TECHNICAL MEMORANDUM

DATE December 12, 2022 **Project No.** 21493887

TO City of Ottawa
Public Works Department

FROM Caitlin Cooke **EMAIL ccooke@golder.com**

RESAMPLING RESULTS, WELL PW11-1, AND UPDATED TERRAIN ANALYSIS
HYDRO ONE ORLEANS OC, PHASE 2
3440 FRANK KENNY ROAD, OTTAWA, ONTARIO

Golder Associates Ltd. (Golder) was retained by J.L. Richards & Associates Ltd. (JLR) to collect a water sample from supply well PW11-1 at the proposed Hydro One Operations Centre (OC), Phase 2, located at 3440 Frank Kenny Road in Ottawa, Ontario. The purpose of the work was to evaluate the water quality at PW11-1, which is currently being used to supply the temporary building on the site. Well PW11-1 (well tag A116305) was constructed in 2011 by a licensed well contractor. A well inspection by a licensed geoscientist or engineer was not conducted at that time. The water quality at PW11-1 was previously reported in the February 2012 Golder report entitled "*Hydrogeology, Terrain Analysis and Impact Assessment Study, 3406-3450 Frank Kenny Road*."

This memorandum is an addendum to the February 2012 Golder report (included as Attachment 1) and this current memorandum considers the City of Ottawa's *Hydrogeological and Terrain Analysis Guidelines,* dated March 2021 and the Ontario Building Code.

Method

On March 9, 2022, a sample was collected from an untreated port (by bypassing the water softener and other treatment equipment) at the temporary building. Water was purged from the nearest tap (the kitchen sink) for approximately 10 minutes prior to the collection of the sample. The water sample was collected in laboratory supplied bottles and analyzed for the "subdivision suite" of parameters and filtered at the laboratory to be analysed for trace metals. Once collected, the sample was packed in a cooler with ice packs and was delivered to Eurofins Environment Testing (Eurofins) in Ottawa, Ontario for analysis.

On August 30, 2022 a second sample was collected from the same tap using the same sampling and purging methods. The water sample was collected in laboratory supplied bottles and analyzed for volatile organic compounds (VOC). Once collected, the sample was packed in a cooler with ice packs and was delivered to Eurofins in Ottawa, Ontario for analysis. The temperature, pH and conductivity of the water sample were measured in the field, and other sample observations, including colour, were noted.

Results

On the attached Table 1, the analytical results for the subdivision suite of parameters are compared to the Ontario Drinking-Water Quality Standards (ODWQS, Ontario Regulation 169/03) and to the standards (MAC), objectives

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(AO) and guidelines (OG) of the “Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines” (Ontario Ministry of the Environment, Conservation and Parks (MECP); Revised June, 2006). Table 1 also contains historic data collected during 2011 from PW11-1. The laboratory certificates of analysis (including the trace metals and VOC analyses) are also included (Attachment 2).

Analytical results of the groundwater sample collected from PW11-1 on March 9, 2022 indicate an AO exceedance for colour, which was measured to be 96 TCU, above the AO of 5 TCU (MECP, 2006). The sample was described as being clear and colourless when collected. The sample collected on August 30, 2022 was also described as clear and colourless. In accordance with Procedure D-5-5, the treatability limit for colour is 7 TCU; however, higher, iron-related colour may be removed by manganese greensand treatment.

As commonly found in this area of Ontario, the concentration of hardness was 305 mg/L, above the OG of 100 mg/L (MECP, 2006). Hardness in this concentration can be treated with conventional water softening equipment.

The laboratory-measured concentration of hydrogen sulphide was 0.21 mg/L, above the AO of 0.05 mg/L (MECP, 2006). Hydrogen sulphide is typically removed from water by aeration or by chemical oxidation.

The turbidity concentration measured in the sample was 13.2 NTU, greater than the AO of 5 mg/L (applicable at the point of consumption). In accordance with Procedure D-5-5, the treatability limit for turbidity is 5 NTU for non-disinfected water supplies.

The sodium concentration was 46 mg/L, which is below the aesthetic objective for sodium in drinking water of 200 mg/L. However, in accordance with Procedure D-5-5, the local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.

The iron concentration was 1.63 mg/L, above the AO of 0.30 mg/L. In accordance with Procedure D-5-5, the treatability limit for iron is 10 mg/L. Iron in this concentration can be treated with conventional water softening equipment or manganese greensand filters.

The manganese concentration was 0.06 mg/L, slightly above the AO of 0.05 mg/L. In accordance with Procedure D-5-5, the treatability limit for manganese is 1.0 mg/L. Manganese in this concentration can be treated with conventional water softening equipment or manganese greensand filters.

All of the other results of chemical analysis for PW11-1 were below the respective MACs and AOs (see Table 1). The concentrations of trace metals were below the applicable MAC, AO or OG (see lab report 1976973 in Attachment 2).

No VOCs were detected above their respective detection limits.

Based on information provided by JLR, HONI plans to install the following water treatment equipment: two parallel iron/sulphur filters (duty), one water softener, two parallel cartridge filters (one duty, one stand-by), and one ultraviolet (UV) disinfection unit. A cartridge filter will be installed at the facility bottle fill station and a point-of-use reverse osmosis (RO) unit will be installed at a dedicated kitchen sink tap for additional taste/odour treatment that may not be fully addressed by the water treatment system.

Discussion

The groundwater quality at well PW11-1 indicates that the water quality continues to meet applicable standards or objectives for the analyzed parameters, with the exception of colour, hydrogen sulphide, turbidity, iron, and manganese. Treatment may be necessary to reduce the levels of colour, hydrogen sulphide, turbidity, iron and manganese below the AOs. Common techniques for treating hydrogen sulphide, iron and manganese include water softeners, manganese greensand filters or other oxidizing media. Field assessment of colour has consistently shown that the water from this well is clear and colourless upon sample collection. The elevated colour level measured in the laboratory is assumed to be attributed to the elevated iron concentration, and treatment for iron is likely to be effective at reducing the colour level potentially to below the AO.

Turbidity was previously elevated in the samples collected in 2011 from PW11-1. Based on these elevated levels, a strategy was developed to reduce the turbidity of the groundwater at this well to below 1 NTU in order to meet the health-related objective under Table 2 of Procedure D-5-5. On December 22, 2011, the well was surged by the well driller and pumped at a rate of approximately 53 L/min (14 US GPM) for 6.5 hours. Just before pump shut-off, the field turbidity was measured to be 0.72 NTU, below the health-related objective under Procedure D-5-5. While repeating this approach could potentially reduce the 2022 turbidity levels to below 1 NTU, treatment using a carbon filtration system or reverse osmosis may be better suited to this site based on the reported low water use from this well.

Golder's 2012 report concluded that well PW11-1 was capable of supplying at least 16,350 L/day (i.e., more than the current estimated daily water demand for Phase 2 of the site). This capacity remains sufficient to provide water supply to Phase 2 of the development.

The water supply well formerly used for residential water supply at the now-demolished residence should be decommissioned in accordance with Ontario Regulation 903.

Updated Terrain Analysis

The February 2012 Golder report included a terrain analysis based on a preliminary design concept. The design has since progressed and the total daily design sanitary sewage flow has been refined from the assumptions in the February 2012 report to be up to 10,000 L/day. The following discussion presents an updated terrain analysis that incorporates the new total daily design sanitary sewage flow.

A nitrate dilution model was utilized to assess the potential impact of septic effluent on the properties adjoining 3440 Frank Kenny Road. The net potential infiltration was based on the regional climatic data for the Ottawa area provided by Environment Canada. A maximum of 35 employees was assumed based on information provided by Hydro One. The background nitrate concentration was assumed to be less than 0.1 mg/L based on the groundwater sample taken from borehole BH11-5 (Golder, 2012), and the nitrate concentration of the effluent was assumed to be 40 mg/L as per the guidance in MECP Guideline D-5-4. A nitrate pre-treatment system is being designed for the operations facility, and the treatment unit will be constructed as a double-pass system. As per literature from Waterloo Biofilter, a double-pass system can achieve between 50 to 65% nitrogen reduction. A 50% reduction in nitrogen concentrations is therefore assumed for the purposes of this impact assessment. The site area used in the assessment was 2.6 hectares. The nitrate dilution calculation is provided in Attachment 3.

With regard to treatment and dispersal of effluent from the leaching beds, the maximum nitrate concentration at the property boundary was calculated to be 8.7 mg/L, less than the ODWQS of 10 mg/L. It should be noted that this calculation is conservative because many of the 35 employees will spend the majority of their workday away

from the operations facility, and the number of full-day equivalent employees at the facility will be less than 10. It is concluded that the impact of the proposed operations facility on groundwater at the downgradient property boundary is considered acceptable in accordance with MECP Guideline D-5-4.

The source protection mapping in the Source Protection Information Atlas[1] illustrates that the site does not fall within a significant groundwater recharge area. The site does fall within an area marked as a vulnerable aquifer. Based on the results of the impact assessment, no potential impacts to nearby off-site groundwater users were identified.

Percolation/infiltration testing is not deemed to be required at this site. Based on the existing identified soils, a percolation rate (T) of 50 min/cm was estimated for the purposes of the septic design. Because this is the maximum value used in determining the size of the proposed leaching bed, it is considered a conservative estimate.

Conclusions

Apart from the updated information presented here, the remaining conclusions and recommendations in the February 2012 Golder report (included in Attachment 1) remain valid.

Closure

Should you have any questions or require further information, please do not hesitate to contact the undersigned.

Golder Associates Ltd.

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CAMC/rk

Jaime Oxtobee, M.Sc., P.Geo.
Senior Hydrogeologist/Associate

Attachments: Table 1 – Summary of Water Quality Results
Attachment 1 – February 2012 Golder Report
Attachment 2 – Water Quality Summary and Lab Reports 1973087,1976973 and 1985044
Attachment 3 – Updated Nitrate Dilution Calculation

https://golderassociates.sharepoint.com/sites/152302/project files/6 deliverables/well sampling/21493887-tm-rev3-well resampling_2022-12-12.docx

References

Golder Associates Ltd., 2012. Hydrogeology, Terrain Analysis and Impact Assessment Study, 3406-3450 Frank Kenney Road. Report No. 11-1122-0129(3000), February 2012.

Ontario Ministry of the Environment, Conservation and Parks, 2006. Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines, PIBS 4449e01.

[1] https://www.lioapplications.lrc.gov.on.ca/SourceWaterProtection/index.html?viewer=SourceWaterProtection.SWPViewer&locale=en-CA

TABLE 1

Summary of Water Quality Results

Table 1
Summary of Water Quality Results

Parameter	Unit	ODWQS (169/03)-Health [1]	ODWQS-AO [2]	ODWQS-OG [3]	PW11-1 07-Nov-2011 S-1	PW11-1 07-Nov-2011 S-4	PW11-1 22-Dec-2011 PW11-1	PW11-1 09-Mar-2022 HYDRO
Bacterial								
Escherichia coli	cfu/100ml	0	--	--	0	0	--	0
Fecal Coliform	cfu/100ml	--	--	--	0	0	--	0
Fecal Streptococci, Kf Agar	cfu/100ml	--	--	--	0	0	--	--
Heterotrophic Plate Count	cfu/ml	--	--	-- [4]	12	12	--	0
Total Coliform	cfu/100ml	0	--	--	**5**	**2**	--	0
General Chemistry								
Alkalinity (Total as CaCO3)	mg/l	--	--	500	284	295	--	290
Ammonia Nitrogen	mg/l	--	--	--	0.76	0.70	--	0.502
Chloride	mg/l	--	250	--	89	90	--	61
Chlorine, Total (Field)	mg/l	--	--	--	0.01	0	--	--
Chlorine, Free (Field)	mg/l	--	--	--	0	0	--	--
Color	color unit	--	5	--	<2	<2	--	96
Conductivity	uS/cm	--	--	--	848	853	--	747
Conductivity (Field)	uS/cm	--	--	--	823	813	--	2848
Dissolved Organic Carbon	mg/l	--	5	--	1.5	1.2	--	1.6
Fluoride	mg/l	1.5	--	--	0.29	0.27	--	0.27
Hardness, Calcium Carbonate	mg/l	--	--	100	*297*	*279*	--	*305*
Hydrogen Sulfide	mg/l	--	0.05	--	2.88	<0.10	--	0.21
Hydrogen Sulfide (Field)	mg/l	--	0.05	--	2	2	--	--
Ion Balance	no units	--	--	--	1.04	0.94	--	1.00
Nitrate as N	mg/l	10.0	--	--	0.14	<0.10	--	<0.10
Nitrite as N	mg/l	1.0	--	--	<0.10	<0.10	--	<0.10
Nitrogen, Total Kjeldahl	mg/l	--	--	--	0.74	0.87	--	0.629
pH	-	--	--	8.5	7.96	8.03	--	7.82
pH (Field)	-	--	--	8.5	7.6	7.5	--	7.15
Sulphate	mg/l	--	500 [5]	--	22	22	--	35
Tannin & Lignin	mg/l	--	--	--	<0.1	<0.1	--	<1.0
Temperature (Field)	deg c	--	15	--	11.4	11	--	11
Total Dissolved Solids	mg/l	--	500	--	551	554	--	486
Turbidity	ntu	--	5 [6]	-- [7]	102	37.1	--	13.2
Turbidity (Field)	ntu	--	5 [6]	-- [7]	91.9	26.9	0.72	--
Metals								
Calcium	mg/l	--	--	--	76	74	--	94
Iron	mg/l	--	0.3	--	1.48	0.35	--	1.63
Magnesium	mg/l	--	--	--	26	23	--	17
Manganese	mg/l	--	0.05	--	0.05	0.03	--	0.06
Potassium	mg/l	--	--	--	8	6	--	5
Sodium	mg/l	--	200 [8]	--	66	60	--	46
Phenols								
Phenolics, Total Recoverable	mg/l	--	--	--	0.002	<0.001	--	<0.001

Created by:CAMC
Checked by:KAM

Golder Associates Ltd.

ATTACHMENT 1

February 2012 Golder Report

February 2012

REPORT ON

Hydrogeology, Terrain Analysis and Impact Assessment Study 3406-3450 Frank Kenny Road

Submitted to:
J.L. Richards & Associates Limited
864 Lady Ellen Place
Ottawa, Ontario
K1Z 5M2

REPORT

Report Number: 11-1122-0129 (3000)
Distribution:

1 copy - J.L. Richards & Associates Limited
1 e-copy - J.L. Richards & Associates Limited
1 copy - Hydro One Networks Inc.
5 copies - City of Ottawa
1 copy - Bradley Bus Lines
2 copies - Golder Associates Ltd.

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by J.L. Richards & Associates Limited (JLR), on behalf of 743120 Ontario Inc., to conduct a hydrogeology, terrain analysis and impact assessment study in support of a proposed site of the future Hydro One Networks Inc. (HONI) Orleans Service Centre in Ottawa, Ontario (Figure 1). The property is comprised of two civic addresses, 3406 and 3450 Frank Kenny Road Site (see Figure 2), and is located in an industrial/agricultural area adjacent to the Village of Navan. The property is 5.32 hectares (13.16 acres) in area and is topographically flat. The northern part of the Site (3406 Frank Kenny Drive) is 2.53 hectares (6.26 acres) in area and is currently occupied by M. L. Bradley Bus Lines (Bradley), while the southern portion of the Site (3450 Frank Kenny Drive) is 2.79 hectares (6.9 acres) in area and is occupied by a residential bungalow and agricultural land (leased to a tenant by Bradley). HONI will initially lease a small portion of the south parcel of the Site (agricultural land). HONI will eventually lease to own 2.90 hectares south of the bus operation.

HONI proposes to build an operations facility on the south parcel. We understand that the proposed operations facility building will be approximately 30,000 square feet in size and will house up to 35 employees. It is proposed that water supply to the operations facility will be provided by a new water supply well. This study has been prepared based on estimates of the future staffing levels provided to Golder, with the estimated water demand equal to approximately 5,000 L/day.

The purpose of the hydrogeology and terrain analysis study is to determine the following:

- If adequate quantities of potable water are available for the proposed development;
- If the soils are suitable for the installation of an on-site sewage disposal system; and,
- If the impact from the sewage system on downgradient water resources is within acceptable limits.

1.1 Scope of Work

The scope of work for the hydrogeology and terrain analysis study was based on the work program outlined in the Golder proposal to JLR, dated June 17, 2011. The hydrogeology study consisted of the following:

- Collection of background information for the site and surrounding area;
- Drilling of one test well on the site to determine the quality and quantity of groundwater available for water supply;
- Conducting a pumping test on the test well consisting of a pumping phase (6 hours) followed by a recovery phase (up to 10 hours);
- Monitoring of groundwater levels during the pumping and recovery phases in the pumping well and in existing water wells located at the Bradley office and at the nearby residence;
- Collection of groundwater samples from the pumping well after one hour of pumping and just before pump shut-off;
- Collection of groundwater samples at the residence and at the Bradley office; and,

- Submission of these groundwater samples for the analysis of chemical, physical and bacteriological parameters standard to subdivision supply requirements.

The terrain analysis consisted of the following:

- The excavation of four test pits and an inspection of the materials encountered;
- A review of materials encountered during drilling of seven boreholes completed as a part of the geotechnical investigation for the site (Golder, 2012); and,
- Installation of a shallow monitoring well in the clay overburden, collection of a groundwater sample and submission of this sample for analysis of nitrate.

1.2 Impact Assessment

A groundwater impact assessment was conducted in accordance with MOE Procedure D-5-4 (MOE, 1996b). Although Procedure D-5-4 does not strictly apply to this type of development, the City of Ottawa requested, during the Pre-Application consultation meeting held October 18, 2011, that the hydrogeological report incorporate an impact assessment of groundwater resources with respect to hazardous materials storage at the site.

1.3 Applicable Environmental Criteria

The procedures for the assessment of potential groundwater impact generally followed the MOE Guideline entitled “Technical Guideline for Individual On-site Sewage Systems: Water Quality Impact Risk Assessment”, dated August 1996 (Guideline D-5-4). It is assumed that the sewage system will be designed to be a small sewage system (handling no more than 10,000 L/day of effluent). The terrain analysis was not intended to provide specific design of the on-site sewage disposal system, but provided general recommendations for the type of system that would be appropriate for the site.

The procedures for the assessment of water supply for the site generally followed the Ministry of the Environment (MOE) guideline entitled, “Technical Guideline for Private Wells: Water Supply Assessment,” dated August 1996 (MOE Procedure D-5-5).

2.0 BACKGROUND INFORMATION

2.1 Surficial Geology

Published geological mapping indicates that in the area of 3450 Frank Kenny Road, surficial materials consist of offshore marine deposits (clay, silty clay and silt) and glacial till (see Figure 3, Surficial Geology). In the wider area, organic deposits, deltaic and estuary deposits and exposed bedrock are also present. Published geological mapping also indicates that the depth to bedrock is expected to be approximately 2 to 15 metres (Figure 4).

The well record from the existing water supply well at the Bradley office described 5.8 metres of clay underlain by 3.7 metres of glacial till (hardpan) over shale bedrock (Appendix A). At PW11-1, based on the well record, 8.9 metres of silty clay was found to overlie shale bedrock.

2.2 Bedrock Geology

Two bedrock units are indicated to be exposed in the area of the site: the Lindsay Formation and the overlying Billings Formation which are both Upper Ordovician in age (see Figure 5, Bedrock Geology). The Lindsay Formation consists of fossiliferous limestone with shaley partings while the Billings Formation consists of non-calcareous shale with thin limestone interbeds (Williams, 1991). Aquifers in the Lindsay Formation are restricted to seams that are in the calcareous shale layers (GSC, 2004). In the Billings Formation, supply is generally sufficient for domestic use with thick sections with no water. The quality is generally poor with mineral content in excess of accepted levels; aquifers commonly yield saline and sulfurous water (GSC, 2004).

2.3 Hydrogeology

A hydrogeological investigation of the Navan area water supply was conducted by Golder (Golder, 2001). The geology was found to consist of up to 10 m of clay followed by a glacial till aquifer underlain by bedrock of the Billings Formation shale (and/or dark grey to black limestone of the Eastview formation), underlain by the Gull River Formation limestone. Background information indicated that the gravel till was the best source of water and that the shale and limestone were poor water quality producers.

Golder also conducted a desktop review to assess the potential for provision of public water and wastewater services to all privately serviced villages in the City of Ottawa, including the village of Navan (Golder, 2007). The assessment was conducted for the area within 1 kilometre of the village boundaries, and examined information sources such as City of Ottawa base mapping, Ministry of Environment (MOE) water well information system (WWIS) and available mapping of topography, surficial and bedrock geology, drift thickness and surface water bodies. Municipal water supply and waste water services are not available at the site.

Based on an analysis of the WWIS for wells located within 1 km of the village of Navan, 81 overburden wells and 216 bedrock wells were identified. The well depths were reported to be up to 100 metres, with 88% of wells being 30 metres deep or less. Of the overburden wells, 90% reported well yields of 20 L/min/m or less; 36% of wells were reported as having fresh water and 64% of wells had salty water. Of the bedrock wells, 91% reported well yields of 20 L/min/m or less; 54% of wells were reported as having fresh water and 46% of wells had salty water.

Groundwater use within the vicinity of the site is limited to private water supply wells for residences and small businesses. Four groundwater users were identified within 500 metres of the site:

1) The Bradley Bus office well (3406 Frank Kenny Road);

2) On-site residential well (3450 Frank Kenny Road);

3) Private well at the property immediately north of the site (3372 Frank Kenny Road); and,

4) Private well located south of the site (1533 Colonial Road).

3.0 TERRAIN ANALYSIS

3.1 Field Investigation Program

Test pits TP11-1, TP11-2, TP11-3 and TP11-4 and boreholes BH11-4 and BH11-5 were advanced in the area of the proposed on-site sewage disposal system. Details of the subsurface conditions at each location are presented on the Record of Test Pits in Appendix B. The locations of the test pits are shown on Figure 2.

A groundwater sample was collected from the standpipe installed in borehole BH11-5 and submitted for analysis of nitrate in order to determine the background nitrate concentration.

3.2 Subsurface Conditions

This section provides a summarized account of the subsurface soils and groundwater conditions on the site based on the information obtained from the test pits completed on October 31, 2011. It is noted that in some cases the stratigraphic boundaries within the overburden represent a transition between soil types rather than an exact plane of geologic change.

Brown topsoil with a thickness of 0.15 metres was encountered at ground surface at all four test pit locations. Grey brown silty clay was found below the topsoil at all test pit locations. At test pit TP11-2, 1.40 metres of grey brown silty sand with some gravel and clay, with cobbles, and boulders (glacial till) was encountered below the silty clay; however, the sample taken from this layer was found to have a high clay content and was too fine for grain size analysis. The test pits were all terminated in the silty clay at depths of 1.60 to 2.00 mbgs, with the exception of test pit TP11-2 which was terminated in the glacial till at 2.40 mbgs. Groundwater seepage was observed in the test pits at depths of 1.50 to 2.00 mbgs.

Shale was encountered at depths of 3.1 to 4.3 mbgs in boreholes BH11-4, BH11-5, BH11-6 and BH11-7.

A nitrate concentration of less than 0.1 mg/L was measured in the groundwater sample collected from borehole BH11-5.

3.3 Class IV Sewage Disposal Systems

The following sewage system recommendations are based on a conventional Class IV Sewage System comprised of a septic tank and an absorption trench leaching bed. Design parameters contained in this section are derived from the 2006 Ontario Building Code (OBC), and are intended as guidelines only with respect to the feasibility of constructing a system at the proposed operations building. Prior to construction of a sewage system, the system will be designed for the proposed operations building.

For the purpose of demonstrating that this site has adequate land area for sewage disposal, the most conservative soil conditions and largest treatment and disposal area requirements were assumed. It is our understanding that total sewage flows are estimated to be in the range of 3,000 L/day to 5,000 L/day, based on estimates of future staffing levels of 35 employees.

The shallow soil profile in the majority of the site is characterized by a topsoil layer followed by a silty clay unit to at least 1.40 mbgs. Groundwater was encountered below the topsoil layer in the test pits at depths of 1.50 to 2.00 mbgs.

Due to the low permeability native soils present at the site a raised to partially raised leaching bed will be required. Imported sand is required for the construction of raised leaching beds. A minimum of 500 metres of distribution piping is required for conventional leaching bed construction based on the following formula:

$$L = \frac{QT}{200}$$

where:

- L = total length of the distribution pipe in metres;
- Q = the total daily design sanitary sewage flow in litres (5,000 L/day, assuming that the sewage system will be designed to be a small sewage system; and,
- T = the design percolation time imported sand (assumed to be 10 minutes (OBC Table 2)).

The clearances around the distribution piping are to be a minimum of those shown in the OBC Table 8.2.1.6 B. The leaching bed area should be chosen such that the bed is at no steeper grade than 1V:4H, and not in an area prone to flooding. The bed area should be backfilled so as not to settle and create any depressions. The bed should be shaped to shed water, and should be protected from erosion and any compaction, stress or pressure that could negatively impact the bed.

The percolation time of the silty clay encountered below the topsoil across most of the site will exceed 50 minutes per centimetre (see OBC Table 3). The loading rate corresponding to this percolation time is equal to 4 L/m^2/day (see OBC Table 8.7.4.1.A). Therefore, the leaching bed area required for a total daily design sanitary sewage flow of 5,000 L/day is 1,250 m^2.

The grassed area east of the proposed building footprint, adjacent to Frank Kenny Road is approximately 4,900 m^2. The 1,250 m^2 sewage disposal footprint can be accommodated on this area of the site.

4.0 HYDROGEOLOGY STUDY

It should be noted that the hydrogeology study was completed in conjunction with a Phase I ESA and geotechnical program. Results of these investigations are provided under separate cover (Golder 2011 and 2012).

4.1 Field Investigation Program

4.1.1 Health and Safety

Prior to initiating the fieldwork, Golder developed and implemented site-specific protocols to protect the health and safety of its employees and subcontractors through the preparation of a site-specific Health and Safety Plan.

Underground Services Locators Ltd. (a private service utility locator) was retained to coordinate utility clearances with the local utility companies, and to clear the proposed borehole location prior to the initiation of the fieldwork.

4.1.2 Well Construction

A new well, PW11-1, shown on Figure 2, was drilled on November 4, 2011 by Bourgeois Well Drilling Ltd. of St. Albert, Ontario. The installation of the well casing was monitored by Golder field staff to ensure that appropriate grouting procedures were followed.

4.1.3 Pumping Test

A pumping test of approximately 360 minutes in duration was conducted on PW11-1 from approximately 9:30 am until 4 pm on November 7, 2011. The well was pumped at a rate of approximately 15.1 L/min (4 US GPM) for the first 32 minutes of the test, after which the rate was reduced to approximately 9.5 L/min (2.5 US GPM) due to the large amount of drawdown observed in the pumping well. At the 40-minute mark, the rate was increased to 10.2 L/min (2.7 US GPM) and at 66 minutes, increased again to 11.3 L/min (3 US GPM) for the remainder of the test. The pumping rates used in the test are summarized in the following table.

Time Period of Pumping Test	Approximate Pumping Rate
0 to 32 minutes	15.1 L/min
32 to 40 minutes	9.5 L/min
40 to 66 minutes	10.2 L/min
66 minutes to end of test	11.3 L/min

During the test, a total of 4,328 L of water was extracted from the aquifer.

The water levels were measured in PW11-1 and at two observation wells (the nearby residential well and the Bradley Bus well) manually, using an electric water level tape, and electronically, using pressure transducer loggers which took measurements at appropriate intervals. The residential well and the Bradley Bus well are located approximately 60 metres and 220 metres from PW11-1, respectively. A barometric pressure logger was used on-site for post-processing barometric compensation. Following the cessation of pumping, groundwater levels in PW11-1 and the observation wells were measured until water levels had recovered to pre-pumping levels.

Pumped water was discharged to the roadside ditch located approximately 90 metres southeast of PW11-1.

4.1.4 Groundwater Sampling

Two samples of the pumped groundwater were collected from PW11-1 (labelled S-1 and S-4) and submitted to Exova Laboratories of Ottawa for analysis of chemical, physical and microbiological analyses of parameters commonly used to evaluate water quality for residential subdivision developments. The first sample was collected 70 minutes after the start of pumping on November 11, 2011, and the second sample was collected just prior to the end of pumping.

The two existing water supply wells at the site (at the residence (labelled S-2), and at the bus company (labelled S-3)) were sampled after approximately 3.5 hours and 4 hours into the pumping test, respectively, and submitted to Exova Laboratories for chemical, physical and microbiological analyses of parameters standard to subdivision supply requirements.

The turbidity of the discharge water was monitored periodically in the field during the pumping test. Field measurements of temperature, pH, conductivity, chlorine residual, turbidity and hydrogen sulphide were taken at PW11-1 and the observation wells at the time of sampling. All analyses were compared to the applicable maximum acceptable concentrations (MAC), interim maximum acceptable concentrations (IMAC), or aesthetic objectives (AO) found in the Technical Support Document for Ontario Drinking Water Quality Standards, Objectives and Guidelines (ODWQS) (MOE, 2006).

4.2 Field Investigation Results

4.2.1 Subsurface Conditions

Based on the water well record, the 152 millimetre diameter well was completed at a depth of 24.3 metres. During drilling, silty clay overburden was encountered to a depth of 8.9 metres where shale bedrock was encountered. PW11-1 was cased to a depth of 10.9 metres using steel casing. At the end of drilling, the groundwater level in PW11-1 was 9.5 metres below the top of the steel casing. The groundwater level on November 7, 2011, prior to the start of the pumping test, was 1.72 metres below the top of the steel casing. The water well record for PW11-1 is located in Appendix D.

4.2.2 Pumping Test and Observation Wells

The drawdown observed at PW11-1 during the November 2011 pumping test is illustrated on Figure 6, and the drawdown observed at the observation wells is illustrated on Figure 7. The two observation wells were in use during the pumping test on PW11-1 and the abrupt changes in the amount of drawdown measured in these wells were attributed to coincidental pumping from these wells during the pumping test. The general downward trend in measured water levels in the observation wells were assumed to represent the response from pumping PW11-1.

The water level recovery in PW11-1 achieved 95% recovery approximately 26 minutes following the cessation of pumping. The drawdown in the observation wells was small relative to the precision of the pressure transducer loggers and the manual water level tape, and relative to the drawdown caused by coincidental water usage at these wells during the pumping test. As a result, it was difficult to calculate the percent recovery at these wells following the cessation of the pumping test. The residual drawdown measured at the residential well 23 minutes after the end of pumping was 0.04 metres, and at the Bradley Bus well 53 minutes after the end of pumping was 0.02 metres.

Aquifer transmissivity was estimated using the Cooper and Jacob drawdown method (Cooper and Jacob, 1946) and the Theis recovery method (Theis, 1935) to interpret drawdown data collected during the pumping test at PW11-1 (see Appendix E). The water levels at the residential well and at the Bradley Bus well exhibited a decrease of approximately 0.06 metres and 0.03 metres, respectively, in response to pumping at PW11-1. Based on pumping well and observation well data, the aquifer transmissivity is indicated to range from approximately 0.5 to 99 m^2/day, and the storativity is indicated to range from approximately $1.1x10^{-4}$ to $2.6x10^{-4}$.

The wide range in transmissivity calculated from the data can be attributed to an imperfect hydraulic connection between the pumping well and the observation wells.

Based on the data obtained during the pumping test, it can be concluded that PW11-1 is capable of supplying at least 11.3 L/min (16,350 L/day). During the course of the six hour pumping test period, about 31 percent of the available drawdown was utilized while pumping at an average rate of 11.3 L/min. As such, the yield of PW11-1 considerably exceeds the assumed water usage for the new operations facility of 5,000 L/day.

Additional surging followed by pumping was performed on PW11-1 to reduce turbidity (Section 4.2.3.1). This additional well development not only reduced the turbidity, it substantially increased the yield of the well. The well maintained a pumping rate of 53 L/min for 6.5 hours and the water level measured at the end of pumping was 1.86 metres below the top of the well casing. A total of 20,700 L of water were extracted during this operation.

4.2.3 Groundwater Analytical Results

The field observations and the results of the laboratory microbiological, chemical and physical analyses for the groundwater samples collected from PW11-1, the Bradley Bus well and the residential well are summarized in Table 1 following the text of this report. The certificates of laboratory analyses are included in Appendix F.

All laboratory results were compared to the applicable maximum acceptable concentrations (MAC), interim maximum acceptable concentrations (IMAC), aesthetic objectives (AO) found in the Technical Support Document for Ontario Drinking Water Quality Standards (MOE, 2006).

4.2.3.1 PW11-1 (S-1 and S-4)

Analytical results of the groundwater samples collected from PW11-1 on November 7, 2011 indicate an AO exceedance for the total dissolved solids (TDS) concentration, which was measured to be 551 mg/L after 70 minutes of pumping and 554 mg/L after 6.3 hours of pumping, just before pump shut-off. The AO for TDS is 500 mg/L (MOE, 2006). The potential for corrosion or encrustation problems associated with elevated TDS was assessed by calculating the Langelier Saturation Indices (LSI) for the 70-minute and 6.3-hour samples, which were 0.1 and 0, respectively. These LSI values are within the range generally considered stable (between -0.5 and +0.5) and indicate that corrosion or encrustation problems are unlikely.

The field hydrogen sulphide concentrations measured in the samples collected after 70 minutes and 6.3 hours of pumping were 2 mg/L and 2 mg/L, respectively, greater than the AO of 0.05 mg/L. Laboratory measured concentrations of hydrogen sulphide were 2.88 mg/L (initial) and non-detectable at the end of the test. Hydrogen sulphide in these concentrations can be treated with conventional water treatment equipment.

The field turbidity concentrations measured in the samples collected after 70 minutes and 6.3 hours of pumping were 91.9 NTU and 26.9 NTU, respectively, greater than the AO of 5 mg/L (applicable at the point of

consumption). In accordance with Procedure D-5-5, the treatability limit for turbidity is 5 NTU for non-disinfected water supplies.

Based on the elevated levels of turbidity measured in the samples taken from PW11-1, a strategy was developed to reduce the turbidity of the groundwater at this well to below 1 NTU in order to meet the health-related objective under Table 2 of Procedure D-5-5. On December 22, 2011, the well was surged by the well driller and pumped at a rate of approximately 53 L/min (14 US GPM) for 6.5 hours. Just before pump shut-off, the field turbidity was measured to be 0.72 NTU, below the health-related objective under Procedure D-5-5.

The sodium concentration measured in the samples collected after 70 minutes and 6.3 hours of pumping, was 66 mg/L and 60 mg/L, respectively, which is below the aesthetic objective for sodium in drinking water of 200 mg/L. However, in accordance with Procedure D-5-5, the local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.

The iron concentrations measured in the samples collected after 70 minutes and 6.3 hours of pumping were 1.48 mg/L and 0.35 mg/L, respectively, slightly greater than the AO of 0.30 mg/L. In accordance with Procedure D-5-5, the treatability limit for iron is 10 mg/L. Iron in these concentrations can be treated with conventional water treatment equipment.

All of the bacteriological parameters with the exception of the heterotrophic plate count and total coliforms were measured below the laboratory method detection limits for the samples collected after 70 minutes and 6.3 hours of pumping. Heterotrophic plate counts of 12 and 12 cfu/mL were measured in the samples collected after 70 minutes and 6.3 hours of pumping, respectively. The presence of heterotrophic bacteria is not considered a health concern.

Total coliforms of 5 and 2 cfu/100mL were measured in the samples collected after 70 minutes and 6.3 hours of pumping, respectively, above the health-related ODWQS of 0 cfu/100mL established for water systems that are disinfected. In accordance with Procedure D-5-5, a total coliform count of less than 6 cfu/100mL is considered as indicative of acceptable water quality for a raw groundwater supply. However, despite acceptable raw water bacteriological quality, Hydro One has a policy that all groundwater supplies that service their facilities are equipped with disinfection equipment. This policy will apply to both the permanent facility and any temporary facility used by Hydro One.

All of the other results of chemical analysis for PW11-1 were below the respective MACs and AOs (see Table 1).

4.2.3.2 Residential Well (S-2)

Analytical results of the groundwater sample collected from the residential well on November 7, 2011 indicate an AO exceedance for the total dissolved solids (TDS) concentration, which was measured to be 645 mg/L. The AO for TDS is 500 mg/L (MOE, 2006). The potential for corrosion or encrustation problems associated with elevated TDS was assessed by calculating the Langelier Saturation Index (LSI), which was 0.3. This LSI value is within the range generally considered stable (between -0.5 and +0.5) and indicates that corrosion or encrustation problems are unlikely.

The field hydrogen sulphide concentration measured in the sample was 0.1 mg/L, greater than the AO of 0.05 mg/L, but within treatable limits.

The field turbidity concentration measured in the sample was 14.1 NTU, greater than the AO of 5 NTU. In accordance with Procedure D-5-5, the treatability limit for turbidity is 5 NTU. Elevated turbidity is frequently a function of insufficient well development.

The sodium concentration measured in the sample was 41 mg/L, which is below the aesthetic objective for sodium in drinking water of 200 mg/L. However, in accordance with Procedure D-5-5, the local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.

The iron concentration measured in the sample collected was 1.86 mg/L, respectively, greater than the AO of 0.30 mg/L. In accordance with Procedure D-5-5, the treatability limit for iron is 10 mg/L.

The manganese concentration measured in the sample collected was 0.08 mg/L, respectively, greater than the AO of 0.05 mg/L. In accordance with Procedure D-5-5, the treatability limit for manganese is 1.0 mg/L.

All of the other results of chemical analysis for the residential well were below the respective MACs and AOs (see Table 1).

All of the bacteriological parameters with the exception of the total coliforms and heterotrophic plate count were measured below the laboratory method detection limits for the sample collected. Total coliforms of 12 cfu/100mL were measured, above the health-related ODWQS of 0 cfu/100mL established for water systems that are disinfected. A total coliforms count of less than 6 cfu/100mL is generally considered acceptable for untreated supplies. A heterotrophic plate count of 5 cfu/mL was measured. The presence of heterotrophic bacteria is not considered a health concern. The owner of the well was notified of the coliform result. It is also noted that when the site is developed, the residence will be demolished and the residential well will be abandoned in accordance with O. Reg. 903.

The presence of elevated bacterial levels in groundwater is usually specific to a particular well, as opposed to a wider problem within a water supply aquifer. Although a determination of the reason for elevated bacterial levels at the residential well is outside the scope of this study, bacteria may be present in a well due to reasons such as improper well construction, deteriorating well casing, contamination during pump maintenance, etc. No information was provided on the construction of the residential well. The slightly elevated bacterial levels detected in the residential well would not be expected to affect the water quality at PW11-1, as demonstrated by the excellent bacteriological results obtained from this well.

4.2.3.3 Bradley Bus Well (S-3)

Analytical results of the groundwater sample collected from the Bradley Bus well on November 7, 2011 indicate an AO exceedance for the total dissolved solids (TDS) concentration, which was measured to be 650 mg/L. The AO for TDS is 500 mg/L (MOE, 2006). The potential for corrosion or encrustation problems associated with elevated TDS was assessed by calculating the Langelier Saturation Index (LSI), which was 0.1. This LSI value is within the range generally considered stable (between -0.5 and +0.5) and indicates that corrosion or encrustation problems are unlikely.

The laboratory-measured turbidity concentration measured in the sample was 7.6 NTU, greater than the AO of 5 NTU; however, the field turbidity concentration measured at the time of sampling was 3.77 NTU. In accordance with Procedure D-5-5, the treatability limit for turbidity is 5 NTU.

The sodium concentration measured in the sample was 51 mg/L, which is below the aesthetic objective for sodium in drinking water of 200 mg/L. However, in accordance with Procedure D-5-5, the local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.

The iron concentration measured in the sample collected was 0.82 mg/L, respectively, greater than the AO of 0.30 mg/L. In accordance with Procedure D-5-5, the treatability limit for iron is 10 mg/L.

All of the bacteriological parameters with the exception of the heterotrophic plate count were measured below the laboratory method detection limits for the sample collected. A heterotrophic plate count of 18 cfu/mL was measured. The presence of heterotrophic bacteria is not considered a health concern.

All of the other results of chemical analysis for the Bradley Bus well were below the respective MACs and AOs (see Table 1).

5.0 IMPACT ASSESSMENT

A nitrate dilution model was utilized to assess the potential impact of septic effluent on the properties adjoining 3450 Frank Kenny Road, The net potential infiltration was based on the regional climatic data for the Ottawa area provided by Environment Canada. The daily effluent loading was based on 125 L/day per employee, assuming that showers would be built in the operations centre. A maximum of 35 employees was assumed based on information provided by HONI. The background nitrate concentration was assumed to be less than 0.1 mg/L based on the groundwater sample taken from borehole BH11-5, and the nitrate concentration of the effluent was assumed to be 40 mg/L. The site area was assumed to be 2.90 hectares. The nitrate dilution calculation is provided in Appendix G.

With regard to treatment and dispersal of effluent from the leaching beds, the maximum nitrate concentration at the property boundary was calculated to be 9.4 mg/L, less than the ODWQS of 10 mg/L. It should be noted that this calculation is conservative since many of the 35 employees will spend the majority of their work day away from the operations facility, and the number of full-day equivalent employees at the facility will be less than 10. Nevertheless, a nitrate pre-treatment system may be considered for the operations facility, if required. It is concluded that the impact of the proposed operations facility on groundwater at the downgradient property boundary is considered acceptable in accordance with MOE Guideline D-5-4.

It is understood that the operations facility will include limited hazardous materials storage (e.g. PCBs). HONI has established procedures and guidelines for storage of hazardous materials that meet applicable provincial environmental requirements.

6.0 SUMMARY AND CONCLUSIONS

Based on the terrain evaluation and groundwater supply investigation carried out by Golder Associates at the site, the following summary and conclusions are provided:

a) A septic system at the site must be constructed in accordance with the 2006 Ontario Building Code (OBC). Section 3.3 provides general septic leaching bed design considerations. Based on these considerations, the site can accommodate a septic field for the proposed operations centre. Prior to construction of a septic system, detailed design will be required;

b) According to the nitrate dilution calculation, maximum nitrate concentration at the property boundary was calculated to be 9.4 mg/L, less than the maximum of 10 mg/L under Procedure D-5-4. It is concluded that the impact of the proposed operations facility on groundwater at the downgradient property boundary is considered acceptable;

c) It is understood that the operations facility will include limited hazardous materials storage (e.g. PCBs). It is recommended that any hazardous materials storage on the site incorporate measures to prevent release of these materials to the environment, to prevent contamination of the aquifer from sources located at ground surface. HONI has established procedures and guidelines for storage of hazardous materials that meet applicable provincial environmental requirements;

d) The pumping test conducted at well PW11-1 suggests that a sufficient quantity of water is available in the bedrock to satisfy a daily water consumption of 16,350 L/day, above the assumed water usage for the new operations facility of 5,000 L/day or less based on 35 employees at the proposed operations centre;

e) The groundwater quality at well PW11-1 indicates that the water quality meets applicable standards or objectives for the analyzed parameters, with the exception of TDS, iron, hydrogen sulphide and total coliforms. Treatment may be necessary to reduce the iron and hydrogen sulphide concentrations below the AOs. Common techniques for iron include water softeners, manganese greensand filters or other oxidizing media. Corrosion or encrustation problems associated with TDS are considered unlikely. Total coliforms were measured to be 5 and 2 cfu/100mL in raw samples from the well, slightly above the health-related ODWQS of 0 cfu/100mL established for water systems that are disinfected; however, in accordance with Procedure D-5-5, a total coliform count of less than 6 cfu/100mL is considered as indicative of acceptable water quality; and,

f) Based on the small amount of drawdown measured at the observation wells, located approximately 61 and 220 metres from PW11-1, it is not expected that the proposed use of PW11-1 would adversely affect other nearby groundwater users, including the nearby residence and the Bradley Bus office.

7.0 LIMITATIONS AND USE OF REPORT

This letter report was prepared for the exclusive use of the J.L. Richards & Associates, 743120 Ontario Inc. and Hydro One Networks Inc. Should additional parties require reliance on this report, written authorization from Golder Associates Ltd. would be required. The report, which specifically includes all tables, figures and attachments is based on data and information collected during the hydrogeology assessment conducted by Golder Associates Ltd. and is based solely on the conditions of the property at the time of the field investigation, supplemented by historical information and data obtained by Golder Associates Ltd. as described in this report.

The services performed as described in this letter report were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

Any use which a third party makes of this letter report, or any reliance on, or decisions to be made based on it, are the responsibilities of such third parties. Golder Associates Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this letter.

The content of this letter report is based on information collected during our investigation, our present understanding of the site conditions, and our professional judgement in light of such information at the time of this letter report. This letter report provides a professional opinion and therefore no warranty is either expressed, implied, or made as to the conclusions, advice and recommendations offered in this letter report. This letter report does not provide a legal opinion regarding compliance with applicable Canadian laws. With respect to regulatory compliance issues, it should be noted that regulatory statutes and the interpretation of regulatory statutes are subject to change.

The findings and conclusions of this letter report are valid only as of the date of this report. If new information is discovered in future work, including excavations, borings, or other studies, Golder Associates Ltd. should be requested to re-evaluate the conclusions of this letter report, and to provide amendments as required. The groundwater supply well installed during the course of this investigation has been left in place. This well is the property of the owner/client and not Golder Associates Ltd.

8.0 CLOSURE

We trust this report satisfies your current needs. If you have any questions regarding this report, please contact the undersigned.

GOLDER ASSOCIATES LTD.

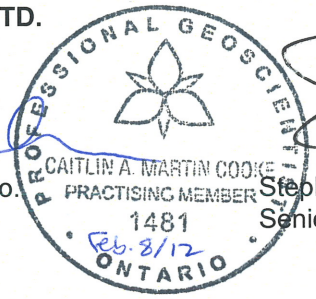

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Table 1
Summary of Groundwater Analytical Results
3406 and 3450 Frank Kenny Road

Parameter	Unit	(2) (1) ODWQS(169/03)-Health	(4) (3) ODWQS-AO	(6) (5) MOE D-5-5	PW11-1 11/7/2011 S-1	PW11-1 11/7/2011 S-4	PW11-1 12/22/2011 PW11-1
Bacterial							
Coliform	cfu/100ml	0	--	--	**5**	**2**	--
Escherichia coli	cfu/100ml	0	--	--	0	0	--
Fecal Coliform	cfu/100ml	--	--	--	0	0	--
Fecal Streptococci, Kf Agar	cfu/100ml	--	--	--	0	0	--
Heterotrophic Plate Count	cfu/ml	--	--	--	12	12	--
General Chemistry							
Alkalinity as CaCO3	mg/l	--	--	--	284	295	--
Ammonia Nitrogen	mg/l	--	--	--	0.76	0.70	--
Chloride	mg/l	--	250	250	89	90	--
Chlorine, Total (Field)	mg/l	--	--	--	0.01	0	--
Chlorine, Free (Field)	mg/l	--	--	--	0	0	--
Color	color unit	--	5	7	<2	<2	--
Conductivity	uS/cm	--	--	--	848	853	--
Conductivity (Field)	uS/cm	--	--	--	823	813	--
Dissolved Organic Carbon	mg/l	--	5	10	1.5	1.2	--
Fluoride	mg/l	1.5	--	--	0.29	0.27	--
Hardness, Calcium Carbonate	mg/l	--	--	--	297	279	--
Hydrogen Sulfide	mg/l	--	0.05	--	2.88	<0.10	--
Hydrogen Sulfide (Field)	mg/l	--	0.05	--	2	2	--
Ion Balance	-	--	--	--	1.04	0.94	--
Nitrate as N	mg/l	10	--	--	0.14	<0.10	--
Nitrite as N	mg/l	1	--	--	<0.10	<0.10	--
Nitrogen, Total Kjeldahl	mg/l	--	--	--	0.74	0.87	--
pH	-	--	--	--	7.96	8.03	--
pH (Field)	-	--	--	--	7.6	7.5	--
Sulfate	mg/l	--	500 (8)	500	22	22	--
Tannin & Lignin	mg/l	--	--	--	<0.1	<0.1	--
Temperature (Field)	deg c	--	15	--	11.4	11	--
Total Dissolved Solids	mg/l	--	500	-- (13)	551	554	--
Turbidity	ntu	--	5 (9)	5	*102*	*37.1*	--
Turbidity (Field)	ntu	--	5 (9)	5	*91.9*	*26.9*	0.72
Metals							
Calcium	mg/l	--	--	--	76	74	--
Iron	mg/l	--	0.3	5 (12)	1.48	0.35	--
Magnesium	mg/l	--	--	--	26	23	--
Manganese	mg/l	--	0.05	1	0.05	0.03	--
Potassium	mg/l	--	--	--	8	6	--
Sodium	mg/l	--	200 (11)	200	66	60	--
Phenols							
Phenolics, Total Recoverable	mg/l	--	--	--	0.002	<0.001	--

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Table 1
Summary of Groundwater Analytical Results
3406 and 3450 Frank Kenny Road

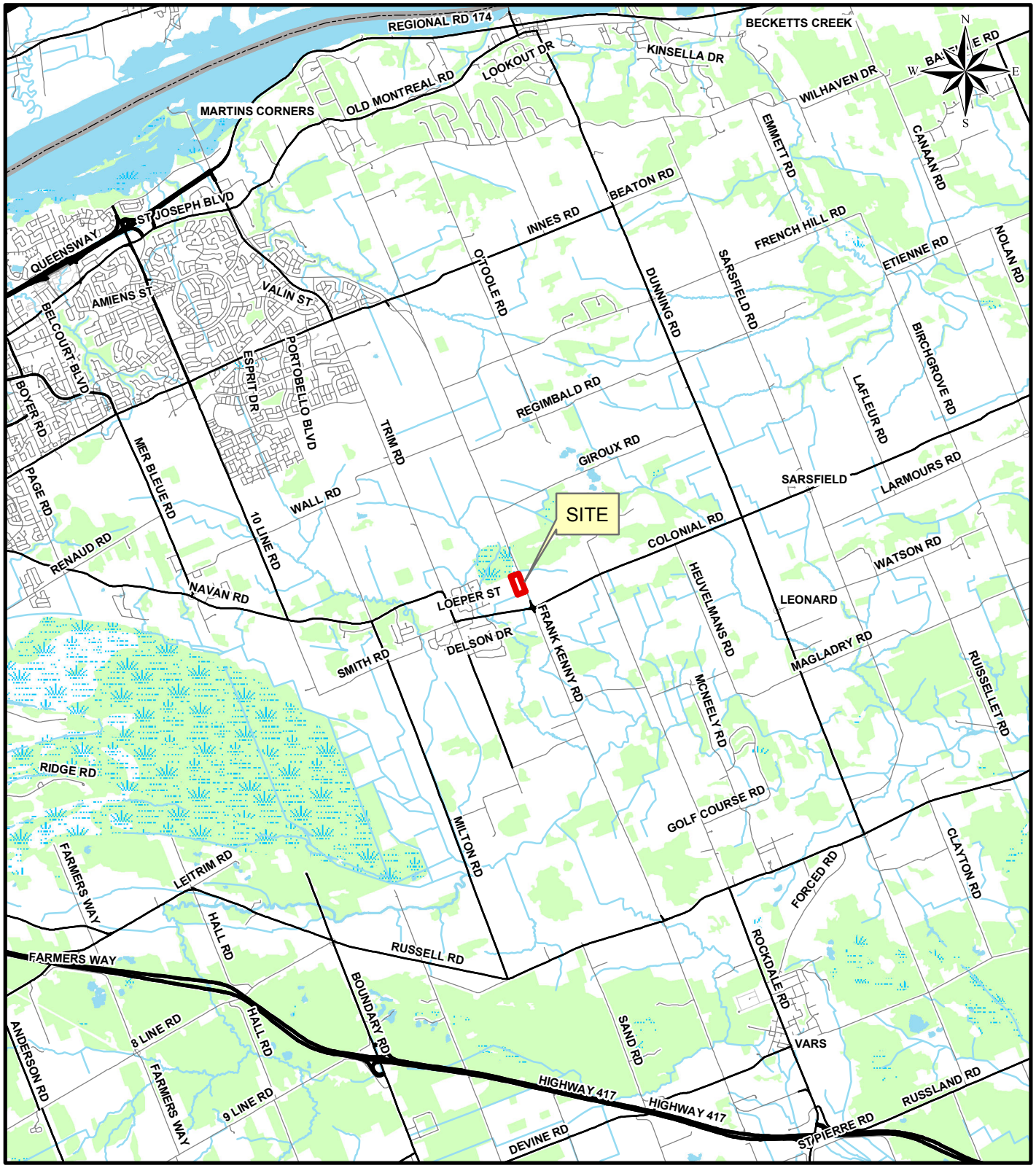
Parameter	Unit	(2) (1) ODWQS(169/03)-Health	(4) (3) ODWQS-AO	DOMESTIC WELL 11/7/2011 S-2
Bacterial				
Coliform	cfu/100ml	0	--	**12**
Escherichia coli	cfu/100ml	0	--	0
Fecal Coliform	cfu/100ml	--	--	0
Fecal Streptococci, Kf Agar	cfu/100ml	--	--	0
Heterotrophic Plate Count	cfu/ml	--	--	5
General Chemistry				
Alkalinity as CaCO3	mg/l	--	--	312
Ammonia Nitrogen	mg/l	--	--	0.14
Chloride	mg/l	--	250	80
Chlorine, Total (Field)	mg/l	--	--	0
Chlorine, Free (Field)	mg/l	--	--	0
Color	color unit	--	5	<2
Conductivity	uS/cm	--	--	992
Conductivity (Field)	uS/cm	--	--	940
Dissolved Organic Carbon	mg/l	--	5	1.3
Fluoride	mg/l	1.5	--	0.11
Hardness, Calcium Carbonate	mg/l	--	--	471
Hydrogen Sulfide	mg/l	--	0.05	0.14
Hydrogen Sulfide (Field)	mg/l	--	0.05	0.1
Ion Balance	-	--	--	1.08
Nitrate as N	mg/l	10	--	<0.10
Nitrite as N	mg/l	1	--	<0.10
Nitrogen, Total Kjeldahl	mg/l	--	--	0.26
pH	-	--	--	7.91
pH (Field)	-	--	--	7.41
Sulfate	mg/l	--	500 (8)	95
Tannin & Lignin	mg/l	--	--	<0.1
Temperature (Field)	deg c	--	15	11.4
Total Dissolved Solids	mg/l	--	500	645
Turbidity	ntu	--	5 (9)	*28.4*
Turbidity (Field)	ntu	--	5 (9)	*14.1*
Metals				
Calcium	mg/l	--	--	169
Iron	mg/l	--	0.3	1.86
Magnesium	mg/l	--	--	12
Manganese	mg/l	--	0.05	0.08
Potassium	mg/l	--	--	3
Sodium	mg/l	--	200 (11)	41
Phenols				
Phenolics, Total Recoverable	mg/l	--	--	<0.001

Table 1
Summary of Groundwater Analytical Results
3406 and 3450 Frank Kenny Road

Parameter	Unit	(2) (1) ODWQS(169/03)-Health	(4) (3) ODWQS-AO	BUS DEPOT WELL 11/7/2011 S-3
Bacterial				
Coliform	cfu/100ml	0	--	0
Escherichia coli	cfu/100ml	0	--	0
Fecal Coliform	cfu/100ml	--	--	0
Fecal Streptococci, Kf Agar	cfu/100ml	--	--	0
Heterotrophic Plate Count	cfu/ml	--	--	18
General Chemistry				
Alkalinity as CaCO3	mg/l	--	--	332
Ammonia Nitrogen	mg/l	--	--	0.07
Chloride	mg/l	--	250	104
Chlorine, Total (Field)	mg/l	--	--	0.02
Chlorine, Free (Field)	mg/l	--	--	0.01
Color	color unit	--	5	2
Conductivity	uS/cm	--	--	1000
Conductivity (Field)	uS/cm	--	--	964
Dissolved Organic Carbon	mg/l	--	5	1.6
Fluoride	mg/l	1.5	--	<0.10
Hardness, Calcium Carbonate	mg/l	--	--	439
Hydrogen Sulfide	mg/l	--	0.05	<0.01
Hydrogen Sulfide (Field)	mg/l	--	0.05	0
Ion Balance	-	--	--	1.06
Nitrate as N	mg/l	10	--	<0.10
Nitrite as N	mg/l	1	--	<0.10
Nitrogen, Total Kjeldahl	mg/l	--	--	<0.10
pH	-	--	--	7.90
pH (Field)	-	--	--	7.23
Sulfate	mg/l	--	500 (8)	43
Tannin & Lignin	mg/l	--	--	<0.1
Temperature (Field)	deg c	--	15	13.2
Total Dissolved Solids	mg/l	--	500	650
Turbidity	ntu	--	5 (9)	*7.6*
Turbidity (Field)	ntu	--	5 (9)	3.77
Metals				
Calcium	mg/l	--	--	156
Iron	mg/l	--	0.3	0.82
Magnesium	mg/l	--	--	12
Manganese	mg/l	--	0.05	0.05
Potassium	mg/l	--	--	2
Sodium	mg/l	--	200 (11)	51
Phenols				
Phenolics, Total Recoverable	mg/l	--	--	<0.001

Footnotes:

Tables should be read in conjunction with the accompanying document.
< value = Indicates parameter not detected above laboratory method detection limit
> value = Indicates parameter detected above equipment analytical range
-- Chemical not analyzed or criteria not defined
(01) Ontario Drinking Water Quality Standards - Health Based Standards
(02) Bold = Parameter concentration greater than ODWQS(169/03)-Health
(03) Ontario Drinking Water Quality Standards - Aesthetic Objectives. Aesthetic Objectives are established for parameters that may impair the taste, odour or colour of water or which may interfere with good water quality control practices. For certain parameters, both aesthetic objectives and health-related MACs have been derived.
(04) Underline = Parameter concentration greater than ODWQS-AO
(05) Maximum concentration considered reasonably treatable for several aesthetic parameters as found in MOE Procedure D-5-5, Technical Guideline for Private Wells: Water Supply Assessment, Last Revision August 1996.
(06) Italic = Parameter concentration greater than MOE D-5-5
(07) Increases in HPC concentrations above baseline levels are considered undesirable.
(08) There may be a laxative effect in some individuals when sulphate levels exceed 500 mg/L.
(09) Applicable for all waters at the point of consumption.
(10) The Operational Guidelines for filtration processes are provided as performance criteria in the Procedure for Disinfection of Drinking Water in Ontario.
(11) The aesthetic objective for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.
(12) iron concentrations up to up to 5.0 mg/L treatable with water softeners or manganese greensand filters; iron concentrations between 5.0 to 10.0 mg/L treatable by oxidation with filtration through proprietary filter media or chlorination followed by sand or multimedia filtration
(13) requires written rationale that corrosion, encrustation or taste problems will not occur



NOTE

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 10-1122-0129/3000

REFERENCE

DIGITAL BASE MAP DATA SUPPLIED BY DMTI SPATIAL INC. CANMAP, 2008
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: MTM ZONE 9

2,500 0 2,500
SCALE 1:100,000 METRES

Golder Associates
Ottawa, Ontario

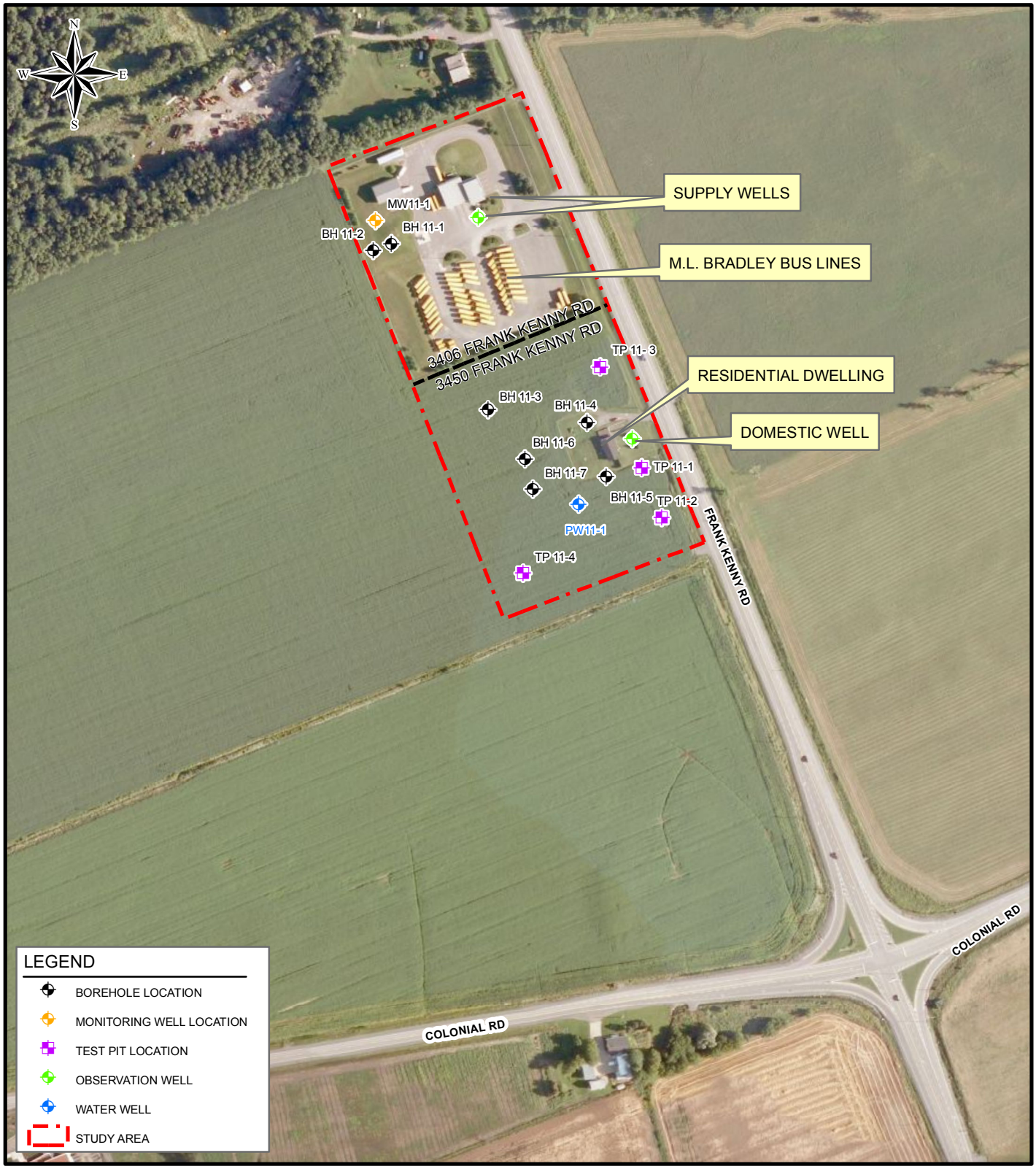
PROJECT No.	11-1122-0129
SCALE	AS SHOWN
REV.	0
DATE	Nov. 2011
DESIGN	CAMC
GIS	BJ
CHECK	CAMC
REVIEW	SRW

TITLE

KEY PLAN

PROJECT
TERRAIN ANALYSIS AND HYDROGEOLOGICAL STUDY
3406-3450 FRANK KENNY ROAD, OTTAWA, ONTARIO

FIGURE 1



NOTE

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD.' REPORT NO. 11-1122-0129/3000

REFERENCE

DIGITAL BASE MAP DATA SUPPLIED BY ESRI CANADA 2011.
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

100 0 100
SCALE 1:4,000 METRES

Golder Associates
Ottawa, Ontario

PROJECT No.	11-1122-0129	CHECK	CAMC
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DATE	Nov. 2011		
DESIGN	CAMC		
GIS	BJ		

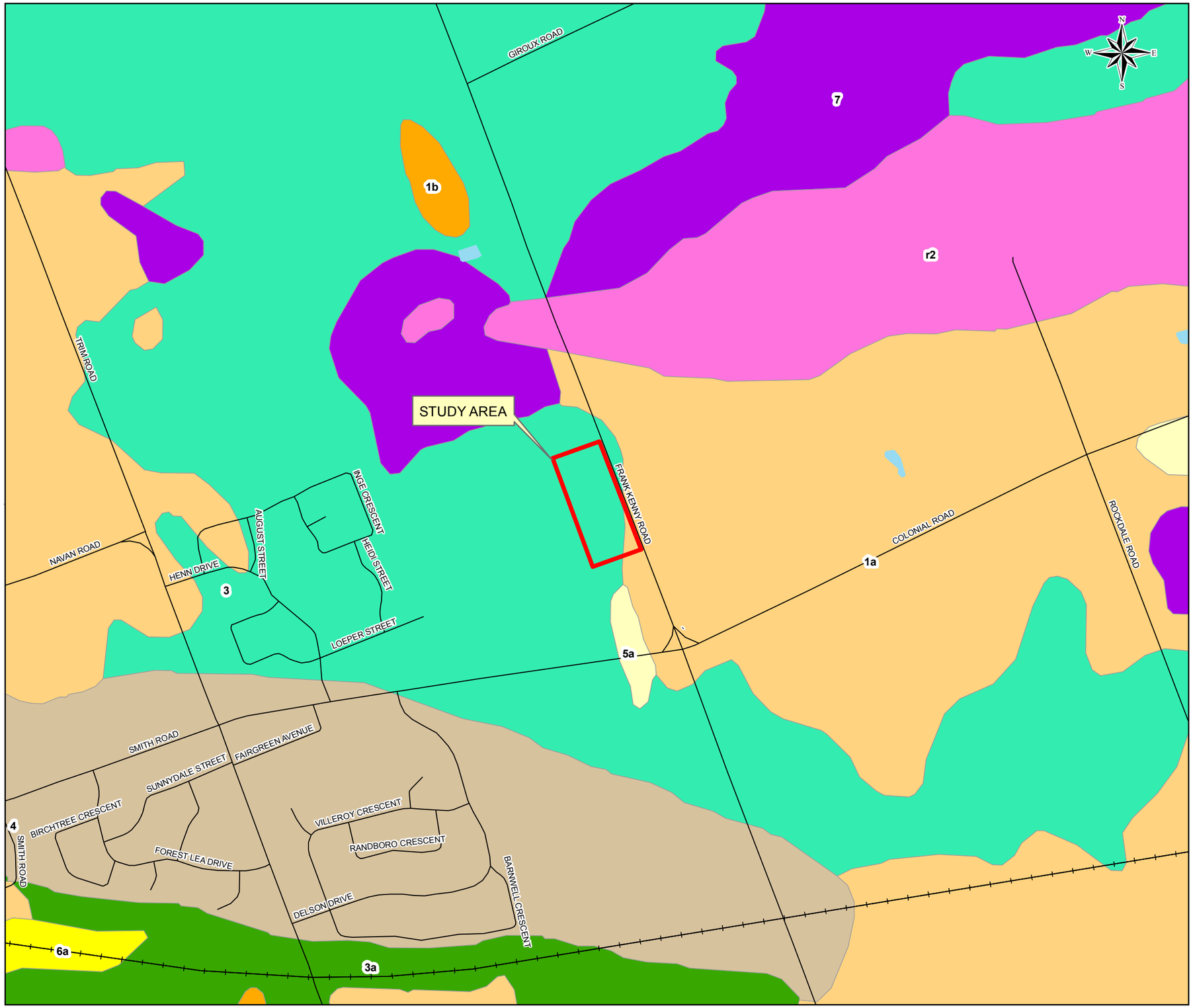
TITLE

SITE PLAN

PROJECT
TERRAIN ANALYSIS AND HYDROGEOLOGICAL STUDY
3406-3450 FRANK KENNY ROAD, OTTAWA, ONTARIO

FIGURE 2

Path: N:\Active\2011\1122 - Contaminated Lands\11-1122-0129 Hydro One Frank Kenny Road\Spatial_IMMXD\Phase 3000\11111220129-3000-02.mxd



LEGEND

SURFICIAL GEOLOGY

- 1a TILL, PLAIN WITH LOCAL RELIEF <5m
- 1b TILL, DRUMLINIZED
- 1c TILL, HUMMOCKY TO ROLLING WITH LOCAL RELIEF 5 TO 10 m
- 2 ICE CONTACT STRATIFIED DRIFT: GRAVEL & SAND
- 3 **OFFSHORE MARINE DEPOSITS: CLAY, SILTY CLAY & SILT**
- 3_g **OFFSHORE MARINE DEPOSITS: CLAY, SILTY CLAY & SILT (GULLIES & RAVINES)**
- 3a OFFSHORE MARINE DEPOSITS: CLAY & SILT UNDERLYING EROSIONAL TERRACES
- 3a_g OFFSHORE MARINE DEPOSITS: CLAY & SILT UNDERLYING EROSIONAL TERRACES (GULLIES & RAVINES)
- 4 DELTAIC AND ESTUARY DEPOSITS: MEDIUM TO FINE GRAINED SAND
- 4_g DELTAIC AND ESTUARY DEPOSITS: MEDIUM TO FINE GRAINED SAND (GULLIES & RAVINES)
- 5a NEARSHORE SEDIMENTS: GRAVEL, SAND & BOULDERS
- 5b NEARSHORE SEDIMENTS: FINE TO MEDIUM GRAINED SAND
- 6a ALLUVIAL DEPOSITS: SILTY SAND, SILT, SAND & CLAY
- 6a_g ALLUVIAL DEPOSITS: SILTY SAND, SILT, SAND & CLAY (GULLIES & RAVINES)
- 6b ALLUVIAL DEPOSITS: MEDIUM GRAINED STRATIFIED SAND WITH SOME SILT
- 6b_g ALLUVIAL DEPOSITS: MEDIUM GRAINED STRATIFIED SAND WITH SOME SILT (GULLIES & RAVINES)
- 7 ORGANIC DEPOSITS: MUCK & PEAT
- d DUNE
- d_g DUNE (GULLIES & RAVINES)
- l LANDSLIDE AREA
- l_g LANDSLIDE AREA (GULLIES & RAVINES)
- r1 BEDROCK: INTRUSIVE & METAMORPHIC
- r2 BEDROCK: LIMESTONE, DOLOMITE, SANDSTONE & LOCAL SHALE
- r2_g BEDROCK: LIMESTONE, DOLOMITE, SANDSTONE & LOCAL SHALE (GULLIES & RAVINES)
- zz WATER

NOTE

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT No. 11-1122-0129/3000

REFERENCE

BÉLANGER, J. R., URBAN GEOLOGY OF THE NATIONAL CAPITAL AREA, GEOLOGICAL SURVEY OF CANADA, OPEN FILE D3256, 2001
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 18

500 0 500
1:12,000 METRES

PROJECT
TERRAIN ANALYSIS AND HYDROGEOLOGICAL STUDY
3406-3450 FRANK KENNY ROAD, OTTAWA, ONTARIO

TITLE
SURFICIAL GEOLOGY

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PROJECT No. 11-122-0129			SCALE AS SHOWN	REV. 0
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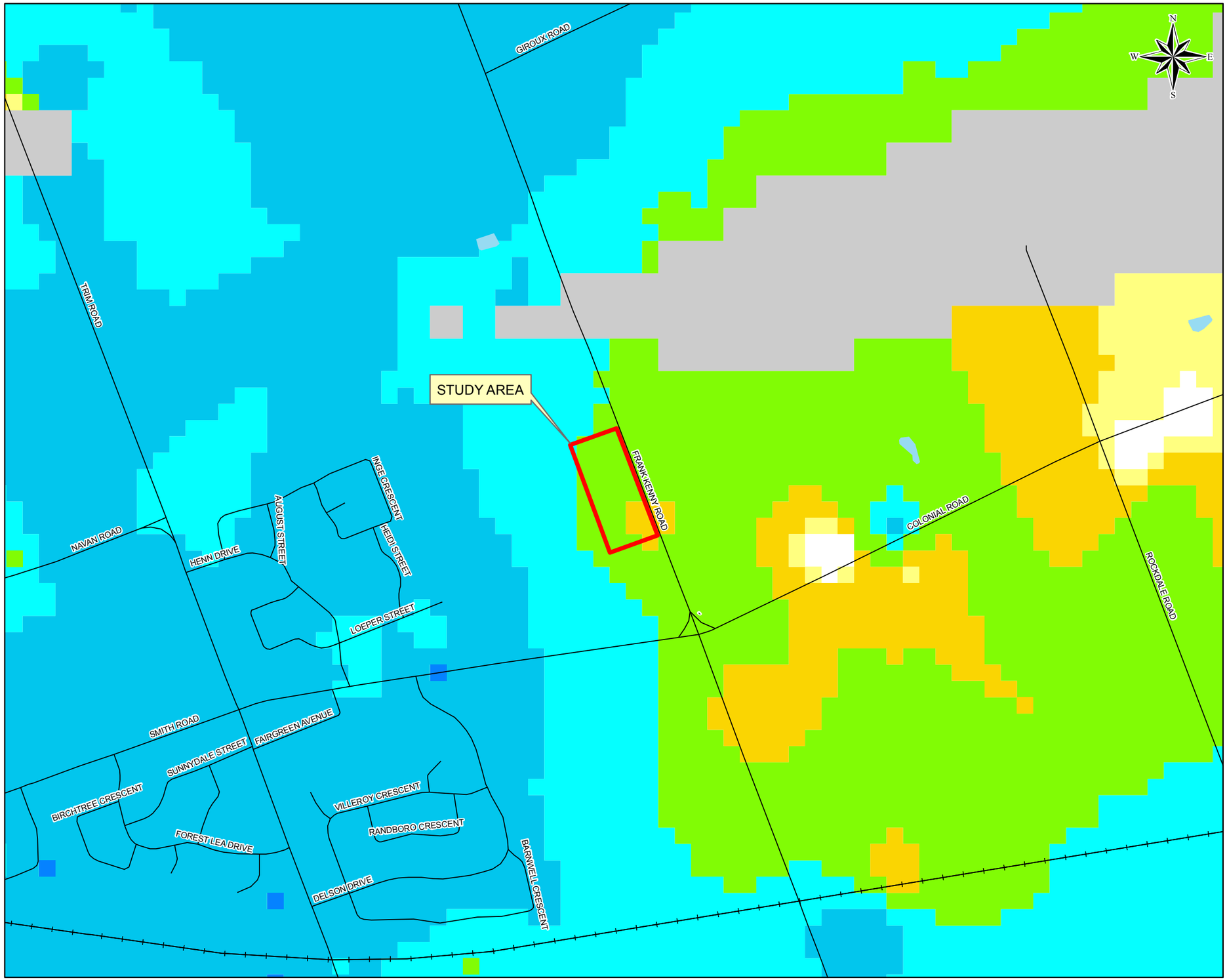
GIS	BJ	Nov. 2011		
CHECK	CAMC	Nov. 2011		
REVIEW	SRW	Nov. 2011		

FIGURE 3



LEGEND

- STUDY AREA
- RAILWAY
- ROAD
- WATERBODY

TREND IN DEPTH TO BEDROCK (METRES)

- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 5
- 5 to 10
- 10 to 15
- 15 to 25
- 25 to 50
- 50 to 100
- 100 to 200

NOTE

THIS FIGURE IS TO BE READ IN CONJUCTION WITH THE ACCOMPANYING GOLDER ASSOCIATED LIMITED REPORT No. 11-1122-0129/3000

REFERENCE

BASE DATA - CANVEC PROVIDED BY HER MAJESTY THE QUEEN IN RIGHT OF CANADA, DEPARTMENT OF NATURAL RESOURCES, 2010
BÉLANGER, J. R., URBAN GEOLOGY OF THE NATIONAL CAPITAL AREA, GEOLOGICAL SURVEY OF CANADA, OPEN FILE D3256, 2001
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18

360 0 360
SCALE 1:12,000 METRES

PROJECT
TERRAIN ANALYSIS AND HYDROGEOLOGICAL STUDY
3406-3450 FRANK KENNY ROAD, OTTAWA, ONTARIO

TITLE
TREND IN DEPTH TO BEDROCK

Golder Associates
Ottawa, Ontario

PROJECT No. 11-1122-0129			SCALE AS SHOWN	REV. 0.0
DESIGN	CAMC	Nov. 2011		
GIS	BJ	Nov. 2011		
CHECK	CAMC	Nov. 2011		
REVIEW	SRW	Nov. 2011		

FIGURE 4

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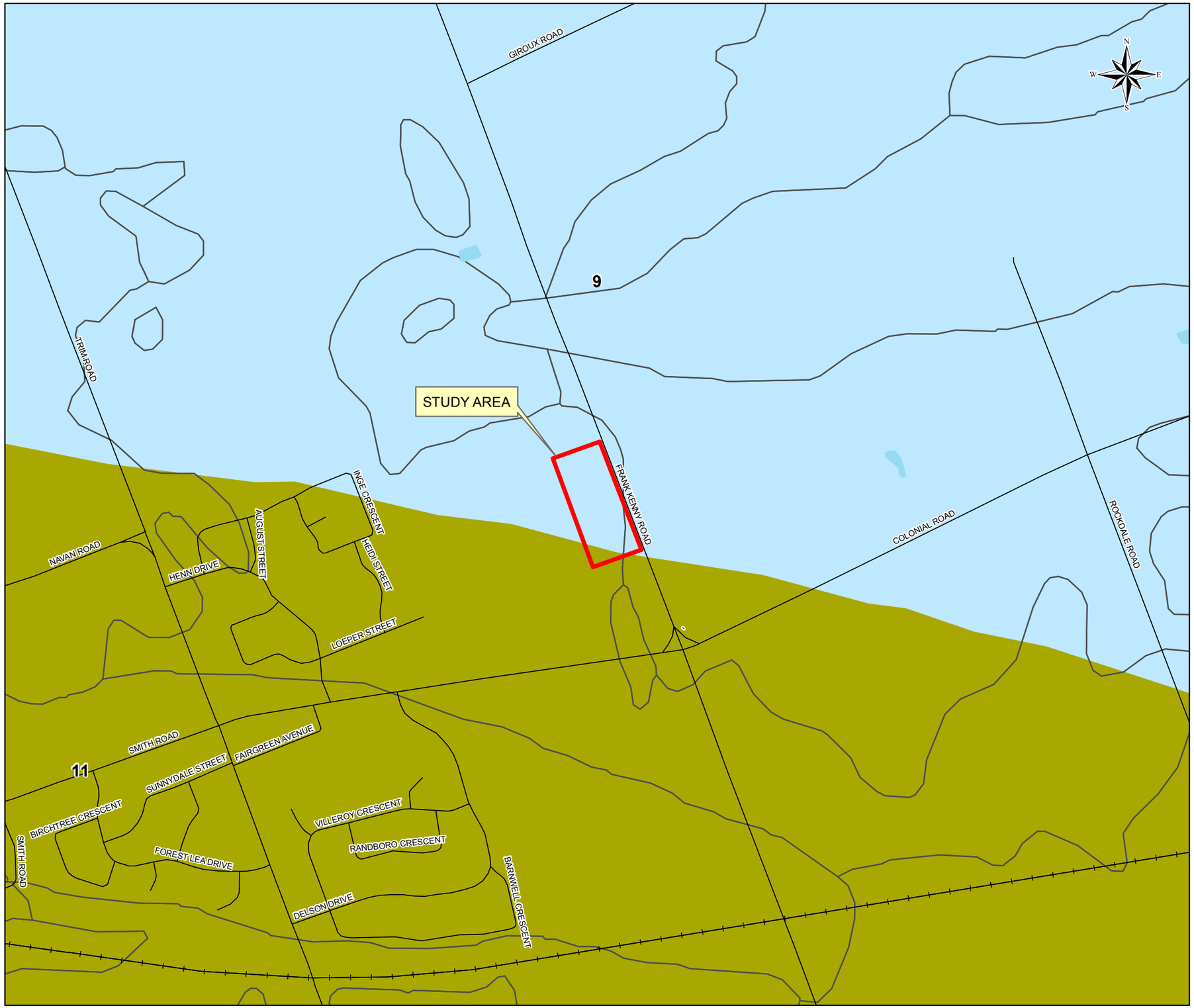


LEGEND

- 13 QUEENSTON FORMATION: RED TO LIGHT GREENISH GRAY SILTSTONE AND SHALE, WITH INTERBEDS OF SILTY BIOCLASTIC LIMESTONE IN LOWER PART
- 12 CARLSBAD FORMATION: INTERBEDDED DARK GRAY SHALE, FOSSILIFEROUS CALCAREOUS SILTSTONE, AND SILTY BIOCLASTIC LIMESTONE
- 11 BILLINGS FORMATION: DARK BROWN TO BLACK SHALE, WITH LAMINATIONS OF CALCAREOUS SILTSTONE
- 10 EASTVIEW FORMATION: INTERBEDDED SUBLITHOGRAPHIC TO FINE CRYSTALLINE LIMESTONE AND DARK BROWN TO DARK GREY SHALE

MIDDLE TO UPPER ORDOVICIAN

- 9 LINDSAY FORMATION: SUBLITHOGRAPHIC TO FINE CRYSTALLINE LIMESTONE, NODUALAR IN PART, WITH INTERBEDS OF CALCARENITE AND SHALE
- 8 VERULAM FORMATION: INTERBEDDED BIOCLASTIC LIMESTONE, SUBLITHOGRAPHIC TO FINE CRYSTALLINE LIMESTONE
- 7 BOBCAYGEON FORMATION: INTERBEDDED SILTY DOLOMITE, LITHOGRAPHIC TO FINE CRYSTALLINE LIMESTONE, OOLITIC LIMESTONE, SHALE, AND FINE-GRAINED CALCAREOUS QUARTZ SANDSTONE
- 6 GULL RIVER FORMATION: INTERBEDDED SILTY DOLOMITE, LITHOGRAPHIC TO FINE CRYSTALLINE LIMESTONE, OOLITIC LIMESTONE , SHALE, AND FINE-GRAINED CALCAREOUS QUARTZ SANDSTONE
- 5 ROCKCLIFFE FORMATION: INTERBEDDED FINE-GRAINED LIGHT GREENISH GREY QUARTZ SANDSTONE, SHALEY LIMESTONE AND SHALE, LOCALLY CONGLOMERATE AT BASE, INTERBEDS OF CALCARENITE (ST. MARTIN MEMBER, 5A) AND SILTY DOLOSTONE IN UPPER PART

LOWER ORDOVICIAN

- 4 OXFORD FORMATION: SUBLITHOGRAPHIC TO FINE CRYSTALLINE DOLOSTONE
- 4* ALTERED FROM PUBLISHED MAPPING
- 3 MARCH FORMATION: INTERBEDDED QUARTZ SANDSTONE, SANDY DOLOSTONE, AND DOLOSTONE

CAMBRIO ORDOVICIAN

- 2 NEPEAN FORMATION: FINE TO COARSE GRAINED QUARTZ SANDSTONE, PARTIALLY CALCAREOUS IN UPPER PART
- 1 COVEY HILL FORMATION: NONCALCAREOUS FELDSPATHIC, FINE TO COARSE GRAINED QUARTZ SANDSTONE AND QUARTZ PEBBLE CONGLOMERATE

UNCONFORMITY

PRECAMBRIAN

- PC UNDIFFERENTIATED METAMORPHIC AND IGNEOUS ROCKS

NOTE

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT No. 11-1122-0129/3000

REFERENCE

BÉLANGER, J. R., URBAN GEOLOGY OF THE NATIONAL CAPITAL AREA, GEOLOGICAL SURVEY OF CANADA, OPEN FILE D3256, 2001

PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 18

500 0 500
1:12,000 METRES

PROJECT
TERRAIN ANALYSIS AND HYDROGEOLOGICAL STUDY
3406-3450 FRANK KENNY ROAD, OTTAWA, ONTARIO

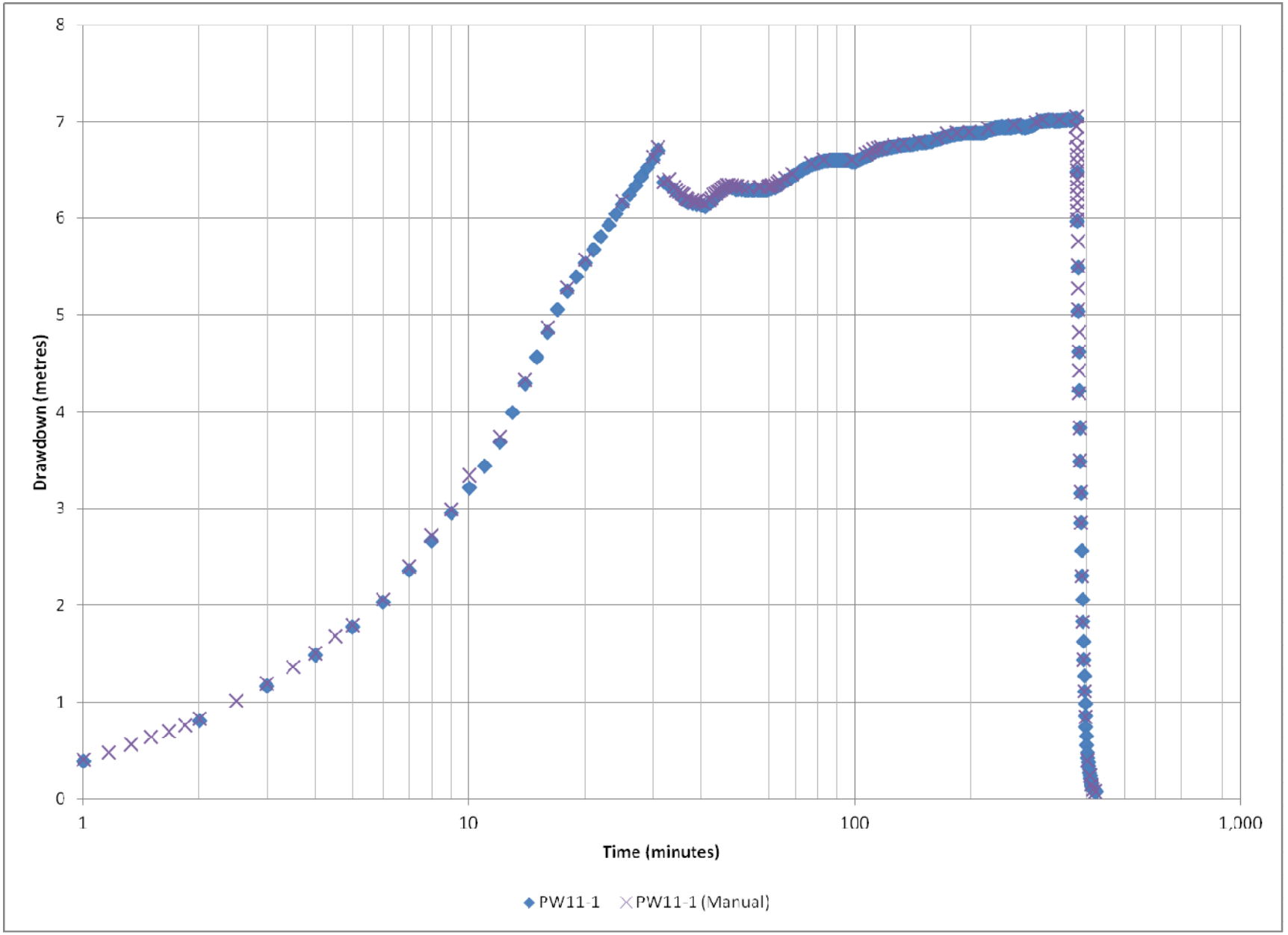
TITLE
BEDROCK GEOLOGY

Golder Associates
Ottawa, Ontario

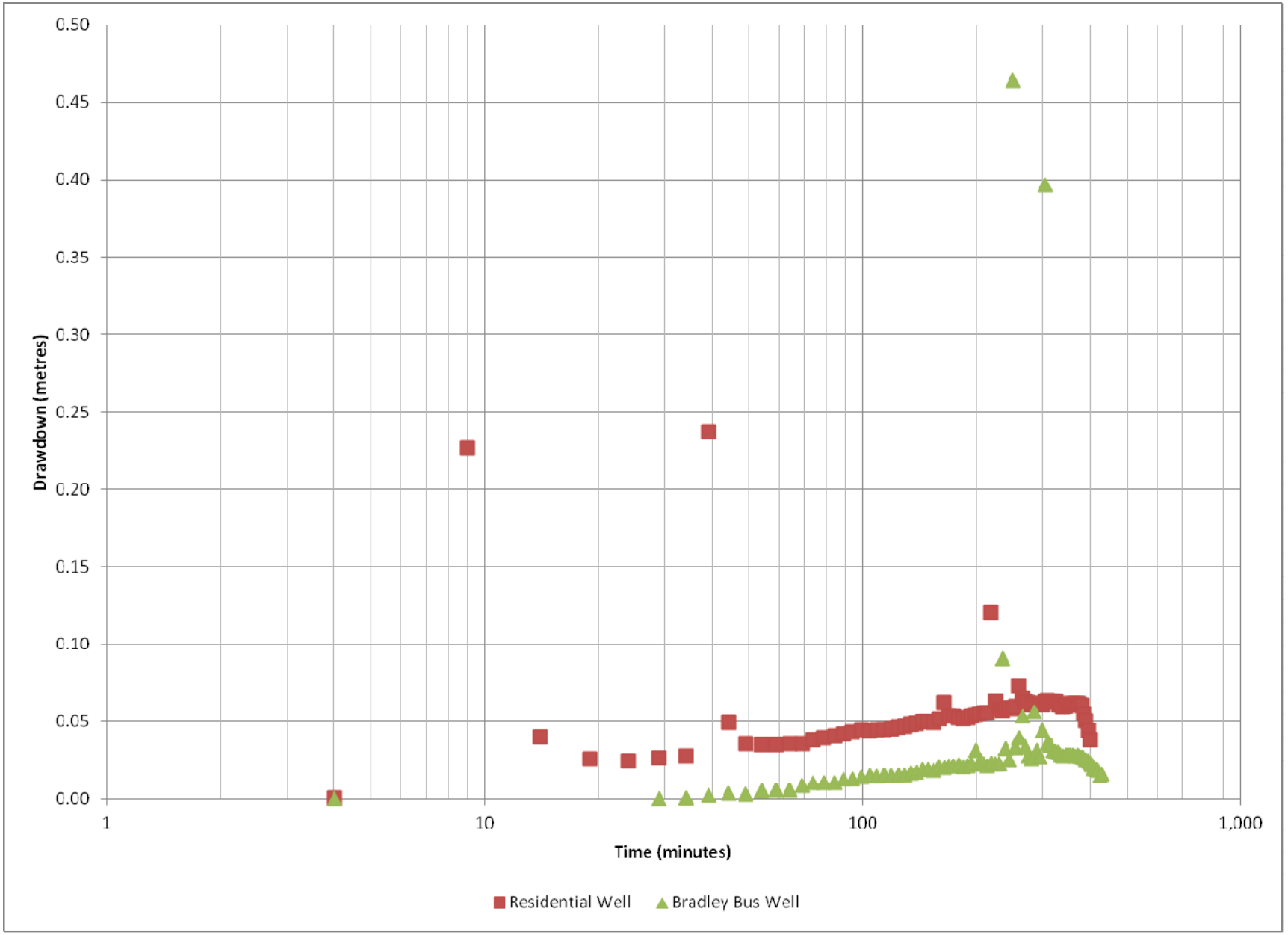
PROJECT No. 11-1122-0129			SCALE AS SHOWN	REV. 0
DESIGN	CAMC	Nov. 2011		
GIS	BJ	Nov. 2011		
CHECK	CAMC	Nov. 2011		
REVIEW	SRW	Nov. 2011		

FIGURE 5

Path: N:\Active\20111122 - Contaminated Lands\11-1122-0129 Hydro One Frank Kenny Road\Spatial_IMMXD\Phase 3000\11112201 29-3000-05.mxd



Golder Associates	Date: November 2011 Drawn: DH Project: 11-1122-0129 Chkd: CAMC	GROUNDWATER LEVEL DRAWDOWN PW11-1	FIGURE 6



Golder Associates	Date: November 2011 Drawn: DH Project: 11-1122-0129 Chkd: CAMC	GROUNDWATER LEVEL DRAWDOWN BRADLEY BUS WELL AND RESIDENTIAL WELL	FIGURE 7

APPENDIX A

Water Well Record, Bradley Bus Well

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON BLOCK, TRACT, SURVEY ETC	LOT
OTTAWA-CARLETON	CUMBERLAND	PART 9 & 10 CON 8	

OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED
BRADLEY BUS LINE		DAY 9 MO 1 YR 91

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
BROWN	CLAY			0	19
BLACK	HARD PAN	BOULDERS		19	31
BLACK	SHALE			31	41

WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER		
39	☑ FRESH ☐ SALTY	☐ SULPHUR ☐ MINERALS ☐ GAS	
	☐ FRESH ☐ SALTY	☐ SULPHUR ☐ MINERALS ☐ GAS	
	☐ FRESH ☐ SALTY	☐ SULPHUR ☐ MINERALS ☐ GAS	
	☐ FRESH ☐ SALTY	☐ SULPHUR ☐ MINERALS ☐ GAS	
	☐ FRESH ☐ SALTY	☐ SULPHUR ☐ MINERALS ☐ GAS	

CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
6 3/4	☑ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE ☐ PLASTIC	1.45	0	31
	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE ☐ PLASTIC			
	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE ☐ PLASTIC			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET
MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN FEET	

PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)
4	26	CEMENT GROUT

PUMPING TEST

PUMPING TEST METHOD	PUMPING RATE	DURATION OF PUMPING
☐ PUMP ☑ BAILER	19 GPM	1 HOURS 20 MINS

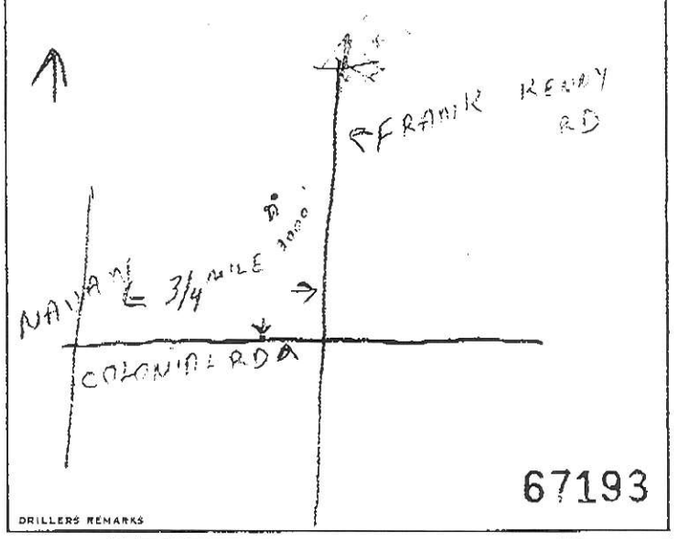
STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING ☑ PUMPING ☐ RECOVERY			
		15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
7 FEET	28 FEET	25 FEET	28 FEET	28 FEET	28 FEET

IF FLOWING, GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
GPM	35 FEET	☐ CLEAR ☑ CLOUDY

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
☐ SHALLOW ☑ DEEP	35 FEET	10 GPM

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



67193

DRILLERS REMARKS

FINAL STATUS OF WELL	☑ WATER SUPPLY ☐ OBSERVATION WELL ☐ TEST HOLE ☐ RECHARGE WELL	☐ ABANDONED, INSUFFICIENT SUPPLY ☐ ABANDONED, POOR QUALITY ☐ UNFINISHED ☐ DEWATERING
WATER USE	☐ DOMESTIC ☐ STOCK ☐ IRRIGATION ☐ INDUSTRIAL ☐ OTHER	☑ COMMERCIAL ☐ MUNICIPAL ☐ PUBLIC SUPPLY ☐ COOLING OR AIR CONDITIONING ☐ NOT USED
METHOD OF CONSTRUCTION	☑ CABLE TOOL ☐ ROTARY (CONVENTIONAL) ☐ ROTARY (REVERSE) ☐ ROTARY (AIR) ☐ AIR PERCUSSION	☐ BORING ☐ DIAMOND ☐ JETTING ☐ DRIVING ☐ DIGGING ☐ OTHER

CONTRACTOR

NAME OF WELL CONTRACTOR	WELL CONTRACTOR'S LICENCE NUMBER
GERLER WELL DRILLING	2351

ADDRESS	
BOX 87 CASSELMAN ONT. KOA-1MO	

NAME OF WELL TECHNICIAN	WELL TECHNICIAN'S LICENCE NUMBER
WM. GERLER	1-0789

SIGNATURE OF TECHNICIAN/CONTRACTOR	SUBMISSION DATE
Wm Gerler	DAY 9 MO 1 YR 91

OFFICE USE ONLY

OWNER'S COPY

764-5710

APPENDIX B

Records of Boreholes BH11-3, BH11-4, BH11-5, BH11-6 and BH11-7 and Test Pits TP11-1, TP11-2, TP11-3 and TP11-4

LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures and in the text of the report are as follows:

I. SAMPLE TYPE

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO	Drive open
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample
DT	Dual Tube sample

II. PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:
The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) drive open Sampler for a distance of 300 mm (12 in.)
DD- Diamond Drilling

Dynamic Penetration Resistance; N_d:
The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) to drive Uncased a 50 mm (2 in.) diameter, 60^0 cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

Peizo-Cone Penetration Test (CPT):
An electronic cone penetrometer with a 60^0 conical tip and a projected end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded Electronically at 25 mm penetration intervals.

III. SOIL DESCRIPTION

(a) Cohesionless Soils

Density Index (Relative Density)	**N** Blows/300 mm Or Blows/ft.
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

(b) Cohesive Soils

Consistency	**C_u or S_u** Kpa	Psf
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1,000
Stiff	50 to 100	1,000 to 2,000
Very stiff	100 to 200	2,000 to 4,000
Hard	Over 200	Over 4,000

IV. SOIL TESTS

w	water content
w_p	plastic limited
w_1	liquid limit
C	consolidaiton (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, G_s)
DS	direct shear test
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	modified Proctor compaction test
SPC	standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V	field vane test (LV-laboratory vane test)
γ	unit weight

Note:
1. Tests which are anisotropically consolidated prior shear are shown as CAD, CAU.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	= 3.1416
ln x, natural logarithm of x	
$\log_{10}$ x or log x,	logarithm of x to base 10
g	Acceleration due to gravity
t	time
F	factor of safety
V	volume
W	weight

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma'$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
ν	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma''-u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1\sigma_2\sigma_3$	principal stresses (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress = $(\sigma_1+\sigma_2+\sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight*)
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma'=\gamma-\gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R= p_s/p_w$) formerly (G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is p. Unit weight symbol is γ where γ=pg(i.e. mass density x acceleration due to gravity)

(a) Index Properties (cont'd.)

w	water content
w_1	liquid limit
w_p	plastic limit
I_p	plasticity Index=(w_1-w_p)
w_s	shrinkage limit
I_L	liquidity index=$(w-w_p)/I_p$
I_c	consistency index=$(w_1-w)/I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index-$(e_{max}-e)/(e_{max}-e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (overconsolidated range)
C_s	swelling index
C_a	coefficient of secondary consolidation
m_v	coefficient of volume change
c_v	coefficient of consolidation
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation pressure
OCR	Overconsolidation ratio=σ'_p/σ'_{vo}

(d) Shear Strength

$\tau_p\tau_r$	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction=tan δ
c'	effective cohesion
c_u, s_u	undrained shear strength (ϕ=0 analysis)
p	mean total stress $(\sigma_1+\sigma_3)/2$
p'	mean effective stress $(\sigma'_1+\sigma'_3)/2$
q	$(\sigma_1-\sigma_3)/2$ or $(\sigma'_1-\sigma_3)/2$
q_u	compressive strength $(\sigma_1-\sigma_3)$
S_t	sensitivity

Notes: 1. $\tau=c'\sigma'\tan\ |'$

2. Shear strength=(Compressive strength)/2

PROJECT: 11-1122-0129-2000

RECORD OF BOREHOLE: 11-1

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 31, 2011

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		86.36							
0	Power Auger 200 mm Diam. (Hollow Stem)	Dark brown silty fine sand, trace organic matter (FILL)		0.00							
		Loose brown fine sand (FILL)		0.08							
		Very stiff to stiff brown to grey brown SILTY CLAY (Weathered Crust)		86.05	1	50 DO	6				
1				0.31	2	50 DO	12				
					3	50 DO	5				
2					4	50 DO	3				
				83.31							
3		Firm grey SILTY CLAY		3.05	5	50 DO	1				
4											
					6	50 DO	WH				
5											
6					7	50 DO	WH				
				79.40							
7		End of Borehole		6.96							
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: HEC

CHECKED: SD

Golder Associates

MIS-BHS 001 1111220129.GPJ GAL-MIS.GDT 1/12/12 JEM

PROJECT: 11-1122-0129-2000

RECORD OF BOREHOLE: 11-2

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 31, 2011

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		85.78							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		Very stiff to stiff grey brown SILTY CLAY (Weathered Crust)		0.08	1	50 DO	12				
1					2	50 DO	7				
					3	50 DO	4				
2				83.80							
		End of Borehole		1.98							
3											
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: HEC

CHECKED: SD

Golder Associates

MIS-BHS 001 1111220129.GPJ GAL-MIS.GDT 1/12/12 JEM

PROJECT: 11-1122-0129-2000

RECORD OF BOREHOLE: 11-3

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: November 1, 2011

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		85.48							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		Very stiff to stiff grey brown SILTY CLAY (Weathered Crust)		0.15	1	50 DO	5				
1					2	50 DO	2				Native Backfill
2					3	50 DO	1				
				82.58							
3		Firm grey SILTY CLAY		2.90	4	50 DO	WH				
4				81.42							Bentonite Seal
		Compact to dense dark grey to black SILTY SAND, some gravel, with shale fragments, cobbles, and boulders (GLACIAL TILL)		4.06	5	50 DO	17				Silica Sand Standpipe
5					6	50 DO	38				W.L. in Standpipe at Elev. 84.38 m on Nov. 14, 2011
				79.84							
		End of Borehole		5.64							
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: HEC

CHECKED: SD

Golder Associates

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PROJECT: 11-1122-0129-2000

RECORD OF BOREHOLE: 11-3A

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: November 2, 2011

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		85.48							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		Very stiff to stiff grey brown SILTY CLAY (Weathered Crust)		0.15							
1											
2				82.74							
		Firm grey SILTY CLAY		2.74	1	73 TP	PH				
3											
					2	73 TP	PH				
4					3	50 DO	WH				
				80.73	4	50 DO	6				
		Compact dark grey to black SILTY SAND, with shale fragments (GLACIAL TILL)		4.75							
5				80.43							
		End of Borehole		5.05							
		Note: Shallow portion of stratigraphy inferred from BH 11-3									
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: HEC

CHECKED: SD

Golder Associates

MIS-BHS 001 1111220129.GPJ GAL-MIS.GDT 1/12/12 JEM

PROJECT: 11-1122-0129-2000

RECORD OF BOREHOLE: 11-4

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: November 2, 2011

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		85.90							
0	Power Auger 200 mm Diam. (Hollow Stem)	Dark brown clayey topsoil (FILL)		0.00							
		Grey crushed stone (FILL)		0.15							
		Grey brown SILTY CLAY (Disturbed)			1	50 DO	6				
1				84.68							
		Stiff grey brown SILTY CLAY (Weathered Crust)		1.22	2	50 DO	3	⊕ at 20; + at 40; + at 60; ○ at 80			
2								⊕ at 20; + at 60			
				83.36	3	50 DO	16	⊕ at 20; + at 60; ○ at 80			
		Compact dark grey to black SILTY SAND, with shale fragments, cobbles, and boulders (GLACIAL TILL)		2.54							
3					4	50 DO	12				
					5	50 DO	16				
4				81.63							
		Highly weathered black SHALE BEDROCK		4.27	6	50 DO	>50				
				81.38							
		End of Borehole Sampler Refusal		4.52							
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: HEC

CHECKED: SD

Golder Associates

MIS-BHS 001 1111220129.GPJ GAL-MIS.GDT 1/12/12 JEM

PROJECT: 11-1122-0129-2000

RECORD OF BOREHOLE: 11-5

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: November 1, 2011

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕; Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		85.64							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		Very stiff to stiff grey brown SILTY CLAY (Weathered Crust)		0.15	1	50 DO	9				
1					2	50 DO	7				
					3	50 DO	2				
2				83.51							
		Compact dark grey to black SILTY SAND, some gravel, with cobbles, boulders, and shale fragments (GLACIAL TILL)		2.13	4	50 DO	11				
3					5	50 DO	16				
				81.83							
		Highly weathered black SHALE BEDROCK		3.81	6	50 DO	>50				
4				81.58							
		End of Borehole		4.06							
5											
6											
7											
8											
9											
10											

Native Backfill

Bentonite Seal

Silica Sand

Standpipe

W.L. in Standpipe at Elev. 84.37 m on Nov. 14, 2011

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: HEC

CHECKED: SD

MIS-BHS 001 1111220129.GPJ GAL-MIS.GDT 1/12/12 JEM

PROJECT: 11-1122-0129-2000

RECORD OF BOREHOLE: 11-6

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: November 1, 2011

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		85.44							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		Very stiff to stiff brown SILTY CLAY (Weathered Crust)		0.15	1	50 DO	4				
1											
					2	50 DO	2				
2											
					3	50 DO	7				
				82.70							
		Compact dark grey to black SILTY SAND, with shale fragments (GLACIAL TILL)		2.74							
3				82.39							
		Highly weathered black SHALE BEDROCK		3.05	4	50 DO	21				
				81.78							
		End of Borehole		3.66							
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: HEC

CHECKED: SD

MIS-BHS 001 1111220129.GPJ GAL-MIS.GDT 1/12/12 JEM

PROJECT: 11-1122-0129-2000

RECORD OF BOREHOLE: 11-7

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: November 1, 2011

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		85.42							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		Very stiff to stiff grey brown SILTY CLAY (Weathered Crust)		0.15	1	50 DO	5				
1					2	50 DO	2				
2		Compact dark grey to black SILTY SAND, with shale fragments, cobbles, and boulders (GLACIAL TILL)		83.44 1.98	3	50 DO	16				
3					4	50 DO	17				
		Highly weathered SHALE BEDROCK		81.91 3.51	5	50 DO	20				
4					6	50 DO	>50				
		End of Borehole		80.70 4.72							
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: HEC

CHECKED: SD

Golder Associates

MIS-BHS 001 1111220129.GPJ GAL-MIS.GDT 1/12/12 JEM

PROJECT: 11-1122-0129-2000

RECORD OF BOREHOLE: MW11-1

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 31, 2011

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		85.96							
0	Power Auger 200 mm Diam. (Hollow Stem)	Grey crushed stone (FILL)		0.00 / 85.35	1	50 DO	22				Gravel
1		Very stiff to stiff grey brown SILTY CLAY (Weathered Crust)		0.61 / 83.52	2	50 DO	8				Bentonite Seal
					3	50 DO	5				Silica Sand
2					4	50 DO	4				
		Firm grey SILTY CLAY		2.44 / 82.30	5	50 DO	1				51 mm Diam. PVC #10 Slot Screen
3					6	50 DO	1				
		End of Borehole		3.66							W.L. in Screen at Elev. 84.77 m on November 4, 2011
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: HEC
CHECKED: SD

MIS-BHS 001 1111220129.GPJ GAL-MIS.GDT 1/12/12 JEM

TABLE 1

RECORD OF TEST PITS

Test Pit Number (Elevation)	Depth (metres)	Description
11-1 (85.74 metres)	0.00 – 0.15	TOPSOIL
	0.15 – 2.00	Grey brown SILTY CLAY (Weathered Crust)
	2.00	END OF TEST PIT
		Note: Groundwater seepage at 2.00 metres depth
		Sample 1 — Depth (m) 1.00
11-2 (85.72 metres)	0.00 – 0.15	TOPSOIL
	0.15 – 1.00	Grey brown SILTY CLAY (Weathered Crust)
	1.00 – 2.40	Grey brown SILTY SAND, some gravel and clay, with cobbles and boulders (GLACIAL TILL)
	2.40	END OF TEST PIT
		Note: Groundwater seepage at 2.00 metres depth
		Sample 1 — Depth (m) 2.00
11-3 (85.90 metres)	0.00 – 0.15	TOPSOIL
	0.15 – 2.00	Grey brown SILTY CLAY (Weathered Crust)
	2.00	END OF TEST PIT
		Note: Groundwater seepage at 2.00 metres depth
11-4 (85.08 metres)	0.00 – 0.15	TOPSOIL
	0.15 – 1.60	Grey brown SILTY CLAY (Weathered Crust)
	1.60	END OF TEST PIT
		Note: Groundwater seepage at 1.50 metres depth
		Sample 1 — Depth (m) 0.50
		Sample 2 — Depth (m) 1.00

APPENDIX C

Ontario Building Code Tables (Sewage Systems)

(4) Where an *occupancy* is not listed in Table 8.2.1.3.B., the highest of metered flow data from at least 3 similar establishments shall be acceptable for determining total daily design *sanitary sewage* flow.

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

Residential Occupancy	Volume, litres
Apartments, Condominiums, Other Multi-family Dwellings - per person(1)	275
Boarding Houses	
(a) Per person,	
i) with meals and laundry facilities, or,	200
ii) without meal or laundry facilities, and	150
(b) Per non-resident staff per 8 hour shift	40
Boarding School - per person	300
Dwellings	
(a) 1 bedroom dwelling	750
(b) 2 bedroom dwelling	1100
(c) 3 bedroom dwelling	1600
(d) 4 bedroom dwelling	2000
(e) 5 bedroom dwelling	2500
(f) Additional flow for(2)	
i) each bedroom over 5,	500
ii) A) each 10 m^2 (or part of it) over 200 m^2 up to 400 m^2 (3),	100
B) each 10 m^2 (or part of it) over 400 m^2 up to 600 m^2 (3), and	75
C) each 10 m^2 (or part of it) over 600 m^2 (3), or	50
iii) each fixture unit over 20 fixture units	50
Hotels and Motels (excluding bars and restaurants)	
(a) Regular, per room	250
(b) Resort hotel, cottage, per person	500
(c) Self service laundry, add per machine	2500
Work Camp/Construction Camp, semi-permanent per worker	250
Column 1	2

Notes to Table 8.2.1.3.A.:
(1) The *occupant load* shall be calculated using Subsection 3.1.17.
(2) Where multiple calculations of sewage volume is permitted the calculation resulting the highest flow shall be used in determining the design daily *sanitary sewage* flow.
(3) Total finished area, excluding the area of the finished *basement*.

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

Establishments[1]	Volume, litres
Airports, Bus Terminals, Train Stations, Dock/Port Facilities (Food Services excluded)	
(a) Per passenger, and	20
(b) Per employee per 8 hour shift	40
Assembly Hall - per seat	
(a) No food service, or	8
(b) Food service provided	36
Barber Shop/Beauty Salon - per service chair	650
Bowling Alleys (Food Service not included) - per lane	400
Churches and Similar Places of Worship - per seat	
(a) No kitchen facilities, or	8
(b) Kitchen facilities provided	36
Country Club (excluding Food Service)	
(a) Per resident,	375
(b) Per employee per 8 hour shift, and	50
(c) Per member or patron	40
Day Care Facility per person (staff and children)	75
Dentist Office	
(a) Per wet service chair, and	275
(b) Per dry service chair	190
Doctors Office	
(a) Per practitioner, and	275
(b) Per employee per 8 hour shift	75
Factory (excluding process or cleaning waters) - per employee per 8 hour shift	
(a) No showers, or	75
(b) Including showers	125
Flea Markets[2] (open not more than 3 days per week)	
(a) Per non-food service vendor space,	60
(b) Per food service establishment / 9.25 m^2 of floor space, and	190
(c) Per limited food service outlet	95
Column 1	2

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

Establishments[1]	Volume, litres
Food Service Operations	
(a) Restaurant (not 24 hour), per seat	125
(b) Restaurant (24 hour), per seat	200
(c) Restaurant on controlled access highway, per seat	400
(d) Paper service restaurant, per seat	60
(e) Donut shop, per seat	400
(f) Bar and cocktail lounge, per seat	125
(g) Drive-in restaurant per parking space	60
(h) Take-out restaurant (no seating area)	
i) per 9.25 m^2 of floor area, and	190
ii) per employee per 8 hour shift	75
(i) Cafeteria - per meal	12
(j) Food outlet	
i) excluding delicatessen, bakery and meat department, per 9.25 m^2 of floor space,	40
ii) per 9.25 m^2 of delicatessen floor space	190
iii) per 9.25 m^2 of bakery floor space	190
iv) per 9.25 m^2 of meat department floor space, and	380
v) per water closet	950
Hospitals - per bed	
(a) Including laundry facilities, or	750
(b) Excluding laundry facilities	550
Nursing Homes, Rest Homes, etc. - per bed	450
Office Building[3]	
(a) Per employee per 8 hour shift, or	75
(b) Per each 9.3 m^2 of floor space	75
Public Parks	
(a) With toilets only per person, or	20
(b) With bathhouse, showers, and toilets per person	50
Recreational Vehicle or Campground Park	
(a) Per site without water or sewer hook-up, or	275
(b) Per site with water and sewer hook-up	425
Column 1	2

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

Establishments[1]	Volume, litres
Schools - per student	
(a) Day school,	30
(b) With showers,	30
(c) With cafeteria, and	30
(d) Per non-teaching employee per 8 hour shift	50
Service Stations (no vehicle washing)[3]	
(a) Per water closet, and	950
i) per fuel outlet[4], or	560
ii) per vehicle served	20
Shopping Centre (excluding food and laundry) - per 1.0 m^2 of floor space	5
Stadiums, Race Tracks, Ball Parks - per seat	20
Stores[3]	
(a) Per 1.0 m^2 of floor area, or	5
(b) Per water closet	1230
Swimming and Bathing Facilities (Public) - per person	40
Theatres	
(a) Indoor, auditoriums per seat,	20
(b) Outdoor, drive-ins per space, or	40
(c) Movie theatres per seat	15
Veterinary Clinics	
(a) Per practitioner,	275
(b) Per employee per 8 hour shift, and	75
(c) Per stall, kennel, or cage if floor drain connected	75
Warehouse	
(a) Per water closet, and	950
(b) Per loading bay	150
Column 1	2

Notes to Table 8.2.1.3.B.:
(1) The *occupant load* shall be calculated using Subsection 3.1.17.
(2) Flea markets open more than 3 days per week shall be assessed using the volumes stated under the heading "Stores".
(3) Where multiple calculations of *sanitary sewage* volume is permitted the calculation resulting in the highest flow shall be used in determining the design daily *sanitary sewage* flow.
(4) The number of fuel outlets is considered the maximum number of gas nozzles that could be in use at the same time.

Table 8.2.1.6.A.
Minimum Clearances for Treatment Units
Forming Part of Sentence 8.2.1.6.(1)

Object	Minimum Clearance, m
Structure	1.5
Well	15
Lake	15
Pond	15
Reservoir	15
River	15
Spring	15
Stream	15
Property Line	3
Column 1	2

(2) Except as provided in Sentences 8.2.1.4.(1) and (2), a *distribution pipe* shall not be located closer than the minimum horizontal distances set out in Table 8.2.1.6.B. and these distances shall be increased when required by Sentence 8.7.4.2.(9).

Table 8.2.1.6.B.
Minimum Clearances for Distribution Piping
Forming Part of Sentence 8.2.1.6.(2)

Object	Minimum Clearance, m
Structure	5
Well with a watertight casing to a depth of 6 m	15
Any other well	30
Lake	15
Pond	15
Reservoir	15
River	15
Spring not used as a source of *potable* water	15
Stream	15
Property Line	3
Column 1	2

(3) Except as provided in Sentences 8.2.1.4.(1) and (2), a *holding tank* shall not be located closer than the minimum horizontal distances set out in Table 8.2.1.6.C.

Table 8.7.3.3.A.
Septic Stone
Forming Part Of Sentence 8.7.3.3.(5)

Gradation of Septic Stone	
Particle Size	Percent Passing
53 mm	100
19 mm	0-5
75 µm	0-1
Column 1	2

8.7.4. Fill Based Absorption Trenches

8.7.4.1. Loading Requirements

(1) The area described in Sentence 8.7.4.2.(1) shall be designed such that the *loading rate* does not exceed, for *soil* having a *percolation time* set out in Column 1 of Table 8.7.4.1.A., the maximum value set out opposite it in Column 2 of Table 8.7.4.1.A.

Table 8.7.4.1.A.
Loading Rates for Fill Based Absorption Trenches and Filter Beds
Forming Part of Sentences 8.7.4.1.(1) and 8.7.5.2.(2)

Percolation Time (T) of *Soil*, min/cm	*Loading Rates*, (L/m^2)/day
$1 < T \leq 20$	10
$20 < T \leq 35$	8
$35 < T \leq 50$	6
$T > 50$	4
Column 1	2

8.7.4.2. Construction Requirements (See Appendix A.)

(1) A *leaching bed* comprised of *absorption trenches* may be *constructed* in *leaching bed fill* if unsaturated *soil* or *leaching bed fill* complying with Clause 8.7.2.1.(1)(b) extends,
(a) to a depth of at least 250 mm over the area covered by the *leaching bed fill*, and
(b) for at least 15 m beyond the outer *distribution pipes* in any direction in which the *effluent* entering the *soil* or *leaching bed fill* will move horizontally.

(2) If the unsaturated *soil* or *leaching bed fill* described in Sentence (1) has a *percolation time* greater than 15 minutes, any *leaching bed fill* added to form the *leaching bed* shall have a *percolation time* not less than 75% of the *percolation time* of the unsaturated *soil* or *leaching bed fill*.

(3) *Leaching bed fill* that does not meet the requirements of Sentence (2) may be used to form the *leaching bed* if,
(a) the distance from the bottom of the *absorption trench* to native *soil* is not less than 900 mm, or
(b) where the distance from the bottom of the *absorption trench* to native *soil* is less than 900 mm, the *percolation time* of the least permeable *soil* or *leaching bed fill* within 900 mm from the bottom of the *absorption trench* is used to calculate the length of the *distribution pipe* under Article 8.7.3.1.

SB-6 Percolation Time and Soil Descriptions

ESTIMATION OF PERCOLATION TIME

(a) The purpose of this Section and the associated Tables and Charts is to provide assistance to those who must decide on the percolation time(s) to be used in design. Suggested relationships between percolation time, coefficient of permeability and soils of various types are given. IT MUST BE EMPHASIZED THAT, PARTICULARLY FOR FINE GRAINED SOILS, THERE IS NO CONSISTENT RELATIONSHIP DUE TO THE MANY FACTORS INVOLVED. The following guidance is presented for the soil types outlined in the Unified Soil Classification System (Table 1). In order to assess a particular soil.

(i) Table 2 and Table 3 - Approximate relationship of soil types to permeability and percolation time.
(ii) Charts 1 to 14 - Typical grain size distribution curves for soil types in the Unified Soil Classification System.

(b) In Table 2 and Table 3, a range of values of "K" and of "T" are given for various soil descriptions. The principal modifiers which will influence selection of a "T" value within the range given are:

(i) The structure - "massive" fine-grained soils have high values of "T".
(ii) The density - For a given soil higher density produces a higher value of "T".
(iii) The percentage of clay - the higher the percentage the higher the value of "T".
(iv) The mineralogy of the clay portion - The more it "swells" the higher the value of "T".
(v) The plasticity of the soil - The higher the plasticity index the higher the value of "T".
(vi) Liquid Limit - the higher the liquid limit the higher the value of "T".
(vii) Organic content - The presence of fine organic particles, detectable by colouration and odour, can significantly reduce the permeability and raise the value of "T".

Table 1
Unified Soil Classification

Coarse - Grained Soils		Fine - Grained Soils	
Group Symbols	Typical Names	Group Symbols	Typical Names
GW	Well-graded gravels, gravel-sand mixtures, little or no fines	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
GM	Silty gravels, gravel-sand-silt mixtures	OL	Organic silts and organic silty clays of low plasticity
GC	Clayey gravels, gravel-sand-clay mixtures	MH	Inorganic silts, micoceous or diatomaceous fine sandy or silty soils, elastic silts
SW	Well-graded sands, gravelly sands, little or no fines	CH	Inorganic clays of high plasticity, fat clays
SP	Poorly-graded sands, gravelly sands, little or no fines	OH	Organic clays of medium to high plasticity, organic silts
SM	Silty sands, sand-silt mixtures		
SC	Clayey sands, sand-clay mixtures	PT (highly organic soils)	Peat and other highly organic soils
Column 1	2	3	4

Table 2
Approximate Relationship of Coarse Grained Soil Types to Permeability and Percolation Time

Soil Type (Unified Soil Classification) Coarse Grained More than 50% Larger than #200	Coefficient of Permeability, K - cm/sec	Percolation Time, T - mins/cm	Comment
G.W. - Well graded gravels, gravel-sand mixtures, little or no fines.	10^{-1}	<1	very permeable unacceptable
G.P. - Poorly graded gravels, gravel-sand mixtures, little or no fines.	10^{-1}	<1	very permeable unacceptable
G.M. - Silty gravels, gravel-sand-silt mixtures.	10^{-2} - 10^{-4}	4 - 12	Permeable to medium permeable depending on amount of silt.
G.C. - Clayey gravels, gravel-sand-clay mxtures.	10^{-4} - 10^{-6}	12 - 50	Important to estimate amount of silt and clay
S.W. - Well graded sands, gravelly sands little orno fines.	10^{-1} - 10^{-4}	2 - 12	medium permeability
S.P. - Poorly graded sands, gravelly sand, little or no fines.	10^{-1} - 10^{-3}	2 - 8	medium permeability
S.M. - Silty sands, sand-silt mixtures.	10^{-3} - 10^{-5}	8 - 20	medium to low permeability
S.C. - Clayey sands, sand-clay mixtures.	10^{-4} - 10^{-6}	12 - 50	medium to low permeability depending on amount of clay
Column 1	2	3	4

Table 3
Approximate Relationship of Fine Grained Soil Types to Permeability and Percolation Time

Soil Type (Unified Soil Classification) Fine Grained More than 50% Passing #200	Coefficient of Permeability, K - cm/sec	Percolation Time, T - mins/cm	Comment
M.L. - Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, clayey silts with slight plasticity	10^{-5} - 10^{-6}	20 - 50	medium to low permeability
C.L. - Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	10^{-6} and less	over 50	unacceptable
O.L. - Organic silts, organic silty clays of low plasticity; liquid limit less than 50	10^{-5} and less	20 - over 50	acceptable depends on clay content
M.H. - Inorganic silts, micareaous or diatomageous fine sandy or silty soils, elastic silts	10^{-6} and less	over 50	unacceptable
C.H. - Inorganic clays of medium to high plasticity, organic silts	10^{-7} and less	over 50	unacceptable
O.H. - Organic clays of medium to high plasticity organic silt; liquid limit over 50	-10^{-6} and less	over 50	unacceptable
Column 1	2	3	4

SELECTION OF "T" TIME FROM THE ABOVE TABULATION

A range of "T" times for each soil type is shown above. Select from within this range by determining if the soil is within the low, middle or high part of the range considering the soil identifiers and soil characteristics. Consider structure, density, colour, prevalence or organics, the clay content and mineralogy, the plasticity index and liquid limit and the functioning of existing systems in similar soils in the area.

Notes:

The following Ministry of the Environment Reports provide further information on the relationship between grain size, coefficient of permeability and percolation time.

1. "Study on the Feasibility of Correlating Percolation Time with Laboratory Permeability" - 1975 - Research Report No. S56 by H. T. Chan, PhD., P.Eng.

2. "Study of Conventional Tile Fields in Fine-Grained Soils" - 1979 Research Report 74 by H. T. Chan, PhD., P.Eng.

APPENDIX D

Water Well Record, PW11-1

Ontario Ministry of the Environment

Well Tag No. (Place Sti: A116305

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Measurements recorded in: ☑ Metric ☐ Imperial

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
ML Brady Ltd.		N/A	

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
PO Box 70	Navan	On	K1B1G3	613-835-3488

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
3450 Frank Kenny St.	Cumberland	10	8

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

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	0467827	5030372		

Overburden and Bedrock Materials/Abandonment Sealing Record

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	To
Brown	clay	Silt	Hard,	0	3.1
Grey	clay	Silt	Hard	3.1	8.9
Grey	limestone		layered	8.9	24.3

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0	10.9	cement grout	.4 m³

Method of Construction

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

Well Use

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

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	To
15.55	Steel	.448	+.6	10.9
15.55	Open Hole		10.9	23.4

Status of Well

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

Construction Record - Screen

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

Water Record

Water found at Depth (m/ft)	Kind of Water	Depth (m/ft) From	To	Diameter (cm/in)
1.9 ☐ Gas	☐ Fresh ☑ Untested ☐ Other, specify			
(m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify	0	10.9	24.7
(m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify	10.9	24.3	15.55

Pumping Test

After test of well yield, water was: ☑ Clear and sand free ☐ Other, specify

If pumping discontinued, give reason:

Pump intake set at (m/ft): 20

Pumping rate (l/min / GPM): 56

Duration of pumping: 1 hrs + ____ min

Final water level end of pumping (m/ft): 1.87

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

Recommended pump depth (m/ft):

Recommended pump rate (l/min / GPM):

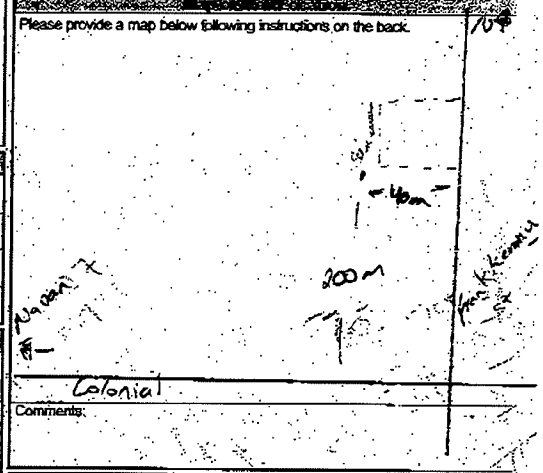
Well production (l/min / GPM):

Disinfected? ☑ Yes ☐ No

Draw Down Time (min)	Water Level (m/ft)	Recovery Time (min)	Water Level (m/ft)
Static Level	1.04		1.87
1		1	1.17
2		2	1.10
3		3	1.08
4		4	1.08
5	1.69	5	1.06
10	1.85	10	1.05
15	1.85	15	1.04
20	1.86	20	1.04
25	1.87	25	1.04
30	1.87	30	1.04
40	1.88	40	1.04
50	1.88	50	1.04
60	1.87	60	

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Bourgeois Well Drilling Ltd.	7141

Business Address (Street Number/Name)	Municipality
151 McIntee D'Aoust	Nation

Province	Postal Code	Business E-mail Address
ON	K0A1G0	N/A

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
6138875529	GENIER, MICHAEL

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
3149		2012/01/13

Well owner's information package delivered: ☐ Yes ☑ No

Date Package Delivered: ____

Date Work Completed: 2012/01/13

Audit No. Z140701

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Contractor's Copy

APPENDIX E

Raw Pumping Test Data and Transmissivity Calculations

PW11-1

Notes:	
Datalogger installed at 10.7 m below top of casing	
Static WL	1.715 m below top of casing
Start of Test	11/7/2011 9:36
End of Test	11/7/2011 15:52

Date/Time	Time (min)	Pumping Rate (L/min)	Datalogger Level (m)	Temperature (deg C)	Datalogger Drawdown (m)	Water Level (m btoc)
11/7/2011 9:36	**0**	15.14	**9.2122**	**8.385**	**0.00**	**1.71**
11/7/2011 9:37	1	15.14	8.825	8.361	0.39	2.10
11/7/2011 9:38	2	15.14	8.4062	8.349	0.81	2.52
11/7/2011 9:39	3	15.14	8.038	8.343	1.17	2.88
11/7/2011 9:40	4	15.14	7.7232	8.345	1.49	3.20
11/7/2011 9:41	5	15.14	7.4403	8.354	1.77	3.48
11/7/2011 9:42	6	15.14	7.1782	8.361	2.03	3.74
11/7/2011 9:43	7	15.14	6.8541	8.386	2.36	4.07
11/7/2011 9:44	8	15.14	6.5403	8.423	2.67	4.38
11/7/2011 9:45	9	15.14	6.2556	8.474	2.96	4.67
11/7/2011 9:46	10	15.14	6.0008	8.531	3.21	4.92
11/7/2011 9:47	11	15.14	5.7696	8.592	3.44	5.15
11/7/2011 9:48	12	15.14	5.5226	8.69	3.69	5.40
11/7/2011 9:49	13	15.14	5.2192	8.764	3.99	5.70
11/7/2011 9:50	14	15.14	4.9205	8.857	4.29	6.00
11/7/2011 9:51	15	15.14	4.6517	8.956	4.56	6.27
11/7/2011 9:52	16	15.14	4.388	9.042	4.82	6.53
11/7/2011 9:53	17	15.14	4.1523	9.144	5.06	6.77
11/7/2011 9:54	18	15.14	3.9616	9.237	5.25	6.96
11/7/2011 9:55	19	15.14	3.8107	9.27	5.40	7.11
11/7/2011 9:56	20	15.14	3.6776	9.286	5.53	7.24
11/7/2011 9:57	21	15.14	3.5343	9.275	5.68	7.39
11/7/2011 9:58	22	15.14	3.4041	9.288	5.81	7.52
11/7/2011 9:59	23	15.14	3.2832	9.282	5.93	7.64
11/7/2011 10:00	24	15.14	3.1722	9.254	6.04	7.75
11/7/2011 10:01	25	15.14	3.0663	9.217	6.15	7.86
11/7/2011 10:02	26	15.14	2.9659	9.239	6.25	7.96
11/7/2011 10:03	27	15.14	2.8715	9.234	6.34	8.05
11/7/2011 10:04	28	15.14	2.7769	9.199	6.44	8.15
11/7/2011 10:05	29	15.14	2.691	9.21	6.52	8.23
11/7/2011 10:06	30	15.14	2.605	9.171	6.61	8.32
11/7/2011 10:07	31	15.14	2.5161	9.135	6.70	8.41
11/7/2011 10:08	32	9.46	2.8412	9.053	6.37	8.08
11/7/2011 10:09	33	9.46	2.874	8.893	6.34	8.05
11/7/2011 10:10	34	9.46	2.9246	8.804	6.29	8.00
11/7/2011 10:11	35	9.46	2.9747	8.733	6.24	7.95
11/7/2011 10:12	36	9.46	3.0168	8.682	6.20	7.91
11/7/2011 10:13	37	9.46	3.0534	8.637	6.16	7.87
11/7/2011 10:14	38	9.46	3.0633	8.62	6.15	7.86
11/7/2011 10:15	39	9.46	3.0708	8.596	6.14	7.85
11/7/2011 10:16	40	10.22	3.0804	8.583	6.13	7.84
11/7/2011 10:17	41	10.22	3.0944	8.564	6.12	7.83
11/7/2011 10:18	42	10.22	3.0621	8.547	6.15	7.86
11/7/2011 10:19	43	10.22	3.0213	8.557	6.19	7.90
11/7/2011 10:20	44	10.22	2.9779	8.563	6.23	7.94
11/7/2011 10:21	45	10.22	2.944	8.573	6.27	7.98
11/7/2011 10:22	46	10.22	2.9133	8.579	6.30	8.01
11/7/2011 10:23	47	10.22	2.8856	8.587	6.33	8.04
11/7/2011 10:24	48	10.22	2.8952	8.59	6.32	8.03
11/7/2011 10:25	49	10.22	2.9073	8.58	6.30	8.02
11/7/2011 10:26	50	10.22	2.9118	8.57	6.30	8.01
11/7/2011 10:27	51	10.22	2.9147	8.571	6.30	8.01
11/7/2011 10:28	52	10.22	2.919	8.565	6.29	8.00

PW11-1

Notes:
Datalogger installed at 10.7 m below top of casing
Static WL 1.715 m below top of casing
Start of Test 11/7/2011 9:36
End of Test 11/7/2011 15:52

Date/Time	Time (min)	Pumping Rate (L/min)	Datalogger Level (m)	Temperature (deg C)	Datalogger Drawdown (m)	Water Level (m btoc)
11/7/2011 10:29	53	10.22	2.9244	8.55	6.29	8.00
11/7/2011 10:30	54	10.22	2.9233	8.535	6.29	8.00
11/7/2011 10:31	55	10.22	2.921	8.522	6.29	8.00
11/7/2011 10:32	56	10.22	2.9235	8.531	6.29	8.00
11/7/2011 10:33	57	10.22	2.9196	8.518	6.29	8.00
11/7/2011 10:34	58	10.22	2.9219	8.507	6.29	8.00
11/7/2011 10:35	59	10.22	2.9219	8.503	6.29	8.00
11/7/2011 10:36	60	10.22	2.9125	8.505	6.30	8.01
11/7/2011 10:37	61	10.22	2.9014	8.505	6.31	8.02
11/7/2011 10:38	62	10.22	2.8938	8.498	6.32	8.03
11/7/2011 10:39	63	10.22	2.8759	8.508	6.34	8.05
11/7/2011 10:40	64	10.22	2.8628	8.5	6.35	8.06
11/7/2011 10:41	65	10.22	2.8467	8.495	6.37	8.08
11/7/2011 10:42	66	11.32	2.8316	8.498	6.38	8.09
11/7/2011 10:43	67	11.32	2.8181	8.495	6.39	8.10
11/7/2011 10:44	68	11.32	2.8026	8.495	6.41	8.12
11/7/2011 10:45	69	11.32	2.7805	8.497	6.43	8.14
11/7/2011 10:46	70	11.32	2.763	8.488	6.45	8.16
11/7/2011 10:47	71	11.32	2.7455	8.485	6.47	8.18
11/7/2011 10:48	72	11.32	2.7271	8.483	6.49	8.20
11/7/2011 10:49	73	11.32	2.7123	8.486	6.50	8.21
11/7/2011 10:50	74	11.32	2.7018	8.482	6.51	8.22
11/7/2011 10:51	75	11.32	2.6864	8.476	6.53	8.24
11/7/2011 10:52	76	11.32	2.6755	8.471	6.54	8.25
11/7/2011 10:53	77	11.32	2.6649	8.465	6.55	8.26
11/7/2011 10:54	78	11.32	2.6577	8.456	6.55	8.26
11/7/2011 10:55	79	11.32	2.6506	8.453	6.56	8.27
11/7/2011 10:56	80	11.32	2.6418	8.454	6.57	8.28
11/7/2011 10:57	81	11.32	2.6378	8.451	6.57	8.28
11/7/2011 10:58	82	11.32	2.6312	8.454	6.58	8.29
11/7/2011 10:59	83	11.32	2.6267	8.451	6.59	8.30
11/7/2011 11:00	84	11.32	2.6219	8.447	6.59	8.30
11/7/2011 11:01	85	11.32	2.6195	8.441	6.59	8.30
11/7/2011 11:02	86	11.32	2.6158	8.432	6.60	8.31
11/7/2011 11:03	87	11.32	2.6135	8.429	6.60	8.31
11/7/2011 11:04	88	11.32	2.6147	8.426	6.60	8.31
11/7/2011 11:05	89	11.32	2.6145	8.426	6.60	8.31
11/7/2011 11:06	90	11.32	2.6135	8.422	6.60	8.31
11/7/2011 11:07	91	11.32	2.6138	8.42	6.60	8.31
11/7/2011 11:08	92	11.32	2.6138	8.416	6.60	8.31
11/7/2011 11:09	93	11.32	2.6107	8.408	6.60	8.31
11/7/2011 11:10	94	11.32	2.6116	8.408	6.60	8.31
11/7/2011 11:11	95	11.32	2.6144	8.408	6.60	8.31
11/7/2011 11:12	96	11.32	2.6177	8.407	6.59	8.30
11/7/2011 11:13	97	11.32	2.621	8.402	6.59	8.30
11/7/2011 11:14	98	11.32	2.6294	8.405	6.58	8.29
11/7/2011 11:15	99	11.32	2.6337	8.407	6.58	8.29
11/7/2011 11:16	100	11.32	2.6302	8.404	6.58	8.29
11/7/2011 11:17	101	11.32	2.6215	8.396	6.59	8.30
11/7/2011 11:18	102	11.32	2.6144	8.394	6.60	8.31
11/7/2011 11:19	103	11.32	2.6041	8.391	6.61	8.32
11/7/2011 11:20	104	11.32	2.5953	8.393	6.62	8.33
11/7/2011 11:21	105	11.32	2.588	8.39	6.62	8.33

PW11-1

Notes:	
Datalogger installed at 10.7 m below top of casing	
Static WL	1.715 m below top of casing
Start of Test	11/7/2011 9:36
End of Test	11/7/2011 15:52

Date/Time	Time (min)	Pumping Rate (L/min)	Datalogger Level (m)	Temperature (deg C)	Datalogger Drawdown (m)	Water Level (m btoc)
11/7/2011 11:22	106	11.32	2.5795	8.395	6.63	8.34
11/7/2011 11:23	107	11.32	2.5741	8.398	6.64	8.35
11/7/2011 11:24	108	11.32	2.5647	8.4	6.65	8.36
11/7/2011 11:25	109	11.32	2.5589	8.401	6.65	8.36
11/7/2011 11:26	110	11.32	2.5465	8.398	6.67	8.38
11/7/2011 11:27	111	11.32	2.5375	8.395	6.67	8.38
11/7/2011 11:28	112	11.32	2.5297	8.392	6.68	8.39
11/7/2011 11:29	113	11.32	2.5207	8.392	6.69	8.40
11/7/2011 11:30	114	11.32	2.5141	8.388	6.70	8.41
11/7/2011 11:31	115	11.32	2.508	8.385	6.70	8.41
11/7/2011 11:32	116	11.32	2.5053	8.383	6.71	8.42
11/7/2011 11:33	117	11.32	2.5022	8.386	6.71	8.42
11/7/2011 11:34	118	11.32	2.5001	8.386	6.71	8.42
11/7/2011 11:35	119	11.32	2.496	8.385	6.72	8.43
11/7/2011 11:36	120	11.32	2.4945	8.381	6.72	8.43
11/7/2011 11:37	121	11.32	2.4903	8.38	6.72	8.43
11/7/2011 11:38	122	11.32	2.4871	8.382	6.73	8.44
11/7/2011 11:39	123	11.32	2.4833	8.38	6.73	8.44
11/7/2011 11:40	124	11.32	2.4826	8.371	6.73	8.44
11/7/2011 11:41	125	11.32	2.4801	8.372	6.73	8.44
11/7/2011 11:42	126	11.32	2.4777	8.37	6.73	8.44
11/7/2011 11:43	127	11.32	2.4724	8.371	6.74	8.45
11/7/2011 11:44	128	11.32	2.4707	8.366	6.74	8.45
11/7/2011 11:45	129	11.32	2.4699	8.367	6.74	8.45
11/7/2011 11:46	130	11.32	2.4663	8.365	6.75	8.46
11/7/2011 11:47	131	11.32	2.4636	8.365	6.75	8.46
11/7/2011 11:48	132	11.32	2.4615	8.365	6.75	8.46
11/7/2011 11:49	133	11.32	2.4589	8.364	6.75	8.46
11/7/2011 11:50	134	11.32	2.4568	8.364	6.76	8.47
11/7/2011 11:51	135	11.32	2.4543	8.365	6.76	8.47
11/7/2011 11:52	136	11.32	2.4514	8.369	6.76	8.47
11/7/2011 11:53	137	11.32	2.4505	8.369	6.76	8.47
11/7/2011 11:54	138	11.32	2.4486	8.365	6.76	8.47
11/7/2011 11:55	139	11.32	2.4464	8.364	6.77	8.48
11/7/2011 11:56	140	11.32	2.4459	8.364	6.77	8.48
11/7/2011 11:57	141	11.32	2.4434	8.361	6.77	8.48
11/7/2011 11:58	142	11.32	2.4408	8.36	6.77	8.48
11/7/2011 11:59	143	11.32	2.4394	8.357	6.77	8.48
11/7/2011 12:00	144	11.32	2.4381	8.356	6.77	8.48
11/7/2011 12:01	145	11.32	2.4335	8.356	6.78	8.49
11/7/2011 12:02	146	11.32	2.4313	8.356	6.78	8.49
11/7/2011 12:03	147	11.32	2.4272	8.354	6.79	8.50
11/7/2011 12:04	148	11.32	2.4275	8.352	6.78	8.49
11/7/2011 12:05	149	11.32	2.4313	8.351	6.78	8.49
11/7/2011 12:06	150	11.32	2.4291	8.349	6.78	8.49
11/7/2011 12:07	151	11.32	2.4296	8.349	6.78	8.49
11/7/2011 12:08	152	11.32	2.4254	8.35	6.79	8.50
11/7/2011 12:09	153	11.32	2.4261	8.351	6.79	8.50
11/7/2011 12:10	154	11.32	2.4226	8.349	6.79	8.50
11/7/2011 12:11	155	11.32	2.4227	8.347	6.79	8.50
11/7/2011 12:12	156	11.32	2.4222	8.351	6.79	8.50
11/7/2011 12:13	157	11.32	2.4205	8.351	6.79	8.50
11/7/2011 12:14	158	11.32	2.4156	8.348	6.80	8.51

PW11-1

Notes:	
Datalogger installed at 10.7 m below top of casing	
Static WL	1.715 m below top of casing
Start of Test	11/7/2011 9:36
End of Test	11/7/2011 15:52

Date/Time	Time (min)	Pumping Rate (L/min)	Datalogger Level (m)	Temperature (deg C)	Datalogger Drawdown (m)	Water Level (m btoc)
11/7/2011 12:15	159	11.32	2.4137	8.345	6.80	8.51
11/7/2011 12:16	160	11.32	2.4123	8.346	6.80	8.51
11/7/2011 12:17	161	11.32	2.404	8.346	6.81	8.52
11/7/2011 12:18	162	11.32	2.4001	8.346	6.81	8.52
11/7/2011 12:19	163	11.32	2.3962	8.344	6.82	8.53
11/7/2011 12:20	164	11.32	2.3941	8.346	6.82	8.53
11/7/2011 12:21	165	11.32	2.3886	8.345	6.82	8.53
11/7/2011 12:22	166	11.32	2.3887	8.346	6.82	8.53
11/7/2011 12:23	167	11.32	2.3884	8.348	6.82	8.53
11/7/2011 12:24	168	11.32	2.3841	8.348	6.83	8.54
11/7/2011 12:25	169	11.32	2.3796	8.346	6.83	8.54
11/7/2011 12:26	170	11.32	2.375	8.343	6.84	8.55
11/7/2011 12:27	171	11.32	2.3738	8.342	6.84	8.55
11/7/2011 12:28	172	11.32	2.3689	8.344	6.84	8.55
11/7/2011 12:29	173	11.32	2.3687	8.341	6.84	8.55
11/7/2011 12:30	174	11.32	2.3671	8.341	6.85	8.56
11/7/2011 12:31	175	11.32	2.3655	8.343	6.85	8.56
11/7/2011 12:32	176	11.32	2.3631	8.342	6.85	8.56
11/7/2011 12:33	177	11.32	2.3607	8.34	6.85	8.56
11/7/2011 12:34	178	11.32	2.3581	8.342	6.85	8.56
11/7/2011 12:35	179	11.32	2.3561	8.343	6.86	8.57
11/7/2011 12:36	180	11.32	2.3544	8.342	6.86	8.57
11/7/2011 12:37	181	11.32	2.3533	8.343	6.86	8.57
11/7/2011 12:38	182	11.32	2.3501	8.343	6.86	8.57
11/7/2011 12:39	183	11.32	2.346	8.343	6.87	8.58
11/7/2011 12:40	184	11.32	2.3442	8.343	6.87	8.58
11/7/2011 12:41	185	11.32	2.3429	8.343	6.87	8.58
11/7/2011 12:42	186	11.32	2.3434	8.342	6.87	8.58
11/7/2011 12:43	187	11.32	2.3439	8.342	6.87	8.58
11/7/2011 12:44	188	11.32	2.3435	8.341	6.87	8.58
11/7/2011 12:45	189	11.32	2.3418	8.338	6.87	8.58
11/7/2011 12:46	190	11.32	2.3373	8.339	6.87	8.59
11/7/2011 12:47	191	11.32	2.3369	8.339	6.88	8.59
11/7/2011 12:48	192	11.32	2.3375	8.337	6.87	8.58
11/7/2011 12:49	193	11.32	2.3372	8.339	6.88	8.59
11/7/2011 12:50	194	11.32	2.3359	8.336	6.88	8.59
11/7/2011 12:51	195	11.32	2.3395	8.333	6.87	8.58
11/7/2011 12:52	196	11.32	2.3396	8.333	6.87	8.58
11/7/2011 12:53	197	11.32	2.3365	8.334	6.88	8.59
11/7/2011 12:54	198	11.32	2.3384	8.333	6.87	8.58
11/7/2011 12:55	199	11.32	2.3364	8.334	6.88	8.59
11/7/2011 12:56	200	11.32	2.3381	8.333	6.87	8.58
11/7/2011 12:57	201	11.32	2.3369	8.333	6.88	8.59
11/7/2011 12:58	202	11.32	2.3312	8.335	6.88	8.59
11/7/2011 12:59	203	11.32	2.3344	8.333	6.88	8.59
11/7/2011 13:00	204	11.32	2.3354	8.331	6.88	8.59
11/7/2011 13:01	205	11.32	2.3317	8.331	6.88	8.59
11/7/2011 13:02	206	11.32	2.3341	8.334	6.88	8.59
11/7/2011 13:03	207	11.32	2.3361	8.333	6.88	8.59
11/7/2011 13:04	208	11.32	2.3319	8.335	6.88	8.59
11/7/2011 13:05	209	11.32	2.3357	8.334	6.88	8.59
11/7/2011 13:06	210	11.32	2.3344	8.332	6.88	8.59
11/7/2011 13:07	211	11.32	2.3375	8.331	6.87	8.58

PW11-1

Notes:	
Datalogger installed at 10.7 m below top of casing	
Static WL	1.715 m below top of casing
Start of Test	11/7/2011 9:36
End of Test	11/7/2011 15:52

Date/Time	Time (min)	Pumping Rate (L/min)	Datalogger Level (m)	Temperature (deg C)	Datalogger Drawdown (m)	Water Level (m btoc)
11/7/2011 13:08	212	11.32	2.3355	8.333	6.88	8.59
11/7/2011 13:09	213	11.32	2.3373	8.332	6.87	8.59
11/7/2011 13:10	214	11.32	2.337	8.331	6.88	8.59
11/7/2011 13:11	215	11.32	2.3345	8.333	6.88	8.59
11/7/2011 13:12	216	11.32	2.3326	8.332	6.88	8.59
11/7/2011 13:13	217	11.32	2.3312	8.333	6.88	8.59
11/7/2011 13:14	218	11.32	2.3236	8.332	6.89	8.60
11/7/2011 13:15	219	11.32	2.3159	8.331	6.90	8.61
11/7/2011 13:16	220	11.32	2.3103	8.331	6.90	8.61
11/7/2011 13:17	221	11.32	2.3044	8.33	6.91	8.62
11/7/2011 13:18	222	11.32	2.2939	8.331	6.92	8.63
11/7/2011 13:19	223	11.32	2.2973	8.33	6.91	8.63
11/7/2011 13:20	224	11.32	2.2892	8.331	6.92	8.63
11/7/2011 13:21	225	11.32	2.2834	8.332	6.93	8.64
11/7/2011 13:22	226	11.32	2.2845	8.328	6.93	8.64
11/7/2011 13:23	227	11.32	2.2885	8.329	6.92	8.63
11/7/2011 13:24	228	11.32	2.2808	8.329	6.93	8.64
11/7/2011 13:25	229	11.32	2.2759	8.332	6.94	8.65
11/7/2011 13:26	230	11.32	2.2772	8.333	6.94	8.65
11/7/2011 13:27	231	11.32	2.2762	8.333	6.94	8.65
11/7/2011 13:28	232	11.32	2.273	8.331	6.94	8.65
11/7/2011 13:29	233	11.32	2.2765	8.331	6.94	8.65
11/7/2011 13:30	234	11.32	2.2733	8.331	6.94	8.65
11/7/2011 13:31	235	11.32	2.2689	8.332	6.94	8.65
11/7/2011 13:32	236	11.32	2.2666	8.331	6.95	8.66
11/7/2011 13:33	237	11.32	2.269	8.33	6.94	8.65
11/7/2011 13:34	238	11.32	2.2676	8.328	6.94	8.65
11/7/2011 13:35	239	11.32	2.2665	8.33	6.95	8.66
11/7/2011 13:36	240	11.32	2.2645	8.33	6.95	8.66
11/7/2011 13:37	241	11.32	2.2623	8.329	6.95	8.66
11/7/2011 13:38	242	11.32	2.2667	8.328	6.95	8.66
11/7/2011 13:39	243	11.32	2.2706	8.329	6.94	8.65
11/7/2011 13:40	244	11.32	2.2683	8.327	6.94	8.65
11/7/2011 13:41	245	11.32	2.2669	8.329	6.95	8.66
11/7/2011 13:42	246	11.32	2.2685	8.328	6.94	8.65
11/7/2011 13:43	247	11.32	2.2656	8.327	6.95	8.66
11/7/2011 13:44	248	11.32	2.2666	8.325	6.95	8.66
11/7/2011 13:45	249	11.32	2.2674	8.328	6.94	8.66
11/7/2011 13:46	250	11.32	2.2648	8.326	6.95	8.66
11/7/2011 13:47	251	11.32	2.2614	8.324	6.95	8.66
11/7/2011 13:48	252	11.32	2.268	8.325	6.94	8.65
11/7/2011 13:49	253	11.32	2.2671	8.325	6.95	8.66
11/7/2011 13:50	254	11.32	2.267	8.324	6.95	8.66
11/7/2011 13:51	255	11.32	2.2672	8.325	6.95	8.66
11/7/2011 13:52	256	11.32	2.2641	8.325	6.95	8.66
11/7/2011 13:53	257	11.32	2.2627	8.322	6.95	8.66
11/7/2011 13:54	258	11.32	2.2626	8.323	6.95	8.66
11/7/2011 13:55	259	11.32	2.2619	8.323	6.95	8.66
11/7/2011 13:56	260	11.32	2.2592	8.323	6.95	8.66
11/7/2011 13:57	261	11.32	2.2574	8.323	6.95	8.67
11/7/2011 13:58	262	11.32	2.2569	8.324	6.96	8.67
11/7/2011 13:59	263	11.32	2.2554	8.325	6.96	8.67
11/7/2011 14:00	264	11.32	2.2563	8.325	6.96	8.67

PW11-1

Notes:	
Datalogger installed at 10.7 m below top of casing	
Static WL	1.715 m below top of casing
Start of Test	11/7/2011 9:36
End of Test	11/7/2011 15:52

Date/Time	Time (min)	Pumping Rate (L/min)	Datalogger Level (m)	Temperature (deg C)	Datalogger Drawdown (m)	Water Level (m btoc)
11/7/2011 14:01	265	11.32	2.254	8.325	6.96	8.67
11/7/2011 14:02	266	11.32	2.2532	8.325	6.96	8.67
11/7/2011 14:03	267	11.32	2.2524	8.326	6.96	8.67
11/7/2011 14:04	268	11.32	2.2527	8.323	6.96	8.67
11/7/2011 14:05	269	11.32	2.255	8.324	6.96	8.67
11/7/2011 14:06	270	11.32	2.2603	8.324	6.95	8.66
11/7/2011 14:07	271	11.32	2.2666	8.323	6.95	8.66
11/7/2011 14:08	272	11.32	2.2644	8.323	6.95	8.66
11/7/2011 14:09	273	11.32	2.2591	8.324	6.95	8.66
11/7/2011 14:10	274	11.32	2.2597	8.323	6.95	8.66
11/7/2011 14:11	275	11.32	2.2673	8.323	6.94	8.66
11/7/2011 14:12	276	11.32	2.2688	8.323	6.94	8.65
11/7/2011 14:13	277	11.32	2.2683	8.323	6.94	8.65
11/7/2011 14:14	278	11.32	2.2668	8.326	6.95	8.66
11/7/2011 14:15	279	11.32	2.2637	8.326	6.95	8.66
11/7/2011 14:16	280	11.32	2.2614	8.327	6.95	8.66
11/7/2011 14:17	281	11.32	2.2614	8.326	6.95	8.66
11/7/2011 14:18	282	11.32	2.2593	8.326	6.95	8.66
11/7/2011 14:19	283	11.32	2.2574	8.326	6.95	8.67
11/7/2011 14:20	284	11.32	2.2561	8.327	6.96	8.67
11/7/2011 14:21	285	11.32	2.2521	8.328	6.96	8.67
11/7/2011 14:22	286	11.32	2.251	8.328	6.96	8.67
11/7/2011 14:23	287	11.32	2.2496	8.328	6.96	8.67
11/7/2011 14:24	288	11.32	2.2495	8.328	6.96	8.67
11/7/2011 14:25	289	11.32	2.2451	8.326	6.97	8.68
11/7/2011 14:26	290	11.32	2.2456	8.324	6.97	8.68
11/7/2011 14:27	291	11.32	2.2409	8.324	6.97	8.68
11/7/2011 14:28	292	11.32	2.2357	8.324	6.98	8.69
11/7/2011 14:29	293	11.32	2.2326	8.323	6.98	8.69
11/7/2011 14:30	294	11.32	2.2279	8.324	6.98	8.69
11/7/2011 14:31	295	11.32	2.2234	8.323	6.99	8.70
11/7/2011 14:32	296	11.32	2.22	8.323	6.99	8.70
11/7/2011 14:33	297	11.32	2.2181	8.324	6.99	8.70
11/7/2011 14:34	298	11.32	2.2158	8.325	7.00	8.71
11/7/2011 14:35	299	11.32	2.2142	8.325	7.00	8.71
11/7/2011 14:36	300	11.32	2.21	8.323	7.00	8.71
11/7/2011 14:37	301	11.32	2.2086	8.321	7.00	8.71
11/7/2011 14:38	302	11.32	2.2082	8.32	7.00	8.71
11/7/2011 14:39	303	11.32	2.2061	8.319	7.01	8.72
11/7/2011 14:40	304	11.32	2.2045	8.319	7.01	8.72
11/7/2011 14:41	305	11.32	2.2053	8.321	7.01	8.72
11/7/2011 14:42	306	11.32	2.2047	8.321	7.01	8.72
11/7/2011 14:43	307	11.32	2.2041	8.32	7.01	8.72
11/7/2011 14:44	308	11.32	2.204	8.32	7.01	8.72
11/7/2011 14:45	309	11.32	2.2036	8.32	7.01	8.72
11/7/2011 14:46	310	11.32	2.2015	8.321	7.01	8.72
11/7/2011 14:47	311	11.32	2.2003	8.322	7.01	8.72
11/7/2011 14:48	312	11.32	2.2016	8.321	7.01	8.72
11/7/2011 14:49	313	11.32	2.2012	8.323	7.01	8.72
11/7/2011 14:50	314	11.32	2.2013	8.322	7.01	8.72
11/7/2011 14:51	315	11.32	2.1999	8.322	7.01	8.72
11/7/2011 14:52	316	11.32	2.1992	8.323	7.01	8.72
11/7/2011 14:53	317	11.32	2.1982	8.324	7.01	8.72

PW11-1

Notes:
Datalogger installed at 10.7 m below top of casing
Static WL 1.715 m below top of casing
Start of Test 11/7/2011 9:36
End of Test 11/7/2011 15:52

Date/Time	Time (min)	Pumping Rate (L/min)	Datalogger Level (m)	Temperature (deg C)	Datalogger Drawdown (m)	Water Level (m btoc)
11/7/2011 14:54	318	11.32	2.2016	8.324	7.01	8.72
11/7/2011 14:55	319	11.32	2.2002	8.323	7.01	8.72
11/7/2011 14:56	320	11.32	2.2016	8.323	7.01	8.72
11/7/2011 14:57	321	11.32	2.1995	8.322	7.01	8.72
11/7/2011 14:58	322	11.32	2.1982	8.322	7.01	8.72
11/7/2011 14:59	323	11.32	2.197	8.32	7.02	8.73
11/7/2011 15:00	324	11.32	2.197	8.322	7.02	8.73
11/7/2011 15:01	325	11.32	2.1965	8.323	7.02	8.73
11/7/2011 15:02	326	11.32	2.1951	8.322	7.02	8.73
11/7/2011 15:03	327	11.32	2.1948	8.322	7.02	8.73
11/7/2011 15:04	328	11.32	2.2016	8.322	7.01	8.72
11/7/2011 15:05	329	11.32	2.2025	8.322	7.01	8.72
11/7/2011 15:06	330	11.32	2.2011	8.32	7.01	8.72
11/7/2011 15:07	331	11.32	2.2023	8.32	7.01	8.72
11/7/2011 15:08	332	11.32	2.2028	8.321	7.01	8.72
11/7/2011 15:09	333	11.32	2.2007	8.321	7.01	8.72
11/7/2011 15:10	334	11.32	2.2002	8.32	7.01	8.72
11/7/2011 15:11	335	11.32	2.2009	8.321	7.01	8.72
11/7/2011 15:12	336	11.32	2.1996	8.321	7.01	8.72
11/7/2011 15:13	337	11.32	2.2004	8.323	7.01	8.72
11/7/2011 15:14	338	11.32	2.2012	8.323	7.01	8.72
11/7/2011 15:15	339	11.32	2.2026	8.322	7.01	8.72
11/7/2011 15:16	340	11.32	2.1998	8.323	7.01	8.72
11/7/2011 15:17	341	11.32	2.201	8.323	7.01	8.72
11/7/2011 15:18	342	11.32	2.1959	8.321	7.02	8.73
11/7/2011 15:19	343	11.32	2.1975	8.322	7.01	8.72
11/7/2011 15:20	344	11.32	2.1974	8.322	7.01	8.73
11/7/2011 15:21	345	11.32	2.1978	8.321	7.01	8.72
11/7/2011 15:22	346	11.32	2.1979	8.319	7.01	8.72
11/7/2011 15:23	347	11.32	2.1953	8.319	7.02	8.73
11/7/2011 15:24	348	11.32	2.1944	8.32	7.02	8.73
11/7/2011 15:25	349	11.32	2.195	8.319	7.02	8.73
11/7/2011 15:26	350	11.32	2.1934	8.319	7.02	8.73
11/7/2011 15:27	351	11.32	2.1941	8.32	7.02	8.73
11/7/2011 15:28	352	11.32	2.1922	8.321	7.02	8.73
11/7/2011 15:29	353	11.32	2.1914	8.322	7.02	8.73
11/7/2011 15:30	354	11.32	2.1921	8.32	7.02	8.73
11/7/2011 15:31	355	11.32	2.1904	8.32	7.02	8.73
11/7/2011 15:32	356	11.32	2.1891	8.319	7.02	8.73
11/7/2011 15:33	357	11.32	2.1903	8.32	7.02	8.73
11/7/2011 15:34	358	11.32	2.1905	8.32	7.02	8.73
11/7/2011 15:35	359	11.32	2.1936	8.32	7.02	8.73
11/7/2011 15:36	360	11.32	2.192	8.32	7.02	8.73
11/7/2011 15:37	361	11.32	2.1935	8.319	7.02	8.51
11/7/2011 15:38	362	11.32	2.1935	8.319	7.02	8.73
11/7/2011 15:39	363	11.32	2.1939	8.32	7.02	8.73
11/7/2011 15:40	364	11.32	2.1944	8.321	7.02	8.73
11/7/2011 15:41	365	11.32	2.1927	8.319	7.02	8.73
11/7/2011 15:42	366	11.32	2.192	8.319	7.02	8.73
11/7/2011 15:43	367	11.32	2.1906	8.319	7.02	8.73
11/7/2011 15:44	368	11.32	2.1884	8.321	7.02	8.73
11/7/2011 15:45	369	11.32	2.1874	8.321	7.02	8.74
11/7/2011 15:46	370	11.32	2.1888	8.32	7.02	8.73

PW11-1

Notes:
Datalogger installed at 10.7 m below top of casing
Static WL 1.715 m below top of casing
Start of Test 11/7/2011 9:36
End of Test 11/7/2011 15:52

Date/Time	Time (min)	Pumping Rate (L/min)	Datalogger Level (m)	Temperature (deg C)	Datalogger Drawdown (m)	Water Level (m btoc)
11/7/2011 15:47	371	11.32	2.1896	8.317	7.02	8.73
11/7/2011 15:48	372	11.32	2.186	8.319	7.03	8.74
11/7/2011 15:49	373	11.32	2.1858	8.319	7.03	8.74
11/7/2011 15:50	374	11.32	2.182	8.318	7.03	8.74
11/7/2011 15:51	375	11.32	2.1814	8.318	7.03	8.74
11/7/2011 15:52	376	0	**2.1782**	**8.317**	**7.03**	**8.74**
11/7/2011 15:53	377	0	2.7355	8.308	6.48	8.19
11/7/2011 15:54	378	0	3.2417	8.293	5.97	7.68
11/7/2011 15:55	379	0	3.7198	8.28	5.49	7.20
11/7/2011 15:56	380	0	4.1715	8.272	5.04	6.75
11/7/2011 15:57	381	0	4.5965	8.268	4.62	6.33
11/7/2011 15:58	382	0	4.9962	8.263	4.22	5.93
11/7/2011 15:59	383	0	5.374	8.261	3.84	5.55
11/7/2011 16:00	384	0	5.7259	8.258	3.49	5.20
11/7/2011 16:01	385	0	6.0546	8.256	3.16	4.87
11/7/2011 16:02	386	0	6.3606	8.255	2.85	4.56
11/7/2011 16:03	387	0	6.6445	8.255	2.57	4.28
11/7/2011 16:04	388	0	6.9091	8.254	2.30	4.01
11/7/2011 16:05	389	0	7.1517	8.252	2.06	3.77
11/7/2011 16:06	390	0	7.3772	8.253	1.84	3.55
11/7/2011 16:07	391	0	7.5812	8.251	1.63	3.34
11/7/2011 16:08	392	0	7.7687	8.25	1.44	3.15
11/7/2011 16:09	393	0	7.9376	8.251	1.27	2.98
11/7/2011 16:10	394	0	8.0927	8.25	1.12	2.83
11/7/2011 16:11	395	0	8.2311	8.25	0.98	2.69
11/7/2011 16:12	396	0	8.355	8.25	0.86	2.57
11/7/2011 16:13	397	0	8.4663	8.249	0.75	2.46
11/7/2011 16:14	398	0	8.5647	8.249	0.65	2.36
11/7/2011 16:15	399	0	8.65	8.25	0.56	2.27
11/7/2011 16:16	400	0	8.7241	8.249	0.49	2.20
11/7/2011 16:17	401	0	8.787	8.249	0.43	2.14
11/7/2011 16:18	402	0	8.8317	8.249	0.38	2.09
11/7/2011 16:19	403	0	8.8712	8.25	0.34	2.05
11/7/2011 16:20	404	0	8.9085	8.25	0.30	2.01
11/7/2011 16:21	405	0	8.9433	8.25	0.27	1.98
11/7/2011 16:22	406	0	8.9724	8.25	0.24	1.95
11/7/2011 16:23	407	0	8.9973	8.25	0.21	1.93
11/7/2011 16:24	408	0	9.0187	8.25	0.19	1.90
11/7/2011 16:25	409	0	9.0368	8.25	0.18	1.89
11/7/2011 16:26	410	0	9.0535	8.25	0.16	1.87
11/7/2011 16:27	411	0	9.0682	8.25	0.14	1.85
11/7/2011 16:28	412	0	9.0801	8.252	0.13	1.84
11/7/2011 16:29	413	0	9.0906	8.252	0.12	1.83
11/7/2011 16:30	414	0	9.0998	8.252	0.11	1.82
11/7/2011 16:31	415	0	9.1077	8.252	0.10	1.81
11/7/2011 16:32	416	0	9.1148	8.253	0.10	1.81
11/7/2011 16:33	417	0	9.1208	8.254	0.09	1.80
11/7/2011 16:34	418	0	9.1258	8.258	0.09	1.80
11/7/2011 16:35	419	0	9.1298	8.258	0.08	1.79
11/7/2011 16:36	420	0	9.134	8.261	0.08	1.79
11/7/2011 16:37	421	0	9.1381	8.262	0.07	1.78
11/7/2011 16:38	422	0	9.1406	8.263	0.07	1.78

Notes	
Datalogger installed at 10 m below top of casing	
Static WL	2.39 m below top of casing

Date/Time	Time (min)	Datalogger Level (m)	Temperature (deg C)	Datalogger Drawdown (m)	Water Level (m btoc)
11/7/2011 9:35		8.8294	9.528	0	2.390
11/7/2011 9:40	4	8.8286	9.54	0.001	2.391
11/7/2011 9:45	9	8.6027	9.568	0.227	2.617
11/7/2011 9:50	14	8.7893	9.659	0.040	2.430
11/7/2011 9:55	19	8.8033	9.683	0.026	2.416
11/7/2011 10:00	24	8.805	9.667	0.024	2.414
11/7/2011 10:05	29	8.8025	9.625	0.027	2.417
11/7/2011 10:10	34	8.8014	9.611	0.028	2.418
11/7/2011 10:15	39	8.5922	9.647	0.237	2.627
11/7/2011 10:20	44	8.78	9.69	0.049	2.439
11/7/2011 10:25	49	8.7933	9.689	0.036	2.426
11/7/2011 10:30	54	8.7939	9.682	0.035	2.426
11/7/2011 10:35	59	8.7939	9.665	0.035	2.426
11/7/2011 10:40	64	8.7933	9.65	0.036	2.426
11/7/2011 10:45	69	8.7932	9.629	0.036	2.426
11/7/2011 10:50	74	8.7908	9.611	0.039	2.429
11/7/2011 10:55	79	8.7901	9.588	0.039	2.429
11/7/2011 11:00	84	8.7889	9.585	0.040	2.431
11/7/2011 11:05	89	8.7875	9.574	0.042	2.432
11/7/2011 11:10	94	8.7865	9.562	0.043	2.433
11/7/2011 11:15	99	8.7849	9.55	0.044	2.435
11/7/2011 11:20	104	8.7856	9.54	0.044	2.434
11/7/2011 11:25	109	8.7846	9.527	0.045	2.435
11/7/2011 11:30	114	8.7844	9.513	0.045	2.435
11/7/2011 11:35	119	8.7841	9.5	0.045	2.435
11/7/2011 11:40	124	8.7827	9.491	0.047	2.437
11/7/2011 11:45	129	8.7821	9.478	0.047	2.437
11/7/2011 11:50	134	8.7811	9.472	0.048	2.438
11/7/2011 11:55	139	8.7805	9.468	0.049	2.439
11/7/2011 12:00	144	8.7797	9.462	0.050	2.440
11/7/2011 12:05	149	8.7796	9.453	0.050	2.440
11/7/2011 12:10	154	8.78	9.443	0.049	2.439
11/7/2011 12:15	159	8.7779	9.434	0.051	2.442
11/7/2011 12:20	164	8.7672	9.459	0.062	2.452
11/7/2011 12:25	169	8.7761	9.471	0.053	2.443
11/7/2011 12:30	174	8.7762	9.476	0.053	2.443
11/7/2011 12:35	179	8.777	9.478	0.052	2.442
11/7/2011 12:40	184	8.7776	9.48	0.052	2.442
11/7/2011 12:45	189	8.7769	9.477	0.053	2.443
11/7/2011 12:50	194	8.7761	9.471	0.053	2.443
11/7/2011 12:55	199	8.775	9.465	0.054	2.444
11/7/2011 13:00	204	8.774	9.458	0.055	2.445
11/7/2011 13:05	209	8.7739	9.453	0.056	2.446
11/7/2011 13:10	214	8.7738	9.448	0.056	2.446
11/7/2011 13:15	219	8.7091	9.556	0.120	2.510
11/7/2011 13:20	224	8.7661	9.634	0.063	2.453
11/7/2011 13:25	229	8.7713	9.621	0.058	2.448
11/7/2011 13:30	234	8.7723	9.603	0.057	2.447
11/7/2011 13:35	239	8.7708	9.598	0.059	2.449
11/7/2011 13:40	244	8.7707	9.586	0.059	2.449
11/7/2011 13:45	249	8.7713	9.572	0.058	2.448
11/7/2011 13:50	254	8.7696	9.56	0.060	2.450
11/7/2011 13:55	259	**8.756**	**9.598**	**0.073**	2.463
11/7/2011 14:00	264	8.7638	9.623	0.066	2.456

Residential Well

Notes	
Datalogger installed at 10 m below top of casing	
Static WL	2.39 m below top of casing

Date/Time	Time (min)	Datalogger Level (m)	Temperature (deg C)	Datalogger Drawdown (m)	Water Level (m btoc)
11/7/2011 14:05	269	8.7665	9.637	0.063	2.453
11/7/2011 14:10	274	8.7675	9.609	0.062	2.452
11/7/2011 14:15	279	8.7683	9.603	0.061	2.451
11/7/2011 14:20	284	8.7683	9.589	0.061	2.451
11/7/2011 14:25	289	8.7681	9.576	0.061	2.451
11/7/2011 14:30	294	8.7681	9.563	0.061	2.451
11/7/2011 14:35	299	8.7683	9.554	0.061	2.451
11/7/2011 14:40	304	8.7667	9.544	0.063	2.453
11/7/2011 14:45	309	8.7652	9.533	0.064	2.454
11/7/2011 14:50	314	8.7658	9.519	0.064	2.454
11/7/2011 14:55	319	8.7667	9.51	0.063	2.453
11/7/2011 15:00	324	8.7665	9.501	0.063	2.453
11/7/2011 15:05	329	8.7683	9.49	0.061	2.451
11/7/2011 15:10	334	8.7686	9.483	0.061	2.451
11/7/2011 15:15	339	8.7699	9.475	0.059	2.450
11/7/2011 15:20	344	8.7694	9.467	0.060	2.450
11/7/2011 15:25	349	8.7686	9.459	0.061	2.451
11/7/2011 15:30	354	8.7679	9.451	0.062	2.452
11/7/2011 15:35	359	8.7676	9.445	0.062	2.452
11/7/2011 15:40	364	8.7679	9.438	0.062	2.452
11/7/2011 15:45	369	8.7679	9.431	0.062	2.452
11/7/2011 15:50	374	8.7679	9.425	0.062	2.452
11/7/2011 15:55	379	8.7687	9.419	0.061	2.451
11/7/2011 16:00	384	8.7741	9.412	0.055	2.445
11/7/2011 16:05	389	8.7791	9.406	0.050	2.440
11/7/2011 16:10	394	8.7851	9.4	0.044	2.434
11/7/2011 16:15	399	8.7909	9.394	0.038	2.429

Bradley Bus Well

Notes	
Datalogger installed at 11 m below top of casing	
Static WL	2.204 m below top of casing

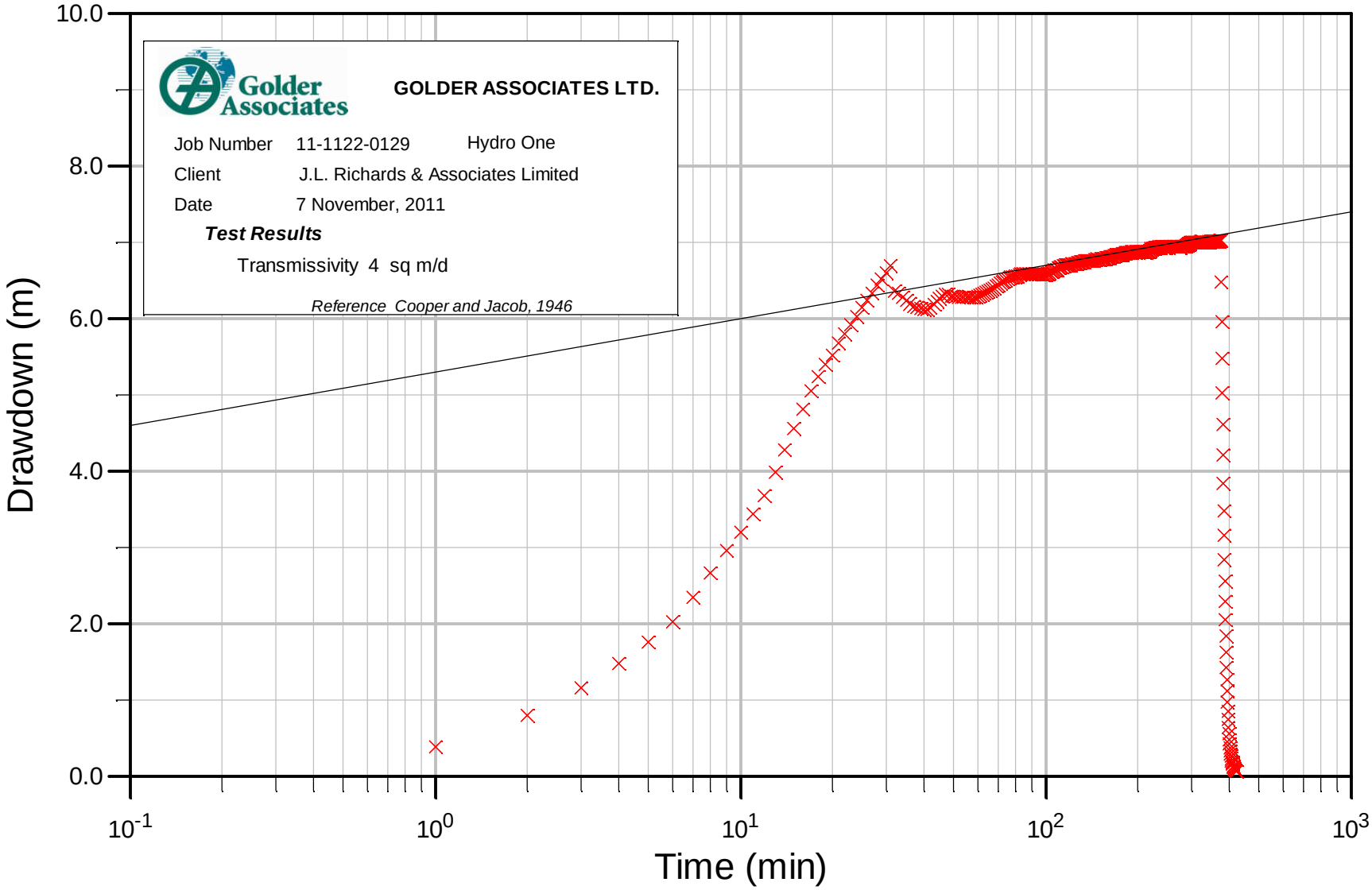
Date/Time	Time (min)	Datalogger Level (m)	Temperature (deg C)	Datalogger Drawdown (m)	Water Level (m btoc)
11/7/2011 9:25		7.9923	12.015		2.20
11/7/2011 9:30		7.9903	12.003		2.20
11/7/2011 9:35		7.5706	11.959	0	2.62
11/7/2011 9:40	4	7.9793	12.093	0.000	2.22
11/7/2011 9:45	9	7.9825	12.062	-0.003	2.21
11/7/2011 9:50	14	7.9816	12.049	-0.002	2.21
11/7/2011 9:55	19	7.9815	12.077	-0.002	2.21
11/7/2011 10:00	24	7.9807	12.066	-0.001	2.21
11/7/2011 10:05	29	7.979	11.995	0.000	2.22
11/7/2011 10:10	34	7.9786	11.966	0.001	2.22
11/7/2011 10:15	39	7.9768	11.945	0.003	2.22
11/7/2011 10:20	44	7.976	11.929	0.003	2.22
11/7/2011 10:25	49	7.9765	11.924	0.003	2.22
11/7/2011 10:30	54	7.9743	11.908	0.005	2.22
11/7/2011 10:35	59	7.9734	11.899	0.006	2.22
11/7/2011 10:40	64	7.9737	11.879	0.006	2.22
11/7/2011 10:45	69	7.9704	11.869	0.009	2.22
11/7/2011 10:50	74	7.969	11.862	0.010	2.23
11/7/2011 10:55	79	7.9689	11.855	0.010	2.23
11/7/2011 11:00	84	7.9687	11.847	0.011	2.23
11/7/2011 11:05	89	7.9665	11.841	0.013	2.23
11/7/2011 11:10	94	7.9664	11.83	0.013	2.23
11/7/2011 11:15	99	7.9653	11.822	0.014	2.23
11/7/2011 11:20	104	7.9644	11.818	0.015	2.23
11/7/2011 11:25	109	7.9647	11.814	0.015	2.23
11/7/2011 11:30	114	7.9637	11.806	0.016	2.23
11/7/2011 11:35	119	7.9641	11.804	0.015	2.23
11/7/2011 11:40	124	7.9636	11.799	0.016	2.23
11/7/2011 11:45	129	7.9635	11.795	0.016	2.23
11/7/2011 11:50	134	7.9624	11.788	0.017	2.23
11/7/2011 11:55	139	7.962	11.783	0.017	2.23
11/7/2011 12:00	144	7.96	11.78	0.019	2.23
11/7/2011 12:05	149	7.9599	11.774	0.019	2.23
11/7/2011 12:10	154	7.9604	11.769	0.019	2.23
11/7/2011 12:15	159	7.9582	11.764	0.021	2.24
11/7/2011 12:20	164	7.9591	11.757	0.020	2.24
11/7/2011 12:25	169	7.9578	11.749	0.022	2.24
11/7/2011 12:30	174	7.958	11.748	0.021	2.24
11/7/2011 12:35	179	7.9573	11.741	0.022	2.24
11/7/2011 12:40	184	7.9583	11.732	0.021	2.24
11/7/2011 12:45	189	7.9579	11.729	0.021	2.24
11/7/2011 12:50	194	7.9568	11.725	0.023	2.24
11/7/2011 12:55	199	7.948	11.783	0.031	2.25
11/7/2011 13:00	204	7.9555	11.838	0.024	2.24
11/7/2011 13:05	209	7.9567	11.803	0.023	2.24
11/7/2011 13:10	214	7.9579	11.801	0.021	2.24
11/7/2011 13:15	219	7.9558	11.813	0.024	2.24
11/7/2011 13:20	224	7.9564	11.798	0.023	2.24
11/7/2011 13:25	229	7.9566	11.794	0.023	2.24
11/7/2011 13:30	234	7.8888	11.788	0.091	2.31
11/7/2011 13:35	239	7.9467	11.849	0.033	2.25
11/7/2011 13:40	244	7.954	11.959	0.025	2.24
11/7/2011 13:45	249	7.5155	11.926	0.464	2.68
11/7/2011 13:50	254	7.9462	12.151	0.033	2.25

Bradley Bus Well

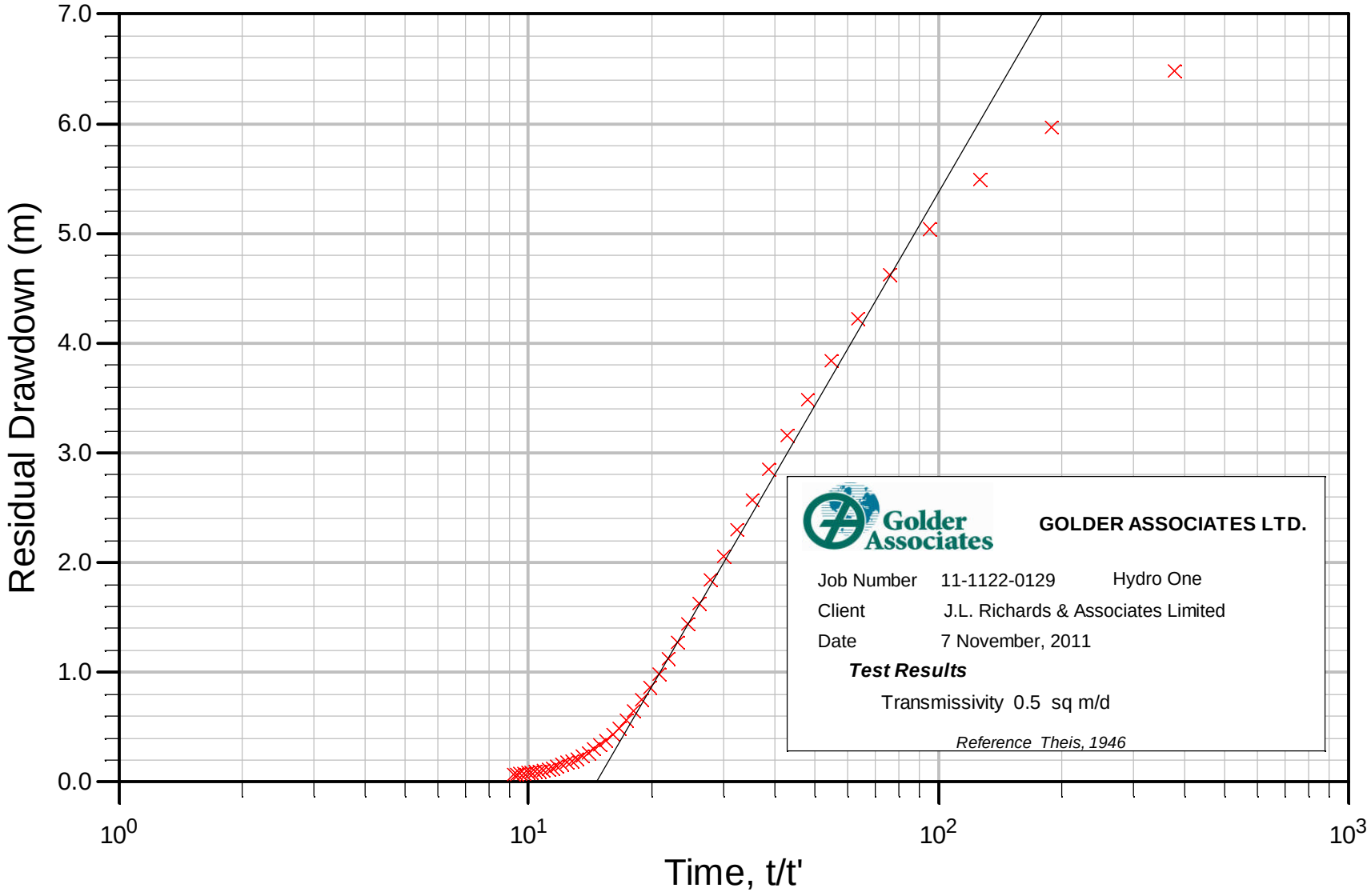
Notes	
Datalogger installed at 11 m below top of casing	
Static WL	2.204 m below top of casing

Date/Time	Time (min)	Datalogger Level (m)	Temperature (deg C)	Datalogger Drawdown (m)	Water Level (m btoc)
11/7/2011 13:55	259	7.9399	11.935	0.039	2.25
11/7/2011 14:00	264	7.9261	11.884	0.053	2.27
11/7/2011 14:05	269	7.9455	11.953	0.034	2.25
11/7/2011 14:10	274	7.9513	11.976	0.028	2.24
11/7/2011 14:15	279	7.9529	12.056	0.026	2.24
11/7/2011 14:20	284	7.9232	11.893	0.056	2.27
11/7/2011 14:25	289	7.9477	11.936	0.032	2.25
11/7/2011 14:30	294	7.9521	12.006	0.027	2.24
11/7/2011 14:35	299	7.9354	11.868	0.044	2.26
11/7/2011 14:40	304	7.5824	11.899	0.397	2.61
11/7/2011 14:45	309	7.9433	12.073	0.036	2.25
11/7/2011 14:50	314	7.9445	12.18	0.035	2.25
11/7/2011 14:55	319	7.9478	12.144	0.032	2.25
11/7/2011 15:00	324	7.9486	12.076	0.031	2.25
11/7/2011 15:05	329	7.9488	12.046	0.031	2.25
11/7/2011 15:10	334	7.9508	12.013	0.029	2.24
11/7/2011 15:15	339	7.9513	12.002	0.028	2.24
11/7/2011 15:20	344	7.9509	11.961	0.028	2.24
11/7/2011 15:25	349	7.9511	11.947	0.028	2.24
11/7/2011 15:30	354	7.9507	11.925	0.029	2.24
11/7/2011 15:35	359	7.9509	11.912	0.028	2.24
11/7/2011 15:40	364	7.9512	11.902	0.028	2.24
11/7/2011 15:45	369	7.9509	11.89	0.028	2.24
11/7/2011 15:50	374	7.9514	11.878	0.028	2.24
11/7/2011 15:55	379	7.9517	11.865	0.028	2.24
11/7/2011 16:00	384	7.9525	11.857	0.027	2.24
11/7/2011 16:05	389	7.9537	11.857	0.026	2.24
11/7/2011 16:10	394	7.9547	11.846	0.025	2.24
11/7/2011 16:15	399	7.9561	11.837	0.023	2.24
11/7/2011 16:20	404	7.9573	11.826	0.022	2.24
11/7/2011 16:25	409	7.9596	11.818	0.020	2.23
11/7/2011 16:30	414	7.9603	11.81	0.019	2.23
11/7/2011 16:35	419	7.9609	11.801	0.018	2.23
11/7/2011 16:40	424	7.9641	11.792	0.015	2.23
11/7/2011 16:45	429	7.963	11.79	0.016	2.23

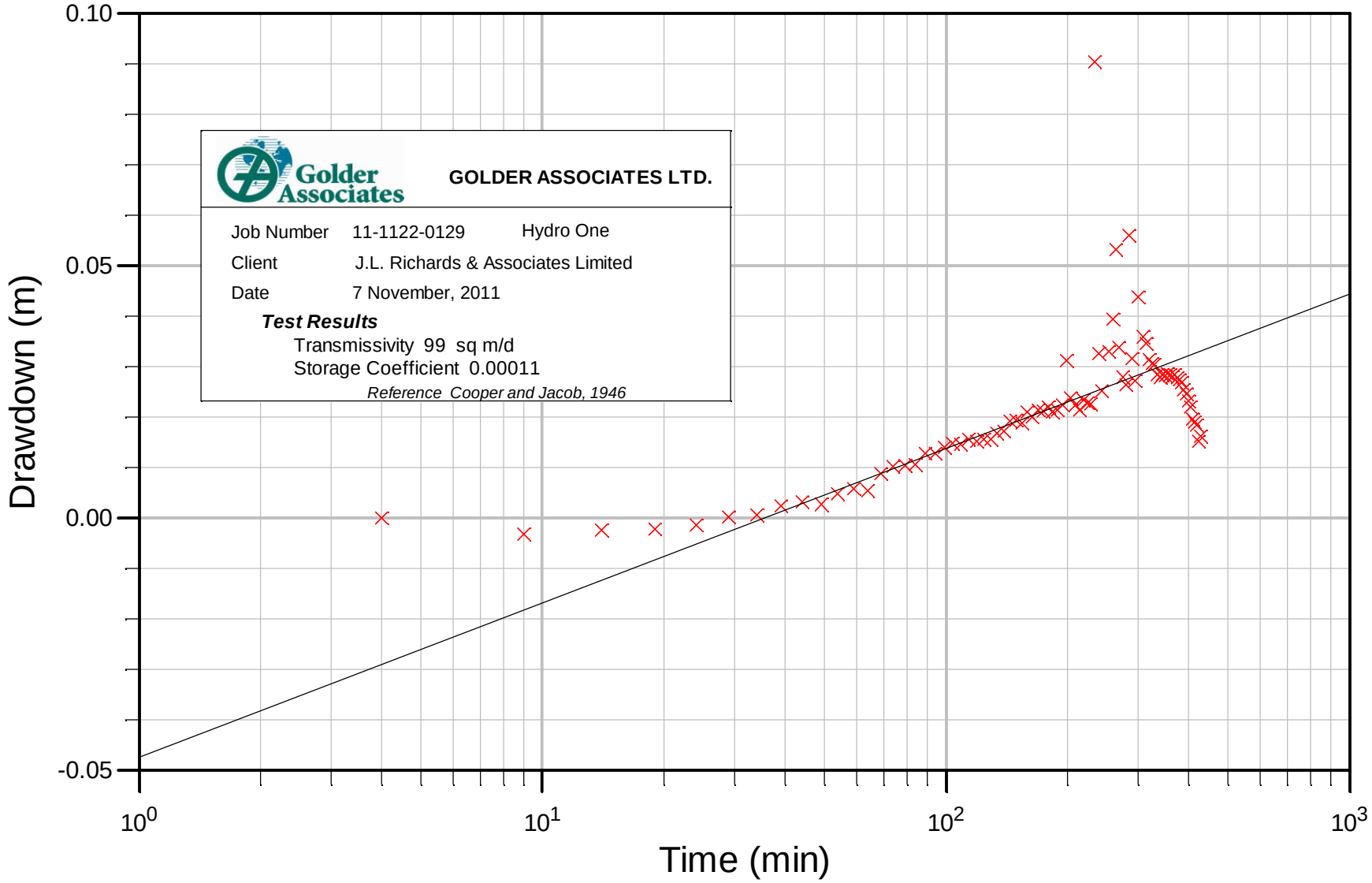
PW11-1 Cooper and Jacob



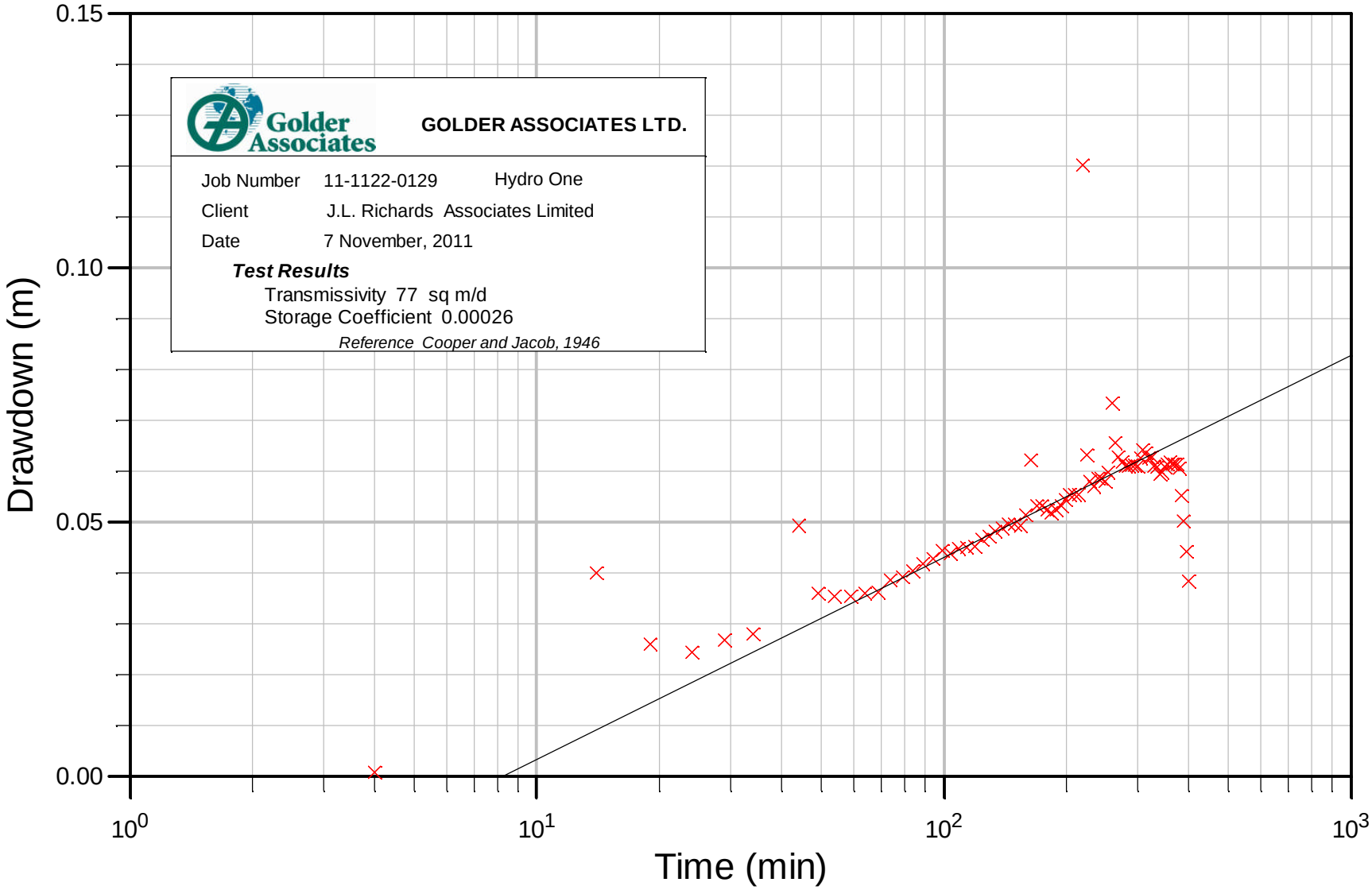
PW11-1 Theis Recovery



Bus Depot - Cooper and Jacob



Residential Well - Cooper and Jacob



APPENDIX F

Laboratory Certificates of Analysis

EXOVA ACCUTEST

REPORT OF ANALYSIS

Exova Accutest

Client: **Golder Associates Ltd. (Ottawa)**
32 Steacie Drive

Kanata, ON
K2K 2A9
Attention: **Ms. Caitlin Cooke**

Report Number: 1126039
Date: 2011-11-10
Date Submitted: 2011-11-07

Project: 11-1122-0129

P.O. Number:

Chain of Custody Number: **155926**

Matrix: Water

			LAB ID:	923194	923195	923196	923197		**GUIDELINE**		
			Sample Date:	2011-11-07	2011-11-07	2011-11-07	2011-11-07				
			Sample ID:	S-1	S-2	S-3	S-4		ODWSOG		
PARAMETER	**UNITS**	**MRL**							**TYPE**	**LIMIT**	**UNITS**
Total Coliforms	CFU/100mL			5	12	0	2		MAC	0	CFU/100mL
Escherichia Coli	CFU/100mL			0	0	0	0		MAC	0	CFU/100mL
Heterotrophic Plate Count	CFU/1mL			12	5	18	12				
Faecal Coliforms	CFU/100mL			0	0	0	0				
Faecal Streptococcus	CFU/100mL			0	0	0	0				

MRL = Method Reporting Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL: for Krista Quantrill
Microbiology Lab Supervisor

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

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

EXOVA ACCUTEST

REPORT OF ANALYSIS

Exova Accutest

Client: Golder Associates Ltd. (Ottawa)
32 Steacie Drive

Kanata, ON
K2K 2A9
Attention: Ms. Caitlin Cooke

Report Number: 1126052
Date: 2011-11-14
Date Submitted: 2011-11-07

Project: 11-1122-0129

P.O. Number:

Chain of Custody Number: 155926
Matrix: Water

			LAB ID:	923239	923240	923241	923242		GUIDELINE		
			Sample Date:	2011-11-07	2011-11-07	2011-11-07	2011-11-07				
			Sample ID:	S-1	S-2	S-3	S-4		ODWSOG		
PARAMETER	**UNITS**	**MRL**							**TYPE**	**LIMIT**	**UNITS**
Alkalinity as CaCO3	mg/L	5		284	312	332	295		OG	500	mg/L
Chloride	mg/L	1		89	80	104	90		AO	250	mg/L
Colour	TCU	2		<2	<2	2	<2		AO	5	TCU
Conductivity	uS/cm	5		848	992	1000	853				
Dissolved Organic Carbon	mg/L	0.5		1.5	1.3	1.6	1.2		AO	5	mg/L
Fluoride	mg/L	0.1		0.29	0.11	<0.10	0.27		MAC	1.5	mg/L
Hydrogen Sulphide	mg/L	0.01		2.88	0.14	<0.01	<0.10		AO	0.05	mg/L
N-NH3 (Ammonia)	mg/L	0.02		0.76	0.14	0.07	0.70				
N-NO2 (Nitrite)	mg/L	0.1		<0.10	<0.10	<0.10	<0.10		MAC	1.0	mg/L
N-NO3 (Nitrate)	mg/L	0.1		0.14	<0.10	<0.10	<0.10		MAC	10.0	mg/L
pH				7.96	7.91	7.90	8.03			6.5-8.5	
Phenols	mg/L	0.001		0.002	<0.001	<0.001	<0.001				
Sulphate	mg/L	1		22	95	43	22		AO	500	mg/L
Tannin & Lignin	mg/L	0.1		<0.1	<0.1	<0.1	<0.1				
Total Dissolved Solids (COND - CALC)	mg/L	1		551	645	650	554		AO	500	mg/L
Total Kjeldahl Nitrogen	mg/L	0.1		0.74	0.26	<0.10	0.87				
Turbidity	NTU	0.1		102	28.4	7.6	37.1		MAC	1.0	NTU
Hardness as CaCO3	mg/L	1		297	471	439	279		OG	100	mg/L
Ion Balance		0.01		1.04	1.08	1.06	0.94				
Calcium	mg/L	1		76	169	156	74				
Magnesium	mg/L	1		26	12	12	23				
Potassium	mg/L	1		8	3	2	6				
Sodium	mg/L	2		66	41	51	60		AO	200	mg/L
Iron	mg/L	0.03		1.48	1.86	0.82	0.35		AO	0.3	mg/L
Manganese	mg/L	0.01		0.05	0.08	0.05	0.03		AO	0.05	mg/L

MRL = Method Reporting Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:
923242: H2S MRL elevated due to sample turbidity.

APPROVAL:
Lorna Wilson
Inorganic Lab Supervisor

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

Client: **Golder Associates Ltd. (Ottawa)**
32 Steacie Drive

Kanata, ON
K2K 2A9
Attention: **Ms. Caitlin Cooke**

Report Number: 1126052
Date: 2011-11-14
Date Submitted: 2011-11-07

Project: 11-1122-0129

P.O. Number:

Chain of Custody Number: 155926

Matrix: Water

								GUIDELINE		
LAB ID:										
Sample Date:										
Sample ID:			LAB BLANK	LAB QC % RECOVERY	QC RECOVERY RANGE	DATE ANALYSED		ODWSOG		
PARAMETER	**UNITS**	**MRL**						**TYPE**	**LIMIT**	**UNITS**
Alkalinity as CaCO3	mg/L	5	<5	101	95-105	2011-11-09		OG	500	mg/L
Chloride	mg/L	1	<1	99	90-112	2011-11-10		AO	250	mg/L
Colour	TCU	2	<2	100	80-120	2011-11-09		AO	5	TCU
Conductivity	uS/cm	5	<5	99	95-105	2011-11-09				
Dissolved Organic Carbon	mg/L	0.5	<0.5	90	84-116	2011-11-10		AO	5	mg/L
Fluoride	mg/L	0.1	<0.10	100	90-110	2011-11-09		MAC	1.5	mg/L
Hydrogen Sulphide	mg/L	0.01	<0.01	84	33-166	2011-11-14		AO	0.05	mg/L
N-NH3 (Ammonia)	mg/L	0.02	<0.02	95	85-115	2011-11-08				
N-NO2 (Nitrite)	mg/L	0.1	<0.10	93	80-120	2011-11-10		MAC	1.0	mg/L
N-NO3 (Nitrate)	mg/L	0.1	<0.10	108	80-120	2011-11-10		MAC	10.0	mg/L
pH			5.78	99	90-110	2011-11-09			6.5-8.5	
Phenols	mg/L	0.001	<0.001	112	73-127	2011-11-11				
Sulphate	mg/L	1	<1	98	90-110	2011-11-10		AO	500	mg/L
Tannin & Lignin	mg/L	0.1	<0.1	94	80-120	2011-11-10				
Total Dissolved Solids (COND - CALC)	mg/L	1	<1		-	2011-11-14		AO	500	mg/L
Total Kjeldahl Nitrogen	mg/L	0.1	<0.10	97	77-123	2011-11-11				
Turbidity	NTU	0.1	<0.1	100	73-127	2011-11-08		MAC	1.0	NTU
Hardness as CaCO3	mg/L	1	<1		-	2011-11-14		OG	100	mg/L
Ion Balance		0.01	<0.01		-	2011-11-14				
Calcium	mg/L	1	<1	100	80-120	2011-11-09				
Magnesium	mg/L	1	<1	98	80-120	2011-11-09				
Potassium	mg/L	1	<1	100	80-120	2011-11-09				
Sodium	mg/L	2	<2	100	80-120	2011-11-09		AO	200	mg/L
Iron	mg/L	0.03	<0.03	108	88-112	2011-11-08		AO	0.3	mg/L
Manganese	mg/L	0.01	<0.01	100	91-109	2011-11-08		AO	0.05	mg/L

MRL = Method Reporting Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL:

Lorna Wilson
Inorganic Lab Supervisor

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

REPORT OF ANALYSIS

Client: Golder Associates Ltd. (Ottawa)
32 Steacie Drive

Kanata, ON
K2K 2A9
Attention: Ms. Caitlin Cooke

Report Number: 1126582
Date: 2011-11-16
Date Submitted: 2011-11-14

Project: 11-1122-0124

P.O. Number:
Matrix: Groundwater

Chain of Custody Number: 156190

			LAB ID:	924767					**GUIDELINE**
			Sample Date:	2011-11-14					ODWSOG
			Sample ID:	11-5					
PARAMETER	**UNITS**	**MRL**						**TYPE**	**LIMIT**	**UNITS**
N-NO3 (Nitrate)	mg/L	0.1	<0.10					MAC	10.0	mg/L

MRL = Method Reporting Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL:

Lorna Wilson
Inorganic Lab Supervisor

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

REPORT OF ANALYSIS

Client: Golder Associates Ltd. (Ottawa)
32 Steacie Drive

Kanata, ON
K2K 2A9
Attention: Ms. Caitlin Cooke

Report Number: 1126582
Date: 2011-11-16
Date Submitted: 2011-11-14

Project: 11-1122-0124

P.O. Number:
Matrix: Groundwater

Chain of Custody Number: 156190

			LAB ID:					GUIDELINE		
			Sample Date:							
			Sample ID:	LAB BLANK	LAB QC % RECOVERY	QC RECOVERY RANGE	DATE ANALYSED		ODWSOG		
PARAMETER	UNITS	MRL						TYPE	LIMIT	UNITS
N-NO3 (Nitrate)	mg/L	0.1	<0.10	97	80-120	2011-11-15		MAC	10.0	mg/L

MRL = Method Reporting Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration
Comment:

APPROVAL:
Lorna Wilson
Inorganic Lab Supervisor

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

APPENDIX G

Nitrate Dilution Calculation

Nitrate Dilution Calculation

Input Parameters

Site Area	29,000	m^2	(approximately 2.90 hectares)
Net Potential Infiltration (NPI)	180	mm/yr	
Nitrate strength in effluent	40	mg/L	
Water usage per employee	125	L/day	
Maximum number of employees	35		

Dilution Calculation

Annual infiltration across site	5.22E+06	L/yr	= NPI * site area
Septic Loading for 35 employees	1.60E+06	L/yr	= water usage * number of employees
Nitrate loading	6.39E+07	mg/L/yr	= septic loading * nitrate strength
Nitrate concentration at property boundary	9.37	mg/L	= (nitrate loading)/(annual infiltration + septic loading)

At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

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Europe	+ 356 21 42 30 20
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solutions@golder.com
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Golder Associates Ltd.
32 Steacie Drive
Kanata, Ontario, K2K 2A9
Canada
T: +1 (613) 592 9600

Golder Associates

ATTACHMENT 2

Water Quality Summary and Lab Reports 1973087,1976973 and 1985044

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)
1931 Robertson Road
Ottawa, ON
K2H 5B7
Attention: Ms. Caitlin Cooke
PO#:
Invoice to: Golder Associates Ltd. (Ottawa)

Report Number: 1973087
Date Submitted: 2022-03-09
Date Reported: 2022-03-16
Project: 21493887
COC #: 216712

Dear Caitlin Cooke:

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 2022.03.16 13:43:57 -04'00'

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.

eurofins | Environment Testing

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)
1931 Robertson Road
Ottawa, ON
K2H 5B7
Attention: Ms. Caitlin Cooke
PO#:
Invoice to: Golder Associates Ltd. (Ottawa)

Report Number: 1973087
Date Submitted: 2022-03-09
Date Reported: 2022-03-16
Project: 21493887
COC #: 216712

				Lab I.D.	1613861
				Sample Matrix	Water
				Sample Type	
				Sampling Date	2022-03-09
				Sample I.D.	Hydro
Group	**Analyte**	**MRL**	**Units**	**Guideline**	
Anions	Cl	1	mg/L	AO 250	61
	F	0.10	mg/L	MAC 1.5	0.27
	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	35
General Chemistry	Alkalinity as CaCO3	5	mg/L	OG 30-500	290
	Colour (Apparent)	2	TCU	AO 5	96*
	Conductivity	5	uS/cm		747
	DOC	0.5	mg/L	AO 5	1.6
	pH	1.00		6.5-8.5	7.82
	Phenols	0.001	mg/L		<0.001
	S2-	0.01	mg/L	AO 0.05	0.21*
	TDS (COND - CALC)	1	mg/L	AO 500	486
	Turbidity	0.1	NTU	AO 5	13.2*
Hardness	Hardness as CaCO3	1	mg/L	OG 80-100	305*
Indices/Calc	Ion Balance	0.01			1.00
Metals	Ca	1	mg/L		94
	Fe	0.03	mg/L	AO 0.3	1.63*
	K	1	mg/L		5
	Mg	1	mg/L		17
	Mn	0.01	mg/L	AO 0.05	0.06*
	Na	1	mg/L	AO 200	46
Microbiology	Escherichia Coli	0	ct/100mL	MAC 0	0
	Faecal Coliforms	0	ct/100mL		0
	Heterotrophic Plate Count	0	ct/1mL		0

Guideline = ODWSOG *** = Guideline Exceedence**

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

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

Certificate of Analysis

eurofins | Environment Testing

Client: Golder Associates Ltd. (Ottawa)
1931 Robertson Road
Ottawa, ON
K2H 5B7
Attention: Ms. Caitlin Cooke
PO#:
Invoice to: Golder Associates Ltd. (Ottawa)

Report Number: 1973087
Date Submitted: 2022-03-09
Date Reported: 2022-03-16
Project: 21493887
COC #: 216712

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.
					1613861 Water 2022-03-09 Hydro
Microbiology	Total Coliforms	0	ct/100mL	MAC 0	0
Nutrients	N-NH3	0.010	mg/L		0.502
	Total Kjeldahl Nitrogen	0.100	mg/L		0.629
Subcontract	Tannin & Lignin	1	mg/L		<1.0

Guideline = ODWSOG *** = Guideline Exceedence**

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

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Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)
1931 Robertson Road
Ottawa, ON
K2H 5B7
Attention: Ms. Caitlin Cooke
PO#:
Invoice to: Golder Associates Ltd. (Ottawa)

Report Number: 1973087
Date Submitted: 2022-03-09
Date Reported: 2022-03-16
Project: 21493887
COC #: 216712

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 418290 **Analysis/Extraction Date** 2022-03-10 **Analyst** DRA **Method** AMBCOLM1			
Escherichia Coli			
Faecal Coliforms			
Heterotrophic Plate Count			
Total Coliforms			
Run No 418310 **Analysis/Extraction Date** 2022-03-10 **Analyst** AsA **Method** C SM4500-S2-D			
S2-	<0.01 mg/L	84	80-120
Run No 418351 **Analysis/Extraction Date** 2022-03-10 **Analyst** IP **Method** SM5530D/EPA420.2			
Phenols	<0.001 mg/L	53	50-120
Run No 418367 **Analysis/Extraction Date** 2022-03-10 **Analyst** SKH **Method** EPA 351.2			
Total Kjeldahl Nitrogen	<0.100 mg/L	106	70-130
Run No 418375 **Analysis/Extraction Date** 2022-03-11 **Analyst** AsA **Method** SM 5310B			
DOC	<0.5 mg/L	93	80-120

Guideline = ODWSOG *** = Guideline Exceedence**

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

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

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)
1931 Robertson Road
Ottawa, ON
K2H 5B7
Attention: Ms. Caitlin Cooke
PO#:
Invoice to: Golder Associates Ltd. (Ottawa)

Report Number: 1973087
Date Submitted: 2022-03-09
Date Reported: 2022-03-16
Project: 21493887
COC #: 216712

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 418376 **Analysis/Extraction Date** 2022-03-11 **Analyst** AsA **Method** C SM2120C			
Colour (Apparent)	<2 TCU	106	90-110
Run No 418403 **Analysis/Extraction Date** 2022-03-11 **Analyst** AaN **Method** C SM2130B			
Turbidity	<0.1 NTU	100	70-130
Run No 418413 **Analysis/Extraction Date** 2022-03-11 **Analyst** SKH **Method** EPA 350.1			
N-NH3	<0.010 mg/L	100	80-120
Run No 418426 **Analysis/Extraction Date** 2022-03-14 **Analyst** AaN **Method** SM 4110			
Chloride	<1 mg/L	100	90-110
N-NO2	<0.10 mg/L	104	90-110
N-NO3	<0.10 mg/L	105	90-110
SO4	<1 mg/L	105	90-110
Run No 418447 **Analysis/Extraction Date** 2022-03-14 **Analyst** Z S **Method** M SM3120B-3500C			
Calcium	<1 mg/L	100	90-110
Potassium	<1 mg/L	100	87-113

Guideline = ODWSOG *** = Guideline Exceedence**

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

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

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)
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Attention: Ms. Caitlin Cooke
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Invoice to: Golder Associates Ltd. (Ottawa)

Report Number: 1973087
Date Submitted: 2022-03-09
Date Reported: 2022-03-16
Project: 21493887
COC #: 216712

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Magnesium	<1 mg/L	100	76-124
Sodium	<1 mg/L	106	82-118
Run No 418474 **Analysis/Extraction Date** 2022-03-14 **Analyst** SD **Method** EPA 200.8			
Iron	<0.03 mg/L	104	80-120
Manganese	<0.01 mg/L	103	80-120
Run No 418491 **Analysis/Extraction Date** 2022-03-14 **Analyst** AET **Method** SUBCONTRACT-A			
Tannin & Lignin	<1.0 mg/L	106	
Run No 418559 **Analysis/Extraction Date** 2022-03-15 **Analyst** AsA **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	95	90-110
pH		98	90-110
Run No 418578 **Analysis/Extraction Date** 2022-03-16 **Analyst** AET **Method** C SM2340B			
Hardness as CaCO3			
Ion Balance			

Guideline = ODWSOG *** = Guideline Exceedence**

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

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

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)
1931 Robertson Road
Ottawa, ON
K2H 5B7
Attention: Ms. Caitlin Cooke
PO#:
Invoice to: Golder Associates Ltd. (Ottawa)

Report Number: 1973087
Date Submitted: 2022-03-09
Date Reported: 2022-03-16
Project: 21493887
COC #: 216712

QC Summary

Analyte	Blank	QC % Rec	QC Limits
TDS (COND - CALC)			

Guideline = ODWSOG *** = Guideline Exceedence**

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1931 Robertson Road
Ottawa, ON
K2H 5B7
Attention: Ms. Caitlin Cooke
PO#:
Invoice to: Golder Associates Ltd. (Ottawa)

Report Number: 1976973
Date Submitted: 2022-05-09
Date Reported: 2022-05-16
Project: 21493887
COC #: 216712

Dear Caitlin Cooke:

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:

Rebecca Koshy
2022.05.17
12:15:01 -04'00'

APPROVAL: _____
Rebecca Koshy, Project Manager

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

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Certificate of Analysis

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1931 Robertson Road
Ottawa, ON
K2H 5B7
Attention: Ms. Caitlin Cooke
PO#:
Invoice to: Golder Associates Ltd. (Ottawa)

Report Number: 1976973
Date Submitted: 2022-05-09
Date Reported: 2022-05-16
Project: 21493887
COC #: 216712

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D. 1625012 / GW / 2022-03-09 / Hydro - Dissolved
Metals	Ag	0.0001	mg/L		<0.0001
	Al	0.01	mg/L	OG 0.1	<0.01
	As	0.001	mg/L	IMAC 0.01	<0.001
	B	0.01	mg/L	IMAC 5.0	0.15
	Ba	0.01	mg/L	MAC 1.0	0.16
	Be	0.0005	mg/L		<0.0005
	Cd	0.0001	mg/L	MAC 0.005	<0.0001
	Co	0.0002	mg/L		<0.0002
	Cr	0.001	mg/L	MAC 0.05	<0.001
	Cu	0.001	mg/L	AO 1	0.004
	Filtration		mg/L		y
	Mo	0.005	mg/L		<0.005
	Ni	0.005	mg/L		<0.005
	Pb	0.001	mg/L	MAC 0.010	<0.001
	Sb	0.0005	mg/L	IMAC 0.006	<0.0005
	Se	0.001	mg/L	MAC 0.05	<0.001
	Sr	0.001	mg/L		1.59
	Tl	0.0001	mg/L		<0.0001
	U	0.001	mg/L	MAC 0.02	0.001
	V	0.001	mg/L		<0.001
	Zn	0.01	mg/L	AO 5	<0.01

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Certificate of Analysis

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1931 Robertson Road
Ottawa, ON
K2H 5B7
Attention: Ms. Caitlin Cooke
PO#:
Invoice to: Golder Associates Ltd. (Ottawa)

Report Number: 1976973
Date Submitted: 2022-05-09
Date Reported: 2022-05-16
Project: 21493887
COC #: 216712

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 421951 **Analysis/Extraction Date** 2022-05-13 **Analyst** SD **Method** EPA 200.8			
Silver	<0.0001 mg/L	91	80-120
Aluminum	<0.01 mg/L	116	80-120
Arsenic	<0.001 mg/L	100	80-120
Boron (total)	<0.01 mg/L	117	80-120
Barium	<0.01 mg/L	110	80-120
Beryllium	<0.0005 mg/L	113	80-120
Cadmium	<0.0001 mg/L	109	80-120
Cobalt	<0.0002 mg/L	103	80-120
Chromium Total	<0.001 mg/L	106	80-120
Copper	<0.001 mg/L	107	80-120
Filtration			
Molybdenum	<0.005 mg/L	99	80-120
Nickel	<0.005 mg/L	107	80-120
Lead	<0.001 mg/L	111	80-120
Antimony	<0.0005 mg/L	90	80-120
Selenium	<0.001 mg/L	109	80-120

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K2H 5B7
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PO#:
Invoice to: Golder Associates Ltd. (Ottawa)

Report Number: 1976973
Date Submitted: 2022-05-09
Date Reported: 2022-05-16
Project: 21493887
COC #: 216712

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Strontium	<0.001 mg/L	104	80-120
Thallium	<0.0001 mg/L	110	80-120
Uranium	<0.001 mg/L	103	80-120
Vanadium	<0.001 mg/L	104	80-120
Zinc	<0.01 mg/L	110	80-120

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Client: Golder Associates Ltd. (Ottawa)
1931 Robertson Road
Ottawa, ON
K2H 5B7
Attention: Ms. Caitlin Cooke
PO#:
Invoice to: Golder Associates Ltd. (Ottawa)

Report Number: 1985044
Date Submitted: 2022-08-30
Date Reported: 2022-08-31
Project:
COC #: 899423

Dear Caitlin Cooke:

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:

Emma-Dawn Ferguson 2022.08.31 16:47:51 -04'00'

APPROVAL: _____
Emma-Dawn Ferguson, Chemist

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Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)
1931 Robertson Road
Ottawa, ON
K2H 5B7
Attention: Ms. Caitlin Cooke
PO#:
Invoice to: Golder Associates Ltd. (Ottawa)

Report Number: 1985044
Date Submitted: 2022-08-30
Date Reported: 2022-08-31
Project:
COC #: 899423

Group	Analyte	MRL	Units	Guideline	Lab I.D. 1648217 Sample Matrix Water Sample Type Sampling Date 2022-08-30 Sample I.D. SA1
VOCs Surrogates	1,2-dichloroethane-d4	0	%		84
	4-bromofluorobenzene	0	%		90
	Toluene-d8	0	%		99
Volatiles	1,1-dichloroethylene	0.5	ug/L	MAC 14	<0.5
	1,2-dichlorobenzene	0.4	ug/L	MAC 200	<0.4
	1,2-dichloroethane	0.5	ug/L	IMAC 5	<0.5
	1,4-dichlorobenzene	0.4	ug/L	MAC 5	<0.4
	Benzene	0.5	ug/L	MAC 1	<0.5
	Bromodichloromethane	0.3	ug/L		<0.3
	Bromoform	0.4	ug/L		<0.4
	Carbon Tetrachloride	0.2	ug/L	MAC 2	<0.2
	Chloroform	0.5	ug/L		<0.5
	Dibromochloromethane	0.3	ug/L		<0.3
	Dichloromethane	4.0	ug/L	MAC 50	<4.0
	Ethylbenzene	0.5	ug/L	MAC 140	<0.5
	m/p-xylene	0.4	ug/L		<0.4
	Monochlorobenzene	0.5	ug/L	MAC 80	<0.5
	o-xylene	0.4	ug/L		<0.4
	Tetrachloroethylene	0.3	ug/L	MAC 10	<0.3
	Toluene	0.4	ug/L	MAC 60	<0.4
	Trichloroethylene	0.3	ug/L	MAC 5	<0.3
	Trihalomethanes (total)	1.5	ug/L		<1.5
	Vinyl Chloride	0.2	ug/L	MAC 1	<0.2
	Xylene; total	0.5	ug/L	MAC 90	<0.5

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Report Number: 1985044
Date Submitted: 2022-08-30
Date Reported: 2022-08-31
Project:
COC #: 899423

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 428649 **Analysis/Extraction Date** 2022-08-31 **Analyst** PJ **Method** EPA 8260			
Dichloroethylene, 1,1-	<0.5 ug/L	85	60-130
Dichlorobenzene, 1,2-	<0.4 ug/L	104	60-130
Dichloroethane, 1,2-	<0.5 ug/L	117	60-130
Dichlorobenzene, 1,4-	<0.4 ug/L	91	60-130
Benzene	<0.5 ug/L	106	60-130
Bromodichloromethane	<0.3 ug/L	104	60-130
Bromoform	<0.4 ug/L	100	60-130
Carbon Tetrachloride	<0.2 ug/L	102	60-130
Chloroform	<0.5 ug/L	112	60-130
Dibromochloromethane	<0.3 ug/L	102	60-130
Methylene Chloride	<4.0 ug/L	112	60-130
Ethylbenzene	<0.5 ug/L	117	60-130
m/p-xylene	<0.4 ug/L	120	60-130
Chlorobenzene	<0.5 ug/L	115	60-130
o-xylene	<0.4 ug/L	111	60-130
Tetrachloroethylene	<0.3 ug/L	102	60-130

Guideline = ODWSOG *** = Guideline Exceedence**

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Report Number: 1985044
Date Submitted: 2022-08-30
Date Reported: 2022-08-31
Project:
COC #: 899423

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Toluene	<0.4 ug/L	108	60-130
Trichloroethylene	<0.3 ug/L	98	60-130
Vinyl Chloride	<0.2 ug/L	86	60-130
Run No 428665 **Analysis/Extraction Date** 2022-08-31 **Analyst** PJ **Method** EPA 8260			
Xylene Mixture			
Run No 428667 **Analysis/Extraction Date** 2022-08-31 **Analyst** PJ **Method** EPA 8260			
Trihalomethanes (total)			80-120

Guideline = ODWSOG *** = Guideline Exceedence**

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ATTACHMENT 3

Updated Nitrate Dilution Calculation

Nitrate Dilution Calculation

Input Parameters			
Site Area	26,480	m^2	(approximately 2.6 hectares)
Net Potential Infiltration (NPI)	180	mm/yr	
Daily effluent volume	10000	L/day	
Nitrate strength in effluent	40	mg/L	
Nitrate reduction via pre-treatment	50%		

Dilution Calculation			
Annual infiltration across site	4.77E+06	L/yr	= NPI * site area
Septic Loading	3.65E+06	L/yr	= daily effluent volume * 365 days
Nitrate loading	7.30E+07	mg/L/yr	= septic loading * nitrate strength * nitrate reduction
Nitrate concentration at property boundary	8.7	mg/L	= (nitrate loading)/(annual infiltration + septic loading)