



**Kollaard Associates**

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Civil • Geotechnical •  
Structural • Environmental •  
Hydrogeology •

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REPORT ON

**HYDROGEOLOGICAL STUDY  
140 REIS ROAD  
CITY OF OTTAWA  
ONTARIO**

Submitted to:

City Wye'd Electric  
132 Reis Road, Carp,  
Ottawa, Ontario

DATE August 13, 2021

DISTRIBUTION

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210430



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City Wye'd Electric  
132 Reis Road, Carp,  
Ottawa, Ontario

RE: HYDROGEOLOGICAL AND TERRAIN STUDY  
EXISTING SUPPLY WELL  
PROPOSED LIGHT INDUSTRIAL BUILDING  
140 REIS ROAD, CARP  
CITY OF OTTAWA, ONTARIO

Dear Sir:

This letter presents the results of an evaluation of the water quality and quantity for the well that will supply water for the above noted proposed light industrial development at 140 Reis Road in the City of Ottawa, Ontario (see Key Plan, Figure 1). It is understood that the proposed light industrial development is to consist of an automobile service station.

The well in question was constructed by Air Rock Drilling Company of Richmond, Ontario on May 25, 2021. A Ministry of the Environment, Conservation and Parks (MECP) Well Record for the subject well (TW1) and the Certificate of Well Compliance, provided by the well driller, are provided as Attachment A.

A pumping test was carried out at the well, TW1, by a member of our engineering staff on June 17, 2021. The testing consisted of a 6 hour duration constant discharge rate pumping test. During the pumping test, water level measurements were made both manually and using a pressure transducer to monitor the drawdown of the water level in the well in response to pumping. Groundwater samples were collected from TW1 at about hour 3 and at hour 6 of the pumping test to characterize groundwater quality. After the pumping period, the pump was shut off and the recovery of the water level in the well was monitored for a period of time until at least 95 percent of the drawdown created during pumping had been recovered or for at least 24 hours, whichever was less.

## **Groundwater Supply Evaluation**

### Water Demand

The water demand is calculated using the information from the sewage system daily design flow and the City of Ottawa Water Distribution Guidelines, 2010. The sewage design flows are provided below, based on the sewage design (sewage design provided in Site Servicing Report prepared by Kollaard Associates Inc. as Appendix C of that document). The calculations are as follows:

Daily sewage design flow:



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of Ontario to offer professional engineering services.



- Office building, per  $9.3 \text{ m}^3$  of floor space =  $75 \text{ Litres}/9.3 \text{ m}^3 \times 62 \text{ m}^3 = 525 \text{ L/day}$
- Warehouse, per water closet (1) And per loading bay (3) =  $950 \text{ L/day} + 150 \text{ L/bay/day} \times 3 = 1400 \text{ L/day}$
- Total daily design flow =  $1,925 \text{ litres / day}$

Since sewage system design is based on the maximum expected daily use, it is equivalent to the Average Daily Demand (ADD). The ADD is based on an eight hour operation schedule (i.e. full day occurs over an eight hour period and not over 24 hours).

City of Ottawa calculates the Maximum Hour Demand (MHD) for a commercial or industrial demand to be  $1.8 \times \text{ADD}$

$$\begin{aligned}\text{ADD} &= 1,925 \text{ litres/day} \times 1 \text{ day} / 8 \text{ hours} \times 1 \text{ hour} / 60 \text{ minutes} \\ &= 4.0 \text{ litres/minute}\end{aligned}$$

$$\begin{aligned}\text{MHD} &= 1.8 \times \text{ADD} \\ &= 1.8 \times 4.5 \text{ litres/minute} \\ &= 7.2 \text{ litres/minute}\end{aligned}$$

Alternatively, the City of Ottawa Water Distribution Guideline Section 4.2.8 indicates the average water demand for light industrial usage is  $35,000 \text{ L/gross ha/day}$ . The gross area of the developable footprint on the site is  $0.18 \text{ hectares}$ .

$$\begin{aligned}\text{ADD} &= 0.18 \text{ ha} \times 35,000 \text{ L/gross ha/day} \\ &= 4.375 \text{ L/min} \\ \text{MHD} &= 4.375 \text{ L/min} \times 1.8 = 7.9 \text{ L/min}\end{aligned}$$

Using the more conservative figure for groundwater usage, the City of Ottawa predicated water usage for ADD and MHD of  $4.4 \text{ L/min}$  and  $7.9 \text{ L/min}$ , respectively, are used.

The Maximum Hourly Demand (MHD) for the site based on its proposed use is expected to be about  $\sim 8 \text{ litres/minute}$ , compared to the pumping test rate which was  $13.7 \text{ litres/minute}$ .

### Water Quantity

The well was pumped for six hours at a pumping rate of about  $13.7 \text{ litres per minute}$ . Over the course of the pumping test, the water level in the well dropped some  $\sim 6.0 \text{ metres}$ . At the end of the pumping test, about 66 minutes was required for 95 percent recovery of the total drawdown in the static water level created during pumping.

The pumping test drawdown and recovery data and plots for TW1 are provided as Attachment B. The drawdown and recovery data provided were measured with reference to the top of the well casing at the test well location.

The pumping test data for the test well was analyzed using the method of Cooper and Jacob (1946). Although the assumptions on which these equations are based are not strictly met, this method provides a reasonable estimate of the aquifer transmissivity.



Transmissivity was calculated using the following relationship:

$$T = \frac{2.3Q}{4\pi ds}$$

where Q is the pump rate, m<sup>3</sup>/day  
ds is the change in drawdown over one time log cycle, m  
T is the transmissivity, m<sup>2</sup>/day

$$\begin{aligned} \text{Specific Capacity} &= Q / \text{TD} \\ &= 19.7 \text{ m}^3/\text{day} / 6.03 \text{ m} \\ &= 3.3 \text{ m}^3/\text{day}/\text{m} \end{aligned}$$

where Q = test pumping rate (m<sup>3</sup>/day)  
TD = total drawdown (m)

Based on the pumping test drawdown data the transmissivity of the aquifer is estimated to be about 9.5 m<sup>2</sup>/day. Based on the recovery data the aquifer transmissivity is estimated to be about 3.1 m<sup>2</sup>/day. It should be noted that pumping tests should typically be carried out for a period of between 24 hours or greater to establish transmissivity for a confined aquifer in order to assess boundary conditions. Over the course of the six hour test, some ~5,000 litres of water were pumped from the well. The available drawdown at the well is about 83.8 metres (based on recommended pump depth and static water level at the time of the test). As the expected maximum daily water demand is only 1,950 litres per day, the expected drawdown at the well should be well within the available drawdown for the well.

### Water Quality

To determine the water quality of the groundwater supply, groundwater samples were obtained from the well during the pumping test and prepared/preserved in the field using appropriate techniques and submitted to Eurofins Environmental Testing in Ottawa, Ontario for the chemical, physical and bacteriological analyses listed in the MECP guideline entitled Procedure D-5-5, Technical Guideline for Private Wells: Water Supply Assessment, August 1996. The temperature, conductivity, pH, total dissolved solids, turbidity and residual chlorine levels of the groundwater were measured and qualitative observations of the odour and colour of the groundwater were made at periodic intervals during the pumping test. The results of the chemical, physical and bacteriological analyses of the water samples obtained from the test well and the field water quality are provided as Attachment C and in Table I, respectively.

The water quality as determined from the results of the analyses is acceptable. The water meets all the Ontario Drinking Water Standards (ODWS) health and aesthetic parameters tested for at the test well except for aesthetic objectives for hardness, total dissolved solids and hydrogen sulphide. Sodium is above the 20 mg/l medical advisory limit for those on sodium restricted diets.

### *Hardness*

The water is considered to be hard by water treatment standards. Water with hardness above 80 to 100 milligrams per litre as CaCO<sub>3</sub> is often softened for domestic use. The hardness at the well is 379 milligrams per litre. Treatment consisting of water softening by conventional sodium ion exchange is effective to reduce scale formation associated with hardness. Ion exchange water softening may introduce relatively high concentrations of sodium into the drinking water, increasing



the corrosive potential of the water. Treatment by water softening can also contribute a significant percentage to the daily sodium intake for a consumer on a sodium restricted diet. Where ion exchange water softeners are used, a separate unsoftened water supply could be used for drinking and culinary purposes.

#### *Total Dissolved Solids*

The total dissolved solids (TDS) were measured at 767 milligrams per litre after three and six hours of pumping and are above the ODWS of 500 milligrams per litre. The Ryznar Stability Indices (RSI) and Langelier Saturation Indices (LSI) were calculated for the samples obtained and gave RSI values of 6.4 to 6.5, and LSI of 0.7 to 0.8, respectively, indicating that the water has some scale potential and scale formation may occur, in the form of calcium carbonate. The effect of elevated TDS levels on drinking water depends on the individual components, which are principally chlorides, sulphates, calcium, magnesium and bicarbonates. Depending on which parameters are elevated, TDS exceedances can include hardness, taste, mineral deposition or corrosion. In this case, the water samples had high levels of hardness. Chloride is well within its aesthetic objective and is not elevated enough to affect the taste of the water significantly. Sodium is elevated but well within the aesthetic objectives of 200 mg/l for taste.

#### *Sulphides*

The sulphides levels of the samples obtained were about 0.06 to 0.08 milligrams per litre after three and six hours of pumping, respectively, compared to the aesthetic objective of 0.05 milligrams per litre, as hydrogen sulphide. Sulphide produces taste, odour and staining of laundry items and can cause deterioration of fixtures (appliances, hot water tanks) reducing their life span. The MECP Technical Guideline for Water Supply Assessment (1992) indicates that the maximum concentration considered reasonably treatable using a proprietary filter media is up to 1.0 milligram/litre. It can also be removed using aeration or manganese greensand filter.

#### *Sodium*

The sodium level in the water is about 101 to 103 mg/l. The ODWSOG states that *“the local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/l so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.”*

## **TERRAIN STUDY**

The field work for this investigation was carried out on March 31, 2020, at which time two shallow hand dug test pits, numbered TP1 and TP2, were put down at the site. The test pits encountered topsoil overlying red brown or grey brown silty sand to silty sand with trace clay. The test pits were terminated at a depth of 0.9 metres. Water was observed at about 0.9 metres below the ground surface.

The size of the septic envelopes are a function of the percolation time of the native soil in the vicinity of the septic envelope and/or the fill used for construction of a septic bed and the daily effluent loading to the septic bed. The percolation rate for the silty sand encountered at the site is 15 minutes per centimetre.

The sewage design is based on a daily design flow of 1,950 Litres per day on the design flow information.

The septic system envelope area (septic envelope) represents the area on a lot set aside for the construction of the leaching bed and is for the leaching bed only and does not include that area



required for the septic tank or the isolation/separation distances required by the Ontario Building Code. The deposit or disposal of any materials or the placement of any structure or the operation of any equipment, other than material, structures or equipment required for the construction of the sewage system within or upon the septic envelope is prohibited.

The sewage design for the site consists of a Level 4 treatment unit (ECOFLO) and a Type 'A' Partially Raised Bed. The proposed leaching bed will occupy an area of about 73 square metres in the southeast portion of the site. The location of the sewage system is shown on the Site Servicing Plan (210430-SER) provided under separate cover as part of a Development Application with the City of Ottawa. An imported sand layer (above the native silty sand layer after topsoil and fill are removed) having a percolation time of between 6 and 8 minutes per centimetre with less than 5 percent passing the #200 (0.074 mm) sieve will be used to construct the leaching bed. It is recommended that gradation analyses be carried out on any potential sand fill prior to leaching bed construction in order to verify that the percolation time of the fill material is acceptable.

Based on the terrain information provided, there is sufficient space at the site to accommodate a sewage system. The proposed sewage system design consists of a Level Four treatment which provides a high level of sewage effluent treatment prior to disposal.

## **WELLHEAD PROTECTION / FLOODPLAIN CONSIDERATIONS**

The supply well is located within the northeast portion of the site, while the location of the proposed septic system is within the southeast portion of the site, and is greater than 20 metres distance from the well location. The well casing extended greater than 400 millimetres above grade at the time of construction. It should be verified that the top of the well casing is at least 400 millimetres above the finished grade at the well location.

Additionally, the ground surface shall be graded such that the well is the highest point on the ground surface within 3 metres radially from the exterior of the well casing and shall ensure that water does not collect or pond near the well head. The well has been properly grouted and cased to a depth of about 6.7 metres below the existing ground surface. The well is physically separated from the adjacent driveway and parking lot by the placement of bollards. With these measures in place, it is considered that an adequate amount of wellhead protection is going to be in place to protect the water supply for the proposed light industrial use of the property. The well location is also appropriate for access in case of repairs and well maintenance.

Recommendations for wellhead protection include ensuring that potential contaminant sources are at least 15 metres or more from the well. Possible contaminant sources include; chemical storage, garage and related chemicals, such as antifreeze, gasoline, oils, vehicle/boat/equipment storage, sewer lines, septic systems, animal enclosures, manure or compost piles. If liquid chemicals, such as antifreeze, oil and gasoline/diesel, and their waste products, are to be stored at the site, they should be stored in containers approved for that purpose. The container(s) should be labelled with their contents. Secondary containment should be installed around all bulk liquid chemical or waste storage containers, to collect and contain leaks and spills from the tank and all connections.

Recommendations for well maintenance include; inspect wellhead annually to ensure that the casing is structurally sound, verify well cap is sealed and that surface water is not pooling around wellhead. The well location is adjacent to the parking lot and access driveway. To protect the well from physical damage, the placement of bollards is required. The well is located such that it is easily accessible for maintenance/repairs. A lock on the well cap is useful to prevent vandalism.



Based on the results of this evaluation it is considered that the well in question should supply water of adequate quantity and quality for the proposed development with suitable treatment and wellhead protection as indicated above.

We trust this letter provides sufficient information for your purposes. If you have any questions concerning this letter, please do not hesitate to contact our office.

Yours truly,  
Kollaard Associates Inc.

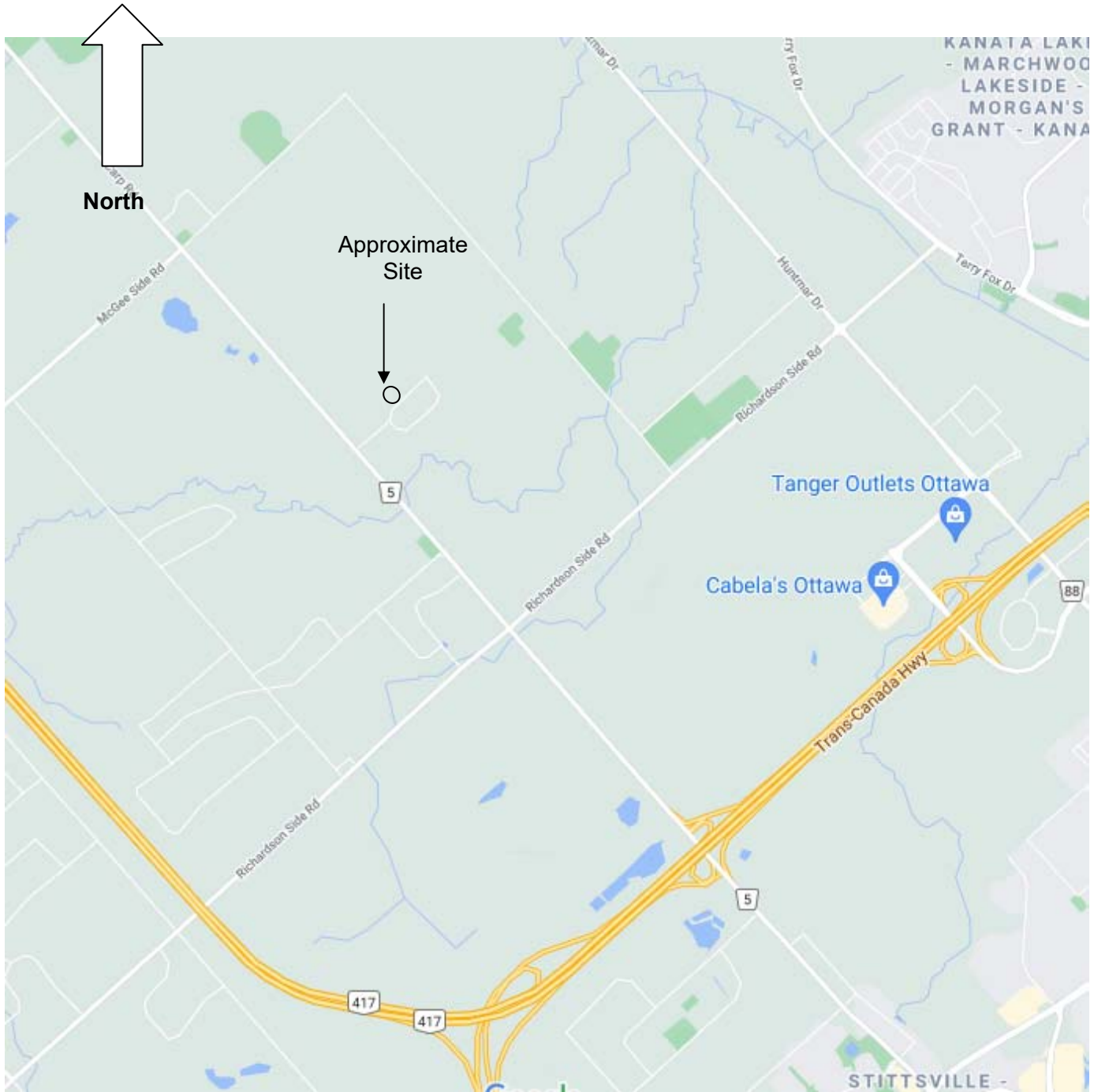


Colleen Vermeersch, P. Eng.

Attachments:	Figure 1	- Key Plan
	Table I	- Field Water Quality
	Attachment A	- Well Record and Certificate of Well Compliance
	Attachment B	- Pumping Test Data
	Attachment C	- Well Water Laboratory Test Results

# KEY PLAN

# FIGURE 1



NOT TO SCALE



TABLE I  
FIELD WATER QUALITY MEASUREMENTS  
FOR TEST WELL

	Time Since Pumping Test Started (min)	Temp. (°C)	pH	Turbidity (NTU)	Total Dissolved Solids (ppm)	Conductivity (µS)	Free chlorine (ppm)
TW 1	60	11.2	7.3	19.7	608	1207	0.0
	120	11.1	7.2	14.4	610	1210	-
	180	11.0	7.2	2.8	575	1120	0.0
	240	11.7	7.1	2.5	575	1220	-
	300	11.6	7.1	2.5	595	1180	-
	360	12.0	7.1	2.9	603	1200	0.0
	420	12.0	7.2	0.7	1200	570	-



ATTACHMENT A

MOE WELL RECORD FOR TW1  
CERTIFICATE OF WELL COMPLIANCE  
PROVIDED BY WELL DRILLER

# CERTIFICATE OF WELL COMPLIANCE



I ( Jeremy Hanna ) AIR ROCK DRILLING CO. LTD. - DO HEREBY CERTIFY

that I am licensed to drill water wells in the Province of Ontario, and that I have supervised the drilling of the water well on the property of :

OWNER: WINCH HOLDINGS LTD.

Location: # 140 REIS ROAD, Carp

LOT: 8 CON: 2 PLAN # 4M-745 ~~574~~ Block 2

Ottawa-Carleton / Geographical Township of West Carleton

I CERTIFY FURTHER that, I am aware of the well drilling requirements, the guidelines, recommendations and regulations of the Ministry of the Environment governing well installations in the Province of Ontario, and the standards specified in any subdivision agreement and hydrogeological report applicable to this site and City Standards.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased, grouted (cement or bentonite) as applicable and constructed in strict conformity with the standards required.

Signed this 25<sup>TH</sup> Day of MAY, 2021

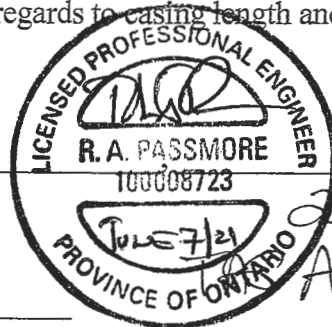
Jeremy Hanna (T3632)

Air Rock Drilling Co. Ltd. ( C-7681 )

The Engineer on behalf of the Landowner set out above, Certifies that he/she has inspected the well and it was constructed in accordance with the specifications in O.Reg 903, this report and the Hydrogeological Report with regards to casing length and grouting requirements.

Signed this 7<sup>th</sup> day of JUNE, 2021

(Engineer)



Measurements recorded in:  Metric  Imperial

Well Owner's Information

First Name: Last Name/Organization: **Winch Holdings Ltd** E-mail Address:  Well Constructed by Well Owner

Mailing Address (Street Number/Name): **Box 502** Municipality: **Stittsville** Province: **ON** Postal Code: **K2S1A6** Telephone No. (inc. area code):

Well Location

Address of Well Location (Street Number/Name): **140 Reis Road** Township: **West Carleton** Lot: **8** Concession: **2**

County/District/Municipality: **Ottawa Carleton** City/Town/Village: **Carp** Province: **Ontario** Postal Code:

UTM Coordinates Zone: **18** Easting: **423097** Northing: **5017388** Municipal Plan and Sublot Number: **4M-745** Other: **Block 2**

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m)
				From To
	<b>Sand &amp; Gravel</b>	<b>+ Boulders</b>		0' 18'
<b>Grey &amp; Brown</b>	<b>Limestone</b>			18' 105'
<b>Grey &amp; Brown</b>	<b>Limestone</b>			105' 294'
<b>Grey &amp; Brown</b>	<b>Limestone</b>			294' 300'

Annular Space		
Depth Set at (m)	Type of Sealant Used (Material and Type)	Volume Placed (m³)
22' 12'	<b>Neat cement</b>	<b>10.92</b>
12' 0'	<b>Bentonite slurry</b>	<b>4.2</b>

Results of Well Yield Testing				
After test of well yield, water was: <input type="checkbox"/> Clear and sand free <input type="checkbox"/> Other, specify <b>Not tested</b>	Draw Down		Recovery	
	Time (min)	Water Level (m)	Time (min)	Water Level (m)
If pumping discontinued, give reason: <b>Surged</b>	Static Level	<b>10' 1"</b>		<b>189' 1"</b>
	1	<b>17</b>	1	<b>158</b>
	2	<b>22.3</b>	2	<b>155</b>
	3	<b>27.2</b>	3	<b>151</b>
	4	<b>32</b>	4	<b>147</b>
	5	<b>36.7</b>	5	<b>143</b>
Duration of pumping: <b>1 hrs + 0 min</b>	10	<b>57.9</b>	10	<b>126</b>
Final water level end of pumping (m): <b>189' 1"</b>	15	<b>76.3</b>	15	<b>109</b>
If flowing give rate (l/min/GPM): <b>X</b>	20	<b>92.2</b>	20	<b>94.6</b>
Recommended pump depth (m): <b>280</b>	25	<b>106</b>	25	<b>81</b>
Recommended pump rate (l/min/GPM): <b>5</b>	30	<b>118</b>	30	<b>68.7</b>
Well production (l/min/GPM): <b>5</b>	40	<b>140</b>	40	<b>47.6</b>
Disinfected? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	50	<b>156</b>	50	<b>27.1</b>
	60	<b>169'</b>	60	<b>10' 1"</b>

Method of Construction		Well Use	
<input type="checkbox"/> Cable Tool	<input type="checkbox"/> Diamond	<input type="checkbox"/> Public	<input type="checkbox"/> Commercial
<input type="checkbox"/> Rotary (Conventional)	<input type="checkbox"/> Jetting	<input checked="" type="checkbox"/> Domestic	<input type="checkbox"/> Municipal
<input type="checkbox"/> Rotary (Reverse)	<input type="checkbox"/> Driving	<input type="checkbox"/> Livestock	<input type="checkbox"/> Test Hole
<input type="checkbox"/> Boring	<input type="checkbox"/> Digging	<input type="checkbox"/> Irrigation	<input type="checkbox"/> Cooling & Air Conditioning
<input checked="" type="checkbox"/> All percussion		<input type="checkbox"/> Industrial	<input type="checkbox"/> Monitoring
<input type="checkbox"/> Other, specify		<input type="checkbox"/> Other, specify	

Construction Record - Casing			Status of Well	
Inside Diameter (cm)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm)	Depth (m)	Water Supply
<b>6 1/4"</b>	<b>Steel</b>	<b>.188</b>	<b>+2' 22'</b>	<input checked="" type="checkbox"/> Replacement Well
<b>6"</b>	<b>Open Hole</b>		<b>22' 300'</b>	<input type="checkbox"/> Test Hole
				<input type="checkbox"/> Recharge Well
				<input type="checkbox"/> Dewatering Well
				<input type="checkbox"/> Observation and/or Monitoring Hole
				<input type="checkbox"/> Alteration (Construction)
				<input type="checkbox"/> Abandoned, Insufficient Supply
				<input type="checkbox"/> Abandoned, Poor Water Quality
				<input type="checkbox"/> Abandoned, other, specify
				<input type="checkbox"/> Other, specify

Construction Record - Screen			
Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)
			From To

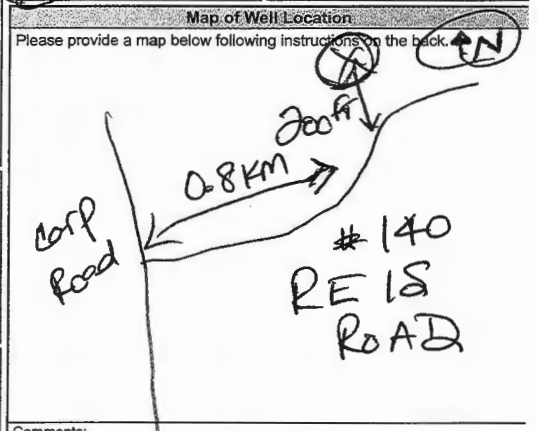
Water Details		Hole Diameter	
Water found at Depth: <b>105 (m)</b>	Kind of Water: <input type="checkbox"/> Fresh <input checked="" type="checkbox"/> Untested	Depth (m)	Diameter (cm)
Water found at Depth: <b>294 (m)</b>	Kind of Water: <input type="checkbox"/> Fresh <input checked="" type="checkbox"/> Untested	0' 22'	<b>93/4"</b>
Water found at Depth: (m/ft)	Kind of Water: <input type="checkbox"/> Fresh <input type="checkbox"/> Untested	22' 300'	<b>6"</b>

Well Contractor and Well Technician Information

Business Name of Well Contractor: **Air Rock Drilling Co. Ltd.** Well Contractor's Licence No.: **C7681**

Business Address (Street Number/Name): **6659 Franktown Road** Municipality: **Richmond**

Province: **ON** Postal Code: **K0A 2Z0** Business E-mail Address: **air-rock@sympatico.ca**



Comments: **3/4 HP 5 GPM SET AT 280 FEET**

Bus. Telephone No. (inc. area code): **813882170** Name of Well Technician (Last Name, First Name): **Hanna, Jeremy**

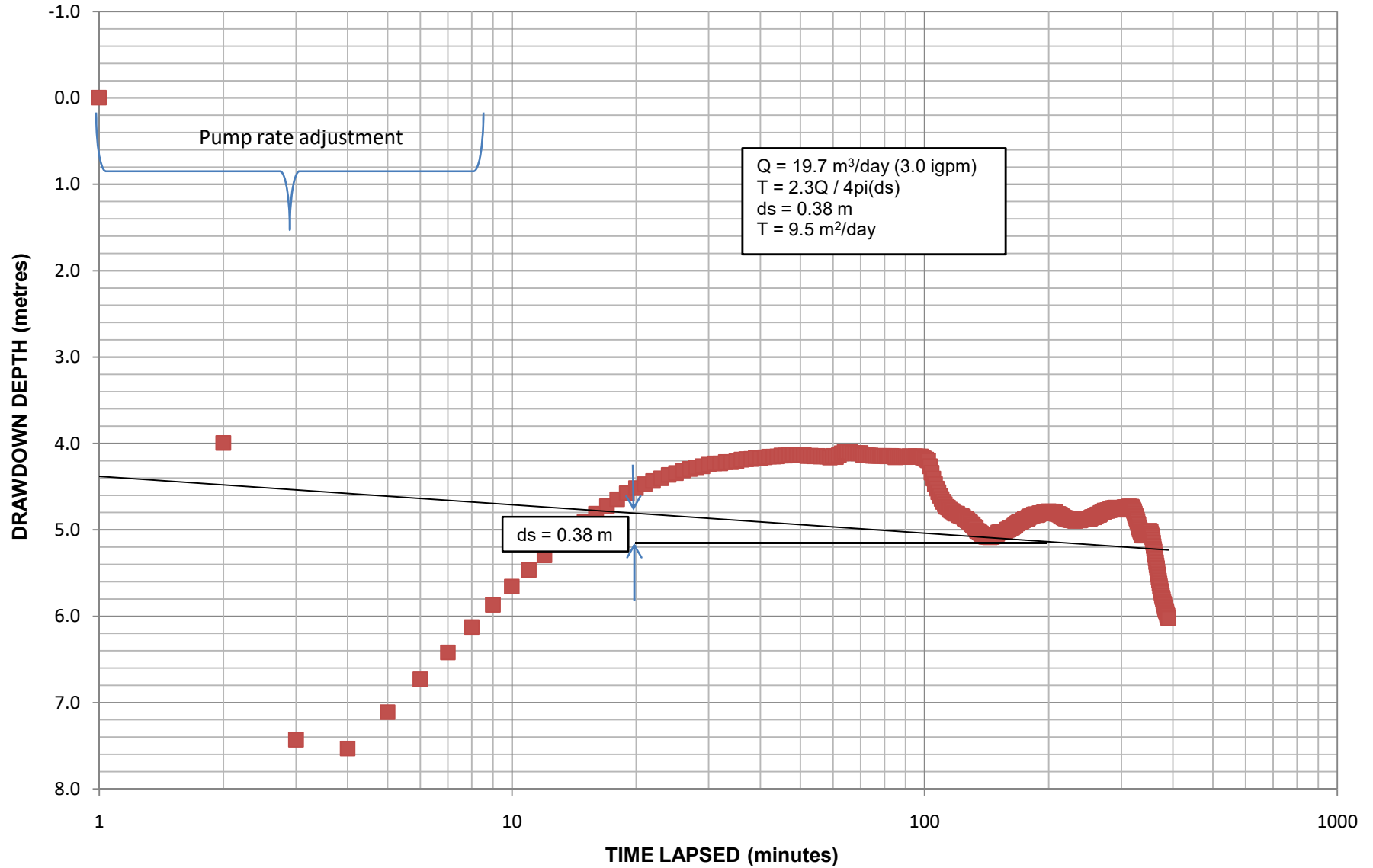
Well Technician's Licence No.: **T3632** Signature of Technician and/or Contractor: *[Signature]* Date Submitted: **2021 05 31**

Well owner's information package delivered	Date Package Delivered	Ministry Use Only
<input checked="" type="checkbox"/> Yes	<b>2021 05 28</b>	Audit No. <b>Z355157</b>
<input type="checkbox"/> No	<b>2021 05 25</b>	Received



ATTACHMENT B  
PUMPING TEST DATA FOR TW1

# TW1-WELL DRAWDOWN VS. TIME-KOLLAARD FILE 210430



**DRAWDOWN DATA TW-1**

Time Lapsed (minutes)	Abs Pres (kPa)	Temp (°C)	Water Level (m)	Drawdown (m)
0	393.269	8.581	-1.55	0.00
1	393.299	8.581	-1.547	0.00
2	354.106	8.581	-5.544	3.99
3	320.435	8.581	-8.977	7.43
4	319.425	8.581	-9.08	7.53
5	323.555	8.581	-8.659	7.11
6	327.269	8.581	-8.28	6.73
7	330.331	8.581	-7.968	6.42
8	333.215	8.581	-7.674	6.12
9	335.743	8.581	-7.416	5.87
10	337.795	8.581	-7.207	5.66
11	339.699	8.581	-7.013	5.46
12	341.365	8.581	-6.843	5.29
13	342.764	8.581	-6.7	5.15
14	344.014	8.581	-6.573	5.02
15	345.115	8.581	-6.46	4.91
16	346.067	8.581	-6.363	4.81
17	346.93	8.581	-6.275	4.73
18	347.704	8.581	-6.196	4.65
19	348.389	8.581	-6.126	4.58
20	348.991	8.68	-6.065	4.52
21	349.431	8.581	-6.02	4.47
22	349.795	8.68	-5.983	4.43
23	350.092	8.68	-5.953	4.40
24	350.479	8.68	-5.913	4.36
25	350.688	8.68	-5.892	4.34
26	350.986	8.68	-5.862	4.31
27	351.164	8.68	-5.844	4.29
28	351.343	8.68	-5.825	4.28
29	351.462	8.68	-5.813	4.26
30	351.641	8.68	-5.795	4.25
31	351.79	8.68	-5.78	4.23
32	351.79	8.68	-5.78	4.23
33	351.938	8.68	-5.765	4.22
34	351.938	8.68	-5.765	4.22
35	352.028	8.68	-5.755	4.21
36	352.206	8.68	-5.737	4.19
37	352.266	8.68	-5.731	4.18
38	352.296	8.68	-5.728	4.18
39	352.445	8.68	-5.713	4.16
40	352.385	8.68	-5.719	4.17
41	352.474	8.68	-5.71	4.16
42	352.564	8.68	-5.701	4.15
43	352.564	8.68	-5.701	4.15
44	352.594	8.68	-5.698	4.15
45	352.683	8.68	-5.689	4.14
46	352.683	8.68	-5.689	4.14
47	352.772	8.68	-5.68	4.13
48	352.802	8.68	-5.676	4.13
49	352.713	8.68	-5.686	4.14
50	352.772	8.68	-5.68	4.13
51	352.772	8.68	-5.68	4.13
52	352.623	8.68	-5.695	4.15
53	352.653	8.68	-5.692	4.14
54	352.594	8.68	-5.698	4.15
55	352.623	8.68	-5.695	4.15
56	352.564	8.68	-5.701	4.15
57	352.594	8.68	-5.698	4.15
58	352.564	8.68	-5.701	4.15
59	352.445	8.68	-5.713	4.16
60	352.623	8.68	-5.695	4.15
61	352.511	8.779	-5.706	4.16
62	352.719	8.779	-5.685	4.14
63	352.928	8.779	-5.664	4.11
64	353.106	8.779	-5.645	4.10
65	353.106	8.779	-5.645	4.10
66	353.076	8.779	-5.649	4.10
67	352.928	8.779	-5.664	4.11
68	352.957	8.779	-5.661	4.11
69	352.928	8.779	-5.664	4.11
70	352.957	8.779	-5.661	4.11
71	352.749	8.779	-5.682	4.13
72	352.719	8.779	-5.685	4.14
73	352.689	8.779	-5.688	4.14
74	352.689	8.779	-5.688	4.14
75	352.63	8.779	-5.694	4.14
76	352.63	8.779	-5.694	4.14
77	352.63	8.779	-5.694	4.14
78	352.63	8.779	-5.694	4.14
79	352.63	8.779	-5.694	4.14
80	352.63	8.779	-5.694	4.14
81	352.6	8.779	-5.697	4.15
82	352.63	8.779	-5.694	4.14
83	352.63	8.779	-5.694	4.14
84	352.6	8.779	-5.697	4.15
85	352.481	8.779	-5.709	4.16
86	352.54	8.779	-5.703	4.15
87	352.57	8.779	-5.7	4.15
88	352.54	8.779	-5.703	4.15
89	352.54	8.779	-5.703	4.15
90	352.511	8.779	-5.706	4.16
91	352.54	8.779	-5.703	4.15
92	352.6	8.779	-5.697	4.15
93	352.54	8.779	-5.703	4.15
94	352.54	8.779	-5.703	4.15
95	352.6	8.779	-5.697	4.15
96	352.57	8.779	-5.7	4.15
97	352.54	8.779	-5.703	4.15
98	352.57	8.779	-5.7	4.15
99	352.451	8.779	-5.712	4.16
100	352.332	8.779	-5.724	4.17
101	352.213	8.779	-5.737	4.19
102	352.123	8.779	-5.746	4.20
103	351.468	8.779	-5.813	4.26

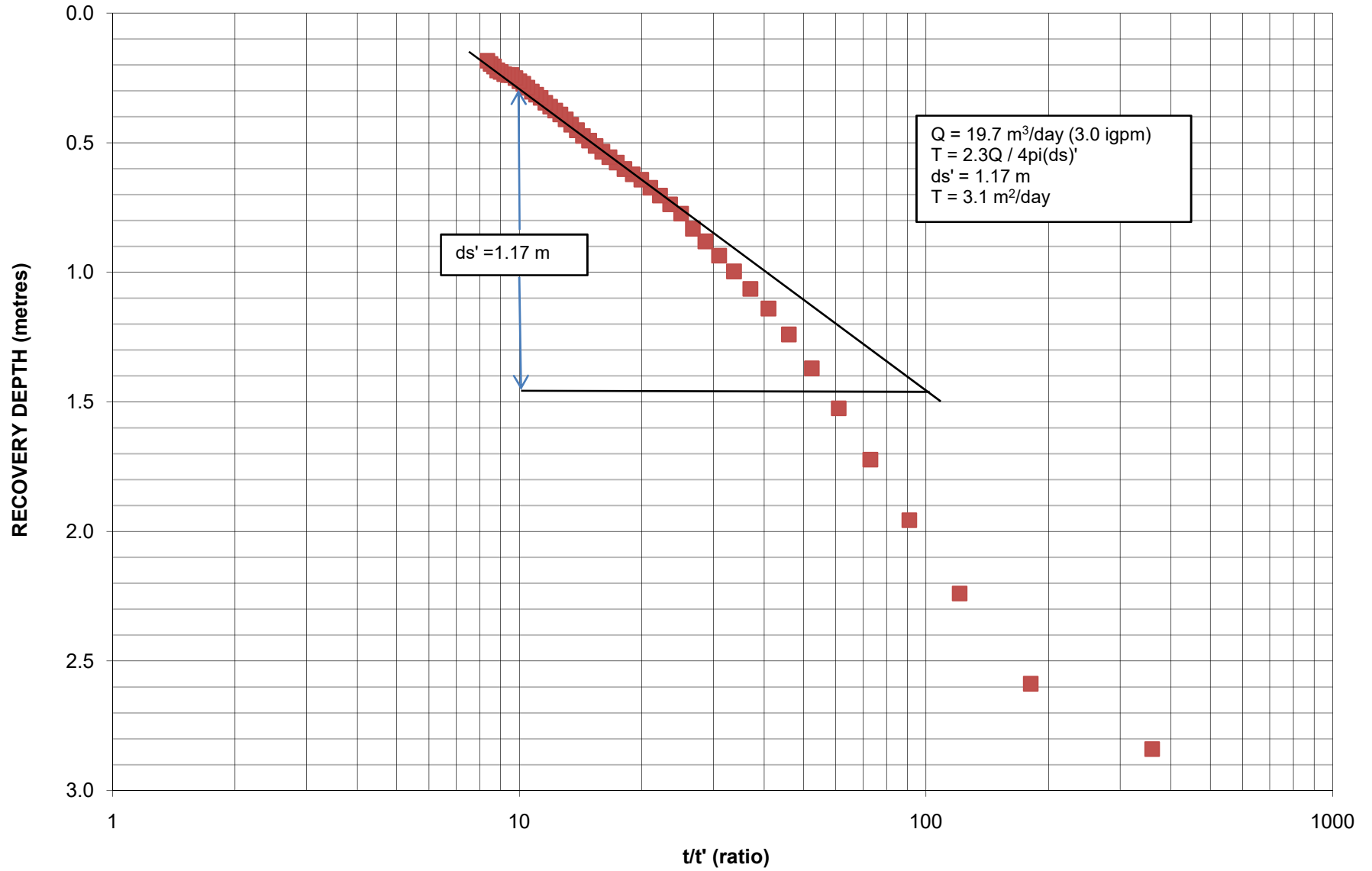
104	350.724	8.779	-5.888	4.34
105	350.069	8.779	-5.955	4.41
106	349.444	8.779	-6.019	4.47
107	348.937	8.779	-6.071	4.52
108	348.521	8.779	-6.113	4.56
109	348.104	8.779	-6.156	4.61
110	347.747	8.779	-6.192	4.64
111	347.419	8.779	-6.225	4.68
112	347.151	8.779	-6.253	4.70
113	346.854	8.779	-6.283	4.73
114	346.764	8.779	-6.292	4.74
115	346.526	8.779	-6.316	4.77
116	346.407	8.779	-6.329	4.78
117	346.348	8.779	-6.335	4.79
118	346.139	8.779	-6.356	4.81
119	346.08	8.779	-6.362	4.81
120	346.08	8.779	-6.362	4.81
121	345.901	8.779	-6.38	4.83
122	345.871	8.779	-6.383	4.83
123	345.841	8.779	-6.386	4.84
124	345.722	8.779	-6.398	4.85
125	345.544	8.779	-6.417	4.87
126	345.484	8.779	-6.423	4.87
127	345.335	8.779	-6.438	4.89
128	345.187	8.779	-6.453	4.90
129	345.068	8.779	-6.465	4.92
130	344.889	8.779	-6.483	4.93
131	344.77	8.779	-6.496	4.95
132	344.591	8.779	-6.514	4.96
133	344.443	8.779	-6.529	4.98
134	344.145	8.779	-6.559	5.01
135	344.085	8.779	-6.565	5.02
136	343.937	8.779	-6.58	5.03
137	343.847	8.779	-6.59	5.04
138	343.728	8.779	-6.602	5.05
139	343.609	8.779	-6.614	5.06
140	343.52	8.779	-6.623	5.07
141	343.46	8.779	-6.629	5.08
142	343.49	8.779	-6.626	5.08
143	343.431	8.779	-6.632	5.08
144	343.401	8.779	-6.635	5.09
145	343.431	8.779	-6.632	5.08
146	343.49	8.779	-6.626	5.08
147	343.52	8.779	-6.623	5.07
148	343.639	8.779	-6.611	5.06
149	343.699	8.779	-6.605	5.06
150	343.788	8.779	-6.596	5.05
151	343.937	8.779	-6.58	5.03
152	343.966	8.779	-6.578	5.03
153	343.937	8.779	-6.58	5.03
154	343.996	8.779	-6.574	5.02
155	343.996	8.779	-6.574	5.02
156	343.996	8.779	-6.574	5.02
157	344.056	8.779	-6.568	5.02
158	344.234	8.779	-6.55	5.00
159	344.264	8.779	-6.547	5.00
160	344.294	8.779	-6.544	4.99
161	344.413	8.779	-6.532	4.98
162	344.502	8.779	-6.523	4.97
163	344.502	8.779	-6.523	4.97
164	344.621	8.779	-6.511	4.96
165	344.71	8.779	-6.502	4.95
166	344.77	8.779	-6.496	4.95
167	344.949	8.779	-6.477	4.93
168	344.978	8.779	-6.474	4.92
169	345.068	8.779	-6.465	4.92
170	345.157	8.779	-6.456	4.91
171	345.157	8.779	-6.456	4.91
172	345.187	8.779	-6.453	4.90
173	345.335	8.779	-6.438	4.89
174	345.365	8.779	-6.435	4.89
175	345.514	8.779	-6.42	4.87
176	345.484	8.779	-6.423	4.87
177	345.484	8.779	-6.423	4.87
178	345.574	8.779	-6.414	4.86
179	345.693	8.779	-6.401	4.85
180	345.752	8.779	-6.395	4.85
181	345.752	8.779	-6.395	4.85
182	345.871	8.779	-6.383	4.83
183	345.871	8.779	-6.383	4.83
184	345.99	8.779	-6.371	4.82
185	345.931	8.779	-6.377	4.83
186	346.02	8.779	-6.368	4.82
187	345.901	8.779	-6.38	4.83
188	345.931	8.779	-6.377	4.83
189	346.02	8.779	-6.368	4.82
190	346.139	8.779	-6.356	4.81
191	346.139	8.779	-6.356	4.81
192	346.139	8.779	-6.356	4.81
193	346.169	8.779	-6.353	4.80
194	346.169	8.779	-6.353	4.80
195	346.258	8.779	-6.344	4.79
196	346.288	8.779	-6.341	4.79
197	346.288	8.779	-6.341	4.79
198	346.228	8.779	-6.347	4.80
199	346.288	8.779	-6.341	4.79
200	346.348	8.779	-6.335	4.79
201	346.258	8.779	-6.344	4.79
202	346.169	8.779	-6.353	4.80
203	346.109	8.779	-6.359	4.81
204	346.318	8.779	-6.338	4.79
205	346.228	8.779	-6.347	4.80
206	346.258	8.779	-6.344	4.79
207	346.288	8.779	-6.341	4.79
208	346.169	8.779	-6.353	4.80
209	346.05	8.779	-6.365	4.82
210	346.05	8.779	-6.365	4.82
211	346.05	8.779	-6.365	4.82
212	345.961	8.779	-6.374	4.82



213	345.961	8.779	-6.374	4.82
214	345.841	8.779	-6.386	4.84
215	345.752	8.779	-6.395	4.85
216	345.752	8.779	-6.395	4.85
217	345.663	8.779	-6.404	4.85
218	345.603	8.779	-6.411	4.86
219	345.574	8.779	-6.414	4.86
220	345.544	8.779	-6.417	4.87
221	345.544	8.779	-6.417	4.87
222	345.484	8.779	-6.423	4.87
223	345.425	8.779	-6.429	4.88
224	345.395	8.779	-6.432	4.88
225	345.425	8.779	-6.429	4.88
226	345.365	8.779	-6.435	4.89
227	345.335	8.779	-6.438	4.89
228	345.365	8.779	-6.435	4.89
229	345.335	8.779	-6.438	4.89
230	345.276	8.779	-6.444	4.89
231	345.365	8.779	-6.435	4.89
232	345.246	8.779	-6.447	4.90
233	345.365	8.779	-6.435	4.89
234	345.335	8.779	-6.438	4.89
235	345.395	8.779	-6.432	4.88
236	345.335	8.779	-6.438	4.89
237	345.335	8.779	-6.438	4.89
238	345.306	8.779	-6.441	4.89
239	345.365	8.779	-6.435	4.89
240	345.395	8.779	-6.432	4.88
241	345.484	8.779	-6.423	4.87
242	345.514	8.779	-6.42	4.87
243	345.484	8.779	-6.423	4.87
244	345.514	8.779	-6.42	4.87
245	345.514	8.779	-6.42	4.87
246	345.484	8.779	-6.423	4.87
247	345.455	8.779	-6.426	4.88
248	345.514	8.779	-6.42	4.87
249	345.425	8.779	-6.429	4.88
250	345.455	8.779	-6.426	4.88
251	345.484	8.779	-6.423	4.87
252	345.544	8.779	-6.417	4.87
253	345.603	8.779	-6.411	4.86
254	345.663	8.779	-6.404	4.85
255	345.693	8.779	-6.401	4.85
256	345.693	8.779	-6.401	4.85
257	345.722	8.779	-6.398	4.85
258	345.663	8.779	-6.404	4.85
259	345.841	8.779	-6.386	4.84
260	345.782	8.779	-6.392	4.84
261	345.931	8.779	-6.377	4.83
262	345.901	8.779	-6.38	4.83
263	345.99	8.779	-6.371	4.82
264	345.961	8.779	-6.374	4.82
265	345.931	8.779	-6.377	4.83
266	346.02	8.779	-6.368	4.82
267	346.169	8.779	-6.353	4.80
268	346.169	8.779	-6.353	4.80
269	346.199	8.779	-6.35	4.80
270	346.228	8.779	-6.347	4.80
271	346.288	8.779	-6.341	4.79
272	346.288	8.779	-6.341	4.79
273	346.437	8.779	-6.326	4.78
274	346.377	8.779	-6.332	4.78
275	346.407	8.779	-6.329	4.78
276	346.437	8.779	-6.326	4.78
277	346.377	8.779	-6.332	4.78
278	346.496	8.779	-6.32	4.77
279	346.496	8.779	-6.32	4.77
280	346.496	8.779	-6.32	4.77
281	346.467	8.779	-6.322	4.77
282	346.586	8.779	-6.31	4.76
283	346.556	8.779	-6.313	4.76
284	346.615	8.779	-6.307	4.76
285	346.705	8.779	-6.298	4.75
286	346.675	8.779	-6.301	4.75
287	346.615	8.779	-6.307	4.76
288	346.705	8.779	-6.298	4.75
289	346.734	8.779	-6.295	4.75
290	346.764	8.779	-6.292	4.74
291	346.615	8.779	-6.307	4.76
292	346.734	8.779	-6.295	4.75
293	346.734	8.779	-6.295	4.75
294	346.675	8.779	-6.301	4.75
295	346.734	8.779	-6.295	4.75
296	346.675	8.779	-6.301	4.75
297	346.526	8.779	-6.316	4.77
298	346.556	8.779	-6.313	4.76
299	346.556	8.779	-6.313	4.76
300	346.645	8.779	-6.304	4.75
301	346.615	8.779	-6.307	4.76
302	346.705	8.779	-6.298	4.75
303	346.675	8.779	-6.301	4.75
304	346.705	8.779	-6.298	4.75
305	346.824	8.779	-6.286	4.74
306	346.764	8.779	-6.292	4.74
307	346.734	8.779	-6.295	4.75
308	346.824	8.779	-6.286	4.74
309	346.794	8.779	-6.289	4.74
310	346.794	8.779	-6.289	4.74
311	346.824	8.779	-6.286	4.74
312	346.854	8.779	-6.283	4.73
313	346.913	8.779	-6.277	4.73
314	346.854	8.779	-6.283	4.73
315	346.854	8.779	-6.283	4.73
316	346.824	8.779	-6.286	4.74
317	346.883	8.779	-6.28	4.73
318	346.824	8.779	-6.286	4.74
319	346.645	8.779	-6.304	4.75
320	346.556	8.779	-6.313	4.76
321	346.467	8.779	-6.322	4.77

322	346.348	8.779	-6.335	4.79
323	346.109	8.779	-6.359	4.81
324	345.901	8.779	-6.38	4.83
325	345.782	8.779	-6.392	4.84
326	345.574	8.779	-6.414	4.86
327	345.425	8.779	-6.429	4.88
328	345.216	8.779	-6.45	4.90
329	344.949	8.779	-6.477	4.93
330	344.83	8.779	-6.489	4.94
331	344.532	8.779	-6.52	4.97
332	344.294	8.779	-6.544	4.99
333	344.115	8.779	-6.562	5.01
334	343.996	8.779	-6.574	5.02
335	343.847	8.779	-6.59	5.04
336	343.699	8.779	-6.605	5.06
337	343.58	8.779	-6.617	5.07
338	343.609	8.779	-6.614	5.06
339	343.58	8.779	-6.617	5.07
340	343.639	8.779	-6.611	5.06
341	343.669	8.779	-6.608	5.06
342	343.788	8.779	-6.596	5.05
343	343.818	8.779	-6.593	5.04
344	343.758	8.779	-6.599	5.05
345	343.847	8.779	-6.59	5.04
346	343.907	8.779	-6.584	5.03
347	343.966	8.779	-6.578	5.03
348	343.996	8.779	-6.574	5.02
349	343.996	8.779	-6.574	5.02
350	344.115	8.779	-6.562	5.01
351	344.145	8.779	-6.559	5.01
352	344.085	8.779	-6.565	5.02
353	344.026	8.779	-6.571	5.02
354	343.818	8.779	-6.593	5.04
355	343.609	8.779	-6.614	5.06
356	343.401	8.779	-6.635	5.09
357	343.103	8.779	-6.666	5.12
358	342.776	8.779	-6.699	5.15
359	342.389	8.779	-6.738	5.19
360	342.062	8.779	-6.772	5.22
361	341.794	8.779	-6.799	5.25
362	341.377	8.779	-6.842	5.29
363	340.991	8.779	-6.881	5.33
364	340.574	8.779	-6.923	5.37
365	340.217	8.779	-6.96	5.41
366	339.89	8.779	-6.993	5.44
367	339.503	8.779	-7.033	5.48
368	339.176	8.779	-7.066	5.52
369	338.849	8.779	-7.099	5.55
370	338.492	8.779	-7.136	5.59
371	338.164	8.779	-7.169	5.62
372	337.837	8.779	-7.202	5.65
373	337.629	8.779	-7.224	5.67
374	337.302	8.779	-7.257	5.71
375	337.093	8.779	-7.278	5.73
376	336.796	8.779	-7.309	5.76
377	336.558	8.779	-7.333	5.78
378	336.35	8.779	-7.354	5.80
379	336.088	8.879	-7.381	5.83
380	335.88	8.879	-7.402	5.85
381	335.731	8.879	-7.417	5.87
382	335.464	8.879	-7.444	5.89
383	335.22	8.779	-7.469	5.92
384	335.101	8.779	-7.481	5.93
385	334.988	8.879	-7.493	5.94
386	334.809	8.879	-7.511	5.96
387	334.595	8.779	-7.533	5.98
388	334.506	8.779	-7.542	5.99
389	334.268	8.779	-7.566	6.02
390	334.179	8.779	-7.576	6.03
391	337.331	8.779	-7.254	5.70
392	340.485	8.779	-6.932	5.38
393	343.229	8.879	-6.653	5.10
394	345.544	8.779	-6.417	4.87
395	347.479	8.779	-6.219	4.67
396	349.205	8.779	-6.043	4.49
397	350.849	8.879	-5.876	4.33
398	352.07	8.879	-5.751	4.20
399	353.166	8.779	-5.639	4.09
400	354.066	8.879	-5.548	4.00
401	354.9	8.879	-5.463	3.91
402	355.644	8.879	-5.387	3.84
403	356.181	8.879	-5.332	3.78
404	356.776	8.879	-5.271	3.72
405	357.253	8.879	-5.223	3.67
406	357.67	8.879	-5.18	3.63
407	358.206	8.879	-5.125	3.58
408	358.713	8.879	-5.074	3.52
409	359.1	8.879	-5.034	3.48
410	359.577	8.879	-4.986	3.44
411	360.024	8.879	-4.94	3.39
412	360.56	8.879	-4.885	3.34
413	361.037	8.879	-4.837	3.29
414	361.663	8.879	-4.773	3.22
415	362.259	8.879	-4.712	3.16
416	362.766	8.879	-4.66	3.11
417	363.272	8.879	-4.609	3.06
418	363.779	8.879	-4.557	3.01
419	364.286	8.879	-4.505	2.96
420	364.852	8.879	-4.448	2.90

# TW1- WELL RECOVERY VS. TIME - KOLLAARD FILE 210430



**RECOVERY DATA TW-1**

<b>t'</b>	<b>t / t'</b>	<b>Abs Pres (kPa)</b>	<b>Temp (°C)</b>	<b>Water Level (m)</b>	<b>Drawdown (m)</b>	<b>Recovery (%)</b>
1	360	365.418	8.879	-4.39	2.84	52%
2	181.0	367.893	8.879	-4.138	2.588	56%
3	121.0	371.299	8.978	-3.79	2.24	62%
4	91.0	374.073	8.978	-3.507	1.957	67%
5	73.0	376.37	8.978	-3.273	1.723	71%
6	61.0	378.31	8.978	-3.075	1.525	74%
7	52.4	379.825	8.879	-2.921	1.371	77%
8	46.0	381.108	8.879	-2.79	1.24	79%
9	41.0	382.093	8.879	-2.69	1.14	81%
10	37.0	382.839	8.879	-2.614	1.064	82%
11	33.7	383.496	8.879	-2.547	0.997	83%
12	31.0	384.093	8.879	-2.486	0.936	84%
13	28.7	384.63	8.879	-2.431	0.881	85%
14	26.7	385.108	8.879	-2.382	0.832	86%
15	25.0	385.675	8.879	-2.324	0.774	87%
16	23.5	386.033	8.879	-2.288	0.738	88%
17	22.2	386.362	8.879	-2.254	0.704	88%
18	21.0	386.66	8.879	-2.224	0.674	89%
19	19.9	386.959	8.879	-2.193	0.643	89%
20	19.0	387.168	8.879	-2.172	0.622	89%
21	18.1	387.37	8.779	-2.152	0.602	90%
22	17.4	387.609	8.779	-2.127	0.577	90%
23	16.7	387.818	8.779	-2.106	0.556	91%
24	16.0	388.027	8.779	-2.085	0.535	91%
25	15.4	388.236	8.779	-2.063	0.513	91%
26	14.8	388.445	8.779	-2.042	0.492	92%
27	14.3	388.624	8.779	-2.024	0.474	92%
28	13.9	388.833	8.779	-2.002	0.452	92%
29	13.4	389.042	8.779	-1.981	0.431	93%
30	13.0	389.251	8.779	-1.96	0.41	93%
31	12.6	389.43	8.779	-1.941	0.391	93%
32	12.3	389.58	8.779	-1.926	0.376	94%
33	11.9	389.729	8.779	-1.911	0.361	94%
34	11.6	389.878	8.779	-1.896	0.346	94%
35	11.3	390.058	8.779	-1.877	0.327	94%
36	11.0	390.177	8.779	-1.865	0.315	95%
37	10.7	390.296	8.779	-1.853	0.303	95%
38	10.5	390.446	8.779	-1.838	0.288	95%
39	10.2	390.595	8.779	-1.823	0.273	95%
40	10.0	390.685	8.779	-1.813	0.263	96%
41	9.8	390.804	8.779	-1.801	0.251	96%
42	9.6	390.924	8.779	-1.789	0.239	96%
43	9.4	390.924	8.779	-1.789	0.239	96%
44	9.2	390.954	8.779	-1.786	0.236	96%
45	9.0	391.043	8.779	-1.777	0.227	96%
46	8.8	391.103	8.779	-1.771	0.221	96%
47	8.7	391.252	8.779	-1.756	0.206	97%
48	8.5	391.342	8.779	-1.746	0.196	97%
49	8.3	391.461	8.779	-1.734	0.184	97%



ATTACHMENT C  
RESULTS OF LABORATORY TESTING  
OF WELL WATER SAMPLES

Client: Kollaard Associates Inc.  
210 Prescott St., Box 189  
Kemptville, ON  
K0G 1J0  
Attention: Ms. Colleen Vermeersch  
PO#:  
Invoice to: Kollaard Associates Inc.

Report Number: 1955815  
Date Submitted: 2021-06-18  
Date Reported: 2021-06-25  
Project: 210430  
COC #: 875413

Page 1 of 5

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**Dear Colleen Vermeersch:**

**Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).**

Report Comments:

Addrine  
Thomas  
2021.06.25  
10:30:13 -04'00'



APPROVAL:

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Addrine Thomas, Inorganics Supervisor

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Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at: <http://www.cala.ca/scopes/2602.pdf>.

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Client: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:  
 Invoice to: Kollaard Associates Inc.

Report Number: 1955815  
 Date Submitted: 2021-06-18  
 Date Reported: 2021-06-25  
 Project: 210430  
 COC #: 875413

Group	Analyte	MRL	Units	Guideline	1563781 Water 2021-06-17 TW1-3hrs	1563782 Water 2021-06-17 TW1-6hrs
Anions	Cl	1	mg/L	AO 250	163	159
	F	0.10	mg/L	MAC 1.5	0.27	0.28
	N-NO2	0.10	mg/L	MAC 1.0	<0.10	<0.10
	N-NO3	0.10	mg/L	MAC 10.0	<0.10	<0.10
	SO4	1	mg/L	AO 500	79	79
General Chemistry	Alkalinity as CaCO3	5	mg/L	OG 30-500	274	274
	Colour (True)	2	TCU		4	5
	Conductivity	5	uS/cm		1180	1180
	DOC	0.5	mg/L	AO 5	2.2	2.3
	pH	1.00		6.5-8.5	7.98	8.02
	S2-	0.01	mg/L	AO 0.05	0.06*	0.08*
	TDS (COND - CALC)	1	mg/L		767	767
Hardness	Turbidity	0.1	NTU	AO 5	3.2	1.1
	Hardness as CaCO3	1	mg/L	OG 80-100	376*	379*
Indices/Calc	Ion Balance	0.01			1.03	1.05
Metals	Ca	1	mg/L		88	89
	Fe	0.03	mg/L	AO 0.3	0.31*	0.09
	K	1	mg/L		7	7
	Mg	1	mg/L		38	38
	Mn	0.01	mg/L	AO 0.05	<0.01	<0.01
	Na	2	mg/L	AO 200	101	103
Nutrients	N-NH3	0.010	mg/L		0.228	0.234
	Total Kjeldahl Nitrogen	0.100	mg/L		0.236	0.294
Subcontract	Tannin & Lignin	0.10	mg/L		0.99	0.92
Subcontract-Inorg	Phenols	0.001	mg/L		<0.001	<0.001

Guideline = ODWSOG

\* = Guideline Exceedence

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 Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

**Certificate of Analysis**

Client: Kollaard Associates Inc.  
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 Kemptville, ON  
 K0G 1J0  
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Report Number: 1955815  
 Date Submitted: 2021-06-18  
 Date Reported: 2021-06-25  
 Project: 210430  
 COC #: 875413

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 402918 <b>Analysis/Extraction Date</b> 2021-06-18 <b>Analyst</b> SWS <b>Method</b> C SM2130B			
Turbidity	<0.1 NTU	100	70-130
<b>Run No</b> 402968 <b>Analysis/Extraction Date</b> 2021-06-21 <b>Analyst</b> SKH <b>Method</b> EPA 350.1			
N-NH3	<0.010 mg/L	101	80-120
<b>Run No</b> 402970 <b>Analysis/Extraction Date</b> 2021-06-21 <b>Analyst</b> SKH <b>Method</b> M SM3120B-3500C			
Calcium	<1 mg/L	100	90-110
Potassium	<1 mg/L	110	87-113
Magnesium	<1 mg/L	102	76-124
Sodium	<2 mg/L	112	82-118
<b>Run No</b> 402973 <b>Analysis/Extraction Date</b> 2021-06-21 <b>Analyst</b> SKH <b>Method</b> EPA 200.8			
Iron	<0.03 mg/L	103	80-120
Manganese	<0.01 mg/L	109	80-120
<b>Run No</b> 402975 <b>Analysis/Extraction Date</b> 2021-06-21 <b>Analyst</b> AET <b>Method</b> C SM4500-S2-D			
S2-	<0.01 mg/L	101	80-120

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 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:   
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Report Number: 1955815  
 Date Submitted: 2021-06-18  
 Date Reported: 2021-06-25  
 Project: 210430  
 COC #: 875413

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 403009 <b>Analysis/Extraction Date</b> 2021-06-21 <b>Analyst</b> SWS			
<b>Method</b> SM2320,2510,4500H/F			
Alkalinity (CaCO3)	<5 mg/L	102	90-110
Conductivity	<5 uS/cm	99	90-110
F	<0.10 mg/L	99	90-110
pH		99	90-110
<b>Run No</b> 403010 <b>Analysis/Extraction Date</b> 2021-06-22 <b>Analyst</b> AX			
<b>Method</b> SM 4110			
N-NO2	0.53 mg/L	111	90-110
N-NO3	<0.10 mg/L	102	90-110
SO4	<1 mg/L	100	90-110
<b>Run No</b> 403013 <b>Analysis/Extraction Date</b> 2021-06-21 <b>Analyst</b> AET			
<b>Method</b> SUBCONTRACT P-INORG			
Phenols	<0.001 mg/L	104	69-132
<b>Run No</b> 403031 <b>Analysis/Extraction Date</b> 2021-06-22 <b>Analyst</b> SWS			
<b>Method</b> C SM2120C			
Colour (True)	<2 TCU	98	90-110
<b>Run No</b> 403042 <b>Analysis/Extraction Date</b> 2021-06-22 <b>Analyst</b> SKH			
<b>Method</b> EPA 351.2			

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**Certificate of Analysis**

Client: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:   
 Invoice to: Kollaard Associates Inc.

Report Number: 1955815  
 Date Submitted: 2021-06-18  
 Date Reported: 2021-06-25  
 Project: 210430  
 COC #: 875413

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
Total Kjeldahl Nitrogen	<0.100 mg/L	110	70-130
<b>Run No</b> 403068 <b>Analysis/Extraction Date</b> 2021-06-22 <b>Analyst</b> AX <b>Method</b> SM 4110			
Chloride	<5 mg/L		90-110
<b>Run No</b> 403083 <b>Analysis/Extraction Date</b> 2021-06-22 <b>Analyst</b> SWS <b>Method</b> SM 5310B			
DOC	<0.5 mg/L	87	80-120
<b>Run No</b> 403088 <b>Analysis/Extraction Date</b> 2021-06-23 <b>Analyst</b> AET <b>Method</b> C SM2340B			
Hardness as CaCO3			
Ion Balance			
TDS (COND - CALC)			
<b>Run No</b> 403229 <b>Analysis/Extraction Date</b> 2021-06-24 <b>Analyst</b> AET <b>Method</b> SUBCONTRACT-A			
Tannin & Lignin	<0.10 mg/L	99	

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210 Prescott St., Box 189  
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Attention: Ms. Colleen Vermeersch  
PO#:  
Invoice to: Kollaard Associates Inc.

Report Number: 1955816  
Date Submitted: 2021-06-18  
Date Reported: 2021-06-20  
Project: 210430  
COC #: 875413

**Dear Colleen Vermeersch:**

**Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).**

Report Comments:

Dragana  
Dzeletovic  
2021.06.20  
11:24:43 -04'00'

APPROVAL: \_\_\_\_\_  
Dragana Dzeletovic-Andric, Microbiology Team Lead

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 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
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Report Number: 1955816  
 Date Submitted: 2021-06-18  
 Date Reported: 2021-06-20  
 Project: 210430  
 COC #: 875413

Group	Analyte	MRL	Units	Guideline	Lab I.D.	Sample Matrix
					Sample Type	Sampling Date
Microbiology	Escherichia Coli	0	ct/100mL	MAC 0	1563783	Water
	Faecal Coliforms	0	ct/100mL		2021-06-17	Water
	Heterotrophic Plate Count	0	ct/1mL		TW1-3hrs	2021-06-17
	Total Coliforms	0	ct/100mL	MAC 0		TW1-6hrs

Guideline = ODWSOG

\* = Guideline Exceedence

Results relate only to the parameters tested on the samples submitted.

Analytical Method: AMBCOLM1

additional QA/QC information available on request.

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## Ryznar Stability Index

$$RSI = 2(pH_s) - pH$$

RSI << 6 → the scale tendency increases as the index decreases

RSI >> 7 → the calcium carbonate formation probably does not lead to a protective corrosion inhibitor film

RSI >> 8 → mild steel corrosion becomes an increasing problem

## Langelier Saturation Index

$$LSI = pH - pH_s$$

If LSI is negative → no potential to scale, the water will dissolve CaCO<sub>3</sub>

If LSI is positive → scale can form and CaCO<sub>3</sub> precipitation may occur

If LSI is close to zero → borderline scale potential, water quality or temperature change or evaporation could change the index

where pH measured from sample

pH<sub>s</sub> = pH at saturation in calcite or calcium carbonate

$$pH_s = (9.3 + A + B) - (C + D)$$

$$A = \frac{\log_{10}[TDS] - 1}{10}$$

$$B = -13.12 \times \log_{10}(\text{°C} + 273) + 34.55$$

$$C = \log_{10}[Ca^{2+} \text{ as } CaCO_3] - 0.4$$

$$D = \log_{10}[\text{alkalinity as } CaCO_3]$$

	TW1-3hr	TW1-6hr
pH	7.98	8.02
hardness [mg/l as CaCO <sub>3</sub> ]	376	379
Alkalinity [mg/l as CaCO <sub>3</sub> ]	274	274
total dissolved solids [mg/l]	767	767
temperature (°C)	11	12
→→ RSI	6.50	6.41
→→ LSI	0.74	0.81