HYDROGEOLOGICAL STUDY
495 JINKINSON ROAD

Project No.: CP-17-0613

Prepared for:

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R1 - January 2019

McINTOSH PERRY

Executive Summary

McIntosh Perry Consulting Engineers Ltd. (McIntosh Perry) was retained by J.R. Brisson Equipment to conduct a hydrogeological assessment at a site located at 495 Jinkinson Road, Ottawa, Ontario (the Site, Figure 1). This assessment has been prepared in support of a proposed development at the Site. An outline of the Site, showing the neighbouring properties and an aerial photograph, is presented on Figure 3. At the present time, the Site consists of cleared land (previously forested), forested areas, a cultural meadow (buried service corridor), and a Provincially Significant Wetland (PSW).

Ground surface at the Site is generally relatively flat. Regional relief is generally sloped toward the PSW, which is connected to the non-developed portion of the Site. Ground surface elevation at the Site varies between 136 and 151 m asl (above sea level). Drainage in the area of proposed development is interpreted to reflect surface topography, and is likely controlled by ditches along Jinkinson Road. Other areas of the Site likely drain to the south, toward the Goulbourn Wetland Complex (Provincially Significant Wetland). Regional groundwater is interpreted to flow to the northeast, toward the Ottawa River.

To satisfy the requirements of this hydrogeological assessment, McIntosh Perry tested a newly drilled, on-site water supply well (Test Well 1, TW1) for water quality and quantity. TW1 was pumped for a duration exceeding six hours (380 minutes), and was sampled twice during this time. The pumping rate during the pumping test (approximately 25 L/min) is considered more than sufficient to supply the proposed development.

No analyzed parameters in either pre-test or post-test samples (TW1_1 and TW1_2, respectively) exceed maximum acceptable concentrations (MAC) under the Ontario Drinking Water Quality Standards. Exceedances of non-health-related parameters (total dissolved solids, chloride, sulphide, and turbidity) are considered treatable. From a quality and quantity perspective, TW1 can supply sufficient water to support development.

On-site soils in the area of the proposed development appear to consist of a thin layer of organic-rich overburden overlaying Paleozoic bedrock, which is characterized as limestone, dolostone, shale, arkose, or sandstones of the Ottawa and Simcoe Lake Groups. Soils in the non-developed portion of the Site are classified as either thin, or as organic deposits (peat, muck/marl) (OGS 2018). As such, it is likely that imported fill will need to be used to permit the construction of an on-site septic system. Additional investigation will be required at the design stage to confirm suitability and infiltration capacity of overburden material at the Site. Any septic systems should be constructed with all appropriate setbacks as per Ontario Regulations and the Ontario Building Code.

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1.0 INTRODUCTION

McIntosh Perry Consulting Engineers Ltd. (McIntosh Perry) was retained by J.R. Brisson Equipment to conduct a hydrogeological assessment at a site located at 495 Jinkinson Road, Ottawa, Ontario (the Site, Figure 1). This study has been prepared in support of a proposed development at the Site. An outline of the Site, showing the neighbouring properties and an aerial photograph, is presented on Figure 3. At the present time, the Site consists of cleared land (previously forested), forested areas, a cultural meadow (buried service corridor), and a Provincially Significant Wetland (PSW).

This work was conducted in general accordance with Ontario Ministry of Environment and Climate Change (MOECC) guidance as follows:

- Procedure D-5-5: Technical Guideline for Private Wells: Water Supply Assessment (August 1996)

The Site is addressed at 495 Jinkinson Road (Ottawa, Ontario). The proposed development consists of an approximately 10,000 square foot sales, rental, and servicing facility and yard on the developable portion of the Site. The proposed development layout is shown on Figure 4.

The Site is owned by the J.R. Brisson Equipment, and it is our understanding that the northwestern portion of the Site will be developed. The City of Ottawa property pin is 044461652, and the Site is legally described as Goulbourn Concession 11, Lot 17. A site plan of the proposed severance, prepared by KWC Architects Inc. (May 28, 2018), has been submitted under separate cover.

This assessment considers the Site suitability for only the proposed development, which is located in the northwestern portion of the Site. The proposed development is approximately 3.0 ha, leaving a non-developed area of approximately 19.6 ha. This Hydrogeological Assessment addresses the following:

- General site setting information
- Geological and hydrogeological background
- Site specific conditions
- Water treatment options, and wastewater treatment and disposal options

2.0 INVESTIGATION

2.1 Site Setting

The Site is located within the City of Ottawa, and is designated as 'Rural General Industrial' (proposed development area), 'Rural Countryside' (non-developed portion), 'Environmental Protection' (non-developed portion – wetland), and 'Parks and Open Space' (non-developed portion – buried service corridor) in the City of Ottawa Zoning By-Law.

At the present time, the proposed development consists solely of cleared (previously forested) land, and is situated approximately 120 m from an on-site PSW, at its closest point. It is noted that the proposed building footprint is located significantly further from the PSW. The retained (non-developed) portion of the Site consists of forested areas (dry-fresh White Pine/Maple/Oak mixed forest), cultural meadows (buried service easement), and Provincially Significant Wetland (predominantly cattails). Based on a review of aerial photographs available on GeoOttawa, no signs of previous Site development can be seen (earliest photo is 1976). Based on Site conditions observed during fieldwork, it is further unlikely that the Site has seen any contemporary use, other than forest clearing for the gas easement.

The climate is humid continental with cool winters and warm summers. The 1981-2010 mean annual precipitation is approximately 919.5 mm with 175.4 cm as snow, and the mean daily temperature is 6.6 °C (Environment Canada Climate Normals for Ottawa, ON).

2.2 Neighbouring Properties and Land Uses

The Site is bound by a buried service corridor and by forested land to the northeast, by Jinkinson Road and Highway 7 to the northwest, by forested land, rural-residential dwellings, and a PSW to the southwest, and by forested land to the southeast.

The nearest inhabited building relative to the proposed severance is located adjacent to the Site, at 557 Jinkinson Road. Based on a review of MOECC well records, it appears that all serviced development in the area is privately serviced with wells and septic systems.

2.3 Hydrology

Ground surface at the Site is generally relatively flat. Regional relief appears to be sloped toward the Provincially Significant Wetland which is connected to the Site (non-developed portion). Ground surface elevation at the Site varies minimally. Drainage in the area of proposed development is generally poor, but is interpreted to be controlled by surface topography and ditches along Jinkinson Road. Other areas of the Site likely drain to the south, toward the Goulbourn Wetland Complex (PSW).

Based on topographic data collected for the Site as well as the City of Ottawa's municipal drain boundary, the septic bed and groundwater supply well (TW1) are located within different municipal drainage areas, and are cross-gradient from each other. In the vicinity of the on-site septic bed, regional surface water and overburden groundwater are interpreted to flow southwest to the Jinkinson Drain. In the vicinity of TW1,

flow appears to be toward the Hazeldean Municipal Drain (GeoOttawa, 2019). Based on base mapping of static water levels and bedrock elevation from the Ontario Geological Survey (dataset MRD283-REV), deeper regional groundwater flow is interpreted to flow to the northeast, toward the Ottawa River.

2.4 Geology and Hydrogeology

On-site soils in the area of the proposed development appear to consist of a thin layer of organic-rich overburden overlaying Paleozoic bedrock, which is characterized as limestone, dolostone, shale, arkose, or sandstones of the Ottawa and Simcoe Lake Groups. Soils in the non-developed portion of the Site are classified as either thin, or as organic deposits (peat, muck/marl). Overburden and bedrock geology appears to be classified similarly to the Site within an approximate 700 m radius of the proposed development. (OGS 2018)

The above characterization is generally consistent with water well records in the vicinity of the Site, which show bedrock encountered between 0 – 1.83 m bgs (below ground surface), followed by competent limestone to depths exceeding 150 m bgs.

The bedrock encountered in the well record for TW1 is consistent with OGS mapping of Paleozoic bedrock in the area.

2.4.1 Recharge and Discharge Areas

Based on a review of topographic data, geological maps, and a site visit, it is our interpretation that the Site as a whole consists of both groundwater recharge zones (proposed development area and surrounding forested land) and discharge zones (Goulbourn Wetland Complex). Site drainage appears to be moderate in the area of proposed development; areas of ponded water were observed only when portions of the Site were cleared of vegetation and overburden, prior to TW1 installation. Drainage becomes relatively poor in the south and southwest portions of the Site, in close proximity to the Goulbourn Wetland Complex.

2.4.2 Hydrogeologically Sensitive Areas

While majority of the Site is subject to thin overburden, there were no observed areas of bedrock outcrop or karst condition, and the proposed development does not appear to be located in a groundwater discharge area. This being said, portions of the Site are likely hydrogeologically sensitive. To mitigate this sensitivity, various measures have been postulated in Section 6 of this report.

2.4.3 Potential Sources of Contamination

A windshield survey of the surrounding area was conducted in combination with a review of maps and zoning information. The Site is located in a predominantly forested area with some industrial properties (aggregate processing, pits and quarries, etc.). While none of these uses appear to pose any significant source of contamination to the Site, consideration was given to the changes that significant water takers (quarry operations) can have on smaller water supply wells. Pumping test data for TW1 were reviewed to ensure sufficient quality and quantity, and are discussed in subsequent sections of this report.

The Site and surrounding properties are not connected to the City of Ottawa's wastewater treatment system. As such, there are likely private on-site wastewater systems at nearby developments.

2.4.4 Water Well Record Review

Data for seven water wells were found for locations within approximately 500 m of the Site. Five wells were listed for domestic purposes, and one each for commercial and industrial purposes. The MOECC Water Well Information System records are shown on Figure 2, and data are summarized in Appendix B.

The total well depths ranged from 9 to 201 m, with an average depth of 72 m. Overburden thickness ranged from 0 to 27.7 m, with the majority of observed overburden thicknesses listed as 0 m. Reported static water levels ranged from 1.4 to 6.3 m bgs.

To establish typical pumping rates for water wells in the vicinity of the Site, a separate search for physical well records was carried out. Ten records were found within approximately 1 km of the Site, with recommended pumping rates ranging from approximately 4 to 40 L/min. It is noted that the driller-recommended pumping rate for TW1 is 48 L/min.

3.0 METHODOLOGY – HYDROGEOLOGICAL ASSESSMENT

McIntosh Perry conducted a detailed hydrogeological investigation at the Site to assess the feasibility of servicing the proposed development. As noted in the above sections, the work generally followed the Guidance of MOECC Procedure D-5-5: Technical Guideline for Private Wells: Water Supply Assessment.

McIntosh Perry tested a newly drilled, on-site water supply well (Test Well 1, TW1), which is believed to be representative of the hydrogeological conditions across the proposed development area. According to the MOECC well record, the well extends approximately 42.7 m bgs, with a 0.159 m (6 ¼ inch) diameter casing extending approximately 12.8 m bgs. The MOECC Well Record for TW1 is included in Appendix G.

The initial estimation of TW1 yield was made based on a 1-hour pumping test completed by the driller (>55 L/min). McIntosh Perry personnel pumped the well at a rate of approximately 25 L/min during the 380 minute pumping test.

The pumping test was conducted at TW1 by McIntosh Perry staff on June 15, 2018. During the testing period, water levels in the well were measured using an electronic water level tape. Water quality (pH, temperature, conductivity, turbidity, dissolved oxygen, and oxidation-reduction potential) was also monitored and recorded in the field during the test, and two samples (TW1_1 and TW1_2) were collected for the 'subdivision supply' suite of parameters, in addition to a select suite of metals.

During the pumping test, turbidity was observed to decrease from 362 FNU to 3.5 FNU within the first hour of the test. The final turbidity reading recorded at 6 hr 10 min was 5.5 FNU. Initial high turbidity measurements are considered to be a result of drilling the well. Continued use of TW1 is expected to lower turbidity levels even further.

All groundwater samples were collected unfiltered and unchlorinated, directly into clean bottles supplied by the analytical laboratories (Paracel Laboratories Ltd., Ottawa, ON). Chlorine indicator strips were used to ensure no chlorine residual remained in the sampled water. The samples were kept on ice and shipped directly to Paracel under strict chain of custody procedures. All of the samples were received by the laboratory within 24 hours of collection.

Paracel is fully accredited by SCC/CALA, and has accreditation for Ontario Safe Drinking Water Act (OSDWA) testing.

During the pumping test, water level monitoring consisted of manual readings of drawdown and recovery made with an electronic water level tape. Following pump shutoff, water levels were measured in TW1 until approximately 88% recovery was achieved (1 hr 48 min post-shutoff). Due to equipment availability constraints, full recovery to 95% could not be measured on June 15, 2018.

Drawdown and recovery data from the pumping test were plotted and analyzed using the Cooper-Jacob and Theis Recovery methods, respectively. The hydraulic conductivity (K, m/s) and transmissivity (T, m^2/d) of the

aquifer were estimated. Storativity cannot be assessed properly without the use of an additional observation well, which was not available at the time of the test.

4.0 RESULTS

A drawdown curve and tabular data from the pumping test at TW1 are available in Appendix D and Table 1, respectively. A summary of recorded groundwater field parameter data and the official Laboratory Certificates of Analysis are available in Tables 2 and 3 and Appendix C, respectively.

4.1 Static Conditions

Prior to the initiation of pumping, water levels were measured in TW1. The static groundwater level was recorded at 2.664 m below top of casing (btoc) at the time of the pumping test (t=0). Assigning an arbitrary site benchmark of 100.00 m to the top of the casing, the static water elevation in the well was 97.336 m local.

Standing water was present in the vicinity of TW1, and is thought to be due to rain occurring on June 14, 2018. No strong evidence of groundwater discharge was observed in the development area at the time of the pumping test.

4.2 Pumping Test

The pumping test was conducted at TW1 under the supervision of McIntosh Perry. Water was pumped directly from the test well using a pump and tubing supplied by Wilf Hall & Sons Well Drilling. The water discharge was directed away from the well, and was allowed to flow overland across the Site. At the time of the pumping test, the weather was approximately 20-25°C and clear.

All water level measurement data are presented in Table 1, appended to this report.

Based on a short-term pumping test completed by Saunders Drilling upon completion of the well, it was estimated that a pumping rate exceeding 25 L/min would be sustainable at the well.

On June 15, 2018, following installation of the pumping equipment by Wilf Hall & Sons, a static water level of 2.664 m btoc was measured in the well. At approximately 08:20, the pump was turned on and the flow rate adjusted to approximately 25 L/min. This pumping rate was maintained with minimal variation for the duration of the test (380 minutes total).

The water level ranged between 95.725 m to 97.336 m asl (2.664 to 4.275 m btoc), with a maximum drawdown of 1.611 m observed. Due to the relatively low drawdown observed throughout the test, only 88% recovery in water level was achieved within 1 hr 48 min of terminating the test.

It is noted that the driller-recommended pumping rate for TW1 is 48 L/min.

4.3 Well Yield

The pumping test undertaken by McIntosh Perry provides a reasonable indication of the yield of TW1. During this test, approximately 9,250 L of water was pumped from the well at a rate (25 L/min). Based on the City of Ottawa Water Distribution Guidelines (July 2010) the peak demand for this development is 161.5 L/min (2.69 L/s). Using this peak value and an assumption of 100% well efficiency, a drawdown vs log-time chart (see Appendix D) shows that the static water level is expected to be drawn down approximately 8.5 m over a one-hour period. Because this calculation assumes 100% well efficiency, a 50% safety factor has been added to this figure, such that the drawdown under peak demand conditions (per the City of Ottawa Water Distribution Guidelines) is expected to be 12.75 m. The pump is currently recommended to be set at 39.6 m below top of casing.

While above rate calculation using City of Ottawa Water Distribution Guidelines is a useful screening tool, it is noted that the site will require significantly less water than the stated peak rate value of 2.69 L/s. Based on site-specific information provided by the proponent which was used to prepare the septic permit application, total water discharge to the septic system will not exceed 5,800 L/day. This represents an actual peak water demand of 1.61 L/s.

4.4 Transmissivity

A summary of the well and hydrogeological properties determined during the testing work at the Site are presented in Appendix D. A transmissivity of approximately 19 m^2/d was calculated using the Cooper-Jacob and Theis Recovery methods. Assuming an aquifer thickness of 29.9 m (corresponding to the interval between the bottom of the casing and the bottom of the well) and fully horizontal groundwater flow, a hydraulic conductivity of 7.4 x 10^{-6} m/s was calculated using the Transmissivity equation (T=Kb).

Storativity (S) could not be calculated as no observation wells were available for measurement at the time of the pumping test.

4.5 Long Term Yield

The long-term yield (maximum recommended pumping rate) of TW1 was estimated based on the following factors:

- Observations during six-hour pumping test
- Calculated properties
- Details of proposed development

By extrapolating the drawdown data on a semi-logarithmic scale, it is estimated that a conservatively maximum pumping rate of 161.5 L/min could be sustained for over 100,000 minutes (69 days) of continuous pumping with a maximum drawdown of only 16.5 m (see Appendix D). It is noted that this situation is inherently conservative, as the pump will cycle on and off on a much shorter time scale, allowing the well to recharge.

Based on the available information, a long-term sustainable pumping rate of 161.5 L/min is considered appropriate for the well. This yield is generally sufficient to supply water to the proposed severance at this Site.

4.6 Water Quality

Laboratory Certificates of Analysis for on-site groundwater testing are presented in Appendix C. A summary of field and laboratory results from TW1 is presented in Tables 2 and 3. Samples were taken twice during the six-hour test on June 15, 2018. Pre- and post-test samples (TW1_1 and TW1_2, respectively) were taken directly from the on-site pump tubing. Analytical results were compared to the Ontario Drinking Water Standards, Objectives, and Guidelines (ODWS).

Based on the analytical results from June 15, 2018, any exceedances of ODWS are of an aesthetic (AO) nature only. Total dissolved solids and chloride are two notable exceedances in both TW1_1 and TW1_2, and sulphide and turbidity were found to exceed AO in TW1_2 only. Although turbidity is above 5 NTU in the final laboratory-analyzed sample, field measurements toward the end of the pumping test indicate turbidity levels ranging from 3.5 – 5.5 FNU (NTU equivalent); these field measurements for turbidity are taken to be more representative than laboratory analysis. It is our opinion that further development of TW1 will reduce turbidity even lower. All other parameters in exceedance of ODWS can be addressed through treatment.

No maximum acceptable concentration (MAC) or operational guideline (OG) objectives were exceeded in TW1_2 or TW1_2.

5.0 WATER TREATMENT

The use of disinfection such as an ultraviolet (UV) system, although not required, may be desired. Based on the observed water quality there should not be any hindrances to UV disinfection.

The Langelier Saturation Index (LSI) and Ryznar Stability Index (RSI) were calculated for TW1 (Appendix E). These results indicate that scale formation is possible, though not likely at the tested temperature. This is to be expected in areas of carbonate bedrock.

For aesthetic reasons, water treatment such as softening may be desired. Softening of water can be achieved through reverse osmosis or ion exchange. It is noted that depending on which resin is used in the treatment system, softening with ion exchange will increase the concentrations of sodium or potassium relative to those noted in Table 3.

6.0 RECOMMENDATIONS

6.1 Water Supply

Well Construction

- Due to the shallow soils exhibited throughout most of the Site, any newly installed wells should have at least 12 m of casing and adhere to all other requirements of O.Reg. 903, as amended.
- Any newly installed test wells should be appropriately developed and tested prior to domestic use.

Water Quality and Treatment

- It is noted that TW1 will not be used for public water supply purposes.
- Water from TW1 meets all applicable health related standards at the present time.
- The elevated concentration for TDS is most likely attributable to the elevated chloride concentration. TDS is an aesthetic objective and not considered a health hazard. Treatment for TDS depends whether the cause is due to anions or cations.
- The elevated chloride concentration is most likely associated with leaching of the underlying bedrock. Chloride is an aesthetic objective and not considered a health hazard. Treatment options for chloride include anion exchange, distillation, and reverse osmosis.
- Field measurements of turbidity ranged from 3.5 to 5.5 FNU within the last five hours of the pumping test; it is our opinion that further development of TW1 will reduce these levels further.
- If water softening is desired, this can be achieved through reverse osmosis or ion exchange. It is noted that softening with ion exchange will increase the concentration of sodium or potassium depending on which resin is used in the treatment system.

6.2 Wastewater Treatment

Potential Septic Systems

- Based on the general absence of overburden observed in the vicinity of TW1, as well as review of records for other wells within the vicinity, imported fill materials may be needed to permit the construction of an on-site septic system. Additional investigation will be required at the design stage to confirm suitability and infiltration capacity of overburden material at the Site.
- Any septic systems must be constructed with all appropriate setbacks and stipulations as per Ontario Regulations and the Ontario Building Code.

Potential Lot Layout

- This hydrogeological assessment is in support of the commercial development described herein; this assessment does not address the potential for more than one water well user or septic system at the Site.

7.0 LIMITATIONS

This report has been prepared and the work referred to in this report has been undertaken by McIntosh Perry Consulting Engineers Ltd. for J.R. Brisson Equipment. It is intended for the sole and exclusive use of J.R. Brisson Equipment, their affiliated companies and partners and their respective insurers, agents, employees, advisors, and reviewers. The report may not be relied upon by any other person or entity without the express written consent (Reliance Letter) of McIntosh Perry Consulting Engineers Ltd.

Any use which a third party makes of this report, or any reliance on decisions made based on it, without a reliance letter are the responsibility of such third parties. McIntosh Perry Consulting Engineers Ltd. accept no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The investigation undertaken by McIntosh Perry Consulting Engineers Ltd. with respect to this report and any conclusions or recommendations made in this report reflect McIntosh Perry Consulting Engineers Ltd. judgment based on the Site conditions observed at the time of the site inspection on the date(s) set out in this report and on information available at the time of the preparation of this report.

This report has been prepared for specific application to this site and it is based, in part, upon visual observation of the Site, subsurface investigation at discrete locations and depths, and specific analysis of specific chemical parameters and materials during a specific time interval, all as described in this report. Unless otherwise stated, the findings cannot be extended to previous or future Site conditions, portions of the Site which were unavailable for direct investigation, subsurface locations which were not investigated directly, or chemical parameters, materials or analysis which were not addressed. Substances other than those addressed by the investigation described in this report may exist within the Site, substances addressed by the investigation may exist in areas of the Site not investigated and concentrations of substances addressed which are different than those reported may exist in areas other than the locations from which samples were taken.

If site conditions or applicable standards change or if any additional information becomes available at a future date, modifications to the findings, conclusions and recommendations in this report may be necessary.

We trust that this information is satisfactory for your present requirements. Should you have any questions or require additional information, please do not hesitate to contact the undersigned.

Respectfully submitted,

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TABLES

Table 1
Summary of Water Level Data
Pump ing Test - TW1 - 15-Jun-2018

TOC Elevation (assumed)	100.000	m ASL
Static Water Level	2.664	m BTOC
Static Water Elevation	97.336	m ASL
95% Recovery Level	2.745	m BTOC
95% Recovery Elevation	97.255	m ASL

Elapsed Time (minutes)	Elapsed Time (Recovery)	Water Level (m BTOC)	Water Level (m ASL)	Drawdown (m)	Notes
0		2.664	97.336	0	
1		3.299	96.701	0.635	
2		3.464	96.536	0.8	
3		3.546	96.454	0.882	
4		3.598	96.402	0.934	
5		3.637	96.363	0.973	
10		3.726	96.274	1.062	
15		3.753	96.247	1.089	
20		3.815	96.185	1.151	
30		3.865	96.135	1.201	
60		3.98	96.02	1.316	
120		4.126	95.874	1.462	
180		4.177	95.823	1.513	
240		4.219	95.781	1.555	
300		4.248	95.752	1.584	
360		4.267	95.733	1.603	
370		4.274	95.726	1.61	
380		4.275	95.725	1.611	
381	1	3.574	96.426	0.91	
382	2	3.439	96.561	0.775	
383	3	3.382	96.618	0.718	
384	4	3.336	96.664	0.672	
385	5	3.315	96.685	0.651	
390	10	3.209	96.791	0.545	
395	15	3.152	96.848	0.488	
400	20	3.106	96.894	0.442	
405	25	3.074	96.926	0.41	
410	30	3.046	96.954	0.382	
420	40	2.996	97.004	0.332	
430	50	2.965	97.035	0.301	
440	60	2.934	97.066	0.27	
450	70	2.916	97.084	0.252	
460	80	2.893	97.107	0.229	
470	90	2.874	97.126	0.21	
480	100	2.867	97.133	0.203	
488	108	2.856	97.144	0.192	

NOTES
TOC: Top of Casing
m BTOC: metres below top of casing
m ASL: metres above sea level

Table 2
Summary of Field Parameters
New Development 495 Jinkinson Road, Ottawa, Ontario

Test Well 1

Pumping Test at:	TW1	Date:	15-Jun-18			
Time Elapsed (min)	Turbidity (NTU)	pH	Conductivity (us/cm)	Temperature (^{o}C)	DO (mg/L)	Flow Rate (L/min)
Pump On						25
1	362	8.2	797	12.7	7.95	
2	289	3.38	1290	10.37	5.7	25.5
3	288	8.4	1372	8.96	4.41	
4	217	8.25	1379	8.84	3.81	
5	136	8.79	1377	8.97	3.81	
10	38.1	7.51	1351	8.94	3.86	
15	16	7.23	1348	9.06	3.79	
20	13.8	7.12	1351	9.06	3.79	24.5
30	4.5	7	1356	9.16	3.79	
60	3.5	6.92	1355	9.18	3.8	
120	5.4	6.9	1354	9.28	3.8	
180	9.5	6.91	1347	9.36	3.8	
240	10.4	6.92	1339	9.44	3.79	24
300	12.2	6.93	1333	9.5	3.79	
360	11.9	6.93	1327	9.6	3.77	
370	5.5	6.99	1321	10.0	3.98	
Notes:	*Flow rate measured with flow meter*					

NOTES:

min	Minutes
FTU	Formazin Nephelometric Units
ms/cm	Millisiemens per centimeter
(^{o}C)	Degrees celsius
mg/L	Milligrams per litre
L/min	Litres per minute

Table 3
Summary of Laboratory Results
New Development, 495 Jinkinson Road, Ottawa, ON

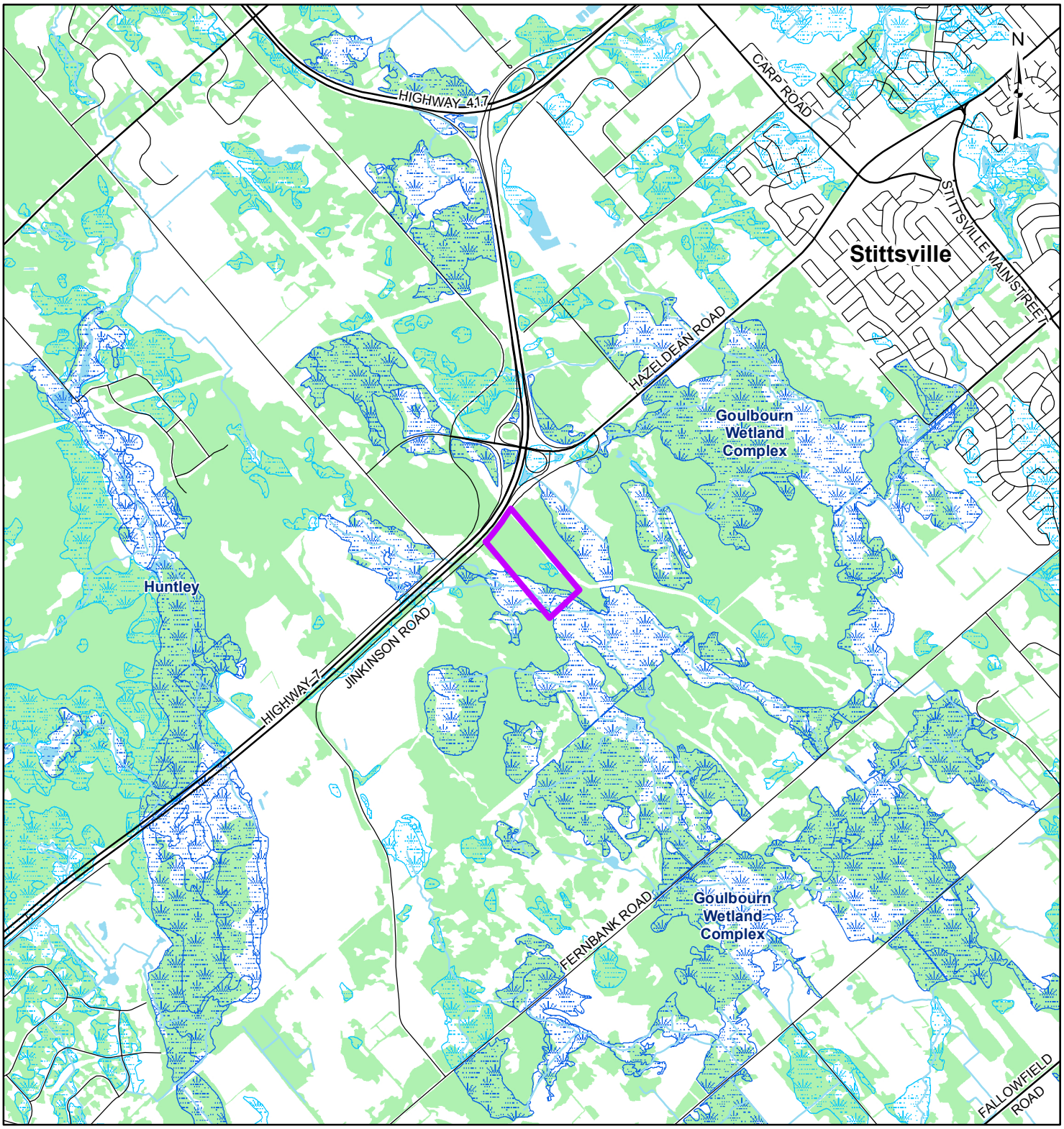
Test Well 1

Sample ID / Sample Date / Location / Parameter:	Units	MDL	ODWSOG	Limit Type	TW 1_1 15-Jun-18 Test Well 1	TW 1_2 15-Jun-18 Test Well 1
Microbiological Parameters						
E. Coli	CFU/100 mL	1	0	MAC	<1	<1
Fecal Coliforms	CFU/100 mL	1	-		<1	<1
Total Coliforms	CFU/100 mL	1	0	MAC	<1	<1
Heterotrophic Plate Count	CFU/mL	10	-		-	-
General Inorganics						
Alkalinity, total	mg/L	5	500	OG	244	247
Ammonia as N	mg/L	0.01	-		0.25	0.28
Dissolved Organic Carbon	mg/L	0.5	5	AO	2.2	1.9
Colour	TCU	2	5	AO	<2	<2
Conductivity	uS/cm	5	-		1470	1420
Hardness	mg/L		-		446	447
pH	pH Units	0.1	-		7.6	7.6
Phenolics	mg/L	0.001	-		<0.001	<0.001
Total Dissolved Solids	mg/L	10	500	AO	2140	1050
Sulphide	mg/L	0.02	0.05	AO	0.05	0.27
Tannin & Lignin	mg/L	0.1	-		<0.1	<0.1
Total Kjeldahl Nitrogen	mg/L	0.1	-		0.4	0.4
Turbidity	NTU	0.1	5	AO	1.2	5.8
Anions						
Chloride	mg/L	1	250	AO	299	287
Fluoride	mg/L	0.1	1.5	MAC	0.4	0.4
Nitrate as N	mg/L	0.1	10	MAC	<0.1	<0.1
Nitrite as N	mg/L	0.05	1	MAC	<0.05	<0.05
Sulphate	mg/L	1	500	AO	63	64
Metals						
Calcium	ug/L	0.1	-		111000	113000
Iron	ug/L	0.1	300	AO	<100	287
Magnesium	ug/L	0.2	-		41100	40200
Manganese	ug/L	0.005	50	AO	18	15
Potassium	ug/L	0.1	-		6190	5780
Sodium	ug/L	0.2	200000	AO	75000	71400

Notes:

*	Detection limits were elevated due to excessive turbidity in samples
MDL	Method Detection Limit
ODWSOG	Ontario Drinking Water Standards, Objectives, and Guidelines (MOECC, 2003 rev. 2006; PIBs 4449e01)
AO	Aesthetic Objective
MAC	Maximum Allowable Concentration (Health-Related Parameter)
OG	Operational Guideline
ND	Non detectable (below MDL)
mg/L	Milligrams per litre
TCU	True Colour Units
uS/cm	Microsemens per centimeter
NTU	Nephelometric Turbidity Units
ct/100 mL	Number of bacteria-forming colonies per 100 mL

FIGURES



LEGEND

- Existing Property Boundary
- Local Road
- Major Road
- Watercourse
- Waterbody
- Wooded Area
- Provincially Significant Wetland
- Unevaluated Wetland

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2018.

CLIENT: J.R. BRISSON EQUIPMENT

PROJECT: HYDROGEOLOGICAL STUDY
495 JINKINSON ROAD

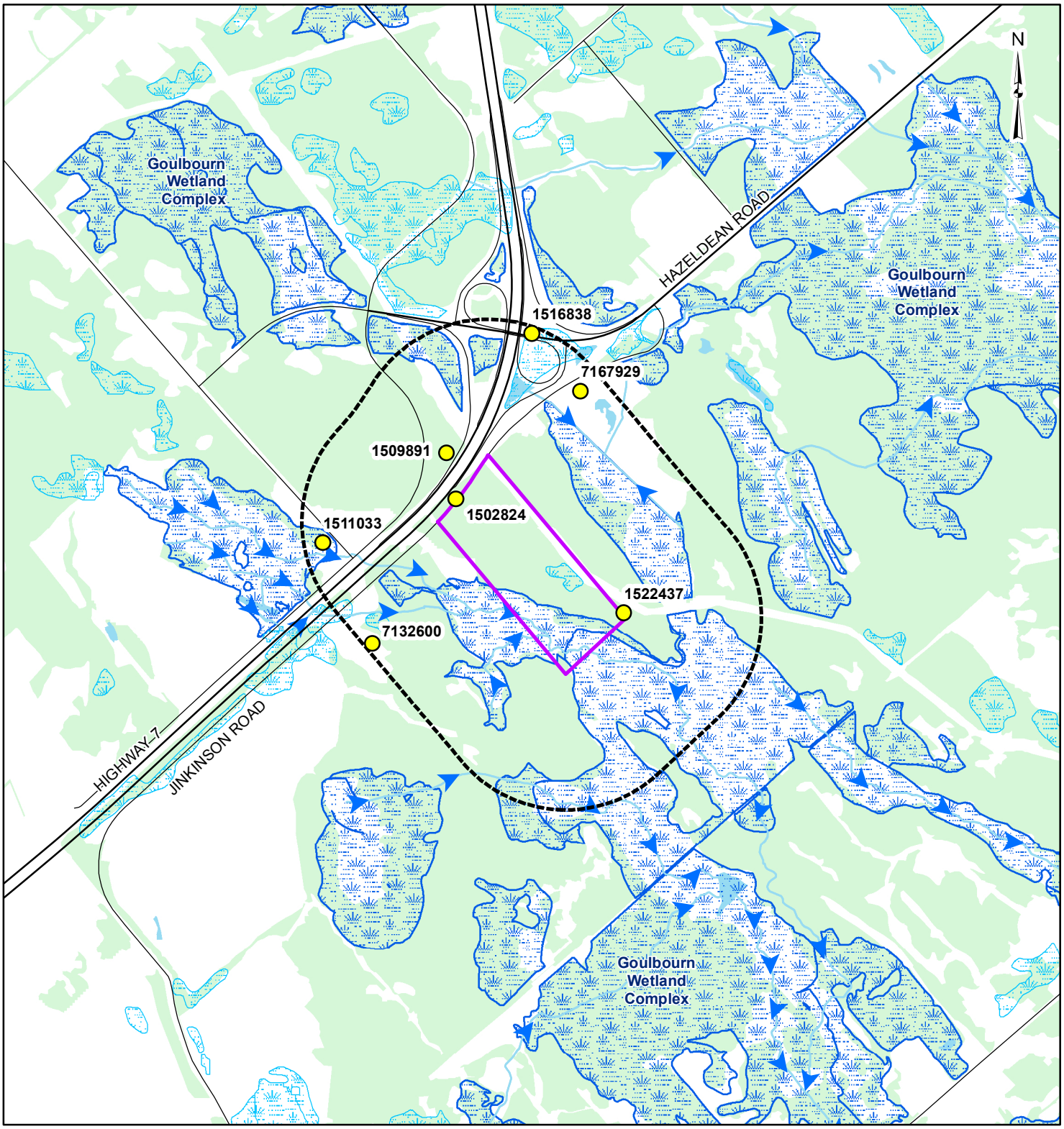
TITLE: SITE LOCATION

McINTOSH PERRY
115 Walgreen Road, RR3, Carp, ON K0A1L0
Tel: 613-836-2184 Fax: 613-836-3742
www.mcintoshperry.com

PROJECT NO:	CP-17-0613
Date	Jun., 19, 2018
GIS	SK
Checked By	JB

FIGURE: 1

H:\01 Project - Proposals\2017 Jobs\CP\0CP-17-0613 - J.R. Brisson – Site Plan Control – 495 Jinkinson Road\07 - GIS\mxd\HydroG\0CP-17-0613_01_SiteLocation.mxd



LEGEND

- MOECC Well Record
- Property Boundary
- 500m Radius
- Local Road
- Major Road
- Flow Direction
- Watercourse
- Waterbody
- Provincially Significant Wetland
- Unevaluated Wetland
- Wooded Area

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2018.

500 250 0 500

Scale 1:20,000 Metres

CLIENT: J.R. BRISSON EQUIPMENT

PROJECT: HYDROGEOLOGICAL STUDY
495 JINKINSON ROAD

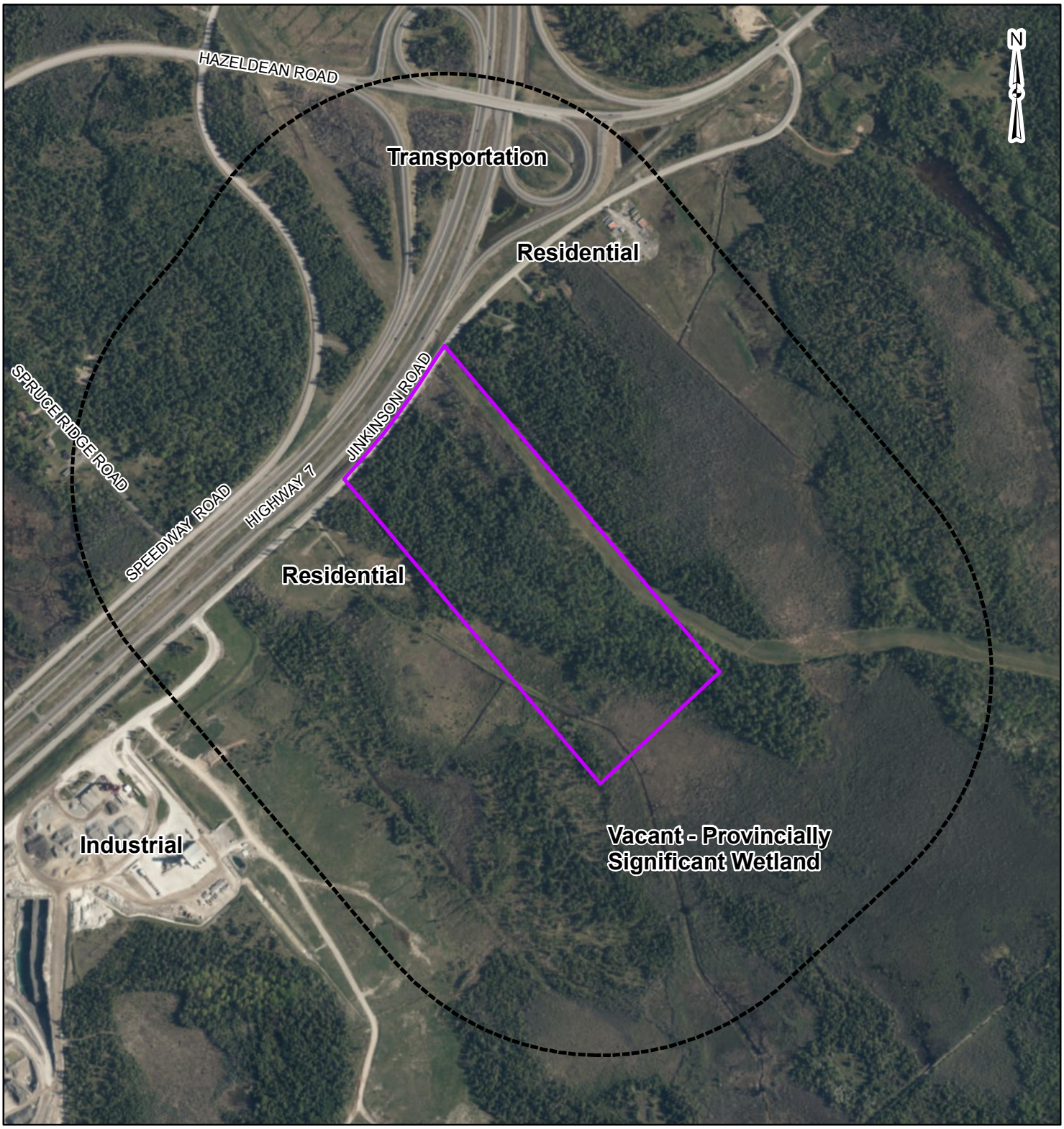
TITLE: MOECC WWIS SUMMARY

McINTOSH PERRY
115 Walgreen Road, RR3, Carp, ON K0A1L0
Tel: 613-836-2184 Fax: 613-836-3742
www.mcintoshperry.com

PROJECT NO:	CP-17-0613
Date	Jun., 19, 2018
GIS	SK
Checked By	JB

FIGURE: 2

H:\01 Project - Proposals\2017 Jobs\CP\0CP-17-0613 - J.R. Brisson – Site Plan Control – 495 Jinkinson Road\07 - GIS\mxd\HydroG\0CP-17-0613_02_MOECCWWISSummary.mxd



280 140 0 280

Scale 1:10,000 Metres

LEGEND

Approximate Site Boundary

500m Radius

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2018.

CLIENT: J.R. BRISSON EQUIPMENT

PROJECT: HYDROGEOLOGICAL STUDY
495 JINKINSON ROAD

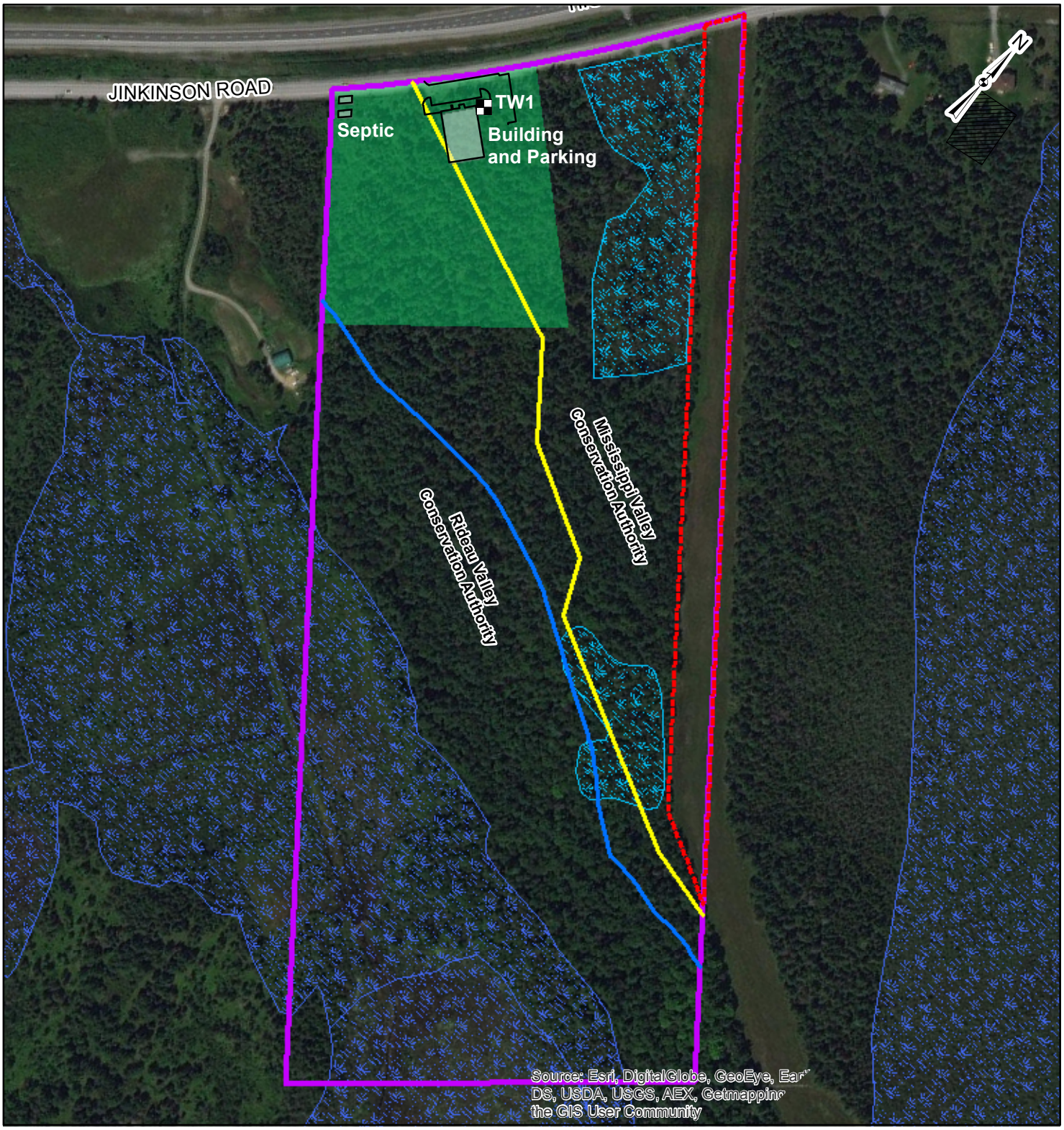
TITLE: STUDY AREA AND
SURROUNDING LAND USE

McINTOSH PERRY
115 Walgreen Road, RR3, Carp, ON K0A1L0
Tel: 613-836-2184 Fax: 613-836-3742
www.mcintoshperry.com

PROJECT NO:	CP-17-0613
Date	Jun., 18, 2018
GIS	SK
Checked By	JB

FIGURE: 3

H:\01 Project - Proposals\2017 Jobs\CP\0CP-17-0613 - J.R. Brisson – Site Plan Control – 495 Jinkinson Road\07 - GIS\mxd\HydroG\0CP-17-0613_03_SurroundingLandUse.mxd



100 50 0 100

Scale 1:4,000 Metres

LEGEND

- Approximate Site Boundary
- Building and Parking Lot
- PSW 120m Buffer
- Conservation Authority Boundary
- Trans-Canada Pipeline
- Cleared
- Test Well
- UnevaluatedWetland
- Provincially Significant Wetland
- Unevaluated Wetland

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2018.

CLIENT: J.R. BRISSON EQUIPMENT

PROJECT: HYDROGEOLOGICAL STUDY
495 JINKINSON ROAD

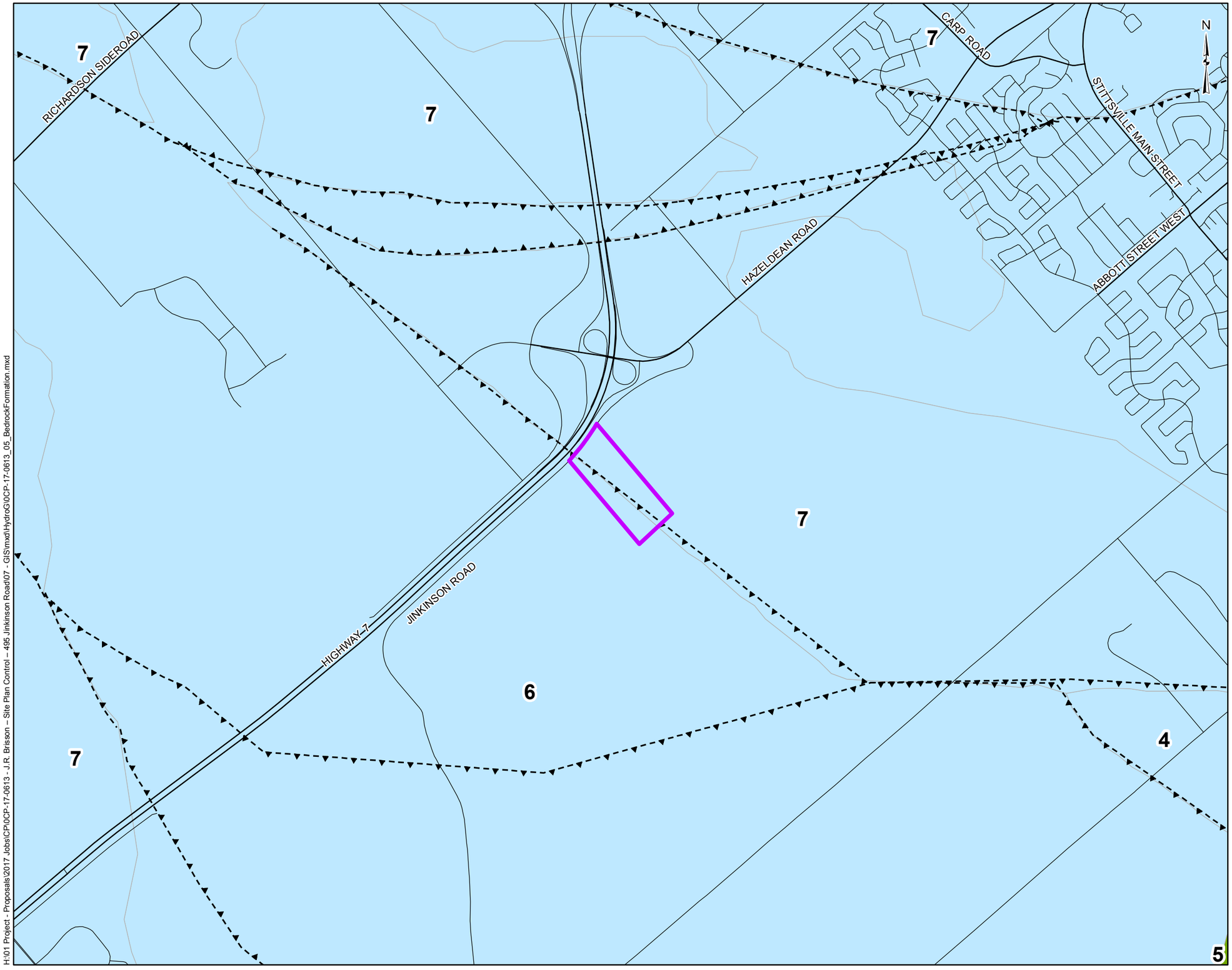
TITLE: SITE LAYOUT

McINTOSH PERRY
115 Walgreen Road, RR3, Carp, ON K0A1L0
Tel: 613-836-2184 Fax: 613-836-3742
www.mcintoshperry.com

PROJECT NO:	CP-17-0613
Date	Jun., 20, 2018
GIS	SK
Checked By	JB

FIGURE: 4

H:\01 Project - Proposals\2017 Jobs\CP\0CP-17-0613 - J.R. Brisson – Site Plan Control – 495 Jinkinson Road\07 - GIS\mxd\HydroG\0CP-17-0613_04_SiteLayout.mxd



LEGEND

- Property Boundary
- Local Road
- Major Road
- Fault

Bedrock Geology

7	Bobcaygeon Formation: Interbedded sitly 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	Rockliffe Formation: Interbedded fine-grained light greenish grey quartz sandstone, shaley limestone and shale, locally congomerate at base, interbeds of calcarenite and silty dolostone in upper part
4	Oxford Formation: Sublithographic to fine crystalline dolostone

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2018.
Urban Geology of the National Captial Area, Bélanger, R; Geological Survey of Canada, Open File 5311, 2008

0 250 500 1,000

Scale 1:25,000 Metres

CLIENT: J.R. BRISSON EQUIPMENT

PROJECT: HYDROGEOLOGICAL STUDY
495 JINKINSON ROAD

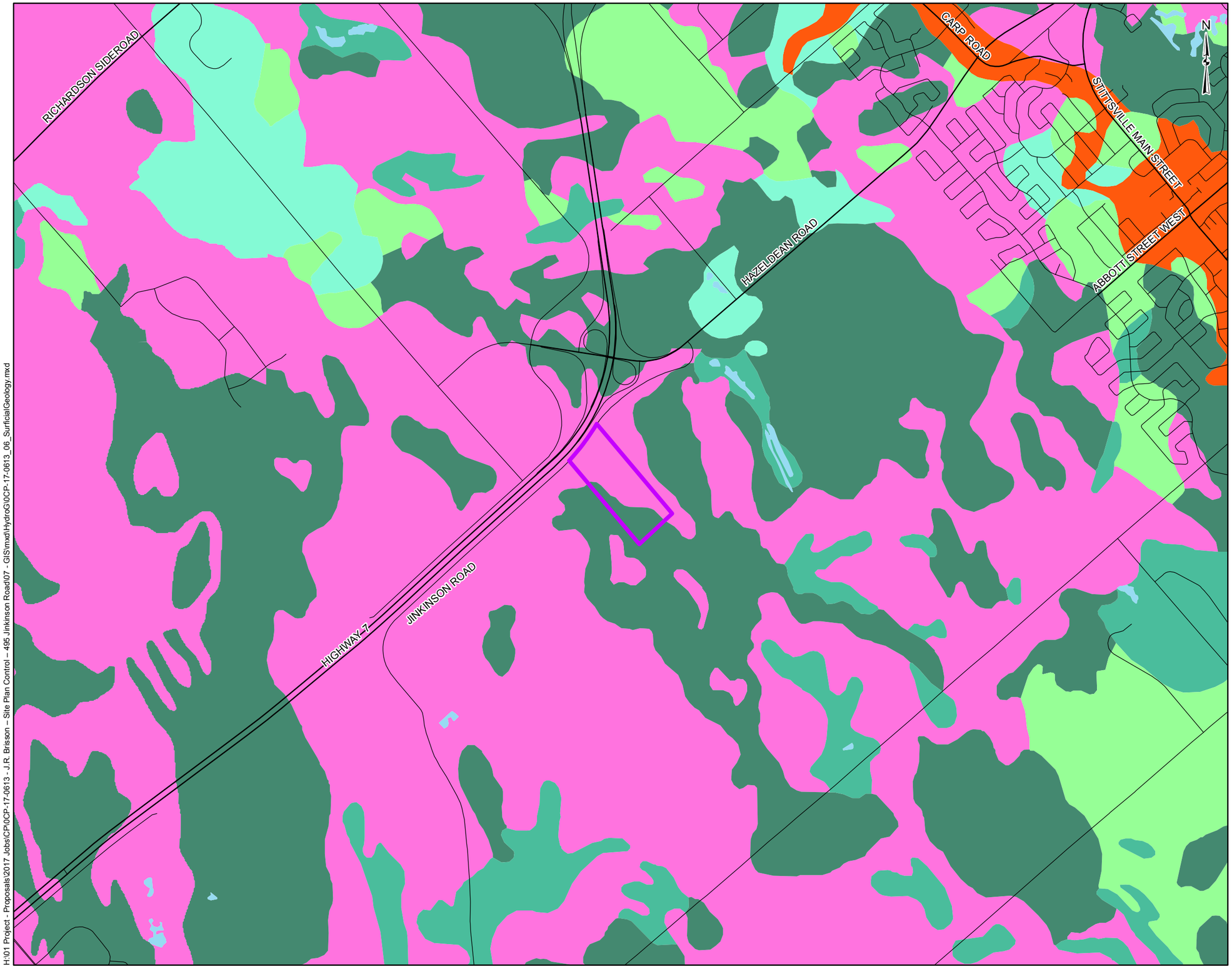
TITLE: BEDROCK FORMATION

McINTOSH PERRY
115 Walgreen Road, RR3, Carp, ON K0A1L0
Tel: 613-836-2184 Fax: 613-836-3742
www.mcintoshperry.com

PROJECT NO:	CP-17-0613
Date	Jun., 19, 2018
GIS	SK
Checked By	JB

FIGURE: 5

H:\01 Project - Proposals\2017 Jobs\CP\0CP-17-0613 - J.R. Brisson – Site Plan Control – 495 Jinkinson Road\07 - GIS\mxd\HydroG\0CP-17-0613_05_BedrockFormation.mxd



LEGEND

- Property Boundary
- Local Road
- Major Road

Surficial geology

Description

- Organic Deposits
- Sand Dunes
- Floodplains, sand, silt, clay
- Fluvial Terraces, sand, silt
- Reworked Marine Sediments
- Beach Formations
- Sand, reworked glaciofluvial
- Deltaic and Estuarian Deposits
- Marine Deposits, clay, silt
- Erosional Terraces
- Glaciofluvial Deposits
- Till, plain
- Till, drumlinized
- Till, hummocky to rolling
- Paleozoic Bedrock
- Precambrian Bedrock
- Water

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2018.
Surficial Geology of Southern Ontario provided by the Ontario Geological Survey, Miscellaneous Release - Data 128 - Revised

0 250 500 1,000

Scale 1:25,000 Metres

CLIENT: J.R. BRISSON EQUIPMENT

PROJECT: HYDROGEOLOGICAL STUDY
495 JINKINSON ROAD

TITLE: SURFICIAL GEOLOGY

McINTOSH PERRY
115 Walgreen Road, RR3, Carp, ON K0A1L0
Tel: 613-836-2184 Fax: 613-836-3742
www.mcintoshperry.com

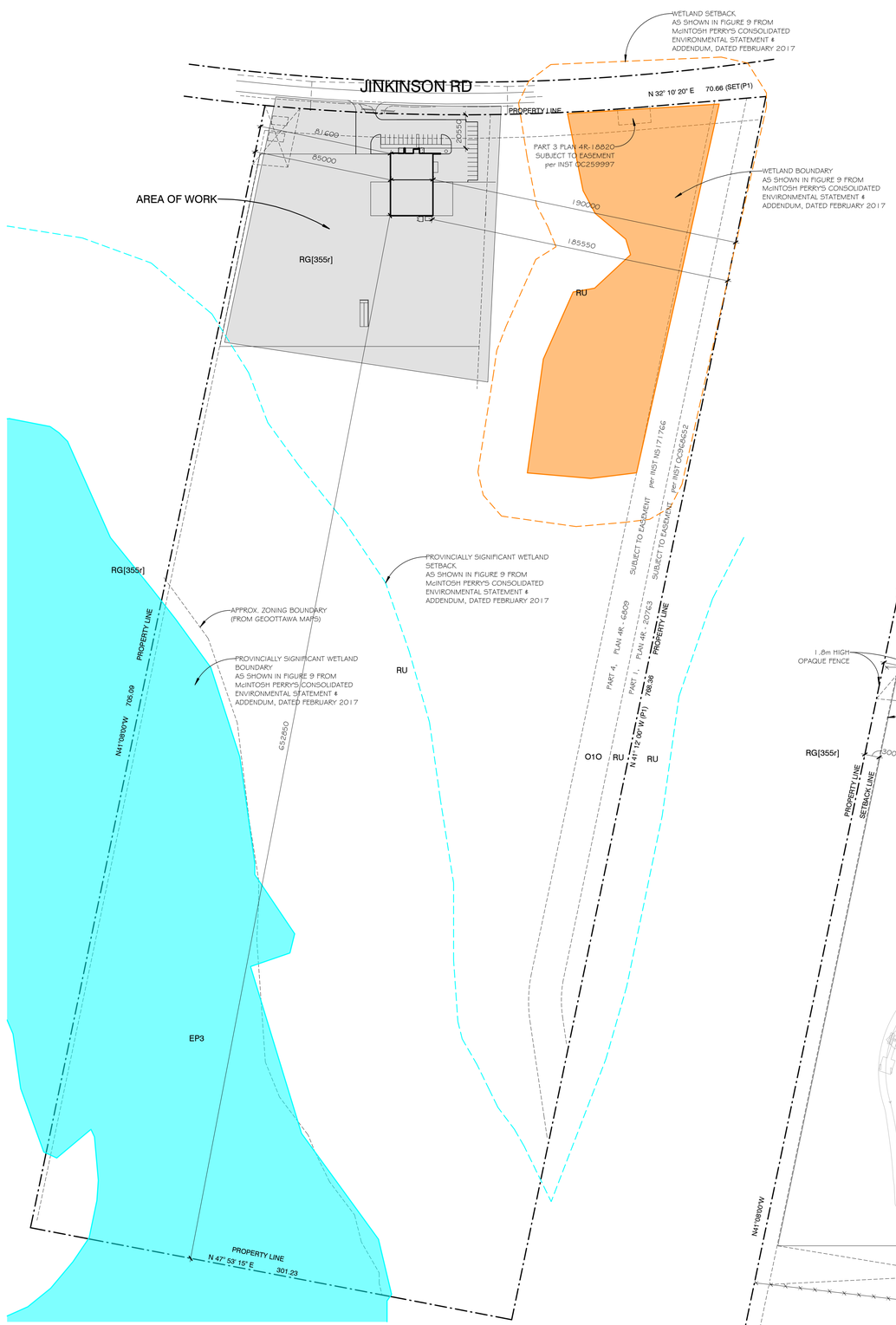
PROJECT NO:	CP-17-0613
Date	Jun., 20, 2018
GIS	SK
Checked By	JB

FIGURE: 6

H:\01 Project - Proposals\2017 Jobs\CP\0CP-17-0613 - J.R. Brisson – Site Plan Control – 495 Jinkinson Road\07 - GIS\mxd\HydroG\0CP-17-0613_06_SurficialGeology.mxd

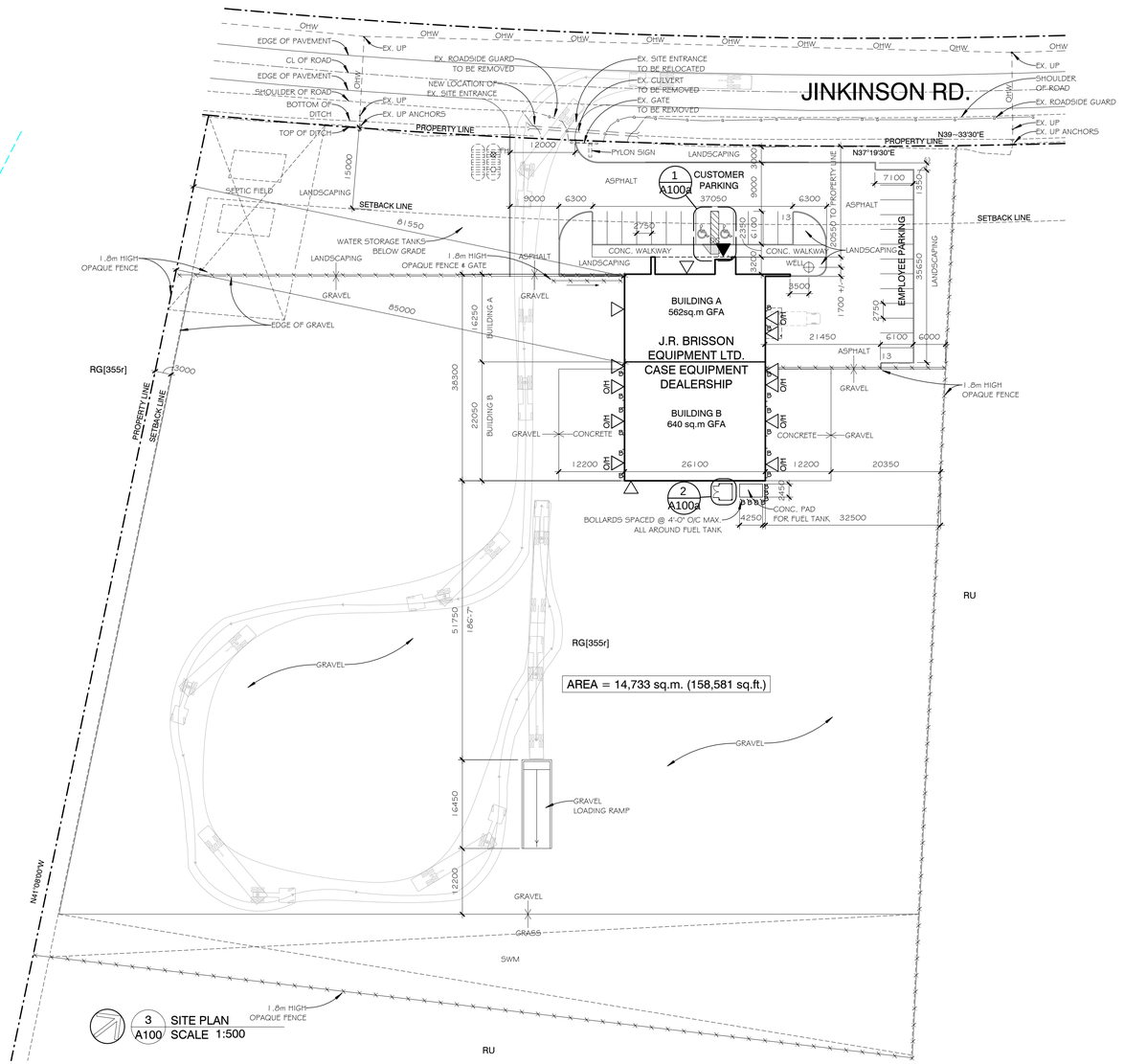
APPENDICES

APPENDIX A – SITE PLAN



2 KEY PLAN
A100 SCALE 1 : 1500

1 LOCATION PLAN
A100 SCALE 12" = 1'-0"



3 SITE PLAN
A100 SCALE 1:500

plot scale 1:1

SHEET SIZE: ARCH D (24"x36")

NOTES:

Contractor shall check and verify all dimensions on site and report any discrepancies to the Architect before proceeding.

no.	revision	date

north nord

383 Parkdale Avenue, Suite 201
Ottawa Ontario Canada K1Y 4R4

KWC ARCHITECTS INC.

PHONE (613) 238-2117
FAX (613) 238-6595
E MAIL kwc@kwc-arch.com

detail no. 1 / A1 détail no.
sheet no. feuille no.

project
projet

J.R. Brisson Equipment Ltd.
CASE EQUIPMENT DEALERSHIP

495 JINKINSON RD.
STITTSVILLE, ON

designed by / conçu par	KWC
approved by / approuvé par	
drawn by / dessiné par	TC
project no. / no. du projet	1829
date	28 MAY 2018
scale	as noted

drawing / dessin

SITE PLAN

revision / révision

sheet no. / no. de la feuille **A100**

APPENDIX B – MOECC WELL RECORDS

MOECC ID	Year Complete	Depth (m)	Depth to BR (m)	Static WL (m below casing)	Use	Completion Material
7132600	2009	110	0.0	6.3	Domestic	Limestone
1509891	1968	50	0.0	1.5	Domestic	Limestone
1522437	1988	61	0.0	3.0	Domestic	Limestone
1502824	1960	9	3.7	3.0	Domestic	Limestone
1511033	1971	37	27.7	4.6	Domestic	Limestone
7167929	2011	35	0.0	1.4	Commercial	Shale
1516838	1978	201	1.2	5.5	Industrial	Granite

APPENDIX C – LABORATORY CERTIFICATES OF ANALYSIS

PARACEL LABORATORIES LTD.
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www.paracellabs.com

Certificate of Analysis

McIntosh Perry Consulting Eng. (Carp)

115 Walgreen Rd.
Carp, ON K0A 1L0
Attn: Stefan Holik

Client PO:
Project: 17-0613
Custody: 111590

Report Date: 18-Jun-2018
Order Date: 15-Jun-2018

Order #: 1824669

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

Paracel ID	Client ID
1824669-01	TW1-1
1824669-02	TW1-2

Approved By:

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: McIntosh Perry Consulting Eng. (Carp)
Client PO:

Report Date: 18-Jun-2018
Order Date: 15-Jun-2018
Project Description: 17-0613

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	18-Jun-18	18-Jun-18
Ammonia, as N	EPA 351.2 - Auto Colour	18-Jun-18	18-Jun-18
Anions	EPA 300.1 - IC	18-Jun-18	18-Jun-18
Colour	SM2120 - Spectrophotometric	18-Jun-18	18-Jun-18
Conductivity	EPA 9050A- probe @25 °C	18-Jun-18	18-Jun-18
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	15-Jun-18	18-Jun-18
E. coli	MOE E3407	15-Jun-18	15-Jun-18
Fecal Coliform	SM 9222D	15-Jun-18	15-Jun-18
Metals, ICP-MS	EPA 200.8 - ICP-MS	18-Jun-18	18-Jun-18
pH	EPA 150.1 - pH probe @25 °C	18-Jun-18	18-Jun-18
Phenolics	EPA 420.2 - Auto Colour, 4AAP	18-Jun-18	18-Jun-18
Subdivision Package	Hardness as CaCO3	18-Jun-18	18-Jun-18
Sulphide	SM 4500SE - Colourimetric	18-Jun-18	18-Jun-18
Tannin/Lignin	SM 5550B - Colourimetric	18-Jun-18	18-Jun-18
Total Coliform	MOE E3407	15-Jun-18	15-Jun-18
Total Dissolved Solids	SM 2540C - gravimetric, filtration	15-Jun-18	18-Jun-18
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	18-Jun-18	18-Jun-18
Turbidity	SM 2130B - Turbidity meter	18-Jun-18	18-Jun-18

Certificate of Analysis

Client: McIntosh Perry Consulting Eng. (Carp)

Client PO:

Report Date: 18-Jun-2018

Order Date: 15-Jun-2018

Project Description: 17-0613

	Client ID:	TW1-1	TW1-2	-	-
	Sample Date:	06/15/2018 08:45	06/15/2018 02:20	-	-
	Sample ID:	1824669-01	1824669-02	-	-
	MDL/Units	Water	Water	-	-
Microbiological Parameters					
E. coli	1 CFU/100 mL	ND [1]	ND	-	-
Fecal Coliforms	1 CFU/100 mL	ND	ND	-	-
Total Coliforms	1 CFU/100 mL	ND [1]	ND	-	-
General Inorganics					
Alkalinity, total	5 mg/L	244	247	-	-
Ammonia as N	0.01 mg/L	0.25	0.28	-	-
Dissolved Organic Carbon	0.5 mg/L	2.2	1.9	-	-
Colour	2 TCU	<2 [2]	<2 [2]	-	-
Conductivity	5 uS/cm	1470	1420	-	-
Hardness	mg/L	446	447	-	-
pH	0.1 pH Units	7.6	7.6	-	-
Phenolics	0.001 mg/L	<0.001	<0.001	-	-
Total Dissolved Solids	10 mg/L	2140	1050	-	-
Sulphide	0.02 mg/L	0.05	0.27	-	-
Tannin & Lignin	0.1 mg/L	<0.1	<0.1	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.4	0.4	-	-
Turbidity	0.1 NTU	1.2 [2]	5.8 [2]	-	-
Anions					
Chloride	1 mg/L	299	287	-	-
Fluoride	0.1 mg/L	0.4	0.4	-	-
Nitrate as N	0.1 mg/L	<0.1	<0.1	-	-
Nitrite as N	0.05 mg/L	<0.05	<0.05	-	-
Sulphate	1 mg/L	63	64	-	-
Metals					
Calcium	100 ug/L	111000	113000	-	-
Iron	100 ug/L	<100	287	-	-
Magnesium	200 ug/L	41100	40200	-	-
Manganese	5 ug/L	18	15	-	-
Potassium	100 ug/L	6190	5780	-	-
Sodium	200 ug/L	75000	71400	-	-

Certificate of Analysis
Client: McIntosh Perry Consulting Eng. (Carp)
Client PO:

Report Date: 18-Jun-2018
Order Date: 15-Jun-2018
Project Description: 17-0613

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Fluoride	ND	0.1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
Ammonia as N	ND	0.01	mg/L						
Dissolved Organic Carbon	ND	0.5	mg/L						
Colour	ND	2	TCU						
Conductivity	ND	5	uS/cm						
Phenolics	ND	0.001	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Sulphide	ND	0.02	mg/L						
Tannin & Lignin	ND	0.1	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Turbidity	ND	0.1	NTU						
Metals									
Calcium	ND	100	ug/L						
Magnesium	ND	200	ug/L						
Sodium	ND	200	ug/L						
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL						
Fecal Coliforms	ND	1	CFU/100 mL						
Total Coliforms	ND	1	CFU/100 mL						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	295	5	mg/L	299			1.3	10	
Fluoride	0.36	0.1	mg/L	0.35			3.7	10	
Nitrate as N	ND	0.1	mg/L	ND				20	
Nitrite as N	ND	0.05	mg/L	ND				20	
Sulphate	64.7	1	mg/L	62.9			2.8	10	
General Inorganics									
Alkalinity, total	ND	5	mg/L	ND				14	
Ammonia as N	0.236	0.01	mg/L	0.255			7.8	17.7	
Dissolved Organic Carbon	1.9	0.5	mg/L	2.2			14.9	37	
Colour	ND	2	TCU	ND				12	
Conductivity	ND	5	uS/cm	1470			0.0	11	
pH	7.6	0.1	pH Units	7.6			0.1	10	
Phenolics	ND	0.001	mg/L	ND				10	
Total Dissolved Solids	908	10	mg/L	924			1.8	10	
Sulphide	0.05	0.02	mg/L	0.05			0.0	10	
Tannin & Lignin	ND	0.1	mg/L	ND			0.0	11	
Total Kjeldahl Nitrogen	0.28	0.1	mg/L	0.29			2.2	10	
Turbidity	1.2	0.1	NTU	1.2			0.9	10	
Metals									
Calcium	227000	1000	ug/L	228000			0.5	20	
Magnesium	41100	200	ug/L	41600			1.0	20	
Sodium	581000	200	ug/L	585000			0.8	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL	ND				30	
Total Coliforms	ND	1	CFU/100 mL	ND				30	

Certificate of Analysis
Client: McIntosh Perry Consulting Eng. (Carp)
Client PO:

Report Date: 18-Jun-2018
Order Date: 15-Jun-2018
Project Description: 17-0613

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	308	1	mg/L	299	92.8	78-112			
Fluoride	1.35	0.1	mg/L	0.35	99.6	73-113			
Nitrate as N	1.04	0.1	mg/L	ND	104	81-112			
Nitrite as N	0.903	0.05	mg/L	ND	90.3	76-117			
Sulphate	73.8	1	mg/L	62.9	109	75-111			
General Inorganics									
Ammonia as N	0.463	0.01	mg/L	0.255	83.3	81-124			
Dissolved Organic Carbon	12.5	0.5	mg/L	2.2	102	60-133			
Phenolics	0.022	0.001	mg/L	ND	86.7	69-132			
Total Dissolved Solids	84.0	10	mg/L		84.0	75-125			
Sulphide	0.53	0.02	mg/L	0.05	95.8	79-115			
Tannin & Lignin	0.9	0.1	mg/L	ND	94.7	71-113			
Total Kjeldahl Nitrogen	2.24	0.1	mg/L	0.29	97.3	81-126			
Metals									
Calcium	938		ug/L		93.8	80-120			
Magnesium	906		ug/L		90.6	80-120			
Sodium	886		ug/L		88.6	80-120			

Qualifier Notes:

Login Qualifiers :

Container(s) - Bottle and COC sample ID don't match -
Applies to samples: TW1-2

Sample Qualifiers :

1 : A2C - Background counts greater than 200

2 : This analysis was conducted after the accepted holding time had been exceeded.

QC Qualifiers :

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

PARACEL LABORATORIES LTD.

TRUSTED. RESPONSIVE. RELIABLE.

Paracel ID: 1824669

Chain of Custody
(Lab Use Only)
№ 111590

Page 1 of 1

Client Name: MPCE	Project Reference: 17-0613	**Turnaround Time:**
Contact Name: Stefan Holik	Quote # S/O.	☒ 1 Day ☐ 3 Day
Address: 115 Walgreen Road	PO #	☐ 2 Day ☐ Regular
Telephone: 613-836-2184	Email Address: S.holik@mcintoshperry.com J.boaventura@mcintoshperry.com.	Date Required:

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ☒ Other: ODWS

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Required Analyses

Paracel Order Number: 1824669

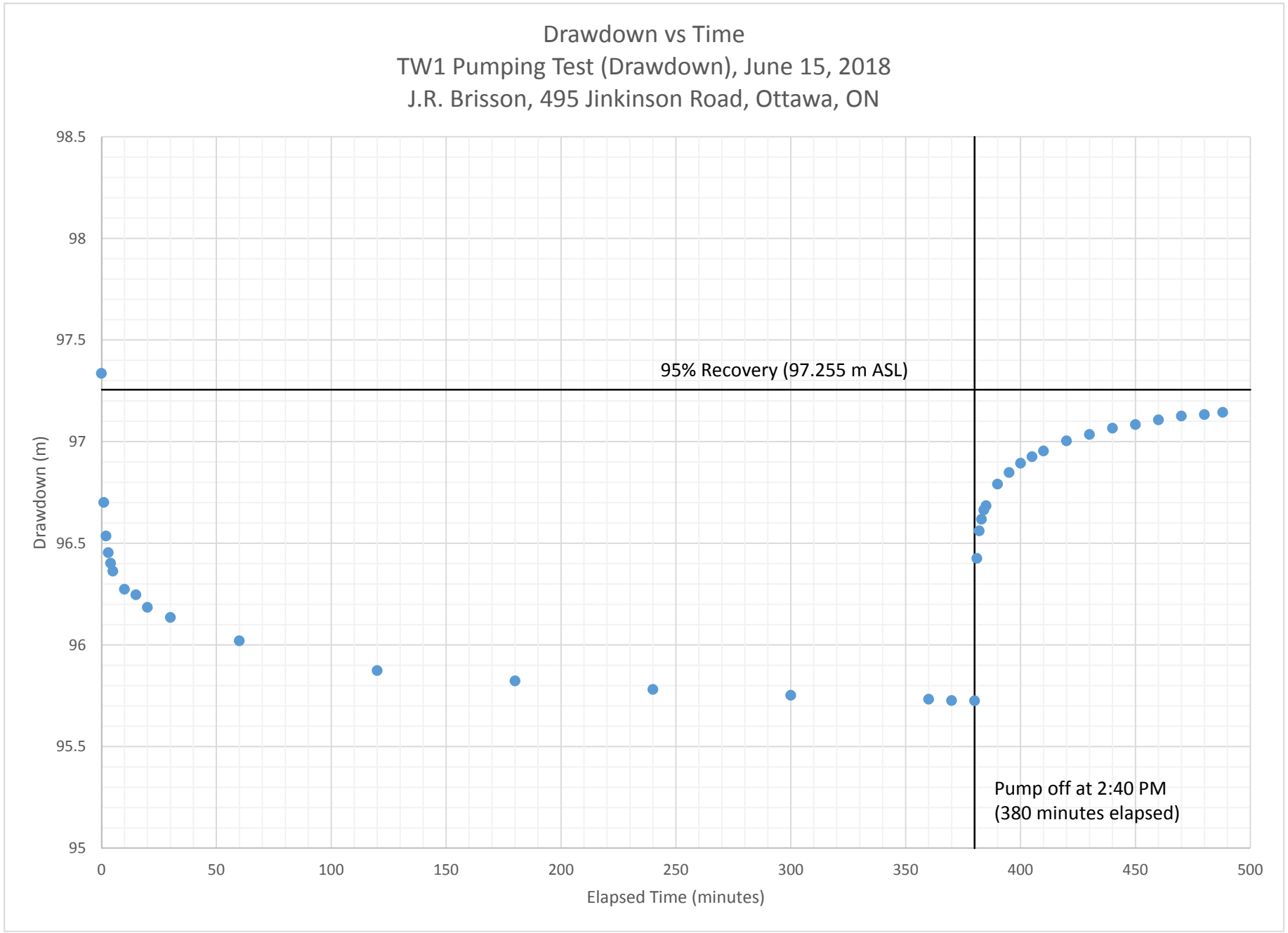
	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	Sub-Lists: Sanitary						
1	TW1-1	GW	/		15-Jun-18	8:45am								/						
X 2	TW1-2	GW	/		15-Jun-18	2:20 pm								/						
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

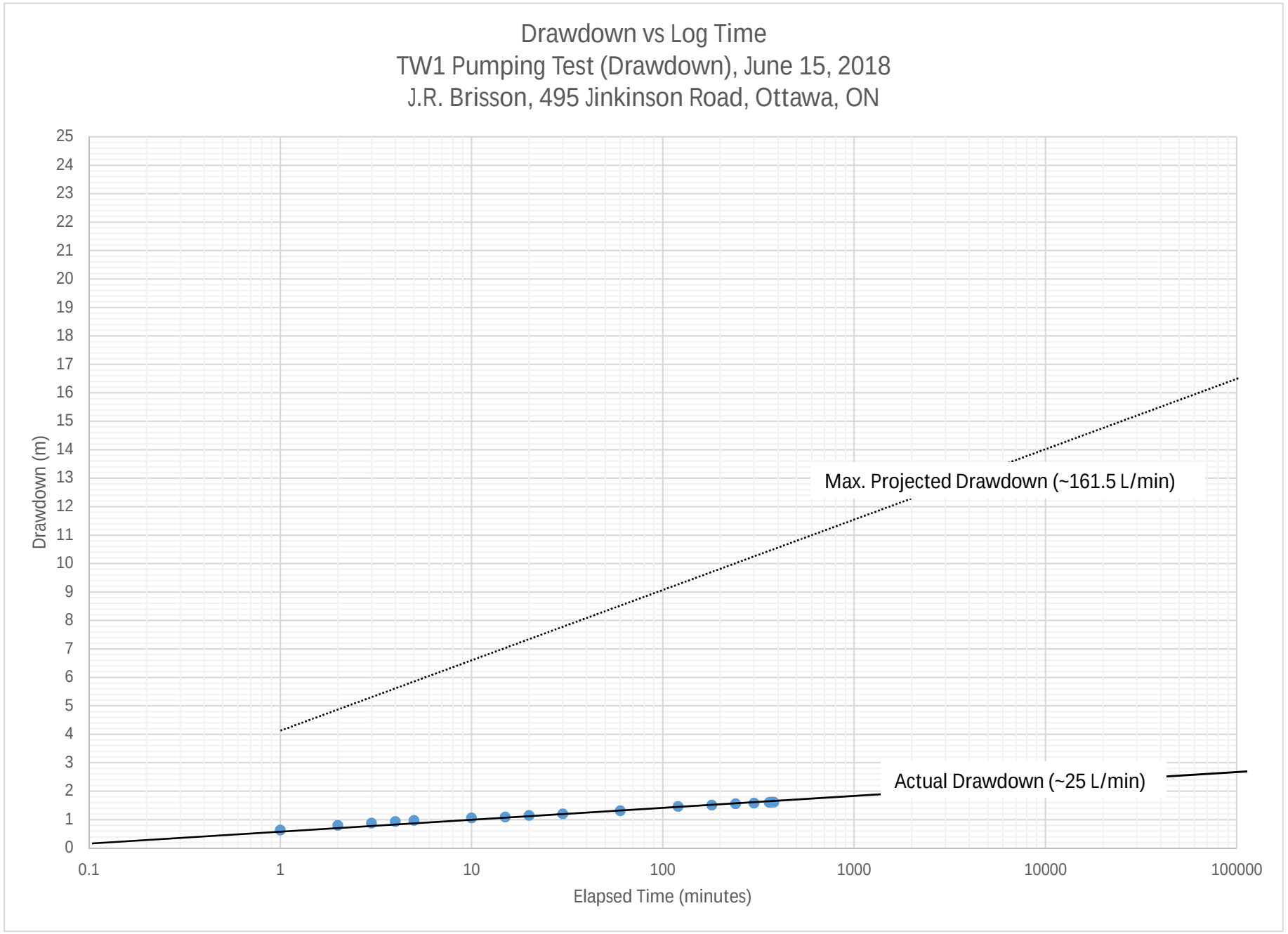
Comments: Rush needed on full Samples ↑ All Sample Bottles Read TW01-2 Report as per COC per garden. ecl

Method of Delivery: Walk-in

Relinquished By (Sign): S. Holik	Received by Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Stefan Holik	Date/Time:	Date/Time: Jun 18 4:03	Date/Time: Jun 18 4:19 pm
Date/Time: 15-Jun-18 / 15:45 pm	Temperature: °C	Temperature: 20. °C	pH Verified ☐ By:

APPENDIX D – WATER LEVEL DATA AND ASSOCIATED ANALYSES


Drawdown vs Time
TW1 Pumping Test (Drawdown), June 15, 2018
J.R. Brisson, 495 Jinkinson Road, Ottawa, ON
98.5
98
97.5
97
96.5
96
95.5
95
Drawdown (m)
95% Recovery (97.255 m ASL)
Pump off at 2:40 PM
(380 minutes elapsed)
0
50
100
150
200
250
300
350
400
450
500
Elapsed Time (minutes)


Drawdown vs Log Time
TW1 Pumping Test (Drawdown), June 15, 2018
J.R. Brisson, 495 Jinkinson Road, Ottawa, ON
Drawdown (m)
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.1
1
10
100
1000
10000
100000
Elapsed Time (minutes)
Max. Projected Drawdown (~161.5 L/min)
Actual Drawdown (~25 L/min)

APPENDIX E – LANGELIER SATURATION INDEX (LSI) AND RYZNAR STABILITY INDEX (RSI) CALCULATIONS

Langelier Saturation Index (LSI)

If LSI is negative: No potential to scale, the water will dissolve $CaCO_3$

If LSI is positive: Scale can form and $CaCO_3$ precipitation may occur

If LSI is close to zero: Borderline scale potential. Water quality or changes in temperature, or evaporation could change the index.

The LSI is probably the most widely used indicator of cooling water scale potential. It is purely an equilibrium index and deals only with the thermodynamic driving force for calcium carbonate scale formation and growth.

$LSI = pH - pH_s$

Where:

pH is the measured water pH

pH_s is the pH at saturation in calcite or calcium carbonate and is defined as:

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

Where:

$A = (Log_{10}\ [TDS] - 1) / 10$

$B = -13.12 \times Log_{10}\ (^{o}C + 273) + 34.55$

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

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

TW1_2					
pH	6.93			A	0.202119
TDS	1050			B	2.390621
Hardness	446			C	2.249335
Alkalinity	247			D	2.392697
Temp.	9.6				
pHs =					7.250708
LSI =					-0.32071
RSI=					7.571417

Ryznar Stability Index (RSI)

RSI = 2(pHs) - pH

Where:

pH is the measured water pH

pHs is the pH at saturation in calcite or calcium carbonate

The empirical correlation of the Ryznar stability index can be summarized as follows:

RSI << 6 the scale tendency increases as the index decreases

RSI >> 7 the calcium carbonate formation probably does not lead to a protective corrosion inhibitor film

RSI >> 8 mild steel corrosion becomes an increasing problem.

APPENDIX F – PHOTOGRAPHIC LOG

Photo 1: Site entrance, view along Jinkinson Road

Photo 2: Cleared land along edge of forest – development area

Photo 3: Drilling of TW1

Photo 4: Buried service (gas) easement along northeast side of Site

APPENDIX G – TW1 WELL RECORD

Ontario — Ministry of the Environment and Climate Change

Measurements recorded in: ☐ Metric ☒ Imperial

Well Tag No. *(Place Sticker and/or Print Below)* A228018

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
DANIEL	RIENDEAU		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
121 ST-PIERRE RD	VARS	ONT	K0A3H0	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
495 JINKINSON RD.	OTTAWA		

County/District/Municipality	City/Town/Village	Province	Postal Code
OTTAWA	STITTSVILLE	Ontario	K2S1B9

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	423677	5010490		

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
GREY	LIMESTONE			0	140

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (~~m³/ft³~~) yd³
0	32	BENTONITE GROUT	.320
32	42	CEMENT GROUT	.130

Method of Construction

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

Well Use

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

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6¼	STEEL	.188	0 +2	42

Construction Record - Screen

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

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

Water Details

Water found at Depth	Kind of Water	Hole Diameter Depth From	Depth To	Diameter (cm/in)
121.5 (m/ft) ☐ Gas	☐ Fresh ☒ Untested ☐ Other, specify	42	140	6"
127.5 (m/ft) ☐ Gas	☐ Fresh ☒ Untested ☐ Other, specify			
(m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify			

Results of Well Yield Testing

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

If pumping discontinued, give reason:

Pump intake set at (m/ft): 130

Pumping rate (l/min / GPM): 12

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 25.40

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

Recommended pump depth (m/ft): 130'

Recommended pump rate (l/min / GPM): 12

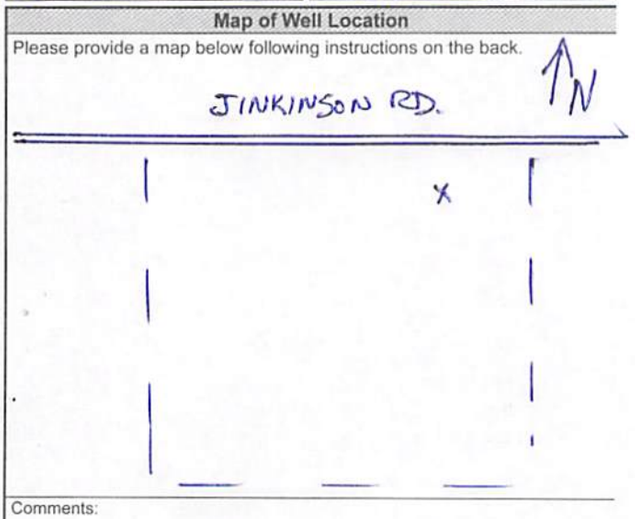
Well production (l/min / GPM): 12+

Disinfected? ☒ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level		60.50		
1	1	11.55	1	17.55
2	2	14.75	2	13.45
3	3	16.0	3	10.35
4	4	17.20	4	9.85
5	5	18.15	5	9.53
10	10	20.62	10	8.70
15	15	22.13	15	8.32
20	20	22.85	20	8.05
25	25	23.50	25	7.90
30	30	23.85	30	7.73
40	40	24.52	40	7.53
50	50	25.05	50	7.33
60	60	25.40	60	7.23

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.
SAUNDERS WELL DRILLING LTD	4879

Business Address (Street Number/Name)	Municipality
1680 SCHEEL DR	BRAESIDE

Province	Postal Code	Business E-mail Address
ONT	K0A1G0	

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
6136235648	SAUNDERS TROY

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
5117	Troy Saunders	2018 07 08

Well owner's information package delivered	Date Package Delivered	Ministry Use Only
☒ Yes ☐ No	2018 06 08	Audit No. Z260704
	Date Work Completed: 2018 06 08	Received

0506E (2014/11)

Ministry's Copy