Maxxam
A Bureau Veritas Group Company

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Toll Free (800) 665 8566
Victoria: 460 Tennyson Place, Unit 1, Victoria, BC V8Z 6S8 Toll Free (866) 385-6112
maxxam.ca

CHAIN OF CUSTODY RECORD

G182578

Page 1 of 2

Invoice Information

Company: #1756 Public Works + Gov. Services
Contact Name: Dave Osguthorpe
Address: 800 Burrard St Rm 219
Vancouver BC PC: V6Z 0B
Phone/Fax: 250 217 4767
Email: Dave.Osguthorpe@pwgsc-tpsgc.gc.ca
Copies:

Report Information (if differs from invoice)

Company: SNC-Lavalin
Contact Name: Distribution List
Address: 202-3440 Douglas St.
Victoria BC PC: V8Z 3L5
Phone/Fax: 250 385 5028
Email: Doug.McMillan@snclavalin.com
Copies:

Project Information

Quotation: B70654
P.O. #/AFE#: F00420197
Project #: 658344
Site Location: CFB Comox PFAS FFTA
Sampled By: CP/TD

Turnaround Time (TAT) Required

☒ 5 - 7 Days Regular (Most analyses)

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Rush TAT (Surcharges will be applied)

☐ Same Day ☐ 2 Days
☐ 1 Day ☐ 3-4 Days

Date Required:
Rush Confirmation #:

Laboratory Use Only

	YES	NO	Cooler ID			
Seal Present		✓				
Seal Intact	N/A		Temp	6	6	4
Cooling Media						

	YES	NO	Cooler ID			
Seal Present						
Seal Intact			Temp			
Cooling Media						

	YES	NO	Cooler ID			
Seal Present						
Seal Intact			Temp			
Cooling Media						

Depot Reception

Analysis Requested

☐ BTEXS / VPH ☐ VOC / BTEXS / VPH ☐ MTBE
☐ BTEX F1 ☐ VOC / BTEX / F1
☐ PAH ☐ LEPH / HEPH / PAH
☐ EPH ☐ TEH ☐ F2 - F4
☐ Dissolved Metals ☐ Filtered? ☐ Preserved?
☐ Dissolved Mercury ☐ Filtered? ☐ Preserved?
☐ Total Metals ☐ Field Preserved?
☐ Total Mercury ☐ Field Preserved?
☐ Chloride ☐ Fluoride ☐ Sulphate
☐ TSS ☐ TDS ☐ BOD ☐ COD
☐ pH ☐ Conductivity ☐ Alkalinity
☐ Nitrite ☐ Nitrate ☐ Ammonia

Regulatory Criteria

☐ BC CSR
☐ YK CSR
☐ CCME
☐ Drinking Water
☐ BC Water Quality
☐ Other

	Sample Identification	Date Sampled (yyyy/mm/dd)	Time Sampled (hh:mm)	Matrix	# of Containers	PFOS	HOLD - DO NOT ANALYZE	Special Instructions
1	MW19-66-190312	19/03/12	1713	GW	2	X		
2	EQUIP-WLP-1-190312		1530		2	X		
3	EQUIP-WLP-2-190312		1530		2	X		
4	MW19-68-190312		1700		2	X		
5	MW19-62-190312		1630		2	X		
6	MW19-61-190313	19/03/13	1400		2	X		
7	MW19-56-190313		1115		2	X		
8	MW19-57-190313		1000		2	X		
9	MW19-64-190313		1250		2	X		
10	MW19-60-190313		1105		2	X		

Unless otherwise agreed to in writing, work submitted on this Chain of Custody is subject to Maxxam's standard Terms and Conditions. Signing of this Chain of Custody document is acknowledgement and acceptance of our terms which are avail

Relinquished by: (Signature/ Print)	Date (yyyy/mm/dd):	Time (hh:mm):	Received by: (Signature/ Print)	Date (yyyy/mm/dd):	Time (hh:mm):
CPakstas CP	19/03/15	1500	L Martin	2019/03/15	1500

B919002_COC

Maxxam
A Bureau Veritas Group Company

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Victoria: 460 Tennyson Place, Unit 1, Victoria, BC V8Z 6S8 Toll Free (866) 385-6112
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CHAIN OF CUSTODY RECORD

G132580

Page 2 of 2

Invoice Information

Company: #1756 Public Works + Gov Service
Contact Name: Dave Osguthorpe
Address: 800 Burrard St, Rm 214. Vancouver BC PC: V6Z0B9.
Phone/Fax: 250 217 4767
Email: Dave.Osguthorpe@pwgsc-tpsgc.gc.ca
Copies:

Report Information (If differs from invoice)

Company: #17306 SNC-Lavalin
Contact Name: Distribution List 1
Address: 202-3440 Douglas St Victoria BC PC: V8Z3L5
Phone/Fax: 250 385 5028
Email: doug.mcmillan@snclavalin.com
Copies:

Project Information

Quotation: B70654
P.O. #/AFE#: 700420197
~~658~~
Project #: 658394
Site Location: CFB COMOX PFAS FFTA.
Sampled By: CP/TP

Turnaround Time (TAT) Required

☒ 5 - 7 Days Regular (Most analyses)

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Rush TAT (Surcharges will be applied)

☐ Same Day ☐ 2 Days
☐ 1 Day ☐ 3-4 Days

Date Required:
Rush Confirmation #:

Laboratory Use Only

	YES	NO	Cooler ID			
Seal Present		✓	Temp	6	6	4
Seal Intact	n/a					
Cooling Media	✓					
	YES	NO	Cooler ID			
Seal Present			Temp			
Seal Intact						
Cooling Media						
	YES	NO	Cooler ID			
Seal Present			Temp			
Seal Intact						
Cooling Media						

Depot Reception

Regulatory Criteria

☐ BC CSR
☐ YK CSR
☐ CCME
☐ Drinking Water
☐ BC Water Quality
☐ Other

Analysis Requested

	Sample Identification	Date Sampled (yyyy/mm/dd)	Time Sampled (hh:mm)	Matrix	# of Containers	☐ BTEXS / VPH ☐ VOC / BTEXS / VPH ☐ MTBE	☐ BTEX F1 ☐ VOC / BTEX / F1	☐ PAH ☐ LEPH / HEPH / PAH	☐ EPH ☐ TEH ☐ F2 - F4	☐ Dissolved Metals ☐ Filtered? ☐ Preserved?	☐ Dissolved Mercury ☐ Filtered? ☐ Preserved?	☐ Total Metals ☐ Field Preserved?	☐ Total Mercury ☐ Field Preserved?	☐ Chloride ☐ Fluoride ☐ Sulphate	☐ TSS ☐ TDS ☐ BOD ☐ COD	☐ pH ☐ Conductivity ☐ Alkalinity	☐ Nitrite ☐ Nitrate ☐ Ammonia					PFOS	HOLD - DO NOT ANALYZE	Special Instructions
1	MW19-58-190313	19/03/13	1230	GW	2																	X		
2	MW19-A-190313	19/03/13	—		2																	X		
3	MW19-63-190314	19/03/14	1200		2																	X		
4	MW19-50-190313	19/03/13	0815		2																	X		
5	TBLK-PFOW-20190115	—	—		2																	X		
6	MW19-B-190314	19/03/14	—		1																	X		
7	MW19-65-190314	19/03/14	1300		2																	X		
8	FBLK-PFOW-20190115	19/03/15	1000	↓	2																	X		
9																								
10																								

Unless otherwise agreed to in writing, work submitted on this Chain of Custody is subject to Maxxam's standard Terms and Conditions. Signing of this Chain of Custody document is acknowledgement and acceptance of our terms which

Relinquished by: (Signature/ Print)	Date (yyyy/mm/dd):	Time (hh:mm):	Received by: (Signature/ Print)	Date (yyyy/mm/dd):	Time (hh:mm):	
CPakstas	19/03/15	15 00	JL Martin	2019/03/15	1500	

B919002_COC

Your P.O. #: 700420197
Your Project #: 658394 [B919002]
Site Location: CFB COMOX PFAS FFTA
Your C.O.C. #: B919002-ONTV-01-01

Attention: Tim Li

Maxxam Analytics
4606 Canada Way
Burnaby, BC
CANADA V5G 1K5

Report Date: 2019/04/04
Report #: R5657382
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B970445
Received: 2019/03/19, 08:58

Sample Matrix: Water
Samples Received: 18

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	9	2019/03/26	2019/03/26	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	8	2019/03/26	2019/03/27	CAM SOP-00894	EPA 537 m
PFOS and PFOA in water by SPE/LCMS (1)	1	2019/03/28	2019/03/29	CAM SOP-00894	EPA 537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

Maxxam
A Bureau Veritas Group Company

Your P.O. #: 700420197
Your Project #: 658394 [B919002]
Site Location: CFB COMOX PFAS FFTA
Your C.O.C. #: B919002-ONTV-01-01

Attention: Tim Li

Maxxam Analytics
4606 Canada Way
Burnaby, BC
CANADA V5G 1K5

Report Date: 2019/04/04
Report #: R5657382
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B970445
Received: 2019/03/19, 08:58

Encryption Key NRahaman

Nazeema Rahaman
Project Manager
04 Apr 2019 17:10:20

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Nazeema Rahaman, English, Project Manager
Email: NRahaman@maxxam.ca
Phone# (905)817-5700 Ext:5806
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

RESULTS OF ANALYSES OF WATER

Maxxam ID		JFP515	JFP516	JFP517		
Sampling Date		2019/03/12 17:13	2019/03/12 15:30	2019/03/12 15:30		
COC Number		B919002-ONTV-01-01	B919002-ONTV-01-01	B919002-ONTV-01-01		
	UNITS	**VJ3199-MW19-66-190312**	**VJ3200-EQUIP-WLP-1-190312**	**VJ3201-EQUIP-WLP-2-190312**	**RDL**	**QC Batch**
Perfluorobutanoic acid	ug/L	0.043	ND	ND	0.020	6036970
Perfluoropentanoic Acid (PFPeA)	ug/L	0.26	ND	ND	0.020	6036970
Perfluorohexanoic Acid (PFHxA)	ug/L	0.22	ND	ND	0.020	6036970
Perfluoroheptanoic Acid (PFHpA)	ug/L	0.070	ND	ND	0.020	6036970
Perfluorooctanoic Acid (PFOA)	ug/L	0.035	ND	ND	0.020	6036970
Perfluorononanoic Acid (PFNA)	ug/L	ND	ND	ND	0.020	6036970
Perfluorodecanoic Acid (PFDA)	ug/L	ND	ND	ND	0.020	6036970
Perfluoroundecanoic Acid (PFUnA)	ug/L	ND	ND	ND	0.020	6036970
Perfluorododecanoic Acid (PFDoA)	ug/L	ND	ND	ND	0.020	6036970
Perfluorotridecanoic Acid	ug/L	ND	ND	ND	0.020	6036970
Perfluorotetradecanoic Acid	ug/L	ND	ND	ND	0.020	6036970
Perfluorobutanesulfonic acid	ug/L	0.030	ND	ND	0.020	6036970
Perfluorohexanesulfonic acid	ug/L	0.33	ND	ND	0.020	6036970
Perfluoroheptanesulfonic acid	ug/L	ND	ND	ND	0.020	6036970
Perfluorooctanesulfonic acid	ug/L	0.021	ND	ND	0.020	6036970
Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	ND	ND	0.020	6036970
Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	ND	ND	0.020	6036970
EtFOSA	ug/L	ND	ND	ND	0.020	6036970
MeFOSA	ug/L	ND	ND	ND	0.020	6036970
EtFOSE	ug/L	ND	ND	ND	0.020	6036970
MeFOSE	ug/L	ND	ND	ND	0.020	6036970
EtFOSAA	ug/L	ND	ND	ND	0.020	6036970
MeFOSAA	ug/L	ND	ND	ND	0.020	6036970
6:2 Fluorotelomer sulfonic acid	ug/L	ND	ND	ND	0.020	6036970
8:2 Fluorotelomer sulfonic acid	ug/L	ND	ND	ND	0.020	6036970
Surrogate Recovery (%)						
13C2-4:2-Fluorotelomersulfonic Acid	%	72	82	87	N/A	6036970
13C2-6:2 Fluorotelomer sulfonate	%	80	80	86	N/A	6036970
13C2-6:2-Fluorotelomersulfonic Acid	%	80	80	86	N/A	6036970
13C2-8:2 Fluorotelomer sulfonate	%	74	80	85	N/A	6036970
13C2-8:2-Fluorotelomersulfonic Acid	%	74	80	85	N/A	6036970
13C2-Perfluorodecanoic acid	%	71	79	82	N/A	6036970
13C2-Perfluorododecanoic acid	%	64	76	77	N/A	6036970

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

RESULTS OF ANALYSES OF WATER

Maxxam ID		JFP515	JFP516	JFP517		
Sampling Date		2019/03/12 17:13	2019/03/12 15:30	2019/03/12 15:30		
COC Number		B919002-ONTV-01-01	B919002-ONTV-01-01	B919002-ONTV-01-01		
	UNITS	**VJ3199-MW19-66-190312**	**VJ3200-EQUIP-WLP-1-190312**	**VJ3201-EQUIP-WLP-2-190312**	**RDL**	**QC Batch**
13C2-Perfluorohexanoic acid	%	78	79	82	N/A	6036970
13C2-perfluorotetradecanoic acid	%	60	69	73	N/A	6036970
13C2-Perfluoroundecanoic acid	%	66	77	79	N/A	6036970
13C3-Perfluorobutanesulfonic acid	%	77	77	81	N/A	6036970
13C4-Perfluorobutanoic acid	%	74	75	79	N/A	6036970
13C4-Perfluoroheptanoic acid	%	77	77	81	N/A	6036970
13C4-Perfluorooctanesulfonate	%	71	79	80	N/A	6036970
13C4-Perfluorooctanesulfonic acid	%	71	79	80	N/A	6036970
13C4-Perfluorooctanoic acid	%	75	77	80	N/A	6036970
13C5-Perfluorononanoic acid	%	74	78	80	N/A	6036970
13C5-Perfluoropentanoic acid	%	76	77	80	N/A	6036970
13C8-Perfluorooctane Sulfonamide	%	66	74	76	N/A	6036970
18O2-Perfluorohexanesulfonate	%	75	76	78	N/A	6036970
18O2-Perfluorohexanesulfonic acid	%	75	76	78	N/A	6036970
D3-MeFOSA	%	55	57	50	N/A	6036970
D3-MeFOSAA	%	69	75	78	N/A	6036970
D5-EtFOSA	%	54	54	48 (1)	N/A	6036970
D5-EtFOSAA	%	66	71	72	N/A	6036970
D7-MeFOSE	%	64	69	68	N/A	6036970
D9-EtFOSE	%	62	69	68	N/A	6036970

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
(1) Extracted internal standard analyte recovery was below the method defined lower control limit (LCL), however, BC Environmental Laboratory Manual Performance Based Method criteria were satisfied. There is no impact on the data.

RESULTS OF ANALYSES OF WATER

Maxxam ID		JFP518		JFP519		
Sampling Date		2019/03/12 17:00		2019/03/12 16:30		
COC Number		B919002-ONTV-01-01		B919002-ONTV-01-01		
	UNITS	**VJ3202-MW19-68-190312**	**RDL**	**VJ3203-MW19-62-190312**	**RDL**	**QC Batch**
Perfluorobutanoic acid	ug/L	0.45	0.040	0.060	0.020	6036970
Perfluoropentanoic Acid (PFPeA)	ug/L	2.1	0.40	0.13	0.020	6036970
Perfluorohexanoic Acid (PFHxA)	ug/L	2.3	0.40	0.13	0.020	6036970
Perfluoroheptanoic Acid (PFHpA)	ug/L	0.71	0.040	0.058	0.020	6036970
Perfluorooctanoic Acid (PFOA)	ug/L	0.69	0.040	0.085	0.020	6036970
Perfluorononanoic Acid (PFNA)	ug/L	ND	0.040	ND	0.020	6036970
Perfluorodecanoic Acid (PFDA)	ug/L	ND	0.040	ND	0.020	6036970
Perfluoroundecanoic Acid (PFUnA)	ug/L	ND	0.040	ND	0.020	6036970
Perfluorododecanoic Acid (PFDoA)	ug/L	ND	0.040	ND	0.020	6036970
Perfluorotridecanoic Acid	ug/L	ND	0.040	ND	0.020	6036970
Perfluorotetradecanoic Acid	ug/L	ND	0.040	ND	0.020	6036970
Perfluorobutanesulfonic acid	ug/L	0.45	0.040	0.042	0.020	6036970
Perfluorohexanesulfonic acid	ug/L	6.7	0.40	0.72	0.020	6036970
Perfluoroheptanesulfonic acid	ug/L	ND	0.040	ND	0.020	6036970
Perfluorooctanesulfonic acid	ug/L	0.45	0.040	0.41	0.020	6036970
Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	0.040	ND	0.020	6036970
Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	0.040	ND	0.020	6036970
EtFOSA	ug/L	ND	0.040	ND	0.020	6036970
MeFOSA	ug/L	ND	0.040	ND	0.020	6036970
EtFOSE	ug/L	ND	0.040	ND	0.020	6036970
MeFOSE	ug/L	ND	0.040	ND	0.020	6036970
EtFOSAA	ug/L	ND	0.040	ND	0.020	6036970
MeFOSAA	ug/L	ND	0.040	ND	0.020	6036970
6:2 Fluorotelomer sulfonic acid	ug/L	ND	0.040	ND	0.020	6036970
8:2 Fluorotelomer sulfonic acid	ug/L	ND	0.040	ND	0.020	6036970
Surrogate Recovery (%)						
13C2-4:2-Fluorotelomersulfonic Acid	%	87	N/A	64	N/A	6036970
13C2-6:2 Fluorotelomer sulfonate	%	91	N/A	76	N/A	6036970
13C2-6:2-Fluorotelomersulfonic Acid	%	91	N/A	76	N/A	6036970
13C2-8:2 Fluorotelomer sulfonate	%	86	N/A	75	N/A	6036970
13C2-8:2-Fluorotelomersulfonic Acid	%	86	N/A	75	N/A	6036970
13C2-Perfluorodecanoic acid	%	76	N/A	70	N/A	6036970
13C2-Perfluorododecanoic acid	%	73	N/A	63	N/A	6036970

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

RESULTS OF ANALYSES OF WATER

Maxxam ID		JFP518		JFP519		
Sampling Date		2019/03/12 17:00		2019/03/12 16:30		
COC Number		B919002-ONTV-01-01		B919002-ONTV-01-01		
	UNITS	**VJ3202-MW19-68-190312**	**RDL**	**VJ3203-MW19-62-190312**	**RDL**	**QC Batch**
13C2-Perfluorohexanoic acid	%	81	N/A	73	N/A	6036970
13C2-perfluorotetradecanoic acid	%	71	N/A	61	N/A	6036970
13C2-Perfluoroundecanoic acid	%	72	N/A	65	N/A	6036970
13C3-Perfluorobutanesulfonic acid	%	83	N/A	69	N/A	6036970
13C4-Perfluorobutanoic acid	%	80	N/A	63	N/A	6036970
13C4-Perfluoroheptanoic acid	%	81	N/A	71	N/A	6036970
13C4-Perfluorooctanesulfonate	%	79	N/A	69	N/A	6036970
13C4-Perfluorooctanesulfonic acid	%	79	N/A	69	N/A	6036970
13C4-Perfluorooctanoic acid	%	80	N/A	69	N/A	6036970
13C5-Perfluorononanoic acid	%	81	N/A	69	N/A	6036970
13C5-Perfluoropentanoic acid	%	78	N/A	69	N/A	6036970
13C8-Perfluorooctane Sulfonamide	%	69	N/A	64	N/A	6036970
18O2-Perfluorohexanesulfonate	%	75	N/A	67	N/A	6036970
18O2-Perfluorohexanesulfonic acid	%	75	N/A	67	N/A	6036970
D3-MeFOSA	%	56	N/A	52	N/A	6036970
D3-MeFOSAA	%	71	N/A	63	N/A	6036970
D5-EtFOSA	%	57	N/A	52	N/A	6036970
D5-EtFOSAA	%	71	N/A	64	N/A	6036970
D7-MeFOSE	%	67	N/A	62	N/A	6036970
D9-EtFOSE	%	70	N/A	61	N/A	6036970

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

RESULTS OF ANALYSES OF WATER

Maxxam ID		JFP520		JFP521		
Sampling Date		2019/03/13 14:00		2019/03/13 11:15		
COC Number		B919002-ONTV-01-01		B919002-ONTV-01-01		
	UNITS	**VJ3204-MW19-61-190313**	**RDL**	**VJ3205-MW19-56-190313**	**RDL**	**QC Batch**
Perfluorobutanoic acid	ug/L	0.17	0.020	0.031	0.020	6036970
Perfluoropentanoic Acid (PFPeA)	ug/L	0.43	0.020	0.10	0.020	6036970
Perfluorohexanoic Acid (PFHxA)	ug/L	0.74	0.020	0.097	0.020	6036970
Perfluoroheptanoic Acid (PFHpA)	ug/L	0.12	0.020	0.030	0.020	6036970
Perfluorooctanoic Acid (PFOA)	ug/L	0.10	0.020	ND	0.020	6036970
Perfluorononanoic Acid (PFNA)	ug/L	ND	0.020	ND	0.020	6036970
Perfluorodecanoic Acid (PFDA)	ug/L	ND	0.020	ND	0.020	6036970
Perfluoroundecanoic Acid (PFUnA)	ug/L	ND	0.020	ND	0.020	6036970
Perfluorododecanoic Acid (PFDoA)	ug/L	ND	0.020	ND	0.020	6036970
Perfluorotridecanoic Acid	ug/L	ND	0.020	ND	0.020	6036970
Perfluorotetradecanoic Acid	ug/L	ND	0.020	ND	0.020	6036970
Perfluorobutanesulfonic acid	ug/L	0.66	0.020	0.048	0.020	6036970
Perfluorohexanesulfonic acid	ug/L	1.2	0.20	0.18	0.020	6036970
Perfluoroheptanesulfonic acid	ug/L	0.021	0.020	ND	0.020	6036970
Perfluorooctanesulfonic acid	ug/L	0.21	0.020	ND	0.020	6036970
Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	0.020	ND	0.020	6036970
Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	0.020	ND	0.020	6036970
EtFOSA	ug/L	ND	0.020	ND	0.020	6036970
MeFOSA	ug/L	ND	0.020	ND	0.020	6036970
EtFOSE	ug/L	ND	0.020	ND	0.020	6036970
MeFOSE	ug/L	ND	0.020	ND	0.020	6036970
EtFOSAA	ug/L	ND	0.020	ND	0.020	6036970
MeFOSAA	ug/L	ND	0.020	ND	0.020	6036970
6:2 Fluorotelomer sulfonic acid	ug/L	0.13	0.020	ND	0.020	6036970
8:2 Fluorotelomer sulfonic acid	ug/L	ND	0.020	ND	0.020	6036970
Surrogate Recovery (%)						
13C2-4:2-Fluorotelomersulfonic Acid	%	86	N/A	44 (1)	N/A	6036970
13C2-6:2 Fluorotelomer sulfonate	%	88	N/A	45 (1)	N/A	6036970
13C2-6:2-Fluorotelomersulfonic Acid	%	88	N/A	45 (1)	N/A	6036970
13C2-8:2 Fluorotelomer sulfonate	%	85	N/A	41 (1)	N/A	6036970

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

(1) Extracted internal standard analyte recovery was below the method defined lower control limit (LCL), however, BC Environmental Laboratory Manual Performance Based Method criteria were satisfied. There is no impact on the data.

RESULTS OF ANALYSES OF WATER

Maxxam ID		JFP520		JFP521		
Sampling Date		2019/03/13 14:00		2019/03/13 11:15		
COC Number		B919002-ONTV-01-01		B919002-ONTV-01-01		
	UNITS	**VJ3204-MW19-61-190313**	**RDL**	**VJ3205-MW19-56-190313**	**RDL**	**QC Batch**
13C2-8:2-Fluorotelomersulfonic Acid	%	85	N/A	41 (1)	N/A	6036970
13C2-Perfluorodecanoic acid	%	75	N/A	37 (1)	N/A	6036970
13C2-Perfluorododecanoic acid	%	71	N/A	25 (1)	N/A	6036970
13C2-Perfluorohexanoic acid	%	80	N/A	41 (1)	N/A	6036970
13C2-perfluorotetradecanoic acid	%	70	N/A	25 (1)	N/A	6036970
13C2-Perfluoroundecanoic acid	%	71	N/A	30 (1)	N/A	6036970
13C3-Perfluorobutanesulfonic acid	%	80	N/A	41 (1)	N/A	6036970
13C4-Perfluorobutanoic acid	%	80	N/A	39 (1)	N/A	6036970
13C4-Perfluoroheptanoic acid	%	83	N/A	40 (1)	N/A	6036970
13C4-Perfluorooctanesulfonate	%	80	N/A	38 (1)	N/A	6036970
13C4-Perfluorooctanesulfonic acid	%	80	N/A	38 (1)	N/A	6036970
13C4-Perfluorooctanoic acid	%	81	N/A	40 (1)	N/A	6036970
13C5-Perfluorononanoic acid	%	80	N/A	39 (1)	N/A	6036970
13C5-Perfluoropentanoic acid	%	79	N/A	40 (1)	N/A	6036970
13C8-Perfluorooctane Sulfonamide	%	70	N/A	30 (1)	N/A	6036970
18O2-Perfluorohexanesulfonate	%	62	N/A	40 (1)	N/A	6036970
18O2-Perfluorohexanesulfonic acid	%	62	N/A	40 (1)	N/A	6036970
D3-MeFOSA	%	57	N/A	20 (1)	N/A	6036970
D3-MeFOSAA	%	70	N/A	28 (1)	N/A	6036970
D5-EtFOSA	%	57	N/A	20 (1)	N/A	6036970
D5-EtFOSAA	%	69	N/A	25 (1)	N/A	6036970
D7-MeFOSE	%	68	N/A	23 (1)	N/A	6036970
D9-EtFOSE	%	66	N/A	23 (1)	N/A	6036970

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
(1) Extracted internal standard analyte recovery was below the method defined lower control limit (LCL), however, BC Environmental Laboratory Manual Performance Based Method criteria were satisfied. There is no impact on the data.

RESULTS OF ANALYSES OF WATER

Maxxam ID		JFP522	JFP523	JFP524		
Sampling Date		2019/03/13 10:00	2019/03/13 12:50	2019/03/13 11:05		
COC Number		B919002-ONTV-01-01	B919002-ONTV-01-01	B919002-ONTV-01-01		
	UNITS	**VJ3206-MW19-57-190313**	**VJ3207-MW19-64-190313**	**VJ3208-MW19-60-190313**	**RDL**	**QC Batch**
Perfluorobutanoic acid	ug/L	ND	0.19	ND	0.020	6036970
Perfluoropentanoic Acid (PFPeA)	ug/L	0.039	0.64	0.064	0.020	6036970
Perfluorohexanoic Acid (PFHxA)	ug/L	0.035	0.58	0.069	0.020	6036970
Perfluoroheptanoic Acid (PFHpA)	ug/L	ND	0.15	0.036	0.020	6036970
Perfluorooctanoic Acid (PFOA)	ug/L	ND	0.19	ND	0.020	6036970
Perfluorononanoic Acid (PFNA)	ug/L	ND	ND	ND	0.020	6036970
Perfluorodecanoic Acid (PFDA)	ug/L	ND	ND	ND	0.020	6036970
Perfluoroundecanoic Acid (PFUnA)	ug/L	ND	ND	ND	0.020	6036970
Perfluorododecanoic Acid (PFDoA)	ug/L	ND	ND	ND	0.020	6036970
Perfluorotridecanoic Acid	ug/L	ND	ND	ND	0.020	6036970
Perfluorotetradecanoic Acid	ug/L	ND	ND	ND	0.020	6036970
Perfluorobutanesulfonic acid	ug/L	ND	0.14	ND	0.020	6036970
Perfluorohexanesulfonic acid	ug/L	0.098	0.98	0.11	0.020	6036970
Perfluoroheptanesulfonic acid	ug/L	ND	0.023	ND	0.020	6036970
Perfluorooctanesulfonic acid	ug/L	0.039	0.23	ND	0.020	6036970
Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	ND	ND	0.020	6036970
Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	ND	ND	0.020	6036970
EtFOSA	ug/L	ND	ND	ND	0.020	6036970
MeFOSA	ug/L	ND	ND	ND	0.020	6036970
EtFOSE	ug/L	ND	ND	ND	0.020	6036970
MeFOSE	ug/L	ND	ND	ND	0.020	6036970
EtFOSAA	ug/L	ND	ND	ND	0.020	6036970
MeFOSAA	ug/L	ND	ND	ND	0.020	6036970
6:2 Fluorotelomer sulfonic acid	ug/L	ND	0.21	ND	0.020	6036970
8:2 Fluorotelomer sulfonic acid	ug/L	ND	ND	ND	0.020	6036970
Surrogate Recovery (%)						
13C2-4:2-Fluorotelomersulfonic Acid	%	77	73	82	N/A	6036970
13C2-6:2 Fluorotelomer sulfonate	%	83	77	85	N/A	6036970
13C2-6:2-Fluorotelomersulfonic Acid	%	83	77	85	N/A	6036970
13C2-8:2 Fluorotelomer sulfonate	%	77	82	80	N/A	6036970
13C2-8:2-Fluorotelomersulfonic Acid	%	77	82	80	N/A	6036970
13C2-Perfluorodecanoic acid	%	73	72	75	N/A	6036970
13C2-Perfluorododecanoic acid	%	66	63	66	N/A	6036970

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

RESULTS OF ANALYSES OF WATER

Maxxam ID		JFP522	JFP523	JFP524		
Sampling Date		2019/03/13 10:00	2019/03/13 12:50	2019/03/13 11:05		
COC Number		B919002-ONTV-01-01	B919002-ONTV-01-01	B919002-ONTV-01-01		
	UNITS	**VJ3206-MW19-57-190313**	**VJ3207-MW19-64-190313**	**VJ3208-MW19-60-190313**	**RDL**	**QC Batch**
13C2-Perfluorohexanoic acid	%	77	78	81	N/A	6036970
13C2-perfluorotetradecanoic acid	%	64	60	66	N/A	6036970
13C2-Perfluoroundecanoic acid	%	69	67	70	N/A	6036970
13C3-Perfluorobutanesulfonic acid	%	75	77	78	N/A	6036970
13C4-Perfluorobutanoic acid	%	72	60	77	N/A	6036970
13C4-Perfluoroheptanoic acid	%	76	80	80	N/A	6036970
13C4-Perfluorooctanesulfonate	%	74	77	75	N/A	6036970
13C4-Perfluorooctanesulfonic acid	%	74	77	75	N/A	6036970
13C4-Perfluorooctanoic acid	%	75	78	77	N/A	6036970
13C5-Perfluorononanoic acid	%	75	79	77	N/A	6036970
13C5-Perfluoropentanoic acid	%	73	72	77	N/A	6036970
13C8-Perfluorooctane Sulfonamide	%	66	64	68	N/A	6036970
18O2-Perfluorohexanesulfonate	%	75	78	75	N/A	6036970
18O2-Perfluorohexanesulfonic acid	%	75	78	75	N/A	6036970
D3-MeFOSA	%	55	51	59	N/A	6036970
D3-MeFOSAA	%	66	69	73	N/A	6036970
D5-EtFOSA	%	53	52	57	N/A	6036970
D5-EtFOSAA	%	65	65	69	N/A	6036970
D7-MeFOSE	%	62	61	64	N/A	6036970
D9-EtFOSE	%	60	61	64	N/A	6036970

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

RESULTS OF ANALYSES OF WATER

Maxxam ID		JFP525			JFP526		
Sampling Date		2019/03/13 12:30			2019/03/13		
COC Number		B919002-ONTV-01-01			B919002-ONTV-01-01		
	UNITS	**VJ3227-MW19-58-190313**	**RDL**	**QC Batch**	**VJ3228-MW19-A-190313**	**RDL**	**QC Batch**
Perfluorobutanoic acid	ug/L	2.1	0.10	6042023	ND	0.020	6036970
Perfluoropentanoic Acid (PFPeA)	ug/L	4.1	0.10	6042023	0.025	0.020	6036970
Perfluorohexanoic Acid (PFHxA)	ug/L	12	1.0	6042023	0.020	0.020	6036970
Perfluoroheptanoic Acid (PFHpA)	ug/L	1.5	0.10	6042023	ND	0.020	6036970
Perfluorooctanoic Acid (PFOA)	ug/L	2.5	0.10	6042023	ND	0.020	6036970
Perfluorononanoic Acid (PFNA)	ug/L	ND	0.10	6042023	ND	0.020	6036970
Perfluorodecanoic Acid (PFDA)	ug/L	ND	0.10	6042023	ND	0.020	6036970
Perfluoroundecanoic Acid (PFUnA)	ug/L	ND	0.10	6042023	ND	0.020	6036970
Perfluorododecanoic Acid (PFDoA)	ug/L	ND	0.10	6042023	ND	0.020	6036970
Perfluorotridecanoic Acid	ug/L	ND	0.10	6042023	ND	0.020	6036970
Perfluorotetradecanoic Acid	ug/L	ND	0.10	6042023	ND	0.020	6036970
Perfluorobutanesulfonic acid	ug/L	5.1	1.0	6042023	ND	0.020	6036970
Perfluorohexanesulfonic acid	ug/L	23	1.0	6042023	0.039	0.020	6036970
Perfluoroheptanesulfonic acid	ug/L	0.32	0.10	6042023	ND	0.020	6036970
Perfluorooctanesulfonic acid	ug/L	16	1.0	6042023	ND	0.020	6036970
Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	0.10	6042023	ND	0.020	6036970
Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	0.10	6042023	ND	0.020	6036970
EtFOSA	ug/L	ND	0.10	6042023	ND	0.020	6036970
MeFOSA	ug/L	ND	0.10	6042023	ND	0.020	6036970
EtFOSE	ug/L	ND	0.10	6042023	ND	0.020	6036970
MeFOSE	ug/L	ND	0.10	6042023	ND	0.020	6036970
EtFOSAA	ug/L	ND	0.10	6042023	ND	0.020	6036970
MeFOSAA	ug/L	ND	0.10	6042023	ND	0.020	6036970
6:2 Fluorotelomer sulfonic acid	ug/L	34	1.0	6042023	ND	0.020	6036970
8:2 Fluorotelomer sulfonic acid	ug/L	0.55	0.10	6042023	ND	0.020	6036970
Surrogate Recovery (%)							
13C2-4:2-Fluorotelomersulfonic Acid	%	103	N/A	6042023	84	N/A	6036970
13C2-6:2 Fluorotelomer sulfonate	%	N/A	N/A	N/A	86	N/A	6036970
13C2-6:2-Fluorotelomersulfonic Acid	%	92	N/A	6042023	86	N/A	6036970
13C2-8:2 Fluorotelomer sulfonate	%	N/A	N/A	N/A	78	N/A	6036970
13C2-8:2-Fluorotelomersulfonic Acid	%	105	N/A	6042023	78	N/A	6036970
13C2-Perfluorodecanoic acid	%	90	N/A	6042023	72	N/A	6036970
13C2-Perfluorododecanoic acid	%	92	N/A	6042023	66	N/A	6036970

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

RESULTS OF ANALYSES OF WATER

Maxxam ID		JFP525			JFP526		
Sampling Date		2019/03/13 12:30			2019/03/13		
COC Number		B919002-ONTV-01-01			B919002-ONTV-01-01		
	UNITS	**VJ3227-MW19-58-190313**	**RDL**	**QC Batch**	**VJ3228-MW19-A-190313**	**RDL**	**QC Batch**
13C2-Perfluorohexanoic acid	%	97	N/A	6042023	78	N/A	6036970
13C2-perfluorotetradecanoic acid	%	89	N/A	6042023	64	N/A	6036970
13C2-Perfluoroundecanoic acid	%	91	N/A	6042023	70	N/A	6036970
13C3-Perfluorobutanesulfonic acid	%	97	N/A	6042023	77	N/A	6036970
13C4-Perfluorobutanoic acid	%	102	N/A	6042023	75	N/A	6036970
13C4-Perfluoroheptanoic acid	%	104	N/A	6042023	77	N/A	6036970
13C4-Perfluorooctanesulfonate	%	N/A	N/A	N/A	74	N/A	6036970
13C4-Perfluorooctanesulfonic acid	%	92	N/A	6042023	74	N/A	6036970
13C4-Perfluorooctanoic acid	%	102	N/A	6042023	75	N/A	6036970
13C5-Perfluorononanoic acid	%	103	N/A	6042023	74	N/A	6036970
13C5-Perfluoropentanoic acid	%	101	N/A	6042023	76	N/A	6036970
13C8-Perfluorooctane Sulfonamide	%	90	N/A	6042023	68	N/A	6036970
18O2-Perfluorohexanesulfonate	%	N/A	N/A	N/A	75	N/A	6036970
18O2-Perfluorohexanesulfonic acid	%	93	N/A	6042023	75	N/A	6036970
D3-MeFOSA	%	60	N/A	6042023	56	N/A	6036970
D3-MeFOSAA	%	96	N/A	6042023	70	N/A	6036970
D5-EtFOSA	%	58	N/A	6042023	57	N/A	6036970
D5-EtFOSAA	%	96	N/A	6042023	66	N/A	6036970
D7-MeFOSE	%	77	N/A	6042023	62	N/A	6036970
D9-EtFOSE	%	77	N/A	6042023	62	N/A	6036970

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

RESULTS OF ANALYSES OF WATER

Maxxam ID		JFP527	JFP528	JFP529		
Sampling Date		2019/03/14 12:00	2019/03/13 08:15	2019/03/14		
COC Number		B919002-ONTV-01-01	B919002-ONTV-01-01	B919002-ONTV-01-01		
	UNITS	**VJ3229-MW19-63-190314**	**VJ3230-MW19-50-190313**	**VJ3231-TRIP-190314**	**RDL**	**QC Batch**
Perfluorobutanoic acid	ug/L	0.038	ND	ND	0.020	6036970
Perfluoropentanoic Acid (PFPeA)	ug/L	0.092	0.025	ND	0.020	6036970
Perfluorohexanoic Acid (PFHxA)	ug/L	0.082	ND	ND	0.020	6036970
Perfluoroheptanoic Acid (PFHpA)	ug/L	0.041	ND	ND	0.020	6036970
Perfluorooctanoic Acid (PFOA)	ug/L	0.049	ND	ND	0.020	6036970
Perfluorononanoic Acid (PFNA)	ug/L	ND	ND	ND	0.020	6036970
Perfluorodecanoic Acid (PFDA)	ug/L	ND	ND	ND	0.020	6036970
Perfluoroundecanoic Acid (PFUnA)	ug/L	ND	ND	ND	0.020	6036970
Perfluorododecanoic Acid (PFDoA)	ug/L	ND	ND	ND	0.020	6036970
Perfluorotridecanoic Acid	ug/L	ND	ND	ND	0.020	6036970
Perfluorotetradecanoic Acid	ug/L	ND	ND	ND	0.020	6036970
Perfluorobutanesulfonic acid	ug/L	0.031	ND	ND	0.020	6036970
Perfluorohexanesulfonic acid	ug/L	0.39	0.037	ND	0.020	6036970
Perfluoroheptanesulfonic acid	ug/L	ND	ND	ND	0.020	6036970
Perfluorooctanesulfonic acid	ug/L	0.32	ND	ND	0.020	6036970
Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	ND	ND	0.020	6036970
Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	ND	ND	0.020	6036970
EtFOSA	ug/L	ND	ND	ND	0.020	6036970
MeFOSA	ug/L	ND	ND	ND	0.020	6036970
EtFOSE	ug/L	ND	ND	ND	0.020	6036970
MeFOSE	ug/L	ND	ND	ND	0.020	6036970
EtFOSAA	ug/L	ND	ND	ND	0.020	6036970
MeFOSAA	ug/L	ND	ND	ND	0.020	6036970
6:2 Fluorotelomer sulfonic acid	ug/L	ND	ND	ND	0.020	6036970
8:2 Fluorotelomer sulfonic acid	ug/L	ND	ND	ND	0.020	6036970
Surrogate Recovery (%)						
13C2-4:2-Fluorotelomersulfonic Acid	%	65	82	92	N/A	6036970
13C2-6:2 Fluorotelomer sulfonate	%	77	85	90	N/A	6036970
13C2-6:2-Fluorotelomersulfonic Acid	%	77	85	90	N/A	6036970
13C2-8:2 Fluorotelomer sulfonate	%	77	77	83	N/A	6036970
13C2-8:2-Fluorotelomersulfonic Acid	%	77	77	83	N/A	6036970
13C2-Perfluorodecanoic acid	%	71	73	80	N/A	6036970
13C2-Perfluorododecanoic acid	%	65	68	74	N/A	6036970

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

RESULTS OF ANALYSES OF WATER

Maxxam ID		JFP527	JFP528	JFP529		
Sampling Date		2019/03/14 12:00	2019/03/13 08:15	2019/03/14		
COC Number		B919002-ONTV-01-01	B919002-ONTV-01-01	B919002-ONTV-01-01		
	UNITS	**VJ3229-MW19-63-190314**	**VJ3230-MW19-50-190313**	**VJ3231-TRIP-190314**	**RDL**	**QC Batch**
13C2-Perfluorohexanoic acid	%	72	77	82	N/A	6036970
13C2-perfluorotetradecanoic acid	%	60	67	71	N/A	6036970
13C2-Perfluoroundecanoic acid	%	69	69	75	N/A	6036970
13C3-Perfluorobutanesulfonic acid	%	72	75	79	N/A	6036970
13C4-Perfluorobutanoic acid	%	64	74	80	N/A	6036970
13C4-Perfluoroheptanoic acid	%	72	76	81	N/A	6036970
13C4-Perfluorooctanesulfonate	%	69	73	78	N/A	6036970
13C4-Perfluorooctanesulfonic acid	%	69	73	78	N/A	6036970
13C4-Perfluorooctanoic acid	%	70	74	77	N/A	6036970
13C5-Perfluorononanoic acid	%	70	74	78	N/A	6036970
13C5-Perfluoropentanoic acid	%	69	74	80	N/A	6036970
13C8-Perfluorooctane Sulfonamide	%	65	68	74	N/A	6036970
18O2-Perfluorohexanesulfonate	%	69	73	77	N/A	6036970
18O2-Perfluorohexanesulfonic acid	%	69	73	77	N/A	6036970
D3-MeFOSA	%	56	55	44 (1)	N/A	6036970
D3-MeFOSAA	%	68	67	75	N/A	6036970
D5-EtFOSA	%	55	56	43 (1)	N/A	6036970
D5-EtFOSAA	%	66	67	70	N/A	6036970
D7-MeFOSE	%	61	63	67	N/A	6036970
D9-EtFOSE	%	60	65	62	N/A	6036970

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
(1) Extracted internal standard analyte recovery was below the method defined lower control limit (LCL), however, BC Environmental Laboratory Manual Performance Based Method criteria were satisfied. There is no impact on the data.

RESULTS OF ANALYSES OF WATER

Maxxam ID		JFP530		JFP531		
Sampling Date		2019/03/14		2019/03/14 13:00		
COC Number		B919002-ONTV-01-01		B919002-ONTV-01-01		
	UNITS	**VJ3232-MW19-B-190314**	**RDL**	**VJ3233-MW19-65-190314**	**RDL**	**QC Batch**
Perfluorobutanoic acid	ug/L	0.037	0.020	0.29	0.020	6036970
Perfluoropentanoic Acid (PFPeA)	ug/L	0.085	0.020	0.99	0.020	6036970
Perfluorohexanoic Acid (PFHxA)	ug/L	0.076	0.020	0.86	0.020	6036970
Perfluoroheptanoic Acid (PFHpA)	ug/L	0.040	0.020	0.22	0.020	6036970
Perfluorooctanoic Acid (PFOA)	ug/L	0.048	0.020	0.28	0.020	6036970
Perfluorononanoic Acid (PFNA)	ug/L	ND	0.020	0.027	0.020	6036970
Perfluorodecanoic Acid (PFDA)	ug/L	ND	0.020	ND	0.020	6036970
Perfluoroundecanoic Acid (PFUnA)	ug/L	ND	0.020	ND	0.020	6036970
Perfluorododecanoic Acid (PFDoA)	ug/L	ND	0.020	ND	0.020	6036970
Perfluorotridecanoic Acid	ug/L	ND	0.020	ND	0.020	6036970
Perfluorotetradecanoic Acid	ug/L	ND	0.020	ND	0.020	6036970
Perfluorobutanesulfonic acid	ug/L	0.030	0.020	0.22	0.020	6036970
Perfluorohexanesulfonic acid	ug/L	0.36	0.020	1.4	0.20	6036970
Perfluoroheptanesulfonic acid	ug/L	ND	0.020	0.038	0.020	6036970
Perfluorooctanesulfonic acid	ug/L	0.31	0.020	0.43	0.020	6036970
Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	0.020	ND	0.020	6036970
Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	0.020	ND	0.020	6036970
EtFOSA	ug/L	ND	0.020	ND	0.020	6036970
MeFOSA	ug/L	ND	0.020	ND	0.020	6036970
EtFOSE	ug/L	ND	0.020	ND	0.020	6036970
MeFOSE	ug/L	ND	0.020	ND	0.020	6036970
EtFOSAA	ug/L	ND	0.020	ND	0.020	6036970
MeFOSAA	ug/L	ND	0.020	ND	0.020	6036970
6:2 Fluorotelomer sulfonic acid	ug/L	ND	0.020	0.32	0.020	6036970
8:2 Fluorotelomer sulfonic acid	ug/L	ND	0.020	ND	0.020	6036970
Surrogate Recovery (%)						
13C2-4:2-Fluorotelomersulfonic Acid	%	65	N/A	69	N/A	6036970
13C2-6:2 Fluorotelomer sulfonate	%	75	N/A	77	N/A	6036970
13C2-6:2-Fluorotelomersulfonic Acid	%	75	N/A	77	N/A	6036970
13C2-8:2 Fluorotelomer sulfonate	%	77	N/A	84	N/A	6036970
13C2-8:2-Fluorotelomersulfonic Acid	%	77	N/A	84	N/A	6036970
13C2-Perfluorodecanoic acid	%	72	N/A	74	N/A	6036970
13C2-Perfluorododecanoic acid	%	64	N/A	66	N/A	6036970

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

RESULTS OF ANALYSES OF WATER

Maxxam ID		JFP530		JFP531		
Sampling Date		2019/03/14		2019/03/14 13:00		
COC Number		B919002-ONTV-01-01		B919002-ONTV-01-01		
	UNITS	**VJ3232-MW19-B-190314**	**RDL**	**VJ3233-MW19-65-190314**	**RDL**	**QC Batch**
13C2-Perfluorohexanoic acid	%	78	N/A	80	N/A	6036970
13C2-perfluorotetradecanoic acid	%	57	N/A	65	N/A	6036970
13C2-Perfluoroundecanoic acid	%	68	N/A	69	N/A	6036970
13C3-Perfluorobutanesulfonic acid	%	76	N/A	79	N/A	6036970
13C4-Perfluorobutanoic acid	%	70	N/A	66	N/A	6036970
13C4-Perfluoroheptanoic acid	%	76	N/A	81	N/A	6036970
13C4-Perfluorooctanesulfonate	%	74	N/A	77	N/A	6036970
13C4-Perfluorooctanesulfonic acid	%	74	N/A	77	N/A	6036970
13C4-Perfluorooctanoic acid	%	75	N/A	80	N/A	6036970
13C5-Perfluorononanoic acid	%	75	N/A	81	N/A	6036970
13C5-Perfluoropentanoic acid	%	75	N/A	74	N/A	6036970
13C8-Perfluorooctane Sulfonamide	%	63	N/A	63	N/A	6036970
18O2-Perfluorohexanesulfonate	%	75	N/A	70	N/A	6036970
18O2-Perfluorohexanesulfonic acid	%	75	N/A	70	N/A	6036970
D3-MeFOSA	%	49 (1)	N/A	52	N/A	6036970
D3-MeFOSAA	%	66	N/A	69	N/A	6036970
D5-EtFOSA	%	51	N/A	52	N/A	6036970
D5-EtFOSAA	%	61	N/A	68	N/A	6036970
D7-MeFOSE	%	58	N/A	60	N/A	6036970
D9-EtFOSE	%	56	N/A	61	N/A	6036970

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
(1) Extracted internal standard analyte recovery was below the method defined lower control limit (LCL), however, BC Environmental Laboratory Manual Performance Based Method criteria were satisfied. There is no impact on the data.

RESULTS OF ANALYSES OF WATER

Maxxam ID		JFP532		
Sampling Date		2019/03/15 10:00		
COC Number		B919002-ONTV-01-01		
	UNITS	**VJ3234-FIELD-190315**	**RDL**	**QC Batch**
Perfluorobutanoic acid	ug/L	ND	0.020	6036970
Perfluoropentanoic Acid (PFPeA)	ug/L	ND	0.020	6036970
Perfluorohexanoic Acid (PFHxA)	ug/L	ND	0.020	6036970
Perfluoroheptanoic Acid (PFHpA)	ug/L	ND	0.020	6036970
Perfluorooctanoic Acid (PFOA)	ug/L	ND	0.020	6036970
Perfluorononanoic Acid (PFNA)	ug/L	ND	0.020	6036970
Perfluorodecanoic Acid (PFDA)	ug/L	ND	0.020	6036970
Perfluoroundecanoic Acid (PFUnA)	ug/L	ND	0.020	6036970
Perfluorododecanoic Acid (PFDoA)	ug/L	ND	0.020	6036970
Perfluorotridecanoic Acid	ug/L	ND	0.020	6036970
Perfluorotetradecanoic Acid	ug/L	ND	0.020	6036970
Perfluorobutanesulfonic acid	ug/L	ND	0.020	6036970
Perfluorohexanesulfonic acid	ug/L	ND	0.020	6036970
Perfluoroheptanesulfonic acid	ug/L	ND	0.020	6036970
Perfluorooctanesulfonic acid	ug/L	ND	0.020	6036970
Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	0.020	6036970
Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	0.020	6036970
EtFOSA	ug/L	ND	0.020	6036970
MeFOSA	ug/L	ND	0.020	6036970
EtFOSE	ug/L	ND	0.020	6036970
MeFOSE	ug/L	ND	0.020	6036970
EtFOSAA	ug/L	ND	0.020	6036970
MeFOSAA	ug/L	ND	0.020	6036970
6:2 Fluorotelomer sulfonic acid	ug/L	ND	0.020	6036970
8:2 Fluorotelomer sulfonic acid	ug/L	ND	0.020	6036970
Surrogate Recovery (%)				
13C2-4:2-Fluorotelomersulfonic Acid	%	85	N/A	6036970
13C2-6:2 Fluorotelomer sulfonate	%	82	N/A	6036970
13C2-6:2-Fluorotelomersulfonic Acid	%	82	N/A	6036970
13C2-8:2 Fluorotelomer sulfonate	%	76	N/A	6036970
13C2-8:2-Fluorotelomersulfonic Acid	%	76	N/A	6036970
13C2-Perfluorodecanoic acid	%	68	N/A	6036970
13C2-Perfluorododecanoic acid	%	63	N/A	6036970

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

RESULTS OF ANALYSES OF WATER

Maxxam ID		JFP532		
Sampling Date		2019/03/15 10:00		
COC Number		B919002-ONTV-01-01		
	UNITS	**VJ3234-FIELD-190315**	**RDL**	**QC Batch**
13C2-Perfluorohexanoic acid	%	73	N/A	6036970
13C2-perfluorotetradecanoic acid	%	62	N/A	6036970
13C2-Perfluoroundecanoic acid	%	64	N/A	6036970
13C3-Perfluorobutanesulfonic acid	%	68	N/A	6036970
13C4-Perfluorobutanoic acid	%	70	N/A	6036970
13C4-Perfluoroheptanoic acid	%	72	N/A	6036970
13C4-Perfluorooctanesulfonate	%	68	N/A	6036970
13C4-Perfluorooctanesulfonic acid	%	68	N/A	6036970
13C4-Perfluorooctanoic acid	%	70	N/A	6036970
13C5-Perfluorononanoic acid	%	70	N/A	6036970
13C5-Perfluoropentanoic acid	%	70	N/A	6036970
13C8-Perfluorooctane Sulfonamide	%	65	N/A	6036970
18O2-Perfluorohexanesulfonate	%	69	N/A	6036970
18O2-Perfluorohexanesulfonic acid	%	69	N/A	6036970
D3-MeFOSA	%	56	N/A	6036970
D3-MeFOSAA	%	64	N/A	6036970
D5-EtFOSA	%	56	N/A	6036970
D5-EtFOSAA	%	61	N/A	6036970
D7-MeFOSE	%	62	N/A	6036970
D9-EtFOSE	%	63	N/A	6036970

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

TEST SUMMARY

Maxxam ID: JFP515
Sample ID: VJ3199-MW19-66-190312
Matrix: Water

Collected: 2019/03/12
Shipped:
Received: 2019/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6036970	2019/03/26	2019/03/26	Adnan Khan

Maxxam ID: JFP516
Sample ID: VJ3200-EQUIP-WLP-1-190312
Matrix: Water

Collected: 2019/03/12
Shipped:
Received: 2019/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6036970	2019/03/26	2019/03/26	Adnan Khan

Maxxam ID: JFP517
Sample ID: VJ3201-EQUIP-WLP-2-190312
Matrix: Water

Collected: 2019/03/12
Shipped:
Received: 2019/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6036970	2019/03/26	2019/03/26	Adnan Khan

Maxxam ID: JFP518
Sample ID: VJ3202-MW19-68-190312
Matrix: Water

Collected: 2019/03/12
Shipped:
Received: 2019/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6036970	2019/03/26	2019/03/26	Adnan Khan

Maxxam ID: JFP519
Sample ID: VJ3203-MW19-62-190312
Matrix: Water

Collected: 2019/03/12
Shipped:
Received: 2019/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6036970	2019/03/26	2019/03/26	Adnan Khan

Maxxam ID: JFP520
Sample ID: VJ3204-MW19-61-190313
Matrix: Water

Collected: 2019/03/13
Shipped:
Received: 2019/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6036970	2019/03/26	2019/03/26	Adnan Khan

Maxxam ID: JFP521
Sample ID: VJ3205-MW19-56-190313
Matrix: Water

Collected: 2019/03/13
Shipped:
Received: 2019/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6036970	2019/03/26	2019/03/26	Adnan Khan

TEST SUMMARY

Maxxam ID: JFP522
Sample ID: VJ3206-MW19-57-190313
Matrix: Water

Collected: 2019/03/13
Shipped:
Received: 2019/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6036970	2019/03/26	2019/03/26	Adnan Khan

Maxxam ID: JFP523
Sample ID: VJ3207-MW19-64-190313
Matrix: Water

Collected: 2019/03/13
Shipped:
Received: 2019/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6036970	2019/03/26	2019/03/26	Adnan Khan

Maxxam ID: JFP524
Sample ID: VJ3208-MW19-60-190313
Matrix: Water

Collected: 2019/03/13
Shipped:
Received: 2019/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6036970	2019/03/26	2019/03/27	Adnan Khan

Maxxam ID: JFP525
Sample ID: VJ3227-MW19-58-190313
Matrix: Water

Collected: 2019/03/13
Shipped:
Received: 2019/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6042023	2019/03/28	2019/03/29	Anjan Desai

Maxxam ID: JFP526
Sample ID: VJ3228-MW19-A-190313
Matrix: Water

Collected: 2019/03/13
Shipped:
Received: 2019/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6036970	2019/03/26	2019/03/27	Adnan Khan

Maxxam ID: JFP527
Sample ID: VJ3229-MW19-63-190314
Matrix: Water

Collected: 2019/03/14
Shipped:
Received: 2019/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6036970	2019/03/26	2019/03/27	Adnan Khan

Maxxam ID: JFP528
Sample ID: VJ3230-MW19-50-190313
Matrix: Water

Collected: 2019/03/13
Shipped:
Received: 2019/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6036970	2019/03/26	2019/03/27	Adnan Khan

TEST SUMMARY

Maxxam ID: JFP529
Sample ID: VJ3231-TRIP-190314
Matrix: Water

Collected: 2019/03/14
Shipped:
Received: 2019/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6036970	2019/03/26	2019/03/27	Adnan Khan

Maxxam ID: JFP530
Sample ID: VJ3232-MW19-B-190314
Matrix: Water

Collected: 2019/03/14
Shipped:
Received: 2019/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6036970	2019/03/26	2019/03/27	Adnan Khan

Maxxam ID: JFP531
Sample ID: VJ3233-MW19-65-190314
Matrix: Water

Collected: 2019/03/14
Shipped:
Received: 2019/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6036970	2019/03/26	2019/03/27	Adnan Khan

Maxxam ID: JFP532
Sample ID: VJ3234-FIELD-190315
Matrix: Water

Collected: 2019/03/15
Shipped:
Received: 2019/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6036970	2019/03/26	2019/03/27	Adnan Khan

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	1.3°C

Per- and Polyfluoroalkyl Substances (PFAS) water data were evaluated against the prescribed elements for performance and quality in its respective British Columbia Environmental Laboratory Manual Performance Based Method (PBM). All criteria were satisfied except where indicated in sample comments.

Sample JFP518 [VJ3202-MW19-68-190312] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was extracted and analyzed. Detection limits were adjusted accordingly.

Sample JFP520 [VJ3204-MW19-61-190313] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was extracted and analyzed. Detection limits were adjusted accordingly.

Sample JFP525 [VJ3227-MW19-58-190313] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was extracted and analyzed. Detection limits were adjusted accordingly.

Sample JFP531 [VJ3233-MW19-65-190314] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was extracted and analyzed. Detection limits were adjusted accordingly.

Results relate only to the items tested.

QUALITY ASSURANCE REPORT

			SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6036970	13C2-4:2-Fluorotelomersulfonic Acid	2019/03/26	93	50 - 150	87	%		
6036970	13C2-6:2 Fluorotelomer sulfonate	2019/03/26	94	50 - 150	86	%		
6036970	13C2-6:2-Fluorotelomersulfonic Acid	2019/03/26	94	50 - 150	86	%		
6036970	13C2-8:2 Fluorotelomer sulfonate	2019/03/26	94	50 - 150	83	%		
6036970	13C2-8:2-Fluorotelomersulfonic Acid	2019/03/26	94	50 - 150	83	%		
6036970	13C2-Perfluorodecanoic acid	2019/03/26	93	50 - 150	76	%		
6036970	13C2-Perfluorododecanoic acid	2019/03/26	86	50 - 150	74	%		
6036970	13C2-Perfluorohexanoic acid	2019/03/26	93	50 - 150	80	%		
6036970	13C2-perfluorotetradecanoic acid	2019/03/26	84	50 - 150	71	%		
6036970	13C2-Perfluoroundecanoic acid	2019/03/26	90	50 - 150	74	%		
6036970	13C3-Perfluorobutanesulfonic acid	2019/03/26	92	50 - 150	78	%		
6036970	13C4-Perfluorobutanoic acid	2019/03/26	93	50 - 150	78	%		
6036970	13C4-Perfluoroheptanoic acid	2019/03/26	92	50 - 150	78	%		
6036970	13C4-Perfluorooctanesulfonate	2019/03/26	94	50 - 150	74	%		
6036970	13C4-Perfluorooctanesulfonic acid	2019/03/26	94	50 - 150	74	%		
6036970	13C4-Perfluorooctanoic acid	2019/03/26	93	50 - 150	76	%		
6036970	13C5-Perfluorononanoic acid	2019/03/26	91	50 - 150	76	%		
6036970	13C5-Perfluoropentanoic acid	2019/03/26	93	50 - 150	78	%		
6036970	13C8-Perfluorooctane Sulfonamide	2019/03/26	84	50 - 150	73	%		
6036970	18O2-Perfluorohexanesulfonate	2019/03/26	92	50 - 150	76	%		
6036970	18O2-Perfluorohexanesulfonic acid	2019/03/26	92	50 - 150	76	%		
6036970	D3-MeFOSA	2019/03/26	65	50 - 150	55	%		
6036970	D3-MeFOSAA	2019/03/26	81	50 - 150	74	%		
6036970	D5-EtFOSA	2019/03/26	64	50 - 150	55	%		
6036970	D5-EtFOSAA	2019/03/26	81	50 - 150	71	%		
6036970	D7-MeFOSE	2019/03/26	83	50 - 150	70	%		
6036970	D9-EtFOSE	2019/03/26	83	50 - 150	69	%		
6042023	13C2-4:2-Fluorotelomersulfonic Acid	2019/03/29	100	50 - 150	111	%		
6042023	13C2-6:2-Fluorotelomersulfonic Acid	2019/03/29	101	50 - 150	105	%		
6042023	13C2-8:2-Fluorotelomersulfonic Acid	2019/03/29	99	50 - 150	100	%		
6042023	13C2-Perfluorodecanoic acid	2019/03/29	96	50 - 150	94	%		
6042023	13C2-Perfluorododecanoic acid	2019/03/29	92	50 - 150	92	%		

QUALITY ASSURANCE REPORT(CONT'D)

			SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6042023	13C2-Perfluorohexanoic acid	2019/03/29	100	50 - 150	100	%		
6042023	13C2-perfluorotetradecanoic acid	2019/03/29	84	50 - 150	81	%		
6042023	13C2-Perfluoroundecanoic acid	2019/03/29	95	50 - 150	93	%		
6042023	13C3-Perfluorobutanesulfonic acid	2019/03/29	100	50 - 150	99	%		
6042023	13C4-Perfluorobutanoic acid	2019/03/29	99	50 - 150	97	%		
6042023	13C4-Perfluoroheptanoic acid	2019/03/29	99	50 - 150	98	%		
6042023	13C4-Perfluorooctanesulfonic acid	2019/03/29	97	50 - 150	97	%		
6042023	13C4-Perfluorooctanoic acid	2019/03/29	97	50 - 150	94	%		
6042023	13C5-Perfluorononanoic acid	2019/03/29	97	50 - 150	95	%		
6042023	13C5-Perfluoropentanoic acid	2019/03/29	99	50 - 150	98	%		
6042023	13C8-Perfluorooctane Sulfonamide	2019/03/29	93	50 - 150	94	%		
6042023	18O2-Perfluorohexanesulfonic acid	2019/03/29	97	50 - 150	95	%		
6042023	D3-MeFOSA	2019/03/29	75	50 - 150	65	%		
6042023	D3-MeFOSAA	2019/03/29	92	50 - 150	90	%		
6042023	D5-EtFOSA	2019/03/29	75	50 - 150	66	%		
6042023	D5-EtFOSAA	2019/03/29	90	50 - 150	89	%		
6042023	D7-MeFOSE	2019/03/29	86	50 - 150	81	%		
6042023	D9-EtFOSE	2019/03/29	85	50 - 150	81	%		
6036970	6:2 Fluorotelomer sulfonic acid	2019/03/26	112	70 - 130	ND, RDL=0.020	ug/L	1.9	30
6036970	8:2 Fluorotelomer sulfonic acid	2019/03/26	107	70 - 130	ND, RDL=0.020	ug/L	2.0	30
6036970	EtFOSA	2019/03/26	113	70 - 130	ND, RDL=0.020	ug/L	3.2	30
6036970	EtFOSAA	2019/03/26	119	70 - 130	ND, RDL=0.020	ug/L	4.7	30
6036970	EtFOSE	2019/03/26	107	70 - 130	ND, RDL=0.020	ug/L	5.1	30
6036970	MeFOSA	2019/03/26	116	70 - 130	ND, RDL=0.020	ug/L	1.8	30
6036970	MeFOSAA	2019/03/26	107	70 - 130	ND, RDL=0.020	ug/L	5.0	30
6036970	MeFOSE	2019/03/26	110	70 - 130	ND, RDL=0.020	ug/L	3.1	30
6036970	Perfluorobutanesulfonic acid	2019/03/26	102	70 - 130	ND, RDL=0.020	ug/L	3.2	30
6036970	Perfluorobutanoic acid	2019/03/26	117	70 - 130	ND, RDL=0.020	ug/L	3.5	30
6036970	Perfluorodecanesulfonic acid (PFDS)	2019/03/26	104	70 - 130	ND, RDL=0.020	ug/L	0.84	30
6036970	Perfluorodecanoic Acid (PFDA)	2019/03/26	111	70 - 130	ND, RDL=0.020	ug/L	3.7	30
6036970	Perfluorododecanoic Acid (PFDoA)	2019/03/26	109	70 - 130	ND, RDL=0.020	ug/L	3.4	30
6036970	Perfluoroheptanesulfonic acid	2019/03/26	107	70 - 130	ND, RDL=0.020	ug/L	3.3	30

QUALITY ASSURANCE REPORT(CONT'D)

			SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6036970	Perfluoroheptanoic Acid (PFHpA)	2019/03/26	102	70 - 130	ND, RDL=0.020	ug/L	3.9	30
6036970	Perfluorohexanesulfonic acid	2019/03/26	110	70 - 130	ND, RDL=0.020	ug/L	3.8	30
6036970	Perfluorohexanoic Acid (PFHxA)	2019/03/26	104	70 - 130	ND, RDL=0.020	ug/L	2.5	30
6036970	Perfluorononanoic Acid (PFNA)	2019/03/26	107	70 - 130	ND, RDL=0.020	ug/L	4.7	30
6036970	Perfluorooctane Sulfonamide (PFOSA)	2019/03/26	111	70 - 130	ND, RDL=0.020	ug/L	2.6	30
6036970	Perfluorooctanesulfonic acid	2019/03/26	103	70 - 130	ND, RDL=0.020	ug/L	0.75	30
6036970	Perfluorooctanoic Acid (PFOA)	2019/03/26	115	70 - 130	ND, RDL=0.020	ug/L	2.3	30
6036970	Perfluoropentanoic Acid (PFPeA)	2019/03/26	102	70 - 130	ND, RDL=0.020	ug/L	2.9	30
6036970	Perfluorotetradecanoic Acid	2019/03/26	123	70 - 130	ND, RDL=0.020	ug/L	2.6	30
6036970	Perfluorotridecanoic Acid	2019/03/26	114	70 - 130	ND, RDL=0.020	ug/L	2.8	30
6036970	Perfluoroundecanoic Acid (PFUnA)	2019/03/26	105	70 - 130	ND, RDL=0.020	ug/L	1.6	30
6042023	6:2 Fluorotelomer sulfonic acid	2019/03/29	109	70 - 130	ND, RDL=0.020	ug/L	2.0	30
6042023	8:2 Fluorotelomer sulfonic acid	2019/03/29	103	70 - 130	ND, RDL=0.020	ug/L	2.0	30
6042023	EtFOSA	2019/03/29	102	70 - 130	ND, RDL=0.020	ug/L	3.7	30
6042023	EtFOSAA	2019/03/29	108	70 - 130	ND, RDL=0.020	ug/L	1.6	30
6042023	EtFOSE	2019/03/29	104	70 - 130	ND, RDL=0.020	ug/L	0.095	30
6042023	MeFOSA	2019/03/29	105	70 - 130	ND, RDL=0.020	ug/L	4.5	30
6042023	MeFOSAA	2019/03/29	96	70 - 130	ND, RDL=0.020	ug/L	1.7	30
6042023	MeFOSE	2019/03/29	103	70 - 130	ND, RDL=0.020	ug/L	5.2	30
6042023	Perfluorobutanesulfonic acid	2019/03/29	98	70 - 130	ND, RDL=0.020	ug/L	1.2	30
6042023	Perfluorobutanoic acid	2019/03/29	111	70 - 130	ND, RDL=0.020	ug/L	1.6	30
6042023	Perfluorodecanesulfonic acid (PFDS)	2019/03/29	102	70 - 130	ND, RDL=0.020	ug/L	0.39	30
6042023	Perfluorodecanoic Acid (PFDA)	2019/03/29	107	70 - 130	ND, RDL=0.020	ug/L	1.3	30
6042023	Perfluorododecanoic Acid (PFDoA)	2019/03/29	102	70 - 130	ND, RDL=0.020	ug/L	0.36	30
6042023	Perfluoroheptanesulfonic acid	2019/03/29	100	70 - 130	ND, RDL=0.020	ug/L	2.4	30
6042023	Perfluoroheptanoic Acid (PFHpA)	2019/03/29	96	70 - 130	ND, RDL=0.020	ug/L	0.55	30
6042023	Perfluorohexanesulfonic acid	2019/03/29	106	70 - 130	ND, RDL=0.020	ug/L	0.71	30
6042023	Perfluorohexanoic Acid (PFHxA)	2019/03/29	99	70 - 130	ND, RDL=0.020	ug/L	2.2	30
6042023	Perfluorononanoic Acid (PFNA)	2019/03/29	101	70 - 130	ND, RDL=0.020	ug/L	0.71	30
6042023	Perfluorooctane Sulfonamide (PFOSA)	2019/03/29	105	70 - 130	ND, RDL=0.020	ug/L	0.69	30
6042023	Perfluorooctanesulfonic acid	2019/03/29	103	70 - 130	ND, RDL=0.020	ug/L	1.2	30
6042023	Perfluorooctanoic Acid (PFOA)	2019/03/29	111	70 - 130	ND, RDL=0.020	ug/L	0.94	30

QUALITY ASSURANCE REPORT(CONT'D)

			SPIKED BLANK		Method Blank		RPD	
QC Batch	**Parameter**	**Date**	**% Recovery**	**QC Limits**	**Value**	**UNITS**	**Value (%)**	**QC Limits**
6042023	Perfluoropentanoic Acid (PFPeA)	2019/03/29	97	70 - 130	ND, RDL=0.020	ug/L	1.4	30
6042023	Perfluorotetradecanoic Acid	2019/03/29	119	70 - 130	ND, RDL=0.020	ug/L	0.48	30
6042023	Perfluorotridecanoic Acid	2019/03/29	112	70 - 130	ND, RDL=0.020	ug/L	0.92	30
6042023	Perfluoroundecanoic Acid (PFUnA)	2019/03/29	101	70 - 130	ND, RDL=0.020	ug/L	1.4	30

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Colm McNamara, Senior Analyst, Liquid Chromatography

Sin Chii Chia, Scientific Services

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Your P.O. #: 700420197
Your Project #: 658394
Site Location: CFB COMOX PFAS FFTA
Your C.O.C. #: G132545

Attention: Distribution List 1
SNC LAVALIN ENVIRONMENT INC.
202 - 3440 DOUGLAS STREET
VICTORIA, BC
Canada V8Z 3L5

Report Date: 2019/04/02
Report #: R2705307
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B919738
Received: 2019/03/18, 10:30

Sample Matrix: Ground Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
PFOS/PFOA Water Full List (25 Compounds) (1)	4	N/A	2019/04/02		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) This test was performed by Maxxam Ontario (From Burnaby)

Encryption Key

Tim Li
Project Manager
02 Apr 2019 16:27:21

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Tim Li, Project Manager
Email: TLi@maxxam.ca
Phone# (604)639-8418
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total Cover Pages : 1

RESULTS OF CHEMICAL ANALYSES OF GROUND WATER

Maxxam ID		VJ7394	VJ7395	VJ7396	VJ7397	
Sampling Date		2019/03/18 07:45	2019/03/18 08:30	2019/03/18 09:00	2019/03/18 09:30	
COC Number		G132545	G132545	G132545	G132545	
	UNITS	**MW19-51-190318**	**MW19-52-190318**	**MW19-70-190318**	**MW19-A-190318**	**QC Batch**
Internal Sublet Analysis						
Subcontract Parameter	N/A	ATTACHED	ATTACHED	ATTACHED	ATTACHED	9369210

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	8.0°C

Results relate only to the items tested.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Thomas Pinchin, Junior Project Manager

Maxxam
A Bureau Veritas Group Company

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Toll Free (800) 665 8566
Victoria: 460 Tennyson Place, Unit 1, Victoria, BC V8Z 6S8 Toll Free (866) 385-6112
maxxam.ca

CHAIN OF CUSTODY RECORD

G132545

Page 1 of 1

Invoice Information

Company: #1756 Public Works + Government Service
Contact Name: Dave Osguthorpe
Address: 800 Burrard St, Room 219
Vancouver, BC V6Z 0B9 PC:
Phone/Fax: 250-217-4767
Email: Dave.Osguthorpe@pwgsc-tpsgc.gc.ca
Copies:

Report Information (if differs from invoice)

Company: #17306 SNC-Lavalin Enviro.
Contact Name: Distribution List 1
Address: 202-3440 Douglas St.
Victoria, BC V8Z 3L5 PC:
Phone/Fax: 250-385-5028
Email: doug.mcmillan@snclavalin.com
Copies: envwestbclabdata@snclavalin.com

Project Information

Quotation: B70654
P.O. #/AFE#: 700420197
Project #: 658394
Site Location: CFB Comox PFAS ffta
Site #:
Sampled By: Troy Parsons

Turnaround Time (TAT) Required

☑ 5 - 7 Days Regular (Most analyses)

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Rush TAT (Surcharges will be applied)

☐ Same Day ☐ 2 Days
☐ 1 Day ☐ 3-4 Days

Date Required:
Rush Confirmation #:

Laboratory Use Only

	YES	NO	Cooler ID			
Seal Present		X				
Seal Intact	—		Temp	9	9	6
Cooling Media	X					

	YES	NO	Cooler ID			
Seal Present		✓				
Seal Intact		✓	Temp	8	3	9
Cooling Media	✓					

	YES	NO	Cooler ID			
Seal Present						
Seal Intact			Temp			
Cooling Media						

Depot Reception

Analysis Requested

☐ BTEXS / VPH ☐ VOC / BTEXS / VPH ☐ MTBE
☐ BTEX F1 ☐ VOC / BTEX / F1
☐ PAH ☐ LEPH / HEPH / PAH
☐ EPH ☐ TEH ☐ F2 - F4
☐ Dissolved Metals ☐ Filtered? ☐ Preserved?
☐ Dissolved Mercury ☐ Filtered? ☐ Preserved?
☐ Total Metals ☐ Field Preserved?
☐ Total Mercury ☐ Field Preserved?
☐ Chloride ☐ Fluoride ☐ Sulphate
☐ TSS ☐ TDS ☐ BOD ☐ COD
☐ pH ☐ Conductivity ☐ Alkalinity
☐ Nitrite ☐ Nitrate ☐ Ammonia

Regulatory Criteria

☐ BC CSR
☐ YK CSR
☒ CCME
☐ Drinking Water
☐ BC Water Quality
☐ Other

Special Instructions

	Sample Identification	Date Sampled (yyyy/mm/dd)	Time Sampled (hh:mm)	Matrix	# of Containers	HOLD - DO NOT ANALYZE
1	MW19-51-190318	2019/03/18	7:45	GW		X
2	MW19-52-190318	↓	8:30	↓		X
3	MW19-70-190318		9:00			X
4	MW19-A-190318		9:30			X
5						
6						
7						
8						
9						
10						

Unless otherwise agreed to in writing, work submitted on this Chain of Custody is subject to Maxxam's standard Terms and Conditions. Signing of this Chain of Custody document is acknowledgement and acceptance of our ter

Relinquished by: (Signature/ Print)	Date (yyyy/mm/dd):	Time (hh:mm):	Received by: (Signature/ Print)	Date (yyyy/mm/dd):	Time (hh:mm):
Troy Parsons	2019/03/18	10:30		2019/03/18	10:30
				2019/03/19	08:45

B919738_COC

COC-1020

Maxxam Analytics Success Through Science©

Maxxam
A Bureau Veritas Group Company

Your P.O. #: 700420197
Your Project #: 6581394 [B919738]
Site Location: CFB COMOX PFAS FFTA
Your C.O.C. #: B919738-ONTV-01-01

Attention: Tim Li

Maxxam Analytics
4606 Canada Way
Burnaby, BC
CANADA V5G 1K5

Report Date: 2019/04/02
Report #: R5653652
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B974912
Received: 2019/03/22, 08:48

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	4	2019/03/28	2019/03/29	CAM SOP-00894	EPA 537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

Encryption Key NRahaman

Nazeema Rahaman
Project Manager
02 Apr 2019 14:00:02

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Nazeema Rahaman, English, Project Manager
Email: NRahaman@maxxam.ca
Phone# (905)817-5700 Ext:5806
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

RESULTS OF ANALYSES OF WATER

Maxxam ID		JGN034		JGN035		
Sampling Date		2019/03/18 07:45		2019/03/18 08:30		
COC Number		B919738-ONTV-01-01		B919738-ONTV-01-01		
	UNITS	**VJ394-MW19-51-190318**	**RDL**	**VJ395-MW19-52-190318**	**RDL**	**QC Batch**
Perfluorobutanoic acid	ug/L	0.13	0.040	ND	0.020	6042023
Perfluoropentanoic Acid (PFPeA)	ug/L	0.51	0.040	ND	0.020	6042023
Perfluorohexanoic Acid (PFHxA)	ug/L	0.58	0.040	0.035	0.020	6042023
Perfluoroheptanoic Acid (PFHpA)	ug/L	0.16	0.040	ND	0.020	6042023
Perfluorooctanoic Acid (PFOA)	ug/L	0.21	0.040	ND	0.020	6042023
Perfluorononanoic Acid (PFNA)	ug/L	0.12	0.040	ND	0.020	6042023
Perfluorodecanoic Acid (PFDA)	ug/L	ND	0.040	ND	0.020	6042023
Perfluoroundecanoic Acid (PFUnA)	ug/L	ND	0.040	ND	0.020	6042023
Perfluorododecanoic Acid (PFDoA)	ug/L	ND	0.040	ND	0.020	6042023
Perfluorotridecanoic Acid	ug/L	ND	0.040	ND	0.020	6042023
Perfluorotetradecanoic Acid	ug/L	ND	0.040	ND	0.020	6042023
Perfluorobutanesulfonic acid	ug/L	0.24	0.040	0.020	0.020	6042023
Perfluorohexanesulfonic acid	ug/L	0.98	0.040	0.31	0.020	6042023
Perfluoroheptanesulfonic acid	ug/L	0.053	0.040	ND	0.020	6042023
Perfluorooctanesulfonic acid	ug/L	7.0	0.40	0.038	0.020	6042023
Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	0.040	ND	0.020	6042023
Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	0.040	ND	0.020	6042023
EtFOSA	ug/L	ND	0.040	ND	0.020	6042023
MeFOSA	ug/L	ND	0.040	ND	0.020	6042023
EtFOSE	ug/L	ND	0.040	ND	0.020	6042023
MeFOSE	ug/L	ND	0.040	ND	0.020	6042023
EtFOSAA	ug/L	ND	0.040	ND	0.020	6042023
MeFOSAA	ug/L	ND	0.040	ND	0.020	6042023
6:2 Fluorotelomer sulfonic acid	ug/L	0.25	0.040	ND	0.020	6042023
8:2 Fluorotelomer sulfonic acid	ug/L	ND	0.040	ND	0.020	6042023
Surrogate Recovery (%)						
13C2-4:2-Fluorotelomersulfonic Acid	%	102	N/A	98	N/A	6042023
13C2-6:2-Fluorotelomersulfonic Acid	%	99	N/A	104	N/A	6042023
13C2-8:2-Fluorotelomersulfonic Acid	%	97	N/A	97	N/A	6042023
13C2-Perfluorodecanoic acid	%	88	N/A	96	N/A	6042023
13C2-Perfluorododecanoic acid	%	83	N/A	89	N/A	6042023
13C2-Perfluorohexanoic acid	%	96	N/A	98	N/A	6042023

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

RESULTS OF ANALYSES OF WATER

Maxxam ID		JGN034		JGN035		
Sampling Date		2019/03/18 07:45		2019/03/18 08:30		
COC Number		B919738-ONTV-01-01		B919738-ONTV-01-01		
	UNITS	**VJ394-MW19-51-190318**	**RDL**	**VJ395-MW19-52-190318**	**RDL**	**QC Batch**
13C2-perfluorotetradecanoic acid	%	80	N/A	78	N/A	6042023
13C2-Perfluoroundecanoic acid	%	86	N/A	92	N/A	6042023
13C3-Perfluorobutanesulfonic acid	%	93	N/A	97	N/A	6042023
13C4-Perfluorobutanoic acid	%	91	N/A	92	N/A	6042023
13C4-Perfluoroheptanoic acid	%	95	N/A	98	N/A	6042023
13C4-Perfluorooctanesulfonic acid	%	92	N/A	95	N/A	6042023
13C4-Perfluorooctanoic acid	%	91	N/A	96	N/A	6042023
13C5-Perfluorononanoic acid	%	92	N/A	96	N/A	6042023
13C5-Perfluoropentanoic acid	%	92	N/A	95	N/A	6042023
13C8-Perfluorooctane Sulfonamide	%	83	N/A	95	N/A	6042023
18O2-Perfluorohexanesulfonic acid	%	90	N/A	94	N/A	6042023
D3-MeFOSA	%	64	N/A	77	N/A	6042023
D3-MeFOSAA	%	87	N/A	99	N/A	6042023
D5-EtFOSA	%	66	N/A	79	N/A	6042023
D5-EtFOSAA	%	86	N/A	91	N/A	6042023
D7-MeFOSE	%	73	N/A	85	N/A	6042023
D9-EtFOSE	%	75	N/A	82	N/A	6042023

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

RESULTS OF ANALYSES OF WATER

Maxxam ID		JGN036	JGN037		
Sampling Date		2019/03/18 09:00	2019/03/18 09:30		
COC Number		B919738-ONTV-01-01	B919738-ONTV-01-01		
	UNITS	**VJ396-MW19-70-190318**	**VJ397-MW19-A-190318**	**RDL**	**QC Batch**
Perfluorobutanoic acid	ug/L	0.71	0.68	0.020	6042023
Perfluoropentanoic Acid (PFPeA)	ug/L	2.5	2.6	0.20	6042023
Perfluorohexanoic Acid (PFHxA)	ug/L	2.3	2.4	0.20	6042023
Perfluoroheptanoic Acid (PFHpA)	ug/L	0.50	0.49	0.020	6042023
Perfluorooctanoic Acid (PFOA)	ug/L	0.33	0.32	0.020	6042023
Perfluorononanoic Acid (PFNA)	ug/L	ND	ND	0.020	6042023
Perfluorodecanoic Acid (PFDA)	ug/L	ND	ND	0.020	6042023
Perfluoroundecanoic Acid (PFUnA)	ug/L	ND	ND	0.020	6042023
Perfluorododecanoic Acid (PFDoA)	ug/L	ND	ND	0.020	6042023
Perfluorotridecanoic Acid	ug/L	ND	ND	0.020	6042023
Perfluorotetradecanoic Acid	ug/L	ND	ND	0.020	6042023
Perfluorobutanesulfonic acid	ug/L	0.67	0.65	0.020	6042023
Perfluorohexanesulfonic acid	ug/L	2.5	2.5	0.20	6042023
Perfluoroheptanesulfonic acid	ug/L	0.052	0.050	0.020	6042023
Perfluorooctanesulfonic acid	ug/L	0.82	0.81	0.020	6042023
Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	ND	0.020	6042023
Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	ND	0.020	6042023
EtFOSA	ug/L	ND	ND	0.020	6042023
MeFOSA	ug/L	ND	ND	0.020	6042023
EtFOSE	ug/L	ND	ND	0.020	6042023
MeFOSE	ug/L	ND	ND	0.020	6042023
EtFOSAA	ug/L	ND	ND	0.020	6042023
MeFOSAA	ug/L	ND	ND	0.020	6042023
6:2 Fluorotelomer sulfonic acid	ug/L	4.4	4.4	0.20	6042023
8:2 Fluorotelomer sulfonic acid	ug/L	ND	ND	0.020	6042023
Surrogate Recovery (%)					
13C2-4:2-Fluorotelomersulfonic Acid	%	100	101	N/A	6042023
13C2-6:2-Fluorotelomersulfonic Acid	%	91	94	N/A	6042023
13C2-8:2-Fluorotelomersulfonic Acid	%	103	107	N/A	6042023
13C2-Perfluorodecanoic acid	%	88	92	N/A	6042023
13C2-Perfluorododecanoic acid	%	82	83	N/A	6042023
13C2-Perfluorohexanoic acid	%	93	94	N/A	6042023

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

RESULTS OF ANALYSES OF WATER

Maxxam ID		JGN036	JGN037		
Sampling Date		2019/03/18 09:00	2019/03/18 09:30		
COC Number		B919738-ONTV-01-01	B919738-ONTV-01-01		
	UNITS	**VJ396-MW19-70-190318**	**VJ397-MW19-A-190318**	**RDL**	**QC Batch**
13C2-perfluorotetradecanoic acid	%	71	72	N/A	6042023
13C2-Perfluoroundecanoic acid	%	87	88	N/A	6042023
13C3-Perfluorobutanesulfonic acid	%	94	99	N/A	6042023
13C4-Perfluorobutanoic acid	%	88	93	N/A	6042023
13C4-Perfluoroheptanoic acid	%	98	102	N/A	6042023
13C4-Perfluorooctanesulfonic acid	%	100	101	N/A	6042023
13C4-Perfluorooctanoic acid	%	100	102	N/A	6042023
13C5-Perfluorononanoic acid	%	100	105	N/A	6042023
13C5-Perfluoropentanoic acid	%	91	90	N/A	6042023
13C8-Perfluorooctane Sulfonamide	%	83	87	N/A	6042023
18O2-Perfluorohexanesulfonic acid	%	89	91	N/A	6042023
D3-MeFOSA	%	67	65	N/A	6042023
D3-MeFOSAA	%	89	93	N/A	6042023
D5-EtFOSA	%	67	63	N/A	6042023
D5-EtFOSAA	%	84	87	N/A	6042023
D7-MeFOSE	%	75	78	N/A	6042023
D9-EtFOSE	%	74	77	N/A	6042023

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

TEST SUMMARY

Maxxam ID: JGN034
Sample ID: VJ394-MW19-51-190318
Matrix: Water
Collected: 2019/03/18
Shipped:
Received: 2019/03/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6042023	2019/03/28	2019/03/29	Anjan Desai

Maxxam ID: JGN035
Sample ID: VJ395-MW19-52-190318
Matrix: Water
Collected: 2019/03/18
Shipped:
Received: 2019/03/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6042023	2019/03/28	2019/03/29	Anjan Desai

Maxxam ID: JGN036
Sample ID: VJ396-MW19-70-190318
Matrix: Water
Collected: 2019/03/18
Shipped:
Received: 2019/03/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6042023	2019/03/28	2019/03/29	Anjan Desai

Maxxam ID: JGN037
Sample ID: VJ397-MW19-A-190318
Matrix: Water
Collected: 2019/03/18
Shipped:
Received: 2019/03/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6042023	2019/03/28	2019/03/29	Anjan Desai

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	1.3°C

Revised Report (2019/04/02): Parameters list has been amended.

Per- and Polyfluoroalkyl Substances (PFAS) water data were evaluated against the prescribed elements for performance and quality in its respective British Columbia Environmental Laboratory Manual Performance Based Method (PBM). All criteria were satisfied except where indicated in sample comments.

Sample JGN034 [VJ394-MW19-51-190318] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was extracted and analyzed. Detection limits were adjusted accordingly.

Sample JGN036 [VJ396-MW19-70-190318] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was extracted and analyzed. Detection limits were adjusted accordingly.

Sample JGN037 [VJ397-MW19-A-190318] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was extracted and analyzed. Detection limits were adjusted accordingly.

Results relate only to the items tested.

QUALITY ASSURANCE REPORT

			SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6042023	13C2-4:2-Fluorotelomersulfonic Acid	2019/03/29	100	50 - 150	111	%		
6042023	13C2-6:2-Fluorotelomersulfonic Acid	2019/03/29	101	50 - 150	105	%		
6042023	13C2-8:2-Fluorotelomersulfonic Acid	2019/03/29	99	50 - 150	100	%		
6042023	13C2-Perfluorodecanoic acid	2019/03/29	96	50 - 150	94	%		
6042023	13C2-Perfluorododecanoic acid	2019/03/29	92	50 - 150	92	%		
6042023	13C2-Perfluorohexanoic acid	2019/03/29	100	50 - 150	100	%		
6042023	13C2-perfluorotetradecanoic acid	2019/03/29	84	50 - 150	81	%		
6042023	13C2-Perfluoroundecanoic acid	2019/03/29	95	50 - 150	93	%		
6042023	13C3-Perfluorobutanesulfonic acid	2019/03/29	100	50 - 150	99	%		
6042023	13C4-Perfluorobutanoic acid	2019/03/29	99	50 - 150	97	%		
6042023	13C4-Perfluoroheptanoic acid	2019/03/29	99	50 - 150	98	%		
6042023	13C4-Perfluorooctanesulfonic acid	2019/03/29	97	50 - 150	97	%		
6042023	13C4-Perfluorooctanoic acid	2019/03/29	97	50 - 150	94	%		
6042023	13C5-Perfluorononanoic acid	2019/03/29	97	50 - 150	95	%		
6042023	13C5-Perfluoropentanoic acid	2019/03/29	99	50 - 150	98	%		
6042023	13C8-Perfluorooctane Sulfonamide	2019/03/29	93	50 - 150	94	%		
6042023	18O2-Perfluorohexanesulfonic acid	2019/03/29	97	50 - 150	95	%		
6042023	D3-MeFOSA	2019/03/29	75	50 - 150	65	%		
6042023	D3-MeFOSAA	2019/03/29	92	50 - 150	90	%		
6042023	D5-EtFOSA	2019/03/29	75	50 - 150	66	%		
6042023	D5-EtFOSAA	2019/03/29	90	50 - 150	89	%		
6042023	D7-MeFOSE	2019/03/29	86	50 - 150	81	%		
6042023	D9-EtFOSE	2019/03/29	85	50 - 150	81	%		
6042023	6:2 Fluorotelomer sulfonic acid	2019/03/29	109	70 - 130	ND, RDL=0.020	ug/L	2.0	30
6042023	8:2 Fluorotelomer sulfonic acid	2019/03/29	103	70 - 130	ND, RDL=0.020	ug/L	2.0	30
6042023	EtFOSA	2019/03/29	102	70 - 130	ND, RDL=0.020	ug/L	3.7	30
6042023	EtFOSAA	2019/03/29	108	70 - 130	ND, RDL=0.020	ug/L	1.6	30
6042023	EtFOSE	2019/03/29	104	70 - 130	ND, RDL=0.020	ug/L	0.095	30
6042023	MeFOSA	2019/03/29	105	70 - 130	ND, RDL=0.020	ug/L	4.5	30
6042023	MeFOSAA	2019/03/29	96	70 - 130	ND, RDL=0.020	ug/L	1.7	30
6042023	MeFOSE	2019/03/29	103	70 - 130	ND, RDL=0.020	ug/L	5.2	30

QUALITY ASSURANCE REPORT(CONT'D)

			SPIKED BLANK		Method Blank		RPD	
QC Batch	**Parameter**	**Date**	**% Recovery**	**QC Limits**	**Value**	**UNITS**	**Value (%)**	**QC Limits**
6042023	Perfluorobutanesulfonic acid	2019/03/29	98	70 - 130	ND, RDL=0.020	ug/L	1.2	30
6042023	Perfluorobutanoic acid	2019/03/29	111	70 - 130	ND, RDL=0.020	ug/L	1.6	30
6042023	Perfluorodecanesulfonic acid (PFDS)	2019/03/29	102	70 - 130	ND, RDL=0.020	ug/L	0.39	30
6042023	Perfluorodecanoic Acid (PFDA)	2019/03/29	107	70 - 130	ND, RDL=0.020	ug/L	1.3	30
6042023	Perfluorododecanoic Acid (PFDoA)	2019/03/29	102	70 - 130	ND, RDL=0.020	ug/L	0.36	30
6042023	Perfluoroheptanesulfonic acid	2019/03/29	100	70 - 130	ND, RDL=0.020	ug/L	2.4	30
6042023	Perfluoroheptanoic Acid (PFHpA)	2019/03/29	96	70 - 130	ND, RDL=0.020	ug/L	0.55	30
6042023	Perfluorohexanesulfonic acid	2019/03/29	106	70 - 130	ND, RDL=0.020	ug/L	0.71	30
6042023	Perfluorohexanoic Acid (PFHxA)	2019/03/29	99	70 - 130	ND, RDL=0.020	ug/L	2.2	30
6042023	Perfluorononanoic Acid (PFNA)	2019/03/29	101	70 - 130	ND, RDL=0.020	ug/L	0.71	30
6042023	Perfluorooctane Sulfonamide (PFOSA)	2019/03/29	105	70 - 130	ND, RDL=0.020	ug/L	0.69	30
6042023	Perfluorooctanesulfonic acid	2019/03/29	103	70 - 130	ND, RDL=0.020	ug/L	1.2	30
6042023	Perfluorooctanoic Acid (PFOA)	2019/03/29	111	70 - 130	ND, RDL=0.020	ug/L	0.94	30
6042023	Perfluoropentanoic Acid (PFPeA)	2019/03/29	97	70 - 130	ND, RDL=0.020	ug/L	1.4	30
6042023	Perfluorotetradecanoic Acid	2019/03/29	119	70 - 130	ND, RDL=0.020	ug/L	0.48	30
6042023	Perfluorotridecanoic Acid	2019/03/29	112	70 - 130	ND, RDL=0.020	ug/L	0.92	30
6042023	Perfluoroundecanoic Acid (PFUnA)	2019/03/29	101	70 - 130	ND, RDL=0.020	ug/L	1.4	30

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Colm McNamara, Senior Analyst, Liquid Chromatography

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Your P.O. #: 700420197
Your Project #: 658394
Site Location: CFB COMOX PFAS FFTA
Your C.O.C. #: G132556

Attention: Distribution List 1

SNC LAVALIN ENVIRONMENT INC.
202 - 3440 DOUGLAS STREET
VICTORIA, BC
Canada V8Z 3L5

Report Date: 2019/04/10
Report #: R2708987
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B921316
Received: 2019/03/22, 09:30

Sample Matrix: Ground Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
PFOS/PFOA Water Full List (25 Compounds) (1)	3	N/A	2019/04/09		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) This test was performed by Maxxam Ontario (From Burnaby)

Encryption Key Nahed Amer

```
Nahed Amer
Project Manager
10 Apr 2019 19:05:04
```

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Tim Li, Project Manager
Email: TLi@maxxam.ca
Phone# (604)639-8418
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total Cover Pages : 1

Maxxam Job #: B921316
Report Date: 2019/04/10

SNC LAVALIN ENVIRONMENT INC.
Client Project #: 658394
Site Location: CFB COMOX PFAS FFTA
Your P.O. #: 700420197
Sampler Initials: TP

RESULTS OF CHEMICAL ANALYSES OF GROUND WATER

Maxxam ID		VK5123	VK5124	VK5125	
Sampling Date		2019/03/22 07:40	2019/03/22 08:20	2019/03/22 08:40	
COC Number		G132556	G132556	G132556	
	UNITS	**MW19-49-190322**	**MW19-54-190322**	**MW19-55-190322**	**QC Batch**
Internal Sublet Analysis					
Subcontract Parameter	N/A	ATTACHED	ATTACHED	ATTACHED	9376303

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	6.7°C

Results relate only to the items tested.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Thomas Pinchin, Junior Project Manager

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam
A Bureau Veritas Group Company

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Toll Free (800) 665 8566
Victoria: 460 Tennyson Place, Unit 1, Victoria, BC V8Z 6S8 Toll Free (866) 385-6112
maxxam.ca

CHAIN OF CUSTODY RECORD

G132556

Page 1 of 1

Invoice Information

Company: #1756 Public Works + Government Service
Contact Name: Dave Osguthorpe
Address: 800 Burrard St. Room 219
Vancouver, BC V6Z0B9 PC:
Phone/Fax: 250-217-4767
Email: Dave.osguthorpe@pwgsc-tpgsc.gc.ca
Copies:

Report Information (if differs from invoice)

Company: ~~#[illegible]~~ #17306 SNC-Lavalin Env.
Contact Name: Distribution List 1
Address: #202-3440 Douglas St.
Victoria, BC, V8Z 3L5 PC:
Phone/Fax: 250-385-5028
Email: doug.McMillan@SNClavalin.com
Copies: envwestbclabdata@snclavalin.com

Project Information

Quotation: B70654
P.O. #/AFE#: 700420197
Project #: 658394
Site Location: CFB Comox ffta
Site #:
Sampled By: Troy Parsons

Turnaround Time (TAT) Required

☒ 5 - 7 Days Regular (Most analyses)

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Rush TAT (Surcharges will be applied)

☐ Same Day ☐ 2 Days
☐ 1 Day ☐ 3-4 Days

Date Required:
Rush Confirmation #:

Laboratory Use Only

	YES	NO	Cooler ID			
Seal Present		X	Temp	7	8	5
Seal Intact	—	—				
Cooling Media	X					

	YES	NO	Cooler ID	1		
Seal Present	✓		Temp	3	3	4
Seal Intact	✓					
Cooling Media	✓					

	YES	NO	Cooler ID			
Seal Present			Temp			
Seal Intact						
Cooling Media						

Depot Reception

Analysis Requested

	Sample Identification	Date Sampled (yyyy/mm/dd)	Time Sampled (hh:mm)	Matrix	# of Containers	☐ BTEXS / VPH ☐ VOC / BTEXS / VPH ☐ MTBE	☐ BTEX F1 ☐ VOC / BTEX / F1	☐ PAH ☐ LEPH / HEPH / PAH	☐ EPH ☐ TEH ☐ F2 - F4	☐ Dissolved Metals ☐ Filtered? ☐ Preserved?	☐ Dissolved Mercury ☐ Filtered? ☐ Preserved?	☐ Total Metals ☐ Field Preserved?	☐ Total Mercury ☐ Field Preserved?	☐ Chloride ☐ Fluoride ☐ Sulphate	☐ TSS ☐ TDS ☐ BOD ☐ COD	☐ pH ☐ Conductivity ☐ Alkalinity	☐ Nitrite ☐ Nitrate ☐ Ammonia						HOLD - DO NOT ANALYZE
1	MW19-49-190322	2019/03/22	07:40	GW																			☒
2	MW19-54-190322	↓	08:20	↓																			☒
3	MW19-55-190322		08:40																				☒
4																							
5																							
6																							
7																							
8																							
9																							
10																							

Regulatory Criteria

☐ BC CSR
☐ YK CSR
☒ CCME
☐ Drinking Water
☐ BC Water Quality
☐ Other

Special Instructions

Unless otherwise agreed to in writing, work submitted on this Chain of Custody is subject to Maxxam's standard Terms and Conditions. Signing of this Chain of Custody document is acknowledgement and acceptance of our terms

Relinquished by: (Signature/ Print)	Date (yyyy/mm/dd):	Time (hh:mm):	Received by: (Signature/ Print)	Date (yyyy/mm/dd):	Time (hh:mm):
Troy Parsons	2019/03/22	09:30	Michelle [illegible]	2019/03/22	09:30
Michelle von Schilling	2019/03/22	15:00	[illegible]	2019/03/23	11:20

B921316_COC

Maxxam
A Bureau Veritas Group Company

Your P.O. #: 700420197
Your Project #: 658394 [B921316]
Site Location: CFB COMOX PFAS FFTA
Your C.O.C. #: B921316-ONTV-01-01

Attention: Tim Li

Maxxam Analytics
4606 Canada Way
Burnaby, BC
CANADA V5G 1K5

Report Date: 2019/04/08
Report #: R5661774
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B977530
Received: 2019/03/26, 08:45

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PFOS and PFOA in water by SPE/LCMS (1)	3	2019/04/04	2019/04/04	CAM SOP-00894	EPA 537 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.

Encryption Key NRahaman

```
Nazeema Rahaman
Project Manager
08 Apr 2019 16:13:16
```

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Nazeema Rahaman, English, Project Manager
Email: NRahaman@maxxam.ca
Phone# (905)817-5700 Ext:5806

==

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total Cover Pages : 1

RESULTS OF ANALYSES OF WATER

Maxxam ID		JHB225	JHB226		
Sampling Date		2019/03/22 07:40	2019/03/22 08:20		
COC Number		B921316-ONTV-01-01	B921316-ONTV-01-01		
	UNITS	**VK5123-MW19-49-190322**	**VK5124-MW19-54-190322**	**RDL**	**QC Batch**
Perfluorobutanoic acid	ug/L	ND	ND	0.020	6052974
Perfluoropentanoic Acid (PFPeA)	ug/L	ND	ND	0.020	6052974
Perfluorohexanoic Acid (PFHxA)	ug/L	ND	ND	0.020	6052974
Perfluoroheptanoic Acid (PFHpA)	ug/L	ND	ND	0.020	6052974
Perfluorooctanoic Acid (PFOA)	ug/L	ND	ND	0.020	6052974
Perfluorononanoic Acid (PFNA)	ug/L	ND	ND	0.020	6052974
Perfluorodecanoic Acid (PFDA)	ug/L	ND	ND	0.020	6052974
Perfluoroundecanoic Acid (PFUnA)	ug/L	ND	ND	0.020	6052974
Perfluorododecanoic Acid (PFDoA)	ug/L	ND	ND	0.020	6052974
Perfluorotridecanoic Acid	ug/L	ND	ND	0.020	6052974
Perfluorotetradecanoic Acid	ug/L	ND	ND	0.020	6052974
Perfluorobutanesulfonic acid	ug/L	ND	ND	0.020	6052974
Perfluorohexanesulfonic acid	ug/L	ND	ND	0.020	6052974
Perfluoroheptanesulfonic acid	ug/L	ND	ND	0.020	6052974
Perfluorooctanesulfonic acid	ug/L	ND	0.058	0.020	6052974
Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	ND	0.020	6052974
Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	ND	0.020	6052974
EtFOSA	ug/L	ND	ND	0.020	6052974
MeFOSA	ug/L	ND	ND	0.020	6052974
EtFOSE	ug/L	ND	ND	0.020	6052974
MeFOSE	ug/L	ND	ND	0.020	6052974
EtFOSAA	ug/L	ND	ND	0.020	6052974
MeFOSAA	ug/L	ND	ND	0.020	6052974
6:2 Fluorotelomer sulfonic acid	ug/L	ND	0.020	0.020	6052974
8:2 Fluorotelomer sulfonic acid	ug/L	ND	ND	0.020	6052974
Surrogate Recovery (%)					
13C2-6:2-Fluorotelomersulfonic Acid	%	75	83	N/A	6052974
13C2-8:2-Fluorotelomersulfonic Acid	%	75	83	N/A	6052974
13C2-Perfluorodecanoic acid	%	78	81	N/A	6052974
13C2-Perfluorododecanoic acid	%	68	72	N/A	6052974
13C2-Perfluorohexanoic acid	%	81	84	N/A	6052974
13C2-perfluorotetradecanoic acid	%	60	57	N/A	6052974

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

RESULTS OF ANALYSES OF WATER

Maxxam ID		JHB225	JHB226		
Sampling Date		2019/03/22 07:40	2019/03/22 08:20		
COC Number		B921316-ONTV-01-01	B921316-ONTV-01-01		
	UNITS	**VK5123-MW19-49-190322**	**VK5124-MW19-54-190322**	**RDL**	**QC Batch**
13C2-Perfluoroundecanoic acid	%	74	77	N/A	6052974
13C3-Perfluorobutanesulfonic acid	%	77	82	N/A	6052974
13C4-Perfluorobutanoic acid	%	76	81	N/A	6052974
13C4-Perfluoroheptanoic acid	%	80	84	N/A	6052974
13C4-Perfluorooctanesulfonic acid	%	77	81	N/A	6052974
13C4-Perfluorooctanoic acid	%	78	81	N/A	6052974
13C5-Perfluorononanoic acid	%	80	82	N/A	6052974
13C5-Perfluoropentanoic acid	%	78	81	N/A	6052974
13C8-Perfluorooctane Sulfonamide	%	68	72	N/A	6052974
18O2-Perfluorohexanesulfonic acid	%	78	80	N/A	6052974
D3-MeFOSA	%	56	62	N/A	6052974
D3-MeFOSAA	%	77	77	N/A	6052974
D5-EtFOSA	%	55	59	N/A	6052974
D5-EtFOSAA	%	69	71	N/A	6052974
D7-MeFOSE	%	63	66	N/A	6052974
D9-EtFOSE	%	62	63	N/A	6052974

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

RESULTS OF ANALYSES OF WATER

Maxxam ID		JHB227		
Sampling Date		2019/03/22 08:40		
COC Number		B921316-ONTV-01-01		
	UNITS	**VK5125-MW19-55-190322**	**RDL**	**QC Batch**
Perfluorobutanoic acid	ug/L	1.9	0.20	6052974
Perfluoropentanoic Acid (PFPeA)	ug/L	7.8	0.20	6052974
Perfluorohexanoic Acid (PFHxA)	ug/L	13	2.0	6052974
Perfluoroheptanoic Acid (PFHpA)	ug/L	2.5	0.20	6052974
Perfluorooctanoic Acid (PFOA)	ug/L	7.0	0.20	6052974
Perfluorononanoic Acid (PFNA)	ug/L	0.27	0.20	6052974
Perfluorodecanoic Acid (PFDA)	ug/L	ND	0.20	6052974
Perfluoroundecanoic Acid (PFUnA)	ug/L	ND	0.20	6052974
Perfluorododecanoic Acid (PFDoA)	ug/L	ND	0.20	6052974
Perfluorotridecanoic Acid	ug/L	ND	0.20	6052974
Perfluorotetradecanoic Acid	ug/L	ND	0.20	6052974
Perfluorobutanesulfonic acid	ug/L	1.8	0.20	6052974
Perfluorohexanesulfonic acid	ug/L	26	2.0	6052974
Perfluoroheptanesulfonic acid	ug/L	1.3	0.20	6052974
Perfluorooctanesulfonic acid	ug/L	71	2.0	6052974
Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	0.20	6052974
Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	0.20	6052974
EtFOSA	ug/L	ND	0.20	6052974
MeFOSA	ug/L	ND	0.20	6052974
EtFOSE	ug/L	ND	0.20	6052974
MeFOSE	ug/L	ND	0.20	6052974
EtFOSAA	ug/L	ND	0.20	6052974
MeFOSAA	ug/L	ND	0.20	6052974
6:2 Fluorotelomer sulfonic acid	ug/L	64	2.0	6052974
8:2 Fluorotelomer sulfonic acid	ug/L	5.1	0.20	6052974
Surrogate Recovery (%)				
13C2-6:2-Fluorotelomersulfonic Acid	%	90	N/A	6052974
13C2-8:2-Fluorotelomersulfonic Acid	%	99	N/A	6052974
13C2-Perfluorodecanoic acid	%	88	N/A	6052974
13C2-Perfluorododecanoic acid	%	88	N/A	6052974
13C2-Perfluorohexanoic acid	%	94	N/A	6052974
13C2-perfluorotetradecanoic acid	%	83	N/A	6052974

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

RESULTS OF ANALYSES OF WATER

Maxxam ID		JHB227		
Sampling Date		2019/03/22 08:40		
COC Number		B921316-ONTV-01-01		
	UNITS	**VK5125-MW19-55-190322**	**RDL**	**QC Batch**
13C2-Perfluoroundecanoic acid	%	91	N/A	6052974
13C3-Perfluorobutanesulfonic acid	%	99	N/A	6052974
13C4-Perfluorobutanoic acid	%	96	N/A	6052974
13C4-Perfluoroheptanoic acid	%	93	N/A	6052974
13C4-Perfluorooctanesulfonic acid	%	91	N/A	6052974
13C4-Perfluorooctanoic acid	%	93	N/A	6052974
13C5-Perfluorononanoic acid	%	99	N/A	6052974
13C5-Perfluoropentanoic acid	%	91	N/A	6052974
13C8-Perfluorooctane Sulfonamide	%	75	N/A	6052974
18O2-Perfluorohexanesulfonic acid	%	93	N/A	6052974
D3-MeFOSA	%	45 (1)	N/A	6052974
D3-MeFOSAA	%	89	N/A	6052974
D5-EtFOSA	%	40 (1)	N/A	6052974
D5-EtFOSAA	%	83	N/A	6052974
D7-MeFOSE	%	61	N/A	6052974
D9-EtFOSE	%	62	N/A	6052974

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

N/A = Not Applicable

(1) Extracted internal standard analyte recovery was below the method defined lower control limit (LCL), however, BC Environmental Laboratory Manual Performance Based Method criteria were satisfied. There is no impact on the data.

TEST SUMMARY

Maxxam ID: JHB225
Sample ID: VK5123-MW19-49-190322
Matrix: Water

Collected: 2019/03/22
Shipped:
Received: 2019/03/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6052974	2019/04/04	2019/04/04	Adnan Khan

Maxxam ID: JHB226
Sample ID: VK5124-MW19-54-190322
Matrix: Water

Collected: 2019/03/22
Shipped:
Received: 2019/03/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6052974	2019/04/04	2019/04/04	Adnan Khan

Maxxam ID: JHB227
Sample ID: VK5125-MW19-55-190322
Matrix: Water

Collected: 2019/03/22
Shipped:
Received: 2019/03/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PFOS and PFOA in water by SPE/LCMS	LCMS	6052974	2019/04/04	2019/04/04	Adnan Khan

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	0.7°C

Revised Report (2019/04/02): Parameters list has been amended.

Per- and Polyfluoroalkyl Substances (PFAS) water data were evaluated against the prescribed elements for performance and quality in its respective British Columbia Environmental Laboratory Manual Performance Based Method (PBM). All criteria were satisfied except where indicated in sample comments.

Sample JHB227 [VK5125-MW19-55-190322] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was extracted and analyzed. Detection limits were adjusted accordingly.

Results relate only to the items tested.

QUALITY ASSURANCE REPORT

			SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6052974	13C2-6:2-Fluorotelomersulfonic Acid	2019/04/04	76	50 - 150	85	%		
6052974	13C2-8:2-Fluorotelomersulfonic Acid	2019/04/04	79	50 - 150	86	%		
6052974	13C2-Perfluorodecanoic acid	2019/04/04	76	50 - 150	83	%		
6052974	13C2-Perfluorododecanoic acid	2019/04/04	72	50 - 150	79	%		
6052974	13C2-Perfluorohexanoic acid	2019/04/04	79	50 - 150	86	%		
6052974	13C2-perfluorotetradecanoic acid	2019/04/04	68	50 - 150	78	%		
6052974	13C2-Perfluoroundecanoic acid	2019/04/04	75	50 - 150	80	%		
6052974	13C3-Perfluorobutanesulfonic acid	2019/04/04	79	50 - 150	83	%		
6052974	13C4-Perfluorobutanoic acid	2019/04/04	79	50 - 150	84	%		
6052974	13C4-Perfluoroheptanoic acid	2019/04/04	79	50 - 150	86	%		
6052974	13C4-Perfluorooctanesulfonic acid	2019/04/04	79	50 - 150	83	%		
6052974	13C4-Perfluorooctanoic acid	2019/04/04	78	50 - 150	85	%		
6052974	13C5-Perfluorononanoic acid	2019/04/04	79	50 - 150	85	%		
6052974	13C5-Perfluoropentanoic acid	2019/04/04	78	50 - 150	84	%		
6052974	13C8-Perfluorooctane Sulfonamide	2019/04/04	69	50 - 150	79	%		
6052974	18O2-Perfluorohexanesulfonic acid	2019/04/04	79	50 - 150	83	%		
6052974	D3-MeFOSA	2019/04/04	59	50 - 150	69	%		
6052974	D3-MeFOSAA	2019/04/04	69	50 - 150	77	%		
6052974	D5-EtFOSA	2019/04/04	57	50 - 150	67	%		
6052974	D5-EtFOSAA	2019/04/04	67	50 - 150	70	%		
6052974	D7-MeFOSE	2019/04/04	69	50 - 150	77	%		
6052974	D9-EtFOSE	2019/04/04	68	50 - 150	73	%		
6052974	6:2 Fluorotelomer sulfonic acid	2019/04/04	109	70 - 130	ND, RDL=0.020	ug/L	3.9	30
6052974	8:2 Fluorotelomer sulfonic acid	2019/04/04	103	70 - 130	ND, RDL=0.020	ug/L	0.60	30
6052974	EtFOSA	2019/04/04	109	70 - 130	ND, RDL=0.020	ug/L	1.0	30
6052974	EtFOSAA	2019/04/04	106	70 - 130	ND, RDL=0.020	ug/L	4.5	30
6052974	EtFOSE	2019/04/04	103	70 - 130	ND, RDL=0.020	ug/L	0.033	30
6052974	MeFOSA	2019/04/04	104	70 - 130	ND, RDL=0.020	ug/L	2.5	30
6052974	MeFOSAA	2019/04/04	104	70 - 130	ND, RDL=0.020	ug/L	0.47	30
6052974	MeFOSE	2019/04/04	102	70 - 130	ND, RDL=0.020	ug/L	1.9	30
6052974	Perfluorobutanesulfonic acid	2019/04/04	102	70 - 130	ND, RDL=0.020	ug/L	0.40	30

QUALITY ASSURANCE REPORT(CONT'D)

			SPIKED BLANK		Method Blank		RPD	
QC Batch	**Parameter**	**Date**	**% Recovery**	**QC Limits**	**Value**	**UNITS**	**Value (%)**	**QC Limits**
6052974	Perfluorobutanoic acid	2019/04/04	104	70 - 130	ND, RDL=0.020	ug/L	0.77	30
6052974	Perfluorodecanesulfonic acid (PFDS)	2019/04/04	102	70 - 130	ND, RDL=0.020	ug/L	1.5	30
6052974	Perfluorodecanoic Acid (PFDA)	2019/04/04	106	70 - 130	ND, RDL=0.020	ug/L	1.9	30
6052974	Perfluorododecanoic Acid (PFDoA)	2019/04/04	104	70 - 130	ND, RDL=0.020	ug/L	0.38	30
6052974	Perfluoroheptanesulfonic acid	2019/04/04	103	70 - 130	ND, RDL=0.020	ug/L	2.2	30
6052974	Perfluoroheptanoic Acid (PFHpA)	2019/04/04	103	70 - 130	ND, RDL=0.020	ug/L	1.2	30
6052974	Perfluorohexanesulfonic acid	2019/04/04	103	70 - 130	ND, RDL=0.020	ug/L	1.6	30
6052974	Perfluorohexanoic Acid (PFHxA)	2019/04/04	104	70 - 130	ND, RDL=0.020	ug/L	0.99	30
6052974	Perfluorononanoic Acid (PFNA)	2019/04/04	104	70 - 130	ND, RDL=0.020	ug/L	1.9	30
6052974	Perfluorooctane Sulfonamide (PFOSA)	2019/04/04	109	70 - 130	ND, RDL=0.020	ug/L	1.6	30
6052974	Perfluorooctanesulfonic acid	2019/04/04	104	70 - 130	ND, RDL=0.020	ug/L	2.7	30
6052974	Perfluorooctanoic Acid (PFOA)	2019/04/04	105	70 - 130	ND, RDL=0.020	ug/L	1.1	30
6052974	Perfluoropentanoic Acid (PFPeA)	2019/04/04	104	70 - 130	ND, RDL=0.020	ug/L	0.62	30
6052974	Perfluorotetradecanoic Acid	2019/04/04	106	70 - 130	ND, RDL=0.020	ug/L	0.42	30
6052974	Perfluorotridecanoic Acid	2019/04/04	108	70 - 130	ND, RDL=0.020	ug/L	2.1	30
6052974	Perfluoroundecanoic Acid (PFUnA)	2019/04/04	104	70 - 130	ND, RDL=0.020	ug/L	1.7	30

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Colm McNamara, Senior Analyst, Liquid Chromatography

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

SNC-Lavalin Inc.
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GEOTECHNICAL ASSESSMENT
ARCADIS, 2020

CFB Comox FFTA Source Control Project
PSPC
CFB Comox, Lazo, BC
Requisition No.: R.111173.004

MEMORANDUM

Arcadis Canada Inc.
308 - 1080 Mainland Street
Vancouver
British Columbia V6B 2T4
Tel 604 632 9941
Fax 604 632 9942
www.arcadis.com

To:
Dave Osguthorpe, B.Sc., EP
Senior Environmental Specialist
Public Works and Government Services Canada
1230 Government Street, Suite 401
Victoria, B.C. V8W 3X4

CC: Vijay Kallur, P.Eng. Arcadis Canada Inc.

From:
Vijay Kallur, P. Eng.
Project Director / Client Program Manager

Date:	Arcadis Project No.:
February 28, 2020	30000397

Subject:

CFB Comox FFTA Remediation Planning – Laboratory Testing for Geotechnical Properties

INTRODUCTION

Arcadis Canada Inc. (Arcadis) was retained by Public Services and Procurement Canada (PSPC) on behalf of the Department of National Defence (DND) to perform remediation planning for per- and polyfluoroalkyl substances (PFAS) contamination in the Fire Fighter Training Area (FFTA) at Canadian Forces Base (CFB) Comox, Lazo, B.C. (referred hereafter as “the Site”). As part of this scope, field sampling was carried out for Stabilization bench scale tests which included assessment of geotechnical properties. Details on the field sampling and results of laboratory testing of the geotechnical properties are provided in this memo to assist in restoration and association construction planning during remediation..

FIELD SAMPLING

Soil samples were collected at designated locations and depths to coincide with the highest levels of PFAS contamination. These locations and depths are provided in the table below and shown on the attached Figure 1A. The samples were collected using a hand showel at the surface and an excavator for other depths.

The samples from the individual testing locations were shipped to the Arcadis laboratory where they were placed onto a large double-layered HDPE plastic sheet and then homogenized using the “cone and quartering” method. Following homogenization, samples were sent for baseline geotechnical characterization by Geotechnics, Inc. in Raleigh, NC.

\

Table 1: Locations and Depths of Soil Sampling

Sampling Locations	Depths below Grade
TP 19-04	0.0 – 0.6
TP 19-01	0.0 – 0.5
TP 19-05	0.0 – 0.3
TP 19-03	0.6 – 0.9
TP 19-02	1.2 – 1.5

The baseline geotechnical characterization testing included the following analyses:

- Grain size analysis (with hydrometer) by ASTM D422
- Atterberg limits by ASTM D4318
- Loss on ignition (ash and organic content) by ASTM D2974
- Classification by ASTM D2487
- Water content by ASTM D2216

RESULTS

A copy of the laboratory certificate is attached to this memo with the results and the testing methods. Following were the key characteristics of the soil:

Moisture content	14%
Organic content	6%
Gravel	18.64%
Sand	54.61%
Silt and Clay	26.46%
Liquid Limit	33%
Plastic Limit	30%
Plasticity Index	3%
USCS Symbol	ML

Trust the information provided with this memo is sufficient for your requirements. Please contact us if you have any questions or need additional information.

Attachment:

- Laboratory Certificate

geotechnics
geotechnical & geosynthetic testing

February 14, 2020

Project No. R-2020-037-001

Mr. Andrew Baumeister
David.Liles@arcadis-us.com
Arcadis U.S., Inc.
4915 Prospectus Drive, Suite F
Durham, NC 27713

Andrew.Baumeister@arcadis-us.com

Transmittal
Laboratory Test Results
Comox

Please find attached the laboratory test results for the above referenced project. The tests were outlined on the Project Verification Form that was transmitted to your firm prior to the testing. The testing was performed in general accordance with the methods listed on the enclosed data sheets. The test results are believed to be representative of the samples that were submitted for testing and are indicative only of the specimens which were evaluated. We have no direct knowledge of the origin of the samples and imply no position with regard to the nature of the test results, i.e. pass/fail and no claims as to the suitability of the material for its intended use.

The test data and all associated project information provided shall be held in strict confidence and disclosed to other parties only with authorization by our Client. The test data submitted herein is considered integral with this report and is not to be reproduced except in whole and only with the authorization of the Client and Geotechnics. The remaining sample materials for this project will be retained for a minimum of 90 days as directed by the Geotechnics' Quality Program.

We are pleased to provide these testing services. Should you have any questions or if we may be of further assistance, please contact our office.

Respectively submitted,
Geotechnics, Inc.

Michael P. Sm

Michael P. Smith
Regional Manager

We understand that you have a choice in your laboratory services and we thank you for choosing Geotechnics.

DCN: Data Transmittal Letter Date: 1/28/05 Rev.: 1

MOISTURE CONTENT

ASTM D 2216-10

Client:	Arcadis U.S.
Client Reference:	Comox
Project No.:	R-2020-037-001

Lab ID:	001
Boring No.:	NA
Depth (ft):	NA
Sample No.:	CFB Comox Homogenate
Tare Number	RF-7
Wt. of Tare & Wet Sample (g)	70.09
Wt. of Tare & Dry Sample (g)	64.44
Weight of Tare (g)	23.99
Weight of Water (g)	5.65
Weight of Dry Sample (g)	40.45
Water Content (%)	**14.0**

Notes :

Tested By *RFF* *Date* *2/13/20* *Checked By* *GEM* *Date* *2/14/20*

Moisture, Ash, and Organic Matter (Loss on Ignition)

ASTM D 2974-14

Client:	Arcadis U.S.
Client Reference:	Comox
Project No.:	R-2020-037-001

Method B (To 0.1%)

Moisture Content

ASTM D2216

Lab ID:	001
Boring No.:	NA
Depth (ft):	NA
Sample No.:	CFB Comox Homogenate
Tare Number	RF-7
Weight of Tare & Wet Sample (g)	70.09
Weight of Tare & Dry Sample (g)	64.44
Weight of Tare (g)	23.99
Weight of Water (g)	5.65
Weight of Dry Sample (g)	40.45
Moisture Content	**14.0%**

Method C

Ash Content, Organic Matter

Furnace Temperature (°C)	440
Weight of Tare & Ash (g)	62.02
Weight of Volatiles (g)	2.42
Weight of Ash (g)	38.03
Ash Content (%)	**94.0%**
Organic Matter (%)	**6.0%**

Tested By *RFF* *Date* *2/13/20* *Checked By* *GEM* *Date* 2/14/20

SIEVE AND HYDROMETER ANALYSIS

ASTM D 422-63 (2007)

Client	Arcadis U.S.	Boring No.	NA
Client Reference	Comox	Depth (ft)	NA
Project No.	R-2020-037-001	Sample No.	CFB Comox Homogenate
Lab ID	R-2020-037-001-001	Soil Color	**BROWN**

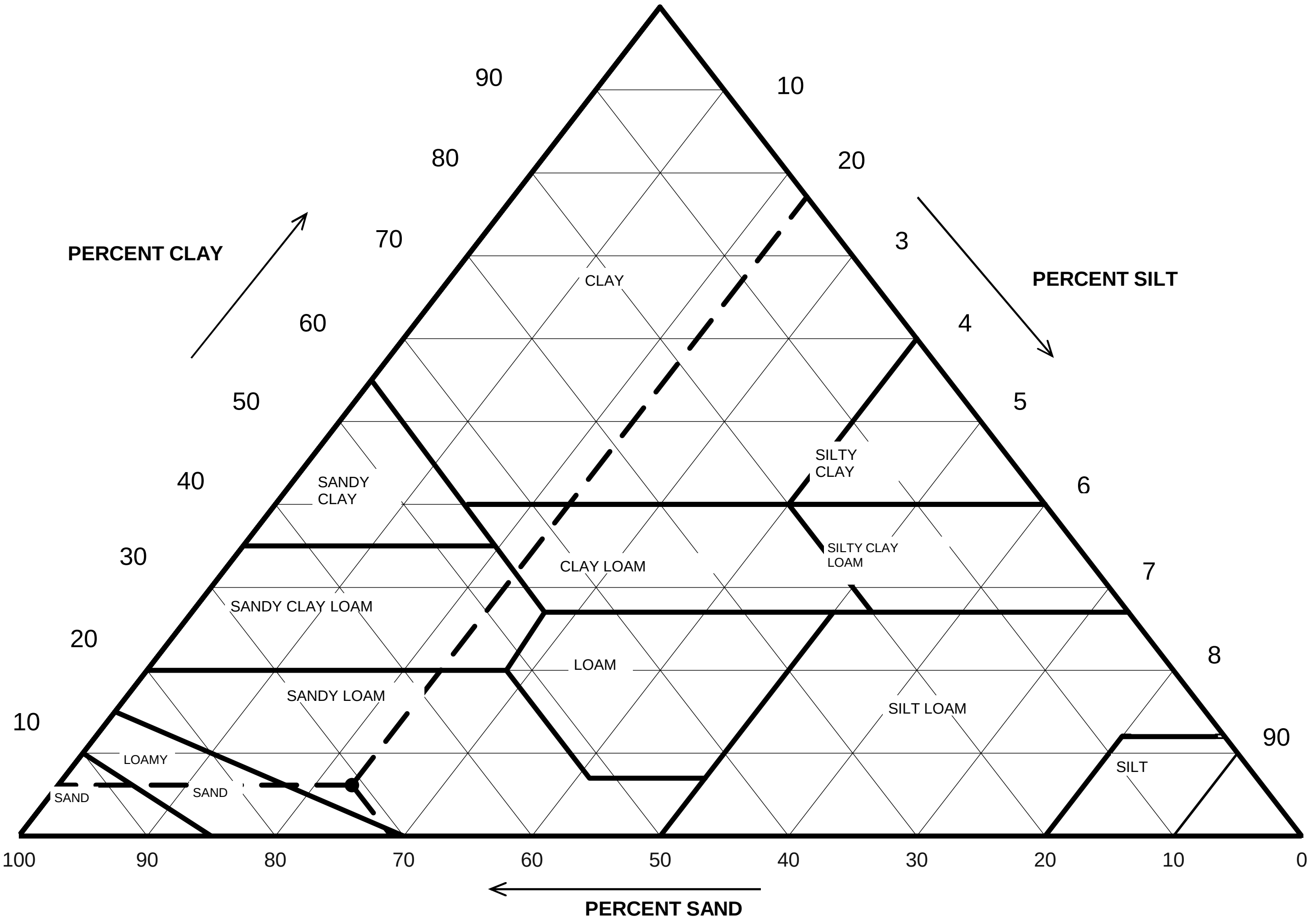
USCS Summary		
Sieve Sizes (mm)		**Percentage**
Greater Than #4	*Gravel*	18.94
#4 To #200	*Sand*	54.61
Finer Than #200	*Silt & Clay*	26.45

USCS Symbol ***SM, TESTED***

USCS Classification ***SILTY SAND WITH GRAVEL***

USDA CLASSIFICATION CHART

Client	Arcadis U.S.	Boring No.	NA
Client Reference	Comox	Depth (ft)	NA
Project No.	R-2020-037-001	Sample No.	CFB Comox Homogenate
Lab ID	R-2020-037-001-001	Soil Color	BROWN



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	30.00	**0.00**
2	70.00	*Sand*	49.67	**70.96**
0.05	20.33	*Silt*	16.03	**22.90**
0.002	4.30	*Clay*	4.30	**6.14**

USDA Classification: ***SANDY LOAM***

WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client	Arcadis U.S.	Boring No.	NA
Client Reference	Comox	Depth (ft)	NA
Project No.	R-2020-037-001	Sample No.	CFB Comox Homogenate
Lab ID	R-2020-037-001-001	Soil Color	**BROWN**

Minus #10 for Hygroscopic Moisture Content		**Hydrometer Specimen Data**	
Tare No.	A	Air Dried - #10 Hydrometer Material (g)	88.93
Wgt.Tare + Wet Soil (g)	46.82	Corrected Dry Wt. of - #10 Material (g)	85.47
Wgt.Tare + Dry Soil (g)	45.59		
Weight of Tare (g)	15.22	Weight of - #200 Material (g)	32.29
Weight of Water (g)	1.23	Weight of - #10 ; + #200 Material (g)	53.18
Weight of Dry Soil (g)	30.37		
Moisture Content (%)	**4.1**	**J-FACTOR (%FINER THAN #10)**	**70.00%**

Soil Specimen Data

Tare No.	300		
Wgt.Tare + Air Dry Soil (g)	346.41		
Weight of Tare (g)	110.45		
Air Dried Wgt. Total Sample (g)	235.96	Dry Weight of Material Retained on #10 (g)	68.83
Total Dry Sample Weight (g)	229.45	Corrected Dry Sample Wt - #10 (g)	160.62

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.0	0.0	100.0	**100.0**
6"	150	0.00	0.0	0.0	100.0	**100.0**
3"	75	0.00	0.0	0.0	100.0	**100.0**
2"	50	0.00	0.0	0.0	100.0	**100.0**
1 1/2"	37.5	0.00	0.0	0.0	100.0	**100.0**
1"	25.0	0.00	0.0	0.0	100.0	**100.0**
3/4"	19.0	0.00	0.0	0.0	100.0	**100.0**
1/2"	12.5	29.15	12.7	12.7	87.3	**87.3**
3/8"	9.50	3.26	1.4	14.1	85.9	**85.9**
#4	4.75	11.06	4.8	18.9	81.1	**81.1**
#10	2.00	25.36	11.1	30.0	70.0	**70.0**
#20	0.85	6.37	7.5	7.5	92.5	**64.8**
#40	0.425	10.23	12.0	19.4	80.6	**56.4**
#60	0.250	14.09	16.5	35.9	64.1	**44.9**
#140	0.106	18.85	22.1	58.0	42.0	**29.4**
#200	0.075	3.64	4.3	62.2	37.8	**26.4**
Pan	-	32.29	37.8	100.0	-	**-**

Notes :

Tested By	RFF	Date	2/14/20	Checked By	GEM	Date	2/14/20

HYDROMETER ANALYSIS

ASTM D 422-63 (2007)

Client	Arcadis U.S.	Boring No.	NA
Client Reference	Comox	Depth (ft)	NA
Project No.	R-2020-037-001	Sample No.	CFB Comox Homogenate
Lab ID	R-2020-037-001-001	Soil Color	**BROWN**

Elapsed Time (min)	R Measured	Temp. (°C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	23.0	23	5.96	17.0	19.7	0.01297	0.0325	**13.8**
5	21.0	23	5.96	15.0	17.4	0.01297	0.0208	**12.2**
15	19.0	23	5.96	13.0	15.1	0.01297	0.0122	**10.6**
30	17.0	23	5.96	11.0	12.8	0.01297	0.0087	**9.0**
60	15.0	23	5.96	9.0	10.5	0.01297	0.0062	**7.3**
250	12.0	23.7	5.71	6.3	7.3	0.01287	0.0031	**5.1**
1440	11.0	21.1	6.62	4.4	5.1	0.01327	0.0013	**3.5**

Soil Specimen Data		**Other Corrections**	
Wgt. of Dry Material (g)	85.47	Hygroscopic Moisture Factor	0.961
Weight of Deflocculant (g)	5.0		
		a - Factor	0.99
		Percent Finer than # 10	70.00
		Specific Gravity	2.70 Assumed

Notes:

Tested By RFF Date 2/13/20 Checked By GEM Date 2/14/20

ATTERBERG LIMITS

ASTM D 4318-17

Client:	Arcadis U.S.	Boring No.:	NA
Client Reference:	Comox	Depth (ft):	NA
Project No.:	R-2020-037-001	Sample No.:	CFB Comox Homogenate
Lab ID:	R-2020-037-001-001	Soil Description:	BROWN SILT

***Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description*.** (Minus No. 40 sieve material, Air dried)

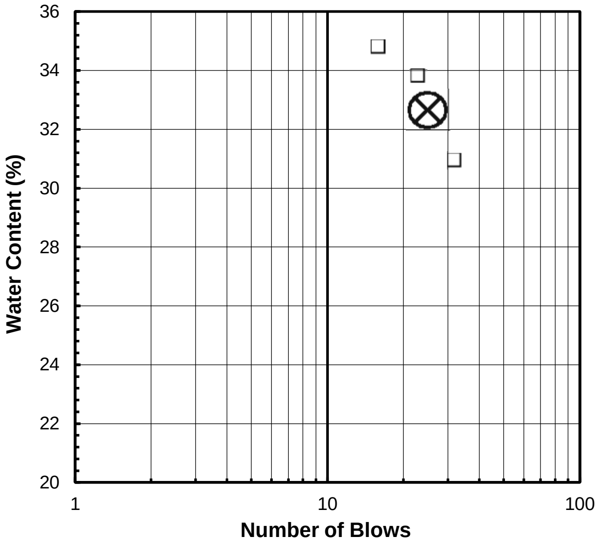
As Received Moisture Content ASTM D2216-10		Liquid Limit Test 1	2	3	M
Tare Number:	RF-7	X-9	17	A-H	U
Wt. of Tare & Wet Sample (g):	70.09	28.63	22.12	28.13	L
Wt. of Tare & Dry Sample (g):	64.44	25.55	18.29	24.88	T
Weight of Tare (g):	23.99	15.59	6.96	15.54	I
Weight of Water (g):	5.7	3.1	3.8	3.3	P
Weight of Dry Sample (g):	40.5	10.0	11.3	9.3	O
Was As Received MC Preserved:	**Yes**				I
Moisture Content (%):	**14.0**	**30.9**	**33.8**	**34.8**	N
Number of Blows:		**32**	**23**	**16**	T

Plastic Limit Test	1	2	Range
Tare Number:	34	27	
Wt. of Tare & Wet Sample (g):	15.55	13.64	
Wt. of Tare & Dry Sample (g):	13.54	12.11	
Weight of Tare (g):	6.98	6.97	
Weight of Water (g):	2.0	1.5	
Weight of Dry Sample (g):	6.6	5.1	
Moisture Content (%):	**30.6**	**29.8**	**0.9**

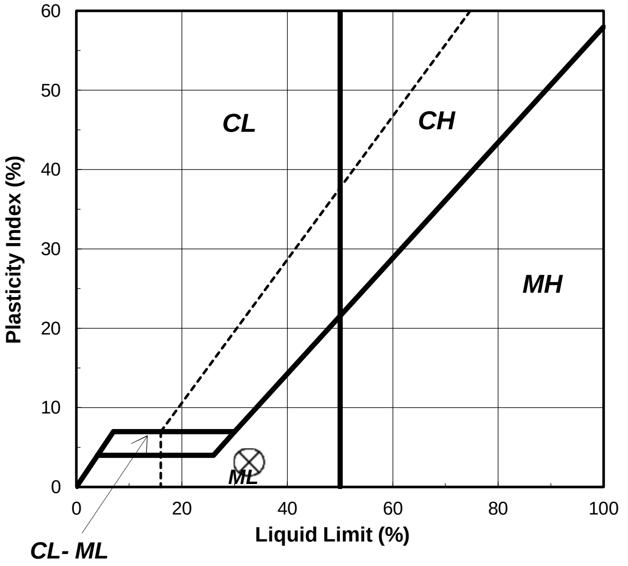
Note: The acceptable range of the two Moisture Contents is ± 0.84

Test Results	
Liquid Limit (%):	**33**
Plastic Limit (%):	**30**
Plasticity Index (%):	**3**
USCS Symbol:	**ML**

Flow Curve



Plasticity Chart



Tested By	*SS*	*Date*	*2/13/20*	*Checked By*	*GEM*	*Date*	*2/14/20*

GEOTECHNICAL ASSESSMENT
WSP, 2020

CFB Comox FFTA Source Control Project
PSPC
CFB Comox, Lazo, BC
Requisition No.: R.111173.004

CFB COMOX FIRE FIGHTING TRAINING AREA CONTROL PROJECT

Geotechnical Assessment Report

WSP Canada Inc.
1935 Bollinger Road
Nanaimo, BC
Canada V9S 5W9

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October 30, 2020

Confidential

SLR Consulting Ltd.
303 – 3960 Quadra Street
Victoria, BC
V8X 4A3

Attention: **Korene Torney, P.Geo., PMP**

Dear Madam:

Subject: **CFB Comox Fire Fighting Training Area Control Project
Geotechnical Assessment Report**

1. INTRODUCTION

At the request of SLR Consulting Ltd. (SLR), WSP Canada Inc. (WSP) has completed a geotechnical assessment in support of the proposed reconstruction of the Fire Fighting Training Area (FFTA) at the CFB Comox facility in Comox BC. Initially, WSP's geotechnical scope of work was focussed on the condition and potential upgrade needs of a temporary road system to import and remove soil from the area of the FFTA. That work was described in a proposal dated May 1, 2020 and confirmed through SLR's PO# VIC3363. The scope was subsequently expanded to include geotechnical support to the civil and structural design of the FFTA through an email dated June 19, 2020 and a proposal dated July 10, 2020. The scope change was confirmed through SLR PO#'s VIC3363-1 and -2.

A significant component of the planned reconstruction of the FFTA involves the removal and/or environmental improvement of soils impacted over the years by the fire fighting training operations. SLR is managing the specifics of that aspect of the project and has developed a soil management plan that is outlined below.

Outlined below is a description of the site and project along with the findings of a two-phase geotechnical assessment. Our discussion and recommendations section have been broadly divided into geotechnical design and geotechnical construction considerations. In developing these recommendations, certain assumptions have been made that will need to be verified during detailed design. These include final grades and the types of additives and mixing procedures that may be used to enable on-site impacted soils to be re-used as engineered fill.

2. SITE AND PROJECT DESCRIPTION

The Fire Fighting Training Area (FFTA) is located within the northwest quadrant of the CFB Comox facility, approximately 850 m north of the main gates on Ryan Road. The FFTA is most practically accessed from “Gate A”, located on Little River Road. The surrounding area is generally flat, at an elevation of around 18 m, and generally clear of trees. A general site location plan is included as Figure 1.

The new FFTA facility is shown on Figure 3. The facility has a central rigid concrete area that measures approximately 20 m in diameter that is used for fire fighting. This is surrounded by an oval asphalt paved surface with a width of 70 m and a gravel surfaced surround that extend a further 16 m beyond the asphalt. The asphalt grades towards the central concrete area at approximately 2% and directs surface water to a central collection system of pipes that convey collected water north to a series of holding tanks. The outer gravel surface is graded away from the centre at about 2%. We understand from SLR that the fire fighting trucks that will operate on the facility have a design load equivalent to H-20 or HS-20 loading in which the front axial load is up to 8,000 lbs (3,636 kg) and the rear axial load is up to 32,000 lb (14,545 kg) .

As part of the project, there will be upgrades to Gate A to enable dump trucks to be able to enter the site and make the left hand turn onto Little River Road. It is assumed that these trucks when loaded have H-20 design loading. There are several existing culverts carrying ditch water beneath the gravel surfaced access road leading the 150 m east from Gate A to the FFTA.

As mentioned above, an important component of the project is the removal and replacement of environmentally impacted soil from beneath the footprint of the FFTA and, potentially, areas adjacent to the FFTA. The impacted soil has been categorized by SLR and a tentative soil removal plan developed that requires excavation to variable depths of up to about 3 m below the footprint of the FFTA, as indicated on Figure 2. While there is an expectation that final grades within the footprint of the FFTA will be established through the import of sand and gravel aggregates to the site, consideration is also being given by SLR to the mixing of portions of less impacted soil with propriety additives to stabilize the contaminates of concern and allow them to remain on site. The stabilized materials would be used in shoulder zones beyond the trafficked area of the FFTA. The geotechnical aspects of this are discussed further in Section 5.2, below. The earthworks are scheduled for the summer/Fall of 2021 to reduce the risk of poor weather, which is an important factor in completing the work efficiently.

Photographs were taken by SLR during a reconnaissance of the site and the subsequent test pitting program, described below. After a period of review by government staff, the photos were released to WSP. A photo log of select surface features and test pits is presented in Appendix 1. Photo 7 illustrates the general nature of the FFTA and the presence of relatively flat but uneven grass covered ground. Photos 5 and 6 relate to the temporary access road and improvements proposed at Gate A. As discussed further below, the access road crosses a ditch approximately 30 m into the site from Gate A in which three culverts (two 900 mm and one 800 mm dia) have been installed to convey flow beneath the road. The approximate cover of granular fill above the culverts was measured at 600 mm.

It is noted that the configuration of Gate A, shown in Photo 6, results in limited left turn ability for loaded dump trucks.

3. GROUND INVESTIGATION

3.1. EXPLORATION PROGRAM

WSP completed two stages of test pitting. The first stage was completed on June 18, 2020 and comprised four test pits (TP20-01 to 04) excavated to provide information related to the temporary access road and existing culverts. The second stage was completed on July 21, 2020 and consisted of twelve test pits (TP20-05(A) to TP20-16(L) that were excavated across the footprint area of the proposed FFTA in order to assess ground conditions for civil design and for environmental purposes. The test pits were excavated using a rubber tire mounted backhoe contracted from Edgett Excavating of Courtenay. The test pits were advanced to depths ranging from 0.6 m to 2.3 m. Restoration was achieved through backfilling with on-site spoil and bucket tamped compaction.

The approximate locations of the test pits are shown on Figure 3.

WSP and SLR had site representative present during the test pitting to log conditions encountered and collect soil samples for laboratory testing. The work was completed in accordance with work permits issued by the Base on June 3 and July 7, 2020. Each test pit location was confirmed clear of underground utilities by Kelly's 1st Call Locating.

3.2. LABORATORY TESTING

Soil samples collected during the test pitting were returned to WSP's Nanaimo soil's laboratory for classification and index testing. Additional samples were collected by SLR and taken to their facilities for environmental purposes. Table 1 presents a summary of the laboratory soil testing completed by WSP. The results of the tests are shown on the Test Pit logs in Appendix 2 and on the test sheets in Appendix 3.

Table 1: Summary of Laboratory Soil Tests

Type of Test	Test Pit Number	Comment
Gradation analysis	TP20-14	Well graded sand and gravel trace fines
Modified Proctors	TP20-05, 07, 09, 09, 10, 14	See Table 2
Moisture content determination	All test pits	7 to 29 %
Atterberg Limits	TP20-05, TP20-09	Medium Plastic

Table 2: Summary of Modified Proctor Tests

Sample Location	Natural Moisture (%) [1]	Corrected Max Density (kg/m^3)	Corrected Optimum Moisture (%)	Soil type
TP20-05 (0.8m)	19	1950	11.1	Till
TP20-07 (0.4m)	17	1928	13.3	Till
TP20-09 (0.5m)	10.9	2212	6.8	Sand and gravel fill
TP20-09 (1.8m)	24.8	1935	11.5	Till
TP20-10 (0.4m)	16	2065	7.3	Till
TP20-14 (0.9m)	8.8	2219	7.6	Sand and gravel fill

Notes: 1. Natural moisture was determined for the soil matrix and is not representative of the soil mass (with gravel and cobble size content)

4. SUBSURFACE CONDITIONS

4.1. ACCESS ROAD LEADING TO FFTA

The subsurface conditions in the 150 m portion of the access road under consideration are characterized by Test Pit logs TP20-1 to 4 and shown in Photos 1 to 4 in Appendix 1. Test Pit 20-1 was located in an area just inside of Gate A where suspected access improvements are required to improve truck turning onto Little River Road. That test pit encountered approximately 0.5 m of organic topsoil and loose sand underlain by compact sand with some gravel, some fines and occasional cobbles. A very stiff, low plastic, silt with occasional cobbles was encountered 0.8 m. This material is interpreted to be glacial till.

Test Pits 2 and 3 were located either side of a series of culverts located about 30 m in from Gate A. The test pits encountered 0.7 to 0.8 m of compact sand and gravel fill over loose dark brown sand with some fines, organics and wood debris. Sloughing and moderate seepage was observed below about 0.8 m. The thickness of gravel cover above the nearby culverts was estimated to be 0.6 m.

Test Pit 20-04 was located on the west side of a second ditch, approximately 120 m east of Gate A. Ground conditions included 0.4 m of gravel fill over a 0.3 m thick layer of low plastic silt over 0.4 m of compact sand. Glacial till was encountered at 1.1 m below grade.

4.2. FIRE FIGHTING TRAINING AREA

The subsurface conditions in the FFTA were characterized through Test Pits 20-05(A) to 20-16(L). The use of letters in the naming of the test pits was to match that used by SLR. The general soil profile consisted of:

- Organic silt (top soil) – thickness ranging from 0.2 to 0.5 m;
- Various fill material – locally absent ranging to a maximum of 1.7 m;
- Sand - typically compact with some fines and a trace of gravel sometimes interbedded with a stiff silt – thickness ranging from locally absent to 1.3 m. underlain by:
- Glacial till – upper portion weathered and becoming dense, clayey, sand and silt, some gravel with occasional cobbles.

At some test pit locations, the sand/silt was not present, and the topsoil layer was up to 0.5 m thick. In Test Pit 20-09, 12 and 16 there was close to a meter of random fill materials. In Test Pit TP20-14, the fill was wet and extended to a depth of 1.7 m. It is noted that TP20-14 is located closest to the area of proposed rigid pavement. A strong hydrocarbon smell was recorded in TP's 20-09, 14, 15 and 16.

No sloughing or strong seepage was noted during the excavation of the majority of the test pits with the exception of the thick fill materials in TP20-14 and 16.

5. DISCUSSIONS AND RECOMMENDATIONS

5.1. GENERAL

From a geotechnical perspective, the site is considered to be suitable for the development of a new fire fighting training area. There are natural subgrade soils that occur at a relatively shallow depth that include dense glacial till and/or compact sands and gravels that, once prepared, would be suitable to support relatively conventional flexible or rigid pavement structures. There are also areas of poorer quality fills, including a relatively thick layer in the vicinity of the rigid pavement, for which some additional subgrade preparation measures may be required, as described below.

We note that the Comox Valley hosts good quality local aggregates for use in the construction of the new pavements and that import materials are expected to be used exclusively below the areas of new pavement. We understand from SLR that certain areas of environmentally impacted on-site soils will be environmentally stabilized through on-site mixing and that there is an intent to reuse these materials in non-settlement sensitive areas beyond the trafficked areas of the FFTA. Discussion on re-use is included below.

Outlined in the sections below is discussion and recommendations related to the design and the construction aspects of the project. A number of items of civil design and earthworks being finalized at the time of writing and, therefore, we have included discussion on possible future geotechnical input.

The properties of the import aggregates described below (Base Gravel, Subbase Gravel and Pit Run Gravel) are defined in the civil project specifications.

5.2. DESIGN CONSIDERATIONS

5.2.1. PAVEMENT DESIGN

In general, subgrade for the pavement structures may consist of dense glacial till or compact sand and gravel. It is anticipated, based on the test pit information, that these materials will be exposed at the base of the environmentally required excavation, schematically shown in Figure 2. Exposed subgrades are to be reviewed and approved by the geotechnical engineer. Proof rolling with a loaded dump truck may be required in areas of till as part of the verification process. Thorough compaction of exposed sand and gravel subgrades may be required to tighten surficial material disturbed through the excavation process.

Test Pits TP20-09, 12, 14 and 16 encountered fill materials some with construction debris and hydrocarbon odour that extended beyond the anticipated depth of environmental excavation. It is noted that these test pits are aligned north -south through the center of the FFTA towards the existing retention pond (Figure 3). In the central area of the FFTA, final grades are below existing grades and the depth of excavation below final grade is about 0.8 m. A specific review of the condition and suitability of the fill materials for pavement support will be required, possibly including considerations of environmental suitability. Dependent on actual conditions, it may be necessary to locally sub-excavate and remove poor quality fill material, or heavily re-compact them to provide a suitable subgrade for pavement support.

Recommendations related to backfill and compaction are provided in Section 5.2.2, below. Recommendations related to the protection of approved subgrades and the control of water are provided in Section 5.3.

The FFTA will include three types of surfacing, namely; gravel, flexible asphaltic concrete and a rigid reinforced concrete. Based on H-20 design loading, the recommended minimum section for the areas of flexible pavement is provided in Table 3.

Table 3. Recommended Minimum Asphaltic Concrete Pavement Section

Element	**Minimum Thickness (mm)**
Hot Mix Asphalt (single lift of Upper Course #1 (19 mm minus))	80 mm
Granular Base (19 mm minus)	150 mm
Granular Sub-base (75 mm minus crushed gravel)	300 mm

In areas of the FFTA with asphalt surfacing where the required excavation depth for environmental reasons exceeds a depth of 300 mm below the base of the pavement section, an imported 100 mm minus Pit Run Gravel with a fines content of less than 8% may be used to establish the elevation of the underside of the pavement sub-base gravel material.

The central area of the FFTA is to be surfaced with rigid reinforced concrete. The design of the concrete is to be undertaken by WSP's structural group. We would recommend that the concrete be immediately underlain by 150 mm of 19 mm minus, Base Gravel compacted to a minimum of 95% Modified Proctor maximum dry density. An imported 75 mm minus Crushed Granular Sub-base material should be used below the Base Gravel layer and bear on an approved subgrade surface. Based on the SLR sections, we anticipate a minimum of approximately 500 mm of Crushed Granular Sub-base material. As noted above, the subgrade in the vicinity of the rigid pavement could contain thick fills and preparation of the subgrade could require local over-excavation or heavy re-compaction.

For the purpose of preliminary structural design, a concrete slab placed on the prepared ground may be designed assuming a Modulus of Subgrade Reaction of 50 MPa/m. This value takes into consideration the size of the footprint area and scales down the unit value associated with a 0.3 m square test plate. It is recommended that the calculated deflections and design of the slab be reviewed by WSP geotechnical prior to finalization.

The outer areas of the FFTA are to be gravel surfaced but may be paved in the future. The SLR drawings indicate a minimum thickness from subgrade to finished surface of about 0.7 m. It is recommended that the gravel pavement comprise a minimum thickness of 150 mm of 19 mm minus Granular Base, with the remaining section comprised of 75 mm minus, Crushed Granular Sub-base. Periodic ravelling or shoving of the unbound gravel surface should be expected over time and routine maintenance in the form of regrading and re-compaction may be required.

As indicated on Figure 2, the northern area of the FFTA beyond the footprint of the paved portion may be utilized for re-use of improved/stabilized on-site soils. These soils will abut the engineered gravel fills supporting the FFTA pavements. In order to provide lateral support to the engineered fill, it is recommended that the footprint of the engineered fill extend downwards and out at no greater than 1 (H) to 1 (V) to intercept the approved subgrade. In order to achieve this steep grade, it may be necessary to place ad compact the reused material at the same time as the engineered fill. It may be necessary to use a shallower slope angle if the engineered fill pad is built independently of the re-use material. Further discussion on backfilling is provided below.

The anticipated surface of the subgrade shown on Figure 2 is based purely on environmental considerations and results in abrupt thicknesses of fill over short horizontal distances. In turn, this has the potential cause differential settlement in the pavement surface, particular where areas of the fill are of limited thickness. In order to reduce the risk of differential settlement, it is recommended that internal excavation slopes be graded at no more than 2(H) to 1(V). It is also recommended that engineered fills placed on included surfaces be stepped a nominal 300 mm into the inclined surface to avoid potential interfaces of weakness.

5.2.2. BACKFILL

The project will involve two general types of backfill; namely, imported granular materials and re-used on-site soils. Due to the environmentally impacted nature of the on-site soils, it is expected that a propriety additive will be mixed into the soil prior to its reuse.

We understand that imported 19 mm Granular Base and 75 mm minus Crushed Granular Sub-base are to comply with the Civil specifications, which reference the Master Municipal Construction Specifications (MMCD). These materials are to be placed in horizontal layers and uniformly compacted to a minimum of 95 % of the Modified Proctor maximum density.

As indicated in Section 5.2.1 above, import granular materials may be required to raise subgrade and establish the underside of the pavement section. Under the rigid pavement area, this material will be 75 mm minus Crushed Granular Sub-base. However, under areas of asphaltic concrete pavement and gravel surface, a 100 mm minus Pit Run Gravel with a fines content of less than 8% may be used. This material is to be placed in horizontal layers and uniformly compacted to a minimum of 95% of the Modified Proctor maximum density.

The native on-site soils described in Section 4 included organic silt (top soil), various fill materials, native sand with some fines and a trace of gravel, stiff silt and glacial till (upper portion weathered and becoming dense, sand and silt, some gravel with occasional cobbles). The organic silt top soil is not considered to be suitable for reuse other than as landscaping cover. This material should be stripped and either removed from site or separately stockpiled. The remaining mineral soils are considered to be suitable for reuse in the designated non-structural fringe area adjacent to the north side FFTA but may need to be moisture conditioned to achieve adequate compaction. Appendix 3 includes a number of Modified Proctor tests that were completed on samples of the surficial granular soils and the glacial till, with the results being summarized in Table 2. It appears from the results that the natural moisture content of the till materials is above the corrected optimum moisture content for maximum density but it is noted that the measured natural moisture in the laboratory corresponds to samples of the finer matrix material and is not necessarily representative of the mixture of gravel and cobbles.

We understand that the propriety product to be mixed with the non-organic on-site soils has not been selected and that the specifics of the mixing process including equipment and moisture requirements are not known. If the treated on-site soils are to be used in the fringe areas adjacent to the FFTA, it is recommended that these specifics be confirmed in order to verify that the treated soil will be in a physically suitable condition to be placed and compacted to provide shoulder support of the FFTA imported aggregates. On the basis that the fringe area will purely be used for landscaping purposes, the required degree of compaction may be reduced to 90 % Modified Proctor maximum dry density.

5.3. CONSTRUCTION CONSIDERATIONS

Temporary works construction considerations relate to the temporary road required to gain access from Gate A to the FFTA; and the temporary excavation and groundwater control needed for the FFTA. There are also considerations related to soil handling and environmental management.

5.3.1. TEMPORARY ACCESS ROAD

The section of temporary road reviewed by WSP runs from Gate A to the FFTA, a distance of approximately 150 m. There are two ditch crossings within this section although only the culverts associated with the most westerly crossing could be identified in the field. The more easterly crossing was heavily overgrown with no defined channel.

The culverts for the westerly ditch, located about 30 m into the site from Gate A, included two 900 mm and one 800 mm dia steel corrugated pipes. The approximate cover of granular fill above the culverts was estimated to be 600 mm. Some corrosion was observed in the base of one of the pipes.

Based on our review of published literature and design guidelines, a 600 mm thickness of cover above these culverts should be adequate to provide protection for H-20 commercial loading. Notwithstanding this, the condition of buried parts of the culverts is not known and potential deflections of the ground surface above the culverts should be carefully reviewed by the contractor once operations commence. If deflections under live truck loads are observed, it may be necessary to remove 150 mm of road gravel, and place two layers of medium strength bi-axial geogrid at 200 mm nominal intervals with a minimum of 150 mm of cover. The geogrid should be the width of the road and extend a minimum of 2 m beyond the outsides of the culverts. We would recommend that the new fill comprise a 19 mm minus Granular Base. The slight increase in road grade elevation will need to be field fitted to meet existing grades beyond the culverts.

While the remaining portions of the access road appeared to be adequate to provide access, the contractor should be prepared for localized maintenance and regrading particularly following periods of wetter weather.

The approach area to Gate A is to be improved through widening to enable access to Little River Road. The details of the widening are shown on the Civil Drawings, which indicate the access road will be gravel surfaced. Geotechnical items of site preparation for the improvements include:

- Strip the footprint of the new roadway access of top soil and loose dark brown silty sand to a depth of 0.6 m. Footprint of existing road to be stripped of gravel to a depth of 200 mm. Excavation to be stepped into existing road aggregates in nominal 300 mm high benches.
- Exposed subgrades to be reviewed and approved by the Geotechnical Engineer prior to re-compaction of loosened subgrade surface.

- Approved 75 mm minus Crushed Granular Sub-base material to be placed in areas of new roadway access in horizontal layers no greater than 300 mm loose thickness and uniformly compacted to a minimum of 95 % Modified Proctor maximum density.

- Approved 19 mm minus Granular Base to be placed in areas of new and existing roadway access and uniformly compacted to a minimum of 95% maximum Modified Proctor; and

- The Minimum pavement section in areas of new construction should include 400 mm of 75 mm minus Crushed Granular Sub-base and 200 mm of 19 mm Granular Base. On the portion of the existing road, the minimum section should include 200 mm of 19 mm minus Granular Base.

It is noted that the actual sub-base thickness will need to be adjusted upwards as necessary to suit final excavation depths and grades. Periodic maintenance of the unbound Granular Base may be required, in the form of regrading and re-compaction.

5.3.2. TEMPORARY EXCAVATIONS WITHIN FFTA

The general nature of the temporary excavations within the FFTA and fringe areas is shown on Figure 2. As noted, excavations depths are expected to change over short distances as a result of anticipated soil contamination. Recommendations for maximum excavation slope grades under areas of rigid and flexible pavement are detailed in Section 5.2.1. These grades relate to the control of differential settlement and are not related to worker safety.

Excavation work must be completed in accordance with WorkSafeBC, OHS Regulation Part 20: Construction, Excavation and Demolition.

Final approved subgrades must be protected and not allow to dry, soften or become disturbed through trafficking. Once approved, it is recommended that the subgrade be protected through the placement of engineered fill as described I Section 5.2.2, above.

5.3.3. TEMPORARY GROUNDWATER CONTROL

Seepage and sloughing of the test pits walls was observed in TP20-14. This test pit is located in the central area of the site, close to the area of designated rigid pavement. The fill extended to 1.7 m and was wet below 1.2 m, accompanied by a smell of hydrocarbons. From a geotechnical perspective, it is anticipated that seepage may be managed through a series of sumps and pumps. WSP understands from SLR that the environmental management and disposal of impacted groundwater is addressed in the contract documents and may require provision for storage and treatment prior to disposal.

5.3.4. ENVIRONMENTAL MANAGEMENT

WSP understands that much of the on-site soil and, potentially, groundwater is environmentally impacted, and that extensive on-site treatment is anticipated as part of the earthworks for the FFTA project. This is described in the contract documents and is beyond the scope of this geotechnical report.

5.4. FUTURE GEOTECHNICAL INPUT

Future geotechnical input is anticipated to include the following items:

- Interaction with the civil and structural engineers during final design and specification development;
- Review of the geotechnical aspects of tender documents for compliance with the recommendations presented herein;
- Field reviews during construction to assess actual conditions and verify the recommendations presented herein; and
- Materials compliance testing during construction to confirm that materials types and compaction requirements are satisfied.

6. CLOSURE

This report has been prepared for the exclusive use of SLR Consulting Ltd., for application to the FFTA project described above. Public Services and Procurement Canada is considered to be an authorized user of the report and may copy and redistribute the report, subject to the terms of the professional services agreement under which the work was performed. The report has been provided in support of the civil and structural design of the proposed facility and prepared in accordance with the appended Standard Limitations.

Please do not hesitate to contact the undersigned if you require any further information.

Yours sincerely,

WSP Canada Inc.

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
C. MILLER
21265
2020-11-02

Per: Carl Miller M.Sc., P.Eng
Senior Geotechnical Engineer

Reviewed by: Luke Marquis., PMP., P.Eng.
Geotechnical Project Manager

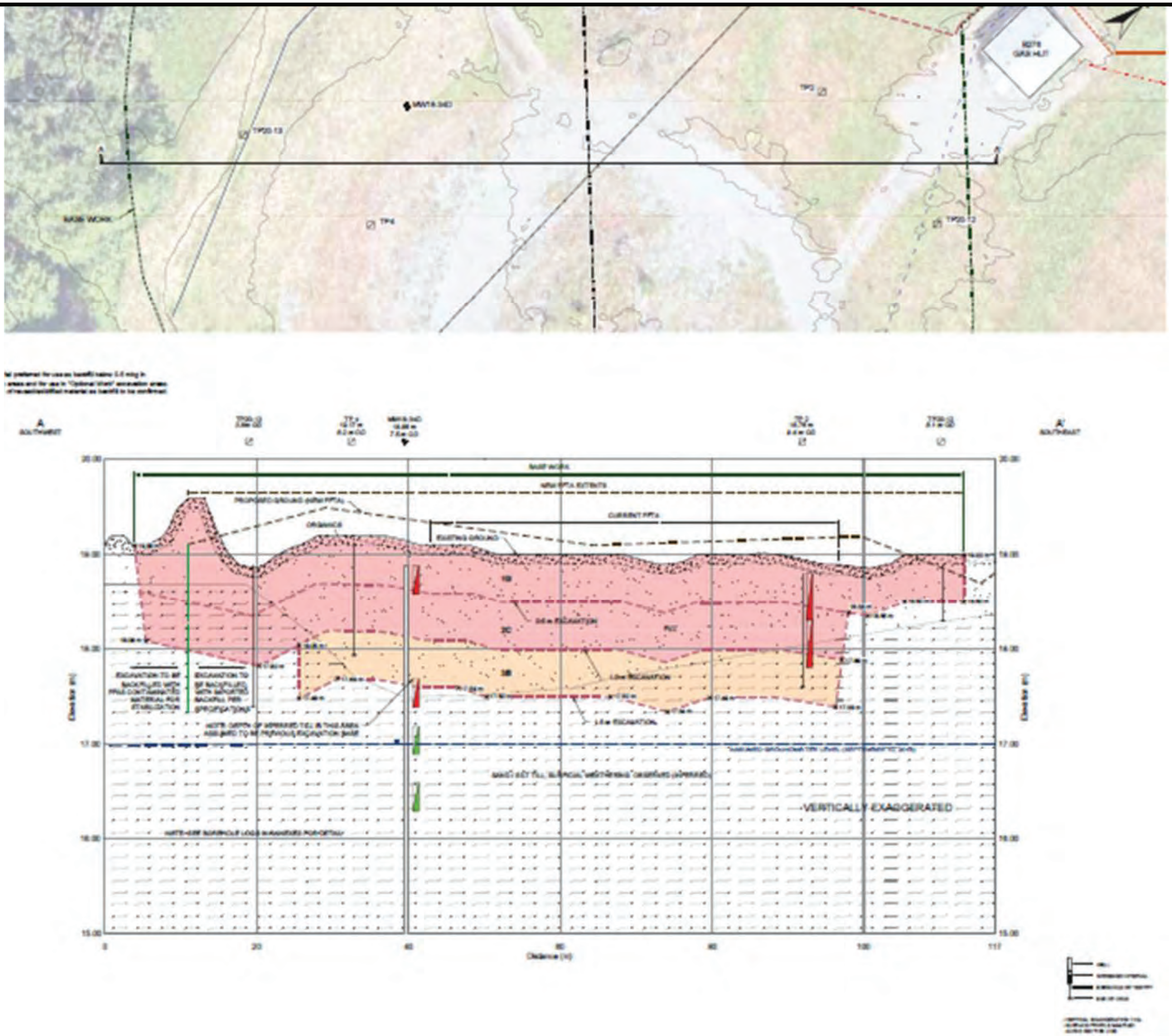
N

PROJECT:
CFB COMOX FIRE FIGHTING TRAINING AREA, COMOX BC
GEOTECHNICAL ASSESSMENT

TITLE:
SITE LOCATION PLAN

CLIENT:
SLR CONSULTING LTD.

FIGURE NO.:	DATE:	FILE NO.:	SCALE:	DRAWN BY:	REV NO.:
1	OCTOBER 2020	201-05243-00	NTS	LM	-



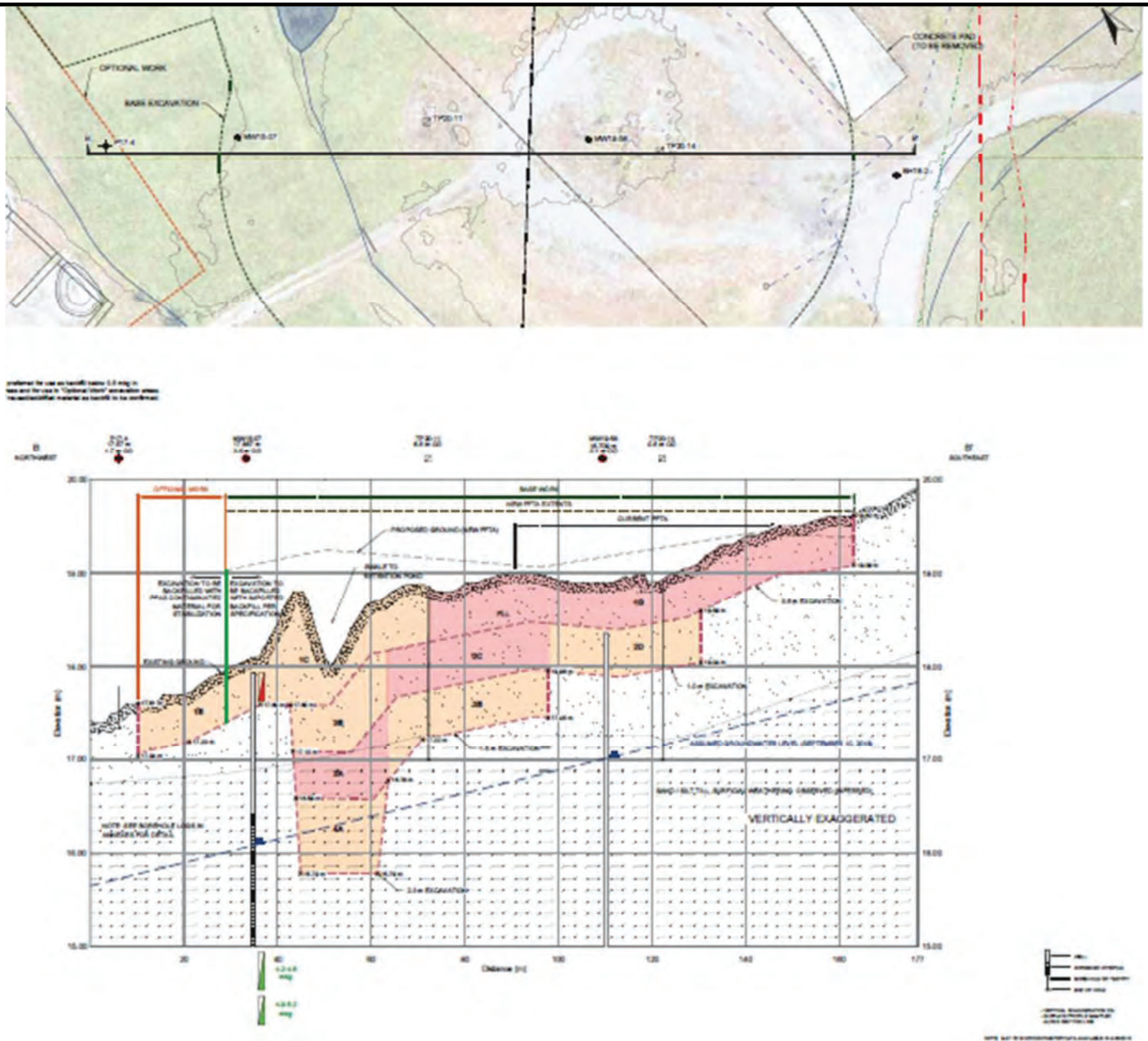
Reproduced from SLR 95 % Design Submission Drawing No 011, dated 2020/07/09.

PROJECT:
CFB COMOX FIRE FIGHTING TRAINING AREA, COMOX BC
GEOTECHNICAL ASSESSMENT

TITLE:
TENTATIVE ENVIRONMENTAL EXCAVATION PLAN

CLIENT:
SLR CONSULTING LTD.

FIGURE NO.:	DATE:	FILE NO.:	SCALE:	DRAWN BY:	REV NO.:
2a	OCTOBER 2020	201-05243-00	NTS	LM	-



Reproduced from SLR 95 % Design Submission Drawing No 012, dated 2020/07/09.

PROJECT:

CFB COMOX FIRE FIGHTING TRAINING AREA, COMOX BC
GEOTECHNICAL ASSESSMENT

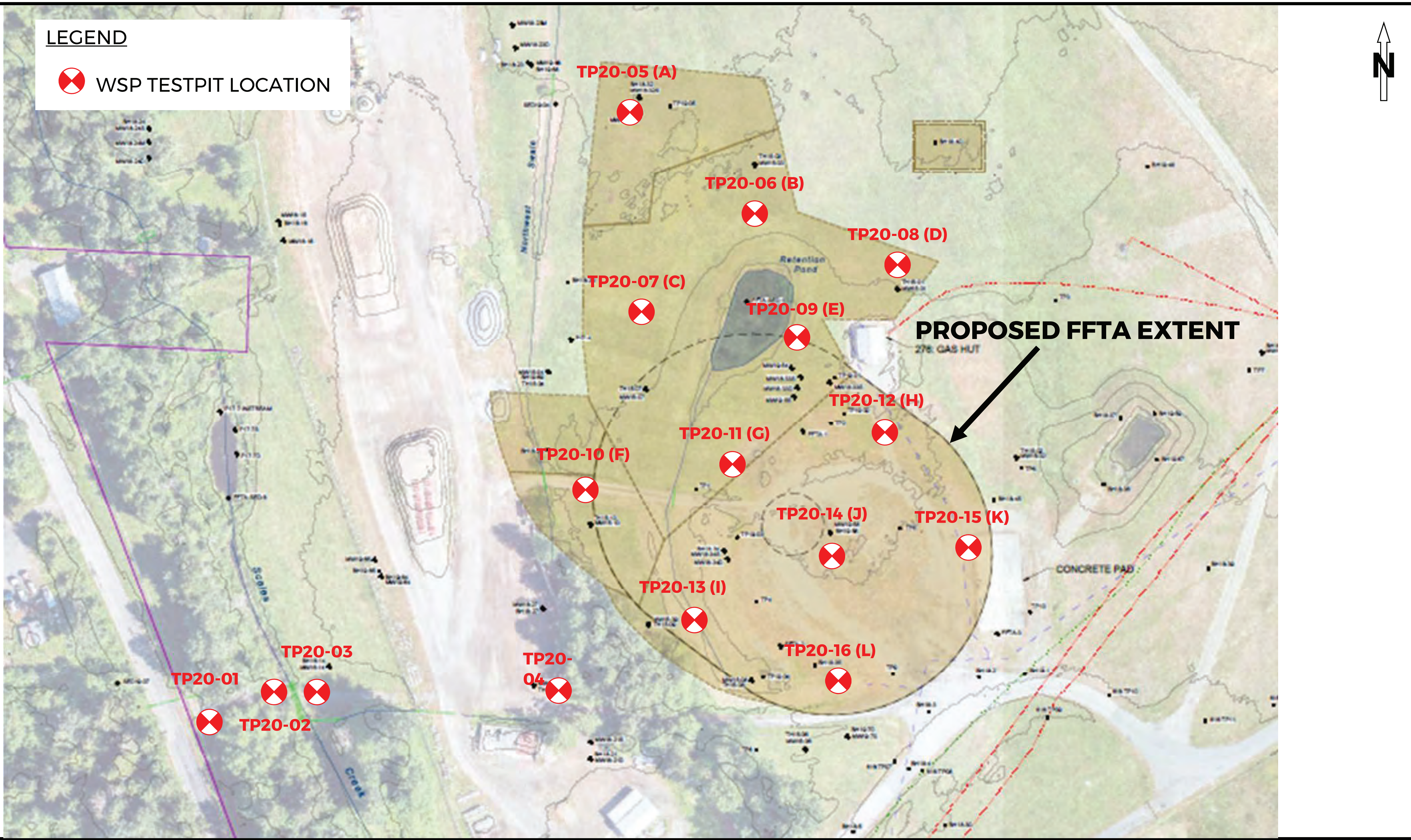
TITLE:

TENTATIVE ENVIRONMENTAL EXCAVATION PLAN

CLIENT:

SLR CONSULTING LTD.

FIGURE NO.:	DATE:	FILE NO.:	SCALE:	DRAWN BY:	REV NO.:
2b	OCTOBER 2020	201-05243-00	NTS	LM	-



wsp

FIGURE NO.: 3

PROJECT: CFB COMOX FIRE FIGHTING TRAINING AREA, COMOX BC
GEOTECHNICAL ASSESSMENT

TITLE: TESTPIT LOCATION PLAN

CLIENT: SLR CONSULTING LTD.

DATE: OCTOBER 2020

FILE NO.: 201-05243-00

SCALE: NTS

DRAWN BY: LM

REV NO.: -

APPENDIX

1. PHOTO LOG

APPENDIX I – ANNOTATED PHOTOGRAPHS

Photo	Description
	**Photo 1:** View of TP20-01 (near the access gate) at completion. In order of increasing depth: topsoil over, light dark brown silty sand over, light brown sand over, very stiff sandy silt. Test pit depth of 1.4 m.
	**Photo 2:** View of TP20-02 (west of the culverts near the access gate) at completion. In order of increasing depth: crushed gravel fill over, sand and gravel fill over, gravelly sand fill over, loose sand with organics and wood/log debris. Test pit depth of 1.3 m.

APPENDIX 1 – ANNOTATED PHOTOGRAPHS

Photo	Description
	**Photo 3:** View of TP20-03 (east of the culverts near the access gate) at completion. In order of increasing depth: crushed gravel fill over, sand and gravel fill over, gravelly sand fill over, loose to compact sand with organics and wood/log debris between 1.0 m and 1.1 m. Test pit depth of 1.5 m.
	**Photo 4:** View of TP20-04 (near treed area) at completion. In order of increasing depth: sand and gravel fill over, stiff sandy silt over, compact sand over, hard silt and sand. Test pit depth of 1.5 m.

APPENDIX 1 – ANNOTATED PHOTOGRAPHS

Photo	Description
	**Photo 5:** View of the three culverts (two 900 mm and one 800 mm diameter) with 600 mm of cover near the gate access looking from the south side.
	**Photo 6:** View looking east at the proposed access gate off Little River Road. Gate opening is 5.6 m wide.

APPENDIX 1 – ANNOTATED PHOTOGRAPHS

Photo	Description
	**Photo 7:** Looking southeast at the existing firefighting training area.
	**Photo 8:** View of TP20-05 (A) at completion. In order of increasing depth: organic topsoil over, compact sand dense sand and silt inferred to be weathered till. Test pit depth of 1.0 m.

APPENDIX 1 – ANNOTATED PHOTOGRAPHS

Photo	Description
	**Photo 9:** View of TP20-09 (E) at completion. In order of increasing depth: organic topsoil over, compact silt sand fill over, compact sand over, compact sand and silt inferred to be weathered till over, dense to very dense sand and silt. Test pit depth of 2.3 m.
	**Photo 10:** View of TP20-10 (F) at completion. In order of increasing depth: organic topsoil over, dense silty sand inferred to be weathered till. Test pit depth of 0.8 m.

APPENDIX 1 – ANNOTATED PHOTOGRAPHS

Photo	Description
	**Photo 11:** View of TP20-11 (G) at completion. In order of increasing depth: organic topsoil over, compact silty sand over, dense silty sand. Test pit depth of 1.8 m.
	**Photo 12:** View of TP20-14 (J) at completion. In order of increasing depth: gravel fill over, compact sand and gravel fill over, dense silty sand. Test pit depth of 1.9 m.

APPENDIX

2. TEST PIT LOGS

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TP20-01
Pg 1 of 1
Project No: 201-05243-00

Depth (m)	Depth (ft)	Description	C	N	Type/ Sample #/ Recovery	Water Level	10 20 30 40 50 60 70 80 90
		ORGANIC TOPSOIL with grass.					
		loose to compact dark brown, silty, SAND, some gravel, moist, trace cobbles and organics.	▥		G1		
	2	compact, light brown, SAND, some fines, some gravel, moist to wet, occasional cobbles.	▥		G2		
1		very stiff, mottled red/brown and grey, sandy, SILT, trace gravel, low plasticity, moist. -below 1.0 m, hard, occasional cobbles.	▥		G3		**PP** = 350kPa
	4		▥		G4		**PP** > 450kPa
		End of test pit at 1.4 m due to hard digging. No sloughing and no seepage noted. Test pit backfilled with bucket packed excavated material.					
2	6						
	8						
3	10						
	12						
4	14						
	16						

C: Condition of Sample
Good ▇
Disturbed ▥
No Recovery ☒

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

DCPT Blow/300 mm

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Plastic Limit (%) ▶—●—◀ Liquid Limit (%)
Moisture Content (%)
▼ Ground Water Level
⊗ Shear strength in kPa (Torvane)
PP Pocket Penetrometer (compressive strength in kPa)
X Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
⊠ Remolded strength in kPa
■ Percent Passing # 200 sieve

▥
▨

Drill Method: Backhoe
Date Drilled: 6/18/2020
Logged by: LM
Checked by: CM

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TP20-02
Pg 1 of 1
Project No: 201-05243-00

Depth (m)	Depth (ft)	Description	C	N	Type/ Sample #/ Recovery	Water Level
		compact, grey, GRAVEL (FILL), trace fines, angular, dry, trace rootlets.				
		compact to dense, brown, SAND AND GRAVEL (FILL), trace fines, subangular to angular, moist.	▥		G1	
	2	dense, light brown, gravelly SAND (FILL), trace to some fines, moist, occasional cobbles.	▥		G2	
1	4	loose, dark brown and black, SAND, some fines, wet, organics and wood debris/logs.	▥		G3	
		End of test pit at 1.3 m due to sloughing. Significant sloughing and seepage noted below 1,0 m. Test pit backfilled with bucket packed excavated material.				
2	6, 8					
3	10, 12					
4	14, 16					

10 20 30 40 50 60 70 80 90

C: Condition of Sample
- Good ■
- Disturbed ▥
- No Recovery ☒

Type: Type of Sampler
- SPT : 2 in. standard
- ST : Shelby
- G : Grab
- CORE

N: Number of Blows
- WH : Weight of Hammer
- WR : Weight of Rod
- Standard Penetration Test : ASTM D1586
- Hammer Type:

DCPT Blow/300 mm

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Plastic Limit (%) ▶—●—◀ Liquid Limit (%)
Moisture Content (%)
- ▼ Ground Water Level
- ⊗ Shear strength in kPa (Torvane)
- PP Pocket Penetrometer (compressive strength in kPa)
- X Shear strength in kPa (Unconfined)
- ⊗ Shear strength in kPa (Field vane)
- ☒ Remolded strength in kPa
- ■ Percent Passing # 200 sieve

▦
▨

Drill Method: Backhoe
Date Drilled: 6/18/2020
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Checked by: CM

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TP20-03
Pg 1 of 1
Project No: 201-05243-00

Depth (m)	Depth (ft)	Description	C	N	Type/ Sample #/ Recovery	Water Level
		compact, grey, GRAVEL (FILL), trace fines, angular, dry, trace rootlets.				
		compact to dense, brown, SAND AND GRAVEL (FILL), trace fines, subangular to angular, moist.	▦		G1	
	2	dense, light brown, gravelly SAND (FILL), trace to some fines, moist, occasional cobbles.	▦		G2	
1	4	loose to compact, dark brown, SAND, some fines, moist to wet. -between 1.0 m and 1.1 m, organics and wood debris/logs. -below 1.1 m, compact, mottled light brown and red/brown, some silt to silty.	▦ ▦		G3 G4	
2	6	End of test pit at 1.5 m due to scheduled depth. Minor sloughing and moderate seepage noted below 0.8 m. Test pit backfilled with bucket packed excavated material.				
	8					
3	10					
	12					
4	14					
	16					

10 20 30 40 50 60 70 80 90

C: Condition of Sample
Good ▬
Disturbed ▦
No Recovery ☒

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

DCPT Blow/300 mm

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Plastic Limit (%) ▶—●—◀ Liquid Limit (%)
Moisture Content (%)
▼ Ground Water Level
⊗ Shear strength in kPa (Torvane)
PP Pocket Penetrometer (compressive strength in kPa)
X Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
⊠ Remolded strength in kPa
■ Percent Passing # 200 sieve

▦
▨

Drill Method: Backhoe
Date Drilled: 6/18/2020
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Checked by: CM

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TP20-04
Pg 1 of 1
Project No: 201-05243-00

Depth (m)	Depth (ft)	Description	C	N	Type/ Sample #/ Recovery	Water Level	10 20 30 40 50 60 70 80 90
		dense, brown, SAND AND GRAVEL (FILL), trace fines, angular, moist.	▥		G1		
	2	stiff, red/brown with black, sandy, SILT, low plasticity, moist.	▥		G2		**PP** = 125kPa
1		compact, light brown, SAND, some fines, moist to wet.	▥		G3		
	4	hard, mottled red and light brown, SILT AND SAND, trace gravel, non plastic, moist, occasional cobbles.	▥		G4		**PP** > 450kPa
		End of test pit at 1.5 m due to scheduled depth. No sloughing and no seepage noted. Test pit backfilled with bucket packed excavated material.					
	6						
2							
	8						
3	10						
	12						
4							
	14						
	16						

C: Condition of Sample
Good ■
Disturbed ▥
No Recovery ☒

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

DCPT Blow/300 mm

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Plastic Limit (%) ▶—●—◀ Liquid Limit (%)
Moisture Content (%)

▼	Ground Water Level
⊗	Shear strength in kPa (Torvane)
PP	Pocket Penetrometer (compressive strength in kPa)
X	Shear strength in kPa (Unconfined)
⊗	Shear strength in kPa (Field vane)
☒	Remolded strength in kPa
■	Percent Passing # 200 sieve

▥

▨

Drill Method: Backhoe
Date Drilled: 6/18/2020
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1 LOG PER PAGE 8/26/20

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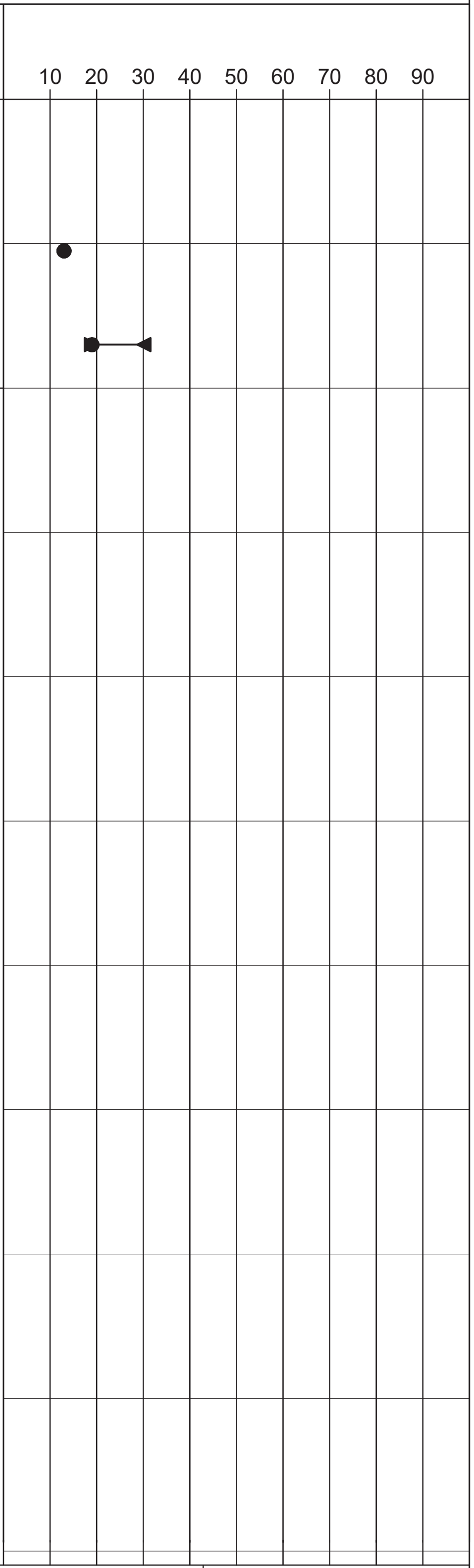
TP20-05 (A)

Pg 1 of 1
Project No: 201-05243-00

Description	SOIL REUSE	C	N	Type/ Sample #/ Recovery	Water Level
black, ORGANIC SILT (TOPSOIL), moist, rootlets.	▦				
compact, light brown, SAND, some fines, trace gravel, moist.	▦	▥		G1	
very stiff, light brown, silty CLAY (inferred weathered till), some sand, trace gravel, low to intermediate plasticity, moist, occasional cobbles.	▦ ▨	▥		GB1	
End of test pit at 1.0 m due to scheduled depth. No sloughing and no seepage noted. Test pit backfilled with bucket packed excavated material.					

Depth (m) 1, 2, 3, 4; (ft) 2, 4, 6, 8, 10, 12, 14, 16



C: Condition of Sample
Good ▬
Disturbed ▥
No Recovery ☒

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

DCPT Blow/300 mm

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Plastic Limit (%) ▶—●—◀ Liquid Limit (%)
Moisture Content (%)
▼ Ground Water Level
⊗ Shear strength in kPa (Torvane)
PP Pocket Penetrometer (compressive strength in kPa)
X Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
☒ Remolded strength in kPa
■ Percent Passing # 200 sieve

SOIL REUSE
DESTROY ▦
REUSE ▨

Drill Method: Backhoe
Date Drilled: 7/21/2020
Logged by: LM
Checked by: CM

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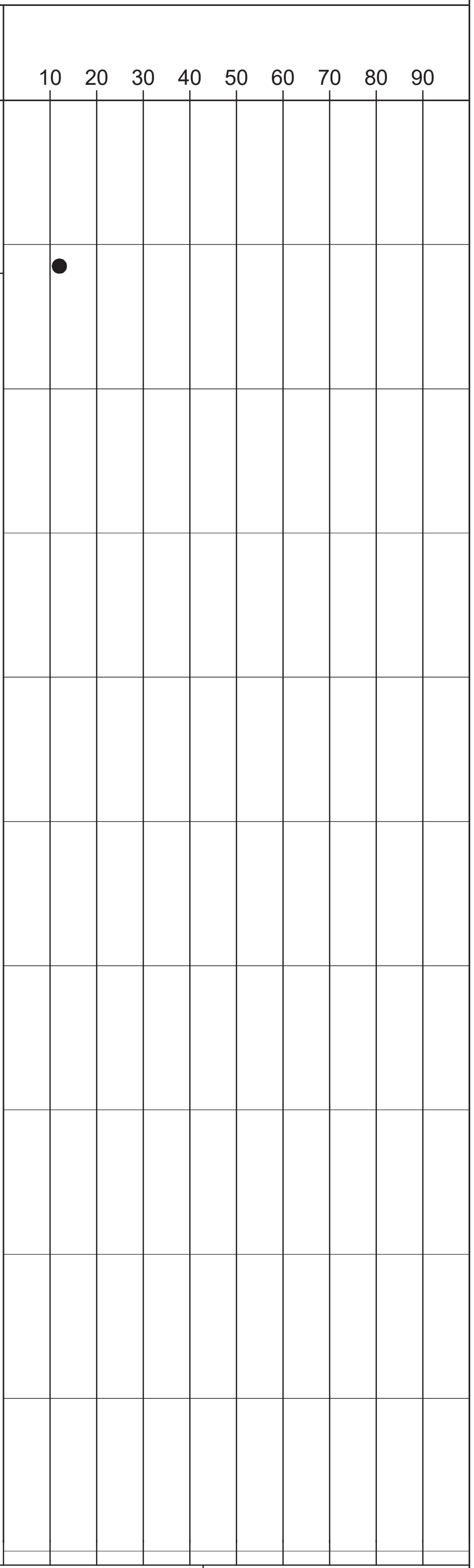
TP20-06 (B)

Pg 1 of 1
Project No: 201-05243-00

Depth (m)	Depth (ft)	Description	SOIL REUSE	C	N	Type/ Sample #/ Recovery	Water Level
		black, ORGANIC SILT (TOPSOIL), some sand, moist, rootlets.	▨				
	2	compact to dense, light brown, SAND, trace to some fines, moist.		▥		G1	
		End of test pit at 0.6 m due to scheduled depth. No sloughing and no seepage noted. Test pit backfilled with bucket packed excavated material.					



Depth scale (m): 1, 2, 3, 4
Depth scale (ft): 2, 4, 6, 8, 10, 12, 14, 16

C: Condition of Sample
Good ■
Disturbed ▥
No Recovery ☒

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

DCPT Blow/300 mm

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Plastic Limit (%) ▶—●—◀ Liquid Limit (%)
Moisture Content (%)
Ground Water Level
Shear strength in kPa (Torvane)
PP Pocket Penetrometer (compressive strength in kPa)
X Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
⊠ Remolded strength in kPa
■ Percent Passing # 200 sieve

SOIL REUSE
DESTROY ▥
REUSE ▨

Drill Method: Backhoe
Date Drilled: 7/21/2020
Logged by: LM
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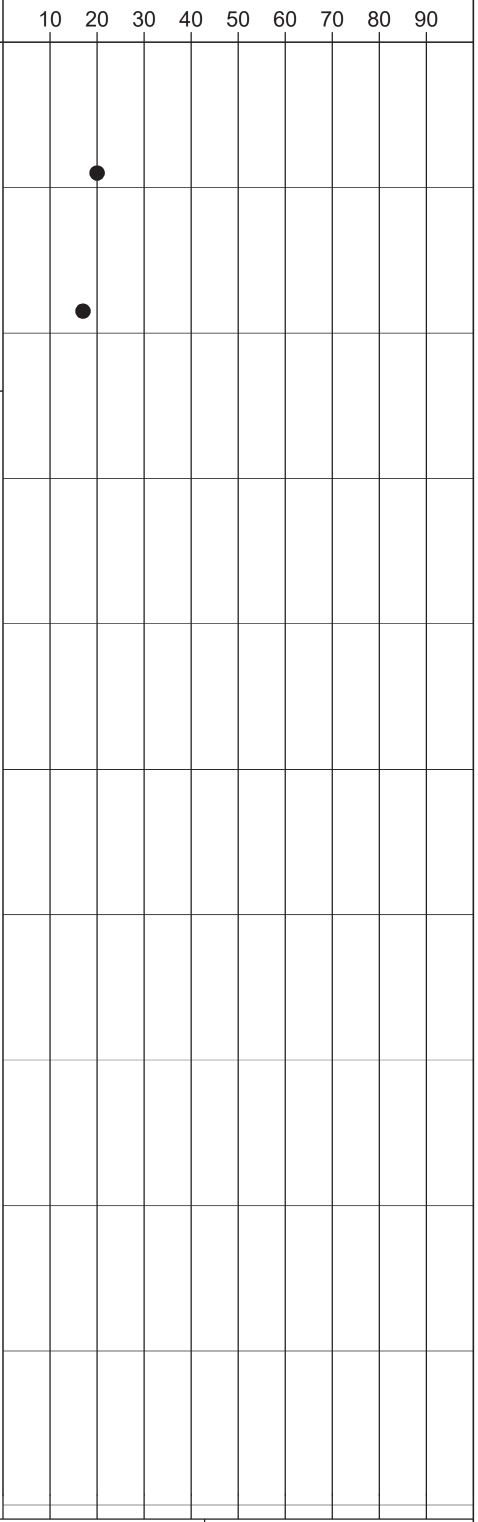
TP20-07 (C)
Pg 1 of 1
Project No: 201-05243-00

Depth (m)	Depth (ft)	Description	SOIL REUSE	C	N	Type/ Sample #/ Recovery	Water Level
		black, ORGANIC SILT (TOPSOIL), some sand, moist, rootlets.	▨				
	2	stiff, brown/grey, silty CLAY (inferred weathered till), some sand, trace gravel, low plasticity, moist to wet, occasional cobbles.	▨	▥		GB1	
1	4	dense to very dense, grey, SAND, some fines, some gravel, moist (hydrocarbon odour).		▥		G1	
2, 3, 4	6, 8, 10, 12, 14, 16	End of test pit at 1.2 m due to scheduled depth. No sloughing and no seepage noted. Test pit backfilled with bucket packed excavated material.					



C: Condition of Sample
- Good ■
- Disturbed ▥
- No Recovery ☒

Type: Type of Sampler
- SPT : 2 in. standard
- ST : Shelby
- G : Grab
- CORE

N: Number of Blows
- WH : Weight of Hammer
- WR : Weight of Rod
- Standard Penetration Test : ASTM D1586
- Hammer Type:

DCPT Blow/300 mm

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Plastic Limit (%) ▶—●—◀ Liquid Limit (%)
Moisture Content (%)
- ▼ Ground Water Level
- ∞ Shear strength in kPa (Torvane)
- PP Pocket Penetrometer (compressive strength in kPa)
- X Shear strength in kPa (Unconfined)
- ⊗ Shear strength in kPa (Field vane)
- ⊠ Remolded strength in kPa
- ■ Percent Passing # 200 sieve

SOIL REUSE
- DESTROY ▦
- REUSE ▨

Drill Method: Backhoe
Date Drilled: 7/21/2020
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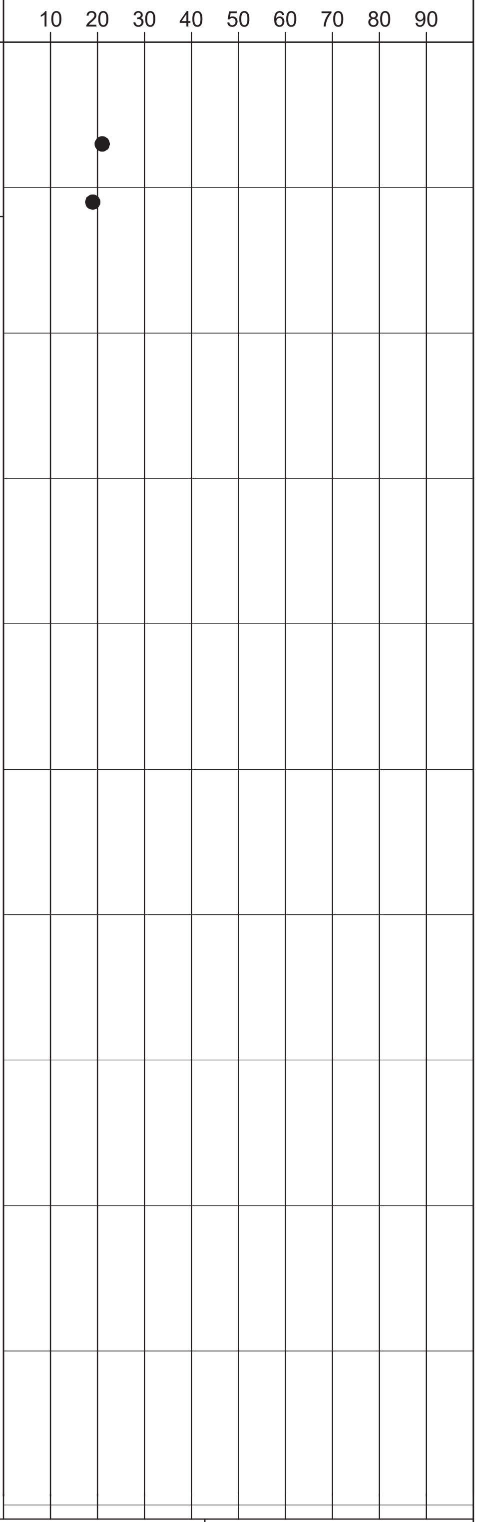
TP20-08 (D)

Pg 1 of 1
Project No: 201-05243-00

Depth (m)	Depth (ft)	Description	SOIL REUSE	C	N	Type/ Sample #/ Recovery	Water Level
		black, ORGANIC SILT (TOPSOIL), moist, rootlets.	▨				
		compact, red/brown, silty SAND, trace gravel, moist, occasional cobbles, boulders, and organics.	▨	▥		GB1	
	2	stiff, brown/grey, silty CLAY (inferred weathered till), some sand, trace gravel, low plasticity, moist to wet, occasional cobbles.	▨	▥		GB2	
		End of test pit at 0.6 m due to scheduled depth. No sloughing and no seepage noted. Test pit backfilled with bucket packed excavated material.					
1	4						
2	6						
	8						
3	10						
	12						
4	14						
	16						



C: Condition of Sample
Good ■
Disturbed ▥
No Recovery ☒

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

DCPT Blow/300 mm

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Plastic Limit (%) ▶—●—◀ Liquid Limit (%)
Moisture Content (%)
▼ Ground Water Level
(X) Shear strength in kPa (Torvane)
PP Pocket Penetrometer (compressive strength in kPa)
X Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
☒ Remolded strength in kPa
■ Percent Passing # 200 sieve

SOIL REUSE
DESTROY ▦
REUSE ▨

Drill Method: Backhoe
Date Drilled: 7/21/2020
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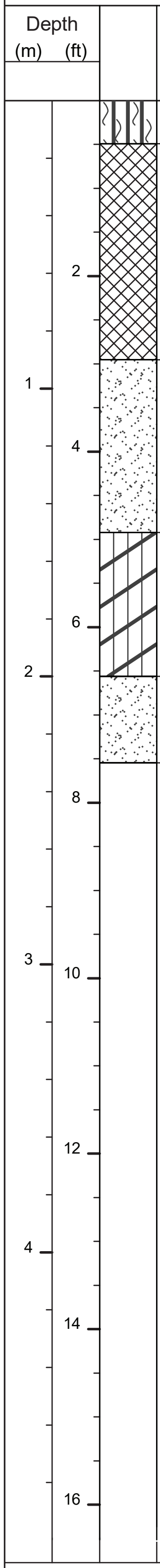
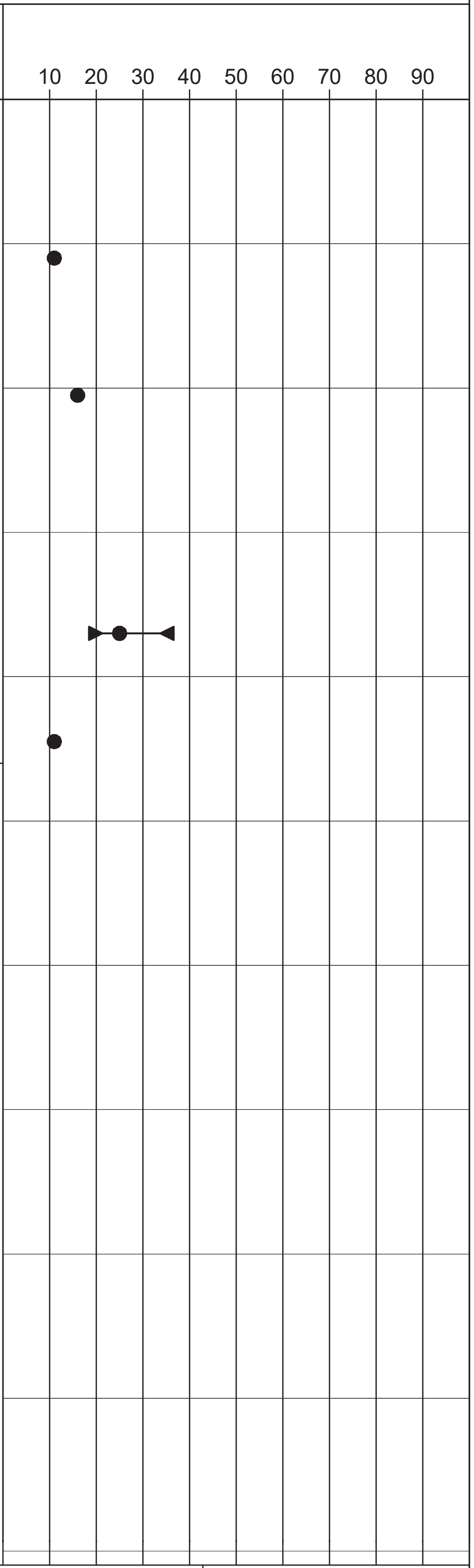
TP20-09 (E)

Pg 1 of 1
Project No: 201-05243-00



Description	SOIL REUSE	C	N	Type/ Sample #/ Recovery	Water Level
black, ORGANIC SILT (TOPSOIL), moist, rootlets.	▨				
compact, brown, silty SAND (FILL), trace gravel, moist, occasional cobbles, boulders, organics, and construction debris.	▨	▥		GB1	
compact, red/brown, SAND, some fines, some gravel, moist, occasional organics and roots.	▦	▥		G1	
stiff, brown/grey, silty CLAY (inferred weathered till), some sand, trace gravel, intermediate plasticity, moist to wet, occasional cobbles.	▨	▥		GB2	
dense to very dense, grey, SAND, some fines, some gravel, moist (hydrocarbon odour).	▨	▥		G2	

End of test pit at 2.3 m due to scheduled depth. No sloughing and no seepage noted. Test pit backfilled with bucket packed excavated material.



C: Condition of Sample	**Type: Type of Sampler**	**N: Number of Blows**
Good ■	SPT : 2 in. standard	WH : Weight of Hammer
Disturbed ▥	ST : Shelby	WR : Weight of Rod
No Recovery ☒	G : Grab	Standard Penetration Test : ASTM D1586
	CORE	Hammer Type:

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DCPT Blow/300 mm

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Plastic Limit (%) ▶—●—◀ Liquid Limit (%)
Moisture Content (%)
Ground Water Level
Shear strength in kPa (Torvane)
PP Pocket Penetrometer (compressive strength in kPa)
X Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
⊠ Remolded strength in kPa
■ Percent Passing # 200 sieve

SOIL REUSE
DESTROY ▦
REUSE ▨

Drill Method: Backhoe
Date Drilled: 7/21/2020
Logged by: LM
Checked by: CM

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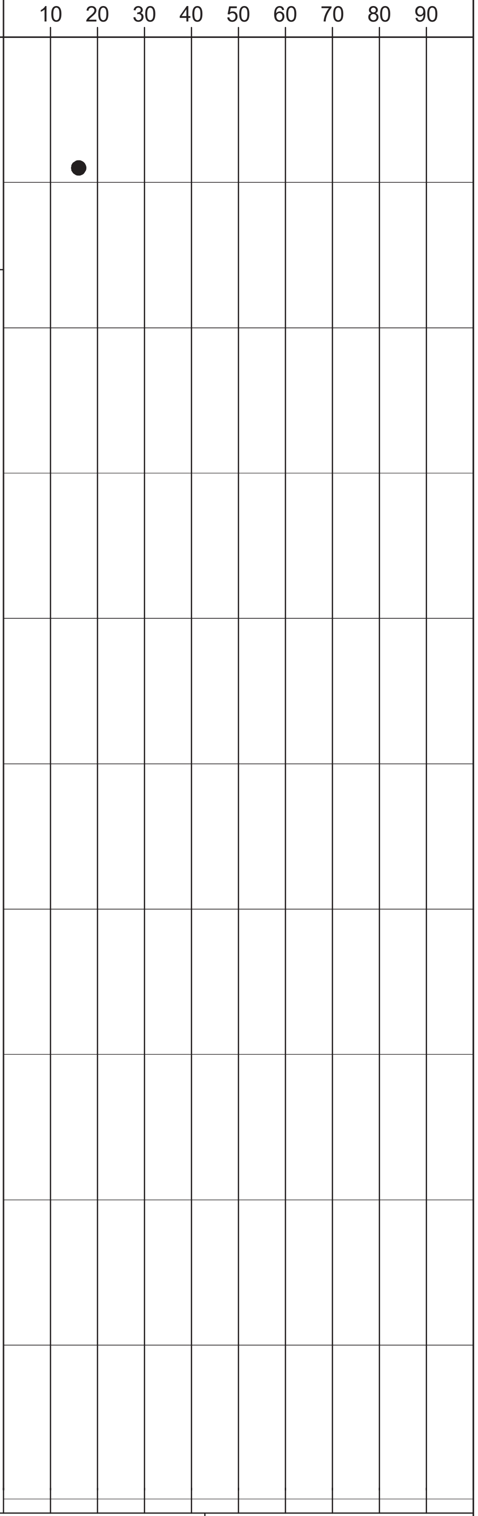
TP20-10 (F)
Pg 1 of 1
Project No: 201-05243-00

Depth (m) (ft)		Description	SOIL REUSE	C	N	Type/ Sample #/ Recovery	Water Level	10 20 30 40 50 60 70 80 90
		black, ORGANIC SILT (TOPSOIL), some sand, moist, rootlets.	▨					
		stiff, brown/grey, silty CLAY (inferred weathered till), some sand, trace gravel, low plasticity, moist to wet, occasional cobbles.	▨	▥		GB1		●
		End of test pit at 0.8 m due to scheduled depth. No sloughing and no seepage noted. Test pit backfilled with bucket packed excavated material.						

(m) 1 2 3 4
(ft) 2 4 6 8 10 12 14 16



C: Condition of Sample
Good ■
Disturbed ▥
No Recovery ☒

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

DCPT Blow/300 mm

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Plastic Limit (%) Liquid Limit (%)
▶—●—◀
Moisture Content (%)
▼ Ground Water Level
(X) Shear strength in kPa (Torvane)
PP Pocket Penetrometer (compressive strength in kPa)
X Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
⊠ Remolded strength in kPa
■ Percent Passing # 200 sieve

SOIL REUSE
DESTROY ▦
REUSE ▨

Drill Method: Backhoe
Date Drilled: 7/21/2020
Logged by: LM
Checked by: CM

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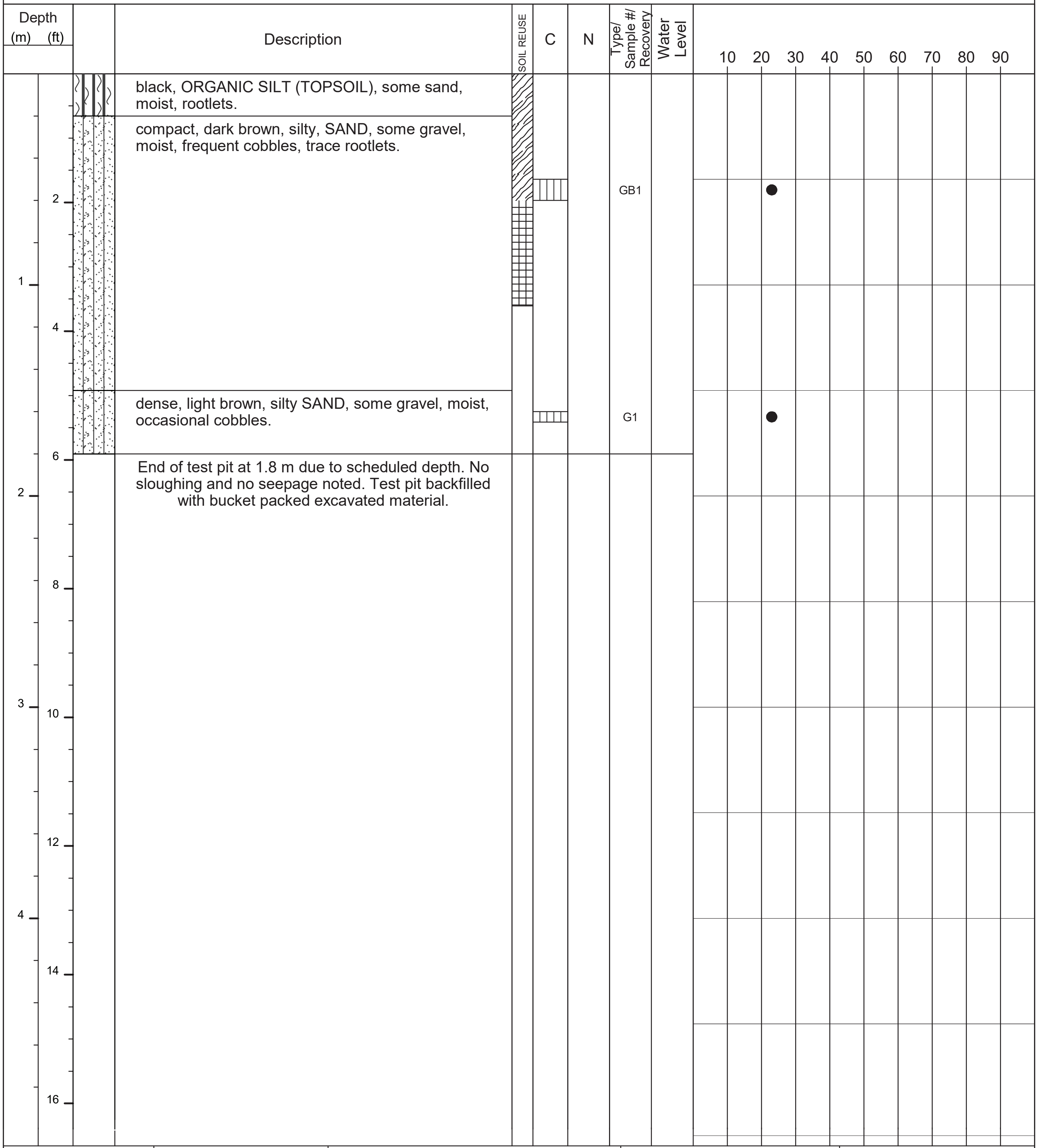
TP20-11 (G)

Pg 1 of 1
Project No: 201-05243-00

Depth (m)	Depth (ft)	Description	SOIL REUSE	C	N	Type/ Sample #/ Recovery	Water Level
		black, ORGANIC SILT (TOPSOIL), some sand, moist, rootlets.	▨				
		compact, dark brown, silty, SAND, some gravel, moist, frequent cobbles, trace rootlets.	▨ / ▦	▥		GB1	
		dense, light brown, silty SAND, some gravel, moist, occasional cobbles.		▥		G1	
		End of test pit at 1.8 m due to scheduled depth. No sloughing and no seepage noted. Test pit backfilled with bucket packed excavated material.					



C: Condition of Sample
Good ▬
Disturbed ▥
No Recovery ☒

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

DCPT Blow/300 mm

Plastic Limit (%) ▶—●—◀ Liquid Limit (%)
Moisture Content (%)
Ground Water Level
Shear strength in kPa (Torvane)
PP Pocket Penetrometer (compressive strength in kPa)
X Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
⊠ Remolded strength in kPa
■ Percent Passing # 200 sieve

SOIL REUSE
DESTROY ▦
REUSE ▨

Drill Method: Backhoe
Date Drilled: 7/21/2020
Logged by: LM
Checked by: CM

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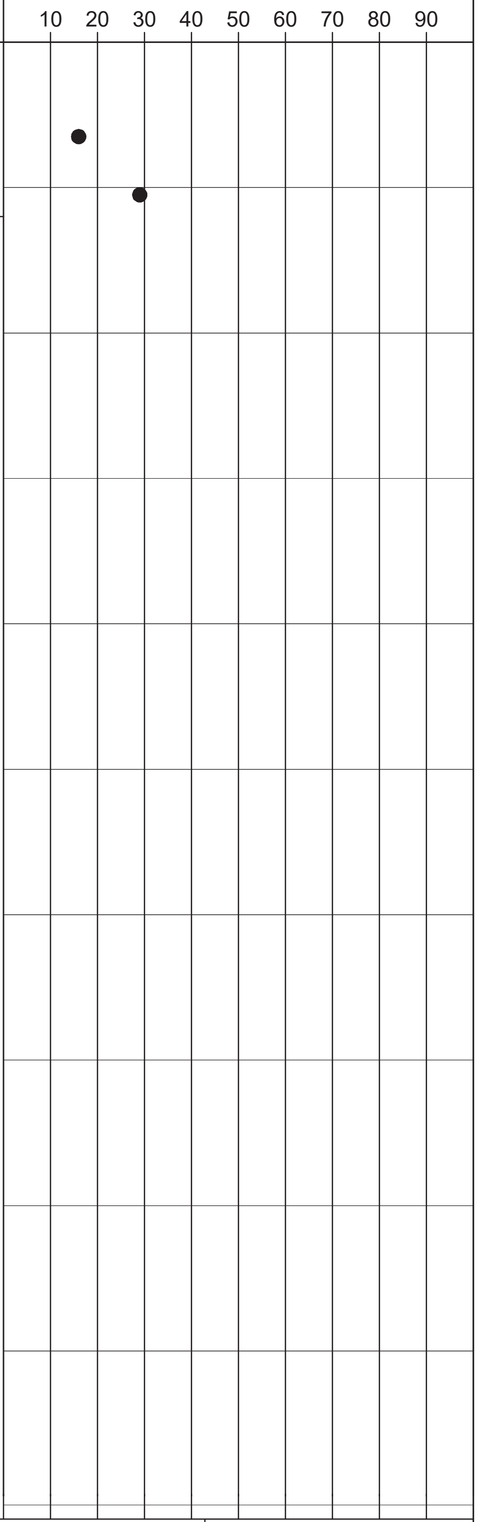
TP20-12 (H)
Pg 1 of 1
Project No: 201-05243-00

Depth (m)	Depth (ft)	Description	SOIL REUSE	C	N	Type/ Sample #/ Recovery	Water Level
		black, ORGANIC SILT (TOPSOIL), some sand, moist, rootlets.	⊞				
		compact to dense, grey, sandy GRAVEL AND ASH (FILL), trace fines, angular, maximum particle size encountered = 25 mm, moist.	⊞	▥		G1	
	2	compact, dark brown, silty SAND (FILL), some gravel, moist, occasional wood debris.	⊞	▥		G2	
		End of test pit at 0.6 m due to scheduled depth. No sloughing and no seepage noted. Test pit backfilled with bucket packed excavated material.					
1	4						
	6						
2	8						
3	10						
	12						
4	14						
	16						



C: Condition of Sample
Good ▬
Disturbed ▥
No Recovery ☒

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

DCPT Blow/300 mm

Plastic Limit (%) ▶—●—◀ Liquid Limit (%)
Moisture Content (%)
⊻ Ground Water Level
⊗ Shear strength in kPa (Torvane)
PP Pocket Penetrometer (compressive strength in kPa)
X Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
⊠ Remolded strength in kPa
■ Percent Passing # 200 sieve

SOIL REUSE
DESTROY ⊞
REUSE ▨

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Drill Method: Backhoe
Date Drilled: 7/21/2020
Logged by: LM
Checked by: CM

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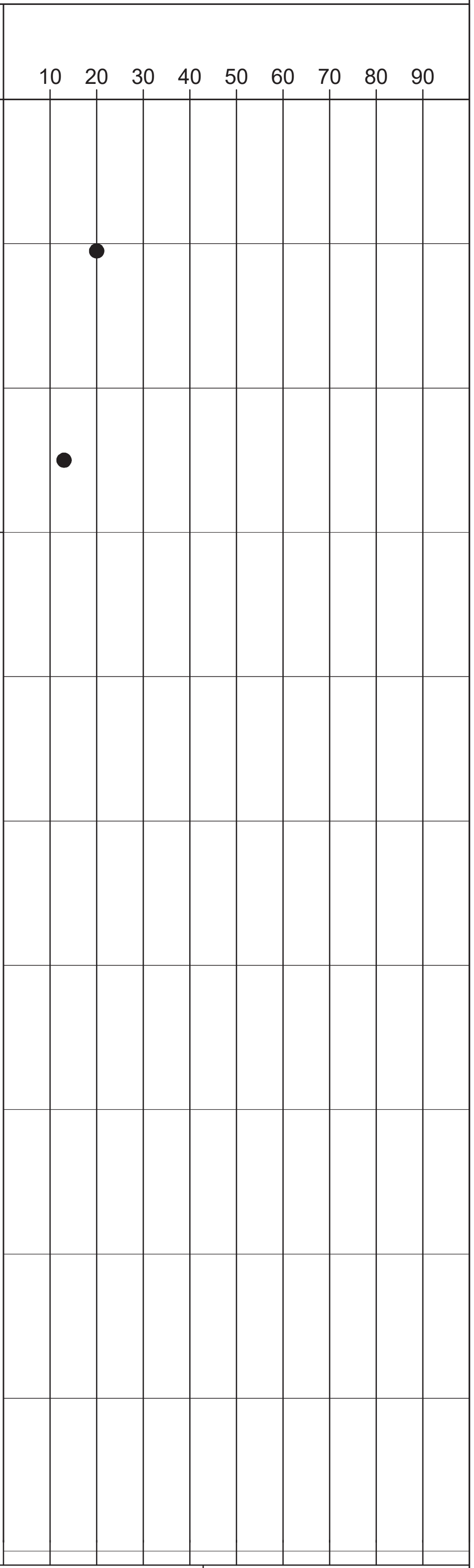
TP20-13 (I)
Pg 1 of 1
Project No: 201-05243-00

Depth (m)	Depth (ft)	Description	SOIL REUSE	C	N	Type/ Sample #/ Recovery	Water Level
		black, ORGANIC SILT (TOPSOIL), some sand, moist, rootlets.	▦				
	2	stiff, brown/grey, silty CLAY (inferred weathered till), some sand, trace gravel, low plasticity, moist to wet, occasional cobbles.	▦	▥		G1	
1	4	dense to very dense, grey, SAND, some fines, some gravel, moist.	▦ ▨	▥		GB1	
2 3 4	6 8 10 12 14 16	End of test pit at 1.5 m due to scheduled depth. No sloughing and no seepage noted. Test pit backfilled with bucket packed excavated material.					



C: Condition of Sample
Good ■
Disturbed ▥
No Recovery ☒

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

DCPT Blow/300 mm

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Plastic Limit (%) ▶—●—◀ Liquid Limit (%)
Moisture Content (%)
Ground Water Level
Shear strength in kPa (Torvane)
PP Pocket Penetrometer (compressive strength in kPa)
X Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
☒ Remolded strength in kPa
■ Percent Passing # 200 sieve

SOIL REUSE
DESTROY ▦
REUSE ▨

Drill Method: Backhoe
Date Drilled: 7/21/2020
Logged by: LM
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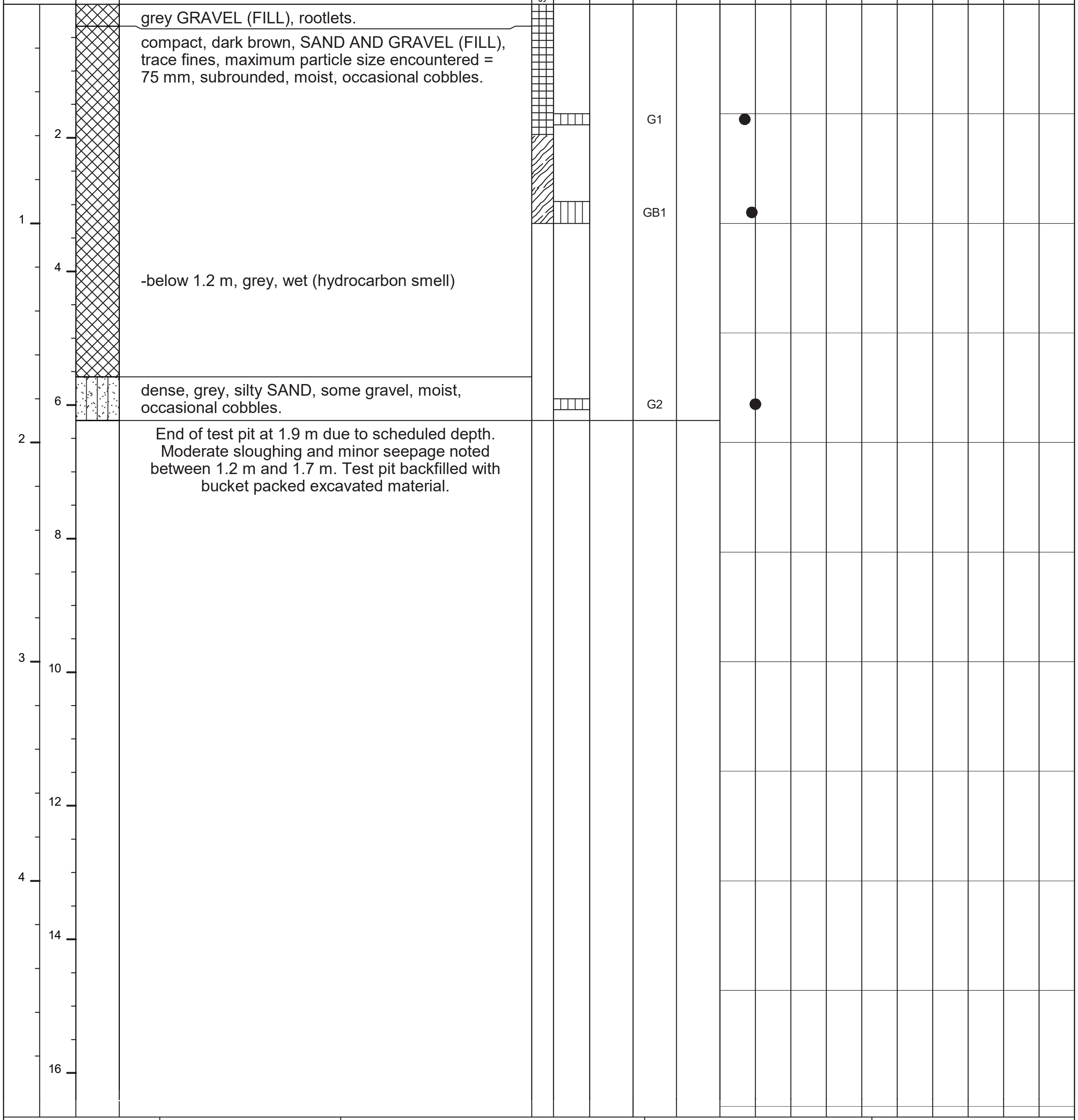
TP20-14 (J)
Pg 1 of 1
Project No: 201-05243-00

Depth (m)	Depth (ft)	Description	SOIL REUSE	C	N	Type/ Sample #/ Recovery	Water Level
		grey GRAVEL (FILL), rootlets.	▦				
		compact, dark brown, SAND AND GRAVEL (FILL), trace fines, maximum particle size encountered = 75 mm, subrounded, moist, occasional cobbles.	▦	▥		G1	
1	2 4		▨	▥		GB1	
		-below 1.2 m, grey, wet (hydrocarbon smell)					
	6	dense, grey, silty SAND, some gravel, moist, occasional cobbles.		▥		G2	
2		End of test pit at 1.9 m due to scheduled depth. Moderate sloughing and minor seepage noted between 1.2 m and 1.7 m. Test pit backfilled with bucket packed excavated material.					
3	8 10						
4	12 14 16						



C: Condition of Sample
Good ▇
Disturbed ▥
No Recovery ☒

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

DCPT Blow/300 mm

Plastic Limit (%) ▶—●—◀ Liquid Limit (%)
Moisture Content (%)
▼ Ground Water Level
∞ Shear strength in kPa (Torvane)
PP Pocket Penetrometer (compressive strength in kPa)
X Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
⊠ Remolded strength in kPa
■ Percent Passing # 200 sieve

SOIL REUSE
DESTROY ▦
REUSE ▨

Drill Method: Backhoe
Date Drilled: 7/21/2020
Logged by: LM
Checked by: CM

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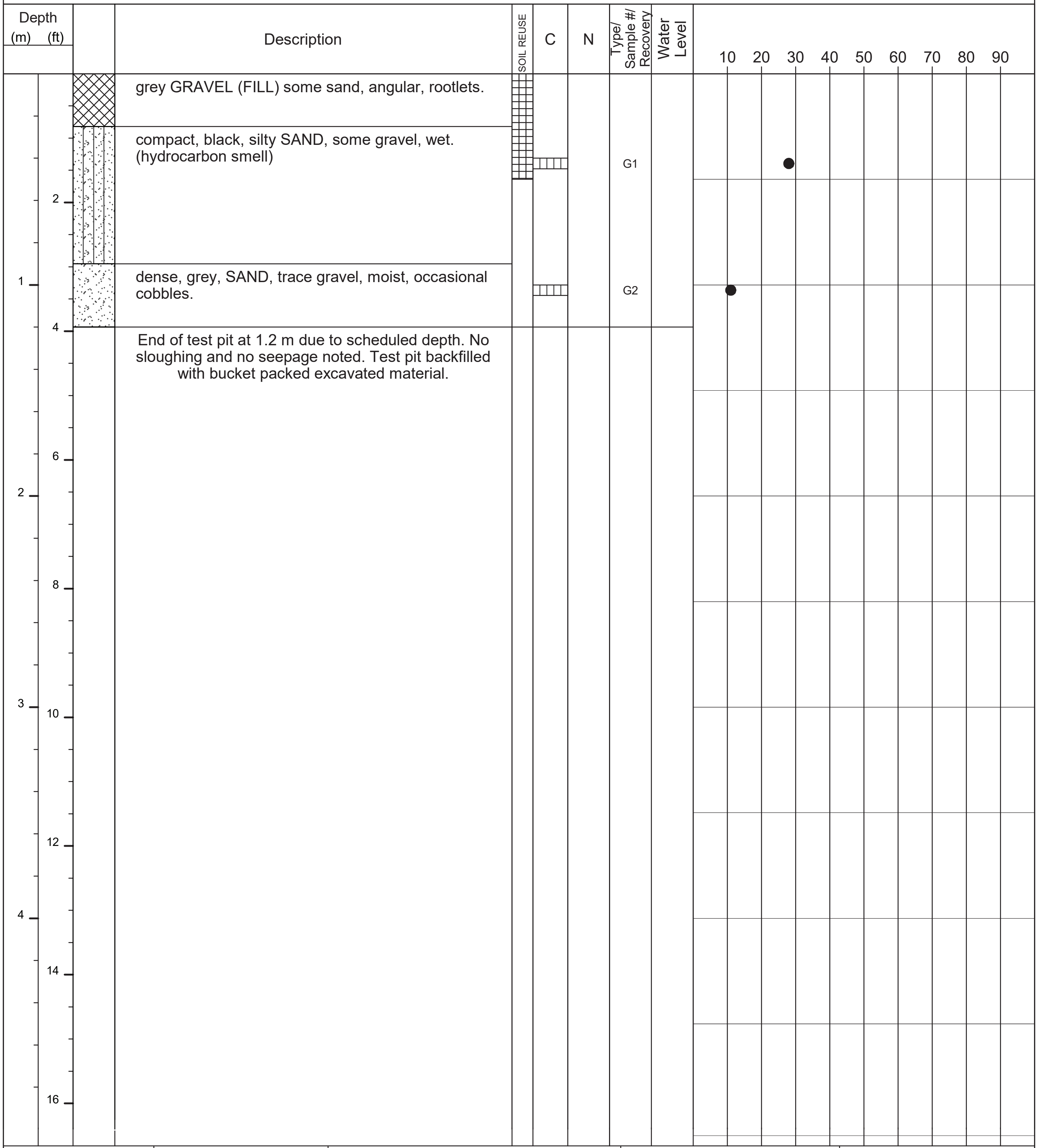
TP20-15 (K)
Pg 1 of 1
Project No: 201-05243-00



Description	SOIL REUSE	C	N	Type/ Sample #/ Recovery	Water Level
grey GRAVEL (FILL) some sand, angular, rootlets.	▦				
compact, black, silty SAND, some gravel, wet. (hydrocarbon smell)	▦	▥		G1	
dense, grey, SAND, trace gravel, moist, occasional cobbles.		▥		G2	
End of test pit at 1.2 m due to scheduled depth. No sloughing and no seepage noted. Test pit backfilled with bucket packed excavated material.					

C: Condition of Sample
Good ▬
Disturbed ▥
No Recovery ☒

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

DCPT Blow/300 mm

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Plastic Limit (%) ▶—●—◀ Liquid Limit (%)
Moisture Content (%)
▼ Ground Water Level
⊗ Shear strength in kPa (Torvane)
PP Pocket Penetrometer (compressive strength in kPa)
X Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
⊠ Remolded strength in kPa
■ Percent Passing # 200 sieve

SOIL REUSE
DESTROY ▦
REUSE ▨

Drill Method: Backhoe
Date Drilled: 7/21/2020
Logged by: LM
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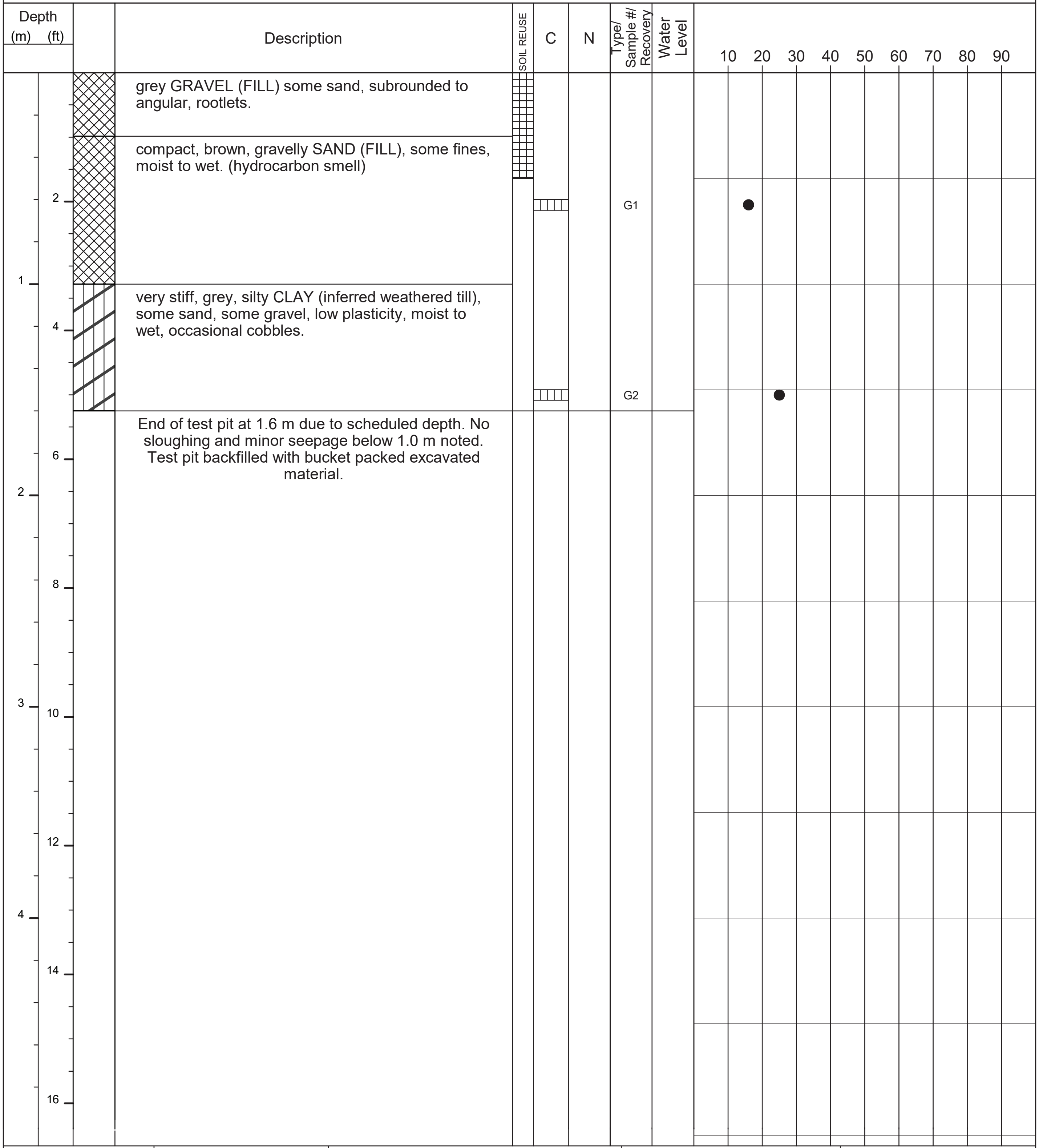
TP20-16 (L)
Pg 1 of 1
Project No: 201-05243-00

Description	SOIL REUSE	C	N	Type/ Sample #/ Recovery	Water Level
grey GRAVEL (FILL) some sand, subrounded to angular, rootlets.	▦				
compact, brown, gravelly SAND (FILL), some fines, moist to wet. (hydrocarbon smell)	▦	▥		G1	
very stiff, grey, silty CLAY (inferred weathered till), some sand, some gravel, low plasticity, moist to wet, occasional cobbles.		▥		G2	
End of test pit at 1.6 m due to scheduled depth. No sloughing and minor seepage below 1.0 m noted. Test pit backfilled with bucket packed excavated material.					



C: Condition of Sample
Good ▬
Disturbed ▥
No Recovery ☒

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

DCPT Blow/300 mm

Plastic Limit (%) Liquid Limit (%)
▶—●—◀
Moisture Content (%)
Ground Water Level
Shear strength in kPa (Torvane)
PP Pocket Penetrometer (compressive strength in kPa)
X Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
⊠ Remolded strength in kPa
■ Percent Passing # 200 sieve

SOIL REUSE
DESTROY ▦
REUSE ▨

Drill Method: Backhoe
Date Drilled: 7/21/2020
Logged by: LM
Checked by: CM

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APPENDIX

3. LABORATORY TESTING RESULTS

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PROCTOR TEST REPORT

PROJECT: CFB Comox Base

DATE ISSUED: 10 August, 2020

CLIENT: SLR Consulting

ISSUED BY: WSP-Nanaimo

JOB NO.: 201-05243-00

REPORT NO.: 1

SAMPLE NO.: 5240

Client PO.: PO

Sample Information

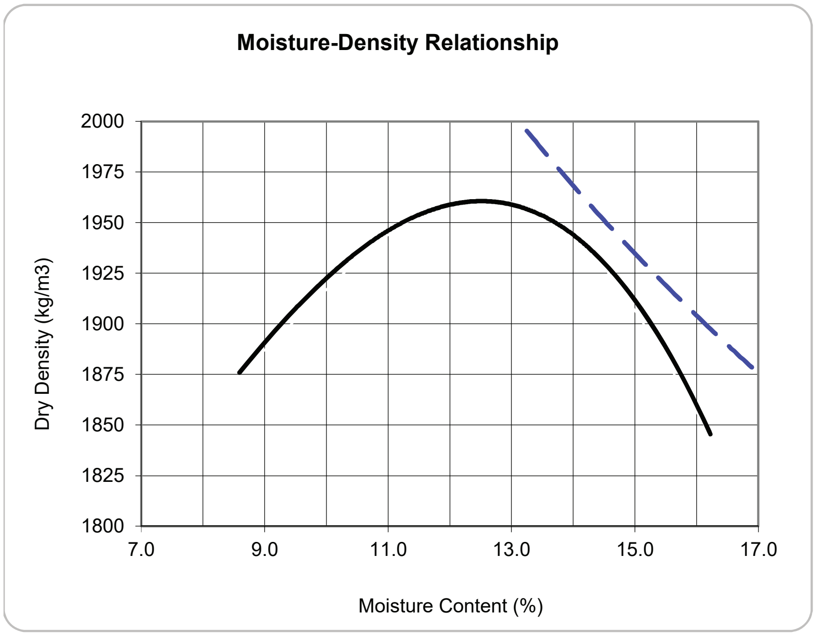
Material Classification: NA

Material Description: Silty Sand some gravel

Date sampled	21-Jul-20	Sampled by	LM	Estimated SG	2.80
Date received	4-Aug-20	Supplier	In-situ	Insitu moisture	19.1%
Sample Source	Test Pit TP20-05 (A) 0.8m	Specification	N/A	Sample Number	5240

Test Information

Trial Number	1	2	3	4	5	Test Type	Modified	
Wet Density (kg/m³)	2037	2183	2216	2145		Test Procedure	ASTM D-1557	Method B
Dry Density (kg/m³)	1876	1955	1944	1845		Date tested	10-Aug-20	
Moisture Content (%)	8.6	11.6	14.0	16.2		Tested by	OU	



Test Result Summary

Oversize correction method:	ASTM 4718
Retained 9.5mm sieve	12.2%
Oversize specific gravity:	2.80

Maximum Dry Density Values

Uncorrected Value	1871	kg/m³
Corrected Value	1950	kg/m³

Optimum Moisture Content

Uncorrected Value	12.5	%
Corrected Value	11.1	%

Distribution

Per:

WSP CANADA INC.

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PROCTOR TEST REPORT

PROJECT: CFB Comox Base

DATE ISSUED: 10 August, 2020

CLIENT: SLR Consulting

ISSUED BY: WSP-Nanaimo

JOB NO.: 201-05243-00

REPORT NO.: 2

SAMPLE NO.: 5241

Client PO.: PO

Sample Information

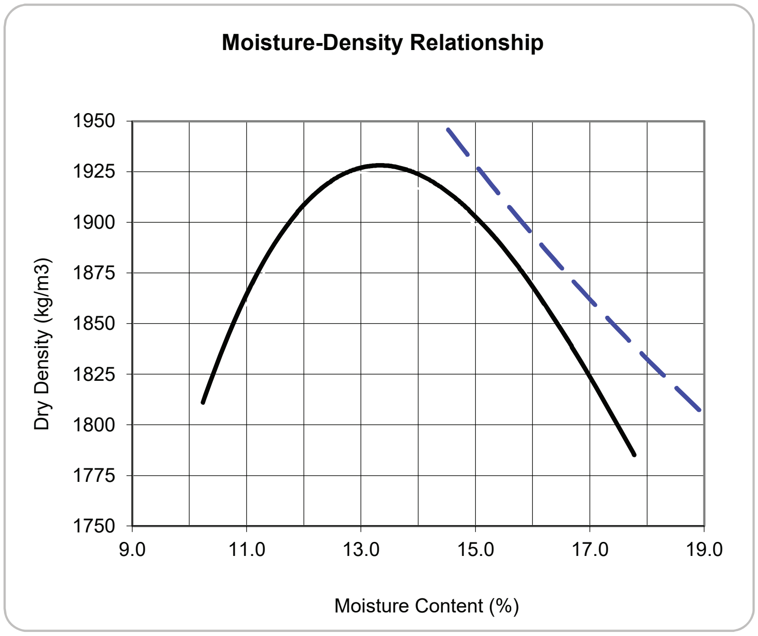
Material Classification: NA

Material Description: Silty Sand some gravel

Date sampled	21-Jul-20	Sampled by	LM	Estimated SG	2.80
Date received	4-Aug-20	Supplier	In-situ	Insitu moisture	17.2%
Sample Source	Test Pit TP20-07 C	Specification	N/A	Sample Number	5241

Test Information

Trial Number	1	2	3	4	5	Test Type	Modified	
Wet Density (kg/m³)	2046	2167	2179	2102		Test Procedure	ASTM D-1557	Method B
Dry Density (kg/m³)	1848	1923	1886	1785		Date tested	12-Aug-20	
Moisture Content (%)	10.7	12.7	15.5	17.8		Tested by	OU	



Test Result Summary

Oversize correction method:	ASTM 4718
Retained 9.5mm sieve	0.0%
Oversize specific gravity:	2.80

Maximum Dry Density Values

Uncorrected Value	1928	kg/m³
Corrected Value	N/A	kg/m³

Optimum Moisture Content

Uncorrected Value	13.3	%
Corrected Value	N/A	%

Distribution

Per: Stephen [illegible]

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PROCTOR TEST REPORT

PROJECT:	CFB Comox Base	**DATE ISSUED:**	10 August, 2020
CLIENT:	SLR Consulting	**ISSUED BY:**	WSP-Nanaimo
JOB NO.:	201-05243-00	**REPORT NO.:**	3
SAMPLE NO.:	5242	**Client PO.:**	PO

Sample Information

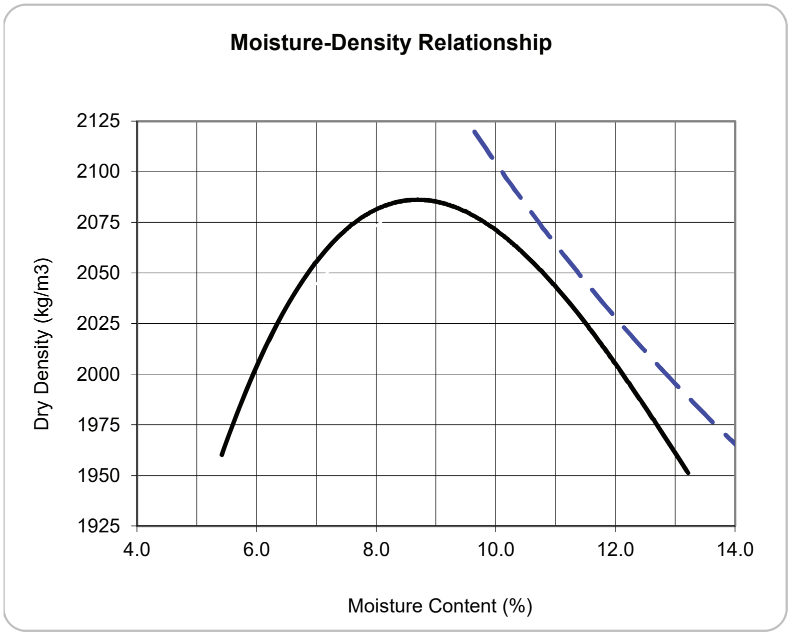
Material Classification: NA

Material Description: Sand, trace Gravel, some fines

Date sampled	21-Jul-20	Sampled by	LM	Estimated SG	2.75
Date received	4-Aug-20	Supplier	In-situ	Insitu moisture	10.9%
Sample Source	Test Pit TP20-09 E B1	Specification	N/A	Sample Number	5242

Test Information

Trial Number	1	2	3	4	5	Test Type	Modified	
Wet Density (kg/m³)	2159	2270	2267	2209		Test Procedure	ASTM D-1557	Method A
Dry Density (kg/m³)	2029	2086	2041	1951		Date tested	12-Aug-20	
Moisture Content (%)	6.4	8.8	11.1	13.2		Tested by	OU	



Test Result Summary

Oversize correction method:	ASTM 4718	
Retained 4.75mm sieve:	23.6%	
Oversize specific gravity:	2.75	
Maximum Dry Density Values		
Uncorrected Value	2086	kg/m³
Corrected Value	2212	kg/m³
Optimum Moisture Content		
Uncorrected Value	8.7	%
Corrected Value	6.8	%

Distribution

Per:

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PROCTOR TEST REPORT

PROJECT: CFB Comox Base

DATE ISSUED: 26 August, 2020

CLIENT: SLR Consulting

ISSUED BY: WSP-Nanaimo

JOB NO.: 201-05243-00

REPORT NO.: 4

SAMPLE NO.: 5243

Client PO.: PO

Sample Information

Material Classification: NA

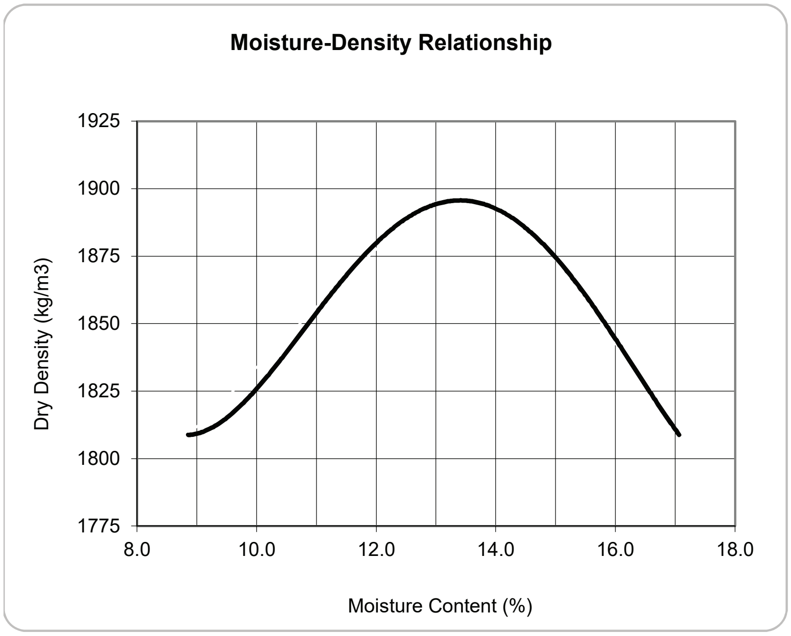
Material Description: Clayey SILT, some sand, trace gravel

Date sampled	21-Jul-20	Sampled by	LM	Estimated SG	2.65
Date received	4-Aug-20	Supplier	In-situ	Insitu moisture	24.8%
Sample Source	Test Pit TP20-09 E B2	Specification	N/A	Sample Number	5243

Test Information

Trial Number	1	2	3	4	5
Wet Density (kg/m³)	1969	2136	2159	2157	
Dry Density (kg/m³)	1809	1893	1890	1878	
Moisture Content (%)	8.9	12.8	14.2	14.9	

Test Type	Modified	
Test Procedure	ASTM D-1557	Method A
Date tested	12-Aug-20	
Tested by	OU	



Test Result Summary

Oversize correction method:	ASTM 4718
Retained 4.75mm sieve:	5.0%
Oversize specific gravity:	2.65

Maximum Dry Density Values

Uncorrected Value	1907	kg/m³
Corrected Value	1935	kg/m³

Optimum Moisture Content

Uncorrected Value	12.1	%
Corrected Value	11.5	%

Distribution

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PROCTOR TEST REPORT

PROJECT: CFB Comox Base

DATE ISSUED: 13 August, 2020

CLIENT: SLR Consulting

ISSUED BY: WSP-Nanaimo

JOB NO.: 201-05243-00

REPORT NO.: 5

SAMPLE NO.: 5244

Client PO.: PO

Sample Information

Material Classification: NA

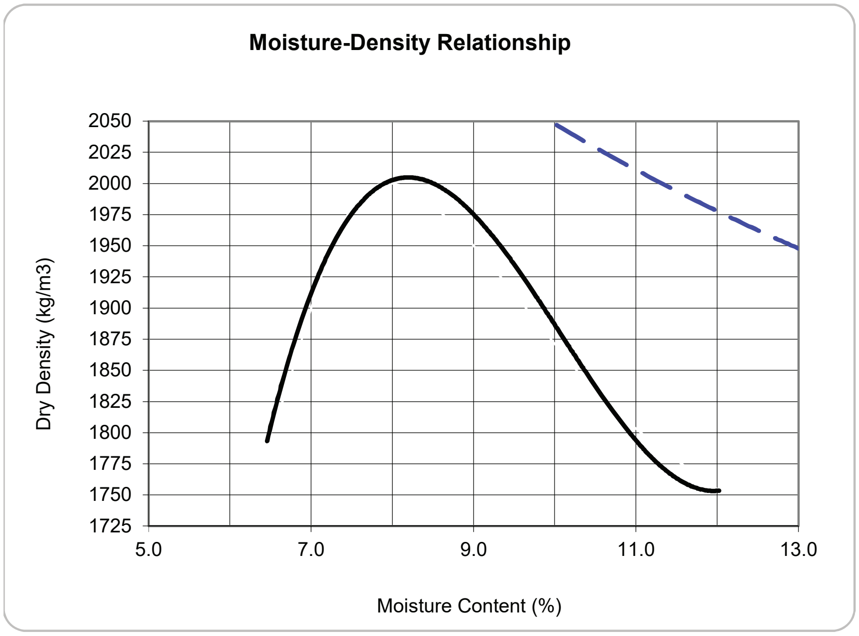
Material Description: Silty Sand, some Gravel

Date sampled	21-Jul-20	Sampled by	LM	Estimated SG	2.65
Date received	4-Aug-20	Supplier	In-situ	Insitu moisture	16.0%
Sample Source	Test Pit TP20-10 (F) B1 0.4m	Specification	N/A	Sample Number	5244

Test Information

Trial Number	1	2	3	4	5
Wet Density (kg/m³)	1909	2158	2017	1964	
Dry Density (kg/m³)	1793	2000	1823	1753	
Moisture Content (%)	6.5	7.9	10.6	12.0	

Test Type	Modified		
Test Procedure	ASTM D-1557	Method	A
Date tested	13-Aug-20		
Tested by	OU		



Test Result Summary

Oversize correction method:	ASTM 4718
Retained 4.75mm sieve:	12.0%
Oversize specific gravity:	2.65

Maximum Dry Density Values

Uncorrected Value	2004	kg/m³
Corrected Value	2065	kg/m³

Optimum Moisture Content

Uncorrected Value	8.2	%
Corrected Value	7.3	%

Distribution

Per:

WSP CANADA INC.

This report constitutes a testing service only. No engineering interpretation opinion is expressed or implied. Engineering review and interpretation can be provided on written request.

WSP Canada Inc.
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PROCTOR TEST REPORT

PROJECT: CFB Comox Base

DATE ISSUED: 14 August, 2020

CLIENT: SLR Consulting

ISSUED BY: WSP-Nanaimo

JOB NO.: 201-05243-00

REPORT NO.: 6

SAMPLE NO.: 5245

Client PO.: PO

Sample Information

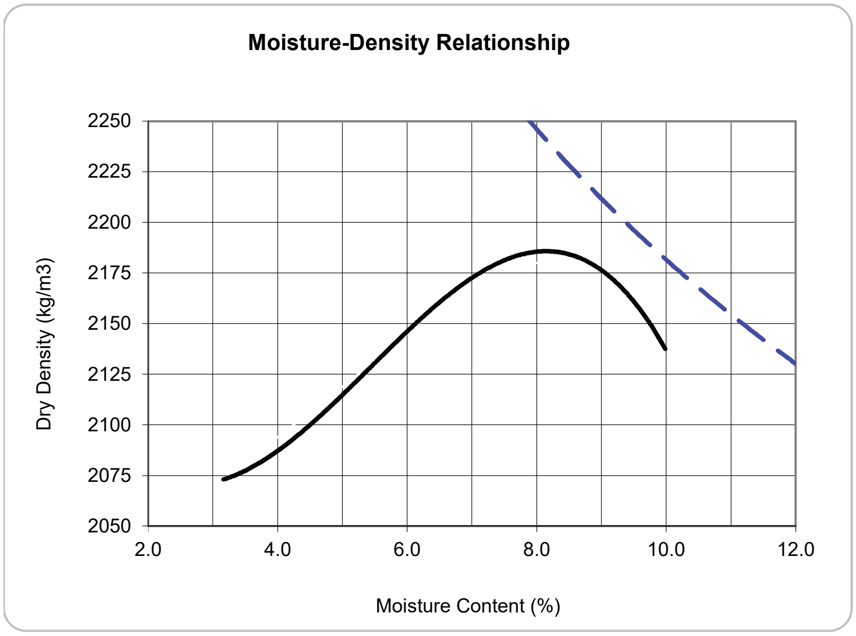
Material Classification: Fill

Material Description: Sand and Gravel, Some fines

Date sampled	21-Jul-20	Sampled by	LM	Estimated SG	2.80
Date received	4-Aug-20	Supplier	In-situ	Insitu moisture	8.8%
Sample Source	Test Pit TP20-14 (J) B1 &B2	Specification	N/A	Sample Number	5245

Test Information

Trial Number	1	2	3	4	5	Test Type	Modified		
Wet Density (kg/m³)	2139	2256	2334	2372		Test Procedure	ASTM D-1557	Method	C
Dry Density (kg/m³)	2073	2135	2177	2177		Date tested	13-Aug-20		
Moisture Content (%)	3.2	5.7	7.2	9.0		Tested by	OU		



Test Result Summary

Oversize correction method:	ASTM 4718	
Retained 19.0mm sieve:	6.8%	
Oversize specific gravity:	2.80	

Maximum Dry Density Values

Uncorrected Value	2186	kg/m³
Corrected Value	2219	kg/m³

Optimum Moisture Content

Uncorrected Value	8.2	%
Corrected Value	7.6	%

Distribution

Per:

WSP CANADA INC.

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WSP Canada Inc.
1935 Bollinger Road
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Fax.: 250-753-1203

AGGREGATE GRADATION ANALYSIS

IDENTIFICATION:

Client: SLR Consulting
Project: CFB Comox
Sample Location: Grab Sample
TP20-14 (J) B1 & B2

File No.: 201-05243-00
Report No.: 1
Date: 14-Aug-20

SAMPLING INFORMATION:

Material: WG Sand and Gravel, trace fines
Specification: N/A

Date Sampled 21-Jul-20
Date Tested 14-Aug-20
Sample No: 5245
Fracture by mass N/A
Supplier: in-situ
Sampled by: LM
Tested by: OU

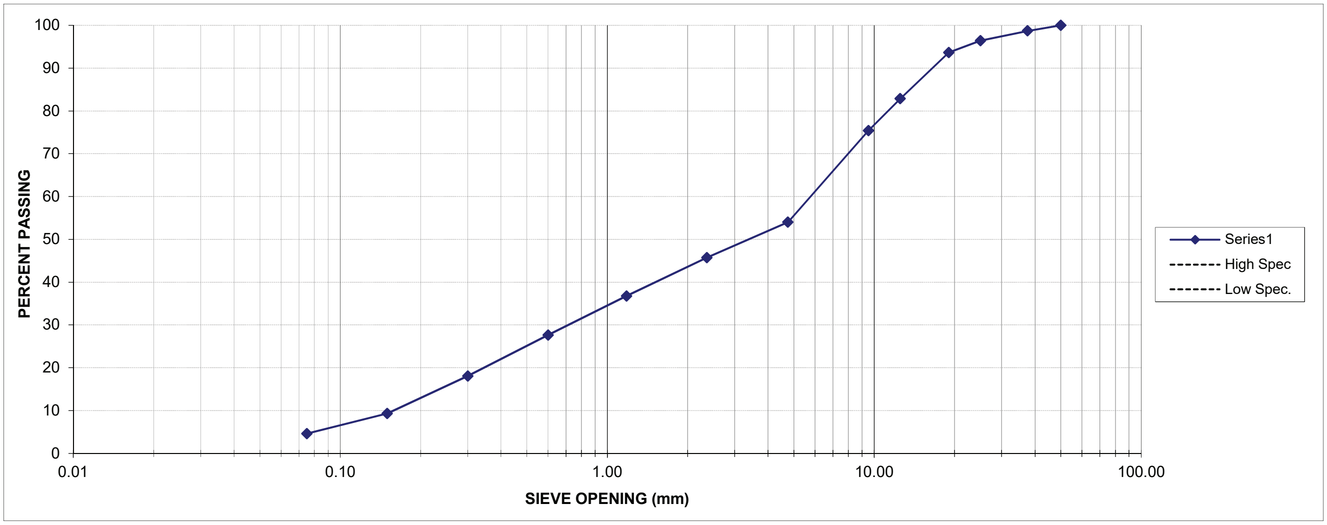
Material Specification

Sieve	High Spec.	Low Spec.

Sieve Analysis

Sieve	% Passing
150	100.0
100	100.0
75	100.0
50	100.0
37.5	98.7
25	96.4
19	93.6
12.5	82.9
9.5	75.4
4.75	54.0
2.36	45.7
1.18	36.8
0.600	27.6
0.300	18.1
0.150	9.3
0.075	4.6

AGGREGATE GRADATION:



REMARKS: Tested in accordance with ASTM C- 136 and C-117

REPORTS TO:

WSP CANADA INC.

per:

This report represents a testing service only. No engineering interpretation opinion is expressed or implied. Engineering review and interpretation can be provided on written request.

APPENDIX

4. STANDARD LIMITATIONS

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The conclusions presented in this report are based on work performed by trained, professional and technical staff, in accordance with their reasonable interpretation of current and accepted engineering and scientific practices at the time the work was performed.

The content and opinions contained in the present report are based on the observations and/or information available to WSP at the time of preparation, using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by WSP and other engineering/scientific practitioners working under similar conditions, and subject to the same time, financial and physical constraints applicable to this project.

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Standard Limitations

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HYDROGEOLOGICAL ASSESSMENT
ARCADIS, 2020

CFB Comox FFTA Source Control Project
PSPC
CFB Comox, Lazo, BC
Requisition No.: R.111173.004

MEMORANDUM

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To:
Dave Osguthorpe, B.Sc., EP
Senior Environmental Specialist
Public Works and Government Services Canada
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CC:
Vijay Kallur, P.Eng.
Project Director / Senior Reviewer

From:
Ryan Black Ph.Dc, B.Sc., EIT
Environmental Engineer

Kim Tan Ph.D., P.Eng.
Senior Hydrogeologist

Date:
March 20, 2020

Arcadis Project No.:
30000397

Subject:
CFB Comox FFTA Hydrogeological Assessment

---

1 INTRODUCTION

Arcadis Canada Inc. (Arcadis) was retained by Public Services and Procurement Canada (PSPC) on behalf of the Department of National Defence (DND) to perform remediation planning for per- and polyfluoroalkyl substances (PFAS) contamination in the Fire Fighter Training Area (FFTA) at Canadian Forces Base (CFB) Comox, Lazo, B.C. (referred hereafter as “the Site”). As part of this planning, a hydrogeologic assessment was carried out to estimate the dewatering rates during the proposed remedial excavations at the FFTA. Theoretical calculations were carried out based on historical data collected by others. Field testing was performed on October 11, 2019 to verify the theoretical calculations and consisted of the following tasks:

- Preparing a health and safety plan, engaging subcontractors, and coordinating site access.
- Gauging water levels in the newly installed pump test well (PW19-01) and available closest surrounding monitoring wells for response (A Site Plan is provided on attached Figure 1).
- Performing a pumping test at PW19-01.
- To optimize the field visit a rising head test was also carried out at PW19-01.

2 METHODOLOGY AND RESULTS

2.1 Preliminary Dewatering Calculations

Hydraulic conductivity estimates ranging from approximately 3×10^{-8} m/sec to 3×10^{-6} m/sec (geometric mean of 5×10^{-7} m/sec) had been derived previously from single-well response tests performed within the shallow glaciomarine and/or marine silt deposits near the FFTA (SLR, 2017; SLR, 2018; SNC-Lavalin, 2019). Based on historical water levels observed during the winter (i.e., October to May), 4 m of drawdown was conservatively assumed for dewatering the proposed excavation. Using the Theim solution for steady-state radial flow within an unconfined aquifer, an initial rate of 32.5 L/min (46,800 L/day) was estimated to be necessary for dewatering the proposed excavation.

Table 1: Summary of Parameters and Results

Parameter	Value	Comments
Hydraulic Conductivity	5×10^{-7} m/sec	Geometric mean of previous single-well response tests
Drawdown in Excavation	4.0 m	Based on water levels observed, relative to constant head boundary
Constant Head Boundary	14.0 m	Relative to the inferred elevation of the base of aquifer
Area of Excavation	500 m^2	Approximate; based on geometry
Equivalent Radius	12.0 m	Radius of equal area for a 500 m^2 excavation
Radius of Influence	22.0 m	Sichardt formula added from the edge of excavation
Safety Factor	2	Account for uncertainties (e.g., contributions from rainfall)
Dewatering Rate	32.5 L/min	Initial estimate during the wet season (46,800 L/day)

2.2 Pumping Test

A constant rate pumping test was performed at a well PW19-01, which had been installed previously by Arcadis on September 8, 2019. The lithology in the vicinity of the PW19-01 is comprised of predominantly dense silt with traces of fine sand and gravel. The pump test well consists of a 30.5 cm-diameter well casing installed to approximately 3.2 m below ground surface (mbgs) within a test pit, measuring approximately 3.2 m deep, 0.8 m wide, and 3.1 m long, that was filled with clear drain rock to approximately 1.2 mbgs, and completed with the excavated soil backfilled to surface. The pump test was carried out using a 22.9 cm-submersible pump with 5.1 cm-tubing and discharged through a gate valve and flow meter into a 3,785 L holding tank. Water levels were recorded at the pumping well, PW19-01, and two existing monitoring wells, MW19-58 and FFTA-1, which are located approximately 2.5 m to the south and 34.3 m to the north of PW19-01, respectively. MW19-58 and FFTA-1 were selected as response wells as they were the closest existing monitoring wells to PW19-01.

Different pumping rates were evaluated for the test. However, considering that the recharge rates were fairly low, a pumping rate of approximately 7.23 L/min was utilized for the test. This was the lowest rate the pump could sustain. However, the well was dry after approximately 111 minutes, producing roughly 800 L of water. No change in water level was observed in either of the response monitoring wells.

Table 2: Gauging Data

Well ID	Bottom of Well (mbtoc)	Depth to Water (mbtoc)	Distance to PW19-01 (m)
PW19-01 (Pumping Well)	3.58	1.02	0
MW19-58 (Response Well)	16.4	2.21	2.5
FFTA-1 (Response Well)	4.21	0.91	34.3

mbtoc = m below top of casing

2.3 Rising Head and Falling Head Tests

After the pumping test was completed, and optimize the field visit, a rising head test was performed at PW19-01 over a 2-hour period, during which the water level increased by a total of 16.6 cm. Using the Bouwer-Rice (1976) method, the hydraulic conductivity near PW19-01 was estimated to be 2.2×10^{-8} m/sec. A falling head test was also performed at FFTA-1 over a 1.5-hour period with a 5.1 cm-diameter by 61 cm-long solid slug, during which the water level decreased by a total of 3 cm. Using the Bouwer-Rice (1976) method, the hydraulic conductivity near FFTA-1 was estimated to be 5.8×10^{-8} m/sec.

3 SUMMARY AND CONCLUSIONS

During the pumping test, an extraction rate of 7.23 L/min completely dewatered a 30.5 cm-diameter well (PW19-01) installed to 3.2 mbgs within an excavated test pit, and no change in water level was observed at the nearby response wells. This suggests that the native soil has a relatively low hydraulic conductivity. Estimated hydraulic conductivities of 2.2×10^{-8} m/sec and 5.8×10^{-8} m/sec were derived from a rising head test at PW19-01 and FFTA-1, respectively. These are typical of a silt or glacial till formation, and are also on the lower end of the 3×10^{-8} m/sec to 3×10^{-6} m/sec range that has been estimated previously within the FFTA (SLR, 2017; SLR, 2018; SNC-Lavalin, 2019).

Based on the above, a dewatering rate of 10 L/min to 15 L/min can be utilized for planning purposes. This assumes that the overall excavation will be conducted in sections of 20 m or less.

4 REFERNECES

Bouwer, H. and R.C. Rice, 1976. A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells. Water Resources Research, 12(3), 423-428.

SLR Consulting Ltd., 2017. 2016-17 Detailed Testing Program, Firefighting Training Area, CFB Comox, Lazo, BC. Client Reference No. CX42802. March 30.

SLR Consulting Ltd., 2018. 2017-18 Detailed Testing Program, Firefighting Training Area, CFB Comox, Lazo, BC. July 30.

SNC-Lavalin, 2019. Supplementary Detailed Site Investigation, Fire Fighting Training Area, CFB Comox, Lazo, BC. Project No. R.097421.002. October 24.

5 ATTACHMENTS

1. Figure 1 – Pump Test Location
2. Pump Test Pit Log – PW19-01

Legend

✕	Pump Test Well (305mm diam.)
◉	Flow Gauge
⊕	Monitoring Well
⊕	Monitoring Well (Others)
▼	Piezometer
▼	Piezometer (In Stream)
▲	Surface Water/ Sediment Sample
- - -	Site Boundary
—	Study Area

RESPONSE WELLS:

FFTA-1(RW2)
MW19-58(RW1)

Title:
PUMP TEST LOCATION

Project:
FIREFIGHTING TRAINING AREA (FFTA)

Client:
PUBLIC SERVICES AND PROCUREMENT CANADA

ARCADIS

Date: **MARCH 2020**
Updated: **MARCH 2020**
FIGURE 1

Layout: (Author:)

{xx\cbird} G:\PROJECTS\30000397 - 102867 CFB Comox Remedial Options Analysis\GIS\Locations_.mxd

TEST PIT LOG PW19-01

PROJECT NUMBER 30000397
PROJECT NAME CFB Comox FFTA
CLIENT PSPC
ADDRESS 19 Wing Comox
PO Box 1000 Station Main, Lazo, BC

TEST PIT DATE 2019-09-09
TEST PIT DEPTH 3.2 m
TEST PIT WIDTH 0.8 m
TEST PIT LENGTH 3.1 m
CONTRACTOR Edgett Excavating

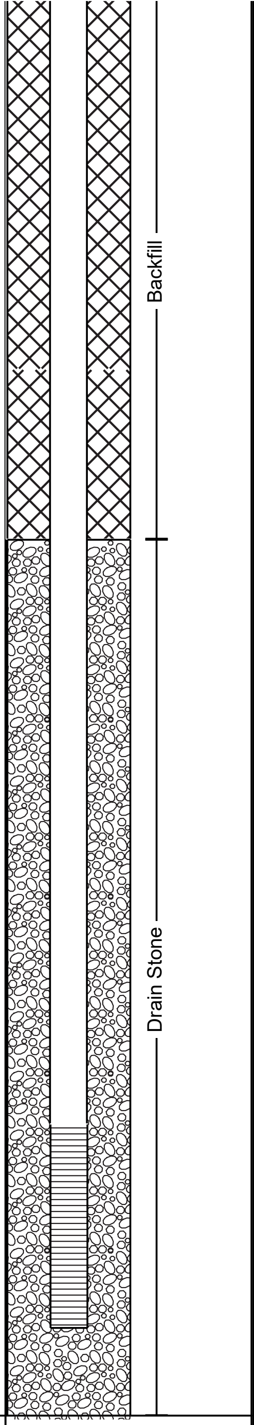
NORTHING 5509559 (est.)
EASTING 362412 (est.)
SURFACE ELEVATION 18.7 m (est.)
WELL TOC 0.38 m above ground (est.)
CASING / SCREEN 0.3048 m dia. PVC

COMMENTS Coordinates and elevations are estimated

LOGGED BY RB

Depth (m)	Soil Description	Samples	Samples	Elevation (m)
	TOPSOIL, grass, rootlets, organics, fine sand			
0.2	Fine SAND, trace gravel, some rootlets, dry, medium brown Fine SAND, trace gravel, trace silt, dry, light brown, dense	PW-19-01-01 TP19-02-01 TP19-04-01 TP19-05-02 TP19-02-02 TP19-04-02 TP19-03-02	TP19-05-01 TP19-01-01 TP19-03-01 TP19-01-02 PW-19-01-02	18.6 18.4
0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 2.6 2.8 3 3.2	SILT, trace fine sand, trace gravel, dry, red brown, v. dense SILT, trace gravel, dry, grey, v. dense			18.2 18 17.8 17.6 17.4 17.2 17 16.8 16.6 16.4 16.2 16 15.8 15.6
	Termination Depth at:3.2 m			15.4

Well Diagram



Disclaimer This bore log is intended for environmental not geotechnical purposes.

PFAS SOIL STABILIZATION TREATABILITY STUDY REPORT
ARCADIS, 2020

CFB Comox FFTA Source Control Project
PSPC
CFB Comox, Lazo, BC
Requisition No.: R.111173.004

Public Services and Procurement Canada

On Behalf of Department of National Defence

PFAS SOIL STABILIZATION TREATABILITY STUDY REPORT

PFAS Contamination
Fire Fighting Training Area
CFB Comox, Lazo, BC

27 October 2020

PFAS SOIL STABILIZATION TREATABILITY STUDY REPORT

Prepared for:
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Environmental Specialist, Environmental Services
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On behalf of Department of National Defence

Prepared by:
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Our Ref.:
30050594

Date:
27 October 2020

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Vijay Kallur, P.Eng. (BC)
Project Director / Senor Reviewer

John Vogan

John Vogan, M.Sc.
Vice President / Technical Expert

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DEFINITIONS

Fixant:	Additive (e.g. Fluorosorb, Rembind);
Homogenate:	Mechanically mixed soils (homogenized);
Unamended Baseline:	Homogenized samples obtained from the FFTA to establish a contaminant concentration baseline;
Composite:	Multiple samples combined;
Pre-TOP:	PFAS concentrations before (pre-) TOP (Total Oxidizable Precursor)-Assay;
Post-TOP:	PFAS concentrations after (post-) TOP (Total Oxidizable Precursor)-Assay;
Supernatant:	Usually clear liquid obtained after settling, precipitation, or centrifugation of sample;
Oxidation:	Loss of electrons through chemical or physical processes – Opposite reaction = Reduction.

1 INTRODUCTION

Arcadis Canada Inc. (Arcadis) was retained by Public Services and Procurement Canada (PSPC) on behalf of the Department of National Defence (DND) to carry out remediation planning for per- and polyfluoroalkyl substances (PFAS) contamination in the Fire Fighter Training Area (FFTA) at Canadian Forces Base (CFB) Comox, Lazo, BC (referred hereafter as “the Site”). As part of this planning, soil stabilization was identified as a potential remedial option for treating PFAS-impacted soils (Arcadis, 2020).

PFAS are emerging contaminants and therefore relatively little field data is available on the efficacy of this approach (or other approaches). Consequently, a bench scale test was conducted to evaluate currently available commercial products as binding agents for stabilization of PFAS in soil. The bench scale test was carried out in two phases at the Arcadis Laboratory located in Durham, North Carolina, USA, after developing a work plan on July 2, 2019. The first phase of testing was carried out in 2019, using samples collected from the Site. An interim report with the results of the first phase testing was provided to PSPC on 22nd May 2020. The second phase of testing was carried out between April 2020 and August 2020. This report presents the results of both the first phase and second phase of the testing. The data is presented in Figures 1 through 9, Tables 1 through 6, and Appendix A through Appendix E.

2 SCOPE OF WORK

Soil stabilization involves mechanically mixing the soil with binders and other additives to reduce the leachability of Constituents of Concern (CoC) during precipitation and infiltration. This study focuses on reducing leachability of PFAS in soil. Solidification admixtures (e.g., Portland cement, lime) can also be added to improve soil properties. However, testing with the addition of solidification admixtures was not part of the scope of this study.

The scope of work for this treatability study specifically included the following:

Phase I

- Collecting PFAS-impacted soil samples from within the FFTA at the CFB Comox;
- Shipping the samples to the Arcadis Laboratory in Durham, North Carolina under a permit;
- Characterizing baseline PFAS concentrations and soil geotechnical properties;
- Performing batch stabilization tests at various fixant dosages; and,
- Characterizing PFAS concentrations post-treatment.

Phase II

- Assessing potential long term sorptive capacity using United States Environmental Protection Agency (US EPA) Leaching Environmental Assessment Framework (LEAF)[1] Method 1314 using specific fixant dosages.

---

[1] https://www.epa.gov/sites/production/files/2017-10/documents/method_1314_-_final_8-3-17.pdf.

3 MATERIALS AND METHODS

Two commercially available products (collectively referred to as “fixants” in this document) marketed and sold as having sorptive affinity for PFAS were utilized for the treatability study:

- RemBind Plus (Ziltek) – is a proprietary blend of aluminum hydroxide (AlOH) and granular activated carbon (GAC), manufactured by Ziltek in Australia (referred to as “RemBind” in this document).
- Fluorosorb 200 (CETCO) – is a modified organoclay manufactured by CETCO in Aberdeen, Mississippi (referred to as “Fluorosorb” in this document).

Samples of the above fixants for use in the laboratory study were provided to Arcadis directly by the respective vendors. Dosage rates of both products were selected based on the observed performance of such products during previous trials conducted by the Arcadis Laboratory, as well as discussions with the respective product vendors and in consultation with PSPC.

It should be noted that, although specific percentages of the above products have been used in this treatability study, the objectives of this study do not include evaluation and comparison of the quality and performance of the two products.

A simplified Top-Assay laboratory procedure is provided in Figure A below. In summary, the soil taken from the original soil sample, shown as ‘A’ in Figure A below is divided into two portions, one for pre-TOP assay analysis (A1), and one for post-TOP analysis (A2).

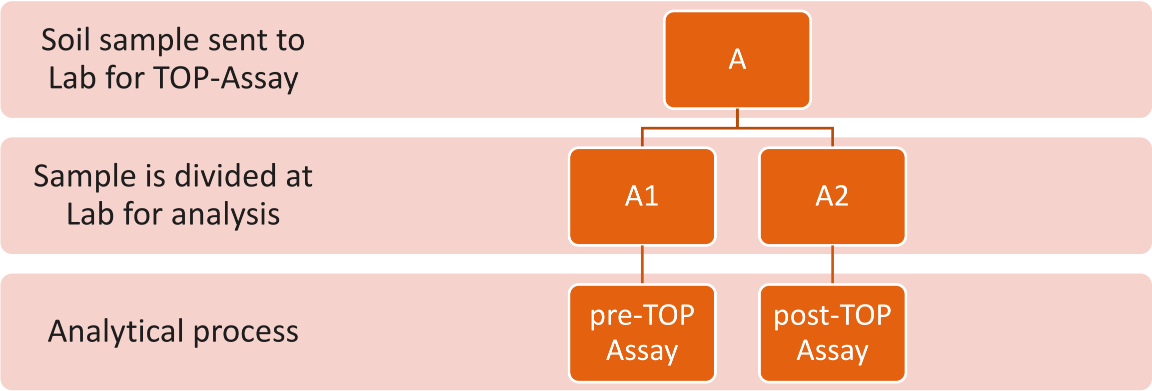

Figure A: Simplified TOP-Assay Lab Procedure

3.1 Phase I - Baseline Sample Processing and Characterization

Based on the results of investigations previously completed by SNC Lavalin Inc. (SNC Lavalin), five specific locations with the highest concentrations of PFAS impacts were identified in the FFTA area for collection of samples for the stabilization testing (workplan dated July 2, 2019). Soil collected on September 9, 2019 from each of the five test pit locations (Figure 9), was utilized in this bench scale treatability study. These samples were obtained from different depths at each location as follows:

- TP19-01: 19-23 and 32-37 cm BGS
- TP19-02: 11-15 and 25-29 cm BGS
- TP19-03: 20-25 and 33-40 cm BGS
- TP19-04: 17-21 and 29-34 cm BGS
- TP19-05: 10-15 and 20-25 cm BGS

Four 19 litre (5-gallon) high-density polyethylene (HDPE) buckets from each location (20 total buckets) were filled on site and shipped via air from CFB Comox to the Arcadis Laboratory under a permit (P330-19-00246) from the United States Department of Agriculture. Upon receipt, soil was stored under ambient laboratory temperature (approximately 23°C). Five homogenous samples (one per location) were created by compositing the four buckets in a 208-litre (55-gallon) drum, using one drum per location. An electric drill with steel mixing auger attachment was then used for mixing for approximately ten minutes or until visual homogeneity was achieved. Mechanical components that came in contact with soils were thoroughly cleaned. Following homogenization, a subsample of each soil location (totalling five samples; see Table A below) was collected and sent to SGS Laboratories in Orlando, FL (SGS) for total PFAS screening by USEPA Method 537 (Modified).

Table A: Baseline Homogenized Samples sent to SGS for Total PFAS Screening

Baseline FTA Soil samples from Testpits				
TP19-01	**TP19-02**	**TP19-02**	**TP19-04**	**TP19-04**

Following receipt of results from SGS (Appendix A), the Arcadis project team determined that equal parts from each of the five sample locations would be used to create a single composite soil sample, representative of PFAS concentrations at the Site, with which to conduct the remainder of the treatability study. Proportions added from each location were adjusted according to reported percent solids content in each of the samples. The calculations were as follows:

TP19-01 = 84.4%; TP19-02 = 94.1%; TP19-03 = 85.6%; TP19-04 = 89.3%; TP19-05 = 88.8%

Using the formula $\sum_{n=1}^{5}[x_n/(0.844)]$ = Final Composite

n = Sample Number

x = Total mass of homogenized soil per sampling location (g or kg)

Samples from each of the five homogenized baseline samples were composited in a 208 litre plastic drum using the electric drill and steel mixing auger to produce the final soil composite. The mixing was conducted for at least 10 minutes or until visual homogeneity was achieved. Duplicate moisture samples of the final soil composite were collected for in-house moisture content gravimetrically by oven drying.

The approach (mixing rate and time) used to subsequently mix the samples of this overall composite with the fixants in the batch test vessels was intended to optimize contact between the fixant, soil, and water phases. The batch tests were designed to provide an idealized scenario so that fixant doses could be compared directly against one another. For the second phase of treatability testing to assess long-term sorptive capacity using USEPA LEAF Method 1314, a steel mixing auger was used, which was considered more representative of a field-scale mixing strategy.

3.1.1 Soil Geotechnical Characterization

The extent of PFAS stabilization in soil is dependant on its composition and geotechnical properties, which in turn are site specific. Hence, a baseline geotechnical characterization was carried out on the soil samples used for the treatability study from the Site. A four-litre (one-gallon) HDPE plastic bucket was filled with a subsample of the final composite soil to support baseline geotechnical characterization by Geotechnics, Inc. in Raleigh, North Carolina, USA. The testing included the following analyses (please see report included in Appendix B):

- Grain size analysis (with hydrometer) by ASTM D422
- Atterberg limits by ASTM D4318
- Loss on ignition (ash and organic content) by ASTM D2974
- Classification by ASTM D2487
- Water content by ASTM D2216

3.1.2 PFAS Baseline Concentration

Triplicate baseline samples (see Table B below) of the final soil composite (of all locations and a subset of the sample used for testing geotechnical properties) were collected and shipped to Bureau Veritas Laboratories of Mississauga ON (BV Labs) for analysis of TOP assay (pre- and post-oxidation).

Table B: Unamended Triplicate Soil Samples taken from Homogenized Soil

Soil Homogenates Created from FTA Baseline Soil Samples		
Soil-Homogenate-1	**Soil-Homogenate-2**	**Soil-Homogenate-3**

The TOP assay followed the methodology of thermolysis of persulfate under basic conditions (Houtz and Sedlak 2012). The remaining soil composite was placed back into dedicated 19-litre buckets for storage until further use. Results of this baseline characterization are discussed in Section 4.1. and can be found in the attached Table 2.

3.2 Phase I - Fixant Dose Evaluation and Optimization Batch Testing

A batch test was conducted to compare performance of the candidate fixant formulations. During batch testing, multiple dosages of the fixants can be efficiently tested to differentiate the sorption capacity of various amendments and dosages, indicating the most cost-effective dosage. Reaction vessel contents (presented in the attached Table 3, and also summarized in the Table C below) were created using composite soil, deionized water, and the identified fixant type and mass. One hundred grams of soil was weighed into each of twenty 250 mL plastic centrifuge tubes. Fixant doses (based on soil dry mass w/w addition rate) were then placed into respective test vessels, followed by addition of 200 mL of deionized water. Test vessels were thoroughly shaken by hand to mix all contents and then placed on a roller table for 120 hours to provide continuous gentle mixing. After the 120-hour reaction interval, the test vessels were centrifuged to separate soil/fixant mass from the aqueous phase.

Table C: Soil Sample Fractions related to Fixant Dose Evaluation taken from Homogenized Soil

Soil Sample Fractions created from Homogenates for Reagant Batch Testing				
No Fixant	***RemBind***		**Fluorosorb**	
CONTROL-1	0.5%	BATCH-1	0.5%	BATCH-7
CONTROL-2	1%	BATCH-2	-	
	1%	BATCH-2 (Lab-Dup)	1%	BATCH-8
	2%	BATCH-3	2%	BATCH-9
	3%	BATCH-4	3%	BATCH-10
	4%	BATCH-5	4%	BATCH-11
	5%	BATCH-6	5%	BATCH-12

Following initial centrifugation, several samples (predominantly the unamended controls (i.e., soil and water only in a test vessel, without any fixant) and low fixant addition rate vessels were observed to have a tan/brown hue. The supernatant of each sample was transferred into a series of four 50 mL centrifuge tubes and centrifuged a second time at a higher rate to remove additional suspended solids. Some samples were still found to have coloration after the second centrifuge run. The Arcadis Laboratory contacted BV Labs to determine the potential for this coloration to influence the oxidative digesting process performed during TOP assay. BV Labs did not think any significant interference would occur, and the Arcadis Laboratory proceeded with sampling. The supernatant of each sample was consequently poured into 500 mL HDPE bottles and sent to BV Labs for PFAS analysis by TOP assay (post-oxidation concentrations only).

3.3 Phase II - LEAF Method 1314 - PFAS Leachate Evaluation

US EPA LEAF is a collection of leaching tests and leaching assessment approach developed to identify characteristic leaching behaviors of a wide variety of solid materials that was created during 20 years of research by a multinational team of scientists[2]. USEPA LEAF Method 1314 was selected since it has been judged to be the best available method for the leaching assessment of the fixant dosages.

During Method 1314 leaching, clean deionized water passes over the solid phase being tested in an upflow manner within a column environment. Samples are collected at the top of the column. The upflow movement of water is intended to minimize air entrainment and channels. Method 1314 is designed to provide data on liquid-solid (L/S) partitioning of non-volatile organic constituents in a granular solid material (i.e. soil) as a function of liquid-to-solid ratio under percolation conditions. L/S ratio is defined as the fraction

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[2] www.vanderbilt.edu/leaching/leaf/

of total liquid volume to the dry mass equivalent of the solid material expressed in volume units of liquid per dry mass of solid material.

3.3.1 Test Setup

Based on the results of the fixant dosage evaluation and optimization batch testing (see Section 4.2 below) the previously homogenized PFAS-impacted soils were used and the following three soil mixes were created using polyethylene 10 L buckets (2.5 US gallons):

1. One bucket with unamended soils as an untreated control (Homogenate Mix-1),
2. One bucket with a Fluorosorb dosage of 1.0% of the soil (Homogenate Mix-2), and
3. One bucket with a Fluorosorb dosage of 2.0% of the soil (Homogenate Mix-3).

After mixing, the stabilized soil in the three 10 L buckets were shipped to Eurofins TestAmerica (TestAmerica) in Pittsburgh, USA, for a leach test in accordance with Method 1314. TestAmerica generated five aqueous samples (data points) per mix as follows:

1. The first fraction exiting the column (T01)
2. Equivalent volume of fractions 2 through 4 (T02-T04) composited into one sample
3. Collection of the fifth fraction exiting the column (T05)
4. Equivalent volume of fractions 6 through 8 (T06-T08) composited into one sample, and
5. Collection of a ninth fraction exiting the column (T09).

Fifteen (15) leachate samples (Table D below) were shipped to Bureau Vistas Laboratory (BV) in Mississauga, ON, for PFAS analysis. BV processed the samples for Post-Total Oxidizable Precursor (TOP) PFAS analysis. Methodology and justification for performance of the TOP assay was based on research carried out by Houtz and Sedlak (2012).

Table D: LEAF Method 1314 Leachate Sample Summary – Sampling Key

Water Leachate Samples generated from Method 1314 Mixes		
Extracted Leachate Fraction	*Analyzed Fractions*	*No. of Lab Samples*
T01	T01	1 per Mix = 3 Total
T02	Combined to T02-T04	1 per Mix = 3 Total
T03		
T04		
T05	T05	1 per Mix = 3 Total
T06	Combined as T06-T08	1 per Mix = 3 Total
T07		
T08		
T09	T09	1 per Mix = 3 Total

4 RESULTS

4.1 Baseline Sample Characterization

The results of PFAS screening by USEPA Method 537 (Modified) on subsamples of each of the five soil boring locations are presented in the attached Table 1. Laboratory reports are included in Appendix A.

The predominant PFAS molecule detected in all five borings was perfluorooctanesulfonic acid (PFOS) with an average concentration of 3,629 µg/kg which is in line with the expected concentrations based on previous soil boring results at nearby locations. Lesser concentrations of perfluorohexanoic acid (PFHxA), perfluoroheptanoic acid (PFHpA), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), perfluorobutanesulfonic acid (PFBS), and perfluorohexanesulfonic acid (PFHxS) were also detected. In general, soil from location TP19-01 was the least impacted with PFAS constituents and soil from TP19-05 was the most impacted with PFAS constituents of the five samples. A composite soil sample was created by mixing equal parts (by soil wet mass) of each of the five locations.

TOP-Assay analysis was performed on triplicate subsamples of this final soil composite and the results are presented in the attached Table 2. The laboratory reports are included in Appendix A. Pre-oxidation TOP assay results of the final soil composite from Method 537M screening (2933 µg/kg for PFOS) generally agreed with the average concentrations observed across the five testpit locations. An increase in concentrations of select compounds such as PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFHxS, and 6:2 FTS was observed between the pre- and post-oxidation results suggesting the presence of precursor compound mass which was transformed to these species during the TOP assay oxidation reaction. Decreases in concentrations of PFOS and PFOSA were observed following the oxidation reaction. Because these compounds are not expected to be transformed or destroyed during the oxidative process, the decreased concentrations in the post-oxidation samples are considered to be an anomaly. This anomaly may be related to the variability in the CoC distribution in the soil matrix relative to the size of the individual sample.

Existing precursors preferably transform into shorter compounds, C8 and carboxylates (e.g. PFOA) rather than sulfonates (e.g. PFOS), which explains PFOS concentrations not increasing in the post TOP-Assay results.

Baseline geotechnical characterization results of the composite soil are presented in the Geotechnics report in Appendix B. The composite soil was classified as a sandy loam (USCS symbol ML), with an ash content of 94.0% and organic matter content of 6.0%. The coloration observed in several supernatants during the batch testing (as described in Section 3.2) might be due to the organic component of the composite soil.

4.2 Fixant Dose Evaluation and Optimization Batch Testing

The results of the fixant dose evaluation and optimization batch testing are presented in the attached Table 3 and Figures 2 to 6. Laboratory reports are included in Appendix C. Arcadis submitted two control samples to confirm homogeneity of the soils and laboratory analytical quality. Analytical parameters of both control samples exhibit <40% relative percent difference (RPD). An average value was calculated from both control samples and used for future comparison. A QC analysis for Batch-2 was initiated by the laboratory (Lab-Dup) to satisfy their internal quality procedures. Analytical parameters of both control samples exhibit <40% relative percent difference (RPD). An average value was again calculated from both control samples and used for future comparison.

Attached Figure 7 in combination with the attached Table 5 visualizes the percent reduction versus control for the ten PFAS compounds detected in the post-oxidation TOP assay of the batch supernatant.

The two commercial products used in this bench scale study demonstrated slightly varied results. At the 0.5% fixant addition rate, Fluorosorb had an average percent reduction in total PFAS release of 94.4% compared with a 54.4% reduction associated with RemBind at the same addition rate. At the 5% fixant addition rate, the highest tested in this study, Fluorosorb demonstrated total PFAS reduction of 98.0% compared with a 94.9% reduction for Rembind. The rate of total PFAS released appeared to level off at dosages greater than 1% of Fluorosorb at 96.6% reduction with marginal increases above 3% of Fluorosorb (this is comparable and slightly better than another soil stabilization treatability bench scale test carried out by Arcadis for another site in Canada which indicated total PFAS released levelling off at dosages rates greater than 2% of Fluorosorb). The release of PFOS in this study was limited by greater than 99% in all dosage rates investigated including at 0.5% (the lowest dose tested) for Fluorosorb , while 4% of the Rembind (by soil dry mass) was needed to limit PFOS release by 98%.

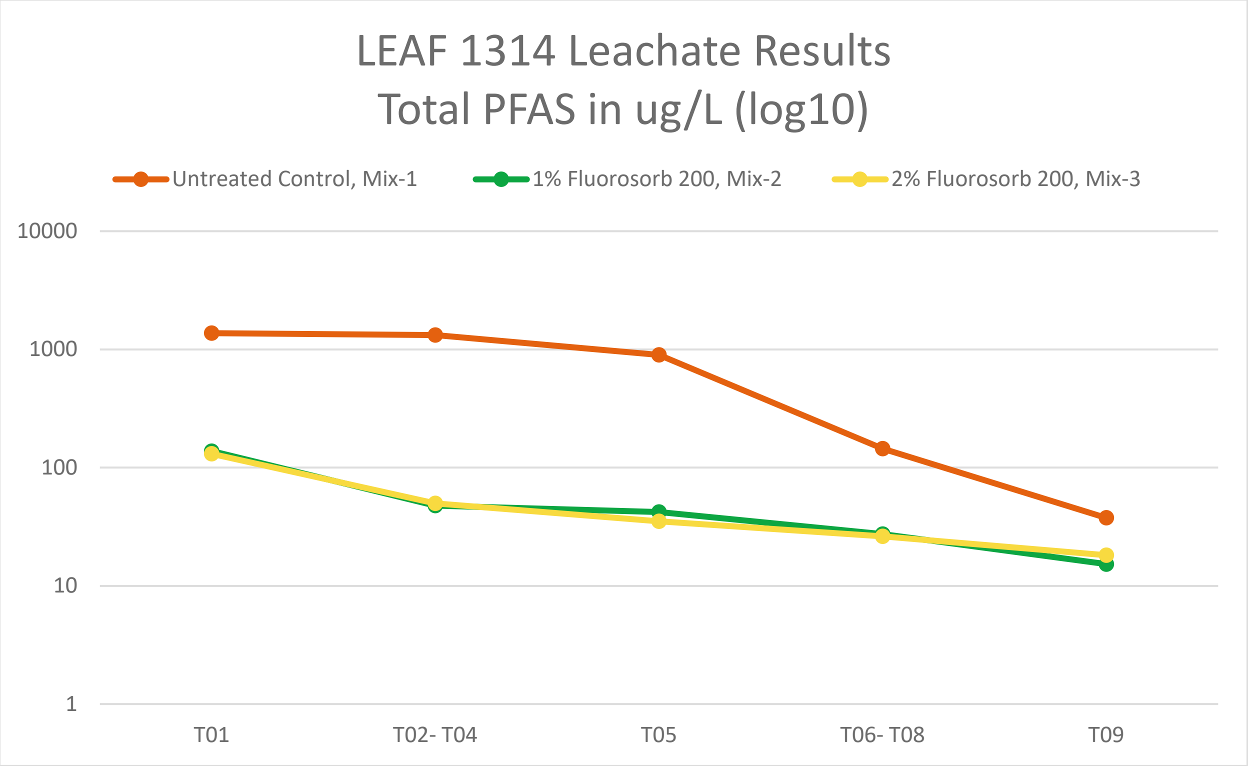
Based on the above results, 1% and 2% of Fluorosorb fixant were carried forward to LEAF Method 1314 leachate testing.

4.3 LEAF Method 1314 Leachate Test Results

LEAF Method 1314 TOP-Assay results can be found in consolidated form in the attached Table 4 and were extracted from the Laboratory reports included in Appendix D.

As calculated in detail below, cumulative total PFAS mass in the amended column effluents was only about 10% of the mass measured from the control column effluent. The TOP-Assay analytical results indicate that leaching of PFAS in the Fluorosorb amended soils decreases as the leaching interval progresses for all tested scenarios. Mix-3 (2%) and Mix-2 (1%) perform within a narrow band for each interval. A steady decline of PFAS leachate concentrations was also observed in the untreated control soils, which likely indicates that PFAS constituents are being washed out of the soil matrix. The graph below (Figure B) visualizes the leachate reduction potential for each amendment mix compared to the untreated control. Attached Figures 8.1 to 8.5 visualize the concentration development in leachate for selected PFAS constituents which generally follow a similar pattern.

Figure B: LEAF 1314 Leachate Results for Total PFAS



In comparison to the mass measured in the Control Mix-1 at a given time , Mix-2 (1%) reduced total PFAS leachate concentrations around 89.5% (T01) to 59.3% (T09), whereas Mix-3 (2%) leachate reductions were observed to be 90.5% (T01) and 51.6% at the end of the test (T09).

For individual PFAS constituents the data suggests that the fixant effectively reduces PFAS leachate concentrations across all constituents. Reductions of at least 76% (PFHxA) up to 99% (PFHxS) were achieved shortly after amendment (T01) and subsequently decreased for all compounds. Sulfonate leaching reduction (98%-99%) was achieved to a better degree than for carboxylates which ranged from 76% - 91 %. Based on comparison of initial TOP assay and cumulative mass leached which was calculated by summing up the total PFAS mass leached throughout the study for each of the three columns as follows:

$$\sum_{n=1}^{9}[x_{T0n} * (y_{T0n})]$$

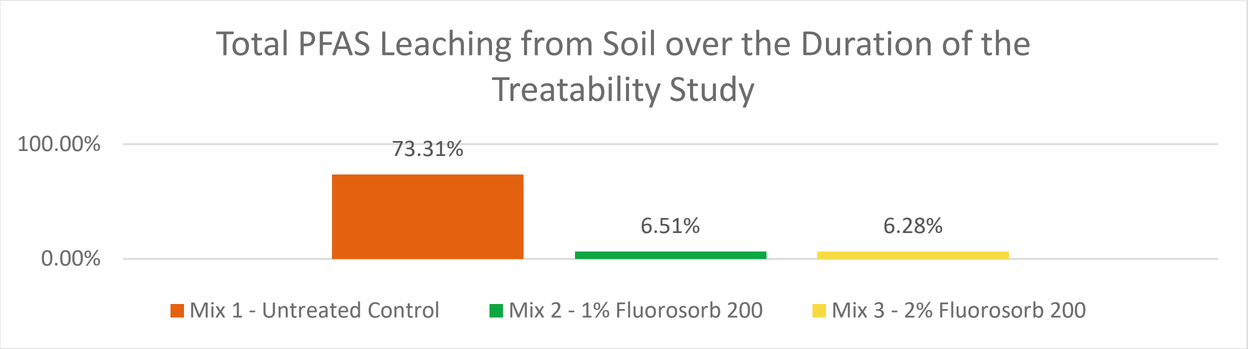
For

x = Liters leached

y = Total PFAS mass in leachate

73.31% of total PFAS contained within the soil matrix at start of the LEAF 1314 test leached from the untreated soil column by the end of the test. Both, 1% Fluorosorb and 2% Fluorosorb showed comparable performance with only 6.51% and 6.28% of the initial soil PFAS mass leached from the column over the entire testing period, respectively (see below Figure C and attached Table 6 with PFAS Leachate data extracted from Bureau Veritas report and Leach 1314 data from Eurofins report in Appendix D).

Figure C: Total PFAS Leaching from Soil over the Duration of the LEAF 1314 Test



A comparison of the relative performance of 2% Fluorosorb to 1% Fluorosorb can be found in the following Table E and was calculated as [1-(Concentration2%Fluorosorb/Concentration1%Fluorosorb)] for the individual time steps. White cells indicate that less PFAS was observed (i.e. released) in the leachate sample from the 2% mix relative to the 1% mix. Red cells (negative %) indicate better performance of 1% soil mix than the 2% mix in that particular sample. For PFOS at timestep T09 for example, the soil amended with 2% Fluorosorb exhibited more than double the PFOS concentration in leachate than what was observed for leachate from the 1% amended soils.

Table E: Comparison of Performance of 2% Fluorosorb vs. 1% Fluorosorb; (red cells (negative %) indicate better performance of 1% soil mix and white cells indicate better performance of 2% Fluorosorb over 1% Fluorosorb)

PFAS	T01	T02- T04	T05	T06- T08	T09
PFBA	4.5%	-10.3%	19.1%	3.3%	-18.8%
PFBS	-8.3%	ND	ND	ND	ND
PFPeA	3.1%	-22.2%	20.5%	3.7%	-6.1%
PFHxA	5.3%	15.0%	13.3%	12.9%	-8.0%
PFHxS	23.5%	21.4%	13.1%	17.6%	N.D
PFHpA	0.0%	-60.0%	3.5%	-6.9%	-14.3%
PFHpS	25.0%	26.8%	-9.1%	ND	ND
PFOA	2.0%	-15.6%	5.6%	5.3%	ND
PFOS	19.0%	-10.6%	41.9%	0.0%	-115.7%
PFNA	22.4%	13.0%	7.7%	ND	ND

ND. Concentrations were below laboratory detection limits thus no % difference was calculated.

The soil mix containing 2% Fluorosorb outperformed the 1% for most parameters during T01, T05, and T06-T08. Fluorosorb 1% mix however delivered higher PFAS leachate reduction performance for all PFAS constituents where concentrations were above detection limits at the end of the LEAF 1314 test, especially for PFOS at 1.1 ug/L for 2% and 0.51 ug/L for 1% fixant mix.

5 SUMMARY AND CONCLUSIONS

Two commercially available fixants were tested for potential reduction in PFAS leachability from the soil collected at FFTA of CFB Comox. These products were: Fluorosorb 200 (CETCO) and RemBind Plus (Ziltek).

The treatability study was carried out in two phases. Based on the results obtained during initial fixant dose evaluation and optimization testing, one of the fixants (Fluorosorb) was selected for additional testing in the second phase.

The second phase compared the performance of the selected fixant (Fluorosorb) in two different ratios (1% vs. 2%) using USEPA LEAF Method 1314 (USEPA, 2013). Both, 1% Fluorosorb and 2% Fluorosorb showed comparable performance with only 6.51% and 6.28% of the initial soil PFAS mass leached from the column over the testing period, respectively. 73.31% of total PFAS contained within the soil matrix at start of the LEAF 1314 test leached from the untreated soil column by the end of the test. Overall, less than 1% difference in the total PFAS leached between 1% and 2% of Fluorosorb can be considered not significant and is likely to be attributed to general statistical laboratory uncertainties. Additionally, it was observed that Fluorosorb generally reduced sulfonate PFAS leaching to a better degree than carboxylates PFAS leaching.

There are currently no long-term (multiple year) field-scale data sets examining PFAS adsorption/stabilization for either of the two fixants used in this study. Although leachate collected from the LEAF column may not be representative of groundwater concentrations egressing a full-scale fixant mixed zone at the Site, it seems reasonable to assume that an order of magnitude decline in mass flux out of the source zone could be achieved, based on these data.

In addition, 2% Fluorosorb mix did not significantly outperform the 1% Fixant mix while doubling the necessary fixant volume and therefore associated costs. It is reasonable to assume that using at least 1% Fluorosorb could translate into a decrease of PFAS leaching in the order of one magnitude. However, some contingency will have to be taken into account for the fixant volume when translating results from bench scale tests in controlled conditions of the laboratory to field applications where large scale mixing of fixant into the soil may not achieve total homogeneity.

As additional data becomes available, an increased understanding and certainty is expected to be developed on the efficacy of soil stabilization as a remedial solution for PFAS. Currently, and based on the experience that Arcadis gathered, it is important to note the following:

- That the batch test structure primarily serves as a mechanism by which to compare fixant dosage rates, rather than to predict actual groundwater concentrations following full-scale remediation. The soil-to-water ratio utilized in the batch testing may not be representative of full-scale site conditions and therefore directly translating PFAS concentrations observed in the supernatant of the batch vials to those expected in site groundwater following remedial implementation should be avoided.

- Weather and temperature effects on the long-term stabilization of PFAS are yet to be understood. There are currently no freeze thaw bench scale results available for review. However, we are aware of insitu stabilization applications in regions such as northern New York state.
- While use of cement as an admixture alone has not been found to be effective in stabilizing PFAS, another study performed by Arcadis has recently shown that adding 5% Portland cement did not compromise the PFAS leachate reduction capability of Fluorosorb. The use of such admixtures could be further evaluated through additional site-specific studies.
- Geotechnical properties of soil at each site vary and hence the effectiveness of stabilization of PFAS will be site-specific.
- The quality of commercial products in the market continues to improve. Hence any application of a specific commercial product should be evaluated through bench scale or pilot tests prior to use at a site and not rely on past studies.

6 STATEMENT OF LIMITATIONS

This report has been prepared by Arcadis Canada Inc. (Arcadis) for Canada, who has been party to the development of the scope of work for this project and understands its limitations. Copyright of this report vests with Her Majesty the Queen in Right of Canada. This report was prepared in accordance with a services contract between Arcadis and Canada, including General Conditions 2035 of the Standard Acquisition Clauses and Conditions (SACC) Manual.

This report is intended to provide information to Canada to assist it in making business decisions.

Arcadis is not a party to the various considerations underlying the business decisions and does not make recommendations regarding such business decisions.

The findings, conclusions and recommendations in this report have been developed in a manner consistent with the level of skill normally exercised by environmental professionals currently practising under similar conditions in the area. The findings contained in this report are based, in part, upon information provided by others. If any of the information is inaccurate, modifications to the findings, conclusions and recommendations may be necessary.

The findings, conclusions and recommendations presented by Arcadis in this report reflect Arcadis's best judgement based on the site conditions at the time of the site inspection on the date(s) set out in this report and on information available at the time of preparation of this report. They have been prepared for specific application to this site and are based, in part, upon visual observation of the site and specific analysis of hazardous building material samples as described in this report. Substances other than those described may exist within the site, reported substance parameters may exist in areas of the site not investigated, and concentrations of substances greater or less than those reported may exist between sample locations.

The findings and conclusions of this report are valid only as of the date of this report. If site conditions change, new information is discovered, or unexpected site conditions are encountered in future work, including excavations, borings, or other studies, the findings, conclusions and/or recommendations of this report should be re-evaluated. It is recommended that users of this report should engage a suitably qualified professional to assist in interpreting the significance, if any, of the findings.

7 SELECTED REFERENCES

Arcadis (2020). *Remedial Options Analysis: PFAS Contamination, Fire Fighting Training Area, CFB Comox, Lazo, BC*. Prepared for Public Services and Procurement Canada. January 13.

Houtz, E.F., and Sedlak, D.L. (2012). Oxidative Conversion as a Means of detecting precursors to perfluoroalkyl acids in urban runoff. *Environmental Science & Technology*, *46*(17), 9342-9349.

USEPA (2013). *LEAF Method 1314: Liquid-Solid Partitioning as a Function of Liquid-Solid Ratio for Constituents in Solid Materials using an Up-Flow Percolation Column Procedure*. URL: https://www.epa.gov/sites/production/files/2015-12/documents/method_1314_final_03-22-13.pdf

Table 1 – Phase I: Method 537 PFAS Soil Screening Data

Table 1. Phase I: Method 537 PFAS Soil Screening Data

Comox PFAS Baseline Soil Analytical Data										
Homogenate ID:	**TP19-01**		**TP19-02**		**TP19-03**		**TP19-04**		**TP19-05**	
Description:	**Unamended Baseline**		**Unamended Baseline**		**Unamended Baseline**		**Unamended Baseline**		**Unamended Baseline**	
Analyte	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
PFAS - Method 537MOD (µg/kg)										
Perfluorohexanoic acid (PFHxA)	8.08		25.6		7.18	J	14.1		33.1	
Perfluoroheptanoic acid (PFHpA)	2.52		9.19	J	3.88	J	4.94	J	14.0	
Perfluorooctanoic acid (PFOA)	10.8		50.1		15.3		12.4		38.7	
Perfluorononanoic acid (PFNA)	1.15	J	6.1	J	30.4		7.81	J	35.7	
Perfluorodecanoic acid (PFDA)	0.330	J	< 2.6	ND	5.62	J	< 2.5	ND	6.29	J
Perfluoroundecanoic acid (PFUnA)	< 0.29	ND	< 2.6	ND	< 2.9	ND	< 2.5	ND	< 2.6	ND
Perfluorododecanoic acid (PFDoA)	< 0.29	ND	< 2.6	ND	< 2.9	ND	< 2.5	ND	< 2.6	ND
Perfluorotridecanoic acid (PFTrDA)	< 0.29	ND	< 2.6	ND	< 2.9	ND	< 2.5	ND	< 2.6	ND
Perfluorotetradecanoic acid (PFTeDA)	< 0.29	ND	< 2.6	ND	< 2.9	ND	< 2.5	ND	< 2.6	ND
Perfluorobutanesulfonic acid (PFBS)	1.03	J	< 2.6	ND	< 2.9	ND	5.55	J	8.59	J
Perfluorohexanesulfonic acid (PFHxS)	27.8		72.0		30.2		68.0		124	
Perfluorooctanesulfonic acid (PFOS)	507		4,320		1,340		1,680		10,300	
2-(N-Methyl-perfluorooctane sulfonamido) acetic acid (MeFOSAA)	< 0.59	ND	< 5.3	ND	< 5.8	ND	< 5.1	ND	< 5.2	ND
2-(N-Ethyl-perfluorooctane sulfonamido) acetic acid (EtFOSAA)	< 0.59	ND	6.77	J	< 5.8	ND	< 5.1	ND	< 5.2	ND

Notes/Qualifiers:

ND (Non-Detect) Indicates a result <MDL (Maximum Detection Limit)

J (J-Flag) Indicates a result ≥ MDL but < LOQ (Limit of Quantitation)

NP (Not Performed) Analysis Not Performed

[a] Assiciated CCV (Continuing Calibration Verification) outside of control limits high, sample was ND

Table 2 – Phase I: Triplicate PFAS TOP Assay Data for Comox Soil Homogenate

Table 2. Phase I: Triplicate PFAS TOP Assay Data for Comox Soil Homogenate

PERFLUOROALKYL SUBSTANCES (SOIL): Triplicate Baseline TOP Assay Results				
Sample ID:	SOIL HOMOGENATE-1	SOIL HOMOGENATE-2	SOIL HOMOGENATE-3	AVERAGE
Perfluorinated Compounds - Pre- and Post-Oxidation (µg/kg)				
Perfluorobutanoic acid (PFBA)	<10	<10	<10	<10
Post Oxidation Perfluorobutanoic acid (PFBA)	**210**	**250**	**210**	**223.3**
Perfluoropentanoic acid (PFPeA)	**25**	**23**	**26**	**24.7**
Post Oxidation Perfluoropentanoic acid (PFPeA)	**280**	**260**	**220**	**253.3**
Perfluorohexanoic acid (PFHxA)	**22**	**22**	**22**	**22**
Post Oxidation Perfluorohexanoic acid (PFHxA)	**340**	**380**	**330**	**350**
Perfluoroheptanoic acid (PFHpA)	<10	<10	<10	<10
Post Oxidation Perfluoroheptanoic acid (PFHpA)	**120**	**140**	**110**	**123.3**
Perfluorooctanoic acid (PFOA)	**31**	**33**	**32**	**32**
Post Oxidation Perfluorooctanoic acid (PFOA)	**200**	**260**	**210**	**223.3**
Perfluorononanoic acid (PFNA)	**16**	**14**	**15**	**15**
Post Oxidation Perfluorononanoic acid (PFNA)	**25**	**26**	**25**	**25.3**
Perfluorodecanoic acid (PFDA)	<10	<10	<10	<10
Post Oxidation Perfluorodecanoic acid (PFDA)	<6	<6	<6	<6
Perfluoroundecanoic acid (PFUnA)	<10	<10	<10	<10
Post Oxidation Perfluoroundecanoic acid (PFUnA)	<6	<6	<6	<6
Perfluorododecanoic acid (PFDoA)	<10	<10	<10	<10
Post Oxidation Perfluorododecanoic acid (PFDoA)	<6	<6	<6	<6
Perfluorotridecanoic acid (PFTRDA)	<10	<10	<10	<10
Post Oxidation Perfluorotridecanoic acid (PFTRDA)	<6	<6	<6	<6
Perfluorotetradecanoic acid(PFTEDA)	<10	<10	<10	<10
Post Oxidation Perfluorotetradecanoic acid(PFTEDA)	<6	<6	<6	<6
Perfluorobutanesulfonic acid (PFBS)	<10	<10	<10	<10
Post Oxidation Perfluorobutanesulfonic acid (PFBS)	**6**	**6.3**	**6.1**	**6.1**
Perfluorohexanesulfonic acid(PFHxS)	**82**	**79**	**79**	**80**
Post Oxidation Perfluorohexanesulfonic acid(PFHxS)	**120**	**130**	**110**	**120**
Perfluoroheptanesulfonic acid PFHpS	<10	<10	<10	<10
Post Oxidation Perfluoroheptanesulfonic acid PFHpS	**14**	**16**	**14**	**14.7**
Perfluorooctanesulfonic acid (PFOS)	**3200**	**2800**	**2800**	**2933.3**
Post Oxidation Perfluorooctanesulfonic acid (PFOS)	**2300**	**2500**	**2400**	**2400**
Perfluorodecanesulfonic acid (PFDS)	<10	<10	<10	<10
Post Oxidation Perfluorodecanesulfonic acid (PFDS)	<6	<6	<6	<6
Perfluorooctane Sulfonamide (PFOSA)	**210**	**250**	**210**	**223.3**
Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	**98**	**93**	**120**	**103.7**
EtFOSA	<10	<10	<10	<10
Post Oxidation EtFOSA	<6	<6	<6	<6
MeFOSA	<10	<10	<10	<10
Post Oxidation MeFOSA	<6	<6	<6	<6
EtFOSE	<10	<10	<10	<10
Post Oxidation EtFOSE	<6	<6	<6	<6
MeFOSE	<10	<10	<10	<10
Post Oxidation MeFOSE	<6	<6	<6	<6
EtFOSAA	<10	<10	<10	<10
Post Oxidation EtFOSAA	<6	<6	<6	<6
MeFOSAA	<10	<10	<10	<10
Post Oxidation MeFOSAA	<6	<6	<6	<6
6:2 Fluorotelomer sulfonic acid	**140**	**160**	**150**	**150**
Post Oxidation 6:2 Fluorotelomer sulfonic acid	**340**	**360**	**420**	**373.3**
8:2 Fluorotelomer sulfonic acid	**210**	**240**	**210**	**220**
Post Oxidation 8:2 Fluorotelomer sulfonic acid	**140**	**160**	**160**	**153.3**
Surrogate Recovery (%)				
Post Oxidation 13C2-6:2-Fluorotelomersulfonic Acid	108	107	106	107.0
Post Oxidation 13C2-8:2-Fluorotelomersulfonic Acid	89	93	88	90.0
Post Oxidation 13C2-Perfluorodecanoic acid	92	94	92	92.7
Post Oxidation 13C2-Perfluorododecanoic acid	79	87	82	82.7
Post Oxidation 13C2-Perfluorohexanoic acid	105	109	108	107.3
Post Oxidation 13C2-perfluorotetradecanoic acid	75	85	77	79.0
Post Oxidation 13C2-Perfluoroundecanoic acid	85	90	87	87.3
Post Oxidation 13C3-Perfluorobutanesulfonic acid	96	97	95	96.0
Post Oxidation 13C4-Perfluorobutanoic acid	54	49 (1)	53	53.5
Post Oxidation 13C4-Perfluoroheptanoic acid	95	96	95	95.3
Post Oxidation 13C4-Perfluorooctanesulfonic acid	101	100	101	100.7
Post Oxidation 13C4-Perfluorooctanoic acid	96	97	95	96.0
Post Oxidation 13C5-Perfluorononanoic acid	95	99	93	95.7
Post Oxidation 13C5-Perfluoropentanoic acid	89	105	103	99.0
Post Oxidation 13C8-Perfluorooctane Sulfonamide	82	88	82	84.0
Post Oxidation 18O2-Perfluorohexanesulfonic acid	97	101	95	97.7
Post Oxidation D3-MeFOSAA	85	87	82	84.7
Post Oxidation D5-EtFOSAA	82	87	80	83.0
Post Oxidation D7-MeFOSE	76	81	76	77.7
Post Oxidation D9-EtFOSE	75	79	74	76.0
13C2-6:2-Fluorotelomersulfonic Acid	96	94	94	94.7
13C2-8:2-Fluorotelomersulfonic Acid	95	93	96	94.7
13C2-Perfluorodecanoic acid	99	101	102	100.7
13C2-Perfluorododecanoic acid	96	97	98	97.0
13C2-Perfluorohexanoic acid	111	111	115	112.3
13C2-perfluorotetradecanoic acid	93	94	94	93.7
13C2-Perfluoroundecanoic acid	98	99	101	99.3
13C3-Perfluorobutanesulfonic acid	97	97	99	97.7
13C4-Perfluorobutanoic acid	103	104	106	104.3
13C4-Perfluoroheptanoic acid	109	110	111	110.0
13C4-Perfluorooctanesulfonic acid	97	97	97	97.0
13C4-Perfluorooctanoic acid	103	104	105	104.0
13C5-Perfluorononanoic acid	104	106	105	105.0
13C5-Perfluoropentanoic acid	107	107	110	108.0
13C8-Perfluorooctane Sulfonamide	96	94	95	95.0
18O2-Perfluorohexanesulfonic acid	94	94	97	95.0
D3-MeFOSA	87	88	88	87.7
D3-MeFOSAA	97	94	95	95.3
D5-EtFOSA	88	90	88	88.7
D5-EtFOSAA	91	95	96	94.0
D7-MeFOSE	86	89	88	87.7
D9-EtFOSE	85	86	88	86.3

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable
(1) Extracted internal standard analyte recovery was below the defined lower control limit (LCL)
Laboratory spiked soil resulted in satisfactory recovery of the extracted internal standard analyte
When considered together, these QC data suggest that matrix interferences may be increasing the variability of the associated native analyte result (Perfluorobutanoic acid - PFBA).

Results relate only to the items tested.

Table 3 – Phase I: PFAS Stabilization Reagent Batch Testing Data

Table 3 - Phase I: PFAS Stabilization Reagent Batch Testing Data

Sample ID:	**CONTROL-1**	**CONTROL-2**	**CONTROL-AVG**	**BATCH-1**	**BATCH-2**	**BATCH-2 (Lab-Dup)**	**BATCH-2 AVG**	**BATCH-3**	**BATCH-4**	**BATCH-5**	**BATCH-6**	**BATCH-7**	**BATCH-8**	**BATCH-9**	**BATCH-10**	**BATCH-11**	**BATCH-12**
Sample Description:	**No Fixant**	**No Fixant**	**No Fixant**	**0.5% RemBind**	**1% RemBind**	**1% RemBind**	**1% RemBind**	**2% RemBind**	**3% RemBind**	**4% RemBind**	**5% RemBind**	**0.5% Fluorosorb**	**1% Fluorosorb**	**2% Fluorosorb**	**3% Fluorosorb**	**4% Fluorosorb**	**5% Fluorosorb**
Perfluorinated Compounds - Post-oxidation (µg/L)																	
Perfluorobutanoic acid (PFBA)	**18**	**17**	**17.5**	**8.2**	**5.2**	**4.9**	**5.1**	**3.6**	**2.9**	**2.5**	**2.4**	**4.2**	**2.8**	**2.7**	**2.3**	**2.3**	**1.9**
Perfluoropentanoic acid (PFPeA)	**39**	**34**	**36.5**	**19**	**14**	**13**	**13.5**	**11**	**11**	**8.7**	**8.5**	**6.4**	**4.1**	**4.2**	**3.3**	**3.4**	**2.6**
Perfluorohexanoic acid (PFHxA)	**80**	**73**	**76.5**	**24**	**14**	**12**	**13.0**	**8.9**	**7.5**	**5.5**	**5.6**	**11**	**6.1**	**6.1**	**4.4**	**4.5**	**3.2**
Perfluoroheptanoic acid (PFHpA)	**12**	**9.9**	**11.0**	**4.5**	**3**	**2.9**	**3.0**	**1.8**	**1.3**	**0.76**	**0.69**	**4.4**	**2.8**	**3**	**2.3**	**2.4**	**1.8**
Perfluorooctanoic acid (PFOA)	**20**	**16**	**18.0**	**9.6**	**5.7**	**5.4**	**5.6**	**2.5**	**1.7**	**0.93**	**0.93**	**1.8**	**1.3**	**1.3**	**0.94**	**1.1**	**0.7**
Perfluorononanoic acid (PFNA)	**4.1**	**4.2**	**4.2**	**2.3**	**0.94**	**0.86**	**0.9**	**0.39**	**0.27**	<0.1	**0.093**	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Perfluorodecanoic acid (PFDA)	<1	<1	<1	<1	<0.2	<0.2	<0.2	<0.1	<0.04	<0.1	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Perfluoroundecanoic acid (PFUnA)	<1	<1	<1	<1	<0.2	<0.2	<0.2	<0.1	<0.04	<0.1	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Perfluorododecanoic acid (PFDoA)	<1	<1	<1	<1	<0.2	<0.2	<0.2	<0.1	<0.04	<0.1	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Perfluorotridecanoic acid (PFTRDA)	<1	<1	<1	<1	<0.2	<0.2	<0.2	<0.1	<0.04	<0.1	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Perfluorotetradecanoic acid(PFTEDA)	<1	<1	<1	<1	<0.2	<0.2	<0.2	<0.1	<0.04	<0.1	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Perfluorobutanesulfonic acid (PFBS)	**1.7**	**1.8**	**1.8**	**1.6**	**1.5**	**1.4**	**1.5**	**1.2**	**1**	**0.71**	**0.63**	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Perfluorohexanesulfonic acid(PFHxS)	**31**	**33**	**32.0**	**22**	**12**	**12**	**12.0**	**5.4**	**3.7**	**1.9**	**1.7**	**0.29**	**0.098**	<0.04	<0.04	<0.04	<0.04
Perfluoroheptanesulfonic acid (PFHpS)	**3.3**	**2.9**	**3.1**	**1.7**	**0.68**	**0.66**	**0.7**	**0.22**	**0.15**	<0.1	**0.067**	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Perfluorooctanesulfonic acid (PFOS)	**310**	**310**	**310.0**	**140**	**51**	**48**	**49.5**	**18**	**12**	**5.2**	**5.5**	**0.47**	**0.18**	**0.15**	**0.094**	**0.076**	**0.054**
Perfluorodecanesulfonic acid (PFDS)	<1	<1	<1	<1	<0.2	<0.2	<0.2	<0.1	<0.04	<0.1	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Perfluorooctane Sulfonamide (PFOSA)	<1	<1	<1	<1	<0.2	<0.2	<0.2	<0.1	<0.04	<0.1	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
EtFOSA	<1	<1	<1	<1	<0.2	<0.2	<0.2	<0.1	<0.04	<0.1	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
MeFOSA	<1	<1	<1	<1	<0.2	<0.2	<0.2	<0.1	<0.04	<0.1	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
EtFOSE	<1	<1	<1	<1	<0.2	<0.2	<0.2	<0.1	<0.04	<0.1	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
MeFOSE	<1	<1	<1	<1	<0.2	<0.2	<0.2	<0.1	<0.04	<0.1	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
EtFOSAA	<1	<1	<1	<1	<0.2	<0.2	<0.2	<0.1	<0.04	<0.1	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
MeFOSAA	<1	<1	<1	<1	<0.2	<0.2	<0.2	<0.1	<0.04	<0.1	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
6:2 Fluorotelomer sulfonic acid	<1	<1	<1	<1	<0.2	<0.2	<0.2	<0.1	<0.04	<0.1	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
8:2 Fluorotelomer sulfonic acid	<1	<1	<1	<1	<0.2	<0.2	<0.2	<0.1	<0.04	<0.1	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Surrogate Recovery (%)																	
Post Oxidation 13C2-6:2-Fluorotelomersulfonic acid	101	103	102.0	93	92	99	95.5	95	106	91	97	95	96	97	101	98	108
Post Oxidation 13C2-8:2-Fluorotelomersulfonic acid	86	92	89.0	83	80	83	81.5	78	94	82	87	86	83	87	93	88	94
Post Oxidation 13C2-Perfluorodecanoic acid	84	91	87.5	78	79	82	80.5	77	89	80	86	80	81	84	89	87	95
Post Oxidation 13C2-Perfluorododecanoic acid	78	78	78.0	72	67	73	70.0	68	83	66	81	77	78	76	79	78	86
Post Oxidation 13C2-Perfluorohexanoic acid	105	106	105.5	97	104	106	105.0	104	106	106	105	85	88	91	92	92	98
Post Oxidation 13C2-perfluorotetradecanoic acid	79	80	79.5	72	71	77	74.0	68	77	73	83	71	79	76	82	76	81
Post Oxidation 13C2-Perfluoroundecanoic acid	82	85	83.5	78	70	74	72.0	71	83	71	79	76	78	78	83	80	89
Post Oxidation 13C3-Perfluorobutanesulfonic acid	97	104	100.5	91	94	100	97.0	96	103	93	98	99	100	98	101	101	108
Post Oxidation 13C4-Perfluorobutanoic acid	86	88	87.0	82	84	87	85.5	84	110	82	107	85	88	93	93	94	97
Post Oxidation 13C4-Perfluoroheptanoic acid	96	101	98.5	90	91	94	92.5	92	102	93	97	90	93	94	97	97	101
Post Oxidation 13C4-Perfluorooctanesulfonic acid	101	101	101.0	102	103	102	102.5	100	107	103	107	87	84	89	89	92	98
Post Oxidation 13C4-Perfluorooctanoic acid	93	100	96.5	90	91	95	93.0	94	98	90	93	91	94	92	94	96	105
Post Oxidation 13C5-Perfluorononanoic acid	96	104	100.0	91	93	99	96.0	91	97	90	92	89	89	90	93	93	99
Post Oxidation 13C5-Perfluoropentanoic acid	96	103	99.5	94	102	104	103.0	104	106	103	106	85	89	92	95	96	98
Post Oxidation 13C8-Perfluorooctane Sulfonamide	86	89	87.5	77	77	79	78.0	76	81	76	80	75	75	77	82	79	85
Post Oxidation 18O2-Perfluorohexanesulfonic acid	97	96	96.5	87	101	99	100.0	99	107	94	95	98	98	96	98	100	110
Post Oxidation D3-MeFOSAA	80	83	81.5	70	74	83	78.5	72	80	72	79	78	76	74	80	79	90
Post Oxidation D5-EtFOSAA	75	78	76.5	71	72	81	76.5	75	82	69	80	76	77	76	80	76	85
Post Oxidation D7-MeFOSE	78	88	83.0	72	71	77	74.0	72	78	72	80	79	77	76	81	75	89
Post Oxidation D9-EtFOSE	78	78	78.0	69	70	74	72.0	72	81	73	85	80	78	82	85	78	86

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
ND = Not detected
N/A = Not Applicable
Results relate only to the items tested.

Table 4 – Phase II: LEAF Method 1314 TOP-Assay Results

PERFLUOROALKYL SUBSTANCES (LEAF 1314 Leachate)																		
	Untreated Control, Mix-1						1% Fluorosorb 200, Mix-2						2% Fluorosorb 200, Mix-3					
Sample ID:	**T01**	**T02- T04**	**T05**	**T06- T08**	**T09**	**Sparkline**	**T01**	**T02- T04**	**T05**	**T06- T08**	**T09**	**Sparkline**	**T01**	**T02- T04**	**T05**	**T06- T08**	**T09**	**Sparkline**
Perfluorinated Compounds - Pre- and Post-Oxidation (µg/L)																		
Post Oxidation Perfluorobutanoic acid (PFBA)	**110**	**32**	**16**	**4.8**	**3.5**		**22**	**5.8**	**4.7**	**3**	**1.6**		**21**	**6.4**	**3.8**	**2.9**	**1.9**	
Post Oxidation Perfluoropentanoic acid (PFPeA)	**340**	**63**	**32**	**8.4**	**4.6**		**32**	**8.1**	**7.8**	**5.4**	**3.3**		**31**	**9.9**	**6.2**	**5.2**	**3.5**	
Post Oxidation Perfluorohexanoic acid (PFHxA)	**240**	**100**	< 2.0	**20**	**6.9**		**57**	**20**	**15**	**9.3**	**5**		**54**	**17**	**13**	**8.1**	**5.4**	
Post Oxidation Perfluoroheptanoic acid (PFHpA)	**60**	**26**	**22**	**8.2**	**4.8**		**11**	**4**	**5.7**	**5.8**	**4.2**		**11**	**6.4**	**5.5**	**6.2**	**4.8**	
Post Oxidation Perfluorooctanoic acid (PFOA)	< 2.0	< 2.0	< 2.0	**5.9**	**3.4**		**5.1**	**3.2**	**3.6**	**1.9**	**0.62**		**5**	**3.7**	**3.4**	**1.8**	**1.3**	
Post Oxidation Perfluorononanoic acid (PFNA)	< 2.0	< 2.0	< 2.0	**0.56**	**0.12**		**0.49**	**0.23**	**0.13**	< 0.040	< 0.040		**0.38**	**0.2**	**0.12**	< 0.040	< 0.040	
Post Oxidation Perfluorodecanoic acid (PFDA)	< 2.0	< 2.0	< 2.0	< 0.20	< 0.10		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	
Post Oxidation Perfluoroundecanoic acid (PFUnA)	< 2.0	< 2.0	< 2.0	< 0.20	< 0.10		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	
Post Oxidation Perfluorododecanoic acid (PFDoA)	< 2.0	< 2.0	< 2.0	< 0.20	< 0.10		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	
Post Oxidation Perfluorotridecanoic acid (PFTRDA)	< 4.0	< 4.0	< 4.0	< 0.20	< 0.10		< 0.20	< 0.050	< 0.050	< 0.040	< 0.040		< 0.20	< 0.050	< 0.050	< 0.040	< 0.040	
Post Oxidation Perfluorotetradecanoic acid(PFTEDA)	< 2.0	< 2.0	< 2.0	< 0.20	< 0.10		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	
Post Oxidation Perfluorobutanesulfonic acid (PFBS)	**32**	< 4.0	< 4.0	< 0.20	< 0.10		**0.24**	< 0.050	< 0.050	< 0.040	< 0.040		**0.26**	< 0.050	< 0.050	< 0.040	< 0.040	
Post Oxidation Perfluorohexanesulfonic acid(PFHxS)	**220**	< 2.0	< 2.0	**0.89**	**0.22**		**1.7**	**1.4**	**0.84**	**0.34**	**0.045**		**1.3**	**1.1**	**0.73**	**0.28**	**0.16**	
Post Oxidation Perfluoroheptanesulfonic acid PFHpS	< 2.0	< 2.0	< 2.0	< 0.20	< 0.10		**0.1**	**0.082**	**0.044**	< 0.040	< 0.040		**0.075**	**0.06**	< 0.040	< 0.040	< 0.040	
Post Oxidation Perfluorooctanesulfonic acid (PFOS)	**370**	**1100**	**830**	**96**	**14**		**8.4**	**4.7**	**4.3**	**1.7**	**0.51**		**6.8**	**5.2**	**2.5**	**1.7**	**1.1**	
Post Oxidation Perfluorodecanesulfonic acid (PFDS)	< 2.0	< 2.0	< 2.0	< 0.20	< 0.10		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	
Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	< 2.0	< 2.0	< 2.0	< 0.20	< 0.10		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	
Post Oxidation EtFOSA	< 2.0	< 2.0	< 2.0	< 0.20	< 0.10		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	
Post Oxidation MeFOSA	< 2.0	< 2.0	< 2.0	< 0.20	< 0.10		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	
Post Oxidation EtFOSE	< 2.0	< 2.0	< 2.0	< 0.20	< 0.10		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	
Post Oxidation MeFOSE	< 2.0	< 2.0	< 2.0	< 0.20	< 0.10		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	
Post Oxidation EtFOSAA	< 2.0	< 2.0	< 2.0	< 0.20	< 0.10		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	
Post Oxidation MeFOSAA	< 4.0	< 4.0	< 4.0	< 0.20	< 0.10		< 0.20	< 0.050	< 0.050	< 0.040	< 0.040		< 0.20	< 0.050	< 0.050	< 0.040	< 0.040	
Post Oxidation 6:2 Fluorotelomer sulfonic acid	< 2.0	< 2.0	< 2.0	< 0.20	< 0.10		< 0.040	**0.076**	< 0.040	< 0.040	< 0.040		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	
Post Oxidation 8:2 Fluorotelomer sulfonic acid	< 2.0	< 2.0	< 2.0	< 0.20	< 0.10		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040		< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	
Surrogate Recovery (%)																		
Post Oxidation 13C2-6:2-Fluorotelomersulfonic Acid	84	85	86	116	95	--	84	85	92	117	109	--	76	81	86	119	117	--
Post Oxidation 13C2-8:2-Fluorotelomersulfonic Acid	82	84	82	104	88	--	82	77	88	108	100	--	71	76	80	113	110	--
Post Oxidation 13C2-Perfluorodecanoic acid	78	81	82	104	88	--	81	79	91	108	102	--	73	74	78	109	116	--
Post Oxidation 13C2-Perfluorododecanoic acid	73	73	69	100	82	--	70	72	79	96	90	--	65	67	72	100	104	--
Post Oxidation 13C2-Perfluorohexanoic acid	86	83	84	117	115	--	106	83	80	117	116	--	107	72	76	114	119	--
Post Oxidation 13C2-perfluorotetradecanoic acid	101	91	93	94	72	--	91	73	59	96	85	--	102	68	79	96	96	--
Post Oxidation 13C2-Perfluoroundecanoic acid	74	75	74	105	88	--	74	76	83	102	98	--	66	69	73	105	110	--
Post Oxidation 13C3-Perfluorobutanesulfonic acid	118	106	108	118	93	--	110	119	108	107	108	--	115	114	111	113	116	--
Post Oxidation 13C4-Perfluorobutanoic acid	113	108	105	99	78	--	108	106	105	115	98	--	107	109	92	111	107	--
Post Oxidation 13C4-Perfluoroheptanoic acid	114	110	110	113	116	--	111	109	109	120	118	--	109	114	87	118	118	--
Post Oxidation 13C4-Perfluorooctanesulfonic acid	109	108	112	105	113	--	106	105	100	103	97	--	107	107	100	98	108	--
Post Oxidation 13C4-Perfluorooctanoic acid	82	86	83	116	95	--	66	83	71	109	111	--	65	64	75	115	118	--
Post Oxidation 13C5-Perfluorononanoic acid	84	86	85	116	95	--	84	83	93	116	108	--	76	78	81	118	123	--
Post Oxidation 13C5-Perfluoropentanoic acid	110	106	105	109	112	--	106	105	103	116	115	--	106	107	87	110	113	--
Post Oxidation 13C8-Perfluorooctane Sulfonamide	72	72	70	98	81	--	70	72	79	93	91	--	64	65	71	102	105	--
Post Oxidation 18O2-Perfluorohexanesulfonic acid	78	84	79	110	91	--	83	82	91	106	105	--	75	79	84	111	112	--
Post Oxidation D3-MeFOSAA	97	86	91	100	85	--	89	86	78	98	91	--	97	87	91	95	102	--
Post Oxidation D5-EtFOSAA	71	72	74	98	82	--	69	71	80	95	89	--	64	69	69	97	101	--
Post Oxidation D7-MeFOSE	72	69	70	81	68	--	68	69	78	71	74	--	63	66	66	81	77	--
Post Oxidation D9-EtFOSE	68	65	68	81	67	--	67	69	81	74	74	--	63	66	66	82	79	--
Total PFAS in ug/L	**1372**	**1321**	**900**	**144.75**	**37.540**		**138.030**	**47.59**	**42.114**	**27.440**	**15.275**		**130.815**	**49.96**	**35.250**	**26.180**	**18.160**	

Table 5 – Supporting Data for Calculation of Figure 7

BV Labs Job Number: C040257
Report Date: 2020/03/13
Post-TOP PERFLUOROALKYL SUBSTANCES (WATER)

Non-detects set to 1/2 detection limit
Compounds with non-detects across the board (control and treatments) not included

0.5% 1% 2% 3% 4% 5%

	UNITS	CONTROL-AVG	BATCH-1	BATCH-2 AVG	BATCH-3	BATCH-4	BATCH-5	BATCH-6	BATCH-7	BATCH-8	BATCH-9	BATCH-10	BATCH-11	BATCH-12
Stabilization Reagent and Dose		**N/A**	**RemBind 0.5%**	**RemBind 1%**	**RemBind 2%**	**RemBind 3%**	**RemBind 4%**	**RemBind 5%**	**Fluorosorb 0.5%**	**Fluorosorb 1%**	**Fluorosorb 2%**	**Fluorosorb 3%**	**Fluorosorb 4%**	**Fluorosorb 5%**
Perfluorobutanoic acid (PFBA)	ug/L	17.5	8.2	5.1	3.6	2.9	2.5	2.4	4.2	2.8	2.7	2.3	2.3	1.9
Perfluoropentanoic acid (PFPeA)	ug/L	36.5	19	13.5	11	11	8.7	8.5	6.4	4.1	4.2	3.3	3.4	2.6
Perfluorohexanoic acid (PFHxA)	ug/L	76.5	24	13.0	8.9	7.5	5.5	5.6	11	6.1	6.1	4.4	4.5	3.2
Perfluoroheptanoic acid (PFHpA)	ug/L	11.0	4.5	3.0	1.8	1.3	0.76	0.69	4.4	2.8	3	2.3	2.4	1.8
Perfluorooctanoic acid (PFOA)	ug/L	18.0	9.6	5.6	2.5	1.7	0.93	0.93	1.8	1.3	1.3	0.94	1.1	0.7
Perfluorononanoic acid (PFNA)	ug/L	4.2	2.3	0.9	0.39	0.27	0.05	0.093	0.02	0.02	0.02	0.02	0.02	0.02
Perfluorobutanesulfonic acid (PFBS)	ug/L	1.8	1.6	1.5	1.2	1	0.71	0.63	0.02	0.02	0.02	0.02	0.02	0.02
Perfluorohexanesulfonic acid(PFHxS)	ug/L	32.0	22	12.0	5.4	3.7	1.9	1.7	0.29	0.098	0.02	0.02	0.02	0.02
Perfluoroheptanesulfonic acid (PFHpS)	ug/L	3.1	1.7	0.7	0.22	0.15	0.05	0.067	0.02	0.02	0.02	0.02	0.02	0.02
Perfluorooctanesulfonic acid (PFOS)	ug/L	310.0	140	49.5	18	12	5.2	5.5	0.47	0.18	0.15	0.094	0.076	0.054
PFAS Sum	ug/L	510.5	232.9	104.6	53.01	41.52	26.3	26.11	28.62	17.44	17.53	13.41	13.86	10.33
Average Percent Reduction	**(Control - BatchX)/Control**		**54.4%**	**79.5%**	**89.6%**	**91.9%**	**94.8%**	**94.9%**	**94.4%**	**96.6%**	**96.6%**	**97.4%**	**97.3%**	**98.0%**

	UNITS	CONTROL-AVG	BATCH-1	BATCH-2 AVG	BATCH-3	BATCH-4	BATCH-5	BATCH-6	BATCH-7	BATCH-8	BATCH-9	BATCH-10	BATCH-11	BATCH-12
Stabilization Reagent and Dose		**N/A**	**RemBind 0.5%**	**RemBind 1%**	**RemBind 2%**	**RemBind 3%**	**RemBind 4%**	**RemBind 5%**	**Fluorosorb 0.5%**	**Fluorosorb 1%**	**Fluorosorb 2%**	**Fluorosorb 3%**	**Fluorosorb 4%**	**Fluorosorb 5%**
Perfluorobutanoic acid (PFBA)		N/A	53.1%	71.1%	79.4%	83.4%	85.7%	86.3%	76.0%	84.0%	84.6%	86.9%	86.9%	89.1%
Perfluoropentanoic acid (PFPeA)		N/A	47.9%	63.0%	69.9%	69.9%	76.2%	76.7%	82.5%	88.8%	88.5%	91.0%	90.7%	92.9%
Perfluorohexanoic acid (PFHxA)		N/A	68.6%	83.0%	88.4%	90.2%	92.8%	92.7%	85.6%	92.0%	92.0%	94.2%	94.1%	95.8%
Perfluoroheptanoic acid (PFHpA)		N/A	58.9%	73.1%	83.6%	88.1%	93.1%	93.7%	59.8%	74.4%	72.6%	79.0%	78.1%	83.6%
Perfluorooctanoic acid (PFOA)		N/A	46.7%	69.2%	86.1%	90.6%	94.8%	94.8%	90.0%	92.8%	92.8%	94.8%	93.9%	96.1%
Perfluorononanoic acid (PFNA)		N/A	44.6%	78.3%	90.6%	93.5%	98.8%	97.8%	99.5%	99.5%	99.5%	99.5%	99.5%	99.5%
Perfluorobutanesulfonic acid (PFBS)		N/A	8.6%	17.1%	31.4%	42.9%	59.4%	64.0%	98.9%	98.9%	98.9%	98.9%	98.9%	98.9%
Perfluorohexanesulfonic acid(PFHxS)		N/A	31.3%	62.5%	83.1%	88.4%	94.1%	94.7%	99.1%	99.7%	99.9%	99.9%	99.9%	99.9%
Perfluoroheptanesulfonic acid (PFHpS)		N/A	45.2%	78.4%	92.9%	95.2%	98.4%	97.8%	99.4%	99.4%	99.4%	99.4%	99.4%	99.4%
Perfluorooctanesulfonic acid (PFOS)		N/A	54.8%	84.0%	94.2%	96.1%	98.3%	98.2%	99.8%	99.9%	100.0%	100.0%	100.0%	100.0%

Table 6 – Supporting Data for Treatability Study: Total PFAS Leaching from Soil

Fraction	Mix 1 - Untreated Control			Mix 2 - 1% Fluorosorb 200			Mix 3 - 2% Fluorosorb 200		
	Soil used in kg		5.500	Soil used in kg		5.800	Soil used in kg		5.348
	Total PFAS per ug/kg		3,780	Total PFAS per ug/kg		3,780	Total PFAS per ug/kg		3,780
	Total PFAS mass in Colum ug		20,790	Total PFAS mass in Colum ug		21,924	Total PFAS mass in Colum ug		20,215
	Liters Leached	PFOS	PFOS Mass Balance	Liters Leached	PFOS	PFOS Mass Balance	Liters Leached	PFOS	PFOS Mass Balance
		ug/L	ug/fraction		ug/L	ug/fraction		ug/L	ug/fraction
T01	0.9	370	350	1.0	8.4	8.7	0.9	6.8	6.3
T02	1.5	1,100	1,639	1.5	4.7	7.2	1.4	5.2	7.3
T03	2.5	1,100	2,761	2.6	4.7	12.0	2.3	5.2	12.2
T04	2.5	1,100	2,766	2.6	4.7	12.0	2.3	5.2	12.2
T05	2.5	830	2,073	2.5	4.3	11.0	2.3	2.5	5.8
T06	12.9	96	1,238	13.0	1.7	22.1	12.0	1.7	20.4
T07	2.5	96	244	2.6	1.7	4.4	2.4	1.7	4.0
T08	22.7	96	2,176	22.9	1.7	39.0	21.1	1.7	35.9
T09	2.5	14	35	2.5	0.51	1.3	2.3	1.1	2.6
Total	50.6	- -	13,283	51.3	- -	118	47.2	- -	107
Total Leaching Pre TOP-Assay			**63.89%**			**0.54%**			**0.53%**

Fraction	Mix 1 - Untreated Control			Mix 2 - 1% Fluorosorb 200			Mix 3 - 2% Fluorosorb 200		
	Soil used in kg		5.500	Soil used in kg		5.800	Soil used in kg		5.348
	Total PFAS per ug/kg		4,405	Total PFAS per ug/kg		4,405	Total PFAS per ug/kg		4,405
	Total PFAS mass in Colum ug		24,228	Total PFAS mass in Colum ug		25,549	Total PFAS mass in Colum ug		23,558
	Liters Leached	PFAS	PFAS Mass Balance	Liters Leached	PFAS	PFAS Mass Balance	Liters Leached	PFAS	PFAS Mass Balance
		ug/L	ug/fraction		ug/L	ug/fraction		ug/L	ug/fraction
T01	0.9	1372	1299	1.0	138.03	142.8	0.9	130.815	121.0
T02	1.5	1,321	1,969	1.5	48	73.0	1.4	50	70.0
T03	2.5	1,321	3,315	2.6	48	121.8	2.3	50	117.3
T04	2.5	1,321	3,322	2.6	48	121.9	2.3	50	117.3
T05	2.5	900	2,248	2.5	42.114	107.3	2.3	35.25	82.3
T06	12.9	144.75	1,867	13.0	27.44	356.7	12.0	26.18	314.2
T07	2.5	144.75	368	2.6	27.44	70.5	2.4	26.18	62.0
T08	22.7	144.75	3,281	22.9	27.44	629.6	21.1	26.18	553.4
T09	2.5	37.54	94	2.5	15.275	38.6	2.3	18.16	42.4
Total	50.6	- -	17,762	51.3	- -	1,662	47.2	- -	1,480
Total Leaching Post TOP-Assay			**73.31%**			**6.51%**			**6.28%**

Figure 1 – Phase I: Triplicate Baseline Pre- and Post-TOP PFAS Analytical Results

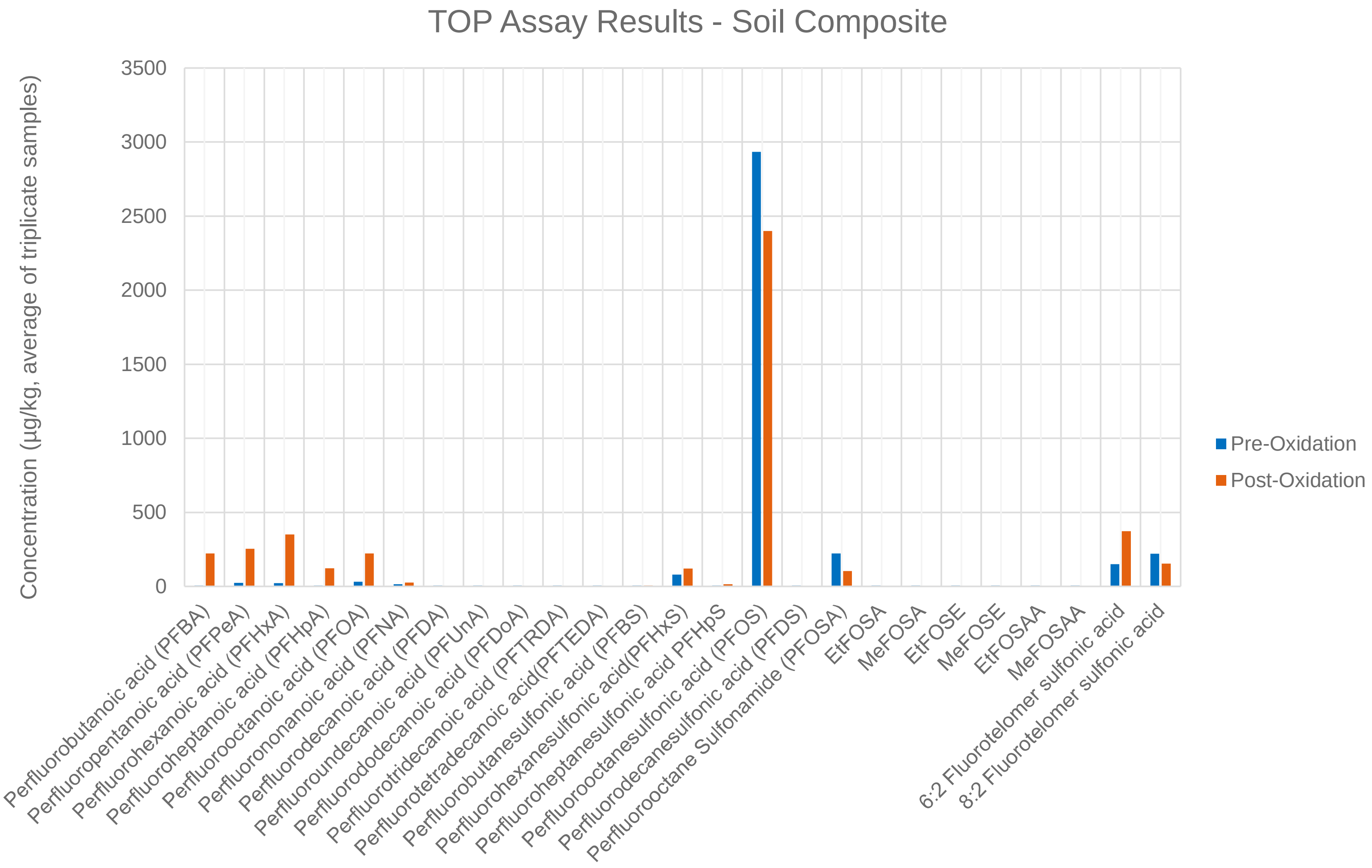


Figure 1. Triplicate Baseline Post-TOP PFAS Analytical Results.

Figure 2 – Phase I: PFOA Post-TOP Batch Test Results

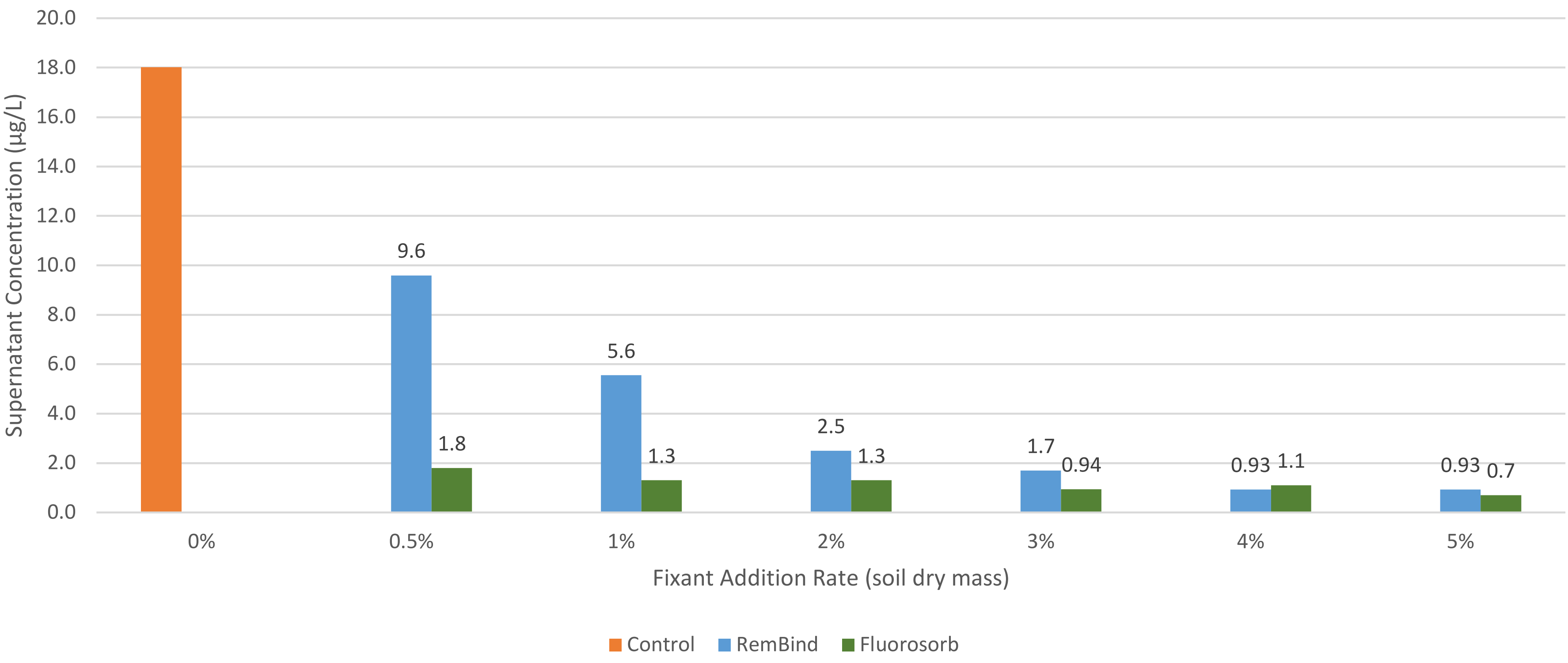


Figure 2: PFOA Post-TOP Batch Test Results based on Data Table 3

Figure 3 – Phase I: PFOS Post-TOP Batch Test Results

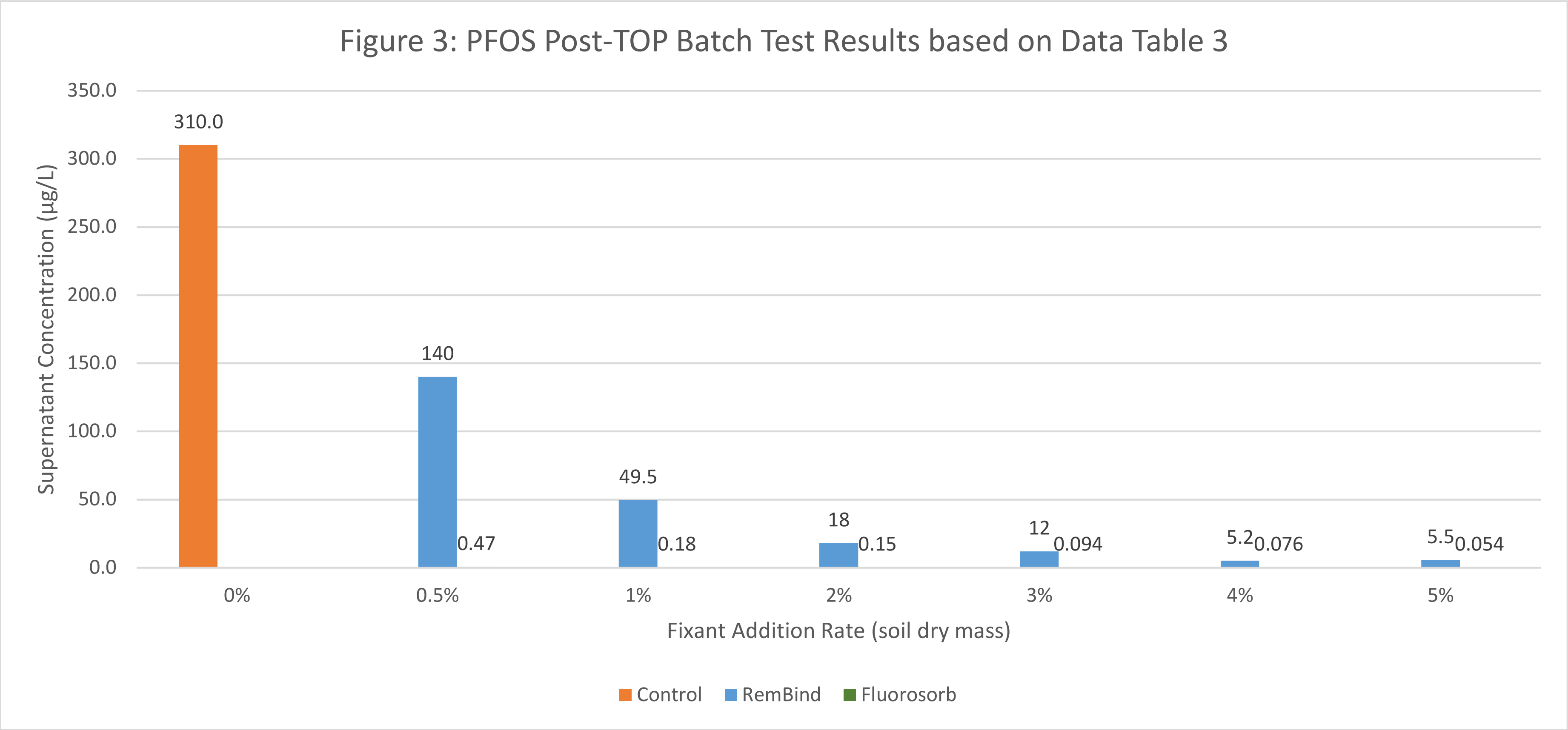


Figure 3: PFOS Post-TOP Batch Test Results based on Data Table 3

Figure 4 – Phase I: PFHxA Post-TOP Batch Test Results

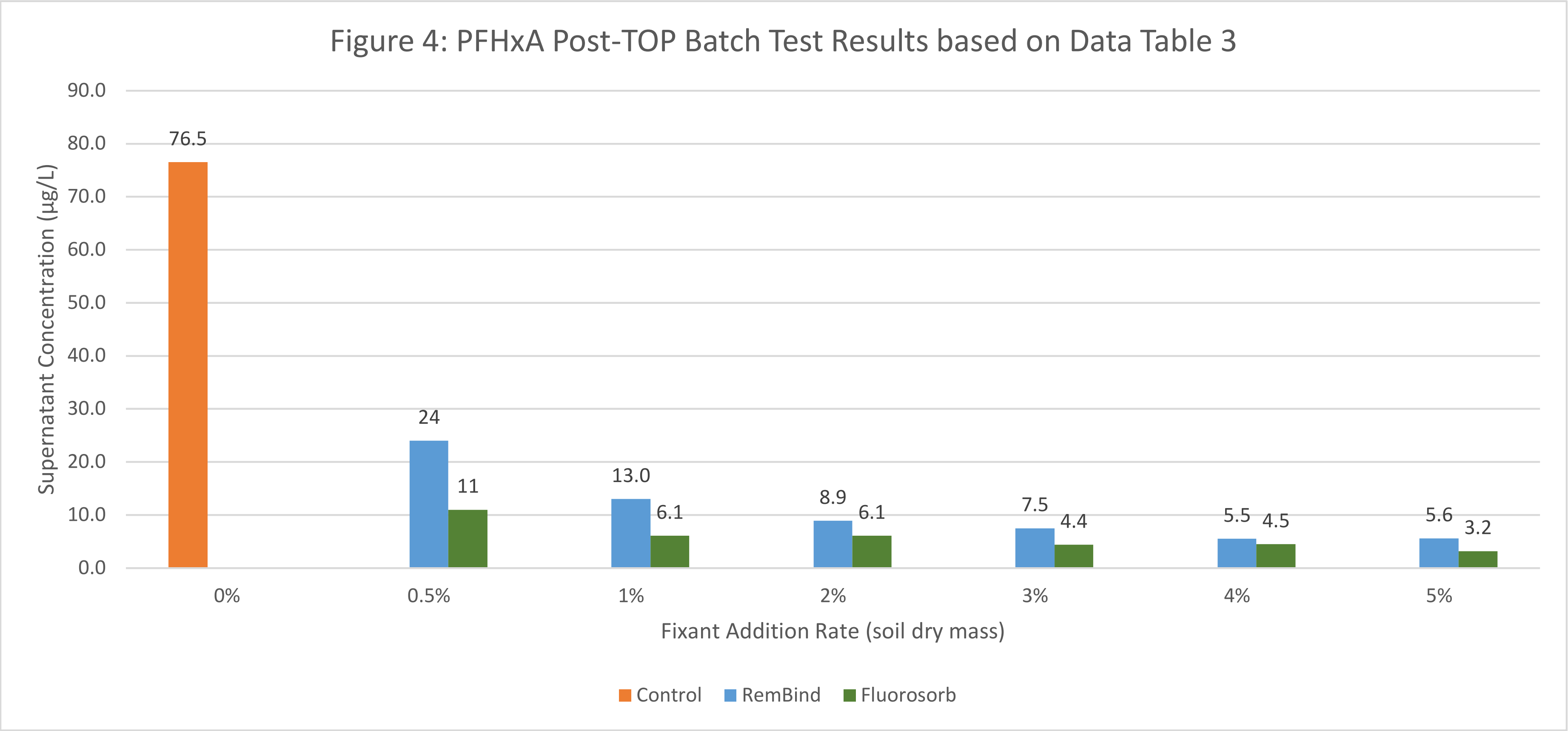


Figure 4: PFHxA Post-TOP Batch Test Results based on Data Table 3
Supernatant Concentration (µg/L)
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
76.5
24
11
13.0
6.1
8.9
6.1
7.5
4.4
5.5
4.5
5.6
3.2
0%
0.5%
1%
2%
3%
4%
5%
Fixant Addition Rate (soil dry mass)
Control
RemBind
Fluorosorb

Figure 5 – Phase I: PFPeA Post-TOP Batch Test Results

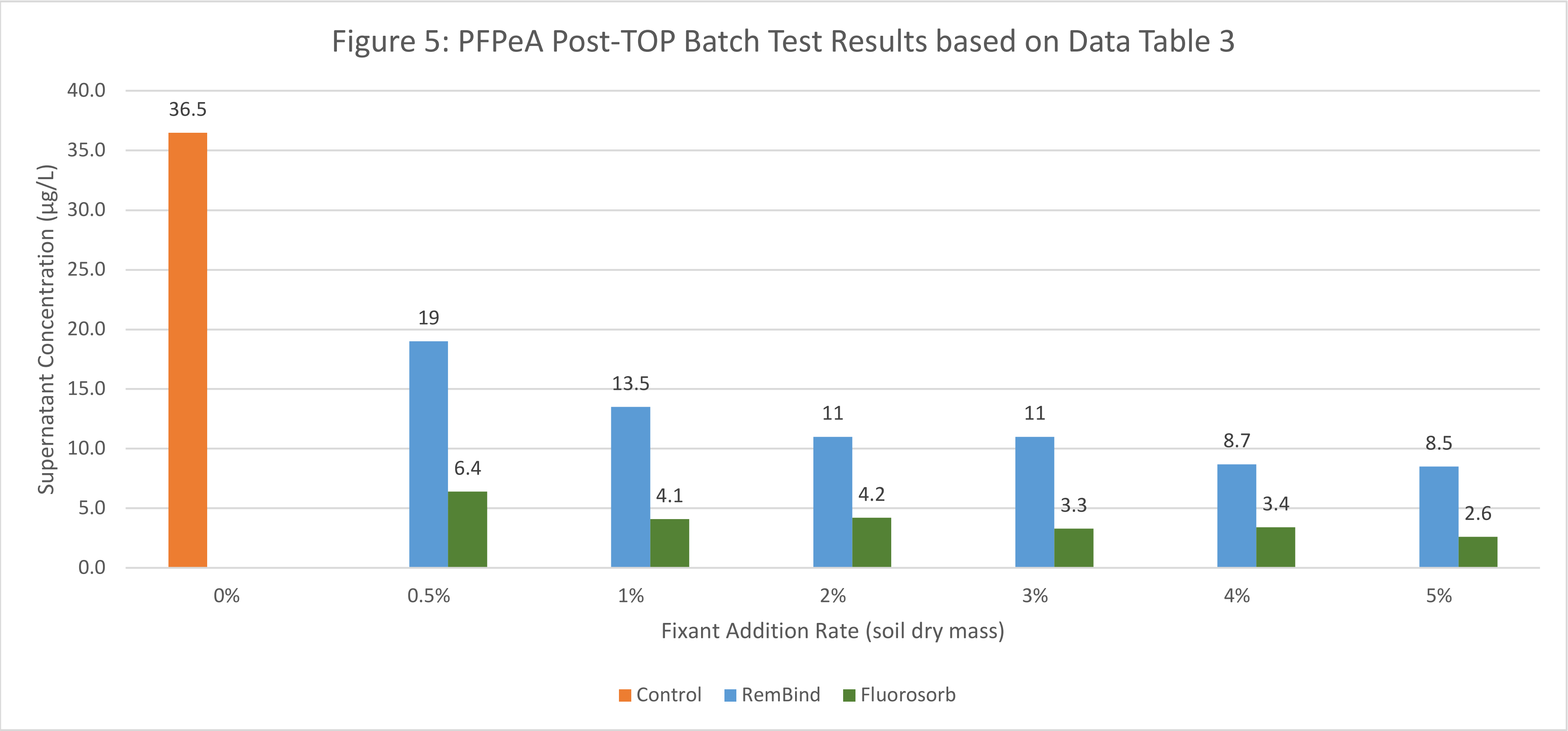


Figure 5: PFPeA Post-TOP Batch Test Results based on Data Table 3
Supernatant Concentration (µg/L)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
36.5
19
6.4
13.5
4.1
11
4.2
11
3.3
8.7
3.4
8.5
2.6
0%
0.5%
1%
2%
3%
4%
5%
Fixant Addition Rate (soil dry mass)
Control
RemBind
Fluorosorb

Figure 6 – Phase I: PFHxS Post-TOP Batch Test Results

Figure 6: PFHxS Post-TOP Batch Test Results based on Data Table 3

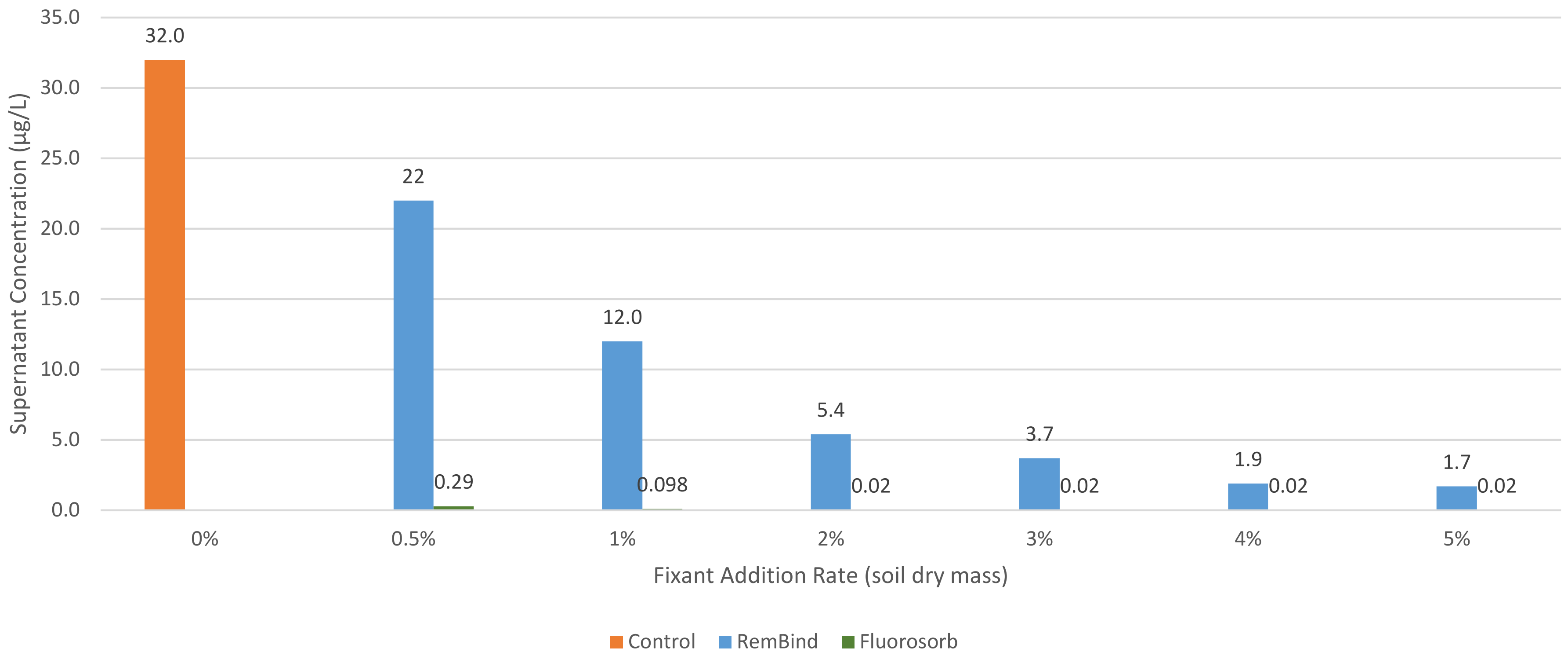


Figure 7 – Phase I: Average Percent PFAS Reduction vs. Control

Figure 7

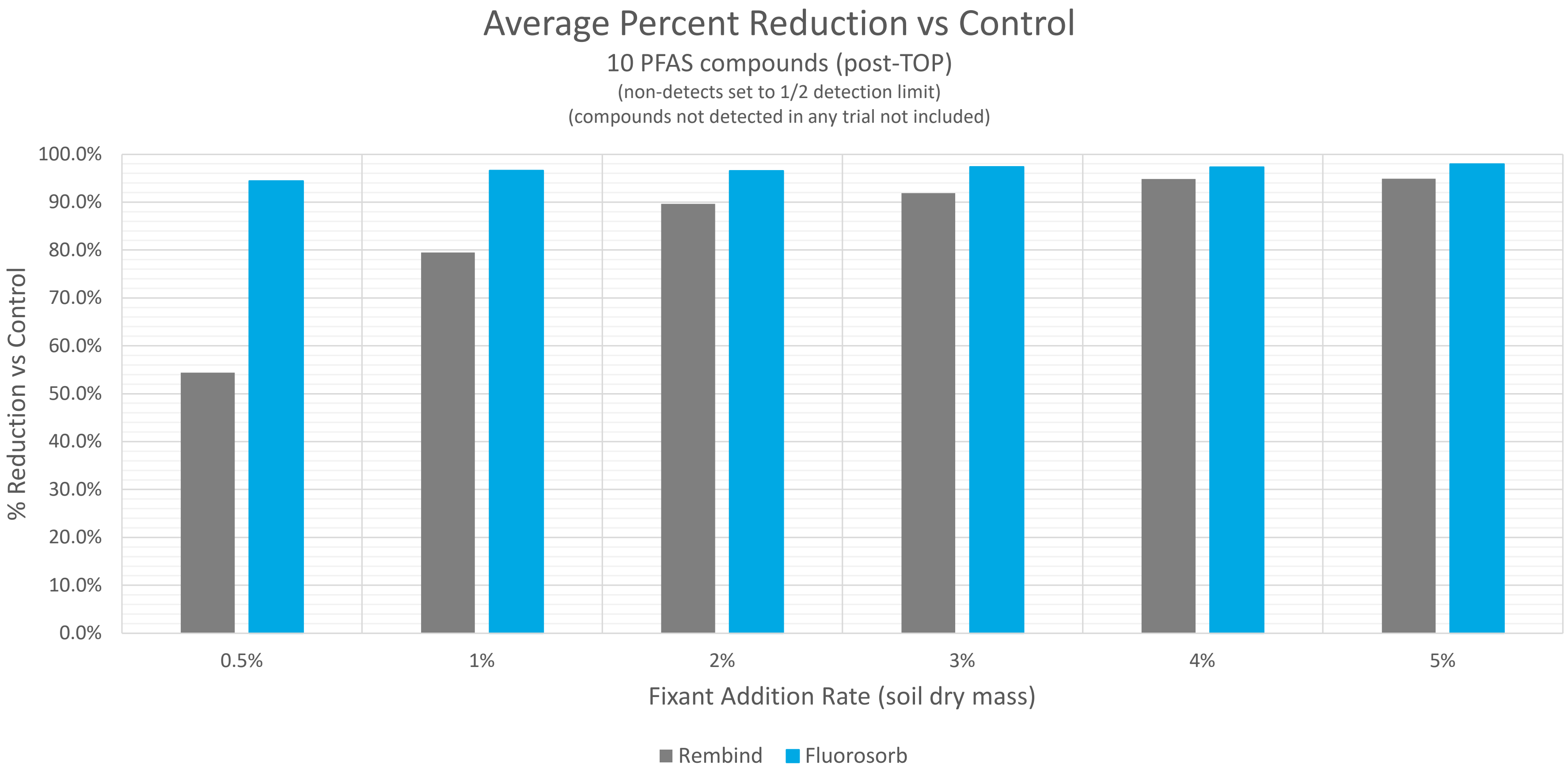

Average Percent Reduction vs Control
10 PFAS compounds (post-TOP)
(non-detects set to 1/2 detection limit)
(compounds not detected in any trial not included)
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
% Reduction vs Control
0.5%
1%
2%
3%
4%
5%
Fixant Addition Rate (soil dry mass)
Rembind
Fluorosorb

Figure 8 – Phase II: Method 1314 Reduction in PFAS Leachate for Selected Constituents

Figure 8.1

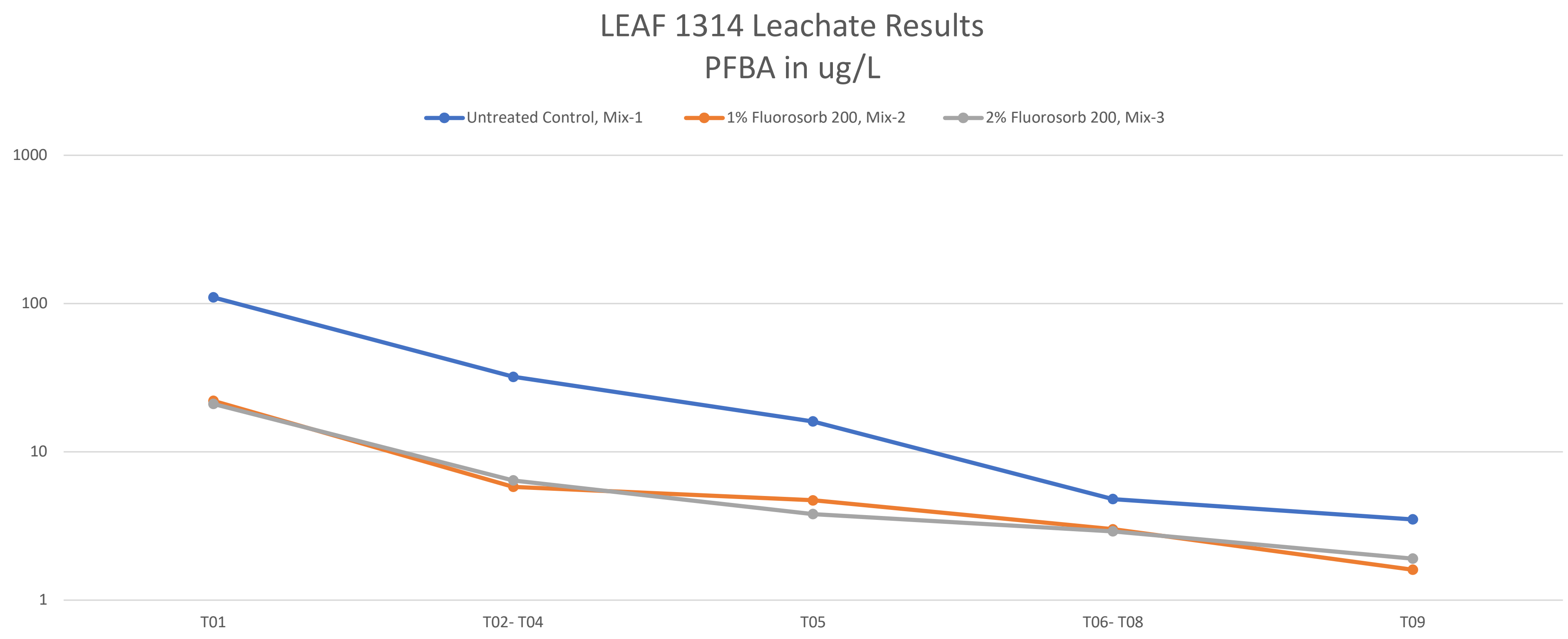

LEAF 1314 Leachate Results
PFBA in ug/L
Untreated Control, Mix-1
1% Fluorosorb 200, Mix-2
2% Fluorosorb 200, Mix-3
1000
100
10
1
T01
T02- T04
T05
T06- T08
T09

Figure 8.2

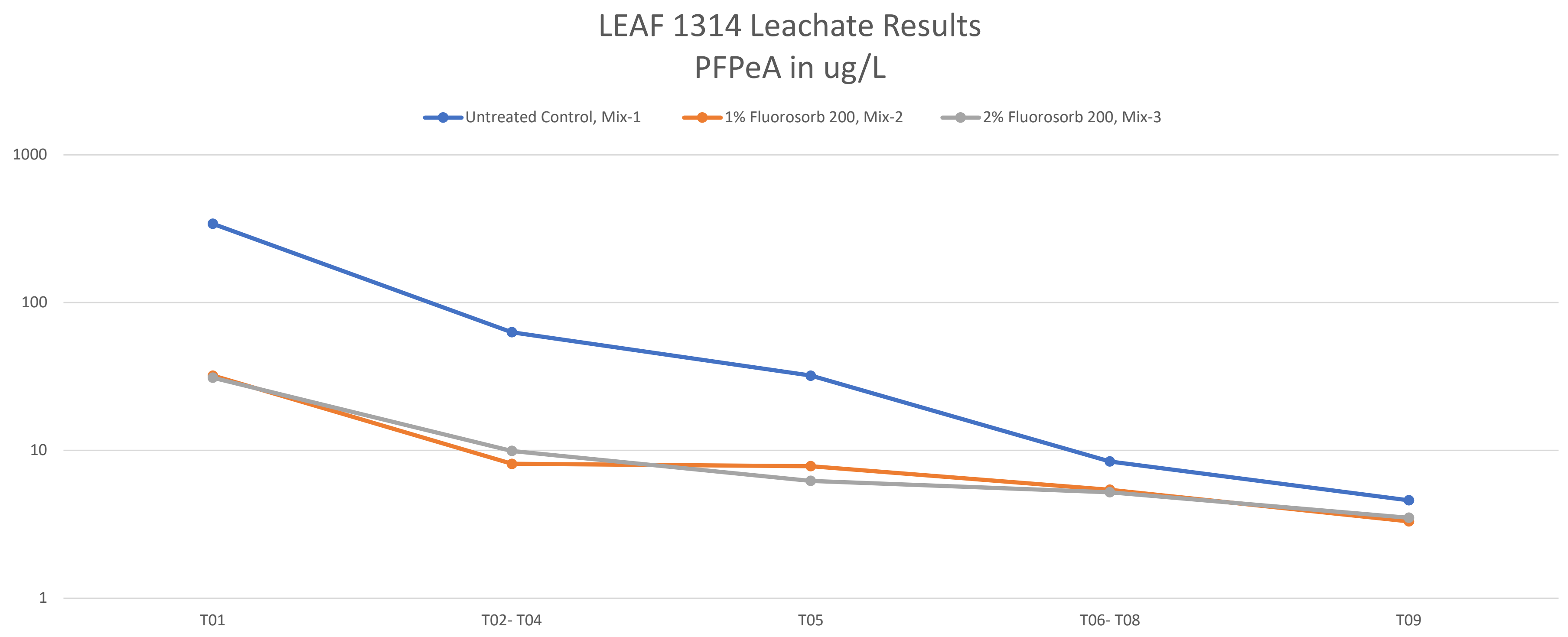

LEAF 1314 Leachate Results
PFPeA in ug/L
Untreated Control, Mix-1
1% Fluorosorb 200, Mix-2
2% Fluorosorb 200, Mix-3
1000
100
10
1
T01
T02- T04
T05
T06- T08
T09

Figure 8.3

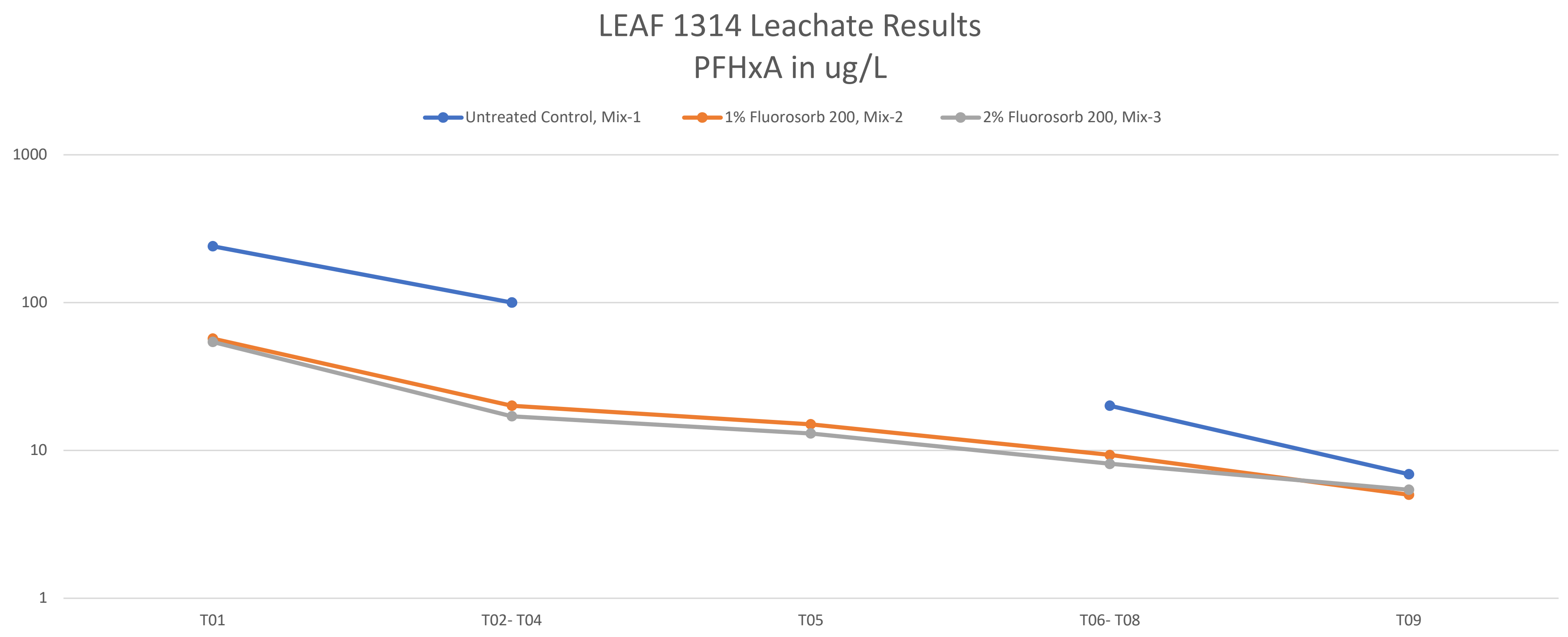

LEAF 1314 Leachate Results
PFHxA in ug/L
Untreated Control, Mix-1
1% Fluorosorb 200, Mix-2
2% Fluorosorb 200, Mix-3
1000
100
10
1
T01
T02- T04
T05
T06- T08
T09

Figure 8.4

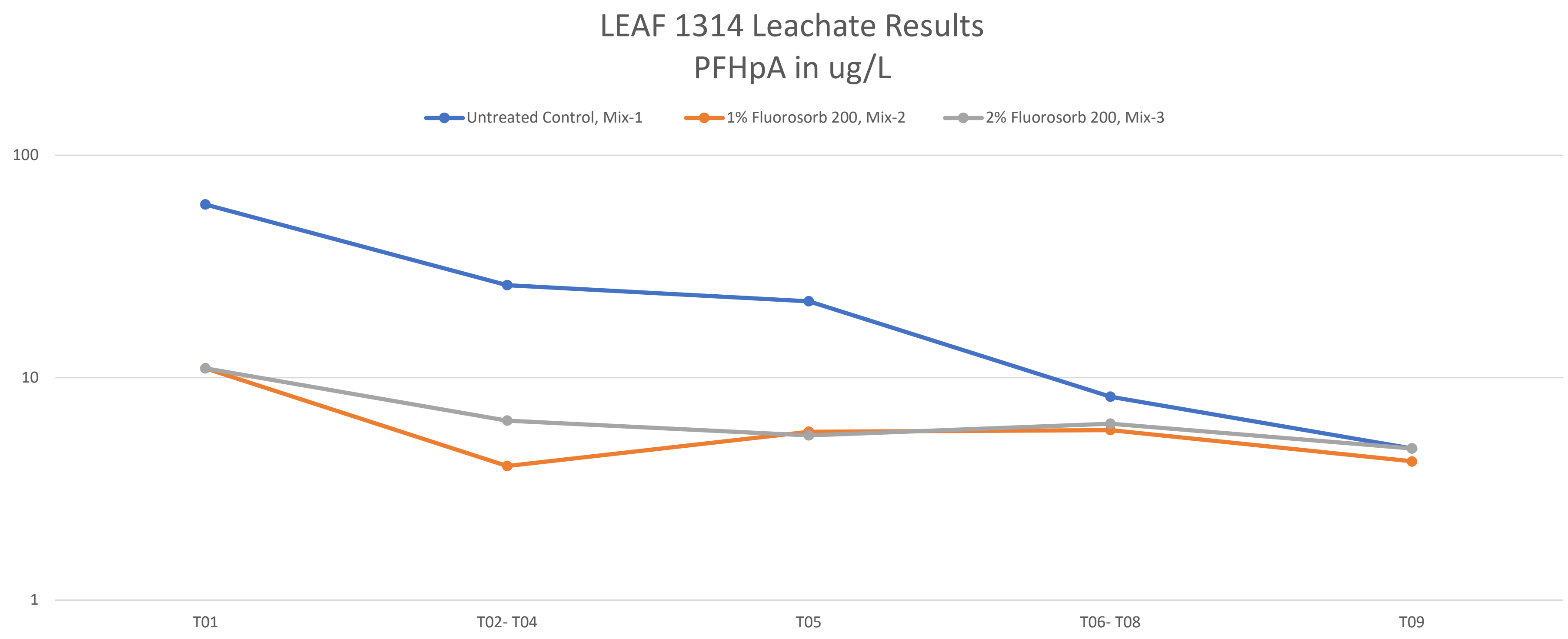

LEAF 1314 Leachate Results
PFHpA in ug/L
Untreated Control, Mix-1
1% Fluorosorb 200, Mix-2
2% Fluorosorb 200, Mix-3
100
10
1
T01
T02- T04
T05
T06- T08
T09

Figure 8.5

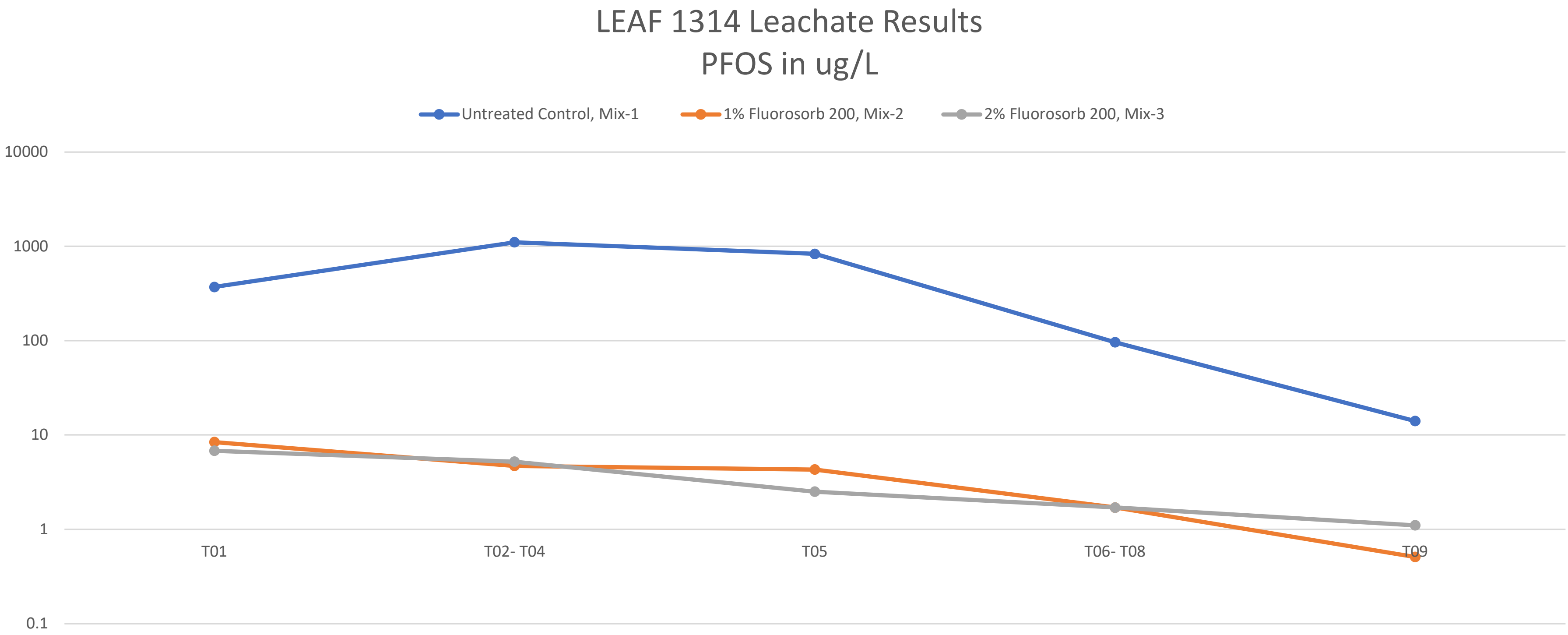

LEAF 1314 Leachate Results
PFOS in ug/L
Untreated Control, Mix-1
1% Fluorosorb 200, Mix-2
2% Fluorosorb 200, Mix-3
10000
1000
100
10
1
0.1
T01
T02- T04
T05
T06- T08
T09

Figure 9 – Test Pit Locations for Soil Stabilization Testing

LEGEND

- - -	Property Boundary
▬	Extents of Proposed Excavation
—	Creek and/or Swales
▚	Test Pit Location

Scale 1:2000
40 20 0 20 40
metres

Title:
TEST PIT LOCATIONS FOR
SOIL STABILIZATION TESTING

Project:
FFTA REMEDIATION
CFB COMOX, LAZO, BC

Client:
PUBLIC SERVICES AND PROCUREMENT
CANADA (PSPC) FOR THE DEPARTMENT OF
NATIONAL DEFENCE (DND)

Project Number:	Drawn By:	Plot Size:
30000397	NR/CB/PH	17X11"

ARCADIS

Date:
MAY 2020

FIGURE 9*

Stabilization Testing C:\Users\phegele\Desktop\CFB_Comox_Site Plans_RAP.dwg

APPENDIX A:
PHASE I – SITE SOIL BASELINE PFAS ANALYTICAL REPORT - SGS ORLANDO

SGS

Orlando, FL

01/16/20

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

ARCADIS

Comox Transport PFAS

SGS Job Number: FA71468

Sampling Date: 01/09/20

Report to:

ARCADIS
4915 Prospectus Dr Suite G
Durham, NC 27713
david.liles@arcadis-us.com; andrew.baumeister@arcadis.com

ATTN: David Liles

Total number of pages in report: **25**

NELAP ACCREDITED TNI LABORATORY

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Caitlin Brice

Caitlin Brice, M.S.
General Manager

Client Service contact: Andrea Colby 407-425-6700

Certifications: FL(E83510), LA(03051), KS(E-10327), IL(200063), NC(573), NJ(FL002), NY(12022), SC(96038001)
DoD ELAP(ANAB L2229), AZ(AZ0806), CA(2937), TX(T104704404), PA(68-03573), VA(460177),
AK, AR, IA, KY, MA, MS, ND, NH, NV, OK, OR, UT, WA, WV
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Test results relate only to samples analyzed.

Table of Contents

-1-

Sample Summary

ARCADIS

Comox Transport PFAS

Job No: FA71468

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
FA71468-1	01/09/20	14:00	RP	01/10/20	SO	Soil	TP19-01
FA71468-2	01/09/20	14:00	RP	01/10/20	SO	Soil	TP19-02
FA71468-3	01/09/20	14:00	RP	01/10/20	SO	Soil	TP19-03
FA71468-4	01/09/20	14:00	RP	01/10/20	SO	Soil	TP19-04
FA71468-5	01/09/20	14:00	RP	01/10/20	SO	Soil	TP19-05

This report contains results reported as ND = Not detected. The following applies:
Organics ND = Not detected above the MDL

Soil samples reported on a dry weight basis unless otherwise indicated on result page.

Summary of Hits

Job Number: FA71468
Account: ARCADIS
Project: Comox Transport PFAS
Collected: 01/09/20

Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
FA71468-1	**TP19-01**					
Perfluorohexanoic acid		8.08	1.2	0.24	ug/kg	EPA 537M BY ID
Perfluoroheptanoic acid		2.52	1.2	0.29	ug/kg	EPA 537M BY ID
Perfluorooctanoic acid		10.8	1.2	0.29	ug/kg	EPA 537M BY ID
Perfluorononanoic acid		1.15 J	1.2	0.29	ug/kg	EPA 537M BY ID
Perfluorodecanoic acid		0.330 J	1.2	0.29	ug/kg	EPA 537M BY ID
Perfluorobutanesulfonic acid		1.03 J	1.2	0.29	ug/kg	EPA 537M BY ID
Perfluorohexanesulfonic acid		27.8	1.2	0.29	ug/kg	EPA 537M BY ID
Perfluorooctanesulfonic acid		507	12	2.9	ug/kg	EPA 537M BY ID
FA71468-2	**TP19-02**					
Perfluorohexanoic acid [a]		25.6	11	2.1	ug/kg	EPA 537M BY ID
Perfluoroheptanoic acid [a]		9.19 J	11	2.6	ug/kg	EPA 537M BY ID
Perfluorooctanoic acid [a]		50.1	11	2.6	ug/kg	EPA 537M BY ID
Perfluorononanoic acid [a]		6.10 J	11	2.6	ug/kg	EPA 537M BY ID
Perfluorohexanesulfonic acid [a]		72.0	11	2.6	ug/kg	EPA 537M BY ID
Perfluorooctanesulfonic acid		4320	110	26	ug/kg	EPA 537M BY ID
EtFOSAA [a]		6.77 J	26	5.3	ug/kg	EPA 537M BY ID
FA71468-3	**TP19-03**					
Perfluorohexanoic acid [a]		7.18 J	12	2.3	ug/kg	EPA 537M BY ID
Perfluoroheptanoic acid [a]		3.88 J	12	2.9	ug/kg	EPA 537M BY ID
Perfluorooctanoic acid [a]		15.3	12	2.9	ug/kg	EPA 537M BY ID
Perfluorononanoic acid [a]		30.4	12	2.9	ug/kg	EPA 537M BY ID
Perfluorodecanoic acid [a]		5.62 J	12	2.9	ug/kg	EPA 537M BY ID
Perfluorohexanesulfonic acid [a]		30.2	12	2.9	ug/kg	EPA 537M BY ID
Perfluorooctanesulfonic acid		1340	58	15	ug/kg	EPA 537M BY ID
FA71468-4	**TP19-04**					
Perfluorohexanoic acid [a]		14.1	10	2.0	ug/kg	EPA 537M BY ID
Perfluoroheptanoic acid [a]		4.94 J	10	2.5	ug/kg	EPA 537M BY ID
Perfluorooctanoic acid [a]		12.4	10	2.5	ug/kg	EPA 537M BY ID
Perfluorononanoic acid [a]		7.81 J	10	2.5	ug/kg	EPA 537M BY ID
Perfluorobutanesulfonic acid [a]		5.55 J	10	2.5	ug/kg	EPA 537M BY ID
Perfluorohexanesulfonic acid [a]		68.0	10	2.5	ug/kg	EPA 537M BY ID
Perfluorooctanesulfonic acid		1680	51	13	ug/kg	EPA 537M BY ID
FA71468-5	**TP19-05**					
Perfluorohexanoic acid [a]		33.1	10	2.1	ug/kg	EPA 537M BY ID
Perfluoroheptanoic acid [a]		14.0	10	2.6	ug/kg	EPA 537M BY ID

Summary of Hits

Job Number: FA71468
Account: ARCADIS
Project: Comox Transport PFAS
Collected: 01/09/20

Lab Sample ID Client Sample ID Analyte	Result/ Qual	RL	MDL	Units	Method
Perfluorooctanoic acid [a]	38.7	10	2.6	ug/kg	EPA 537M BY ID
Perfluorononanoic acid [a]	35.7	10	2.6	ug/kg	EPA 537M BY ID
Perfluorodecanoic acid [a]	6.29 J	10	2.6	ug/kg	EPA 537M BY ID
Perfluorobutanesulfonic acid [a]	8.59 J	10	2.6	ug/kg	EPA 537M BY ID
Perfluorohexanesulfonic acid [a]	124	10	2.6	ug/kg	EPA 537M BY ID
Perfluorooctanesulfonic acid	10300	260	65	ug/kg	EPA 537M BY ID

(a) Dilution required due to matrix interference.

Sample Results

Report of Analysis

Report of Analysis

Client Sample ID: TP19-01
Lab Sample ID: FA71468-1
Matrix: SO - Soil
Method: EPA 537M BY ID IN HOUSE
Project: Comox Transport PFAS
Date Sampled: 01/09/20
Date Received: 01/10/20
Percent Solids: 84.4

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3Q14856.D	1	01/15/20 23:09	NG	01/13/20 09:00	OP78498	S3Q245
Run #2	3Q14857.D	10	01/15/20 23:24	NG	01/13/20 09:00	OP78498	S3Q245

	Initial Weight	Final Volume
Run #1	2.01 g	1.0 ml
Run #2	2.01 g	1.0 ml

EPA 537 Method List

CAS No.	Compound	Result	RL	MDL	Units	Q
PERFLUOROALKYLCARBOXYLIC ACIDS						
307-24-4	Perfluorohexanoic acid	8.08	1.2	0.24	ug/kg	
375-85-9	Perfluoroheptanoic acid	2.52	1.2	0.29	ug/kg	
335-67-1	Perfluorooctanoic acid	10.8	1.2	0.29	ug/kg	
375-95-1	Perfluorononanoic acid	1.15	1.2	0.29	ug/kg	J
335-76-2	Perfluorodecanoic acid	0.330	1.2	0.29	ug/kg	J
2058-94-8	Perfluoroundecanoic acid	ND	1.2	0.29	ug/kg	
307-55-1	Perfluorododecanoic acid	ND	1.2	0.29	ug/kg	
72629-94-8	Perfluorotridecanoic acid	ND	1.2	0.29	ug/kg	
376-06-7	Perfluorotetradecanoic acid	ND	1.2	0.29	ug/kg	
PERFLUOROALKYLSULFONATES						
375-73-5	Perfluorobutanesulfonic acid	1.03	1.2	0.29	ug/kg	J
355-46-4	Perfluorohexanesulfonic acid	27.8	1.2	0.29	ug/kg	
1763-23-1	Perfluorooctanesulfonic acid	507 [a]	12	2.9	ug/kg	
PERFLUOROOCTANESULFONAMIDOACETIC ACIDS						
2355-31-9	MeFOSAA	ND	2.9	0.59	ug/kg	
2991-50-6	EtFOSAA	ND	2.9	0.59	ug/kg	

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C5-PFHxA	87%	78%	50-150%
	13C4-PFHpA	95%	85%	50-150%
	13C8-PFOA	94%	87%	50-150%
	13C9-PFNA	71%	81%	50-150%
	13C6-PFDA	93%	85%	50-150%
	13C7-PFUnDA	99%	89%	50-150%
	13C2-PFDoDA	95%	86%	50-150%
	13C2-PFTeDA	93%	84%	50-150%
	13C3-PFBS	89%	81%	50-150%
	13C3-PFHxS	96%	89%	50-150%

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	TP19-01		
Lab Sample ID:	FA71468-1	**Date Sampled:**	01/09/20
Matrix:	SO - Soil	**Date Received:**	01/10/20
Method:	EPA 537M BY ID IN HOUSE	**Percent Solids:**	84.4
Project:	Comox Transport PFAS		

EPA 537 Method List

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C8-PFOS	72%	85%	50-150%
	d3-MeFOSAA	90%	85%	50-150%

(a) Result is from Run# 2

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	TP19-02		
Lab Sample ID:	FA71468-2	**Date Sampled:**	01/09/20
Matrix:	SO - Soil	**Date Received:**	01/10/20
Method:	EPA 537M BY ID IN HOUSE	**Percent Solids:**	94.1
Project:	Comox Transport PFAS		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	3Q14858.D	10	01/15/20 23:38	NG	01/13/20 09:00	OP78498	S3Q245
Run #2	3Q14859.D	100	01/15/20 23:52	NG	01/13/20 09:00	OP78498	S3Q245

	Initial Weight	Final Volume
Run #1	2.02 g	1.0 ml
Run #2	2.02 g	1.0 ml

EPA 537 Method List

CAS No.	Compound	Result	RL	MDL	Units	Q
PERFLUOROALKYLCARBOXYLIC ACIDS						
307-24-4	Perfluorohexanoic acid	25.6	11	2.1	ug/kg	
375-85-9	Perfluoroheptanoic acid	9.19	11	2.6	ug/kg	J
335-67-1	Perfluorooctanoic acid	50.1	11	2.6	ug/kg	
375-95-1	Perfluorononanoic acid	6.10	11	2.6	ug/kg	J
335-76-2	Perfluorodecanoic acid	ND	11	2.6	ug/kg	
2058-94-8	Perfluoroundecanoic acid	ND	11	2.6	ug/kg	
307-55-1	Perfluorododecanoic acid	ND	11	2.6	ug/kg	
72629-94-8	Perfluorotridecanoic acid	ND	11	2.6	ug/kg	
376-06-7	Perfluorotetradecanoic acid	ND	11	2.6	ug/kg	
PERFLUOROALKYLSULFONATES						
375-73-5	Perfluorobutanesulfonic acid	ND	11	2.6	ug/kg	
355-46-4	Perfluorohexanesulfonic acid	72.0	11	2.6	ug/kg	
1763-23-1	Perfluorooctanesulfonic acid	4320 [b]	110	26	ug/kg	
PERFLUOROOCTANESULFONAMIDOACETIC ACIDS						
2355-31-9	MeFOSAA	ND	26	5.3	ug/kg	
2991-50-6	EtFOSAA	6.77	26	5.3	ug/kg	J

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C5-PFHxA	79%	93%	50-150%
	13C4-PFHpA	86%	100%	50-150%
	13C8-PFOA	87%	102%	50-150%
	13C9-PFNA	68%	95%	50-150%
	13C6-PFDA	86%	99%	50-150%
	13C7-PFUnDA	90%	102%	50-150%
	13C2-PFDoDA	88%	99%	50-150%
	13C2-PFTeDA	84%	97%	50-150%
	13C3-PFBS	82%	92%	50-150%
	13C3-PFHxS	91%	100%	50-150%

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	TP19-02		
Lab Sample ID:	FA71468-2	**Date Sampled:**	01/09/20
Matrix:	SO - Soil	**Date Received:**	01/10/20
Method:	EPA 537M BY ID IN HOUSE	**Percent Solids:**	94.1
Project:	Comox Transport PFAS		

EPA 537 Method List

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C8-PFOS	73%	96%	50-150%
	d3-MeFOSAA	85%	104%	50-150%

(a) Dilution required due to matrix interference.
(b) Result is from Run# 2

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID: TP19-03
Lab Sample ID: FA71468-3
Matrix: SO - Soil
Method: EPA 537M BY ID IN HOUSE
Project: Comox Transport PFAS
Date Sampled: 01/09/20
Date Received: 01/10/20
Percent Solids: 85.6

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	3Q14860.D	10	01/16/20 00:07	NG	01/13/20 09:00	OP78498	S3Q245
Run #2	3Q14861.D	50	01/16/20 00:21	NG	01/13/20 09:00	OP78498	S3Q245

	Initial Weight	Final Volume
Run #1	2.01 g	1.0 ml
Run #2	2.01 g	1.0 ml

EPA 537 Method List

CAS No.	Compound	Result	RL	MDL	Units	Q
PERFLUOROALKYLCARBOXYLIC ACIDS						
307-24-4	Perfluorohexanoic acid	7.18	12	2.3	ug/kg	J
375-85-9	Perfluoroheptanoic acid	3.88	12	2.9	ug/kg	J
335-67-1	Perfluorooctanoic acid	15.3	12	2.9	ug/kg	
375-95-1	Perfluorononanoic acid	30.4	12	2.9	ug/kg	
335-76-2	Perfluorodecanoic acid	5.62	12	2.9	ug/kg	J
2058-94-8	Perfluoroundecanoic acid	ND	12	2.9	ug/kg	
307-55-1	Perfluorododecanoic acid	ND	12	2.9	ug/kg	
72629-94-8	Perfluorotridecanoic acid	ND	12	2.9	ug/kg	
376-06-7	Perfluorotetradecanoic acid	ND	12	2.9	ug/kg	
PERFLUOROALKYLSULFONATES						
375-73-5	Perfluorobutanesulfonic acid	ND	12	2.9	ug/kg	
355-46-4	Perfluorohexanesulfonic acid	30.2	12	2.9	ug/kg	
1763-23-1	Perfluorooctanesulfonic acid	1340 [b]	58	15	ug/kg	
PERFLUOROOCTANESULFONAMIDOACETIC ACIDS						
2355-31-9	MeFOSAA	ND	29	5.8	ug/kg	
2991-50-6	EtFOSAA	ND	29	5.8	ug/kg	

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C5-PFHxA	67%	97%	50-150%
	13C4-PFHpA	74%	105%	50-150%
	13C8-PFOA	75%	106%	50-150%
	13C9-PFNA	66%	98%	50-150%
	13C6-PFDA	74%	103%	50-150%
	13C7-PFUnDA	79%	107%	50-150%
	13C2-PFDoDA	75%	103%	50-150%
	13C2-PFTeDA	71%	100%	50-150%
	13C3-PFBS	70%	97%	50-150%
	13C3-PFHxS	77%	106%	50-150%

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	TP19-03		
Lab Sample ID:	FA71468-3	**Date Sampled:**	01/09/20
Matrix:	SO - Soil	**Date Received:**	01/10/20
Method:	EPA 537M BY ID IN HOUSE	**Percent Solids:**	85.6
Project:	Comox Transport PFAS		

EPA 537 Method List

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C8-PFOS	73%	101%	50-150%
	d3-MeFOSAA	64%	110%	50-150%

(a) Dilution required due to matrix interference.
(b) Result is from Run# 2

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: TP19-04
Lab Sample ID: FA71468-4
Matrix: SO - Soil
Method: EPA 537M BY ID IN HOUSE
Project: Comox Transport PFAS

Date Sampled: 01/09/20
Date Received: 01/10/20
Percent Solids: 89.3

	File ID	**DF**	**Analyzed**	**By**	**Prep Date**	**Prep Batch**	**Analytical Batch**
Run #1 [a]	3Q14862.D	10	01/16/20 00:35	NG	01/13/20 09:00	OP78498	S3Q245
Run #2	3Q14863.D	50	01/16/20 00:49	NG	01/13/20 09:00	OP78498	S3Q245

	Initial Weight	**Final Volume**
Run #1	2.20 g	1.0 ml
Run #2	2.20 g	1.0 ml

EPA 537 Method List

CAS No.	**Compound**	**Result**	**RL**	**MDL**	**Units**	**Q**
PERFLUOROALKYLCARBOXYLIC ACIDS						
307-24-4	Perfluorohexanoic acid	14.1	10	2.0	ug/kg	
375-85-9	Perfluoroheptanoic acid	4.94	10	2.5	ug/kg	J
335-67-1	Perfluorooctanoic acid	12.4	10	2.5	ug/kg	
375-95-1	Perfluorononanoic acid	7.81	10	2.5	ug/kg	J
335-76-2	Perfluorodecanoic acid	ND	10	2.5	ug/kg	
2058-94-8	Perfluoroundecanoic acid	ND	10	2.5	ug/kg	
307-55-1	Perfluorododecanoic acid	ND	10	2.5	ug/kg	
72629-94-8	Perfluorotridecanoic acid	ND	10	2.5	ug/kg	
376-06-7	Perfluorotetradecanoic acid	ND	10	2.5	ug/kg	
PERFLUOROALKYLSULFONATES						
375-73-5	Perfluorobutanesulfonic acid	5.55	10	2.5	ug/kg	J
355-46-4	Perfluorohexanesulfonic acid	68.0	10	2.5	ug/kg	
1763-23-1	Perfluorooctanesulfonic acid	1680 [b]	51	13	ug/kg	
PERFLUOROOCTANESULFONAMIDOACETIC ACIDS						
2355-31-9	MeFOSAA	ND	25	5.1	ug/kg	
2991-50-6	EtFOSAA	ND	25	5.1	ug/kg	

CAS No.	**ID Standard Recoveries**	**Run# 1**	**Run# 2**	**Limits**
	13C5-PFHxA	84%	89%	50-150%
	13C4-PFHpA	89%	97%	50-150%
	13C8-PFOA	91%	99%	50-150%
	13C9-PFNA	79%	91%	50-150%
	13C6-PFDA	90%	97%	50-150%
	13C7-PFUnDA	95%	100%	50-150%
	13C2-PFDoDA	91%	97%	50-150%
	13C2-PFTeDA	87%	95%	50-150%
	13C3-PFBS	81%	90%	50-150%
	13C3-PFHxS	91%	99%	50-150%

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	TP19-04		
Lab Sample ID:	FA71468-4	**Date Sampled:**	01/09/20
Matrix:	SO - Soil	**Date Received:**	01/10/20
Method:	EPA 537M BY ID IN HOUSE	**Percent Solids:**	89.3
Project:	Comox Transport PFAS		

EPA 537 Method List

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C8-PFOS	85%	93%	50-150%
	d3-MeFOSAA	87%	104%	50-150%

(a) Dilution required due to matrix interference.
(b) Result is from Run# 2

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	TP19-05		
Lab Sample ID:	FA71468-5	**Date Sampled:**	01/09/20
Matrix:	SO - Soil	**Date Received:**	01/10/20
Method:	EPA 537M BY ID IN HOUSE	**Percent Solids:**	88.8
Project:	Comox Transport PFAS		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	3Q14866.D	10	01/16/20 01:32	NG	01/13/20 09:00	OP78498	S3Q245
Run #2	3Q14867.D	250	01/16/20 01:47	NG	01/13/20 09:00	OP78498	S3Q245

	Initial Weight	Final Volume
Run #1	2.16 g	1.0 ml
Run #2	2.16 g	1.0 ml

EPA 537 Method List

CAS No.	Compound	Result	RL	MDL	Units	Q
PERFLUOROALKYLCARBOXYLIC ACIDS						
307-24-4	Perfluorohexanoic acid	33.1	10	2.1	ug/kg	
375-85-9	Perfluoroheptanoic acid	14.0	10	2.6	ug/kg	
335-67-1	Perfluorooctanoic acid	38.7	10	2.6	ug/kg	
375-95-1	Perfluorononanoic acid	35.7	10	2.6	ug/kg	
335-76-2	Perfluorodecanoic acid	6.29	10	2.6	ug/kg	J
2058-94-8	Perfluoroundecanoic acid	ND	10	2.6	ug/kg	
307-55-1	Perfluorododecanoic acid	ND	10	2.6	ug/kg	
72629-94-8	Perfluorotridecanoic acid	ND	10	2.6	ug/kg	
376-06-7	Perfluorotetradecanoic acid	ND	10	2.6	ug/kg	
PERFLUOROALKYLSULFONATES						
375-73-5	Perfluorobutanesulfonic acid	8.59	10	2.6	ug/kg	J
355-46-4	Perfluorohexanesulfonic acid	124	10	2.6	ug/kg	
1763-23-1	Perfluorooctanesulfonic acid	10300 [b]	260	65	ug/kg	
PERFLUOROOCTANESULFONAMIDOACETIC ACIDS						
2355-31-9	MeFOSAA	ND	26	5.2	ug/kg	
2991-50-6	EtFOSAA	ND	26	5.2	ug/kg	

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C5-PFHxA	66%	93%	50-150%
	13C4-PFHpA	72%	101%	50-150%
	13C8-PFOA	72%	102%	50-150%
	13C9-PFNA	55%	94%	50-150%
	13C6-PFDA	74%	101%	50-150%
	13C7-PFUnDA	77%	105%	50-150%
	13C2-PFDoDA	75%	101%	50-150%
	13C2-PFTeDA	71%	97%	50-150%
	13C3-PFBS	70%	93%	50-150%
	13C3-PFHxS	74%	102%	50-150%

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	TP19-05		
Lab Sample ID:	FA71468-5	**Date Sampled:**	01/09/20
Matrix:	SO - Soil	**Date Received:**	01/10/20
Method:	EPA 537M BY ID IN HOUSE	**Percent Solids:**	88.8
Project:	Comox Transport PFAS		

EPA 537 Method List

CAS No.	ID Standard Recoveries	Run# 1	Run# 2	Limits
	13C8-PFOS	58%	96%	50-150%
	d3-MeFOSAA	64%	109%	50-150%

(a) Dilution required due to matrix interference.
(b) Result is from Run# 2

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Certification Exceptions
- Chain of Custody

Parameter Certification Exceptions

Job Number: FA71468
Account: ARCNCR ARCADIS
Project: Comox Transport PFAS

The following parameters included in this report are exceptions to NELAC certification.
The certification status of each is indicated below.

Parameter	CAS#	Method	Mat	Certification Status
EtFOSAA	2991-50-6	**EPA 537M BY ID**	SO	Certified by SOP MS014
MeFOSAA	2355-31-9	**EPA 537M BY ID**	SO	Certified by SOP MS014
Perfluorobutanesulfonic acid	375-73-5	**EPA 537M BY ID**	SO	Certified by SOP MS014
Perfluorodecanoic acid	335-76-2	**EPA 537M BY ID**	SO	Certified by SOP MS014
Perfluorododecanoic acid	307-55-1	**EPA 537M BY ID**	SO	Certified by SOP MS014
Perfluoroheptanoic acid	375-85-9	**EPA 537M BY ID**	SO	Certified by SOP MS014
Perfluorohexanesulfonic acid	355-46-4	**EPA 537M BY ID**	SO	Certified by SOP MS014
Perfluorohexanoic acid	307-24-4	**EPA 537M BY ID**	SO	Certified by SOP MS014
Perfluorononanoic acid	375-95-1	**EPA 537M BY ID**	SO	Certified by SOP MS014
Perfluorooctanesulfonic acid	1763-23-1	**EPA 537M BY ID**	SO	Certified by SOP MS014
Perfluorooctanoic acid	335-67-1	**EPA 537M BY ID**	SO	Certified by SOP MS014
Perfluorotetradecanoic acid	376-06-7	**EPA 537M BY ID**	SO	Certified by SOP MS014
Perfluorotridecanoic acid	72629-94-8	**EPA 537M BY ID**	SO	Certified by SOP MS014
Perfluoroundecanoic acid	2058-94-8	**EPA 537M BY ID**	SO	Certified by SOP MS014

ARCADIS

ID#:

CHAIN OF CUSTODY & LABORATORY ANALYSIS REQUEST FORM

Page 1 of 1

Lab Work Order#: FA71468

Send Results to:

Contact & Company Name: ARCADIS Dave Liles

Telephone: (919) 328-5574

Address: 4915 Prospectus Drive STE B

Fax:

City: Durham State: NC Zip: 27713

E-mail Address: david.liles@arcadis.com

Project Name/Location (City, State): Comox Transport Canada

Project #: 30039878.0006

Sampler's Printed Name: Robert Prigge

Sampler's Signature:

Preservative: None

Filtered (✓):

# of Containers:

Container Information:

PARAMETER ANALYSIS & METHOD

Keys

Preservation Key:	Container Information Key:
A. H_2SO_4	1. 40 ml Vial
B. HCL	2. 1 L Amber
C. HNO_3	3. 250 ml Plastic
D. NaOH	4. 500 ml Plastic
E. None	5. Encore
F. Other: ______	6. 2 oz. Glass
G. Other: ______	7. 4 oz. Glass
	8. 8 oz. Glass
H. Other: ______	9. Other: ______
	10. Other: ______

Matrix Key:

SO - Soil	SE - Sediment	NL - NAPL/Oil
W - Water	SL - Sludge	SW - Sample Wipe
T - Tissue	A - Air	Other: ______

	Sample ID	Collection Date	Collection Time	Type (✓) Comp	Type (✓) Grab	Matrix	PFAS LLID 537LIST							REMARKS
1	TP19-01	01/09/20	1400	✓		SO	X							
2	TP19-02	↓	↓	✓		SO	X							
3	TP19-03	↓	↓	✓		SO	X							
4	TP19-04	↓	↓	✓		SO	X							
5	TP19-05	↓	↓	✓		SO	X							

Special Instructions/Comments:

☐ Special QA/QC Instructions(✓):

Laboratory Information and Receipt

Lab Name:

☐ Cooler packed with ice (✓)

Specify Turnaround Requirements:

Shipping Tracking #:

Cooler Custody Seal (✓)

☐ Intact ☐ Not Intact

Sample Receipt:

Condition/Cooler Temp: ______

	Relinquished By	Received By	Relinquished By	Laboratory Received By
Printed Name:	Robert Prigge	FedEX	Fx	Trinity Martel
Signature:				
Firm:	ARCADIS	FedEX		SGS
Date/Time:	01/09/20 1600	01/09/20 1600		1/10/20 @ 8:50

20730826 CofC AR Form 08.27.2015

1.3°

Distribution: WHITE – Laboratory returns with results YELLOW – Lab copy PINK – Retained by Arcadis

SGS Sample Receipt Summary

Job Number: FA71468 **Client:** ARCADIS **Project:** COMOX TRANSPORT CANADA

Date / Time Received: 1/10/2020 8:50:00 AM **Delivery Method:** FED EX **Airbill #'s:**

Therm ID: IR 1; **Therm CF:** -0.8; **# of Coolers:** 1

Cooler Temps (Raw Measured) °C: Cooler 1: (2.1);

Cooler Temps (Corrected) °C: Cooler 1: (1.3);

Cooler Information	**Y**	**or**	**N**
1. Custody Seals Present	☑		☐
2. Custody Seals Intact	☑		☐
3. Temp criteria achieved	☑		☐
4. Cooler temp verification	IR Gun		
5. Cooler media	Ice (Bag)		

Trip Blank Information	**Y**	**or**	**N**	**N/A**
1. Trip Blank present / cooler	☐		☑	☐
2. Trip Blank listed on COC	☐		☑	☐

	W	**or**	**S**	**N/A**
3. Type Of TB Received	☐		☐	☑

Sample Information	**Y**	**or**	**N**	**N/A**
1. Sample labels present on bottles	☑		☐	
2. Samples preserved properly	☑		☐	
3. Sufficient volume/containers recvd for analysis:	☑		☐	
4. Condition of sample	Intact			
5. Sample recvd within HT	☑		☐	
6. Dates/Times/IDs on COC match Sample Label	☑		☐	
7. VOCs have headspace	☐		☐	☑
8. Bottles received for unspecified tests	☐		☑	
9. Compositing instructions clear	☐		☐	☑
10. Voa Soil Kits/Jars received past 48hrs?	☐		☐	☑
11. % Solids Jar received?	☐		☐	☑
12. Residual Chlorine Present?	☐		☐	☑

Misc. Information

Number of Encores: 25-Gram ______ 5-Gram ______ Number of 5035 Field Kits: ______ Number of Lab Filtered Metals: ______

Test Strip Lot #s: pH 0-3 230315 pH 10-12 219813A Other: (Specify) ______ ______

Residual Chlorine Test Strip Lot #: ______

Comments

SM001
Rev. Date 05/24/17

Technician: TRINITYM Date: 1/10/2020 8:50:00 AM Reviewer: ______ Date: ______

MS Semi-volatiles

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

Method Blank Summary

Job Number: FA71468
Account: ARCNCR ARCADIS
Project: Comox Transport PFAS

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP78498-MB	3Q14821.D	1	01/15/20	NG	01/13/20	OP78498	S3Q245

The QC reported here applies to the following samples: **Method:** EPA 537M BY ID

FA71468-1, FA71468-2, FA71468-3, FA71468-4, FA71468-5

CAS No.	Compound	Result	RL	MDL	Units	Q
307-24-4	Perfluorohexanoic acid	ND	1.0	0.20	ug/kg	
375-85-9	Perfluoroheptanoic acid	ND	1.0	0.25	ug/kg	
335-67-1	Perfluorooctanoic acid	ND	1.0	0.25	ug/kg	
375-95-1	Perfluorononanoic acid	ND	1.0	0.25	ug/kg	
335-76-2	Perfluorodecanoic acid	ND	1.0	0.25	ug/kg	
2058-94-8	Perfluoroundecanoic acid	ND	1.0	0.25	ug/kg	
307-55-1	Perfluorododecanoic acid	ND	1.0	0.25	ug/kg	
72629-94-8	Perfluorotridecanoic acid	ND	1.0	0.25	ug/kg	
376-06-7	Perfluorotetradecanoic acid	ND	1.0	0.25	ug/kg	
375-73-5	Perfluorobutanesulfonic acid	ND	1.0	0.25	ug/kg	
355-46-4	Perfluorohexanesulfonic acid	ND	1.0	0.25	ug/kg	
1763-23-1	Perfluorooctanesulfonic acid	ND	1.0	0.25	ug/kg	
2355-31-9	MeFOSAA	ND	2.5	0.50	ug/kg	
2991-50-6	EtFOSAA	ND	2.5	0.50	ug/kg	

CAS No.	ID Standard Recoveries		Limits
	13C4-PFBA	99%	50-150%
	13C5-PFPeA	103%	50-150%
	13C5-PFHxA	103%	50-150%
	13C4-PFHpA	106%	50-150%
	13C8-PFOA	110%	50-150%
	13C9-PFNA	107%	50-150%
	13C6-PFDA	106%	50-150%
	13C7-PFUnDA	107%	50-150%
	13C2-PFDoDA	106%	50-150%
	13C2-PFTeDA	109%	50-150%
	13C3-PFBS	101%	50-150%
	13C3-PFHxS	106%	50-150%
	13C8-PFOS	105%	50-150%
	13C8-FOSA	109%	50-150%
	d3-MeFOSAA	105%	50-150%
	13C2-4:2FTS	96%	50-150%
	13C2-6:2FTS	102%	50-150%
	13C2-8:2FTS	100%	50-150%

Instrument Blank

Job Number: FA71468
Account: ARCNCR ARCADIS
Project: Comox Transport PFAS

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
S3Q245-IBLK	3Q14815.D	1	01/15/20	NG	n/a	n/a	S3Q245

The QC reported here applies to the following samples: **Method:** EPA 537M QSM5.1 B-15

FA71468-1, FA71468-2, FA71468-3, FA71468-4, FA71468-5

CAS No.	Compound	Result	RL	MDL	Units	Q
307-24-4	Perfluorohexanoic acid	ND	1.0	0.20	ug/kg	
375-85-9	Perfluoroheptanoic acid	ND	1.0	0.25	ug/kg	
335-67-1	Perfluorooctanoic acid	ND	1.0	0.25	ug/kg	
375-95-1	Perfluorononanoic acid	ND	1.0	0.25	ug/kg	
335-76-2	Perfluorodecanoic acid	ND	1.0	0.25	ug/kg	
2058-94-8	Perfluoroundecanoic acid	ND	1.0	0.25	ug/kg	
307-55-1	Perfluorododecanoic acid	ND	1.0	0.25	ug/kg	
72629-94-8	Perfluorotridecanoic acid	ND	1.0	0.25	ug/kg	
376-06-7	Perfluorotetradecanoic acid	ND	1.0	0.25	ug/kg	
375-73-5	Perfluorobutanesulfonic acid	ND	1.0	0.25	ug/kg	
355-46-4	Perfluorohexanesulfonic acid	ND	1.0	0.25	ug/kg	
1763-23-1	Perfluorooctanesulfonic acid	ND	1.0	0.25	ug/kg	
2355-31-9	MeFOSAA	ND	2.5	0.50	ug/kg	
2991-50-6	EtFOSAA	ND	2.5	0.50	ug/kg	

CAS No.	ID Standard Recoveries		Limits
	13C4-PFBA	100%	50-150%
	13C5-PFPeA	101%	50-150%
	13C5-PFHxA	101%	50-150%
	13C4-PFHpA	102%	50-150%
	13C8-PFOA	104%	50-150%
	13C9-PFNA	103%	50-150%
	13C6-PFDA	104%	50-150%
	13C7-PFUnDA	103%	50-150%
	13C2-PFDoDA	103%	50-150%
	13C2-PFTeDA	102%	50-150%
	13C3-PFBS	100%	50-150%
	13C3-PFHxS	103%	50-150%
	13C8-PFOS	102%	50-150%
	13C8-FOSA	107%	50-150%
	d3-MeFOSAA	102%	50-150%
	13C2-4:2FTS	94%	50-150%
	13C2-6:2FTS	97%	50-150%
	13C2-8:2FTS	96%	50-150%

Blank Spike Summary

Job Number: FA71468
Account: ARCNCR ARCADIS
Project: Comox Transport PFAS

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP78498-BS	3Q14820.D	1	01/15/20	NG	01/13/20	OP78498	S3Q245

The QC reported here applies to the following samples: **Method:** EPA 537M BY ID

FA71468-1, FA71468-2, FA71468-3, FA71468-4, FA71468-5

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
307-24-4	Perfluorohexanoic acid	10	7.76	78	63-130
375-85-9	Perfluoroheptanoic acid	10	7.69	77	63-122
335-67-1	Perfluorooctanoic acid	10	7.72	77	71-128
375-95-1	Perfluorononanoic acid	10	7.61	76	66-124
335-76-2	Perfluorodecanoic acid	10	7.70	77	68-127
2058-94-8	Perfluoroundecanoic acid	10	7.59	76	61-137
307-55-1	Perfluorododecanoic acid	10	7.64	76	71-126
72629-94-8	Perfluorotridecanoic acid	10	7.35	74	60-137
376-06-7	Perfluorotetradecanoic acid	10	7.64	76	61-131
375-73-5	Perfluorobutanesulfonic acid	10	7.71	77	70-135
355-46-4	Perfluorohexanesulfonic acid	10	7.68	77	72-129
1763-23-1	Perfluorooctanesulfonic acid	10	7.52	75	69-125
2355-31-9	MeFOSAA	10	7.60	76	71-124
2991-50-6	EtFOSAA	10	8.04	80	63-129

CAS No.	ID Standard Recoveries	BSP	Limits
	13C4-PFBA	104%	50-150%
	13C5-PFPeA	108%	50-150%
	13C5-PFHxA	107%	50-150%
	13C4-PFHpA	111%	50-150%
	13C8-PFOA	113%	50-150%
	13C9-PFNA	110%	50-150%
	13C6-PFDA	109%	50-150%
	13C7-PFUnDA	110%	50-150%
	13C2-PFDoDA	110%	50-150%
	13C2-PFTeDA	115%	50-150%
	13C3-PFBS	107%	50-150%
	13C3-PFHxS	111%	50-150%
	13C8-PFOS	110%	50-150%
	13C8-FOSA	109%	50-150%
	d3-MeFOSAA	112%	50-150%
	13C2-4:2FTS	105%	50-150%
	13C2-6:2FTS	109%	50-150%
	13C2-8:2FTS	107%	50-150%

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* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: FA71468
Account: ARCNCR ARCADIS
Project: Comox Transport PFAS

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP78498-MS	3Q14846.D	1	01/15/20	NG	01/13/20	OP78498	S3Q245
OP78498-MSD	3Q14848.D	1	01/15/20	NG	01/13/20	OP78498	S3Q245
FA71310-1	3Q14844.D	1	01/15/20	NG	01/13/20	OP78498	S3Q245

The QC reported here applies to the following samples: **Method:** EPA 537M BY ID

FA71468-1, FA71468-2, FA71468-3, FA71468-4, FA71468-5

CAS No.	Compound	FA71310-1 ug/kg	Q	Spike ug/kg	MS ug/kg	MS %	Spike ug/kg	MSD ug/kg	MSD %	RPD	Limits Rec/RPD
307-24-4	Perfluorohexanoic acid	ND		21.8	17.9	82	20.1	16.7	83	7	63-130/30
375-85-9	Perfluoroheptanoic acid	ND		21.8	17.9	82	20.1	16.8	84	6	63-122/30
335-67-1	Perfluorooctanoic acid	ND		21.8	18.1	83	20.1	16.8	84	7	71-128/30
375-95-1	Perfluorononanoic acid	ND		21.8	17.8	82	20.1	16.7	83	6	66-124/30
335-76-2	Perfluorodecanoic acid	ND		21.8	17.6	81	20.1	16.4	82	7	68-127/30
2058-94-8	Perfluoroundecanoic acid	ND		21.8	17.6	81	20.1	16.6	83	6	61-137/30
307-55-1	Perfluorododecanoic acid	ND		21.8	17.7	81	20.1	16.7	83	6	71-126/30
72629-94-8	Perfluorotridecanoic acid	ND		21.8	19.4	89	20.1	18.6	93	4	60-137/30
376-06-7	Perfluorotetradecanoic acid	ND		21.8	17.7	81	20.1	16.8	84	5	61-131/30
375-73-5	Perfluorobutanesulfonic acid	ND		21.8	18.0	83	20.1	16.9	84	6	70-135/30
355-46-4	Perfluorohexanesulfonic acid	ND		21.8	17.7	81	20.1	16.7	83	6	72-129/30
1763-23-1	Perfluorooctanesulfonic acid	ND		21.8	17.9	82	20.1	16.6	83	8	69-125/30
2355-31-9	MeFOSAA	ND		21.8	17.4	80	20.1	16.5	82	5	71-124/30
2991-50-6	EtFOSAA	ND		21.8	18.7	86	20.1	18.4	92	2	63-129/30

CAS No.	ID Standard Recoveries	MS	MSD	FA71310-1	Limits
	13C4-PFBA	84%	86%	73%	50-150%
	13C5-PFPeA	85%	86%	73%	50-150%
	13C5-PFHxA	85%	87%	74%	50-150%
	13C4-PFHpA	91%	92%	79%	50-150%
	13C8-PFOA	93%	95%	82%	50-150%
	13C9-PFNA	89%	91%	78%	50-150%
	13C6-PFDA	90%	92%	78%	50-150%
	13C7-PFUnDA	92%	94%	80%	50-150%
	13C2-PFDoDA	96%	98%	81%	50-150%
	13C2-PFTeDA	82%	82%	58%	50-150%
	13C3-PFBS	88%	89%	75%	50-150%
	13C3-PFHxS	94%	95%	81%	50-150%
	13C8-PFOS	92%	94%	80%	50-150%
	13C8-FOSA	75%	80%	78%	50-150%
	d3-MeFOSAA	83%	83%	68%	50-150%
	13C2-4:2FTS	84%	85%	69%	50-150%
	13C2-6:2FTS	91%	93%	76%	50-150%
	13C2-8:2FTS	90%	92%	75%	50-150%

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* = Outside of Control Limits.

APPENDIX B:
PHASE I - GEOTECHNICS REPORT

geotechnics
geotechnical & geosynthetic testing

February 14, 2020

Project No. R-2020-037-001

Mr. Andrew Baumeister
David.Liles@arcadis-us.com
Arcadis U.S., Inc.
4915 Prospectus Drive, Suite F
Durham, NC 27713

Andrew.Baumeister@arcadis-us.com

Transmittal
Laboratory Test Results
Comox

Please find attached the laboratory test results for the above referenced project. The tests were outlined on the Project Verification Form that was transmitted to your firm prior to the testing. The testing was performed in general accordance with the methods listed on the enclosed data sheets. The test results are believed to be representative of the samples that were submitted for testing and are indicative only of the specimens which were evaluated. We have no direct knowledge of the origin of the samples and imply no position with regard to the nature of the test results, i.e. pass/fail and no claims as to the suitability of the material for its intended use.

The test data and all associated project information provided shall be held in strict confidence and disclosed to other parties only with authorization by our Client. The test data submitted herein is considered integral with this report and is not to be reproduced except in whole and only with the authorization of the Client and Geotechnics. The remaining sample materials for this project will be retained for a minimum of 90 days as directed by the Geotechnics' Quality Program.

We are pleased to provide these testing services. Should you have any questions or if we may be of further assistance, please contact our office.

Respectively submitted,
Geotechnics, Inc.

Michael P. Sm

Michael P. Smith
Regional Manager

We understand that you have a choice in your laboratory services
and we thank you for choosing Geotechnics.

MOISTURE CONTENT

ASTM D 2216-10

Client:	Arcadis U.S.
Client Reference:	Comox
Project No.:	R-2020-037-001

Lab ID:	001
Boring No.:	NA
Depth (ft):	NA
Sample No.:	CFB Comox Homogenate
Tare Number	RF-7
Wt. of Tare & Wet Sample (g)	70.09
Wt. of Tare & Dry Sample (g)	64.44
Weight of Tare (g)	23.99
Weight of Water (g)	5.65
Weight of Dry Sample (g)	40.45
Water Content (%)	**14.0**

Notes :

Tested By	*RFF*	*Date*	*2/13/20*	*Checked By*	*GEM*	*Date*	*2/14/20*

Moisture, Ash, and Organic Matter (Loss on Ignition)

ASTM D 2974-14

Client:	Arcadis U.S.
Client Reference:	Comox
Project No.:	R-2020-037-001

Method B (To 0.1%)

Moisture Content

ASTM D2216

Lab ID:	001
Boring No.:	NA
Depth (ft):	NA
Sample No.:	CFB Comox Homogenate
Tare Number	RF-7
Weight of Tare & Wet Sample (g)	70.09
Weight of Tare & Dry Sample (g)	64.44
Weight of Tare (g)	23.99
Weight of Water (g)	5.65
Weight of Dry Sample (g)	40.45
Moisture Content	**14.0%**

Method C

Ash Content, Organic Matter

Furnace Temperature (°C)	440
Weight of Tare & Ash (g)	62.02
Weight of Volatiles (g)	2.42
Weight of Ash (g)	38.03
Ash Content (%)	**94.0%**
Organic Matter (%)	**6.0%**

Tested By *RFF* *Date* *2/13/20* *Checked By* *GEM* *Date* 2/14/20

SIEVE AND HYDROMETER ANALYSIS

ASTM D 422-63 (2007)

Client	Arcadis U.S.	Boring No.	NA
Client Reference	Comox	Depth (ft)	NA
Project No.	R-2020-037-001	Sample No.	CFB Comox Homogenate
Lab ID	R-2020-037-001-001	Soil Color	**BROWN**

USCS Summary

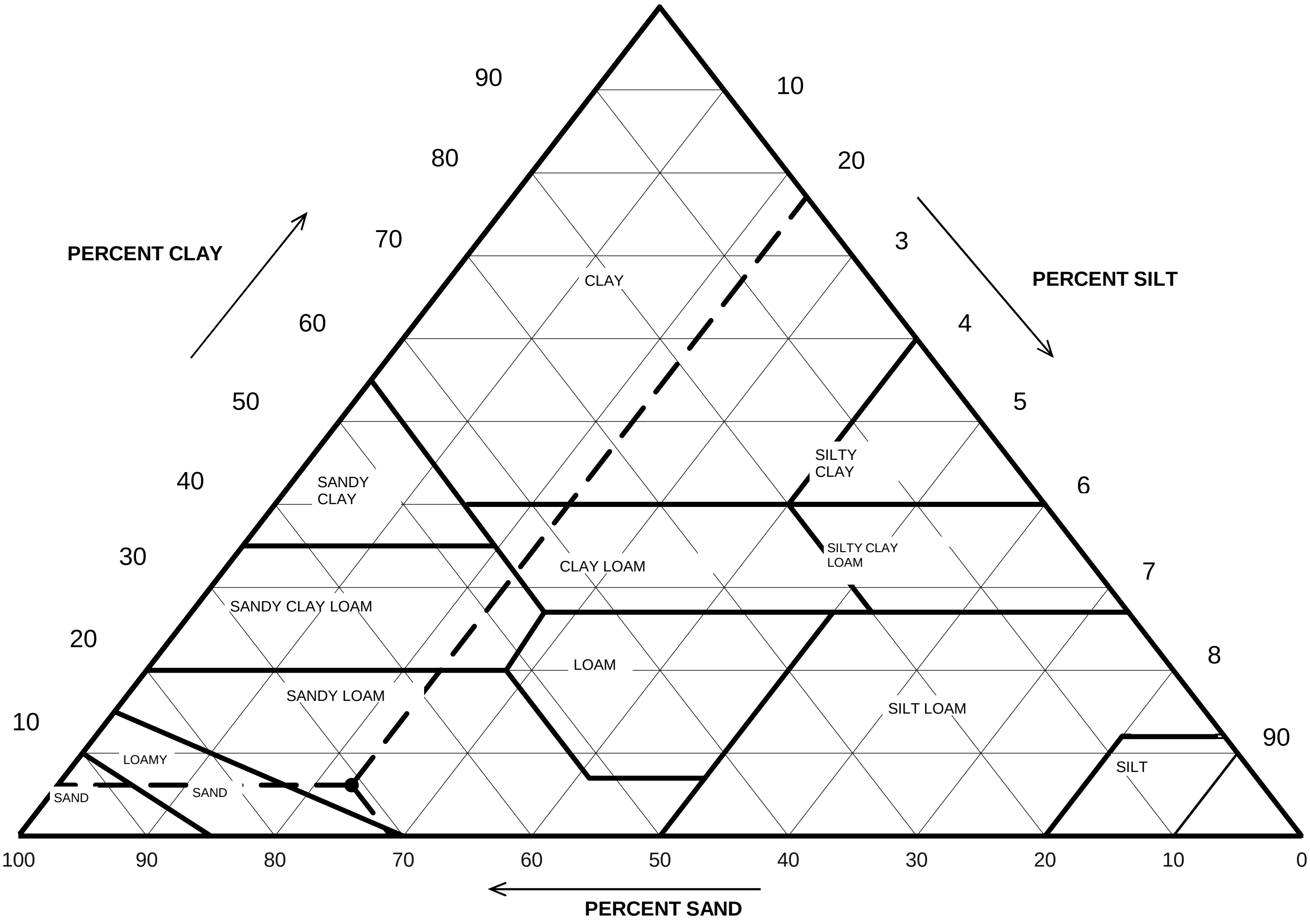
Sieve Sizes (mm)		Percentage
Greater Than #4	*Gravel*	18.94
#4 To #200	*Sand*	54.61
Finer Than #200	*Silt & Clay*	26.45

USCS Symbol ***SM, TESTED***

USCS Classification ***SILTY SAND WITH GRAVEL***

USDA CLASSIFICATION CHART

Client	Arcadis U.S.	Boring No.	NA
Client Reference	Comox	Depth (ft)	NA
Project No.	R-2020-037-001	Sample No.	CFB Comox Homogenate
Lab ID	R-2020-037-001-001	Soil Color	BROWN



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	30.00	**0.00**
2	70.00	*Sand*	49.67	**70.96**
0.05	20.33	*Silt*	16.03	**22.90**
0.002	4.30	*Clay*	4.30	**6.14**

USDA Classification: ***SANDY LOAM***

WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client	Arcadis U.S.	Boring No.	NA
Client Reference	Comox	Depth (ft)	NA
Project No.	R-2020-037-001	Sample No.	CFB Comox Homogenate
Lab ID	R-2020-037-001-001	Soil Color	**BROWN**

Minus #10 for Hygroscopic Moisture Content		**Hydrometer Specimen Data**	
Tare No.	A	Air Dried - #10 Hydrometer Material (g)	88.93
Wgt.Tare + Wet Soil (g)	46.82	Corrected Dry Wt. of - #10 Material (g)	85.47
Wgt.Tare + Dry Soil (g)	45.59		
Weight of Tare (g)	15.22	Weight of - #200 Material (g)	32.29
Weight of Water (g)	1.23	Weight of - #10 ; + #200 Material (g)	53.18
Weight of Dry Soil (g)	30.37		
Moisture Content (%)	**4.1**	**J-FACTOR (%FINER THAN #10)**	**70.00%**

Soil Specimen Data

Tare No.	300		
Wgt.Tare + Air Dry Soil (g)	346.41		
Weight of Tare (g)	110.45		
Air Dried Wgt. Total Sample (g)	235.96	Dry Weight of Material Retained on #10 (g)	68.83
Total Dry Sample Weight (g)	229.45	Corrected Dry Sample Wt - #10 (g)	160.62

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.0	0.0	100.0	**100.0**
6"	150	0.00	0.0	0.0	100.0	**100.0**
3"	75	0.00	0.0	0.0	100.0	**100.0**
2"	50	0.00	0.0	0.0	100.0	**100.0**
1 1/2"	37.5	0.00	0.0	0.0	100.0	**100.0**
1"	25.0	0.00	0.0	0.0	100.0	**100.0**
3/4"	19.0	0.00	0.0	0.0	100.0	**100.0**
1/2"	12.5	29.15	12.7	12.7	87.3	**87.3**
3/8"	9.50	3.26	1.4	14.1	85.9	**85.9**
#4	4.75	11.06	4.8	18.9	81.1	**81.1**
#10	2.00	25.36	11.1	30.0	70.0	**70.0**
#20	0.85	6.37	7.5	7.5	92.5	**64.8**
#40	0.425	10.23	12.0	19.4	80.6	**56.4**
#60	0.250	14.09	16.5	35.9	64.1	**44.9**
#140	0.106	18.85	22.1	58.0	42.0	**29.4**
#200	0.075	3.64	4.3	62.2	37.8	**26.4**
Pan	-	32.29	37.8	100.0	-	**-**

Notes :

Tested By RFF Date 2/14/20 Checked By GEM Date 2/14/20

HYDROMETER ANALYSIS

ASTM D 422-63 (2007)

Client	Arcadis U.S.	Boring No.	NA
Client Reference	Comox	Depth (ft)	NA
Project No.	R-2020-037-001	Sample No.	CFB Comox Homogenate
Lab ID	R-2020-037-001-001	Soil Color	**BROWN**

Elapsed Time (min)	R Measured	Temp. (°C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	23.0	23	5.96	17.0	19.7	0.01297	0.0325	**13.8**
5	21.0	23	5.96	15.0	17.4	0.01297	0.0208	**12.2**
15	19.0	23	5.96	13.0	15.1	0.01297	0.0122	**10.6**
30	17.0	23	5.96	11.0	12.8	0.01297	0.0087	**9.0**
60	15.0	23	5.96	9.0	10.5	0.01297	0.0062	**7.3**
250	12.0	23.7	5.71	6.3	7.3	0.01287	0.0031	**5.1**
1440	11.0	21.1	6.62	4.4	5.1	0.01327	0.0013	**3.5**

Soil Specimen Data		**Other Corrections**	
Wgt. of Dry Material (g)	85.47	Hygroscopic Moisture Factor	0.961
Weight of Deflocculant (g)	5.0		
		a - Factor	0.99
		Percent Finer than # 10	70.00
		Specific Gravity	2.70 Assumed

Notes:

Tested By	RFF	Date	2/13/20	Checked By	GEM	Date	2/14/20

ATTERBERG LIMITS

ASTM D 4318-17

Client: Arcadis U.S.
Client Reference: Comox
Project No.: R-2020-037-001
Lab ID: R-2020-037-001-001
Boring No.: NA
Depth (ft): NA
Sample No.: CFB Comox Homogenate
Soil Description: BROWN SILT

Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Air dried)

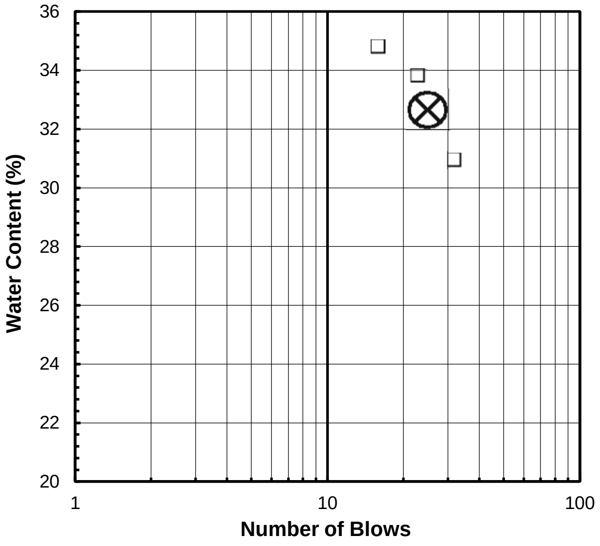
As Received Moisture Content		**Liquid Limit Test**			
ASTM D2216-10		**1**	**2**	**3**	**M**
Tare Number:	RF-7	X-9	17	A-H	**U**
Wt. of Tare & Wet Sample (g):	70.09	28.63	22.12	28.13	**L**
Wt. of Tare & Dry Sample (g):	64.44	25.55	18.29	24.88	**T**
Weight of Tare (g):	23.99	15.59	6.96	15.54	**I**
Weight of Water (g):	5.7	3.1	3.8	3.3	**P**
Weight of Dry Sample (g):	40.5	10.0	11.3	9.3	**O**
Was As Received MC Preserved:	**Yes**				**I**
Moisture Content (%):	**14.0**	**30.9**	**33.8**	**34.8**	**N**
Number of Blows:		**32**	**23**	**16**	**T**

Plastic Limit Test	**1**	**2**	**Range**
Tare Number:	34	27	
Wt. of Tare & Wet Sample (g):	15.55	13.64	
Wt. of Tare & Dry Sample (g):	13.54	12.11	
Weight of Tare (g):	6.98	6.97	
Weight of Water (g):	2.0	1.5	
Weight of Dry Sample (g):	6.6	5.1	
Moisture Content (%):	**30.6**	**29.8**	**0.9**

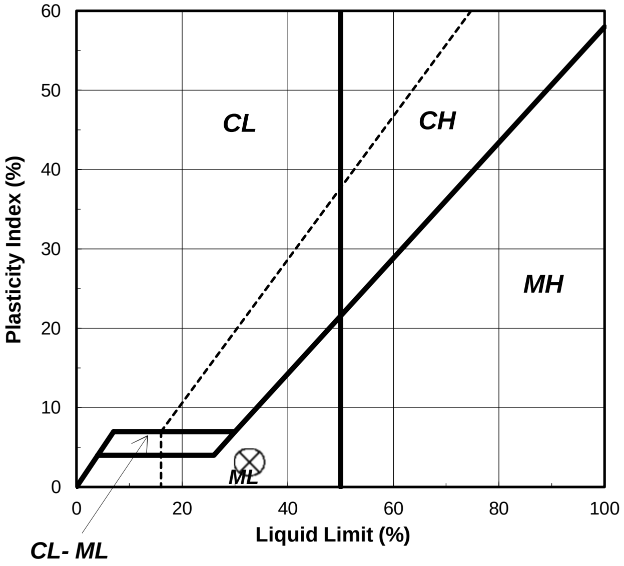
Note: The acceptable range of the two Moisture Contents is ± 0.84

Test Results	
Liquid Limit (%):	**33**
Plastic Limit (%):	**30**
Plasticity Index (%):	**3**
USCS Symbol:	**ML**

Flow Curve



Plasticity Chart



Tested By *SS* *Date* *2/13/20* *Checked By* *GEM* *Date* *2/14/20*

APPENDIX C:
PHASE I - HOMOGENIZED SOILS LABORATORY REPORTS - BUREAU VERITAS

Your Project #: COMOX CFB
Your C.O.C. #: na

Attention: Dave Liles

Arcadis
North Carolina
4915 Prospectus Dr
Suite G
Durham, NC
USA 27713

Report Date: 2020/03/13
Report #: R6108895
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C040257
Received: 2020/02/13, 13:25

Sample Matrix: Water
Samples Received: 15

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Post Oxidation PFAS in water (1)	6	2020/02/25	2020/02/26	CAM SOP-00095	Houtz & Sedlak 2012
Post Oxidation PFAS in water (1)	1	2020/02/25	2020/02/27	CAM SOP-00095	Houtz & Sedlak 2012
Post Oxidation PFAS in water (1)	8	2020/02/26	2020/02/27	CAM SOP-00095	Houtz & Sedlak 2012

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Oxidation was performed adhering to the protocol as described by Houtz, E.F. and Sedlak, D.L. (2012). Environ. Sci. Technol., 46, 9342-9349

Your Project #: COMOX CFB
Your C.O.C. #: na

Attention: Dave Liles

Arcadis
North Carolina
4915 Prospectus Dr
Suite G
Durham, NC
USA 27713

Report Date: 2020/03/13
Report #: R6108895
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C040257
Received: 2020/02/13, 13:25

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: Stephanie.Pollen@bvlabs.com
Phone# (905)817-5830
==
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		LZY155	LZY156		LZY157		LZY158		
Sampling Date		2020/02/12 13:30	2020/02/12 13:35		2020/02/12 13:40		2020/02/12 13:45		
COC Number		na	na		na		na		
	UNITS	CONTROL-1	CONTROL-2	RDL	BATCH-1	RDL	BATCH-2	RDL	QC Batch
Perfluorinated Compounds									
Post Oxidation Perfluorobutanoic acid (PFBA)	ug/L	18	17	1.0	8.2	1.0	5.2	0.20	6605351
Post Oxidation Perfluoropentanoic acid (PFPeA)	ug/L	39	34	1.0	19	1.0	14	2.0	6605351
Post Oxidation Perfluorohexanoic acid (PFHxA)	ug/L	80	73	10	24	1.0	14	2.0	6605351
Post Oxidation Perfluoroheptanoic acid (PFHpA)	ug/L	12	9.9	1.0	4.5	1.0	3.0	0.20	6605351
Post Oxidation Perfluorooctanoic acid (PFOA)	ug/L	20	16	1.0	9.6	1.0	5.7	0.20	6605351
Post Oxidation Perfluorononanoic acid (PFNA)	ug/L	4.1	4.2	1.0	2.3	1.0	0.94	0.20	6605351
Post Oxidation Perfluorodecanoic acid (PFDA)	ug/L	ND	ND	1.0	ND	1.0	ND	0.20	6605351
Post Oxidation Perfluoroundecanoic acid (PFUnA)	ug/L	ND	ND	1.0	ND	1.0	ND	0.20	6605351
Post Oxidation Perfluorododecanoic acid (PFDoA)	ug/L	ND	ND	1.0	ND	1.0	ND	0.20	6605351
Post Oxidation Perfluorotridecanoic acid (PFTRDA)	ug/L	ND	ND	1.0	ND	1.0	ND	0.20	6605351
Post Oxidation Perfluorotetradecanoic acid(PFTEDA)	ug/L	ND	ND	1.0	ND	1.0	ND	0.20	6605351
Post Oxidation Perfluorobutanesulfonic acid (PFBS)	ug/L	1.7	1.8	1.0	1.6	1.0	1.5	0.20	6605351
Post Oxidation Perfluorohexanesulfonic acid(PFHxS)	ug/L	31	33	1.0	22	1.0	12	2.0	6605351
Post Oxidation Perfluoroheptanesulfonic acid PFHpS	ug/L	3.3	2.9	1.0	1.7	1.0	0.68	0.20	6605351
Post Oxidation Perfluorooctanesulfonic acid (PFOS)	ug/L	310	310	10	140	10	51	2.0	6605351
Post Oxidation Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	ND	1.0	ND	1.0	ND	0.20	6605351
Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	ND	1.0	ND	1.0	ND	0.20	6605351
Post Oxidation EtFOSA	ug/L	ND	ND	1.0	ND	1.0	ND	0.20	6605351
Post Oxidation MeFOSA	ug/L	ND	ND	1.0	ND	1.0	ND	0.20	6605351
Post Oxidation EtFOSE	ug/L	ND	ND	1.0	ND	1.0	ND	0.20	6605351
Post Oxidation MeFOSE	ug/L	ND	ND	1.0	ND	1.0	ND	0.20	6605351
Post Oxidation EtFOSAA	ug/L	ND	ND	1.0	ND	1.0	ND	0.20	6605351
Post Oxidation MeFOSAA	ug/L	ND	ND	1.0	ND	1.0	ND	0.20	6605351
Post Oxidation 6:2 Fluorotelomer sulfonic acid	ug/L	ND	ND	1.0	ND	1.0	ND	0.20	6605351
Post Oxidation 8:2 Fluorotelomer sulfonic acid	ug/L	ND	ND	1.0	ND	1.0	ND	0.20	6605351
Surrogate Recovery (%)									
Post Oxidation 13C2-6:2-Fluorotelomersulfonic Acid	%	101	103	N/A	93	N/A	92	N/A	6605351
Post Oxidation 13C2-8:2-Fluorotelomersulfonic Acid	%	86	92	N/A	83	N/A	80	N/A	6605351
Post Oxidation 13C2-Perfluorodecanoic acid	%	84	91	N/A	78	N/A	79	N/A	6605351
Post Oxidation 13C2-Perfluorododecanoic acid	%	78	78	N/A	72	N/A	67	N/A	6605351
Post Oxidation 13C2-Perfluorohexanoic acid	%	105	106	N/A	97	N/A	104	N/A	6605351
Post Oxidation 13C2-perfluorotetradecanoic acid	%	79	80	N/A	72	N/A	71	N/A	6605351
Post Oxidation 13C2-Perfluoroundecanoic acid	%	82	85	N/A	78	N/A	70	N/A	6605351

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		LZY155	LZY156		LZY157		LZY158		
Sampling Date		2020/02/12 13:30	2020/02/12 13:35		2020/02/12 13:40		2020/02/12 13:45		
COC Number		na	na		na		na		
	UNITS	**CONTROL-1**	**CONTROL-2**	**RDL**	**BATCH-1**	**RDL**	**BATCH-2**	**RDL**	**QC Batch**
Post Oxidation 13C3-Perfluorobutanesulfonic acid	%	97	104	N/A	91	N/A	94	N/A	6605351
Post Oxidation 13C4-Perfluorobutanoic acid	%	86	88	N/A	82	N/A	84	N/A	6605351
Post Oxidation 13C4-Perfluoroheptanoic acid	%	96	101	N/A	90	N/A	91	N/A	6605351
Post Oxidation 13C4-Perfluorooctanesulfonic acid	%	101	101	N/A	102	N/A	103	N/A	6605351
Post Oxidation 13C4-Perfluorooctanoic acid	%	93	100	N/A	90	N/A	91	N/A	6605351
Post Oxidation 13C5-Perfluorononanoic acid	%	96	104	N/A	91	N/A	93	N/A	6605351
Post Oxidation 13C5-Perfluoropentanoic acid	%	96	103	N/A	94	N/A	102	N/A	6605351
Post Oxidation 13C8-Perfluorooctane Sulfonamide	%	86	89	N/A	77	N/A	77	N/A	6605351
Post Oxidation 18O2-Perfluorohexanesulfonic acid	%	97	96	N/A	87	N/A	101	N/A	6605351
Post Oxidation D3-MeFOSAA	%	80	83	N/A	70	N/A	74	N/A	6605351
Post Oxidation D5-EtFOSAA	%	75	78	N/A	71	N/A	72	N/A	6605351
Post Oxidation D7-MeFOSE	%	78	88	N/A	72	N/A	71	N/A	6605351
Post Oxidation D9-EtFOSE	%	78	78	N/A	69	N/A	70	N/A	6605351

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		LZY158		LZY159			LZY160		
Sampling Date		2020/02/12 13:45		2020/02/12 13:50			2020/02/12 13:55		
COC Number		na		na			na		
	UNITS	**BATCH-2 Lab-Dup**	**RDL**	**BATCH-3**	**RDL**	**QC Batch**	**BATCH-4**	**RDL**	**QC Batch**
Perfluorinated Compounds									
Post Oxidation Perfluorobutanoic acid (PFBA)	ug/L	4.9	0.20	3.6	0.10	6605351	2.9	0.40	6607953
Post Oxidation Perfluoropentanoic acid (PFPeA)	ug/L	13	2.0	11	1.0	6605351	11	0.40	6607953
Post Oxidation Perfluorohexanoic acid (PFHxA)	ug/L	12	2.0	8.9	1.0	6605351	7.5	0.40	6607953
Post Oxidation Perfluoroheptanoic acid (PFHpA)	ug/L	2.9	0.20	1.8	0.10	6605351	1.3	0.040	6607953
Post Oxidation Perfluorooctanoic acid (PFOA)	ug/L	5.4	0.20	2.5	0.10	6605351	1.7	0.040	6607953
Post Oxidation Perfluorononanoic acid (PFNA)	ug/L	0.86	0.20	0.39	0.10	6605351	0.27	0.040	6607953
Post Oxidation Perfluorodecanoic acid (PFDA)	ug/L	ND	0.20	ND	0.10	6605351	ND	0.040	6607953
Post Oxidation Perfluoroundecanoic acid (PFUnA)	ug/L	ND	0.20	ND	0.10	6605351	ND	0.040	6607953
Post Oxidation Perfluorododecanoic acid (PFDoA)	ug/L	ND	0.20	ND	0.10	6605351	ND	0.040	6607953
Post Oxidation Perfluorotridecanoic acid (PFTRDA)	ug/L	ND	0.20	ND	0.10	6605351	ND	0.040	6607953
Post Oxidation Perfluorotetradecanoic acid(PFTEDA)	ug/L	ND	0.20	ND	0.10	6605351	ND	0.040	6607953
Post Oxidation Perfluorobutanesulfonic acid (PFBS)	ug/L	1.4	0.20	1.2	0.10	6605351	1.0	0.040	6607953
Post Oxidation Perfluorohexanesulfonic acid(PFHxS)	ug/L	12	2.0	5.4	1.0	6605351	3.7	0.40	6607953
Post Oxidation Perfluoroheptanesulfonic acid PFHpS	ug/L	0.66	0.20	0.22	0.10	6605351	0.15	0.040	6607953
Post Oxidation Perfluorooctanesulfonic acid (PFOS)	ug/L	48	2.0	18	1.0	6605351	12	0.40	6607953
Post Oxidation Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	0.20	ND	0.10	6605351	ND	0.040	6607953
Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	0.20	ND	0.10	6605351	ND	0.040	6607953
Post Oxidation EtFOSA	ug/L	ND	0.20	ND	0.10	6605351	ND	0.040	6607953
Post Oxidation MeFOSA	ug/L	ND	0.20	ND	0.10	6605351	ND	0.040	6607953
Post Oxidation EtFOSE	ug/L	ND	0.20	ND	0.10	6605351	ND	0.040	6607953
Post Oxidation MeFOSE	ug/L	ND	0.20	ND	0.10	6605351	ND	0.040	6607953
Post Oxidation EtFOSAA	ug/L	ND	0.20	ND	0.10	6605351	ND	0.040	6607953
Post Oxidation MeFOSAA	ug/L	ND	0.20	ND	0.10	6605351	ND	0.040	6607953
Post Oxidation 6:2 Fluorotelomer sulfonic acid	ug/L	ND	0.20	ND	0.10	6605351	ND	0.040	6607953
Post Oxidation 8:2 Fluorotelomer sulfonic acid	ug/L	ND	0.20	ND	0.10	6605351	ND	0.040	6607953
Surrogate Recovery (%)									
Post Oxidation 13C2-6:2-Fluorotelomersulfonic Acid	%	99	N/A	95	N/A	6605351	106	N/A	6607953
Post Oxidation 13C2-8:2-Fluorotelomersulfonic Acid	%	83	N/A	78	N/A	6605351	94	N/A	6607953
Post Oxidation 13C2-Perfluorodecanoic acid	%	82	N/A	77	N/A	6605351	89	N/A	6607953
Post Oxidation 13C2-Perfluorododecanoic acid	%	73	N/A	68	N/A	6605351	83	N/A	6607953
Post Oxidation 13C2-Perfluorohexanoic acid	%	106	N/A	104	N/A	6605351	106	N/A	6607953
Post Oxidation 13C2-perfluorotetradecanoic acid	%	77	N/A	68	N/A	6605351	77	N/A	6607953

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
ND = Not detected
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		LZY158		LZY159			LZY160		
Sampling Date		2020/02/12 13:45		2020/02/12 13:50			2020/02/12 13:55		
COC Number		na		na			na		
	UNITS	**BATCH-2 Lab-Dup**	**RDL**	**BATCH-3**	**RDL**	**QC Batch**	**BATCH-4**	**RDL**	**QC Batch**
Post Oxidation 13C2-Perfluoroundecanoic acid	%	74	N/A	71	N/A	6605351	83	N/A	6607953
Post Oxidation 13C3-Perfluorobutanesulfonic acid	%	100	N/A	96	N/A	6605351	103	N/A	6607953
Post Oxidation 13C4-Perfluorobutanoic acid	%	87	N/A	84	N/A	6605351	110	N/A	6607953
Post Oxidation 13C4-Perfluoroheptanoic acid	%	94	N/A	92	N/A	6605351	102	N/A	6607953
Post Oxidation 13C4-Perfluorooctanesulfonic acid	%	102	N/A	100	N/A	6605351	107	N/A	6607953
Post Oxidation 13C4-Perfluorooctanoic acid	%	95	N/A	94	N/A	6605351	98	N/A	6607953
Post Oxidation 13C5-Perfluorononanoic acid	%	99	N/A	91	N/A	6605351	97	N/A	6607953
Post Oxidation 13C5-Perfluoropentanoic acid	%	104	N/A	104	N/A	6605351	106	N/A	6607953
Post Oxidation 13C8-Perfluorooctane Sulfonamide	%	79	N/A	76	N/A	6605351	81	N/A	6607953
Post Oxidation 18O2-Perfluorohexanesulfonic acid	%	99	N/A	99	N/A	6605351	107	N/A	6607953
Post Oxidation D3-MeFOSAA	%	83	N/A	72	N/A	6605351	80	N/A	6607953
Post Oxidation D5-EtFOSAA	%	81	N/A	75	N/A	6605351	82	N/A	6607953
Post Oxidation D7-MeFOSE	%	77	N/A	72	N/A	6605351	78	N/A	6607953
Post Oxidation D9-EtFOSE	%	74	N/A	72	N/A	6605351	81	N/A	6607953

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		LZY161			LZY162		LZY163		
Sampling Date		2020/02/12 14:00			2020/02/12 14:05		2020/02/12 14:10		
COC Number		na			na		na		
	UNITS	**BATCH-5**	**RDL**	**QC Batch**	**BATCH-6**	**RDL**	**BATCH-7**	**RDL**	**QC Batch**
Perfluorinated Compounds									
Post Oxidation Perfluorobutanoic acid (PFBA)	ug/L	2.5	0.10	6605351	2.4	0.40	4.2	0.40	6607953
Post Oxidation Perfluoropentanoic acid (PFPeA)	ug/L	8.7	1.0	6605351	8.5	0.40	6.4	0.40	6607953
Post Oxidation Perfluorohexanoic acid (PFHxA)	ug/L	5.5	1.0	6605351	5.6	0.40	11	0.40	6607953
Post Oxidation Perfluoroheptanoic acid (PFHpA)	ug/L	0.76	0.10	6605351	0.69	0.040	4.4	0.40	6607953
Post Oxidation Perfluorooctanoic acid (PFOA)	ug/L	0.93	0.10	6605351	0.93	0.040	1.8	0.040	6607953
Post Oxidation Perfluorononanoic acid (PFNA)	ug/L	ND	0.10	6605351	0.093	0.040	ND	0.040	6607953
Post Oxidation Perfluorodecanoic acid (PFDA)	ug/L	ND	0.10	6605351	ND	0.040	ND	0.040	6607953
Post Oxidation Perfluoroundecanoic acid (PFUnA)	ug/L	ND	0.10	6605351	ND	0.040	ND	0.040	6607953
Post Oxidation Perfluorododecanoic acid (PFDoA)	ug/L	ND	0.10	6605351	ND	0.040	ND	0.040	6607953
Post Oxidation Perfluorotridecanoic acid (PFTRDA)	ug/L	ND	0.10	6605351	ND	0.040	ND	0.040	6607953
Post Oxidation Perfluorotetradecanoic acid(PFTEDA)	ug/L	ND	0.10	6605351	ND	0.040	ND	0.040	6607953
Post Oxidation Perfluorobutanesulfonic acid (PFBS)	ug/L	0.71	0.10	6605351	0.63	0.040	ND	0.040	6607953
Post Oxidation Perfluorohexanesulfonic acid(PFHxS)	ug/L	1.9	0.10	6605351	1.7	0.040	0.29	0.040	6607953
Post Oxidation Perfluoroheptanesulfonic acid PFHpS	ug/L	ND	0.10	6605351	0.067	0.040	ND	0.040	6607953
Post Oxidation Perfluorooctanesulfonic acid (PFOS)	ug/L	5.2	1.0	6605351	5.5	0.40	0.47	0.040	6607953
Post Oxidation Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	0.10	6605351	ND	0.040	ND	0.040	6607953
Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	0.10	6605351	ND	0.040	ND	0.040	6607953
Post Oxidation EtFOSA	ug/L	ND	0.10	6605351	ND	0.040	ND	0.040	6607953
Post Oxidation MeFOSA	ug/L	ND	0.10	6605351	ND	0.040	ND	0.040	6607953
Post Oxidation EtFOSE	ug/L	ND	0.10	6605351	ND	0.040	ND	0.040	6607953
Post Oxidation MeFOSE	ug/L	ND	0.10	6605351	ND	0.040	ND	0.040	6607953
Post Oxidation EtFOSAA	ug/L	ND	0.10	6605351	ND	0.040	ND	0.040	6607953
Post Oxidation MeFOSAA	ug/L	ND	0.10	6605351	ND	0.040	ND	0.040	6607953
Post Oxidation 6:2 Fluorotelomer sulfonic acid	ug/L	ND	0.10	6605351	ND	0.040	ND	0.040	6607953
Post Oxidation 8:2 Fluorotelomer sulfonic acid	ug/L	ND	0.10	6605351	ND	0.040	ND	0.040	6607953
Surrogate Recovery (%)									
Post Oxidation 13C2-6:2-Fluorotelomersulfonic Acid	%	91	N/A	6605351	97	N/A	95	N/A	6607953
Post Oxidation 13C2-8:2-Fluorotelomersulfonic Acid	%	82	N/A	6605351	87	N/A	86	N/A	6607953
Post Oxidation 13C2-Perfluorodecanoic acid	%	80	N/A	6605351	86	N/A	80	N/A	6607953
Post Oxidation 13C2-Perfluorododecanoic acid	%	66	N/A	6605351	81	N/A	77	N/A	6607953
Post Oxidation 13C2-Perfluorohexanoic acid	%	106	N/A	6605351	105	N/A	85	N/A	6607953
Post Oxidation 13C2-perfluorotetradecanoic acid	%	73	N/A	6605351	83	N/A	71	N/A	6607953
Post Oxidation 13C2-Perfluoroundecanoic acid	%	71	N/A	6605351	79	N/A	76	N/A	6607953

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		LZY161			LZY162		LZY163		
Sampling Date		2020/02/12 14:00			2020/02/12 14:05		2020/02/12 14:10		
COC Number		na			na		na		
	UNITS	**BATCH-5**	**RDL**	**QC Batch**	**BATCH-6**	**RDL**	**BATCH-7**	**RDL**	**QC Batch**
Post Oxidation 13C3-Perfluorobutanesulfonic acid	%	93	N/A	6605351	98	N/A	99	N/A	6607953
Post Oxidation 13C4-Perfluorobutanoic acid	%	82	N/A	6605351	107	N/A	85	N/A	6607953
Post Oxidation 13C4-Perfluoroheptanoic acid	%	93	N/A	6605351	97	N/A	90	N/A	6607953
Post Oxidation 13C4-Perfluorooctanesulfonic acid	%	103	N/A	6605351	107	N/A	87	N/A	6607953
Post Oxidation 13C4-Perfluorooctanoic acid	%	90	N/A	6605351	93	N/A	91	N/A	6607953
Post Oxidation 13C5-Perfluorononanoic acid	%	90	N/A	6605351	92	N/A	89	N/A	6607953
Post Oxidation 13C5-Perfluoropentanoic acid	%	103	N/A	6605351	106	N/A	85	N/A	6607953
Post Oxidation 13C8-Perfluorooctane Sulfonamide	%	76	N/A	6605351	80	N/A	75	N/A	6607953
Post Oxidation 18O2-Perfluorohexanesulfonic acid	%	94	N/A	6605351	95	N/A	98	N/A	6607953
Post Oxidation D3-MeFOSAA	%	72	N/A	6605351	79	N/A	78	N/A	6607953
Post Oxidation D5-EtFOSAA	%	69	N/A	6605351	80	N/A	76	N/A	6607953
Post Oxidation D7-MeFOSE	%	72	N/A	6605351	80	N/A	79	N/A	6607953
Post Oxidation D9-EtFOSE	%	73	N/A	6605351	85	N/A	80	N/A	6607953

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		LZY164	LZY165	LZY166	LZY167	LZY168		
Sampling Date		2020/02/12 14:15	2020/02/12 14:20	2020/02/12 14:25	2020/02/12 14:30	2020/02/12 14:35		
COC Number		na	na	na	na	na		
	UNITS	**BATCH-8**	**BATCH-9**	**BATCH-10**	**BATCH-11**	**BATCH-12**	**RDL**	**QC Batch**
Perfluorinated Compounds								
Post Oxidation Perfluorobutanoic acid (PFBA)	ug/L	2.8	2.7	2.3	2.3	1.9	0.40	6607953
Post Oxidation Perfluoropentanoic acid (PFPeA)	ug/L	4.1	4.2	3.3	3.4	2.6	0.40	6607953
Post Oxidation Perfluorohexanoic acid (PFHxA)	ug/L	6.1	6.1	4.4	4.5	3.2	0.40	6607953
Post Oxidation Perfluoroheptanoic acid (PFHpA)	ug/L	2.8	3.0	2.3	2.4	1.8	0.40	6607953
Post Oxidation Perfluorooctanoic acid (PFOA)	ug/L	1.3	1.3	0.94	1.1	0.70	0.040	6607953
Post Oxidation Perfluorononanoic acid (PFNA)	ug/L	ND	ND	ND	ND	ND	0.040	6607953
Post Oxidation Perfluorodecanoic acid (PFDA)	ug/L	ND	ND	ND	ND	ND	0.040	6607953
Post Oxidation Perfluoroundecanoic acid (PFUnA)	ug/L	ND	ND	ND	ND	ND	0.040	6607953
Post Oxidation Perfluorododecanoic acid (PFDoA)	ug/L	ND	ND	ND	ND	ND	0.040	6607953
Post Oxidation Perfluorotridecanoic acid (PFTRDA)	ug/L	ND	ND	ND	ND	ND	0.040	6607953
Post Oxidation Perfluorotetradecanoic acid(PFTEDA)	ug/L	ND	ND	ND	ND	ND	0.040	6607953
Post Oxidation Perfluorobutanesulfonic acid (PFBS)	ug/L	ND	ND	ND	ND	ND	0.040	6607953
Post Oxidation Perfluorohexanesulfonic acid(PFHxS)	ug/L	0.098	ND	ND	ND	ND	0.040	6607953
Post Oxidation Perfluoroheptanesulfonic acid PFHpS	ug/L	ND	ND	ND	ND	ND	0.040	6607953
Post Oxidation Perfluorooctanesulfonic acid (PFOS)	ug/L	0.18	0.15	0.094	0.076	0.054	0.040	6607953
Post Oxidation Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	ND	ND	ND	ND	0.040	6607953
Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	ND	ND	ND	ND	0.040	6607953
Post Oxidation EtFOSA	ug/L	ND	ND	ND	ND	ND	0.040	6607953
Post Oxidation MeFOSA	ug/L	ND	ND	ND	ND	ND	0.040	6607953
Post Oxidation EtFOSE	ug/L	ND	ND	ND	ND	ND	0.040	6607953
Post Oxidation MeFOSE	ug/L	ND	ND	ND	ND	ND	0.040	6607953
Post Oxidation EtFOSAA	ug/L	ND	ND	ND	ND	ND	0.040	6607953
Post Oxidation MeFOSAA	ug/L	ND	ND	ND	ND	ND	0.040	6607953
Post Oxidation 6:2 Fluorotelomer sulfonic acid	ug/L	ND	ND	ND	ND	ND	0.040	6607953
Post Oxidation 8:2 Fluorotelomer sulfonic acid	ug/L	ND	ND	ND	ND	ND	0.040	6607953
Surrogate Recovery (%)								
Post Oxidation 13C2-6:2-Fluorotelomersulfonic Acid	%	96	97	101	98	108	N/A	6607953
Post Oxidation 13C2-8:2-Fluorotelomersulfonic Acid	%	83	87	93	88	94	N/A	6607953
Post Oxidation 13C2-Perfluorodecanoic acid	%	81	84	89	87	95	N/A	6607953
Post Oxidation 13C2-Perfluorododecanoic acid	%	78	76	79	78	86	N/A	6607953
Post Oxidation 13C2-Perfluorohexanoic acid	%	88	91	92	92	98	N/A	6607953
Post Oxidation 13C2-perfluorotetradecanoic acid	%	79	76	82	76	81	N/A	6607953
Post Oxidation 13C2-Perfluoroundecanoic acid	%	78	78	83	80	89	N/A	6607953

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		LZY164	LZY165	LZY166	LZY167	LZY168		
Sampling Date		2020/02/12 14:15	2020/02/12 14:20	2020/02/12 14:25	2020/02/12 14:30	2020/02/12 14:35		
COC Number		na	na	na	na	na		
	UNITS	**BATCH-8**	**BATCH-9**	**BATCH-10**	**BATCH-11**	**BATCH-12**	**RDL**	**QC Batch**
Post Oxidation 13C3-Perfluorobutanesulfonic acid	%	100	98	101	101	108	N/A	6607953
Post Oxidation 13C4-Perfluorobutanoic acid	%	88	93	93	94	97	N/A	6607953
Post Oxidation 13C4-Perfluoroheptanoic acid	%	93	94	97	97	101	N/A	6607953
Post Oxidation 13C4-Perfluorooctanesulfonic acid	%	84	89	89	92	98	N/A	6607953
Post Oxidation 13C4-Perfluorooctanoic acid	%	94	92	94	96	105	N/A	6607953
Post Oxidation 13C5-Perfluorononanoic acid	%	89	90	93	93	99	N/A	6607953
Post Oxidation 13C5-Perfluoropentanoic acid	%	89	92	95	96	98	N/A	6607953
Post Oxidation 13C8-Perfluorooctane Sulfonamide	%	75	77	82	79	85	N/A	6607953
Post Oxidation 18O2-Perfluorohexanesulfonic acid	%	98	96	98	100	110	N/A	6607953
Post Oxidation D3-MeFOSAA	%	76	74	80	79	90	N/A	6607953
Post Oxidation D5-EtFOSAA	%	77	76	80	76	85	N/A	6607953
Post Oxidation D7-MeFOSE	%	77	76	81	75	89	N/A	6607953
Post Oxidation D9-EtFOSE	%	78	82	85	78	86	N/A	6607953

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		LZY169		
Sampling Date		2020/02/12		
COC Number		na		
	UNITS	**EQUIP BLK**	**RDL**	**QC Batch**
Perfluorinated Compounds				
Post Oxidation Perfluorobutanoic acid (PFBA)	ug/L	ND	0.040	6607953
Post Oxidation Perfluoropentanoic acid (PFPeA)	ug/L	ND	0.040	6607953
Post Oxidation Perfluorohexanoic acid (PFHxA)	ug/L	ND	0.040	6607953
Post Oxidation Perfluoroheptanoic acid (PFHpA)	ug/L	ND	0.040	6607953
Post Oxidation Perfluorooctanoic acid (PFOA)	ug/L	ND	0.040	6607953
Post Oxidation Perfluorononanoic acid (PFNA)	ug/L	ND	0.040	6607953
Post Oxidation Perfluorodecanoic acid (PFDA)	ug/L	ND	0.040	6607953
Post Oxidation Perfluoroundecanoic acid (PFUnA)	ug/L	ND	0.040	6607953
Post Oxidation Perfluorododecanoic acid (PFDoA)	ug/L	ND	0.040	6607953
Post Oxidation Perfluorotridecanoic acid (PFTRDA)	ug/L	ND	0.040	6607953
Post Oxidation Perfluorotetradecanoic acid(PFTEDA)	ug/L	ND	0.040	6607953
Post Oxidation Perfluorobutanesulfonic acid (PFBS)	ug/L	ND	0.040	6607953
Post Oxidation Perfluorohexanesulfonic acid(PFHxS)	ug/L	ND	0.040	6607953
Post Oxidation Perfluoroheptanesulfonic acid PFHpS	ug/L	ND	0.040	6607953
Post Oxidation Perfluorooctanesulfonic acid (PFOS)	ug/L	ND	0.040	6607953
Post Oxidation Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	0.040	6607953
Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	0.040	6607953
Post Oxidation EtFOSA	ug/L	ND	0.040	6607953
Post Oxidation MeFOSA	ug/L	ND	0.040	6607953
Post Oxidation EtFOSE	ug/L	ND	0.040	6607953
Post Oxidation MeFOSE	ug/L	ND	0.040	6607953
Post Oxidation EtFOSAA	ug/L	ND	0.040	6607953
Post Oxidation MeFOSAA	ug/L	ND	0.040	6607953
Post Oxidation 6:2 Fluorotelomer sulfonic acid	ug/L	ND	0.040	6607953
Post Oxidation 8:2 Fluorotelomer sulfonic acid	ug/L	ND	0.040	6607953
Surrogate Recovery (%)				
Post Oxidation 13C2-6:2-Fluorotelomersulfonic Acid	%	98	N/A	6607953
Post Oxidation 13C2-8:2-Fluorotelomersulfonic Acid	%	87	N/A	6607953
Post Oxidation 13C2-Perfluorodecanoic acid	%	85	N/A	6607953
Post Oxidation 13C2-Perfluorododecanoic acid	%	80	N/A	6607953
Post Oxidation 13C2-Perfluorohexanoic acid	%	95	N/A	6607953
Post Oxidation 13C2-perfluorotetradecanoic acid	%	76	N/A	6607953
Post Oxidation 13C2-Perfluoroundecanoic acid	%	81	N/A	6607953

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		LZY169		
Sampling Date		2020/02/12		
COC Number		na		
	UNITS	**EQUIP BLK**	**RDL**	**QC Batch**
Post Oxidation 13C3-Perfluorobutanesulfonic acid	%	101	N/A	6607953
Post Oxidation 13C4-Perfluorobutanoic acid	%	96	N/A	6607953
Post Oxidation 13C4-Perfluoroheptanoic acid	%	97	N/A	6607953
Post Oxidation 13C4-Perfluorooctanesulfonic acid	%	89	N/A	6607953
Post Oxidation 13C4-Perfluorooctanoic acid	%	95	N/A	6607953
Post Oxidation 13C5-Perfluorononanoic acid	%	90	N/A	6607953
Post Oxidation 13C5-Perfluoropentanoic acid	%	97	N/A	6607953
Post Oxidation 13C8-Perfluorooctane Sulfonamide	%	81	N/A	6607953
Post Oxidation 18O2-Perfluorohexanesulfonic acid	%	98	N/A	6607953
Post Oxidation D3-MeFOSAA	%	84	N/A	6607953
Post Oxidation D5-EtFOSAA	%	80	N/A	6607953
Post Oxidation D7-MeFOSE	%	84	N/A	6607953
Post Oxidation D9-EtFOSE	%	84	N/A	6607953

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

TEST SUMMARY

BV Labs ID: LZY155
Sample ID: CONTROL-1
Matrix: Water

Collected: 2020/02/12
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6605351	2020/02/25	2020/02/26	Marian Godax

BV Labs ID: LZY156
Sample ID: CONTROL-2
Matrix: Water

Collected: 2020/02/12
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6605351	2020/02/25	2020/02/26	Marian Godax

BV Labs ID: LZY157
Sample ID: BATCH-1
Matrix: Water

Collected: 2020/02/12
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6605351	2020/02/25	2020/02/26	Marian Godax

BV Labs ID: LZY158
Sample ID: BATCH-2
Matrix: Water

Collected: 2020/02/12
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6605351	2020/02/25	2020/02/26	Marian Godax

BV Labs ID: LZY158 Dup
Sample ID: BATCH-2
Matrix: Water

Collected: 2020/02/12
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6605351	2020/02/25	2020/02/26	Marian Godax

BV Labs ID: LZY159
Sample ID: BATCH-3
Matrix: Water

Collected: 2020/02/12
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6605351	2020/02/25	2020/02/26	Marian Godax

BV Labs ID: LZY160
Sample ID: BATCH-4
Matrix: Water

Collected: 2020/02/12
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6607953	2020/02/25	2020/02/27	Marian Godax

TEST SUMMARY

BV Labs ID: LZY161
Sample ID: BATCH-5
Matrix: Water

Collected: 2020/02/12
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6605351	2020/02/25	2020/02/26	Marian Godax

BV Labs ID: LZY162
Sample ID: BATCH-6
Matrix: Water

Collected: 2020/02/12
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6607953	2020/02/26	2020/02/27	Marian Godax

BV Labs ID: LZY163
Sample ID: BATCH-7
Matrix: Water

Collected: 2020/02/12
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6607953	2020/02/26	2020/02/27	Marian Godax

BV Labs ID: LZY164
Sample ID: BATCH-8
Matrix: Water

Collected: 2020/02/12
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6607953	2020/02/26	2020/02/27	Marian Godax

BV Labs ID: LZY165
Sample ID: BATCH-9
Matrix: Water

Collected: 2020/02/12
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6607953	2020/02/26	2020/02/27	Marian Godax

BV Labs ID: LZY166
Sample ID: BATCH-10
Matrix: Water

Collected: 2020/02/12
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6607953	2020/02/26	2020/02/27	Marian Godax

BV Labs ID: LZY167
Sample ID: BATCH-11
Matrix: Water

Collected: 2020/02/12
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6607953	2020/02/26	2020/02/27	Marian Godax

TEST SUMMARY

BV Labs ID: LZY168
Sample ID: BATCH-12
Matrix: Water

Collected: 2020/02/12
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6607953	2020/02/26	2020/02/27	Marian Godax

BV Labs ID: LZY169
Sample ID: EQUIP BLK
Matrix: Water

Collected: 2020/02/12
Shipped:
Received: 2020/02/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6607953	2020/02/26	2020/02/27	Marian Godax

GENERAL COMMENTS

Sample LZY155 [CONTROL-1] : PFAS Post-Oxidation Analysis: Due to high concentrations of target analytes, a reduced sample volume was oxidized, extracted and analyzed. Detection limit was adjusted accordingly.

Sample LZY156 [CONTROL-2] : PFAS Post-Oxidation Analysis: Due to high concentrations of target analytes, a reduced sample volume was oxidized, extracted and analyzed. Detection limit was adjusted accordingly.

Sample LZY157 [BATCH-1] : PFAS Post-Oxidation Analysis: Due to high concentrations of target analytes, a reduced sample volume was oxidized, extracted and analyzed. Detection limit was adjusted accordingly.

Sample LZY158 [BATCH-2] : PFAS Post-Oxidation Analysis: Due to high concentrations of target analytes, a reduced sample volume was oxidized, extracted and analyzed. Detection limit was adPFAS Post-Oxidation Analysis: Due to high concentrations of target analytes, a reduced sample volume was oxidized, extracted and analyzed. Detection limit was adjusted accordingly.justed accordingly.

Sample LZY159 [BATCH-3] : PFAS Post-Oxidation Analysis: Due to high concentrations of target analytes, a reduced sample volume was oxidized, extracted and analyzed. Detection limit was adjusted accordingly.

Sample LZY160 [BATCH-4] : PFAS Post-Oxidation Analysis: Due to high concentrations of target analytes, sample required dilution. Detection limit was adjusted accordingly.

Sample LZY161 [BATCH-5] : PFAS Post-Oxidation Analysis: Due to high concentrations of target analytes, a reduced sample volume was oxidized, extracted and analyzed. Detection limit was adjusted accordingly.

Sample LZY162 [BATCH-6] : PFAS Post-Oxidation Analysis: Due to high concentrations of target analytes, sample required dilution. Detection limit was adjusted accordingly.

Sample LZY163 [BATCH-7] : PFAS Post-Oxidation Analysis: Due to high concentrations of target analytes, sample required dilution. Detection limit was adjusted accordingly.

Sample LZY164 [BATCH-8] : PFAS Post-Oxidation Analysis: Due to high concentrations of target analytes, sample required dilution. Detection limit was adjusted accordingly.

Sample LZY165 [BATCH-9] : PFAS Post-Oxidation Analysis: Due to high concentrations of target analytes, sample required dilution. Detection limit was adjusted accordingly.

Sample LZY166 [BATCH-10] : PFAS Post-Oxidation Analysis: Due to high concentrations of target analytes, sample required dilution. Detection limit was adjusted accordingly.

Sample LZY167 [BATCH-11] : PFAS Post-Oxidation Analysis: Due to high concentrations of target analytes, sample required dilution. Detection limit was adjusted accordingly.

Sample LZY168 [BATCH-12] : PFAS Post-Oxidation Analysis: Due to high concentrations of target analytes, sample required dilution. Detection limit was adjusted accordingly.

Results relate only to the items tested.

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6605351	M_G	Spiked Blank	Post Oxidation 13C2-6:2-Fluorotelomersulfonic	2020/02/26		107	%	50 - 150
			Post Oxidation 13C2-8:2-Fluorotelomersulfonic	2020/02/26		102	%	50 - 150
			Post Oxidation 13C2-Perfluorodecanoic acid	2020/02/26		98	%	50 - 150
			Post Oxidation 13C2-Perfluorododecanoic acid	2020/02/26		93	%	50 - 150
			Post Oxidation 13C2-Perfluorohexanoic acid	2020/02/26		109	%	50 - 150
			Post Oxidation 13C2-perfluorotetradecanoic aci	2020/02/26		85	%	50 - 150
			Post Oxidation 13C2-Perfluoroundecanoic acid	2020/02/26		93	%	50 - 150
			Post Oxidation 13C3-Perfluorobutanesulfonic ac	2020/02/26		106	%	50 - 150
			Post Oxidation 13C4-Perfluorobutanoic acid	2020/02/26		104	%	50 - 150
			Post Oxidation 13C4-Perfluoroheptanoic acid	2020/02/26		104	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanesulfonic ac	2020/02/26		104	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanoic acid	2020/02/26		103	%	50 - 150
			Post Oxidation 13C5-Perfluorononanoic acid	2020/02/26		106	%	50 - 150
			Post Oxidation 13C5-Perfluoropentanoic acid	2020/02/26		108	%	50 - 150
			Post Oxidation 13C8-Perfluorooctane Sulfonami	2020/02/26		93	%	50 - 150
			Post Oxidation 18O2-Perfluorohexanesulfonic a	2020/02/26		100	%	50 - 150
			Post Oxidation D3-MeFOSAA	2020/02/26		88	%	50 - 150
			Post Oxidation D5-EtFOSAA	2020/02/26		87	%	50 - 150
			Post Oxidation D7-MeFOSE	2020/02/26		85	%	50 - 150
			Post Oxidation D9-EtFOSE	2020/02/26		85	%	50 - 150
			Post Oxidation Perfluorobutanoic acid (PFBA)	2020/02/26		99	%	70 - 130
			Post Oxidation Perfluoropentanoic acid (PFPeA)	2020/02/26		101	%	70 - 130
			Post Oxidation Perfluorohexanoic acid (PFHxA)	2020/02/26		102	%	70 - 130
			Post Oxidation Perfluoroheptanoic acid (PFHpA)	2020/02/26		97	%	70 - 130
			Post Oxidation Perfluorooctanoic acid (PFOA)	2020/02/26		105	%	30 - 130
			Post Oxidation Perfluorononanoic acid (PFNA)	2020/02/26		97	%	70 - 130
			Post Oxidation Perfluorodecanoic acid (PFDA)	2020/02/26		101	%	70 - 130
			Post Oxidation Perfluoroundecanoic acid (PFUn	2020/02/26		101	%	70 - 130
			Post Oxidation Perfluorododecanoic acid (PFDo	2020/02/26		92	%	70 - 130
			Post Oxidation Perfluorotridecanoic acid (PFTR	2020/02/26		99	%	70 - 130
			Post Oxidation Perfluorotetradecanoic acid(PFT	2020/02/26		92	%	70 - 130
			Post Oxidation Perfluorobutanesulfonic acid (PF	2020/02/26		100	%	30 - 130
			Post Oxidation Perfluorohexanesulfonic acid(PF	2020/02/26		98	%	30 - 130
			Post Oxidation Perfluoroheptanesulfonic acid P	2020/02/26		98	%	30 - 130
			Post Oxidation Perfluorooctanesulfonic acid (PF	2020/02/26		104	%	30 - 130
			Post Oxidation Perfluorodecanesulfonic acid (PF	2020/02/26		95	%	30 - 130
			Post Oxidation Perfluorooctane Sulfonamide (P	2020/02/26		91	%	70 - 130
			Post Oxidation EtFOSA	2020/02/26		81	%	70 - 130
			Post Oxidation MeFOSA	2020/02/26		77	%	70 - 130
			Post Oxidation EtFOSE	2020/02/26		96	%	70 - 130
			Post Oxidation MeFOSE	2020/02/26		94	%	70 - 130
			Post Oxidation EtFOSAA	2020/02/26		102	%	70 - 130
			Post Oxidation MeFOSAA	2020/02/26		102	%	70 - 130
			Post Oxidation 6:2 Fluorotelomer sulfonic acid	2020/02/26		101	%	30 - 130
			Post Oxidation 8:2 Fluorotelomer sulfonic acid	2020/02/26		101	%	30 - 130
6605351	M_G	Method Blank	Post Oxidation 13C2-6:2-Fluorotelomersulfonic	2020/02/26		97	%	50 - 150
			Post Oxidation 13C2-8:2-Fluorotelomersulfonic	2020/02/26		86	%	50 - 150
			Post Oxidation 13C2-Perfluorodecanoic acid	2020/02/26		83	%	50 - 150
			Post Oxidation 13C2-Perfluorododecanoic acid	2020/02/26		67	%	50 - 150
			Post Oxidation 13C2-Perfluorohexanoic acid	2020/02/26		99	%	50 - 150
			Post Oxidation 13C2-perfluorotetradecanoic aci	2020/02/26		69	%	50 - 150
			Post Oxidation 13C2-Perfluoroundecanoic acid	2020/02/26		76	%	50 - 150

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Post Oxidation 13C3-Perfluorobutanesulfonic ac	2020/02/26		96	%	50 - 150
			Post Oxidation 13C4-Perfluorobutanoic acid	2020/02/26		83	%	50 - 150
			Post Oxidation 13C4-Perfluoroheptanoic acid	2020/02/26		97	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanesulfonic ac	2020/02/26		89	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanoic acid	2020/02/26		92	%	50 - 150
			Post Oxidation 13C5-Perfluorononanoic acid	2020/02/26		95	%	50 - 150
			Post Oxidation 13C5-Perfluoropentanoic acid	2020/02/26		96	%	50 - 150
			Post Oxidation 13C8-Perfluorooctane Sulfonami	2020/02/26		78	%	50 - 150
			Post Oxidation 18O2-Perfluorohexanesulfonic a	2020/02/26		93	%	50 - 150
			Post Oxidation D3-MeFOSAA	2020/02/26		68	%	50 - 150
			Post Oxidation D5-EtFOSAA	2020/02/26		66	%	50 - 150
			Post Oxidation D7-MeFOSE	2020/02/26		75	%	50 - 150
			Post Oxidation D9-EtFOSE	2020/02/26		72	%	50 - 150
			Post Oxidation Perfluorobutanoic acid (PFBA)	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluoropentanoic acid (PFPeA)	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorohexanoic acid (PFHxA)	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluoroheptanoic acid (PFHpA)	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorooctanoic acid (PFOA)	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorononanoic acid (PFNA)	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorodecanoic acid (PFDA)	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluoroundecanoic acid (PFUnA)	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorododecanoic acid (PFDoA)	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorotridecanoic acid (PFTRDA)	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorotetradecanoic acid (PFTEDA)	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorobutanesulfonic acid (PFBS)	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorohexanesulfonic acid (PFHxS)	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluoroheptanesulfonic acid PFHpS	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorooctanesulfonic acid (PFOS)	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorodecanesulfonic acid (PFDS)	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation EtFOSA	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation MeFOSA	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation EtFOSE	2020/02/26	ND, RDL=0.020		ug/L	

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Post Oxidation MeFOSE	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation EtFOSAA	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation MeFOSAA	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation 6:2 Fluorotelomer sulfonic acid	2020/02/26	ND, RDL=0.020		ug/L	
			Post Oxidation 8:2 Fluorotelomer sulfonic acid	2020/02/26	ND, RDL=0.020		ug/L	
6605351	M_G	RPD [LZY158-01]	Post Oxidation Perfluorobutanoic acid (PFBA)	2020/02/26	4.7		%	30
			Post Oxidation Perfluoropentanoic acid (PFPeA)	2020/02/26	10		%	30
			Post Oxidation Perfluorohexanoic acid (PFHxA)	2020/02/26	14		%	30
			Post Oxidation Perfluoroheptanoic acid (PFHpA)	2020/02/26	5.0		%	30
			Post Oxidation Perfluorooctanoic acid (PFOA)	2020/02/26	6.2		%	30
			Post Oxidation Perfluorononanoic acid (PFNA)	2020/02/26	9.1		%	30
			Post Oxidation Perfluorodecanoic acid (PFDA)	2020/02/26	NC		%	30
			Post Oxidation Perfluoroundecanoic acid (PFUn	2020/02/26	NC		%	30
			Post Oxidation Perfluorododecanoic acid (PFDo	2020/02/26	NC		%	30
			Post Oxidation Perfluorotridecanoic acid (PFTR	2020/02/26	NC		%	30
			Post Oxidation Perfluorotetradecanoic acid(PFT	2020/02/26	NC		%	30
			Post Oxidation Perfluorobutanesulfonic acid (PF	2020/02/26	5.7		%	30
			Post Oxidation Perfluorohexanesulfonic acid(PF	2020/02/26	5.9		%	30
			Post Oxidation Perfluoroheptanesulfonic acid P	2020/02/26	2.6		%	30
			Post Oxidation Perfluorooctanesulfonic acid (PF	2020/02/26	5.9		%	30
			Post Oxidation Perfluorodecanesulfonic acid (PF	2020/02/26	NC		%	30
			Post Oxidation Perfluorooctane Sulfonamide (P	2020/02/26	NC		%	30
			Post Oxidation EtFOSA	2020/02/26	NC		%	30
			Post Oxidation MeFOSA	2020/02/26	NC		%	30
			Post Oxidation EtFOSE	2020/02/26	NC		%	30
			Post Oxidation MeFOSE	2020/02/26	NC		%	30
			Post Oxidation EtFOSAA	2020/02/26	NC		%	30
			Post Oxidation MeFOSAA	2020/02/26	NC		%	30
			Post Oxidation 6:2 Fluorotelomer sulfonic acid	2020/02/26	NC		%	30
			Post Oxidation 8:2 Fluorotelomer sulfonic acid	2020/02/26	NC		%	30
6607953	M_G	Spiked Blank	Post Oxidation 13C2-6:2-Fluorotelomersulfonic	2020/02/27		99	%	50 - 150
			Post Oxidation 13C2-8:2-Fluorotelomersulfonic	2020/02/27		94	%	50 - 150
			Post Oxidation 13C2-Perfluorodecanoic acid	2020/02/27		94	%	50 - 150
			Post Oxidation 13C2-Perfluorododecanoic acid	2020/02/27		88	%	50 - 150
			Post Oxidation 13C2-Perfluorohexanoic acid	2020/02/27		98	%	50 - 150
			Post Oxidation 13C2-perfluorotetradecanoic aci	2020/02/27		79	%	50 - 150
			Post Oxidation 13C2-Perfluoroundecanoic acid	2020/02/27		88	%	50 - 150
			Post Oxidation 13C3-Perfluorobutanesulfonic ac	2020/02/27		103	%	50 - 150
			Post Oxidation 13C4-Perfluorobutanoic acid	2020/02/27		103	%	50 - 150
			Post Oxidation 13C4-Perfluoroheptanoic acid	2020/02/27		100	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanesulfonic ac	2020/02/27		97	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanoic acid	2020/02/27		97	%	50 - 150
			Post Oxidation 13C5-Perfluorononanoic acid	2020/02/27		96	%	50 - 150
			Post Oxidation 13C5-Perfluoropentanoic acid	2020/02/27		100	%	50 - 150
			Post Oxidation 13C8-Perfluorooctane Sulfonami	2020/02/27		83	%	50 - 150
			Post Oxidation 18O2-Perfluorohexanesulfonic a	2020/02/27		98	%	50 - 150
			Post Oxidation D3-MeFOSAA	2020/02/27		87	%	50 - 150

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Post Oxidation D5-EtFOSAA	2020/02/27		83	%	50 - 150
			Post Oxidation D7-MeFOSE	2020/02/27		80	%	50 - 150
			Post Oxidation D9-EtFOSE	2020/02/27		86	%	50 - 150
			Post Oxidation Perfluorobutanoic acid (PFBA)	2020/02/27		102	%	70 - 130
			Post Oxidation Perfluoropentanoic acid (PFPeA)	2020/02/27		108	%	70 - 130
			Post Oxidation Perfluorohexanoic acid (PFHxA)	2020/02/27		111	%	70 - 130
			Post Oxidation Perfluoroheptanoic acid (PFHpA)	2020/02/27		106	%	70 - 130
			Post Oxidation Perfluorooctanoic acid (PFOA)	2020/02/27		110	%	30 - 130
			Post Oxidation Perfluorononanoic acid (PFNA)	2020/02/27		108	%	70 - 130
			Post Oxidation Perfluorodecanoic acid (PFDA)	2020/02/27		106	%	70 - 130
			Post Oxidation Perfluoroundecanoic acid (PFUn	2020/02/27		106	%	70 - 130
			Post Oxidation Perfluorododecanoic acid (PFDo	2020/02/27		103	%	70 - 130
			Post Oxidation Perfluorotridecanoic acid (PFTR	2020/02/27		110	%	70 - 130
			Post Oxidation Perfluorotetradecanoic acid(PFT	2020/02/27		103	%	70 - 130
			Post Oxidation Perfluorobutanesulfonic acid (PF	2020/02/27		106	%	30 - 130
			Post Oxidation Perfluorohexanesulfonic acid(PF	2020/02/27		106	%	30 - 130
			Post Oxidation Perfluoroheptanesulfonic acid P	2020/02/27		109	%	30 - 130
			Post Oxidation Perfluorooctanesulfonic acid (PF	2020/02/27		116	%	30 - 130
			Post Oxidation Perfluorodecanesulfonic acid (PF	2020/02/27		102	%	30 - 130
			Post Oxidation Perfluorooctane Sulfonamide (P	2020/02/27		100	%	70 - 130
			Post Oxidation EtFOSA	2020/02/27		83	%	70 - 130
			Post Oxidation MeFOSA	2020/02/27		83	%	70 - 130
			Post Oxidation EtFOSE	2020/02/27		100	%	70 - 130
			Post Oxidation MeFOSE	2020/02/27		108	%	70 - 130
			Post Oxidation EtFOSAA	2020/02/27		113	%	70 - 130
			Post Oxidation MeFOSAA	2020/02/27		110	%	70 - 130
			Post Oxidation 6:2 Fluorotelomer sulfonic acid	2020/02/27		111	%	30 - 130
			Post Oxidation 8:2 Fluorotelomer sulfonic acid	2020/02/27		114	%	30 - 130
6607953	M_G	Method Blank	Post Oxidation 13C2-6:2-Fluorotelomersulfonic	2020/02/27		96	%	50 - 150
			Post Oxidation 13C2-8:2-Fluorotelomersulfonic	2020/02/27		89	%	50 - 150
			Post Oxidation 13C2-Perfluorodecanoic acid	2020/02/27		85	%	50 - 150
			Post Oxidation 13C2-Perfluorododecanoic acid	2020/02/27		70	%	50 - 150
			Post Oxidation 13C2-Perfluorohexanoic acid	2020/02/27		92	%	50 - 150
			Post Oxidation 13C2-perfluorotetradecanoic aci	2020/02/27		66	%	50 - 150
			Post Oxidation 13C2-Perfluoroundecanoic acid	2020/02/27		77	%	50 - 150
			Post Oxidation 13C3-Perfluorobutanesulfonic ac	2020/02/27		95	%	50 - 150
			Post Oxidation 13C4-Perfluorobutanoic acid	2020/02/27		87	%	50 - 150
			Post Oxidation 13C4-Perfluoroheptanoic acid	2020/02/27		95	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanesulfonic ac	2020/02/27		89	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanoic acid	2020/02/27		91	%	50 - 150
			Post Oxidation 13C5-Perfluorononanoic acid	2020/02/27		90	%	50 - 150
			Post Oxidation 13C5-Perfluoropentanoic acid	2020/02/27		93	%	50 - 150
			Post Oxidation 13C8-Perfluorooctane Sulfonami	2020/02/27		76	%	50 - 150
			Post Oxidation 18O2-Perfluorohexanesulfonic a	2020/02/27		95	%	50 - 150
			Post Oxidation D3-MeFOSAA	2020/02/27		68	%	50 - 150
			Post Oxidation D5-EtFOSAA	2020/02/27		69	%	50 - 150
			Post Oxidation D7-MeFOSE	2020/02/27		74	%	50 - 150
			Post Oxidation D9-EtFOSE	2020/02/27		73	%	50 - 150
			Post Oxidation Perfluorobutanoic acid (PFBA)	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluoropentanoic acid (PFPeA)	2020/02/27	ND, RDL=0.020		ug/L	

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Post Oxidation Perfluorohexanoic acid (PFHxA)	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluoroheptanoic acid (PFHpA)	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorooctanoic acid (PFOA)	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorononanoic acid (PFNA)	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorodecanoic acid (PFDA)	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluoroundecanoic acid (PFUnA)	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorododecanoic acid (PFDoA)	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorotridecanoic acid (PFTRDA)	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorotetradecanoic acid (PFTEDA)	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorobutanesulfonic acid (PFBS)	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorohexanesulfonic acid (PFHxS)	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluoroheptanesulfonic acid PFHpS	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorooctanesulfonic acid (PFOS)	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorodecanesulfonic acid (PFDS)	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation EtFOSA	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation MeFOSA	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation EtFOSE	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation MeFOSE	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation EtFOSAA	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation MeFOSAA	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation 6:2 Fluorotelomer sulfonic acid	2020/02/27	ND, RDL=0.020		ug/L	
			Post Oxidation 8:2 Fluorotelomer sulfonic acid	2020/02/27	ND, RDL=0.020		ug/L	

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Colm McNamara, Senior Analyst, Liquid Chromatography

Sin Chii Chia, Scientific Services

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Your Project #: CFB COMOX
Your C.O.C. #: na

Attention: Dave Liles

Arcadis
North Carolina
4915 Prospectus Dr
Suite G
Durham, NC
USA 27713

Report Date: 2020/03/13
Report #: R6109362
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C051752
Received: 2020/02/26, 13:25

Sample Matrix: Soil
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Moisture	3	N/A	2020/02/28	CAM SOP-00445	Carter 2nd ed 51.2 m
Post Oxidation PFAS in soil (1)	3	2020/03/09	2020/03/10	CAM SOP-00095	Houtz & Sedlak 2012m
PFAS in soil by SPE/LCMS (2)	3	2020/03/05	2020/03/07	CAM SOP-00894	ASTM D7968-17a m
Change in PFAS after oxidation (3)	3	N/A	2020/02/29	CAM SOP-00095	

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Oxidation was performed following the protocol as described by Houtz, E.F. and Sedlak, D.L. (2012). Environ. Sci. Technol., 46, 9342-9349, with some modifications for method optimization.
(2) Per- and polyfluoroalkyl substances (PFAS) identified as surrogates on the certificate of analysis represent the extracted internal standard.
(3) The change in PFAS concentration was calculated by subtracting the pre oxidation concentration from the post oxidation concentration. A negative change indicates a decrease in PFAS concentration after oxidation. If the concentration of a parameter was <RDL either prior to or post oxidation, the concentration was treated as “zero” for the difference calculation. While the PFOS and PFOA analysis by SPE/LCMS used for the quantitation of per- and polyfluoroalkyl substances (PFAS) is an accredited method, the oxidation of PFASs via the TOPs Assay is not an accredited method.

Your Project #: CFB COMOX
Your C.O.C. #: na

Attention: Dave Liles

Arcadis
North Carolina
4915 Prospectus Dr
Suite G
Durham, NC
USA 27713

Report Date: 2020/03/13
Report #: R6109362
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C051752
Received: 2020/02/26, 13:25

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: Stephanie.Pollen@bvlabs.com
Phone# (905)817-5830
==
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total Cover Pages : 2

RESULTS OF ANALYSES OF SOIL

BV Labs ID		MCL134	MCL135	MCL136		
Sampling Date		2020/02/25 12:00	2020/02/25 12:00	2020/02/25 12:00		
COC Number		na	na	na		
	UNITS	**SOIL HOMOGENATE-1**	**SOIL HOMOGENATE-2**	**SOIL HOMOGENATE-3**	**RDL**	**QC Batch**
Inorganics						
Moisture	%	12	11	12	1.0	6611537

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

PERFLUOROALKYL SUBSTANCES (SOIL)

BV Labs ID		MCL134		MCL135		
Sampling Date		2020/02/25 12:00		2020/02/25 12:00		
COC Number		na		na		
	UNITS	**SOIL HOMOGENATE-1**	**RDL**	**SOIL HOMOGENATE-2**	**RDL**	**QC Batch**
Perfluorinated Compounds						
Perfluorobutanoic acid (PFBA)	ug/kg	ND	10	ND	10	6620577
Post Oxidation Perfluorobutanoic acid (PFBA)	ug/kg	210	6.0	250	6.0	6625933
Perfluoropentanoic acid (PFPeA)	ug/kg	25	10	23	10	6620577
Post Oxidation Perfluoropentanoic acid (PFPeA)	ug/kg	280	6.0	260	60	6625933
Perfluorohexanoic acid (PFHxA)	ug/kg	22	10	22	10	6620577
Post Oxidation Perfluorohexanoic acid (PFHxA)	ug/kg	340	60	380	60	6625933
Perfluoroheptanoic acid (PFHpA)	ug/kg	ND	10	ND	10	6620577
Post Oxidation Perfluoroheptanoic acid (PFHpA)	ug/kg	120	6.0	140	6.0	6625933
Perfluorooctanoic acid (PFOA)	ug/kg	31	10	33	10	6620577
Post Oxidation Perfluorooctanoic acid (PFOA)	ug/kg	200	6.0	260	6.0	6625933
Perfluorononanoic acid (PFNA)	ug/kg	16	10	14	10	6620577
Post Oxidation Perfluorononanoic acid (PFNA)	ug/kg	25	6.0	26	6.0	6625933
Perfluorodecanoic acid (PFDA)	ug/kg	ND	10	ND	10	6620577
Post Oxidation Perfluorodecanoic acid (PFDA)	ug/kg	ND	6.0	ND	6.0	6625933
Perfluoroundecanoic acid (PFUnA)	ug/kg	ND	10	ND	10	6620577
Post Oxidation Perfluoroundecanoic acid (PFUnA)	ug/kg	ND	6.0	ND	6.0	6625933
Perfluorododecanoic acid (PFDoA)	ug/kg	ND	10	ND	10	6620577
Post Oxidation Perfluorododecanoic acid (PFDoA)	ug/kg	ND	6.0	ND	6.0	6625933
Perfluorotridecanoic acid (PFTRDA)	ug/kg	ND	10	ND	10	6620577
Post Oxidation Perfluorotridecanoic acid (PFTRDA)	ug/kg	ND	6.0	ND	6.0	6625933
Perfluorotetradecanoic acid(PFTEDA)	ug/kg	ND	10	ND	10	6620577
Post Oxidation Perfluorotetradecanoic acid(PFTEDA)	ug/kg	ND	6.0	ND	6.0	6625933
Perfluorobutanesulfonic acid (PFBS)	ug/kg	ND	10	ND	10	6620577
Post Oxidation Perfluorobutanesulfonic acid (PFBS)	ug/kg	6.0	6.0	6.3	6.0	6625933
Perfluorohexanesulfonic acid(PFHxS)	ug/kg	82	10	79	10	6620577
Post Oxidation Perfluorohexanesulfonic acid(PFHxS)	ug/kg	120	6.0	130	6.0	6625933
Perfluoroheptanesulfonic acid PFHpS	ug/kg	ND	10	ND	10	6620577
Post Oxidation Perfluoroheptanesulfonic acid PFHpS	ug/kg	14	6.0	16	6.0	6625933
Perfluorooctanesulfonic acid (PFOS)	ug/kg	3200	100	2800	100	6620577
Post Oxidation Perfluorooctanesulfonic acid (PFOS)	ug/kg	2300	60	2500	60	6625933
Perfluorodecanesulfonic acid (PFDS)	ug/kg	ND	10	ND	10	6620577
Post Oxidation Perfluorodecanesulfonic acid (PFDS)	ug/kg	ND	6.0	ND	6.0	6625933
Perfluorooctane Sulfonamide (PFOSA)	ug/kg	210	10	250	10	6620577
Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	ug/kg	98	6.0	93	6.0	6625933

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected

PERFLUOROALKYL SUBSTANCES (SOIL)

BV Labs ID		MCL134		MCL135		
Sampling Date		2020/02/25 12:00		2020/02/25 12:00		
COC Number		na		na		
	UNITS	**SOIL HOMOGENATE-1**	**RDL**	**SOIL HOMOGENATE-2**	**RDL**	**QC Batch**
EtFOSA	ug/kg	ND	10	ND	10	6620577
Post Oxidation EtFOSA	ug/kg	ND	6.0	ND	6.0	6625933
MeFOSA	ug/kg	ND	10	ND	10	6620577
Post Oxidation MeFOSA	ug/kg	ND	6.0	ND	6.0	6625933
EtFOSE	ug/kg	ND	10	ND	10	6620577
Post Oxidation EtFOSE	ug/kg	ND	6.0	ND	6.0	6625933
MeFOSE	ug/kg	ND	10	ND	10	6620577
Post Oxidation MeFOSE	ug/kg	ND	6.0	ND	6.0	6625933
EtFOSAA	ug/kg	ND	10	ND	10	6620577
Post Oxidation EtFOSAA	ug/kg	ND	6.0	ND	6.0	6625933
MeFOSAA	ug/kg	ND	10	ND	10	6620577
Post Oxidation MeFOSAA	ug/kg	ND	6.0	ND	6.0	6625933
6:2 Fluorotelomer sulfonic acid	ug/kg	140	10	160	10	6620577
Post Oxidation 6:2 Fluorotelomer sulfonic acid	ug/kg	340	60	360	60	6625933
8:2 Fluorotelomer sulfonic acid	ug/kg	210	10	240	10	6620577
Post Oxidation 8:2 Fluorotelomer sulfonic acid	ug/kg	140	6.0	160	6.0	6625933
Surrogate Recovery (%)						
Post Oxidation 13C2-6:2-Fluorotelomersulfonic Acid	%	108	N/A	107	N/A	6625933
Post Oxidation 13C2-8:2-Fluorotelomersulfonic Acid	%	89	N/A	93	N/A	6625933
Post Oxidation 13C2-Perfluorodecanoic acid	%	92	N/A	94	N/A	6625933
Post Oxidation 13C2-Perfluorododecanoic acid	%	79	N/A	87	N/A	6625933
Post Oxidation 13C2-Perfluorohexanoic acid	%	105	N/A	109	N/A	6625933
Post Oxidation 13C2-perfluorotetradecanoic acid	%	75	N/A	85	N/A	6625933
Post Oxidation 13C2-Perfluoroundecanoic acid	%	85	N/A	90	N/A	6625933
Post Oxidation 13C3-Perfluorobutanesulfonic acid	%	96	N/A	97	N/A	6625933
Post Oxidation 13C4-Perfluorobutanoic acid	%	54	N/A	49 (1)	N/A	6625933
Post Oxidation 13C4-Perfluoroheptanoic acid	%	95	N/A	96	N/A	6625933
Post Oxidation 13C4-Perfluorooctanesulfonic acid	%	101	N/A	100	N/A	6625933
Post Oxidation 13C4-Perfluorooctanoic acid	%	96	N/A	97	N/A	6625933
Post Oxidation 13C5-Perfluorononanoic acid	%	95	N/A	99	N/A	6625933

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

ND = Not detected

N/A = Not Applicable

(1) Extracted internal standard analyte recovery was below the defined lower control limit (LCL). Laboratory spiked soil resulted in satisfactory recovery of the extracted internal standard analyte. When considered together, these QC data suggest that matrix interferences may be increasing the variability of the associated native analyte result (Perfluorobutanoic acid - PFBA).

PERFLUOROALKYL SUBSTANCES (SOIL)

BV Labs ID		MCL134		MCL135		
Sampling Date		2020/02/25 12:00		2020/02/25 12:00		
COC Number		na		na		
	UNITS	**SOIL HOMOGENATE-1**	**RDL**	**SOIL HOMOGENATE-2**	**RDL**	**QC Batch**
Post Oxidation 13C5-Perfluoropentanoic acid	%	89	N/A	105	N/A	6625933
Post Oxidation 13C8-Perfluorooctane Sulfonamide	%	82	N/A	88	N/A	6625933
Post Oxidation 18O2-Perfluorohexanesulfonic acid	%	97	N/A	101	N/A	6625933
Post Oxidation D3-MeFOSAA	%	85	N/A	87	N/A	6625933
Post Oxidation D5-EtFOSAA	%	82	N/A	87	N/A	6625933
Post Oxidation D7-MeFOSE	%	76	N/A	81	N/A	6625933
Post Oxidation D9-EtFOSE	%	75	N/A	79	N/A	6625933
13C2-6:2-Fluorotelomersulfonic Acid	%	96	N/A	94	N/A	6620577
13C2-8:2-Fluorotelomersulfonic Acid	%	95	N/A	93	N/A	6620577
13C2-Perfluorodecanoic acid	%	99	N/A	101	N/A	6620577
13C2-Perfluorododecanoic acid	%	96	N/A	97	N/A	6620577
13C2-Perfluorohexanoic acid	%	111	N/A	111	N/A	6620577
13C2-perfluorotetradecanoic acid	%	93	N/A	94	N/A	6620577
13C2-Perfluoroundecanoic acid	%	98	N/A	99	N/A	6620577
13C3-Perfluorobutanesulfonic acid	%	97	N/A	97	N/A	6620577
13C4-Perfluorobutanoic acid	%	103	N/A	104	N/A	6620577
13C4-Perfluoroheptanoic acid	%	109	N/A	110	N/A	6620577
13C4-Perfluorooctanesulfonic acid	%	97	N/A	97	N/A	6620577
13C4-Perfluorooctanoic acid	%	103	N/A	104	N/A	6620577
13C5-Perfluorononanoic acid	%	104	N/A	106	N/A	6620577
13C5-Perfluoropentanoic acid	%	107	N/A	107	N/A	6620577
13C8-Perfluorooctane Sulfonamide	%	96	N/A	94	N/A	6620577
18O2-Perfluorohexanesulfonic acid	%	94	N/A	94	N/A	6620577
D3-MeFOSA	%	87	N/A	88	N/A	6620577
D3-MeFOSAA	%	97	N/A	94	N/A	6620577
D5-EtFOSA	%	88	N/A	90	N/A	6620577
D5-EtFOSAA	%	91	N/A	95	N/A	6620577
D7-MeFOSE	%	86	N/A	89	N/A	6620577
D9-EtFOSE	%	85	N/A	86	N/A	6620577

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (SOIL)

BV Labs ID		MCL136		
Sampling Date		2020/02/25 12:00		
COC Number		na		
	UNITS	**SOIL HOMOGENATE-3**	**RDL**	**QC Batch**
Perfluorinated Compounds				
Perfluorobutanoic acid (PFBA)	ug/kg	ND	10	6620577
Post Oxidation Perfluorobutanoic acid (PFBA)	ug/kg	210	6.0	6625933
Perfluoropentanoic acid (PFPeA)	ug/kg	26	10	6620577
Post Oxidation Perfluoropentanoic acid (PFPeA)	ug/kg	220	60	6625933
Perfluorohexanoic acid (PFHxA)	ug/kg	22	10	6620577
Post Oxidation Perfluorohexanoic acid (PFHxA)	ug/kg	330	60	6625933
Perfluoroheptanoic acid (PFHpA)	ug/kg	ND	10	6620577
Post Oxidation Perfluoroheptanoic acid (PFHpA)	ug/kg	110	6.0	6625933
Perfluorooctanoic acid (PFOA)	ug/kg	32	10	6620577
Post Oxidation Perfluorooctanoic acid (PFOA)	ug/kg	210	6.0	6625933
Perfluorononanoic acid (PFNA)	ug/kg	15	10	6620577
Post Oxidation Perfluorononanoic acid (PFNA)	ug/kg	25	6.0	6625933
Perfluorodecanoic acid (PFDA)	ug/kg	ND	10	6620577
Post Oxidation Perfluorodecanoic acid (PFDA)	ug/kg	ND	6.0	6625933
Perfluoroundecanoic acid (PFUnA)	ug/kg	ND	10	6620577
Post Oxidation Perfluoroundecanoic acid (PFUnA)	ug/kg	ND	6.0	6625933
Perfluorododecanoic acid (PFDoA)	ug/kg	ND	10	6620577
Post Oxidation Perfluorododecanoic acid (PFDoA)	ug/kg	ND	6.0	6625933
Perfluorotridecanoic acid (PFTRDA)	ug/kg	ND	10	6620577
Post Oxidation Perfluorotridecanoic acid (PFTRDA)	ug/kg	ND	6.0	6625933
Perfluorotetradecanoic acid(PFTEDA)	ug/kg	ND	10	6620577
Post Oxidation Perfluorotetradecanoic acid(PFTEDA)	ug/kg	ND	6.0	6625933
Perfluorobutanesulfonic acid (PFBS)	ug/kg	ND	10	6620577
Post Oxidation Perfluorobutanesulfonic acid (PFBS)	ug/kg	6.1	6.0	6625933
Perfluorohexanesulfonic acid(PFHxS)	ug/kg	79	10	6620577
Post Oxidation Perfluorohexanesulfonic acid(PFHxS)	ug/kg	110	6.0	6625933
Perfluoroheptanesulfonic acid PFHpS	ug/kg	ND	10	6620577
Post Oxidation Perfluoroheptanesulfonic acid PFHpS	ug/kg	14	6.0	6625933
Perfluorooctanesulfonic acid (PFOS)	ug/kg	2800	100	6620577
Post Oxidation Perfluorooctanesulfonic acid (PFOS)	ug/kg	2400	60	6625933
Perfluorodecanesulfonic acid (PFDS)	ug/kg	ND	10	6620577
Post Oxidation Perfluorodecanesulfonic acid (PFDS)	ug/kg	ND	6.0	6625933
Perfluorooctane Sulfonamide (PFOSA)	ug/kg	210	10	6620577
Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	ug/kg	120	6.0	6625933

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected

PERFLUOROALKYL SUBSTANCES (SOIL)

BV Labs ID		MCL136		
Sampling Date		2020/02/25 12:00		
COC Number		na		
	UNITS	**SOIL HOMOGENATE-3**	**RDL**	**QC Batch**
EtFOSA	ug/kg	ND	10	6620577
Post Oxidation EtFOSA	ug/kg	ND	6.0	6625933
MeFOSA	ug/kg	ND	10	6620577
Post Oxidation MeFOSA	ug/kg	ND	6.0	6625933
EtFOSE	ug/kg	ND	10	6620577
Post Oxidation EtFOSE	ug/kg	ND	6.0	6625933
MeFOSE	ug/kg	ND	10	6620577
Post Oxidation MeFOSE	ug/kg	ND	6.0	6625933
EtFOSAA	ug/kg	ND	10	6620577
Post Oxidation EtFOSAA	ug/kg	ND	6.0	6625933
MeFOSAA	ug/kg	ND	10	6620577
Post Oxidation MeFOSAA	ug/kg	ND	6.0	6625933
6:2 Fluorotelomer sulfonic acid	ug/kg	150	10	6620577
Post Oxidation 6:2 Fluorotelomer sulfonic acid	ug/kg	420	60	6625933
8:2 Fluorotelomer sulfonic acid	ug/kg	210	10	6620577
Post Oxidation 8:2 Fluorotelomer sulfonic acid	ug/kg	160	6.0	6625933
Surrogate Recovery (%)				
Post Oxidation 13C2-6:2-Fluorotelomersulfonic Acid	%	106	N/A	6625933
Post Oxidation 13C2-8:2-Fluorotelomersulfonic Acid	%	88	N/A	6625933
Post Oxidation 13C2-Perfluorodecanoic acid	%	92	N/A	6625933
Post Oxidation 13C2-Perfluorododecanoic acid	%	82	N/A	6625933
Post Oxidation 13C2-Perfluorohexanoic acid	%	108	N/A	6625933
Post Oxidation 13C2-perfluorotetradecanoic acid	%	77	N/A	6625933
Post Oxidation 13C2-Perfluoroundecanoic acid	%	87	N/A	6625933
Post Oxidation 13C3-Perfluorobutanesulfonic acid	%	95	N/A	6625933
Post Oxidation 13C4-Perfluorobutanoic acid	%	53	N/A	6625933
Post Oxidation 13C4-Perfluoroheptanoic acid	%	95	N/A	6625933
Post Oxidation 13C4-Perfluorooctanesulfonic acid	%	101	N/A	6625933
Post Oxidation 13C4-Perfluorooctanoic acid	%	95	N/A	6625933
Post Oxidation 13C5-Perfluorononanoic acid	%	93	N/A	6625933
Post Oxidation 13C5-Perfluoropentanoic acid	%	103	N/A	6625933
Post Oxidation 13C8-Perfluorooctane Sulfonamide	%	82	N/A	6625933
Post Oxidation 18O2-Perfluorohexanesulfonic acid	%	95	N/A	6625933
Post Oxidation D3-MeFOSAA	%	82	N/A	6625933

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (SOIL)

BV Labs ID		MCL136		
Sampling Date		2020/02/25 12:00		
COC Number		na		
	UNITS	**SOIL HOMOGENATE-3**	**RDL**	**QC Batch**
Post Oxidation D5-EtFOSAA	%	80	N/A	6625933
Post Oxidation D7-MeFOSE	%	76	N/A	6625933
Post Oxidation D9-EtFOSE	%	74	N/A	6625933
13C2-6:2-Fluorotelomersulfonic Acid	%	94	N/A	6620577
13C2-8:2-Fluorotelomersulfonic Acid	%	96	N/A	6620577
13C2-Perfluorodecanoic acid	%	102	N/A	6620577
13C2-Perfluorododecanoic acid	%	98	N/A	6620577
13C2-Perfluorohexanoic acid	%	115	N/A	6620577
13C2-perfluorotetradecanoic acid	%	94	N/A	6620577
13C2-Perfluoroundecanoic acid	%	101	N/A	6620577
13C3-Perfluorobutanesulfonic acid	%	99	N/A	6620577
13C4-Perfluorobutanoic acid	%	106	N/A	6620577
13C4-Perfluoroheptanoic acid	%	111	N/A	6620577
13C4-Perfluorooctanesulfonic acid	%	97	N/A	6620577
13C4-Perfluorooctanoic acid	%	105	N/A	6620577
13C5-Perfluorononanoic acid	%	105	N/A	6620577
13C5-Perfluoropentanoic acid	%	110	N/A	6620577
13C8-Perfluorooctane Sulfonamide	%	95	N/A	6620577
18O2-Perfluorohexanesulfonic acid	%	97	N/A	6620577
D3-MeFOSA	%	88	N/A	6620577
D3-MeFOSAA	%	95	N/A	6620577
D5-EtFOSA	%	88	N/A	6620577
D5-EtFOSAA	%	96	N/A	6620577
D7-MeFOSE	%	88	N/A	6620577
D9-EtFOSE	%	88	N/A	6620577

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

DIFFERENCE IN PRE & POST OXIDATION CONC. (SOIL)

BV Labs ID		MCL134	MCL135	MCL136	
Sampling Date		2020/02/25 12:00	2020/02/25 12:00	2020/02/25 12:00	
COC Number		na	na	na	
	UNITS	**SOIL HOMOGENATE-1**	**SOIL HOMOGENATE-2**	**SOIL HOMOGENATE-3**	**QC Batch**
Perfluorinated Compounds					
Change in Perfluorobutanoic acid (PFBA)	ug/kg	210	250	210	6607854
Change in Perfluoropentanoic acid (PFPeA)	ug/kg	250	230	200	6607854
Change in Perfluorohexanoic acid (PFHxA)	ug/kg	320	360	310	6607854
Change in Perfluoroheptanoic acid (PFHpA)	ug/kg	120	140	110	6607854
Change in Perfluorooctanoic acid (PFOA)	ug/kg	170	220	170	6607854
Change in Perfluorononanoic acid (PFNA)	ug/kg	9.1	12	9.3	6607854
Change in Perfluorodecanoic acid (PFDA)	ug/kg	0	0	0	6607854
Change in Perfluoroundecanoic acid (PFUnA)	ug/kg	0	0	0	6607854
Change in Perfluorododecanoic acid (PFDoA)	ug/kg	0	0	0	6607854
Change in Perfluorotridecanoic acid (PFTRDA)	ug/kg	0	0	0	6607854
Change in Perfluorotetradecanoic acid(PFTEDA)	ug/kg	0	0	0	6607854
Change in Perfluorobutanesulfonic acid (PFBS)	ug/kg	6.0	6.3	6.1	6607854
Change in Perfluorohexanesulfonic acid(PFHxS)	ug/kg	41	49	34	6607854
Change in Perfluoroheptanesulfonic acid PFHpS	ug/kg	14	16	14	6607854
Change in Perfluorooctanesulfonic acid (PFOS)	ug/kg	-940	-350	-370	6607854
Change in Perfluorodecanesulfonic acid (PFDS)	ug/kg	0	0	0	6607854
Change in Perfluorooctane Sulfonamide (PFOSA)	ug/kg	-110	-160	-90	6607854
Change in EtFOSA	ug/kg	0	0	0	6607854
Change in MeFOSA	ug/kg	0	0	0	6607854
Change in EtFOSE	ug/kg	0	0	0	6607854
Change in MeFOSE	ug/kg	0	0	0	6607854
Change in EtFOSAA	ug/kg	0	0	0	6607854
Change in MeFOSAA	ug/kg	0	0	0	6607854
Change in 6:2 Fluorotelomer sulfonic acid	ug/kg	200	200	280	6607854
Change in 8:2 Fluorotelomer sulfonic acid	ug/kg	-75	-88	-44	6607854

QC Batch = Quality Control Batch

TEST SUMMARY

BV Labs ID: MCL134
Sample ID: SOIL HOMOGENATE-1
Matrix: Soil

Collected: 2020/02/25
Shipped:
Received: 2020/02/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	6611537	N/A	2020/02/28	Min Yang
Post Oxidation PFAS in soil	LCMS	6625933	2020/03/09	2020/03/10	Adnan Khan
PFAS in soil by SPE/LCMS	LCMS	6620577	2020/03/05	2020/03/07	Patrick Yu Peng Li
Change in PFAS after oxidation	LCMS	6607854	N/A	2020/02/29	Automated Statchk

BV Labs ID: MCL135
Sample ID: SOIL HOMOGENATE-2
Matrix: Soil

Collected: 2020/02/25
Shipped:
Received: 2020/02/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	6611537	N/A	2020/02/28	Min Yang
Post Oxidation PFAS in soil	LCMS	6625933	2020/03/09	2020/03/10	Adnan Khan
PFAS in soil by SPE/LCMS	LCMS	6620577	2020/03/05	2020/03/07	Patrick Yu Peng Li
Change in PFAS after oxidation	LCMS	6607854	N/A	2020/02/29	Automated Statchk

BV Labs ID: MCL136
Sample ID: SOIL HOMOGENATE-3
Matrix: Soil

Collected: 2020/02/25
Shipped:
Received: 2020/02/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	6611537	N/A	2020/02/28	Min Yang
Post Oxidation PFAS in soil	LCMS	6625933	2020/03/09	2020/03/10	Adnan Khan
PFAS in soil by SPE/LCMS	LCMS	6620577	2020/03/05	2020/03/07	Patrick Yu Peng Li
Change in PFAS after oxidation	LCMS	6607854	N/A	2020/02/29	Automated Statchk

GENERAL COMMENTS

Sample MCL134 [SOIL HOMOGENATE-1] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, sample required dilution. Detection limits were adjusted accordingly.

Sample MCL135 [SOIL HOMOGENATE-2] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, sample required dilution. Detection limits were adjusted accordingly.

Sample MCL136 [SOIL HOMOGENATE-3] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, sample required dilution. Detection limits were adjusted accordingly.

Results relate only to the items tested.

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6611537	KJP	RPD	Moisture	2020/02/28	2.5		%	20
6620577	YPL	Matrix Spike	13C2-6:2-Fluorotelomersulfonic Acid	2020/03/07		94	%	50 - 150
			13C2-8:2-Fluorotelomersulfonic Acid	2020/03/07		90	%	50 - 150
			13C2-Perfluorodecanoic acid	2020/03/07		93	%	50 - 150
			13C2-Perfluorododecanoic acid	2020/03/07		86	%	50 - 150
			13C2-Perfluorohexanoic acid	2020/03/07		102	%	50 - 150
			13C2-perfluorotetradecanoic acid	2020/03/07		80	%	50 - 150
			13C2-Perfluoroundecanoic acid	2020/03/07		89	%	50 - 150
			13C3-Perfluorobutanesulfonic acid	2020/03/07		94	%	50 - 150
			13C4-Perfluorobutanoic acid	2020/03/07		93	%	50 - 150
			13C4-Perfluoroheptanoic acid	2020/03/07		101	%	50 - 150
			13C4-Perfluorooctanesulfonic acid	2020/03/07		91	%	50 - 150
			13C4-Perfluorooctanoic acid	2020/03/07		98	%	50 - 150
			13C5-Perfluorononanoic acid	2020/03/07		97	%	50 - 150
			13C5-Perfluoropentanoic acid	2020/03/07		101	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2020/03/07		83	%	50 - 150
			18O2-Perfluorohexanesulfonic acid	2020/03/07		93	%	50 - 150
			D3-MeFOSA	2020/03/07		60	%	50 - 150
			D3-MeFOSAA	2020/03/07		86	%	50 - 150
			D5-EtFOSA	2020/03/07		61	%	50 - 150
			D5-EtFOSAA	2020/03/07		80	%	50 - 150
			D7-MeFOSE	2020/03/07		69	%	50 - 150
			D9-EtFOSE	2020/03/07		68	%	50 - 150
			Perfluorobutanoic acid (PFBA)	2020/03/07		102	%	70 - 130
			Perfluoropentanoic acid (PFPeA)	2020/03/07		104	%	70 - 130
			Perfluorohexanoic acid (PFHxA)	2020/03/07		108	%	70 - 130
			Perfluoroheptanoic acid (PFHpA)	2020/03/07		105	%	70 - 130
			Perfluorooctanoic acid (PFOA)	2020/03/07		109	%	70 - 130
			Perfluorononanoic acid (PFNA)	2020/03/07		104	%	70 - 130
			Perfluorodecanoic acid (PFDA)	2020/03/07		103	%	70 - 130
			Perfluoroundecanoic acid (PFUnA)	2020/03/07		107	%	70 - 130
			Perfluorododecanoic acid (PFDoA)	2020/03/07		107	%	70 - 130
			Perfluorotridecanoic acid (PFTRDA)	2020/03/07		113	%	70 - 130
			Perfluorotetradecanoic acid(PFTEDA)	2020/03/07		109	%	70 - 130
			Perfluorobutanesulfonic acid (PFBS)	2020/03/07		100	%	70 - 130
			Perfluorohexanesulfonic acid(PFHxS)	2020/03/07		100	%	70 - 130
			Perfluoroheptanesulfonic acid PFHpS	2020/03/07		100	%	70 - 130
			Perfluorooctanesulfonic acid (PFOS)	2020/03/07		108	%	70 - 130
			Perfluorodecanesulfonic acid (PFDS)	2020/03/07		100	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2020/03/07		108	%	70 - 130
			EtFOSA	2020/03/07		105	%	70 - 130
			MeFOSA	2020/03/07		106	%	70 - 130
			EtFOSE	2020/03/07		114	%	70 - 130
			MeFOSE	2020/03/07		109	%	70 - 130
			EtFOSAA	2020/03/07		112	%	70 - 130
			MeFOSAA	2020/03/07		107	%	70 - 130
			6:2 Fluorotelomer sulfonic acid	2020/03/07		107	%	70 - 130
			8:2 Fluorotelomer sulfonic acid	2020/03/07		115	%	70 - 130
6620577	YPL	Spiked Blank	13C2-6:2-Fluorotelomersulfonic Acid	2020/03/07		90	%	50 - 150
			13C2-8:2-Fluorotelomersulfonic Acid	2020/03/07		92	%	50 - 150
			13C2-Perfluorodecanoic acid	2020/03/07		90	%	50 - 150
			13C2-Perfluorododecanoic acid	2020/03/07		84	%	50 - 150

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			13C2-Perfluorohexanoic acid	2020/03/07		98	%	50 - 150
			13C2-perfluorotetradecanoic acid	2020/03/07		83	%	50 - 150
			13C2-Perfluoroundecanoic acid	2020/03/07		88	%	50 - 150
			13C3-Perfluorobutanesulfonic acid	2020/03/07		89	%	50 - 150
			13C4-Perfluorobutanoic acid	2020/03/07		93	%	50 - 150
			13C4-Perfluoroheptanoic acid	2020/03/07		97	%	50 - 150
			13C4-Perfluorooctanesulfonic acid	2020/03/07		88	%	50 - 150
			13C4-Perfluorooctanoic acid	2020/03/07		94	%	50 - 150
			13C5-Perfluorononanoic acid	2020/03/07		93	%	50 - 150
			13C5-Perfluoropentanoic acid	2020/03/07		96	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2020/03/07		79	%	50 - 150
			18O2-Perfluorohexanesulfonic acid	2020/03/07		89	%	50 - 150
			D3-MeFOSA	2020/03/07		54	%	50 - 150
			D3-MeFOSAA	2020/03/07		84	%	50 - 150
			D5-EtFOSA	2020/03/07		53	%	50 - 150
			D5-EtFOSAA	2020/03/07		80	%	50 - 150
			D7-MeFOSE	2020/03/07		67	%	50 - 150
			D9-EtFOSE	2020/03/07		65	%	50 - 150
			Perfluorobutanoic acid (PFBA)	2020/03/07		97	%	70 - 130
			Perfluoropentanoic acid (PFPeA)	2020/03/07		101	%	70 - 130
			Perfluorohexanoic acid (PFHxA)	2020/03/07		105	%	70 - 130
			Perfluoroheptanoic acid (PFHpA)	2020/03/07		103	%	70 - 130
			Perfluorooctanoic acid (PFOA)	2020/03/07		107	%	70 - 130
			Perfluorononanoic acid (PFNA)	2020/03/07		104	%	70 - 130
			Perfluorodecanoic acid (PFDA)	2020/03/07		102	%	70 - 130
			Perfluoroundecanoic acid (PFUnA)	2020/03/07		104	%	70 - 130
			Perfluorododecanoic acid (PFDoA)	2020/03/07		105	%	70 - 130
			Perfluorotridecanoic acid (PFTRDA)	2020/03/07		106	%	70 - 130
			Perfluorotetradecanoic acid(PFTEDA)	2020/03/07		105	%	70 - 130
			Perfluorobutanesulfonic acid (PFBS)	2020/03/07		98	%	70 - 130
			Perfluorohexanesulfonic acid(PFHxS)	2020/03/07		100	%	70 - 130
			Perfluoroheptanesulfonic acid PFHpS	2020/03/07		99	%	70 - 130
			Perfluorooctanesulfonic acid (PFOS)	2020/03/07		105	%	70 - 130
			Perfluorodecanesulfonic acid (PFDS)	2020/03/07		97	%	70 - 130
			Perfluorooctane Sulfonamide (PFOSA)	2020/03/07		104	%	70 - 130
			EtFOSA	2020/03/07		107	%	70 - 130
			MeFOSA	2020/03/07		106	%	70 - 130
			EtFOSE	2020/03/07		107	%	70 - 130
			MeFOSE	2020/03/07		107	%	70 - 130
			EtFOSAA	2020/03/07		112	%	70 - 130
			MeFOSAA	2020/03/07		106	%	70 - 130
			6:2 Fluorotelomer sulfonic acid	2020/03/07		106	%	70 - 130
			8:2 Fluorotelomer sulfonic acid	2020/03/07		106	%	70 - 130
6620577	YPL	Method Blank	13C2-6:2-Fluorotelomersulfonic Acid	2020/03/07		102	%	50 - 150
			13C2-8:2-Fluorotelomersulfonic Acid	2020/03/07		97	%	50 - 150
			13C2-Perfluorodecanoic acid	2020/03/07		92	%	50 - 150
			13C2-Perfluorododecanoic acid	2020/03/07		87	%	50 - 150
			13C2-Perfluorohexanoic acid	2020/03/07		108	%	50 - 150
			13C2-perfluorotetradecanoic acid	2020/03/07		81	%	50 - 150
			13C2-Perfluoroundecanoic acid	2020/03/07		91	%	50 - 150
			13C3-Perfluorobutanesulfonic acid	2020/03/07		93	%	50 - 150
			13C4-Perfluorobutanoic acid	2020/03/07		96	%	50 - 150

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			13C4-Perfluoroheptanoic acid	2020/03/07		104	%	50 - 150
			13C4-Perfluorooctanesulfonic acid	2020/03/07		92	%	50 - 150
			13C4-Perfluorooctanoic acid	2020/03/07		101	%	50 - 150
			13C5-Perfluorononanoic acid	2020/03/07		100	%	50 - 150
			13C5-Perfluoropentanoic acid	2020/03/07		101	%	50 - 150
			13C8-Perfluorooctane Sulfonamide	2020/03/07		80	%	50 - 150
			18O2-Perfluorohexanesulfonic acid	2020/03/07		94	%	50 - 150
			D3-MeFOSA	2020/03/07		54	%	50 - 150
			D3-MeFOSAA	2020/03/07		90	%	50 - 150
			D5-EtFOSA	2020/03/07		52	%	50 - 150
			D5-EtFOSAA	2020/03/07		82	%	50 - 150
			D7-MeFOSE	2020/03/07		64	%	50 - 150
			D9-EtFOSE	2020/03/07		68	%	50 - 150
			Perfluorobutanoic acid (PFBA)	2020/03/07	ND, RDL=1.0		ug/kg	
			Perfluoropentanoic acid (PFPeA)	2020/03/07	ND, RDL=1.0		ug/kg	
			Perfluorohexanoic acid (PFHxA)	2020/03/07	ND, RDL=1.0		ug/kg	
			Perfluoroheptanoic acid (PFHpA)	2020/03/07	ND, RDL=1.0		ug/kg	
			Perfluorooctanoic acid (PFOA)	2020/03/07	ND, RDL=1.0		ug/kg	
			Perfluorononanoic acid (PFNA)	2020/03/07	ND, RDL=1.0		ug/kg	
			Perfluorodecanoic acid (PFDA)	2020/03/07	ND, RDL=1.0		ug/kg	
			Perfluoroundecanoic acid (PFUnA)	2020/03/07	ND, RDL=1.0		ug/kg	
			Perfluorododecanoic acid (PFDoA)	2020/03/07	ND, RDL=1.0		ug/kg	
			Perfluorotridecanoic acid (PFTRDA)	2020/03/07	ND, RDL=1.0		ug/kg	
			Perfluorotetradecanoic acid(PFTEDA)	2020/03/07	ND, RDL=1.0		ug/kg	
			Perfluorobutanesulfonic acid (PFBS)	2020/03/07	ND, RDL=1.0		ug/kg	
			Perfluorohexanesulfonic acid(PFHxS)	2020/03/07	ND, RDL=1.0		ug/kg	
			Perfluoroheptanesulfonic acid PFHpS	2020/03/07	ND, RDL=1.0		ug/kg	
			Perfluorooctanesulfonic acid (PFOS)	2020/03/07	ND, RDL=1.0		ug/kg	
			Perfluorodecanesulfonic acid (PFDS)	2020/03/07	ND, RDL=1.0		ug/kg	
			Perfluorooctane Sulfonamide (PFOSA)	2020/03/07	ND, RDL=1.0		ug/kg	
			EtFOSA	2020/03/07	ND, RDL=1.0		ug/kg	
			MeFOSA	2020/03/07	ND, RDL=1.0		ug/kg	
			EtFOSE	2020/03/07	ND, RDL=1.0		ug/kg	

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			MeFOSE	2020/03/07	ND, RDL=1.0		ug/kg	
			EtFOSAA	2020/03/07	ND, RDL=1.0		ug/kg	
			MeFOSAA	2020/03/07	ND, RDL=1.0		ug/kg	
			6:2 Fluorotelomer sulfonic acid	2020/03/07	ND, RDL=1.0		ug/kg	
			8:2 Fluorotelomer sulfonic acid	2020/03/07	ND, RDL=1.0		ug/kg	
6620577	YPL	RPD	Perfluorobutanoic acid (PFBA)	2020/03/07	NC		%	30
			Perfluoropentanoic acid (PFPeA)	2020/03/07	NC		%	30
			Perfluorohexanoic acid (PFHxA)	2020/03/07	NC		%	30
			Perfluoroheptanoic acid (PFHpA)	2020/03/07	NC		%	30
			Perfluorooctanoic acid (PFOA)	2020/03/07	NC		%	30
			Perfluorononanoic acid (PFNA)	2020/03/07	NC		%	30
			Perfluorodecanoic acid (PFDA)	2020/03/07	NC		%	30
			Perfluoroundecanoic acid (PFUnA)	2020/03/07	NC		%	30
			Perfluorododecanoic acid (PFDoA)	2020/03/07	NC		%	30
			Perfluorotridecanoic acid (PFTRDA)	2020/03/07	NC		%	30
			Perfluorotetradecanoic acid(PFTEDA)	2020/03/07	NC		%	30
			Perfluorobutanesulfonic acid (PFBS)	2020/03/07	NC		%	30
			Perfluorohexanesulfonic acid(PFHxS)	2020/03/07	NC		%	30
			Perfluoroheptanesulfonic acid PFHpS	2020/03/07	NC		%	30
			Perfluorooctanesulfonic acid (PFOS)	2020/03/07	NC		%	30
			Perfluorodecanesulfonic acid (PFDS)	2020/03/07	NC		%	30
			Perfluorooctane Sulfonamide (PFOSA)	2020/03/07	NC		%	25
			EtFOSAA	2020/03/07	NC		%	30
			MeFOSAA	2020/03/07	NC		%	30
			6:2 Fluorotelomer sulfonic acid	2020/03/07	NC		%	30
			8:2 Fluorotelomer sulfonic acid	2020/03/07	NC		%	30
6625933	AKH	Spiked Blank	Post Oxidation 13C2-6:2-Fluorotelomersulfonic	2020/03/10		96	%	50 - 150
			Post Oxidation 13C2-8:2-Fluorotelomersulfonic	2020/03/10		91	%	50 - 150
			Post Oxidation 13C2-Perfluorodecanoic acid	2020/03/10		90	%	50 - 150
			Post Oxidation 13C2-Perfluorododecanoic acid	2020/03/10		80	%	50 - 150
			Post Oxidation 13C2-Perfluorohexanoic acid	2020/03/10		101	%	50 - 150
			Post Oxidation 13C2-perfluorotetradecanoic aci	2020/03/10		78	%	50 - 150
			Post Oxidation 13C2-Perfluoroundecanoic acid	2020/03/10		83	%	50 - 150
			Post Oxidation 13C3-Perfluorobutanesulfonic ac	2020/03/10		96	%	50 - 150
			Post Oxidation 13C4-Perfluorobutanoic acid	2020/03/10		98	%	50 - 150
			Post Oxidation 13C4-Perfluoroheptanoic acid	2020/03/10		97	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanesulfonic ac	2020/03/10		90	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanoic acid	2020/03/10		97	%	50 - 150
			Post Oxidation 13C5-Perfluorononanoic acid	2020/03/10		93	%	50 - 150
			Post Oxidation 13C5-Perfluoropentanoic acid	2020/03/10		98	%	50 - 150
			Post Oxidation 13C8-Perfluorooctane Sulfonami	2020/03/10		83	%	50 - 150
			Post Oxidation 18O2-Perfluorohexanesulfonic a	2020/03/10		95	%	50 - 150
			Post Oxidation D3-MeFOSAA	2020/03/10		79	%	50 - 150
			Post Oxidation D5-EtFOSAA	2020/03/10		79	%	50 - 150
			Post Oxidation D7-MeFOSE	2020/03/10		69	%	50 - 150
			Post Oxidation D9-EtFOSE	2020/03/10		69	%	50 - 150
			Post Oxidation Perfluorobutanoic acid (PFBA)	2020/03/10		89	%	70 - 130

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Post Oxidation Perfluoropentanoic acid (PFPeA)	2020/03/10		87	%	70 - 130
			Post Oxidation Perfluorohexanoic acid (PFHxA)	2020/03/10		87	%	70 - 130
			Post Oxidation Perfluoroheptanoic acid (PFHpA)	2020/03/10		86	%	70 - 130
			Post Oxidation Perfluorooctanoic acid (PFOA)	2020/03/10		86	%	30 - 130
			Post Oxidation Perfluorononanoic acid (PFNA)	2020/03/10		87	%	70 - 130
			Post Oxidation Perfluorodecanoic acid (PFDA)	2020/03/10		86	%	70 - 130
			Post Oxidation Perfluoroundecanoic acid (PFUn	2020/03/10		85	%	70 - 130
			Post Oxidation Perfluorododecanoic acid (PFDo	2020/03/10		85	%	70 - 130
			Post Oxidation Perfluorotridecanoic acid (PFTR	2020/03/10		83	%	70 - 130
			Post Oxidation Perfluorotetradecanoic acid(PFT	2020/03/10		80	%	70 - 130
			Post Oxidation Perfluorobutanesulfonic acid (PF	2020/03/10		86	%	70 - 130
			Post Oxidation Perfluorohexanesulfonic acid(PF	2020/03/10		85	%	30 - 130
			Post Oxidation Perfluoroheptanesulfonic acid P	2020/03/10		83	%	30 - 130
			Post Oxidation Perfluorooctanesulfonic acid (PF	2020/03/10		90	%	30 - 130
			Post Oxidation Perfluorodecanesulfonic acid (PF	2020/03/10		79	%	30 - 130
			Post Oxidation Perfluorooctane Sulfonamide (P	2020/03/10		83	%	70 - 130
			Post Oxidation EtFOSA	2020/03/10		92	%	70 - 130
			Post Oxidation MeFOSA	2020/03/10		86	%	70 - 130
			Post Oxidation EtFOSE	2020/03/10		64 (1)	%	70 - 130
			Post Oxidation MeFOSE	2020/03/10		68 (1)	%	70 - 130
			Post Oxidation EtFOSAA	2020/03/10		87	%	70 - 130
			Post Oxidation MeFOSAA	2020/03/10		95	%	70 - 130
			Post Oxidation 6:2 Fluorotelomer sulfonic acid	2020/03/10		88	%	70 - 130
			Post Oxidation 8:2 Fluorotelomer sulfonic acid	2020/03/10		88	%	70 - 136
6625933	AKH	Method Blank	Post Oxidation 13C2-6:2-Fluorotelomersulfonic	2020/03/10		105	%	50 - 150
			Post Oxidation 13C2-8:2-Fluorotelomersulfonic	2020/03/10		97	%	50 - 150
			Post Oxidation 13C2-Perfluorodecanoic acid	2020/03/10		95	%	50 - 150
			Post Oxidation 13C2-Perfluorododecanoic acid	2020/03/10		82	%	50 - 150
			Post Oxidation 13C2-Perfluorohexanoic acid	2020/03/10		103	%	50 - 150
			Post Oxidation 13C2-perfluorotetradecanoic aci	2020/03/10		79	%	50 - 150
			Post Oxidation 13C2-Perfluoroundecanoic acid	2020/03/10		87	%	50 - 150
			Post Oxidation 13C3-Perfluorobutanesulfonic ac	2020/03/10		101	%	50 - 150
			Post Oxidation 13C4-Perfluorobutanoic acid	2020/03/10		55	%	50 - 150
			Post Oxidation 13C4-Perfluoroheptanoic acid	2020/03/10		102	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanesulfonic ac	2020/03/10		100	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanoic acid	2020/03/10		101	%	50 - 150
			Post Oxidation 13C5-Perfluorononanoic acid	2020/03/10		99	%	50 - 150
			Post Oxidation 13C5-Perfluoropentanoic acid	2020/03/10		97	%	50 - 150
			Post Oxidation 13C8-Perfluorooctane Sulfonami	2020/03/10		82	%	50 - 150
			Post Oxidation 18O2-Perfluorohexanesulfonic a	2020/03/10		99	%	50 - 150
			Post Oxidation D3-MeFOSAA	2020/03/10		82	%	50 - 150
			Post Oxidation D5-EtFOSAA	2020/03/10		80	%	50 - 150
			Post Oxidation D7-MeFOSE	2020/03/10		67	%	50 - 150
			Post Oxidation D9-EtFOSE	2020/03/10		68	%	50 - 150
			Post Oxidation Perfluorobutanoic acid (PFBA)	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation Perfluoropentanoic acid (PFPeA)	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation Perfluorohexanoic acid (PFHxA)	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation Perfluoroheptanoic acid (PFHpA)	2020/03/10	ND, RDL=6.0		ug/kg	

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Post Oxidation Perfluorooctanoic acid (PFOA)	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation Perfluorononanoic acid (PFNA)	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation Perfluorodecanoic acid (PFDA)	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation Perfluoroundecanoic acid (PFUnA)	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation Perfluorododecanoic acid (PFDoA)	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation Perfluorotridecanoic acid (PFTRDA)	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation Perfluorotetradecanoic acid (PFTEDA)	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation Perfluorobutanesulfonic acid (PFBS)	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation Perfluorohexanesulfonic acid (PFHxS)	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation Perfluoroheptanesulfonic acid PFHpS	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation Perfluorooctanesulfonic acid (PFOS)	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation Perfluorodecanesulfonic acid (PFDS)	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation EtFOSA	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation MeFOSA	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation EtFOSE	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation MeFOSE	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation EtFOSAA	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation MeFOSAA	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation 6:2 Fluorotelomer sulfonic acid	2020/03/10	ND, RDL=6.0		ug/kg	
			Post Oxidation 8:2 Fluorotelomer sulfonic acid	2020/03/10	ND, RDL=6.0		ug/kg	
6625933	AKH	RPD	Post Oxidation Perfluorobutanoic acid (PFBA)	2020/03/10	2.1		%	30
			Post Oxidation Perfluoropentanoic acid (PFPeA)	2020/03/10	6.4		%	30
			Post Oxidation Perfluorohexanoic acid (PFHxA)	2020/03/10	4.0		%	30
			Post Oxidation Perfluoroheptanoic acid (PFHpA)	2020/03/10	2.1		%	30
			Post Oxidation Perfluorooctanoic acid (PFOA)	2020/03/10	7.0		%	30
			Post Oxidation Perfluorononanoic acid (PFNA)	2020/03/10	10		%	30
			Post Oxidation Perfluorodecanoic acid (PFDA)	2020/03/10	NC		%	30
			Post Oxidation Perfluoroundecanoic acid (PFUn	2020/03/10	NC		%	30
			Post Oxidation Perfluorododecanoic acid (PFDo	2020/03/10	NC		%	30
			Post Oxidation Perfluorotridecanoic acid (PFTR	2020/03/10	NC		%	30
			Post Oxidation Perfluorotetradecanoic acid(PFT	2020/03/10	NC		%	30

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Post Oxidation Perfluorobutanesulfonic acid (PF	2020/03/10	NC		%	30
			Post Oxidation Perfluorohexanesulfonic acid(PF	2020/03/10	NC		%	N/A
			Post Oxidation Perfluoroheptanesulfonic acid P	2020/03/10	NC		%	30
			Post Oxidation Perfluorooctanesulfonic acid (PF	2020/03/10	3.0		%	30
			Post Oxidation Perfluorodecanesulfonic acid (PF	2020/03/10	NC		%	30
			Post Oxidation Perfluorooctane Sulfonamide (P	2020/03/10	NC		%	30
			Post Oxidation EtFOSA	2020/03/10	NC		%	30
			Post Oxidation MeFOSA	2020/03/10	NC		%	30
			Post Oxidation EtFOSE	2020/03/10	NC		%	30
			Post Oxidation MeFOSE	2020/03/10	NC		%	30
			Post Oxidation EtFOSAA	2020/03/10	NC		%	30
			Post Oxidation MeFOSAA	2020/03/10	NC		%	30
			Post Oxidation 6:2 Fluorotelomer sulfonic acid	2020/03/10	NC		%	30
			Post Oxidation 8:2 Fluorotelomer sulfonic acid	2020/03/10	28		%	30

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery was below the lower control limit. This may represent a low bias in some results for this specific analyte.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Anastassia Hamanov, Scientific Specialist

Adam Robinson, Supervisor, LC/MS/MS

Colm McNamara, Senior Analyst, Liquid Chromatography

Eva

CHARTERED
Eva Pranjic
CHEMIST

Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

APPENDIX D:
PHASE II – METHOD 1314 LABORATORY REPORTS - BUREAU VERITAS & EUROFINS

Your P.O. #: 30036728.5
Your Project #: SAULT STE MARIE LEAF 1315
Your C.O.C. #: na

Attention: Dave Liles

Arcadis
North Carolina
4915 Prospectus Dr
Suite G
Durham, NC
USA 27713

Report Date: 2020/07/15
Report #: R6247298
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C0F7882
Received: 2020/06/25, 11:55

Sample Matrix: Water
Samples Received: 10

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Post Oxidation PFAS in water (1)	10	2020/07/01	2020/07/04	CAM SOP-00095/CAM SOP-00894	Houtz & Sedlak 2012

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Oxidation was performed adhering to the protocol as described by Houtz, E.F. and Sedlak, D.L. (2012). Environ. Sci. Technol., 46, 9342-9349

Your P.O. #: 30036728.5
Your Project #: SAULT STE MARIE LEAF 1315
Your C.O.C. #: na

Attention: Dave Liles

Arcadis
North Carolina
4915 Prospectus Dr
Suite G
Durham, NC
USA 27713

Report Date: 2020/07/15
Report #: R6247298
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C0F7882
Received: 2020/06/25, 11:55

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: Stephanie.Pollen@bvlabs.com
Phone# (905)817-5830
==
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		MYQ749		MYQ750		
Sampling Date		2020/06/17 09:48		2020/06/17 09:48		
COC Number		na		na		
	UNITS	**MB**	**RDL**	**HOMOGENATE MIX-1 T01**	**RDL**	**QC Batch**
Perfluorinated Compounds						
Post Oxidation Perfluorobutanoic acid (PFBA)	ug/L	ND	0.040	110	4.0	6833963
Post Oxidation Perfluoropentanoic acid (PFPeA)	ug/L	ND	0.040	340	40	6833963
Post Oxidation Perfluorohexanoic acid (PFHxA)	ug/L	ND	0.040	240	20	6814469
Post Oxidation Perfluoroheptanoic acid (PFHpA)	ug/L	ND	0.040	60	4.0	6833963
Post Oxidation Perfluorooctanoic acid (PFOA)	ug/L	ND	0.040	ND	2.0	6814469
Post Oxidation Perfluorononanoic acid (PFNA)	ug/L	ND	0.040	ND	2.0	6814469
Post Oxidation Perfluorodecanoic acid (PFDA)	ug/L	ND	0.040	ND	2.0	6814469
Post Oxidation Perfluoroundecanoic acid (PFUnA)	ug/L	ND	0.040	ND	2.0	6814469
Post Oxidation Perfluorododecanoic acid (PFDoA)	ug/L	ND	0.040	ND	2.0	6814469
Post Oxidation Perfluorotridecanoic acid (PFTRDA)	ug/L	ND	0.040	ND	4.0	6833963
Post Oxidation Perfluorotetradecanoic acid(PFTEDA)	ug/L	ND	0.040	ND	2.0	6814469
Post Oxidation Perfluorobutanesulfonic acid (PFBS)	ug/L	ND	0.040	32	4.0	6833963
Post Oxidation Perfluorohexanesulfonic acid(PFHxS)	ug/L	ND	0.040	220	20	6814469
Post Oxidation Perfluoroheptanesulfonic acid PFHpS	ug/L	ND	0.040	ND	2.0	6814469
Post Oxidation Perfluorooctanesulfonic acid (PFOS)	ug/L	ND	0.040	370	40	6833963
Post Oxidation Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	0.040	ND	2.0	6814469
Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	0.040	ND	2.0	6814469
Post Oxidation EtFOSA	ug/L	ND	0.040	ND	2.0	6814469
Post Oxidation MeFOSA	ug/L	ND	0.040	ND	2.0	6814469
Post Oxidation EtFOSE	ug/L	ND	0.040	ND	2.0	6814469
Post Oxidation MeFOSE	ug/L	ND	0.040	ND	2.0	6814469
Post Oxidation EtFOSAA	ug/L	ND	0.040	ND	2.0	6814469
Post Oxidation MeFOSAA	ug/L	ND	0.040	ND	4.0	6833963
Post Oxidation 6:2 Fluorotelomer sulfonic acid	ug/L	ND	0.040	ND	2.0	6814469
Post Oxidation 8:2 Fluorotelomer sulfonic acid	ug/L	ND	0.040	ND	2.0	6814469
Surrogate Recovery (%)						
Post Oxidation 13C2-6:2-Fluorotelomersulfonic Acid	%	80	N/A	84	N/A	6814469
Post Oxidation 13C2-8:2-Fluorotelomersulfonic Acid	%	75	N/A	82	N/A	6814469
Post Oxidation 13C2-Perfluorodecanoic acid	%	73	N/A	78	N/A	6814469
Post Oxidation 13C2-Perfluorododecanoic acid	%	66	N/A	73	N/A	6814469
Post Oxidation 13C2-Perfluorohexanoic acid	%	84	N/A	86	N/A	6814469
Post Oxidation 13C2-perfluorotetradecanoic acid	%	87	N/A	101	N/A	6833963

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		MYQ749		MYQ750		
Sampling Date		2020/06/17 09:48		2020/06/17 09:48		
COC Number		na		na		
	UNITS	**MB**	**RDL**	**HOMOGENATE MIX-1 T01**	**RDL**	**QC Batch**
Post Oxidation 13C2-Perfluoroundecanoic acid	%	67	N/A	74	N/A	6814469
Post Oxidation 13C3-Perfluorobutanesulfonic acid	%	105	N/A	118	N/A	6833963
Post Oxidation 13C4-Perfluorobutanoic acid	%	98	N/A	113	N/A	6833963
Post Oxidation 13C4-Perfluoroheptanoic acid	%	105	N/A	114	N/A	6833963
Post Oxidation 13C4-Perfluorooctanesulfonic acid	%	94	N/A	109	N/A	6833963
Post Oxidation 13C4-Perfluorooctanoic acid	%	79	N/A	82	N/A	6814469
Post Oxidation 13C5-Perfluorononanoic acid	%	76	N/A	84	N/A	6814469
Post Oxidation 13C5-Perfluoropentanoic acid	%	99	N/A	110	N/A	6833963
Post Oxidation 13C8-Perfluorooctane Sulfonamide	%	66	N/A	72	N/A	6814469
Post Oxidation 18O2-Perfluorohexanesulfonic acid	%	80	N/A	78	N/A	6814469
Post Oxidation D3-MeFOSAA	%	89	N/A	97	N/A	6833963
Post Oxidation D5-EtFOSAA	%	65	N/A	71	N/A	6814469
Post Oxidation D7-MeFOSE	%	64	N/A	72	N/A	6814469
Post Oxidation D9-EtFOSE	%	64	N/A	68	N/A	6814469

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		MYQ750			MYQ751		
Sampling Date		2020/06/17 09:48			2020/06/17 09:48		
COC Number		na			na		
	UNITS	**HOMOGENATE MIX-1 T01 Lab-Dup**	**RDL**	**QC Batch**	**HOMOGENATE MIX-2 T01**	**RDL**	**QC Batch**
Perfluorinated Compounds							
Post Oxidation Perfluorobutanoic acid (PFBA)	ug/L	110	4.0	6833963	22	2.0	6833963
Post Oxidation Perfluoropentanoic acid (PFPeA)	ug/L	340	40	6833963	32	2.0	6833963
Post Oxidation Perfluorohexanoic acid (PFHxA)	ug/L	N/A	20	6814469	57	2.0	6833963
Post Oxidation Perfluoroheptanoic acid (PFHpA)	ug/L	58	4.0	6833963	11	2.0	6833963
Post Oxidation Perfluorooctanoic acid (PFOA)	ug/L	N/A	2.0	6814469	5.1	0.40	6814469
Post Oxidation Perfluorononanoic acid (PFNA)	ug/L	N/A	2.0	6814469	0.49	0.040	6814469
Post Oxidation Perfluorodecanoic acid (PFDA)	ug/L	N/A	2.0	6814469	ND	0.040	6814469
Post Oxidation Perfluoroundecanoic acid (PFUnA)	ug/L	N/A	2.0	6814469	ND	0.040	6814469
Post Oxidation Perfluorododecanoic acid (PFDoA)	ug/L	N/A	2.0	6814469	ND	0.040	6814469
Post Oxidation Perfluorotridecanoic acid (PFTRDA)	ug/L	ND	4.0	6833963	ND	0.20	6833963
Post Oxidation Perfluorotetradecanoic acid(PFTEDA)	ug/L	N/A	2.0	6814469	ND	0.040	6814469
Post Oxidation Perfluorobutanesulfonic acid (PFBS)	ug/L	32	4.0	6833963	0.24	0.20	6833963
Post Oxidation Perfluorohexanesulfonic acid(PFHxS)	ug/L	N/A	20	6814469	1.7	0.040	6814469
Post Oxidation Perfluoroheptanesulfonic acid PFHpS	ug/L	N/A	2.0	6814469	0.10	0.040	6814469
Post Oxidation Perfluorooctanesulfonic acid (PFOS)	ug/L	320	40	6833963	8.4	2.0	6833963
Post Oxidation Perfluorodecanesulfonic acid (PFDS)	ug/L	N/A	2.0	6814469	ND	0.040	6814469
Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	ug/L	N/A	2.0	6814469	ND	0.040	6814469
Post Oxidation EtFOSA	ug/L	N/A	2.0	6814469	ND	0.040	6814469
Post Oxidation MeFOSA	ug/L	N/A	2.0	6814469	ND	0.040	6814469
Post Oxidation EtFOSE	ug/L	N/A	2.0	6814469	ND	0.040	6814469
Post Oxidation MeFOSE	ug/L	N/A	2.0	6814469	ND	0.040	6814469
Post Oxidation EtFOSAA	ug/L	N/A	2.0	6814469	ND	0.040	6814469
Post Oxidation MeFOSAA	ug/L	ND	4.0	6833963	ND	0.20	6833963
Post Oxidation 6:2 Fluorotelomer sulfonic acid	ug/L	N/A	2.0	6814469	ND	0.040	6814469
Post Oxidation 8:2 Fluorotelomer sulfonic acid	ug/L	N/A	2.0	6814469	ND	0.040	6814469
Surrogate Recovery (%)							
Post Oxidation 13C2-6:2-Fluorotelomersulfonic Acid	%	N/A	N/A	6814469	84	N/A	6814469
Post Oxidation 13C2-8:2-Fluorotelomersulfonic Acid	%	N/A	N/A	6814469	82	N/A	6814469
Post Oxidation 13C2-Perfluorodecanoic acid	%	N/A	N/A	6814469	81	N/A	6814469
Post Oxidation 13C2-Perfluorododecanoic acid	%	N/A	N/A	6814469	70	N/A	6814469
Post Oxidation 13C2-Perfluorohexanoic acid	%	N/A	N/A	6814469	106	N/A	6833963

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
ND = Not detected

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		MYQ750			MYQ751		
Sampling Date		2020/06/17 09:48			2020/06/17 09:48		
COC Number		na			na		
	UNITS	**HOMOGENATE MIX-1 T01 Lab-Dup**	**RDL**	**QC Batch**	**HOMOGENATE MIX-2 T01**	**RDL**	**QC Batch**
Post Oxidation 13C2-perfluorotetradecanoic acid	%	105	N/A	6833963	91	N/A	6833963
Post Oxidation 13C2-Perfluoroundecanoic acid	%	N/A	N/A	6814469	74	N/A	6814469
Post Oxidation 13C3-Perfluorobutanesulfonic acid	%	121	N/A	6833963	110	N/A	6833963
Post Oxidation 13C4-Perfluorobutanoic acid	%	114	N/A	6833963	108	N/A	6833963
Post Oxidation 13C4-Perfluoroheptanoic acid	%	116	N/A	6833963	111	N/A	6833963
Post Oxidation 13C4-Perfluorooctanesulfonic acid	%	108	N/A	6833963	106	N/A	6833963
Post Oxidation 13C4-Perfluorooctanoic acid	%	N/A	N/A	6814469	66	N/A	6814469
Post Oxidation 13C5-Perfluorononanoic acid	%	N/A	N/A	6814469	84	N/A	6814469
Post Oxidation 13C5-Perfluoropentanoic acid	%	104	N/A	6833963	106	N/A	6833963
Post Oxidation 13C8-Perfluorooctane Sulfonamide	%	N/A	N/A	6814469	70	N/A	6814469
Post Oxidation 18O2-Perfluorohexanesulfonic acid	%	N/A	N/A	6814469	83	N/A	6814469
Post Oxidation D3-MeFOSAA	%	103	N/A	6833963	89	N/A	6833963
Post Oxidation D5-EtFOSAA	%	N/A	N/A	6814469	69	N/A	6814469
Post Oxidation D7-MeFOSE	%	N/A	N/A	6814469	68	N/A	6814469
Post Oxidation D9-EtFOSE	%	N/A	N/A	6814469	67	N/A	6814469

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		MYQ752			MYQ753		
Sampling Date		2020/06/17 09:48			2020/06/18 17:00		
COC Number		na			na		
	UNITS	**HOMOGENATE MIX-3 T01**	**RDL**	**QC Batch**	**HOMOGENATE MIX-1 T02-T04**	**RDL**	**QC Batch**
Perfluorinated Compounds							
Post Oxidation Perfluorobutanoic acid (PFBA)	ug/L	21	2.0	6833963	32	4.0	6833963
Post Oxidation Perfluoropentanoic acid (PFPeA)	ug/L	31	2.0	6833963	63	4.0	6833963
Post Oxidation Perfluorohexanoic acid (PFHxA)	ug/L	54	2.0	6833963	100	20	6814469
Post Oxidation Perfluoroheptanoic acid (PFHpA)	ug/L	11	2.0	6833963	26	4.0	6833963
Post Oxidation Perfluorooctanoic acid (PFOA)	ug/L	5.0	0.40	6814469	ND	2.0	6814469
Post Oxidation Perfluorononanoic acid (PFNA)	ug/L	0.38	0.040	6814469	ND	2.0	6814469
Post Oxidation Perfluorodecanoic acid (PFDA)	ug/L	ND	0.040	6814469	ND	2.0	6814469
Post Oxidation Perfluoroundecanoic acid (PFUnA)	ug/L	ND	0.040	6814469	ND	2.0	6814469
Post Oxidation Perfluorododecanoic acid (PFDoA)	ug/L	ND	0.040	6814469	ND	2.0	6814469
Post Oxidation Perfluorotridecanoic acid (PFTRDA)	ug/L	ND	0.20	6833963	ND	4.0	6833963
Post Oxidation Perfluorotetradecanoic acid(PFTEDA)	ug/L	ND	0.040	6814469	ND	2.0	6814469
Post Oxidation Perfluorobutanesulfonic acid (PFBS)	ug/L	0.26	0.20	6833963	ND	4.0	6833963
Post Oxidation Perfluorohexanesulfonic acid(PFHxS)	ug/L	1.3	0.040	6814469	ND	2.0	6814469
Post Oxidation Perfluoroheptanesulfonic acid PFHpS	ug/L	0.075	0.040	6814469	ND	2.0	6814469
Post Oxidation Perfluorooctanesulfonic acid (PFOS)	ug/L	6.8	0.20	6833963	1100	40	6833963
Post Oxidation Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	0.040	6814469	ND	2.0	6814469
Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	0.040	6814469	ND	2.0	6814469
Post Oxidation EtFOSA	ug/L	ND	0.040	6814469	ND	2.0	6814469
Post Oxidation MeFOSA	ug/L	ND	0.040	6814469	ND	2.0	6814469
Post Oxidation EtFOSE	ug/L	ND	0.040	6814469	ND	2.0	6814469
Post Oxidation MeFOSE	ug/L	ND	0.040	6814469	ND	2.0	6814469
Post Oxidation EtFOSAA	ug/L	ND	0.040	6814469	ND	2.0	6814469
Post Oxidation MeFOSAA	ug/L	ND	0.20	6833963	ND	4.0	6833963
Post Oxidation 6:2 Fluorotelomer sulfonic acid	ug/L	ND	0.040	6814469	ND	2.0	6814469
Post Oxidation 8:2 Fluorotelomer sulfonic acid	ug/L	ND	0.040	6814469	ND	2.0	6814469
Surrogate Recovery (%)							
Post Oxidation 13C2-6:2-Fluorotelomersulfonic Acid	%	76	N/A	6814469	85	N/A	6814469
Post Oxidation 13C2-8:2-Fluorotelomersulfonic Acid	%	71	N/A	6814469	84	N/A	6814469
Post Oxidation 13C2-Perfluorodecanoic acid	%	73	N/A	6814469	81	N/A	6814469
Post Oxidation 13C2-Perfluorododecanoic acid	%	65	N/A	6814469	73	N/A	6814469
Post Oxidation 13C2-Perfluorohexanoic acid	%	107	N/A	6833963	83	N/A	6814469
Post Oxidation 13C2-perfluorotetradecanoic acid	%	102	N/A	6833963	91	N/A	6833963

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		MYQ752			MYQ753		
Sampling Date		2020/06/17 09:48			2020/06/18 17:00		
COC Number		na			na		
	UNITS	**HOMOGENATE MIX-3 T01**	**RDL**	**QC Batch**	**HOMOGENATE MIX-1 T02-T04**	**RDL**	**QC Batch**
Post Oxidation 13C2-Perfluoroundecanoic acid	%	66	N/A	6814469	75	N/A	6814469
Post Oxidation 13C3-Perfluorobutanesulfonic acid	%	115	N/A	6833963	106	N/A	6833963
Post Oxidation 13C4-Perfluorobutanoic acid	%	107	N/A	6833963	108	N/A	6833963
Post Oxidation 13C4-Perfluoroheptanoic acid	%	109	N/A	6833963	110	N/A	6833963
Post Oxidation 13C4-Perfluorooctanesulfonic acid	%	107	N/A	6833963	108	N/A	6833963
Post Oxidation 13C4-Perfluorooctanoic acid	%	65	N/A	6814469	86	N/A	6814469
Post Oxidation 13C5-Perfluorononanoic acid	%	76	N/A	6814469	86	N/A	6814469
Post Oxidation 13C5-Perfluoropentanoic acid	%	106	N/A	6833963	106	N/A	6833963
Post Oxidation 13C8-Perfluorooctane Sulfonamide	%	64	N/A	6814469	72	N/A	6814469
Post Oxidation 18O2-Perfluorohexanesulfonic acid	%	75	N/A	6814469	84	N/A	6814469
Post Oxidation D3-MeFOSAA	%	97	N/A	6833963	86	N/A	6833963
Post Oxidation D5-EtFOSAA	%	64	N/A	6814469	72	N/A	6814469
Post Oxidation D7-MeFOSE	%	63	N/A	6814469	69	N/A	6814469
Post Oxidation D9-EtFOSE	%	63	N/A	6814469	65	N/A	6814469

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		MYQ754		MYQ755		
Sampling Date		2020/06/19 17:00		2020/06/18 17:00		
COC Number		na		na		
	UNITS	HOMOGENATE MIX-1 T05	RDL	HOMOGENATE MIX-2 T02-T04	RDL	QC Batch
Perfluorinated Compounds						
Post Oxidation Perfluorobutanoic acid (PFBA)	ug/L	16	4.0	5.8	0.50	6833963
Post Oxidation Perfluoropentanoic acid (PFPeA)	ug/L	32	4.0	8.1	0.50	6833963
Post Oxidation Perfluorohexanoic acid (PFHxA)	ug/L	ND	2.0	20	0.40	6814469
Post Oxidation Perfluoroheptanoic acid (PFHpA)	ug/L	22	4.0	4.0	0.50	6833963
Post Oxidation Perfluorooctanoic acid (PFOA)	ug/L	ND	2.0	3.2	0.40	6814469
Post Oxidation Perfluorononanoic acid (PFNA)	ug/L	ND	2.0	0.23	0.040	6814469
Post Oxidation Perfluorodecanoic acid (PFDA)	ug/L	ND	2.0	ND	0.040	6814469
Post Oxidation Perfluoroundecanoic acid (PFUnA)	ug/L	ND	2.0	ND	0.040	6814469
Post Oxidation Perfluorododecanoic acid (PFDoA)	ug/L	ND	2.0	ND	0.040	6814469
Post Oxidation Perfluorotridecanoic acid (PFTRDA)	ug/L	ND	4.0	ND	0.050	6833963
Post Oxidation Perfluorotetradecanoic acid(PFTEDA)	ug/L	ND	2.0	ND	0.040	6814469
Post Oxidation Perfluorobutanesulfonic acid (PFBS)	ug/L	ND	4.0	ND	0.050	6833963
Post Oxidation Perfluorohexanesulfonic acid(PFHxS)	ug/L	ND	2.0	1.4	0.040	6814469
Post Oxidation Perfluoroheptanesulfonic acid PFHpS	ug/L	ND	2.0	0.082	0.040	6814469
Post Oxidation Perfluorooctanesulfonic acid (PFOS)	ug/L	830	40	4.7	0.50	6833963
Post Oxidation Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	2.0	ND	0.040	6814469
Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	2.0	ND	0.040	6814469
Post Oxidation EtFOSA	ug/L	ND	2.0	ND	0.040	6814469
Post Oxidation MeFOSA	ug/L	ND	2.0	ND	0.040	6814469
Post Oxidation EtFOSE	ug/L	ND	2.0	ND	0.040	6814469
Post Oxidation MeFOSE	ug/L	ND	2.0	ND	0.040	6814469
Post Oxidation EtFOSAA	ug/L	ND	2.0	ND	0.040	6814469
Post Oxidation MeFOSAA	ug/L	ND	4.0	ND	0.050	6833963
Post Oxidation 6:2 Fluorotelomer sulfonic acid	ug/L	ND	2.0	0.076	0.040	6814469
Post Oxidation 8:2 Fluorotelomer sulfonic acid	ug/L	ND	2.0	ND	0.040	6814469
Surrogate Recovery (%)						
Post Oxidation 13C2-6:2-Fluorotelomersulfonic Acid	%	86	N/A	85	N/A	6814469
Post Oxidation 13C2-8:2-Fluorotelomersulfonic Acid	%	82	N/A	77	N/A	6814469
Post Oxidation 13C2-Perfluorodecanoic acid	%	82	N/A	79	N/A	6814469
Post Oxidation 13C2-Perfluorododecanoic acid	%	69	N/A	72	N/A	6814469
Post Oxidation 13C2-Perfluorohexanoic acid	%	84	N/A	83	N/A	6814469
Post Oxidation 13C2-perfluorotetradecanoic acid	%	93	N/A	73	N/A	6833963

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		MYQ754		MYQ755		
Sampling Date		2020/06/19 17:00		2020/06/18 17:00		
COC Number		na		na		
	UNITS	**HOMOGENATE MIX-1 T05**	**RDL**	**HOMOGENATE MIX-2 T02-T04**	**RDL**	**QC Batch**
Post Oxidation 13C2-Perfluoroundecanoic acid	%	74	N/A	76	N/A	6814469
Post Oxidation 13C3-Perfluorobutanesulfonic acid	%	108	N/A	119	N/A	6833963
Post Oxidation 13C4-Perfluorobutanoic acid	%	105	N/A	106	N/A	6833963
Post Oxidation 13C4-Perfluoroheptanoic acid	%	110	N/A	109	N/A	6833963
Post Oxidation 13C4-Perfluorooctanesulfonic acid	%	112	N/A	105	N/A	6833963
Post Oxidation 13C4-Perfluorooctanoic acid	%	83	N/A	83	N/A	6814469
Post Oxidation 13C5-Perfluorononanoic acid	%	85	N/A	83	N/A	6814469
Post Oxidation 13C5-Perfluoropentanoic acid	%	105	N/A	105	N/A	6833963
Post Oxidation 13C8-Perfluorooctane Sulfonamide	%	70	N/A	72	N/A	6814469
Post Oxidation 18O2-Perfluorohexanesulfonic acid	%	79	N/A	82	N/A	6814469
Post Oxidation D3-MeFOSAA	%	91	N/A	86	N/A	6833963
Post Oxidation D5-EtFOSAA	%	74	N/A	71	N/A	6814469
Post Oxidation D7-MeFOSE	%	70	N/A	69	N/A	6814469
Post Oxidation D9-EtFOSE	%	68	N/A	69	N/A	6814469

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		MYQ756	MYQ757		
Sampling Date		2020/06/19 17:00	2020/06/18 17:00		
COC Number		na	na		
	UNITS	**HOMOGENATE MIX-2 T05**	**HOMOGENATE MIX-3 T02-T04**	**RDL**	**QC Batch**
Perfluorinated Compounds					
Post Oxidation Perfluorobutanoic acid (PFBA)	ug/L	4.7	6.4	0.50	6833963
Post Oxidation Perfluoropentanoic acid (PFPeA)	ug/L	7.8	9.9	0.50	6833963
Post Oxidation Perfluorohexanoic acid (PFHxA)	ug/L	15	17	0.40	6814469
Post Oxidation Perfluoroheptanoic acid (PFHpA)	ug/L	5.7	6.4	0.50	6833963
Post Oxidation Perfluorooctanoic acid (PFOA)	ug/L	3.6	3.7	0.40	6814469
Post Oxidation Perfluorononanoic acid (PFNA)	ug/L	0.13	0.20	0.040	6814469
Post Oxidation Perfluorodecanoic acid (PFDA)	ug/L	ND	ND	0.040	6814469
Post Oxidation Perfluoroundecanoic acid (PFUnA)	ug/L	ND	ND	0.040	6814469
Post Oxidation Perfluorododecanoic acid (PFDoA)	ug/L	ND	ND	0.040	6814469
Post Oxidation Perfluorotridecanoic acid (PFTRDA)	ug/L	ND	ND	0.050	6833963
Post Oxidation Perfluorotetradecanoic acid(PFTEDA)	ug/L	ND	ND	0.040	6814469
Post Oxidation Perfluorobutanesulfonic acid (PFBS)	ug/L	ND	ND	0.050	6833963
Post Oxidation Perfluorohexanesulfonic acid(PFHxS)	ug/L	0.84	1.1	0.040	6814469
Post Oxidation Perfluoroheptanesulfonic acid PFHpS	ug/L	0.044	0.060	0.040	6814469
Post Oxidation Perfluorooctanesulfonic acid (PFOS)	ug/L	4.3	5.2	0.50	6833963
Post Oxidation Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	ND	0.040	6814469
Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	ND	0.040	6814469
Post Oxidation EtFOSA	ug/L	ND	ND	0.040	6814469
Post Oxidation MeFOSA	ug/L	ND	ND	0.040	6814469
Post Oxidation EtFOSE	ug/L	ND	ND	0.040	6814469
Post Oxidation MeFOSE	ug/L	ND	ND	0.040	6814469
Post Oxidation EtFOSAA	ug/L	ND	ND	0.040	6814469
Post Oxidation MeFOSAA	ug/L	ND	ND	0.050	6833963
Post Oxidation 6:2 Fluorotelomer sulfonic acid	ug/L	ND	ND	0.040	6814469
Post Oxidation 8:2 Fluorotelomer sulfonic acid	ug/L	ND	ND	0.040	6814469
Surrogate Recovery (%)					
Post Oxidation 13C2-6:2-Fluorotelomersulfonic Acid	%	92	81	N/A	6814469
Post Oxidation 13C2-8:2-Fluorotelomersulfonic Acid	%	88	76	N/A	6814469
Post Oxidation 13C2-Perfluorodecanoic acid	%	91	74	N/A	6814469
Post Oxidation 13C2-Perfluorododecanoic acid	%	79	67	N/A	6814469
Post Oxidation 13C2-Perfluorohexanoic acid	%	80	72	N/A	6814469
Post Oxidation 13C2-perfluorotetradecanoic acid	%	59	68	N/A	6833963

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		MYQ756	MYQ757		
Sampling Date		2020/06/19 17:00	2020/06/18 17:00		
COC Number		na	na		
	UNITS	**HOMOGENATE MIX-2 T05**	**HOMOGENATE MIX-3 T02-T04**	**RDL**	**QC Batch**
Post Oxidation 13C2-Perfluoroundecanoic acid	%	83	69	N/A	6814469
Post Oxidation 13C3-Perfluorobutanesulfonic acid	%	108	114	N/A	6833963
Post Oxidation 13C4-Perfluorobutanoic acid	%	105	109	N/A	6833963
Post Oxidation 13C4-Perfluoroheptanoic acid	%	109	114	N/A	6833963
Post Oxidation 13C4-Perfluorooctanesulfonic acid	%	100	107	N/A	6833963
Post Oxidation 13C4-Perfluorooctanoic acid	%	71	64	N/A	6814469
Post Oxidation 13C5-Perfluorononanoic acid	%	93	78	N/A	6814469
Post Oxidation 13C5-Perfluoropentanoic acid	%	103	107	N/A	6833963
Post Oxidation 13C8-Perfluorooctane Sulfonamide	%	79	65	N/A	6814469
Post Oxidation 18O2-Perfluorohexanesulfonic acid	%	91	79	N/A	6814469
Post Oxidation D3-MeFOSAA	%	78	87	N/A	6833963
Post Oxidation D5-EtFOSAA	%	80	69	N/A	6814469
Post Oxidation D7-MeFOSE	%	78	66	N/A	6814469
Post Oxidation D9-EtFOSE	%	81	66	N/A	6814469

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		MYQ780		
Sampling Date		2020/06/19 17:00		
COC Number		na		
	UNITS	**HOMOGENATE MIX-3 T05**	**RDL**	**QC Batch**
Perfluorinated Compounds				
Post Oxidation Perfluorobutanoic acid (PFBA)	ug/L	3.8	0.50	6833963
Post Oxidation Perfluoropentanoic acid (PFPeA)	ug/L	6.2	0.50	6833963
Post Oxidation Perfluorohexanoic acid (PFHxA)	ug/L	13	0.40	6814469
Post Oxidation Perfluoroheptanoic acid (PFHpA)	ug/L	5.5	0.50	6833963
Post Oxidation Perfluorooctanoic acid (PFOA)	ug/L	3.4	0.40	6814469
Post Oxidation Perfluorononanoic acid (PFNA)	ug/L	0.12	0.040	6814469
Post Oxidation Perfluorodecanoic acid (PFDA)	ug/L	ND	0.040	6814469
Post Oxidation Perfluoroundecanoic acid (PFUnA)	ug/L	ND	0.040	6814469
Post Oxidation Perfluorododecanoic acid (PFDoA)	ug/L	ND	0.040	6814469
Post Oxidation Perfluorotridecanoic acid (PFTRDA)	ug/L	ND	0.050	6833963
Post Oxidation Perfluorotetradecanoic acid(PFTEDA)	ug/L	ND	0.040	6814469
Post Oxidation Perfluorobutanesulfonic acid (PFBS)	ug/L	ND	0.050	6833963
Post Oxidation Perfluorohexanesulfonic acid(PFHxS)	ug/L	0.73	0.040	6814469
Post Oxidation Perfluoroheptanesulfonic acid PFHpS	ug/L	ND	0.040	6814469
Post Oxidation Perfluorooctanesulfonic acid (PFOS)	ug/L	2.5	0.050	6833963
Post Oxidation Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	0.040	6814469
Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	0.040	6814469
Post Oxidation EtFOSA	ug/L	ND	0.040	6814469
Post Oxidation MeFOSA	ug/L	ND	0.040	6814469
Post Oxidation EtFOSE	ug/L	ND	0.040	6814469
Post Oxidation MeFOSE	ug/L	ND	0.040	6814469
Post Oxidation EtFOSAA	ug/L	ND	0.040	6814469
Post Oxidation MeFOSAA	ug/L	ND	0.050	6833963
Post Oxidation 6:2 Fluorotelomer sulfonic acid	ug/L	ND	0.040	6814469
Post Oxidation 8:2 Fluorotelomer sulfonic acid	ug/L	ND	0.040	6814469
Surrogate Recovery (%)				
Post Oxidation 13C2-6:2-Fluorotelomersulfonic Acid	%	86	N/A	6814469
Post Oxidation 13C2-8:2-Fluorotelomersulfonic Acid	%	80	N/A	6814469
Post Oxidation 13C2-Perfluorodecanoic acid	%	78	N/A	6814469
Post Oxidation 13C2-Perfluorododecanoic acid	%	72	N/A	6814469
Post Oxidation 13C2-Perfluorohexanoic acid	%	76	N/A	6814469
Post Oxidation 13C2-perfluorotetradecanoic acid	%	79	N/A	6833963

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		MYQ780		
Sampling Date		2020/06/19 17:00		
COC Number		na		
	UNITS	**HOMOGENATE MIX-3 T05**	**RDL**	**QC Batch**
Post Oxidation 13C2-Perfluoroundecanoic acid	%	73	N/A	6814469
Post Oxidation 13C3-Perfluorobutanesulfonic acid	%	111	N/A	6833963
Post Oxidation 13C4-Perfluorobutanoic acid	%	92	N/A	6833963
Post Oxidation 13C4-Perfluoroheptanoic acid	%	87	N/A	6833963
Post Oxidation 13C4-Perfluorooctanesulfonic acid	%	100	N/A	6833963
Post Oxidation 13C4-Perfluorooctanoic acid	%	75	N/A	6814469
Post Oxidation 13C5-Perfluorononanoic acid	%	81	N/A	6814469
Post Oxidation 13C5-Perfluoropentanoic acid	%	87	N/A	6833963
Post Oxidation 13C8-Perfluorooctane Sulfonamide	%	71	N/A	6814469
Post Oxidation 18O2-Perfluorohexanesulfonic acid	%	84	N/A	6814469
Post Oxidation D3-MeFOSAA	%	91	N/A	6833963
Post Oxidation D5-EtFOSAA	%	69	N/A	6814469
Post Oxidation D7-MeFOSE	%	66	N/A	6814469
Post Oxidation D9-EtFOSE	%	66	N/A	6814469

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

TEST SUMMARY

BV Labs ID: MYQ749
Sample ID: MB
Matrix: Water

Collected: 2020/06/17
Shipped:
Received: 2020/06/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6814469	2020/07/01	2020/07/04	Xinhe Xing (Helena)

BV Labs ID: MYQ750
Sample ID: HOMOGENATE MIX-1 T01
Matrix: Water

Collected: 2020/06/17
Shipped:
Received: 2020/06/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6814469	2020/07/01	2020/07/04	Xinhe Xing (Helena)

BV Labs ID: MYQ750 Dup
Sample ID: HOMOGENATE MIX-1 T01
Matrix: Water

Collected: 2020/06/17
Shipped:
Received: 2020/06/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6833963	2020/07/14	2020/07/14	Patrick Yu Peng Li

BV Labs ID: MYQ751
Sample ID: HOMOGENATE MIX-2 T01
Matrix: Water

Collected: 2020/06/17
Shipped:
Received: 2020/06/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6814469	2020/07/01	2020/07/04	Xinhe Xing (Helena)

BV Labs ID: MYQ752
Sample ID: HOMOGENATE MIX-3 T01
Matrix: Water

Collected: 2020/06/17
Shipped:
Received: 2020/06/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6814469	2020/07/01	2020/07/04	Xinhe Xing (Helena)

BV Labs ID: MYQ753
Sample ID: HOMOGENATE MIX-1 T02-T04
Matrix: Water

Collected: 2020/06/18
Shipped:
Received: 2020/06/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6814469	2020/07/01	2020/07/04	Xinhe Xing (Helena)

BV Labs ID: MYQ754
Sample ID: HOMOGENATE MIX-1 T05
Matrix: Water

Collected: 2020/06/19
Shipped:
Received: 2020/06/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6814469	2020/07/01	2020/07/04	Xinhe Xing (Helena)

TEST SUMMARY

BV Labs ID: MYQ755
Sample ID: HOMOGENATE MIX-2 T02-T04
Matrix: Water

Collected: 2020/06/18
Shipped:
Received: 2020/06/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6814469	2020/07/01	2020/07/04	Xinhe Xing (Helena)

BV Labs ID: MYQ756
Sample ID: HOMOGENATE MIX-2 T05
Matrix: Water

Collected: 2020/06/19
Shipped:
Received: 2020/06/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6814469	2020/07/01	2020/07/04	Xinhe Xing (Helena)

BV Labs ID: MYQ757
Sample ID: HOMOGENATE MIX-3 T02-T04
Matrix: Water

Collected: 2020/06/18
Shipped:
Received: 2020/06/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6814469	2020/07/01	2020/07/04	Xinhe Xing (Helena)

BV Labs ID: MYQ780
Sample ID: HOMOGENATE MIX-3 T05
Matrix: Water

Collected: 2020/06/19
Shipped:
Received: 2020/06/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6814469	2020/07/01	2020/07/04	Xinhe Xing (Helena)

GENERAL COMMENTS

Per- and polyfluoroalkyl substances (PFAS): Prior to oxidization samples were centrifuged at 4000 rpm for 10 minutes. Centrifuge rotor radius = 195 mm.

Sample MYQ750 [HOMOGENATE MIX-1 T01] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was oxidized, extracted and analyzed with further dilutions. Detection limit was adjusted accordingly.

Sample MYQ751 [HOMOGENATE MIX-2 T01] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, sample required dilution. Detection limits were adjusted accordingly.

Sample MYQ752 [HOMOGENATE MIX-3 T01] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, sample required dilution. Detection limits were adjusted accordingly.

Sample MYQ753 [HOMOGENATE MIX-1 T02-T04] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was oxidized, extracted and analyzed with further dilutions. Detection limit was adjusted accordingly.

Sample MYQ754 [HOMOGENATE MIX-1 T05] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was oxidized, extracted and analyzed with further dilutions. Detection limit was adjusted accordingly.

Sample MYQ755 [HOMOGENATE MIX-2 T02-T04] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, sample required dilution. Detection limits were adjusted accordingly.

Sample MYQ756 [HOMOGENATE MIX-2 T05] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, sample required dilution. Detection limits were adjusted accordingly.

Sample MYQ757 [HOMOGENATE MIX-3 T02-T04] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, sample required dilution. Detection limits were adjusted accordingly.

Sample MYQ780 [HOMOGENATE MIX-3 T05] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, sample required dilution. Detection limits were adjusted accordingly.

Sample MYQ749, Post Oxidation PFAS in water: Test repeated.
Sample MYQ750, Post Oxidation PFAS in water: Test repeated.
Sample MYQ751, Post Oxidation PFAS in water: Test repeated.
Sample MYQ752, Post Oxidation PFAS in water: Test repeated.
Sample MYQ753, Post Oxidation PFAS in water: Test repeated.
Sample MYQ754, Post Oxidation PFAS in water: Test repeated.
Sample MYQ755, Post Oxidation PFAS in water: Test repeated.
Sample MYQ756, Post Oxidation PFAS in water: Test repeated.
Sample MYQ757, Post Oxidation PFAS in water: Test repeated.
Sample MYQ780, Post Oxidation PFAS in water: Test repeated.

Results relate only to the items tested.

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6814469	XIN	Spiked Blank	Post Oxidation 13C2-6:2-Fluorotelomersulfonic	2020/07/04		81	%	50 - 150
			Post Oxidation 13C2-8:2-Fluorotelomersulfonic	2020/07/04		83	%	50 - 150
			Post Oxidation 13C2-Perfluorodecanoic acid	2020/07/04		80	%	50 - 150
			Post Oxidation 13C2-Perfluorododecanoic acid	2020/07/04		71	%	50 - 150
			Post Oxidation 13C2-Perfluorohexanoic acid	2020/07/04		85	%	50 - 150
			Post Oxidation 13C2-Perfluoroundecanoic acid	2020/07/04		75	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanoic acid	2020/07/04		80	%	50 - 150
			Post Oxidation 13C5-Perfluorononanoic acid	2020/07/04		81	%	50 - 150
			Post Oxidation 13C8-Perfluorooctane Sulfonami	2020/07/04		73	%	50 - 150
			Post Oxidation 18O2-Perfluorohexanesulfonic a	2020/07/04		79	%	50 - 150
			Post Oxidation D5-EtFOSAA	2020/07/04		71	%	50 - 150
			Post Oxidation D7-MeFOSE	2020/07/04		67	%	50 - 150
			Post Oxidation D9-EtFOSE	2020/07/04		70	%	50 - 150
			Post Oxidation Perfluorohexanoic acid (PFHxA)	2020/07/04		130	%	70 - 130
			Post Oxidation Perfluorooctanoic acid (PFOA)	2020/07/04		129	%	30 - 130
			Post Oxidation Perfluorononanoic acid (PFNA)	2020/07/04		126	%	70 - 130
			Post Oxidation Perfluorodecanoic acid (PFDA)	2020/07/04		122	%	70 - 130
			Post Oxidation Perfluoroundecanoic acid (PFUn	2020/07/04		122	%	70 - 130
			Post Oxidation Perfluorododecanoic acid (PFDo	2020/07/04		125	%	70 - 130
			Post Oxidation Perfluorotetradecanoic acid(PFT	2020/07/04		124	%	70 - 130
			Post Oxidation Perfluorohexanesulfonic acid(PF	2020/07/04		127	%	30 - 130
			Post Oxidation Perfluoroheptanesulfonic acid P	2020/07/04		125	%	30 - 130
			Post Oxidation Perfluorodecanesulfonic acid (PF	2020/07/04		122	%	30 - 130
			Post Oxidation Perfluorooctane Sulfonamide (P	2020/07/04		117	%	70 - 130
			Post Oxidation EtFOSA	2020/07/04		106	%	70 - 130
			Post Oxidation MeFOSA	2020/07/04		109	%	70 - 130
			Post Oxidation EtFOSE	2020/07/04		111	%	70 - 130
			Post Oxidation MeFOSE	2020/07/04		123	%	70 - 130
			Post Oxidation EtFOSAA	2020/07/04		130	%	70 - 130
			Post Oxidation 6:2 Fluorotelomer sulfonic acid	2020/07/04		124	%	30 - 130
			Post Oxidation 8:2 Fluorotelomer sulfonic acid	2020/07/04		126	%	30 - 130
6814469	XIN	Method Blank	Post Oxidation 13C2-6:2-Fluorotelomersulfonic	2020/07/04		79	%	50 - 150
			Post Oxidation 13C2-8:2-Fluorotelomersulfonic	2020/07/04		76	%	50 - 150
			Post Oxidation 13C2-Perfluorodecanoic acid	2020/07/04		72	%	50 - 150
			Post Oxidation 13C2-Perfluorododecanoic acid	2020/07/04		64	%	50 - 150
			Post Oxidation 13C2-Perfluorohexanoic acid	2020/07/04		83	%	50 - 150
			Post Oxidation 13C2-Perfluoroundecanoic acid	2020/07/04		67	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanoic acid	2020/07/04		80	%	50 - 150
			Post Oxidation 13C5-Perfluorononanoic acid	2020/07/04		78	%	50 - 150
			Post Oxidation 13C8-Perfluorooctane Sulfonami	2020/07/04		65	%	50 - 150
			Post Oxidation 18O2-Perfluorohexanesulfonic a	2020/07/04		78	%	50 - 150
			Post Oxidation D5-EtFOSAA	2020/07/04		60	%	50 - 150
			Post Oxidation D7-MeFOSE	2020/07/04		61	%	50 - 150
			Post Oxidation D9-EtFOSE	2020/07/04		64	%	50 - 150
			Post Oxidation Perfluorohexanoic acid (PFHxA)	2020/07/04	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorooctanoic acid (PFOA)	2020/07/04	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorononanoic acid (PFNA)	2020/07/04	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorodecanoic acid (PFDA)	2020/07/04	ND, RDL=0.020		ug/L	

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Post Oxidation Perfluoroundecanoic acid (PFUnA)	2020/07/04	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorododecanoic acid (PFDoA)	2020/07/04	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorotetradecanoic acid (PFTEDA)	2020/07/04	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorohexanesulfonic acid (PFHxS)	2020/07/04	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluoroheptanesulfonic acid PFHpS	2020/07/04	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorodecanesulfonic acid (PFDS)	2020/07/04	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	2020/07/04	ND, RDL=0.020		ug/L	
			Post Oxidation EtFOSA	2020/07/04	ND, RDL=0.020		ug/L	
			Post Oxidation MeFOSA	2020/07/04	ND, RDL=0.020		ug/L	
			Post Oxidation EtFOSE	2020/07/04	ND, RDL=0.020		ug/L	
			Post Oxidation MeFOSE	2020/07/04	ND, RDL=0.020		ug/L	
			Post Oxidation EtFOSAA	2020/07/04	ND, RDL=0.020		ug/L	
			Post Oxidation 6:2 Fluorotelomer sulfonic acid	2020/07/04	ND, RDL=0.020		ug/L	
			Post Oxidation 8:2 Fluorotelomer sulfonic acid	2020/07/04	ND, RDL=0.020		ug/L	
6814469	XIN	RPD	Post Oxidation Perfluorohexanoic acid (PFHxA)	2020/07/04	7.0		%	30
			Post Oxidation Perfluorooctanoic acid (PFOA)	2020/07/04	0.20		%	30
			Post Oxidation Perfluorononanoic acid (PFNA)	2020/07/04	NC		%	30
			Post Oxidation Perfluorodecanoic acid (PFDA)	2020/07/04	NC		%	30
			Post Oxidation Perfluoroundecanoic acid (PFUn	2020/07/04	NC		%	30
			Post Oxidation Perfluorododecanoic acid (PFDo	2020/07/04	NC		%	30
			Post Oxidation Perfluorotetradecanoic acid(PFT	2020/07/04	NC		%	30
			Post Oxidation Perfluorohexanesulfonic acid(PF	2020/07/04	NC		%	30
			Post Oxidation Perfluoroheptanesulfonic acid P	2020/07/04	NC		%	30
			Post Oxidation Perfluorodecanesulfonic acid (PF	2020/07/04	NC		%	30
			Post Oxidation Perfluorooctane Sulfonamide (P	2020/07/04	NC		%	30
			Post Oxidation EtFOSA	2020/07/04	NC		%	30
			Post Oxidation MeFOSA	2020/07/04	NC		%	30
			Post Oxidation EtFOSE	2020/07/04	NC		%	30
			Post Oxidation MeFOSE	2020/07/04	NC		%	30
			Post Oxidation EtFOSAA	2020/07/04	NC		%	30
			Post Oxidation 6:2 Fluorotelomer sulfonic acid	2020/07/04	NC		%	30
			Post Oxidation 8:2 Fluorotelomer sulfonic acid	2020/07/04	NC		%	30
6833963	YPL	Spiked Blank	Post Oxidation 13C2-perfluorotetradecanoic aci	2020/07/14		77	%	50 - 150
			Post Oxidation 13C3-Perfluorobutanesulfonic ac	2020/07/14		47 (1)	%	50 - 150
			Post Oxidation 13C4-Perfluorobutanoic acid	2020/07/14		82	%	50 - 150
			Post Oxidation 13C4-Perfluoroheptanoic acid	2020/07/14		99	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanesulfonic ac	2020/07/14		79	%	50 - 150
			Post Oxidation 13C5-Perfluoropentanoic acid	2020/07/14		89	%	50 - 150
			Post Oxidation D3-MeFOSAA	2020/07/14		65	%	50 - 150

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Post Oxidation Perfluorobutanoic acid (PFBA)	2020/07/14		90	%	70 - 130
			Post Oxidation Perfluoropentanoic acid (PFPeA)	2020/07/14		85	%	70 - 130
			Post Oxidation Perfluorohexanoic acid (PFHxA)	2020/07/14		86	%	70 - 130
			Post Oxidation Perfluoroheptanoic acid (PFHpA)	2020/07/14		91	%	70 - 130
			Post Oxidation Perfluorotridecanoic acid (PFTR	2020/07/14		78	%	70 - 130
			Post Oxidation Perfluorobutanesulfonic acid (PF	2020/07/14		93	%	30 - 130
			Post Oxidation Perfluorooctanesulfonic acid (PF	2020/07/14		92	%	30 - 130
			Post Oxidation MeFOSAA	2020/07/14		93	%	70 - 130
6833963	YPL	Method Blank	Post Oxidation 13C2-perfluorotetradecanoic aci	2020/07/14		77	%	50 - 150
			Post Oxidation 13C3-Perfluorobutanesulfonic ac	2020/07/14		104	%	50 - 150
			Post Oxidation 13C4-Perfluorobutanoic acid	2020/07/14		86	%	50 - 150
			Post Oxidation 13C4-Perfluoroheptanoic acid	2020/07/14		104	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanesulfonic ac	2020/07/14		98	%	50 - 150
			Post Oxidation 13C5-Perfluoropentanoic acid	2020/07/14		98	%	50 - 150
			Post Oxidation D3-MeFOSAA	2020/07/14		76	%	50 - 150
			Post Oxidation Perfluorobutanoic acid (PFBA)	2020/07/14	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluoropentanoic acid (PFPeA)	2020/07/14	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorohexanoic acid (PFHxA)	2020/07/14	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluoroheptanoic acid (PFHpA)	2020/07/14	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorotridecanoic acid (PFTRDA)	2020/07/14	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorobutanesulfonic acid (PFBS)	2020/07/14	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorooctanesulfonic acid (PFOS)	2020/07/14	ND, RDL=0.020		ug/L	
			Post Oxidation MeFOSAA	2020/07/14	ND, RDL=0.020		ug/L	
6833963	YPL	RPD [MYQ750-01]	Post Oxidation Perfluorobutanoic acid (PFBA)	2020/07/14	0.79		%	30
			Post Oxidation Perfluoropentanoic acid (PFPeA)	2020/07/14	0.16		%	30
			Post Oxidation Perfluoroheptanoic acid (PFHpA)	2020/07/14	2.0		%	30
			Post Oxidation Perfluorotridecanoic acid (PFTR	2020/07/14	NC		%	30
			Post Oxidation Perfluorobutanesulfonic acid (PF	2020/07/14	0.13		%	30
			Post Oxidation Perfluorooctanesulfonic acid (PF	2020/07/14	14		%	30
			Post Oxidation MeFOSAA	2020/07/14	NC		%	30

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Adam Robinson, Supervisor, LC/MS/MS

Colm McNamara, Senior Analyst, Liquid Chromatography

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Your P.O. #: 30036728.5
Your Project #: SAULT STE MARIE LEAF 1315
Your C.O.C. #: na

Attention: Dave Liles

Arcadis
North Carolina
4915 Prospectus Dr
Suite G
Durham, NC
USA 27713

Report Date: 2020/07/16
Report #: R6248571
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C0G4395
Received: 2020/07/02, 13:30

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Post Oxidation PFAS in water (1)	6	2020/07/11	2020/07/13	CAM SOP-00095/CAM SOP-00894	Houtz & Sedlak 2012

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Oxidation was performed adhering to the protocol as described by Houtz, E.F. and Sedlak, D.L. (2012). Environ. Sci. Technol., 46, 9342-9349

Your P.O. #: 30036728.5
Your Project #: SAULT STE MARIE LEAF 1315
Your C.O.C. #: na

Attention: Dave Liles

Arcadis
North Carolina
4915 Prospectus Dr
Suite G
Durham, NC
USA 27713

Report Date: 2020/07/16
Report #: R6248571
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C0G4395
Received: 2020/07/02, 13:30

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stephanie Pollen, Project Manager
Email: Stephanie.Pollen@bvlabs.com
Phone# (905)817-5830
==
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		NAC295		NAC296		
Sampling Date		2020/06/26 17:00		2020/06/27 17:00		
COC Number		na		na		
	UNITS	**HOMOGENATE MIX-1 T06-T08**	**RDL**	**HOMOGENATE MIX-1 T09**	**RDL**	**QC Batch**
Perfluorinated Compounds						
Post Oxidation Perfluorobutanoic acid (PFBA)	ug/L	4.8	0.20	3.5	0.10	6831014
Post Oxidation Perfluoropentanoic acid (PFPeA)	ug/L	8.4	0.20	4.6	1.0	6831014
Post Oxidation Perfluorohexanoic acid (PFHxA)	ug/L	20	2.0	6.9	1.0	6831014
Post Oxidation Perfluoroheptanoic acid (PFHpA)	ug/L	8.2	0.20	4.8	1.0	6831014
Post Oxidation Perfluorooctanoic acid (PFOA)	ug/L	5.9	0.20	3.4	0.10	6831014
Post Oxidation Perfluorononanoic acid (PFNA)	ug/L	0.56	0.20	0.12	0.10	6831014
Post Oxidation Perfluorodecanoic acid (PFDA)	ug/L	ND	0.20	ND	0.10	6831014
Post Oxidation Perfluoroundecanoic acid (PFUnA)	ug/L	ND	0.20	ND	0.10	6831014
Post Oxidation Perfluorododecanoic acid (PFDoA)	ug/L	ND	0.20	ND	0.10	6831014
Post Oxidation Perfluorotridecanoic acid (PFTRDA)	ug/L	ND	0.20	ND	0.10	6831014
Post Oxidation Perfluorotetradecanoic acid(PFTEDA)	ug/L	ND	0.20	ND	0.10	6831014
Post Oxidation Perfluorobutanesulfonic acid (PFBS)	ug/L	ND	0.20	ND	0.10	6831014
Post Oxidation Perfluorohexanesulfonic acid(PFHxS)	ug/L	0.89	0.20	0.22	0.10	6831014
Post Oxidation Perfluoroheptanesulfonic acid PFHpS	ug/L	ND	0.20	ND	0.10	6831014
Post Oxidation Perfluorooctanesulfonic acid (PFOS)	ug/L	96	2.0	14	1.0	6831014
Post Oxidation Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	0.20	ND	0.10	6831014
Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	0.20	ND	0.10	6831014
Post Oxidation EtFOSA	ug/L	ND	0.20	ND	0.10	6831014
Post Oxidation MeFOSA	ug/L	ND	0.20	ND	0.10	6831014
Post Oxidation EtFOSE	ug/L	ND	0.20	ND	0.10	6831014
Post Oxidation MeFOSE	ug/L	ND	0.20	ND	0.10	6831014
Post Oxidation EtFOSAA	ug/L	ND	0.20	ND	0.10	6831014
Post Oxidation MeFOSAA	ug/L	ND	0.20	ND	0.10	6831014
Post Oxidation 6:2 Fluorotelomer sulfonic acid	ug/L	ND	0.20	ND	0.10	6831014
Post Oxidation 8:2 Fluorotelomer sulfonic acid	ug/L	ND	0.20	ND	0.10	6831014
Surrogate Recovery (%)						
Post Oxidation 13C2-6:2-Fluorotelomersulfonic Acid	%	116	N/A	95	N/A	6831014
Post Oxidation 13C2-8:2-Fluorotelomersulfonic Acid	%	104	N/A	88	N/A	6831014
Post Oxidation 13C2-Perfluorodecanoic acid	%	104	N/A	88	N/A	6831014
Post Oxidation 13C2-Perfluorododecanoic acid	%	100	N/A	82	N/A	6831014
Post Oxidation 13C2-Perfluorohexanoic acid	%	117	N/A	115	N/A	6831014
Post Oxidation 13C2-perfluorotetradecanoic acid	%	94	N/A	72	N/A	6831014

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		NAC295		NAC296		
Sampling Date		2020/06/26 17:00		2020/06/27 17:00		
COC Number		na		na		
	UNITS	**HOMOGENATE MIX-1 T06-T08**	**RDL**	**HOMOGENATE MIX-1 T09**	**RDL**	**QC Batch**
Post Oxidation 13C2-Perfluoroundecanoic acid	%	105	N/A	88	N/A	6831014
Post Oxidation 13C3-Perfluorobutanesulfonic acid	%	118	N/A	93	N/A	6831014
Post Oxidation 13C4-Perfluorobutanoic acid	%	99	N/A	78	N/A	6831014
Post Oxidation 13C4-Perfluoroheptanoic acid	%	113	N/A	116	N/A	6831014
Post Oxidation 13C4-Perfluorooctanesulfonic acid	%	105	N/A	113	N/A	6831014
Post Oxidation 13C4-Perfluorooctanoic acid	%	116	N/A	95	N/A	6831014
Post Oxidation 13C5-Perfluorononanoic acid	%	116	N/A	95	N/A	6831014
Post Oxidation 13C5-Perfluoropentanoic acid	%	109	N/A	112	N/A	6831014
Post Oxidation 13C8-Perfluorooctane Sulfonamide	%	98	N/A	81	N/A	6831014
Post Oxidation 18O2-Perfluorohexanesulfonic acid	%	110	N/A	91	N/A	6831014
Post Oxidation D3-MeFOSAA	%	100	N/A	85	N/A	6831014
Post Oxidation D5-EtFOSAA	%	98	N/A	82	N/A	6831014
Post Oxidation D7-MeFOSE	%	81	N/A	68	N/A	6831014
Post Oxidation D9-EtFOSE	%	81	N/A	67	N/A	6831014

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		NAC297		NAC298		
Sampling Date		2020/06/26 17:00		2020/06/27 17:00		
COC Number		na		na		
	UNITS	**HOMOGENATE MIX-2 T06-T08**	**RDL**	**HOMOGENATE MIX-2 T09**	**RDL**	**QC Batch**
Perfluorinated Compounds						
Post Oxidation Perfluorobutanoic acid (PFBA)	ug/L	3.0	0.20	1.6	0.040	6831014
Post Oxidation Perfluoropentanoic acid (PFPeA)	ug/L	5.4	0.20	3.3	0.20	6831014
Post Oxidation Perfluorohexanoic acid (PFHxA)	ug/L	9.3	0.20	5.0	0.20	6831014
Post Oxidation Perfluoroheptanoic acid (PFHpA)	ug/L	5.8	0.20	4.2	0.20	6831014
Post Oxidation Perfluorooctanoic acid (PFOA)	ug/L	1.9	0.040	0.62	0.040	6831014
Post Oxidation Perfluorononanoic acid (PFNA)	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation Perfluorodecanoic acid (PFDA)	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation Perfluoroundecanoic acid (PFUnA)	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation Perfluorododecanoic acid (PFDoA)	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation Perfluorotridecanoic acid (PFTRDA)	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation Perfluorotetradecanoic acid(PFTEDA)	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation Perfluorobutanesulfonic acid (PFBS)	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation Perfluorohexanesulfonic acid(PFHxS)	ug/L	0.34	0.040	0.045	0.040	6831014
Post Oxidation Perfluoroheptanesulfonic acid PFHpS	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation Perfluorooctanesulfonic acid (PFOS)	ug/L	1.7	0.040	0.51	0.040	6831014
Post Oxidation Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation EtFOSA	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation MeFOSA	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation EtFOSE	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation MeFOSE	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation EtFOSAA	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation MeFOSAA	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation 6:2 Fluorotelomer sulfonic acid	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation 8:2 Fluorotelomer sulfonic acid	ug/L	ND	0.040	ND	0.040	6831014
Surrogate Recovery (%)						
Post Oxidation 13C2-6:2-Fluorotelomersulfonic Acid	%	117	N/A	109	N/A	6831014
Post Oxidation 13C2-8:2-Fluorotelomersulfonic Acid	%	108	N/A	100	N/A	6831014
Post Oxidation 13C2-Perfluorodecanoic acid	%	108	N/A	102	N/A	6831014
Post Oxidation 13C2-Perfluorododecanoic acid	%	96	N/A	90	N/A	6831014
Post Oxidation 13C2-Perfluorohexanoic acid	%	117	N/A	116	N/A	6831014
Post Oxidation 13C2-perfluorotetradecanoic acid	%	96	N/A	85	N/A	6831014

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		NAC297		NAC298		
Sampling Date		2020/06/26 17:00		2020/06/27 17:00		
COC Number		na		na		
	UNITS	**HOMOGENATE MIX-2 T06-T08**	**RDL**	**HOMOGENATE MIX-2 T09**	**RDL**	**QC Batch**
Post Oxidation 13C2-Perfluoroundecanoic acid	%	102	N/A	98	N/A	6831014
Post Oxidation 13C3-Perfluorobutanesulfonic acid	%	107	N/A	108	N/A	6831014
Post Oxidation 13C4-Perfluorobutanoic acid	%	115	N/A	98	N/A	6831014
Post Oxidation 13C4-Perfluoroheptanoic acid	%	120	N/A	118	N/A	6831014
Post Oxidation 13C4-Perfluorooctanesulfonic acid	%	103	N/A	97	N/A	6831014
Post Oxidation 13C4-Perfluorooctanoic acid	%	109	N/A	111	N/A	6831014
Post Oxidation 13C5-Perfluorononanoic acid	%	116	N/A	108	N/A	6831014
Post Oxidation 13C5-Perfluoropentanoic acid	%	116	N/A	115	N/A	6831014
Post Oxidation 13C8-Perfluorooctane Sulfonamide	%	93	N/A	91	N/A	6831014
Post Oxidation 18O2-Perfluorohexanesulfonic acid	%	106	N/A	105	N/A	6831014
Post Oxidation D3-MeFOSAA	%	98	N/A	91	N/A	6831014
Post Oxidation D5-EtFOSAA	%	95	N/A	89	N/A	6831014
Post Oxidation D7-MeFOSE	%	71	N/A	74	N/A	6831014
Post Oxidation D9-EtFOSE	%	74	N/A	74	N/A	6831014

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		NAC299		NAC300		
Sampling Date		2020/06/26 17:00		2020/06/27 17:00		
COC Number		na		na		
	UNITS	**HOMOGENATE MIX-3 T06-T08**	**RDL**	**HOMOGENATE MIX-3 T09**	**RDL**	**QC Batch**
Perfluorinated Compounds						
Post Oxidation Perfluorobutanoic acid (PFBA)	ug/L	2.9	0.20	1.9	0.040	6831014
Post Oxidation Perfluoropentanoic acid (PFPeA)	ug/L	5.2	0.20	3.5	0.20	6831014
Post Oxidation Perfluorohexanoic acid (PFHxA)	ug/L	8.1	0.20	5.4	0.20	6831014
Post Oxidation Perfluoroheptanoic acid (PFHpA)	ug/L	6.2	0.20	4.8	0.20	6831014
Post Oxidation Perfluorooctanoic acid (PFOA)	ug/L	1.8	0.040	1.3	0.040	6831014
Post Oxidation Perfluorononanoic acid (PFNA)	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation Perfluorodecanoic acid (PFDA)	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation Perfluoroundecanoic acid (PFUnA)	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation Perfluorododecanoic acid (PFDoA)	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation Perfluorotridecanoic acid (PFTRDA)	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation Perfluorotetradecanoic acid(PFTEDA)	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation Perfluorobutanesulfonic acid (PFBS)	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation Perfluorohexanesulfonic acid(PFHxS)	ug/L	0.28	0.040	0.16	0.040	6831014
Post Oxidation Perfluoroheptanesulfonic acid PFHpS	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation Perfluorooctanesulfonic acid (PFOS)	ug/L	1.7	0.040	1.1	0.040	6831014
Post Oxidation Perfluorodecanesulfonic acid (PFDS)	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation EtFOSA	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation MeFOSA	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation EtFOSE	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation MeFOSE	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation EtFOSAA	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation MeFOSAA	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation 6:2 Fluorotelomer sulfonic acid	ug/L	ND	0.040	ND	0.040	6831014
Post Oxidation 8:2 Fluorotelomer sulfonic acid	ug/L	ND	0.040	ND	0.040	6831014
Surrogate Recovery (%)						
Post Oxidation 13C2-6:2-Fluorotelomersulfonic Acid	%	119	N/A	117	N/A	6831014
Post Oxidation 13C2-8:2-Fluorotelomersulfonic Acid	%	113	N/A	110	N/A	6831014
Post Oxidation 13C2-Perfluorodecanoic acid	%	109	N/A	116	N/A	6831014
Post Oxidation 13C2-Perfluorododecanoic acid	%	100	N/A	104	N/A	6831014
Post Oxidation 13C2-Perfluorohexanoic acid	%	114	N/A	119	N/A	6831014
Post Oxidation 13C2-perfluorotetradecanoic acid	%	96	N/A	96	N/A	6831014

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected
N/A = Not Applicable

PERFLUOROALKYL SUBSTANCES (WATER)

BV Labs ID		NAC299		NAC300		
Sampling Date		2020/06/26 17:00		2020/06/27 17:00		
COC Number		na		na		
	UNITS	**HOMOGENATE MIX-3 T06-T08**	**RDL**	**HOMOGENATE MIX-3 T09**	**RDL**	**QC Batch**
Post Oxidation 13C2-Perfluoroundecanoic acid	%	105	N/A	110	N/A	6831014
Post Oxidation 13C3-Perfluorobutanesulfonic acid	%	113	N/A	116	N/A	6831014
Post Oxidation 13C4-Perfluorobutanoic acid	%	111	N/A	107	N/A	6831014
Post Oxidation 13C4-Perfluoroheptanoic acid	%	118	N/A	118	N/A	6831014
Post Oxidation 13C4-Perfluorooctanesulfonic acid	%	98	N/A	108	N/A	6831014
Post Oxidation 13C4-Perfluorooctanoic acid	%	115	N/A	118	N/A	6831014
Post Oxidation 13C5-Perfluorononanoic acid	%	118	N/A	123	N/A	6831014
Post Oxidation 13C5-Perfluoropentanoic acid	%	110	N/A	113	N/A	6831014
Post Oxidation 13C8-Perfluorooctane Sulfonamide	%	102	N/A	105	N/A	6831014
Post Oxidation 18O2-Perfluorohexanesulfonic acid	%	111	N/A	112	N/A	6831014
Post Oxidation D3-MeFOSAA	%	95	N/A	102	N/A	6831014
Post Oxidation D5-EtFOSAA	%	97	N/A	101	N/A	6831014
Post Oxidation D7-MeFOSE	%	81	N/A	77	N/A	6831014
Post Oxidation D9-EtFOSE	%	82	N/A	79	N/A	6831014

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

TEST SUMMARY

BV Labs ID: NAC295
Sample ID: HOMOGENATE MIX-1 T06-T08
Matrix: Water

Collected: 2020/06/26
Shipped:
Received: 2020/07/02

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6831014	2020/07/11	2020/07/13	Lovelpreet Thind

BV Labs ID: NAC296
Sample ID: HOMOGENATE MIX-1 T09
Matrix: Water

Collected: 2020/06/27
Shipped:
Received: 2020/07/02

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6831014	2020/07/11	2020/07/13	Lovelpreet Thind

BV Labs ID: NAC297
Sample ID: HOMOGENATE MIX-2 T06-T08
Matrix: Water

Collected: 2020/06/26
Shipped:
Received: 2020/07/02

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6831014	2020/07/11	2020/07/13	Lovelpreet Thind

BV Labs ID: NAC298
Sample ID: HOMOGENATE MIX-2 T09
Matrix: Water

Collected: 2020/06/27
Shipped:
Received: 2020/07/02

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6831014	2020/07/11	2020/07/13	Lovelpreet Thind

BV Labs ID: NAC299
Sample ID: HOMOGENATE MIX-3 T06-T08
Matrix: Water

Collected: 2020/06/26
Shipped:
Received: 2020/07/02

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6831014	2020/07/11	2020/07/13	Lovelpreet Thind

BV Labs ID: NAC300
Sample ID: HOMOGENATE MIX-3 T09
Matrix: Water

Collected: 2020/06/27
Shipped:
Received: 2020/07/02

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Post Oxidation PFAS in water	LCMS	6831014	2020/07/11	2020/07/13	Lovelpreet Thind

GENERAL COMMENTS

Post Oxidation PFAS in water: Samples centrifuged at 4000 rpm for 10 minutes. Centrifuge rotor radius = 195 mm.

Sample NAC295 [HOMOGENATE MIX-1 T06-T08] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was extracted and analyzed. Detection limits were adjusted accordingly.

Sample NAC296 [HOMOGENATE MIX-1 T09] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was extracted and analyzed. Detection limits were adjusted accordingly.

Sample NAC297 [HOMOGENATE MIX-2 T06-T08] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was extracted and analyzed. Detection limits were adjusted accordingly.

Sample NAC298 [HOMOGENATE MIX-2 T09] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was extracted and analyzed. Detection limits were adjusted accordingly.

Sample NAC299 [HOMOGENATE MIX-3 T06-T08] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was extracted and analyzed. Detection limits were adjusted accordingly.

Sample NAC300 [HOMOGENATE MIX-3 T09] : Per- and polyfluoroalkyl substances (PFAS): Due to high concentrations of the target analytes, a reduced sample volume was extracted and analyzed. Detection limits were adjusted accordingly.

Results relate only to the items tested.

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6831014	LOV	Spiked Blank	Post Oxidation 13C2-6:2-Fluorotelomersulfonic	2020/07/13		104	%	50 - 150
			Post Oxidation 13C2-8:2-Fluorotelomersulfonic	2020/07/13		102	%	50 - 150
			Post Oxidation 13C2-Perfluorodecanoic acid	2020/07/13		106	%	50 - 150
			Post Oxidation 13C2-Perfluorododecanoic acid	2020/07/13		95	%	50 - 150
			Post Oxidation 13C2-Perfluorohexanoic acid	2020/07/13		108	%	50 - 150
			Post Oxidation 13C2-perfluorotetradecanoic aci	2020/07/13		94	%	50 - 150
			Post Oxidation 13C2-Perfluoroundecanoic acid	2020/07/13		103	%	50 - 150
			Post Oxidation 13C3-Perfluorobutanesulfonic ac	2020/07/13		106	%	50 - 150
			Post Oxidation 13C4-Perfluorobutanoic acid	2020/07/13		104	%	50 - 150
			Post Oxidation 13C4-Perfluoroheptanoic acid	2020/07/13		104	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanesulfonic ac	2020/07/13		101	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanoic acid	2020/07/13		105	%	50 - 150
			Post Oxidation 13C5-Perfluorononanoic acid	2020/07/13		109	%	50 - 150
			Post Oxidation 13C5-Perfluoropentanoic acid	2020/07/13		105	%	50 - 150
			Post Oxidation 13C8-Perfluorooctane Sulfonami	2020/07/13		93	%	50 - 150
			Post Oxidation 18O2-Perfluorohexanesulfonic a	2020/07/13		107	%	50 - 150
			Post Oxidation D3-MeFOSAA	2020/07/13		88	%	50 - 150
			Post Oxidation D5-EtFOSAA	2020/07/13		90	%	50 - 150
			Post Oxidation D7-MeFOSE	2020/07/13		83	%	50 - 150
			Post Oxidation D9-EtFOSE	2020/07/13		82	%	50 - 150
			Post Oxidation Perfluorobutanoic acid (PFBA)	2020/07/13		100	%	70 - 130
			Post Oxidation Perfluoropentanoic acid (PFPeA)	2020/07/13		97	%	70 - 130
			Post Oxidation Perfluorohexanoic acid (PFHxA)	2020/07/13		94	%	70 - 130
			Post Oxidation Perfluoroheptanoic acid (PFHpA)	2020/07/13		99	%	70 - 130
			Post Oxidation Perfluorooctanoic acid (PFOA)	2020/07/13		93	%	30 - 130
			Post Oxidation Perfluorononanoic acid (PFNA)	2020/07/13		94	%	70 - 130
			Post Oxidation Perfluorodecanoic acid (PFDA)	2020/07/13		93	%	70 - 130
			Post Oxidation Perfluoroundecanoic acid (PFUn	2020/07/13		91	%	70 - 130
			Post Oxidation Perfluorododecanoic acid (PFDo	2020/07/13		89	%	70 - 130
			Post Oxidation Perfluorotridecanoic acid (PFTR	2020/07/13		88	%	70 - 130
			Post Oxidation Perfluorotetradecanoic acid(PFT	2020/07/13		86	%	70 - 130
			Post Oxidation Perfluorobutanesulfonic acid (PF	2020/07/13		98	%	30 - 130
			Post Oxidation Perfluorohexanesulfonic acid(PF	2020/07/13		93	%	30 - 130
			Post Oxidation Perfluoroheptanesulfonic acid P	2020/07/13		97	%	30 - 130
			Post Oxidation Perfluorooctanesulfonic acid (PF	2020/07/13		99	%	30 - 130
			Post Oxidation Perfluorodecanesulfonic acid (PF	2020/07/13		79	%	30 - 130
			Post Oxidation Perfluorooctane Sulfonamide (P	2020/07/13		81	%	70 - 130
			Post Oxidation EtFOSA	2020/07/13		58 (1)	%	70 - 130
			Post Oxidation MeFOSA	2020/07/13		52 (1)	%	70 - 130
			Post Oxidation EtFOSE	2020/07/13		77	%	70 - 130
			Post Oxidation MeFOSE	2020/07/13		82	%	70 - 130
			Post Oxidation EtFOSAA	2020/07/13		94	%	70 - 130
			Post Oxidation MeFOSAA	2020/07/13		99	%	70 - 130
			Post Oxidation 6:2 Fluorotelomer sulfonic acid	2020/07/13		91	%	30 - 130
			Post Oxidation 8:2 Fluorotelomer sulfonic acid	2020/07/13		95	%	30 - 130
6831014	LOV	Method Blank	Post Oxidation 13C2-6:2-Fluorotelomersulfonic	2020/07/13		100	%	50 - 150
			Post Oxidation 13C2-8:2-Fluorotelomersulfonic	2020/07/13		98	%	50 - 150
			Post Oxidation 13C2-Perfluorodecanoic acid	2020/07/13		98	%	50 - 150
			Post Oxidation 13C2-Perfluorododecanoic acid	2020/07/13		91	%	50 - 150
			Post Oxidation 13C2-Perfluorohexanoic acid	2020/07/13		105	%	50 - 150
			Post Oxidation 13C2-perfluorotetradecanoic aci	2020/07/13		82	%	50 - 150
			Post Oxidation 13C2-Perfluoroundecanoic acid	2020/07/13		95	%	50 - 150

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Post Oxidation 13C3-Perfluorobutanesulfonic ac	2020/07/13		106	%	50 - 150
			Post Oxidation 13C4-Perfluorobutanoic acid	2020/07/13		87	%	50 - 150
			Post Oxidation 13C4-Perfluoroheptanoic acid	2020/07/13		103	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanesulfonic ac	2020/07/13		95	%	50 - 150
			Post Oxidation 13C4-Perfluorooctanoic acid	2020/07/13		103	%	50 - 150
			Post Oxidation 13C5-Perfluorononanoic acid	2020/07/13		100	%	50 - 150
			Post Oxidation 13C5-Perfluoropentanoic acid	2020/07/13		101	%	50 - 150
			Post Oxidation 13C8-Perfluorooctane Sulfonami	2020/07/13		92	%	50 - 150
			Post Oxidation 18O2-Perfluorohexanesulfonic a	2020/07/13		98	%	50 - 150
			Post Oxidation D3-MeFOSAA	2020/07/13		94	%	50 - 150
			Post Oxidation D5-EtFOSAA	2020/07/13		84	%	50 - 150
			Post Oxidation D7-MeFOSE	2020/07/13		81	%	50 - 150
			Post Oxidation D9-EtFOSE	2020/07/13		81	%	50 - 150
			Post Oxidation Perfluorobutanoic acid (PFBA)	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluoropentanoic acid (PFPeA)	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorohexanoic acid (PFHxA)	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluoroheptanoic acid (PFHpA)	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorooctanoic acid (PFOA)	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorononanoic acid (PFNA)	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorodecanoic acid (PFDA)	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluoroundecanoic acid (PFUnA)	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorododecanoic acid (PFDoA)	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorotridecanoic acid (PFTRDA)	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorotetradecanoic acid (PFTEDA)	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorobutanesulfonic acid (PFBS)	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorohexanesulfonic acid (PFHxS)	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluoroheptanesulfonic acid PFHpS	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorooctanesulfonic acid (PFOS)	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorodecanesulfonic acid (PFDS)	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation Perfluorooctane Sulfonamide (PFOSA)	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation EtFOSA	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation MeFOSA	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation EtFOSE	2020/07/13	ND, RDL=0.020		ug/L	

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Post Oxidation MeFOSE	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation EtFOSAA	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation MeFOSAA	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation 6:2 Fluorotelomer sulfonic acid	2020/07/13	ND, RDL=0.020		ug/L	
			Post Oxidation 8:2 Fluorotelomer sulfonic acid	2020/07/13	ND, RDL=0.020		ug/L	
6831014	LOV	RPD	Post Oxidation Perfluorobutanoic acid (PFBA)	2020/07/13	NC		%	30
			Post Oxidation Perfluoropentanoic acid (PFPeA)	2020/07/13	NC		%	30
			Post Oxidation Perfluorohexanoic acid (PFHxA)	2020/07/13	8.1		%	30
			Post Oxidation Perfluoroheptanoic acid (PFHpA)	2020/07/13	NC		%	30
			Post Oxidation Perfluorooctanoic acid (PFOA)	2020/07/13	NC		%	30
			Post Oxidation Perfluorononanoic acid (PFNA)	2020/07/13	NC		%	30
			Post Oxidation Perfluorodecanoic acid (PFDA)	2020/07/13	NC		%	30
			Post Oxidation Perfluoroundecanoic acid (PFUn	2020/07/13	NC		%	30
			Post Oxidation Perfluorododecanoic acid (PFDo	2020/07/13	NC		%	30
			Post Oxidation Perfluorotridecanoic acid (PFTR	2020/07/13	NC		%	30
			Post Oxidation Perfluorotetradecanoic acid(PFT	2020/07/13	NC		%	30
			Post Oxidation Perfluorobutanesulfonic acid (PF	2020/07/13	NC		%	30
			Post Oxidation Perfluorohexanesulfonic acid(PF	2020/07/13	NC		%	30
			Post Oxidation Perfluoroheptanesulfonic acid P	2020/07/13	NC		%	30
			Post Oxidation Perfluorooctanesulfonic acid (PF	2020/07/13	NC		%	30
			Post Oxidation Perfluorodecanesulfonic acid (PF	2020/07/13	NC		%	30
			Post Oxidation Perfluorooctane Sulfonamide (P	2020/07/13	NC		%	30
			Post Oxidation EtFOSA	2020/07/13	NC		%	30
			Post Oxidation MeFOSA	2020/07/13	NC		%	30
			Post Oxidation EtFOSE	2020/07/13	NC		%	30
			Post Oxidation MeFOSE	2020/07/13	NC		%	30
			Post Oxidation EtFOSAA	2020/07/13	NC		%	30
			Post Oxidation MeFOSAA	2020/07/13	NC		%	30
			Post Oxidation 6:2 Fluorotelomer sulfonic acid	2020/07/13	NC		%	30
			Post Oxidation 8:2 Fluorotelomer sulfonic acid	2020/07/13	NC		%	30

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery was below the lower control limit. This may represent a low bias in some results for this specific analyte.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Adam Robinson, Supervisor, LC/MS/MS

eurofins | Environment Testing America

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ANALYTICAL REPORT

Eurofins TestAmerica, Pittsburgh
301 Alpha Drive
RIDC Park
Pittsburgh, PA 15238
Tel: (412)963-7058

Laboratory Job ID: 180-106447-1
Client Project/Site: Canadian Soil for LEAF 1314

For:
ARCADIS U.S., Inc.
10559 Citation Drive
Suite 100
Brighton, Michigan 48116

Attn: Scott Clearwater

Carrie A. Gamber

Authorized for release by:
6/30/2020 4:28:42 PM

Carrie Gamber, Senior Project Manager
(412)963-2428
carrie.gamber@testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

PA Lab ID: 02-00416

Table of Contents

Job ID: 180-106447-1

Laboratory: Eurofins TestAmerica, Pittsburgh

Narrative

CASE NARRATIVE

Client: ARCADIS U.S., Inc.

Project: Canadian Soil for LEAF 1314

Report Number: 180-106447-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT

The samples were received on 06/01/2020; the samples arrived in good condition, properly preserved and on ice. The temperatures of the 2 coolers at receipt time were 14.6º C and 18.6º C.

GENERAL CHEMSITRY

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Definitions/Glossary

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Accreditation/Certification Summary

Client: ARCADIS U.S., Inc.
Project/Site: Canadian Soil for LEAF 1314

Job ID: 180-106447-1

Laboratory: Eurofins TestAmerica, Pittsburgh

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Arkansas DEQ	State	19-033-0	06-27-21
California	State	2891	04-30-21
Connecticut	State	PH-0688	09-30-20
Florida	NELAP	E871008	06-30-20
Georgia	State	PA 02-00416	04-30-21
Illinois	NELAP	004375	06-30-20
Kansas	NELAP	E-10350	01-31-21
Kentucky (UST)	State	162013	04-30-21
Kentucky (WW)	State	KY98043	12-31-20
Louisiana	NELAP	04041	06-30-20
Maine	State	PA00164	03-06-22
Minnesota	NELAP	042-999-482	12-31-20
Nevada	State	PA00164	07-31-20
New Hampshire	NELAP	2030	04-05-21
New Jersey	NELAP	PA005	06-30-20
New York	NELAP	11182	04-01-21
North Carolina (WW/SW)	State	434	01-01-21
North Dakota	State	R-227	04-30-21
Oregon	NELAP	PA-2151	02-06-21
Pennsylvania	NELAP	02-00416	05-23-21
Rhode Island	State	LAO00362	12-31-20
South Carolina	State	89014	04-30-21
Texas	NELAP	T104704528	03-31-21
US Fish & Wildlife	US Federal Programs	058448	07-31-20
USDA	Federal	P-Soil-01	06-26-22
USDA	US Federal Programs	P330-16-00211	06-26-22
Utah	NELAP	PA001462019-8	05-31-20 *
Virginia	NELAP	10043	09-15-20
West Virginia DEP	State	142	02-01-21
Wisconsin	State	998027800	08-31-20

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Sample Summary

Client: ARCADIS U.S., Inc.
Project/Site: Canadian Soil for LEAF 1314

Job ID: 180-106447-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
180-106447-1	HOMOGENATE MIX-1 T01	Solid	05/29/20 15:00	06/01/20 12:00	
180-106447-2	HOMOGENATE MIX-1 T02	Solid	05/29/20 15:00	06/01/20 12:00	
180-106447-3	HOMOGENATE MIX-1 T03	Solid	05/29/20 15:00	06/01/20 12:00	
180-106447-4	HOMOGENATE MIX-1 T04	Solid	05/29/20 15:00	06/01/20 12:00	
180-106447-5	HOMOGENATE MIX-1 T05	Solid	05/29/20 15:00	06/01/20 12:00	
180-106447-6	HOMOGENATE MIX-1 T06	Solid	05/29/20 15:00	06/01/20 12:00	
180-106447-7	HOMOGENATE MIX-1 T07	Solid	05/29/20 15:00	06/01/20 12:00	
180-106447-8	HOMOGENATE MIX-1 T08	Solid	05/29/20 15:00	06/01/20 12:00	
180-106447-9	HOMOGENATE MIX-1 T09	Solid	05/29/20 15:00	06/01/20 12:00	
180-106447-10	HOMOGENATE MIX-2 T01	Solid	05/29/20 15:15	06/01/20 12:00	
180-106447-11	HOMOGENATE MIX-2 T02	Solid	05/29/20 15:15	06/01/20 12:00	
180-106447-12	HOMOGENATE MIX-2 T03	Solid	05/29/20 15:15	06/01/20 12:00	
180-106447-13	HOMOGENATE MIX-2 T04	Solid	05/29/20 15:15	06/01/20 12:00	
180-106447-14	HOMOGENATE MIX-2 T05	Solid	05/29/20 15:15	06/01/20 12:00	
180-106447-15	HOMOGENATE MIX-2 T06	Solid	05/29/20 15:15	06/01/20 12:00	
180-106447-16	HOMOGENATE MIX-2 T07	Solid	05/29/20 15:15	06/01/20 12:00	
180-106447-17	HOMOGENATE MIX-2 T08	Solid	05/29/20 15:15	06/01/20 12:00	
180-106447-18	HOMOGENATE MIX-2 T09	Solid	05/29/20 15:15	06/01/20 12:00	
180-106447-19	HOMOGENATE MIX-3 T01	Solid	05/29/20 15:30	06/01/20 12:00	
180-106447-20	HOMOGENATE MIX-3 T02	Solid	05/29/20 15:30	06/01/20 12:00	
180-106447-21	HOMOGENATE MIX-3 T03	Solid	05/29/20 15:30	06/01/20 12:00	
180-106447-22	HOMOGENATE MIX-3 T04	Solid	05/29/20 15:30	06/01/20 12:00	
180-106447-23	HOMOGENATE MIX-3 T05	Solid	05/29/20 15:30	06/01/20 12:00	
180-106447-24	HOMOGENATE MIX-3 T06	Solid	05/29/20 15:30	06/01/20 12:00	
180-106447-25	HOMOGENATE MIX-3 T07	Solid	05/29/20 15:30	06/01/20 12:00	
180-106447-26	HOMOGENATE MIX-3 T08	Solid	05/29/20 15:30	06/01/20 12:00	
180-106447-27	HOMOGENATE MIX-3 T09	Solid	05/29/20 15:30	06/01/20 12:00	
180-106447-28	MB	Solid	05/29/20 00:00	06/01/20 12:00	
180-106447-29	MB	Water	06/17/20 09:48	06/01/20 12:00	
180-106447-30	HOMOGENATE MIX-1 T01	Water	06/17/20 09:48	06/01/20 12:00	
180-106447-31	HOMOGENATE MIX-1 T02-T04	Water	06/18/20 17:00	06/01/20 12:00	
180-106447-32	HOMOGENATE MIX-1 T05	Water	06/19/20 05:00	06/01/20 12:00	
180-106447-33	HOMOGENATE MIX-1 T06-T08	Water	06/26/20 17:00	06/01/20 12:00	
180-106447-34	HOMOGENATE MIX-1 T09	Water	06/27/20 05:00	06/01/20 12:00	
180-106447-35	HOMOGENATE MIX-2 T01	Water	06/17/20 09:48	06/01/20 12:00	
180-106447-36	HOMOGENATE MIX-2 T02-T04	Water	06/18/20 17:00	06/01/20 12:00	
180-106447-37	HOMOGENATE MIX-2 T05	Water	06/19/20 05:00	06/01/20 12:00	
180-106447-38	HOMOGENATE MIX-2 T06-T08	Water	06/26/20 17:00	06/01/20 12:00	
180-106447-39	HOMOGENATE MIX-2 T09	Water	06/27/20 05:00	06/01/20 12:00	
180-106447-40	HOMOGENATE MIX-3 T01	Water	06/17/20 09:48	06/01/20 12:00	
180-106447-41	HOMOGENATE MIX-3 T02-T04	Water	06/18/20 17:00	06/01/20 12:00	
180-106447-42	HOMOGENATE MIX-3 T05	Water	06/19/20 05:00	06/01/20 12:00	
180-106447-43	HOMOGENATE MIX-3 T06-T08	Water	06/26/20 17:00	06/01/20 12:00	
180-106447-44	HOMOGENATE MIX-3 T09	Water	06/27/20 05:00	06/01/20 12:00	

Method Summary

Client: ARCADIS U.S., Inc.
Project/Site: Canadian Soil for LEAF 1314

Job ID: 180-106447-1

Method	Method Description	Protocol	Laboratory
2540G	SM 2540G	SM22	TAL PIT
EPA 9040C	pH	SW846	TAL PIT
SM 2510B	Conductivity, Specific Conductance	SM	TAL PIT
SM 2580B	Reduction-Oxidation (REDOX) Potential	SM	TAL PIT
Subcontract	General Subcontract Method	None	TAL PIT
1314	Up-Flow Percolation Column Leach Procedure	SW846	TAL PIT

Protocol References:

None = None
SM = "Standard Methods For The Examination Of Water And Wastewater"
SM22 = Standard Methods For The Examination Of Water And Wastewater, 22nd Edition
SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL PIT = Eurofins TestAmerica, Pittsburgh, 301 Alpha Drive, RIDC Park, Pittsburgh, PA 15238, TEL (412)963-7058

Lab Chronicle

Client: ARCADIS U.S., Inc.
Job ID: 180-106447-1
Project/Site: Canadian Soil for LEAF 1314

Client Sample ID: HOMOGENATE MIX-1 T01
Lab Sample ID: 180-106447-1
Date Collected: 05/29/20 15:00
Matrix: Solid
Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1			317304	06/03/20 08:20	MM1	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5500 g	946.7 mL	318609	06/17/20 06:00	LWM	TAL PIT
Leach	Analysis	EPA 9040C		1			318691	06/17/20 10:53	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5500 g	946.7 mL	318609	06/17/20 06:00	LWM	TAL PIT
Leach	Analysis	SM 2510B		1			318695	06/17/20 10:56	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5500 g	946.7 mL	318609	06/17/20 06:00	LWM	TAL PIT
Leach	Analysis	SM 2580B		1			318694	06/17/20 10:53	MTW	TAL PIT
	Instrument ID:	NOEQUIP								

Client Sample ID: HOMOGENATE MIX-1 T02
Lab Sample ID: 180-106447-2
Date Collected: 05/29/20 15:00
Matrix: Solid
Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5500 g	1490.4 mL	318639	06/17/20 10:48	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			318785	06/17/20 18:13	LWM	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5500 g	1490.4 mL	318639	06/17/20 10:48	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			318789	06/17/20 18:16	LWM	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5500 g	1490.4 mL	318639	06/17/20 10:48	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			318788	06/17/20 18:13	LWM	TAL PIT
	Instrument ID:	NOEQUIP								

Client Sample ID: HOMOGENATE MIX-1 T03
Lab Sample ID: 180-106447-3
Date Collected: 05/29/20 15:00
Matrix: Solid
Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5500 g	2509.8 mL	318641	06/17/20 18:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			318774	06/18/20 06:18	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5500 g	2509.8 mL	318641	06/17/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			318777	06/18/20 06:21	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5500 g	2509.8 mL	318641	06/17/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			318776	06/18/20 06:18	MTW	TAL PIT
	Instrument ID:	NOEQUIP								

Lab Chronicle

Client Sample ID: HOMOGENATE MIX-1 T04

Lab Sample ID: 180-106447-4

Date Collected: 05/29/20 15:00

Matrix: Solid

Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5500 g	2514.6 mL	318648	06/18/20 06:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			318917	06/18/20 18:13	LWM	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5500 g	2514.6 mL	318648	06/18/20 06:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			318921	06/18/20 18:18	LWM	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5500 g	2514.6 mL	318648	06/18/20 06:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			318919	06/18/20 18:13	LWM	TAL PIT
	Instrument ID: NOEQUIP									

Client Sample ID: HOMOGENATE MIX-1 T05

Lab Sample ID: 180-106447-5

Date Collected: 05/29/20 15:00

Matrix: Solid

Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5500 g	2497.3 mL	318650	06/18/20 18:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			318923	06/19/20 06:23	MTW	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5500 g	2497.3 mL	318650	06/18/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			318926	06/19/20 06:26	MTW	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5500 g	2497.3 mL	318650	06/18/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			318924	06/19/20 06:23	MTW	TAL PIT
	Instrument ID: NOEQUIP									

Client Sample ID: HOMOGENATE MIX-1 T06

Lab Sample ID: 180-106447-6

Date Collected: 05/29/20 15:00

Matrix: Solid

Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5500 g	12900 mL	318651	06/19/20 06:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			319091	06/22/20 06:28	MTW	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5500 g	12900 mL	318651	06/19/20 06:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			319093	06/22/20 06:31	MTW	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5500 g	12900 mL	318651	06/19/20 06:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			319092	06/22/20 06:28	MTW	TAL PIT
	Instrument ID: NOEQUIP									

Lab Chronicle

Client Sample ID: HOMOGENATE MIX-1 T07

Lab Sample ID: 180-106447-7

Date Collected: 05/29/20 15:00
Date Received: 06/01/20 12:00
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5500 g	2539.0 mL	318652	06/21/20 18:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			319091	06/22/20 06:40	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5500 g	2539.0 mL	318652	06/21/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			319093	06/22/20 06:43	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5500 g	2539.0 mL	318652	06/21/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			319092	06/22/20 06:40	MTW	TAL PIT
	Instrument ID:	NOEQUIP								

Client Sample ID: HOMOGENATE MIX-1 T08

Lab Sample ID: 180-106447-8

Date Collected: 05/29/20 15:00
Date Received: 06/01/20 12:00
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5500 g	22666.6 mL	318658	06/22/20 06:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			319899	06/26/20 18:03	LWM	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5500 g	22666.6 mL	318658	06/22/20 06:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			319902	06/26/20 18:06	LWM	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5500 g	22666.6 mL	318658	06/22/20 06:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			319901	06/26/20 18:03	LWM	TAL PIT
	Instrument ID:	NOEQUIP								

Client Sample ID: HOMOGENATE MIX-1 T09

Lab Sample ID: 180-106447-9

Date Collected: 05/29/20 15:00
Date Received: 06/01/20 12:00
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5500 g	2503.9 mL	318660	06/26/20 18:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			319903	06/29/20 06:23	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5500 g	2503.9 mL	318660	06/26/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			319905	06/29/20 06:26	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5500 g	2503.9 mL	318660	06/26/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			319904	06/29/20 06:23	MTW	TAL PIT
	Instrument ID:	NOEQUIP								

Lab Chronicle

Client Sample ID: HOMOGENATE MIX-2 T01

Lab Sample ID: 180-106447-10

Date Collected: 05/29/20 15:15

Matrix: Solid

Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1			317304	06/03/20 08:20	MM1	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5800 g	1034.4 mL	318609	06/17/20 06:00	LWM	TAL PIT
Leach	Analysis	EPA 9040C		1			318691	06/17/20 10:59	MTW	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5800 g	1034.4 mL	318609	06/17/20 06:00	LWM	TAL PIT
Leach	Analysis	SM 2510B		1			318695	06/17/20 11:02	MTW	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5800 g	1034.4 mL	318609	06/17/20 06:00	LWM	TAL PIT
Leach	Analysis	SM 2580B		1			318694	06/17/20 10:59	MTW	TAL PIT
	Instrument ID: NOEQUIP									

Client Sample ID: HOMOGENATE MIX-2 T02

Lab Sample ID: 180-106447-11

Date Collected: 05/29/20 15:15

Matrix: Solid

Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5800 g	1533.8 mL	318639	06/17/20 10:48	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			318785	06/17/20 18:19	LWM	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5800 g	1533.8 mL	318639	06/17/20 10:48	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			318789	06/17/20 18:23	LWM	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5800 g	1533.8 mL	318639	06/17/20 10:48	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			318788	06/17/20 18:19	LWM	TAL PIT
	Instrument ID: NOEQUIP									

Client Sample ID: HOMOGENATE MIX-2 T03

Lab Sample ID: 180-106447-12

Date Collected: 05/29/20 15:15

Matrix: Solid

Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5800 g	2559.1 mL	318641	06/17/20 18:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			318774	06/18/20 06:24	MTW	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5800 g	2559.1 mL	318641	06/17/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			318777	06/18/20 06:27	MTW	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5800 g	2559.1 mL	318641	06/17/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			318776	06/18/20 06:24	MTW	TAL PIT
	Instrument ID: NOEQUIP									

Lab Chronicle

Client Sample ID: HOMOGENATE MIX-2 T04

Lab Sample ID: 180-106447-13

Date Collected: 05/29/20 15:15
Matrix: Solid
Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5800 g	2562.3 mL	318648	06/18/20 06:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			318917	06/18/20 18:29	LWM	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5800 g	2562.3 mL	318648	06/18/20 06:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			318921	06/18/20 18:26	LWM	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5800 g	2562.3 mL	318648	06/18/20 06:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			318919	06/18/20 18:29	LWM	TAL PIT
	Instrument ID:	NOEQUIP								

Client Sample ID: HOMOGENATE MIX-2 T05

Lab Sample ID: 180-106447-14

Date Collected: 05/29/20 15:15
Matrix: Solid
Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5800 g	2546.8 mL	318650	06/18/20 18:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			318923	06/19/20 06:29	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5800 g	2546.8 mL	318650	06/18/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			318926	06/19/20 06:33	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5800 g	2546.8 mL	318650	06/18/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			318924	06/19/20 06:29	MTW	TAL PIT
	Instrument ID:	NOEQUIP								

Client Sample ID: HOMOGENATE MIX-2 T06

Lab Sample ID: 180-106447-15

Date Collected: 05/29/20 15:15
Matrix: Solid
Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5800 g	13000 mL	318651	06/19/20 06:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			319091	06/22/20 06:34	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5800 g	13000 mL	318651	06/19/20 06:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			319093	06/22/20 06:37	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5800 g	13000 mL	318651	06/19/20 06:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			319092	06/22/20 06:34	MTW	TAL PIT
	Instrument ID:	NOEQUIP								

Lab Chronicle

Client: ARCADIS U.S., Inc.
Project/Site: Canadian Soil for LEAF 1314

Job ID: 180-106447-1

Client Sample ID: HOMOGENATE MIX-2 T07

Lab Sample ID: 180-106447-16

Date Collected: 05/29/20 15:15
Date Received: 06/01/20 12:00

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5800 g	2568.8 mL	318652	06/21/20 18:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			319091	06/22/20 06:43	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5800 g	2568.8 mL	318652	06/21/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			319093	06/22/20 06:46	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5800 g	2568.8 mL	318652	06/21/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			319092	06/22/20 06:43	MTW	TAL PIT
	Instrument ID:	NOEQUIP								

Client Sample ID: HOMOGENATE MIX-2 T08

Lab Sample ID: 180-106447-17

Date Collected: 05/29/20 15:15
Date Received: 06/01/20 12:00

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5800 g	22942.9 mL	318658	06/22/20 06:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			319899	06/26/20 18:09	LWM	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5800 g	22942.9 mL	318658	06/22/20 06:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			319902	06/26/20 18:13	LWM	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5800 g	22942.9 mL	318658	06/22/20 06:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			319901	06/26/20 18:09	LWM	TAL PIT
	Instrument ID:	NOEQUIP								

Client Sample ID: HOMOGENATE MIX-2 T09

Lab Sample ID: 180-106447-18

Date Collected: 05/29/20 15:15
Date Received: 06/01/20 12:00

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5800 g	2525.6 mL	318660	06/26/20 18:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			319903	06/29/20 06:29	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5800 g	2525.6 mL	318660	06/26/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			319905	06/29/20 06:32	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5800 g	2525.6 mL	318660	06/26/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			319904	06/29/20 06:29	MTW	TAL PIT
	Instrument ID:	NOEQUIP								

Lab Chronicle

Client Sample ID: HOMOGENATE MIX-3 T01

Lab Sample ID: 180-106447-19

Date Collected: 05/29/20 15:30

Matrix: Solid

Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	2540G		1			317304	06/03/20 08:20	MM1	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5348 g	924.7 mL	318609	06/17/20 06:00	LWM	TAL PIT
Leach	Analysis	EPA 9040C		1			318691	06/17/20 11:02	MTW	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5348 g	924.7 mL	318609	06/17/20 06:00	LWM	TAL PIT
Leach	Analysis	SM 2510B		1			318695	06/17/20 11:05	MTW	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5348 g	924.7 mL	318609	06/17/20 06:00	LWM	TAL PIT
Leach	Analysis	SM 2580B		1			318694	06/17/20 11:02	MTW	TAL PIT
	Instrument ID: NOEQUIP									

Client Sample ID: HOMOGENATE MIX-3 T02

Lab Sample ID: 180-106447-20

Date Collected: 05/29/20 15:30

Matrix: Solid

Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5348 g	1401.2 mL	318639	06/17/20 10:48	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			318785	06/17/20 18:22	LWM	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5348 g	1401.2 mL	318639	06/17/20 10:48	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			318789	06/17/20 18:26	LWM	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5348 g	1401.2 mL	318639	06/17/20 10:48	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			318788	06/17/20 18:22	LWM	TAL PIT
	Instrument ID: NOEQUIP									

Client Sample ID: HOMOGENATE MIX-3 T03

Lab Sample ID: 180-106447-21

Date Collected: 05/29/20 15:30

Matrix: Solid

Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5348 g	2348.5 mL	318641	06/17/20 18:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			318774	06/18/20 06:27	MTW	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5348 g	2348.5 mL	318641	06/17/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			318777	06/18/20 06:30	MTW	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5348 g	2348.5 mL	318641	06/17/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			318776	06/18/20 06:27	MTW	TAL PIT
	Instrument ID: NOEQUIP									

Client Sample ID: HOMOGENATE MIX-3 T04

Lab Sample ID: 180-106447-22
Date Collected: 05/29/20 15:30
Matrix: Solid
Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5348 g	2348.1 mL	318648	06/18/20 06:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			318917	06/18/20 18:32	LWM	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5348 g	2348.1 mL	318648	06/18/20 06:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			318921	06/18/20 18:30	LWM	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5348 g	2348.1 mL	318648	06/18/20 06:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			318919	06/18/20 18:32	LWM	TAL PIT
	Instrument ID:	NOEQUIP								

Client Sample ID: HOMOGENATE MIX-3 T05

Lab Sample ID: 180-106447-23
Date Collected: 05/29/20 15:30
Matrix: Solid
Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5348 g	2333.9 mL	318650	06/18/20 18:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			318923	06/19/20 06:32	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5348 g	2333.9 mL	318650	06/18/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			318926	06/19/20 06:36	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5348 g	2333.9 mL	318650	06/18/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			318924	06/19/20 06:32	MTW	TAL PIT
	Instrument ID:	NOEQUIP								

Client Sample ID: HOMOGENATE MIX-3 T06

Lab Sample ID: 180-106447-24
Date Collected: 05/29/20 15:30
Matrix: Solid
Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5348 g	12000 mL	318651	06/19/20 06:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			319091	06/22/20 06:37	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5348 g	12000 mL	318651	06/19/20 06:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			319093	06/22/20 06:40	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			5348 g	12000 mL	318651	06/19/20 06:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			319092	06/22/20 06:37	MTW	TAL PIT
	Instrument ID:	NOEQUIP								

Lab Chronicle

Client Sample ID: HOMOGENATE MIX-3 T07

Lab Sample ID: 180-106447-25

Date Collected: 05/29/20 15:30
Matrix: Solid
Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5348 g	2367.8 mL	318652	06/21/20 18:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			319091	06/22/20 06:46	MTW	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5348 g	2367.8 mL	318652	06/21/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			319093	06/22/20 06:49	MTW	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5348 g	2367.8 mL	318652	06/21/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			319092	06/22/20 06:46	MTW	TAL PIT
	Instrument ID: NOEQUIP									

Client Sample ID: HOMOGENATE MIX-3 T08

Lab Sample ID: 180-106447-26

Date Collected: 05/29/20 15:30
Matrix: Solid
Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5348 g	21137.8 mL	318658	06/22/20 06:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			319899	06/26/20 18:12	LWM	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5348 g	21137.8 mL	318658	06/22/20 06:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			319902	06/26/20 18:16	LWM	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5348 g	21137.8 mL	318658	06/22/20 06:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			319901	06/26/20 18:12	LWM	TAL PIT
	Instrument ID: NOEQUIP									

Client Sample ID: HOMOGENATE MIX-3 T09

Lab Sample ID: 180-106447-27

Date Collected: 05/29/20 15:30
Matrix: Solid
Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			5348 g	2335.6 mL	318660	06/26/20 18:00	MTW	TAL PIT
Leach	Analysis	EPA 9040C		1			319903	06/29/20 06:32	MTW	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5348 g	2335.6 mL	318660	06/26/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2510B		1			319905	06/29/20 06:35	MTW	TAL PIT
	Instrument ID: NOEQUIP									
Leach	Leach	1314			5348 g	2335.6 mL	318660	06/26/20 18:00	MTW	TAL PIT
Leach	Analysis	SM 2580B		1			319904	06/29/20 06:32	MTW	TAL PIT
	Instrument ID: NOEQUIP									

Client Sample ID: MB
Lab Sample ID: 180-106447-28
Date Collected: 05/29/20 00:00
Matrix: Solid
Date Received: 06/01/20 12:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Leach	Leach	1314			1.0 g	1000 mL	318609	06/17/20 06:00	LWM	TAL PIT
Leach	Analysis	EPA 9040C		1			318691	06/17/20 11:05	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			1.0 g	1000 mL	318609	06/17/20 06:00	LWM	TAL PIT
Leach	Analysis	SM 2510B		1			318695	06/17/20 11:08	MTW	TAL PIT
	Instrument ID:	NOEQUIP								
Leach	Leach	1314			1.0 g	1000 mL	318609	06/17/20 06:00	LWM	TAL PIT
Leach	Analysis	SM 2580B		1			318694	06/17/20 11:05	MTW	TAL PIT
	Instrument ID:	NOEQUIP								

Laboratory References:

TAL PIT = Eurofins TestAmerica, Pittsburgh, 301 Alpha Drive, RIDC Park, Pittsburgh, PA 15238, TEL (412)963-7058

Analyst References:

Lab: TAL PIT
- Batch Type: Leach
  - LWM = Larry Matko
  - MTW = Michael Wesoloski
- Batch Type: Analysis
  - LWM = Larry Matko
  - MM1 = Mary Beth Miller
  - MTW = Michael Wesoloski

Client Sample Results

Client: ARCADIS U.S., Inc.
Project/Site: Canadian Soil for LEAF 1314

Job ID: 180-106447-1

Client Sample ID: HOMOGENATE MIX-1 T01

Lab Sample ID: 180-106447-1
Date Collected: 05/29/20 15:00
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	**9.5**		0.1	0.1	%			06/03/20 08:20	1
Percent Solids	**90.5**		0.1	0.1	%			06/03/20 08:20	1

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**6.7**		0.1	0.1	SU			06/17/20 10:53	1
Specific Conductance	**730**		1.0	1.0	umhos/cm			06/17/20 10:56	1
Oxidation Reduction Potential	**280**		10	10	millivolts			06/17/20 10:53	1

Client Sample ID: HOMOGENATE MIX-1 T02

Lab Sample ID: 180-106447-2
Date Collected: 05/29/20 15:00
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**6.9**		0.1	0.1	SU			06/17/20 18:13	1
Specific Conductance	**210**		1.0	1.0	umhos/cm			06/17/20 18:16	1
Oxidation Reduction Potential	**210**		10	10	millivolts			06/17/20 18:13	1

Client Sample ID: HOMOGENATE MIX-1 T03

Lab Sample ID: 180-106447-3
Date Collected: 05/29/20 15:00
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**6.9**		0.1	0.1	SU			06/18/20 06:18	1
Specific Conductance	**99**		1.0	1.0	umhos/cm			06/18/20 06:21	1
Oxidation Reduction Potential	**220**		10	10	millivolts			06/18/20 06:18	1

Client Sample ID: HOMOGENATE MIX-1 T04

Lab Sample ID: 180-106447-4
Date Collected: 05/29/20 15:00
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.0**		0.1	0.1	SU			06/18/20 18:13	1
Specific Conductance	**62**		1.0	1.0	umhos/cm			06/18/20 18:18	1
Oxidation Reduction Potential	**440**		10	10	millivolts			06/18/20 18:13	1

Client Sample ID: HOMOGENATE MIX-1 T05

Lab Sample ID: 180-106447-5
Date Collected: 05/29/20 15:00
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.0**		0.1	0.1	SU			06/19/20 06:23	1
Specific Conductance	**52**		1.0	1.0	umhos/cm			06/19/20 06:26	1
Oxidation Reduction Potential	**280**		10	10	millivolts			06/19/20 06:23	1

Client Sample Results

Client: ARCADIS U.S., Inc.
Project/Site: Canadian Soil for LEAF 1314

Job ID: 180-106447-1

Client Sample ID: HOMOGENATE MIX-1 T06

Lab Sample ID: 180-106447-6
Date Collected: 05/29/20 15:00
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.2		0.1	0.1	SU			06/22/20 06:28	1
Specific Conductance	36		1.0	1.0	umhos/cm			06/22/20 06:31	1
Oxidation Reduction Potential	240		10	10	millivolts			06/22/20 06:28	1

Client Sample ID: HOMOGENATE MIX-1 T07

Lab Sample ID: 180-106447-7
Date Collected: 05/29/20 15:00
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.0		0.1	0.1	SU			06/22/20 06:40	1
Specific Conductance	30		1.0	1.0	umhos/cm			06/22/20 06:43	1
Oxidation Reduction Potential	270		10	10	millivolts			06/22/20 06:40	1

Client Sample ID: HOMOGENATE MIX-1 T08

Lab Sample ID: 180-106447-8
Date Collected: 05/29/20 15:00
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.1		0.1	0.1	SU			06/26/20 18:03	1
Specific Conductance	26		1.0	1.0	umhos/cm			06/26/20 18:06	1
Oxidation Reduction Potential	360		10	10	millivolts			06/26/20 18:03	1

Client Sample ID: HOMOGENATE MIX-1 T09

Lab Sample ID: 180-106447-9
Date Collected: 05/29/20 15:00
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.2		0.1	0.1	SU			06/29/20 06:23	1
Specific Conductance	24		1.0	1.0	umhos/cm			06/29/20 06:26	1
Oxidation Reduction Potential	310		10	10	millivolts			06/29/20 06:23	1

Client Sample ID: HOMOGENATE MIX-2 T01

Lab Sample ID: 180-106447-10
Date Collected: 05/29/20 15:15
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	11.0		0.1	0.1	%			06/03/20 08:20	1
Percent Solids	89.0		0.1	0.1	%			06/03/20 08:20	1

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	6.6		0.1	0.1	SU			06/17/20 10:59	1
Specific Conductance	2600		1.0	1.0	umhos/cm			06/17/20 11:02	1
Oxidation Reduction Potential	280		10	10	millivolts			06/17/20 10:59	1

Client Sample Results

Client: ARCADIS U.S., Inc.
Job ID: 180-106447-1
Project/Site: Canadian Soil for LEAF 1314

Client Sample ID: HOMOGENATE MIX-2 T02
Lab Sample ID: 180-106447-11
Date Collected: 05/29/20 15:15
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	6.9		0.1	0.1	SU			06/17/20 18:19	1
Specific Conductance	320		1.0	1.0	umhos/cm			06/17/20 18:23	1
Oxidation Reduction Potential	270		10	10	millivolts			06/17/20 18:19	1

Client Sample ID: HOMOGENATE MIX-2 T03
Lab Sample ID: 180-106447-12
Date Collected: 05/29/20 15:15
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.2		0.1	0.1	SU			06/18/20 06:24	1
Specific Conductance	130		1.0	1.0	umhos/cm			06/18/20 06:27	1
Oxidation Reduction Potential	260		10	10	millivolts			06/18/20 06:24	1

Client Sample ID: HOMOGENATE MIX-2 T04
Lab Sample ID: 180-106447-13
Date Collected: 05/29/20 15:15
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.1		0.1	0.1	SU			06/18/20 18:29	1
Specific Conductance	90		1.0	1.0	umhos/cm			06/18/20 18:26	1
Oxidation Reduction Potential	210		10	10	millivolts			06/18/20 18:29	1

Client Sample ID: HOMOGENATE MIX-2 T05
Lab Sample ID: 180-106447-14
Date Collected: 05/29/20 15:15
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.2		0.1	0.1	SU			06/19/20 06:29	1
Specific Conductance	80		1.0	1.0	umhos/cm			06/19/20 06:33	1
Oxidation Reduction Potential	280		10	10	millivolts			06/19/20 06:29	1

Client Sample ID: HOMOGENATE MIX-2 T06
Lab Sample ID: 180-106447-15
Date Collected: 05/29/20 15:15
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.3		0.1	0.1	SU			06/22/20 06:34	1
Specific Conductance	46		1.0	1.0	umhos/cm			06/22/20 06:37	1
Oxidation Reduction Potential	260		10	10	millivolts			06/22/20 06:34	1

Client Sample ID: HOMOGENATE MIX-2 T07
Lab Sample ID: 180-106447-16
Date Collected: 05/29/20 15:15
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.1		0.1	0.1	SU			06/22/20 06:43	1
Specific Conductance	38		1.0	1.0	umhos/cm			06/22/20 06:46	1

Client Sample ID: HOMOGENATE MIX-2 T07

Lab Sample ID: 180-106447-16
Date Collected: 05/29/20 15:15
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry - Leach (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation Reduction Potential	**250**		10	10	millivolts			06/22/20 06:43	1

Client Sample ID: HOMOGENATE MIX-2 T08

Lab Sample ID: 180-106447-17
Date Collected: 05/29/20 15:15
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.2**		0.1	0.1	SU			06/26/20 18:09	1
Specific Conductance	**30**		1.0	1.0	umhos/cm			06/26/20 18:13	1
Oxidation Reduction Potential	**300**		10	10	millivolts			06/26/20 18:09	1

Client Sample ID: HOMOGENATE MIX-2 T09

Lab Sample ID: 180-106447-18
Date Collected: 05/29/20 15:15
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.2**		0.1	0.1	SU			06/29/20 06:29	1
Specific Conductance	**25**		1.0	1.0	umhos/cm			06/29/20 06:32	1
Oxidation Reduction Potential	**310**		10	10	millivolts			06/29/20 06:29	1

Client Sample ID: HOMOGENATE MIX-3 T01

Lab Sample ID: 180-106447-19
Date Collected: 05/29/20 15:30
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture	**12.2**		0.1	0.1	%			06/03/20 08:20	1
Percent Solids	**87.8**		0.1	0.1	%			06/03/20 08:20	1

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**6.4**		0.1	0.1	SU			06/17/20 11:02	1
Specific Conductance	**4500**		1.0	1.0	umhos/cm			06/17/20 11:05	1
Oxidation Reduction Potential	**280**		10	10	millivolts			06/17/20 11:02	1

Client Sample ID: HOMOGENATE MIX-3 T02

Lab Sample ID: 180-106447-20
Date Collected: 05/29/20 15:30
Matrix: Solid
Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**6.9**		0.1	0.1	SU			06/17/20 18:22	1
Specific Conductance	**550**		1.0	1.0	umhos/cm			06/17/20 18:26	1
Oxidation Reduction Potential	**280**		10	10	millivolts			06/17/20 18:22	1

Client Sample Results

Client Sample ID: HOMOGENATE MIX-3 T03

Lab Sample ID: 180-106447-21

Date Collected: 05/29/20 15:30
Date Received: 06/01/20 12:00

Matrix: Solid

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.1		0.1	0.1	SU			06/18/20 06:27	1
Specific Conductance	190		1.0	1.0	umhos/cm			06/18/20 06:30	1
Oxidation Reduction Potential	260		10	10	millivolts			06/18/20 06:27	1

Client Sample ID: HOMOGENATE MIX-3 T04

Lab Sample ID: 180-106447-22

Date Collected: 05/29/20 15:30
Date Received: 06/01/20 12:00

Matrix: Solid

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.2		0.1	0.1	SU			06/18/20 18:32	1
Specific Conductance	120		1.0	1.0	umhos/cm			06/18/20 18:30	1
Oxidation Reduction Potential	260		10	10	millivolts			06/18/20 18:32	1

Client Sample ID: HOMOGENATE MIX-3 T05

Lab Sample ID: 180-106447-23

Date Collected: 05/29/20 15:30
Date Received: 06/01/20 12:00

Matrix: Solid

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.2		0.1	0.1	SU			06/19/20 06:32	1
Specific Conductance	95		1.0	1.0	umhos/cm			06/19/20 06:36	1
Oxidation Reduction Potential	270		10	10	millivolts			06/19/20 06:32	1

Client Sample ID: HOMOGENATE MIX-3 T06

Lab Sample ID: 180-106447-24

Date Collected: 05/29/20 15:30
Date Received: 06/01/20 12:00

Matrix: Solid

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.3		0.1	0.1	SU			06/22/20 06:37	1
Specific Conductance	63		1.0	1.0	umhos/cm			06/22/20 06:40	1
Oxidation Reduction Potential	250		10	10	millivolts			06/22/20 06:37	1

Client Sample ID: HOMOGENATE MIX-3 T07

Lab Sample ID: 180-106447-25

Date Collected: 05/29/20 15:30
Date Received: 06/01/20 12:00

Matrix: Solid

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.2		0.1	0.1	SU			06/22/20 06:46	1
Specific Conductance	49		1.0	1.0	umhos/cm			06/22/20 06:49	1
Oxidation Reduction Potential	250		10	10	millivolts			06/22/20 06:46	1

Client Sample ID: HOMOGENATE MIX-3 T08

Lab Sample ID: 180-106447-26

Date Collected: 05/29/20 15:30
Date Received: 06/01/20 12:00

Matrix: Solid

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.2		0.1	0.1	SU			06/26/20 18:12	1
Specific Conductance	35		1.0	1.0	umhos/cm			06/26/20 18:16	1

Client Sample ID: HOMOGENATE MIX-3 T08

Lab Sample ID: 180-106447-26

Date Collected: 05/29/20 15:30

Matrix: Solid

Date Received: 06/01/20 12:00

General Chemistry - Leach (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation Reduction Potential	**310**		10	10	millivolts			06/26/20 18:12	1

Client Sample ID: HOMOGENATE MIX-3 T09

Lab Sample ID: 180-106447-27

Date Collected: 05/29/20 15:30

Matrix: Solid

Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.2**		0.1	0.1	SU			06/29/20 06:32	1
Specific Conductance	**28**		1.0	1.0	umhos/cm			06/29/20 06:35	1
Oxidation Reduction Potential	**290**		10	10	millivolts			06/29/20 06:32	1

Client Sample ID: MB

Lab Sample ID: 180-106447-28

Date Collected: 05/29/20 00:00

Matrix: Solid

Date Received: 06/01/20 12:00

General Chemistry - Leach

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**5.8**		0.1	0.1	SU			06/17/20 11:05	1
Specific Conductance	ND		1.0	1.0	umhos/cm			06/17/20 11:08	1
Oxidation Reduction Potential	**630**		10	10	millivolts			06/17/20 11:05	1

QC Sample Results

Client: ARCADIS U.S., Inc.
Project/Site: Canadian Soil for LEAF 1314

Job ID: 180-106447-1

Method: EPA 9040C - pH

Lab Sample ID: LCS 180-318691/1
Matrix: Solid
Analysis Batch: 318691

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
pH	7.00	7.0		SU		100	99 - 101

Lab Sample ID: LCS 180-318774/1
Matrix: Solid
Analysis Batch: 318774

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
pH	7.00	7.0		SU		100	99 - 101

Lab Sample ID: LCS 180-318785/1
Matrix: Solid
Analysis Batch: 318785

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
pH	7.00	7.0		SU		100	99 - 101

Lab Sample ID: LCS 180-318917/1
Matrix: Solid
Analysis Batch: 318917

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
pH	7.00	7.0		SU		100	99 - 101

Lab Sample ID: LCS 180-318923/1
Matrix: Solid
Analysis Batch: 318923

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
pH	7.00	7.0		SU		100	99 - 101

Lab Sample ID: LCS 180-319091/1
Matrix: Solid
Analysis Batch: 319091

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
pH	7.00	7.0		SU		100	99 - 101

Lab Sample ID: LCS 180-319899/1
Matrix: Solid
Analysis Batch: 319899

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
pH	7.00	7.0		SU		100	99 - 101

Lab Sample ID: LCS 180-319903/1
Matrix: Solid
Analysis Batch: 319903

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
pH	7.00	7.0		SU		100	99 - 101

QC Sample Results

Method: EPA 9040C - pH

Lab Sample ID: 180-106447-1 DU
Client Sample ID: HOMOGENATE MIX-1 T01
Matrix: Solid
Prep Type: Leach
Analysis Batch: 318691

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
pH	6.7			6.7		SU				0	2

Lab Sample ID: 180-106447-3 DU
Client Sample ID: HOMOGENATE MIX-1 T03
Matrix: Solid
Prep Type: Leach
Analysis Batch: 318774

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
pH	6.9			6.9		SU				0.1	2

Lab Sample ID: 180-106447-2 DU
Client Sample ID: HOMOGENATE MIX-1 T02
Matrix: Solid
Prep Type: Leach
Analysis Batch: 318785

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
pH	6.9			6.9		SU				0.6	2

Lab Sample ID: 180-106447-4 DU
Client Sample ID: HOMOGENATE MIX-1 T04
Matrix: Solid
Prep Type: Leach
Analysis Batch: 318917

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
pH	7.0			7.0		SU				0	2

Lab Sample ID: 180-106447-5 DU
Client Sample ID: HOMOGENATE MIX-1 T05
Matrix: Solid
Prep Type: Leach
Analysis Batch: 318923

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
pH	7.0			7.0		SU				0	2

Lab Sample ID: 180-106447-6 DU
Client Sample ID: HOMOGENATE MIX-1 T06
Matrix: Solid
Prep Type: Leach
Analysis Batch: 319091

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
pH	7.2			7.2		SU				0	2

Lab Sample ID: 180-106447-8 DU
Client Sample ID: HOMOGENATE MIX-1 T08
Matrix: Solid
Prep Type: Leach
Analysis Batch: 319899

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
pH	7.1			7.1		SU				0.4	2

Lab Sample ID: 180-106447-9 DU
Client Sample ID: HOMOGENATE MIX-1 T09
Matrix: Solid
Prep Type: Leach
Analysis Batch: 319903

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
pH	7.2			7.2		SU				0	2

1 2 3 4 5 6 7 8 9 10 11 12 13

QC Sample Results

Method: SM 2510B - Conductivity, Specific Conductance

Lab Sample ID: MB 180-318695/2
Matrix: Solid
Analysis Batch: 318695

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	ND		1.0	1.0	umhos/cm			06/17/20 10:53	1

Lab Sample ID: LCS 180-318695/1
Matrix: Solid
Analysis Batch: 318695

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Specific Conductance			84.0	87.3		umhos/cm		104	90 - 110		

Lab Sample ID: MB 180-318777/2
Matrix: Solid
Analysis Batch: 318777

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	ND		1.0	1.0	umhos/cm			06/18/20 06:18	1

Lab Sample ID: LCS 180-318777/1
Matrix: Solid
Analysis Batch: 318777

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Specific Conductance			84.0	87.0		umhos/cm		104	90 - 110		

Lab Sample ID: MB 180-318789/2
Matrix: Solid
Analysis Batch: 318789

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	ND		1.0	1.0	umhos/cm			06/17/20 18:13	1

Lab Sample ID: LCS 180-318789/1
Matrix: Solid
Analysis Batch: 318789

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Specific Conductance			84.0	88.3		umhos/cm		105	90 - 110		

Lab Sample ID: MB 180-318921/2
Matrix: Solid
Analysis Batch: 318921

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	ND		1.0	1.0	umhos/cm			06/18/20 18:14	1

Lab Sample ID: LCS 180-318921/1
Matrix: Solid
Analysis Batch: 318921

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Specific Conductance			84.0	89.0		umhos/cm		106	90 - 110		

QC Sample Results

Method: SM 2510B - Conductivity, Specific Conductance

Lab Sample ID: MB 180-318926/2
Client Sample ID: Method Blank
Matrix: Solid
Prep Type: Total/NA
Analysis Batch: 318926

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	ND		1.0	1.0	umhos/cm			06/19/20 06:23	1

Lab Sample ID: LCS 180-318926/1
Client Sample ID: Lab Control Sample
Matrix: Solid
Prep Type: Total/NA
Analysis Batch: 318926

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Specific Conductance			84.0	88.5		umhos/cm		105	90 - 110		

Lab Sample ID: MB 180-319093/2
Client Sample ID: Method Blank
Matrix: Solid
Prep Type: Total/NA
Analysis Batch: 319093

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	ND		1.0	1.0	umhos/cm			06/22/20 06:28	1

Lab Sample ID: LCS 180-319093/1
Client Sample ID: Lab Control Sample
Matrix: Solid
Prep Type: Total/NA
Analysis Batch: 319093

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Specific Conductance			84.0	87.9		umhos/cm		105	90 - 110		

Lab Sample ID: MB 180-319902/2
Client Sample ID: Method Blank
Matrix: Solid
Prep Type: Total/NA
Analysis Batch: 319902

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	ND		1.0	1.0	umhos/cm			06/26/20 18:03	1

Lab Sample ID: LCS 180-319902/1
Client Sample ID: Lab Control Sample
Matrix: Solid
Prep Type: Total/NA
Analysis Batch: 319902

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Specific Conductance			84.0	91.1		umhos/cm		108	90 - 110		

Lab Sample ID: MB 180-319905/2
Client Sample ID: Method Blank
Matrix: Solid
Prep Type: Total/NA
Analysis Batch: 319905

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	ND		1.0	1.0	umhos/cm			06/29/20 06:23	1

Lab Sample ID: LCS 180-319905/1
Client Sample ID: Lab Control Sample
Matrix: Solid
Prep Type: Total/NA
Analysis Batch: 319905

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Specific Conductance			84.0	88.1		umhos/cm		105	90 - 110		

Method: SM 2510B - Conductivity, Specific Conductance

Lab Sample ID: 180-106447-1 DU
Matrix: Solid
Analysis Batch: 318695

Client Sample ID: HOMOGENATE MIX-1 T01
Prep Type: Leach

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Specific Conductance	730			733		umhos/cm				0.1	20

Lab Sample ID: 180-106447-3 DU
Matrix: Solid
Analysis Batch: 318777

Client Sample ID: HOMOGENATE MIX-1 T03
Prep Type: Leach

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Specific Conductance	99			99.5		umhos/cm				0.1	20

Lab Sample ID: 180-106447-2 DU
Matrix: Solid
Analysis Batch: 318789

Client Sample ID: HOMOGENATE MIX-1 T02
Prep Type: Leach

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Specific Conductance	210			217		umhos/cm				1	20

Lab Sample ID: 180-106447-4 DU
Matrix: Solid
Analysis Batch: 318921

Client Sample ID: HOMOGENATE MIX-1 T04
Prep Type: Leach

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Specific Conductance	62			62.2		umhos/cm				0.3	20

Lab Sample ID: 180-106447-5 DU
Matrix: Solid
Analysis Batch: 318926

Client Sample ID: HOMOGENATE MIX-1 T05
Prep Type: Leach

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Specific Conductance	52			52.0		umhos/cm				0.4	20

Lab Sample ID: 180-106447-6 DU
Matrix: Solid
Analysis Batch: 319093

Client Sample ID: HOMOGENATE MIX-1 T06
Prep Type: Leach

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Specific Conductance	36			35.5		umhos/cm				0.8	20

Lab Sample ID: 180-106447-8 DU
Matrix: Solid
Analysis Batch: 319902

Client Sample ID: HOMOGENATE MIX-1 T08
Prep Type: Leach

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Specific Conductance	26			26.1		umhos/cm				2	20

Lab Sample ID: 180-106447-9 DU
Matrix: Solid
Analysis Batch: 319905

Client Sample ID: HOMOGENATE MIX-1 T09
Prep Type: Leach

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Specific Conductance	24			24.0		umhos/cm				0.2	20

Method: SM 2580B - Reduction-Oxidation (REDOX) Potential

Lab Sample ID: LCS 180-318694/1
Matrix: Solid
Analysis Batch: 318694

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Oxidation Reduction Potential	475	480		millivolts		101	90 - 110

Lab Sample ID: LCS 180-318776/1
Matrix: Solid
Analysis Batch: 318776

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Oxidation Reduction Potential	475	477		millivolts		100	90 - 110

Lab Sample ID: LCS 180-318788/1
Matrix: Solid
Analysis Batch: 318788

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Oxidation Reduction Potential	475	483		millivolts		102	90 - 110

Lab Sample ID: LCS 180-318919/1
Matrix: Solid
Analysis Batch: 318919

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Oxidation Reduction Potential	475	470		millivolts		99	90 - 110

Lab Sample ID: LCS 180-318924/1
Matrix: Solid
Analysis Batch: 318924

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Oxidation Reduction Potential	475	481		millivolts		101	90 - 110

Lab Sample ID: LCS 180-319092/1
Matrix: Solid
Analysis Batch: 319092

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Oxidation Reduction Potential	475	481		millivolts		101	90 - 110

Lab Sample ID: LCS 180-319901/1
Matrix: Solid
Analysis Batch: 319901

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Oxidation Reduction Potential	475	480		millivolts		101	90 - 110

Lab Sample ID: LCS 180-319904/1
Matrix: Solid
Analysis Batch: 319904

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Oxidation Reduction Potential	475	478		millivolts		101	90 - 110

Method: SM 2580B - Reduction-Oxidation (REDOX) Potential

Lab Sample ID: 180-106447-1 DU
Matrix: Solid
Analysis Batch: 318694
Client Sample ID: HOMOGENATE MIX-1 T01
Prep Type: Leach

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Oxidation Reduction Potential	280			280		millivolts				1	20

Lab Sample ID: 180-106447-3 DU
Matrix: Solid
Analysis Batch: 318776
Client Sample ID: HOMOGENATE MIX-1 T03
Prep Type: Leach

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Oxidation Reduction Potential	220			225		millivolts				2	20

Lab Sample ID: 180-106447-2 DU
Matrix: Solid
Analysis Batch: 318788
Client Sample ID: HOMOGENATE MIX-1 T02
Prep Type: Leach

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Oxidation Reduction Potential	210			210		millivolts				1	20

Lab Sample ID: 180-106447-4 DU
Matrix: Solid
Analysis Batch: 318919
Client Sample ID: HOMOGENATE MIX-1 T04
Prep Type: Leach

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Oxidation Reduction Potential	440			446		millivolts				0.9	20

Lab Sample ID: 180-106447-5 DU
Matrix: Solid
Analysis Batch: 318924
Client Sample ID: HOMOGENATE MIX-1 T05
Prep Type: Leach

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Oxidation Reduction Potential	280			285		millivolts				1	20

Lab Sample ID: 180-106447-6 DU
Matrix: Solid
Analysis Batch: 319092
Client Sample ID: HOMOGENATE MIX-1 T06
Prep Type: Leach

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Oxidation Reduction Potential	240			238		millivolts				1	20

Lab Sample ID: 180-106447-8 DU
Matrix: Solid
Analysis Batch: 319901
Client Sample ID: HOMOGENATE MIX-1 T08
Prep Type: Leach

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Oxidation Reduction Potential	360			365		millivolts				1	20

Lab Sample ID: 180-106447-9 DU
Matrix: Solid
Analysis Batch: 319904
Client Sample ID: HOMOGENATE MIX-1 T09
Prep Type: Leach

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Oxidation Reduction Potential	310			303		millivolts				1	20

QC Association Summary

General Chemistry

Analysis Batch: 317304

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-1	HOMOGENATE MIX-1 T01	Total/NA	Solid	2540G	
180-106447-10	HOMOGENATE MIX-2 T01	Total/NA	Solid	2540G	
180-106447-19	HOMOGENATE MIX-3 T01	Total/NA	Solid	2540G	

Leach Batch: 318609

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-1	HOMOGENATE MIX-1 T01	Leach	Solid	1314	
180-106447-10	HOMOGENATE MIX-2 T01	Leach	Solid	1314	
180-106447-19	HOMOGENATE MIX-3 T01	Leach	Solid	1314	
180-106447-28	MB	Leach	Solid	1314	
180-106447-1 DU	HOMOGENATE MIX-1 T01	Leach	Solid	1314	

Leach Batch: 318639

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-2	HOMOGENATE MIX-1 T02	Leach	Solid	1314	
180-106447-11	HOMOGENATE MIX-2 T02	Leach	Solid	1314	
180-106447-20	HOMOGENATE MIX-3 T02	Leach	Solid	1314	
180-106447-2 DU	HOMOGENATE MIX-1 T02	Leach	Solid	1314	

Leach Batch: 318641

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-3	HOMOGENATE MIX-1 T03	Leach	Solid	1314	
180-106447-12	HOMOGENATE MIX-2 T03	Leach	Solid	1314	
180-106447-21	HOMOGENATE MIX-3 T03	Leach	Solid	1314	
180-106447-3 DU	HOMOGENATE MIX-1 T03	Leach	Solid	1314	

Leach Batch: 318648

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-4	HOMOGENATE MIX-1 T04	Leach	Solid	1314	
180-106447-13	HOMOGENATE MIX-2 T04	Leach	Solid	1314	
180-106447-22	HOMOGENATE MIX-3 T04	Leach	Solid	1314	
180-106447-4 DU	HOMOGENATE MIX-1 T04	Leach	Solid	1314	

Leach Batch: 318650

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-5	HOMOGENATE MIX-1 T05	Leach	Solid	1314	
180-106447-14	HOMOGENATE MIX-2 T05	Leach	Solid	1314	
180-106447-23	HOMOGENATE MIX-3 T05	Leach	Solid	1314	
180-106447-5 DU	HOMOGENATE MIX-1 T05	Leach	Solid	1314	

Leach Batch: 318651

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-6	HOMOGENATE MIX-1 T06	Leach	Solid	1314	
180-106447-15	HOMOGENATE MIX-2 T06	Leach	Solid	1314	
180-106447-24	HOMOGENATE MIX-3 T06	Leach	Solid	1314	
180-106447-6 DU	HOMOGENATE MIX-1 T06	Leach	Solid	1314	

Leach Batch: 318652

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-7	HOMOGENATE MIX-1 T07	Leach	Solid	1314	
180-106447-16	HOMOGENATE MIX-2 T07	Leach	Solid	1314	

General Chemistry (Continued)

Leach Batch: 318652 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-25	HOMOGENATE MIX-3 T07	Leach	Solid	1314	

Leach Batch: 318658

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-8	HOMOGENATE MIX-1 T08	Leach	Solid	1314	
180-106447-17	HOMOGENATE MIX-2 T08	Leach	Solid	1314	
180-106447-26	HOMOGENATE MIX-3 T08	Leach	Solid	1314	
180-106447-8 DU	HOMOGENATE MIX-1 T08	Leach	Solid	1314	

Leach Batch: 318660

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-9	HOMOGENATE MIX-1 T09	Leach	Solid	1314	
180-106447-18	HOMOGENATE MIX-2 T09	Leach	Solid	1314	
180-106447-27	HOMOGENATE MIX-3 T09	Leach	Solid	1314	
180-106447-9 DU	HOMOGENATE MIX-1 T09	Leach	Solid	1314	

Analysis Batch: 318691

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-1	HOMOGENATE MIX-1 T01	Leach	Solid	EPA 9040C	318609
180-106447-10	HOMOGENATE MIX-2 T01	Leach	Solid	EPA 9040C	318609
180-106447-19	HOMOGENATE MIX-3 T01	Leach	Solid	EPA 9040C	318609
180-106447-28	MB	Leach	Solid	EPA 9040C	318609
LCS 180-318691/1	Lab Control Sample	Total/NA	Solid	EPA 9040C	
180-106447-1 DU	HOMOGENATE MIX-1 T01	Leach	Solid	EPA 9040C	318609

Analysis Batch: 318694

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-1	HOMOGENATE MIX-1 T01	Leach	Solid	SM 2580B	318609
180-106447-10	HOMOGENATE MIX-2 T01	Leach	Solid	SM 2580B	318609
180-106447-19	HOMOGENATE MIX-3 T01	Leach	Solid	SM 2580B	318609
180-106447-28	MB	Leach	Solid	SM 2580B	318609
LCS 180-318694/1	Lab Control Sample	Total/NA	Solid	SM 2580B	
180-106447-1 DU	HOMOGENATE MIX-1 T01	Leach	Solid	SM 2580B	318609

Analysis Batch: 318695

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-1	HOMOGENATE MIX-1 T01	Leach	Solid	SM 2510B	318609
180-106447-10	HOMOGENATE MIX-2 T01	Leach	Solid	SM 2510B	318609
180-106447-19	HOMOGENATE MIX-3 T01	Leach	Solid	SM 2510B	318609
180-106447-28	MB	Leach	Solid	SM 2510B	318609
MB 180-318695/2	Method Blank	Total/NA	Solid	SM 2510B	
LCS 180-318695/1	Lab Control Sample	Total/NA	Solid	SM 2510B	
180-106447-1 DU	HOMOGENATE MIX-1 T01	Leach	Solid	SM 2510B	318609

Analysis Batch: 318774

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-3	HOMOGENATE MIX-1 T03	Leach	Solid	EPA 9040C	318641
180-106447-12	HOMOGENATE MIX-2 T03	Leach	Solid	EPA 9040C	318641
180-106447-21	HOMOGENATE MIX-3 T03	Leach	Solid	EPA 9040C	318641
LCS 180-318774/1	Lab Control Sample	Total/NA	Solid	EPA 9040C	
180-106447-3 DU	HOMOGENATE MIX-1 T03	Leach	Solid	EPA 9040C	318641

QC Association Summary

General Chemistry

Analysis Batch: 318776

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-3	HOMOGENATE MIX-1 T03	Leach	Solid	SM 2580B	318641
180-106447-12	HOMOGENATE MIX-2 T03	Leach	Solid	SM 2580B	318641
180-106447-21	HOMOGENATE MIX-3 T03	Leach	Solid	SM 2580B	318641
LCS 180-318776/1	Lab Control Sample	Total/NA	Solid	SM 2580B	
180-106447-3 DU	HOMOGENATE MIX-1 T03	Leach	Solid	SM 2580B	318641

Analysis Batch: 318777

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-3	HOMOGENATE MIX-1 T03	Leach	Solid	SM 2510B	318641
180-106447-12	HOMOGENATE MIX-2 T03	Leach	Solid	SM 2510B	318641
180-106447-21	HOMOGENATE MIX-3 T03	Leach	Solid	SM 2510B	318641
MB 180-318777/2	Method Blank	Total/NA	Solid	SM 2510B	
LCS 180-318777/1	Lab Control Sample	Total/NA	Solid	SM 2510B	
180-106447-3 DU	HOMOGENATE MIX-1 T03	Leach	Solid	SM 2510B	318641

Analysis Batch: 318785

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-2	HOMOGENATE MIX-1 T02	Leach	Solid	EPA 9040C	318639
180-106447-11	HOMOGENATE MIX-2 T02	Leach	Solid	EPA 9040C	318639
180-106447-20	HOMOGENATE MIX-3 T02	Leach	Solid	EPA 9040C	318639
LCS 180-318785/1	Lab Control Sample	Total/NA	Solid	EPA 9040C	
180-106447-2 DU	HOMOGENATE MIX-1 T02	Leach	Solid	EPA 9040C	318639

Analysis Batch: 318788

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-2	HOMOGENATE MIX-1 T02	Leach	Solid	SM 2580B	318639
180-106447-11	HOMOGENATE MIX-2 T02	Leach	Solid	SM 2580B	318639
180-106447-20	HOMOGENATE MIX-3 T02	Leach	Solid	SM 2580B	318639
LCS 180-318788/1	Lab Control Sample	Total/NA	Solid	SM 2580B	
180-106447-2 DU	HOMOGENATE MIX-1 T02	Leach	Solid	SM 2580B	318639

Analysis Batch: 318789

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-2	HOMOGENATE MIX-1 T02	Leach	Solid	SM 2510B	318639
180-106447-11	HOMOGENATE MIX-2 T02	Leach	Solid	SM 2510B	318639
180-106447-20	HOMOGENATE MIX-3 T02	Leach	Solid	SM 2510B	318639
MB 180-318789/2	Method Blank	Total/NA	Solid	SM 2510B	
LCS 180-318789/1	Lab Control Sample	Total/NA	Solid	SM 2510B	
180-106447-2 DU	HOMOGENATE MIX-1 T02	Leach	Solid	SM 2510B	318639

Analysis Batch: 318917

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-4	HOMOGENATE MIX-1 T04	Leach	Solid	EPA 9040C	318648
180-106447-13	HOMOGENATE MIX-2 T04	Leach	Solid	EPA 9040C	318648
180-106447-22	HOMOGENATE MIX-3 T04	Leach	Solid	EPA 9040C	318648
LCS 180-318917/1	Lab Control Sample	Total/NA	Solid	EPA 9040C	
180-106447-4 DU	HOMOGENATE MIX-1 T04	Leach	Solid	EPA 9040C	318648

Analysis Batch: 318919

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-4	HOMOGENATE MIX-1 T04	Leach	Solid	SM 2580B	318648

General Chemistry (Continued)

Analysis Batch: 318919 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-13	HOMOGENATE MIX-2 T04	Leach	Solid	SM 2580B	318648
180-106447-22	HOMOGENATE MIX-3 T04	Leach	Solid	SM 2580B	318648
LCS 180-318919/1	Lab Control Sample	Total/NA	Solid	SM 2580B	
180-106447-4 DU	HOMOGENATE MIX-1 T04	Leach	Solid	SM 2580B	318648

Analysis Batch: 318921

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-4	HOMOGENATE MIX-1 T04	Leach	Solid	SM 2510B	318648
180-106447-13	HOMOGENATE MIX-2 T04	Leach	Solid	SM 2510B	318648
180-106447-22	HOMOGENATE MIX-3 T04	Leach	Solid	SM 2510B	318648
MB 180-318921/2	Method Blank	Total/NA	Solid	SM 2510B	
LCS 180-318921/1	Lab Control Sample	Total/NA	Solid	SM 2510B	
180-106447-4 DU	HOMOGENATE MIX-1 T04	Leach	Solid	SM 2510B	318648

Analysis Batch: 318923

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-5	HOMOGENATE MIX-1 T05	Leach	Solid	EPA 9040C	318650
180-106447-14	HOMOGENATE MIX-2 T05	Leach	Solid	EPA 9040C	318650
180-106447-23	HOMOGENATE MIX-3 T05	Leach	Solid	EPA 9040C	318650
LCS 180-318923/1	Lab Control Sample	Total/NA	Solid	EPA 9040C	
180-106447-5 DU	HOMOGENATE MIX-1 T05	Leach	Solid	EPA 9040C	318650

Analysis Batch: 318924

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-5	HOMOGENATE MIX-1 T05	Leach	Solid	SM 2580B	318650
180-106447-14	HOMOGENATE MIX-2 T05	Leach	Solid	SM 2580B	318650
180-106447-23	HOMOGENATE MIX-3 T05	Leach	Solid	SM 2580B	318650
LCS 180-318924/1	Lab Control Sample	Total/NA	Solid	SM 2580B	
180-106447-5 DU	HOMOGENATE MIX-1 T05	Leach	Solid	SM 2580B	318650

Analysis Batch: 318926

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-5	HOMOGENATE MIX-1 T05	Leach	Solid	SM 2510B	318650
180-106447-14	HOMOGENATE MIX-2 T05	Leach	Solid	SM 2510B	318650
180-106447-23	HOMOGENATE MIX-3 T05	Leach	Solid	SM 2510B	318650
MB 180-318926/2	Method Blank	Total/NA	Solid	SM 2510B	
LCS 180-318926/1	Lab Control Sample	Total/NA	Solid	SM 2510B	
180-106447-5 DU	HOMOGENATE MIX-1 T05	Leach	Solid	SM 2510B	318650

Analysis Batch: 319091

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-6	HOMOGENATE MIX-1 T06	Leach	Solid	EPA 9040C	318651
180-106447-7	HOMOGENATE MIX-1 T07	Leach	Solid	EPA 9040C	318652
180-106447-15	HOMOGENATE MIX-2 T06	Leach	Solid	EPA 9040C	318651
180-106447-16	HOMOGENATE MIX-2 T07	Leach	Solid	EPA 9040C	318652
180-106447-24	HOMOGENATE MIX-3 T06	Leach	Solid	EPA 9040C	318651
180-106447-25	HOMOGENATE MIX-3 T07	Leach	Solid	EPA 9040C	318652
LCS 180-319091/1	Lab Control Sample	Total/NA	Solid	EPA 9040C	
180-106447-6 DU	HOMOGENATE MIX-1 T06	Leach	Solid	EPA 9040C	318651

QC Association Summary

Client: ARCADIS U.S., Inc.
Project/Site: Canadian Soil for LEAF 1314

Job ID: 180-106447-1

General Chemistry

Analysis Batch: 319092

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-6	HOMOGENATE MIX-1 T06	Leach	Solid	SM 2580B	318651
180-106447-7	HOMOGENATE MIX-1 T07	Leach	Solid	SM 2580B	318652
180-106447-15	HOMOGENATE MIX-2 T06	Leach	Solid	SM 2580B	318651
180-106447-16	HOMOGENATE MIX-2 T07	Leach	Solid	SM 2580B	318652
180-106447-24	HOMOGENATE MIX-3 T06	Leach	Solid	SM 2580B	318651
180-106447-25	HOMOGENATE MIX-3 T07	Leach	Solid	SM 2580B	318652
LCS 180-319092/1	Lab Control Sample	Total/NA	Solid	SM 2580B	
180-106447-6 DU	HOMOGENATE MIX-1 T06	Leach	Solid	SM 2580B	318651

Analysis Batch: 319093

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-6	HOMOGENATE MIX-1 T06	Leach	Solid	SM 2510B	318651
180-106447-7	HOMOGENATE MIX-1 T07	Leach	Solid	SM 2510B	318652
180-106447-15	HOMOGENATE MIX-2 T06	Leach	Solid	SM 2510B	318651
180-106447-16	HOMOGENATE MIX-2 T07	Leach	Solid	SM 2510B	318652
180-106447-24	HOMOGENATE MIX-3 T06	Leach	Solid	SM 2510B	318651
180-106447-25	HOMOGENATE MIX-3 T07	Leach	Solid	SM 2510B	318652
MB 180-319093/2	Method Blank	Total/NA	Solid	SM 2510B	
LCS 180-319093/1	Lab Control Sample	Total/NA	Solid	SM 2510B	
180-106447-6 DU	HOMOGENATE MIX-1 T06	Leach	Solid	SM 2510B	318651

Analysis Batch: 319899

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-8	HOMOGENATE MIX-1 T08	Leach	Solid	EPA 9040C	318658
180-106447-17	HOMOGENATE MIX-2 T08	Leach	Solid	EPA 9040C	318658
180-106447-26	HOMOGENATE MIX-3 T08	Leach	Solid	EPA 9040C	318658
LCS 180-319899/1	Lab Control Sample	Total/NA	Solid	EPA 9040C	
180-106447-8 DU	HOMOGENATE MIX-1 T08	Leach	Solid	EPA 9040C	318658

Analysis Batch: 319901

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-8	HOMOGENATE MIX-1 T08	Leach	Solid	SM 2580B	318658
180-106447-17	HOMOGENATE MIX-2 T08	Leach	Solid	SM 2580B	318658
180-106447-26	HOMOGENATE MIX-3 T08	Leach	Solid	SM 2580B	318658
LCS 180-319901/1	Lab Control Sample	Total/NA	Solid	SM 2580B	
180-106447-8 DU	HOMOGENATE MIX-1 T08	Leach	Solid	SM 2580B	318658

Analysis Batch: 319902

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-8	HOMOGENATE MIX-1 T08	Leach	Solid	SM 2510B	318658
180-106447-17	HOMOGENATE MIX-2 T08	Leach	Solid	SM 2510B	318658
180-106447-26	HOMOGENATE MIX-3 T08	Leach	Solid	SM 2510B	318658
MB 180-319902/2	Method Blank	Total/NA	Solid	SM 2510B	
LCS 180-319902/1	Lab Control Sample	Total/NA	Solid	SM 2510B	
180-106447-8 DU	HOMOGENATE MIX-1 T08	Leach	Solid	SM 2510B	318658

Analysis Batch: 319903

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-9	HOMOGENATE MIX-1 T09	Leach	Solid	EPA 9040C	318660
180-106447-18	HOMOGENATE MIX-2 T09	Leach	Solid	EPA 9040C	318660
180-106447-27	HOMOGENATE MIX-3 T09	Leach	Solid	EPA 9040C	318660

General Chemistry (Continued)

Analysis Batch: 319903 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 180-319903/1	Lab Control Sample	Total/NA	Solid	EPA 9040C	
180-106447-9 DU	HOMOGENATE MIX-1 T09	Leach	Solid	EPA 9040C	318660

Analysis Batch: 319904

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-9	HOMOGENATE MIX-1 T09	Leach	Solid	SM 2580B	318660
180-106447-18	HOMOGENATE MIX-2 T09	Leach	Solid	SM 2580B	318660
180-106447-27	HOMOGENATE MIX-3 T09	Leach	Solid	SM 2580B	318660
LCS 180-319904/1	Lab Control Sample	Total/NA	Solid	SM 2580B	
180-106447-9 DU	HOMOGENATE MIX-1 T09	Leach	Solid	SM 2580B	318660

Analysis Batch: 319905

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-106447-9	HOMOGENATE MIX-1 T09	Leach	Solid	SM 2510B	318660
180-106447-18	HOMOGENATE MIX-2 T09	Leach	Solid	SM 2510B	318660
180-106447-27	HOMOGENATE MIX-3 T09	Leach	Solid	SM 2510B	318660
MB 180-319905/2	Method Blank	Total/NA	Solid	SM 2510B	
LCS 180-319905/1	Lab Control Sample	Total/NA	Solid	SM 2510B	
180-106447-9 DU	HOMOGENATE MIX-1 T09	Leach	Solid	SM 2510B	318660

ARCADIS
Infrastructure, environment, buildings

ID#:

CHAIN OF CUSTODY & LABORATORY ANALYSIS REQUEST FORM

Page 1 of 1

Lab Work Order #

Send Results to:

Contact & Company Name: Dave Liles ARCADIS
Telephone: 919 328 5574
Address: 4915 Prospectus Drive
Fax: STE G
City: Durham State: NC Zip: 27713
E-mail Address: david.liles@arcadis.com
Project Name/Location (City, State): Comox
Project #: 30034878
Sampler's Printed Name: Robert Prigge
Sampler's Signature:

Preservative	Nar
Filtered (✓)	NO
# of Containers	1
Container Information	Plastic bucket

PARAMETER ANALYSIS & METHOD

Keys

Preservation Key:
A. H_2SO_4
B. HCL
C. HNO_3
D. NaOH
E. None
F. Other: ________
G. Other: ________
H. Other: ________

Container Information Key:
1. 40 ml Vial
2. 1 L Amber
3. 250 ml Plastic
4. 500 ml Plastic
5. Encore
6. 2 oz. Glass
7. 4 oz. Glass
8. 8 oz. Glass
9. Other: ________
10. Other: ________

Matrix Key:
SO - Soil
W - Water
T - Tissue
SE - Sediment
SL - Sludge
A - Air
NL - NAPL/Oil
SW - Sample Wipe
Other: ________

Sample ID	Collection Date	Collection Time	Type (✓) Comp	Type (✓) Grab	Matrix	LEAF 1314 *							REMARKS
Homogenate Mix-1	5/29/20	1500	✓		So	1							
Homogenate Mix-2	↓	1515	✓		So	1							
Homogenate Mix 3	↓	1530	✓		So	1							

180-106447 Chain of Custody

Special Instructions/Comments: * PFAS Samples at T01, T02-T04, T05, T06-T08, T09 *

☐ Special QA/QC Instructions(✓):

Laboratory Information and Receipt

Lab Name: TA Pittsburg
☐ Cooler packed with ice (✓) NO
Specify Turnaround Requirements: – –
Shipping Tracking #:
Cooler Custody Seal (✓)
☐ Intact ☐ Not Intact
Sample Receipt: NO Ice
Condition/Cooler Temp: 17.6

	Relinquished By	Received By	Relinquished By	Laboratory Received By
Printed Name:	Robert Prigge	Jacob Wiedemer		
Signature:				
Firm/Courier:	ARCADIS	Fed Ex	ETA/TAL	
Date/Time:	05/29/20 1700	05/29/20 1700	6/1/20 1200	

20730826 CofC AR Form 01.12.2007

Distribution: WHITE – Laboratory returns with results YELLOW – Lab copy PINK – Retained by ARCADIS

180-106447 Chain of Custody

ATTN:

Larry Matko

Watson
ETAPH
6-20-20
9:00

NO
COC

ORIGIN ID:RDUA (919) 328-5602
DAVE LILES
ARCADIS
4915 PROSPECTUS DRIVE
STE G
DURHAM, NC 27713
UNITED STATES US

SHIP DATE: 29MAY20
ACTWGT: 16.00 LB
CAD: 5688756/INET4220

BILL SENDER

TO **SAMPLE RECEIVING**
EUROFINS TESTAMERICA
301 ALPHA DRIVE

PITTSBURGH PA 15238
(412) 963-7058 REF: 30039878.00001
INV:
PO: DEPT:

56BJ3/2925/FE4A

FedEx Express

E

J201120042401uv

MON - 01 JUN 3:00P
STANDARD OVERNIGHT

1 of 2
TRK# 0201 **7705 8341 6348**
MASTER

XH AGCA

PA-US **15238**
PIT

Uncorrected temp 18.6 °C
Thermometer ID 17

CF 0 Initials JW

PT-WI-SR-001 effective 7/26/13

After printing this label:
1. Use the 'Print' button on this page to print your label to your laser or inkjet printer.
2. Fold the printed page along the horizontal line.
3. Place label in shipping pouch and affix it to your shipment so that the barcode portion of the label can be read and scanned.

Warning: Use only the printed original label for shipping. Using a photocopy of this label for shipping purposes is fraudulent and could result in additional billing charges, along with the cancellation of your FedEx account number.
Use of this system constitutes your agreement to the service conditions in the current FedEx Service Guide, available on fedex.com.FedEx will not be responsible for any claim in excess of $100 per package, whether the result of loss, damage, delay, non-delivery,misdelivery,or misinformation, unless you declare a higher value, pay an additional charge, document your actual loss and file a timely claim.Limitations found in the current FedEx Service Guide apply. Your right to recover from FedEx for any loss, including intrinsic value of the package, loss of sales, income interest, profit, attorney's fees, costs, and other forms of damage whether direct, incidental,consequential, or special is limited to the greater of $100 or the authorized declared value. Recovery cannot exceed actual documented loss.Maximum for items of extraordinary value is $1,000, e.g. jewelry, precious metals, negotiable instruments and other items listed in our ServiceGuide. Written claims must be filed within strict time limits, see current FedEx Service Guir

180-106447 Waybill

ORIGIN ID:RDUA (919) 328-5602
DAVE LILES
ARCADIS
4915 PROSPECTUS DRIVE
STE G
DURHAM, NC 27713
UNITED STATES US

SHIP DATE: 29MAY20
ACTWGT: 32.00 LB
CAD: 5688756/INET4220

BILL SENDER

TO **SAMPLE RECEIVING**
EUROFINS TESTAMERICA
301 ALPHA DRIVE

PITTSBURGH PA 15238
(412) 963-7058 REF: 30039878.00001
INV:
PO: DEPT:

56BJ3/2925/FE4A

FedEx Express

E

J201120042401uv

MON - 01 JUN 3:00P
STANDARD OVERNIGHT

2 of 2
MPS# 0263 **7705 8341 7024**
Mstr# 7705 8341 6348
0201

15238
PA-US PIT

XH AGCA

Uncorrected temp 14.6 °C
Thermometer ID 17
CF 0 Initials JW
PT-WI-SR-001 effective 7/26/13

After printing this label:
1. Use the 'Print' button on this page to print your label to your laser or inkjet printer.
2. Fold the printed page along the horizontal line.
3. Place label in shipping pouch and affix it to your shipment so that the barcode portion of the label can be read and scanned.

Warning: Use only the printed original label for shipping. Using a photocopy of this label for shipping purposes is fraudulent and could result in additional billing charges, along with the cancellation of your FedEx account number.
Use of this system constitutes your agreement to the service conditions in the current FedEx Service Guide, available on fedex.com.FedEx will not be responsible for any claim in excess of $100 per package, whether the result of loss, damage, delay, non-delivery,misdelivery,or misinformation, unless you declare a higher value, pay an additional charge, document your actual loss and file a timely claim.Limitations found in the current FedEx Service Guide apply. Your right to recover from FedEx for any loss, including intrinsic value of the package, loss of sales, income interest, profit, attorney's fees, costs, and other forms of damage whether direct, incidental,consequential, or special is limited to the greater of $100 or the authorized declared value. Recovery cannot exceed actual documented loss.Maximum for items of extraordinary value is $1,000, e.g. jewelry, precious metals, negotiable instruments and other items listed in our ServiceGuide. Written claims must be filed within strict time limits, see current FedEx Service Guide.

1 2 3 4 5 6 7 8 9 10 11 12 13

Login Sample Receipt Checklist

Client: ARCADIS U.S., Inc. | Job Number: 180-106447-1

Login Number: 106447
List Number: 1
Creator: Say, Thomas C

List Source: Eurofins TestAmerica, Pittsburgh

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	Thermal preservation not required.
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

APPENDIX E:
MANUFACTURER SAFETY DATA SHEETS

Section 1 - Identification of the Material and Supplier

Ziltek Pty Ltd **Phone: 08 8152 9390 (office hours)**
40-46 West Thebarton Rd
Thebarton SA 5031

Chemical nature:	Blend of activated carbon and clays.
Trade Name:	**RemBind Plus™**
Product Use:	Fixates, (or binds up) chemical contaminants in soil, sludges and waste.
Creation Date:	**April, 2014**
This version issued:	**July, 2015** and is valid for 5 years from this date.

Section 2 - Hazards Identification

Statement of Hazardous Nature

This product is classified as: Not classified as hazardous according to the criteria of SWA.

Not a Dangerous Good according to the Australian Dangerous Goods (ADG) Code.

Risk Phrases: Not Hazardous - No criteria found.
Safety Phrases: S22, S36, S24/25. Do not breathe dust. Wear suitable protective clothing. Avoid contact with skin and eyes.
SUSMP Classification: None allocated.
ADG Classification: None allocated. Not a Dangerous Good under the ADG Code.
UN Number: None allocated

GHS Signal word: NONE. Not hazardous.

PREVENTION
- P232: Protect from moisture.
- P262: Do not get in eyes, on skin, or on clothing.
- P271: Use only outdoors or in a well ventilated area.
- P281: Use personal protective equipment as required.

RESPONSE
- P337: If eye irritation persists: seek medical attention.
- P353: Rinse skin or shower with water.
- P301+P330+P331: IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
- P370+P378: In case of fire, use carbon dioxide, dry chemical, foam, water fog.

STORAGE
- P402+P404: Store in a dry place. Store in a closed container.

DISPOSAL
- P501: If product can not be recycled, consider controlled incineration, or contact a specialist waste disposal company (see Section 13 of this SDS).

Emergency Overview

Physical Description & Colour: Black powdered solid. The particle size and colour of the product may vary between batches due to differences in moisture content and other factors. Product may become clumpy if stored over time.
Odour: No odour.
Major Health Hazards: no significant risk factors have been found for this product.

Wet activated carbon depletes oxygen from air and, therefore, dangerously low levels of oxygen may be encountered. Whenever workers enter a vessel or confined space that contains or recently contained activated carbon in significant quantities, the oxygen content should be determined and work procedures for potentially low oxygen areas be followed.

Potential Health Effects

Inhalation:

Short Term Exposure: Available data indicates that this product is not harmful. However product may be mildly irritating, although unlikely to cause anything more than mild transient discomfort.
Long Term Exposure: No data for health effects associated with long term inhalation.

Skin Contact:

Short Term Exposure: Available data indicates that this product is not harmful. It should present no hazards in normal use. However product may be mildly irritating, but is unlikely to cause anything more than mild discomfort which should disappear once contact ceases.
Long Term Exposure: No data for health effects associated with long term skin exposure.

Eye Contact:

Short Term Exposure: This product is likely to be mechanically irritating. If exposure is minor or brief, no long term effects should result. However, if material is not removed promptly, scratches to surface of the eye may result with long term consequences.
Long Term Exposure: No data for health effects associated with long term eye exposure.

Ingestion:

Short Term Exposure: Significant oral exposure is considered to be unlikely. However, this product may be mildly irritating to mucous membranes but is unlikely to cause anything more than mild transient discomfort.
Long Term Exposure: No data for health effects associated with long term ingestion.

Carcinogen Status:

SWA: No significant ingredient is classified as carcinogenic by SWA.
NTP: No significant ingredient is classified as carcinogenic by NTP.
IARC: No significant ingredient is classified as carcinogenic by IARC.

Section 3 - Composition/Information on Ingredients

Ingredients	CAS No	Conc,%	TWA (mg/m^3)	STEL (mg/m^3)
Kaolin *	1332-58-7	1-30	10	not set
Aluminium hydroxide, amorphous	21645-51-2	1-20	not set	not set
Other non-hazardous ingredients	secret	<10	not set	not set
Carbon, activated **	7440-44-0	to 100	not set	not set

* Kaolin is a clay. It is a complex of silica and alumina (aluminium oxide) in a variable ratio. May also contain each ingredient in uncombined form.

** Note that activated carbon may contain up to 6% crystalline silica which, if extremely finely divided, may cause silicosis if inhaled over a lengthy period of time.

This is a commercial product whose exact ratio of components may vary. The product may also contain trace amounts of heavy metals. Minor quantities of other non-hazardous ingredients may also be present.

The SWA TWA exposure value is the average airborne concentration of a particular substance when calculated over a normal 8 hour working day for a 5 day working week. The STEL (Short Term Exposure Limit) is an exposure value that may be equalled (but should not be exceeded) for no longer than 15 minutes and should not be repeated more than 4 times per day. There should be at least 60 minutes between successive exposures at the STEL. The term "peak "is used when the TWA limit, because of the rapid action of the substance, should never be exceeded, even briefly.

Section 4 - First Aid Measures

General Information:

You should call The Poisons Information Centre if you feel that you may have been poisoned, burned or irritated by this product. The number is 13 1126 from anywhere in Australia (0800 764 766 in New Zealand) and is available at all times. Have this SDS with you when you call.

Inhalation: First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor.
Skin Contact: Gently brush away excess solids. Irritation is unlikely. However, if irritation does occur, flush with lukewarm, gently flowing water for 5 minutes or until chemical is removed.
Eye Contact: Quickly and gently brush particles from eyes. Immediately flush the contaminated eye(s) with lukewarm, gently flowing water until the particles are removed, while holding the eyelid(s) open. Obtain medical attention if irritation persists, or if particles are lodged in surface of the eye(s). Take special care if exposed person is wearing contact lenses.
Ingestion: If product is swallowed or gets in mouth, do NOT induce vomiting; wash mouth with water and give some water to drink. If symptoms develop, or if in doubt contact a Poisons Information Centre or a doctor.

Section 5 - Fire Fighting Measures

Fire and Explosion Hazards: There is no risk of an explosion from this product under normal circumstances if it is involved in a fire. This product, if scattered, may form flammable or explosive dust clouds in air.
Fire decomposition products from this product are likely to be harmful if inhaled. Take suitable protective measures.
Due to the thermal insulation properties of carbon, fires may continue undetected for extended periods of time.
Product may intensely burn beneath the surface, giving little evidence of combustion.

Extinguishing Media: Suitable extinguishing media are carbon dioxide, dry chemical, foam, water fog. Avoid the use of water jets.

Fire Fighting: If a significant quantity of this product is involved in a fire, call the fire brigade. Do not scatter spilled material with high pressure water jets.

Flash point:	Combustible solid.
Upper Flammability Limit:	No data.
Lower Flammability Limit:	No data.
Autoignition temperature:	No data.
Flammability Class:	Combustible solid.

Section 6 - Accidental Release Measures

Accidental release: Minor spills do not normally need any special cleanup measures. In the event of a major spill, prevent spillage from entering drains or water courses. No special protective clothing is normally necessary because of this product. However it is good practice to wear overalls, goggles and gloves when handling chemicals. Suitable materials for protective clothing include cotton, rubber, PVC. Eye/face protective equipment should comprise as a minimum, protective goggles. If there is a significant chance that dusts are likely to build up in cleanup area, we recommend that you use a suitable Dust Mask. Use a P1 mask, designed for use against mechanically generated particles eg silica & asbestos.

Stop leak if safe to do so, and contain spill. Sweep up and shovel or collect recoverable product into labelled containers for recycling or salvage, and dispose of promptly. Consider vacuuming if appropriate. Recycle containers wherever possible after careful cleaning. After spills, wash area preventing runoff from entering drains. If a significant quantity of material enters drains, advise emergency services. This material may be suitable for approved landfill. Ensure legality of disposal by consulting regulations prior to disposal. Thoroughly launder protective clothing before storage or re-use. Advise laundry of nature of contamination when sending contaminated clothing to laundry.

Section 7 - Handling and Storage

Handling: Keep exposure to this product to a minimum, and minimise the quantities kept in work areas. Check Section 8 of this SDS for details of personal protective measures, and make sure that those measures are followed. The measures detailed below under "Storage" should be followed during handling in order to minimise risks to persons using the product in the workplace. Also, avoid contact or contamination of product with incompatible materials listed in Section 10.

Storage: Make sure that containers of this product are kept tightly closed. Keep containers dry and away from water. Keep away from sources of ignition such as sparks and open flames. Make sure that the product does not come into contact with substances listed under "Incompatibilities" in Section 10. **Wet activated carbon depletes oxygen from air and, therefore, dangerously low levels of oxygen may be encountered. Whenever workers enter a vessel or confined space that contains or recently contained activated carbon in significant quantities, the oxygen content should be determined and work procedures for potentially low oxygen areas be followed.** Appropriate protective equipment should be worn. Check packaging - there may be further storage instructions on the label.

Section 8 - Exposure Controls and Personal Protection

The following Australian Standards will provide general advice regarding safety clothing and equipment:

Respiratory equipment: **AS/NZS 1715**, Protective Gloves: **AS 2161**, Occupational Protective Clothing: AS/NZS 4501 set 2008, Industrial Eye Protection: **AS1336** and **AS/NZS 1337**, Occupational Protective Footwear: **AS/NZS2210**.

SWA Exposure Limits	**TWA (mg/m^3)**	**STEL (mg/m^3)**
Kaolin	10	not set

No special equipment is usually needed when occasionally handling small quantities. The following instructions are for bulk handling or where regular exposure in an occupational setting occurs without proper containment systems.

Ventilation: This product should only be used in a well ventilated area. If natural ventilation is inadequate, use of a fan is suggested.

Eye Protection: Eye protection is not normally necessary when this product is being used. However, if in doubt, wear suitable protective glasses or goggles.

Skin Protection: The information at hand indicates that this product is not harmful and that normally no special skin protection is necessary. However, we suggest that you routinely avoid contact with all chemical products and that you wear suitable gloves (preferably elbow-length) when skin contact is likely.

Protective Material Types: We suggest that protective clothing be made from the following materials: cotton, rubber, PVC.

Respirator: If there is a significant chance that dusts are likely to build up in the area where this product is being used, we recommend that you use a suitable Dust Mask.

Safety deluge showers should, if practical, be provided near to where this product is being used.

Section 9 - Physical and Chemical Properties:

Physical Description & colour:	Black powdered solid. The particle size and colour of the product may vary between batches due to differences in moisture content and other factors. Product may become clumpy if stored over time.
Moisture Content:	Moisture content will vary depending on atmospheric and storage conditions.
Odour:	No odour.
Boiling Point:	Not applicable.
Freezing/Melting Point:	No specific data. Solid at normal temperatures.
Volatiles:	No specific data. Expected to be low at 100°C.
Vapour Pressure:	Negligible at normal ambient temperatures.
Vapour Density:	No data.
Specific Gravity:	No data.
Water Solubility:	Insoluble.
pH:	No data.
Volatility:	Negligible at normal ambient temperatures.
Odour Threshold:	No data.
Evaporation Rate:	No data.
Coeff Oil/water Distribution:	No data
Autoignition temp:	No data.

Section 10 - Stability and Reactivity

Reactivity: This product is unlikely to react or decompose under normal storage conditions. However, if you have any doubts, contact the supplier for advice on shelf life properties.

Conditions to Avoid: This product should be kept in a cool place, preferably below 30°C. Keep containers tightly closed. Containers should be kept dry. Keep containers and surrounding areas well ventilated.

Incompatibilities: water, strong oxidising agents.

Fire Decomposition: Combustion forms carbon dioxide, and if incomplete, carbon monoxide and smoke. Carbon monoxide poisoning produces headache, weakness, nausea, dizziness, confusion, dimness of vision, disturbance of judgment, and unconsciousness followed by coma and death.

NOTE that substances adsorbed during use, may be released during combustion.

Polymerisation: This product will not undergo polymerisation reactions.

Section 11 - Toxicological Information

Local Effects:	
Target Organs:	There is no data to hand indicating any particular target organs.

Classification of Hazardous Ingredients

Ingredient	Risk Phrases

No ingredient mentioned in the HSIS Database is present in this product at hazardous concentrations.

Section 12 - Ecological Information

This product is unlikely to adversely effect the environment. Biologically inert. May contain copper at concentrations of up to 0.4%. In jurisdictions where there are restrictions on soil copper levels, care should be taken to ensure that these limits are not exceeded due to application of this product to soil.

Section 13 - Disposal Considerations

Disposal: This product may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by some means. If neither of these options is suitable in-house, consider controlled incineration (if combustible), or contact a specialist waste disposal company.

Section 14 - Transport Information

ADG Code: This product is not classified as a Dangerous Good. No special transport conditions are necessary unless required by other regulations.

Section 15 - Regulatory Information

AICS: All of the significant ingredients in this formulation are compliant with NICNAS regulations.

Section 16 - Other Information

This SDS contains only safety-related information. For other data see product literature.

Acronyms:

ADG Code	Australian Code for the Transport of Dangerous Goods by Road and Rail (7th edition)
AICS	Australian Inventory of Chemical Substances
SWA	Safe Work Australia, formerly ASCC and NOHSC
CAS number	Chemical Abstracts Service Registry Number
IARC	International Agency for Research on Cancer
NTP	National Toxicology Program (USA)
R-Phrase	Risk Phrase
SUSMP	Standard for the Uniform Scheduling of Medicines & Poisons
UN Number	United Nations Number

THIS SDS SUMMARISES OUR BEST KNOWLEDGE OF THE HEALTH AND SAFETY HAZARD INFORMATION OF THE PRODUCT AND HOW TO SAFELY HANDLE AND USE THE PRODUCT IN THE WORKPLACE. EACH USER MUST REVIEW THIS SDS IN THE CONTEXT OF HOW THE PRODUCT WILL BE HANDLED AND USED IN THE WORKPLACE.

IF CLARIFICATION OR FURTHER INFORMATION IS NEEDED TO ENSURE THAT AN APPROPRIATE RISK ASSESSMENT CAN BE MADE, THE USER SHOULD CONTACT THIS COMPANY SO WE CAN ATTEMPT TO OBTAIN ADDITIONAL INFORMATION FROM OUR SUPPLIERS

OUR RESPONSIBILITY FOR PRODUCTS SOLD IS SUBJECT TO OUR STANDARD TERMS AND CONDITIONS, A COPY OF WHICH IS SENT TO OUR CUSTOMERS AND IS ALSO AVAILABLE ON REQUEST.

Please read all labels carefully before using product.

This SDS is prepared in accord with the SWA document “Preparation of Safety Data Sheets for Hazardous Chemicals - Code of Practice” (December 2011)

http://www.kilford.com.au/ Phone (02)9251 4532

SAFETY DATA SHEET

1. Identification

Product identifier	**FLUORO-SORB™ Sample B**
Other means of identification	
CAS number	68953-58-2
Recommended use	Not available.
Recommended restrictions	None known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company name	CETCO, an MTI Company	
Address	2870 Forbs Avenue Hoffman Estates, IL 60192 United States	
Telephone	General Information	800 527-9948
Website	www.cetco.com	
E-mail	safetydata@mineralstech.com	
Emergency phone number	.	
Americas	1.866.519.4752 (US, Canada, Mexico) 1 760 476 3962	

2. Hazard(s) identification

Physical hazards	Not classified.
Health hazards	Not classified.
Environmental hazards	Not classified.
OSHA defined hazards	Not classified.

Label elements

Hazard symbol	None.
Signal word	None.
Hazard statement	May cause respiratory irritation.
Precautionary statement	
Prevention	Read label before use. Use only outdoors or in a well-ventilated area. Wash thoroughly after handling. Keep out of reach of children.
Response	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell. If medical advice is needed, have product container or label at hand.
Storage	Store locked up. Store in a well-ventilated place. Keep container tightly closed.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	None.

3. Composition/information on ingredients

Substances

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200.

#: This substance has been assigned Community workplace exposure limit(s).
PBT: persistent, bioaccumulative and toxic substance.
vPvB: very persistent and very bioaccumulative substance.
No dangerous ingredients according to Directive 2001/58/EC

Composition comments	Not applicable to consumer products. Occupational Exposure Limits for constituents are listed in Section 8.

4. First-aid measures

Inhalation	Remove to fresh air. Move to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Call a POISON CENTER or doctor/physician if you feel unwell. Get medical attention, if needed.
Skin contact	No special measures required. Get medical attention if irritation develops or persists.
Eye contact	Flush eyes immediately with large amounts of water. Remove contact lenses, if present and easy to do. Continue rinsing. If irritation persists get medical attention. If eye irritation persists: Get medical advice/attention.
Ingestion	Rinse mouth thoroughly. If ingestion of a large amount does occur, seek medical attention. Do not induce vomiting without advice from poison control center. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. If ingestion of a large amount does occur, call a poison control center immediately. No special measures required.
Most important symptoms/effects, acute and delayed	Irritation of eyes and mucous membranes.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. If you feel unwell, seek medical advice (show the label where possible). Show this safety data sheet to the doctor in attendance.

5. Fire-fighting measures

Suitable extinguishing media	Dry chemical, CO2, water spray or regular foam. Use any media suitable for the surrounding fires.
Unsuitable extinguishing media	None known.
Specific hazards arising from the chemical	Not applicable.
Special protective equipment and precautions for firefighters	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.
Fire fighting equipment/instructions	In the event of fire, cool tanks with water spray.
Specific methods	Cool containers exposed to flames with water until well after the fire is out.
General fire hazards	Dust accumulation from this product may present an explosion hazard in the presence of an ignition source.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Local authorities should be advised if significant spillages cannot be contained. Keep people away from and upwind of spill/leak. Ensure adequate ventilation. Wear a dust mask if dust is generated above exposure limits.
Methods and materials for containment and cleaning up	Stop leak if you can do so without risk. Dike far ahead of spill for later disposal. Collect dust or particulates using a vacuum cleaner with a HEPA filter. Avoid the generation of dusts during clean-up. Following product recovery, flush area with water. Reduce airborne dust and prevent scattering by moistening with water.
Environmental precautions	Prevent further leakage or spillage if safe to do so. No special environmental precautions required.

7. Handling and storage

Precautions for safe handling	In case of insufficient ventilation, wear suitable respiratory equipment. Keep formation of airborne dusts to a minimum. Provide appropriate exhaust ventilation at places where dust is formed. Avoid contact with eyes. Wash hands thoroughly after handling. Handle and open container with care.
Conditions for safe storage, including any incompatibilities	No special restrictions on storage with other products. Keep in a well-ventilated place. Store in a dry area. Keep container tightly closed. Guard against dust accumulation of this material. Keep out of the reach of children. Use care in handling/storage.

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-3 (29 CFR 1910.1000)

Constituents	Type	Value	Form
INERT OR NUISANCE DUSTS	TWA	5 mg/m3	Respirable fraction.

US. OSHA Table Z-3 (29 CFR 1910.1000)

Constituents	Type	Value	Form
		15 mg/m3	Total dust.
		50 mppcf	Total dust.
		15 mppcf	Respirable fraction.

Biological limit values No biological exposure limits noted for the ingredient(s).

Exposure guidelines Occupational exposure to nuisance dust (total and respirable) and respirable crystalline silica should be monitored and controlled. No Exposure standards allocated.

Appropriate engineering controls If material is ground, cut, or used in any operation which may generate dusts, use appropriate local exhaust ventilation to keep exposures below the recommended exposure limits. If engineering measures are not sufficient to maintain concentrations of dust particulates below the OEL, suitable respiratory protection must be worn.

Individual protection measures, such as personal protective equipment

Eye/face protection Avoid contact with eyes. Wear eye/face protection. Wear dust goggles. Eye wash fountain is recommended.

Skin protection

Hand protection Not normally needed.

Other No special protective equipment required.

Respiratory protection Use a particulate filter respirator for particulate concentrations exceeding the Occupational Exposure Limit.

Thermal hazards Not available.

General hygiene considerations Avoid contact with eyes. Handle in accordance with good industrial hygiene and safety practice. Use good industrial hygiene practices in handling this material.

9. Physical and chemical properties

Appearance	Micropowder.
Physical state	Solid.
Form	Powder.
Color	White to Grey.
Odor	None.
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	Not available.
Initial boiling point and boiling range	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Not available.

Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.

Other information

Flammability	>= 950 °F (>= 510 °C) >= 950 °F (>= 510 °C)
VOC	CARB

10. Stability and reactivity

Reactivity	Not available.
Chemical stability	Stable at normal conditions.
Possibility of hazardous reactions	Will not occur.
Conditions to avoid	None known.
Incompatible materials	None known.
Hazardous decomposition products	Upon decomposition, this product may yield gaseous nitrogen oxides, carbon monoxide, carbon dioxide and/or low molecular weight hydrocarbons.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Knowledge about health hazard is incomplete.
Skin contact	Knowledge about health hazard is incomplete.
Eye contact	Causes serious eye irritation.
Ingestion	Knowledge about health hazard is incomplete.
Symptoms related to the physical, chemical and toxicological characteristics	Not available.

Information on toxicological effects

Acute toxicity	Not available.
Skin corrosion/irritation	Knowledge about health hazard is incomplete.
Serious eye damage/eye irritation	Causes serious eye irritation. Mild irritant to eyes (according to the modified Kay & Calandra criteria)

Respiratory or skin sensitization

Respiratory sensitization	Knowledge about sensitization hazard is incomplete.
Skin sensitization	None known. Knowledge about sensitization hazard is incomplete.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic. Knowledge about mutagenicity is incomplete.
Carcinogenicity	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA. Not classifiable as to carcinogenicity to humans. Knowledge about carcinogenicity is incomplete. Not classified.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1052)

Not regulated.

US. National Toxicology Program (NTP) Report on Carcinogens

Not listed.

Reproductive toxicity	Not classified. Knowledge about health hazard is incomplete.
Specific target organ toxicity - single exposure	Respiratory tract irritation.
Specific target organ toxicity - repeated exposure	Knowledge about health hazard is incomplete.
Aspiration hazard	Knowledge about health hazard is incomplete.

Chronic effects	Overexposure to dusts may result in pneumoconiosis, a lung disease due to permanent deposition of substantial amounts of particulate matter in the lungs.
Further information	This product has no known adverse effect on human health.

12. Ecological information

Ecotoxicity	This material is not expected to be harmful to aquatic life.
Persistence and degradability	No data is available on the degradability of this product.
Bioaccumulative potential	Not available.
Mobility in soil	Not available.
Other adverse effects	Not available.

13. Disposal considerations

Disposal instructions	Contract with a disposal operator licensed by the Law on Disposal and Cleaning. Collect and reclaim or dispose in sealed containers at licensed waste disposal site. This material and its container must be disposed of as hazardous waste. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. This product, in its present state, when discarded or disposed of, is not a hazardous waste according to Federal regulations (40 CFR 261.4 (b)(4)). Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste. Dispose of contents/container in accordance with local/regional/national/international regulations. Dispose in accordance with all applicable regulations. When your own wastewater treatment plant is not available, collect entire waste and then charge to a licensed industrial waste management professional with manifests for industrial waste.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions). Not applicable.
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not available.

15. Regulatory information

US federal regulations	OSHA Process Safety Standard: This material is not known to be hazardous by the OSHA Highly Hazardous Process Safety Standard, 29 CFR 1910.119. This product is not known to be a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. All components are on the U.S. EPA TSCA Inventory List. CERCLA/SARA Hazardous Substances - Not applicable.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1052)

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical	No (Exempt)

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA)	Not regulated.
US state regulations	California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
Taiwan	Taiwan Toxic Chemical Substances (TCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date	27-February-2018
Revision date	27-February-2018
Version #	05
Further information	This safety datasheet only contains information relating to safety and does not replace any product information or product specification. HMIS® is a registered trade and service mark of the NPCA.
HMIS® ratings	Health: 0 Flammability: 0 Physical hazard: 0
NFPA ratings	Health: 0 Flammability: 0 Instability: 0

References

ACGIH
EPA: AQUIRE database
NLM: Hazardous Substances Data Base
US. IARC Monographs on Occupational Exposures to Chemical Agents
Korea. Accidental Release Prevention Substances (Presidential Decree of Toxic Chemical Control Law, Executive Order No. 19203)
Korea. Dangerous Substances Threshold Quantity (Presidential Decree of Dangerous Substances Safety Management Act No. 18406, Schedule 1)
Korea. Harmful Substances Prohibited from Manufacturing (Presidential Decree on the Industrial Safety and Health Act (No. 13053), Article 29)
Korea. Harmful Substances Requiring Permission for Manufacture or Use (Presidential Decree on the Industrial Safety and Health Act (No. 13053), Article 30)
Korea. Non-Toxic Chemicals List (National Institute of Environment Research (NIER) Public Notice No. 1997-10, as amended)
Korea. Observational Chemicals (Ministerial Decree of TCCL Article 6)
Korea. OELs. Regulation for Permitted Concentration of Hazardous Substances (Ministry of Labor (MOL) Public Notice No. 1986-45, as amended)
Korea. Prohibited Chemical Substances (TCCL Article 11)
Korea. Regulated volatile organic compounds (VOCs) (MOE Notice No. 2001-36, March 8, 2001, as amended)
Korea. Restricted Chemical Substances (TCCL Article 11)
Korea. Toxic Chemical Control Law (TCCL), Existing Chemicals Inventory (KECI)
Korea. Toxic Chemical Control Law (TCCL), pre-1997 List
Korea. Toxic Chemicals (TCCL Article 10)
Korea. Toxic Release Inventory (TRI) Chemicals (TCCL Article 14)
Taiwan. Dangerous Materials (Rules on Hazard Communication of Dangerous Materials and Toxic Materials)
Taiwan. Industrial Precursor Chemicals (Categories and Regulations Governing Inspection and Declaration of Industrial Precursor Chemicals, MOEA Decree No. 87, as amended)
Taiwan. OELs. (Standards on Workplace Atmosphere of Dangerous and Hazardous Materials)
Taiwan. Toxic Chemical Substances (TCS) (List of Toxic Chemical Substances announced by the Environmental Protection Administration)
Taiwan. Toxic Materials (Rules on Hazard Communication of Dangerous Materials and Toxic Materials)
HSDB® - Hazardous Substances Data Bank
JIS Z 7250: 2005 Safety data sheet for chemical products-Part 1:Content and order of sections
JCIA GHS Guideline, October 2008
IARC Monographs. Overall Evaluation of Carcinogenicity
National Toxicology Program (NTP) Report on Carcinogens
ACGIH Documentation of the Threshold Limit Values and Biological Exposure Indices
Japan Society for Occupational Health, Recommendation of Occupational Exposure Limits
GOST 30333-2007 - Chemical production safety passport. General requirements

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The manufacturer expressly does not make any representations, warranties, or guarantees as to its accuracy, reliability or completeness nor assumes any liability, for its use. It is the user's responsibility to verify the suitability and completeness of such information for each particular use.

Third party materials: Insofar as materials not manufactured or supplied by this manufacturer are used in conjunction with, or instead of this product, it is the responsibility of the customer to obtain, from the manufacturer or supplier, all technical data and other properties relating to these and other materials and to obtain all necessary information relating to them. No liability can be accepted in respect of the use of this product in conjunction with materials from another supplier. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text. This safety data sheet was prepared in accordance with the Safety Data Sheet for Chemical Products (JIS Z 7250:2005). Additional information is given in the Material Safety Data Sheet. The information in the sheet was written based on the best knowledge and experience currently available.

Revision information

Product and Company Identification: Synonyms
Composition / Information on Ingredients: Ingredients

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FLUORO-SORB ADSORBENT PRODUCT OVERVIEW

CFB Comox FFTA Source Control Project

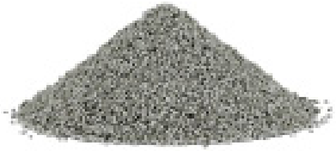
PSPC

CFB Comox, Lazo, BC

Requisition No.: R.111173.004

FLUORO-SORB® ADSORBENT

FLUORO-SORB® 100



FLUORO-SORB® 200

FLUORO-SORB® 300

FLUORO-SORB® 400

FLUORO-SORB® ADSORBENT

ADSORPTION MEDIA FOR THE REMEDIATION AND REMOVAL OF PFAS

FLUORO-SORB adsorbent is a proprietary, NSF-certified adsorption media that is proven to effectively treat multiple variants of PFAS. Unlike other sorbent products that are selective and unpredictable in adsorbing PFAS, FLUORO-SORB adsorbent binds the entire spectrum of PFAS and in a wide variety of removal and remediation processes.

With a specially modified surface, FLUORO-SORB adsorbent resists competitive adsorption from other water and sediment contaminants making it a more effective and efficient choice.

FLUORO-SORB adsorbent is commercially available in four variations. For more information or to obtain a sample for your laboratory treatability study, contact cetco@mineralstech.com.

TREATMENT APPLICATIONS

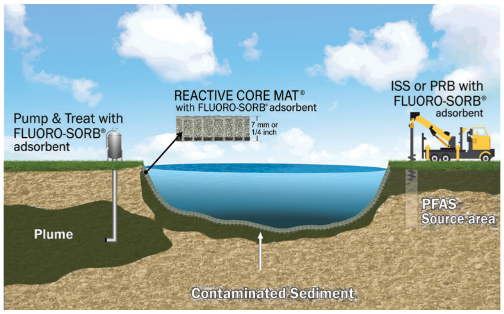
Groundwater

Drinking Water

Surface Water

Soil

FLUORO-SORB® ADSORBENT



Adaptable Solutions for Your Specific Project

Versatility in deployment

- Flow-through filtration technology for drinking and/or groundwater
- Permeable Reactive Barrier (PRB) for passive groundwater
- In-situ stabilization for source zone treatment
- Within a CETCO REACTIVE CORE MAT® composite geotextile mat for sediment capping
- Pre- or post-treatment in connection with other treatment media

Variability in design

- Three available grain sizes in four custom blends
- 1500lb (680.4kg) supersacks

High-Performing Treatment Option

Superior Technology

- Higher sorption kinetics and better sorption capacity
- More selective toward entire family of PFAS
- Not impacted by co-contaminants in the waste stream
- Use with or in place of other treatment media for improved efficacy

Trusted

- NSF/ANSI 61 certified
- Manufactured in an ISO9001:2015 facility
- Made in the USA

To obtain a sample for your laboratory treatability study, contact cetco@mineralstech.com.

Our Standards. Your Peace of Mind.

At CETCO, our goal is to help you succeed. Through our knowledge and experience in minerals, polymers, and the construction industry, we provide solutions to unique challenges globally. Our remediation technologies exceed industry standards and offer innovative alternatives to traditional construction options.

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UPDATED: PS_FLUOROSORB_AM_EN_201910_V2

REMBIND PRODUCT OVERVIEW

CFB Comox FFTA Source Control Project
PSPC
CFB Comox, Lazo, BC
Requisition No.: R.111173.004

RemBind™

AquaBlok®

Product Overview

Immobilising Soil Contaminants

Z070-10 02/18

RemBind™

Features and Benefits

RemBind is a powdered reagent that binds up and immobilises contaminants in soil. The product is typically added at less than 5% by weight using conventional soil blending equipment and binding occurs within 24hrs.

RemBind is designed to treat a range of organic contaminants including TPH, PAH, PFOS, PCBs, PCPs and various pesticides. The product can also bind up heavy metals such as arsenic, chromium and mercury.

The product is available in two grades: RemBind (standard) and RemBind Plus. RemBind is adequate for most applications, particularly for PAHs and TPHs. For contaminants with relatively low regulatory threshold values like PFCs, RemBind Plus is more suitable because it has a stronger binding capacity. Simple bench-scale trials will help to determine the right product for your situation.

The product was used to successfully treat more than 2,000 tonnes of gas works soil and the project team was awarded a National CCF Earth Award for environmental excellence.

Ziltek can also perform treatability trials and provide post-treatment validation testing and reporting where required.

Benefits

- Avoid landfill costs by leaving soil onsite
- Fast, low risk alternative to bioremediation
- Reclassify soil to a cheaper disposal category

Features

- High performance – meets stringent global standards
- Easy to apply using conventional equipment
- Developed in collaboration with the CSIRO

Applications

- Contaminated soil treatment
- Odour control
- Wastewater treatment
- Sediment remediation

"RemBind lived up to our technical expectations in reducing the leachability of PAHs and passed the most rigorous stability test"

Paul Bowden, General Manager
Integrated Waste Services

RemBind: Immobilising Soil Contaminants

1. What is RemBind?

RemBind is a powdered reagent for the chemical fixation (immobilisation) of organic and inorganic contaminants in soil. The product was developed by Ziltek in collaboration with CSIRO and contains a proprietary blend of reagents.

The main constituents of RemBind are:

- Activated carbon
- Aluminium hydroxide (amorphous)
- Kaolin clay and other proprietary additives

2. Target Contaminants

To date, RemBind has been used to successfully immobilise the following contaminants in soil:

- Organic contaminants: PAH, TPH, PFOS/PFOA, and a wide range of pesticides and herbicides
- Inorganic contaminants: arsenic, chromium, fluoride, mercury

3. Regulatory Approvals

RemBind has been granted regulatory approvals for use in several projects in Australia. A key example involved the remediation of 2,000 tonnes of gas work soil from Mead St, Birkenhead, South Australia. The South Australian EPA approved a treatment work plan based on extensive lab treatability trials. Treated soils were tested at an independent NATA accredited laboratory using TCLP analysis. The treated soil also passed the Multiple Extraction Procedure (MEP) test which is the most stringent leachability test used worldwide. The project team was awarded the National CCF Earth Award in 2011 for Environmental Excellence.

THE CCF
EARTH AWARDS
EXCELLENCE IN CIVIL CONSTRUCTION
WINNER 2011

4. Application

- Low application rates minimising project costs. Application rates will vary with each situation, however the typical rate is from 2% to 10% (w/w). This ensures minimal bulking allowing for either reuse on site, or minimising landfill fees. Low addition rates directly relates to less reagent to be purchased. Low addition rates means less freight costs.
- RemBind flows easily and evenly within soil blending equipment. Even flow ensures a consistent result and minimises machine down time. Even flow minimises workers' direct exposure to processing equipment, reagents and contaminants by removing the need to intervene within the process.
- Provides a single pass solution, thus saving processing costs and complexities when dealing with multiple contaminants.

5. Shelf Life, Storage, Transport and Handling

- Shelf life: minimum of 3 years
- Temperature tolerance: Up to 60°C (storage and use)
- Classified: Non Dangerous Good – Non Hazardous
  S22, S36, S24/25 – Do not breathe dust. Wear suitable protective clothing. Avoid contact with skin and eyes.
- The product is supplied in 1 m^3 “bulky bags” and also available for bulk transport.

* Refer to MSDS for further details.

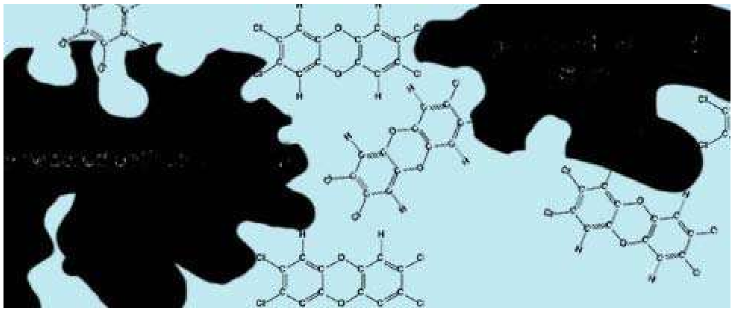
6. The Benefits

- Avoid landfill costs by leaving soil onsite.
- Fast, low risk alternative to bioremediation.
- Reclassify soil to a cheaper disposal category.

7. Mechanisms of Action

The RemBind product has two key mechanisms of action:

- The activated carbon component binds to organic compounds through adsorption, where the organic molecules adhere to the surface of the activated carbon through physical attraction forces. The exact mechanism of action depends on the type of molecule in question, but the adsorption process mainly involves Van der Waals forces but can also involve covalent bonding and/or electrostatic attraction. Due to its relatively large internal surface area, activated carbon is the most widely used adsorbent in the world.



- The aluminium hydroxide component of RemBind is in an amorphous form which means it lacks a rigid crystalline structure. This results in an irregular, charged, and relatively large internal surface area which renders it suitable for binding a range of compounds, particularly the amphoteric metals.

An example of one of the binding mechanisms to arsenic are shown below:

Arsenate with Al surface (Al-OH)
$Al\text{-}OH + HAsO_4^{2-} = Al\text{-}AsO_4^{2-} + H_2O$
$2\ Al\text{-}OH + HAsO_4^{2-} = Al_2\text{-}AsO_4^{-} + OH^{-} + H_2O$

Arsenite with Al surface (Al-OH)
$Al\text{-}OH + H_3AsO_3 = Al\text{-}AsO_3H_2 + H_2O$
$2\ Al\text{-}OH + H_3AsO_3 = Al_2\text{-}AsO_3H + 2\ H_2O$

Frequently Asked Questions (FAQ)

RemBind: Immobilising Soil Contaminants

1. **What is RemBind?**

   RemBind is a proprietary mix of activated carbon, aluminum hydroxide (amorphous) and other adsorption agents. These create a large internal surface area with mixed charges that bind chemical contaminants via ionic bonding, Van der Waals forces (adsorption) and other physical and chemical interactions. This binding reduces the leachability of the contaminants, mitigating effects on health and the environment.

2. **Which contaminants can RemBind immobilise?**

   In theory, RemBind will immobilise any organic contaminant including PCBs, PAHs, TPH, PCP, PFOS and PFAS (Per- and Polyfluorinated Alkyl Substances) etc. It will also immobilise amphoteric metals including chromium and arsenic. It binds certain shorter chain PFAS with a higher affinity than activated carbon (e.g. 6:2 FtS, PTBS).

3. **How much product do I need to add? How do I know it will work for my soil?**

   While RemBind has been fully proven over all soil types, Ziltek recommends running a simple bench-scale trial to determine the type and amount of RemBind required for your situation. Ziltek can undertake the trials (if you send us 5-10 kg of soil) or you can run them yourself using an easy-to-follow protocol. Typically, addition rates of 2% to 5% (w/w) are adequate for most situations. Trials can be completed in around 1-2 weeks.

4. **Which grade of RemBind product is right for me?**

   The product is available in two grades: RemBind (standard) and RemBind Plus. RemBind is adequate for most applications, particularly suitable for PAHs and TPHs. For contaminants with relatively stringent regulatory threshold values like PFAS, RemBind Plus is more suitable because it has a stronger binding capacity. Simple bench-scale trials will help to determine the right product for your situation (see 3 above).

5. **How do I add the product in the field?**

   RemBind is very simple to use. You basically add the product to the soil at the pre-determined addition rate and mix thoroughly. Then add water to 40% moisture content (apple crumble consistency) and leave to fix for 48 hours before collecting validation samples. Purpose-built soil blending equipment (e.g. pug mill) can be used to process 500 tonnes of soil per day, but a loader or backhoe can also be used for smaller volumes or budgets.

ziltek

For more information please contact:

Phone: +61 (0)8 8152 9390
Email: info@ziltek.com
Website: www.ziltek.com

6. **What is the availability of the product?**

   The product is available in 1m^3 bulk bags world-wide, delivered to any location.

7. **Why wouldn't I use activated carbon?**

   While activated carbon will bind a range of organic contaminants, it is relatively expensive and does not bind some shorter chain compounds with the same affinity as RemBind. These smaller compounds tend to be important from a regulatory perspective due to their high mobility (e.g. perfluorinated compounds PTBS, 6:2 FtS).

8. **Has it been validated? Are there credible case studies?**

   Yes. RemBind has been used for many projects to treat PAHs, TPH, and PFAS on a large scale and at bench scale. It was used to treat 15,000 m^3 of PAH impacted soil on Sydney harbour, Australia at an addition rate of 5%. This soil was reused onsite saving significant transport and disposal costs.

   Another PAH project won a national award for environmental excellence in South Australia, treating 2,000 tonnes of soil from a manufactured gas plant for safe landfill disposal. PFAS impacted soil has been treated with RemBind to reduce leachability to <0.02 ug/L, well below the Minnesota Department of Health drinking water guideline of 0.3 ug/L. Project referees are available on request.

   RemBind has been used at commercial scale to treat PFAS contaminated soil. In Australia, it was used to treat 1,000 tonnes of PFAS contaminated soil from 2 airport fire-training grounds for safe landfill disposal with full EPA sign-off and no ongoing management requirements, with a target soil leachability of 0.02µg/L. In the USA, it was used to backfill a PFAS contaminated excavation which is nearby a drinking water source. References available on request.

9. **Has it got regulatory acceptance?**

   All full-scale projects completed to date have had specific regulatory approvals.

10. **How long does the binding last?**

    The long term stability of the RemBind product has been rigorously tested using the Multiple Extraction Procedure (EPA Method 1320) which simulates 1,000 years of acid rain in an improperly designed sanitary landfill. This is the most stringent test available for soil leachability.

11. **Can you leave treated soil on site?**

    Yes, depending on the jurisdiction and intended site use. In Sydney, Australia 15,000 m^3 of treated soil was reused at an industrial site as part of a redevelopment.

12. **What if I have other inorganic co-contaminants in my soil such as heavy metals?**

    Specific amendments can be added to RemBind to tailor a solution for most situations. For example, to treat lead co-contaminants, a phosphate-based amendment can be added to RemBind by the manufacturer to facilitate a single-step addition rate in the field. Contact Ziltek for your specific treatment requirements.

13. Does it also treat water?

Yes, RemBind also effectively removes contaminants from water. It is particularly effective in removing PFAS compounds from waste water and groundwater with trial results available from independent studies conducted in Germany and Australia. It can be used in bed filters, slurry reactors, permeable reactive barriers and some pump and treat systems.

14. After water treatment, what do you do with the spent RemBind?

It can be incinerated, disposed to landfill, or can be regenerated for reuse through a proprietary washing process. Contact Ziltek for further information.

15. RemBind doesn't actually destroy the contaminants, what are the implications?

RemBind immobilises contaminants in soil with proven long term stability using the most rigorous soil leaching test available worldwide (US EPA method 1320). Immobilisation is a very cost-effective and immediate solution. Other treatment technologies are relatively expensive and time consuming and have variable efficacy. For example, for PFAS contaminants, incineration temperatures of >1,100^{o}C are required to destroy the contaminant – this is an extremely expensive process and is not suitable for small volumes for soil.

16. Is RemBind effective at high ionic strengths?

Yes, trials conducted by CSIRO have shown that RemBind is not significantly affected by changes in ionic strength.

17. Is it safe to leave RemBind treated soil in place?

Yes, trials by University of Queensland show that RemBind significantly reduced the bioavailability and ecotoxicity of PFAS in contaminated soils using plants and worm studies as ecological receptors.

18. Does RemBind leach any metals that may breach drinking water guidelines?

The RemBind product does contain certain metals which contribute to its effectiveness, however the leachability of these metals is very low – test's performed by a water authority in the USA confirmed that the metal content of leachate from RemBind Plus in an in-situ water treatment scenario were well within the allowable limits for drinking water.

19. Does the total aluminum content affect reuse options?

The aluminium content of treated soil will generally be less than 1%. Aluminium is not considered a toxic substance at these levels. Some jurisdictions will have regulatory thresholds for aluminium for contaminated sites but these are relatively high.