



**Naval Facilities Engineering Systems Command Pacific
JBPHH HI**

**Per- and Polyfluoroalkyl Substances
Delineation
Baseline Groundwater Wells
Investigation Report**

**Red Hill Bulk Fuel Storage Facility
JOINT BASE PEARL HARBOR-HICKAM O'AHU HI**

November 27, 2023



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CONTENTS

Acronyms and Abbreviations	iv
1. Introduction	5
2. Groundwater Sampling, Analysis, and Validation	6
3. Groundwater Analytical Results	7
4. Issues Encountered and Changes	7
5. Quality Control Summary Report	7
6. Summary and Conclusion	7
7. References	9

APPENDIX

- A Comprehensive Validated Groundwater Analytical Results
- B Monitoring Well and Drilling Components

FIGURES

TABLES

Table 1: Groundwater Monitoring Well Information	6
Table 2: Maximum PFAS Detections in Groundwater Sample Results	7

ACRONYMS AND ABBREVIATIONS

AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film-forming foam
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOH	Department of Health, State of Hawai'i
EAL	environmental action level
EPA	Environmental Protection Agency, United States
ng/L	nanograms per liter
PFAS	per- and polyfluoroalkyl substances
PFOS	perfluorooctanesulfonic acid
RHBFSF	Red Hill Bulk Fuel Storage Facility

1. Introduction

This report summarizes groundwater monitoring data collected by the Navy related to per- and polyfluoroalkyl substances (PFAS), which will be utilized in the ongoing Remedial Investigation under the federal cleanup law, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The Navy has been conducting PFAS groundwater sampling since December 2022, and this report summarizes monitoring data collected in September 2023 in response to Regulatory Agencies' request of July 31, 2023, to establish the baseline for which any future remedial investigations and remedial actions will be considered by the Navy.

On November 29, 2022, approximately 1,100 gallons of aqueous film-forming foam (AFFF) concentrate, which contains PFAS, was released at the entrance of Adit 6 of the Red Hill Bulk Fuel Storage Facility (RHBFSF). The impacted areas included an approximately 100-foot-long floor section inside the tunnel entrance, and areas outside and adjacent to the Adit 6 entrance. The outside areas include a crushed-rock apron, an asphalt roadway, a stormwater conveyance system that eventually empties into Halawa Stream, and presumably the underlying and adjacent soils. Figure 1 provides the approximate overland release location as identified by soil sampling decision units. The Navy initiated actions on the day of the spill that included the following:

- Recovery of released AFFF concentrate with appropriate spill-absorbing material
- Over-excavation of crushed rock apron and underlying and adjacent soils
- Removal of impacted stormwater conveyance structures and over-excavation of underlying and adjacent soils
- Removal of impacted asphalt and over-excavation of underlying and adjacent soils
- Containerization of all recovered AFFF and excavated soil, rock, asphalt, and concrete for pending characterization and disposal

The soil removal and confirmation sampling listed above was completed in January 2023. Weekly groundwater sampling was conducted at ten locations in the vicinity of the Adit 6 spill location from December 2022 through May 2023 and transitioned to monthly sampling starting from June 2023, with an end of this sampling scheduled for December 2023. The results of the soil and groundwater sampling are summarized in monthly reports (DON 2023a, b, c, d, e, f, g, h, i).

In addition to the actions above, the Navy performed sampling in September 2023 to determine the baseline groundwater quality for the network of monitoring wells installed in the vicinity of the RHBFSF. This was done by:

- Conducting a baseline sampling event to collect groundwater samples from monitoring wells. Initially, 25 monitoring wells in the vicinity of Red Hill were considered for sampling, but it was found that four (4) have the Westbay system installed. These 4 wells were not included, as the Westbay system potentially has PFAS components that cannot be removed/replaced.
- Analyzing groundwater samples by draft United States Environmental Protection Agency (EPA) Method 1633 for PFAS constituents.
- Screening groundwater data against State of Hawai'i Department of Health (DOH) non-regulatory Environmental Action Levels (EALs) (see reference DOH 2021).

Analytical results provided in this report are validated except as noted.

2. Groundwater Sampling, Analysis, and Validation

The Navy collected baseline samples from 21 monitoring wells in September 2023 for analysis of PFAS constituents using draft EPA Method 1633. Four wells (RHMW11, RHMW13, RHMW14, and RHMW15) were not sampled due to the Westbay systems installed in the wells. This report summarizes activities from the baseline sampling event conducted in September 2023. See Figure 1 for the locations of the monitoring wells. See Table 1 for information on the monitoring wells sampled in September 2023.

Table 1: Groundwater Monitoring Well Information

Well ID	Driller	Well Completion Date	Well Diameter (inches)	Screen Depth (Feet below ground surface)	Borehole Depth (Feet below ground surface)
RHMW01	VWD	02/2001	1	74–84	100
RHMW01R	VWD	03/2021	2	74–94	98.5
RHMW05	VWD	03/2010	2	78–93	103.5
RHMW07	VWD	10/2014	4	184–214	240
RHMW08	VWD	08/2016	4	278.9–308.9	315
RHMW09	VWD	07/2016	4	363.5–393.5	405
RHMW19	VWD	04/2020	4	415–445	455
RHMW20	YK Drilling	06/2023	4	223–253	261
NMW24	VWD	11/2022	4	80–110	116
NMW25	YK Drilling	07/2023	4	181.4–211.4	216.2
RHP01	YK Drilling	06/2022	2	125–155	160
RHP02	GeoTek Hawaii	05/2022	2	109.75–139.75	145
RHP03	VWD	07/2022	2	104–134	141.03
RHP04A	YK Drilling	08/2022	2	130.26–160.26	165
RHP04B	YK Drilling	10/2022	2	300.56–320.56	326
RHP04C	YK Drilling	02/2023	4	486.3–506.3	526
RHP05	GeoTek Hawaii	11/2022	2	203.85–233.85	238
RHP06	GeoTek Hawaii	07/2023	3	239–268.5	280.2
RHP07 ^b	VWD	02/2023	2	73.7–93.7	71
RHP08	Precision Drilling Services	08/2023	4	276–306	311
NMW32	YK Drilling	08/2023	4	161–191	210

- Prior to sampling, all non-PFAS-free materials were removed from the wells and the wells purged a minimum of one casing volume to remove water in the well that may have contacted non-PFAS free materials.
- Samples were collected using low flow sampling methods with rental or dedicated PFAS-free material pumps or with a high-density polyethylene bailer.
- Field duplicate samples were collected at a rate of 10 percent of the samples. Stage 2 data validation was conducted for all samples, while Stage 4 validation was conducted on 10 percent of the samples.

See Figure 2 for the monitoring well locations and Appendix A for analytical results to date.

3. Groundwater Analytical Results

Results of analytical data from samples collected during the September 2023 monitoring well sampling were compared to the DOH-EALs (Appendix A). Analytical results have been validated in accordance with the *Data Validation Guideline Module 6: Data Validation Procedure for Per and Polyfluoroalkyl Substances Analysis by QSM Table B-24* (DoD 2021, 2022). Draft EPA Method 1633 analyses for PFAS constituents identified the presence of 10 out of 40 analytes reported above the detection limit. Table 3 shows maximum detections of various PFAS parameters during this baseline sampling event. Four wells (RHP01, RHP02 [including duplicate sample], RHP07, and NMW32) had detected concentrations above the screening level identified in the DOH EALs for perfluorooctanesulfonic acid (PFOS) see Appendix A. No additional analytes were detected above the DOH EALs. Note that detections below the limit of quantitation (defined as the lowest concentration that the laboratory determines is reasonably repeatable and accurate) are estimated and noted with a “J” flag.

Table 2: Maximum PFAS Detections in Groundwater Sample Results

Parameter	Maximum Detected Concentration (ng/L)	Samples Exceeding Regulatory Level	Location of Maximum Detected Concentration
Perfluorobutanesulfonic acid (PFBS)	4.3	No	RHP02
Perfluorobutanoic acid (PFBA)	14.2	No	RHP02
Perfluoroheptanesulfonic acid (PFHpS)	14.8	No	RHP08
Perfluoroheptanoic acid (PFHpA)	5.2	No	RHP02
Perfluorohexanesulfonic acid (PFHxS)	5.0	No	RHP02
Perfluorohexanoic acid (PFHxA)	6.3	No	RHP02
Perfluorononanoic acid (PFNA)	1.6 J	No	RHP02
Perfluorooctanesulfonic acid (PFOS)	16.0 J	Yes	NMW32
Perfluorooctanoic acid (PFOA)	5.9	No	NMW32
Perfluoropentanesulfonic acid (PFPeS)	1.7 J	No	NMW32

Note: All concentrations are reported in nanograms per liter.

J estimated concentration
 ng/L nanogram per liter

4. Issues Encountered and Changes

Four of the proposed monitoring wells (RHMW11, RHMW13, RHMW14, and RHMW15) were not sampled due to the Westbay system installed in the wells. The Westbay system potentially has PFAS-containing components that cannot be removed/replaced without completely removing the entire well. The Westbay wells were installed with regulatory coordination in 2017-2019 as part of the response to the 2015 Administrative Order on Consent and selected mainly due to multiple screening levels at a single location rather than multiple wells. At the time, PFAS-containing components was not considered as an issue.

5. Quality Control Summary Report

No identified quality control issues were noted during the sampling period. All field blank and equipment blank results were non-detect for PFAS compounds.

6. Summary and Conclusion

Baseline sampling for PFAS of 21 groundwater monitoring wells was conducted in September 2023. Overall, ten PFAS were detected, but only PFOS was detected above DOH EALs. Analytical result

from four wells (RHP01, RHP02, RHP07, and NMW32) had concentrations of PFOS ranging from 9.0 nanograms per liter (ng/L) to 16.0 ng/L compared to the DOH EAL of 7.69 ng/L (Appendix A).

Due to the PFOS detections in the four wells exceeding the DOH screening levels (EALs), groundwater sampling equipment, well construction techniques, and materials were reviewed for potential PFAS cross-contamination.

- A list of groundwater sampling equipment reviewed is provided in Appendix B. Groundwater sampling equipment used in this baseline sampling event were confirmed to be PFAS-free.
- A review of well construction techniques noted four different contractors installed the 21 wells sampled. Drilling techniques do not appear to be a source of cross contamination.
- A review of PFOS ion profiles for the monitoring wells with PFOS detections was conducted. Based on this information and the presence of branched PFOS isomers in the cases where PFOS exceeds the DOH EAL, the PFOS detections are not related to the known AFFF product released in November 2022.

These sample results will be provided to Naval Facilities Engineering Systems Command (NAVFAC) Hawaii for inclusion in their CERCLA Remedial Investigation of PFAS at Red Hill.

7. References

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Michigan Department of Environmental Quality (MDEQ). 2018. *Groundwater PFAS Sampling Guidance*. October.



Location Map

Legend

- Existing Monitoring Well
- Decision Unit (DU)
- Red Hill Facility Boundary

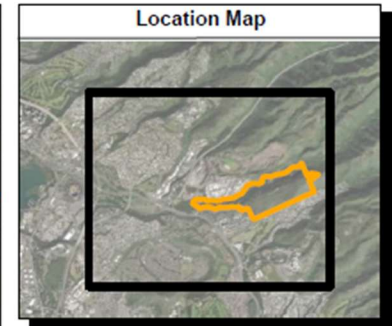
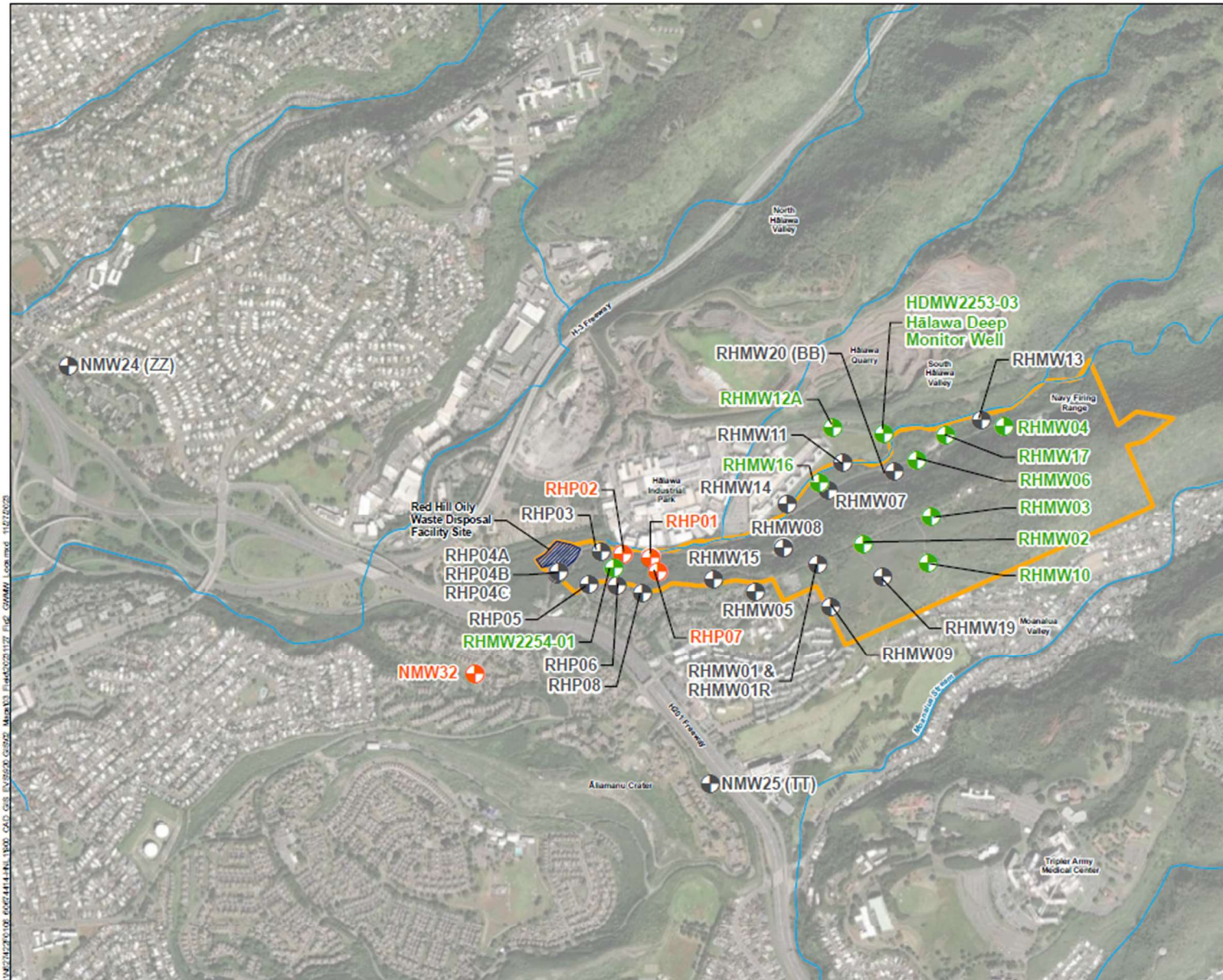
Notes

- Map projection: NAD 1983 Hawaii State Plane Z3 ft
- Base Map: Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Figure 1
 AFFF Decision Units
 Red Hill Bulk Fuel Storage Facility
 JBPBH, O'ahu, Hawai'i

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Legend

- Monthly PFAS GWM Wells
- ⊕ Non-Routine PFAS Groundwater Monitoring Wells (GWM) with Perfluorooctanesulfonic acid (PFOS) exceedance
- ⊕ Non-Routine PFAS GWM
- Red Hill Facility Boundary
- Red Hill Oily Waste Disposal Facility
- Stream

Notes

1. Map projection: NAD 1983 Hawaii State Plane Z3 ft
2. Base Map: Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
3. Coordinates: NAD 1983 Hawaii State Plane Z3 ft

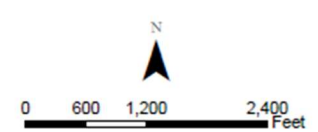


Figure 2
 Groundwater Monitoring Well Locations
 Red Hill Bulk Fuel Storage Facility
 JBPHH, O'ahu, Hawaii

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**Appendix A:
Comprehensive Validated Groundwater Analytical Results**

Table A-1: Comprehensive Groundwater Analytical Results

2023 May EPA Tapwater (TR 1E-06 THQ 0.1)	Hawaii DOH GW Environmental Action Levels 2023 (Table A)	Compound	Job Code:	FC10029	FC10029	FC10042	FC9604
			Client Sample ID:	AF-RHMW08-WGN01LF-2309	AF-RHMW19-WGN01LF-2309	AF-RHP04C-WGN01LF-2309	AF-RHP01-WGN01LF-2309
			Lab Sample ID:	FC10029-1	FC10029-2	FC10042-1	FC9604-1
			Matrix:	Ground Water	Ground Water	Ground Water	Ground Water
			Location:	N/A	N/A	N/A	N/A
			Sample Date:	9/26/2023 5:50 PM	9/26/2023 1:15 PM	9/28/2023 1:50 PM	9/12/2023 2:30 PM
			Units				
NA	NA	11CI-PF3OUdS (F-53B Minor)	ng/l	1.8 U	1.6 U	1.7 U	1.7 U
NA	NA	3:3 Fluorotelomer carboxylate	ng/l	4.6 U	4.2 U	4.4 U	4.3 U
NA	NA	4:2 Fluorotelomer sulfonate	ng/l	3.3 U	3.0 U	3.2 U	3.0 U
NA	NA	5:3 Fluorotelomer carboxylate	ng/l	8.9 U	8.2 U	8.6 U	8.2 U
NA	1,500	6:2 Fluorotelomer sulfonate	ng/l	3.5 U	3.2 U	3.4 U	3.3 U
NA	NA	7:3 Fluorotelomer carboxylate	ng/l	8.0 U	7.3 U	7.7 U	7.4 U
NA	NA	8:2 Fluorotelomer sulfonate	ng/l	4.2 U	3.8 U	4.0 U	3.9 U
NA	NA	9CI-PF3ONS (F-53B Major)	ng/l	1.4 U	1.3 U	1.4 U	1.3 U
NA	1,154	ADONA	ng/l	1.9 U	1.7 U	1.8 U	1.8 U
NA	NA	EtFOSA	ng/l	1.0 U	0.93 U	0.98 U	0.94 U
NA	NA	EtFOSAA	ng/l	1.4 U	1.2 U	1.3 U	1.3 U
NA	NA	EtFOSE	ng/l	7.6 U	6.9 U	7.3 U	7.0 U
6	11.5	HFPO-DA (GenX)	ng/l	1.0 U	0.93 U	0.98 U	0.94 U
NA	NA	MeFOSA	ng/l	1.0 U	0.93 U	0.98 U	0.94 U
NA	NA	MeFOSAA	ng/l	1.0 U	0.93 U	0.98 U	0.94 U
NA	NA	MeFOSE	ng/l	4.5 U	4.1 U	4.3 U	4.1 U
NA	NA	NFDHA	ng/l	1.2 U	1.1 U	1.2 U	1.1 U
NA	NA	PFEESA	ng/l	0.80 U	0.73 U	0.76 U	0.74 U
NA	NA	PFMBA	ng/l	1.2 U	1.1 U	1.1 U	1.1 U
NA	NA	PFMPA	ng/l	1.0 U	0.93 U	0.98 U	0.94 U
NA	46.2	PFOSA	ng/l	0.68 U	0.63 U	0.66 U	0.63 U
600	1,695	Perfluorobutanesulfonic acid	ng/l	0.51 U	0.47 U	0.49 U	1.7 J
1,800	14,615	Perfluorobutanoic acid	ng/l	8.4 J	1.8 U	1.9 U	13.7 J
NA	38.5	Perfluorodecanesulfonic acid	ng/l	0.65 U	0.60 U	0.63 U	0.60 U
NA	7.69	Perfluorodecanoic acid	ng/l	0.51 U	0.47 U	0.49 U	0.47 U
NA	NA	Perfluorododecanesulfonic acid	ng/l	1.2 U	1.1 U	1.1 U	1.1 U
NA	25.6	Perfluorododecanoic acid	ng/l	0.61 U	0.56 U	0.59 U	0.57 U
NA	38.5	Perfluoroheptanesulfonic acid	ng/l	0.51 U	0.47 U	0.49 U	0.47 U
NA	76.9	Perfluoroheptanoic acid	ng/l	2.3 J	0.47 U	0.49 U	3.9
39	76.9	Perfluorohexanesulfonic acid	ng/l	0.71 U	0.65 U	0.69 U	4.9
990	1,923	Perfluorohexanoic acid	ng/l	3.0 J	0.47 U	0.49 U	4.4
NA	NA	Perfluoronanesulfonic acid	ng/l	0.58 U	0.53 U	0.56 U	0.54 U
5.9	11.5	Perfluorononanoic acid	ng/l	0.62 U	0.57 U	0.60 U	1.1 J
4	7.69	Perfluorooctanesulfonic acid	ng/l	0.55 U	0.50 U	0.53 U	13.2
6	11.5	Perfluorooctanoic acid	ng/l	0.51 U	0.47 U	0.49 U	3.9
NA	NA	Perfluoropentanesulfonic acid	ng/l	1.1 U	1.0 U	1.1 U	1.1 U
NA	1,538	Perfluoropentanoic acid	ng/l	10.4	0.88 U	0.92 U	9.5
NA	256	Perfluorotetradecanoic acid	ng/l	0.51 U	0.47 U	0.49 U	0.47 U
NA	25.6	Perfluorotridecanoic acid	ng/l	0.86 U	0.79 U	0.82 U	0.79 U
NA	19.2	Perfluoroundecanoic acid	ng/l	0.61 U	0.56 U	0.59 U	0.57 U

Notes:

Results highlighted in purple exceed the Hawaii DOH GW Environmental Action Level

Table A-1: Comprehensive Groundwater Analytical Results (cont.)

2023 May EPA Tapwater (TR 1E-06 THQ 0.1)	Hawaii DOH GW Environmental Action Levels 2023 (Table A)	Compound	Job Code:	FC9604	FC9640	FC9640	FC9666
			Client Sample ID:	AF-RHMW01R-WGN01LF-2309	AF-RHP02-WGN01LF-2309	AF-RHP02-WGFD01LF-2309	AF-RHP03-WGN01LF-2309
			Lab Sample ID:	FC9604-4	FC9640-1	FC9640-2	FC9666-1
			Matrix:	Ground Water	Ground Water	Ground Water Field Duplicate	Ground Water
			Location:	N/A	N/A	N/A	N/A
			Sample Date:	9/12/2023 2:15 PM	9/13/2023 12:05 PM	9/13/2023 12:05 PM	9/14/2023 1:30 PM
			Units				
NA	NA	11CI-PF3OUdS (F-53B Minor)	ng/l	1.6 U	1.5 U	1.6 U	1.7 U
NA	NA	3:3 Fluorotelomer carboxylate	ng/l	4.2 U	4.0 U	4.1 U	4.3 U
NA	NA	4:2 Fluorotelomer sulfonate	ng/l	3.0 U	2.8 U	2.9 U	3.1 U
NA	NA	5:3 Fluorotelomer carboxylate	ng/l	8.1 U	7.7 U	7.9 U	8.4 U
NA	1,500	6:2 Fluorotelomer sulfonate	ng/l	3.2 U	3.0 U	3.2 U	3.3 U
NA	NA	7:3 Fluorotelomer carboxylate	ng/l	7.3 U	6.9 U	7.1 U	7.5 U
NA	NA	8:2 Fluorotelomer sulfonate	ng/l	3.8 U	3.6 U	3.7 U	4.0 U
NA	NA	9CI-PF3ONS (F-53B Major)	ng/l	1.3 U	1.2 U	1.3 U	1.3 U
NA	1,154	ADONA	ng/l	1.7 U	1.6 U	1.7 U	1.8 U
NA	NA	EtFOSA	ng/l	0.93 U	0.88 U	0.91 U	0.96 U
NA	NA	EtFOSAA	ng/l	1.2 U	1.2 U	1.2 U	1.3 U
NA	NA	EtFOSE	ng/l	6.9 U	6.5 U	6.7 U	7.1 U
6	11.5	HFPO-DA (GenX)	ng/l	0.93 U	0.88 U	0.91 U	0.96 U
NA	NA	MeFOSA	ng/l	0.93 U	0.88 U	0.91 U	0.96 U
NA	NA	MeFOSAA	ng/l	0.93 U	0.88 U	0.91 U	0.96 U
NA	NA	MeFOSE	ng/l	4.1 U	3.8 U	4.0 U	4.2 U
NA	NA	NFDHA	ng/l	1.1 U	1.1 U	1.1 U	1.2 U
NA	NA	PFEESA	ng/l	0.72 U	0.68 U	0.71 U	0.75 U
NA	NA	PFMBA	ng/l	1.1 U	1.0 U	1.0 U	1.1 U
NA	NA	PFMPA	ng/l	0.93 U	0.88 U	0.91 U	0.96 U
NA	46.2	PFOSA	ng/l	0.62 U	0.59 U	0.61 U	0.64 U
600	1,695	Perfluorobutanesulfonic acid	ng/l	0.46 U	4.3	3.6	1.9 J
1,800	14,615	Perfluorobutanoic acid	ng/l	1.8 U	14.2	12.9 J	6.0 J
NA	38.5	Perfluorodecanesulfonic acid	ng/l	0.59 U	0.56 U	0.58 U	0.62 U
NA	7.69	Perfluorodecanoic acid	ng/l	0.46 U	0.44 U	0.45 U	0.48 U
NA	NA	Perfluorododecanesulfonic acid	ng/l	1.1 U	1.0 U	1.0 U	1.1 U
NA	25.6	Perfluorododecanoic acid	ng/l	0.56 U	0.53 U	0.55 U	0.58 U
NA	38.5	Perfluoroheptanesulfonic acid	ng/l	0.46 U	0.46 J	0.45 U	0.48 U
NA	76.9	Perfluoroheptanoic acid	ng/l	0.46 U	5.0	5.2	2.8 J
39	76.9	Perfluorohexanesulfonic acid	ng/l	0.65 U	5.0	4.5	4.0
990	1,923	Perfluorohexanoic acid	ng/l	0.46 U	6.3	5.8	3.1 J
NA	NA	Perfluoronanesulfonic acid	ng/l	0.53 U	0.50 U	0.52 U	0.55 U
5.9	11.5	Perfluorononanoic acid	ng/l	0.56 U	1.6 J	1.3 J	0.59 U
4	7.69	Perfluorooctanesulfonic acid	ng/l	0.50 U	16.0 J	11.4 J	5.1
6	11.5	Perfluorooctanoic acid	ng/l	0.46 U	5.8	5.2	2.6 J
NA	NA	Perfluoropentanesulfonic acid	ng/l	1.0 U	0.98 U	1.0 U	1.1 U
NA	1,538	Perfluoropentanoic acid	ng/l	2.4 J	12.3	11.2	5.7 J
NA	256	Perfluorotetradecanoic acid	ng/l	0.46 U	0.44 U	0.45 U	0.48 U
NA	25.6	Perfluorotridecanoic acid	ng/l	0.78 U	0.74 U	0.76 U	0.81 U
NA	19.2	Perfluoroundecanoic acid	ng/l	0.56 U	0.53 U	0.55 U	0.58 U

Notes:

Results highlighted in purple exceed the Hawaii DOH GW Environmental Action Level

Table A-1: Comprehensive Groundwater Analytical Results (cont.)

2023 May EPA Tapwater (TR 1E-06 THQ 0.1)	Hawaii DOH GW Environmental Action Levels 2023 (Table A)	Compound	Job Code:	FC9666	FC9666	FC9674	FC9720
			Client Sample ID:	AF-RHP07-WGN01LF-2309	AF-RHMMW05-WGN01LF-2309	AF-RHP04A-WGN01LF-2309	AF-RHP05-WGN01LF-2309
			Lab Sample ID:	FC9666-2	FC9666-3	FC9674-1	FC9720-1
			Matrix:	Ground Water	Ground Water	Ground Water	Ground Water
			Location:	N/A	N/A	N/A	N/A
			Sample Date:	9/14/2023 1:10 PM	9/14/2023 3:45 PM	9/15/2023 12:50 PM	9/18/2023 1:35 PM
			Units				
NA	NA	11CI-PF3OUdS (F-53B Minor)	ng/l	1.7 U	1.7 U	1.7 U	1.7 U
NA	NA	3:3 Fluorotelomer carboxylate	ng/l	4.3 U	4.3 U	4.4 U	4.3 U
NA	NA	4:2 Fluorotelomer sulfonate	ng/l	3.0 U	3.1 U	3.2 U	3.0 U
NA	NA	5:3 Fluorotelomer carboxylate	ng/l	8.2 U	8.4 U	8.6 U	8.2 U
NA	1,500	6:2 Fluorotelomer sulfonate	ng/l	3.3 U	3.3 U	3.4 U	3.3 U
NA	NA	7:3 Fluorotelomer carboxylate	ng/l	7.4 U	7.5 U	7.7 U	7.4 U
NA	NA	8:2 Fluorotelomer sulfonate	ng/l	3.9 U	4.0 U	4.0 U	3.9 U
NA	NA	9CI-PF3ONS (F-53B Major)	ng/l	1.3 U	1.3 U	1.4 U	1.3 U
NA	1,154	ADONA	ng/l	1.8 U	1.8 U	1.8 U	1.8 U
NA	NA	EtFOSA	ng/l	0.94 U	0.96 U	0.98 U	0.94 U
NA	NA	EtFOSAA	ng/l	1.3 U	1.3 U	1.3 U	1.3 U
NA	NA	EtFOSE	ng/l	7.0 U	7.1 U	7.3 U	7.0 U
6	11.5	HFPO-DA (GenX)	ng/l	0.94 U	0.96 U	0.98 U	0.94 U
NA	NA	MeFOSA	ng/l	0.94 U	0.96 U	0.98 U	0.94 U
NA	NA	MeFOSAA	ng/l	0.94 U	0.96 U	0.98 U	0.94 U
NA	NA	MeFOSE	ng/l	4.1 U	4.2 U	4.3 U	4.1 U
NA	NA	NFDHA	ng/l	1.1 U	1.2 U	1.2 U	1.1 U
NA	NA	PFEESA	ng/l	0.74 U	0.75 U	0.76 U	0.74 U
NA	NA	PFMBA	ng/l	1.1 U	1.1 U	1.1 U	1.1 U
NA	NA	PFMPA	ng/l	0.94 U	0.96 U	0.98 U	0.94 U
NA	46.2	PFOSA	ng/l	0.63 U	0.64 U	0.66 U	0.63 U
600	1,695	Perfluorobutanesulfonic acid	ng/l	1.1 J	0.48 U	0.49 U	1.1 J
1,800	14,615	Perfluorobutanoic acid	ng/l	5.8 J	1.8 U	1.9 U	1.8 U
NA	38.5	Perfluorodecanesulfonic acid	ng/l	0.60 U	0.62 U	0.63 U	0.60 U
NA	7.69	Perfluorodecanoic acid	ng/l	0.47 U	0.48 U	0.49 U	0.47 U
NA	NA	Perfluorododecanesulfonic acid	ng/l	1.1 U	1.1 U	1.1 U	1.1 U
NA	25.6	Perfluorododecanoic acid	ng/l	0.57 U	0.58 U	0.59 U	0.57 U
NA	38.5	Perfluoroheptanesulfonic acid	ng/l	0.47 U	0.48 U	0.49 U	0.47 U
NA	76.9	Perfluoroheptanoic acid	ng/l	1.5 J	0.48 U	0.49 U	1.2 J
39	76.9	Perfluorohexanesulfonic acid	ng/l	3.6 J	0.67 U	4.6	5.2
990	1,923	Perfluorohexanoic acid	ng/l	1.6 J	0.48 U	0.49 U	1.2 J
NA	NA	Perfluorononanesulfonic acid	ng/l	0.54 U	0.55 U	0.56 U	0.54 U
5.9	11.5	Perfluorononanoic acid	ng/l	0.58 U	0.59 U	0.60 U	0.58 U
4	7.69	Perfluorooctanesulfonic acid	ng/l	9.0	0.52 U	0.53 U	3.6 J
6	11.5	Perfluorooctanoic acid	ng/l	1.8 J	0.48 U	0.49 U	2.3 J
NA	NA	Perfluoropentanesulfonic acid	ng/l	1.1 U	1.1 U	1.1 U	1.1 U
NA	1,538	Perfluoropentanoic acid	ng/l	3.3 J	0.90 U	0.92 U	0.89 U
NA	256	Perfluorotetradecanoic acid	ng/l	0.47 U	0.48 U	0.49 U	0.47 U
NA	25.6	Perfluorotridecanoic acid	ng/l	0.79 U	0.81 U	0.82 U	0.79 U
NA	19.2	Perfluoroundecanoic acid	ng/l	0.57 U	0.58 U	0.59 U	0.57 U

Notes:

Results highlighted in purple exceed the Hawaii DOH GW Environmental Action Level

Table A-1: Comprehensive Groundwater Analytical Results (cont.)

2023 May EPA Tapwater (TR 1E-06 THQ 0.1)	Hawaii DOH GW Environmental Action Levels 2023 (Table A)	Compound	Job Code:	FC9720	FC9796	FC9796	FC9816
			Client Sample ID:	AF-NMW32-WGN01LF-2309	AF-RHMW09-WGN01LF-2309	AF-RHMW20-WGN01LF-2309	AF-RHP08-WGN01LF-2309
			Lab Sample ID:	FC9720-2	FC9796-1	FC9796-2	FC9816-1
			Matrix:	Ground Water	Ground Water	Ground Water	Ground Water
			Location:	N/A	N/A	N/A	N/A
			Sample Date:	9/18/2023 2:55 PM	9/19/2023 1:55 PM	9/19/2023 2:45 PM	9/20/2023 2:35 PM
			Units				
NA	NA	11CI-PF3OUdS (F-53B Minor)	ng/l	1.7 U	1.6 U	1.6 U	1.6 U
NA	NA	3:3 Fluorotelomer carboxylate	ng/l	4.3 U	4.1 U	4.2 U	4.1 U
NA	NA	4:2 Fluorotelomer sulfonate	ng/l	3.1 U	2.9 U	3.0 U	2.9 U
NA	NA	5:3 Fluorotelomer carboxylate	ng/l	8.4 U	7.9 U	8.2 U	7.9 U
NA	1,500	6:2 Fluorotelomer sulfonate	ng/l	3.3 U	3.2 U	3.2 U	3.7 J
NA	NA	7:3 Fluorotelomer carboxylate	ng/l	7.5 U	7.1 U	7.3 U	7.1 U
NA	NA	8:2 Fluorotelomer sulfonate	ng/l	4.0 U	3.7 U	3.8 U	3.7 U
NA	NA	9CI-PF3ONS (F-53B Major)	ng/l	1.3 U	1.3 U	1.3 U	1.2 U
NA	1,154	ADONA	ng/l	1.8 U	1.7 U	1.7 U	1.7 U
NA	NA	EtFOSA	ng/l	0.96 U	0.91 U	0.93 U	0.90 U
NA	NA	EtFOSAA	ng/l	1.3 U	1.2 U	1.2 U	1.2 U
NA	NA	EtFOSE	ng/l	7.1 U	6.7 U	6.9 U	6.7 U
6	11.5	HFPO-DA (GenX)	ng/l	0.96 U	0.91 U	0.93 U	0.90 U
NA	NA	MeFOSA	ng/l	0.96 U	0.91 U	0.93 U	0.90 U
NA	NA	MeFOSAA	ng/l	0.96 U	0.91 U	0.93 U	0.90 U
NA	NA	MeFOSE	ng/l	4.2 U	4.0 U	4.1 U	3.9 U
NA	NA	NFDHA	ng/l	1.2 U	1.1 U	1.1 U	1.1 U
NA	NA	PFEESA	ng/l	0.75 U	0.71 U	0.73 U	0.70 U
NA	NA	PFMBA	ng/l	1.1 U	1.0 U	1.1 U	1.0 U
NA	NA	PFMPA	ng/l	0.96 U	0.91 U	0.93 U	0.90 U
NA	46.2	PFOSA	ng/l	0.64 U	0.61 U	0.63 U	0.60 U
600	1,695	Perfluorobutanesulfonic acid	ng/l	3.9	0.45 U	0.47 U	1.5 J
1,800	14,615	Perfluorobutanoic acid	ng/l	4.2 J	1.7 U	1.8 U	1.7 U
NA	38.5	Perfluorodecanesulfonic acid	ng/l	0.62 U	0.58 U	0.60 U	0.58 U
NA	7.69	Perfluorodecanoic acid	ng/l	0.48 U	0.45 U	0.47 U	0.45 U
NA	NA	Perfluorododecanesulfonic acid	ng/l	1.1 U	1.0 U	1.1 U	1.0 U
NA	25.6	Perfluorododecanoic acid	ng/l	0.58 U	0.55 U	0.56 U	0.54 U
NA	38.5	Perfluoroheptanesulfonic acid	ng/l	0.48 U	0.45 U	0.47 U	4.8
NA	76.9	Perfluoroheptanoic acid	ng/l	3.3 J	0.45 U	0.47 U	1.1 J
39	76.9	Perfluorohexanesulfonic acid	ng/l	9.7	0.64 U	0.65 U	2.9 J
990	1,923	Perfluorohexanoic acid	ng/l	4.5	0.45 U	0.55 J	1.5 J
NA	NA	Perfluorononanesulfonic acid	ng/l	0.55 U	0.52 U	0.53 U	0.51 U
5.9	11.5	Perfluorononanoic acid	ng/l	0.59 U	0.55 U	0.57 U	0.55 U
4	7.69	Perfluorooctanesulfonic acid	ng/l	14.7	0.49 U	0.69 J	3.9
6	11.5	Perfluorooctanoic acid	ng/l	5.9	0.45 U	0.47 U	2.4 J
NA	NA	Perfluoropentanesulfonic acid	ng/l	1.7 J	1.0 U	1.0 U	1.5 J
NA	1,538	Perfluoropentanoic acid	ng/l	5.2 J	0.85 U	1.0 J	1.9 J
NA	256	Perfluorotetradecanoic acid	ng/l	0.48 U	0.45 U	0.47 U	0.45 U
NA	25.6	Perfluorotridecanoic acid	ng/l	0.81 U	0.76 U	0.79 U	0.76 U
NA	19.2	Perfluoroundecanoic acid	ng/l	0.58 U	0.55 U	0.56 U	0.54 U

Notes:

Results highlighted in purple exceed the Hawaii DOH GW Environmental Action Level

Table A-1: Comprehensive Groundwater Analytical Results (cont.)

2023 May EPA Tapwater (TR 1E-06 THQ 0.1)	Hawaii DOH GW Environmental Action Levels 2023 (Table A)	Compound	Job Code:	FC9816	FC9816	FC9898	FC9898
			Client Sample ID:	AF-RHP06-WGN01LF-2309	AF-RHP06-WGFD01LF-2309	AF-RHMW07-WGN01LF-2309	AF-NMW25-WGN01LF-2309
			Lab Sample ID:	FC9816-2	FC9816-3	FC9898-1	FC9898-2
			Matrix:	Ground Water	Ground Water Field Duplicate	Ground Water	Ground Water
			Location:	N/A	N/A	N/A	N/A
			Sample Date:	9/20/2023 10:35 AM	9/20/2023 10:35 AM	9/21/2023 2:00 PM	9/21/2023 4:20 PM
			Units				
NA	NA	11CI-PF3OUdS (F-53B Minor)	ng/l	1.6 U	1.6 U	1.6 U	1.6 U
NA	NA	3:3 Fluorotelomer carboxylate	ng/l	4.1 U	4.1 U	4.0 U	4.2 U
NA	NA	4:2 Fluorotelomer sulfonate	ng/l	2.9 U	3.0 U	2.9 U	3.0 U
NA	NA	5:3 Fluorotelomer carboxylate	ng/l	7.9 U	8.0 U	7.8 U	8.1 U
NA	1,500	6:2 Fluorotelomer sulfonate	ng/l	3.1 U	3.2 U	3.1 U	3.2 U
NA	NA	7:3 Fluorotelomer carboxylate	ng/l	7.1 U	7.2 U	7.0 U	7.3 U
NA	NA	8:2 Fluorotelomer sulfonate	ng/l	3.7 U	3.8 U	3.7 U	3.8 U
NA	NA	9CI-PF3ONS (F-53B Major)	ng/l	1.2 U	1.3 U	1.2 U	1.3 U
NA	1,154	ADONA	ng/l	1.7 U	1.7 U	1.7 U	1.7 U
NA	NA	EtFOSA	ng/l	0.90 U	0.92 U	0.89 U	0.93 U
NA	NA	EtFOSAA	ng/l	1.2 U	1.2 U	1.2 U	1.2 U
NA	NA	EtFOSE	ng/l	6.7 U	6.8 U	6.6 U	6.9 U
6	11.5	HFPO-DA (GenX)	ng/l	0.90 U	0.92 U	0.89 U	0.93 U
NA	NA	MeFOSA	ng/l	0.90 U	0.92 U	0.89 U	0.93 U
NA	NA	MeFOSAA	ng/l	0.90 U	0.92 U	0.89 U	0.93 U
NA	NA	MeFOSE	ng/l	3.9 U	4.0 U	3.9 U	4.1 U
NA	NA	NFDHA	ng/l	1.1 U	1.1 U	1.1 U	1.1 U
NA	NA	PFEESA	ng/l	0.70 U	0.72 U	0.70 U	0.72 U
NA	NA	PFMBA	ng/l	1.0 U	1.0 U	1.0 U	1.1 U
NA	NA	PFMPA	ng/l	0.90 U	0.92 U	0.89 U	0.93 U
NA	46.2	PFOSA	ng/l	0.60 U	0.61 U	0.60 U	0.62 U
600	1,695	Perfluorobutanesulfonic acid	ng/l	1.3 J	1.5 J	0.45 U	2.1 J
1,800	14,615	Perfluorobutanoic acid	ng/l	2.2 J	2.3 J	1.7 U	1.8 U
NA	38.5	Perfluorodecanesulfonic acid	ng/l	0.58 U	0.59 U	0.57 U	0.59 U
NA	7.69	Perfluorodecanoic acid	ng/l	0.45 U	0.46 U	0.45 U	0.46 U
NA	NA	Perfluorododecanesulfonic acid	ng/l	1.0 U	1.0 U	1.0 U	1.1 U
NA	25.6	Perfluorododecanoic acid	ng/l	0.54 U	0.55 U	0.54 U	0.56 U
NA	38.5	Perfluoroheptanesulfonic acid	ng/l	0.45 U	0.46 U	0.45 U	0.46 U
NA	76.9	Perfluoroheptanoic acid	ng/l	1.7 J	1.9 J	0.46 J	1.4 J
39	76.9	Perfluorohexanesulfonic acid	ng/l	4.5	4.5	0.62 U	4.2
990	1,923	Perfluorohexanoic acid	ng/l	2.2 J	2.4 J	0.45 U	1.6 J
NA	NA	Perfluorononanesulfonic acid	ng/l	0.51 U	0.52 U	0.51 U	0.53 U
5.9	11.5	Perfluorononanoic acid	ng/l	0.55 U	0.56 U	0.54 U	0.56 U
4	7.69	Perfluorooctanesulfonic acid	ng/l	4.1	3.3 J	0.48 U	1.6 J
6	11.5	Perfluorooctanoic acid	ng/l	2.4 J	2.6 J	0.85 J	2.9 J
NA	NA	Perfluoropentanesulfonic acid	ng/l	1.0 U	1.0 U	1.0 U	1.0 U
NA	1,538	Perfluoropentanoic acid	ng/l	2.8 J	3.0 J	0.84 U	2.4 J
NA	256	Perfluorotetradecanoic acid	ng/l	0.45 U	0.46 U	0.45 U	0.46 U
NA	25.6	Perfluorotridecanoic acid	ng/l	0.76 U	0.77 U	0.75 U	0.78 U
NA	19.2	Perfluoroundecanoic acid	ng/l	0.54 U	0.55 U	0.54 U	0.56 U

Table A-1: Comprehensive Groundwater Analytical Results (cont.)

2023 May EPA Tapwater (TR 1E-06 THQ 0.1)	Hawaii DOH GW Environmental Action Levels 2023 (Table A)	Compound	Job Code:	FC9898	FC9898	FC9898
			Client Sample ID:	AF-RHP04B-WGN01LF-2309	AF-NMW24-WGN01LF-2309	AF-RHMMW01-WGN01B-2309
			Lab Sample ID:	FC9898-3	FC9898-5	FC9898-6
			Matrix:	Ground Water	Ground Water	Ground Water
			Location:	N/A	N/A	N/A
			Sample Date:	9/25/2023 3:00 PM	9/22/2023 11:05 AM	9/22/2023 11:15 AM
			Units			
NA	NA	11CI-PF3OUdS (F-53B Minor)	ng/l	1.6 U	1.6 U	1.6 U
NA	NA	3:3 Fluorotelomer carboxylate	ng/l	4.0 U	4.1 U	4.2 U
NA	NA	4:2 Fluorotelomer sulfonate	ng/l	27 U	2.9 U	3.0 U
NA	NA	5:3 Fluorotelomer carboxylate	ng/l	7.8 U	7.9 U	8.1 U
NA	1,500	6:2 Fluorotelomer sulfonate	ng/l	3.1 U	3.2 U	128
NA	NA	7:3 Fluorotelomer carboxylate	ng/l	7.0 U	7.1 U	7.3 U
NA	NA	8:2 Fluorotelomer sulfonate	ng/l	3.7 U	3.7 U	3.8 U
NA	NA	9CI-PF3ONS (F-53B Major)	ng/l	1.2 U	1.3 U	1.3 U
NA	1,154	ADONA	ng/l	1.7 U	1.7 U	1.7 U
NA	NA	EtFOSA	ng/l	0.89 U	0.91 U	0.93 U
NA	NA	EtFOSAA	ng/l	1.2 U	1.2 U	1.2 U
NA	NA	EtFOSE	ng/l	6.6 U	6.7 U	6.9 U
6	11.5	HFPO-DA (GenX)	ng/l	0.89 U	0.91 U	0.93 U
NA	NA	MeFOSA	ng/l	0.89 U	0.91 U	0.93 U
NA	NA	MeFOSAA	ng/l	0.89 U	0.91 U	0.93 U
NA	NA	MeFOSE	ng/l	3.9 U	4.0 U	4.1 U
NA	NA	NFDHA	ng/l	1.1 U	1.1 U	1.1 U
NA	NA	PFEESA	ng/l	0.70 U	0.71 U	0.72 U
NA	NA	PFMBA	ng/l	1.0 U	1.0 U	1.1 U
NA	NA	PFMPA	ng/l	0.89 U	0.91 U	0.93 U
NA	46.2	PFOSA	ng/l	0.60 U	0.61 U	0.62 U
600	1,695	Perfluorobutanesulfonic acid	ng/l	0.45 U	0.45 U	0.46 U
1,800	14,615	Perfluorobutanoic acid	ng/l	1.7 U	1.7 U	1.8 U
NA	38.5	Perfluorodecanesulfonic acid	ng/l	0.57 U	0.58 U	0.59 U
NA	7.69	Perfluorodecanoic acid	ng/l	0.45 U	0.45 U	0.46 U
NA	NA	Perfluorododecanesulfonic acid	ng/l	1.0 U	1.0 U	1.1 U
NA	25.6	Perfluorododecanoic acid	ng/l	0.54 U	0.55 U	0.56 U
NA	38.5	Perfluoroheptanesulfonic acid	ng/l	0.45 U	0.45 U	0.46 U
NA	76.9	Perfluoroheptanoic acid	ng/l	0.45 U	0.54 J	0.93 J
39	76.9	Perfluorohexanesulfonic acid	ng/l	0.62 U	0.64 U	0.65 U
990	1,923	Perfluorohexanoic acid	ng/l	0.45 U	0.68 J	2.5 J
NA	NA	Perfluorononanesulfonic acid	ng/l	0.51 U	0.52 U	0.53 U
5.9	11.5	Perfluorononanoic acid	ng/l	0.54 U	0.55 U	0.56 U
4	7.69	Perfluorooctanesulfonic acid	ng/l	0.48 U	3.4 J	0.50 U
6	11.5	Perfluorooctanoic acid	ng/l	0.45 U	1.6 J	0.46 U
NA	NA	Perfluoropentanesulfonic acid	ng/l	1.0 U	1.0 U	1.0 U
NA	1,538	Perfluoropentanoic acid	ng/l	1.6 J	0.95 J	3.4 J
NA	256	Perfluorotetradecanoic acid	ng/l	0.45 U	0.45 U	0.46 U
NA	25.6	Perfluorotridecanoic acid	ng/l	0.75 U	0.76 U	0.78 U
NA	19.2	Perfluoroundecanoic acid	ng/l	0.54 U	0.55 U	0.56 U

**Table A-2: Comprehensive Groundwater Analytical Results
Field and Equipment Blanks**

2023 May EPA Tapwater (TR 1E-06 THQ 0.1)	Hawaii DOH GW Environmental Action Levels 2023 (Table A)	Compound	Job Code:	FC10029	FC9604	FC9604	FC9604
			Client Sample ID:	AF-RHMW19-FB01-2309	AF-RHP01-EB01LF-2309	AF-RHP01-EB02LF-2309	AF-RHMW01R-EB01LF-2309
			Lab Sample ID:	FC10029-3	FC9604-2	FC9604-3	FC9604-5
			Matrix:	Field Blank Water	Equipment Blank	Equipment Blank	Equipment Blank
			Location:	N/A	N/A	N/A	N/A
			Sample Date:	9/26/2023 9:45 AM	9/12/2023 10:15 AM	9/12/2023 10:30 AM	9/12/2023 11:45 AM
			Units				
NA	NA	11CI-PF3OUdS (F-53B Minor)	ng/l	1.7 U	1.7 U	1.8 U	1.7 U
NA	NA	3:3 Fluorotelomer carboxylate	ng/l	4.3 U	4.3 U	4.6 U	4.3 U
NA	NA	4:2 Fluorotelomer sulfonate	ng/l	3.1 U	3.1 U	3.3 U	3.1 U
NA	NA	5:3 Fluorotelomer carboxylate	ng/l	8.4 U	8.4 U	8.9 U	8.4 U
NA	1,500	6:2 Fluorotelomer sulfonate	ng/l	3.3 U	3.3 U	3.5 U	3.3 U
NA	NA	7:3 Fluorotelomer carboxylate	ng/l	7.5 U	7.5 U	8.0 U	7.5 U
NA	NA	8:2 Fluorotelomer sulfonate	ng/l	4.0 U	4.0 U	4.2 U	4.0 U
NA	NA	9CI-PF3ONS (F-53B Major)	ng/l	1.3 U	1.3 U	1.4 U	1.3 U
NA	1,154	ADONA	ng/l	1.8 U	1.8 U	1.9 U	1.8 U
NA	NA	EtFOSA	ng/l	0.96 U	0.96 U	1.0 U	0.96 U
NA	NA	EtFOSAA	ng/l	1.3 U	1.3 U	1.4 U	1.3 U
NA	NA	EtFOSE	ng/l	7.1 U	7.1 U	7.6 U	7.1 U
6	11.5	HFPO-DA (GenX)	ng/l	0.96 U	0.96 U	1.0 U	0.96 U
NA	NA	MeFOSA	ng/l	0.96 U	0.96 U	1.0 U	0.96 U
NA	NA	MeFOSAA	ng/l	0.96 U	0.96 U	1.0 U	0.96 U
NA	NA	MeFOSE	ng/l	4.2 U	4.2 U	4.5 U	4.2 U
NA	NA	NFDHA	ng/l	1.2 U	1.2 U	1.2 U	1.2 U
NA	NA	PFEESA	ng/l	0.75 U	0.75 U	0.80 U	0.75 U
NA	NA	PFMBA	ng/l	1.1 U	1.1 U	1.2 U	1.1 U
NA	NA	PFMPA	ng/l	0.96 U	0.96 U	1.0 U	0.96 U
NA	46.2	PFOSA	ng/l	0.64 U	0.64 U	0.68 U	0.64 U
600	1,695	Perfluorobutanesulfonic acid	ng/l	0.48 U	0.48 U	0.51 U	0.48 U
1,800	14,615	Perfluorobutanoic acid	ng/l	1.8 U	1.8 U	1.9 U	1.8 U
NA	38.5	Perfluorodecanesulfonic acid	ng/l	0.62 U	0.62 U	0.65 U	0.62 U
NA	7.69	Perfluorodecanoic acid	ng/l	0.48 U	0.48 U	0.51 U	0.48 U
NA	NA	Perfluorododecanesulfonic acid	ng/l	1.1 U	1.1 U	1.2 U	1.1 U
NA	25.6	Perfluorododecanoic acid	ng/l	0.58 U	0.58 U	0.61 U	0.58 U
NA	38.5	Perfluoroheptanesulfonic acid	ng/l	0.48 U	0.48 U	0.51 U	0.48 U
NA	76.9	Perfluoroheptanoic acid	ng/l	0.48 U	0.48 U	0.51 U	0.48 U
39	76.9	Perfluorohexanesulfonic acid	ng/l	0.67 U	0.67 U	0.71 U	0.67 U
990	1,923	Perfluorohexanoic acid	ng/l	0.53 U	0.48 U	0.51 U	0.48 U
NA	NA	Perfluorononanesulfonic acid	ng/l	0.55 U	0.55 U	0.58 U	0.55 U
5.9	11.5	Perfluorononanoic acid	ng/l	0.59 U	0.59 U	0.62 U	0.59 U
4	7.69	Perfluorooctanesulfonic acid	ng/l	0.52 U	0.52 U	0.55 U	0.52 U
6	11.5	Perfluorooctanoic acid	ng/l	0.48 U	0.48 U	0.51 U	0.48 U
NA	NA	Perfluoropentanesulfonic acid	ng/l	1.1 U	1.1 U	1.1 U	1.1 U
NA	1,538	Perfluoropentanoic acid	ng/l	0.90 U	0.90 U	0.96 U	0.90 U
NA	256	Perfluorotetradecanoic acid	ng/l	0.48 U	0.48 U	0.51 U	0.48 U
NA	25.6	Perfluorotridecanoic acid	ng/l	0.81 U	0.81 U	0.86 U	0.81 U
NA	19.2	Perfluoroundecanoic acid	ng/l	0.58 U	0.58 U	0.61 U	0.58 U

**Table A-2: Comprehensive Groundwater Analytical Results
Field and Equipment Blanks (cont.)**

2023 May EPA Tapwater (TR 1E-06 THQ 0.1)	Hawaii DOH GW Environmental Action Levels 2023 (Table A)	Compound	Job Code:	FC9604	FC9604	FC9898
			Client Sample ID:	AF-RHMW01R-EB02LF-2309	AF-RHMW01R-EB03LF-2309	AF-RHP04B-EB01-2309-QED PUMP
			Lab Sample ID:	FC9604-6	FC9604-7	FC9898-4
			Matrix:	Equipment Blank	Equipment Blank	Equipment Blank
			Location:	N/A	N/A	N/A
			Sample Date:	9/12/2023 11:50 AM	9/12/2023 4:20 PM	9/25/2023 3:20 PM
			Units			
NA	NA	11CI-PF3OUdS (F-53B Minor)	ng/l	1.7 U	1.7 U	1.6 U
NA	NA	3:3 Fluorotelomer carboxylate	ng/l	4.3 U	4.3 U	4.1 U
NA	NA	4:2 Fluorotelomer sulfonate	ng/l	3.1 U	3.0 U	2.9 U
NA	NA	5:3 Fluorotelomer carboxylate	ng/l	8.4 U	8.2 U	7.9 U
NA	1,500	6:2 Fluorotelomer sulfonate	ng/l	3.3 U	3.3 U	3.2 U
NA	NA	7:3 Fluorotelomer carboxylate	ng/l	7.5 U	7.4 U	7.1 U
NA	NA	8:2 Fluorotelomer sulfonate	ng/l	4.0 U	3.9 U	3.7 U
NA	NA	9CI-PF3ONS (F-53B Major)	ng/l	1.3 U	1.3 U	1.3 U
NA	1,154	ADONA	ng/l	1.8 U	1.8 U	1.7 U
NA	NA	EtFOSA	ng/l	0.96 U	0.94 U	0.91 U
NA	NA	EtFOSAA	ng/l	1.3 U	1.3 U	1.2 U
NA	NA	EtFOSE	ng/l	7.1 U	7.0 U	6.7 U
6	11.5	HFPO-DA (GenX)	ng/l	0.96 U	0.94 U	0.91 U
NA	NA	MeFOSA	ng/l	0.96 U	0.94 U	0.91 U
NA	NA	MeFOSAA	ng/l	0.96 U	0.94 U	0.91 U
NA	NA	MeFOSE	ng/l	4.2 U	4.1 U	4.0 U
NA	NA	NFDHA	ng/l	1.2 U	1.1 U	1.1 U
NA	NA	PFEESA	ng/l	0.75 U	0.74 U	0.71 U
NA	NA	PFMBA	ng/l	1.1 U	1.1 U	1.0 U
NA	NA	PFMPA	ng/l	0.96 U	0.94 U	0.91 U
NA	46.2	PFOSA	ng/l	0.64 U	0.63 U	0.61 U
600	1,695	Perfluorobutanesulfonic acid	ng/l	0.48 U	0.47 U	0.45 U
1,800	14,615	Perfluorobutanoic acid	ng/l	1.8 U	1.8 U	1.7 U
NA	38.5	Perfluorodecanesulfonic acid	ng/l	0.62 U	0.60 U	0.58 U
NA	7.69	Perfluorodecanoic acid	ng/l	0.48 U	0.47 U	0.45 U
NA	NA	Perfluorododecanesulfonic acid	ng/l	1.1 U	1.1 U	1.0 U
NA	25.6	Perfluorododecanoic acid	ng/l	0.58 U	0.57 U	0.55 U
NA	38.5	Perfluoroheptanesulfonic acid	ng/l	0.48 U	0.47 U	0.45 U
NA	76.9	Perfluoroheptanoic acid	ng/l	0.48 U	0.47 U	0.45 U
39	76.9	Perfluorohexanesulfonic acid	ng/l	0.67 U	0.66 U	0.64 U
990	1,923	Perfluorohexanoic acid	ng/l	0.48 U	0.47 U	0.45 U
NA	NA	Perfluorononanesulfonic acid	ng/l	0.55 U	0.54 U	0.52 U
5.9	11.5	Perfluorononanoic acid	ng/l	0.59 U	0.58 U	0.55 U
4	7.69	Perfluorooctanesulfonic acid	ng/l	0.52 U	0.51 U	0.49 U
6	11.5	Perfluorooctanoic acid	ng/l	0.48 U	0.47 U	0.45 U
NA	NA	Perfluoropentanesulfonic acid	ng/l	1.1 U	1.1 U	1.0 U
NA	1,538	Perfluoropentanoic acid	ng/l	0.90 U	0.89 U	0.85 U
NA	256	Perfluorotetradecanoic acid	ng/l	0.48 U	0.47 U	0.45 U
NA	25.6	Perfluorotridecanoic acid	ng/l	0.81 U	0.79 U	0.76 U
NA	19.2	Perfluoroundecanoic acid	ng/l	0.58 U	0.57 U	0.55 U

Appendix B:
Monitoring Well and Drilling Components

Well Sampling Components	Item Manufacturer	Part #	Item Description
Oil Water Interface Probe	Solinst	114823	122 (CSA) Interface Meter, P8/LM2/500ft
Oil Water Interface Probe	Solinst	114824	122 (CSA) Interface Meter, P8/LM2/750ft
Pump	Geotech	81150121	BLADDER PUMP, 166SS18, DEDICATED CMP=A:3/8 D:3/8
Pump	QED	P1101HM-Z	PUMP HIGH PRESSURE PVC/TEFLON FREE
Stariner	QED	37789	STRAINER ASSEMBLY PVC 6
Tubing	QED	P5000	TUBING 3/8 +1/4 P.E. BONDED
Adapter	QED	40991	FLEX FLOW ADAPTER 3/8 INCH ID X 6 FOOT LONG
Adapter	QED	C46HS	CAP 4 HIGH PRESSURE LOW CLEARANCE SEALING
Bailer	SinkFast		SF- Dis PVC (Sinkfast) 1.6" x 36", CLEAR (PFAS- Free)
Bailer	Uline	S-12866	1/8" 320lb-test solid braided nylon bailer twine
Transducer for FOS & OWDF	Insitu	96400	Aquatroll Sensor 600
Transducer for FOS & OWDF	Insitu	45700	Aquatroll Sensor 700
Tubing	Pine Environmental	75299	HDPE 0.17" ID x 1/4" OD, 500' Roll

Well Construction Components	Product Name
Jet-Lube	Well Guard
BioBlend Renewable Resources	Biolube TJC
Halliburton	N-Seal
Plews/Edelmann	ISO46 & ISO68 Hydraulic Oil
Petro-Canada	ENVIRONM MV 32, 46
ExxonMobil	MOBILFLUID 424
Control Chemical/MATEX	RDO 302 ES
BioBlend Renewable Resources	BioLube RDP
Ingersoll Rand	XHP 605 Compressor Oil
BioBlend Renewable Resources	BioBlend PO Aerosol
CRC Industries	Food grade Gear Oil SAE 90
Environmental Lubricants Manufacturing, Inc.	SoyGrease Food Machinery/
UltraLube CITGO Petroleum	Clarion Food Machinery
Grease No. 2	
Control Chemical/MATEX	Foamer ES
Dow Corning	Xiameter® AFE-150 Antifoam Emulsion
Baker Water Systems	Monoflex Schedule 80 PVC Casing & Accessories
Johnson	Schedule 80 PVC Casing & Accessories
Cemex	Lapis Luster Marine Sand (#3)
Wyo Ben	Enviroplug Medium Bentonite Chips
Polymer Drilling Systems (PDSCo, Inc)	PEL-PLUG TR30
Koby Enviromental	2" and 4" Schedule 80 Troquer Plug
Hawaiian Cement	Taiwan Portland Cement
Laval	R-Cam 1000 XLT Portable Borehole Camera
In-Situ	Aqua TROLL 200
Solinst	Model 103 Tag Line and Tagger
Heron Instruments	Series 1500 Multipurpose Tag Line
Drill Partner	Flap Bailer 90mm long
Geotech	Grundfos Redi-Flo2 Environmental Pump