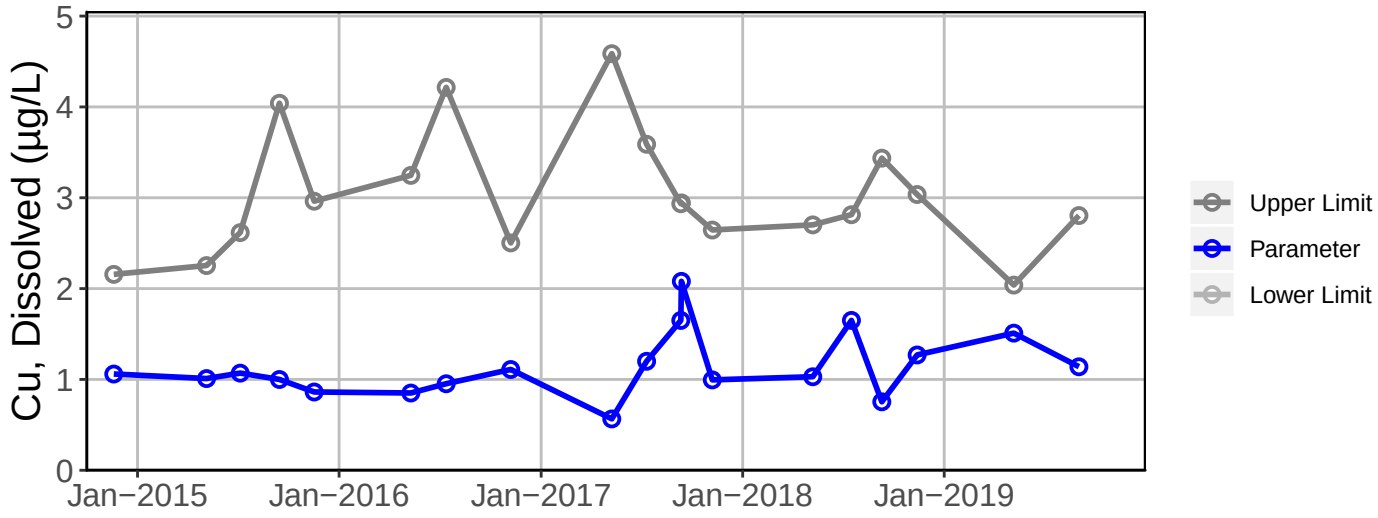
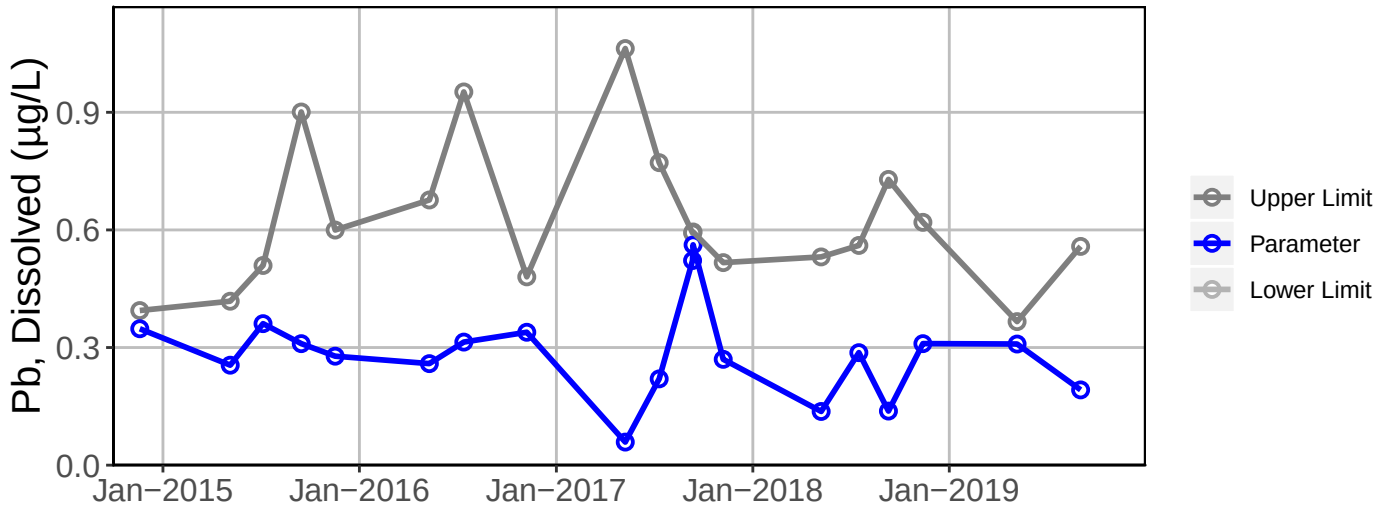
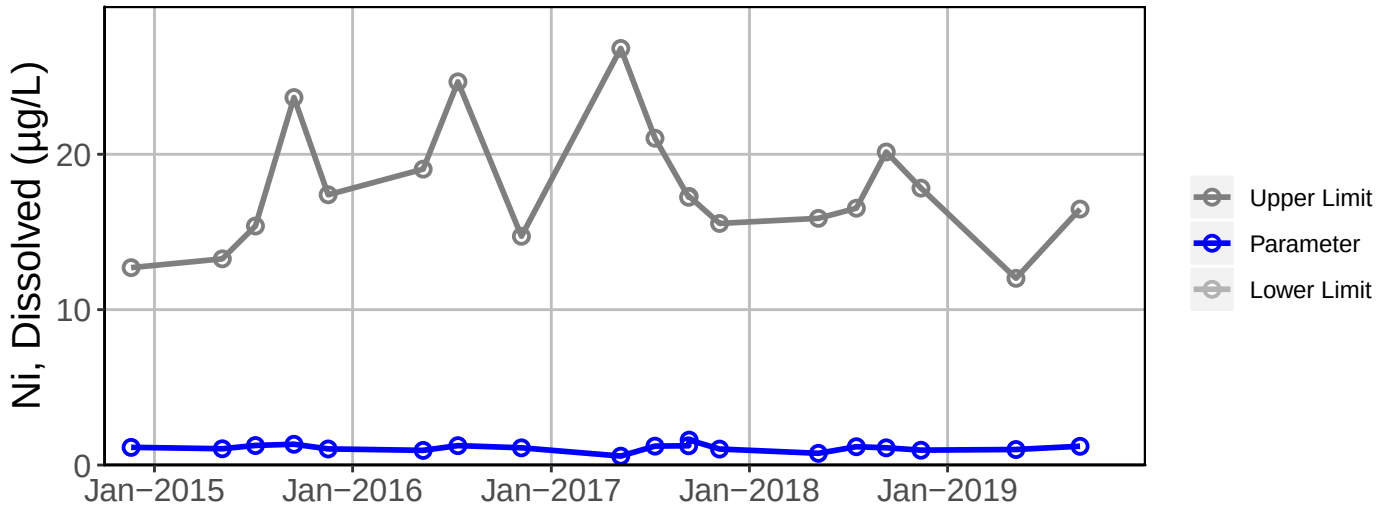
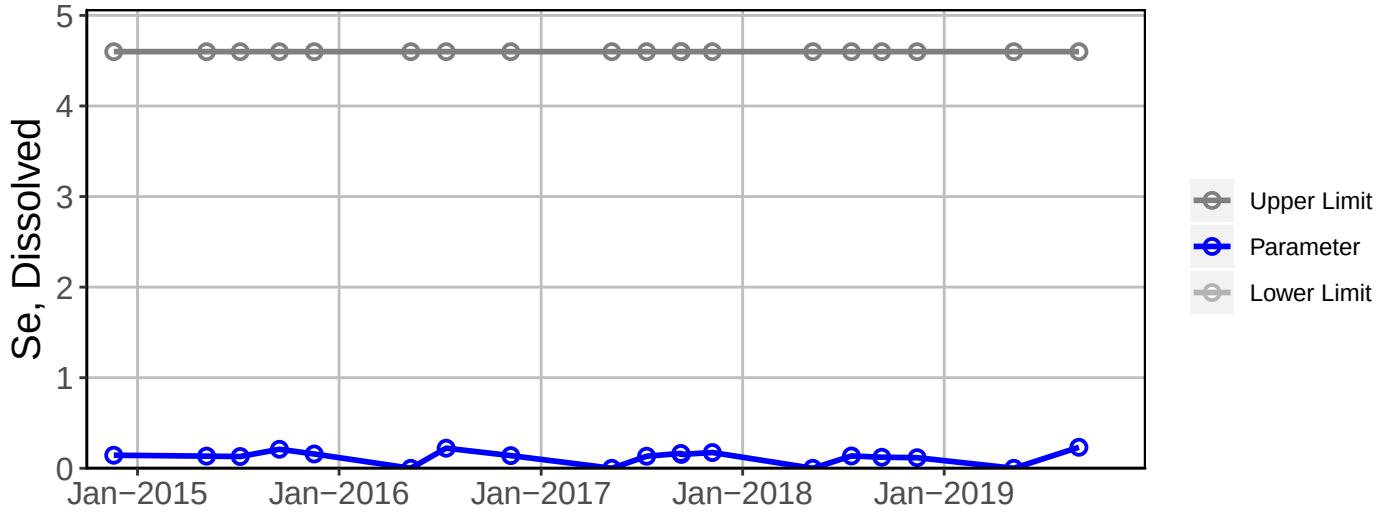
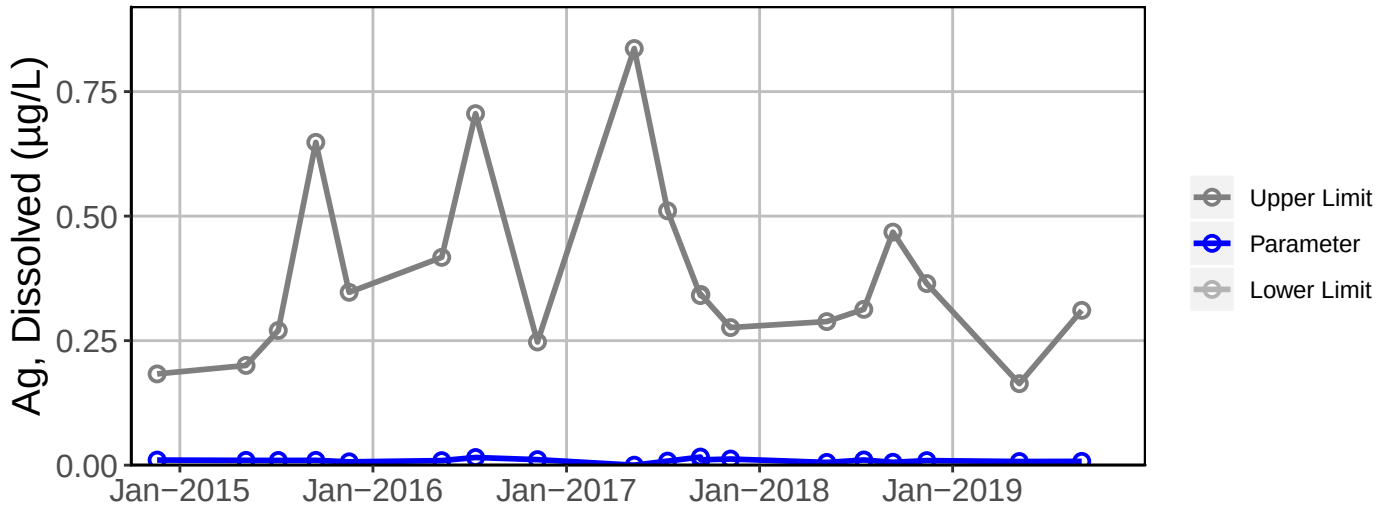


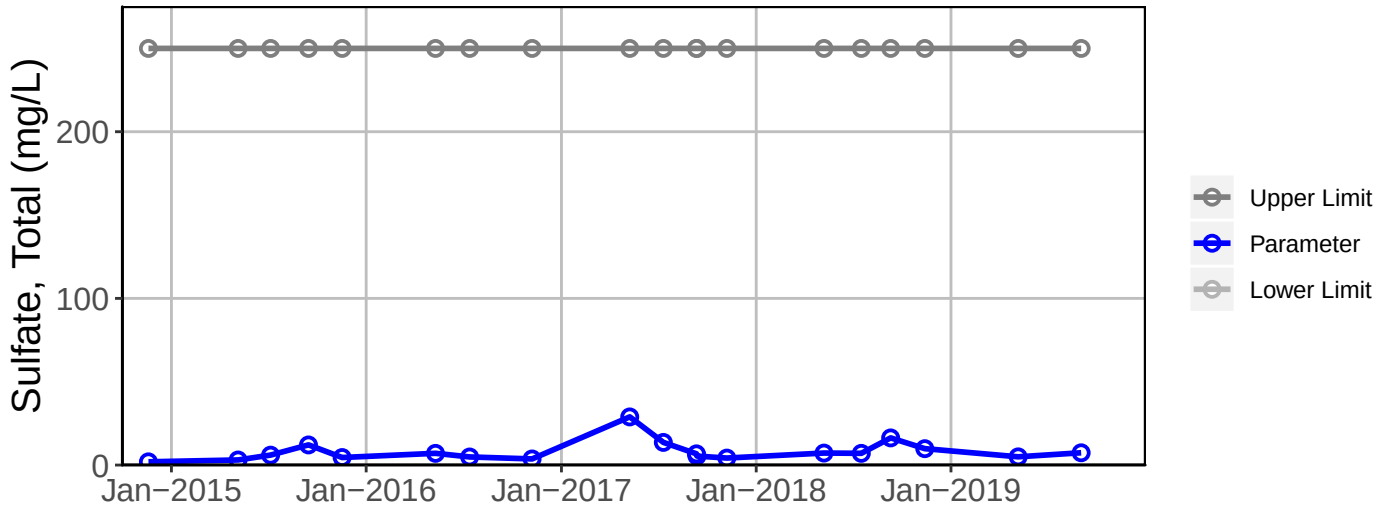




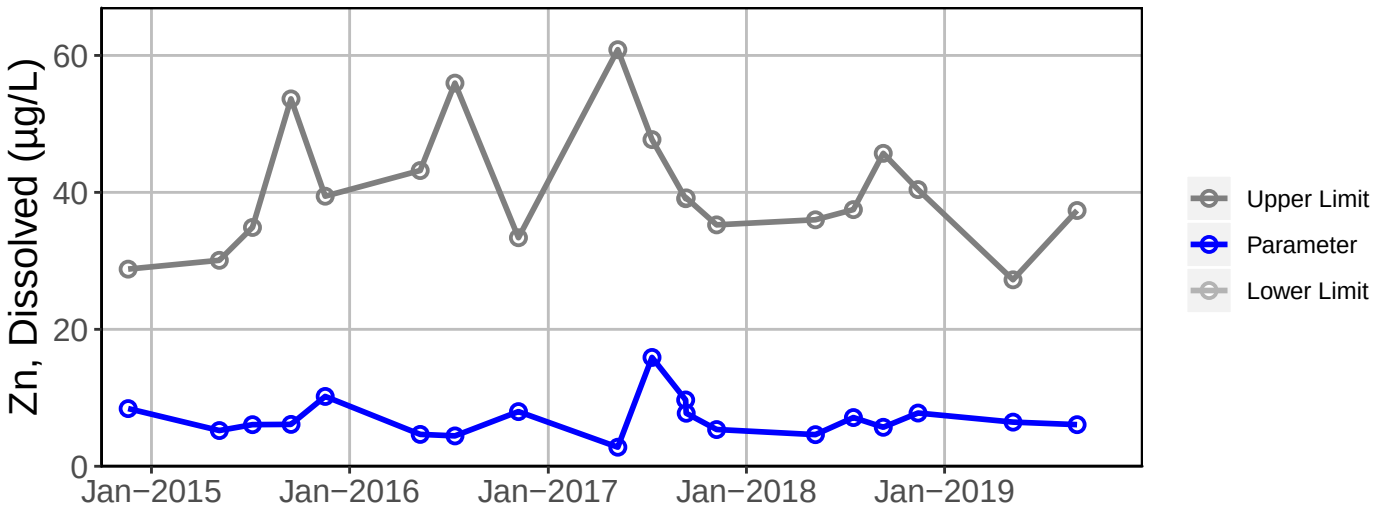
Site 60 Analyte Charts







Site 60 Analyte Charts



Site #60 Seasonal Kendall analysis for Specific Conductance, Field (µS/cm)

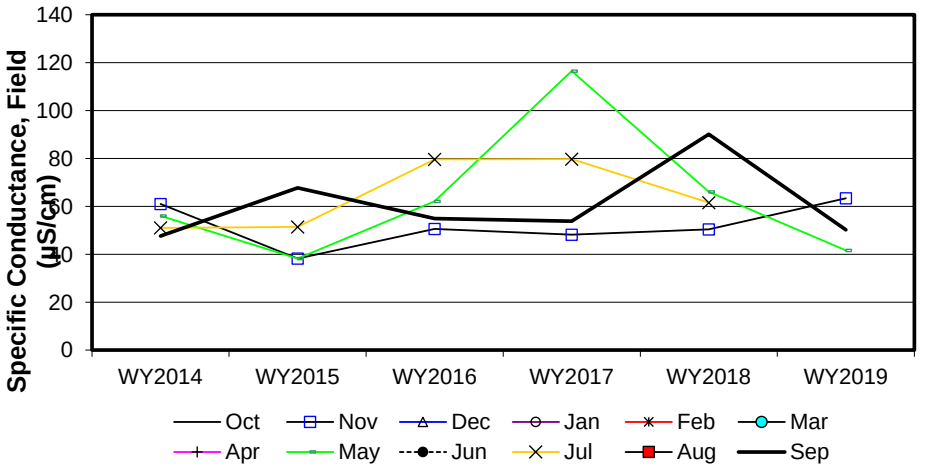
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		61.0						56.0		51.0		47.6
b	**WY2015**		38.2						38.2		51.4		67.7
c	**WY2016**		50.6						62.1		79.6		54.9
d	**WY2017**		48.2						116.5		79.7		53.8
e	**WY2018**		50.4						66.0		61.5		90.1
f	**WY2019**		63.4						41.6				50.2
	n	0	6	0	0	0	0	0	6	0	5	0	6
	t_1	0	6	0	0	0	0	0	6	0	5	0	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						-1		1		1
	c-a		-1						1		1		1
	d-a		-1						1		1		1
	e-a		-1						1		1		1
	f-a		1						-1				1
	c-b		1						1		1		-1
	d-b		1						1		1		-1
	e-b		1						1		1		1
	f-b		1						1				-1
	d-c		-1						1		1		-1
	e-c		-1						1		-1		1
	f-c		1						-1				-1
	e-d		1						-1		-1		1
	f-d		1						-1				-1
	f-e		1						-1				-1
	S_k	0	3	0	0	0	0	0	3	0	6	0	1
	σ^2_S=		28.33						28.33		16.67		28.33
	$Z_k = S_k/\sigma_S$		0.56						0.56		1.47		0.19
	Z^2_k		0.32						0.32		2.16		0.04

ΣZ_k= 2.78
ΣZ^2_k= 2.83
Z-bar=$\Sigma Z_k/K$= 0.70

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	23	0	0	0	0

Σn 23
ΣS_k 13

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	0.89		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.827**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	1.19	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
101.67	**p**	**0.883**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-2.70	**2.07**	7.49
0.050	-1.48		4.21
0.100	-0.09		3.64
0.200	0.42		2.94

Site #60 Seasonal Kendall analysis for pH, Field, Standard Units

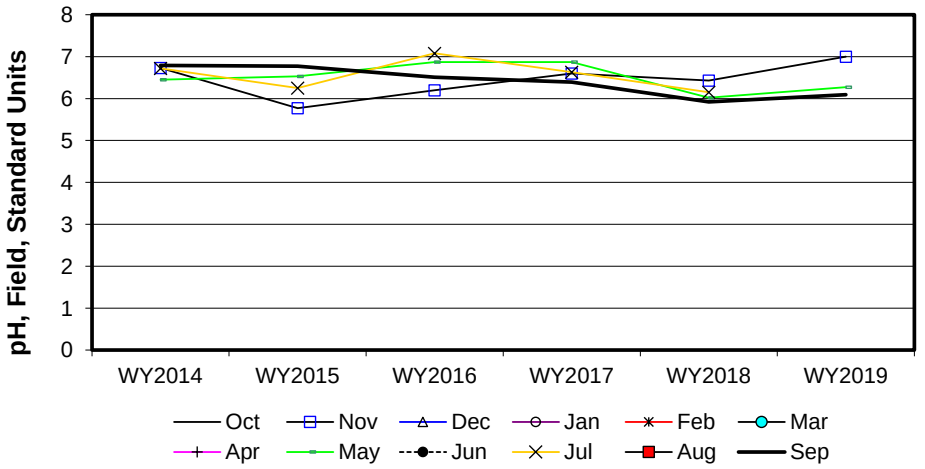
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		6.7						6.5		6.7		6.8
b	**WY2015**		5.8						6.5		6.3		6.8
c	**WY2016**		6.2						6.9		7.1		6.5
d	**WY2017**		6.6						6.9		6.6		6.4
e	**WY2018**		6.4						6.0		6.2		5.9
f	**WY2019**		7.0						6.3				6.1
	n	0	6	0	0	0	0	0	6	0	5	0	6
	t_1	0	6	0	0	0	0	0	4	0	5	0	6
	t_2	0	0	0	0	0	0	0	1	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						1		-1		-1
	c-a		-1						1		1		-1
	d-a		-1						1		-1		-1
	e-a		-1						-1		-1		-1
	f-a		1						-1				-1
	c-b		1						1		1		-1
	d-b		1						1		1		-1
	e-b		1						-1		-1		-1
	f-b		1						-1				-1
	d-c		1						0		-1		-1
	e-c		1						-1		-1		-1
	f-c		1						-1				-1
	e-d		-1						-1		-1		-1
	f-d		1						-1				-1
	f-e		1						1				1
	S_k	0	5	0	0	0	0	0	-2	0	-4	0	-13
	σ^2_S=		28.33						27.33		16.67		28.33
	$Z_k = S_k/\sigma_S$		0.94						-0.38		-0.98		-2.44
	Z^2_k		0.88						0.15		0.96		5.96

ΣZ_k= -2.87
ΣZ^2_k= 7.95
Z-bar=$\Sigma Z_k/K$= -0.72

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	21	1	0	0	0

Σn 23
ΣS_k -14

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	5.90	@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
p	**0.117**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
$\Sigma VAR(S_k)$	Z_{calc} -1.30	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
100.67	**p** **0.098**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.19	**-0.08**	0.15
0.050	-0.17		0.04
0.100	-0.14		-0.02
0.200	-0.14		-0.03

Site #60 Seasonal Kendall analysis for Total Alk, (mg/l)

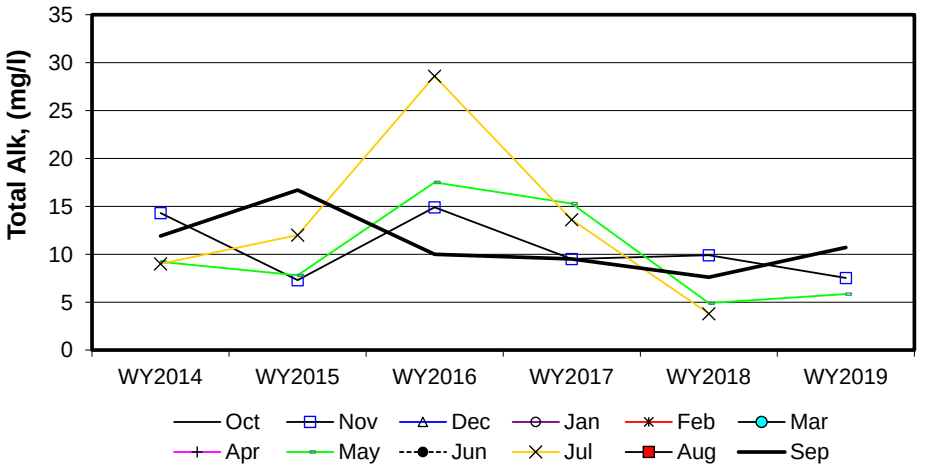
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		14.3						9.2		9.0		11.9
b	**WY2015**		7.3						7.8		12.0		16.7
c	**WY2016**		14.9						17.5		28.6		10.0
d	**WY2017**		9.5						15.3		13.6		9.5
e	**WY2018**		9.9						4.9		3.8		7.6
f	**WY2019**		7.5						5.8				10.7
	n	0	6	0	0	0	0	0	6	0	5	0	6
	t_1	0	6	0	0	0	0	0	6	0	5	0	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		-1						-1		1		1
	c-a		1						1		1		-1
	d-a		-1						1		1		-1
	e-a		-1						-1		-1		-1
	f-a		-1						-1				-1
	c-b		1						1		1		-1
	d-b		1						1		1		-1
	e-b		1						-1		-1		-1
	f-b		1						-1				-1
	d-c		-1						-1		-1		-1
	e-c		-1						-1		-1		-1
	f-c		-1						-1				1
	e-d		1						-1		-1		-1
	f-d		-1						-1				1
	f-e		-1						1				1
	S_k	0	-3	0	0	0	0	0	-5	0	0	0	-7
	σ^2_S=		28.33						28.33		16.67		28.33
	$Z_k = S_k/\sigma_S$		-0.56						-0.94		0.00		-1.32
	Z^2_k		0.32						0.88		0.00		1.73

ΣZ_k= -2.82
ΣZ^2_k= 2.93
Z-bar=$\Sigma Z_k/K$= -0.70

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	23	0	0	0	0

Σn 23
ΣS_k -15

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	0.94		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.815**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
ΣVAR(S_k)	Z_{calc}	-1.39	@α/2=2.5% Z=	1.96	**H_0** (No trend) ACCEPT
101.67	**p**	**0.082**			**H_A** (± trend) REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-2.39		0.45
0.050	-1.58	**-0.99**	0.00
0.100	-1.40		-0.49
0.200	-1.27		-0.70

Site #60 Seasonal Kendall analysis for Sulfate, Total (mg/l)

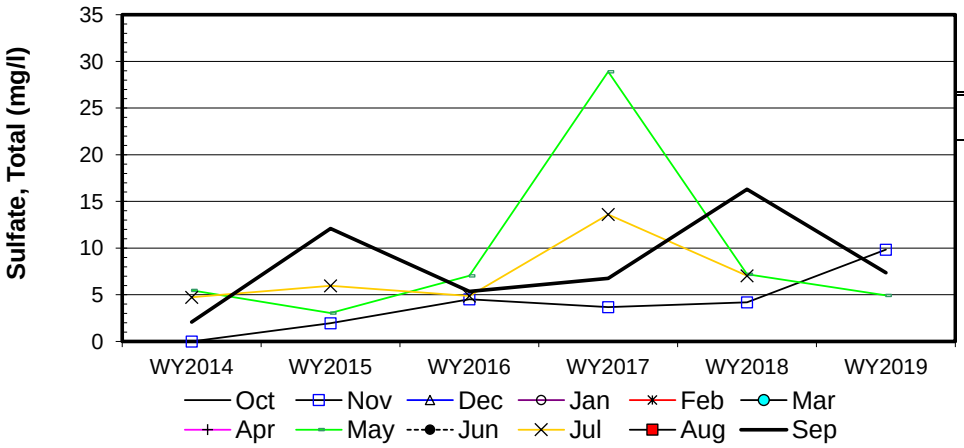
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		0.0						5.5		4.7		2.1
b	**WY2015**		2.0						3.1		6.0		12.1
c	**WY2016**		4.5						7.0		4.9		5.4
d	**WY2017**		3.7						28.9		13.6		6.8
e	**WY2018**		4.2						7.2		7.0		16.3
f	**WY2019**		9.8						4.9				7.4
	n	0	6	0	0	0	0	0	6	0	5	0	6
	t_1	0	6	0	0	0	0	0	6	0	5	0	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		1						-1		1		1
	c-a		1						1		1		1
	d-a		1						1		1		1
	e-a		1						1		1		1
	f-a		1						-1				1
	c-b		1						1		-1		-1
	d-b		1						1		1		-1
	e-b		1						1		1		1
	f-b		1						1				-1
	d-c		-1						1		1		1
	e-c		-1						1		1		1
	f-c		1						-1				1
	e-d		1						-1		-1		1
	f-d		1						-1				1
	f-e		1						-1				-1
	S_k	0	11	0	0	0	0	0	3	0	6	0	7
	σ^2_S=		28.33						28.33		16.67		28.33
	$Z_k = S_k/\sigma_S$		2.07						0.56		1.47		1.32
	Z^2_k		4.27						0.32		2.16		1.73

ΣZ_k= 5.41
ΣZ^2_k= 8.48
Z-bar=$\Sigma Z_k/K$= 1.35

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	23	0	0	0	0

Σn 23
ΣS_k 27

$\chi^2_h=\Sigma Z^2_k-K(\text{Z-bar})^2$=	1.15		@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity
	p	**0.766**			$\chi^2_h<\chi^2_{(K-1)}$ ACCEPT
$\Sigma VAR(S_k)$	Z_{calc}	2.58	@α=2.5% **Z**=	1.96	**H_0** (No trend) REJECT
101.67	**p**	**0.995**			**H_A** (± trend) ACCEPT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	0.07		1.97
0.050	0.44	**1.06**	1.63
0.100	0.52		1.40
0.200	0.69		1.34

19.3%

Site #60 Seasonal Kendall analysis for Zinc, Dissolved (ug/l)

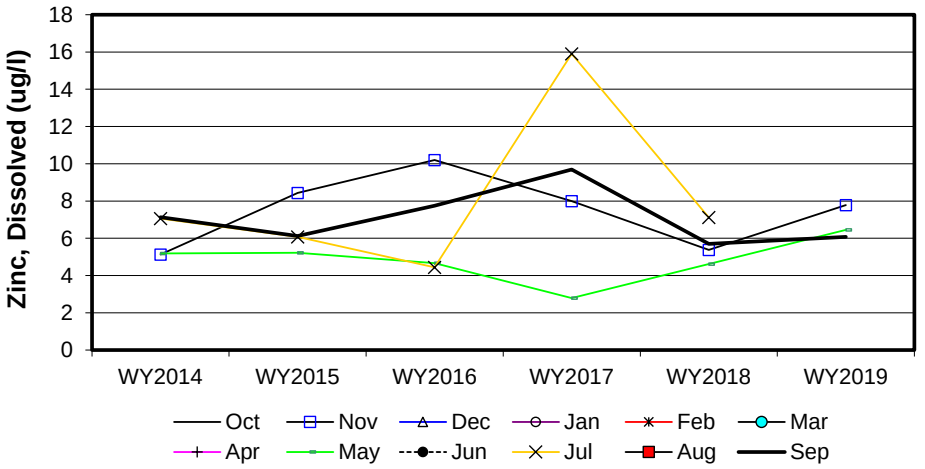
Row label	Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
a	**WY2014**		5.1						5.2		7.1		7.1
b	**WY2015**		8.4						5.2		6.1		6.1
c	**WY2016**		10.2						4.7		4.4		7.8
d	**WY2017**		8.0						2.8		15.9		9.7
e	**WY2018**		5.4						4.6		7.1		5.7
f	**WY2019**		7.8						6.5				6.1
	n	0	6	0	0	0	0	0	6	0	5	0	6
	t_1	0	6	0	0	0	0	0	6	0	5	0	6
	t_2	0	0	0	0	0	0	0	0	0	0	0	0
	t_3	0	0	0	0	0	0	0	0	0	0	0	0
	t_4	0	0	0	0	0	0	0	0	0	0	0	0
	t_5	0	0	0	0	0	0	0	0	0	0	0	0
	b-a		1						1		-1		-1
	c-a		1						-1		-1		1
	d-a		1						-1		1		1
	e-a		1						-1		1		-1
	f-a		1						1				-1
	c-b		1						-1		-1		1
	d-b		-1						-1		1		1
	e-b		-1						-1		1		-1
	f-b		-1						1				-1
	d-c		-1						-1		1		1
	e-c		-1						-1		1		-1
	f-c		-1						1				-1
	e-d		-1						1		-1		-1
	f-d		-1						1				-1
	f-e		1						1				1
	S_k	0	-1	0	0	0	0	0	-1	0	2	0	-3
	σ^2_S=		28.33						28.33		16.67		28.33
	$Z_k = S_k/\sigma_S$		-0.19						-0.19		0.49		-0.56
	Z^2_k		0.04						0.04		0.24		0.32

ΣZ_k= -0.45
ΣZ^2_k= 0.63
Z-bar=$\Sigma Z_k/K$= -0.11

Tie Extent	t_1	t_2	t_3	t_4	t_5
Count	23	0	0	0	0

Σn 23
ΣS_k -3

$\chi^2_h=\Sigma Z^2_k-K(Z\text{-bar})^2$=	0.58	@α=5% $\chi^2_{(K-1)}$=	7.81	Test for station homogeneity	
p	**0.902**			$\chi^2_h<\chi^2_{(K-1)}$	ACCEPT
ΣVAR(S_k)	Z_{calc} -0.20	@α/2=2.5% **Z**=	1.96	**H_0** (No trend)	ACCEPT
101.67	**p** **0.421**			**H_A** (± trend)	REJECT



Seasonal-Kendall Slope Confidence Intervals

α	Lower Limit	Sen's Slope	Upper Limit
0.010	-0.80		0.66
0.050	-0.34	**-0.02**	0.34
0.100	-0.22		0.31
0.200	-0.19		0.05

INTERPRETIVE REPORT
SITE 609

Sampling at this site was initiated during the spring of Water Year 2013. This site was added to the FWMP at the request of the state and federal regulators. Site 609 is located west of the tailings disposal facility on a small, surface drainage. The sampling location is near the bottom of the drainage, therefore monitoring a larger expanse upgradient from the site.

The data collected during the current water year are listed in the following "Table of Results for Water Year 2019" report. The table includes all the required FWMP analyte data (field and laboratory) collected for the current water year and a series of flags keyed to the summary report "Qualified Data by QA Reviewer." The QA report lists any associated data limitations found during the monthly QA reviews of laboratory data for this site. Median values for all analytes have been calculated and are shown in the right-most column of the table of results. Any value reported as less than MDL has been replaced with a value of one-half of the MDL for the purpose of median calculation.

All data collected at this site for the past year is included in the data analyses. As shown in the table below, there were no data outliers.

Sample Date	Parameter	Value	Qualifier	Notes
No outliers, in the past six years, have been identified by HGCMC.				

The results for the current water year have been compared to the strictest freshwater quality criterion for each applicable analyte. One sample was slightly above the AWQS for total sulfate.

Table of Exceedance for Water Year 2019

			Limits		
Sample Date	Parameter	Value	Lower	Upper	Hardness
2-Sep-19	Sulfate, Total	272 mg/L		250	316 mg/L

X-Y plots have been generated to graphically present the data for each of the analytes requested in the Statistical Information Goals for this site. These plots have been visually analyzed for the appearance of any trend in concentration. There were no noticeable trends.

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Table of Results for Water Year 2019

Site 609FMS - 'Further Creek Lower'

Sample Date/Parameter	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019	**Median**
Water Temp (°C)		5.5						5.7		12.1		10.8	8.3
Conductivity-Field(μmho)		526.1						448.3		350.4		451.9	450.1
Conductivity-Lab (μmho)		507						421		278		557	464
pH Lab (standard units)		6.48						6.44		6.22		6.39	6.42
pH Field (standard units)		7.51						7.53		6.62		6.81	7.16
Total Alkalinity (mg/L)		45.7						37.8		45.8		36.4	41.8
Total Sulfate (mg/L)		229						172		101		272	200.5
Hardness (mg/L)		273						217		151		316	245.0
Dissolved As (ug/L)		1.38						1.61		2.36		0.759	1.495
Dissolved Ba (ug/L)		50.6						49.1		39.7		78.5	49.9
Dissolved Cd (ug/L)		0.238						0.216		0.0766		0.193	0.2045
Dissolved Cr (ug/L)		0.709						0.78		1.61		0.766	0.773
Dissolved Cu (ug/L)		0.867						1.09		0.884		0.627	0.876
Dissolved Pb (ug/L)		0.337						0.429		1.52		0.136	0.3830
Dissolved Ni (ug/L)		3.65						3.06		3.37		3.33	3.350
Dissolved Ag (ug/L)		0.004						0.006		0.011		0.002	0.005
Dissolved Zn (ug/L)		63.3						50.8		33.3		56.7	53.75
Dissolved Se (ug/L)		2.35						2.62		0.183		0.831	1.591
Dissolved Hg (ug/L)		0.00303						0.00474		0.00363		0.00129	0.003330

For individual sample/analyte qualifier descriptions see "Qualified Data by QA Reviewer" table.

Values reported as less than MDL are replaced by 1/2 MDL for median calculation purposes.

Shaded data has been qualified as an outlier by HGCMC and removed from any further analysis and is not included into the calculation of the median

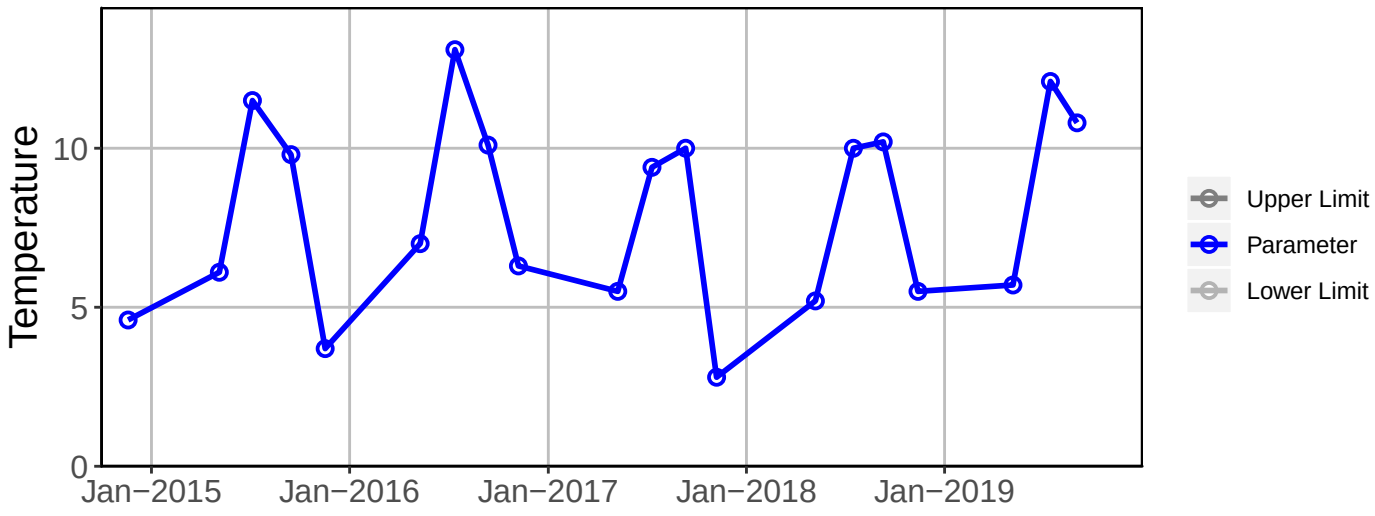
Qualified Data by QA Reviewer

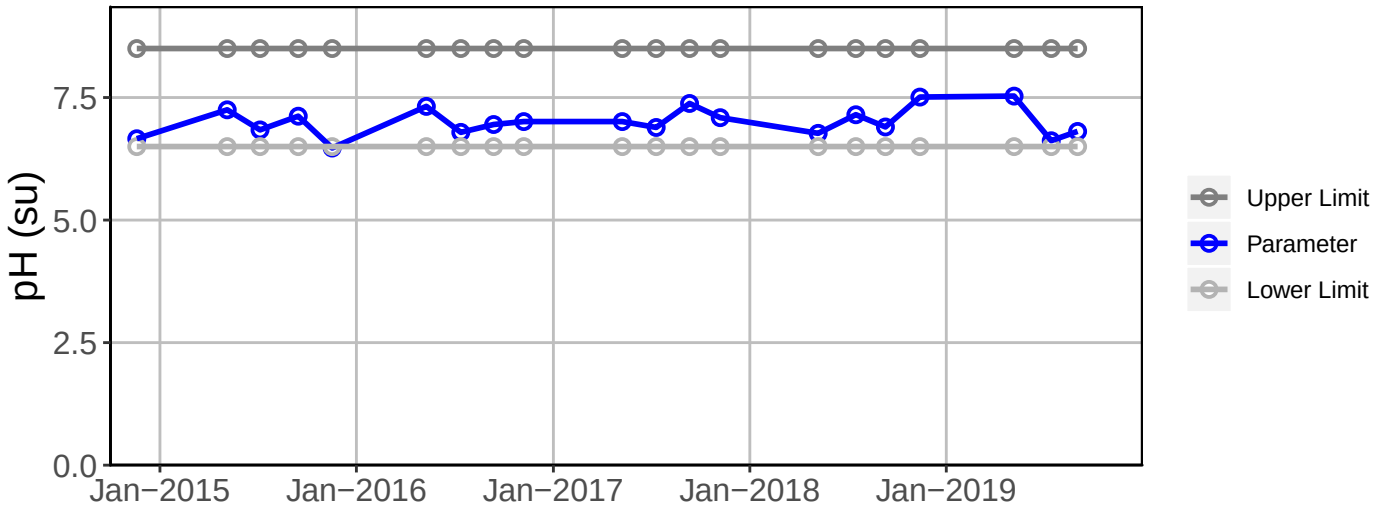
Date Range: 10/01/2018 to 09/30/2019

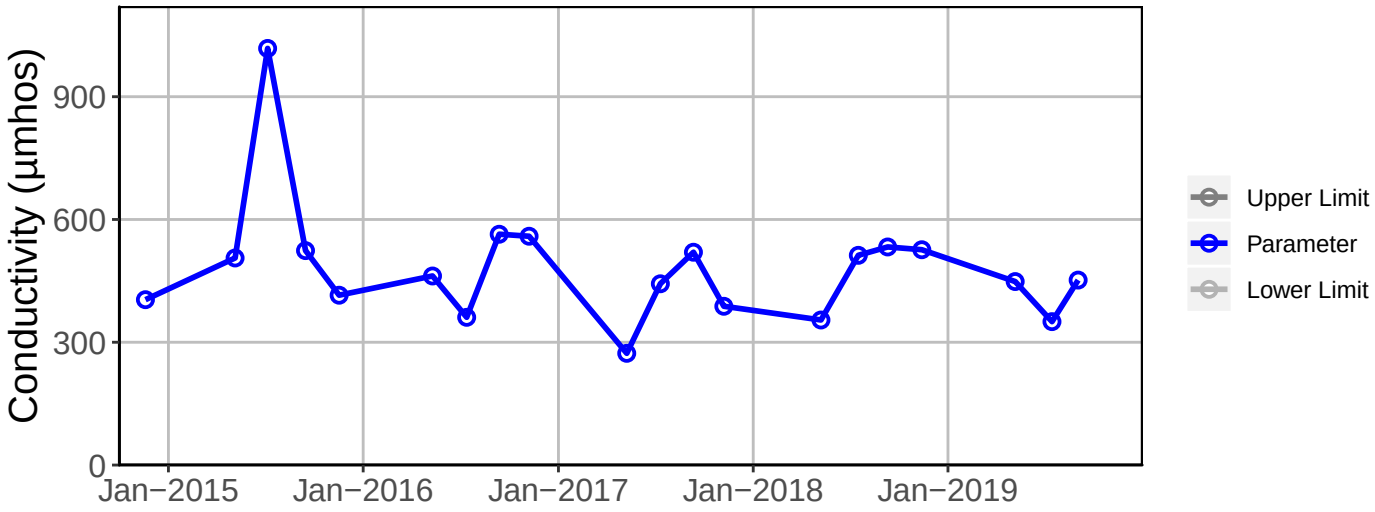
Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
609FMS	13-Nov-18	Diss. Ag-ICP/MS	0.00432	µg/L	J	Below Quantitative Range
	7-May-19	Diss. Ag-ICP/MS	0.00574	µg/L	J	Below Quantitative Range
	15-Jul-19	Diss. Se-ICP/MS	0.18	µg/L	J	Below Quantitative Range
	2-Sep-19	Diss. Cr-ICP/MS	0.76	µg/L	U	Field Blank Contamination
		Diss. Pb-ICP/MS	0.13	µg/L	U	Field Blank Contamination
		Total Sulfate	272.0	µg/L	J	Sample Receipt Temperature

Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

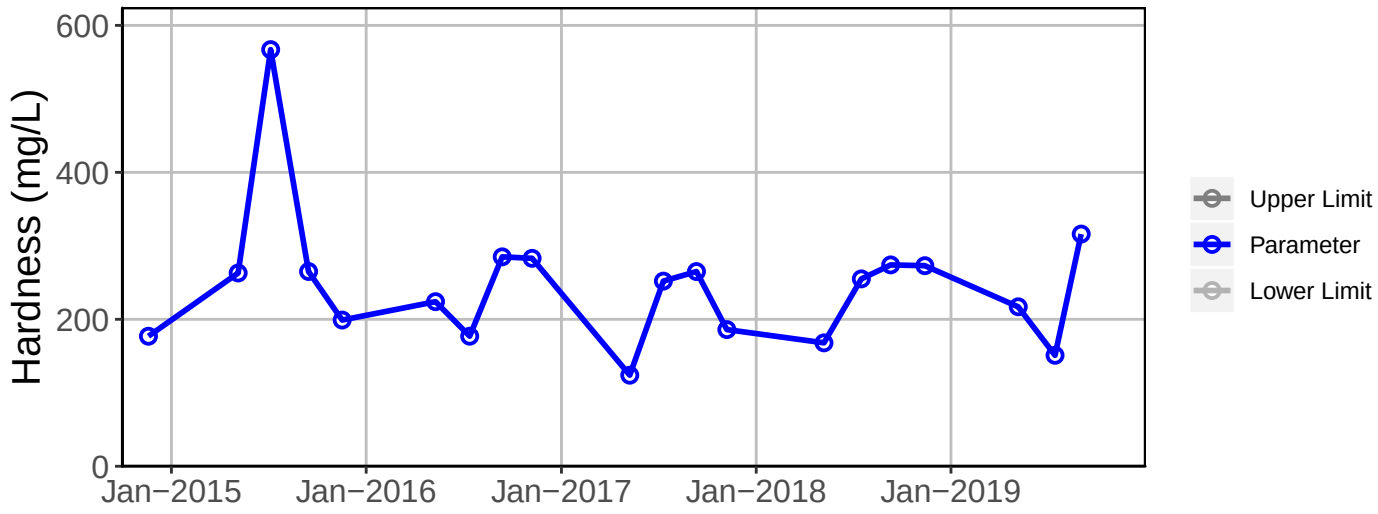
Site 609 Analyte Charts

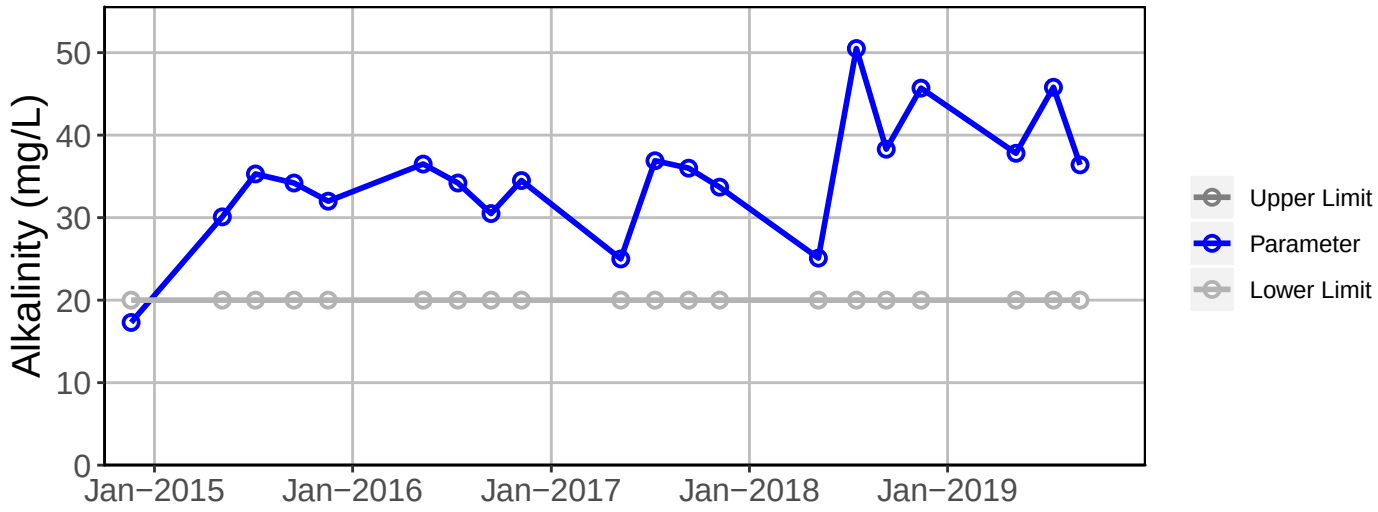


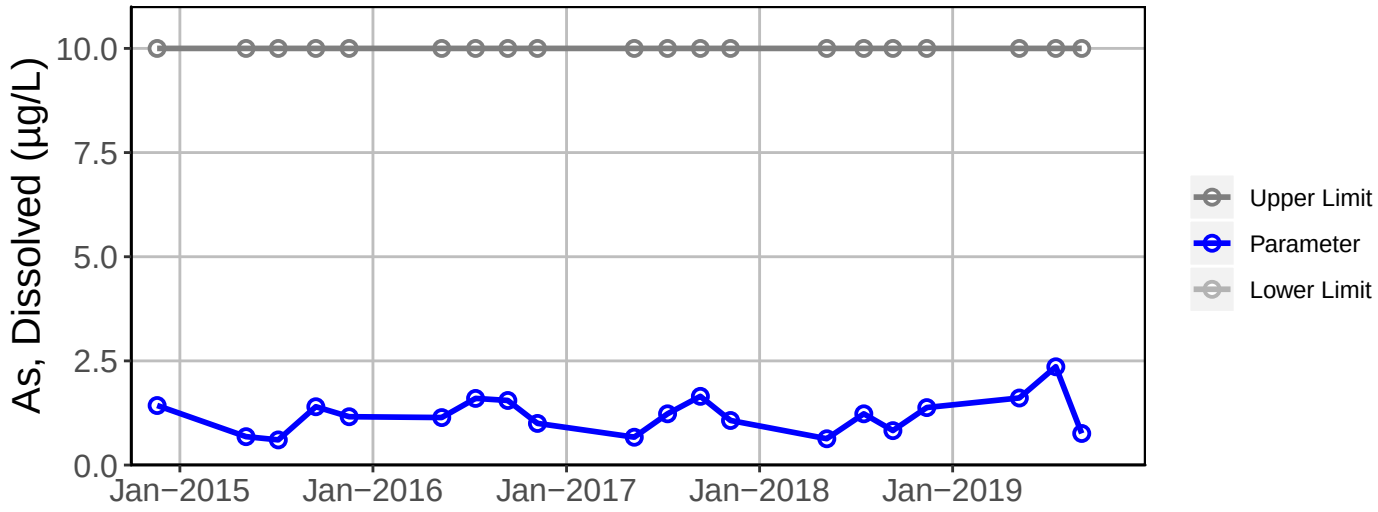




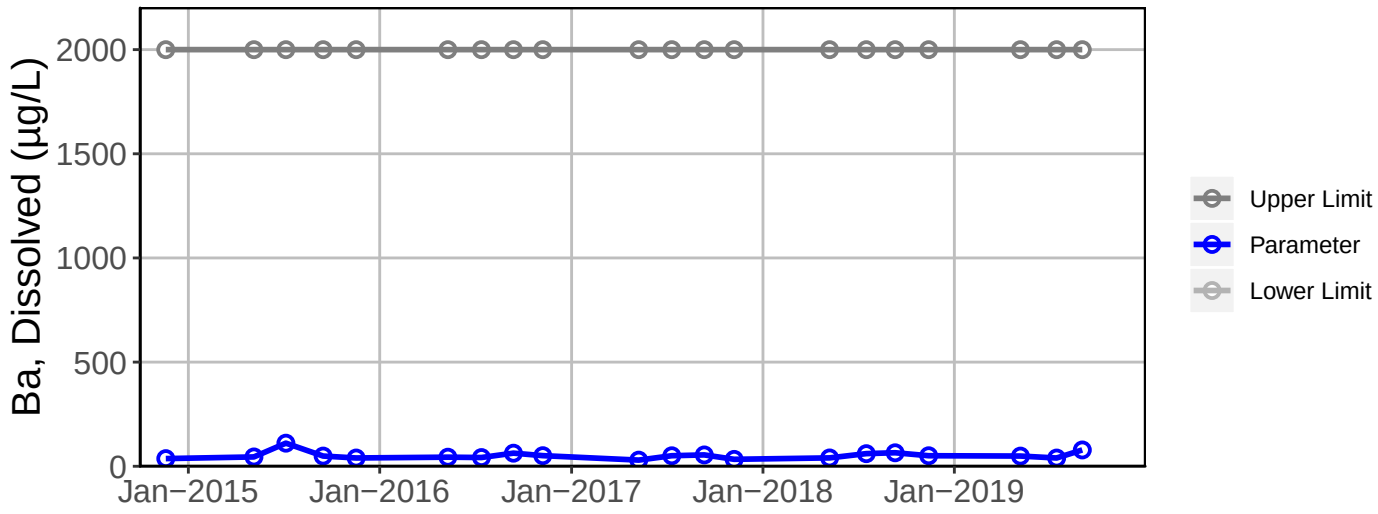
Site 609 Analyte Charts

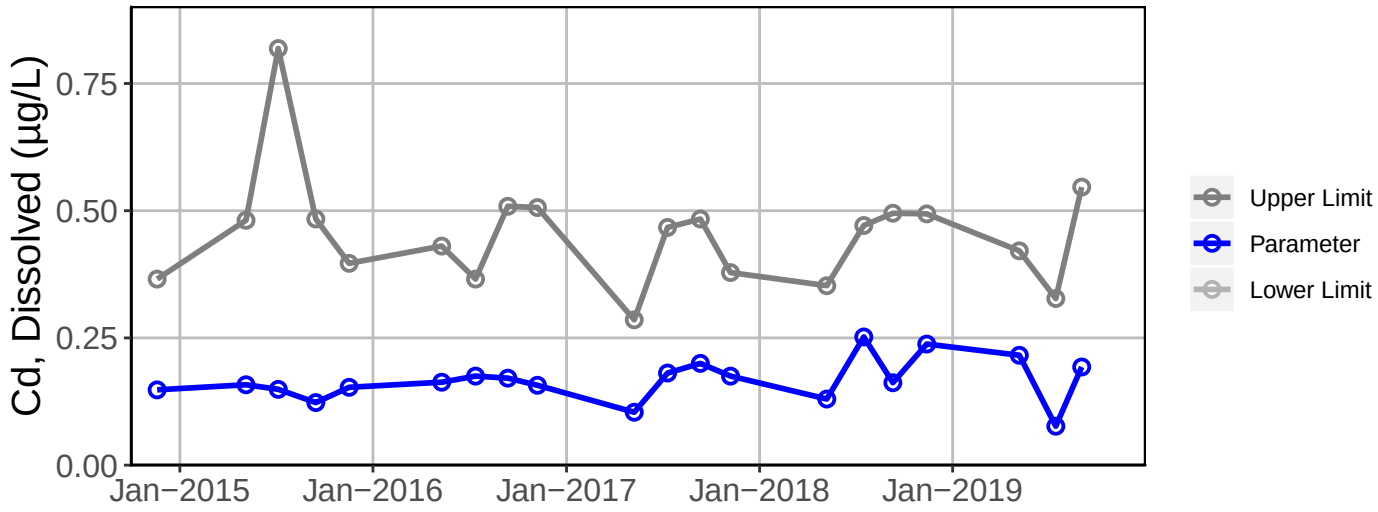


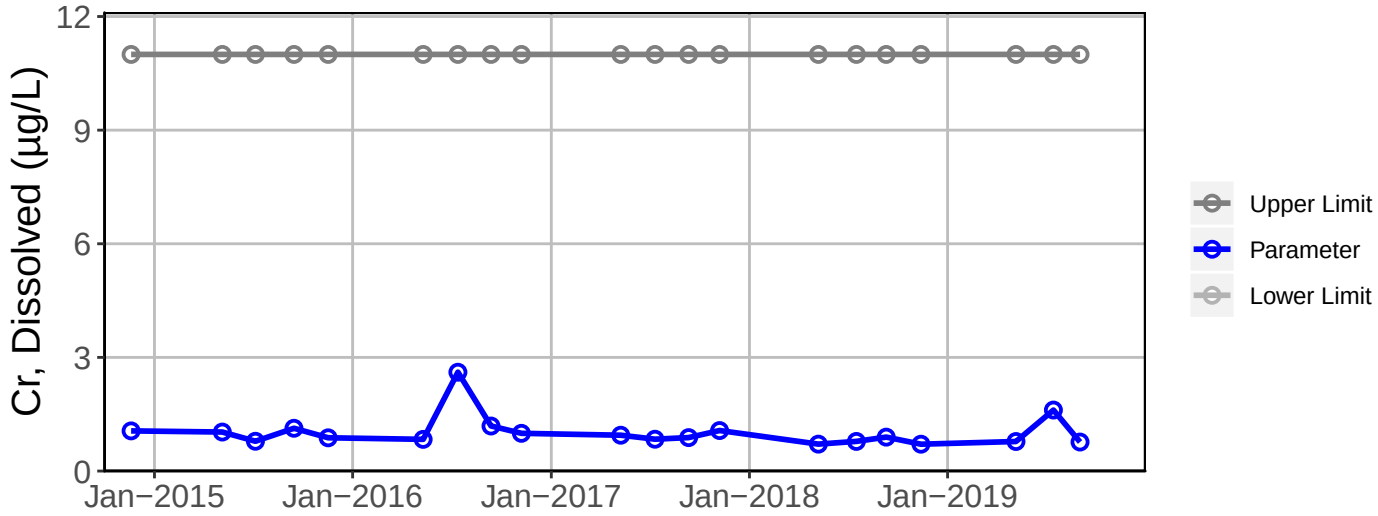




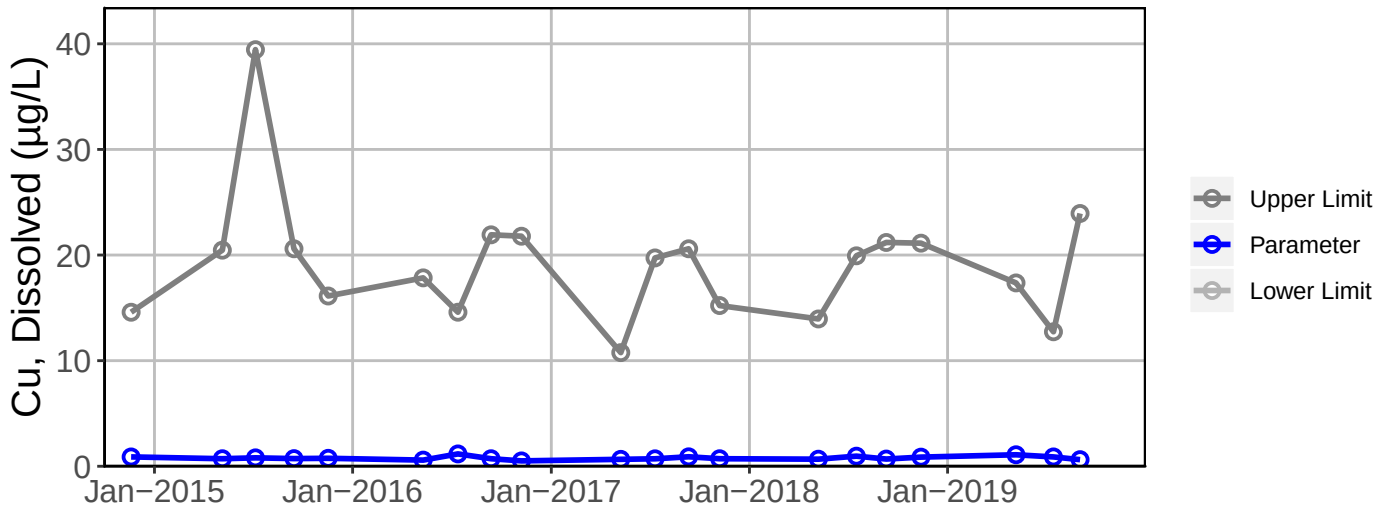
Site 609 Analyte Charts

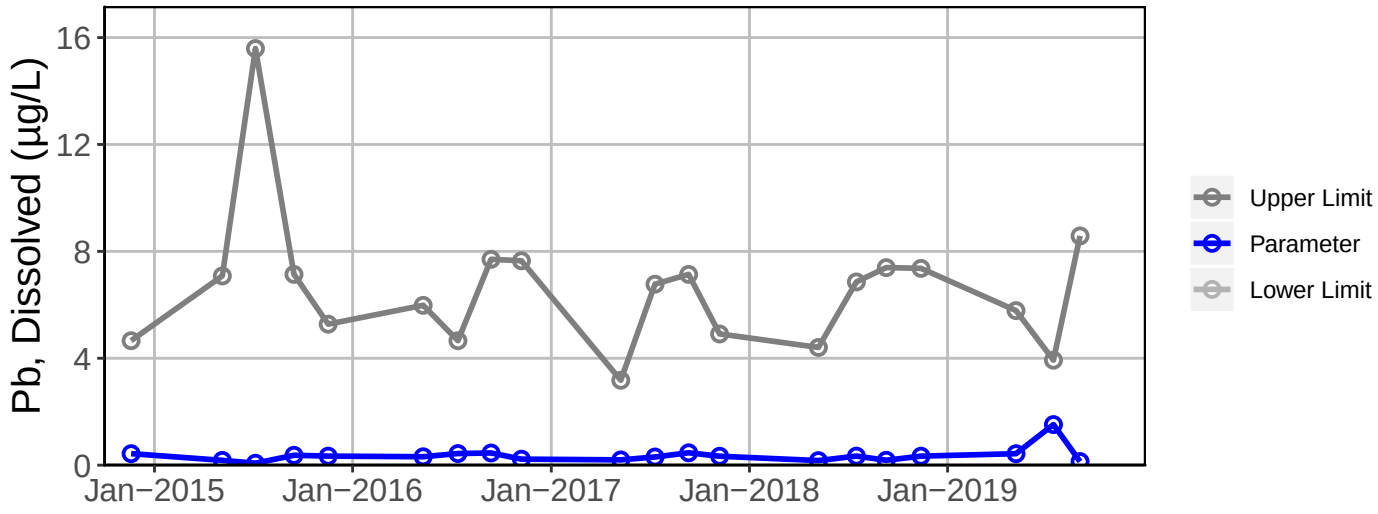


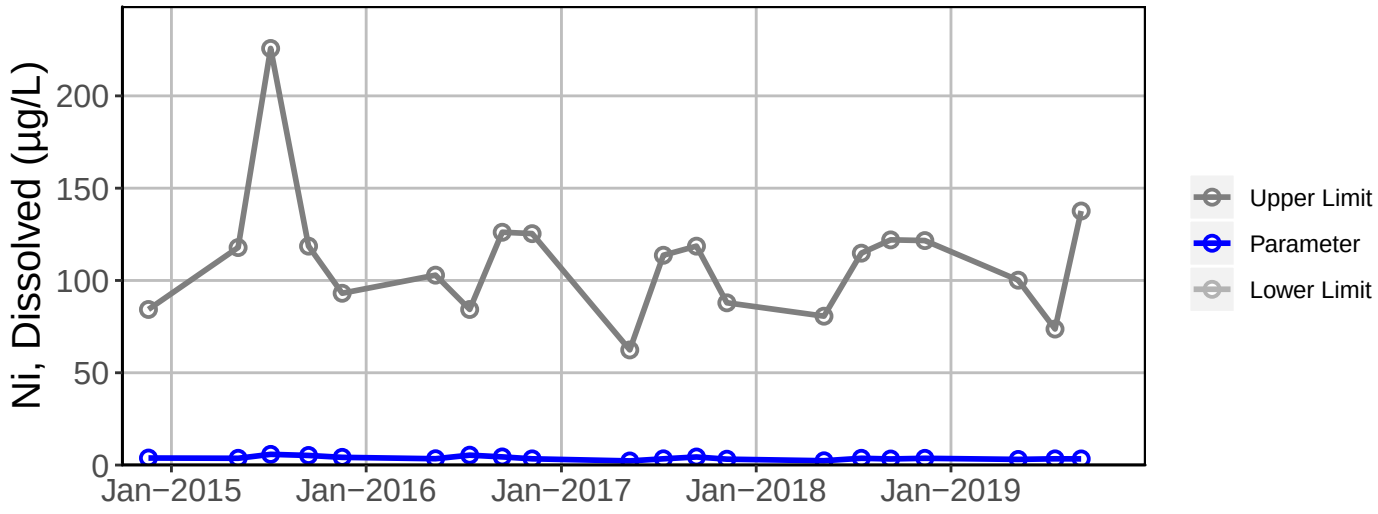




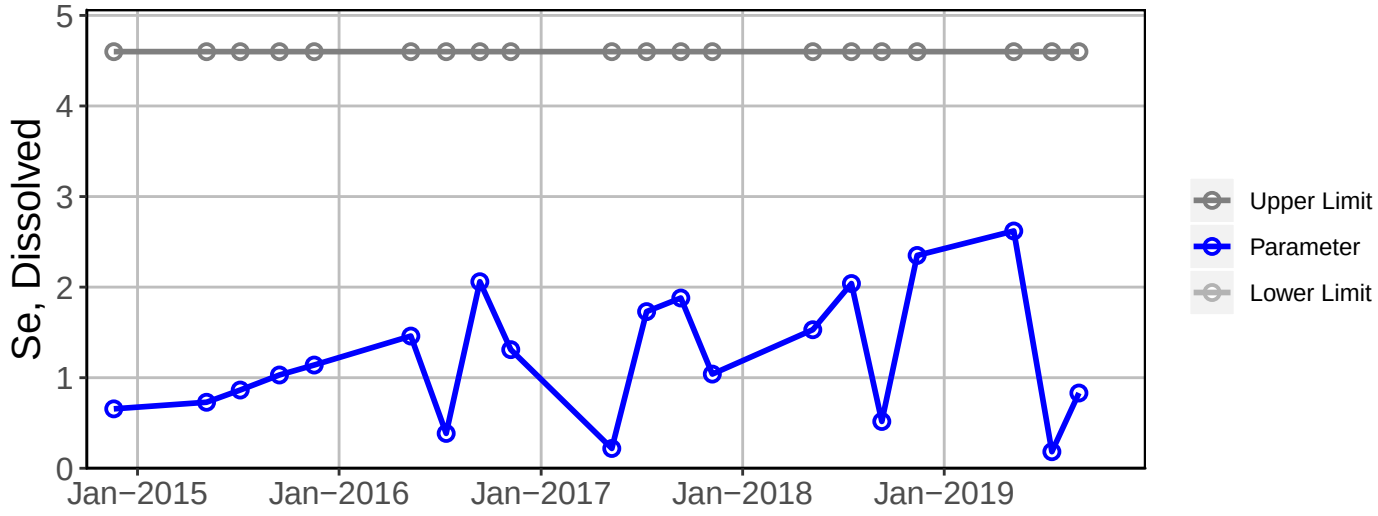
Site 609 Analyte Charts

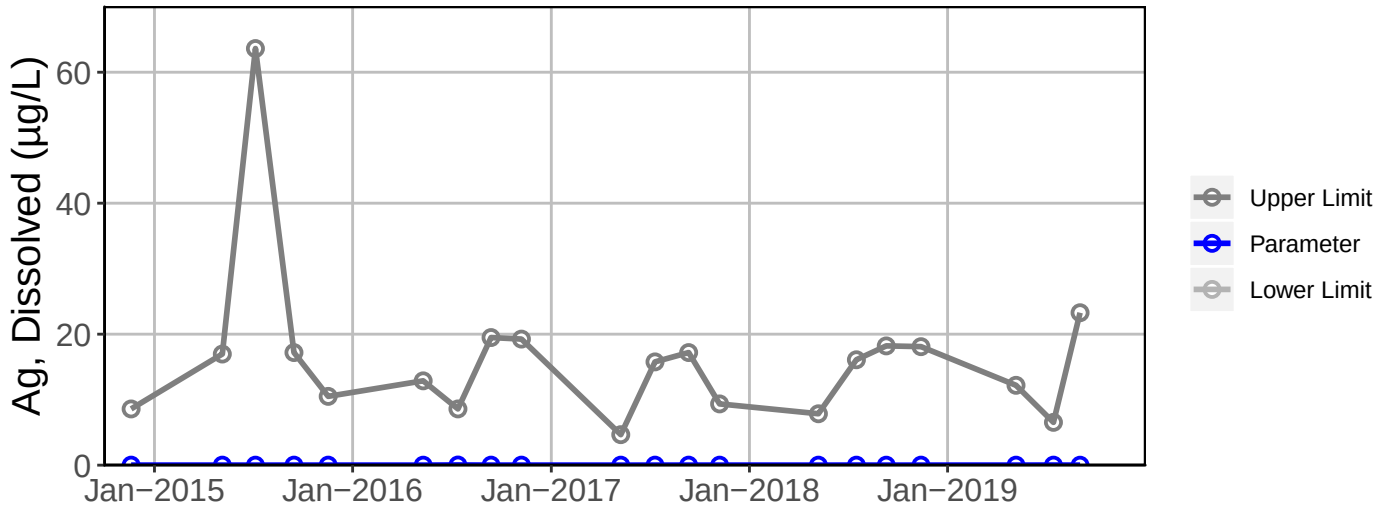


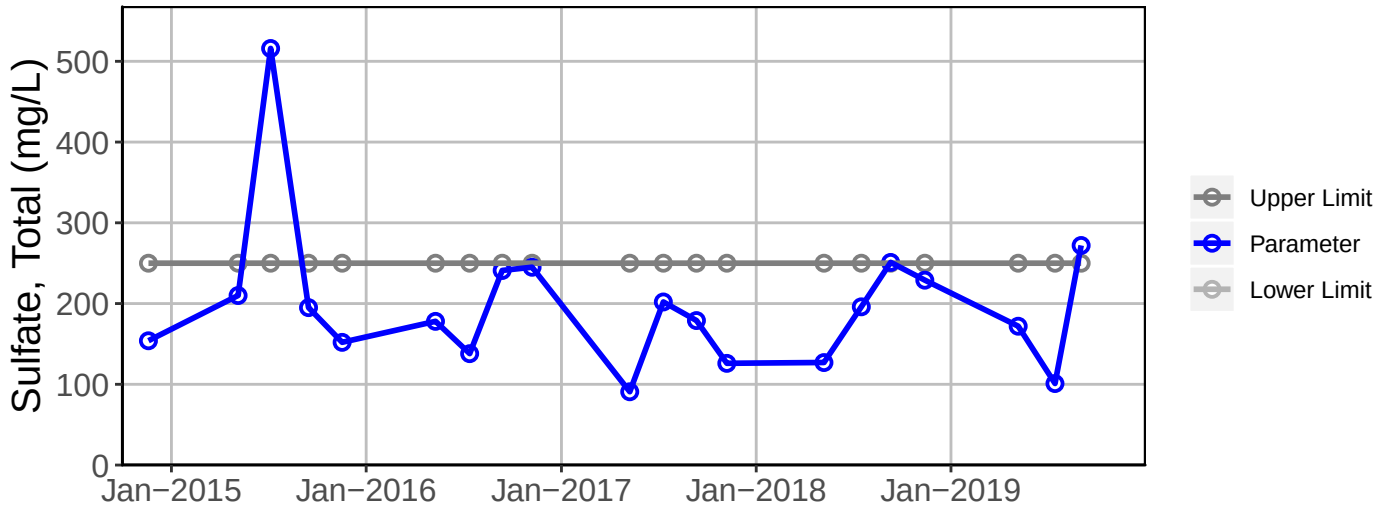




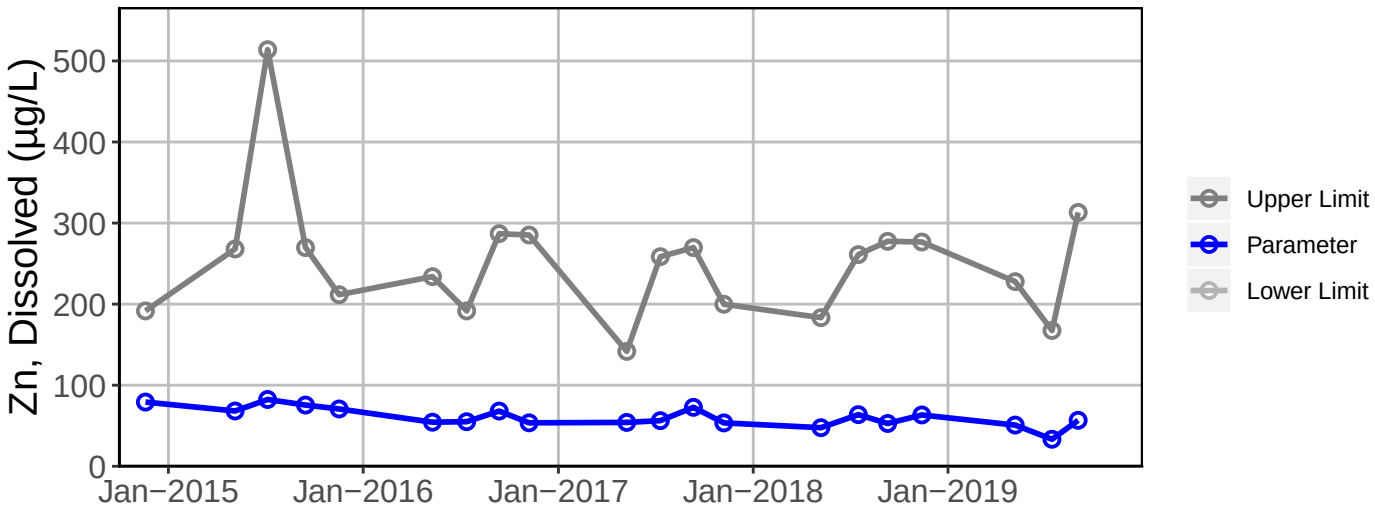
Site 609 Analyte Charts







Site 609 Analyte Charts



INTERPRETIVE REPORT
SITE 711

Sampling at this site was initiated during the spring of Water Year 2014. This site was added to the FWMP at the request of the Forest Service. Site 711 is located on Greens Creek upgradient to any drainage from Site E, a waste rock disposal area.

The data collected during the current water year are listed in the following "Table of Results for Water Year 2019" report. The table includes all the required FWMP analyte data (field and laboratory) collected for the current water year and a series of flags keyed to the summary report "Qualified Data by QA Reviewer." The QA report lists any associated data limitations found during the monthly QA reviews of laboratory data for this site. Median values for all analytes have been calculated and are shown in the right-most column of the table of results. Any value reported as less than MDL has been replaced with a value of one-half of the MDL for the purpose of median calculation.

All data collected at this site for the past year is included in the data analyses. As shown in the table below, there were no data outliers.

Sample Date	Parameter	Value	Qualifier	Notes
No outliers, in the past six years, have been identified by HGCMC.				

The results for the current water year have been compared to the strictest freshwater quality criterion for each applicable analyte. No results exceeding these criteria were identified, as listed in the table below.

Table of Exceedance for Water Year 2019

			Limits		
Sample Date	Parameter	Value	Lower	Upper	Hardness
No exceedances have been identified by HGCMC for the period of October 2018 through September 2019.					

X-Y plots have been generated to graphically present the data for each of the analytes requested in the Statistical Information Goals for this site. These plots have been visually analyzed for the appearance of any trend in concentration. There were no noticeable trends.

Table of Results for Water Year 2019

Site 711FMS - 'Greens Creek Above Site E'

Sample Date/Parameter	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019	**Median**
Water Temp (°C)									7.9			10.1	9.0
Conductivity-Field(μmho)									121.5			144	132.8
Conductivity-Lab (μmho)									117			147	132
pH Lab (standard units)									6.95			6.62	6.79
pH Field (standard units)									8.08			7.99	8.04
Total Alkalinity (mg/L)									48.1			68.5	58.3
Total Sulfate (mg/L)									12.7			15.9	14.3
Hardness (mg/L)									58.6			74.5	66.6
Dissolved As (ug/L)									0.191			0.233	0.212
Dissolved Ba (ug/L)									33.5				33.5
Dissolved Cd (ug/L)									0.0274			0.0277	0.0276
Dissolved Cr (ug/L)									0.091				0.091
Dissolved Cu (ug/L)									0.31			0.59	0.450
Dissolved Pb (ug/L)									0.0069			0.0301	0.0185
Dissolved Ni (ug/L)									0.259				0.259
Dissolved Ag (ug/L)									0.002				0.002
Dissolved Zn (ug/L)									2.21			2.37	2.29
Dissolved Se (ug/L)									0.651				0.651
Dissolved Hg (ug/L)									0.00041			0.000941	0.000676

For individual sample/analyte qualifier descriptions see "Qualified Data by QA Reviewer" table.

Values reported as less than MDL are replaced by 1/2 MDL for median calculation purposes.

Shaded data has been qualified as an outlier by HGCMC and removed from any further analysis and is not included into the calculation of the median

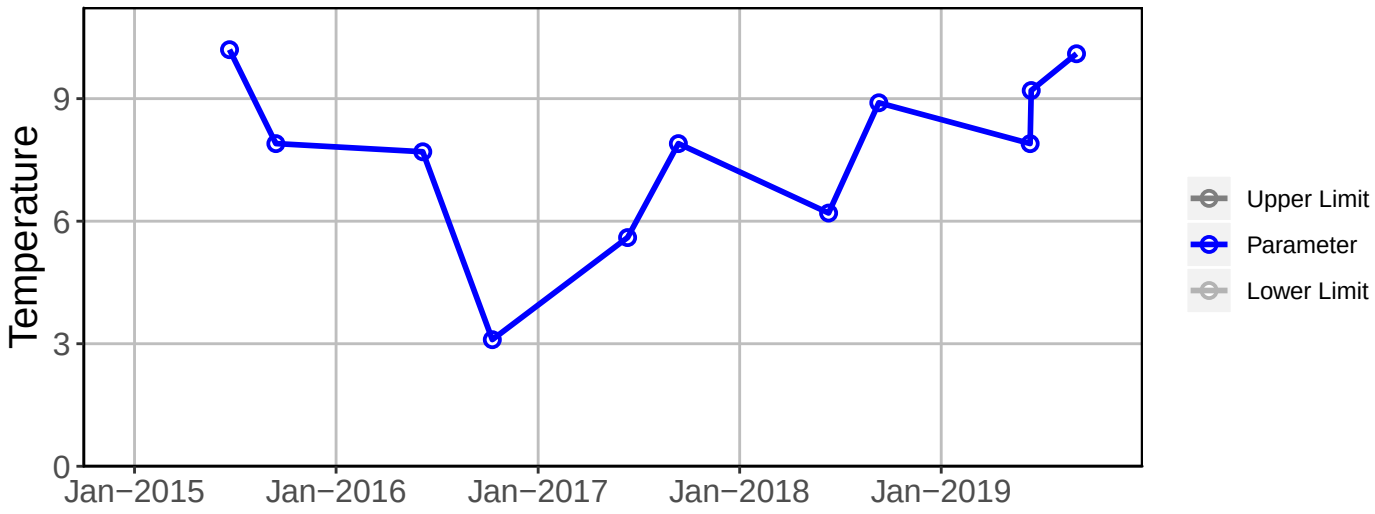
Qualified Data by QA Reviewer

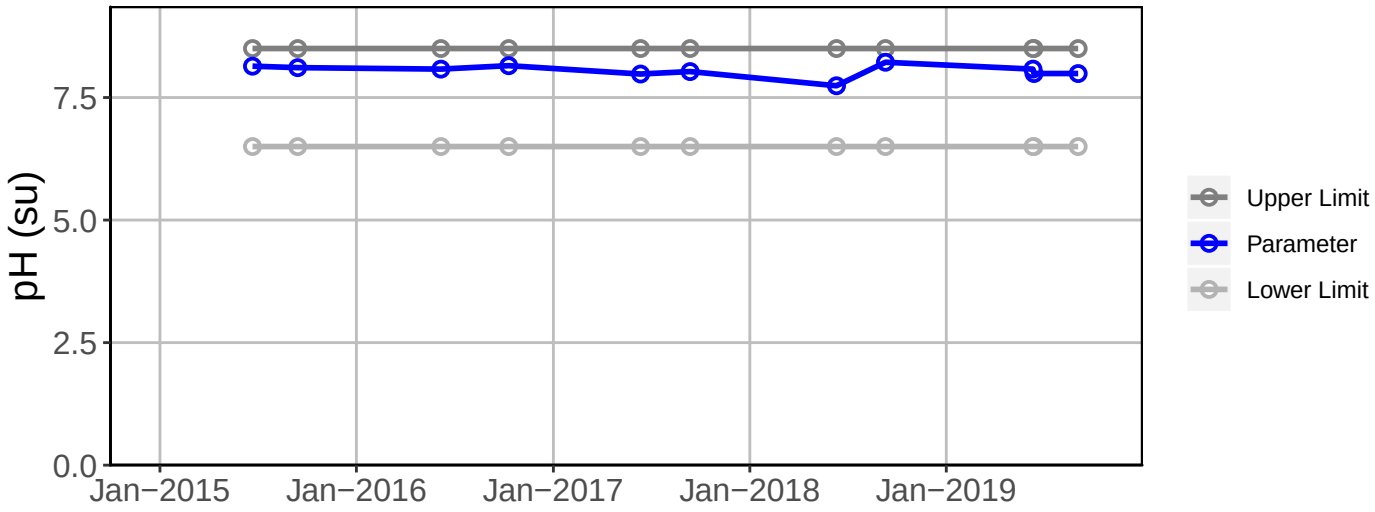
Date Range: 10/01/2018 to 09/30/2019

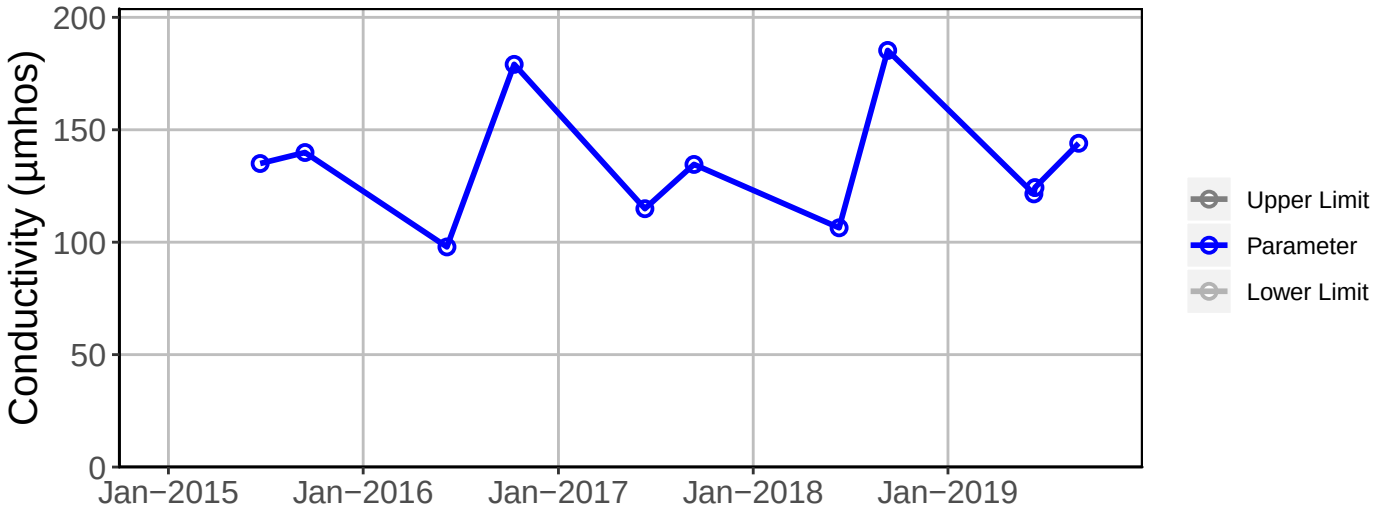
Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
711FMS	11-Jun-19	Diss. Cr-ICP/MS	0.09	µg/L	J	Below Quantitative Range
		Diss. Pb-ICP/MS	0.00694	µg/L	J	Below Quantitative Range
	3-Sep-19	Diss. Pb-ICP/MS	0.03	µg/L	U	Field Blank Contamination
		Total Sulfate	15.90	µg/L	J	Sample Receipt Temperature

Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

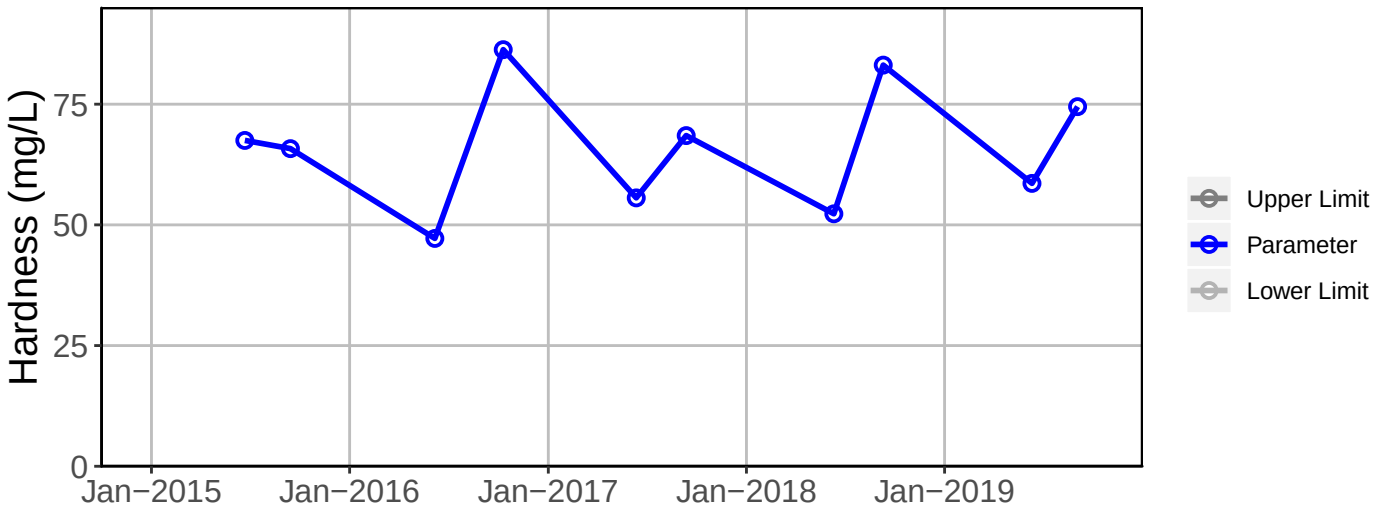
Site 711 Analyte Charts

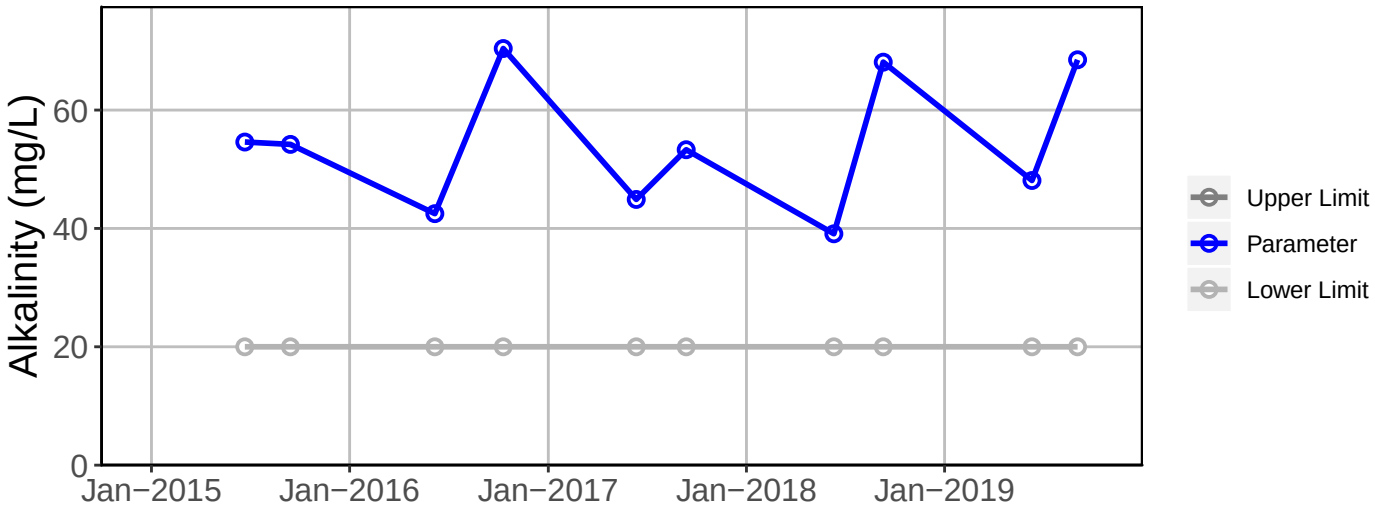


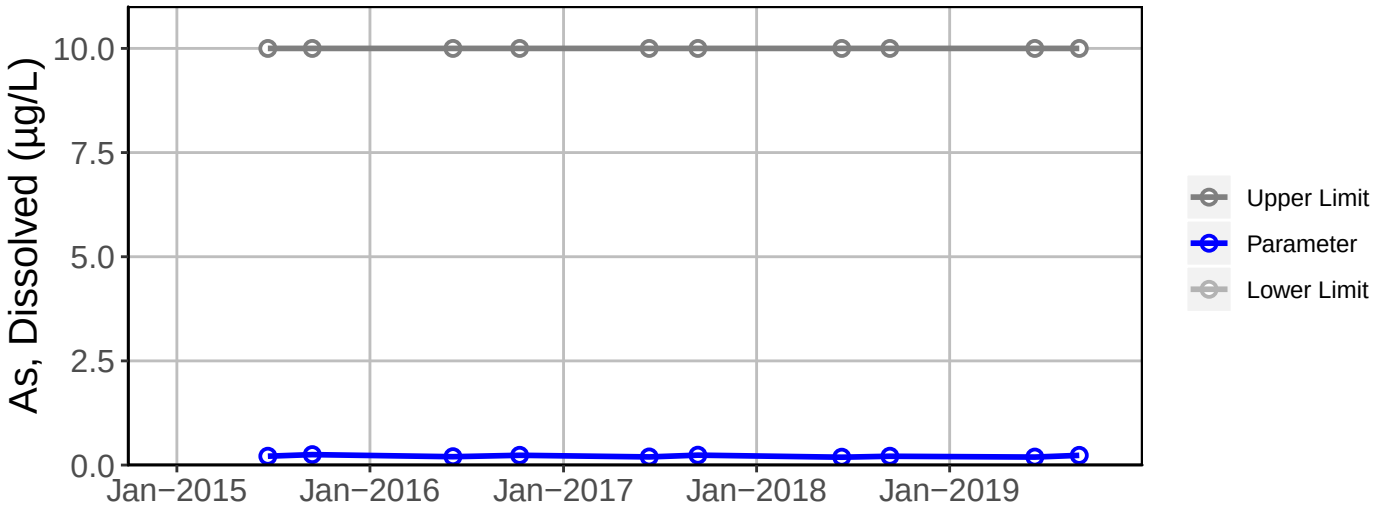




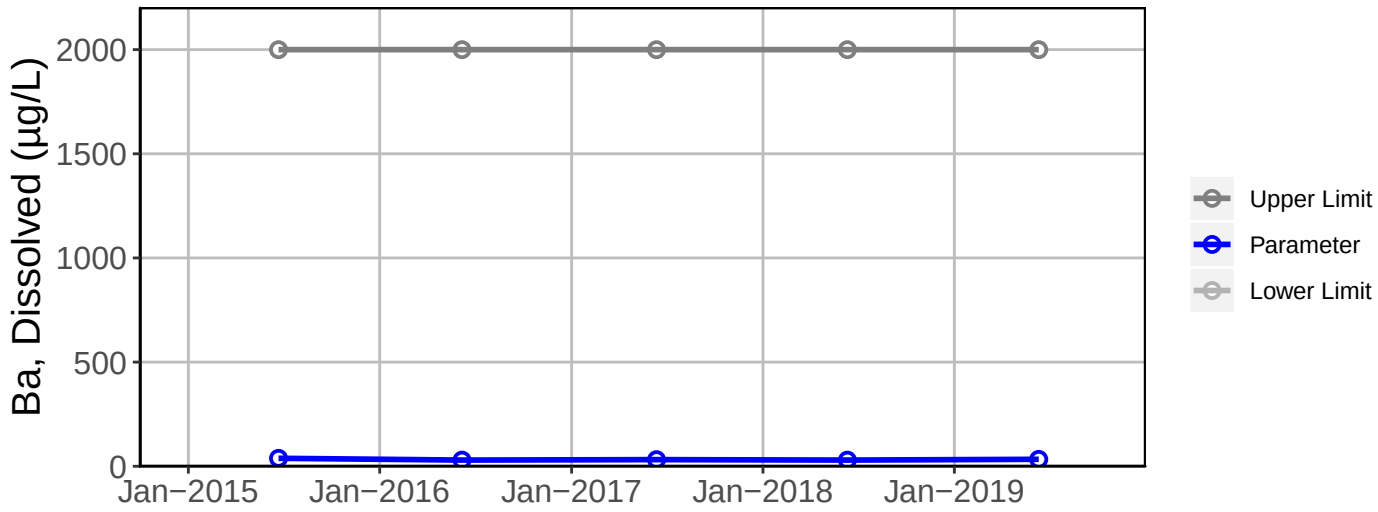
Site 711 Analyte Charts

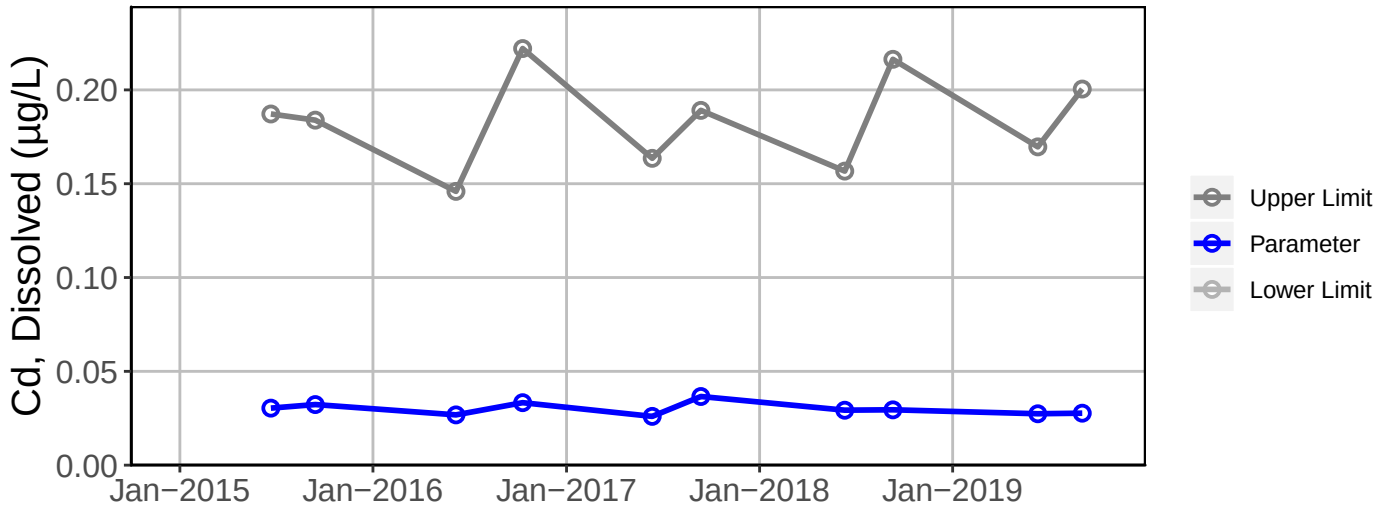


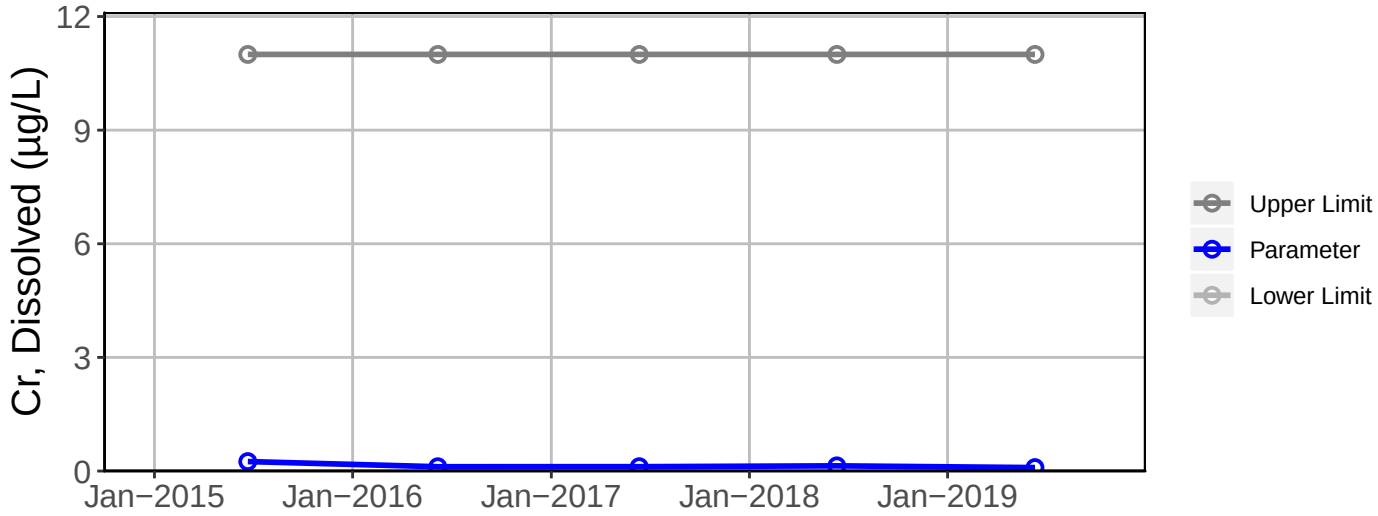




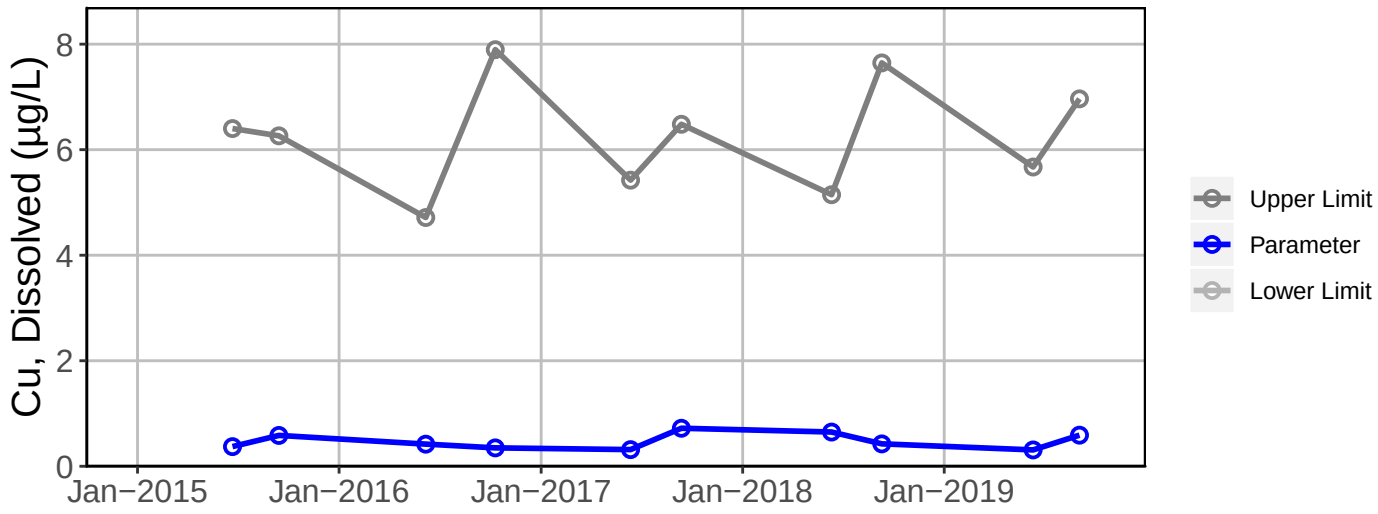
Site 711 Analyte Charts

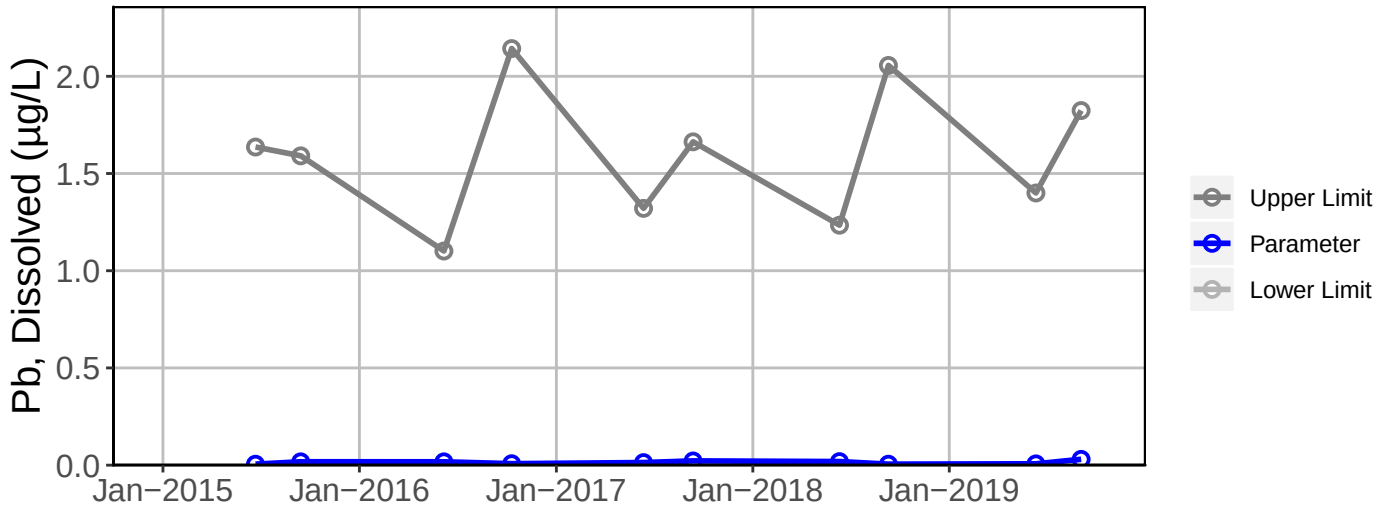


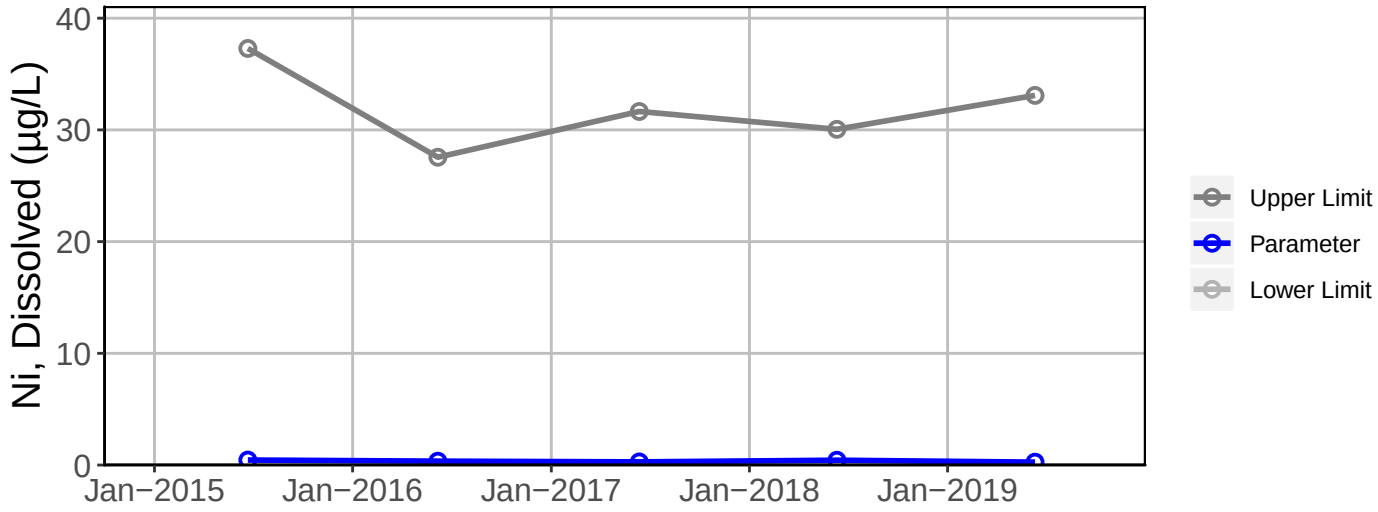




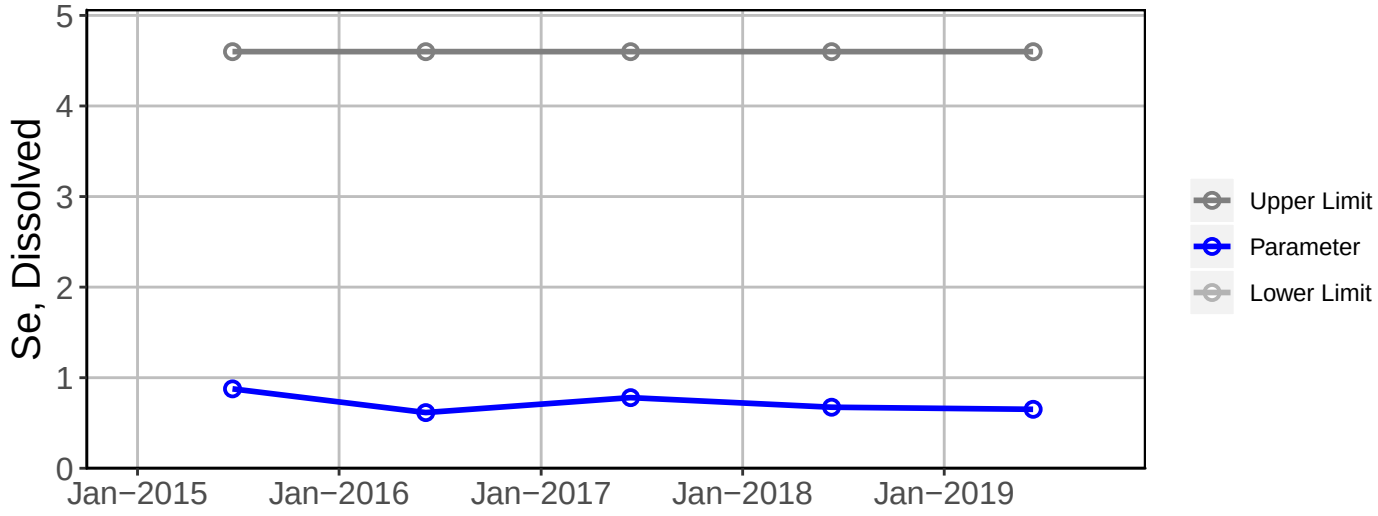
Site 711 Analyte Charts

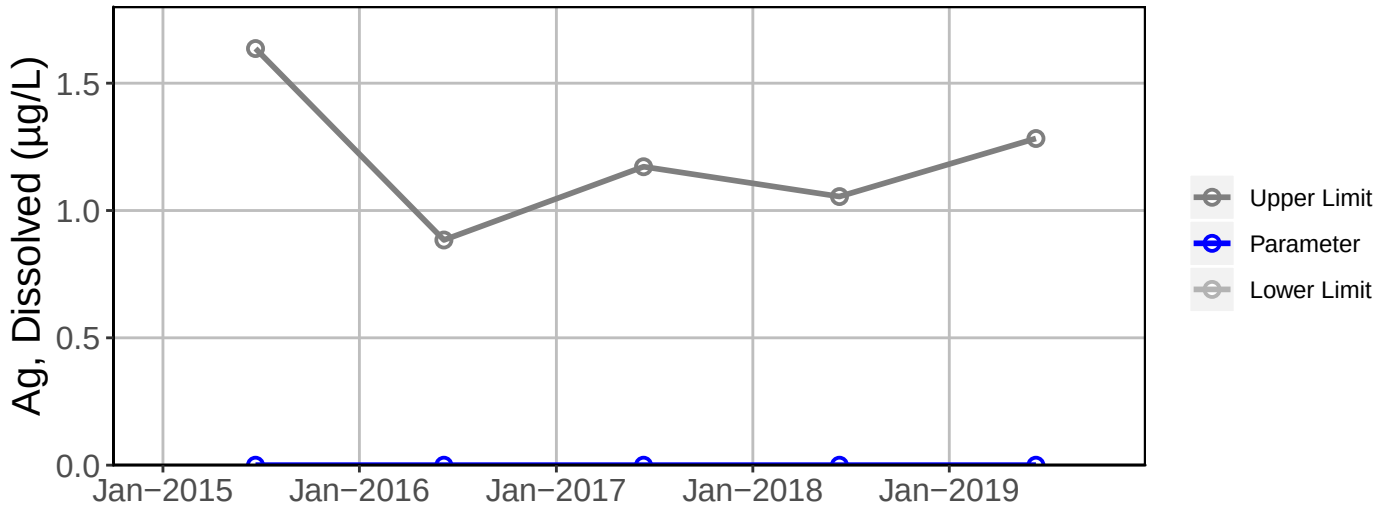


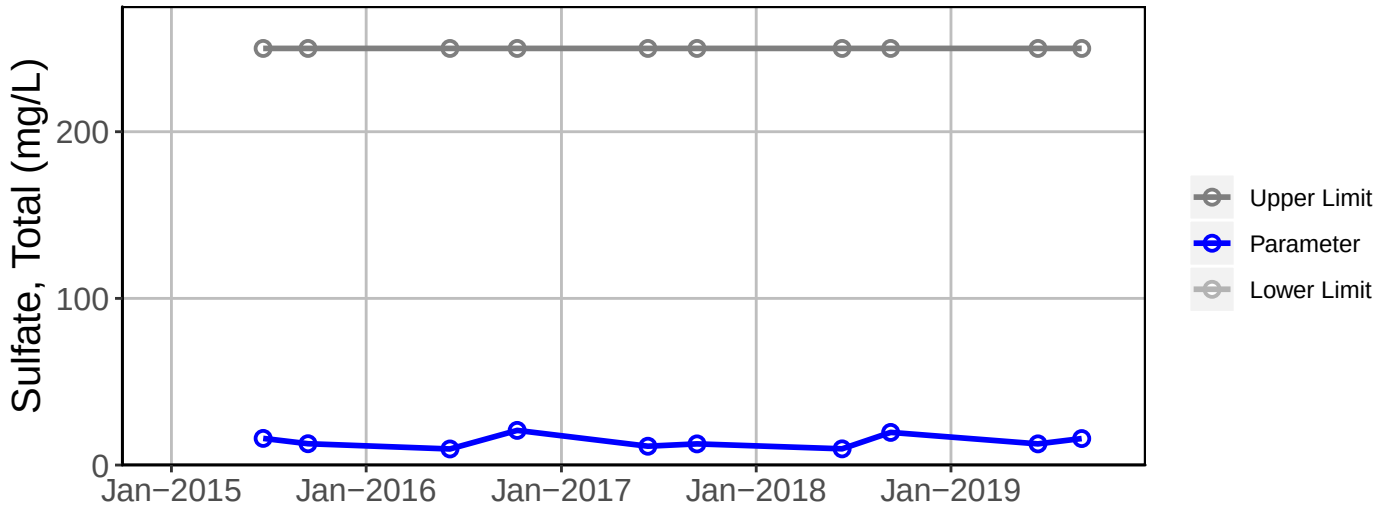




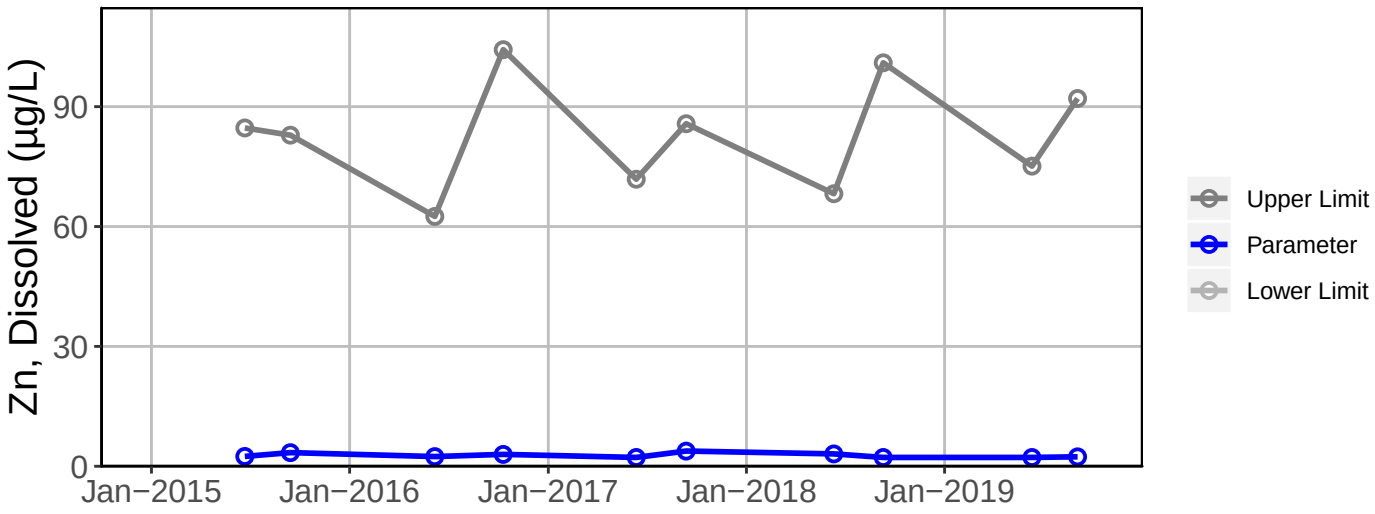
Site 711 Analyte Charts







Site 711 Analyte Charts



INTERPRETIVE REPORT
SITE 712

In the spring of Water Year 2014, sampling was initiated. This site was added to the FWMP at the request of the Forest Service. Site 712 is located on Greens Creek downgradient to any drainage from Site E, a waste rock disposal area.

The data collected during the current water year are listed in the following "Table of Results for Water Year 2019" report. The table includes all the required FWMP analyte data (field and laboratory) collected for the current water year and a series of flags keyed to the summary report "Qualified Data by QA Reviewer." The QA report lists any associated data limitations found during the monthly QA reviews of laboratory data for this site. Median values for all analytes have been calculated and are shown in the right-most column of the table of results. Any value reported as less than MDL has been replaced with a value of one-half of the MDL for the purpose of median calculation.

All data collected at this site for the past year is included in the data analyses. As shown in the table below, there were no data outliers.

Sample Date	Parameter	Value	Qualifier	Notes
No outliers, in the past six years, have been identified by HGCMC.				

The results for the current water year have been compared to the strictest freshwater quality criterion for each applicable analyte. No results exceeding these criteria were identified, as listed in the table below.

Table of Exceedance for Water Year 2019

			Limits		
Sample Date	Parameter	Value	Lower	Upper	Hardness
No exceedances have been identified by HGCMC for the period of October 2018 through September 2019.					

X-Y plots have been generated to graphically present the data for each of the analytes requested in the Statistical Information Goals for this site. These plots have been visually analyzed for the appearance of any trend in concentration. There were no noticeable trends.

Table of Results for Water Year 2019

Site 712FMS - 'Greens Creek Below Site E'

Sample Date/Parameter	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019	**Median**
Water Temp (°C)									7.8			10	8.9
Conductivity-Field(μmho)									123.8			147.6	135.7
Conductivity-Lab (μmho)									121			148	135
pH Lab (standard units)									7.68			6.64	7.16
pH Field (standard units)									7.54			7.87	7.71
Total Alkalinity (mg/L)									49.3			69.2	59.3
Total Sulfate (mg/L)									13.6			17	15.3
Hardness (mg/L)									59.3			76.5	67.9
Dissolved As (ug/L)									0.196			0.249	0.223
Dissolved Ba (ug/L)									33.4				33.4
Dissolved Cd (ug/L)									0.0272			0.0257	0.0265
Dissolved Cr (ug/L)									0.093				0.093
Dissolved Cu (ug/L)									0.305			0.62	0.463
Dissolved Pb (ug/L)									0.0062			0.0212	0.0137
Dissolved Ni (ug/L)									0.258				0.258
Dissolved Ag (ug/L)									0.002				0.002
Dissolved Zn (ug/L)									2.46			2.57	2.52
Dissolved Se (ug/L)									0.605				0.605
Dissolved Hg (ug/L)									0.000423			0.000956	0.000690

For individual sample/analyte qualifier descriptions see "Qualified Data by QA Reviewer" table.

Values reported as less than MDL are replaced by 1/2 MDL for median calculation purposes.

Shaded data has been qualified as an outlier by HGCMC and removed from any further analysis and is not included into the calculation of the median

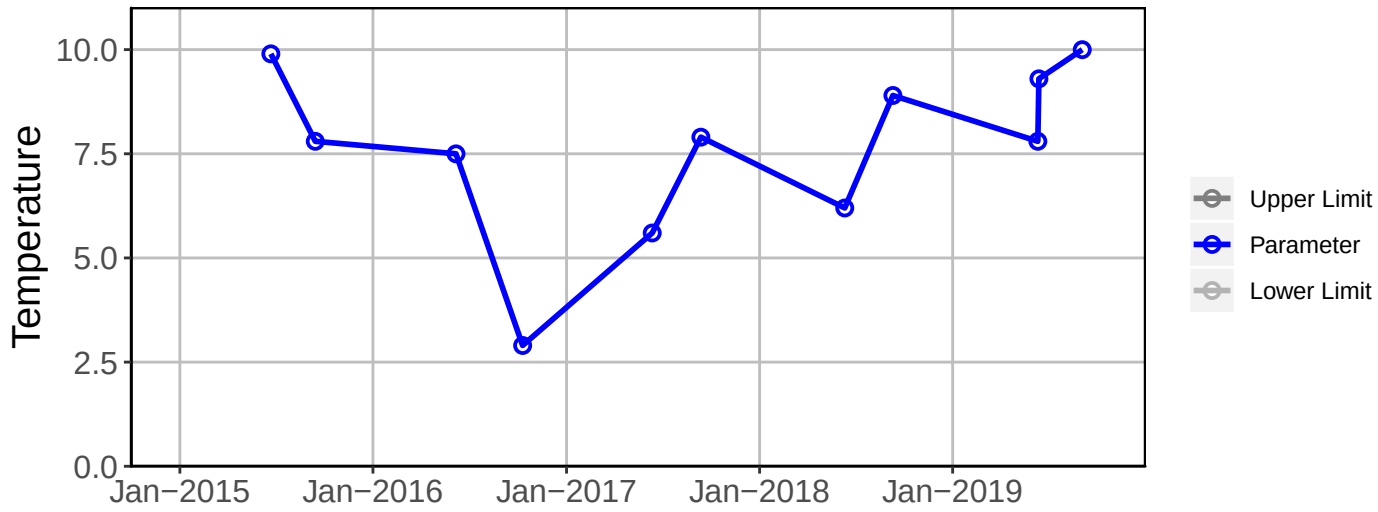
Qualified Data by QA Reviewer

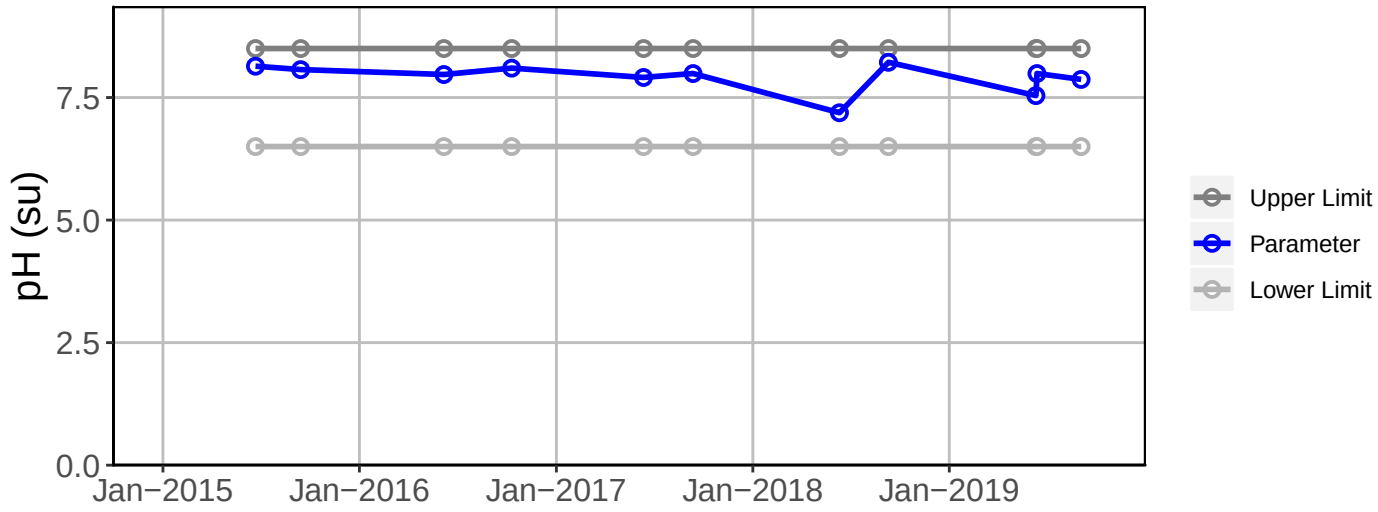
Date Range: 10/01/2018 to 09/30/2019

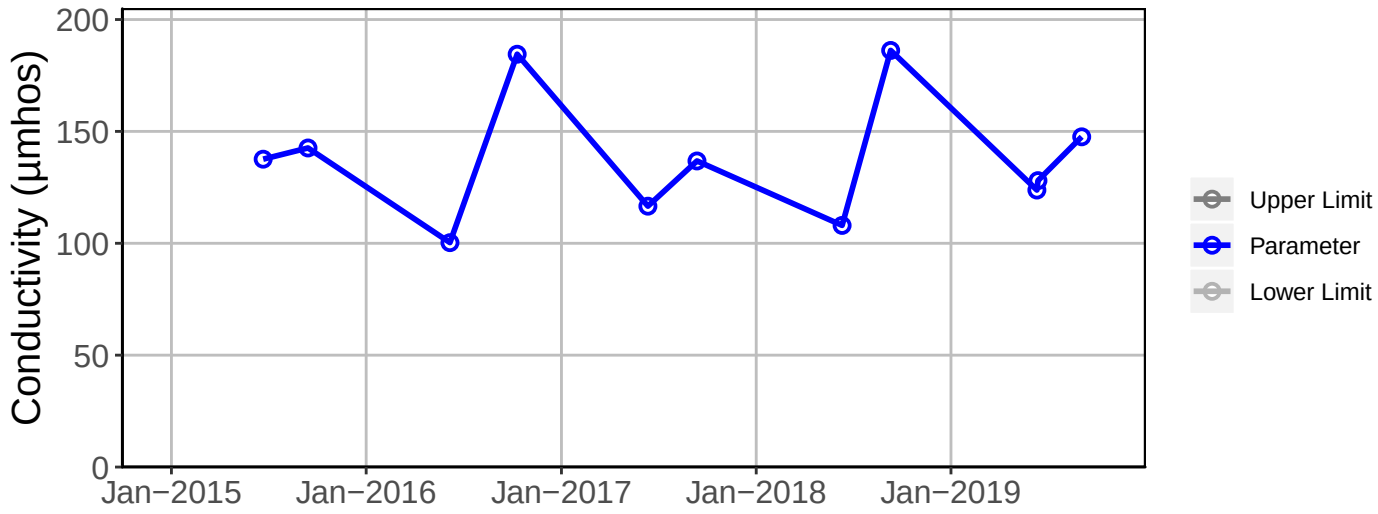
Site No.	Sample Date	Parameter	Value		Qualifier	Reason for Qualifier
712FMS	11-Jun-19	Diss. Cr-ICP/MS	0.09	µg/L	J	Below Quantitative Range
		Diss. Pb-ICP/MS	0.00618	µg/L	J	Below Quantitative Range
	3-Sep-19	Diss. Pb-ICP/MS	0.02	µg/L	U	Field Blank Contamination
		Total Sulfate	17	µg/L	J	Sample Receipt Temperature

Qualifier	Description
J	Positively Identified - Approximate Concentration
N	Presumptive Evidence for Tentative Identification
NJ	Tentatively Identified - Approximate Concentration
U	Not Detected Above Quantitation Limit
UJ	Not Detected Above Approximate Quantitation Limit

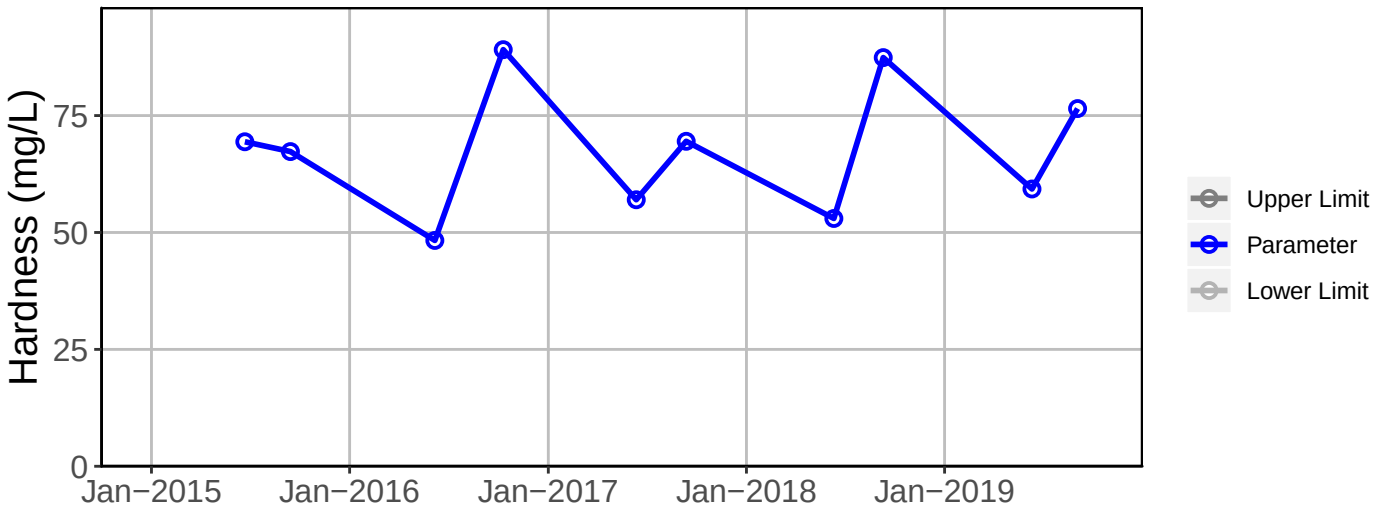
Site 712 Analyte Charts

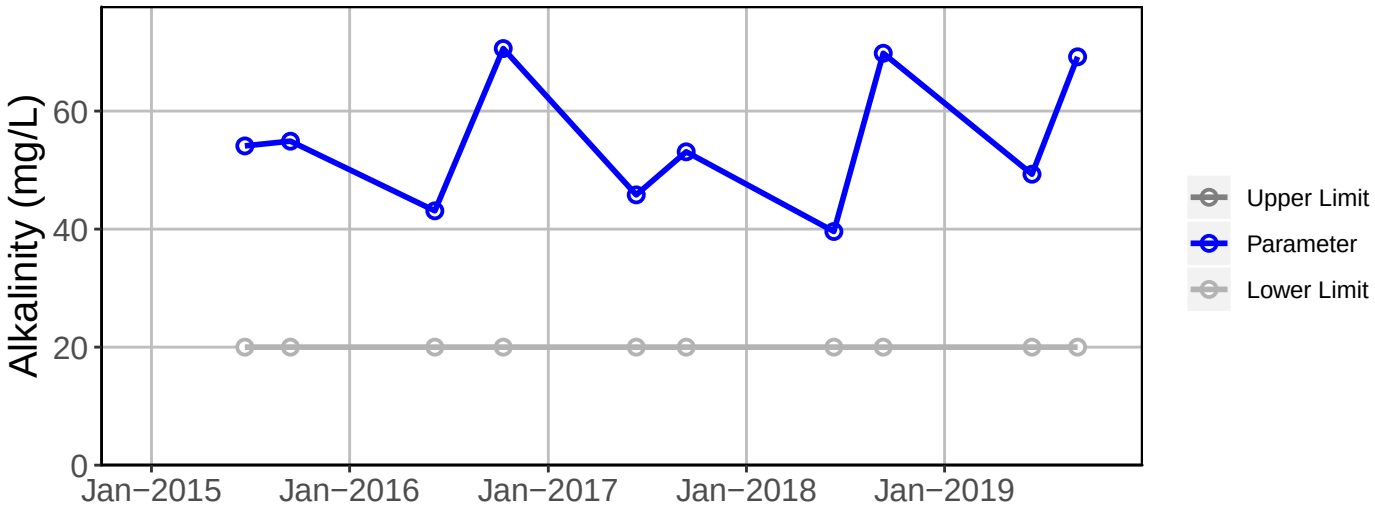


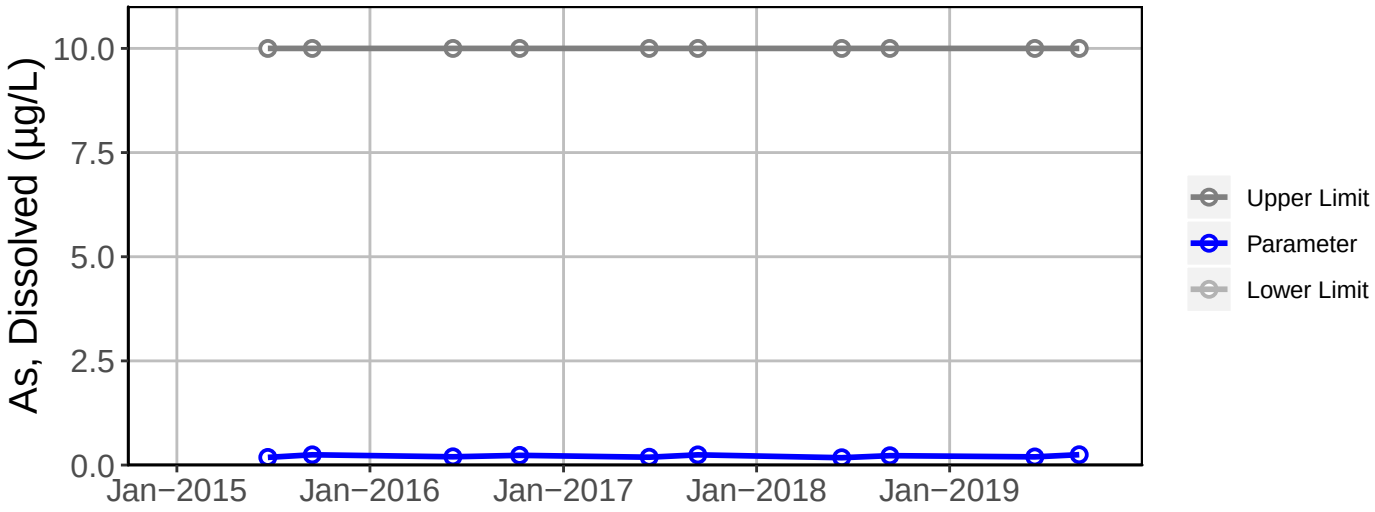




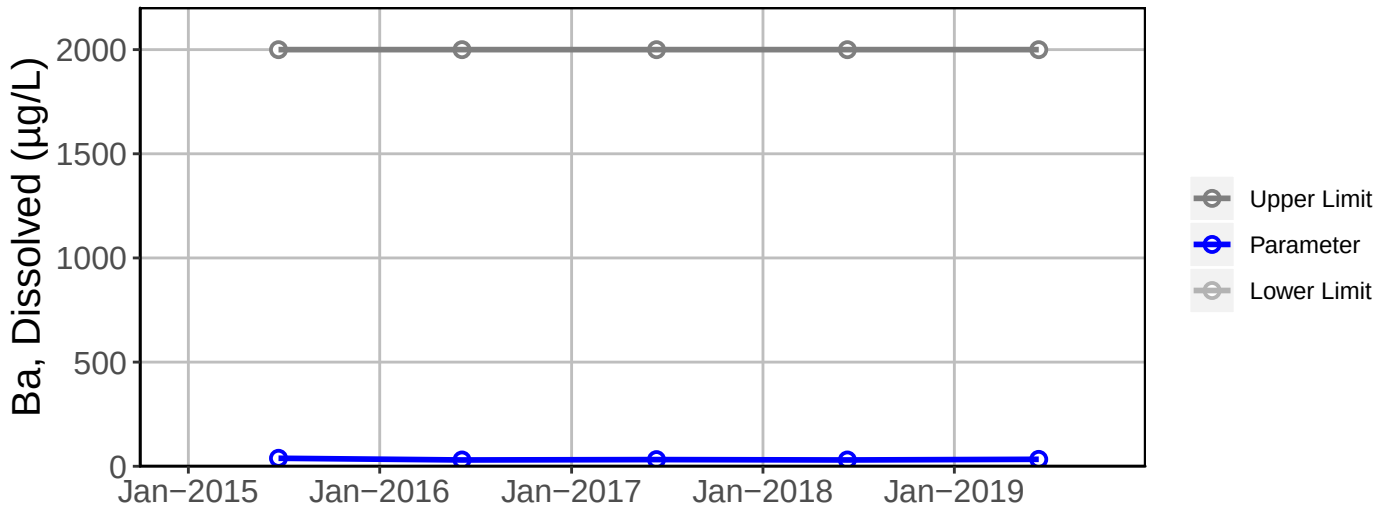
Site 712 Analyte Charts

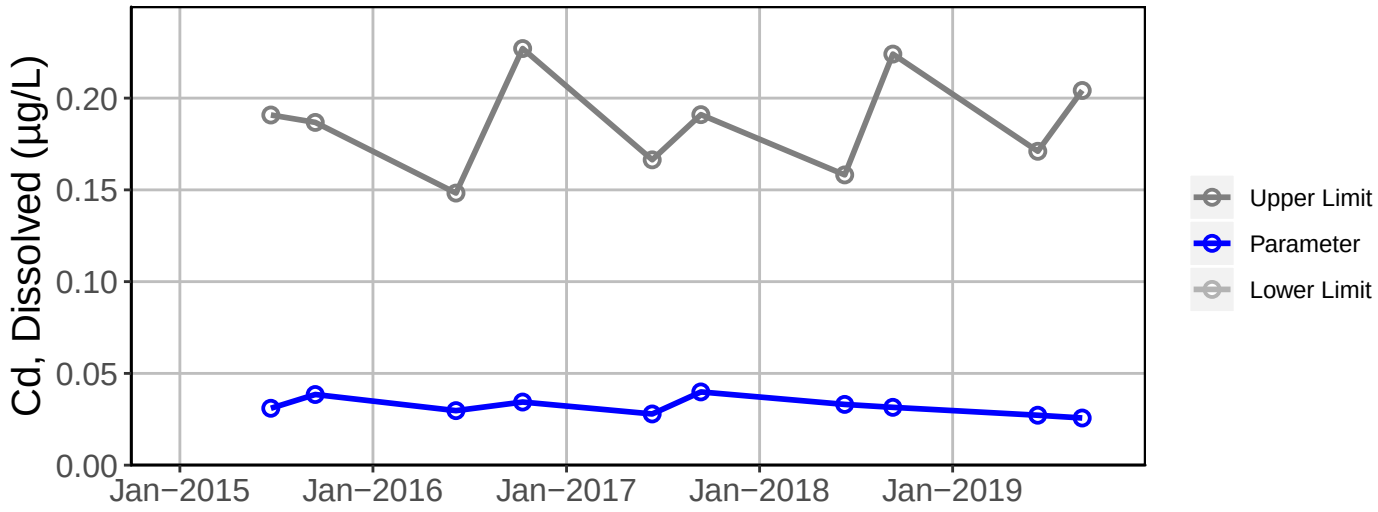


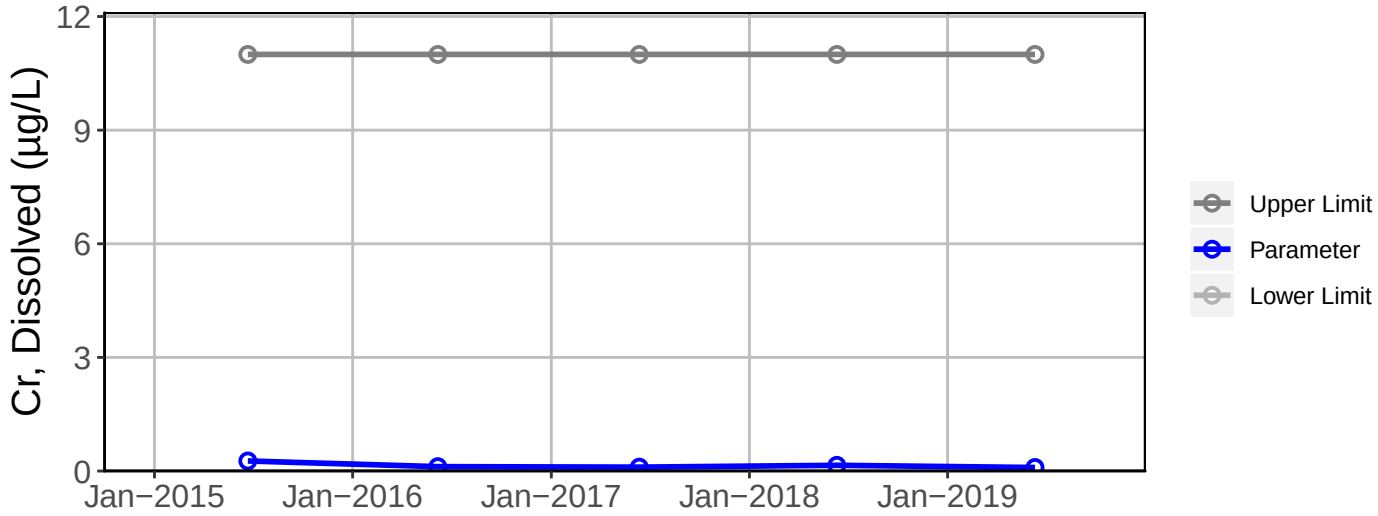




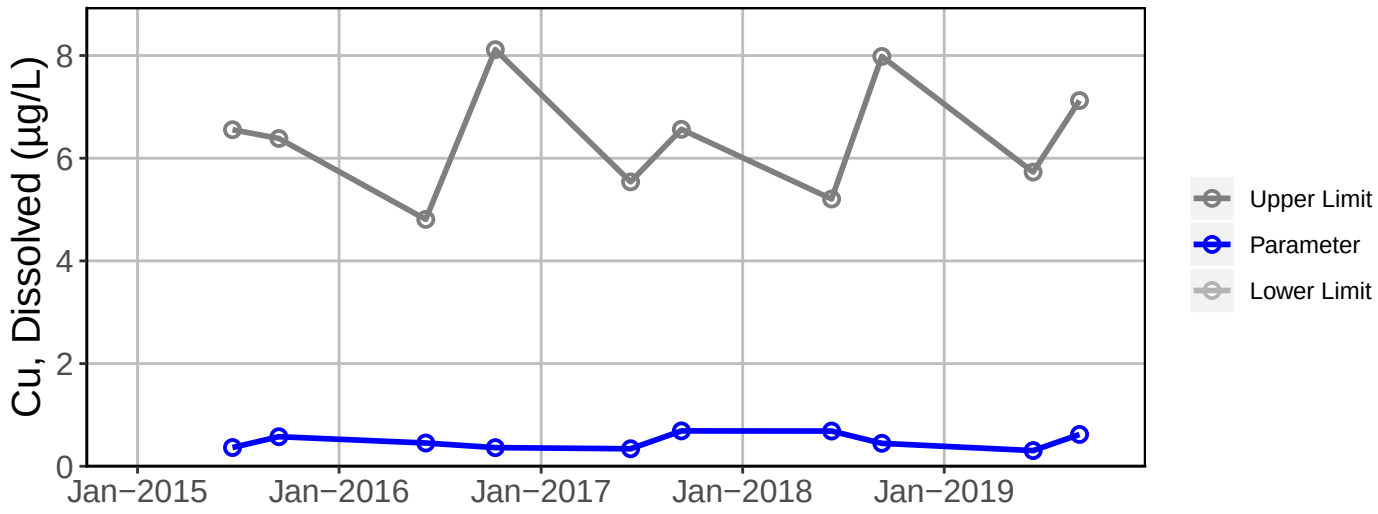
Site 712 Analyte Charts

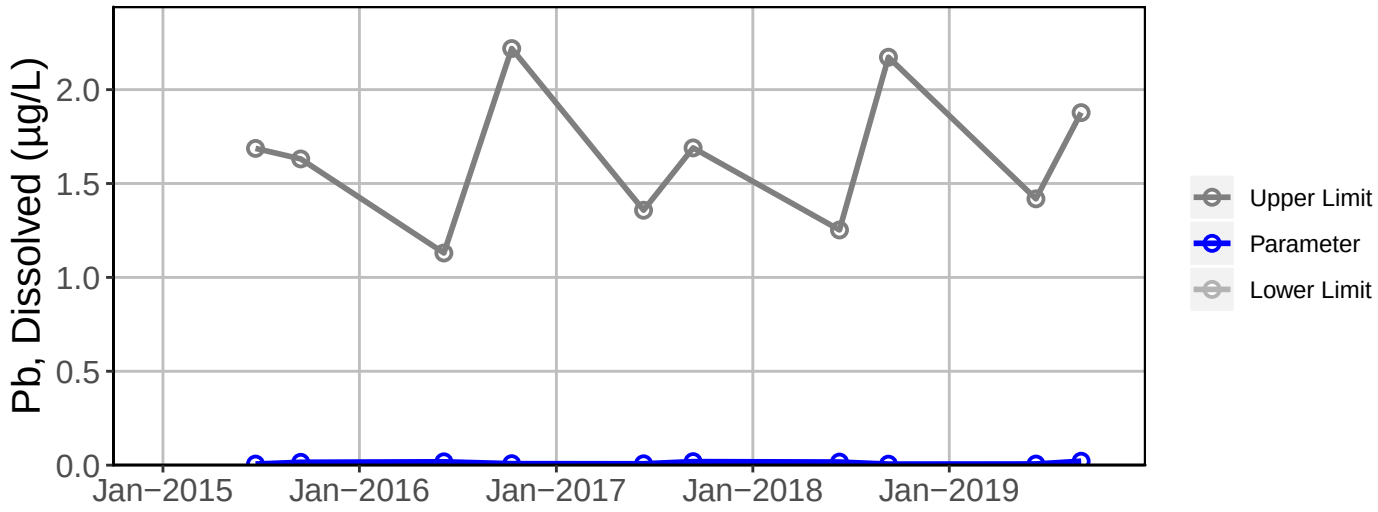


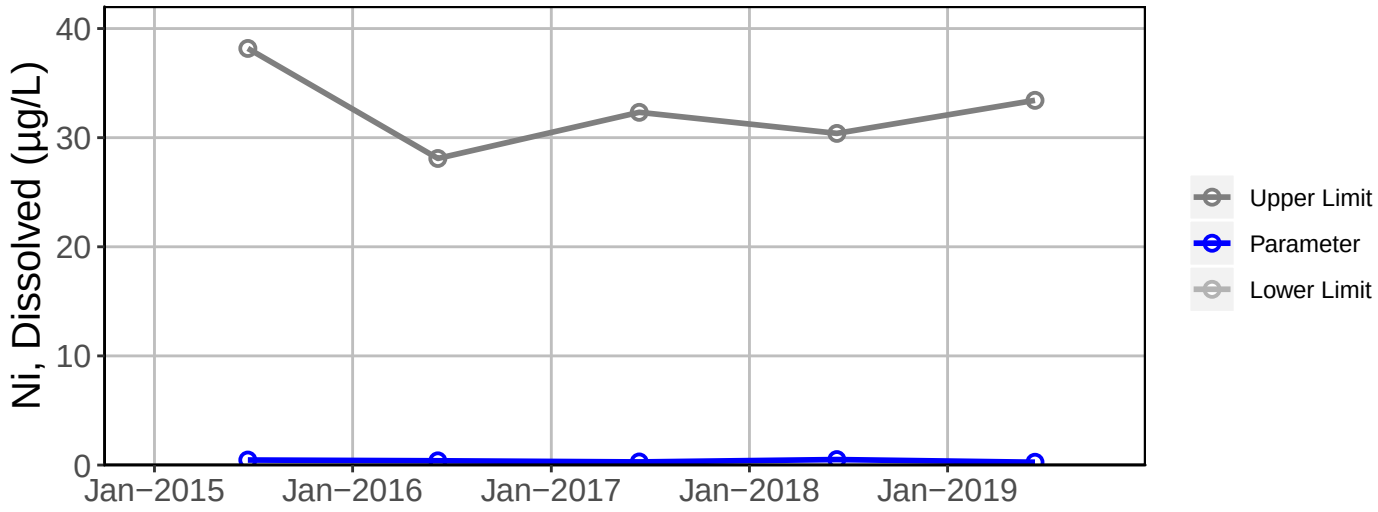




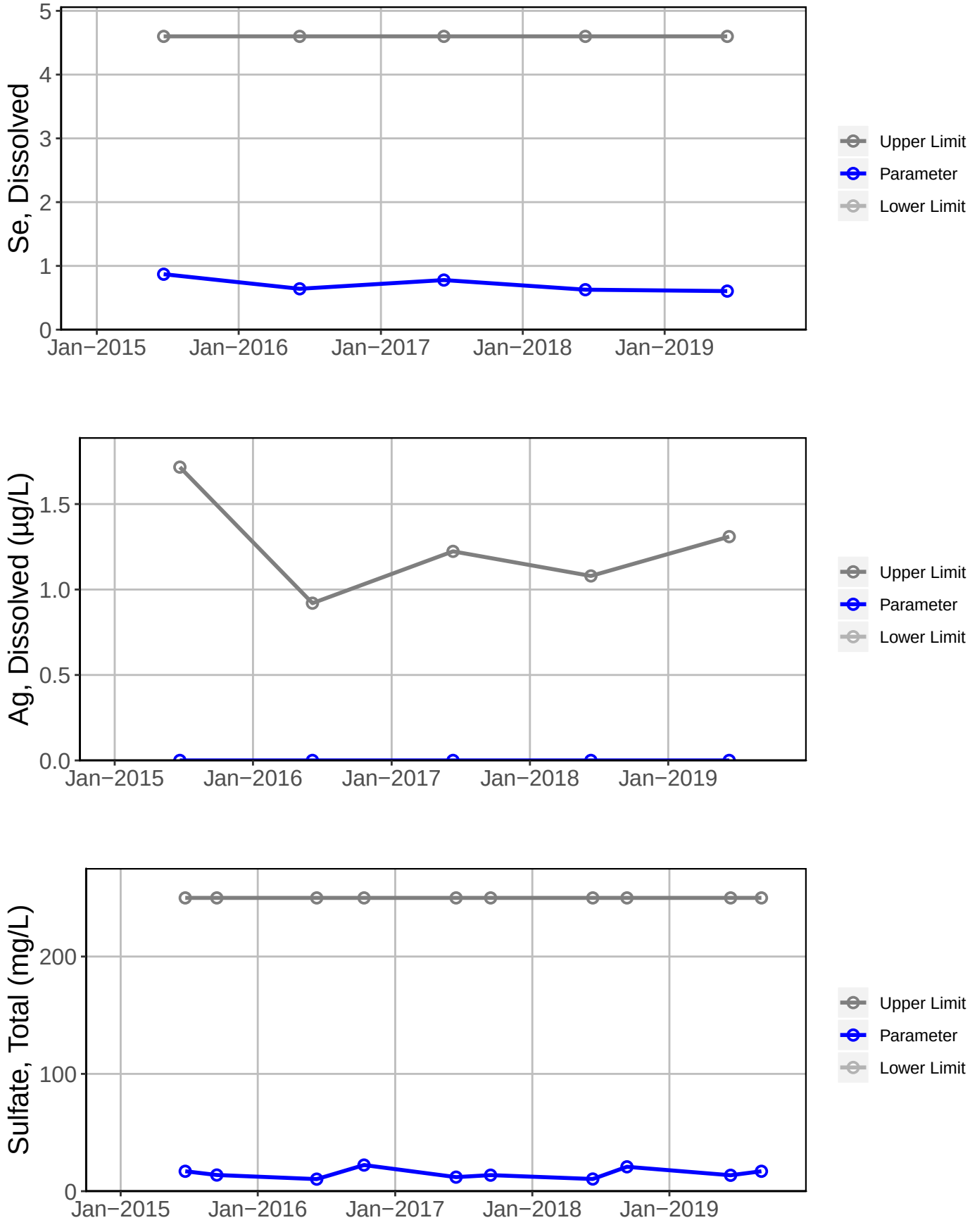
Site 712 Analyte Charts



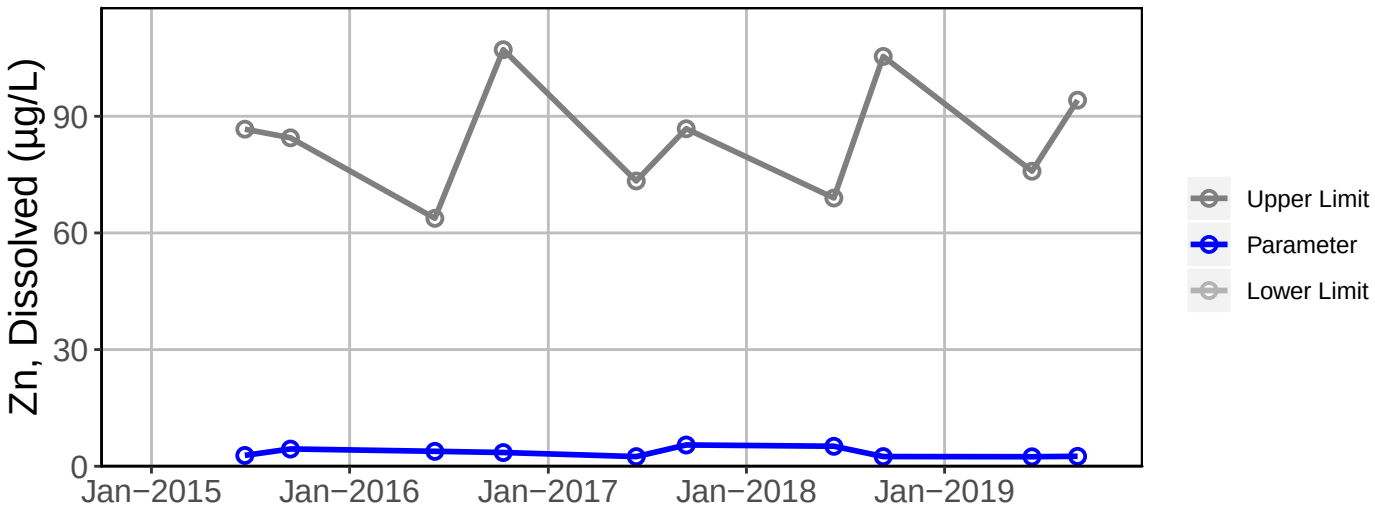




Site 712 Analyte Charts



Site 712 Analyte Charts



APPENDIX A

Parameter	Drinking Water	Stockwater	Irrigation Water	Aquatic Life-Fresh Water								Human Health Criteria for NonCarcinogens	
				Acute				Chronic				Water + Aquatic Organisms	Aquatic Organisms Only
				criteria	as	multilply by conversion factor	to convert to	criteria	as	multiply by conversion factor	to convert to		
alkalinity								**20,000 minimum**					
As	**10**	50	100	340	TR	1	D	150	TR	1	D		
Ba	**2,000**												
Cd	5	10	10	e^1.0166(ln hardness)-3.924	TR	1.136672-[(ln hardness)(0.041838)]	D	e^0.7409(ln hardness)-4.719	TR	1.101672-[(ln hardness)(0.041838)]	**D**		
Cr	100												
Cr(total)			100										
Cr(III)				e^0.819(ln hardness)+3.7256	TR	0.316	D	e^0.819(ln hardness)+0.6848	TR	0.860	D		
Cr(VI)		50		16	D			**11**	**D**				
Cu			200	e^0.9422(ln hardness)-1.700	TR	0.960	D	e^0.8545(ln hardness)-1.702	TR	**0.960**	**D**	1,300	
Pb		50	5,000	e^1.273(ln hardness)-1.460	TR	1.46203-[(ln hardness)(0.145712)]	D	e^1.273(ln hardness)-4.705	TR	1.46203-[(ln hardness)(0.145712)]	**D**		
Hg	2			1.4	D			**0.012**	TR			0.05	0.051
Ni	100		200	e^0.846(ln hardness)+2.255	TR	0.998	D	e^0.846(ln hardness)+0.0584	TR	0.997	D	610	4,600
Se	50	10	20	1/[([selenite]/185.9)+ ([selenate]/12.83]	TR	0.922	D	**5**	**TR**	**0.922**	**D**	170	11,000
Ag				**e^1.72(ln hardness)-6.52**	**TR**	**0.850**	**D**						
Zn			2,000	e^0.8473(ln hardness)+0.884	TR	0.978	D	e^0.8473(ln hardness)+0.884	TR	**0.986**	**D**	9,100	69,000

all units in micrograms per liter (ug/L)

DENOTES STRICTEST CRITERIA

TR total recoverable
D dissolved
H some of the criteria for this parameter are hardness dependant
FWA Fresh Water Acute
FWC Fresh Water Chronic

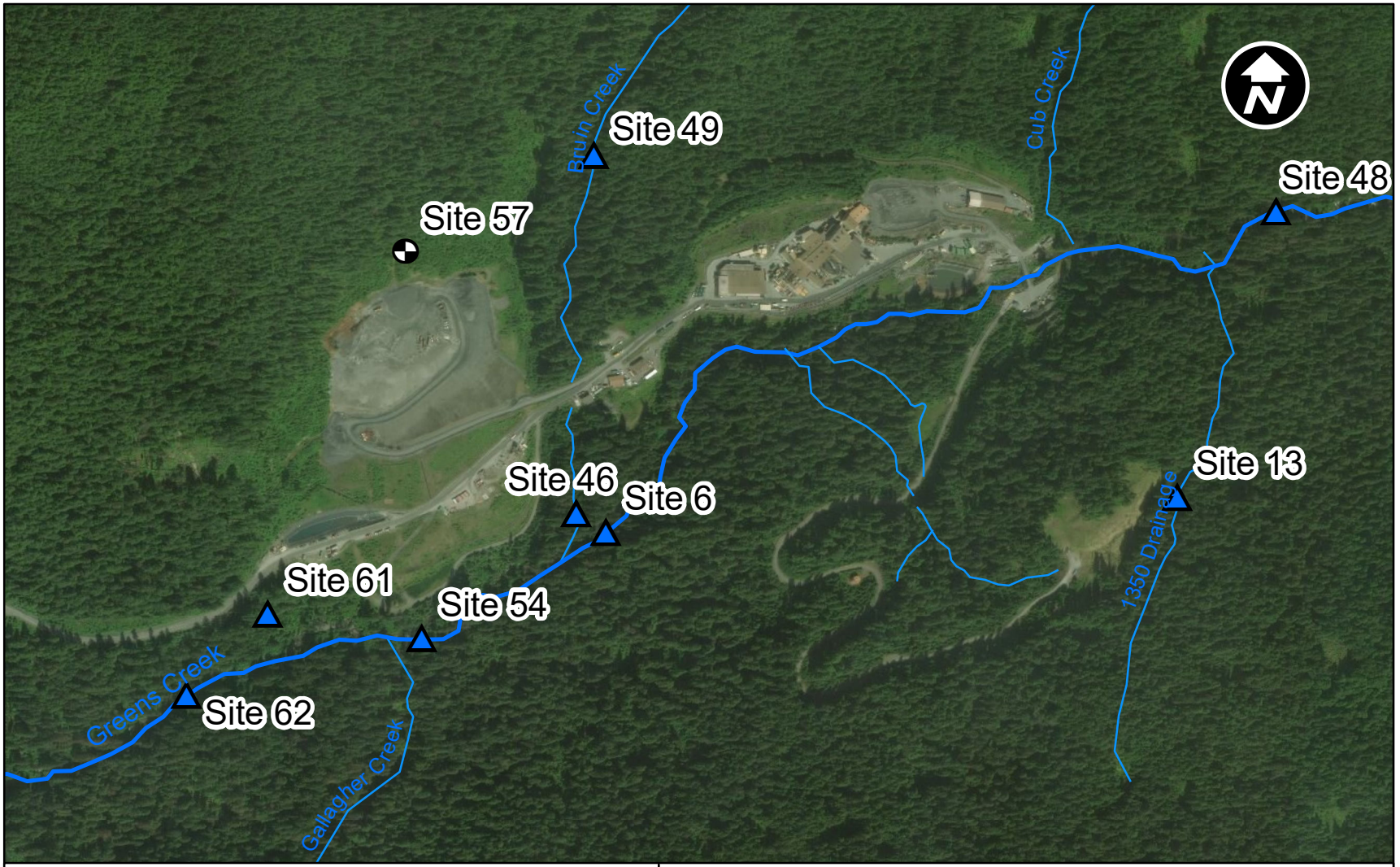
Source: http://www.dec.state.ak.us/water/wqsar/wqs/toxicsbook.xls

Table formatting was modified by HGCMC to include only parameters include in Suite P and Q and to highlight the strictest standard.

APPENDIX B

Map Sheets

Map 1-920 Area FWMP Sites
Map 2-Tailings Area FWMP Sites
Map 3-Site 9, Tributary Creek



Map 1
FWMP Sample Sites in the 920 Area

Map 2
FWMP Sample Sites in the Tailings Area


Site 609
Site 29
Site 32
Site 60
Site 27
Site 9
Tributary Ck
Tributary Ck
0 250 500 1,000 1,500 2,000
Feet
Map 3
FWMP Site 9
Monitoring Well
Surface Water