Final

First Quarter 2019 - Quarterly Groundwater Monitoring Report

Red Hill Bulk Fuel Storage Facility
Joint Base Pearl Harbor-Hickam, O‘ahu, Hawai‘i

DOH Facility ID No.: 9-102271
DOH Release ID Nos.: 990051, 010011, 020028, and 140010

May 2019

Contract Number N62742-17-D-1800, CTO 18F0126

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May 2019

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EXECUTIVE SUMMARY

This groundwater monitoring report presents the results of a monthly groundwater sampling event conducted during December 12–13, 2018, and the First Quarter 2019 groundwater monitoring event conducted during January 22–30 and February 7, 2019, at the Red Hill Bulk Fuel Storage Facility ("the Facility"), Joint Base Pearl Harbor-Hickam, Hawai'i. The Facility is located in the south-central portion of the island of O'ahu. The Facility contains 18 active and 2 inactive underground fuel storage tanks. The State of Hawai'i Department of Health (DOH) Facility Identification (ID) number (No.) is 9-102271. The DOH Release ID Nos. are 990051, 010011, 020028, and 140010.

The groundwater sampling was conducted as part of the Red Hill groundwater long-term monitoring (LTM) program pursuant to the *Groundwater Protection Plan* (DON 2014), and performed under the Comprehensive Long-Term Environmental Action Navy V contract task order 18F0126. Data collected for this groundwater monitoring event also support Sections 6 and 7 of the *Administrative Order on Consent* [AOC] *in the Matter of Red Hill Bulk Fuel Storage Facility, EPA Docket No: RCRA 7003-R9-2015-01 and DOH Docket No: 15-UST-EA-01*, Attachment A, Statement of Work (EPA Region 9 and DOH 2015). The purpose of the sampling is to assess the condition of groundwater beneath the Facility, and to ensure that the United States (U.S.) Department of the Navy (DON; "Navy") remains in compliance with DOH Underground Storage Tank release response requirements as described in Hawai'i Administrative Rules Chapter 11-280.1 Subchapter 6, Release Response Action. The sampling was conducted in accordance with the Naval Facilities Engineering Command, Pacific Environmental Restoration Program *Project Procedures Manual* (DON 2015b), the DOH *Technical Guidance Manual for the Implementation of the Hawaii State Contingency Plan* (DOH 2017b), and the AOC Statement of Work Sections 6 and 7 *Work Plan/Scope of Work* (DON 2017a). A *Sampling and Analysis Plan* and addenda (DON 2017b, 2017c, 2017d, 2018f) were also prepared for AOC Statement of Work Sections 6 and 7 that contain updated information for the groundwater sampling.

Additional groundwater samples were collected from RHMW2254-01 in December 2018 to verify the volatile organic carbon (VOC) concentrations reported there in analytical results for the Fourth Quarter (October) 2018 groundwater monitoring event. Low-level concentrations of VOCs detected during the Fourth Quarter (October) 2018 event were not confirmed during a November 2018 confirmation sampling event at RHMW2254-01 (i.e., samples were non-detect). To further evaluate the effects of the Red Hill Shaft water supply pumping on the groundwater COPC concentrations, the confirmation samples were collected on two consecutive days, with Red Hill Shaft water supply pumps running on Day 1 and pumps off on Day 2.

During First Quarter 2019, AECOM Technical Services, Inc. personnel collected groundwater samples from 14 monitoring locations within the Red Hill groundwater monitoring network. These include: the sampling point at Red Hill Shaft (RHMW2254-01); 11 monitoring wells located within the Facility boundary (RHMW01 through RHMW10 and OWDFMW01); and 2 monitoring wells located outside of the Facility at the Hālawa Correctional Facility (Hālawa Deep Monitor Well [HDMW2253-03] and multilevel well RHMW11 [from Zone 5, located within the groundwater table in the basalt layer]). RHMW11 Zones 1–4 (also located within the groundwater table in the basalt layer) were not sampled based on the lack of chemical of potential concern (COPC) detections in groundwater samples collected during the First Quarter 2018 through Third Quarter 2018 monitoring events. Additionally, sampling was not conducted in the top three monitoring zones of RHMW11 (Zones 6–8) due to low hydraulic conductivity of the saprolite formation. Zones 6–8 are located at depths below the elevation of the regional basal aquifer but are completed within saprolite, and have hydraulic head measurements well above the elevation of the regional basal aquifer, suggesting isolation from it. Groundwater levels in RHMW11 Zones 6–8 appear to either have equilibrated or are asymptotically approaching

equilibration with the formation they are completed in; sampling these zones would cause additional stress in the formation, requiring another extensive period for water level recovery and equilibration at these zones.

Primary and field duplicate samples were collected from sampling point RHMW2254-01 during the December 2018 monthly sampling event. During the First Quarter 2019 monitoring event, one primary and one duplicate sample each were collected from sampling point RHMW2254-01 and monitoring well RHMW02.

Analytical results from the sampling events were compared to the current LTM screening criteria. The LTM screening criteria were agreed upon by the Parties to the AOC and were presented in the February 4, 2016, AOC Statement of Work Sections 6 and 7 scoping completion letter (EPA Region 9 and DOH 2016). The LTM screening criteria were updated (when applicable) with the most current (Fall 2017) DOH Tier 1 Groundwater Environmental Action Levels for sites where groundwater is a potential or current drinking water resource and the nearest surface water body is greater than 150 meters from the release site (DOH 2017a).

The analytical results for groundwater samples collected from RHMW01, RHMW02, and RHMW03 were also compared to the Site-Specific Risk-Based Levels (SSRBLs) for total petroleum hydrocarbons – diesel range organics (TPH-d) (4,500 micrograms per liter [µg/L]) and benzene (750 µg/L). The use of these screening SSRBLs was described in the Red Hill *Groundwater Protection Plan* (DON 2014) and later presented in the February 4, 2016, AOC Statement of Work Sections 6 and 7 scoping completion letter (EPA Region 9 and DOH 2016).

Analytical results for the December 2018 monthly sampling event and the First Quarter (January–February) 2019 groundwater monitoring event are summarized as follows:

- *RHMW2254-01 (pumps on and off, primary and duplicate), RHMW01, RHMW05, RHMW06, RHMW07, RHMW08, RHMW09, RHMW10, RHMW11-05, and HDMW2253-03:* No COPCs were detected.
- *RHMW02 (primary and duplicate):* TPH-d (2,400 and 2,700 µg/L), 1-methylnaphthalene (11 and 9.6 µg/L), and naphthalene (32 and 26 µg/L) were detected at concentrations exceeding the respective screening criteria (400, 10, and 17 µg/L). TPH-d was also detected in the TPH-d with silica gel cleanup (SGC) analysis at concentrations of 420 and 430 µg/L. The concentrations of TPH-d did not exceed the SSRBL of 4,500 µg/L. TPH-gasoline range organics (TPH-g) (48 and 22 µg/L) and 2-methylnaphthalene (8.8 and 7.2 µg/L) were detected at concentrations below the respective screening criteria (300 and 10 µg/L).
- *RHMW03:* TPH-d (380 µg/L) and TPH-residual range organics (TPH-o) (310 µg/L) were detected at concentrations below the respective screening criteria (400 and 500 µg/L).
- *RHMW04:* Total xylenes (0.18 J µg/L) were detected at concentrations below the screening criterion (20 µg/L).

Analytical results of natural attenuation parameters (NAPs) suggest that anaerobic biodegradation is occurring at RHMW02 based on depleted dissolved oxygen (DO), very high dissolved methane concentrations, and depleted nitrate and sulfate concentrations. Concentrations of SGC TPH-d and polynuclear aromatic hydrocarbons (PAHs) also suggest that attenuation is occurring at RHMW02. The depleted DO, dissolved methane, depleted nitrate, and reduced sulfate concentrations at RHMW01 and the depleted DO at RHMW03 indicate that biodegradation is likely occurring at those locations.

The increase in concentrations starting from the Fourth Quarter 2017 is attributable to changes to the Navy-contracted laboratory's extraction and analysis protocols in an effort to optimize the laboratory's U.S. Environmental Protection Agency (EPA) Method 8015 and EPA Method 8270 selected ion monitoring (SIM) standard operating procedures. The optimization was prompted by results of split sampling conducted by the EPA Region 9 laboratory during quarterly monitoring events in 2017, wherein the EPA Region 9 laboratory's protocols were more effective at recovering higher TPH-d and PAH concentrations, especially for samples with higher concentrations of polar hydrocarbons and metabolites. The Third Quarter 2018 split sampling results indicated that the optimization of the Navy-contracted laboratory's standard operating procedures (based on the EPA Methods 8015 and 8270 SIM) yields higher concentrations of TPH-d, TPH-o, and PAHs than in previous events. Evaluation of the Third Quarter 2018 split sampling results for TPH-d, TPH-o, and PAHs at RHMW01 to RHMW03 showed similar recoveries between the Navy-contracted laboratory and the EPA Region 9 laboratory.

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CONTENTS

APPENDIXES

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

%	percent
%D	percent difference
%R	percent recovery
%RSD	percent relative standard deviation
µg/L	microgram per liter
AOC	Administrative Order on Consent
APPL	Agriculture and Priority Pollutants Laboratories, Inc.
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAS	Chemical Abstracts Service
CCV	continuing calibration verification
CoC	chain-of-custody
COPC	chemical of potential concern
CSM	conceptual site model
DL	detection limit
DLNR	Department of Land and Natural Resources, State of Hawai‘i
DO	dissolved oxygen
DOC	dissolved organic carbon
DoD	Department of Defense, United States
DOH	Department of Health, State of Hawai‘i
DON	Department of the Navy, United States
EAL	Environmental Action Level
EPA	Environmental Protection Agency, United States
F-24	NATO-grade F-24 jet fuel
F-76	Marine Diesel Fuel
Facility	Red Hill Bulk Fuel Storage Facility
ft	foot/feet
GW	groundwater
HAR	Hawai‘i Administrative Rules
ID	identification
IDW	investigation-derived waste
J	estimated value
JBPHH	Joint Base Pearl Harbor-Hickam
JP	Jet Fuel Propellant
JP-5	Jet Fuel Propellant No. 5
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOD	limit of detection
LOQ	limit of quantitation
LTM	long-term monitoring
mg/L	milligram per liter
mL	milliliter
MPC	measurement performance criterion
MS	matrix spike
MSD	matrix spike duplicate
msl	mean sea level

mV	millivolt
N	normal or primary sample
NAP	natural attenuation parameter
NATO	North Atlantic Treaty Organization
NAVFAC	Naval Facilities Engineering Command
NAVSUP FLC	Naval Supply Systems Command Fleet Logistics Center
Navy	Department of the Navy, United States
No.	number
ORP	oxidation reduction potential
PAH	polynuclear aromatic hydrocarbon
PARCCS	precision, accuracy, representativeness, completeness, comparability, and sensitivity
pH	hydrogen activity
PID	photoionization detector
ppm	parts per million
PT	performance testing
QA	quality assurance
QC	quality control
QSM	Quality Systems Manual
RPD	relative percent difference
SAP	sampling and analysis plan
SIM	selected ion monitoring
SGC	silica gel cleanup/cleaned
SOW	scope of work
SSRBL	Site-Specific Risk-Based Level
SVOC	semivolatile organic compound
TGM	Technical Guidance Manual
TIC	tentatively identified compound
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TPH-d	total petroleum hydrocarbons – diesel range organics
TPH-g	total petroleum hydrocarbons – gasoline range organics
TPH-o	total petroleum hydrocarbons – residual range organics (i.e., TPH-oil)
U	non-detect value
U.S.	United States
UST	underground storage tank
VOC	volatile organic compound
WP	work plan

1. Introduction

This groundwater monitoring report presents the results of the December 2018 monthly groundwater sampling event conducted during December 12–13, 2018, and the First Quarter 2019 groundwater monitoring event conducted during January 21–30 and February 7, 2019, at the Red Hill Bulk Fuel Storage Facility (“the Facility”), Joint Base Pearl Harbor-Hickam (JBPHH), O‘ahu, Hawai‘i (Figure 1). In accordance with the *Groundwater Protection Plan* (DON 2014), the purpose of the sampling is to (1) assess the condition of groundwater beneath the Facility with respect to chemical constituents associated with Jet Fuel Propellant (JP) and Marine Diesel Fuel (F-76), and (2) ensure that the United States (U.S.) Department of the Navy (DON; “Navy”) remains in compliance with State of Hawai‘i Department of Health (DOH) Underground Storage Tank (UST) release response requirements as described in Hawai‘i Administrative Rules (HAR) Chapter 11-280.1 Subchapter 6, Release Response Action (2018). The DOH Facility Identification (ID) number (No.) for the Facility is 9-102271. The DOH Release ID Nos. are 990051, 010011, 020028, and 140010.

The groundwater sampling was conducted as part of the long-term groundwater and soil vapor monitoring program at the Facility for Naval Supply Systems Command Fleet Logistics Center (NAVSUP FLC) Pearl Harbor, pursuant to the *Groundwater Protection Plan* (DON 2014) and under Naval Facilities Engineering Command (NAVFAC) Pacific Contract No. N62742-17-D-1800. Soil vapor monitoring is being conducted under another contract and reported separately. The groundwater sampling was conducted in accordance with the NAVFAC Pacific Environmental Restoration Program *Project Procedures Manual* (DON 2015b), the DOH *Technical Guidance Manual for the Implementation of the Hawaii State Contingency Plan* (TGM) (DOH 2017b), and the Administrative Order on Consent (AOC) Statement of Work Sections 6 and 7 *Work Plan/Scope of Work* (WP/SOW) (DON 2017a). A *Sampling and Analysis Plan* (SAP) and addenda (DON 2017b, 2017c, 2017d, 2018f) were also prepared for AOC Statement of Work Sections 6 and 7 (EPA Region 9 and DOH 2015) that contain updated information for the groundwater sampling.

This report presents the results for sampling activities conducted at groundwater monitoring locations both inside and outside of the Facility tunnels. Cumulative historical monitoring results for the Red Hill groundwater monitoring network are presented in tables and charts in Appendix A. Field activity and analytical documentation for the December 2018 monthly sampling event and First Quarter 2019 monitoring event are presented in Appendix B and Appendix C, respectively.

1.1 Site Description

The Facility is located on Federal government land (on land zoned by the City and County of Honolulu as a mix of F-1 Federal and Military and P-1 Restricted Preservation districts) in south-central O‘ahu, approximately 2.5 miles northeast of Pearl Harbor (Figure 1). It is located on a low ridge on the western edge of the Ko‘olau Mountain Range that divides Hālawa Valley and Moanalua Valley. Proximate to the Facility lie Hālawa Industrial Park and Hālawa Correctional Facility to the north, preservation land to the northeast, residential neighborhoods in Moanalua Valley to the southeast, and additional residential neighborhoods and the U.S. Coast Guard reservation to the southwest. A quarry is located less than one-quarter mile to the northwest. The Facility occupies 144 acres of land, and the majority of the ground surface of the site lies at an elevation of approximately 200–500 feet (ft) above mean sea level (msl).

The Facility contains 18 active and 2 inactive underground fuel storage tanks that are operated by NAVSUP FLC Pearl Harbor. Each tank has a capacity of approximately 12.5 million gallons. The bottoms of the Facility’s tanks are located approximately 100 ft above the basal aquifer. The fuel storage tanks currently contain Jet Fuel Propellant No. 5 (JP-5), North Atlantic Treaty Organization (NATO)-grade F-24 jet fuel, and F-76 Marine Diesel Fuel. The current status of each tank is summarized in Table 1-1.

Table 1-1: Current Status of the Facility's Fuel Storage Tanks as of March 2019

Tank ID	Fuel Type	Status [a]	Capacity (million gallons) [b]
F-1	Empty	Inactive	12.5
F-2	F-24	Active	12.5
F-3	F-24	Active	12.5
F-4	F-24	Active	12.5
F-5	Empty	Active	12.5
F-6	F-24	Active	12.5
F-7	JP-5	Active	12.5
F-8	JP-5	Active	12.5
F-9	JP-5	Active	12.5
F-10	JP-5	Active	12.5
F-11	JP-5	Active	12.5
F-12	JP-5	Active	12.5
F-13	Empty	Active	12.5
F-14	Empty	Active	12.5
F-15	F-76	Active	12.5
F-16	F-76	Active	12.5
F-17	Empty	Active	12.5
F-18	JP-5	Active	12.5
F-19	Empty	Inactive	12.5
F-20	JP-5	Active	12.5

F-24 NATO-grade F-24 jet fuel
F-76 Marine Diesel Fuel
JP-5 Jet Fuel Propellant No. 5
[a] Active status indicates a tank is currently available for use, but does not necessarily indicate the tank is currently filled. Inactive status indicates a tank is currently not available for use.
[b] Tank capacity in this table is estimated and is not considered a tank-rated capacity or maximum allowable fill volume.

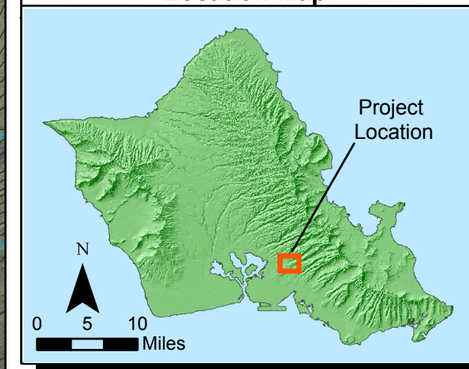
One sampling point at Red Hill Shaft (RHMW2254-01) and 11 groundwater monitoring wells (RHMW01 to RHMW10 and OWFMW01) are located within the Facility boundary. Two monitoring wells (HDMW2253-03 and RHMW11) are located outside the Facility boundary.

All monitoring locations except RHMW2254-01, HDMW2253-03, and RHMW11 are conventional monitoring wells, which are single screen wells typically installed across or near the water table. Sampling point RHMW2254-01 is located inside the water development tunnel of Navy Supply Well 2254-01. HDMW2253-03 is a deep monitor well cased to approximately 50 feet below the water table located north of the tank farm at the Hālawa Correctional Facility. RHMW11 is a multilevel monitoring well also located at the Hālawa Correctional Facility. RHMW11 has eight monitoring zones: one monitoring zone near the groundwater table, two zones below the groundwater table with measurement ports within the saprolite layer (the layer of heavily weathered and altered clay-rich basalts), and five zones below the groundwater table with measurement ports within the basalt layer.

1.2 PHYSICAL SETTING

The Facility is situated on the southwest flank of the Ko'olau shield volcano and is underlain by primarily Ko'olau volcanic series basalts. Climatological conditions in the area of the Facility consist of warm to moderate temperatures and low to moderate rainfall. The average annual precipitation is approximately 40 inches, which occurs mainly between November and April (Giambelluca, Nullet, and Schroeder 1986). Average temperatures range from the low 60s to high 80s (degrees Fahrenheit) (Juvik and Juvik 1998).

Location Map



Legend

- Existing Monitoring Well Location
- Existing Water Supply Well
- Red Hill Tank
- Stream
- Topographic Contour (feet above mean sea level)
- Red Hill Installation Boundary

Notes

1. Map projection: NAD 1983 UTM Zone 4N
2. Base Map: DigitalGlobe, Inc. (DG) and NRCS. Publication_Date: 2015

N

0 400 800 1,600 Feet

Figure 1
Site Location Map
1st Qtr 2019 Groundwater LTM Report
Red Hill Bulk Fuel Storage Facility
JBPHH, O'ahu, Hawai'i

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The Facility is located at the boundary between the Waimalu Aquifer System of the Pearl Harbor Aquifer Sector and the Moanalua Aquifer System of the Honolulu Aquifer Sector. The aquifer is classified as a basal, unconfined, flank-type and is currently used as a drinking water source. The aquifer is considered fresh, with less than 250 milligrams per liter (mg/L) of chloride, and is considered an irreplaceable resource with a high vulnerability to contamination (Mink and Lau 1990).

The nearest drinking water supply well is Navy Supply Well 2254-01 (also known as Red Hill Shaft), located within the Facility lower tunnel. Navy Supply Well 2254-01 is located approximately 2,600 ft topographically downgradient of the fuel storage tanks (Figure 1) and provides potable water to the JBPHH Water System, which serves approximately 65,200 military customers. NAVFAC Hawaii Utilities Energy Management Division operates the water development tunnel and Navy Supply Well 2254-01.

The nearest surface water body is South Hālawa Stream, which is an ephemeral stream present along the north side of the Facility. Wells RHMW01 through RHMW03, RHMW05, RHMW09, and RHMW10 are located greater than 150 meters from any portion of South Hālawa Stream. Sampling point RHMW2254-01 and wells RHMW04, RHMW06 through RHMW08, RHMW11, HDMW2253-03, and OWDFMW01 are located within 150 meters of a portion of Hālawa Stream. The approximate distance from each well and sampling point to Hālawa Stream is presented in Table 1-2.

Table 1-2: Distance of Wells/Sampling Point to South Hālawa Stream

Well/Sampling Point	Approximate Closest Distance to South Hālawa Stream (meters)
RHMW2254-01	85
RHMW01	232
RHMW02	299
RHMW03	271
RHMW04	81
RHMW05	225
RHMW06	104
RHMW07	81
RHMW08	64
RHMW09	376
RHMW10	452
RHMW11	3 [a]
HDMW2253-03	20
OWDFMW01	143

[a] RHMW11 is located approximately 3 meters from the concrete-lined portion of South Hālawa Stream.

Despite some wells being located within 150 meters of surface water (South Hālawa Stream), there are no indications of any complete pathways to ecological receptors in the nearby water bodies. Both South Hālawa Stream and Moanalua Stream (located in Moanalua Valley east of the Facility) are intermittent streams (USGS 2017) located approximately 100 ft or more above the water table of the basal aquifer. Additionally, the bottoms of the fuel tanks are located at least 50 ft below the bottom of the streams (a cross-section diagram depicting these elevations is presented in the Red Hill Monitoring Well Installation WP; DON 2016), and the segment of South Hālawa Stream between Red Hill and Hālawa Correctional Facility is concrete-lined. Thus, analytical results for the long-term monitoring (LTM) program are compared to the screening criteria based on the DOH Environmental Action Levels (EALs) Table D-1b (i.e., groundwater EALs for sites where groundwater is a current or potential drinking water resource and the nearest surface water body is greater than 150 meters from release site) (DOH 2017a).

1.3 BACKGROUND

The U.S. Government constructed the Facility in the early 1940s. Twenty steel-lined concrete underground fuel storage tanks and a series of tunnels were constructed. In the past, the tanks have stored Navy special fuel oil, Navy distillate, aviation gasoline, and motor gasoline (DON 2010). The tanks currently contain JP-5, F-24, and F-76. The fueling system is a self-contained underground unit that was installed into native rock composed primarily of basalt with some interbedded tuffs and breccias (DON 2010). Each tank measures approximately 250 ft in height and 100 ft in diameter. The upper domes of the tanks lie at depths varying between 100 ft and 200 ft below ground surface (bgs).

1.3.1 Previous Groundwater Monitoring Results

Groundwater samples for the Red Hill groundwater LTM program were sent to offsite laboratories for analysis as listed in Table 1-3. The Red Hill groundwater LTM program results spanning from 2005 to January 2019 are summarized in Table 1-4.

Table 1-3: Red Hill Groundwater LTM Program Analytical Laboratories

Groundwater Monitoring Event	Analytical Laboratory
1st Qtr 2019 (current)	APPL (all COPCs and NAPs except TOC during the December 2018 event) ARI (TOC during the December 2018 event only)
3rd Qtr 2018 – 4th Qtr 2018	APPL (all COPCs and NAPs except TOC and DOC) ALS Environmental - Houston (TOC and DOC only)
4th Qtr 2016 – 2nd Qtr 2018	APPL (all COPCs and all NAPs except TOC) Eurofins Lancaster Laboratories (TOC only)
1st Qtr 2017 – 3rd Qtr 2017, 1st Qtr 2018, 3rd Qtr 2018 (split samples only)	EPA Region 9 Laboratory
2nd Qtr 2015 – 3rd Qtr 2016	ALS Environmental - Kelso
4th Qtr 2012 – 1st Qtr 2015	Calscience Environmental Laboratories, Inc. (currently Eurofins Calscience)
4th Qtr 2010 – 3rd Qtr 2012	APPL
1st Qtr 2008 – 3rd Qtr 2010	SGS Environmental Services, Inc. - Alaska Division
3rd Qtr 2006 [a] – 3rd Qtr 2007 [b]	Accutest Laboratories - Florida (currently SGS Accutest Laboratories Southeast)
1st Qtr 2005 – 4th Qtr 2005	Columbia Analytical Services, Inc. (currently ALS Environmental - Kelso)

APPL Agriculture and Priority Pollutants Laboratories, Inc.
ARI Analytical Resources, Inc.
COPC chemical of potential concern
DOC dissolved organic carbon
EPA Environmental Protection Agency, United States
NAP natural attenuation parameter
Qtr quarter
TOC total organic carbon

[a] Groundwater LTM samples were not collected during the First and Second Quarters 2006 due to Phase I and Phase II site investigation activities (DON 2007) occurring at that time.
[b] Groundwater LTM samples were not collected during the Fourth Quarter 2007.

Table 1-4: Summary Statistics of Groundwater COPCs, First Quarter 2019 - Quarterly Groundwater Monitoring Report
Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i

		RHMW2254-01						Inside-Tunnel Wells							Outside-Tunnel Wells						
Analyte	DOH EAL (µg/L)	No. of Detects	No. of Non-detects	Percent Detected	Did Detects Exceed EALs?	Maximum Detected Concentration (µg/L)	Date Sampled of Max Concentration	No. of Detects	No. of Non-detects	Percent Detected	Did Detects Exceed EALs?	Location of Max Concentration	Maximum Detected Concentration (µg/L)	Date Sampled of Max Concentration	No. of Detects	No. of Non-detects	Percent Detected	Did Detects Exceed EALs?	Location of Max Concentration	Maximum Detected Concentration (µg/L)	Date Sampled of Max Concentration
TPH-d	400	11	90	11%	No	67	28-Jun-05	237	66	78%	**Yes**	RHMW02	6500	20-Jan-16	64	194	25%	**Yes**	OWDFMW01	3100	22-Jul-15
TPH-g	300	1	93	1.1%	No	14	4-Feb-09	81	191	30%	**Yes**	RHMW02	660	28-Jan-13	1	256	0.4%	No	HDMW2253-03	16	19-Oct-15
TPH-o	500	3	52	5.5%	No	59	8-Sep-05	44	73	38%	**Yes**	RHMW01	890	17-Feb-05	23	166	12%	No	OWDFMW01	390	22-Jul-15
Benzene	5	0	102	0%	—	—	—	20	279	6.7%	No	RHMW02	0.26	4-Feb-09	24	235	9%	No	OWDFMW01	1.3	19-Jul-12
Ethylbenzene	30	2	100	2%	No	1	8-Sep-05	52	247	17%	No	RHMW02	1.3	10-Jul-06	0	259	0%	—	—	—	—
Toluene	40	3	99	2.9%	No	0.71	22-Oct-12	11	288	3.7%	No	RHMW01	2.5	15-Jan-14	4	255	1.5%	No	HDMW2253-03	3.8	22-Oct-14
Xylenes, Total (p/m-, o-xylene)	20	2	100	2%	No	0.81	22-Oct-18	68	231	23%	No	RHMW02	1.4	6-Jul-17	2	257	0.8%	No	OWDFMW01	0.39	21-Apr-11
1-Methylnaphthalene	10	1	86	1.1%	No	0.0276	22-Oct-08	138	157	47%	**Yes**	RHMW02	142	10-Jul-06	11	247	4.3%	No	OWDFMW01	0.03	19-Jan-16
2-Methylnaphthalene	10	4	95	4.0%	No	0.038	6-Dec-05	145	158	48%	**Yes**	RHMW02	88.5	20-Sep-05	16	242	6.2%	No	OWDFMW01	0.02	19-Jan-16
Naphthalene	17	13	105	11%	No	0.099	23-Jul-13	203	174	54%	**Yes**	RHMW02	343	10-Jul-06	31	245	11%	No	RHMW04	0.18	19-Jul-16

Notes:
Bold and shaded text indicates analyte detected above DOH EAL.
Inside Wells: RHMW01, RHMW02, RHMW03, RHMW05.
Outside Wells: RHMW04, RHMW06, RHMW07, RHMW08, RHMW09, RHMW10, RHMW11, HDMW2253-03, OWDFMW01.
As of the Third Quarter 2018 Groundwater Monitoring Report, the "No. of Detects" and "No. of Non-detects" includes all primary and replicate results for each sampling event; versions of this table previous to the Third Quarter 2018 report included only the maximum detected concentration between primary and replicate samples.
— = no data
% = percent
µg/L = microgram per liter
DOH = Department of Health, State of Hawai'i
EAL = Environmental Action Level
No. = number
TPH-d = total petroleum hydrocarbons-diesel range organics
TPH-g = total petroleum hydrocarbons-gasoline range organics
TPH-o = total petroleum hydrocarbons-residual range organics (i.e., TPH-oil)

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Groundwater sampling locations are depicted on Figure 1. Cumulative results of historical groundwater monitoring are tabulated in Appendix A.1, and concentration graphs of chemicals of potential concern (COPCs) over time are presented in Appendix A.2. All historical data are compared to the Fall 2017 DOH EALs (DOH 2017a). Total petroleum hydrocarbons – diesel range organics (TPH-d) and benzene are also screened against the Site-Specific Risk-Based Levels (SSRBLs), as discussed in the Red Hill *Groundwater Protection Plan* (DON 2014) and subsequently presented in the February 4, 2016, AOC Statement of Work Sections 6 and 7 scoping completion letter (EPA Region 9 and DOH 2016). Historical results indicate that the most and generally highest detected concentrations of COPCs occur in monitoring well RHMW02.

Sampling results analyzed by Navy-contracted laboratories from 2005 to Fourth Quarter 2018 are summarized below:

- *RHMW2254-01* is a sampling point located inside the water development tunnel of Navy Supply Well 2254-01. Detections of TPH-gasoline range organics (TPH-g), TPH-d, TPH-residual range organics (TPH-o), and polynuclear aromatic hydrocarbons (PAHs) occurred occasionally during monitoring events between 2005 and October 2017, but no COPCs have been detected above the screening criteria. Ethylbenzene, toluene, and total xylenes were detected below screening criteria during the Fourth Quarter 2018 (October) groundwater monitoring event but were non-detect during the subsequent sampling events.
- *RHMW01*, an inside-tunnel monitoring well located southwest of the tank farm, was installed in 2001 (DON 2002). TPH-d was consistently detected at RHMW01, with the most recent DOH screening criterion (400 micrograms per liter [µg/L]) exceedance occurring during the First Quarter (January) 2016 monitoring event. TPH-d has never exceeded the SSRBL (4,500 µg/L). PAHs were periodically detected before Fourth Quarter 2016 below the screening criteria but have not been detected since. Sporadic detections of benzene and toluene below their respective screening criteria have occurred in 2005, 2014, and 2017.
- *RHMW02*, an inside-tunnel monitoring well located next to Tank 6, was installed in 2005 (DON 2007). TPH-g was regularly detected and exceeded the screening criterion (300 µg/L) during 2012 and 2013 monitoring events. TPH-d was always detected; concentrations exceeded the screening criterion in all monitoring events and exceeded the SSRBL in 2008, 2014, 2015, and 2016. TPH-o was detected below the screening criterion (500 µg/L) in most monitoring events from April 2015 to April 2017 but has not been detected since. PAHs regularly exceeded their screening criteria during monitoring events from 2005 onwards. Ethylbenzene and total xylenes were also detected in most events between 2005 and 2017 at trace concentrations below the screening criteria. Benzene and toluene were also detected at trace concentrations below the screening criteria between 2008 and 2016, but less frequently than ethylbenzene and total xylenes.
- *RHMW03*, an inside-tunnel monitoring well located next to Tank 14, was installed in 2005 (DON 2007). TPH-d and TPH-o were regularly detected at concentrations below the screening criteria. TPH-g, toluene, and PAHs were occasionally detected at trace concentrations below screening criteria between 2005 and 2016. No COPCs have been detected above the screening criteria.
- *RHMW04*, an outside-tunnel monitoring well located northeast of the tank farm, was installed in 2005 as a background monitoring location (DON 2007). TPH-d, benzene, and PAHs were sporadically detected below screening criteria, but none have been detected after July 2016. No COPCs have been detected above the screening criteria.

- *RHMW05,* an inside-tunnel monitoring well located southwest of the tank farm and southeast of sampling point RHMW2254-01, was installed in 2009. TPH-d exceeded the screening criterion during monitoring events in 2009 and 2010, but subsequent TPH-d detections were below screening criteria. TPH-o and PAHs were occasionally detected below screening criteria, but no COPCs have been detected after January 2016. Evaluations of historical TPH chromatograms indicate non-petroleum chemical signatures.
- *RHMW06 & RHMW07*, outside-tunnel monitoring wells located north of the tank farm, were installed in 2014 in response to the January 2014 release (DON 2015a). TPH-d, TPH-o, and PAHs were occasionally detected below screening criteria. No COPCs have been detected above screening criteria and no COPCs have been detected after March 2017.
- *RHMW08 & RHMW09*, outside-tunnel monitoring wells located west and south, respectively, of Tank 1, were installed in 2016 as part of the AOC Statement of Work Sections 6 and 7 investigation (DON 2017a). TPH-d and TPH-o have been detected below the screening criteria at RHMW08. No COPCs have been detected at RHMW09.
- *RHMW10,* an outside-tunnel monitoring well located south of Tank 14, was installed in April 2017 as part of the AOC Statement of Work Sections 6 and 7 investigation (DON 2017a). TPH-d and TPH-o were detected at concentrations below the screening criteria during the May and October 2017 events. No COPCs have been detected above the screening criteria.
- *RHMW11,* an outside-tunnel multilevel monitoring well located north of the tank farm at the at the Hālawa Correctional Facility, was installed in November 2017 as part of the AOC Statement of Work Sections 6 and 7 investigation (DON 2017a). Five of the eight multilevel monitoring zones (RHMW11-01, -02, -03, -04, and -05) were sampled during the First, Second, and Third Quarter 2018 events. Sampling was conducted at one monitoring zone (RHMW11-05) during the Fourth Quarter 2018 event due to no COPC detections in groundwater samples collected during the First Quarter 2018 through Third Quarter 2018 for RHMW11-01, -02, -03, and -04. Sampling was not performed in the monitoring zones located in the saprolite formation (RHMW11-06, -07, and -08) due to low hydraulic conductivity. Sampling RHMW11-06, -07, and -08 would cause additional stress in the formation, requiring another extensive period for water level recovery and equilibration at these zones.
- *HDMW2253-03* (Hālawa Deep Monitor Well 2253-03), an outside-tunnel well located north of the tank farm at the Hālawa Correctional Facility, was installed in 2000 by the State of Hawai'i Department of Land and Natural Resources (DLNR). COPCs have been detected below screening criteria with the exception of a TPH-d screening criterion exceedance during the January 2013 quarterly monitoring event. No COPCs have been detected since July 2016. HDMW2253-03 was not sampled during quarterly and monthly monitoring events from April to July 2017 due to experimental testing conducted by the DLNR Commission on Water Resource Management and the University of Hawai'i.
- *OWDFMW01*, located at the former Oily Waste Disposal Facility west of Navy Supply Well 2254-01, was installed in 1998 (DON 2000). TPH-d exceeded the screening criterion during quarterly monitoring events in 2010, 2012, 2013, and 2015, but, along with TPH-o and PAHs, was occasionally detected at concentrations below the respective screening criteria. Evaluations of historical TPH chromatograms indicate non-petroleum chemical signatures.

The TPH and PAH concentrations for the Second Quarter 2018 through Fourth Quarter 2018 monitoring events were higher than the reported results from the Fourth Quarter 2016 through First Quarter 2018 monitoring events. The increase in concentrations starting from the Fourth Quarter 2017 are attributable to changes to the Navy-contracted laboratory's extraction and analysis protocols in an

effort to optimize the laboratory's EPA Method 8015 and EPA Method 8270 selected ion monitoring (SIM) standard operating procedures. The changes were prompted by the January–March 2017 split sampling and October 2017 TPH-d performance testing (PT) results conducted by the EPA Region 9 laboratory in Richmond, CA and the Navy-contracted laboratory (EPA Region 9 and DOH 2017b; DON 2017e). The split sampling and PT results showed that the EPA Region 9 laboratory had higher TPH-d and PAH recoveries than the Navy-contracted laboratory for analytes present in groundwater samples at high concentrations (EPA Region 9 and DOH 2017a, 2017b; DON 2018b). The differences in recoveries were due to the EPA Region 9 laboratory protocols being more effective at recovering higher TPH-d and PAH concentrations, especially for samples with higher concentrations of polar hydrocarbons and metabolites. Changes to the Navy-contracted laboratory's protocols include: using calibration standards identical to those used by the EPA Region 9 laboratory; sample acidification to pH less than 5 prior to extraction; switching extraction methodologies from EPA Method 3510C (separatory funnel liquid-liquid extraction) to EPA Method 3520C (continuous liquid-liquid extraction); using a rotary evaporator for extract condensation; and reduction of the field-collected sample volume for optimal extraction within the liquid-liquid extractor vessel. The Third Quarter 2018 split sampling results indicated that TPH-d and PAH data generated by the Navy-contracted laboratory were approximately 12–37% lower than results reported by the EPA Region 9 laboratory (DON 2018a). The Navy-contracted laboratory's recoveries have significantly improved since the First Quarter 2017 split sampling event, during which recoveries were approximately 65% lower than the EPA Region 9 laboratory's results. Evaluation of the split sampling data is presented in detail in the Third Quarter 2018 monitoring report (DON 2018a).

1.3.2 Previous Reports

The Red Hill groundwater LTM reports listed in Table 1-5 were prepared and submitted to DOH. Starting from the Fourth Quarter 2016 groundwater monitoring event, information for both the inside-tunnel and outside-tunnel monitoring locations has been combined into one report.

Table 1-5: Previous Groundwater Monitoring Reports

Year	Title	Sampling Period	Submittal Date
Combined Reports for Inside- and Outside-Tunnel Wells			
2018	4th Qtr 2018 GW Monitoring Rpt	Oct to Nov	Mar 2019
	3rd Qtr 2018 GW Monitoring Rpt	July to Aug	Nov
	2nd Qtr 2018 GW Monitoring Rpt	Apr	Oct
	1st Qtr 2018 GW Monitoring Rpt	Mar	Jul
2017	4th Qtr 2017 GW Monitoring Rpt	Oct	Jan 2018
	3rd Qtr 2017 GW Monitoring Rpt	May to July	Oct
	2nd Qtr 2017 GW Monitoring Rpt	Feb to Apr	Jul
	1st Qtr 2017 GW Monitoring Rpt	Nov 2016 to Jan 2017	Apr
2016	4th Qtr 2016 GW Monitoring Rpt	Oct	Dec

Separate Reports for Inside- and Outside-Tunnel Wells		Inside-Tunnel Wells		Outside-Tunnel Wells	
Year	Title	Sampling Period	Submittal Date	Sampling Period	Submittal Date
2016	3rd Qtr 2016 GW Monitoring Rpt	Jul	Oct	Jul	Oct
	2nd Qtr 2016 GW Monitoring Rpt	Apr	Jul	Apr	Jul
	1st Qtr 2016 GW Monitoring Rpt	Jan	Mar	Jan	Mar
2015	4th Qtr 2015 GW Monitoring Rpt	Oct	Jan 2016	Oct	Feb 2016
	3rd Qtr 2015 GW Monitoring Rpt	Jul	Nov	Jul	Nov
	2nd Qtr 2015 GW Monitoring Rpt	Apr	Aug	Apr	Aug
	1st Qtr 2015 GW Monitoring Rpt	Jan	Mar	Jan	Mar
	Draft Monitoring Well Installation Rpt for RHMW06 and RHMW07	—	—	—	Mar
2014	4th Qtr 2014 GW Monitoring Rpt	Oct	Jan 2015	Oct	Jan 2015
	3rd Qtr 2014 GW Monitoring Rpt	Jul	Sep	Jul	Sep
	GW Sampling Rpt for Tank 5 Release Response on June 23 and 24	Jun 23, 24	Jul	—	—
	GW Sampling Rpt for Tank 5 Release Response on May 27 and 28	May 27, 28	Jun	—	—
	2nd Qtr 2014 GW Monitoring Rpt	Apr	Jun	Apr	Jun
	GW Sampling Rpt for Tank 5 Release Response on Apr 7	Apr	Apr	—	—
	GW Sampling Rpt for Tank 5 Release Response on March 25 and 26	Mar 25, 26	Apr	—	—
	GW Sampling Rpt for Tank 5 Release Response on March 10	Mar 10	Mar	—	—
	GW Sampling Rpt for Tank 5 Release Response on March 5 and 6	Mar 5, 6	Mar	—	—
	GW Sampling Rpt for Additional Sampling (Inside-Tunnel)/GW Monitoring Rpt for Additional Sampling of HDMW2253-03 (Outside-Tunnel)	Jan	Jan	Jan	Feb
	1st Qtr 2014 GW Monitoring Rpt	Jan	Apr	Jan	Apr
2013	4th Qtr 2013 GW Monitoring Rpt	Oct	Jan 2014	Oct	Jan 2014
	3rd Qtr 2013 GW Monitoring Rpt	Jul	Sep	Jul	Sep
	2nd Qtr 2013 GW Monitoring Rpt	Apr	Jul	Apr	Jul
	1st Qtr 2013 GW Monitoring Rpt	Jan	Apr	Jan	Apr
2012	4th Qtr 2012 GW Monitoring Rpt	Oct	Jan 2013	Nov	Jan 2013
	3rd Qtr 2012 GW Monitoring Rpt	Jul	Sep	Jul	Sep
	2nd Qtr 2012 GW Monitoring Rpt	Apr	Jul	Apr	Jul
	1st Qtr 2012 GW Monitoring Rpt	Jan, Feb	Oct	Jan	Mar
2011	4th Qtr 2011 GW Monitoring Rpt	Oct	Dec	Oct	Dec
	3rd Qtr 2011 GW Monitoring Rpt	Jul	Sep	Jul	Sep
	2nd Qtr 2011 GW Monitoring Rpt	Apr	Jun	Apr	Jun
	1st Qtr 2011 GW Monitoring Rpt	Jan	Mar	Jan	Mar
2010	4th Qtr 2010 GW Monitoring Rpt	Oct	Dec	Oct	Dec
	3rd Qtr 2010 GW Monitoring Rpt	Jul	Aug	Jul	Aug
	2nd Qtr 2010 GW Monitoring Rpt	Apr	May	Apr	May
	1st Qtr 2010 GW Monitoring Rpt	Jan, Feb, Mar	Apr	Jan	Apr

Separate Reports for Inside- and Outside-Tunnel Wells		Inside-Tunnel Wells		Outside-Tunnel Wells	
Year	Title	Sampling Period	Submittal Date	Sampling Period	Submittal Date
2009	4th Qtr 2009 GW Monitoring Rpt	Oct	Dec	Oct	Dec
	3rd Qtr 2009 GW Monitoring Rpt	Jul	Sep	Aug	Sep
	2nd Qtr 2009 GW Monitoring Rpt	May	Jul	—	—
	1st Qtr 2009 GW Monitoring Rpt	Feb	May	—	—
2008	4th Qtr 2008 GW Monitoring Rpt	Oct, Dec	Feb 2009	—	—
	3rd Qtr 2008 GW Monitoring Rpt	Jul	Oct	—	—
	2nd Qtr 2008 GW Monitoring Rpt	Apr	May	—	—
	1st Qtr 2008 GW Monitoring Rpt	Jan	Mar	—	—
2007	3rd Qtr 2007 GW Monitoring Results	Sep	Oct	—	—
	2nd Qtr 2007 GW Monitoring Results	Jun	Aug	—	—
	1st Qtr 2007 GW Monitoring Results	Mar	May	—	—
2006	4th Qtr 2006 GW Monitoring Results	Dec	Jan 2007	—	—
	3rd Qtr 2006 GW Monitoring Results	Jul	Sep	—	—
2005	4th Qtr 2005 GW Sampling Rpt	4th Qtr	Feb 2006	—	—
	3rd Qtr 2005 GW Sampling Rpt	3rd Qtr	Nov	—	—
	2nd Qtr 2005 GW Sampling Rpt	2nd Qtr	Aug	—	—
	1st Qtr 2005 GW Sampling Rpt	1st Qtr	Apr	—	—

— no data
GW groundwater
Rpt report

2. Groundwater Monitoring Activities

During the December 2018 monthly sampling event, groundwater samples were collected from the sampling point at Red Hill Shaft (RHMW2254-01) on two consecutive days with different supply well pumping conditions, following the same protocol used during the November 2018 confirmation sampling event. During the "pumps-on" conditions, the supply well pumps were turned on at least 3 hours prior to the groundwater sampling and were kept running for the duration of the sample collection. The following day, during the "pumps-off" conditions, the supply well pumps were kept turned off at least 3 hours prior to the groundwater sampling and remained off until the sample collection was complete.

During the First Quarter 2019 monitoring event, groundwater samples were collected from 14 monitoring locations within the Red Hill groundwater monitoring network, including RHMW2254-01 (during pumps on and pumps off conditions), 11 monitoring wells within the Facility (RHMW01 through RHMW10, and OWDFMW01), and 2 monitoring wells located outside of the Facility at Hālawa Correctional Facility (Hālawa Deep Monitor Well [HDMW2253−03], and multilevel well RHMW11 (from Zone 5, located within the groundwater table in the basalt layer]). RHMW11 Zones 1–4 (also located within the groundwater table in the basalt layer) were not sampled during the First Quarter 2019 monitoring event based on the lack of COPC detections in groundwater samples collected during the First Quarter 2018 through Third Quarter 2018 monitoring events. Sampling was not conducted in the top three monitoring zones of RHMW11 (Zones 6–8) due to low hydraulic conductivity of the saprolite formation. Zones 6–8 are located at depths below the elevation of the regional basal aquifer but are completed within saprolite, and have hydraulic head measurements well above the elevation of the regional basal aquifer, suggesting isolation from it. Groundwater levels in RHMW11 Zones 6–8 appear to either have equilibrated or are asymptotically approaching

equilibration with the formation they are completed in; sampling these zones would cause additional stress in the formation, requiring another extensive period for water level recovery and equilibration at these zones.

All samples were collected in accordance with the AOC Statement of Work Sections 6 and 7 WP/SOW (DON 2017a), SAP (DON 2017b, 2017c), SAP Addendum 01 (DON 2017d), and SAP Addendum 03 (DON 2018f). The WP/SOW and SAP are consistent with DOH UST release response requirements (HAR 11-280.1), NAVFAC Pacific Environmental Restoration Program Project Procedure I-C-3, *Monitoring Well Sampling* (DON 2015b), and the Red Hill *Groundwater Protection Plan* (DON 2014). Prior to purging and sampling, ambient and headspace organic vapor readings (volatile organic compounds [VOCs], oxygen, hydrogen sulfide, carbon monoxide, and lower explosive levels of vapors) were measured using a MultiRAE PGM-6228 multi-gas monitor at all inside-tunnel sampling locations, and VOCs were measured using a MiniRAE 3000 photoionization detector (PID) at all outside-tunnel sampling locations. The depth to groundwater was measured using Heron oil/water interface probes and calibrated Solinst water level measuring tapes (see Appendix B.3 for tape correction factors). No sheen was observed in any of the wells. Headspace PID detections occurred at RHMW2254-01, RHMW01, RHMW02, RHMW03, and RHMW05. Field measurements and observations are presented in the groundwater purge logs in Appendix B.1 and field logbooks in Appendix B.2.

2.1 GROUNDWATER SAMPLING

Prior to collecting groundwater samples, the monitoring wells (excluding the multilevel monitoring well RHMW11) were purged of standing water in the well casings. These monitoring locations each contain a dedicated bladder pump, which was used to purge the well and collect samples. The groundwater wells were purged using low-flow sampling methodology at flow rates of approximately 0.10–0.30 liter per minute to minimize VOC loss and drawdown.

To operate the pump, a portable air compressor with an in-line filter was connected to a QED MP10 MicroPurge Basics Controller box, which was then connected to the pump. The compressor was turned on to power the pump, and the controller was used to adjust the pumping rate to less than 1 liter of water per minute. Compressed nitrogen gas was used to purge and sample these non-multilevel monitoring wells.

Water quality parameters were monitored on a periodic basis during well purging using an In-Situ smarTROLL multi-parameter handheld water quality meter. Parameters measured included total dissolved solids (TDS), hydrogen activity (pH), temperature, specific conductivity, dissolved oxygen (DO), turbidity, oxidation-reduction potential (ORP), and salinity. The water quality parameters were used to evaluate whether the natural characteristics of the aquifer formation water were present within the monitoring wells before the samples were collected. A minimum of six readings were collected at each well during the purging process. When feasible, water level measurements were collected and recorded during purging to detect indications of drawdown; if drawdown was detected approaching 0.2 ft, the rate of low-flow purging was reduced. Purging was considered complete when at least three consecutive water quality measurements stabilized within the specified range for each parameter noted in groundwater sampling logs (Appendix B.1) and in accordance with NAVFAC Pacific Environmental Restoration Program Project Procedure I-C-3, *Monitoring Well Sampling* (DON 2015b). The readings were recorded on the groundwater sampling logs (Appendix B.1). Field notes were recorded to document the monitoring event (Appendix B.2).

Once water quality parameters stabilized, groundwater samples were immediately collected from the wells using the bladder pumps. Groundwater samples from these non-multilevel monitoring wells were

collected no more than 3 hours after purging was completed. Groundwater samples were collected in sampling containers that were pre-preserved (as necessary) and provided by the analytical laboratory. Samples collected for ferrous iron analysis were filtered in the field using new, individual 0.45-micron filters attached at the end of the pump/probe discharge tubing.

Due to the multilevel monitoring well design of RHMW11, purging was not required prior to collecting groundwater from the sampled monitoring zone, since the measurement ports allow groundwater to flow directly from the surrounding formation and there is no filter pack. Groundwater was sampled from Zone 5, located within the basalt layer at 285.3 ft bgs, and collected using sampling probes. A string of four sealed 250-milliliter (mL) sample containers were connected to the sampling probe, which was lowered to the monitoring zone, and the containers filled with groundwater from the formation. Once sampling containers were filled, the probe and container string were brought to the surface, and the groundwater was transferred to the appropriate laboratory-supplied containers. During the collection of groundwater quality parameters, the sample containers were flushed with nitrogen to remove air within the container prior to the collection of groundwater. The nitrogen flush was performed to minimize DO enrichment due to high water pressure in the formation forcing the air in the sample containers to mix into the groundwater collected. Groundwater quality parameters were collected at least twice during the sampling of Zone 5 and recorded in the groundwater sampling logs (Appendix B.1). Observations of groundwater DO enrichment were presented in the *First Quarter 2018 Groundwater Monitoring Report* (DON 2018g).

The analytical program for the December 2018 monthly sampling event and the First Quarter 2019 groundwater monitoring event is shown in Table 2-1.

2.2 FIELD QUALITY ASSURANCE/QUALITY CONTROL

A quality assurance/quality control (QA/QC) program was implemented in the field in accordance with the NAVFAC Pacific *Project Procedures Manual* (DON 2015b), DOH TGM (DOH 2017b), the project WP (DON 2015c), AOC Statement of Work Sections 6 and 7 WP/SOW (DON 2017a), SAP (DON 2017b, 2017c), SAP Addendum 01 (DON 2017d), and SAP Addendum 03 (DON 2018f) to support generating data of known and defensible quality. The QA/QC program was designed to minimize error, provide early identification and correction of potential problems, and evaluate the performance of the sampling program.

Field instruments were calibrated each morning prior to starting field activities. The PID was calibrated with 100 parts per million (ppm) isobutylene calibration gas. The multi-gas monitor was calibrated with 100 ppm isobutylene calibration gas and a multi-gas monitor calibration gas composed of 50 ppm carbon monoxide, 25 ppm dihydrogen sulfide, 19 percent (%) oxygen, and 50% of the lower explosive limit of methane. The water quality meter was calibrated with an auto-calibration solution prior to recording measurements.

To assess the effectiveness of the equipment decontamination process, one equipment blank sample was collected prior to sampling at multilevel monitoring well RHMW11. The equipment blank sample was collected on site by pouring distilled water into the decontaminated multilevel well sample container string, then into sample containers. A field blank sample was also collected to assess the quality of the locally sourced Menehune Water Company distilled water used to collect the equipment blank. The field blank was collected by pouring distilled water directly into sample containers. The field blank and equipment blank samples were analyzed for the same COPCs as the groundwater samples.

Table 2-1: Groundwater Sampling Program for the December 2018 Monthly Sampling Event and First Quarter 2019 Quarterly Monitoring Event

Parameter	Analytical Method	Analyte(s) [a]	Screening Criterion (µg/L) [a]	RHMW2254-01 [e]	RHMW01	RHMW02	RHMW03	RHMW04	RHMW05	RHMW06	RHMW07	RHMW08	RHMW09	RHMW10	RHMW11-05	HDMW2253-03	OWDFMW01
TPH	EPA 8260	TPH-g	300	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	EPA 8015	TPH-d	400	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		TPH-o	500	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TPH with SGC [c]	EPA 3630/8015	TPH-d	400	✓ [f]	—	✓	✓	—	—	—	—	—	—	—	—	—	—
		TPH-o	500	✓ [f]	—	✓	✓	—	—	—	—	—	—	—	—	—	—
VOCs	EPA 8260	Benzene	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Ethyl Benzene	30	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Toluene	40	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Total Xylenes	20	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PAHs	EPA 8270 SIM	1-Methylnaphthalene	10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		2-Methylnaphthalene	10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Naphthalene	17	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fuel Additives	EPA 8270	Phenol	300	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Lab Procedure	2-(2-Methoxyethoxy)Ethanol	800 [b]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lead Scavengers [d]	EPA 8011	1,2-Dibromoethane	0.04	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	EPA 8260	1,2-Dichloroethane	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—
NAPs	Field parameter	DO, ORP	—	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SM 3500-Fe	Ferrous Iron	—	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	RSK 175M	Methane	—	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	EPA 300.0	Nitrate, Sulfate, Chloride	—	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	EPA 353.2	Nitrate-Nitrite as Nitrogen	—	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	EPA 2320	Carbonate, Bicarbonate, and Total Alkalinity	—	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	EPA 9060A	Total Organic Carbon	—	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

— not available/not analyzed ✓ analyzed SGC silica gel cleanup SIM selected ion monitoring

[a] COPCs and associated screening criteria were provided in the February 4, 2016, AOC Statement of Work Sections 6 and 7 scoping completion letter from the Regulatory Agencies (EPA Region 9 and DOH 2016), and updated with the most current DOH Tier 1 EALs in Table D-1b (DOH 2017a) where appropriate.

[b] Screening criterion is from EPA Tap Water Regional Screening Levels, target hazard quotient = 1.0, May 2018 (EPA 2018).

[c] TPH-d and TPH-o with silica gel cleanup were analyzed only on samples with positive detections of TPH-d and TPH-o without silica gel cleanup.

[d] Lead scavengers are collected only from newly installed monitoring wells for at least 1 year of sampling, and may be discontinued if sample results are below the Groundwater Action Levels established in the February 4, 2016, scoping completion letter (EPA Region 9 and DOH 2016). Lead scavenger analysis requirement has been completed for all existing monitoring locations as of the Fourth Quarter 2018 monitoring event.

[e] During the December 2018 monthly sampling event, groundwater samples were collected only from monitoring location RHMW2254-01. Groundwater samples with the "pumps on" and the "pumps off" were collected in two consecutive days to evaluate effects of the Red Hill Shaft supply well pumping on the groundwater conditions and COPC concentrations.

[f] TPH-d and TPH-o with silica gel cleanup were analyzed only on RHMW2254-01 samples collected during December 2018 monthly sampling event.

As of the Fourth Quarter 2018, dedicated bladder pumps have been furnished for monitoring locations RHMW01, HDMW2253-03, and OWDFMW01, which previously required rental bladder pumps for sampling. As all non-multilevel monitoring wells have dedicated bladder pumps installed, no field and equipment blanks were collected associated with these locations during the December 2018 monthly sampling event and First Quarter 2019 groundwater monitoring event.

To assess the precision of the data collection activity, including sampling and analysis, field duplicates were collected at the same approximate time as their respective primary samples. One field duplicate was collected for each of the two days RHMW2254-01 was sampled during the December 2018 monthly sampling event and First Quarter 2019 groundwater monitoring event. One duplicate each was also collected from RHMW02 during the First Quarter 2019 groundwater monitoring event.

During the December 2018 and First Quarter 2019 events, one trip blank was used at each sampling location to accurately represent the condition of the samples in each shipment. The hermetically sealed trip blank samples were supplied pre-filled by the analytical laboratory and remained with the associated groundwater sample in the cooler during the field event and transport to and from the site.

2.3 SAMPLING HANDLING AND ANALYSIS

The samples were labeled and logged in accordance with NAVFAC Pacific Environmental Restoration Program Project Procedure III-E, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures* (DON 2015b). Immediately after collection, all samples were labeled, logged in the field logbooks, custody sealed, sealed with tape, and placed in a resealable plastic bag. To meet the recommended hold time for nitrate analysis, efforts were made to ship samples to the laboratory on the day of collection. Samples not shipped on the day of collection were stored in secure cold storage overnight and shipped the following day.

Prior to shipping, the samples were logged in a chain-of-custody (CoC) form and loaded into a cooler with double-bagged wet ice. Packed coolers were sent by field personnel via express-courier overnight shipping in custody-sealed coolers to APPL in Clovis, CA. Sample transport and custody details are provided in the CoC records in the laboratory reports in Appendix C.1.

2.4 DECONTAMINATION

Decontamination activities were performed in accordance with NAVFAC Pacific Environmental Restoration Program Project Procedure I-F, *Equipment Decontamination* (DON 2015b). A staging and decontamination area was established near each well location. Non-disposable sampling equipment (e.g., water level meter, oil/water interface probe, and multilevel monitoring well sample container string) was decontaminated at the beginning of each day and after purging and sampling each well. As of the Fourth Quarter 2018 groundwater monitoring event, dedicated pumps have been installed at all non-multilevel monitoring wells, thus no rental pumps were used. The decontamination process included washing and scrubbing the equipment with stiff-bristled nylon brushes and a non-phosphate detergent (e.g., Alconox) solution, followed by rinsing once with isopropyl alcohol and twice with distilled water. Liquid wastes generated during decontamination activities were captured and containerized in properly labeled, U.S. Department of Transportation-approved 55-gallon drums or other suitable temporary containers and managed as investigation-derived waste (IDW).

2.5 INVESTIGATION-DERIVED WASTE MANAGEMENT

IDW generated during the monitoring events consisted of purged groundwater from the monitoring wells and decontamination water. The IDW was handled, stored, and labeled in accordance with NAVFAC Pacific Environmental Restoration Program Project Procedure I-A-6, *Investigation-Derived*

Waste Management (DON 2015b). Approximately 140 gallons of fluid from all wells were containerized in three clearly labeled, 55-gallon-capacity drums, covered with a tarp, and stored on site in an area designated by the Navy, pending disposal. Disposable personal protective equipment and sampling equipment and supplies were collected in plastic trash bags and disposed of as municipal waste.

3. Data Evaluation and Quality Assessment

Field observations and measurements and laboratory groundwater analytical results collected during the December 2018 monthly sampling event and First Quarter 2019 groundwater monitoring event were evaluated along with available correction factors and historical groundwater concentrations. A data quality assessment consisting of a review of the overall groundwater sample collection and analysis process was performed to determine whether the analytical data generated met the quality objectives for the project. The data quality assessment was performed in accordance with the AOC Statement of Work Sections 6 and 7 WP/SOW (DON 2017a) and the SAP and addenda (DON 2017b, 2017c, 2017d, 2018f). The field QC program consisted of standardized sample collection and management procedures, and the collection of field duplicate samples, matrix spike (MS) samples, and trip blank samples. The laboratory QA program consisted of the use of standard analytical methods and the preparation and analyses of MS/MS duplicate (MSD) samples, surrogate spikes, blanks, and laboratory control samples (LCSs)/LCS duplicates (LCSDs).

3.1 GROUNDWATER LEVEL MEASUREMENTS

Depths to groundwater were gauged from the notched and surveyed top of casing using calibrated water level measuring tapes at non-multilevel monitoring well locations prior to sampling (Table 3-1). Additionally, a Heron or Solinst oil/water interface probe was used to detect non-aqueous-phase liquid, and measure if present.

The oil/water interface probe and water level measuring tapes were decontaminated between well measurements by washing with a non-phosphate detergent solution and rinsing with isopropyl alcohol and distilled water to prevent cross-contamination. Measuring points for all wells are detailed in two well elevation survey reports (DON 2018c, 2018e) and presented in Table 3-1. Groundwater elevations beneath and near the site ranged from 17.64 to 23.46 ft msl during the First Quarter 2019 groundwater monitoring event. Due to the location and construction of the multilevel well monitoring zones, the groundwater level was not measured at RHMW11. PID readings at the wellheads ranged from 0.0 to 2.8 ppm. No sheen or measurable non-aqueous-phase liquid was observed during the December monthly sampling event and First Quarter 2019 groundwater monitoring event. Graphs of cumulative historical depth to water readings are presented in Appendix A.4.

Table 3-1: Groundwater Elevations

Monitoring Well No.	Sampling Date	PID Reading at Wellhead (ppm)	Depth to Water (ft btoc) [a]	Measuring Tape Correction Factor [Tape ID] (ft) [b]	Well Horizontal Displacement Correction Factor (ft) [c]	Corrected Depth to Water (ft btoc)	Measuring Point Elevation (ft msl) [d]	Groundwater Elevation (ft msl)
RHMW2254-01	12/12/2018 [h]	0.9	82.83	-0.02 [N-1]	—	82.81	100.4501	17.64
RHMW2254-01	12/13/2018 [i]	2.8	81.18	-0.02 [N-1]	—	81.16	100.4501	19.29
RHMW2254-01	1/23/2019 [h]	0.0	82.66	-0.02 [N-1]	—	82.64	100.4501	17.81
RHMW2254-01	1/24/2019 [i]	0.1	81.03	-0.02 [N-1]	—	81.01	100.4501	19.44
RHMW01	1/22/2019	0.4	82.41	-0.02 [N-1]	—	82.39	101.9955	19.61
RHMW02	1/21/2019	0.4 [e]	85.08	-0.02 [N-1]	-0.06	85.00	104.5970	19.60
RHMW03	1/22/2019	0.5	101.26	-0.03 [N-1]	-0.04	101.19	120.8980	19.71
RHMW04	1/21/2019	0.0	292.53	-0.03 [N-2]	-0.02	292.48	312.1062	19.63
RHMW05	1/21/2019	1.2	81.83	-0.02 [N-1]	-0.01	81.80	101.3102	19.51
RHMW06 [f]	1/21/2019	0.0	239.60	-0.02 [N-2]	-0.01	239.57	259.1275	19.56
RHMW07 [f]	1/23/2019	0.0	197.02	-0.02 [N-2]	-0.01	196.99	220.4517	23.46
RHMW08 [f]	1/21/2019	0.0	291.04	-0.03 [N-2]	-0.03	290.98	310.4817	19.50
RHMW09 [f]	1/22/2019	0.0	376.27	-0.04 [N-2]	-0.24	375.99	395.4299	19.44
RHMW10 [f]	1/24/2019	0.0	476.28	-0.04 [N-2]	-0.09	476.15	495.6388	19.49
RHMW11-05 [g]	1/28/2019	0.0 [j]	—	—	-0.09	—	—	—
HDMW2253-03	2/7/2019	0.0	205.84	-0.02 [N-2]	-0.01	205.81	226.6812	20.87
OWDFMW01	1/23/2019	0.0	118.91	-0.03 [N-1]	-0.03	118.85	138.1361	19.29

— not applicable
btoc below top of casing
[a] Depth to water readings were taken using the calibrated water level measuring tapes.
[b] Water level measuring tape calibration information and correction factors are presented in Appendix B.3.
[c] Well horizontal displacement correction factor based on gyroscopic survey of the monitoring well's vertical plumbness. Correction factors are presented in the *Technical Memorandum, Gyroscopic Survey Results and Calculated Correction Factors for Groundwater Monitoring Network Wells at the Red Hill Bulk Fuel Storage Facility* (DON 2018d).
[d] *Well Elevation Survey Report, Red Hill Bulk Fuel Storage Facility* (DON 2018c).
[e] Slight sulfur odor was noted during sampling.
[f] Depth to water is measured from the top of the gray plate at monitoring wells RHMW06, RHMW07, RHMW08, RHMW09, and RHMW10.
[g] Depth to water measurements are not applicable to the RHMW11 monitoring zones.
[h] Measurements collected during Red Hill Shaft supply well "pumps-on" groundwater conditions.
[i] Measurements collected during Red Hill Shaft supply well "pumps-off" groundwater conditions.
[j] Slight organic odor was noted after approximately 8 liters of water had been collected.

3.2 ANALYTICAL RESULTS

The samples were analyzed for:

- TPH-d and TPH-o by EPA SW846 Test Method 8015B
- TPH-g and benzene, toluene, ethylbenzene, and xylenes (BTEX) by EPA Method 8260B
- 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene by EPA Method 8270D SIM
- Phenol with tentatively identified compounds (TICs) by EPA Method 8270D
- 2-(2-methoxyethoxy)-ethanol by a proprietary laboratory procedure
- Nitrate, chloride, and sulfate by EPA Method 300.0
- Nitrate-nitrite as nitrogen, methane, ferrous iron, and alkalinity by EPA 353.2, RSK175, Standard Method (SM) 3500-Fe-B, and SM2320B, respectively
- Total organic carbon (TOC) by EPA Method 9060A

The chemicals analyzed and the respective analytical methods for each groundwater sample are identified in Table 3-2. Copies of the laboratory reports are presented in Appendix C.1. Copies of the third-party data validation reports are presented in Appendix C.2.

Analytical results were compared to the current LTM screening criteria as established by the February 4, 2016 AOC Statement of Work Sections 6 and 7 scoping completion letter (EPA Region 9 and DOH 2016) and updated with the Fall 2017 DOH Tier 1 EALs in Table D-1b. The DOH Groundwater Action Levels used are those where groundwater is a current or potential drinking water resource and a surface water body is not located within 150 meters of release site (DOH 2017a) (Section 1.2). The field and QC sample results of the December 2018 monthly sampling event and First Quarter 2019 groundwater monitoring event are summarized in Table 3-2.

In general, COPCs were not detected at RHMW2254-01, RHMW01, RHMW05 through RHMW10, RHMW11-05, HDMW2253-03, and OWDFMW01. One or more of the following COPCs were detected in RHMW02, RHMW03, and RHMW04: TPH-g, TPH-d, TPH-o, total xylenes, 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene. In RHMW02, TPH-d, 1-methylnaphthalene, 2-methylnapthalene, and naphthalene were detected above the respective screening criteria, and TPH-g was detected below the screening criterion. In RHMW03, TPH-d and TPH-o were detected below the respective screening criteria. In RHMW04, total xylenes were detected below the screening criterion.

Figure 2 presents COPC detections, and Figure 3A and Figure 3B present the natural attenuation parameter (NAP) results at all monitoring locations. A description of laboratory data qualifiers, definitions of the terms detection limit (DL), limit of detection (LOD), and limit of quantitation (LOQ), and basic concepts of those terms are presented in the Department of Defense (DoD) Environmental Data Quality Workgroup Fact Sheet included as Appendix C.3.

Table 3-2: Groundwater and QC Sample Results, First Quarter 2019 - Quarterly Groundwater Monitoring Report
Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i

						Location	RHMW2254-01	RHMW2254-01	RHMW2254-01	RHMW2254-01	RHMW2254-01	RHMW2254-01	RHMW2254-01	RHMW2254-01	RHMW01	RHMW02	RHMW02	RHMW03	RHMW04	RHMW05	RHMW06	RHMW07	RHMW08	RHMW09	RHMW10	RHMW11-05	HDMW2253-03
						COC ID	ERH719	ERH720	ERH722	ERH723	ERH730	ERH731	ERH733	ERH734	ERH736	ERH738	ERH739	ERH741	ERH743	ERH745	ERH747	ERH749	ERH751	ERH753	ERH755	ERH764	ERH759
						Collection Date	12/12/2018	12/12/2018	12/13/2018	12/13/2018	1/23/2019	1/23/2019	1/24/2019	1/24/2019	1/22/2019	1/21/2019	1/21/2019	1/22/2019	1/21/2019	1/21/2019	1/21/2019	1/23/2019	1/21/2019	1/22/2019	1/24/2019	1/28/2019	2/7/2019
						Sample Type	N (pumps on)	FD (pumps on)	N (pumps off)	FD (pumps off)	N (pumps on)	FD (pumps on)	N (pumps off)	FD (pumps off)	N	N	FD	N	N	N	N	N	N	N	N	N	N
						FD Parent Sample	—	ERH719	—	ERH722	—	ERH730	—	ERH733	—	—	ERH738	—	—	—	—	—	—	—	—	—	—
Analyte	**CAS No.**	**Method**	**Criteria**	**SSRBL[a]**	**Unit**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Chemicals of Potential Concern																											
Benzene	71-43-2	8260B	5	750	µg/L	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 UJ	< 0.30 UJ	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 UJ	< 0.30 U	< 0.30 U	< 0.30 U
Ethylbenzene	100-41-4	8260B	30	—	µg/L	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 UJ	< 0.50 UJ	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 UJ	< 0.50 U	< 0.50 U	< 0.50 U
Toluene	108-88-3	8260B	40	—	µg/L	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 UJ	< 0.30 UJ	< 0.30 U	< 0.30 U	< 0.30 UJ	< 0.30 UJ	< 0.30 UJ	< 0.30 UJ	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 UJ	< 0.30 U	< 0.30 UJ	< 0.30 U	< 0.30 U	< 0.30 U
Xylenes	1330-20-7	8260B	20	—	µg/L	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 UJ	< 0.30 UJ	< 0.30 U	**0.18 J**	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 UJ	< 0.30 U	< 0.30 U	< 0.30 U
TPH-g (C6-C10)	PHCC6C10	8260B	300	—	µg/L	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	**48**	**22**	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 UJ
TPH-d (C10-C24)	PHCC10C24	8015B_E	400	4500	µg/L	< 25.00 UJ	< 25.00 U	< 25.00 U	< 25.00 U	< 25.00 U	< 25.00 U	< 25.00 U	< 25.00 U	< 25.00 U	**2400**	**2700**	**380**	< 25.00 U	< 25.00 U	< 25.00 U	< 25.00 U	< 25.00 U	< 25.00 U	< 25.00 U	< 25.00 U	< 25.00 U	< 25.00 U
TPH-d (C10-C24) with Silica Gel Cleanup	PHCC10C24SGC	8015B_E	400	—	µg/L	< 25.00 UJ	—	—	< 25.00 U	—	—	—	—	—	**420**	**430**	< 25.00 U	—	—	—	—	—	—	—	—	—	—
TPH-o (C24-C40)	PHCC24C40	8015B_E	500	—	µg/L	< 40.00 UJ	< 40.00 U	< 40.00 U	< 40.00 U	< 40.00 U	< 40.00 U	< 40.00 U	< 40.00 U	< 40.00 U	< 40.00 U	< 40.00 U	**310**	< 40.00 U	< 40.00 U	< 40.00 U	< 40.00 U	< 40.00 U	< 40.00 U	< 40.00 U	< 40.00 U	< 40.00 U	< 40.00 U
TPH-o (C24-C40) with Silica Gel Cleanup	PHCC24C40SGC	8015B_E	500	—	µg/L	< 40.00 UJ	—	—	< 40.00 U	—	—	—	—	—	< 40.00 U	< 40.00 U	< 40.00 U	—	—	—	—	—	—	—	—	—	—
1-Methylnaphthalene	90-12-0	8270DSIM	10	—	µg/L	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	**11**	**9.6**	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U
2-Methylnaphthalene	91-57-6	8270DSIM	10	—	µg/L	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	**8.8**	**7.2**	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U
Naphthalene	91-20-3	8270DSIM	17	—	µg/L	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	**32**	**26**	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U
Fuel Additives																											
Phenol	108-95-2	8270D	300	—	µg/L	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U
2-(2-Methoxyethoxy)-ethanol	111-77-3	8270D	80	—	µg/L	< 80.0 U	< 80.0 U	< 80.0 U	< 80.0 U	< 80.0 UJ	< 80.0 UJ	< 80.0 UJ	< 80.0 UJ	< 80.0 UJ	< 80.0 UJ	< 80.0 UJ	< 80.0 UJ	< 80.0 UJ	< 80.0 UJ	< 80.0 U	< 80.0 U	< 80.0 UJ	< 80.0 UJ	< 80.0 UJ	< 80.0 UJ	< 80.0 U	< 80.0 U
Natural Attenuation Parameters																											
Methane	74-82-8	RSK175	—	—	µg/L	< 1.00 UJ	—	< 1.00 UJ	—	< 1.00 U	—	< 1.00 U	—	**200**	**5000**	—	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Nitrogen, Nitrate (As N)	14797-55-8	300.0	—	—	mg/L	**2.3 J**	—	**2.2**	—	**2.3**	—	**2.2**	—	< 0.18 UJ	< 0.18 UJ	—	**6.2 J**	**2.3 J**	**3.3**	**2.5**	**3.6 J**	**4.7 J**	**2.0**	**1.7**	< 0.18 UJ	**0.85**
Chloride (As Cl)	16887-00-6	300.0	—	—	mg/L	**107**	—	**105**	—	**108**	—	**108**	—	**40.3**	**42.0**	—	**48.2**	**68.7**	**145**	**457**	**392**	**143**	**45.4**	**41.2**	**52.3**	**82.4**
Sulfate (As SO4)	14808-79-8	300.0	—	—	mg/L	**17.0**	—	**14.4**	—	**15.7**	—	**16.7**	—	**4.5**	< 0.38 U	—	**46.1**	**10.6**	**41.4**	**92.1**	**60.9**	**45.7**	**9.5**	**6.0**	**10.5**	**29.4**
Nitrogen, Nitrate-Nitrite	NO3NO2N	353.2	—	—	mg/L	**0.61**	—	**0.61**	—	**0.51**	—	**0.52**	—	< 0.100 U	< 0.100 U	—	**1.7**	**0.48**	**0.77**	**0.53**	**0.89**	**1.1**	**0.38**	**0.38**	< 0.100 U	**0.19**
Alkalinity, Total (As CaCO3)	ALK	2320B	—	—	mg/L	**71.4**	—	**62.7**	—	**59.0**	—	**58.7**	—	**81.0**	**190**	—	**266**	**75.0**	**91.8**	**108**	**104**	**91.2**	**62.9**	**65.5**	**114**	**54.7**
Bicarbonate	71-52-3	2320B	—	—	mg/L	**71.4**	—	**62.7**	—	**59.0**	—	**58.7**	—	**81.0**	**190**	—	**266**	**75.0**	**91.8**	**108**	**104**	**91.2**	**62.9**	**65.5**	**114**	**54.7**
Carbonate (As CO3)	3812-32-6	2320B	—	—	mg/L	< 1.70 U	—	< 1.70 U	—	< 1.70 U	—	< 1.70 U	—	< 1.70 U	< 1.70 U	—	< 1.70 U	< 1.70 U	< 1.70 U	< 1.70 U	< 1.70 U	< 1.70 U	< 1.70 U	< 1.70 U	< 1.70 U	< 1.70 U
Iron, Ion (Fe2+)	15438-31-0	3500-FE-B	—	—	mg/L	**0.30 J**	—	**0.35 J**	—	< 0.32 U	—	< 0.32 U	—	< 0.32 U	**2.2**	—	< 0.32 U	< 0.32 U	< 0.32 U	< 0.32 U	**0.40 J**	< 0.32 U	< 0.32 U	< 0.32 U	**0.20 J**	**0.85 J**
Total Organic Carbon	TOC	9060A	—	—	mg/L	< 0.50 U	—	< 0.50 U	—	< 0.68 U	—	< 0.48 U	—	< 1.2 U	**3.9**	—	**1.8**	< 0.67 U	< 0.71 U	< 0.76 U	< 0.96 U	< 0.92 U	< 0.55 U	< 0.63 U	< 1.0 U	< 0.26 U
Dissolved Oxygen	—	Field	—	—	mg/L	**8.58**	—	**8.68**	—	**8.61**	—	**8.69**	—	**0.71**	**0.29**	—	**0.96**	**8.82**	**8.43**	**7.13**	**5.18**	**5.26**	**8.48**	**8.30**	**0.76**	**1.26**
Oxidation-Reduction Potential	—	Field	—	—	mV	**77.9**	—	**87.5**	—	**98.3**	—	**104.5**	—	**-8.7**	**-31.3**	—	**69.6**	**105.6**	**69.4**	**79.8**	**185**	**116.9**	**99.2**	**155.4**	**76.1**	**41.7**
Tentatively Identified Compounds																											
1-Methyl-3-propylcyclohexane	4291-80-9	8270D	—	—	µg/L	—	—	**7.5**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3,3'-Dimethyl Benzidine Dihydrochloride	612-82-8	8270D	—	—	µg/L	—	—	—	—	—	**6.1**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4H-Pyran-4-one, Tetrahydro-	29943-42-8	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**32**	—	—	—	—
Bis(2-Methoxyethyl) Phthalate	117-82-8	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Butyl Isobutyl Phthalate	17851-53-5	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**5.7**	—
Decamethyl-cyclopentasiloxane	541-02-6	8270D	—	—	µg/L	—	—	—	—	—	—	**15**	—	—	—	—	—	—	—	—	**16**	—	—	—	—	—
Diacetone Alcohol	123-42-2	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	**43**	—	—	**12**	—	—	—	—	—	—	—	—
Ethyl Isothiocyanate	542-85-8	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**7.8**
Hexamethylcyclotrisiloxane	541-05-9	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**140**	—	—	—	—	—
Hexanedioic Acid Dioctyl Ester	123-79-5	8270D	—	—	µg/L	—	—	—	**11**	**13**	—	—	**19**	—	—	—	—	—	—	—	**11**	—	—	—	**20**	—
Mesityl Oxide	141-79-7	8270D	—	—	µg/L	—	—	—	—	—	—	**110**	**20**	**66**	—	—	**56**	**84**	**19**	**48**	**88**	—	**68**	—	—	—
N-Ethyl-4-methyl-benzenesulfonamide	80-39-7	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Octamethylcyclotetrasiloxane	556-67-2	8270D	—	—	µg/L	—	—	—	—	—	—	**43**	—	**16**	—	—	—	**12**	—	—	—	**22**	**12**	—	—	—
Pentanedioic Acid, Dimethyl Ester	1119-40-0	8270D	—	—	µg/L	—	—	**15**	—	—	—	—	—	—	—	—	—	—	**11**	**9.6**	—	—	—	< 24 U	—	—
Tetrachloroethylene (PCE)	127-18-4	8270D	—	—	µg/L	—	—	**77**	**78**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Toluene	108-88-3	8270D	—	—	µg/L	—	—	**87**	**14**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Notes:

Bold text indicates detected value.

Bold and shaded text indicates analyte exceeds the screening criterion.

— = not analyzed or not applicable
µg/L = microgram per liter
EB = equipment blank (rinsate)
FB = field blank (source water)
FD = field duplicate
J = estimated value
N = normal (primary) sample
mg/L = milligrams per liter
mV = millivolts
QC = quality control
SSRBL = Site-Specific Risk-Based Level
TB = trip blank
U = nondetect value

[a] SSRBL applies to RHMW01, RHMW02, and RHMW03.

Table 3-2: Groundwater and QC Sample Results, First Quarter 2019 - Quarterly Groundwater Monitoring Report
Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (cont'd)

						Location	OWDFMW01	Multilevel Well QC	Multilevel Well QC	RHMW2254-01	RHMW2254-01	RHMW2254-01	RHMW2254-01	RHMW01	RHMW02	RHMW03	RHMW04	RHMW05	RHMW06	RHMW07	RHMW08	RHMW09	RHMW10	RHMW11-05	HDMW2253-03	OWDFMW01	Multilevel Well QC
						COC ID	ERH757	ERH762	ERH761	ERH718	ERH721	ERH729	ERH732	ERH735	ERH737	ERH740	ERH742	ERH744	ERH746	ERH748	ERH750	ERH752	ERH754	ERH763	ERH758	ERH756	ERH760
						Collection Date	1/23/2019	1/28/2019	1/28/2019	12/12/2018	12/13/2018	1/23/2019	1/24/2019	1/22/2019	1/21/2019	1/22/2019	1/21/2019	1/21/2019	1/21/2019	1/23/2019	1/21/2019	1/22/2019	1/24/2019	1/28/2019	2/7/2019	1/23/2019	1/28/2019
						Sample Type	N	FB	EB	TB (pumps on)	TB (pumps off)	TB (pumps on)	TB (pumps off)	TB	TB	TB	TB	TB	TB	TB	TB	TB	TB	TB	TB	TB	TB
						FD Parent Sample	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Analyte	**CAS No.**	**Method**	**Criteria**	**SSRBL[a]**	**Unit**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Chemicals of Potential Concern																											
Benzene	71-43-2	8260B	5	750	µg/L	< 0.30 UJ	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U
Ethylbenzene	100-41-4	8260B	30	—	µg/L	< 0.50 UJ	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
Toluene	108-88-3	8260B	40	—	µg/L	< 0.30 UJ	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 UJ	< 0.30 U	< 0.30 UJ	< 0.30 U	< 0.30 UJ	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 UJ	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U
Xylenes	1330-20-7	8260B	20	—	µg/L	< 0.30 UJ	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U
TPH-g (C6-C10)	PHCC6C10	8260B	300	—	µg/L	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 UJ	< 18.0 U	< 18.0 U
TPH-d (C10-C24)	PHCC10C24	8015B_E	400	4500	µg/L	< 25.00 U	< 25.00 U	< 25.00 U	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TPH-d (C10-C24) with Silica Gel Cleanup	PHCC10C24SGC	8015B_E	400	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TPH-o (C24-C40)	PHCC24C40	8015B_E	500	—	µg/L	< 40.00 U	< 40.00 U	< 40.00 U	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TPH-o (C24-C40) with Silica Gel Cleanup	PHCC24C40SGC	8015B_E	500	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1-Methylnaphthalene	90-12-0	8270DSIM	10	—	µg/L	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2-Methylnaphthalene	91-57-6	8270DSIM	10	—	µg/L	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Naphthalene	91-20-3	8270DSIM	17	—	µg/L	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fuel Additives																											
Phenol	108-95-2	8270D	300	—	µg/L	< 4.00 U	< 4.00 U	< 4.00 U	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2-(2-Methoxyethoxy)-ethanol	111-77-3	8270D	80	—	µg/L	< 80.0 UJ	< 80.0 U	< 80.0 U	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Natural Attenuation Parameters																											
Methane	74-82-8	RSK175	—	—	µg/L	< 1.00 U	—	—	< 1.00 UJ	< 1.00 UJ	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	—
Nitrogen, Nitrate (As N)	14797-55-8	300.0	—	—	mg/L	**6.6**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chloride (As Cl)	16887-00-6	300.0	—	—	mg/L	**1110**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sulfate (As SO4)	14808-79-8	300.0	—	—	mg/L	**311**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nitrogen, Nitrate-Nitrite	NO3NO2N	353.2	—	—	mg/L	**1.8**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Alkalinity, Total (As CaCO3)	ALK	2320B	—	—	mg/L	**139**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Bicarbonate	71-52-3	2320B	—	—	mg/L	**139**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Carbonate (As CO3)	3812-32-6	2320B	—	—	mg/L	< 1.70 U	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Iron, Ion (Fe2+)	15438-31-0	3500-FE-B	—	—	mg/L	< 0.32 U	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total Organic Carbon	TOC	9060A	—	—	mg/L	< 1.1 U	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dissolved Oxygen	—	Field	—	—	mg/L	**2.50**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oxidation-Reduction Potential	—	Field	—	—	mV	**123.3**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tentatively Identified Compounds																											
1-Methyl-3-propylcyclohexane	4291-80-9	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3,3'-Dimethyl Benzidine Dihydrochloride	612-82-8	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4H-Pyran-4-one, Tetrahydro-	29943-42-8	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Bis(2-Methoxyethyl) Phthalate	117-82-8	8270D	—	—	µg/L	—	**5.1**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Butyl Isobutyl Phthalate	17851-53-5	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Decamethyl-cyclopentasiloxane	541-02-6	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Diacetone Alcohol	123-42-2	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ethyl Isothiocyanate	542-85-8	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hexamethylcyclotrisiloxane	541-05-9	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hexanedioic Acid Dioctyl Ester	123-79-5	8270D	—	—	µg/L	**50**	—	**6.9**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mesityl Oxide	141-79-7	8270D	—	—	µg/L	—	—	**61**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
N-Ethyl-4-methyl-benzenesulfonamide	80-39-7	8270D	—	—	µg/L	**23**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Octamethylcyclotetrasiloxane	556-67-2	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Pentanedioic Acid, Dimethyl Ester	1119-40-0	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tetrachloroethylene (PCE)	127-18-4	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Toluene	108-88-3	8270D	—	—	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Notes:
Bold text indicates detected value.
Bold and shaded text indicates analyte exceeds the screening criterion.
— = not analyzed or not applicable
µg/L = microgram per liter
EB = equipment blank (rinsate)
FB = field blank (source water)
FD = field duplicate
J = estimated value
N = normal (primary) sample
mg/L = milligrams per liter
mV = millivolts
QC = quality control
SSRBL = Site-Specific Risk-Based Level
TB = trip blank
U = nondetect value
[a] SSRBL applies to RHMW01, RHMW02, and RHMW03.

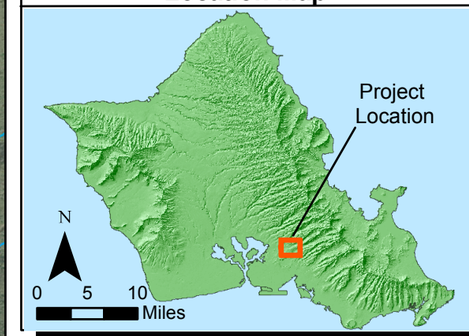
				Location	RHMW02	RHMW02
				Sample ID	ERH738	ERH739
				Collection Date	1/21/2019	1/21/2019
				Sample Type	N	FD
				FD Parent Sample	—	ERH738
Analyte	Criteria	SSRBL	Unit		Result	Result
TPH-g (C6-C10)	300	—	µg/L		**48**	**22**
TPH-d (C10-C24)	400	4500	µg/L		**2400**	**2700**
TPH-d (C10-C24) with SGC	400	—	µg/L		**420**	**430**
TPH-o (C24-C40)	500	—	µg/L		< 40.00 U	< 40.00 U
TPH-o (C24-C40) with SGC	500	—	µg/L		< 40.00 U	< 40.00 U
1-Methylnaphthalene	10	—	µg/L		**11**	**9.6**
2-Methylnaphthalene	10	—	µg/L		**8.8**	**7.2**
Naphthalene	17	—	µg/L		**32**	**26**

				Location	RHMW04
				Sample ID	ERH743
				Collection Date	1/21/2019
				Sample Type	N
Analyte	Criteria	SSRBL	Unit		Result
Xylenes	20	—	µg/L		**0.18 J**

				Location	RHMW03
				Sample ID	ERH741
				Collection Date	1/22/2019
				Sample Type	N
Analyte	Criteria	SSRBL	Unit		Result
TPH-d (C10-C24)	400	4500	µg/L		**380**
TPH-d (C10-C24) with SGC	400	—	µg/L		< 25.00 UJ
TPH-o (C24-C40)	500	—	µg/L		**310**
TPH-o (C24-C40) with SGC	500	—	µg/L		< 40.00 UJ

BWS Hālawa Shaft Well 2354-01
North Hālawa Valley
Hālawa Quarry
South Hālawa Valley
South Hālawa Stream
Navy Firing Range
Hālawa Deep Monitor Well (HDMW2253-03)
RHMW04
RHMW11
RHMW06
RHMW07
Hālawa Correctional Facility
Hālawa Industrial Park
North Hālawa Stream
H-3 Freeway
RHMW02
RHMW03
RHMW08
RHMW10
RHMW01
Oily Waste Disposal Facility
OWDFMW01
Navy Supply Well 2254-01 and RHMW2254-01
RHMW05
RHMW09
H201 Freeway
U.S. Coast Guard Housing
Red Hill Elementary School
Moanalua Hillside Apartments
Moanalua Golf Course
Moanalua Stream
Āliamanu Crater
Tripler Army Medical Center

Location Map



Legend

- Monitoring Well with Screening Criteria Exceedance(s)
- Existing Monitoring Well Location
- Existing Water Supply Well
- Red Hill Tank
- Stream
- Red Hill Installation Boundary

Notes

1. Map projection: NAD 1983 UTM Zone 4N
2. Base Map: DigitalGlobe, Inc. (DG) and NRCS. Publication_Date: 2015
3. Only analytes with detections and associated SGC data (if applicable) are shown.

ABBREVIATIONS:

FD	field duplicate sample
ID	identification
J	estimated value
N	primary (normal) sample
SGC	silica gel cleanup
SSRBL	site-specific risk based level
TPH-d	total petroleum hydrocarbon - diesel range organics
TPH-g	total petroleum hydrocarbon - gasoline range organics
TPH-o	total petroleum hydrocarbon - oil/residual organics
U	non-detect value (reported as less than the limit of detection)
µg/L	microgram per liter
1300	Exceeds screening criterion

Bold text indicates detected value.

N
0 400 800 1,600 Feet

Figure 2
COPC Detections
1st Qtr 2019 Groundwater LTM Report
Red Hill Bulk Fuel Storage Facility
JBPHH, O'ahu, Hawai'i

S:\Projects\NAVFAC PAC\CLEAN V\60571032 CTO18\F0126900-Work\920 GIS\02 Maps\LTM\2019Q1\Fig2 Detections 1stQtr2019 LTM v10.5.mxd 3/25/2019

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Location		RHMW07
Collection Date		1/23/2019
Analyte	Unit	Result
Methane	µg/L	< 1.00 U
Nitrate	mg/L	**3.6 J**
Sulfate	mg/L	**392**
Chloride	mg/L	**60.9**
Nitrogen, Nitrate-Nitrite	mg/L	**0.89**
Alkalinity, Total	mg/L	**104**
Alkalinity, Bicarbonate	mg/L	**104**
Alkalinity, Carbonate	mg/L	< 1.70 U
Ferrous Iron	mg/L	**0.40 J**
Total Organic Carbon	mg/L	< 0.96 U
DO	mg/L	**5.18**
ORP	mV	**185**

Sampling Port Depth		285.3 ft bgs
Location		RHMW11-05
Collection Date		1/28/2019
Analyte	Unit	Result
Methane	µg/L	< 1.00 U
Nitrate	mg/L	< 0.18 UJ
Sulfate	mg/L	**52.3**
Chloride	mg/L	**10.5**
Nitrogen, Nitrate-Nitrite	mg/L	< 0.100 U
Alkalinity, Total	mg/L	**114**
Alkalinity, Bicarbonate	mg/L	**114**
Alkalinity, Carbonate	mg/L	< 1.70 U
Ferrous Iron	mg/L	**0.20 J**
Total Organic Carbon	mg/L	< 1.0 U
DO	mg/L	**0.76**
ORP	mV	**76.1**

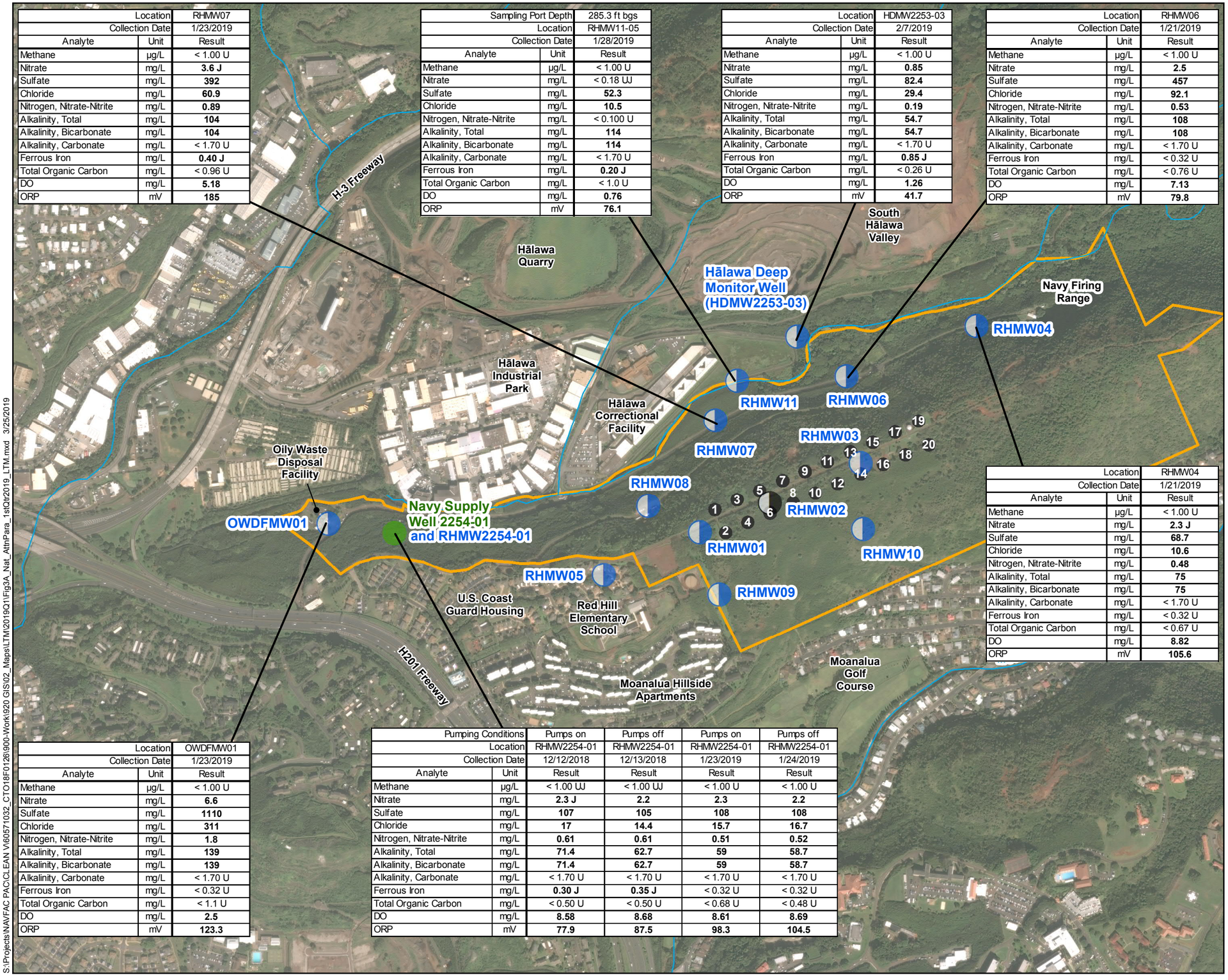
Location		HDMW2253-03
Collection Date		2/7/2019
Analyte	Unit	Result
Methane	µg/L	< 1.00 U
Nitrate	mg/L	**0.85**
Sulfate	mg/L	**82.4**
Chloride	mg/L	**29.4**
Nitrogen, Nitrate-Nitrite	mg/L	**0.19**
Alkalinity, Total	mg/L	**54.7**
Alkalinity, Bicarbonate	mg/L	**54.7**
Alkalinity, Carbonate	mg/L	< 1.70 U
Ferrous Iron	mg/L	**0.85 J**
Total Organic Carbon	mg/L	< 0.26 U
DO	mg/L	**1.26**
ORP	mV	**41.7**

Location		RHMW06
Collection Date		1/21/2019
Analyte	Unit	Result
Methane	µg/L	< 1.00 U
Nitrate	mg/L	**2.5**
Sulfate	mg/L	**457**
Chloride	mg/L	**92.1**
Nitrogen, Nitrate-Nitrite	mg/L	**0.53**
Alkalinity, Total	mg/L	**108**
Alkalinity, Bicarbonate	mg/L	**108**
Alkalinity, Carbonate	mg/L	< 1.70 U
Ferrous Iron	mg/L	< 0.32 U
Total Organic Carbon	mg/L	< 0.76 U
DO	mg/L	**7.13**
ORP	mV	**79.8**

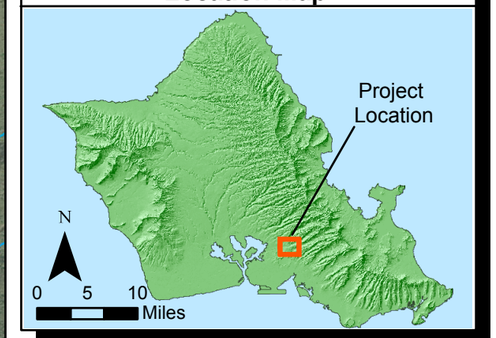
Location		RHMW04
Collection Date		1/21/2019
Analyte	Unit	Result
Methane	µg/L	< 1.00 U
Nitrate	mg/L	**2.3 J**
Sulfate	mg/L	**68.7**
Chloride	mg/L	**10.6**
Nitrogen, Nitrate-Nitrite	mg/L	**0.48**
Alkalinity, Total	mg/L	**75**
Alkalinity, Bicarbonate	mg/L	**75**
Alkalinity, Carbonate	mg/L	< 1.70 U
Ferrous Iron	mg/L	< 0.32 U
Total Organic Carbon	mg/L	< 0.67 U
DO	mg/L	**8.82**
ORP	mV	**105.6**

Location		OWDFMW01
Collection Date		1/23/2019
Analyte	Unit	Result
Methane	µg/L	< 1.00 U
Nitrate	mg/L	**6.6**
Sulfate	mg/L	**1110**
Chloride	mg/L	**311**
Nitrogen, Nitrate-Nitrite	mg/L	**1.8**
Alkalinity, Total	mg/L	**139**
Alkalinity, Bicarbonate	mg/L	**139**
Alkalinity, Carbonate	mg/L	< 1.70 U
Ferrous Iron	mg/L	< 0.32 U
Total Organic Carbon	mg/L	< 1.1 U
DO	mg/L	**2.5**
ORP	mV	**123.3**

Pumping Conditions		Pumps on	Pumps off	Pumps on	Pumps off
Location		RHMW2254-01	RHMW2254-01	RHMW2254-01	RHMW2254-01
Collection Date		12/12/2018	12/13/2018	1/23/2019	1/24/2019
Analyte	Unit	Result	Result	Result	Result
Methane	µg/L	< 1.00 UJ	< 1.00 UJ	< 1.00 U	< 1.00 U
Nitrate	mg/L	**2.3 J**	**2.2**	**2.3**	**2.2**
Sulfate	mg/L	**107**	**105**	**108**	**108**
Chloride	mg/L	**17**	**14.4**	**15.7**	**16.7**
Nitrogen, Nitrate-Nitrite	mg/L	**0.61**	**0.61**	**0.51**	**0.52**
Alkalinity, Total	mg/L	**71.4**	**62.7**	**59**	**58.7**
Alkalinity, Bicarbonate	mg/L	**71.4**	**62.7**	**59**	**58.7**
Alkalinity, Carbonate	mg/L	< 1.70 U	< 1.70 U	< 1.70 U	< 1.70 U
Ferrous Iron	mg/L	**0.30 J**	**0.35 J**	< 0.32 U	< 0.32 U
Total Organic Carbon	mg/L	< 0.50 U	< 0.50 U	< 0.68 U	< 0.48 U
DO	mg/L	**8.58**	**8.68**	**8.61**	**8.69**
ORP	mV	**77.9**	**87.5**	**98.3**	**104.5**



Location Map



Legend

- Monitoring Well with Screening Criteria Exceedance(s)
- Existing Monitoring Well Location
- Existing Water Supply Well
- Red Hill Tank
- Stream
- Red Hill Installation Boundary

Notes

1. Map projection: NAD 1983 UTM Zone 4N
2. Base Map: DigitalGlobe, Inc. (DG) and NRCS. Publication_Date: 2015

ABBREVIATIONS:

bgs	below ground surface
DO	dissolved oxygen
ft	feet
J	estimated value
mg/L	milligrams per liter
mV	millivolts
NA	not analyzed or not applicable
ORP	oxidation-reduction potential
U	non-detect value (reported as less than the limit of detection)
µg/L	microgram per liter

Bold text indicates detected value.

N

0 400 800 1,600 Feet

Figure 3A
Natural Attenuation Parameter Results
1st Qtr 2019 Groundwater LTM Report
Red Hill Bulk Fuel Storage Facility
JBPHH, O'ahu, Hawai'i

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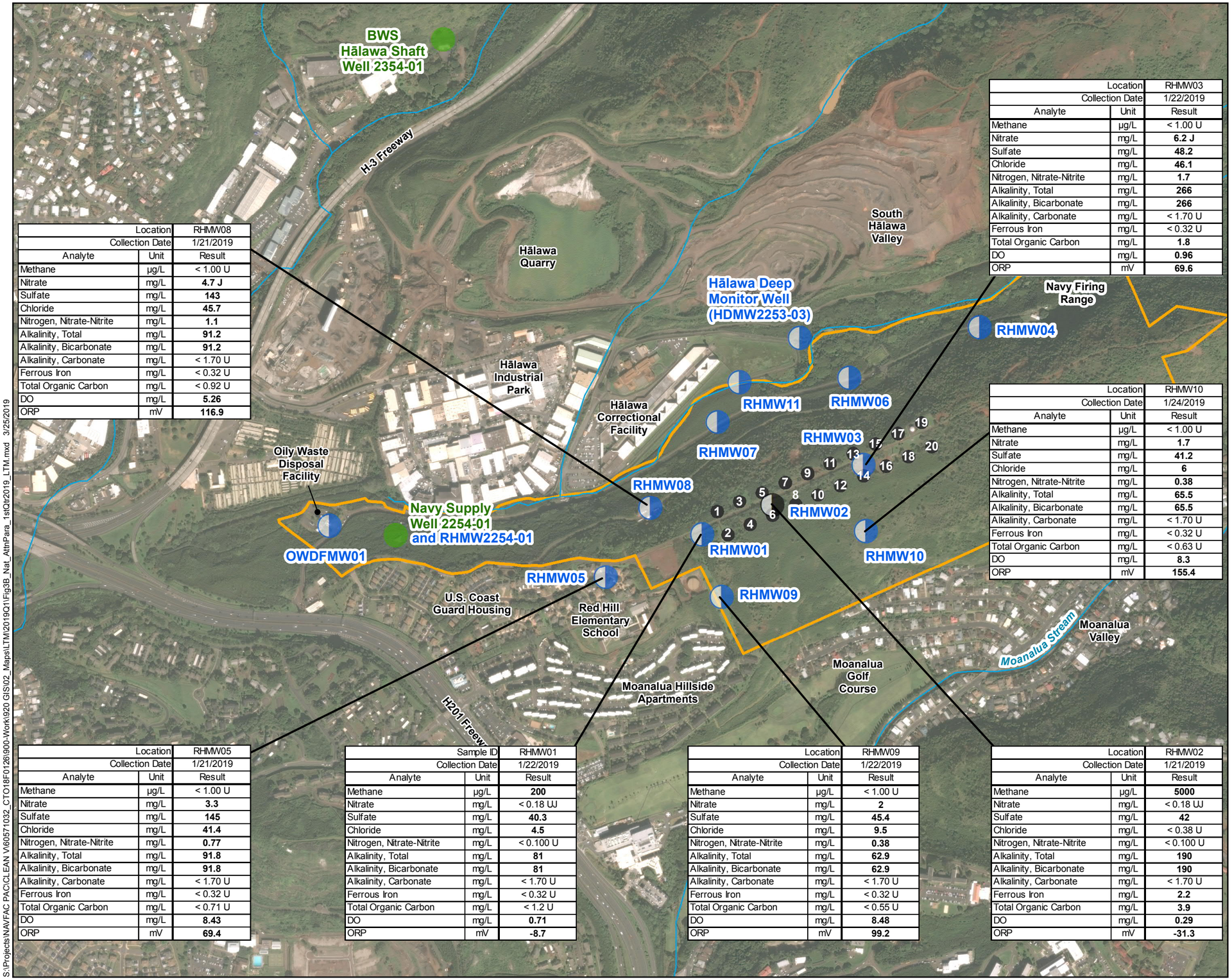


	Location	RHMW08
	Collection Date	1/21/2019
Analyte	Unit	Result
Methane	µg/L	< 1.00 U
Nitrate	mg/L	**4.7 J**
Sulfate	mg/L	**143**
Chloride	mg/L	**45.7**
Nitrogen, Nitrate-Nitrite	mg/L	**1.1**
Alkalinity, Total	mg/L	**91.2**
Alkalinity, Bicarbonate	mg/L	**91.2**
Alkalinity, Carbonate	mg/L	< 1.70 U
Ferrous Iron	mg/L	< 0.32 U
Total Organic Carbon	mg/L	< 0.92 U
DO	mg/L	**5.26**
ORP	mV	**116.9**

	Location	RHMW03
	Collection Date	1/22/2019
Analyte	Unit	Result
Methane	µg/L	< 1.00 U
Nitrate	mg/L	**6.2 J**
Sulfate	mg/L	**48.2**
Chloride	mg/L	**46.1**
Nitrogen, Nitrate-Nitrite	mg/L	**1.7**
Alkalinity, Total	mg/L	**266**
Alkalinity, Bicarbonate	mg/L	**266**
Alkalinity, Carbonate	mg/L	< 1.70 U
Ferrous Iron	mg/L	< 0.32 U
Total Organic Carbon	mg/L	**1.8**
DO	mg/L	**0.96**
ORP	mV	**69.6**

	Location	RHMW10
	Collection Date	1/24/2019
Analyte	Unit	Result
Methane	µg/L	< 1.00 U
Nitrate	mg/L	**1.7**
Sulfate	mg/L	**41.2**
Chloride	mg/L	**6**
Nitrogen, Nitrate-Nitrite	mg/L	**0.38**
Alkalinity, Total	mg/L	**65.5**
Alkalinity, Bicarbonate	mg/L	**65.5**
Alkalinity, Carbonate	mg/L	< 1.70 U
Ferrous Iron	mg/L	< 0.32 U
Total Organic Carbon	mg/L	< 0.63 U
DO	mg/L	**8.3**
ORP	mV	**155.4**

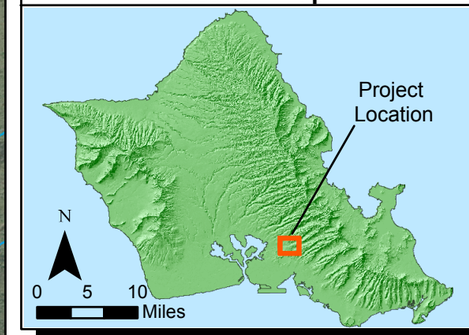
	Location	RHMW05
	Collection Date	1/21/2019
Analyte	Unit	Result
Methane	µg/L	< 1.00 U
Nitrate	mg/L	**3.3**
Sulfate	mg/L	**145**
Chloride	mg/L	**41.4**
Nitrogen, Nitrate-Nitrite	mg/L	**0.77**
Alkalinity, Total	mg/L	**91.8**
Alkalinity, Bicarbonate	mg/L	**91.8**
Alkalinity, Carbonate	mg/L	< 1.70 U
Ferrous Iron	mg/L	< 0.32 U
Total Organic Carbon	mg/L	< 0.71 U
DO	mg/L	**8.43**
ORP	mV	**69.4**

	Sample ID	RHMW01
	Collection Date	1/22/2019
Analyte	Unit	Result
Methane	µg/L	**200**
Nitrate	mg/L	< 0.18 UJ
Sulfate	mg/L	**40.3**
Chloride	mg/L	**4.5**
Nitrogen, Nitrate-Nitrite	mg/L	< 0.100 U
Alkalinity, Total	mg/L	**81**
Alkalinity, Bicarbonate	mg/L	**81**
Alkalinity, Carbonate	mg/L	< 1.70 U
Ferrous Iron	mg/L	< 0.32 U
Total Organic Carbon	mg/L	< 1.2 U
DO	mg/L	**0.71**
ORP	mV	**-8.7**

	Location	RHMW09
	Collection Date	1/22/2019
Analyte	Unit	Result
Methane	µg/L	< 1.00 U
Nitrate	mg/L	**2**
Sulfate	mg/L	**45.4**
Chloride	mg/L	**9.5**
Nitrogen, Nitrate-Nitrite	mg/L	**0.38**
Alkalinity, Total	mg/L	**62.9**
Alkalinity, Bicarbonate	mg/L	**62.9**
Alkalinity, Carbonate	mg/L	< 1.70 U
Ferrous Iron	mg/L	< 0.32 U
Total Organic Carbon	mg/L	< 0.55 U
DO	mg/L	**8.48**
ORP	mV	**99.2**

	Location	RHMW02
	Collection Date	1/21/2019
Analyte	Unit	Result
Methane	µg/L	**5000**
Nitrate	mg/L	< 0.18 UJ
Sulfate	mg/L	**42**
Chloride	mg/L	< 0.38 U
Nitrogen, Nitrate-Nitrite	mg/L	< 0.100 U
Alkalinity, Total	mg/L	**190**
Alkalinity, Bicarbonate	mg/L	**190**
Alkalinity, Carbonate	mg/L	< 1.70 U
Ferrous Iron	mg/L	**2.2**
Total Organic Carbon	mg/L	**3.9**
DO	mg/L	**0.29**
ORP	mV	**-31.3**

Location Map



Legend

- Monitoring Well with Screening Criteria Exceedance(s)
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Notes

1. Map projection: NAD 1983 UTM Zone 4N
2. Base Map: DigitalGlobe, Inc. (DG) and NRCS. Publication_Date: 2015

ABBREVIATIONS:

bgs	below ground surface
DO	dissolved oxygen
ft	feet
J	estimated value
mg/L	milligrams per liter
mV	millivolts
NA	not analyzed or not applicable
ORP	oxidation-reduction potential
U	non-detect value (reported as less than the limit of detection)
µg/L	microgram per liter

Bold text indicates detected value.

N

0 400 800 1,600 Feet

Figure 3B
Natural Attenuation Parameter Results
1st Qtr 2019 Groundwater LTM Report
Red Hill Bulk Fuel Storage Facility
JBPHH, O'ahu, Hawai'i

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Analytical results for the December 2018 monthly sampling event and First Quarter 2019 (January–February) groundwater monitoring event are summarized as follows:

- *RHMW2254-01 (pumps on and pumps off, primary and duplicate), RHMW01, RHMW05, RHMW06, RHMW07, RHMW08, RHMW09, RHMW10, RHMW11-05, and HDMW2253-03:* No COPCs were detected.
- *RHMW02 (primary and duplicate):* TPH-d (2,400 and 2,700 µg/L), 1-methylnaphthalene (11 and 9.6 µg/L), 2-methylnaphthalene (8.8 and 7.2 µg/L), and naphthalene (32 and 26 µg/L) were detected at concentrations exceeding the respective screening criteria (400, 10, 10, and 17 µg/L). The concentrations of TPH-d did not exceed the SSRBL of 4,500 µg/L. TPH-d was also detected in the TPH-d with SGC analysis at concentrations of 420 and 430 µg/L. Additional discussion of SGC TPH is presented in Section 4.1.8. TPH-g (48 and 22 µg/L) was detected at concentrations below the screening criterion (300 µg/L).
- *RHMW03:* TPH-d (380 µg/L) and TPH-o (310 µg/L) were detected at concentrations below the respective screening criteria (400 and 500 µg/L). SGC TPH-d and SGC TPH-o were non-detect.
- *RHMW04:* Total xylenes (0.18 J µg/L) were detected at concentrations below the screening criterion (20 µg/L).

A slight organic odor was observed during sampling of RHMW02; however, PID readings at the wellhead were 0.0 ppm for the duration of the sampling. The odor was not observed as petroleum-like. No visible sheen or color was observed from the groundwater collected from RHMW02 for the duration of the sampling. Analysis of the groundwater samples yielded COPC detections exceeding the screening criteria for TPH-d, 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene, and detections below the screening criterion for TPH-g, indicating that the odor may have been a hydrocarbon.

A slight organic odor was observed during sampling of RHMW11-05 after approximately 8 liters of groundwater had been collected from the formation. The odor was not observed as petroleum-like. The PID readings at the wellhead were 0.0 ppm for the duration of the sampling. No visible sheen or color was observed from the groundwater collected from RHMW11-05.

3.3 GROUNDWATER CONTAMINANT CONCENTRATIONS

A table of cumulative historical groundwater results is included as Appendix A.1. The historical groundwater COPC concentrations for TPH-g, TPH-d, TPH-o, BTEX, 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene are illustrated in Appendix A.2. NAP measurements starting from the Fourth Quarter 2016 event are illustrated in Appendix A.3.1. The only detections of lead scavengers and other fuel additives in groundwater samples were below-screening-criteria concentrations of 1,2-dichloroethane from April 2015 to January 2016 at OWDFMW01 and phenol (one detection) during a December 2016 sampling event at RHMW09. No graphs were created for analytes that are no longer included as COPCs for the Red Hill groundwater LTM program.

3.4 DATA VALIDATION AND ASSESSMENT

The analytical laboratory data for the December 2018 monthly sampling event and First Quarter 2019 groundwater monitoring event were submitted to a third-party data validator (Laboratory Data Consultants, Inc.) for data validation and assessment. Analytical data from monitoring events from 2005 to Third Quarter 2016 underwent a limited data verification for all events where a third-party data validation was not performed (DON 2018a). Analytical data from Fourth Quarter 2016 onward were validated by a third-party data validator.

The objective of data validation is to provide data of known quality for project decisions. Data quality is judged in terms of precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS). Data validation is performed in accordance with the data validation procedures in the NAVFAC Pacific Environmental Restoration Program *Project Procedures Manual* (DON 2015b), and consistent with the protocol in the DoD *Quality Systems Manual (QSM) for Environmental Laboratories* Version 5.1 (DoD and DOE 2017) as presented in the SAP and addenda (DON 2017b, 2017c, 2017d, 2018f). A number of factors may affect the quality of data, including sample collection methods, sample analysis methods, and adherence to established procedures for sample collection, preservation, management, shipment, and analysis. Data validation reports are presented in Appendix C.2.

Precision

Precision is defined as the reproducibility of replicate measurements. Precision is evaluated by the relative percent difference (RPD) of field duplicates, LCS/LCSD, and MS/MSD results. Field duplicate and MS/MSD samples were collected at a rate of approximately 10% of primary samples. Field duplicates were sent to the laboratory along with the primary samples. Primary and field duplicate RPDs are presented in Table 3-3. When COPCs were not detected in the primary and field duplicate samples, no RPDs could be calculated.

Table 3-3: Field Duplicate COPC RPDs

Sampling Location	Analyte	Screening Criterion (µg/L)	Sample ID	Concentration (µg/L)	RPD [a]
RHMW02	TPH-g	300	ERH738	48	74%
			ERH739	22	
	TPH-d	400	ERH738	2,400	12%
			ERH739	2,700	
	TPH-d w/ SGC	400	ERH738	420	2%
			ERH739	430	
	1-Methylnaphthalene	10	ERH738	11	14%
			ERH739	9.6	
	2-Methylnaphthalene	10	ERH738	8.8	20%
			ERH739	7.2	
	Naphthalene	17	ERH738	32	21%
			ERH739	26	

[a] Field duplicate RPD measurement performance criterion for groundwater is 50% in accordance with criteria presented in Table 5-1 of the SAP (DON 2017b, 2018c) and Table 3-2 of the SAP addenda (DON 2017d, 2018g).

All primary and field duplicate samples RPDs were within the 50% measurement performance criteria (MPC) (Table 3-3) except for the TPH-g RPD of 74%. The data were not qualified based on the field duplicate imprecision. No other COPCs besides those listed in Table 3-3 were detected in the primary and field duplicate samples collected during the December 2018 monthly sampling event and First Quarter 2019 groundwater monitoring event.

LCS/LCSD RPDs exceeded the 20% criterion (see criteria in SAP Appendix D [DON 2017b, 2018c] and SAP addenda Appendix C [DON 2017d, 2018g]) for 2-(2-methoxyethoxy)-ethanol for 14 groundwater samples and TPH-g for one groundwater sample, with results qualified as non-detect estimated (UJ).

Methane results for the RHMW2254-01 (pumps on and off, December 2018 monthly sampling event) groundwater samples were flagged as non-detect estimated (UJ) due to the initial calibration relative standard deviation (%RSD) slightly above acceptance criteria.

No other precision concerns were identified during validation of sample results. Data usability of the samples is discussed in Section 3.5.

Accuracy

Accuracy is defined as the degree of conformity of a measurement to a standard or true value. Accuracy is evaluated through measurement of the percent recovery (%R) of an analyte in a reference standard or spiked sample. Accuracy limits for surrogates, LCS, MS, and MSD samples are either prescribed by the DoD or established by the individual laboratory. The acceptance criteria for accuracy are dependent on the analytical method and based on historical laboratory or DoD data.

Five toluene results for groundwater samples from RHMW2254-01 (pumps on, primary and duplicate samples, First Quarter 2019 groundwater monitoring event), RHMW01, RHMW03, and RHMW07 were flagged as non-detect estimated (UJ) due to slight low LCS %Rs, indicating possible low bias.

One toluene result for a groundwater sample from RHMW2254-01 (pumps on, First Quarter 2019 groundwater monitoring event) was also flagged as non-detect estimated (UJ) due to low MS and MSD %Rs, indicating possible low bias.

The TPH-g result for the HDMW2253-03 groundwater sample was flagged non-detect estimated (UJ) due the LCS %R exceeding acceptance criteria, indicating possible high bias.

The TPH-g result for the HDMW2253-03 groundwater sample was also flagged non-detect estimated (UJ) due to the continuing calibration %D exceeding acceptance criteria, indicating possible high bias.

BTEX results for groundwater samples from RHMW02 (primary and duplicate), RHMW09, and OWDFMW01 were flagged as non-detect estimated (UJ) due to one surrogate %R below acceptance criteria, indicating possible low bias.

TPH-d, SGC TPH-d, TPH-o, and SGC TPH-o results for a groundwater sample from RHMW2254-01 (pumps on, primary sample, December 2018 monthly sampling event) were flagged as non-detect estimated (UJ) due to one surrogate %R below acceptance criteria, indicating possible low bias.

No other accuracy concerns identified during validation affected sample results. Data usability is discussed in Section 3.5.

Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness was achieved by conducting sampling in accordance with the sample collection procedures described in the AOC Statement of Work Sections 6 and 7 WP/SOW (DON 2017a) and the SAP (DON 2017b, 2017c, 2017d), including standardized sample collection methods identified in NAVFAC Pacific Environmental Restoration Program Project Procedure I-C-3, *Monitoring Well Sampling* (DON 2015b).

Representativeness is also evaluated through compliance with the method-recommended sample holding time and sample preservation methods, and through the analysis of blank samples, including

method blank, equipment blank, field blank, and trip blank samples. All sample holding times and sample preservation were evaluated in accordance with EPA SW-846 method recommendations and DoD QSM Version 5.1 (DoD and DOE 2017).

All samples were associated with a trip blank and laboratory blanks. Field and equipment blanks were collected and analyzed to demonstrate field equipment decontamination efficiency. No analytes were detected in the trip blanks, field blanks, and equipment blanks.

One (1) TIC (dimethyl ester pentanedioic acid), sulfate, and TOC were detected in the laboratory method blanks. The dimethyl ester pentanedioic acid result in RHMW10, the sulfate result in RHMW02, and the TOC results for RHMW2254-01 (pumps on and off, First Quarter 2019 event), RHMW01, RHMW04 through RHMW11-05, HDMW2253-03, and OWDFMW01 groundwater samples were qualified as non-detect (U) due to laboratory method blank contamination.

Eight (8) nitrate samples (RHMW2254-01 [pumps on, December 2018 monthly sampling event], RHMW01 through RHWM04, RHMW07, RHMW08, and RHMW11-05) were analyzed beyond the method-recommended 48-hour holding time. These samples were analyzed between 49 and 77 hours from sample collection. All eight (8) results were qualified as estimated (J) or non-detect estimated (UJ) due to exceedance of the recommended holding time, possibly causing a low bias attributable to possible analyte loss. None of the sample results were rejected as none of the non-detect results exceeded the method-recommended 48-hour holding time by a factor of 2. All samples were also analyzed for nitrate-nitrite as nitrogen, which can be used to confirm the nitrate results. Nitrate was recovered between 81% and 119% of the calculated equivalent nitrate concentration based on nitrate-nitrite as nitrogen results (Table 3-4). The nitrate results for RHMW2254-01 and RHMW03 recovered below 90% of the calculated equivalent nitrate concentration, indicating possible low bias.

The representativeness of the data is considered acceptable after qualification for recommended holding time. Data usability is discussed in Section 3.5.

Completeness

Completeness is defined as the overall percentage of valid analytical results (including estimated results) compared to the total number of analytical results reported by the analytical laboratory.

Of the 617 results reported, none were rejected. The completeness of the data (100%) met the 90% completeness goal.

Comparability

Comparability expresses the confidence with which one data set can be compared to another data set. Comparability can be related to accuracy and precision because these quantities are measures of data reliability. Data with acceptable precision and accuracy are considered comparable if collection techniques, analytical procedures, methods, and reporting are equivalent.

Samples collected from 2005 through the current monitoring event have been analyzed by multiple laboratories (Table 1-3). Data comparability is complicated by differences in analytical methods and extraction and analysis protocols used. For example, TPH-g and naphthalene have been reported using different EPA methods (either or both EPA 8260 and EPA 8270 SIM), and TPH-d and TPH-o have been reported using the same method (EPA 8015) but with differing carbon ranges over time (e.g., C10–C28, C10–C24 for reporting TPH-d) and different extraction methods (i.e., separatory funnel liquid-liquid extraction [EPA 3510] versus continuous liquid-liquid extraction [EPA 3520]) yielding different TPH concentrations.

Table 3-4: Nitrate Result Confirmation

Location	Sample ID	Nitrate Result (mg/L)	Nitrate-Nitrite as Nitrogen Result (mg/L)	Calculated Equivalent Nitrate Concentration Based on Nitrate-Nitrite as Nitrogen Result (mg/L) [a]	%R
RHMW2254-01 [b]	ERH719	2.3 J	0.61	2.7023	85%
RHMW2254-01	ERH722	2.2	0.61	2.7023	81%
RHMW2254-01	ERH730	2.3	0.51	2.2593	102%
RHMW2254-01	ERH733	2.2	0.52	2.3036	96%
RHMW01 [b]	ERH736	< 0.18 UJ	< 0.100 U	— [c]	— [c]
RHMW02 [b]	ERH738	< 0.18 UJ	< 0.100 U	— [c]	— [c]
RHMW03 [b]	ERH741	6.2 J	1.7	7.531	82%
RHMW04 [b]	ERH743	2.3 J	0.48	2.1264	108%
RHMW05	ERH745	3.3	0.77	3.4111	97%
RHMW06	ERH747	2.5	0.53	2.3479	106%
RHMW07 [b]	ERH749	3.6 J	0.89	3.9427	91%
RHMW08 [b]	ERH751	4.7 J	1.1	4.873	96%
RHMW09	ERH753	2.0	0.38	1.6834	119%
RHMW10	ERH755	1.7	0.38	1.6834	101%
RHMW11-05 [b]	ERH764	< 0.18 UJ	< 0.100 U	— [c]	— [c]
HDMW2253-03	ERH759	0.85	0.19	0.8417	101%
OWDFMW01	ERH757	6.6	1.8	7.974	83%

— not calculable
J estimated value
U non-detect value
[a] Nitrate-nitrite as nitrogen result converted to nitrate by multiplying nitrate-nitrite as nitrogen result by a factor of 4.43 (CalEPA 2011).
[b] Groundwater samples from these locations were extracted outside of the holding time for nitrate analysis.
[c] No equivalent nitrate concentration or %R was calculated due to the nitrate or nitrate-nitrate results reported as non-detect(s).

Current analytical methods used are aimed to have laboratory limits lower than the current screening criteria. Starting from the Fourth Quarter 2016 event, analytical method DLs, LODs, and LOQs have been lower for most analytes than they had been during previous events. The method used to analyze TPH-g was changed from EPA Method 8015 to EPA Method 8260 beginning with the Third Quarter 2018 sampling event to improve sensitivity. The improved reporting limits should be considered when results are compared to data from previous events. An evaluation of data reported between laboratories is presented in the *Conceptual Site Model* (CSM) report (DON 2018h) as part of the AOC Statement of Work Sections 6 and 7 investigation.

The laboratory used standard analytical methods for all analyses. In all cases, the DLs and LODs attained were below the specified LOQs. Target analytes detected below the LOQs flagged (J) by the laboratory should be considered estimated.

Sensitivity

The LOQs are established by the laboratory based on the LODs or instrument DLs, historical data, and limits established for the various methods. The LOQs and LODs for samples may require adjustment by the laboratory due to matrix interference, or if high levels of target analytes necessitate dilution

before analysis. Matrix interference and sample dilutions decrease sensitivity and increase the LOQs/LODs. No results in this data set had increased LOQs or LODs that impacted sensitivity and data usability.

3.5 DATA ASSESSMENT AND USABILITY CONCLUSIONS

The PARCCS criteria were evaluated, and with some exceptions the criteria were met. Results associated with QC data that failed acceptance criteria are discussed in detail in Section 3.4. Data quality issues that need to be taken into account for project decisions are summarized below.

The LCS/LCSD RPD exceedances associated with 2-(2-methoxyethoxy)-ethanol (RHMW2254-01 [pumps on and off, primary and duplicate, First Quarter 2019 event], RHMW01 through RHMW04, RHMW07 through RHMW10, HDMW2253-03, and OWDFMW01) and TPH-g (HDMW2253-03) indicate indeterminate bias. The methane initial calibration %RSD exceedance associated with the RHMW2254-01 (pumps on and off, December 2018 monthly sampling event) groundwater samples also indicates indeterminate bias. However, the above-mentioned results are non-detect, similar to all associated previous results for 2-(2-methoxyethoxy)-ethanol and methane, thus the results are likely not affected by possible bias.

The low LCS/LCSD %Rs associated with toluene results from RHMW2254-01 (pumps on, First Quarter 2019 event), RHMW01, RHMW03, and RHMW07 groundwater samples, and the low MS and MSD %Rs for the RHMW2254-01 result (pumps on, First Quarter 2019 event) both indicate possible low bias. Comparison of the toluene results to previous events show that the concentrations are consistent among events, and that the bias is likely not affecting the sample results.

The high LCS %R and high CCV %D associated TPH-g result for HDMW2253-03 indicate possible high bias. However, as the TPH-g result was non-detect, the result is not affected by the high bias.

The low surrogate %Rs for BTEX (RHMW02 [primary and duplicate], RHMW09, and OWDFMW01) and for TPH-d, SGC TPH-d, TPH-o, and SGC TPH-o (RHMW2254-01 [pumps on, primary sample, December 2018 event]) groundwater samples indicate possible low bias. Comparison of the BTEX and TPH results to recent previous events show that the concentrations are consistent among events, and that the bias is likely not affecting the sample results.

The presence of one TIC (dimethyl ester pentanedioic acid), sulfate, and TOC in the laboratory method blanks resulted in the following groundwater sample results being qualified as non-detect (U): the dimethyl ester pentanedioic acid result in RHMW10, the sulfate result in RHMW02, and the TOC results for RHMW2254-01 (pumps on and pumps off, First Quarter 2019 event), RHMW01, RHMW04 through RHMW11-05, HDMW2253-03, and OWDFMW01. The contamination does not present a significant impact, as the TIC detection did not correspond with petroleum hydrocarbons, and previous sulfate and TOC results for these well locations were similar to previous events.

The holding time exceedances for nitrate results in RHMW2254-01 (pumps on, December 2018 event), RHMW01 through RHWM04, RHMW07, RHMW08, and RHMW11-05 may indicate possible low bias. None of the samples were analyzed outside of the holding time by a factor of 2. Comparison of the nitrate and nitrate-nitrate as N results (Table 3-4) for these samples indicate that results were not biased low based on the calculated equivalent nitrate results within 10% of the reported nitrate results except for the nitrate results for RHMW2254-01 and RHMW03, which recovered below 90% of the calculate equivalent nitrate concentration, indicating possible low bias. Nonetheless, comparison of the RHW2254-01 and RHMW03 results to previous events (Appendix A.3.1) shows that the affected results are within historical values for these locations.

The third-party data assessment (Appendix C.2) concludes that all data generated during the monitoring events reported herein are usable for the intended purpose, with the limitations described above.

4. Natural Attenuation Evaluation

The natural attenuation evaluation uses the following lines of evidence:

- The use of historical groundwater primary indicators (COPC data) to demonstrate contaminant concentration over time.
- The use of secondary indicators (hydrogeologic and geochemical data) can demonstrate that natural attenuation processes are active at the site, and the rate at which such processes will reduce contaminant concentration to screening levels.
- The analysis of TPH-d and TPH-o with and without SGC can be used to evaluate the fraction of polar-weathered hydrocarbons and total recoverable hydrocarbons.

Two objectives for analyzing NAPs are to assess whether natural attenuation is occurring on site, and whether there is the potential for natural attenuation to reduce the concentrations of petroleum-related constituents in groundwater. Secondary lines of evidence for natural attenuation are based on additional information collected during the groundwater monitoring events and include DO, ORP, pH, specific conductance, dissolved ferrous iron, methane, nitrate, and sulfate.

Fuel hydrocarbons can be biodegraded by microorganisms in the subsurface under aerobic or anaerobic conditions. Biodegradation is the result of microbial-mediated redox reactions in which coupling of oxidation of an electron donor and reduction of an electron acceptor occurs.

Biodegradation of fuel hydrocarbons causes changes to the groundwater geochemistry. During aerobic biodegradation of hydrocarbons, DO concentrations are depleted as aerobic respiration occurs because DO is the most thermodynamically favored electron acceptor used in biodegradation. ORP is a measure of electron activity and an indicator of the relative tendency of a solute species to gain or lose electrons. Higher ORP measurements suggest aerobic respiration is occurring.

In anaerobic respiration, potential electron acceptors include nitrate, ferric iron, sulfate, and carbon dioxide. Use of the electron acceptors proceeds along a natural succession in the order listed above because of decreasing energetic efficiency (Leeson et al. 2004). Nitrate is the most thermodynamically favored electron acceptor of the anaerobic pathways, biodegrading to nitrite (followed by nitrogen gas) and carbon dioxide. Ferric iron in soil can be consumed by anaerobic biodegradation when both DO and nitrate have been depleted in anaerobic groundwater, yielding dissolved ferrous iron in groundwater. Sulfate can be consumed by anaerobic degradation after DO, nitrate, and ferric iron are depleted, yielding precipitated iron sulfides. Lower concentrations of sulfate in groundwater compared to background levels indicate that sulfate reduction is an ongoing biological process for petroleum hydrocarbon degradation within plume areas. When all the soluble electron acceptors (i.e., DO, nitrate, ferric iron, and sulfate) are depleted, groundwater conditions become conducive to fermentation and methane is generated by methanogenesis.

Alkalinity is a general indicator of the buffering capacity of an aquifer system against pH changes due to attenuation processes in the groundwater. Alkalinity is used in conjunction with pH measurements to determine if the groundwater is sufficient to neutralize metabolic acids produced by biodegradation. Production of carbon dioxide during biodegradation causes carbonate minerals to dissolve, increasing alkalinity concentrations in the groundwater.

Both aerobic and anaerobic biodegradation may be occurring at the site. COPCs such as naphthalene are known to degrade both aerobically and anaerobically, and geochemical parameters indicative of biodegradation may vary with location and with time (Wiedemeier et al. 1999).

The field water quality data parameters for the December 2018 monthly sampling event and First Quarter 2019 groundwater monitoring event are included in the field sampling logs (Appendix B.1). Table 3-2 and Figure 3A and Figure 3B summarize DO, ORP, and other NAPs. Graphs of the DO, ORP, and NAP results are presented in Appendix A.3.

Unweathered petroleum contains hydrocarbons (non-polar) that, when weathered in the environment, create polar compounds as byproducts of biological sources and processes. SGC is commonly used to separate polar from nonpolar compounds. Polar compounds will preferentially adsorb to silica, while non-polar compounds will not. DOH TGM Section 9.3.1.2, Total Petroleum Hydrocarbons, discusses the use of SGC to separate out the polar TPH fraction and compare the remaining non-polar TPH fraction to the screening criteria: "*Comparison of data for groundwater samples tested with and without silica gel cleanup could be useful for assessing the state of natural biodegradation within a plume of petroleum-contaminated groundwater and optimizing remedial and monitoring actions*" (DOH 2017b). Analysis of SGC TPH-d or SGC TPH-o was performed on samples with detected concentrations of TPH-d or TPH-o without SGC.

Table 4-1 presents a comparison of TPH-d and TPH-o concentrations without and with SGC for RHMW01, RHMW02, and RHMW03 from the Fourth Quarter 2016 monitoring event onward.

4.1 EVALUATION USING NATURAL ATTENUATION PARAMETERS

NAPs were collected during the groundwater monitoring field activities and include DO and oxidation reduction potential (ORP), nitrate, ferrous iron, methane, sulfate, and chloride. These parameters indicate the conditions under which natural attenuation is likely occurring.

4.1.1 Dissolved Oxygen and Oxidation Reduction Potential

DO and ORP concentrations for the December 2018 monthly sampling event and First Quarter 2019 groundwater monitoring event were generally consistent with previous measurements. The background (RHMW04) DO measurement for the First Quarter 2019 monitoring event was 8.82 mg/L. Similar to previous events, the monitoring locations with COPC detections (RHMW01, RHMW02, and RHMW03) still had depressed DO measurements (0.29–0.96 mg/L) and low or negative ORP values (-31.3–69.6 millivolts [mV]).

In RHMW01 and RHMW02, the depleted DO in conjunction with the presence of dissolved-phase COPCs and other NAP results such as the dissolved methane concentrations (200 and 5,000 µg/L, respectively) indicate that both aerobic and anaerobic respirations are likely occurring. The presence of dissolved-phase COPCs and the DO depletion at RHMW03 are indicative of aerobic biodegradation, but the absence of methane indicates that methanogenesis is likely not occurring.

RHMW11-05 also had depressed DO measurements similar to values historically seen at HDMW2253-03, the monitoring well on the same side of South Hālawa Stream. Based on the NAP measurements at RHMW11-01 through RHMW11-05 from the First Quarter 2018 through Fourth Quarter 2018 monitoring events, the very low DO and negative ORP values are baseline for these multilevel well monitoring zones and are not related to attenuation of the COPCs.

Table 4-1: Comparison of TPH Concentrations without and with Silica Gel Cleanup

Monitoring Well	Monitoring Event [a]	TPH-d (µg/L)	TPH-d w/ SGC (µg/L)	TPH-o (µg/L)	TPH-o w/ SGC (µg/L)
RHMW01	4th Qtr 2018	170 J	67 J	< 40 UJ	< 40 UJ
	3rd Qtr 2018	350	< 25 U	< 40 U	< 40 U
	1st Qtr 2018	150	< 25 U	< 40 U	< 40 U
	4th Qtr 2017 [b]	86	< 25 U	< 40 U	< 40 U
	3rd Qtr 2017	110	< 25 U	67	< 40 U
	Jun 2017	98	36	< 40 U	< 40 U
	May 2017	110	< 51 U [c]	< 40 U	< 40 U
	4th Qtr (Oct) 2016	120	< 25 U	< 40 U	< 40 U
RHMW02	1st Qtr 2019 [b]	**2,700**	**430**	< 40 U	< 40 U
	4th Qtr 2018 [b]	**2,100 J**	**430 J**	< 40 UJ	< 40 UJ
	3rd Qtr 2018 [b]	**2,100**	**580**	< 40 U	< 40 U
	2nd Qtr 2018 [b]	**2,800**	**510**	< 40 U	< 40 U
	1st Qtr 2018 [b]	**1,900**	**640**	< 40 U	< 40 U
	4th Qtr 2017 [b]	**1,600**	230	< 40 U	< 40 U
	3rd Qtr 2017	**1,000**	250	< 40 U	< 40 U
	Jun 2017	**1,000**	**570**	< 40 U	< 40 U
	May 2017	**1,000**	**< 480** U [c]	< 40 U	< 40 U
	4th Qtr (Oct) 2016	**1,300 J**	300	< 40 U	< 40 U
RHMW03	1st Qtr 2018	380	< 25 U	310	< 40 U
	4th Qtr 2018	220 J	< 25 UJ	190 J	< 40 UJ
	3rd Qtr 2018	300	< 25 U	140	< 40 U
	2nd Qtr 2018	160	< 25 U	110	< 40 U
	1st Qtr 2018	190	< 25 U	180	< 40 U
	4th Qtr 2017 [b]	210	< 25 U	200	< 40 U
	3rd Qtr 2017	49	< 25 U	46	< 40 U
	Jun 2017	46	50	36 J	34
	May 2017	50	< 25 U	46	< 40 U
	4th Qtr (Oct) 2016	65	< 25 U	59	< 40 U

Bold text indicates concentrations exceeding the TPH-d screening criterion of 400 µg/L.
[a] Table presents only monitoring events during which TPH with SGC is analyzed.
[b] Concentrations presented are the maximum detected concentrations of the primary and field duplicate samples.
[c] Result was flagged as non-detect during data validation due to laboratory method blank contamination.

4.1.2 Nitrate

Of the known anaerobic pathways for hydrocarbons biodegradation, nitrate is the most thermodynamically favored electron acceptor; decreased nitrate concentrations indicate that anaerobic respiration may be occurring. For the First Quarter 2019 monitoring event, RHMW01, RHMW02, HDMW2253-03, and RHMW11-05 had non-detect or very low nitrate concentrations. These results are in line with previously measured nitrate concentrations at these locations. The low nitrate results in RHMW01 and RHMW02 in conjunction with the DO and ORP measurements suggest that anaerobic respiration is likely occurring at these two wells. Based on the NAP measurements at RHMW11-05 from the First Quarter 2018 through First Quarter 2019 monitoring events, the very low or non-detect nitrate concentrations are baseline for this location and not related to attenuation of the COPCs.

The remaining wells had nitrate at concentrations that were similar to or greater than the historical background nitrate levels. Evaluation of the nitrate results at these wells, in conjunction with the DO and ORP results, suggests that attenuation is likely not occurring (for wells that show no TPH detections) or that aerobic conditions are likely occurring, such as at RHMW03 where DO was lower than background but nitrate was higher than background.

4.1.3 Ferrous Iron

Bacteria will typically break down ferric iron in soil once oxygen is depleted, which causes ferrous iron to be detected in groundwater. Elevated levels of ferrous iron indicate that the groundwater environment can sustain iron reduction for anaerobic respiration. Ferrous iron was detected in RHMW2254-01 groundwater samples (0.30 J and 0.35 J µg/L) during the December 2018 monthly event in pumps on and pumps off conditions and in four monitoring locations during the First Quarter 2019 monitoring event: RHMW02 (2.2 mg/L), RHMW07 (0.40 J mg/L), RHMW11-05 (0.20 J mg/L), and HDMW2253-03 (0.85 J mg/L). When compared to the other monitoring locations and evaluated with other NAPs discussed above, the ferrous iron results for RHMW02 also suggest that anaerobic biodegradation is likely occurring at these wells. Though ferrous iron was detected in the other four monitoring locations, the other NAP results do not indicate anaerobic biodegradation at those locations.

4.1.4 Methane

An additional line of evidence for biological degradation of petroleum hydrocarbons includes the presence of methane, a reaction byproduct of fermentative biological reactions. Methane was again detected in the samples from RHMW01 and RHMW02 at concentrations of 200 µg/L and 5,000 µg/L, respectively. These methane concentrations suggest that methanogenic biodegradation is occurring in these wells. Methane was not detected in any of the other monitoring locations.

4.1.5 Sulfate

Sulfate is usually consumed by bacteria only when DO, nitrate, and ferric iron have been depleted. Concentrations of sulfate lower than background concentrations, when evaluated in conjunction with depressed DO and nitrate concentrations, suggest that anaerobic activity is occurring. The concentrations of sulfate in groundwater at RHMW01 and RHMW02 were 4.5 mg/L and non-detect (< 0.38 U mg/L), respectively, which are much lower than the background sulfate concentrations in RHMW04 (10.6 mg/L). The sulfate results in RHMW01 and RHMW02 suggest that anaerobic activity is likely actively occurring there.

The RHMW09, RHMW10, and RHMW11-05 sulfate concentrations were less than the background (RHMW04) sulfate concentration. Based on the consistently low historical sulfate concentrations, lack of TPH detections, and lack of other NAP results indicative of biodegradation, the lower-than-background sulfate concentrations at these monitoring locations were likely within the normal range for the locations.

4.1.6 Chloride

Chloride is a general water quality parameter. Elevated levels of chloride in the aquifer may indicate that anaerobic dechlorination of organochlorines is occurring. However, background concentrations of chloride in the aquifer can obscure the input of chloride into an aquifer from anaerobic dechlorination. Additionally, elevated chloride levels can also inhibit certain microbial activity. As such, chloride is generally considered as an indicator parameter only.

Chloride concentrations at RHMW01, RHMW02, RHMW03, RHMW09, RHMW10, and RHMW11-05 were below the background (RHMW04) concentration of 68.7 mg/L. All other locations had chloride concentrations higher than background, more than twice the background concentration in several locations (i.e., RHMW05, RHMW06, RHMW07, RHMW08, and OWDFMW01). If anaerobic dechlorination is occurring at the site, the most likely locations where this would be evident would be where other NAP data indicate anaerobic biodegradation (i.e., RHMW01 and RHMW02). However, the chloride concentrations at RHMW01 and RHMW02 were less than background. Evaluation of NAP data from the Fourth Quarter 2016 monitoring event onward and the groundwater geochemistry parameters indicate that the chloride concentrations at the site are indicative of the aquifer geochemistry rather than of contributions of anaerobic dechlorination.

4.1.7 Alkalinity

The alkalinity concentrations in RHMW01 (81.0 mg/L), RHMW02 (190 mg/L), RHMW03 (266 mg/L), RHMW05 (91.8 mg/L), RHMW06 (108 mg/L), RHMW07 (104 mg/L), RHMW08 (91.2 mg/L), RHMW11-05 (114 mg/L), and OWDFMW01 (139 mg/L) were greater than the background concentration of 75.0 mg/L. The elevated alkalinity in RHMW01, RHMW02, and RHMW03 may be attributable to natural attenuation processes occurring at these locations; the elevated alkalinity at the other monitoring locations may be attributable to aquifer geochemistry, based on the lack of COPC detections and other NAP results indicative of biodegradation.

4.1.8 TPH with Silica Gel Cleanup

SGC TPH-d and TPH-o results for RHMW01, RHMW02 and RHMW03 showed reduced or non-detect concentrations compared to non-SGC TPH-d and TPH-o results (Table 3-2). The SGC TPH-d and TPH-o results suggest that petroleum weathering is occurring at RHMW01, RHMW02 and RHMW03, especially when evaluated in conjunction with the other NAPs.

SGC TPH-d and TPH-o were non-detects for RHMW03. For RHMW02, the SGC TPH-d concentrations for the primary and field duplicate samples were 420 and 430 µg/L (with non-SGC TPH-d concentrations of 2,400 J and 2,700 J µg/L), respectively. The SGC TPH-d results indicate that attenuation is occurring. The recoveries of SGC TPH-d to non-SGC TPH-d for RHMW02 have ranged from 14% to 57%, indicating that 43–86% of the reported non-SGC TPH mass is likely biodegradation by-products.

Non-SGC chromatograms for the RHMW02 sample show signal evidence of soluble components of degraded jet fuel, with a large portion of the mass showing a signature indicative of polar metabolites from petroleum degradation. The corresponding SGC chromatogram for RHMW02 is characteristic of dissolved aromatic hydrocarbons expected from jet fuel. Further evaluation of the SGC TPH results and natural attenuation, along with the potential role of other site-specific factors (e.g., complex geology, surface water recharge, infiltration rates), was included in the AOC Statement of Work Sections 6 and 7 CSM report (DON 2018h).

4.1.9 Total and Dissolved Organic Carbon

TOC concentrations in groundwater samples include all volatile, non-volatile, soluble, and insoluble forms of carbon present in the sample, while dissolved organic carbon (DOC) concentrations include only the volatile, non-volatile, and soluble forms of carbon. TOC and DOC concentrations are useful especially for samples with known high concentrations of polar hydrocarbons and metabolites, which are not efficiently extracted and analyzed using the TPH-d and TPH-o analysis. However, as the TOC and DOC method (EPA 9060) does not discriminate between petroleum and non-petroleum hydrocarbons, TOC and DOC must be evaluated in conjunction with TPH and other NAP results to

determine if the TOC and DOC concentrations found in groundwater samples may be contributed by petroleum constituents in groundwater. During the December 2018 monthly sampling event and First Quarter 2019 groundwater monitoring event, only TOC was analyzed.

TOC was not detected in the groundwater samples except for samples from RHMW02 and RHMW03, which were in line with historical TPH, SGC TPH, and NAP data, indicating that petroleum constituents and petroleum biodegradation by-products are present at these wells, contributing to TOC concentrations. Additionally, the TOC concentrations were higher than corresponding TPH concentrations (i.e., for RHMW02, TOC was 3.9 mg/L and TPH-d was 2.7 mg/L [2,700 µg/L]), confirming that the TPH method does not capture all polar hydrocarbons and metabolites present in the groundwater and supporting evidence of natural attenuation occurring at these locations. Additionally, the TOC concentrations at other locations may also indicate the presence of polar hydrocarbons and metabolites that are not captured in the TPH extraction; however, NAP concentrations at these locations do not indicate that biodegradation is currently occurring at these locations.

4.2 NAP CONCENTRATIONS

Graphs of cumulative groundwater NAP results are presented in Appendix A.3.1, and graphs of NAP results for the First Quarter 2019 are presented in Appendix A.3.2. Evaluation of the NAP data from the Fourth Quarter 2016 monitoring event onward indicates there is no evidence that seasonal variations (i.e., wet and dry season effects) influence NAP concentrations (and thus biodegradation) in the groundwater at the Red Hill monitoring well network.

The NAP concentrations at RHMW01, RHMW02, and RHMW03 indicate that aerobic or anaerobic biodegradation may be occurring at these locations. This is confirmed by the SGC TPH results, which present a relative ratio of non-biodegraded (non-polar) hydrocarbons to biodegradation by-product hydrocarbons (polar hydrocarbons and metabolites). However, evaluation of NAPs along with TPH trends (based on numerical TPH results alone) must be performed with caution. The variability of TPH-d procedures and results from one laboratory to another precludes reliable trend analyses, such that higher or lower results over time may be due not to changing conditions in the groundwater at the Facility but rather to changes in the laboratory's TPH extraction and analysis protocols. Nonetheless, the RHMW03 NAP results (i.e., depleted DO and relatively high concentrations of other electron acceptors) indicate that continuous aerobic biodegradation is occurring at this location, possibly due to an influx of oxygenated water at this location providing sufficient DO that anaerobic biodegradation is not evident. Similarly, continuous aerobic and anaerobic biodegradation is occurring at RHMW01 and RHMW02 based on the depleted electron acceptors and presence of dissolved methane. Notably, methane concentrations at RHMW01 and RHMW02 have generally decreased over time, which may be an indicator of reduced available biodegradable fuel at the subsurface from various natural source-zone depletion processes and natural attenuation.

Additional evaluation of the 2014 fuel release, natural source-zone depletion, and natural attenuation at the Facility is discussed in the AOC Statement of Work Sections 6 and 7 CSM report (DON 2018h).

5. Summary, Conclusions, and Recommendations

5.1 SUMMARY

During the December 2018 monthly sampling event, groundwater samples were collected from the sampling point at Red Hill Shaft (RHMW2254-01) on two consecutive days with different supply well pumping conditions, following the same protocol used during the November 2018 confirmation sampling event (DON 2019). During the "pumps-on" conditions, the supply well pumps were turned on at least 3 hours prior to the groundwater sampling and kept running for the duration of the sample

collection. The following day, during the "pumps-off" conditions, the supply well pumps were kept turned off from at least 3 hours prior to the groundwater sampling event until the sample collection was complete.

During the First Quarter 2019 monitoring event, groundwater samples were collected from the sampling point at Red Hill Shaft (RHMW2254-01, during pumps on and pumps off conditions), 11 monitoring wells within the Facility boundary (RHMW01 through RHMW10 and OWDFMW01), one monitoring zone in a multilevel monitoring well (RHMW11 Zone 5) located outside of the Facility, and 1 monitoring well (Hālawa Deep Monitor Well [HDMW2253-03]) located outside of the Facility. This groundwater sampling event was conducted as part of the Red Hill groundwater LTM program. Analytical results for the sampling locations are summarized as follows:

- *RHMW2254-01 (pumps on and pumps off, primary and duplicate), RHMW01, RHMW05, RHMW06, RHMW07, RHMW08, RHMW09, RHMW10, RHMW11-05, and HDMW2253-03:* No COPCs were detected.
- *RHMW02 (primary and duplicate):* TPH-d (2,400 and 2,700 µg/L), 1-methylnaphthalene (11 and 9.6 µg/L), 2-methylnaphthalene (8.8 and 7.2 µg/L), and naphthalene (32 and 26 µg/L) were detected at concentrations exceeding the respective screening criteria (400, 10, 10, and 17 µg/L). The concentrations of TPH-d did not exceed the SSRBL of 4,500 µg/L. TPH-d was also detected in the SGC TPH-d analysis at concentrations of 420 and 430 µg/L. Additional discussion of SGC TPH is presented in Section 4.1.8. TPH-g (48 and 22 µg/L) was detected at concentrations below the screening criterion (300 µg/L).
- *RHMW03:* TPH-d (380 µg/L) and TPH-o (310 µg/L) were detected at concentrations below the respective screening criteria (400 and 500 µg/L). SGC TPH-d and SGC TPH-o were non-detect.
- *RHMW04:* Total xylenes (0.18 J µg/L) were detected at concentrations below the screening criterion (20 µg/L).

A table of cumulative historical groundwater results is presented in Appendix A.1, and historical groundwater COPC concentration graphs are presented in Appendix A.2.

The NAP and SGC TPH data present evidence of aerobic and anaerobic biodegradation occurring at RHMW02 based on depleted DO, elevated dissolved methane concentrations, depleted nitrate and sulfate concentrations, high alkalinity concentrations compared to other monitoring wells in the network, and SGC TPH-d concentrations indicating that the majority of the reported non-SGC TPH mass is likely biodegradation by-products. The concentrations of NAPs and SGC TPH at RHMW01 and RHMW03 suggest that biodegradation is also occurring there. Other monitoring wells showed no TPH detections or detections related to non-petroleum hydrocarbons, which, when evaluated in consideration with the NAP results, indicates that biodegradation is unlikely to be occurring at those locations.

5.2 CONCLUSIONS AND RECOMMENDATIONS

No COPCs were detected at RHMW224-01 during the December 2018 monthly sampling event and the First Quarter 2019 groundwater monitoring events. During the First Quarter 2019 monitoring event, no SSRBL exceedances occurred at RHMW01, RHMW02 and RHMW03, and screening criteria exceedances (TPH-d, 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene) occurred only at RHMW02.

Based on the groundwater monitoring results, pursuant to the *Groundwater Protection Plan* (DON 2014), and in accordance with AOC Statement of Work Sections 6 and 7 (EPA Region 9 and DOH 2015), groundwater monitoring at locations within the Red Hill groundwater monitoring network will continue. Additionally, groundwater monitoring at sampling point RHMW2254-01 is recommended to resume on a quarterly schedule, with samples collected during both pumping and non-pumping conditions at the Red Hill Shaft supply well.

It is recommended that the Red Hill groundwater LTM program continue testing for NAPs at each monitoring event, and continue SGC TPH-d and TPH-o analysis for all locations with non-SGC TPH-d or TPH-o detections.

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Appendix A:
Cumulative Historical Monitoring Results

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Table A.1-1: Cumulative Groundwater COPC Results
First Quarter 2019 - Quarterly Groundwater Monitoring Report, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i

		Analyte Class	TPH	TPH	TPH	TPH	Volatiles	Volatiles	Volatiles	Volatiles	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Semivolatiles	Semivolatiles
		Analyte Type	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Fuel Additive	Fuel Additive
		Analytical Method	8015	8260	8015	8015	8260	8260	8260	8260	8270 SIM	8270 SIM	8270 SIM	8260	8011	8260	504.1	8260SIM	8260SIM	8260	8270	8270/8270 Mod.
		Analyte	TPH-g ****	TPH-g ****	TPH-d	TPH-o	Benzene	Ethylbenzene	Toluene	Xylenes, Total (p/m-, o-xylene)	1-Methylnaphthalene	2-Methylnaphthalene	Naphthalene *****	Naphthalene *****	1,2-Dibromoethane *****	1,2-Dibromoethane *****	1,2-Dibromoethane *****	1,2-Dibromoethane *****	1,2-Dichloroethane *****	1,2-Dichloroethane *****	Phenol	2-(2-Methoxyethoxy)-ethanol
		CAS No.	Gas	Gas	Diesel	Oil	71-43-2	100-41-4	108-88-3	1330-20-7	90-12-0	91-57-6	91-20-3	91-20-3	106-93-4	106-93-4	106-93-4	106-93-4	107-06-2	107-06-2	108-95-2	111-77-3
		Unit	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
		DOH EAL	300	300	400	500	5	30	40	20	10	10	17	17	0.04	0.04	0.04	0.04	5	5	300	800
		SSRBL	—	—	4500	—	750	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Well Name	Sample ID	Date Sampled	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note
RHMW2254-01	RH-B-001	2/16/2005[be]	< 50 U	—	< 50 U	< 100 U	< 0.50 U	< 0.50 U	< 1.0 UJ t	< 0.50 U	—	< 0.020 U	< 0.020 U	—	—	—	< 0.0083 U b	—	—	< 0.50 U	—	—
RHMW2254-01	RH-B-002	2/16/2005[bf]	< 50 U	—	< 53 U	< 110 U	< 0.50 U	< 0.50 U	< 1.2 UJ t	< 0.50 U	—	< 0.022 U	< 0.022 U	—	—	—	< 0.0081 U b	—	—	< 0.50 U	—	—
RHMW2254-01	RH-B-003	2/16/2005[bf]	< 50 U	—	< 50 U	< 100 U	< 0.50 U	< 0.50 U	< 0.81 UJ t	< 0.50 U	—	< 0.021 U	< 0.021 U	—	—	—	< 0.0082 U b	—	—	< 0.50 U	—	—
RHMW2254-01	RH-B-004	6/28/2005[be]	< 13 U	—	43 J	—	< 0.50 U b	< 0.50 U b	< 0.50 U b	< 0.50 U b	—	< 0.020 U b	< 0.020 U b	—	—	—	< 0.0095 U b	—	—	< 0.50 U b	—	—
RHMW2254-01	RH-B-005	6/28/2005[abe]	< 13 U	—	67 Z	—	< 0.50 U b	< 0.50 U b	< 0.50 U b	< 0.50 U b	—	< 0.020 U b	< 0.020 U b	—	—	—	< 0.0097 U b	—	—	< 0.50 U b	—	—
RHMW2254-01	RH-B-006	6/28/2005[abf]	< 13 U	—	58 Z	—	< 0.50 U b	< 0.50 U b	< 0.50 U b	< 0.50 U b	—	< 0.021 U b	< 0.021 U b	—	—	—	< 0.0095 U b	—	—	< 0.50 U b	—	—
RHMW2254-01	RH-B-007	9/8/2005[be]	< 13 U	—	45 J	59 J	< 0.14 U	< 0.13 U	< 0.11 U	< 0.22 U	—	< 0.020 U b	0.085	—	—	—	< 0.0095 U b	—	—	< 0.12 U	—	—
RHMW2254-01	RH-B-008	9/8/2005[bf]	< 13 U	—	< 19 U	< 28 U	< 0.14 U	< 0.13 U	< 0.11 U	< 0.22 U	—	< 0.020 U b	< 0.020 U b	—	—	—	< 0.0095 U b	—	—	< 0.12 U	—	—
RHMW2254-01	RH-B-009	9/8/2005[abf]	< 13 U	—	< 50 U d	< 100 U d	< 0.14 U	< 0.13 U	< 0.11 U	< 0.22 U	—	< 0.020 U b	0.045	—	—	—	< 0.0095 U b	—	—	< 0.12 U	—	—
RHMW2254-01	RHMW2254W01	9/20/2005[bd]	—	—	—	—	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	—	—	—	< 1.0 U	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW2254-01	RH-B-010	12/6/2005[be]	< 13 U	—	38 J	—	< 0.14 U	< 0.13 U	< 0.11 U	< 0.22 U	—	0.038	0.036	—	—	—	< 0.0096 U b	—	—	< 0.12 U	—	—
RHMW2254-01	RH-B-011	12/6/2005[abe]	< 13 U	—	24 J	—	< 0.14 U	< 0.13 U	< 0.11 U	< 0.22 U	—	0.022	< 0.024 UJ b	—	—	—	< 0.0094 U b	—	—	< 0.12 U	—	—
RHMW2254-01	RH-B-012	12/7/2005[bf]	< 13 U	—	< 20 U	—	< 0.14 U	< 0.13 U	< 0.11 U	< 0.22 U	—	0.0071 J	0.011 J	—	—	—	< 0.0095 U b	—	—	< 0.12 U	—	—
RHMW2254-01	RHMW2254-01-GW02	7/10/2006[a]	< 50 U	—	< 110 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.26 U	< 0.26 U	< 0.26 U	< 1.0 U	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW2254-01	RHMW2254-01-GW06	12/5/2006[a]	< 50 U	—	< 100 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.25 U	< 0.25 U	< 0.25 U	< 1.0 U	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW2254-01	RHMW2254-01-WG07	3/27/2007[a]	< 50 U	—	< 98 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.24 U	< 0.24 U	< 0.24 U	< 1.0 U	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW2254-01	RHMW2254-01-WG08	6/12/2007[a]	< 50 U	—	< 98 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.25 U	< 0.25 U	< 0.25 U	< 1.0 U	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW2254-01	RHMW2254-01-WG0	9/10/2007[a]	< 50 U	—	< 97 U	—	< 0.20 U	< 0.20 U	< 0.27 U	< 0.36 U	< 0.25 U	< 0.25 U	< 0.25 U	< 0.44 U	—	< 0.20 U	—	—	—	< 0.20 U	—	—
RHMW2254-01	RHMW2254-01-WG10 (RHMW2254-WG10)	1/15/2008[a]	< 10.0 U	—	< 102 UJ b	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	< 0.0150 U	< 0.0150 U	< 0.0310 U	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW2254-01	RHMW2254-01-WG10.1	2/6/2008[a]	—	—	< 100 U	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
RHMW2254-01	RHMW2254-01-WG10.1	2/6/2008[a]	—	—	< 10.3 U	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
RHMW2254-01	RHMW2254-01-WG11 (RHMW2254-WG11)	4/15/2008[a]	< 10.0 U	—	< 86.0 U	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	< 0.0435 UJ b	< 0.0561 UJ b	< 0.0332 U	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW2254-01	RHMW2254-01-WG12	7/29/2008[ad]	< 10.0 U	—	< 83.3 U	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	< 0.0156 U	< 0.0156 U	< 0.0323 U	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW2254-01	RHMW2254-01-WG13	10/22/2008[ad]	< 10.0 U	—	< 84.2 U	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	0.0276 J	< 0.0150 U	0.0466 J	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW2254-01	RHMW2254-WG13B	12/16/2008[c]	—	—	—	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.93 U	—	—	—	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW2254-01	RHMWA01-WG13B	12/16/2008[c]	—	—	—	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.93 U	—	—	—	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW2254-01	RHMW2254-01-WG14	2/4/2009[a]	14.0 J	—	< 92.0 U	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	< 0.0161 U	< 0.0161 U	< 0.0333 U	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW2254-01	RHMW2254-01-WG15	5/13/2009[a]	< 19.1 UJ b t	—	< 169 U	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	< 0.0156 U	0.0180 J	< 0.0323 U	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW2254-01	RHMW2254-01-WG16	7/15/2009[a]	< 30.0 U	—	< 163 U	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	< 0.0165 U	< 0.0165 U	< 0.0341 U	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW2254-01	RHMW254-WG17	10/14/2009[a]	< 30 U	—	< 158 U	—	< 0.12 U	< 0.31 U	< 0.31 U	< 1 U	< 0.017 U	< 0.017 U	< 0.0352 U	< 0.62 U	—	< 0.31 U	—	—	—	< 0.15 U	—	—
RHMW2254-01	RHMW2254-01-WG18	2010-01-27	< 60.0 U	—	< 320 U	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	< 0.0316 U	< 0.0316 U	0.0375 J	< 1.24 U	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW2254-01	RHMW2254-01-WG19 (RHMW225-WG19)	2010-04-13	< 60.0 U	—	< 320 U	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	< 0.0330 U	< 0.0330 U	< 0.0682 U	< 1.24 U	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW2254-01	RHMW2254-01-WG20 (RHMW2254-WG20)	2010-07-13	< 60.0 U	—	< 320 U	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	< 0.0320 U	< 0.0320 U	< 0.0664 U	< 1.24 U	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW2254-01	ES004	2010-10-19	—	< 12.12 U	< 80.0 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW2254-01	ES014	1/20/2011[d]	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW2254-01	ES019	4/19/2011[d]	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW2254-01	ES040	2011-07-20	—	< 12.12 U	< 80.8 U	< 212.0 U	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW2254-01	ES050	2011-10-25	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW2254-01	ES062	2012-02-01	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW2254-01	ES074	2012-04-17	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW2254-01	ES077	2012-07-17	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW2254-01	ES006	2012-10-22	—	< 18 UJ b	< 20 U	—	< 0.50 U	< 0.50 U	0.71 J	< 1.0 U	< 0.050 U	< 0.050 U	0.037 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW2254-01	ES014	2013-01-29	—	< 30 U	22 J Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	0.052 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW2254-01	ES023	2013-04-23	—	< 30 U	< 20 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.051 U	< 0.051 U	< 0.051 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW2254-01	ES032	2013-07-23	—	< 30 U	< 20 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	0.099 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW2254-01	ES041	2013-10-22	—	< 21 UJ b t	< 20 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	0.036 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW2254-01	ES050	1/16/2014[d]	—	—	< 20 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.049 U	< 0.049 U	0.046 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW2254-01	ES060	1/29/2014[d]	—	< 16 UJ b	< 20 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	0.049 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW2254-01	ES067	3/6/2014[d]	—	—	< 20 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	0.081 J	—	—	—	—	—	—	—	—	—
RHMW2254-01	ES075	3/26/2014[d]	—	—	< 10 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	< 0.050 U	—	—	—	—	—	—	—	—	—
RHMW2254-01	ES085	4/22/2014[d]	—	< 30 U	< 10 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.049 U	< 0.049 U	< 0.049 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW2254-01	ES094	5/28/2014[d]	—	—	< 12 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	< 0.050 U	—	—	—	—	—	—	—	—	—
RHMW2254-01	ES102	6/24/2014[d]	—	—	< 12 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.049 U	< 0.049 U	< 0.049 U	—	—	—	—	—	—	—	—	—
RHMW2254-01	ES107	2014-07-22	—	< 30 U	< 12 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.048 U	< 0.048 U	< 0.048 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW2254-01	ES117	2014-10-28	—	< 30 U	22 J Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.097 U	< 0.049 U	< 0.049 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW2254-01	ES125	2015-01-27	—	< 30 U	< 12 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.10 U	< 0.050 U	< 0.050 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW2254-01	ES134	2015-04-21	< 25 U	—	< 14 UJ b	< 37 UJ b	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0050 U	—	< 0.0040 U	< 0.20 U	—	< 0.010 U	< 0.015 U	—	—	—
RHMW2254-01	ES149	2015-07-21	< 25 U	—	17 J	42 J	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0050 U	—	< 0.0040 U	< 0.20 U	—	—	< 0.015 U	—	—	—
RHMW2254-01	ERH009	2015-10-20	< 25 U	—	< 16 UJ b	< 53 UJ b	< 0.10 UJ h	< 0.10 UJ h	< 0.99 UJ t	< 0.20 UJ h	< 0.0050 U	< 0.0050 U	< 0.0050 U	—	< 0.0040 U	< 0.20 UJ h	—	—	< 0.015 U	—	—	—
RHMW2254-01	ERH021	2016-01-20	< 25 U	—	< 21 UJ b	< 54 UJ b	< 0.10 U	< 0.10 U	< 0.16 UJ t	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0050 U	—	< 0.0040 U	< 0.20 U	—	—	< 0.015 U	—	—	—
RHMW2254-01	ERH037	2016-04-20	< 25 U	—	< 21 U b f	< 61 U b f	< 0.10 U	< 0.10 U f	< 0.10 U	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0050 U	—	—	—	—	—	—	—	—	—
RHMW2254-01	ERH051	2016-07-20	< 25 U	—	< 21 U	< 27 U b f	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0051 U b f	—	—	—	—	—	—	—	—	—
RHMW2254-01	ERH088	2016-10-18	—	< 18 UJ q	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ h	—
RHMW2254-01	ERH092	10/18/2016*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ h	—
RHMW2254-01	ERH115	2016-11-14	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	< 4.00 U	< 80.0 U	—
RHMW2254-01	ERH116	11/14/2016*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	< 4.00 U	< 80.0 U	—
RHMW2254-01	ERH135	2016-12-12	—	< 18 U	14 J Y	16 J	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	< 4.00 U	< 80.0 U	—
RHMW2254-01	ERH137	12/12/2016*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	< 4.00 U	< 80.0 U	—
RHMW2254-01	ERH161	2017-01-09	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	< 4.00 U	< 80.0 U	—
RHMW2254-01	ERH162	1/9/2017*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	< 4.00 U	< 80.0 U	—
RHMW2254-01	ERH205	2017-02-06	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	< 4.00 U	< 80.0 U	—
RHMW2254-01	ERH206	2/6/2017*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	< 4.00 U	< 80.0 U	—
RHMW2254-01	ERH257	2017-03-06	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	< 4.00 U	< 80.0 U	—
RHMW2254-01	ERH258	3/6/2017*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	< 4.00 U	< 80.0 U	—
RHMW2254-01	ERH292	2017-04-03	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	< 4.00 U	< 80.0 U	—
RHMW2254-01	ERH293	4/3/2017*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	< 4.00 U	< 80.0 U	—
RHMW2254-01	ERH329	2017-05-02	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	< 4.00 U	< 80.0 U	—
RHMW2254-01	ERH330	5/2/2017*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	< 4.00 U	< 80.0 U	—
RHMW2254-01	ERH349	2017-06-06	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	< 4.00 U	< 80.0 U	—
RHMW2254-01	ERH350	6/6/2017*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	< 4.00 U	< 80.0 U	—

Table A.1-1: Cumulative Groundwater COPC Results (cont'd)
First Quarter 2019 - Quarterly Groundwater Monitoring Report, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i

		Analyte Class	TPH	TPH	TPH	TPH	Volatiles	Volatiles	Volatiles	Volatiles	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Semivolatiles	Semivolatiles
		Analyte Type	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Fuel Additive	Fuel Additive
		Analytical Method	8015	8260	8015	8015	8260	8260	8260	8260	8270 SIM	8270 SIM	8270 SIM	8260	8011	8260	504.1	8260SIM	8260SIM	8260	8270	8270/8270 Mod.
		Analyte	TPH-g ****	TPH-g ****	TPH-d	TPH-o	Benzene	Ethylbenzene	Toluene	Xylenes, Total (p/m-, o-xylene)	1-Methylnaphthalene	2-Methylnaphthalene	Naphthalene *****	Naphthalene *****	1,2-Dibromoethane *****	1,2-Dibromoethane *****	1,2-Dibromoethane *****	1,2-Dibromoethane *****	1,2-Dichloroethane *****	1,2-Dichloroethane *****	Phenol	2-(2-Methoxyethoxy)-ethanol
		CAS No.	Gas	Gas	Diesel	Oil	71-43-2	100-41-4	108-88-3	1330-20-7	90-12-0	91-57-6	91-20-3	91-20-3	106-93-4	106-93-4	106-93-4	106-93-4	107-06-2	107-06-2	108-95-2	111-77-3
		Unit	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
		DOH EAL	300	300	400	500	5	30	40	20	10	10	17	17	0.04	0.04	0.04	0.04	5	5	300	800
		SSRBL	—	—	4500	—	750	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Well Name	Sample ID	Date Sampled	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note
RHMW2254-01	ERH378	2017-07-05	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW2254-01	ERH379	7/5/2017*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW2254-01	ERH409	2017-10-24	—	< 18 U	65 J e q Z	< 40 UJ q	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW2254-01	ERH410	10/24/2017*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW2254-01	ERH542	2018-03-14	—	< 18 U	< 25 UJ h	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW2254-01	ERH543	3/14/2018*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW2254-01	ERH588	2018-04-23	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW2254-01	ERH589	4/23/2018*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW2254-01	ERH634	2018-07-23	—	< 18 U	< 25 U	< 40 UJ l	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 UJ h	< 80.0 U
RHMW2254-01	ERH635	7/23/2018*	—	< 18 U	< 25 UJ s	< 40 UJ l s	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW2254-01	ERH678	2018-10-22	—	< 18 U	< 25 UJ h	< 40 UJ h	< 0.30 U	1	0.24 J	0.81 J	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW2254-01	ERH679	10/22/2018*	—	< 18 U	< 25 UJ h	< 40 UJ h	< 0.30 U	0.99 J	0.21 J	0.73 J	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW2254-01	ERH712	2018-11-13	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U q	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW2254-01	ERH713	11/13/2018*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW2254-01	ERH715	2018-11-14	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW2254-01	ERH716	11/14/2018*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW2254-01	ERH719	2018-12-12	—	< 18 U	< 25 UJ s	< 40 UJ s	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW2254-01	ERH720	12/12/2018*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW2254-01	ERH722	2018-12-13	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW2254-01	ERH723	12/13/2018*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW2254-01	ERH730	2019-01-23	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 UJ q l	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW2254-01	ERH731	1/23/2019*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 UJ l	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW2254-01	ERH733	2019-01-24	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW2254-01	ERH734	1/24/2019*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW01	RH-W-001	2/17/2005[b]	< 50 U b	—	1,400 Y	770 Y	< 0.50 U b	< 0.50 U b	< 0.50 U b	< 0.50 U b	—	0.14	0.25	—	—	—	< 0.0083 U	—	—	< 0.50 U b	—	—
RHMW01	RH-W-002	2/17/2005[a,b]	< 50 U b	—	1,500	890	< 0.50 U b	< 0.50 U b	< 0.50 U b	< 0.50 U b	—	0.057	0.21	—	—	—	< 0.0082 U	—	—	< 0.50 U b	—	—
RHMW01	RH-W-003	6/28/2005[a]	< 13 U	—	1,300 Z	—	< 0.50 U b	< 0.50 U b	< 0.50 U b	< 0.50 U b	—	0.054	0.073	—	—	—	< 0.0095 U	—	—	< 0.50 U b	—	—
RHMW01	RH-W-004	6/28/2005[a]	< 13 U	—	1,100 Z	—	< 0.50 U b	< 0.50 U b	< 0.50 U b	< 0.50 U b	—	0.051	0.055	—	—	—	< 0.0095 U	—	—	< 0.50 U b	—	—
RHMW01	RH-W-005	9/8/2005[a]	< 13 U	—	950 Y	540 Y	< 0.14 U	< 0.13 U	0.15 J	< 0.22 U	—	0.038	0.83	—	—	—	< 0.00096 U	—	—	< 0.12 U	—	—
RHMW01	RH-W-006	9/8/2005*[a]	< 13 U	—	1,100 Y	720 Y	< 0.14 U	< 0.13 U	0.15 J	< 0.22 U	—	0.038	0.78	—	—	—	< 0.00096 U	—	—	< 0.12 U	—	—
RHMW01	RHMW01W01	9/20/2005[a]	—	—	—	—	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	—	—	—	< 1.0 U	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW01	RH-W-007	12/6/2005[a]	< 13 U	—	670 Z	—	< 0.14 U	< 0.13 U	< 0.12 UJ t	< 0.33 U	—	0.098	0.51	—	—	—	< 0.0096 U b	—	—	< 0.12 U	—	—
RHMW01	RH-W-008	12/6/2005*[a]	< 13 U	—	740 Z	—	< 0.14 U	< 0.13 U	< 11 U	< 0.33 U	—	0.11	0.48	—	—	—	< 0.0095 U b	—	—	< 0.12 U	—	—
RHMW01	RHMW01-GW02	7/10/2006[a]	< 50 U	—	509	—	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.25 U	< 0.25 U	< 0.25 U	< 1.0 U	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW01	RHMW01-GW06	12/5/2006[a]	< 50 U	—	303	—	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.25 U	< 0.25 U	< 0.25 U	< 1.0 U	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW01	RHMW01-WG07	3/27/2007[a]	< 50 U	—	307	—	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.25 U	< 0.25 U	< 0.25 U	< 1.0 U	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW01	RHMW01-WG08	6/12/2007[a]	< 50 U	—	274	—	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.25 U	< 0.25 U	< 0.25 U	< 1.0 U	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW01	RHMW01-WG08	6/12/2007[a]	< 50 U	—	261	—	< 0.20 U	< 0.20 U	< 0.27 U	< 0.36 U	< 0.25 U	< 0.25 U	< 0.25 U	< 0.44 U	—	< 0.20 U	—	—	—	< 0.20 U	—	—
RHMW01	RHMW01-WG10	1/15/2008[a]	< 10.0 U	—	574 Y	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	0.0640	0.0478 J	0.210	5.98	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW01	RHMW01-WG11	4/15/2008[a]	13.6 J	—	427 J	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	0.101	0.0789	0.216	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW01	RHMW01-WG12	7/29/2008[ad]	< 10.0 U	—	327 J	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	< 0.0150 U	< 0.0150 U	0.114	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW01	RHMW01-WG13	10/22/2008[ad]	< 10.0 U	—	459	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	< 0.0150 U	< 0.0150 U	0.103	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW01	RHMW01-WG14	2/4/2009[a]	14.4 J	—	387 J	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	< 0.0165 U	< 0.0165 U	0.173	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW01	RHMW01-WG15	5/13/2009[a]	< 16.6 UJ b t	—	373 J	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	< 0.0150 U	< 0.0150 U	0.182	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW01	RHMW01-WG16	7/15/2009[a]	< 30.0 U	—	248 J	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	9.44	3.07	5.61	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW01	RHMW01-WG17	10/14/2009[a]	< 30 U	—	299 J	—	< 0.12 U	< 0.31 U	< 0.31 U	< 1 U	< 0.0174 U	< 0.0174 U	0.193	< 0.62 U	—	< 0.31 U	—	—	—	< 0.15 U	—	—
RHMW01	RHMW01-WG18	2010-01-27	< 60.0 U	—	312 J	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	< 0.0334 U	0.0559	0.330	< 1.24 U	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW01	RHMW01-WG19	2010-04-13	< 60.0 U	—	377 J	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	< 0.0322 U	< 0.0322 U	< 0.0666 U	< 1.24 U	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW01	RHMW01-WG20	2010-07-13	< 60.0 U	—	228 J	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	< 0.0316 U	< 0.0316 U	0.184	< 1.24 U	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW01	ES009	11/3/2010[d]	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	0.17 J	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW01	ES015	1/20/2011[d]	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW01	ES033	4/28/2011[d]	—	< 12.12 U	300 O	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW01	ES041	2011-07-20	—	< 12.12 U	290 O	< 212.0 U	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	0.12 J	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW01	ES057	2011-11-02	—	< 12.12 U	210 O	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW01	ES069	2012-02-14	—	< 12.12 U	210 Y	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW01	ES075	2012-04-17	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW01	ES088	2012-07-20	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	0.13 J	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW01	ES001	2012-10-22	—	< 20 UJ b	85 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	< 0.050 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW01	ES010	2013-02-04	—	< 13 UJ t	79	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	0.10 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW01	ES019	2013-04-22	—	< 30 U	340 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.052 U	< 0.052 U	< 0.052 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW01	ES028	2013-07-22	—	< 30 UJ h	99 Y	—	< 0.50 UJ h	< 0.50 UJ h	< 0.50 UJ h	< 1.0 UJ h	< 0.050 U	< 0.050 U	0.048 J	—	—	< 0.50 UJ h	—	—	—	< 0.50 UJ h	—	—
RHMW01	ES037	2013-10-21	—	< 21 UJ b t	92 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.052 U	< 0.052 U	< 0.052 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW01	ES048	1/15/2014[d]	—	—	250 Y	—	< 0.50 U	< 0.50 U	2.5	< 1.0 U	0.040 J	0.039 J	0.062 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW01	ES056	1/28/2014[d]	—	< 26 UJ b	130 Y	—	< 0.50 U	< 0.50 U	1.3	< 1.0 U	< 0.050 U	< 0.050 U	0.045 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW01	ES062	2/24/2014[d]	—	< 30 U	89 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	0.037 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW01	ES064	3/5/2014[d]	—	—	93	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	0.038 J	< 0.050 U	—	—	—	—	—	—	—	—	—
RHMW01	ES069	3/10/2014[d]	—	—	38 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.052 U	< 0.052 U	< 0.052 U	—	—	—	—	—	—	—	—	—
RHMW01	ES072	3/25/2014[d]	—	—	82 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.051 U	< 0.051 U	< 0.051 U	—	—	—	—	—	—	—	—	—
RHMW01	ES077	4/7/2014[d]	—	—	140 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	< 0.050 U	—	—	—	—	—	—	—	—	—
RHMW01	ES080	4/21/2014[d]	—	< 30 U	88 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	< 0.050 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW01	ES091	5/27/2014[d]	—	—	66 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.051 U	< 0.051 U	< 0.051 U	—	—	—	—	—	—	—	—	—
RHMW01	ES098	6/23/2014[d]	—	—	77	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	< 0.050 U	—	—	—	—	—	—	—	—	—
RHMW01	ES103	2014-07-21	—	< 30 U	67 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.051 U	< 0.051 U	< 0.051 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW01	ES113	2014-10-27	—	< 30 U	120 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.10 U	< 0.052 U	< 0.052 U	—	—	< 0.50 U	—	—	—	< 0.50 UJ c	—	—
RHMW01	ES120X	2015-01-27	—	< 30 U	33 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.11 U	< 0.054 U	< 0.054 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW01	ES130	2015-04-20	< 25 U	—	170 Y	< 23 UJ b	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	0.014 J	0.0093 J	0.056	—	< 0.0040 U	< 0.20 U	—	< 0.010 U	< 0.015 U	—	—	—
RHMW01	ES143	2015-06-25	—	—	130 Y	40 J	—	—	—	—	0.0068 J	0.0058 J	0.040 X	—	—	—	—	—	—	—	—	—
RHMW01	ES145	2015-07-20	< 25 U	—	150 J s Y	21 J s	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	0.014 J	0.013 J	0.057	—	< 0.0040 U	< 0.20 U	—	—	< 0.015 U	—	—	—
RHMW01	ERH011	2015-10-20	< 25 U	—	330 Y	< 54 UJ b	< 0.10 UJ h	< 0.10 UJ h	< 0.10 UJ h	< 0.20 UJ t h	0.037	0.024	0.20	—	< 0.0040 U	< 0.20 UJ h	—	—	< 0.015 U	—	—	—
RHMW01	ERH024	2016-01-20	< 25 U	—	430 Y	< 60 UJ b	< 0.10 U	< 0.10 U	< 0.17 UJ t	< 0.20 U	0.029	0.023	0.18	—	< 0.0040 U	< 0.004 U	—	—	< 0.015 U	< 0.020 U	—	—
RHMW01	ERH039	2016-04-20	< 25 U	—	360 Y	< 120 U b f Y	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.024 UJ f v	< 0.014 UJ f v	< 0.23 UJ f	—	—	—	—	—	—	—	—	—
RHMW01	ERH053	2016-07-20	< 25 U	—	250 Y	< 59 U b f	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	0.032 J v	0.0068 J v	0.21	—	—	—	—	—	—	—	—	—
RHMW01	ERH090	2016-10-17	—	< 18 U	120 O	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ h
RHMW01	ERH117	2016-11-14	—	< 18 U	94 O	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U

Table A.1-1: Cumulative Groundwater COPC Results (cont'd)
First Quarter 2019 - Quarterly Groundwater Monitoring Report, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i

		Analyte Class	TPH	TPH	TPH	TPH	Volatiles	Volatiles	Volatiles	Volatiles	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Semivolatiles	Semivolatiles
		Analyte Type	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Fuel Additive	Fuel Additive
		Analytical Method	8015	8260	8015	8015	8260	8260	8260	8260	8270 SIM	8270 SIM	8270 SIM	8260	8011	8260	504.1	8260SIM	8260SIM	8260	8270	8270/8270 Mod.
		Analyte	TPH-g ****	TPH-g ****	TPH-d	TPH-o	Benzene	Ethylbenzene	Toluene	Xylenes, Total (p/m-, o-xylene)	1-Methylnaphthalene	2-Methylnaphthalene	Naphthalene ****	Naphthalene ****	1,2-Dibromoethane ****	1,2-Dibromoethane ****	1,2-Dibromoethane ****	1,2-Dibromoethane ****	1,2-Dichloroethane ****	1,2-Dichloroethane ****	Phenol	2-(2-Methoxyethoxy)-ethanol
		CAS No.	Gas	Gas	Diesel	Oil	71-43-2	100-41-4	108-88-3	1330-20-7	90-12-0	91-57-6	91-20-3	91-20-3	106-93-4	106-93-4	106-93-4	106-93-4	107-06-2	107-06-2	108-95-2	111-77-3
		Unit	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
		DOH EAL	300	300	400	500	5	30	40	20	10	10	17	17	0.04	0.04	0.04	0.04	5	5	300	800
		SSRBL	—	—	4500	—	750	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Well Name	Sample ID	Date Sampled	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note
RHMW01	ERH143	2016-12-13	—	< 18 U	< 96 U f	O < 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW01	ERH172	2017-01-11	—	< 18 U	88	O < 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW01	ERH223	2017-02-08	—	< 18 U	150	O < 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW01	ERH275	2017-03-08	—	< 18 U	83	O < 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW01	ERH310	2017-04-03	—	< 18 U	97	O < 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW01	ERH332	2017-05-01	—	< 18 U	110	Y < 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW01	ERH352	2017-06-05	—	< 18 U	98	O < 40 U	0.18 J	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW01	ERH383	2017-07-05	—	< 18 U	110	O < 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW01	ERH412	2017-10-25	—	< 18 U	86	Y 67	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	< 0.50 U	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW01	ERH413	10/25/2017*	—	—	83	Y 59	—	—	—	—	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW01	ERH545	2018-03-12	—	< 18 U	150	O < 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW01	ERH591	2018-04-25	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW01	ERH637	2018-07-24	—	< 18 UJ s	350	O < 40 U	< 0.30 UJ s	< 0.50 UJ s	< 0.30 UJ s	< 0.30 UJ s	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW01	ERH681	2018-10-25	—	< 18 U	170 J h	Y < 40 UJ h	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW01	ERH736	2019-01-22	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 UJ l	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW02	RHMW02W01	9/20/2005[a]	< 50 U	—	2,660	—	< 2.5 U	< 2.5 U	< 2.5 U	< 2.5 U	104	88.5	120	283 J c	—	< 2.5 U	—	—	—	< 2.5 U	—	—
RHMW02	RHMW02Q01	9/20/2005[a,t]	< 50 U	—	2,500	—	< 2.5 U	< 2.5 U	< 2.5 U	< 2.5 U	102	87.2	123	319	—	< 2.5 U	—	—	—	< 2.5 U	—	—
RHMW02	RHMW02-GW02	7/10/2006[a]	124 J s	—	2,800	—	< 0.50 U	1.3	< 0.50 U	< 0.50 U	142	65.8	171	343	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	RHMW05-GW02	7/10/2006[a,t]	119 J s	—	2,790	—	< 2.5 U	< 2.5 U	< 2.5 U	< 2.5 U	133	67.1	180	335	—	< 2.5 U	—	—	—	< 2.5 U	—	—
RHMW02	RHMW02-GW06	12/5/2006[a]	110 J s	—	2,600	—	< 0.50 U	1.2	< 0.50 U	< 0.50 U	124	45.1	160	257	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	RHMWA01-GW06	12/5/2006[a,t]	138 J s	—	2,690	—	< 0.50 U	1.1	< 0.50 U	< 0.50 U	114	51.1	147	269	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	RHMW02-WG07	3/27/2007[a]	122 J s	—	2,750	—	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	72.1	30.3	105	196	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	RHMWA01-WG07	3/27/2007[a,t]	148 J s	—	2,250	Y —	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	59.4	26.2	90.1	207	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	RHMW02-WG08	6/12/2007[a]	52.5 J	—	2,750	—	< 0.50 U	< 0.50 U	< 0.50 U	< 0.5 U	67.3	26.5	87.2	209	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	RHMWA01-WG08	6/12/2007[a,t]	56.5 J	—	2,900	—	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	88.3	33	128	207	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	RHMW02-WG09	9/10/2007[a]	76 J s	—	2,810	—	< 0.20 U	< 0.20 U	< 0.27 U	< 0.36 U	109	21.5	144	206	—	< 0.20 U	—	—	—	< 0.20 U	—	—
RHMW02	RHMWA01-WG09	9/10/2007[a,t]	78.2 J s	—	3,180	—	< 0.2 U	< 0.20 U	< 0.27 U	< 0.38 U	102	19.7	136	264	—	< 0.20 U	—	—	—	< 0.20 U	—	—
RHMW02	RHMW02-WG10	1/15/2008[a]	64.3 J	—	2,310	Y —	0.170 J	< 0.310 U	< 0.310 U	1.06	67.0	23.8	93.6	195	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW02	RHMWA01-WG10	1/15/2008[a,t]	66.2 J	—	3,230	Y —	0.170 J	0.350 J	< 0.310 U	1.10	73.2	27.6	102	194	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW02	RHMW02-WG11	4/15/2008[a]	58.9 J	—	3,120	Y —	< 0.120 U	< 0.310 U	< 0.310 U	0.740 J	75.8	34.5	73.0	290	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW02	RHMWA01-WG11	4/15/2008[a,t]	58.9 J	—	3,020	Y —	0.150 J	< 0.310 U	< 0.310 U	0.750 J	71.9	40.8	105	293	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW02	RHMW02-WG12	7/29/2008[a,d]	61.7 J	—	4,470	—	< 0.120 U	0.580 J	< 0.310 U	< 0.620 U	102	31.5	140	320	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW02	RHMWA01-WG12	7/29/2008[a,d,t]	61.2 J	—	3,640	—	0.120 J	0.560 J	< 0.310 U	< 0.620 U	96.0	42.2	132	309	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW02	RHMW02-WG13	10/22/2008[a,d]	52.8 J	—	4,540	—	0.140 J	0.450 J	< 0.310 U	0.450 J	72.1	13.7	97.4	239	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW02	RHMWA01-WG13	10/22/2008[a,d,t]	52.9 J	—	6,300	—	0.150 J	0.420 J	< 0.310 U	0.490 J	62.4	12.7	82.3	245	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW02	RHMW02-WG14	2/4/2009[a]	52.3 J	—	2,840	—	0.260 J	0.490 J	< 0.310 U	0.400 J	21.2 J s	10.5	15.2	42.8	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW02	RHMWA01-WG14	2/4/2009[a,t]	54.3 J	—	2,840	—	0.240 J	0.520 J	< 0.310 U	0.470 J	22.8	11.1	16.6	43.0	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW02	RHMW02-WG15	5/13/2009[a]	< 39.1 U b t	—	1,620	—	< 0.120 U	< 0.310 U	< 0.310 U	0.310 J	17.9	0.136	1.17	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW02	RHMWA01-WG15	5/13/2009[a,t]	< 36.7 U b t	—	2,000	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	24.6	0.107	1.08	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW02	RHMW02-WG16	7/15/2009[a]	< 30.0 U	—	1,450	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	13.2	3.66	8.37	10.1	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW02	RHMWA01-WG16	7/15/2009[a,t]	< 30.0 U	—	1,300	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	10.6	2.58	6.71	11.2	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW02	RHMW02-WG17	10/13/2009[a]	36.9 J	—	2,570	—	< 0.12 U	< 0.31 U	< 0.31 U	< 1 U	2.46	0.486	6.77	23.3	—	< 0.31 U	—	—	—	< 0.15 U	—	—
RHMW02	RHMWA01-WG17	10/13/2009[a,t]	< 30 U	—	2,570	—	< 0.12 U	< 0.31 U	< 0.31 U	< 1 U	4.03	0.783	7.82	20.0	—	< 0.31 U	—	—	—	< 0.15 U	—	—
RHMW02	RHMW02-WG18	2010-01-26	42.3 J	—	2,130	Y —	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	9.03	3.85	17.3	31.5	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW02	RHMWA01-WG18	1/26/2010*	38.1 J	—	3,410	Y —	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	8.26	2.65	15.7	9.30	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW02	RHMW02-WG19	2010-04-13	39.3 J	—	2,350	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	6.61	1.69	14.3	20.6	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW02	RHMWA01-WG19	4/13/2010*	39.0 J	—	2,080	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	5.90	1.90	12.7	21.4	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW02	RHMW02-WG20	2010-07-13	46.5 J	—	3,060	—	< 0.240 U	< 0.620 U	< 0.620 U	0.690 J	7.43	1.06	59.9	107	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW02	RHMWA01-WG20	7/13/2010*	45.4 J	—	3,110	—	< 0.240 U	< 0.620 U	< 0.620 U	0.660 J	7.05	0.937	61.1	102	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW02	ES002	2010-10-18	—	150 O	1,700	O —	< 0.32 U	0.25 J	< 0.34 U	0.60 J	15	5.0	59	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW02	ES003	10/18/2010*	—	160 O	1,700	O —	< 0.32 U	0.32 J	< 0.34 U	0.51 J	15	6.3	54	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW02	ES010	1/18/2011[d]	—	17 J O	1,100	O —	< 0.32 U	0.29 J	< 0.34 U	0.48 J	19	3.6	57	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW02	ES011	1/18/2011*[d]	—	20 O	980	O —	< 0.32 U	0.25 J	< 0.34 U	0.58 J	23	5.6	63	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW02	ES020	4/19/2011[d]	—	24 O	1,100	O —	< 0.32 U	< 0.46 U	< 0.34 U	0.41 J	5.1	0.43	3.5	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW02	ES021	4/19/2011*[d]	—	29 O	1,100	O —	< 0.32 U	< 0.46 U	< 0.34 U	0.41 J	5.2	0.53	4.2	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW02	ES037	2011-07-19	—	< 12.12 U	1,100	O < 212.0 U	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	0.85	0.16 J	2.2	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW02	ES038	7/19/2011*	—	< 12.12 U	1,800 J s	O < 212.0 U	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	0.90	0.12 J	2.7	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW02	ES046	2011-10-24	—	< 12.12 U	750	O —	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	0.53	0.15 J	0.80	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW02	ES047	10/24/2011*	—	< 12.12 U	730	O —	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	0.62	0.20	1.0	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW02	ES061	2012-01-26	—	< 12.12 U	1,700	O —	< 0.32 U	0.30 J	< 0.34 U	< 0.38 U	0.57	0.17 J	1.7	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW02	ES071	2012-04-16	—	< 12.12 U	1,200	O —	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	0.30	< 0.12 U	0.86	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW02	ES072	4/16/2012*	—	< 12.12 U	1,100	O —	< 0.32 U	0.23 J	< 0.34 U	< 0.38 U	1.2	0.61	2.9	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW02	ES082	2012-07-18	—	< 12.12 U	1,700	Y —	< 0.32 U	< 0.46 U	< 0.34 U	0.43 J	4.7	0.88	17	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW02	ES002	2012-10-22	—	320	2,200	Y —	< 0.50 U	0.18 J	0.59 J	0.51 J	24	14	63	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	ES003	10/22/2012*	—	360	1,800	Y —	< 0.50 U	0.18 J	0.60 J	0.47 J	21	12	61	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	ES011	2013-01-28	—	660	1,700	Y —	< 0.50 U	0.21 J	< 0.50 U	0.65 J	47	35	110	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	ES012	1/28/2013*	—	650	1,500	Y —	< 0.50 U	0.24 J	< 0.50 U	0.69 J	41	31	100	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	ES020	2013-04-22	—	< 54 UJ t	2,600	Y —	< 0.50 U	0.21 J	< 0.50 U	0.58 J	16	13	53	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	ES021	4/22/2013*	—	< 56 UJ t	3,300	Y —	< 0.50 U	0.21 J	< 0.50 U	0.58 J	20	16	61	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	ES029	2013-07-22	—	55 J h	2,500	Y —	< 0.50 UJ h	0.17 J h	< 0.50 UJ h	0.45 J h	21	9.1	73	—	—	< 0.50 UJ h	—	—	—	< 0.50 UJ h	—	—
RHMW02	ES030	7/22/2013*	—	61 J h	2,600	Y —	< 0.50 UJ h	0.19 J h	< 0.50 UJ h	0.50 J h	18	6.6	67	—	—	< 0.50 UJ h	—	—	—	< 0.50 UJ h	—	—
RHMW02	ES038	2013-10-21	—	< 48 UJ b	2,400	Y —	< 0.50 U	0.14 J	< 0.50 U	0.37 J	9.0	9.0	30	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	ES039	10/21/2013*	—	< 63 UJ b	2,400	Y —	< 0.50 U	< 0.50 U	< 0.50 U	0.37 J	7.5	7.5	25	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	ES046	1/15/2014[d]	—	—	5,000	—	< 0.50 U	0.17 J	< 0.50 U	0.48 J	6.0	4.9	18	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	ES047	1/15/2014*[d]	—	—	5,200	—	< 0.50 U	0.17 J	< 0.50 U	0.45 J	5.3	4.3	17	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	ES057	1/28/2014[d]	—	< 50 U b	2,300	Y —	0.14 J	0.20 J	< 0.50 U	0.38 J	8.8	5.4	18	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	ES058	1/28/2014*[d]	—	< 52 U b	2,100	Y —	0.15 J	0.20 J	< 0.50 U	0.34 J	9.0	5.9	18	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	ES063	2/24/2014[d]	—	40 J	2,200	Y —	< 0.50 U	0.15 J	< 0.50 U	0.29 J	5.2	2.5	15	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW02	ES065	3/5/2014[d]	—	—	2,100	—	< 0.50 U	0.15 J	< 0.50 U	0.29 J	2.6	1.5	10	—	—	—	—	—	—	—	—	—
RHMW02	ES066	3/5/2014*[d]	—	—	2,200	—	< 0.50 U	0.15 J	< 0.50 U	0.32 J	3.9	2.9	13	—	—	—	—	—	—	—	—	—
RHMW02	ES070	3/10/2014[d]	—	—	930	—	< 0.50 U	< 0.50 U	< 0.50 U	0.30 J	3.7	2.5	11	—	—	—	—	—	—	—	—	—
RHMW02	ES071	3/10/2014*[d]	—	—	890	—	< 0.50 U	< 0.50 U	< 0.50 U	0.31 J	4.2	3.0	12	—	—	—	—	—	—	—	—	—
RHMW02	ES073	3/25/2014[d]	—	—	1,700	Y —	< 0.50 U	0.15 J	< 0.50 U	0.38 J	9.0	4.9	33	—	—	—	—	—	—	—	—	—

Table A.1-1: Cumulative Groundwater COPC Results (cont'd)
First Quarter 2019 - Quarterly Groundwater Monitoring Report, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i

Well Name	Sample ID	Date Sampled	TPH-g **** Result Q	rc	note	TPH-g **** Result Q	rc	note	TPH-d Result Q	rc	note	TPH-o Result Q	rc	note	Benzene Result Q	rc	note	Ethylbenzene Result Q	rc	note	Toluene Result Q	rc	note	Xylenes, Total (p/m-, o-xylene) Result Q	rc	note	1-Methylnaphthalene Result Q	rc	note	2-Methylnaphthalene Result Q	rc	note
		Analyte Class	TPH			TPH			TPH			TPH			Volatiles			Volatiles			Volatiles			Volatiles			Semivolatiles (PAHs)			Semivolatiles (PAHs)		
		Analyte Type	COPC			COPC			COPC			COPC			COPC			COPC			COPC			COPC			COPC			COPC		
		Analytical Method	8015			8260			8015			8015			8260			8260			8260			8260			8270 SIM			8270 SIM		
		CAS No.	Gas			Gas			Diesel			Oil			71-43-2			100-41-4			108-88-3			1330-20-7			90-12-0			91-57-6		
		Unit	µg/L			µg/L			µg/L			µg/L			µg/L			µg/L			µg/L			µg/L			µg/L			µg/L		
		DOH EAL	300			300			400			500			5			30			40			20			10			10		
		SSRBL	—			—			4500			—			750			—			—			—			—			—		
RHMW02	ES074	3/25/2014*[d]	—			—			1,700		Y	—			< 0.50 U			0.16 J			< 0.50 U			0.41 J			8.1			4.0		
RHMW02	ES078	4/7/2014[d]	—			—			3,500		Y	—			< 0.50 U			0.18 J			< 0.50 U			0.40 J			6.2			4.4		
RHMW02	ES079	4/7/2014*[d]	—			—			3,300		Y	—			< 0.50 U			< 0.50 U			< 0.50 U			0.33 J			9.0			7.6		
RHMW02	ES081	4/21/2014[d]	—			53			1,900			—			< 0.50 U			0.17 J			< 0.50 U			0.43 J			8.7			8.1		
RHMW02	ES082	4/21/2014*[d]	—			50			1,500			—			< 0.50 U			0.16 J			< 0.50 U			0.42 J			8.3			7.7		
RHMW02	ES092	5/27/2014[d]	—			—			1,500		Y	—			< 0.50 U			< 0.50 U			< 0.50 U			0.31 J			9.3			2.7		
RHMW02	ES093	5/27/2014*[d]	—			—			1,300		Y	—			< 0.50 U			< 0.50 U			< 0.50 U			0.32 J			7.8			1.5		
RHMW02	ES099	6/23/2014[d]	—			—			1,800			—			< 0.50 U			0.16 J			< 0.50 U			0.40 J			11			3.4		
RHMW02	ES100	6/23/2014*[d]	—			—			1,600			—			< 0.50 U			0.18 J			< 0.50 U			0.37 J			12			4.5		
RHMW02	ES104	2014-07-21	—			48 J			1,200		Y	—			< 0.50 U			< 0.50 U			< 0.50 U			0.36 J			25			20		
RHMW02	ES105	7/21/2014*	—			49 J			1,300		Y	—			< 0.50 U			< 0.50 U			< 0.50 U			0.33 J			26			22		
RHMW02	ES114	2014-10-27	—			57			2,000		Y	—			< 0.50 U			0.15 J			< 0.50 U			0.32 J			59			43		
RHMW02	ES115	2014-10-27	—			53			2,000		Y	—			< 0.50 U			0.14 J			< 0.50 U			0.29 J			54			36		
RHMW02	ES126	2015-01-28	—			54			1,100		Y	—			< 0.50 U			0.16 J			< 0.50 U			0.35 J			34			7.6		
RHMW02	ES127	1/28/2015*	—			59			1,700		Y	—			< 0.50 U			0.17 J			< 0.50 U			0.35 J			25			2.7		
RHMW02	ES131	2015-04-20	46 J			—			5,200		Y	360		Y	0.090 J			0.18 J			< 0.10 U			0.26 J			31			15		
RHMW02	ES132	4/20/2015*	47 J			—			5,400		Y	360		Y	0.080 J			0.19 J			< 0.10 U			0.30 J			68			37		
RHMW02	ES144	2015-06-25	—			—			3,800		Y	250		Y	—			—			—			—			71			48		
RHMW02	ES146	2015-07-20	40 J			—			3,900 J	s	Y	240 J	s	Y	< 0.10 U			0.16 J			0.060 J			0.26 J			65			43		
RHMW02	ES147	7/20/2015*	41 J			—			3,200		Y	260		Y	0.10 J			0.17 J			< 0.10 U			0.27 J			66			43		
RHMW02	ERH012	2015-10-20	47 J			—			6,100		Y	310		Y	0.090 J	h		0.29 J	h		< 0.3 UJ	b h t		0.32 J	h		60			27		
RHMW02	ERH013	10/20/2015*	47 J			—			6,200		Y	320		Y	0.090 J	h		0.26 J	h		< 0.49 UJ	b h t		0.30 J	h		57			24		
RHMW02	ERH025	2016-01-20	36 J			—			6,500		Y	340		Y	0.080 J			0.014 J			< 0.07 UJ	t		0.21 J			48			7.9		
RHMW02	ERH040	2016-04-20	< 35 U	f		—			4,400		Y	390		Y	< 0.10 U			< 0.17 U	f		< 0.10 U			< 0.16 U	f		59			38		
RHMW02	ERH041	4/20/2016*	< 35 U	f		—			3,700		Y	400		Y	0.070 J			< 0.17 U	f		< 0.10 U			< 0.18 U	f		61			39		
RHMW02	ERH054	2016-07-20	31 J	s		—			3,600		Y	280		Y	0.070 J			< 0.13 U	f		< 0.10 U			< 0.21 U	f		36			13		
RHMW02	ERH055	7/20/2016*	30 J	s		—			3,200		Y	270		Y	0.080 J			< 0.14 U	f		< 0.10 U			< 0.23 U	f		33			12		
RHMW02	ERH091	2016-10-19	—			35			1,300			< 40 U			< 0.30 U			< 0.50 U			< 0.30 U			< 0.30 U			25			9.2		
RHMW02	ERH124	2016-11-15	—			26		Y	1,300		O	100			< 0.30 U			< 0.50 U			< 0.30 U			< 0.30 U			29			12		
RHMW02	ERH144	2016-12-13	—			< 18 U			1,300		O	< 40 U			< 0.30 U			< 0.50 U			< 0.30 U			0.19 J			17			11		
RHMW02	ERH174	2017-01-10	—			63		Y	1,400		O	42			< 0.30 U			< 0.50 U			< 0.30 U			0.26 J			25			11		
RHMW02	ERH216	2017-02-07	—			65		Y	1,000		O	< 40 U			< 0.30 U			< 0.50 U			< 0.30 U			0.23 J			22			16		
RHMW02	ERH265	2017-03-07	—			73		W	1,200		O	< 40 U			< 0.30 U			< 0.50 U			< 0.30 U			< 0.30 U			22			17		
RHMW02	ERH300	2017-04-04	—			57		W	940		O	84			< 0.30 U			< 0.50 U			< 0.30 U			< 0.30 U			20			17		
RHMW02	ERH334	2017-05-01	—			94		Y	1000		Y	< 40 U			< 0.30 U			< 0.50 U			< 0.30 U			< 0.30 U			28			24		
RHMW02	ERH354	2017-06-05	—			65		Y	1000		O	< 40 U			< 0.30 U			< 0.50 U			< 0.30 U			< 0.30 U			25			16		
RHMW02	ERH391	2017-07-06	—			33		Y	1000		O	< 40 U			< 0.30 U			< 0.50 U			< 0.30 U			1.4 J			14			1.5		
RHMW02	ERH415	2017-10-23	—			43		Y	1300 J	q	O	< 40 U			< 0.30 U			< 0.50 U			< 0.30 U			0.25 J			14 J	q		7.4 J	e q	
RHMW02	ERH416	10/23/2017*	—			76		Y	1600		O	< 40 U			< 0.30 U			< 0.50 U			< 0.30 U			0.26 J			15			8.6		
RHMW02	ERH547	2018-03-13	—			47		Y	1900		O	< 40 U			< 0.30 U			< 0.50 U			< 0.30 U			0.28 J			20			13		
RHMW02	ERH548	3/13/2018*	—			42		Y	1800		O	< 40 U			< 0.30 U			< 0.50 U			< 0.30 U			0.37 J			25			18		
RHMW02	ERH593	2018-04-24	—			51			2700		O	< 40 U			< 0.30 U			< 0.50 U			< 0.30 U			< 0.30 U			26			25		
RHMW02	ERH594	4/24/2018*	—			44			2800		O	< 40 U			< 0.30 U			< 0.50 U			< 0.30 U			< 0.30 U			27			27		
RHMW02	ERH639	2018-07-24	—			78		Y	2100		O	< 40 U			< 0.30 U			< 0.50 U			< 0.30 U			< 0.30 U			16			10		
RHMW02	ERH640	7/24/2018*	—			78		Y	1500		O	< 40 U			< 0.30 U			< 0.50 U			< 0.30 U			< 0.30 U			19			14		
RHMW02	ERH683	2018-10-23	—			81		Y	2000 J	h	O	< 40 UJ	h		< 0.30 U			< 0.50 U			< 0.30 U			< 0.30 U			21			20		
RHMW02	ERH684	10/23/2018*	—			92		Y	2100 J	h	O	< 40 UJ	h		< 0.30 U			< 0.50 U			< 0.30 U			< 0.30 U			20			18		
RHMW02	ERH738	2019-01-21	—			48		W	2400		O	< 40 U			< 0.30 UJ	s		< 0.50 UJ	s		< 0.30 UJ	s		< 0.30 UJ	s		11			8.8		
RHMW02	ERH739	1/21/2019*	—			22		W	2700		O	< 40 U			< 0.30 UJ	s		< 0.50 UJ	s		< 0.30 UJ	s		< 0.30 UJ	s		9.6			7.2		
RHMW03	RHMW03W01	9/20/2005[a]	< 0.50 U			—			162 J		Y	—			< 0.50 U			< 0.50 U			< 0.50 U			< 0.50 U			< 0.24 U			< 0.24 U		
RHMW03	RHMW03-GW02	7/10/2006[a]	< 50 U			—			142		Y	—			< 0.50 U			< 0.50 U			< 0.50 U			< 0.50 U			< 0.25 U			< 0.25 U		
RHMW03	RHMW03-GW06	12/5/2006[a]	< 50 U			—			< 100 U			—			< 0.50 U			< 0.50 U			< 0.50 U			< 0.50 U			< 0.25 U			< 0.25 U		
RHMW03	RHMW03-WG07	3/27/2007[a]	< 50 U			—			95.7 J			—			< 0.50 U			< 0.50 U			< 0.50 U			< 0.50 U			< 0.25 U			< 0.25 U		
RHMW03	RHMW03-WG08	6/12/2007[a]	< 50 U			—			123 J			—			< 0.50 U			< 0.50 U			< 0.50 U			< 0.50 U			< 0.25 U			< 0.25 U		
RHMW03	RHMW03-WG09	9/10/2007[a]	< 50 U			—			< 96 U			—			< 0.20 U			< 0.20 U			< 0.27 U			< 0.36 U			< 0.25 U			< 0.25 U		
RHMW03	RHMW03-WG10	1/15/2008[a]	< 10.0 U			—			242 J			—			< 0.120 U			< 0.310 U			< 0.310 U			< 0.620 U			< 0.0156 U			< 0.0156 U		
RHMW03	RHMW03-WG11	4/15/2008[a]	< 10.0 U			—			190 J			—			< 0.120 U			< 0.310 U			< 0.310 U			< 0.620 U			< 0.0268 UJ	b		< 0.0279 UJ	b	
RHMW03	RHMW03-WG12	7/29/2008[ad]	< 10.0 U			—			199 J			—			< 0.120 U			< 0.310 U			< 0.310 U			< 0.620 U			0.0294 J			< 0.0156 U		
RHMW03	RHMW03-WG13	10/22/2008[ad]	< 10.0 U			—			244 J			—			< 0.120 U			< 0.310 U			< 0.310 U			< 0.620 U			0.0658			0.0937		
RHMW03	RHMW03-WG14	2/4/2009[a]	16.1 J			—			207 J			—			< 0.120 U			< 0.310 U			< 0.310 U			< 0.620 U			< 0.0161 U			< 0.0161 U		
RHMW03	RHMW03-WG15	5/13/2009[a]	< 14.8 UJ	b t		—			< 161 U			—			< 0.120 U			< 0.310 U			< 0.310 U			< 0.620 U			< 0.0152 U			< 0.0152 U		
RHMW03	RHMW03-WG16	7/15/2009[a]	< 30.0 U			—			< 150 U			—			< 0.120 U			< 0.310 U			< 0.310 U			< 0.620 U			< 0.0158 U			< 0.0158 U		
RHMW03	RHMW03-WG17	10/14/2009[a]	< 30 U			—			< 163 U			—			< 0.12 U			< 0.31 U			< 0.31 U			< 1 U			< 0.0169 U			< 0.0169 U		
RHMW03	RHMW03-WG18	2010-01-27	< 60.0 U			—			< 330 U			—			< 0.240 U			< 0.620 U			< 0.620 U			< 1.24 U			< 0.0322 U			< 0.0322 U		
RHMW03	RHMW03-WG19	2010-04-13	< 60.0 U			—			< 320 U			—			< 0.240 U			< 0.620 U			< 0.620 U			< 1.24 U			< 0.0322 U			< 0.0322 U		
RHMW03	RHMW03-WG20	2010-07-13	< 60.0 U			—			< 324 U			—			< 0.240 U			< 0.620 U			< 0.620 U			< 1.24 U			< 0.0322 U			< 0.0322 U		
RHMW03	ES001	10/18/2010[d]	—			< 12.12 U			330		Y	—			< 0.32 U			< 0.46 U			< 0.34 U			< 0.38 U			< 0.12 U			< 0.12 U		
RHMW03	ES012	2011-01-19	—			< 12.12 U			< 80.8 U			—			< 0.32 U			< 0.46 U			< 0.34 U			< 0.38 U			< 0.12 U			< 0.12 U		
RHMW03	ES025	4/20/2011[d]	—			< 12.12 U			< 80.8 U			—			< 0.32 U			< 0.46 U			< 0.34 U			< 0.38 U			< 0.12 U			< 0.12 U		
RHMW03	ES035	2011-07-19	—			< 12.12 U			< 80.8 U			< 212.0 U			< 0.32 U			< 0.46 U			< 0.34 U			< 0.38 U			< 0.12 U			< 0.12 U		
RHMW03	ES049	2011-10-24	—			< 12.12 U			< 80.8 U			—			< 0.32 U			< 0.46 U			< 0.34 U			< 0.38 U			< 0.12 U			< 0.12 U		
RHMW03	ES060	2012-01-26	—			< 12.12 U			< 80.8 U			—			< 0.32 U			< 0.46 U			< 0.34 U			< 0.38 U			< 0.12 U			< 0.12 U		
RHMW03	ES073	2012-04-16	—			< 12.12 U			< 80.8 U			—			< 0.32 U			< 0.46 U			< 0.34 U			< 0.38 U			< 0.12 U			< 0.12 U		
RHMW03	ES081	2012-07-18	—			< 12.12 U			< 80.8 U			< 212.0 U			< 0.32 U			< 0.46 U			< 0.34 U			< 0.38 U			< 0.12 U			< 0.12 U		
RHMW03	ES004	2012-10-22	—			< 30 U			45 J		Y	—			< 0.50 U			< 0.50 U			0.54 J			< 1.0 U			< 0.050 U			< 0.050 U		
RHMW03	ES013	2013-01-28	—			< 30 U			59		Y	—			< 0.50 U			< 0.50 U			< 0.50 U			< 1.0 U			0.10 J			0.069 J		
RHMW03	ES022	2013-04-22	—			< 30 U			69		Y	—			< 0.50 U			< 0.50 U			< 0.50 U			< 1.0 U			< 0.053 U			< 0.053 U		
RHMW03	ES031	2013-07-22	—			< 30 UJ	h		48 J		Y	—			< 0.50 UJ	h		< 0.50 UJ	h		< 0.50 UJ	h		< 1.0 UJ	h		< 0.050 U			< 0.050 U		
RHMW03	ES040	2013-10-21	—			< 23 UJ	b		54		Y	—			< 0.50 U			< 0.50 U			< 0.50 U			< 1.0 U			< 0.050 U			< 0.050 U		
RHMW03	ES059	1/28/2014[d]	—			< 20 UJ	b		74			—			< 0.50 U			< 0.50 U			< 0.50 U			< 1.0 U			< 0.050 U			< 0.050 U		
RHMW03	ES083	4/21/2014[d]	—			< 30 U			39		Y	—			< 0.50 U			< 0.50 U			< 0.50 U			< 1.0 U			< 0.049 U			< 0.049 U		
RHMW03	ES106	2014-07-22	—			< 30 U			37		Y	—			< 0.50 U			< 0.50 U			< 0.50 U			< 1.0 U			< 0.047 U			< 0.047 U		
RHMW03	ES116	2014-10-27	—			< 30 U			80		Y	—			< 0.50 U			< 0.50 U			< 0.50 U			< 1.0 U			< 0.11 U			< 0.054 U		
RHMW03	ES123	2015-01-28	—			< 30 U			39		Y	—			< 0.50 U			< 0.50 U			< 0.50 U			< 1.0 U			< 0.097 U			< 0.048 U		
RHMW03	ES133	2015-04-20	< 25 U			—			100		Y	110		Y	< 0.10 U			< 0.10 U			< 0.10 U			< 0.20 U			0.015 J			0.0083 J		

Well Name	Sample ID	Date Sampled	Naphthalene ***** Result Q	rc	note	Naphthalene ***** Result Q	rc	note	1,2-Dibromoethane ***** Result Q	rc	note	1,2-Dibromoethane ***** Result Q	rc	note	1,2-Dibromoethane ***** Result Q	rc	note	1,2-Dibromoethane ***** Result Q	rc	note	1,2-Dichloroethane ***** Result Q	rc	note	1,2-Dichloroethane ***** Result Q	rc	note	Phenol Result Q	rc	note	2-(2-Methoxyethoxy)-ethanol Result Q	rc	note
		Analyte Class	Semivolatiles (PAHs)			Semivolatiles (PAHs)			Lead Scavenger			Lead Scavenger			Lead Scavenger			Lead Scavenger			Lead Scavenger			Lead Scavenger			Semivolatiles			Semivolatiles		
		Analyte Type	COPC			COPC			Lead Scavenger			Lead Scavenger			Lead Scavenger			Lead Scavenger			Lead Scavenger			Lead Scavenger			Fuel Additive			Fuel Additive		
		Analytical Method	8270 SIM			8260			8011			8260			504.1			8260SIM			8260SIM			8260			8270			8270/8270 Mod.		
		CAS No.	91-20-3			91-20-3			106-93-4			106-93-4			106-93-4			106-93-4			107-06-2			107-06-2			108-95-2			111-77-3		
		Unit	µg/L			µg/L			µg/L			µg/L			µg/L			µg/L			µg/L			µg/L			µg/L			µg/L		
		DOH EAL	17			17			0.04			0.04			0.04			0.04			5			5			300			800		
		SSRBL	—			—			—			—			—			—			—			—			—			—		
RHMW02	ES074	3/25/2014*[d]	33			—			—			—			—			—			—			—			—			—		
RHMW02	ES078	4/7/2014[d]	25			—			—			—			—			—			—			—			—			—		
RHMW02	ES079	4/7/2014*[d]	31			—			—			—			—			—			—			—			—			—		
RHMW02	ES081	4/21/2014[d]	31			—			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW02	ES082	4/21/2014*[d]	32			—			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW02	ES092	5/27/2014[d]	34			—			—			—			—			—			—			—			—			—		
RHMW02	ES093	5/27/2014*[d]	28			—			—			—			—			—			—			—			—			—		
RHMW02	ES099	6/23/2014[d]	38			—			—			—			—			—			—			—			—			—		
RHMW02	ES100	6/23/2014*[d]	41			—			—			—			—			—			—			—			—			—		
RHMW02	ES104	2014-07-21	71			—			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW02	ES105	7/21/2014*	76			—			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW02	ES114	2014-10-27	140			—			—			< 0.50 U			—			—			—			< 0.50 UJ	c		—			—		
RHMW02	ES115	2014-10-27	130			—			—			< 0.50 U			—			—			—			< 0.50 UJ	c		—			—		
RHMW02	ES126	2015-01-28	90			—			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW02	ES127	1/28/2015*	63			—			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW02	ES131	2015-04-20	39			—			< 0.0040 U			< 0.20 U			—			< 0.010 U			< 0.015 U			—			—			—		
RHMW02	ES132	4/20/2015*	140			—			< 0.0040 U			< 0.20 U			—			< 0.010 U			< 0.015 U			—			—			—		
RHMW02	ES144	2015-06-25	150			—			—			—			—			—			—			—			—			—		
RHMW02	ES146	2015-07-20	150			—			< 0.0040 U			< 0.20 U			—			—			< 0.015 U			—			—			—		
RHMW02	ES147	7/20/2015*	160			—			< 0.0040 U			< 0.20 U			—			—			< 0.015 U			—			—			—		
RHMW02	ERH012	2015-10-20	120			—			< 0.0040 U			< 0.20 UJ	h		—			—			< 0.015 U			—			—			—		
RHMW02	ERH013	10/20/2015*	88			—			< 0.0040 U			< 0.20 UJ	h		—			—			< 0.015 U			—			—			—		
RHMW02	ERH025	2016-01-20	120			—			< 0.0040 U			< 0.20 U			—			—			< 0.015 U			—			—			—		
RHMW02	ERH040	2016-04-20	100			—			—			—			—			—			—			—			—			—		
RHMW02	ERH041	4/20/2016*	110			—			—			—			—			—			—			—			—			—		
RHMW02	ERH054	2016-07-20	67			—			—			—			—			—			—			—			—			—		
RHMW02	ERH055	7/20/2016*	62			—			—			—			—			—			—			—			—			—		
RHMW02	ERH091	2016-10-19	49			—			—			—			—			—			—			—			< 4.00 U			< 80.0 UJ	h	
RHMW02	ERH124	2016-11-15	58			—			—			—			—			—			—			—			< 4.00 U			< 80.0 U		
RHMW02	ERH144	2016-12-13	40			—			—			—			—			—			—			—			< 4.00 U			< 80.0 U		
RHMW02	ERH174	2017-01-10	69			—			—			—			—			—			—			—			< 4.00 U			< 80.0 U		
RHMW02	ERH216	2017-02-07	57			—			—			—			—			—			—			—			< 4.00 U			< 80.0 U		
RHMW02	ERH265	2017-03-07	49			—			—			—			—			—			—			—			< 4.00 U			< 80.0 U		
RHMW02	ERH300	2017-04-04	52			—			—			—			—			—			—			—			< 4.00 U			< 80.0 U		
RHMW02	ERH334	2017-05-01	65			—			—			—			—			—			—			—			< 4.00 U			< 80.0 U		
RHMW02	ERH354	2017-06-05	62			—			—			—			—			—			—			—			< 4.00 U			< 80.0 U		
RHMW02	ERH391	2017-07-06	56			—			—			—			—			—			—			—			< 4.00 U			< 80.0 U		
RHMW02	ERH415	2017-10-23	38 J	q		—			—			< 0.50 U			—			—			—			< 0.30 U			< 4.00 U			< 80.0 U		
RHMW02	ERH416	10/23/2017*	37			—			—			< 0.50 U			—			—			—			< 0.30 U			< 4.00 U			< 80.0 U		
RHMW02	ERH547	2018-03-13	53			—			—			—			—			—			—			—			< 4.00 U			< 80.0 U		
RHMW02	ERH548	3/13/2018*	65			—			—			—			—			—			—			—			< 4.00 U			< 80.0 U		
RHMW02	ERH593	2018-04-24	70			—			—			—			—			—			—			—			< 4.00 U			< 80.0 U		
RHMW02	ERH594	4/24/2018*	73			—			—			—			—			—			—			—			< 4.00 U			< 80.0 U		
RHMW02	ERH639	2018-07-24	38			—			—			—			—			—			—			—			< 4.00 U			< 80.0 U		
RHMW02	ERH640	7/24/2018*	48			—			—			—			—			—			—			—			< 4.00 U			< 80.0 U		
RHMW02	ERH683	2018-10-23	51			—			—			—			—			—			—			—			< 4.00 U			< 80.0 UJ	l	
RHMW02	ERH684	10/23/2018*	49			—			—			—			—			—			—			—			< 4.00 U			< 80.0 UJ	l	
RHMW02	ERH738	2019-01-21	32			—			—			—			—			—			—			—			< 4.00 U			< 80.0 UJ	l	
RHMW02	ERH739	1/21/2019*	26			—			—			—			—			—			—			—			< 4.00 U			< 80.0 UJ	l	
RHMW03	RHMW03W01	9/20/2005[a]	< 0.24 U			< 1.0 U			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW03	RHMW03-GW02	7/10/2006[a]	< 0.25 U			< 1.0 U			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW03	RHMW03-GW06	12/5/2006[a]	< 0.25 U			< 1.0 U			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW03	RHMW03-WG07	3/27/2007[a]	< 0.25 U			< 1.0 U			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW03	RHMW03-WG08	6/12/2007[a]	< 0.25 U			< 1.0 U			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW03	RHMW03-WG09	9/10/2007[a]	< 0.25 U			< 0.44 U			—			< 0.20 U			—			—			—			< 0.20 U			—			—		
RHMW03	RHMW03-WG10	1/15/2008[a]	< 0.0323 U			< 0.620 U			—			< 0.310 U			—			—			—			< 0.150 U			—			—		
RHMW03	RHMW03-WG11	4/15/2008[a]	< 0.0341 U			< 0.620 U			—			< 0.310 U			—			—			—			< 0.150 U			—			—		
RHMW03	RHMW03-WG12	7/29/2008[ad]	0.0689 J			< 0.620 U			—			< 0.310 U			—			—			—			< 0.150 UJ			—			—		
RHMW03	RHMW03-WG13	10/22/2008[ad]	0.219			< 0.620 U			—			< 0.310 U			—			—			—			< 0.150 U			—			—		
RHMW03	RHMW03-WG14	2/4/2009[a]	< 0.0333 U			< 0.620 U			—			< 0.310 U			—			—			—			< 0.150 U			—			—		
RHMW03	RHMW03-WG15	5/13/2009[a]	< 0.0313 U			< 0.620 U			—			< 0.310 U			—			—			—			< 0.150 U			—			—		
RHMW03	RHMW03-WG16	7/15/2009[a]	< 0.0326 U			< 0.620 U			—			< 0.310 U			—			—			—			< 0.150 U			—			—		
RHMW03	RHMW03-WG17	10/14/2009[a]	< 0.0348 U			< 0.62 U			—			< 0.31 U			—			—			—			< 0.15 U			—			—		
RHMW03	RHMW03-WG18	2010-01-27	< 0.0666 U			< 1.24 U			—			< 0.620 U			—			—			—			< 0.300 U			—			—		
RHMW03	RHMW03-WG19	2010-04-13	< 0.0666 U			< 1.24 U			—			< 0.620 U			—			—			—			< 0.300 U			—			—		
RHMW03	RHMW03-WG20	2010-07-13	< 0.0666 U			< 1.24 U			—			< 0.620 U			—			—			—			< 0.300 U			—			—		
RHMW03	ES001	10/18/2010[d]	< 0.10 U			—			—			< 0.40 U			—			—			—			< 0.28 U			—			—		
RHMW03	ES012	2011-01-19	< 0.10 U			—			—			< 0.40 U			—			—			—			< 0.28 U			—			—		
RHMW03	ES025	4/20/2011[d]	< 0.10 U			—			—			< 0.40 U			—			—			—			< 0.28 U			—			—		
RHMW03	ES035	2011-07-19	< 0.10 U			—			—			< 0.40 U			—			—			—			< 0.28 U			—			—		
RHMW03	ES049	2011-10-24	< 0.10 U			—			—			< 0.40 U			—			—			—			< 0.28 U			—			—		
RHMW03	ES060	2012-01-26	< 0.10 U			—			—			< 0.40 U			—			—			—			< 0.28 U			—			—		
RHMW03	ES073	2012-04-16	< 0.10 U			—			—			< 0.40 U			—			—			—			< 0.28 U			—			—		
RHMW03	ES081	2012-07-18	< 0.10 U			—			—			< 0.40 U			—			—			—			< 0.28 U			—			—		
RHMW03	ES004	2012-10-22	0.029 J			—			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW03	ES013	2013-01-28	0.32			—			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW03	ES022	2013-04-22	< 0.053 U			—			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW03	ES031	2013-07-22	0.064 J			—			—			< 0.50 UJ	h		—			—			—			< 0.50 UJ	h		—			—		
RHMW03	ES040	2013-10-21	< 0.050 U			—			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW03	ES059	1/28/2014[d]	0.15 J			—			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW03	ES083	4/21/2014[d]	0.11 J			—			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW03	ES106	2014-07-22	< 0.047 U			—			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW03	ES116	2014-10-27	< 0.054 U			—			—			< 0.50 U			—			—			—			< 0.50 UJ	c		—			—		
RHMW03	ES123	2015-01-28	< 0.048 U			—			—			< 0.50 U			—			—			—			< 0.50 U			—			—		
RHMW03	ES133	2015-04-20	0.035			—			< 0.0040 U			< 0.20 U			—			< 0.010 U			< 0.015 U			—			—			—		

Table A.1-1: Cumulative Groundwater COPC Results (cont'd)
First Quarter 2019 - Quarterly Groundwater Monitoring Report, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i

Well Name	Sample ID	Date Sampled	TPH-g ****	TPH-g ****	TPH-d	TPH-o	Benzene	Ethylbenzene	Toluene	Xylenes, Total (p/m-, o-xylene)	1-Methylnaphthalene	2-Methylnaphthalene	Naphthalene *****	Naphthalene *****	1,2-Dibromoethane *****	1,2-Dibromoethane *****	1,2-Dibromoethane *****	1,2-Dibromoethane *****	1,2-Dichloroethane *****	1,2-Dichloroethane *****	Phenol	2-(2-Methoxyethoxy)-ethanol
		Analyte Class	TPH	TPH	TPH	TPH	Volatiles	Volatiles	Volatiles	Volatiles	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Semivolatiles	Semivolatiles
		Analyte Type	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Fuel Additive	Fuel Additive
		Analytical Method	8015	8260	8015	8015	8260	8260	8260	8260	8270 SIM	8270 SIM	8270 SIM	8260	8011	8260	504.1	8260SIM	8260SIM	8260	8270	8270/8270 Mod.
		CAS No.	Gas	Gas	Diesel	Oil	71-43-2	100-41-4	108-88-3	1330-20-7	90-12-0	91-57-6	91-20-3	91-20-3	106-93-4	106-93-4	106-93-4	106-93-4	107-06-2	107-06-2	108-95-2	111-77-3
		Unit	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
		DOH EAL	300	300	400	500	5	30	40	20	10	10	17	17	0.04	0.04	0.04	0.04	5	5	300	800
		SSRBL	—	—	4500	—	750	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
			Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note
RHMW03	ES148	2015-07-20	< 25 U	—	130 Y	150 Y	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0052 U	< 0.0052 U	< 0.0052 U	—	< 0.0040 U	< 0.20 U	—	—	< 0.015 U	—	—	—
RHMW03	ERH014	2015-10-20	< 25 U	—	130 Y	< 160 UJ b Y	< 0.10 UJ h	< 0.10 UJ h	< 0.4 UJ h t	< 0.20 UJ h	0.0039 J	< 0.0034 UJ b	< 0.0094 UJ b	—	< 0.0040 U	< 0.20 UJ h	—	—	< 0.015 U	—	—	—
RHMW03	ERH026	2016-01-20	< 25 U	—	150 Y	< 160 UJ b Y	< 0.10 U	< 0.10 U	< 0.14 UJ t	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0050 U	—	< 0.0040 U	< 0.20 U	—	—	< 0.015 U	—	—	—
RHMW03	ERH042	2016-04-20	< 25 U	—	< 95 U f Y	< 170 U b f Y	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0084 U f	< 0.0075 U f	< 0.0050 U	—	—	—	—	—	—	—	—	—
RHMW03	ERH056	2016-07-20	< 25 U	—	< 70 U f Y	< 110 U b f	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	0.0073 J	0.0040 J	< 0.025 U f	—	—	—	—	—	—	—	—	—
RHMW03	ERH093	2016-10-19	—	< 18 U	65 Y	59	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ h
RHMW03	ERH125	2016-11-15	—	< 18 U	51 Y	42	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW03	ERH152	2016-12-14	—	< 18 U	56 Y	49	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW03	ERH181	2017-01-12	—	< 18 U	51 Y	46	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW03	ERH231	2017-02-08	—	< 18 U	67 Y	71	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW03	ERH268	2017-03-07	—	< 18 U	55 Y	41	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW03	ERH303	2017-04-04	—	< 18 U	47 Y	47	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW03	ERH336	2017-05-01	—	< 18 U	50 Y	46	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW03	ERH356	2017-06-06	—	< 18 U	46 Y	36 J	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW03	ERH393	2017-07-06	—	< 18 U	49 Y	46	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW03	ERH418	2017-10-23	—	< 18 U	160 Y	160	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	< 0.50 U	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW03	ERH419	10/23/2017*	—	—	210 O	200	—	—	—	—	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW03	ERH550	2018-03-12	—	< 18 U	190 O	180 Y	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW03	ERH596	2018-04-25	—	< 18 U	160 Y	110	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW03	ERH642	2018-07-25	—	< 18 U	300 Y	140	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW03	ERH686	2018-10-23	—	< 18 U	220 J h Y	190 J h	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW03	ERH741	2019-01-22	—	< 18 U	380 Y	310	< 0.30 U	< 0.50 U	< 0.30 UJ l	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW04	RHMW04W01	9/19/2005[a]	< 50.0 U	—	338 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.28 U	< 0.28 U	< 0.28 U	< 1.0 U	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW04	RHMW04-GW02	7/10/2006[a]	< 50.0 U	—	< 100 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.26 U	< 0.26 U	< 0.26 U	< 1.0 U	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW04	RHMW04-WG-01	8/4/2009[ad]	< 30.0 U	—	< 157 U	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	< 0.0162 U	< 0.0162 U	< 0.0335 U	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW04	RHMWA01-WG-01	8/4/2009*[ad]	< 30.0 U	—	< 161 U	—	0.250 J	< 0.310 U	< 0.310 U	< 0.620 U	< 0.0167 U	< 0.0167 U	< 0.0344 U	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW04	RHMW04-WG-02	10/13/2009[abd]	< 30.0 U	—	< 169 U	—	< 0.12 U	< 0.31 U	< 0.31 U	< 0.62 U	< 0.0172 U	< 0.0172 U	< 0.0356 U	< 0.62 U	—	< 0.31 U	—	—	—	< 0.15 U	—	—
RHMW04	RHMWA01-WG-02	10/13/2009*[abd]	< 30.0 U	—	< 174 U	—	< 0.12 U	< 0.31 U	< 0.31 U	< 0.62 U	< 0.0169 U	< 0.0169 U	< 0.0348 U	< 0.62 U	—	< 0.31 U	—	—	—	< 0.15 U	—	—
RHMW04	RHMW04-WG-03	1/26/2010[d]	< 60.0 U	—	< 334 U	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	< 0.0326 U	< 0.0326 U	< 0.0674 U	< 1.24 U	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW04	RHMWA01-WG-03	1/26/2010*[d]	< 60.0 U	—	< 330 U	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	< 0.0338 U	< 0.0338 U	< 0.0696 U	< 1.24 U	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW04	RHMW04-WG-04	4/26/2010[d]	< 60.0 U	—	< 348 U	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	< 0.0352 U	< 0.0352 U	< 0.0730 U	< 1.24 U	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW04	RHMWA01-WG-04	4/26/2010*[d]	< 60.0 U	—	< 352 U	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	< 0.0352 U	< 0.0352 U	< 0.0730 U	< 1.24 U	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW04	ES112	2014-07-23	—	< 30 U	17 J Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.052 U	< 0.052 U	< 0.052 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW04	ES119	2014-10-29	—	< 30 U	< 12 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.099 U	< 0.050 U	< 0.050 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW04	ES129	2015-01-29	—	< 30 U	10 J Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.10 U	< 0.052 U	< 0.052 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW04	ES139	2015-04-22	< 25 UJ s	—	< 21 U	< 28 UJ b	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0050 U	—	< 0.0040 UJ h	< 0.20 U	—	< 0.010 U	< 0.015 U	—	—	—
RHMW04	ES156	2015-08-20	< 25 U	—	< 24 UJ b	< 40 UJ b	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	0.0059 J	0.0075 J	—	< 0.0040 U	< 0.20 U	—	—	< 0.015 U	—	—	—
RHMW04	ERH006	2015-10-19	< 25 U	—	< 22 UJ b	< 53 UJ b	0.08 J h	< 0.10 UJ h	< 0.42 UJ h t	< 0.20 UJ h	0.0043 J	< 0.0047 UJ b	< 0.0051 UJ b	—	< 0.0040 U	< 0.20 UJ h	—	—	< 0.015 U	—	—	—
RHMW04	ERH019	2016-01-19	< 25 U	—	< 36 UJ b	< 52 UJ b	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0050 U	—	< 0.0040 U	< 0.20 U	—	—	< 0.015 U	—	—	—
RHMW04	ERH020	2016-01-19	< 25 U	—	< 29 UJ b	< 53 UJ b	< 0.10 U	< 0.10 U	< 0.11 UJ t	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0050 U	—	< 0.0040 U	< 0.20 U	—	—	< 0.015 U	—	—	—
RHMW04	ERH034	2016-04-19	< 25 U	—	< 20 U b f	< 33 U b f	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0050 U	—	—	—	—	—	—	—	—	—
RHMW04	ERH048	2016-07-19	< 25 U	—	< 23 U f	< 54 U b f	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	0.0070 J	0.0068 J	0.18	—	—	—	—	—	—	—	—	—
RHMW04	ERH096	2016-10-25	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW04	ERH128	2016-11-14	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW04	ERH138	2016-12-13	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW04	ERH166	2017-01-09	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW04	ERH208	2017-02-06	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW04	ERH260	2017-03-06	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW04	ERH295	2017-04-03	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW04	ERH381	2017-07-05	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW04	ERH421	2017-10-24	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW04	ERH552	2018-03-14	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW04	ERH598	2018-04-25	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW04	ERH644	2018-07-26	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW04	ERH688	2018-10-24	—	< 18 U	< 25 UJ h	< 40 UJ h	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW04	ERH743	2019-01-21	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	0.18 J	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW05	RHMW05-WG15	5/13/2009[a]	< 13.2 UJ b t	—	200 J Z	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	< 0.0158 U	< 0.0158 U	< 0.0326 U	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW05	RHMW05-WG16	7/15/2009[a]	< 30.0 U	—	491 Z	—	< 0.120 U	< 0.310 U	< 0.310 U	< 0.620 U	< 0.0165 U	< 0.0165 U	< 0.0341 U	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
RHMW05	RHMW05-WG17	10/13/2009[a]	< 30.0 U	—	673 Z	—	< 0.12 U	< 0.31 U	< 0.31 U	< 1 U	< 0.017 U	< 0.017 U	< 0.0352 U	< 0.62 U	—	< 0.31 U	—	—	—	< 0.15 U	—	—
RHMW05	RHMW05-WG18	2010-01-26	< 60.0 U	—	2,060 Z	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	0.0207 J	0.0246 J	< 0.0712 U	< 1.24 U	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW05	RHMW05-WG19	2010-04-13	< 60.0 U	—	< 300 U	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	0.0335 J	< 0.0326 U	0.0752 J	< 1.24 U	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW05	RHMW05-WG20	2010-07-13	< 60.0 U	—	< 320 U	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	< 0.0316 U	< 0.0316 U	0.0643 J	< 1.24 U	—	< 0.620 U	—	—	—	< 0.300 U	—	—
RHMW05	ES005	2010-10-20	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW05	ES013	2011-01-19	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW05	ES024	4/20/2011[d]	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW05	ES039	2011-07-19	—	< 12.12 U	< 80.8 U	< 212.0 U	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW05	ES051	2011-10-25	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW05	ES063	2012-02-01	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW05	ES070	2012-04-16	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW05	ES079	2012-07-17	—	< 12.12 U	< 80.8 U	< 212.0 U	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW05	ES080	7/17/2012*	—	< 12.12 U	< 80.8 U	< 212.0 U	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
RHMW05	ES005	2012-10-22	—	< 15 UJ b	17 Y	—	< 0.50 U	< 0.50 U	0.31 J	< 1.0 U	< 0.050 U	< 0.050 U	0.038 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW05	ES015	2013-01-29	—	< 30 U	62 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	0.075 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW05	ES024	2013-04-23	—	< 21 UJ t	27 J	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.048 U	< 0.048 U	0.033 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW05	ES033	2013-07-23	—	< 30 U	< 20 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.051 U	< 0.051 U	0.033 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW05	ES042	2013-10-22	—	< 17 UJ b	< 20 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.051 U	< 0.051 U	0.17 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW05	ES049	1/16/2014[d]	—	—	< 20 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	< 0.050 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW05	ES061	1/29/2014[d]	—	< 23 UJ b	16 J Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	0.064 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW05	ES068	3/6/2014[d]	—	—	< 21 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	0.038 J	—	—	—	—	—	—	—	—	—
RHMW05	ES076	3/26/2014[d]	—	—	17 J Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	0.092 J	—	—	—	—	—	—	—	—	—
RHMW05	ES084	4/22/2014[d]	—	< 30 U	< 10 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.051 U	< 0.051 U	0.066 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW05	ES095	5/28/2014[d]	—	—	< 12 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.049 U	< 0.049 U	< 0.049 U	—	—	—	—	—	—	—	—	—
RHMW05	ES101	6/24/2014[d]	—	—	< 12 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.051 U	< 0.051 U	< 0.051 U	—	—	—	—	—	—	—	—	—
RHMW05	ES108	2014-07-22	—	< 30 U	< 12 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.049 U	< 0.049 U	< 0.049 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW05	ES118	2014-10-28	—	< 30 U	16 J Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.096 U	< 0.048 U	< 0.048 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
RHMW05	ES124	2015-01-27	—	< 30 U	< 13 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.096 U	< 0.048 U	< 0.048 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—

Table A.1-1: Cumulative Groundwater COPC Results (cont'd)
First Quarter 2019 - Quarterly Groundwater Monitoring Report, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i

			Analyte Class	TPH	TPH	TPH	TPH	Volatiles	Volatiles	Volatiles	Volatiles	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Semivolatiles	Semivolatiles
			Analyte Type	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Fuel Additive	Fuel Additive
			Analytical Method	8015	8260	8015	8015	8260	8260	8260	8260	8270 SIM	8270 SIM	8270 SIM	8260	8011	8260	504.1	8260SIM	8260SIM	8260	8270	8270/8270 Mod.
			Analyte	TPH-g ****	TPH-g ****	TPH-d	TPH-o	Benzene	Ethylbenzene	Toluene	Xylenes, Total (p/m-, o-xylene)	1-Methylnaphthalene	2-Methylnaphthalene	Naphthalene *****	Naphthalene *****	1,2-Dibromoethane *****	1,2-Dibromoethane *****	1,2-Dibromoethane *****	1,2-Dibromoethane *****	1,2-Dichloroethane *****	1,2-Dichloroethane *****	Phenol	2-(2-Methoxyethoxy)-ethanol
			CAS No.	Gas	Gas	Diesel	Oil	71-43-2	100-41-4	108-88-3	1330-20-7	90-12-0	91-57-6	91-20-3	91-20-3	106-93-4	106-93-4	106-93-4	106-93-4	106-93-4	107-06-2	107-06-2	108-95-2	111-77-3
			Unit	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
			DOH EAL	300	300	400	500	5	30	40	20	10	10	17	17	0.04	0.04	0.04	0.04	5	5	300	800
			SSRBL	—	—	4500	—	750	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Well Name	Sample ID	Date Sampled	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note
RHMW05	ES135	2015-04-21	< 25 U	—	< 17 UJ b	< 34 UJ b	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0050 U	—	< 0.0040 U	< 0.20 U	—	< 0.010 U	< 0.015 U	—	—	—
RHMW05	ES142	2015-06-25	—	—	15 J	41 J	—	—	—	—	0.0046 J	0.0029 J	< 0.0050 U	—	—	—	—	—	—	—	—	—
RHMW05	ES150	2015-07-21	< 25 U	—	18 J s	44 J s	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	0.0041 J	0.0036 J	0.0058 J	—	< 0.0040 U	< 0.20 U	—	—	< 0.015 U	—	—	—
RHMW05	ERH010	2015-10-20	< 25 U	—	< 20 UJ b	< 54 UJ b	< 0.10 UJ h	< 0.10 UJ h	< 0.59 UJ t	< 0.20 UJ h	0.0050 J	< 0.0066 UJ b	< 0.0074 UJ b	—	< 0.0040 U	< 0.20 UJ h	—	—	< 0.015 U	—	—	—
RHMW05	ERH022	2016-01-20	< 25 U	—	< 27 UJ b	< 45 UJ b	< 0.10 U	< 0.10 U	< 0.18 UJ t	< 0.20 U	< 0.0050 U	0.0031 J	< 0.0050 U	—	< 0.0040 U	< 0.20 U	—	—	< 0.015 U	—	—	—
RHMW05	ERH023	1/20/2016*	< 25 U	—	< 26 UJ b	< 44 UJ b	< 0.10 U	< 0.10 U	< 0.12 UJ t	< 0.20 U	< 0.0050 U	0.0039 J	0.0046 J	—	< 0.0040 U	< 0.20 U	—	—	< 0.015 U	—	—	—
RHMW05	ERH038	2016-04-20	< 25 U	—	< 22 U b f	< 65 U b f	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0050 U	—	—	—	—	—	—	—	—	—
RHMW05	ERH052	2016-07-20	< 25 U	—	< 21 U	< 29 U b f	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0060 U b f	—	—	—	—	—	—	—	—	—
RHMW05	ERH089	2016-10-19	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ h
RHMW05	ERH126	2016-11-15	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW05	ERH136	2016-12-12	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW05	ERH164	2017-01-10	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW05	ERH212	2017-02-07	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW05	ERH278	2017-03-08	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW05	ERH313	2017-04-03	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW05	ERH338	2017-05-01	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW05	ERH358	2017-06-06	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW05	ERH387	2017-07-05	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW05	ERH423	2017-10-24	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW05	ERH554	2018-03-13	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW05	ERH600	2018-04-23	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW05	ERH646	2018-07-23	—	< 18 U	< 25 UJ s	< 40 UJ l s	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW05	ERH690	2018-10-22	—	< 18 U	< 25 UJ h	< 40 UJ h	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW05	ERH745	2019-01-21	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW06	RHMW06-GW-01	10/21/2014[d]	< 20 U	—	< 86 U	< 86 U	< 0.200 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.011 U	0.0064 J	< 0.053 U	—	< 0.020 U	< 0.50 U	—	—	—	< 0.100 U	—	—
RHMW06	RHMW06-GW-02	1/23/2015[d]	< 20 U	—	< 76 U	< 76 U	< 0.200 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.010 U	< 0.010 U	< 0.052 U	—	< 0.020 U	< 0.50 U	—	—	—	< 0.100 U	—	—
RHMW06	ES140	2015-04-23	< 25 U	—	20 J	< 47 UJ b	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0052 U	< 0.0052 U	< 0.0052 U	—	< 0.0040 UJ h	< 0.20 U	—	< 0.010 U	< 0.015 U	—	—	—
RHMW06	ES155	2015-07-28	< 25 U	—	< 20 U	< 50 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0050 U	—	< 0.0040 U	< 0.20 U	—	—	< 0.015 U	—	—	—
RHMW06	ERH004	2015-10-19	< 25 U	—	< 17 UJ b	< 53 UJ b	< 0.10 UJ h	< 0.10 UJ h	< 1.1 UJ b h t	< 0.20 UJ h	< 0.0050 U	< 0.0050 U	< 0.0050 UJ b	—	< 0.0040 U	< 0.20 UJ h	—	—	< 0.015 U	—	—	—
RHMW06	ERH005	2015-10-19	< 25 U	—	< 21 UJ b	< 53 UJ b	< 0.10 UJ h	< 0.10 UJ h	< 0.5 UJ b h t	< 0.20 UJ h	< 0.0050 U	< 0.0050 U	< 0.0050 U	—	< 0.0040 U	< 0.20 UJ h	—	—	< 0.015 U	—	—	—
RHMW06	ERH018	2016-01-19	< 25 U	—	< 21 UJ b	< 54 UJ b	< 0.10 U	< 0.10 U	< 0.1 UJ t	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0050 U	—	< 0.0040 U	< 0.20 U	—	—	< 0.015 U	—	—	—
RHMW06	ERH033	2016-04-19	< 25 U	—	< 28 U b f	< 48 U b f	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0050 U	—	—	—	—	—	—	—	—	—
RHMW06	ERH047	2016-07-19	< 25 U	—	< 23 U	< 27 U b f	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0047 U b f	—	—	—	—	—	—	—	—	—
RHMW06	ERH097	2016-10-19	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW06	ERH120	2016-11-14	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW06	ERH139	2016-12-12	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW06	ERH168	2017-01-09	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW06	ERH210	2017-02-07	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW06	ERH284	2017-03-07	—	< 18 U	< 25 U	47 Y	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW06	ERH319	2017-04-03	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW06	ERH369	2017-07-04	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW06	ERH425	2017-10-24	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW06	ERH556	2018-03-12	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW06	ERH602	2018-04-23	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW06	ERH648	2018-07-23	—	< 18 U	< 25 U	< 40 UJ l	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW06	ERH692	2018-10-23	—	< 18 U	< 25 UJ h	< 40 UJ h	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW06	ERH747	2019-01-21	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW07	RHMW07-GW-01	10/20/2014[d]	< 20 U	—	57 J	< 78 U	< 0.200 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.0096 U	0.0084 J	< 0.048 U	—	< 0.020 U	< 0.50 U	—	—	—	< 0.100 U	—	—
RHMW07	RHMW07-GW-01FD	10/20/2014[d]	< 20 U	—	66 J	< 77 U	< 0.200 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.010 U	0.0060 J	< 0.050 U	—	< 0.020 U	< 0.50 U	—	—	—	< 0.100 U	—	—
RHMW07	RHMW07-GW-02	1/22/2015[d]	< 20 U	—	< 75 U	< 75 U	< 0.200 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.011 U	< 0.011 U	< 0.055 U	—	< 0.020 U	< 0.50 U	—	—	—	< 0.100 U	—	—
RHMW07	RHMW07-GW-02FD	1/22/2015*[d]	< 20 U	—	< 81 U	< 81 U	< 0.200 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.010 U	< 0.010 U	< 0.050 U	—	< 0.020 U	< 0.50 U	—	—	—	< 0.100 U	—	—
RHMW07	ES141	2015-04-23	< 25 U	—	26 J	< 47 UJ b	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0052 U	< 0.0052 U	< 0.0052 U	—	< 0.0040 UJ h	< 0.20 U	—	< 0.010 U	< 0.015 U	—	—	—
RHMW07	ES154	2015-07-27	< 25 U	—	22 J	48 J	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	0.0051 J	0.0095 J	0.0060 J	—	< 0.0040 U	< 0.20 U	—	—	< 0.015 U	—	—	—
RHMW07	ERH003	2015-10-19	< 25 U	—	< 26 UJ b	< 59 UJ b	< 0.10 UJ h	< 0.10 UJ h	< 0.64 UJ b h t	< 0.20 UJ h	0.0067 J	< 0.01 UJ b	< 0.01 UJ b	—	< 0.0040 U	< 0.20 UJ h	—	—	< 0.015 U	—	—	—
RHMW07	ERH017	2016-01-19	< 25 U	—	< 28 UJ b	< 44 UJ b	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	0.0046 J	0.0077 J	0.0038 J	—	< 0.0040 U	< 0.20 U	—	—	< 0.015 U	—	—	—
RHMW07	ERH032	2016-04-19	< 25 U	—	< 26 U b f	< 52 U b f	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	< 0.0036 U f	< 0.0050 U	—	—	—	—	—	—	—	—	—
RHMW07	ERH045	2016-07-19	< 25 U	—	< 22 U	< 40 U b f	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	0.0037 J	< 0.0074 U b f	—	—	—	—	—	—	—	—	—
RHMW07	ERH046	2016-07-19	< 25 U	—	< 17 U f	< 160 U b	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	0.0033 J	< 0.0077 U b f	—	—	—	—	—	—	—	—	—
RHMW07	ERH098	2016-10-19	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ h
RHMW07	ERH121	2016-11-14	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW07	ERH140	2016-12-13	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW07	ERH179	2017-01-10	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW07	ERH218	2017-02-08	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW07	ERH270	2017-03-07	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW07	ERH305	2017-04-03	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW07	ERH371	2017-07-04	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW07	ERH427	2017-10-25	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW07	ERH558	2018-03-13	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW07	ERH604	2018-04-24	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW07	ERH650	2018-07-24	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW07	ERH694	2018-10-23	—	< 18 U	< 25 UJ h	< 40 UJ h	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW07	ERH749	2019-01-23	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 UJ l	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW08	ERH102	2016-10-19	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 UJ h
RHMW08	ERH122	2016-11-15	—	< 18 U	33 Y	32 J	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	< 0.02 UJ c	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW08	ERH141	2016-12-12	—	< 18 U	27 J Y	29 J	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW08	ERH157	2016-12-21	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW08	ERH158	12/21/2016*	—	< 18 U	63 O	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW08	ERH169	2017-01-11	—	< 18 U	28 J Y	29 J	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW08	ERH170	1/11/2017*	—	< 18 U	23 J Y	27 J	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW08	ERH220	2017-02-06	—	< 18 U	26 J Y	31 J	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW08	ERH221	2/6/2017*	—	< 18 U	25 J Y	28 J	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW08	ERH262	2017-03-06	—	< 18 U	27 J Y	23 J	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW08	ERH263	3/6/2017*	—	< 18 U	25 J Y	25 J	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW08	ERH297	2017-04-04	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW08	ERH298	4/4/2017*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW08	ERH340	2017-05-02	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW08	ERH360	2017-06-05	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW08	ERH376	2017-07-04	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U

Table A.1-1: Cumulative Groundwater COPC Results (cont'd)

First Quarter 2019 - Quarterly Groundwater Monitoring Report, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i

		Analyte Class	TPH	TPH	TPH	TPH	Volatiles	Volatiles	Volatiles	Volatiles	Semivolatiles (PAHs)
		Analyte Type	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC
		Analytical Method	8015	8260	8015	8015	8260	8260	8260	8260	8270 SIM
		Analyte	TPH-g ****	TPH-g ****	TPH-d	TPH-o	Benzene	Ethylbenzene	Toluene	Xylenes, Total (p/m-, o-xylene)	1-Methylnaphthalene
		CAS No.	Gas	Gas	Diesel	Oil	71-43-2	100-41-4	108-88-3	1330-20-7	90-12-0
		Unit	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
		DOH EAL	300	300	400	500	5	30	40	20	10
		SSRBL	—	—	4500	—	750	—	—	—	—
Well Name	Sample ID	Date Sampled	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note
RHMW08	ERH429	2017-10-23	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW08	ERH560	2018-03-12	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW08	ERH606	2018-04-23	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW08	ERH652	2018-07-24	—	< 18 UJ s	< 25 U	< 40 U	< 0.30 UJ s	< 0.50 UJ s	< 0.30 UJ s	< 0.30 UJ s	< 0.10 U
RHMW08	ERH696	2018-10-24	—	< 18 U	< 25 UJ h	< 40 UJ h	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW08	ERH751	2019-01-21	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW09	ERH103	2016-10-25	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW09	ERH129	2016-11-15	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW09	ERH146	2016-12-12	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW09	ERH178	2017-01-11	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW09	ERH225	2017-02-08	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW09	ERH247	2/8/2017*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW09	ERH272	2017-03-07	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW09	ERH307	2017-04-04	—	< 18 UJ q	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW09	ERH314	4/4/2017*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW09	ERH385	2017-07-05	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW09	ERH431	2017-10-24	—	< 18 U	< 25 UJ s	< 40 UJ s	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW09	ERH562	2018-03-13	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW09	ERH608	2018-04-25	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW09	ERH654	2018-07-25	—	< 18 UJ s	< 25 U	< 40 U	< 0.30 UJ s	< 0.50 UJ s	< 0.30 UJ s	< 0.30 UJ s	< 0.10 U
RHMW09	ERH698	2018-10-23	—	< 18 U	< 25 UJ h	< 40 UJ h	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW09	ERH753	2019-01-22	—	< 18 U	< 25 U	< 40 U	< 0.30 UJ s	< 0.50 UJ s	< 0.30 UJ s	< 0.30 UJ s	< 0.10 U
RHMW10	ERH345	2017-05-04	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW10	ERH346	5/4/2017*	—	< 18 U	89 Z	190	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW10	ERH365	2017-06-05	—	< 18 U	< 25 UJ h	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW10	ERH366	6/5/2017*	—	< 18 U	< 25 UJ h	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW10	ERH373	2017-07-04	—	< 18 U	< 25 U	< 40 U	< 0.30 UJ q	< 0.50 UJ q	< 0.30 UJ q	< 0.30 UJ q	< 0.10 U
RHMW10	ERH374	7/4/2017*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW10	ERH433	2017-10-25	—	< 18 U	< 25 U	61	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW10	ERH564	2018-03-13	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW10	ERH610	2018-04-24	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW10	ERH656	2018-07-24	—	< 18 UJ s	< 25 U	< 40 U	< 0.30 UJ s	< 0.50 UJ s	< 0.30 UJ s	< 0.30 UJ s	< 0.10 U
RHMW10	ERH700	2018-10-31	—	< 18 U	120 J s W	62 J s	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW10	ERH755	2019-01-24	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW11-01	ERH573	2018-03-21	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW11-01	ERH619	2018-05-02	—	< 18 U	< 340 U b	< 450 U b	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW11-01	ERH674	2018-07-30	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW11-02	ERH575	2018-03-22	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW11-02	ERH621	2018-04-30	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW11-02	ERH672	2018-08-01	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW11-03	ERH579	2018-03-27	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW11-03	ERH623	2018-04-30	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW11-03	ERH670	2018-08-01	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW11-04	ERH577	2018-03-27	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW11-04	ERH625	2018-04-26	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW11-04	ERH668	2018-08-02	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW11-05	ERH581	2018-03-28	—	< 18 U	< 25 U	< 40 U	< 0.26 U t	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW11-05	ERH582	3/28/2018*	—	< 18 U	< 25 U	< 40 U	< 0.24 U t	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW11-05	ERH627	2018-05-01	—	< 18 U	< 380 U b	< 530 U b	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW11-05	ERH628	5/1/2018*	—	< 18 U	< 300 U b	< 400 U b	< 0.30 UJ s	< 0.50 UJ s	< 0.30 UJ s	< 0.30 UJ s	< 0.10 U
RHMW11-05	ERH665	2018-07-31	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW11-05	ERH666	7/31/2018*	—	< 18 U	< 25 U	< 40 U	< 0.30 UJ s	< 0.50 UJ s	< 0.30 UJ s	< 0.30 UJ s	< 0.10 U
RHMW11-05	ERH709	2018-10-29	—	< 18 U	< 110 U f Y	< 120 U f	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
RHMW11-05	ERH710	10/29/2018*	—	< 18 U	—	—	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	—
RHMW11-05	ERH764	2019-01-28	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
HDMW2253-03	HDMW2253-03-WG-02	10/13/2009[abd]	< 30 U	—	< 185 U	—	< 0.12 U	< 0.31 U	< 0.31 U	< 0.62 U	< 0.0169 U
HDMW2253-03	HDMW2253-03-WG-03	1/26/2010[d]	< 60.0 U	—	322 J	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	< 0.0500 U
HDMW2253-03	HDMW2253-03-WG-04	4/26/2010[d]	< 60.0 U	—	< 352 U	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	< 0.0348 U
HDMW2253-03	HDMW2253-03-WG-05	7/8/2010[d]	< 60.0 U	—	< 320 U	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	< 0.0348 U
HDMW2253-03	ES006	10/21/2010[d]	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U
HDMW2253-03	ES016	1/21/2011[d]	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U
HDMW2253-03	ES028	4/21/2011[d]	—	< 12.12 U	< 80.8 U	—	0.42 J	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U
HDMW2253-03	ES043	7/21/2011[d]	—	< 12.12 U	< 80.8 U	< 212.0 U	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U
HDMW2253-03	ES053	2011-10-26	—	< 12.12 U	< 80.8 U	—	0.92 J	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U
HDMW2253-03	ES057	2012-01-24	—	< 12.12 U	< 80.8 U	< 212.0 U	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U
HDMW2253-03	ES076	2012-04-26	—	< 12.12 U	160 Y	—	0.20 J	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U
HDMW2253-03	ES083	2012-07-19	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U
HDMW2253-03	ES009	2012-11-07	—	< 15 UJ b h	25 J Y	—	< 0.50 UJ h	< 0.50 UJ h	< 0.50 UJ h	< 1.0 UJ h	< 0.050 U
HDMW2253-03	ES018	2013-01-30	—	< 30 U	600	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U
HDMW2253-03	ES027	2013-04-24	—	< 30 U	45 J	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.052 U
HDMW2253-03	ES036	2013-07-24	—	< 30 U	< 21 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.047 U
HDMW2253-03	ES045	2013-10-23	—	< 15 UJ b	< 20 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U
HDMW2253-03	ES051	1/22/2014[d]	—	—	18 J Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.051 U
HDMW2253-03	ES052	1/22/2014*[d]	—	—	18 J Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.051 U
HDMW2253-03	ES055	1/27/2014[d]	—	< 27 UJ b	35 J Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.051 U
HDMW2253-03	ES088***	4/23/2014[d]	—	< 27 UJ b	220 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.051 U
HDMW2253-03	ES111	2014-07-23	—	< 30 U	< 12 U	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.053 U
HDMW2253-03	ES120	2014-10-22	—	< 30 U	14 J Y	—	< 0.50 U	< 0.50 U	3.8	< 1.0 U	< 0.10 U
HDMW2253-03	ES128	2015-01-29	—	< 30 U	16 J Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.11 U
HDMW2253-03	ES136	2015-04-22	< 25 U	—	13 J	< 55 UJ b	< 0.10 U	< 0.10 U	0.070 J	< 0.20 U	< 0.0052 U
HDMW2253-03	ES151	2015-07-22	< 25 U	—	< 18 UJ b	< 77 UJ b	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U
HDMW2253-03	ERH001	2015-10-19	16 J	—	< 21 UJ b	< 56 UJ b	< 0.10 UJ h	< 0.10 UJ h	< 0.37 UJ h t	< 0.20 UJ h	< 0.0050 U
HDMW2253-03	ERH015	2016-01-19	< 25 U	—	< 43 UJ b	< 63 UJ b	< 0.10 U	< 0.10 U	< 0.24 UJ t	< 0.20 U	< 0.0050 U
HDMW2253-03	ERH029	2016-04-19	< 21 U f	—	< 25 U b f	< 48 U b f	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U
HDMW2253-03	ERH043	2016-07-19	< 25 U	—	< 13 U f	< 32 U b f	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U
HDMW2253-03	ERH095	2016-10-18	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U
HDMW2253-03	ERH127	2016-11-16	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U

		Analyte Class	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Semivolatiles	Semivolatiles
		Analyte Type	COPC	COPC	COPC	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Fuel Additive	Fuel Additive
		Analytical Method	8270 SIM	8270 SIM	8260	8011	8260	504.1	8260SIM	8260SIM	8260	8270	8270/8270 Mod.
		Analyte	2-Methylnaphthalene	Naphthalene *****	Naphthalene *****	1,2-Dibromoethane *****	1,2-Dibromoethane *****	1,2-Dibromoethane *****	1,2-Dibromoethane *****	1,2-Dichloroethane *****	1,2-Dichloroethane *****	Phenol	2-(2-Methoxyethoxy)-ethanol
		CAS No.	91-57-6	91-20-3	91-20-3	106-93-4	106-93-4	106-93-4	106-93-4	107-06-2	107-06-2	108-95-2	111-77-3
		Unit	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
		DOH EAL	10	17	17	0.04	0.04	0.04	0.04	5	5	300	800
		SSRBL	—	—	—	—	—	—	—	—	—	—	—
Well Name	Sample ID	Date Sampled	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note
RHMW08	ERH429	2017-10-23	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW08	ERH560	2018-03-12	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW08	ERH606	2018-04-23	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW08	ERH652	2018-07-24	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW08	ERH696	2018-10-24	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW08	ERH751	2019-01-21	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW09	ERH103	2016-10-25	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW09	ERH129	2016-11-15	< 0.10 U	< 0.10 U	—	< 0.02 UJ c	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW09	ERH146	2016-12-12	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	1.1 J	< 80.0 U
RHMW09	ERH178	2017-01-11	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW09	ERH225	2017-02-08	< 0.10 U	< 0.10 U	—	< 0.02 U	< 0.50 U	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW09	ERH247	2/8/2017*	< 0.10 U	< 0.10 U	—	< 0.02 U	< 0.50 U	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW09	ERH272	2017-03-07	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW09	ERH307	2017-04-04	< 0.10 U	< 0.10 U	—	< 0.02 U	< 0.50 U	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW09	ERH314	4/4/2017*	< 0.10 U	< 0.10 U	—	< 0.02 U	< 0.50 U	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW09	ERH385	2017-07-05	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW09	ERH431	2017-10-24	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW09	ERH562	2018-03-13	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW09	ERH608	2018-04-25	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW09	ERH654	2018-07-25	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW09	ERH698	2018-10-23	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW09	ERH753	2019-01-22	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW10	ERH345	2017-05-04	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW10	ERH346	5/4/2017*	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW10	ERH365	2017-06-05	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW10	ERH366	6/5/2017*	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW10	ERH373	2017-07-04	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW10	ERH374	7/4/2017*	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW10	ERH433	2017-10-25	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW10	ERH564	2018-03-13	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW10	ERH610	2018-04-24	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW10	ERH656	2018-07-24	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
RHMW10	ERH700	2018-10-31	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW10	ERH755	2019-01-24	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
RHMW11-01	ERH573	2018-03-21	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW11-01	ERH619	2018-05-02	< 0.10 U	< 0.10 U	—	< 0.019 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW11-01	ERH674	2018-07-30	< 0.10 U	< 0.10 U	—	< 0.019 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW11-02	ERH575	2018-03-22	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW11-02	ERH621	2018-04-30	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW11-02	ERH672	2018-08-01	< 0.10 U	< 0.10 U	—	< 0.019 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW11-03	ERH579	2018-03-27	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW11-03	ERH623	2018-04-30	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW11-03	ERH670	2018-08-01	< 0.10 U	< 0.10 U	—	< 0.019 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW11-04	ERH577	2018-03-27	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW11-04	ERH625	2018-04-26	< 0.10 U	< 0.10 U	—	< 0.019 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW11-04	ERH668	2018-08-02	< 0.10 U	< 0.10 U	—	< 0.019 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW11-05	ERH581	2018-03-28	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW11-05	ERH582	3/28/2018*	< 0.10 U	< 0.10 U	—	< 0.02 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW11-05	ERH627	2018-05-01	< 0.10 U	< 0.10 U	—	< 0.019 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW11-05	ERH628	5/1/2018*	< 0.10 U	< 0.10 U	—	< 0.019 U	—	—	—	—	< 0.30 UJ s	< 4.00 U	< 80.0 U
RHMW11-05	ERH665	2018-07-31	< 0.10 U	< 0.10 U	—	< 0.019 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 U
RHMW11-05	ERH666	7/31/2018*	< 0.10 U	< 0.10 U	—	< 0.019 U	—	—	—	—	< 0.30 UJ s	< 4.00 U	< 80.0 U
RHMW11-05	ERH709	2018-10-29	< 0.10 U	< 0.10 U	—	< 0.019 U	—	—	—	—	< 0.30 U	< 4.00 U	< 80.0 UJ l
RHMW11-05	ERH710	10/29/2018*	—	—	—	< 0.019 U	—	—	—	—	< 0.30 U	—	—
RHMW11-05	ERH764	2019-01-28	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
HDMW2253-03	HDMW2253-03-WG-02	10/13/2009[abd]	< 0.0169 U	< 0.035 U	< 0.62 U	—	< 0.31 U	—	—	—	< 0.15 U	—	—
HDMW2253-03	HDMW2253-03-WG-03	1/26/2010[d]	< 0.0500 U	< 0.103 U	< 1.24 U	—	< 0.620 U	—	—	—	< 0.300 U	—	—
HDMW2253-03	HDMW2253-03-WG-04	4/26/2010[d]	< 0.0348 U	< 0.0720 U	< 1.24 U	—	< 0.620 U	—	—	—	< 0.300 U	—	—
HDMW2253-03	HDMW2253-03-WG-05	7/8/2010[d]	< 0.0348 U	0.0596 J	< 1.24 U	—	< 0.620 U	—	—	—	< 0.300 U	—	—
HDMW2253-03	ES006	10/21/2010[d]	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
HDMW2253-03	ES016	1/21/2011[d]	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
HDMW2253-03	ES028	4/21/2011[d]	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
HDMW2253-03	ES043	7/21/2011[d]	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
HDMW2253-03	ES053	2011-10-26	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
HDMW2253-03	ES057	2012-01-24	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
HDMW2253-03	ES076	2012-04-26	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
HDMW2253-03	ES083	2012-07-19	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
HDMW2253-03	ES009	2012-11-07	< 0.050 U	< 0.050 U	—	—	< 0.50 UJ h	—	—	—	< 0.50 UJ h	—	—
HDMW2253-03	ES018	2013-01-30	< 0.050 U	0.037 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
HDMW2253-03	ES027	2013-04-24	< 0.052 U	0.16 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
HDMW2253-03	ES036	2013-07-24	< 0.047 U	0.030 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
HDMW2253-03	ES045	2013-10-23	< 0.050 U	0.041 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
HDMW2253-03	ES051	1/22/2014[d]	< 0.051 U	< 0.051 U	—	—	—	—	—	—	—	—	—
HDMW2253-03	ES052	1/22/2014*[d]	< 0.051 U	< 0.051 U	—	—	—	—	—	—	—	—	—
HDMW2253-03	ES055	1/27/2014[d]	< 0.051 U	0.064 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
HDMW2253-03	ES088***	4/23/2014[d]	< 0.051 U	< 0.051 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
HDMW2253-03	ES111	2014-07-23	< 0.053 U	< 0.053 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
HDMW2253-03	ES120	2014-10-22	< 0.051 U	< 0.051 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
HDMW2253-03	ES128	2015-01-29	< 0.053 U	< 0.053 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
HDMW2253-03	ES136	2015-04-22	< 0.0052 U	< 0.0052 U	—	< 0.0040 UJ h	< 0.20 U	—	< 0.010 U	< 0.015 U	—	—	—
HDMW2253-03	ES151	2015-07-22	< 0.0050 U	< 0.0050 U	—	< 0.0040 U	< 0.20 U	—	—	< 0.015 U	—	—	—
HDMW2253-03	ERH001	2015-10-19	< 0.0050 UJ b	< 0.0042 UJ b	—	< 0.0040 U	< 0.20 UJ h	—	—	< 0.015 U	—	—	—
HDMW2253-03	ERH015	2016-01-19	< 0.0050 U	< 0.0050 U	—	< 0.0040 U	< 0.20 U	—	—	< 0.015 U	—	—	—
HDMW2253-03	ERH029	2016-04-19	< 0.0050 U	< 0.0050 U	—	—	—	—	—	—	—	—	—
HDMW2253-03	ERH043	2016-07-19	0.0027 J	< 0.015 U b f	—	—	—	—	—	—	—	—	—
HDMW2253-03	ERH095	2016-10-18	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ h
HDMW2253-03	ERH127	2016-11-16	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U

Table A.1-1: Cumulative Groundwater COPC Results (cont'd)
First Quarter 2019 - Quarterly Groundwater Monitoring Report, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i

Well Name	Sample ID	Analyte	TPH-g ****	TPH-g ****	TPH-d	TPH-o	Benzene	Ethylbenzene	Toluene	Xylenes, Total (p/m-, o-xylene)	1-Methylnaphthalene	2-Methylnaphthalene	Naphthalene *****	Naphthalene *****	1,2-Dibromoethane *****	1,2-Dibromoethane *****	1,2-Dibromoethane *****	1,2-Dibromoethane *****	1,2-Dichloroethane *****	1,2-Dichloroethane *****	Phenol	2-(2-Methoxyethoxy)-ethanol
		Analyte Class	TPH	TPH	TPH	TPH	Volatiles	Volatiles	Volatiles	Volatiles	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Semivolatiles (PAHs)	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Semivolatiles	Semivolatiles
		Analyte Type	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	COPC	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Lead Scavenger	Fuel Additive	Fuel Additive
		Analytical Method	8015	8260	8015	8015	8260	8260	8260	8260	8270 SIM	8270 SIM	8270 SIM	8260	8011	8260	504.1	8260SIM	8260SIM	8260	8270	8270/8270 Mod.
		CAS No.	Gas	Gas	Diesel	Oil	71-43-2	100-41-4	108-88-3	1330-20-7	90-12-0	91-57-6	91-20-3	91-20-3	106-93-4	106-93-4	106-93-4	106-93-4	107-06-2	107-06-2	108-95-2	111-77-3
		Unit	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
		DOH EAL	300	300	400	500	5	30	40	20	10	10	17	17	0.04	0.04	0.04	0.04	5	5	300	800
		SSRBL	—	—	4500	—	750	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Well Name	Sample ID	Date Sampled	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note	Result Q rc note
HDMW2253-03	ERH145	2016-12-13	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
HDMW2253-03	ERH176	2017-01-10	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
HDMW2253-03	ERH214	2017-02-07	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
HDMW2253-03	ERH280	2017-03-08	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
HDMW2253-03	ERH437	2017-10-31	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
HDMW2253-03	ERH568	2018-03-12	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
HDMW2253-03	ERH614	2018-04-23	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
HDMW2253-03	ERH660	2018-07-23	—	< 18 UJ s	< 25 UJ s	< 40 UJ l s	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
HDMW2253-03	ERH704	2018-10-22	—	< 18 U	< 25 UJ h	< 40 UJ h	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
HDMW2253-03	ERH759	2019-02-07	—	< 18 UJ c l	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
OWDFMW01	OWDFMW01-WG-01	8/4/2009[ad]	< 30.0 U	—	< 171 U	—	0.470	< 0.310 U	< 0.310 U	< 0.620 U	< 0.0164 U	< 0.0164 U	< 0.0339 U	< 0.620 U	—	< 0.310 U	—	—	—	< 0.150 U	—	—
OWDFMW01	OWDFMW01-WG-02	10/13/2009[abd]	< 30 U	—	< 167 U	—	< 0.12 U	< 0.31 U	< 0.31 U	< 0.62 U	< 0.0168 U	< 0.0168 U	< 0.0346 U	< 0.62 U	—	< 0.31 U	—	—	—	< 0.15 U	—	—
OWDFMW01	OWDFMW01-WG-03	1/26/2010[d]	< 60.0 U	—	1,490	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	< 0.0320 U	< 0.0320 U	< 0.0664 U	< 1.24 U	—	< 0.620 U	—	—	—	< 0.300 U	—	—
OWDFMW01	OWDFMW01-WG-04	4/26/2010[d]	< 60.0 U	—	288 J	—	< 0.240 U	< 0.620 U	< 0.620 U	< 1.24 U	< 0.0352 U	< 0.0352 U	< 0.0730 U	< 1.24 U	—	< 0.620 U	—	—	—	< 0.300 U	—	—
OWDFMW01	ES007	10/21/2010[d]	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
OWDFMW01	ES008	10/21/2010*[d]	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
OWDFMW01	ES017	1/21/2011[d]	—	< 12.12 U	< 80.8 U	—	0.54 J	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
OWDFMW01	ES018	1/21/2011*[d]	—	< 12.12 U	< 80.8 U	—	0.69 J	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
OWDFMW01	ES029	4/21/2011[d]	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	0.21 J	0.39 J	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
OWDFMW01	ES031	4/21/2011*[d]	—	< 12.12 U	< 80.8 U	—	0.29 J	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
OWDFMW01	ES044	7/21/2011[d]	—	< 12.12 U	< 80.8 U	< 212.0 U	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
OWDFMW01	ES045	7/21/2011*[d]	—	< 12.12 U	< 80.8 U	< 212.0 U	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
OWDFMW01	ES055	10/26/2011[d]	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
OWDFMW01	ES056	10/26/2011*[d]	—	< 12.12 U	< 80.8 U	—	< 0.32 U	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
OWDFMW01	ES058	2012-01-24	—	< 12.12 U	< 80.8 U	< 212.0 U	0.70 J	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
OWDFMW01	ES059	1/24/2012*	—	< 12.12 U	< 80.8 U	< 212.0 U	0.58 J	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
OWDFMW01	ES077	2012-04-26	—	< 12.12 U	220 W	—	0.71 J	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
OWDFMW01	ES084	2012-07-19	—	< 12.12 U	< 80.8 U	—	1.3	< 0.46 U	< 0.34 U	< 0.38 U	< 0.12 U	< 0.12 U	< 0.10 U	—	—	< 0.40 U	—	—	—	< 0.28 U	—	—
OWDFMW01	ES008	2012-11-07	—	< 17 UJ b h	2,500 Y	—	0.38 J h	< 0.50 UJ h	< 0.50 UJ h	< 1 UJ h	< 0.050 U	< 0.050 U	0.025 J	—	—	< 0.50 UJ h	—	—	—	< 0.50 UJ h	—	—
OWDFMW01	ES007	11/7/2012*	—	< 30 UJ h	2,500 Y	—	0.49 J h	< 0.50 UJ h	< 0.50 UJ h	< 1 UJ h	< 0.050 U	< 0.050 U	0.035 J	—	—	< 0.50 UJ h	—	—	—	< 0.50 UJ h	—	—
OWDFMW01	ES016	2013-01-30	—	< 30 U	1,000	—	0.39 J	< 0.50 U	< 0.50 U	< 1 U	< 0.050 U	< 0.050 U	0.032 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
OWDFMW01	ES017	1/30/2013*	—	< 30 U	1,000	—	0.17 J	< 0.50 U	< 0.50 U	< 1 U	< 0.050 U	< 0.050 U	0.039 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
OWDFMW01	ES025	2013-04-24	—	< 30 U	1,900 Y	—	0.82 J	< 0.50 U	< 0.50 U	< 1.0 U	< 0.051 U	< 0.051 U	0.063 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
OWDFMW01	ES026	4/24/2013*	—	< 30 U	1,600 Y	—	0.67 J	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	0.068 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
OWDFMW01	ES034	2013-07-24	—	< 30 U	470 Y	—	0.42 J	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	0.081 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
OWDFMW01	ES035	7/24/2013*	—	< 30 U	340 Y	—	0.44 J	< 0.50 U	< 0.50 U	< 1.0 U	< 0.048 U	< 0.048 U	0.12 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
OWDFMW01	ES043	2013-10-23	—	< 17 UJ b	170 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.049 U	< 0.049 U	< 0.049 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
OWDFMW01	ES044	10/23/2013*	—	< 14 UJ b	200 Y	—	0.17 J	< 0.50 U	< 0.50 U	< 1.0 U	< 0.049 U	< 0.049 U	< 0.049 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
OWDFMW01	ES053	1/27/2014[d]	—	< 26 UJ b	170 Y	—	0.15 J	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	0.093 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
OWDFMW01	ES054	1/27/2014*[d]	—	< 23 UJ b	140 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	0.085 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
OWDFMW01	ES086	4/23/2014[d]	—	< 30 U	270 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.049 U	< 0.049 U	0.035 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
OWDFMW01	ES087***	4/23/2014*[d]	—	< 31 UJ b	32 Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	0.035 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
OWDFMW01	ES109	2014-07-24	—	< 30 U	17 J Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.051 U	< 0.051 U	0.031 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
OWDFMW01	ES110	7/24/2014*	—	< 30 U	15 J Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.050 U	< 0.050 U	0.027 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
OWDFMW01	ES121	2014-10-22	—	< 30 U	19 J Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.10 U	< 0.052 U	0.047 J	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
OWDFMW01	ES122	10/22/2014*	—	< 30 U	19 J Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.10 U	< 0.052 U	< 0.052 U	—	—	< 0.50 U	—	—	—	< 0.50 UJ c	—	—
OWDFMW01	ES121X	2015-01-26	—	< 30 U	24 J Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.10 U	< 0.052 U	< 0.052 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
OWDFMW01	ES122X	1/26/2015*	—	< 30 U	16 J Y	—	< 0.50 U	< 0.50 U	< 0.50 U	< 1.0 U	< 0.10 U	< 0.051 U	< 0.051 U	—	—	< 0.50 U	—	—	—	< 0.50 U	—	—
OWDFMW01	ES137	2015-04-22	< 25 U	—	120 Z	< 110 UJ b Z	0.070 J	< 0.10 U	< 0.10 U	< 0.20 U	0.023	0.017 J	0.025	—	< 0.0040 UJ h	< 0.20 U	—	< 0.010 U	0.010 J	—	—	—
OWDFMW01	ES138	4/22/2015*	< 25 U	—	120 Z	140 Z	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	0.020	0.015 J	0.023	—	< 0.0040 UJ h	< 0.20 U	—	< 0.010 U	0.0081 J	—	—	—
OWDFMW01	ES152	2015-07-22	< 25 U	—	3,100 Z	390 Z	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	0.0088 J	0.0086 J	0.014 J	—	< 0.0040 U	< 0.20 U	—	—	0.012 J	—	—	—
OWDFMW01	ES153	7/22/2015*	< 25 U	—	3,000 Z	330 Z	< 0.10 U	< 0.10 U	0.060 J	< 0.20 U	0.0096 J	0.0097 J	0.016 J	—	< 0.0040 U	< 0.20 U	—	—	0.012 J	—	—	—
OWDFMW01	ERH002	2015-10-19	< 25 U	—	680 Z	100 J	< 0.10 UJ h	< 0.10 UJ h	< 0.4 UJ t	< 0.20 UJ h	0.019 J	< 0.013 UJ b	0.025	—	< 0.0040 U	< 0.20 UJ h	—	< 0.010 U	0.0009 J	—	—	—
OWDFMW01	ERH016	2016-01-19	< 25 U	—	320 Z	< 69 UJ b	< 0.10 U	< 0.10 U	< 0.18 UJ t	< 0.20 U	0.030	0.020	0.024	—	< 0.0040 U	< 0.20 U	—	—	0.0096 J	—	—	—
OWDFMW01	ERH030	2016-04-19	< 13 U f	—	< 38 U b f	< 56 U b f	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0050 U	—	—	—	—	—	—	—	—	—
OWDFMW01	ERH031	4/19/2016*	< 9 U f	—	< 36 U b f	< 67 U b f	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	< 0.0050 U	< 0.0050 U	—	—	—	—	—	—	—	—	—
OWDFMW01	ERH044	2016-07-19	< 25 U	—	< 16 U f	< 40 U b f	< 0.10 U	< 0.10 U	< 0.10 U	< 0.20 U	< 0.0050 U	0.0027 J	< 0.019 U b f	—	—	—	—	—	—	—	—	—
OWDFMW01	ERH104	2016-10-20	—	< 18 U	54 Y	110	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
OWDFMW01	ERH105	10/20/2016*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
OWDFMW01	ERH118	2016-11-15	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
OWDFMW01	ERH119	11/15/2016*	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
OWDFMW01	ERH147	2016-12-14	—	< 18 U	< 58 U Z	39 J	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
OWDFMW01	ERH148	12/14/2016*	—	< 18 U	< 57 U Z	46	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
OWDFMW01	ERH184	2017-01-12	—	< 18 U	< 25 U	45 Y	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
OWDFMW01	ERH227	2017-02-09	—	< 18 U	< 23 U Z	44	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
OWDFMW01	ERH286	2017-03-08	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
OWDFMW01	ERH321	2017-04-04	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
OWDFMW01	ERH389	2017-07-05	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
OWDFMW01	ERH435	2017-10-26	—	< 18 U	110 Y	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
OWDFMW01	ERH566	2018-03-14	—	< 18 U	310 J Z	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
OWDFMW01	ERH612	2018-04-26	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
OWDFMW01	ERH658	2018-07-26	—	< 18 U	< 25 U	< 40 U	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 U
OWDFMW01	ERH702	2018-10-24	—	< 18 U	250 J h Y	160 J h	< 0.30 U	< 0.50 U	< 0.30 U	< 0.30 U	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l
OWDFMW01	ERH757	2019-01-23	—	< 18 U	< 25 U	< 40 U	< 0.30 UJ s	< 0.50 UJ s	< 0.30 UJ s	< 0.30 UJ s	< 0.10 U	< 0.10 U	< 0.10 U	—	—	—	—	—	—	—	< 4.00 U	< 80.0 UJ l

First Quarter 2019 - Quarterly Groundwater Monitoring Report, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i

Table Notes:

A data verification effort was conducted after the Second Quarter 2018 groundwater monitoring event to verify reported values and make data qualification consistent with the current data validation procedures. As such, data presented in the Third Quarter 2018 groundwater monitoring event and succeeding cumulative data tables may differ from data presented in cumulative data tables in previous reports.

DOH Tier 1 Environmental Action Levels, Table D-1b. Groundwater Action Levels (Groundwater IS a current or potential drinking water resource, surface water body IS NOT located within 150 meters of release site).

µg/L	micrograms per liter
Grey highlight	Exceeds EAL
Bold	Detected value
*	Duplicate sample
***	Samples ES087 and ES088 possibly switched prior to analysis.
****	TPH-g analyzed by either 8015 or 8260.
*****	Analyzed by either 8260, 8260 SIM, 8011, and/or 504.1.
a	MDL values were used for non-detects.
b	MRL values were used for non-detects.
c	No analytical lab reports found, could not verify results.
d	No analytical lab reports available, used data table from groundwater monitoring report.
e	Results from stilling basin, pumps offline.
f	Results from stilling basin, pumps online.
g	Analyzed by Method 6010B.
h	Analyzed by Method 6020.
k	Analyzed by Method 200.8.

Result Qualifiers (Q)

J	Estimated value.
U	The compound was analyzed for but not detected above the stated limit.

Reason Codes (rc)

b	Presumed contamination from preparation (method blank).
c	Calibration %RSD, r, r^2, or %D were noncompliant.
e	Matrix Spike/Matrix Spike Duplicate or Duplicate RPD was high.
f	Presumed contamination from field blank or equipment rinsate.
h	Holding times were exceeded.
i	Internal standard performance was unsatisfactory.
l	Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
m	Instrument performance check was noncompliant.
q	Matrix Spike/Matrix Spike Duplicate recovery was poor.
r	Calibration RRF was <0.05.
s	Surrogate recovery was outside QC limits.
t	Presumed contamination from trip blank.
v	Unusual problems found with the data. Description of the problem can be found in the associated laboratory or groundwater monitoring report.

Data Notes (note)

I	RL/DL elevated due to chromatographic interference.
W	Chromatographic signature was mostly non-petroleum hydrocarbon peaks.
X	Possible high bias due to matrix interference.
Y	Chromatographic pattern was inconsistent with the profile of the reference fuel standard.
Z	Chromatographic signature does not resemble a petroleum product.
O	Chromatogram is main match to hydrocarbons in diesel fuel range.

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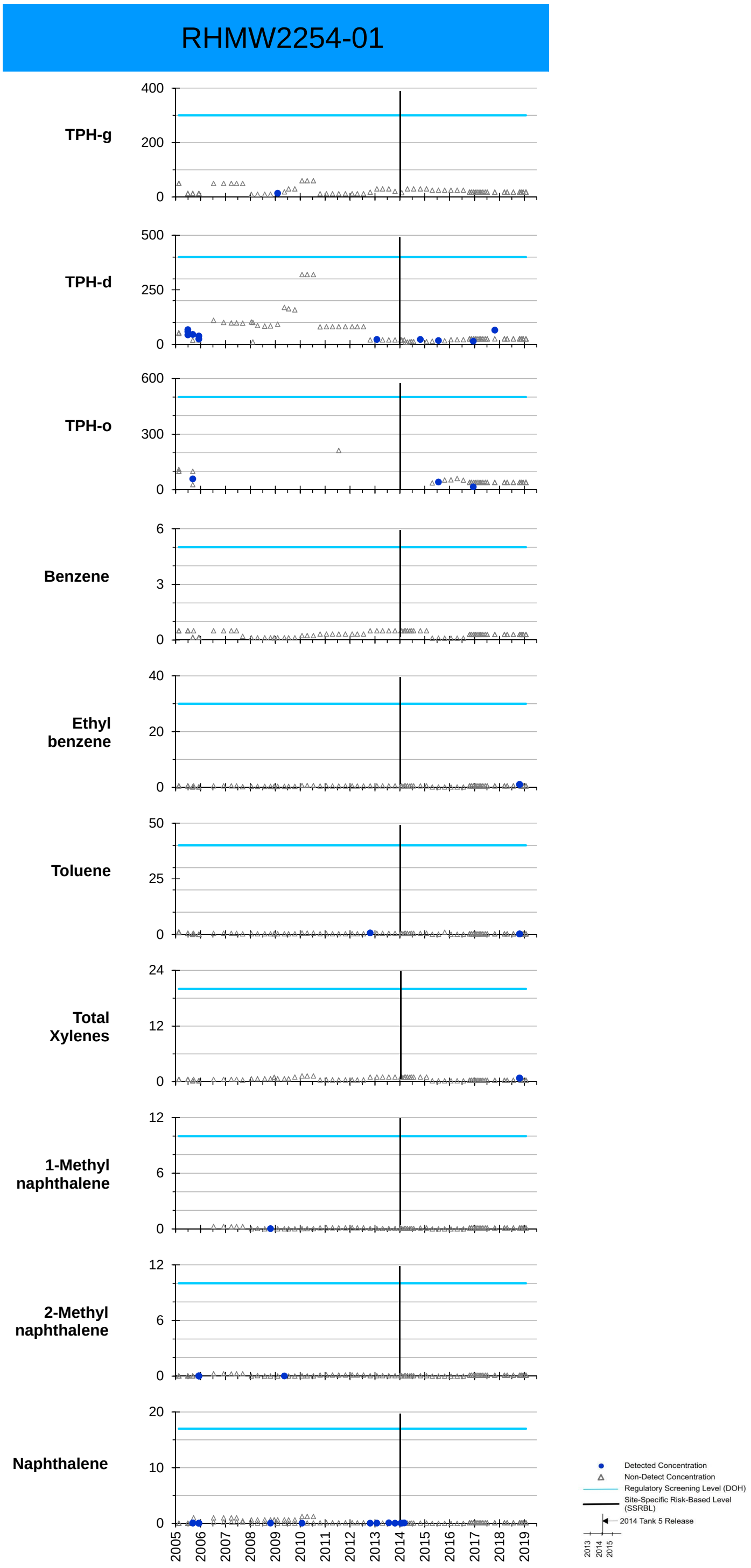
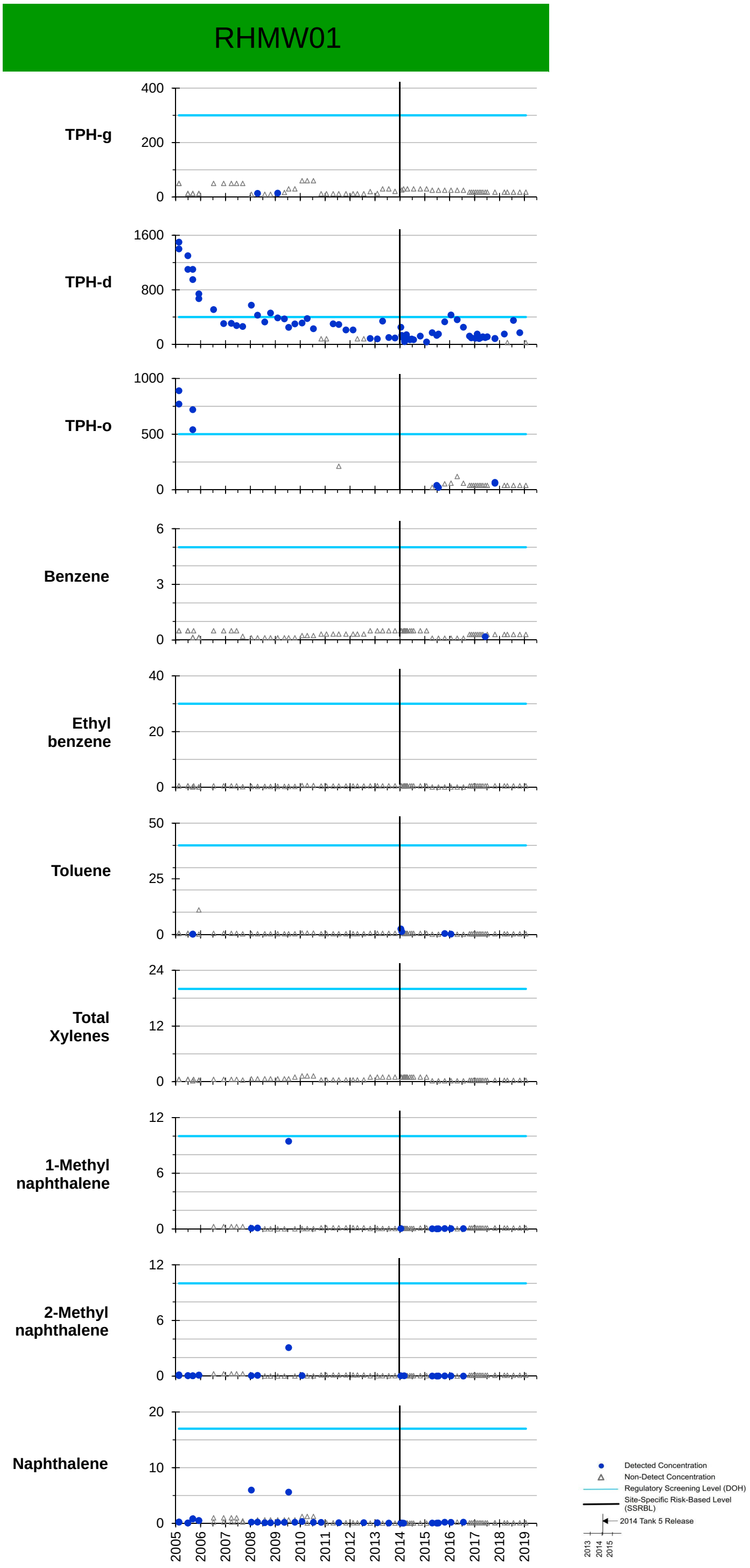
Appendix A.2 Groundwater Concentration Graphs



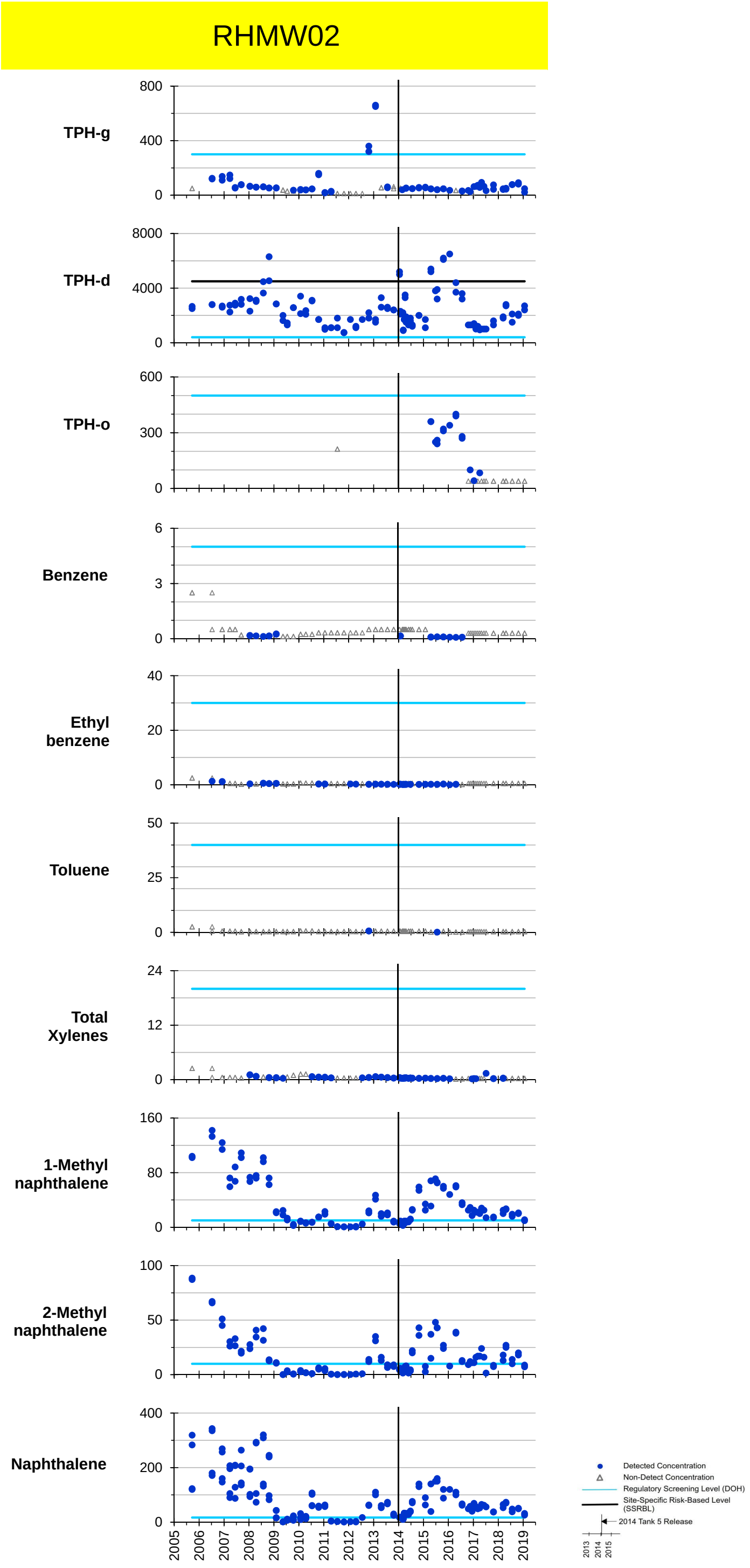
All results in micrograms per liter (µg/L or parts per billion).

Appendix A.2 Groundwater Concentration Graphs



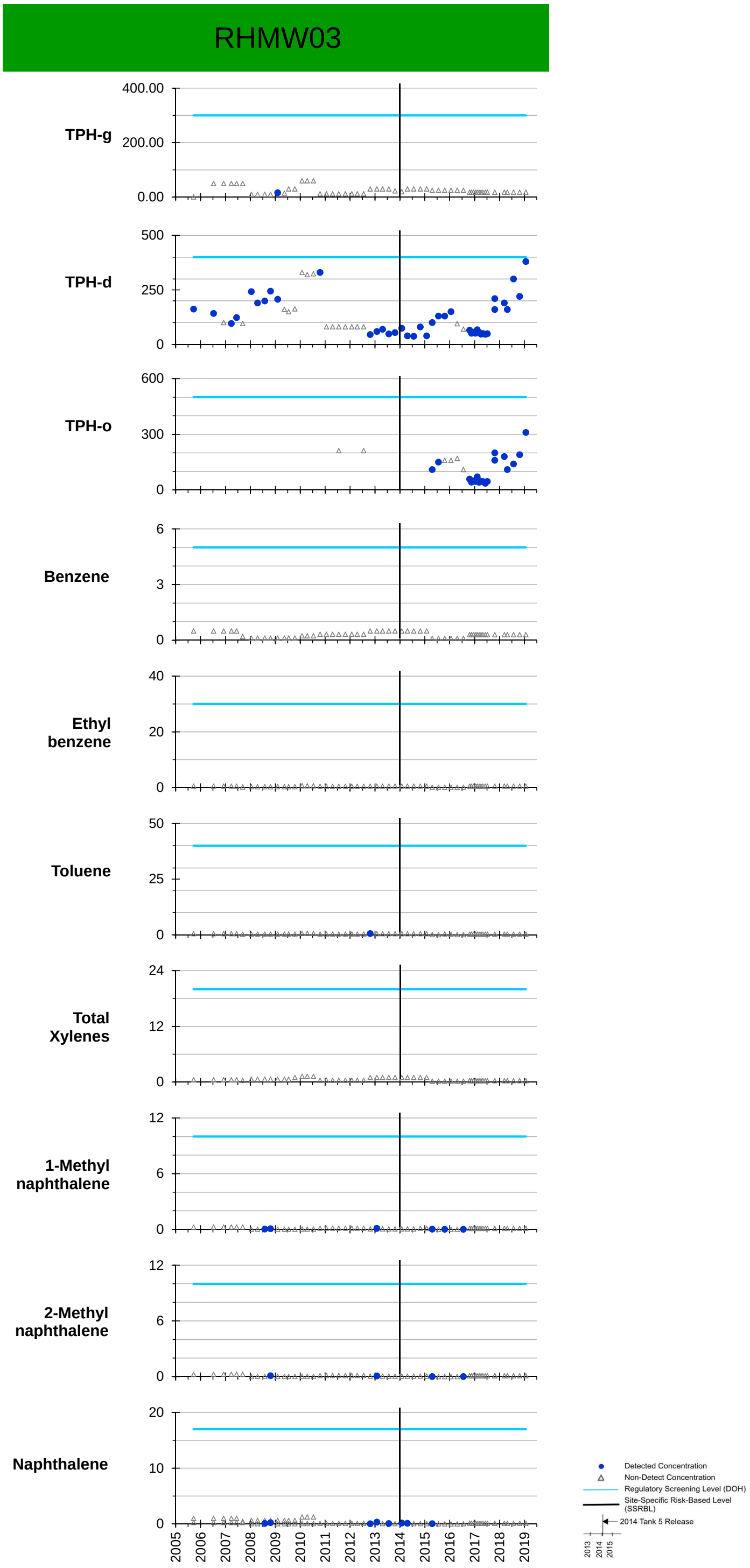
All results in micrograms per liter (µg/L or parts per billion).

Appendix A.2 Groundwater Concentration Graphs



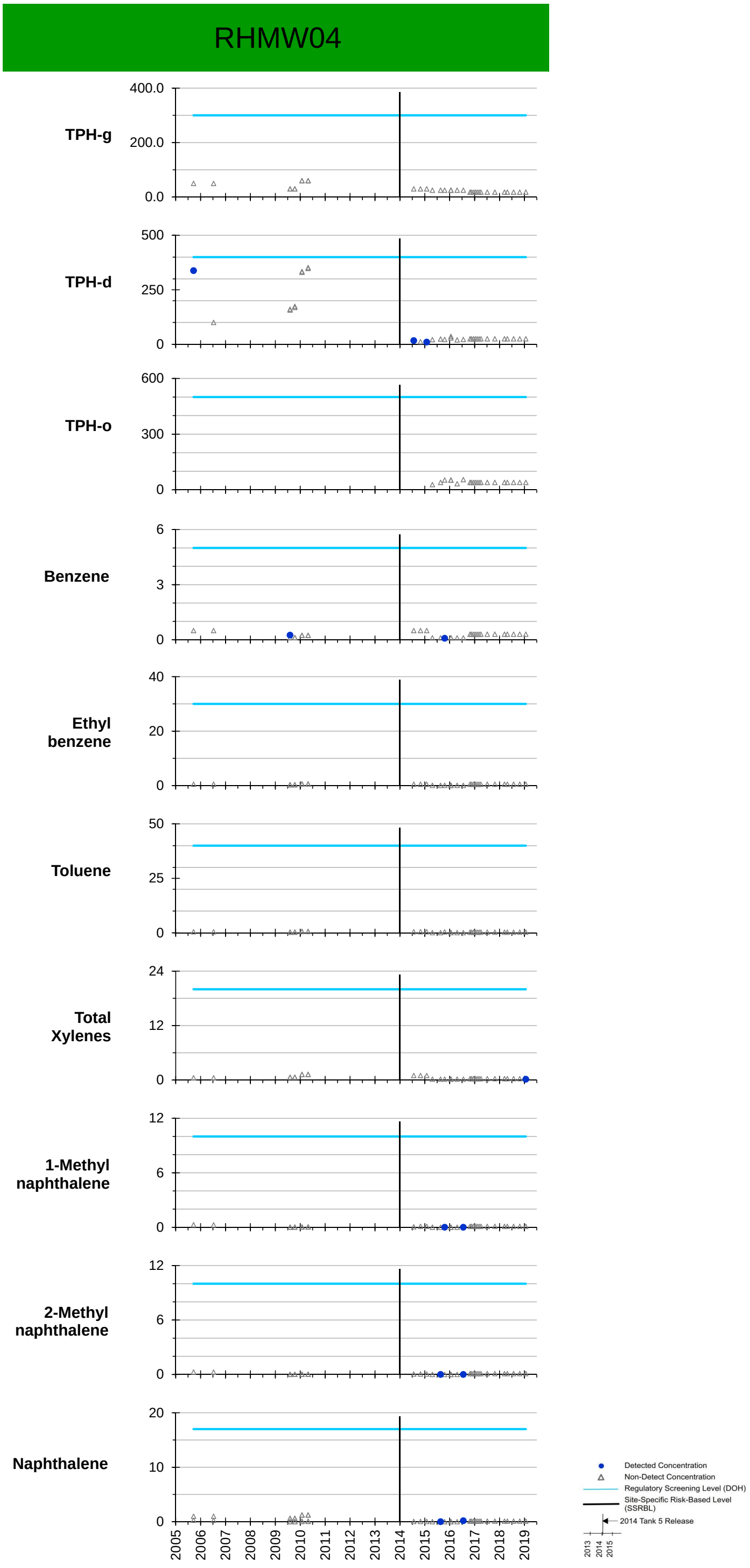
All results in micrograms per liter (µg/L or parts per billion).

Appendix A.2 Groundwater Concentration Graphs



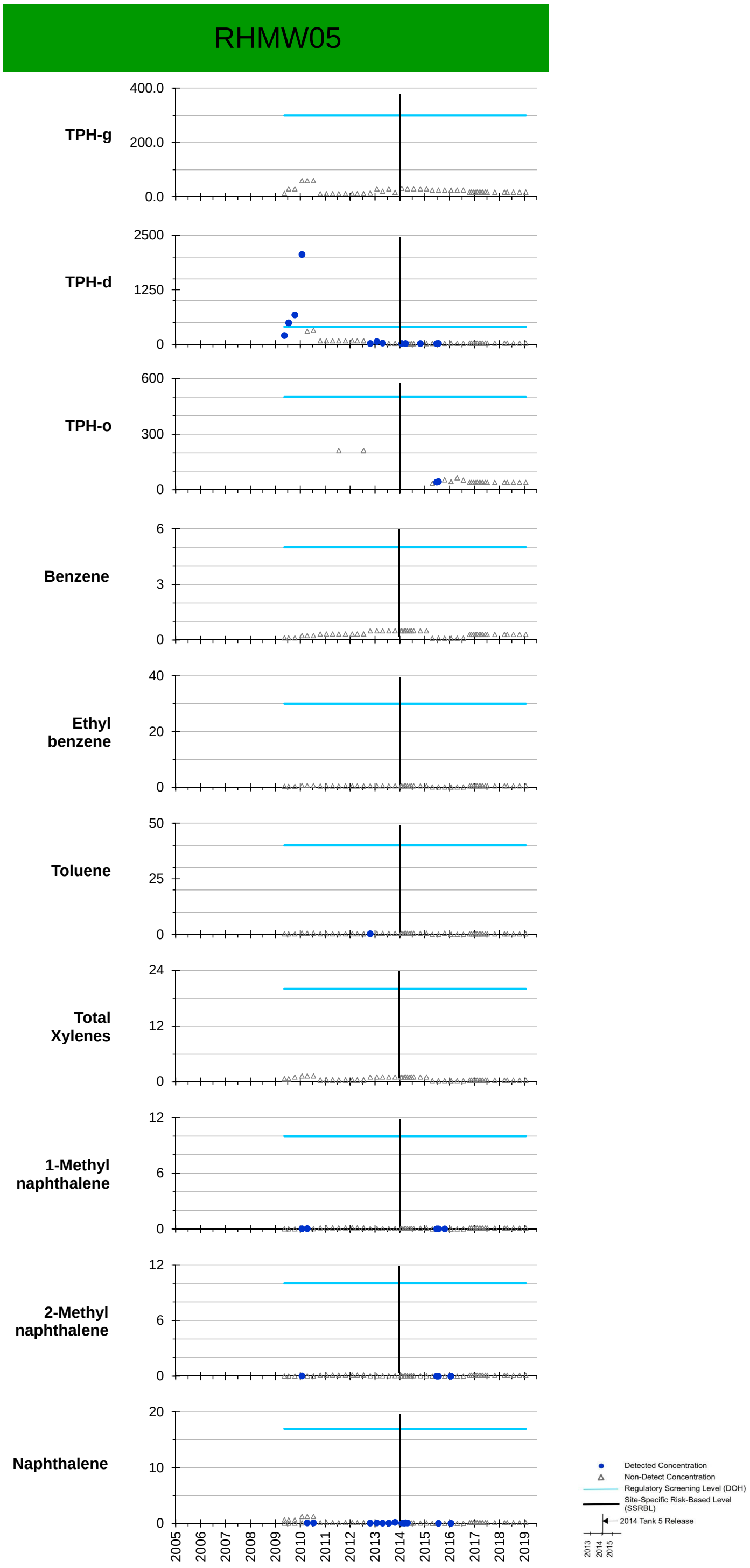
All results in micrograms per liter (µg/L or parts per billion).

Appendix A.2 Groundwater Concentration Graphs



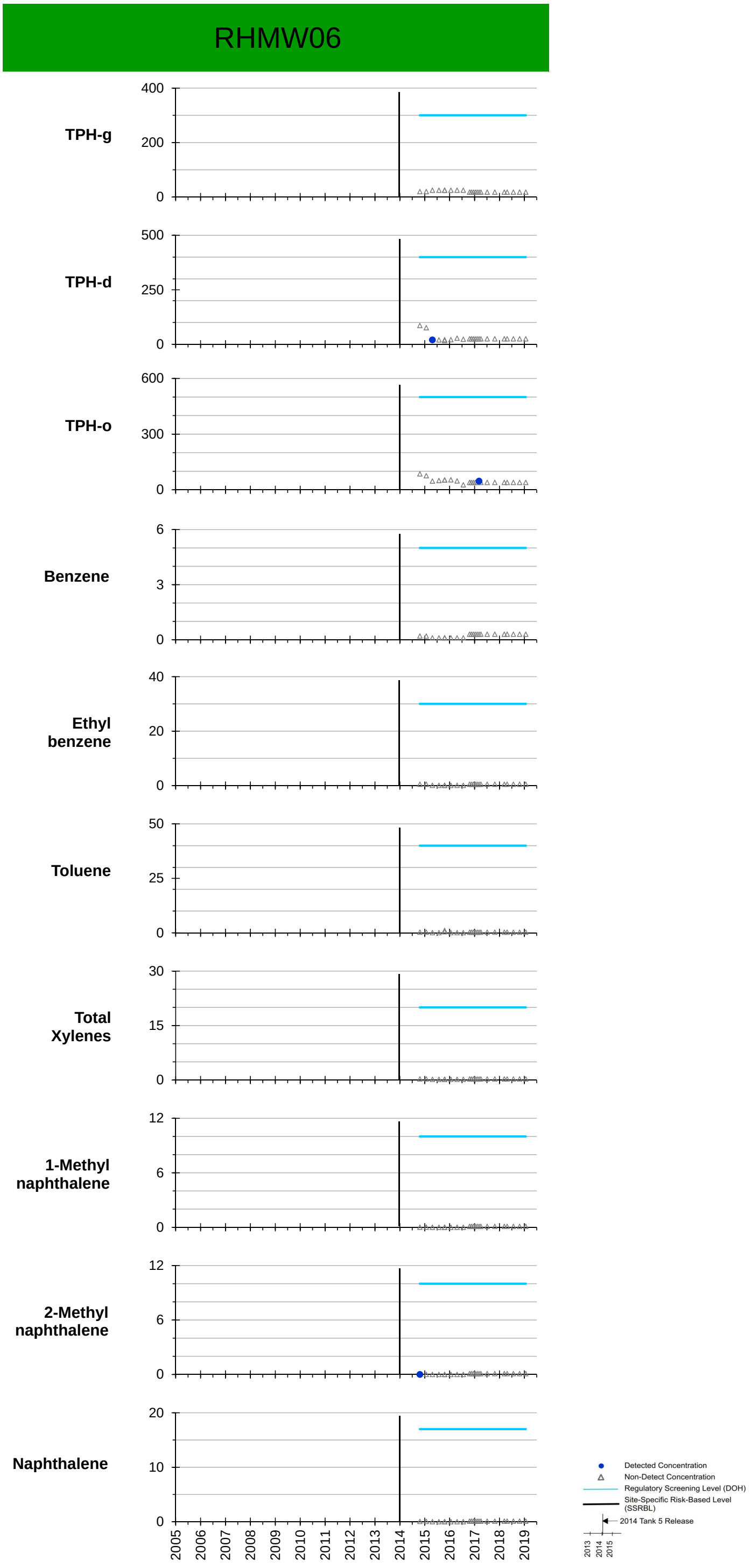
All results in micrograms per liter (µg/L or parts per billion).

Appendix A.2 Groundwater Concentration Graphs



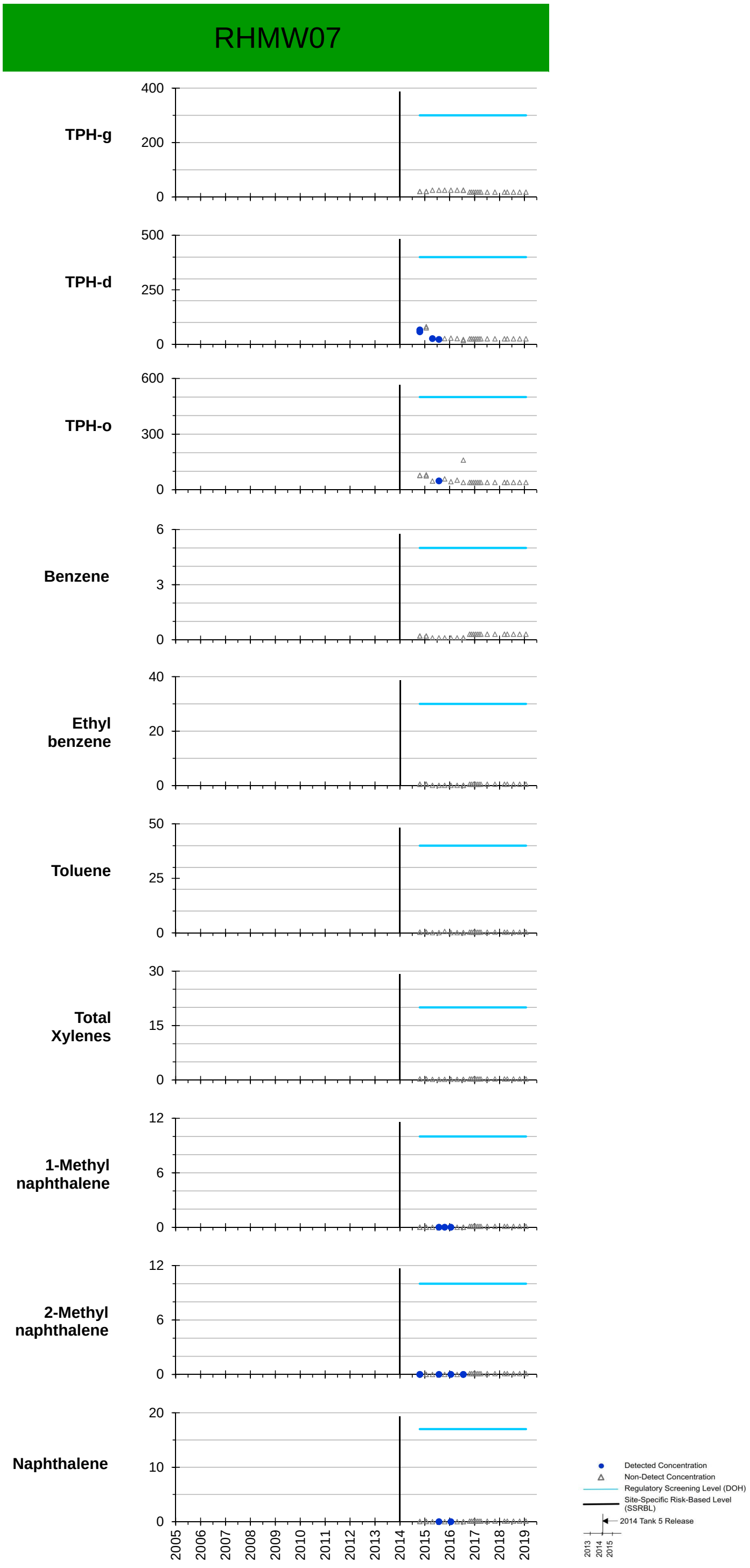
All results in micrograms per liter (µg/L or parts per billion).

Appendix A.2 Groundwater Concentration Graphs



All results in micrograms per liter (µg/L or parts per billion).

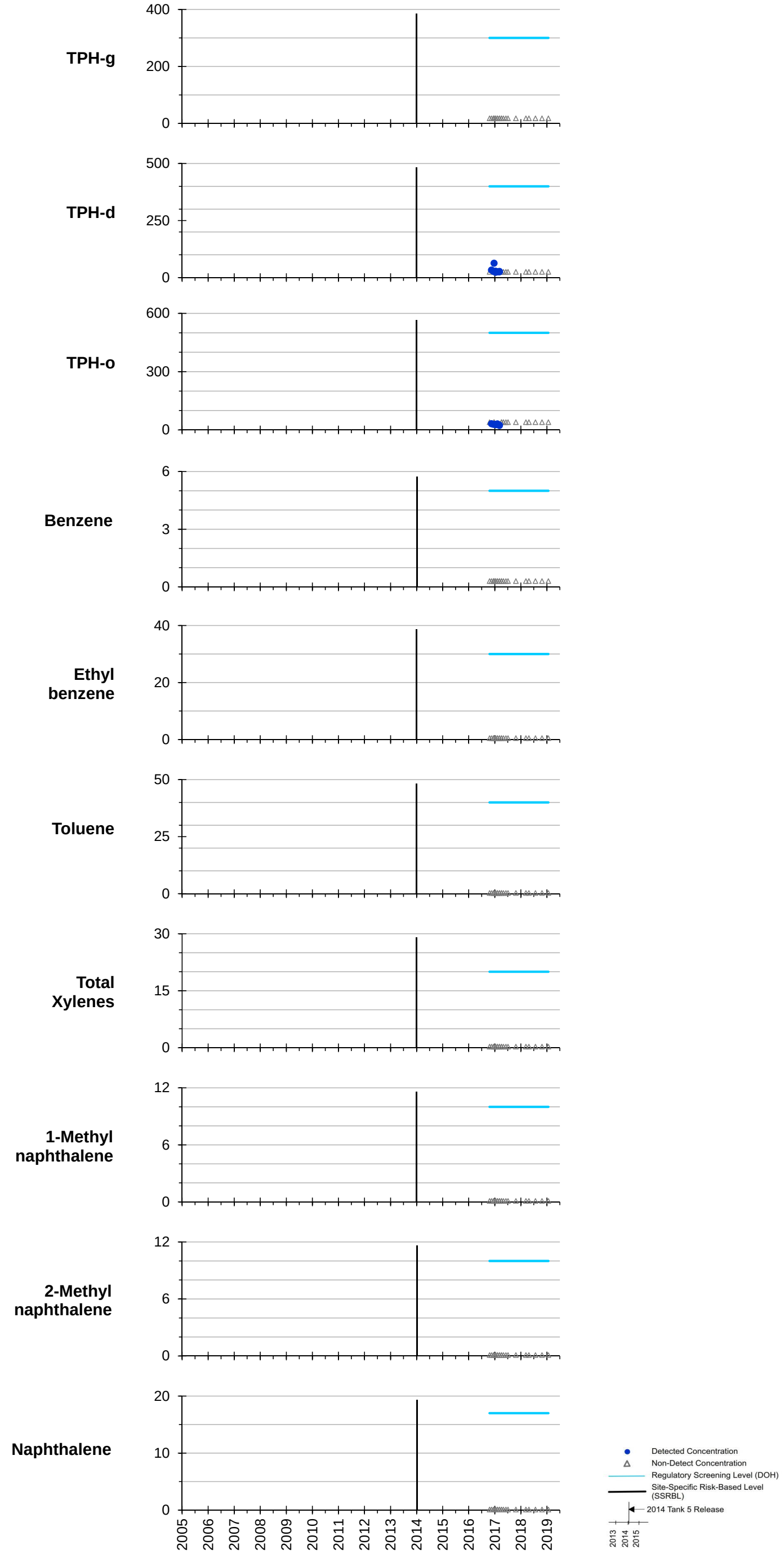
Appendix A.2 Groundwater Concentration Graphs



All results in micrograms per liter (µg/L or parts per billion).

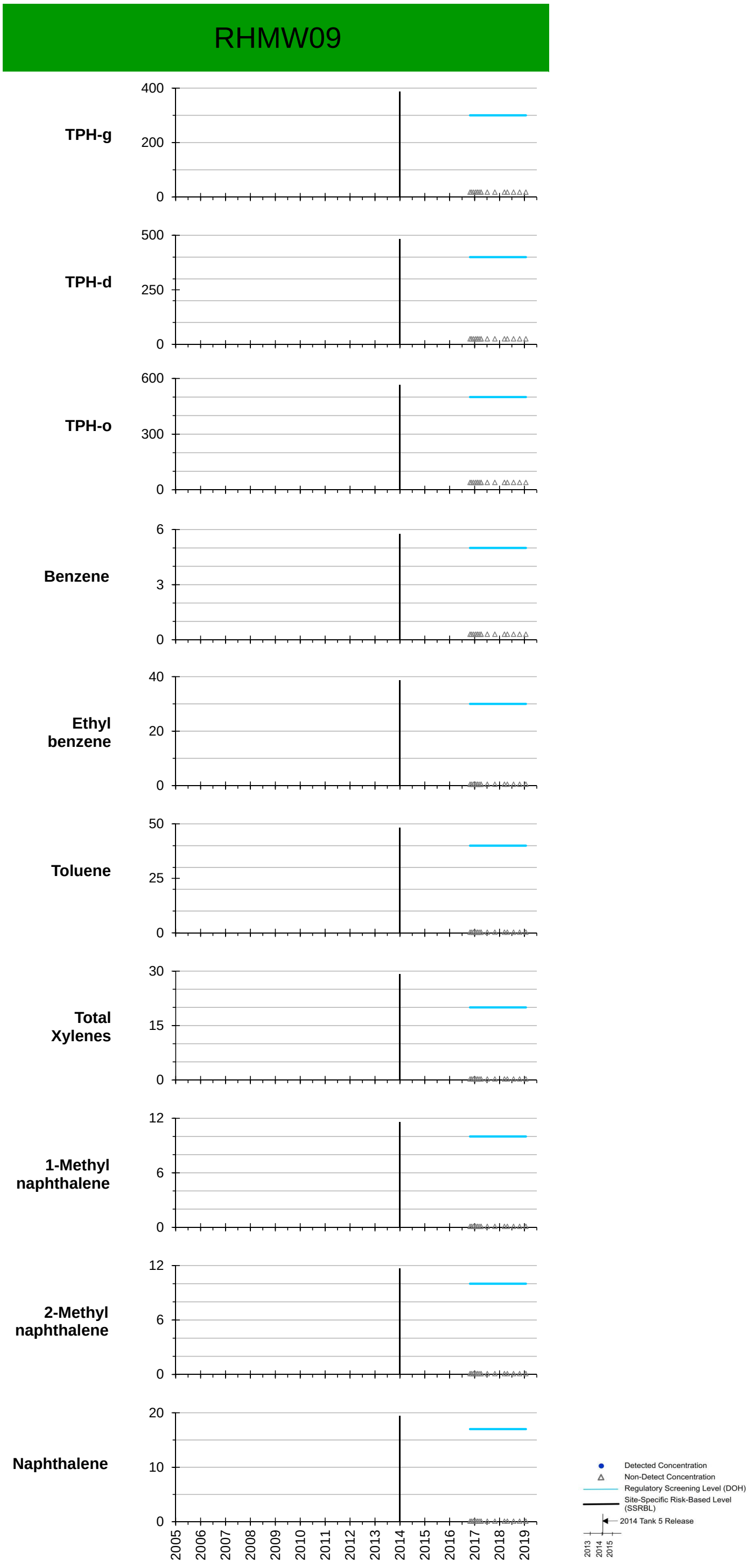
Appendix A.2 Groundwater Concentration Graphs

RHMW08



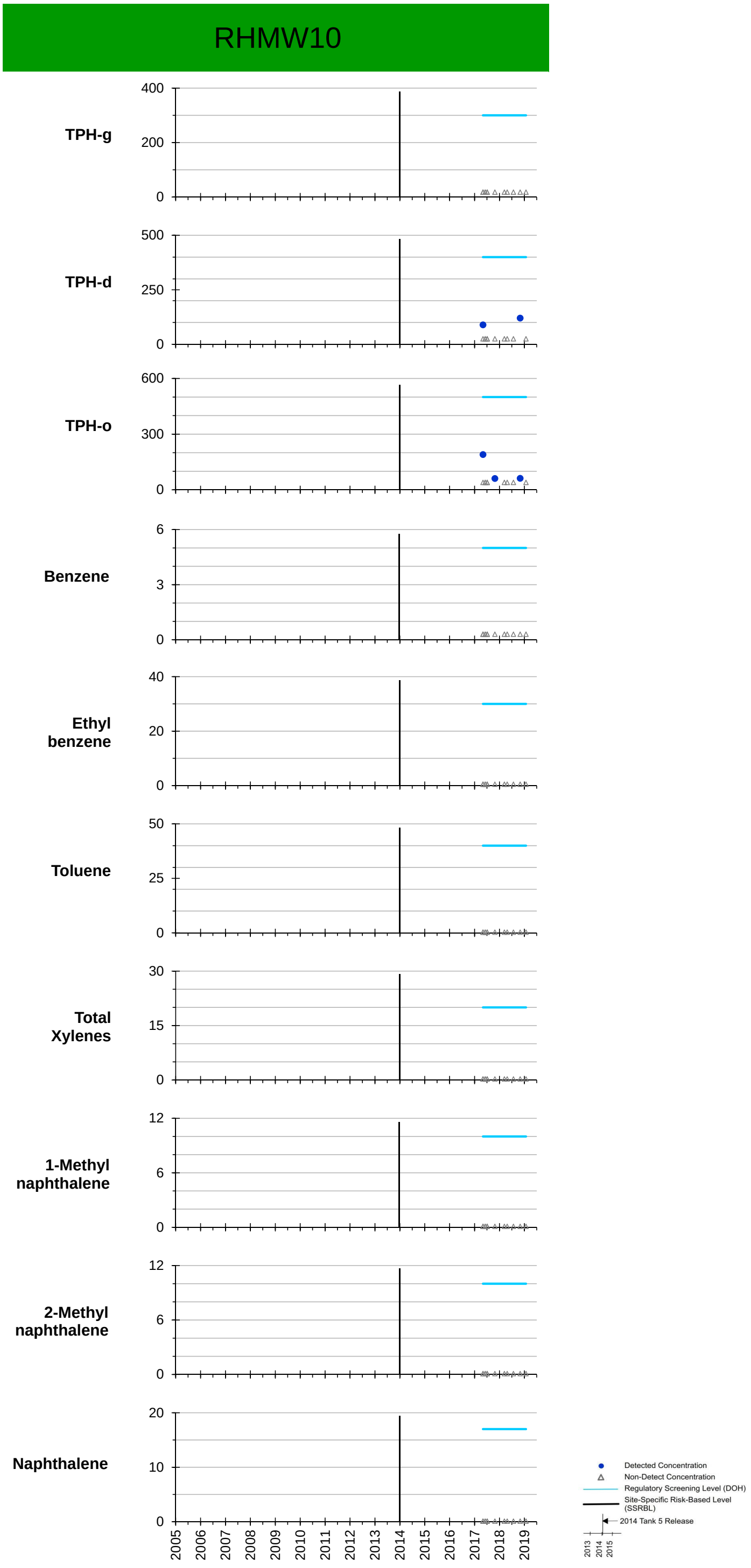
All results in micrograms per liter (µg/L or parts per billion).

Appendix A.2 Groundwater Concentration Graphs



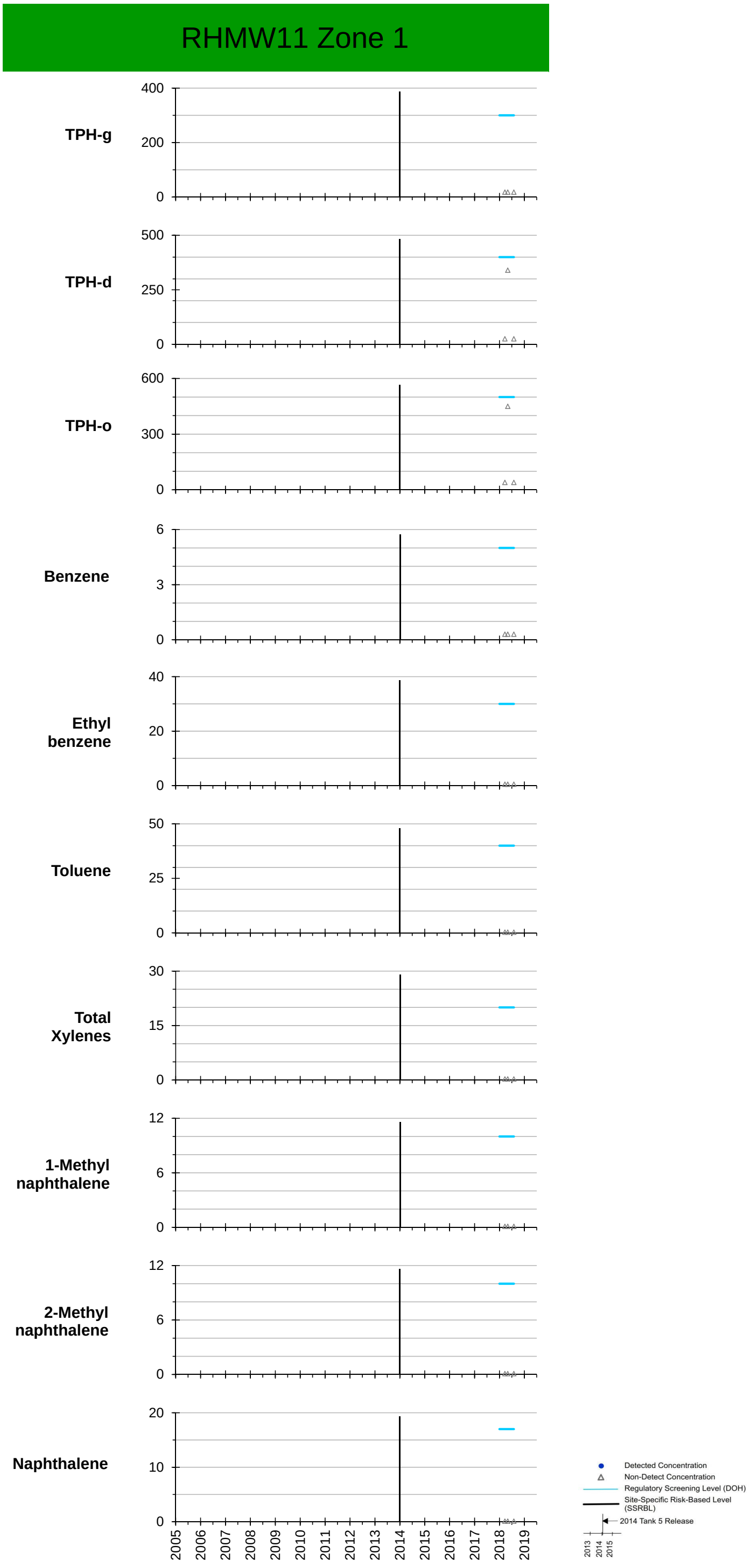
All results in micrograms per liter (µg/L or parts per billion).

Appendix A.2 Groundwater Concentration Graphs



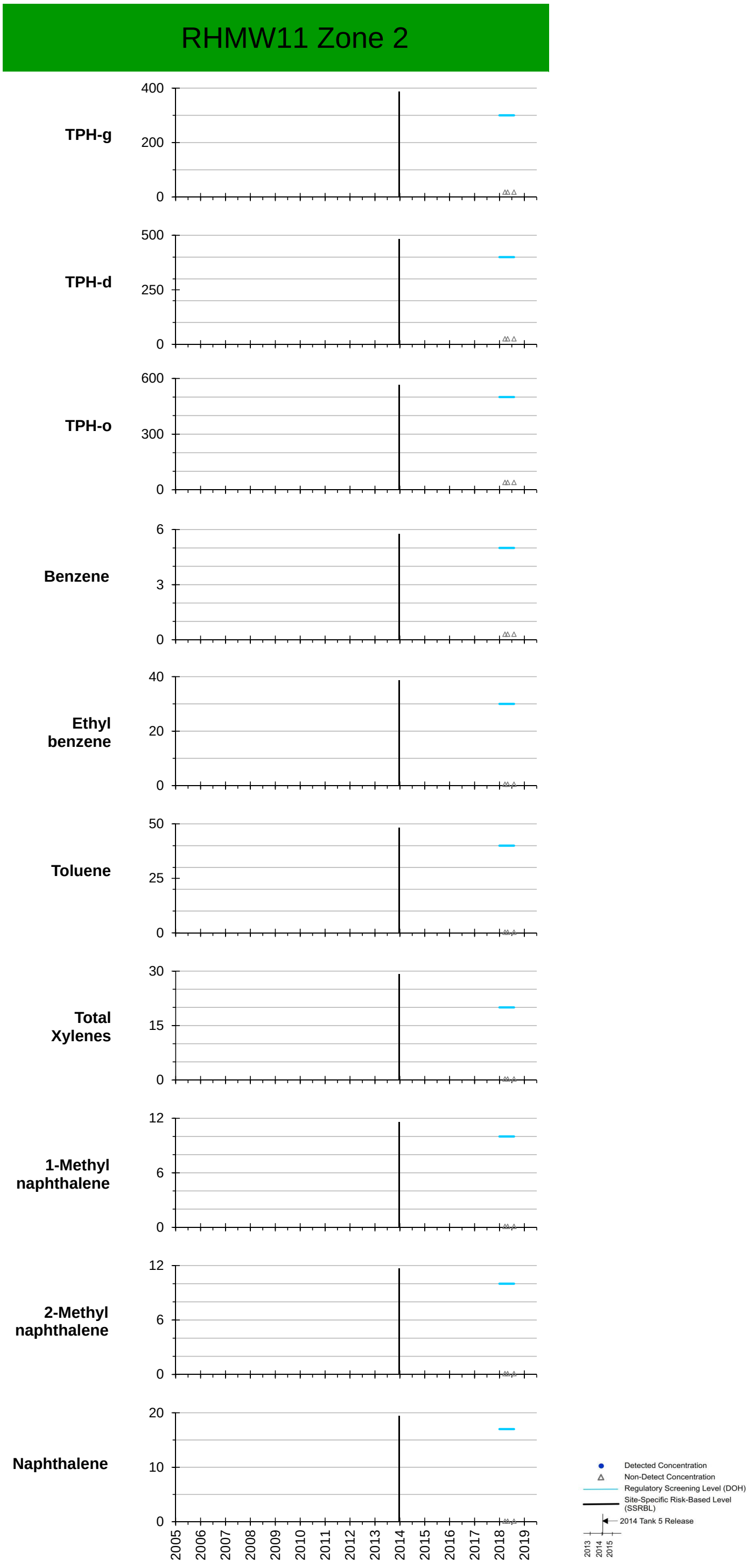
All results in micrograms per liter (µg/L or parts per billion).

Appendix A.2 Groundwater Concentration Graphs



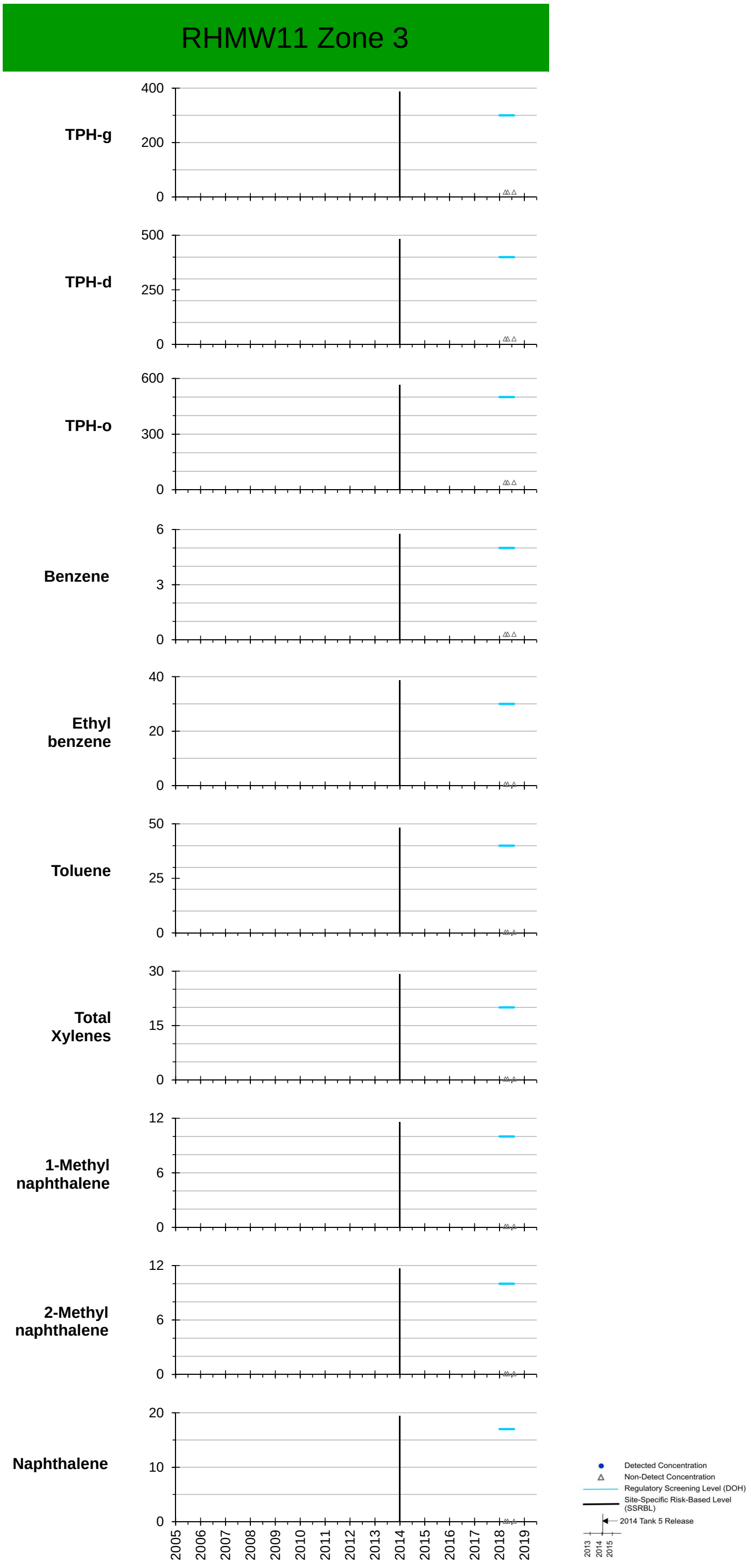
All results in micrograms per liter (µg/L or parts per billion).

Appendix A.2 Groundwater Concentration Graphs



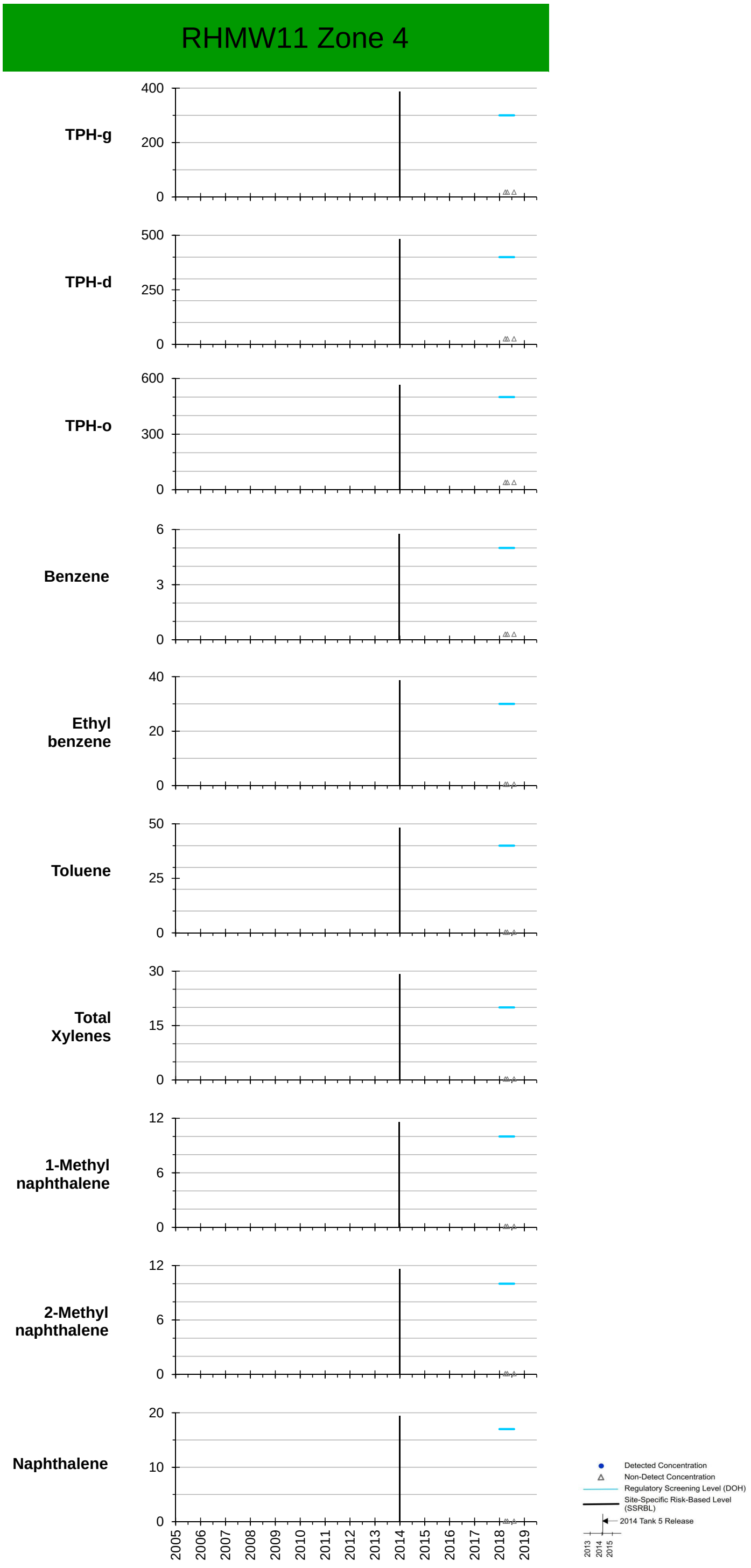
All results in micrograms per liter (µg/L or parts per billion).

Appendix A.2 Groundwater Concentration Graphs



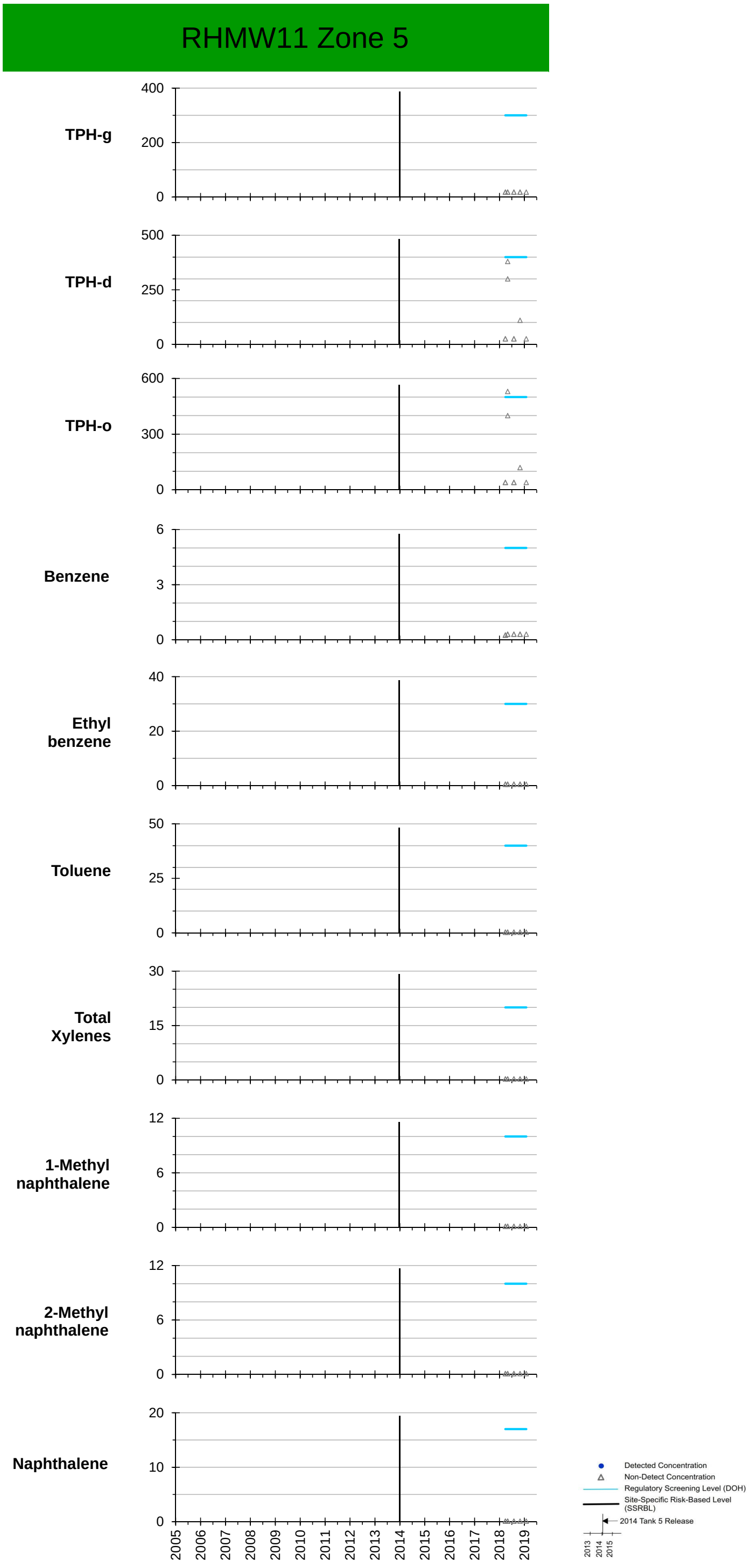
All results in micrograms per liter (µg/L or parts per billion).

Appendix A.2 Groundwater Concentration Graphs



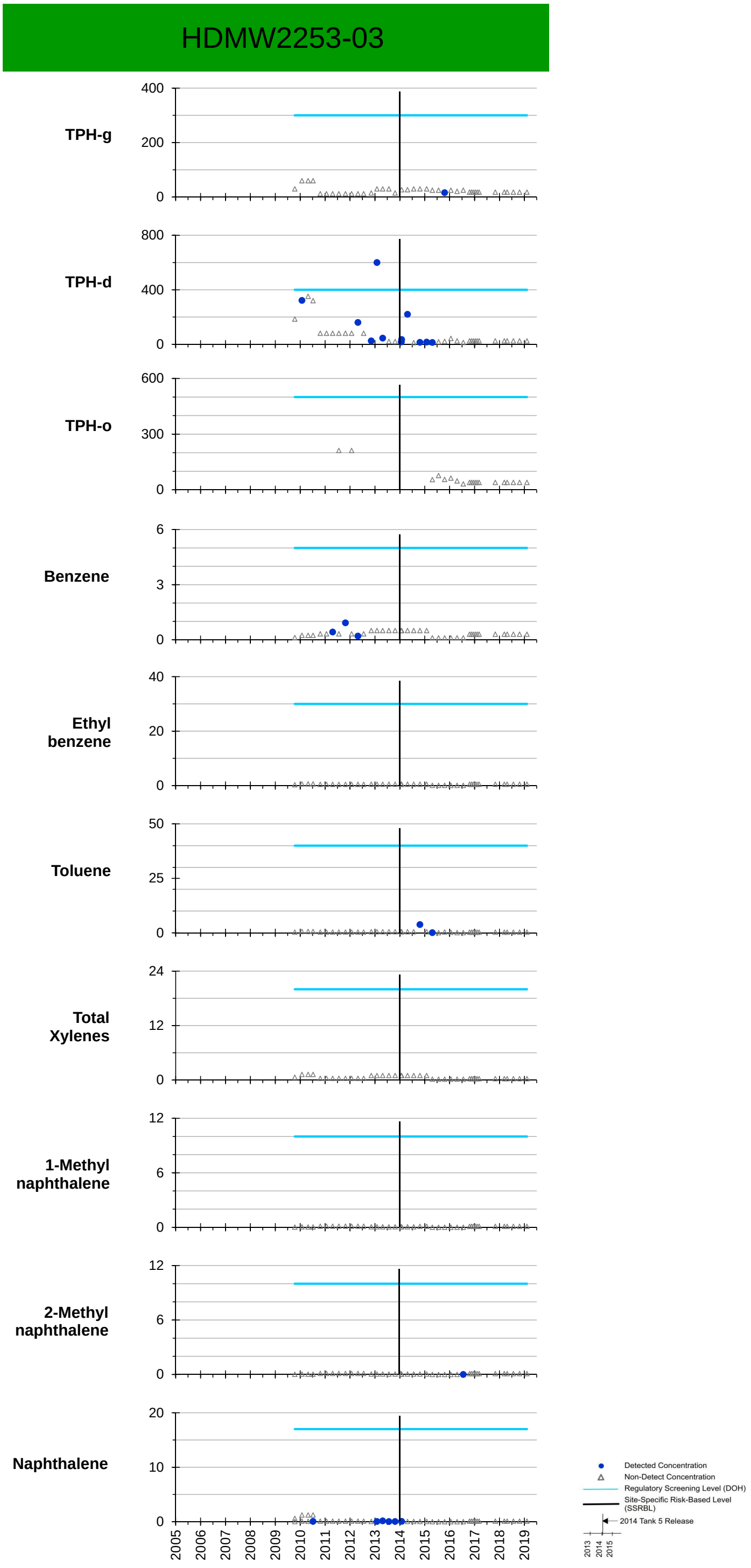
All results in micrograms per liter (µg/L or parts per billion).

Appendix A.2 Groundwater Concentration Graphs



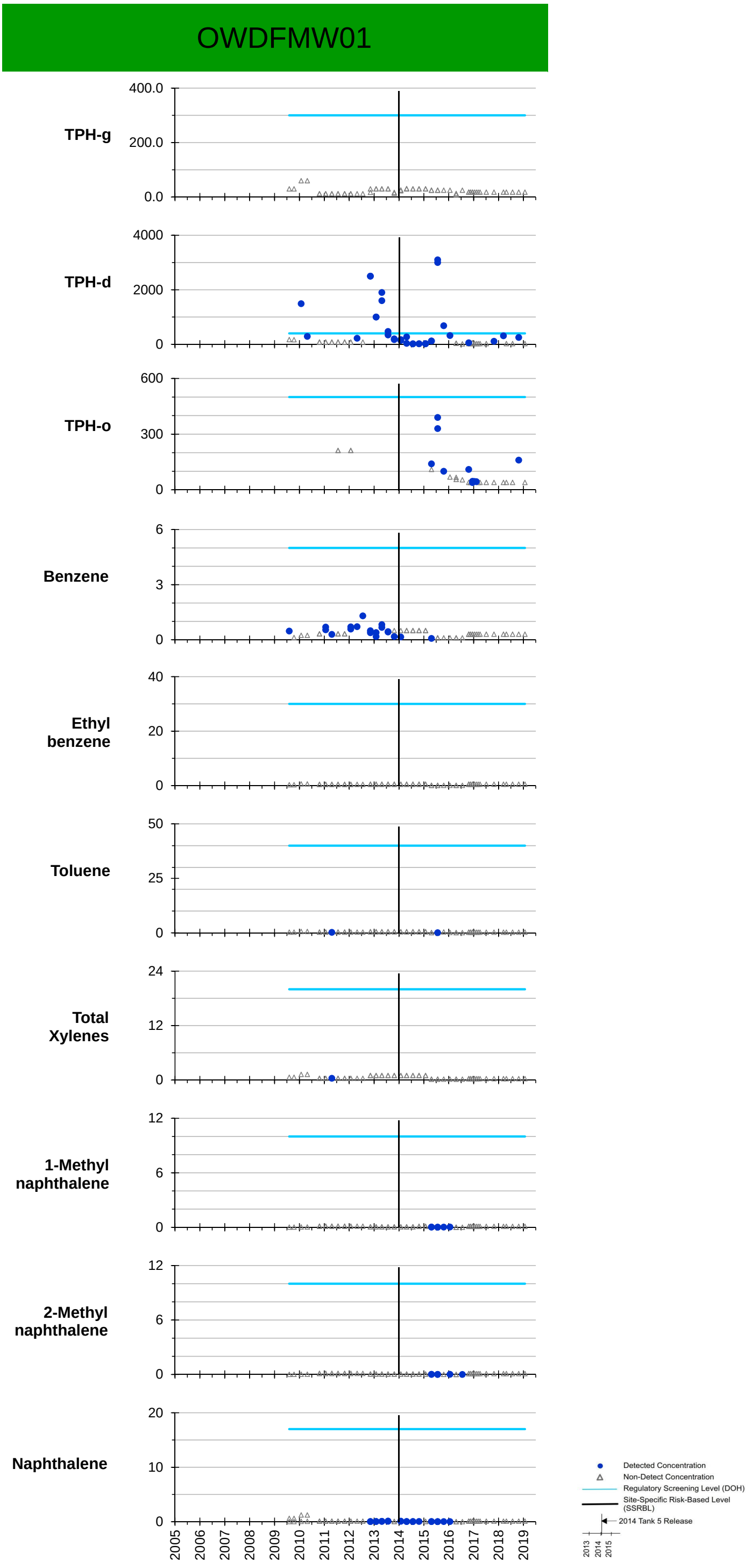
All results in micrograms per liter (µg/L or parts per billion).

Appendix A.2 Groundwater Concentration Graphs



All results in micrograms per liter (µg/L or parts per billion).

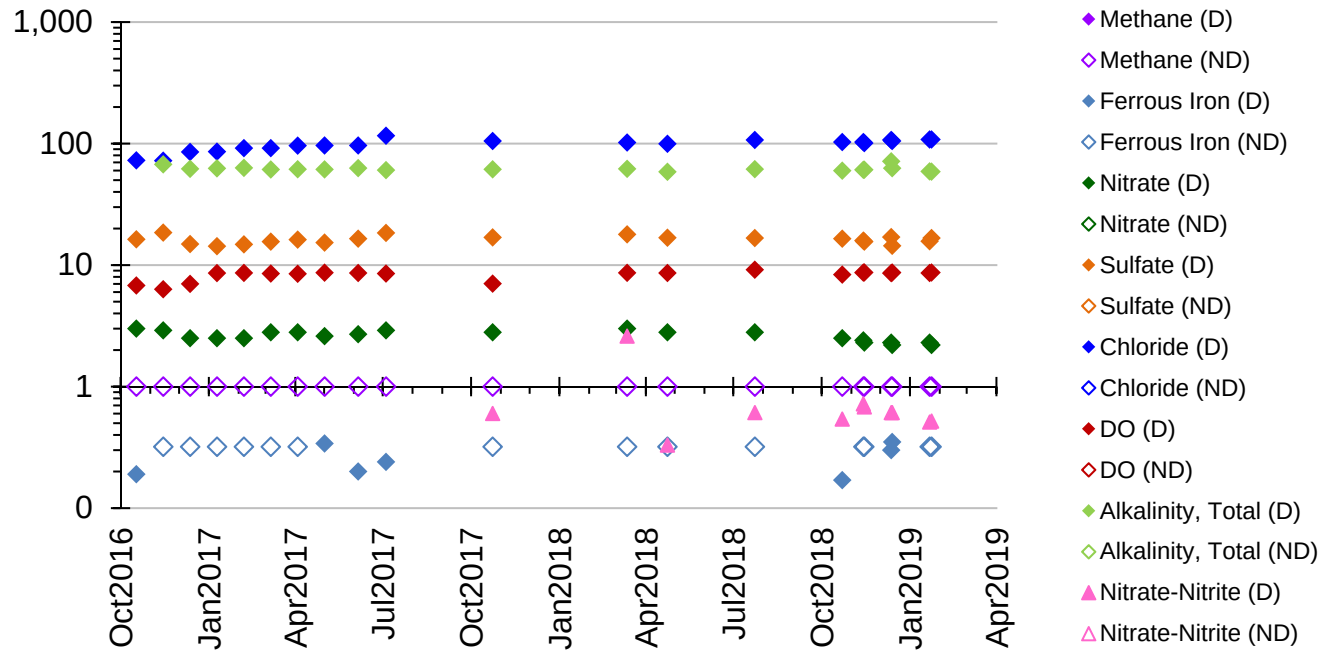
Appendix A.2 Groundwater Concentration Graphs



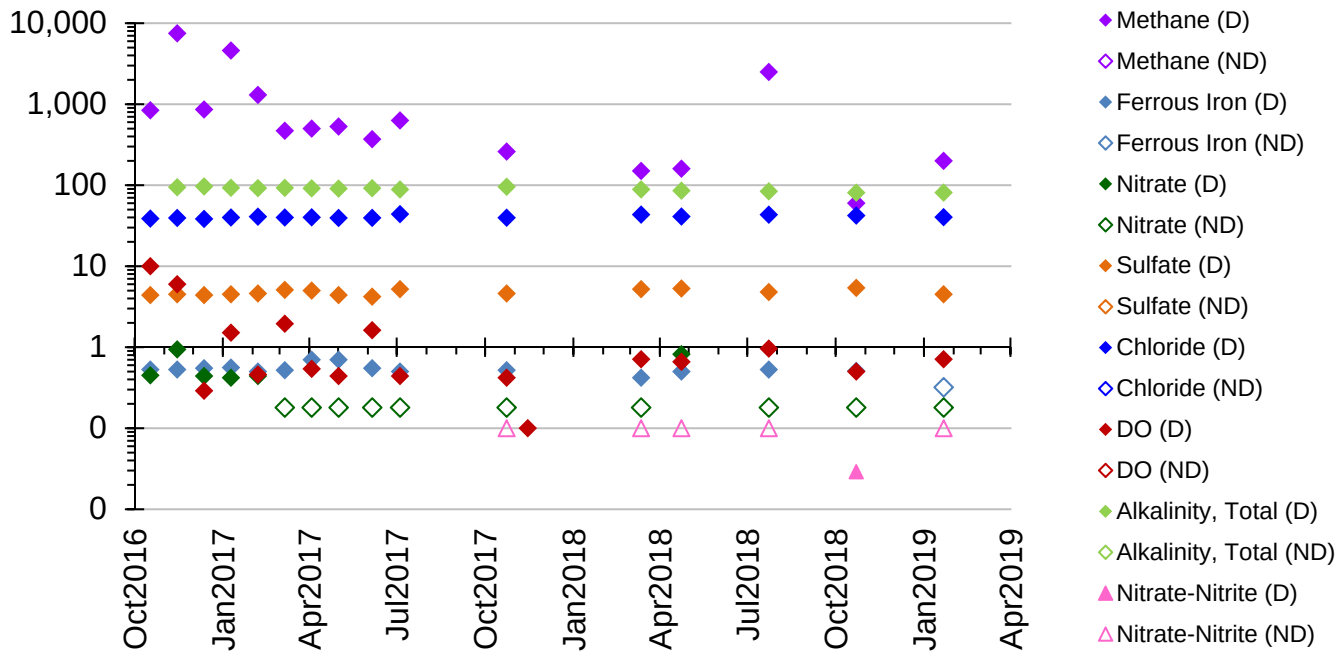
All results in micrograms per liter (µg/L or parts per billion).

Appendix A.3.1 Cumulative Natural Attenuation Parameters Graphs

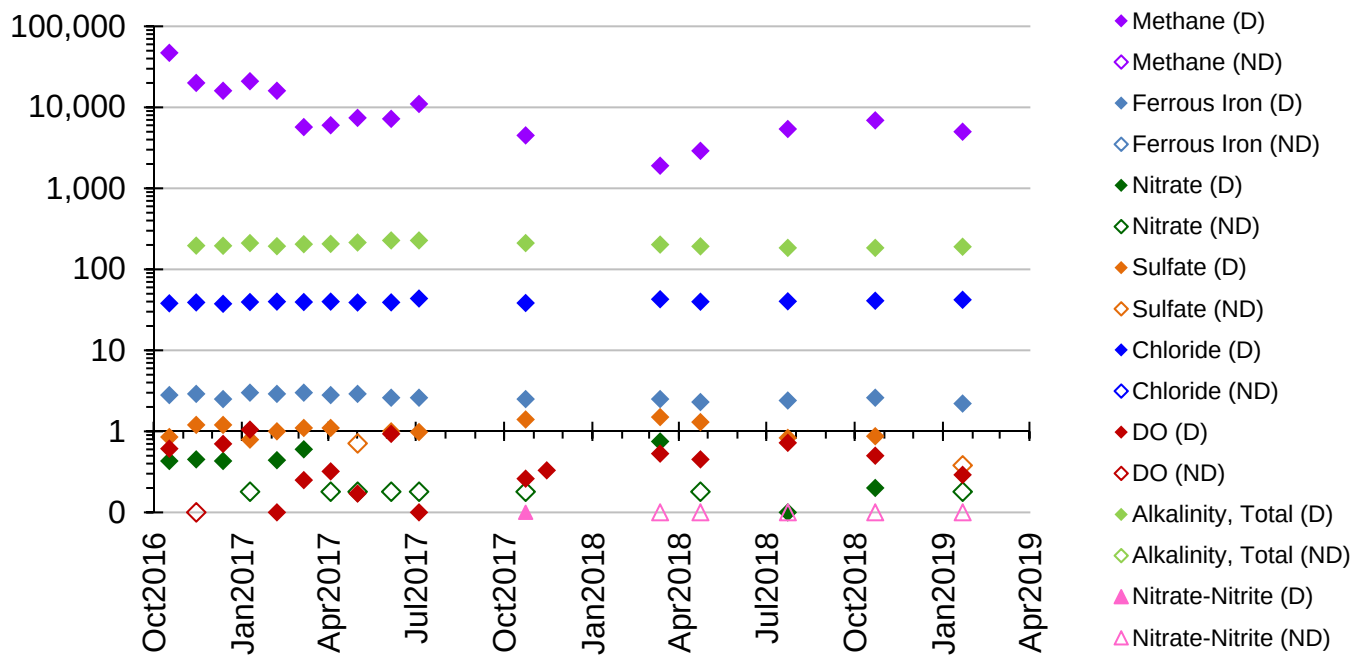
RHMW2254-01 NAPs



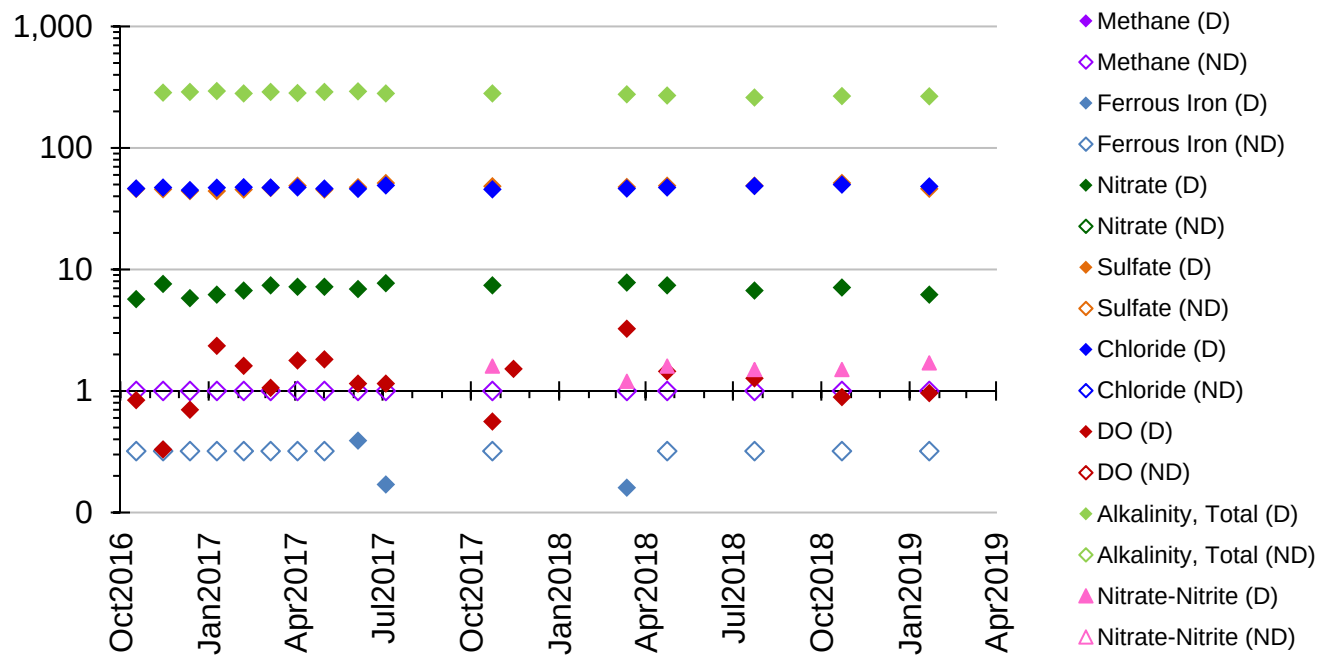
RHMW01 NAPs



RHMW02 NAPs



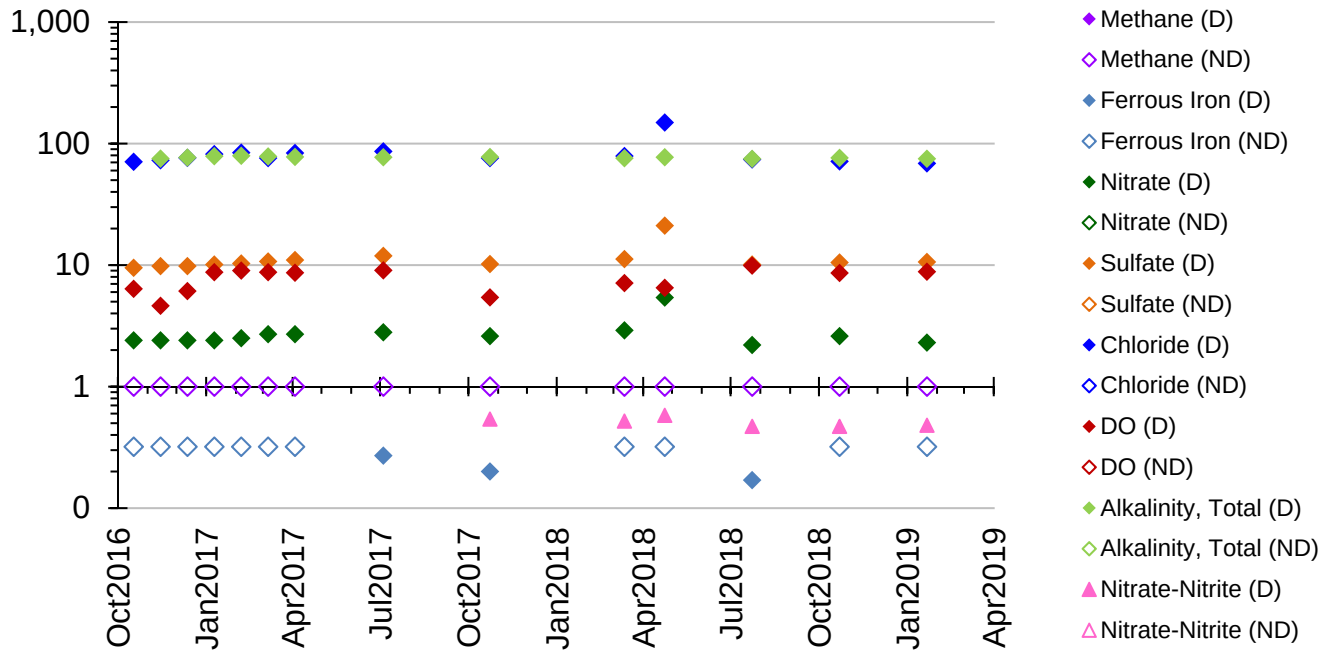
RHMW03 NAPs



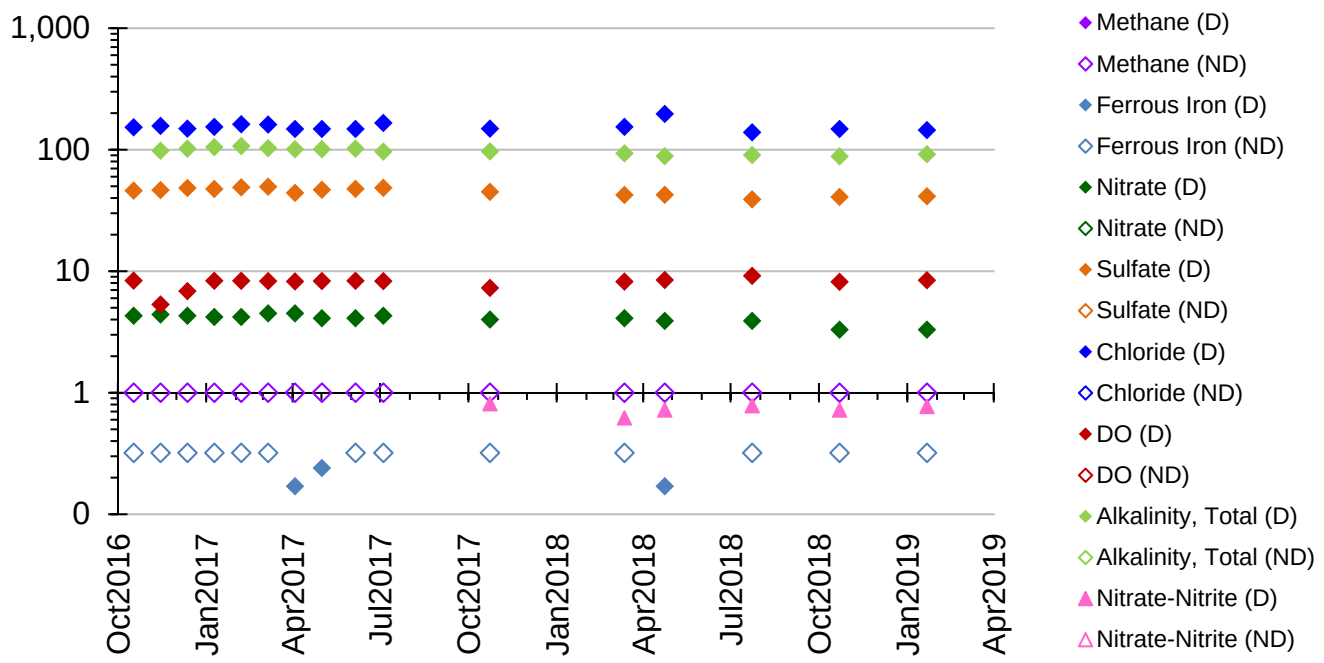
Methane results in micrograms per liter (µg/L or parts per billion).
All other results in milligrams per liter (mg/L or parts per million).

Appendix A.3.1 Cumulative Natural Attenuation Parameters Graphs

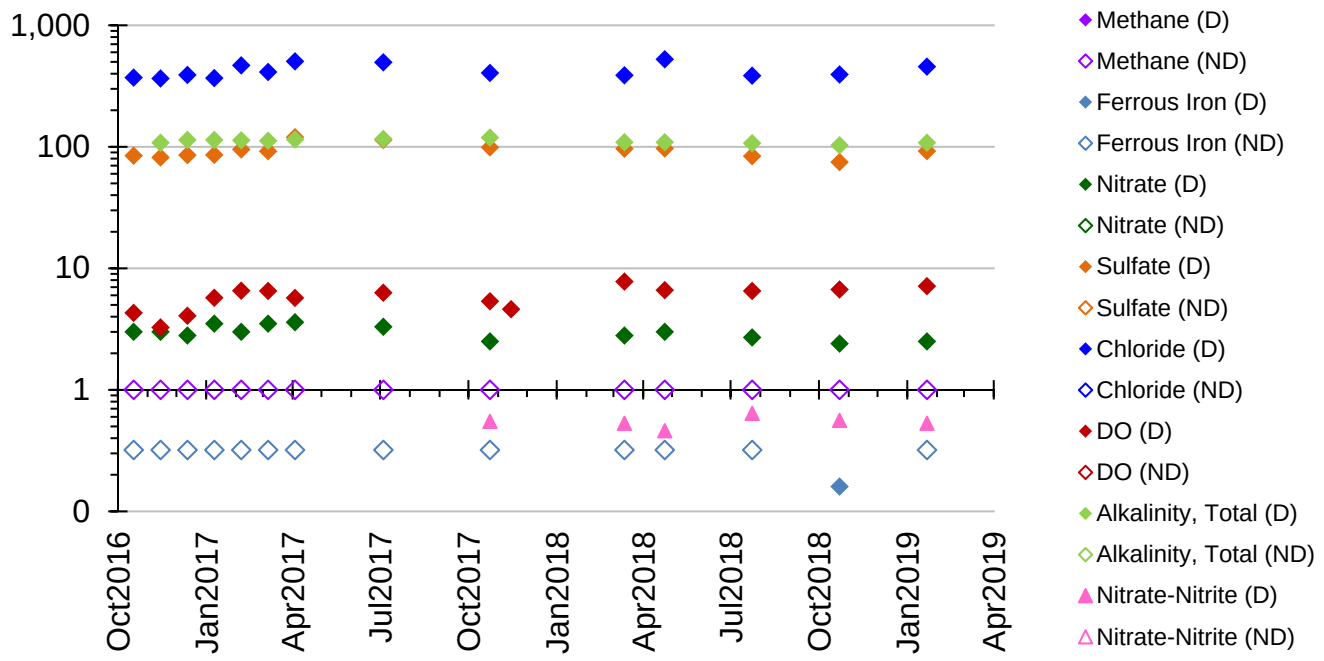
RHMW04 NAPs



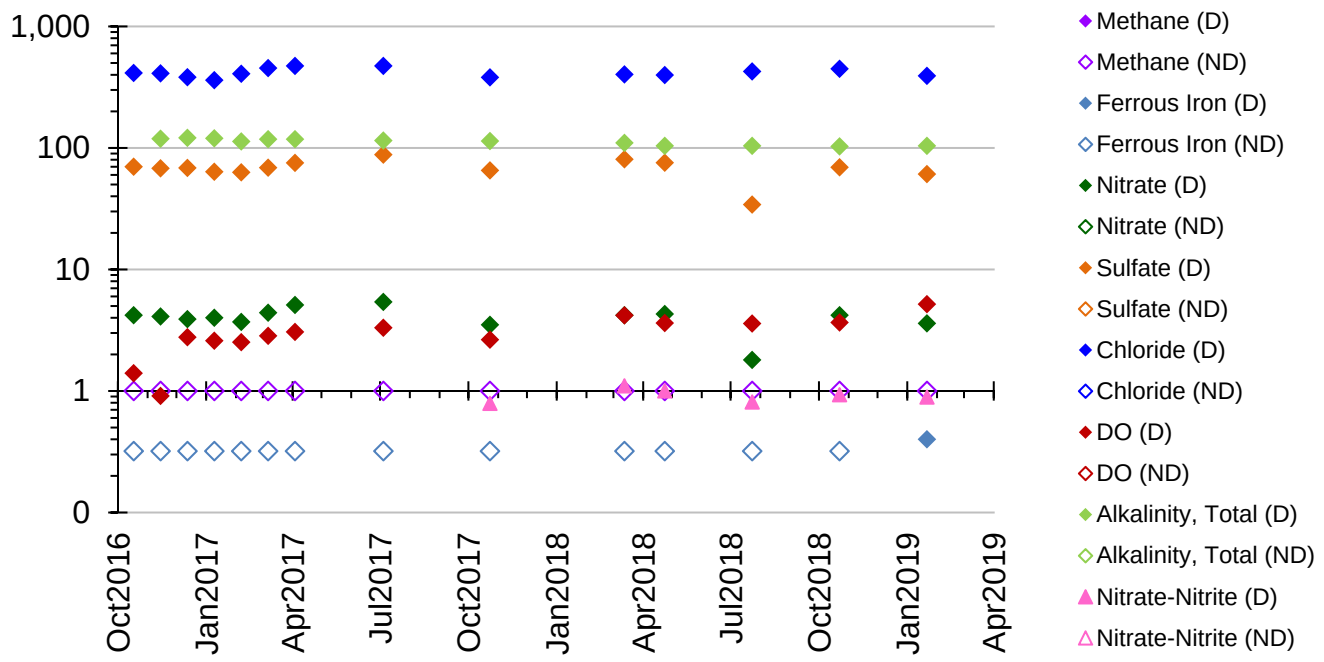
RHMW05 NAPs



RHMW06 NAPs



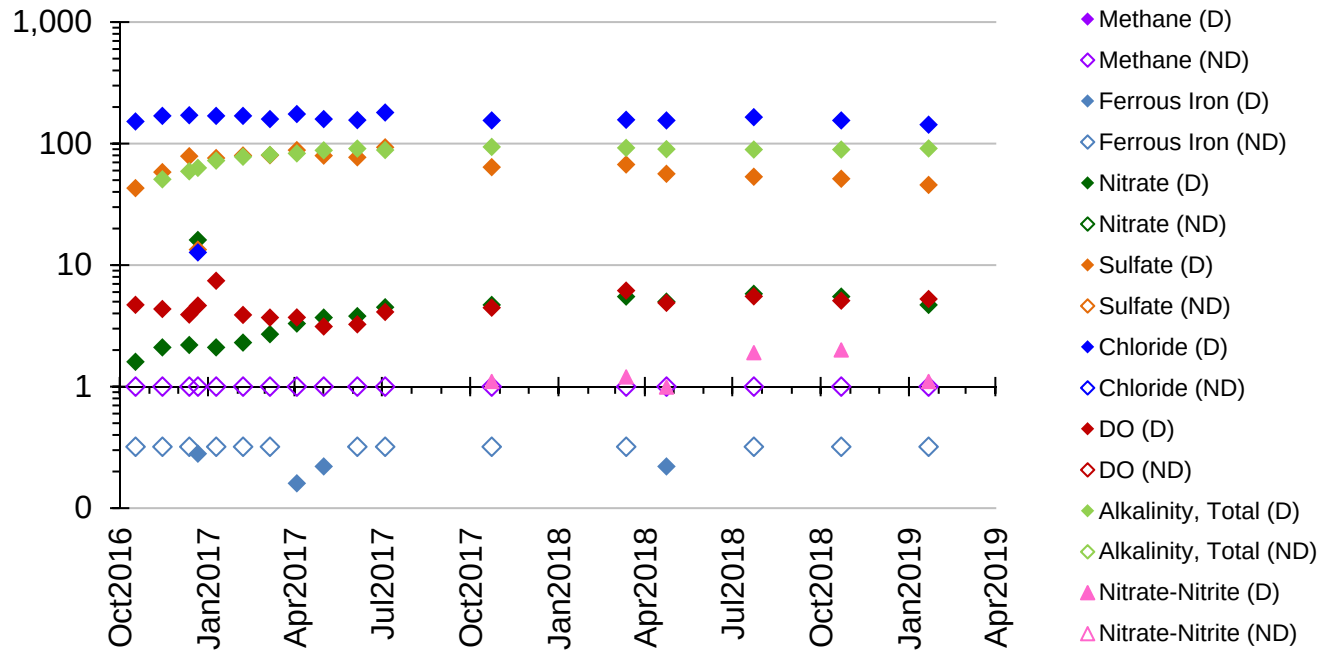
RHMW07 NAPs



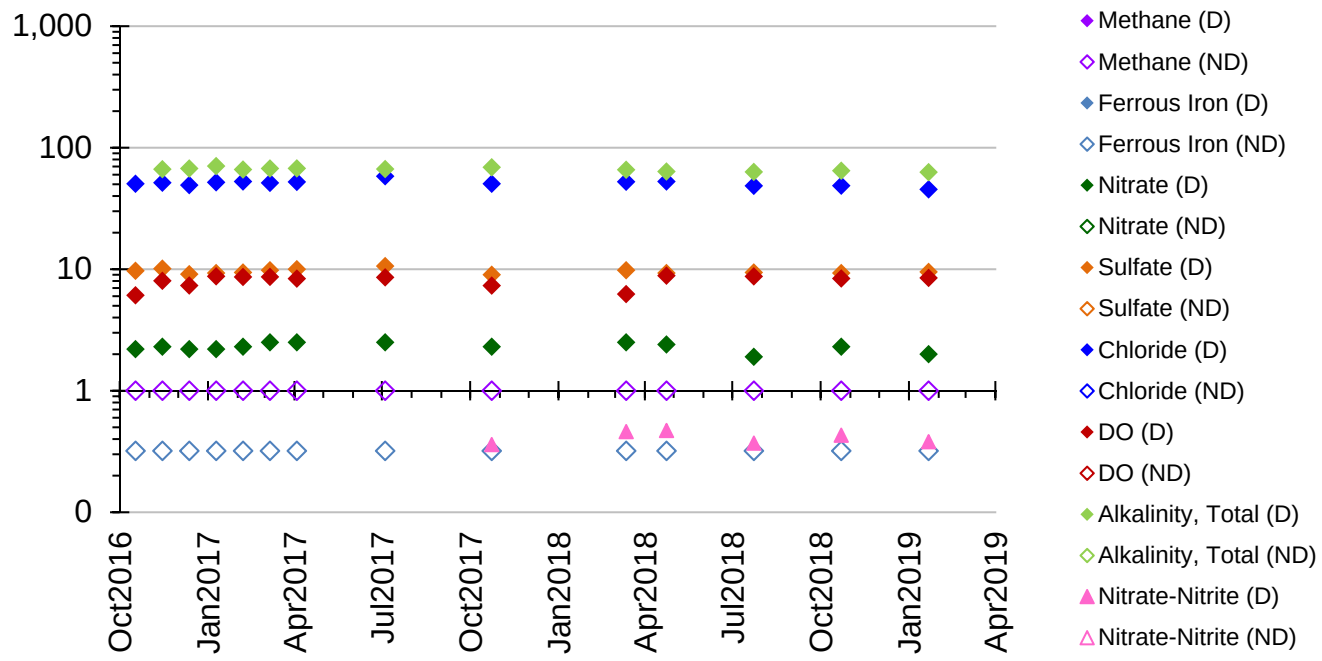
Methane results in micrograms per liter (µg/L or parts per billion).
All other results in milligrams per liter (mg/L or parts per million).

Appendix A.3.1 Cumulative Natural Attenuation Parameters Graphs

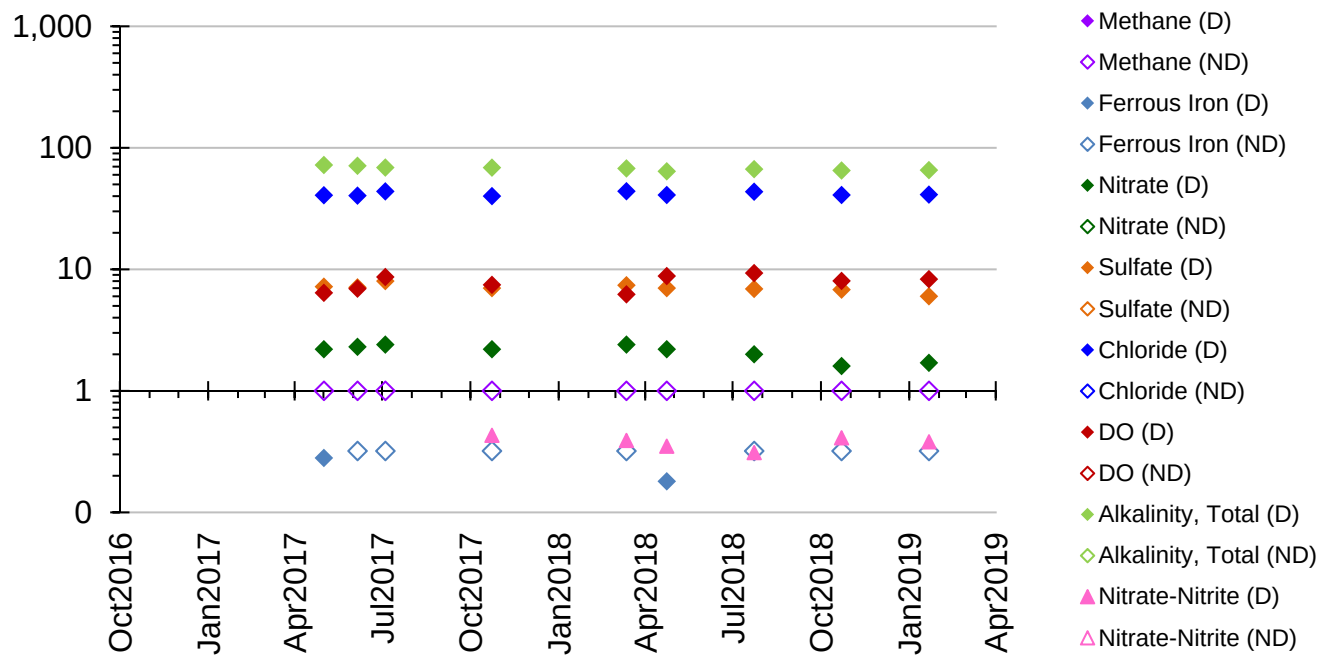
RHMW08 NAPs



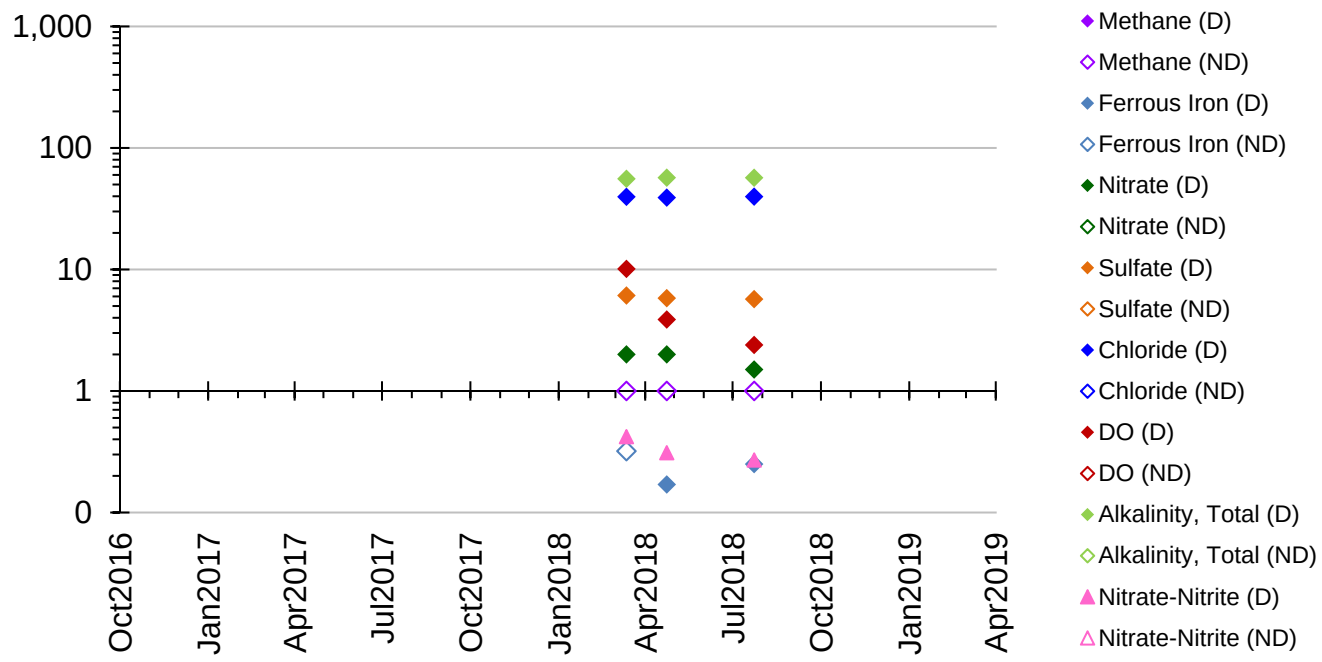
RHMW09 NAPs



RHMW10 NAPs



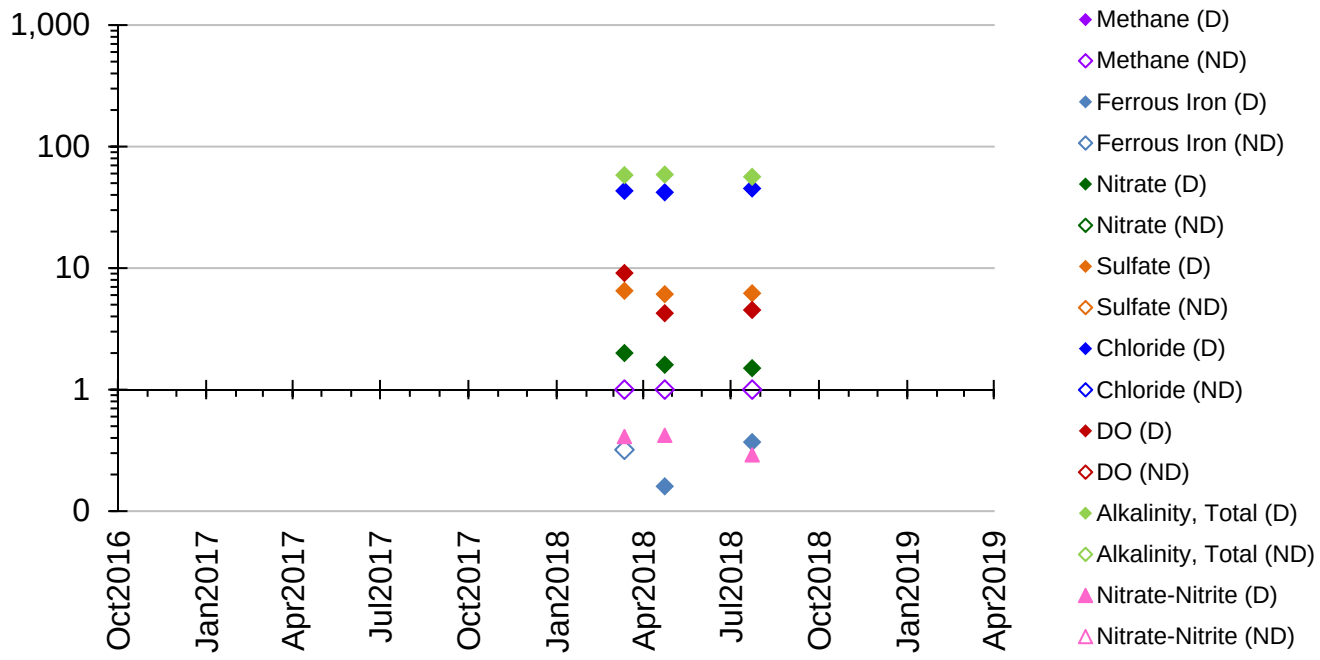
RHMW11 Zone 1 NAPs



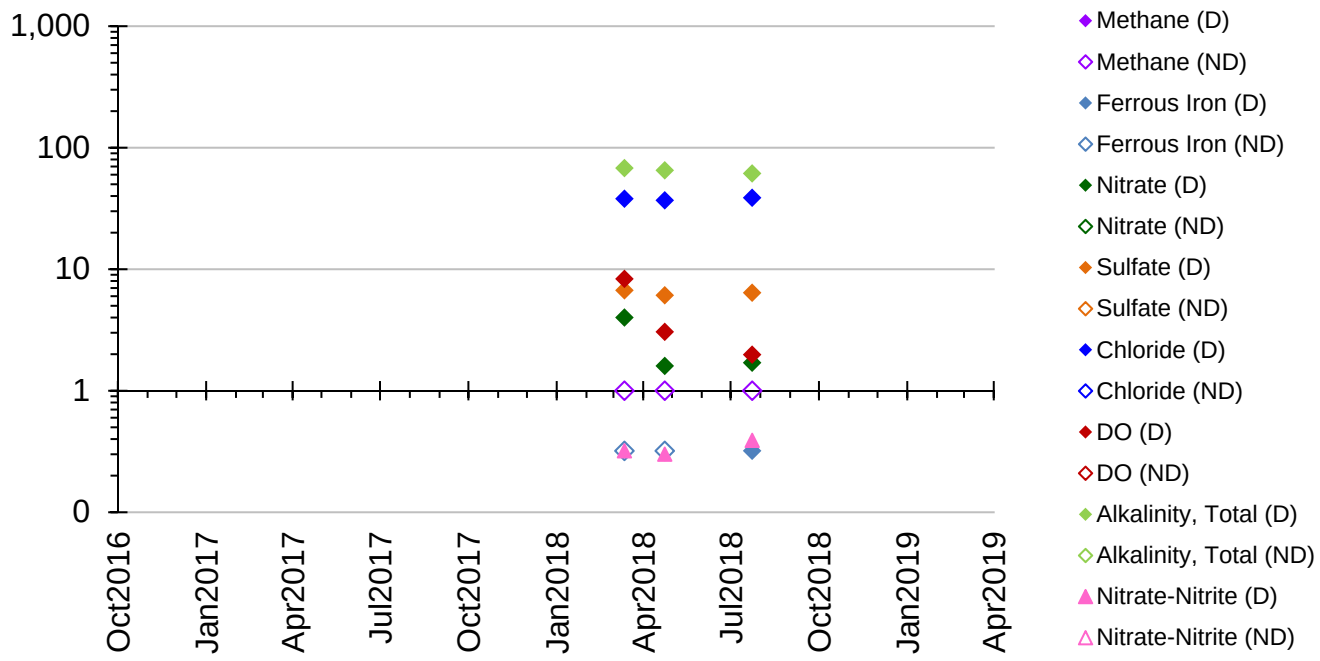
Methane results in micrograms per liter (µg/L or parts per billion).
All other results in milligrams per liter (mg/L or parts per million).

Appendix A.3.1 Cumulative Natural Attenuation Parameters Graphs

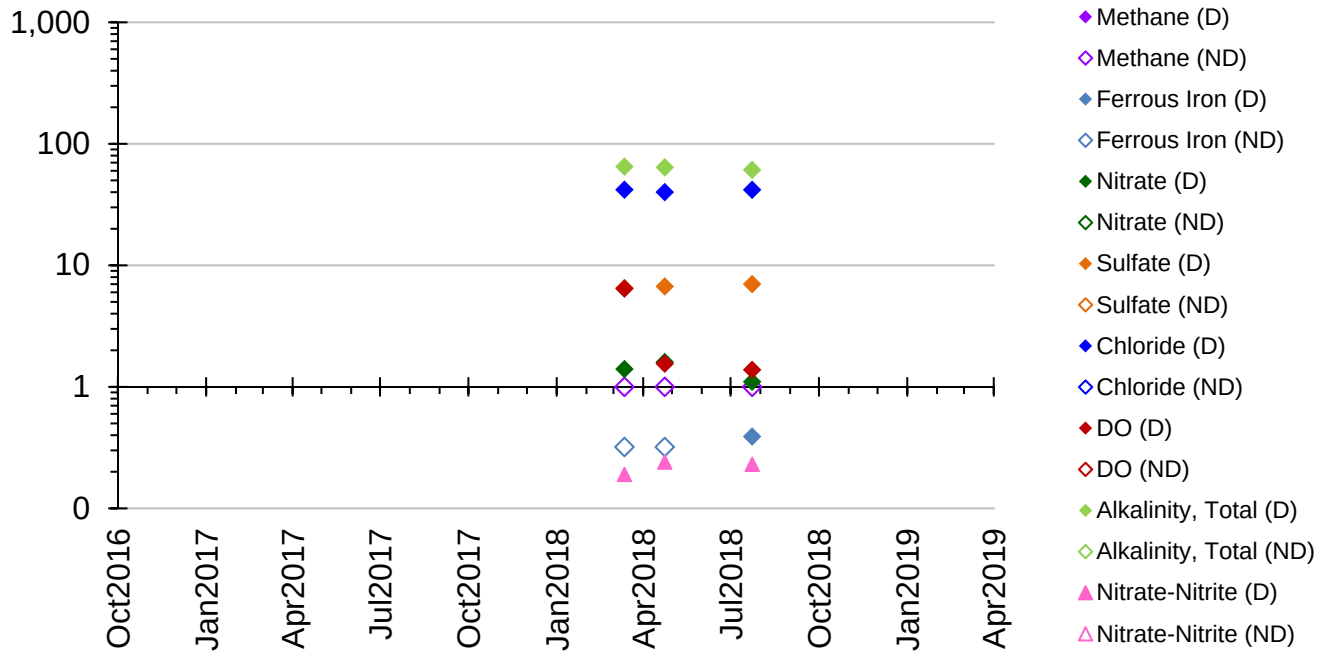
RHMW11 Zone 2 NAPs



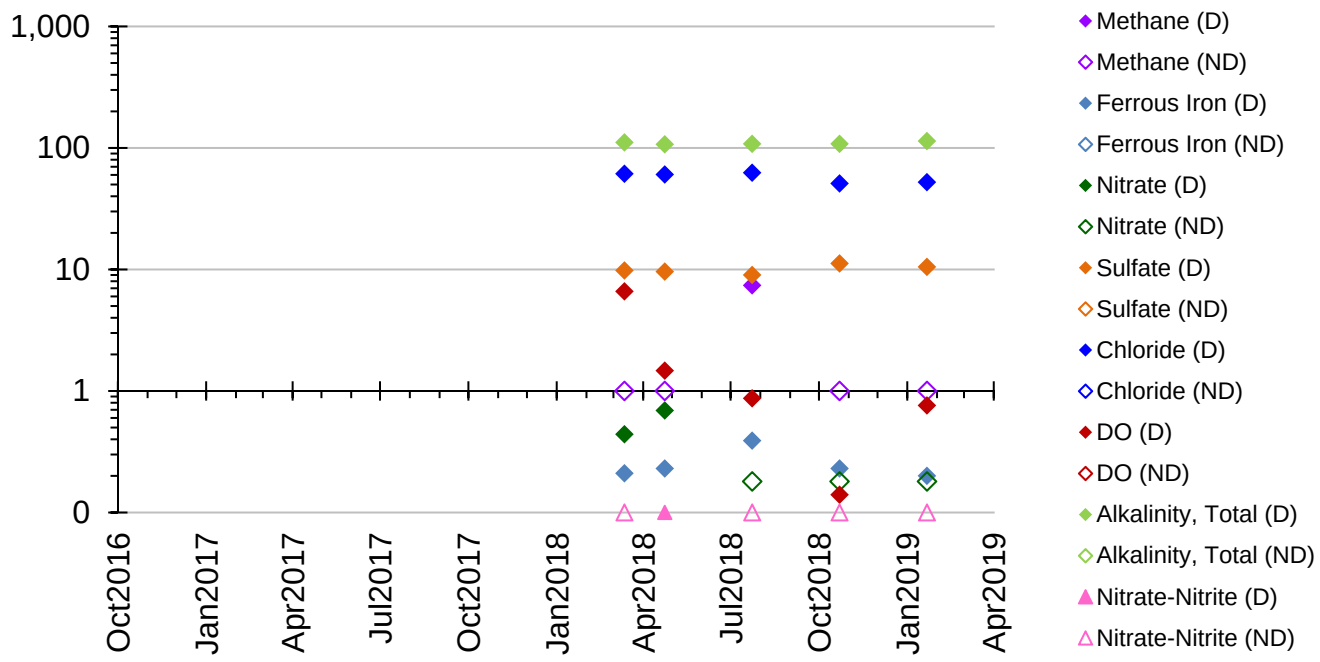
RHMW11 Zone 3 NAPs



RHMW11 Zone 4 NAPs



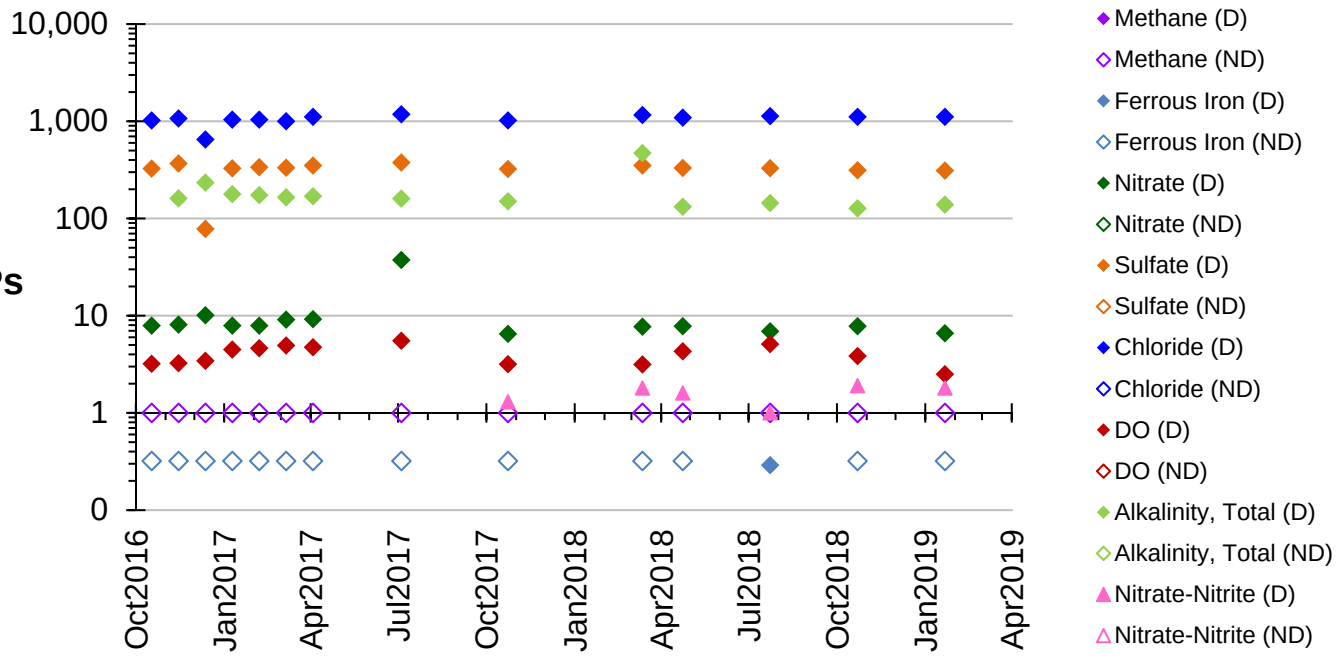
RHMW11 Zone 5 NAPs



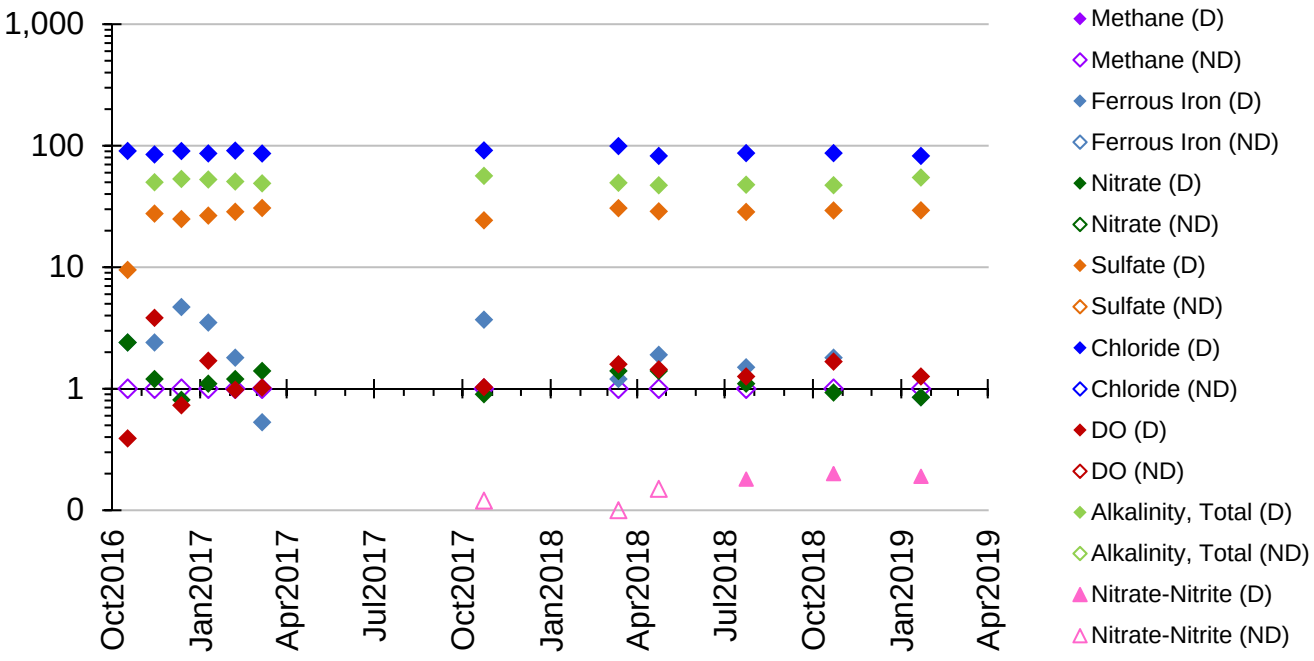
Methane results in micrograms per liter (µg/L or parts per billion).
All other results in milligrams per liter (mg/L or parts per million).

Appendix A.3.1 Cumulative Natural Attenuation Parameters Graphs

OWDFMW01 NAPs

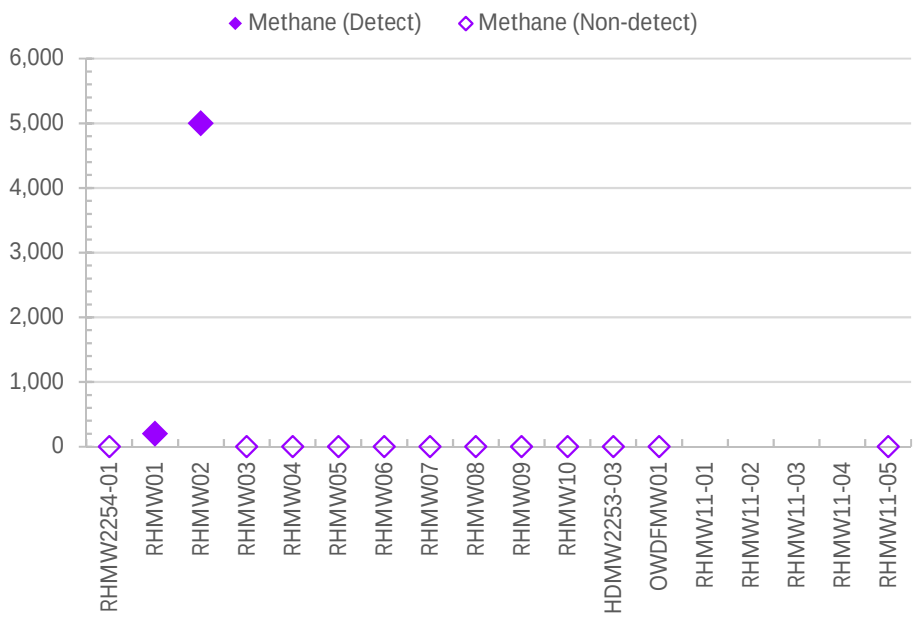


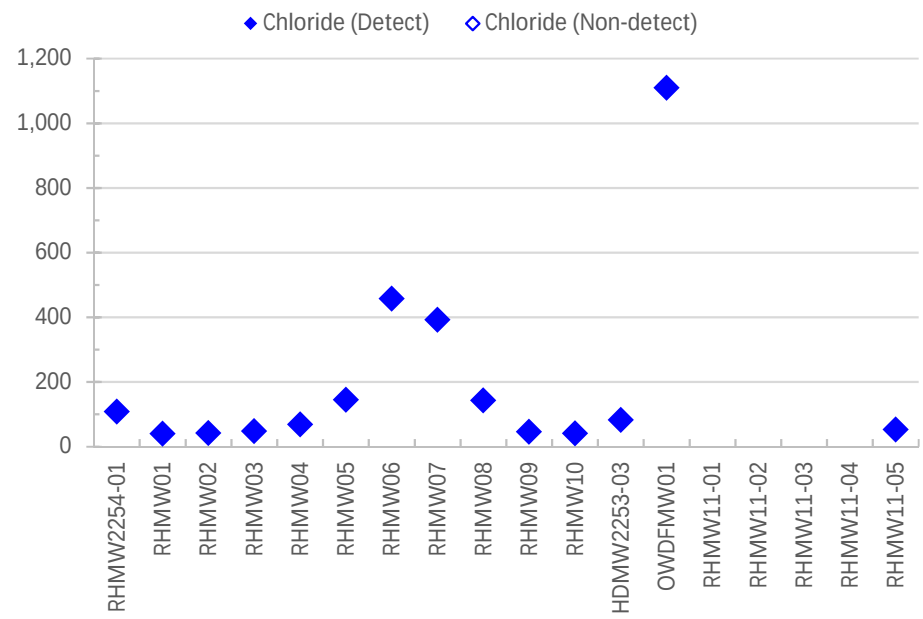
HDMW2253-03 NAPs

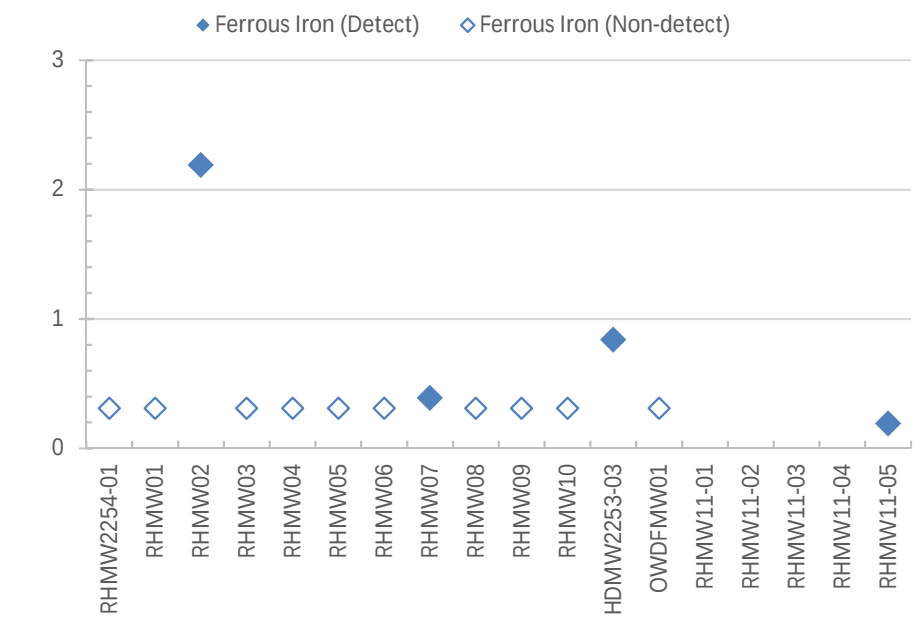


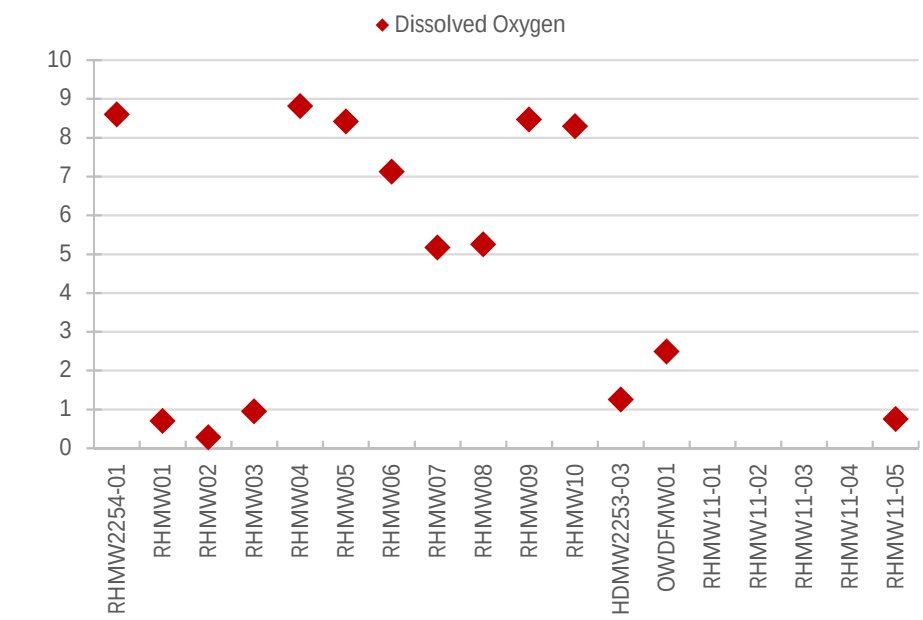
Methane results in micrograms per liter (µg/L or parts per billion).
All other results in milligrams per liter (mg/L or parts per million).

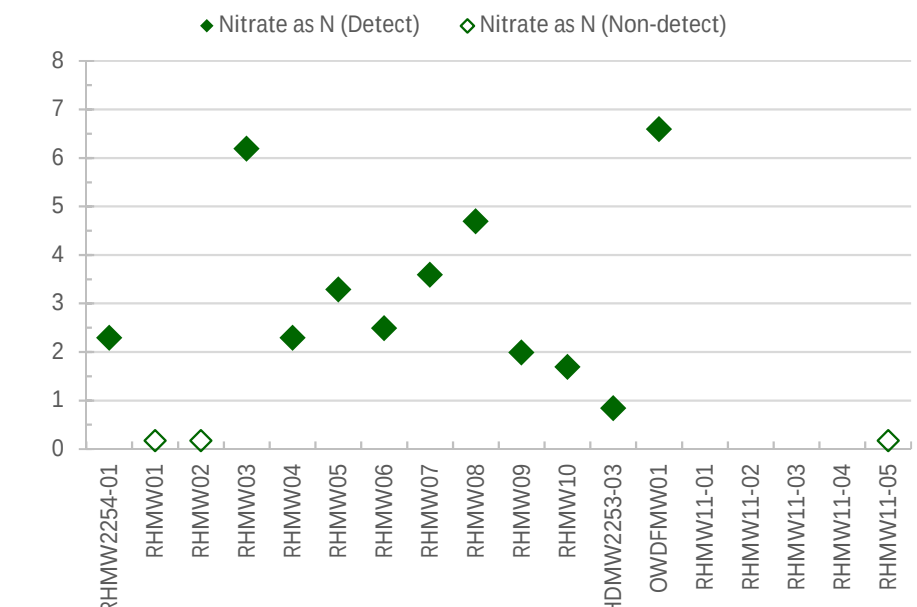
Appendix A.3.2 First Quarter 2019 Natural Attenuation Parameter Graphs

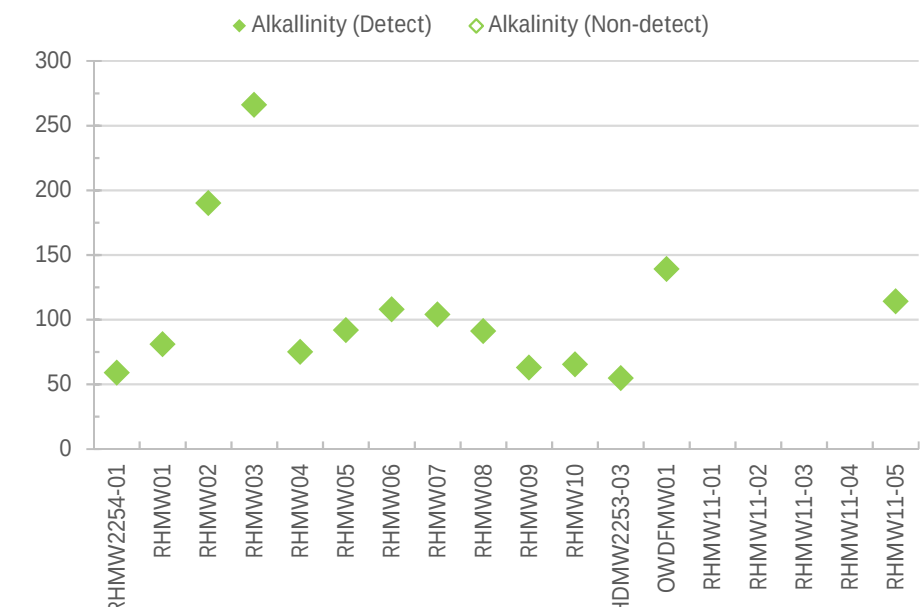


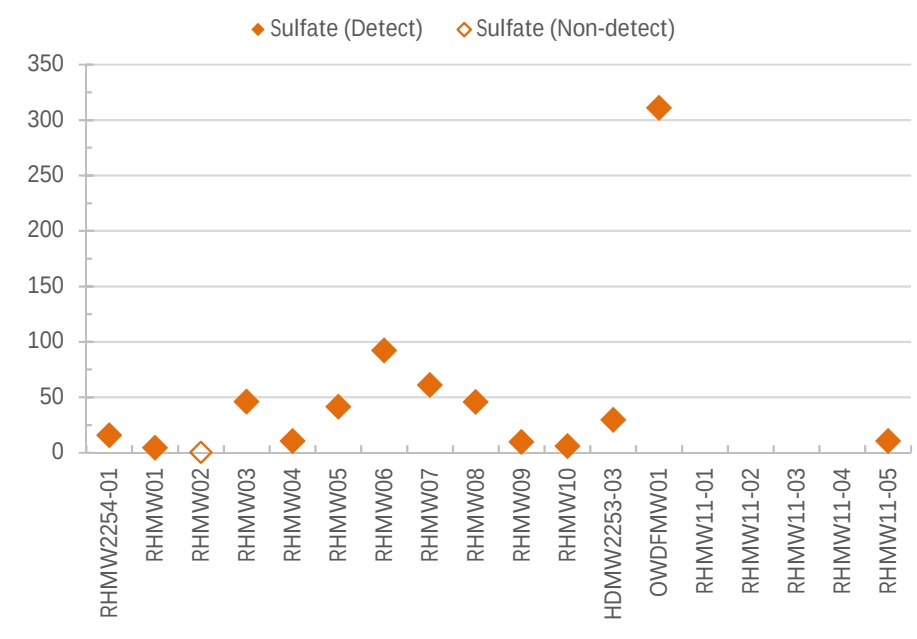


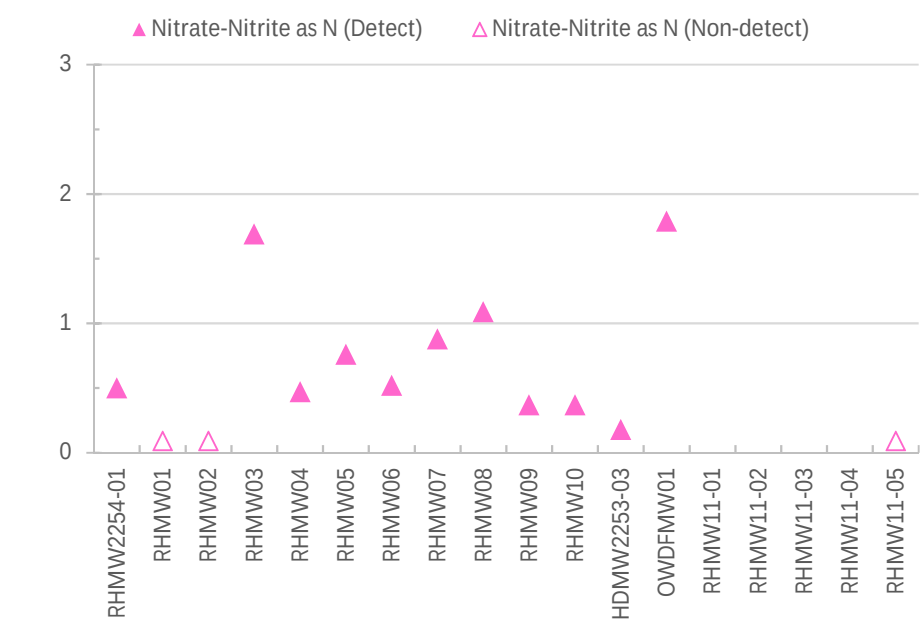












Methane results in micrograms per liter (µg/L).
All other results in milligrams per liter (mg/L).
RHMW11-01 to -04 were not sampled during this monitoring event.

Table A.4-1: Depth to Groundwater (ft btoc) in Red Hill Groundwater Monitoring Wells

Sample Date [a,b]	RHMW2254-01	RHMW01	RHMW02	RHMW03	RHMW04	RHMW05	RHMW06	RHMW07	RHMW08	RHMW09	RHMW10	HDMW2253-03	OWDFMW01
7-Feb-2019 [c]	—	—	—	—	—	—	—	—	—	—	—	205.81	—
24-Jan-2019	—	82.30	84.96	101.22	81.66	—	—	—	—	—	—	—	—
24-Jan-2019 [c]	81.01	—	—	—	—	—	—	—	—	—	476.15	—	—
23-Jan-2019 [c]	82.64	—	—	—	—	—	—	196.99	—	—	—	—	118.85
22-Jan-2019 [c]	—	82.39	—	101.19	—	—	—	—	—	375.99	—	—	—
21-Jan-2019 [c]	—	—	85.00	—	292.48	81.80	239.57	—	290.98	—	—	—	—
13-Dec-2018 [c]	81.16	—	—	—	—	—	—	—	—	—	—	—	—
12-Dec-2018 [c]	82.81	—	—	—	—	—	—	—	—	—	—	—	—
14-Nov-2018 [c]	81.14	—	—	—	—	—	—	—	—	—	—	—	—
13-Nov-2018 [c]	82.53	—	—	—	—	—	—	—	—	—	—	—	—
31-Oct-2018 [c]	—	—	—	—	—	—	—	—	—	—	476.54	—	—
30-Oct-2018	—	82.64	85.34	101.58	—	81.99	—	—	—	—	—	—	—
25-Oct-2018 [c]	—	82.76	—	—	—	—	—	—	—	—	—	—	—
24-Oct-2018 [c]	—	—	—	—	293.09	—	—	—	291.59	—	—	—	119.28
23-Oct-2018 [c]	—	—	85.53	101.71	—	—	240.16	197.58	—	376.39	—	—	—
22-Oct-2018 [c]	81.73	—	—	—	—	82.14	—	—	—	—	—	206.65	—
21-Aug-2018	—	—	86.32	102.58	—	—	—	—	—	—	—	—	—
26-Jul-2018 [c]	—	—	—	—	293.80	—	—	—	—	—	—	—	119.74
25-Jul-2018	—	83.55	86.33	102.58	—	82.89	—	—	—	—	—	—	—
24-Jul-2018 [c]	—	—	—	102.48	—	—	—	—	—	377.21	—	—	—
24-Jul-2018 [c]	—	83.65	86.19	—	—	—	—	197.97	292.35	—	476.89	—	—
23-Jul-2018 [c]	82.26	—	—	—	—	82.92	240.77	—	—	—	—	207.36	—
Jun-2018	—	83.63	86.34	102.57	—	82.99	—	—	—	—	—	—	—
22-May-2018	—	83.61	86.29	102.56	—	82.97	—	—	—	—	—	—	—
26-Apr-2018	—	—	—	—	—	—	—	—	—	—	—	—	119.80
25-Apr-2018	—	83.47	86.14	102.38	—	82.86	—	—	—	—	—	—	—
25-Apr-2018	—	83.43	—	102.33	293.63	—	—	—	—	377.28	—	—	—
24-Apr-2018	—	—	86.19	—	—	—	—	197.50	—	—	477.30	—	—
23-Apr-2018	82.08	—	—	—	—	82.73	240.65	—	292.04	—	—	207.33	—
20-Mar-2018	—	83.56	86.24	102.55	—	82.89	—	—	—	—	—	—	—
14-Mar-2018	82.40	—	—	—	293.82	—	—	—	—	—	—	—	119.62
13-Mar-2018	—	—	86.24	—	—	82.92	—	198.30	—	377.40	477.40	—	—
12-Mar-2018	—	83.44	—	102.40	—	—	240.81	—	292.25	—	—	207.43	—
21-Nov-2017	—	83.66	—	102.62	—	—	—	—	—	—	—	—	—
15-Nov-2017	—	—	86.28	—	—	—	—	—	—	—	—	—	—
14-Nov-2017	—	—	—	—	—	—	240.96	—	—	—	—	—	—
31-Oct-2017	—	—	—	—	—	—	—	—	—	—	—	207.59	—
26-Oct-2017	—	—	—	—	—	—	—	—	—	—	—	—	119.81
25-Oct-2017	—	83.79	—	—	—	—	—	198.06	—	—	477.79	—	—
24-Oct-2017	81.36	—	—	—	294.07	83.21	—	—	—	377.73	—	—	—
23-Oct-2017	—	—	86.38	102.76	—	—	241.18	—	292.77	—	—	—	—
21-Jul-2017	—	83.43	86.50	—	—	82.81	—	—	—	—	—	—	—
06-Jul-2017	—	—	85.88	102.09	—	—	—	—	—	—	—	—	—
05-Jul-2017	82.14	82.11	—	—	293.38	82.49	—	—	—	377.23	—	—	119.39
04-Jul-2017	—	—	—	—	—	—	240.55	197.78	292.14	—	477.26	—	—
22-Jun-2017	—	82.94	85.59	101.89	—	82.30	—	—	—	—	—	—	—
06-Jun-2017	82.66	—	—	101.76	—	82.17	—	—	—	—	—	—	—
05-Jun-2017	—	82.80	85.42	—	—	—	—	—	291.68	—	477.20	—	—
26-May-2017	—	82.45	85.13	101.39	—	81.80	—	—	—	—	—	—	—
04-May-2017	—	—	—	—	—	—	—	—	—	—	476.45	—	—
02-May-2017	80.12	—	—	—	—	—	—	—	291.42	—	—	—	—
01-May-2017	—	82.50	85.09	101.34	—	81.82	—	—	—		—	—	—
20-Apr-2017	—	82.59	85.25	101.50	—	81.94	—	—	—	—	—	—	—
04-Apr-2017	—	—	85.27	101.55	—	—	—	—	291.38	376.70	—	—	118.87
03-Apr-2017	80.23	82.43	—	—	292.78	81.81	239.86	197.07	—	—	—	—	—
24-Mar-2017	—	82.49	85.19	101.45	—	81.84	—	—	—	—	—	—	—
08-Mar-2017	—	82.28	—	—	—	81.61	—	—	—	—	—	206.13	188.61
07-Mar-2017	—	—	84.99	101.30	—	—	239.63	197.08	—	376.30	—	—	—
06-Mar-2017	80.06	—	—	—	292.62	—	—	—	291.19	—	—	—	—
22-Feb-2017	—	82.37	85.01	101.31	—	81.72	—	—	—	—	—	—	—
09-Feb-2017	—	—	—	—	—	—	—	—	—	—	—	—	119.03
08-Feb-2017	—	82.69	—	101.55	—	—	—	197.25	—	376.67	—	—	—
07-Feb-2017	—	—	85.24	—	—	81.91	239.90	—	—	—	—	206.32	—
06-Feb-2017	80.29	—	—	—	292.85	—	—	—	291.51	—	—	—	—
31-Jan-2017	—	82.45	85.13	101.46	—	82.04	—	—	—	—	—	—	—
12-Jan-2017	—	—	—	101.59	—	—	—	—	—	—	—	—	118.93
11-Jan-2017	—	82.70	—	—	—	—	—	—	291.26	376.10	—	—	—
10-Jan-2017	—	—	85.29	—	—	82.10	—	197.02	—	—	—	206.12	—
09-Jan-2017	80.39	—	—	—	292.48	—	239.76	—	—	—	—	—	—
21-Dec-2016	—	—	—	—	—	—	—	—	291.69	—	—	—	—
20-Dec-2016	—	82.67	85.36	101.61	—	82.01	—	—	—	—	—	—	—
14-Dec-2016	—	—	—	101.81	—	—	—	—	—	—	—	—	119.09
13-Dec-2016	—	82.88	85.51	—	292.61	—	—	197.13	—	—	—	206.33	—
12-Dec-2016	80.49	—	—	—	—	82.12	240.04	—	291.42	376.28	—	—	—
18-Nov-2016	80.45	82.85	85.55	101.78	293.11	82.19	240.17	197.45	291.63	376.74	—	—	119.07
17-Nov-2016	—	82.92	85.56	101.82	—	82.24	—	—	—	—	—	—	—
16-Nov-2016	—	—	—	—	—	—	—	—	—	—	—	206.83	—
15-Nov-2016	—	—	85.35	101.87	—	82.25	—	—	291.81	377.05	—	—	119.29
14-Nov-2016	80.52	82.87	—	—	293.22	—	240.31	197.56	—	—	—	—	—
25-Oct-2016	—	—	—	—	293.33	—	—	—	—	377.09	—	—	—
20-Oct-2016	80.68	—	—	—	—	—	—	—	—	—	—	—	119.39
19-Oct-2016	—	83.01	85.69	101.95	—	82.39	—	—	—	—	—	—	—
19-Oct-2016	—	—	85.69	102.02	—	82.37	240.47	197.68	291.94	—	—	—	—
18-Oct-2016	80.68	—	—	—	—	—	—	—	—	—	—	207.02	—
17-Oct-2016	—	83.00	—	—	—	—	—	—	—	—	—	—	—
21-Sep-2016	—	83.13	85.74	102.06	—	82.44	—	—	—	—	—	—	—
23-Aug-2016	—	83.27	85.96	102.20	—	82.63	—	—	—	—	—	—	—
20-Jul-2016	80.96	83.32	85.99	102.31	—	82.63	—	—	—	—	—	—	—
19-Jul-2016	—	—	—	—	293.60	—	240.70	197.79	—	—	—	207.42	119.65
21-Jun-2016	—	83.16	85.77	102.03	—	82.54	—	—	—	—	—	—	—
23-May-2016	—	83.14	85.81	102.03	—	82.50	—	—	—	—	—	—	—
20-Apr-2016	80.57	82.97	85.63	101.91	—	82.31	—	—	—	—	—	—	—
19-Apr-2016	—	—	—	—	293.21	—	240.35	197.76	—	—	—	206.97	119.28
15-Mar-2016	—	82.89	85.60	101.82	—	82.26	—	—	—	—	—	—	—
17-Feb-2016	—	83.17	85.81	102.10	—	—	—	—	—	—	—	—	—
20-Jan-2016	81.00	83.31	85.97	102.21	—	—	—	—	—	—	—	—	—
19-Jan-2016	—	—	—	—	293.61	—	240.69	198.24	—	—	—	207.42	119.82
17-Dec-2015	—	83.76	86.36	102.56	—	83.18	—	—	—	—	—	—	—
18-Nov-2015	—	84.25	86.93	103.24	—	84.62	—	—	—	—	—	—	—
20-Oct-2015	82.34	84.00	86.38	103.38	—	—	—	—	—	—	—	—	—
19-Oct-2015	—	—	—	—	294.61	—	241.69	198.88	—	—	—	208.40	120.88
23-Sep-2015	—	84.26	86.91	103.21	—	83.63	—	—	—	—	—	—	—
27-Aug-2015	—	84.44	87.13	103.41	—	83.69	—	—	—	—	—	—	—
20-Aug-2015	—	—	—	—	295.10	—	—	—	—	—	—	—	—

Table A.4-1: Depth to Groundwater (ft btoc) in Red Hill Groundwater Monitoring Wells (cont'd)

Sample Date [a,b]	RHMW2254-01	RHMW01	RHMW02	RHMW03	RHMW04	RHMW05	RHMW06	RHMW07	RHMW08	RHMW09	RHMW10	HDMW2253-03	OWDFMW01
28-Jul-2015	—	—	—	—	—	—	241.98	—	—	—	—	—	—
27-Jul-2015	—	—	—	—	—	—	—	198.61	—	—	—	—	—
22-Jul-2015	—	—	—	—	—	—	—	—	—	—	—	208.69	120.99
21-Jul-2015	82.24	—	—	—	—	83.76	—	—	—	—	—	—	—
20-Jul-2015	—	84.58	87.24	103.44	—	—	—	—	—	—	—	—	—
25-Jun-2015	—	84.58	87.28	103.57	—	83.75	—	—	—	—	—	—	—
28-May-2015	—	84.29	86.97	103.24	—	83.95	—	—	—	—	—	—	—
23-Apr-2015	—	—	—	—	—	—	—	198.40	—	—	—	—	—
22-Apr-2015	—	—	—	—	294.43	—	241.59	—	—	—	—	—	120.68
21-Apr-2015	82.99	—	—	—	—	83.72	—	—	—	—	—	—	—
20-Apr-2015	—	84.33	86.97	103.18	—	—	—	—	—	—	—	—	—
26-Mar-2015		83.83	86.04	102.79	—	83.24	—	—	—	—	—	—	—
27-Feb-2015		83.68	86.28	102.52	—	83.06	—	—	—	—	—	—	—
29-Jan-2015	—	—	—	—	293.91	—	—	—	—	—	—	206.67	—
28-Jan-2015	—	—	86.35	102.63	—	—	—	—	—	—	—	—	—
27-Jan-2015	81.37	83.63	—	—	—	83.03	—	—	—	—	—	—	—
26-Jan-2015	—	—	—	—	—	—	—	—	—	—	—	—	120.54
23-Dec-2014	—	83.67	86.37	102.64		83.05	—	—	—	—	—	—	—
20-Nov-2014	—	83.87	86.56	102.78		83.35	—	—	—	—	—	—	—
28-Oct-2014	83.44	—	—	—	—	83.21	—	—	—	—	—	—	—
27-Oct-2014	—	83.79	86.51	102.78	—	—	—	—	—	—	—	—	—
22-Oct-2014	—	—	—	—	—	—	—	—	—	—	—	207.99	120.49
25-Sep-2014	—	84.64	87.27	103.51	—	84.10	—	—	—	—	—	—	—
27-Aug-2014	—	84.01	86.65	102.87	—	83.04	—	—	—	—	—	—	—
24-Jul-2014	—	—	—	—	—	—	—	—	—	—	—	—	120.57
23-Jul-2014	—	—	—	—	294.33	—	—	—	—	—	—	208.08	—
22-Jul-2014	82.19	—	—	102.98	—	83.49	—	—	—	—	—	—	—
21-Jul-2014	—	84.13	86.80	—	—	—	—	—	—	—	—	—	—
23-Jun-2014	—	84.06	86.72	103.99	—	83.54	—	—	—	—	—	—	—
10-Jun-2014	—	83.93	86.55	—	—	83.34	—	—	—	—	—	—	—
27-May-2014	—	83.91	86.60	102.85	—	83.31	—	—	—	—	—	—	—
22-May-2014	—	83.81	86.47	—	—	83.15	—	—	—	—	—	—	—
08-May-2014	—	84.03	86.68	—	—	83.46	—	—	—	—	—	—	—
21-Apr-2014	—	83.93	86.58	102.80	—	83.27	—	—	—	—	—	—	—
07-Apr-2014	—	83.42	86.43	—	—	83.21	—	—	—	—	—	—	—
28-Mar-2014	—	83.76	86.42	102.65	—	83.18	—	—	—	—	—	—	—
24-Feb-2014	—	83.54	86.24	102.47	—	82.97	—	—	—	—	—	—	—
10-Feb-2014	—	84.49	86.16	102.47	—	82.83	—	—	—	—	—	—	—
04-Feb-2014	81.08	83.54	86.20	—	—	82.89	—	—	—	—	—	207.72	—
03-Feb-2014	81.08	83.54	86.20	—	—	82.91	—	—	—	—	—	207.72	—
31-Jan-2014	81.03	83.53	86.19	—	—	82.88	—	—	—	—	—	207.73	—
30-Jan-2014	81.09	83.53	86.21	—	—	82.93	—	—	—	—	—	207.67	—
29-Jan-2014	80.35	83.56	86.22	—	—	82.94	—	—	—	—	—	207.75	—
28-Jan-2014	80.40	83.56	86.25	102.52	—	82.94	—	—	—	—	—	207.76	—
27-Jan-2014	80.33	83.55	86.23	—	—	82.93	—	—	—	—	—	207.8	—
24-Jan-2014	80.38	83.57	86.23	—	—	82.93	—	—	—	—	—	207.75	—
23-Jan-2014	80.40	83.58	86.24	—	—	82.94	—	—	—	—	—	207.8	—
22-Jan-2014	80.40	83.53	86.20	—	—	82.87	—	—	—	—	—	207.66	—
16-Jan-2014	80.60	—	—	—	—	83.09	—	—	—	—	—	—	—
15-Jan-2014	—	83.94	86.62	—	—	—	—	—	—	—	—	—	—
23-Dec-2013	—	84.09	86.72	103.00	—	83.72	—	—	—	—	—	—	—
21-Nov-2013	—	84.26	86.91	103.16	—	83.70	—	—	—	—	—	—	—
23-Oct-2013	—	—	—	—	—	—	—	—	—	—	—	—	120.74
22-Oct-2013	—	84.47	87.08	103.31	—	83.80	—	—	—	—	—	—	—
21-Oct-2013	—	84.47	87.08	103.31	—	—	—	—	—	—	—	—	—
26-Sep-2013	—	84.57	87.20	103.43	—	84.00	—	—	—	—	—	—	—
29-Aug-2013	—	84.66	86.28	103.50	—	84.09	—	—	—	—	—	—	—
24-Jul-2013	—	—	—	—	—	—	—	—	—	—	—	—	120.72
23-Jul-2013	82.56	—	—	—	—	83.85	—	—	—	—	—	—	—
22-Jul-2013	—	84.29	86.96	103.23	—	—	—	—	—	—	—	—	—
13-Jul-2013	—	84.29	86.96	103.23	—	83.85	—	—	—	—	—	—	—
27-Jun-2013	—	84.22	86.86	103.12	—	83.66	—	—	—	—	—	—	—
30-May-2013	—	84.03	86.69	102.95	—	83.41	—	—	—	—	—	—	—
25-Apr-2013	—	83.84	86.50	102.78	—	83.41	—	—	—	—	—	—	—
24-Apr-2013	—	—	—	—	—	—	—	—	—	—	—	208.03	120.15
23-Apr-2013	82.61	—	—	—	—	83.41	—		—	—	—	—	—
22-Apr-2013	—	83.84	86.50	102.78	—	—	—	—	—	—	—	—	—
28-Mar-2013	—	83.82	86.48	102.75	—	83.19	—	—	—	—	—	—	—
28-Feb-2013	—	84.04	86.62	102.87	—	83.43	—	—	—	—	—	—	—
04-Feb-2013	—	84.04	—	—	—	—	—	—	—	—	—	—	—
01-Feb-2013	—	—	86.62	102.87	—	83.43	—	—	—	—	—	—	—
30-Jan-2013	—	—	—	—	—	—	—	—	—	—	—	208.15	120.55
29-Jan-2013	82.78	—	—	—	—	83.61	—	—	—	—	—	—	—
28-Jan-2013	—	—	86.75	102.98	—	—	—	—	—	—	—	—	—
13-Jan-2013	—	84.05	86.87	103.14	—	83.70	—	—	—	—	—	—	—
12-Dec-2012	—	84.21	86.87	103.14	—	83.70	—	—	—	—	—	—	—
07-Nov-2012	—	—	—	—	—	—	—	—	—	—	—	208.20	—
12-Nov-2012	—	84.23	86.85	103.10	—	83.70	—	—	—	—	—	—	—
23-Oct-2012	83.05	—	—	—	—	83.72	—	—	—	—	—	—	—
22-Oct-2012	—	84.19	86.81	103.05	—	—	—	—	—	—	—	—	—
Oct-2012	—	84.19	86.81	103.50	—	83.72	—	—	—	—	—	—	—
Aug-2012	—	84.19	86.81	103.30	—	83.62	—	—	—	—	—	—	—
20-Jul-2012	—	84.05	—	—	—	—	—	—	—	—	—	—	—
19-Jul-2012	—	—	—	—	—	—	—	—	—	—	—	207.87	120.15
18-Jul-2012	—	—	86.70	103.09	—	—	—	—	—	—	—	—	—
17-Jul-2012	—	—	—	—	—	83.50	—	—	—	—	—	—	—
Jul-2012	—	84.20	86.64	102.89	—	83.41	—	—	—	—	—	—	—
Jun-2012	—	84.34	86.95	103.17	—	83.97	—	—	—	—	—	—	—
May-2012	—	84.09	86.71	102.98	—	83.53	—	—	—	—	—	—	—
26-Apr-2012	—	—	—	—	—	—	—	—	—	—	—	207.76	120.29
17-Apr-2012	—	83.60	—	—	—	—	—	—	—	—	—	—	—
16-Apr-2012	—	—	86.34	102.71	—	83.17	—	—	—	—	—	—	—
Mar-2012	—	83.41	86.51	102.45	—	82.79	—	—	—	—	—	—	—
14-Feb-2012	—	83.75	—	—	—	—	—	—	—	—	—	—	—
01-Feb-2012	—	—	—	—	—	83.15	—	—	—	—	—	—	—
Feb-2012	—	83.80	86.41	102.71	—	83.20	—	—	—	—	—	—	—
26-Jan-2012	—	—	86.31	102.56	—	—	—	—	—	—	—	—	—
24-Jan-2012	—	—	—	—	—	—	—	—	—	—	—	207.60	120.02
Jan-2012	—	83.57	86.18	102.56	—	82.90	—	—	—	—	—	—	—
Dec-2011	—	83.49	86.10	102.36	—	82.85	—	—	—	—	—	—	—
02-Nov-2011	—	83.71	—	—	—	—	—	—	—	—	—	—	—
Nov-2011	—	83.60	86.25	102.47	—	83.00	—	—	—	—	—	—	—
26-Oct-2011	—	—	—	—	—	—	—	—	—	—	—	207.73	120.12
25-Oct-2011	—	—	—	—	—	83.15	—	—	—	—	—	—	—
24-Oct-2011	—	—	86.38	102.90	—	—	—	—	—	—	—	—	—
Oct-2011	—	83.71	—	—	—	—	—	—	—	—	—	—	—

Table A.4-1: Depth to Groundwater (ft btoc) in Red Hill Groundwater Monitoring Wells (cont'd)

Sample Date [a,b]	RHMW2254-01	RHMW01	RHMW02	RHMW03	RHMW04	RHMW05	RHMW06	RHMW07	RHMW08	RHMW09	RHMW10	HDMW2253-03	OWDFMW01
Sep-2011	—	83.81	86.44	102.69	—	83.21	—	—	—	—	—	—	—
Aug-2011	—	83.81	86.42	102.66	—	83.21	—	—	—	—	—	—	—
20-Jul-2011	—	83.60	—	—	—	—	—	—	—	—	—	—	—
19-Jul-2011	—	—	86.28	102.49	—	83.08	—	—	—	—	—	—	—
Jul-2011	—	83.57	86.22	102.44	—	82.99	—	—	—	—	—	—	—
Jun-2011	—	83.41	86.11	102.33	—	82.81	—	—	—	—	—	—	—
May-2011	—	83.39	86.05	102.69	—	82.72	—	—	—	—	—	—	—
Apr-2011	—	83.54	86.18	102.39	—	82.90	—	—	—	—	—	—	—
Mar-2011	—	83.77	86.39	102.87	—	83.20	—	—	—	—	—	—	—
Feb-2011	—	83.82	86.48	103.02	—	83.20	—	—	—	—	—	—	—
Jan-2011	—	85.32	86.91	103.41	—	83.65	—	—	—	—	—	—	—
Dec-2010	—	84.87	87.55	103.98	—	84.22	—	—	—	—	—	—	—
Nov-2010	—	85.20	87.84	104.30	—	84.60	—	—	—	—	—	—	—
Oct-2010	—	85.29	87.91	104.13	—	84.75	—	—	—	—	—	—	—
Sep-2010	—	85.30	87.92	104.13	—	84.71	—	—	—	—	—	—	—
Jul-2010	—	85.03	87.66	103.89	—	84.48	—	—	—	—	—	—	—
Jun-2010	—	84.87	87.51	103.74	—	84.30	—	—	—	—	—	—	—
May-2010	—	84.80	87.43	103.66	—	84.23	—	—	—	—	—	—	—
Apr-2010	—	84.75	87.37	103.60	—	84.17	—	—	—	—	—	—	—
Mar-2010	—	84.53	87.15	103.38	—	83.96	—	—	—	—	—	—	—
Feb-2010	—	84.24	86.89	103.14	—	83.60	—	—	—	—	—	—	—
Jan-2010	—	84.36	87.00	103.22	—	83.75	—	—	—	—	—	—	—
Dec-2009	—	84.12	86.75	103.00	—	83.53	—	—	—	—	—	—	—
Nov-2009	—	83.91	86.56	102.81	—	83.25	—	—	—	—	—	—	—
Oct-2009	—	84.24	86.87	103.07	—	83.62	—	—	—	—	—	—	—
Sep-2009	—	84.21	86.84	103.07	—	83.61	—	—	—	—	—	—	—
Aug-2009	—	84.04	86.71	102.84	—	83.51	—	—	—	—	—	—	—
Jul-2009	—	83.75	86.42	102.67	—	83.09	—	—	—	—	—	—	—
May-2009	—	83.50	86.15	102.41	—	—	—	—	—	—	—	—	—
Apr-2009 [b]	—	83.72	86.37	102.59	—	—	—	—	—	—	—	—	—
Mar-2009	—	83.82	86.44	102.64	—	—	—	—	—	—	—	—	—
Feb-2009	—	—	86.35	102.56	—	—	—	—	—	—	—	—	—
Jan-2009	—	83.13	85.79	102.04	—	—	—	—	—	—	—	—	—
Nov-2008	—	83.91	86.56	102.80	—	—	—	—	—	—	—	—	—
Oct-2008	—	83.80	86.45	102.49	—	—	—	—	—	—	—	—	—
Jul-2008	—	83.37	86.10	102.45	—	—	—	—	—	—	—	—	—
Jan-2008	—	84.67	86.23	—	—	—	—	—	—	—	—	—	—
Sep-2007	—	—	86.80	103.44	—	—	—	—	—	—	—	—	—
28-Jun-2005	87.00	83.56	—	—	—	—	—	—	—	—	—	—	—
17-Feb-2005	86.48	82.64	—	—	—	—	—	—	—	—	—	—	—

Notes:

— no data

ft feet

btoc below top of casing

[a] Dates in month year format (e.g., Sep 2007) were obtained from oil/water interface reports, and exact dates were not available.

[b] The April 2009 measurements were pushed back a week (to 5/6/2009) due to the RHMW05 installation.

[c] The measurements have been corrected based on water level tape calibration and gyroscopic survey. See associated groundwater monitoring report.

Source:

Depth to groundwater values from recent oil/water interface reports and from the Appendix A Groundwater Tables GW-9, GW-10, GW-14, GW-15, and GW-17 through GW-24 in:
Department of the Navy. 2007. *Existing Data Summary and Evaluation Report for Groundwater Flow and Contaminant Fate and Transport Modeling, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i; March 5, 2017 [Revision 00].* Prepared by AECOM Technical Services, Inc., Honolulu, HI. Prepared for Defense Logistics Agency Energy, Fort Belvoir, VA, under Naval Facilities Engineering Command, Hawaii, JBPHH HI.

Reference points for these depth to water measurements may have varied over time:

- Reference points for data prior to October 2016 are unknown.
- Reference points for RHMW01 to RHMW05, OWDFMW01, and HDMW2253-03 are the tops of permanent casings.
- Reference point for RHMW2254-01 was the top of the PVC casing for data prior to March 2018, and the high precision survey mark for data from March 2018 onwards.
- Reference points for RHMW06 to RHMW10 from October 2016 to July 2017 groundwater LTM events were the tops of the stand tubes (RHMW06 and RHMW07) and the tops of the slip rings (RHMW08, RHMW09, and RHMW10).
- Reference points for RHMW06 to RHMW10 from October 2017 groundwater LTM event onwards are the high precision survey mark on the tops of the gray plates.

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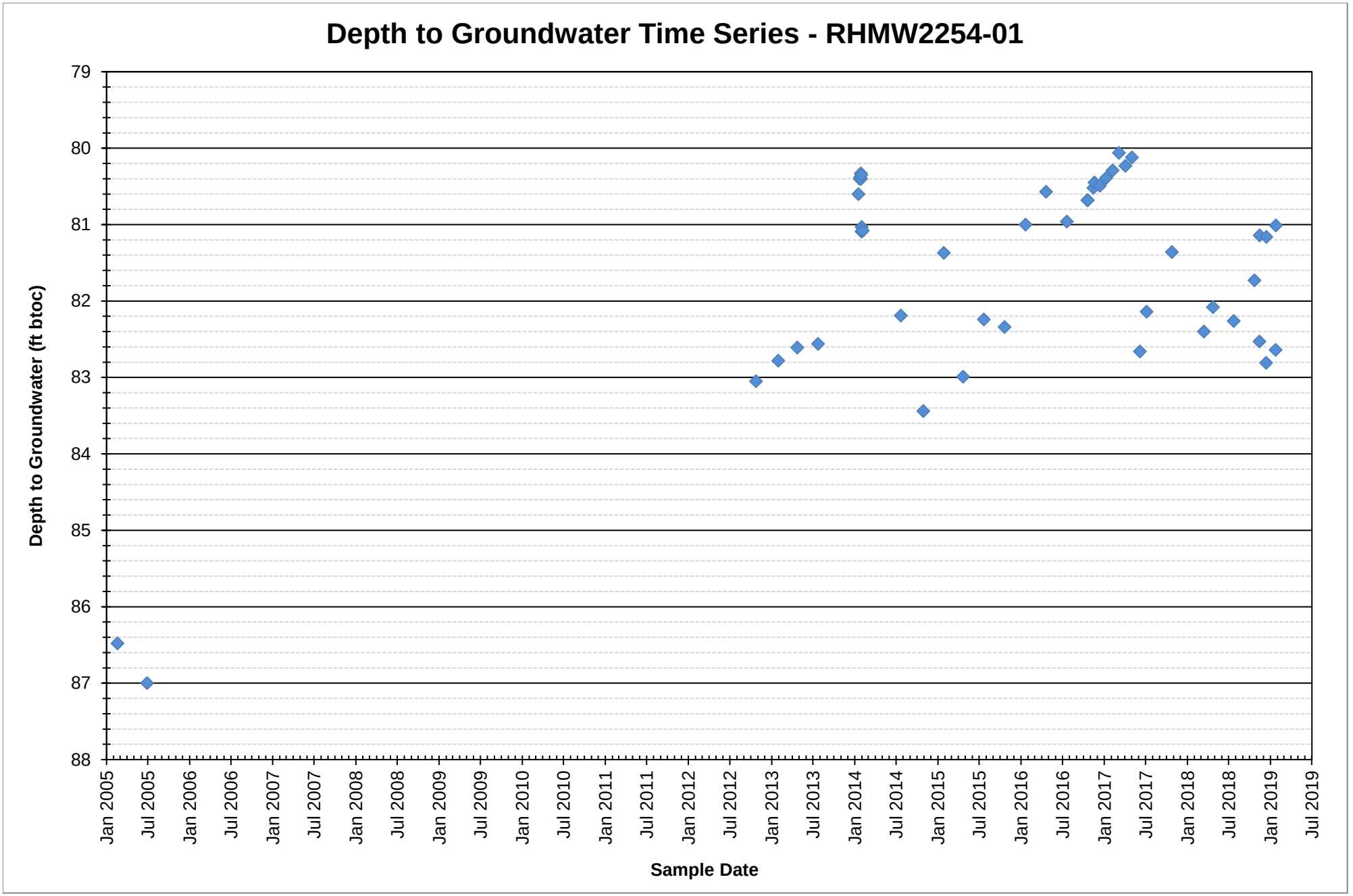
Depth to Groundwater Time Series - RHMW2254-01
Depth to Groundwater (ft btoc)
79
80
81
82
83
84
85
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87
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Jan 2005
Jul 2005
Jan 2006
Jul 2006
Jan 2007
Jul 2007
Jan 2008
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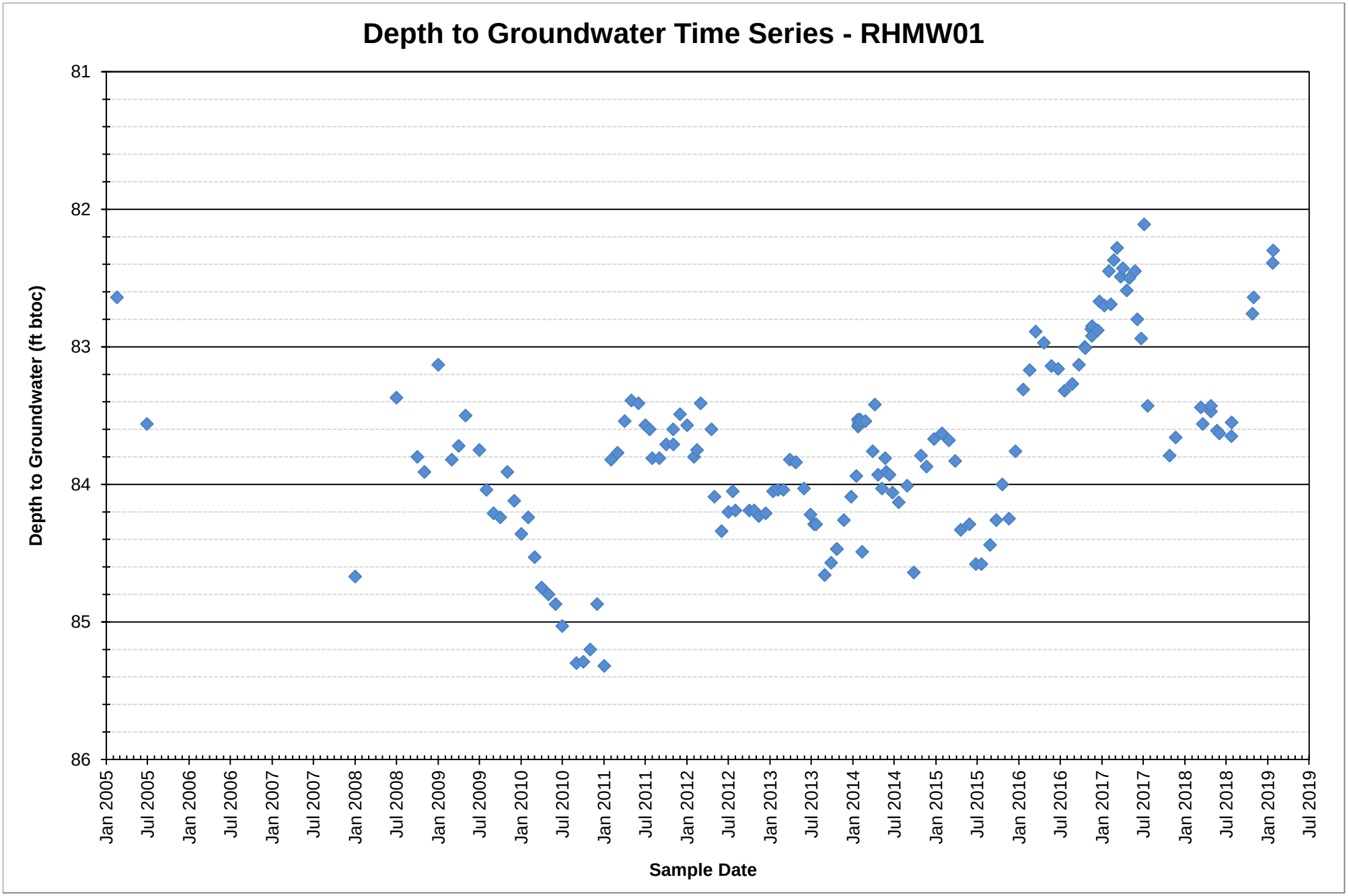
Sample Date


Depth to Groundwater Time Series - RHMW01
Depth to Groundwater (ft btoc)
81
82
83
84
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86
Jan 2005
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Jan 2007
Jul 2007
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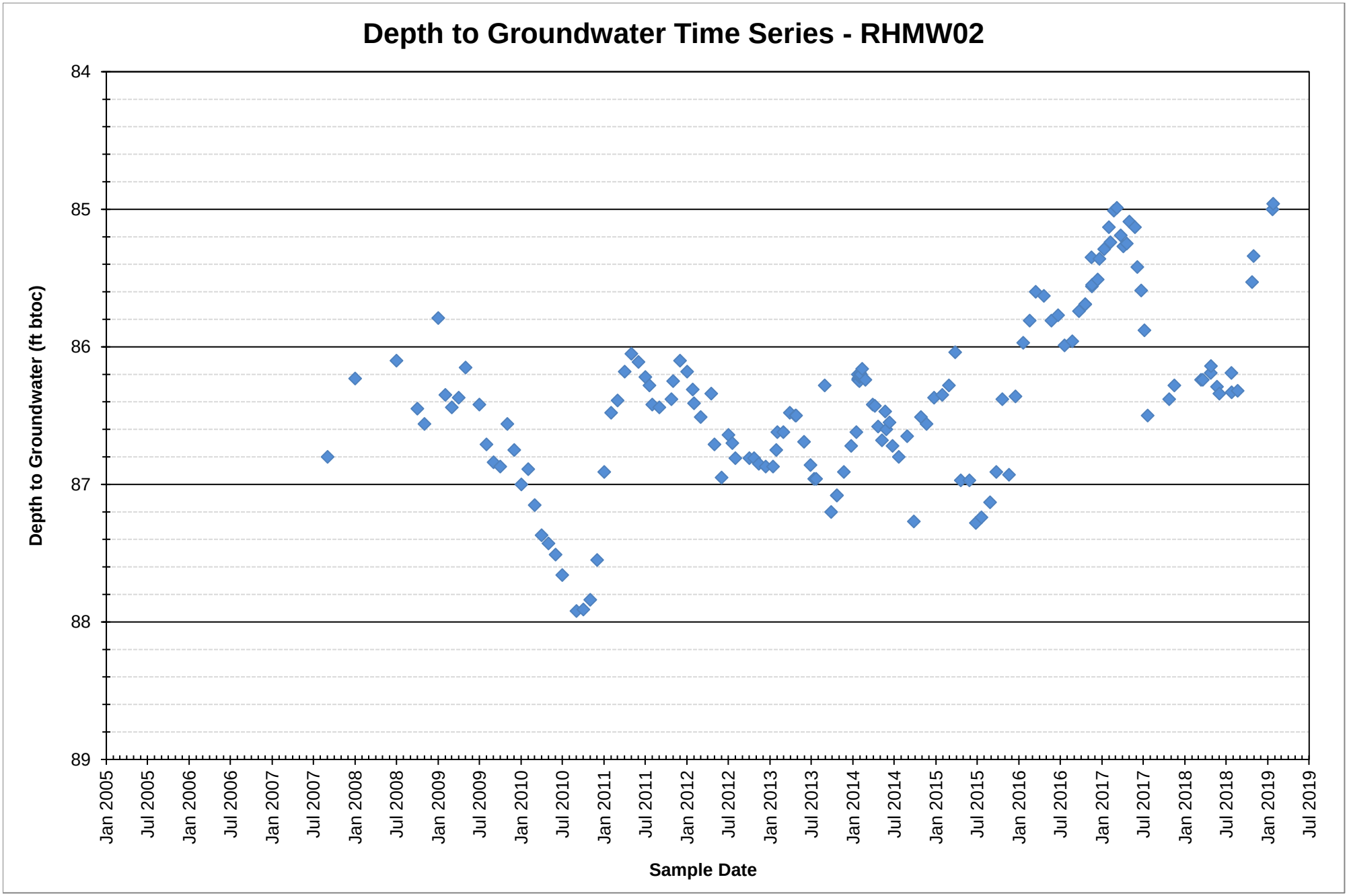
Jul 2019
Sample Date


Depth to Groundwater Time Series - RHMW02
Depth to Groundwater (ft btoc)
84
85
86
87
88
89
Jan 2005
Jul 2005
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Jan 2007
Jul 2007
Jan 2008
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Jul 2010
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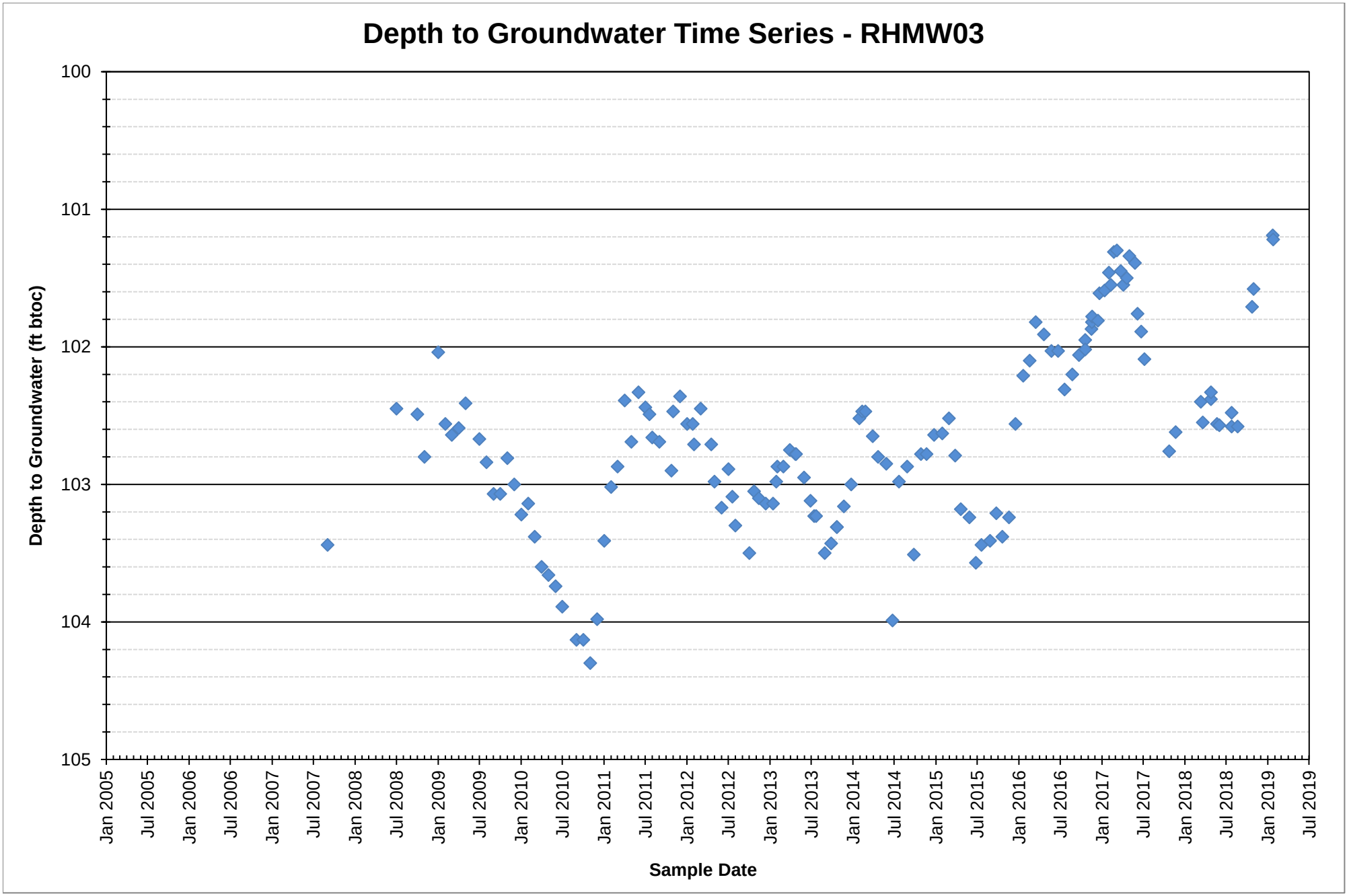
Jul 2019
Sample Date


Depth to Groundwater Time Series - RHMW03
Depth to Groundwater (ft btoc)
100
101
102
103
104
105
Jan 2005
Jul 2005
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Jan 2007
Jul 2007
Jan 2008
Jul 2008
Jan 2009
Jul 2009
Jan 2010
Jul 2010
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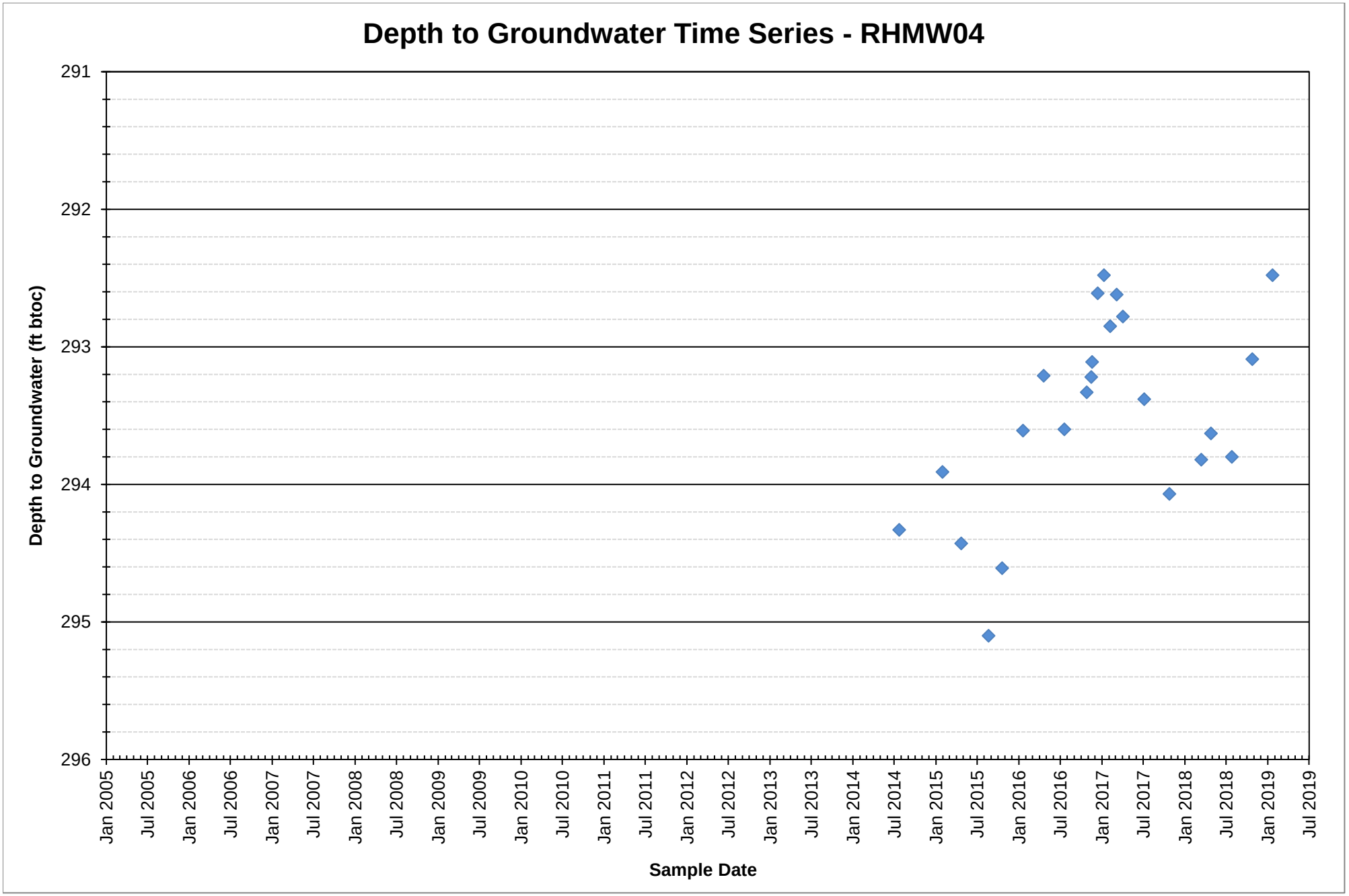
Sample Date


Depth to Groundwater Time Series - RHMW04
Depth to Groundwater (ft btoc)
291
292
293
294
295
296
Jan 2005
Jul 2005
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Jan 2007
Jul 2007
Jan 2008
Jul 2008
Jan 2009
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Jan 2010
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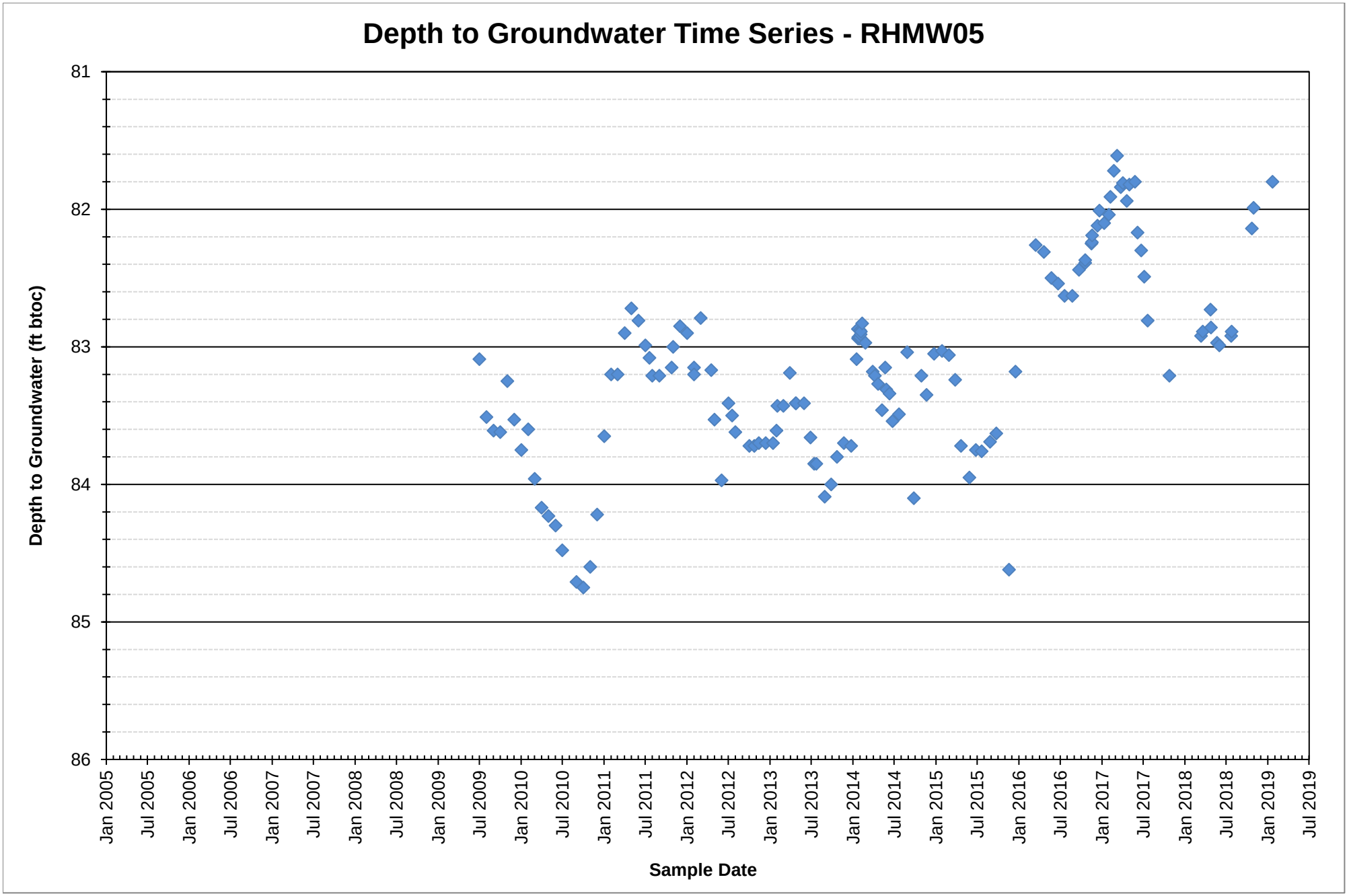
Sample Date


Depth to Groundwater Time Series - RHMW05
Depth to Groundwater (ft btoc)
81
82
83
84
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Jan 2005
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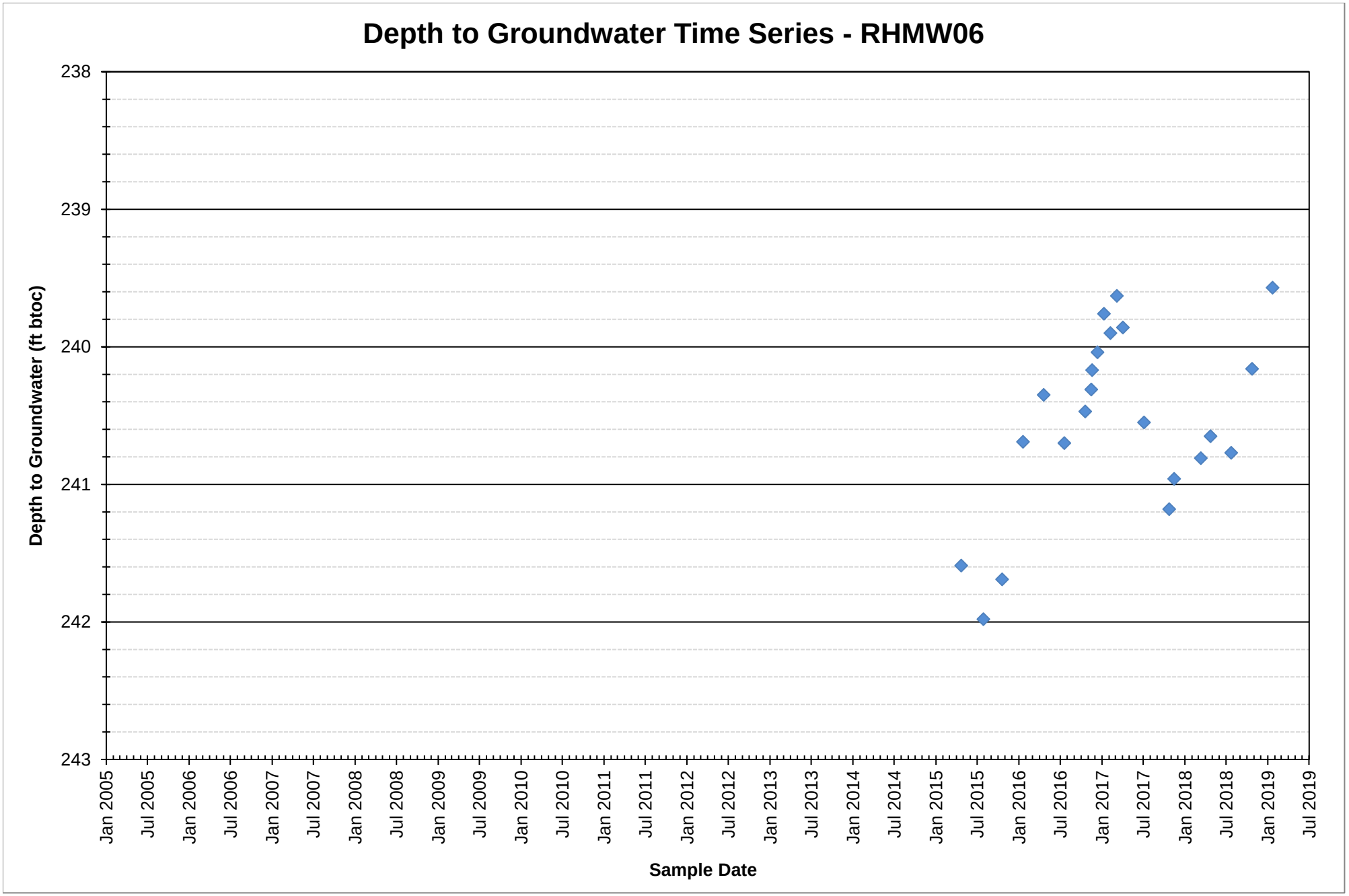
Sample Date


Depth to Groundwater Time Series - RHMW06
Depth to Groundwater (ft btoc)
238
239
240
241
242
243
Jan 2005
Jul 2005
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Jan 2007
Jul 2007
Jan 2008
Jul 2008
Jan 2009
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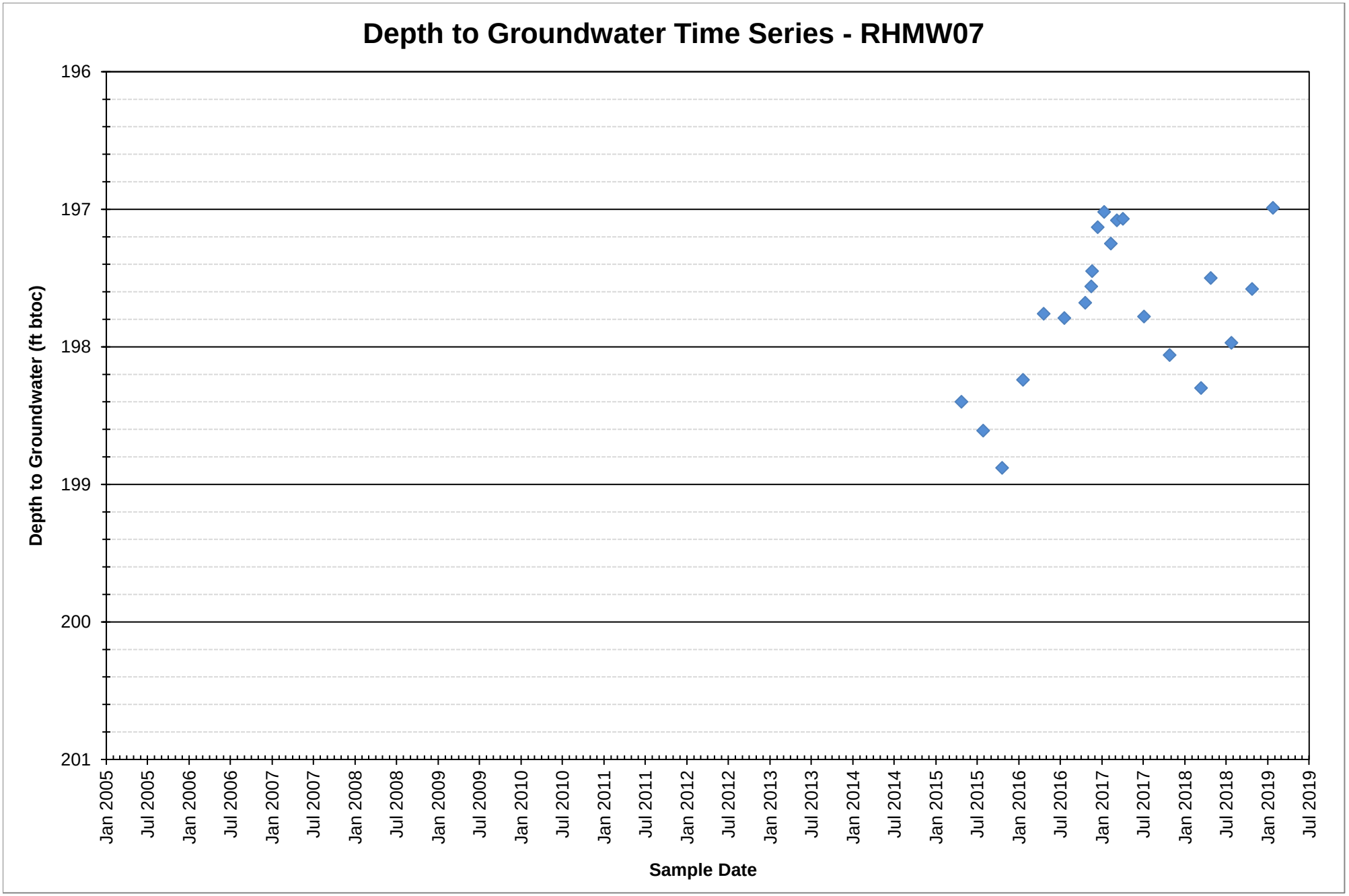
Sample Date


Depth to Groundwater Time Series - RHMW07
Depth to Groundwater (ft btoc)
196
197
198
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Jan 2005
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Jul 2007
Jan 2008
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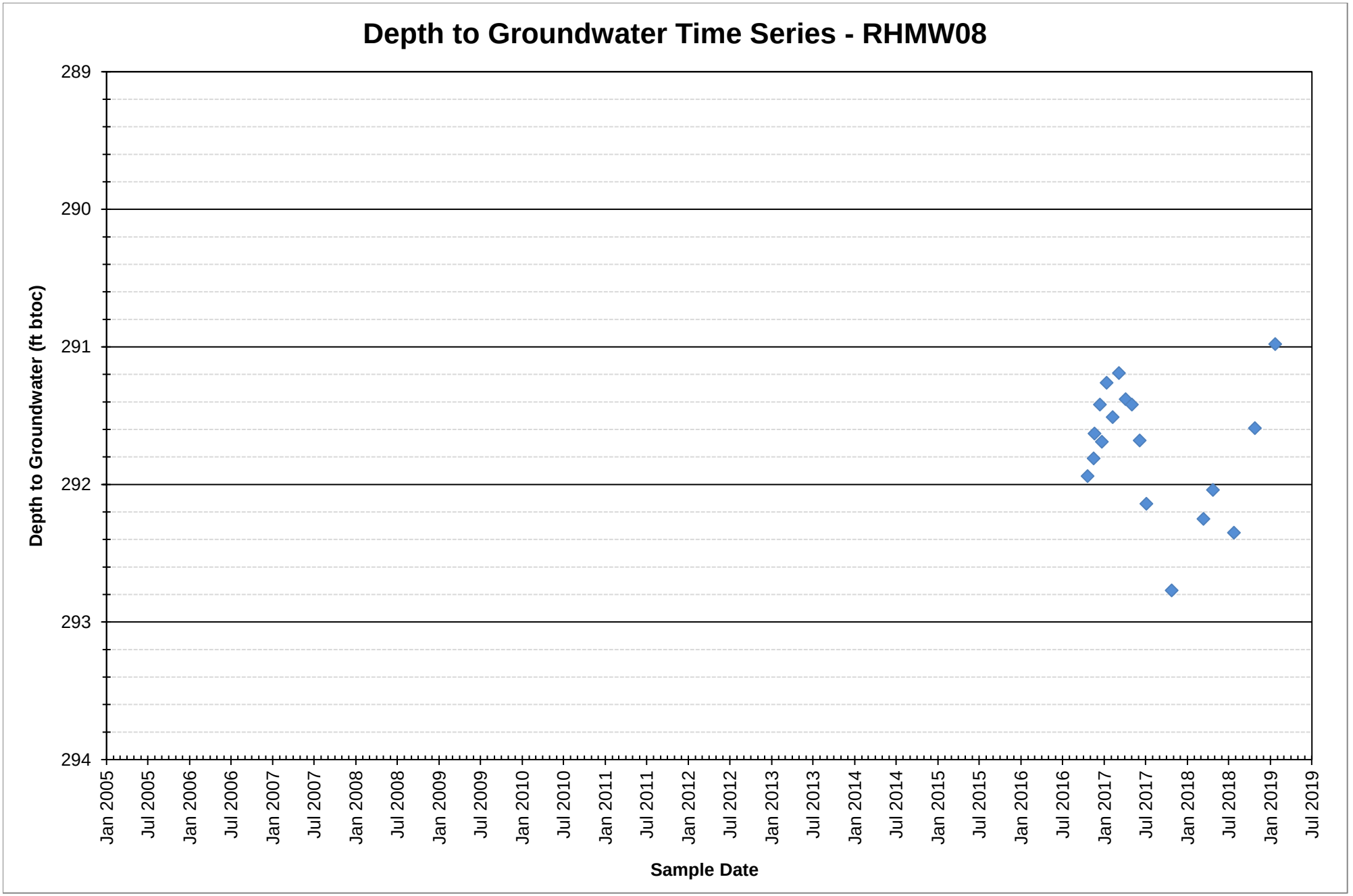
Sample Date


Depth to Groundwater Time Series - RHMW08
Depth to Groundwater (ft btoc)
289
290
291
292
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Jan 2005
Jul 2005
Jan 2006
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Jan 2007
Jul 2007
Jan 2008
Jul 2008
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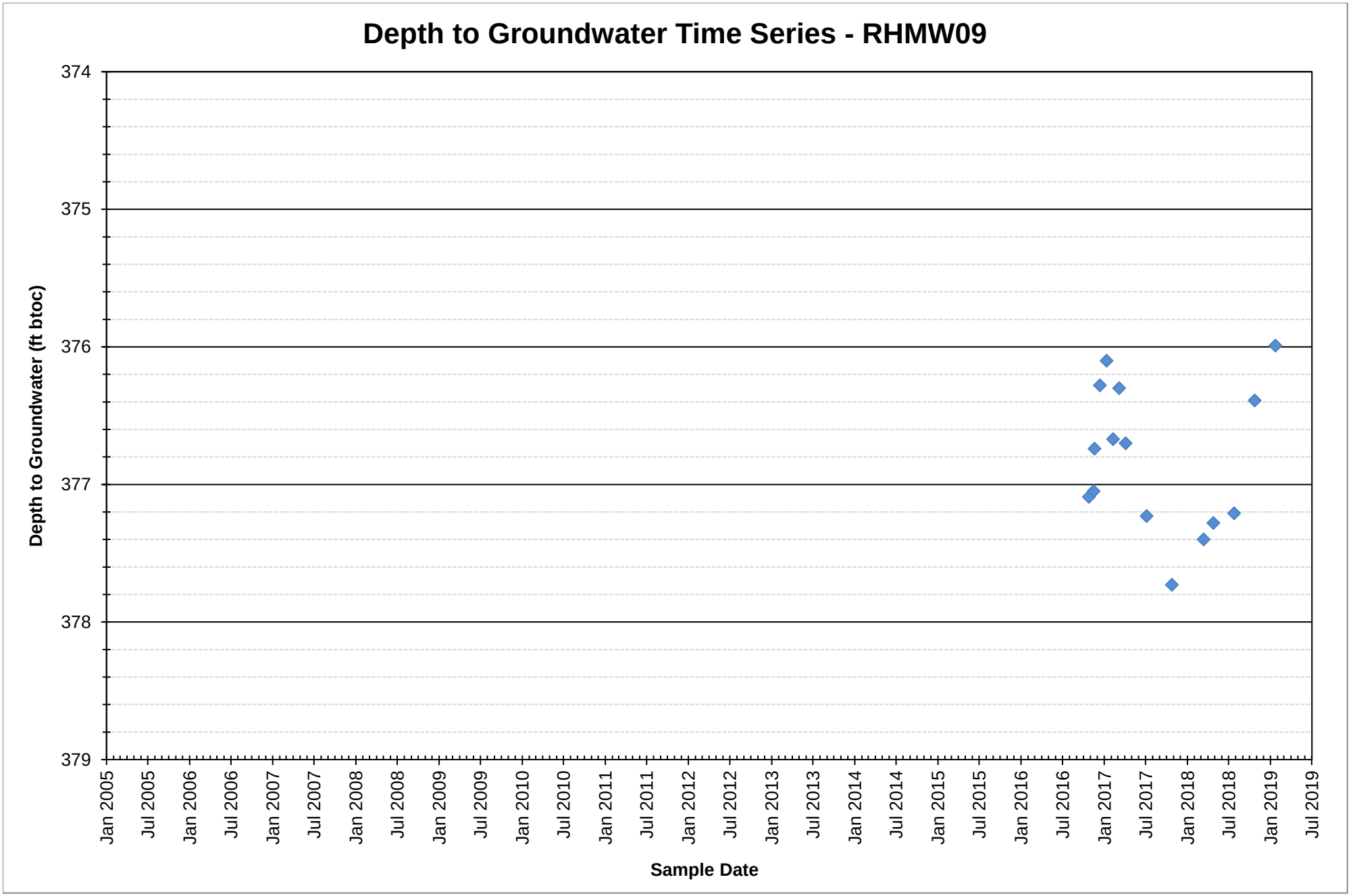
Sample Date


Depth to Groundwater Time Series - RHMW09
Depth to Groundwater (ft btoc)
374
375
376
377
378
379
Jan 2005
Jul 2005
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Jan 2007
Jul 2007
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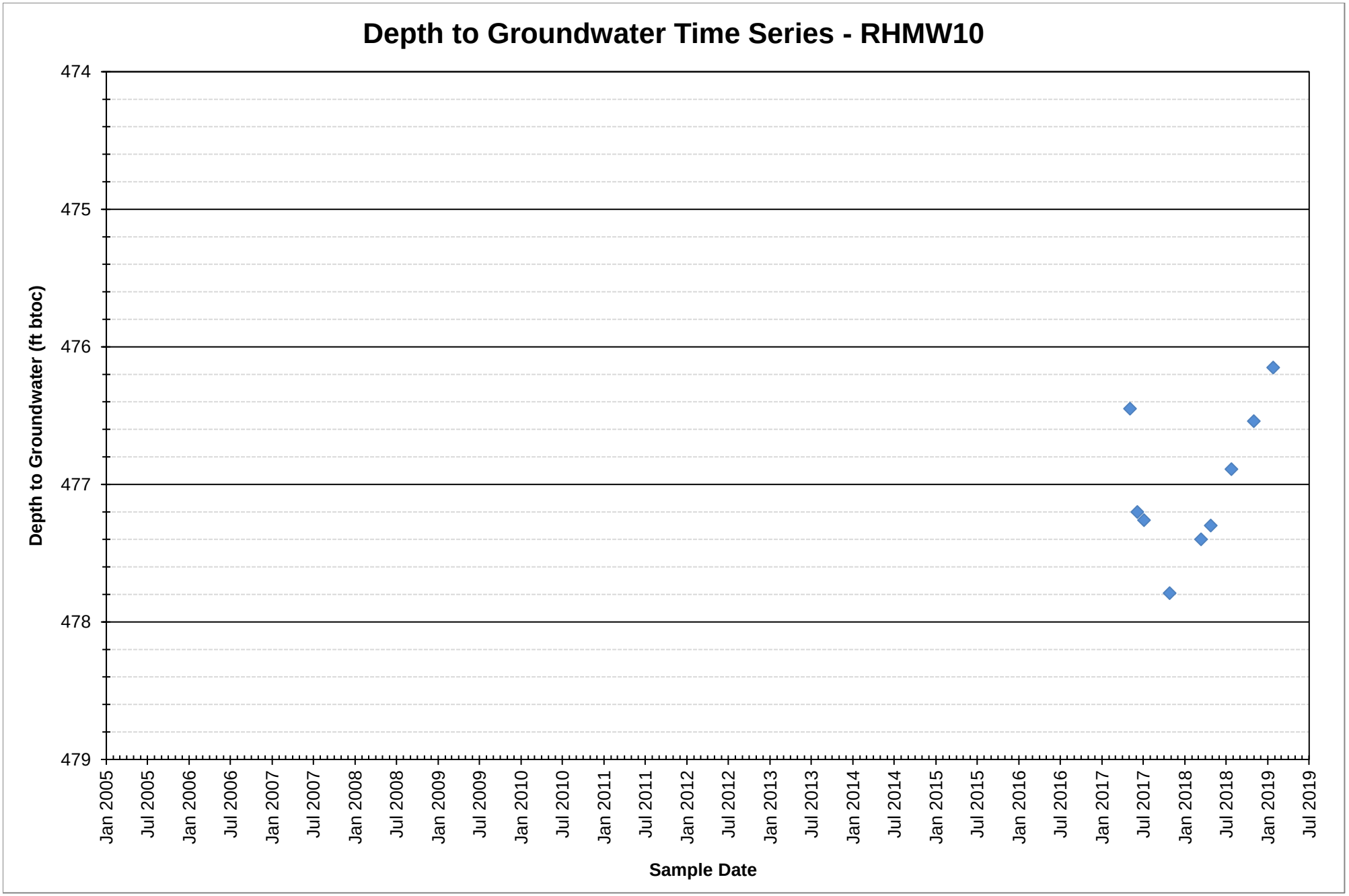
Sample Date


Depth to Groundwater Time Series - RHMW10
Depth to Groundwater (ft btoc)
474
475
476
477
478
479
Jan 2005
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Jan 2007
Jul 2007
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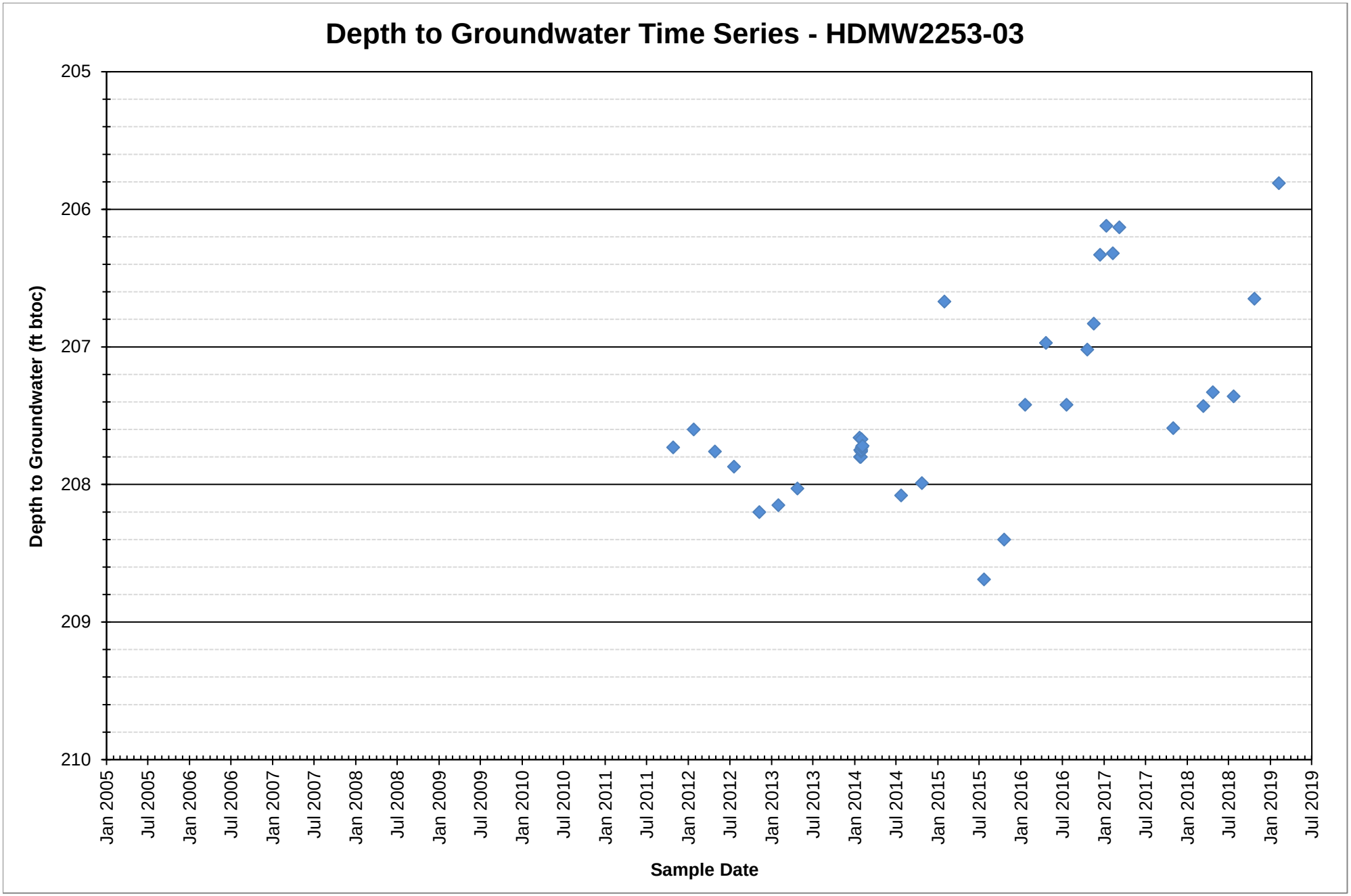
Depth to Groundwater Time Series - HDMW2253-03
Depth to Groundwater (ft btoc)
205
206
207
208
209
210
Jan 2005
Jul 2005
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Jul 2006
Jan 2007
Jul 2007
Jan 2008
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Jan 2009
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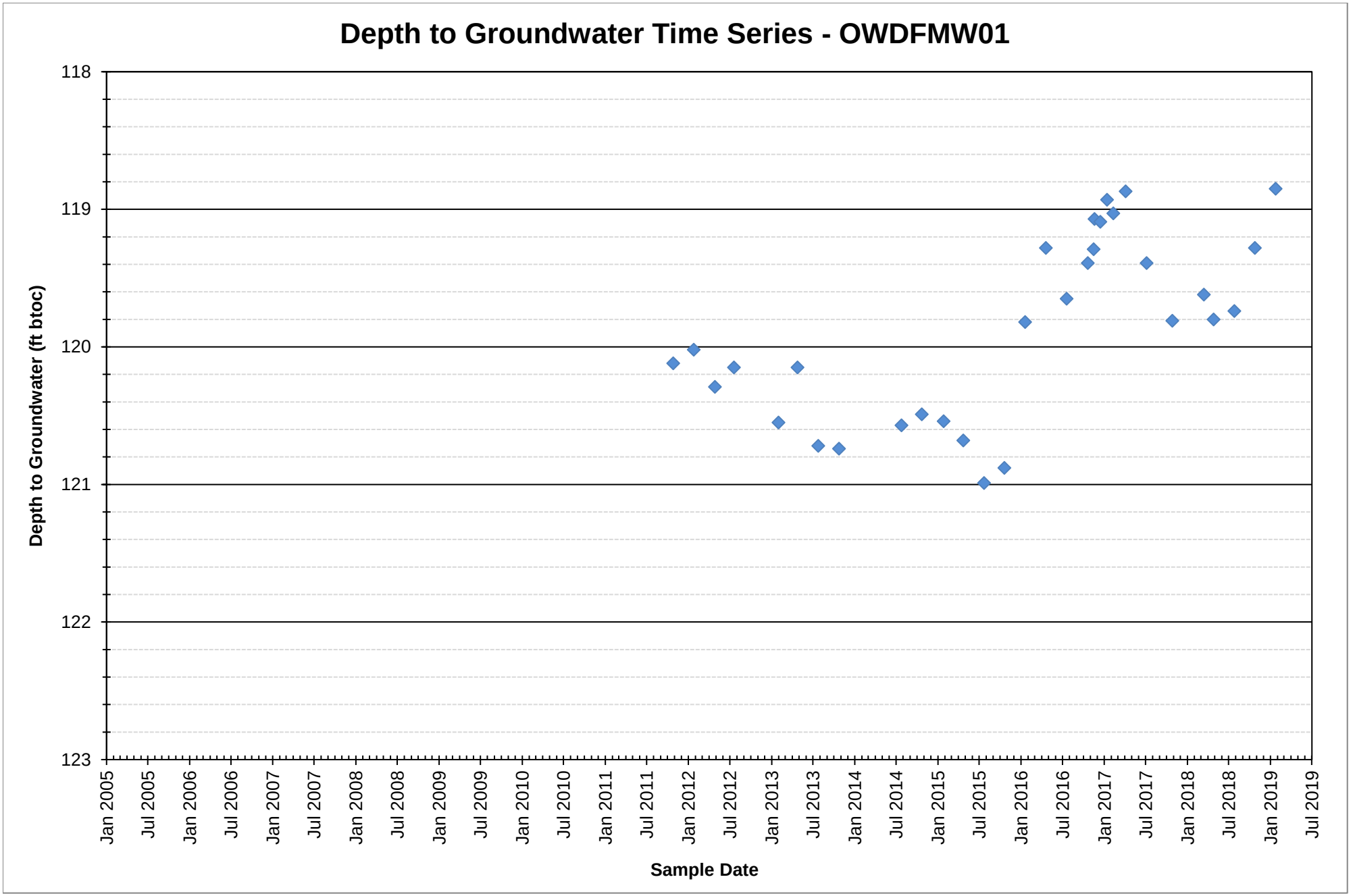
Sample Date


Depth to Groundwater Time Series - OWDFMW01
Depth to Groundwater (ft btoc)
118
119
120
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Jan 2005
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Jul 2007
Jan 2008
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Sample Date

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Appendix B:
Field Activity Documentation,
First Quarter 2019
(on CD-ROM at end of document)

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Red Hill Groundwater Sampling Log

WELL NO. **RHMW2254-01** LOCATION: Inside Tunnel PROJECT NO. 60571032

DATE: 12/12/18 TIME: 08:00 CLIMATIC CONDITIONS: In Tunnel

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Battery Pack
*82.60	82.82 @ 08:20	82.79 @ 11:28	n/a	115.79	n/a	300	08:30	2.5	Deep Cycle 90
**82.55	82.83 @ 08:25								

Pump settings:	Pressure (PSI)		Discharge (sec)		Fill (sec)	
Previous/Actual	55	55	7	7	23	23

Headspace VOCs:	0.9	ppm	Ambient VOCs:	0.0	ppm
Headspace O_2:	20.9	%	Ambient O_2:	20.9	%
Headspace LEL:	0	%	Ambient LEL:	0	%
Ambient CO:	0	ppm	Ambient H_2S:	0	%
O/W Interface Probe Type/Water Level Meter:	Solinst H.Oil/ Solinst WLM 101		Serial Number:	269453/N-1	
Gas Detector Type:	MultiRAE		Serial Number:	74q7	
Water Quality Meter Type:	Smart TROLL		Serial Number:	589972	

Stabilization:+/- 0.2 ºC, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

Depth to water measured from outside casing (free fall). Measure to survey mark.

* 200' Oil/Water Interface Probe measurement

** 500' Calibrated Water Level Meter measurement (N-1)

SAMPLING EQUIPMENT: Dedicated bladder pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

ODOR/OTHER: No odor

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 18 primary + 11 dup + 18 MS/MSD = 47 total

VOAs HCl: 4+4+4 =**12** H2SO4: 4 = **4**	Amber 1-L: 3+3+6= **12** 1-L (800mL): 2+2+4=**8** 500-mL: 2+2+4= **8**	Poly 250 mL H2SO4: **1** 250 mL HCl (brown): **1 filtered** 250 mL unpreserved.: **1**

SAMPLE IDENTIFICATION NUMBER(S) **ERH719 (N, MS/MSD), ERH720 (Dup). and ERH718 (Trip Blank)**

DATE: 12/12/18 TIME: ERH718 @ 08:40; ERH719 & ERH720 @ 09:25

DECONTAMINATION PROCEDURES: Alconox, DI H_2O, Isopropyl, and DI H_2O wash End: 11:30

NOTES: Strong paint/solvent odor @ warehouse on 12/11/18 while prepping bottles.

SAMPLED BY: MH, KE, MD SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

WELL NO. **RHMW2254-01** LOCATION: Inside Tunnel PROJECT NO. 60571032

TIME	DTW **	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
08:30	Start purge									
08:42	Water at surface									
08:44	—	< 0.25	355.18	7.40	0.55	—	0.03	22.67	54.1	0.3
08:49	—	0.25	359.80	7.60	0.55	8.52	0.02	22.17	61.0	0.3
08:54	—	0.50	359.89	7.64	0.55	8.56	0.05	22.04	67.8	0.3
08:59	—	0.75	360.53	7.65	0.55	8.55	0.01	21.99	71.6	0.3
09:04	—	1.0	361.04	7.66	0.56	8.57	0.01	21.96	73.5	0.3
09:09	—	1.5	361.52	7.65	0.56	8.58	0.07	21.95	74.8	0.3
09:14	—	2.0	361.70	7.67	0.56	8.58	0.02	21.94	77.1	0.3
09:19	—	2.5	361.76	7.65	0.56	8.58	0.02	21.95	77.9	0.3
	Reduced flow rate to ~100 mL/min for sampling VOAs									

Red Hill Groundwater Sampling Log

WELL NO. **RHMW2254-01** LOCATION: Inside Tunnel PROJECT NO. 60571032

DATE: 12/13/18 TIME: 08:00 CLIMATIC CONDITIONS: In Tunnel

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Battery Pack
*82.60	81.23 @ 07:55	81.11 @ 11:00	n/a	115.79	n/a	300	08:10	3.5	Deep Cycle 90
**82.55	81.18 @ 08:00								

Pump settings:	Pressure (PSI)		Discharge (sec)		Fill (sec)	
Previous/Actual	55	55	7	7	23	23

Headspace VOCs:	2.8	ppm	Ambient VOCs:	0.0	ppm
Headspace O_2:	20.9	%	Ambient O_2:	20.9	%
Headspace LEL:	0.0	%	Ambient LEL:	0.0	%
Ambient CO:	0	ppm	Ambient H_2S:	0	%
O/W Interface Probe Type/Water Level Meter:	Solinst H.Oil/ Solinst WLM 101		Serial Number:	269453/N-1	
Gas Detector Type:	MultiRAE		Serial Number:	74q7	
Water Quality Meter Type:	Smart TROLL		Serial Number:	589972	

Stabilization:+/- 0.2 ºC, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

Depth to water measured from outside casing (free fall). Measure to survey mark.

* 200' Oil/Water Interface Probe measurement

** 500' Calibrated Water Level Meter measurement (N-1)

SAMPLING EQUIPMENT: Dedicated bladder pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

ODOR/OTHER: No odor

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 18 primary + 11 dup + 18 MS/MSD = 47 total

VOAs HCl: 4+4+4 =**12** H2SO4: 4 = **4**	Amber 1-L: 3+3+6= **12** 1-L (800mL): 2+2+4=**8** 500-mL: 2+2+4= **8**	Poly 250 mL H2SO4: **1** 250 mL HCl (brown): **1 filtered** 250 mL unpreserved.: **1**

SAMPLE IDENTIFICATION NUMBER(S) **ERH722 (N, MS/MSD), ERH723 (Dup). and ERH721 (Trip Blank)**

DATE: 12/13/18 TIME: ERH721@ 08:05; ERH722 & ERH723@ 09:05

DECONTAMINATION PROCEDURES: Alconox, DI H_2O, Isopropyl, and DI H_2O wash End: 11:00

NOTES: Strong paint/solvent odor at warehouse on 12/11/18 while prepping bottles

SAMPLED BY: MH, MD, KE SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

WELL NO. **RHMW2254-01** LOCATION: Inside Tunnel PROJECT NO. 60571032

TIME	DTW **	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
08:14	Water at surface									
08:15	—	< 0.25	355.94	7.22	0.55	8.71	0.02	23.07	85.8	0.3
08:20	—	0.25	356.55	7.52	0.55	8.64	0.00	22.27	87.5	0.3
08:25	—	0.5	356.73	7.59	0.55	8.66	0.00	22.08	88.7	0.3
08:30	—	0.75	357.30	7.60	0.55	8.68	0.01	22.01	88.9	0.3
08:35	—	1	357.44	7.61	0.55	8.67	-0.04	21.99	88.6	0.3
08:40	—	1.25	357.73	7.61	0.55	8.67	-0.01	21.97	88.3	0.3
08:45	—	2.0	357.27	7.61	0.55	8.66	0.00	21.94	88.0	0.3
08:50	—	2.25	357.69	7.62	0.55	8.67	0.01	21.93	87.8	0.3
08:55	—	3.0	357.59	7.62	0.55	8.68	-0.01	21.93	87.6	0.3
09:00	—	3.5	357.47	7.62	0.55	8.68	-0.01	21.90	87.5	0.3
	Reduced flow rate to 100 mL/min for sampling VOAs									

Red Hill Groundwater Sampling Log

WELL NO. **RHMW2254-01** LOCATION: Inside Tunnel PROJECT NO. 60571032

DATE: (Day 1) 01/23/19 TIME: 0758 CLIMATIC CONDITIONS: In Tunnel

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Battery Pack
*81.83	82.70@0817	82.63@ 1051	N/A	115.79	N/A	300	0821	2.5	Deep Cycle 90
**81.75	82.66@0829								

Pump settings:	Pressure (PSI)		Discharge (sec)		Fill (sec)	
Previous/Actual	55	50	7	12	23	18

Headspace VOCs:	0.0	ppm	Ambient VOCs:	0.0	ppm
Headspace O_2:	20.9	%	Ambient O_2:	20.9	%
Headspace LEL:	0	%	Ambient LEL:	0	%
Ambient CO:	0	ppm	Ambient H_2S:	0	%
O/W Interface Probe Type/Water Level Meter:	Heron H.Oil/ Solinst WLM 101		Serial Number:	250750/N-1	
Gas Detector Type:	MultiRAE		Serial Number:	74Q7	
Water Quality Meter Type:	Smartroll		Serial Number:	476554	

Stabilization:+/- 0.2 ºC, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

Depth to water measured from outside casing (free fall). Measure to survey mark.

* 200' Oil/Water Interface Probe measurement

** 500' Calibrated Water Level Meter measurement (N-1)

SAMPLING EQUIPMENT: Dedicated bladder pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

ODOR/OTHER: None

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 24 primary + 11 dup + 18 MS/MSD = 53 total

VOAs	Amber	Poly
HCl: 4+4+4 = **12** H2SO4: **5 + 5 (filtered)** = **10**	1-L: 3+3+6= **12** 1-L (800mL): 2+2+4= **8** 500-mL: 2+2+4= **8**	250 mL H2SO4: **1** 250 mL HCl (brown): **1 filtered** 250 mL unpreserved.: **1**

SAMPLE IDENTIFICATION NUMBER(S) **ERH730 (N, MS/MSD), ERH731 (Dup). and ERH729 (Trip Blank)**

DATE: 01/23/19 TIME: ERH729 – 0845, ERH730/ERH731 – Start; 0910 End: 10:49

DECONTAMINATION PROCEDURES: Alconox, DI H_2O, Isopropyl, and DI H_2O wash

NOTES: PUMPS ON – MP3

SAMPLED BY: KL,MM,BM SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

WELL NO. **RHMW2254-01** LOCATION: Inside Tunnel PROJECT NO. 60571032

TIME	DTW **	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
0826	Water at surface									
0838	—	<0.5	360.02	7.06	0.55	8.47	0.26	22.42	97.2	0.3
0842	—	0.5	360.93	7.33	0.56	8.54	0.23	22.04	97.7	0.3
0846	—	1	360.60	7.41	0.56	8.57	-0.28	21.96	98.1	0.3
0850	—	—	360.94	7.45	0.56	8.59	-0.28	21.93	98.7	0.3
0854	—	2	361.05	7.47	0.56	8.59	-0.28	21.92	98.8	0.3
0858	—	—	361.83	7.48	0.56	8.61	-0.28	21.92	98.1	0.3
0902	—	2.5	361.80	7.49	0.56	8.61	—	21.93	98.3	0.3
0910	Start Sampling Lower Flow Rate to 100mL/min for sampling									
0920	Resume Sampling at 300 mL/min									
1049	End Sampling									

Red Hill Groundwater Sampling Log

WELL NO. **RHMW2254-01** LOCATION: Inside Tunnel PROJECT NO. 60571032

DATE: (Day 2) 01/24/19 TIME: 0738 CLIMATIC CONDITIONS: In Tunnel

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Battery Pack
*81.83	81.07@0756	80.98@ 1021	N/A	115.79	N/A	300	0802	3.5	Deep Cycle 90
**81.75	81.03@0758								

Pump settings:	Pressure (PSI)		Discharge (sec)		Fill (sec)	
Previous/Actual	55	55	7	7	23	23

Headspace VOCs:	0.1	ppm	Ambient VOCs:	0.1	ppm
Headspace O_2:	20.9	%	Ambient O_2:	20.9	%
Headspace LEL:	0	%	Ambient LEL:	0	%
Ambient CO:	0	ppm	Ambient H_2S:	0	%
O/W Interface Probe Type/Water Level Meter:	Heron H.Oil/ Solinst WLM 101		Serial Number:	25070/N1	
Gas Detector Type:	MultiRAE		Serial Number:	74Q7	
Water Quality Meter Type:	Smartroll		Serial Number:	592203	

Stabilization:+/- 0.2 ºC, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

Depth to water measured from outside casing (free fall). Measure to survey mark.

* 200' Oil/Water Interface Probe measurement

** 500' Calibrated Water Level Meter measurement (N-1)

SAMPLING EQUIPMENT: Dedicated bladder pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

ODOR/OTHER: None

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 22 primary + 11 dup + 18 MS/MSD = 51 total

VOAs HCl: 4+4+4 = **12** H2SO4: 8 = **8**	Amber 1-L: 3+3+6= **12** 1-L (800mL): 2+2+4= **8** 500-mL: 2+2+4= **8**	Poly 250 mL H2SO4: **1** 250 mL HCl (brown): **1 filtered** 250 mL unpreserved.: **1**

SAMPLE IDENTIFICATION NUMBER(S) **ERH733 (N, MS/MSD), ERH734 (Dup). and ERH732 (Trip Blank)**

DATE: 01/24/19 TIME: ERH732 – 08:15, ERH733/734 – Start: 08:45 End: 10:19

DECONTAMINATION PROCEDURES: Alconox, DI H_2O, Isopropyl, and DI H_2O wash

NOTES: PUMPS OFF

SAMPLED BY: KL,MM.BM SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

WELL NO. **RHMW2254-01** LOCATION: Inside Tunnel PROJECT NO. 60571032

TIME	DTW **	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
0806	Water at Surface									
0812	—	<0.5	356.27	7.28	0.55	8.63	0.12	22.24	102.5	0.3
0816	—	—	356.67	7.46	0.55	8.67	0.12	21.98	102.6	0.3
0820	—	1	357.32	7.53	0.55	8.67	0.00	21.93	103.3	0.3
0824	—	—	357.70	7.55	0.55	8.68	0.00	21.90	103.0	0.3
0828	—	2	358.03	7.56	0.55	8.69	-0.03	21.89	103.4	0.3
0832	—	—	357.97	7.57	0.55	8.68	0.00	21.88	104.3	0.3
0836	—	3	358.18	7.58	0.55	8.69	0.03	21.86	104.3	0.3
0840	—	3.5	358.19	7.58	0.55	8.69	0.03	21.86	104.5	0.3
0845	Start Sampling Lower Flor Rate for VOAs to 100mL/min w/ 24R 6D no pressure change									
0900	Raise Flow Rate for remaining bottles									
1019	End Sampling									

Red Hill Groundwater Sampling Log

WELL NO. **RHMW01** LOCATION: Inside Tunnel PROJECT NO. 60571032

DATE: 01/22/19 TIME: 0747 CLIMATIC CONDITIONS: Inside Tunnel

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Battery Pack
*83.71	82.46@0754	82.40@ 1340	N/A	99.8	N/A	*70 100	0759	4	Deep cycle 90
**83.67	82.41@0756								

Pump settings:	Pressure (PSI)		Discharge (sec)		Fill (sec)	
Previous/Actual	50	50	7	7	5	8

Headspace VOCs:	0.4	ppm *48	Ambient VOCs:*7		ppm *8
Headspace O_2:	20.9	%	Ambient O_2:	20.9	%
Headspace LEL:	0	%	Ambient LEL:	0	%
Ambient CO:	0	ppm	Ambient H_2S:	0	ppm
O/W Interface Probe Type/Water Level Meter:	Heron H. Oil/ Solinst WLM 101		Serial Number:	250750/N-1	
Gas Detector Type:	MultiRAE		Serial Number:	74Q7	
Water Quality Meter Type:	Smartroll		Serial Number:	476554	

Stabilization:+/- 0.2 ºC, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

Depth to water measured from red survey mark on top of permanent casing.

* 200' Oil/Water Interface Probe measurement

** 500' Calibrated Water Level Meter measurement (N-1)

SAMPLING EQUIPMENT: Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

ODOR/OTHER: None

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 24 Primary = 24 Total

VOAs	Amber	Poly
HCl: **4**	1-L: **3**	250 mL H2SO4: **1**
H2SO4: **5 + 5 (field filtered) = 10**	500-mL: **2**	250 mL HCl (brown): **1 filtered**
	1-L (800mL): **2**	250 mL unpres.: **1**

SAMPLE IDENTIFICATION NUMBER(S) **ERH736 (N), ERH735 (Trip Blank)**

DATE: 01/22/19 TIME: ERH735 – 08:30, ERH736 – Start: 12:10 End: 13:45

DECONTAMINATION PROCEDURES: Alconox, DI water, Isopropyl, and DI water wash

NOTES: See Purge Log, Second Purge Log Sheet used, *change setting @ 0945

SAMPLED BY: KL, MM, BM

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

WELL NO. **RHMW01** LOCATION: Inside Tunnel PROJECT NO. 60571032

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
0808	Water at Surface									
0819	82.41	<0.5	209.83	6.97	0.32	5.61	0.30	24.22	32.0	0.2
0823	82.42	<0.5	207.32	6.94	0.32	2.22	0.21	24.28	19.0	0.2
0827	82.42	<0.5	206.51	6.94	0.32	1.77	0.11	24.25	14.3	0.2
0831	82.42	—	206.65	6.94	0.32	1.55	0.13	24.22	11.3	0.2
0835	82.42	—	206.10	6.94	0.32	1.43	0.07	24.19	8.9	0.2
0839	82.42	.5	206.06	6.93	0.32	1.35	0.13	24.17	6.9	0.2
0843	82.43	—	206.26	6.93	0.32	1.24	0.08	24.13	4.7	0.2
0847	82.43	—	206.06	6.94	0.32	1.17	0.10	24.12	2.7	0.2
0851	82.43	—	206.09	6.94	0.32	1.12	0.09	24.09	1.0	0.2
0855	82.43	—	205.97	6.94	0.32	1.06	0.12	24.07	-0.7	0.2
0859	82.43	1	205.84	6.94	0.32	1.02	0.09	24.05	-1.3	0.2
0903	82.43	—	205.75	6.94	0.32	0.98	0.19	24.04	-3.7	0.2
0907	82.43	—	205.55	6.94	0.32	0.95	0.08	24.03	-4.8	0.2
0911	82.43	—	205.69	6.94	0.32	0.93	0.10	24.03	-5.4	0.2
0915	82.43	—	205.84	6.95	0.32	1.28	0.10	24.14	-6.6	0.2
0919	Bubbles observed in tubing. Paused purge to pull pump, check pump and bladder, reassemble pump									
0928	Resume purge									
0936	See Bubbles, pull pump find slight crease in bladder, reassemble pump									
0945	Resume purge, bubbles still observed 70mL/min									
1012	82.42	2	204.25	6.95	0.31	2.41	0.15	24.60	4.8	0.2
1016	82.42	—	204.26	6.95	0.31	2.12	0.12	24.61	2.9	0.2
1020	82.43	—	204.21	6.95	0.31	1.91	0.16	24.62	1.2	0.2
1024	82.43	—	204.19	6.95	0.31	1.61	0.17	24.50	-0.8	0.2
1028	82.43	—	204.26	6.95	0.31	1.41	0.29	24.40	-2.4	0.2
1032	82.43	2.5	204.38	6.95	0.31	1.31	0.12	24.31	-3.7	0.2
1036	82.43	—	204.51	6.95	0.31	1.23	0.15	24.27	-4.8	0.2
1040	82.43	—	204.56	6.95	0.31	1.18	0.20	24.24	-5.8	0.2
1045	82.43	—	204.56	6.96	0.31	1.11	0.19	24.22	-6.1	0.2
1050	82.43	—	204.55	6.96	0.31	1.06	0.17	24.20	-7.1	0.2
1055	82.43	—	204.52	6.96	0.31	1.01	0.09	24.17	-7.3	0.2
1059	82.43	—	204.48	6.95	0.31	0.98	0.13	24.16	-7.9	0.2
1103	82.43	—	204.53	6.97	0.31	0.96	0.12	24.14	-8.6	0.2
1107	82.43	3	204.62	6.95	0.31	0.93	0.17	24.13	-8.6	0.2
1111	82.43	—	204.65	6.96	0.31	0.92	0.18	24.12	-8.6	0.2
1115	82.43	—	204.84	6.97	0.31	0.90	0.21	24.10	-8.7	0.2
1119	82.43	—	204.84	6.95	0.32	0.88	0.24	24.10	-8.9	0.2
1123	82.43	—	204.86	6.97	0.32	0.86	0.24	24.09	-8.1	0.2
1127	82.43	—	204.91	6.98	0.32	0.84	0.22	24.09	-8.9	0.2
1131	82.43	—	204.89	6.98	0.32	0.82	0.18	24.08	-9.0	0.2
1135	82.43	3.5	204.83	6.97	0.32	0.80	0.24	27.08	-8.5	0.2
1139	82.43	—	204.90	6.97	0.32	0.79	0.26	24.06	-8.4	0.2

WELL NO. **RHMW01** LOCATION: Inside Tunnel PROJECT NO. 60571032

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
1143	82.43	—	205.03	6.98	0.32	0.77	0.27	24.05	-8.8	0.2
1147	82.43	—	205.01	6.98	0.32	0.76	0.30	24.06	-8.4	0.2
1151	82.43	—	205.05	6.98	0.32	0.74	0.27	24.04	-8.4	0.2
1155	82.43	—	205.09	6.96	0.32	0.73	0.25	24.04	-8.4	0.2
1159	82.43	—	205.04	6.98	0.32	0.71	0.26	24.04	-8.7	0.2
1203	82.43	4	205.02	6.96	0.32	0.71	0.23	24.04	-8.7	0.2
1210	Start Sampling									
1345	End Sampling									

Red Hill Groundwater Sampling Log

WELL NO. **RHMW02** LOCATION: Inside Tunnel PROJECT NO. 60571032

DATE: 01/21/19 TIME: 0954 CLIMATIC CONDITIONS: Inside Tunnel

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Battery Pack
*85.65	85.14@1003	85.07@ 1150	N/A	99	N/A	300	1006	2.5	Deep cycle 90
**85.61	85.08@1005								

Pump settings:	Pressure (PSI)		Discharge (sec)		Fill (sec)	
Previous/Actual	50	50	10	10	20	20

Headspace VOCs:	0.4	ppm	Ambient VOCs:	0.0	ppm
Headspace O_2:	14.9	%	Ambient O_2:	20.9	%
Headspace LEL:	0.0	%	Ambient LEL:	0.0	%
Ambient CO:	0.0	%	Ambient H_2S:	0.0	%
O/W Interface Probe Type/Water Level Meter:	*Heron H. Oil/ **Solinst WLM 101		Serial Number:	250750/N-1	
Gas Detector Type:	MultiRAE		Serial Number:	74Q7	
Water Quality Meter Type:	Smartroll		Serial Number:	4716554	

Stabilization:+/- 0.2 ºC, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

Depth to water measured from red survey mark on top of permanent casing.

* 200' Oil/Water Interface Probe measurement

** 500' Calibrated Water Level Meter measurement (N-1)

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

ODOR/OTHER: Slight sulfur odor

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED:

24 Primary + 11 Duplicate = 35 Total

VOAs	Amber	Poly
HCl: 4 + 4 = **8**	1-L: 3 + 3 = **6**	250 mL H2SO4: **1**
H2SO4: **5 + 5 (field filtered) = 10**	500-mL: 2 + 2 = **4**	250 mL HCl (brown): **1 filtered**
	1-L: (800 ml): 2 + 2 = **4**	250 mL unpres.: **1**

SAMPLE IDENTIFICATION NUMBER(S) **ERH738 (N/Split), and ERH 739 (dup). ERH 737 (Trip Blank)**

DATE: 01/22/19 TIME: ERH737 – 10:25, ERH738/ERH739 – Start: 10:45 End: 11:49

DECONTAMINATION PROCEDURES: Alconox, DI water, Isopropyl, and DI water wash

NOTES: —

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SAMPLED BY: KL, MM, BM

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

WELL NO. **RHMW02** LOCATION: Inside Tunnel PROJECT NO. 60571032

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
1010	Water at Suface									
1020	85.08	<0.5	327.07	6.57	0.50	0.48	0.85	24.28	-17.4	0.2
1024	85.08	—	327.03	6.59	0.50	0.37	0.88	24.17	-23.4	0.2
1028	85.09	1	327.61	6.61	0.50	0.31	0.60	24.15	-27.9	0.2
1032	85.10	—	327.56	6.62	0.50	0.30	0.62	24.14	-29.6	0.2
1036	85.10	—	327.01	6.64	0.50	0.29	0.50	24.15	-30.7	0.2
1040	85.10	2	326.37	6.65	0.50	0.29	0.50	24.15	-31.3	0.2
1045	Start sampling, lower flor rate for VOAs									
1104	Raise flow rate to sample rest of bottles									
1144	End sampling									

Red Hill Groundwater Sampling Log

WELL NO. **RHMW03** LOCATION: Inside Tunnel PROJECT NO. 60571032

DATE: 01/22/19 TIME: 1404 CLIMATIC CONDITIONS: Inside Tunnel

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Battery Pack
*101.84	101.30@1416	101.68@ 1540	N/A	117.30	N/A	300	1421	4.5	Deep cycle 90
**101.78	101.26@1420								

Pump settings:	Pressure (PSI)		Discharge (sec)		Fill (sec)	
Previous/Actual	60	57.5	15	35	15	25

Headspace VOCs:	0.5	ppm	Ambient VOCs:	0.0	ppm
Headspace O_2:	20.3	%	Ambient O_2:	20.9	%
Headspace LEL:	0	%	Ambient LEL:	0	%
Ambient CO:	0	ppm	Ambient H_2S:	0	%
O/W Interface Probe Type/Water Level Meter:	Heron H. Oil* /**Solinst WLM 101		Serial Number:	250750/N-1	
Gas Detector Type:	MultiRAE		Serial Number:	74Q7	
Water Quality Meter Type:	Smartroll		Serial Number:	476554	

Stabilization:+/- 0.2 ºC, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

Depth to water measured from red survey mark on top of permanent casing.

* 200' Oil/Water Interface Probe measurement

** 500' Calibrated Water Level Meter measurement (N-1)

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

ODOR/OTHER: None

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 24 primary = 24 total

VOAs	Amber	Poly
HCl: **4**	1-L: **3**	250 mL H2SO4: **1**
H2SO4: **5 + 5 (field filtered) = 10**	500-mL: **2**	250 mL HCl (brown): **1 filtered**
	1-L (800mL): **2**	250 mL unpres.: **1**

SAMPLE IDENTIFICATION NUMBER(S) **ERH741 (N) and ERH740 (Trip Blank)**

DATE: 01/22/19 TIME: ERH740 – 14:30, ERH741 – Start: 15:15 End: 15:39

DECONTAMINATION PROCEDURES: Alconox, DI water, Isopropyl, and DI water wash

NOTES: —

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SAMPLED BY: KL, MM, BM

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

WELL NO. **RHMW03** LOCATION: Inside Tunnel PROJECT NO. 60571032

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
1423	Water at Surface									
1434	101.46	<0.5	525.47	6.83	0.81	0.74	8.03	26.86	54.0	0.4
1438	101.62	1	524.28	6.83	0.81	0.78	6.32	26.77	58.0	0.4
1442	101.67	—	522.97	6.84	0.80	0.82	2.37	26.70	61.1	0.4
1446	101.67	2	522.82	6.85	0.80	0.84	0.89	26.66	63.2	0.4
1450	101.68	—	522.68	6.86	0.80	0.87	0.58	26.63	64.8	0.4
1454	101.68	—	522.59	6.87	0.80	0.88	0.33	26.59	65.7	0.4
1458	101.68	3	522.48	6.88	0.80	0.90	0.30	26.58	67.1	0.4
1502	101.68	—	522.45	6.87	0.80	0.93	0.22	26.56	68.2	0.4
1506	101.68	4	522.08	6.88	0.80	0.96	0.23	26.54	68.8	0.4
1510	101.68	4.5	521.95	6.88	0.80	0.96	0.24	26.54	69.6	0.4
1515	Start Sampling									
1539	End Sampling									

Red Hill Groundwater Sampling Log

WELL NO. **RHMW04** LOCATION: Outside Tunnel PROJECT NO. 60571032

DATE:01/21/19 TIME: 1110 CLIMATIC CONDITIONS: No clouds, 82°, 80% humidity, light winds

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
*293.25	292.55	292.48	N/A	305	N/A	250	1121	6	Start 900 Start 2000 End 500 End 1650
**293.14	292.53								

Pump settings:	Pressure (PSI)		Discharge (sec)		Fill (sec)	
Previous/Actual	140	140	28	28	32	32

Headspace VOCs: 0.0 ppm Ambient VOCs: 0.0 ppm

O/W Interface Probe Type/Water Level Meter: Heron/Solinst Serial Number: Heron: 01-3977 Solinst: N-2

Gas Detector Type: MiniRAE 3000 (10.6 eV) Serial Number: 592-917442

Water Quality Meter Type: In Situ Smartroll MP Serial Number: 589972

Stabilization:+/- 0.2 ºC, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

Depth to water measured from red survey mark on top of permanent casing.

* 500' Oil/Water Interface Probe measurement

** 1000' Calibrated Water Level Meter measurement (N-2)

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
1126	Water at Surface									
1133	292.52	0.3	281.90	8.37	0.43	7.97	0.71	23.83	56.8	0.2
1138	292.52	0.6	281.70	7.53	0.43	10.43	0.90	22.62	84.1	0.2

(see next page)

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

ODOR/OTHER: None

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 24 Primary = 24 total

VOAs	Amber	Poly
HCl: **4**	1-L: **3**	250 mL H2S04: **1**
H2SO4: **5 + 5 filtered = 10**	1-L (800 mL): **2**	250 mL HCl (brown): **1 filtered**
	500-mL: **2**	250 mL unpres.: **1**

SAMPLE IDENTIFICATION NUMBER(S) ERH743 (N). ERH742 (Trip Blank)

DATE: 01/21/19 TIME: ERH742 – 11:35, ERH 743 - Start 1320 End 1402

DECONTAMINATION PROCEDURES: Alconox, DI water, Isopropyl, and DI water wash

NOTES: —

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SAMPLED BY: GM, CE, RS, TV

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

WELL NO. **RHMW04** LOCATION: Outside Tunnel PROJECT NO. 60571032

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
1143	292.51	0.8	281.71	7.47	0.43	9.91	0.88	22.54	87.3	0.2
1148	292.51	1.2	280.18	7.45	0.43	9.47	0.80	22.44	92.1	0.2
Stopped purging to spot check/calibrate DO Sensor, (DO reading 98.6%)										
1206	292.51	2.3	284.38	7.51	0.44	8.98	0.80	22.87	102.4	0.2
1211	292.51	2.7	285.84	7.44	0.44	9.01	0.78	22.36	100.0	0.2
1215	292.51	3.5	285.39	7.44	0.44	8.97	0.79	22.34	99.6	0.2
1220	292.51	4	285.23	7.44	0.44	8.94	0.85	22.36	99.5	0.2
1225	292.51	4.5	284.62	7.43	0.44	8.87	1.02	22.38	99.7	0.2
Stopped purging to spot check/calibrate DO Sensor (DO reading 97.97%)										
1240	292.51	5	283.92	7.44	0.44	8.80	1.2	22.75	112.5	0.2
1245	292.51	5.5	285.36	7.42	0.44	8.90	0.65	22.61	107.6	0.2
1250	292.51	5.9	285.31	7.42	0.44	8.85	0.59	22.66	106.0	0.2
1255	295.51	6	284.97	7.42	0.44	8.82	0.54	22.65	105.6	0.2
1320	Sample collected. Flow rate decreased to 100mL/min for VOAs. Returned to 250ml/min for amber samples									

Red Hill Groundwater Sampling Log

WELL NO. **RHMW05** LOCATION: Inside Tunnel PROJECT NO. 60571032

DATE: 01/21/19 TIME: 0742 CLIMATIC CONDITIONS: Inside Tunnel

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Battery Pack
*82.21	81.87@0748	82.00 @0926	N/A	93	N/A	275	0756	3.5	Deep cycle 90
**82.17	81.83@0752								

Pump settings:	Pressure (PSI)		Discharge (sec)		Fill (sec)	
Previous/Actual	47.5	45	25	25	35	35

Headspace VOCs:	1.2	ppm	Ambient VOCs:	0.0	ppm
Headspace O_2:	20.9	%	Ambient O_2:	20.9	%
Headspace LEL:	0.0	%	Ambient LEL:	0.0	%
Ambient CO:	2.0	ppm	Ambient H_2S:	0.0	%
O/W Interface Probe Type/Water Level Meter:	Heron H. Oil/ Solinst WLM 101		Serial Number:	250750/N-1	
Gas Detector Type:	MultiRAE		Serial Number:	74Q7	
Water Quality Meter Type:	Smartroll		Serial Number:	476554	

Stabilization:+/- 0.2 ºC, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

Depth to water measured from red survey mark on top of permanent casing.

* 200' Oil/Water Interface Probe measurement

** 500' Calibrated Water Level Meter measurement (N-1)

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

ODOR/OTHER: None

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 24 Primary = 24 total

VOAs	Amber	Poly
HCl: **4**	1-L: **3**	250 mL H2SO4: **1**
H2SO4: **5 + 5 (field filtered) = 10**	1-L (800 mL): **2**	250 mL HCl (brown): **1 filtered**
	500-mL: **2**	250 mL unpres.: **1**

SAMPLE IDENTIFICATION NUMBER(S) **ERH745 (N) and ERH744 (Trip Blank)**

DATE: 01/21/19 TIME: ERH744 – 0820, ERH745 – Start: 0845 End: 0925

DECONTAMINATION PROCEDURES: Alconox, DI water, Isopropyl, and DI water wash

NOTES: Sampling end time 0925

SAMPLED BY: KL, MM, BM

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

WELL NO. **RHMW05** LOCATION: Inside Tunnel PROJECT NO. 60571032

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
0756	Water at Surface									
0805	81.83	0.5	485.96	7.71	0.75	8.30	0.65	23.97	76.1	0.4
0809	81.83	—	486.95	8.00	0.75	8.34	0.47	24.13	71.4	0.4
0813	81.84	1	486.75	8.04	0.75	8.37	0.35	24.17	70.1	0.4
0817	81.84	1.5	486.09	8.05	0.75	8.39	0.30	24.18	69.5	0.4
0821	81.85	2	486.72	8.06	0.75	8.40	0.32	24.19	69.2	0.4
0825	81.85	—	486.26	8.06	0.75	8.41	0.25	24.19	69.0	0.4
0829	81.85	2.5	485.82	8.07	0.75	8.42	0.25	24.19	68.9	0.4
0833	81.85	3	485.45	8.07	0.75	8.44	0.19	24.20	69.1	0.4
0837	81.85	—	485.93	8.07	0.75	8.43	0.12	24.20	69.3	0.4
0841	81.85	3.5	485.58	8.07	0.75	8.43	0.10	24.19	69.4	0.4
0845	Start Sampling, lower flow rate to sample VOAs									
0855	Raise flow rate for remaining bottles									
0925	End Sampling									

Red Hill Groundwater Sampling Log

WELL NO. **RHMW06** LOCATION: Outside Tunnel PROJECT NO. 60571032

DATE: 01/21/19 TIME: 0720 CLIMATIC CONDITIONS: No clouds, light wind, 72°, 70% humidity

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
*240.30	239.65	239.59@ 1023	N/A	263.20	N/A	250	0743	4.5	Start 1700 End 900
**240.19	239.60								

Pump settings:	Pressure (PSI)		Discharge (sec)		Fill (sec)	
Previous/Actual	120	120	25	25	25	25

Headspace VOCs: 0.0 ppm Ambient VOCs: 0.0 ppm

O/W Interface Probe Type/Water Level Meter: Heron/Solinst Serial Number: Heron: 01-3977 Solinst: N-2

Gas Detector Type: MiniRAE 3000 (10.6 eV) Serial Number: 592-917442

Water Quality Meter Type: Smartroll MP Serial Number: 589972

Stabilization:+/- 0.2 ºC, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

Depth to groundwater is measured from the top of grey plate (survey mark).

* 500' Oil/Water Interface Probe measurement

** 1000' Calibrated Water Level Meter measurement (N-2)

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
0747	Water at Surface									
0757	239.61	—	1168.48	6.78	1.80	8.25	0.15	22.38	87.0	0.9
0802	239.61	.5	1162.88	6.50	1.79	6.98	0.07	22.82	78.2	0.9

(see next page)

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

ODOR/OTHER: None

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 24 Primary = 24 total

VOAs	Amber	Poly
HCl: **4**	1-L: **3**	250 mL H2SO4: **1**
H2SO4: **5 + 5 (field filtered) = 10**	1-L (800mL): **2**	250 mL HCl (brown): **1 filtered**
	500-mL: **2**	250 mL unpres.: **1**

SAMPLE IDENTIFICATION NUMBER(S): **ERH747 (N) and ERH746 (Trip Blank)**

DATE: 1/21/19 TIME: ERH746 - 08:35, ERH747 - Start: 09:45 End:10:23

DECONTAMINATION PROCEDURES: Alconox, DI water, Isopropyl, and DI water wash

NOTES: Standpipe w/ calibrated tape 239.67@ 0721

SAMPLED BY: GM, CE, RS, TV

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

WELL NO. **RHMW06** LOCATION: Outside Tunnel PROJECT NO. 60571032

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
0807	239.61	1	1161.55	6.80	1.79	7.39	0.07	22.80	78.0	0.9
0812	239.61	1.75	1163.06	6.81	1.79	7.26	0.07	22.75	78.6	0.9
0817	239.62	2.5	1162.14	6.80	1.79	7.23	0.06	22.76	78.9	0.9
0822	239.63	3	1161.69	6.80	1.79	7.10	0.05	22.79	79.2	0.9
0827	239.63	3.75	1161.95	6.80	1.79	7.21	0.08	22.75	79.5	0.9
0832	239.61	4.25	1162.33	6.80	1.79	7.13	0.08	22.75	79.8	0.9
0845	Started Sampling									
0935	Stopped sampling, Smartroll tubing still attached. Potential contamination point									
0945	Resampled MW-06 w/ no tubing present. Flowrate was set to approx.. 100mL/min for VOAs, returned to 250mL/min for rest.									

WELL NO. **RHMW07** LOCATION: Outside Tunnel PROJECT NO. 60571032

DATE: 01/23/19 TIME: 0800 CLIMATIC CONDITIONS: Partly cloudy, 79°

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
*197.67	197.02	197.66	N/A	217.76	N/A	250	0918	7	Start 2500 End 1750
**197.61	197.02								

Pump settings:	Pressure (PSI)		Discharge (sec)		Fill (sec)	
Previous/Actual	95	95	28	28	32	32

Headspace VOCs: 0.0 ppm Ambient VOCs: 0.0 ppm

O/W Interface Probe Type/Water Level Meter: Heron/Solinst Serial Number: Heron: 01-3977 Solinst: N-2

Gas Detector Type: MiniRAE 3000 (10.6 eV) Serial Number: 593-91442

Water Quality Meter Type: Horiba U-52 Serial Number: RTOT3K89

Stabilization:+/- 0.2 ºC, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

Depth to groundwater is measure from top of grey plate (survey mark).

* 500' Oil/Water Interface Probe measurement

** 1000' Calibrated Water Level Meter measurement (N-2)

TIME	DTW**	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
0927	Water at Surface									
0942	197.44	0.66	1.17	6.25	1.83	6.51	0.0	24.27	255	0.9
0947	197.47	0.8	1.16	6.37	1.81	6.38	0.0	24.26	249	0.9
0952	197.49	1.2	1.16	6.40	1.81	6.35	0.0	24.27	245	0.9

(see next page)

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

ODOR/OTHER: None

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 24 Primary = 24 total

VOAs	Amber	Poly
HCl: **4**	1-L: **3**	250 mL H2SO4: **1**
H2SO4: **5 + 5 (field filtered) = 10**	1-L(800mL): **2**	250 mL HCl (brown): **1 filtered**
	500-mL: **2**	250 mL unpres.: **1**

SAMPLE IDENTIFICATION NUMBER(S) **ERH749 (N) and ERH748 (Trip Blank)**

DATE: 01/23/19 TIME: ERH748 - 11:25, ERH749 – Start: 1130 End: 1213

DECONTAMINATION PROCEDURES: Alconox, DI water, Isopropyl, and DI water wash

NOTES: Standpipe w/ calibrated tape: 197.02

Started reading turbidity measurements with Horiba, until DRT-15CE meter dried out.

SAMPLED BY: GM, CE, RS, TV

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

WELL NO. **RHMW07** LOCATION: Outside Tunnel PROJECT NO. 60571032

TIME	DTW**	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
0957	197.52	1.4	1.16	6.40	1.81	6.37	0.0	24.28	245	0.9
1002	197.54	1.8	1.15	6.44	1.80	7.90	0.0	24.32	242	0.9
1007	197.54	2.3	1.15	6.44	1.80	7.77	0.0	24.43	243	0.9
Adjusted flow rate to 225mL/min, moved Horibu, air bubble in flow through because high DO reading										
1013	197.53	2.9	1.15	6.47	1.80	5.59	0.0	24.44	242	0.9
1018	197.49	3.2	1.15	6.42	1.80	5.39	0.0	24.53	239	0.9
1023	197.53	3.5	1.15	6.53	1.79	5.12	0.0	24.63	235	0.9
1028	197.50	3.8	1.15	6.73	1.79	5.06	0.0	24.71	208	0.9
1033	197.55	4.2	1.14	7.03	1.79	4.87	0.0	24.83	202	0.9
1038	197.53	4.5	1.14	7.14	1.78	4.78	0.0	25.01	194	0.9
1043	197.53	4.8	1.13	7.21	1.77	4.83	0.0	25.14	194	0.9
1048	197.51	5.3	1.12	7.41	1.75	4.97	0.0	25.33	187	0.9
10.53	197.49	5.6	1.12	7.40	1.75	5.12	0.0	25.54	186	0.9
1058	197.49	5.8	1.11	7.41	1.73	5.23	0.23	25.58	187	0.9
Last reading and all reading moving forward. Used DRT-15CE turbidity meter.										
1103	197.47	6.1	1.11	7.40	1.73	5.26	0.25	25.63	185	0.9
1108	197.47	6.3	1.11	7.40	1.73	5.22	0.30	25.74	186	0.9
1113	197.48	6.7	1.09	7.43	1.72	5.22	0.08	25.73	189	0.9
1118	197.51	7.0	1.09	7.44	1.68	5.18	0.12	25.68	185	0.8
Reduced flow rate to 100mL/min for VOA sampling. Returned to 250 mL/min for ambers.										

Red Hill Groundwater Sampling Log

WELL NO. **RHMW08** LOCATION: Outside Tunnel PROJECT NO. 60571032

DATE: 01/21/19 TIME: 1430 CLIMATIC CONDITIONS: Sunny, light wind, no clouds

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
*292.75	291.07	291.16	N/A	311.30	N/A	300	1450	4.7	Start 1650 End 900
**292.65	291.04								

Pump settings:	Pressure (PSI)		Discharge (sec)		Fill (sec)	
Previous/Actual	145	145	31	31	29	29

Headspace VOCs: 0.0 ppm Ambient VOCs: 0.0 ppm

O/W Interface Probe Type/Water Level Meter: Heron/ Solinst Serial Number: Heron: 01-3977 Solinst: N-2

Gas Detector Type: MiniRAE 3000 (10.6 eV) Serial Number: 592-917442

Water Quality Meter Type: Insitu Smartroll MP Serial Number: 589972

Stabilization:+/- 0.2 ºC, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

Depth to groundwater is measure from top of grey plate (survey mark).

* 500' Oil/Water Interface Probe measurement

** 1000' Calibrated Water Level Meter measurement (N-2)

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
1500	Water at Surface									
1505	291.13	0	525.00	8.16	0.81	6.86	0.2	25.54	92.7	0.4
1510	291.17	0.25	531.95	8.16	0.82	5.88	0.07	24.55	102.7	0.4
1515	291.15	.5	535.82	8.16	0.82	5.75	0.04	24.14	109.8	0.4

(see next page)

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

ODOR/OTHER: None

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 24 primary = 24 total

VOAs	Amber	Poly
HCl: **4**	1-L: **3**	250 mL H2SO4: **1**
H2SO4: **5 + 5 (field filtered) = 10**	500-mL: **2**	250 mL HCl (brown): **1 filtered**
	1-L (800 mL): **2**	250 mL unpres.: **1**

SAMPLE IDENTIFICATION NUMBER(S) **ERH751 (N) and ERH750 (Trip Blank)**

DATE: 01/21/09 TIME: ERH750 - 15:30, ERH751 - Start time 1545 End time 1640

DECONTAMINATION PROCEDURES: Alconox, DI water, Isopropyl, and DI water wash

NOTES:

SAMPLED BY: GM, CE, RS, TV

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

WELL NO. **RHMW08** LOCATION: Outside Tunnel PROJECT NO. 60571032

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
1520	291.15	1	531.98	8.16	0.82	5.60	0.06	23.06	113.7	0.4
1525	291.15	1.75	530.37	8.16	0.82	5.47	0.01	23.01	115.6	0.4
1530	291.16	2.5	529.00	8.15	0.81	5.42	0.05	23.98	116.6	0.4
1535	291.14	3	525.76	8.15	0.81	5.36	0.01	23.87	116.9	0.4
1540	291.14	4.5	523.61	8.14	0.81	5.26	0.02	23.87	116.9	0.4
1545	Sample collected. Flow rate decreased to 100mL/min for VOAs. Returned to 300mL/min									

Red Hill Groundwater Sampling Log

WELL NO. **RHMW09** LOCATION: Outside Tunnel PROJECT NO. 60571032

DATE:01/22/19 TIME: 0728 CLIMATIC CONDITIONS: Sunny, light wind, 71°, humid

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
*376.87	376.31	376.28	N/A	396.69	N/A	280	0738	7	Start 1600 End 300 Start 2800 End 300 Start 2700 End 1750
**376.67	376.27								

Pump settings:	Pressure (PSI)		Discharge (sec)		Fill (sec)	
Previous/Actual	180		40		40	

Headspace VOCs: 0.0 ppm Ambient VOCs: 0.0 ppm

O/W Interface Probe Type/Water Level Meter: Heron/ Solinst Serial Number: Heron: 01-3977 Solinst: N-2

Gas Detector Type: MniRae 3000 Serial Number: 592-917442

Water Quality Meter Type: In-Situ SmarTroll MP Serial Number: 589972

Stabilization:+/- 0.2 ºC, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

Depth to groundwater is measure from top of grey plate (survey mark).

* 500' Oil/Water Interface Probe measurement

** 1000' Calibrated Water Level Meter measurement (N-2)

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
0755	Water at Surface									
0814	376.26	0.9	219.11	7.52	0.34	11.25	0.30	23.06	89.6	0.2
0819	376.27	1.5	218.34	7.53	0.34	9.53	0.04	22.94	91.3	0.2
0824	376.27	2.0	218.87	7.52	0.34	9.45	0.18	22.89	90.8	0.2
0829	376.27	2.3	218.53	7.53	0.34	8.95	0.05	22.86	90.8	0.2

(see next page)

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

ODOR/OTHER: None

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 24 primary = 24 total

VOAs	Amber	Poly
HCl: **4**	1-L: **3**	250 mL H2SO4: **1**
H2SO4: **5 + 5 (field filtered) = 10**	500-mL: **2**	250 mL HCl (brown): **1 filtered**
	1-L (800 mL): **2**	250 mL unpres.: **1**

SAMPLE IDENTIFICATION NUMBER(S) **ERH753 (N) and ERH752 (Trip Blank)**

DATE: 01/22/19 TIME: ERH752 – 09:30, ERH753 - Start: 0945 End: 1058

DECONTAMINATION PROCEDURES: Alconox, DI water, Isopropyl, and DI water wash

NOTES: 2nd nitrogen tank did not show correct PSI on gauge

SAMPLED BY: GM, CE, RS, TV

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

WELL NO. **RHMW09** LOCATION: Outside Tunnel PROJECT NO. 60571032

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
Stopped purging. Calibrated DO because reading over 105%. Calibrated to 96.4%										
0840	376.27	3.7	219.37	7.53	0.34	8.65	0.04	22.80	104.0	0.2
0845	376.27	4.2	219.19	7.54	0.34	9.05	0.06	22.84	106.2	0.2
0850	376.27	4.8	219.28	7.54	0.34	8.98	0.03	22.87	105.9	0.2
0855	Stopped purging. Calibrated DO because still reading high. Calibrated to 95.6%, 8.16mg/L									
0902	376.27	5.2	219.15	7.56	0.34	8.77	0.06	22.91	110.2	0.2
0907	376.27	5.6	219.31	7.54	0.34	8.58	0.04	22.93	104.4	0.2
Changed out nitrogen tank										
0918	Water returned to surface									
0920	376.27	6.0	219.65	7.63	0.34	8.87	0.20	23.66	102.5	0.2
0925	376.27	6.3	219.22	7.58	0.34	8.50	0.08	23.56	100.9	0.2
0930	376.27	6.5	219.09	7.57	0.34	8.57	0.28	23.36	99.5	0.2
0935	376.27	6.8	219.14	7.56	0.34	8.63	0.24	23.16	99.3	0.2
0940	376.27	7	218.93	7.56	0.34	8.48	0.25	23.10	99.2	0.2
Flow rate decreased to 100mL/min for VOAs. Collected first set of HCL VOAs. Had to change out the nitrogen tank again. Finished VOA sampling and returned flow rate to 280mL/min.										

Red Hill Groundwater Sampling Log

WELL NO. **RHMW10** LOCATION: Outside Tunnel PROJECT NO. 60571032

DATE: 01/22/19 TIME: 1142 CLIMATIC CONDITIONS: Partly cloudy, 82°, humid, light wind

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
*476.90	476.35	476.19 @ 1635	N/A	497.37	N/A	300	1202	3	Start 1750 End 500 Start 1200 End 650 empty Start 2800 End 1750
**476.67	476.24								

Pump settings:	Pressure (PSI)		Discharge (sec)		Fill (sec)	
Previous/Actual	220		40		40	

Headspace VOCs: 0.0 ppm Ambient VOCs: 0.0 ppm

O/W Interface Probe Type/Water Level Meter: Heron/ Solinst Serial Number: Heron: 01-3977 Solinst: N-2

Gas Detector Type: MiniRae 3000 Serial Number: 592-917442

Water Quality Meter Type: In-Situ SmarTroll MP Serial Number: 589972

Stabilization:+/- 0.2 ºC, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

Depth to groundwater is measure from top of grey plate (survey mark).

* 500' Oil/Water Interface Probe measurement

** 1000' Calibrated Water Level Meter measurement (N-2)

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
1227	Water at Surface. Regulator was limited to 180PSI, took extra time to get to surface. Now at 220PSI									
1255	*476.39	0.75	185.73	7.66	0.29	8.14	0.11	27.15	137.5	0.1
1300	Battery dead, changed out battery and restarted pump. *Reading taken during fill. All other during discharge									

(see next page)

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

ODOR/OTHER: None

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 24 Primary = 24 total

VOAs	Amber	Poly
HCl: **4** H2SO4: **5 + 5 (field filtered) = 10**	1-L: **3** 500-mL: **2** 1-L (800mL): **2**	250 mL H2SO4: **1** 250 mL HCl (brown): **1 filtered** 250 mL unpres.: **1**

SAMPLE IDENTIFICATION NUMBER(S) **ERH755 (N) and ERH754 (Trip Blank)**

DATE: No Sample TIME: No Sample due to lack of water

DECONTAMINATION PROCEDURES: Alconox, DI water, Isopropyl, and DI water wash

NOTES: Could not collect sample. Nitrogen problems, could not get water to surface for completion of purging and Sampling.

SAMPLED BY: GM, CE, RS, TV

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

WELL NO. **RHMW10** LOCATION: Outside Tunnel PROJECT NO. 60571032

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
1308	276.24	1.15	184.37	7.65	0.28	8.18	Turb wet	27.93	146.2	0.1
1313	276.24	1.5	190.48	7.54	0.29	8.15	—	25.72	122.9	0.1
1318	276.24	1.75	188.16	7.54	0.29	8.14	—	25.75	152.0	0.1
1323	276.24	2.25	186.22	7.62	0.29	8.05	—	27.40	158.5	0.1
Changed nitrogen tank										
1358	276.23	2.65	184.21	7.61	0.29	8.53	—	28.03	152.1	0.1
Out of nitrogen. TV leaves to get more tanks.										
1505	TV returns to site with more nitrogen. New nitrogen attached. Restart purging									
1610	Could not get water to surface. Called it for the day.									

Red Hill Groundwater Sampling Log

WELL NO. **RHMW10** LOCATION: Outside Tunnel PROJECT NO. 60571032

DATE: 01/24/19 TIME: 0700 CLIMATIC CONDITIONS: Partly cloudy, light rain, 75°, humid

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
*476.90	476.32	476.17	N/A	497.37	N/A	200	0900	6.75	Start 1600 End 600 Start 2700 End 500 Start 2750 End 700
**476.67	476.28								

Pump settings:	Pressure (PSI)		Discharge (sec)		Fill (sec)	
Previous/Actual	220	230	40	40	40	40

Headspace VOCs: 0.0 ppm Ambient VOCs: 0.0 ppm

O/W Interface Probe Type/Water Level Meter: Heron/ Solinst Serial Number: Heron: 01-3977 Solinst: N-2

Gas Detector Type: MiniRae 3000 Serial Number: 592-917442

Water Quality Meter Type: In-Situ SmarTroll MP Serial Number: 589972

Stabilization:+/- 0.2 ºC, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

Depth to groundwater is measure from top of grey plate (survey mark).

* 500' Oil/Water Interface Probe measurement

** 1000' Calibrated Water Level Meter measurement (N-2)

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
0935	Water at Surface. Narrowing down flow rate, ran out of nitrogen.									
1020	Water at surface									
1040	continued on next page									

(see next page)

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

ODOR/OTHER: None

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 24 Primary = 24 total

VOAs	Amber	Poly
HCl: **4**	1-L: **3**	250 mL H2SO4: **1**
H2SO4: **5 + 5 (field filtered) = 10**	500-mL: **2**	250 mL HCl (brown): **1 filtered**
	1-L (800mL): **2**	250 mL unpres.: **1**

SAMPLE IDENTIFICATION NUMBER(S) **ERH755 (N) and ERH754 (Trip Blank)**

DATE: 01/24/19 TIME: ERH 755 - 12:08, ERH754 - Start: 1240 End: 1429

DECONTAMINATION PROCEDURES: Alconox, DI water, Isopropyl, and DI water wash

NOTES: Turbidity meter not working properly, set out in sun

SAMPLED BY: GM, CE, RS, TV

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

WELL NO. **RHMW10** LOCATION: Outside Tunnel PROJECT NO. 60571032

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
1040	476.23	2	191.10	7.38	0.30	8.51	*	24.67	108.4	0.1
1045	476.20	2.25	193.46	7.52	0.30	10.09	*	24.52	124.1	0.1
1050	476.23	2.5	193.90	7.56	0.30	9.28	*	24.21	133.4	0.1
1055	476.14	3	195.74	7.58	0.30	8.55	*	24.28	133.6	0.1
1100	476.22	3.25	194.56	7.59	0.30	9.06	*	24.05	131.4	0.1
1105	476.13	3.5	195.08	7.62	0.30	8.47	*	24.05	132.9	0.1
1110	476.22	4	195.61	7.60	0.30	8.92	*	24.10	136.9	0.1
1115	476.21	4.25	196.12	7.59	0.30	N/A	*	24.01	138.8	0.1
1120	Recalibrated RDO sensor on Smartroll (96.2%)									
1127	476.12	4.75	199.99	7.66	0.30	8.07	*	24.64	136.0	0.1
1132	476.18	5.0	196.32	7.53	0.30	8.31	*	24.01	144.0	0.1
1137	476.22	5.1	195.26	7.58	0.30	9.20	0.25	23.87	155.8	0.1
1142	476.22	5.25	196.17	7.58	0.30	8.97	*	23.99	142.3	0.1
1147	476.21	5.5	195.71	7.62	0.30	8.81	*	24.09	143.0	0.1
1152	476.22	5.75	195.11	7.59	0.30	8.67	*	24.10	138.9	0.1
1157	476.22	6	196.82	7.59	0.30	8.67	0.21	24.23	132.0	0.1
1158	476.22	6.25	195.35	7.60	0.30	8.65	0.06	24.19	146.1	0.1
1203	476.22	6.5	194.97	7.60	0.30	8.54	0.13	24.18	149.4	0.1
1208	476.22	6.75	197.78	7.59	0.30	8.30	0.10	24.36	155.4	0.1
1240	Sampled collected. Flow rate decreased to 100mL/min for VOAs. Batter pack died, switched and continued.									
1310	Switched back to 300mL/min to sample ambers									

Westbay Well Groundwater Sampling

Field Data Sheet

Project: 60571032 Red Hill
Monitoring Well No.: RHMW11
Sampling Zone No(s).: Zone 5
Sampled by: MH, GM, TV, BM

Ambiant VOCs (ppm): 0.0 ppm
Headspace VOCs (ppm): 0.0 ppm
Start Time: 9:29 Atm. Reading: 26.05
End Time: 15:33 Atm. Reading: 14.62

Date: 2019-01-28
Sheet: 1 of 1
Sampling Equipment: 5285

Time	Port No.	Run No.	Surface Function Tests (probe in flushing collar)						Position Sampler					Sample Collection Checks (probe located at sampling zone in Westbay casing)							Comments (volume recovered)
			Shoe Out	Close Valve	Check Vacuum	Open Valve	Evacuate Bottles (3-5 psi)	Close Valve	Shoe In	Arm In	Locate Port	Arm Out	Land Probe	Pressure in Westbay ( )	Shoe Out	Zone Pressure ( )	Open Valve	Zone Pressure ( )	Close Valve	Shoe In	Pressure in Westbay ( )	
9:54	5	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	26.08	✓	55.94	✓	55.95	✓	✓	26.08	Used for parameters
			Changed data logger																			
10:21	5	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Reading atmospheric pressure								
11:15	5	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	26.08	✓	55.93	✓	55.94	✓	✓	26.08	VOAs
11:39	5	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Reading atmospheric pressure								
12:19	5	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	26.01	✓	55.94	✓	55.95	✓	✓	26.07	TPHDRO
12:37	5	6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	26.01	✓	55.94	✓	55.93	✓	✓	26.02	TPHDRO
12:59	5	7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	25.96	✓	55.92	✓	55.93	✓	✓	26.00	Parameters
13:24	5	8	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	25.94	✓	55.92	✓	55.91	✓	✓	26.00	PAHs & TPHDRO
13:44	5	9	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	25.94	✓	55.92	✓	55.93	✓	✓	25.99	PAHs very slight organic odor
14:07	5	10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	25.92	✓	55.91	✓	55.93	✓	✓	25.95	PAHs & SVOCs slight organic odor
14:24	5	11	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	25.92	✓	55.92	✓	55.91	✓	✓	25.95	SVOCs & Polys slight odor
14:48	5	12	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	25.90	✓	55.93	✓	55.93	✓	✓	25.93	filter
15:10	5	13	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	25.89	✓	55.93	✓	55.91	✓	✓	25.88	Parameters

TIME	Liters Removed	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)	Comments
10:23	1	221.15	7.36	0.34	0.76	*	23.60	76.1	0.2	*not collected
13:32	4	264.51	7.90	0.41	0.59	0.88	23.74	33.0	0.2	
15:36	11	268.54	7.93	0.41	0.17	0.54	23.06	9.9	0.2	

Sample Identification Numbers: ERH764 (N) & ERH763 (TB)
Sample Start Time: 9:10 End Time: 15:33
Appearance of Sample:
COLOR: Clear
SEDIMENT: none
OTHER: No odor, slight odor after ~8L
Notes: Run No. 9 very slight organic odor, Run No. 10 slight organic odor
Run No. 11 slight odor

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED:

24 total

VOAs	**Amber**	**Poly**
HCl: **4**	1-L: **3**	250 mL H2SO4: **1**
H2SO4: **5**	500-mL: **2**	250 mL HCl (brown): **1 filtered**
H2SO4 (filtered): **5**	1-L (800 mL): **2**	250 mL unpres.: **1**

Red Hill Groundwater Sampling Log

WELL NO. **HDMW2253-03** LOCATION: Outside Tunnel PROJECT NO. 60571032

DATE: 02/07/19 TIME: 0810 CLIMATIC CONDITIONS: Morning rain, sunny later 75°

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
*206.74	205.87@ 0844	205.84@ 1127	N/A	1575	N/A	300	0935	5	Start 2600 End 2000
**206.68	205.84@ 0847								

Pump settings:	Pressure (PSI)		Discharge (sec)		Fill (sec)	
Previous/Actual	170	170	30	30	30	30

Headspace VOCs: 0.0 ppm Ambient VOCs: 0.0 ppm

O/W Interface Probe Type/Water Level Meter: Heron/ Solinst Serial Number: Heron: 16504/N-2 Solinst: 01-3977

Gas Detector Type: MiniRAE 3000 (10.6 eV) Serial Number: 920683

Water Quality Meter Type: SmarTroll Insitu Serial Number: 589972

Stabilization:+/- 0.2 ºC, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

Depth to water measured from red survey mark on top of permanent casing.

* 500' Oil/Water Interface Probe measurement

** 1000' Calibrated Water Level Meter measurement (N-2)

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
0941	Water at surface									
0946	205.82	—	309.29	6.87	0.48	10.29	13.60	23.15	10.2	0.2
0951	205.83	—	305.85	6.35	0.47	2.66	13.46	22.90	21.7	0.2
0956	205.85	1	305.51	6.29	0.47	2.02	11.67	22.88	30.2	0.2

(see next page)

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Slightly murky

SEDIMENT: None

ODOR/OTHER: None

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 24 primary = 24 total

VOAs	Amber	Poly
HCl: **4**	1-L: **3**	250 mL H2SO4: **1**
H2SO4: **5 + 5 (field filtered) = 10**	500-mL: **2**	250 mL HCl (brown): **1 filtered**
	1-L (800mL): **2**	250 mL unpres.: **1**

SAMPLE IDENTIFICATION NUMBER(S) **ERH759 (N) and ERH758 (Trip Blank)**

DATE: 02/07/19 TIME: ERH758 – 0740, ERH759 Start: 1045 End: 11:25

DECONTAMINATION PROCEDURES: Alconox, DI water, Isopropyl, and DI water wash

NOTES: Depth to water collected after pump was installed

SAMPLED BY: MH, RS,BM

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

WELL NO. **HDMW2253-03** LOCATION: Outside Tunnel PROJECT NO. 60571032

TIME	DTW	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
1001	205.85	2	304.61	6.28	0.47	1.65	12.24	22.90	34.4	0.2
1006	205.85	—	304.04	6.28	0.47	1.55	12.16	22.89	36.8	0.2
1011	205.85	2.5	303.28	6.28	0.47	1.47	11.14	22.90	38.1	0.2
1016	205.85	3	303.27	6.29	0.47	1.37	10.75	22.89	38.1	0.2
1021	205.85	4	303.22	6.28	0.47	1.31	11.73	22.88	40.2	0.2
1026	205.85	4.5	303.46	6.28	0.47	1.25	11.28	22.88	41.7	0.2
1031	205.86	5	323.33	6.28	0.47	1.26	10.82	22.88	41.7	0.2
1045	Begin sampling. Lower flow rate to 100mL/min for VOAs									
1052	Raise to 300 mL/min for remaining bottles									
1125	End Sampling									

Red Hill Groundwater Sampling Log

WELL NO. **OWDFMW01** LOCATION: Outside Tunnel PROJECT NO. 60571032

DATE: 01/23/19 TIME: 1245 CLIMATIC CONDITIONS: Mostly sunny, 81° F

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
*119.43	118.93	119.10	—	144.74	—	80mL/min	1316	4.5	start 1750 start 2800 end 200 end 600
**119.34	118.91								

Pump settings:	Pressure (PSI)		Discharge (sec)		Fill (sec)	
Previous/Actual	65	65	13	13	17	17

Headspace VOCs: 0.0 ppm Ambient VOCs: 0.0 ppm

O/W Interface Probe Type/Water Level Meter: Heron Solinst Serial Number: Heron: 01-3977 Solinst : N-2

Gas Detector Type: MultiRAE Serial Number: 592-917442

Water Quality Meter Type: In-Situ Smartroll MP Serial Number: 589976

Stabilization:+/- 0.2 ºC, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

Depth to water measured from red survey mark on top of permanent casing.

* 200' Oil/Water Interface Probe measurement

** 500' Calibrated Water Level Meter measurement (N-1)

TIME	DTW	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
1321	Water at Surface									
1327	119.48	0.25	2250.62	10.49	3.49	3.61	*	28.89	102.1	1.9
1335	119.53	0.50	2383.74	10.81	3.67	3.34	*	25.89	100.1	2.0

(see next page)

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

ODOR/OTHER: None

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 24 Primary = 24 total

VOAs HCl: **4** H2SO4: **5 + 5 (field filtered) = 10**	Amber 1-L: **3** 1-L (800 mL): **2** 500-mL: **2**	Poly 250 mL H2SO4: **1** 250 mL HCl (brown): **1 filtered** 250 mL unpres.: **1**

SAMPLE IDENTIFICATION NUMBER(S) **ERH757 (Primary) and ERH756 (Trip Blank)**

DATE: 01/23/19 TIME: ERH756 – 13:20, ERH757 - Start 15:25 End 17:38

DECONTAMINATION PROCEDURES: Alconox, DI water, Isopropyl, and DI water wash

NOTES: *Turbidity meter not working properly, received new DRT-15CE @ 1345

SAMPLED BY: GM, CE, RS, TV

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

WELL NO. **OWDFMW01** LOCATION: Outside Tunnel PROJECT NO. 60571032

TIME	DTW**	GALLONS REMOVED	TDS (ppm)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (psu)
1340	119.53	0.5	2438.89	9.84	3.75	3.21	*	25.89	115.9	2.0
1345	119.53	0.75	2573.37	9.07	3.97	3.15	16.48	28.87	122.9	2.1
1350	119.53	1	2689.06	8.77	4.14	3.08	11.20	25.94	124.7	2.2
1355	119.49	1.25	2773.35	8.59	4.27	3.02	7.62	25.98	126.3	2.3
1400	119.49	1.4	2803.42	8.51	4.32	2.95	5.92	25.95	126.9	2.3
1405	119.48	1.5	2822.95	8.47	4.34	2.89	6.43	25.94	127.3	2.3
1410	119.46	1.75	2830.28	8.45	4.36	2.86	5.84	25.92	127.0	2.3
1415	119.45	2	2837.67	8.43	4.37	2.83	4.94	25.94	127.1	2.4
1420	119.44	2.25	2841.29	8.41	4.37	2.80	3.82	25.98	126.8	2.4
1425	119.42	2.4	2847.97	8.38	4.38	2.80	3.15	26.01	126.1	2.4
			Adjusted pressure slightly, flow rate dropped to approx. 80mL/min. Turned up to 100mL/min							
1430	119.57	2.6	2847.43	8.35	4.38	2.78	3.23	25.58	129.1	2.4
1435	119.61	2.8	2846.77	8.35	4.38	2.62	3.84	25.48	126.2	2.4
1440	119.65	3	2759.32	8.75	4.24	2.54	3.28	25.42	123.5	2.3
1445	119.69	3.2	2737.09	8.78	4.21	2.52	2.88	25.35	123.5	2.3
			Returned flow rate to 80mL/min. Too much draw down.							
1455	119.68	3.6	2784.74	8.59	4.28	2.51	2.96	25.58	123.9	2.3
1500	119.69	3.7	2830.35	8.39	4.36	2.48	2.08	25.49	124.0	2.4
1505	119.69	3.8	2841.74	8.31	4.38	2.49	1.83	25.39	124.8	2.4
1510	119.69	4	2833.04	8.37	4.36	2.50	1.73	25.34	123.7	2.3
1515	119.68	4.5	2829.37	8.37	4.36	2.50	1.14	25.35	123.3	2.3
1525			Sample Collected, Changed Nitrogen tank for sample collection after first few VOAs							

12/12/18 RHMW2254-01 sample pump on.

0515 MH @ warehouse to calibrate equipment. See cal logs for details

0545 MD, ICE @ warehouse to help load equipment.

0615 MH conducts H+S tailgate, see sign in sheet for details.

0630 Depart warehouse & proceed to Red Hill.

weather: Partly cloudy, 80°, 75% humidity, mod. trade winds.

objective: Collect primary, dup, MS/MSD sample from RHMW2254-01 w/ pumps running

Personnel: AECOM (MH, MD, KB)

Equipment: Insitu smarttroll 269453
HF scientific Turbidimeter
QED MP50
WL meter N-1 Solinst
O/W interface probe ~~Heron~~ Solinst 269453
Deep cycle battery
MultiRAE 5 gas 7497

0710 Arrive @ Adit 3 and mob equip into tunnel.

0725 wait for NAVFAC escort.

0733 Darren Uchima (NAVFAL) @ adit 3 MH gives safety brief, wait for

Scale: 1 square = _____

MH
0745 UEM escort into shaft

0745 Ken (UEM) onsite, mob into Tunnel

0800 @ RHMW2254-01, open manhole, Ambient VOC's = 0.0 ppm, headspace in manhole = 0.9 ppm, see purge log for other readings

0830 start purge, see purge log for details.

0840 collect TB ERH718 4 VOA's w/ HCl

0925 collect Primary/MS/MSD ERH719 and Duplicate ~~@~~ MH ERH720.

Note: pump ~~#3~~ MH #2 was running when AECOM arrived @ the shaft and remained running while sampling. Pump #2 is the 3rd pump as you count starting closest to the entrance to pump room.

1130 end sampling, clean up.

1150 demob from tunnel through Adit 3, Darren Uchima departs site, AECOM takes IDW to staging area + adds ~3 gal to New drum ~~OM00594~~ 63 (MH)

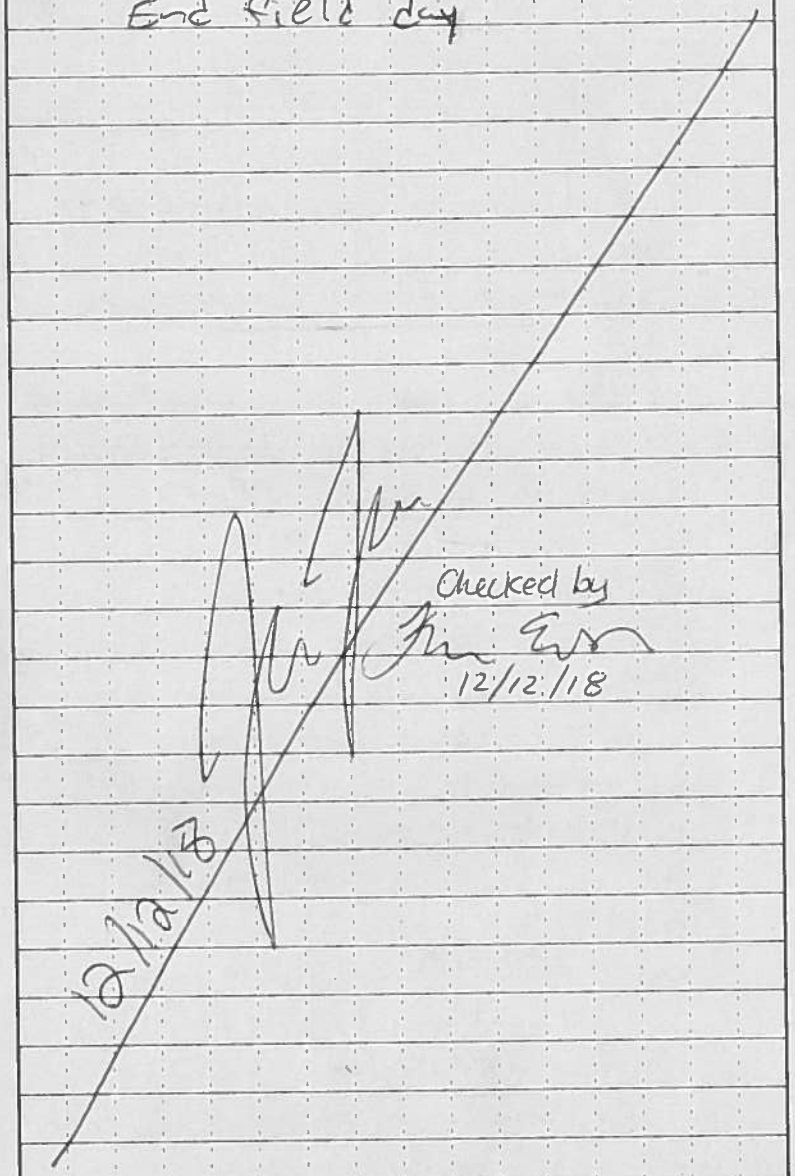
1230 AECOM departs site + proceeds to warehouse.

Scale: 1 square = _____

Rite in the Rain

12/12/18

1300 Arrive @ warehouse, End field day



Scale: 1 square = _____

0515 MH @ warehouse to calibrate equipment. (See cal logs for details)

objective: collect primary, MS/MSD, Duplicate GW sample from RHMW2254-01 w/ pumps off.

weather: Partly cloudy, 82°, 75% humidity, mod. trade winds

Personnel: AECOM: (MH, KE, MD)

0545 MD, KE @ warehouse to help load equipment

0615 MH conducts H+S tailgate (see sign in sheet for details)

Equipment: insitu smarttroll 589972
HF scientific turbidimeter
QED MP50
WL meter solinst N-1
O/W IP: solinst 269453
DeepCycle Battery
multi RAE 5 gas 74g7

0630 depart warehouse, proceed to Red Hill.

0650 Arrive @ Adit 3, Mob equipment into tunnel.

0706 wait for NAVFAC + UEM escort.

0730 Cory Waki (NAVFAC) onsite, MH gives safety brief.

0745 Ken (UEM) onsite, mob into

Scale: 1 square = _____

Rite in the Rain

12/13/18 cont.

tunnel through adit 3

0800 @ RHMW2254-01 & open man hole cover. very humid air inside, VOC's headspace = 2.8 ppm, ambient air = 0.0 ppm, no odors

0810 begin purge (see purge logs for details). Ken (USM) informs MH that pumps have been shut off since at least 0500 hrs on 12/13/18. Most likely they have not run since they were running during sampling on 12/12/18

Late Entry 0805 collect Trip blank ERH721

0905 collect primary & MS/MSD ERH722 + duplicate ERH723

1100 end sampling. clean up and mob out of tunnel through adit 3.

1135 out of tunnel, Cory Waki departs site, AECOM loads vehicles & takes IDW to staging area. Add ~4 gal H_2O to DMW0053 (MH)

1215 depart red hill, proceed

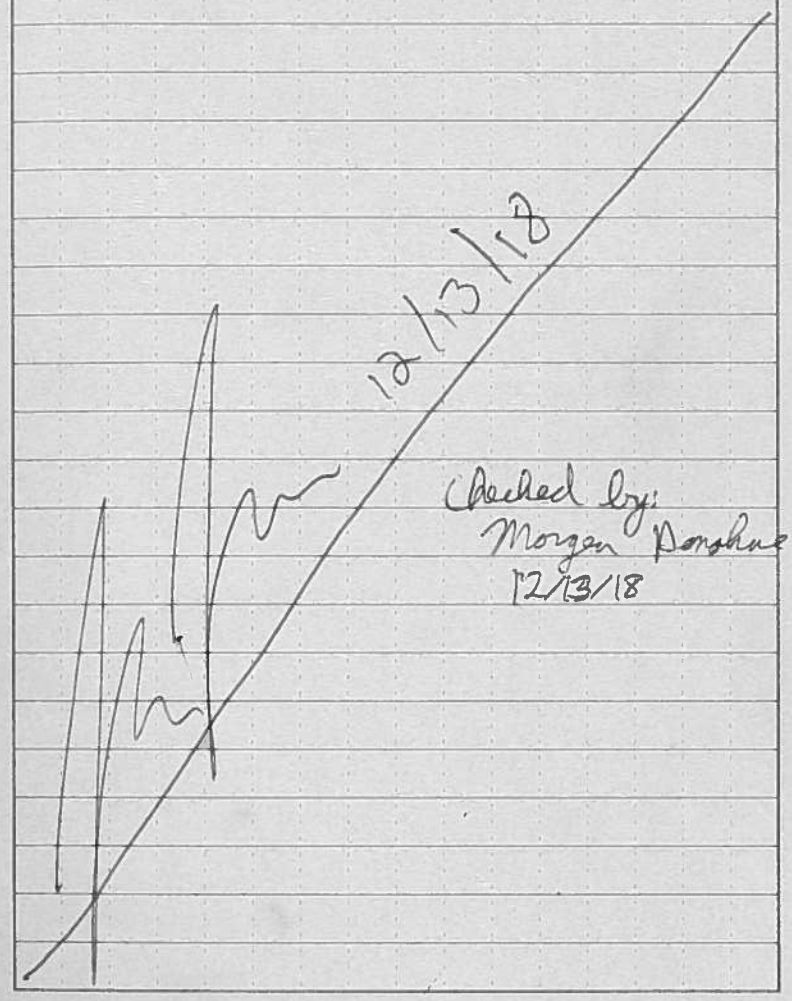
Scale: 1 square = _____

12/13/18 cont.

to warehouse.

1240 At wire house, end field day.

Note: All pumps remained off for the duration of sampling.



Checked by:
Morgan Donahue
12/13/18

Scale: 1 square = _____

Rite in the Rain

1/15/19 January LTM Pump Install

0520 mH @ warehouse, load equipment, TV helps load nitrogen on flatbed.

objective: Install dedicated bladder pumps in wells & test for correct operation.

Personnel: AECOM (mH, RS, ~~SF~~ KH) Sean Flaherty (SF))

weather: Partly cloudy, light trade wind, 85°, 70% humidity.

0600 SF @ warehouse

0620 depart warehouse & proceed to Red Hill

0645 @ Red Hill gate, meet RS @ gate.

0650 proceed into Red Hill, ask guard to open gate to gun Range for access to RHMW04. Guard calls chief for permission to open.

0655 Gate open proceed to RHMW04 & set up.

0705 Conduct H&S tailgate, See sign in sheet for details.

(mH) ~~0730~~ 0720 begin lowering pump.

0735 begin purging RHMW04.

0745 good water return. clean up site.

0810 proceed to RHMW10 & set up

0830 begin lowering pump.

0900 begin testing/purging

1000 End testing, water discharge is satisfactory pressure = 220 psi, 40 sec fill & discharge, ~10-15 bubbles less than the size of a pea in discharge, will not go away w/ any setting adjustment. Suspect pin hole in tubing.

1010 mob to RHMW04 & setup.

1018 begin lowering pump into well.

1046 begin purge/test.

1111 good water return, pack up.

1120 mob to RHMW08 & set up.

1130 begin installing pump.

1150 begin purge/test

1218 good water return, some bubbles @ first

but able to maintain steady flow w/ot bubbles for 5 cycles. End test.

1230 mob to RHMW07 & set up.

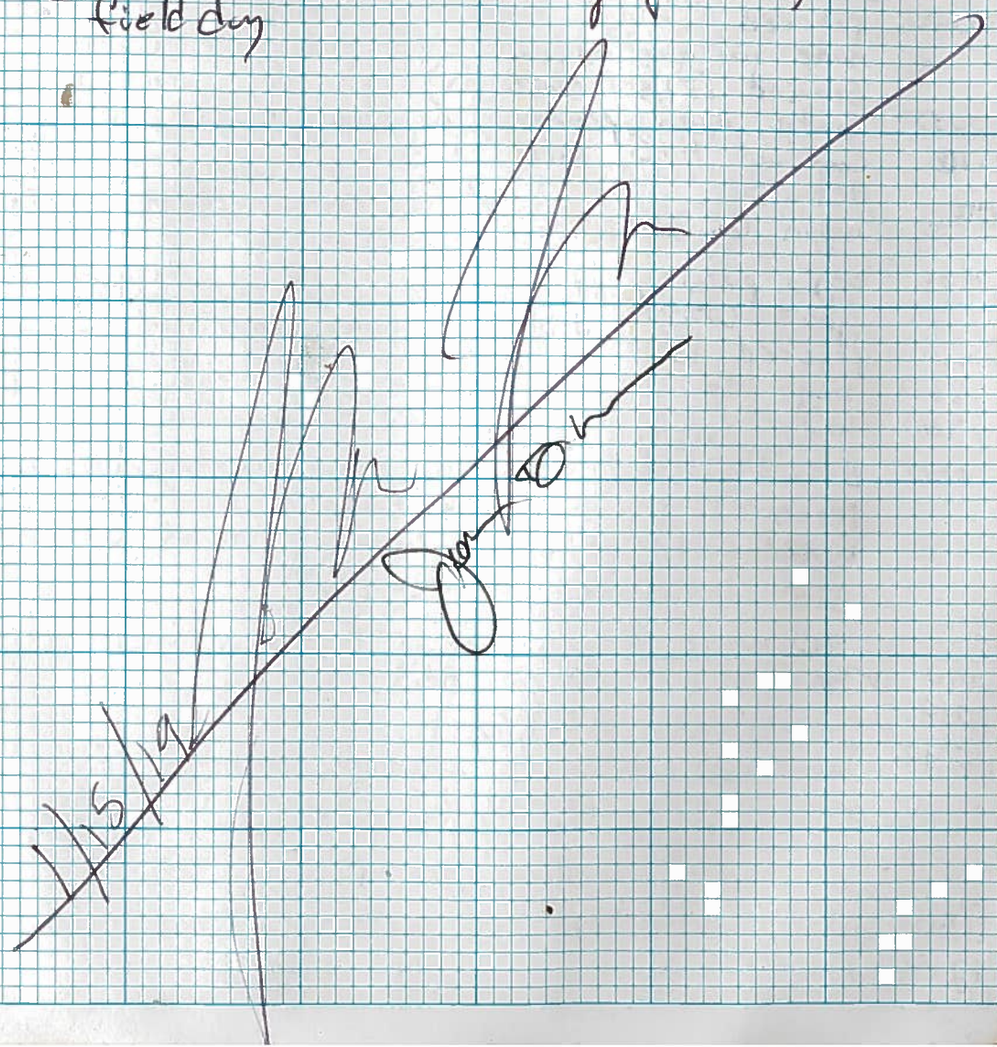
1250 begin lowering pump.

1315 begin purge/test.

1347 good water return, end test, clean up.

1415 mH departs site, RS, SF ~~the~~ IDW & Add ~5 gal to DM063

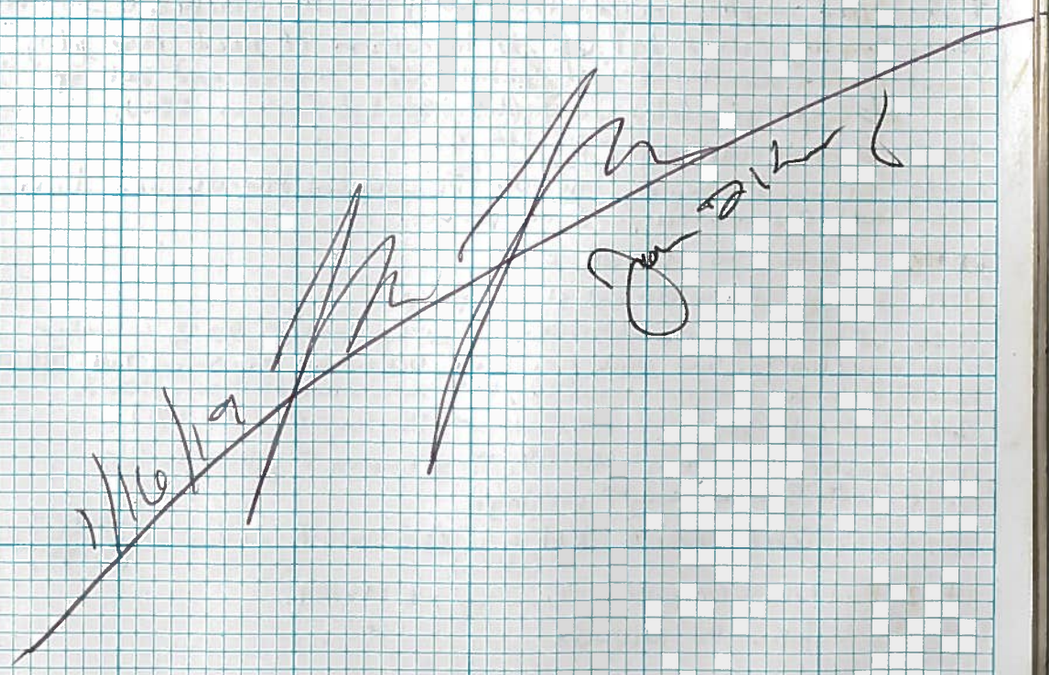
1440 @ warehouse, offload equipment, end field day



1/16/19 January LTM pump Install

0530 MH @ warehouse to load equipment. TV already loading nitrogen.
0600 SF (Jack Flaherty) @ warehouse
0610 depart warehouse & proceed to Red Hill.
Personnel: AECOM (MH, SF, RS)
objective: Install dedicated bladder pump in RHMW06 & inside tunnel wells.
Weather: Partly cloudy, 82°, light trade wind, 70% humidity.
0640 meet RS @ Red Hill gate & proceed to RHMW06, conduct H&S tailgate (see sign in sheet for details)
0650 begin installing pump @ RHMW06
0712 begin testing/purging RHMW06.
0730 good water return, clean up & mob to ~~0000225~~ OWOFMW01
0750 lower 18" bladder pump into well, ~~RS~~
0810 pump in well, did not test because Geotech controller is not sensitive enough for settings @ OWOFMW01 to reduce drawdown.
0820 RS, SF depart site. MH proceeds to Adit 6 to meet Marc Muraoka (MM)
0830 MM onsite, MH gives safety briefing (see sign in sheet for details)
0840 calibrate 5 gas meter (see cal sheet) drop 1 vehicle @ Adit 3.
0855 mob into Adit 6.
0914 Arrive @ RHMW03 Ambient readings = oxy 20.9%, LEL 0%, H_2S 0.0 ppm, CO 0 ppm, VOC = 0.0 ppm.
Headspace reading same.
0947 good water return, pack up & mob to RHMW02

0954 @ RHMW02 Ambient readings same as RHMW03. Headspace oxy 17.3% VOC's 0.7 ppm
1012 good water return @ RHMW02, pack up & mob to RHMW05.
1022 @ RHMW05 Ambient Readings same as RHMW03. Headspace same except VOC's = 0.4 ppm
1046 good WR @ RHMW05. clean up
1115 demob out of Adit 3
1130 drive up to Adit 6 and leave carts inside tunnel @ Adit 6.
1150 MM & MH add ~2 gal water to OMW03 then depart site.
1215 MH @ warehouse. end field day



0530 MH, TV, BM, KL, MM @ Warehouse to load equipment, nitrogen, and Calibrate instruments. (See cal logs for details)

600 RS, GM, CE arrive to finish loading and TV conducts H2S tailgate safety meeting. Everyone signs safety stand down and TV reviews safety procedures.

640 Leave warehouse to head to site. Check in at main gate and head to MW-06. Extensive poisoned area near MW-06, even on concrete monument when arrived.

Personnel: AECOM (GM, TV, CE, RS)
Objective: Sample wells RHMW06, 04 and 08.
Weather: No clouds, haze in sky, 72°, light trade winds, 70% humidity

0720 Set up at MW-06 to start purge. Took water levels and began pumping.

0747 Water at surface, set up SmartTroll. Began purge. See Log for details. Worked pressure up to 120 PSI.

Equipment: Water Quality Meter: In Situ SmarTroll: 558972
Turbidity - HF ScientificD3T-15C
MINIRAE: 592-917442 (PGM 7320)
Watermark Meter: N/2 OW Interface: 01-3977

757 Started SmarTroll readings, 120 PSI, Fill: 25, discharge: 25
no air being displaced.

835 Water at MW-06 stabilized. Labeled bottles and got ready for sample collection. Sample #: ERH747 (N) and ERH746 (Trip Blank) GM ~~(9:45)~~ (last collected) (8:35)

9:35 Stopped sampling, realized that tubing was still attached to SmartTroll during sampling. Called MP, JK, JJ to confirm if needs resampling. Cannot confirm decontamination of SmartTroll. Removed and set up for re-sampling. Labeled new bottles. Disposed of sample as IDW.

9:45 Started collecting ERH747 (N)

10:23 Finished sampling MW-06. Clean up at MW-06 and down water level, OW interface, and equipment.

10:48 Mobilized to MW-04.

11:10 Set up at MW-04 and started purge.

11:26 Water at Surface at MW-04. Purged for awhile, DO% saturation was over 100%. Spot check / calibrate DO sensor on SmartTroll. (98.6%)

12:05 Restarted purge. Let stabilize, DO% saturation still over 100%

12:28 Stoped purge. Spot Check/Calibrate DO sensor (97.9%)

12:40 Restarted Purge at MW-04. Purged aprox 5 gallons so far.

12:55 Restarted ~~sampling~~ on purging.

13:20 Collected sample # ERH743 (N) (13:20) @ MW04 and ERH742 (Trip Blank) (11:55)

14:02 End sample collection. Clean up at MW04.

14:10 Mobilize to MW-08.

14:30 Set up at MW-08.

1450 Start Purge at MW-08. Water at surface @ 15:00

1530 Collected ERH750 (Trip Blank) @ 15:30

1545 Finished purging, starting collecting primary sample from MW-08. Primary Sample = ERH751 @ 15:45.

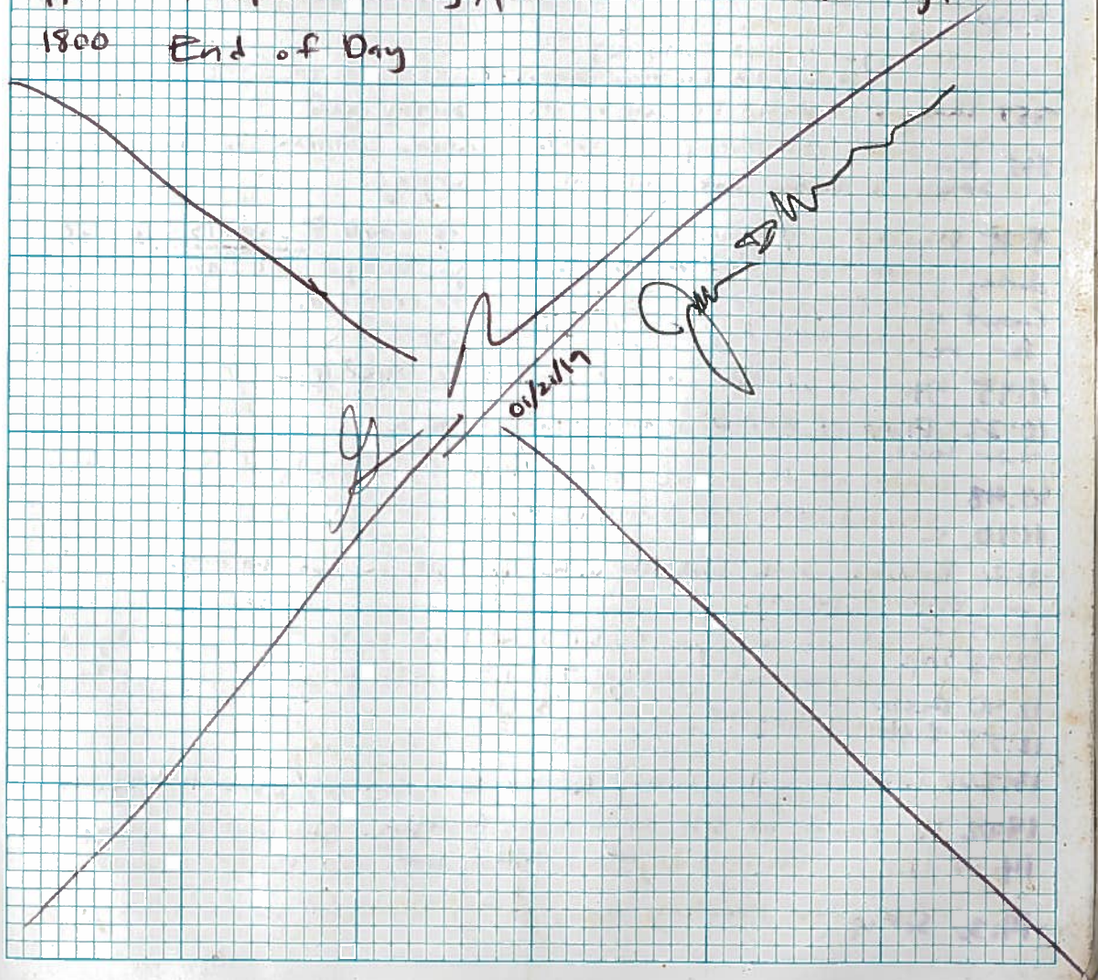
1640 Finished sampling at MW-08 and started cleanup.

1715 GM and CE take IDW to storage area. RS and TV return to warehouse to unload.

1730 GM and CE return to warehouse to help RS and TV.

1745 Finish up for the day, plan for tomorrow and sign out.

1800 End of Day



0530 MH, TV, BM, KL, and MM arrive @ warehouse to load equipment and nitrogen. MM and BM perform instrument calibrations. See calibration log for details.

600 RS, EE, GM arrive to help with loading equipment. TV conducts HASP meeting and team signs off. See tailgate safety log for details.

640 Leave warehouse to head to site. Entered vmine gate and headed to MW-09.

Personnel: (TV, GM, RS and CE)

Objective: Sample monitoring wells RHMW-09 and RHMW-10.

Weather: 80 clouds, light wind, 71°, humid.

0728 Set up at MW-09 and started purging. Took initial water level readings and started pump.

0755 Water at the surface at RHMW-09. Set up SmarTroll and began purge. See log for details. Some bubbles at first, but stopped after about 10 minutes of purging.

Equipment: Water Quality Meter: In-Situ SmarTroll: 589972

Turbidity: HF Scientific DST-156

MiniRAE: 592-917442 (PGM7320)

Water Level: N-2, Dr Interface: 01-3977

8:35 GM ~~8:55 changed~~ Calibrated DO Sensor, started purging again.

8:55 D.O. Sensor still reading over 100% saturation, calibrated again.

9:07 Changed Nitrogen tank and continued purging.

9:45 Finished purging and started collecting sample # ERH-753 @ 9:45

Stopped sample for a few minutes to change Nitrogen tank again, continued sampling. Trip Blank = ERH752 @ 9:30 collected.

10:58 Finished collecting sample at RHMW-09.

11:15 Clean up at MW-09 and mobilize to RHMW-10.

11:42 Set up at RHMW-10 and started purge.

12:27 Water at the surface at RHMW-10. Ran out of battery, while purging. Started with new battery pack.

1300 Problems with Turbidity meter. Let sit in sun to dry. Continued purging.

1323 Ran out of nitrogen. Switched to last tank. Tank was only at 1200 PSI and ran out quickly. TV left site to go to air gas to pick up more nitrogen.

1358 Purging stopped. Waiting for TV to return w/ more nitrogen.

1505 TV returns to site with more Nitrogen. Started the purge again. Had bubbles in tubing but when tested, ~~but~~ DO water reached the surface after reaching appropriate pressure, fill and discharge.

1535 Called JK and MH to try to troubleshoot problems. Attempted to reset controller and start over from 0 pressure and work up to 220 PSI. No leaks in nitrogen tubing or Controller.

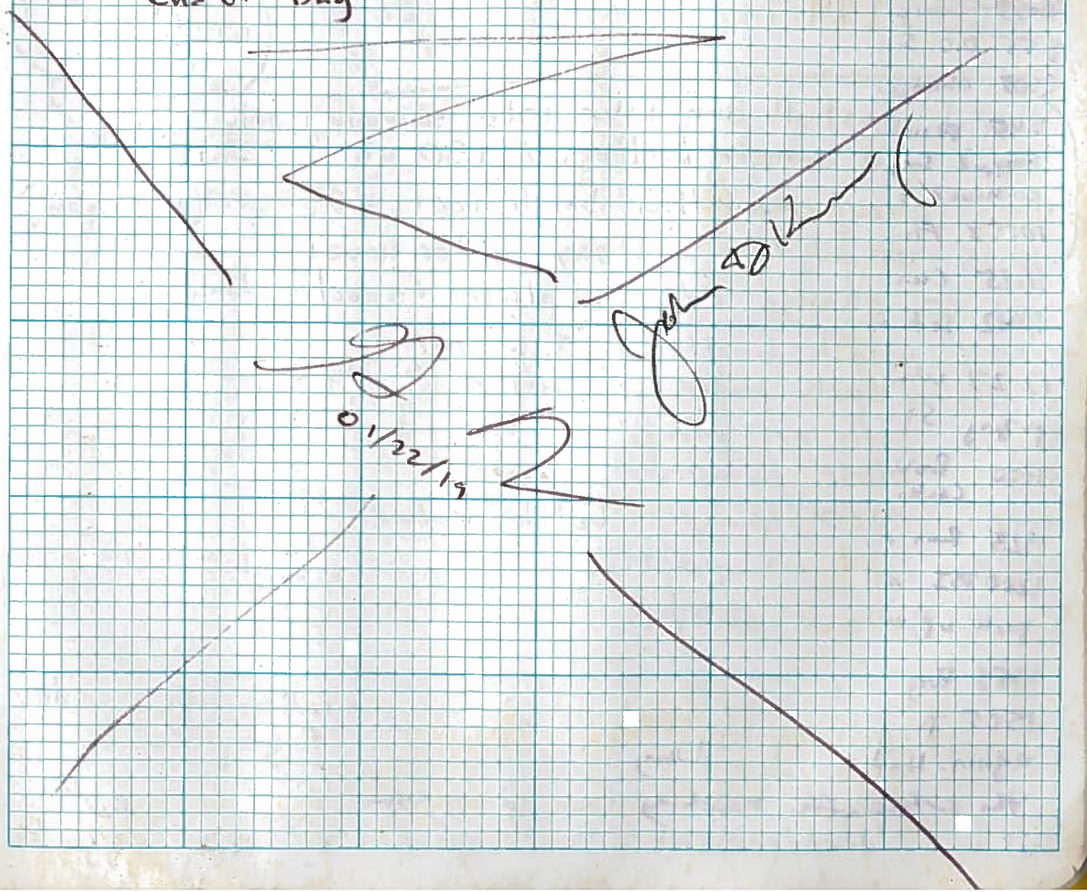
1610 Could not get water to surface. Called JK and MH to let them know the situation. Started to pack up for the day.

1645 Finished packing up at RHMW-10. ~~and~~ CE and RS took IDW to storage drums. TV and GM returned to warehouse to unpack equipment and nitrogen tanks.

1658 Arrive at Warehouse. Emptied vehicles and discussed plan for tomorrow w/ MH and KL.

1720 Finished up for the day and everyone signed out.

End of Day



0600 KL arrives at Warehouse. Help LTM group mobilize for field work. Safety stand down and tailgate Safety meeting by TV. KL, mm, Bm, GM, RS in attendance

0645 KL, mm, Bm depart for site.

0705 KL, mm, Bm arrive at site. move to Adit 6. Breather kits #2, #4, #10 all checked, all good to use. Weather ~70°F, 69% humidity mostly clear. multiRAE PGM6228 used. Ambient Outside Adit 6: 0 - VOCs, CO, LEL, H_2S, 20.9% O_2

0730 KL, Bm, mm enter Adit 6. Ambient inside: 0 - VOCs CO, LEL, H_2S, 20.9% O_2

0742 Arrive at RHMW05. Set up on well. Ambient @ RHMW05: 0 - VOCs, CO, H_2S, 20.9% O_2

0756 Begin Purging at RHMW05. MP50-1446 used. West Marine Deep Cycle #14513 Smart troll 476554, HFscientific DRT-15CE, Solinst Interface meter (apply) #122, #250750 Solinst Water level meter, model 101, Aecom N-1

0820 Trip blank for RHMW05 taken ERH744

0845 Begin sample at RHMW05 ERH745

0925 End sample at RHMW05

0935 Clean up to move.

0945 Move to RHMW02.

Scale: 1 square = _____

0954 Arrive at RHMW02. Begin set up.

1006 Begin purge at RHMW02. See log for Details.

1025 Trip Blank for RHMW02 taken ERH737

1045 Begin sample for RHMW02 ERH738 & 739

1149 end sample for RHMW02, clean up.

1215 KL, mm, Bm depart Adit 6, clean up load onto vehicles.

1230 Check in with out door team.

1240 mm & Bm take ERH738 & ERH739 to shippers. KL & RS move to IDW area to dump IDW.

1310 IDW dumped into IDW drums. RS returns to outdoor sampling team. KL departs site.

1345 KL arrives at warehouse. Unload equipment. End field work.

1430 KL, Bm, mm depart warehouse.

checked by 01/21/19

01/21/19

Scale: 1 square = _____

Rite in the Rain

LTM Sampling 01/22/2019

0600 KL Arrives at warehouse. Mobilize with LTM field team for field work.

0625 Tailgate Safety meeting by TV, CE, KL, BM, MM, GM, RS in attendance.

0645 MM, KL, BM depart for site.

0705 MM, KL, BM arrive onsite. Prep to enter Adit 6.

0725 MultiRAE recalibrated before entering Adit 6. Ambient outdoor = 0 VOCs, H2S, LEL, CO 20.9 % O2, Weather Clear ~70°F, 80% humidity

0735 KL, MM, BM enter tunnel ~~through~~ Adit 6 for RHMWO1.

0747 KL, MM, BM arrive at RHMWO1 set up. Equipment used today:
MultiRAE Pgm 8228; MP50-1446 Compressor; West-Marine Rec Cycle # 14513; Smart troll # 471554 HF Scientific DRT-15CE; Solinst Int. Water Model # 122 # 550750; Solinst WLM model 101, # Accom N-1

0759 Begin Purging at RHMWO1. See purge log for details.

0830 Trip blank taken for RHMWO1 ERH735

0919 Bubbles in line from down hole. Pump pulled.

0936 Pump pulled again. Pump disassembled and checked No issues observed. Reassembled and dropped back in.

Scale: 1 square = _____

0945 Purge resumed.

1000 Bubbles from down well stopped.

1012 Begin taking parameters again

1210 RHMWO1 parameters stable. Begin sample.

KL 01/24/19 ~~1345~~ ERH736

1345 end sample at RHMWO1. clean up.

1350 move to RHMWO3.

1404 Set up on RHMWO3.

1421 Start purge at RHMWO3.

1430 Trip blank taken for RHMWO3 ERH740

1515 Begin sample at RHMWO3 ERH 741

1539 End sample at RHMWO3. Clean up.

1600 Exit Adit 6. load up vehicles.

1615 Drop IDW water into IDW Drum at IDW area.

1630 Drop cargo carts at Adit 3.

1640 KL, MM, BM depart site.

1710 KL, MM, BM arrive at warehouse. Unload. End Field work.

checked by 01/22/2019
01/24/2019

Scale: 1 square = _____

Rite in the Rain

0600 KL arrives at Warehouse. Load up vehicles with LTM team.

0635 Tailgate safety meeting by TV. KL, CE, MM BM, GM, RS in attendance.

0645 KL, BM, MM depart warehouse for site

0705 KL, BM, MM arrive onsite. Load to enter Adit 3. Ambient air outside Adit 3: 0.0 - VOCs, CO, H_2S, LEL, 20.9% O_2

0715 KL, BM, MM enter tunnel. move equipment to pump house door.

0730 Ambient Air pump house door 0.0 - VOCs, CO, H_2S, LEL, 20.9% O_2

0735 KL, BM, MM exit Adit 3 to wait for escort. Melvin Muraoka (Navfac) onsite.

Weather: Clear ~70°F 81% humidity

Equipment used today:

Multirae PGM6228, MP50-144% compressor, West marine Battery #144512, Smart Troll #592205 HTScientific DRT-15CE, Solinst Int Meter Model 122 #250750, Solinst WLM model 101 Aecom #N-1

0750 Ken (UFM escort) onsite. KL, BM, MM re-enter adit #3 with Ken (UFM) & Melvin Muraoka (Navfac)

0758 Arrive ~~at~~ KL 1/23/19 in Pump house. Set up for sampling. Begin purge. Pump MP3 running in pump house.

0845 Trip Blank taken for RHMW2254-01 ER#7729

0845 (cont.) JK, TH, DM - (AECOM) arrive at pump house for site walk. with Darren Uchima (NAVFAC)

0910 Begin Sampling RHMW2254-01 ER#7730 (N+MS/MSD) ER#7731 Dup

0920 JK, TH, DM (AECOM) + Darren Uchima (NAVFAC) depart pump house.

1049 End Sampling RHMW2254-01

1110 Exit Adit 3. Melvin Muraoka (NAVFAC) offsite.

1150 KL, BM, MM join Outside team (GM, TV, CE, RS)

1210 KL, RS, MM move up to RHMW10 to pull and diagnose pump. BM to run samples when RHMW07 is finished.

1330 RHMW10 pump pulled. tubing and pump loaded in truck to take back to warehouse.

1345 KL, RS, MM join outdoor team at OWDFMW01

1415 KL, MM, BM depart site for warehouse.

1430 KL, MM, BM unload at warehouse.

1500 KL, MM, BM end work

Checked by 01/23/19 01/23/19

Scale: 1 square = _____

Rite in the Rain

0600 KL Arrives at warehouse Load up vehicles with LTM team. Breather kits #2, 4, 10 okay

0630 Tailgate Safety meeting by KL, MM, BM in attendance. Depart for site

0645 Arrive at site (Adit 3). Weather ~70°F Clear

Ambient air outside adit 3: 20.9 O_2, 0-VOC; CO, H_2S, LEL

0700 KL, BM, MM enter tunnel at Adit 3 to load equipment in.

0728 KL, BM, MM return ~~to~~ KL 1/24 out of tunnel. Wait for escort.

Equipment used for day:

Multi RAE PGM 6228; MPSO-1446 Compressor; West Marine Deep Cycle Battery #14512; Smart Troll #592203; HF Scientific DRT-15CE; Solinst Int. Meter Model 122 #230750; Solinst WLM model 101, Aecom N-1

0730 Tracy Miyamoto (NAVFAC) arrives.

~~0735~~ ~~0740~~ KL 1/24/19 Ken (UEM) arrives. All enter Adit 3. (KL, MM, BM, T. Miyamoto, Ken (UEM))

Ken (UEM) says pumps have been off since around 0500 (1/24/19).

0755 arrive at RHMW2254-01 in RH pump house to set up.

0821 Begin Purging RHMW2254-01. See log for Details

Scale: 1 square = _____

0815 Trip Blank taken for RHMW2284-01, pumps OFF ERH732

0845 Stabilization reached. Begin Sampling RHMW2254-01 pumps OFF ERH733 (N/MS/MSD) and ERH734 (Dup)

1019 End sampling RHMW2254-01.

1045 KL, BM, MM & Tracy Miyamoto (NAVFAC) exit tunnel at Adit 3. Tracy Miyamoto Departs site.

1100 KL, BM, MM load equipment into vehicles.

1115 KL, BM, MM move up to IDW area to Pump purge water.

1130 KL, BM, MM depart site.

1200 KL, BM, MM arrive at warehouse. Remove tunnel supplies.

1300 End work.

Checked by:
Kristina Mang 01/24/19
01/24/19

Scale: 1 square = _____

Rite in the Rain

Location RHSF Date 01/23/19

Project / Client January LTM October Sampling

0530 TV, CE, and GM at warehouse to load equipment and nitrogen. CE and GM perform morning calibrations. See cal log for details. One of the Smar Troll battery reciever was not turning on even after battery changes. TV pressure checked regulator and hose.

0600 KL, MM, BM, RS arrive at warehouse to finish loading supplies. TV conducts Tailgate safety HES meeting. See sign in log for details.

0630. Could not get SmarTroll working. Let MH know and he called HER for replacement Horiba unit. Working SmarTroll was given to tunnel team.

0720 Arrive onsite, set up at RHMW-07. Had to wait for Joel to arrive with new water quality meter. Evidence of herbicide in area around RHMW-07.

0845 HER arrives at front gate to drop off Horiba. Team begins RHMW-07 with water levels and set up. GM calibrates Horiba Quality Meter.

0918 Started purge at RHMW-07. Water at surface at 9:27. Took a long time for parameters to stabilize. See log for details. Turbidity meter arrived onsite. Switched to DRT-15CE meter for turbidity ~~meter~~ readings. Trip Blank ERHH48@ 11:25

11:30 Collected RHMW07 sample: ERH749

@11:30, GM asked workers to move at OWDFMW01. Workers moved vehicle for set up.

Location RHSF Date 01/23/19

Project / Client January LTM October Sampling

12:13 Finished collecting sample at RHMW07. Cleanup and mobilized to OWDFMW-01.

Objective: Sample wells RHMW07 and OWDFMW-01.

Personnel: AECOM (GM, TV, CE, RS)

Weather: 79°F, pct cloudy, light winds, humid.

Equipment: Water Quality Meter @RHMW07 was Horiba U52 = RTOT3K89

Water Quality Meter@ OWDFMW-01 was

SmarTroll MP = 589976

Mini RAE = 592-917442

Water Level Meter: N-2, OW Interface: 01-3977

12:40 Set up at OWDFMW-01. KL and team (MM, RS) went up to RHMW-10 to pull pump. GM, BM, TV, and CE started at OWDFMW-01.

GM ~~12:50~~ 13:16 Started OWDFMW-01 purge.

13:21 Water at Surface, started parameter readings. See sample log for details.

KL, MM, and RS returned to well.

14:00: KL, MM, and BM return to warehouse. RS returns to OWDFMW-01 to take BMs place. Had to adjust flow rate several times to ensure no draw down. Stabilized at a flow rate of 80mL/min.

Location RHSF Date 01/23/19

Project / Client January LTM October Sampling

15:25 Started collecting sample at OWDPMW-01 Sample # ERH757. Trip Blank was also collected at 15:20, Sample # ERH756. Had to change out Nitrogen tank just as sample collection started. Checked with MH to ensure it's fine to sample.

GM ~~TB~~ 17:40 Finished collecting sample at OWDPMW-01. Started cleaning up site. CE took IDW to storage area.

18:03 Packed up and left site.

18:20 Arrive at warehouse. Unpack vehicles into warehouse and unload nitrogen tanks.

18:35 End of Day. GM, TV, RS, CE signed out.

01/23/19

Location RHSF Date 01/24/19

Project / Client January LTM October Sampling

0530 TV and MH were at the warehouse to test tubing and change bladder for the RHMW-10 pump set up. GM and CE arrived at warehouse to calibrate equipment. See calibration log for details.

0600 KL, MM, and BM arrived at the warehouse. All teams start to load equipment. TV loads Nitrogen tanks to return and pick up new GM at Airgas.

0625 Teams leave for site. GM and CE ~~Lead~~ enter front gate and have the gate at the top of the hill opened.

0645 TV arrives at front gate to pick up RS and they drive up to RHMW-10 to meet GM and CE.

0700 Whole team meets at well area. TV conducts tailgate safety meeting and discusses hazards of deep well. Team sets up at well and deploys RHMW-10 into well. CE mentions to TV that she has pinched her left hand during work. Pinch is very small and no first aid was required. TV will report minor incident to Industry safe.

0900 Started purge at RHMW-10.

0935 Well at surface. Narrowed down flow rate and then ran out of Nitrogen.

Rite in the Rain

Location RHSF Date 01/24/19

Project / Client January LTM October Sampling

10:00 Replaced Nitrogen tank and restarted controller at low pressure / fill / discharge. Resumed purging of well.

10:20 Water at surface again. Set flow rate to aprox 225mL/min for parameter check and sampling. Started to take readings for sampling.

11:20 Recalibrated RDO sensor on SmartTroll. Continued taking readings.

12:40 Started collecting sample at RHMW-10.

TB Sample = ERH754, Primary Sample = ERH755 (GM)

During sample collection, had to stop to switch out Nitrogen tank twice. Battery died during sampling. Had to switch to 2nd battery.

14:29 Finished collecting ERH755. CE took samples to gate to meet DH and MD. DH and MD took samples to FedEx.

14:53 Packed up at RHMW-10. Pulled pump and tubing out of well.

15:25 Finished at RHMW-10. TV leaves site to return Nitrogen tanks to airgas. GM and RS take IDW to storage area. CE returns to warehouse to start unloading.

15:33 Leave site to return to warehouse.

15:58 Arrive at warehouse. Start unloading all supplies and equipment.

Location RHSF Date 01/24/19

Project / Client January LTM October Sampling.

16:40 Finished unloading equipment and supplies. Discuss tasks for pulling pumps on 1/25/19.

17:00 All team members signed out on Tailgate Safety form. See log for details

17:10 End of Day

01/24/19

Location RHSF Date 01/25/19

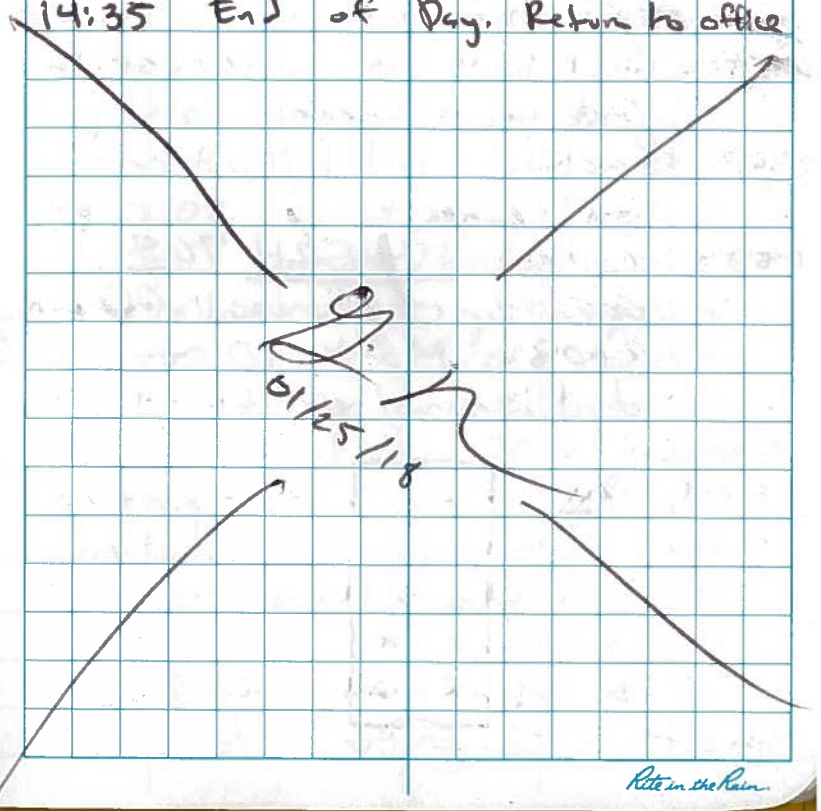
Project / Client January LTM October Sampling

9:35 Arrive at warehouse. GM meets TV and RS. Team packs supplies for the day.
Objectives: Pull tubing and pumps from wells 04, 08, 09, 07, 06, and OWDFMW-01
Personnel: AECOM (GM, TV, and RS)
Weather: 82°, sunny/prt. cloudy, humid.
10:05 Arrive onsite and check in with front gate.
10:20 Drive up to RHMW-09. TV conducts tailgate safety meeting. See log for details.
10:35 Set up at RHMW-09 and pulled pump from well.
11:10 Set up at RHMW-08 and pulled pump from well.
11:42 Set up at RHMW-07 and pulled pump from well.
11:58 Talk to Guard shack to have the gate opened that leads to RHMW-04.
12:08 MH arrives onsite to drop off additional supplies.
12:24 Proceed to RHMW-04 and pulled pump from well.
13:05 Set up at RHMW-06 and pulled pump from well.

Location RHSF Date 01/25/19

Project / Client January LTM October Sampling

13:37 Set up at OWDFMW-01 and pulled pump from well.
13:45 TV heads back to warehouse. GM and RS go up to IDW storage label to add side label to drum.
14:23 Arrive back at warehouse and unload pumps, spools and equipment. Team signs out of tailgate safety log.
14:35 End of Day. Return to office



Rite in the Rain

Location Red Hill Date 1/30/14

Project / Client RHMW14 soil IDW sampling ROOB

0600 MH & CE @ ware house, load equipment

0630 MH conducts H+S tailgate briefing, see sign in sheet for details.

0640 depart warehouse and proceed to red Hill.

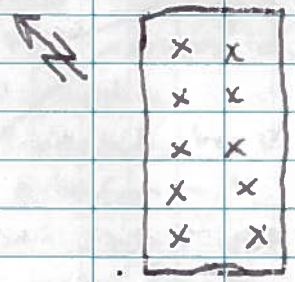
0710 At red Hill RHMW14 staging area, heavy rain

0720 head back to warehouse to grab rain gear

0800 back @ red hill, decon hand auger

0825 collect TB ERH 768

open up IDW Rolloff bin ROOB. Mark 10 ~~evenly~~ (MH) locations w/ pin flags.



x = pin flag location

Location Date

Project / Client 1/30/14 cont.

pin flag locations are slightly more concentrated (i.e. closer together) on South west side of rolloff because soil pile is higher there.

0845 collect primary and split samples ERH 769

primary = 1 gal size ziplock and 6 x 4oz ambers preserved w/ 25 ml methanol. 5 x 5g terra core plugs of soil were put in each of the 4 oz ambers.

split sample bottle cost is the same as the primary.

split samples were collected from the same intervals.

a total of 30 increments were collected. At each (MH) pin flag location, an ~~IDW~~ incremental sample was taken from the top 1/3, middle 1/3, & bottom 1/3 of the soil in roll off. using a hand auger.

Rite in the Rain

Location _____ Date _____

Project / Client 1/30/19 cont.

terra core plugs were collected from the bottom of hand auger bucket then ~100 grams was collected and placed in ziplock ~~bag~~ (MH) bag for bulk TPH c/o sample.

1130 end sampling, decon all equipment & clean up.

1150 take ~1gal decon water and add to new drum DM066.

1230 depart site, MH proceeds to warehouse.

1300 MH @ warehouse, split sample placed in refrigerator. Ref: primary sample & trip blank for shipping. End field day

weather: Rainy, 75°, 90% humidity, variable wind.

Personnel: AECOM (MH, CE)

1/30/19

Location Red Hill/HCF 2/7/19 Date

Project / Client ~~RE~~ (MH) HDMW2253-03

0600 MH & BM @ warehouse to load equipment & calibrate, see callogs for details

0630 RS @ warehouse to help load up.

objective: collect GW sample from HDMW2253-03

personnel: AECOM (MH, BM, RS)

Equipment: Insitu smartroll S/N 589972
RAE miniRAE 3000 PID S/N 920683
HF scientific Turbidimeter (no S/N)
Navy calibrated WL meter N2
HERON DW interface Pine S/N 16504
manufacture S/N 01-3977

0640 MH conducts H&S tailgate, see sign in sheet for details.

0705 depart warehouse, proceed to HCF.

0725 Arrive @ HCF, sign in & wait for Patrick Casey (PC) of CWRM.

weather: Rainy, 75°, variable light wind

0755 Patrick Casey & USGS @ HCF

0800 mob to HDMW2253-03

0805 Open well head.

Rite in the Rain

Location _____ Date _____

Project / Client 2/7/19 cont.

PID headspace = 0.0 ppm
Ambient = 0.0 ppm.

0815 USGS removing pressure transducers, will take back to their office to download.

0827 USGS DTW in well = 205.76' btoc. Measured w/ steel tape.

0835 AECOM begins lowering pump into well. USGS departs site.

0844 depth to water w/ ow interface = 205.87' btoc

0847 DTW w/ calibrated WL meter W2 = 205.84' btoc.

0855 attempt to begin purge but controller not working. Trouble shoot w/ Geotech Denver.

0935 controller working. Problem was a stuck solenoid. Begin purge.

0941 water @ surface, see purge logs for more details.

*Late Entry 0740 collect TB ERH 740

1045 parameters stabilz collect ERH 741. Note that geophysical toning is ongoing at nearby

Location _____ Date _____

Project / Client 2/7/19 cont.

RH TB01 ~20ft - 100ft away spray paint is being used to mark lines found. Occasional paint odor in the air @ HDMW2257-03. PID does not read any higher than 0.0 ppm.

1125 end sampling, clean up + pull pump.

1155 USGS onsite to install transducer in well.

1205 AECOM waits for USGS to finish so they can ~~pull~~ MH remove tent.

1208 205.80' = USGS DTW btoc w/ steel tape

1220 take down tent + depart site MH takes ~6 gal H_2O to IDW staging area + adds to DM065. DM + RS head to warehouse to pack samples. DM065 ~25% full

1310 All @ warehouse, end field day

2/7/19

Rite in the Rain

0520 MH + TV @ warehouse to load equipment & calibrate (See cal logs for details)
0600 BM + GM @ warehouse to help calibrate
0625 MH conducts hits tailgate. See sign in sheet for details.
0640 All depart warehouse & proceed to RHMW11
weather: 80° 70% humidity, mod. breeze wind, partly cloudy
personnel: AECOM (MH, GM, TV, BM)
objectives: Collect GW sample from RHMW11 zone 5, Run pressure profile, collect EB & FB from sample canisters.
0700 sign in w/ HCF & proceed to RHMW11 & set up.
0810 open well VOC's in headspace = 0.0 ppm, ambient = 0.0 all other parameters (CO, H_2S, CH_4, O_2) normal.
0745 begin pressure profile
0750 collect TB ERH 763
0800 fill 1 set of 4 sample canisters w/ DI water (1L) & purge w/ nitrogen. Recovered full volume of water, nitrogen flush complete, (use this set of nitro purged canisters for measuring parameters)
0925 pressure profile complete, send Nitro purged canisters down hole to collect parameters.
0930 trouble shooting evacuation pump.
0956 pump working, send canisters down to zone 5. for collecting parameters,
1020 setting up to send 2nd sample canister string down hole, routinely getting motor function error when 'shoe out' suspect mag. II problem not probe problem per instruction from Dave Larsen (Westbay). Change to re-tool mag. logger and set it up as a probe controller. Problem arises because mag. logger is reading atmospheric pressure not probe pressure, wait to get phone call back from Westbay to see if it can read probe pressure.
1100 using mag. II data logger but has intermittent problems w/ reading pressure

Westbay unable to diagnose over phone.
1200 resort back to using mag. II interface. Westbay says motor error message is a known problem and they have updated the firmware to fix it. Will send firmware update to MH, Westbay says its ok to use mag. II for sampling. AECOM resumes sampling w/ mag. II.
*Late Entry 0910 collect ERH 764
*Late Entry 1040 collect EB/FB trip blanks ERH 760
*Late Entry 1100 collect EB ERH 761
*Late Entry 1045 collect Field Blank ERH 762
Note that designated Equipment blank & Field blank ERH numbers have switched.
1344 after 48 liters removed from zone 5, very slight organic odor present in sample. Smell continues through remainder of samples (PAH's, SVOCs, poly's, & DOC) No detections in 5-gas meter.
1533 end sampling, clean up site & decon equipment.
1615 depart HCF, MH TV to warehouse, GM + BM take ~3 gal IDWs and Add to drum DM 064
1650 MH + TV @ warehouse
1710 GM + BM @ warehouse, End field day

1/28/19

(82) 1/29/19 Rtmwll Transducer String Install

0545 MH @ warehouse, TK already loading equipment. MH attempting to download new firmware update for MAGI II. Unsuccessful because administrator password needed for computer.

Objective: install Modax pressure probes in zones 1 through 7. Open pumping port 5.

Personnel: AECOM (MH, TK, BM, GM)

Weather: 80°, 70% humidity, partly cloudy, strong trade wind.

0630 GM + BM @ warehouse, conduct HAS tailgate (see sign in sheet for details)

0650 depart warehouse + proceed to HCF

0710 sign in w/ HCF + proceed to Rtmwll + begin setting up. MH adds 5 gal DI water to westbay center tube to bring P_i + $P_{outside}$ to near equilibrium so formation water does not flood into center tube too fast.

0810 use sampler probe EMS 5285 to measure ~~pressure~~ in center tube @ 50.28 psi ($P_{outside}$ ≈ 35 psi.)

*late entry: GM departs site @ ~ 0750 to get supplies from warehouse.

0900 GM returns to site. MH pressurize sample canister to 300 psi (25 p.i + 250 ps.) + send to zone 5 pumping port (PP)

0910 Zone 5 PP confirmed open because P_i was equalized w/ $P_{outsite}$.

Pull out sample probe + prepare transducer string. (See modax install sheet for probe assignments).

1/29/19 cont. (83)

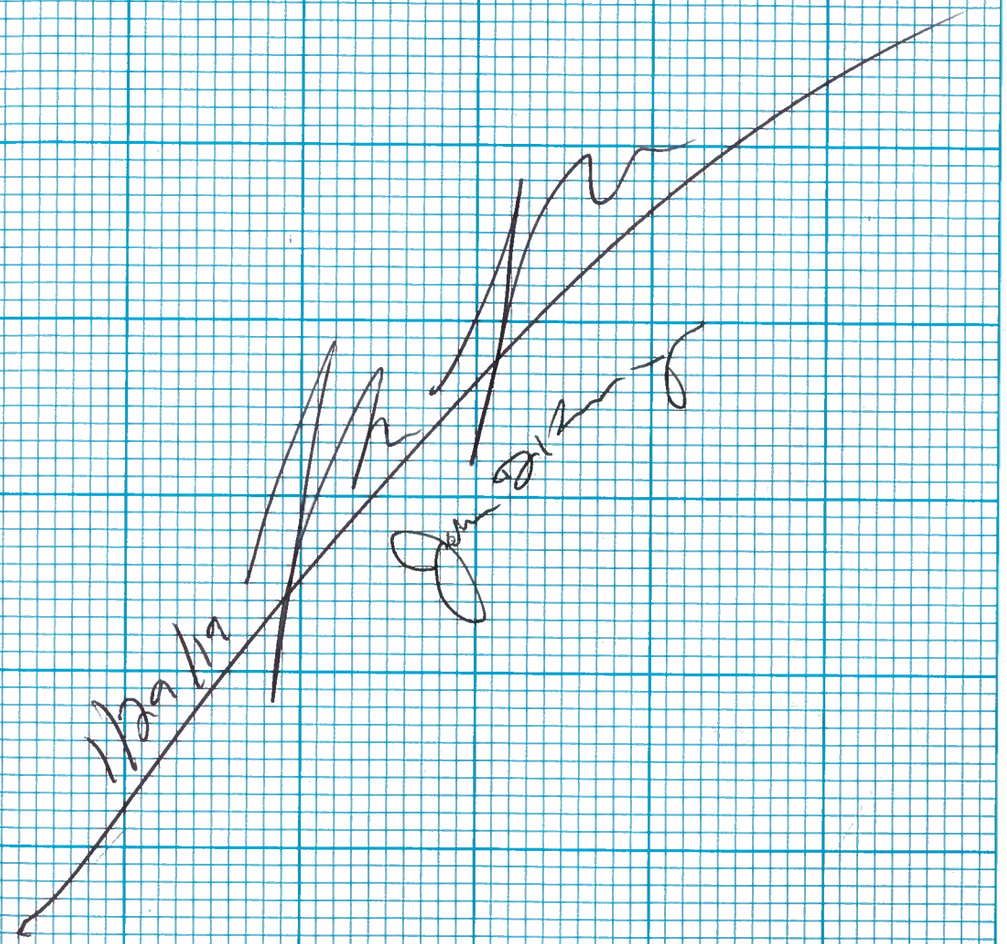
0945 begin probe string install.

1100 probes installed in zones 1 through 7. Pack up site.

1130 set data logger to record every 10 min.

1200 All depart site.

1230 back @ warehouse, end field day



For Participant

Owner: **U.S. Navy**
Tape ID: **N-1**
Make: **Solinst**
Serial number: **133795**
Length: **500 feet**
Dates: **9/13/2017 - 9/15/2017**

Table 1. Correction table for Solinst 500-foot tape (serial number 133795; tape identifier N-1), tested 9/13/2017 to 9/15/2017.

Tape interval, in feet		[1]Correction to add to depth to water, in feet
From	To	
0.00	*6.41*	*0.00*
6.42	14.02	0.00
14.03	52.17	-0.01
52.18	90.33	-0.02
90.34	128.49	-0.03
128.50	166.64	-0.04
166.65	204.80	-0.05
204.81	242.96	-0.06
242.97	392.45	-0.07
392.46	*500.00*	*-0.07*

Values in red italics are extrapolated outside the range defined by the shallowest and deepest test measurements

[1]Use of the indicated correction values is expected to improve accuracy in water-level measurements made with this tape. However, because of scatter in the calibration data, the indicated corrections for this tape may contain uncertainty on the order of 0.01 - 0.02 feet.

Table 2. Depth-to-water measurements and errors for Solinst 500-foot tape (serial number 133795; tape identifier N-1), tested 9/13/2017 to 9/15/2017.

Well site	Reference tape depth to water, in feet	N-1 depth to water, in feet	[1]Error, in feet
Halawa Kiosk	6.40	6.42	-0.02
Moanalua	17.60	17.61	-0.01
Halawa	43.37	43.39	-0.02
Waiawa	69.97	69.96	0.01
Waialae Shaft	152.41	152.44	-0.03
Kapakahi	261.97	262.04	-0.07
Waipio	392.38	392.45	-0.07

[1]Negative error indicates tape shortening; positive error indicates tape stretch

For Participant

Owner:	**U.S. Navy**
Tape ID:	**N-2**
Make:	**Solinst**
Serial number:	**133937**
Length:	**1,000 feet**
Dates:	**9/13/2017 - 9/15/2017**

Table 1. Correction table for Solinst 1,000-foot tape (serial number 133937; tape identifier N-2), tested 9/13/2017 to 9/15/2017.

Tape interval, in feet		[1]Correction to add to depth to water, in feet
From	To	
0.00	*6.40*	*0.01*
6.41	8.23	0.01
8.24	80.71	0.00
80.72	161.31	-0.01
161.32	253.61	-0.02
253.62	364.91	-0.03
364.92	516.53	-0.04
516.54	593.17	-0.05
593.18	*764.02*	*-0.05*
764.03	*1000.00*	*-0.06*

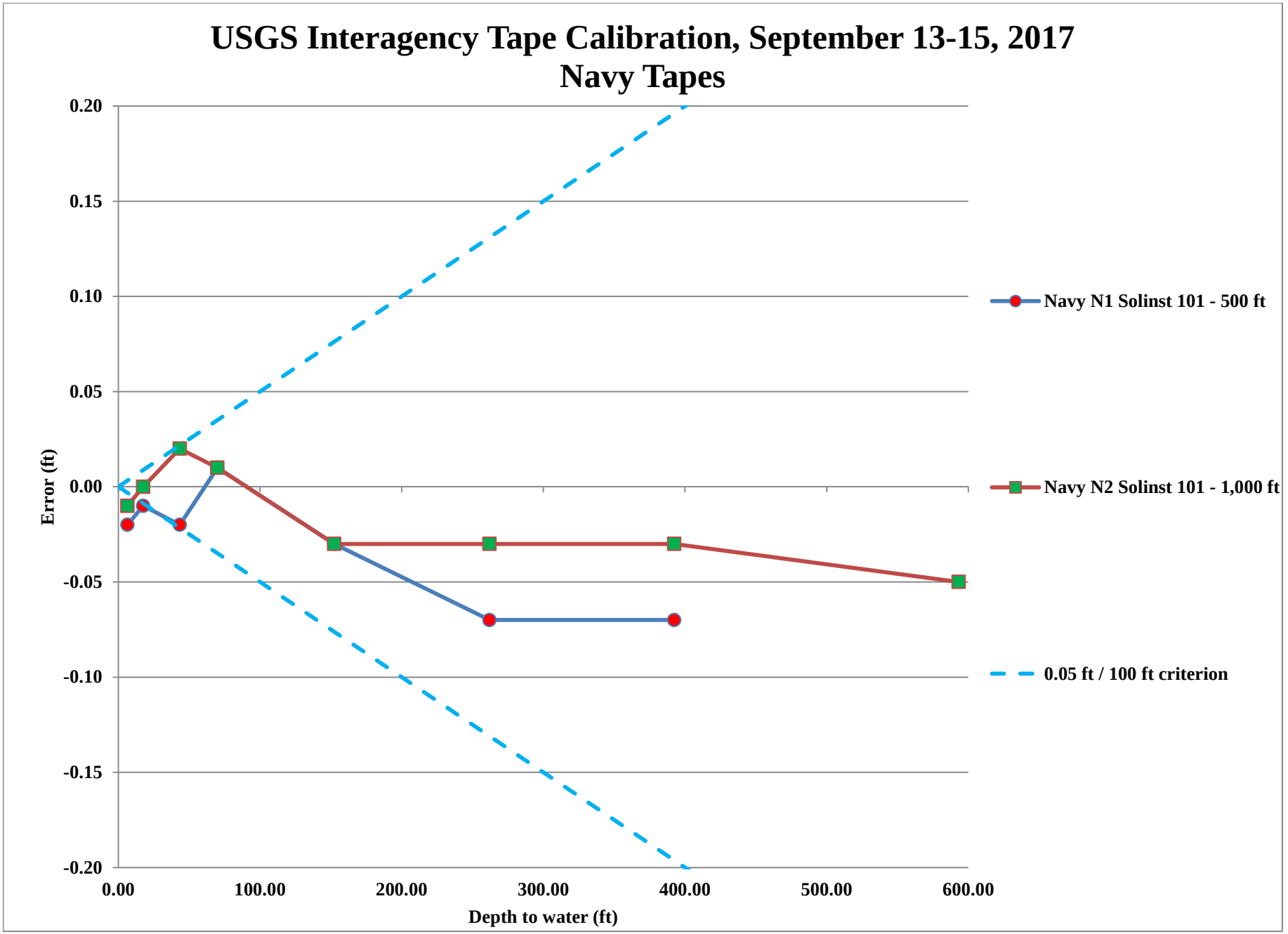
Values in red italics are extrapolated outside the range defined by the shallowest and deepest test measurements

[1]Use of the indicated correction values is expected to improve accuracy in water-level measurements made with this tape. However, because of scatter in the calibration data, the indicated corrections for this tape may contain uncertainty on the order of 0.01 - 0.02 feet.

Table 2. Depth-to-water measurements and errors for Solinst 1,000-foot tape (serial number 133937; tape identifier N-2), tested 9/13/2017 to 9/15/2017.

Well site	Reference tape depth to water, in feet	N-2 depth to water, in feet	[1]Error, in feet
Halawa Kiosk	6.40	6.41	-0.01
Moanalua	17.60	17.60	0.00
Halawa	43.37	43.35	0.02
Waiawa	69.97	69.96	0.01
Waialae Shaft	152.41	152.44	-0.03
Kapakahi	261.97	262.00	-0.03
Waipio	392.38	392.41	-0.03
Poliwai	593.12	593.17	-0.05

[1]Negative error indicates tape shortening; positive error indicates tape stretch


USGS Interagency Tape Calibration, September 13-15, 2017
Navy Tapes
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
Error (ft)
0.00
100.00
200.00
300.00
400.00
500.00
600.00
Depth to water (ft)
Navy N1 Solinst 101 - 500 ft
Navy N2 Solinst 101 - 1,000 ft
0.05 ft / 100 ft criterion

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Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: Multi RAE	Manufacturer: RAE
Serial Number: 7497	Last Service Date:
Parameter(s): CO, H_2S, CH_4, Oxy, VOC's	Calibration Gas:
Calibration Procedure: zero cal w/ charcoal filter	multi gas lot# 206587 exp Aug 2019 — H_2S 25 ppm, CO 50 ppm, CH_4 50% LEL, Oxy 19% — VOC's lot# 211952 exp Feb 2021 isobutylene 100 ppm

Daily Calibration Results	
Date: 12/12/18	Calibration Result: cal passed
Name: Mark Higley	Signature:
Notes:	
Date: 12/13/18	Calibration Result: cal passed
Name: mark Higley	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: Job No.:

Date: Operator:

Instrument: Calibration:

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Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: Turbidimeter	Manufacturer: HF Scientific
Serial Number: N/A Model ORS-15CE	Last Service Date:
Parameter(s): Turbidity	Calibration Gas:
Calibration Procedure: 0.02 NTU standard lot# 72529 Pro cal	

Daily Calibration Results	
Date: 12/12/18	Calibration Result: 0.02 Passed.
Name: Mark Higley	Signature:
Notes:	
Date: 12/13/18 ~~Mark Higley~~	Calibration Result: 0.02 passed.
Name: Mark Higley	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: Job No.:

Date: Operator:

Instrument: Calibration:

AECOM

Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: smartroll	Manufacturer: insitu
Serial Number: 589972	Last Service Date:
Parameter(s): See back of sheet	Calibration Gas: See back of sheet.
Calibration Procedure:	

Daily Calibration Results	
Date: 12/12/18	Calibration Result: passed
Name: Mark Higley	Signature:
Notes:	
Date: 12/13/18	Calibration Result: passed
Name: Mark Higley	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: Job No.:

Date: Operator:

Instrument: Calibration:

Parameter	value	lot#	exp
pH	7	C819546	11/2019
	10	C830367	11/2019
	4	C825641	11/2019
Sp Cond.	4.49 ms/cm	"	"
ORP	228 mV	C842257	11/2019
DO	100%	water saturated sponge.	

//

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Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: SmartRoll, PID	Manufacturer: Insitu, RAE
Serial Number: 589972, 592-917442	Last Service Date: 1/14/2019
Parameter(s): PH, ORP, Sp Cond, RDO	Calibration Gas: see below
Calibration Procedure: pH: 7.45, 10.18, 4.20 Sp Cond: 4573 μS/cm	RDO: 95.1% ORP: 228 mV Zero Air: 0.0 ppm Span: 100 ppm

Daily Calibration Results	
Date: 01/21/19	Calibration Result: pH: PASSED
Name: Marc Muraoka	Signature: [signature]
Notes: pH(10): C8 30367 Exp 11/2019 pH(7): C819 546 Exp 11/2019 pH(4): C82 5641 Exp 11/19 ORP: C842257 Exp 11/19	
Date: 01	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: ~~[illegible] 60559110~~ Red Hill

Date: 1/21/19

Instrument: Smartroll

Job No.: 60571032

Operator: Marc M

Calibration: passed

→ 1/21

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Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: SMARTROLL, PID	Manufacturer: INSITU, RAE
Serial Number: 589972, 592-917442	Last Service Date: 1/14/19
Parameter(s): PH, ORP, Sp Cond, RDO	Calibration Gas: ISO-BUTYLENE 100PPM
Calibration Procedure: pH: 7.46, 10.13 ORP: 228mV RDO: 95.9% Sp Cond: 4396 ms/km ZERO AIR: 0.0ppm Span: 100 ppm	

Daily Calibration Results	
Date: 01/22/19	Calibration Result: PASSED
Name: MARC MURAOKA	Signature: Marc Muraoka
Notes: pH(10): C830367 Exp: 11/19 pH(7): C819546 Exp: 11/19 pH(4): C825641 Exp 11/19 ORP: C842257 Exp 11/19	
Date: 01/22/19	Calibration Result: PASSED
Name: Caitlin Ellis	Signature:
Notes:	
Date: ~~1/24/19~~	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: Red Hill
Date: 1/22/19
Instrument: water quality meter PID

Job No.: 60571032
Operator: ~~Mark M~~ Marc Muraoka
Calibration: passed

AECOM

Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: Mini RAE 3000	Manufacturer: RAE SYSTEMS
Serial Number: 592-917442	Last Service Date: 1/14/19
Parameter(s): VOCs, fresh air	Calibration Gas: Isobutylene 100 ppm, fresh air
Calibration Procedure: Span cal with: Isobutylene 100 ppm - 213264# Lot, July 2021 fresh air calibration	

Daily Calibration Results	
Date: 1/23/19	Calibration Result: passed
Name: Caitlin Ellis	Signature:
Notes:	
Date: 1/24/19	Calibration Result: 0.0 ppm / 100.0 ppm
Name: Mark Higby	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: RED HILL
Date: 1/23/19
Instrument: Mini RAE

Job No.: 60571052
Operator: Caitlin Ellis
Calibration: passed

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Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: Turbidimeter DRT-15CE	Manufacturer: HF scientific, inc
Serial Number: N/A	Last Service Date: —
Parameter(s): turbidity	Calibration Gas: 0.02 NTU
Calibration Procedure: LINED UP lowest READING on REFERENCE vial @ 0.02 NTU	

Daily Calibration Results	
Date: 1/24/19	Calibration Result: Passed
Name: Caitlin Ellis	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: 60471032 RED MILL
Date: 1/24/19
Instrument: Turbidimeter

Job No.: 60571032
Operator: CE, RS, GM
Calibration: Passed

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Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: Smar Troll MP	Manufacturer: In-Situ Inc.
Serial Number: 589972	Last Service Date:
Parameter(s): pH, ORP, ~~Turbidity~~, Sp Cond, DO	Calibration ~~Gas~~ Liquid: pH 10: Lot# C830367 Exp: 11/2019 pH 7: Lot# C819546 Exp: 11/2019 ORP ~~Auto Cal~~: Lot# C842257 Exp 11/2019 Auto Cal: Lot# C825641 Exp: 11/2019
Calibration Procedure: Start with pH, 7, 10, and then 4 (w/ Auto Cal) Calibrating one at a time. ~~Started~~ with rest of auto cal next. Calibrated specific conductivity. Lastly, calibrated ORP ~~solution~~ sensor. Rinsed sensors in between each calibration.	

Daily Calibration Results	
Date: 01/23/18	Calibration Result: pH: 7.52 → 7.0, 10.10 → 10.0, 4.62 → 4.0 Sp Con: 4330 → 4490 mS/cm ORP: 198.5 → 228 mV do%: 95.3 → 100%
Name: Gavin Mura	Signature: Gavin Mura
Notes:	
Date: 01/24/18	Calibration Result: pH: 7.43 → 7.0, 10.01 → 10.0, ~~4.70~~ 4.64 → 4.0 Cm Sp Con: ~~4226~~ → 4490 ORP: 231 → 228
Name: Gavin Mura	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: Red Hill Bulk Fuel Storage

Job No.: 60571032

Date: 11/23/18

Operator: GM, RS, TV, and CE

Instrument: In Situ Smar-Troll

Calibration: passed

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Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: Horiba U-52	Manufacturer: Horiba
Serial Number: RTOT3KB9	Last Service Date:
Parameter(s): pH, turbidity, SpCond., DO,	Calibration ~~Gas~~ Liquid: Auto Cal Solution Lot# CS25641 Exp. 11/2019
Calibration Procedure: Perform Auto calibration with Auto Cal Solution. Dip probe in solution and give 5-10 minutes for all parameters to calibrate. Write down difference between Auto cal solution and readings.	

Daily Calibration Results	
Date: 11/23/19	Calibration Result: pH = 3.[illegible] → 4.0, Turbidity 0.0 → 0.0 Sp Cond. 4.51 → 4.49
Name: Gavin Mura	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: Red Hill Bulk Fuel Storage

Job No.: 60571032

Date: 11/23/19

Operator: GM, TV, CE and KS

Instrument: Horiba U-52

Calibration: passed

AECOM

Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: Smart Troll MP	Manufacturer: In-Situ Inc.
Serial Number: 589972	Last Service Date: 2/5/19
Parameter(s): see below	Calibration Gas: see below
Calibration Procedure: Do-Sponge BM pH 7 → Lot# C819546 exp 11/2019 pH 10 → Lot# C830367 exp 11/2019 pH 4/SP 4.49 mS/cm → Lot# C825641 exp 11/2019 ORP +228 mV → Lot# C842257 exp 11/2019	

Daily Calibration Results	
Date: 2/7/19	Calibration Result: pH 7 → 7.04 ✓ pH 10 → 10.00 ✓ pH 4 → 4.65 ✓ SP 4.49 mS/cm → 4393 mS/cm ORP 228 mV → 207 ✓ DO → 95.3%
Name: Bianca Mintz	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: 60571032
Date: 2/7/19
Instrument: Water Quality Meter

Job No.: 60571032
Operator: Bianca Mintz
Calibration: passed

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Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: MiniRae 3000	Manufacturer: Rae Systems
Serial Number: 920683	Last Service Date: 2/5/19
Parameter(s): VOCs, freshair	Calibration Gas: Isobutylene 100 ppm, freshair
Calibration Procedure: - freshair (zero cal) - Isobutylene 100 ppm → Lot # 225112 exp Jan 2022 (span cal)	

Daily Calibration Results	
Date: 2/7/19	Calibration Result: pass
Name: Bianca Mintz	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: Red Hill
Date: 2/7/19
Instrument: PID

Job No.: 60571032
Operator: Bianca Mintz
Calibration: passed

AECOM

Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: Turbidmeter	Manufacturer: HF Scientific Inc.
Serial Number: DRT-15CE	Last Service Date: ←
Parameter(s): Turbidity	Calibration Gas: NTU 0.02 Pro Cal
Calibration Procedure: Used the Pro Cal Standard bottle and rotated to find lowest value (-0.00). Set bottle to dot at -0.00 then adjusted to -0.02. Range set at 10.	

Daily Calibration Results	
Date: 2/7/19	Calibration Result: Passed.
Name: Ryan Shimoda	Signature: Ryan Shimoda
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: Parkland

Date: 2/7/19

Instrument: Turbidimeter

Job No.: 60571037

Operator: Ryan Shimoda

Calibration: Passed

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Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: MultiRAE	Manufacturer: RAE
Serial Number: MB3Z374Q7	Last Service Date: 1/14/19
Parameter(s): VOC's, CH_4, H_2S, O_2, CO	Calibration Gas: See below
Calibration Procedure: H_2S 25ppm, CO 50ppm, CH_4 50%LEL Lot# 209591 exp. Nov 19 Oxy 19% VOC's 100ppm isobutylene Lot# 211952 Exp. Feb 2021 fresh air cal.	

Daily Calibration Results	
Date: 1/16/19	Calibration Result: cal passed
Name: Mark Higley	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: Red Hill
Date: 1/16/19
Instrument: MultiRae

Job No.: 60571032
Operator: Mark Higley
Calibration: passed

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Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: Smartroll	Manufacturer: In Situ
Serial Number: 476554	Last Service Date: —
Parameter(s): pH, SP, ORP, RDO	Calibration Gas: Liquid
Calibration Procedure: pH → 7, 10, 4 ORP → 228 mV SB4409 µS/cm	

Daily Calibration Results	
Date: 1/21/19	Calibration Result: pH → 7.33 C819546 11/2019 pH → 10.22 C830367 11/2019
Name: Bianca Mintz	Signature: pH → 4.48 SP → 4411 µS/cm C825641 11/2019 11/2019
Notes:	ORP → ~~73.9%~~ C847225 11/2019 RDO ~~%~~ 192.6 mV 93.9% BM
Date: 1/22/19	Calibration Result: pH → 7.33 Lot # Date pH → 10.25
Name: Bianca Mintz	Signature: pH → 4.48 SP → 4359 µS/cm
Notes:	ORP → 140.4 mV RDO → 93.0%
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: Red Hill

Date: 1/22/19

Instrument: Smartroll

Job No.: 60571032

Operator: BM

Calibration: passed

AECOM

Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: MultiRAE	Manufacturer: RAE
Serial Number: SN 7487	Last Service Date: 1/10/19
Parameter(s): VOCs, CH4, H2S, O2, CO	Calibration Gas: See Below
Calibration Procedure: Lot# 209591 exp 1/2019 H2S 25ppm O2 19% CO 50ppm CH4 50% LEL	Lot# 211952 VOC's Exp 9/2021 100ppm isobutylene BM / freshair

Daily Calibration Results	
Date: 1/21/19	Calibration Result: cal passed
Name: Bianca Mintz	Signature:
Notes:	
Date: 1/22/19	Calibration Result: cal passed
Name: Bianca Mintz	Signature:
Notes: recal at 0730 due to error reading	
Date: 1/23/19	Calibration Result: Cal Passed
Name: Caitlin Ellis	Signature:
Notes:	
Date: 1/24/19	Calibration Result: cal passed
Name: Mark Higley	Signature:
Notes:	

Project: RED HILL
Date: 1/21/19
Instrument: MultiRAE

Job No.: ~~60481245~~, 60571032
Operator: Bianca Mintz
Calibration: passed

AECOM

Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: SmarTroll MP	Manufacturer: In Situ Inc.
Serial Number: 589976	Last Service Date: —
Parameter(s): pH, ORP, Sp Con, DO	Calibration ~~Gas~~: Liquid:
Calibration Procedure: Start w/ pH 7, 10, and then 4 (w/ Auto cal) Calibrated one at a time, rinsed sensor in between each calibration Sp. cond. 4.49 ms/cm ORP 228 mv DO moist sponge in cal chamber 100% saturation	

Daily Calibration Results	
Date: 11/23/18	Calibration Result: pH: 7.45→7.0, 10.18→10.0, 4.52→4.0 Sp Con: 4370→4490 ORP: 191.4→228 DO% 93.9→100%
Name: Gavin Mura	Signature:
Notes:	
Date: 1/23/19	Calibration Result: pH: 7.0, 10.0, 4.0 Sp Con 4490 ORP: 228 DO: 100%
Name: Caitlin Ellis	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: Red Hill Bulk Fuel Storage

Job No.: 60571032

Date: 11/23/18

Operator: GM, KS, TV, and CE

Instrument: In Situ SmarTroll

Calibration:

Cal solutions

solution	Lot #	exp.
pH 7.00	C819546	11/2019
pH 10.00	C830367	11/2019
pH 4.00	C825641	11/2019
Sp. Cond. 4.49 mS/cm	C825641	11/2019
ORP 228 mV	C842257	11/2019

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Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: Multi Rae	Manufacturer: RAE
Serial Number: MBB3Z37Q7	Last Service Date: Not available
Parameter(s): CO, H_2S, Oxy, CH_4, VOC's	Calibration Gas: see below
Calibration Procedure: Zero cal/fresh air w/ charcoal filter. • 100 ppm isobutylene Lot#211952, exp Feb 2021 • H_2S 25 ppm, CO 50 ppm, CH_4 50% LEL, Oxy 19% lot#209591, exp. Nov. 2019	

Daily Calibration Results	
Date: 1/28/19	Calibration Result: passed
Name: Mark Higley	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: Red Hill
Date: 1/28/19
Instrument: Multi Rae

Job No.: 60571037
Operator: Mark Higley
Calibration: passed

Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: Turbidimeter	Manufacturer: HF Scientific
Serial Number: N/A	Last Service Date: ———
Parameter(s): Turbidity	Calibration Gas: 0.02 NTU standard
Calibration Procedure: 0.02 NTU standard. rotated until lowest reading found, mark position and set sensor to 0.02 NTU.	

Daily Calibration Results	
Date: 1/28/19	Calibration Result: passed.
Name: mark Higley	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: Red Hill
Date: 1/28/19
Instrument: Turbidimeter

Job No.: 60571032
Operator: mark Higley
Calibration: passed

Americas

Instrument Calibration Log

S3AM-127-FM10

Instrument Information	
Instrument Name: Smartroll	Manufacturer: Insitu
Serial Number: 589976	Last Service Date: 1/14/19
Parameter(s): pH, sp.cond., ORP, DO	Calibration Gas: see back of sheet
Calibration Procedure: see back of sheet for cal solution values.	

Daily Calibration Results	
Date: 1/28/19	Calibration Result: passed
Name: Mark Higley	Signature:
Notes: pH 4.20→4.0 pH 7.2→7.0 ORP 191.3→228 pH 10.22→10.0 Sp Cond 4393 µS→4490 DO 93.1%→	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: Red Hill
Date: 1/28/19
Instrument: Smartroll

Job No.: 60571032
Operator: Mark Higley
Calibration: passed

Solution	Value	Lot #	exp.
pH	7.0	C819546	11/2019
pH	10.0	C830367	11/2019
pH	4.0	C825641	11/2019
Sp. Cond.	4.49 mS/cm	C825641	11/2019
ORP	228 mV	C842257	11/2019
DO	100% saturation w/ wet sponge in cal chamber.		

HAWAII ENVIRONMENTAL RENTAL INC.

Certificate of Calibration

Instrument Type: **MultiRae**

Serial Number: 74Q7

Calibration Gas Lot #: **988828 exp. 09/2019**

Calibration Gas	*Result*
CO 50 ppm	50 ppm
H2S 25 ppm	25 ppm
CH4 50% LEL	50% LEL
OXY 19.0% Volume	19.0% Volume
VOC 100PPM	100PPM

Calibrated by: [signature]

Calibration Date: 1-14-19

HAWAII ENVIRONMENTAL RENTAL INC.

Certificate of Calibration

Instrument Type: **MINIRAE RAE 3000** Serial Number: **917442**

Calibration Gas	Lot Number	Result
Isobutylene 100 ppm	**987369**	**100ppm**

Calibrated by: _____ Calibration Date: 1-14-19

HAWAII ENVIRONMENTAL RENTAL INC.

Certificate of Calibration

Instrument Type: **MINIRAE RAE 3000** Serial Number: **914105**

Calibration Gas	Lot Number	Result
Isobutylene 100 ppm	**987369**	**100ppm**

Calibrated by: _____ Calibration Date: 01/11/19

HAWAII ENVIRONMENTAL RENTAL INC.

Certificate of Calibration

Instrument Type: **MINIRAE RAE 3000** Serial Number: **910651**

Calibration Gas	Lot Number	Result
Isobutylene 100 ppm	**987369**	**100ppm**

Calibrated by: _____ Calibration Date: 01/02/19

Calibration Report: RDO Calibration Report
2019-01-14 09:14:49
Probe: 589972
Slope: 1.0410
Offset: -0.0000
Stability: Full

Calibration Report: ORP Calibration Report
2019-01-14 09:12:46
Probe: 589976
User Defined: 228.0 mV
Offset: 28.7 mV
Stability: Full

Calibration Report: Conductivity Calibration Report
2019-01-14 09:10:41
Probe: 589976
Cell Constant: 0.9904
Stability: Full