Hydrogeological and Site Servicing Assessment
Proposed McCamus Residential Subdivision
1910 County Road 10, Hamlet of Ida
Part Lot 12, Concession 11 (Cavan)
Township of Cavan Monaghan
County of Peterborough

Prepared For:

Barry McCamus
1910 County Road 10
Cavan, Ontario
LOA 1L0

ORE
Oakridge Environmental Ltd.
Environmental and Hydrogeological Services

Project#: 23-3349
April 2024

ORE
Oakridge Environmental Limited
Environmental and Hydrogeological Services

April 18, 2024

Richard J. Taylor, LL.B,
Barrister, Solicitor, Notary Public
Lower Level Peterborough Square
360 George St N Unit 12
Peterborough, Ontario
K9H 7E7

Attention: **Richard J. Taylor**

Re: Hydrogeological and Site Servicing Assessment
Proposed McCamus Residential Subdivision
1910 County Road 10, Hamlet of Ida
Part Lot 12, Concession 11 (Cavan)
Township of Cavan Monaghan, County of Peterborough
ORE File No. 23-3349

Dear Mr. Taylor:

We are pleased to present our report in support of the above Plan of Subdivision application. As you will see, our findings are supportive with regard to the suitability of the proposed lots, specifically with respect to groundwater supply and capacity to sustain private sewage systems.

Recommendations are provided herein to assist with the placement of the well and sewage system on the proposed lots.

Should you have any questions, please contact the undersigned.

Yours truly,
Oakridge Environmental Ltd.

Dan MacIntyre, B.Sc.
Project Manager - Hydrogeology and Geoscience

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Prepared By:

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Township of Cavan Monaghan, County of Peterborough

1.0 Introduction

1.1 Site Location and Access

The subject property consists of agricultural lands within the hamlet of Ida, approximately 10 km southwest of the City of Peterborough, Ontario (Figure 1). The property can be accessed from Highway 115 by taking exit 38 and travelling north on County Road 10 for approximately 4.5 km. The entrance to the subject property is located approximately 148 m north of the intersection between Sharpe Line and County Road 10. The proposed five (5) lot subdivision would front onto Sharpe Line, west of County Road 10.

Comprising a small portion of the subject property, the 1.43 ha (3.53 acre) proposed subdivision site consists of an open agricultural field, with no existing structures. Surrounding land uses (i.e., within 500 m of the site) include residential development and agricultural crop production.

As outlined above, the proposed development site comprises a small portion of the subject property (Figure 2), which is utilized mainly for crop production. However, data has also been obtained from the two (2) adjoining residential lots to the east of the site, which were created by consent (i.e., severed) from the subject property in 2021. As a result, this report includes data obtained from the site and the adjoining residential properties to the east.

1.2 Approach

A five (5) lot Plan of Subdivision is proposed for the subject property. To support the development application, a hydrogeological and site servicing study is required to verify that there is a sufficient quantity of acceptable quality water available to supply the future residences. The study must also determine the allowable density of lots by completing an impact assessment based on effluent loading from future septic systems on the site.

The hydrogeological study requirements for development applications are described in Ministry of the Environment, Conservation and Parks' (MECP's) Procedure D-5-4 and Procedure D-5-5. Briefly, Procedure D-5-4 pertains to evaluating the site's capacity to manage septic effluent and environmental impact, whereas Procedure D-5-5 pertains to

the various tests needed to demonstrate whether there is an adequate groundwater supply available. Both documents are intended to be used to predict the cumulative effects of a proposed subdivision on groundwater resources using a finite amount of resources/data.

In recent years, the Conservation Authorities of Ontario have also published guidelines for hydrogeological investigations in support of various types of development. For Plan of Subdivision developments, these guidelines expand slightly on the requirements of Procedures D-5-4 and D-5-5, requiring examination of source protection areas, groundwater recharge/discharge areas and an evaluation of the soils for the suitability of Low Impact Development (LID) stormwater management techniques/technologies.

This report has been completed in general accordance with the above guidance and industry best management practices. This report also has regard for the Ontario Building Code (OBC), the municipal Official Plan (OP) and zoning requirements.

The reader is referred to the accompanying application documents prepared by Richard J. Taylor, Barrister and Solicitor, for the most up to date concept plan for the development.

2.0 Scope of Work

Based on the above guidelines, the following scope of work has been completed:

- Relevant available background data associated with the site and surrounding lands have been compiled and reviewed.

- A base plan has been created to incorporate our field data, augmented with our own mapping-grade differential GPS data.

- Site inspections have been conducted to assess the terrain and hydrogeological conditions.

- Ministry of the Environment, Conservation and Parks (MECP) well record data for the site area have been obtained and reviewed using our Groundwater Information System (GwIS). Cross sections have been prepared to illustrate aquifer distribution in the area.

- A survey of neighbouring wells near the site has been conducted to obtain information regarding local groundwater supply conditions.

- Shallow soil explorations were completed by advancing test pits and manual (hand auger) boreholes about the site. The soils were logged in accordance with

the Unified Soil Classification System (USCS).

- Representative soil samples were subjected to grain size distribution analysis.
- Shallow works (<3 m deep) standpipes were installed to monitor shallow groundwater and to facilitate shallow groundwater sampling on the site.
- A nitrate impact assessment has been completed in accordance with MECP Procedure D-5-4.
- A review of local groundwater supply conditions, based on existing data, has been conducted.
- Three (3) representative test wells were constructed about the site for the purpose of conducting hydraulic tests in accordance with MECP Procedure D-5-5.
- Pumping tests were completed on two (2) of the new test wells in accordance with MECP Procedure D-5-5. During the pumping tests, nearby wells were monitored.
- Water samples were collected from the discharges during the pumping tests for water quality analyses. The samples were analysed by a qualified laboratory for the parameters required by MECP Procedure D-5-5 and any additional parameters of interest. Given the anecdotal information that methane could be present in local groundwater, analysis of methane was also included in the testing program.
- Additional hydrogeological information was incorporated into this report using data obtained from the neighbouring Cameron Subdivision.
- A conceptual servicing plan has been prepared to illustrate how each proposed lot could be serviced, while satisfying the constraints determined by this study and the Environmental Impact Study (under separate cover).
- All data have been assessed and interpreted.
- This Hydrogeological and Site Servicing report has been prepared.

Our findings are presented in the following sections.

3.0 Physical Setting

3.1 Topography and Drainage

The subject site is relatively flat but slopes gently from west to east, towards a nearby drainage swale that runs along County Road 10. According to site plan prepared by M.J. Davenport & Associates Limited (Appendix A), the total relief across the subject site is 5 m, with an average gradient of approximately 0.03 m/m (or 3 cm of relief for every 1 m travelled). A local topographic high, representing the drainage divide between the Otonabee River subwatershed to the west and the Cavan Creek subwatershed to the east, occurs approximately 400 m west of the subject site. As a result, the site is entirely within the Cavan Creek subwatershed.

The nearby drainage swale contains a small tributary of Cavan Creek, flowing generally southward toward the main branch, situated about 2.2 km south of the site. The local tributary is one of many similar watercourses that appear to be headwater components of the Cavan Creek system. As suggested by its highly linear segments, the tributary has likely been altered (i.e., ditched) as part of agricultural drainage works. Historical subsurface drainage is known to exist in proximity to the subject site, as a gravel bed was intersected immediately north of the proposed subdivision during initial test pit explorations.

Despite the published mapping showing a watercourse traversing the northern extent of the site (Figure 2), this feature was not observed on the property and could simply represent the small trough-like depression that occurs in the general area.

3.2 Source Water Protection

The subject site falls within the Otonabee-Peterborough Source Water Protection Area. The nearest community water supply and source water protection zone occurs approximately 8 km northeast of the subject site, associated with a groundwater supply well and golf course irrigation system registered to a numbered company (233859 Ontario Inc.).

From the MECP Source Protection atlas, the site is described as follows:

Source Protection Area:	Otonabee-Peterborough
Wellhead Protection Area:	No
Wellhead Protection Area E (GUDI):	No
Intake Protection Zone:	No
Issue Contributing Area:	No
Significant Groundwater Recharge Area:	No
Highly Vulnerable Aquifer:	No

Event Based Area:	No
Wellhead Protection Area Q1:	No
Wellhead Protection Area Q2:	No
Intake Protection Zone Q:	No

The atlas also provides that the nearest PTTW occurs approximately 7.5 km to the west, where water is taken from a dugout pond for snow making at a ski hill.

3.3 Regional Geology

3.3.1 Surficial Geology

Published surficial geology mapping (Figure 3) indicates that the subject site and surrounding lands occur in an area dominated by a thick stratum of Newmarket Till. The till tends to be a poorly sorted mixture of clay, silt, sand and gravel, with occasional bouldery layers. The till is carbonate rich and can be highly consolidated. The till unit is widely recognized as a regional aquitard and is an important substrate.

In the site area, the till is somewhat drumlinized, resulting in low ridges aligned roughly along northeast axial trends. The closest mapped drumlins to the site are about 1.25 km to the west and southwest. However, the local topographic high near the site could also be a low drumlin, which would place the subject site on its eastern flank.

The mapping also indicates that the proposed lots occur in an area consisting of medium to fine textured glaciolacustrine deposits, described as foreshore-basinal deposits. These deposits are typically composed of layered fine sand and silty sand, representing the bottom sediment remnants of an ancient glacial lake that inundated the area in what have been referred to as the “Schomberg Ponds”. Deeper water glaciolacustrine deposits are also present in the area, consisting of laminated silt and clay. Muck and wetlands often occupy lower-lying areas within these deposits. An example of this occurs immediately north of the site.

From the published mapping, the on-site soils would be expected to be dominated by the dense, silt and clay-rich Newmarket Till. However, the nearby presence of glaciolacustrine deposits suggests that some of these fine granular soils could also occur on the site, likely as a thin mantle, thickening to the east.

3.3.2 Bedrock Geology

The available Paleozoic geology mapping (Figure 4) indicates that the bedrock underlying the site consists of Ordovician age limestone, belonging to the Lindsay Formation. Rocks of the Lindsay Formation typically consist of fossiliferous limestone and shale.

Local well records indicate that the bedrock occurs at a depth of >70 m in the immediate site area.

3.4 On-Site Geological Conditions

A series of ten (10) test pits were excavated to examine the shallow soil and groundwater conditions on the site in 2017. The test pits (Appendix B) revealed relatively consistent shallow soils throughout the site consisting of Newmarket Till with a discontinuous overlying mantle of brown fine sand/silt, likely representing a weathered portion of the underlying till.

The till typically exhibits considerable heterogeneity and varying degrees of fissuring in the near-surface zone, resulting in a somewhat enhanced hydraulic conductivity in the upper few tens of centimetres. Also, the upper surface zone of the till can be weathered, increasing the sand content, further enhancing hydraulic conductivity. Although not tested, experience with this till unit (ML type) at other sites in the area suggest that its percolation rate[1] will be on the order of 40 min/cm, although its uppermost part can be up to 20 min/cm.

The Newmarket Till exhibits a fairly uniform composition throughout the Peterborough area. Marich (2016) published the results of grain size distribution testing conducted on 82 samples of Newmarket Till from the region, revealing that the till matrix averages 55% sand, 38% silt and 7% clay. These are consistent with our own tests conducted throughout the region. The envelope of grain size distribution test curves for these samples is included in Appendix C.

Hydraulic conductivity (K) of the till can be estimated from the average grain size distribution curves, utilizing the Hazen method for sandy sediments:

$$K = C(d_{10})^2$$

where...

K is hydraulic conductivity (cm/s);
C is a coefficient based on soil properties (unitless), and
d_{10} is the effective grain size (cm).

From this expression, the estimated soil matrix K value of the Newmarket Till is 9.0×10^{-5} cm/s, based on its grain size distribution, consistent with a percolation rate of

[1] Corresponding to Table 2 - Approximate Relationships of Soil Types to Permeability and Percolation Time, from the Supplementary Standard SB-6 of the Ontario Building Code, which correlates soil types to coefficients of permeability and percolation rates.

20 min/cm to 50 min/cm for ML type soils. According to Appendix C of the Low Impact Development (LID) Stormwater Management Planning and Design Guide (2010), the corresponding infiltration rate of the till is expected to be between 12 mm/hr and 30 mm/hr.

The test pit logs are presented in Appendix B and the test pit locations are illustrated on Figure 5.

4.0 Hydrogeology

4.1 Well Record Data

As part of this study, we have compiled and reviewed the available Ministry of the Environment, Conservation and Parks (MECP) well record data for recorded wells within approximately 1 km of the subject site (Figure 6). In total, twenty-eight (28) local well records have been incorporated into our Groundwater Information System (GWIS), representing conditions in the site area (Appendix D). The locations of these wells have been plotted based on the co-ordinates provided with the exception of the test wells on the subject site (referred to as TW-1, TW-2 and TW-3), which have been corrected based on coordinates obtained from a mapping-grade differential Global Positioning System (dGPS). As would be expected, there is an uneven distribution of recorded wells in the site area, with the majority being closely associated with the roads within the hamlet area.

All but six (6) of the recorded wells that have descriptions are listed as being for domestic and/or livestock use, typical of a rural area. Three (3) of the exceptions are listed as "test holes", representing *test wells* constructed for a hydrogeological study in support of a nearby subdivision development situated south of the site (Cameron).[2] Another exception is a well that was subsequently abandoned due to water supply considerations (assumed to be of insufficient yield). Two (2) records contain no information other than coordinates.

While the majority of recorded wells represent small diameter drilled wells, six (6) of the records indicate that the wells are larger diameter dug wells or were "previously dug", suggesting that older dug wells may be more common than the statistics indicate. These have commonly been replaced by drilled wells or have been abandoned. It is common for (typically unreliable) dug wells to be replaced by drilled wells.

[2] Note: Information regarding the Cameron development was obtained from publicly accessible sources, including: Township of Cavan Monaghan, Special Council Meeting, Cameron (Duguay) OPA and ZBA Report), July 20, 2020 (see pg 119/337) accessed from https://peterboroughcounty.civicweb.net/document/266221

Statistical analysis of the well data (Figure 7) reveals that the *mean* test-yield reported by well drillers is approximately 9 gallons per minute (gpm), although the average is skewed by a group of comparatively higher-yield wells that are considered statistically anomalous (i.e., 20 gpm). The most common reported test-yield is typically between 3 gpm and 10 gpm. As only one (1) record indicates an abandonment due to yield considerations, these statistics suggest that an adequate quantity of groundwater is available in the area for typical domestic uses.

A histogram of the driller's reported "water found" elevation has also been presented on Figure 7. The water found elevation is interpreted as the aquifer elevations, as this is the depth at which the contractor would note where water was encountered in bedrock or where an aquifer was encountered in sediments. The average water found (i.e., aquifer) elevation is approximately 237.5 masl, however, there appears to be a three (3) distinct elevation ranges that most well appear to exploit. The majority of the wells appear to be normally distributed around 220 masl, representing a depth of approximately 60 m (~200 ft) below the subject site. A second grouping of wells occurs at an elevation of approximately 245 masl, representing a depth of approximately 35 m (~115 ft) below the subject site, corresponding to the depths of the test wells located on the property (discussed below). The last grouping of wells appear to exploit a relatively shallow aquifer, at an elevation of about 275 masl, which is expected to be represented by the dug wells included in the database.

4.2 Aquifer Systems

Figures 8 and 9 illustrate projected cross sections through the study area using the lithology descriptions provided by the well contractors. Consistent with the well stats discussed above, the cross sections illustrate three (3) distinct aquifers (or aquifer elevation ranges) that have been interpreted from the available data, as briefly described below:

Shallow Overburden Aquifer (SOA)

The SOA is (and has been) widely utilized by dug wells in the Ida area, typically occurring between depths of 5.8 m and 15 m, depending on the location and topography. This aquifer is variably described as occurring at the interface between the upper part of the till and the underlying units, likely representing a geological contact where a thin seam of granular materials occur. While some of those wells may be viable, it is apparent that most are not reliable, given the number that have been replaced by drilled wells. This aquifer is not expected to be a water supply target for the proposed development. Any future well constructed within the proposed subdivision will need to obtain water from a deeper aquifer.

Intermediate Overburden Aquifer (IOA)

The IOA typically occurs between depths of 22 m and 38 m (as referenced to the median elevation on the subject site), and is described as a sand or gravel-rich layer. This aquifer may occur at the base of the Newmarket Till or may be an inter-till granular layer, which are fairly common in this till unit. This type of inter-till aquifer tends to be fairly localized and often directional, although can be a significant water source, often capable of meeting typical domestic water demand. The IOA represents a potential target aquifer for the proposed development.

Deep Overburden/Basal Aquifer (DOBA)

The DOBA consists of deeply buried granular layers (>46 m deep) that occur below the dominant till, including a basal sand and gravel zone that occurs at the overburden-bedrock interface. This aquifer may also be hydraulically connected to water-bearing zones in the upper bedrock, given its proximity. This aquifer represents a potential target aquifer for the proposed development.

The available well record data for the study area does not provide any insights into whether the IOA or the DOBA would be more or less prospective in terms of well yield or potability. As such, both aquifers are suitable targets for the proposed subdivision.

4.3 Well Survey

As part of the initial portion of the hydrogeological study in 2020, the proponent approached neighbours of the property to determine if they would be interested in participating in the hydrogeological study. Two (2) neighbours agreed to have water levels in their wells monitored during the components of the study that were completed in 2020.

Subsequently, a comprehensive well survey was completed on October 26, 2023 of all neighbouring properties within 500 m of the proposed subdivision. A well survey letter and questionnaire were dropped off at each residence, either deposited in their mailbox or left at the door. A copy of the well survey letter and questionnaire has been included in Appendix E.

The response rate for the well survey was low, with only two (2) respondents willing to participate in 2020 and two (2) respondents providing responses to the well survey completed in 2023. This low response rate is not unusual and can be attributed to privacy concerns and/or a lack of interest/concern.

The location of the respondent's wells are indicated on Figure 10. Respondents indicated that there was generally an adequate supply of potable groundwater available in both the drilled and dug wells located within the study area. However, it is understood that careful water consumption is required by the owners of dug wells within the area. Water quality was generally described as good, with iron and elevated hardness being common.

4.4 Shallow Groundwater Flow

As the field where the proposed subdivision is located contains a series of constructed buried gravel beds for drainage of the lands upgradient of this location, all of the test pits intersected shallow groundwater. Slotted (1.5") standpipes were installed in TP-17-2, TP-17-3, TP-17-4, TP-17-6 and TP-17-8 prior to backfilling, to facilitate water table measurements and the collection of samples for nitrate analyses. In addition, neighbouring dug wells (W-2 and W-3) have also been subjected to periodic water level measurements. The water level data from manual measurements are summarized in Table 1 below:

Table 1 - Shallow Aquifer Water Level Summary

Location I.D.	Total Depth (m bgs)	Mean Water Level (m bgs)	Recorded High Water Level (m bgs)
TP-17-2	2.414	0.875	0.57
TP-17-3	2.325	1.454	1.29
TP-17-4	2.66	0.787	0.645
TP-17-6	2.435	1.2	1.09
TP-17-8	2.652	1.459	1.295
W-1*	5.78	2.61	2.44
W-2*	7.987	3.21	3.057
W-3	5.085	0.91	0.665

*based on data obtained from datalogger installed in well

The compiled manual water level data are included in Appendix F.

The shallow groundwater flow pattern across the property has been interpreted from groundwater levels obtained from the on-site test pit standpipes and neighbouring dug wells, and is illustrated by Figure 5.

As would be expected, Figure 5 illustrates the shallow water table as representing a subdued reflection of the topography of the site. Groundwater flows predominantly from west to east, towards a drainage features that occurs immediately adjacent to

County Road 10, which becomes a tributary of Cavan Creek to the east of the subject site.

The average groundwater flow gradient across the site is approximately 0.03 m/m (3 cm/m). Based on the assumed hydraulic conductivity of the Newmarket Till that comprises the shallow soils on the site (9.0×10^{-5} cm/s), the average linear (horizontal) groundwater flow velocity is expected to be on the order of 0.009 m/day (~3.3 m/year).

4.4 Test Well Construction

Three (3) test wells were constructed for the purposes of this study, herein referred to as TW-1, TW-2 and TW-3 (or Test Wells 1, 2 and 3, respectively). The well records for each of the test wells has been presented in Appendix G. A brief summary of each test well is provided below.

TW-1

TW-1 was constructed within the greater property (Figure 5), outside the proposed subdivision lands, to serve dual purposes. The existing residence on the property required a new water supply well, as the previous well utilized by the residence had fallen into disrepair and was subsequently abandoned. In addition, the well would be utilized for this study to primarily serve as an observation well.

The drilled well was constructed on January 5, 2018 by Burgess Well Drilling to a depth of 59.44 m (195 ft) below grade. During construction, the contractor intersected a 57.6 m (189 ft) thick sequence of till overlying the DOBA. The aquifer materials are described as a 1.52 m (5 ft) thick sequence of sand. A 2.13 m (7 ft) length of 5.25 inch diameter wire-wound stainless steel #10 slot well screen was installed between the depths of 57.3 m (188 ft) and 59.44 m (195 ft). As this would suggest the well screen extends into the overlying till, it is anticipated that the driller either installed a leader pipe for the well packer that holds the well screen or the aquifer materials were actually thicker than stated on the record.

Upon completion, the well contractor measured the static water level in TW-1 to be 28.8 m (94.5 ft) below grade. The driller's 1-hour pumping test was subsequently conducted at a rate of 18.93 L/min (5 gpm). During the test, the water level in the well declined to 49.16 m (161.3 ft) below grade, representing approximately 71% of the available drawdown[3] in the well. Following the

[3] Available drawdown is represented by the difference between the static water level and the top of the well screen as specified by the well contractor.

cessation of pumping, the well recovered to within 95% of the original static water level within 40 minutes.

TW-2

TW-2 was originally constructed for the purpose of servicing a lot that was to be severed from the existing property. Prior to the severance, the well was constructed and tested as part of this study.

The drilled well was constructed on January 17, 2018 by Burgess Well Drilling to a depth of 54.86 m (180 ft) below grade. During construction, the contractor intersected a 53.34 m (189 ft) thick sequence of till overlying the DOBA. The aquifer materials are described as a 1.52 m (5 ft) thick sequence of sand. A 2.44 m (8 ft) length of 5.25 inch diameter wire-wound stainless steel #10 slot well screen was installed between the depths of 52.43 m (172 ft) and 54.86 m (180 ft). Similar to TW-1 (above), it is assumed that a leader pipe was used with the well packer to hold the well screen in place but may not have been differentiated from the well screen description on the contractor's record.

Upon completion, the well contractor measured the static water level in TW-2 to be 30.33 m (99.5 ft) below grade. The driller's 1-hour pumping test was subsequently conducted at a rate of 18.93 L/min (5 gpm). During the test, the water level in the well declined to 40.02 m (131.3 ft) below grade, representing approximately 44% of the well's available drawdown. Following the cessation of pumping, the well recovered to within 95% of the original static water level within 40 minutes.

TW-3

TW-3 is a drilled well that was constructed within the proposed subdivision lands on January 26, 2018 by Burgess Well Drilling to a depth of 57.3 m (188 ft) below grade. During construction, the contractor intersected a 54.56 m (179 ft) thick sequence of till overlying the DOBA. The aquifer materials are described as a 1.52 m (5 ft) thick sequence of sand. However, as a 1.83 m (6 ft) length of 5.25 inch diameter wire-wound stainless steel #10 slot well screen was installed between the depths of 55.47 m (182 ft) and 54.86 m (188 ft), the aquifer materials are expected to extend to at least this depth.

Upon completion, the well contractor measured the static water level in TW-3 to be 34.87 m (114.4 ft) below grade. The driller's 1-hour pumping test was subsequently conducted at a rate of 18.93 L/min (5 gpm). During the test, the water level in the well declined to 47.24 m (155 ft) below grade, representing approximately 60% of the available drawdown in the well. Following the

cessation of pumping, the well recovered to within 95% of the original static water level within 40 minutes.

Cameron Development

In addition to the above test wells, our assessment has reviewed the well construction details for three (3) test wells constructed as part of a nearby Plan of Subdivision application, referred to as the Cameron Subdivision. The most relevant test well for this study is referred to as "TW-3" with MECP Well Tag No. A170666 and MECP Well Record No. 7236970, which occurs approximately 200 m south of the subject site, at a similar elevation to the test wells described above.

According to the well record, the well was constructed on December 31, 2014 by G. Hart and Sons Well Drilling Ltd. The well was completed to a total depth of 59.7 m (196 ft). During construction, the contractor intersected a 41.45 m (136 ft) thick sequence of till overlying the DOBA. The aquifer materials are described as a 12.19 m (40 ft) thick sequence of water bearing sand. The contractor installed a 1.22 m (4 ft) length of 6-inch diameter #12 slot well screen at the bottom of the sand sequence.

Upon completion, the well contractor measured the static water level in MECP No. 7236970 to be 29.75 m (97.6 ft) below grade. These results are remarkably similar to the results obtained from the test wells described above.

The driller's 1-hour pumping test was subsequently conducted at a rate of 37.85 L/min (10 gpm). During the test, the water level in the well declined to 31.76 m (104.2 ft) below grade, representing approximately 7% of the available drawdown in the well. Following the cessation of pumping, the well recovered to within 100% of the original static water level within 5 minutes.

4.5 Well Testing

4.5.1 General

According to the Ministry of the Environment, Conservation and Parks' (MECP's) Procedure D-5-5 guidance, a minimum of three (3) test wells are required for a hydrogeological assessment on sites that comprise 15 ha or less. In addition, Section 4.2 of Procedure D-5-5 provides that "existing water wells located on the site or in the immediate proximity of the site may be used as test wells", provided the wells are representative of local aquifer/water supply conditions.

For the purpose of this study, the on-site well (TW-3), was subjected to a formal

pumping test in 2020, with a subsequent test completed in 2024 following the well survey described above. In addition, a neighbouring well (TW-2) was subjected to formal testing in 2020. Unfortunately, TW-1 was not available for formal testing due to logistical factors involving temporarily suspending water use at the residence. As a result, this assessment also provides a summary of the results obtained from the nearby Cameron Subdivision property.

In addition, Procedure D-5-5 specifies that domestic water usage is typically split into two main daily usage periods (i.e., one demand period in the morning and one in the evening), with the average per-person water demand is 450 L per day[4]. This is equivalent to a peak demand rate of 3.75 litres/minute for each person. The occupancy is generally considered to be *the number of bedrooms "plus one"*.

Taking into consideration the above, a four (4) bedroom home would theoretically have an occupancy of five (5) persons, resulting in a daily average water demand of 5 X 450 L/day = 2,250 L/day. If the day is split according to a morning and evening peak usage period, each period would require approximately 1,125 L. These higher usage periods would most often occur within a relatively short time frame of 1 to 2 hours.

To comply with this minimum requirement of Procedure D-5-5, the test wells should be capable of meeting the above criteria. For wells capable of meeting the *average* daily demand, but are not able to meet the *peak*, short-term demand, lower pumping rates can be acceptable, provided supplementary water storage is available in the system.

An alternate interpretation of the D-5-5 guidelines suggests that a test well should be tested at a rate that is three-times (3x) greater than the daily demand described above (6,750 L/day). Therefore, given the modest yield results from the driller's well tests described above and as a conservative approach, the target duration and flow rate utilized for each pumping test was based on extracting a minimum volume of 6,750 L, within a single 24-hour period.

4.5.2 TW-1

As indicated above, TW-1 was not subjected to a formal pumping test due to logistical complications with supplying a temporary water supply to the existing residence. However, it is important to recognize that the data obtained from the driller's pumping test described above, suggests that the same test procedure (that withdrew approximately 1,135 L) could be repeated multiple times throughout the day without causing excessive drawdown (i.e., running out of water). As a result, these data suggest the well is more than capable of supplying the demand described above. It is also

[4] It is important to recognize that MECP Procedure D-5-5 was developed prior to the wide-scale use of low flow fixture units. As a result, water demand rates are anticipated to be much lower than suggested by the guidelines.

understood that the well has been utilized since 2018 without incident.

4.5.3 TW-2

Prior to conducting pumping tests in 2020, the proponent made arrangements to allow for select neighbouring wells to be monitored as part of the testing program in 2020. As a result, the test wells and these select neighbouring wells were outfitted with data logging pressure transducers ("dataloggers") to monitor water level and temperature fluctuations in the well. The dataloggers were supplemented by manual ("dip meter") measurements over the course of the monitoring period. Test pit standpipes were also subjected to periodic manual measurements over the course of the monitoring period[5].

Immediately prior to the pumping test, the static water level was measured to be 30.29 m (~99 ft) below the top of the well casing (btoc). Based on the driller's well record, the available drawdown in the well was estimated to be 52.43 m + 0.795 m (stick-up) - 30.29 m = 22.935 m.

The pumping test of TW-2 was completed on September 9, 2020 at a constant rate of 18.93 L/min (~5 gpm). During the test, the rate was controlled with a flow control ("Dole") valve and periodically checked using a flow metre and graduated pail. During the 360.5 minute pumping test, approximately 6,824 L of water was extracted. The discharge water was directed onto a tarp to disperse flows adjacent to the road side swale along Sharpe Line, approximately 50 m south of the well.

During the initial part of the pumping test, the water level in TW-2 declined rapidly for the initial 40 minutes of the test, then quickly stabilized. The total drawdown observed during the pumping test was 10.63 m, representing approximately 46% of the available drawdown. Upon cessation of pumping, water level recovery was rapid with the water level reaching within 95% of the initial static water level measurement after only 21 minutes and achieving the pre-pumping water level after just 141 minutes. The pumping test data has been presented in Appendix H.

A Cooper Jacob analysis of the pumped well data provides an estimated transmissivity of 6.2 m^2/day. Similarly, analysis of the recovery data provides a slightly lower estimated transmissivity of 1.5 m^2/day. However, these are expected to represent an under estimation of the aquifer transmissivity due to near well effects and well (loss) inefficiency. Despite minimal drawdown (i.e., 0.027 m) observed at the nearest monitored well (TW-3), a more accurate estimate of the aquifer transmissivity may be obtained from a Hantush (leaky-aquifer) analysis of these data. This method provides an estimated transmissivity of 60 m^2/day and a corresponding storativity factor of 1.65×10^{-4} (unitless). The estimated transmissivity values obtained from the pumping

[5] The diameter of the test pit standpipes did not permit monitoring with dataloggers.

test data are generally considered to be adequate for servicing small communities (Krasny 1993).

Hydrographs and analysis of the pumping test data have been presented in Appendix H. As illustrated, TW-3 represents the only observation well that exhibited a water level response that can be directly attributed to pumping TW-2.

4.5.4 TW-3 (2020)

An initial pumping test of TW-3 was completed on September 10, 2020. Immediately prior to the pumping test, the static water level was measured to be 34.59 m (~113 ft) btoc. Based on the driller's well record, the available drawdown in the well was estimated to be 55.47 m + 0.74 m (stick-up) - 34.59 m = 21.62 m.

The 2020 pumping test of TW-3 was completed at a constant rate of 18.93 L/min (~5 gpm). During the test, the rate was controlled with a flow control ("Dole") valve and periodically checked using a flow metre and graduated pail. During the 366 minute pumping test, approximately 6,928 L of water was extracted. The discharge water was directed onto a tarp to disperse flows adjacent to the road side swale along Sharpe Line, approximately 54 m south of the well.

During the initial part of the pumping test, the water level in TW-3 declined rapidly for the initial 30 minutes of the test, then quickly stabilized. The total drawdown observed during the pumping test was 9.3 m, representing approximately 43% of the available drawdown. Upon cessation of pumping, water level recovery was rapid with the water level reaching within 95% of the initial static water level measurement after only 24 minutes and achieving the pre-pumping water level after just 89 minutes. The pumping test data are presented in Appendix H.

A Cooper Jacob analysis of the pumped well data provides an estimated transmissivity of 5.0 m^2/day. Similarly, analysis of the recovery data provides a slightly lower estimated transmissivity of 2.7 m^2/day. Similar to the test described above, despite minimal drawdown (i.e., 0.02 m) observed at the nearest monitored well (TW-2), a more accurate estimate using the Hantush (leaky-aquifer) analysis provides an estimated transmissivity of 62 m^2/day, with a corresponding storativity factor of 1.9 x 10^{-4} (unitless).

Hydrographs and analysis of the pumping test data have been presented in Appendix H. As illustrated, TW-2 represents the only observation well that exhibited a water level response that can be directly attributed to pumping TW-2.

4.5.5 TW-3 (2024)

Immediately prior to the pumping test of TW-3 on January 30, 2024, the static water level in the well was measured to be 34.63 m (~116 ft) btoc, providing an estimated total available drawdown of 21.6 m. Subsequently, the test was completed at an average rate of 20.46 L/min (5.4 gpm). During the test, the rate was controlled with a flow control ("Dole") valve and periodically checked using a flow metre and graduated pail. During the 367 minute pumping test, approximately 7,508 L of water was extracted. The discharge water was directed onto a tarp to disperse flows adjacent to the road side swale along Sharpe Line, approximately 54 m south of the well.

During the initial part of the pumping test, the water level in TW-3 declined rapidly for the initial 30 minutes, then quickly stabilized. The total drawdown observed during the pumping test was 9.6 m, representing approximately 44% of the available drawdown. Upon cessation of pumping, water level recovery was rapid with the water level reaching within 95% of the initial static water level measurement after only 33 minutes and achieving the pre-pumping water level after just 62 minutes. These results are remarkably similar to the 2020 pumping test, suggesting the well and local aquifer conditions have not changed much over the time between the pumping tests. The pumping test data has been presented in Appendix H.

A Cooper Jacob analysis of the pumped well data provides an estimated transmissivity of 3.5 m^2/day. Similarly, analysis of the recovery data provides a slightly higher estimated transmissivity of 6.2 m^2/day. Unfortunately, periodic usage of the nearest observation wells obscured any potentially discernable drawdown that could be attributed to the pumping of TW-3. Regardless, the pumped well estimated transmissivity values outlined above are similar to the values obtained from the 2020 data.

Hydrographs and analysis of the pumping test data have been presented in Appendix H.

4.5.6 Cameron Subdivision Well No. 7236970

Cambium (2015) provided the following description of their testing of the well referred to as "TW-3" (MECP No. 7236970):

> *"On January 15, 2015 Cambium staff were onsite to complete a hydraulic pumping test on test well TW-3. The static water level recorded at the well was 29.64 mTOP prior to the commencement of the constant rate pumping test; therefore, there was an available drawdown of approximately 11 m above the pump. The pumping test was initiated at a rate of 45 Lpm (10 ipgm).*
>
> *The pumping level in the well reached steady state conditions between 60 and 120*

minutes into the pumping test (refer to Figure 8). The drawdown during this time fluctuated between 2.35 m and 2.38 m (the maximum drawdown of 2.38 m being reached at 118 minutes into the pumping test). At approximately 120 minutes into the pumping test the generator briefly malfunctioned. The generator was quickly restarted, however the pump was discharging at approximately 20 Lpm (4.4 ipgm). After 30 minutes of pumping at 20 Lpm (4.4 ipgm) the generator was shut off for three (3) minutes to allow the pump to reset. The generator was again restarted approximately 155 minutes into the pumping test at a discharge rate of 43 Lpm (9.5 igpm). The discharge rate was increased to 45 Lpm (10 ipgm) 310 minutes into the pumping test. The water level stabilized and reached equilibrium at immediately after the discharge rate had been set at 45 Lpm (10 ipgm) for the rest of the pumping test. The drawdown recorded between 310 and 360 minutes into the pumping test fluctuated between 2.32 m and 2.37 m.

Upon completion of the test the pump was shut down and the well was allowed to recover. The water level measured in TW-3 recovered to 100% of the static condition approximately 10 minutes after shutdown."

and,

"Upon analysis of the data produced from each pumping test, it was determined that water withdrawal at a rate of 45 Lpm (10 ipgm) from any of the three test wells (TW-1, TW-2 and TW-3) did not produce a significant degree of interference in the monitoring wells. Some drawdown was recorded in each monitoring well during the pumping tests, however it was generally less than 0.05 m."

Based on the test data, the *near-well* transmissivity was estimated to be 29.8 m^2/day. A compilation of transmissivity estimates obtained from observation well data for all the tested wells within the Cameron Subdivision property were also provided to be in the range of 80 m^2/day, relatively consistent with the results obtained from subject site outlined above. Cambium (2015) also indicated:

"The calculated transmissivity and hydraulic conductivity for in each of the pumping wells are both consistent with a sand aquifer."

The well record and hydrographs representing the 2015 pumping test are presented in Appendix I. The test results are believed to be representative of the DOBA and are expected to be representative of the subject site.

4.5.7 Discussion

Based on the above pumping test data, it is clear that future well construction within the proposed subdivision should target the DOBA identified by the test well evaluation program. The average transmissivity of the aquifer is expected to be on the order of 60 m^2/day, with a corresponding storativity coefficient of approximately 1.5×10^{-4} (unitless). As described by Krasny (1993), aquifers with transmissivities over 10 m^2/day

as being "intermediate", meaning that they are typically suitable for supplying a small community water systems.

It's also important to recognize that the magnitude of the observed drawdown in the pumped wells is primarily related to well inefficiency, with the aquifer exhibiting minimal response in nearby observation wells.

Based on the above, all of the tested wells meet the minimum D-5-5 yield criteria. Given the remarkably consistent data, it is our opinion that the test wells are representative of the conditions that should be expected for future lots in the development.

4.6 Impact Review

4.6.1 Projected Mutual Well Interference

The pumping test data provided above suggests that water takings within the proposed subdivision would likely result in barely discernable drawdown interference effects in nearby wells constructed in the same aquifer. Similarly, the test data suggests there should be no interference with neighbouring wells constructed in the shallow aquifer.

However, in an attempt to quantify the expected interference from the development of five (5) residential lots on the property, a classic (multiple well) Theis analytical model for confined conditions was utilized based on the average transmissivity and storativity values provided above (60 m^2/day and 1.5 x 10^{-4}, respectively). Figure 11 illustrates the results of the simulation utilizing a "hydro" module of the program Rockworks, which calculates the analytical solution.

For this purpose, the model assumes an average water taking rate of 1,000 L/day[6], projected over a 20 year period, with a total of 5 drilled wells operating simultaneously, based on the maximum expected development density. The model does not include infiltration/recharge or aquitard leakage, thus is considered highly conservative.

As illustrated on Figure 11, the modelling predicted a maximum drawdown of approximately 0.13 m immediately surrounding the development, with lesser amounts extending outward. Based on the typical *available drawdown* in local drilled wells (e.g., 20 m), the projected interference (i.e., <1% of the typical available drawdown) is not expected to be discernable to the typical well owner.

[6] Note: 1,000 L/day is assumed average rate as per D-5-4 impact assessment.

4.6.2 Seasonal Water Level Fluctuations

As illustrated by monitoring data hydrograph in Appendix H, water levels monitored between January 29, 2024 and February 8, 2024 remained fairly consistent throughout the monitoring period. Although private wells exhibit typical drawdown responses with use, the water levels appear to reach the pre-pumping (i.e., static) water level shortly after the pump is shut off. There is no evidence of aquifer mining (i.e., a persistent lowering of water levels) in the compiled data.

Despite the data encapsulating a period of unseasonable daytime high temperatures above zero degrees Celsius (according to Environment Canada - Peterborough A data), there does not appear to be any significant fluctuations in water levels of the test wells (TW-1, TW-2 and TW-3). In contrast, the dug well (W-3) monitored over this period exhibited a slight increase in water level between February 2nd and February 4th. It is unclear whether this is a result of local recharge from the unseasonably warm daytime temperatures or simply represents a period where water use within the dug wells in the community was lower.

Based on the monitoring hydrograph and compiled water level data spanning 2018 to 2024, ORE is of the opinion that seasonal fluctuations in water levels within the DOBA are not likely to have an effect on the availability of groundwater for domestic (residential) uses. In contrast, it is understood from anecdotal information provided by neighbouring well owners, that dug wells which utilize the shallow aquifer can exhibit a wide variation of seasonal water level changes and have been known to almost run dry during drought conditions.

4.7 Water Quality

4.7.1 General

The test well evaluations described above included sampling and analyses in accordance with the parameters required by Procedure D-5-5. A time-series of groundwater samples were collected from the test wells to assist in evaluating water quality stability.

Samples from TW-2 and TW-3 were forwarded to Caduceon Environmental Laboratories in Ottawa/Kingston for chemical and bacteria analysis. In addition, field water quality measurements for pH, conductivity, temperature, total dissolved solids (TDS), turbidity and dissolved oxygen (DO) were taken periodically throughout the pumping tests. The available field water quality data are presented in Appendix J. The laboratory certificates and a summary of the data with comparison to the Ontario Drinking Water Quality Standards (ODWQS) are presented in Appendix K. In addition, water quality data provided by Cambium in 2015 for MECP Well No. 7236970 have also been included for comparison purposes.

Overall, the water quality data are similar from well to well, indicating reasonably good conditions occurring within the expected range of values. A brief summary is presented below.

4.7.2 Findings and Discussion

As the water quality data are fairly consistent among the sampled wells, the general water quality findings of the study are discussed here (for ease of review), rather than presenting a separate discussion for each well.

The laboratory data indicate that groundwater from the sampled wells generally exhibit slightly elevated hardness concentrations, at 207 mg/L in TW-2, 248 mg/L at TW-3 and 200 mg/L at MECP Well No. 7236970, all occurring above the Ontario Drinking Water Quality Standards (ODWQS) ideal range of 80 mg/L to 100 mg/L. Hardness is an aesthetic parameter and does not pose any threat to human health. However, at elevated concentrations, hardness could cause staining of fixtures. If the individual well owner choses to implement treatment for hardness, it is expected that the concentration of hardness found at the site will be readily treatable utilizing a commercially available water softener. However, treatment to reduce hardness is not mandatory.

Nitrate and nitrite occur below the laboratory's method detection limit in almost all the samples, indicating pristine conditions in that regard. The only exception occurred at the end of the pumping test of TW-3 in 2020. This result is anomalous and the condition was not observed to return in the sample collected during the 2024 pumping test. The absence of nitrate is also consistent with anaerobic conditions in the aquifer.

Similarly, the dissolved organic carbon (DOC) concentration in all wells was observed to be well below the ODWQS objective of 5 mg/L, ranging from 1.3 mg/L at TW-3 to 1.7 mg/L at TW-2.

Samples for bacteriological analyses were also collected during the pumping tests. Prior to sampling, an in-field test was conducted to verify the absence of residual chlorine. The laboratory results indicate zero Total Coliform and E. Coli counts for all of the test wells. However, Total Coliform was present in the initial sample from 2020 and the sample collected in 2024. It was expected that the elevated Total Coliform are a result of incomplete disinfection of the pumping equipment. As a result, the well was chlorinated and re-sampled for bacteriological parameters prior to the pumping equipment being removed from the well. The samples were collected once two (2) successive free chlorine strips indicated no detection of free chlorine, which occurred after a discharge period of approximately 1-hour. The subsequent analytical results indicated no discernable Total Coliform or E.Coli. Background bacteria counts were noted in most samples, which could be a result of nuisance bacteria, such as iron-related bacteria.

Chloride concentrations in all the wells were found to be low, ranging from 1.4 mg/L to 3.0 mg/L, well below the ODWQS objective of 250 mg/L. Despite the proximity of the site to a major road network, there is no indication of water quality deterioration from potential road salt contamination. Similarly, sodium occurs below the warning limit of 20 mg/L for persons on sodium-restricted diets[7], ranging from 3.6 mg/L to 6.8 mg/L.

Dissolved and total iron concentrations are relatively consistent throughout the dataset. While the data include some low or "non-detect" *dissolved* values, the *total* concentrations indicate that iron concentrations exceed the water quality objective of 0.3 mg/L, suggesting the presence of iron precipitates. The difference between the dissolved and total iron appears to have influenced the laboratory's reported turbidity values. While TW-2 and TW-3 were found to have field turbidity values below 1 NTU prior to the cessation of pumping, the reported laboratory turbidity was 6.4 NTU and 12 NTU respectively. This is not unexpected, as the iron concentrations in each of these wells are approaching 3x the ODWQS objective.

In contrast to the iron concentration, the dissolved and total manganese appears to be relatively stable in all wells, occurring well below the ODWQS objective.

As the bacteriological testing revealed that it is possible to obtain zero Total Coliform and E. Coli counts for each of the wells, this appears to satisfy the *health-related* criteria of D-5-5. As a precaution, future well owners should make use of a pre-filter that can remove iron precipitates and minor amounts of formation sediments if they choose to employ a UV system in order to ensure proper disinfection.

It is also recommended that future well owners submit two (2) samples per year (i.e., one in the spring and one in the fall) to the local Health Unit for bacteriological analysis as a check on the condition of their well.

Samples were checked in the field for the visible presence of bubbles and odours that could indicate the presence of dissolved gases (i.e., methane and hydrogen sulphide). None of the samples exhibited characteristics that would suggest the presence of dissolved gases. A sample collected from TW-3 was analysed for the presence of sulphide and was found to be below the laboratory's method detection limit.

The in-field water quality data collected from TW-3 (Appendix J) illustrate relatively stable water quality conditions during the 2024 pumping test. An exception to this trend occurs during the initial portion of the tests (as water storage is removed) and during periods where the instrumentation was removed to facilitate sample/rate checks. Unfortunately, the field Oxidation Reduction Potential (ORP) was not functioning at

[7] It is generally recommended that the local Medical Officer of Health 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 time of the test and provided erroneous results.

As presented, the field Total Dissolved Solids (calculated from the Conductivity) remained relatively stable, at just below 200 mg/L, following the initial portion of the TW-3 test. In contrast, the pH was observed to rise after the initial 120 minutes of the test. A corresponding slight decrease in temperature during the test could suggest that colder recharge (during winter conditions) was occurring, which is consistent with the leaky confined aquifer interpretation from the pumping test data. As the flow-through device used for the water quality instrument was not completely sealed, the Relative Dissolved Oxygen (RDO) concentration fluctuated throughout the test but remained relatively low throughout, as would be expected from the expected anoxic aquifer conditions.

Based on the compiled data, it is our opinion that the target aquifer can supply acceptable quality groundwater, generally complying with the water quality requirements of MECP Procedure D-5-5. Treatment for hardness and iron will likely be desirable.

5.0 Nitrate Impact Assessment

5.1 General

The principal potential impact of the proposed development on groundwater resources is related to the introduction of septic effluent into the shallow flow zone from the proposed individual tile bed systems.

Within the effluent, nitrate is considered the critical contaminant as elevated nitrate concentrations are linked to infant methaemoglobinaemia (nitrate poisoning). To protect groundwater resources, the MECP's Procedure D-5-4 sets the maximum allowable nitrate concentration at the site boundary to be 10 mg/L (also the Ontario Drinking Water Standard). The nitrate impact assessment is therefore conducted to verify that this limit is not exceeded.

Naturally occurring bacteria and soil interaction mechanisms can, and usually do, result in nitrate being renovated. However, Procedure D-5-4 acknowledges ***dilution*** as the principal attenuation mechanism[8] to be used to predict future nitrate concentrations resulting from subdivision development.

[8] Procedure D-5-4 also acknowledges monitoring-based assessments and other specialized assessment forms, primarily for use in areas where there is scientific precedent.

5.2 Background Nitrate Concentration

To assess the potential impacts from sewage systems within the proposed subdivision, it is important to establish the baseline nitrate concentration of the shallow groundwater on the site. As a result, groundwater samples have been collected from the on-site test pit standpipes since 2017. Initial results in November 2017 revealed an elevated background nitrate concentration, with an average concentration of 18.6 mg/L. A subsequent round of samples collected in May 2018 revealed a higher average concentration of 27.32 mg/L. It was anticipated that regular nutrient applications to the field containing the standpipes and lands immediately upgradient were likely contributing the high nitrate concentrations encountered in the test pit standpipes.

Since 2018, it is understood that the field that contains the test pit stanpipes has not been subjected to crop production/nutrient applications. As a result, there has been a noticeable decline in nitrate concentrations in samples collected in 2020 and 2022, as illustrated in Appendix L, with the lowest average concentration occurring in 2022, at 7 mg/L. While the trend was expected to continue in 2023, samples obtained from the test pit standpipes revealed a slight increase in the average nitrate concentration (i.e., to 8 mg/L). It is understood that crop production had advanced towards the field that contains the test pit standpipes during the 2023 growing season, which likely contributed to the deviation in the general decline in nitrate concentrations.

Regardless, it is expected that the proposed subdivision development would preclude crop production in this area moving forward, so it would be expected that the nitrate concentrations would continue to decline over time. A sample collected from a neighbouring dug well (W-3) suggests the natural background nitrate concentration may be closer to 1 mg/L, as this well exhibited a concentration of 0.91 mg/L directly south of the site. Similarly, the average nitrate concentrations for dug wells in the study area as presented by Cambium in their 2015 report was found to be approximately 1.1 mg/L. As a result, it is anticipated that the nitrate concentration of the shallow aquifer below the subject site would decline to approximately 1 mg/L if the agricultural inputs were removed entirely. As a result, a conservative nitrate concentration limit at the property boundary of 10 mg/L - 1 mg/L = **9 mg/L** should be utilized for the nitrate impact assessment.

In contrast, water quality analyses of the supply aquifer reveal pristine conditions, with all samples exhibiting nitrate concentrations at or below the laboratory's method detection limit (i.e., 0.1 mg/L).

5.3 Available Dilution and Water Balance

In order to estimate the availability of sustained dilution from direct recharge, the following calculation has been considered:

$$D_w = A \times W_s \times I_f$$

where,

D_w= Available dilution water — A = Net dilution area
W_s= Water surplus — I_f = Infiltration factor[9]

For this assessment, the average regional water surplus has been determined from the 1981 to 2010 climate normals at the nearest meteorological station in Peterborough (Appendix M). The average precipitation rate for Peterborough is 855.3 mm/year. From the climate normal data, the Thornwaite adjusted potential evapotranspiration rate is 566 mm/yr, yielding a theoretical Water Surplus (W_s) of 289.3 mm/yr.

As outlined above, although regional topography consists of drumlins with significant relief, the subject site contains a much more subdued gentle slope and is generally considered relatively flat lying. The site is mostly comprised of open field habitat and contains a till substrate. As a result, the following infiltration factor has been determined:

Soil factor	=	0.20 (sandy silt till)
Slope factor	=	0.25 (relatively flat terrain)
Cover factor	=	0.15 (mostly open field)
Total	=	0.60

Substituting the various factors into the above expression, yields the following total dilution availabilities for the (1.43 ha) site area:

1.43 ha X 289.3 mm/yr X 0.60 = 2,482 m^3/yr (6.8 m^3/day)

However, to account for the proposed development, 5% of the available area is assumed to contain impermeable surfaces. As a result, the available dilution (i.e., infiltration) is expected to be on the order of 6.46 m^3/day. A summary of the water balance using the above methodology is presented in Table 2 below:

[9] Infiltration factor calculation method: From MOEE Hydrogeological Technical Information Requirements for Land Development Applications, April 1995

Table 2: Water Balance	
Average Precipitation	855.3 mm/year
Evapotranspiration	566 mm/year
Water Surplus	289.3 mm/year
Infiltration Rate	173.6 mm/year
Assumed Runoff Rate	115.7 mm/year

It is important to recognize that the above methodology was intended to assess the available dilution for conventional septic systems and was not intended for stormwater management design. The above methodology also does not consider Low Impact Development (LID) stormwater management practices, which would attempt to infiltrate any runoff generated by the development. Should infiltration LID be utilized for the proposed development, it is expected that the additional available dilution will further mitigate any nitrate plumes generated by the septic systems.

5.4 Development Area Impact Assessment

5.4.1 Conventional System Assessment

Lot density is determined through a simple mass-balance calculation which considers the following factors:

- available dilution (6.46 m^3/day, see above)
- total volume of septic effluent (1,000 L/day)
- baseline nitrate levels in the supply aquifer (assumed to be 0.1 g/day[10])
- nitrate input from septic systems (40 g/day)

To determine the total number of supportable lots, an evaluation of the site has been conducted:

$$[Nitrate] = \frac{(septic\ input + supply\ aquifer\ input) \bullet No.\ of\ Lots}{available\ dilution + volume\ of\ septic\ effluent}$$

$$[Nitrate] = \frac{(40\ g/day + 0.1\ g/day)\ X\ 5)}{6.46\ m^3/day + (1\ m^3/day\ X\ 5\ lots)}$$

$$= \boldsymbol{17.5\ mg/L}$$

[10] Based on the laboratory Method Detection Limit (MDL)

Based on the above conservative analysis, *a total of 5 lots with conventional sewage disposal systems would not be supported* by the current proposed lot configuration. As it is understood that there is a desire to maintain lot dimensions similar to the surrounding severed lots, it is anticipated that tertiary treatment and/or enhanced infiltration (i.e., through Low Impact Development stormwater management) would be required to reduce the nitrate concentration in the septic effluent generated by the proposed subdivision.

5.4.2 Tertiary Treatment System Assessment

Procedure D-5-4 recognizes that proprietary sewage treatment systems may offer denitrification and as such, the guideline does not necessarily apply when such systems are in use., as per Section 3.0:

> *This guideline may not apply to non-standard individual on-site systems which are specifically designed to reduce nitrate loadings. It should be emphasised that MOEE encourages the development of new technologies for the treatment of domestic sewage waste. The Ministry will entertain proposals for development which incorporate new technologies.*

Clearly, the intent of the guideline is to encourage the use of such systems. Some systems have well documented effluent quality which can meet the 10 mg/L criterion, essentially at the bed, thereby complying with the impact assessment requirements of D-5-4.

The acceptance of tertiary treatment has also been reflected in changes to the Ontario Building Code in 2017, which now provides certification (CAN/BNQ 3680-600) for tertiary treatment systems that are proven to meet effluent quality requirements for Suspended Solids and Carbonaceous Biological Oxygen Demand (CBOD) concentrations.

An example manufacturer that provides certified tertiary treatment systems is Waterloo Biofilter, which also provides products for their systems that are proven effective at reducing the total nitrogen loading to a disposal bed. These systems use a conventional septic tank in combination with a treatment tank that comprises a media that hosts bacteria that naturally breaks down the nutrients, including Total Nitrogen, within the septic effluent. While Waterloo Biofilter's most advanced systems (i.e., WaterNOx) have been proven to remove 90% to 95% of the Total Nitrogen, typical removal rates are 25% to 35% with single pass standard Biofilter units and 50% to 60% with double-pass (i.e., recirculation) systems.

In addition to the above, there is president within the Township of Cavan Monaghan, where an Ontario Municipal Board (OMB) appeal (Case No. PL070662) provided an opportunity for our firm to examine the performance of the residential Waterloo

Biofilter systems as part of a Plan of Subdivision development within the Township. Subsequent monitoring of effluent and groundwater quality revealed that the Waterloo Biofilter system was consistently able to achieve an effluent quality limit of less than 24 mg/L of nitrate (as nitrogen). Concurrence with respect to the efficacy and suitability of these systems was provided by the Township and their peer review consultant in 2021.

Examination of the data collected from the monitoring program suggests that the performance of the Waterloo Biofilter system exceeded expectations, with each of the monitored systems achieving an average nitrate concentration below 20 mg/L in the effluent being directed to the disposal bed. As a result, the pilot program demonstrated that 50% reduction was achievable.

In addition, a 2019 Local Planning Appeal Tribunal (LPAT) Decision (Case PL170858) supported the utilization of denitrification treatment for a development in the Hamilton area, for the same purpose.

As a result, provided Waterloo Biofilter (or similar tertiary treatment units that offer similar total nitrogen reduction) are utilized, the above impact assessment calculation can be modified as follows:

$$[Nitrate] = \frac{(\text{tertiary system input} + \text{supply aquifer input}) \bullet \text{No. of Lots}}{\text{available dilution} + \text{volume of septic effluent}}$$

$$[Nitrate] = \frac{(20\ g/day + 0.1\ g/day)\ X\ 5)}{6.46\ m^3/day + (1\ m^3/day\ X\ 5\ lots)}$$

$$= \boldsymbol{8.8\ mg/L}$$

Based on the above analysis, *a total of 5 lots that incorporate properly maintained tertiary treatment systems prior to effluent disposal would be supported* by the current proposed lot configuration, provided background nitrate concentrations decline to expected levels.

5.4.3 Enhanced Infiltration (Mitigation)

Utilizing the concepts presented in the Low Impact Development (LID) Stormwater Management Planning and Design Guide (2010), it could be feasible to enhance the natural attenuation (i.e., dilution) of septic effluent by promoting the infiltration of stormwater runoff. For example, to promote infiltrating runoff from the adjacent fields to the northwest, an infiltration trench could be constructed along the northern lot boundaries. Similarly, runoff from driveways could be directed to rain gardens and roof leaders could drain to dry wells/infiltration trenches.

Utilizing the conventional sewage system calculation included in Section 5.4.1 above, the total amount of additional infiltration water needed to satisfy the expected nitrate limit at the property boundary (i.e., 9 mg/L) is 17.3 m^3/day - 6.46 m^3/day = 10.84 m^3/day (3,957 m^3/yr).

As the infiltration rate (based on the estimated hydraulic conductivity of the till) is expected to be on the order of 12 mm/hr to 30 mm/hr, the above additional infiltration would only be possible if runoff from upgradient neighbouring lands were captured and/or the proposed lot areas were to expanded. As a result, it is expected that tertiary treatment would still be required and that any infiltration of stormwater would simply act to further enhance shallow groundwater quality below the site.

6.0 Servicing Considerations

6.1 Private Wells

The results of this study support the construction and sustainable use of private, individual wells to supply potable water for each of the proposed subdivision lots.

Figure 12 illustrates the proposed/recommended locations for future private wells within the development area based on the grading plan provided by M.J. Davenport & Associates. These locations are based on accommodating minimum separation distances and the juxtaposition of proposed building envelopes and proposed septic systems. Figure 12 also incorporates various setbacks and constraints arising from the accompanying ecological study.

Construction of a drilled well will be required for each proposed lot (that does not already have an acceptable well).

Although the target aquifer (i.e., DOBA) conditions on the subject site appear to be relatively stable in terms of the availability and quality of groundwater, it is our opinion that future well construction on the subject property should only utilize this aquifer. To ensure proper well construction and to provide assurances to the well owners in and around the development, we are recommending that a *Well Certification Program* be implemented at this site.

The program will require that prior to issuance of a Building Permit for any lot, a well shall be constructed under the supervision of, and tested by, a Qualified Person (P. Geo. or P. Eng.). Upon completion of the well and subsequent pumping test, the Qualified Person will certify in writing that the drilled well has been constructed, meeting the minimum construction, water demand and water quality requirements as set forth in Appendix N. The well "certification report" shall be submitted to the Municipality prior to the lot being released for sale. This type of program is commonly implemented for

privately serviced rural developments in Ontario.

6.2 Sewage Disposal

In order to satisfy Procedure D-5-4, it is anticipated that the proposed development will need to be serviced by tertiary treatment systems such as those offered by Waterloo Biofilter, that can achieve a minimum 50% reduction in Total Nitrogen.

In addition to obtaining data regarding the shallow aquifer, the soils information obtained during the test pitting and test well drilling is also valuable for determining the size of tile bed system most appropriate for the site (e.g., fully raised, partially raised, or in-ground). It is anticipated that the development will comprise of fully raised configurations based on the native soil conditions. Regardless, it is expected that individual septic system locations will require excavation of test pits as part of the Building Permit application process to verify the appropriate configuration. This will be important, especially if a lot has been subjected to grading or filling, resulting in different soil conditions from the current conditions.

As a conservative measure, Figure 12 illustrates the recommended locations for sewage disposal bed areas based the grading plan provided by M.J. Davenport & Associates and would accommodate a fully-raised configuration. It is important to recognize that the intent of Figure 12 is to demonstrate that there is a viable location for the on-site services for each lot, based on a worst-case scenario. The actual servicing arrangement may vary to suit lot-specific conditions, under the direction of a qualified professional.

6.3 Stormwater Management

Low impact development (LID) design criteria has been briefly discussed above. A complete assessment of the feasibility of LID stormwater management features has not been included in this report. However, supporting information with regards to the anticipated infiltration rate of the native soils (i.e., 12 mm/year to 30 mm/year) and the shallow water table information attained from the test pit standpipes should provide a starting point for any discussions regarding the feasibility of these systems.

For instance, as infiltration-based BMPs are generally required to remain 1.0 m above the “water table”, the presence of shallow groundwater at an average depth of 1.1 m may become a significant constraint for LID design.

Regardless, it is recommended that infiltrating runoff from adjacent (i.e., upgradient) properties be considered to provide additional dilution to assist in the attenuation of septic effluent from the proposed development.

7.0 Conclusions and Recommendations

7.1 This Hydrogeological and Site Servicing Study has been prepared in support of a proposed five (5) lot residential development within the hamlet of Ida, Ontario. Our report presents a summary of the explorations and testing completed at the site, including a summary of the site conditions and assessments, with respect to the applicable MECP Procedures, conducted to verify the sustainability of privately serviced lots on the site.

It is recommended that prospective purchasers be provided with a copy of this report so that they can be made aware of the local conditions and the various servicing recommendations.

7.2 The subject property is currently vacant, with relatively flat topography and silty soils. The site is mostly comprised of a former crop field, with seasonal west-to-east drainage through a trough-like depression north of the proposed subdivision. The drainage feature has been addressed by an Environmental Impact Study (EIS) prepared by our firm under separate cover.

7.3 A series of ten (10) test pits were excavated on the site and neighbouring property to examine the shallow soils. The shallow soils consist of a sandy silt till with gravel, cobbles and boulders, consistent with Newmarket Till that comprises local drumlins. Marich (2016) published the results of grain size distribution testing conducted on 82 samples of Newmarket Till from the region, revealing that the till matrix averages 55% sand, 38% silt and 7% clay. These are consistent with our own tests conducted throughout the region. As a result, the expected hydraulic conductivity of the shallow soils is expected to be on the order of 9.0×10^{-5} cm/s, corresponding to a percolation rate between 20 min/cm and 50 min/cm and an infiltration rate between 12 mm/hr and 30 mm/hr.

7.4 Standpipes installed prior to backfilling select test pits revealed an elevated water table, typically within approximately 1 m of the ground surface. The average hydraulic gradient is expected to be 0.03 m/m, yielding an approximate horizontal groundwater flow velocity of 3.3 m/year.

7.5 Three (3) test wells have been constructed on the property in accordance with the requirements of Ontario Regulation 903, as amended and two (2) of those wells were subsequently tested in accordance to MECP Procedure D-5-5. All wells were completed in the deep overburden/basal aquifer, exceeding the minimum yield requirements to support a 4-bedroom dwelling. The test data and data obtained from the nearby

Cameron Subdivision development clearly confirm the presence of continuous aquifer conditions below the study area that can clearly support the proposed development without causing any impacts to surrounding wells.

7.6 In all instances, water supplies should be obtained through construction of drilled wells meeting the requirements of Ontario Regulation 903 (as amended) for each lot. The test wells are suitable for future use as supply wells for their respective lots. Dug wells are *not* appropriate nor will be acceptable for this site.

7.7 The test well data indicate that future drilled wells will produce acceptable quality water from the target aquifers. Water quality analyses indicate that slightly hard water will likely be encountered. In addition, elevated iron concentrations are expected to occur at levels capable of producing visible precipitates. Conventional water treatment systems (e.g., water softener, air injection/filtration) should be capable of ameliorating these parameters.

Given the nature of the aquifer materials and the presence of readily precipitating iron, turbidity in excess of 1 NTU is possible. Provided all new wells are properly developed following construction, it is expected that the formation-related turbidity will remain below 1 NTU.

As a precaution, it is recommended that UV disinfection be utilized by future well owners. To ensure proper disinfection, a filtration system should be utilized prior to the UV system to remove any particulate matter (including precipitates).

Since each new well is likely to be somewhat different, the owner should consult with a water treatment expert to determine the best approach for their individual needs. The need for water treatment is ultimately a personal choice to be made by the homeowner. Treatment is not mandatory.

7.8 Although the target aquifer conditions on the subject site appear to be relatively consistent in terms of the availability and quality of groundwater, it will be imperative that future well construction on the subject property only utilize this aquifer. To ensure proper well construction and to provide assurances to the well owners in and around the development, we are recommending that a *Well Certification Program* be implemented at this site. The program will require that prior to issuance of a Building Permit for any lot, a well shall be constructed under the supervision of, and tested by, a Qualified Person (P. Geo. or P. Eng.).

Upon completion of the testing, the Qualified Person will prepare and submit a well certification report to the Township of Cavan Monaghan, certifying in writing that the drilled well has been constructed, meeting the minimum construction, water demand

and water quality requirements as set forth in Appendix N.

As a general guide, unless the Qualified Person recommends otherwise, new drilled wells should be constructed at the locations illustrated on the accompanying conceptual lot servicing plan, Figure 12. As a conservative measure, the conceptual lot servicing plan illustrates that each of the lots has ample area to support the construction of a residence, a drilled well and a fully-raised sewage disposal (area bed) system in excess of the anticipated sewage flow of 3,000 L/day.

Although TW-3, which was constructed as part of this study, has been subjected to pumping tests and water quality analysis, it will be necessary to have this well "re-certified" as part of the well certification program to ensure the well has remained in good condition and to ensure proper well development before being put into use.

7.9 Interference effects among or between future subdivision wells and existing nearby wells are expected to be minimal and manageable, given the low density of the development and the prevailing aquifer conditions. A conservative mutual interference assessment has been conducted, also revealing manageable conditions, based on a worst-case scenario model.

7.10 In the event that TW-3 or any other well constructed for the development that is not used for production purposes, it must be properly abandoned in accordance with the requirements of Ont. Reg. 903 (as amended).

7.11 The feasibility of open loop heat pump use at this site has not been assessed and is not recommended. Any such heat pump installations should only be considered if a hydrogeologist has determined that such systems can be utilized without compromising groundwater availability and quality. Closed loop systems may be useful at this site. However any such determination must be made on a lot-by-lot basis by a Qualified Person.

7.12 A nitrate impact assessment has been completed in accordance with MECP Procedure D-5-4, demonstrating that five (5) residential lots that employ denitrification treatment units are sustainable on the subject site without causing an impact to shallow groundwater resources in the area. Where feasible, it is recommended that infiltration-type Low Impact Development (LID) stormwater management facilities also be considered for the proposed development. The infiltration of additional recharge will further dilute the septic effluent, providing additional protections for shallow groundwater users.

7.13 Lots in the proposed development will be serviced for sewage treatment/disposal by tertiary treatment systems with individual area beds for effluent disposal. The design of each system should be assessed at the time of construction in accordance with the Ontario Building Code. Each homeowner will be required to enter into a maintenance agreement with the tertiary treatment system provider to ensure these systems function adequately and continue to provide the desired denitrification. Each prospective purchaser should be aware that these maintenance agreements mean that the system will have on-going maintenance costs.

Percolation rates and depth to groundwater may vary slightly across the site. Fully raised beds are likely going to be required for all lots. Each sewage system will require a permit from the Township of Cavan Monaghan and will be subjected to the appropriate design guidelines.

7.14 Recommended locations for future building envelopes, private drilled wells and tile bed systems are illustrated on Figure 12 of this report. Those recommendations are intended only to illustrate that the proposed services are viable on each lot. An individual assessment of any lot may suggest a different arrangement, at the discretion of the approval authority and/or Qualified Person. The example area bed systems are presented as fully raised systems to demonstrate that the worst-case scenario is viable. Smaller area bed systems may be possible based on an individual assessment at the time of application. The placements illustrated on Figure 12 include accommodation of recommended setbacks, including those recommended for sensitive environmental features.

* end of report *

Yours truly,
Oakridge Environmental Ltd.

Dan MacIntyre, B.Sc.
Project Manager - Hydrogeology and Geoscience

PROFESSIONAL GEOSCIENTIST
BRIAN R. KING
PRACTISING MEMBER
0396
ONTARIO

Brian R. King, P. Geo.
Principal

Selected References

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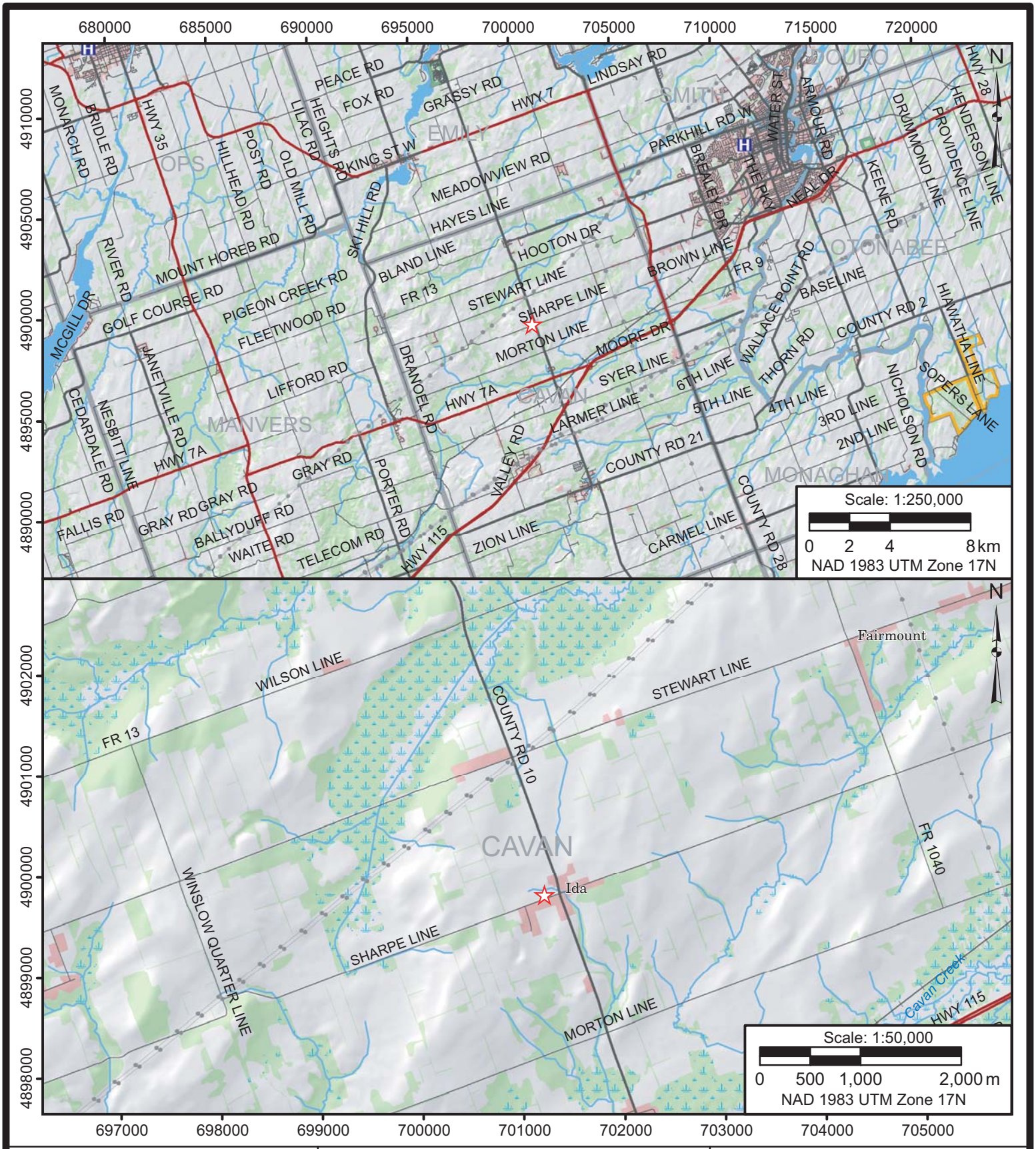
Figures



☆ Approximate Site Location

Notes: Base maps provided by Land Information Ontario and Natural Resources Canada (2023)

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Hydrogeological and Site Servicing Assessment
Proposed McCamus Residential Subdivision
1910 County Road 10, Hamlet of Ida
Part Lot 12, Concession 11 (Cavan)
Township of Cavan Monaghan, County of Peterborough

ORE Oakridge Environmental Ltd.
Environmental and Hydrogeological Services

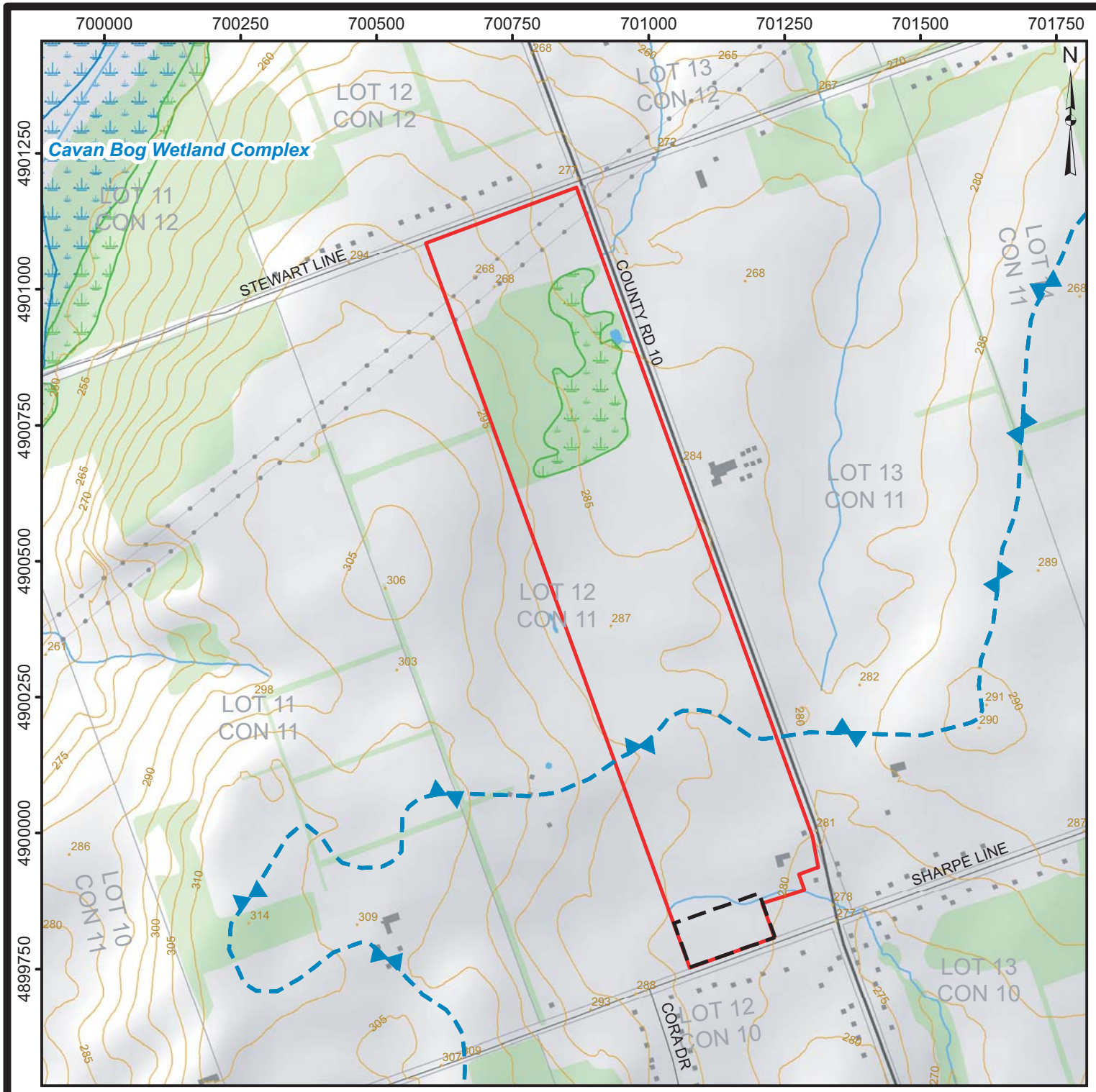
North American Datum (NAD) 1983

TITLE
General Location

PROJECT # 23-3349

DATE April 2024

FIGURE NO. **1**



NAD 1983 UTM Zone 17N

Hydrogeological and Site Servicing Assessment Proposed McCamus Residential Subdivision

1910 County Road 10, Hamlet of Ida
Part Lot 12, Concession 11 (Cavan)
Township of Cavan Monaghan,
County of Peterborough

- Subwatershed Divide
- Proposed Subdivision
- Approximate Property Boundary
- Wooded Area
- Waterbody
- Wetland (Unevaluated)
- Wetland (Provincially Significant)
- Watercourse
- Contour (5m Intervals)
- Spot Height (m asl)
- Building (symbol)
- Building (to scale)
- Transmission Line
- Road
- Geographic Lot Fabric

Scale: 1:10,000

0 100 200 400 m

Notes: Base maps provided by Land Information Ontario and Natural Resources Canada (2023)

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TITLE

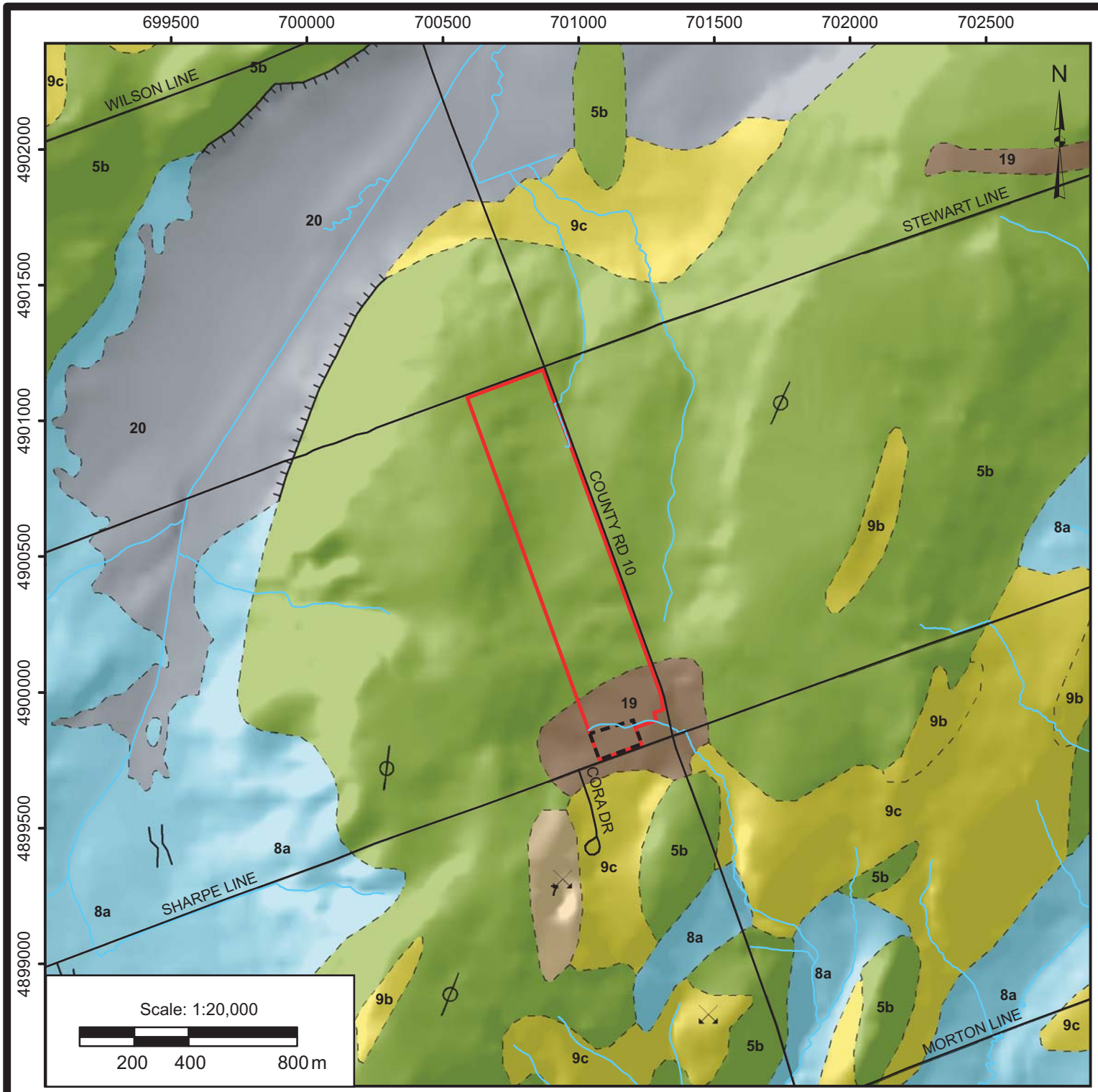
Topography and Drainage

ORE Oakridge Environmental Ltd.
Environmental and Hydrogeological Services

PROJECT #	FIGURE NO.
23-3349	2
DATE	
April 2024	

Hydrogeological and Site Servicing Assessment Proposed McCamus Residential Subdivision

1910 County Road 10, Hamlet of Ida
Part Lot 12, Concession 11 (Cavan)
Township of Cavan Monaghan,
County of Peterborough



NAD 1983 UTM Zone 17N

- Watercourse
- Proposed Subdivison
- Approximate Property Boundary
- Sand and Gravel Pit
- Drumlin or Drumlinoid Ridges
- Fluvial Terrace
- Contact (approximate/assumed)
- 5b — Glacial Deposits (Till): Stone-poor, carbonate-derived silty to sandy till
- 7 — Glaciofluvial deposits
- 8a — Fine-textured glaciolacustrine deposits: Massive-well laminated
- 9b — Coarse-textured glaciolacustrine deposits: Littoral-foreshore deposits
- 9c — Coarse-textured glaciolacustrine deposits: Foreshore-basinal deposits
- 19 — Modern alluvial deposits
- 20 — Organic deposits

Notes: Base plan provided by the Ontario Geological Survey (OGS), copyright the King's Printer (MRD-128REV, 2011).

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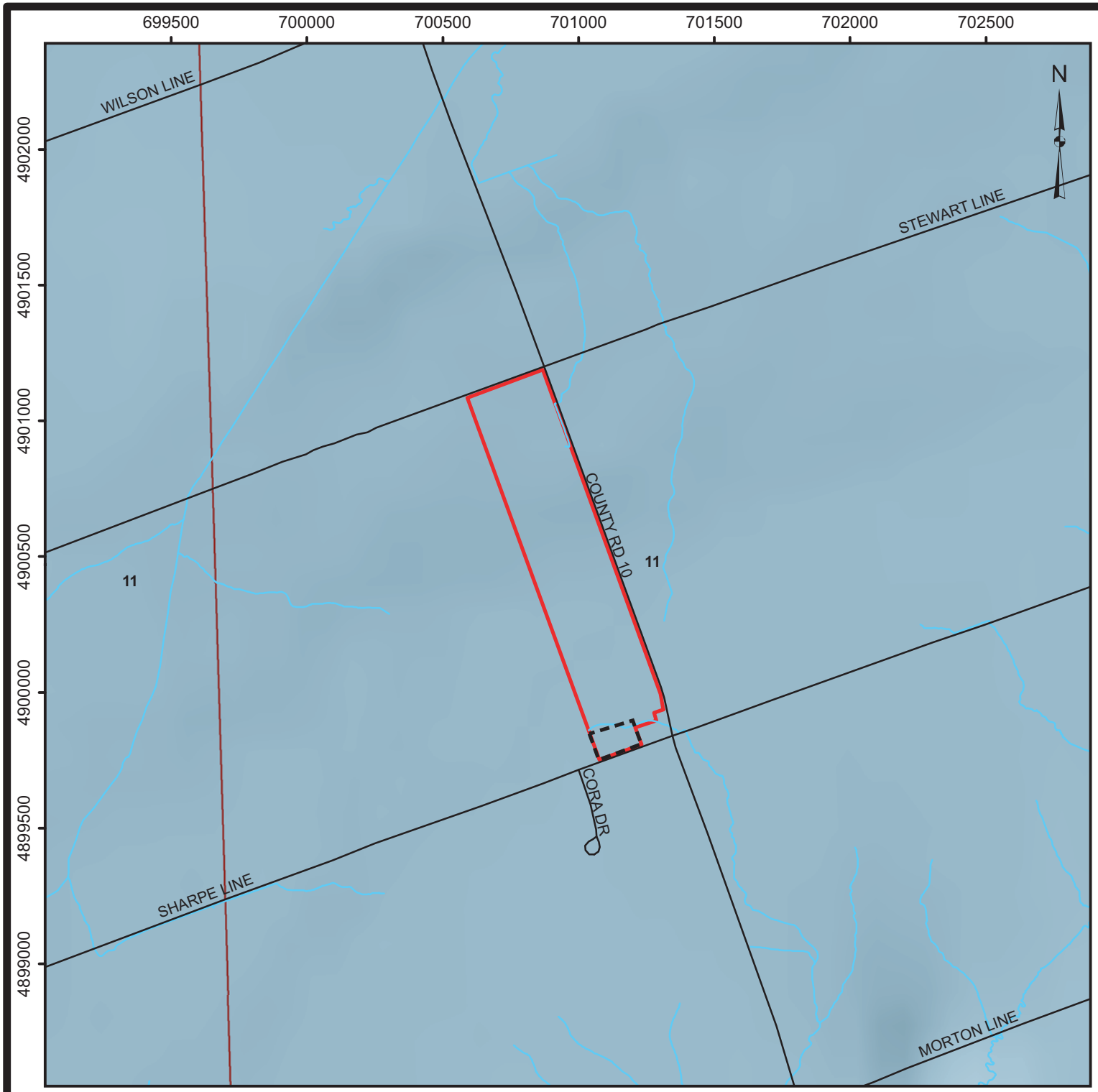
TITLE

Surficial Geology

ORE Oakridge Environmental Ltd.
Environmental and Hydrogeological Services

PROJECT #	FIGURE NO.
23-3349	3
DATE	
April 2024	



Hydrogeological and Site Servicing Assessment Proposed McCamus Residential Subdivision

1910 County Road 10, Hamlet of Ida
Part Lot 12, Concession 11 (Cavan)
Township of Cavan Monaghan,
County of Peterborough

- Watercourse
- Proposed Subdivison
- Approximate Property Boundary
- Roads
- 11 Lindsay Formation

Scale: 1:20,000

0 200 400 800 m

Notes: Base plan provided by the Ontario Geological Survey, copyright the King's Printer (MRD-219, 2007).

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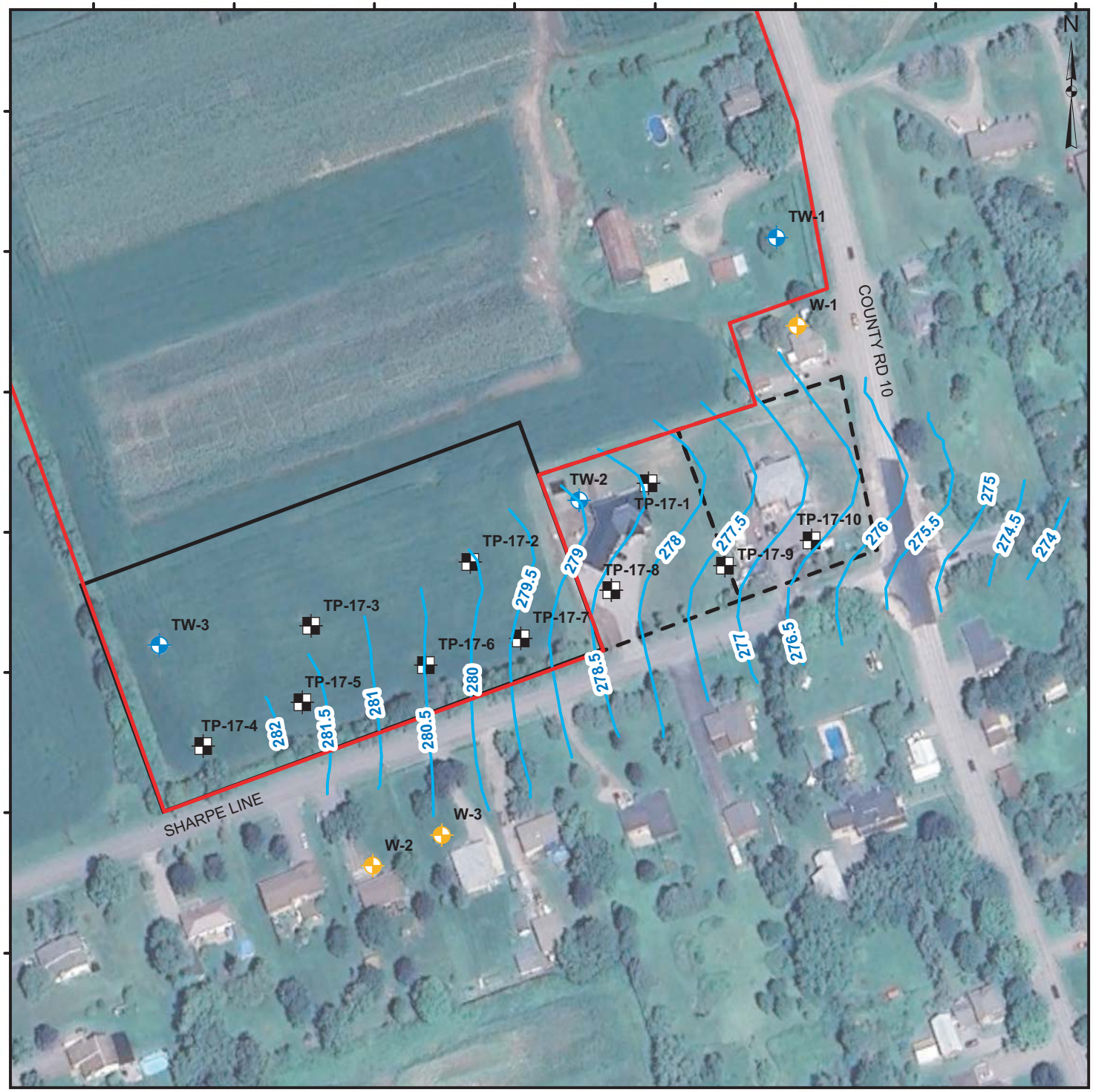
TITLE

Paleozoic Geology

ORE Oakridge Environmental Ltd.
Environmental and Hydrogeological Services

PROJECT #	FIGURE NO.
23-3349	4
DATE	
April 2024	



NAD 1983 UTM Zone 17N

Hydrogeological and Site Servicing Assessment Proposed McCamus Residential Subdivision

1910 County Road 10, Hamlet of Ida
Part Lot 12, Concession 11 (Cavan)
Township of Cavan Monaghan,
County of Peterborough

- Approximate Property Boundary
- Approximate Extent of Proposed Subdivision
- Approximate Location of Previously Severed Lands
- Shallow Water Table Contour (0.5 m interval)
- Drilled Well Location
- Dug Well Location
- Test Pit Location

Scale: 1:2,000

0 20 40 80 m

Elevations in m asl

Notes: Imagery provided by GoogleEarth (2023)

Feature locations determined by mapping-grade differential GPS (+/- 1.5 m)

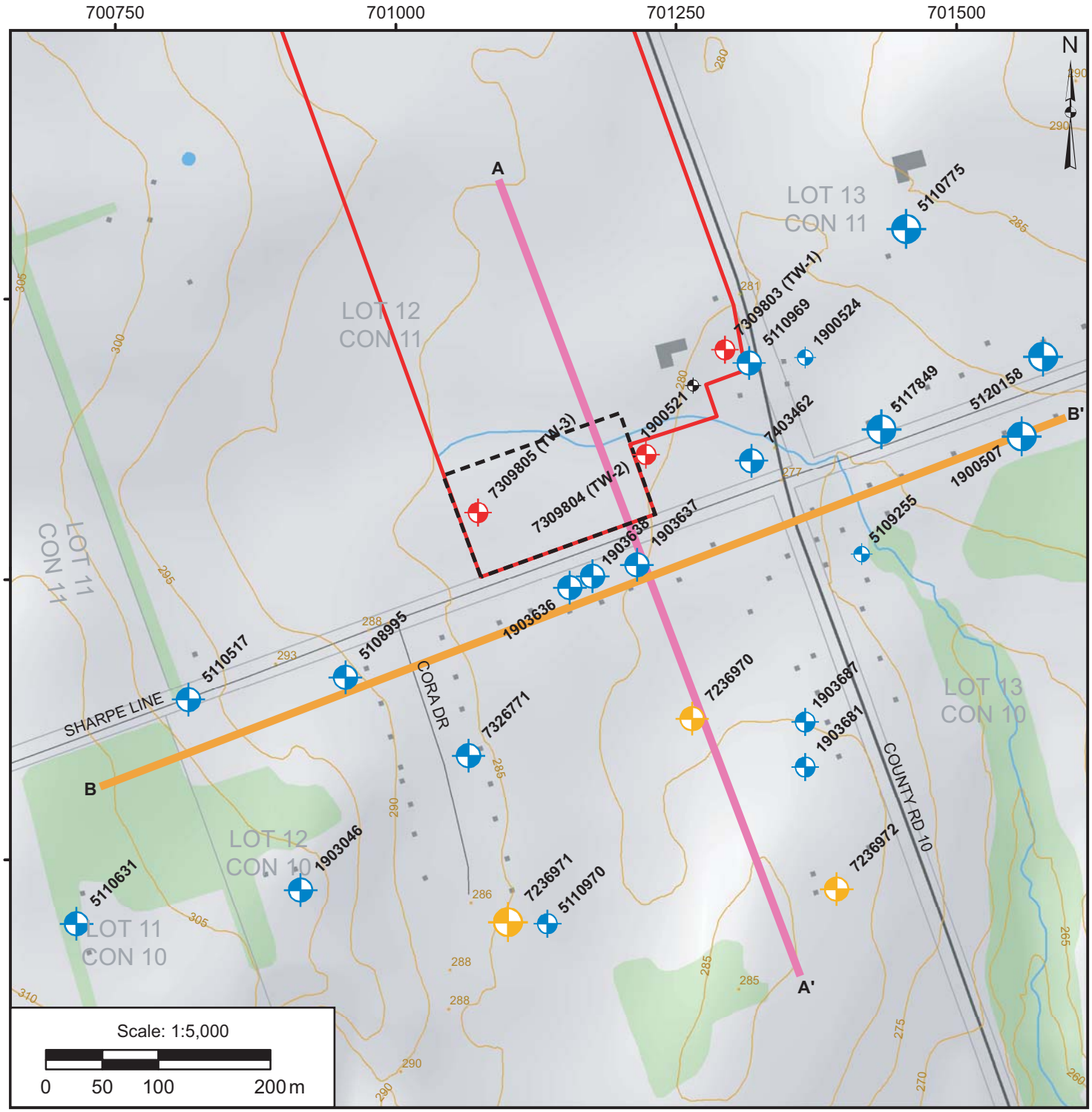
Water table contours generated by using a simple triangulation algorithm

TITLE

Physical Features

ORE Oakridge Environmental Ltd.
Environmental and Hydrogeological Services

PROJECT #	FIGURE NO.
23-3349	5
DATE	
April 2024	



Hydrogeological and Site Servicing Assessment Proposed McCamus Residential Subdivision

1910 County Road 10, Hamlet of Ida
Part Lot 12, Concession 11 (Cavan)
Township of Cavan Monaghan,
County of Peterborough

Proposed Subdivison

Approximate Property Boundary

Test Well

Well Use (Colour):

Abandoned / Unknown

Domestic / Livestock

Test Well

B to B' Line of Section
(Refer to Figure 8 for Projected Cross Section)

A to A' Line of Section
(Refer to Figure 9 for Projected Cross Section)

Driller's Test Rate (GPM):

0 GPM

> 10 GPM

Notes: Wells from the Water Well Information System, Ministry of the Environment, Conservation and Parks (MECP), 2021.

Base map after Land Information Ontario, 2023.

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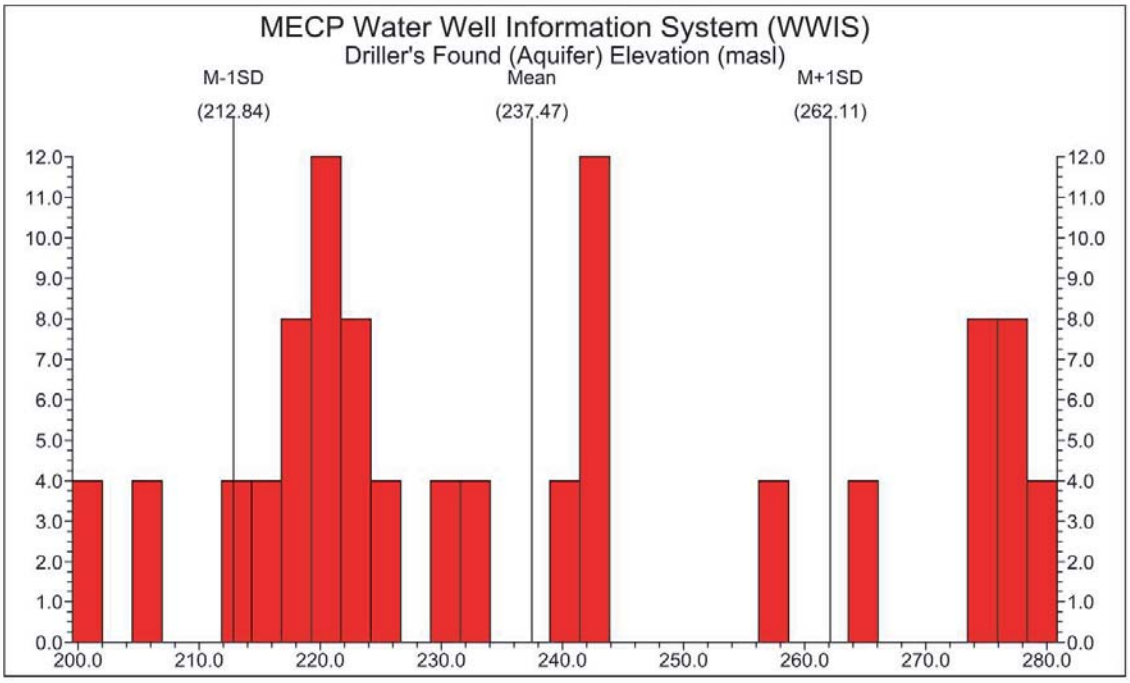
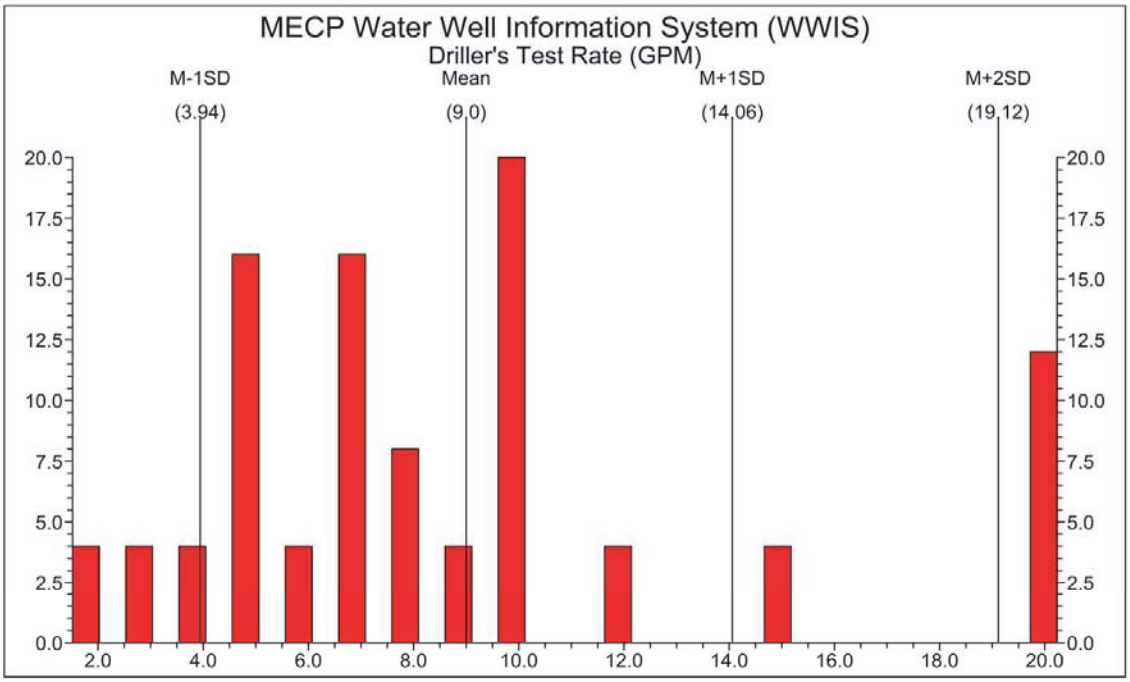
TITLE

MECP Well Locations

ORE Oakridge Environmental Ltd.
Environmental and Hydrogeological Services

PROJECT #	FIGURE NO.
23-3349	6
DATE	
April 2024	





Hydrogeological and Site Servicing Assessment
Proposed McCamus Residential Subdivision

1910 County Road 10, Hamlet of Ida
Part Lot 12, Concession 11 (Cavan)
Township of Cavan Monaghan, County of Peterborough

TITLE
Well Statistics

Notes: Well statistics interpretted from the Ministry of Environment, Conservation and Parks well record data, copyright the Queen's Printer, 2023.

Original figure to be viewed in colour on letter size (8.5" x 11") paper.

ORE Oakridge Environmental Ltd.
Environmental and Hydrogeological Services

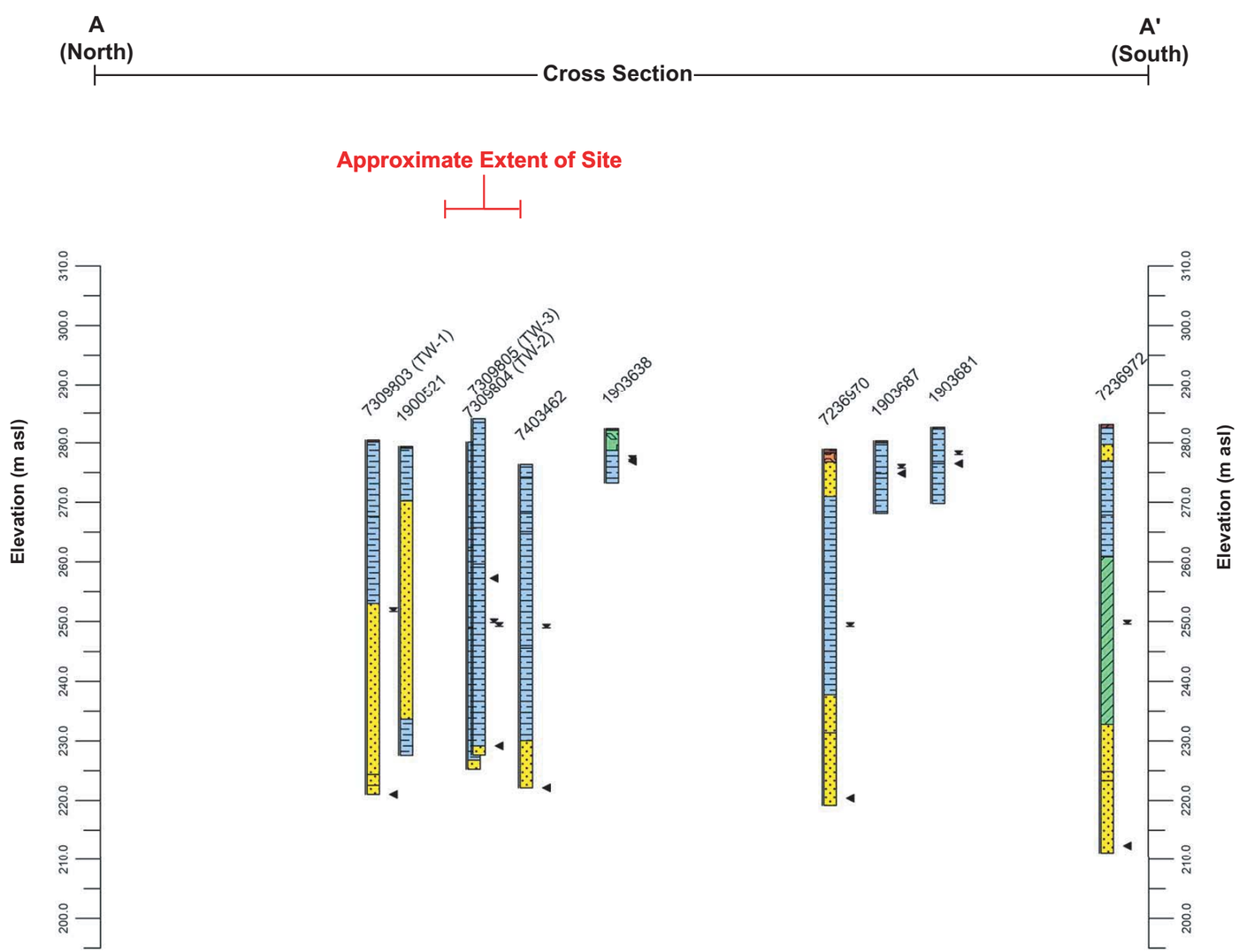
PROJECT # 23-3349

DATE April 2024

FIGURE NO. **7**

Hydrogeological and Site Servicing Assessment
Proposed McCamus Residential Subdivision

1910 County Road 10, Hamlet of Ida
Part Lot 12, Concession 11 (Cavan)
Township of Cavan Monaghan, County of Peterborough



- Static Water Level
- Water Found
- Boulders
- Clay
- Limestone
- Gravel
- Sand
- Till
- Topsoil

Approximate Distance Along
Projected Line of Section
Vertical Exaggeration: 4×

0 150 300 600 m

Notes: Wells from the Water Well Information System, Ministry of the Environment, Conservation and Parks (MECP), 2023.

Refer to projected line of section on Figure 6

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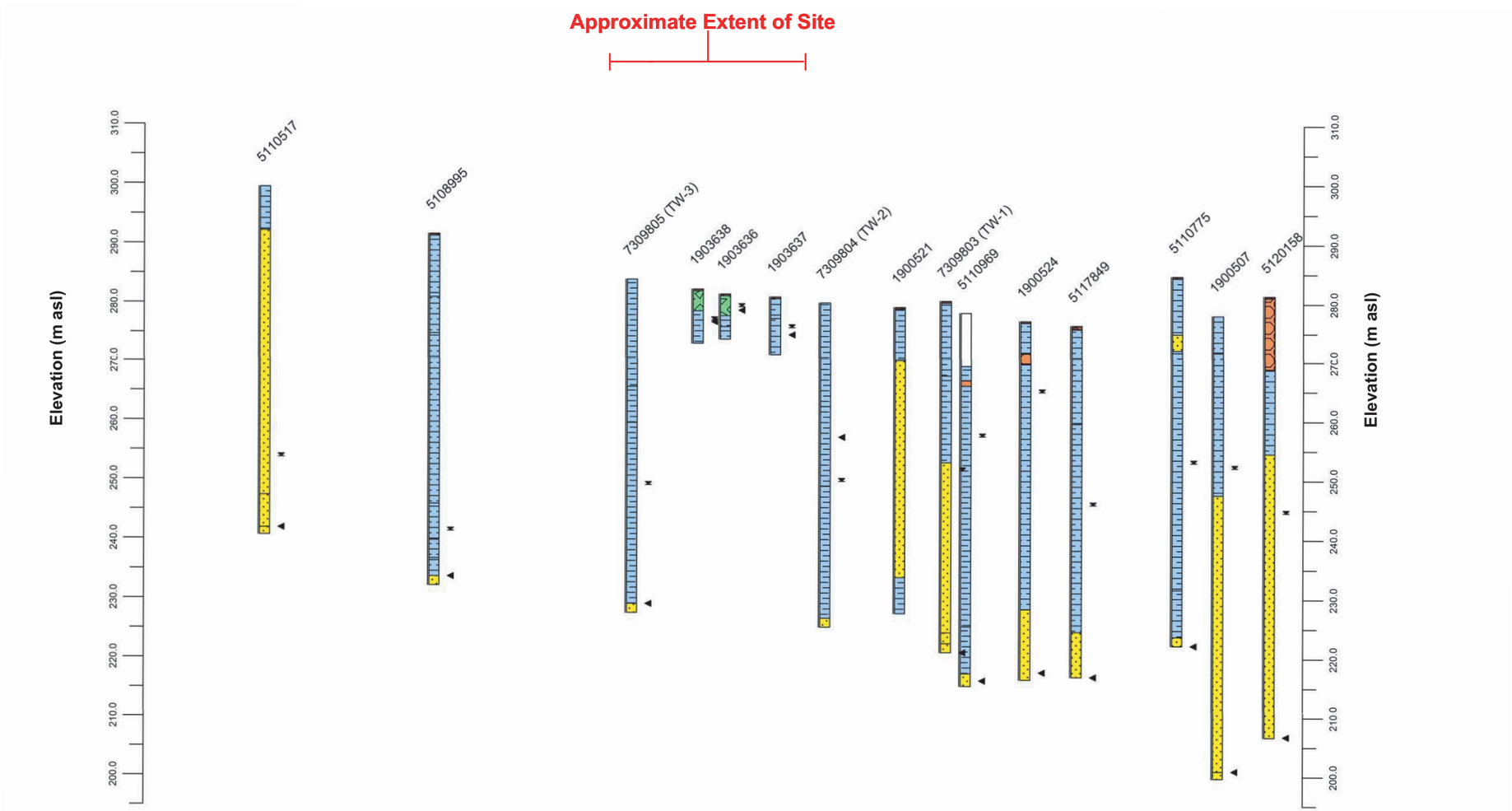
TITLE

A to A' Cross Section

ORE Oakridge Environmental Ltd.
Environmental and Hydrogeological Services

PROJECT #	FIGURE NO.
23-3349	**8**
DATE	
April 2024	

B (West) — **Cross Section** — **B' (East)**



Hydrogeological and Site Servicing Assessment
Proposed McCamus Residential Subdivision

1910 County Road 10, Hamlet of Ida
Part Lot 12, Concession 11 (Cavan)
Township of Cavan Monaghan, County of Peterborough

- Static Water Level
- Water Found
- Boulders
- Clay
- Limestone
- Gravel
- Sand
- Till
- Topsoil

Approximate Distance Along Projected Line of Section
Vertical Exaggeration: 4×

0 50 100 200 m

Notes: Wells from the Water Well Information System, Ministry of the Environment, Conservation and Parks (MECP), 2023.

Refer to projected line of section on Figure 6

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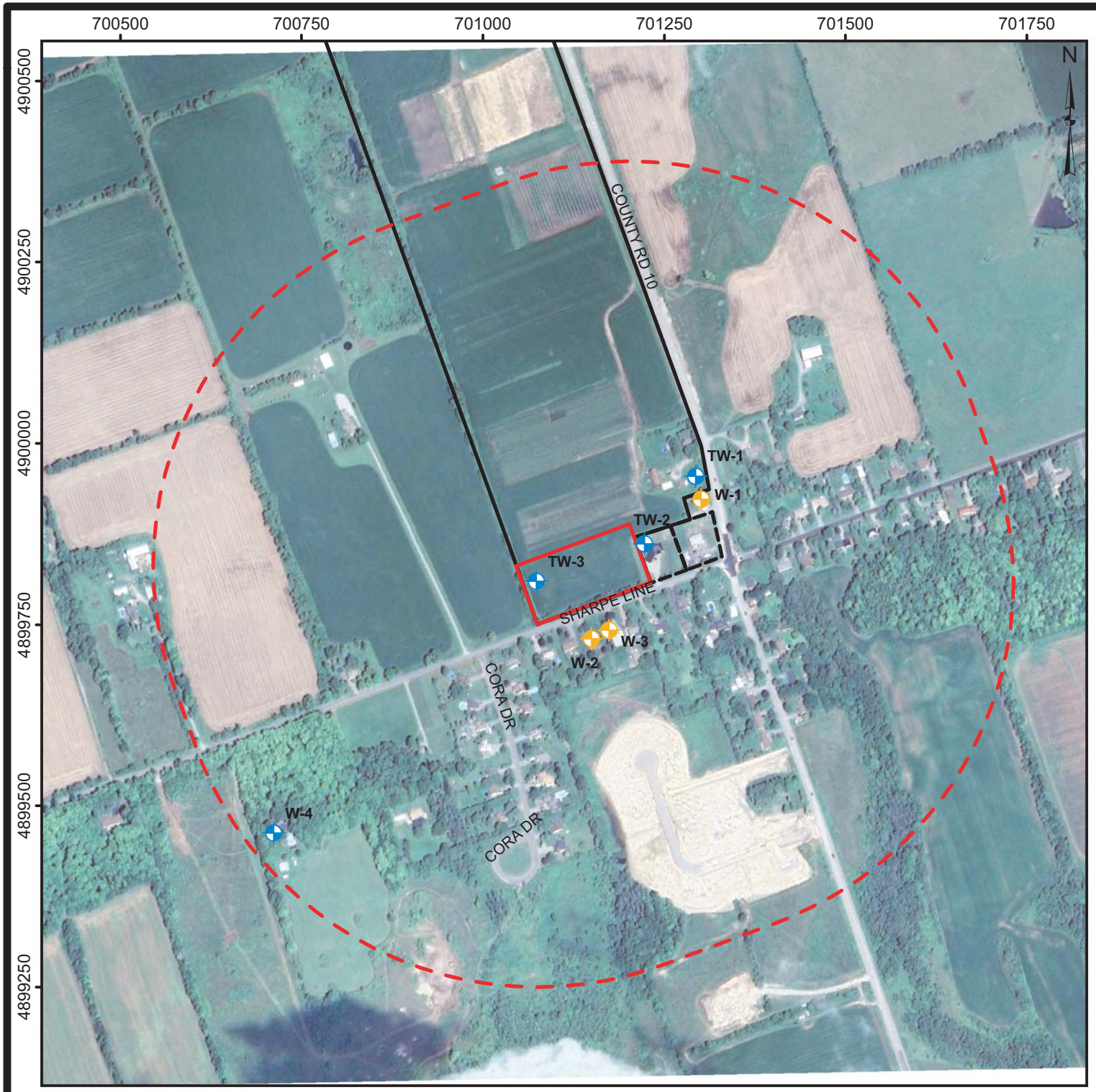
TITLE

B to B' Cross Section

ORE Oakridge Environmental Ltd.
Environmental and Hydrogeological Services

PROJECT #	FIGURE NO.
23-3349	9
DATE	
April 2024	



NAD 1983 UTM Zone 17N

Hydrogeological and Site Servicing Assessment Proposed McCamus Residential Subdivision

1910 County Road 10, Hamlet of Ida
Part Lot 12, Concession 11 (Cavan)
Township of Cavan Monaghan,
County of Peterborough

- Approximate Property Boundary
- Approximate Extent of Proposed Subdivision
- Approximate Location of Previously Severed Lands
- Well Survey Radius (500 m)
- Drilled Well Location
- Dug Well Location

Scale: 1:7,500

0 75 150 300 m

Notes: Imagery provided by GoogleEarth (2023)

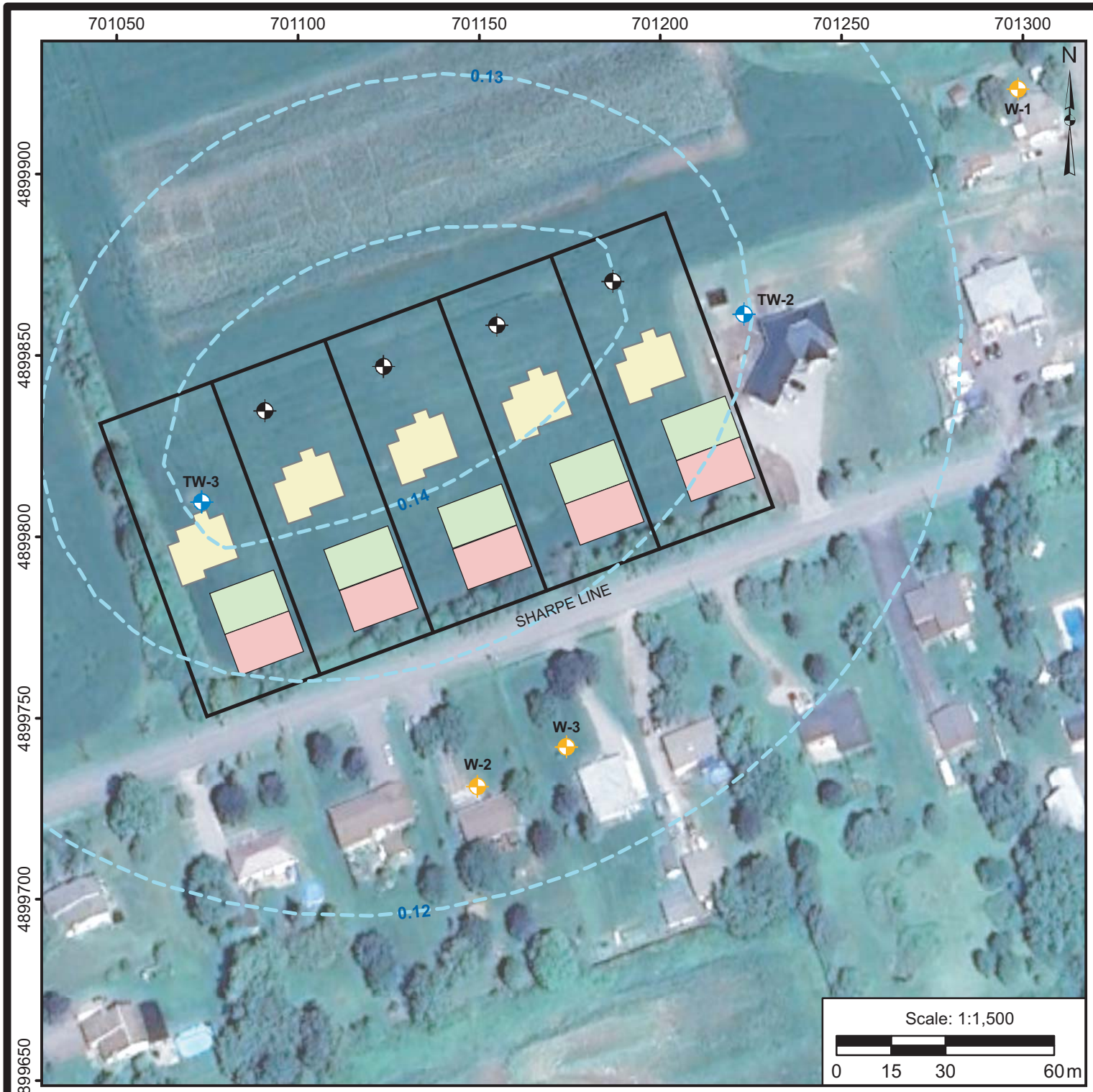
Feature locations determined by mapping-grade differential GPS (+/- 1.5 m)

TITLE

Well Survey

ORE Oakridge Environmental Ltd.
Environmental and Hydrogeological Services

PROJECT #	FIGURE NO.
23-3349	10
DATE	
April 2024	



Hydrogeological and Site Servicing Assessment Proposed McCamus Residential Subdivision

1910 County Road 10, Hamlet of Ida
Part Lot 12, Concession 11 (Cavan)
Township of Cavan Monaghan,
County of Peterborough

- Proposed Subdivision (Davenport, 2023)
- Approximate Location of Previously Severed Lands
- 0.14 Estimated Drawdown in DOBA (5 mm intervals)
- Drilled Well Location
- Dug Well Location
- Conceptual Well Location (Davenport, 2023)
- Conceptual Residence (Davenport, 2023)
- Conceptual Sewage System (Davenport, 2023)
- Conceptual 100% Replacement Sewage System (Davenport, 2023)

Notes: Imagery provided by GoogleEarth (2023)

Feature locations determined by mapping-grade differential GPS (+/- 1.5 m)

Drawdown in Deep Overburden/Basal Aquifer (DOBA) estimated from a simple Theis multiple well simulation in Rockworks

Subdivision and conceptual elements after M.J. Davenport & Associates Lot Grading Plan (Drawing No. 6213-03, 2023)

TITLE

Drawdown Simulation

ORE Oakridge Environmental Ltd.
Environmental and Hydrogeological Services

PROJECT #	FIGURE NO.
23-3349	11
DATE	
April 2024	

NAD 1983 UTM Zone 17N

Hydrogeological and Site Servicing Assessment Proposed McCamus Residential Subdivision

1910 County Road 10, Hamlet of Ida
Part Lot 12, Concession 11 (Cavan)
Township of Cavan Monaghan,
County of Peterborough

- Approximate Extent of Proposed Subdivision (Davenport, 2023)
- Approximate Lot Line (Davenport, 2023)
- Existing Drilled Well with 15 m OBC Setback
- Conceptual Drilled Well with 15 m OBC Setback
- Existing Dug Well with 30 m OBC Setback
- Conceptual Residence (Davenport, 2023)
- Conceptual Sewage System (Davenport, 2023)
- Conceptual 100% Replacement Sewage System (Davenport, 2023)

Scale: 1:1,000

0 10 20 40 m

Notes: Aerial photography provided by ESRI (Maxar, 2022)

Feature locations determined by mapping-grade differential GPS (+/- 1.5 m)

After M.J. Davenport & Associates Lot Grading Plan (Drawing No. 6213-03, 2023)

TITLE

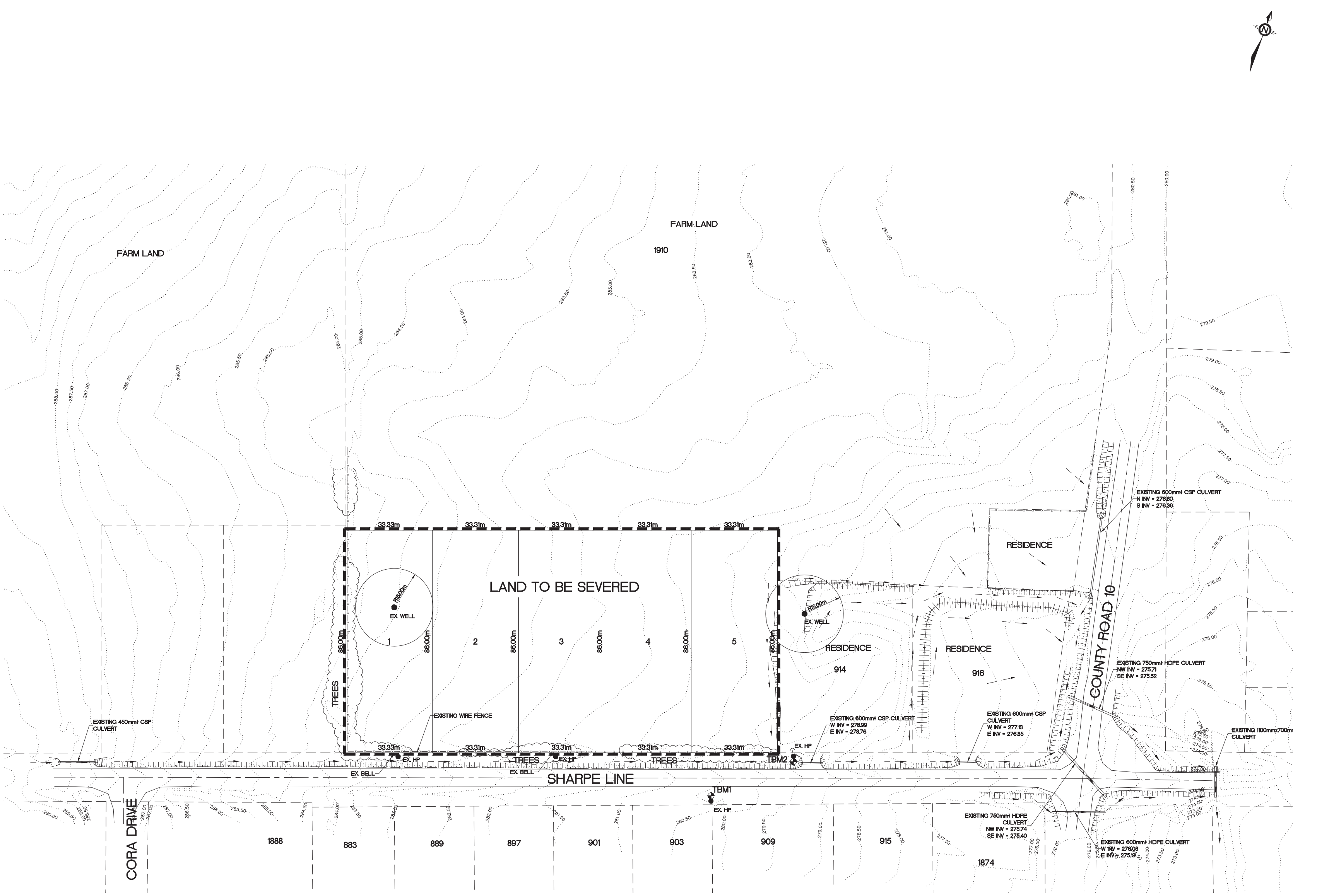
Conceptual Servicing

ORE Oakridge Environmental Ltd.
Environmental and Hydrogeological Services

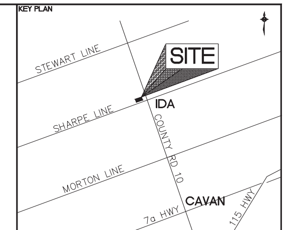
PROJECT #	FIGURE NO.
23-3349	12
DATE	
April 2024	

Appendix A

Topography and Conceptual Site Plan



KEY PLAN



NO.	REVISIONS	DATE	BY	APP'D

BENCHMARKS

BM 1 (U.T.M.) ELEV. 212.084 (CGVD2013)

Township: CAVAN - C.P.RY., BRIDGE OVER MILLBROOK-OMEMEE ROAD, 2.4 KM SOUTHWEST OF STATION AND 55.7 KM FROM HAVELOCK, BOLT IN SOUTHWEST CONCRETE ABUTMENT, SOUTHEAST END OF NORTHEAST FACE, 43 CM ABOVE BRIDGE SEAT.

STATION: 0011918U208G

TBM 1 ELEV. 280.26

NAIL ON NORTH FACE OF HYDRO POLE, 0.20m ABOVE GRADE, SOUTH OF SHARPE LINE, BETWEEN #903 AND 909.

TBM 2 ELEV. 279.53

NAIL ON SOUTH FACE OF HYDRO POLE, 0.20m ABOVE GRADE, AT SOUTHWEST CORNER OF #914 SHARPE LINE.

LEGEND

PROPERTY LIMIT
PHASE LIMIT
NEW SANITARY SEWER
NEW STORM SEWER
NEW WATERMAIN
PROPOSED DRAINAGE
100.00 PROPOSED LOT CORNER ELEVATION
X 100.00 PROPOSED ELEVATION AT HOUSE
100.00 PROPOSED SWALE ELEVATION
EXISTING DRAINAGE
EXISTING SANITARY SEWER
EXISTING STORM SEWER
EXISTING WATERMAIN
100.00 EXISTING LOT CORNER ELEVATION
+100.00 EXISTING ELEVATION TO REMAIN THE SAME

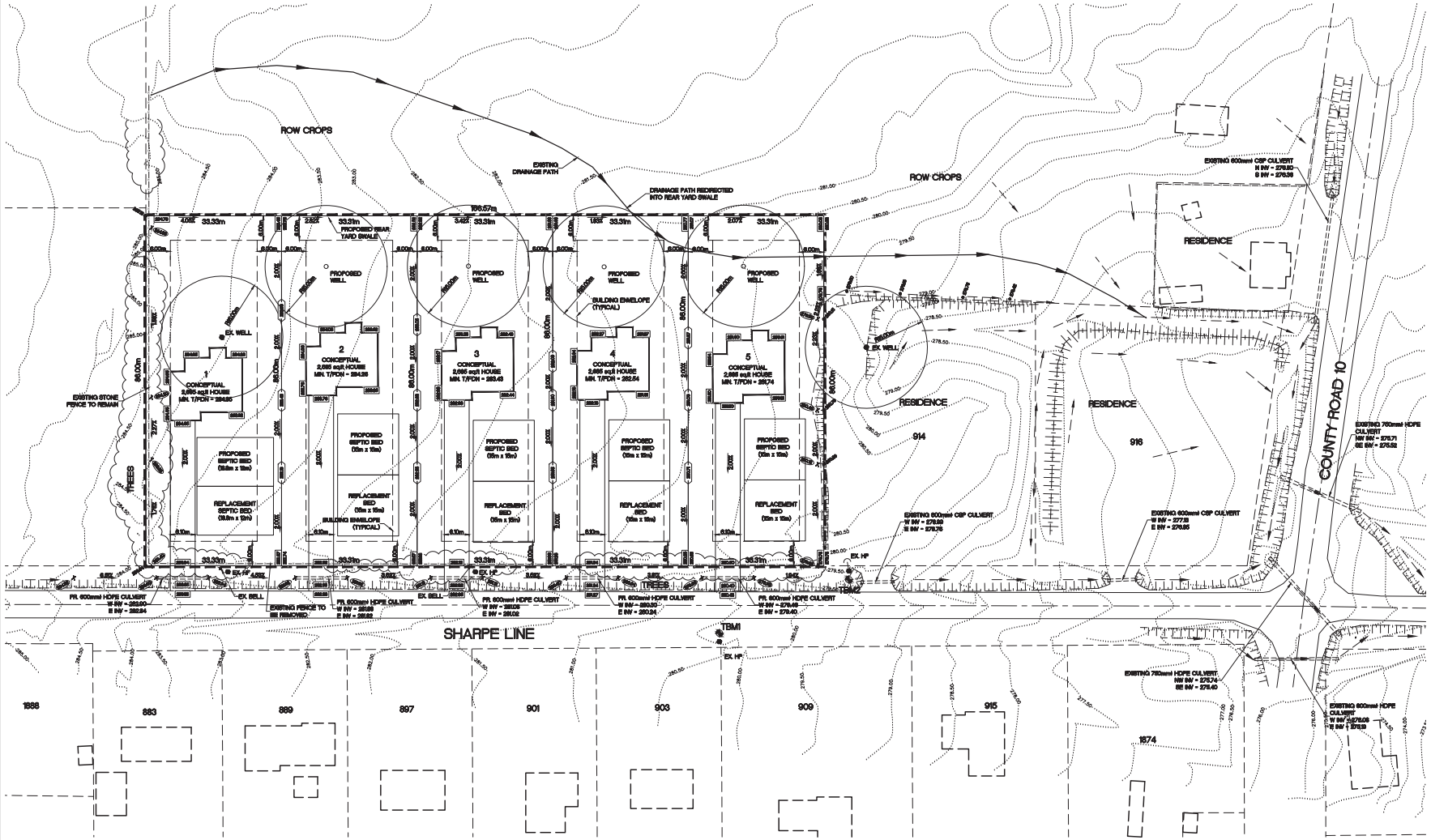
M.J. DAVENPORT
& ASSOCIATES LIMITED
P.O. BOX 2452 STN MAIN,
PETERBOROUGH, ONTARIO K9J 7Y8
TEL. : (705) 745-6676
FAX : (705) 745-7326

IDA SUBDIVISION

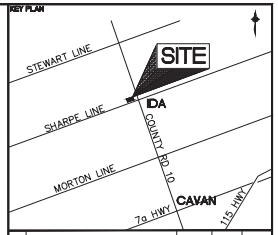
SHARPE LINE
TOWNSHIP OF CAVAN MONAGHAN
COUNTY OF PETERBOROUGH

SITE PLAN

DESIGNED BY: M.M. DAVENPORT	SCALE: 1 : 750
DRAWN BY: J. ZHOU	
DATE: AUGUST, 2023	DRWG. NO.: 6213-02
PROJECT NO.: 23-D-6213	



KEY PLAN



NO.	REVISIONS	DATE	BY	APP'D
1	REVISED GRADING AND SERVICING LAYOUT	19/09/24	JZ	JC

BENCHMARKS

BM 1 (U.T.M.) ELEV. 212.084 (CGVD2013)

Township CAVAN - C.P.R., BRIDGE OVER MILLBROOK-OMEMEE ROAD, 0.4 KM SOUTHWEST OF STATION AND 457 KM FROM HAVELOCK, BOLT IN SOUTH-WEST CONCRETE ABUTMENT, SOUTH-EAST END OF NORTH-EAST FACE, 45 CM ABOVE BRIDGE SEAT.

STATION 0389E5893

TBM 1 ELEV. 280.26

NAIL ON NORTH FACE OF HYDRO POLE, 0.20m ABOVE GRADE, SOUTH OF SHARPE LINE, BETWEEN 0928 AND 909.

TBM 2 ELEV. 279.53

NAIL ON SOUTH FACE OF HYDRO POLE, 0.80m ABOVE GRADE, AT SOUTHWEST CORNER OF 914 SHARPE LINE.

LEGEND

- PROPERTY LIMIT
- PHASE LIMIT
- NEW SANITARY SEWER
- NEW STORM SEWER
- NEW WATERMAIN
- PROPOSED DRAINAGE
- 100.00 PROPOSED LOT CORNER ELEVATION
- X 100.00 PROPOSED ELEVATION AT HOUSE
- 100.00 PROPOSED SWALE ELEVATION
- EXISTING DRAINAGE
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING WATERMAIN
- 100.00 EXISTING LOT CORNER ELEVATION
- x100.00 EXISTING ELEVATION TO REMAIN THE SAME

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FAX : (705) 745-7326

IDA SUBDIVISION

SHARPE LINE
TOWNSHIP OF CAVAN MONAGHAN
COUNTY OF PETERBOROUGH

LOT GRADING PLAN

DESIGNED BY: J. CLARK	SCALE: 1 : 500
DRAWN BY: J. ZHOU	
DATE: AUGUST, 2023	DRWG. NO.: 6213-03
PROJECT NO.: 23-D-6213	

Appendix B

Test Pit Logs

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Phone: 705-745-1181 | Fax: 705-745-4163 | www.oakridgeenvironmental.com |

TESTPIT NO.: **TP-17-1**

TOTAL DEPTH (m): **1.52**

UTM Coordinates:	Elevation (masl):
701247, 4899867	281.0

PROJECT INFORMATION

PROJECT NO: **16-2166**
SITE LOCATION: **Ida, Ontario**
LOGGED BY: **MD**
DATES ASSESSED: **November 2, 2017**

CONTRACTOR INFORMATION

EXCAVATION CO.: **Gary Nelson Excavating**
BACKHOE TYPE: **Kobelco 135SR LC**
STANDPIPE/PIEZOMETERS: **Not installed**
SAMPLING METHODS: **Composite grab**

▽ Saturated ▼ Water Level △ Moist

FIELD BOREHOLE LOG

Depth	Water	Piezometer Installation	Special Notes	Sample #	Depth	Soil Symbol	Soil Description
0.00	△			TP-17-1 Topsoil	0.19 m		TOPSOIL: Dark brown, moist silty topsoil. Roots to 19 cm.
0.25							ML (TILL): Brown, moist sandy silt with clay, gravel and cobbles. Gravel and cobbles sub-angular to sub-rounded, with maximum dimension 120 mm. Mottling present throughout soil layer. Low plasticity and toughness.
0.50							Tile drainage secondary main was inadvertantly cut into.
0.75				TP-17-1 0.19-1.52m			End @ 1.52 m
1.00							
1.25							
1.50							

NOTES: 15 °C / Overcast / Periodic rain

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TESTPIT NO.: **TP-17-2**

TOTAL DEPTH (m): **2.5**

UTM Coordinates:	Elevation (masl):
701184, 4899839	283.1

PROJECT INFORMATION

PROJECT NO: **16-2166**
SITE LOCATION: **Ida, Ontario**
LOGGED BY: **MD**
DATES ASSESSED: **November 2, 2017**

CONTRACTOR INFORMATION

EXCAVATION CO.: **Gary Nelson Excavating**
BACKHOE TYPE: **Kobelco 135SR LC**
STANDPIPE/PIEZOMETERS: **3/4" standpipe**
SAMPLING METHODS: **Composite grab**

▽ Saturated ▼ Water Level △ Moist

FIELD BOREHOLE LOG

Depth	Water	Piezometer Installation	Special Notes	Sample #	Depth	Soil Symbol	Soil Description
0.00	△						TOPSOIL: Dark brown, moist silty topsoil. Roots to 27 cm.
0.25					0.27 m		ML: Brown-red, moist sandy silt with clay. Low plasticity.
0.50				TP-17-2 0.27-0.67m			
0.75	▼		Static Water Level = 0.819 mbgs (Nov. 7, 2017)		0.67 m		ML (TILL): Brown, moist sandy silt with clay, gravel and cobbles. Gravel and cobbles sub-angular to sub-rounded, with maximum dimension 120 mm. Mottling present throughout soil layer. Low plasticity and toughness.
1.00	▽						Saturated @ 1.10 m
1.25							Water pooling prior to backfill
1.50				TP-17-2 0.67-2.5m			End @ 2.50 m
1.75							
2.00							
2.25							
2.50	▼						

NOTES: 15 °C / Overcast / Periodic rain

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TESTPIT NO.: **TP-17-3**

TOTAL DEPTH (m): **2.65**

UTM Coordinates:	Elevation (masl):
701127, 4899816	283.4

PROJECT INFORMATION

PROJECT NO: **16-2166**
SITE LOCATION: **Ida, Ontario**
LOGGED BY: **MD**
DATES ASSESSED: **November 2, 2017**

CONTRACTOR INFORMATION

EXCAVATION CO.: **Gary Nelson Excavating**
BACKHOE TYPE: **Kobelco 135SR LC**
STANDPIPE/PIEZOMETERS: **3/4" standpipe**
SAMPLING METHODS: **Composite grab**

▽ Saturated ▼ Water Level △ Moist

FIELD BOREHOLE LOG

Depth	Water	Piezometer Installation	Special Notes	Sample #	Depth	Soil Symbol	Soil Description
0.00 – 0.22	△				0.22 m		TOPSOIL: Dark brown, moist silty topsoil. Roots to 22 cm.
0.22 – 0.54					0.54 m		ML: Brown-red, moist sandy silt with clay. Low plasticity.
0.54 – 2.65	▽ 1.25 ▼ 2.50		Static Water Level = 1.238 mbgs (Nov. 7, 2017)	TP-17-3 0.54-2.65m			ML (TILL): Brown, moist sandy silt with clay, gravel and cobbles. Gravel and cobbles sub-angular to sub-rounded, with maximum dimension 320 mm. Mottling present throughout soil layer. Low plasticity and toughness. Saturated @ 1.35 m Water pooling prior to backfill End @ 2.65 m

NOTES: 15 °C / Overcast / Periodic rain

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TESTPIT NO.: **TP-17-4**

TOTAL DEPTH (m): **2.59**

UTM Coordinates:	Elevation (masl):
701088, 4899773	284.1

PROJECT INFORMATION

PROJECT NO: **16-2166**
SITE LOCATION: **Ida, Ontario**
LOGGED BY: **MD**
DATES ASSESSED: **November 2, 2017**

CONTRACTOR INFORMATION

EXCAVATION CO.: **Gary Nelson Excavating**
BACKHOE TYPE: **Kobelco 135SR LC**
STANDPIPE/PIEZOMETERS: **3/4" standpipe**
SAMPLING METHODS: **Composite grab**

▽ Saturated ▼ Water Level △ Moist

FIELD BOREHOLE LOG

Depth	Water	Piezometer Installation	Special Notes	Sample #	Depth	Soil Symbol	Soil Description
0.00	△		Static Water Level = 0.772 mbgs (Nov. 7, 2017)	TP-17-4 ~2m	0.10 m		TOPSOIL: Dark brown, moist silty topsoil. Roots to 10 cm.
0.25					0.27 m		ML: Brown-red, moist sandy silt with clay. Low plasticity.
0.50							ML (TILL): Brown, moist sandy silt with clay, gravel and cobbles. Gravel and cobbles sub-angular to sub-rounded, with maximum dimension 320 mm. Mottling present throughout soil layer. Low plasticity and toughness.
0.75	▼						Saturated @ 1.55 m Water pooling prior to backfill
1.00							End @ 2.59 m
1.25							
1.50	▽						
1.75							
2.00							
2.25							
2.50	▼						

NOTES: 15 °C / Overcast / Periodic rain

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TESTPIT NO.: **TP-17-5**

TOTAL DEPTH (m): **2.50**

UTM Coordinates:	Elevation (masl):
701124, 4899789	283.2

PROJECT INFORMATION

PROJECT NO: **16-2166**
SITE LOCATION: **Ida, Ontario**
LOGGED BY: **MD**
DATES ASSESSED: **November 2, 2017**

CONTRACTOR INFORMATION

EXCAVATION CO.: **Gary Nelson Excavating**
BACKHOE TYPE: **Kobelco 135SR LC**
STANDPIPE/PIEZOMETERS: **Not installed**
SAMPLING METHODS: **Composite grab**

▽ Saturated ▼ Water Level △ Moist

FIELD BOREHOLE LOG

Depth	Water	Piezometer Installation	Special Notes	Sample #	Depth	Soil Symbol	Soil Description
0.00	△			TP-17-5 ~1m	0.30 m		TOPSOIL: Dark brown, moist silty topsoil. Roots to 30 cm.
0.25							
0.50					0.70 m		ML: Brown-red, moist sandy silt with clay. Low plasticity.
0.75							
1.00							ML (TILL): Brown, moist sandy silt with clay, gravel and cobbles. Gravel and cobbles sub-angular to sub-rounded, with maximum dimension 400 mm. Mottling present throughout soil layer. Low plasticity and toughness.
1.25	▽						Saturated @ 1.15 m Water pooling prior to backfill
1.50							End @ 2.50 m
1.75							
2.00							
2.25							
2.50	▼						

NOTES: 15 °C / Overcast / Periodic rain

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TESTPIT NO.: **TP-17-6**

TOTAL DEPTH (m): **2.40**

UTM Coordinates:	Elevation (masl):
701168, 4899802	282.2

PROJECT INFORMATION

PROJECT NO: **16-2166**
SITE LOCATION: **Ida, Ontario**
LOGGED BY: **MD**
DATES ASSESSED: **November 2, 2017**

CONTRACTOR INFORMATION

EXCAVATION CO.: **Gary Nelson Excavating**
BACKHOE TYPE: **Kobelco 135SR LC**
STANDPIPE/PIEZOMETERS: **3/4" standpipe**
SAMPLING METHODS: **Composite grab**

▽ Saturated ▼ Water Level △ Moist

FIELD BOREHOLE LOG

Depth	Water	Piezometer Installation	Special Notes	Sample #	Depth	Soil Symbol	Soil Description
0.00	△						TOPSOIL: Dark brown, moist silty topsoil. Roots to 20 cm.
0.20 m							ML: Brown-red, moist sandy silt with clay. Low plasticity.
0.53 m							ML (TILL): Brown, moist sandy silt with clay, gravel and cobbles. Gravel and cobbles sub-angular to sub-rounded, with maximum dimension 370 mm. Mottling present throughout soil layer. Low plasticity and toughness.
1.00	▼		Static Water Level = 1.101 mbgs (Nov. 7, 2017)				Saturated @ 1.60 m Water pooling prior to backfill
1.50	▽			TP-17-6 0.53-2.4m			End @ 2.40 m
2.25	▼						

NOTES: 15 °C / Overcast / Periodic rain

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TESTPIT NO.: **TP-17-7**

TOTAL DEPTH (m): **2.3**

UTM Coordinates:	Elevation (masl):
701202, 4899812	282.4

PROJECT INFORMATION

PROJECT NO: **16-2166**
SITE LOCATION: **Ida, Ontario**
LOGGED BY: **MD**
DATES ASSESSED: **November 2, 2017**

CONTRACTOR INFORMATION

EXCAVATION CO.: **Gary Nelson Excavating**
BACKHOE TYPE: **Kobelco 135SR LC**
STANDPIPE/PIEZOMETERS: **Not installed**
SAMPLING METHODS: **Composite grab**

▽ Saturated ▼ Water Level △ Moist

FIELD BOREHOLE LOG

Depth	Water	Piezometer Installation	Special Notes	Sample #	Depth	Soil Symbol	Soil Description
0.00	△						TOPSOIL: Dark brown, moist silty topsoil. Roots to 30 cm.
0.30 m							ML: Brown-red, moist sandy silt with clay. Low plasticity.
0.70 m				TP-17-7 0.7-2.3m			ML (TILL): Brown, moist sandy silt with clay, gravel and cobbles. Gravel and cobbles sub-angular to sub-rounded, with maximum dimension 250 mm. Mottling present throughout soil layer. Low plasticity and toughness. Saturated @ 1.25 m Water pooling prior to backfill End @ 2.30 m
1.25	▽						
2.25	▼						

NOTES: 15 °C / Overcast / Periodic rain

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TESTPIT NO.: **TP-17-8**

TOTAL DEPTH (m): **2.61**

UTM Coordinates:	Elevation (masl):
701234, 4899829	281.2

PROJECT INFORMATION

PROJECT NO: **16-2166**
SITE LOCATION: **Ida, Ontario**
LOGGED BY: **MD**
DATES ASSESSED: **November 2, 2017**

CONTRACTOR INFORMATION

EXCAVATION CO.: **Gary Nelson Excavating**
BACKHOE TYPE: **Kobelco 135SR LC**
STANDPIPE/PIEZOMETERS: **3/4" standpipe**
SAMPLING METHODS: **Composite grab**

▽ Saturated ▼ Water Level △ Moist

FIELD BOREHOLE LOG

Depth	Water	Piezometer Installation	Special Notes	Sample #	Depth	Soil Symbol	Soil Description
0.00 – 2.50	△ ▼ ▽ ▼		Static Water Level = 1.255 mbgs (Nov. 7, 2017)	TP-17-8 0.5-2.5m	0.15 m 0.50 m		TOPSOIL: Dark brown, moist silty topsoil. Roots to 15 cm. ML: Brown-red, moist sandy silt with clay. Low plasticity. ML (TILL): Brown, moist sandy silt with clay, gravel and cobbles. Gravel and cobbles sub-angular to sub-rounded, with maximum dimension 500 mm. Mottling present throughout soil layer. Low plasticity and toughness. Saturated @ 1.55 m Water pooling prior to backfill End @ 2.61 m

NOTES: 15 °C / Overcast / Periodic rain

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TESTPIT NO.: **TP-17-9**

TOTAL DEPTH (m): **2.60**

UTM Coordinates:	Elevation (masl):
701274, 4899838	280.4

PROJECT INFORMATION

PROJECT NO: **16-2166**
SITE LOCATION: **Ida, Ontario**
LOGGED BY: **MD**
DATES ASSESSED: **November 2, 2017**

CONTRACTOR INFORMATION

EXCAVATION CO.: **Gary Nelson Excavating**
BACKHOE TYPE: **Kobelco 135SR LC**
STANDPIPE/PIEZOMETERS: **Not installed**
SAMPLING METHODS: **Composite grab**

▽ Saturated ▼ Water Level △ Moist

FIELD BOREHOLE LOG

Depth	Water	Piezometer Installation	Special Notes	Sample #	Depth	Soil Symbol	Soil Description
0.00	△						TOPSOIL: Dark brown, moist silty topsoil. Roots to 25 cm.
0.25					0.25 m		ML: Brown-red, moist sandy silt with clay. Low plasticity.
0.50					0.55 m		ML (TILL): Brown, moist sandy silt with clay, gravel and cobbles. Gravel and cobbles sub-angular to sub-rounded, with maximum dimension 250 mm. Mottling present throughout soil layer. Low plasticity and toughness.
0.75							Saturated @ 1.50 m
1.00							Water pooling prior to backfill
1.25							End @ 2.60 m
1.50	▽			TP-17-9 0.55-2.6m			
1.75							
2.00							
2.25							
2.50	▼						

NOTES: 15 °C / Overcast / Periodic rain

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TESTPIT NO.: **TP-17-10**

TOTAL DEPTH (m): **2.60**

UTM Coordinates:	Elevation (masl):
701305, 4899847	278.5

PROJECT INFORMATION

PROJECT NO: **16-2166**
SITE LOCATION: **Ida, Ontario**
LOGGED BY: **MD**
DATES ASSESSED: **November 2, 2017**

CONTRACTOR INFORMATION

EXCAVATION CO.: **Gary Nelson Excavating**
BACKHOE TYPE: **Kobelco 135SR LC**
STANDPIPE/PIEZOMETERS: **Not installed**
SAMPLING METHODS: **Composite grab**

▽ Saturated ▼ Water Level △ Moist

FIELD BOREHOLE LOG

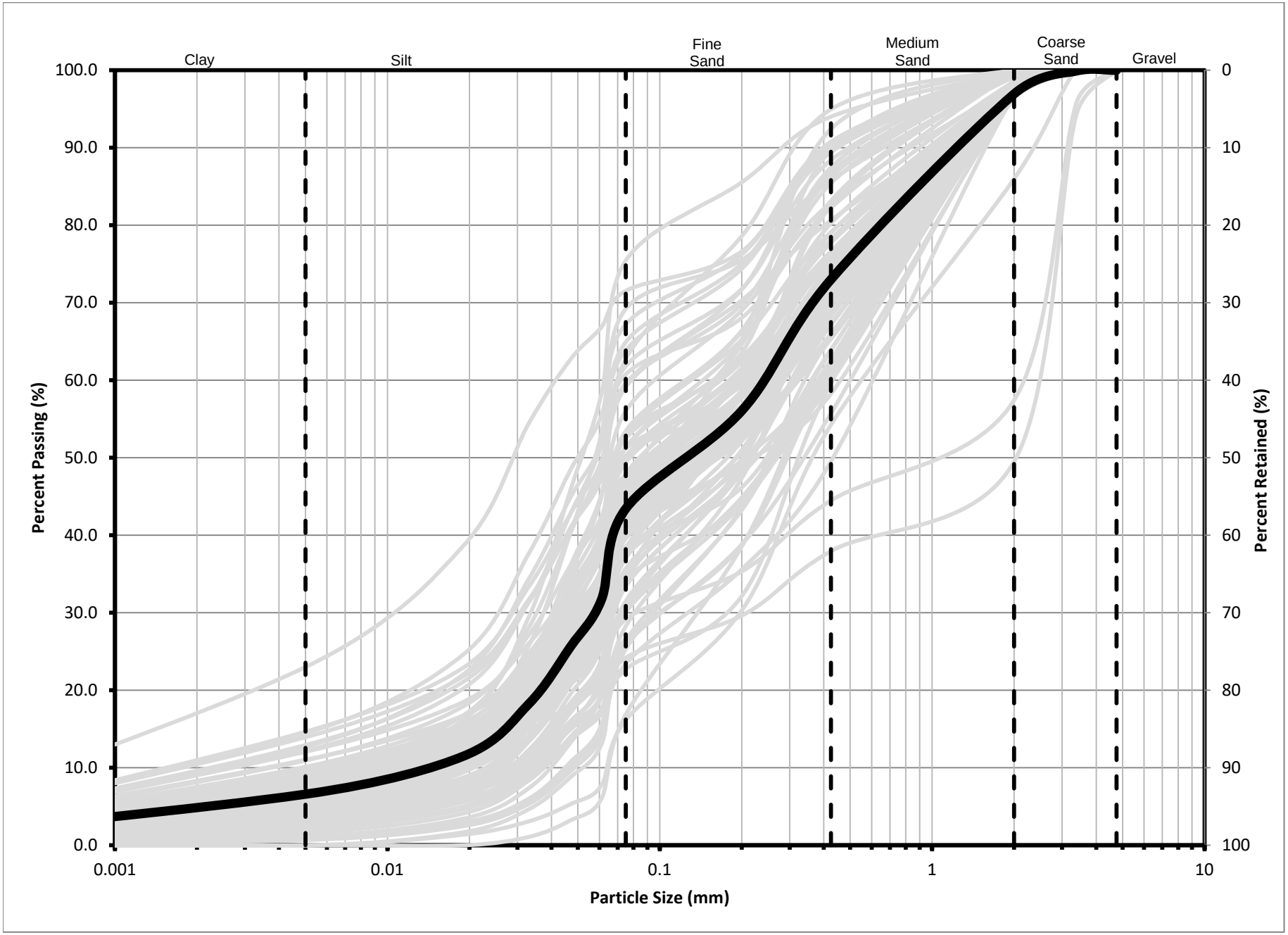
Depth	Water	Piezometer Installation	Special Notes	Sample #	Depth	Soil Symbol	Soil Description
0.00	△						TOPSOIL: Dark brown, moist silty topsoil. Roots to 22 cm.
0.25					0.22 m		ML: Brown-red, moist sandy silt with clay. Low plasticity.
0.50					0.39 m		ML (TILL): Brown, moist sandy silt with clay, gravel and cobbles. Gravel and cobbles sub-angular to sub-rounded, with maximum dimension 340 mm. Mottling present throughout soil layer. Low plasticity and toughness.
0.75							
1.00							Saturated @ 1.50 m
1.25							Seepage @ 2.40 m
1.50	▽			TP-17-10 0.39-2.6m			Water level @ 2.50 m prior to backfill
1.75							
2.00							End @ 2.60 m
2.25							
2.50	▼						

NOTES: 15 °C / Overcast / Periodic rain

Appendix C

Grain Size Distribution Data
(Newmarket Till)

Newmarket Till (Marich 2016)



Appendix D

MECP Water Well Information System

Water Well Records

March 22, 2024
3:25:32 PM

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
CAVAN TOWNSHIP	17 701127 4899741 W	1911-11 1455						7443111 (Z390239) A328221 P	
CAVAN TOWNSHIP CON 10 011	17 700715 4899443 W	1983-01 2104	6	UK 0216 UK 0220	199/204/8/5:0	DO	0211 4	5110631 ()	BRWN GRVL CLAY STNS 0015 BRWN MSND MGVL CLAY 0040 GREY MSND CLAY STNS 0172 GREY MSND CLAY 0191 BRWN SAND GRVL LOOS 0214 BRWN SAND GRVL LOOS 0220
CAVAN TOWNSHIP CON 10 012	17 701100 4899445 W	2014-12 2662	6.25	FR 0212	120/131/20/1:	TH	0212 4	7236971 (Z195128) A170665	BLCK LOAM STNS 0002 BRWN GRVL CLAY SNDY 0006 GREY CLAY BLDR SNDY 0013 BRWN SAND CLAY GRVL 0030 GREY CLAY GRVL 0036 BRWN CLAY SNDY 0042 GREY CLAY SILT 0070 GREY CLAY GRVL 0148 GREY SAND GRVL WBRG 0216
CAVAN TOWNSHIP CON 10 012	17 700955 4899663 W	1975-05 1904	6	FR 0190	165/170/10/16:0	DO		5108995 ()	LOAM 0001 GREY CLAY SAND 0035 GREY CLAY 0055 GREY CLAY SAND 0150 GREY CLAY SAND 0170 BLUE CLAY SAND 0180 GREY CLAY SAND 0190 BRWN SAND 0195
CAVAN TOWNSHIP CON 10 012	17 701365 4899623 W	1973-09 5207	36	FR 0018	15/40/6/2:0	DO		1903687 ()	BLCK LOAM CLAY 0001 BRWN CLAY STNS 0018 BLUE CLAY SAND STNS 0040
CAVAN TOWNSHIP CON 10 012	17 701135 4899443 W	1983-10 4635	6	FR 0195	87/192/4/4:0	ST	0194 7	5110970 ()	LOAM 0001 WHIT CLAY STNS 0038 BRWN FSND 0046 WHIT CLAY 0144 WHIT CLAY SAND 0176 WHIT CLAY SILT 0195 BRWN CGVL 0200
CAVAN TOWNSHIP CON 10 012	17 701365 4899583 W	1973-09 5207	36	FR 0020	15/41/5/2:0	DO		1903681 ()	BLCK LOAM CLAY 0001 BRWN CLAY STNS 0020 BLUE CLAY SAND STNS 0042
CAVAN TOWNSHIP CON 10 012	17 701264 4899626 W	2014-12 2662	6.25	FR 0192	98/104/10/1:	TH	0192 4	7236970 (Z195129) A170666	BLCK LOAM 0002 BRWN GRVL CLAY SNDY 0007 GREY SAND CLAY GRVL 0026 GREY CLAY SLTY 0135 GREY SAND SILT 0156 GREY SAND WBRG 0196
CAVAN TOWNSHIP CON 10 012	17 701393 4899474 W	2014-12 2662	6.25	FR 0232 FR 0236	110/113/10/1:	TH	0232 4	7236972 (Z195130) A170664	BLCK LOAM 0002 BRWN CLAY SNDY 0011 GREY SAND GRVL BLDR 0020 GREY CLAY GRVL BLDR 0050 GREY CLAY SNDY 0073 GREY SILT CLAY 0165 GREY SAND FSND 0191 BRWN SAND FSND 0196 GREY SAND MSND 0236
CAVAN TOWNSHIP CON 10 012	17 701215 4899763 W	1973-07 3129	30	FR 0021	17/32/7/1:0	DO		1903637 ()	LOAM 0001 GREY CLAY STNS 0012 BLUE CLAY STNS 0032
CAVAN TOWNSHIP CON 10 012	17 701175 4899753 W	1973-07 3129	30	FR 0009	7/24/8/1:0	DO		1903636 ()	LOAM 0001 HPAN STNS 0012 GREY CLAY STNS 0018 BLUE CLAY 0025
CAVAN TOWNSHIP CON 10 012	17 700915 4899473 W	1970-12 2104	6	FR 0202	178/201/10/2:30	DO	0202 4	1903046 ()	BRWN LOAM 0001 BRWN MSND 0034 BRWN GRVL MSND 0042 BRWN FSND 0094 BRWN CSND STNS 0101 GREY GRVL MSND 0133 BRWN MSND 0154 GREY CLAY MSND STNS 0180 BRWN MSND CSND STNS 0201 BRWN CSND 0206
CAVAN TOWNSHIP CON 10 012	17 701065 4899593 W	2018-05 4635	6	UT 0143	124/126/7/1:0	DO		7326771 (Z243489) A213380	BRWN LOAM 0001 BRWN CLAY STNS 0017 GREY CLAY STNS 0105 BRWN SAND CLAY STNS 0110 GREY CLAY STNS 0141 GRVL PCKD 0143
CAVAN TOWNSHIP CON 10 012	17 701121 4899744 W	2022-09 1455						7430070 (Z390233) A328169 P	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
CAVAN TOWNSHIP CON 10 012	17 701155 4899743 W	1973-07 3129	30	FR 0018	17/29/7/1:0	DO		1903638 ()	LOAM 0001 HPAN STNS 0012 BLUE CLAY 0030
CAVAN TOWNSHIP CON 10 013	17 701415 4899773 W	1978-12 4867	36	FR 0023	10/26/3/1:0	DO		5109255 ()	BLCK LOAM SOFT 0001 BRWN CLAY STNS HARD 0020 BLUE CLAY SAND 0023 BLUE CLAY SAND 0028
CAVAN TOWNSHIP CON 10 013	17 701558 4899878 W	1968-01 1904	6	FR 0253	85/200/15/15:0	DO	0249 4	1900507 ()	BRWN CLAY STNS 0020 GREY CLAY STNS MSND 0100 FSND SILT GRVL 0253 MSND GRVL 0257
CAVAN TOWNSHIP CON 11 012	17 701265 4899923 W	1959-05 2113	6					1900521 () A	LOAM 0001 BRWN CLAY 0030 MSND CLAY 0150 GREY CLAY MSND 0170
CAVAN TOWNSHIP CON 11 012	17 700815 4899643 W	1981-08 4635	6	FR 0189	150/151/10/4:0	DO	0184 9	5110517 ()	BRWN CLAY SAND 0024 BRWN FSND 0171 BRWN MSND 0189 BRWN FSND 0193
CAVAN TOWNSHIP CON 11 012	17 701315 4899943 W	1983-09 4635	6	FR 0204	69/138/7/4:0	ST DO	0199 8	5110969 ()	PRDG 0030 WHIT CLAY STNS 0038 BRWN GRVL FSND 0041 WHIT CLAY 0174 WHIT CLAY SAND 0200 BRWN FSND 0207
CAVAN TOWNSHIP CON 11 012	17 701288 4899977 W	2018-01 1455	6.25	0195	94/161/5/1:	DO	0188 7	7309803 (Z266041) A239731	BLCK LOAM 0001 BRWN CLAY SAND STNS 0042 GREY CLAY 0090 GREY SAND CLAY 0184 BRWN SAND CLAY 0190 BRWN SAND 0195
CAVAN TOWNSHIP CON 11 012	17 701221 4899862 W	2018-01 1455	6.25	0075	99/131/5/1:	DO	0172 8	7309804 (Z266042) A239733	BRWN CLAY STNS 0058 GREY CLAY STNS 0102 GREY CLAY SAND 0175 BRWN SAND 0180
CAVAN TOWNSHIP CON 11 012	17 701076 4899810 W	2018-01 1455	6.25	0180	114/155/5/1:	DO	0182 3	7309805 (Z266043) A239730	BRWN CLAY STNS 0060 GREY CLAY BLDR 0080 GREY CLAY SAND 0180 BRWN SAND 0185
CAVAN TOWNSHIP CON 11 012	17 701317 4899856 W	2021-09 7560	6.25 5.25	UT 0178	90/100/9/1:10	DO	0174 4	7403462 (DO8BYQHT) A319339	BRWN CLAY STNS SOFT 0007 BRWN CLAY STNS PCKD 0027 GREY CLAY FSND PCKD 0037 GREY CLAY DNSE 0101 GREY CLAY FSND DNSE 0152 BRWN MSND CLAY LOOS 0178
CAVAN TOWNSHIP CON 11 013	17 701433 4899884 W	1998-07 3367	6	FR 0195	100/155/20/3:0	DO	0191 4	5117849 (194297)	BRWN LOAM SOFT 0002 BRWN CLAY GRVL PCKD 0018 GREY CLAY STNS HARD 0055 GREY CLAY DNSE 0170 BRWN FSND LOOS 0195
CAVAN TOWNSHIP CON 11 013	17 701577 4899949 W	2004-03 1455	6.26	FR 0245	121/180/10/2:	DO		5120158 (Z11303) A011269	BRWN LOAM 0001 BRWN GRVL CLAY 0041 GREY CLAY STNS 0088 BLCK CSND 0245
CAVAN TOWNSHIP CON 11 013	17 701365 4899948 W	1966-07 2104	6	FR 0195	40/180/2/8:0	DO	0186 13	1900524 ()	LOAM 0001 BRWN CLAY STNS 0018 GRVL MSND 0024 GREY CLAY SILT 0160 GREY MSND 0199
CAVAN TOWNSHIP CON 11 013	17 701455 4900063 W	1982-09 4635	6	FR 0205	104/177/20/3:30	ST DO	0197 9	5110775 ()	LOAM 0001 WHIT CLAY STNS 0032 BRWN FSND 0041 WHIT CLAY 0174 WHIT CLAY SAND 0200 BRWN FSND 0205

TOWNSHIP CON LOT UTM DATE CNTR CASING DIA WATER PUMP TEST WELL USE SCREEN WELL FORMATION

Notes:
UTM: UTM in Zone, Easting, Northing and Datum is NAD83; L: UTM estimated from Centroid of Lot; W: UTM not from Lot Centroid
DATE CNTR: Date Work Completedand Well Contractor Licence Number
CASING DIA: .Casing diameter in inches
WATER: Unit of Depth in Fee. See Table 4 for Meaning of Code
PUMP TEST: Static Water Level in Feet / Water Level After Pumping in Feet / Pump Test Rate in GPM / Pump Test Duration in Hour : Minutes
WELL USE: See Table 3 for Meaning of Code
SCREEN: Screen Depth and Length in feet
WELL: WEL (AUDIT #) Well Tag . A: Abandonment; P: Partial Data Entry Only
FORMATION: See Table 1 and 2 for Meaning of Code

1. Core Material and Descriptive terms

Code	Description	Code	Description	Code	Description	Code	Description	Code	Description
BLDR	BOULDERS	FCRD	FRACTURED	IRFM	IRON FORMATION	PORS	POROUS	SOFT	SOFT
BSLT	BASALT	FGRD	FINE-GRAINED	LIMY	LIMY	PRDG	PREVIOUSLY DUG	SPST	SOAPSTONE
CGRD	COARSE-GRAINED	FGVL	FINE GRAVEL	LMSN	LIMESTONE	PRDR	PREV. DRILLED	STKY	STICKY
CGVL	COARSE GRAVEL	FILL	FILL	LOAM	TOPSOIL	QRTZ	QUARTZITE	STNS	STONES
CHRT	CHERT	FLDS	FELDSPAR	LOOS	LOOSE	QSND	QUICKSAND	STNY	STONEY
CLAY	CLAY	FLNT	FLINT	LTCL	LIGHT-COLOURED	QTZ	QUARTZ	THIK	THICK
CLN	CLEAN	FOSS	FOSILIFEROUS	LYRD	LAYERED	ROCK	ROCK	THIN	THIN
CLYY	CLAYEY	FSND	FINE SAND	MARL	MARL	SAND	SAND	TILL	TILL
CMTD	CEMENTED	GNIS	GNEISS	MGRD	MEDIUM-GRAINED	SHLE	SHALE	UNKN	UNKNOWN TYPE
CONG	CONGLOMERATE	GRNT	GRANITE	MGVL	MEDIUM GRAVEL	SHLY	SHALY	VERY	VERY
CRYS	CRYSTALLINE	GRSN	GREENSTONE	MRBL	MARBLE	SHRP	SHARP	WBRG	WATER-BEARING
CSND	COARSE SAND	GRVL	GRAVEL	MSND	MEDIUM SAND	SHST	SCHIST	WDFR	WOOD FRAGMENTS
DKCL	DARK-COLOURED	GRWK	GREYWACKE	MUCK	MUCK	SILT	SILT	WTHD	WEATHERED
DLMT	DOLOMITE	GVLY	GRAVELLY	OBDN	OVERBURDEN	SLTE	SLATE		
DNSE	DENSE	GYPS	GYPSUM	PCKD	PACKED	SLTY	SILTY		
DRTY	DIRTY	HARD	HARD	PEAT	PEAT	SNDS	SANDSTONE		
DRY	DRY	HPAN	HARDPAN	PGVL	PEA GRAVEL	SNDY	SANDYOAPSTONE		

2. Core Color

Code	Description
WHIT	WHITE
GREY	GREY
BLUE	BLUE
GREN	GREEN
YLLW	YELLOW
BRWN	BROWN
RED	RED
BLCK	BLACK
BLGY	BLUE-GREY

3. Well Use

Code	Description	Code	Description
DO	Domestic	OT	Other
ST	Livestock	TH	Test Hole
IR	Irrigation	DE	Dewatering
IN	Industrial	MO	Monitoring
CO	Commercial	MT	Monitoring TestHole
MN	Municipal		
PS	Public		
AC	Cooling And A/C		
NU	Not Used		

4. Water Detail

Code	Description	Code	Description
FR	Fresh	GS	Gas
SA	Salty	IR	Iron
SU	Sulphur		
MN	Mineral		
UK	Unknown		

Appendix E

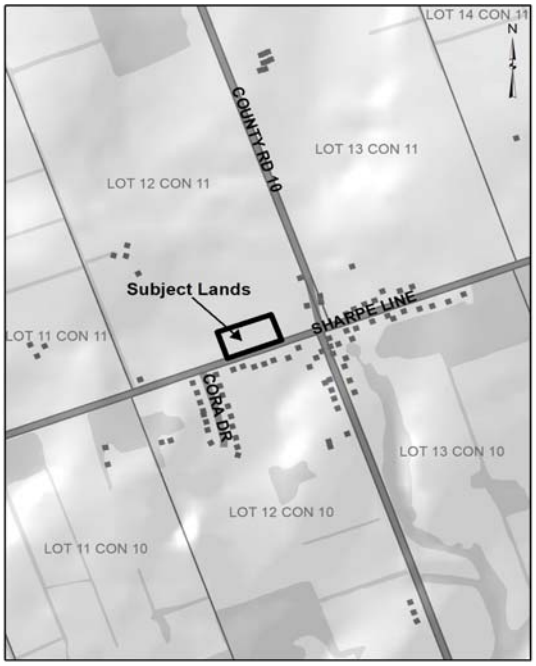
Well Survey Letter & Questionnaire

ORE
Oakridge Environmental Limited
Environmental and Hydrogeological Services

October 26, 2023
Reference #23-3349

Dear Homeowner or Occupant:

Oakridge Environmental Ltd. (ORE) has been commissioned to conduct a door-to-door well and septic survey in your area. The purpose of the survey is to obtain information about local water supply and septic system conditions. The information is being collected in accordance with provisions of the Ministry of the Environment, Conservation and Parks' (MECP's) Procedure D-5-5 guidelines for a neighbouring property looking to create five (5) new residential lots.



Your water supply and sewage system information is an important part of our study and is needed to ensure that we will have an accurate database. The information will be included in the hydrogeological study and will only be used for scientific purposes. Personal information (i.e., contact information) will not be disseminated and will only be utilized in the event we need to contact you directly.

We have a brief questionnaire that we can complete with you by telephone, fax, or e-mail (whichever is most convenient for you). A copy of the survey questionnaire is attached.

As part of the study, we will also be conducting well testing on the subject property, as shown on the enclosed location map. The testing is expected to take place in November 2023. While we do not anticipate any problems with neighbouring wells during the test period, we would like to provide you with our contact information (found at the end of this letter) in the event that you experience any interference with your water supply. Should you wish to have your well monitored during the testing, please contact our office. Please note, only a select number of representative wells will be monitored during the testing.

The success of our survey depends on obtaining accurate information. You are under no obligation to participate in our survey, however, if you are interested in participating please contact our office at your earliest convenience. We would appreciate receiving your response on or before November 6th, 2023.

If you have any questions, please feel free to contact our office at the contact information found below. We thank you for your time.

Chista Lemelin, BSc.
Oakridge Environmental Ltd.
647 Neal Drive, Suite 3
Peterborough, Ontario
K9J 6X7

Telephone: (705) 745-1181
1-888-OAKRIDGE (625-7434)
Fax: (705) 745-4163
1-877-796-7781
Email: christa@oakenv.com

WATER SUPPLY SUMMARY

For Office Use Only
By:_____
Project No:_____
MECP #:_____
Ref. No:_____

Township:_____
Hamlet/Town:_____
Lot:_____ Concession:_____
Well Owner:_____
Mailing Address:_____
Phone: _____ Date:_____
Type of Residence: (house, seasonal cottage, business, etc.)_____

WATER SUPPLY SOURCE

Dug Well: ❑ Drilled Well: ❑ Lake/River: ❑ Other:_____
Well Depth:_____ Diameter: _____
Well Construction:_____
Well Drilled by: _____Date:_____

WATER QUANTITY

Never Dry: ❑ Occasionally Dry: ❑ Often Dry: ❑ Last Date:_____
Ever hauled water? _____ Last Date:_____ Contractor:_____

WATER QUALITY

Odour Problems (describe):_____
Taste Problems (describe):_____
Turbidity Problems (describe):_____
Staining (describe):_____
Bacteria Problems (describe): _____
Other:_____
Ever had water sampled? Bacteria? ❑ Chemical? ❑ Last Date:_____

WATER TREATMENT

Water Softener:_____
Chlorinator:_____
Filter:_____
Other:_____

More on reverse...

PROPERTY AND WATER USE

Lot Size:_____ No. of Washrooms:_____ No. of Bedrooms:_____

No. of Fixture Units:_____

SEWAGE DISPOSAL

Tile Bed: Raised: ❑ In-ground: ❑

Problems: Odours: ❑ Breakouts: ❑ No problems: ❑

System Age:_____ Constructed By:_____

Distance to Well:_____ Direction: (eg. Upgradient) _____

Distance to Building:_____

PROPERTY SKETCH

(showing house, well, and tile bed locations)

Are you interested in having your well monitored during any well testing as part of our study (please circle one)?

Yes No

Please note, there is no cost to you to participate. Only representative, accessible wells (complying with the current well regulations) can be monitored as part of any testing program. Please contact our office if you require further details.

Appendix F

Shallow Groundwater Level Data

Shallow Aquifer Water Levels

	TP-17-2	TP-17-3	TP-17-4	TP-17-6	TP-17-8	W-1	W-2	W-3
Easting	701248	701127.3	701088.8	701168.2	701234.1	701300.7	701149.5	701174.1
Northing	4899868	4899816	4899774	4899804	4899829	4899924	4899731	4899742
Elevation	279.53	282.9463	283.5906	281.7094	279.6613	278.6231	281.93	281.3794
Stick-up (m)	0.61	0.46	0.37	0.53	0.31	0.26	0.33	0.25
Depth (m btoc)	3.024	2.785	3.03	2.965	2.962	6.04	8.317	5.335
2017-11-02		2.625		2.595	2.125			
2017-11-07	1.49	1.785	1.205	1.66	1.605			
2017-11-15	1.69	1.95	1.365	1.745	1.665			
2017-11-24	1.553	1.868	1.245	1.75	1.695			
2018-05-01	1.56	1.9	1.325	1.7885	1.755			
2020-09-08						2.748	3.683	
2020-10-23	1.63	2.328	1.23	1.635				
2022-06-23	1.295	1.984	1.617	1.875				
2023-12-11	1.18	1.75	1.1	1.66				
2024-01-29		1.815	1.05	1.65				0.925
2024-01-30[(a)]		1.81	1.015	1.64				0.925
2024-01-30[(b)]		1.81	1.015	1.625				0.915
2024-01-30[(b)]		1.81	1.015	1.625				0.92
2024-01-30[(b)]		1.81	1.015	1.62				2.39
2024-01-30[(b)]		1.81	1.015	1.625				
2024-01-30[(b)]		1.81	1.015	1.625				
2024-01-30[(c)]		1.815	1.02	1.625				1.07
2024-02-07		1.865	1.26	1.67				0.975
MEAN	1.485429	1.914412	1.156688	1.730206	1.769	2.748	3.683	1.16
MAX	1.69	2.625	1.617	2.595	2.125	2.748	3.683	2.39
MIN	1.18	1.75	1.015	1.62	1.605	2.748	3.683	0.915

All water level measurements referenced to the top of casing (toc)

Pumping test of TW-3 was conducted from 9:15 to 15:15 on January 30, 2024

(a) Water level measured prior to TW-3 pumping test

(b) Water levels measured during TW-3 pumping test

(c) Water levels measured after TW-3 pumping test and one hour recovery period was completed

Appendix G

Test Well Records

Ontario — Ministry of the Environment and Climate Change

Measurements recorded in: ☐ Metric ☐ Imperial

Well Tag No. *(Place Sticker and/or Print Below)*: Tag#: A 239731

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
	McCAMUS. FARMS.		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. *(inc. area code)*
1910 COUNTY. RD 10	PETERBOROUGH.	ONT.		

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
1910 COUNTY. ROAD 10	CAVAN.	12	11.

County/District/Municipality	City/Town/Village	Province	Postal Code
PETERBOROUGH.	IDA.	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 8 3	17	701288	4899977		

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
BLACK	TOPSOIL			0	1
BROWN	CLAY.	SAND, STONES.		1	42.
GREY	CLAY.			42	90
GREY	SANDY, CLAY.			90	184.
BROWN	SAND. CLAY.			184.	190
BROWN	SAND.			190	195.

Annular Space

Depth Set at (m/ft) From	Depth Set at (m/ft) To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0	20	2 bgs. 3/8 hole plug	
		1 barrel. quick grout mix	

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	188W	0	190

Construction Record - Screen

Inside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To
5¼.	S. STEEL.	10	188	195.

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 (m/ft)	Gas	Kind of Water	Other, specify
185	☐	☑ Fresh ☑ Untested	
	☐	☐ Fresh ☐ Untested	
	☐	☐ Fresh ☐ Untested	

Hole Diameter

Depth (m/ft) From	Depth (m/ft) To	Diameter (cm/in)
0	195	6¼.

Results of Well Yield Testing

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

If pumping discontinued, give reason: ____

Pump intake set at (m/ft): 180'

Pumping rate (l/min / GPM): 5 G.P.M.

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 161-3

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

Recommended pump depth (m/ft): 180'

Recommended pump rate (l/min / GPM): 5 G.P.M.

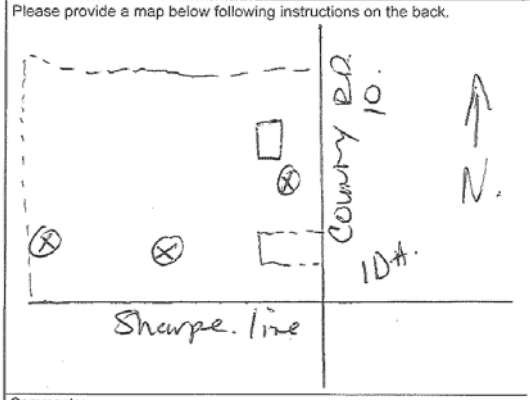
Well production (l/min / GPM): 8 G.P.M

Disinfected? ☑ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	94.5.		
1	115.4.	1	156-4
2	118.3	2	152
3	120-4	3	147-5
4	123-3	4	143
5	125.	5	140
10	133-7	10	123
15	138-8	15	
20	144-1	20	107-7
25	148-6	25	
30	151-6	30	100-4
40	154-9	40	97-3
50	156-5.	50	95-8
60	161-3	60	95-1

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.
BURGESS WELL DRILLING.	1455.

Business Address (Street Number/Name)	Municipality
467 EMILY. PARK. RD	Omemee

Province	Postal Code	Business E-mail Address
ONT.	K0L2W0	

Bus. Telephone No. *(inc. area code)*	Name of Well Technician (Last Name, First Name)
705 799 5871	WHITNELL - DAN.

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
		2018 01 30

Well owner's information package delivered ☑ Yes ☐ No

Date Package Delivered: 2018 01 30

Date Work Completed: 2018 01 05

Ministry Use Only

Audit No. Z266041

Received APR 26 2018

506E (2014/11)

Ministry's Copy

Ontario — Ministry of the Environment and Climate Change

Measurements recorded in: ☐ Metric ☐ Imperial

Well Tag No. *(Place Sticker and/or Print Below)*: Tag#: A 239733

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
	McCAMUS. FARMS.		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. *(inc. area code)*
910 COUNTY. RD 10	PETERBOROUGH	ONT		

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
910 COUNTY. RD. 10	CAVAN.	12	11

County/District/Municipality	City/Town/Village	Province	Postal Code
PETERBOROUGH.	IDA.	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 8 3	17	701221	4899862		

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
BROWN	CLAY, STONES.			0	58
GREY	CLAY	STONES.		58	102
GREY	CLAY	FINE SAND		102	175.
BROWN	COARSE SAND.			175	180

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used *(Material and Type)*	Volume Placed (m^3/ft^3)
0	20	3/8 hole plug	
		1 barrel. quick grout	
		Dry. quick grout.	

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
6 1/4	STEEL	188W	0	176

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

Inside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To
5 1/4	S.STEEL	10	172	180

Water Details

Water found at Depth (m/ft)	Kind of Water	Hole Diameter Depth From	Depth To	Diameter (cm/in)
75-180 ☐ Gas	☑ Fresh ☐ Untested ☐ Other, *specify* ____	0	180	6 1/4
Water found at Depth (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify* ____			
Water found at Depth (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify* ____			

Results of Well Yield Testing

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

If pumping discontinued, give reason:

Pump intake set at (m/ft): 170

Pumping rate (l/min / GPM): 56. D.M.

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 131-3

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

Recommended pump depth (m/ft): 170

Recommended pump rate (l/min / GPM): 56. D.M.

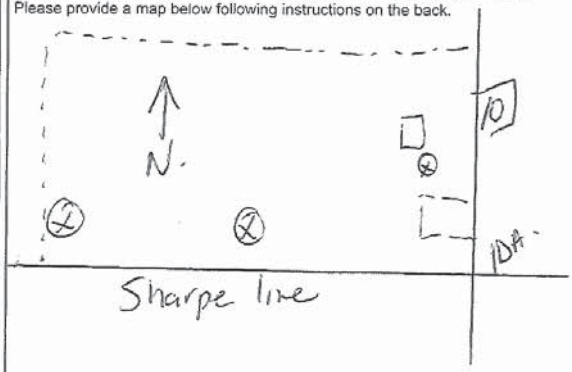
Well production (l/min / GPM): 16. D.M.

Disinfected? ☑ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	99-5		
1		1	128-8
2		2	126-5
3	112-	3	124-4
4	114-5	4	122-4
5	115-9	5	120-4
10	121-9	10	113-4
15	125	15	107-6
20	127-2	20	105-6
25	128-8	25	103-5
30	129-6	30	102-2
40	103-7	40	100-6
50	131-3	50	100
60	131-3	60	99-6

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.
Wm. BURGESS well Drilling	1455

Business Address (Street Number/Name)	Municipality
467 EMILY PARK RD	OMEMEE

Province	Postal Code	Business E-mail Address
ONT.	K0L2W0	

Business Telephone No. *(inc. area code)*	Name of Well Technician (Last Name, First Name)
705 799 5870	Whitnell Brad.

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
1866		2018 01 30

Well owner's information package delivered	Date Package Delivered	Ministry Use Only
☐ Yes ☐ No	2018 01 30	Audit No. Z266042
	Date Work Completed: 2018 01 17	Received APR 26 2018

508E (2014/11)

Ministry's Copy

Ontario — Ministry of the Environment and Climate Change

Measurements recorded in: ☐ Metric ☐ Imperial

Well Tag No. (Place Sticker and/or Print Below) Tag#: A 239730

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
	McCANNS. FARMS.		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
1910 COUNTY. RD. 10	PETERBOROUGH	ONT.		

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
910 County. RD. 10	CAVAN.	12	11.

County/District/Municipality	City/Town/Village	Province	Postal Code
PETERBOROUGH.	1DA.	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 8 3	17	701076	4899810		

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
BROWN	CLAY	STONES -		1	60
GREY	CLAY	BOULDERS, STONE.		60	80
GREY	CLAY, SAND.			80	180
BROWN	SAND		COARSE	180	185.

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0	20	3/8 hole plug.	2 bgs.
		quick grout mix	1 barrel.
		1 bg dry top.	1 bg.

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)	Well Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6 1/4	STEEL	188W	0	185

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	Depth (m/ft) To
5 1/4	S. STEEL	10	182	188

Water Details

Water found at Depth (m/ft)	Kind of Water: ☐ Fresh ☐ Untested ☐ Gas ☐ Other, specify
Water found at Depth (m/ft)	Kind of Water: ☐ Fresh ☐ Untested ☐ Gas ☐ Other, specify
Water found at Depth (m/ft)	Kind of Water: ☐ Fresh ☐ Untested ☐ Gas ☐ Other, specify

Hole Diameter

Depth (m/ft) From	Depth (m/ft) To	Diameter (cm/in)
0	188	6 1/4

Results of Well Yield Testing

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

If pumping discontinued, give reason:

Pump intake set at (m/ft): 180

Pumping rate (l/min / GPM): 56, P.M.

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 155

If flowing give rate (l/min / GPM)

Recommended pump depth (m/ft): 180

Recommended pump rate (l/min / GPM): 56, P.M

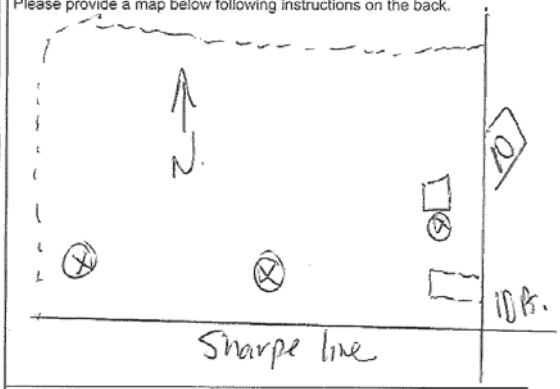
Well production (l/min / GPM): 56, P.M

Disinfected? ☑ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	114-4			
1			1	150-6
2	123-6		2	148
3	127-1		3	145
4	130		4	142-1
5	132-4		5	139-7
10			10	130-2
15	148-6		15	124-2
20	149-6		20	120-3
25	151-9		25	118-6
30	152-5		30	116-6
40	154		40	115-1
50	154-7		50	114-7
60	155		60	114-4

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.
BURGESS WELL Drilling	1455

Business Address (Street Number/Name)	Municipality
467 EMILY PARK RD.	Omemee

Province	Postal Code	Business E-mail Address
ONT.	K0L2W0	

Business Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
705 799 5871	Cuthbertell - Dan

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
		2018/01/30

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☑ Yes ☐ No	2018/01/29	2018/01/26

Ministry Use Only

Audit No. Z266043

APR 26 2018

Received

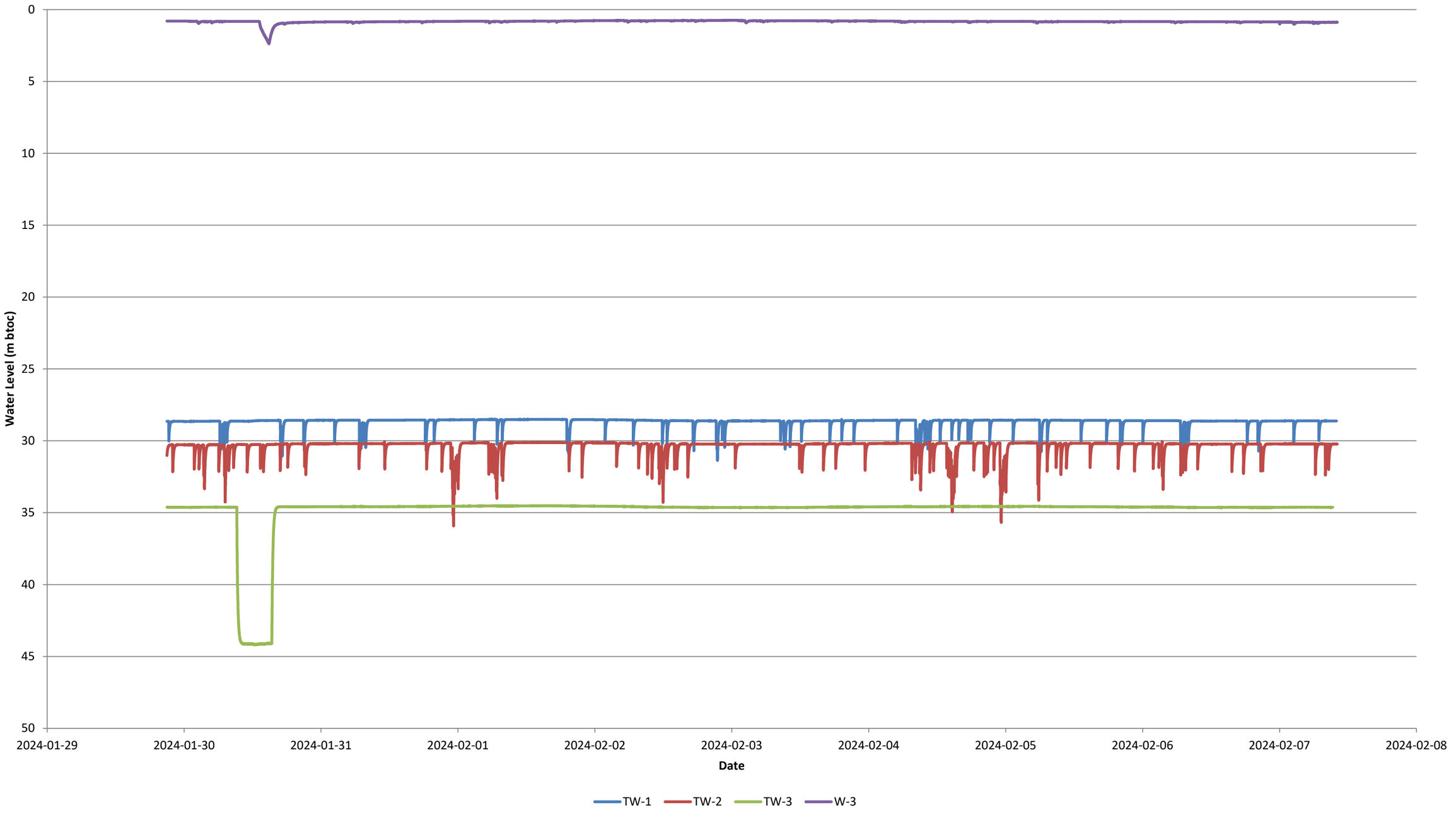
506E (2014/11)

Ministry's Copy

Appendix H

Monitoring Period Hydrograph and
Pumping Test Data

Monitoring Period Hydrograph
(January 29, 2024 to February 8, 2024)



Oakridge Environmental Ltd.
647 Neal Drive, Suite #3
Peterborough, Ontario
K9J 6X7
ore@oakenv.com

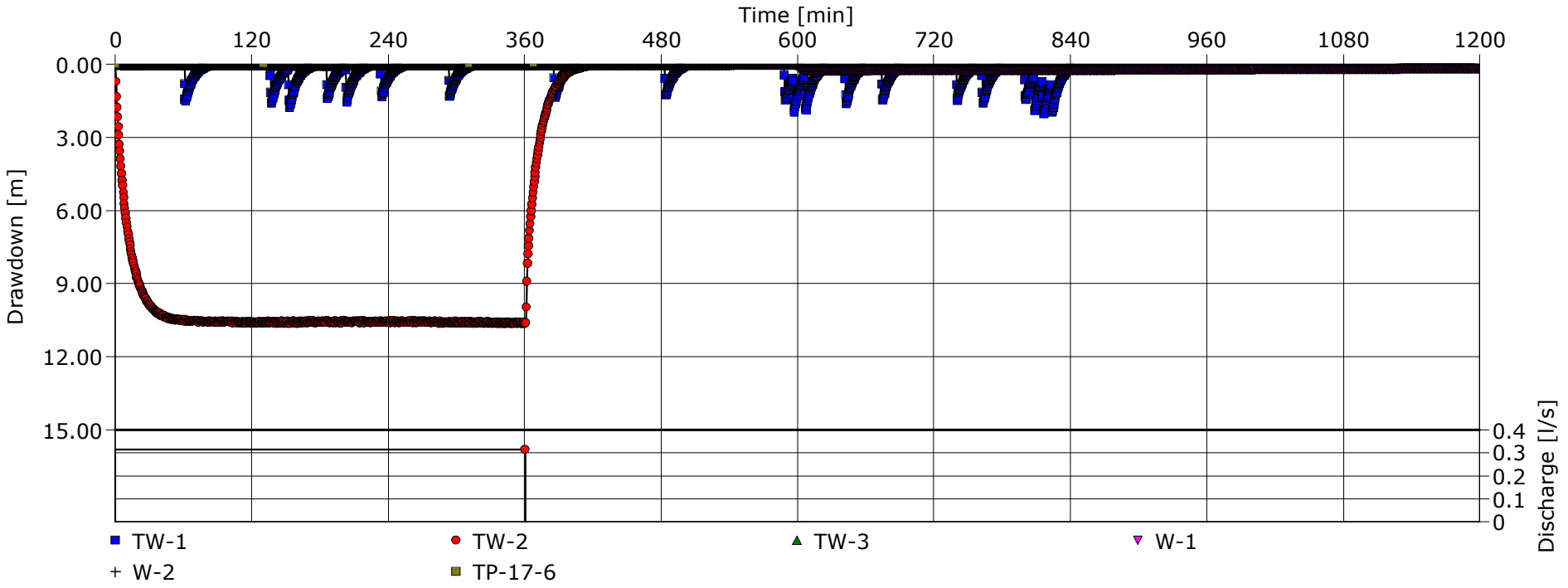
Pumping Test Analysis Report

Project: Ida Subdivision

Number: 20-2810

Client: McCamus

Location: Ida, Ontario	Pumping Test: TW-2	Pumping Well: TW-2
Test Conducted by: MD		Test Date: 2020-09-09
Analysis Performed by: DM/BK	TW-2, Time-Drawdown (all wells)	Analysis Date: 2021-06-17
Aquifer Thickness: 1.00 m	Discharge: variable, average rate 0.3155 [l/s]	



Oakridge Environmental Ltd.
647 Neal Drive, Suite #3
Peterborough, Ontario
K9J 6X7
ore@oakenv.com

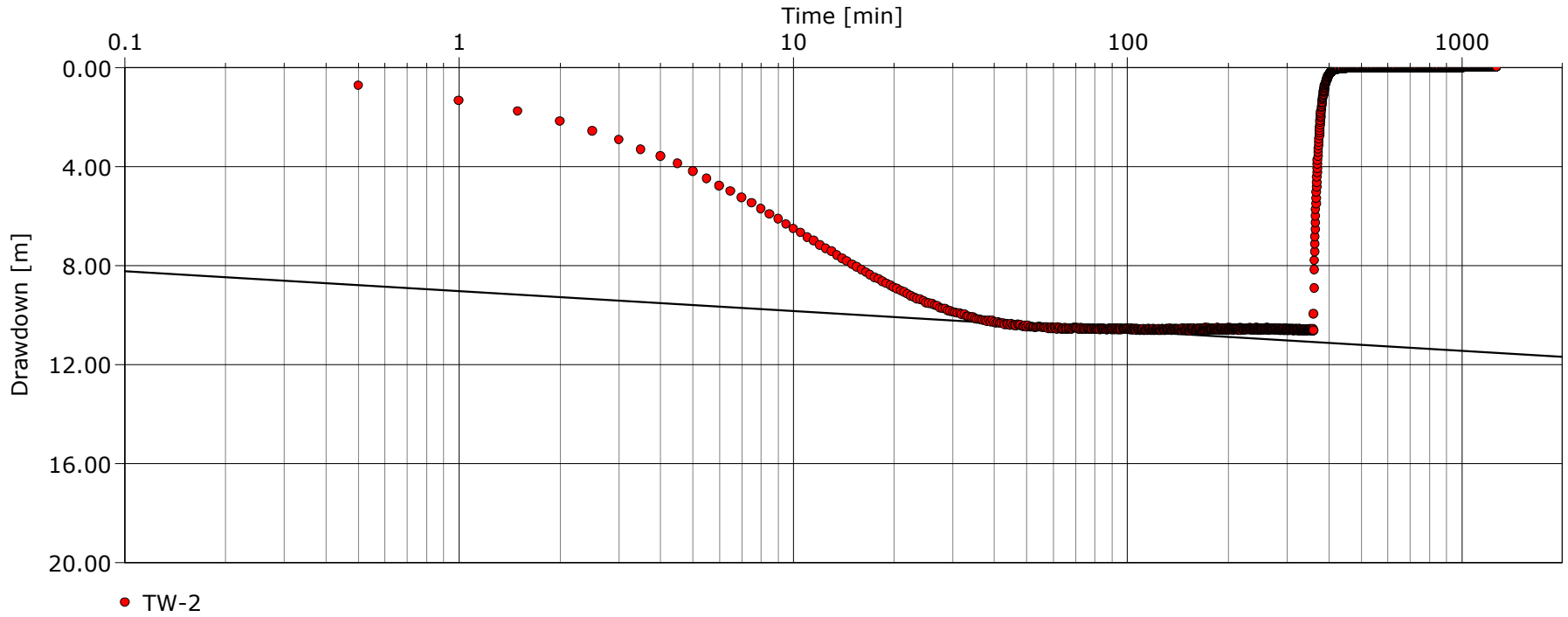
Pumping Test Analysis Report

Project: Ida Subdivision

Number: 20-2810

Client: McCamus

Location: Ida, Ontario	Pumping Test: TW-2	Pumping Well: TW-2
Test Conducted by: MD		Test Date: 2020-09-09
Analysis Performed by: DM/BK	TW-2, Cooper-Jacob (pumped well)	Analysis Date: 2021-06-16
Aquifer Thickness: 1.00 m	Discharge: variable, average rate 0.3155 [l/s]	



Calculation using COOPER & JACOB

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Storage coefficient	Radial Distance to PW [m]	
TW-2	6.20×10^{0}	6.20×10^{0}		0.08	

Oakridge Environmental Ltd.
647 Neal Drive, Suite #3
Peterborough, Ontario
K9J 6X7
ore@oakenv.com

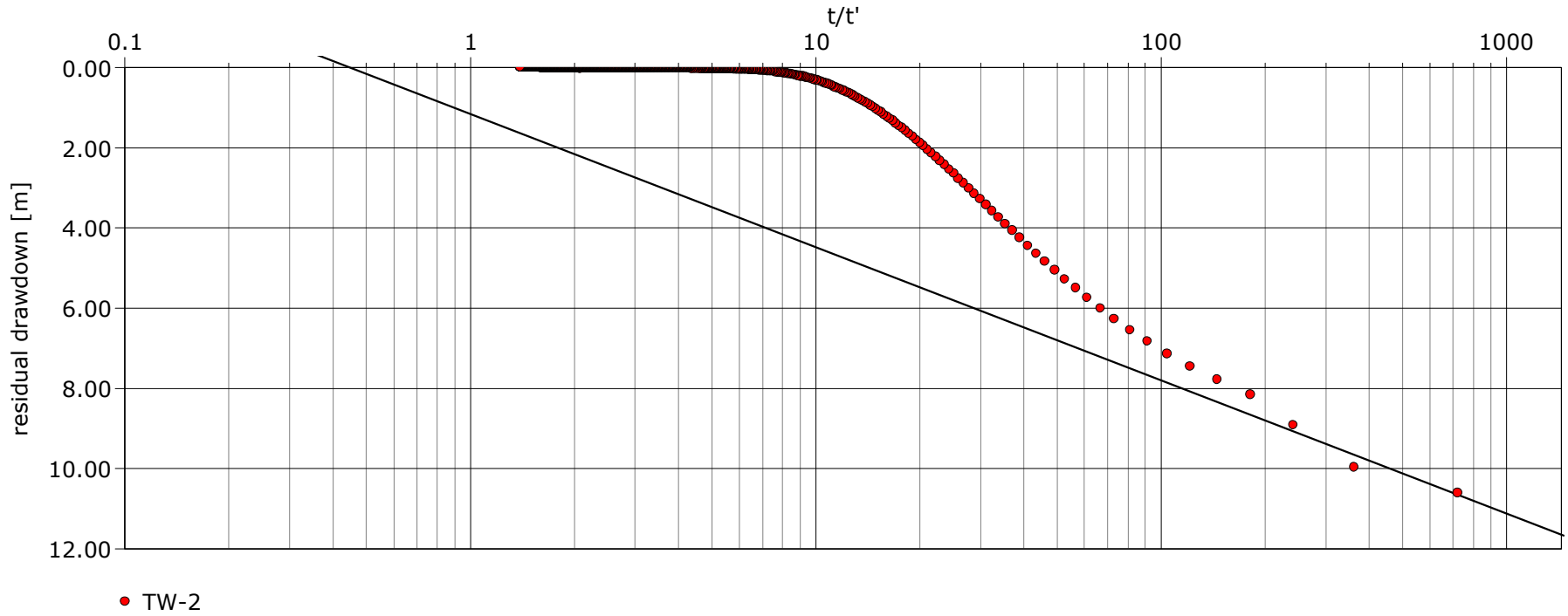
Pumping Test Analysis Report

Project: Ida Subdivision

Number: 20-2810

Client: McCamus

Location: Ida, Ontario	Pumping Test: TW-2	Pumping Well: TW-2
Test Conducted by: MD		Test Date: 2020-09-09
Analysis Performed by: DM/BK	TW-2, Theis Recovery (pumped well)	Analysis Date: 2024-04-12
Aquifer Thickness: 1.00 m	Discharge: variable, average rate 0.3155 [l/s]	



Calculation using THEIS & JACOB

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Radial Distance to PW [m]
TW-2	1.50×10^{0}	1.50×10^{0}	0.08

Oakridge Environmental Ltd.
647 Neal Drive, Suite #3
Peterborough, Ontario
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ore@oakenv.com

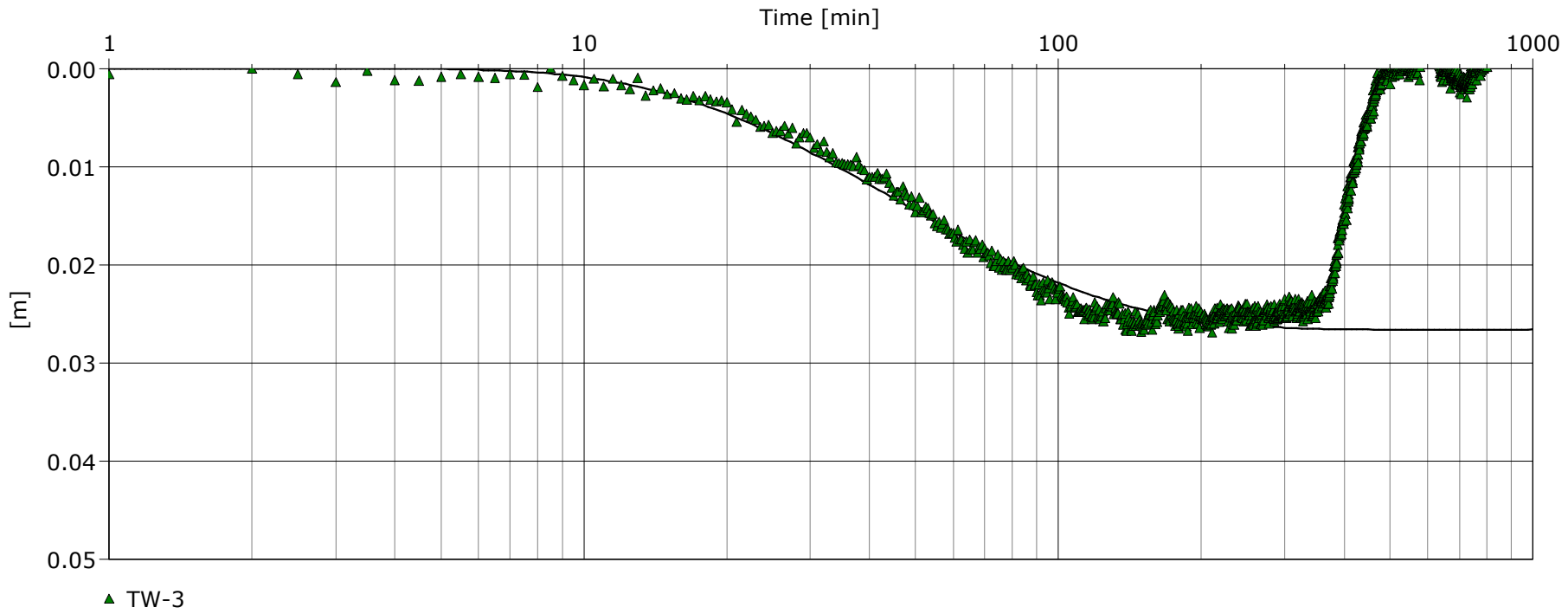
Pumping Test Analysis Report

Project: Ida Subdivision

Number: 20-2810

Client: McCamus

Location: Ida, Ontario	Pumping Test: TW-2	Pumping Well: TW-2
Test Conducted by: MD		Test Date: 2020-09-09
Analysis Performed by: DM/BK	TW-2, Hantush (Leaky Aquifer) - TW-3 Obs	Analysis Date: 2020-09-22
Aquifer Thickness: 1.00 m	Discharge: variable, average rate 0.3155 [l/s]	



Calculation using Hantush

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Storage coefficient	Hydr. resistance [min]	Leakage factor [m]	Radial Distance to PW [m]	
TW-3	6.00×10^{1}	6.00×10^{1}	1.65×10^{-4}	5.00×10^{5}	1.44×10^{2}	158.26	

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647 Neal Drive, Suite #3
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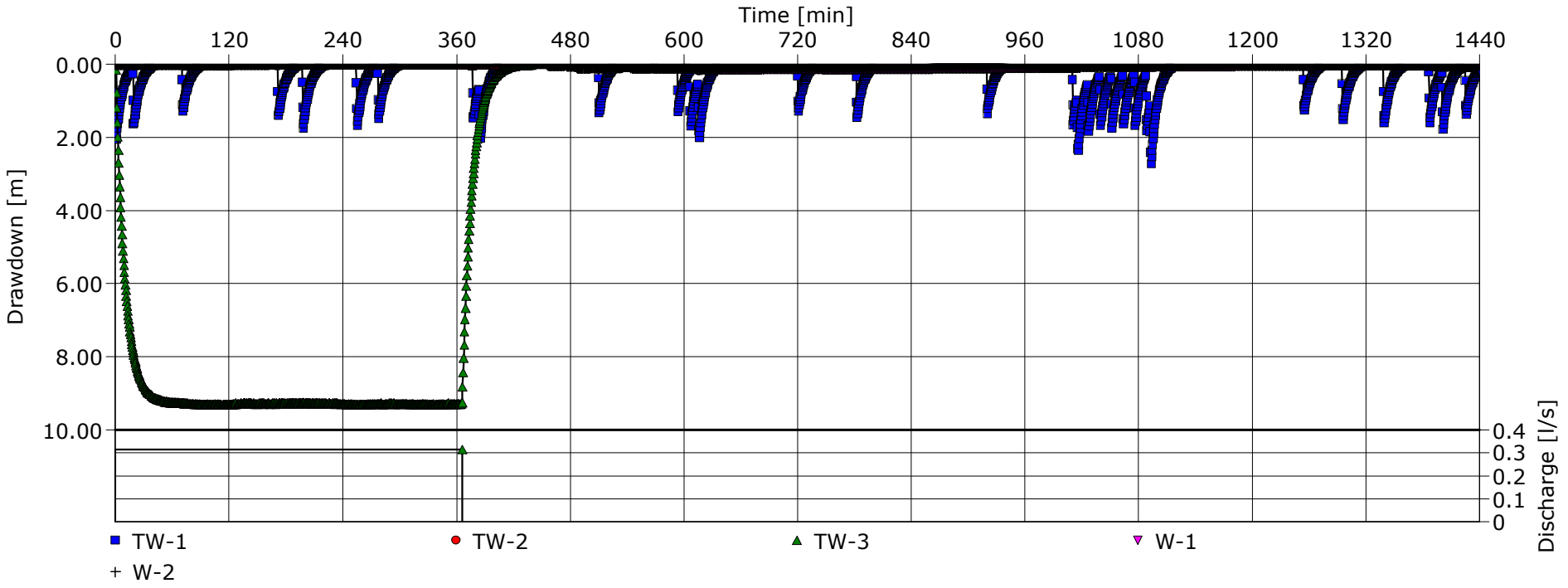
Pumping Test Analysis Report

Project: Ida Subdivision

Number: 20-2810

Client: McCamus

Location: Ida, Ontario	Pumping Test: TW-3 (2020)	Pumping Well: TW-3
Test Conducted by: DRM		Test Date: 2020-09-10
Analysis Performed by: DM/BK	TW-3 (2020) Time-Drawdown (all wells)	Analysis Date: 2020-09-22
Aquifer Thickness: 1.00 m	Discharge: variable, average rate 0.3155 [l/s]	



Oakridge Environmental Ltd.
647 Neal Drive, Suite #3
Peterborough, Ontario
K9J 6X7
ore@oakenv.com

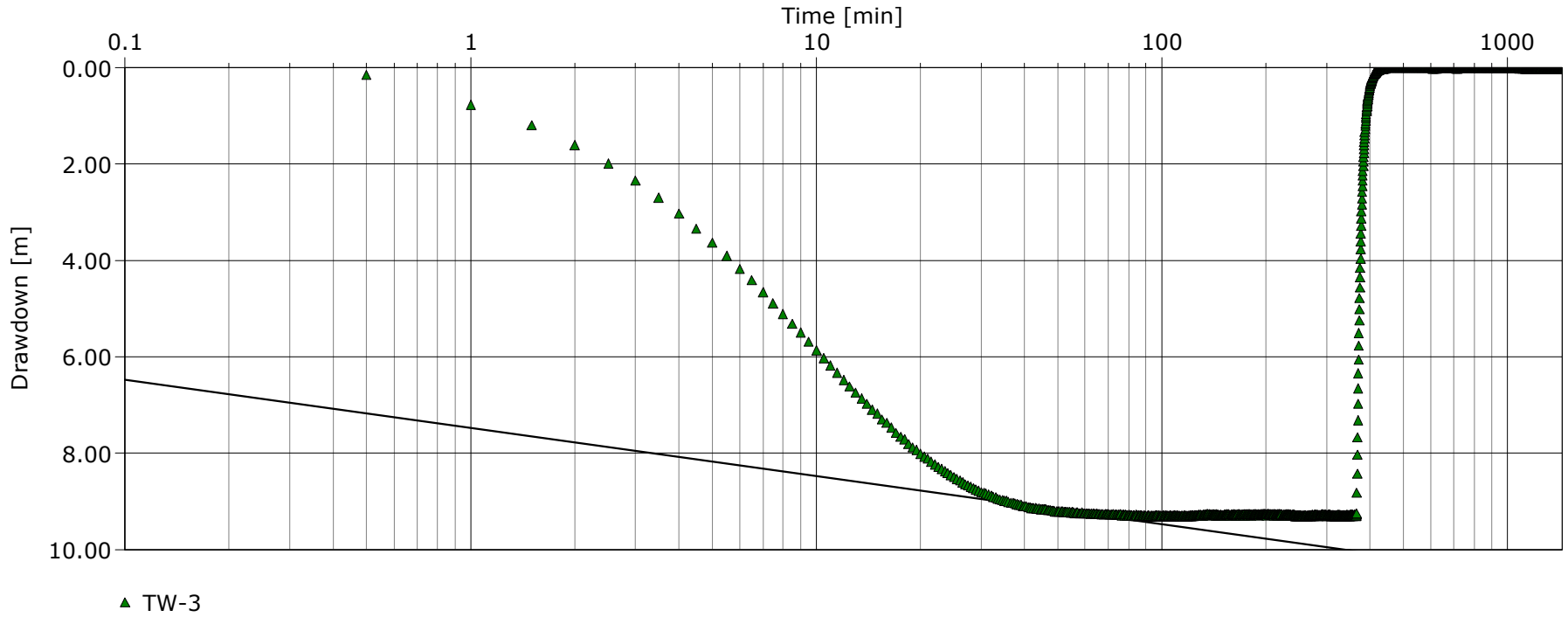
Pumping Test Analysis Report

Project: Ida Subdivision

Number: 20-2810

Client: McCamus

Location: Ida, Ontario	Pumping Test: TW-3 (2020)	Pumping Well: TW-3
Test Conducted by: DRM		Test Date: 2020-09-10
Analysis Performed by: DM/BK	TW-3 (2020), Cooper-Jacob (pumped well)	Analysis Date: 2024-04-12
Aquifer Thickness: 1.00 m	Discharge: variable, average rate 0.3155 [l/s]	



Calculation using COOPER & JACOB

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Storage coefficient	Radial Distance to PW [m]	
TW-3	5.00×10^{0}	5.00×10^{0}		0.08	

Oakridge Environmental Ltd.
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Peterborough, Ontario
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ore@oakenv.com

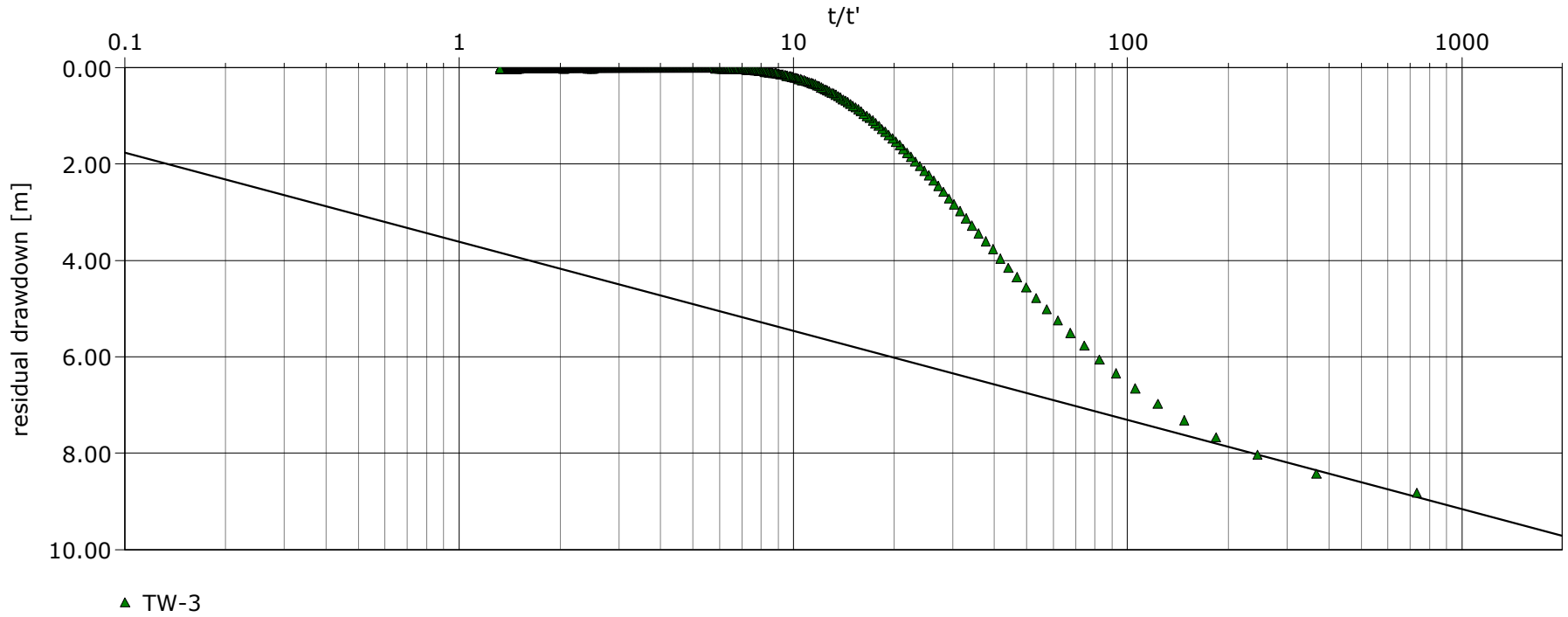
Pumping Test Analysis Report

Project: Ida Subdivision

Number: 20-2810

Client: McCamus

Location: Ida, Ontario	Pumping Test: TW-3 (2020)	Pumping Well: TW-3
Test Conducted by: DRM		Test Date: 2020-09-10
Analysis Performed by: DM/BK	TW-3 (2020), Theis Recovery (pumped well)	Analysis Date: 2024-04-12
Aquifer Thickness: 1.00 m	Discharge: variable, average rate 0.3155 [l/s]	



Calculation using THEIS & JACOB

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Radial Distance to PW [m]
TW-3	2.70×10^{0}	2.70×10^{0}	0.08

Oakridge Environmental Ltd.
647 Neal Drive, Suite #3
Peterborough, Ontario
K9J 6X7
ore@oakenv.com

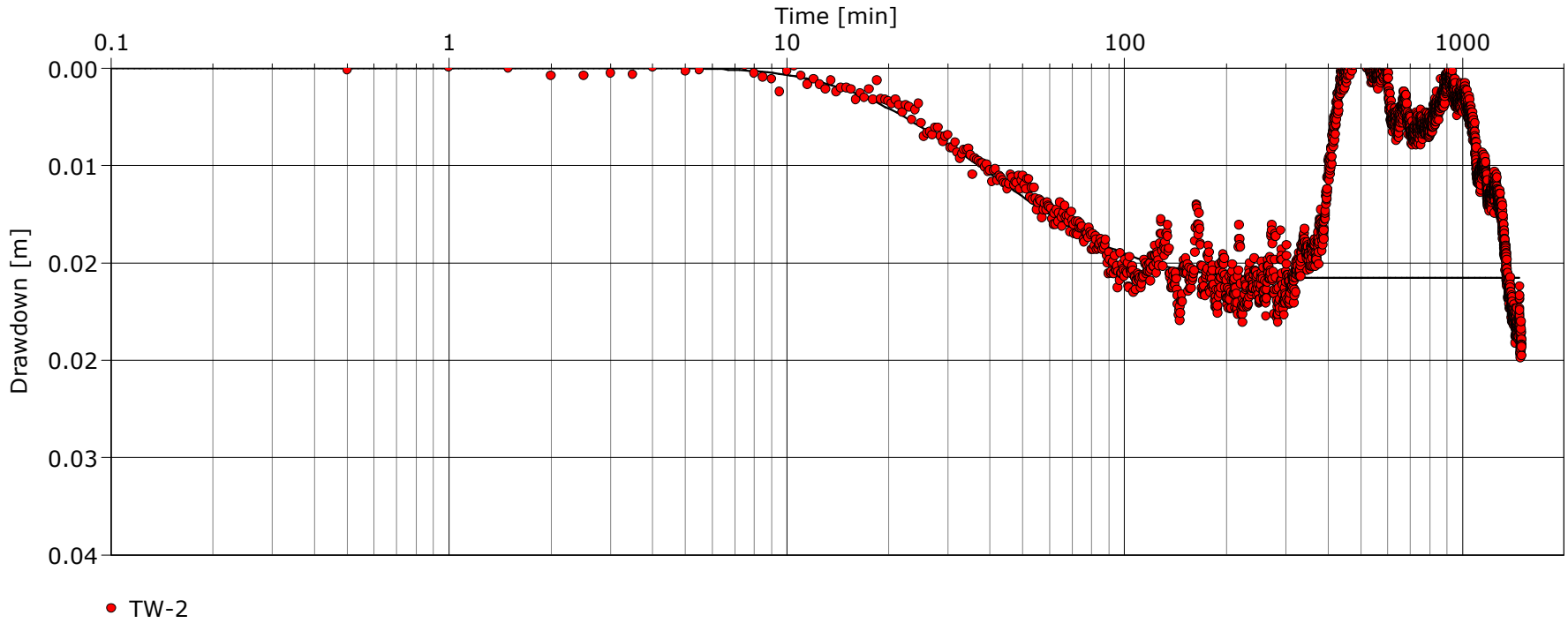
Pumping Test Analysis Report

Project: Ida Subdivision

Number: 20-2810

Client: McCamus

Location: Ida, Ontario	Pumping Test: TW-3 (2020)	Pumping Well: TW-3
Test Conducted by: DRM		Test Date: 2020-09-10
Analysis Performed by: DM/BK	TW-3 (2020), Hantush (TW-2 obs well)	Analysis Date: 2024-04-12
Aquifer Thickness: 1.00 m	Discharge: variable, average rate 0.3155 [l/s]	



Calculation using Hantush

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Storage coefficient	Hydr. resistance [min]	Leakage factor [m]	Radial Distance to PW [m]	
TW-2	6.20×10^{1}	6.20×10^{1}	1.90×10^{-4}	3.00×10^{5}	1.14×10^{2}	158.26	

Oakridge Environmental Ltd.
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Peterborough, Ontario
K9J 6X7
ore@oakenv.com

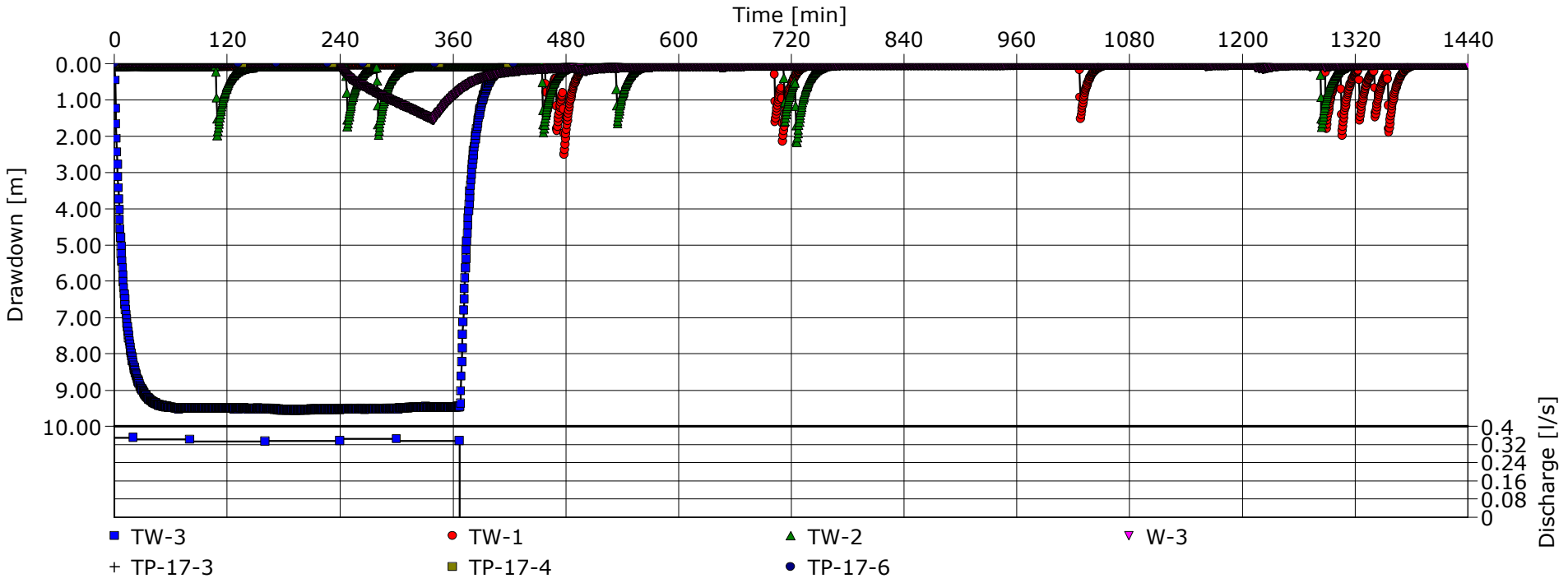
Pumping Test Analysis Report

Project: McCamus Ida

Number: 23-3349

Client: B. McCamus

Location: Cavan Monaghan	Pumping Test: Part Lot 10, Concession 11	Pumping Well: TW-3
Test Conducted by: ORE		Test Date: 2024-01-30
Analysis Performed by: DM/BK	Time-Drawdown (all wells)	Analysis Date: 2024-02-12
Aquifer Thickness: 1.00 m	Discharge: variable, average rate 0.33914 [l/s]	



Oakridge Environmental Ltd.
647 Neal Drive, Suite #3
Peterborough, Ontario
K9J 6X7
ore@oakenv.com

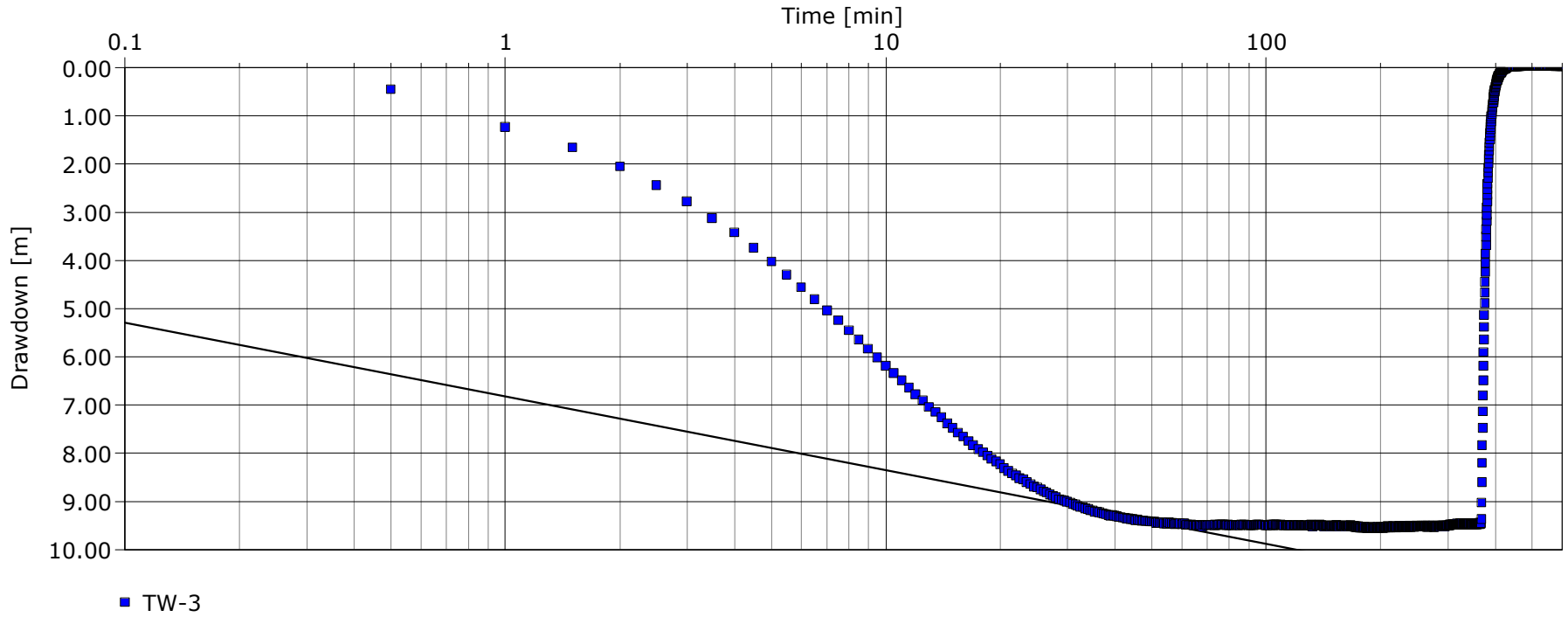
Pumping Test Analysis Report

Project: McCamus Ida

Number: 23-3349

Client: B. McCamus

Location: Cavan Monaghan	Pumping Test: Part Lot 10, Concession 11	Pumping Well: TW-3
Test Conducted by: ORE		Test Date: 2024-01-30
Analysis Performed by: DM/BK	Cooper-Jacob (pumped well)	Analysis Date: 2024-04-12
Aquifer Thickness: 1.00 m	Discharge: variable, average rate 0.33914 [l/s]	



Calculation using COOPER & JACOB

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Storage coefficient	Radial Distance to PW [m]	
TW-3	3.50×10^{0}	3.50×10^{0}		0.08	

Oakridge Environmental Ltd.
647 Neal Drive, Suite #3
Peterborough, Ontario
K9J 6X7
ore@oakenv.com

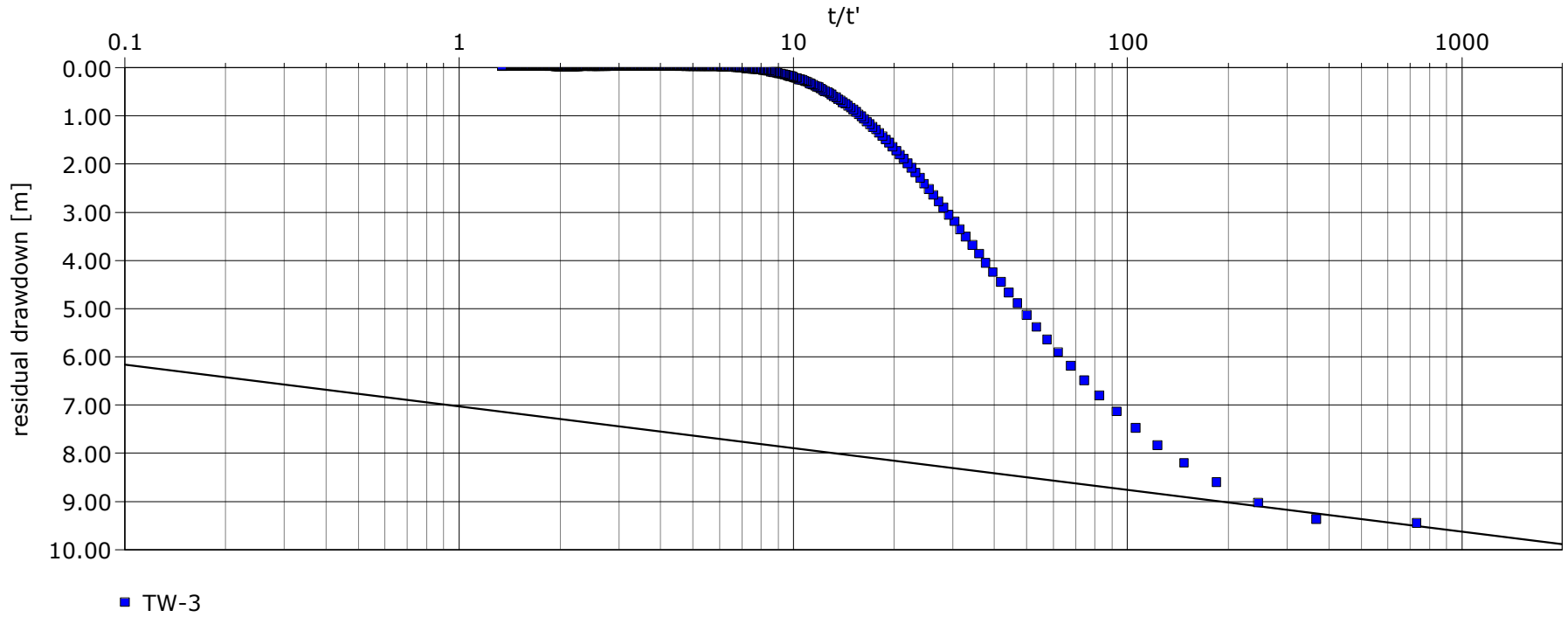
Pumping Test Analysis Report

Project: McCamus Ida

Number: 23-3349

Client: B. McCamus

Location: Cavan Monaghan	Pumping Test: Part Lot 10, Concession 11	Pumping Well: TW-3
Test Conducted by: ORE		Test Date: 2024-01-30
Analysis Performed by: DM/BK	Theis Recovery (pumped well)	Analysis Date: 2024-04-12
Aquifer Thickness: 1.00 m	Discharge: variable, average rate 0.33914 [l/s]	

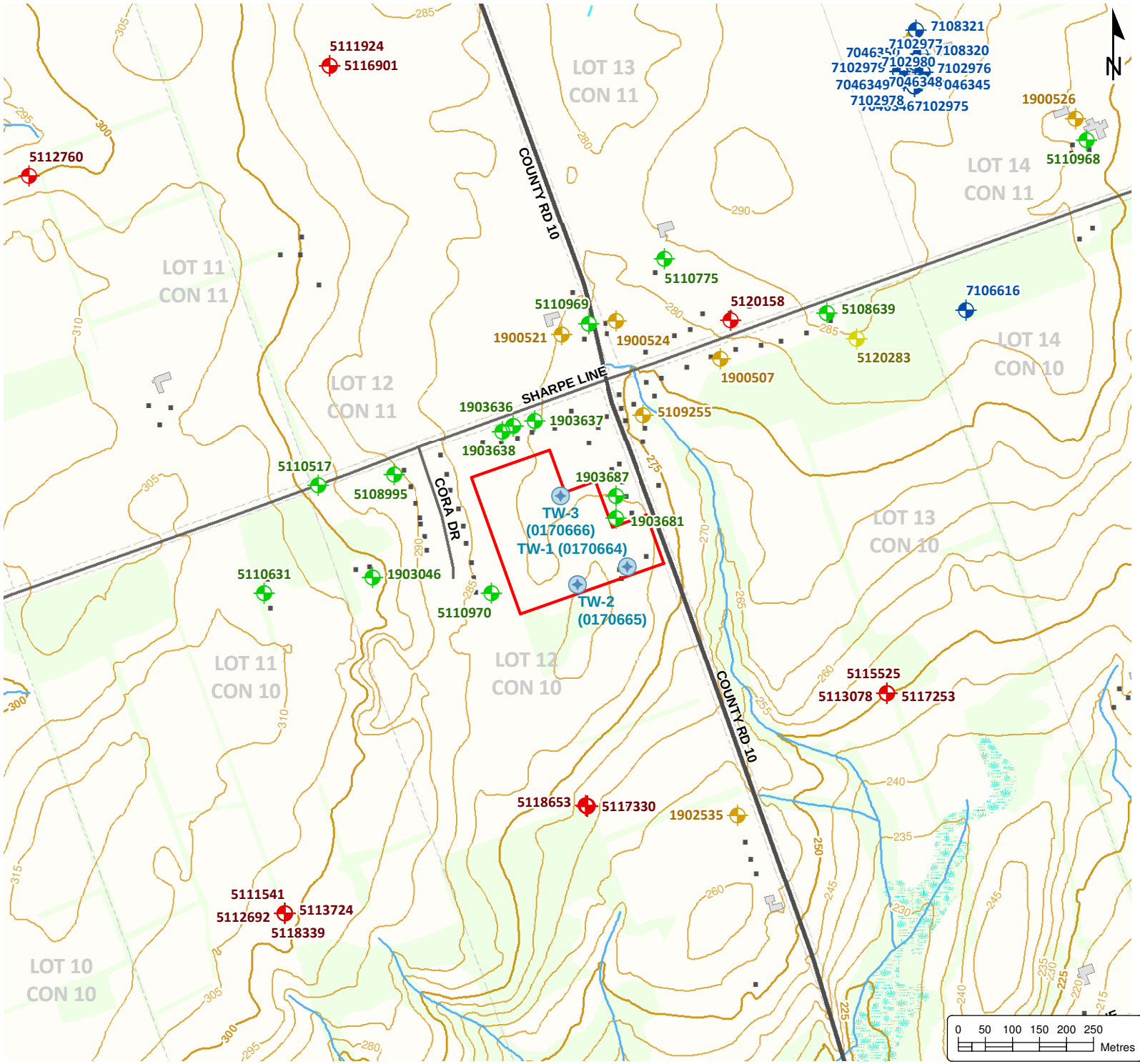


Calculation using THEIS & JACOB

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Radial Distance to PW [m]
TW-3	6.20×10^{0}	6.20×10^{0}	0.08

Appendix I

Cameron Subdivision Well No. 7236970 Data



HYDROGEOLOGICAL ASSESSMENT

IAN CAMERON
1844 County Road 10,
Ida, Ontario

LEGEND

- Test Well

Water Well (MOE Position Accuracy)

- 10-30m
- 30-100m
- 100-300m
- Unknown
- From Lot Centroid
- Site Plan Subdivision Boundary
- Building
- Large Building
- Major Road
- Minor Road
- Watercourse, Permanent
- Watercourse, Intermittent
- Contour (index)
- Contour (5m)
- Lot
- Wetland Area
- Wooded Area

Notes:
- Base mapping features are © Queen's Printer of Ontario, 2010 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

CAMBIUM
P.O. Box 325, 52 Hunter Street East
Peterborough, Ontario, K9H 1G5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

WELL LOCATION PLAN

Project No.: 3751-001		Date: December 2014	
		Rev.:	
Scale: 1:10,000		Projection: NAD 1983 UTM Zone 17N	
Created by: NLB	Checked by: KDW	Figure:	3

Ontario Ministry of the Environment

Well Tag No. Tag #: A170666

A170666

Well Record

Regulation 903 Ontario Water Resources Act

Measurements recorded in: ☐ Metric ☒ Imperial

Page ____ of ____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
Ian	Cameron		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
1844 Cty Rd 10	Cavan	Ontario	L0A 1C0	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
1844 Cty Rd 10	Cavan Monaghan	pt lt 12	10

County/District/Municipality	City/Town/Village	Province	Postal Code
Peterborough	Ida	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 8 3	17	701264	4899626		

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
Black	Topsoil			0	2
Brown	Sandy Clay	Gravel		2	7
Grey	Sand	Clay, Gravel Boulders		7	26
Grey	Silty Clay			26	136
Grey	Sand	Silt	fine	136	156
Grey	Sand		water bearing	156	196

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0	20	Holeplug	

Method of Construction

☐ Cable Tool ☐ Diamond ☐ Rotary (Conventional) ☐ Jetting ☐ Rotary (Reverse) ☐ Driving ☐ Boring ☐ Digging ☐ Air percussion ☐ Other, specify dual 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
6¼"	steel	.188w	+2.5	192

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No	Depth (m/ft) From	To
6"	Ssteel	12	192	196

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 (m/ft)	Kind of Water	Gas	Other, specify
192 196	☒ Fresh ☐ Untested	☐	
	☐ Fresh ☐ Untested	☐	
	☐ Fresh ☐ Untested	☐	

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	20	10"
20	196	6"

Results of Well Yield Testing

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

If pumping discontinued, give reason:

Pump intake set at (m/ft): 155ft

Pumping rate (l/min / GPM): 10gpm

Duration of pumping: 1 hrs + ____ min

Final water level end of pumping (m/ft): 104.2

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

Recommended pump depth (m/ft): 155ft

Recommended pump rate (l/min / GPM): 10gpm

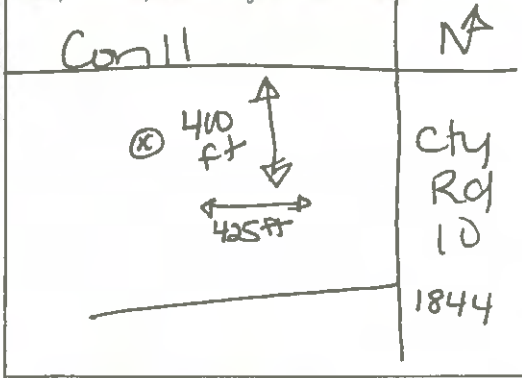
Well production (l/min / GPM): 40gpm+

Disinfected? ☒ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level		97.6		
1		101.1	1	98.0
2		102.3	2	97.8
3		103.6	3	97.5
4		103.9	4	97.7
5		104.2	5	97.6
10		104.2	10	97.6
15		104.3	15	97.6
20		104.3	20	97.6
25		104.3	25	97.6
30		104.3	30	97.6
40		104.2	40	97.5
50		104.2	50	97.5
60			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
G.Hart & Sons Well Drilling Ltd	2662

Business Address (Street Number/Name)	Municipality
P.O. Box 850 Fenelon Falls	

Province	Postal Code	Business E-mail Address
Ontario	K0M 1N0	ghart ghart.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
705 887 3331	Rochetta, Mike

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
3436		

Well owner's information package delivered ☐ Yes ☐ No

Date Package Delivered

Date Work Completed: 2014 12 31

Ministry Use Only

Audit No. Z 195129

Received

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Ministry's Copy

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

23-January-2015

Cambium Environmental
Attn : Kevin Warner

52 Hunter Street East, Peterborough
Canada, K9H 1G5
Phone: 705-742-7900, Fax:

Date Rec. : 16 January 2015
LR Report: **CA14220-JAN15**
Reference: 3751-001

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: MAC	6: AO/OG	7: MW 103-15
Sample Date & Time					15-Jan-15 15:00
Temperature Upon Receipt [°C]	---	---	--	---	7.0
Total Coliform [cfu/100mL]	19-Jan-15	09:06	0	---	0
E. Coli [cfu/100mL]	19-Jan-15	09:06	0	---	0
Alkalinity [mg/L as CaCO3]	19-Jan-15	10:43	--	30-500	207
Bicarbonate [mg/L as CaCO3]	19-Jan-15	10:43	---	---	206
Carbonate [mg/L as CaCO3]	19-Jan-15	10:43	---	---	< 2
pH [no unit]	19-Jan-15	10:43	---	6.5-8.5	8.23
Colour [TCU]	19-Jan-15	11:56	--	5	4
Conductivity [uS/cm]	19-Jan-15	10:43	---	---	409
Turbidity [NTU]	19-Jan-15	10:39	1	5	0.42
Dissolved Organic Carbon [mg/L]	19-Jan-15	13:59	--	5	1.4
Chloride [mg/L]	21-Jan-15	10:59	--	250	1.4
Fluoride [mg/L]	20-Jan-15	08:42	1.5	---	0.22
Nitrite (as N) [mg/L]	21-Jan-15	09:59	1	---	< 0.03
Nitrate (as N) [mg/L]	21-Jan-15	09:59			< 0.06
Sulphate [mg/L]	23-Jan-15	09:04	--	500	20
Hardness [mg/L as CaCO3]	20-Jan-15	10:32	--	80-100	200
Boron [ug/L]	20-Jan-15	09:34	5000	---	26.5
Calcium [mg/L]	20-Jan-15	10:32	---	---	34.0
Iron [ug/L]	20-Jan-15	10:32	---	300	106
Potassium [mg/L]	20-Jan-15	10:32	---	---	1.45
Magnesium [mg/L]	20-Jan-15	10:32	---	---	27.9
Sodium [mg/L]	20-Jan-15	10:32	20*	200	5.74
Aluminum [ug/L]	20-Jan-15	09:34	--	100	5.1
Antimony [ug/L]	20-Jan-15	09:34	6	---	0.04
Arsenic [ug/L]	20-Jan-15	09:34	25	---	1.3
Barium [ug/L]	20-Jan-15	09:34	1000	---	146
Beryllium [ug/L]	20-Jan-15	09:34	---	---	< 0.007
Bismuth [ug/L]	20-Jan-15	09:34	---	---	< 0.007
Cadmium [ug/L]	20-Jan-15	09:34	5	---	< 0.003

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

LR Report : **CA14220-JAN15**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: MAC	6: AO/OG	7: MW 103-15
Cobalt [ug/L]	20-Jan-15	09:34	---	---	0.174
Chromium [ug/L]	20-Jan-15	09:34	50	---	< 0.03
Copper [ug/L]	20-Jan-15	09:34	---	1000	0.29
Manganese [ug/L]	20-Jan-15	09:34	--	50	10.0
Molybdenum [ug/L]	20-Jan-15	09:34	---	---	1.09
Nickel [ug/L]	20-Jan-15	09:34	---	---	0.7
Phosphorus [mg/L]	20-Jan-15	10:32	---	---	0.015
Lead [ug/L]	20-Jan-15	09:34	10	---	< 0.01
Selenium [ug/L]	20-Jan-15	09:34	10	---	< 1
Silicon [mg/L]	20-Jan-15	10:32	---	---	13.6
Silver [ug/L]	20-Jan-15	09:34	---	---	< 0.002
Strontium [ug/L]	20-Jan-15	09:34	---	---	578
Thallium [ug/L]	20-Jan-15	09:34	---	---	0.006
Tin [ug/L]	20-Jan-15	09:34	---	---	0.05
Titanium [µg/L]	20-Jan-15	09:34	---	---	0.28
Uranium [ug/L]	20-Jan-15	09:34	20	---	0.293
Vanadium [ug/L]	20-Jan-15	09:34	---	---	0.94
Zinc [ug/L]	20-Jan-15	09:34	--	5000	1
Total Dissolved Solids (calculated) [mg/L]	---	---	---	---	215
Conductivity (calculated) [uS/cm]	---	---	---	---	443
Cation sum [meq/L]	---	---	---	---	4.28
Anion Sum [meq/L]	---	---	---	---	4.59
Anion-Cation Balance [% difference]			---	---	-3.50

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

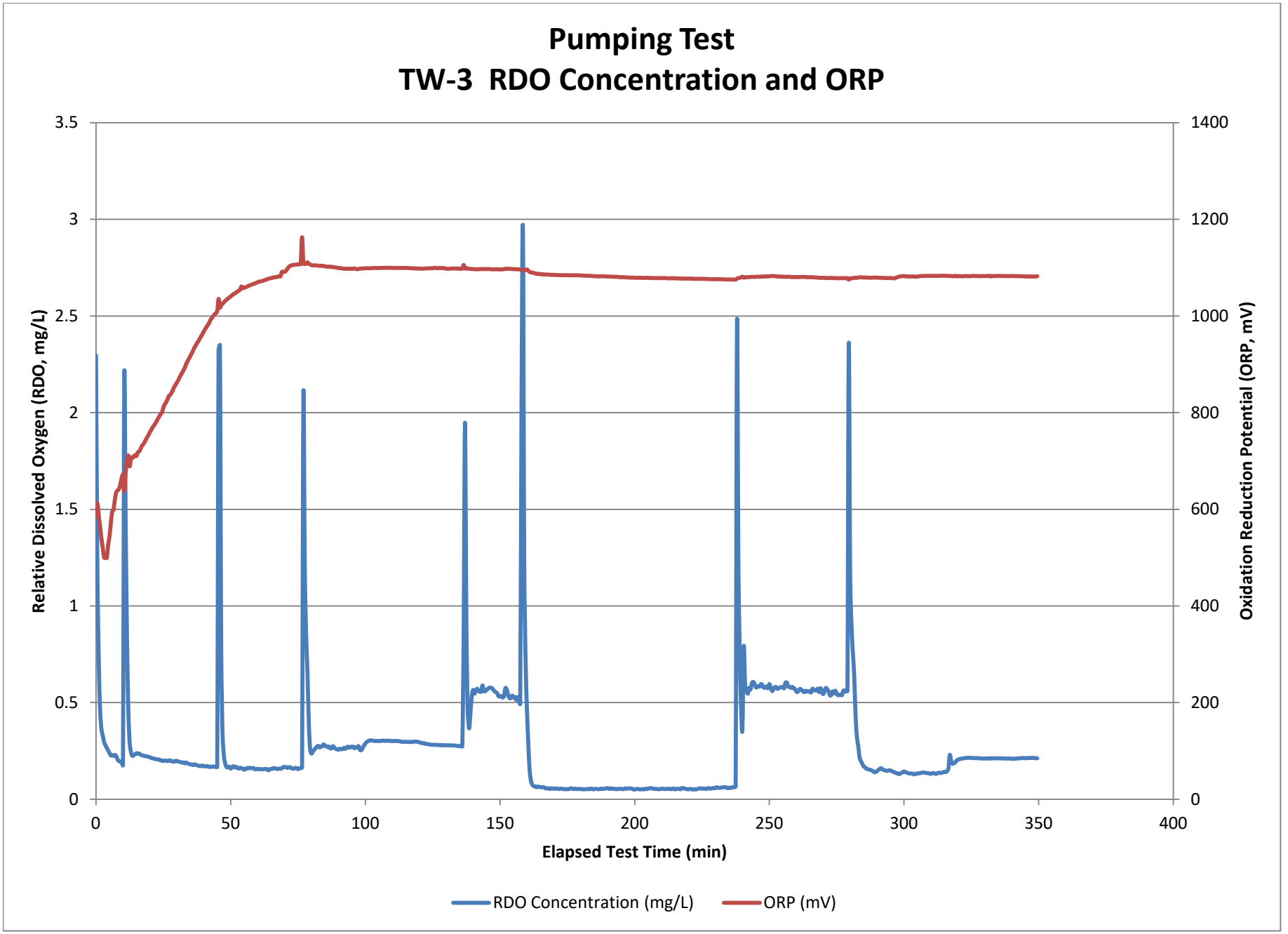
0000332443

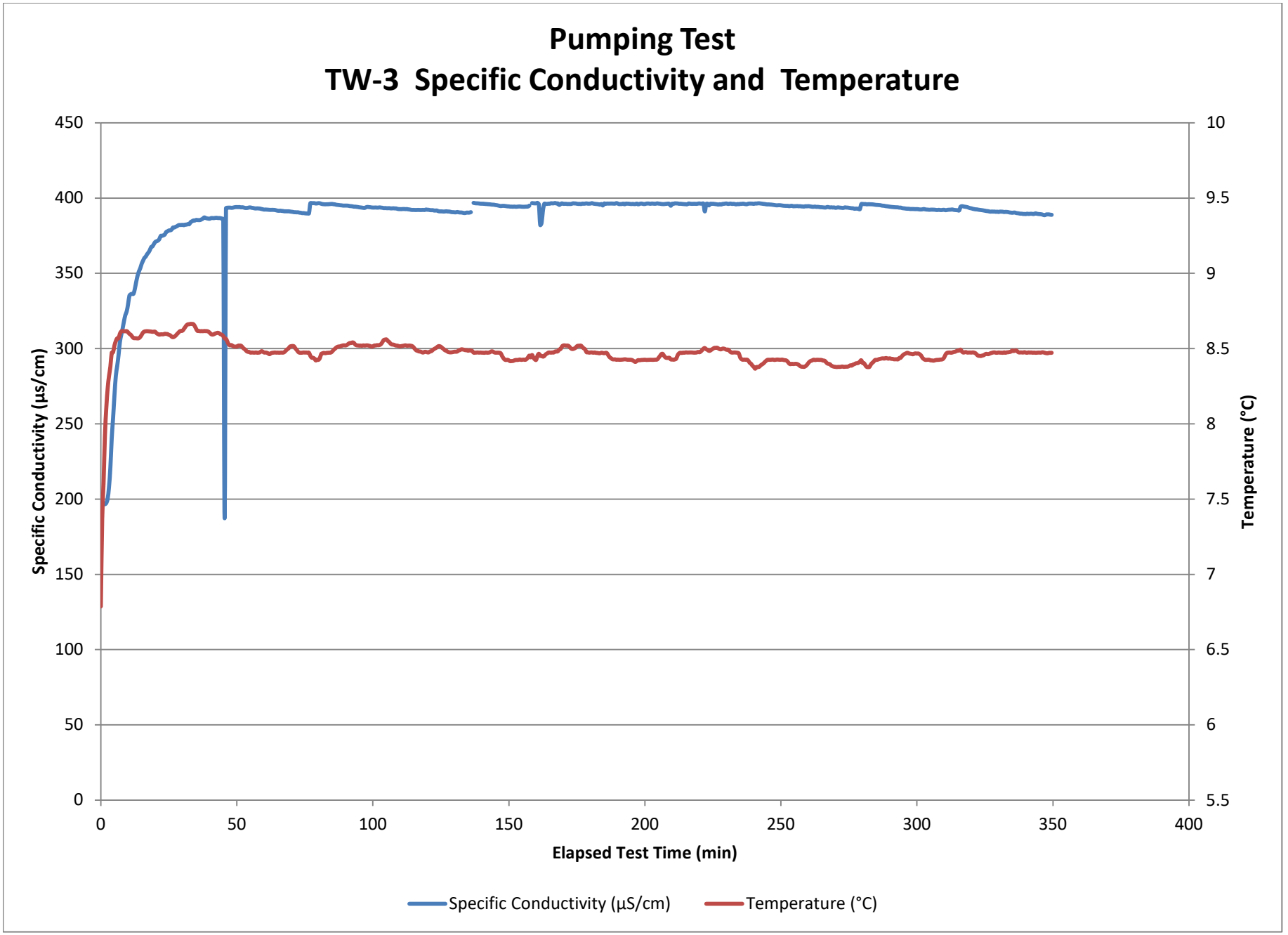
SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

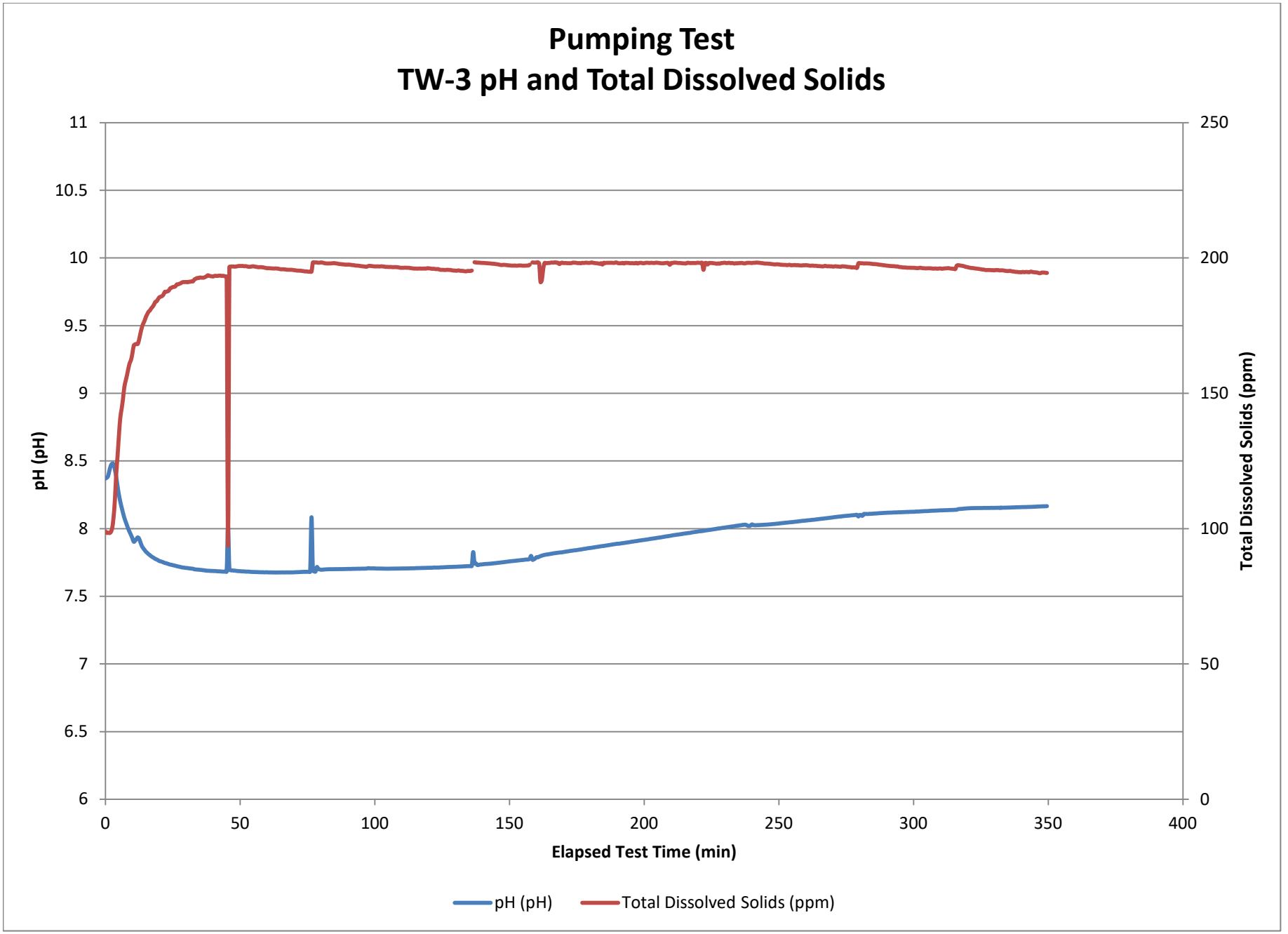
LR Report : **CA14220-JAN15**

Appendix J

TW-3 Field Water Quality Data


Pumping Test
TW-3 RDO Concentration and ORP
Relative Dissolved Oxygen (RDO, mg/L)
Oxidation Reduction Potential (ORP, mV)
Elapsed Test Time (min)
3.5
3
2.5
2
1.5
1
0.5
0
1400
1200
1000
800
600
400
200
0
0
50
100
150
200
250
300
350
400
RDO Concentration (mg/L)
ORP (mV)


Pumping Test
TW-3 Specific Conductivity and Temperature
Specific Conductivity (µs/cm)
Temperature (°C)
Elapsed Test Time (min)
0
50
100
150
200
250
300
350
400
450
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Specific Conductivity (µS/cm)
Temperature (°C)


Pumping Test
TW-3 pH and Total Dissolved Solids
pH (pH)
Total Dissolved Solids (ppm)
Elapsed Test Time (min)
11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
250
200
150
100
50
0
0
50
100
150
200
250
300
350
400
pH (pH)
Total Dissolved Solids (ppm)

Appendix K

Water Quality Summary and
Test Well Laboratory Certificates

Water Quality Summary

Parameter	Units	TW-2		TW-3		TW-3	TW-3	7236970	ODWQS
		09/09/2020		09/10/2020		01/30/2024	07/02/2024	01/15/2015	
		3 hours	6 hours	3 hours	6 hours	6 hours			
Total Coliform	cfu/100 ml	0	0	2	0	16	0	0	n.d. [MAC]
E. coli	cfu/100 ml	0	0	0	0	0	0	0	n.d. [MAC]
Heterotrophic Plate Count	cfu/ml	40	10	20	10	60	< 10	-	b [OG]
Alkalinity ($CaCO_3$)	mg/L	177	177	192	194	207	-	207	30–500 [OG]
Bicarbonate (as $CaCO_3$)	mg/L	177	177	192	194	207	-	206	
Carbonate (as $CaCO_3$)	mg/L	< 5	< 5	< 5	< 5	< 5	-	< 2	
pH @ 25°C	pH Units	8.07	8.06	8.00	8.00	8.05	-	8.23	6.5–8.5 [OG]
Conductivity	µS/cm	398	400	447	447	466	-	409	
Total Dissolved Solids (ion sum calc.)	mg/L	205	206	231	231	258	-	215	500 [AO]
Colour	TCU	< 2	< 2	< 2	< 2	3	-	4	5 [AO]
Turbidity	NTU	7.7	6.4	11.8	12	12	-	0.42	5[c AO], d [OG]
Fluoride	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	0.22	1.5[e MAC]
Chloride	mg/L	2.1	2.3	2.0	2.0	3.0	-	1.4	250 [AO]
Nitrite (N)	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.05	-	< 0.03	1.0[f MAC]
Nitrate (N)	mg/L	< 0.1	< 0.1	< 0.1	0.1	< 0.05	-	< 0.06	10.0[f MAC]
Sulphate	mg/L	28	28	36	36	38	-	20	500[g AO]
Ammonia (N) - Total	mg/L	0.10	0.10	0.04	0.04	0.06	-	-	
o-Phosphate (P)	mg/L	0.011	0.006	0.002	< 0.002	< 0.002	-	0.015	
Dissolved Organic Carbon	mg/L	1.7	1.7	1.7	1.7	1.3	-	1.4	5 [AO]
Hardness (as $CaCO_3$)	mg/L	208	207	242	239	248	-	200	80–100 [OG]
Calcium	mg/L	42.7	42.6	66.8	65.9	67.6	-	34.0	
Calcium - Total	mg/L	43.7	44.4	67.8	71.1	65.9	-	-	
Copper	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	0.0001	-	0.0290	1 [AO]
Copper - Total	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	0.0001	-	-	1 [AO]
Iron	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	0.860	-	0.106	0.3 [AO]
Iron - Total	mg/L	0.813	0.749	0.994	0.985	0.894	-	-	0.3 [AO]
Magnesium	mg/L	24.7	24.5	18.2	18.0	19.2	-	27.9	
Magnesium - Total	mg/L	24.8	24.9	17.9	18.5	18.3	-	-	
Manganese	mg/L	0.015	0.014	0.020	0.020	0.021	-	0.010	0.05 [AO]
Manganese - Total	mg/L	0.016	0.015	0.021	0.022	0.022	-	-	0.05 [AO]
Potassium	mg/L	1.2	1.2	1.2	1.2	1.2	-	1.45	
Potassium - Total	mg/L	1.1	1.1	1.2	1.2	1.5	-	-	
Sodium	mg/L	6.7	6.6	3.7	3.7	3.8	-	5.74	20, 200[h AO]
Sodium - Total	mg/L	6.5	6.8	3.6	4.2	4.3	-	-	20, 200[h AO]
Zinc	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	-	0.001	5 [AO]
Zinc - Total	mg/L	< 0.005	0.010	< 0.005	0.031	0.006	-	-	5 [AO]
Uranium	mg/L	-	-	-	-	0.00021	-	0.00029	0.02 [MAC]
Temperature - Field	°C	12.1	11.4	10.7		8.5	-	-	15 [AO]
pH - Field	pH Units	7.88	7.85	7.68		8.16	-	-	6.5–8.5 [OG]
Conductivity - Field	µS/cm	409	413	460		389	-	-	
Total Dissolved Solids - Field	ppm	205	206	230		195	-	-	500 [AO]
Turbidity - Field	NTU	0.68	< 0.01	2.29	< 0.01	0.24	-	-	5[c AO], d [OG]

Notes: ODWQS - "Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines", Ministry of the Environment, Conservation and Parks, 2006.
D-5-5 - "D-5-5 Private Wells: Water Supply Assessment", Ministry of the Environment, Conservation and Parks, 1996.
Highlighted values exceed or are out of range of the ODWQS or D-5-5 criteria.
n.d. - not detectable; MAC - Maximum Acceptable Concentration; AO - Aesthetic Objective; OG - Operational Guideline.

[a] *Elevated detection limit due to dilution.*
[b] *Increases in HPC concentrations above baseline levels are considered undesirable.*
[c] *Applicable for all waters at the point of consumption.*
[d] *The Operational Guidelines for filtration processes are provided as performance criteria in the Procedure for Disinfection of Drinking Water in Ontario.*
[e] *Where fluoride is added to drinking water, it is recommended that the concentration be adjusted to 0.5–0.8 mg/L the optimum level for control of tooth decay. Where supplies contain naturally occurring fluoride at levels higher than 1.5 mg/L but less than 2.4 mg/L the Ministry of Health and Long Term Care recommends an approach through local boards of health to raise public and professional awareness to control excessive exposure to fluoride from other sources.*
[f] *Where both nitrate and nitrite are present, the total of the two should not exceed 10 mg/L (as nitrogen).*
[g] *When sulphate levels exceed 500 mg/L, water may have a laxative effect on some people.*
[h] *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.*

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G77679 **REPORT No. B20-27546 (i)**

Report To:

Oakridge Environmental
PO Box 431 ,
Peterborough ON K9J 6Z3 Canada
Attention: Matthew Dimitroff

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

DATE RECEIVED: 11-Sep-20
DATE REPORTED: 18-Sep-20
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: IDA
P.O. NUMBER: 20-2810
WATERWORKS NO.

	Client I.D.				TW-2 (3 Hours)	TW-2 (6 Hours)		
	Sample I.D.				B20-27546-1	B20-27546-2		
	Date Collected				09-Sep-20	09-Sep-20		
Parameter	**Units**	**R.L.**	**Reference Method**	**Date/Site Analyzed**				
Total Coliform	cfu/100mL	1	MOE E3407	11-Sep-20/K	0	0		
E coli	cfu/100mL	1	MOE E3407	11-Sep-20/K	0	0		
Heterotrophic Plate Count	cfu/mL	10	SM9215D	11-Sep-20/K	40	10		
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	14-Sep-20/O	177	177		
Carbonate (as CaCO3)	mg/L	5	SM 2320B	14-Sep-20/O	< 5	< 5		
Bicarbonate(as CaCO3)	mg/L	5	SM 2320B	14-Sep-20/O	177	177		
Conductivity @25°C	µmho/cm	1	SM 2510B	14-Sep-20/O	398	400		
pH @25°C	pH Units		SM 4500H	14-Sep-20/O	8.07	8.06		
Colour	TCU	2	SM 2120C	14-Sep-20/O	< 2	< 2		
Turbidity	NTU	0.1	SM 2130	15-Sep-20/O	7.7	6.4		
Fluoride	mg/L	0.1	SM4110C	15-Sep-20/O	< 0.1	< 0.1		
Chloride	mg/L	0.5	SM4110C	15-Sep-20/O	2.1	2.3		
Nitrite (N)	mg/L	0.1	SM4110C	15-Sep-20/O	< 0.1	< 0.1		
Nitrate (N)	mg/L	0.1	SM4110C	15-Sep-20/O	< 0.1	< 0.1		
Sulphate	mg/L	1	SM4110C	15-Sep-20/O	28	28		
TDS (Calc. from Cond.)	mg/L	1	Calc.	16-Sep-20	205	206		
Ammonia (N)-Total	mg/L	0.01	SM4500-NH3-H	11-Sep-20/K	0.10	0.10		
o-Phosphate (P)	mg/L	0.002	PE4500-S	11-Sep-20/K	0.011	0.006		
Dissolved Organic Carbon	mg/L	0.2	EPA 415.2	14-Sep-20/O	1.7	1.7		
Hardness (as CaCO3)	mg/L	1	SM 3120	14-Sep-20/O	208	207		
Calcium	mg/L	0.02	SM 3120	14-Sep-20/O	42.7	42.6		
Copper	mg/L	0.002	SM 3120	14-Sep-20/O	< 0.002	< 0.002		
Iron	mg/L	0.005	SM 3120	14-Sep-20/O	< 0.005	< 0.005		
Magnesium	mg/L	0.02	SM 3120	14-Sep-20/O	24.7	24.5		
Manganese	mg/L	0.001	SM 3120	14-Sep-20/O	0.015	0.014		
Potassium	mg/L	0.1	SM 3120	14-Sep-20/O	1.2	1.2		

R. Lecompte

Richard Lecompte
Laboratory Supervisor

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

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G77679 **REPORT No. B20-27546 (i)**

Report To:

Oakridge Environmental
PO Box 431 ,
Peterborough ON K9J 6Z3 Canada
Attention: Matthew Dimitroff

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

DATE RECEIVED: 11-Sep-20
DATE REPORTED: 18-Sep-20
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: IDA
P.O. NUMBER: 20-2810
WATERWORKS NO.

			Client I.D.		TW-2 (3 Hours)	TW-2 (6 Hours)		
			Sample I.D.		B20-27546-1	B20-27546-2		
			Date Collected		09-Sep-20	09-Sep-20		
Parameter	**Units**	**R.L.**	**Reference Method**	**Date/Site Analyzed**				
Sodium	mg/L	0.2	SM 3120	14-Sep-20/O	6.7	6.6		
Zinc	mg/L	0.005	SM 3120	14-Sep-20/O	< 0.005	< 0.005		
Anion Sum	meq/L		Calc.	16-Sep-20/O	4.18	4.19		
Cation Sum	meq/L		Calc.	16-Sep-20/O	4.58	4.64		
% Difference	%		Calc.	16-Sep-20/O	4.60	5.12		
Ion Ratio	AS/CS		Calc.	16-Sep-20/O	0.912	0.903		
Sodium Adsorption Ratio	-		Calc.	16-Sep-20/O	0.193	0.204		
Langelier Index(25°C)	S.I.		Calc.	16-Sep-20/O	0.526	0.524		

R. Lecompte

Richard Lecompte
Laboratory Supervisor

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

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G77679 **REPORT No. B20-27546 (ii)**

Report To:

Oakridge Environmental
PO Box 431 ,
Peterborough ON K9J 6Z3 Canada
Attention: Matthew Dimitroff

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

DATE RECEIVED: 11-Sep-20
DATE REPORTED: 18-Sep-20
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: IDA
P.O. NUMBER: 20-2810
WATERWORKS NO.

			Client I.D.		TW-2 (3 Hours)	TW-2 (6 Hours)		
			Sample I.D.		B20-27546-1	B20-27546-2		
			Date Collected		09-Sep-20	09-Sep-20		
Parameter	**Units**	**R.L.**	**Reference Method**	**Date/Site Analyzed**				
Calcium	mg/L	0.02	SM 3120	15-Sep-20/O	43.7	44.4		
Copper	mg/L	0.002	SM 3120	15-Sep-20/O	< 0.002	< 0.002		
Iron (Total)	mg/L	0.005	SM 3120	15-Sep-20/O	0.813	0.749		
Magnesium	mg/L	0.02	SM 3120	15-Sep-20/O	24.8	24.9		
Manganese (Total)	mg/L	0.001	SM 3120	15-Sep-20/O	0.016	0.015		
Potassium	mg/L	0.1	SM 3120	15-Sep-20/O	1.1	1.1		
Sodium	mg/L	0.2	SM 3120	15-Sep-20/O	6.5	6.8		
Zinc	mg/L	0.005	SM 3120	15-Sep-20/O	< 0.005	0.010		

This page contains Total Metals results.

R. Lecompte

Richard Lecompte
Laboratory Supervisor

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

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G77678 **REPORT No. B20-27549 (i)**

Report To:

Oakridge Environmental
PO Box 431 ,
Peterborough ON K9J 6Z3 Canada
Attention: Dan MacIntyre

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

DATE RECEIVED: 11-Sep-20
DATE REPORTED: 18-Sep-20
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: IDA
P.O. NUMBER: 20-2810
WATERWORKS NO.

			Client I.D.		TW-3 (3 Hours)	TW-3 (6 Hours)		
			Sample I.D.		B20-27549-1	B20-27549-2		
			Date Collected		10-Sep-20	10-Sep-20		
Parameter	**Units**	**R.L.**	**Reference Method**	**Date/Site Analyzed**				
Total Coliform	cfu/100mL	1	MOE E3407	11-Sep-20/K	2	0		
E coli	cfu/100mL	1	MOE E3407	11-Sep-20/K	0	0		
Heterotrophic Plate Count	cfu/mL	10	SM9215D	11-Sep-20/K	20	10		
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	14-Sep-20/O	192	194		
Carbonate (as CaCO3)	mg/L	5	SM 2320B	14-Sep-20/O	< 5	< 5		
Bicarbonate(as CaCO3)	mg/L	5	SM 2320B	14-Sep-20/O	192	194		
pH @25°C	pH Units		SM 4500H	14-Sep-20/O	8.00	8.00		
Conductivity @25°C	µmho/cm	1	SM 2510B	14-Sep-20/O	447	447		
Colour	TCU	2	SM 2120C	14-Sep-20/O	< 2	< 2		
Turbidity	NTU	0.1	SM 2130	15-Sep-20/O	11.8	12.0		
Fluoride	mg/L	0.1	SM4110C	15-Sep-20/O	< 0.1	< 0.1		
Chloride	mg/L	0.5	SM4110C	15-Sep-20/O	2.0	2.0		
Nitrite (N)	mg/L	0.1	SM4110C	15-Sep-20/O	< 0.1	< 0.1		
Nitrate (N)	mg/L	0.1	SM4110C	15-Sep-20/O	< 0.1	0.1		
Sulphate	mg/L	1	SM4110C	15-Sep-20/O	36	36		
Ammonia (N)-Total	mg/L	0.01	SM4500-NH3-H	11-Sep-20/K	0.04	0.04		
o-Phosphate (P)	mg/L	0.002	PE4500-S	11-Sep-20/K	0.002	< 0.002		
TDS (Calc. from Cond.)	mg/L	1	Calc.	16-Sep-20	231	231		
Dissolved Organic Carbon	mg/L	0.2	EPA 415.2	14-Sep-20/O	1.7	1.7		
Hardness (as CaCO3)	mg/L	1	SM 3120	14-Sep-20/O	242	239		
Calcium	mg/L	0.02	SM 3120	14-Sep-20/O	66.8	65.9		
Copper	mg/L	0.002	SM 3120	14-Sep-20/O	< 0.002	< 0.002		
Iron	mg/L	0.005	SM 3120	14-Sep-20/O	< 0.005	< 0.005		
Magnesium	mg/L	0.02	SM 3120	14-Sep-20/O	18.2	18.0		
Manganese	mg/L	0.001	SM 3120	14-Sep-20/O	0.020	0.020		
Potassium	mg/L	0.1	SM 3120	14-Sep-20/O	1.2	1.2		

R. Lecompte

Richard Lecompte
Laboratory Supervisor

R.L. = Reporting Limit
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Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G77678 **REPORT No. B20-27549 (i)**

Report To:

Oakridge Environmental
PO Box 431 ,
Peterborough ON K9J 6Z3 Canada
Attention: Dan MacIntyre

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

DATE RECEIVED: 11-Sep-20
DATE REPORTED: 18-Sep-20
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: IDA
P.O. NUMBER: 20-2810
WATERWORKS NO.

			Client I.D.		TW-3 (3 Hours)	TW-3 (6 Hours)		
			Sample I.D.		B20-27549-1	B20-27549-2		
			Date Collected		10-Sep-20	10-Sep-20		
Parameter	**Units**	**R.L.**	**Reference Method**	**Date/Site Analyzed**				
Sodium	mg/L	0.2	SM 3120	14-Sep-20/O	3.7	3.7		
Zinc	mg/L	0.005	SM 3120	14-Sep-20/O	< 0.005	< 0.005		
Anion Sum	meq/L		Calc.	16-Sep-20/O	4.66	4.69		
Cation Sum	meq/L		Calc.	16-Sep-20/O	5.10	5.34		
% Difference	%		Calc.	16-Sep-20/O	4.51	6.44		
Ion Ratio	AS/CS		Calc.	16-Sep-20/O	0.914	0.879		
Sodium Adsorption Ratio	-		Calc.	16-Sep-20/O	0.100	0.114		
Langelier Index(25°C)	S.I.		Calc.	16-Sep-20/O	0.683	0.706		

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

Richard Lecompte
Laboratory Supervisor

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G77678 **REPORT No. B20-27549 (ii)**

Report To:

Oakridge Environmental
PO Box 431 ,
Peterborough ON K9J 6Z3 Canada
Attention: Dan MacIntyre

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

DATE RECEIVED: 11-Sep-20
DATE REPORTED: 18-Sep-20
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: IDA
P.O. NUMBER: 20-2810
WATERWORKS NO.

			Client I.D.		TW-3 (3 Hours)	TW-3 (6 Hours)		
			Sample I.D.		B20-27549-1	B20-27549-2		
			Date Collected		10-Sep-20	10-Sep-20		
Parameter	**Units**	**R.L.**	**Reference Method**	**Date/Site Analyzed**				
Calcium	mg/L	0.02	SM 3120	15-Sep-20/O	67.8	71.1		
Copper	mg/L	0.002	SM 3120	15-Sep-20/O	< 0.002	< 0.002		
Iron (Total)	mg/L	0.005	SM 3120	15-Sep-20/O	0.994	0.985		
Magnesium	mg/L	0.02	SM 3120	15-Sep-20/O	17.9	18.5		
Manganese (Total)	mg/L	0.001	SM 3120	15-Sep-20/O	0.021	0.022		
Potassium	mg/L	0.1	SM 3120	15-Sep-20/O	1.2	1.2		
Sodium	mg/L	0.2	SM 3120	15-Sep-20/O	3.6	4.2		
Zinc	mg/L	0.005	SM 3120	15-Sep-20/O	< 0.005	0.031		

This page contains Total Metals results.

R. Lecompte

Richard Lecompte
Laboratory Supervisor

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

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G89673 **REPORT No: 24-002943 - Rev. 1**

Report To:
Oakridge Environmental
PO Box 431
Peterborough, ON K9J 6Z3

CADUCEON Environmental Laboratories
285 Dalton Ave
Kingston, ON K7K 6Z1

Attention: Dan MacIntyre

DATE RECEIVED: 2024-Jan-31
DATE REPORTED: 2024-Feb-08
SAMPLE MATRIX: Ground Water

CUSTOMER PROJECT: McCamus Ida
P.O. NUMBER: 23-3349

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Anions (Liquid)	1	OTTAWA	PCURIEL	2024-Feb-02	A-IC-01	SM 4110B
Colour (Liquid)	1	OTTAWA	AWILSON	2024-Feb-02	A-COL-01	SM 2120C
Cond/pH/Alk Auto (Liquid)	1	OTTAWA	SBOUDREAU	2024-Feb-01	COND-02/PH-02/ALK-02	SM 2510B/4500H/2320B
Coliforms - DC Media (Liquid)	1	KINGSTON	BBURTCH	2024-Jan-31	ECTC-001	MECP E3407
DOC/DIC (Liquid)	1	OTTAWA	VKASYAN	2024-Feb-01	C-OC-01	EPA 415.2
HPC MF (Liquid)	1	KINGSTON	BBURTCH	2024-Jan-31	HPC-001	SM 9215D
Ion Balance (Calc.)	1	OTTAWA	STAILLON		CP-028	MECP E3196
ICP/MS Total (Liquid)	1	OTTAWA	AOZKAYMAK	2024-Feb-02	D-ICPMS-01	EPA 6020
ICP/MS (Liquid)	1	OTTAWA	TPRICE	2024-Feb-05	D-ICPMS-01	EPA 200.8
ICP/OES Total (Liquid)	1	OTTAWA	NHOGAN	2024-Feb-01	D-ICP-01	SM 3120B
ICP/OES (Liquid)	1	OTTAWA	NHOGAN	2024-Feb-02	D-ICP-01	SM 3120B
Ammonia & o-Phosphate (Liquid)	1	KINGSTON	JYEARWOOD	2024-Feb-02	NH3-001	SM 4500NH3
Sulphide (Liquid)	1	KINGSTON	EHINCH	2024-Jan-31	H2S-001	SM 4500-S2
TP & TKN (Liquid)	1	KINGSTON	KDIBBITS	2024-Feb-05	TPTKN-001	MECP E3516.2
Turbidity (Liquid)	1	OTTAWA	AWILSON	2024-Feb-02	A-TURB-01	SM 2130B

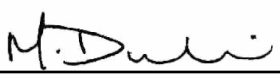
R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

Michelle Dubien
Data Specialist

	Client I.D.		TW-3
	Sample I.D.		24-002943-1
	Date Collected		2024-01-30
Parameter	**Units**	**R.L.**	-
Total Coliform (DC Media)	CFU/100mL	1	16
E coli (DC Media)	CFU/100mL	1	0
Background (DC Media)	CFU/100mL	1	58
Heterotrophic Plate Count	CFU/1mL	10	60
Alkalinity(CaCO3) to pH4.5	mg/L	5	207
Bicarbonate (as CaCO3)	mg/L	5	207
Carbonate (as CaCO3)	mg/L	5	<5
Conductivity @25°C	uS/cm	1	466
pH @25°C	pH units	-	8.05
Colour	TCU	2	3
Turbidity	NTU	0.1	12.0
Fluoride	mg/L	0.1	<0.1
Chloride	mg/L	0.5	3.0
Nitrate (N)	mg/L	0.05	<0.05
Nitrite (N)	mg/L	0.05	<0.05
Sulphate	mg/L	1	38
Total Kjeldahl Nitrogen	mg/L	0.1	0.1
Ammonia (N)-Total (NH3+NH4)	mg/L	0.05	0.06
o-Phosphate (P)	mg/L	0.002	<0.002
Dissolved Organic Carbon	mg/L	0.2	1.3
Sulphide	mg/L	0.01	<0.01

Michelle Dubien
Data Specialist

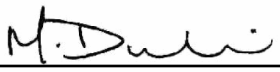
			Client I.D.	TW-3
			Sample I.D.	24-002943-1
			Date Collected	2024-01-30
Parameter	Units	R.L.		-
Hardness (as CaCO3)	mg/L	0.02		248
Calcium	mg/L	0.02		67.6
Iron	mg/L	0.005		0.860
Magnesium	mg/L	0.02		19.2
Manganese	mg/L	0.001		0.021
Potassium	mg/L	0.1		1.2
Sodium	mg/L	0.2		3.8
Zinc	mg/L	0.005		<0.005
Calcium (Total)	mg/L	0.02		65.9
Iron (Total)	mg/L	0.005		0.894
Magnesium (Total)	mg/L	0.02		18.3
Manganese (Total)	mg/L	0.001		0.022
Potassium (Total)	mg/L	0.1		1.5
Sodium (Total)	mg/L	0.2		4.3
Zinc (Total)	mg/L	0.005		0.006
Copper	mg/L	0.0001		0.0001
Uranium	mg/L	0.00005		0.00021
Copper (Total)	mg/L	0.0001		0.0001
Lead (Total)	mg/L	0.00002		<0.00002
Anion Sum	meq/L	-		5.03
Cation Sum	meq/L	-		5.20



Michelle Dubien
Data Specialist

		Client I.D.	TW-3
		Sample I.D.	24-002943-1
		Date Collected	2024-01-30
Parameter	**Units**	**R.L.**	-
% Difference	%	-	1.71
Ion Ratio	-	-	0.966
Sodium Adsorption Ratio	-	-	0.105
TDS (Ion Sum Calc)	mg/L	1	258
TDS(calc.)/EC(actual)	-	-	0.555
Conductivity Calc	µmho/cm	-	476
Conductivity Calc / Conductivity	-	-	1.02
Langelier Index(25°C)	-	-	0.764
Saturation pH (25°C)	-	-	7.29

Revised to include additional parameter



Michelle Dubien
Data Specialist

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G89675 **REPORT No: 24-003775 - Rev. 0**

Report To:
Oakridge Environmental
PO Box 431
Peterborough, ON K9J 6Z3

CADUCEON Environmental Laboratories
285 Dalton Ave
Kingston, ON K7K 6Z1

Attention: Dan MacIntyre

DATE RECEIVED: 2024-Feb-08
DATE REPORTED: 2024-Feb-12
SAMPLE MATRIX: Ground Water

CUSTOMER PROJECT: IDA
P.O. NUMBER: 23-3349

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Coliforms - DC Media (Liquid)	1	KINGSTON	BBURTCH	2024-Feb-08	ECTC-001	MECP E3407
HPC MF (Liquid)	1	KINGSTON	BBURTCH	2024-Feb-08	HPC-001	SM 9215D

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

		Parameter	Background Bacteria (DC Method) Raw	Total Coliform (DC Media)	E coli (DC Media)	Heterotrophic Plate Count
		Units	-	CFU/100mL	CFU/100mL	CFU/1mL
		R.L.	-	1	1	10
Client I.D.	Sample I.D.	Date Collected	-	-	-	-
TW-3	24-003775-1	2024-Feb-07	6	0	0	<10

Brandon Burtch
Microbiology Supervisor

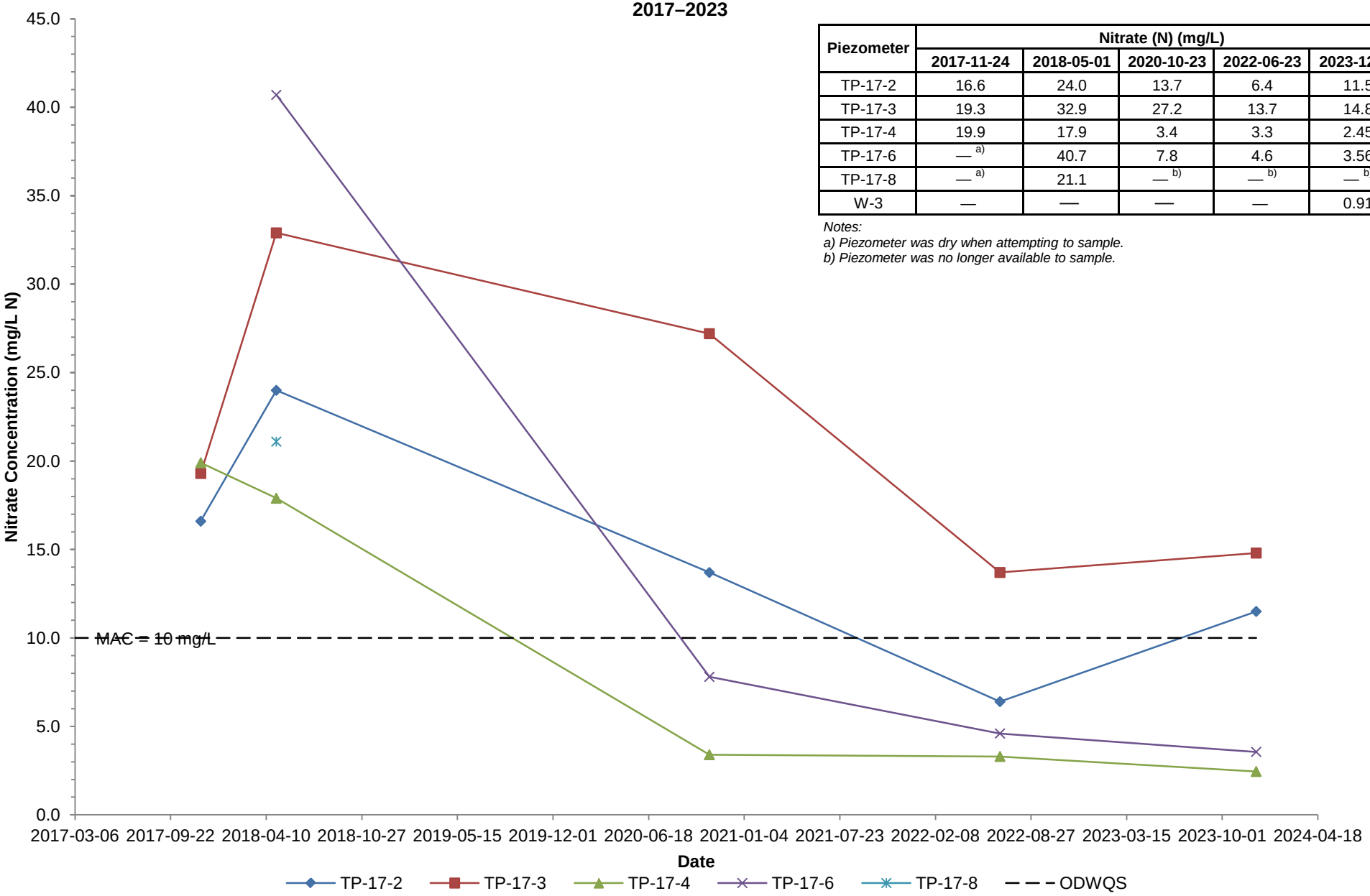
Appendix L

Shallow Aquifer Nitrate Analysis

Ida Shallow Groundwater Quality
2017–2023

Piezometer	Nitrate (N) (mg/L)				
	2017-11-24	2018-05-01	2020-10-23	2022-06-23	2023-12-11
TP-17-2	16.6	24.0	13.7	6.4	11.5
TP-17-3	19.3	32.9	27.2	13.7	14.8
TP-17-4	19.9	17.9	3.4	3.3	2.45
TP-17-6	— a)	40.7	7.8	4.6	3.56
TP-17-8	— a)	21.1	— b)	— b)	— b)
W-3	—	—	—	—	0.91

Notes:
a) Piezometer was dry when attempting to sample.
b) Piezometer was no longer available to sample.



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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G35518 **REPORT No. B17-35770**

Report To:

Oakridge Environmental
PO Box 431 ,
Peterborough ON K9J 6Z3 Canada
Attention: Dan MacIntyre

Caduceon Environmental Laboratories
2378 Holly Lane
Ottawa Ontario K1V 7P1
Tel: 613-526-0123
Fax: 613-526-1244

DATE RECEIVED: 25-Nov-17
DATE REPORTED: 11-Dec-17
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: IDA
P.O. NUMBER: 16-2166
WATERWORKS NO.

	Parameter		Nitrate (N)				
	Units		mg/L				
	R.L.		0.1				
	Reference Method		SM4110C				
	Date Analyzed/Site		08-Dec-17/O				
Client I.D.	**Sample I.D.**	**Date Collected**					
TP-17-2	B17-35770-1	24-Nov-17	16.6				
TP-17-3	B17-35770-2	24-Nov-17	19.3				
TP-17-4	B17-35770-3	24-Nov-17	19.9				

Greg Clarkin , BSc., C. Chem
Lab Manager - Ottawa District

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

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G74739 **REPORT No. B18-11738**

Report To:

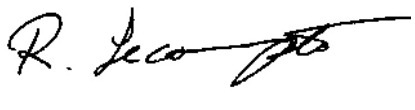
Oakridge Environmental
PO Box 431 ,
Peterborough ON K9J 6Z3 Canada
Attention: Mathew Dimitroff

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

DATE RECEIVED: 03-May-18
DATE REPORTED: 07-May-18
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: IDA
P.O. NUMBER: 16-2166
WATERWORKS NO.

	Parameter		Nitrate (N)				
	Units		mg/L				
	R.L.		0.1				
	Reference Method		SM4110C				
	Date Analyzed/Site		04-May-18/O				
Client I.D.	**Sample I.D.**	**Date Collected**					
TP-17-2	B18-11738-1	01-May-18	24.0				
TP-17-3	B18-11738-2	01-May-18	32.9				
TP-17-4	B18-11738-3	01-May-18	17.9				
TP-17-6	B18-11738-4	01-May-18	40.7				
TP-17-8	B18-11738-5	01-May-18	21.1				



Richard Lecompte
Lab Supervisor

R.L. = Reporting Limit
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Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G77698 **REPORT No. B20-33596**

Report To:

Oakridge Environmental
PO Box 431 ,
Peterborough ON K9J 6Z3 Canada
Attention: Matthew Dimitroff

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

DATE RECEIVED: 27-Oct-20
DATE REPORTED: 04-Nov-20
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: IDA
P.O. NUMBER: 20-2810
WATERWORKS NO.

	Parameter		Nitrate (N)				
	Units		mg/L				
	R.L.		0.1				
	Reference Method		SM4110C				
	Date Analyzed/Site		02-Nov-20/O				
Client I.D.	**Sample I.D.**	**Date Collected**					
TP-17-2	B20-33596-1	23-Oct-20	13.7				
TP-17-3	B20-33596-2	23-Oct-20	27.2				
TP-17-4	B20-33596-3	23-Oct-20	3.4				
TP-17-6	B20-33596-4	23-Oct-20	7.8				

R. Lecompte

Richard Lecompte
Laboratory Supervisor

R.L. = Reporting Limit
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Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON ENVIRONMENTAL LABORATORIES
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CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G89466 **REPORT No. B22-19677**

Report To:

Oakridge Environmental
PO Box 431 ,
Peterborough ON K9J 6Z3 Canada
Attention: Dan MacIntyre

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

DATE RECEIVED: 24-Jun-22
DATE REPORTED: 29-Jun-22
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.: IDA
P.O. NUMBER: 20-2810
WATERWORKS NO.

	Parameter		Nitrate (N)				
	Units		mg/L				
	R.L.		0.1				
	Reference Method		SM4110C				
	Date Analyzed/Site		28-Jun-22/O				
Client I.D.	**Sample I.D.**	**Date Collected**					
TP17-2	B22-19677-1	23-Jun-22	6.4				
TP17-3	B22-19677-2	23-Jun-22	13.7				
TP17-4	B22-19677-3	23-Jun-22	3.3				
TP17-6	B22-19677-4	23-Jun-22	4.6				

R. Lecompte

Richard Lecompte
Laboratory Supervisor

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

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured. Canadian owned.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G89669 **REPORT No: 23-034681 - Rev. 0**

Report To:
Oakridge Environmental
PO Box 431
Peterborough, ON K9J 6Z3

CADUCEON Environmental Laboratories
285 Dalton Ave
Kingston, ON K7K 6Z1

Attention: Matt Susac

DATE RECEIVED: 2023-Dec-12
DATE REPORTED: 2023-Dec-18
SAMPLE MATRIX: Ground Water

CUSTOMER PROJECT: IDA
P.O. NUMBER: PO#23-3349

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Anions (Liquid)	5	OTTAWA	PCURIEL	2023-Dec-14	A-IC-01	SM 4110B

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

			Client I.D.	TP-17-2	TP-17-3	TP-17-4	TP-17-6	W-3
			Sample I.D.	23-034681-1	23-034681-2	23-034681-3	23-034681-4	23-034681-5
			Date Collected	2023-12-11	2023-12-11	2023-12-11	2023-12-11	2023-12-11
Parameter	**Units**	**R.L.**		-	-	-	-	-
Nitrate (N)	mg/L	0.05		11.5	14.8	2.45	3.56	0.91
Nitrite (N)	mg/L	0.05		<0.05	<0.05	<0.05	<0.05	<0.05

Michelle Dubien
Data Specialist

Appendix M

Climate Data

Thornthwaite Estimates of Potential Evapotranspiration

Site: Peterborough A

Latitude: 44.3
Hemisphere: N

month	mean monthly air temp °F	mean monthly air temp °C	unadj PET mm	adj coeff	Thornthwaite estimates adj PET mm	Thornthwaite estimates adj PET in
Jan		-8.9	0	0.76	0	0.00
Feb		-7.7	0	0.87	0	0.00
Mar		-2.0	0	0.99	0	0.00
Apr		5.7	28	1.12	32	1.25
May		12.4	62	1.23	77	3.03
June		16.8	85	1.30	110	4.32
July		19.4	98	1.27	125	4.91
Aug		18.2	92	1.18	108	4.25
Sept		13.5	68	1.05	71	2.80
Oct		7.3	36	0.92	33	1.32
Nov		1.7	8	0.80	7	0.26
Dec		-5.3	0	0.74	0	0.00
	Annual Total	-	478	-	**562**	**22.15**

annual heat index I = 32.27
constant a = 1.01

Climate Normals 1981-2010 Station Data

Metadata including Station Name, Province or Territory, Latitude, Longitude, Elevation, Climate ID, WMO ID, TC ID

STATION_NAME	PROVINCE_OR_TERRITORY	LATITUDE	LONGITUDE	ELEVATION	CLIMATE_ID	WMO_ID	TC_ID
PETERBOROUGH A	ON	44°14'00.000" N	78°22'00.000" W	191.4 m	6166418		

Legend

A = WMO "3 and 5 rule" (i.e. no more than 3 consecutive and no more than 5 total missing for either temperature or precipitation)
B = At least 25 years
C = At least 20 years
D = At least 15 years

1981 to 2010 Canadian Climate Normals station data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Temperature														
Daily Average (°C)	-8.5	-7	-1.8	5.9	12.1	17	19.6	18.3	13.9	7.5	1.9	-4.4	6.2	A
Standard Deviation	3.6	2.6	2.1	1.5	1.7	1.4	1.3	1.3	1.3	1.2	1.5	3.2	1	A
Daily Maximum (°C)	-3.2	-1.4	3.7	11.7	18.6	23.6	26.4	25.2	20.6	13.4	6.4	0.2	12.1	A
Daily Minimum (°C)	-13.7	-12.5	-7.3	0.1	5.6	10.4	12.8	11.4	7.2	1.5	-2.6	-8.9	0.3	A
Extreme Maximum (°C)	12.2	12.5	24.3	29.7	32.5	34.4	36.1	36.2	33.9	28.9	22.8	19.2		
Date (yyyy/dd)	1995/14	1984/23	1998/30	1990/26	2006/30	1988/14	Aug-88	Aug-01	Sep-02	Feb-71	Jan-74	Mar-82		
Extreme Minimum (°C)	-37.9	-37.8	-31.4	-15	-7.7	-0.7	3.5	0	-6.3	-9.4	-19.2	-33.9		
Date (yyyy/dd)	1984/15	1979/18	Jul-03	Jul-72	Apr-95	Dec-80	2001/27	1976/31	1991/30	1969/23	1994/24	Nov-77		
Precipitation														
Rainfall (mm)	24.5	24.7	30.8	60.5	81.4	79.9	70.6	77	84.5	75.2	71.7	31.8	712.5	C
Snowfall (cm)	40	29.2	24.6	6.7	0	0	0	0	0	1.4	15.2	34	151.2	C
Precipitation (mm)	57.4	51.5	56.1	68.6	81.5	79.9	70.6	77	85.3	76.9	86.4	64.2	855.3	C
Average Snow Depth (cm)	14	16	8	0	0	0	0	0	0	0	1	6	4	A
Median Snow Depth (cm)	13	16	8	0	0	0	0	0	0	0	0	5	4	A
Snow Depth at Month-end (cm)	17	13	1	0	0	0	0	0	0	0	1	9	3	A
Extreme Daily Rainfall (mm)	43.2	35.4	59.8	46.7	50.6	56.6	83.8	70	52.8	42.6	55.6	37.2		
Date (yyyy/dd)	1995/15	1985/23	1980/21	Jan-73	1995/17	1998/25	2004/15	1995/31	Jan-89	May-95	Feb-99	Jan-06		
Extreme Daily Snowfall (cm)	20.7	33.2	22.4	16.8	1.5	0	0	0	0	10.4	17	33.2		
Date (yyyy/dd)	2004/27	Aug-01	Apr-85	Mar-75	Aug-77	Jan-69	Jan-69	Jan-69	Jan-69	1981/22	Apr-95	Nov-92		
Extreme Daily Precipitation (mm)	43.2	35.4	61.3	46.7	50.6	56.6	83.8	70	52.8	42.6	55.6	41		
Date (yyyy/dd)	1995/15	1985/23	1980/21	Jan-73	1995/17	1998/25	2004/15	1995/31	Jan-89	May-95	Feb-99	Mar-90		
Extreme Snow Depth (cm)	61	70	71	38	0	0	0	0	0	7	25	64		
Date (yyyy/dd)	1978/25	Jun-82	Dec-71	Jan-71	Jan-70	Jan-70	Jan-70	Jan-70	Jan-70	1992/19	1971/30	Dec-92		
Days with Maximum Temperature														
<= 0 °C	20.2	15.9	8.3	0.62	0	0	0	0	0	0	3.2	14.4	62.5	A
> 0 °C	10.8	12.4	22.7	29.4	31	30	31	31	30	31	26.8	16.6	302.7	A
> 10 °C	0.28	0.27	4.8	17.7	29.5	30	31	31	29.7	22.6	7.8	1.4	206.1	A
> 20 °C	0	0	0.46	2.8	11.7	24	30	28.8	16.2	3.1	0.04	0	117.2	A
> 30 °C	0	0	0	0	0.31	2	3.9	2.3	0.42	0	0	0	8.9	A
> 35 °C	0	0	0	0	0	0	0.19	0.19	0	0	0	0	0.38	A
Days with Minimum Temperature														
> 0 °C	1.1	1.4	3.2	14.4	27.6	30	31	31	27.7	17.3	8.2	2.2	195	A
<= 2 °C	30.8	28	29.9	21	8.1	0.54	0	0.12	5.4	18.5	25.2	30.3	197.8	A
<= 0 °C	29.9	26.8	27.8	15.7	3.4	0.04	0	0	2.4	13.7	21.8	28.8	170.2	A
< -2 °C	27.6	24.9	23.3	9.4	0.46	0	0	0	0.65	7.1	15.4	25	133.9	A
< -10 °C	19.4	17	9.2	0.35	0	0	0	0	0	0	2.2	12.4	60.6	A
< -20 °C	7.6	5.5	1.6	0	0	0	0	0	0	0	0	2.4	17.1	A
< - 30 °C	0.92	0.35	0.08	0	0	0	0	0	0	0	0	0.04	1.4	A
Days with Rainfall														

Climate Normals 1981-2010 Station Data

Metadata including Station Name, Province or Territory, Latitude, Longitude, Elevation, Climate ID, WMO ID, TC ID

STATION_NAME	PROVINCE_OR_TERRITORY	LATITUDE	LONGITUDE	ELEVATION	CLIMATE_ID	WMO_ID	TC_ID
PETERBOROUGH A	ON	44°14'00.000" N	78°22'00.000" W	191.4 m	6166418		

Legend

A = WMO "3 and 5 rule" (i.e. no more than 3 consecutive and no more than 5 total missing for either temperature or precipitation)
B = At least 25 years
C = At least 20 years
D = At least 15 years

1981 to 2010 Canadian Climate Normals station data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
>= 0.2 mm	4.9	4.9	7.5	11.4	12.6	11.5	10.2	11.7	12.5	14.3	12	6.7	120	A
>= 5 mm	1.5	1.5	2	4.4	5.4	4.6	3.9	4.1	5.2	4.6	4.4	2.4	44	A
>= 10 mm	0.6	0.65	1	2.1	3.1	2.9	2.3	2.7	2.9	2.3	2.5	0.84	23.8	A
>= 25 mm	0.08	0.15	0	0.15	0.31	0.65	0.52	0.58	0.65	0.36	0.36	0.04	3.9	A
Days With Snowfall														
>= 0.2 cm	14.6	11.7	7.9	3.2	0.08	0	0	0	0	0.64	6	11.4	55.5	A
>= 5 cm	2.7	1.6	1.8	0.38	0	0	0	0	0	0.08	0.68	2	9.2	A
>= 10 cm	0.52	0.54	0.46	0.08	0	0	0	0	0	0.04	0.32	0.64	2.6	A
>= 25 cm	0	0.04	0	0	0	0	0	0	0	0	0	0.08	0.12	A
Days with Precipitation														
>= 0.2 mm	16.3	13.6	13	12.9	12.7	11.5	10.2	11.7	12.5	14.5	16	15.4	160.3	C
>= 5 mm	3.5	3	3.9	4.9	5.4	4.6	3.9	4.1	5.3	4.8	5.3	4	52.7	C
>= 10 mm	1	1.3	1.6	2.4	3.1	2.9	2.3	2.7	2.9	2.4	3	1.7	27.2	C
>= 25 mm	0.08	0.31	0.08	0.19	0.31	0.65	0.52	0.58	0.65	0.36	0.36	0.24	4.3	C
Days with Snow Depth														
>= 1 cm	27.7	25.6	18	2.8	0	0	0	0	0	0.28	5.4	19.8	99.6	A
>= 5 cm	22.9	21.8	13	1	0	0	0	0	0	0.12	2.1	12.5	73.4	A
>= 10 cm	16.2	14.9	8.5	0.42	0	0	0	0	0	0	1.1	7.8	48.9	A
>= 20 cm	8.8	9.3	5.1	0.12	0	0	0	0	0	0	0	2.1	25.4	A
Wind														
Speed (km/h)	12.3	11.7	12.2	12.6	11	9.7	8.8	7.7	8.4	9.8	11.6	11.7	10.6	C
Most Frequent Direction	W	W	W	W	W	W	W	W	W	W	W	W	W	C
Maximum Hourly Speed (km/h)	64	69	58	70	52	52	42	46	52	56	63	63	70	
Date (yyyy/dd)	1974/27	1971/27	1971/15	Jun-79	Jan-97	1986/16	1975/21	1980/30	1992/27	Apr-93	Oct-75	1992/25	Jun-79	
Direction of Maximum Hourly Speed	W	SW	SW	W	SW	SW	SE	S	W	SW	W	W	W	
Maximum Gust Speed (km/h)	100	87	117	101	109	104	98	133	89	89	100	104	133	
Date (yyyy/dd)	1974/27	1974/22	1991/27	1975/19	Feb-83	1986/16	1995/15	Aug-83	Jun-83	Apr-90	1991/30	1982/28	Aug-83	
Direction of Maximum Gust	CALM	W	W	W	SW	W	NW	SW	W	W	SW	SW	SW	
Degree Days														
Above 24 °C	0	0	0	0	0	0.9	3.9	2	0.1	0	0	0	6.8	A
Above 18 °C	0	0	0	0.7	5.3	31.2	67.7	46.3	9.9	0.2	0	0	161.3	A
Above 15 °C	0	0	0	2.9	20.8	80.2	145	110.4	35.8	2.1	0	0	397.4	A
Above 10 °C	0	0	1.4	16.1	89.2	212	298.4	258.1	129	23.6	2	0.2	1029.9	A
Above 5 °C	0.5	0.3	10.4	68.5	220.9	361.2	453.4	412.9	267.8	94.4	22.9	3.2	1916.4	A
Above 0 °C	8.9	10.9	49.8	184.2	375.2	511.2	608.4	567.9	417.3	230	89.9	21.8	3075.4	A
Below 0 °C	271.3	207.8	106	6.2	0	0	0	0	0	0.9	31.9	157.2	781.3	A
Below 5 °C	417.9	338.4	221.5	40.4	0.7	0	0	0	0.5	20.3	114.9	293.6	1448.4	A
Below 10 °C	572.5	479.2	367.6	138	24	0.9	0	0.2	11.7	104.5	244	445.6	2388.1	A
Below 15 °C	727.5	620.4	521.2	274.9	110.6	19.1	1.6	7.5	68.5	238	392	600.4	3581.7	A
Below 18 °C	820.5	705.1	614.2	362.7	188.1	60.1	17.3	36.3	132.6	329.1	482	693.4	4441.3	A

Climate Normals 1981-2010 Station Data

Metadata including Station Name, Province or Territory, Latitude, Longitude, Elevation, Climate ID, WMO ID, TC ID

STATION_NAME	PROVINCE_OR_TERRITORY	LATITUDE	LONGITUDE	ELEVATION	CLIMATE_ID	WMO_ID	TC_ID
PETERBOROUGH A	ON	44°14'00.000" N	78°22'00.000" W	191.4 m	6166418		

Legend

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B = At least 25 years
C = At least 20 years
D = At least 15 years

1981 to 2010 Canadian Climate Normals station data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Humidex														
Extreme Humidex	13.3	12.5	28.1	36.4	38.7	42.5	45.5	45.8	42.3	34.2	25.8	21.8		
Date (yyyy/dd)	Mar-04	2000/27	1998/30	1990/27	1987/28	1994/16	Apr-99	Jan-75	Jan-73	Feb-71	Jan-74	Mar-82		
Wind Chill														
Extreme Wind Chill (°C)	-44.2	-44.5	-35.4	-22.3	-7.2	0	0	0	-3.9	-13.3	-23.3	-37.8		
Date (yyyy/dd)	1994/19	1979/18	Mar-03	Jul-82	Jan-78	Feb-69	Feb-69	Jan-69	1980/27	1969/23	1987/21	2004/20		
Humidity														
Average Relative Humidity - 0600LST (%)	82.2	80.9	83.2	83	87.1	89.9	92.7	95.2	94.8	91.2	87.7	85.6	87.8	C

1981 to 2010 Canadian Climate Normals station data (Frost-

	Frost-Free:	Code
Average Date of Last Spring Frost	14-May	C
Average Date of First Fall Frost	24-Sep	C
Average Length of Frost-Free Period	132 Days	C

Probability of last temperature in spring of 0 °C or lower on	10%	25%	33%	50%	66%	75%	90%
Date	09-Jun	18-May	17-May	14-May	09-May	09-May	04-May
Probability of first temperature in fall of 0 °C or lower on or	10%	25%	33%	50%	66%	75%	90%
Date	08-Sep	18-Sep	20-Sep	24-Sep	29-Sep	30-Sep	05-Oct
Probability of frost-free period equal to or less than	10%	25%	33%	50%	66%	75%	90%
Days	108	123	126	130	134	137	146

Appendix N

Draft Well Certification Program

Well Certification Program

1.0 Introduction

All development lots are subject to this *Well Certification Program*. It is the responsibility of the lot owner to ensure that the program is carried out.

The Program requires that prior to a Building Permit being approved for any lot, a Qualified Person is to be retained to provide assistance with respect to the placement and testing of a private well. A Qualified Person (QP) is a Hydrogeologist who is a licensed Professional Geoscientist in the Province of Ontario (PGO) or a licensed Professional Engineer, with appropriate hydrogeological training and experience.

This Program draws upon the results of the hydrogeological study submitted in support of the development. Nothing in this Program should limit the Qualified Person from modifying the requirements as needed to suit the site conditions.

2.0 Water Wells

The Program requires that a water well is to be constructed on each lot under the supervision of, and to be tested by, a Qualified Person, who will certify as part of a written report that a drilled well has been constructed, meeting the minimum construction, water demand and water quality requirements as set forth herein. The report shall be submitted to the municipality as part of the Building Permit application. The Qualified Person is to ensure that the following tasks are completed:

- As a general guide, unless the Qualified Person recommends otherwise, new drilled wells are to be constructed at the locations illustrated on the accompanying Conceptual Lot Servicing Plans - Figure 12 of the Hydrogeological Study, as may be updated.

- Wherever possible, the distance separating wells and sewage systems is to be maximized, while complying with all required setbacks of O. Reg. 903, as amended, and the Ontario Building Code.

- All wells are to be drilled, constructed and sealed in accordance with O. Reg. 903, as amended.

- A single target aquifer has been identified at the base of the approximately 60 m (~200 ft) deep within the overburden. It is anticipated that well screens will be required for each of the wells. The decision as to the length, slot size and diameter for a well screen should be made by the well contractor in consultation with the Qualified Person, at the time of well construction. Additional well development may be required to achieve acceptable (sediment-free) conditions. The drilling contractor should be advised of this potential requirement in advance. Additional well development costs may, therefore, be incurred to

achieve a satisfactory outcome.

- The lot owner should be aware and understand that there is no guarantee that any new well constructed on the lot will be successful. Although considered highly unlikely, more than one attempt to construct a well may be needed.

- The Qualified Person shall conduct a pumping test of the new well. The pumping test shall have a 2-hour *minimum* duration at a minimum of 20 L/min for wells that will not require supplementary water storage. A longer pumping test may be required in the case of a lower yield well where water storage will be recommended. Following the pumping test there must be at least 95% water level recovery within 24 hours.

- If the subject well is located within 15 m of a neighbouring well, for the purpose of conducting an interference assessment, the Qualified Person should make an attempt to monitor the water levels in neighbouring wells during the course of the (previously described) pumping test.

- The pumping test is to include water sampling and laboratory analyses for the following parameters:

  nitrate (as N);
  chloride;
  sodium;
  dissolved organic carbon (DOC);
  hardness;
  iron (dissolved and total);
  manganese (dissolved and total), and
  total coliform bacteria and E. Coli bacteria.

- Further well development may be necessary to demonstrate that turbidity is acceptable (i.e., not to exceed 5 NTU, in the absence of bacteria issue). Note: wellhead turbidity measurements can be more representative than laboratory reported data in some instances, therefore, field-measured turbidity is required.

- In the event that any well is found to produce insufficient supply for domestic use, the Qualified Person shall instruct the owner as to the requirements of O. Reg. 903, as amended, to properly have the well abandoned by a licensed contractor. The owner should be aware that additional costs for well abandonment may be incurred, in the event that a well is not successful. The abandonment water well record shall be retained by the owner and a copy included in the Qualified Person's report.

- In the event that a well is found to be unacceptable, a subsequent attempt to construct a new well can be undertaken if desired. The Qualified Person shall ensure that the testing procedures outlined above are conducted on all new wells. In the event that a lot contains one of the test wells described in the hydrogeological study, it should also be subjected to the requirements of the Program.

3.0 Report

A *Well Certification Program* report is to be prepared by a Qualified Person and submitted to the municipality prior to issuance of a Building Permit. The report shall include the following.

- The location of the on-site water well.
- A copy of the well record).
- A description of the required pumping test and water quality data.
- A professional opinion indicating that the source and treatment system (as outlined in the report), will provide an adequate and sustainable supply of acceptable quality water for the subject lot. A summary of any unknowns or limitations on that opinion shall also be provided.
- Recommendations regarding, but not limited to: water treatment; supplemental water storage; wellhead protection; regular testing; maintenance; water conservation, and any other matters deemed appropriate by the Qualified Person.