

**THE TOWNSHIP OF EDWARDSBUGH/CARDINAL  
DEVELOPMENT AGREEMENT**

THIS AGREEMENT, made in triplicate, the \_\_\_\_ day of \_\_\_\_\_ 2021.

BETWEEN:

**1504107 ONTARIO INC.**  
(the "Owner")

**-and-**

**THE CORPORATION OF THE TOWNSHIP OF EDWARDSBUGH/CARDINAL**  
( the "Township")

**FOR LANDS DESCRIBED AS**  
PT LT 3 W/S SPENCER STREET  
4 W/S SPENCER STREET  
PL 40, PT 1, 15R6898  
Township of Edwardsburgh Cardinal  
PIN 68141-0362

RECITALS:

1. The Owner is the owner of the lands described in Schedule "A" to this Agreement and proposes to subdivide it for the purpose of selling, conveying, or leasing it in lots.
2. The said lands are the subject matter of consent application B-80-21 which has received conditional approval from the United Counties of Leeds and Grenville Consent Granting Authority, a copy of which is annexed hereto as Schedule "B";
3. The Township, pursuant to Section 53 of the Planning Act, R.S.O. 1990, as amended, has the authority to enter into an agreement imposed as a condition of the approval of consent.
4. This agreement shall be registered at the cost of the Owner against the land to which it applies subject to the Registry Act and the Land Titles Act;

NOW THEREFORE THIS AGREEMENT WITNESSETH that in consideration of the other good and valuable consideration and the sum of One (\$1.00) Dollar of lawful money of Canada, now paid by each of the other parties hereto (the receipt whereof is

**DEVELOPMENT AGREEMENT  
BETWEEN 1504107 ONTARIO INC.  
AND THE TOWNSHIP OF EDWARDSBURGH/CARDINAL**

hereby acknowledged) the Parties hereby covenant, promise and agree with each other as follows:

1. This Agreement affects the Lands described in Schedule "A" to this Agreement and shall ensure to the benefit of and be binding upon parties hereto, and their respective successors and assigns, The Owner hereby agrees to the registration of this Agreement against the title to the severed lands and retained lands, at the sole cost of the Owner.
2. The Owner hereby agrees to obtain all required municipal approvals and comply with all applicable Zoning By-Laws of the Township, the Building Code Act, 1992, S.O. 1992, c.23 requirements and approvals required by applicable government authorities which may be required prior to the development of the lands.
3. The Owner hereby acknowledges that the lands described in Schedule "A" to this Agreement are the subject of the Hydrogeological Study as shown in Schedule "C" to this Agreement, which was completed in order to assess the groundwater quality and quantity for a proposed semi-detached dwelling, serviced by existing on-site private wells and municipal sanitary and storm sewers.
4. The owner hereby acknowledges and agrees that the conditions, facilities and matters as shown on Schedule "D" and described in Schedule "C" shall be provided and maintained by the Owner at the Owner's sole risk and expense.
5. Any notice to be given hereunto shall be in writing to all other parties and either delivered personally or sent by prepaid registered mail, and in the latter case shall be deemed to have been given three (3) business days following the date upon which it was mailed. The address of the parties for the purpose hereof shall be:

to the Owner at:

1504107 Ontario Inc.  
2010 Totem Ranch Rd  
Oxford Station ON K0G 1T0

to the Township at:

Township of Edwardsburgh/Cardinal  
PO Box 129  
Spencerville ON KOE 1X0

6. The following schedules will form part of this agreement:  
SCHEDULE "A" – Description of the Property  
SCHEDULE "B" – Decision of the United Counties of Leeds and Grenville  
Consent Granting Authority  
SCHEDULE "C" – Hydrogeological Study  
Prepared by Morey Associates Ltd., April 2021  
SCHEDULE "D" – Development Requirements

**DEVELOPMENT AGREEMENT  
BETWEEN 1504107 ONTARIO INC.  
AND THE TOWNSHIP OF EDWARDSBURGH/CARDINAL**

IN WITNESS WHEREOF the parties hereto have executed this agreement.

THE CORPORATION OF THE TOWNSHIP OF EDWARDSBURGH/CARDINAL

\_\_\_\_\_  
Mayor

\_\_\_\_\_  
Clerk

I/We have authority to bind the  
Corporation.

OWNER, 1504107 ONTARIO INC.

\_\_\_\_\_  
Owner

I/We have authority to bind the  
Corporation.

DATED AT Spencerville, ON this \_\_\_\_ day of \_\_\_\_\_, 2021

**DEVELOPMENT AGREEMENT  
BETWEEN 1504107 ONTARIO INC.  
AND THE TOWNSHIP OF EDWARDSBURGH/CARDINAL**

**SCHEDULE "A"**

**DESCRIPTION OF THE PROPERTY**

PT LT 3 W/S SPENCER STREET  
4 W/S SPENCER STREET  
PL 40, PT 1, 15R6898  
Township of Edwardsburgh Cardinal  
PIN 68141-0362

DRAFT

**DEVELOPMENT AGREEMENT  
BETWEEN 1504107 ONTARIO INC.  
AND THE TOWNSHIP OF EDWARDSBUGH/CARDINAL**

**SCHEDULE “B”**

**DECISION OF THE UNITED COUNTIES OF LEEDS AND GRENVILLE  
CONSENT GRANTING AUTHORITY**

DRAFT



**UNITED COUNTIES OF LEEDS AND GRENVILLE  
CONSENT GRANTING AUTHORITY**

**DECISION**

**APPLICATION B-80-21**

We the undersigned members of the Consent Granting Authority of the United Counties of Leeds and Grenville; do hereby certify that the following is a decision reached by us at a hearing held at the Counties Offices, 25 Central Avenue, Brockville, Ontario on **September 29, 2021**. The said decision was reached on the application of **1504107 Ontario Inc.** to sever a parcel of land being; part of Lots 3 & 4, Registered Plan 40; **Township of Edwardsburgh Cardinal** having dimensions of approximately 25.4 metres by 19.25 metres with an area of 0.0468 hectares; retaining the existing easement in favour of the Township.

**DECISION:** **GRANTED** providing the conditions as stated below are met.

**REASONS:**

Division of land is compatible with the intent and purpose of the Official Plan and meets the criteria in Section 51 (24) of the Planning Act providing conditions are met.

**CONDITIONS:**

- (1) That all conditions imposed in the granting of this decision be met and **one (1)** original paper copy and **one (1)** digital copy of the registered reference plan of the subject lands, which conforms substantially with the application as submitted, and the instrument relating to the transaction (deed/transfer, grant of right-of-way, etc.) be presented to the Secretary-Treasurer of the Consent Granting Authority for the Certificate of Consent no later than **October 1, 2022**.
- (2) That a copy of the deposited reference plan for the newly severed lot be submitted to the Township.
- (3) That a Minor Variance be obtained to address the deficient rear yard setback.
- (4) That the applicant enter into a Development Agreement, to the satisfaction of the Township, to implement the recommendations of the Hydrogeological Study prepared by Morey Associates.
- (5) That written release of conditions 2, 3 and 4 from the Township be submitted to the Consent Granting Authority prior to endorsement of consent on the deed for the severed land.

**NOTES:**

- (1) The Township had no objection providing conditions 2, 3 and 4 are complied with.
  - That the Township is in favour of the severance in order to accommodate a semi-detached dwelling. Note that the Township's Zoning By-law 2012-35 includes the following provisions for semi-detached dwellings:
    - 6.2 Residential Second Density (R2)
    - (c) [iv] Provisions for Semi-detached Dwelling
      - Despite the above requirements for lot area, lot frontage and dwelling units per lot, a semi-detached dwelling may be severed and sold as an individual unit.
      - The minimum interior side yard shall not apply to the party wall of a semi-detached dwelling or shared garage appurtenant thereto.
- (2) South Nation Conservation had no objection.
  - SNC's review did not identify any natural heritage or natural hazards features on the proposed severed or retained lots.

**I hereby certify this to be a true and exact copy**

Handwritten signature of Cheryl Mills in cursive script.

**Chair**

Handwritten signature of Krista Weidenaar in cursive script.

**Secretary-Treasurer**



**This Decision was mailed on October 1, 2021**

**The last date for appealing this decision is October 21, 2021**

**DEVELOPMENT AGREEMENT  
BETWEEN 1504107 ONTARIO INC.  
AND THE TOWNSHIP OF EDWARDSBUGH/CARDINAL**

**SCHEDULE "C"**

**HYDROGEOLOGICAL STUDY  
PREPARED BY MOREY ASSOCIATES LTD.  
APRIL 2021**

DRAFT



**REPORT ON**

**HYDROGEOLOGICAL STUDY  
PROPOSED SEMI-DETACHED DWELLING  
SOUTH STREET, SPENCERVILLE  
TOWNSHIP OF EDWARDSBURGH/CARDINAL  
ONTARIO**

Submitted to:

Lockwood Brothers Construction  
2010 Totem Ranch Road  
Oxford Station, Ontario  
K0G 1T0

**DISTRIBUTION**

1 PDF copy – Lockwood Brothers Construction  
1 PDF copy – Morey Associates Ltd.

April 2021

File No. 021256



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## **1.0 INTRODUCTION**

Morey Associates Ltd. was retained by Lockwood Brothers Construction to undertake a hydrogeological study for the proposed semi-detached dwelling located on the east side of South Street in Spencerville, within Lot 4, Concession 7, Edwardsburgh/Cardinal Township, Ontario (see Key Plan, Figure 1 and Aerial Photograph, Figure 2).

For the purpose of this report South Street is considered to exist at the west side of the subject site.

It is understood that a semi-detached dwelling is proposed at the above noted site on two residential lots about 0.05 and 0.03 hectares in plan area with some 25 and 17 metres of frontage on South Street, respectively (see Appendix A). The proposed semi-detached dwelling is to be serviced by existing on-site private wells and municipal sanitary and storm sewers. It is further understood based on a discussion with Lockwood Brothers Construction that each dwelling unit in the proposed semi-detached dwelling will have two bedrooms.

This hydrogeological study was carried out in general accordance with our interpretation of the applicable sections of the Ministry of the Environment, Conservation and Parks (MOE) Procedure D-5-5 Technical Guideline for Private Wells: Water Supply Assessment (August 1996).

## **2.0 SITE BACKGROUND**

The site is bordered on the west by the South Street right-of-way with residential development beyond, on the north by an existing dwelling with residential and commercial development beyond, on the east by an existing commercial building and dwelling with residential and commercial development beyond, and on the south by an existing dwelling with residential development and the South Nation River beyond. The ground cover at the site consists, in general, of grass. No drainage ditches exist at or adjacent to the site. A municipal storm sewer exists within the South Street right-of-way adjacent to the site.

The South Nation River exists some 90 metres south/southeast of the site. A Drummond Gas service station exists southeast of the site. The fuel pumps, an above ground diesel fuel storage tank and below ground fuel storage tank(s) at the service station exist some 60, 65 and 75 metres



from the southeast corner of the site. Based on available topographic mapping the existing service station is some 2 metres downgradient of the site.

Based on a review of surficial geology information for the site area, obtained from the Ontario Geological Survey (2010), the site is indicated to be underlain by a till deposit consisting of stone-poor, sandy silt to silty sand-textured till. Based on a review of the bedrock geology map for the site area and on a previous study carried out in the site area by others (Thompson 1985) the bedrock underlying the site area is indicated to consist of dolostone of the Oxford Formation underlain by limestone and sandstone of the March Formation and sandstone of the Nepean Formation. Based on a previous study carried out in the site area by others (MOE 2020) the Oxford, March and Nepean Formations are indicated to support viable aquifers for domestic use.

Based on the above mentioned previous studies carried out in the site area by others (Thompson 1985 and MOE 2020) the shallow groundwater flow in the site area is expected to be towards the South Nation River and in general follow the local topography.

Two wells exist at the site, one within the north portion (well tag # A298757) and one within the south portion (well tag # A298756) of the site and for the purpose of this report will be referred to as the “north well” and “south well”, respectively. It is understood, based on discussion with Lockwood Brothers Construction, that the north well and south well will each service one of the dwelling units of the proposed semi-detached dwelling at the site. The MOE Water Well Records associated with the north and south wells are attached in Appendix B and a summary of the well construction details are provided in Table 2.1 below.

**Table 2.1: Summary of On-Site Well Construction Details**

Well	Thickness of Overburden Encountered (m)	Thickness of Rock Encountered [Limestone] (m)	Total Depth of Well (m BGS)	Inside Diameter of Well Casing (m)	Depth of Well Casing (m BGS)	Depth Water Found (m BGS)
North Well	1.4	17.5	18.9	0.16	6.2	12.2, 15.8
South Well	1.4	17.5	18.9	0.16	6.2	12.2, 14.6

Note: m BGS = Metres Below Ground Surface

The water well records for the north and south wells supplied by the well driller indicate that at each well a nominal 16 centimetre inside diameter steel casing was installed through about a 1.4 metre thickness of overburden material consisting of clay and stones and was set some 4.8 metres into



bedrock and grouted in place using cement and bentonite slurry. The wells are indicated to be some 18.9 metres in depth from the ground surface, and advanced into a limestone and dolomite aquifer. Based on the above and on the available general site area bedrock geology it is considered that the north and south wells at the site have been completed in the Oxford Formation.

Eight MOE water well records indicated to be for site area/neighbouring wells (obtained from the MOE online database) indicate that the overburden depth in the area of the site ranges from about 0.6 to 3.1 metres. The well records indicate that the wells are between some 24.7 to 58.5 metres in depth and that the bedrock encountered during drilling consisted of limestone, dolomite and sandstone. The well records indicate that water was found at depths of between some 9 to 55 metres. The well records further indicate recommended pumping rates of between some 5 to 22 gallons per minute (23 to 100 litres per minute). The above mentioned eight MOE water well records are provided in Appendix B.

**Table 2.2: Summary of Neighbouring Well Construction Details**

Well ID or Well Tag No.	Well Location	Approximate Distance to Site (m)	Year of Well Construction	Total Depth of Well (m BGS)	Depth to Surface of Bedrock (m BGS)	Static Water Level (assumed m BGS)	Available Drawdown (m)
A193373	9 Centre Street	60	2016	30.8	0.6	4	26.8
2406530	<sup>1</sup> 12 Centre Street	100	1991	58.5	2.4	6.1	52.4
A006191	<sup>1</sup> 13 Centre Street	85	2004	55.2	1.5	3.7	51.5
A275102	15 Centre Street	125	2019	36.9	1.1	5.8	31.1
A059303	16 Centre Street	120	2007	24.7	1.4	5.0	19.7
A074127	9 South Street	30	2008	24.7	1.4	4.0	20.7
A019576	11 Water Street	150	2005	36.6	3.1	0.7	35.9
2400650	<sup>1</sup> 16 Spencer Street	70	1962	25.0	1.2	3.7	21.3

Note: m BGS = Metres Below Ground Surface

<sup>1</sup>Likely well location associated with well record based on limited information provided on well record

Based on the above MOE well water records information and on the available general site area bedrock geology it is considered that the above mentioned eight site area/neighbouring wells are completed in the Oxford Formation, except for the wells at 12, 13 and 15 Centre Street which are suspected to have been completed in the March Formation.



### 3.0 WELL WATER QUANTITY

A pumping test was conducted on the north well at the site on April 20, 2021 by a member of our engineering staff and consisted of a six hour duration constant discharge rate pumping test. During the pumping test, water level measurements were made on a regular basis to monitor the drawdown of the water level in the well in response to pumping. 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. During the pump test, the pump discharge outlet was located an adequate distance and downgradient from the well to ensure the discharge did not interfere with the natural recharge to the well.

The drawdown and recovery data and plots for the well pumping test is shown in Appendix C. The drawdown and recovery data provided were measured with reference to the top of the well casing.

The pumping test data for the 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. The analysis of the data obtained during the pumping tests is summarized in the attached Table II.

The six hour duration pumping test was carried out at a discharge rate of about 25 litres per minute (5.5 lpm). The static water level prior to testing was about 2.63 metres below the top of the well casing and the water level after six hours of pumping was about 2.83 metres below the top of the well casing for a total drawdown at the end of pumping of 0.20 metres. The available drawdown in the well is about 15.2 metres. The specific capacity of the well at this pumping rate is approximately 180 cubic metres per day per metre of drawdown.

Based on the pumping test drawdown data the transmissivity of the aquifer is estimated to be 82.4 m<sup>2</sup>/day. Based on the pumping test recovery data the aquifer transmissivity is estimated to be 65.9 m<sup>2</sup>/day. The average transmissivity of the aquifer in the area of the well is estimated to be 74.2 m<sup>2</sup>/day. At the end of pumping, 40 minutes was required for 100 percent recovery of the total drawdown in the static water level created during pumping.



Based on the data obtained during the pumping test, it can be concluded that the well is capable of sustaining a short term yield of at least 25 litres per minute (5.5 l/gpm) and that during the course of the six hour pumping period about 1 percent of the available drawdown in the well was utilized.

### **3.1 SUMMARY OF ON SITE WELL YIELD**

The MOE Guideline D-5-5 Section 4.3.2 for water quantity requirement indicates that the per-person requirement shall be 450 litres per day and relates that quantity to an equivalent peak per person demand rate of 3.75 litres per minute. The MOE guideline indicates that for a dwelling the likely number of persons per well (per dwelling) is considered to be the number of bedrooms in the dwelling plus one. The MOE guidelines further requires that regardless of the demand rate determined using the above mentioned calculation, the demand rate (minimum pumping rate of a well servicing a dwelling) shall not be less than 13.7 litres per minute.

As previously mentioned each dwelling unit in the proposed semi-detached dwelling is to be a two bedroom dwelling. As such, the MOE peak demand rate for each dwelling unit is 13.7 litres per minute.

The results of the well pumping test carried out at the site for this present hydrogeological study indicate that the pumped well at the site is capable of more than meeting the MOE minimum demand rate of 13.7 litres per minute and that the pumped well at the site is capable of more than meeting the MOE peak demand rate for up to a five bedroom dwelling.

### **3.2 SUMMARY OF TRANSMISSIVITY ANALYSIS**

The above mentioned transmissivity values based on the pumping test drawdown and recovery data are summarized in Table 3.1 and classified regarding magnitude, designation and groundwater supply potential based on Krasny (1993).





**Table 3.1: Classification of Transmissivity Values**

<sup>1</sup> Magnitude (m <sup>2</sup> /day)	<sup>1</sup> Class	<sup>1</sup> Designation	<sup>1</sup> Groundwater Supply Potential	Transmissivity Values Based on North Well Pumping Tests		
				Pump.	Rec.	Avg.
>1000	I	Very High	Regional Importance			
100 - 1000	II	High	Lesser Regional Importance			
10 - 100	III	Intermediate	Local Water Supply	82.4	65.9	74.2
1 - 10	IV	Low	Private Consumption			
0.1 - 1	V	Very Low	Limited Consumption			
<0.1	VI	Imperceptible	Very difficult to Utilize for Water Supply			

<sup>1</sup>Kransy (1993) "Classification of Transmissivity Magnitude and Variation", Vol.31, No.2 - Ground Water

Based on the above, the existing pumped well at the site is indicated to be capable of providing an adequate quantity related to a supply potential of local water supply. It is pointed out that a groundwater supply potential of "Private Consumption" is associated with a water supply well adequate for dwellings.

### 3.3 WELL INTERFERENCE EFFECTS

During the pumping of the north well periodic water level measurements were made at the south well located some 17 metres south of the north well. The graph of the observation of the south well drawdown versus time during the pumping test at the north well is shown in the attached Appendix C.

In order to estimate the maximum interference of the north and south wells at the site, calculations were carried out to predict the cumulative thirty-year drawdown due to the proposed semi-detached dwelling domestic use of the wells at the site (for the purposes of this calculation the north well is considered to be the centrally located well at the site/site area). The existing site area/neighbouring wells indicated in the above Table 2.2 were also included in the cumulative thirty-year drawdown calculation. Further, wells servicing the properties adjacent to and opposite the subject site (if not already included in Table 2.2) were also included in the cumulative thirty-year drawdown calculation. The cumulative drawdown at the wells was calculated for a thirty-year pumping rate of



3150 litres per day, which allows for six bedroom households in accordance with Section 4.3.2 of MOE Procedure D-5-5.

The calculation was carried out using the following Cooper-Jacob formula:

$$s = \frac{2.3Q}{4\pi T} \log\left(\frac{2.25Tt}{r^2 S}\right)$$

Where, Q = 30 year pumping rate, 3150L/day

T = lowest transmissivity from north well pumping test, 65.9 m<sup>2</sup>/day

t = duration, 30 years

S = storativity estimate from north well pumping test, 2.3 x 10<sup>-2</sup>

s = expected drawdown from use of site wells and site area/neighbouring wells

The results of the calculations indicate that the cumulative thirty-year drawdown at the north well, including the interference from the south well and the other 18 site area/neighbouring wells included in the calculations is about 0.8 metres (see attached Table V). It is pointed out that it is considered, in Morey Associates Ltd. professional opinion, that the actual cumulative thirty-year drawdown at the centrally located well could be more accurately estimated by the use of the average transmissivity value determined from the pumping test and the use of a more likely daily pumping rate given today's more efficient plumbing. However, for the purpose of this present report and for a conservative approach the cumulative thirty-year drawdown at the north well was estimated using the lowest transmissivity value determined during the pumping test and a daily pumping rate of 3150 litres.

Based on the above mentioned conservative thirty-year drawdown calculation, the expected drawdown was found to be about 0.8 metres at the north well which results in the reduction of available drawdown at the north well of about 5 percent. Applying this drawdown value to the south well and the existing site area/neighbouring wells indicated on Table 2.2 for which available drawdown information is known would result in the reduction of available drawdown at those existing wells of between about 2 percent to 4 percent.

The above estimated drawdown values provide a fair assurance of adequate long term water supply for the proposed semi-detached dwelling based on current site conditions. Further, as



indicated above it is considered that the above estimated drawdown values are conservative and the actual cumulative drawdown values should be less and interference with existing neighbouring wells should not result in significant reduction of available well drawdown for the proposed semi-detached dwelling as well as the above mentioned existing nearby site area/neighbouring wells.

## **4.0 WELL WATER QUALITY**

### **4.1 ON-SITE WELLS WATER SAMPLES**

In order to characterize the groundwater quality of the groundwater supply, a groundwater sample was collected from both the north well and south well by a member of our engineering staff on April 20, 2021. The north well was sampled at about hour 6 of the above mentioned pumping test. The south well was sampled after pumping the south well for about one hour at a rate of some 68 litres per minute (15 lgpm). The groundwater samples were collected and prepared/preserved in the field using appropriate techniques and submitted to Eurofins Environment Testing laboratory in Ottawa, Ontario for the chemical, physical and bacteriological analyses listed in the MOE guideline entitled Procedure D-5-5, Technical Guideline for Private Wells: Water Supply Assessment, August 1996 ("MOE Subdivision Package" list of parameters). The temperature, conductivity, pH, TDS, turbidity and residual chlorine levels of the groundwater were measured just prior to sampling at both wells and at other periodic intervals during the pumping test at the north well.

The results of the above mentioned laboratory testing and field testing are provided in Table 4.1 below and in the attached Table I, respectively.



**Table 4.1: On-Site Well Water Samples Laboratory Testing Results**

Parameter	MRL	Units	<sup>1</sup> Guideline	Test Well	
				North Well Sample	South Well Sample
Hardness as CaCO <sub>3</sub>	1	mg/L	OG-100, <sup>3</sup> 500	<b>373</b>	<b>375</b>
Ion Balance	0.01			1.05	1.03
TDS (COND - CALC)	1	mg/L	AO-500	<b>580</b>	<b>600</b>
Alkalinity as CaCO <sub>3</sub>	5	mg/L	OG-30 - 500	259	269
Cl	1	mg/L	AO-250	136	132
Colour	2	TCU	AO-5	<2	2
Conductivity	5	uS/cm		1000	1010
DOC	0.5	mg/L	AO-5	0.7	0.8
F	0.10	mg/L	MAC-1.5	0.40	0.36
N-NO <sub>2</sub>	0.10	mg/L	MAC-1.0	<0.10	<0.10
N-NO <sub>3</sub>	0.10	mg/L	MAC-10.0	<0.10	<0.10
pH	1.00		OG-6.5 - 8.5	8.14	8.12
SO <sub>4</sub>	1	mg/L	AO-500	43	45
Ca	1	mg/L		90	91
Fe	0.03	mg/L	AO-0.3	0.29	0.30
K	1	mg/L		4	4
Mg	1	mg/L		36	36
Mn	0.01	mg/L	AO-0.05	0.03	0.03
Na	2	mg/L	AO-200, <sup>2</sup> A-20	65	64
TKN	0.1	mg/L		0.287	0.490
Phenols	0.001	mg/L		<0.001	<0.001
N-NH <sub>3</sub>	0.01	mg/L		0.045	0.033
S <sub>2</sub> -	0.02	mg/L	AO-0.05	<0.01	<0.01
Tannin & Lignin	0.1	mg/L		<0.1	<0.1
Turbidity	0.1	NTU	AO-5.0	1.2	1.5
Heterotrophic Plate Count	0	ct/1mL		5	7
E.Coli	0	ct/100mL	MAC-0	0	0
Faecal Coliforms	0	ct/100mL		0	0
Total Coliforms	0	ct/100mL	MAC-0	0	0
<sup>4</sup> Organic Nitrogen		mg/L	OG-0.15	<b>0.242</b>	<b>0.457</b>

<sup>1</sup> Guideline = Ontario Drinking Water Standards Objectives and Guidelines

<sup>2</sup> Table 2, Appendix, MOECC Guideline 'D-5-5 Private Wells: Water Supply Assessment' document

<sup>3</sup> "Hardness in excess of 500mg/L in drinking water is unacceptable for most domestic purposes" - Technical Support Document for Ontario Drinking Water

Standards, Objectives and Guidelines, Revised June 2006, Province of Ontario.

<sup>4</sup> Organic Nitrogen = Total Kjeldahl Nitrogen - N-NH<sub>3</sub>

MRL = Method Reporting Limit

AO = MOE Aesthetic Objective

OG = MOE Operational Guideline

MAC = MOE Max. Acceptable Concentration

A = MOE Advisory Limit (See Note 2)

The well water samples meet all the Ontario Drinking Water Standards, Objectives and Guidelines (ODWSOG) health and aesthetic parameters tested for except for hardness, total dissolved solids (TDS) and for organic nitrogen.



The water samples obtained from the existing on-site wells are considered to be hard by water treatment standards with a hardness level above the ODWSOG operational guideline of 80 to 100 mg/L. The hardness at the north well and south well was measured at 373 and 375 mg/L, respectively. However, based on the Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines, Revised June 2006, the hardness levels of the water samples are less than what is considered unacceptable (greater than 500 mg/L) for most domestic purposes and is considered treatable. Water with hardness above 80 to 100 mg/L as  $\text{CaCO}_3$  is often softened for domestic use. Water softening by conventional sodium ion exchange may introduce relatively high concentrations of sodium into the drinking water, which may 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.

The levels of TDS measured for the samples obtained from the north well and south well were 580 and 600 mg/L respectively, which are above the ODWS aesthetic objective of 500 mg/L. The results of Langelier Saturation Index (LSI) calculations (see attached Table III) for the water samples gave LSI values of about 0.94 and can be interpreted (based on Carrier 1965) to indicate potential for the groundwater to be scale-forming but non-corrosive (LSI 0.5 to 2.0). The results of Ryznar Stability Index (RSI) calculations for the water samples gave RSI values of about 5.8 and indicate potential for the groundwater to form light scale.

Organic nitrogen concentration is calculated as the difference between Total Kjeldahl Nitrogen (TKN) and ammonia. The concentration of organic nitrogen for the north well and south well water samples is calculated as about 0.24 and 0.46 mg/L, respectively. The ODWSOG operational guideline for organic nitrogen is 0.15 mg/L and relates to the potential severe reduction for chlorine as a disinfectant. Organic nitrogen may also result in taste and odour problems with levels greater than 0.15 mg/L. Based on the results of bacteriological testing of the above mentioned well water samples it is considered that continuous/permanent disinfectant treatment systems using chlorine for the well water at the proposed semi-detached dwelling is not likely. As such, it is considered that the presence of organic nitrogen slightly above the ODWSOG operational guideline in the well water sample is not a concern from an operational point of view.



It is pointed out that the levels of sodium for the north well and south well water samples were measured at 65 and 64 mg/L, respectively, which is below the ODWSOG aesthetic objective of 200 mg/L. However, according to the MOE the local Medical Office of Health should be notified where sodium levels are above 20 milligrams per litre in order that this information may be relayed to local physicians. Accordingly, the levels of sodium for the well water samples obtained from the existing on-site wells may be of interest to persons on a sodium restricted diet.

## **4.2 IMPACTS TO WELL WATER QUALITY**

The above mentioned previous studies carried out by Thompson (1985) and the MOE (2020) indicate that the water quality of a relatively large number of drinking water wells in the general site area (Spencerville) have been impacted by existing private sewage systems in Spencerville. The MOE 2020 study report indicates elevated levels of total coliform, E.Coli and nitrate measured for samples obtained from drinking water wells.

A combination of elevated levels of E.Coli, total coliform, faecal coliform, nitrate, nitrite and organic nitrogen are commonly associated with septic system effluent impacting drinking water wells. The results of the above mentioned laboratory testing indicate 0 ct/100mL for E.Coli, total coliform and faecal coliform and less than the method reporting limit for nitrate and nitrite for both the north and south wells. As mentioned above the organic nitrogen levels for the north and south wells are calculated as about 0.24 and 0.46 mg/L, respectively.

Based on the above and considering that organic nitrogen is the only above mentioned parameter somewhat elevated, the laboratory testing results of the well water samples obtained from the north and south wells at the site indicate that the north and south wells at the site have not been impacted by existing septic system effluent.

The above mentioned previous studies carried out by Thompson (1985) and the MOE (2020) also indicate that due to the geological setting (shallow discontinuous overburden and weathered/fractured upper bedrock unit) in the general site area, wells are vulnerable to surface impacts.



The overburden encountered by the well driller at the subject site wells is indicated to be 1.4 metres thick and consists of clay and stones, as per the MOE well records. No exposed bedrock was observed at the site and the cement and bentonite slurry grout indicated on the MOE well records for the north and south wells was observed at the ground surface around the well casings by members of our engineering staff at the time of the field work. Notwithstanding the above, and due to the above mentioned well vulnerability and groundwater impacts indicated by Thompson (1985) and the MOE (2020), recommendations to encourage safe domestic well usage for the future residents of the proposed semi-detached dwelling is provided in Section 5 of this report.

## **5.0 CONCLUSIONS AND RECOMMENDATIONS**

### **5.1 SUMMARY AND CONCLUSIONS**

Based on the groundwater supply investigation carried out for the subject site, the following summary and conclusions are provided by Morey Associates Ltd. and are based on our professional opinion and our interpretation of the relevant sections of the MOE Procedure D-5-5 guideline document:

- 1) There is a sufficient groundwater supply of acceptable drinking water quality in the bedrock aquifer system to satisfy the water requirements of the proposed semi-detached dwelling at the site.
- 2) The groundwater quality in the aquifer system at the existing wells at the site meets all the ODWSOG concentrations for all health related chemical, physical and bacteriological parameters tested, except for hardness, TDS and organic nitrogen. The level of hardness measured at the wells is well within the acceptable range that is considered reasonably treatable. Water softeners and manganese greensand filters are indicated to be adequate to lower hardness to acceptable levels, respectively. In relation to the measured TDS levels, the results of LSI and RSI calculations for the water samples from the existing wells at the site indicate there is a potential for scale to form on plumbing fixtures. The levels of organic nitrogen measured at the existing wells at the site were above the ODWSOG operational guideline concentration. However, based on the results of bacteriological testing of the well water samples it is considered that need for continuous/permanent disinfectant treatment





systems using chlorine for the well water at the proposed semi-detached dwelling is not likely. As such, it is considered that the presence of organic nitrogen above the ODWSOG operational guideline in the well water samples is not a concern from an operational point of view.

- 3) The levels of sodium for the water samples obtained from the existing on site wells may be of interest to persons on a sodium restricted diet (see report Section 4.1).

## 5.2 RECOMMENDATIONS

Morey Associates Ltd. provides the following recommendations regarding the existing groundwater supply well at the site:

- 1) The final landscaping at the site should be graded such that surface water (including any eavestrough downspout discharge and sumpline discharge) is not directed to or ponds around the existing well heads and such that the well casing heights extend not less than 0.4 metres above the ground surface.
- 2) In order to encourage domestic supply well education and best management practices future residents at the site should be made aware of and refer to the province of Ontario web-doc publication: [ontario.ca/document/water-supply-wells-requirements-and-best-practices](http://ontario.ca/document/water-supply-wells-requirements-and-best-practices)
- 3) Future residents at the site should be made aware that it is considered prudent to adhere to the regulatory well maintenance requirements, general maintenance for well owners (Table 11-1: Well Maintenance Checklist Items), and well water quality laboratory testing outlined in the above mentioned province of Ontario web-doc publication.
- 4) Future residents at the site should be made aware that the use of a water softener for treatment of hardness may be desired based on the results of the water quality testing carried out for this present hydrogeological study.
- 5) Future residents at the site should be made aware that the use of conventional sodium ion exchange water softeners may introduce relatively high concentrations of sodium into the



drinking water, which may 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.

- 6) Future residents at the site should be made aware that water wells should be adequately disinfected by chlorination prior to use for the proposed semi-detached dwelling at the site.
- 7) Future residents at the site should be made aware that Langelier Saturation Index (LSI) and Ryznar Stability Index (RSI) calculations for water samples obtained from the existing wells at the site can be interpreted to indicate potential for the groundwater to cause scale to form on plumbing fixtures.

## **6.0 LIMITATIONS AND USE OF REPORT**

This report was prepared for the exclusive use of Lockwood Brothers Construction. This report may not be relied upon by any other person or entity without the express written consent of Lockwood Brothers Construction and Morey Associates Ltd.

This report documents work that was carried out with generally accepted professional standards at the time and location in which the services were provided and in a manner consistent with a level of care and skill normally exercised by other professional engineering and geoscientist firms practicing under similar conditions and subject to the time limits and financial and physical constraints applicable to the services.

Any third party use of this report, including reliance of this report and/or decisions made based on this report, is the sole responsibility of the third party. Morey Associates Ltd. accepts no responsibility for damages, whether direct or indirect, suffered by any third party as a result of any third party use of this report.

The conclusions provided herein represent an opinion of Morey Associates Ltd. as of the time of preparation of this report. It is recognized that the passage of time affects the information provided in this report. This report should not be construed as legal advice, nothing in this report is intended to provide a legal opinion. If new information is discovered during future work, including



excavations, borings or other studies, Morey Associates Ltd. should be requested to re-evaluate the conclusions presented in this report and provide amendments as required.

## 7.0 SIGNATURES

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

Yours truly,  
Morey Associates Ltd.

D. G. Morey, P.Eng.  
Director/Civil Engineer



C. R. Morey, M.Sc. (Eng.), P. Eng.  
Senior Consulting Engineer



---

## 8.0 REFERENCES

*Province of Ontario:* The Surficial Geology of Southern Ontario data set: Ontario Geological Survey, Miscellaneous Release 2010

*Ontario Ministry of the Environment, Conservation and Parks:* Procedure D-5-5: Technical Guideline for Private Wells: Water Supply Assessment, August 1996

*Ontario Ministry of the Environment, Conservation and Parks:* On line map-based water well records search website

*Ontario Ministry of the Environment, Conservation and Parks:* Technical Report, Potable Well Water Quality Survey, Village of Spencerville, November 2020

*Thompson, M.S. and Associates Ltd. In association with Water and Earth Science Associates Ltd.:* Private Services Grant Program, Police Village of Spencerville, Township of Edwardsburgh, Ministry of the Environment Project Number 8-0082, 4-0094, March 1985.

*Kransy:* Classification of Transmissivity Magnitude and Variation, Vol.31, No.2 - Ground Water, dated 1993

*Province of Ontario:* Web-doc publication – Water Supply Wells: Requirements and Best Practices, revised April 2015

*Province of Ontario:* Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines, revised June 2006



**TABLE I**  
**RESULTS OF THE FIELD WATER QUALITY MEASUREMENTS**  
**FOR ON SITE WELLS**

Well	Hours Since Pumping Started	Temp. (°C)	Conductivity (mS/cm)	pH (pH units)	TDS (ppm)	Turbidity (NTU)	Free Chlorine (mg/L)	Sample
North Well	1	12.0	1.21	8.3	610	0.2	0.00	-
	2	11.4	1.22	8.3	610	0.1	0.00	-
	3	11.1	1.20	8.1	600	0.1	0.00	-
	4	13.0	1.19	8.0	600	0.4	0.00	-
	5	13.5	1.19	8.0	600	0.2	0.00	-
	6	11.9	1.22	8.1	610	0.1	0.00	6hr sample
South Well	n/a	11.1	1.21	8.0	610	0.1	0.00	sampled



**TABLE II**  
**SUMMARY OF PUMPING TEST RESULTS AND WELL PARAMETERS**

Well	Tp (m <sup>2</sup> /day)	Tr (m <sup>2</sup> /day)	Tav (m <sup>2</sup> /day)	Q (m <sup>3</sup> /day)	SC (m <sup>3</sup> /day/m)	ho m	hf m	Td m	TD m	CS m	AD m
North Well	82.4	65.9	74.2	36.0	180.0	2.63	2.83	0.20	18.90	0.45	15.2

Well	% Available Drawdown Used
North Well	1%

**Overall Average Transmissivity**

T	74.2	m <sup>2</sup> /day
---	------	---------------------

Note:	Tp:	Transmissivity as calculated from pumping data (m <sup>2</sup> /day)
	Tr:	Transmissivity as calculated from recovery data (m <sup>2</sup> /day)
	Tav:	Average transmissivity (average of pumping and recovery) (m <sup>2</sup> /day)
	Q:	Test pumping rate (m <sup>3</sup> /day)
	SC:	Specific Capacity (m <sup>3</sup> /day/m)
	ho:	Static water level (below top of casing) at beginning of pumping test (metres)
	hf:	Water level (below top of casing) at end of 6 hour pumping test (metres)
	Td:	Total drawdown (metres)
	TD:	Total depth of well (below ground surface) (metres)
	CS:	Casing stickup above ground surface, as measured at time of pumping test (metres)
	AD:	Approximate available drawdown (metres)



TABLE III  
LANGELIER SATURATION INDEX CALCULATIONS

Well Sample	pH	TDS (mg/L)	Temp. (°C)	Ca (mg/L)	Ca as CaCO <sub>3</sub> (mg/L)	Alkalinity as CaCO <sub>3</sub> (mg/L)	A	B	C	D	pHs	Langelier Saturation Index (pH - pHs)	*Comment
North Well	8.14	580	25	90	225	259	0.176	2.088	1.952	2.413	7.199	0.94	Scale-forming, non-corrosive
South Well	8.12	600	25	91	228	269	0.178	2.088	1.957	2.430	7.179	0.94	Scale-forming, non-corrosive

\*Based on (Carrier 1965) -2 to -0.5 indicates serious corrosion

\*Based on (Carrier 1965) -0.5 to <0 indicates slight corrosion, non scale-forming

\*Based on (Carrier 1965) 0 indicates balanced but pitting corrosion possible

\*Based on (Carrier 1965) >0 to 0.5 indicates slight scale-forming, and slight corrosion possible

\*Based on (Carrier 1965) 0.5 to 2.0 indicates scale-forming, non corrosive

Notes:

Ca as CaCO<sub>3</sub> = Ca / 0.4

A = (Log<sub>10</sub>[TDS] -1)/10

B = -13.12[(Log<sub>10</sub>(Temp. + 273))+34.55

C = Log<sub>10</sub>[Ca as CaCO<sub>3</sub>]-0.4

D = Log<sub>10</sub>[alkalinity as CaCO<sub>3</sub>]

pHs = (9.3+A+B)-(C+D)

Langelier Saturation Index = pH-pHs





**TABLE IV**  
**ESTIMATE OF STORATIVITY BY COOPER-JACOB METHOD**

$$S = \frac{2.25 T t_0}{r^2}$$

(A curve of drawdown versus time was generated for an observation well as an adjacent well was pumped)

<b>Pumping Well</b>	<b>Observation Well</b>	<b>r (m)</b>	<b>Q (m<sup>3</sup>/day)</b>	<b>t<sub>0</sub> (s)</b>	<b>T (m<sup>2</sup>/s)</b>	<b>Storativity</b>
North Well	South Well	16.7	36.0	1939	1.5E-03	2.3E-02



**TABLE V**  
**MUTUAL WELL INTERFERENCE**  
**30 YEAR ASSESSMENT**

Central Well: North Well

S = 2.3E-02  
T = 65.9 m<sup>2</sup>/day  
T = 7.8E-04 m<sup>2</sup>/s  
Q = 3150 L/day  
Q = 3.6E-05 m<sup>3</sup>/s  
Duration = 30 years  
Duration = 9.5E+08 seconds

Calculated by Cooper-Jacob Method using:

Lowest Transmissivity value determined from pumping test (conservative).

Storativity value calculated from pumping test.

Flow/pump rate (Q) using section 4.3.2 of MOECC Procedure D-5-5 for six bedroom dwellings, [6 + 1] \* 450 L/day = 3150 L/d, being serviced by each well.

Well	Approx. Distance (m)	30 year Drawdown (m)
North Well	0.08	0.09
South Well	17	0.05
Directly South of Site	40	0.04
9 Centre St.	100	0.03
12 Centre St.	85	0.03
13 Centre St.	125	0.03
15 Centre St.	120	0.03
16 Centre St.	30	0.04
8 South St.	50	0.04
9 South St.	35	0.04
10 South St.	40	0.04
11 South St.	150	0.03
11 Water St.	70	0.04
2 Irving St.	35	0.04
4 Spencer St.	50	0.04
6 Spencer St.	40	0.04
8 Spencer St.	30	0.04
10 Spencer St.	30	0.04
12 Spencer St.	60	0.04
16 Spencer St.	70	0.04
Cumulative aquifer drawdown at North Well		0.80

## KEY PLAN

FIGURE 1



NOT TO SCALE



## AERIAL PHOTOGRAPH

FIGURE 2



NOT TO SCALE



## **APPENDIX A**

### **SITE INFORMATION PROVIDED BY LOCKWOOD BROTHERS CONSTRUCTION**

DAVE MARCEL	NAME	SIGNATURE	22/11/2021
LOGANWOOD BROTHERS CONSTRUCTION	FIRM	BCIN	306030
CUSTOMER:			
NOCCEY			
DRAWING NAME:			
SITE PLAN			
SCALE:		Sheet #	
DATE:		A12	
MAR. 01, 2021			



## **APPENDIX B**

### **MOE WELL RECORDS FOR ON SITE WELLS AND AREA WELLS**





## **APPENDIX C**

### **PUMPING TEST DATA FOR ON SITE WELL**



## DRAWDOWN DATA NORTH WELL

File: 021256

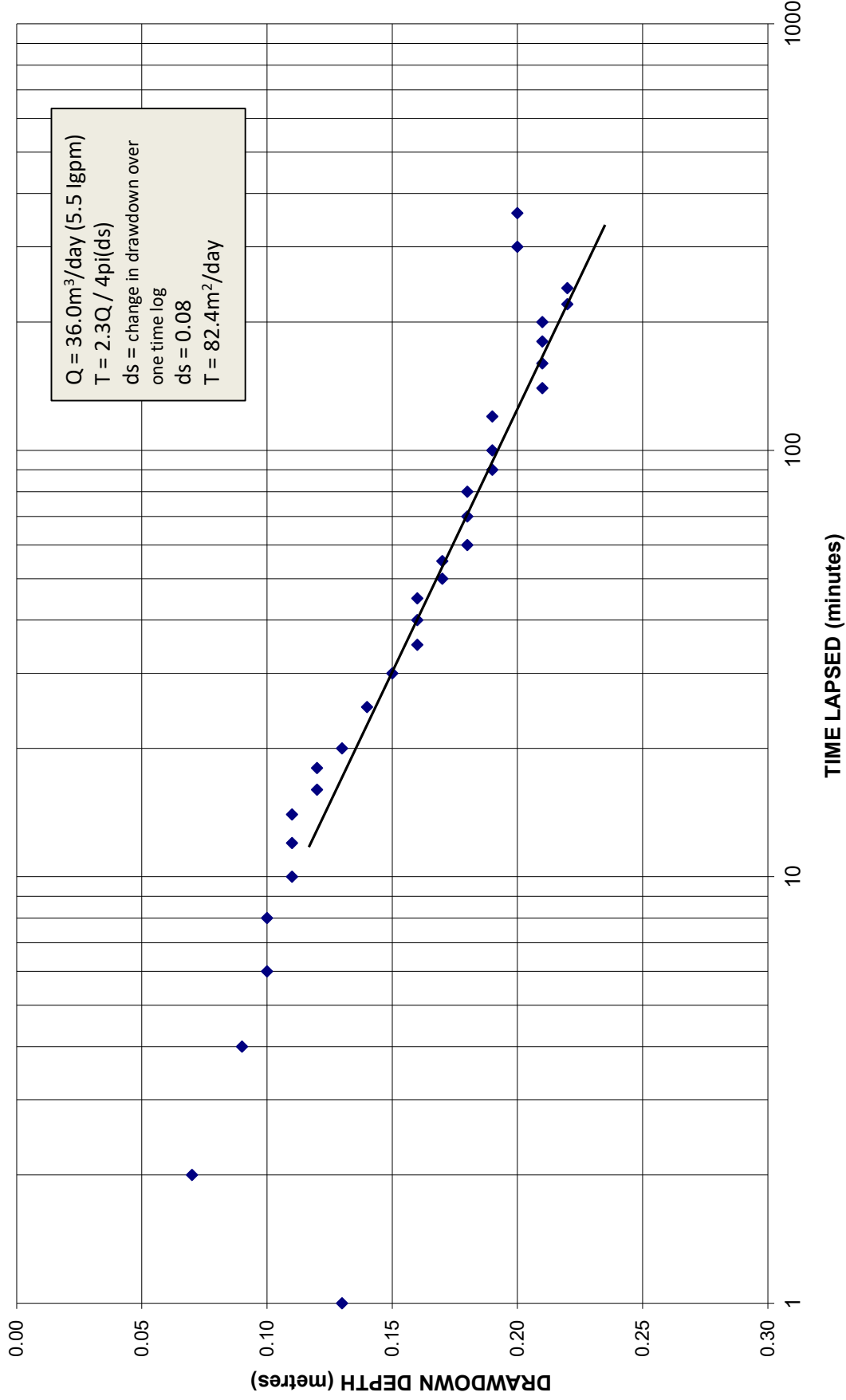
Pump Test Date: Apr.20/21

Pump Rate: 5.5 l/gpm

Time of Day	Time Lapsed (minutes)	Depth (metres)	h-ho (metres)
8:28	0	2.63	0.00
8:29	1	2.76	0.13
8:30	2	2.70	0.07
8:32	4	2.72	0.09
8:34	6	2.73	0.10
8:36	8	2.73	0.10
8:38	10	2.74	0.11
8:40	12	2.74	0.11
8:42	14	2.74	0.11
8:44	16	2.75	0.12
8:46	18	2.75	0.12
8:48	20	2.76	0.13
8:53	25	2.77	0.14
8:58	30	2.78	0.15
9:03	35	2.79	0.16
9:08	40	2.79	0.16
9:13	45	2.79	0.16
9:18	50	2.80	0.17
9:23	55	2.80	0.17
9:28	60	2.81	0.18
9:38	70	2.81	0.18
9:48	80	2.81	0.18
9:58	90	2.82	0.19
10:08	100	2.82	0.19
10:28	120	2.82	0.19
10:48	140	2.84	0.21
11:08	160	2.84	0.21
11:28	180	2.84	0.21
11:48	200	2.84	0.21
12:08	220	2.85	0.22
12:28	240	2.85	0.22
13:28	300	2.83	0.20
14:28	360	2.83	0.20



## NORTH WELL DRAWDOWN VS. TIME





## RECOVERY DATA NORTH WELL

File: 021256

Pump Test Date: Apr.20/21

Recovery Time t' (minutes)	t / t' (ratio)	Depth (metres)	h-ho (metres)
0		2.83	0.20
1	361	2.79	0.16
2	181	2.76	0.13
4	91	2.75	0.12
6	61	2.74	0.11
8	46	2.73	0.10
10	37	2.73	0.10
12	31	2.72	0.09
14	27	2.72	0.09
16	24	2.70	0.07
18	21	2.70	0.07
20	19	2.69	0.06
25	15	2.67	0.04
30	13	2.66	0.03
35	11	2.64	0.01
40	10	2.63	0.00

**100%**

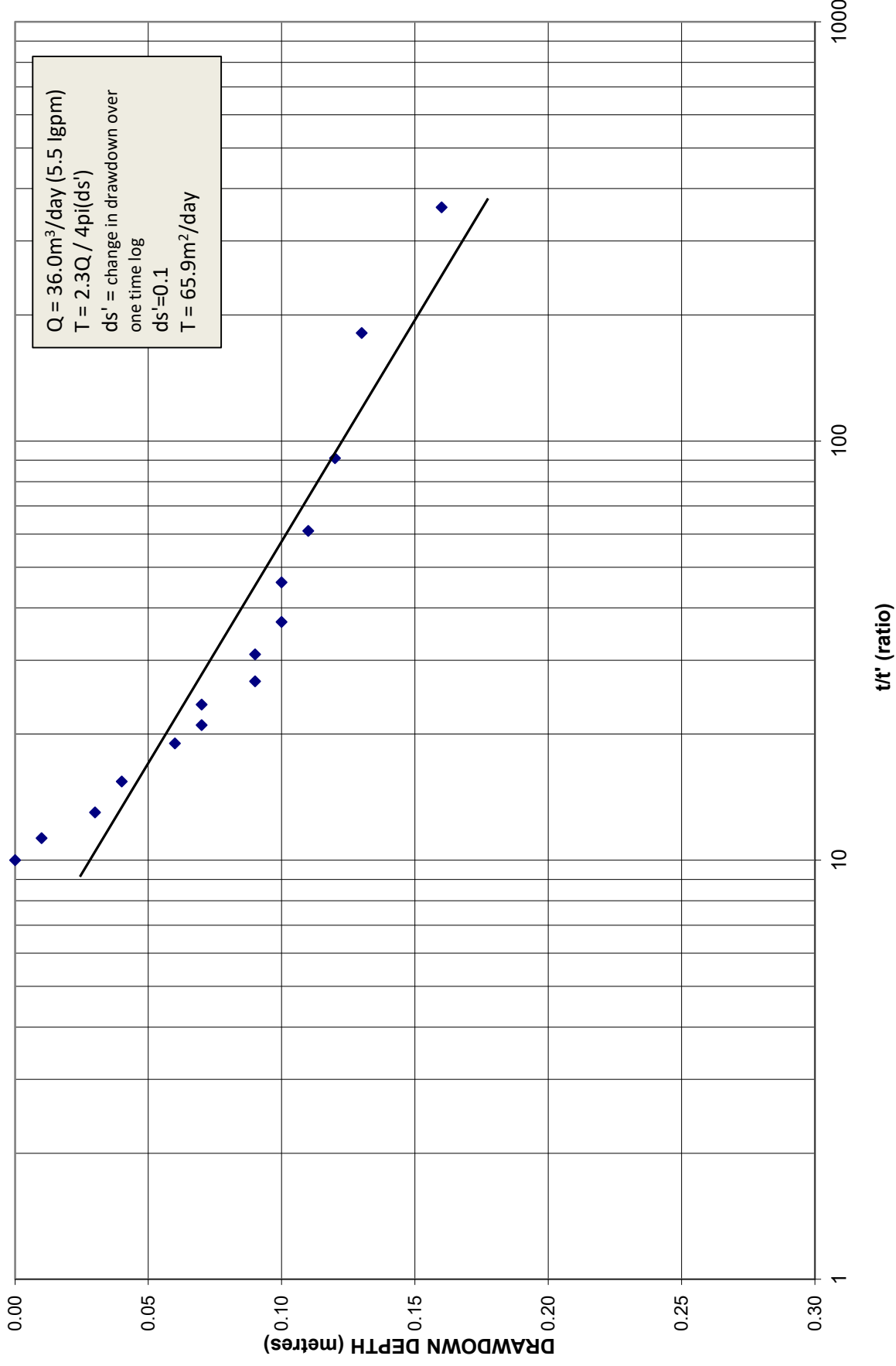
**RECOVERY AFTER**

**40**

**MINUTES**



## NORTH WELL RECOVERY DATA



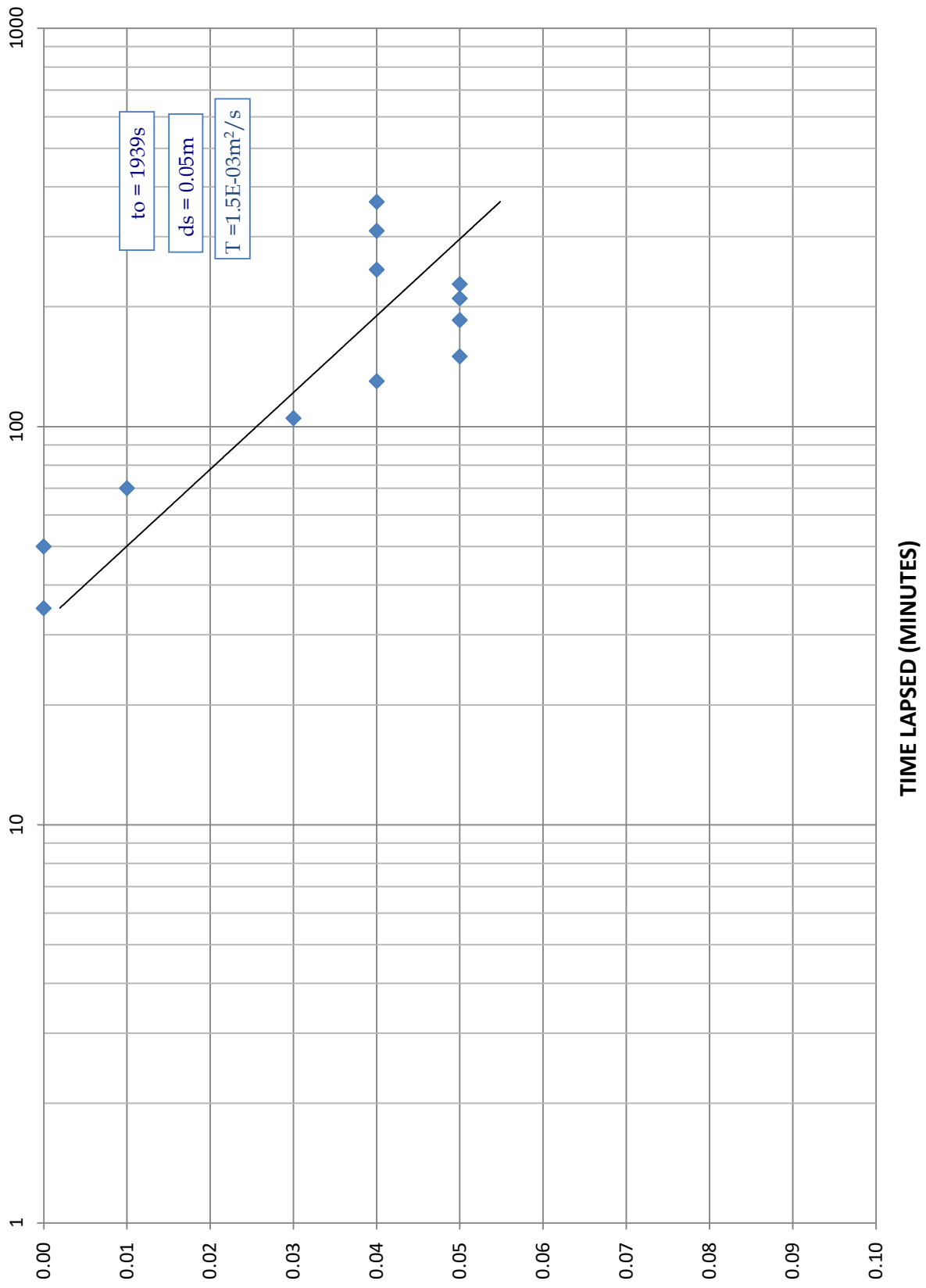


**OBSERVATION WELL (SOUTH WELL) DRAWDOWN DURING NORTH  
WELL PUMPING TEST**

Approximate Time of Day	Time Lapsed (minutes)	South Well	
		Depth (m)	h-ho (m)
8:20	0	2.64	
8:55	35	2.64	0.00
9:10	50	2.64	0.00
9:30	70	2.65	0.01
10:05	105	2.67	0.03
10:30	130	2.68	0.04
10:50	150	2.69	0.05
11:25	185	2.69	0.05
11:50	210	2.69	0.05
12:08	228	2.69	0.05
12:28	248	2.68	0.04
13:30	310	2.68	0.04
14:27	367	2.68	0.04



**DRAWDOWN VS. TIME IN OBSERVATION WELL (SOUTH WELL)  
DURING PUMPING TEST OF NORTH WELL**





## **APPENDIX D**

### **RESULTS OF LABORATORY TESTING OF ON SITE WELLS WATER SAMPLES**





Client: Morey Associates  
2672 Highway 43  
Kemptville, ON  
K0G 1J0  
Attention: Mr. Dan Morey  
PO#:   
Invoice to: Morey Associates


Report Number: 1951746  
Date Submitted: 2021-04-21  
Date Reported: 2021-04-29  
Project: 021256  
COC #: 211236

Page 1 of 7

**Dear Dan Morey:**

**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  
2021.04.29  
15:33:40 -04'00'

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

Client: Morey Associates  
2672 Highway 43  
Kemptville, ON  
K0G 1J0  
Attention: Mr. Dan Morey  
PO#:   
Invoice to: Morey Associates

Report Number: 1951746  
Date Submitted: 2021-04-21  
Date Reported: 2021-04-29  
Project: 021256  
COC #: 211236

Group		Analyte	MRL	Units	Guideline	1552993 Water  2021-04-20 South St - Northern Well
Anions		Cl	1	mg/L	AO 250	136
		F	0.10	mg/L	MAC 1.5	0.40
		N-NO2	0.10	mg/L	MAC 1.0	<0.10
		N-NO3	0.10	mg/L	MAC 10.0	<0.10
		SO4	1	mg/L	AO 500	43
General Chemistry		Alkalinity as CaCO3	5	mg/L	OG 500	259
		Colour	2	TCU		<2
		Conductivity	5	uS/cm		1000
		DOC	0.5	mg/L	AO 5	0.7
		pH	1.00		6.5-8.5	8.14
		S2-	0.01	mg/L	AO 0.05	<0.01
		TDS	10	mg/L	AO 500	580*
Hardness		Turbidity	0.1	NTU	AO 5.0	1.2
		Hardness as CaCO3	1	mg/L	OG 100	373*
		Ion Balance	0.01			1.05
		Ca	1	mg/L		90
		Fe	0.03	mg/L	AO 0.3	0.29
Metals		K	1	mg/L		4
		Mg	1	mg/L		36
		Mn	0.01	mg/L	AO 0.05	0.03
		Na	2	mg/L	AO 200	65
		Escherichia Coli	0	ct/100mL	MAC 0	0
Microbiology		Faecal Coliforms	0	ct/100mL		0
		Heterotrophic Plate Count	0	ct/1mL		5
		Total Coliforms	0	ct/100mL	MAC 0	0

Guideline = OBWSOG

\* = Guideline Exceedence

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

Results relate only to the parameters tested on the samples submitted.  
Methods references and/or additional QA/QC information available on request.



Environment Testing

## Certificate of Analysis

Client: Morey Associates  
2672 Highway 43  
Kemptville, ON  
K0G 1J0  
Attention: Mr. Dan Morey  
PO#:   
Invoice to: Morey Associates

Report Number: 1951746  
Date Submitted: 2021-04-21  
Date Reported: 2021-04-29  
Project: 021256  
COC #: 211236

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.
Nutrients	N-NH3	0.010	mg/L		1552993 Water
	Total Kjeldahl Nitrogen	0.100	mg/L		2021-04-20 South St - Northern Well
Subcontract-Ihorg	Phenols	0.001	mg/L		
	Tannin & Lignin	0.1	mg/L		

**Guideline = OBWSOG**

**\* = Guideline Exceedence**

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Environment Testing

## Certificate of Analysis

Client: Morey Associates  
2672 Highway 43  
Kemptville, ON  
K0G 1J0  
Attention: Mr. Dan Morey  
PO#:   
Invoice to: Morey Associates

Report Number: 1951746  
Date Submitted: 2021-04-21  
Date Reported: 2021-04-29  
Project: 021256  
COC #: 211236

### QC Summary

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 399222 <b>Method</b> C SM2130B	<b>Analysis/Extraction Date</b> 2021-04-21 <b>Analyst</b> K B		
Turbidity	<0.1 NTU	101	70-130
<b>Run No</b> 399253 <b>Method</b> AMBCOLM1	<b>Analysis/Extraction Date</b> 2021-04-23 <b>Analyst</b> L V		
Escherichia Coli			
Faecal Coliforms			
Heterotrophic Plate Count			
Total Coliforms			
<b>Run No</b> 399306 <b>Method</b> EPA 350.1	<b>Analysis/Extraction Date</b> 2021-04-22 <b>Analyst</b> SKH		
N-NH3	<0.010 mg/L	109	80-120
<b>Run No</b> 399386 <b>Method</b> EPA 200.8	<b>Analysis/Extraction Date</b> 2021-04-23 <b>Analyst</b> EMM		
Iron	<0.03 mg/L	99	80-120
Manganese	<0.01 mg/L	95	80-120
<b>Run No</b> 399418 <b>Method</b> EPA 351.2	<b>Analysis/Extraction Date</b> 2021-04-24 <b>Analyst</b> SKH		
Total Kjeldahl Nitrogen	<0.100 mg/L	97	70-130

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### QC Summary

Analyte		Blank	QC % Rec	QC Limits
Run No	399434	Analysis/Extraction Date	2021-04-23	Analyst AET
Method	SM2320.2510.4500H/F			
	Alkalinity (CaCO <sub>3</sub> )	<5 mg/L	98	90-110
	Conductivity	<5 uS/cm	99	90-110
	F	<0.10 mg/L	103	90-110
	pH		100	90-110
Run No	399435	Analysis/Extraction Date	2021-04-24	Analyst AET
Method	SM 5310B			
	DOC	<0.5 mg/L	96	80-120
Run No	399455	Analysis/Extraction Date	2021-04-26	Analyst R R
Method	SM 4110			
	N-NO <sub>2</sub>	<0.10 mg/L	101	90-110
	N-NO <sub>3</sub>	<0.10 mg/L	101	90-110
	SO <sub>4</sub>	<1 mg/L	100	90-110
Run No	399457	Analysis/Extraction Date	2021-04-27	Analyst K B
Method	C SM2540			
	TDS	<10 mg/L	99	90-110
Run No	399462	Analysis/Extraction Date	2021-04-26	Analyst Z S
Method	M SM3120B-3500C			

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## QC Summary

Analyte	Blank	QC % Rec	QC Limits
Calcium	<1 mg/L	104	90-110
Potassium	<1 mg/L	105	87-113
Magnesium	<1 mg/L	103	76-124
Sodium	<2 mg/L	105	82-118
Run No 399513 Method C SM2120C	Analysis/Extraction Date 2021-04-27	Analyst K B	
Colour	<2 TCU	98	90-110
Run No 399576 Method C SM4500-S2-D	Analysis/Extraction Date 2021-04-27	Analyst AET	
S2-	<0.01 mg/L	84	80-120
Run No 399597 Method SM 4110	Analysis/Extraction Date 2021-04-27	Analyst R R	
Chloride	<1 mg/L	100	90-110
Run No 399608 Method C SM2340B	Analysis/Extraction Date 2021-04-28	Analyst AET	
Hardness as CaCO3 Ion Balance			
Run No 399705 Method SUBCONTRACT P-INORG	Analysis/Extraction Date 2021-04-28	Analyst AET	

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Project: 021256  
COC #: 211236

### QC Summary

Analyte	Blank	QC % Rec	QC Limits
Phenols	<0.001 mg/L	84	69-132
Tannin & Lignin	<0.1 mg/L	90	

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Client: Morey Associates  
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Report Number: 1951747  
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Project: 021256  
COC #: 211237

Page 1 of 7

**Dear Dan Morey:**

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

Report Comments:

Addrine Thomas  
2021.04.29  
15:33:29 -04'00'

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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Report Number: 1951747  
Date Submitted: 2021-04-21  
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Project: 021256  
COC #: 211237

Group	Analyte	MRL	Units	Guideline	1552994 Water  2021-04-20 South St - Southern Well
Anions	Cl	1	mg/L	AO 250	132
	F	0.10	mg/L	MAC 1.5	0.36
	N-NO2	0.10	mg/L	MAC 1.0	<0.10
	N-NO3	0.10	mg/L	MAC 10.0	<0.10
	SO4	1	mg/L	AO 500	45
General Chemistry	Alkalinity as CaCO3	5	mg/L	OG 500	269
	Colour	2	TCU		2
	Conductivity	5	uS/cm		1010
	DOC	0.5	mg/L	AO 5	0.8
	pH	1.00		6.5-8.5	8.12
	S2-	0.01	mg/L	AO 0.05	<0.01
	TDS	10	mg/L	AO 500	600*
	Turbidity	0.1	NTU	AO 5.0	1.5
	Hardness as CaCO3	1	mg/L	OG 100	375*
	Ion Balance	0.01			1.03
Hardness Indices/Calc Metals	Ca	1	mg/L		91
	Fe	0.03	mg/L	AO 0.3	0.30
	K	1	mg/L		4
	Mg	1	mg/L		36
	Mn	0.01	mg/L	AO 0.05	0.03
Microbiology	Na	2	mg/L	AO 200	64
	Escherichia Coli	0	ct/100mL	MAC 0	0
	Faecal Coliforms	0	ct/100mL		0
	Heterotrophic Plate Count	0	ct/1mL		7
	Total Coliforms	0	ct/100mL	MAC 0	0

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Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.
Nutrients	N-NH3	0.010	mg/L		1552994 Water  2021-04-20 South St - Southern Well
	Total Kjeldahl Nitrogen	0.100	mg/L		
Subcontract-Inorg	Phenols	0.001	mg/L		
	Tannin & Lignin	0.1	mg/L		

**Guideline = OBWSOG**

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### QC Summary

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 399222 <b>Method</b> C SM2130B	<b>Analysis/Extraction Date</b> 2021-04-21	<b>Analyst</b> K B	
Turbidity	<0.1 NTU	101	70-130
<b>Run No</b> 399253 <b>Method</b> AMBCOLM1	<b>Analysis/Extraction Date</b> 2021-04-23	<b>Analyst</b> L V	
Escherichia Coli			
Faecal Coliforms			
Heterotrophic Plate Count			
Total Coliforms			
<b>Run No</b> 399306 <b>Method</b> EPA 350.1	<b>Analysis/Extraction Date</b> 2021-04-22	<b>Analyst</b> SKH	
N-NH3	<0.010 mg/L	109	80-120
<b>Run No</b> 399386 <b>Method</b> EPA 200.8	<b>Analysis/Extraction Date</b> 2021-04-23	<b>Analyst</b> EMM	
Iron	<0.03 mg/L	99	80-120
Manganese	<0.01 mg/L	95	80-120
<b>Run No</b> 399418 <b>Method</b> EPA 351.2	<b>Analysis/Extraction Date</b> 2021-04-24	<b>Analyst</b> SKH	
Total Kjeldahl Nitrogen	<0.100 mg/L	97	70-130

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### QC Summary

Analyte		Blank	QC % Rec	QC Limits	
Run No	399434	Analysis/Extraction Date	2021-04-23	Analyst	AET
Method	SM2320.2510.4500H/F				
	Alkalinity (CaCO3)	<5 mg/L	98		90-110
	Conductivity	<5 uS/cm	99		90-110
	F	<0.10 mg/L	103		90-110
	pH		100		90-110
Run No	399435	Analysis/Extraction Date	2021-04-24	Analyst	AET
Method	SM 5310B				
	DOC	<0.5 mg/L	96		80-120
Run No	399455	Analysis/Extraction Date	2021-04-26	Analyst	R R
Method	SM 4110				
	N-NO2	<0.10 mg/L	101		90-110
	N-NO3	<0.10 mg/L	101		90-110
	SO4	<1 mg/L	100		90-110
Run No	399457	Analysis/Extraction Date	2021-04-27	Analyst	K B
Method	C SM2540				
	TDS	<10 mg/L	99		90-110
Run No	399462	Analysis/Extraction Date	2021-04-26	Analyst	Z S
Method	M SM3120B-3500C				

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Calcium	<1 mg/L	104	90-110
Potassium	<1 mg/L	105	87-113
Magnesium	<1 mg/L	103	76-124
Sodium	<2 mg/L	105	82-118
Run No 399513 Method C SM2120C	Analysis/Extraction Date 2021-04-27	Analyst K B	
Colour	<2 TCU	98	90-110
Run No 399576 Method C SM4500-S2-D	Analysis/Extraction Date 2021-04-27	Analyst AET	
S2-	<0.01 mg/L	84	80-120
Run No 399597 Method SM 4110	Analysis/Extraction Date 2021-04-27	Analyst R R	
Chloride	<1 mg/L	100	90-110
Run No 399608 Method C SM2340B	Analysis/Extraction Date 2021-04-28	Analyst AET	
Hardness as CaCO3 Ion Balance			
Run No 399705 Method SUBCONTRACT P-INORG	Analysis/Extraction Date 2021-04-28	Analyst AET	

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### QC Summary

Analyte	Blank	QC % Rec	QC Limits
Phenols	<0.001 mg/L	84	69-132
Tannin & Lignin	<0.1 mg/L	90	

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**SCHEDULE “D”  
DEVELOPMENT REQUIREMENTS**

- 1) The final landscaping at the site should be graded such that surface water (including any eavestrough downspout discharge and sump line discharge) is not directed to or ponds around the existing well heads and such that the well casing heights extend not less than 0.4 metres above the ground surface.
- 2) In order to encourage domestic supply well education and best management practices future residents at the site should be made aware of and refer to the province of Ontario web-doc publication: [ontario.ca/document/water-supply-wells-requirements-and-best-practices](http://ontario.ca/document/water-supply-wells-requirements-and-best-practices)
- 3) Future residents at the site should be made aware that it is considered prudent to adhere to the regulatory well maintenance requirements, general maintenance for well owners (Table 11-1: Well Maintenance Checklist Items), and well water quality laboratory testing outlined in the above-mentioned province of Ontario web-doc publication.
- 4) Future residents at the site should be made aware that the use of a water softener for treatment of hardness may be desired based on the results of the water quality testing carried out for the current hydrogeological study located in Schedule C.
- 5) Future residents at the site should be made aware that the use of conventional sodium ion exchange water softeners may introduce relatively high concentrations of sodium into the drinking water, which may 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.
- 6) Future residents at the site should be made aware that water wells should be adequately disinfected by chlorination prior to use for the proposed semi-detached dwelling at the site.
- 7) Future residents at the site should be made aware that Langelier Saturation Index (LSI) and Ryznar Stability Index (RSI) calculations for water samples obtained from the existing wells at the site can be interpreted to indicate potential for the groundwater to cause scale to form on plumbing fixtures.