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REPORT ON

HYDROGEOLOGICAL STUDY
6793 HIRAM DRIVE
OSGOODE WARD, GREELY
CITY OF OTTAWA
ONTARIO

Submitted to:

Mr. Natale Giust
3226 Woodroffe Avenue
Nepean, Ontario K2J 4G5

2nd REVISION DATE April 29, 2020
1st REVISION DATE June 28, 2019
DATE April 22, 2019

DISTRIBUTION

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April 22, 2019 (2nd rev. April 29, 2020) 180938

Mr. Natale Giust
3226 Woodroffe Avenue
Nepean, Ontario K2J 4G5

RE: HYDROGEOLOGICAL AND TERRAIN STUDY
EXISTING SUPPLY WELL
PROPOSED LIGHT INDUSTRIAL BUILDING
6793 HIRAM DRIVE, GREELY
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 6793 Hiram Drive 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 auto mechanics shop with an accessory office use.

The well in question was constructed by Air Rock Drilling Company of Richmond, Ontario on March 19, 2019. 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 April 4, 2019. 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 is 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:

- Office building, per employee per eight hour shift = 75 Litres/employee/day x 8 = 750 L/day
- Warehouse, per water closet (1) And per loading bay (3) = 950 L/day + 150 L/bay/day x 3 = 1400 L/day
- Total daily design flow = 2150 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 x ADD

ADD = 2150 litres/day x 1 day / 8 hours x 1 hour / 60 minutes
= 4.5 litres/minute

MHD = 1.8 x ADD
= 1.8 x 4.5 litres/minute
= 8.1 litres/minute

Alternatively, the City of Ottawa Water Distribution Guideline Section 4.2.8 indicates the average water demand for light industrial usage is 35,000 L/gross ha/day. The gross area of the developable footprint on the site is 0.30 hectares.

ADD = 0.3027 ha x 35,000 L/gross ha/day
= 7.4 L/min
MHD = 7.4 L/min x 1.8 = 13.3 L/min

Using the more conservative figure for groundwater usage, the City of Ottawa predicated water usage for ADD and MHD of 7.4 L/min and 13.3 L/min, respectively are used.

The Maximum Hourly Demand for the site based on its proposed use is expected to be about 13.3 litres/minute, compared to the pumping test rate which was 49 litres/minute.

Water Quantity

The well was pumped for six hours at a pumping rate of about 49 litres per minute. Over the course of the pumping test, the water level in the well dropped some 6.55 metres. At the end of the pumping test, about 4 hours and 15 minutes were required for 95 percent recovery of the total drawdown in the static water level created during pumping. Full recovery occurred in less than 8 hours.

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^3/day
ds is the change in drawdown over one time log cycle, m
T is the transmissivity, m^2/day

Specific Capacity = Q / TD
= 70.7 m^3/day / 6.55 m
=10.8 m^3/day/m

where Q = test pumping rate (m^3/day)
TD = total drawdown (m)

Based on the pumping test drawdown data the transmissivity of the aquifer is estimated to be about 8.5 m^2/day. Based on the recovery data the aquifer transmissivity is estimated to be about 5.5 m^2/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. However, the test was sufficient to establish that the specific capacity for the well pumping at the test rate is sufficient to supply 10,800 litres of water per day per metre of drawdown. The available drawdown at the well is about 25.6 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 2150 litres per day, expected drawdowns 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 $CaC0_3$ is often softened for domestic use. The hardness at the well is 183 milligrams per litre. Since the water supply at the site is not being used for domestic uses, and the water is considered to be moderately hard (i.e. less than 200 mg/l), the owner should consider

whether the water requires treatment to reduce hardness (See Comments below on Total Dissolved Solids and Sulphides for further information regarding corrosivity). Treatment consisting of water softening by conventional sodium ion exchange 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 495 and 522 milligrams per litre after three and six hours of pumping, respectively, and may be 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 7.32 to 7.45, and LSI of 0.17 to 0.30, respectively, indicating that the water is there is little scale potential and that the water may be mildly corrosive. 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 moderate 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 a bit elevated but well within the aesthetic objectives of 200 mg/l for taste.

Sulphides
The sulphides levels of the samples obtained were about 0.48 to 0.53 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 86 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 April 2, 2019, at which time two boreholes numbered BH1 and BH2 were put down at the site using a track mounted drill rig equipped with a hollow stem auger owned and operated by Marathon Drilling of Greely, Ontario. A description of the subsurface conditions encountered at the boreholes is given in the attached Record of Borehole Sheets. The approximate locations of the boreholes are shown on the attached Site Plan, Figure 2.

In general, the upper overburden materials encountered at the site are indicated to consist of fill overlying topsoil followed by a deposit of silty sand (BH2) or silt (BH1).

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 2150 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 (Waterloo Biofilter) and a shallow buried trench system which is to be timer dosed to ensure uniform dispersal. The proposed leaching bed will occupy an area of about 104 square metres in the northeast portion of the site. The location of the sewage system is shown on the Site Plan (180938-SP) provided under separate cover as part of a Development Application with the City of Ottawa. An imported sand layer of about 0.45 metres thickness (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.

Adjacent Sewage Systems

- The adjacent property north of the site (6799 Hiram Drive) is vacant and there is no sewage system on that site.
- The adjacent property south of the site (6787 Hiram Drive) is currently under Development Review. The proposed sewage system is located in the northwest portion of that site with their existing drilled well located in the southwest portion of that site. This is based on a review of a drawing entitled Site Plan & Landscape Plan, prepared by C. Enendu, revision 1, dated June 18, 2018.
- Based on the proposed well and sewage system locations on the subject property and that of the adjacent property to the south, there are no concerns with meeting the Ontario Building Code separation distances between the proposed sewage systems and existing wells.
- Any future well proposed on the adjacent undeveloped property to the north at 6799 Hiram Drive, would need to be constructed to ensure that the required separation distance of at least 16.1 metres (twice the grade raise of the proposed sewage bed plus 15 metres) is maintained between the proposed well on that property and the sewage system on the subject lot. There is currently about 3.2 metres of distance between the proposed sewage system and the property line to the north.

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 southeast portion of the site, while the location of the proposed septic system is within the northeast portion of the site, and is greater than 16.2 metres distance from the well location. It is understood that grey water is directed to a holding tank located inside

the building. The well casing was observed to extend about 600 millimetres above grade. The Site Grading Plan (Kollaard Drawing 180938-GR) indicates that the proposed finished grade elevation at the well location is about 100.30 metres geodetic. The top of the well casing shall be at a minimum elevation of at least 100.70 metres to ensure that 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 17.3 metres below the existing ground surface. The well is physically separated from the adjacent driveway and parking lot by the placement of armour stone. 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. The stormwater pond is located in the southwest portion of the site and is at least 15 metres away from the well location. Grey water is to be stored in a holding tank inside the building. 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. It is understood that all chemical storage at the site is to be located within the building. This is sufficient secondary storage to ensure protection of the well.

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 Site Grading Plan (Kollaard Drawing 180938-GR) for the proposed development shows the placement of armour stone. The well is located such that it is easily accessible for maintenance/repairs. A lock on the well cap is useful to prevent vandalism.

Floodplain Considerations

The 1:100 year floodplain elevation at the site is indicated to be 99.89 metres geodetic. Information from the City of Ottawa indicates that the top of the well casing shall be at least 300 millimetres above the floodplain elevation (~100.19 metres). The proposed finished grade at the well location is indicated to be at 100.30 metres. The top of the well casing shall be at a minimum elevation of at least 100.70 metres to ensure that it is at least 400 millimetres above the finished grade at the well location.

Therefore, the potential for contamination of the well due to flooding is minimized.

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:
Records of Borehole Sheets
Figure 1 - Key Plan
Figure 2 - Site 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

RECORD OF BOREHOLE BH1

PROJECT: Proposed Light Industrial Development
CLIENT: Mr. Nat Guist
LOCATION: 6793 Hiram Drive, Greely, Ottawa, Ontario
PENETRATION TEST HAMMER: 63.5kg, Drop, 0.76mm

PROJECT NUMBER: 180938
DATE OF BORING: April 2, 2019
SHEET 1 of 1
DATUM: Geodetic

DEPTH SCALE (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	NUMBER	TYPE	BLOWS/0.3m	UNDIST. SHEAR STRENGTH / REM. SHEAR STRENGTH Cu, kPa (20 40 60 80)	DYNAMIC CONE PENETRATION TEST blows/300 mm (10 30 50 70 90)	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface		99.75							
0	Grey crushed stone (FILL)		0.00							
			99.15							
	Yellow brown silty sand, trace clay and organics (FILL)		0.60							
			98.85							
1	Grey brown SILT, trace sand		0.90	1	SS	6				
				2	SS	25				
2			97.45							
	Grey SILT, trace to some sand and clay seams		2.30	3	SS	15				
3				4	SS	19				
				5	SS	6				
4										
				6	SS	4				
5										
				7	SS	8				
6										
				8	SS	7				
7			92.57							
	Grey fine to medium SAND, trace silt		7.18	9	SS	15				
				10	SS	21				
8			91.53							
	End of Borehole		8.22							

Water observed in borehole at approximately 1.5 metres below the existing ground surface on April 2, 2019.

DEPTH SCALE: 1 to 75
LOGGED: DT

BORING METHOD: Power Auger
AUGER TYPE: 200 mm Hollow Stem
CHECKED: SD

RECORD OF BOREHOLE BH2

PROJECT: Proposed Light Industrial Development
CLIENT: Mr. Nat Guist
LOCATION: 6793 Hiram Drive, Greely, Ottawa, Ontario
PENETRATION TEST HAMMER: 63.5kg, Drop, 0.76mm

PROJECT NUMBER: 180938
DATE OF BORING: April 2, 2019
SHEET 1 of 1
DATUM: Geodetic

DEPTH SCALE (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	NUMBER	TYPE	BLOWS/0.3m
	Ground Surface		99.74			
0	Grey brown sand, gravel, trace brick and concrete, organics (FILL)		0.00 / 99.19	1	SS	23
	TOPSOIL		0.55 / 98.89			
1	Grey brown SILTY SAND		0.85 / 98.59	2	SS	6
	Grey brown SILTY CLAY		1.15	3	SS	14
2			97.44			
	Grey SILTY CLAY		2.30	4	SS	12
3				5	SS	10
4				6	SS	14
			94.92			
5	Grey SILT, trace sand, and clay		4.82	7	SS	21
				8	SS	23
6				9	SS	20
7				10	SS	15
			92.28			
	Borehole continued as Probe Hole, probably grey silt, then grey silty sand with some gravel, cobbles and boulders (GLACIAL TILL)		7.46			
8						
9						
10						
11			88.23			
	End of Borehole, Practical refusal on large boulder or bedrock		11.51			
12						
13						

UNDIST. SHEAR STRENGTH (Cu, kPa) — 20, 40, 60, 80
REM. SHEAR STRENGTH (Cu, kPa) — 20, 40, 60, 80

DYNAMIC CONE PENETRATION TEST blows/300 mm — 10, 30, 50, 70, 90

ADDITIONAL LAB TESTING

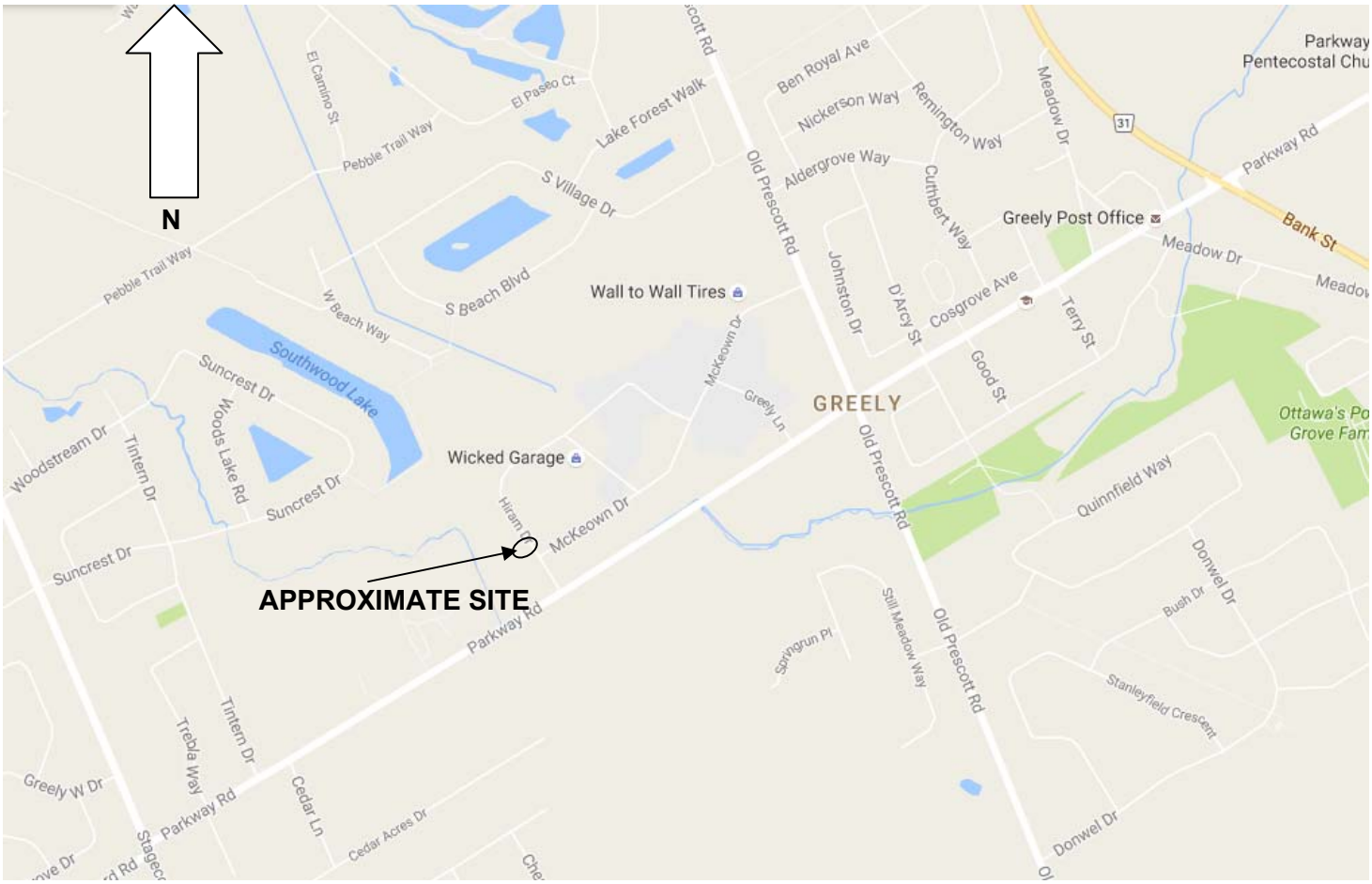
PIEZOMETER OR STANDPIPE INSTALLATION

Water observed in borehole at approximately 1.4 metres below the existing ground surface on April 2, 2019.

DEPTH SCALE: 1 to 75
BORING METHOD: Power Auger
AUGER TYPE: 200 mm Hollow Stem
LOGGED: DT
CHECKED: SD

KEY PLAN

FIGURE 1



NOT TO SCALE

Kollaard Associates
Engineers

Project No. 180938

Date April 2019

DRAWING NUMBER:

SITE PLAN, FIGURE 2

LEGEND:

BH1 APPROXIMATE BOREHOLE LOCATION

REFERENCE: PLAN SUPPLIED BY CITY OF OTTAWA EMAPS.

SPECIAL NOTE: THIS DRAWING TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT.

REV.	NAME	DATE	DESCRIPTION

Kollaard Associates
Engineers

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http://www.kollaard.ca

(613) 860-0923
info@kollaard.ca

CLIENT:
MR. NAT GIUST

PROJECT:
GEOTECHNICAL INVESTIGATION FOR PROPOSED WAREHOUSE BUILDING

LOCATION:
6793 HIRAM DRIVE, GREELY
CITY OF OTTAWA, ONTARIO

DESIGNED BY:	*DATE:*
--	MARCH 18, 2019
DRAWN BY:	*SCALE:*
DT	N.T.S

KOLLAARD FILE NUMBER:
180938

TABLE I

FIELD WATER QUALITY MEASUREMENTS
FOR TEST WELL

	Time Since Pumping Test Started (min)	Temp. (^{0}C)	pH	Turbidity (NTU)	Total Dissolved Solids (ppm)	Conductivity (µS)	Free chlorine (ppm)
TW 1	60	10.7	8.2	3.2	350	700	-
	120	8.3	8.5	0.0	346	695	-
	180	8.3	8.0	0.0	344	687	0.0
	240	8.4	8.1	0.0	350	700	-
	300	8.4	8.0	0.0	362	720	-
	360	8.4	8.1	0.0	368	734	0.0

ATTACHMENT A

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

Ontario — Ministry of the Environment and Climate Change

Measurements recorded in: ☐ Metric ☒ Imperial

We Tag#:A260947 (int Below)

A260947

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	Watko Construction Ltd.		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
811 Kennedy Road	Kemptville	ON	K0G 1J0	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
6793 Hiram Drive	Osgoode	P/L 5	4

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa Carleton	Greely	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	454576	5011571	4M-351	PT Blk 7

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/ft) From	Depth (m/ft) To
	Sand	+ Clay Gravel		0	52
Grey	Limestone			52	120
Grey	Limestone	W/ Grey Sandstone Mix		120	152
Grey	Limestone	W/ Grey Sandstone Mix		152	162

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³)
58'	48'	Neat cement	9.36
48'	0'	Bentonite slurry	16.8

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify

Well Use

☐ Public ☐ Commercial ☐ Not used
☒ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6 1/4"	Steel	.188"	+2'	58'
5 7/8"	Open Hole		58'	162'

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Construction Record - Screen

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

Water Details

Water found at Depth (m/ft)	Kind of Water	Hole Diameter Depth From	Depth To	Diameter (cm/in)
152 (m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify	0'	58'	9 7/8"
(m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify	58'	162'	5 7/8"
(m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify			

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, specify **Not tested**

If pumping discontinued, give reason: X

Pump intake set at (m/ft): 100

Pumping rate (l/min / GPM): 15

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 38.3"

If flowing give rate (l/min / GPM): X

Recommended pump depth (m/ft): 100'

Recommended pump rate (l/min / GPM): 15

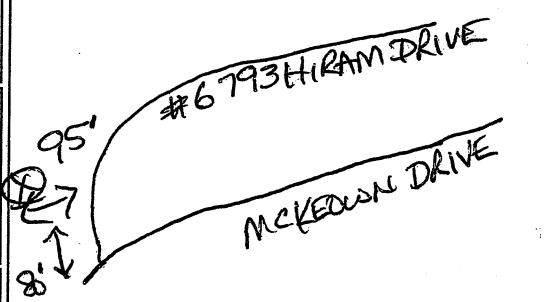
Well production (l/min / GPM): [redacted] 15

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	17'4"		38.3'
1	25.6	1	31.5
2	28.1	2	26.7
3	29.8	3	22.3
4	30.7	4	19.7
5	31.8	5	18.1
10	34.7	10	17.4
15	36.2	15	17.4
20	37.9	20	17.4
25	38	25	17.4
30	38.1	30	17.4
40	38.3	40	17.4
50	38.3	50	17.4
60	38.3'	60	17.4"

Map of Well Location

Please provide a map below following instructions on the back.



Comments: 3/4HP 15GPM Set @ 100 Ft

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd.	1119

Business Address (Street Number/Name)	Municipality
6659 Franktown Road, RR#1	Richmond

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

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
6138382170	Hogan, Dan

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
T3058		2019 03 31

Well owner's information package delivered	Date Package Delivered	Ministry Use Only
☒ Yes ☐ No	2019 03 22	Audit No. Z302592
	Date Work Completed: 2019 03 19	Received

0506E (2014/11) — Ministry's Copy

CERTIFICATE OF WELL COMPLIANCE

Ottawa

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: WATKO CONSTRUCTION LTD.

Location: #6793 HIRAM DRIVE, Greely

LOT: 5 **CON:** 4 **PLAN #** 4M-351 **S/L #** PT BLK 7 part

Ottawa-Carleton / Geographical Township of OSGOODE

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 19TH Day of MARCH, 2019

Jeremy Hanna (T3632) Air Rock Drilling Co. Ltd. (# 1119)

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. Twp of Osgoode Requirements, 1998

Signed this 1st day of April, 2019

(Engineer)

2019106
A260947

Shaping our future together
Ensemble, formons notre avenir

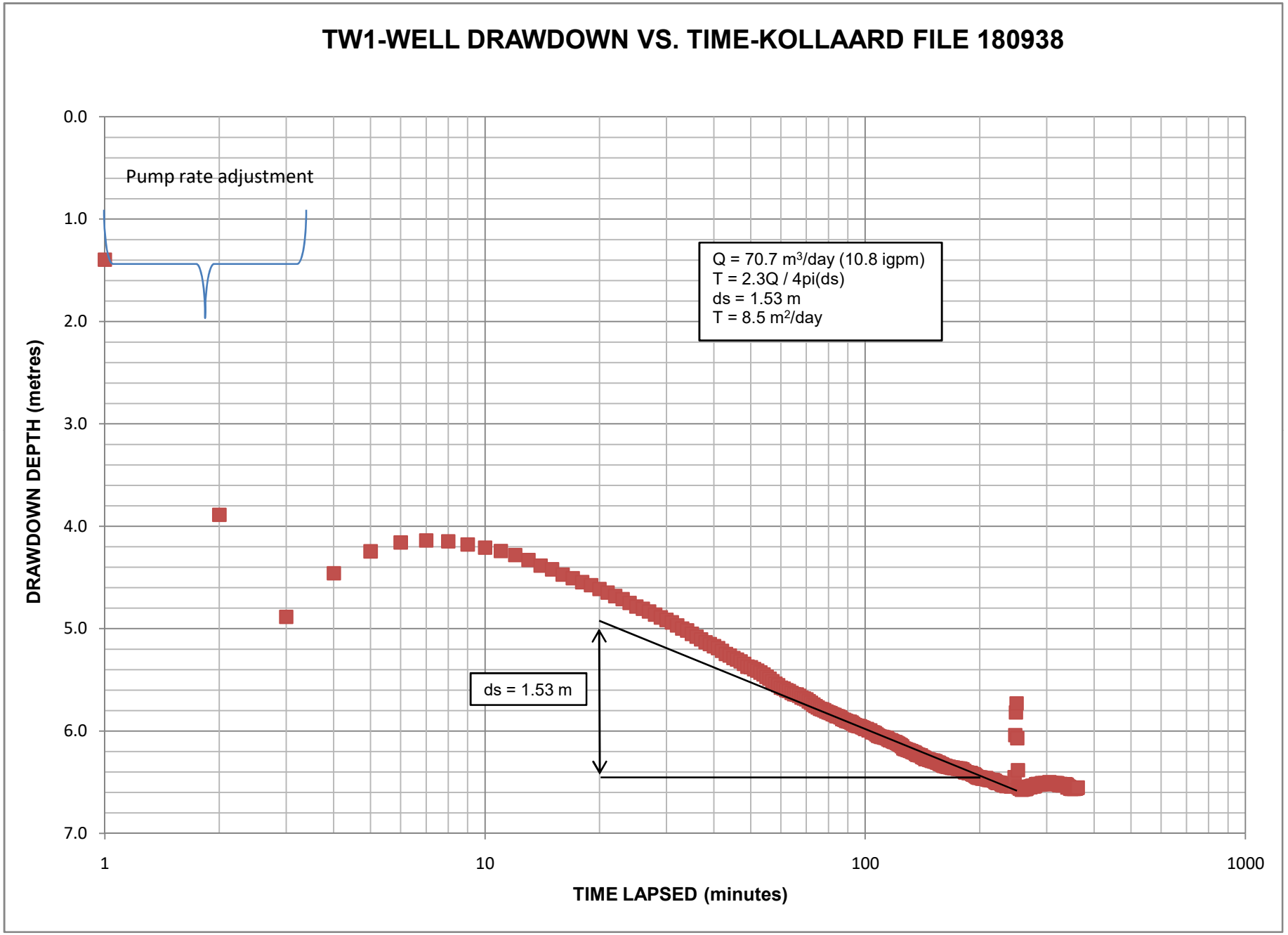
City of Ottawa
Client Service Ce
8763 Victoria Stree

Kollaard Associates
Engineers
P.O. Box 189
210 Prescott Street, Unit 1
Kemptville, Ontario K0G 1J0

2001 International Year of Volunteers Année internationale

ATTACHMENT B

PUMPING TEST DATA FOR TW1


TW1-WELL DRAWDOWN VS. TIME-KOLLAARD FILE 180938
Pump rate adjustment
Q = 70.7 m³/day (10.8 igpm)
T = 2.3Q / 4pi(ds)
ds = 1.53 m
T = 8.5 m²/day
ds = 1.53 m
DRAWDOWN DEPTH (metres)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
1
10
100
1000
TIME LAPSED (minutes)

Kollaard File 180938 Pump Rate 49.1 litres/minute

DRAWDOWN DATA TW-1

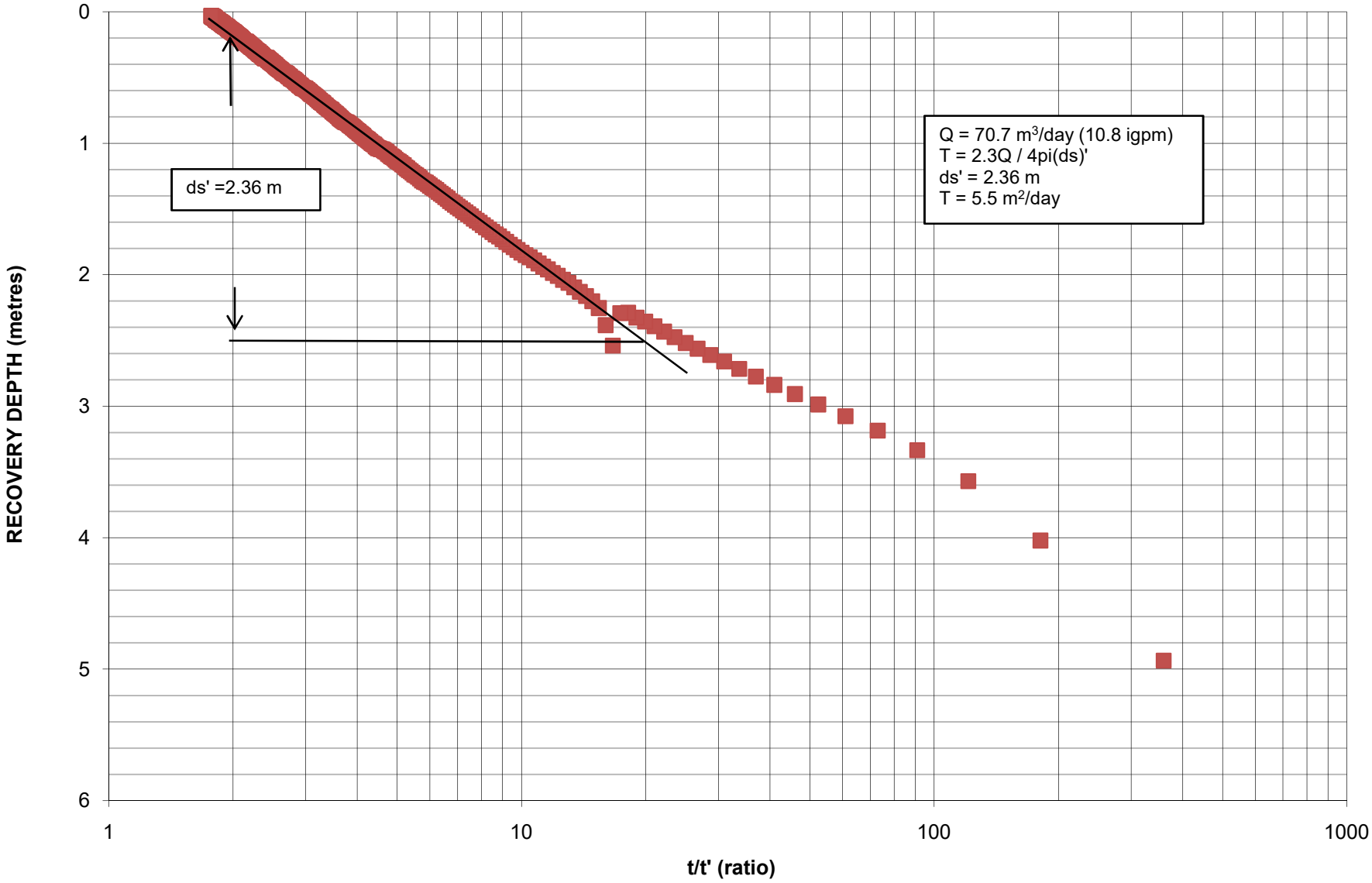
Time Lapsed (minutes)	Abs Pres (kPa)	Temp (°C)	Water Level (m)	Drawdown (m)
0	293.688	8.382	-4.853	0.00
1	280.012	8.382	-6.248	1.40
2	255.561	8.282	-8.741	3.89
3	245.79	8.182	-9.738	4.89
4	249.962	8.082	-9.312	4.46
5	252.069	8.082	-9.097	4.24
6	252.919	7.983	-9.011	4.16
7	253.117	7.882	-8.991	4.14
8	253.028	7.882	-9	4.15
9	252.731	7.882	-9.03	4.18
10	252.424	7.782	-9.061	4.21
11	252.098	7.782	-9.094	4.24
12	251.712	7.782	-9.134	4.28
13	251.237	7.782	-9.182	4.33
14	250.703	7.782	-9.237	4.38
15	250.347	7.782	-9.273	4.42
16	249.833	7.682	-9.325	4.47
17	249.507	7.682	-9.359	4.51
18	249.121	7.682	-9.398	4.55
19	248.825	7.682	-9.428	4.58
20	248.469	7.682	-9.465	4.61
21	248.113	7.682	-9.501	4.65
22	247.787	7.682	-9.534	4.68
23	247.49	7.682	-9.564	4.71
24	247.134	7.682	-9.601	4.75
25	246.778	7.682	-9.637	4.78
26	246.571	7.682	-9.658	4.81
27	246.304	7.682	-9.685	4.83
28	246.007	7.682	-9.716	4.86
29	245.74	7.682	-9.743	4.89
30	245.503	7.682	-9.767	4.91
31	245.266	7.682	-9.791	4.94
32	244.969	7.682	-9.821	4.97
33	244.673	7.682	-9.852	5.00
34	244.495	7.682	-9.87	5.02
35	244.168	7.682	-9.903	5.05
36	243.902	7.682	-9.93	5.08
37	243.635	7.682	-9.957	5.10
38	243.368	7.682	-9.985	5.13
39	243.19	7.682	-10.003	5.15
40	242.982	7.682	-10.024	5.17
41	242.804	7.682	-10.042	5.19
42	242.538	7.682	-10.069	5.22
43	242.241	7.682	-10.1	5.25
44	242.093	7.682	-10.115	5.26
45	241.856	7.682	-10.139	5.29
46	241.707	7.682	-10.154	5.30
47	241.529	7.682	-10.172	5.32
48	241.292	7.682	-10.196	5.34
49	241.025	7.682	-10.224	5.37
50	240.966	7.682	-10.23	5.38
51	240.788	7.682	-10.248	5.40
52	240.64	7.682	-10.263	5.41
53	240.462	7.682	-10.281	5.43
54	240.284	7.682	-10.299	5.45
55	240.047	7.682	-10.323	5.47
56	239.869	7.682	-10.341	5.49
57	239.632	7.682	-10.366	5.51
58	239.395	7.682	-10.39	5.54
59	239.247	7.682	-10.405	5.55
60	239.009	7.682	-10.429	5.58
61	238.921	7.682	-10.438	5.59
62	238.772	7.682	-10.453	5.60
63	238.683	7.682	-10.462	5.61
64	238.506	7.682	-10.48	5.63
65	238.387	7.682	-10.493	5.64
66	238.357	7.682	-10.496	5.64
67	238.239	7.682	-10.508	5.66
68	238.061	7.682	-10.526	5.67
69	237.972	7.682	-10.535	5.68
70	237.883	7.682	-10.544	5.69
71	237.705	7.682	-10.562	5.71
72	237.557	7.682	-10.577	5.72
73	237.379	7.682	-10.595	5.74
74	237.231	7.682	-10.61	5.76
75	237.112	7.682	-10.623	5.77
76	236.994	7.682	-10.635	5.78
77	236.934	7.682	-10.641	5.79
78	236.846	7.682	-10.65	5.80
79	236.727	7.682	-10.662	5.81
80	236.638	7.682	-10.671	5.82
81	236.579	7.682	-10.677	5.82
82	236.46	7.682	-10.689	5.84
83	236.401	7.682	-10.695	5.84
84	236.282	7.682	-10.707	5.85
85	236.253	7.682	-10.71	5.86
86	236.164	7.682	-10.719	5.87
87	235.986	7.682	-10.737	5.88
88	235.927	7.682	-10.743	5.89

89	235.838	7.682	-10.753	5.90
90	235.778	7.682	-10.759	5.91
91	235.749	7.682	-10.762	5.91
92	235.66	7.682	-10.771	5.92
93	235.541	7.682	-10.783	5.93
94	235.423	7.682	-10.795	5.94
95	235.363	7.682	-10.801	5.95
96	235.334	7.682	-10.804	5.95
97	235.304	7.682	-10.807	5.95
98	235.215	7.682	-10.816	5.96
99	235.156	7.682	-10.822	5.97
100	235.037	7.682	-10.834	5.98
101	235.037	7.682	-10.834	5.98
102	234.919	7.682	-10.846	5.99
103	234.919	7.682	-10.846	5.99
104	234.741	7.682	-10.864	6.01
105	234.711	7.682	-10.867	6.01
106	234.652	7.682	-10.873	6.02
107	234.534	7.682	-10.886	6.03
108	234.415	7.682	-10.898	6.05
109	234.356	7.682	-10.904	6.05
110	234.297	7.682	-10.91	6.06
111	234.297	7.682	-10.91	6.06
112	234.237	7.682	-10.916	6.06
113	234.208	7.682	-10.919	6.07
114	234.178	7.682	-10.922	6.07
115	234.059	7.682	-10.934	6.08
116	233.97	7.682	-10.943	6.09
117	233.97	7.682	-10.943	6.09
118	233.882	7.682	-10.952	6.10
119	233.822	7.682	-10.958	6.11
120	233.793	7.682	-10.961	6.11
121	233.704	7.682	-10.97	6.12
122	233.644	7.682	-10.976	6.12
123	233.556	7.682	-10.985	6.13
124	233.496	7.682	-10.991	6.14
125	233.378	7.682	-11.003	6.15
126	233.2	7.682	-11.022	6.17
127	233.141	7.682	-11.028	6.18
128	233.111	7.682	-11.031	6.18
129	233.052	7.682	-11.037	6.18
130	233.022	7.682	-11.04	6.19
131	232.963	7.682	-11.046	6.19
132	232.933	7.682	-11.049	6.20
133	232.844	7.682	-11.058	6.21
134	232.815	7.682	-11.061	6.21
135	232.785	7.682	-11.064	6.21
136	232.667	7.682	-11.076	6.22
137	232.578	7.682	-11.085	6.23
138	232.578	7.682	-11.085	6.23
139	232.518	7.682	-11.091	6.24
140	232.518	7.682	-11.091	6.24
141	232.37	7.682	-11.106	6.25
142	232.341	7.682	-11.109	6.26
143	232.281	7.682	-11.115	6.26
144	232.163	7.682	-11.127	6.27
145	232.163	7.682	-11.127	6.27
146	232.163	7.682	-11.127	6.27
147	232.103	7.682	-11.133	6.28
148	232.074	7.682	-11.136	6.28
149	232.044	7.682	-11.139	6.29
150	231.985	7.682	-11.145	6.29
151	232.015	7.682	-11.142	6.29
152	231.926	7.682	-11.151	6.30
153	231.955	7.682	-11.148	6.30
154	231.866	7.682	-11.158	6.31
155	231.837	7.682	-11.161	6.31
156	231.807	7.682	-11.164	6.31
157	231.718	7.682	-11.173	6.32
158	231.689	7.682	-11.176	6.32
159	231.659	7.682	-11.179	6.33
160	231.57	7.682	-11.188	6.34
161	231.511	7.682	-11.194	6.34
162	231.54	7.682	-11.191	6.34
163	231.481	7.682	-11.197	6.34
164	231.452	7.682	-11.2	6.35
165	231.422	7.682	-11.203	6.35
166	231.422	7.682	-11.203	6.35
167	231.392	7.682	-11.206	6.35
168	231.392	7.682	-11.206	6.35
169	231.333	7.682	-11.212	6.36
170	231.363	7.682	-11.209	6.36
171	231.303	7.682	-11.215	6.36
172	231.303	7.682	-11.215	6.36
173	231.303	7.682	-11.215	6.36
174	231.274	7.682	-11.218	6.37
175	231.244	7.682	-11.221	6.37
176	231.274	7.682	-11.218	6.37
177	231.214	7.682	-11.224	6.37
178	231.244	7.682	-11.221	6.37
179	231.185	7.682	-11.227	6.37
180	231.185	7.682	-11.227	6.37
181	231.066	7.682	-11.239	6.39
182	231.037	7.682	-11.242	6.39
183	230.918	7.682	-11.254	6.40

184	230.889	7.682	-11.257	6.40
185	230.889	7.682	-11.257	6.40
186	230.859	7.682	-11.26	6.41
187	230.829	7.682	-11.263	6.41
188	230.829	7.682	-11.263	6.41
189	230.829	7.682	-11.263	6.41
190	230.8	7.682	-11.266	6.41
191	230.74	7.682	-11.272	6.42
192	230.681	7.682	-11.278	6.43
193	230.711	7.682	-11.275	6.42
194	230.622	7.682	-11.284	6.43
195	230.563	7.682	-11.29	6.44
196	230.503	7.682	-11.297	6.44
197	230.444	7.682	-11.303	6.45
198	230.414	7.682	-11.306	6.45
199	230.385	7.682	-11.309	6.46
200	230.414	7.682	-11.306	6.45
201	230.385	7.682	-11.309	6.46
202	230.385	7.682	-11.309	6.46
203	230.296	7.682	-11.318	6.47
204	230.326	7.682	-11.315	6.46
205	230.326	7.682	-11.315	6.46
206	230.296	7.682	-11.318	6.47
207	230.326	7.682	-11.315	6.46
208	230.355	7.682	-11.312	6.46
209	230.237	7.682	-11.324	6.47
210	230.237	7.682	-11.324	6.47
211	230.177	7.682	-11.33	6.48
212	230.177	7.682	-11.33	6.48
213	230.177	7.682	-11.33	6.48
214	230.177	7.682	-11.33	6.48
215	230.148	7.682	-11.333	6.48
216	230.148	7.682	-11.333	6.48
217	230.148	7.682	-11.333	6.48
218	230.088	7.682	-11.339	6.49
219	230.088	7.682	-11.339	6.49
220	229.97	7.682	-11.351	6.50
221	229.97	7.682	-11.351	6.50
222	229.911	7.682	-11.357	6.50
223	229.881	7.682	-11.36	6.51
224	229.911	7.682	-11.357	6.50
225	229.881	7.682	-11.36	6.51
226	229.881	7.682	-11.36	6.51
227	229.881	7.682	-11.36	6.51
228	229.792	7.682	-11.369	6.52
229	229.733	7.682	-11.375	6.52
230	229.733	7.682	-11.375	6.52
231	229.674	7.682	-11.381	6.53
232	229.703	7.682	-11.378	6.53
233	229.674	7.682	-11.381	6.53
234	229.703	7.682	-11.378	6.53
235	229.585	7.682	-11.39	6.54
236	229.614	7.682	-11.387	6.53
237	229.644	7.682	-11.384	6.53
238	229.614	7.682	-11.387	6.53
239	229.644	7.682	-11.384	6.53
240	229.614	7.682	-11.387	6.53
241	229.585	7.682	-11.39	6.54
242	229.525	7.682	-11.396	6.54
243	229.555	7.682	-11.393	6.54
244	229.585	7.682	-11.39	6.54
245	229.644	7.682	-11.384	6.53
246	229.555	7.682	-11.393	6.54
247	230.444	7.682	-11.303	6.45
248	234.474	7.682	-10.892	6.04
249	236.638	7.682	-10.671	5.82
250	237.498	7.682	-10.583	5.73
251	234.178	7.682	-10.922	6.07
252	231.096	7.682	-11.236	6.38
253	229.466	7.682	-11.402	6.55
254	229.496	7.682	-11.399	6.55
255	229.348	7.682	-11.414	6.56
256	229.377	7.682	-11.411	6.56
257	229.377	7.682	-11.411	6.56
258	229.229	7.682	-11.426	6.57
259	229.318	7.682	-11.417	6.56
260	229.259	7.682	-11.423	6.57
261	229.288	7.682	-11.42	6.57
262	229.348	7.682	-11.414	6.56
263	229.348	7.682	-11.414	6.56
264	229.288	7.682	-11.42	6.57
265	229.318	7.682	-11.417	6.56
266	229.377	7.682	-11.411	6.56
267	229.437	7.682	-11.405	6.55
268	229.496	7.682	-11.399	6.55
269	229.466	7.682	-11.402	6.55
270	229.496	7.682	-11.399	6.55
271	229.496	7.682	-11.399	6.55
272	229.466	7.682	-11.402	6.55
273	229.555	7.682	-11.393	6.54
274	229.555	7.682	-11.393	6.54
275	229.614	7.682	-11.387	6.53
276	229.555	7.682	-11.393	6.54
277	229.585	7.682	-11.39	6.54
278	229.555	7.682	-11.393	6.54

279	229.585	7.682	-11.39	6.54
280	229.644	7.682	-11.384	6.53
281	229.733	7.682	-11.375	6.52
282	229.763	7.682	-11.372	6.52
283	229.763	7.682	-11.372	6.52
284	229.792	7.682	-11.369	6.52
285	229.733	7.682	-11.375	6.52
286	229.733	7.682	-11.375	6.52
287	229.763	7.682	-11.372	6.52
288	229.733	7.682	-11.375	6.52
289	229.792	7.682	-11.369	6.52
290	229.792	7.682	-11.369	6.52
291	229.763	7.682	-11.372	6.52
292	229.881	7.682	-11.36	6.51
293	229.822	7.682	-11.366	6.51
294	229.822	7.682	-11.366	6.51
295	229.792	7.682	-11.369	6.52
296	229.822	7.682	-11.366	6.51
297	229.881	7.682	-11.36	6.51
298	229.851	7.682	-11.363	6.51
299	229.792	7.682	-11.369	6.52
300	229.792	7.682	-11.369	6.52
301	229.851	7.682	-11.363	6.51
302	229.851	7.682	-11.363	6.51
303	229.851	7.682	-11.363	6.51
304	229.881	7.682	-11.36	6.51
305	229.97	7.682	-11.351	6.50
306	229.881	7.682	-11.36	6.51
307	229.881	7.682	-11.36	6.51
308	229.881	7.682	-11.36	6.51
309	229.881	7.682	-11.36	6.51
310	229.822	7.682	-11.366	6.51
311	229.763	7.682	-11.372	6.52
312	229.851	7.682	-11.363	6.51
313	229.792	7.682	-11.369	6.52
314	229.822	7.682	-11.366	6.51
315	229.851	7.682	-11.363	6.51
316	229.792	7.682	-11.369	6.52
317	229.851	7.682	-11.363	6.51
318	229.822	7.682	-11.366	6.51
319	229.851	7.682	-11.363	6.51
320	229.851	7.682	-11.363	6.51
321	229.792	7.682	-11.369	6.52
322	229.733	7.682	-11.375	6.52
323	229.733	7.682	-11.375	6.52
324	229.674	7.682	-11.381	6.53
325	229.703	7.682	-11.378	6.53
326	229.792	7.682	-11.369	6.52
327	229.733	7.682	-11.375	6.52
328	229.703	7.682	-11.378	6.53
329	229.733	7.682	-11.375	6.52
330	229.644	7.682	-11.384	6.53
331	229.703	7.682	-11.378	6.53
332	229.733	7.682	-11.375	6.52
333	229.703	7.682	-11.378	6.53
334	229.703	7.682	-11.378	6.53
335	229.733	7.682	-11.375	6.52
336	229.733	7.682	-11.375	6.52
337	229.733	7.682	-11.375	6.52
338	229.703	7.682	-11.378	6.53
339	229.674	7.682	-11.381	6.53
340	229.437	7.682	-11.405	6.55
341	229.555	7.682	-11.393	6.54
342	229.525	7.682	-11.396	6.54
343	229.496	7.682	-11.399	6.55
344	229.466	7.682	-11.402	6.55
345	229.437	7.682	-11.405	6.55
346	229.348	7.682	-11.414	6.56
347	229.348	7.682	-11.414	6.56
348	229.318	7.682	-11.417	6.56
349	229.318	7.682	-11.417	6.56
350	229.348	7.682	-11.414	6.56
351	229.377	7.682	-11.411	6.56
352	229.377	7.682	-11.411	6.56
353	229.318	7.682	-11.417	6.56
354	229.377	7.682	-11.411	6.56
355	229.318	7.682	-11.417	6.56
356	229.348	7.682	-11.414	6.56
357	229.377	7.682	-11.411	6.56
358	229.348	7.682	-11.414	6.56
359	229.377	7.682	-11.411	6.56
360	229.407	7.682	-11.408	6.56
361	229.407	7.682	-11.408	6.56
362	229.437	7.682	-11.405	6.55

TW1- WELL RECOVERY VS. TIME - KOLLAARD FILE 180938



Kollaard File 180938

RECOVERY DATA TW-1

t'	t / t'	Abs Pres (kPa)	Temp (°C)	Water Level (m)	Drawdown (m)	Recovery (%)
1	360	245.295	7.682	-9.788	4.935	25%
2	181.0	254.253	7.682	-8.875	4.022	39%
3	121.0	258.675	7.682	-8.424	3.571	45%
4	91.0	260.99	7.682	-8.188	3.335	49%
5	73.0	262.444	7.682	-8.039	3.186	51%
6	61.0	263.513	7.682	-7.93	3.077	53%
7	52.4	264.403	7.682	-7.84	2.987	54%
8	46.0	265.175	7.682	-7.761	2.908	56%
9	41.0	265.858	7.682	-7.691	2.838	57%
10	37.0	266.482	7.682	-7.628	2.775	58%
11	33.7	267.046	7.682	-7.57	2.717	59%
12	31.0	267.61	7.682	-7.513	2.66	59%
13	28.7	268.085	7.682	-7.464	2.611	60%
14	26.7	268.56	7.682	-7.416	2.563	61%
15	25.0	268.976	7.682	-7.373	2.52	62%
16	23.5	269.421	7.682	-7.328	2.475	62%
17	22.2	269.837	7.682	-7.286	2.433	63%
18	21.0	270.223	7.682	-7.246	2.393	63%
19	19.9	270.579	7.682	-7.21	2.357	64%
20	19.0	270.876	7.682	-7.18	2.327	64%
21	18.1	271.233	7.682	-7.143	2.29	65%
22	17.4	271.203	7.682	-7.146	2.293	65%
23	16.7	268.798	7.682	-7.392	2.539	61%
24	16.0	270.312	7.682	-7.237	2.384	64%
25	15.4	271.589	7.682	-7.107	2.254	66%
26	14.8	272.094	7.682	-7.055	2.202	66%
27	14.3	272.48	7.682	-7.016	2.163	67%
28	13.9	272.807	7.682	-6.983	2.13	67%
29	13.4	273.133	7.682	-6.95	2.097	68%
30	13.0	273.46	7.682	-6.916	2.063	69%
31	12.6	273.698	7.682	-6.892	2.039	69%
32	12.3	273.995	7.682	-6.862	2.009	69%
33	11.9	274.203	7.682	-6.84	1.987	70%
34	11.6	274.47	7.682	-6.813	1.96	70%
35	11.3	274.678	7.682	-6.792	1.939	70%
36	11.0	274.915	7.682	-6.768	1.915	71%
37	10.7	275.153	7.682	-6.744	1.891	71%
38	10.5	275.361	7.682	-6.722	1.869	71%
39	10.2	275.539	7.682	-6.704	1.851	72%
40	10.0	275.717	7.682	-6.686	1.833	72%
41	9.8	275.925	7.682	-6.665	1.812	72%
42	9.6	276.133	7.682	-6.644	1.791	73%
43	9.4	276.312	7.682	-6.625	1.772	73%
44	9.2	276.519	7.682	-6.604	1.751	73%

45	9.0	276.727	7.682	-6.583	1.73	74%
46	8.8	276.935	7.682	-6.562	1.709	74%
47	8.7	277.084	7.682	-6.547	1.694	74%
48	8.5	277.262	7.682	-6.528	1.675	74%
49	8.3	277.44	7.682	-6.51	1.657	75%
50	8.2	277.6	7.782	-6.494	1.641	75%
51	8.1	277.778	7.782	-6.476	1.623	75%
52	7.9	277.956	7.782	-6.458	1.605	76%
53	7.8	278.105	7.782	-6.443	1.59	76%
54	7.7	278.253	7.782	-6.427	1.574	76%
55	7.5	278.432	7.782	-6.409	1.556	76%
56	7.4	278.58	7.782	-6.394	1.541	76%
57	7.3	278.729	7.782	-6.379	1.526	77%
58	7.2	278.877	7.782	-6.364	1.511	77%
59	7.1	279.026	7.782	-6.349	1.496	77%
60	7.0	279.145	7.782	-6.336	1.483	77%
61	6.9	279.293	7.782	-6.321	1.468	78%
62	6.8	279.442	7.782	-6.306	1.453	78%
63	6.7	279.561	7.782	-6.294	1.441	78%
64	6.6	279.739	7.782	-6.276	1.423	78%
65	6.5	279.858	7.782	-6.264	1.411	78%
66	6.5	280.006	7.782	-6.249	1.396	79%
67	6.4	280.125	7.782	-6.237	1.384	79%
68	6.3	280.244	7.782	-6.224	1.371	79%
69	6.2	280.393	7.782	-6.209	1.356	79%
70	6.1	280.511	7.782	-6.197	1.344	79%
71	6.1	280.601	7.782	-6.188	1.335	80%
72	6.0	280.719	7.782	-6.176	1.323	80%
73	5.9	280.838	7.782	-6.164	1.311	80%
74	5.9	280.957	7.782	-6.152	1.299	80%
75	5.8	281.017	7.782	-6.146	1.293	80%
76	5.7	281.106	7.782	-6.136	1.283	80%
77	5.7	281.254	7.782	-6.121	1.268	81%
78	5.6	281.373	7.782	-6.109	1.256	81%
79	5.6	281.492	7.782	-6.097	1.244	81%
80	5.5	281.551	7.782	-6.091	1.238	81%
81	5.4	281.67	7.782	-6.079	1.226	81%
82	5.4	281.789	7.782	-6.067	1.214	81%
83	5.3	281.878	7.782	-6.058	1.205	82%
84	5.3	281.997	7.782	-6.046	1.193	82%
85	5.2	282.086	7.782	-6.037	1.184	82%
86	5.2	282.235	7.782	-6.021	1.168	82%
87	5.1	282.294	7.782	-6.015	1.162	82%
88	5.1	282.413	7.782	-6.003	1.15	82%
89	5.0	282.502	7.782	-5.994	1.141	83%
90	5.0	282.562	7.782	-5.988	1.135	83%
91	5.0	282.651	7.782	-5.979	1.126	83%
92	4.9	282.77	7.782	-5.967	1.114	83%

93	4.9	282.859	7.782	-5.958	1.105	83%
94	4.8	282.918	7.782	-5.952	1.099	83%
95	4.8	283.037	7.782	-5.94	1.087	83%
96	4.8	283.097	7.782	-5.933	1.08	84%
97	4.7	283.216	7.782	-5.921	1.068	84%
98	4.7	283.275	7.782	-5.915	1.062	84%
99	4.6	283.364	7.782	-5.906	1.053	84%
100	4.6	283.424	7.782	-5.9	1.047	84%
101	4.6	283.424	7.782	-5.9	1.047	84%
102	4.5	283.483	7.782	-5.894	1.041	84%
103	4.5	283.513	7.782	-5.891	1.038	84%
104	4.5	283.572	7.782	-5.885	1.032	84%
105	4.4	283.661	7.782	-5.876	1.023	84%
106	4.4	283.78	7.782	-5.864	1.011	85%
107	4.4	283.84	7.782	-5.858	1.005	85%
108	4.3	283.899	7.782	-5.852	0.999	85%
109	4.3	283.988	7.782	-5.843	0.99	85%
110	4.3	284.048	7.782	-5.836	0.983	85%
111	4.2	284.137	7.782	-5.827	0.974	85%
112	4.2	284.196	7.782	-5.821	0.968	85%
113	4.2	284.256	7.782	-5.815	0.962	85%
114	4.2	284.345	7.782	-5.806	0.953	85%
115	4.1	284.434	7.782	-5.797	0.944	86%
116	4.1	284.523	7.782	-5.788	0.935	86%
117	4.1	284.583	7.782	-5.782	0.929	86%
118	4.1	284.642	7.782	-5.776	0.923	86%
119	4.0	284.731	7.782	-5.767	0.914	86%
120	4.0	284.791	7.782	-5.761	0.908	86%
121	4.0	284.85	7.782	-5.755	0.902	86%
122	4.0	284.939	7.782	-5.746	0.893	86%
123	3.9	284.999	7.782	-5.74	0.887	86%
124	3.9	285.058	7.782	-5.733	0.88	87%
125	3.9	285.147	7.782	-5.724	0.871	87%
126	3.9	285.177	7.782	-5.721	0.868	87%
127	3.8	285.237	7.782	-5.715	0.862	87%
128	3.8	285.326	7.782	-5.706	0.853	87%
129	3.8	285.385	7.782	-5.7	0.847	87%
130	3.8	285.445	7.782	-5.694	0.841	87%
131	3.7	285.445	7.782	-5.694	0.841	87%
132	3.7	285.474	7.782	-5.691	0.838	87%
133	3.7	285.534	7.782	-5.685	0.832	87%
134	3.7	285.593	7.782	-5.679	0.826	87%
135	3.7	285.653	7.782	-5.673	0.82	87%
136	3.6	285.712	7.782	-5.667	0.814	88%
137	3.6	285.772	7.782	-5.661	0.808	88%
138	3.6	285.861	7.782	-5.652	0.799	88%
139	3.6	285.92	7.782	-5.646	0.793	88%
140	3.6	285.98	7.782	-5.639	0.786	88%

141	3.6	286.039	7.782	-5.633	0.78	88%
142	3.5	286.098	7.782	-5.627	0.774	88%
143	3.5	286.128	7.782	-5.624	0.771	88%
144	3.5	286.217	7.782	-5.615	0.762	88%
145	3.5	286.247	7.782	-5.612	0.759	88%
146	3.5	286.336	7.782	-5.603	0.75	89%
147	3.4	286.396	7.782	-5.597	0.744	89%
148	3.4	286.425	7.782	-5.594	0.741	89%
149	3.4	286.455	7.782	-5.591	0.738	89%
150	3.4	286.515	7.782	-5.585	0.732	89%
151	3.4	286.574	7.782	-5.579	0.726	89%
152	3.4	286.604	7.782	-5.576	0.723	89%
153	3.4	286.693	7.782	-5.567	0.714	89%
154	3.3	286.723	7.782	-5.564	0.711	89%
155	3.3	286.782	7.782	-5.558	0.705	89%
156	3.3	286.871	7.782	-5.549	0.696	89%
157	3.3	286.901	7.782	-5.546	0.693	89%
158	3.3	286.931	7.782	-5.542	0.689	89%
159	3.3	286.96	7.782	-5.54	0.687	90%
160	3.3	287.05	7.782	-5.53	0.677	90%
161	3.2	287.05	7.782	-5.53	0.677	90%
162	3.2	287.139	7.782	-5.521	0.668	90%
163	3.2	287.169	7.782	-5.518	0.665	90%
164	3.2	287.228	7.782	-5.512	0.659	90%
165	3.2	287.287	7.782	-5.506	0.653	90%
166	3.2	287.317	7.782	-5.503	0.65	90%
167	3.2	287.377	7.782	-5.497	0.644	90%
168	3.1	287.406	7.782	-5.494	0.641	90%
169	3.1	287.466	7.782	-5.488	0.635	90%
170	3.1	287.495	7.782	-5.485	0.632	90%
171	3.1	287.555	7.782	-5.479	0.626	90%
172	3.1	287.555	7.782	-5.479	0.626	90%
173	3.1	287.614	7.782	-5.473	0.62	91%
174	3.1	287.674	7.782	-5.467	0.614	91%
175	3.1	287.733	7.782	-5.461	0.608	91%
176	3.0	287.763	7.782	-5.458	0.605	91%
177	3.0	287.822	7.782	-5.452	0.599	91%
178	3.0	287.852	7.782	-5.449	0.596	91%
179	3.0	287.882	7.782	-5.446	0.593	91%
180	3.0	287.923	7.882	-5.441	0.588	91%
181	3.0	287.971	7.782	-5.436	0.583	91%
182	3.0	287.971	7.782	-5.436	0.583	91%
183	3.0	287.971	7.782	-5.436	0.583	91%
184	3.0	288.001	7.782	-5.433	0.58	91%
185	2.9	288.031	7.782	-5.43	0.577	91%
186	2.9	288.06	7.782	-5.427	0.574	91%
187	2.9	288.12	7.782	-5.421	0.568	91%
188	2.9	288.179	7.782	-5.415	0.562	91%

189	2.9	288.19	7.882	-5.414	0.561	91%
190	2.9	288.22	7.882	-5.411	0.558	91%
191	2.9	288.28	7.882	-5.405	0.552	92%
192	2.9	288.328	7.782	-5.4	0.547	92%
193	2.9	288.369	7.882	-5.396	0.543	92%
194	2.9	288.398	7.882	-5.393	0.54	92%
195	2.8	288.428	7.882	-5.39	0.537	92%
196	2.8	288.488	7.882	-5.384	0.531	92%
197	2.8	288.517	7.882	-5.381	0.528	92%
198	2.8	288.577	7.882	-5.375	0.522	92%
199	2.8	288.607	7.882	-5.372	0.519	92%
200	2.8	288.636	7.882	-5.369	0.516	92%
201	2.8	288.666	7.882	-5.366	0.513	92%
202	2.8	288.696	7.882	-5.363	0.51	92%
203	2.8	288.696	7.882	-5.363	0.51	92%
204	2.8	288.725	7.882	-5.36	0.507	92%
205	2.8	288.755	7.882	-5.357	0.504	92%
206	2.7	288.844	7.882	-5.347	0.494	92%
207	2.7	288.844	7.882	-5.347	0.494	92%
208	2.7	288.874	7.882	-5.344	0.491	93%
209	2.7	288.904	7.882	-5.341	0.488	93%
210	2.7	288.934	7.882	-5.338	0.485	93%
211	2.7	288.993	7.882	-5.332	0.479	93%
212	2.7	289.023	7.882	-5.329	0.476	93%
213	2.7	289.052	7.882	-5.326	0.473	93%
214	2.7	289.082	7.882	-5.323	0.47	93%
215	2.7	289.112	7.882	-5.32	0.467	93%
216	2.7	289.112	7.882	-5.32	0.467	93%
217	2.7	289.112	7.882	-5.32	0.467	93%
218	2.7	289.142	7.882	-5.317	0.464	93%
219	2.6	289.171	7.882	-5.314	0.461	93%
220	2.6	289.201	7.882	-5.311	0.458	93%
221	2.6	289.231	7.882	-5.308	0.455	93%
222	2.6	289.29	7.882	-5.302	0.449	93%
223	2.6	289.32	7.882	-5.299	0.446	93%
224	2.6	289.35	7.882	-5.296	0.443	93%
225	2.6	289.379	7.882	-5.293	0.44	93%
226	2.6	289.379	7.882	-5.293	0.44	93%
227	2.6	289.439	7.882	-5.287	0.434	93%
228	2.6	289.439	7.882	-5.287	0.434	93%
229	2.6	289.498	7.882	-5.281	0.428	93%
230	2.6	289.498	7.882	-5.281	0.428	93%
231	2.6	289.558	7.882	-5.275	0.422	94%
232	2.6	289.588	7.882	-5.272	0.419	94%
233	2.5	289.588	7.882	-5.272	0.419	94%
234	2.5	289.647	7.882	-5.266	0.413	94%
235	2.5	289.706	7.882	-5.26	0.407	94%
236	2.5	289.677	7.882	-5.262	0.409	94%

237	2.5	289.736	7.882	-5.256	0.403	94%
238	2.5	289.766	7.882	-5.253	0.4	94%
239	2.5	289.796	7.882	-5.25	0.397	94%
240	2.5	289.825	7.882	-5.247	0.394	94%
241	2.5	289.855	7.882	-5.244	0.391	94%
242	2.5	289.855	7.882	-5.244	0.391	94%
243	2.5	289.885	7.882	-5.241	0.388	94%
244	2.5	289.944	7.882	-5.235	0.382	94%
245	2.5	289.944	7.882	-5.235	0.382	94%
246	2.5	290.004	7.882	-5.229	0.376	94%
247	2.5	289.974	7.882	-5.232	0.379	94%
248	2.5	290.034	7.882	-5.226	0.373	94%
249	2.4	290.063	7.882	-5.223	0.37	94%
250	2.4	290.093	7.882	-5.22	0.367	94%
251	2.4	290.093	7.882	-5.22	0.367	94%
252	2.4	290.152	7.882	-5.214	0.361	94%
253	2.4	290.182	7.882	-5.211	0.358	95%
254	2.4	290.182	7.882	-5.211	0.358	95%
255	2.4	290.242	7.882	-5.205	0.352	95%
256	2.4	290.242	7.882	-5.205	0.352	95%
257	2.4	290.242	7.882	-5.205	0.352	95%
258	2.4	290.212	7.882	-5.208	0.355	95%
259	2.4	290.212	7.882	-5.208	0.355	95%
260	2.4	290.242	7.882	-5.205	0.352	95%
261	2.4	290.271	7.882	-5.202	0.349	95%
262	2.4	290.301	7.882	-5.199	0.346	95%
263	2.4	290.331	7.882	-5.196	0.343	95%
264	2.4	290.331	7.882	-5.196	0.343	95%
265	2.4	290.361	7.882	-5.193	0.34	95%
266	2.4	290.42	7.882	-5.187	0.334	95%
267	2.3	290.45	7.882	-5.184	0.331	95%
268	2.3	290.45	7.882	-5.184	0.331	95%
269	2.3	290.479	7.882	-5.181	0.328	95%
270	2.3	290.509	7.882	-5.178	0.325	95%
271	2.3	290.569	7.882	-5.172	0.319	95%
272	2.3	290.569	7.882	-5.172	0.319	95%
273	2.3	290.539	7.882	-5.175	0.322	95%
274	2.3	290.598	7.882	-5.169	0.316	95%
275	2.3	290.658	7.882	-5.162	0.309	95%
276	2.3	290.628	7.882	-5.166	0.313	95%
277	2.3	290.688	7.882	-5.159	0.306	95%
278	2.3	290.688	7.882	-5.159	0.306	95%
279	2.3	290.717	7.882	-5.156	0.303	95%
280	2.3	290.747	7.882	-5.153	0.3	95%
281	2.3	290.747	7.882	-5.153	0.3	95%
282	2.3	290.777	7.882	-5.15	0.297	95%
283	2.3	290.777	7.882	-5.15	0.297	95%
284	2.3	290.807	7.882	-5.147	0.294	96%

285	2.3	290.836	7.882	-5.144	0.291	96%
286	2.3	290.866	7.882	-5.141	0.288	96%
287	2.3	290.896	7.882	-5.138	0.285	96%
288	2.3	290.925	7.882	-5.135	0.282	96%
289	2.2	290.955	7.882	-5.132	0.279	96%
290	2.2	290.955	7.882	-5.132	0.279	96%
291	2.2	290.985	7.882	-5.129	0.276	96%
292	2.2	291.015	7.882	-5.126	0.273	96%
293	2.2	291.044	7.882	-5.123	0.27	96%
294	2.2	291.044	7.882	-5.123	0.27	96%
295	2.2	291.074	7.882	-5.12	0.267	96%
296	2.2	291.074	7.882	-5.12	0.267	96%
297	2.2	291.104	7.882	-5.117	0.264	96%
298	2.2	291.134	7.882	-5.114	0.261	96%
299	2.2	291.134	7.882	-5.114	0.261	96%
300	2.2	291.134	7.882	-5.114	0.261	96%
301	2.2	291.193	7.882	-5.108	0.255	96%
302	2.2	291.223	7.882	-5.105	0.252	96%
303	2.2	291.223	7.882	-5.105	0.252	96%
304	2.2	291.252	7.882	-5.102	0.249	96%
305	2.2	291.252	7.882	-5.102	0.249	96%
306	2.2	291.312	7.882	-5.096	0.243	96%
307	2.2	291.312	7.882	-5.096	0.243	96%
308	2.2	291.342	7.882	-5.093	0.24	96%
309	2.2	291.342	7.882	-5.093	0.24	96%
310	2.2	291.371	7.882	-5.09	0.237	96%
311	2.2	291.401	7.882	-5.087	0.234	96%
312	2.2	291.431	7.882	-5.084	0.231	96%
313	2.2	291.461	7.882	-5.081	0.228	97%
314	2.1	291.461	7.882	-5.081	0.228	97%
315	2.1	291.461	7.882	-5.081	0.228	97%
316	2.1	291.431	7.882	-5.084	0.231	96%
317	2.1	291.371	7.882	-5.09	0.237	96%
318	2.1	291.401	7.882	-5.087	0.234	96%
319	2.1	291.431	7.882	-5.084	0.231	96%
320	2.1	291.49	7.882	-5.078	0.225	97%
321	2.1	291.49	7.882	-5.078	0.225	97%
322	2.1	291.49	7.882	-5.078	0.225	97%
323	2.1	291.55	7.882	-5.071	0.218	97%
324	2.1	291.55	7.882	-5.071	0.218	97%
325	2.1	291.58	7.882	-5.068	0.215	97%
326	2.1	291.609	7.882	-5.065	0.212	97%
327	2.1	291.609	7.882	-5.065	0.212	97%
328	2.1	291.669	7.882	-5.059	0.206	97%
329	2.1	291.669	7.882	-5.059	0.206	97%
330	2.1	291.669	7.882	-5.059	0.206	97%
331	2.1	291.728	7.882	-5.053	0.2	97%
332	2.1	291.758	7.882	-5.05	0.197	97%

333	2.1	291.728	7.882	-5.053	0.2	97%
334	2.1	291.758	7.882	-5.05	0.197	97%
335	2.1	291.788	7.882	-5.047	0.194	97%
336	2.1	291.788	7.882	-5.047	0.194	97%
337	2.1	291.817	7.882	-5.044	0.191	97%
338	2.1	291.817	7.882	-5.044	0.191	97%
339	2.1	291.877	7.882	-5.038	0.185	97%
340	2.1	291.847	7.882	-5.041	0.188	97%
341	2.1	291.877	7.882	-5.038	0.185	97%
342	2.1	291.907	7.882	-5.035	0.182	97%
343	2.0	291.907	7.882	-5.035	0.182	97%
344	2.0	291.907	7.882	-5.035	0.182	97%
345	2.0	291.936	7.882	-5.032	0.179	97%
346	2.0	291.936	7.882	-5.032	0.179	97%
347	2.0	291.966	7.882	-5.029	0.176	97%
348	2.0	291.996	7.882	-5.026	0.173	97%
349	2.0	291.996	7.882	-5.026	0.173	97%
350	2.0	292.026	7.882	-5.023	0.17	97%
351	2.0	292.055	7.882	-5.02	0.167	97%
352	2.0	292.085	7.882	-5.017	0.164	97%
353	2.0	292.085	7.882	-5.017	0.164	97%
354	2.0	292.115	7.882	-5.014	0.161	98%
355	2.0	292.115	7.882	-5.014	0.161	98%
356	2.0	292.144	7.882	-5.011	0.158	98%
357	2.0	292.144	7.882	-5.011	0.158	98%
358	2.0	292.144	7.882	-5.011	0.158	98%
359	2.0	292.174	7.882	-5.008	0.155	98%
360	2.0	292.174	7.882	-5.008	0.155	98%
361	2.0	292.204	7.882	-5.005	0.152	98%
362	2.0	292.204	7.882	-5.005	0.152	98%
363	2.0	292.204	7.882	-5.005	0.152	98%
364	2.0	292.234	7.882	-5.002	0.149	98%
365	2.0	292.234	7.882	-5.002	0.149	98%
366	2.0	292.263	7.882	-4.999	0.146	98%
367	2.0	292.293	7.882	-4.996	0.143	98%
368	2.0	292.293	7.882	-4.996	0.143	98%
369	2.0	292.293	7.882	-4.996	0.143	98%
370	2.0	292.323	7.882	-4.993	0.14	98%
371	2.0	292.323	7.882	-4.993	0.14	98%
372	2.0	292.323	7.882	-4.993	0.14	98%
373	2.0	292.353	7.882	-4.99	0.137	98%
374	2.0	292.353	7.882	-4.99	0.137	98%
375	2.0	292.353	7.882	-4.99	0.137	98%
376	2.0	292.382	7.882	-4.987	0.134	98%
377	2.0	292.412	7.882	-4.984	0.131	98%
378	2.0	292.412	7.882	-4.984	0.131	98%
379	1.9	292.412	7.882	-4.984	0.131	98%
380	1.9	292.442	7.882	-4.981	0.128	98%

381	1.9	292.472	7.882	-4.977	0.124	98%
382	1.9	292.442	7.882	-4.981	0.128	98%
383	1.9	292.501	7.882	-4.975	0.122	98%
384	1.9	292.501	7.882	-4.975	0.122	98%
385	1.9	292.531	7.882	-4.971	0.118	98%
386	1.9	292.531	7.882	-4.971	0.118	98%
387	1.9	292.561	7.882	-4.968	0.115	98%
388	1.9	292.561	7.882	-4.968	0.115	98%
389	1.9	292.561	7.882	-4.968	0.115	98%
390	1.9	292.561	7.882	-4.968	0.115	98%
391	1.9	292.59	7.882	-4.965	0.112	98%
392	1.9	292.59	7.882	-4.965	0.112	98%
393	1.9	292.59	7.882	-4.965	0.112	98%
394	1.9	292.62	7.882	-4.962	0.109	98%
395	1.9	292.59	7.882	-4.965	0.112	98%
396	1.9	292.65	7.882	-4.959	0.106	98%
397	1.9	292.65	7.882	-4.959	0.106	98%
398	1.9	292.65	7.882	-4.959	0.106	98%
399	1.9	292.65	7.882	-4.959	0.106	98%
400	1.9	292.68	7.882	-4.956	0.103	98%
401	1.9	292.68	7.882	-4.956	0.103	98%
402	1.9	292.709	7.882	-4.953	0.1	98%
403	1.9	292.709	7.882	-4.953	0.1	98%
404	1.9	292.709	7.882	-4.953	0.1	98%
405	1.9	292.769	7.882	-4.947	0.094	99%
406	1.9	292.769	7.882	-4.947	0.094	99%
407	1.9	292.769	7.882	-4.947	0.094	99%
408	1.9	292.769	7.882	-4.947	0.094	99%
409	1.9	292.799	7.882	-4.944	0.091	99%
410	1.9	292.799	7.882	-4.944	0.091	99%
411	1.9	292.828	7.882	-4.941	0.088	99%
412	1.9	292.799	7.882	-4.944	0.091	99%
413	1.9	292.858	7.882	-4.938	0.085	99%
414	1.9	292.858	7.882	-4.938	0.085	99%
415	1.9	292.858	7.882	-4.938	0.085	99%
416	1.9	292.858	7.882	-4.938	0.085	99%
417	1.9	292.888	7.882	-4.935	0.082	99%
418	1.9	292.918	7.882	-4.932	0.079	99%
419	1.9	292.888	7.882	-4.935	0.082	99%
420	1.9	292.918	7.882	-4.932	0.079	99%
421	1.9	292.918	7.882	-4.932	0.079	99%
422	1.9	292.918	7.882	-4.932	0.079	99%
423	1.9	292.947	7.882	-4.929	0.076	99%
424	1.8	292.947	7.882	-4.929	0.076	99%
425	1.8	292.947	7.882	-4.929	0.076	99%
426	1.8	292.947	7.882	-4.929	0.076	99%
427	1.8	293.007	7.882	-4.923	0.07	99%
428	1.8	293.007	7.882	-4.923	0.07	99%

429	1.8	293.007	7.882	-4.923	0.07	99%
430	1.8	293.036	7.882	-4.92	0.067	99%
431	1.8	293.036	7.882	-4.92	0.067	99%
432	1.8	293.036	7.882	-4.92	0.067	99%
433	1.8	293.066	7.882	-4.917	0.064	99%
434	1.8	293.036	7.882	-4.92	0.067	99%
435	1.8	293.036	7.882	-4.92	0.067	99%
436	1.8	293.096	7.882	-4.914	0.061	99%
437	1.8	293.066	7.882	-4.917	0.064	99%
438	1.8	293.096	7.882	-4.914	0.061	99%
439	1.8	293.096	7.882	-4.914	0.061	99%
440	1.8	293.096	7.882	-4.914	0.061	99%
441	1.8	293.096	7.882	-4.914	0.061	99%
442	1.8	293.126	7.882	-4.911	0.058	99%
443	1.8	293.155	7.882	-4.908	0.055	99%
444	1.8	293.185	7.882	-4.905	0.052	99%
445	1.8	293.185	7.882	-4.905	0.052	99%
446	1.8	293.185	7.882	-4.905	0.052	99%
447	1.8	293.215	7.882	-4.902	0.049	99%
448	1.8	293.215	7.882	-4.902	0.049	99%
449	1.8	293.245	7.882	-4.899	0.046	99%
450	1.8	293.245	7.882	-4.899	0.046	99%
451	1.8	293.245	7.882	-4.899	0.046	99%
452	1.8	293.245	7.882	-4.899	0.046	99%
453	1.8	293.274	7.882	-4.896	0.043	99%
454	1.8	293.304	7.882	-4.893	0.04	99%
455	1.8	293.274	7.882	-4.896	0.043	99%
456	1.8	293.304	7.882	-4.893	0.04	99%
457	1.8	293.304	7.882	-4.893	0.04	99%
458	1.8	293.304	7.882	-4.893	0.04	99%
459	1.8	293.304	7.882	-4.893	0.04	99%
460	1.8	293.304	7.882	-4.893	0.04	99%
461	1.8	293.334	7.882	-4.89	0.037	99%
462	1.8	293.334	7.882	-4.89	0.037	99%
463	1.8	293.364	7.882	-4.887	0.034	99%
464	1.8	293.364	7.882	-4.887	0.034	99%
465	1.8	293.364	7.882	-4.887	0.034	99%
466	1.8	293.364	7.882	-4.887	0.034	99%
467	1.8	293.393	7.882	-4.884	0.031	100%

ATTACHMENT C

RESULTS OF LABORATORY TESTING OF WELL WATER SAMPLES

Certificate of Analysis

Client: Kollaard Associates Inc.
210 Prescott St., Box 189
Kemptville, ON
K0G 1J0
Attention: Ms. Colleen Vermeersch
PO#: 180938
Invoice to: Kollaard Associates Inc.

Report Number: 1904982
Date Submitted: 2019-04-05
Date Reported: 2019-04-12
Project: 180938
COC #: 199654

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:

APPROVAL: _____
Addrine Thomas, Inorganics Supervisor

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise indicated.

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.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is licensed by the Ontario Ministry of the Environment, Conservation, and Parks (MECP) for specific tests in drinking water (license #2318). A copy of the license is available upon request.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by the Ontario Ministry of Agriculture, Food, and Rural Affairs for specific tests in agricultural soils.

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

Certificate of Analysis

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				Lab I.D.	1419136	1419137
				Sample Matrix	Water	Water
				Sample Type		
				Sampling Date	2019-04-05	2019-04-05
				Sample I.D.	TW1 3hr	TW1 6hr
Group	**Analyte**	**MRL**	**Units**	**Guideline**		
Anions	Cl	1	mg/L	AO 250	16	82
	F	0.10	mg/L	MAC 1.5	0.59	0.64
	N-NO2	0.10	mg/L	MAC 1.0	<0.10	<0.10
	N-NO3	0.10	mg/L	MAC 10.0	6.26	<0.10
	SO4	1	mg/L	AO 500	39	43
General Chemistry	Alkalinity as CaCO3	5	mg/L	OG 500	249	257
	Colour	2	TCU	AO 5	<2	<2
	Conductivity	5	uS/cm		761	803
	pH	1.00		6.5-8.5	7.80	7.91
	S2-	0.01	mg/L	AO 0.05	0.48*	0.53*
	TDS (COND - CALC)	1	mg/L	AO 500	495	522*
	Turbidity	0.1	NTU	AO 5.0	3.8	1.1
Hardness	Hardness as CaCO3	1	mg/L	OG 100	183*	183*
Indices/Calc	Ion Balance	0.01			1.10	0.91
Metals	Ca	1	mg/L		37	37
	Fe	0.03	mg/L	AO 0.3	0.10	0.05
	K	1	mg/L		8	8
	Mg	1	mg/L		22	22
	Mn	0.01	mg/L	AO 0.05	0.01	0.01
	Na	2	mg/L	AO 200	81	86
Subcontract-Inorg	DOC	0.5	mg/L	AO 5	1.3	1.8
	N-NH3	0.01	mg/L		0.31	0.31
	Phenols	0.001	mg/L		<0.001	<0.001
	Tannin & Lignin	0.1	mg/L		<0.1	<0.1
	Total Kjeldahl Nitrogen	0.1	mg/L		0.5	0.3

Guideline = ODWSOG *** = Guideline Exceedence**

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

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Report Number: 1904982
Date Submitted: 2019-04-05
Date Reported: 2019-04-12
Project: 180938
COC #: 199654

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 363192 **Analysis/Extraction Date** 2019-04-05 **Analyst** K J **Method** C SM2130B			
Turbidity	<0.1 NTU	100	70-130
Run No 363523 **Analysis/Extraction Date** 2019-04-10 **Analyst** AA **Method** SM 4110			
Chloride	<1 mg/L	100	90-110
N-NO3	<0.10 mg/L	102	90-110
SO4	<1 mg/L	100	90-110
Run No 363547 **Analysis/Extraction Date** 2019-04-11 **Analyst** K J **Method** C SM2120C			
Colour	<2 TCU	101	90-110
Run No 363549 **Analysis/Extraction Date** 2019-04-10 **Analyst** AET **Method** SUBCONTRACT P-INORG			
DOC	<0.5 mg/L	117	
N-NH3	<0.01 mg/L	100	
Phenols	<0.001 mg/L	92	69-132
Tannin & Lignin	<0.1 mg/L	90	
Total Kjeldahl Nitrogen	<0.1 mg/L	94	81-126

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Date Reported: 2019-04-12
Project: 180938
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QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 363615 **Analysis/Extraction Date** 2019-04-11 **Analyst** Z S **Method** SM2320,2510,4500H/F			
Alkalinity (CaCO3)	<5 mg/L	111	90-110
Conductivity	<5 uS/cm	100	90-110
F	<0.10 mg/L	99	90-110
pH		97	90-110
Run No 363653 **Analysis/Extraction Date** 2019-04-12 **Analyst** Z S **Method** C SM4500-NO3-F			
N-NO2	<0.10 mg/L	100	80-120
N-NO3	<0.10 mg/L	92	80-120
Run No 363663 **Analysis/Extraction Date** 2019-04-12 **Analyst** AA **Method** SM 4110			
Chloride	<1 mg/L	100	90-110
SO4	<1 mg/L	110	90-110
Run No 363665 **Analysis/Extraction Date** 2019-04-12 **Analyst** H_D **Method** M SM3120B-3500C			
Calcium	<1 mg/L	101	90-110
Potassium	<1 mg/L	101	87-113
Magnesium	<1 mg/L	96	76-124

Guideline = ODWSOG *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
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Certificate of Analysis

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Kemptville, ON
K0G 1J0
Attention: Ms. Colleen Vermeersch
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Report Number: 1904982
Date Submitted: 2019-04-05
Date Reported: 2019-04-12
Project: 180938
COC #: 199654

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Sodium	<2 mg/L	100	82-118
Run No 363668 **Analysis/Extraction Date** 2019-04-11 **Analyst** H D **Method** EPA 200.8			
Iron	<0.03 mg/L	95	91-109
Manganese	<0.01 mg/L	100	92.9-107
Run No 363675 **Analysis/Extraction Date** 2019-04-12 **Analyst** AET **Method** C SM2340B			
Hardness as CaCO3			
Ion Balance			
TDS (COND - CALC)			
Run No 363676 **Analysis/Extraction Date** 2019-04-12 **Analyst** AET **Method** C SM4500-S2-D			
S2-	<0.01 mg/L	101	80-120

Guideline = ODWSOG *** = Guideline Exceedence**

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

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

Report Number: 1904953
Date Submitted: 2019-04-05
Date Reported: 2019-04-08
Project: 180938
COC #: 199654

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:

APPROVAL: _____
Dragana Dzeletovic, Team Leader

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise indicated.

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.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is licensed by the Ontario Ministry of the Environment, Conservation, and Parks (MECP) for specific tests in drinking water (license #2318). A copy of the license is available upon request.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by the Ontario Ministry of Agriculture, Food, and Rural Affairs for specific tests in agricultural soils.

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

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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#: 180938
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Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1419059 GW 2019-04-03 TW1 3 hr	1419060 GW 2019-04-03 TW1 6 hr
Microbiology	Escherichia Coli	0	ct/100mL	MAC 0		0	0
	Faecal Coliforms	0	ct/100mL			0	0
	Heterotrophic Plate Count	0	ct/1mL			12	12
	Total Coliforms	0	ct/100mL	MAC 0		0	1*

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.

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

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 $CaCO_3$
If LSI is positive → scale can form and $CaCO_3$ 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_s = pH at saturation in calcite or calcium carbonate

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

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

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

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

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

	TW1-3hr	TW1-6hr
pH	7.8	7.91
hardness [mg/l as $CaCo_3$]	183	183
Alkalinity [mg/l as $CaCo_3$]	249	257
total dissolved solids [mg/l]	495	522
temperature (°C)	8.4	8.4
→→ RSI	7.45	7.32
→→ LSI	0.17	0.30