

December 19, 2018

File: 64153.89 – R02

Novatech
200-240 Michael Cowpland Drive
Ottawa, Ontario
K2M 1P6

**Re: Hydrogeological Investigation
Proposed Rezoning
2800 Moodie Drive
Ottawa, Ontario**

BACKGROUND

This report presents the results of a hydrogeological investigation carried out as part of a proposed rezoning of 2800 Moodie Drive, in Ottawa, Ontario (refer to Key Plan, Figure 1). The property is currently vacant and has been used as agricultural land in the past. A newly drilled on site test well (TW18-1) was used to evaluate water quality and quantity for this investigation.

The purpose of the investigation was to confirm the following:

- The quality of the well water meets the Ontario Drinking Water Standards and maximum treatable limits prescribed in Ontario Ministry of Environment and Climate Change (MOECC) Procedure D-5-5; and,
- The well yield of the newly drilled on-site test well.

SITE GEOLOGY

Surficial geology maps of the Ottawa area (Ontario Geologic Survey, 2010) indicate that the site is underlain by nearshore marine sediments (gravel, sand and boulders) and glacial till (sandy silt to silty sand). Bedrock geology maps of the Ottawa area (Ontario Geological Survey, 2011 and Paleozoic Geology of Southern Ontario, 1972) show that the overburden has a thickness of about 2 to 10 metres and is underlain by interbedded limestone and dolostone bedrock of the Gull River Formation.

WELL CONTRUCTION

The water supply well was constructed at 2800 Moodie Drive on August 16, 2018, by a licensed MOECC well contractor (Air Rock Drilling; License No. 1119) using a rotary air percussion drill rig. The approximate location of the water well is provided on the Detailed Site Plan, Figure 2. A copy of the MOECC Water Well Record is provided in Attachment A.

The construction details from the MOECC Water Well Record are summarized in the following table.

Well Construction Details (Well Tag A252837)	
Depth to Bedrock	7.62 metres
Length of Well Casing	10.36 metres
Length of Well Casing Above Ground Surface	0.61 metres
Length of Well Casing Set Into Bedrock	2.13 metres
Depth Water Found	26.5 & 33.2 & 53.0 metres
Total Well Depth	54.87 metres

The MOECC Water Well Record indicates the overburden thickness is 7.62 metres and consists of sand and gravel, which is consistent with OGS mapping description nearshore marine sediments consisting of gravel, sand and boulders. Also, the bedrock is classified as limestone bedrock, which is consistent with bedrock geology maps (limestone of the Gull River Formation).

GROUNDWATER QUANTITY

A pumping test was carried out on the water well by a member of GEMTEC staff on August 28, 2018. The well was pumped at a constant rate of about 80 litres per minute for a period of about eight (8) hours. The water from the pumping test was discharged to the ground surface a minimum of 10 metres from the test well such that the discharge flow was away from the well head.

Water level measurements were taken at regular intervals throughout the pumping test. Water levels were also taken during the recovery phase of the pumping test (after the pump was turned off). The drawdown and recovery graph is provided in Attachment B. The transmissivity of the water supply aquifer was estimated from the pump test drawdown data using Aqtesolv version 4.5, a commercially available software program from HydroSOLVE Inc. An analysis of the pump test and recovery data was carried out using the Cooper-Jacob method of analysis. The results of the Aqtesolv 4.5 analysis are provided in Attachment C.

Based on the proposed rezoning of the subject site to RG: Rural General Industrial land use, the daily design sanitary sewage flow (DDSSF; anticipated to be the same as the water demand) is

estimated from available information within the Ontario Building Code (OBC). It is noted that the exact use of the subject site is unknown at this time and estimates of water demand are provided based on 'typical' rural general industrial land use. For example, the OBC indicates that in 'factory or office' type settings, a DDSSF of 75 litres per employee per shift is to be allotted. As such, based on 39,200 litres pumped during the 8-hour pumping test, a DDSSF of 39,200 litres allows for a maximum employee occupancy of 522. Alternatively, for a warehouse, the DDSSF is calculated per water closet (950 litres) and loading bay (150 litres), which would allow for 100+ loading bays and 10+ water closets. Based on the proposed rezoning to Rural General Industrial land use, a DDSSF (water demand) of 39,200 litres per day is significantly greater than 'typical' Rural General Industrial land use.

The Cooper-Jacob analysis indicates that the transmissivity of the water supply aquifer is approximately 6.8 m²/day. A qualitative evaluation of the drawdown pumping test data indicates approximately four (4) metres of drawdown upon initiation of pumping and gradual drawdown throughout the remaining eight (8) hours of pumping. The pumping test discharged a total of about 39,200 litres from the well over the course of the pumping test and the maximum drawdown in the water level of the well was about eight (8) metres at the end of the pumping test. Based on the depth of the well and the water level after eight (8) hours of pumping, the remaining available drawdown in the well is approximately 36 metres.

The conclusion that the quantity of water available from the well is more than sufficient is based on the volume of water pumped in combination with the recovery of the well, the minimal drawdown observed during pumping and the large remaining available drawdown at the end of the pumping test. The high sustained flow rate in combination with the available drawdown remaining indicates that the well should be capable of providing adequate quantities of groundwater for typical commercial use. Furthermore, the recovery of the well following the pumping test indicates that the water well should be able to sustain repeated pumping in the long term.

GROUNDWATER QUALITY

Water samples were collected by GEMTEC during the pumping test on August 28, 2018 (TW18-1). A summary of the field measurements is provided in Tables D1 (Attachment D). The results of the laboratory analysis on the water samples are summarized in Table D2 along with the applicable standards, guidelines and objectives provided in the Ontario Drinking Water Standards (ODWS). Copies of the laboratory certificates of analysis for the water samples are provided in Attachment D.

The following comments are provided regarding the drinking water quality and exceedances of the ODWS.

Bacteriological Results

Total chlorine measurements made at regular intervals during the pumping test confirmed that total chlorine concentrations in the well water were non-detectable at the time of bacteriological sampling.

The results of the bacteriological analysis of the August 28, 2018 water samples indicate that the water samples met all the standards of the ODWS for bacteriological parameters. In addition, the concentration of other bacteria indicator species such as fecal coliform and *Escherichia coli* bacteria were determined to be non-detectable in all of the water samples.

Based on the bacteriological testing, the water is suitable for consumption.

Chemical Results

The results of the chemical testing on the water samples indicate the operational guideline for hardness and organic nitrogen and the aesthetic objective for colour, sodium ('warning level'), chloride and total dissolved solids were exceeded. The above noted exceedances are discussed in the follow sections:

Hardness

The hardness of the water samples was reported to be 599 and 611 mg/L as CaCO_3 , which exceeds the ODWS operational guideline for hardness. Water having a hardness above 100 milligrams per litre as CaCO_3 is often softened for domestic use. Water softeners are widely used throughout rural areas to treat hardness and there is no upper treatable limit for hardness. The ODWS indicates that hardness levels exceeding 200 mg/L as CaCO_3 is considered poor but tolerable and hardness levels exceeding 500 mg/L as CaCO_3 is considered to be unacceptable for most domestic purposes.

Organic Nitrogen

The organic nitrogen concentration was reported to be 0.1 and 0.2 mg/L [TKN – ammonia] which slightly exceeds the operational guideline of 0.15 mg/L for Ontario Drinking Water Standards (ODWS). The ODWS indicates that levels of organic nitrogen in excess of 0.15 mg/L may be caused by septic tank or sewage effluent contamination. It is noted that the test well is located in the vicinity of former agricultural lands and that the levels of ammonia and total kjeldahl nitrogen were reported to be 0.12 mg/L and 0.3 mg/L respectively for the calculated organic nitrogen exceedance (0.2 mg/L), which only slightly exceed the laboratory method detection limits.

Organic nitrogen can react with chlorine and severely reduce its disinfectant power; in addition, taste and odour problems may also occur. It is not expected that chlorination will be utilized (other than occasional shock-chlorination as part of regular well maintenance) and, as such, no concerns with the operational objective exceedance for organic nitrogen were identified.

Total Dissolved Solids (TDS)

The TDS level in the water samples obtained decreased from 956 to 318 milligrams per litre during the 8-hour pumping test. Although the 4-hour sample exceeds the ODWS aesthetic objective of 500 milligrams per litre, the water sample collected at the end of the 8-hour pumping test meets the ODWS. Elevated levels of TDS can lead to problems associated with encrustation and corrosion. Given the observed decrease during the pumping test, it is anticipated that the total dissolved solids will continue to decrease with additional pumping.

Colour

The colour level was reported to decrease from 7 and 6 TCU during the 8-hour pumping test, which exceeded the aesthetic objective of 5 TCU listed by the ODWS. Elevated levels of colour can be associated with certain metals and organic substances in the water. Although the samples exceeded the aesthetic objective, the colour level is within the treatable limits (7 TCU) provided in Table 3 of the Appendix in the MOECC Guideline D-5-5.

It is noted that the field measurement of TCU in the 8-hour sample was measured to be 20 TCU (refer to Table D1 for field measurements), which exceeds the maximum acceptable treatability limits. However, given the apparent colour (unfiltered) was measured to be 1 actual colour unit (ACU), the TCU, which was field-filtered, and the laboratory measurements, the field reading is likely a measurement error.

Water having a faint yellow/brown colour can be caused by organic materials and contributed to by iron and manganese. Colour is not generally considered a health issue and the aesthetic objective is set by appearance. The use of carbon filter treatment systems can be used to reduce colour levels.

Chloride

Chloride was measured at concentrations of 351 and 373 mg/L in the 4-hour and 8-hour samples respectively, which exceed the ODWS aesthetic objective. There are no health-based guidelines for chlorides, which are generally not harmful to humans, but can be an indicator of poor groundwater quality. The chloride concentration is also above the maximum reasonably treatable limit of 250 mg/L provided by MOECC Procedure D-5-5, however current water treatment systems, such as reverse osmosis, are capable of significantly reducing chloride concentrations.

Chloride-containing minerals such as sodium, potassium, and calcium are common non-toxic materials in drinking water which can produce a detectable salty taste at concentrations exceeding the ODWS aesthetic objective of 250 mg/L. Elevated chloride concentrations can be caused by the weathering and leaching of sedimentary rocks, naturally occurring salts and/or contamination from road salt. Furthermore, elevated chloride concentrations can contribute to total dissolved solids in drinking water which may lead to corrosion of steel and aluminum.

Notable Parameters

The results of the chemical testing on the water samples indicate detectable levels of nitrate and elevated sodium concentrations. Although the parameters do not exceed the ODWS, they are noted, and are discussed in the follow sections:

Nitrate

The nitrate was reported to be 2.7 and 2.3 mg/L during the 8-hour pumping test, which is below the ODWS maximum acceptable concentration of 10 mg/L. The presence of nitrates in groundwater can be caused by the decaying of plant and animal materials, agricultural fertilizers, and septic sewage. The detectable nitrate concentrations are likely attributed to past agricultural practices on the lands and are anticipated to decrease following a change in land use (from agricultural to commercial).

Sodium

The sodium concentration was reported to be 167 and 181 milligrams per litre during the pumping test, which is not considered an exceedance of the ODWS aesthetic objective of 200 milligrams per litre; however, it exceeds the health-related limit of 20 mg/L for persons on sodium restricted diets and should be reported to the local Medical Officer of Health. It should be noted that conventional water softeners could introduce elevated concentrations of sodium into the drinking water, therefore, a separate faucet, which bypasses the softener may be considered for drinking water purposes.

CONCLUSIONS

Based on the results of the pumping test carried out on August 28, 2018, the quantity of water from the test well is considered to be sufficient for 'typical' commercial use. As the development details are unknown at this time, groundwater quantity requirements should be confirmed at the time of development. The test well (TW18-1) sustained pumping at a rate of approximately 80 litres per minute for a period of eighty (8) hours and ten (10) minutes and recovered within 90%, sixteen (16) hours after the pump was shut off. This is considered to be more than sufficient for typical commercial use (greater than 39,200 litres per day).

The water from this well meets all of the ODWS maximum acceptable concentrations, aesthetic objectives and operational guidelines for the parameters tested, with the following exceptions:

- The operational guideline for hardness and organic nitrogen;
- The aesthetic objectives for colour, chloride and total dissolved solids (4-hour sample only); and,
- Sodium - warning level for persons on sodium restricted diets (should be reported to the local Medical Officer of Health).

The operational guideline exceedance for hardness is considered to be not suitable for domestic purposes as outlined in the ODWS; however, it is noted that there are no upper treatability limits outlined in MOECC D-5-5. The use of conventional water softening can be used to reduce the total hardness.

The aesthetic objective for colour can be treated using carbon filter treatment systems. The aesthetic objective exceedance for chloride is above the maximum reasonably treatable limits of 250 mg/L as outlined in MOECC Procedure D-5-5. However, new water treatment systems, such as reverse osmosis, have the ability to treat chloride concentrations within the ranges found in the test well (373 mg/L). The use of water treatment systems will result in the creation of wastewater (approximately 25% of the incoming water), which may affect the maximum daily septic design flows. Drinking water can be treated at the point of consumption (such as washroom or kitchen taps) to reduce the quantity of treated water and the associated wastewater.

If water treatment systems are used, it is recommended that the water treatment systems monitoring and water quality testing be conducted by a licensed drinking water quality specialist. In addition, a licensed drinking water quality specialist should confirm there are no interference effects between the use of multiple treatment systems (softener, carbon filter and reverse osmosis). Alternatively, if no water treatment systems are in place (with the exception of a water softener), the groundwater can be used for the plumbing system only and potable water provided to commercial tenants.

Based on the results of our investigation, the water quality does not meet the ODWS and maximum treatable limits as outlined in MOECC Procedure D-5-5 for chloride and is considered to be aesthetically poor. The use of multiple water treatment systems is required to provide potable water for the proposed development; alternatively, groundwater can be used for plumbing system only and potable water (e.g. bottled water) can be provided to employees.

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

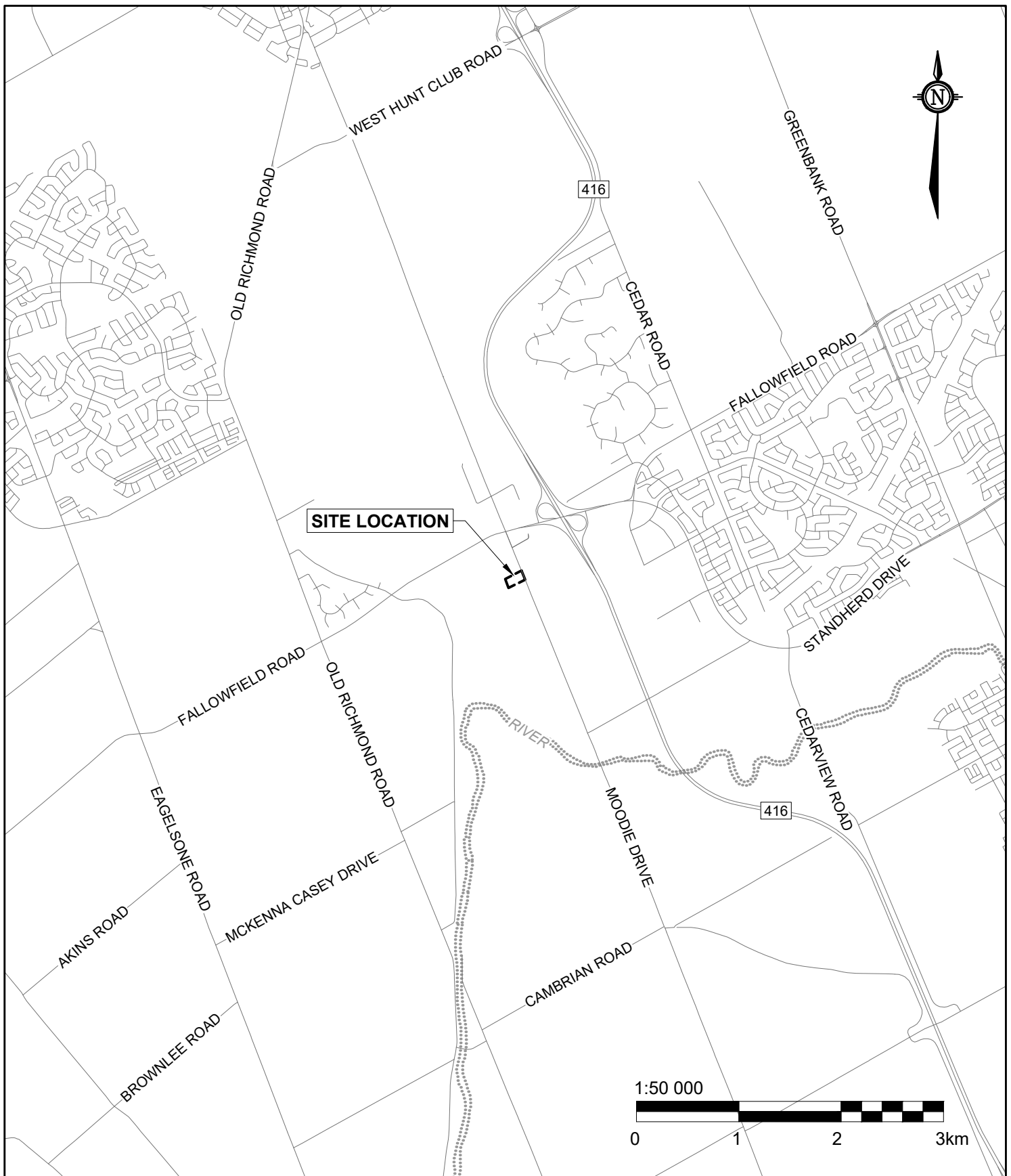


Andrius Paznekas, M.Sc.
Environmental Scientist



Shaun Pelkey, M.Sc.E., P.Eng.
Principal, Environmental Engineer





GEMTEC

CONSULTING ENGINEERS
AND SCIENTISTS

32 Steacie Drive, Ottawa, ON K2K 2A9
T: (613) 836-1422 | www.gemtec.ca | ottawa@gemtec.ca

Project
HYDROGEOLOGICAL INVESTIGATION
2800 MOODIE DRIVE
OTTAWA, ONTARIO

Drwn By	Chkd By	Date
P.C.	A.P.	SEPTEMBER 2018

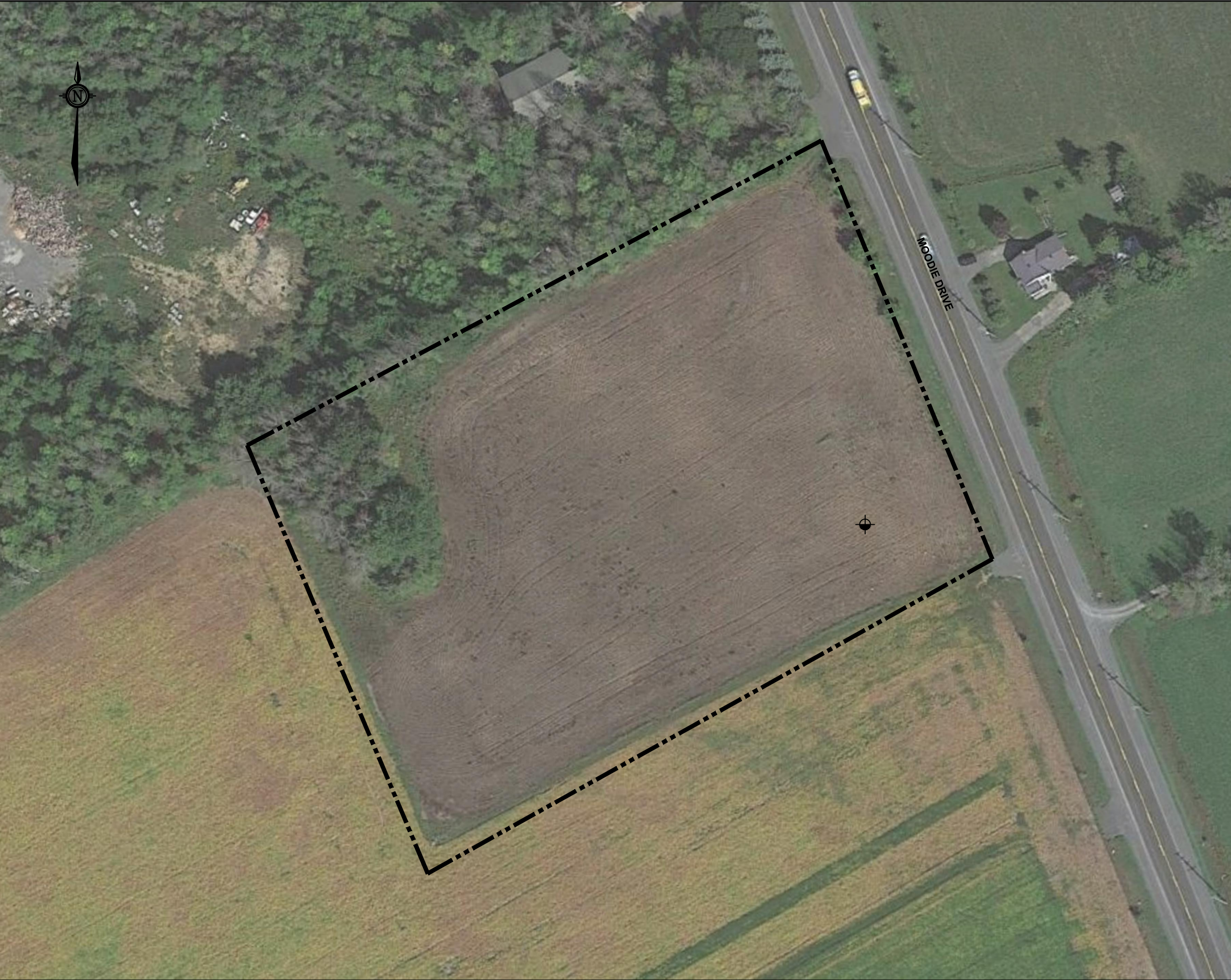
Drawing

KEY PLAN

Project No.
64153.89

Revision No.
0

FIGURE 1



LEGEND

PROPERTY BOUNDARY

TW 18-1

TEST WELL LOCATION IN PLAN
(current investigation by GEMTEC)

Scale

1:1000

0204060m

GEMTEC
CONSULTING ENGINEERS
AND SCIENTISTS

32 Steacie Drive
Ottawa, ON K2K 2A9
Tel: (613) 836-1422
www.gemtec.ca
ottawa@gemtec.ca

Drawing

SITE PLAN

Client

NOVATECH

Project

64153.89

Drwn by

P.C.

Chkd by

A.P.

Date

SEPTEMBER 2018

Rev.

0

FIGURE 2

HYDROGEOLOGICAL
INVESTIGATION
2800 MOODIE DRIVE
OTTAWA, ONTARIO



ATTACHMENT A

MOECC Water Well Record



Ministry of the Environment
and Climate Change

Tag#: A252837

(Print Below)

Well Record

Regulation 903 Ontario Water Resources Act

Measurements recorded in: ☐ Metric ☒ Imperial

Page of

Well Owner's Information

First Name: Phil DeKemp
Last Name / Organization: Phil DeKemp
E-mail Address:
☐ Well Constructed by Well Owner
Mailing Address (Street Number/Name): 17 Piety Hill Way
Municipality: Nepean
Province: ON
Postal Code: K2R 1E3
Telephone No. (inc. area code):

Well Location

Address of Well Location (Street Number/Name): 2800 Moodie Drive
Township: Nepean
Lot: 8/149
Concession: 5RF
County/District/Municipality: Ottawa Carleton
City/Town/Village: Nepean
Province: Ontario
Postal Code:
UTM Coordinates: Zone: 18, Easting: 437185, Northing: 5012729
Municipal Plan and Sublot Number: RP-4R-16177
Other: Parts 1+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)
	Sand & Gravel			From To
Grey	Limestone			0 25
Grey	Limestone			25 87
Grey	Limestone			87 109
Grey	Limestone			109 188
Grey	Limestone			188 180

Annular Space			
Depth Set at (m)	From To	Type of Sealant Used (Material and Type)	Volume Placed (m³)
32	22	Neat cement	9.38
22	0	Bentonite slurry	8.4

Method of Construction		Well Use	
<input type="checkbox"/> Cable Tool <input type="checkbox"/> Rotary (Conventional) <input type="checkbox"/> Rotary (Reverse) <input type="checkbox"/> Boring <input checked="" type="checkbox"/> Air percussion <input type="checkbox"/> Other, specify	<input type="checkbox"/> Diamond <input type="checkbox"/> Jetting <input type="checkbox"/> Driving <input type="checkbox"/> Digging	<input type="checkbox"/> Public <input checked="" type="checkbox"/> Domestic <input type="checkbox"/> Livestock <input type="checkbox"/> Irrigation <input type="checkbox"/> Industrial <input type="checkbox"/> Other, specify	<input type="checkbox"/> Commercial <input type="checkbox"/> Municipal <input type="checkbox"/> Test Hole <input type="checkbox"/> Cooling & Air Conditioning <input type="checkbox"/> Not used <input type="checkbox"/> Dewatering <input type="checkbox"/> Monitoring

Construction Record - Casing				Status of Well	
Inside Diameter (cm)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Well Thickness (cm)	Depth (m)	From To	
6 1/4"	Steel	188"	+2'	32'	<input checked="" type="checkbox"/> Water Supply
6 1/8"	Open Hole		32'	180'	<input type="checkbox"/> Replacement Well
					<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 (m/ft)	Kind of Water: <input type="checkbox"/> Fresh <input checked="" type="checkbox"/> Untested <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify	Depth (m/ft)	Diameter (cm/in)
87		From To	
109		0 32	9 3/4"
174		32 180	6 1/8"

Well Contractor and Well Technician Information
Business Name of Well Contractor: Air Rock Drilling Co. Ltd.
Well Contractor's Licence No.: 1119
Business Address (Street Number/Name): 6659 Franktown Road, RR#1
Municipality: Richmond
Province: ON
Postal Code: K0A 2Z0
Business E-mail Address: air-rock@sympatico.ca
Bus. Telephone No. (inc. area code): 613-832-170
Name of Well Technician (Last Name, First Name): Purcell, Shannon
Well Technician's Licence No.: T4033
Signature of Technician and/or Contractor:
Date Submitted: 2018 08 31

Results of Well Yield Testing			
After test of well yield, water was:		Draw Down	
<input type="checkbox"/> Clear and sand free	<input type="checkbox"/> Other, specify Not tested	Time (min)	Water Level (m/ft)
If pumping discontinued, give reason:		Static Level	Recovery
<input checked="" type="checkbox"/>		40.1'	57.6"
Pump intake set at (m/ft): 140		1 48.5	1 46.9
Pumping rate (l/min / GPM): 20		2 48.2	2 45.1
Duration of pumping: 1 hrs + 0 min		3 49.8	3 44.1
Final water level end of pumping (m/ft): 57.6"		4 50.8	4 43.7
If flowing give rate (l/min / GPM):		5 51.5	5 43.3
<input checked="" type="checkbox"/>		10 53.4	10 42.5
Recommended pump depth (m/ft): 140		15 54.4	15 41.8
Recommended pump rate (l/min / GPM): 20		20 55.1	20 41.1
Well production (l/min / GPM): 20		25 55.5	25 40.5
Disinfected? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		30 55.9	30 40.4
		40 56.6	40 40.2
		50 57.3	50 40.1
		60 57.6"	60 40.1"

Map of Well Location
Please provide a map below following instructions on the back.
Fallowfield Road.
#2800 MOODIE DRIVE
1.3km
40'

Comments: 1/2 HP 10 SET AT 140 FEET
Well owner's information package delivered: ☒ Yes ☐ No
Date Package Delivered: 2018 08 31
Date Work Completed: 2018 08 16
Ministry Use Only
Audit No: 2276855
Received:



CERTIFICATE OF WELL COMPLIANCE

I, Ken Desaulniers DO HEREBY CERTIFY that I am licensed to drill wells in the Province of Ontario, and that I have supervised the drilling of a well on the

property of PHIL De KEMP

located at # 2800 Moodie Drive, Nepean

Lot/Plan No.) in the City of Ottawa (Geographical Township of Osgoode).

Part
LOT 19 CONC 5 R.F. PLAN # 4R-16177 S/L # Parts 1 & 2

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.

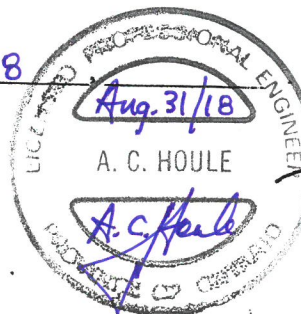
AND DO HEREBY CERTIFY THAT the said well has been drilled, cased, grouted (cement or bentonite) as applicable and constructed in strict conformity with the standards required.

Signed this 16th day of August 2018
Kenny Air Rock Drilling Co. Ltd.
Well Driller/Company

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 ^{and} this report ~~and the Hydrogeological Report~~ with regards to casing length and grouting requirements.

SIGNED this 31 day of August, 2018
A.C. Houle, P. Eng
Engineer

Gemtec



2018505
TAQ A 252837





ATTACHMENT B

TW18-1 Drawdown and Recovery



GEMTEC

CONSULTING ENGINEERS
AND SCIENTISTS

Pumping Test Analysis Report

Project: Hydrogeological Investigation

Project Number: 64153.89

Client: Phil DeKemp

Location: 2800 Moodie Drive, Ottawa, Ontario

P-Test Date: August 28, 2018

Test Conducted by: NS

Pumping Well: TW18-1

Well Tag: A080997

Analysis Performed by: AP

Method: Raw Pumping Test Data

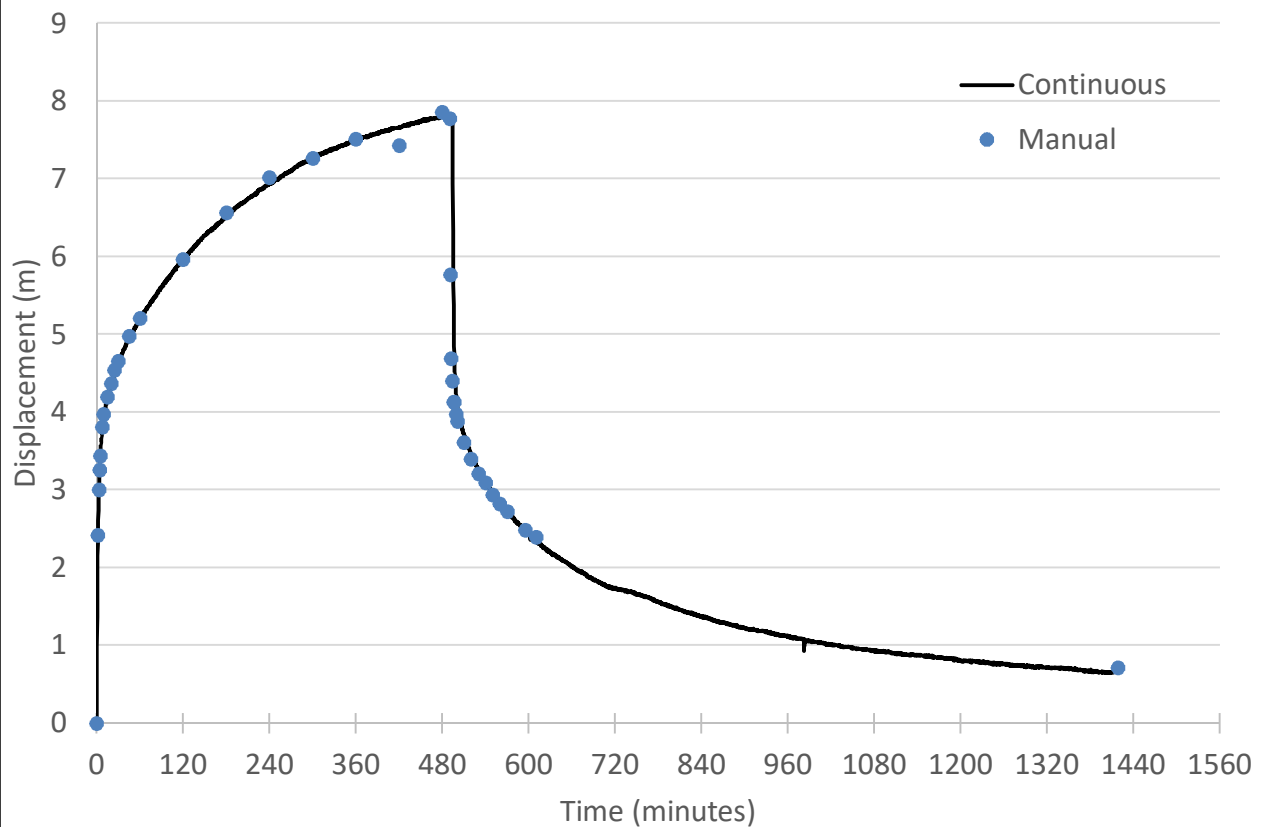
Static WL: 10.90 m

Well Depth: 54.9 m

Discharge: Constant: 80 L/min

Duration: 8 hours, 10 minutes

Pumping Test Data (TW18-1): Drawdown and Recovery





ATTACHMENT C

TW18-1 Transmissivity Analyses



GEMTEC

CONSULTING ENGINEERS
AND SCIENTISTS

Pumping Test Analysis Report

Project: Hydrogeological Investigation

Project Number: 64153.89

Client: Phil DeKemp

Location: 2800 Moodie Drive, Ottawa, Ontario

P-Test Date: August 28, 2018

Test Conducted by: NS

Pumping Well: TW18-1

Well Tag: A080997

Analysis Performed by: AP

Method: Cooper-Jacob

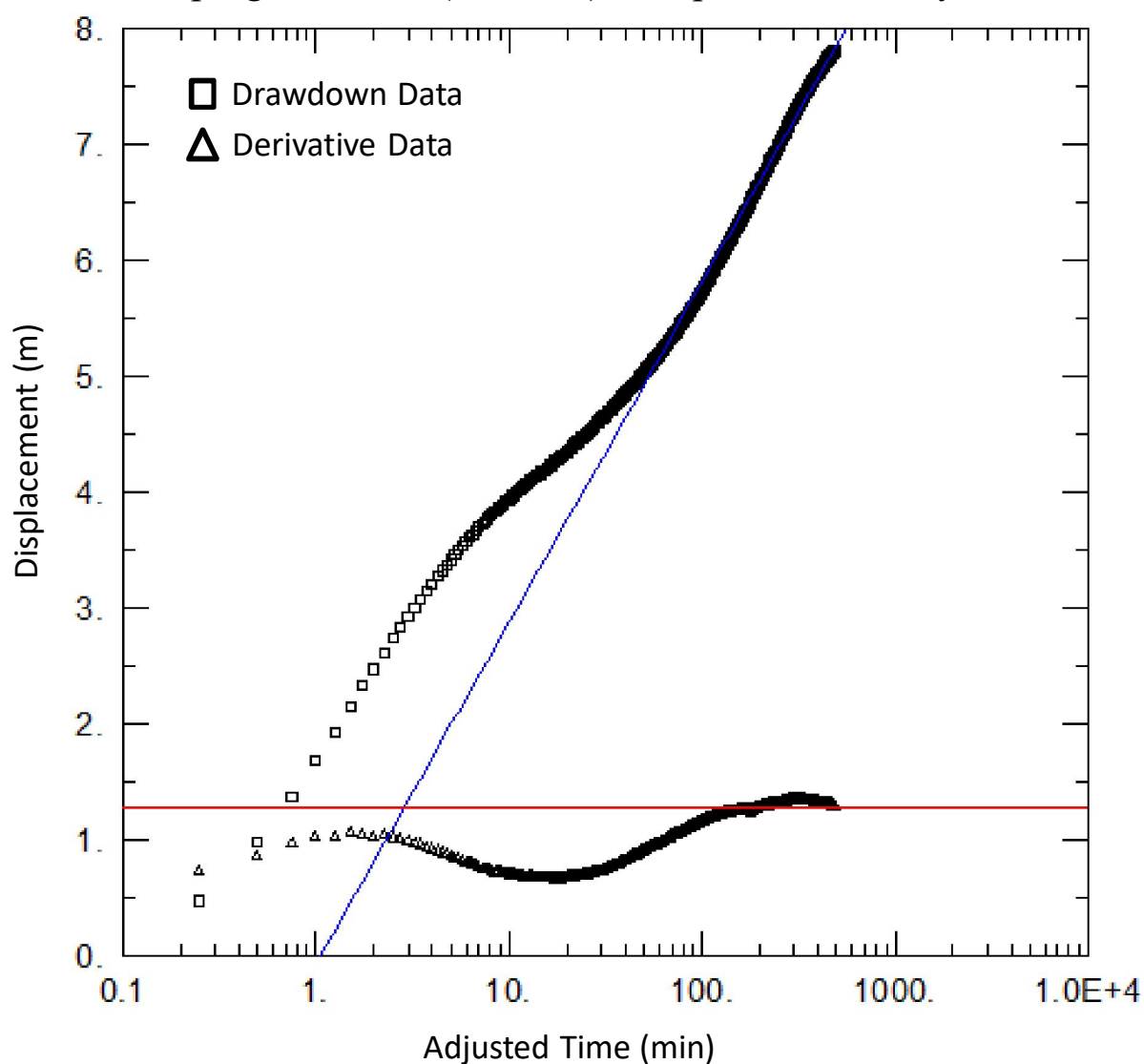
Static WL: 10.90 m

Well Depth: 54.9 m

Discharge: Constant 80 L/min

Duration: 8 hours, 10 minutes

Pumping Test Data (TW18-1): Cooper-Jacob Analysis



Estimated Hydraulic Conductivity (k) = $8 \times 10^{-5} \text{ m}^2/\text{s}$ or $6.8 \text{ m}^2/\text{day}$



ATTACHMENT D

Summary of Field and Laboratory Measurements Laboratory Certificates of Analysis

Table D1
Summary of Field Parameters (TW18-1)

Time Since Pumping Started (hr:min)	Temp (°C)	EC ¹ (uS)	pH	Total Dissolved Solids (ppm)	Turbidity (NTU)	Colour (ACU) ²	Colour (TCU) ³	Chlorine (mg/L)
1	14.6	1816	7.03	887	4.35, 5.08, 4.57	30	-	0.08
2	14.5	1644	7.21	812	2.96, 4.18, 3.90	16	-	0.0
3	17.6	1634	7.33	819	8.82, 3.96, 8.81	0	-	0.0
4	14.5	1680	6.51	855	3.57, 3.54, 16.7	0	0	0.0
5	14.8	1621	6.81	810	3.61, 5.57, 3.75	32	-	0.0
6	14.1	1703	7.33	693	3.73, 2.55, 3.01	0	-	0.0
7	12.9	1547	7.15	817	2.44, 4.15, 2.68	0	-	0.0
8	13.2	1716	7.15	815	3.68, 1.57, 2.87	1	20	0.0

Notes:

1. EC: Electrical Conductivity
2. ACU: Actual Colour Units (unfiltered sample)
3. TCU: True Colour Units (filtered sample)

Table D2 (1/2)
Summary of Laboratory Parameters Analyzed (TW18-1)

	Parameter	Units	TW18-1 4 hr P-Test	TW18-1 8 hr P-Test	Ontario Drinking Water Standard	Type of Standard
Microbiological Parameters	Escherichia coli	CFU/100mL	ND ¹	ND ¹	0	MAC
	Fecal Coliform	CFU/100mL	ND	ND	0	MAC
	Total coliforms	CFU/100mL	ND ¹	ND ¹	0	MAC
	Heterotrophic Plate Count	CFU/1mL	110	10	-	-
General Inorganics	Alkalinity (as CaCO ₃)	mg/L	378	373	30-500	OG
	Ammonia as N (NH ₃)	mg/L	0.09	0.12	-	-
	Dissolved Organic Carbon (DOC)	mg/L	1.2	1.6	5	AO
	Colour	TCU	7	6	5	AO
	Electrical Conductivity	uS/cm	1790	1790	-	-
	Total Hardness (as CaCO ₃)	mg/L	599	611	80-100	OG
	pH	pH units	7.6	7.7	6.5-8.5	OG
	Phenols	mg/L	ND (0.001)	ND (0.001)	-	-
	Total Dissolved Solids (TDS)	mg/L	956	318	500	AO
	Sulphide (S ₂)	mg/L	ND (0.02)	ND (0.02)	0.05	AO
	Tannins and Lignins	mg phenol/L	ND (0.1)	ND (0.1)	-	-
	Total Kjeldahl Nitrogen (TKN)	mg/L	0.2	0.3	-	-
	Organic Nitrogen (TKN - NH ₃)	mg/L	0.1	0.2	0.15	OG
	Turbidity	NTU	0.6	0.4	5	AO
Anions	Chloride (Cl)	mg/L	351	373	250	AO
	Fluoride (F)	mg/L	0.2	0.3	1.5	MAC
	Nitrate as N (NO ₃)	mg/L	2.7	2.3	10	MAC
	Nitrite as N (NO ₂)	mg/L	ND (0.05)	ND (0.05)	0.1	MAC
	Sulphate (SO ₄)	mg/L	77	75	500	AO
Metals	Calcium (Ca)	mg/L	177	182	-	-
	Iron (Fe)	mg/L	ND (0.1)	ND (0.1)	0.3	AO
	Magnesium (Mg)	mg/L	38.0	37.9	-	-
	Manganese (Mn)	mg/L	0.014	0.015	0.05	AO
	Potassium (K)	mg/L	4.4	4.9	-	-
	Sodium (Na)	mg/L	167	181	200	AO

Bolded = Exceeds Ontario Drinking Water Standards

1. Background counts greater than 200 (refer to Laboratory Certificate of Analysis)

MAC = Maximum acceptable concentration NR = Not Reportable OG = Operational guideline

AO = Aesthetic objective ND = Not Detected

Table D2 (2/2)
Summary of Laboratory Parameters Analyzed (TW18-1)

	Parameter	Units	TW18-1 8 hr P-Test	Ontario Drinking Water Standard	Type of Standard
Metals	Mercury	mg/L	ND (0.0001)	0.001	MAC
	Aluminum	mg/L	0.003	0.1	OG
	Antimony	mg/L	ND (0.0005)	0.006	MAC
	Arsenic	mg/L	ND (0.001)	0.01	MAC
	Barium	mg/L	0.139	1	MAC
	Beryllium	mg/L	ND (0.0005)	-	-
	Boron	mg/L	0.22	5	MAC
	Cadmium	mg/L	ND (0.0001)	0.005	MAC
	Chromium	mg/L	ND (0.001)	0.05	MAC
	Chromium (VI)	mg/L	ND (0.010)	-	-
	Cobalt	mg/L	0.0012	-	-
	Copper	mg/L	ND (0.0005)	1	AO
	Lead	mg/L	ND (0.0001)	0.01	MAC
	Molybdenum	mg/L	0.0008	-	-
	Nickel	mg/L	0.003	-	-
	Potassium	mg/L	4.9	-	-
	Selenium	mg/L	ND (0.001)	0.05	MAC
	Silicon	mg/L	4.97	-	-
	Silver	mg/L	ND (0.0001)	-	-
	Strontium	mg/L	11.8	-	-
	Thallium	mg/L	ND (0.001)	-	-
	Tin	mg/L	ND (0.01)	-	-
	Titanium	mg/L	ND (0.005)	-	-
	Tungsten	mg/L	ND (0.01)	-	-
	Uranium	mg/L	0.0008	0.02	MAC
	Vanadium	mg/L	ND (0.0005)	-	-
	Zinc	mg/L	ND (0.005)	5	AO

Bolded = Exceeds Ontario Drinking Water Standards

MAC = Maximum acceptable concentration NR = Not Reportable

AO = Aesthetic objective

ND = Not Detected

OG = Operational guideline



Date: September 2018

Project: 64153.89

Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Andrius Paznekas

Client PO:
Project: 64153.89
Custody: 9899

Report Date: 7-Sep-2018
Order Date: 29-Aug-2018

Order #: 1835324

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1835324-01	TW 18-1 4hr
1835324-02	TW 18-1 8hr

Approved By:



Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 07-Sep-2018

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 29-Aug-2018

Client PO:

Project Description: 64153.89

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	30-Aug-18	30-Aug-18
Ammonia, as N	EPA 351.2 - Auto Colour	4-Sep-18	4-Sep-18
Anions	EPA 300.1 - IC	29-Aug-18	29-Aug-18
Chromium, hexavalent - water	MOE E3056 - colourimetric	30-Aug-18	30-Aug-18
Colour	SM2120 - Spectrophotometric	29-Aug-18	29-Aug-18
Conductivity	EPA 9050A- probe @25 °C	30-Aug-18	30-Aug-18
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	4-Sep-18	5-Sep-18
E. coli	MOE E3407	29-Aug-18	29-Aug-18
Fecal Coliform	SM 9222D	29-Aug-18	29-Aug-18
Heterotrophic Plate Count	SM 9215C	29-Aug-18	29-Aug-18
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	30-Aug-18	31-Aug-18
Metals, ICP-MS	EPA 200.8 - ICP-MS	4-Sep-18	4-Sep-18
pH	EPA 150.1 - pH probe @25 °C	30-Aug-18	30-Aug-18
Phenolics	EPA 420.2 - Auto Colour, 4AAP	29-Aug-18	30-Aug-18
Subdivision Package	Hardness as CaCO ₃	4-Sep-18	4-Sep-18
Sulphide	SM 4500SE - Colourimetric	30-Aug-18	30-Aug-18
Tannin/Lignin	SM 5550B - Colourimetric	29-Aug-18	29-Aug-18
Total Coliform	MOE E3407	29-Aug-18	29-Aug-18
Total Dissolved Solids	SM 2540C - gravimetric, filtration	4-Sep-18	5-Sep-18
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	31-Aug-18	4-Sep-18
Turbidity	SM 2130B - Turbidity meter	29-Aug-18	29-Aug-18

Certificate of Analysis

Report Date: 07-Sep-2018

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 29-Aug-2018

Client PO:

Project Description: 64153.89

Client ID:	TW 18-1 4hr	TW 18-1 8hr	-	-
Sample Date:	08/28/2018 11:59	08/28/2018 15:59	-	-
Sample ID:	1835324-01	1835324-02	-	-
MDL/Units	Drinking Water	Drinking Water	-	-

Microbiological Parameters

E. coli	1 CFU/100 mL	ND [1]	ND [1]	-	-
Fecal Coliforms	1 CFU/100 mL	ND	ND	-	-
Total Coliforms	1 CFU/100 mL	ND [1]	ND [1]	-	-
Heterotrophic Plate Count	10 CFU/mL	110	10	-	-

General Inorganics

Alkalinity, total	5 mg/L	378	373	-	-
Ammonia as N	0.01 mg/L	0.09	0.12	-	-
Dissolved Organic Carbon	0.5 mg/L	1.2	1.6	-	-
Colour	2 TCU	7	6	-	-
Conductivity	5 uS/cm	1790	1790	-	-
Hardness	mg/L	599	611	-	-
pH	0.1 pH Units	7.6	7.7	-	-
Phenolics	0.001 mg/L	<0.001	<0.001	-	-
Total Dissolved Solids	10 mg/L	956	318	-	-
Sulphide	0.02 mg/L	<0.02	<0.02	-	-
Tannin & Lignin	0.1 mg/L	<0.1	<0.1	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.2	0.3	-	-
Turbidity	0.1 NTU	0.6	0.4	-	-

Anions

Chloride	1 mg/L	351	373	-	-
Fluoride	0.1 mg/L	0.2	0.3	-	-
Nitrate as N	0.1 mg/L	2.7	2.3	-	-
Nitrite as N	0.05 mg/L	<0.05	<0.05	-	-
Sulphate	1 mg/L	77	75	-	-

Metals

Mercury	0.0001 mg/L	-	<0.0001	-	-
Aluminum	0.001 mg/L	-	0.003	-	-
Antimony	0.0005 mg/L	-	<0.0005	-	-
Arsenic	0.001 mg/L	-	<0.001	-	-
Barium	0.001 mg/L	-	0.139	-	-
Beryllium	0.0005 mg/L	-	<0.0005	-	-
Boron	0.01 mg/L	-	0.22	-	-
Cadmium	0.0001 mg/L	-	<0.0001	-	-
Calcium	0.1 mg/L	177	182	-	-
Chromium	0.001 mg/L	-	<0.001	-	-

Certificate of Analysis

Report Date: 07-Sep-2018

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 29-Aug-2018

Client PO:

Project Description: 64153.89

	Client ID:	TW 18-1 4hr	TW 18-1 8hr	-	-
	Sample Date:	08/28/2018 11:59	08/28/2018 15:59	-	-
	Sample ID:	1835324-01	1835324-02	-	-
	MDL/Units	Drinking Water	Drinking Water	-	-
Chromium (VI)	0.010 mg/L	-	<0.010	-	-
Cobalt	0.0005 mg/L	-	0.0012	-	-
Copper	0.0005 mg/L	-	<0.0005	-	-
Iron	0.1 mg/L	<0.1	<0.1	-	-
Lead	0.0001 mg/L	-	<0.0001	-	-
Magnesium	0.2 mg/L	38.0	37.9	-	-
Manganese	0.005 mg/L	0.014	0.015	-	-
Molybdenum	0.0005 mg/L	-	0.0008	-	-
Nickel	0.001 mg/L	-	0.003	-	-
Potassium	0.1 mg/L	4.4	4.9	-	-
Selenium	0.001 mg/L	-	<0.001	-	-
Silicon	0.01 mg/L	-	4.97	-	-
Silver	0.0001 mg/L	-	<0.0001	-	-
Sodium	0.2 mg/L	167	181	-	-
Strontium	0.01 mg/L	-	11.8	-	-
Thallium	0.001 mg/L	-	<0.001	-	-
Tin	0.01 mg/L	-	<0.01	-	-
Titanium	0.005 mg/L	-	<0.005	-	-
Tungsten	0.01 mg/L	-	<0.01	-	-
Uranium	0.0001 mg/L	-	0.0008	-	-
Vanadium	0.0005 mg/L	-	<0.0005	-	-
Zinc	0.005 mg/L	-	<0.005	-	-

Certificate of Analysis

Report Date: 07-Sep-2018

Client: **GEMTEC Consulting Engineers and Scientists Limited**

Order Date: 29-Aug-2018

Client PO:

Project Description: **64153.89**

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Fluoride	ND	0.1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
Ammonia as N	ND	0.01	mg/L						
Dissolved Organic Carbon	ND	0.5	mg/L						
Colour	ND	2	TCU						
Conductivity	ND	5	uS/cm						
Phenolics	ND	0.001	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Sulphide	ND	0.02	mg/L						
Tannin & Lignin	ND	0.1	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Turbidity	ND	0.1	NTU						
Metals									
Mercury	ND	0.0001	mg/L						
Aluminum	ND	0.001	mg/L						
Antimony	ND	0.0005	mg/L						
Arsenic	ND	0.001	mg/L						
Barium	ND	0.001	mg/L						
Beryllium	ND	0.0005	mg/L						
Boron	ND	0.01	mg/L						
Cadmium	ND	0.0001	mg/L						
Calcium	ND	0.1	mg/L						
Chromium (VI)	ND	0.010	mg/L						
Chromium	ND	0.001	mg/L						
Cobalt	ND	0.0005	mg/L						
Copper	ND	0.0005	mg/L						
Iron	ND	0.1	mg/L						
Lead	ND	0.0001	mg/L						
Magnesium	ND	0.2	mg/L						
Manganese	ND	0.005	mg/L						
Molybdenum	ND	0.0005	mg/L						
Nickel	ND	0.001	mg/L						
Potassium	ND	0.1	mg/L						
Selenium	ND	0.001	mg/L						
Silicon	ND	0.01	mg/L						
Silver	ND	0.0001	mg/L						
Sodium	ND	0.2	mg/L						
Strontium	ND	0.01	mg/L						
Thallium	ND	0.001	mg/L						
Tin	ND	0.01	mg/L						
Titanium	ND	0.005	mg/L						
Tungsten	ND	0.01	mg/L						
Uranium	ND	0.0001	mg/L						
Vanadium	ND	0.0005	mg/L						
Zinc	ND	0.005	mg/L						
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL						
Fecal Coliforms	ND	1	CFU/100 mL						
Total Coliforms	ND	1	CFU/100 mL						
Heterotrophic Plate Count	ND	10	CFU/mL						

Certificate of Analysis

Report Date: 07-Sep-2018

Client: **GEMTEC Consulting Engineers and Scientists Limited**

Order Date: 29-Aug-2018

Client PO:

Project Description: 64153.89

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	2.89	1	mg/L	2.91			0.6	10	
Fluoride	1.98	0.1	mg/L	2.03			2.6	10	
Nitrate as N	ND	0.1	mg/L	ND				20	
Nitrite as N	ND	0.05	mg/L	ND				20	
Sulphate	4.40	1	mg/L	4.36			0.9	10	
General Inorganics									
Alkalinity, total	376	5	mg/L	378			0.5	14	
Ammonia as N	0.133	0.01	mg/L	0.134			0.9	17.7	
Dissolved Organic Carbon	3.4	0.5	mg/L	3.1			10.5	37	
Colour	7	2	TCU	7			0.0	12	
Conductivity	1770	5	uS/cm	1790			1.1	11	
pH	7.6	0.1	pH Units	7.6			0.1	10	
Phenolics	ND	0.001	mg/L	ND				10	
Total Dissolved Solids	992	10	mg/L	956			3.7	10	
Sulphide	ND	0.02	mg/L	ND				10	
Tannin & Lignin	ND	0.1	mg/L	ND			0.0	11	
Total Kjeldahl Nitrogen	0.25	0.1	mg/L	0.31			21.5	10	QR-01
Turbidity	9.7	0.1	NTU	9.6			0.5	10	
Metals									
Mercury	ND	0.0001	mg/L	ND			0.0	20	
Aluminum	0.002	0.001	mg/L	0.002			14.5	20	
Antimony	ND	0.0005	mg/L	0.0171			0.0	20	
Arsenic	ND	0.001	mg/L	0.003			0.0	20	
Barium	0.010	0.001	mg/L	0.036			115.0	20	
Beryllium	ND	0.0005	mg/L	ND			0.0	20	
Boron	0.03	0.01	mg/L	0.03			0.6	20	
Cadmium	ND	0.0001	mg/L	0.0019			0.0	20	
Calcium	57.5	0.1	mg/L	48.7			16.5	20	
Chromium (VI)	ND	0.010	mg/L	ND				20	
Chromium	ND	0.001	mg/L	0.005			0.0	20	
Cobalt	ND	0.0005	mg/L	0.0052			0.0	20	
Copper	0.0019	0.0005	mg/L	0.0167			160.0	20	QR-01
Iron	1	0.1	mg/L	1			13.8	20	
Lead	ND	0.0001	mg/L	0.0042			0.0	20	
Magnesium	28.8	0.2	mg/L	22.6			23.9	20	
Manganese	0.034	0.005	mg/L	0.074			74.4	20	
Molybdenum	ND	0.0005	mg/L	0.0201			0.0	20	
Nickel	ND	0.001	mg/L	0.008			0.0	20	
Potassium	1.3	0.1	mg/L	6.7			137.0	20	
Selenium	ND	0.001	mg/L	0.019			0.0	20	
Silicon	ND	0.01	mg/L	ND				20	
Silver	ND	0.0001	mg/L	0.0080			0.0	20	
Sodium	0.9	0.2	mg/L	37.7			191.0	20	QR-01
Thallium	ND	0.001	mg/L	0.003			0.0	20	
Tin	ND	0.01	mg/L	0.02			0.0	20	
Titanium	ND	0.005	mg/L	0.007			0.0	50	
Tungsten	ND	0.01	mg/L	0.01			0.0	20	
Uranium	ND	0.0001	mg/L	0.0025			0.0	20	
Vanadium	ND	0.0005	mg/L	0.0038			0.0	20	
Zinc	0.013	0.005	mg/L	0.071			139.0	20	QR-01
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL	ND				30	
Total Coliforms	ND	1	CFU/100 mL	ND				30	
Heterotrophic Plate Count	100	10	CFU/mL	110			10.0	30	

Certificate of Analysis

Report Date: 07-Sep-2018

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 29-Aug-2018

Client PO:

Project Description: 64153.89

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	12.3	1	mg/L	2.91	93.8	78-112			
Fluoride	2.96	0.1	mg/L	2.03	92.6	73-113			
Nitrate as N	1.04	0.1	mg/L	ND	104	81-112			
Nitrite as N	0.946	0.05	mg/L	ND	94.6	76-107			
Sulphate	14.5	1	mg/L	4.36	101	75-111			
General Inorganics									
Ammonia as N	0.402	0.01	mg/L	0.134	107	81-124			
Dissolved Organic Carbon	14.6	0.5	mg/L	3.1	115	60-133			
Phenolics	0.023	0.001	mg/L	ND	93.9	69-132			
Total Dissolved Solids	86.0	10	mg/L		86.0	75-125			
Sulphide	0.50	0.02	mg/L	ND	99.8	79-115			
Tannin & Lignin	0.9	0.1	mg/L	ND	87.3	71-113			
Total Kjeldahl Nitrogen	2.35	0.1	mg/L	0.31	102	81-126			
Metals									
Mercury	0.0029	0.0001	mg/L	ND	95.3	70-130			
Aluminum	46.8		ug/L	2.45	88.8	80-120			
Antimony	45.9		ug/L	17.1	57.6	80-120			QM-07
Arsenic	48.3		ug/L	3.08	90.3	80-120			
Barium	56.1		ug/L	36.2	39.9	80-120			QM-07
Beryllium	45.5		ug/L	0.0039	90.9	80-120			
Boron	63.9		ug/L	25.6	76.6	80-120			QM-07
Cadmium	47.2		ug/L	1.92	90.5	80-120			
Chromium (VI)	0.187	0.010	mg/L	ND	93.5	70-130			
Chromium	50.0		ug/L	5.38	89.2	80-120			
Cobalt	45.3		ug/L	5.22	80.2	80-120			
Copper	47.5		ug/L	16.7	61.6	80-120			QM-06
Iron	2250		ug/L	1210	104	80-120			
Lead	44.7		ug/L	4.20	81.0	80-120			
Magnesium	941		ug/L		94.1	80-120			
Manganese	43.9		ug/L		87.9	80-120			
Molybdenum	44.2		ug/L	3.34	81.7	80-120			
Nickel	47.6		ug/L		95.2	80-120			
Potassium	3220		ug/L	2350	87.4	80-120			
Selenium	44.8		ug/L		89.6	80-120			
Silver	48.7		ug/L		97.4	80-120			
Sodium	831		ug/L		83.1	80-120			
Thallium	44.8		ug/L	3.43	82.7	80-120			
Tin	47.7		ug/L	15.4	64.6	80-120			QM-07
Titanium	47.5		ug/L		95.0	70-130			
Tungsten	48.8		ug/L	14.4	68.9	80-120			QM-07
Uranium	45.7		ug/L	2.49	86.4	80-120			
Vanadium	49.2		ug/L	3.84	90.8	80-120			
Zinc	40.2		ug/L	2.65	75.2	80-120			

Certificate of Analysis

Client: GEMTEC Consulting Engineers and Scientists Limited

Client PO:

Report Date: 07-Sep-2018

Order Date: 29-Aug-2018

Project Description: 64153.89

Qualifier Notes:

Sample Qualifiers :

1 : A2C - Background counts greater than 200

QC Qualifiers :

QM-06 : Due to noted non-homogeneity of the QC sample matrix, the spike recoveries were out side the accepted range. Batch data accepted based on other QC.

QM-07 : The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

Sample Data Revisions

None

Work Order Revisions / Comments:

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.