GREER GALLOWAY
CONSULTING ENGINEERS

Hydrogeology and Servicing Assessment

1244 County Road 2
Wellington, Ontario

Prepared for:

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Submitted by:

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Project: 1836383

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Summary

This report presents the results of a hydrogeological and servicing assessment for a proposed wedding venue and short stay cabins development planned for an approximately 38 ha property located at 1244 County Road 2 north of Wellington.

Water for the development is to be obtained from an existing dug well located in the southern portion of the property to the southeast of the agricultural field. Testing indicates that the well has an ample yield and can supply sufficient water for the planned development without affecting neighbouring wells. Shallow dug wells are vulnerable to bacterial contamination and will experience seasonal changes in water quality (e.g. increased levels of dissolved organic carbon and colour during the summer months). Adequate treatment, consistent with that required for a surface water source, is therefore necessary. A treatment system consisting of initial media filtration to 5-microns followed membrane filtration to one-micron then ultraviolet disinfection plus chlorination would meet minimum requirements under O.Reg 319.

The site is large enough to accommodate individual Class 4 septic systems while maintaining regulatory setbacks from structures and property lines. Groundwater recharge over the property is predicted to reduce sewage effluent nitrate concentrations to less than the Ontario Drinking Water Standard of 10 mg/L at the property boundary. The total design flows are above the 10,000 L/day threshold requiring an ECA.

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1. Introduction

The Greer Galloway Group was retained by Ms. Jessica and Natalie Schnurr to carry out a hydrogeological investigation and servicing assessment for a proposed wedding venue planned for an approximately 40.1 ha property located north of Wellington, Ontario. This work was authorized by Ms. Jessica Schnurr on February 7, 2019.

The scope of work included site reconnaissance, pumping test of the large diameter water table well on the property, and water quality sampling of the well. Other studies including traffic engineering and a stormwater management report are provided under separate cover.

2. Project Description

A wedding venue and cabins is proposed for the subject lands with potential future expansion to include an event space, and 15 rental cabins. The development is accessed from County Road 2, approximately 550 metres south of the its intersection with Closson Road. The wedding venue is an old barn located centrally on the within the portion of property that fronts onto County Road 2. An existing 3 bedroom residence is located between the existing barn and County Road 2.

The development is to be serviced with groundwater from an existing large diameter blasted well located to the approximately 330 metres south of the barn and proximal to the southeast corner of an agricultural field. Wastewater from the wedding venue and cabins will generate sewage flows by employees and guests and will be managed using conventional Class 4 septic systems.

3. Methods

The study was carried out in general accordance with the Ministry of the Environment, Conservation and Parks (MECP) Procedures D-5-4 and D-5-5 (Individual On-Site Sewage Systems and water supply) and included:

1) Review of existing information
2) An assessment of groundwater yield and quality
3) Shock chlorination of the well and further sampling for Bacteriological Parameters
4) Evaluation of potential impacts to groundwater from the proposed development

3.1 Information Sources

The initial task was a review of available information to characterize existing soil and groundwater conditions, and to identify any potential hazards/constraints associated with the planned permanent infrastructure. Information sources include topographic and geologic mapping, aerial photography and MECP Water Well Records.

The site was visited in February and again in early March of 2019. During the site reconnaissance visits, the property was traversed on foot and observations made regarding topography, bedrock outcrop, vegetation, drainage, and neighbouring lands. The purpose of the site reconnaissance visit was to corroborate information from published sources and to identify access and environmental constraints that could affect the planned development.

3.2 Well Records Search

One water supply well record was found on the Ministry of the Environment Conservation and Parks wells database within a search radius of 500 metres from the supply well at the subject property. This was a dry drilled well with the well record number of 5300880.

3.4 Septic System Sizing

The thin overburden across the site requires the use of raised beds in order to achieve a sufficient separation between the distribution tile and the bedrock. Representative total daily design sanitary sewage flows were estimated using the Ontario Building Code (OBC) Table 8.2.1.3.A assuming a total of 250 guests, 15 cabins and a 3 bedroom residence. Design sewage flows for the future event space and tourist cabins were also estimated using the Ontario Building Code.

3.5 Water Supply

The water supply assessment included a 6-hour constant rate pumping test performed on the existing blasted dug well located on the subject property. The pumping test was started at 9:59 AM on February 12, 2019 at a constant rate of approximately 23 L/min[1] and continued for 6 hours and 4 minutes. All pumped water was discharged on the property just to the east of the barn. The pumping test was stopped, water level recovery was monitored, and the transducers were then removed from the well returned to our office for downloading and analysis.

An untreated groundwater sample was obtained from the well discharge in a variety of laboratory-prepared sample containers that were sealed, placed into a cooler with ice packs to maintain a temperature of approximately 4 degrees Celsius and transported Caduceon Laboratories in Kingston, Ontario. Analytical parameters included E. coli and total coliform bacteria, pH, total hardness, total alkalinity; calcium, magnesium, sodium; potassium; iron, manganese; chloride; sulphate; nitrate (NO3-N); nitrite (NO2-N), ammonia/ammonium NH3-N; conductivity; dissolved solids; dissolved organic carbon, suspended solids; and a variety of additional parameters (refer to the Laboratory Certificates of Analysis in Appendix B).

4. Summarized Findings

4.1 Physical Setting

The subject property is in Prince Edward County approximately 5.25 kilometres north of the Community of Wellington, Ontario. The area forms part of a broad flat limestone plateau located in the physiographic region of Ontario referred to as the Prince Edward Peninsula (Chapman and Putnam 1984). This region is separated from the mainland by the Bay of Quinte and is characterized by low relief (typically between 75 and 100 metres Above Sea Level). Soils are generally less than 1 metre deep.

[1] The rate was selected in order to remove sufficient water from storage to allow for the collection of a representative groundwater sample for chemical/bacteriological analysis and is estimated to be similar to peak water quantity demands of the project.

Elevations for the property were estimated from the Ministry of Natural Resources and Forestry Base Mapping. Elevations range from 107 mASL in the north portion of the property to about 102 mASL along the southern portion of the property near the entrance to the development. The ground surface slopes gently southward from the northwest to the southwest

The proximity of the area to Lake Ontario has a moderating effect on the climate, creating less extreme conditions in summer and winter than in other parts of the province. The subject area is characterized by mild winters and relatively cool humid summers. Snow typically occurs during 5 months of the year from December to April with lake effect snow resulting in highly variable levels of winter precipitation from year to year. Typical seasonal variations in temperature and precipitation are summarized on Table 1.

Table 1: Climate Normals (CFB Mountainview, Latitude: 44.1° Longitude: -77.3°)

Month	T_{max} (°C)	T_{min} (°C)	T_{mean} (°C)	P (mm)
January	-5.8	-1.5	-10.1	80
February	-5.4	-0.9	-9.8	53
March	-0.3	4.2	-4.8	68
April	6.7	11.5	1.9	75
May	13.3	18.7	7.7	75
June	18.5	24.1	12.9	81
July	21.4	27	15.8	72
August	20.3	25.7	14.9	84
September	15.7	20.7	10.7	91
October	9.2	13.8	4.7	79
November	3.1	6.8	-0.6	100
December	-3.0	0.9	-6.8	76
		Annual average		934

Modelling carried out by Quinte Conservation indicates that the total annual ET is approximately 600 mm for Prince Edward County however this estimate is carried out on a watershed scale that includes a variety of land cover including pasture lands, deciduous forest, and wetlands – each of which has a differing value for ET. Liu et al. (2003) show that in Canada, pasture lands yield an ET approximately equal to coniferous forests and about 55% of the ET found for deciduous forest and 69% of the ET found for mixed forest. ET in wetlands is potentially higher still as Bradford (1999) found that ET exceeded precipitation by approximately 50% during the May-October growing season in her study of the Minesing swamp. Furthermore, winter ET has been found to be significant in southern Ontario wetlands, accounting of 23 to 30% of the annual ET (Lafleur et al, 2005). Recent mapping by Prince Edward County indicates that approximately 37% of the land cover in the County is composed of forests and a further 11.2% by wetlands. Therefore, partitioning of the average ET may be derived as shown below:

Compartment	County-wide areas (ha)[1]	ET (mm/a)	Site area (%)[5]
Total	100,000	600[2]	
Open/farmland (ð)	52,854	488[3]	37

Woodland (φ)	36,000	707[3]	8
Wetland	11,176	780[4]	55

1 - County of Prince Edward Issues Paper 5 –Natural Environment – May 2012
2 – Estimated from Quinte Conservation Conceptual Water Budget – 2006
3 – Derived from ETδ=0.69ETϕ after Liu et al. (2003)
4 – Estimated from Bradford (1999) and Lafleur et al (2005)
5 – Estimated for the subject site from MNRF base mapping

Based on the land cover across the property, the nominal average annual ET is estimated to be 665 mm. However, the overburden thickness across the area is mapped as being less than 1 m (Carson, 1981) – an interpretation which is supported by the bedrock joining visible in aerial photography. Based on an average soil thickness of about 0.9 m with an effective water holding capacity of 150 mm, the net actual ET across the site will be lower than the regional estimate. Based on water budget modelling by Quinte Conservation (Quinte Conservation, 2006) a correction for water holding capacity results in a net actual evapotranspiration of approximately 600 mm.

Mapping shows primarily thin surficial soils classified as Ameliasburg Clay Loam[2] corresponding to the Clay Loam soil type referenced in the MECP guidance document *Technical and Engineering Guidelines for Stormwater Management Submissions*. The following table presents the runoff coefficient estimates based on the details of the ground cover factors and the runoff coefficient for the development area under current (i.e. pre-development) conditions:

Table 2: Estimated Runoff Coefficient

Topography		Runoff Coefficient Based on Soil Type[1]			Percentage of site area[2]
		Sandy Loam	Silt Loam	Clay Loam	
Vegetated lands	Flat (0 to 5%)	0.08	0.25	**0.35**	**8**
	Rolling (5 to 10%)	0.12	0.30	0.42	0
	Hilly (10 to 30%)	0.18	0.35	0.52	0
	Basin (0%)	**0.00**			**55**
Pasture Lands	Flat (0 to 5%)	0.10	0.28	**0.40**	**37**
	Rolling (5 to 10%)	0.15	0.35	0.45	0
	Hilly (10 to 30%)	0.22	0.40	0.55	0

[2] Richards, N.R. and Morwick, F.F.1948. Soil Survey of Prince Edward County. Experimental Farm Service, Dominion Department of Agriculture and the Ontario Agricultural College. Report No. 10 of the Ontario Soil Survey. Guelph Ontario November 1948, Map Scale 1:68,300 or 1 inch to 1 mile.

Topography		Runoff Coefficient Based on Soil Type[1]			Percentage of site area[2]
		Sandy Loam	Silt Loam	Clay Loam	
	Basin (0%)	0.00			0

Weighted Average: 0.18

1) MECP, 2014 - Technical and Engineering Guidelines for Stormwater Management Submissions
2) Approximate value interpreted from site topography

Assuming an average runoff coefficient of 0.18 we can estimate the net infiltration using a simple water balance approach defined by:

$$I = P - R - ET \qquad [1]$$

Where,

I = Infiltration

P = Precipitation

ET = Evapotranspiration losses

R = Surface runoff

Given an average annual moisture surplus (P-ET) of approximately 334 mm and a runoff coefficient of 0.18, the above equation indicates an average infiltration of about 166 mm/a for the purpose of nitrate attenuation calculations, or roughly 4,548 L/day per hectare. This estimate is consistent with water budget modelling by Quinte Conservation (Quinte Conservation, 2006[3]) which estimated groundwater recharge in the range of 100 to 283 mm/a within the broader area.

4.2 Geology

The lands in question are underlain by limestone bedrock, which is covered by a relatively thin layer overburden (typically about 1 m or less in thickness based on the rock fracturing and jointing visible in aerial imagery for the area).

Carson (1981) has described the area as being underlain by interbedded limestone and shale of the Eastview (Johnson et. al, 1992) member of the middle Ordovician Lindsay Formation. The Lindsay Formation consists mainly of medium brown and grey, finely crystalline limestone, uniformly bedded with subequal thickness of pale to medium brown shale. The entire formation weathers pale grey and brown and occurs in beds 3 to 15 cm in thickness.

[3] Quinte Conservation 2006, Conceptual Water Budget Quinte Region, 93p.

4.3 Hydrogeology

The fractured limestones and shales of the upper Lindsay Formation form the primary source of exploitable groundwater in the area. Potable groundwater is generally limited to the upper 25 m of the bedrock with mineralized and/or methane-bearing groundwater predominating at greater depths.

Groundwater flow in the vicinity of the subject property is in a southwesterly direction generally paralleling the surface water drainage. Precipitation falling on the subject property contributes to recharge of the bedrock aquifer and ultimately to the wetland and the east-west trending watercourse to the south of the property. The property is relatively flat with surface with any surface water flowing in the same direction as the shallow bedrock aquifer.

5. Discussion

5.1 Water Supply

5.1.1 Water Supply Requirements

Water supply requirements are based on the assumption that total water consumption will be maintained below the 50,000 L/day threshold beyond which a Permit to Take Water (PTTW) is required. Water needs are therefore the sum of process water requirements and the design sewage flows. The former are dependent on production volumes and the water reclamation technology selected while the latter have been estimated based on Part 8 of the Ontario Building Code as summarized below:

Wastewater flows may include the event space and seasonal tourist cabins with design sewage flows also estimated from the Ontario Building Code:

Table 8.2.1.3.A. Residential Occupancies Forming Part of Sentence 8.2.1.3.(1)

Dwelling

4 c) 3-bedroom dwelling	1 residence at 1,600 L= 1,600 L

Hotels and Motels (excluding bars and restaurants)

(a) Resort hotel, **cottage**, per person occupancy @ 500 L/person = 22,000 L	5 cabins with average 2-person 8 cabins with average 4-person 2 cabins with average 6-person

Table 8.2.1.3.B. Other Occupancies Forming Part of Sentence 8.2.1.3.(2)

Assembly Hall – per seat

(a) No food service, or (b) Food service provided	170 persons x 36 L/person = 6,120 L/day

Total Design Sanitary Sewage Flows	= 29,720 L/day

The required yield can be calculated as the maximum daily requirement over a full 24 hour period (e.g. 29,720 L over 24 h, or 20.6 L/min).

5.1.2 Available Yield

During pumping at a rate of 23 L/min, water levels in the test well declined by 11 cm accounting for 0.5% of available drawdown and recovered fully within 45 minutes following completion of the test. The large diameter well is a blasted well with a large availability of storage and a depth of 3.69 m below the top of casing, the well has been historically used as a water supply for a dairy farm. A wedding venue activity is seasonal in nature although peak water usage would account for a daily demand of 20.6 L/min this water quantity demand would be reserved for summer and early fall weekends. Annual infiltration of precipitation would suggest a minimum recharge area of 7.84 hectares would be required, indicating that there is sufficient infiltration on the property to support the proposed development. A hydrograph of water levels measured during the pumping and recovery is provided in Appendix C.

Based on the high groundwater table in the vicinity of the well and the history of the well's use supplying a dairy farm, it is our opinion that the tested well yield is representative of the long-term yields which would be obtained under normal climatic conditions.

5.1.3 Water Quality

Two water sample were obtained from Well during the 6-hour pumping test and analyzed at Caduceon Laboratories Ltd. in Kingston, Ontario for selected parameters. Chlorine was added to the well at the beginning of the test. One sample (TW:1HR) was taken after 1 hour of pumping occurred and then a second sample (TW:6HR) was acquired at the end of the pumping test. Results of this testing are included with the Laboratory Certificate of Analysis in Appendix B. The testing indicated that the water is moderately hard and alkaline, with the levels of sodium slightly higher than the aesthetic objective. Levels of total coliform bacteria overgrow) exceed health-related drinking water standards. E. coli. bacteria were also reported to be overgrown for the 6-hour water sample.

Following the initial pump test, the well was shock chlorinated in order to decrease the quantity of bacteriological populations within the well. Following this well chlorination the well was pumped for another 6 hour period on March 19, 2019 and a second sample was collected at the end of this pumping period. This water sample was found to have no E.coli present.

5.1.4 Potential for Interference

There are no wells within 500 metre of the water supply well at the property, any neighbouring well is too far away to be impacted by a large diameter blasted well considering the daily water requirements for the property. There is no potential of well interference caused by this proposed development with existing neighbouring wells.

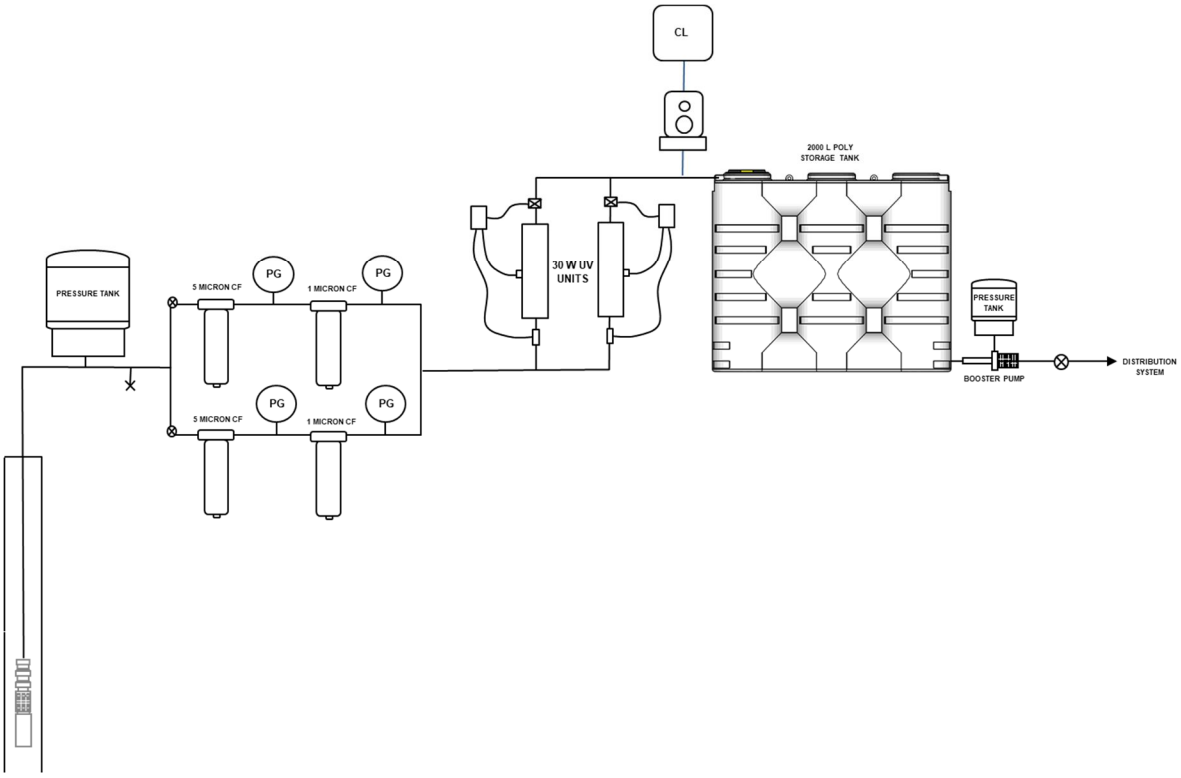
5.1.5 Treatment Requirements

We note that GUDI wells are directly influenced by the surface water quality and should be considered a surface water source with respect to water quality and vulnerability to contamination. Shallow dug wells are intrinsically vulnerable to bacterial contamination and the proximity to the wetland (environmental protection area) will result in seasonal water quality changes (e.g. increased levels of dissolved organic carbon and colour during the summer months).

Water takings to supply the cabins and wedding venue would be classified as a small drinking water system under O. Reg. 319/08. As the well is susceptible to bacterial contamination and the ingress of surface water run-off, treatment must be to an equivalent level to that required for a surface water source. Water treatment equipment must be capable of achieving, at all times, primary disinfection including at least 99 per cent removal or inactivation of Cryptosporidium oocysts, at least 99.9 per cent removal or inactivation of Giardia cysts and at least 99.99 per cent removal or inactivation of

viruses by the time water enters the distribution system. Permission in writing must be obtained from the medical officer of health from the Hastings Prince Edward Health Unit prior to beginning operation.

The necessary treatment may be achieved in accordance with the Procedure for Disinfection of Drinking Water in Ontario using a combination of filtration, ultraviolet disinfection and chlorine injection. A conceptual process flow chart for an O.Reg. 319-compliant water treatment system is shown below:



Conceptual Drinking Water Treatment System

5.2 Onsite Sewage Treatment

Environmental impacts to groundwater from private sewage works permittable under the Ontario Building Code are typically assessed under the MECP's Guideline entitled "Technical Guideline for Individual On-site Sewage Systems: Water Quality Impact Risk Assessment", dated August 1996

(Guideline D-5-4). In the case of nitrate[4], the Ontario Drinking Water Standard of 10 mg/L of nitrate-nitrogen is used as an indicator of groundwater impact potential.

The capacity of the portion of the property accepting sewage waste to provide sufficient attenuation of the sewage derived nitrate, can be calculated by estimating the amount of dilution and biological denitrification which will occur between the tile bed and the property boundary. To take a conservative approach, we have ignored biological denitrification and groundwater flow onto the property in accordance with Policy D-5-4.

Therefore, the total nitrate loading to groundwater resulting from sewage disposal may be estimated by dividing the total nitrate input from private sewage systems by the volume of groundwater recharge over the property, and the volume of sewage effluent. The volume of sewage effluent is taken as 1,000 L/day per cabin and the existing residence (for a total of 16,000 /day) plus an additional 1,749 L/day) from the event space (6,120 L/event with two events per week) for a total sewage flow of 17,749 L/day. Sewage effluent nitrate of 40 mg/L is assumed for non-process sewage flows yielding a total nitrate (as N) load of 1,739 g/day of nitrate from sewage effluent. Total dilution is equal to the sum of the 17,749 L generated by sewage flows and the total groundwater recharge over the 38.45 ha property (total 174,870 L/day). The 38.45 ha has been used for the calculation as an application has been submitted to sever out two new lots 1.65 ha from the existing subject property. These quantities yield a nitrate concentration of 3.69 mg/L in groundwater leaving the property.

Approval of septic systems under Section 8 of the Building Code is limited to domestic-type sewage flows of less than 10,000 L/day. This proposed project, will exceed this level (29,750 L/day) and will require an Environmental Compliance Approval (ECA) from the Ontario Ministry of Environment Conservation and Parks (MECP). This sometimes necessitates tertiary treatment if the MECP applies Policy B-7 (which uses 25% of the difference between background concentrations and the Ontario Drinking Water Standard for a given parameter instead of the Ontario Drinking Water Standard) however the modelled nitrate concentration in groundwater leaving the property is lower than the background nitrate concentration (6 mg/L) suggesting that tertiary treatment would not be necessary.

The design of an individual leaching bed system(s) should be adjusted to suit local site conditions. Either a single large leaching bed system or multiple systems are considered feasible for the site. The shallow bedrock will require the use of fully raised leaching beds regardless of the location and configuration.

6. Closure

Based on the results of this assessment, it is our opinion that the site has a sufficient water supply to accommodate the proposed development and that the site is suitable for the construction a private septic waste disposal system(s). Specific conclusions and recommendations include the following:

[4] Nitrate is the principal contaminant of concern for “domestic” type sewage since other chemical constituents of sewage degrade quickly and are relatively immobile in the subsurface. Nitrate is formed by oxidation of the ammonia contained in human wastes and is the stable form of nitrogen in an oxidizing environment.

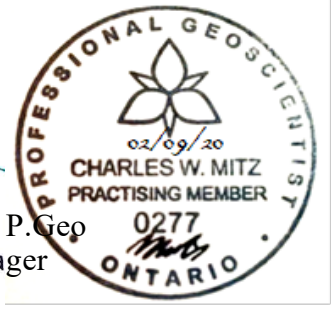
1. The pumping test carried out on the existing blasted well demonstrated that the well yield is greater than 23 L per minute for the well. This well is sufficient to meet anticipated water demands for the planned development.
2. Water supply for the planned development will be classified as a small drinking water system under Ontario Regulation 319. Water in the blasted well contains high levels of coliform bacteria and is not safe to use for potable water supply without treatment to surface water standards.
3. The site is large enough to accommodate one or more Class 4 septic systems sized to meet projected design flows. Groundwater recharge over the property is predicted to reduce sewage effluent nitrate concentrations to less than 10 mg/L.
4. The existing blasted well should be cleaned out with a vacuum truck and upgraded by a license well contractor to comply with Ontario Regulation 903. Upgrading should include mounding of fine soil around the casing to protect the water supply by directing precipitation and surface water away from the water supply. The annular space between the well tiles and the upper overburden should be sealed using an impermeable barrier and the top of the casing should be made vermin proof. Following well upgrade, further shock chlorination of the well should be carried out.
5. If the recommended well upgrades fail to reduce bacterial levels to a range typical of properly constructed dug wells, consideration should be given to replacing the dug well with one or more drilled wells constructed with a minimum 6 m of sealed casing.

We trust that this report is complete within our terms of reference and sufficient for your present requirements. If you have any questions about the report or our conclusions, please contact us.

Respectfully Submitted,

THE GREER GALLOWAY GROUP INC.
CONSULTING ENGINEERS

David Cooper, M.Env.Sc., B.Sc.
Consulting Hydrogeologist



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NOTES:

1. ALL WORK SHALL BE IN ACCORDANCE WITH RELEVANT CODES AND GUIDELINES.
2. ALL DRAWINGS AND ADDENDA ARE TO BE READ AS, AND IN CONJUNCTION WITH THE SPECIFICATIONS.
3. ALL EQUIPMENT SHALL BE INSTALLED AS SPECIFIED OR APPROVED EQUIVALENT.
4. CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS BEFORE PROCEEDING WITH WORK AND BE RESPONSIBLE FOR SAME.
5. CONTRACTOR MUST REPORT ANY DISCREPANCIES TO ENGINEER FOR RESOLUTION BEFORE COMMENCING THE WORK.
6. ANY CHANGES MUST BE APPROVED BY THE ENGINEER.

A — A DETAIL NO.
B — B DRAWING NO. – WHERE DETAILED

REVISION	DESCRIPTION	DATE
01	–	YY/MM/DD

NORTH

STAMP

PROJECT
SCHNURR PROPERTY DEVELOPMENT
1244 COUNTY ROAD 2
PARTS 1 AND 2 OF LOT 18, PLAN 33
HALLOWELL TOWNSHIP
PRINCE EDWARD COUNTY

JESSICA SCHNURR

DRAWING TITLE
SITE PLAN
SERVICING STUDY

DESIGNED BY: D.C
DRAWN BY: JC
REVIEWED BY: C.M
APPROVED BY: C.M
PROJECT DATE: 2019/05/16 (YYYY/MM/DD)
PROJECT #: 18-3-6383
DRAWING #: SP1
DRAWING SCALE (ISO A1): HOR: 1:2000(A1 PLOT) VER: X : XXX

BORDER SIZE: ISO A1 (841mm x 594mm) DATE PLOTTED: 2019 / 05 / 16 @ 10:07 AM PLOT SCALE: 1:1 FILE PATH: P:\Belleville Project\6000\18363383 – PEC Property Studies\Drawings\Working Drawings\18363383 PEC PROPERTY STUDY-SERVICING.dwg CAD PLOTTER: Justin Russell

(METRIC SCALE – ALL DIMS IN MILLIMETERS U.N.O.)

Table 3: Water Quality Results Test Well

			Sample ID:	TW: 1HR	TW: 6HR	W-1	
			Date Collected:	Feb 21 2019	Feb 21 2019	Mar 19 2019	
Parameter	**Units**	**M.D.L.**	**Reference Method**				ODWSOG*
Total Coliform	cfu/100mL	1	MOE E3407		**Overgrown**	**>200**	0
E coli	cfu/100mL	1	MOE E3407		**Overgrown**	0	0
Background	cfu/100mL	1	SM9222B		Overgrown		NA
Alkalinity (CaCO3) to pH 4.5	mg/L	5	SM 2320B	184	182		30-500
pH @25°C	pH Units		SM 4500H	8.04	8.04		6.5-8.5
Conductivity @25°C	µmho/cm	1	SM 2510B	733	711		NA
Colour	TCU	2	SM2120C	<2	2		5
Turbidity	NTU	0.1	SM2130B	**1.4**	0.5		5
Fluoride	mg/L	0.1	SM4110C	<0.1	<0.1		1.5
Chloride	mg/L	0.5	SM4110C	82.8	81.3		250
Nitrite (N)	mg/L	0.1	SM4110C	<0.1	<0.1		1
Nitrate (N)	mg/L	0.1	SM4110C	6.2	6		10
Sulphate	mg/L	1	SM4110C	21	22		500
Total Kjeldahl Nitrogen	mg/L	0.1	E3199A.1	0.2	0.3		NA
Ammonia + Ammonium (N)	mg/L	0.05	SM4500-NH3-H	<0.05	<0.05		NA
Organic Nitrogen	mg/L	0.1	E3199A.1	0.2	0.2		0.15
Dissolved Organic Carbon	mg/L	0.2	EPA 415.1	1.5	1.7		5
Tannins and Lignins	mg/L	0.5	SM5500B	<0.5	<0.5		NA
Sulphide	mg/L	0.01	SM4500-S2	<0.01	<0.01		0.05
Methane	L/m3	0.006		<0.02	<0.02		
Phenolics	mg/L	0.002	MOEE 3179	<0.002	<0.002		NA
Hardness (as CaCO3)	mg/L	1	SM 3120	279	279		500
Calcium	mg/L	0.02	SM 3120	106	106		NA
Copper	mg/L	0.002	SM 3120	<0.002	<0.002		1
Iron	mg/L	0.005	SM 3120	0.006	<0.005		0.3
Magnesium	mg/L	0.02	SM 3120	3.49	3.5		NA
Manganese	mg/L	0.001	SM 3120	<0.001	<0.001		0.05
Potassium	mg/L	0.1	SM 3120	0.3	0.3		NA
Silica	mg/L	0.02	SM 3120	2.95	2.95		NA
Sodium	mg/L	0.2	SM 3120	*34.2*	*31.4*		200
Zinc	mg/L	0.005	SM 3120	<0.005	<0.005		5

*Ontario Drinking Water Standards,Objectives and Guidelines

Appendix A

Well Record

UTM 18 Z 310655 E

5 R 4874699 N

31C3C

The Ontario Water Resources Commission Act

WATER WELL RECORD

Elev 4(5) R 0337

Basin 24 PR ED.

County or District .... Township, Village, Town or City HALLOWELL

Con. 2 BROKEN FRONT ED Lot 79 Date completed 26 (day) AUG (month) 63 (year)

[redacted] ress RR WELLINGTON

Casing and Screen Record

Inside diameter of casing 6 1/4
Total length of casing 5
Type of screen
Length of screen
Depth to top of screen
Diameter of finished hole 6

Pumping Test

Static level 16 IN 24 HRS
Test-pumping rate 1/2 G.P.M.
Pumping level DRY
Duration of test pumping 20 MINS
Water clear or cloudy at end of test CLEAR
Recommended pumping rate 1/2 G.P.M.
with pump setting of 47 feet below ground surface

Well Log / Water Record

Overburden and Bedrock Record	From ft.	To ft.	Depth(s) at which water(s) found	Kind of water (fresh, salty, sulphur)
GRAVEL	0	5		
LIMESTONE	5	50	45	FRESH

For what purpose(s) is the water to be used?
FARM

Is well on upland, in valley, or on hillside? ✓ (upland)

Drilling or Boring Firm
H. Y. K. ROLSTON

Address BLOOMFIELD

Licence Number 919
Name of Driller or Borer SAME
Address
Date OCT 7 63

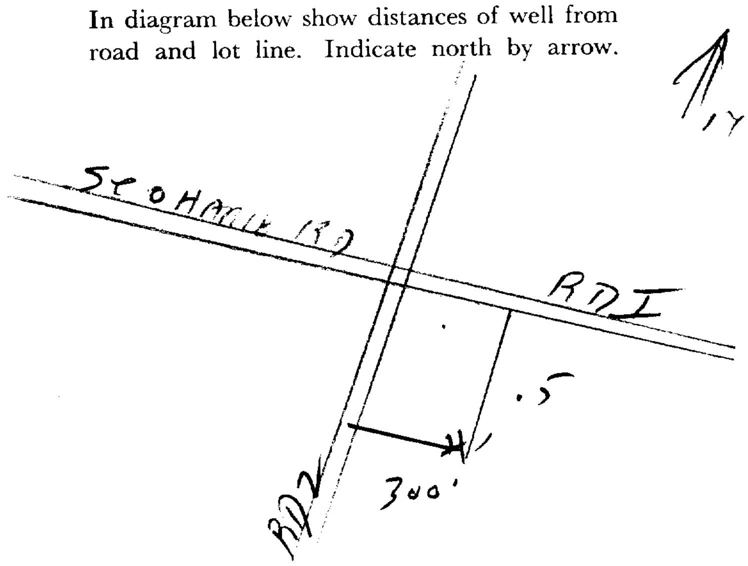
(Signature of Licensed Drilling or Boring Contractor)

Form 7 15M-60-4138

OWRC COPY

Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.



Appendix B

Laboratory Certificates of Analysis

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: ---

REPORT No. B19-04654

Report To:

The Greer Galloway Group
1620 Wallbridge-Loyalist Road, RR #5,
Belleville Ontario K8N 4Z5 Canada
Attention: David Cooper

Caduceon Environmental Laboratories
285 Dalton Ave
Kingston Ontario K7K 6Z1
Tel: 613-544-2001
Fax: 613-544-2770

DATE RECEIVED: 22-Feb-19
DATE REPORTED: 04-Mar-19
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: 18-3-6383
P.O. NUMBER:
WATERWORKS NO.

	Client I.D.				TW:1HR	TW:6HR		
	Sample I.D.				B19-04654-1	B19-04654-2		
	Date Collected				21-Feb-19	21-Feb-19		
Parameter	**Units**	**R.L.**	**Reference Method**	**Date/Site Analyzed**				
Total Coliform	cfu/100mL	1	MOE E3407	22-Feb-19/K		NDOGT [1]		
E coli	cfu/100mL	1	MOE E3407	22-Feb-19/K		NDOGT [1]		
Background	cfu/100mL	1	SM9222B	22-Feb-19/K		NDOGT [1]		
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	25-Feb-19/O	184	182		
pH @25°C	pH Units		SM 4500H	25-Feb-19/O	8.04	8.04		
Conductivity @25°C	µmho/cm	1	SM 2510B	25-Feb-19/O	733	711		
Colour	TCU	2	SM 2120C	26-Feb-19/O	< 2	2		
Turbidity	NTU	0.1	SM 2130	26-Feb-19/O	1.4	0.5		
Fluoride	mg/L	0.1	SM4110C	25-Feb-19/O	< 0.1	< 0.1		
Chloride	mg/L	0.5	SM4110C	25-Feb-19/O	82.8	81.3		
Nitrite (N)	mg/L	0.1	SM4110C	25-Feb-19/O	< 0.1	< 0.1		
Nitrate (N)	mg/L	0.1	SM4110C	25-Feb-19/O	6.2	6.0		
Sulphate	mg/L	1	SM4110C	25-Feb-19/O	21	22		
Total Kjeldahl Nitrogen	mg/L	0.1	E3199A.1	25-Feb-19/K	0.2	0.3		
Ammonia + Ammonium (N)	mg/L	0.05	SM4500-NH3-H	22-Feb-19/K	< 0.05	< 0.05		
Organic Nitrogen	mg/L	0.1	E3199A.1	28-Feb-19/K	0.2	0.2		
Dissolved Organic Carbon	mg/L	0.2	EPA 415.1	25-Feb-19/O	1.5	1.7		
Sulphide	mg/L	0.01	SM4500-S2	22-Feb-19/K	< 0.01	< 0.01		
Methane	L/m3	0.02	NA	28-Feb-19	< 0.02 [2]	< 0.02 [2]		
Phenolics	mg/L	0.002	MOEE 3179	26-Feb-19/K	< 0.002	< 0.002		
Tannins and Lignins	mg/L	0.5	SM5500B	22-Feb-19/K	< 0.5	< 0.5		
Hardness (as CaCO3)	mg/L	1	SM 3120	26-Feb-19/O	279	279		
Calcium	mg/L	0.02	SM 3120	26-Feb-19/O	106	106		
Copper	mg/L	0.002	SM 3120	26-Feb-19/O	< 0.002	< 0.002		
Iron	mg/L	0.005	SM 3120	26-Feb-19/O	0.006	< 0.005		
Magnesium	mg/L	0.02	SM 3120	26-Feb-19/O	3.49	3.50		
Manganese	mg/L	0.001	SM 3120	26-Feb-19/O	< 0.001	< 0.001		

R. Lecompte

Richard Lecompte
Laboratory Supervisor

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: ---

REPORT No. B19-04654

Report To:

The Greer Galloway Group
1620 Wallbridge-Loyalist Road, RR #5,
Belleville Ontario K8N 4Z5 Canada
Attention: David Cooper

Caduceon Environmental Laboratories
285 Dalton Ave
Kingston Ontario K7K 6Z1
Tel: 613-544-2001
Fax: 613-544-2770

DATE RECEIVED: 22-Feb-19
DATE REPORTED: 04-Mar-19
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: 18-3-6383
P.O. NUMBER:
WATERWORKS NO.

			Client I.D.		TW:1HR	TW:6HR		
			Sample I.D.		B19-04654-1	B19-04654-2		
			Date Collected		21-Feb-19	21-Feb-19		
Parameter	**Units**	**R.L.**	**Reference Method**	**Date/Site Analyzed**				
Potassium	mg/L	0.1	SM 3120	26-Feb-19/O	0.3	0.3		
Silica	mg/L	0.02	SM 3120	26-Feb-19/O	2.95	2.95		
Sodium	mg/L	0.2	SM 3120	26-Feb-19/O	34.2	31.4		
Zinc	mg/L	0.005	SM 3120	26-Feb-19/O	< 0.005	< 0.005		

1. NDOGT = No Data; Overgrown with target bacteria.
2. Subcontracted to SGS AXYS

R. Lecompte

Richard Lecompte
Laboratory Supervisor

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report-Microbiology

C.O.C.: ---

REPORT No. B19-07050

Report To:

The Greer Galloway Group
1620 Wallbridge-Loyalist Road, RR #5,
Belleville Ontario K8N 4Z5 Canada
Attention: David Cooper

Caduceon Environmental Laboratories
285 Dalton Ave
Kingston Ontario K7K 6Z1
Tel: 613-544-2001
Fax: 613-544-2770

DATE RECEIVED: 20-Mar-19
DATE REPORTED: 22-Mar-19
SAMPLE MATRIX: Raw Water

JOB/PROJECT NO.: 18-3-6383
P.O. NUMBER:
WATERWORKS NO.

	Parameter		Total Coliform	E coli			
	Units		cfu/100mL	cfu/100mL			
	R.L.		1	1			
	Reference Method		MOE E3407	MOE E3407			
	Date Analyzed/Site		20-Mar-19/K	20-Mar-19/K			
Client I.D.	Sample I.D.	Date Collected					
W-1	B19-07050-1	19-Mar-19	> 200	0			

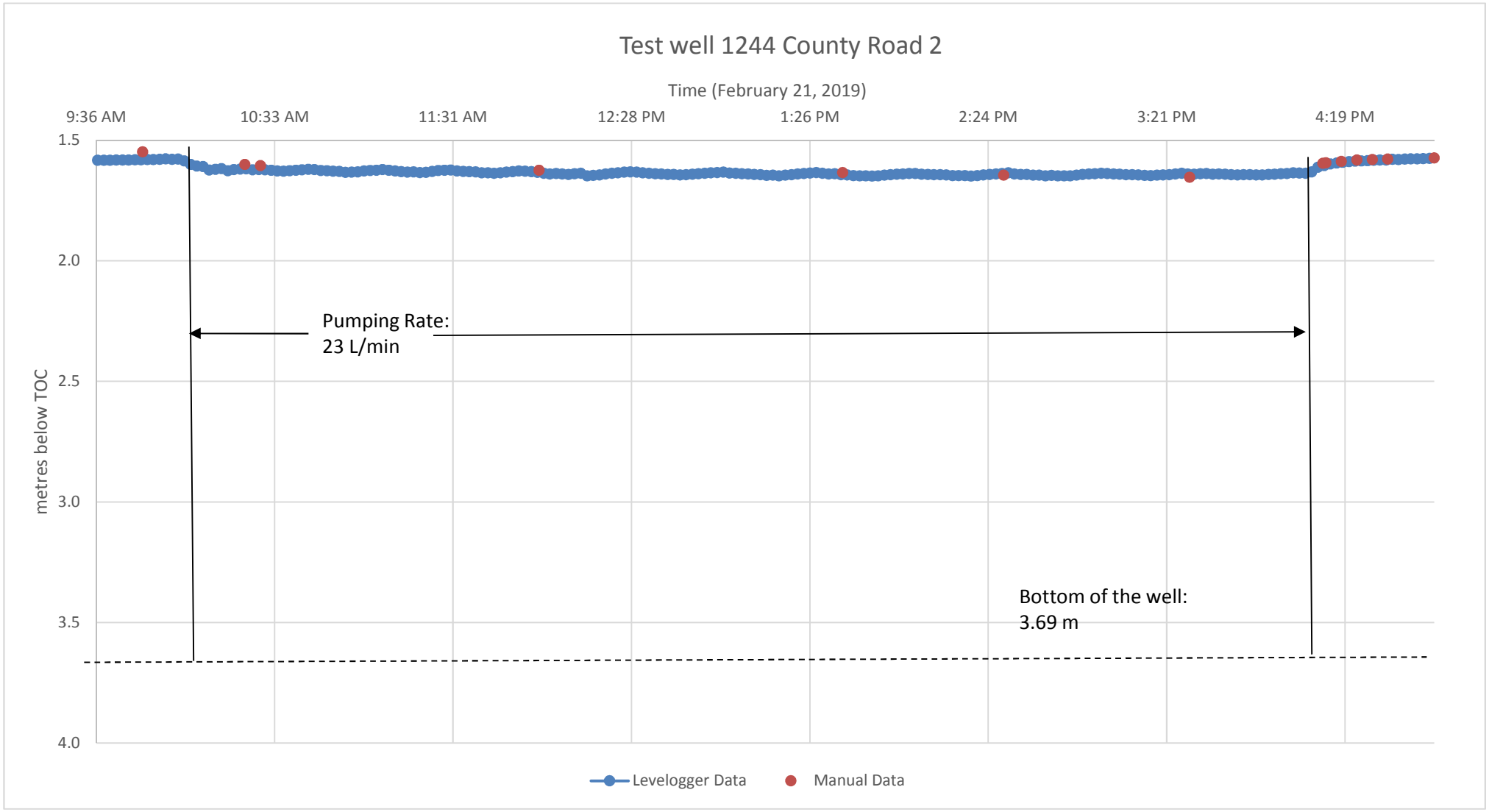
E. Livermore

Evan Livermore
Senior Microbiology Analyst

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Appendix C

Hydrograph


Test well 1244 County Road 2
Time (February 21, 2019)
9:36 AM
10:33 AM
11:31 AM
12:28 PM
1:26 PM
2:24 PM
3:21 PM
4:19 PM
1.5
2.0
2.5
3.0
3.5
4.0
metres below TOC
Pumping Rate:
23 L/min
Bottom of the well:
3.69 m
Levelogger Data
Manual Data