
Halifax Landfill 2044 Branch Road Halifax, Vermont

VTDEC Project# NS95-0165
Solid Waste Facility ID# WH280
KAS Job# 610110045

FALL 2019 SEMI-ANNUAL WATER QUALITY MONITORING REPORT

December 17, 2019

Prepared for:

Town of Halifax
P.O. Box 45
Halifax, VT 05358



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Introduction

KAS, Inc. (KAS) conducted a semi-annual water quality monitoring event on October 28, 2019 at the Halifax Landfill (Site Location Map and Site Map in Appendix A). A groundwater sample was collected from monitoring well MW-3 and analyzed for perfluorinated compounds (PFCs) via EPA Method 537 (short list). The October 2019 sampling effort was conducted in accordance with the current landfill certification. The sample was field analyzed for temperature, pH, and specific conductance using a properly calibrated YSI® Pro Multi-Meter. The depth to water was gauged using a Geotech™ water level indicator.

At the request of the Town of Halifax (Town), KAS also collected water samples from MW-4 and the Rafus residence private supply well located at 637 Hubbard Hill Road, Halifax, Vermont. Both samples were analyzed for PFCs. Sampling of MW-4 or private supply wells in the vicinity are not a current requirement in the landfill's certification or post-closure monitoring plan. Rather, the Town elected to do this sampling on a voluntary basis; the results are included herein.

Results

Field measurements

Depth to water in MW-3 was measured at 5.04 feet below top of casing (btoc). The water temperature was 10 degrees Celsius and a pH value of 7.14 standard units was recorded at the time of sampling. The depth to water, temperature and pH measurements recorded are within range of historical measurements. A specific conductance reading of 425.9 $\mu\text{S}/\text{cm}$ was noted at the time of sampling and is within range of historical fluctuations. Field measurement data is tabulated in Appendix B.

Laboratory results

Analytical testing indicated the presence of several PFCs in the groundwater sample collected from MW-3. A combined concentration of perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), perfluorohexanesulfonic acid (PFHxS) and perfluoroheptanoic acid (PFHpA) in MW-3 was reported at 105.7 nanograms per liter (ng/l) which exceeds the Vermont Groundwater Enforcement Standard (VGES) of 20 ng/l. No PFCs were detected above laboratory method detection limits in the field blank sample. Current and historical analytical data is tabulated in Appendix B and a copy of the laboratory report is provided in Appendix C.

PFC concentrations at MW-3 decreased compared to the previous sampling in May 2019 and current concentrations remain well below the peak high of 227 ng/l detected in May 2018. The data set continues to show PFC concentrations fluctuate over time. While an overall increasing trend appears apparent based on the linear trend R-square value (See Graph in Appendix B), a statistically significant trend has not been established. The figure on page 2 (Figure 1) is the concentration of total PFCs in MW-3 over time using a concentration linear trend generated by the Groundwater Spatio-Temporal Data Analysis Tool (GWSDAT Version 2.12). The solid green line shows the trend estimate and the dashed green lines are the 95% confidence intervals. The statistical significance of this trend is assessed using the Mann-Kendall trend test. If the Mann-Kendall p-value is below 0.05, then the estimated trend is statistically significantly different from 0, meaning that there is a trend within the data (GWSDAT User Manual v2.12). The Mann-Kendall p-value for MW-3 is 0.548; which is above 0.05, indicating a statistically relevant trend could not be established.

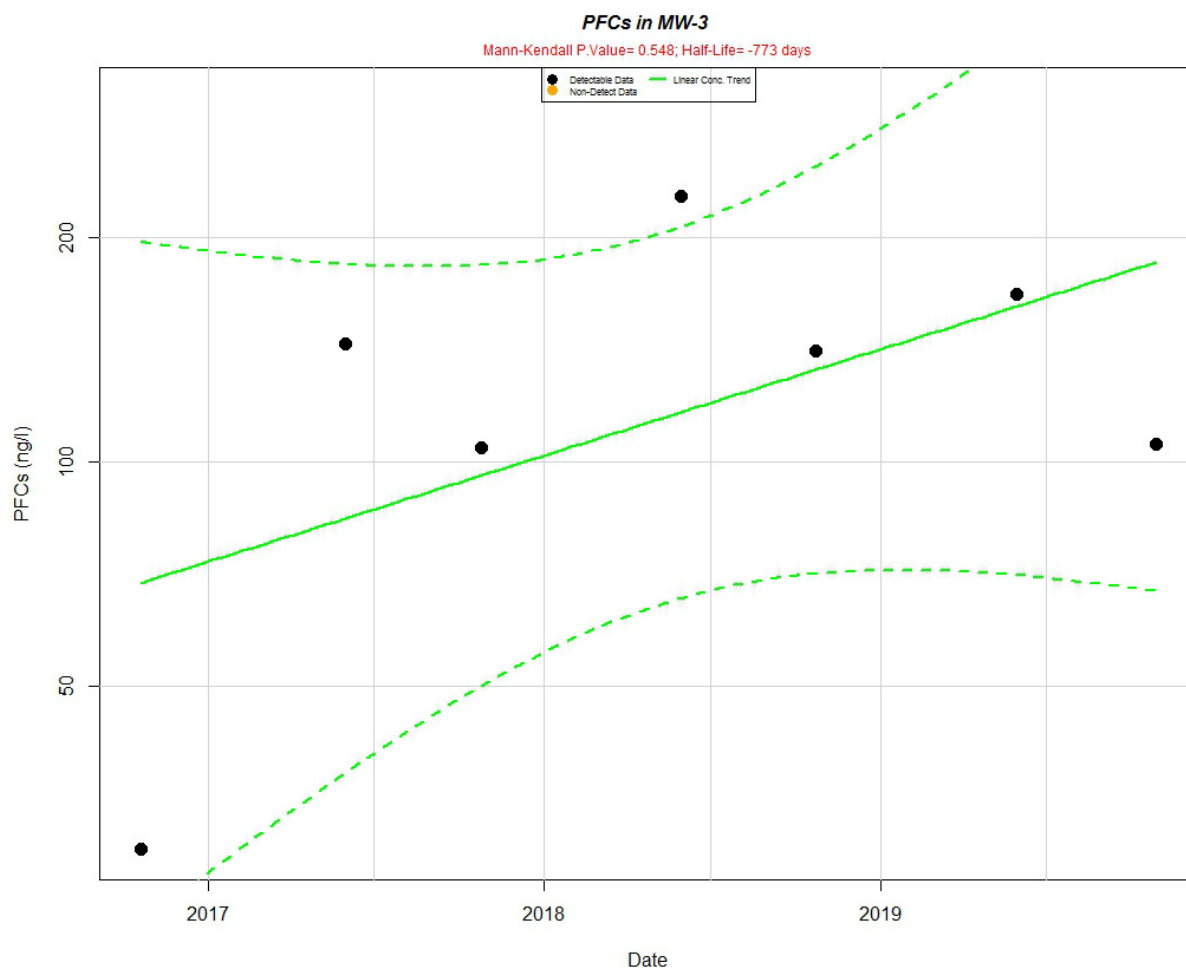


Figure 1. Total PFC concentration trend for monitoring wells MW-3

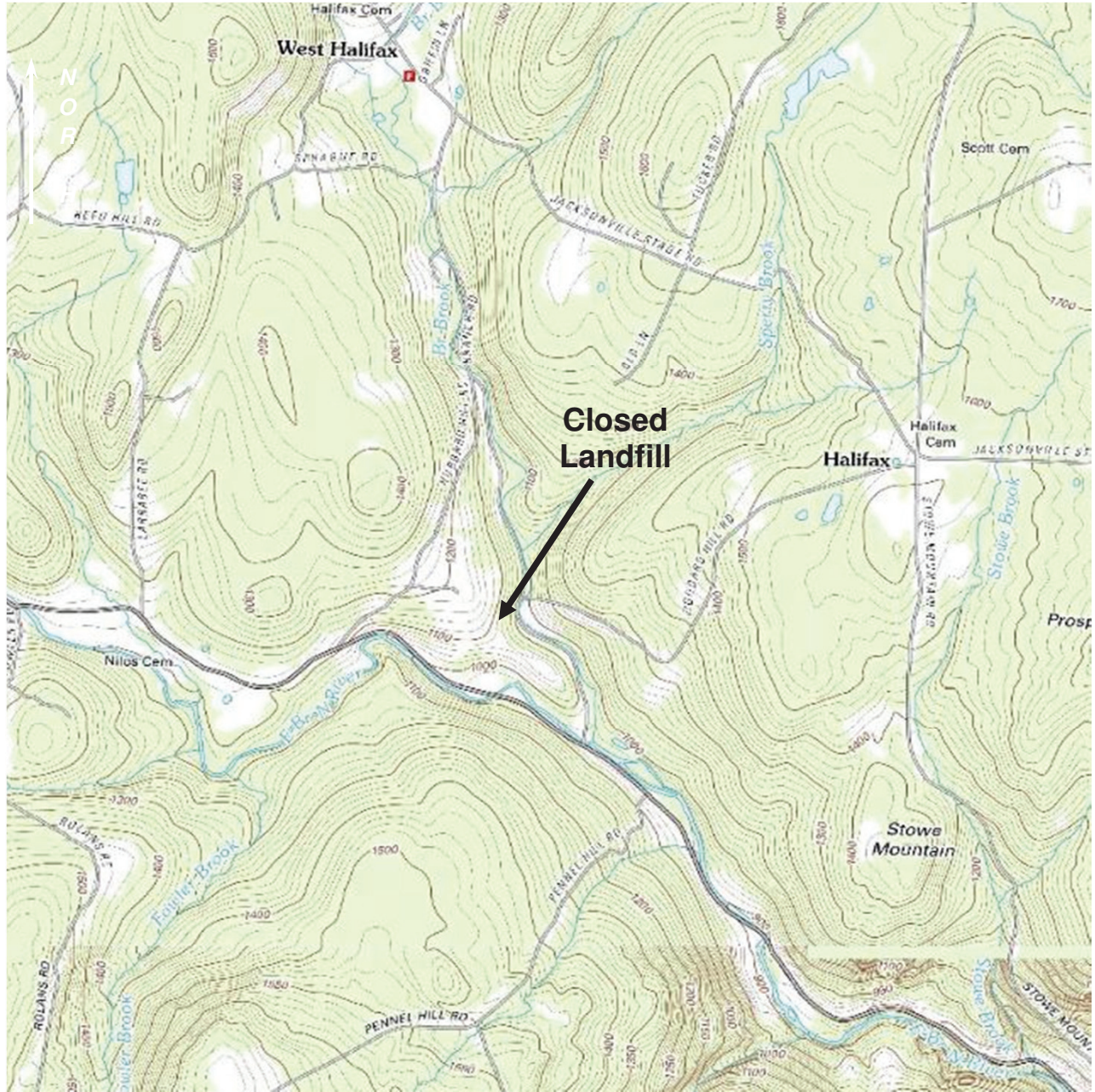
A seasonal correlation between PFC levels and depth to groundwater remains unclear; however, lower PFC concentrations are apparent during fall sampling events. The next groundwater monitoring event is scheduled to occur in May 2020.

As previously stated in the introduction, the Town voluntarily elected to sample MW-4 and the Rafus private supply well for PFCs. A total combined PFC concentration of 6.99 ng/L was reported in MW-4 which is above the Vermont Preventive Action Level (PAL) of 2 ng/L but remains well below VGES. No PFCs were detected above laboratory method detection limits in the field blank sample. This is the second sampling round for PFCs at MW-4. The initial sampling round conducted in October 2016 reported a total PFC concentration of 10.05 ng/L. No PFCs were detected above laboratory method detection limits in the Rafus private supply well. This is the fourth sampling round for the Rafus private supply well. Previous sampling events for the Rafus private supply well occurred in December 2016, August 2017, October 2018. All PFC results for the Rafus private supply well to date have been non-detect.



APPENDIX A

Site Location Map and Site Map



KAS Job Number: 610110045

Source: <http://anrmaps.vermont.gov/websites/anra5/>



TOWN OF HALIFAX CLOSED LANDFILL
2044 Branch Road, Halifax, VT

Site Location Map

Date: 05/25/16	Drawing No. 0	Scale: NTS	By: CS
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MONITORING WELL



SURFACE WATER SAMPLE

* monitoring well and surface water locations are approximate



HALIFAX CLOSED LANDFILL

2044 Branch Road, Halifax, VT

SITE MAP

VTDEC Project: NS95-0165
 KAS Job Number: 610110045
 Source: Google Earth

Date: 07/31/17

Drawing No. 2

Scale: NTS

By: RT



APPENDIX B

Historical Sampling Data (MW-3)



GROUNDWATER QUALITY SUMMARY

HALIFAX LANDFILL
HALIFAX, VT

MW-3

Parameter (PPM unless noted)	VGES	PAL	SAMPLING DATE:																
			Aug-93	Dec-95	May-96	Nov-96	May-97	Oct-97	May-98	Oct-98	May-99	Oct-99	May-00	Dec-00	Oct-01	Jan-02	Jun-02	Dec-02	Jun-03
pH**	change of 1 ph unit		6.4	6.27	6.1	6.1	6.4	6.3	6.2	5.8	6.2	6	6.6	6.5	6.5	nt	6.5	6.6	6.7
Conductivity (µS/cm)**	change of 100 µS/cm		328	440	600	610	530	380	480	280	340	390	520	500	320	nt	320	360	430
COD**	change of 25 ppm		6.9	ND<50	22	16	16	18	10	20	20	10	20	10	10	nt	30	20	20
Chloride*	250 125		14	27	29	26	20	1	17	8	14	ND<1	18	17	8	nt	15	10	12
Sodium* ⁸ ** (change of 10 ppm)	250	125	nt	23	28	27	23	15	18	11	14	nt	21	16	13	nt	39	11	16
Ca Hardness**	change of 100	NA	nt	nt	230	nt	230	160	220	120	150	190	230	190	130	nt	nt	130	220
Dissolved Chromium	0.1	0.05	nt	ND<0.05	ND<0.002	ND<0.002	0.003	ND<0.002	ND<0.002	0.004	ND<0.002	ND<0.002	ND<0.002	0.005	0.004	nt	ND<0.001	ND<0.001	ND<0.001
Dissolved Copper	1.3	0.65	nt	ND<0.05	ND<0.01	ND<0.01	0.03	ND<0.01	ND<0.01	0.02	ND<0.01	ND<0.01	0.01	0.02	0.002	nt	0.003	0.001	0.002
Dissolved Iron*	0.3	0.15	0.06	ND<0.05	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	0.18	nt	nt
Dissolved Manganese*	0.05	0.025	ND<0.02	ND<0.05	ND<0.005	0.046	0.22	0.075	0.38	0.45	0.21	0.067	0.12	0.28	0.015	nt	0.005	ND<0.005	ND<0.005
Dissolved Nickel	0.1	0.05	nt	ND<0.05	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	nt	ND<0.01	ND<0.01	0.002	0.003	ND<0.001	0.001
Dissolved Zinc*	5	2.5	nt	ND<0.05	0.07	0.057	0.095	0.015	0.058	0.042	0.013	0.015	0.014	0.024	0.24	nt	0.23	0.084	0.2
Dissolved Arsenic	0.05	0.005	nt	ND<0.010	ND<0.002	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	0.003	nt	ND<0.001	ND<0.001	ND<0.001
Dissolved Cadmium	0.005	0.0025	nt	ND<0.005	ND<0.0005	ND<0.001	ND<0.001	ND<0.001	nt	ND<0.001	ND<0.001	ND<0.001	0.002	ND<0.001	ND<0.001	nt	ND<0.001	ND<0.001	ND<0.001
Dissolved Lead	0.015	0.005	nt	ND<0.005	ND<0.001	ND<0.01	ND<0.01	ND<0.01	ND<0.01	0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	ND<0.01	nt	ND<0.001	ND<0.001	ND<0.001
Calcium	NA	NA	nt	nt	nt	nt	nt	nt	2.3	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt
Methylene Chloride	0.005	0.0005	ND<10	ND<2	ND<2	ND<2	ND<2	nt	ND<2	nt	nt	ND<5	nt	nt	nt	ND<5	nt	1600 ^E	560

Parameter (PPM unless noted)	VGES	PAL	SAMPLING DATE:																
			11/3/03	6/17/04	10/28/04	12/1/05	5/6/06	10/6/06	5/7/07	10/7/07	5/8/08	10/24/08	5/15/09	10/22/09	5/10/10	10/13/10	5/25/11	10/26/11	5/8/12
pH**	change of 1 ph unit		6.1	6.1	ns	ns	nt	6.63	5.67	6.41	6.41	6.78	6.59	NR	6.15	6.49	6.03	6.63	6.70
Conductivity (µS/cm) **	change of 100 µS/cm		450	420	ns	ns	nt	391	329	128	128	413	92	108	83.4	223.3	83.8	387.6	599
Temperature (degrees C)	change of 5.6 deg C		nt	nt	ns	ns	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	10.9	11.7
Depth to Water (feet btoc)	NA NA		nt	nt	ns	ns	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	4.60	4.41
COD**	change of 25 ppm		10	20	ns	ns	121	60	ND<10	50	10	<10	28	290	29	27	11	18	nt
Chloride*	250 125		12	12	ns	ns	1460	1	10	6	9	7	2.8	6.2	ND<2.5	5.7	4.3	12	6.2
Sodium* ⁸ ** (change of 10 ppm)	250	125	17	28	ns	ns	17.6	ND<5	15	ND<5	16	13	2.3	2.7	1.9	10	2	12	13
Ca Hardness**	change of 100	NA	170	180	ns	ns	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt
Dissolved Chromium	0.1	0.05	ND<0.001	ND<0.001	ns	ns	ND<0.002	ND<0.001	0.004	ND<0.001	0.002	ND<0.001	ND<0.02	ND<0.02	ND<0.02	ND<0.005	ND<0.005	ND<0.005	ND<0.005
Dissolved Copper	1.3	0.65	0.001	0.002	ns	ns	ND<0.05	0.002	0.01	0.002	0.002	ND<0.001	ND<0.02	ND<0.02	ND<0.02	ND<0.02	ND<0.02	ND<0.020	ND<0.020
Dissolved Iron*	0.3	0.15	ND<0.05	ND<0.05	ns	ns	0.35	0.1	3.6	0.08	0.002	ND<0.05	ND<0.05	0.17	0.88	0.1	0.11	0.2	ND<0.020
Dissolved Manganese*	0.05	0.025	ND<0.005	ND<0.005	ns	ns	0.05	0.006	0.079	0.007	0.003	ND<0.005	ND<0.005	ND<0.02	0.15	ND<0.02	ND<0.02	ND<0.020	ND<0.020
Dissolved Nickel	0.1	0.05	ND<0.001	0.002	ns	ns	ND<0.05	0.003	0.007	0.003	0.005	0.004	ND<0.02	ND<0.02	ND<0.005	ND<0.005	ND<0.005	ND<0.005	nt
Dissolved Zinc*	5	2.5	0.078	0.13	ns	ns	ND<0.01	0.047	0.045	0.033	0.013	0.007	ND<0.02	ND<0.02	ND<0.005	ND<0.005	0.007	ND<0.020	nt
Dissolved Arsenic	0.05	0.005	ND<0.001	ND<0.001	ns	ns	ND<0.002	ND<0.002	ND<0.001	ND<0.001	ND<0.001	ND<0.001	ND<0.002	ND<0.002	ND<0.001	ND<0.001	ND<0.001	ND<0.020	nt
Dissolved Cadmium	0.005	0.0025	ND<0.001	ND<0.001	ns	ns	ND<0.0005	ND<0.0005	ND<0.001	ND<0.001	ND<0.001	ND<0.001	ND<0.002	ND<0.002	ND<0.002	ND<0.002	ND<0.002	ND<0.002	nt
Dissolved Lead	0.015	0.005	ND<0.001	ND<0.001	ns	ns	ND<0.002	ND<0.001	0.003	ND<0.001	ND<0.001	ND<0.001	ND<0.001	ND<0.001	ND<0.001	ND<0.001	ND<0.001	ND<0.001	nt
Calcium	NA	AN	nt	nt	ns	ns	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt
Methylene Chloride	0.005	0.0005	ND<5	ND<5	ns	ns	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt

continued on next page

Notes:

Only detected or previously detected volatile organic compounds are listed.

btoc = below top of casing

ND<xx = Not Detected< Detection Limit

VGES = Vermont Groundwater Enforcement Standard (December 2016)

PAL = Preventative Action Level (December 2016)

NA = No VGES/PAL available

Results reported above detection limits are indicated in bold.

ns = not sampled

nt = not tested during sampling round

* = secondary groundwater quality standards (mg/L or ppm)

** = maximum acceptable change (units as noted)

*** = All perfluorinated compound values reported in ng/L. Analysis via EPA Method 537 (short list)

VGES and PALs pertain to total metals and are provided for reference only

E - The reported value exceeds largest calibration standard. Extrapolation of the calibration curve was employed to obtain the reported value.

	= exceeds PAL
	= exceeds VGES
	= exceeds max acceptable change



GROUNDWATER QUALITY SUMMARY

HALIFAX LANDFILL
HALIFAX, VT

MW-3 (continued)

Parameter (PPM unless noted)	VGES	PAL	SAMPLING DATE:															
			10/9/12	5/30/13	10/16/13	5/15/14	10/21/14	5/28/15	10/29/15	May-16	10/19/16	5/30/2017	10/25/2017	5/30/2018	10/23/2018	5/29/2019	10/28/2019	
pH	NA	NA	6.06	6.71	6.09	6.05	5.73	6.56	6.71	ns	nt	7.04	6.51	6.55	6.53	6.52	7.14	
Conductivity (µS/cm)	NA	NA	293	215.6	625	358.1	187	376	340.6	ns	nt	470.7	500	388	160.7	306.8	425.9	
Temperature (degrees C)	NA	NA	11.5	15.7	11.3	12.5	10.7	13.0	10.9	ns	nt	9.9	13.2	10.9	9.7	10.5	10.0	
Depth to Water (feet btoc)	NA	NA	5.63	4.38	5.49	5.23	5.34	5.55	4.51	ns	6.87	5.07	4.85	6.50	5.62	5.57	5.04	
COD	NA	NA	nt	22	nt	nt	nt	nt	nt	ns	nt	nt	nt	nt	nt	nt	nt	
Chloride	NA	NA	19	12	6.5	5.7	6.7	4.5	52	ns	nt	nt	nt	nt	nt	nt	nt	
Sodium	NA	NA	12	13	nt	nt	nt	nt	nt	ns	nt	nt	nt	nt	nt	nt	nt	
Dissolved Chromium	0.1	0.05	nt	ND<0.005	nt	nt	nt	nt	nt	ns	nt	nt	nt	nt	nt	nt	nt	
Dissolved Copper	1.3	0.65	nt	ND<0.020	nt	nt	nt	nt	nt	ns	nt	nt	nt	nt	nt	nt	nt	
Dissolved Iron	NA	NA	ND<0.020	ND<0.020	0.030	0.086	0.020	ND<0.020	ND<0.020	ns	nt	nt	nt	nt	nt	nt	nt	
Dissolved Manganese	0.3	0.15	ND<0.020	ND<0.020	ND<0.020	ND<0.020	ND<0.020	ND<0.020	ND<0.020	ns	nt	nt	nt	nt	nt	nt	nt	
Dissolved Nickel	0.1	0.05	nt	ND<0.005	nt	nt	nt	nt	nt	ns	nt	nt	nt	nt	nt	nt	nt	
Dissolved Zinc	NA	NA	nt	ND<0.020	nt	nt	nt	nt	nt	ns	nt	nt	nt	nt	nt	nt	nt	
Dissolved Arsenic	0.05	0.005	nt	ND<0.001	nt	nt	nt	nt	nt	ns	nt	nt	nt	nt	nt	nt	nt	
Dissolved Cadmium	0.005	0.001	nt	ND<0.002	nt	nt	nt	nt	nt	ns	nt	nt	nt	nt	nt	nt	nt	
Dissolved Lead	0.015	0.002	nt	ND<0.001	nt	nt	nt	nt	nt	ns	nt	nt	nt	nt	nt	nt	nt	
Perfluorobutanesulfonic acid (PFBS)*	NA	NA	nt	nt	nt	nt	nt	nt	nt	ns	ND<11	ND<6.6	ND<6.6	3.75	ND<6.6	ND<6.6	ND<5.1	
Perfluorohexanesulfonic acid (PFHxS)*	20	2	nt	nt	nt	nt	nt	nt	nt	ns	ND<3.8	11.7	9.2	13.1	12.3	10.1	4.8	
Perfluoroheptanoic acid (PFHpA)*	20	2	nt	nt	nt	nt	nt	nt	nt	ns	2.06	22	13.2	41.2	15.1	21.4	10.3	
Perfluorooctanoic acid (PFOA)*	20	2	nt	nt	nt	nt	nt	nt	nt	ns	11.5	78.2	44.9	134	76.8	106	52.8	
Perfluorooctanesulfonic acid (PFOS)*	20	2	nt	nt	nt	nt	nt	nt	nt	ns	16.7	32.1	37	33.3	36.4	30	37.8	
Perfluorononanoic acid (PFNA)*	20	2	nt	nt	nt	nt	nt	nt	nt	ns	ND<2.3	ND<1.5	ND<1.5	1.9	ND<1.5	ND<1.5	ND<1.8	
Total Regulated PFC Compounds	20	2	nt	nt	nt	nt	nt	nt	nt	ns	30.3	144	104	224	140.6	167	105.7	

Notes:

Only detected or previously detected volatile organic compounds are listed.

btoc = below top of casing

ND<xx = Not Detected< Detection Limit

VGES = Vermont Groundwater Enforcement Standard (July 2019)

PAL = Preventative Action Level (July 2019)

NA = No VGES/PAL available

Results reported above detection limits are indicated in bold.

ns = not sampled

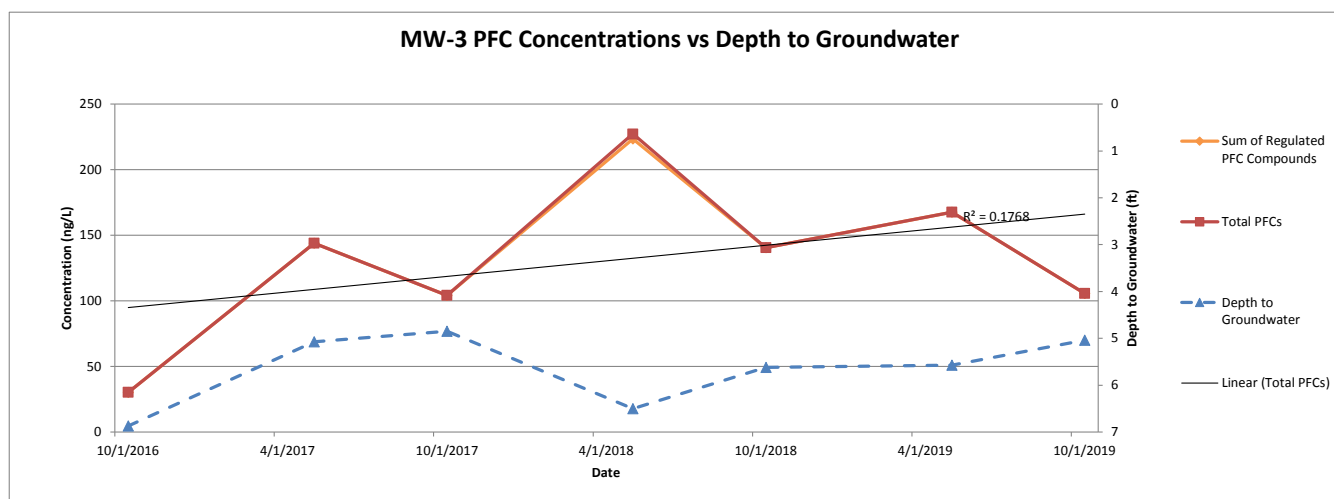
nt = not tested during sampling round

VGES and PALs pertain to total metals and are provided for reference only

E - The reported value exceeds largest calibration standard. Extrapolation of the calibration curve was employed to obtain the reported value.

* = All perfluorinated compound values reported in ng/L. Analysis via EPA Method 537 (short list). For PFHxS, PFHpA, PFOA, PFOS and PFNA, the VGES and PAL standards applies to the individual compounds and the sum of these compounds.

= exceeds current PAL
 = exceeds current VGES





APPENDIX C

Laboratory Report

ANALYTICAL REPORT

Client: KAS
 Attn: Rebecca Treat
 589 Avenue D, Suite 10
 PO Box 787
 Williston, VT 05495

NLS Project: 334246

NLS Customer: 108400

Phone: 802 383 0486

PO # 610110045

Project: Halifax Landfill

MW-3 NLS ID: 1158927

COC: 235473:1 Matrix: GW

Collected: 10/28/19 11:20 Received: 11/05/19

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Perfluorinated Chemicals by EPA Method 537.1	see attached					11/08/19	EPA 537.1	721026460
Solid Phase Extraction by EPA Method 537.1	yes					11/05/19	EPA 537.1	721026460

MW-3 FB NLS ID: 1158928

COC: 235473:2 Matrix: FB

Collected: 10/28/19 11:15 Received: 11/05/19

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Perfluorinated Chemicals by EPA Method 537.1	see attached					11/08/19	EPA 537.1	721026460
Solid Phase Extraction by EPA Method 537.1	yes					11/06/19	EPA 537.1	721026460

MW-4 NLS ID: 1158929

COC: 235473:3 Matrix: GW

Collected: 10/28/19 11:59 Received: 11/05/19

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Perfluorinated Chemicals by EPA Method 537.1	see attached					11/08/19	EPA 537.1	721026460
Solid Phase Extraction by EPA Method 537.1	yes					11/05/19	EPA 537.1	721026460

MW-4 FB NLS ID: 1158930

COC: 235473:4 Matrix: FB

Collected: 10/28/19 11:53 Received: 11/05/19

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Perfluorinated Chemicals by EPA Method 537.1	see attached					11/08/19	EPA 537.1	721026460
Solid Phase Extraction by EPA Method 537.1	yes					11/06/19	EPA 537.1	721026460

Rafus Well NLS ID: 1158931

COC: 235473:5 Matrix: DW

Collected: 10/28/19 13:03 Received: 11/05/19

Parameter	Result	Units	Dilution	LOD	LOQ/MCL	Analyzed	Method	Lab
Perfluorinated Chemicals by EPA Method 537.1	see attached					11/08/19	EPA 537.1	721026460
Solid Phase Extraction by EPA Method 537.1	yes					11/05/19	EPA 537.1	721026460

Rafus Well FB NLS ID: 1158932

COC: 235473:6 Matrix: FB

Collected: 10/28/19 12:54 Received: 11/05/19

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Perfluorinated Chemicals by EPA Method 537.1	not analyzed					11/08/19	EPA 537.1	721026460
Solid Phase Extraction by EPA Method 537.1	yes					11/06/19	EPA 537.1	721026460

Values in brackets represent results greater than or equal to the LOD but less than the LOQ and are within a region of "Less-Certain Quantitation". Results greater than or equal to the LOQ are considered to be in the region of "Certain Quantitation". LOD and/or LOQ tagged with an asterisk(*) are considered Reporting Limits. All LOD/LOQs adjusted to reflect dilution and/or solids content.

ND = Not Detected (< LOD) LOD = Limit of Detection LOQ = Limit of Quantitation NA = Not Applicable

DWB = Dry Weight Basis %DWB = (mg/kg DWB) / 10000 1000 ug/L = 1 mg/L

MCL = Maximum Contaminant Levels for Drinking Water Samples. Shaded results indicate >MCL.

Reviewed by:



Authorized by:
 R. T. Krueger
 President

ANALYTICAL RESULTS: Perfluorinated Chemicals by EPA Method 537.1 Safe Drinking Water Analysis
Customer: KAS NLS Project: 334246 PO # 610110045
Project Description: Halifax Landfill
Project Title: Template: SCI1537.1 Printed: 11/19/2019 10:30

Sample: 1158927 MW-3 Collected: 10/28/19 Analyzed: 11/08/19 - Analytes: 6

ANALYTE NAME	RESULT	UNITS WWB	DIL	LOD	LOQ	Note
Perfluoroheptanoic acid (PFHpA)	10.3	ng/L	1	0.57	1.9	
Perfluorooctanoic acid (PFOA)	52.8	ng/L	1	1.6	5.3	
Perfluorononanoic acid (PFNA)	ND	ng/L	1	1.8	5.9	
Perfluorobutanesulfonic acid (PFBS)	ND	ng/L	1	5.1	17	
Perfluorohexanesulfonic acid (PFHxS)	[4.8]	ng/L	1	2.3	7.8	J
Perfluorooctanesulfonic acid (PFOS)	37.8	ng/L	1	2.7	9.1	

NOTES APPLICABLE TO THIS ANALYSIS:

J = Result enclosed in brackets is between LOD and LOQ, a region of less certain quantitation.

No surrogates added at extraction.

Sample: 1158928 MW-3 FB Collected: 10/28/19 Analyzed: 11/08/19 - Analytes: 6

ANALYTE NAME	RESULT	UNITS WWB	DIL	LOD	LOQ	Note
Perfluoroheptanoic acid (PFHpA)	ND	ng/L	1	0.57	1.9	
Perfluorooctanoic acid (PFOA)	ND	ng/L	1	1.6	5.3	
Perfluorononanoic acid (PFNA)	ND	ng/L	1	1.8	5.9	
Perfluorobutanesulfonic acid (PFBS)	ND	ng/L	1	5.1	17	
Perfluorohexanesulfonic acid (PFHxS)	ND	ng/L	1	2.3	7.8	
Perfluorooctanesulfonic acid (PFOS)	ND	ng/L	1	2.7	9.1	
C13-PFHxA (SURR)	81.431%		1			S
C13-HFPODA (SURR)	85.4%		1			S
C13-PFDA (SURR)	100.816%		1			S
d5-NEtFOSAA (SURR)	94.372%		1			S

NOTES APPLICABLE TO THIS ANALYSIS:

S = This compound is a surrogate used to evaluate the quality control of a method.

Sample: 1158929 MW-4 Collected: 10/28/19 Analyzed: 11/08/19 - Analytes: 6

ANALYTE NAME	RESULT	UNITS WWB	DIL	LOD	LOQ	Note
Perfluoroheptanoic acid (PFHpA)	[1.88]	ng/L	1	0.57	1.9	J
Perfluorooctanoic acid (PFOA)	[5.11]	ng/L	1	1.6	5.3	J
Perfluorononanoic acid (PFNA)	ND	ng/L	1	1.8	5.9	
Perfluorobutanesulfonic acid (PFBS)	ND	ng/L	1	5.1	17	
Perfluorohexanesulfonic acid (PFHxS)	ND	ng/L	1	2.3	7.8	
Perfluorooctanesulfonic acid (PFOS)	ND	ng/L	1	2.7	9.1	

NOTES APPLICABLE TO THIS ANALYSIS:

J = Result enclosed in brackets is between LOD and LOQ, a region of less certain quantitation.

No surrogates added at extraction.

ANALYTICAL RESULTS: Perfluorinated Chemicals by EPA Method 537.1 Safe Drinking Water Analysis
Customer: KAS NLS Project: 334246 PO # 610110045
Project Description: Halifax Landfill
Project Title: Template: SCI1537.1 Printed: 11/19/2019 10:30

Sample: 1158930 MW-4 FB Collected: 10/28/19 Analyzed: 11/08/19 - Analytes: 6

ANALYTE NAME	RESULT	UNITS WWB	DIL	LOD	LOQ	Note
Perfluoroheptanoic acid (PFHpA)	ND	ng/L	1	0.57	1.9	
Perfluorooctanoic acid (PFOA)	ND	ng/L	1	1.6	5.3	
Perfluorononanoic acid (PFNA)	ND	ng/L	1	1.8	5.9	
Perfluorobutanesulfonic acid (PFBS)	ND	ng/L	1	5.1	17	
Perfluorohexanesulfonic acid (PFHxS)	ND	ng/L	1	2.3	7.8	
Perfluorooctanesulfonic acid (PFOS)	ND	ng/L	1	2.7	9.1	
C13-PFHxA (SURR)	85.369%		1			S
C13-HFPODA (SURR)	84.552%		1			S
C13-PFDA (SURR)	94.411%		1			S
d5-NEtFOSAA (SURR)	94.039%		1			S

NOTES APPLICABLE TO THIS ANALYSIS:

S = This compound is a surrogate used to evaluate the quality control of a method.

Sample: 1158931 Rafus Well Collected: 10/28/19 Analyzed: 11/08/19 - Analytes: 6

ANALYTE NAME	RESULT	UNITS WWB	DIL	LOD	LOQ	MCL	Note
Perfluoroheptanoic acid (PFHpA)	ND	ng/L	1	0.57	1.9		
Perfluorooctanoic acid (PFOA)	ND	ng/L	1	1.6	5.3		
Perfluorononanoic acid (PFNA)	ND	ng/L	1	1.8	5.9		
Perfluorobutanesulfonic acid (PFBS)	ND	ng/L	1	5.1	17		
Perfluorohexanesulfonic acid (PFHxS)	ND	ng/L	1	2.3	7.8		
Perfluorooctanesulfonic acid (PFOS)	ND	ng/L	1	2.7	9.1		
C13-PFHxA (SURR)	71.476%		1				S
C13-HFPODA (SURR)	76.2%		1				S
C13-PFDA (SURR)	86.917%		1				S
d5-NEtFOSAA (SURR)	86.403%		1				S

NOTES APPLICABLE TO THIS ANALYSIS:

S = This compound is a surrogate used to evaluate the quality control of a method.

SAMPLE COLLECTION AND CHAIN OF CUSTODY RECORD

NORTHERN LAKE SERVICE, INC.

Analytical Laboratory and Environmental Services

400 North Lake Avenue • Crandon, WI 54520-1298

Tel: (715) 478-2777 • Fax: (715) 478-3060

CLIENT KAS, Inc.	
ADDRESS P.O. Box 787	
CITY Williston	STATE VT
ZIP 05495	
PROJECT DESCRIPTION / NO. Halfax Landf. 11	QUOTATION NO.
DNR FID #	DNR LICENSE #
CONTACT Rebecca Treet	PHONE 802-383-0486
PURCHASE ORDER NO. 610110045	FAX 802-383-0490

Wisconsin DNR cert ID
721026460 (Cran) / 268533760 (Wauk)
Wisconsin DATCP ID
105-000330 (Cran) / 105-000479 (Wauk)

MATRIX:
SW = surface water
WW = waste water
GW = groundwater
DW = drinking water
TIS = tissue
AIR = air
SOIL = soil
SED = sediment
PROD = product
SL = sludge
OTHER

ANALYZE PER ORDER OF ANALYSIS PFC'S via EPA 537 Short List	USE BOXES BELOW: Indicate Y or N if GW Sample is field filtered. Indicate G or C if WW Sample is Grab or Composite.									
	G									



NO. **235473**

ITEM NO.	NLS LAB. NO.	SAMPLE ID	COLLECTION		MATRIX (See above)	ANALYZE PER ORDER OF ANALYSIS	USE BOXES BELOW: Indicate Y or N if GW Sample is field filtered. Indicate G or C if WW Sample is Grab or Composite.										COLLECTION REMARKS (i.e. DNR Well ID #)		
			DATE	TIME															
1.	1158927	MW-3	10/28/19	1120	GW	X													
2.	928	MW-3FB	↓	1115	Blank H2O	↓													
3.	929	MW-4		1159	GW														
4.	930	MW-4FB		1153	Blank H2O														
5.	931	Refus Well		1303	DW														
6.	932	Refus Well FB		1254	Blank H2O														
7.																			
8.																			
9.																			
10.																			

COLLECTED BY (signature) <i>[Signature]</i>	CUSTODY SEAL NO. (IF ANY)	DATE/TIME 10/28/19
RELINQUISHED BY (signature)	RECEIVED BY (signature)	DATE/TIME
DISPATCHED BY (signature) <i>[Signature]</i>	METHOD OF TRANSPORT UPS	DATE/TIME 12/4/19

REPORT TO rebecca@kas-consulting.com KAS, Inc.
--

RECEIVED AT NLS BY (signature) <i>[Signature]</i>	DATE/TIME 11/5/19 10	CONDITION	TEMP. 1.12c
COOLER #	REMARKS & OTHER INFORMATION Analyze field blank only if associated sample has a positive result for PFC's		
PRESERVATIVE: NP = no preservative S = sulfuric acid	N = nitric acid Z = zinc acetate M = methanol	OH = sodium hydroxide HA = hydrochloric & ascorbic acid H = hydrochloric acid	WDNR FACILITY NUMBER E-MAIL ADDRESS

INVOICE TO rebecca@kas-consulting.com KAS, Inc.

IMPORTANT:
1. TO MEET REGULATORY REQUIREMENTS, THIS FORM **MUST** BE COMPLETED IN DETAIL AND INCLUDED IN THE COOLER CONTAINING THE SAMPLES DESCRIBED.
2. PLEASE USE ONE LINE PER SAMPLE, **NOT** PER BOTTLE.
3. RETURN THIS FORM WITH SAMPLES - CLIENT MAY KEEP YELLOW COPY.
4. PARTIES COLLECTING SAMPLE, LISTED AS **REPORT TO** AND LISTED AS **INVOICE TO** AGREE TO STANDARD TERMS & CONDITIONS ON REVERSE.