LMS/RFS/50541

Annual PFAS Monitoring Report Rocky Flats Site, Colorado Calendar Year 2024

April 2025

U.S. DEPARTMENT OF ENERGY | Legacy Management

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Abbreviations

AFFF	aqueous film-forming foam
ANOVA	analysis of variance
CY	calendar year
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ESI	Expanded Site Inspection
ID	interim directive
ng/L	nanograms per liter
OLF	Original Landfill
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PLFTS	Present Landfill Treatment System
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SAP	Sampling and Analysis Plan
WQCC	Water Quality Control Commission

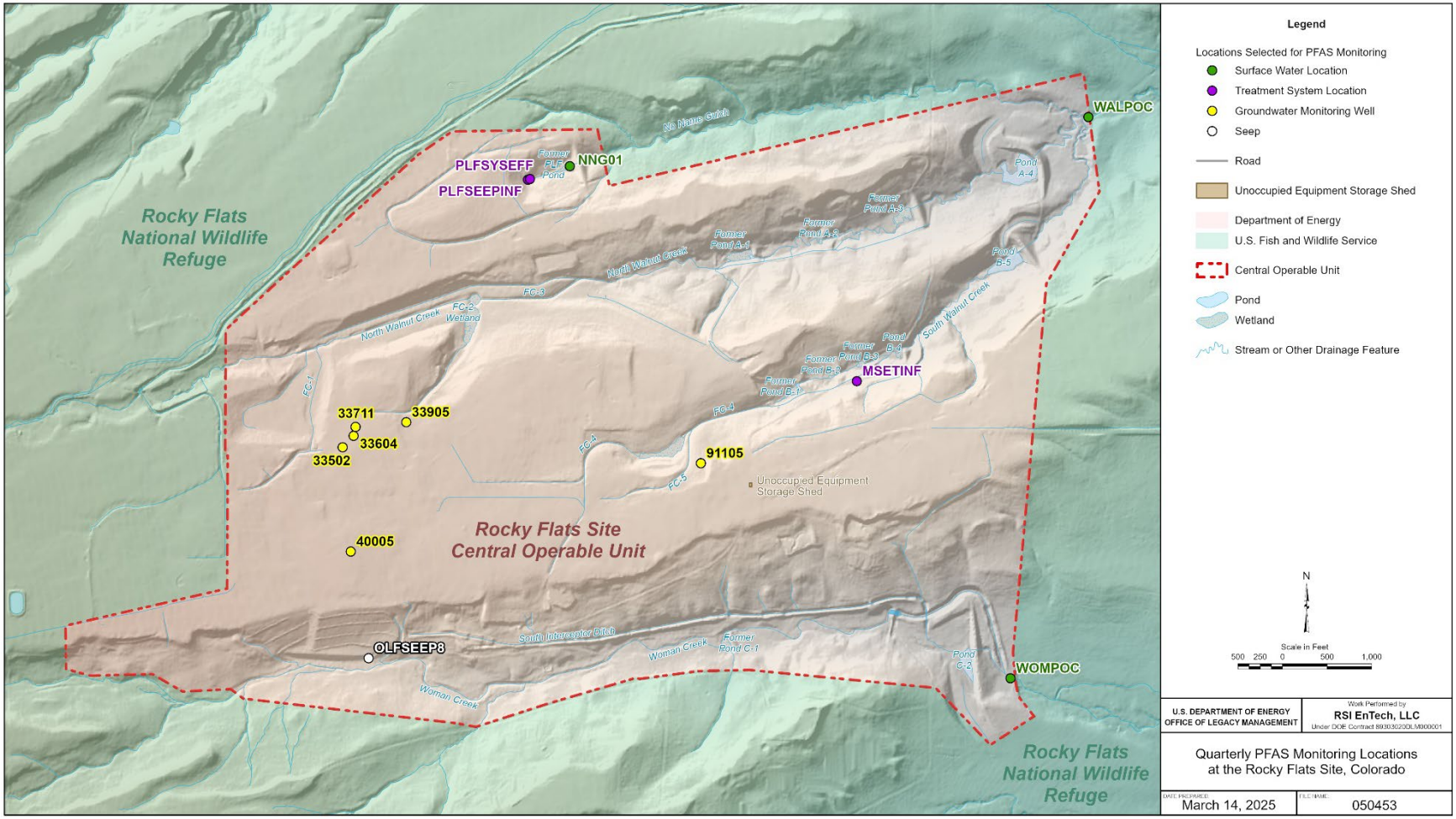
1.0 Introduction

Per- and polyfluoroalkyl substances (PFAS) are a group of thousands of human-made chemicals that have been in use since the 1930s and are found in a variety of industrial and commercial products. Common applications include cosmetics, food packaging, stain-resistant and water-resistant articles and treatments, nonstick coatings such as Teflon, and many others. In addition, PFAS have been used in metallurgy and have been important ingredients in aqueous film-forming foam (AFFF) used in firefighting. Some PFAS have been identified as potentially harmful to human health and are being investigated at facilities across the nation.

The Colorado Department of Public Health and Environment (CDPHE), the U.S. Environmental Protection Agency (EPA), and the U.S. Department of Energy (DOE) developed a Sampling and Analysis Plan (SAP), *Sampling Plan for PFOA/PFOS at the Rocky Flats Site, Colorado* (DOE 2019), that described a limited sampling program at the Rocky Flats Site, Colorado (Site). Eight locations were sampled to screen groundwater and surface water for the presence of the two PFAS that have received the greatest scrutiny, perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). At the time, there was no published method for analyzing PFAS in environmental matrixes that would meet the very low detection limits needed to support this program; instead, a widely-used modification to the drinking-water Method 537.1 was selected. Both PFOA and PFOS were detected in the samples collected in 2019 (DOE 2020). Two of the locations produced samples with concentrations exceeding EPA's nonenforceable drinking water health advisory limit, at that time 70 nanograms per liter (ng/L) (or parts per trillion) for the sum of the concentrations of PFOA + PFOS. These two locations include a monitoring well near the former Rocky Flats Fire Department and associated training area, and the influent to the Present Landfill Treatment System (PLFTS) that treats seepage from the former landfill.

Based on the 2019 screening results, DOE developed a new SAP in 2021, *Sampling and Analysis Plan for PFAS at the Rocky Flats Site, Colorado* (DOE 2021), that specifies additional sampling to further assess the presence of PFAS at the Site. The SAP describes the special personal protective equipment, clothing, sampling preparations, sampling staff preparations, and other special requirements that are specific to collecting samples for the analysis of PFAS. The 2021 SAP increased the number of sample locations from 8 to 12 (Figure 1). The additional monitoring locations are near the former fire department and at the PLFTS—the two locations that presented the highest concentrations of PFOA + PFOS in 2019. The target analyte list was increased to 28 PFAS, including PFOA, PFOS, and other PFAS listed in Colorado Water Quality Control Commission (WQCC) Policy 20-1 (WQCC 2020), hereafter called the Colorado WQCC Policy, as well as three PFAS that are not listed in that policy. This sampling effort would be conducted quarterly for a total of 8 quarters (2 years). Results are provided in quarterly reports; the report for the fourth quarter of each calendar year (CY) is combined with an annual report. The quarterly reports are brief data summaries, and the annual reports include additional information.

Sampling as described in the 2021 SAP began in the third quarter of CY 2021, and the eighth quarterly sampling event took place in the second quarter of CY 2023. Although it was planned to be performed for 8 quarters, sampling continued in accordance with the 2021 SAP through the third quarter of CY 2023, resulting in a ninth consecutive quarter of sampling.



Abbreviation: PLF = Present Landfill

Figure 1. Central Operable Unit with PFAS Sampling Locations

The 2021 SAP was revised again in the fourth quarter of CY 2023 to include Interim Directive (ID) ID-23-08 (DOE 2023), which reduced the number of sample locations to six and included the collection of split samples to allow a statistical comparison of results obtained through two different analytical methods, modified EPA Method 537.1 and EPA Method 1633 (see the PFAS SAP ID [DOE 2023]). Split samples were first collected from the six selected locations in the second quarter of CY 2023 at DOE's initiative. In the second quarter and the following (third) quarter of CY 2023, the other six locations were still sampled, but those samples were analyzed using only the original analytical method (modified EPA Method 537.1). The number of PFAS sampling locations was then reduced via the ID, and only the selected six locations identified in the ID (DOE 2023) were sampled using the split sampling approach.

The split samples comparison would require a minimum of 4 quarters of data. As noted above, the former analytical method was used starting in 2019 and is a modification of a drinking water method that has not been formally approved for use with environmental matrixes such as groundwater and surface water. The latter method (Method 1633) was finalized and approved for use with environmental matrixes in 2023. See Section 5.0 of this report for the results of the statistical comparison of the two analytical methods.

Quarterly monitoring for PFAS at the Site underwent further adjustment in late 2024 following discussions with the CDPHE and EPA. A comprehensive review and revision of the 2021 SAP was conducted, and the resulting new SAP was issued in October 2024 (DOE 2024b). This SAP focuses on continued quarterly sampling using the EPA 1633 analytical method at three Site locations: the two surface water Points of Compliance (WALPOC and WOMPOC) and the surface water location downstream of the PLFTS (NNG01).

Table 1 summarizes the locations that have been periodically sampled for PFAS through the end of CY 2024 and which SAP(s) drove this sampling.

Table 1. Summary of Planned Quarterly PFAS Sampling at the Rocky Flats Site Through CY 2024

Location	General Description	SAP
33502	Monitoring well near former fire training area and Oil Burn Pit #1	1, 2, 3
33604	Monitoring well near former fire training area and Oil Burn Pit #1	2
33711	Monitoring well farther downgradient of former fire training area	2
33905	Monitoring well farther downgradient of former fire training area	2, 3
40005	Monitoring well near former Building 444	1, 2
91105	Monitoring well near former Oil Burn Pit No. 2	1, 2
OLFSEEP8	Seep at base of OLF hillside	1, 2, 3
MSETINF	Influent to East Trenches Plume Treatment System	1, 2
PLFSEEPINF	Seep portion of influent to PLFTS	1, 2
PLFSYSEFF	Effluent from PLFTS	2, 3
WOMPOC	Woman Creek Point of Compliance	1, 2, 3, 4
WALPOC	Walnut Creek Point of Compliance	1, 2, 3, 4
NNG01	Surface water in No Name Gulch before it leaves the Central Operable Unit	4

Notes:
1 = initial PFAS SAP (DOE 2019)
2 = expanded PFAS SAP (DOE 2021)
3 = PFAS SAP ID (DOE 2023)
4 = reduced PFAS SAP (DOE 2024b)

Abbreviation:
OLF = Original Landfill

2.0 Monitoring Highlights: Fourth Quarter CY 2024

The WALPOC monitoring location was dry during the fourth quarter of CY 2024. All other locations were successfully sampled. Sampling events are summarized in Table 2.

Table 2. PFAS Samples Collected in Fourth Quarter 2024

Location ID		Sample ID	Sample Date and Time	Sample Type	Analytical Method[b]
Actual	Dummy[a]				
WOMPOC	2770	RFS01-18.2411010-001	11/20/2024 14:30	D	1633
WOMPOC	2784	RFS01-18.2411010-003	11/20/2024 14:25	FB	1633
NNG01		RFS01-18.2411010-005	11/20/2024 13:20	F	1633
WOMPOC		RFS01-18.2411010-012	11/20/2024 14:30	F	1633

Notes:
[a] "Dummy" location codes are assigned to quality assurance/quality control samples (sample types D, E, FB) that are physically collected at the actual locations indicated. Refer to the PFAS SAP ID (DOE 2023) for additional information on sample types.
[b] Analytical method is EPA Method 1633.

Abbreviations:
D = duplicate
E = equipment rinse
F = field
FB = field blank

3.0 Analytical Data: Fourth Quarter CY 2024

Analytical data for the fourth quarter of CY 2024 are provided in Table 6, and field parameter data are provided in Table 7. These two tables are attached at the end of this report.

4.0 Summary of PFAS Monitoring at Rocky Flats in CY 2024

Surface water location WALPOC was successfully sampled in the first and second quarters but was dry for the other 2 quarters of CY 2024. Surface water location WOMPOC was dry in the third quarter but was successfully sampled in the other 3 quarters of CY 2024. All other designated locations (see Figure 1 and the relevant SAP[s] listed in Table 1) produced sufficient water for sampling. Other than the dry surface water locations, there were no difficulties in collecting samples. Surface water location NNG01 was sampled in the second, third, and fourth quarters. The sample in the third quarter was not required but was collected at DOE's discretion to continue the collection of data at this location. Table 3 summarizes the samples that were collected for PFAS analysis in CY 2024.

As part of an Expanded Site Inspection/Resource Conservation and Recovery Act (RCRA) Facility Investigation (ESI/RFI) for PFAS at the Rocky Flats Site, a Sitewide sampling event took place in the second quarter of CY 2024. Attempts were made to sample 26 surface water locations, 9 treatment system locations, and 97 groundwater locations during the second quarter of CY 2024. A small number of these locations were dry during the sampling event and, therefore, were not sampled. The six sample locations specified in the 2023 revision to the SAP

were included in the Sitewide sampling event (see the *PFAS Monitoring Report, Rocky Flats Site, Colorado, Second Quarter 2024* [DOE 2024a] for more details on these six samples). The results of the Sitewide sampling event will be provided in a future report that will be a part of the ESI/RFI for PFAS at the Rocky Flats Site.

Table 3. Summary of PFAS Samples Collected in 2024

Location ID		Sample ID	Sample Date and Time	Sample Type	Analytical Method[b]
Actual	Dummy[a]				
33502	2399	RFS01-15.2312031-003	1/17/2024 10:09	FB	M 537.1
33502	2399	RFS01-18.2312004-003	1/17/2024 10:09	FB	1633
33502	2770	RFS01-15.2312031-004	1/17/2024 10:20	E	M 537.1
33502	2770	RFS01-18.2312004-004	1/17/2024 10:20	E	1633
33502	2398	RFS01-15.2312031-002	1/17/2024 11:05	D	M 537.1
33502		RFS01-15.2312031-007	1/17/2024 11:05	F	M 537.1
33502	2398	RFS01-18.2312004-002	1/17/2024 11:05	D	1633
33502		RFS01-18.2312004-006	1/17/2024 11:05	F	1633
33905		RFS01-15.2312031-010	1/17/2024 12:15	F	M 537.1
33905		RFS01-18.2312004-007	1/17/2024 12:15	F	1633
OLFSEEP8	2397	RFS01-15.2312031-001	1/17/2024 9:15	D	M 537.1
OLFSEEP8		RFS01-15.2312031-014	1/17/2024 9:15	F	M 537.1
OLFSEEP8	2397	RFS01-18.2312004-001	1/17/2024 9:15	D	1633
OLFSEEP8		RFS01-18.2312004-008	1/17/2024 9:15	F	1633
PLFSYSEFF		RFS01-15.2312031-016	1/17/2024 13:00	F	M 537.1
PLFSYSEFF		RFS01-18.2312004-010	1/17/2024 13:00	F	1633
WOMPOC		RFS01-15.2401032-018	1/31/2024 10:10	F	M 537.1
WOMPOC		RFS01-18.2401005-012	1/31/2024 10:10	F	1633
WALPOC		RFS01-15.2403033-017	3/27/2024 11:20	F	M 537.1
WALPOC		RFS01-18.2403006-011	3/27/2024 11:20	F	1633
33502		RFS01-18.2405007-006	6/10/2024 10:55	F	1633
33905		RFS01-18.2405007-007	6/10/2024 9:15	F	1633
OLFSEEP8		RFS01-19.2405001-026	5/23/2024 14:30	F	1633
PLFSYSEFF		RFS01-18.2405007-149	6/7/2024 9:05	F	1633
NNG01		RFS01-19.2405001-023	5/15/2024 12:50	F	1633
WALPOC		RFS01-19.2405001-040	5/15/2024 13:45	F	1633
WOMPOC		RFS01-19.2405001-041	5/15/2024 14:15	F	1633
33905	2783	RFS01-18.2405007-141	6/10/2024 8:35	FB	1633
33905	2784	RFS01-18.2405007-124	6/10/2024 8:45	E	1633
33502		RFS01-15.2408034-001	8/27/2024 10:55	F	1633
33905		RFS01-15.2408034-002	8/27/2024 12:01	F	1633
OLFSEEP8		RFS01-15.2408034-003	8/27/2024 09:30	F	1633
PLFSYSEFF		RFS01-15.2408034-004	8/27/2024 12:55	F	1633
NNG01		RFS01-18.2409009-010	9/30/2024 11:00	F	1633

Table 3. Summary of PFAS Samples Collected in 2024 (continued)

Location ID		Sample ID	Sample Date and Time	Sample Type	Analytical Method[b]
Actual	Dummy[a]				
33502	2399	RFS01-15.2408034-010	8/27/2024 10:10	FB	1633
33502	2770	RFS01-15.2408034-011	8/27/2024 10:25	E	1633
33502	2397	RFS01-15.2408034-008	8/27/2024 10:55	D	1633
PLFSYSEFF	2398	RFS01-15.2408034-009	8/27/2024 12:55	D	1633
WOMPOC	2770	RFS01-18.2411010-001	11/20/2024 14:30	D	1633
WOMPOC	2784	RFS01-18.2411010-003	11/20/2024 14:25	FB	1633
NNG01		RFS01-18.2411010-005	11/20/2024 13:20	F	1633
WOMPOC		RFS01-18.2411010-012	11/20/2024 14:30	F	1633

Notes:

[a] "Dummy" location codes are assigned to quality assurance/quality control samples (sample types D, E, FB) that are physically collected at the actual locations indicated. Refer to the PFAS SAP ID (DOE 2023) for additional information on sample types.

[b] Analytical methods include modified EPA Method 537.1 (referred to here as M 537.1 and in data tables as PFC_IDA_DOD5.3) and EPA Method 1633.

Abbreviations:

D = duplicate
E = equipment rinse
F = field
FB = field blank

Analytical results for PFOA and PFOS in CY 2024 were similar to those obtained since 2019, the first year of PFAS monitoring. Because of the early recognition of health concerns associated with PFOA and PFOS, those were the only PFAS analyzed in 2019, while the samples collected starting in 2021 were analyzed for additional compounds identified in the Colorado WQCC Policy (WQCC 2020). Table 4 summarizes concentrations of PFOA and PFOS in samples collected in 2019, 2021, 2022, 2023, and 2024, as determined using modified EPA Method 537.1 and EPA Method 1633. The concentrations reported for each given location are fairly similar over time.

Table 4. Summary of PFOA and PFOS Analytical Results (ng/L) Since 2019

Monitoring Wells													
Location	**Analytical Method**	**33502**		**33604**		**33711**		**33905**		**40005**		**91105**	
Quarter/Year		**PFOA**	**PFOS**	**PFOA**	**PFOS**	**PFOA**	**PFOS**	**PFOA**	**PFOS**	**PFOA**	**PFOS**	**PFOA**	**PFOS**
2/19	Modified 537.1	120	310	NS	NS	NS	NS	NS	NS	21	24 (J)	0.9 (J)	0.99 (U)
4/19	Modified 537.1	70 (J)	240	NS	NS	NS	NS	NS	NS	19	24	0.55 (J)	1.1 (U)
3/21	Modified 537.1	66 (J)	250 (J)	38	8.1	13	7 (J)	32	140	16	22	1.3 (J)	1 (U)
4/21	Modified 537.1	73 (J)	270 (J)	45	6.7	12	6.2	35	110	16	24	1.4 (J)	1.1 (J)
1/22	Modified 537.1	72	250	47	5.5	11	6.4	27	150 (J)	18	22	1.4 (J)	1.3 (J)
2/22	Modified 537.1	100	310	57	13 (J)	6.7	3.6	26	140	18	26	1.1 (J)	2.9 (J)
3/22	Modified 537.1	93	260	58	13 (J)	7.6	4.5	28	140	17	25	0.96 (J)	1.2 (J)
4/22	Modified 537.1	97 (HJ)	280 (HJ)	89 (HJ)	22 (HJ)	11 (HJ)	5 (HJ)	31 (HJ)	150 (HJ)	19 (HJ)	31 (HJ)	0.68 (HJ)	0.53 (UHJ)
1/23	Modified 537.1	88	260	49	15 (J)	22	10 (J)	27	140	18	27	0.76 (J)	0.77 (J)
2/23	Modified 537.1	96	290	58	15 (J)	12	8.6 (J)	13	54 (J)	18	29	0.73 (J)	0.55 (U)
	1633	160 (J)	350	NS	NS	NS	NS	16	46 (J)	NS	NS	NS	NS
3/23	Modified 537.1	90	260	59	20 (J)	14	6.1	44	140	20	24	1.8 (J)	2.1 (J)
	1633	130	350 (J)	NS	NS	NS	NS	56	150	22	22 (J)	NS	NS
4/23	Modified 537.1	82 (J)	240	NS	NS	NS	NS	35	110	NS	NS	NS	NS
	1633	190	530 (J)	NS	NS	NS	NS	40	120	NS	NS	NS	NS
1/24	Modified 537.1	95	240	NS	NS	NS	NS	25	150	NS	NS	NS	NS
	1633	130	270	NS	NS	NS	NS	29	160 (NJ)	NS	NS	NS	NS
2/24	1633	110	250	65	21 (J)	9.8	3.9	27	120	18	19	2	0.75 (J)
3/24	Modified 537.1	98 (J)	260 (J)	NS	NS	NS	NS	33 (J)	120 (J)	NS	NS	NS	NS
	1633	130	260	NS	NS	NS	NS	38	110	NS	NS	NS	NS
4/24	1633	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Treatment System and Surface Water Locations															
Location	**Method**	**MSETINF**		**PLFSEEPINF**		**PLFSYSEFF**		**OLFSEEP8**		**WOMPOC**		**WALPOC**		**NNG01**	
Quarter/Year		**PFOA**	**PFOS**	**PFOA**	**PFOS**	**PFOA**	**PFOS**	**PFOA**	**PFOS**	**PFOA**	**PFOS**	**PFOA**	**PFOS**	**PFOA**	**PFOS**
2/19	Modified 537.1	2 (J)	1 (U)	69 (H)	23 (H)	NS	NS	7.4	3.4 (J)	1.6 (J)	1.2 (J)	13	18	NS	NS
4/19	Modified 537.1	1.1 (J)	1 (U)	59	20	NS	NS	7.3	3.3 (J)	1.1 (U)	1.5 (J)	1.3 (J)	2.3 (J)	NS	NS
3/21	Modified 537.1	1.3 (J)	1 (U)	55 (J)	21 (J)	40 (J)	17 (J)	12	4.3	*	*	*	*	NS	NS

Table 4. Summary of PFOA and PFOS Analytical Results (ng/L) Since 2019 (continued)

Treatment System and Surface Water Locations (continued)															
Location	**Method**	**MSETINF**		**PLFSEEPINF**		**PLFSYSEFF**		**OLFSEEP8**		**WOMPOC**		**WALPOC**		**NNG01**	
Quarter/Year		**PFOA**	**PFOS**	**PFOA**	**PFOS**	**PFOA**	**PFOS**	**PFOA**	**PFOS**	**PFOA**	**PFOS**	**PFOA**	**PFOS**	**PFOA**	**PFOS**
4/21	Modified 537.1	1.3 (J)	1 (J)	50 (J)	17 (J)	45 (J)	15	5.9 (J)	2.1 (J)	0.54 (U)	0.56 (U)	*	*	NS	NS
1/22	Modified 537.1	1.4 (J)	0.91 (J)	47	14	44	13 (J)	6.6	2.1 (J)	*	*	*	*	NS	NS
2/22	Modified 537.1	1.3 (J)	0.89 (J)	53	18	41	14	7	2.4 (J)	0.55 (J)	0.75 (J)	7.6	14 (J)	NS	NS
3/22	Modified 537.1	1.1 (J)	0.52 (U)	54	18	43	17	8	2.1	1.5 (JX)	1.9 (J)	*	*	NS	NS
4/22	Modified 537.1	1.3 (HJ)	0.55 (UHJ)	68 (HJ)	21 (HJ)	58 (HJ)	18 (HJ)	2.2 (HJ)	0.56 (UHJ)	1.4 (HJ)	0.56 (UHJ)	*	*	NS	NS
1/23	Modified 537.1	1.1 (J)	0.56 (U)	60	19	44	15	7.4	2 (J)	0.49 (U)	0.5 (U)	*	*	NS	NS
2/23	Modified 537.1	1.1 (J)	0.54 (U)	90 (J)	27	47	16	5.3	0.55 (U)	2.2	0.53 (U)	6.1**	9.8**	NS	NS
	1633	NS	NS	NS	NS	59	20 (J)	5.3	2.3 (J)	2.5 (J)	1.7 (J)	7.4	8.8	NS	NS
3/23	Modified 537.1	1.3 (J)	0.66 (J)	74	27	55	19	10	3.8 (J)	*	*	*	*	NS	NS
	1633	NS	NS	NS	NS	46	14	9.8	3.4 (J)	*	*	*	*	NS	NS
4/23	Modified 537.1	NS	NS	NS	NS	46 (J)	16	5.6 (J)	1.7 (J)	0.56 (U)	2.3	*	*	NS	NS
	1633	NS	NS	NS	NS	81 (J)	20	7.2	1.8 (J)	0.57 (J)	0.44 (J)	*	*	NS	NS
1/24	Modified 537.1	NS	NS	NS	NS	48	18	10	2.4 (J)	0.57 (J)	0.51 (U)	6.9	10 (J)	NS	NS
	1633	NS	NS	NS	NS	69	19 (NJ)	10	1.6 (U)	0.56 (U)	0.28 (U)	6.1	9.7 (J)	NS	NS
2/24	1633	1.3 (J)	0.2 (U)	30 (J)	10 (J)	56	21	18 (J)	3 (J)	1.5 (J)	0.28 (U)	15 (J)	22 (J)	43 (J)	15 (J)
3/24	Modified 537.1	NS	NS	NS	NS	45 (J)	22 (J)	10 (J)	2.8 (J)	*	*	*	*	NS	NS
	1633	NS	NS	NS	NS	54	18	10	2.5 (J)	*	*	*	*	93	23
4/24	1633	NS	NS	NS	NS	NS	NS	NS	NS	0.50 (U)	0.16 (U)	*	*	55	12

Notes:
Results represent only “primary” samples, not field duplicates, and data generated using modified Method 537.1 and Method 1633.
EPA has proposed maximum contaminant levels of 4 ng/L for each of these compounds.
Qualifiers: H = hold time concerns
J = estimated result
N = recovery exceeds control limits
U = not detected at the listed detection limit
X indicates presumptive evidence of a compound
* = location was dry
** = WALPOC was sampled twice in this quarter, but only results from the sample that was collected when the other locations were sampled are shown

Abbreviation:
NS = not sampled: location was not scheduled for sampling (may be method-specific)

Table 5 summarizes the evolution of periodic PFAS sampling at the Rocky Flats Site since sampling started in 2019. Table 5 also shows when the sampling program began utilizing the approved 1633 analytical method. Based on the October 2024 revised SAP, future quarterly and annual PFAS reports will focus on three sampling locations (WALPOC, WOMPOC, and NNG01) that will be analyzed using only EPA Method 1633. This is to continue until a new PFAS sampling program is finalized.

Table 5. Summary of Sampled Locations and Analytical Methods in 2019, 2021, 2022, 2023, and 2024

Monitoring Wells							
Quarter/Year	**Method**	**33502**	**33604**	**33711**	**33905**	**40005**	**91105**
2/19	Modified 537.1	Yes	No	No	No	Yes	Yes
	1633	No	No	No	No	No	No
4/19	Modified 537.1	Yes	No	No	No	Yes	Yes
	1633	No	No	No	No	No	No
3/21	Modified 537.1	Yes	Yes	Yes	Yes	Yes	Yes
	1633	No	No	No	No	No	No
4/21	Modified 537.1	Yes	Yes	Yes	Yes	Yes	Yes
	1633	No	No	No	No	No	No
1/22	Modified 537.1	Yes	Yes	Yes	Yes	Yes	Yes
	1633	No	No	No	No	No	No
2/22	Modified 537.1	Yes	Yes	Yes	Yes	Yes	Yes
	1633	No	No	No	No	No	No
3/22	Modified 537.1	Yes	Yes	Yes	Yes	Yes	Yes
	1633	No	No	No	No	No	No
4/22	Modified 537.1	Yes	Yes	Yes	Yes	Yes	Yes
	1633	No	No	No	No	No	No
1/23	Modified 537.1	Yes	Yes	Yes	Yes	Yes	Yes
	1633	No	No	No	No	No	No
2/23	Modified 537.1	Yes	Yes	Yes	Yes	Yes	Yes
	1633	Yes	No	No	Yes	No	No
3/23	Modified 537.1	Yes	Yes	Yes	Yes	Yes	Yes
	1633	Yes	No	No	Yes	Yes	No
4/23	Modified 537.1	Yes	No	No	Yes	No	No
	1633	Yes	No	No	Yes	No	No
1/24	Modified 537.1	Yes	No	No	Yes	No	No
	1633	Yes	No	No	Yes	No	No
2/24	Modified 537.1	No	No	No	No	No	No
	1633	Yes	Yes	Yes	Yes	Yes	Yes
3/24	Modified 537.1	Yes	No	No	Yes	No	No
	1633	Yes	No	No	Yes	No	No
4/24	Modified 537.1	No	No	No	No	No	No
	1633	No	No	No	No	No	No

Table 5. Summary of Sampled Locations and Analytical Methods in 2019, 2021, 2022, 2023, and 2024 (continued)

Treatment System and Surface Water Locations								
Quarter/Year	**Method**	**MSETINF**	**PLFSEEPINF**	**PLFSYSEFF**	**OLFSEEP8**	**WOMPOC**	**WALPOC**	**NNG01**
2/19	Modified 537.1	Yes	Yes	No	Yes	Yes	Yes	No
	1633	No	No	No	No	No	No	No
4/19	Modified 537.1	Yes	Yes	No	Yes	Yes	Yes	No
	1633	No	No	No	No	No	No	No
3/21	Modified 537.1	Yes	Yes	Yes	Yes	Yes	Yes	No
	1633	No	No	No	No	No	No	No
4/21	Modified 537.1	Yes	Yes	Yes	Yes	Yes	Yes	No
	1633	No	No	No	No	No	No	No
1/22	Modified 537.1	Yes	Yes	Yes	Yes	Yes	Yes	No
	1633	No	No	No	No	No	No	No
2/22	Modified 537.1	Yes	Yes	Yes	Yes	Yes	Yes	No
	1633	No	No	No	No	No	No	No
3/22	Modified 537.1	Yes	Yes	Yes	Yes	Yes	Yes	No
	1633	No	No	No	No	No	No	No
4/22	Modified 537.1	Yes	Yes	Yes	Yes	Yes	Yes	No
	1633	No	No	No	No	No	No	No
1/23	Modified 537.1	Yes	Yes	Yes	Yes	Yes	Yes	No
	1633	No	No	No	No	No	No	No
2/23	Modified 537.1	Yes	Yes	Yes	Yes	Yes	Yes	No
	1633	No	No	Yes	Yes	Yes	Yes	No
3/23	Modified 537.1	Yes	Yes	Yes	Yes	Yes	Yes	No
	1633	No	No	Yes	Yes	Yes	Yes	No
4/23	Modified 537.1	No	No	Yes	Yes	Yes	Yes	No
	1633	No	No	Yes	Yes	Yes	Yes	No
1/24	Modified 537.1	No	No	Yes	Yes	Yes	Yes	No
	1633	No	No	Yes	Yes	Yes	Yes	No
2/24	Modified 537.1	No	No	No	No	No	No	No
	1633	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3/24	Modified 537.1	No	No	Yes	Yes	Yes	Yes	No
	1633	No	No	Yes	Yes	Yes	Yes	Yes
4/24	Modified 537.1	No	No	No	No	No	No	No
	1633	No	No	No	No	Yes	Yes	Yes
Future Quarters	Modified 537.1	No	No	No	No	No	No	No
	1633	No	No	No	No	Yes	Yes	Yes

Variances from the SAP in 2024 included using a peristaltic pump with single-use, disposable silicone tubing to collect surface water samples. This was performed to minimize particulates in the collected water, as elevated turbidity and the presence of particulates can hamper analysis. Fieldwork was also conducted on a weekend, outside of normal working hours, in order to collect samples from commonly dry locations. During the second quarter Sitewide sampling event, some sample coolers were reported by the laboratory at a temperature above the desired range, causing results for the corresponding samples to be J qualified as estimated concentrations. This qualifier was applied to the second quarter sample results summarized in Table 4 for locations OLFSEEP8, NNG01, WOMPOC, and WALPOC.

5.0 Results of Statistical Comparison of PFAS Analytical Methods

Analytical results for split samples collected over the 4 quarters from the second quarter of 2023 through the first quarter of 2024 were statistically compared. This comparative analysis was conducted to evaluate whether the datasets are equivalent and can be combined, for example for use in evaluating the presence of trends.

Data Collection Methodology

- Split samples were collected at six locations.
  - Two "identical" samples were collected from each of the following locations:
    - Two streams
    - Two monitoring wells (including one that is closest to the former fire training area)
    - Seep at the toe of the Original Landfill (OLF) hillside
    - Effluent from the PLFTS
  - One sample was analyzed using modified EPA Method 537.1
  - The other was analyzed using EPA Method 1633
- Samples were collected each quarter for 4 quarters if feasible; neither stream location provided the full set of four samples due to dry conditions.
- Mann-Whitney and analysis of variance (ANOVA) statistical approaches were used to compare results from the two methods (both with alpha = 0.05).[1]

Results and Conclusions

In some cases, analytical data from modified EPA Method 537.1 and EPA Method 1633 may be considered as equivalent, but in others, there was a clear statistical difference. However, varying detection limits and a large quantity of nondetects affected some statistical results.

[1] An alpha value of 0.05 means there is a 5% chance that a difference will be recorded even when there is no actual difference.

The main findings were as follows:

- How nondetects are treated through statistical calculations can impact statistical results, especially if detection limits are widely variable
- Analytical results for groundwater near the former fire training area where AFFF was used (well 33502; Figure 2) showed statistical differences attributable to the analytical method:
  - Both statistical approaches identified differences for PFOA, PFOS, perfluoroheptanesulfonic acid, and perfluoropentanoic acid
  - The ANOVA approach also identified differences for perfluorohexanesulfonic acid (PFHxS) and perfluorodecanoic acid
  - Concentrations of three compounds with promulgated maximum contaminant levels (PFOA, PFOS, and PFHxS) were found to be statistically different depending on which analytical method was used
  - Reported concentrations of some PFAS analyzed using EPA Method 1633 were substantially higher in some cases than those analyzed using modified EPA Method 537.1 (Figure 2)
- Analytical results for groundwater farther from the fire training area, which may also be impacted by other source terms (well 33905; Figure 3), were not calculated to be statistically different depending on the analytical method
- Analytical results for treated effluent from the system that receives leachate from the Present Landfill (location PLFSYSEFF) were calculated to have no statistical difference related to analytical method
- Analytical results for a seep at the toe of the OLF (location OLFSEEP8) also showed no statistical difference related to analytical method

Therefore, caution is advised when forming conclusions based on PFAS datasets that include concentration data generated by both modified EPA Method 537.1 and EPA Method 1633 as shown in Figure 2 and Figure 3.

Figure 2 shows concentrations of PFOA and PFOS in samples from well 33502. The data collected from the third quarter of 2021 to the first quarter of 2024, linked by dashed lines, were generated using modified EPA Method 537.1. The four sets of newer data, linked with solid lines, were generated using EPA Method 1633. The results indicate higher concentrations using EPA Method 1633. In contrast, Figure 3 shows concentration results from both methods for PFHxS, perfluorobutanesulfonic acid (PFBS), and perfluorobutanoic acid (PFBA) from well 33905, but in this case the results are very similar and may be considered interchangeable.

Quarterly environmental samples requiring PFAS analysis are now analyzed using EPA Method 1633 only.

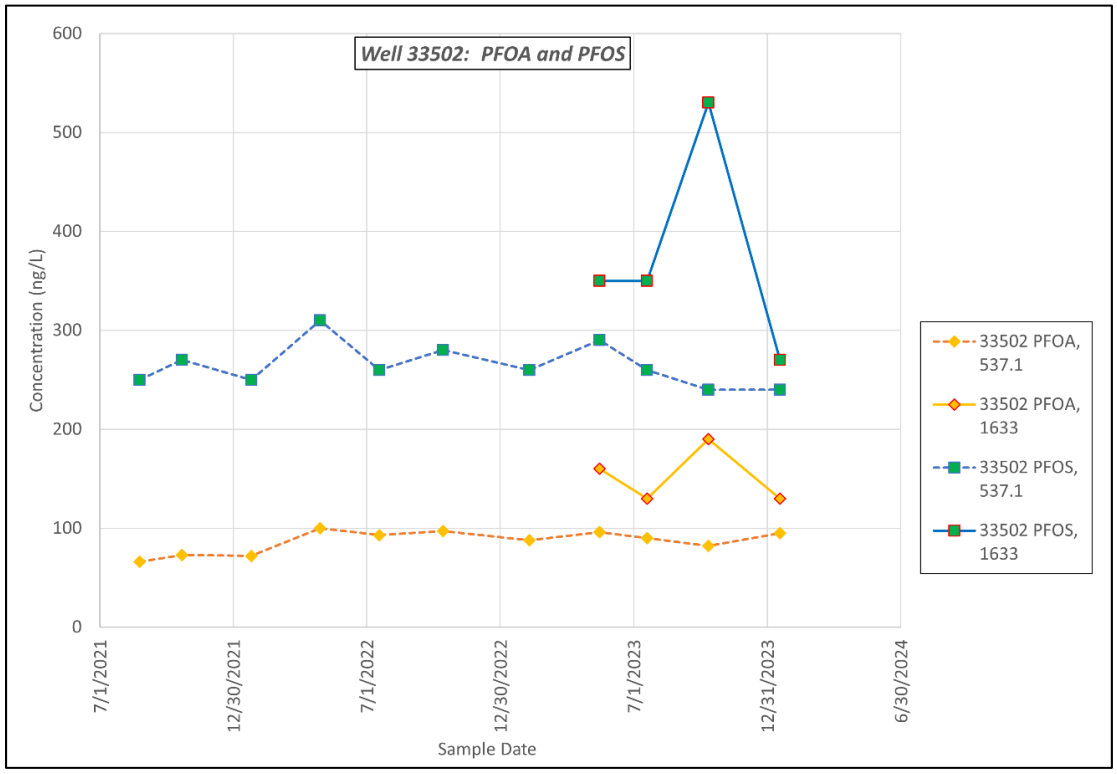


Figure 2. Comparison of PFOA and PFOS Concentrations in Samples from Well 33502 Analyzed by Different Methods

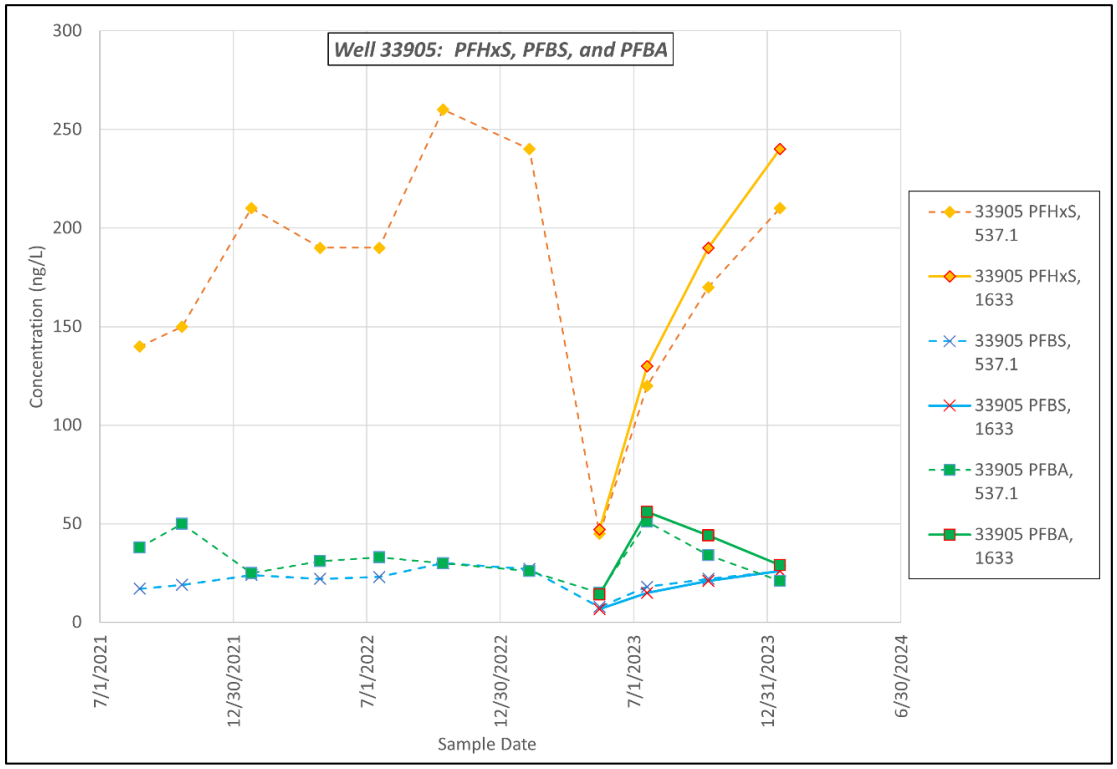


Figure 3. Comparison of PFHxS, PFBS, and PFBA Concentrations in Samples from Well 33905 Analyzed by Different Methods

6.0 References

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Table 6. Analytical Results for Water Samples

Location Code	Location Type	Date Sampled	Sample Code	CAS No.	Analyte	Sample Type	Result (ng/L)	Lab Qualifier	Data Validation Qualifier	Detection Limit (ng/L)	Analytical Method
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	113507-82-7	Perfluoro(2-ethoxyethane)sulfonic acid	D	0.16	U		0.16	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	13252-13-6	Perfluoro-2-propoxypropionic acid	D	0.51	U		0.51	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	151772-58-6	Nonafluoro-3,6-dioxaheptanoic acid	D	0.51	U		0.51	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	1691-99-2	N-ethyl perfluorooctanesulfonamidoethanol	D	1.5	U		1.5	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	1763-23-1	Perfluorooctanesulfonic acid (PFOS)	D	0.18	U		0.18	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	2058-94-8	Perfluoroundecanoic acid (PFUnA)	D	0.25	U		0.25	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	2355-31-9	N-methyl perfluorooctanesulfonamidoacetic acid	D	0.77	U		0.77	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	24448-09-7	N-methyl perfluorooctanesulfonamidoethanol	D	1.6	U		1.6	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	2706-90-3	Perfluoropentanoic acid (PFPeA)	D	0.13	U		0.13	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	2706-91-4	Perfluoropentane Sulfonic acid (PFPS)	D	0.32	U		0.32	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	27619-97-2	6:2 fluorotelomersulfonic acid	D	1.8	U		1.8	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	2991-50-6	N-ethyl perfluorooctanesulfonamidoacetic acid	D	0.52	U		0.52	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	307-24-4	Perfluorohexanoic acid (PFHxA)	D	0.50	U		0.50	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	307-55-1	Perfluorododecanoic acid (PFDoA)	D	0.16	U		0.16	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	31506-32-8	N-methyl perfluorooctanesulfonamide	D	0.61	U		0.61	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	335-67-1	Perfluorooctanoic acid (PFOA)	D	0.88	J		0.56	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	335-76-2	Perfluorodecanoic acid (PFDA)	D	0.19	U		0.19	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	335-77-3	Perfluorodecanesulfonic acid (PFDS)	D	0.27	U		0.27	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	355-46-4	Perfluorohexanesulfonic acid (PFHxS)	D	0.67	U		0.67	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	356-02-5	3-Perfluoropropyl propanoic acid	D	0.60	U		0.60	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	375-22-4	Perfluorobutanoic acid (PFBA)	D	0.95	J		0.24	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	375-73-5	Perfluorobutanesulfonic acid (PFBS)	D	0.67	U		0.67	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	375-85-9	Perfluoroheptanoic acid (PFHpA)	D	0.19	U		0.19	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	375-92-8	Perfluoroheptanesulfonic Acid (PFHpS)	D	0.41	U		0.41	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	375-95-1	Perfluorononanoic acid (PFNA)	D	0.38	U		0.38	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	376-06-7	Perfluorotetradecanoic acid (PFTeA)	D	0.38	U		0.38	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	377-73-1	Perfluoro-3-methoxypropanoic acid	D	0.15	U		0.15	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	39108-34-4	8:2 fluorotelomersulfonic acid	D	1.6	U		1.6	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	4151-50-2	N-ethyl perfluorooctanesulfonamide	D	0.71	U		0.71	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	68259-12-1	Perfluorononane Sulfonic acid (PFNS)	D	0.25	U		0.25	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	72629-94-8	Perfluorotridecanoic Acid (PFTriA)	D	0.28	U		0.28	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	754-91-6	Perfluorooctane Sulfonamide (FOSA)	D	0.38	U		0.38	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	756426-58-1	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	D	0.28	U		0.28	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	757124-72-4	4:2 Fluorotelomer sulfonate (4:2 FTS)	D	0.53	U		0.53	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	763051-92-9	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	D	0.27	U		0.27	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	79780-39-5	Perfluorododecanesulfonic acid	D	0.44	U		0.44	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	812-70-4	3-Perfluoroheptyl propanoic acid	D	1.4	U		1.4	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	863090-89-5	Perfluoro-4-methoxybutanoic acid	D	0.20	U		0.20	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	914637-49-3	2H,2H,3H,3H-Perfluorooctanoic acid	D	0.70	U		0.70	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-001	919005-14-4	4,8-Dioxa-3H-perfluorononanoic acid (DONA)	D	0.24	U		0.24	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	113507-82-7	Perfluoro(2-ethoxyethane)sulfonic acid	FB	0.15	U		0.15	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	13252-13-6	Perfluoro-2-propoxypropionic acid	FB	0.48	U		0.48	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	151772-58-6	Nonafluoro-3,6-dioxaheptanoic acid	FB	0.48	U		0.48	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	1691-99-2	N-ethyl perfluorooctanesulfonamidoethanol	FB	1.4	U		1.4	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	1763-23-1	Perfluorooctanesulfonic acid (PFOS)	FB	0.17	U		0.17	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	2058-94-8	Perfluoroundecanoic acid (PFUnA)	FB	0.24	U		0.24	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	2355-31-9	N-methyl perfluorooctanesulfonamidoacetic acid	FB	0.72	U		0.72	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	24448-09-7	N-methyl perfluorooctanesulfonamidoethanol	FB	1.5	U		1.5	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	2706-90-3	Perfluoropentanoic acid (PFPeA)	FB	0.12	U		0.12	EPA 1633

Table 6. Analytical Results for Water Samples (continued)

Location Code	Location Type	Date Sampled	Sample Code	CAS No.	Analyte	Sample Type	Result (ng/L)	Lab Qualifier	Data Validation Qualifier	Detection Limit (ng/L)	Analytical Method
2784	QC	11/20/2024	RFS01-18.2411010-003	2706-91-4	Perfluoropentane Sulfonic acid (PFPS)	FB	0.30	U		0.30	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	27619-97-2	6:2 fluorotelomersulfonic acid	FB	1.7	U		1.7	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	2991-50-6	N-ethyl perfluorooctanesulfonamidoacetic acid	FB	0.49	U		0.49	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	307-24-4	Perfluorohexanoic acid (PFHxA)	FB	0.47	U		0.47	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	307-55-1	Perfluorododecanoic acid (PFDoA)	FB	0.15	U		0.15	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	31506-32-8	N-methyl perfluorooctanesulfonamide	FB	0.57	U		0.57	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	335-67-1	Perfluorooctanoic acid (PFOA)	FB	0.52	U	J	0.52	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	335-76-2	Perfluorodecanoic acid (PFDA)	FB	0.18	U		0.18	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	335-77-3	Perfluorodecanesulfonic acid (PFDS)	FB	0.26	U		0.26	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	355-46-4	Perfluorohexanesulfonic acid (PFHxS)	FB	0.63	U		0.63	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	356-02-5	3-Perfluoropropyl propanoic acid	FB	0.56	U		0.56	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	375-22-4	Perfluorobutanoic acid (PFBA)	FB	0.22	U		0.22	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	375-73-5	Perfluorobutanesulfonic acid (PFBS)	FB	0.63	U		0.63	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	375-85-9	Perfluoroheptanoic acid (PFHpA)	FB	0.18	U		0.18	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	375-92-8	Perfluoroheptanesulfonic Acid (PFHpS)	FB	0.38	U		0.38	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	375-95-1	Perfluorononanoic acid (PFNA)	FB	0.35	U		0.35	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	376-06-7	Perfluorotetradecanoic acid (PFTeA)	FB	0.35	U		0.35	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	377-73-1	Perfluoro-3-methoxypropanoic acid	FB	0.14	U		0.14	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	39108-34-4	8:2 fluorotelomersulfonic acid	FB	1.5	U		1.5	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	4151-50-2	N-ethyl perfluorooctanesulfonamide	FB	0.66	U		0.66	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	68259-12-1	Perfluorononane Sulfonic acid (PFNS)	FB	0.24	U		0.24	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	72629-94-8	Perfluorotridecanoic Acid (PFTriA)	FB	0.26	U		0.26	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	754-91-6	Perfluorooctane Sulfonamide (FOSA)	FB	0.36	U		0.36	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	756426-58-1	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	FB	0.26	U		0.26	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	757124-72-4	4:2 Fluorotelomer sulfonate (4:2 FTS)	FB	0.49	U		0.49	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	763051-92-9	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	FB	0.25	U		0.25	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	79780-39-5	Perfluorododecanesulfonic acid	FB	0.41	U		0.41	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	812-70-4	3-Perfluoroheptyl propanoic acid	FB	1.3	U		1.3	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	863090-89-5	Perfluoro-4-methoxybutanoic acid	FB	0.18	U		0.18	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	914637-49-3	2H,2H,3H,3H-Perfluorooctanoic acid	FB	0.66	U		0.66	EPA 1633
2784	QC	11/20/2024	RFS01-18.2411010-003	919005-14-4	4,8-Dioxa-3H-perfluorononanoic acid (DONA)	FB	0.22	U		0.22	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	113507-82-7	Perfluoro(2-ethoxyethane)sulfonic acid	F	0.16	U		0.16	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	13252-13-6	Perfluoro-2-propoxypropionic acid	F	0.49	U		0.49	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	151772-58-6	Nonafluoro-3,6-dioxaheptanoic acid	F	0.49	U		0.49	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	1691-99-2	N-ethyl perfluorooctanesulfonamidoethanol	F	1.4	U		1.4	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	1763-23-1	Perfluorooctanesulfonic acid (PFOS)	F	12			0.17	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	2058-94-8	Perfluoroundecanoic acid (PFUnA)	F	0.24	U		0.24	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	2355-31-9	N-methyl perfluorooctanesulfonamidoacetic acid	F	0.74	U		0.74	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	24448-09-7	N-methyl perfluorooctanesulfonamidoethanol	F	1.6	U		1.6	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	2706-90-3	Perfluoropentanoic acid (PFPeA)	F	31			0.12	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	2706-90-3	Perfluoropentanoic acid (PFPeA)	F	21		J	0.65	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	2706-91-4	Perfluoropentane Sulfonic acid (PFPS)	F	0.31	U		0.31	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	27619-97-2	6:2 fluorotelomersulfonic acid	F	1.7	U		1.7	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	2991-50-6	N-ethyl perfluorooctanesulfonamidoacetic acid	F	0.50	U		0.50	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	307-24-4	Perfluorohexanoic acid (PFHxA)	F	28			0.48	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	307-55-1	Perfluorododecanoic acid (PFDoA)	F	0.15	U		0.15	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	31506-32-8	N-methyl perfluorooctanesulfonamide	F	0.59	U		0.59	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	335-67-1	Perfluorooctanoic acid (PFOA)	F	55			0.54	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	335-76-2	Perfluorodecanoic acid (PFDA)	F	0.18	U		0.18	EPA 1633

Table 6. Analytical Results for Water Samples (continued)

Location Code	Location Type	Date Sampled	Sample Code	CAS No.	Analyte	Sample Type	Result (ng/L)	Lab Qualifier	Data Validation Qualifier	Detection Limit (ng/L)	Analytical Method
NNG01	SL	11/20/2024	RFS01-18.2411010-005	335-77-3	Perfluorodecanesulfonic acid (PFDS)	F	0.26	U		0.26	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	355-46-4	Perfluorohexanesulfonic acid (PFHxS)	F	8.5		J	0.64	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	356-02-5	3-Perfluoropropyl propanoic acid	F	0.57	U	J	0.57	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	356-02-5	3-Perfluoropropyl propanoic acid	F	3.1	U		3.1	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	375-22-4	Perfluorobutanoic acid (PFBA)	F	48			0.23	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	375-22-4	Perfluorobutanoic acid (PFBA)	F	65		J	1.2	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	375-73-5	Perfluorobutanesulfonic acid (PFBS)	F	2.6			0.64	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	375-85-9	Perfluoroheptanoic acid (PFHpA)	F	12			0.18	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	375-92-8	Perfluoroheptanesulfonic Acid (PFHpS)	F	0.39	U		0.39	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	375-95-1	Perfluorononanoic acid (PFNA)	F	1.0	J		0.36	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	376-06-7	Perfluorotetradecanoic acid (PFTeA)	F	0.36	U		0.36	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	377-73-1	Perfluoro-3-methoxypropanoic acid	F	0.14	U	J	0.14	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	377-73-1	Perfluoro-3-methoxypropanoic acid	F	0.77	U		0.77	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	39108-34-4	8:2 fluorotelomersulfonic acid	F	1.5	U		1.5	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	4151-50-2	N-ethyl perfluorooctanesulfonamide	F	0.68	U		0.68	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	68259-12-1	Perfluorononane Sulfonic acid (PFNS)	F	0.24	U		0.24	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	72629-94-8	Perfluorotridecanoic Acid (PFTriA)	F	0.27	U		0.27	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	754-91-6	Perfluorooctane Sulfonamide (FOSA)	F	0.37	U	J	0.37	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	756426-58-1	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	F	0.27	U		0.27	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	757124-72-4	4:2 Fluorotelomer sulfonate (4:2 FTS)	F	0.51	U		0.51	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	763051-92-9	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	F	0.26	U		0.26	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	79780-39-5	Perfluorododecanesulfonic acid	F	0.42	U		0.42	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	812-70-4	3-Perfluoroheptyl propanoic acid	F	1.3	U		1.3	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	863090-89-5	Perfluoro-4-methoxybutanoic acid	F	0.19	U		0.19	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	863090-89-5	Perfluoro-4-methoxybutanoic acid	F	1.0	U		1.0	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	914637-49-3	2H,2H,3H,3H-Perfluorooctanoic acid	F	0.67	U		0.67	EPA 1633
NNG01	SL	11/20/2024	RFS01-18.2411010-005	919005-14-4	4,8-Dioxa-3H-perfluorononanoic acid (DONA)	F	0.23	U		0.23	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	113507-82-7	Perfluoro(2-ethoxyethane)sulfonic acid	F	0.15	U		0.15	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	13252-13-6	Perfluoro-2-propoxypropionic acid	F	0.46	U		0.46	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	151772-58-6	Nonafluoro-3,6-dioxaheptanoic acid	F	0.46	U		0.46	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	151772-58-6	Nonafluoro-3,6-dioxaheptanoic acid	F	2.6	U		2.6	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	1691-99-2	N-ethyl perfluorooctanesulfonamidoethanol	F	1.3	U		1.3	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	1763-23-1	Perfluorooctanesulfonic acid (PFOS)	F	0.16	U		0.16	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	2058-94-8	Perfluoroundecanoic acid (PFUnA)	F	0.23	U		0.23	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	2355-31-9	N-methyl perfluorooctanesulfonamidoacetic acid	F	0.69	U		0.69	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	24448-09-7	N-methyl perfluorooctanesulfonamidoethanol	F	1.5	U		1.5	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	2706-90-3	Perfluoropentanoic acid (PFPeA)	F	0.11	U		0.11	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	2706-90-3	Perfluoropentanoic acid (PFPeA)	F	0.64	U		0.64	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	2706-91-4	Perfluoropentane Sulfonic acid (PFPS)	F	0.29	U		0.29	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	27619-97-2	6:2 fluorotelomersulfonic acid	F	1.6	U		1.6	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	2991-50-6	N-ethyl perfluorooctanesulfonamidoacetic acid	F	0.47	U		0.47	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	307-24-4	Perfluorohexanoic acid (PFHxA)	F	0.45	U		0.45	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	307-55-1	Perfluorododecanoic acid (PFDoA)	F	0.14	U		0.14	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	31506-32-8	N-methyl perfluorooctanesulfonamide	F	0.55	U		0.55	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	335-67-1	Perfluorooctanoic acid (PFOA)	F	0.50	U		0.50	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	335-76-2	Perfluorodecanoic acid (PFDA)	F	0.17	U		0.17	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	335-77-3	Perfluorodecanesulfonic acid (PFDS)	F	0.25	U		0.25	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	355-46-4	Perfluorohexanesulfonic acid (PFHxS)	F	0.61	U		0.61	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	356-02-5	3-Perfluoropropyl propanoic acid	F	0.54	U		0.54	EPA 1633

Table 6. Analytical Results for Water Samples (continued)

Location Code	Location Type	Date Sampled	Sample Code	CAS No.	Analyte	Sample Type	Result (ng/L)	Lab Qualifier	Data Validation Qualifier	Detection Limit (ng/L)	Analytical Method
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	356-02-5	3-Perfluoropropyl propanoic acid	F	3.1	U		3.1	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	375-22-4	Perfluorobutanoic acid (PFBA)	F	0.21	U		0.21	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	375-22-4	Perfluorobutanoic acid (PFBA)	F	1.2	U		1.2	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	375-73-5	Perfluorobutanesulfonic acid (PFBS)	F	0.60	U		0.60	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	375-73-5	Perfluorobutanesulfonic acid (PFBS)	F	3.4	U		3.4	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	375-85-9	Perfluoroheptanoic acid (PFHpA)	F	0.17	U		0.17	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	375-92-8	Perfluoroheptanesulfonic Acid (PFHpS)	F	0.37	U		0.37	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	375-95-1	Perfluorononanoic acid (PFNA)	F	0.34	U		0.34	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	376-06-7	Perfluorotetradecanoic acid (PFTeA)	F	0.34	U		0.34	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	377-73-1	Perfluoro-3-methoxypropanoic acid	F	0.13	U		0.13	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	377-73-1	Perfluoro-3-methoxypropanoic acid	F	0.75	U		0.75	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	39108-34-4	8:2 fluorotelomersulfonic acid	F	1.4	U		1.4	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	4151-50-2	N-ethyl perfluorooctanesulfonamide	F	0.64	U		0.64	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	68259-12-1	Perfluorononane Sulfonic acid (PFNS)	F	0.23	U		0.23	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	72629-94-8	Perfluorotridecanoic Acid (PFTriA)	F	0.25	U		0.25	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	754-91-6	Perfluorooctane Sulfonamide (FOSA)	F	0.34	U		0.34	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	756426-58-1	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	F	0.25	U		0.25	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	757124-72-4	4:2 Fluorotelomer sulfonate (4:2 FTS)	F	0.48	U		0.48	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	763051-92-9	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	F	0.24	U		0.24	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	79780-39-5	Perfluorododecanesulfonic acid	F	0.40	U		0.40	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	812-70-4	3-Perfluoroheptyl propanoic acid	F	1.3	U		1.3	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	863090-89-5	Perfluoro-4-methoxybutanoic acid	F	0.18	U		0.18	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	863090-89-5	Perfluoro-4-methoxybutanoic acid	F	1.0	U		1.0	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	914637-49-3	2H,2H,3H,3H-Perfluorooctanoic acid	F	0.63	U		0.63	EPA 1633
WOMPOC	SL	11/20/2024	RFS01-18.2411010-012	919005-14-4	4,8-Dioxa-3H-perfluorononanoic acid (DONA)	F	0.21	U		0.21	EPA 1633

Abbreviations:
CAS No. = Chemical Abstracts Service registry number
D = duplicate
F = field
FB = field blank
J = estimated
QC = quality control sample (dummy location code)
SL = surface location
U = analytical result below detection limit

Table 7. Field Parameter Results for Water Samples

Location Code	Date Sampled	Parameter	Result	Unit
NNG01	11/20/2024	Turbidity	10.7	NTU
NNG01	11/20/2024	Alkalinity, total (as $CaCO_3$)	358	mg/L
NNG01	11/20/2024	Specific conductance	979	µmhos/cm
NNG01	11/20/2024	pH	7.13	s.u.
NNG01	11/20/2024	Temperature	9.73	C
WOMPOC	11/20/2024	Turbidity	1.34	NTU
WOMPOC	11/20/2024	Alkalinity, total (as $CaCO_3$)	135	mg/L
WOMPOC	11/20/2024	Specific conductance	641	µmhos/cm
WOMPOC	11/20/2024	pH	8.06	s.u.
WOMPOC	11/20/2024	Temperature	7.81	°C

Abbreviations:
$CaCO_3$ = calcium carbonate
mg/L = milligrams per liter
µmhos/cm = micromhos per centimeter
NTU = nephelometric turbidity units
s.u. = standard pH units