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June 29, 2017 File: 2016-8113.010.000

Brady Nelless Regional Director BC Ministry of Environment Northern Regional Operations Bag 5000 3726 Alfred Avenue Smithers, BC V0J 2N0

Re: GRACE-MAR FARMS SPRING 2017 WATER SAMPLING RESULTS MINISTRY OF ENVIRONMENT FILE NO. 350101 - ACTION PLAN ITEM #14

Dear Mr. Nelless:

1 BACKGROUND

Grace-Mar Farms Ltd. (Grace-Mar) operates a feeding operation for heifers at 5904 Salmon River Road, Armstrong, BC. Grace-Mar operated a dairy operation at the same location up to Feb 28, 2017, when the milking cows were moved to their Fraser Valley operation. On May 12, 2016, the BC Ministry of Environment (MOE) issued a Pollution Abatement Order ("the Order") to Grace-Mar (File AMS#350101, MOE 2016). The Order required that Grace-Mar carry out a comprehensive monitoring program, complete an environmental assessment (EIA), prepare an Action Plan to detail measures to be taken to abate any environmental impacts identified in the EIA, and submit formal written summaries for three years identifying what actions from the Action Plan were undertaken. The EIA and Action Plan were submitted to MOE on November 17, 2016 and April 6, 2017, respectively.

2 SCOPE OF WORK AND OBJECTIVES

As one of the specified actions in the Action Plan submitted to MOE in March 2017 and subsequently accepted, Grace-Mar retained Associated Environmental Consultants Inc. (Associated) to complete groundwater and surface water quality sampling from nine locations (Associated 2017). The Action (#14) is to:

"Sample groundwater from MW1, MW2, MW3S, MW3D, WT94334, WT94335, WT48878, WT82426¹ and Floyd's Swamp. Analyze for nitrate-N, nitrite-N, ammonia, total Kjeldahl nitrogen (TKN), total nitrogen, and chloride, low detection level phosphorous."

¹ Note: there was typographical mistake in the March 2017 Action Plan. WT42426 should have read WT82426 and is therefore changed above. Associated informed MOE of this error.







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As described in the Order, formal summary letters must be submitted to MOE annually for three years to confirm that certain Actions have been completed. The reports are to:

- i) summarize in reasonable detail what actions from the Action Plan were undertaken;
- ii) identify of all agriculture operational changes that occurred;
- iii) summarize in reasonable detail monitoring results;
- iv) summarize environmental impact assessment (first year only); and
- v) recommend additional mitigation and restoration measures, if appropriate.

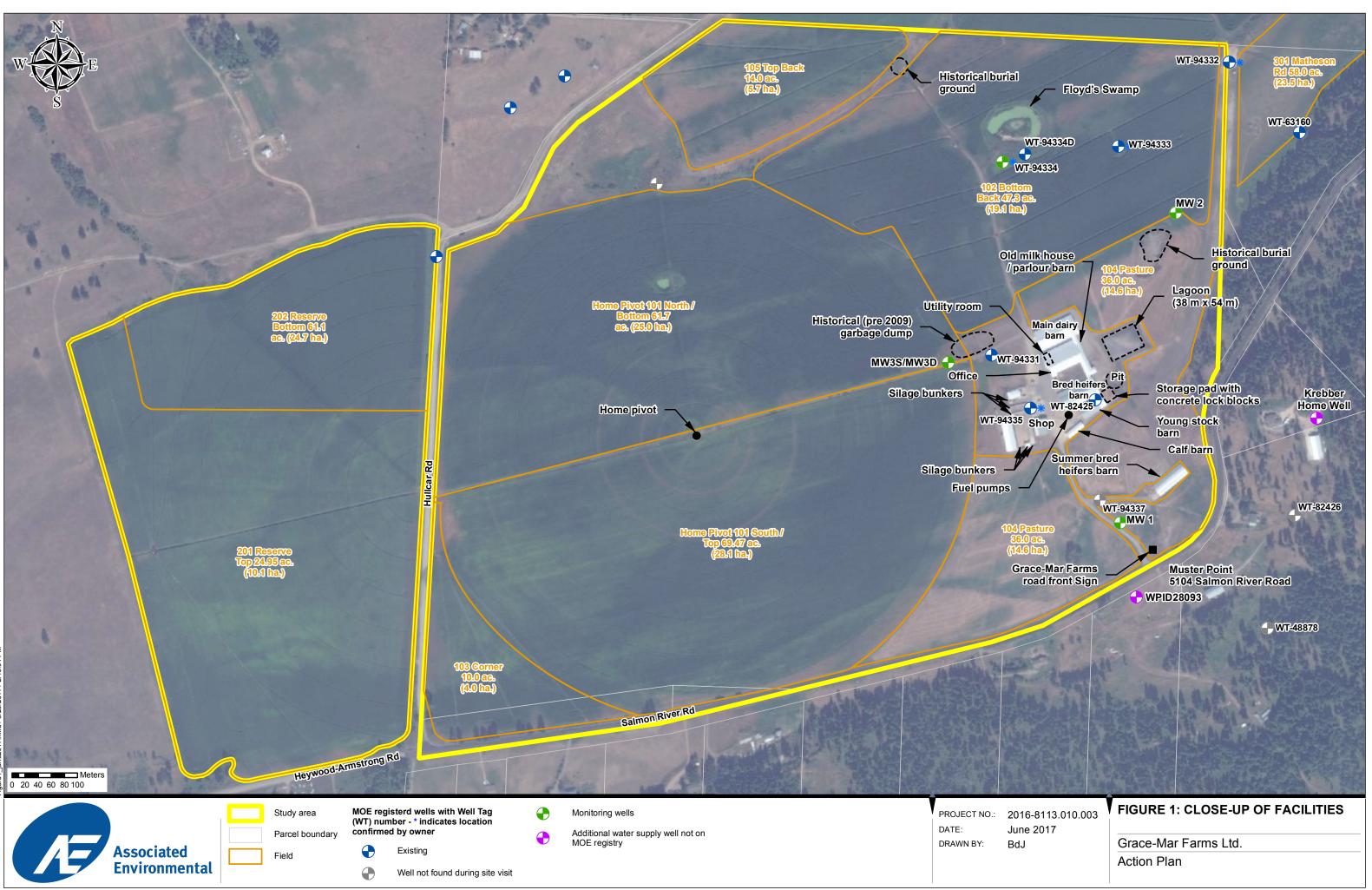
The first formal summary letter is due June 30, 2017. This letter meets the requirements of the first formal summary letter for Action #14. The letter includes methods, results and discussion, quality assurance/quality control, and any additional measures.

3 METHODS

Water quality samples were collected by Marta Green of Associated, following standard BC methods (MWLAP 2013), from the locations listed in Table 1 and shown on Figure 1. These locations differ slightly from those listed in the Action Plan in that WPID 28093 and Mr. James Krebber's Well were sampled instead of WT82426 and WT48878. This was because during the field visit, Associated confirmed that WT82426 and WT48878 either do not exist, or are in a different location than shown on the BC Water Resource Atlas. Instead, WPID 28093 and Mr. Krebber's Well were sampled because they represent the closest domestic wells to MW1 (which was the goal in the Action Plan). Samples were collected on May 24, 2017, with the exception of Mr. Krebber's Well, which could not be accessed during the May site visit and was instead sampled on June 20, 2017. Field sheets from the sampling events are attached.



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Sample Location	Sample Description
MW1	Monitoring well (installed in 2016)
MW2	Monitoring well (installed in 2016)
MW3S	Monitoring well (installed in 2016)
MW3D	Monitoring well (installed in 2016)
WTN 94334	Industrial well owned by Grace-Mar Farms. Used for livestock watering and barn washing.
WTN 94335	Industrial well owned by Grace-Mar Farms. Used for livestock watering and barn washing.
WPID 28093	Domestic, Irrigation and Industrial Use well owned by James Krebber. Used for domestic purposes (rental home) and livestock watering.
James Krebber's Well (no well tag number or well plate identifier)	Domestic well owned by James Krebber. Used for domestic purposes.
Floyd's Swamp	Surface water

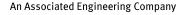
Table 1: Spring 2017 Sampling Locations

Note: WTN refers to well tag number, which is a number assigned to a well log that is voluntarily submitted to MOE. WPID refers to well plate identifier, which is a steel plate affixed to the top of the casing on some wells by the well driller.

Water samples were shipped under chain-of-custody protocol to CARO Analytical Services (CARO) in Kelowna, BC for analysis of the parameters listed in the Action Plan: nitrate-N, nitrite-N, ammonia, TKN, total nitrogen, chloride, and total phosphorous (Associated 2017). A field duplicate sample² was also collected during the May 2017 sampling event.

The groundwater results were compared with the BC Approved and Working Water Quality Guidelines (BCAWQG/BCWWQG) for irrigation (I), livestock (L), and drinking water (DW) (MOE 2017a,b) and the Guidelines for Canadian Drinking Water Quality (GCDWQ) Maximum Acceptable Concentrations (MAC) and Aesthetic Objectives (AO) (Health Canada 2017). The results from Floyd's Swamp were compared with the same guidelines plus the BCAWQG/BCWWQG for aquatic life (AL) (MOE 2017a,b).

² Collection and analysis of duplicate samples provides information on the combined (field and analytical) precision of the sampling and the analytical program. Data are assessed by calculating the relative percent difference between the primary and duplicate sample, and comparing the data to acceptable thresholds (MWLAP 2013).







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4 RESULTS AND DISCUSSION

4.1 WATER QUALITY DATA

The groundwater results, tabulated and compared with applicable guidelines, are presented in Table 2. Also included in the tables are the results for nitrate-N, nitrite-N, ammonia-N, TKN, total nitrogen, chloride and total phosphorus from the October 2016 sampling event, for comparison purposes. Table 3 presents the results from Floyd's Swamp, which was only tested in May 2017. The original laboratory reports are attached.

The May 2017 groundwater quality data (Table 2) generally met applicable guidelines with the exception of the nitrate-N concentration in Mr. Krebber's Well, which was detected at 13.0 mg/L (the GCDWQ MAC and BCAWQG DW is 10 mg/L). The field-measured pH (6.95) in Mr. Krebber's Well was just below the lower end the GCDWQ Operational Guideline range of 7.0-10.5. pH is not considered to directly affect health; however, pH changes can influence the bio-availability of other parameters. The GCDWQ Operational Guideline for pH is set to maximize the effectiveness of treatment and to control corrosion/leaching from pipes (Health Canada 2015).

Of general note, nitrate-N, which exceeded the GCDWQ MAC and BCAWQG DW guideline in October 2016 in MW1 and MW3S, was not detected in either of these wells in May 2017. Interpretation of the results will occur after the next scheduled sampling event, which is planned for fall 2017.

The water quality data from Floyd's Swamp (Table 3) met the applicable guidelines with the exception of temperature (15.3°C), which exceeded the BCAWQG DW and GCDWQ AO (both 15°C), and nitrite-N (0.720 mg/L), which exceeded the BCAWQ AL (0.60 mg/L when chloride is >10 mg/L).

Based on the sampling completed for this report, completed to address Action #14, there are no changes to the overall conclusions of the November 2016 EIA report. The spring sampling confirmed that nitrate-N concentrations in local groundwater can be variable – nitrate-N was not detected in two wells where it previously exceeded the DW guideline (MW1 and MW3S), but was found to be above-guideline in a well that was not sampled before (Krebber). Additional interpretation and update of the environmental assessment findings will be completed after the second round of sampling, and reported in the required June 2018 summary letter.



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Table 2: Grace-Mar Groundwater Quality Results (Action #14 Sampling) Fall 2016 and Spring 2017 Data

							Samp	ling Location	M	W1	M	N2	MV	V3S	MV	V3D	WPID 28093	WTN 94335		WTN 94334	ļ	James Krebber Home
							C	ate Sampled	18-Oct-16	24-May-17	04-Oct-16	24-May-17	04-Oct-16	24-May-17	05-Oct-16	24-May-17	24-May-17	24-May-17	04-Oct-16	24-May-17	24-May-17	20-Jun-17
		1						Sample Type	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Duplicate	Normal
• • •			11	1	Guideline ¹	1	000140	0.0014/0														
Analyte	Unit	BCAWQG I	BCWWQG	BCAWQG	BCWWQG I	BCAWQG DW	GCDWQ MAC	GCDWQ AO														
Field Results							MAC															
Conductivity	µS/cm	NG	700 ^{3.1}	NG	NG	NG	NG	NG	1441	880	1320	1080	1720	1410	1510	1280	1180	1110	1550	1580	1580	1730
Oxidation reduction potential	mV	NG	NG	NG	NG	NG	NG	NG	66	13	34	15	83	16	18	24	16	99	38	78	78	110
рН		5.0 - 9.0 ^{2.1}	NG	5.0 - 9.5 ^{4.1}	NG	6.5 - 8.5 ^{5.1}	NG	7.0 - 10.5 7.1	7.17	7.5	7.06	7.3	6.80	7.1	7.23	7.4	7.4	8.0	7.16	7.4	7.4	6.95
Temperature	°C	N ^{2.2}	NG	N ^{4.2}	NG	15 ^{5.2}	NG	15	10.1	7.9	12.9	8.4	9.7	9.0	9.4	9.1	10.0	9.5	10.9	9.7	9.7	12.2
Lab Results																						
General																						
Chloride	mg/L	100	NG	600 ^{4.3}	NG	250 ^{5.3}	NG	250	47.5	22.6	41.9	35.6	54.5	50.5	30.3	30.3	6.72	36.2	18.9	26.1	26.4	28.1
Nutrients																						
Ammonia (total, as N)	mg/L	NG	NG	NG	NG	NG	NG	NG	0.031	0.030	0.050	0.022	<0.020	0.031	0.257	0.176	0.025	0.036	0.330	0.375	0.356	<0.020
Nitrate (as N)	mg/L	NG	NG	100 4.4	NG	10 ^{5.4}	10	NG	<u>21.0</u>	<0.010	7.82	<0.010	<u>16.6</u>	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<u>13.0</u>
Nitrate + Nitrite (as N)	mg/L	NG	NG	100 4.5	NG	NG	10 ^{6.1}	NG	21.0	<0.0100	7.91	0.0420	16.7	0.0292	<0.010	0.0147	<0.0100	<0.0100	<0.010	<0.0100	<0.0100	13.0
Nitrite (as N)	mg/L	NG	NG	10 ^{4.6}	NG	1 ^{5.5}	1	NG	<0.010	<0.010	0.094	0.042	0.016	0.029	<0.010	0.015	<0.010	<0.010	<0.010	<0.010	<0.010	0.028
Total nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	21.5	0.457	8.61	0.335	17.2	0.423	0.468	0.429	0.0890	0.275	0.552	0.563	0.558	13.5
Total kjeldahl nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	0.56	0.457	0.69	0.293	0.52	0.394	0.47	0.414	0.089	0.275	0.55	0.563	0.558	0.446
Phosphorus (total, by ICPMS/ICPOES method)	mg/L	NG	NG	NG	NG	N ^{5.6}	NG	NG	0.04		0.03		<0.02		0.05				0.05			
Phosphorus (total, APHA method)	mg/L	NG	NG	NG	NG	N ^{5.6}	NG	NG	0.025	0.0452		0.0096		<0.0020	0.026	0.0399	0.0027	0.0056		0.0401	0.0408	<0.0020

¹ See attachments for guideline notes.

Legend	
<	Less than reported detection limit
NG	No Guideline
N	Narrative type of guideline or standard, or Result Note.
Calc	Calculated guideline. The guideline is dependent on the value of one or more other analytes, and is calculated from a formula or table.
BCAWQG I	Highlighted value exceeds the BC Approved Water Quality Guidelines for irrigation (BCAWQG I)
BCWWQG I	Highlighted value exceeds the BC Working Water Quality Guidelines for irrigation (BCWWQG I)
BCAWQG L	Highlighted value exceeds the BC Approved Water Quality Guidelines for livestock (BCAWQG L)
BCWWQG L	Highlighted value exceeds the BC Working Water Quality Guidelines for livestock (BCWWQG L)
BCAWQG DW	Highlighted value exceeds the BC Approved Water Quality Guidelines for drinking water (BCAWQG DW)
GCDWQ MAC	Highlighted value exceeds the Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentrations (GCDWQ MAC)
GCDWQ AO	Highlighted value exceeds the Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives (GCDWQ AO)



									Sam	oling Location	Floyd's Swamp
										Date Sampled	24-May-17
										Sample Type	Normal
						Guideline	_				
Analyte	Unit	BCAWQG AL	BCWWQG AL	BCAWQG I	BCWWQG I	BCAWQG L	BCWWQG L	BCAWQG	GCDWQ	GCDWQ	
Field Results		AL	AL					<u>DW</u>	MAC	AO	
Conductivity	µS/cm	NG	NG	NG	700 ^{3.1}	NG	NG	NG	NG	NG	1490
Oxidation reduction potential	mV	NG	NG	NG	NG	NG	NG	NG	NG	NG	3
рН		N ^{1.1}	NG	5.0 - 9.0 ^{2.1}	NG	5.0 - 9.5 ^{4.1}	NG	6.5 - 8.5 ^{5.1}	NG	7.0 - 10.5 ^{7.1}	7.7
Temperature	°C	19 ^{1.2}	NG	N ^{2.2}	NG	N ^{4.2}	NG	15 ^{5.2}	NG	15	<u>15.3</u>
Lab Results											
General											
Chloride	mg/L	600 ^{1.3}	NG	100	NG	600 ^{4.3}	NG	250 ^{5.3}	NG	250	30.4
Nutrients											
Ammonia (total, as N)	mg/L	Calc ^{1.4}	NG	NG	NG	NG	NG	NG	NG	NG	1.14
Nitrate (as N)	mg/L	32.8 ^{1.5}	NG	NG	NG	100 4.4	NG	10 ^{5.4}	10	NG	<0.010
Nitrate + Nitrite (as N)	mg/L	32.8 ^{1.6}	NG	NG	NG	100 ^{4.5}	NG	NG	10 ^{6.1}	NG	0.720
Nitrite (as N)	mg/L	Calc 1.7	NG	NG	NG	10 4.6	NG	1 ^{5.5}	1	NG	0.720
Total nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	4.72
Total kjeldahl nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	4.00
Phosphorus (total, APHA 4500-P)	mg/L	N ^{1.8}	NG	NG	NG	NG	NG	N ^{5.6}	NG	NG	0.410

¹ See attachments for guideline notes.

Legend	
<	Less than reported detection limit
NG	No Guideline
Ν	Narrative type of guideline or standard, or Result Note.
Calc	Calculated guideline. The guideline is dependent on the value of one or more other analytes, and is calculated from a formula or table.
BCAWQG AL	Highlighted value exceeds the BC Approved Water Quality Guidelines for aquatic life (BCAWQG AL)
BCWWQG AL	Highlighted value exceeds the BC Working Water Quality Guidelines for aquatic life (BCWWQG AL)
BCAWQG I	Highlighted value exceeds the BC Approved Water Quality Guidelines for irrigation (BCAWQG I)
BCWWQG I	Highlighted value exceeds the BC Working Water Quality Guidelines for irrigation (BCWWQG I)
BCAWQG L	Highlighted value exceeds the BC Approved Water Quality Guidelines for livestock (BCAWQG L)
BCWWQG L	Highlighted value exceeds the BC Working Water Quality Guidelines for livestock (BCWWQG L)
BCAWQG DW	Highlighted value exceeds the BC Approved Water Quality Guidelines for drinking water (BCAWQG DW)
GCDWQ MAC	Highlighted value exceeds the Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentrations (GCDWQ MAC)
GCDWQ AO	Highlighted value exceeds the Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives (GCDWQ AO)





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4.2 QUALITY ASSURANCE/QUALITY CONTROL DATA (QA/QC)

The relative percent difference (RPD) calculations from the duplicate sample set collected from WTN 94334 in May 2017 indicated good reproducibility, suggesting acceptable precision of the analytical data. The highest calculated RPD was 5.2%, and the average was 1.1%.

Information about the laboratory's QA/QC are provided as part of the attached laboratory reports. The laboratory used for the analysis (CARO) is accredited with the Canadian Association for Laboratory Accreditation.

5 **RECOMMENDATIONS**

Two changes to the monitoring program are recommended as follows:

- 1. Continue to sample WPID 28093 and Mr. Krebber's Well, which were sampled instead of WT82426 and WT48878 because these wells do not exist where they were originally thought to be located. The goal of sampling these two wells (WT48878 and 82426) was to sample the closest domestic well to MW1, because MW1 exceeded guidelines for nitrate-N. Collecting samples from the wells nearest to MW1 are the next step to better understand the source of the nitrate-N, and also to assess groundwater quality in nearby receptors. Mr. Krebber, owner of the property on which WT82426 and 48878 were thought to have been located, confirmed that his home well and WPID 28093, which is the source water for his rental home and cattle watering, are the nearest water supply wells to MW1.
- 2. Sample during high groundwater period (e.g.: spring or early summer) and low groundwater period (e.g. fall/winter) in 2017 and then re-assess frequency. The rationale for this change is the current schedule has sampling occurring in March and November in 2017 and then re-assess frequency. The goal of sampling in May and November was to sample twice a year coinciding with periods of high groundwater and low water respectively. High water was late this year. Grace-Mar therefore requests a change to the schedule in Action 14 to provide more flexibility to better capture the range in the hydrological cycle. This will improve the ability to assess environmental effects from land use activities.





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6 **CLOSURE**

We trust that this report satisfactorily meets the requirements of Action Plan Item #14. The next sampling event will occur in fall 2017. Please contact the undersigned if you have any questions.

Yours truly,



Senior Hydrogeologist

ATTACHMENTS

Field Sheets Laboratory Reports Guideline Notes (for Tables 2 and 3)

> BEST MANAGED COMPANIES

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REFERENCES

- Associated Environmental Consultants Inc. (Associated). 2017. Grace-Mar Farms Ltd. Action Plan: AMS# 350101 (UA Hullcar Aquifer). March 2017.
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- British Columbia Ministry of Water, Land and Air Protection (MWLAP). 2013. British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples. 2013 Edition. Available at: <u>http://www2.gov.bc.ca/assets/gov/environment/research-monitoring-and-reporting/monitoring/emre</u> /field_sample_man2013.pdf
- Health Canada. 2015. Guidelines for Canadian Drinking Water Quality. Guideline Technical Document pH. Prepared by the Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment. Available at: <u>https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadiandrinking-water-quality-guideline-technical-document-ph.html</u>
- Health Canada. 2017. Guidelines for Canadian Drinking Water Quality Summary Table. Prepared by the Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment. Updated February 2017. Available at: <u>https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reportspublications/water-quality/guidelines-canadian-drinking-water-quality-summary-table-healthcanada-2012.html</u>



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ATTACHMENT 1: FIELD SHEETS

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	acility Nar		FRACE	MAR		Client:			2	1
Well	ID:		MWI			Project Nu	umber:	2916-	8113,000	
Date				24,201	7	Sampled b	oy:	MG		
Casir	ng Diameter	r:				Weather:				
Well	Stick-up:					Remarks:			-	
Cond	lition of well	:	good	needs	attention					
			-						,	5
					_	Is the well	marked/fla	gged? Y	es No	
DTB:			7-883	m	Pressure:					
DTW			3.575	m	negative	positive		UTM Coor	dinates:	
Diffe	rence:		4.3	m	none			Easting (6	digits)	
			X 2	L/m						
	ne of water in		8-6	Litres	-	sing has 18L		Northing (7	⁷ digits)	
	ne of water to		,25	Litres	1	sing has 8L/n	n	7		
Volum	ne actually pu			Litres	5cm (2") cas	ing has 2L/m		Zone:		
Purge	e method:		or until st Bailer	Pump	None	Other: /	2014. 1h	i lou	Am	
-	ed to dry:		Yes	No	Nono	e unon.	001911	(100	TIDU	
Purge	e water disp	osal:	Ground	Container					luring purging	g or sampli
Field I	Parameters						Yes	No		
-	Volume (L)	Time	pН	Temp °C	Cond µS/cm	ORP (mv)	Turbidity	Colour	Odour	Comme
1st	2	8:45	8.3	7.9	8/08/ 830	46	Clr			
2nd	3	8:49	7.6	7.9	830	30	d			
3rd	Ŷ	8:53	7.5	29	880	17	CIF			4
4th	6	8:58	7.5	7-9	480	12	11-			5. 20
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Appea			about	LAAL	mi iles		Sample Cold			
	of bottles colle		npled/bottles	micodi	1.40					
	-		Preserved?	0						
VVEIE	Samples Fi	tereu anu r	-Teserveu :	Tes NO						
	cate Samp	le?	Yes	No	Duplicate	Sample ID	:			
Dupli				Conserved	-	-				
-	-									
Additi	onal Notes:									
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Casing Diameter: Wealther: Weather: Particle of the second of the	Casing Diameter: Weather:	Well I):				2			1016	8113	
Well Stick-up: Own the second state and the sec	Well Stick-up: Oracu Remarks: Condition of well: gGod needs attention Is the well marked/flagged? Yes No DTB: 1/34 m negative positive UTM Coordinates: DTW: 1/34 m negative positive UTM Coordinates: Difference: 3.3 m none Easting (6 digits) Volume of water in well: 7 Litres 15cm (6') casing has 18L/m Northing (7 digits) Volume actually purged: Litres 10cm (4') casing has 2L/m Zone: Zone: Purge method: Bailer Pump None Other: Yes No Yeld Parameters Ground Container Was sheen observed during purging or sam Yes No Yeld Parameters Ground Cond U/4 Litres No Litres No ard 1/1.00 7.4 8.3 1/240 Litres No Litres No ard 1/1.00 7.4 8.3 1/240 Litres No Litres No ard 1/1.10 7.3 <td< td=""><td>Date:</td><td></td><td></td><td>hlay</td><td>2017</td><td></td><td>Sampled b</td><td>by:</td><td>MF</td><td></td><td></td></td<>	Date:			hlay	2017		Sampled b	by:	MF		
Condition of well: gGod needs attention Is the well marked/flagged? Yes No DTB: 1/34 m negative positive UTM Coordinates: DTW: 1/34 m none Easting (6 digits)	Condition of well: good needs attention Is the well marked/flagged? Yes No DTB: 1/24 m negative positive UTM Coordinates: DTW: 1/24 m negative positive UTM Coordinates: Difference: 3.3 m none negative positive UTM Coordinates: Volume of water in well: 7.2 Um Litres fism (6") casing has 18Um Northing (7 digits) Volume actually purged: Litres 5cm (2") casing has 2Um Zone: Zone: Purge method: Bailer Pump None Other: Yes No Purge water disposal: Ground Container Was sheen observed during purging or sam Yes No Field Parameters Cond Cond ORP (mv) Turbidity Colour Cond 1st 3 11:00 2.4 2.3 Cond 2 1 2 2nd 11:00 2.5 9.4 (070 1 1 1 2 3rd 11:00 2.5 9.4 (070 1	Casing	J Diameter	r:		\$		Weather:	٢	104014	W/ av	n 1 WW
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8th Image: Sample date: Image: Sample date: Image: Sample date: Image: Sample time: (IIII0-144H) ///////////////////////////////////	8th write additional lines on the back Sample Descriptions: Sample Descriptions: Sample date: Minute additional lines on the back Appearance: Sample time: Order of bottles collected: Sample time: List any Parameters not Sampled/bottles missed: Sample Siltered and Preserved? Yes No Duplicate Sample? Yes Additional Notes: - site access - hidden well location - safety concerns		Δ	11.10	1.7	8-9	1080	15				
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	Were Samples Filtered and Preserved? Yes No Duplicate Sample? Yes No Duplicate Sample ID: Additional Notes: - site access - hidden well location - safety concerns - safety concerns				H							
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Site/Fa	cility Nar	ne:				Client:				
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			8			Is the well	marked/flag	gged? Y	es No	
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DTW:			5.755	m	negative	positive		UTM Coor	dinates:	
Differe	nce:		3-6	m	none			Easting (6		
		1. A.	X 2	L/m						
	of water in		7	Litres	15cm (6") ca	sing has 18L/	'n	Northing (7	7 digits)	
	of water to		21	Litres	10cm (4'') ca	sing has 8L/n	ı			
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iold Do	rameters						Yes	No		
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		/	,	0,1	1490	15				
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3rd	4	10:15	7.1	8.9	1480	16				
4th	S	10:18	7.1	8.8	1450	16				
5th	6	10:24	7.1	9.1	1410	16				
6th	7	10-31	7.1	9.0	1410	16				
7th		1					-			
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	e Descrip	on the back tions: MAY 2 th	2017		Sample time:	(10-20	on soffle	5) 103	31	
ppeara	nce:						Sample Colo	ur: ///		
order of	bottles colle	ected:		- yell	an der	· ·				
	Paramete	ers not Sam	pled/bottles	missed:						
				Vee Ne						
		tered and P	reserved?	res no						
Vere Sa			Yes	No	Duplicate	Sample ID:		-	×	
Vere Sa Duplica	amples Fil ate Samp nal Notes:	le?			Duplicate	Sample ID:				
Vere Sa Duplica	amples Fil ate Samp nal Notes: cess	le?			Duplicate	Sample ID:				
Vere Sa Duplica Addition site acc hidden safety of	amples Fil ate Samp nal Notes: cess well locatio concerns	le? n			Duplicate	Sample ID:				
Vere Sa Duplica Addition - site acc - hidden - safety of	amples Fil ate Samp nal Notes: cess well locatio	le? n			Duplicate	Sample ID:				
Vere Sa Duplica Addition - site acc - hidden - safety of	amples Fil ate Samp nal Notes: cess well locatio concerns	le? n			Duplicate	Sample ID:				
Vere Sa Duplica Addition - site acc - hidden - safety of	amples Fil ate Samp nal Notes: cess well locatio concerns	le? n			Duplicate	Sample ID:				
Vere Sa Duplica Addition site acc hidden safety of	amples Fil ate Samp nal Notes: cess well locatio concerns	le? n			Duplicate	Sample ID:			, , , ,	
Vere Sa Duplica Addition site acc hidden safety of	amples Fil ate Samp nal Notes: cess well locatio concerns al well behav	le? n viour			Duplicate	Sample ID:			х. Х.	
dditior site acc hidden safety o	amples Fil ate Samp mal Notes: cess well locatio concerns al well behav	le? n	Yes		Duplicate	Sample ID:				

	Facility Nar	ne:	1	0		Client:		5		
Well			Mu	130		Project Nu	imber:			
Date	:		May	23 2017		Sampled b	by:	Ma		. e
	ng Diamete	r:				Weather:	900	wholy		
	Stick-up:		YL			Remarks:		(
Conc	dition of wel	l :	good	needs	attention					
								10		
DTB	(1	[13		7_	Is the well	marked/fla	gged? Y	'es No	
DTW	12.1	105)	17 5.805	m	Pressure:	positive				
	rence:		7-0.07	m	negative none	positive		UTM Cool		
Dine			71 × 2	m L/m				Easting (6	algits)	
Volun	ne of water ir	ı well:	22	Litres	- 15cm (6") c	asing has 18L/	m	Northing (7 digits)	
	ne of water to		1	Litres		asing has 16L/ asing has 8L/m		(. digitoj	
	ne actually p			Litres	-	sing has 2L/m		Zone:		
		0	k chtil st		misty			L		
	e method:		Bailer	Pump	None	Other:				
-	ed to dry: e water disp	ocal	Yes Ground	No Container			Wee cheer	choomed		
Furge	e water uisp	USal.	Ground	Container			Yes	No	auring purgin	g or sampling
Field	Parameters			*	Cond	1	1	1		
	Volume (L)	Time	pH	Temp °C	µS/cm	ORP (mv)	Turbidity	Colour	Odour	Comment
1st	2	9:40	7.4	9.1	1320	17	dr	CIT	ngene	
2nd	3	9.46	7.5	9.1	1310	19	clr	01	hond	
3rd	4	9:49	7.4	9.1	1300	20	dr	1	[]	
4th	5	9:52	24	9_1	1280	2.4	dr.	11/	h	
5th										
6th										
7th							,			
8th										
write a	I dditional lines	on the back					200	1		
Samp	ole Descrip		22210			0				
- 1	e date:	May	L'S 2017		Sample time	9:5	2		_	
Sampl	rance:	11/			1		Sample Cold	our: c/-		
	of bottles colle	ected:	hello	the clar		1. E. I.				
Appea	of bottles colle		nled/hottle	s missed:						
Appea Order	ny Paramete	ers not Sam	ipica/sollic							
Appea Order List a			-							
Appea Order List a Were	ny Paramete Samples Fil	tered and F	Preserved?	Yes No		0	×			
Appea Order List a Were	ny Paramete	tered and F	-		Duplicate	Sample ID:				
Appea Order List a Were Dupli Additi	ny Paramete Samples Fil icate Samp ional Notes:	tered and P le?	Preserved?	Yes No	Duplicate	Sample ID:				
Appea Order List a Were Dupli Additi - site a	ny Paramete Samples Fil icate Samp ional Notes: access	tered and F	Preserved?	Yes No	Duplicate	Sample ID:	-			
Appea Order List a Were Dupli Additi - site a - hidde - safet	ny Paramete Samples Fil icate Samp ional Notes: access en well locatio ty concerns	tered and F le?	Preserved?	Yes No	Duplicate	Sample ID:				
Appea Order List a Were Dupli Additi - site a - hidde - safet	ny Paramete Samples Fil icate Samp ional Notes: access en well locatio	tered and F le?	Preserved?	Yes No	Duplicate	Sample ID:				
Appea Order List a Were Dupli Additi - site a - hidde - safet	ny Paramete Samples Fil icate Samp ional Notes: access en well locatio ty concerns	tered and F le?	Preserved?	Yes No	Duplicate	Sample ID:				
Appea Order List a Were Dupli Additi - site a - hidde - safet	ny Paramete Samples Fil icate Samp ional Notes: access en well locatio ty concerns	tered and F le?	Preserved?	Yes No	Duplicate	Sample ID:				

	acility Nan	ne:				Client:				
Vell I	D:		Flou	d su	amp	Project Nu	mber:		2016 811	3
Date:			Mar	24 2017	T	Sampled b	oy:	MG		
Casin	g Diameter	:	: svife	ilewate		Weather:		ny + 1-1	014 85	
	Stick-up:					Remarks:			5,8	2
	ition of well	:	good	needs	attention	1				
						·				
						Is the well	marked/flag	gged? Y	es No	
DTB:				m	Pressure:					
DTW:			· · ·	m	negative	positive		UTM Coor	dinates:	
Differe	ence:			m	none			Easting (6		
			X 2	L/m] ·					
Volum	e of water in	well:		Litres] 15cm (6") ca	sing has 18L/	m	Northing (7 digits)	
Volum	e of water to	purge:		Litres	10cm (4") ca	ising has 8L/m	1			
/olum	e actually pu	irged:		Litres	1	ing has 2L/m		Zone:		
			N.		7 - Ann			-		
-	method:		Bailer	Pump	None	Other:				
_	d to dry: water disp	osal:	Yes Ground	No Container			Was shoon	observed o	during purging	or sampling?
				to sapl	1.		Yes	No	a karauri	, si samping f
	Parameters	· · · · · · · · · · · · · · · · · · ·	1	1	Cond				1	
	Volume (L)	Time	рН	Temp °C	μS/cm	ORP (mv)	Turbidity	Colour	Odour	Comments
1st		11:35	7.7	15.3	1490	3	some bl	toun fli	ets non	4
2nd		2								
3rd										
4th										
5th				1.5						
6th			Š.							
7th		-								
8th										
	dditional lines									
	le Descript	tions:	(M) V	1		11.do	11126	1 127	17	
ample	e date:	1 lay	1 1/101		Sample time	: 11.10	(11 ")	on boll-	e) Faint LV	
ppear	ance:		11	1	1	0	Sample Colo	ur:)119ht	Faint GV	0V-n
Irdor c	of bottles colle	cted:	yella	the v	hite ,	from wh	ite ~	-	1	v ²
nuerc	ny Paramete	rs not Sam	pled/bottles	s missed:			2			
		tered and P	reserved?	Yes No						
.ist an	Samples Fil			2						
.ist an Vere S				(.)						
ist an Vere S	cate Samples Fill	e?	Yes	No	Duplicate	Sample ID:	1			
.ist an Vere S Duplic								/		
ist an Vere S Duplic Additic	cate Sampl		Invested	to bu	reh de	oth pl	-h Str			
List an Vere S Duplic Additic site a hidde	cate Sampl		Inverted	to bu	reh de	oth pl	-h Str		2 m f	en H_
List an Were S Duplic Additic - site an - hidde - safety - unusu	cate Sampl onal Notes: access on well location y concerns ual well behav	n Taken	Invested 3 m	to bu	sf ha	the pr	-h Str		2m f	en thei
List an Were S Duplic Additic - site an - hidde - safety - unusu	cate Sampl onal Notes: access on well location y concerns ual well behav	n Taken	Invested 3 m	to bu	sf ha	the pr	-h Str		2m f	on floring
List an Were S Duplic Additic - site an - hidde - safety - unusu	cate Sampl onal Notes: access on well location y concerns ual well behav	n Taken	Invested 3 m	to bu	sf ha	the pr	-h Str		2m f	on them,
List an Were S Duplic Additic - site an - hidde - safety - unusu	cate Sampl onal Notes: access on well location y concerns ual well behav	n Taken	Invested 3 m	to bu	sf ha	the pr	-h Str		2m f	on flori,
List an Vere S Duplic Additic site an hidde safety unusu	cate Sample onal Notes: cccess in well location y concerns ual well behave when y	n taken viour 2056 fron (be ensil)	Invested 3 m	to bu	sf ha	the pr	-h Str		2m f	en flori Fo
ist an Vere S Duplic Additionsite an hidde safety unusu	cate Sample onal Notes: ccess in well location y concerns ual well behave well well behave on the second second of the second second second second second second second second second second second second se	n Taken	Inverted 3 m SW fer	to bu	sf ha	the pr	-h Str		2m f	en fler,

and and a

Field Sampling	Sheet - Gi	roundwate	r		3				
Site/Facility Na	ime:				Client:				
Well ID:		WPID	2809	3	Project Nu	mber:	2016.2	P113	
Date:		MAY	2420	ort	Sampled b	y: a	MF		
Casing Diamete	er:		1		Weather:		cloug	4 10	6
Well Stick-up:				11	Remarks:		West and a second s		
Condition of we	II:	good	needs	attention	8				
					1				
					Is the well	marked/fla	gged? Y	es No	
DTB: Noinfo			m	Pressure:		8			
DTW: NO 9	ccess		m	negative	positive		UTM Coor	dinates:	
Difference:			m	none			Easting (6	digits)	
		X 2	L/m]					
Volume of water	in well:		Litres] 15cm (6") ca	asing has 18L/	m	Northing (7	' digits)	
Volume of water	to purge:		Litres]10cm (4") ca	asing has 8L/m	1. ¹ . 2		1995 P	
Volume actually p	ourged:		Litres	5cm (2") cas	sing has 2L/m		Zone:		
		N.							
Purge method:		Bailer	Pump	None	Other:				
Purged to dry: Purge water dis	nosal	Yes Ground	No Container			Was shoor	observed		g or sampling?
Fulge water uis	p05a1.	Giouna	Container			Yes	No	uning purgin	g or sampling?
Field Parameters	1	1	T	Cand	<u>, </u>		1		-
Volume (L)	Time	рН	Temp °C	Cond µS/cm	ORP (mv)	Turbidity	Colour	Odour	Comments
1st									
2nd	1:34	2.4	10-3	1190	19				
3rd	1:26	74	98	1200	15				
4th	1:44	7.0	1-0	1190	15				
	111	+. 5	10-2		1				
5th	1:46	7.5	10-0	1180	16				
6th		1	ж. ⁴	- -					
7th			N						
8th									
write additional line		2					-L		
Sample Descri	- /				11-110	1 Litte	1111		
Sample date:	Clea	/		Sample time	<u> </u>	on solle	1-45		
Appearance:		89				Sample Cold	o <u>ur:</u>		
Order of bottles co	llected:	yellon	riller			5			
List any Parame	ters not San	npled/bottle	s missed:		2		5 - S		1
Were Samples F	iltered and I	Preserved?	Yes No	al du	rected in	bothle			
Duplicate Sam	ple?	Yes	No	Duplicate	Sample ID:				
Additional Note: - site access - hidden well locat - safety concerns - unusual well beh	s: ion aviour	ores 3 Jason	homes, know	- thi - thi		ly ward	ul avoi	and as	for as

Associated Environmental

3

	cility Nar	ne:				Client:				MAGMAIL
Nell ID			WTQL	+334		Project Nu	mber:		201	6-8118
Date:			May 2.	4207		Sampled b	by:	me		-1
Casing	Diameter	r:				Weather:	clady	1001	an pl	DWRN
	tick-up:					Remarks:)			
Conditi	on of well	l:	good	needs	attention	1				
						1				
						Is the well	marked/fla	gged? Y	es No	
DTB:				m	Pressure:					
DTW:				m	negative	positive		UTM Coor	dinates:	-
Differer	nce:			m	none			Easting (6	digits)	
			X 2	L/m						
	of water in			Litres	15cm (6'') ca	sing has 18L/	m	Northing (7	⁷ digits)	-
	of water to		1	Litres	1	sing has 8L/m	1			
Volume	actually p	urged:		Litres	5cm (2") cas	ing has 2L/m		Zone:		
Duras	nothed		Pailer	Dumo	None	Other:				
Purge n Purged	nethod: to dry:		Bailer Yes	Pump No	None	Other:				
-	vater disp	osal:	Ground	Container			Was sheer	observed d	luring purg	ing or sampling
Field Pa	rameters						Yes	No		
1	olume (L)	Time	рН	Temp °C	Cond	ORP (mv)	Turbidity	Colour	Odour	Comments
1st	. ,	12:37	7.4	92	µS/cm 1560	76				
				9.8	1					tomostap on
2nd		12:43	7.4		1370	78				
3rd		12145	1-7	9.8	1560	79				
4th		1249	7-4	9-7	1580	78				
5th										
6th					×					
7th										
8th										
write add	litional lines	s on the back	I			×				1
Sample	e Descrip	tions:				NUT	1.0	10.1	+47.)	
Sample o	date: /	1A724	2017		Sample time:	12 4 4	(12	20023	2011(0)	
		clem					Sample Cold	our: clea	C	
	nce:			· al	er					
Appeara	nce: bottles colle	ected:	yello.	1	en					
Appearai Order of	bottles colle		pled/bottles	1						
Appearan Order of List any	bottles colle Paramete	ers not Sam	Ó	missed:						
Appearan Order of List any Were Sa	bottles colle Paramet e amples Fil	ers not Sam Itered and P	pled/bottles	missed: Yes No						<u>.</u>
Appearan Order of List any Were Sa	bottles colle Paramete	ers not Sam Itered and P	pled/bottles	missed: Yes No		Sample ID:	Pup!			
Appearan Order of List any Were Sa Duplica	bottles colle Paramete amples Fil ate Samp	ers not Sam Itered and P Ile?	pled/bottles Preserved? Yes	s missed: Yes No No	Duplicate		1			1)
Appearan Order of List any Were Sa Duplica Additior - site acc	bottles colle v Paramete amples Fil ate Samp mal Notes cess	ers not Sam Itered and P Ile?	pled/bottles Preserved? Yes	s missed: Yes No No	Duplicate		1	ile pre	e Su.	benter sp
Appearan Order of List any Were Sa Duplica Additior - site acc - hidden	bottles colle v Paramete amples Fil ate Samp nal Notes cess well locatio	ers not Sam Itered and P Ile?	pled/bottles Preserved?	s missed: Yes No No	Duplicate		1	ile fre	esu.	tenter st
Appearan Order of List any Were Sa Duplica Additior - site acc - hidden - safety of	bottles colle v Paramete amples Fil ate Samp mal Notes cess	ers not Sam Itered and P ole?	pled/bottles Preserved? Yes	s missed: Yes No No	Duplicate		1	ill be	esu.	treated st
Appearan Order of List any Were Sa Duplica Additior - site acc - hidden - safety of	bottles colle v Paramete amples Fil ate Samp nal Notes cess well locatio concerns	ers not Sam Itered and P ole?	pled/bottles Preserved? Yes	s missed: Yes No No	Duplicate		1	ile fre	esu-	benter st
Appearan Order of List any Were Sa Duplica Additior - site acc - hidden - safety of	bottles colle v Paramete amples Fil ate Samp nal Notes cess well locatio concerns	ers not Sam Itered and P ole?	piped/bottles Preserved? Yes	s missed: Yes No No	Duplicate		1	ile be	e su	teater st
Appearan Order of List any Were Sa Duplica Additior - site acc - hidden - safety of	bottles colle v Paramete amples Fil ate Samp nal Notes cess well locatio concerns	ers not Sam Itered and P ole?	piped/bottles Preserved? Yes	s missed: Yes No No	Duplicate		1	ile he	esu	treated st
Appearan Order of List any Were Sa Duplica Additior - site acc - hidden - safety of	bottles colle v Paramete amples Fil ate Samp nal Notes cess well locatio concerns	ers not Sam Itered and P ole?	piped/bottles Preserved? Yes	s missed: Yes No No	Duplicate		1	ile fre	esu.	treated st
Appearan Order of List any Were Sa Duplica Additior - site acc - hidden - safety of	bottles colle v Paramete amples Fil ate Samp nal Notes cess well locatio concerns	ers not Sam Itered and P ole?	Yes	s missed: Yes No No	Duplicate		1	ill be	esu:	beater" st
Appearan Order of List any Were Sa Duplica Additior - site acc - hidden - safety of	bottles colle v Paramete amples Fil ate Samp nal Notes cess well locatio concerns	ers not Sam Itered and P ole? f viour Associated	Yes	s missed: Yes No No	Duplicate		1	ile he	esu.	trater st
Appearan Order of List any Were Sa Duplica Additior - site acc - hidden - safety of	bottles colle v Paramete amples Fil ate Samp nal Notes cess well locatio concerns	ers not Sam Itered and P ole? f viour Associated	Yes	s missed: Yes No No	Duplicate		1	ill fre	e su	teater" st

Field Sampling		oundwate	r						a i Karan
Site/Facility Nar	me:			1.17	Client:			SK .	ACEMAR
Well ID:		Wt9433	5 BUI	kg wy 1"	Project Nu		1	016-11	13
Date:		May 7	MUL	•	Sampled b	by:	MF		
Casing Diamete	r:	Ginch			Weather:	rang	howers	10C	
Well Stick-up:					Remarks:	0			
Condition of wel	1:	good	needs	attention	- now	PIDTO	only Itt	abovegi	What #
							l	, V	
					Is the well	marked/flag	gged? Y	es No	1.
DTB: 17.0F	+ (from wellin	36m	m	Pressure:					
DTW:	J	4.677	m	negative	positive		UTM Cool	dinates:	
Difference:			m	none			Easting (6	digits)	
		X 2	L/m	1					
/olume of water in	n well:		Litres	- 15cm (6") ca	asing has 18L/	'n	Northing (7 digits)	
/olume of water to	o purge:		Litres	10cm (4'') ca	asing has 8L/n	n			
/olume actually p	urged:		Litres	7	sing has 2L/m		Zone:		
			0	-		à · .]	11 -		
Purge method:		Bailer	Pump	None	Other:	De 1Sta	the	Eet a	w~5m
Purged to dry:		Yes	No						
Purge water disp	osal:	Ground	Container			Yes	No	auring purg	ing or sampling?
Field Parameters						100			
Volume (L)	Time	рН	Temp °C	Cond µS/cm	ORP (mv)	Turbidity	Colour	Odour	Comments
1st	1220				· · · ·				State alast
2nd / 2	1165	NI.	95	1110	91				1112 1
1	1255	0.1	9.4	1110	93	,			a 11110 517 14)70
3rd 13	1201	8.1		1120	17				Still
4th	13.05	8.0	9.5	110	24				
5th			11.5						
6th									
7th									
8th									
vrite additional lines	on the back		1						
Sample Descrip	tions:					_			
Sample date:	May	24 201		Sample time	: 13205)		_	~ 1
ppearance:	,			_		Sample Cold	our: St	sht ru	12 relation.
Order of bottles coll	ected:	4110	willer	-			2		
.ist any Paramet		1				· · · · ·			-
Vere Samples Fi				1 -00	inced			Sources as the Argeneric and the Argeneric	
				0, 1					
Duplicate Samp	le?	Yes	No	Duplicate	Sample ID:				
Additional Notes	:	. [1]	2 V 1.1.	1	1	1	1 1	L	1 1
- site access		well	sat use	Amul	n by	t Unc	e/tain	as to	Uhat t
 hidden well location safety concerns 	20	Co.	tals 1	of tol	Hat	DUM	VC	the.	a reita
- unusual well beha	viour	~ 1	(1 mil	Prop	1		. 1 . 1
		C	lain'	pump	, SO QA	day of	tion	is peri	uhat naja staltic jurp
	2 ¹⁰			1	1 bl	14 1		F	1. /
	Associated								
19	Environment	tal							

	acility Nan	ne:				Client:				
Well II			TAME	KREPPE	RHONE	Project Nu	imber:	2018	P113	010
Date:			JUNE 20, 20A			Sampled by:				
Casing	g Diameter		611			Weather: 29°C Whaty				
Well S	Stick-up:		24			Remarks:				
Condit	tion of well	:	good	needs a	attention					
						×			01	
					-	Is the well	marked/flag	gged? Y	es No	
DTB:		nfo		m	Pressure:					
		prokle		m	negative	positive		UTM Coor		11607
Differe	ence: 60	eneral	das	m	none			Easting (6	digits) 30	190 to
Volume	e of water in	well	X 2	L/m	15		1	Northing (7	LLU	. 409
	e of water to			Litres Litres	15cm (6'') ca 10cm (4'') ca	-			ugita	
	e actually pu		-	Litres	5cm (2") casi	T		Zone:		
			1			ng nas zu/ill				*
-	method:		Bailer	Pump	None	Other:				
-	d to dry: water disp	ocal:	Yes Ground	No Container			Was about	obsorved	uring purging	a or complia
		0541.	Ground	Container			Yes	No	uning purging	g or samplin
	arameters	· ·			Cond		×_,			
	Volume (L)	Time	pH	Temp °C	µS/cm	ORP (mv)	Turbidity	Colour	Odour	Commen
1st		1:50	7.01	12.3	1702	11+	cler		-	
2nd		2:53	6.99	12.2	1727	(FF	cla	, ,	-	
3rd		2055	6.94	12.2	1732	116	V			
4th		2257	6.93	12.2	1726	114	21	Т.		
5th		3:01	6.95	12.2	1730	110	М			
6th								-		
7th	2		ан. К							
8th							_			
		on the back								
	le Descrip		10 201	2		3:01				
Sample	0.	PUNE			Sample time:					
Annears	ance:						Sample Cold	our:		_
	of bottles colle									
Order o	Dest			s missoy.						
Order o List an	iy Paramete									
Order o List an		ers not Sam Itered and P						2		
Order o List an Were S		Itered and P			Duplicate			2		
Order o List an Were S Duplic	Samples Fil cate Samp	Itered and F	reserved?	Yes No						
Order o List an Were S Duplic	Samples Fil cate Samp	Itered and F	reserved?	Yes No						
Order o List an Were S Duplic Additic - site ac - hidder	Samples Fil cate Samp onal Notes: ccess n well locatio	Itered and F Ile?	reserved?	Yes No						
Order or List an Were S Duplic Additic - site ac - hidder - safety	Samples Fil cate Samp onal Notes: ccess	Itered and P Ile?	reserved?	Yes No					- -	
Order or List an Were S Duplic Additic - site ac - hidder - safety	Samples Fil cate Samp onal Notes: ccess n well locatio concerns	Itered and P Ile?	reserved?	Yes No					-	
Order or List an Were S Duplic Additic - site ac - hidder - safety	Samples Fil cate Samp onal Notes: ccess n well locatio concerns	Itered and P Ile?	reserved?	Yes No						
Order or List an Were S Duplic Additic - site ac - hidder - safety	Samples Fil cate Samp onal Notes: ccess n well locatio concerns	Itered and P Ile?	reserved?	Yes No						
Order or List an Were S Duplic Additic - site ac - hidder - safety	Samples Fil cate Samp onal Notes: ccess n well locatio concerns	Itered and P Ile?	reserved?	Yes No						



June 29, 2017 Brady Nelless BC Ministry of Environment

ATTACHMENT 2: LABORATORY REPORTS

An Associated Engineering Company





REPORTED TO	Associated Environmental Consultants Inc. (Ve #200 - 2800 29th Street Vernon, BC V1T 9P9	ernon) TEL FAX	(250) 545-3672 (250) 545-3654
ATTENTION	Marta Green	WORK ORDER	7052134
PO NUMBER PROJECT PROJECT INFO	2016-8113.010.003 2016-8113.010.003 Gracemar	RECEIVED / TEMP REPORTED COC NUMBER	2017-05-25 09:30 / 4°C 2017-06-01 B39719

General Comments:

CARO Analytical Services employs methods which are conducted according to procedures accepted by appropriate regulatory agencies, and/or are conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts, except where otherwise agreed to by the client.

The results in this report apply to the samples analyzed in accordance with the Chain of Custody or Sample Requisition document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.

Saca Gulendyn

Authorized By:

Sara Gulenchyn, B.Sc, P.Chem. Client Service Coordinator

If you have any questions or concerns, please contact me at sgulenchyn@caro.ca

Locations:

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ANALYSIS INFORMATION

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	WORK ORDER	7052134
PROJECT	2016-8113.010.003	REPORTED	2017-06-01

Analysis Description	Method Reference	Technique	Location
Ammonia, Total in Water	APHA 4500-NH3 G*	Automated Colorimetry (Phenate)	Kelowna
Anions by IC in Water	APHA 4110 B	Ion Chromatography with Chemical Suppression of Eluent Conductivity	Kelowna
Nitrogen, Total Kjeldahl in Water	APHA 4500-Norg D*	Block Digestion and Flow Injection Analysis	Kelowna
Phosphorus, Total by Colorimetry in Water	APHA 4500-P B.5* / APHA 4500-P F	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	Kelowna

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Method Reference Descriptions:

APHA Standard Methods for the Examination of Water and Wastewater, 22nd Edition, American Public Health Association/American Water Works Association/Water Environment Federation

Glossary of Terms:

MRL <	Method Reporting Limit Less than the Reported Detection Limit (RDL) - the RDL may be higher than the MRL due to various factors such as dilutions, limited sample volume, high moisture, or interferences
AO	Aesthetic objective
MAC	Maximum acceptable concentration (health based)
OG	Operational guideline (treated water)
mg/L	Milligrams per litre
0	

Standards / Guidelines Referenced in this Report:

Guidelines for Canadian Drinking Water Quality (Feb 2017)

Website: http://www.hc-sc.gc.ca/ewh-semt/alt_formats/pdf/pubs/water-eau/sum_guide-res_recom/sum_guide-res_recom-e ng.pdf

Note: In some cases, the values displayed on the report represent the lowest guideline and are to be verified by the end user



REPORTED TO PROJECT	Associated Environn 2016-8113.010.003	nental Consult	tants Inc. (Verno	n)		WORK REPO	ORDER RTED	7052134 2017-06-01
Analyte		Result / Recovery	Standard / Guideline	MRL / Limits	Units	Prepared	Analyzed	Notes
Sample ID: MW1	(7052134-01) [Water]	Sampled: 201	17-05-24 09:00					
Anions								
Chloride		22.6	AO ≤ 250	0.10	mg/L	N/A	2017-05-26	
Nitrate (as N)		< 0.010	MAC = 10	0.010	mg/L	N/A	2017-05-26	
Nitrite (as N)		< 0.010	MAC = 1	0.010	mg/L	N/A	2017-05-26	
General Parameters	S							
Ammonia, Total (as	N)	0.030	N/A	0.020	mg/L	N/A	2017-05-29	
Nitrogen, Total Kjelo	lahl	0.457	N/A	0.050	mg/L	2017-05-30	2017-06-01	
Phosphorus, Total (as P)	0.0452	N/A	0.0020	mg/L	2017-05-29	2017-05-31	
Calculated Parame	ters							
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	N/A	
Nitrogen, Total		0.457	N/A	0.0500	mg/L	N/A	N/A	

Anions							
Chloride	35.6	AO ≤ 250	0.10	mg/L	N/A	2017-05-26	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	N/A	2017-05-26	
Nitrite (as N)	0.042	MAC = 1	0.010	mg/L	N/A	2017-05-26	
General Parameters							
Ammonia, Total (as N)	0.022	N/A	0.020	mg/L	N/A	2017-05-29	
Nitrogen, Total Kjeldahl	0.293	N/A	0.050	mg/L	2017-05-30	2017-06-01	
Phosphorus, Total (as P)	0.0096	N/A	0.0020	mg/L	2017-05-29	2017-05-31	
Calculated Parameters							
Nitrate+Nitrite (as N)	0.0420	N/A	0.0100	mg/L	N/A	N/A	
Nitrogen, Total	0.335	N/A	0.0500	mg/L	N/A	N/A	

Sample ID: MW3S (7052134-03) [Water] Sampled: 2017-05-24 10:20

Anions						
Chloride	50.5	AO ≤ 250	0.10 mg/L	N/A	2017-05-26	
Nitrate (as N)	< 0.010	MAC = 10	0.010 mg/L	N/A	2017-05-26	
Nitrite (as N)	0.029	MAC = 1	0.010 mg/L	N/A	2017-05-26	
General Parameters						
Ammonia, Total (as N)	0.031	N/A	0.020 mg/L	N/A	2017-05-29	
Nitrogen, Total Kjeldahl	0.394	N/A	0.050 mg/L	2017-05-30	2017-06-01	
Phosphorus, Total (as P)	< 0.0020	N/A	0.0020 mg/L	2017-05-29	2017-05-31	
Calculated Parameters						
Nitrate+Nitrite (as N)	0.0292	N/A	0.0100 mg/L	N/A	N/A	
Nitrogen, Total	0.423	N/A	0.0500 mg/L	N/A	N/A	

Sample ID: MW3D (7052134-04) [Water] Sampled: 2017-05-24 09:52

Anions						
Chloride	30.3	AO ≤ 250	0.10 mg/L	N/A	2017-05-26	



REPORTED TO PROJECT	Associated Environi 2016-8113.010.003	mental Consul	ants Inc. (Verno	n)		WORK REPO	ORDER RTED	7052134 2017-06-01
Analyte		Result / Recovery	Standard / Guideline	MRL / Limits	Units	Prepared	Analyzed	Notes
Sample ID: MW3D	(7052134-04) [Wate] Sampled: 2	017-05-24 09:52	, Continue	d			
Anions, Continued								
Nitrate (as N)		< 0.010	MAC = 10	0.010	mg/L	N/A	2017-05-26	
Nitrite (as N)		0.015	MAC = 1	0.010	mg/L	N/A	2017-05-26	
General Parameters								
Ammonia, Total (as N	1)	0.176	N/A	0.020	mg/L	N/A	2017-05-29	
Nitrogen, Total Kjelda	ahl	0.414	N/A	0.050	mg/L	2017-05-30	2017-06-01	
Phosphorus, Total (as	s P)	0.0399	N/A	0.0020	mg/L	2017-05-29	2017-05-31	
Calculated Paramete	ers							
Nitrate+Nitrite (as N)		0.0147	N/A	0.0100	mg/L	N/A	N/A	
Nitrogen, Total		0.429	N/A	0.0500	mg/L	N/A	N/A	

Chloride	30.4	AO ≤ 250	0.10 mg/L	N/A	2017-05-26
Nitrate (as N)	< 0.010	MAC = 10	0.010 mg/L	N/A	2017-05-26
Nitrite (as N)	0.720	MAC = 1	0.010 mg/L	N/A	2017-05-26
General Parameters					
Ammonia, Total (as N)	1.14	N/A	0.020 mg/L	N/A	2017-05-29
Nitrogen, Total Kjeldahl	4.00	N/A	0.050 mg/L	2017-05-30	2017-06-01
Phosphorus, Total (as P)	0.410	N/A	0.0020 mg/L	2017-05-29	2017-05-31
Calculated Parameters					
Nitrate+Nitrite (as N)	0.720	N/A	0.0100 mg/L	N/A	N/A
Nitrogen, Total	4.72	N/A	0.500 mg/L	N/A	N/A

Sample ID: WPID 28093 (7052134-06) [Water] Sampled: 2017-05-24 13:40

Anions						
Chloride	6.72	AO ≤ 250	0.10 mg/L	N/A	2017-05-26	
Nitrate (as N)	< 0.010	MAC = 10	0.010 mg/L	N/A	2017-05-26	
Nitrite (as N)	< 0.010	MAC = 1	0.010 mg/L	N/A	2017-05-26	
General Parameters						
Ammonia, Total (as N)	0.025	N/A	0.020 mg/L	N/A	2017-05-29	
Nitrogen, Total Kjeldahl	0.089	N/A	0.050 mg/L	2017-05-30	2017-06-01	
Phosphorus, Total (as P)	0.0027	N/A	0.0020 mg/L	2017-05-29	2017-05-31	
Calculated Parameters						
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100 mg/L	N/A	N/A	
Nitrogen, Total	0.0890	N/A	0.0500 mg/L	N/A	N/A	

Sample ID: WT 94334 (7052134-07) [Water] Sampled: 2017-05-24 12:40

Anions						
Chloride	26.1	AO ≤ 250	0.10 mg/L	N/A	2017-05-26	
Nitrate (as N)	< 0.010	MAC = 10	0.010 mg/L	N/A	2017-05-26	



REPORTED TO PROJECT		WORK REPO	CORDER RTED	7052134 2017-06-01				
Analyte		Result / Recovery	Standard / Guideline	MRL / Limits	Units	Prepared	Analyzed	Notes
Sample ID: WT 943	34 (7052134-07) [Water] Sampled	l: 2017-05-24 12	:40, Contir	nued			
Anions, Continued								
Nitrite (as N)		< 0.010	MAC = 1	0.010	mg/L	N/A	2017-05-26	
General Parameters								
Ammonia, Total (as N	N)	0.375	N/A	0.020	mg/L	N/A	2017-05-29	
Nitrogen, Total Kjelda	ahl	0.563	N/A	0.050	mg/L	2017-05-30	2017-06-01	
Phosphorus, Total (a	s P)	0.0401	N/A	0.0020	mg/L	2017-05-29	2017-05-31	
Calculated Paramete	ers							
Nitrate+Nitrite (as N)		< 0.0100	N/A	0.0100	mg/L	N/A	N/A	
Nitrogen, Total		0.563	N/A	0.0500	ma/l	N/A	N/A	

Sample ID: WT 94335 (7052134-08) [Water] Sampled: 2017-05-24 13:05

Anions						
Chloride	36.2	AO ≤ 250	0.10	mg/L	N/A	2017-05-26
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	N/A	2017-05-26
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	N/A	2017-05-26
General Parameters						
Ammonia, Total (as N)	0.036	N/A	0.020	mg/L	N/A	2017-05-29
Nitrogen, Total Kjeldahl	0.275	N/A	0.050	mg/L	2017-05-30	2017-06-01
Phosphorus, Total (as P)	0.0056	N/A	0.0020	mg/L	2017-05-29	2017-05-31
Calculated Parameters						
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	N/A
Nitrogen, Total	0.275	N/A	0.0500	mg/L	N/A	N/A

Sample ID: Dup (7052134-09) [Water] Sampled: 2017-05-24 00:00

Anions							
Chloride	26.4	AO ≤ 250	0.10	mg/L	N/A	2017-05-26	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	N/A	2017-05-26	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	N/A	2017-05-26	
General Parameters							
Ammonia, Total (as N)	0.356	N/A	0.020	mg/L	N/A	2017-05-29	
Nitrogen, Total Kjeldahl	0.558	N/A	0.050	mg/L	2017-05-30	2017-06-01	
Phosphorus, Total (as P)	0.0408	N/A	0.0020	mg/L	2017-05-29	2017-05-31	
Calculated Parameters							
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	N/A	
Nitrogen, Total	0.558	N/A	0.0500	mg/L	N/A	N/A	



APPENDIX 1: QUALITY CONTROL DATA

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	WORK ORDER	7052134
PROJECT	2016-8113.010.003	REPORTED	2017-06-01

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- Method Blank (Blk): Laboratory reagent water is carried through sample preparation and analysis steps. Method Blanks indicate that results are free from contamination, i.e. not biased high from sources such as the sample container or the laboratory environment
- **Duplicate (Dup)**: Preparation and analysis of a replicate aliquot of a sample. Duplicates provide a measure of the analytical method's precision, i.e. how reproducible a result is. Duplicates are only reported if they are associated with your sample data.
- Blank Spike (BS): A known amount of standard is carried through sample preparation and analysis steps. Blank Spikes, also known as laboratory control samples (LCS), are prepared from a different source of standard than used for the calibration. They ensure that the calibration is acceptable (i.e. not biased high or low) and also provide a measure of the analytical method's accuracy (i.e. closeness of the result to a target value).
- Standard Reference Material (SRM): A material of similar matrix to the samples, externally certified for the parameter(s) listed. Standard Reference Materials ensure that the preparation steps in the method are adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	MRL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Notes
Anions, Batch B7E1863									
Blank (B7E1863-BLK1)			Prepared	d: 2017-05-	26, Analyz	zed: 2017	-05-26		
Chloride	< 0.10	0.10 mg/L							
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Blank (B7E1863-BLK2)			Prepared	d: 2017-05-	26, Analyz	zed: 2017	-05-26		
Chloride	< 0.10	0.10 mg/L							
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
LCS (B7E1863-BS1)			Prepared	d: 2017-05-	26, Analyz	zed: 2017	-05-26		
Chloride	16.0	0.10 mg/L	16.0		100	90-110			
Nitrate (as N)	4.28	0.010 mg/L	4.00		107	93-108			
Nitrite (as N)	1.94	0.010 mg/L	2.00		97	85-114			
LCS (B7E1863-BS2)			Prepared	d: 2017-05-	26, Analyz	zed: 2017	-05-26		
Chloride	16.4	0.10 mg/L	16.0		103	90-110			
Nitrate (as N)	4.29	0.010 mg/L	4.00		107	93-108			
Nitrite (as N)	1.97	0.010 mg/L	2.00		99	85-114			
Duplicate (B7E1863-DUP2)	Sou	rce: 7052134-09	Prepared	d: 2017-05-	26, Analyz	zed: 2017	-05-26		
Chloride	26.4	0.10 mg/L		26.4			< 1	10	
Nitrate (as N)	< 0.010	0.010 mg/L		< 0.010				10	
Nitrite (as N)	< 0.010	0.010 mg/L		< 0.010				6	
Matrix Spike (B7E1863-MS2)	Sou	rce: 7052134-09	09 Prepared: 2017-05-26, Analyzed: 2017-05-26						
Chloride	42.8	0.10 mg/L	16.0	26.4	102	75-125			
Nitrate (as N)	3.97	0.010 mg/L	4.00	< 0.010	99	75-125			
Nitrite (as N)	1.91	0.010 mg/L	2.00	< 0.010	96	80-120			

General Parameters, Batch B7E1814



APPENDIX 1: QUALITY CONTROL DATA

	Associated Environm 2016-8113.010.003	nental Cor	nsultants Inc. (Verno	on)				K ORDEF ORTED		52134 17-06-01
Analyte		Result	MRL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Notes
General Parameters,B	atch B7E1814, Contir	nued								
Blank (B7E1814-BLK1)				Prepared	d: 2017-05-	-29, Analy	zed: 2017-	-05-29		
Ammonia, Total (as N)		< 0.020	0.020 mg/L							
Blank (B7E1814-BLK2)				Prepared	d: 2017-05-	-29, Analy	zed: 2017-	-05-29		
Ammonia, Total (as N)		< 0.020	0.020 mg/L							
LCS (B7E1814-BS1)				Prepared	d: 2017-05-	-29, Analy	zed: 2017-	-05-29		
Ammonia, Total (as N)		0.914	0.020 mg/L	1.00		91	86-111			
LCS (B7E1814-BS2)				Prepared	d: 2017-05-	-29, Analy	zed: 2017-	-05-29		
Ammonia, Total (as N)		0.913	0.020 mg/L	1.00		91	86-111			
Phosphorus, Total (as P) Blank (B7E2013-BLK2) Phosphorus, Total (as P) LCS (B7E2013-BS1) Phosphorus, Total (as P)		< 0.0020 < 0.0020 0.106	0.0020 mg/L 0.0020 mg/L 0.0020 mg/L		d: 2017-05- d: 2017-05-					
LCS (B7E2013-BS2)				Prepared	d: 2017-05-	-29, Analy	zed: 2017-	-05-31		
Phosphorus, Total (as P)		0.0956	0.0020 mg/L	0.100		96	80-112			
Duplicate (B7E2013-DL	JP2)	S	ource: 7052134-08	Prepared	d: 2017-05-	-29, Analy	zed: 2017-	-05-31		
Phosphorus, Total (as P)		0.0053	0.0020 mg/L		0.0056				30	
Matrix Spike (B7E2013	-MS2)	S	ource: 7052134-08	Prepared	d: 2017-05-	-29, Analy	zed: 2017-	-05-31		
Phosphorus, Total (as P)		0.474	0.0020 mg/L	0.500	0.0056	94	69-122			
General Parameters, B				December	1. 0047 OF	00 A		00.04		
Blank (B7E2127-BLK1)		< 0.050	0.050 ma/	Prepared	d: 2017-05-	-30, Analy	zea: 2017-	-06-01		
Nitrogen, Total Kjeldahl		< 0.050	0.050 mg/L	_						
LCS (B7E2127-BS1)		1.05	0.050 <i>ľ</i>	•	d: 2017-05-			-06-01		
Nitrogen, Total Kjeldahl		1.00	0.050 mg/L	1.00		100	84-121			
LCS (B7E2127-BS2)				•	d: 2017-05-			-06-01		
Nitrogen, Total Kjeldahl		0.933	0.050 mg/L	1.00		93	84-121			



REPORTED TOAssociated Environmental Consultants Inc. (Vernon)**PROJECT**2016-8113.010.003

Nitrogen, Total (mg/L)

 WORK ORDER
 7052134

 REPORTED
 2017-06-01

		7052134-01	7052134-02	7052134-03	7052134-04	7052134-05	7052134-06
		Water	Water	Water	Water	Water	Water
		2017-05-24	2017-05-24	2017-05-24	2017-05-24	2017-05-24	2017-05-24
		MW1	MW2	MW3S	MW3D	Floyd Swamp	WPID 28093
Anions	Chloride (mg/L)	22.6	35.6	50.5	30.3	30.4	6.72
	Nitrate (as N) (mg/L)	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
	Nitrite (as N) (mg/L)	< 0.010	0.042	0.029	0.015	0.720	< 0.010
General Parameters	Ammonia, Total (as N) (mg/L)	0.030	0.022	0.031	0.176	1.14	0.025
	Nitrogen, Total Kjeldahl (mg/L)	0.457	0.293	0.394	0.414	4.00	0.089
	Phosphorus, Total (as P) (mg/L)	0.0452	0.0096	< 0.0020	0.0399	0.410	0.0027
Calculated Parameters	Nitrate+Nitrite (as N) (mg/L)	< 0.0100	0.0420	0.0292	0.0147	0.720	< 0.0100
	Nitrogen, Total (mg/L)	0.457	0.335	0.423	0.429	4.72	0.0890
		7052134-07	7052134-08	7052134-09]		
		Water	Water	Water			
		2017-05-24	2017-05-24	2017-05-24			
		WT 94334	WT 94335	Dup			
				00.4			
Anions	Chloride (mg/L)	26.1	36.2	26.4			
	Nitrate (as N) (mg/L)	< 0.010	< 0.010	< 0.010			
	Nitrite (as N) (mg/L)	< 0.010	< 0.010	< 0.010			
General Parameters	Ammonia, Total (as N) (mg/L)	0.375	0.036	0.356			
	Nitrogen, Total Kjeldahl (mg/L)	0.563	0.275	0.558			
	Phosphorus, Total (as P) (mg/L)	0.0401	0.0056	0.0408			
Calculated Parameters	Nitrate+Nitrite (as N) (mg/L)	< 0.0100	< 0.0100	< 0.0100			

0.563

0.275

0.558

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REPORTED TO	Associated Environmental Consultants Inc. (Ve #200 - 2800 29th Street Vernon, BC V1T 9P9	ernon) TEL FAX	(250) 545-3672 (250) 545-3654
ATTENTION	Nicole Penner	WORK ORDER	7061861
PO NUMBER PROJECT PROJECT INFO	2016-8113.010.004 Grace-Mar Farms	RECEIVED / TEMP REPORTED COC NUMBER	2017-06-21 11:15 / 7°C 2017-06-23 B50531

General Comments:

CARO Analytical Services employs methods which are conducted according to procedures accepted by appropriate regulatory agencies, and/or are conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts, except where otherwise agreed to by the client.

The results in this report apply to the samples analyzed in accordance with the Chain of Custody or Sample Requisition document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.

Saca Gulendyn

Authorized By:

Sara Gulenchyn, B.Sc, P.Chem. Client Service Coordinator

If you have any questions or concerns, please contact me at sgulenchyn@caro.ca

Locations:

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ANALYSIS INFORMATION

Analysis Descri	ption	Method Reference	Technique		Location
REPORTED TO	Associated Er	nvironmental Consultants Inc	WORK ORDER	7061861	
PROJECT	2016-8113.01	0.004	REPORTED	2017-06-23	

Analysis Description		lecinique	Location
Ammonia, Total in Water	APHA 4500-NH3 G*	Automated Colorimetry (Phenate)	Kelowna
Anions by IC in Water	APHA 4110 B	Ion Chromatography with Chemical Suppression of Eluent Conductivity	Kelowna
Nitrogen, Total Kjeldahl in Water	APHA 4500-Norg D*	Block Digestion and Flow Injection Analysis	Kelowna
Phosphorus, Total by Colorimetry in Water	APHA 4500-P B.5* / APHA 4500-P F	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	Kelowna

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Method Reference Descriptions:

APHA

Standard Methods for the Examination of Water and Wastewater, 22nd Edition, American Public Health Association/American Water Works Association/Water Environment Federation

Glossary of Terms:

MRL	Method Reporting Limit
<	Less than the Reported Detection Limit (RDL) - the RDL may be higher than the MRL due to various factors such as dilutions, limited sample volume, high moisture, or interferences
mg/L	Milligrams per litre



REPORTED TO PROJECT	Associated Environi 2016-8113.010.004	nvironmental Consultants Inc. (Vernon) 10.004			WORK ORDER REPORTED		7061861 2017-06-23
Analyte		Result / Recovery	MRL / Limits	Units	Prepared	Analyzed	Notes
Sample ID: James	Krebber Home (706 ⁻	1861-01) [Water] Sai	mpled: 2017-06-20 1	5:01			
Anions							
Chloride		28.1	0.10	mg/L	N/A	2017-06-22	
Nitrate (as N)		13.0	0.010	mg/L	N/A	2017-06-23	
Nitrite (as N)		0.028	0.010	mg/L	N/A	2017-06-22	
General Parameters							
Ammonia, Total (as I	۷)	< 0.020	0.020	mg/L	N/A	2017-06-21	
Nitrogen, Total Kjelda	ahl	0.446	0.050	mg/L	2017-06-21	2017-06-22	
Phosphorus, Total (a	s P)	< 0.0020	0.0020	mg/L	2017-06-22	2017-06-23	
Calculated Parameter	ers						
Nitrate+Nitrite (as N)		13.0	0.100	mg/L	N/A	N/A	
Nitrogen, Total		13.5	0.100	mg/L	N/A	N/A	
Nitrogen, Organic		0.446	0.0500	mg/L	N/A	N/A	



APPENDIX 1: QUALITY CONTROL DATA

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	WORK ORDER	7061861
PROJECT	2016-8113.010.004	REPORTED	2017-06-23

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- Method Blank (Blk): Laboratory reagent water is carried through sample preparation and analysis steps. Method Blanks indicate that results are free from contamination, i.e. not biased high from sources such as the sample container or the laboratory environment
- **Duplicate (Dup)**: Preparation and analysis of a replicate aliquot of a sample. Duplicates provide a measure of the analytical method's precision, i.e. how reproducible a result is. Duplicates are only reported if they are associated with your sample data.
- Blank Spike (BS): A known amount of standard is carried through sample preparation and analysis steps. Blank Spikes, also known as laboratory control samples (LCS), are prepared from a different source of standard than used for the calibration. They ensure that the calibration is acceptable (i.e. not biased high or low) and also provide a measure of the analytical method's accuracy (i.e. closeness of the result to a target value).
- Standard Reference Material (SRM): A material of similar matrix to the samples, externally certified for the parameter(s) listed. Standard Reference Materials ensure that the preparation steps in the method are adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	MRL Units	Spike	Source	% REC	REC	% RPD	RPD	Notes
, unaly to	Rooun		Level	Result	/01120	Limit	70 RF D	Limit	110100

Anions, Batch B7F1555

Blank (B7F1555-BLK1)			Prepared: 201	7-06-22, Analy	zed: 2017-06-22	
Chloride	< 0.10	0.10 mg/L				
Nitrate (as N)	< 0.010	0.010 mg/L				
Nitrite (as N)	< 0.010	0.010 mg/L				
LCS (B7F1555-BS1)			Prepared: 201	7-06-22, Analy	zed: 2017-06-22	
Chloride	16.2	0.10 mg/L	16.0	101	90-110	
Nitrate (as N)	4.12	0.010 mg/L	4.00	103	93-108	

General Parameters, Batch B7F1511

Blank (B7F1511-BLK1)			Prepared: 201	7-06-21, Analy	zed: 2017-06-21		
Ammonia, Total (as N)	< 0.020	0.020 mg/L					
Blank (B7F1511-BLK2)			Prepared: 201	7-06-21, Analy	/zed: 2017-06-21		
Ammonia, Total (as N)	< 0.020	0.020 mg/L					
LCS (B7F1511-BS1)			Prepared: 201	7-06-21, Analy	zed: 2017-06-21		
Ammonia, Total (as N)	1.00	0.020 mg/L	1.00	100	90-115		
LCS (B7F1511-BS2)			Prepared: 2017-06-21, Analyzed: 2017-06-21				
Ammonia, Total (as N)	1.02	0.020 mg/L	1.00	102	90-115		

General Parameters, Batch B7F1605

Blank (B7F1605-BLK1)			Prepared: 2017-06-21, Analyzed: 2017-06-22	
Nitrogen, Total Kjeldahl	< 0.050	0.050 mg/L		
Blank (B7F1605-BLK2)			Prepared: 2017-06-21, Analyzed: 2017-06-22	



APPENDIX 1: QUALITY CONTROL DATA

REPORTED TO PROJECT	D TO Associated Environmental Consultants Inc. (Vernon) 2016-8113.010.004						K ORDEF ORTED	• • •	7061861 2017-06-23	
Analyte		Result	MRL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Notes
General Parameters,	Batch B7F1605, Contin	ued								
LCS (B7F1605-BS1)				Prepared	I: 2017-06-	21, Analy	zed: 2017	-06-22		
Nitrogen, Total Kjeldahl		1.16	0.050 mg/L	1.00		116	84-121			
LCS (B7F1605-BS2)				Prepared	I: 2017-06-	21, Analy	zed: 2017	-06-22		
Nitrogen, Total Kjeldahl		0.972	0.050 mg/L	1.00		97	84-121			
General Parameters, Blank (B7F1695-BLK				Prenared	l: 2017-06-	22 Analy	zed: 2017	-06-23		
Phosphorus, Total (as P)	•	< 0.0020	0.0020 mg/L	Tropuleo		22, 7 that y	200. 2017	00 20		
Blank (B7F1695-BLK	•			Prepared	I: 2017-06-	22, Analy	zed: 2017	-06-23		
Phosphorus, Total (as P))	< 0.0020	0.0020 mg/L							
LCS (B7F1695-BS1)				Prepared	I: 2017-06-	22, Analy	zed: 2017	-06-23		
Phosphorus, Total (as P))	0.0977	0.0020 mg/L	0.100		98	80-112			
LCS (B7F1695-BS2)				Prepared	I: 2017-06-	22, Analy	zed: 2017	-06-23		
Phosphorus, Total (as P))	0.0968	0.0020 mg/L	0.100		97	80-112			

$\frac{\mathbf{REPORT}_{10}}{\mathbf{ADDRESS}} = \frac{290}{290} = \frac{290}{290} = \frac{297}{290}$	Tel: (250) 765-9646 Fax: (250) 765-3893 17225 109 Avenue NW, Edmonton, AB T5S 1H7 Tel: (780) 489-9100 Fax: (780) 489-9700 INVOICE TO: SAME AS REPORT TO COMPANY:	RELINQUISHED BY: Nicola Permer PROJECT: 2016 - 8113,010,000 TURNAROUND TIME REQUESTED: Routine: (5-7 Days)	REGULATORY APPLICATION: Regs on Canadian Drinking Water Quality Guidelines Report?
VERINON BC	-	Rush: 1 Day* 2 Day* 3 Day* Other*	BC Drinking Water Protection Act / Reg.
CONTACT: MARTA GREEN	_ CONTACT:	*Contact Lab To Confirm, Surcharge May Appl	
TEL/FAX: ZSO So3 7330 DELIVERY METHOD: EMAIL MAIL OTHER* T		ANA	ALYSES REQUESTED:
DATA FORMAT: EXCEL WATERTRAX ESdat EQUIS BC EMS OTHER* EMAIL 1: CCC O O CHER* EMAIL 2: EMAIL 2: EMAIL 3: ** NEW ** If you would like to sign up for ClientConnect and/or Er SAMPLED BY: CFCEN	EMAIL 1: EMAIL 2: EMAIL 3: PO #: nviroChain, CARO's online service offerings, check here: RIX: SAMPLING:	BTEX VPH PHC F1 VOC VPH VPHC F1 VOC VPH VPHC EPH PHC F2-F4 PAL PAH L/HEPH Non-Chlor. PHENOLS Chlorinated Non-Chlor. PHENOLS ACID HERBICIDES PAR PESTICIDES ACID HERBICIDES PAR METALS - WATER DISSOLVED H9 METALS - SOIL (SALM)	EC ALK C vss TDS TDS C cod C MOG COLIFORMS HPC C COLIFORMS C COLIFORMS HPC C COLIFORMS C COLIFORMS C C COLIFORMS C C COLIFORMS C C COLIFORMS C C COLIFORMS C C C C C C C C C C C C C C C C C C C
CLIENT SAMPLE ID: James Krebber Hurrer X	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	BTEX VPH PHC VOC VPH PHC VOC VPH PHC PAH L/HEPH PHC PAH PHC PHC PHC PHC	PH EC ALK TSS VSS TT TSS VSS TT TDG ND COD TDS TOG MOG TDS TOTAL COLIFORMS TDS ASBESTOS TDS AMMENT TDS AMMENT
Supplies Needed: 60 Days	RETENTION INSTRUCTIONS (Discarded 30 days after Report 90 Days Longer Date (Surcharges will Apply): RINSTRUCTIONS: Sch Samples - 2 Day TAT (50%)	surcharge)	PAYMENT: SAMPLE RECEIPT CONDITION: CHEQUE COOLER 1 (°C): ICE: Y COOLER 2 (°C): ICE: Y N DEBIT COOLER 3 (°C): ICE: Y CASH COOLER 3 (°C): ICE: Y INVOICE CUSTODY SEALS INTACT: N



June 29, 2017 Brady Nelless BC Ministry of Environment

ATTACHMENT 3: GUIDELINE NOTES FOR TABLES 2 AND 3

An Associated Engineering Company



1. Notes for BC Approved Water Quality Guidelines for freshwater aquatic life (BCAWQG AL) General Notes:

The Water Quality Guidelines (Criteria) Reports by BC Ministry of Environment were used as references for the guidelines. (Internet address: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html). Overview Reports (BC MOE) were used as the references for the guidelines unless the note for specific analyte indicates that the Technical Appendix (BC MOE) was used. / For some parameters, guidelines are specified as two values: the maximum value or the acute criterion, and the 30-day average value or the chronic criterion. The maximum value was used in this report for parameters that have both guideline values.

Note 1.1 for pH:

pH less than 6.5: No statistically significant decrease in pH from background.

pH from 6.5 to 9.0: Unrestricted change permitted within this range.

pH over 9.0: No statistically significant increase in pH from background.

See BC MOE Overview Report for additional details.

Note 1.2 for Temperature:

The maximum daily temperature of 19 degrees Celsius is for streams with unknown fish distribution. See BC MOE Overview Report for additional details for streams with unknown fish distribution, and specific guidelines for streams with known fish distribution, and guideline for lakes and impoundments.

Note 1.3 for Chloride:

To protect freshwater aquatic life from acute and lethal effects, the maximum concentration of chloride (mg/L as NaCl) at any time should not exceed 600 mg/L.

To protect freshwater aquatic life from chronic effects, the average (arithmetic mean computed from five weekly samples collected over a 30-day period) concentration of chloride (mg/L as NaCl) should not exceed 150 mg/L.

Note 1.4 for Ammonia (total, as N):

The maximum guideline for ammonia varies as a function of pH and temperature. See Table 3 in Overview Report Update September 2009.

The 30-day average guideline for ammonia varies as a function of pH and temperature. See Table 4 in Overview Report Update September 2009. / The lab pH and field temperature results were used for determining the maximum ammonia for this report. If a lab pH result was not available then the field pH result was used.

Note 1.5 for Nitrate (as N):

The guideline maximum for nitrate (as N) is 32.8 mg/l.

The 30-day average guideline for nitrate (as N) is 3.0 mg /L. The 30-day average (chronic) concentration is based on 5 weekly samples collected within a 30-day period.

Where nitrate and nitrite are present, the total nitrate+nitrite nitrogen should not exceed these values.

Note 1.6 for Nitrate + Nitrite (as N):

The guideline maximum for nitrate (as N) is 32.8 mg/l.

The 30-day average guideline for nitrate (as N) is 3.0 mg /L. The 30-day average (chronic) concentration is based on 5 weekly samples collected within a 30-day period.

Where nitrate and nitrite are present, the total nitrate+nitrite nitrogen should not exceed these values.

Note 1.7 for Nitrite (as N):

The guideline maximum for nitrite as N is: 0.06 mg/L if chloride less than 2 mg/L 0.12 mg/L if chloride is 2 to 4 mg/L 0.18 mg/L if chloride is 2 to 4 mg/L 0.24 mg/L if chloride is 6 to 8 mg/L 0.30 mg/L if chloride is 8 to 10 mg/L 0.60 mg/L if chloride is greater than 10 mg/L. The guideline 30-day average for nitrite as N is: 0.02 mg/L if chloride less than 2 mg/L 0.04 mg/L if chloride is 2 to 4 mg/L 0.06 mg/L if chloride is 4 to 6 mg/L 0.08 mg/L if chloride is 6 to 8 mg/L 0.10 mg/L if chloride is 8 to 10 mg/L 0.20 mg/L if chloride is 8 to 10 mg/L

Grace-Mar Water Quality Sampling (Action #14) Guideline Notes for Table 2 and Table 3

Note 1.8 for Phosphorus (total, APHA 4500-P):

Streams: None proposed for streams.

Lakes: It is not possible to specify a single phosphorous concentration to achieve protection of aquatic life in lakes. A range of total phosphorous concentrations (5-15 μ g/L) is suggested as the criterion which can be used as the basis for site specific water quality objectives.

2. Notes for BC Approved Water Quality Guidelines for irrigation (BCAWQG I) General Notes:

The Water Quality Guidelines (Criteria) Reports by BC Ministry of Environment were used as references for the guidelines. (Internet address: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html). Overview Reports (BC MOE) were used as the references for the guidelines unless the note for specific analyte indicates that the Technical Appendix (BC MOE) was used.

Note 2.1 for pH:

The recommended criterion for irrigation waters is a pH ranging between 5.0 and 9.0. This guideline recognizes that soil acidity, alkalinity and salinity are a concern in agriculture.

Note 2.2 for Temperature:

The recommended guideline for temperature is + or - 1 degree Celsius change from natural ambient background.

3. Notes for Working Water Quality Guidelines for British Columbia for irrigation (BCWWQG I) General Notes:

Reference: Working Water Quality Guidelines for British Columbia (2015). WWQG values are long-term (i.e. average) concentrations unless identified as a short-term maximum in the "Notes" for a specific analyte. Long-term WWQGs represent average substance concentrations calculated from 5 samples in 30 days. WWQG are given for total substance concentrations unless otherwise noted.

Note 3.1 for Conductivity:

The guideline varies from 700 to 5000 μ S/cm depending on the type of crop. The most stringent guideline has been used for this report.

4. Notes for BC Approved Water Quality Guidelines for livestock (BCAWQG L)

General Notes:

The Water Quality Guidelines (Criteria) Reports by BC Ministry of Environment were used as references for the guidelines. (Internet address: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html). Overview Reports (BC MOE) were used as the references for the guidelines unless the note for specific analyte indicates that the Technical Appendix (BC MOE) was used.

Note 4.1 for pH:

pH does not interfere with the palatability of water or the health of livestock.

Note 4.2 for Temperature:

The recommended guideline for temperature is + or - 1 degree Celsius change from natural ambient background.

Note 4.3 for Chloride:

The water quality guideline for chloride for livestock watering is 600 mg/L.

Note 4.4 for Nitrate (as N):

Overview Report Update, September 2009.

Note 4.5 for Nitrate + Nitrite (as N):

The guideline maximum for nitrate as nitrogen is 100 mg/l. Where nitrate and nitrite are present, the total nitrate+nitrite nitrogen should not exceed this value. Overview Report Update, September 2009.

Note 4.6 for Nitrite (as N):

Overview Report Update, September 2009.

5. Notes for BC Approved Water Quality Guidelines for drinking water (BCAWQG DW)

General Notes:

References: Table 1. British Columbia Ministry of Environment water quality guidelines for drinking water sources. January 2017; and Table 2. British Columbia Ministry of Environment drinking water quality guidelines for turbidity. January 2017.

Overview Reports (BC MOE) and Technical Appendix (BC MOE) were also used as references for some parameters.

Grace-Mar Water Quality Sampling (Action #14) Guideline Notes for Table 2 and Table 3

Note 5.1 for pH:

Designed to minimize solubilization of heavy metals and salts from water distribution pipes and the precipitation of carbonate salts in the distribution system, and maximize the effectiveness of chlorination. However, natural source water outside the guidelines may be safe to drink from a public health perspective.

Note 5.2 for Temperature:

The guideline for maximum temperature for drinking water is 15 degrees.

Note 5.3 for Chloride:

The guideline maximum for chloride in drinking water (for aesthetic reasons) is 250 mg/L.

Note 5.4 for Nitrate (as N):

Overview Report Update, September 2009

Note 5.5 for Nitrite (as N):

Overview Report Update, September 2009

Note 5.6 for Phosphorus (total, APHA 4500-P):

For lakes used as a source of drinking water, the total phosphorous concentration should not exceed 10 µg/L. No guideline is recommended for streams.

6. Notes for Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentrations (GCDWQ MAC)

Note 6.1 for Nitrate + Nitrite (as N):

The MAC for Nitrate (as N) is 10 mg/L

7. Notes for Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives (GCDWQ AO) Note 7.1 for pH:

The operational guideline for pH is a range of 7.0 to 10.5 in finished drinking water.