MCD
MIAMI CONSERVANCY DISTRICT

2019 Groundwater Quality Survey and Contaminant Trends

Study Report

MCD staff person showing University of Dayton students how to collect groundwater samples from a monitoring well in Clark County, Ohio

Executive Summary

MCD staff collected water samples from 12 monitoring wells located in the buried valley aquifer during the spring and fall of 2019. This is part of an ongoing groundwater quality characterization program started in 2014. The goal of the program is to provide a better understanding of human impact on and to identify trends related to groundwater quality. The samples were analyzed for the presence of E. coli, major ions, nutrients, and volatile organic compounds.

Overall, the results show that groundwater in the sampled wells has a calcium-magnesium-bicarbonate composition. All samples collected in this study had measured water hardness in the very hard range.

The samples met all applicable primary drinking water standards and health-based screening levels in the water collected from 10 of the 12 monitoring wells.

Parameters that exceeded a primary drinking water standard or human health benchmark in at least one groundwater sample included arsenic, iron and manganese. Parameters that exceeded secondary drinking water standards in at least one groundwater sample included iron, manganese, and total dissolved solids.

Parameters detected in one or more groundwater samples indicative of anthropogenic sources of contamination included nitrate, chloroform, trichloroethene, and the ions chloride and sodium. Naturally occurring contaminants included arsenic, iron, hardness, manganese, and total dissolved solids.

Trend analysis of anthropogenic contaminants show levels of trichloroethene in the one monitoring well where the compound was detected are declining. Nitrate concentrations in groundwater samples vary widely between monitoring wells. Monitoring wells with a history of elevated nitrate concentrations show seasonal as well as temporal fluctuations in nitrate. Concentrations of chloride and sodium also vary widely and show fluctuations in wells with a history of elevated concentrations. With the exception of one monitoring well, concentrations of naturally occurring contaminants such as arsenic, iron, and manganese, did not show strong evidence of increasing or decreasing trends.

The results of this study are consistent with the results of previous rounds of sampling as well as other studies which show that low levels of anthropogenic contaminants are not uncommon in sensitive, shallow sand and gravel aquifer settings. This emphasizes the need for groundwater protection to manage the quality of buried valley aquifer resources in southwest Ohio.

Introduction

Since 2014, MCD has engaged in an ongoing groundwater monitoring program in the Great Miami River Watershed. The purpose of the program is to provide a better understanding of human impact on groundwater quality. In 2019, MCD staff collected samples from 12 groundwater monitoring wells to survey groundwater quality in the buried valley aquifer (see Figure 1). All of the wells chosen for the study are surrounded by land uses with the potential to release contaminants into the aquifer.

The wells selected for the study are installed in unconfined sand and gravel aquifers with permeable soils at the surface. Seven of the wells are screened at shallow (< 50 feet) depths. Table 1 summarizes depths and screened intervals for all of the monitoring wells in this survey.

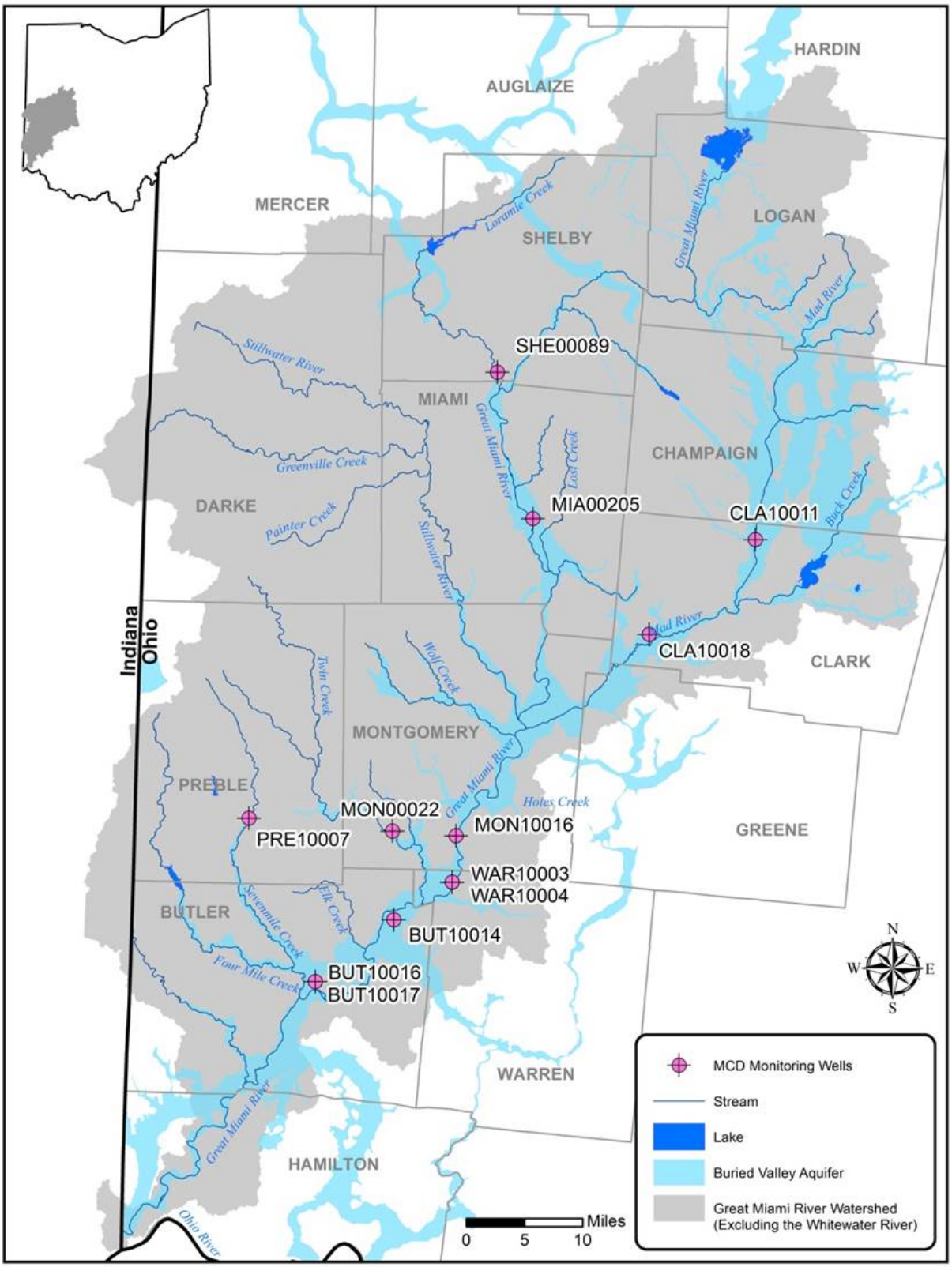
MCD equipped each monitoring well with a bladder pump installed within the screened interval of the well. The bladder pumps allow low-flow purging techniques to be used (Puls and Barcelona, 1996).

Samples were collected twice in 2019; once between May 16 and 29 (spring) and once between September 9 and 25 (fall). The water was analyzed for a range of parameters including E. coli, major ions, metals, nutrients, and volatile organic compounds (VOCs).

Table 1 – Construction details for groundwater quality monitoring wells

Monitoring Well ID	Casing Diameter (in)	Well Depth (ft)	Screened Interval (ft)	Aquifer Screened
BUT10014	2	40	35 - 40	Sand and Gravel
BUT10016	2	65	60 - 65	Sand and Gravel
BUT10017	2	39	34 - 39	Sand and Gravel
CLA10011	2	60	55 - 60	Sand and Gravel
CLA10018	2	16	11 - 16	Sand and Gravel
MIA00205	2	24	19 - 24	Sand and Gravel
MON00022	2	15	10 - 15	Sand and Gravel
MON10016	2	108	88 - 108	Sand and Gravel
PRE10007	2	60	40 - 60	Sand and Gravel
SHE00089	2	43	38 - 43	Sand and Gravel
WAR10003	2	67	62 - 67	Sand and Gravel
WAR10004	2	32.5	27.5 – 32.5	Sand and Gravel

Figure 1 – Locations of monitoring wells



Duplicate samples were also collected from one monitoring well during each sampling event to evaluate laboratory precision. Field blanks were collected to assess potential contamination from field conditions during sampling.

The results of this study were compared with federal drinking water standards and health-based screening levels. Drinking water standards are generally more stringent than other water standards, so when groundwater meets drinking water standards it should be suitable for other uses.

National Primary Drinking Water Regulations for parameters are legally enforceable standards set by the U.S. EPA that apply to public water systems. Primary standards set maximum contaminant levels (MCLs) that help protect public health by limiting the contaminant levels in drinking water. National Secondary Drinking Water Standards are advisable guidelines addressing secondary maximum contaminant levels (SMCLs) that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. The U.S. EPA recommends, but does not require, that public water systems incorporate secondary standards. The U.S. EPA Office of Water also publishes non enforceable health-based screening levels (HBSLs) for some constituents which may pose potential human-health concerns but do not yet have an enforceable standard. HBSLs are used as a supplement for evaluating contaminants in drinking water in a human-health context.

2019 Results

Analysis of major ions (cations and anions) in groundwater samples show the dominant cation is calcium with significant quantities of magnesium and sodium also present. The average calcium concentration of groundwater samples was 110 mg/L. The dominant anion was bicarbonate with lesser amounts of chloride and sulfate. The bicarbonate content was estimated using alkalinity and pH measurements for each sample. The average bicarbonate concentration in groundwater samples was 340 mg/L. A piper diagram of major cations and anions shows the groundwater is a calcium bicarbonate type of water (see Figure 2). Calcium bicarbonate groundwater tends to be present in areas where carbonate rocks comprise a significant amount of the aquifer matrix.

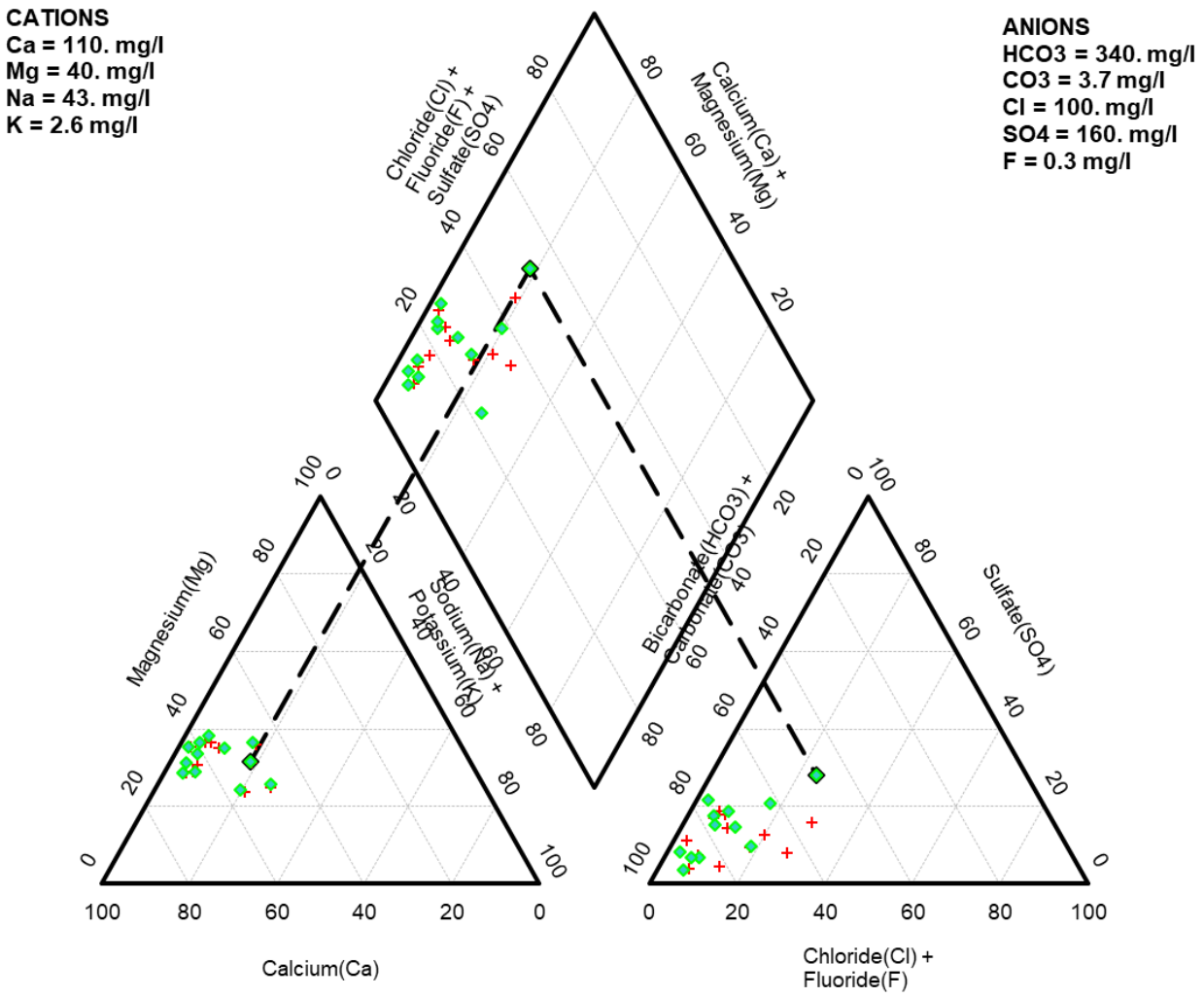
The samples collected at 10 of the 12 monitoring wells met all human health-based drinking water standards including MCLs and HBSLs for both sampling events (see Table 2). See Appendix A for a complete list of all analytical results.

Arsenic, iron, and manganese were the only parameters detected at concentrations exceeding human-health-based drinking water standards in 2019. Arsenic has an MCL while iron and manganese have health-based screening levels (HBSLs) as well as secondary maximum contaminant levels (SMCLs).

The groundwater sample collected in the spring from monitoring well BUT10016 exceeded the HBSL for manganese of 0.3 mg/L. However, manganese levels in the fall sample fell below the HBSL. The arsenic concentration in the spring groundwater sample collected from monitoring well PRE10007 exceeded the MCL of 10 µg/L. Iron concentrations in both the spring and fall groundwater samples collected from monitoring well PRE10007 exceeded the HBSL of 4 mg/L.

There were no other detections of parameters exceeding any human-health-based drinking water standards in groundwater samples collected in 2019.

Figure 2 – Piper diagram showing dominant cations, anions, and water type of samples



At least one parameter exceeded an SMCL in samples collected from 7 of the 12 monitoring wells for the spring event and 8 of the 12 wells for the fall event (see Table 2). Parameters present at concentrations exceeding SMCLs included iron, manganese, and total dissolved solids. There were also detections of parameters at concentrations that reflect anthropogenic sources of contaminants but did not exceed any regulatory standards. These contaminants include chloride,

sodium, and nitrate. Chloride and sodium are present in groundwater naturally, but human activities can elevate their concentration well above natural levels. Likewise, nitrogen in the form of nitrate can be present in groundwater at low concentrations naturally, but anthropogenic sources of nitrogen can elevate nitrate concentrations in groundwater above natural levels.

Contaminants Indicative of Anthropogenic Sources

Trichloroethene (TCE)
TCE is a volatile organic compound used primarily to remove grease from fabricated metal parts. The MCL for trichloroethene is 5 µg/L. TCE was detected in the spring groundwater sample collected from monitoring well BUT10014 at a concentration of 1.1 µg/L. It was also detected in the fall groundwater sample at a concentration of 1.3 µg/L. Well BUT10014 is located at Smith Park in Middletown close to the former Aeronca Air Products site, a site which underwent environmental cleanup activities (Robinson and Richter, 2012). A TCE contaminant plume is present in the aquifer south of the site. The City of Middletown and Ohio EPA have been tracking the extent of the TCE contamination in recent years (Joe Smindak, Ohio Environmental Protection Agency, personal communication, September 8, 2017).

Chloroform
Chloroform is a volatile organic compound often used in the manufacturing process for refrigerants. The compound is a trihalomethane (THM) and can be produced during chlorination of water as a disinfection byproduct. The MCL for chloroform is 80 µg/L. Chloroform was detected in the spring and fall groundwater samples collected from monitoring well BUT10014 at concentrations of 1.6 and 2.5 µg/L respectively. Chloroform was not detected in any groundwater samples previously. Its source is unknown.

Nitrate
Nitrate concentrations did not exceed the MCL of 10 mg/L in any of the groundwater samples collected in 2019. According to Madison and Brunett (1985), nitrate concentrations in excess of 3.0 mg/L in groundwater are often indicative of anthropogenic sources. Nitrate concentrations measured in groundwater samples during the spring sampling event from monitoring wells BUT10017, CLA10018, and MIA00205 exceeded 3.0 mg/L. Nitrate concentrations above 3.0 mg/L also occurred in the fall samples collected from the same three monitoring wells. Common sources of nitrates in groundwater include fertilizers, domestic or municipal wastewater, and animal waste or manure applied as fertilizer.

Chloride and Sodium
Chloride has an SMCL of 250 mg/L. There are no drinking water benchmarks for sodium. Background levels of chloride in the buried valley aquifer system typically do not exceed 50 mg/L (Spieker, 1968), and (Debrewer et al, 2000). Kunz and Sroka (2004) reported mean background concentrations of chloride ranging from 13 to 23 mg/L in shallow unconsolidated aquifers in Champaign, Clark, and Pickaway counties in Ohio. Chloride concentrations above 70 mg/L and sodium concentrations above 43 mg/L in local sand and gravel aquifers likely reflect anthropogenic sources (Kunz and Sroka, 2004, Ohio EPA, 2015). These concentrations are

Table 2 – Summary of significant detections of constituents in groundwater

Spring 2019		Benchmark		Sample Sites					
Parameter	**Units**	**Type**	**Value**	**BUT10014**	**BUT10016**	**BUT10017**	**CLA10011**	**CLA10018**	**MIA00205**
Chloride	mg/L	SMCL	250						
Nitrogen, Nitrate	mg/L	MCL	10	3.4		5.6		8.4	3.9
Arsenic	µg/L	MCL	10		5.9		7.1		
Iron	mg/L	HBSL, SMCL	4, 0.3		**1.69**		**3.21**		
Manganese	mg/L	HBSL, SMCL	0.3, 0.05		**0.40**		**0.067**		**0.090**
Sodium	mg/L	-	-						
Total Dissolved Solids	mg/L	SMCL	500				**502**		
Total Hardness	mg/L	-	-	339	307	298	463	350	386
Chloroform	µg/L	MCL	80	1.6					
Trichloroethene	µg/L	MCL	5	1.1					

Spring 2019		Benchmark		Sample Sites					
Parameter	**Units**	**Type**	**Value**	**MON00022**	**MON10016**	**PRE10007**	**SHE00089**	**WAR10003**	**WAR10004**
Chloride	mg/L	SMCL	250					103	
Nitrogen, Nitrate	mg/L	MCL	10						
Arsenic	µg/L	MCL	10			**33.2**		2.1	
Iron	mg/L	HBSL, SMCL	4, 0.3		**0.46**	**22.70**		**2.19**	
Manganese	mg/L	HBSL, SMCL	0.3, 0.05		**0.088**		**0.283**	**0.062**	
Sodium	mg/L	-	-		51.7				
Total Dissolved Solids	mg/L	SMCL	500					**566**	
Total Hardness	mg/L	-	-	402	325	379	412	428	288
Chloroform	µg/L	MCL	80						
Trichloroethene	µg/L	MCL	5						

Table 2 – Summary of significant detections of constituents in groundwater continued

Fall 2019		Benchmark		Sample Sites					
Parameter	**Units**	**Type**	**Value**	**BUT10014**	**BUT10016**	**BUT10017**	**CLA10011**	**CLA10018**	**MIA00205**
Chloride	mg/L	SMCL	250						
Nitrogen, Nitrate	mg/L	MCL	10			4.9		8.0	5.0
Arsenic	µg/L	MCL	10		4.6		5.7		
Iron	mg/L	HBSL,SMCL	4, 0.3		**1.66**		**3.12**		
Manganese	mg/L	HBSL, SMCL	0.3, 0.05		**0.403**		**0.066**		**0.091**
Sodium	mg/L	-	-						
Total Dissolved Solids	mg/L	SMCL	500						
Total Hardness	mg/L	-	-	306	293	310	434	361	346
Chloroform	µg/L	MCL	80	2.5					
Trichloroethene	µg/L	MCL	5	1.3					

Fall 2019		Benchmark		Sample Sites					
Parameter	**Units**	**Type**	**Value**	**MON00022**	**MON10016**	**PRE10007**	**SHE00089**	**WAR10003**	**WAR10004**
Chloride	mg/L	SMCL	250		87.5			108	
Nitrogen, Nitrate	mg/L	MCL	10						
Arsenic	µg/L	MCL	10			9.9			
Iron	mg/L	HBSL, SMCL	4, 0.3			**5.31**		**2.00**	
Manganese	mg/L	HBSL, SMCL	0.3, 0.05		**0.083**		**0.255**	**0.059**	
Sodium	mg/L	-	-		50.7				
Total Dissolved Solids	mg/L	SMCL	500	**586**				**606**	
Total Hardness	mg/L	-	-	475	319	354	335	402	252
Chloroform	µg/L	MCL	80						
Trichloroethene	µg/L	MCL	5						

MCL – Maximum Contaminant Level set by USPEA
SMCL – Secondary Maximum Contaminant Level set by USEPA
HBSL – Non enforceable Health Based Screening Level based on (1) latest USEPA Office of Water policies for establishing drinking water benchmarks and (2) most recent USEPA peer reviewed toxicity information
Numbers in bold exceed a benchmark

higher than what is typically measured in groundwater samples collected from sand and gravel aquifers in Ohio (Ohio EPA, 2015). Chloride concentrations measured in groundwater samples from monitoring wells MON10016 and WAR10003 exceeded 70 mg/L in at least one sampling event and likely reflect anthropogenic sources. Sodium concentrations in groundwater samples from monitoring well MON10016 exceeded 43 mg/L for both sampling events and also likely reflect anthropogenic sources. Anthropogenic sources of chloride and sodium include road salt applications for deicing and private and municipal wastewater from homes with water softeners.

Naturally Occurring Contaminants

Arsenic

Arsenic occurs naturally in regional groundwater and concentrations of arsenic are largely controlled by redox conditions. The dominant mechanism for moving arsenic into groundwater is thought to be the release of arsenic from iron oxides in the aquifer under reducing conditions (Thomas et al, 2008). The MCL for arsenic is 10 µg/L. Spring and fall groundwater samples collected from monitoring wells BUT10016, CLA10011, and PRE10007 had detectable concentrations of arsenic. The spring groundwater sample collected from monitoring well WAR10003 also had measurable arsenic. The concentration of arsenic measured in the spring groundwater sample collected from monitoring well PRE10007 exceeded the MCL. It should be noted that groundwater samples from all four of these wells had elevated levels of iron and low levels of dissolved oxygen, which indicates reducing conditions present in the aquifer zone in which the wells were screened.

Nuisance Contaminants

Hardness, iron, manganese, and total dissolved solids are generally considered to be "nuisance" contaminants. These contaminants are present naturally in groundwater from the buried valley aquifer system. Their presence does not typically pose a health threat. Nevertheless, they can have adverse aesthetic impacts that cause water to appear cloudy or colored. They can also adversely impact plumbing fixtures, stain laundry, and cause taste and odor issues. At high enough concentrations iron and manganese may pose health concerns, and in 2014 the United State Geological Survey (USGS) established HBSLs for both parameters in its National Water Quality Assessment Program.

Hardness is a measure of the amount of dissolved calcium and magnesium in a water sample. When the hardness value exceeds 180 mg/L the water is considered to be very hard. All groundwater samples collected in 2019 had hardness values exceeding 180 mg/L. There is no SMCL for water hardness.

The SMCL for Iron is 0.3 mg/L. Iron concentrations measured in samples collected from monitoring wells BUT10016, CLA10011, MON10016, PRE10007, and WAR10003 exceeded this standard in at least one of the sampling events. The HBSL for iron is 4 mg/L and both groundwater samples collected from monitoring well PRE10007 exceeded this standard in 2019.

The SMCL for manganese is 0.05 mg/L. Manganese concentrations in groundwater samples collected during both sampling events from monitoring wells BUT10016, CLA10011, MIA00205, MON10016, SHE00089, and WAR10003 exceeded this standard. Manganese also

has a HBSL of 0.3 mg/L. Manganese concentrations in groundwater samples collected during both sampling events from well BUT10016 exceeded this standard.

Total dissolved solids (TDS) are comprised of inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulfates). TDS is the sum of cations and anions in a water sample. The SMCL for TDS is 500 mg/L. Groundwater samples collected from wells CLA10011, MON00022, and WAR10003 exceeded this standard in at least one of the two sampling events.

Contaminant Trends

Groundwater quality data collected from MCD's network of 12 monitoring wells was examined for trends in contaminant concentrations. Groundwater quality monitoring has been conducted by MCD staff twice per year since 2014 at monitoring wells BUT10014, BUT10016, CLA10018, and MON10016. The other eight monitoring wells have been sampled since 2015 or 2016. The chemical parameters TCE, nitrate, chloride, and sodium were selected for analysis as parameters indicative of anthropogenic sources. The parameters arsenic, iron, and manganese were selected to examine trends in naturally occurring contaminant concentrations.

Contaminants Indicative of Anthropogenic Sources

Trichloroethene (TCE)
Since 2014, concentrations of TCE in groundwater samples from monitoring well BUT10014 are trending downward (see figure 3). TCE in the fall 2018 sample was below the detection limit of 1 µg/L and also below the MCL for the first time since sampling began. Groundwater concentrations measured in 2019 were above the detection limit but remained below the MCL.

Nitrate
Nitrate concentrations measured at monitoring wells CLA10018 and BUT10017 consistently exceed 3 mg/L and likely reflect anthropogenic sources of nitrate to the aquifer screened by those wells (see figure 4). Concentrations of nitrate in groundwater samples from monitoring well CLA10018 declined slightly from those measured in 2018. Concentrations of nitrate in groundwater samples collected from monitoring well BUT10017 appear to be trending downward when compared with previous results. Nitrate concentrations measured in groundwater samples from monitoring well MIA00205 have been above 3 mg/L for the past three sampling events suggesting anthropogenic sources of nitrate are impacting the aquifer at that well location.

Chloride and Sodium
Chloride concentrations measured in samples collected from monitoring wells MON10016 and WAR10003 are consistently higher than 70 mg/L and above the concentrations measured in samples from the other monitoring wells (see figure 5). Chloride concentrations in samples show fluctuations from sampling event to sampling event. Likewise, sodium concentrations measured in the two wells remain above concentrations measured at other monitoring wells (see figure 6). Sodium concentrations show similar fluctuations as chloride. Seasonal fluctuations in chloride and sodium are often more pronounced in wells with the highest concentrations of those

parameters. These fluctuations may reflect infiltration of saline water from snow melt and rainfall events after seasonal applications of road salt.

Figure 3 – TCE concentrations in monitoring well BUT10014

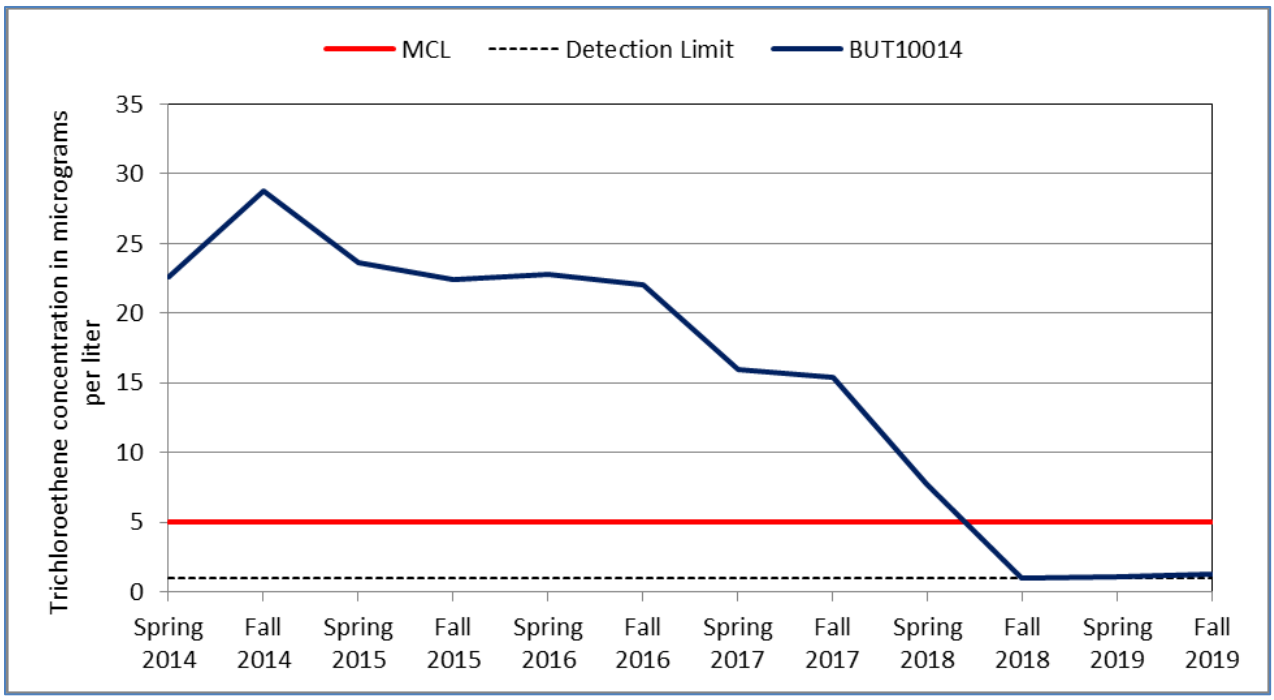
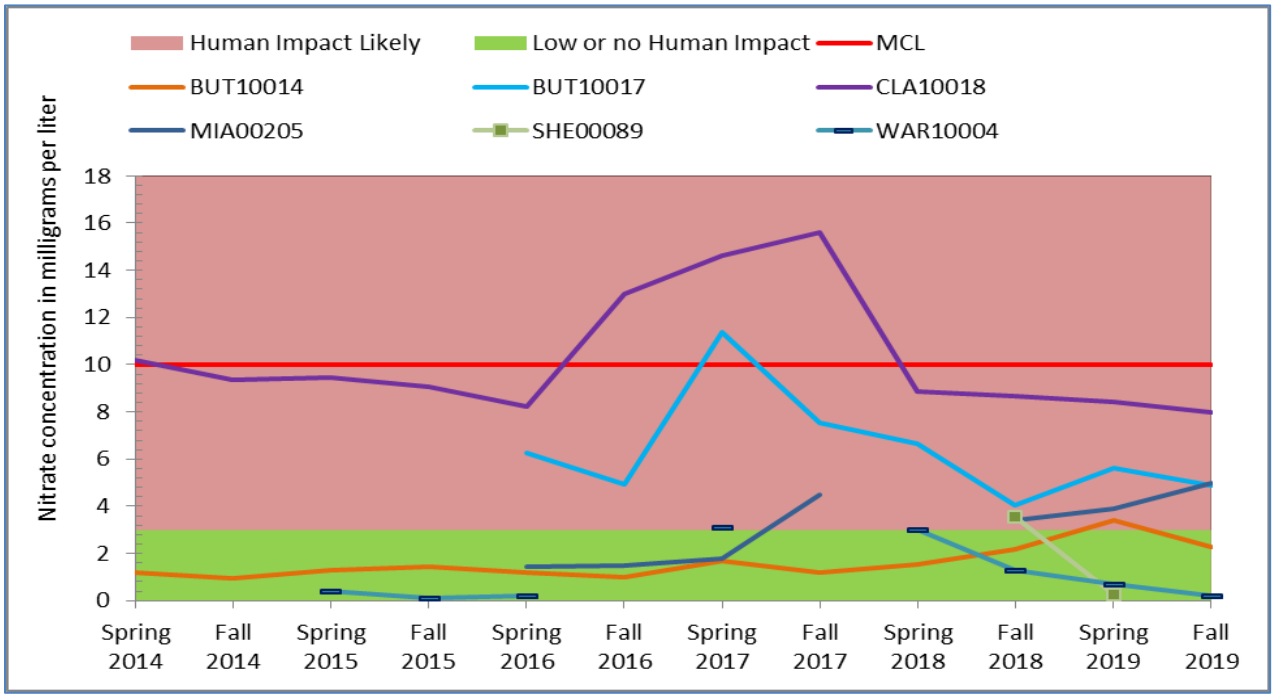


Figure 4 – Nitrate concentrations in monitoring wells



Naturally Occurring Contaminants

Arsenic

Arsenic was detected in groundwater samples collected from monitoring wells BUT10016, CLA10011, and PRE10007 (see figure 7). The arsenic concentration (33.2 µg/L) measured during the spring sampling event from monitoring well PRE10007 exceeded the drinking water MCL of 10 µg/L. This measurement reflects a large increase since the spring 2018 sampling event. The arsenic concentration in the fall groundwater sample from PRE10007 fell sharply to 9.9 µg/L. Arsenic concentrations measured in monitoring wells BUT10016 and CLA10011 fluctuated between 4 and 7 µg/L but showed no overall upward or downward trends.

Iron

There was a sudden and large increase in the iron concentration collected from monitoring well PRE10007 in the spring sampling event compared to previous sampling events. The iron concentration in the fall groundwater sample from PRE10007 was much lower than the spring sample showing a similar up and down pattern as arsenic. This sudden increase and decrease in arsenic and iron concentrations may indicate biofouling of the well screen and a need to redevelop this well. Iron concentrations in groundwater are sensitive to redox conditions and it is interesting to note dissolved oxygen levels in the spring sample were low (0 mg/L) and higher (4.55 mg/L) in the fall sample. This suggests fluctuating redox conditions at the well. There does not appear to be any upward or downward trend in iron concentrations in the other monitoring wells.

Concentrations of dissolved iron greater than 0.1 mg/L in groundwater are often associated with the presence of arsenic in the glacial aquifer system of the northern United States (Thomas, 2007). When compared with previous studies, iron concentrations in groundwater samples collected from monitoring wells BUT10016, CLA10011, MON10016, PRE10007, and WAR10003 consistently exceed the drinking water SMCL of 0.3 mg/L (see figure 8). Groundwater samples from monitoring wells BUT10016, CLA10011, and PRE10007 consistently have detectable concentrations of arsenic.

Manganese

Manganese concentrations in groundwater samples collected from monitoring wells BUT10016, CLA10011, MIA00205, MON10016, SHE00089, and WAR10003 consistently exceed the SMCL of 0.05 mg/L (see figure 9). Manganese concentrations measured in groundwater samples from monitoring well BUT10016 were the highest of all the monitoring wells in 2019 and previous sampling events consistently exceeding the HBSL of 0.3 mg/L. There does not appear to be a strong upward or downward trend in manganese concentration for any of the monitoring wells. Manganese concentrations appear to be fairly consistent from sampling event to sampling event.

Figure 5 – Chloride concentrations in monitoring wells

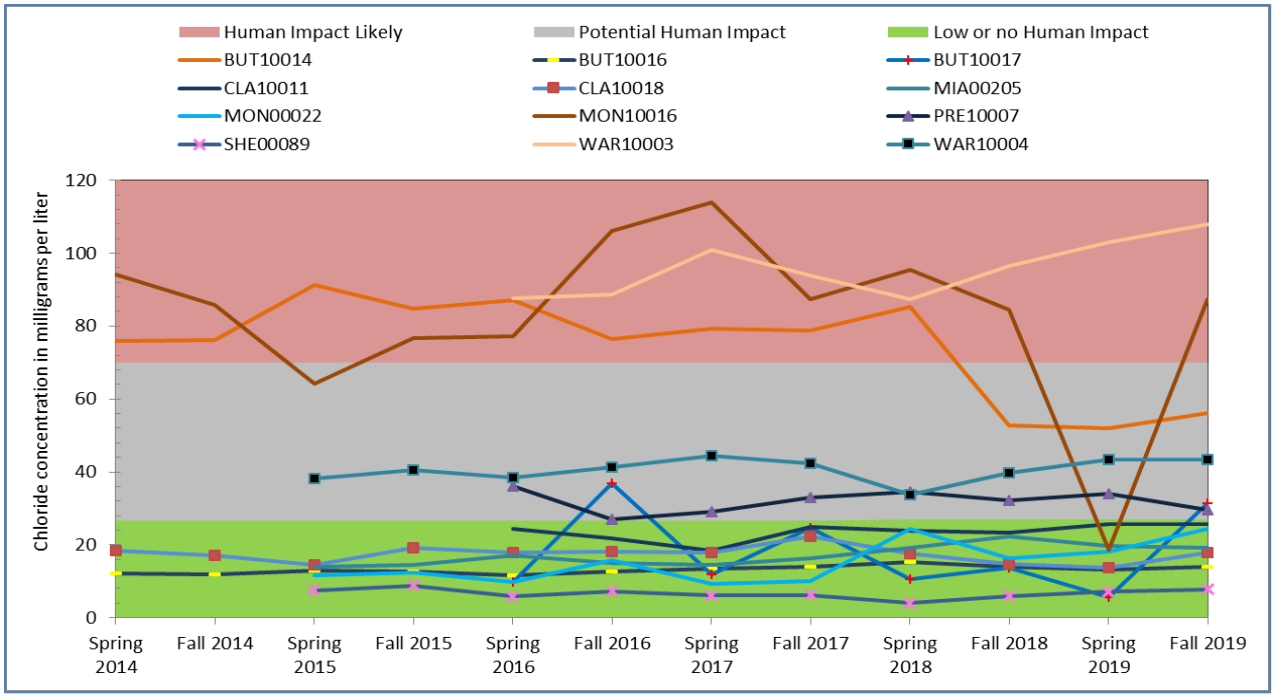


Figure 6 – Sodium concentrations in monitoring wells

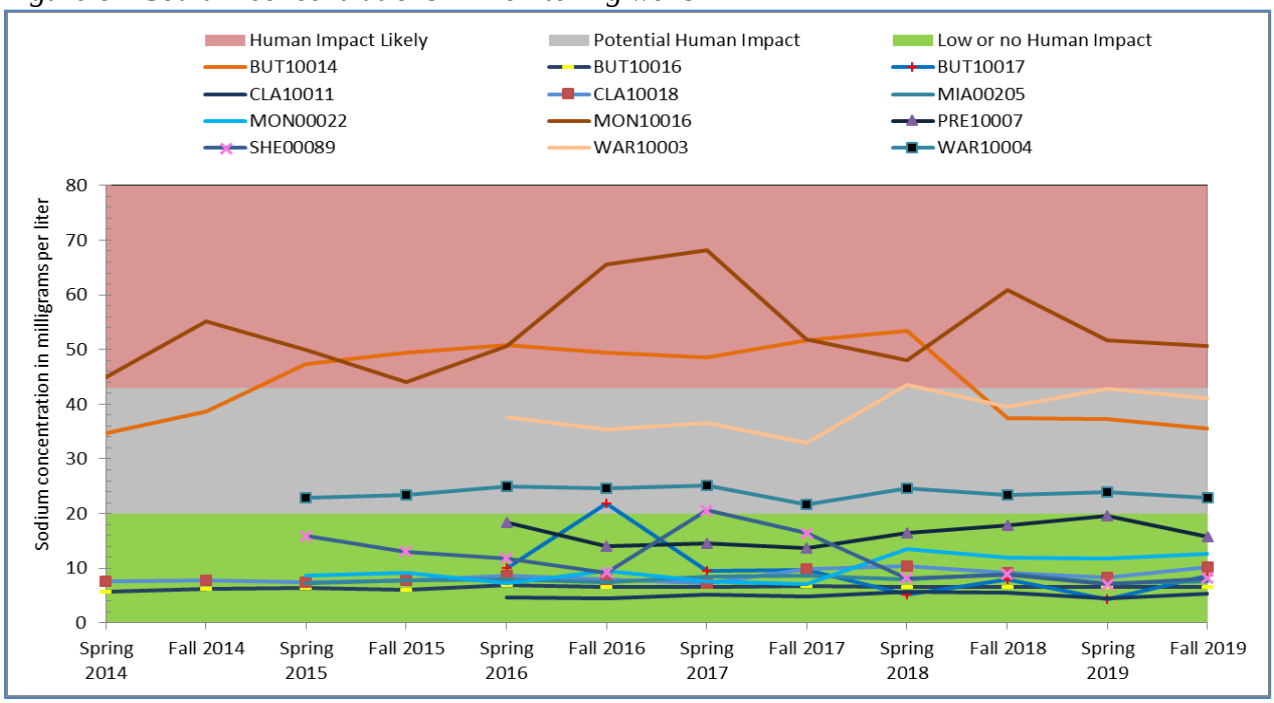


Figure 7 – Arsenic concentrations in monitoring wells

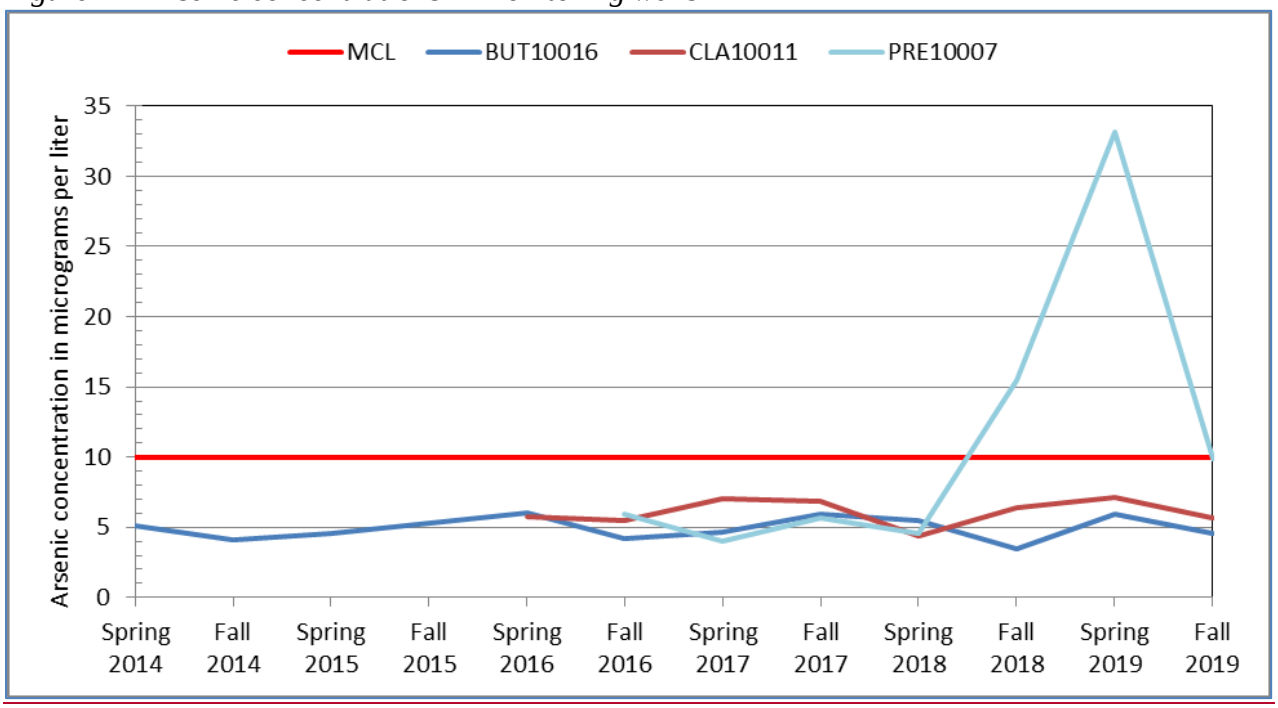


Figure 8 – Iron concentrations in monitoring wells

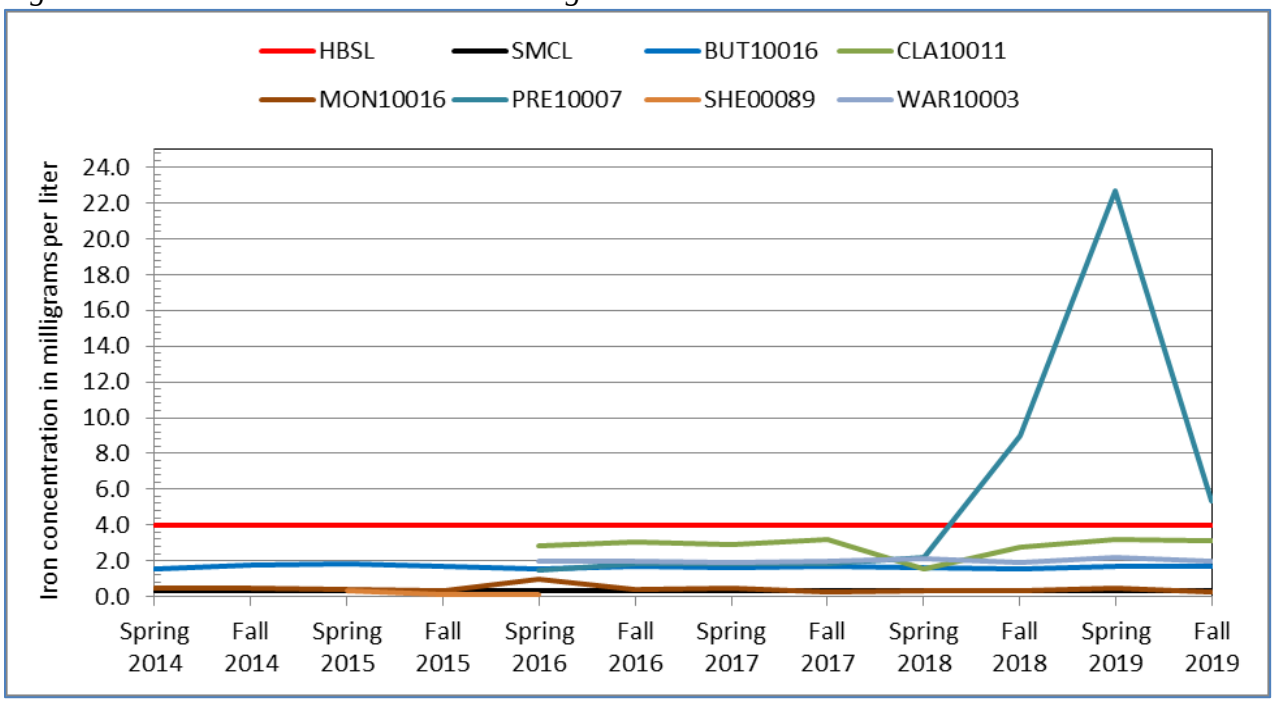
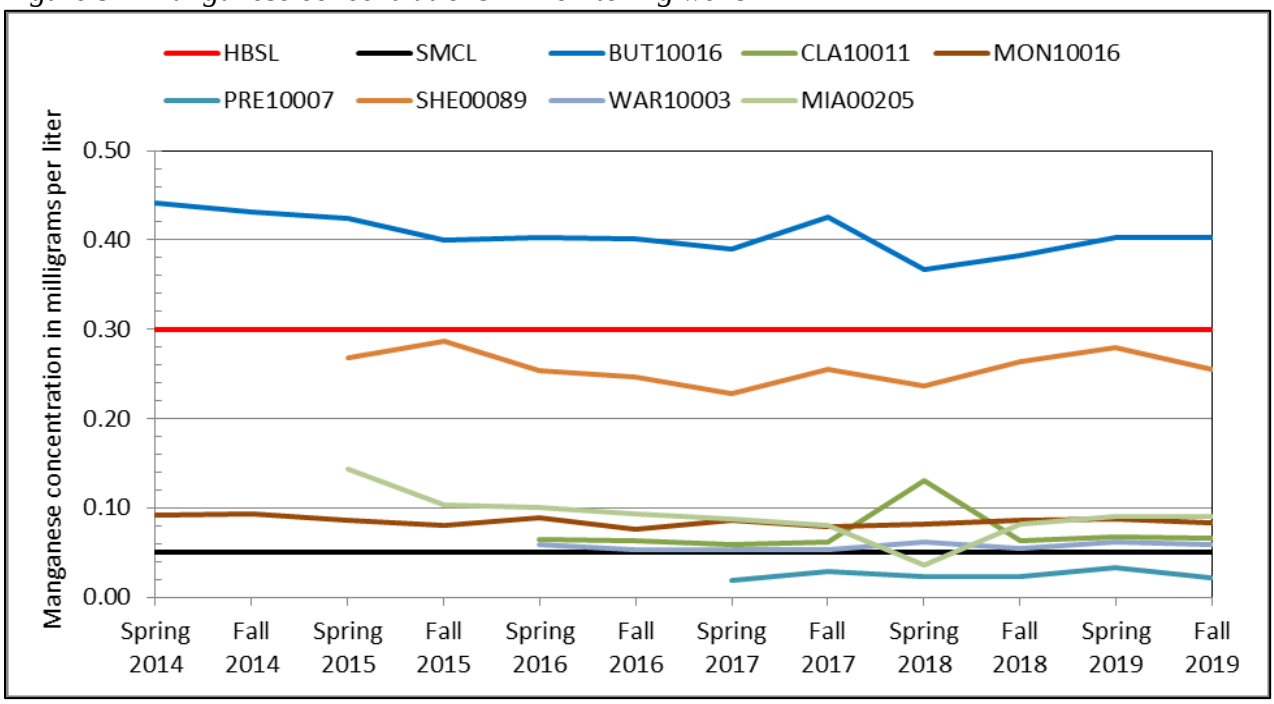


Figure 9 – Manganese concentrations in monitoring wells



Conclusions for 2019

The sample set of the groundwater monitoring program is insufficient in size and scope to characterize in detail the health of the entire buried valley aquifer system. Yet, the results can be used to better understand which contaminants are likely to impact groundwater quality in the buried valley aquifer in southwest Ohio. Furthermore, when the 2019 results are compared with previous rounds of sampling and other studies, trends of groundwater quality in the aquifer begin to emerge.

Contaminants originating from anthropogenic sources such as nitrate, chloride and sodium, and VOCs are sometimes present in groundwater samples from sensitive aquifer settings such as shallow unconfined sand and gravel aquifers. This conclusion is supported by other studies which collected groundwater samples from shallow zones in the buried valley aquifer and found similar results (Ohio Environmental Protection Agency, 2015), (Rowe et al, 2004), and (Stuck, 2016).

Naturally occurring contaminants including arsenic and nuisance contaminants are also commonly present in groundwater samples collected from the buried valley aquifer system. This conclusion is supported by this study and other similar studies such as those mentioned above. Arsenic is a naturally occurring contaminant and may be present in groundwater at concentrations exceeding the MCL. Nuisance contaminants such as hardness, iron, and manganese are present in groundwater at concentrations exceeding secondary drinking water standards and in some cases health-based screening levels. Water softening as well as iron and manganese removal may be necessary to deliver the desired water quality.

These findings emphasize the importance of managing land use over the buried valley aquifer so as to preserve the quality of the water. Proactive groundwater protection is critical to ensure the quality of groundwater in our region.

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Appendix A

Spring 2019					Benchmark		Sample Sites					
Parameter	**Units**	**Method**	**PQL**	**MDL**	**Type**	**Value**	**BUT10014**	**BUT10016**	**BUT10017**	**CLA10011**	**CLA10018**	**MIA00205**
Dissolved Oxygen	mg/L	Field Measured	—	—	—	—	6.39	0.00	8.23	0.00	5.66	0.16
pH	S.U.	Field Measured	—	—	SMCL	6.5 - 8.5	7.24	7.44	7.28	7.12	7.23	7.22
Specific Conductance	mS/cm	Field Measured	—	—	—	—	704	524	491	692	597	598
Temperature	°C	Field Measured	—	—	—	—	12.6	12.5	12.3	11.6	10.4	10.2
Chloride	mg/L	SM 4500-CL-E	2.0	1.0	SMCL	250	52.0	13.2	5.7	25.7	13.7	19.8
Fluoride	mg/L	SM 4500 F-C	0.20	0.022	MCL	4	0.20	0.28	<0.20	0.25	0.2	<0.20
Nitrogen, Ammonia	mg/L	EPA 350.1	0.20	0.073	—	—	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Nitrogen, Total Kjeldahl	mg/L	EPA 351.2	0.50	0.050	—	—	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Nitrogen, Nitrite	mg/L	SM 4500 NO3-F	0.10	0.016	MCL	1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrogen, Nitrate-Nitrite	mg/L	SM 4500 NO3-F	0.10	0.050	MCL	10	3.4	<0.10	5.6	<0.10	8.4	3.9
Total Orthophosphate, as P	mg/L	SM 4500 P-F	0.10	0.015	—	—	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phosphorus	ug/L	SW 6010B	100	4.5	—	—	<100	106	<100	<100	<100	<100
Silica	ug/L	EPA 200.7/SW 6010	100	5.7	—	—	9700	14700	10300	17600	9640	10600
Sulfate	mg/L	EPA 375.4 Modified	10.0	1.6	SMCL	250	86.0	53.9	22.6	76.6	10.7	22.6
Total Hardness	ug/L	EPA 200.7	1000	5.0	—	—	339000	307000	298000	463000	350000	386000
Aluminum	ug/L	SW 6010B	100	5.6	HBSL, SMCL	6000, 200	<100	101	<100	<100	<100	<100
Antimony	ug/L	SW 7041	0.50	0.070	MCL	6	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	ug/L	SW 7060A	2.0	0.44	MCL	10	<2.0	5.9	<2.0	7.1	<2.0	<2.0
Barium	ug/L	SW 6010B	5.0	0.70	MCL	2000	180	219	37.9	57.2	70.8	108
Beryllium	ug/L	SW 6010B	0.50	0.0	MCL	4	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Boron	ug/L	SW 6010B	100	3.3	HBSL	5000	<100	<100	<100	<100	<100	<100
Cadmium	ug/L	SW 7131A	0.20	0.060	MCL	5	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Calcium	ug/L	SW 6010B	100	17.4	—	—	98600	78200	83100	118000	84600	108000
Chromium, Hexavalent	mg/L	SM 3500 Cr B	0.0040	0.0015	HBSL	0.02	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Cobalt	ug/L	SW 6010B	5.0	0.80	HBSL	2	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Copper	ug/L	SW 6010B	5.0	0.60	MCL	1300	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Iron	ug/L	SW 6010B	50.0	5.3	HBSL, SMCL	4000, 300	<50.0	**1690**	<50.0	**3210**	<50.0	<50.0
Lead	ug/L	SW 7421	0.50	0.050	MCL	15	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Lithium	ug/L	SW 6010B	5.0	0.0	HBSL	10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Magnesium	ug/L	SW 6010B	100	10.1	—	—	26000	26100	24300	40700	34800	28000
Manganese	ug/L	SW 6010B	5.0	1.5	HBSL, SMCL	300, 50	<5.0	**402**	<5.0	**66.6**	<5.0	**89.8**
Molybdenum	ug/L	SW 6010B	10.0	2.1	HBSL	30	<10.0	<10.0	<10.0	10.0	<10.0	<10.0
Nickel	ug/L	SW 6010B	5.0	1.2	HBSL	10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Potassium	ug/L	SW 6010B	1000	39.7	—	—	3560	1350	1990	1030	2110	1210
Silver	ug/L	SW 6010B	2.0	0.40	HBSL	100	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Sodium	ug/L	SW 6010B	1000	63.1	—	—	37300	6610	4390	4470	8280	7350
Strontium	ug/L	SW 6010B	5.0	0.50	HBSL	4000	586	420	155	346	2160	393
Thallium	ug/L	SW 7841/EPA 279.2	0.50	0.090	MCL	2	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Vanadium	ug/L	SW 6010B	5.0	0.50	—	—	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Zinc	ug/L	SW 6010B	10.0	1.4	HBSL	2000	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Alkalinity, Total (As CaCO3)	mg/L	SM 2320B	5.0	5.0	—	—	262	239	252	305	287	297
Biochemical Oxygen Demand	mg/L	SM 5210B	2.0	2.0	—	—	<2.0	<2.0	<2.0	<3.0	<2.0	<3.0
Carbonaceous Biological Oxyg	mg/L	EPA 405.1/SM 5210	2.0	2.0	—	—	<2.0	<2.0	<2.0	<3.0	<2.0	<3.0
Chemical Oxygen Demand	mg/L	HACH 8000	5.0	4.1	—	—	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Cyanide, Total	mg/L	EPA 335.4	0.010	0.0050	MCL	0.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Phenolics, Total Recoverable	ug/L	EPA 420.4	10.0	8.0	—	—	<10.0	<10.0	<10.0	41.7	<10.0	<10.0
Total Dissolved Solids (Residu	mg/L	SM 2540C	10.0	10.0	SMCL	500	430	310	252	**502**	360	340
Total Organic Carbon	mg/L	SM 5310C	1.0	0.19	—	—	<1.0	<1.0	<1.0	1.1	<1.0	<1.0

Appendix A

Spring 2019					Benchmark		Sample Sites					
Parameter	**Units**	**Method**	**PQL**	**MDL**	**Type**	**Value**	**BUT10014**	**BUT10016**	**BUT10017**	**CLA10011**	**CLA10018**	**MIA00205**
E. coli	MPN/100ml	Colilert	1.0	1.0	MCL	0	<1.0	<1.0	<1.0	<20.0	<1.0	<5.0
1,1,1,2-Tetrachloroethane	ug/L	SW 8260B	1.0	0.22	HBSL	0.2	<1.0					
1,1,1-Trichloroethane	ug/L	SW 8260B	1.0	0.28	MCL	200	<1.0					
1,1,2,2-Tetrachloroethane	ug/L	SW 8260B	1.0	0.23	HBSL	0.0002	<1.0					
1,1,2-Trichloroethane	ug/L	SW 8260B	1.0	0.34	MCL	5	<1.0					
1,1-Dichloroethane	ug/L	SW 8260B	1.0	0.27	HBSL	1000	<1.0					
1,1-Dichloroethene	ug/L	SW 8260B	1.0	0.22	MCL	7	<1.0					
1,1-Dichloropropene	ug/L	SW 8260B	1.0	0.21	—	—	<1.0					
1,2,3-Trichlorobenzene	ug/L	SW 8260B	1.0	0.23	—	—	<1.0					
1,2,3-Trichloropropane	ug/L	SW 8260B	1.0	0.27	HBSL	30	<1.0					
1,2,4-Trichlorobenzene	ug/L	SW 8260B	1.0	0.21	MCL	70	<1.0					
1,2-Dibromo-3-chloropropane	ug/L	SW 8260B	5.0	0.87	MCL	0.2	<5.0					
1,2-Dibromoethane (EDB)	ug/L	SW 8260B	1.0	0.19	MCL	0.05	<1.0					
1,2-Dichlorobenzene	ug/L	SW 8260B	1.0	0.57	MCL	600	<1.0					
1,2-Dichloroethane	ug/L	SW 8260B	1.0	0.30	MCL	5	<1.0					
1,2-Dichloropropane	ug/L	SW 8260B	1.0	0.23	MCL	5	<1.0					
1,3-Dichlorobenzene	ug/L	SW 8260B	1.0	0.20	HBSL	600	<1.0					
1,3-Dichloropropane	ug/L	SW 8260B	1.0	0.24	HBSL	100	<1.0					
1,4-Dichlorobenzene	ug/L	SW 8260B	1.0	0.21	MCL	75	<1.0					
2,2-Dichloropropane	ug/L	SW 8260B	1.0	0.26	—	—	<1.0					
2-Butanone (MEK)	ug/L	SW 8260B	10.0	2.7	—	—	<10.0					
2-Chlorotoluene	ug/L	SW 8260B	1.0	0.22	—	—	<1.0					
2-Hexanone	ug/L	SW 8260B	10.0	0.078	HBSL	30	<10.0					
4-Chlorotoluene	ug/L	SW 8260B	1.0	0.24	HBSL	100	<1.0					
4-Methyl-2-pentanone (MIBK	ug/L	SW 8260B	10.0	1.9	—	—	<10.0					
Acetone	ug/L	SW 8260B	10.0	3.8	HBSL	6000	<10.0					
Acetonitrile	ug/L	SW 8260B	10.0	2.4	—	—	<10.0					
Benzene	ug/L	SW 8260B	1.0	0.27	MCL	5	<1.0					
Bromobenzene	ug/L	SW 8260B	1.0	0.22	HBSL	50	<1.0					
Bromochloromethane	ug/L	SW 8260B	1.0	0.29	HBSL	60	<1.0					
Bromodichloromethane	ug/L	SW 8260B	1.0	0.23	MCL	80	<1.0					
Bromoform	ug/L	SW 8260B	1.0	0.23	MCL	80	<1.0					
Bromomethane	ug/L	SW 8260B	1.0	0.29	HHBP	140	<1.0					
Carbon disulfide	ug/L	SW 8260B	1.0	0.24	HBSL	600	<1.0					
Carbon tetrachloride	ug/L	SW 8260B	1.0	0.24	MCL	5	<1.0					
Chlorobenzene	ug/L	SW 8260B	1.0	0.26	MCL	100	<1.0					
Chloroethane	ug/L	SW 8260B	1.0	0.26	—	—	<1.0					
Chloroform	ug/L	SW 8260B	1.0	0.27	MCL	80	1.6					
Chloromethane	ug/L	SW 8260B	1.0	0.32	—	—	<1.0					
cis-1,2-Dichloroethene	ug/L	SW 8260B	1.0	0.30	MCL	70	<1.0					
cis-1,3-Dichloropropene	ug/L	SW 8260B	1.0	0.23	HBSL	0.3	<1.0					
Dibromochloromethane	ug/L	SW 8260B	1.0	0.65	MCL	80	<1.0					
Dibromomethane	ug/L	SW 8260B	1.0	0.30	—	—	<1.0					
Dichlorodifluoromethane	ug/L	SW 8260B	1.0	0.24	HBSL	1000	<1.0					
Ethyl acetate	ug/L	SW 8260B	1.0	0.21	HBSL	6000	<1.0					
Ethylbenzene	ug/L	SW 8260B	1.0	0.17	MCL	700	<1.0					
Hexachloro-1,3-butadiene	ug/L	SW 8260B	1.0	0.28	—	—	<1.0					
m&p-Xylene	ug/L	SW 8260B	1.0	0.41	MCL	10000	<1.0					

Appendix A

Spring 2019					Benchmark		Sample Sites					
Parameter	**Units**	**Method**	**PQL**	**MDL**	**Type**	**Value**	**BUT10014**	**BUT10016**	**BUT10017**	**CLA10011**	**CLA10018**	**MIA00205**
Methylene Chloride	ug/L	SW 8260B	1.0	0.16	MCL	5	<1.0					
Methyl-tert-butyl ether	ug/L	SW 8260B	1.0	0.24	—	—	<1.0					
Naphthalene	ug/L	SW 8260B	1.0	0.21	HBSL	100	<1.0					
o-Xylene	ug/L	SW 8260B	1.0	0.22	MCL	10000	<1.0					
p-Isopropyltoluene	ug/L	SW 8260B	1.0	0.18	—	—	<1.0					
Styrene	ug/L	SW 8260B	1.0	0.21	MCL	100	<1.0					
Tetrachloroethene	ug/L	SW 8260B	1.0	0.23	MCL	5	<1.0					
Toluene	ug/L	SW 8260B	1.0	0.23	MCL	1000	<1.0					
trans-1,2-Dichloroethene	ug/L	SW 8260B	1.0	0.22	MCL	100	<1.0					
trans-1,3-Dichloropropene	ug/L	SW 8260B	1.0	0.20	HBSL	0.3	<1.0					
Trichloroethene	ug/L	SW 8260B	1.0	0.30	MCL	5	1.1					
Trichlorofluoromethane	ug/L	SW 8260B	1.0	0.25	HBSL	2000	<1.0					
Vinyl acetate	ug/L	SW 8260B	5.0	0.28	—	—	<5.0					
Vinyl chloride	ug/L	SW 8260B	1.0	0.22	MCL	2	<1.0					
Xylene (Total)	ug/L	SW 8260B	1.0	0.41	MCL	10000	<1.0					

MCL - Maximum Contaminant Level set by USEPA

SMCL - Secondary Maximum Contaminant Level set by USEPA

AMCL - Alternative Maximum Contaminant Level set by USEPA

HBSL - Non enforceable Health Based Screening Level based on (1) latest USEPA Office of Water policies for

HHBP - Human Health Benchmark for Pesticides set by USEPA

— No drinking water benchmark set for the compound

Numbers in bold exceed a benchmark

Appendix A

Spring 2019					Benchmark		Sample Sites					
Parameter	**Units**	**Method**	**PQL**	**MDL**	**Type**	**Value**	**MON00022**	**MON10016**	**PRE10007**	**SHE00089**	**WAR10003**	**WAR10004**
Dissolved Oxygen	mg/L	Field Measured	—	—	—	—	0.00	0.00	0.00	0.00	0	0.96
pH	S.U.	Field Measured	—	—	SMCL	6.5 - 8.5	7.11	7.38	7.31	7.19	7.37	7.48
Specific Conductance	mS/cm	Field Measured	—	—	—	—	676	729	673	599	880	556
Temperature	°C	Field Measured	—	—	—	—	9.7	12.0	12.9	11.9	14.1	13.8
Chloride	mg/L	SM 4500-CL-E	2.0	1.0	SMCL	250	18.1	18.7	34.0	7.2	103	43.5
Fluoride	mg/L	SM 4500 F-C	0.20	0.022	MCL	4	<0.20	<0.20	<0.20	0.46	0.25	0.27
Nitrogen, Ammonia	mg/L	EPA 350.1	0.20	0.073	—	—	<0.20	<0.20	<0.20	0.44	<0.20	<0.20
Nitrogen, Total Kjeldahl	mg/L	EPA 351.2	0.50	0.050	—	—	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Nitrogen, Nitrite	mg/L	SM 4500 NO3-F	0.10	0.016	MCL	1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrogen, Nitrate-Nitrite	mg/L	SM 4500 NO3-F	0.10	0.050	MCL	10	<0.10	<0.10	<0.10	0.28	<0.10	0.68
Total Orthophosphate, as P	mg/L	SM 4500 P-F	0.10	0.015	—	—	<0.10	<0.10	<0.10	<0.10	0.11	<0.10
Phosphorus	ug/L	SW 6010B	100	4.5	—	—	<100	<100	<100	<100	<100	<100
Silica	ug/L	EPA 200.7/SW 6010	100	5.7	—	—	7870	10600	16000	12600	15600	9280
Sulfate	mg/L	EPA 375.4 Modified	10.0	1.6	SMCL	250	26.3	54.7	55.6	88.5	163	31.3
Total Hardness	ug/L	EPA 200.7	1000	5.0	—	—	402000	325000	379000	394000	428000	288000
Aluminum	ug/L	SW 6010B	100	5.6	HBSL, SMCL	6000, 200	<100	<100	<100	<100	<100	<100
Antimony	ug/L	SW 7041	0.50	0.070	MCL	6	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	ug/L	SW 7060A	2.0	0.44	MCL	10	<2.0	<2.0	**33.2**	<2.0	2.1	<2.0
Barium	ug/L	SW 6010B	5.0	0.70	MCL	2000	73.4	108	334	141	207	64.2
Beryllium	ug/L	SW 6010B	0.50	0.0	MCL	4	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Boron	ug/L	SW 6010B	100	3.3	HBSL	5000	<100	<100	<100	<100	224	<100
Cadmium	ug/L	SW 7131A	0.20	0.060	MCL	5	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Calcium	ug/L	SW 6010B	100	17.4	—	—	113000	87700	92300	97600	105000	65000
Chromium, Hexavalent	mg/L	SM 3500 Cr B	0.0040	0.0015	HBSL	0.02	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Cobalt	ug/L	SW 6010B	5.0	0.80	HBSL	2	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Copper	ug/L	SW 6010B	5.0	0.60	MCL	1300	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Iron	ug/L	SW 6010B	50.0	5.3	HBSL, SMCL	4000, 300	<50.0	**464**	**22700**	<50.0	**2190**	<50.0
Lead	ug/L	SW 7421	0.50	0.050	MCL	15	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Lithium	ug/L	SW 6010B	5.0	0.0	HBSL	10	<5.0	<5.0	<5.0	<5.0	5.4	<5.0
Magnesium	ug/L	SW 6010B	100	10.1	—	—	31000	28000	36000	36500	40100	30400
Manganese	ug/L	SW 6010B	5.0	1.5	HBSL, SMCL	300, 50	5.6	**87.5**	32.7	**283**	**62.0**	<5.0
Molybdenum	ug/L	SW 6010B	10.0	2.1	HBSL	30	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Nickel	ug/L	SW 6010B	5.0	1.2	HBSL	10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Potassium	ug/L	SW 6010B	1000	39.7	—	—	3490	2850	2380	1260	2650	2660
Silver	ug/L	SW 6010B	2.0	0.40	HBSL	100	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Sodium	ug/L	SW 6010B	1000	63.1	—	—	11800	51700	19500	7070	42800	24000
Strontium	ug/L	SW 6010B	5.0	0.50	HBSL	4000	346	403	917	618	1090	494
Thallium	ug/L	SW 7841/EPA 279.2	0.50	0.090	MCL	2	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Vanadium	ug/L	SW 6010B	5.0	0.50	—	—	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Zinc	ug/L	SW 6010B	10.0	1.4	HBSL	2000	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Alkalinity, Total (As CaCO3)	mg/L	SM 2320B	5.0	5.0	—	—	356	282	284	317	282	238
Biochemical Oxygen Demand	mg/L	SM 5210B	2.0	2.0	—	—	<2.0	<2.0	<2.0	<3.0	<2.0	<2.0
Carbonaceous Biological Oxyg	mg/L	EPA 405.1/SM 5210	2.0	2.0	—	—	<2.0	<2.0	<3.0	<3.0	<2.0	<2.0
Chemical Oxygen Demand	mg/L	HACH 8000	5.0	4.1	—	—	<5.0	<5.0	<5.0	<20.0	<5.0	<5.0
Cyanide, Total	mg/L	EPA 335.4	0.010	0.0050	MCL	0.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Phenolics, Total Recoverable	ug/L	EPA 420.4	10.0	8.0	—	—	<10.0	11.2	<10.0	<10.0	<10.0	<10.0
Total Dissolved Solids (Residu	mg/L	SM 2540C	10.0	10.0	SMCL	500	468	496	422	412	**566**	352
Total Organic Carbon	mg/L	SM 5310C	1.0	0.19	—	—	1.8	<1.0	<1.0	<1.0	<1.0	<1.0

Appendix A

Spring 2019					Benchmark		Sample Sites					
Parameter	**Units**	**Method**	**PQL**	**MDL**	**Type**	**Value**	**MON00022**	**MON10016**	**PRE10007**	**SHE00089**	**WAR10003**	**WAR10004**
E. coli	MPN/100mL	Colilert	1.0	1.0	MCL	0	<1.0	<1.0	<1.0	<1.0	<20.0	<20.0
1,1,1,2-Tetrachloroethane	ug/L	SW 8260B	1.0	0.22	HBSL	0.2						
1,1,1-Trichloroethane	ug/L	SW 8260B	1.0	0.28	MCL	200						
1,1,2,2-Tetrachloroethane	ug/L	SW 8260B	1.0	0.23	HBSL	0.0002						
1,1,2-Trichloroethane	ug/L	SW 8260B	1.0	0.34	MCL	5						
1,1-Dichloroethane	ug/L	SW 8260B	1.0	0.27	HBSL	1000						
1,1-Dichloroethene	ug/L	SW 8260B	1.0	0.22	MCL	7						
1,1-Dichloropropene	ug/L	SW 8260B	1.0	0.21	—	—						
1,2,3-Trichlorobenzene	ug/L	SW 8260B	1.0	0.23	—	—						
1,2,3-Trichloropropane	ug/L	SW 8260B	1.0	0.27	HBSL	30						
1,2,4-Trichlorobenzene	ug/L	SW 8260B	1.0	0.21	MCL	70						
1,2-Dibromo-3-chloropropane	ug/L	SW 8260B	5.0	0.87	MCL	0.2						
1,2-Dibromoethane (EDB)	ug/L	SW 8260B	1.0	0.19	MCL	0.05						
1,2-Dichlorobenzene	ug/L	SW 8260B	1.0	0.57	MCL	600						
1,2-Dichloroethane	ug/L	SW 8260B	1.0	0.30	MCL	5						
1,2-Dichloropropane	ug/L	SW 8260B	1.0	0.23	MCL	5						
1,3-Dichlorobenzene	ug/L	SW 8260B	1.0	0.20	HBSL	600						
1,3-Dichloropropane	ug/L	SW 8260B	1.0	0.24	HBSL	100						
1,4-Dichlorobenzene	ug/L	SW 8260B	1.0	0.21	MCL	75						
2,2-Dichloropropane	ug/L	SW 8260B	1.0	0.26	—	—						
2-Butanone (MEK)	ug/L	SW 8260B	10.0	2.7	—	—						
2-Chlorotoluene	ug/L	SW 8260B	1.0	0.22	—	—						
2-Hexanone	ug/L	SW 8260B	10.0	0.078	HBSL	30						
4-Chlorotoluene	ug/L	SW 8260B	1.0	0.24	HBSL	100						
4-Methyl-2-pentanone (MIBK)	ug/L	SW 8260B	10.0	1.9	—	—						
Acetone	ug/L	SW 8260B	10.0	3.8	HBSL	6000						
Acetonitrile	ug/L	SW 8260B	10.0	2.4	—	—						
Benzene	ug/L	SW 8260B	1.0	0.27	MCL	5						
Bromobenzene	ug/L	SW 8260B	1.0	0.22	HBSL	50						
Bromochloromethane	ug/L	SW 8260B	1.0	0.29	HBSL	60						
Bromodichloromethane	ug/L	SW 8260B	1.0	0.23	MCL	80						
Bromoform	ug/L	SW 8260B	1.0	0.23	MCL	80						
Bromomethane	ug/L	SW 8260B	1.0	0.29	HHBP	140						
Carbon disulfide	ug/L	SW 8260B	1.0	0.24	HBSL	600						
Carbon tetrachloride	ug/L	SW 8260B	1.0	0.24	MCL	5						
Chlorobenzene	ug/L	SW 8260B	1.0	0.26	MCL	100						
Chloroethane	ug/L	SW 8260B	1.0	0.26	—	—						
Chloroform	ug/L	SW 8260B	1.0	0.27	MCL	80						
Chloromethane	ug/L	SW 8260B	1.0	0.32	—	—						
cis-1,2-Dichloroethene	ug/L	SW 8260B	1.0	0.30	MCL	70						
cis-1,3-Dichloropropene	ug/L	SW 8260B	1.0	0.23	HBSL	0.3						
Dibromochloromethane	ug/L	SW 8260B	1.0	0.65	MCL	80						
Dibromomethane	ug/L	SW 8260B	1.0	0.30	—	—						
Dichlorodifluoromethane	ug/L	SW 8260B	1.0	0.24	HBSL	1000						
Ethyl acetate	ug/L	SW 8260B	1.0	0.21	HBSL	6000						
Ethylbenzene	ug/L	SW 8260B	1.0	0.17	MCL	700						
Hexachloro-1,3-butadiene	ug/L	SW 8260B	1.0	0.28	—	—						
m&p-Xylene	ug/L	SW 8260B	1.0	0.41	MCL	10000						

Appendix A

Spring 2019					Benchmark		Sample Sites					
Parameter	**Units**	**Method**	**PQL**	**MDL**	**Type**	**Value**	**MON00022**	**MON10016**	**PRE10007**	**SHE00089**	**WAR10003**	**WAR10004**
Methylene Chloride	ug/L	SW 8260B	1.0	0.16	MCL	5						
Methyl-tert-butyl ether	ug/L	SW 8260B	1.0	0.24	—	—						
Naphthalene	ug/L	SW 8260B	1.0	0.21	HBSL	100						
o-Xylene	ug/L	SW 8260B	1.0	0.22	MCL	10000						
p-Isopropyltoluene	ug/L	SW 8260B	1.0	0.18	—	—						
Styrene	ug/L	SW 8260B	1.0	0.21	MCL	100						
Tetrachloroethene	ug/L	SW 8260B	1.0	0.23	MCL	5						
Toluene	ug/L	SW 8260B	1.0	0.23	MCL	1000						
trans-1,2-Dichloroethene	ug/L	SW 8260B	1.0	0.22	MCL	100						
trans-1,3-Dichloropropene	ug/L	SW 8260B	1.0	0.20	HBSL	0.3						
Trichloroethene	ug/L	SW 8260B	1.0	0.30	MCL	5						
Trichlorofluoromethane	ug/L	SW 8260B	1.0	0.25	HBSL	2000						
Vinyl acetate	ug/L	SW 8260B	5.0	0.28	—	—						
Vinyl chloride	ug/L	SW 8260B	1.0	0.22	MCL	2						
Xylene (Total)	ug/L	SW 8260B	1.0	0.41	MCL	10000						

MCL - Maximum Contaminant Level set by USEPA

SMCL - Secondary Maximum Contaminant Level set by USEPA

AMCL - Alternative Maximum Contaminant Level set by USEPA

HBSL - Non enforceable Health Based Screening Level based on (1) latest USEPA Office of Water policies for

HHBP - Human Health Benchmark for Pesticides set by USEPA

— No drinking water benchmark set for the compound

Numbers in bold exceed a benchmark

Appendix A

Fall 2019					Benchmark		Sample Sites					
Parameter	**Units**	**Method**	**PQL**	**MDL**	**Type**	**Value**	**BUT10014**	**BUT10016**	**BUT10017**	**CLA10011**	**CLA10018**	**MIA00205**
Dissolved Oxygen	mg/L	Field Measured	—	—	—	—	10.07	0.09	7.72	0.61	4.56	0.23
pH	S.U.	Field Measured	—	—	SMCL	6.5 - 8.5	7.06	7.28	7.12	7.04	7.19	7.06
Specific Conductance	mS/cm	Field Measured	—	—	—	—	540	576	614	553	547	682
Temperature	°C	Field Measured	—	—	—	—	16.4	12.6	12.2	12.8	17.3	13.8
Chloride	mg/L	SM 4500-CL-E	2.0	1.0	SMCL	250	55.2	13.9	31.5	25.6	17.9	19.1
Fluoride	mg/L	SM 4500 F-C	0.20	0.022	MCL	4	0.20	0.26	<0.20	0.23	0.24	<0.20
Nitrogen, Ammonia	mg/L	EPA 350.1	0.20	0.073	—	—	<0.10	0.14	<0.10	<0.10	<0.10	<0.10
Nitrogen, Total Kjeldahl	mg/L	EPA 351.2	0.50	0.050	—	—	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Nitrogen, Nitrite	mg/L	SM 4500 NO3-F	0.10	0.016	MCL	1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrogen, Nitrate-Nitrite	mg/L	SM 4500 NO3-F	0.10	0.050	MCL	10	2.3	<0.10	4.9	<0.10	8.0	5.0
Total Orthophosphate, as P	mg/L	SM 4500 P-F	0.10	0.015	—	—	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phosphorus	ug/L	SW 6010B	100	4.5	—	—	<100	112	<100	<100	<100	<100
Silica	ug/L	EPA 200.7/SW 6010	100	5.7	—	—	9630	14400	10400	16700	11400	10600
Sulfate	mg/L	EPA 375.4 Modified	10.0	1.6	SMCL	250	47.7	52.9	14.0	74.7	13.2	26.3
Total Hardness	ug/L	EPA 200.7	1000	5.0	—	—	306000	293000	310000	434000	361000	346000
Aluminum	ug/L	SW 6010B	100	5.6	HBSL, SMCL	6000, 200	<100	<100	<100	<100	<100	<100
Antimony	ug/L	SW 7041	0.50	0.070	MCL	6	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	ug/L	SW 7060A	2.0	0.44	MCL	10	<2.0	4.6	<2.0	5.7	<2.0	<2.0
Barium	ug/L	SW 6010B	5.0	0.70	MCL	2000	160	221	41.3	58.7	92.9	115
Beryllium	ug/L	SW 6010B	0.50	0.0	MCL	4	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Boron	ug/L	SW 6010B	100	3.3	HBSL	5000	450	<200	<200	<200	<200	<200
Cadmium	ug/L	SW 7131A	0.20	0.060	MCL	5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Calcium	ug/L	SW 6010B	100	17.4	—	—	85800	75800	83200	111000	87700	96600
Chromium, Hexavalent	mg/L	SM 3500 Cr B	0.0040	0.0015	HBSL	0.02	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Cobalt	ug/L	SW 6010B	5.0	0.80	HBSL	2	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Copper	ug/L	SW 6010B	5.0	0.60	MCL	1300	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Iron	ug/L	SW 6010B	50.0	5.3	HBSL, SMCL	4000, 300	<100	**1660**	<100	**3120**	<100	<100
Lead	ug/L	SW 7421	0.50	0.050	MCL	15	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Lithium	ug/L	SW 6010B	5.0	0.0	HBSL	10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Magnesium	ug/L	SW 6010B	100	10.1	—	—	22400	25200	24800	38400	34400	25500
Manganese	ug/L	SW 6010B	5.0	1.5	HBSL, SMCL	300, 50	<5.0	**403**	<5.0	**66.4**	<5.0	**90.8**
Molybdenum	ug/L	SW 6010B	10.0	2.1	HBSL	30	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Nickel	ug/L	SW 6010B	5.0	1.2	HBSL	10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Potassium	ug/L	SW 6010B	1000	39.7	—	—	3370	1310	2220	1070	2940	1280
Silver	ug/L	SW 6010B	2.0	0.40	HBSL	100	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Sodium	ug/L	SW 6010B	1000	63.1	—	—	35500	6500	8640	5310	10200	7700
Strontium	ug/L	SW 6010B	5.0	0.50	HBSL	4000	521	424	162	341	2530	371
Thallium	ug/L	SW 7841/EPA 279.2	0.50	0.090	MCL	2	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Vanadium	ug/L	SW 6010B	5.0	0.50	—	—	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Zinc	ug/L	SW 6010B	10.0	1.4	HBSL	2000	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0
Alkalinity, Total (As CaCO3)	mg/L	SM 2320B	5.0	5.0	—	—	260	244	264	320	316	312
Biochemical Oxygen Demand	mg/L	SM 5210B	2.0	2.0	—	—	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Carbonaceous Biological Oxyg	mg/L	EPA 405.1/SM 5210	2.0	2.0	—	—	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chemical Oxygen Demand	mg/L	HACH 8000	5.0	4.1	—	—	<5.0	<5.0	<5.0	13.0	9.2	<5.0
Cyanide, Total	mg/L	EPA 335.4	0.010	0.0050	MCL	0.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Phenolics, Total Recoverable	ug/L	EPA 420.4	10.0	8.0	—	—	3.4	3.5	2.7	3.5	4.0	3.2
Total Dissolved Solids (Residu	mg/L	SM 2540C	10.0	10.0	SMCL	500	392	278	388	492	342	382
Total Organic Carbon	mg/L	SM 5310C	1.0	0.19	—	—	<1.0	<1.0	<1.0	<1.0	1.2	<1.0

Appendix A

Fall 2019					Benchmark		Sample Sites					
Parameter	**Units**	**Method**	**PQL**	**MDL**	**Type**	**Value**	**BUT10014**	**BUT10016**	**BUT10017**	**CLA10011**	**CLA10018**	**MIA00205**
E. coli	MPN/100ml	Colilert	1.0	1.0	MCL	0	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0
1,1,1,2-Tetrachloroethane	ug/L	SW 8260B	1.0	0.22	HBSL	0.2	<1.0					
1,1,1-Trichloroethane	ug/L	SW 8260B	1.0	0.28	MCL	200	<1.0					
1,1,2,2-Tetrachloroethane	ug/L	SW 8260B	1.0	0.23	HBSL	0.0002	<1.0					
1,1,2-Trichloroethane	ug/L	SW 8260B	1.0	0.34	MCL	5	<1.0					
1,1-Dichloroethane	ug/L	SW 8260B	1.0	0.27	HBSL	1000	<1.0					
1,1-Dichloroethene	ug/L	SW 8260B	1.0	0.22	MCL	7	<1.0					
1,1-Dichloropropene	ug/L	SW 8260B	1.0	0.21	—	—	<1.0					
1,2,3-Trichlorobenzene	ug/L	SW 8260B	1.0	0.23	—	—	<1.0					
1,2,3-Trichloropropane	ug/L	SW 8260B	1.0	0.27	HBSL	30	<1.0					
1,2,4-Trichlorobenzene	ug/L	SW 8260B	1.0	0.21	MCL	70	<1.0					
1,2-Dibromo-3-chloropropane	ug/L	SW 8260B	5.0	0.87	MCL	0.2	<5.0					
1,2-Dibromoethane (EDB)	ug/L	SW 8260B	1.0	0.19	MCL	0.05	<1.0					
1,2-Dichlorobenzene	ug/L	SW 8260B	1.0	0.57	MCL	600	<1.0					
1,2-Dichloroethane	ug/L	SW 8260B	1.0	0.30	MCL	5	<1.0					
1,2-Dichloropropane	ug/L	SW 8260B	1.0	0.23	MCL	5	<1.0					
1,3-Dichlorobenzene	ug/L	SW 8260B	1.0	0.20	HBSL	600	<1.0					
1,3-Dichloropropane	ug/L	SW 8260B	1.0	0.24	HBSL	100	<1.0					
1,4-Dichlorobenzene	ug/L	SW 8260B	1.0	0.21	MCL	75	<1.0					
2,2-Dichloropropane	ug/L	SW 8260B	1.0	0.26	—	—	<1.0					
2-Butanone (MEK)	ug/L	SW 8260B	10.0	2.7	—	—	<10.0					
2-Chlorotoluene	ug/L	SW 8260B	1.0	0.22	—	—	<1.0					
2-Hexanone	ug/L	SW 8260B	10.0	0.078	HBSL	30	<10.0					
4-Chlorotoluene	ug/L	SW 8260B	1.0	0.24	HBSL	100	<1.0					
4-Methyl-2-pentanone (MIBK	ug/L	SW 8260B	10.0	1.9	—	—	<10.0					
Acetone	ug/L	SW 8260B	10.0	3.8	HBSL	6000	<10.0					
Acetonitrile	ug/L	SW 8260B	10.0	2.4	—	—	<10.0					
Benzene	ug/L	SW 8260B	1.0	0.27	MCL	5	<1.0					
Bromobenzene	ug/L	SW 8260B	1.0	0.22	HBSL	50	<1.0					
Bromochloromethane	ug/L	SW 8260B	1.0	0.29	HBSL	60	<1.0					
Bromodichloromethane	ug/L	SW 8260B	1.0	0.23	MCL	80	<1.0					
Bromoform	ug/L	SW 8260B	1.0	0.23	MCL	80	<1.0					
Bromomethane	ug/L	SW 8260B	1.0	0.29	HHBP	140	<1.0					
Carbon disulfide	ug/L	SW 8260B	1.0	0.24	HBSL	600	<1.0					
Carbon tetrachloride	ug/L	SW 8260B	1.0	0.24	MCL	5	<1.0					
Chlorobenzene	ug/L	SW 8260B	1.0	0.26	MCL	100	<1.0					
Chloroethane	ug/L	SW 8260B	1.0	0.26	—	—	<1.0					
Chloroform	ug/L	SW 8260B	1.0	0.27	MCL	80	2.5					
Chloromethane	ug/L	SW 8260B	1.0	0.32	—	—	<1.0					
cis-1,2-Dichloroethene	ug/L	SW 8260B	1.0	0.30	MCL	70	<1.0					
cis-1,3-Dichloropropene	ug/L	SW 8260B	1.0	0.23	HBSL	0.3	<1.0					
Dibromochloromethane	ug/L	SW 8260B	1.0	0.65	MCL	80	<1.0					
Dibromomethane	ug/L	SW 8260B	1.0	0.30	—	—	<1.0					
Dichlorodifluoromethane	ug/L	SW 8260B	1.0	0.24	HBSL	1000	<1.0					
Ethyl acetate	ug/L	SW 8260B	1.0	0.21	HBSL	6000	<1.0					
Ethylbenzene	ug/L	SW 8260B	1.0	0.17	MCL	700	<1.0					
Hexachloro-1,3-butadiene	ug/L	SW 8260B	1.0	0.28	—	—	<1.0					
m&p-Xylene	ug/L	SW 8260B	1.0	0.41	MCL	10000	<1.0					

Appendix A

Fall 2019					Benchmark		Sample Sites					
Parameter	**Units**	**Method**	**PQL**	**MDL**	**Type**	**Value**	**BUT10014**	**BUT10016**	**BUT10017**	**CLA10011**	**CLA10018**	**MIA00205**
Methylene Chloride	ug/L	SW 8260B	1.0	0.16	MCL	5	<1.0					
Methyl-tert-butyl ether	ug/L	SW 8260B	1.0	0.24	—	—	<1.0					
Naphthalene	ug/L	SW 8260B	1.0	0.21	HBSL	100	<1.0					
o-Xylene	ug/L	SW 8260B	1.0	0.22	MCL	10000	<1.0					
p-Isopropyltoluene	ug/L	SW 8260B	1.0	0.18	—	—	<1.0					
Styrene	ug/L	SW 8260B	1.0	0.21	MCL	100	<1.0					
Tetrachloroethene	ug/L	SW 8260B	1.0	0.23	MCL	5	<1.0					
Toluene	ug/L	SW 8260B	1.0	0.23	MCL	1000	<1.0					
trans-1,2-Dichloroethene	ug/L	SW 8260B	1.0	0.22	MCL	100	<1.0					
trans-1,3-Dichloropropene	ug/L	SW 8260B	1.0	0.20	HBSL	0.3	<1.0					
Trichloroethene	ug/L	SW 8260B	1.0	0.30	MCL	5	1.3					
Trichlorofluoromethane	ug/L	SW 8260B	1.0	0.25	HBSL	2000	<1.0					
Vinyl acetate	ug/L	SW 8260B	5.0	0.28	—	—	<5.0					
Vinyl chloride	ug/L	SW 8260B	1.0	0.22	MCL	2	<1.0					
Xylene (Total)	ug/L	SW 8260B	1.0	0.41	MCL	10000	<1.0					

MCL - Maximum Contaminant Level set by USEPA

SMCL - Secondary Maximum Contaminant Level set by USEPA

AMCL - Alternative Maximum Contaminant Level set by USEPA

HBSL - Non enforceable Health Based Screening Level based on (1) latest USEPA Office of Water policies for

HHBP - Human Health Benchmark for Pesticides set by USEPA

— No drinking water benchmark set for the compound

Numbers in bold exceed a benchmark

Appendix A

Fall 2019					Benchmark		Sample Sites					
Parameter	**Units**	**Method**	**PQL**	**MDL**	**Type**	**Value**	**MON00022**	**MON10016**	**PRE10007**	**SHE00089**	**WAR10003**	**WAR10004**
Dissolved Oxygen	mg/L	Field Measured	—	—	—	—	0.98	0.12	4.55	0.43	0.08	0.52
pH	S.U.	Field Measured	—	—	SMCL	6.5 - 8.5	6.86	7.04	7.28	7.05	7.27	7.31
Specific Conductance	mS/cm	Field Measured	—	—	—	—	729	599	514	660	968	601
Temperature	°C	Field Measured	—	—	—	—	17.1	13.5	13.1	12.1	14.1	13.9
Chloride	mg/L	SM 4500-CL-E	2.0	1.0	SMCL	250	24.4	87.5	29.6	7.8	108	43.4
Fluoride	mg/L	SM 4500 F-C	0.20	0.022	MCL	4	<0.20	<0.20	<0.20	0.37	0.21	<0.20
Nitrogen, Ammonia	mg/L	EPA 350.1	0.20	0.073	—	—	<0.10	<0.10	<0.10	<0.10	0.26	<0.10
Nitrogen, Total Kjeldahl	mg/L	EPA 351.2	0.50	0.050	—	—	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Nitrogen, Nitrite	mg/L	SM 4500 NO3-F	0.10	0.016	MCL	1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrogen, Nitrate-Nitrite	mg/L	SM 4500 NO3-F	0.10	0.050	MCL	10	<0.10	<0.10	<0.10	<0.10	<0.10	0.19
Total Orthophosphate, as P	mg/L	SM 4500 P-F	0.10	0.015	—	—	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phosphorus	ug/L	SW 6010B	100	4.5	—	—	<100	<100	<100	<100	<100	<100
Silica	ug/L	EPA 200.7/SW 6010	100	5.7	—	—	9150	10100	12100	11100	14600	8580
Sulfate	mg/L	EPA 375.4 Modified	10.0	1.6	SMCL	250	95.1	33.8	54.9	41.4	78.8	30.7
Total Hardness	ug/L	EPA 200.7	1000	5.0	—	—	475000	319000	354000	335000	402000	252000
Aluminum	ug/L	SW 6010B	100	5.6	HBSL, SMCL	6000, 200	<100	<100	<100	<100	<100	<100
Antimony	ug/L	SW 7041	0.50	0.070	MCL	6	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	ug/L	SW 7060A	2.0	0.44	MCL	10	<2.0	<2.0	9.9	<2.0	<2.0	<2.0
Barium	ug/L	SW 6010B	5.0	0.70	MCL	2000	114	110	250	135	199	58.2
Beryllium	ug/L	SW 6010B	0.50	0.0	MCL	4	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Boron	ug/L	SW 6010B	100	3.3	HBSL	5000	<200	417	<200	<200	221	<200
Cadmium	ug/L	SW 7131A	0.20	0.060	MCL	5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Calcium	ug/L	SW 6010B	100	17.4	—	—	131000	84700	86900	82300	99000	57000
Chromium, Hexavalent	mg/L	SM 3500 Cr B	0.0040	0.0015	HBSL	0.02	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Cobalt	ug/L	SW 6010B	5.0	0.80	HBSL	2	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Copper	ug/L	SW 6010B	5.0	0.60	MCL	1300	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Iron	ug/L	SW 6010B	50.0	5.3	HBSL, SMCL	4000, 300	<100	292	**5310**	<100	**2000**	<100
Lead	ug/L	SW 7421	0.50	0.050	MCL	15	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Lithium	ug/L	SW 6010B	5.0	0.0	HBSL	10	8.6	<5.0	<5.0	<5.0	<5.0	<5.0
Magnesium	ug/L	SW 6010B	100	10.1	—	—	35600	26200	33300	31500	37700	26700
Manganese	ug/L	SW 6010B	5.0	1.5	HBSL, SMCL	300, 50	17.3	**83.0**	22.0	**255**	**59.2**	<5.0
Molybdenum	ug/L	SW 6010B	10.0	2.1	HBSL	30	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Nickel	ug/L	SW 6010B	5.0	1.2	HBSL	10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Potassium	ug/L	SW 6010B	1000	39.7	—	—	4260	2920	2180	1250	2630	2430
Silver	ug/L	SW 6010B	2.0	0.40	HBSL	100	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Sodium	ug/L	SW 6010B	1000	63.1	—	—	12700	50700	15700	8150	41100	22900
Strontium	ug/L	SW 6010B	5.0	0.50	HBSL	4000	435	489	1030	567	1040	435
Thallium	ug/L	SW 7841/EPA 279.2	0.50	0.090	MCL	2	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Vanadium	ug/L	SW 6010B	5.0	0.50	—	—	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Zinc	ug/L	SW 6010B	10.0	1.4	HBSL	2000	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0
Alkalinity, Total (As CaCO3)	mg/L	SM 2320B	5.0	5.0	—	—	392	288	296	332	4290	240
Biochemical Oxygen Demand	mg/L	SM 5210B	2.0	2.0	—	—	<2.0	<2.0	<3.0	<2.0	<2.0	<2.0
Carbonaceous Biological Oxyg	mg/L	EPA 405.1/SM 5210	2.0	2.0	—	—	<2.0	<3.0	<3.0	<2.0	<2.0	<2.0
Chemical Oxygen Demand	mg/L	HACH 8000	5.0	4.1	—	—	<5.0	<5.0	<5.0	<5.0	6.8	<5.0
Cyanide, Total	mg/L	EPA 335.4	0.010	0.0050	MCL	0.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Phenolics, Total Recoverable	ug/L	EPA 420.4	10.0	8.0	—	—	4.0	2.4	4.6	7.2	3.3	<2.0
Total Dissolved Solids (Residu	mg/L	SM 2540C	10.0	10.0	SMCL	500	**586**	470	384	406	**606**	378
Total Organic Carbon	mg/L	SM 5310C	1.0	0.19	—	—	1.5	<1.0	<1.0	<1.0	<1.0	<1.0

Appendix A

Fall 2019					Benchmark		Sample Sites					
Parameter	**Units**	**Method**	**PQL**	**MDL**	**Type**	**Value**	**MON00022**	**MON10016**	**PRE10007**	**SHE00089**	**WAR10003**	**WAR10004**
E. coli	MPN/100mL	Colilert	1.0	1.0	MCL	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1,2-Tetrachloroethane	ug/L	SW 8260B	1.0	0.22	HBSL	0.2						
1,1,1-Trichloroethane	ug/L	SW 8260B	1.0	0.28	MCL	200						
1,1,2,2-Tetrachloroethane	ug/L	SW 8260B	1.0	0.23	HBSL	0.0002						
1,1,2-Trichloroethane	ug/L	SW 8260B	1.0	0.34	MCL	5						
1,1-Dichloroethane	ug/L	SW 8260B	1.0	0.27	HBSL	1000						
1,1-Dichloroethene	ug/L	SW 8260B	1.0	0.22	MCL	7						
1,1-Dichloropropene	ug/L	SW 8260B	1.0	0.21	—	—						
1,2,3-Trichlorobenzene	ug/L	SW 8260B	1.0	0.23	—	—						
1,2,3-Trichloropropane	ug/L	SW 8260B	1.0	0.27	HBSL	30						
1,2,4-Trichlorobenzene	ug/L	SW 8260B	1.0	0.21	MCL	70						
1,2-Dibromo-3-chloropropane	ug/L	SW 8260B	5.0	0.87	MCL	0.2						
1,2-Dibromoethane (EDB)	ug/L	SW 8260B	1.0	0.19	MCL	0.05						
1,2-Dichlorobenzene	ug/L	SW 8260B	1.0	0.57	MCL	600						
1,2-Dichloroethane	ug/L	SW 8260B	1.0	0.30	MCL	5						
1,2-Dichloropropane	ug/L	SW 8260B	1.0	0.23	MCL	5						
1,3-Dichlorobenzene	ug/L	SW 8260B	1.0	0.20	HBSL	600						
1,3-Dichloropropane	ug/L	SW 8260B	1.0	0.24	HBSL	100						
1,4-Dichlorobenzene	ug/L	SW 8260B	1.0	0.21	MCL	75						
2,2-Dichloropropane	ug/L	SW 8260B	1.0	0.26	—	—						
2-Butanone (MEK)	ug/L	SW 8260B	10.0	2.7	—	—						
2-Chlorotoluene	ug/L	SW 8260B	1.0	0.22	—	—						
2-Hexanone	ug/L	SW 8260B	10.0	0.078	HBSL	30						
4-Chlorotoluene	ug/L	SW 8260B	1.0	0.24	HBSL	100						
4-Methyl-2-pentanone (MIBK	ug/L	SW 8260B	10.0	1.9	—	—						
Acetone	ug/L	SW 8260B	10.0	3.8	HBSL	6000						
Acetonitrile	ug/L	SW 8260B	10.0	2.4	—	—						
Benzene	ug/L	SW 8260B	1.0	0.27	MCL	5						
Bromobenzene	ug/L	SW 8260B	1.0	0.22	HBSL	50						
Bromochloromethane	ug/L	SW 8260B	1.0	0.29	HBSL	60						
Bromodichloromethane	ug/L	SW 8260B	1.0	0.23	MCL	80						
Bromoform	ug/L	SW 8260B	1.0	0.23	MCL	80						
Bromomethane	ug/L	SW 8260B	1.0	0.29	HHBP	140						
Carbon disulfide	ug/L	SW 8260B	1.0	0.24	HBSL	600						
Carbon tetrachloride	ug/L	SW 8260B	1.0	0.24	MCL	5						
Chlorobenzene	ug/L	SW 8260B	1.0	0.26	MCL	100						
Chloroethane	ug/L	SW 8260B	1.0	0.26	—	—						
Chloroform	ug/L	SW 8260B	1.0	0.27	MCL	80						
Chloromethane	ug/L	SW 8260B	1.0	0.32	—	—						
cis-1,2-Dichloroethene	ug/L	SW 8260B	1.0	0.30	MCL	70						
cis-1,3-Dichloropropene	ug/L	SW 8260B	1.0	0.23	HBSL	0.3						
Dibromochloromethane	ug/L	SW 8260B	1.0	0.65	MCL	80						
Dibromomethane	ug/L	SW 8260B	1.0	0.30	—	—						
Dichlorodifluoromethane	ug/L	SW 8260B	1.0	0.24	HBSL	1000						
Ethyl acetate	ug/L	SW 8260B	1.0	0.21	HBSL	6000						
Ethylbenzene	ug/L	SW 8260B	1.0	0.17	MCL	700						
Hexachloro-1,3-butadiene	ug/L	SW 8260B	1.0	0.28	—	—						
m&p-Xylene	ug/L	SW 8260B	1.0	0.41	MCL	10000						

Appendix A

Fall 2019					Benchmark		Sample Sites					
Parameter	**Units**	**Method**	**PQL**	**MDL**	**Type**	**Value**	**MON00022**	**MON10016**	**PRE10007**	**SHE00089**	**WAR10003**	**WAR10004**
Methylene Chloride	ug/L	SW 8260B	1.0	0.16	MCL	5						
Methyl-tert-butyl ether	ug/L	SW 8260B	1.0	0.24	—	—						
Naphthalene	ug/L	SW 8260B	1.0	0.21	HBSL	100						
o-Xylene	ug/L	SW 8260B	1.0	0.22	MCL	10000						
p-Isopropyltoluene	ug/L	SW 8260B	1.0	0.18	—	—						
Styrene	ug/L	SW 8260B	1.0	0.21	MCL	100						
Tetrachloroethene	ug/L	SW 8260B	1.0	0.23	MCL	5						
Toluene	ug/L	SW 8260B	1.0	0.23	MCL	1000						
trans-1,2-Dichloroethene	ug/L	SW 8260B	1.0	0.22	MCL	100						
trans-1,3-Dichloropropene	ug/L	SW 8260B	1.0	0.20	HBSL	0.3						
Trichloroethene	ug/L	SW 8260B	1.0	0.30	MCL	5						
Trichlorofluoromethane	ug/L	SW 8260B	1.0	0.25	HBSL	2000						
Vinyl acetate	ug/L	SW 8260B	5.0	0.28	—	—						
Vinyl chloride	ug/L	SW 8260B	1.0	0.22	MCL	2						
Xylene (Total)	ug/L	SW 8260B	1.0	0.41	MCL	10000						

MCL - Maximum Contaminant Level set by USEPA

SMCL - Secondary Maximum Contaminant Level set by USEPA

AMCL - Alternative Maximum Contaminant Level set by USEPA

HBSL - Non enforceable Health Based Screening Level based on (1) latest USEPA Office of Water policies for

HHBP - Human Health Benchmark for Pesticides set by USEPA

— No drinking water benchmark set for the compound

Numbers in bold exceed a benchmark

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