REMEDIATION SYSTEM STARTUP AND TESTING REPORT
U.S. DEPARTMENT OF ENERGY

BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK

CURRENT FIREHOUSE
PFAS SOURCE AREAS
GROUNDWATER TREATMENT SYSTEM

March 20, 2023
REV. 0

Prepared for:

Environmental Protection Division

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"I J. Robert Holzmacher certify that I am currently a NYS registered professional engineer or Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Report was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER 10) and that all activities were performed in full accordance with the DER-approved work plan and any DER-approved modifications."

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Engineer of Record
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1.0 INTRODUCTION

This Startup and Testing Report was prepared by J.R. Holzmacher P.E., LLC (JRH) Consulting Engineers on behalf of Brookhaven National Laboratory (BNL). The report presents the operating conditions and the analytical data results obtained during the first fourteen weeks of the Current Firehouse Per- and Polyfluoroalkyl substances (PFAS) remediation system operation from October 24, 2022 through January 31, 2023. The operable units and areas of concern (AOC) on BNL property are shown in **Figure 1-1**. The perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) Groundwater and Soil Contamination AOC is identified as 33A-L and is designated Operable Unit X (OU X). The Current Firehouse system was designed to remediate the Current Firehouse PFAS plume (sub-AOC 33D) and the Building 170 PFAS plume (sub-AOC-33J).

The Current Firehouse system is configured with a total of nine extraction wells (**Figure 1-2**). The Current firehouse plume is being controlled with eight extraction wells positioned from the source area located just north of the firehouse building at West Brookhaven Avenue south to West Princeton Avenue. The Building 170 plume is being controlled using one extraction well located near West Princeton Avenue. The PFAS plumes have a downward vertical component as they move downgradient (south). This adds a degree of complexity in minimizing the capture of 1,4-Dioxane as this compound has been detected at greater depths in the southern portion of the Current Firehouse plume. Because 1,4-Dioxane cannot be effectively remediated using granular activated carbon (GAC) filtration, the system is designed to minimize capture of the 1,4-Dioxane while still capturing the high concentration portions of the PFAS plume. The flow rates for the nine extraction wells were projected to range from 30 to 90 gpm, with a total pumping rate of 440 gpm. However, during startup testing some of the wells were operated at higher flow rates in order to establish initial capture of the plume. Treated water from t Current Firehouse system is discharged to the OU III and HP recharge basins, which also receive treated water from the OU III Middle Road, South Boundary and Western South Boundary VOC remediation systems.

1.1 System Overview

The GAC filters for this system are in Building 492. The building location is shown on **Figure 1-2**. The building houses the dual 20,000-pound granular activated carbon vessels and the extraction wells control system panel. Water captured by the extraction wells is piped through new PVC water pipelines running from each well to a common water main back to the treatment building. The flow of treated water from the GAC vessels then returns through one 10-inch PVC pipeline, exiting out through the east side of the building, and running south to the OU III/HP recharge basins. A location and layout of the overall system is shown in **Figure 1-3**. The two GAC vessel system with unit mounted piping and valves is operated in series. The carbon used currently for this system is Aquacarb 1230CX enhanced coconut shell type carbon. The influent, midpoint and effluent sampling points on the GAC vessel piping are shown on **Figure 1-4**. There are also sampling ports within each extraction well vault to obtain a discrete water sample at each well head.

The nine extraction wells can operate continuously under normal conditions with automatic monitoring of system operations. The flow rates out of each well are manually adjusted using

valves located within each well vault.

The extraction well identification, depths of the screens and desired pumping rates are summarized in the following table:

Table 1-1. Extraction Well Identification and Pumping Rates

Current Firehouse Extraction Well (Site ID)	Screen Length (ft)	Screen Top (ft BLS)	Screen Bottom (ft BLS)	Desired Pumping Rate (gpm)
CF-RW-A (073-34)	20	48	68	30
CF-RW-B (073-35)	20	54	74	30
CF-RW-C (083-45)	20	117	137	60
CF-RW-D (083-46)	20	70	90	30
CF-RW-E (084-102)	20	132	152	60
CF-RW-F (102-32)	20	121	141	50
CF-RW-G (102-33)	20	88	108	50
CF-RW-H (102-34)	20	98	118	40
CF-RW-I (102-35)	20	70	90	90

BLS = Below Land Surface Total: 440 gpm

1.2 Background

New permanent monitoring wells installed specifically for this remediation system were sampled once during May through September of 2022. Some of the highest concentrations of PFOS/PFOA were observed in monitoring wells in close proximity to the new extraction wells. The highest PFOS/PFOA concentrations were observed in monitoring wells 073-28 (3,110/70.9 ng/L) and well 073-31 (5,550/222 ng/L), both of which are located immediately upgradient of extraction well CF-RW-A. High PFOS/PFOA concentrations were also observed in monitoring well 073-26 (1,560/6.6) located near CF-RW-B, well 084-92 (814/51.7 ng/L) located upgradient of CF-EW-E, and at well 102-37 (590/9.9 ng/L) located to the east of CF-RW-I. The data will be presented in the 2022 Groundwater Status Report and is shown on **Figure 1-2**.

Using the PFOS/PFOA and 1,4-Dioxane data obtained during the plume characterization phase, the extraction well screened intervals were positioned to be most effective in the capture of PFAS while minimizing the capture of 1,4-Dioxane. By closely monitoring the influent, effluent and extraction wells for 1,4-Dioxane, adjustments to the flow rates can be made to minimize the capture of 1,4-Dioxane and remain in compliance with the State Pollution Discharge Elimination System Permit SPDES discharge limits. During the startup testing period, no flow adjustments related to 1,4-Dioxane were necessary because the effluent concentrations ranged from non-detectable (<0.2 µg/L) to 0.24 µg/L. The SPDES discharge limit is 0.35 µg/L.

2.0 BASELINE START-UP MONITORING

2.1 Monitoring Schedule

The table below represents the sampling during the start-up testing of the extraction wells. These samples were collected and analyzed by a NYSDOH certified laboratory. The sampling frequency is the minimum amount of sampling that will be performed on the system. More frequent sampling may be performed to better evaluate the system performance. The samples were analyzed in accordance with the methods listed in **Table 2-1,** below. Sampling frequency is the number of times a sample is collected in a given time period and sample turnaround time is the maximum time allowed for results to be submitted by the laboratory.

Table 2-1. Baseline Start-up Sampling Schedule

SAMPLE LOCATION	ANALYTICAL METHOD	SAMPLING FREQUENCY	MAXIMUM SAMPLE TURNAROUND TIME
System Influent ID 084-99	EPA TCL VOCs, 524.2 EPA PFOA/PFOS, 537.1 (a) EPA 1,4-Dioxane, 522	Daily for 5 days then Weekly for 10 weeks	7 Days *
System Midpoint ID 084-100	EPA TCL VOCs, 524.2 EPA PFOA/PFOS, 537.1 (a) EPA 1,4-Dioxane, 522	Weekly for 10 Weeks after the first 5 days	7 Days *
System Effluent ID 084-101	EPA TCL VOCs, 524.2 EPA PFOA/PFOS, 537.1 (a) EPA 1,4-Dioxane, 522	Daily for 5 days then Weekly for 10 Weeks	7 Days *

* - Initial sampling during performance testing of the recovery wells was 7-day turnaround.
(a): As agreed to by NYSDEC, EPA Method 537.1 was utilized during start-up testing due to faster turnaround times. Long-term monitoring for PFAS will be conducted using EPA Method 1633.

2.2 Monitoring Reports

The following **Table 2-2** reflects the effluent limitations and monitoring requirements for the SPDES equivalency permit. The minimum measurement frequency for the parameters below, with the exception of flow, is monthly following this baseline start-up monitoring of a period of eight consecutive weekly sampling events showing no exceedances of the stated discharge limitations.

Table 2-2. SPDES Equivalency Limitations and Monitoring Requirements

PARAMETERS	LIMITATIONS		Units	MINIMUM MONITORING REQUIREMENTS	
	Monthly Avg. Limits	Daily Max. Limits		Frequency	Sample Type
OUTFALL 001 - Treated Groundwater Remediation Discharge To OU III HP Basins					
Well Flow	Monitor	1000	GPM	Continuous	Recorder
pH (range)	5.0 – 8.5	Same	SU	Monthly	Grab
Carbon Tetrachloride	Monitor	5	µg/L	Monthly	Grab
Chloroform	Monitor --------	7	µg/L	Monthly	Grab
Methyl Chloride	Monitor --------	5	µg/L	Monthly	Grab
Methylene Chloride	Monitor --------	5	µg/L	Monthly	Grab
1,4-Dioxane	Monitor --------	0.35 (a)	µg/L	Monthly	Grab
Perfluorooctanesulfonic (PFOS)	Monitor --------	2.7	ng/L	Monthly	Grab
Perfluorooctanoic (PFOA)	Monitor --------	6.7	ng/L	Monthly	Grab

(a): Based on the SPDES Equivalency Permit, 0.35 µg/L is the final effluent limit for 1,4-Dioxane. Limit will be monitor only until startup optimization proves sufficient to meet the effluent limit or until the upgrade of the treatment system, if necessary, whichever is sooner.

2.3 Facility Operating Parameters

2.3.1 Description of Operation

Prior to remediation system startup, water line pressure testing, extraction well development and electrical power and communications were completed. During initial extraction well development and testing, wells CF-RW-C, CF-RW-D and CF-RW-E exhibited difficulties in establishing an acceptable yield to meet the minimum flow rates required for optimum performance. The well drilling contractor expended additional time to improve the performance through redevelopment and pumping, and as a result, during startup testing all three wells were able to operate at required pumping rates. System startup testing began on October 24, 2022. Well CF-RW-E had a pump issue during startup testing and the pump was replaced, resulting in some down time for this well during the startup period. Sampling of each extraction well discharge and GAC influent and effluent also began at that time and was conducted in accordance with the Baseline Start-up Sampling Schedule as indicated in **Table 2-1**.

All extraction wells have an above grade control panel adjacent to the well vault. The selector switches on the panels were placed in "Auto" mode, and the operations of the extraction wells were monitored using the single PanelView™ screen in Building 492. The programing in the PanelView™ allows for the selection of all wells to be placed in the start position with one control function. Each well starts with a time delay so as not to overdraw the electrical current all at the same time.

Once the wells were operating, each well vault was visited to adjust the flow rates to match as close as possible to the desired flow described in the modeling report and in **Table 1-1** above. However, wells CF-RW-A, CF-RW-B and CF-RW-D were adjusted to operate at 50 GPM during startup instead of 30 GPM. This was done to obtain initial hydraulic control over the plume during startup. **Table 2-3** below indicates the measured flow rates from each of the extraction wells during the startup testing, however the flow rates were not recorded until the week of 11/18/22.

Table 2-3. Extraction Well Weekly Flow Rates

Ext. Well ID	Date: Desired Flow (gpm)	11/18/22 Flow (gpm)	11/23/22 Flow (gpm)	11/30/22 Flow (gpm)	12/7/22 Flow (gpm)	12/14/22 Flow (gpm)	12/21/22 Flow (gpm)
CF-RW-A	**30**	53	61	64	53	68	67
CF-RW-B	**30**	62	49	50	44	55	57
CF-RW-C	**60**	67	57	63	49	0	0
CF-RW-D	**30**	49	49	48	47	0	48
CF-RW-E	**60**	53	41	44	24	0	65
CF-RW-F	**50**	54	47	0	0	48	0
CF-RW-G	**50**	52	43	0	0	44	48
CF-RW-H	**40**	54	47	0	0	48	51
CF-RW-I	**90**	103	89	0	0	91	96
	Total Flow	547	483	269	217	354	432

Ext. Well ID	Date: Desired Flow (gpm)	12/28/22 Flow (gpm)	1/4/23 Flow (gpm)	1/11/23 Flow (gpm)	1/19/23 Flow (gpm)	1/25/23 Flow (gpm)	2/1/23 Flow (gpm)
CF-RW-A	**30**	77	72	72	67	52	51
CF-RW-B	**30**	66	61	62	58	51	50
CF-RW-C	**60**	0	0	0	0	0	62
CF-RW-D	**30**	48	47	46	44	31	30
CF-RW-E	**60**	77	73	75	68	64	62
CF-RW-F	**50**	0	0	0	0	0	51

CF-RW-G	**50**	53	50	50	46	49	44
CF-RW-H	**40**	57	55	56	53	52	41
CF-RW-I	**90**	106	99	96	85	90	87
	Total Flow	484	457	457	421	389	478

2.3.2 Operating Problems Encountered

During the first month of startup the wells were continuously adjusted to achieve the desired flow balance and flow rates. Documenting all flow rates in gallons per minute (gpm) began during the week of November 18, 2022. The flow rate values were taken directly at the well vault from the water meter head. From November 18th to November 23rd all wells, electrical and controls functioned as designed, with flow adjustments taking place to balance overall flow. Extraction well CF-RW-E was the only well out of the nine that was outside of the desired modeled flow rates, being 7 gpm short of the modeled 60 gpm rate. As described previously, the pump for well CF-RW-E was replaced and the performance was restored.

During the startup testing period an issue with the pressure increasing in the lead carbon vessel was noted. By November 2nd the pressure going into the lead vessel had increased from 10 PSI to 40 PSI. On November 2nd a backwash of this vessel was performed and the water from the backwash was very cloudy with some sediment present. After the backwash was performed the water cleared up and the system pressure was reduced. The backflushing process was performed again on 11/17/22, 12/9/22, 12/19/22, 12/28/22 and on 2/22/23. The initial considerations for the cause of the system fouling were high iron levels or residual well drilling fluids that had not been entirely flushed out of the extraction well screen zones prior to startup operations. An influent GAC water sample was sent out for metals analysis on December 20th and the resultant iron level was reported as 2,080 ug/L. This value is considered a high level for the Upper Glacial aquifer. At that time, it was considered that there was the potential of the combination of high iron levels and residual well drilling fluids to be creating a colloidal action which were causing the fouling issues within the lead vessel. Extraction wells CF-RW-C and CF-RW-F were shut down for portions of the startup to see if these wells were contributing more to the fouling of the lead carbon vessel. This was done because samples from these two wells showed visible iron present. The results of this effort were inconclusive. Based upon the increasing time intervals between the backwash efforts, it is believed that the issue of clogging of the lead vessel is resolving itself.

In mid-February the top hatch of the lead GAC vessel was opened to obtain a sample of the GAC for waste profiling for future carbon change-outs. It was observed that a layer of what appeared to be bentonite well drilling fluids was covering the top of the carbon. This most likely led to the channelized flow of influent water to the perimeter of the vessel walls, resulting in higher PFAS sample values at the GAC midpoint sample location. This is also the likely cause for creating the high pressure in the lead vessel.

Water for the initial backwash operations was obtained from a fire hydrant south of Building 492. The carbon vessels, as initially configured, were not readily accessible and the connection was only a 2-inch diameter fitting thus restricting the flow during the backwashing. In February 2023, system piping and valve modifications between the GAC vessels allows water to be more efficiently routed for use as backwash water. The modifications for backwashing allows for higher, more efficient flow through the vessels utilizing either the hydrant water or system water. The system was shut down on February 22nd and a backwash was performed using the pipe modifications. Heavily discolored water from the backwash was observed. At completion of backwashing, the water was clear and the pressure was reduced to the original startup value of about 10 PSI.

3.0 ANALYTICAL DATA RESULTS

3.1 Extraction Well Monitoring Results

Tabulated analytical data results for the extraction wells is included in **Appendix A**. Indicated below in **Table 3-1** are the highest concentration values of 1,4-Dioxane, PFOS and PFOA encountered in each of the extraction wells from October 24, 2022 through January 11, 2023.

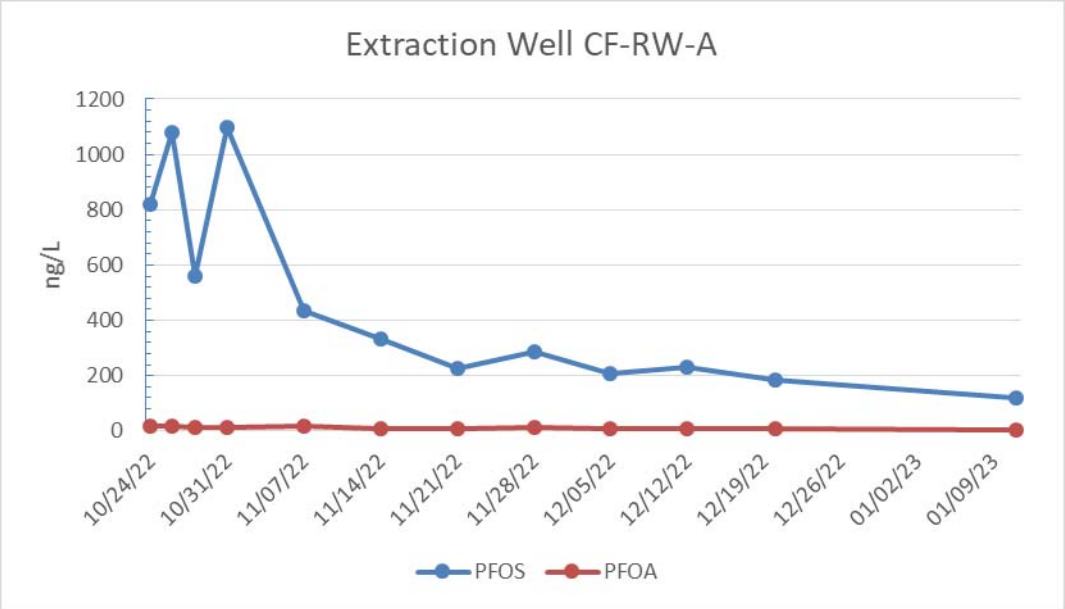
Table 3-1. Extraction Well High Concentration Sampling Data

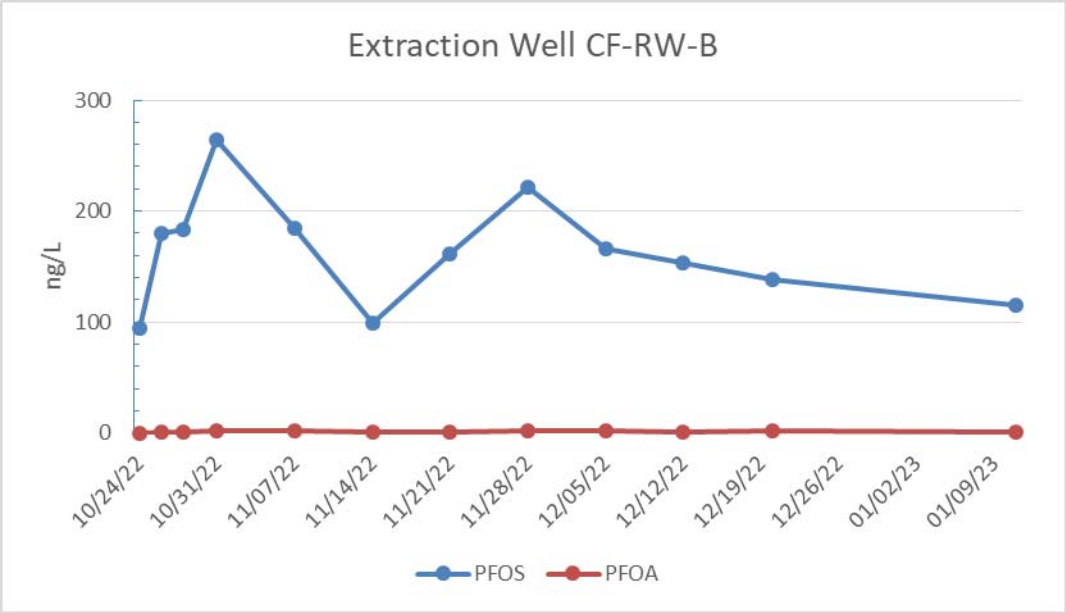
Well	Site ID	Well Screen (ft. BLS)	Sample Date	1,4-D (µg/L)	PFOS (ng/L)	PFOA (ng/L)
CF-RW-A	073-34	48-68	10/24/2022	0.2U	**822**D	**19.8**
			10/31/2022	0.2U	**1,100**D	**14**
CF-RW-B	073-35	54-74	10/31/2022	0.2U	**264**D	1.83
			12/5/2022	0.2U	**166**D	1.96
CF-RW-C	083-45	117-137	10/24/2022	**0.73**	**3.26**	1.58J
			11/28/2022	**0.63**	**273**D	**11.1**
CF-RW-D	083-46	70-90	11/7/2022	0.2U	**547**D	4.25
CF-RW-E	084-102	132-152	10/24/2022	**0.44**	**425**D	**22.5**
			11/28/2022	0.26	**239**D	**24.2**
CF-RW-F	102-32	121-141	1/11/2023	0.2U	**106**	4.53
CF-RW-G	102-33	88-108	11/7/2022	0.2U	**5.03**	2.16
			12/5/2022	0.21U	**6.11**	1.86
CF-RW-H	102-34	98-118	10/24/2022	0.3	**143**	3.09
			11/7/2022	**0.61**	**128**	5.33
			1/11/2023	**0.69**	**79.3**	2.97
CF-RW-I	102-35	70-90	10/24/2022	0.2U	**741**D	**15.4**

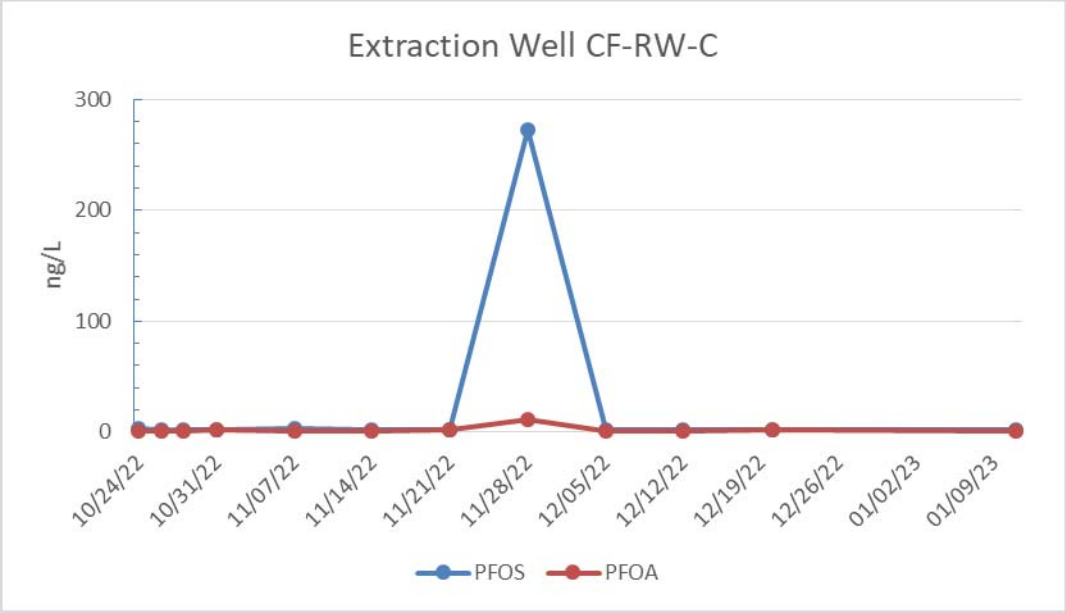
The PFOS/PFOA results highlighted in the table above are consistent with the 2022 monitoring well results shown on **Figure 1-2**. The 1,4-Dioxane results are also consistent with the vertical profile data obtained during the 2020 through 2021 sampling events.

The remediation well locations were selected to maximize the amount of contaminant mass removal. The effectiveness of the remediation system can be observed by charting the concentrations of contaminants being produced by each extraction well. Trend graphs of the extraction wells PFOS/PFOA sampling data from October 24, 2022 through January 11, 2023 are shown below.

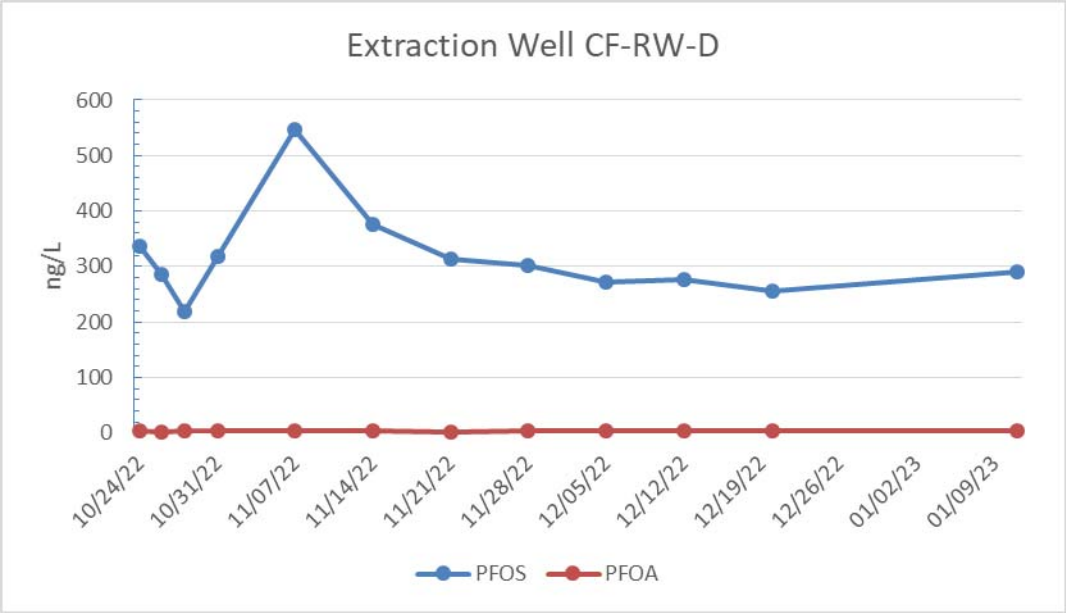
Wells located near the source areas such as CF-RW-A and CF-RW-B show fluctuating concentrations during the first several weeks of operation and then show more stable concentrations which decline at a slow and steady rate. Wells located farther down gradient from the source areas show less rapid declines in contaminant concentrations.







11/28/22 data appears to be erroneous due to samples being switched at the lab or in the field.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400
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100
0
ng/L
10/24/22
10/31/22
11/07/22
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11/21/22
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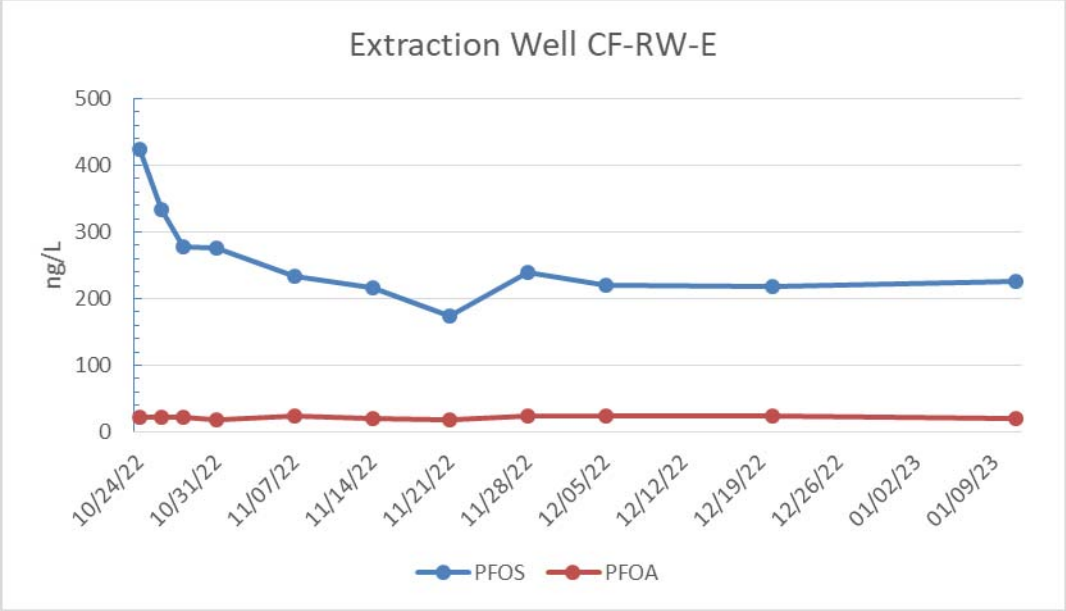
01/02/23
01/09/23
PFOS
PFOA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300
200
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11/07/22
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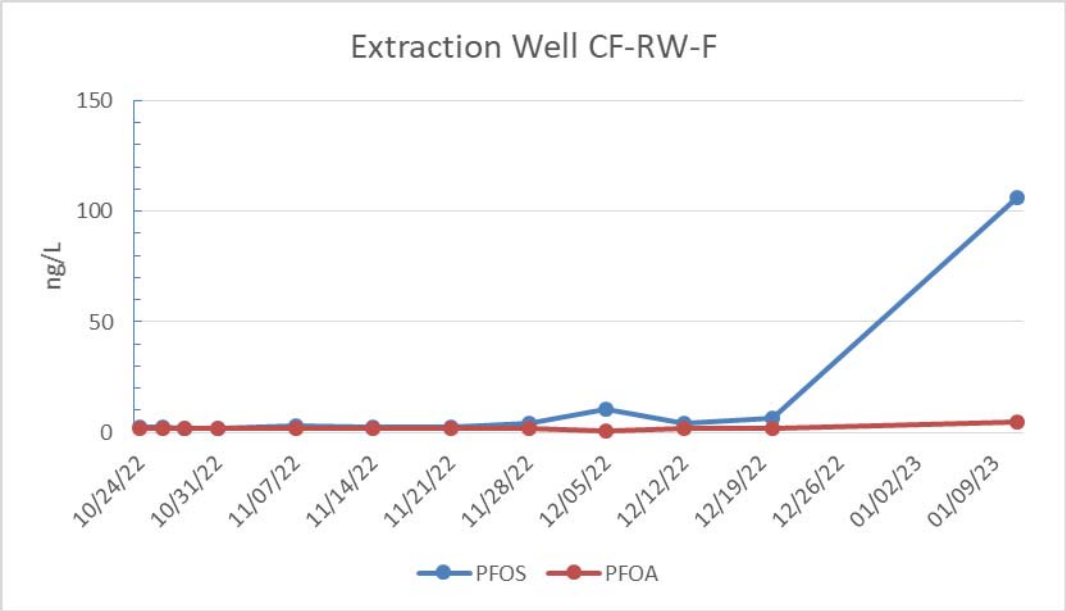
01/02/23
01/09/23
PFOS
PFOA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ng/L
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10/31/22
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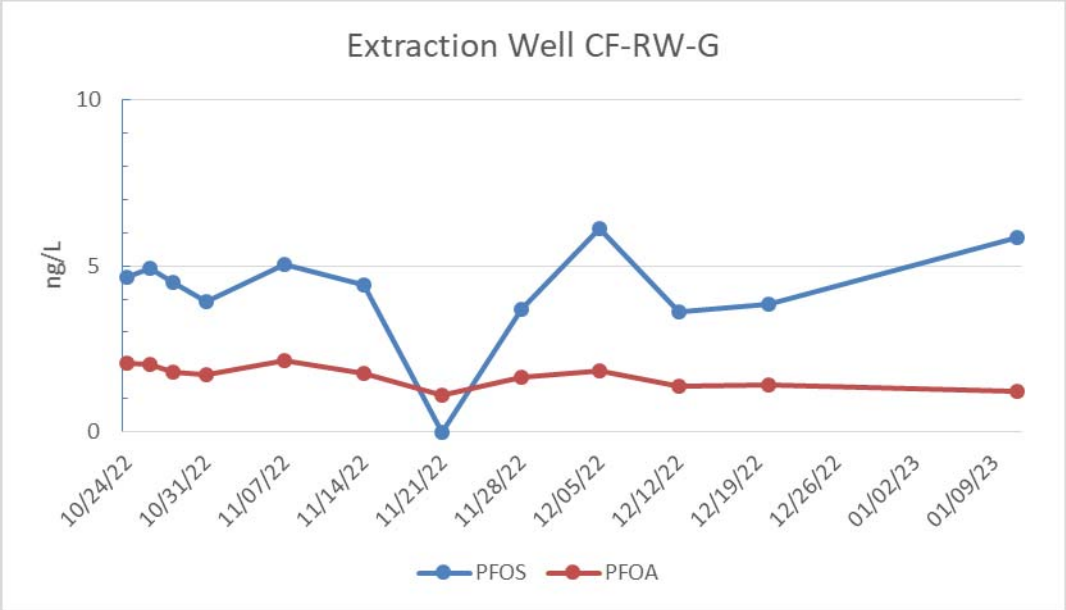
01/09/23
PFOS
PFOA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11/14/22
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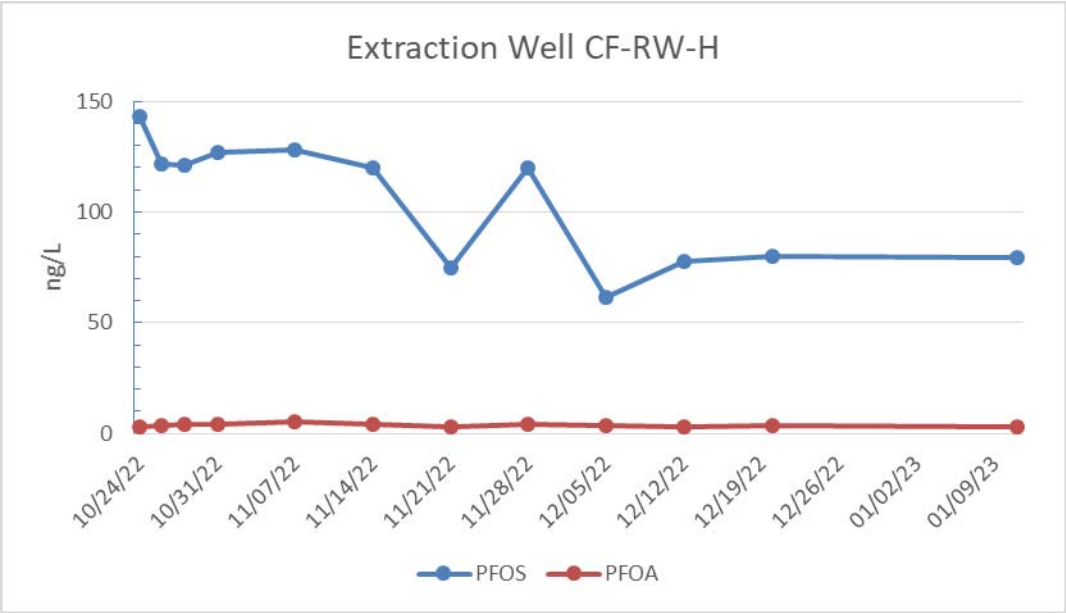
01/02/23
01/09/23
PFOS
PFOA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11/07/22
11/14/22
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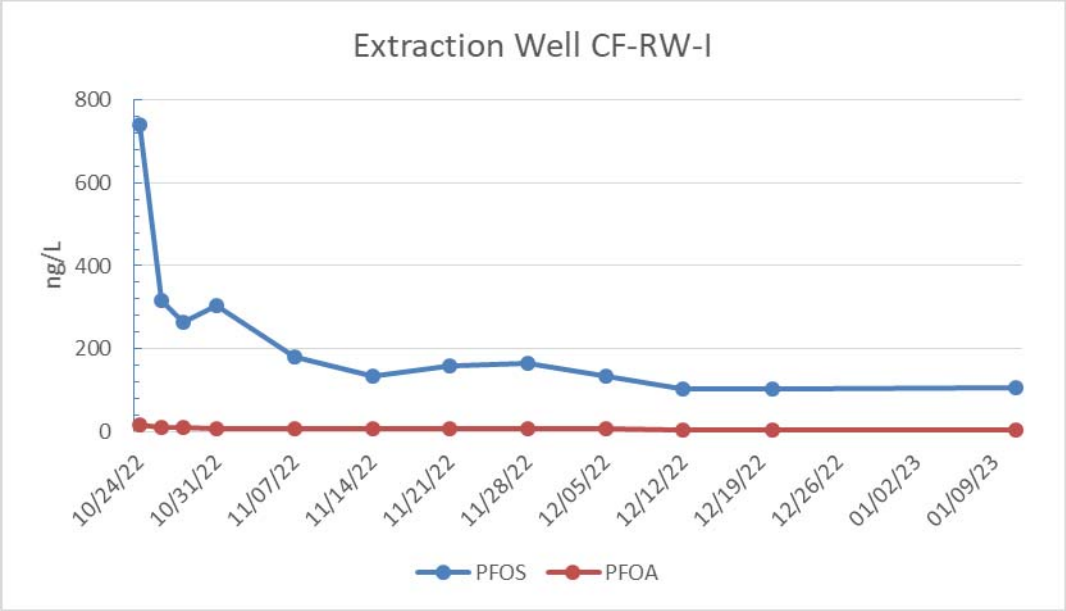
01/02/23
01/09/23
PFOS
PFOA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ng/L
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10/31/22
11/07/22
11/14/22
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11/28/22
12/05/22
12/12/22
12/19/22
12/26/22
01/02/23
01/09/23
PFOS
PFOA

3.2 Influent, Midpoint and Effluent Monitoring Results

The mass removal rate of PFOS and PFOA can be assessed by looking at the graph for the system influent concentration, see **Figure 3-1** below. Influent concentrations were highest at startup 324 ng/L and have generally stabilized with a slight declining trend at 124 ng/L on 2/2/23. As the contaminant concentrations in each well continue to decline the mass removal rate can be optimized by altering the flow rates selected for each individual remediation well.

Figure 3-1. System Influent Concentrations for PFOS, PFOA and Total Other PFAS

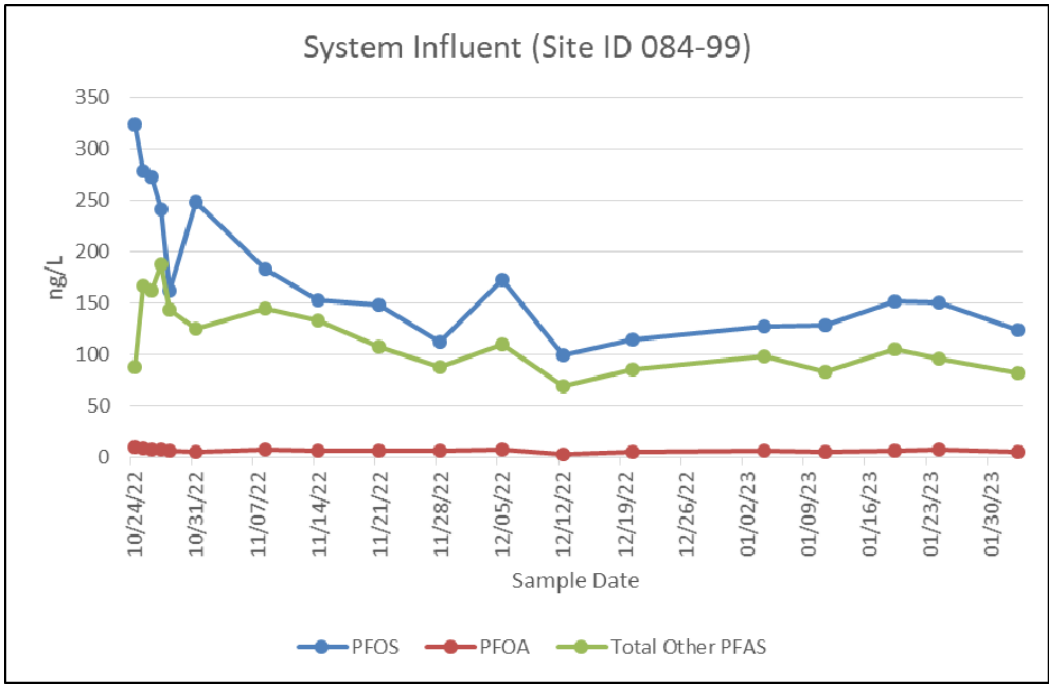


Table 3-2 below indicates the influent concentration values associated with the trend graph above.

Table 3-2. Influent Concentration Sampling Data

Sample Location	Site ID	Sample Date	1,4-D (µg/L)	PFOS (ng/L)	PFOA (ng/L)
System Influent	084-99	10/24/2022	NA	**324**D	**9.66**
System Influent	084-99	10/25/2022	NA	**278**D	**8.68**
System Influent	084-99	10/26/2022	NA	**273**h	**7.98**h
System Influent	084-99	10/27/2022	NA	**241**D	**7.6**
System Influent	084-99	10/28/2022	NA	**162**D	**6.96**
System Influent	084-99	10/31/2022	NA	**248**D	5.8
System Influent	084-99	11/8/2022	0.2U	**183**D	**7.52**
System Influent	084-99	11/14/2022	0.18J	**153**D	6.19
System Influent	084-99	11/21/2022	0.2U	**148**h	6.03h
System Influent	084-99	11/28/2022	0.15J	**112**	5.85
System Influent	084-99	12/5/2022	0.17J	**173**D	**7.66**
System Influent	084-99	12/12/2022	0.14J	**98.8**	3.43
System Influent	084-99	12/20/2022	0.2	**114**	5.05
System Influent	084-99	1/4/2023	0.2U	**127**	**6.85**
System Influent	084-99	1/11/2023	0.19J	**128**	5.45
System Influent	084-99	1/19/2023	0.17J	**152**	6.23
System Influent	084-99	1/24/2023	0.19J	**151h**	7.03h
System Influent	084-99	2/2/2023	0.14J	**124**	4.85

U: Analyte not detected at or above the stated Reporting Limit.
J: Estimated concentration between the Detection Limit and Reporting Limit.
D: Dilution
h: Sample extracted outside of holding time specification
NA: Samples not analyzed for this analyte
µg/L: Micrograms per liter
ng/L: Nanograms per liter
Bold: Numbers in bold exceed standard or guidance value.

The system midpoint concentrations for PFOS and PFOA taken between the two GAC vessels is graphed below on **Figure 3-2**. The low-level breakthrough starting in mid-December may be due to channeling of flow to the perimeter of the lead vessel due to the residual well drilling fluids at the top of the carbon bed. The concentration values averaged just under 6 ng/L through February 2, 2023. The 1,4-Dioxane levels are below the SPDES discharge limit. If 1,4-Dioxane concentrations were to approach the discharge limit, they will be managed by making

adjustments to the pumping rates of the extraction wells and additional sampling of the wells with 1,4-Dioxane with elevated 1,4-Dioxane.

Figure 3-2. System Midpoint Concentrations for PFOS and PFOA

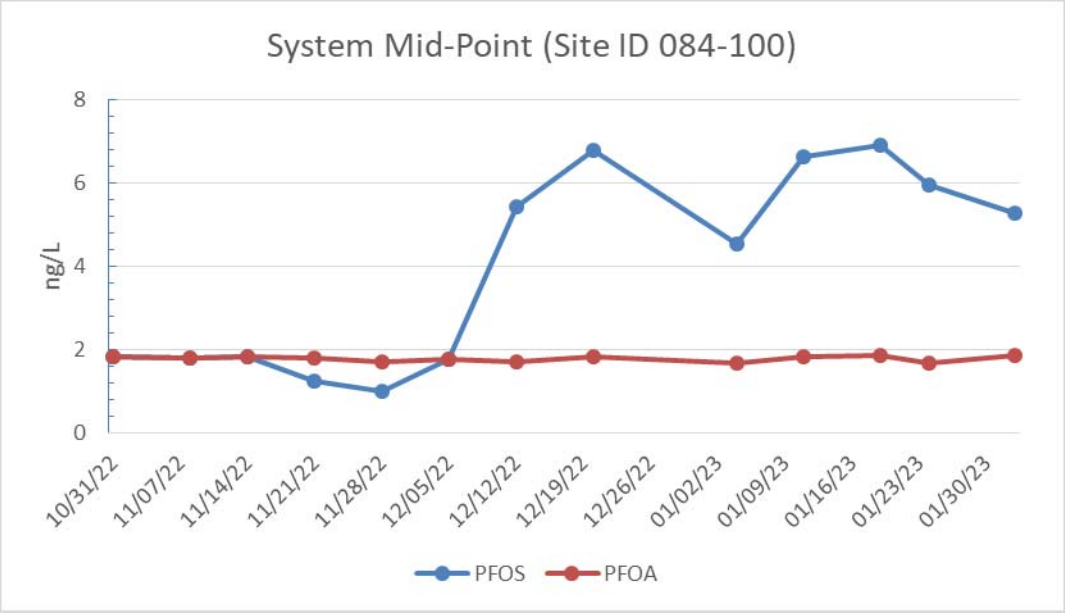


Table 3-3 below indicates the midpoint concentration values associated with the trend graph above.

Table 3-3. Midpoint Concentration Sampling Data

Sample Location	Site ID	Sample Date	1,4-D (µg/L)	PFOS (ng/L)	PFOA (ng/L)
System Midpoint	084-100	10/31/2022	NA	1.84U	1.84U
System Midpoint	084-100	11/8/2022	NA	1.79U	1.79U
System Midpoint	084-100	11/14/2022	NA	1.84U	1.84U
System Midpoint	084-100	11/21/2022	0.2U	1.23Jh	1.79Uh
System Midpoint	084-100	11/28/2022	NA	1.01J	1.69U
System Midpoint	084-100	12/5/2022	0.19J	1.78U	1.78U
System Midpoint	084-100	12/12/2022	0.16J	**5.43**	1.71U
System Midpoint	084-100	12/20/2022	0.16J	**6.77**	1.83U
System Midpoint	084-100	1/4/2023	0.2U	**4.54**	1.68U
System Midpoint	084-100	1/11/2023	0.16J	**6.62***	1.84U*
System Midpoint	084-100	1/19/2023	0.16J	**6.91**	1.85U
System Midpoint	084-100	1/24/2023	0.20	**5.94**	1.67
System Midpoint	084-100	2/2/2023	0.14J	**5.26**	1.87

*: Sample re-run analytical data presented. Midpoint and Effluent samples switched at lab. Corrected data presented.

U: Analyte not detected at or above the stated Reporting Limit.
J: Estimated concentration between the Detection Limit and Reporting Limit.
h: Sample extracted out of holding time specification
NA: Samples not analyzed for this analyte
µg/L: Micrograms per liter
ng/L: Nanograms per liter
Bold: Numbers in bold exceed standard or guidance value.

Table 3-4 below indicates all 1,4-Dioxane, PFOS and PFOA effluent concentration values not exceeding the standard or guidance value.

Table 3-4. Effluent Concentration Sampling Data

Sample Location	Site ID	Sample Date	1,4-D (µg/L)	PFOS (ng/L)	PFOA (ng/L)
System Effluent	084-101	10/24/2022	0.2U	1.81U	1.81U
System Effluent	084-101	10/25/2022	0.2U	1.76U	1.76U
System Effluent	084-101	10/26/2022	0.2U	1.87U	1.87U
System Effluent	084-101	10/27/2022	0.2U	1.70U	1.70U
System Effluent	084-101	10/28/2022	0.2U	1.75U	1.75U
System Effluent	084-101	10/31/2022	0.2U	1.67U	1.67U
System Effluent	084-101	11/8/2022	0.21	1.75U	1.75U
System Effluent	084-101	11/14/2022	0.1J	1.68U	1.68U
System Effluent	084-101	11/21/2022	0.2U	1.72Uh	1.72Uh
System Effluent	084-101	11/28/2022	0.16J	1.66U	1.66U
System Effluent	084-101	12/5/2022	0.21J	1.84U	1.84U
System Effluent	084-101	12/12/2022	0.2J	1.75U	1.75U
System Effluent	084-101	12/20/2022	0.17J	1.74U	1.74U
System Effluent	084-101	1/4/2023	0.13J	1.68U	1.68U
System Effluent	084-101	1/11/2023	0.16J	1.90U*	1.90U*
System Effluent	084-101	1/19/2023	0.16J	1.73U	1.73U
System Effluent	084-101	1/24/2023	0.24	1.70Uh	1.70Uh
System Effluent	084-101	2/2/2023	0.15J	1.69U	1.69U
SPDES Permit Effluent Limit			**0.35**	**2.7**	**6.7**

*: Sample re-run analytical data presented. Midpoint and Effluent samples switched at lab. Corrected data presented.

U: Analyte not detected at or above the stated Reporting Limit.
J: Estimated concentration between the Detection Limit and Reporting Limit.
h: Sample extracted outside of holding time specification
NA: Samples not analyzed for this analyte
µg/L: Micrograms per liter
ng/L: Nanograms per liter
Bold: Numbers in bold exceed standard or guidance value.

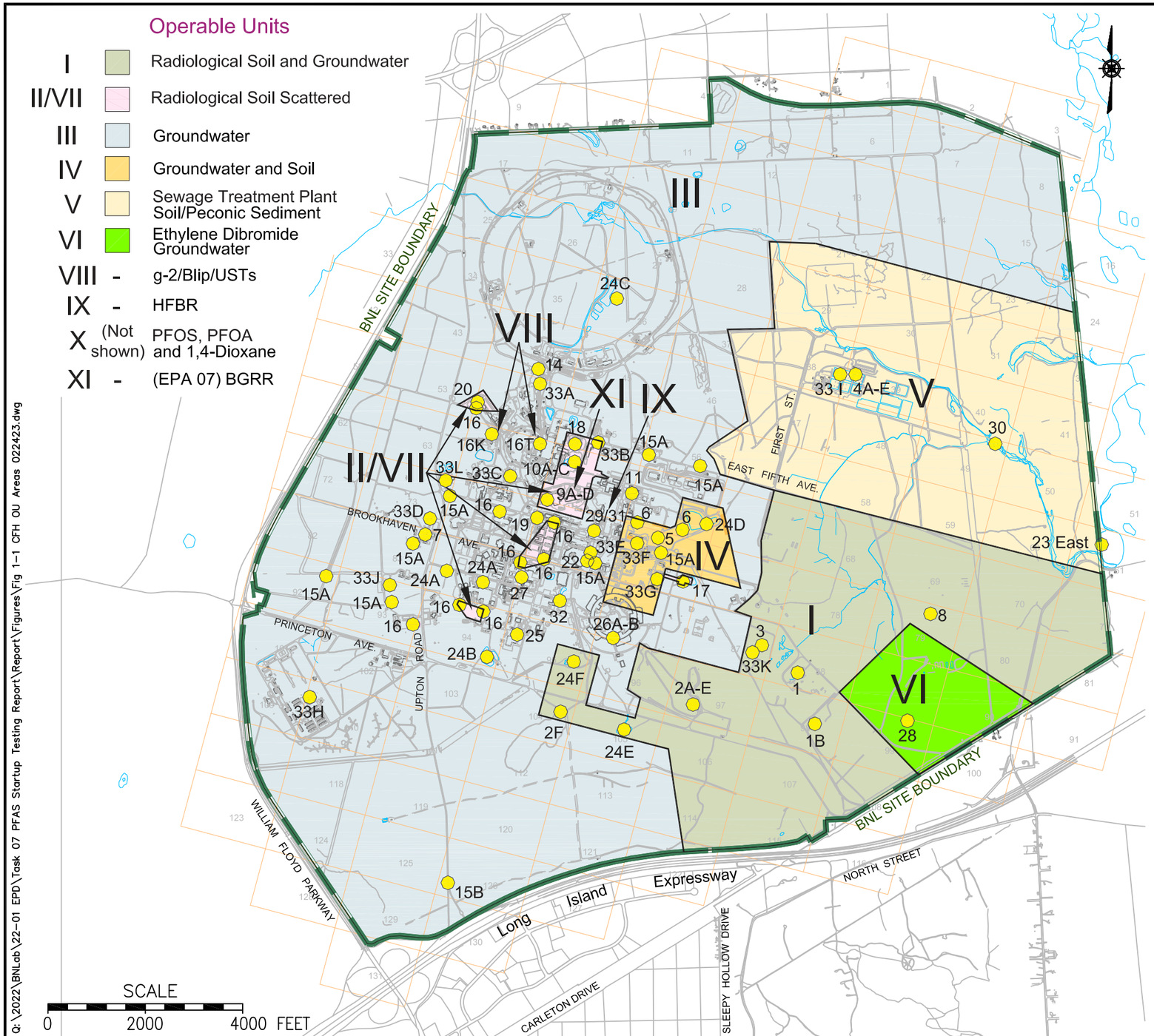
4.0 CONCLUSION

The Startup and Testing determined that the system is working properly and has the required flexibility to adjust flow rate scenarios for optimization and can allow for modifications such as additional extraction wells, if required. The Aquacarb 1230CX enhanced coconut shell type granular activated carbon is effectively removing all of the PFAS compounds to non-detectable levels. 1,4-Dioxane concentrations are below the SPDES discharge limits, and will be managed by modifying extraction well flow rates if required and additional sampling of the extraction wells with 1,4-Dioxane will be done. Wells C and F have thus far shown low concentrations of PFAS and they will continue to be monitored. However these wells were expected to have lower concentrations and will allow some operational flexibility in the future. Data will continue to be collected and additional updates on the system performance will be provided in quarterly and annual system status reports.

Figures

Operable Units

I		Radiological Soil and Groundwater
II/VII		Radiological Soil Scattered
III		Groundwater
IV		Groundwater and Soil
V		Sewage Treatment Plant Soil/Peconic Sediment
VI		Ethylene Dibromide Groundwater
VIII	-	g-2/Blip/USTs
IX	-	HFBR
X	(Not shown)	PFOS, PFOA and 1,4-Dioxane
XI	-	(EPA 07) BGRR



Operable Units and Areas of Concern

Areas of Concern

1	Hazardous Waste Management Facility
1B	Groundwater
2A-E	Former/Interim Landfills, Slit Trench, and Chemical/Animal/Glass Holes
2F	Ash Pit
3	Current Landfill
4A-E	Sewage Treatment Plant (A - Sludge Drying Beds; B - Sand Filter Beds; C - Imhoff Tanks; D - Hold-Up Ponds; E - Satellite Disposal Area)
5	Central Steam Facility
6	Building 650 Sump and Sump Outfall Area
7	Paint Shop
8	Upland Recharge/Meadow Marsh
9A-D	Brookhaven Graphite Research Reactor (A - BGRR Canal; B - Underground Ductwork; C - Spill Sites; D- Pile Fan Sump)
10A-C	(A - Tanks D1, D2, D3; B – Underground Pipelines; C- Six A/B USTs)
11	Building 830 Pipe Leak
12	Underground Storage Tanks (not shown)
13	Cesspools and Septic Tanks (not shown)
14	Bubble Chamber Spill Area
15A	Potable/Supply Wells
15B	Monitoring Well 130-02
16A-S	Aerial Radioactive Monitoring System Results
16T	g-2 Source Area and Tritium Groundwater Plume
17	Area Adjacent to Former Low-Mass Criticality Facility
18	AGS Storage Yards
19	TCE Spill Area
20	Particle Beam Dump, North End of Linear Accelerator
21	Leaking Sewer Pipes (not shown)
22	Old Firehouse
23 East	Eastern Tritium Plume
24A	Process Supply Wells 104, 105
24B	Recharge Basin HP
24C	Recharge Basin HN
24D	Recharge Basin HO
24E	Recharge Basin HS
24F	Weaver Drive Basin HW
25	Heavy Machine Shop (Building 479)
26A-B	Warehouse Area (A - Building 208; B - Former Scrapyard/Drum Storage Area South of Building 96)
27	Building 464 Mercury Contaminated Soil
28	EDB Plume
29	HFBR Spent Fuel Pool and Tritium Plume
30	Peconic River
31	HFBR
32	Building 452 Freon-11
33A-L	PFOS and PFOA Groundwater and Soil Contamination
34	1,4- Dioxane Groundwater Contamination (Not Shown)

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Brookhaven National Laboratory
ENVIRONMENTAL PROTECTION DIVISION

TITLE:

OPERABLE UNITS AND AREAS OF CONCERN

REMEDIATION SYSTEM STARTUP AND TESTING REPORT
(CURRENT FIREHOUSE PFAS SOURCE AREAS
GROUNDWATER TREATMENT SYSTEM)

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
AJZ	–	02/24/23	–
CHKD:	APPD:	REV.:	NOTES:
WRD	WRD	–	–
FIGURE NO.:			
1–1			

Current Firehouse PFAS Plume		
Permanent Monitoring Wells		
Time Critical Removal Action		
Well ID		Screen Ft BLS
073-26		35-50
073-27		35-50
073-28		35-50
073-29		35-50
073-30		35-50
073-31		35-50
073-32		55-65
073-33		35-50
074-135		55-65
083-33		50-60
083-34		70-80
083-35		50-60
083-36		70-80
083-37		50-60
083-38		70-80
083-39		60-70
083-40		100-110
084-86		120-130
084-87		60-70
084-88		90-100
084-89		120-130
084-90		90-100

084-91		120-130
084-92		140-150
083-44		70-80
083-41		120-130
083-42		90-100
083-43		120-130
084-93		90-100
084-94		120-130
084-95		140-150
084-96		90-100
084-97		120-130
084-98		140-150
093-88		120-130
093-89		70-80
093-90		100-110
093-91		80-90
093-92		100-110
094-275		80-90
094-276		100-110
094-277		70-80
094-278		100-110
102-26		90-100
102-27		110-120
102-28		140-150
103-30		90-100
103-31		110-120
103-32		130-140
103-33		90-100

103-34		120-130
102-29		90-100
102-30		110-120
102-31		130-140
083-47		50-70
093-93		50-70
093-94		40-60
093-95		60-70
093-96		55-65
093-97		58-68
093-98		60-70
102-36		70-80
102-37		65-75
102-38		70-80
102-39		70-80
102-40		145-155

LEGEND

- 29 / 2.7 / 1.3 — NEW MONITORING WELL ID WITH DETECTED (PFAS), PFOS/PFOA CONCENTRATIONS (IN ng/L) MAY–SEPT. 2022
- 02 — EXISTING MONITORING WELL
- CF-RW-A — REMEDIATION EXTRACTION WELL
- BNL-4 — POTABLE SUPPLY WELL (PRESENTLY INACTIVE)
- GENERAL GROUNDWATER FLOW DIRECTION
- SUSPECTED FOAM RELEASE AREA
- NS — NOT SAMPLED
- –10– — ISOCONCENTRATION CONTOUR REPRESENTING LINE OF EQUAL PFOS CONCENTRATION IN ng/L (DASHED WHERE INFERRED)

Water Treatment Plant Recharge Basins
HX
01 NS
Cornell Ave
73
74
83
84
93
94
102
103
Drywell
Current Fire House
CF-RW-A
CF-RW-B
Training Area
27 212.0 / 2.9
28 3110.0 / 70.9
29 2.7 / 1.3
31 5550.0 / 222.0
32 2190.0 / 66.3
135 615.0 / 8.8
33 1140.0 / 4.2
1560.0 / 6.6 26
752.0 / 2.2 30
West Brookhaven
BNL Paint Shop
441.0 / 2.7 35
14.1 / 2.3 33
55.8 / ND 34
BNL-4
77.2 / 1.9 36
01 NS
02 NS
38 55.1 / 0.9
39 95.1 / 1.4
86 11.8 / 0.8
87 284.0 / 14.2
88 293.0 / 7.7
89 98.2 / 2.7
40 30.2 / 1.2
37 748.0 / 9.0
Road
Bell Avenue
Columbia Street
Johns Hopkins Street
04 NS
03 NS
05 NS
90 161.0 / 11.3
91 56.5 / 9.3
92 814.0 / 51.7
Building 492
CF-RW-C
CF-RW-D
CF-RW-E
Mitchell Lane
3.1 / 1.2 41
2.3 / 1.0 44
42 ND / ND
43 82.2 / 2.2
05 NS
93 58.3 / 4.7
94 155.0 / 9.3
95 ND / ND
96 776.0 / 16.6
97 692.0 / 13.7
98 ND / ND
Upton
47 8.2 / ND
93 310.0 / 2.5
95 355.0 / 1.1
94 4090.0 / 39.1
96 127.0 / 4.9
BNL-6
88 0.9 / 1.1
35
04 NS
89 2.1 / ND
90 10.4 / ND
97 420.0 / 14.2
98 1870.0 / 44.2
91 33.4 / 0.8
92 164.0 / 1.5
276 82.0 / 2.8
275 22.0 / 1.6
277 43.2 / 5.3
278 176.0 / 8.8
36 27.1 / 1.9
37 590.0 / 9.9
CF-RW-I
26 20.5 / 1.2
27 7.5 / 0.7
CF-RW-F
CF-RW-G
CF-RW-H
West Princeton Ave.
28 ND / ND
38 8.1 / 0.9
39 471.0 / 7.6
94.4 / 3.5 32
319.0 / 10.4 31
89.0 / 5.4 30
29 88.4 / 2.7
12 NS
40 84.9 / 7.4
30 164.0 / 3.1
31 410.0 / 11.0
34 20.9 / 2.7
33 17.0 / 4.3
10 NS
19 NS
18 NS
East Princeton Ave.
02 NS
28 NS
HP
OUIII BASIN
10
100
500
1000
SCALE 0 200 400 FEET

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Brookhaven National Laboratory
ENVIRONMENTAL PROTECTION DIVISION

TITLE:
LOCATION OF MONITORING/EXTRACTION WELLS AND PLUME DISTRIBUTION
REMEDIATION SYSTEM STARTUP AND TESTING REPORT
(CURRENT FIREHOUSE PFAS SOURCE AREAS GROUNDWATER TREATMENT SYSTEM)

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
AJZ	–	02/24/23	–
CHKD:	APPD:	REV.:	NOTES:
DEP	DEP	–	–

FIGURE NO.: 1–2

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Brookhaven National Laboratory

ENVIRONMENTAL PROTECTION DIVISION

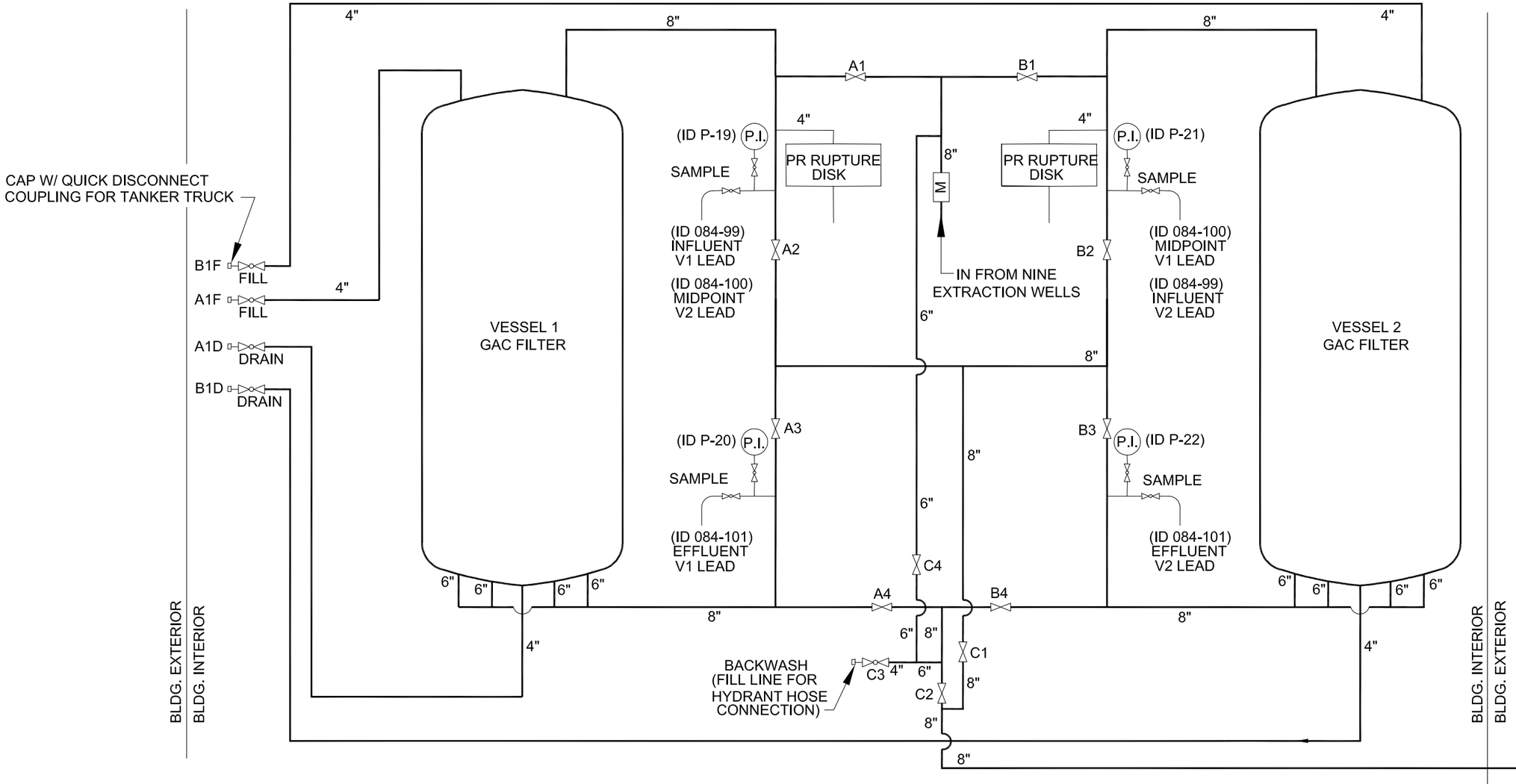
TITLE:

SYSTEM LOCATION AND LAYOUT

REMEDIATION SYSTEM STARTUP AND TESTING REPORT
(CURRENT FIREHOUSE PFAS SOURCE AREAS
GROUNDWATER TREATMENT SYSTEM)

DWN:	VT:HZ.:	DATE:	PROJECT NO.:
AJZ	–	02/24/23	–
CHKD:	APPD:	REV.:	NOTES:
WRD	WRD	–	–

FIGURE NO.: 1–3



LEGEND

P.I.	PRESSURE INDICATOR
PR	PRESSURE RELIEF
A3	VALVE DESIGNATION
⋈	BUTTERFLY VALVE
⋈	GATE VALVE
M	FLOW METER

NOTE:
THE TOP TWO SAMPLE PORTS ON THE GAC VESSELS INFLUENT AND MIDPOINT WILL CHANGE ROLES AND THE EFFLUENT ON THE BOTTOM WILL SHIFT OVER TO THE 4TH PORT UPON CHANGING LEAD AND LAG VESSEL'S 1 TO 2 AND 2 TO 1 CONFIGURATIONS.

BACKWASH VALVE SEQUENCE CHART

OPERATION	A1D	A1F	A1	A2	A3	A4	B1D	B1F	B1	B2	B3	B4	C1	C2	C3	C4
BACKWASH "VESSEL1" FROM INFLUENT LINE	C	C	C	O	C	O	C	C	C	C	C	C	O	C	C	O
BACKWASH "VESSEL2 " FROM INFLUENT LINE	C	C	C	C	C	C	C	C	C	O	C	O	O	C	C	O

SERIES OPERATION VALVE SEQUENCE CHART

OPERATION	A1D	A1F	A1	A2	A3	A4	B1D	B1F	B1	B2	B3	B4	C1	C2	C3	C4
SERIES FLOW "1" THEN "2"	C	C	O	C	O	C	C	C	C	O	C	O	C	O	C	C
SERIES FLOW "2" THEN "1"	C	C	C	O	C	O	C	C	O	C	O	C	C	O	C	C

Brookhaven National Laboratory
ENVIRONMENTAL PROTECTION DIVISION

TITLE:

GAC VESSELS VALVE CONFIGURATION

REMEDIATION SYSTEM STARTUP AND TESTING REPORT
(CURRENT FIREHOUSE PFAS SOURCE AREAS
GROUNDWATER TREATMENT SYSTEM)

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
AJZ	–	02/24/23	–
CHKD:	APPD:	REV.:	NOTES:
WRD	WRD	–	–

FIGURE NO.: 1–4

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APPENDIX A
Analytical Data Results

Appendix A - Analytical Data Results

TCRA PFAS Plume Remediation
Startup Testing of the Current Fiehouse PFAS Treatment System
PFAS and 1,4-Dioxane Results
Sample Period: October 24 - February 2, 2023
Brookhaven National Laboratory

Well	Site ID	Well Screen (ft. BLS)	Sample Date	1,4-D (µg/L)	PFOS (ng/L)	PFOA (ng/L)	PFBS (ng/L)	FBSA (ng/L)	PFBA (ng/L)	PFDA (ng/L)	PFHpS (ng/L)	PFHpA (ng/L)	PFHxS (ng/L)	PFHxA (ng/L)	PFNS (ng/L)	PFNA (ng/L)	PFOSAm (ng/L)	PFPeS (ng/L)	PFPeA (ng/L)	6:2 FTS (ng/L)	8:2 FTS (ng/L)	PFUnDA (ng/L)	PFTrDA (ng/L)
CF-RW-A	073-34	48-68	10/24/2022	0.2U	**822**D	**19.8**	29.5	9.27	19.1	1.78U	6.91	19	392D	60.5	1.70U	2.8	1.49J	31.6	68	8.87DJ	3.46	1.78U	1.78U
			10/26/2022	0.2U	**1,080**D	**18.9**	17.5	9.08	15.3	1.74U	7.32	17.4	363D	50.4	1.67U	2.77	2.74	21.9	53.3	2.90J	3.55	1.74U	1.74U
			10/28/2022	0.2U	**558**D	**13.5**	18.9	7.14	14.6	1.78U	4.61	14.4	228D	46.5	1.70U	2.12	2.59	27.2	42.9	3.81	2.41J	1.78U	1.78U
			10/31/2022	0.2U	**1,100**D	**14**	14.1	7.49	12.7	1.67U	6.49	11.8	394D	36.9	1.60U	2.09	1.65J	20.5	36.6	3.72	1.97J	1.67U	1.67U
			11/7/2022	0.2U	**434**D	**16.1**	22.1	9.16	13.7	1.76U	6.94	14.4	179D	46.5	1.69U	1.72J	1.73J	30.8	37.8	3.51	3.38U	1.76U	1.76U
			11/14/2022	0.2U	**332**D	**10.1**	19.3	6.89	10.9	1.71U	4.75	10.4	114	33	1.64U	1.40J	0.93J	19.8	37.6	3J	3.29U	1.71U	1.71U
			11/21/2022	0.2U	**228**Dh	**9.16h**	11.8h	4.92h	8.85h	1.69Uh	4.15h	7.72h	118h	26.2h	1.62Uh	0.91Jh	1.44Jh	17.4h	24.8h	80.2DUh	3.24Uh	1.69Uh	1.69Uh
			11/28/2022	0.2U	**285**D	**11.8**	12.6	6.09	9.8	1.84U	5.13	10.1	130	33.8	1.77U	1.10J	2.54	17.1	32.7	12	1.61J	1.84U	1.84U
			12/5/2022	0.21U	**206**D	**9.33**	10.2	5.36	8.51	1.77U	4.26	8.54	101	26.2	1.70U	0.98J	1.18J	14.4	26.4	4.06	3.39U	1.77U	1.77U
			12/12/2022	0.21U	**233**D	**7.9**	8.78	4.16	7.75	1.87U	3.29	7.31	114	25.5	1.80U	0.88J	1.36J	14.5	21.8	5.12	3.59U	1.87U	1.87U
			12/20/2022	0.21U	**183**D	6.64	7.7	3.37J	6.81	1.83U	2.79	6.43	60.8	21.3	1.76U	0.78J	1.04J	8.42	21.1	3.19J	3.51U	1.83U	1.83U
			1/11/2023	0.21U	**119**	4.98	6.51	2.83J	5.44	1.80U	1.41J	5.63	57.2	17.4	1.73U	1.81U	0.966J	7.67	16.9	1.20J	3.47U	1.81U	1.81U
CF-RW-B	073-35	54-74	10/24/2022	0.2U	**95**	1.79U	1.59U	3.58U	1.79U	1.79U	1.70U	1.79U	6.3	0.94J	1.72U	1.79U	1.79U	1.68U	1.79U	17DU	3.43U	1.79U	0.72J
			10/26/2022	0.2U	**180**D	1.51J	1.52U	3.42U	1.71U	1.71U	0.72J	0.6J	16.1	1.54J	1.64U	2.07	1.71U	0.82J	0.81J	3.25U	3.28U	1.31J	1.71U
			10/28/2022	0.2U	**183**D	1.41J	1.54U	3.45U	1.73U	1.73U	0.77J	1.73U	18.8	2.38	1.66U	4.88	1.73U	0.73J	0.97J	3.28U	3.32U	1.82	1.73U
			10/31/2022	0.2U	**264**D	1.83	1.47U	3.30U	0.71J	1.65U	0.83J	0.64J	20.5	2.18	1.58U	7.32	1.65U	0.68J	0.88J	3.14U	3.17U	1.57J	0.85J
			11/7/2022	0.2U	**184**D	1.66	1.46U	3.27U	0.71J	1.64U	0.84J	0.71J	19.7	2.88	1.57U	8.55	1.64U	0.86J	1.11J	15.5DU	3.14U	1.67	1.03J
			11/14/2022	0.2U	**99.5**	1.41J	1.55U	3.48U	1.74U	1.74U	1.65U	0.66J	15.6	2.13	1.67U	1.50J	1.74U	0.70J	0.64J	3.30U	3.34U	0.76J	0.67J
			11/21/2022	0.2U	**162**h	1.11Jh	1.50Uh	3.37Uh	1.68Uh	1.68Uh	0.82Jh	1.68Uh	16.8h	1.9h	1.62Uh	5.92h	1.68Uh	0.78Jh	0.66Jh	3.20Uh	3.23Uh	0.84Jh	0.84Jh
			11/28/2022	0.2U	**221**D	1.62J	1.57U	3.52U	0.79J	1.76U	0.92J	0.61J	17.8	2.51	1.69U	8.94	1.76U	0.73J	0.74J	3.34U	3.38U	3.01	2.35
			12/5/2022	0.2U	**166**D	1.96	0.66J	3.84U	0.94J	1.92U	0.94J	0.81J	24.1	2.16	1.84U	6.96	1.92U	0.81J	0.9J	3.65U	3.69U	1.14J	1.37J
			12/12/2022	0.2U	**153**	1.40J	1.61U	3.61U	0.73J	1.81U	0.91J	1.81U	19.3	2.01	1.73U	5.68	1.81U	0.82J	0.86J	3.43U	3.47U	0.83J	1.01J
			12/20/2022	0.2U	**138**	1.54J	1.54U	3.46U	1.73U	1.73U	0.87J	0.62J	19	1.99	1.66U	5.65	1.73U	0.78J	1.75J	3.29U	3.32U	0.84J	1.95J
			1/11/2023	0.2U	**115**	1.23J	1.60U	3.60U	0.739J	1.80U	1.71U	1.80U	14.5	1.56J	1.73U	4.99	1.80U	1.69U	0.648J	3.42U	3.45U	0.613J	1.11J
CF-RW-C	083-45	117-137	10/24/2022	**0.73**	**3.26**	1.58J	1.57U	3.54U	0.85J	1.77U	1.68U	1.77U	0.88J	1.39J	1.70U	1.77U	1.77U	1.66U	0.86J	84DU	3.40U	1.77U	1.77U
			10/26/2022	**0.56**	**2.75**	1.41J	1.47U	3.29U	0.75J	1.65U	1.56U	1.65U	0.65J	1.89J	1.58U	1.65U	1.65U	1.55U	0.62J	3.13U	3.16U	1.65U	1.65U
			10/28/2022	**0.56**	2.48	0.99J	1.59U	3.58U	1.79U	1.79U	1.70U	1.79U	0.73J	0.8J	1.72U	1.79U	1.79U	1.88U	1.79U	3.41U	3.44U	1.79U	1.79U
			10/31/2022	**0.62**	2.33	1.64U	1.46U	3.29U	1.64U	1.64U	1.56U	1.64U	0.71J	1.64U	1.58U	1.64U	1.64U	1.55U	1.64U	3.12U	3.16U	1.64U	1.64U
			11/7/2022	**0.52**	**3.21**	1.13J	1.45U	3.26U	0.94J	1.63U	1.55U	1.63U	0.78J	1.63U	1.57U	1.63U	1.63U	1.53U	1.63U	15.5DU	3.13U	1.63U	1.63U
			11/14/2022	**0.5**	**2.73**	0.96J	1.50U	3.36U	0.75J	1.68U	1.60U	1.68U	0.64J	1.68U	1.61U	1.68U	1.68U	1.58U	1.68U	16DU	3.23U	1.68U	1.68U
			11/21/2022	**0.368**	2.19h	1.65h	1.46Uh	3.29Uh	1.65Uh	1.65Uh	1.56Uh	1.65Uh	0.75Jh	1.65Uh	1.58Uh	1.65Uh	1.65Uh	1.55Uh	1.65Uh	3.13Uh	3.16Uh	1.65Uh	1.65Uh

Appendix A - Analytical Data Results

TCRA PFAS Plume Remediation
Startup Testing of the Current Fiehouse PFAS Treatment System
PFAS and 1,4-Dioxane Results
Sample Period: October 24 - February 2, 2023
Brookhaven National Laboratory

Well	Site ID	Well Screen (ft. BLS)	Sample Date	1,4-D (µg/L)	PFOS (ng/L)	PFOA (ng/L)	PFBS (ng/L)	FBSA (ng/L)	PFBA (ng/L)	PFDA (ng/L)	PFHpS (ng/L)	PFHpA (ng/L)	PFHxS (ng/L)	PFHxA (ng/L)	PFNS (ng/L)	PFNA (ng/L)	PFOSAm (ng/L)	PFPeS (ng/L)	PFPeA (ng/L)	6:2 FTS (ng/L)	8:2 FTS (ng/L)	PFUnDA (ng/L)	PFTrDA (ng/L)
			11/28/2022	**0.63**	**273**D	**11.1**	12	6.01	9.73	1.70U	4.95	9.08	119	28.3	1.63U	1.14J	2.22	16.1	29.6	10.3	2.08J	1.70U	1.70U
			12/5/2022	**0.41**	2.39	1.03J	1.62U	3.63U	0.79J	1.82U	1.73U	1.82U	0.99J	1.82U	1.74U	1.82U	1.82U	1.71U	1.82U	3.45U	3.49U	1.82U	1.82U
			12/12/2022	**0.35**	2.16	0.95J	1.54U	3.46U	1.01J	1.73U	1.64U	1.73U	0.77J	1.73U	1.66U	1.73U	1.73U	1.63U	1.73U	3.29U	3.32U	1.73U	1.73U
			12/20/2022	**0.42**	1.87	1.75U	1.56U	3.51U	1.75U	1.75U	1.67U	1.75U	0.62J	1.75U	1.68U	1.75U	1.75U	1.65U	1.75U	3.33U	3.37U	1.75U	1.75U
			1/11/2023	**0.47**	1.76	0.709J	1.56U	3.50U	1.75U	1.75U	1.66U	1.75U	1.59U	1.75U	1.68U	1.75U	1.75U	1.65U	1.75U	3.33U	3.36U	1.75U	1.75U
CF-RW-D	083-46	70-90	10/24/2022	0.2U	**336**D	3.33	1.34U	3.52U	1.54J	1.76U	1.98	1.27J	50.4	3.46	1.69U	2.66	1.76U	1.61J	1.70J	16.7DU	3.38U	1.76U	1.76U
			10/26/2022	0.2U	**287**D	2.69	1.91J	3.40U	1.52J	1.70U	1.50J	1.13J	35.8	3.12	1.63U	1.70U	1.70U	1.28J	1.37J	3.23U	3.26U	1.70U	1.70U
			10/28/2022	0.2U	**218**D	3.04	1.1J	3.41U	1.69J	1.70U	1.61J	1.42J	35.2	3.93	1.64U	4.87	1.70U	1.34J	1.4J	3.24U	3.27U	1.70U	1.70U
			10/31/2022	0.2U	**319**D	3.43	0.98J	3.36U	1.85	1.68U	1.6	1.33J	41.1	3.69	1.61U	5.22	1.68U	1.29J	1.3J	3.19U	3.22U	1.68U	1.68U
			11/7/2022	0.2U	**547**D	4.25	1.16J	3.29U	1.86	1.65U	2.2	1.84	44.8	5.34	1.58U	7.13	1.65U	1.55J	1.76U	3.13U	3.16U	1.65U	1.65U
			11/14/2022	0.2U	**376**D	3.25	1.09J	3.34U	1.65J	1.67U	1.45J	1.53J	35.3	4.14	1.60U	5.18	1.67U	1.43J	1.72	3.17U	3.20U	1.67U	1.67U
			11/21/2022	0.2U	**313**Dh	2.9h	0.93Jh	3.38Uh	1.34Jh	1.69Uh	1.52Jh	1.33Jh	30.8h	3.59h	1.62Uh	4.03h	1.69Uh	1.31Jh	1.36Jh	3.32Uh	3.25Uh	1.69Uh	1.69Uh
			11/28/2022	0.2U	**301**D	3.55	0.85J	3.54U	1.52J	1.77U	1.60J	1.56J	34.3	3.71	1.70U	4.13	1.77U	1.20J	1.54J	3.36U	3.40U	1.77U	1.77U
			12/5/2022	0.23U	**271**D	3.5	1.1J	3.61U	1.68J	1.80U	1.83	1.42J	39.7	4.57	1.73U	5.03	1.80U	1.60J	1.75J	3.43U	3.46U	1.80U	1.80U
			12/12/2022	0.21U	**277**D	3.26	0.82J	3.57U	1.42J	1.79U	1.79U	1.30J	32.3	3.52	1.71U	4.12	1.79U	1.14J	1.56J	3.38U	3.43U	1.79U	1.79U
			12/20/2022	0.18U	**257**D	3.01	0.9J	3.44U	1.44J	1.72U	1.49J	1.22J	34.5	3.57	1.65U	3.95	1.72U	1.31J	1.5J	3.26U	3.30U	1.72U	1.72U
			1/11/2023	0.22U	**291D**	3.08	0.798J	3.44U	1.47J	1.72U	1.88	1.17J	27.6	3.87	1.65U	4.54	1.72U	1.11J	1.62J	3.26U	3.30U	1.72U	1.72U
CF-RW-E	084-102	132-152	10/24/2022	**0.44**	**425**D	**22.5**	13.6	11.4	6.01	1.76U	6.89	7.32	171	35.6	1.69U	4.12	1.76U	19.9	18	83.6DU	3.38U	1.76U	1.76U
			10/26/2022	**0.38**	**333**D	**22**	11.5	11	4.85	1.65U	5.79	6.43	152	31.5	1.58U	10.2	1.65U	16.8	15	3.13U	3.16U	1.65U	1.65U
			10/28/2022	0.31	**278**Dh	**22.6**h	11.9h	10.8h	5.95h	1.72Uh	7.11h	6.05h	161h	35.7h	1.65Uh	28.4h	0.72Jh	18.4h	15.8h	16.4DUh	3.31Uh	1.72Uh	1.72Uh
			10/31/2022	**0.38**	**275**D	**17.7**	9.06	7.94	5.13	1.66U	4.81	5.01	126	19.4	1.60U	37	1.66U	11.8	12.2	3.16U	3.20U	1.66U	1.66U
			11/7/2022	0.33	**234**D	**23**	11	7.95	4.74	1.75U	5.85	6.24	172	25.7	1.68U	71.3	0.82J	17.1	12.1	3.33U	3.36U	1.75U	1.75U
			11/14/2022	0.32	**217**D	**19.4**	8.07	6.74	4.25	1.69U	5.13	5.7	136	21.9	1.62U	72.9	0.74J	16	11.7	3.21U	3.24U	1.69U	1.69U
			11/21/2022	0.118J	**173**Dh	**18.4**h	7.15h	5.29h	3.38h	1.68Uh	5.22h	4.1h	121h	18.3h	1.61Uh	77.8h	0.88Jh	12.1h	7.71h	3.20Uh	3.23Uh	1.68Uh	1.68Uh
			11/28/2022	0.26	**239**D	**24.2**	7.26	6.68	3.44	1.69U	5.13	4.59	118	20.4	1.62U	83	0.88Jh	11.1	9.61	3.21U	3.24U	1.69U	1.69U
			12/5/2022	0.3	**220**D	**23.6**	6.24	6.21	3.29	1.83U	5.26	4.71	115	18.2	1.76U	84.9	1.12J	11.1	8.75	3.49U	3.52U	1.83U	1.83U
			12/12/2022	NS	**--**	**--**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			12/20/2022	0.28	**218**D	**23.2**	6.34	5.6	3.51	1.81U	4.39	4.25	124	20.4	1.74U	71.9	0.61J	11.6	9.00	3.44U	3.47U	1.81U	1.81U
			1/11/2023	0.25	**225D**	**20.9**	7.42	5.45	3.49	1.71U	4.98	3.91	110	18.4	1.64U	76.7	1.31J	11.3	7.91	3.25U	3.29U	1.71U	1.71U

Appendix A - Analytical Data Results

TCRA PFAS Plume Remediation
Startup Testing of the Current Fiehouse PFAS Treatment System
PFAS and 1,4-Dioxane Results
Sample Period: October 24 - February 2, 2023
Brookhaven National Laboratory

Well	Site ID	Well Screen (ft. BLS)	Sample Date	1,4-D (µg/L)	PFOS (ng/L)	PFOA (ng/L)	PFBS (ng/L)	FBSA (ng/L)	PFBA (ng/L)	PFDA (ng/L)	PFHpS (ng/L)	PFHpA (ng/L)	PFHxS (ng/L)	PFHxA (ng/L)	PFNS (ng/L)	PFNA (ng/L)	PFOSAm (ng/L)	PFPeS (ng/L)	PFPeA (ng/L)	6:2 FTS (ng/L)	8:2 FTS (ng/L)	PFUnDA (ng/L)	PFTrDA (ng/L)
CF-RW-F	102-32	121-141	10/24/2022	0.2U	2.31	1.77U	1.58U	3.54U	1.77U	1.77U	1.68U	1.77U	1.1J	1.77U	1.70U	1.77U	1.77U	1.66U	1.77U	16.8DU	3.40U	1.77U	1.77U
			10/26/2022	0.2U	2.46h	1.78Uh	1.58U	3.55Uh	1.78Uh	1.78Uh	1.69Uh	1.78Uh	0.97Jh	1.78Uh	1.71Uh	1.78Uh	1.78Uh	1.67Uh	1.78Uh	3.38Uh	3.41Uh	1.78Uh	1.78Uh
			10/28/2022	0.2U	1.84	1.83U	1.63U	3.67U	1.83U	1.83U	1.74U	1.83U	0.7J	1.83U	1.76U	1.83U	1.83U	1.72U	1.83U	3.48U	3.52U	1.83U	1.83U
			10/31/2022	0.2U	1.97	1.63U	1.45U	3.25U	1.63U	1.63U	1.54U	1.63U	0.91J	1.63U	1.56U	1.63U	1.63U	1.53U	1.63U	3.09U	3.12U	1.63U	1.63U
			11/7/2022	0.2U	**3.21**	1.78U	1.58U	3.55U	1.78U	1.78U	1.69U	1.78U	1.27J	1.78U	1.71U	1.78U	1.78U	1.67U	1.78U	16.9DU	3.41U	1.78U	1.78U
			11/14/2022	0.2U	2.46	1.72U	1.53U	3.44U	1.72U	1.72U	1.63U	1.72U	1.53J	1.72U	1.65U	1.72U	1.72U	1.62U	1.72U	16.3DU	3.30U	1.72U	1.72U
			11/21/2022	0.2U	2.55h	1.67Uh	1.48Uh	3.33Uh	1.67Uh	1.67Uh	1.58Uh	1.67Uh	1.78h	1.67Uh	1.60Uh	1.67Uh	1.67Uh	1.57Uh	1.67Uh	3.17Uh	3.20Uh	1.67Uh	1.67Uh
			11/28/2022	0.21U	**4.25**	1.78U	1.58U	3.56U	1.78U	1.78U	1.69U	1.78U	1.54J	1.78U	1.71U	1.78U	1.78U	1.67U	1.78U	3.38Uh	3.42U	1.78U	1.78U
			12/5/2022	0.2U	**10.3**	0.86J	0.78J	3.67U	0.75J	1.84U	1.74U	1.84U	11.3	1.09J	1.76U	1.84U	1.84U	1.56J	1.84U	3.49U	3.53U	1.84U	1.84U
			12/12/2022	0.2U	**3.97**	1.70U	1.51U	3.39U	1.70U	1.70U	1.61U	1.70U	1.69	1.70U	1.63U	1.70U	1.70U	1.59U	1.70U	3.22U	3.26U	1.70U	1.70U
			12/20/2022	0.19U	**6.72**	1.79U	1.59U	3.58U	1.79U	1.79U	1.70U	1.79U	2.24	1.79U	1.72U	1.79U	1.79U	1.68U	1.79U	3.40U	3.44U	1.79U	1.79U
			1/11/2023	0.2U	**106**	4.53	5.53	6.29	1.39J	1.80U	1.96	1.16J	69.3	7.02	1.73U	1.80U	1.80U	8.47	2.1	3.42U	3.45U	1.80U	1.80U
CF-RW-G	102-33	88-108	10/24/2022	0.2U	**4.64**	2.09	3.28	3.59U	1.35J	1.79U	1.71U	1.79U	1.29J	1.5J	1.72U	1.79U	1.79U	1.69U	1.3J	17.1DU	3.45U	1.79U	1.79U
			10/26/2022	0.2U	**4.91**	2.04	4.4	3.30U	1.35J	1.65U	1.57U	0.59J	1.29J	1.78	1.58U	1.65U	1.65U	1.55U	1.67	3.14U	3.17U	1.65U	1.65U
			10/28/2022	0.2U	**4.51**	1.80J	4.95	3.71U	1.24J	1.85U	1.76U	1.85U	1.34J	1.46J	1.78U	1.85U	1.85U	1.74U	1.31J	3.52U	3.56U	10.85U	1.85U
			10/31/2022	0.2U	**3.93**	1.74	4.35	3.25U	1.54J	1.63U	1.54U	1.63U	1.51	1.17J	1.56U	1.63U	1.63U	1.53U	1.1J	3.09U	3.12U	1.63U	1.63U
			11/7/2022	0.2U	**5.03**	2.16	4.98	3.71U	1.40J	1.85U	1.76U	0.69J	1.2J	1.48J	1.78U	1.85U	1.85U	1.74U	1.22J	3.52U	3.96U	1.85U	1.85U
			11/14/2022	0.2U	**4.43**	1.77	5.23	3.33U	1.49J	1.66U	1.58U	1.66U	1.54	1.25J	1.60U	1.66U	1.66U	1.56U	1.19J	3.16U	3.20U	1.66U	1.66U
			11/21/2022	0.2U	**3.84h**	1.11Jh	4.06h	3.35Uh	1.05Jh	1.67Uh	1.59Uh	1.67Uh	1.29Jh	1.11Jh	1.61Uh	1.67Uh	1.67Uh	1.57Uh	0.89Jh	3.18Uh	3.21Uh	1.67Uh	1.67Uh
			11/28/2022	0.2U	**3.68**	1.65J	4.69	3.35Uh	1.17J	1.68U	1.59Uh	1.68U	1.12J	1.19J	1.61Uh	1.68U	1.68U	1.58U	1.27J	3.19U	3.22U	1.68U	1.68U
			12/5/2022	0.21U	**6.11**	1.86	4.62	3.55U	2.16	1.78U	1.69U	0.66J	3.07	1.48J	1.71U	1.78U	1.78U	1.67U	1.31J	3.38U	3.41U	1.78U	1.78U
			12/12/2022	0.22U	**3.6**	1.40J	4.23	3.75U	1.11J	1.87U	1.78U	1.87U	1.13J	1.13J	1.80U	1.87U	1.87U	1.76U	0.92J	3.56U	3.60U	1.87U	1.87U
			12/20/2022	0.17U	**3.85**	1.42J	4.37	3.32U	1.04J	1.66U	1.58U	1.66U	1.34J	1.15J	1.59U	1.66U	1.66U	1.56U	0.84J	3.15U	3.19U	1.66U	1.66U
			1/11/2023	0.2U	**5.83**	1.23J	4.42	3.52U	1.02J	1.76U	1.67U	1.76U	1.82	1.09J	1.69U	1.76U	1.76U	1.65U	0.967J	3.34U	3.38U	1.76U	1.76U
CF-RW-H	102-34	98-118	10/24/2022	0.3	**143**	3.09	2.3	1.72J	1.44J	1.80U	2	1.69J	33	6.75	1.73U	8.41	1.80U	2.84	3.04	17.1DU	3.46U	1.80U	1.80U
			10/26/2022	**0.46**	**122**	3.4	2.69	1.95J	1.96	1.75U	1.67	1.33J	29.7	6.34	1.68	6.59	1.75U	2.75	3.6	3.23U	3.35U	1.75U	1.75U
			10/28/2022	**0.51**	**121**	4.1	3.19	2.25J	2.05	1.83U	1.45J	1.56J	31.6	7.54	1.75U	6.16	1.83U	3.34	4.05	3.47U	3.51U	1.83U	1.83U
			10/31/2022	**0.6**	**127**	4.39	2.97	1.80J	2.68	1.66U	1.8	1.73	25.5	7.64	1.59U	6.8	1.66U	2.05	4.44	3.15U	3.18U	1.66U	1.66U
			11/7/2022	**0.61**	**128**	5.33	3.54	1.81J	2.98	1.75U	1.78	2.3	34.7	10.7	1.68U	6.34	1.75U	3.98	5	3.32U	3.35U	1.75U	1.75U
			11/14/2022	**0.58**	**120**	4.21	3.01	1.61J	2.26	1.64U	1.67	1.82	26.2	7.17	1.57U	5.59	1.64U	2.89	4.66	15.6DU	3.14U	1.64U	1.64U
			11/21/2022	0.308	**74.9**h	3.14h	2.15h	1.29Jh	2.04h	1.74Uh	0.99Jh	1.51Jh	25.3h	5.78h	1.67Uh	4.63h	1.74Uh	2.84h	3.12h	3.31Uh	3.34Uh	1.74Uh	1.74Uh

Appendix A - Analytical Data Results

TCRA PFAS Plume Remediation
Startup Testing of the Current Fiehouse PFAS Treatment System
PFAS and 1,4-Dioxane Results
Sample Period: October 24 - February 2, 2023
Brookhaven National Laboratory

Well	Site ID	Well Screen (ft. BLS)	Sample Date	1,4-D (µg/L)	PFOS (ng/L)	PFOA (ng/L)	PFBS (ng/L)	FBSA (ng/L)	PFBA (ng/L)	PFDA (ng/L)	PFHpS (ng/L)	PFHpA (ng/L)	PFHxS (ng/L)	PFHxA (ng/L)	PFNS (ng/L)	PFNA (ng/L)	PFOSAm (ng/L)	PFPeS (ng/L)	PFPeA (ng/L)	6:2 FTS (ng/L)	8:2 FTS (ng/L)	PFUnDA (ng/L)	PFTrDA (ng/L)
			11/28/2022	**0.54**	**120**	4.26	2.57	1.76J	2.21	1.72U	1.5J	1.61J	27.9	7.42	1.65U	5.41	1.72U	2.44	3.79	3.26U	3.30U	1.72U	1.72U
			12/5/2022	0.22U	**61.7**	3.51	3.72	4.02	1.13J	1.78U	1.4J	0.75J	51.4	4.52	1.70U	1.78U	1.78U	5.79	1.48J	3.77U	3.41U	1.78U	1.78U
			12/12/2022	**0.61**	**77.7**	3.05	2.11	1.39J	1.77J	1.89U	1.07J	1.44J	24.2	5.54	1.81U	3.65	1.89U	2.63	2.74	3.59U	3.62U	1.89U	1.89U
			12/20/2022	**0.55**	**79.9**	3.37	2.29	1.39J	1.66J	1.79U	1.16J	1.35J	21.7	5.47	1.72U	4.49	1.79U	2.23	2.86	3.40U	3.43U	1.79U	1.79U
			1/11/2023	**0.69**	**79.3**	2.97	1.88	1.20J	1.68J	1.78U	1.07J	0.932J	17.5	5.20	1.71U	3.69	1.78U	1.84	2.79	3.38U	3.41U	1.78U	1.78U
CF-RW-I	102-35	70-90	10/24/2022	0.2U	**741**D	**15.4**	20.5	34.8	4.79	1.77U	10.6	3.9	463D	31.5	1.70U	1.77U	1.77U	41.5	10.1	16.8DU	3.40U	1.77U	1.77U
			10/26/2022	0.2U	**317**D	**10.7**	15	25	3.13	1.80U	7.67	2.81	286D	21.7	1.73U	1.80U	1.80U	24.9	6.86	3.42U	3.45U	1.80U	1.80U
			10/28/2022	0.2U	**265**Dh	**11.6**h	16.5h	24.4h	3.82h	1.76Uh	7.16h	3.51h	304Dh	24.5h	1.69Uh	1.76Uh	1.76Uh	23.9h	6.62h	16.7DUh	16.9DU	1.76Uh	1.76Uh
			10/31/2022	0.2U	**303**D	**8.08**	10.7	16.2	2.65	1.66U	4.98	2.11	252D	14.1	1.60U	1.66U	1.66U	18.2	4.65	3.16U	3.19U	1.66U	1.66U
			11/7/2022	0.2U	**180**D	**8.88**	10.2	15.3	2.73	1.76U	4.68	2.2	174D	17	1.69U	1.76U	1.76U	22.3	4.28	3.34U	3.38U	1.76U	1.76U
			11/14/2022	0.2U	**134**D	**7.74**	11.1	12.5	2.6	1.77U	3.74	1.96	142	13.2	1.70U	1.77U	1.77U	20.2	4.33	16.8DU	3.40U	1.77U	1.77U
			11/21/2022	0.2U	**159**h	6.16h	8.16h	9.82h	2.24h	1.66Uh	3.78h	1.54Jh	116h	10.8h	1.60Uh	1.66Uh	1.66Uh	15.9h	3.87h	3.16Uh	3.19Uh	1.66Uh	1.66Uh
			11/28/2022	0.2U	**164**	**7.96**	7.38	10.8	1.79	1.69U	4.39	2	117	11.1	1.62U	1.69U	1.69U	16.1	3.14	3.21U	3.25U	1.69U	1.69U
			12/5/2022	0.2U	**135**	6.61	7.66	10.5	1.8	1.80U	2.86	1.68J	100	10.5	1.73U	1.80U	1.80U	12.6	2.96	3.43U	3.46U	1.80U	1.80U
			12/12/2022	0.2U	**104**	5.54	6.27	8.18	1.54J	1.77U	2.75	1.50J	74.2	8.11	1.70U	1.77U	1.77U	10.3	2.72	3.37U	3.40U	1.77U	1.77U
			12/20/2022	0.2U	**102**	5	5.57	6.81	1.34J	1.81U	2.6	1.11J	77.5	6.78	1.74U	1.81U	1.81U	10.2	1.94	3.45U	3.48U	1.81U	1.81U
			1/11/2023	0.2U	**106**	4.92	5.05	6.55	1.36J	1.81U	2.36	1.01J	78.9	6.29	1.73U	1.81U	1.81U	9.74	1.99	3.43U	3.47U	1.81U	1.81U

Appendix A - Analytical Data Results

TCRA PFAS Plume Remediation
Startup Testing of the Current Fiehouse PFAS Treatment System
PFAS and 1,4-Dioxane Results
Sample Period: October 24 - February 2, 2023
Brookhaven National Laboratory

Well	Site ID	Well Screen (ft. BLS)	Sample Date	1,4-D (µg/L)	PFOS (ng/L)	PFOA (ng/L)	PFBS (ng/L)	FBSA (ng/L)	PFBA (ng/L)	PFDA (ng/L)	PFHpS (ng/L)	PFHpA (ng/L)	PFHxS (ng/L)	PFHxA (ng/L)	PFNS (ng/L)	PFNA (ng/L)	PFOSAm (ng/L)	PFPeS (ng/L)	PFPeA (ng/L)	6:2 FTS (ng/L)	8:2 FTS (ng/L)	PFUnDA (ng/L)	PFTrDA (ng/L)
System Influent	084-99	--	10/24/2022	NA	**324**D	**9.66**	9.69	8.57	4.7	1.82U	3.15	4.65	10.5	18.9	1.75U	1.91	1.82U	11.7	14.5	17.3DU	17.5U	1.82U	1.82U
			10/25/2022	NA	**278**D	**8.68**	7.63	7.39	3.81	1.76U	3.64	4.18	97.1	16.9	1.69U	2.39	1.76U	11.3	11.6	16.7DU	3.37U	1.76U	1.76U
			10/26/2022	NA	**273**h	**7.98**h	6.47h	6.31h	3.44h	1.72Uh	3.47h	3.91h	94.9h	15.8h	1.65Uh	3.61h	1.72Uh	9.87h	10.4h	3.26Uh	3.3h	1.72Uh	1.72Uh
			10/27/2022	NA	**241**D	**7.6**	6.99	6.46	3.56	1.85U	4.08	3.87	119	16.1	1.77U	4.14	1.85U	12.8	10.2	3.51U	3.55U	1.85U	1.85U
			10/28/2022	NA	**162**D	**6.96**	6.79	6.58	3.67	1.74U	2.31	3.28	85	12.6	1.67U	4.62	1.74U	9.6	8.62	3.31U	3.34U	1.74U	1.74U
			10/31/2022	NA	**248**D	5.8	5.94	4.74	3.42	1.66U	2.46	2.77	74.1	10.1	1.59U	7.19	1.66U	7.3	7.22	3.15U	3.18U	1.66U	1.66U
			11/8/2022	0.2U	**183**D	**7.52**	6.08	4.97	3.59	1.78U	2.85	3.7	80.5	14.1	1.71U	11.4	1.78U	9.21	8.06	16.9DU	3.42U	1.78U	1.78U
			11/14/2022	0.18J	**153**D	6.19	6.67	3.48J	3.01	1.75U	1.92	2.82	78.9	10.2	1.68U	11.7	1.75U	9.26	7.09	16.6DU	3.36U	1.75U	1.75U
			11/21/2022	0.2U	**148**h	6.03h	4.40h	3.28Jh	2.71h	1.67Uh	2.14h	2.86h	57.3h	8.86h	1.61Uh	11.5h	1.67Uh	7.17h	6.62h	3.18Uh	3.71Uh	1.67Uh	1.67Uh
			11/28/2022	0.15J	**112**	5.85	4.93	3.09J	2.66	1.81U	1.77	2.4	42.8	8.44	1.74U	10.8	1.81U	5.21	6.46	3.45U	3.48U	1.81U	1.81U
			12/5/2022	0.17J	**173**D	**7.66**	3.68	2.46J	2.94	1.66U	2.32	3.67	53.9	10.4	1.59U	18.3	1.66U	5.33	7.1	3.15U	3.18U	1.66U	1.66U
			12/12/2022	0.14J	**98.8**	3.43	3.56	2.42J	1.82	1.77U	1.56J	1.92	40.2	6.68	1.70U	2.01	1.77U	4.31	4.69	3.37U	3.40U	1.77U	1.77U
			12/20/2022	0.2	**114**	5.05	3.13	2.23J	1.95	1.70U	1.56J	1.74	48.1	7.54	1.63U	10.4	1.70U	4.9	4.82	3.23U	3.26U	1.70U	1.70U
			1/4/2023	0.2U	**127**	**6.85**	3.16	2.65J	2.2	1.77U	1.71	1.95	53.9D	7.81	1.70U	14.1	1.77U	5.52DJ	5.34	3.37U	3.40U	1.77U	7.77U
			1/11/2023	0.19J	**128**	5.45	3.18	2.95J	1.91	1.88U	1.81	2	42.3	7.6	1.81U	11.7	1.88U	4.19	4.44	3.76U	3.76U	1.88U	1.88U
			1/19/2023	0.17J	**152**	6.23	4.42	2.84J	2.25	1.85U	1.8	2.15	54.5	9.34	1.78U	17.2	1.85U	5.37	5.07	3.70U	3.70U	1.85U	1.85U
			1/24/2023	0.19J	**151h**	7.03h	3.85h	3.17Jh	2.17h	1.79Uh	1.97h	2.23h	52.2h	8.63h	7.72Uh	15.1h	1.79Uh	4.84h	1.79	3.40Uh	3.44Uh	1.79Uh	1.79Uh
			2/2/2023	0.14J	**124**	4.85	3.36	2.47J	1.72J	1.79U	1.84	1.57J	46.9	6.00	1.72U	10.8	1.79U	4.31	3.21	3.40U	3.44U	1.79U	1.79U
System Mid-Point	084-100	--	10/31/2022	NA	1.84U	1.84U	1.64U	3.68U	1.84U	1.84U	1.75U	1.84U	1.67U	1.84U	1.77U	1.84U	1.84U	1.73U	1.84U	3.50U	3.53U	1.84U	1.84U
			11/8/2022	NA	1.79U	1.79U	1.59U	3.58U	1.79U	1.79U	1.70U	1.79U	1.63U	1.79U	1.72U	1.79U	1.79U	1.68U	1.79U	3.40U	3.43U	1.79U	1.79U
			11/14/2022	NA	1.84U	1.84U	1.63U	3.67U	1.84U	1.84U	1.74U	1.84U	1.67U	1.84U	1.76U	1.84U	1.84U	1.73U	1.84U	3.49U	3.53U	1.84U	1.84U
			11/21/2022	0.2U	1.23Jh	1.79Uh	1.59Uh	3.58Uh	1.79Uh	1.79Uh	1.70Uh	1.79Uh	0.66Jh	1.79Uh	1.72Uh	1.79Uh	1.79Uh	1.68Uh	1.79Uh	3.40Uh	3.44Uh	1.79Uh	1.79Uh
			11/28/2022	NA	1.01J	1.69U	1.51U	3.38U	1.69U	1.69U	1.61U	1.69U	1.54U	1.69U	1.62U	1.69U	1.69U	1.59U	1.69U	3.21U	3.25U	1.69U	1.69U
			12/5/2022	0.19J	1.78U	1.78U	1.59U	3.56U	1.78U	1.78U	1.69U	1.78U	1.62U	1.78U	1.71U	1.78U	1.78U	1.67U	1.78U	3.38U	3.42U	1.78U	1.78U
			12/12/2022	0.16J	**5.43**	1.71U	1.52U	3.42U	1.71U	1.71U	1.63U	1.71U	1.55J	1.71U	1.64U	1.71U	1.71U	1.61U	1.71U	3.25U	3.29U	1.71U	1.71U
			12/20/2022	0.16J	**6.77**	1.83U	1.63U	3.66U	1.83U	1.83U	1.74U	1.83U	2.63	1.83U	1.76U	0.79J	1.83U	1.72U	1.83U	3.47U	3.51U	1.83U	1.83U
			1/4/2023	0.2U	**4.54**	1.68U	1.50U	3.36U	1.68U	1.68U	1.60U	1.68U	1.48J	1.68U	1.61U	0.63J	1.68U	1.58U	1.68U	3.19U	3.23U	1.68U	1.68U
			1/11/2023	0.16J	**6.62***	1.84U*	1.64U*	3.68U*	1.84U*	1.84U*	1.75U*	1.84U*	1.97*	1.84U*	1.77U*	1.84U*	1.84U*	1.73U*	1.84U*	3.68U*	3.68U*	1.84U*	1.84U*
			1/19/2023	0.16J	**6.91**	1.85U	1.65U	3.70U	1.85U	1.85U	1.76U	1.85U	1.93	1.85U	1.78U	0.797J	1.85U	1.74U	1.85U	3.70U	3.70U	1.85U	1.85U
			1/24/2023	0.20	**5.94h**	1.67Uh	1.49Uh	3.35Uh	1.67Uh	1.67Uh	1.59Uh	1.67Uh	2.38h	1.67Uh	1.61Uh	1.67Jh	1.67Uh	1.57Uh	1.67Uh	3.18Uh	3.21Uh	1.67Uh	1.67Uh
			2/2/2023	0.14J	**5.26**	1.87U	1.66U	3.73U	1.87U	1.87U	1.77U	1.87U	2.04	1.87U	1.79U	1.87U	1.87U	1.75U	1.87U	3.55U	3.58U	1.87U	1.87U

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TCRA PFAS Plume Remediation
Startup Testing of the Current Fiehouse PFAS Treatment System
PFAS and 1,4-Dioxane Results
Sample Period: October 24 - February 2, 2023
Brookhaven National Laboratory

Well	Site ID	Well Screen (ft. BLS)	Sample Date	1,4-D (µg/L)	PFOS (ng/L)	PFOA (ng/L)	PFBS (ng/L)	FBSA (ng/L)	PFBA (ng/L)	PFDA (ng/L)	PFHpS (ng/L)	PFHpA (ng/L)	PFHxS (ng/L)	PFHxA (ng/L)	PFNS (ng/L)	PFNA (ng/L)	PFOSAm (ng/L)	PFPeS (ng/L)	PFPeA (ng/L)	6:2 FTS (ng/L)	8:2 FTS (ng/L)	PFUnDA (ng/L)	PFTrDA (ng/L)
System Effluent	084-101	--	10/24/2022	0.2U	1.81U	1.81U	1.61U	3.61U	1.81U	1.81U	1.72U	1.81U	1.64U	1.81U	1.73U	1.81U	1.81U	1.70U	1.81U	17.2DU	3.47U	1.81U	1.81U
			10/25/2022	0.2U	1.76U	1.76U	1.57U	3.53U	1.76U	1.76U	1.67U	1.76U	1.60U	1.76U	1.69U	1.76U	1.76U	1.65U	1.76U	3.34U	3.38U	1.76U	1.76U
			10/26/2022	0.2U	1.87U	1.87U	1.66U	3.73U	1.87U	1.87U	1.77U	1.87U	1.70U	1.87U	1.79U	1.87U	1.87U	1.75U	1.87U	3.55U	3.58U	1.87U	1.87U
			10/27/2022	0.2U	1.70U	1.70U	1.51U	3.39U	1.70U	1.70U	1.61U	1.70U	1.54U	1.70U	1.63U	1.70U	1.70U	1.59U	1.70U	3.22U	3.26U	1.70U	1.70U
			10/28/2022	0.2U	1.75U	1.75U	1.56U	3.50U	1.75U	1.75U	1.66U	1.75U	1.59U	1.75U	1.68U	1.75U	1.75U	1.65U	1.75U	3.33U	3.36U	1.75U	1.75U
			10/31/2022	0.2U	1.67U	1.67U	1.49U	3.34U	1.67U	1.67U	1.59U	1.67U	1.52U	1.67U	1.60U	1.67U	1.67U	1.57U	1.67U	3.17U	3.21U	1.67U	1.67U
			11/8/2022	0.21	1.75U	1.75U	1.56U	3.50U	1.75U	1.75U	1.66U	1.75U	1.59U	1.75U	1.68U	1.75U	1.75U	1.64U	1.75U	3.32U	3.36U	1.75U	1.75U
			11/14/2002	0.1J	1.68U	1.68U	1.49U	3.36U	1.68U	1.68U	1.59U	1.68U	1.53U	1.68U	1.61U	1.68U	1.68U	1.58U	1.68U	3.19U	3.22U	1.68U	1.68U
			11/21/2022	0.2U	1.72Uh	1.72Uh	1.53Uh	3.44Uh	1.72Uh	1.72Uh	1.64Uh	1.72Uh	1.57Uh	1.72Uh	1.65Uh	1.72Uh	1.72Uh	1.62Uh	1.72Uh	3.27Uh	3.31Uh	1.72Uh	1.72Uh
			11/28/2022	0.16J	1.66U	1.66U	1.47U	3.31U	1.66U	1.66U	1.57U	1.66U	1.51U	1.66U	1.59U	1.66U	1.66U	1.56U	1.66U	3.15U	3.18U	1.66U	1.66U
			12/5/2022	0.21J	1.84U	1.84U	1.63U	3.67U	1.84U	1.84U	1.74U	1.84U	1.67U	1.84U	1.76U	1.84U	1.84U	1.73U	1.84U	3.49U	3.52U	1.84U	1.84U
			12/12/2022	0.2J	1.75U	1.75U	1.55U	3.49U	1.75U	1.75U	1.66U	1.75U	1.59U	1.75U	1.68U	1.75U	1.75U	1.64U	1.75U	3.32U	3.35U	1.75U	1.75U
			12/20/2022	0.17J	1.74U	1.74U	1.55U	3.48U	1.74U	1.74U	1.65U	1.74U	1.58U	1.74U	1.67U	1.74U	1.74U	1.64U	1.74U	3.31U	3.34U	1.74U	1.74U
			1/4/2023	0.13J	1.68U	1.68U	1.50U	3.36U	1.68U	1.68U	1.60U	1.68U	1.53U	1.68U	1.61U	1.68U	1.68U	1.58U	1.68U	3.19U	3.23U	1.68U	1.68U
			1/11/2023	0.16J	1.90U*	1.90U*	1.69U*	3.80U*	1.90U*	1.90U*	1.80U*	1.90U*	1.73U*	1.90U*	1.82U*	1.90U*	1.90U*	1.78U*	1.90U*	3.80U*	3.80U*	1.90U*	1.90U*
			1/19/2023	0.16J	1.73U	1.73U	1.54U	3.47U	1.73U	1.73U	1.65U	1.73U	1.58U	1.73U	1.66U	1.73U	1.73U	1.63U	1.73U	3.47U	3.47U	1.73U	1.73U
			1/24/2023	0.24	1.70Uh	1.70Uh	1.51Uh	3.40Uh	1.70Uh	1.70Uh	1.62Uh	1.70Uh	1.55Uh	1.70Uh	1.63Uh	1.70Uh	1.70Uh	1.60Uh	1.70Uh	3.23Uh	3.27Uh	1.70Uh	1.70Uh
			2/2/2023	0.15J	1.69U	1.69U	1.51U	3.39U	1.69U	1.69U	1.61U	1.69U	1.54U	1.69U	1.63U	1.69U	1.69U	1.59U	1.69U	3.22U	3.25U	1.69U	1.69U
SPDES Permit Effluent Limit				**0.35**	**2.7**	**6.7**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

BLS: Below land surface.

Note 1: PFAS analyses were performed by GEL using modified EPA Method 537.1

Note 2: Except as indicated, the 1,4-dioxane analyses were performed by Eurofins-Test America using EPA Method 8270D SIM with a detection limit (DL) of 0.1 µg/L and reporting level (RL) of 0.2 µg/L.

Note 3: The lead GAC vessel was backflushed on the following dates: 11/2/22, 11/17/22, 12/9/22, 12/19/22, 12/28/22 and 2/22/23.

U: Analyte not detected at or above the stated Reporting Limit.

J: Estimated concentration between the DL and RL..

D: Dilution

NA: Samples not analyzed for this analyte

h: Sample extracted outside of holding time specification.

µg/L: Micrograms per liter

ng/L: Nanograms per liter

Bold: Numbers in bold exceed standard or guidance value.

*:Sample re-run at lab indicated midpoint and effluent were switched. Corrected data presented from intial analysis.

APPENDIX B
Extraction Well Construction Logs

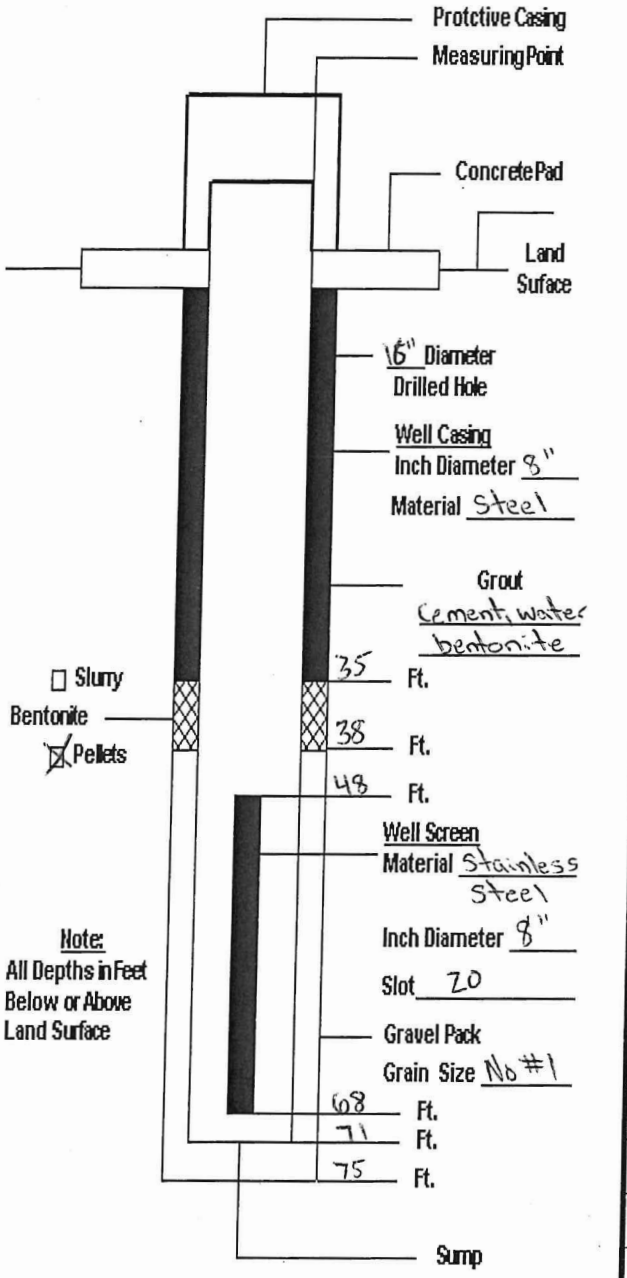
Extraction

BNL ~~Monitoring~~ Well Construction Log

BROOKHAVEN NATIONAL LABORATORY

Extraction

~~MONITORING~~ WELL CONSTRUCTION LOG



BNL Well No: CF-RW-A

NYSDEC Permit No.: 5-136610

Project: PFAS

Surveyor: Survey Date:

Land Surface Elevation:

Measuring Point Elevation:

BNL Northing:

BNL Easting:

Installation Date: 9-9-21 to 9-10-21

Drilling Contractor: Delta

Drilling Method: Hollow Stem Augers

Drilling Fluid:

Fluid Loss During Drilling: Gallons

2ft layer of No. 00 Sand above gravel pack

Development Technique(s) and Date(s): Air lift/Sub pump

Water Removed During Development: ~10,000 Gallons

Static Depth to Water: 45.37 Feet below M.P.

Pumping Depth to Water: 48.02 Feet below M.P.

Pumping Duration: 30 minutes

Yield: GPM: 160 Date: 10-1-21

Specific Capacity: 60.4 GPM/Ft.

Well Purpose: Extraction/Recovery

Observed visibly clear water during development

Hydrologist: Chris Linkletter

Company Name: D+B Engineers

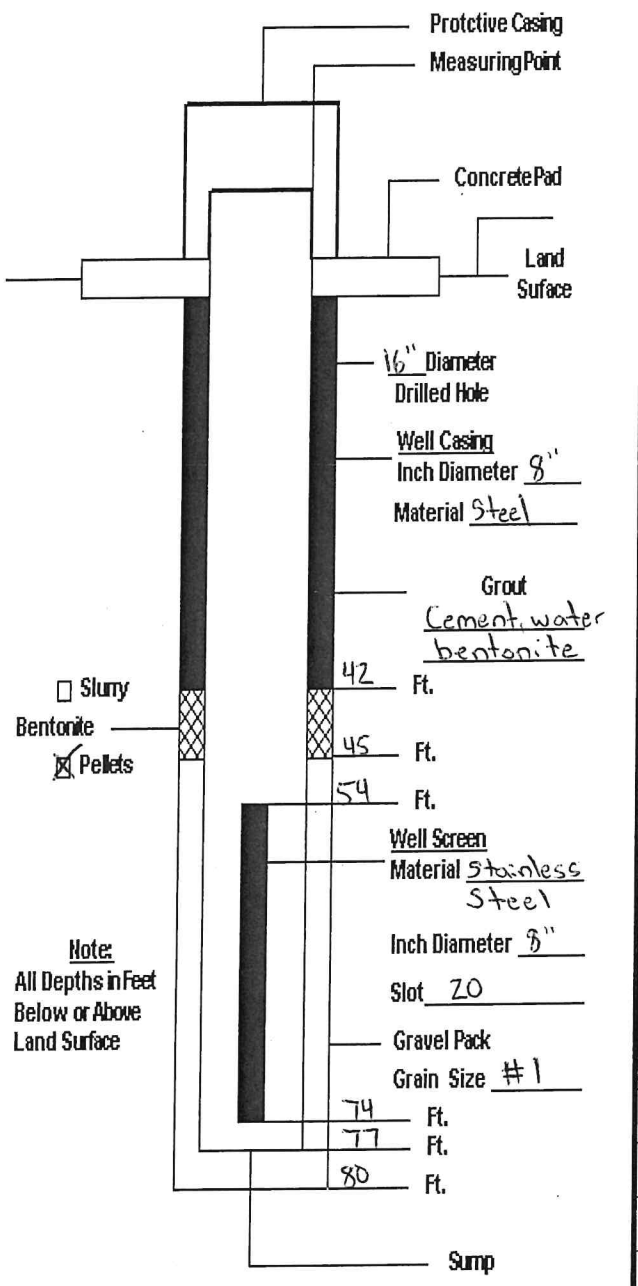
Permanent pump setting in feet below land surface is 51.

073-35

Extraction
BNL ~~Monitoring~~ Well Construction Log

BROOKHAVEN NATIONAL LABORATORY

Extraction
~~MONITORING~~ WELL CONSTRUCTION LOG



BNL Well No: CF-RW-B
NYSDEC Permit No.: 5-136611
Project: PFAS
Surveyor: Survey
Date:
Land Surface Elevation:
Measuring Point Elevation:
BNL Northing:
BNL Easting:
Installation Date: 8-26-21 to 8-27-21
Drilling Contractor: Delta
Drilling Method: Hollow Stem Augers
Drilling Fluid:
Fluid Loss During Drilling: Gallons
2 ft layer of No. 00 Sand above gravel pack
Development Technique(s) and Date(s): Air lifted
Water Removed During Development: ~10,000 Gallons
Static Depth to Water: 45.21 Feet below M.P.
Pumping Depth to Water: Feet below M.P.
Pumping Duration: 6+ hours, ~~fluctuating~~ fluctuating
Yield: GPM: Date: 10/4-10/5/21
Specific Capacity: GPM/Ft.
Well Purpose: Extraction/Recovery
Observed visibly clear water during development
Hydrologist: Chris Linkletter
Company Name: D+B Engineers

Permanent pump setting in feet below land surface is 57.

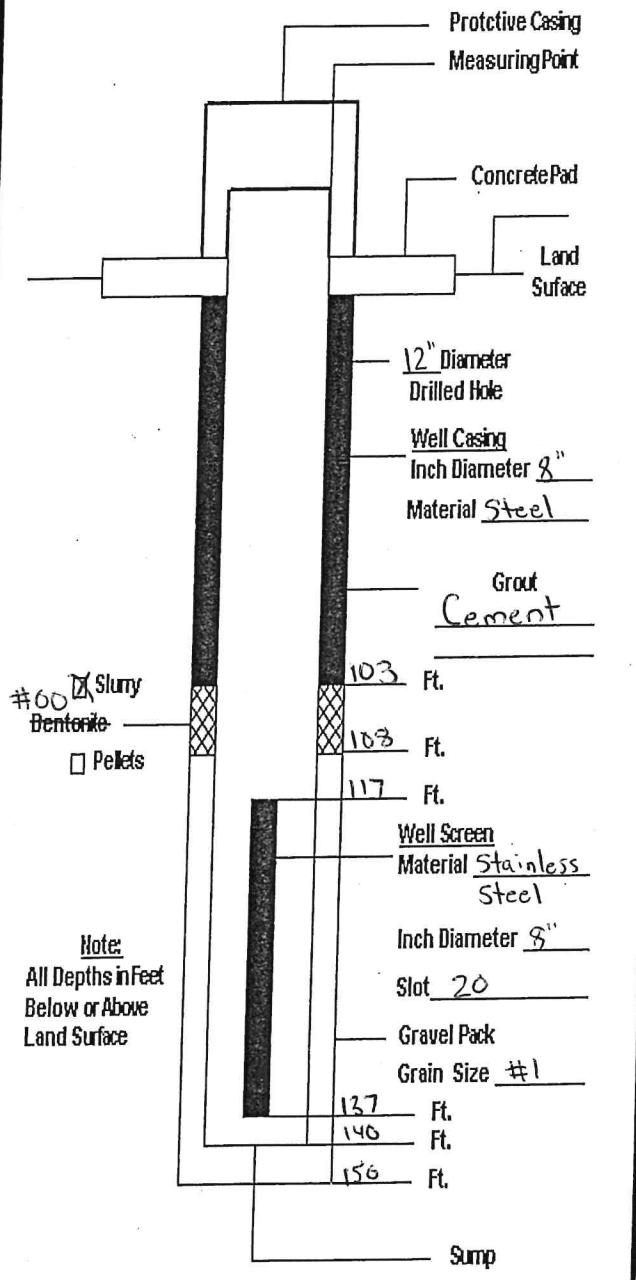
Extraction

BNL ~~Monitoring~~ Well Construction Log

BROOKHAVEN NATIONAL LABORATORY

Extraction

~~MONITORING~~ WELL CONSTRUCTION LOG



BNL Well No: CF-RW-C

NYSDEC Permit No.: S-136612

Project: PFAS

Surveyor: Survey

Date:

Land Surface Elevation:

Measuring Point Elevation:

BNL Northing:

BNL Easting:

Installation Date: 11-9-21 to 11-16-21

Drilling Contractor: Delta

Drilling Method: Mud Rotary

Drilling Fluid: Mud

Fluid Loss During Drilling: Gallons

Development Technique(s) and Date(s): Air lift/pump

Water Removed During Development: Gallons

Static Depth to Water: 57' Feet below M.P.

Pumping Depth to Water: Feet below M.P.

Pumping Duration:

Yield: GPM: Date: 12/6-12/17/21

Specific Capacity: GPM/Ft.

Well Purpose: Extraction/Recovery

Hydrologist: Chris Linkletter

Company Name: O+B Engineers

27 Bags of #1 gravel
5 Bags of #00 Sand
6 Bags of Hole plug

- Air lifting/Pumping 11/30/21
- Jetting

EM-SOP-102

Rev. 5, 1/12

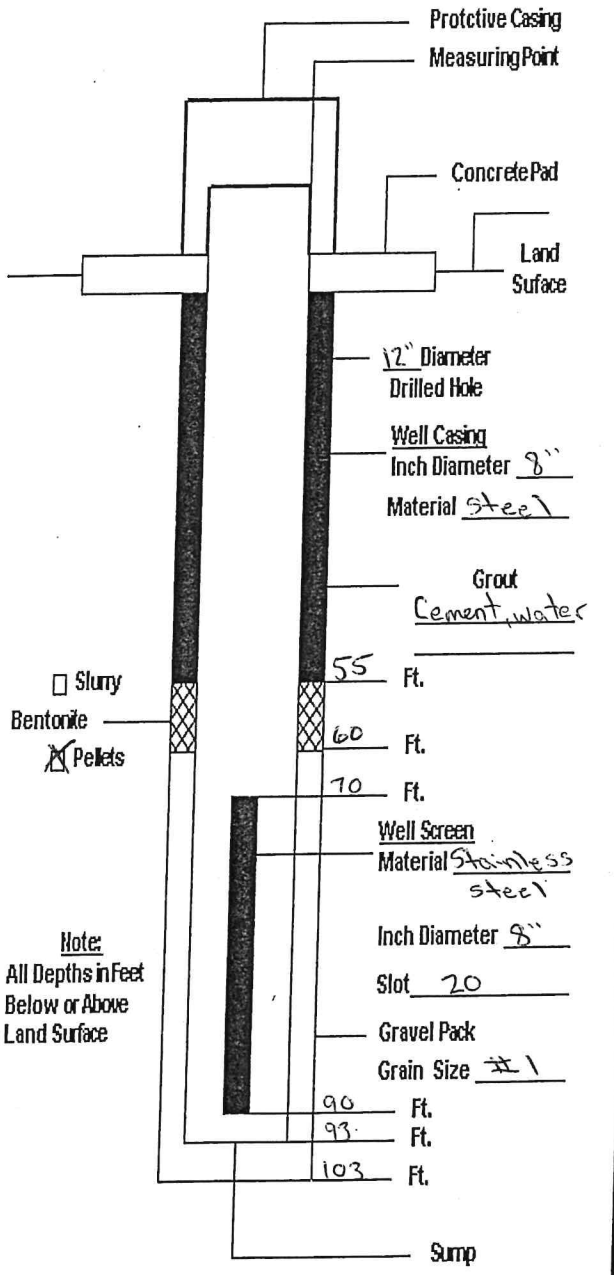
Permanent pump setting in feet below land surface is 121.

083-46

Extraction
BNL ~~Monitoring~~ Well Construction Log

BROOKHAVEN NATIONAL LABORATORY

Extraction
~~MONITORING~~ WELL CONSTRUCTION LOG



BNL Well No: CF-RW-D
NYSDEC Permit No.: S-136613
Project: PFAS
Surveyor: Survey
Date:
Land Surface Elevation:
Measuring Point Elevation:
BNL Northing:
BNL Easting:
Installation Date: 10-25-21 to 10-29-21
Drilling Contractor: Delta
Drilling Method: Mud Rotary
Drilling Fluid: Mud
Fluid Loss During Drilling: Gallons

Development Technique(s) and Date(s):
Water Removed During Development: Gallons
Static Depth to Water: 59.50 Feet below M.P.
Pumping Depth to Water: Feet below M.P.
Pumping Duration:
Yield: GPM: Date:
Specific Capacity: GPM/Ft.
Well Purpose: Extraction / Recovery

Hydrologist: Chris Linkletter
Company Name: D+B Engineers

25 bags of #1 Gravel
5 bags of #00 Sand
6 bags of Holeplug

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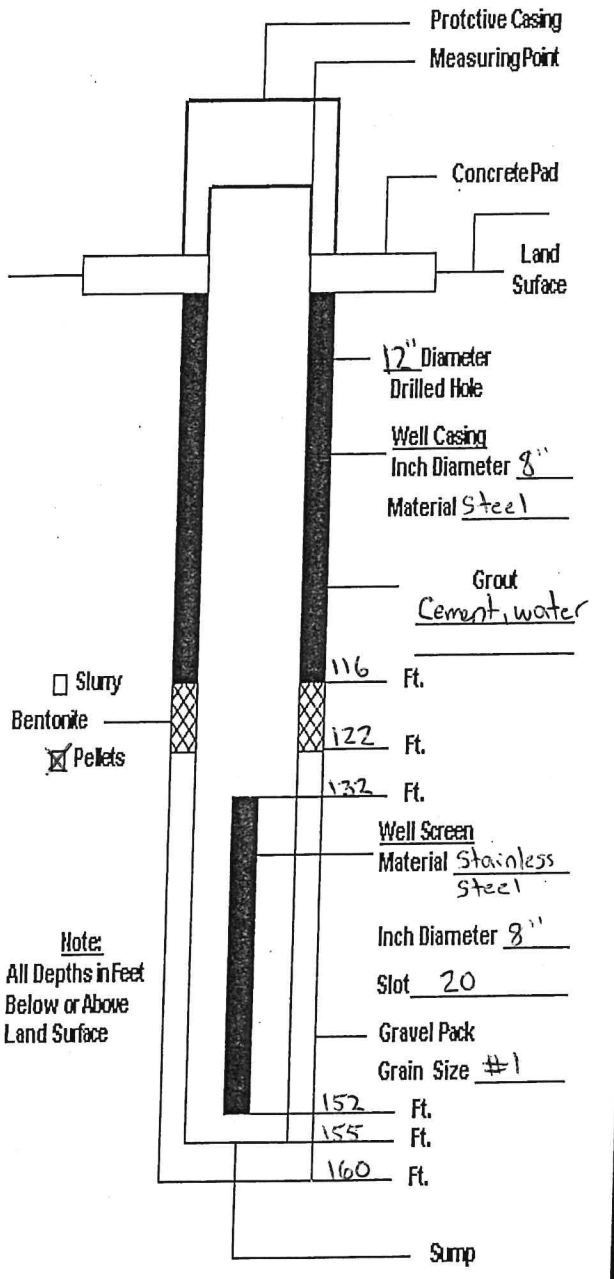
Rev. 5, 1/12

Permanent pump setting in feet below land surface is 73.

Extraction
BNL ~~Monitoring~~ Well Construction Log

BROOKHAVEN NATIONAL LABORATORY

Extraction
~~MONITORING~~ WELL CONSTRUCTION LOG



BNL Well No: CF-RW-E
NYSDEC Permit No.: 5-136614
Project: PFAS
Surveyor: Survey
Date:
Land Surface Elevation:
Measuring Point Elevation:
BNL Northing:
BNL Easting:
Installation Date: 10-12-21 to 10-15-21
Drilling Contractor: Delta
Drilling Method: Mud Rotary
Drilling Fluid: Mud
Fluid Loss During Drilling: Gallons

Development Technique(s) and Date(s): Air lift/Sub pump
Water Removed During Development: Gallons
Static Depth to Water: 59.18 Feet below M.P.
Pumping Depth to Water: Feet below M.P.
Pumping Duration:
Yield: GPM: 60 Date: 10/28 - 11/4/21
Specific Capacity: GPM/Ft.
Well Purpose: Extraction / Recovery
Observed visibly clear water during development
Hydrologist: Chris Linkletter
Company Name: D+B Engineers

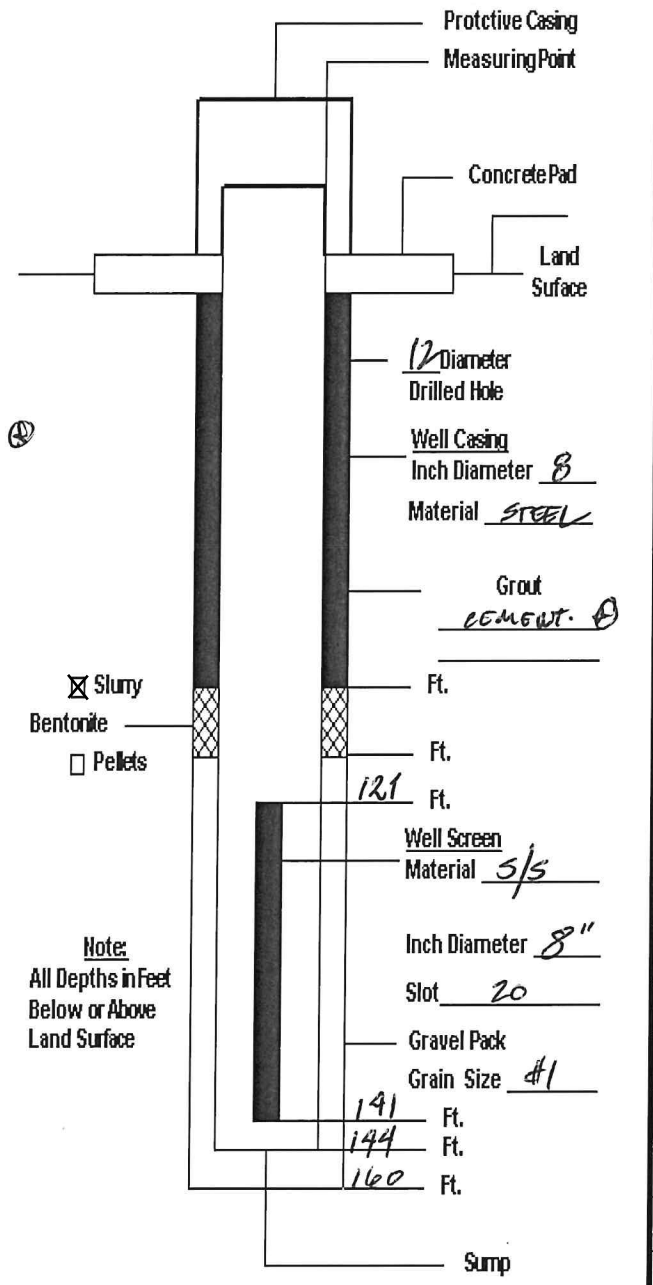
27 bags of #1 gravel
5 bags of #00 Sand
6 bags of holeplug

Permanent pump setting in feet below land surface is 136.

Extraction
BNL ~~Monitoring~~ Well Construction Log

Brookhaven National Laboratory

Extraction
~~MONITORING~~ WELL CONSTRUCTION LOG



BNL Well No: CF-RW-F
NYSDEC Permit No.: S-136615
Project:
Surveyor: Survey Date:
Land Surface Elevation:
Measuring Point Elevation:
BNL Northing:
BNL Easting:
Installation Date: 4·27·2022
Drilling Contractor: Delta well & pump
Drilling Method: MUD Rotary
Drilling Fluid: REVERT.
Fluid Loss During Drilling: ~2,000 Gallons
Development Technique(s) and Date(s): Air lift pump 5/2
Water Removed During Development: 4,5 Gallons
Static Depth to Water: 53' Feet below M.P.
Pumping Depth to Water: 51' Feet below M.P.
Pumping Duration: 2.5 hours
Yield: GPM: Date:
Specific Capacity: 15. GPM/Ft.
Well Purpose: PFAS monitoring & extraction.
Hydrologist: Ian Snuff.
Company Name:

Permanent pump setting in feet below land surface is 126.

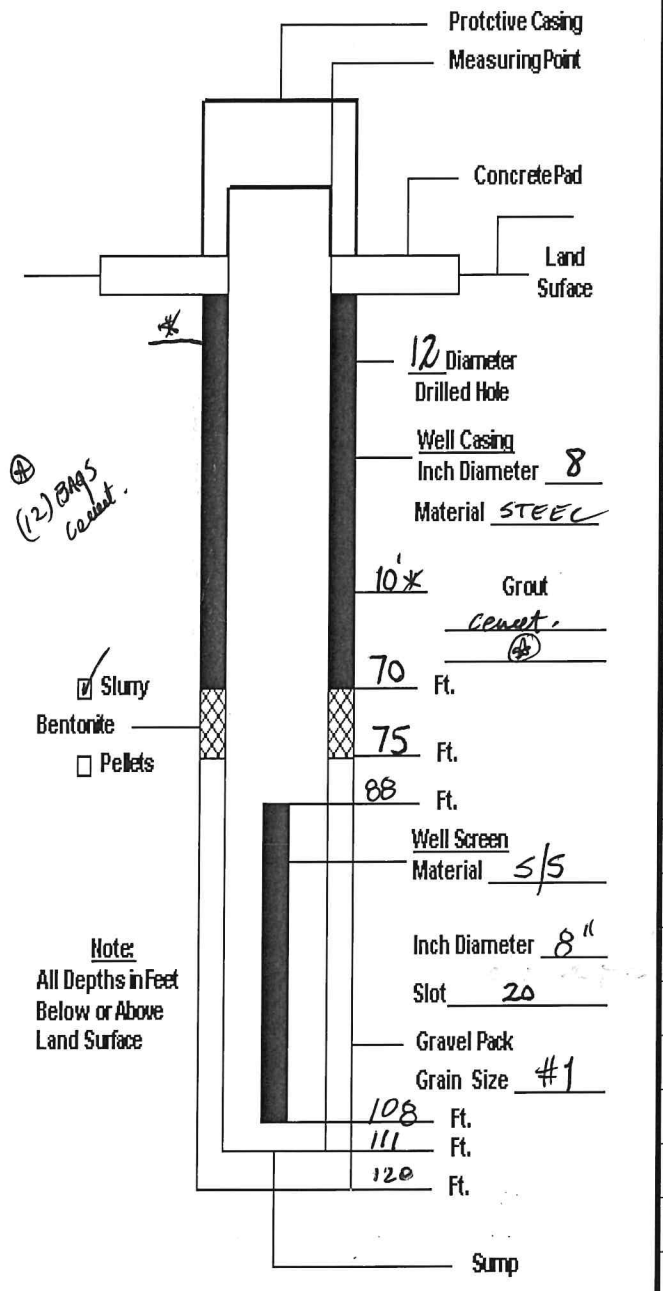
Extraction

BNL ~~Monitoring~~ Well Construction Log

Brookhaven National Laboratory

Extraction

~~MONITORING~~ WELL CONSTRUCTION LOG



BNL Well No: CF-RW-G.

NYSDEC Permit No.: S-136616

Project:

Surveyor: Survey Date:

Land Surface Elevation:

Measuring Point Elevation:

BNL Northing:

BNL Easting:

Installation Date: 4-14-2022

Drilling Contractor: Delta well + pump

Drilling Method: MUD Rotary

Drilling Fluid: REVERT

Fluid Loss During Drilling: 2,000 Gallons

Development Technique(s) and Date(s): Air lift. 4/18/2022 > 4/19

Water Removed During Development: 5,000 Gallons

Static Depth to Water: 54 Feet below M.P.

Pumping Depth to Water: 54' Feet below M.P.

Pumping Duration: 2 HOURS

Yield: GPM: 30 gpm. Date: 4/19/2022

Specific Capacity: GPM/Ft.

Well Purpose: PFAS Extraction.

Hydrologist: Adrian Preiwisch PG.

Company Name: BNL GPG.

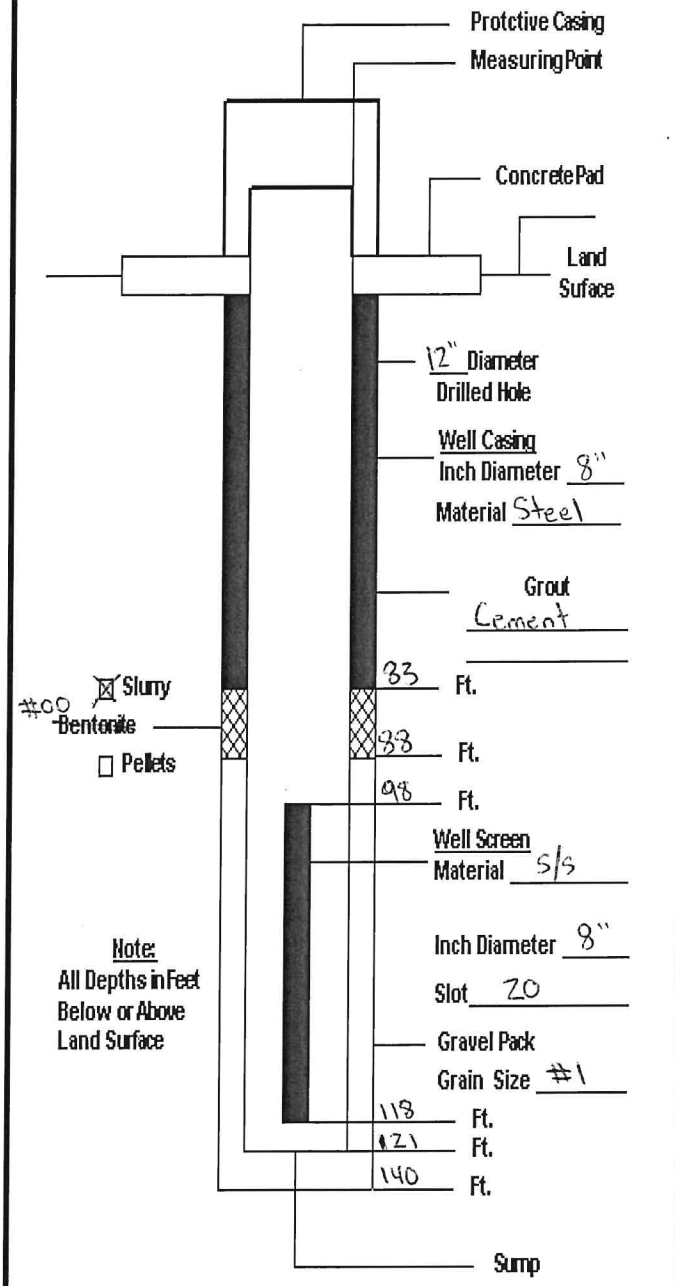
Permanent pump setting in feet below land surface is 96.

* 4-15-2022 - Grouting / drain pit
* 4-18-2022 - Air lifting
* 4-19 2022 - Air lifting

Extraction
BNL ~~Monitoring~~ Well Construction Log

Brookhaven National Laboratory

Extraction
~~MONITORING~~ WELL CONSTRUCTION LOG



BNL Well No: CF-RW-H
NYSDEC Permit No.: S-136617
Project: PFAS
Surveyor: Survey Date:
Land Surface Elevation:
Measuring Point Elevation:
BNL Northing:
BNL Easting:
Installation Date: 5-12-22
Drilling Contractor: Delta
Drilling Method: Mud Rotary
Drilling Fluid: Revert
Fluid Loss During Drilling: 2,000 Gallons

Development Technique(s) and Date(s): Air lift/Sub pump
Water Removed During Development: 8,000 Gallons
Static Depth to Water: 63' Feet below M.P.
Pumping Depth to Water: 64' Feet below M.P.
Pumping Duration: 4 hours
Yield: GPM: 30 gpm Date: 5-18-22
Specific Capacity: GPM/Ft.
Well Purpose: PFAS Extraction
- Observed visibly clear water
Hydrologist: Chris Linkletter
Company Name: D+B

5-17-22 → Air lifting
5-18-22 → Pumping

EM-SOP-102 e1, 1/2022

Permanent pump setting in feet below land surface is 101.

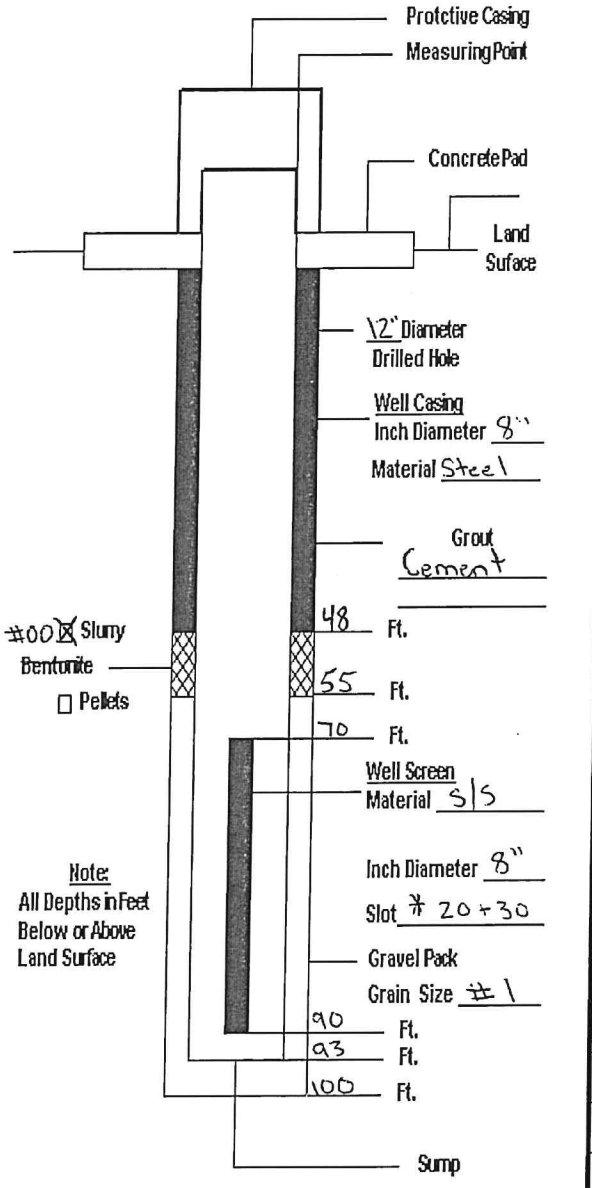
Extraction

BNL ~~Monitoring~~ Well Construction Log

Brookhaven National Laboratory

Extraction

~~MONITORING~~ WELL CONSTRUCTION LOG



BNL Well No: CF-RW-I

NYSDEC Permit No.:

Project: PFAS

Surveyor: Survey Date:

Land Surface Elevation:

Measuring Point Elevation:

BNL Northing:

BNL Easting:

Installation Date: 6-6-22

Drilling Contractor: Delta

Drilling Method: Mud Rotary

Drilling Fluid: Revert

Fluid Loss During Drilling: 2,000 Gallons

Development Technique(s) and Date(s): Air lift / Sub pump

Water Removed During Development: 15,000 Gallons

Static Depth to Water: 50' Feet below M.P.

Pumping Depth to Water: 52' Feet below M.P.

Pumping Duration: 8 hours

Yield: GPM: 30 Date: 6-10-22

Specific Capacity: 15 GPM/Ft.

Well Purpose: Extraction / Recovery

Hydrologist: Chris Linkletter

Company Name: D+B

* Slotted screen
70'-85' = 20 slot] welded together
85'-90' = 30 slot

Air lift - 6/8 + 6/9/22
Sub pump - 6/10/22

EM-SOP-102

el, 1/2022

Permanent pump setting in feet below land surface is 73.