Re: Aqua-Eo Case Study- Aqua-Eo Oil-Water Separation and Filtration Chemical Stoichiometries and Treatment Variables Bench Test/Pilot Test.

Effluent & Application: Composite Gel-FRAC flowback effluent treatment for fracturing reuse applications.

Note: No chemical scientific name or formula will be termed or described in this case study for either a client's request or IP protection reasons. No actual reaction time interval or chemical dosage will be quantified (it will be referred to any case study reaction times as time intervals 1, 2, etc.) No actual cavitation saturation percentage will be provided, and it will be referred to as saturation index 1 and saturation index 2. No flow pattern will be provided. No component or equipment manufacturer or specs will be named or disclosed.

Introduction

A case study about partial treatment of composite frac effluent for gel and slick hydraulic fracturing reuse application: the report compares bench-pilot results of the Eo-Sep (Aqua-Eo oil-water separator and filtration) partial treatment to an existing and third-party commercial oil-water separation setups on the client's site in northwest British Colombia. A client's appointee third-party monitored the pilot and collected the pre/pro treatment samples for designated elements lab verification. The study discussion is customary to verify and study the upshots of applying multi coagulant – flocculants - surfactant chemicals to precondition and later treat the effluent in conjunction with a mechanical operation—data from a lab analysis (lab analysis appendix A-within). In addition, the case study shows Aqua-Eo technology's advancement to polymer production effluent's oil-water separation knowledge and efficiencies in removing suspended solids, hydrocarbons-extractable, emulsified and dissolved (including BETEX), and oxidizing part of the dissolved solids into suspended solids including heavy metals, and organic/inorganic carbons (refer to appendix A for pre/post-test results.)

Such bench and pilot testing aim to prove the treated effluent sustainable and consistent quality for further exploration operations and the "new knowledge" it brings to the effluent treatment process and the treatment extents of the tertiary and complete treatments for like or other effluents from the oil and gas industry.

The scope of work for the case study includes:

- Effluent description and treatment to reuse as hydraulic fracturing startup water;
- Client's Effluent Treatment Target and Abortive Mechanical treatments

- Description of required specs and conditions (specific to the recycle applications),
- Treatment Concepts and Pilot Procedure,
- Results/Discussion. And,
- Conclusion

Client's Treatment Target and Third-Party Abortive Mechanical treatments

The client intended to treat the highly emulsified effluent to water recycle limits that were abortive after relying on mechanical oil-water separation treatment means. Three unsuccessful trials completed using two different mechanical induced flotation technologies, and a third trial executed using micro-bubble flotation technology. The first technology was a mechanical induced technology were Hydraulic Induced Flotation Internal (submerged) Eductors units while the second technology was a Multi-Stage Bottom Feed Co-Current Hydraulic Induced Flotation Using External Eductors. The micro-bubble flotation technology used microscopic bubbles as small as 5 microns in size to untreated water. Albeit these technologies could partially remove part of the extractable hydrocarbon, they were inadequate to meet any of the required water limits for hydraulic fracking reuse application.

Case Study Effluent Description

The case study effluent was a Frac flowback composite from a composite hydraulic fracturing flowbacks pond of an oil and gas producer in NW British Colombia. Below are the initial water onsite measured characteristics.

The measured water temperature (onsite), °C: 21

Turbidity (NTU): 342

pH: 6.8

Appearance: emulsified dark brown effluent.

Odor: Strong/offensive – profound hydrocarbon and ammonia odors.

The measured effluent temperature on arrival was 18 °C while the pH reading was 6.78. The effluent turbidity, color and odor upon arrival were as described above.

The case study aims to partially treat the water for gel and slick hydraulic fracturing applications without inquiring about any new sources of mark-up or dilution - fresh or brine waters. Table 1 shows the raw effluent water limits and specs that are acceptable for any hydraulic fracturing application. A

two-stage partial treatment was estimated to reach the asked water specs limit to satisfy the client's hydraulic fracturing water specs. The chemicals induction and dissolved gas flotation is the first stage, and a multi-stage filtration that includes ultrafiltration was the second stage to polish the first stage overflow.

Table 1. Description of required hydraulic fracturing water specs and condition

		Limit (Water specs required for hydraulic fracturing)	
Parameter	Raw Effluent (Appendix A)	Polymer-Based Cross-Linked Fracturing Fluid	Slick Water Fracturing Fluid
Temperature	19	18-0°C	>4°C
pH	6.8	6-8	6.8.5
Iron	< 39 (mg/L)	< 10 (mg/L)	< 10 (mg/L)
Hardness (Ca and Mg)	1,400 (mg/L)	< 2,000 (mg/L)	< 3,000 (mg/L)
Bicarbonate	534 (mg/L)	< 400 (mg/L)	< 400 (mg/L)
Sulfate	< 5 (mg/L)	< 200 (mg/L)	< 200 (mg/L)
Bacteria	0 (CFU)	0 (CFU)	0 (CFU)
Hydrogen Sulfide	< 0 (mg/L)	< 0 (mg/L)	< 0 (mg/L)
Total Dissolved Solids	< 18,500 (mg/L)	< 60,000 (mg/L)	< 100,000 (mg/L)
Turbidity	342 NTU	100 NTU	100 NTU
Particle Size	Bag filtered to 20 µm	< 5 µm	< 5 µm
Benzene (Fluid)	< 37 (mg/L)	< 2 (mg/L)	< 2 (mg/L)
Toluene (Fluid)	< 29 (mg/L)	< 2 (mg/L)	< 2 (mg/L)
Ethylbenzene (Fluid)	< 11 (mg/L)	< 2 (mg/L)	< 2 (mg/L)
Xylenes (Fluid)	< 9 (mg/L)	< 2 (mg/L)	< 2 (mg/L)
Hydrocarbon F1-F4 (C6-C50)	< 232 (mg/L)	< 5 (mg/L)	< 5 (mg/L)

Treatment Concepts and Pilot Procedure

A two-stage treatment setup was involved in this pilot to achieve the accepted standards (limits) to reuse the effluent after being treated. The first stage is the chemical/mechanical treatment of the raw effluent, where the majority of the removal intended contaminants are to be removed. The second pilot stage is the filtration stage, where the turbidity is reduced by filtering late-developed flocs from the medium and the final residual suspended solids particle size gets polished.

The first stage pilot partial treatment shall incorporate chemicals induction and dissolve gas flotation, referred to as Oil-Water Sep (refer to the short pilot video provided earlier for demonstration and setup facts association purposes. Refer to the early provided YouTube video for the bench test demo.) The incorporated induction chemicals include:

1. Oxidant(s)
2. pH adjustment chemical(s)
3. Surfactant
4. Coagulant
5. Flocculants (a combination of two flocculation chemicals were used to stabilize the coagulated particles.) There is a dosage time-lapse for flocculants 1 and 2.

The bench and pilot testing were conducted with and without using the surfactant as a catalyst to break the effluent medium surface tension. Both bench and pilot testing patterns and other variables were the same (i.e., the bench and the pilot testing were 100% match except for the surfactant implementation part of the bench and pilot tests.)

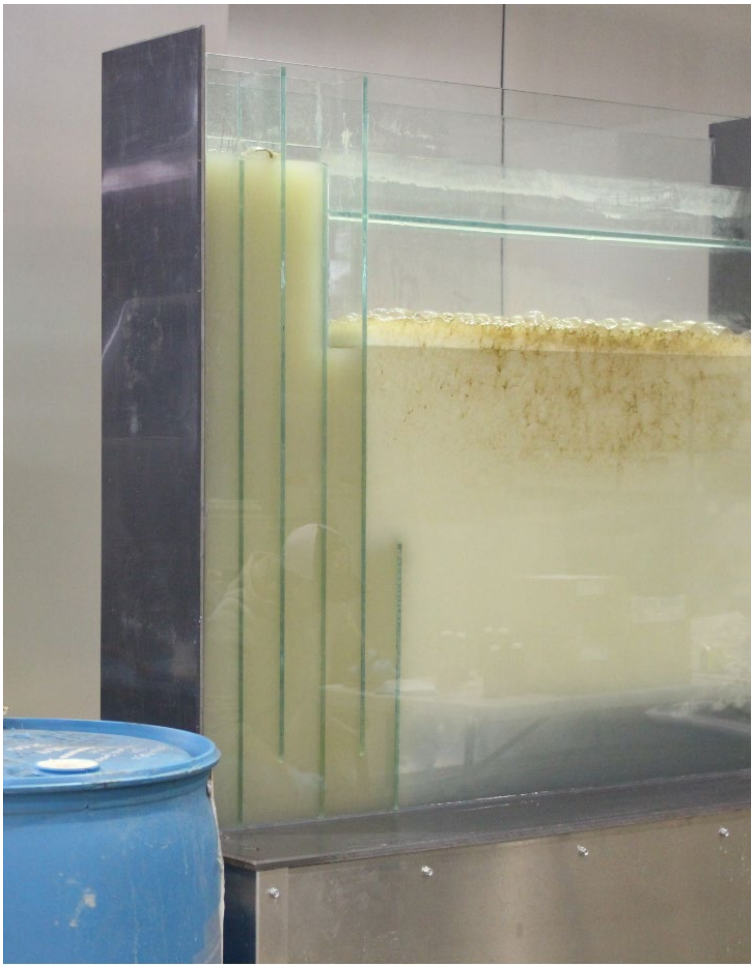
The effluent gets pumped from the holding chamber of the pilot plant dissolved gas flotation (DGF). An in-line oxidant and pH adjustment chemicals were dosed to precondition the effluent for the coagulation and a later flocculation stage in the maze chamber. Next, the mix goes through the tubular reactor system via a transfer pump before being introduced to the first saturation/cavitation pump to be released to the first flotation chamber. A coagulation process with/without "surfactant" occurs under two different flow patterns in the tubular reactor to aid the emulsion surface tension breaking and trigger the oxidation of the dissolved solids and the clotting process of the suspended solids. The chemical coagulation course should develop within a particular time to seam lower molecular weight suspended solids, colloidal suspended solids, and some dissolved metals for later aggregation through flocculation.

The preconditioned/flocculated influent flows into the first dissolved gas flotation stage (primary treatment stage) through a full stream cavitation process. A "complete" stream pressurization process occurs with certain gas saturation to optimize particle-gas contact/exposure in the dispersed phase. The majority of the flocculated hydrocarbons and other organic/inorganics suspended solids typically be removed at this stage.

Overflown effluents from the first stage flotation compartment enter the second dissolved gas flotation tank (polishing treatment stage) central flotation zone through the second cavitation pump. Removal of most emulsified and dissolved hydrocarbons, other suspended solids contaminants, and flocculated aggregates occur at this stage.

Suspended solids (organic & inorganic) floats at the water tank compartments as froth and overflow into a froth collection compartment by mechanical means. In a well-controlled operation, the volume of water and solids skimmed is in the range of 1 – 2 % of the total throughput volume.

Nitrogen (purity of >99.5%) was employed for the cavitation process (pressurization) to produce the microbubbles. The system is equipped with a nitrogen generator to supply the flotation gas to the flotation chambers.



Pilot Eo-Sep with a view of the maze chamber and the first cavitation chamber.

The second pilot stage comprises of multimedia filtration, micron filtration, and Ultrafiltration-UF filter. The partially treated effluent goes through the second stage to remove the late coagulated suspended solids and polish the particle residual particle size to an acceptable range. A minimum 30 minutes continuous-sustainable-fouling free filtration operation of particle size ≤ 0.1 µm is an indicator of successful treatment of the earlier stage.

The induction chemicals were configured for the effluent through intense bench testing. More than 30 different chemical combinations were tested to develop the final pilot chemicals that work with the pilot's effluent.

Table 3 illustrates the bench and pilot tests measuring apparatuses/technology utilized for the pilot to aid the in-situ pilot variables collaborations, adjustments and control. Third-party supervised effluent treatment pilot testing was conducted where samples were collected and sent to AGAT Labs for detailed and accurate results. The two samples represent the final concluded partially treated product from the pilots with and without surfactant addition.

Table 3. Bench & pilot Tests in-situ Testing Apparatuses

Testing Type	Apparatus
pH	HACH-HQd/IntelliCal Rugged Field Kit
Temperature (°C)	HACH-HQd/IntelliCal Rugged Field Kit
Viscosity (cP)	Hydramotion-Viscolite 700
Total Dissolved Solids (mg/L)	HACH-HQd/IntelliCal Rugged Field Kit
Turbidity (NTU)	Hach 2100Q Handheld Turbidity Meter, EPA Compliant

Table 4 illustrates the bench and pilot testing variables contributing to the final "AGAT lab" tested results. Excluding any quantified data stipulated in Aqua_Eo's CRA/SH&RD application and any other data given in both written or verbal forms to CRA/SH&RD technical advisor, there is no more quantified data transfer to or shared with CRA/SH&RD for this case study in particular. As stipulated in the abovementioned "Note" statement, no quantitative values will be disclosed in this document for either client's request for IP protection purposes. The information disclosure limitation part for this case study was agreed to with CRA/SH&RD Technical advisor.

Table 4. Bench Tests & Pilot Tests Variables

Variable	Bench Test / Pilot 1 (with Surfactant)	Bench Test / Pilot 2 (without surfactant)
Retention time (minutes)	✓	✓
Saturation % (N_2 gas to effluent ratio)	✓	✓
Recirculation % (effluent recirculation % back to cavitation pump)	✓	✓
Cavitation pumps shearing speed (rpm)	✓	✓
Bench test various temperature implementation	✓	✓
Pilot test various temperature implementation	✓	✓
Oxidant dosage rate	✓	✓
pH adjustment chemical and dosage rate	✓	✓
Surfactant dosage rate	✓	✓
Coagulant dosage rate	✓	✓
Flocculant 1 dosage rate	✓	✓
Flocculant 2 dosage rate	✓	✓
Coagulant single chemical formula	✓	
Coagulant multiple chemical formula		✓
Flocculant 1 single chemical formula	✓	
Flocculant 2 single chemical formula		✓
Flocculant 1 multiple chemical formula		✓
Flocculant 2 multiple chemical formula	✓	

Results/Discussion

Acronyms used in AGAT lab document:

1. Frac Pond Composite states the raw effluent,

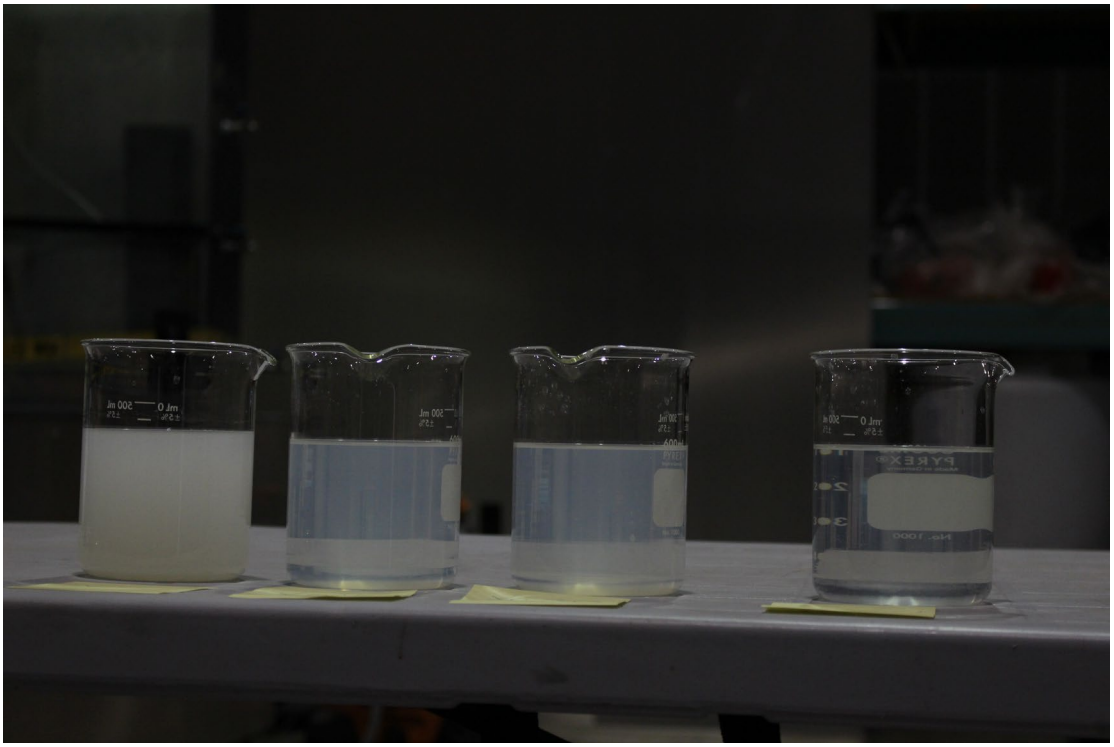
2. P. Treated W-Surfactant results states the partially treated effluent after the filtration stage using the surfactant as a catalyst to reduce/eliminate the raw effluent emulsion surface tension.

3. P. Treated W-out-Surfactant results states the partially treated effluent after the filtration stage without using surfactant or other catalysts to reduce/eliminate the raw effluent emulsion surface tension.

For the partially treated effluent after the filtration stage with the surfactant in AGAT lab results in appendix A and the hydraulic fracturing water limits and standards in table 1; The pilot testing outputs results meet or

exceed the recommended specific water requirements specs and limits for the polymer-based cross-linked fracking fluids and the slickwater fracking fluids.

For the partially treated effluent after the filtration stage without the surfactant impact in AGAT lab results in appendix A and the hydraulic fracturing water limits and standards in table 1; The pilot testing outputs results showed effective removal of the specific water contaminants that were close to meet the water specs and limits for the fracking fluids application.



The Oil-Water Stage supernatant sample from the first and second cavitation compartments. From the left, samples 1-4 were collected subsequently within 10 minutes time intervals. This pilot used surfactant as a catalyst to reduce the effluent surface tension.

Conclusion

The results shown in appendix A prove that a tight emulsion effluent from hydraulic fracturing operations flowback can be treated partially or totally to meet the reuse application of the oil and gas exploration operations or surface release application after extra polishing.

The treatment process is quite challenging and needs robust operating and monitoring components to succeed. Yet, it is not an impossible mission as all it needs is more research and operation procedural enhancement, especially in the chemical part of the treatment and that where Aqua-Eo progressed a breakthrough and proven to bring new knowledge to the tertiary oil and gas effluent treatment technologies.

APPENDIX A

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

CLIENT NAME: [redacted]

ATTENTION TO: [redacted]

PROJECT: [redacted]

AGAT WORK ORDER: [redacted]

TRACE ORGANICS REVIEWED BY: Elena Gorobets, Report Writer

WATER ANALYSIS REVIEWED BY: Jennifer Liu, Analyst, Qualified Person

DATE REPORTED: [redacted] **2019**

PAGES (INCLUDING COVER): 16

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

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Certificate of Analysis

AGAT WORK ORDER: [redacted]
PROJECT: [redacted]

CLIENT NAME: [redacted]
SAMPLING SITE:

ATTENTION TO: [redacted]
SAMPLED BY:

Clear BC - Extended Site Remediation Analysis - Water

DATE RECEIVED: 2019[redacted]

DATE REPORTED: 2019[redacted]

SAMPLE DESCRIPTION:				Frac Pond Composite [redacted]	P. Treated W-Surfactant [redacted]	P. Treated W-out-Surfactant [redacted]
SAMPLE TYPE:				Water	Water	Water
DATE SAMPLED:				[redacted] 2019	[redacted] 2019	[redacted] 2019
Parameter	Unit	G / S	RDL	77[redacted]	77[redacted]	77[redacted]
Benzene (Fluid)	mg/L		0.0005	36.0138	1.0043	3.1888
Toluene (Fluid)	mg/L		0.0003	28.0283	1.0020	2.0132
Ethylbenzene (Fluid)	mg/L		0.0005	10.0124	0.9031	2.9531
Xylenes (Fluid)	mg/L		0.0005	8.117	1.1022	3.4710
Styrene (Fluid)	mg/L		0.0005	<0.0005	<0.0005	<0.0005
VH (Fluid)	mg/L		0.1	76.8	2.8	50.8
VPH (Fluid)	mg/L		0.1	85.6	2.6	58.2
EPH (W C10-C19) (Fluid)	mg/L		0.1	97.3	2.3	57.0
EPH (W C19-C32) (Fluid)	mg/L		0.1	18.5	2.5	18.5
LEPH (Fluid)	mg/L		0.1	96.3	3.3	33.2
HEPH (Fluid)	mg/L		0.1	18.5	1.8	3.7
Acenaphthene (Fluid)	mg/L		0.00001	<0.00001	<0.00001	<0.00001
Acridine (Fluid)	mg/L		0.0001	<0.0001	<0.0001	<0.0001
Anthracene (Fluid)	mg/L		0.00001	<0.00001	<0.00001	<0.00001
Chrysene (Fluid)	mg/L		0.00001	<0.00001	<0.00001	<0.00001
Fluorene (Fluid)	mg/L		0.00001	0.00165	0.00165	0.00165
Naphthalene (Fluid)	mg/L		0.00001	1.04	0.019	0.64
Phenanthrene (Fluid)	mg/L		0.00001	0.00143	0.00105	0.00139
Benzo[a]anthracene (Fluid)	mg/L		0.00001	<0.00001	<0.00001	<0.00001
Benzo[a]pyrene (Fluid)	mg/L		0.000007	<0.000007	<0.000007	<0.000007
Fluoranthene (Fluid)	mg/L		0.00001	<0.00001	<0.00001	<0.00001
Pyrene (Fluid)	mg/L		0.00001	0.00073	0.00071	0.00073
Quinoline (Fluid)	mg/L		0.0001	<0.0001	<0.0001	<0.0001
Benzo[b+j]fluoranthene (Fluid)	mg/L		0.00001	<0.00001	<0.00001	<0.00001
Benzo[k]fluoranthene (Fluid)	mg/L		0.00001	<0.00001	<0.00001	<0.00001
Dibenzo[ah]anthracene (Fluid)	mg/L		0.000008	<0.000008	<0.000008	<0.000008
Indeno[1,2,3-cd]pyrene (Fluid)	mg/L		0.00001	<0.00001	<0.00001	<0.00001

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Certificate of Analysis

AGAT WORK ORDER: [redacted]
PROJECT: [redacted]

CLIENT NAME: [redacted]
SAMPLING SITE:

ATTENTION TO: [redacted]
SAMPLED BY:

[redacted] Extended Site Remediation Analysis - Water

DATE RECEIVED: 2019[redacted]

DATE REPORTED: 2019[redacted]

			Frac Pond Composite	P. Treated W-Surfactant	P. Treated W-out-Surfactant
		SAMPLE DESCRIPTION:	[redacted]	[redacted]	[redacted]
		SAMPLE TYPE:	Water	Water	Water
		DATE SAMPLED:	[redacted] 2019	[redacted] 2019	[redacted] 2019
Surrogate	Unit	Acceptable Limits	77[redacted]	77[redacted]	77[redacted]
Toluene-d8 (BTEX)	%	50-150	94	60	65
o-Terphenyl (EPH)	%	50-150	109	57	73
2-Fluorobiphenyl (PAH)	%	50-150	101	78	85
p-Terphenyl-d14 (PAH)	%	50-150	95	61	82

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

77[redacted] Xylenes is a calculated parameter. The calculated value is the sum of m&p-Xylenes + o-Xylene.
77[redacted] VPH results have been corrected for BTEXS contributions.
LEPH & HEPH results have been corrected for PAH contributions.
77[redacted] VPH: Volatile Petroleum Hydrocarbons (n-C6 - n-C10); all volatile compounds in the n-C6 to n-C10 range quantified based on toluene response.
LEPH: Light Extractable Petroleum Hydrocarbons (n-C10 - n-C19); all extractable compounds in the n-C10 to n-C19 range quantified based on n-eicosane response.
HEPH: Heavy Extractable Petroleum Hydrocarbons (n-C19 - n-C32); all extractable compounds in the n-C19 to n-C32 range quantified based on n-eicosane response.

Certified By: Elena Gorobets

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AGAT WORK ORDER: [redacted]
PROJECT: [redacted]

CLIENT NAME: [redacted]
SAMPLING SITE:

ATTENTION TO: [redacted]
SAMPLED BY:

Methanol Analysis in Water

DATE RECEIVED: 2019[redacted]

DATE REPORTED: 2019[redacted]

SAMPLE DESCRIPTION:				Frac Pond Composite [redacted]	P. Treated W-Surfactant [redacted]	P. Treated W-out-Surfactant [redacted]
SAMPLE TYPE:				Water	Water	Water
DATE SAMPLED:				[redacted] 2019	[redacted] 2019	[redacted] 2019
Parameter	Unit	G / S	RDL	77[redacted]	77[redacted]	77[redacted]
Methanol	mg/L		1	770	258	683
Surrogate	Unit	Acceptable Limits				
4-Methyl-2-pentanone	%	50-150		79	53	72

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
77[redacted] Analysis by GC/FID.
77[redacted]
77[redacted]

Certified By: Elena Gorobets

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AGAT WORK ORDER: [redacted]

PROJECT: [redacted]

CLIENT NAME: [redacted]

ATTENTION TO: [redacted]

SAMPLING SITE:

SAMPLED BY:

British Columbia Detailed Water Salinity

DATE RECEIVED: 2019[redacted]

DATE REPORTED: 2019[redacted]

SAMPLE DESCRIPTION:				Frac Pond Composite [redacted]	P. Treated W-Surfactant [redacted]	P. Treated W-out-Surfactant [redacted]
SAMPLE TYPE:				Water	Water	Water
DATE SAMPLED:				[redacted] 2019	[redacted] 2019	[redacted] 2019
Parameter	**Unit**	**G / S**	**RDL**	77[redacted]	77[redacted]	77[redacted]
pH	pH Units		N/A	6.78	7.25	7.42
T - Alkalinity (as CaCO3)	mg/L		5	438	323	351
Bicarbonate	mg/L		5	534	389	365
Carbonate	mg/L		5	<5	<5	<5
Hydroxide	mg/L		5	<5	<5	<5
Electrical Conductivity	dS/m		0.05	30.7	24.2	27.7
Chloride	mg/L		4	11100	8750	10015
Fluoride	mg/L		0.1	<0.1	<0.1	<0.1
Nitrate	mg/L		0.8	1.6	0.7	1.2
Nitrite	mg/L		0.40	<0.40	<0.40	<0.40
Sulfate	mg/L		1	5	1.8	3
Dissolved Calcium	mg/L		1.0	490	385	416
Dissolved Magnesium	mg/L		2	43	26	23
Dissolved Sodium	mg/L		2.0	6450	5031	5934
Dissolved Potassium	mg/L		3.0	98.8	65.1	88.9
Total Dissolved Solids (Calculated)	mg/L		1	18500	15329	17243
Calculated Salinity	g/L			20.1	15.8	18.3
Hardness	mg CaCO3/L		1	1400	756	769
Ion Balance	%		1	97	78	83
Nitrate+Nitrite - Nitrogen	mg/L		0.02	0.36	0.23	0.26
Nitrate-N	mg/L		0.02	0.36	0.23	0.26
Nitrite-N	mg/L		0.01	<0.01	<0.01	<0.01
Sodium Adsorption Ratio				74.9	78.9	76.5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

77[redacted] < - Values refer to Report Detection Limits.

77[redacted] If sodium results in mg/L are less than detection, SAR is non-calculable and is reported as 0.

77[redacted]

Certified By:

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AGAT WORK ORDER: [redacted]
PROJECT: [redacted]

CLIENT NAME: [redacted]
SAMPLING SITE:

ATTENTION TO: [redacted]
SAMPLED BY:

[redacted] AB - Sulfide

DATE RECEIVED: 2019[redacted]

DATE REPORTED: 2019[redacted]

				Frac Pond Composite	P. Treated W-Surfactant	P. Treated W-out-Surfactant
SAMPLE DESCRIPTION:				[redacted]	[redacted]	[redacted]
SAMPLE TYPE:				Water	Water	Water
DATE SAMPLED:				[redacted] 2019	[redacted] 2019	[redacted] 2019
Parameter	Unit	G / S	RDL	77[redacted]	77[redacted]	77[redacted]
Sulfide	mg/L	(0.05)	0.01	3.22	2.46	3.11

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to 2014 Canadian Drinking Water Quality MAC (AO)

Certified By:

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AGAT WORK ORDER: [redacted]
PROJECT: [redacted]

CLIENT NAME: [redacted]
SAMPLING SITE:

ATTENTION TO: [redacted]
SAMPLED BY:

[redacted] BC - CSR Schedule 6 Total Metals

DATE RECEIVED: 2019[redacted]

DATE REPORTED: 2019[redacted]

SAMPLE DESCRIPTION:				Frac Pond Composite [redacted]	P. Treated W-Surfactant [redacted]	P. Treated W-out-Surfactant [redacted]
SAMPLE TYPE:				Water	Water	Water
DATE SAMPLED:				[redacted]2019	[redacted]2019	[redacted]2019
Parameter	Unit	G / S	RDL	77[redacted]	77[redacted]	77[redacted]
Aluminum (Fluid)	mg/L		0.4	2.0	1.3	2.2
Antimony (Fluid)	mg/L		0.002	0.012	0.012	0.012
Arsenic (Fluid)	mg/L		0.04	0.11	0.09	0.11
Barium (Fluid)	mg/L		0.10	220	15	113
Beryllium (Fluid)	mg/L		0.0040	<0.0040	<0.0040	<0.0040
Boron (Fluid)	mg/L		6	63	03	12
Cadmium (Fluid)	mg/L		0.0032	<0.0032	<0.0032	<0.0032
Calcium (Fluid)	mg/L		1.0	528	412	470
Chromium (Fluid)	mg/L		0.020	0.096	<0.001	0.036
Cobalt (Fluid)	mg/L		0.006	0.015	0.005	0.007
Copper (Fluid)	mg/L		0.020	0.052	0.009	0.012
Iron (Fluid)	mg/L		0.5	64.1	3.1	3.4
Lead (Fluid)	mg/L		0.0010	0.0101	0.0101	0.0101
Lithium (Fluid)	mg/L		0.2	24.2	14.3	22.2
Magnesium (Fluid)	mg/L		1.0	47.6	12.5	22.3
Manganese (Fluid)	mg/L		0.010	0.443	0.225	0.441
Mercury (Fluid)	mg/L		0.000025	0.00108	0.00108	0.00108
Molybdenum (Fluid)	mg/L		0.004	0.075	0.075	0.075
Nickel (Fluid)	mg/L		0.020	0.088	0.062	0.083
Selenium (Fluid)	mg/L		0.10	<0.10	<0.10	<0.10
Silver (Fluid)	mg/L		0.002	0.004	0.004	0.004
Sodium (Fluid)	mg/L		6	7070	5514	6292
Strontium (Fluid)	mg/L		0.2	125	27	59
Thallium (Fluid)	mg/L		0.002	0.003	0.003	0.003
Titanium (Fluid)	mg/L		0.1	<0.1	<0.1	<0.1
Uranium (Fluid)	mg/L		0.002	0.006	0.006	0.006
Vanadium (Fluid)	mg/L		0.2	<0.2	<0.2	<0.2

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Certificate of Analysis

AGAT WORK ORDER: [redacted]

PROJECT: [redacted]

CLIENT NAME: [redacted]

SAMPLING SITE:

SAMPLED BY:

[redacted] BC - CSR Schedule 6 Total Metals

DATE RECEIVED: **2019**[redacted]

DATE REPORTED: **2019-**[redacted]

Parameter	Unit	G / S	RDL	Frac Pond Composite [redacted]-	P. Treated W-Surfactant [redacted]-	P. Treated W-out-Surfactant [redacted]-
SAMPLE DESCRIPTION:				[redacted]	[redacted]	[redacted]
SAMPLE TYPE:				Water	Water	Water
DATE SAMPLED:				[redacted] 2019	[redacted] 2019	[redacted] 2019
Zinc (Fluid)	mg/L		0.2	0.3	0.1	0.1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

77[redacted] < - Values refer to Method Detection Limit.

77[redacted]

77[redacted]

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Certificate of Analysis

AGAT WORK ORDER: [redacted]
PROJECT: [redacted]

CLIENT NAME: [redacted]
SAMPLING SITE:

ATTENTION TO: [redacted]
SAMPLED BY:

Water Analysis - Bromide, Ortho-phosphate, TDS

DATE RECEIVED: 2019[redacted]

DATE REPORTED: 2019[redacted]

Parameter	Unit	G / S	RDL	Frac Pond Composite [redacted]	P. Treated W-Surfactant [redacted]	P. Treated W-out-Surfactant [redacted]
SAMPLE DESCRIPTION:				[redacted]	[redacted]	[redacted]
SAMPLE TYPE:				Water	Water	Water
DATE SAMPLED:				[redacted] 2019	[redacted] 2019	[redacted] 2019
Bromide	mg/L		0.4	127	42	98
Orthophosphate	mg/L		0.15	2.44	1.25	2.24
Total Dissolved Solids Tested	mg/L		5	19500	15210	17193

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

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Certificate of Analysis

AGAT WORK ORDER: [redacted]
PROJECT: [redacted]

CLIENT NAME: [redacted]
SAMPLING SITE:

ATTENTION TO: [redacted]
SAMPLED BY:

Water Analysis - TSS

DATE RECEIVED: 2019[redacted]

DATE REPORTED: 2019[redacted]

				Frac Pond Composite	P. Treated W-Surfactant	P. Treated W-out-Surfactant
		SAMPLE DESCRIPTION:		[redacted]	[redacted]	[redacted]
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		[redacted] 2019	[redacted] 2019	[redacted] 2019
Parameter	Unit	G / S	RDL	77[redacted]	77[redacted]	77[redacted]
Total Suspended Solids	mg/L		20	1370	<5	<5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

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Quality Assurance

CLIENT NAME: [redacted]

AGAT WORK ORDER: [redacted]

PROJECT: [redacted]

ATTENTION TO: [redacted]

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis

RPT Date: [redacted], 2019

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Clear BC - Extended Site Remediation Analysis - Water															
Benzene (Fluid)	1617	7777955	< 0.0005	< 0.0005	NA	< 0.0005	105%	80%	120%	98%	80%	120%	95%	70%	130%
Toluene (Fluid)	1617	7777955	< 0.0003	< 0.0003	NA	< 0.0003	91%	80%	120%	93%	80%	120%	89%	70%	130%
Ethylbenzene (Fluid)	1617	7777955	< 0.0005	< 0.0005	NA	< 0.0005	80%	80%	120%	87%	80%	120%	86%	70%	130%
Xylenes (Fluid)	1617	7777955	< 0.0005	< 0.0005	NA	< 0.0005	81%	80%	120%	95%	80%	120%	94%	70%	130%
Styrene (Fluid)	1617	7777955	< 0.0005	< 0.0005	NA	< 0.0005	87%	80%	120%	91%	80%	120%	88%	70%	130%
VH (Fluid)	1617	7777955	< 0.1	< 0.1	NA	< 0.1	85%	80%	120%	107%	80%	120%	103%	70%	130%
EPH (W C10-C19) (Fluid)	339	7776014	<0.1	<0.1	NA	< 0.1	95%	80%	120%	83%	80%	120%	80%	70%	130%
EPH (W C19-C32) (Fluid)	339	7776014	<0.1	<0.1	NA	< 0.1	95%	80%	120%	80%	80%	120%	81%	70%	130%
Acenaphthene (Fluid)	1002	7777963	< 0.00001	< 0.00001	NA	< 0.00001	108%	70%	130%	100%	70%	130%	82%	70%	130%
Acridine (Fluid)	1002	7777963	< 0.0001	< 0.0001	NA	< 0.0001	111%	70%	130%	100%	70%	130%	90%	70%	130%
Anthracene (Fluid)	1002	7777963	< 0.00001	< 0.00001	NA	< 0.00001	80%	70%	130%	92%	70%	130%	77%	70%	130%
Chrysene (Fluid)	1002	7777963	< 0.00001	< 0.00001	NA	< 0.00001	108%	70%	130%	103%	70%	130%	81%	70%	130%
Fluorene (Fluid)	1002	7777963	< 0.00001	< 0.00001	NA	< 0.00001	97%	70%	130%	98%	70%	130%	82%	70%	130%
Naphthalene (Fluid)	1002	7777963	< 0.00001	< 0.00001	NA	< 0.00001	108%	70%	130%	100%	70%	130%	80%	70%	130%
Phenanthrene (Fluid)	1002	7777963	< 0.00001	< 0.00001	NA	< 0.00001	100%	70%	130%	95%	70%	130%	79%	70%	130%
Benzo[a]anthracene (Fluid)	1002	7777963	< 0.00001	< 0.00001	NA	< 0.00001	73%	70%	130%	103%	70%	130%	86%	70%	130%
Benzo[a]pyrene (Fluid)	1002	7777963	< 0.000007	< 0.000007	NA	< 0.000007	98%	70%	130%	93%	70%	130%	75%	70%	130%
Fluoranthene (Fluid)	1002	7777963	< 0.00001	< 0.00001	NA	< 0.00001	82%	70%	130%	98%	70%	130%	86%	70%	130%
Pyrene (Fluid)	1002	7777963	< 0.00001	< 0.00001	NA	< 0.00001	101%	70%	130%	115%	70%	130%	96%	70%	130%
Quinoline (Fluid)	1002	7777963	< 0.0001	< 0.0001	NA	< 0.0001	105%	70%	130%	105%	70%	130%	94%	70%	130%
Benzo[b+j]fluoranthene (Fluid)	1002	7777963	< 0.00001	< 0.00001	NA	< 0.00001	91%	70%	130%	87%	70%	130%	71%	70%	130%
Benzo[k]fluoranthene (Fluid)	1002	7777963	< 0.00001	< 0.00001	NA	< 0.00001	112%	70%	130%	90%	70%	130%	70%	70%	130%
Dibenzo[ah]anthracene (Fluid)	1002	7777963	< 0.000008	< 0.000008	NA	< 0.000008	82%	70%	130%	88%	70%	130%	72%	70%	130%
Indeno[1,2,3-cd]pyrene (Fluid)	1002	7777963	< 0.00001	< 0.00001	NA	< 0.00001	83%	70%	130%	98%	70%	130%	79%	70%	130%

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Methanol Analysis in Water		77[redacted]													
Methanol	5163	77[redacted]	770	736	5.0%	< 1	106%	80%	120%	104%	70%	130%	80%	60%	140%
		77[redacted]													

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

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Quality Assurance

CLIENT NAME: [redacted]
AGAT WORK ORDER: [redacted]
PROJECT: [redacted]
ATTENTION TO: [redacted]
SAMPLING SITE:
SAMPLED BY:

Water Analysis

RPT Date: [redacted] 2019

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Clear BC - CSR Schedule 6 Total Metals															
Aluminum (Fluid)	7767856		0.007	0.006	NA	< 0.004	104%	80%	120%	106%	80%	120%	116%	80%	120%
Antimony (Fluid)	7767856		<0.001	<0.001	NA	< 0.001	103%	80%	120%	101%	80%	120%	99%	80%	120%
Arsenic (Fluid)	7767856		<0.001	<0.001	NA	< 0.001	104%	80%	120%	99%	80%	120%	99%	80%	120%
Barium (Fluid)	7767856		0.21	0.21	NA	< 0.05	99%	80%	120%	102%	80%	120%	102%	80%	120%
Beryllium (Fluid)	7767856		<0.0005	<0.0005	NA	< 0.0005	106%	80%	120%	116%	80%	120%	116%	80%	120%
Boron (Fluid)	7767856		0.02	0.02	NA	< 0.01	112%	80%	120%	108%	80%	120%	NA	80%	120%
Cadmium (Fluid)	7767856		<0.00005	<0.00005	NA	< 0.00005	103%	80%	120%	101%	80%	120%	101%	80%	120%
Calcium (Fluid)	7767856		113	110	2.7%	< 0.3	109%	80%	120%	105%	80%	120%	NA	80%	120%
Chromium (Fluid)	7767856		<0.0005	<0.0005	NA	< 0.0005	104%	80%	120%	102%	80%	120%	97%	80%	120%
Cobalt (Fluid)	7767856		<0.001	<0.001	NA	< 0.001	106%	80%	120%	103%	80%	120%	100%	80%	120%
Copper (Fluid)	7767856		0.0015	0.0011	NA	< 0.0008	103%	80%	120%	102%	80%	120%	98%	80%	120%
Iron (Fluid)	7767856		<0.1	<0.1	NA	< 0.1	104%	80%	120%	106%	80%	120%	104%	80%	120%
Lead (Fluid)	7767856		<0.0005	<0.0005	NA	< 0.0005	103%	80%	120%	105%	80%	120%	100%	80%	120%
Lithium (Fluid)	7767856		0.008	0.008	3.1%	< 0.001	104%	80%	120%	113%	80%	120%	113%	80%	120%
Magnesium (Fluid)	7767856		42.3	43.0	1.6%	< 0.2	105%	80%	120%	101%	80%	120%	NA	80%	120%
Manganese (Fluid)	7767856		<0.005	<0.005	NA	< 0.005	100%	80%	120%	104%	80%	120%	101%	80%	120%
Mercury (Fluid)	7775681		<0.	<0.	NA	< 0.000025	95%	90%	110%	104%	90%	110%	99%	80%	120%
Molybdenum (Fluid)	7767856		<0.001	<0.001	NA	< 0.001	97%	80%	120%	97%	80%	120%	98%	80%	120%
Nickel (Fluid)	7767856		<0.003	<0.003	NA	< 0.003	102%	80%	120%	102%	80%	120%	99%	80%	120%
Selenium (Fluid)	7767856		0.0008	0.0010	NA	< 0.0005	101%	80%	120%	100%	80%	120%	98%	80%	120%
Silver (Fluid)	7767856		0.0004	0.0001	NA	< 0.0001	93%	80%	120%	86%	80%	120%	83%	80%	120%
Sodium (Fluid)	7767856		7.7	7.7	0.0%	< 0.6	111%	80%	120%	115%	80%	120%	NA	80%	120%
Strontium (Fluid)	7767856		0.703	0.697	0.9%	< 0.001	96%	80%	120%	99%	80%	120%	NA	80%	120%
Thallium (Fluid)	7767856		<0.0001	<0.0001	NA	< 0.0001	98%	80%	120%	101%	80%	120%	98%	80%	120%
Titanium (Fluid)	7767856		<0.001	<0.001	NA	< 0.001	98%	80%	120%	105%	80%	120%	99%	80%	120%
Uranium (Fluid)	7767856		0.006	0.006	0.0%	< 0.001	101%	80%	120%	105%	80%	120%	NA	80%	120%
Vanadium (Fluid)	7767856		<0.001	<0.001	NA	< 0.001	103%	80%	120%	101%	80%	120%	102%	80%	120%
Zinc (Fluid)	7767856		0.011	0.009	20.0%	< 0.001	109%	80%	120%	101%	80%	120%	103%	80%	120%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

British Columbia Detailed Water Salinity															
pH	1235	5978	6.78	6.65	1.9%	N/A	100%	90%	110%						
T - Alkalinity (as CaCO3)	1235	5978	438	438	0.0%	< 5	103%	80%	120%						
Electrical Conductivity	1235	5978	30700	30800	0.3%	< 0.05	100%	80%	120%						
Chloride	7777765		37	38	2.7%	< 1	103%	80%	120%	100%	80%	120%	109%	80%	120%
Fluoride	7777765		<0.06	<0.06	NA	< 0.01	102%	80%	120%	94%	80%	120%	106%	80%	120%
Nitrate	7777765		<0.5	<0.5	NA	< 0.5	107%	80%	120%	106%	80%	120%	112%	80%	120%

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Quality Assurance

CLIENT NAME: [redacted]
AGAT WORK ORDER: [redacted]
PROJECT: [redacted]
ATTENTION TO: [redacted]
SAMPLING SITE:
SAMPLED BY:

Water Analysis (Continued)

RPT Date: [redacted] 2019			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Nitrite	7777765		<0.20	<0.20	NA	< 0.05	105%	80%	120%	103%	80%	120%	109%	80%	120%
Sulfate	7777765		264	281	6.2%	< 1	104%	80%	120%	102%	80%	120%	NA	80%	120%
Dissolved Calcium	7774639		6.3	6.2	1.6%	< 0.3	106%	80%	120%	108%	80%	120%	NA	80%	120%
Dissolved Magnesium	7774639		0.4	0.4	NA	< 0.2	101%	80%	120%	102%	80%	120%	100%	80%	120%
Dissolved Sodium	7774639		568	560	1.4%	< 0.6	103%	80%	120%	112%	80%	120%	NA	80%	120%
Dissolved Potassium	7774639		1.4	1.5	NA	< 0.6	101%	80%	120%	114%	80%	120%	118%	80%	120%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

pH has been analyzed past the recommended holding time of 15 minutes from sampling (field measurement ideal if more accurate data required)

Nitrate and Nitrite: The regulatory hold time for the analysis of nitrate and/or nitrite in water is 48 hours in Alberta and 72 hours in British Columbia.

Clear AB - Sulfide	77[redacted]														
Sulfide	77[redacted]	3.22	3.22	0.0%	< 0.001	118%	80%	120%	110%	80%	120%	108%	80%	120%
	77[redacted]														

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Water Analysis - Bromide, Ortho-phosphate, TDS															
Bromide	7777765	<0.2	<0.2	NA	< 0.1	112%	80%	120%	112%	80%	120%	117%	80%	120%
Orthophosphate	121812	< 0.15	< 0.15	NA	< 0.15	100%	80%	120%	106%	80%	120%	NA	80%	120%
Total Dissolved Solids	7767978	710	715	0.7%	< 5	103%	80%	120%	NA			NA		

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Water Analysis - TSS															
Total Suspended Solids	7801276	<2	<2	NA	< 2	102%	80%	120%				101%	80%	120%

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

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Method Summary

CLIENT NAME: [redacted]

AGAT WORK ORDER: [redacted]

PROJECT: [redacted]

ATTENTION TO: [redacted]

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Benzene (Fluid)	TO 0332	BC Environment	GC/MS
Toluene (Fluid)	TO 0332	BC Environment	GC/MS
Ethylbenzene (Fluid)	TO 0332	BC Environment	GC/MS
Xylenes (Fluid)	TO 0332	BC Environment	GC/MS
Styrene (Fluid)	TO 0332	BC Environment	GC/MS
VH (Fluid)	TO 0542	BC Environment	GC/MS
VPH (Fluid)	TO 0542	BC Environment	GC/MS
EPH (W C10-C19) (Fluid)	TO 0511	AEC A108.0, B.C. Env., EPA SW-846 3511	GC/FID
EPH (W C19-C32) (Fluid)	TO 0511	AEC A108.0, B.C. Env., EPA SW-846 3511	GC/FID
LEPH (Fluid)	TO 0511	AEC A108.0, B.C. Env., EPA SW-846 3511	GC/FID
HEPH (Fluid)	TO 0511	AEC A108.0, B.C. Env., EPA SW-846 3511	GC/FID
Acenaphthene (Fluid)	TO 0200	EPA SW846 3511 & 8270	GC/MS
Acridine (Fluid)	TO 0200	EPA SW846 3511 & 8270	GC/MS
Anthracene (Fluid)	TO 0200	EPA SW846 3511 & 8270	GC/MS
Chrysene (Fluid)	TO 0200	EPA SW846 3511 & 8270	GC/MS
Fluorene (Fluid)	TO 0200	EPA SW846 3511 & 8270	GC/MS
Naphthalene (Fluid)	TO 0200	EPA SW846 3511 & 8270	GC/MS
Phenanthrene (Fluid)	TO 0200	EPA SW846 3511 & 8270	GC/MS
Benzo[a]anthracene (Fluid)	TO 0200	EPA SW846 3511 & 8270	GC/MS
Benzo[a]pyrene (Fluid)	TO 0200	EPA SW846 3511 & 8270	GC/MS
Fluoranthene (Fluid)	TO 0200	EPA SW846 3511 & 8270	GC/MS
Pyrene (Fluid)	TO 0200	EPA SW846 3511 & 8270	GC/MS
Quinoline (Fluid)	TO 0200	EPA SW846 3511 & 8270	GC/MS
Benzo[b+j]fluoranthene (Fluid)	TO 0200	EPA SW846 3511 & 8270	GC/MS
Benzo[k]fluoranthene (Fluid)	TO 0200	EPA SW846 3511 & 8270	GC/MS
Dibenzo[ah]anthracene (Fluid)	TO 0200	EPA SW846 3511 & 8270	GC/MS
Indeno[1,2,3-cd]pyrene (Fluid)	TO 0200	EPA SW846 3511 & 8270	GC/MS
Toluene-d8 (BTEX)	TO 0332	BC Environment	GC/MS
o-Terphenyl (EPH)	TO 0511	BC Environment	GC/FID
2-Fluorobiphenyl (PAH)	TO 0200	EPA SW846 3510C & 8270	GC/MS
p-Terphenyl-d14 (PAH)	TO 0200	EPA SW846 3510C & 8270	GC/MS
Methanol	TO 1420	EPA 8015	GC/FID
4-Methyl-2-pentanone	TO 1420	EPA 8015	GC/FID

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Method Summary

CLIENT NAME: [redacted]
AGAT WORK ORDER: [redacted]
PROJECT: [redacted]
ATTENTION TO: [redacted]
SAMPLING SITE:
SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
pH	INST 0101	SM 4500 H+	PH METER
T - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
Bicarbonate	INST 0101	SM 2320 B	TITRATION
Carbonate	INST 0101	SM 2320 B	TITRATION
Hydroxide	INST 0101	SM 2320 B	TITRATION
Electrical Conductivity	INST 0101	SM 2510 B	CONDUCTIVITY METER
Chloride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate	INST-0150	SM 4110 B	ION CHROMATOGRAPH
Nitrite	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Sulfate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Dissolved Calcium	INST 0140	SM 3120 B	ICP/OES
Dissolved Magnesium	INST 0140	SM 3120 B	ICP/OES
Dissolved Sodium	INST 0140	SM 3120 B	ICP/OES
Dissolved Potassium	INST 0140	SM 3120 B	ICP/OES
Total Dissolved Solids (Calculated)		SM 1030E	CALCULATION
Calculated Salinity			TITRATION
Hardness	INST 0140	SM 2340 B	ICP/OES
Ion Balance		SM 1030E	CALCULATION
Nitrate+Nitrite - Nitrogen	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate-N	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrite-N	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Sodium Adsorption Ratio		CARTER & GREGORICH 2007	CALCULATION
Sulfide	WAT 0100	SM 4500 S2- D	SPECTROPHOTOMETER
Aluminum (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP/MS
Antimony (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Arsenic (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Barium (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Beryllium (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Boron (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Cadmium (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Calcium (Fluid)	WATR 0200; INST 0140	SM 3030 E; SM 3120 B	ICP/OES
Chromium (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Cobalt (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Copper (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Iron (Fluid)	WATR 0200; INST 0140	SM 3030 E; SM 3120 B	ICP/OES
Lead (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Lithium (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP/MS
Magnesium (Fluid)	WATR 0200; INST 0140	SM 3030 E; SM 3120 B	ICP/OES
Manganese (Fluid)	WATR 0200; INST 0140	SM 3030 E; SM 3120 B	ICP/OES
Mercury (Fluid)	WATR 0200; INST 0160	SM 3030 E; SM 3112 B TW	CV/AA
Molybdenum (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP/MS
Nickel (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Selenium (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Silver (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Sodium (Fluid)	WATR 0200; INST 0140	SM 3030 E; SM 3120 B	ICP/OES
Strontium (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Thallium (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Titanium (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS

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Method Summary

CLIENT NAME: [redacted]

AGAT WORK ORDER: [redacted]

PROJECT: [redacted]

ATTENTION TO: [redacted]

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Uranium (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Vanadium (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Zinc (Fluid)	WATR 0200; INST 0141	SM 3030 E; SM 3125 B	ICP-MS
Bromide	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Orthophosphate	INST 0410	365.1	DISCRETE ANALYZER
Total Dissolved Solids	WATR 0610	SM 2540 C	GRAVIMETRIC
Total Suspended Solids	WATR 0600	SM 2540 D	GRAVIMETRIC