

PFAS Water Resources Characterization Study

**Per- and Polyfluoroalkyl Substances (PFAS)
Surface Water Sampling Results, 2019–2021**

Published by the
Philadelphia Water Department

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**PHILADELPHIA
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April 2019 – March 2021

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Executive Summary

The Philadelphia Water Department began voluntary, proactive testing for per- and polyfluoroalkyl substances, or PFAS, in the city's rivers and creeks in 2019. The goal is to better understand the occurrence of these compounds in the city's water supply.

- ▶ PWD has not detected concentrations at or above the U.S. Environmental Protection Agency's health advisory level of 70 ppt (parts per trillion) for two of the most found and widely studied PFAS compounds called perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), combined.
- ▶ Separate from PWD testing, independent studies led by the EPA and the Pennsylvania Department of Environmental Protection indicate non-detectable PFAS concentrations in Philadelphia's drinking water.

The information that follows details the methodology and results of PWD's study. This report will be periodically updated to include additional datasets and relevant information once fully vetted and reviewed by PWD's scientists and engineers.

Overview

PFAS, which stands for per- and polyfluoroalkyl substances, are a broad group of man-made chemicals that have been widely used around the world since the mid-20th century to manufacture industrial and consumer products including cookware, fabrics, furniture, paper goods and firefighting foams. Because they are resistant to heat, oil, and water, they do not break down easily and can remain in the environment for years.

In recent years, these contaminants have gained international attention as they've been detected in soil, water, air, and living organisms, including humans, across the world—even in remote locations such as the Arctic. In short, they are all around us.

Research suggests some PFAS compounds may be linked to serious health problems, including an increased risk of cancer. Yet, despite the everyday use of these chemicals, scientists know relatively little about the health effects of most PFAS. This emphasizes the universal need for additional research and environmental management strategies. As with many emerging contaminants, advances in technology used to detect these substances has evolved faster than research that can help us better understand the public health effects from these low-level concentrations. Numerous PFAS substances are currently being studied to fully understand and better regulate these chemicals.

In the greater Philadelphia area, PFAS has been detected in groundwater near some military bases that once used firefighting foams called AFFF (aqueous film forming foams) that contained PFAS. Philadelphia's drinking water is sourced from the Delaware and Schuylkill rivers, not groundwater. Nevertheless, the existence of these contaminants in water supplies across the globe means drinking water can be a potential route for exposure.

While there are no federal or state drinking water regulations for PFAS in Pennsylvania, in 2016, the U.S. Environmental Protection Agency (EPA) set a health advisory level of 70 parts per trillion for two of the most common and widely studied PFAS compounds called perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA).

For context, one part per trillion (ppt) is roughly equivalent to one grain of sugar in an Olympic-sized swimming pool.

The EPA guideline is not a regulation, but rather a public health guideline. In the absence of a federal regulation, the Commonwealth of Pennsylvania has started the process of developing state specific standards for PFOA and PFOS; releasing a pre-draft version of the limits under consideration in July 2021.

In 2019, PWD began voluntarily and proactively testing for PFAS in the city's rivers and creeks to better understand the occurrence of these compounds in the city's water supply. This document details the methodology and results of the two-year study.

PWD has not detected concentrations at or above the EPA's health advisory level of 70 ppt (parts per trillion) for PFOA and PFOS combined. Furthermore, PWD has not detected concentrations that come close to or exceed the more stringent levels under development by the Pennsylvania Department of Environmental Protection. Additionally, results from independent studies led by the EPA and the Pennsylvania Department of Environmental Protection indicate non-detectable PFAS concentrations in Philadelphia's drinking water.

Methodology and Sampling Locations

Monthly surface water samples were collected at all three PWD drinking water intakes on the Schuylkill and Delaware rivers and from one location on each of the Wissahickon, Poquessing, and Pennypack Creeks starting in April 2019 (Figure 1). These samples were analyzed for PFAS concentrations using EPA Method 537. In March 2020 sampling was

paused due to the COVID-19 pandemic and did not resume until a Health and Safety Plan was approved in September 2020.

Starting in September 2020, sampling efforts focused on the surface water near the intakes, increasing frequency to two samples collected per month for a period of 6 months. These samples were analyzed for the same suite of chemicals as the previous samples using an updated analytical method, EPA Method 537.1.

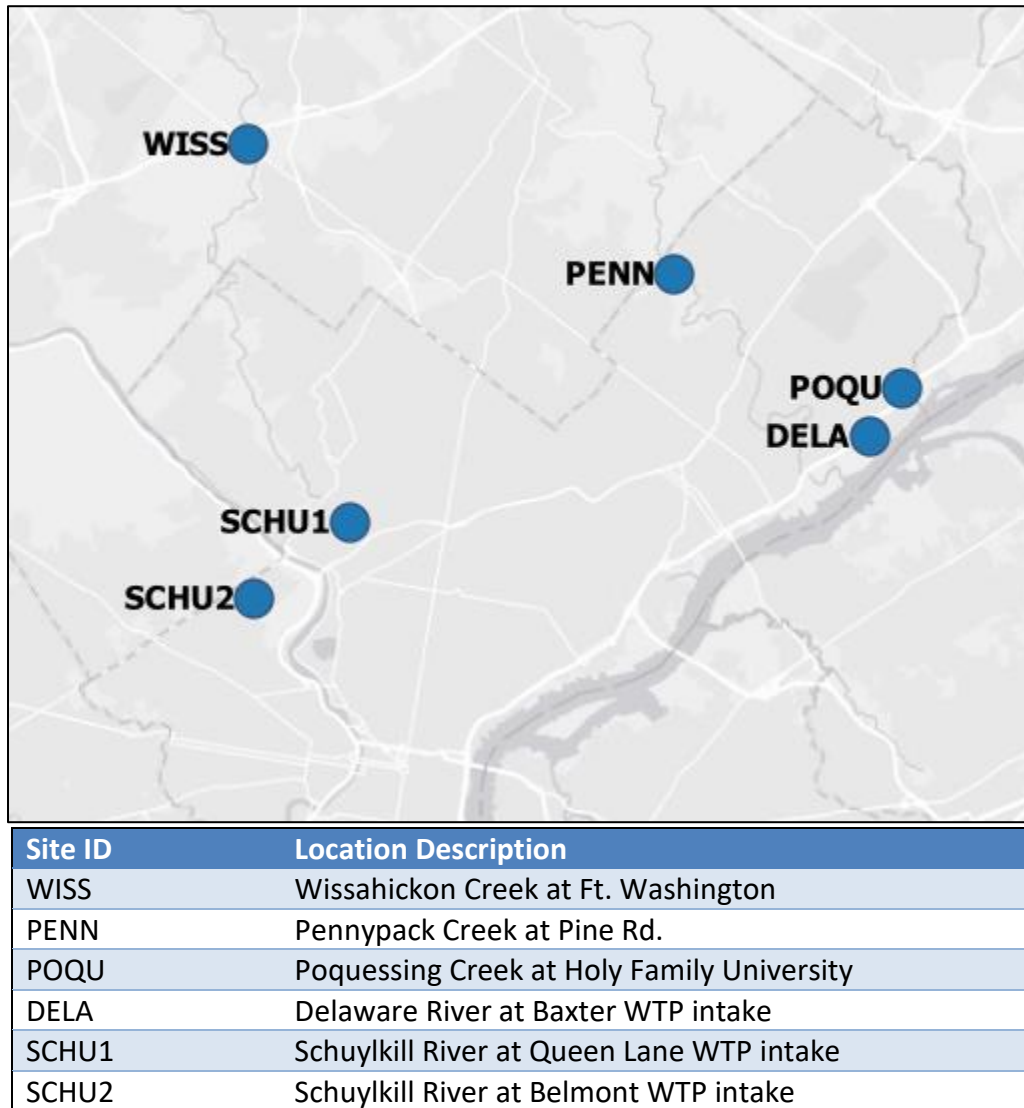


Figure 1. PFAS Watershed Characterization Sampling Site Locations and Descriptions

Results Summary

Samples collected from the surface water near the water treatment plant intake on the Delaware River demonstrated an average combined PFOA and PFOS concentration of 8.3 ppt, ranging from 5.3 to 12.2 ppt. Surface water results from near the Schuylkill River water treatment plant intakes exhibited an average combined PFOA and PFOS concentration of 11.7 ppt and 9.1 ppt, respectively, ranging from 6.7 to 16.2 ppt (Table 1). Concentrations for the individual PFAS compounds PFOS and PFOA are summarized in Tables 2 and 3.

Even assuming no removal by conventional water treatment, these results indicate that concentrations in Philadelphia’s drinking water are far below the EPA lifetime health advisory level of 70 ppt for PFOA and PFOS combined and well below levels under consideration in 2021 for state regulation.

No surface water sample taken by PWD from any site during this characterization study exceeded the EPA lifetime health advisory level of 70 ppt for PFOA and PFOS combined in drinking water (Table 1, Figures 2 and 3). No samples from the water treatment plant intakes exceeded the proposed state regulation (Tables 2 and 3, Figures 4 and 5). Upstream tributary locations exhibited higher PFAS concentrations than locations near PWD intakes, primarily due to lower flows and, consequently, less dilution.

Table 1. Combined Concentration of PFOS + PFOA Summary (ppt)

Location ID	Description	Number of Samples	Average (ppt)	Min (ppt)	Max (ppt)
DELA	Delaware River at Baxter intake	23	8.3	5.3	12.2
SCHU1	Schuylkill River at Queen Lane intake	23	11.7	8.6	15.9
SCHU2	Schuylkill River at Belmont intake	23	9.1	6.7	16.2
PENN	Pennypack Creek at Pine Rd.	11	28.7	19.7	51.0
POQU	Poquessing Creek at Holy Family University	11	29.9	15.5	44.0
WISS	Wissahickon Creek at Ft. Washington	11	20.0	16.8	24.0

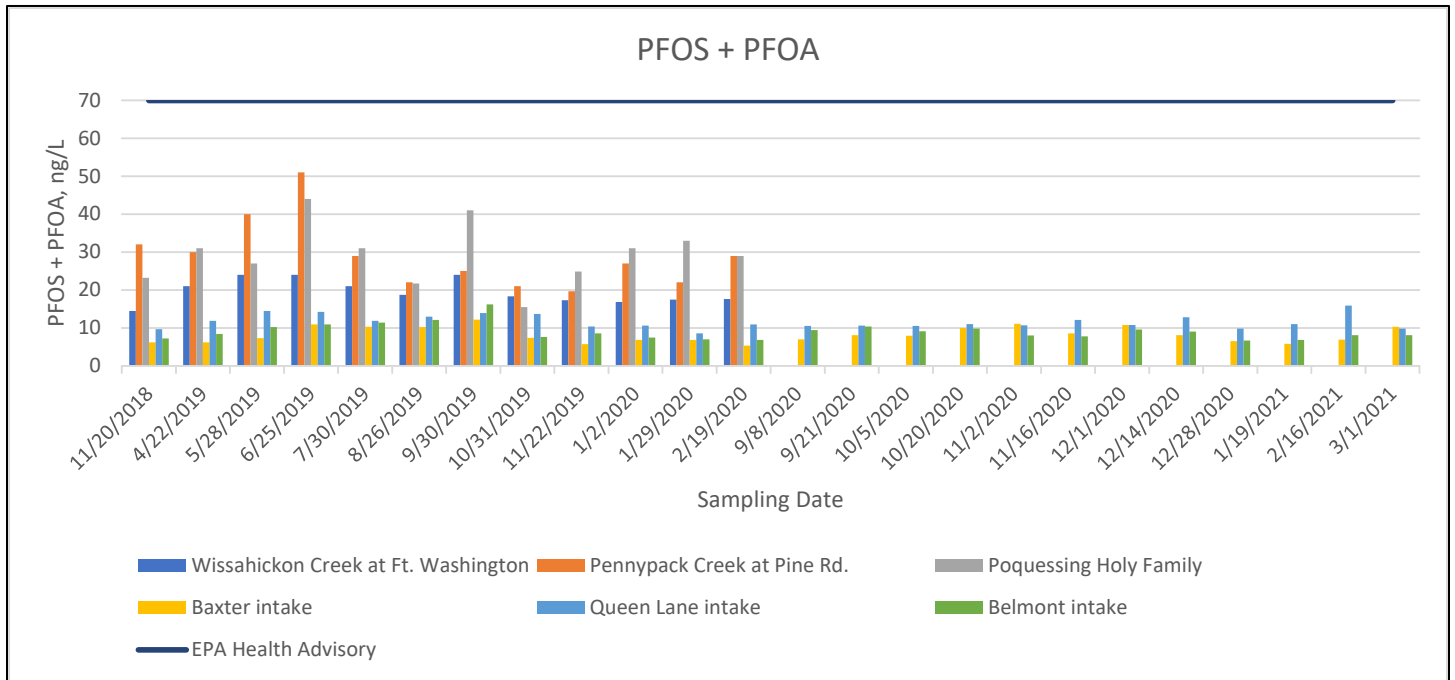


Figure 2. Combined PFOS and PFOA Results for Each Site by Sample Date (ppt)

Table 2. PFOS Concentration Summary (ppt)

Location ID	Description	Number of Samples	Average (ppt)	Min (ppt)	Max (ppt)
DELA	Delaware River at Baxter intake	23	4.4	2.6	7.2
SCHU1	Schuylkill River at Queen Lane intake	23	5.1	3.7	7.0
SCHU2	Schuylkill River at Belmont intake	23	3.9	2.7	8.2
PENN	Pennypack Creek at Pine Rd.	11	16.0	9.7	31.0
POQU	Poquessing Creek at Holy Family University	11	12.9	7.6	20.0
WISS	Wissahickon Creek at Ft. Washington	11	9.8	7.8	12.0

Table 3. PFOA Concentration Summary (ppt)

Location ID	Description	Number of Samples	Average (ppt)	Min (ppt)	Max (ppt)
DELA	Delaware River at Baxter intake	23	3.9	2.7	5.9
SCHU1	Schuylkill River at Queen Lane intake	23	6.6	4.9	8.9
SCHU2	Schuylkill River at Belmont intake	23	5.2	3.8	8.0
PENN	Pennypack Creek at Pine Rd.	11	12.7	10.0	20.0
POQU	Poquessing Creek at Holy Family University	11	17.0	7.9	27.0
WISS	Wissahickon Creek at Ft. Washington	11	10.2	8.1	13.0

The summary statistics from each sampling site are presented as boxplots in Figures 3-5. Boxplots are useful in looking at the variability of the data at each site. The end of each line extending from the box indicates that site’s minimum and maximum normal results value; the majority of each site’s results fall within the range shown by the box itself. The horizontal line within each box is the median, or middle, value. The single dots appearing on the plots represent results that are considered statistical outliers. Tributary sites exhibited greater variability in their results than water treatment plant intake sites.

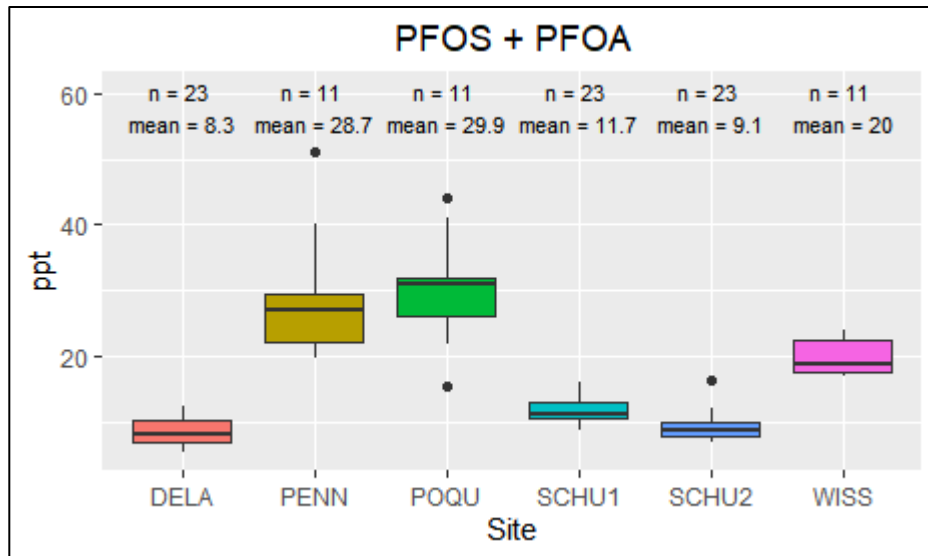


Figure 3. Combined PFOS and PFOA results summarized by sampling site (ppt)

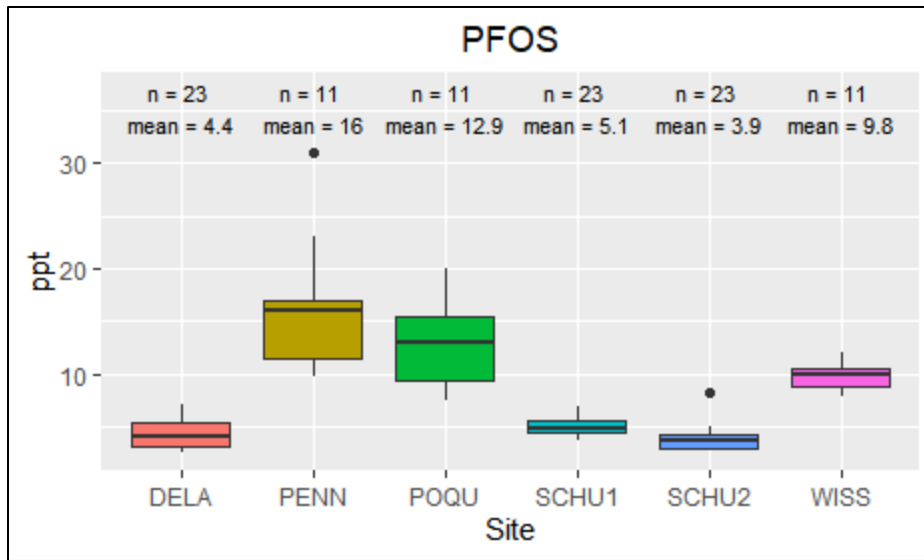


Figure 4. PFOS results summarized by sampling site (ppt)

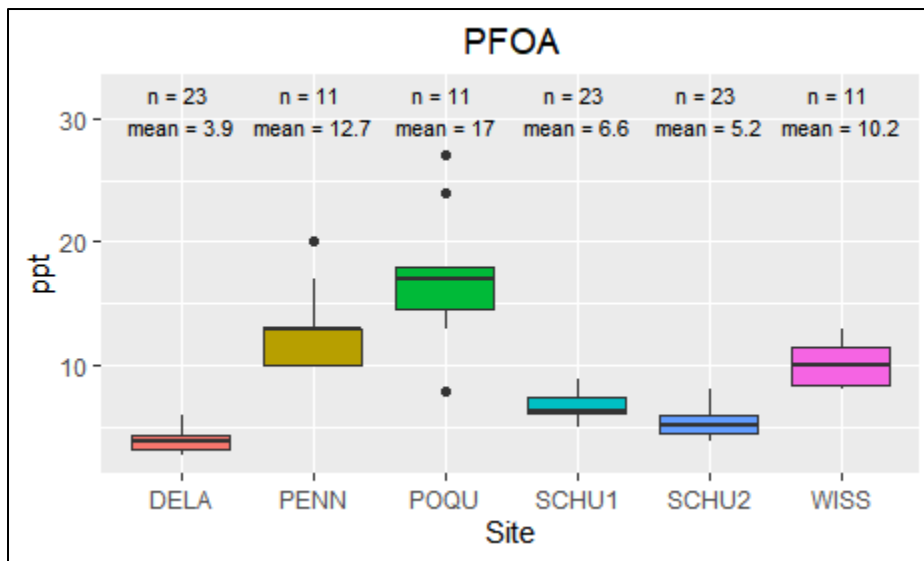


Figure 5. PFOA results summarized by sampling site (ppt)

Discussion and Conclusion

The primary goal of the Water Resources Characterization Study is to determine baseline levels of PFAS occurring in the city's source waters.

Results show that all samples were safely below the 70 ppt EPA health advisory level for PFOS and PFOA combined, with water resource samples taken at PWD intakes being far below this level.

It should be noted that the ability to detect the presence of PFAS compounds is advancing faster than the ability to understand their public health implications. Advances in analytical methods allow us to detect concentrations in the parts per trillion (ppt) magnitude – the equivalent of one grain of sugar in an Olympic-sized swimming pool. As the science surrounding PFAS is constantly evolving, we are working to ensure that we are following the latest scientific advances. We are also collaborating with neighboring water utilities to better understand the influence of regional groundwater contamination in the greater Philadelphia area.

We continue to voluntarily test Philadelphia's water for PFAS. We will continue to follow public health research and track both federal and state regulatory developments as this issue evolves so that we can best protect the integrity of our drinking water for generations to come.

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Table 4. Results from Schuylkill and Delaware Rivers Near Intakes (ppt)

Sampling Date	Delaware River at Baxter Intake			Schuylkill River at Queen Lane Intake			Schuylkill River at Belmont Intake		
	PFOS	PFOA	PFOS+PFOA*	PFOS	PFOA	PFOS+PFOA*	PFOS	PFOA	PFOS+PFOA*
4/22/2019	3.2	3	6.2	5.3	6.6	11.9	3.7	4.7	8.4
5/28/2019	3.8	3.5	7.3	6.2	8.3	14.5	4.3	5.9	10.2
6/25/2019	5.6	5.3	10.9	6.1	8.1	14.2	4.3	6.6	10.9
7/30/2019	5.3	5.0	10.3	5	6.9	11.9	5	6.4	11.4
8/26/2019	5.1	5.1	10.2	5.5	7.5	13	5.1	7	12.1
9/30/2019	6.3	5.9	12.2	5.6	8.3	13.9	8.2	8	16.2
10/31/2019	3.7	3.7	7.4	6.1	7.6	13.7	3.1	4.5	7.6
11/22/2019	2.8	2.9	5.7	4.3	6.1	10.4	3.4	5.2	8.6
1/2/2020	3.6	3.2	6.8	4.6	6	10.6	3	4.5	7.5
1/29/2020	3.2	3.4	6.6	3.7	4.9	8.6	2.8	4.2	7
2/19/2020	2.6	2.7	5.3	4.8	6.1	10.9	2.7	4.1	6.8
9/8/2020	3.9	3.1	7	4.8	5.7	10.5	4.2	5.2	9.4
9/21/2020	4.3	3.8	8.1	4.5	6.1	10.6	4.5	5.9	10.4
10/5/2020	4.2	3.7	7.9	4.3	6.2	10.5	3.8	5.3	9.1
10/20/2020	5.6	4.4	10	4.4	6.6	11	3.7	6.1	9.8
11/2/2020	7.2	3.9	11.1	4.6	6.1	10.7	3.3	4.7	8
11/16/2020	4.3	4.3	8.6	5.0	7.1	12.1	3.0	4.8	7.8
12/1/2020	6.8	4.0	10.8	5.3	5.5	10.8	4.5	5.1	9.6
12/14/2020	4.1	4.0	8.1	5.6	7.2	12.8	3.7	5.3	9
12/28/2020	3.2	3.3	6.5	4.3	5.5	9.8	2.9	3.8	6.7
1/19/2021	2.8	3.0	5.8	4.8	6.2	11	2.7	4.1	6.8
2/16/2021	3.1	3.8	6.9	7.0	8.9	15.9	3.2	4.9	8.1
3/1/2021	5.7	4.6	10.3	4.7	5.1	9.8	3.7	4.4	8.1

***Combined for comparison to 70 ppt EPA Lifetime Health Advisory Level for drinking water (May 2016)**

Table 5. Results from Tributary Creeks (ppt)

Sampling Date	Poquessing Creek at Holy Family (ppt)			Pennypack Creek at Pine Road (ppt)			Wissahickon Creek at Ft. Washington (ppt)		
	PFOS	PFOA	PFOS+PFOA*	PFOS	PFOA	PFOS+PFOA*	PFOS	PFOA	PFOS+PFOA*
4/22/2019	13	18	31	17	13	30	10	11	21
5/28/2019	10	17	27	23	17	40	11	13	24
6/25/2019	20	24	44	31	20	51	12	12	24
7/30/2019	13	18	31	16	13	29	10	11	21
8/26/2019	8.7	13	21.7	11	11	22	8.7	10	18.7
9/30/2019	14	27	41	12	13	25	11	13	24
10/31/2019	7.6	7.9	15.5	11	10	21	10	8.3	18.3
11/22/2019	8.9	16	24.9	9.7	10	19.7	7.8	9.5	17.3
1/2/2020	17	14	31	17	10	27	8.7	8.1	16.8
1/29/2020	18	15	33	12	10	22	9.4	8.1	17.5
2/19/2020	12	17	29	16	13	29	9.1	8.5	17.6

****Combined for comparison to 70 ppt EPA Lifetime Health Advisory Level for drinking water (May 2016)***