WILMOT EMPLOYMENT LANDS INDUSTRIAL SUBDIVISION

Hydrogeological Investigation

Project Location:
Part of Lot 20 North of Bleam's Road &
Part of Lot 20 South of Snyder's Road and,
Part Lot 19 North Bleams Road North of Highway 7 & 8 &
Part Lot 19 South of Snyder's Road as 768957
Township of Wilmot

Prepared for:
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1.0 INTRODUCTION

1.1 Overview

MTE Consultants Inc. (MTE) was retained by Badenview Developments Inc. and New Hamburglrs Inc. to conduct a hydrogeological investigation in support of two Draft Plan of Subdivision applications. The Badenview and New Hamburglrs properties are referred to herein as the 'Subject Lands'. For the purposes of this report the two draft plans will be reviewed as one cohesive development. The Subject Lands are located within what is commonly referred to as the Wilmot Employment Lands (WEL) in the Town of New Hamburg, Township of Wilmot.

The WEL comprise of two parcels of land, formerly known as the Good Lands and the Schneider Lands. The Good Lands are owned by Badenview Developments Inc. The Schneider Lands are owned by New Hamburglrs Inc. Refer to **Figure 1a** for the Subject Lands Location Map and **Figure 1b** for the Subject Lands Key Map.

The proposed development includes industrial lands, municipal roadways and a Stormwater Management (SWM) Facility, which is currently being proposed to be located within the south portion of the Good Lands. The Subject Lands are to be serviced with municipal water and storm and sanitary sewers.

Note: The Ontario Ministry of the Environment, Conservation and Parks (MECP) was previously named the Ontario Ministry of the Environment (MOE) and the Ontario Ministry of the Environment and Climate Change (MOECC). For ease of discussion in this report, "MECP" is used to represent this provincial ministry and is inclusive of MOE and MOECC.

1.2 Scope and Methodology

The objective of this study is to investigate the potential impacts associated with the proposed development on the Subject Lands. More specifically, this investigation will:

- Assess the local and regional hydrogeological characteristics;
- Determine local groundwater elevations and interpret flow direction;
- Determine infiltration opportunities; and
- Provide a preliminary assessment for the need for construction dewatering.

To meet the objective, the following scope of work was implemented:

1) Site Identification:
    - Legal description.
    - Site Features.
    - Neighbouring land uses.
    - Ministry of the Environment, Conservation and Parks (MECP) well records review.
    - Published map review:

    - Ontario Base Maps;
    - Quaternary geology maps; and
    - Bedrock geology maps.
- Review of the Township of Wilmot and the Regional Municipality of Waterloo Official Plans.
- Review of existing geology and hydrogeological reports.
- Review of interactive online mapping tools:
    - Grand River Conservation Authority (GRCA) Source Water Protection Plan; and
    - GRCA Regulation Areas.

2) Field Investigation:

- Review of select off-site wells within 1000 m of the Site to identify:
    - Neighbouring wells;
    - Well depths;
    - Well construction details; and
    - Local geological information.
- Installation of 11 overburden groundwater monitoring wells on-site.
- In-situ hydraulic response testing of 11 on-site groundwater monitoring wells to determine hydraulic conductivity.

3) Analysis and Reporting:

- Geologic and hydrogeological summary.
- Preparation of geological cross-sections through the Subject Lands.
- Assessment of potential hydrogeological impacts from the proposed development on the Subject Lands.
- Determination of shallow groundwater system properties:
    - Horizontal hydraulic gradient;
    - Average linear groundwater velocity; and
    - Shallow groundwater flow patterns.
- Assess stormwater management measures proposed with respect to quantity of groundwater inputs to local aquifers.

This report should be read in conjunction with the following reports that have also been completed by MTE for the Subject Lands:

- Functional Servicing Report, dated December 17, 2018
- Preliminary SWM Report, dated December 17, 2018
- Preliminary Grading and Cut/Fill Analysis, dated December 17, 2018

1.3 Previous Studies

MTE reviewed a number of reports and documents applicable to the Subject Lands regarding the physical framework and hydrogeological characteristics, some regional in nature and some Site specific. Previous works completed and reviewed for the purposes of this study include:

- Enhanced Master Drainage Plan – Wilmot Employment Lands, New Hamburg, ON, last revised May 22, 2012, (MTE); and

- Preliminary Engineering Design and Cost Analysis – Wilmot Employment Lands, Township of Wilmot, July 2004 (Stantec).

A Geotechnical Investigation Report was completed for the Wilmot Employment Lands by Peto MacCallum Ltd. (Peto), dated December 18, 2018. A Geotechnical Investigation Report was completed for the Highway 7 & 8 New Hamburg Lands by Peto, dated December 18, 2018.

2.0 SUBJECT LANDS DESCRIPTION

The Subject Lands comprise a total area of approximately 55.38 hectares. The legal description of the Good Lands is:

Part of Lots 19-21, Concession North, Bleams Road
Part of Lot 21 Concession South, Bleams Road
Township of Wilmot
Regional Municipality of Waterloo

The legal description of the Schneider Lands is:

Part of Lot 19, South Snyder's Road
Part of Lot 19 North of Bleams Road
North of Highway 7 & 8
Township of Wilmot
Regional Municipality of Waterloo

The Study Area for the Subject Lands, including the boundary, geological cross-section locations, monitoring wells and existing features is illustrated on **Figure 2** and **Figure 3**.

Land use within the Subject Lands is primarily agricultural. The Township of Wilmot Official Plan identifies an area of Environmentally Constrained Lands within the south portion of the Subject Lands. This feature is associated with the presence of a floodplain as identified through the GRCA online mapping tool and shown on **Figure 3**.

A Draft Plan of Subdivision for the proposed Good Lands development has been prepared by MHBC Ltd., dated November 22, 2018. The Draft Plan of Subdivision includes industrial blocks, a Stormwater Management Facility block, road widenings, future development blocks, 0.3m reserve blocks and municipal roadways comprising a total area of approximately 42 hectares. The Draft Plan of Subdivision for the Good Lands is enclosed in **Appendix A**.

A Draft Plan of Subdivision for the proposed Schneider Lands development has been prepared by MHBC Ltd., dated November 22, 2018. The Draft Plan of Subdivision includes industrial blocks, emergency access blocks and municipal roadways comprising a total area of approximately 10 hectares. The Draft Plan of Subdivision for the Schneider Lands is enclosed in **Appendix A**.

2.1 Adjacent Land Use

The Subject Lands are bounded by industrial lands to the east and north, Highway 7/8 to the south and existing residential and industrial properties to the west. A woodlot and existing CN/GEXR railway line is present to the north. The Township of Wilmot Official Plan classifies the woodlot as a Locally Significant Natural Area (Map No. 8). In addition, a GRCA-defined wetland is located approximately 30m west of the Subject Lands. The Region of Waterloo Official Plan identifies this feature as a Core Environmental Feature.

2.2 Topography and Surface Water Drainage

MTE conducted a detailed topographical survey in 2018. A topographical low is located within the southeast portion of the Good Lands. The Subject Lands are moderately sloped throughout the majority of the site (generally between 1% and 10%). Existing elevations range between 346.6m at the centerline of Hamilton Road, 346.3 metres above mean sea level (mamsl) at the centerline of Nafziger Road, 346.0mamsl at the highest point of the GEXR, down to 334.2mamsl at the lowest point at the southern property line near an existing drainage outlet.

Overland surface water runoff follows topography towards the topographic low in the southeast corner of the Good Lands.

The Subject Lands currently contain two drainage outlets, known as the east and west tributaries, located near the southeast border of the Good and Schneider Lands and the southwest corner of the Good Lands, respectively, as illustrated on **Figure 4**. Both of these tributaries drain to the Nith River. The area of the Subject Lands that are classified as a floodplain by the GRCA and Environmentally Constrained Lands by the Township of Wilmot is located upstream of the west tributary.

An extensive network of tile drainage is present beneath the Good Lands (**Figure 4**), which outlet immediately upstream of the western tributary. Based on discussions with persons knowledgeable about the Subject Lands, there may be tile drainage beneath the Schneider Lands. If present, the network is no longer in service. No tile drains were encountered within the Schneider Lands during borehole advancement or test trench excavation.

According to the Grand River Information Network (GRIN) online mapping tool, a GRCA-defined wetland is located approximately 30m north of the WEL. There are no provincially significant wetlands located within or adjacent to the Subject Lands.
The Subject Lands are located within the Nith River Subwatershed in the Township of Wilmot. The Nith River (located approximately 870m south and 790m west of the Subject Lands) drains into the Grand River.

2.3 Development Proposal

Development as Proposed by Draft Plan

As illustrated on the proposed Draft Plan of Subdivisions, the proposed developments are made up of a number of blocks comprising industrial blocks, a stormwater management facility, municipal right-of-ways, and MTO setbacks areas.

Municipal Servicing

The proposed development will be serviced by municipal water, sanitary sewer and storm sewers. The reader is referred to the Wilmot Employment Lands Industrial Subdivision, Functional Servicing Report completed by MTE, dated December 17, 2018 for information relating to the proposed municipal servicing within the Subject Lands.

Stormwater Management (SWM)

The proposed development includes a SWM facility in the south portion of the Good Lands. The reader is referred to the Wilmot Employment Lands Industrial Subdivision, Stormwater Management Report completed by MTE, dated December 17, 2018 for information relating to the proposed SWM facility within the Subject Lands.

3.0 FIELD PROGRAM

3.1 Borehole Advancement and Monitoring Well Installation

The 2011 hydrogeological assessment completed for the Enhanced Master Drainage Plan (MTE, 2011) included the advancement of 12 boreholes (BH1-11 through BH12-11) to depths ranging between 8.2 metres below ground surface (mbgs) to 9.1mbgs, 11 test trenches (TT1-11 through TT11-11) to depths of 3.3mbgs, and three mini-piezometers (MP1-11 through MP3-11) to depths ranging between 0.91mbgs to 1.22mbgs on or within the area surrounding the Subject Lands. No monitoring wells were installed as part of the 2011 assessment.

A total of 11 boreholes (BH101-18 through BH109-18, BH111-18 and BH115-18) were advanced at the Good Lands between March 12 and 26, 2018 as part of a geotechnical investigation completed by Peto. Boreholes were advanced to depths ranging from 3.6mbgs to 11.1mbgs and were observed by Peto. Seven of these boreholes were completed as groundwater monitoring wells (BH101-18 through BH107-18). In addition, two mini-piezometers (MP2-11 and MP3-11) were replaced by MTE as these were found to be damaged. The MP2-11 and MP3-11 replacements were installed to depths of 0.93m and 0.98mbgs, respectively.

A total of six boreholes (BH201-18 through BH206-18) were advanced at the Schneider Lands on June 6, 2018 as part of a geotechnical investigation completed by Peto. Boreholes were advanced to a depth of 6.7mbgs and were observed by Peto. Four of these boreholes were completed as groundwater monitoring wells (BH201-18 through BH204-18).

Five test trenches were advanced at the Good Lands on July 20, 2018 (TT1-18 through TT5-18). An additional five test trenches were advanced at the Schneider Lands on October 25, 2018 (TT6-18 through TT10-18). Test trenches were completed by Musselman Excavating and were observed by MTE. Test trenches were advanced to depths ranging from 4.1mbgs to 6.4mbgs which was based on field observations of geologic conditions in order to meet the project objective.

All borehole, monitoring well, test trench, and mini-piezometer locations are illustrated on **Figure 3**. Borehole logs are provided in **Appendix B**.

Following installation, monitoring wells were developed using Waterra™ Surge Blocks to remove any accumulated silt and sediments from the bottom of the well and to remove fine materials from the well screen and sand pack.

Soil conditions observed during borehole and test trench advancement at the Subject Lands generally consist of topsoil ranging in thickness from 0.05m to1.2m underlain by native clayey silt, and silt material to the maximum investigated depth of 11.1mbgs. Occurrences of sandy silt were observed at borehole locations BH103-18 and BH105-18 while occurrences of silty sand were observed at borehole locations BH104-18, BH109-18 and BH202-18. These observations are characteristic of the Maryhill Till geological unit.

Bedrock was not encountered in any of the boreholes advanced on the Subject Lands; however, it is anticipated to be approximately 31 to 64mbgs (refer to Section 4.3).

3.2 Water Well Record Search

Hydrogeological data related to private supply wells within 1000m of the Subject Lands were obtained from water well records on-file with MECP. A total of 34 water well records were located within 1000m of the Subject Lands, as shown on **Figure 2**. Of the 34 water well records:

- Two wells were listed as commercial wells (ID No.'s 6506377 & 6508207);
- Eighteen wells were listed as domestic/livestock use wells, two of which are located on the Subject Lands (ID No.'s 7053495 & 6509204);
- Three wells were listed as industrial wells;
- Six wells were listed as monitoring wells/monitoring and test holes/test holes; and
- Five wells were listed as "not used".

There were no wells identified as municipal water supply wells.

Based on data obtained from the available well records, overburden in the area is generally comprised of silt and clay with various quantities of sand and stones reported.

MECP well records are available online within the MECP Well Records database.

3.3 Groundwater Levels

MTE completed twelve rounds of manual groundwater level measurements between April 8, 2018 and October 12, 2018. Manually measured groundwater levels and elevations within the monitoring wells are presented in Table 1 and Table 2.

Manual water level measurements were also collected from the three mini-piezometers in order to assess the vertical gradients from the wetland to the shallow groundwater system. Table 3 presents the manually measured water levels, elevations and vertical hydraulic gradient calculations within the mini-piezometers.

Electronic pressure transducers (data loggers) were installed within each of the monitoring wells within the Good Lands on June 1, 2018 and within the Schneider Lands on August 10, 2018. Data loggers measure the pressure (in centimeters of water) above the logger at a predetermined time interval, which can then be used to calculate a groundwater level and elevation. The data loggers installed at the Subject Lands were set to record a pressure at a time interval of every 1 hour. Hydrographs illustrating continuous groundwater elevations within the monitoring wells at the Subject Lands are provided in **Appendix C**. Based on the data logger recorded measurements, groundwater elevations were measured to range between 331.74mamsl (BH103-18) and 340.12mamsl (BH105-18).

Daily precipitation data was plotted on the hydrographs to determine how the water table responds to precipitation events. The precipitation data was obtained from the Government of Canada website as reported from the Kitchener/Waterloo weather station (operated by NAVCAN) located at the Region of Waterloo International Airport.

As shown on the hydrographs, monitoring well locations BH101-18 through BH105-18, BH107-18, BH201-18 and BH204-18, show responses to precipitation events however; these responses appear delayed which is likely attributed to the fine-grained soil material and associated low infiltration and percolation rates. Responses to precipitation events were not apparent at monitoring locations BH106-18, BH202-18 and BH203-18 which is likely a result of the heterogeneity of the soils beneath the Subject Lands.

Groundwater levels at the Subject Lands are likely subject to seasonal fluctuations, with seasonal highs expected in the early spring during snow melt. Continuous monitoring of groundwater elevation data will allow for the assessment of seasonal fluctuations of the water table and provide additional information on the short-term responses to precipitation events.

3.4 Hydraulic Conductivity Testing

Qualitatively, hydraulic conductivity (K) is a parameter describing the ease with which groundwater flows through a porous medium. Relatively large K values are attributed to permeable units, i.e. sand and gravel, while small values are attributed to less permeable material (i.e. silt or clay). Representative K values for various soil types are presented in Freeze and Cherry (1979).

MTE conducted single well hydraulic response tests on select on-Site monitoring wells on April 13, 2018 and October 10, 2018 in order to estimate the hydraulic conductivity of the screened interval beneath the Subject Lands. A recovery test (i.e. rising head test) was selected as the testing method due to the expected slow recoveries observed during well development. Recovery testing included purging the well dry, after development with a surge block, and using a pressure transducer (data logger) to record the pressure (in centimeters of water) above the logger during recovery. This pressure was then used to calculate a groundwater level. The data logger was programmed to record a reading every 10 or 60 seconds, in order to adequately capture the well recovery.

Prior to conducting the slug test analysis, recovery data was normalized by dividing the measured drawdown by the maximum recorded drawdown. Water level response data was analyzed using the Hvorslev method (Fetter, 2001) as, upon comparison with the Bouwer and Rice method (Fetter, 2001), more conservative values were calculated.

4.0 REGIONAL HYDROGEOLOGICAL SETTING

4.1 Physiography

The Subject Lands are located in the physiographic region known as the undrumlinized Stratford Till Plain, which consists of a broad clay plain extending from London in the south to Blyth and Listowel in the north. The till is fairly uniform and consists of brown, calcareous silty clay. Sand or gravel is often present in the intermorainal valleys south of St. Mary's (Chapman and Putnam, 1984). **Figures 5a** and **Figure 5b** show the location of the Subject Lands in relation to the physiographic regions and landforms, respectively.

4.2 Quaternary Geology

The Region of Waterloo has relatively thick glacial overburden deposits overlying bedrock attaining thicknesses in excess of 100m. In general, silty to clayey till was deposited as extensive sheets during different periods of glacial ice advance. Granular materials, such as outwash and kame sand, gravels and glaciolacustrine fine-grained deposits (such as silt and clay), were deposited during the ice retreat (Karrow, 1993).

The Quaternary Geology Map (**Figure 6**) identifies regional surficial deposits of clay to silt-textured till with pockets of ice-contact stratified deposits of sand and gravel with minor silt, clay and till.

4.3 Paleozoic Geology

The Region of Waterloo (ROW) is underlain, east to west and oldest to youngest, by Silurian age Guelph (dolostone), Salina (dolostone, shale, salt and gypsum) and Bass Islands (dolostone) Formations. Directly beneath the Subject Lands lies the Salina Formation (Hewitt, 1972), as shown on **Figure 7**.

Bedrock was not encountered during the drilling program, however according to the depth to bedrock reported in MECP well records in the area and borehole logs provided by the ROW, it is anticipated bedrock will be encountered at approximately 31mbgs to 64mbgs.

4.4 Regional Hydrogeology Setting

The ROW obtains approximately 80% of its water supply from groundwater within bedrock and sedimentary aquifers, with approximately half being supplied from the Waterloo Moraine (Bajc et. al., 2014). The Waterloo Moraine is located almost entirely within the ROW and is comprised of three separate units, which grade from coarse-grained sediments (gravel) to finer-grained sediments (silt and clay) with decreasing depth (Bajc et. al., 2014).

The fine-grained units of the Waterloo Moraine are referred to as the Upper, Middle, and Lower Maryhill Tills. These units represent regionally significant aquitards and will “act as a significant barrier to vertical water movement where present in a thickness greater than 5 meters” (Terraqua Ltd., 1995). The Maryhill Till consists primarily of sandy silt to silty clay and clayey silt diamictons (Bajc et. al., 2014). The Waterloo Moraine Aquifer Units are characterized by interbedded layers of silt, sand and gravels. Clay-rich glaciolacustrine deposits with gravels and pebbles are also present.

These Waterloo Moraine sediments overlie the Catfish Creek Till, characterized as a stoney to sandy diamicton, which is often over consolidated and forms an important marker horizon within the Region of Waterloo (Karrow, 1987). The Catfish Creek Till acts as an important, relatively continuous regional aquitard that is compositionally distinct and is widely distributed across the ROW (Terraqua Ltd., 1995; Bajc and Shirota, 2007; AquaResource Inc., 2009).

Regional groundwater elevations, provided from the GRIN, indicate that the regional groundwater flow direction in the area surrounding the Subject Lands is westerly, towards the Nith River (**Figure 8**).

5.0 LOCAL HYDROGEOLOGICAL SETTING

Previously drilled boreholes, MECP water well records and current boreholes and monitoring wells installed in 2018 were used to interpret local hydrostratigraphic units and generate four geological cross-sections.

Regional Geological Cross-Sections (Cross-Section A-A' and B-B') are presented on **Figure 9** and **Figure 10**, respectively. Local Geological Cross-Sections (Cross-Section C-C' and D-D') are presented on **Figure 11** and **Figure 12**, respectively. The cross-section stratigraphy was drawn using HydroGeo Analyst (HGA), which is a relational database system used to store and query the project database to create cross-sections.

Regional Geological Cross-Sections

*Geological Cross-section A-A' (**Figure 9**):*

- Extends approximately 3.0km north to south through the Subject Lands;
- Illustrates undulating topography from north to south with a large depression at the southern-most extent as the Nith River is approached;
- Portrays a subsurface comprised of overburden aquitard material (ATB1/ ATB3) composed primarily of fine-grained sediment (clayey silt to silty clay Maryhill Till) ranging in thickness from approximately 25m to 38m;
- Illustrates a relatively small, localized lens of silty sand within the central area of the property extending to the south which is bounded above and below by finer-grained sediments (Maryhill Till);
- Illustrates a fine-grained unit with a higher content of coarse-materials (i.e. gravel) extending across the entire section at elevations between approximately 323mamsl to 329mamsl which gradually increases in thickness towards the south; and
- Infers the shallow groundwater table is located at elevations ranging between approximately 335m amsl to 338m amsl, based on the October 12, 2018 groundwater measurements, generally decreasing towards the south.

*Geological Cross-section B-B' (**Figure 10**):*

- Extends approximately 2.6km west to east through the southern portion of the Subject Lands;
- Illustrates the Nith River and respective basin to the west, representing the topographic low, followed to the east by gently undulating topography with the Subject Lands crossing a topographical depression;
- Portrays overburden material in the Study Area to be comprised of fine-grained sediment deposits of clayey silt/silty clay till material characteristic of the Maryhill Till geological unit, ranging in thickness from approximately 20.5m (beneath the bed of the Nith River) to 41.5m;

- Illustrates a relatively small, localized lens of silty sand at an elevation of approximately 336m amsl and a fine-grained layer with a higher content of coarse materials (gravel) at an elevation of approximately 327m amsl within the center of the Subject Lands at the intersection of Cross-Section A-A. The lateral extent of these units from east to west is unknown; and
- Does not indicate an inferred groundwater table elevation as there was insufficient information; however, one location within the limits of the Subject Lands illustrates a groundwater elevation of 339.7m amsl.

Local Geological Cross-Sections

*Geological Cross-section C-C' (**Figure 11**):*

- Extends approximately 855m west to east through the south portion of the Subject Lands;
- Shows overburden material at the Subject Lands consists of fine-grained sediment deposits of clayey silt/silty clay till, characteristic of the Maryhill Till geological unit, from ground surface to the depth explored; and
- Illustrates the shallow groundwater table in the south portion of the Subject Lands ranges between approximately 335m amsl to 339.2m amsl. It is noted that that groundwater table is above the ground surface at BH103-18.

*Geological Cross-section D-D' (**Figure 12**):*

- Extends approximately 782m north to south through the east portion of the Subject Lands (Schneider Lands);
- Shows overburden material at the Subject Lands consists of fine-grained sediment deposits of clayey silt/silty clay till, characteristic of the Maryhill Till geological unit, from ground surface to the depth explored;
- Illustrates a seam of coarser-grained silty sand material in approximately the center of the section at BH202-18, which was identified at approximately 335mamsl and extended to the depth explored at BH202-18. Therefore; the width of this unit is currently unknown; and
- Illustrates the shallow groundwater table beneath the east portion of the Subject Lands ranges between approximately 336.9m amsl to 339.8m amsl.

5.1 Hydraulic Conductivity

The single well hydraulic response test analysis resulted in K values ranging from 2.0 $x10^{-8}$m/sec to 1.6 $x10^{-6}$m/sec with a geometric mean of 9.8 $x10^{-8}$m/sec. These results are consistent with the average published values for silt and glacial till soils (Freeze and Cherry, 1979) and the calculated K estimates from the geotechnical investigation, which reported a K value of "less than $1x10^{-8}$m/sec" for the clayey silt material and $1x10^{-6}$m/sec for the Silt, Sandy Silt and Silty Sand material.

Table 5.1 below summarizes the hydraulic conductivity estimates for each analyzed data set. **Appendix D** provides AquiferTest Pro data sheets.

Table 5.1: Hydraulic Conductivity (K) Values (m/sec)

Location	K value (m/sec)
BH101-18	$4.6x10^{-8}$
BH102-18	$3.9x10^{-8}$
BH104-18	$3.9x10^{-8}$
BH105-18	$4.0x10^{-7}$
BH106-18	$1.6x10^{-6}$
BH107-18	$4.0x10^{-8}$
BH201-18	$2.0x10^{-8}$
BH202-18	$1.1x10^{-7}$
BH204-18	$2.2x10^{-7}$
Minimum	$2.0x10^{-8}$
Maximum	$1.6x10^{-6}$
Geo-Mean	$9.8x10^{-8}$

5.2 Groundwater Flow and Average Linear Groundwater Velocity

The interpreted groundwater flow direction was determined using the October 12, 2018 groundwater elevation data. **Figure 13** illustrates groundwater elevation contours and flow patterns, indicating that the local groundwater system beneath the Subject Lands generally flows towards a hydraulic low located within the south portion of the Good Lands. Groundwater flow in the north portion of the Good Lands appears to flow in a northerly direction. The inconsistency between the regional groundwater flow direction interpretation (westerly) and the inferred groundwater flow direction within the west portion of the Good Lands may be due to the influence of the tile drainage network beneath the Subject Lands (**Figure 4**), and the influence of the local topography within the Site.

The horizontal hydraulic gradient is a measurement of the slope of the water table surface which is simply the change in hydraulic head over the change in distance between two or more monitoring points. **Figure 13** was used to calculate the horizontal hydraulic gradient which was estimated to be approximately 0.01m/m.

The average linear groundwater velocity was estimated based on three variables: hydraulic conductivity, horizontal hydraulic gradient and effective soil porosity. Effective soil porosity (n_e) is the percentage of a soils total porosity that allows for fluid flow through the soil (Fetter, 2001).

The equation for calculating average linear groundwater velocity is:

$$v = (-Ki)/n_e \qquad \text{[Eq. 1.]}$$

Where:

v = average linear groundwater velocity (m/sec)
K = hydraulic conductivity ($9.8x10^{-8}$m/sec (geometric mean))
i = horizontal hydraulic gradient (dh/dl) (0.01m/m)
n_e= effective soil porosity (0.25 typical for a silty clay (Bonazountas and Wagner, 1981))

With respect to the above values, the average linear groundwater velocity (v) within the shallow groundwater system at the Subject Lands was estimated to be approximately 0.12 m/year.

5.3 Groundwater – Wetland Interaction

Vertical hydraulic gradients were calculated to provide insight into whether the wetland was gaining (i.e. receiving groundwater from below) or losing (i.e. recharging the shallow groundwater table through infiltration).

Vertical hydraulic gradients were calculated using the following equation:

$$G = (OL - IL) / (MD - OL - [0.5 \times L]) \quad [Eq.2.]$$

Where:
G = hydraulic gradient (m/m)
OL = outside water level at MP (measured from top of MP casing) (m)
IL = inside water level at MP (measured from top of MP casing) (m)
MD = measured depth of MP (measured from top of MP casing) (m)
L = screen length (m)

Table 3 summarizes the calculated vertical gradients from the three MPs.

Where measureable, the vertical hydraulic gradient within the wetland at the three mini-piezometers was negligible representing relatively stagnant water conditions. Vertical hydraulic gradients can vary throughout the year and are influenced by precipitation events.

Determining the interaction between the groundwater and wetland located northwest of the Subject Lands included comparing the average and maximum groundwater elevations recorded in proximity to the wetland (at monitoring location BH107-18) to the average and minimum water elevations recorded inside the mini-piezometers (MP1-11 through MP3-11). The results of this comparison found that the difference between the water levels was, on average, approximately 2.45m, with the minimum separation measured as 0.14m (measured at MP1-11 on June 1, 2018). In addition, two of the mini-piezometers were observed to have “dry” outside levels during this investigation (MP1-11 and MP2-11). Hydrograph 12 in Appendix C illustrates the continuous water level measurements as recorded in MP3-11. As shown, the water level within MP3-11 responds to precipitation events, and the water level within the mini-piezometer gradually decreases during periods of low precipitation.

Based on the separation distances and observed “dry” conditions at two of the mini-piezometers, and the trends observed from the continuous water level monitoring within MP3-11, is interpreted that the wetland is not maintained by groundwater discharge.

The wetland likely receives water inputs as sheet runoff and from small independent subcatchment areas. When water inputs occur, overflows would rise above the organic seal of the wetland beds and, due to the low permeability soils at ground surface, surface water runoff from the wetland would result. Additional losses occur through evapotranspiration which can cause some wetlands to either dry up or experience a receding of their limits within the summer months, and is dependent on the amounts of precipitation.

The soils underlying the wetland were found to consist of clayey silt with similar characteristics to that found throughout the Subject Lands. Therefore, it is expected that surface water infiltration beneath the wetland is very slow.

6.0 SOURCE WATER PROTECTION

6.1 Wellhead Protection Areas

Based on the MECP on-line interactive Source Water Protection Information Atlas (MECP, 2018), no portion of the Subject Lands fall within a Wellhead Protection Area (WHPA), as shown on **Figure 14**.

6.2 Intrinsic Vulnerability

MTE reviewed the GRIN for information pertaining to the aquifer Intrinsic Vulnerability. The Intrinsic Vulnerability of an aquifer is based on the nature of the soil and/or bedrock and how easily surface water can reach the aquifer. Intrinsic Vulnerability is ranked as low, medium or high and does not take into consideration the properties of the contaminant itself (Liggett, Lapcevic, & Miller, May 2011).

As shown on **Figure 15**, the majority of the Subject Lands are classified as Medium Intrinsic Vulnerability with the exception of an area in the northeast portion of the Good Lands which is classified as Low Intrinsic Vulnerability.

6.3 Municipal Well Fields

The closest municipal well field is the New Hamburg Well Field, located approximately 2.25 km southwest of the Subject Lands housing one supply well (NH03). The well is screened from approximately 57mbgs to 76mbgs within the bedrock aquifer (LESPC, 2015).

Based on the distance to the closest municipal well field and the well screened depth, the proposed development is not anticipated to impact municipal water supply.

6.4 Significant Groundwater Recharge Areas (SGRAs)

Groundwater recharge occurs where precipitation and snowmelt infiltrate into the ground to feed aquifers, watercourses and wetlands. SGRAs are typically associated with coarse-grained soils (i.e. sands and gravels) or very shallow overburden material covering upland areas on the landscape. The GRIN shows that no portion of the Subject Lands is within a SGRA.

6.5 Issue Contributing Areas (ICAs)

ICAs were developed to define areas where past or current activities have or are likely to adversely affect the quality of drinking water in a given municipal well in which contaminants have already been measured at elevated levels.

An ICA is defined by the Grand River Source Protection Plan as:

> *"The area within which activities have or are likely to contribute to the elevated contaminant at the well...in most cases, an ICA is the 25 year time-of-travel capture zone."* (Grand River Conservation Authority, 2015)

The GRCA GRIN on-line map shows that no portion of the Subject Lands is within an ICA.

7.0 IMPACT ASSESSMENT

7.1 Stormwater Infiltration Design Considerations

Background evaluation and local field testing conducted under this hydrogeological investigation determined the Subject Lands were unsuitable for infiltration testing due to the fine-grained material, characteristic of the Maryhill Till geological unit, which does not readily transmit water, present throughout the majority of the Subject Lands.

A calculated infiltration rate was provided by Peto as "less than 0.04mm/hr" for clayey silt materials and 5mm/hr for silt, sandy silt, and silty sand material. As a result, the amount of infiltration is considered "negligible". This is consistent with the presence of a thick aquitard unit beneath the ground surface.

Soil samples collected from test trench locations TT1-18 and TT5-18 were submitted to Peto for particle size distribution analysis and an estimate of hydraulic conductivities and infiltration rates. TT1-18 is located within the footprint of the proposed SWM facility. The sample submitted from TT1-18 was collected from a depth of 4mbgs and was characterized as a silt with an estimated hydraulic conductivity of $1x10^{-6}$m/sec and infiltration rate of 10mm/hour. The sample submitted from TT5-18 was collected from a depth of 4mbgs and was characterized as a clayey silt with an estimated hydraulic conductivity of $1x10^{-8}$m/sec and infiltration rate of less than 0.1mm/hour.

The geotechnical grain size analysis report outlining the results from the test pitting program is provided in **Appendix E**.

7.2 Groundwater Separation to Grade at SWM Pond

Based on the proposed Draft Plan of Subdivision for the Good Lands, three groundwater monitoring locations are located within the limits of the proposed SWM facility: BH101-18 to BH103-18. The maximum groundwater elevations measured at these locations throughout this investigation are provided in **Table 7.2.1**, below:

TABLE 7.2.1: MAXIMUM GROUNDWATER ELEVATIONS OBSERVED IN PROPOSED SWM FACILITY

Location	Maximum Water Table Elevation (mamsl)
BH101-18	337.54
BH102-19	335.29
BH103-18*	334.65

*The groundwater elevation at BH103-18 represents an above-ground elevation.

These elevations will need to be taken into consideration upon finalizing the design of the SWM facility. In addition, construction dewatering may be required.

7.3 Groundwater Separation and Site Grading

Composite high groundwater table elevations for the Subject Lands are provided on **Figure 16**. The composite high water level map is a conservative representation of the seasonal high water levels during the spring freshet period (i.e. wet period) and is used to determine if adequate separation exists between the proposed floor foundation elevation and the shallow water table condition.

Although the proposed design specifications for the industrial buildings were unknown at the time of writing this report the development can still be constructed in this low permeable environment with adequate engineering design to move water away from the building foundations (e.g. installing a weeping tile system that collects water pumped out of a designated sump pump system). The potential long-term shallow groundwater flux into the designated sump pump system(s) is expected to be negligible considering that the subsurface soil material is low permeability (i.e. 10^{-8}m/sec). It is anticipated that sump pumps will only being active for short period of time, mainly during the spring freshet periods when the water levels are high.

7.4 Servicing Considerations

The Subject Lands will be serviced by municipal water, sanitary sewers and storm sewers. Refer to the Wilmot Employment Lands Industrial Subdivision, Functional Servicing Report completed by MTE for information relating to the proposed municipal servicing within the Subject Lands.

Composite high groundwater table elevations for the Subject Lands are provided on **Figure 16**.

Based on the composite high groundwater table elevation contours, the groundwater table may be encountered during the spring freshet periods only. Therefore, depending on when the installation of these services is constructed, a dewatering assessment may be required. The use of cut-off collars is recommended in these areas to prevent the migration of groundwater through pipe bedding and backfill. If the water table is encountered, the volumes produced may not exceed 50,000 L/day and therefore a Permit to take Water (PTTW) or Environmental Activity Sector Registry (EASR) may not be required. MTE does not anticipate managing large volumes of discharge water based on the low permeable subsurface soil environment.

7.5 Wetland Assessment

As outlined in Section 5.3, it is interpreted that the wetland located north of the Subject Lands is not maintained by groundwater discharge. Therefore, dewatering activities within the Subject Lands, if required, is not anticipated to impact the wetland.

Surface water runoff, post-construction, is anticipated to be directed towards the proposed SWM facility, located within the south portion of the Good Lands. Therefore, the development is not likely to impact the wetland as the wetland is located up-gradient within the property and therefore will not receive additional surface water inputs post-development.

8.0 SUMMARY AND CONCLUSIONS

Based on this hydrogeological investigation, MTE offers the following findings:

Geology

- Stratigraphic conditions beneath the Subject Lands primarily consist of fine-grained (clayey silt, silt, silt till, etc.) materials characteristic of the Maryhill Till geological unit; and
- Bedrock is anticipated to be at approximately 31 to 64mbgs.

Hydrogeology

- The shallow groundwater table was encountered at a depth range of 0.92m above the ground surface at BH103-18 to 6.61mbgs, at elevations between 327.0mamsl to 340.2mamsl during this investigation;
- The regional groundwater flow is inferred to be westerly, towards the Nith River, while the local groundwater flow direction is inferred to be towards a hydraulic low located within the south portion of the Good Lands. Groundwater flow in the north portion of the Good Lands is inferred to be northerly;
- The expansive network of tile drainage beneath the Subject Lands may be influencing the local shallow groundwater table;
- The horizontal hydraulic gradient is estimated to be 0.01 m/m;
- Hydraulic conductivity values ranged between 2.0 $x10^{-8}$ m/s to 1.6 $x10^{-6}$ m/s with a geometric mean of 9.8 $x10^{-8}$ m/s; and
- The groundwater velocity of the shallow groundwater table beneath the Subject Lands was estimated to be 0.12 m/year.

Impact Assessment and Construction Considerations

Proposed SWM Facility

- The sample submitted from TT1-18 (located within the proposed SWM facility block) from 4mbgs and was characterized as a silt with an estimated hydraulic conductivity of 1x10-6m/sec and infiltration rate of 10mm/hour; and
- Construction dewatering may be required.

Groundwater Separation and Site Grading

- Although the proposed design specifications for the industrial buildings were unknown at the time of writing this report the development can still be constructed in this low permeable environment with adequate engineering design in order to move water away from the building foundations (e.g. installing a weeping tile system that collects water pumped out of a designated sump pump system). It is anticipated that sump pumps will only being active for short periods of time (i.e. spring freshet periods when the water levels are high).

Servicing Considerations

- The groundwater table may be encountered during the installation of services and construction dewatering may be required. The use of cut-off collars is recommended in these areas to prevent the migration of groundwater through pipe bedding and backfill; and
- If the water table is encountered during construction, the volumes produced may not exceed 50,000 L/day and therefore a Permit to take Water (PTTW) or Environmental Activity Sector Registry (EASR) may not be required.

8.1 Recommendations and Monitoring

MTE recommends the Draft Plan Conditions require the following:

- Continuous groundwater monitoring;
- Updated information should be utilized during final design of the development as well as during the design of the site plan blocks;
- Mini-piezometers MP1-11 through MP3-11 should be monitored on continuous basis, during ice-free months, for a minimum period of one year, as outlined in the Work Program dated December 22, 2017;
- Further assessment of the requirement for construction dewatering, including whether a PTTW or EASR is required;
- During the development application process, existing on-site groundwater monitoring wells be maintained in accordance with Ontario Regulation 903 (as amended); and
- Prior to construction activities, monitoring wells located within proposed construction areas will need to be decommissioned in accordance with Ontario Regulation 903 (as amended).

9.0 LIMITATIONS

Services performed by **MTE Consultants Inc.** (MTE) were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the Environmental Engineering & Consulting profession. No other warranty or representation expressed or implied as to the accuracy of the information, conclusions or recommendations is included or intended in this report.

This report was completed for the sole use of MTE and the Client. The assignment was carried out in accordance with the Scope of Work described in Section 1.1 as reviewed with and agreed to by the Client. MTE makes no representation that the present report has dealt with all of the important environmental issues, except as provided in the Scope of Work. This report is not intended to be exhaustive in scope or to imply a risk-free facility. As such, this report may not deal with all issues potentially applicable to the Site and may omit aspects which are or may be of interest to the reader.

In addition, it should be recognized that a soil sample or groundwater level measurement represents one discrete portion of the Site at the time it is collected, and that the findings of this report are based on conditions as they existed during the time period of the investigation.

Any use which another party makes of this report, or any reliance on, or decisions to be made based upon it, are the responsibility of such parties. MTE accepts no responsibility for liabilities incurred by or damages, if any, suffered by another party as a result of decisions made or actions taken, based upon this report. Others with interest in the Site should undertake their own investigations and studies to determine how or if the condition affects them or their plans.

It should be recognized that the passage of time may affect the views, conclusions and recommendations (if any) provided in this report because environmental conditions of a property can change, along with regulatory requirements. Should additional or new information become available, MTE recommends that it be brought to our attention in order that we may determine whether it affects the contents of this report.

Respectfully Submitted,

MTE CONSULTANTS INC.

Kassandra Wallace, B.B.R.M.
Environmental Scientist

Robert Maric, M.Sc., P.Geo., QP$_{ESA}$
Hydrogeologist

KLW:dem

10.0 REFERENCES

Armstrong, D.K. and Carter, T.R, 2010: *The subsurface Paleozoic stratigraphy of southern Ontario:* Ontario Geological Survey, Special Volume 7, 301 p.

Bajc, A.F., Russell, H.A.J., and Sharpe, D.R. 2014. *A three-dimensional hydrostratigraphic model* of the Waterloo Moraine area, Southern Ontario, Canada. Canadian Water Resources Journal / Revue canadienne des ressources hydriques, 39:2, 95-119, DOI: 10.1080/07011784.2014.914794

Bajc, A.F. and Shirota, J. Groundwater Resources Study 3: *Three-Dimensional Mapping of Surficial Deposits in the Regional Municipality of Waterloo, Southwestern Ontario.* Toronto, Ontario: Ontario Geological Survey, 2007.

Bonazountas, M., and Wagner, J.M., (1981). *SESOIL: A Seasonal Soil Compartment Model* (1 ed.). Cambridge, Massachusetts, USA: Arthur D. Little, Inc.

Chapman, L. J., and Putman, D.F., 1984; *The Physiography of Southern Ontario, Third Edition.* Ontario Geological Survey, Special Volume 2, 270p. Accompanied by Map P. 2715, scale 1: 600,000

Fetter, C. W. (2001). *Applied Hydrogeology*(Vol. 4). Upper Saddle River, NJ: Prentice-Hall.

Freeze, R.A. and Cherry, J.A., 1979: *Groundwater;* Prentice-Hall Inc. Englewood Cliffs, New Jersey.

Grand River Conservation Authority, 2016. *Grand River Conservation Authority Web GIS Map Your Property Tool*. Accessed between April 2018 and May 2018: https://maps.grandriver.ca/web-gis/public/?theme=MYP&bbox=541107,4797948,567115,4813503

Karrow, P.F., 1993: *Quaternary Geology Stratford – Conestogo Area*: Ontario Geological Survey, Report 283, Ministry of Northern Development and Mines.

Lake Erie Region Source Protection Committee (LESPC), 2015: Grand River Source Protection Area, Approved Assessment Report under the Clean Water Act, 2006 (Ontario Regulation 287/07). Chapter 9: Region of Waterloo

Ministry of the Environment and Climate Change, 2018a: Source Water Information Atlas: https://www.google.ca/search?q=moecc+source+water+protection+information+atlas&rlz=1C1GGRV_enCA751CA751&oq=moecc+source&aqs=chrome.1.69i57j35i39j0l4.3688j0j4&sourceid=chrome&ie=UTF-8&safe=active&ssui=on

MTE Consultants Ltd. (MTE). 2011. Enhanced Master Drainage Plan, Wilmot Employment Lands, prepared for the Township of Wilmot, revised May 22, 2012.
MTE Consultants Ltd. (MTE). 2018. Wilmot Employment Lands Industrial Subdivision

Functional Servicing Report, prepared for Badenview Developments Inc. and New Hamburglrs Inc.

MTE Consultants Ltd. (MTE). 2018. Wilmot Employment Lands Industrial Subdivision Preliminary Stormwater Management Report, prepared for Badenview Developments Inc. and New Hamburglrs Inc.

MTE Consultants Ltd. (MTE). 2018. Wilmot Employment Lands Industrial Subdivision Preliminary Stormwater Management Report, prepared for Badenview Developments Inc. and New Hamburglrs Inc.

Peto MacCallum Ltd. (Peto), December 18, 2018: *Geotechnical Investigation – Proposed Development, Wilmot Employment Lands, New Hamburg, Ontario.*

Peto MacCallum Ltd. (Peto), December 18, 2018: *Geotechnical Investigation – Proposed Development, Highway 7/8 New Hamburg Property, New Hamburg, Ontario.*

Regional Municipality of Waterloo, *Council-Adopted Official Plan: 2029.*

Schot, P. and Winter, T. 2006. *Groundwater-surface water interactions in wetlands for integrated water resources management:* Journal of Hydrology, Volume 320, p. 261-263.

Stantec Consulting Ltd., July 2004. *Wilmot Employment Lands Preliminary Engineering Design and Cost Analysis.*

Terraqua Investigations Ltd. *The Study of Hydrogeology of the Waterloo Moraine.* 1995.

Waterloo Hydrogeologic Inc. *AquiferTest Pro Software.* Waterloo, Ontario. 2018. www.waterloohydrogeologic.com

Waterloo Hydrogeologic Inc. *HydroGeo Analyst Software.* Waterloo, Ontario. 2018. www.waterloohydrogeologic.com

FIGURES

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Inset map Scale: 1:20,000

NAFZIGER ROAD
HAMILTON ROAD
HIGHWAY 7 & 8
BLEAMS ROAD
ERBS ROAD
NOTRE DAME DRIVE
SANDHILLS ROAD
SNYDERS ROAD EAST
SNYDERS ROAD WEST
GINGERICH ROAD
CHRISTNER ROAD
WILMOT EASTHOPE ROAD
WATERLOO STREET
PERTH STREET
TOWNSHIP OF WILMOT
HURON STREET
HAYSVILLE ROAD
WALKER ROAD
37 LINE TOWNSHIP OF PERTH EAST
34 LINE
PERTH OXFORD ROAD
OXFORD ROAD 5
TOWNSHIP OF EAST-ZORRA TAVISTOCK

AREA OUTSIDE OF REGION OF WATERLOO

IMAGERY UNAVAILABLE

Legend

Boundaries

- Subject Lands Development Limit
- Study Area (500m Radius)
- Study Area (1000m Radius)
- Municipal Boundary

Roads

- Arterial
- Collector
- Expressway / Highway
- Freeway

Special Features

- Wetland Limit (GRCA)
- Waterbody (GRCA)
- Watercourse (GRCA)
- Regulatory Floodplain (GRCA)
- Regulation Limit (GRCA)

Data Sources:

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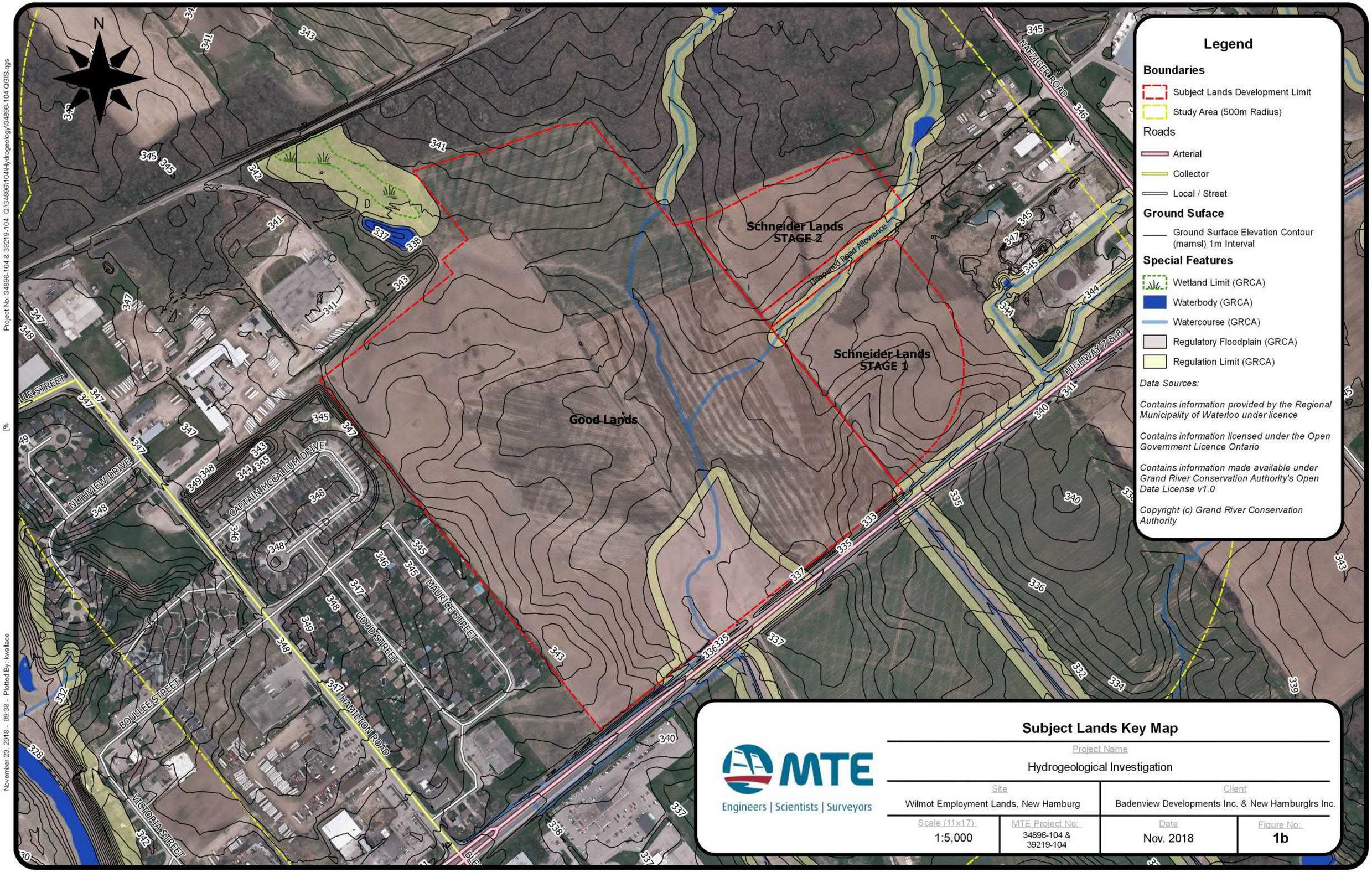
Subject Lands Location Map

Project Name			
Hydrogeological Investigation			
Site: Wilmot Employment Lands, New Hamburg		Client: Badenview Developments Inc. & New Hamburglrs Inc.	
Scale (11x17): 1:50,000	MTE Project No: 34896-104 & 39219-104	Date: Nov. 2018	Figure No: 1a



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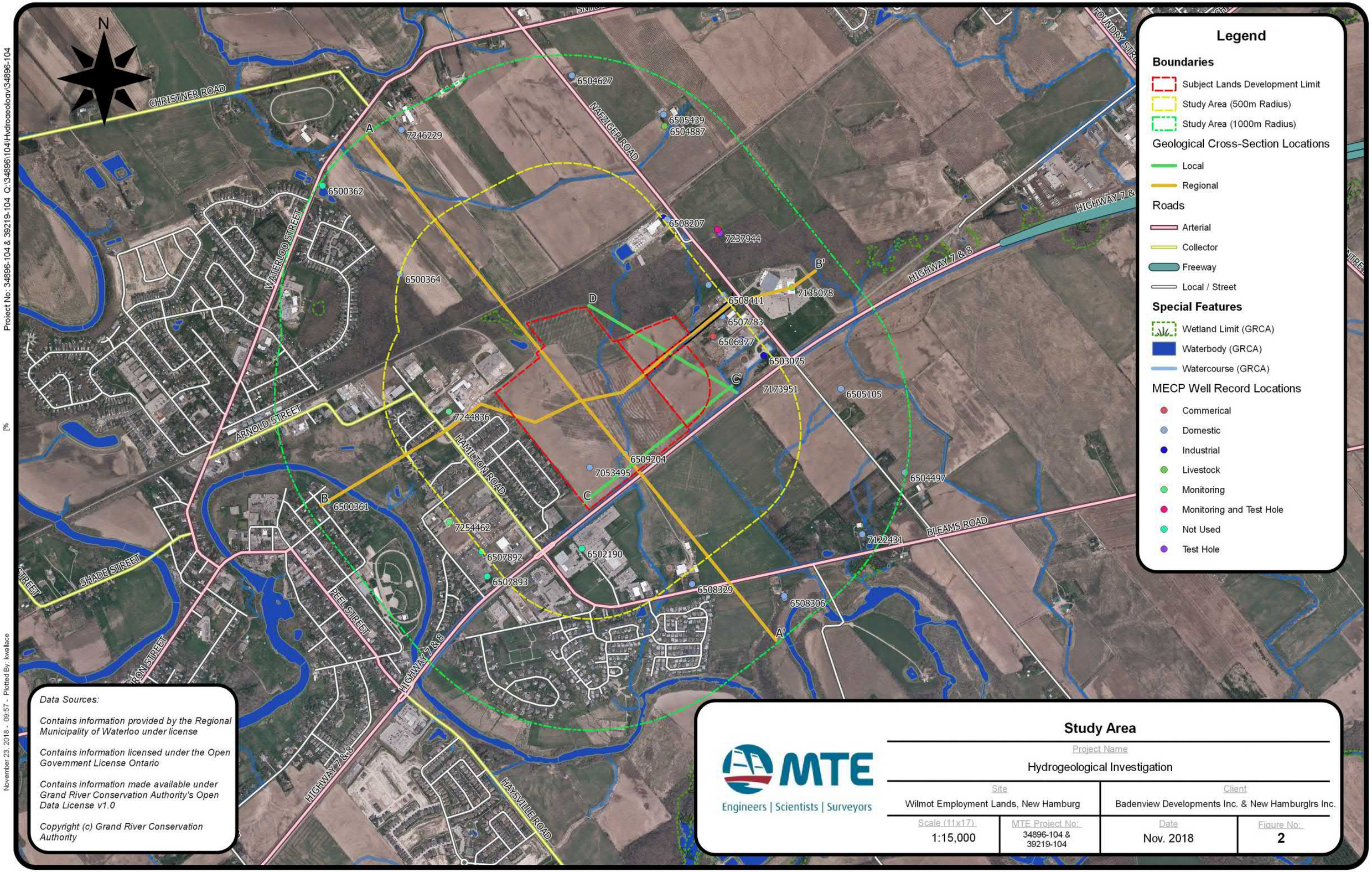
Subject Lands Key Map

Project Name			
Hydrogeological Investigation			
Site: Wilmot Employment Lands, New Hamburg		Client: Badenview Developments Inc. & New HamburgIrs Inc.	
Scale (11x17): 1:5,000	MTE Project No: 34896-104 & 39219-104	Date: Nov. 2018	Figure No: 1b



Legend

Boundaries

- Subject Lands Development Limit
- Study Area (500m Radius)
- Study Area (1000m Radius)

Geological Cross-Section Locations

- Local
- Regional

Roads

- Arterial
- Collector
- Freeway
- Local / Street

Special Features

- Wetland Limit (GRCA)
- Waterbody (GRCA)
- Watercourse (GRCA)

MECP Well Record Locations

- Commerical
- Domestic
- Industrial
- Livestock
- Monitoring
- Monitoring and Test Hole
- Not Used
- Test Hole

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Study Area

Project Name			
Hydrogeological Investigation			
Site: Wilmot Employment Lands, New Hamburg		Client: Badenview Developments Inc. & New Hamburglrs Inc.	
Scale (11x17): 1:15,000	MTE Project No: 34896-104 & 39219-104	Date: Nov. 2018	Figure No: 2

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N

D

C

C'

D'

NAFZIGER ROAD

HIGHWAY 7 & 8

CAPTAIN MCCALLUM DRIVE

HAMILTON ROAD

MAURICE STREET

GOOD STREET

MP2-11
MP3-11
MP1-11
TT5-11
BH5-11
BH106-18
BH107-18
BH114-18
BH108-18
BH4-11
TT4-11
TT5-18
BH113-18
BH112-18
BH3-11
TT3-11
BH109-18
TT10-11
BH105-18
BH111-18
TT11-11
TT4-18
TT2-11
BH104-18
BH1-11
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TT3-18
BH101-18
TT2-18
BH102-18
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BH117-18
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BH119-18
BH201-18
TT10-18
TT8-11
BH103-18
TT1-18
BH10-11

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Legend

Boundaries
- Subject Lands Development Limit
- Study Area (500m Radius)
- Study Area (1000m Radius)

Geological Cross-Section Locations
- Local
- Regional

Roads
- Arterial
- Collector
- Local / Street

Special Features
- Wetland Limit (GRCA)
- Waterbody (GRCA)
- Watercourse (GRCA)
- Regulatory Floodplain (GRCA)
- Regulation Limit (GRCA)

2018 Investigative Locations
- Monitoring Well
- Test Trench
- Borehole

Previous Studies Investigative Locations
- Test Trench
- Minipiezometer
- Borehole

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Existing Features

Project Name			
Hydrogeological Investigation			
Site: Wilmot Employment Lands, New Hamburg		Client: Badenview Developments Inc. & New HamburgIrs Inc.	
Scale (11x17): 1:5,000	MTE Project No: 34896-104 & 39219-104	Date: Nov. 2018	Figure No: 3

N

MP2-11
MP3-11
MP1-11
BH106-18
BH107-18
BH204-18
BH203-18
BH202-18
BH201-18
BH105-18
BH104-18
BH103-18
BH102-18
BH101-18
NAFZIGER ROAD
HIGHWAY 7 & 8
CAPTAIN MCCALLUM DRIVE
HAMILTON ROAD
GOOD STREET
MAURICE STREET
Eastern Tributary
Western Tributary

Legend

Boundaries
- Subject Lands Development Limit
- Study Area (500m Radius)

Roads
- Arterial
- Collector
- Local / Street

2018 Investigative Locations
- Monitoring Well

Previous Studies Investigative Locations
- Minipiezometer

Drainage
- Drainage Outlets
- Catch Basin
- Surface Inlet
- Drainage Tile
- Storm Drain

Special Features
- Wetland Limit (GRCA)
- Waterbody (GRCA)
- Watercourse (GRCA)
- Regulatory Floodplain (GRCA)
- Regulation Limit (GRCA)

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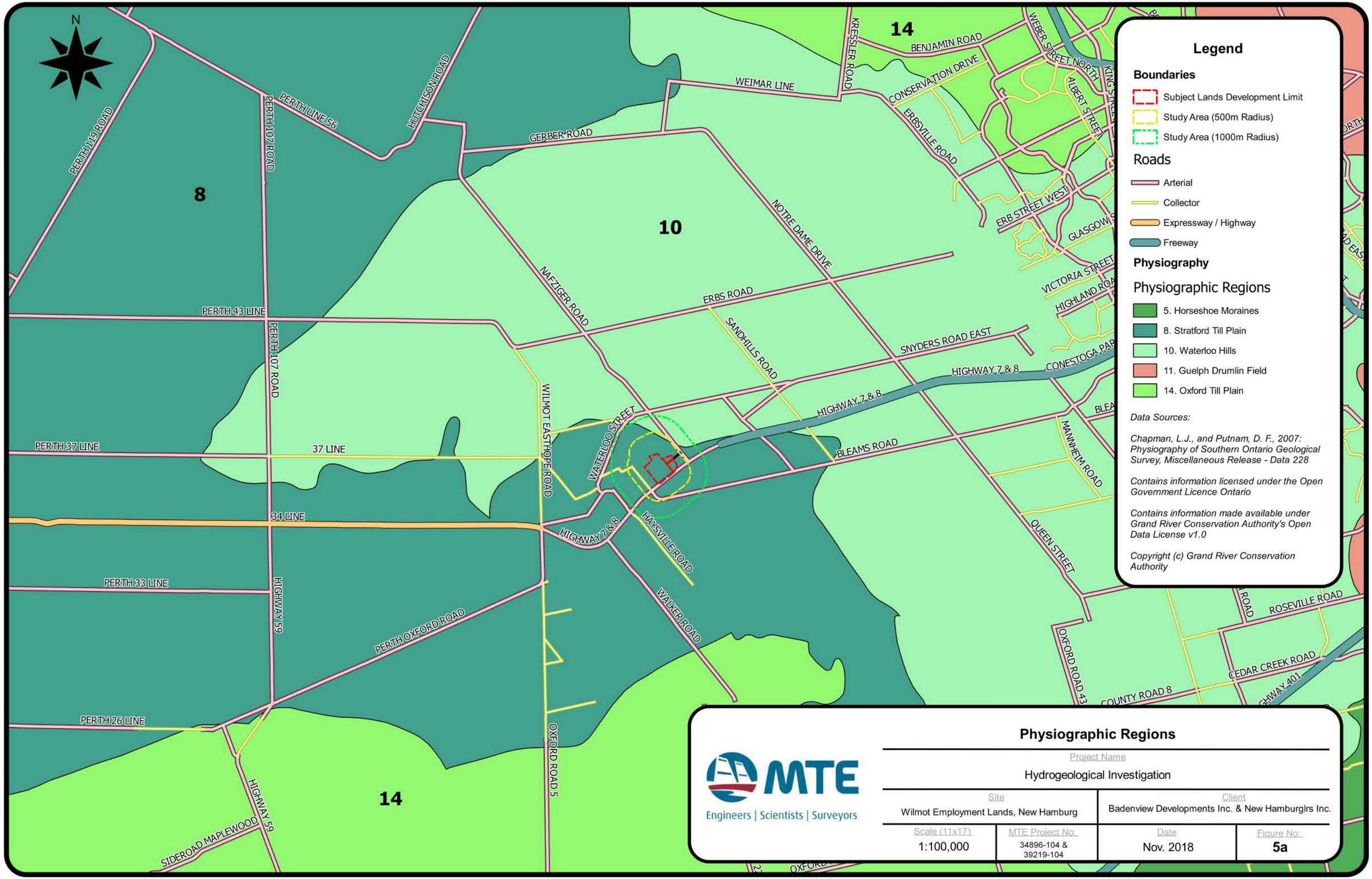
Existing Drainage Features (Locations Approximate)

Project Name			
Hydrogeological Investigation			
Site: Wilmot Employment Lands, New Hamburg		Client: Badenview Developments Inc. & New Hamburglrs Inc.	
Scale (11x17): 1:5,000	MTE Project No: 34896-104 & 39219-104	Date: Nov. 2018	Figure No: 4



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Physiographic Regions

Project Name			
Hydrogeological Investigation			
Site: Wilmot Employment Lands, New Hamburg		Client: Badenview Developments Inc. & New Hamburglrs Inc.	
Scale (11x17): 1:100,000	MTE Project No: 34896-104 & 39219-104	Date: Nov. 2018	Figure No: 5a

N

PERTH 119 ROAD
PERTH 107 ROAD
PERTH LINE 56
HUTCHISON ROAD
GERBER ROAD
WEIMAR LINE
BENJAMIN ROAD
CONSERVATION DRIVE
ERBSVILLE ROAD
WEBER STREET NORTH
ALBERT STREET
CONESTOGA PARKWAY
ERB STREET WEST
GLASGOW STREET
PARK STREET
VICTORIA STREET SOUTH
HIGHLAND ROAD WEST
NOTRE DAME DRIVE
NAFZIGER ROAD
ERBS ROAD
SANDHILLS ROAD
SNYDERS ROAD EAST
CONESTOGA PARKWAY
HIGHWAY 7 & 8
BLEAMS ROAD
MANNHEIM ROAD
HURON ROAD
TRUSSLER ROAD
QUEEN STREET
PERTH 43 LINE
PERTH 107 ROAD
WILMOT EASTHOPE ROAD
WATERLOO STREET
37 LINE
34 LINE
HIGHWAY 7 & 8
HAYSVILLE ROAD
WALKER ROAD
PERTH 33 LINE
HIGHWAY 59
PERTH OXFORD ROAD
OXFORD ROAD 43
COUNTY ROAD 8
CEDAR
ALPS ROAD
PERTH 26 LINE
OXFORD ROAD 5
OXFORD ROAD
OXFORD ROAD 22
SIDEROAD MAPLEWOOD

Legend

Boundaries

- Subject Lands Development Limit
- Study Area (500m Radius)
- Study Area (1000m Radius)

Roads

- Arterial
- Collector
- Expressway / Highway
- Freeway

Physiography

Physiographic Landforms

- 2. Till Moraines
- 3. Spillways
- 4. Kame Moraines
- 5. Till Plains (Undrumlinized)
- 6. Till Plains (Drumlinized)
- 12. Clay Plains
- 17. Peat and Muck

Data Sources:

Chapman, L.J., and Putnam,, D.F., 2007: Physiography of Southern Ontario; Ontario Geological Survey, Miscellaneous Release - Data 228

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Physiographic Landforms

Project Name			
Hydrogeological Investigation			
Site: Wilmot Employment Lands, New Hamburg		Client: Badenview Developments Inc. & New Hamburglrs Inc.	
Scale (11x17): 1:100,000	MTE Project No: 34896-104 & 39219-104	Date: Nov. 2018	Figure No: 5b

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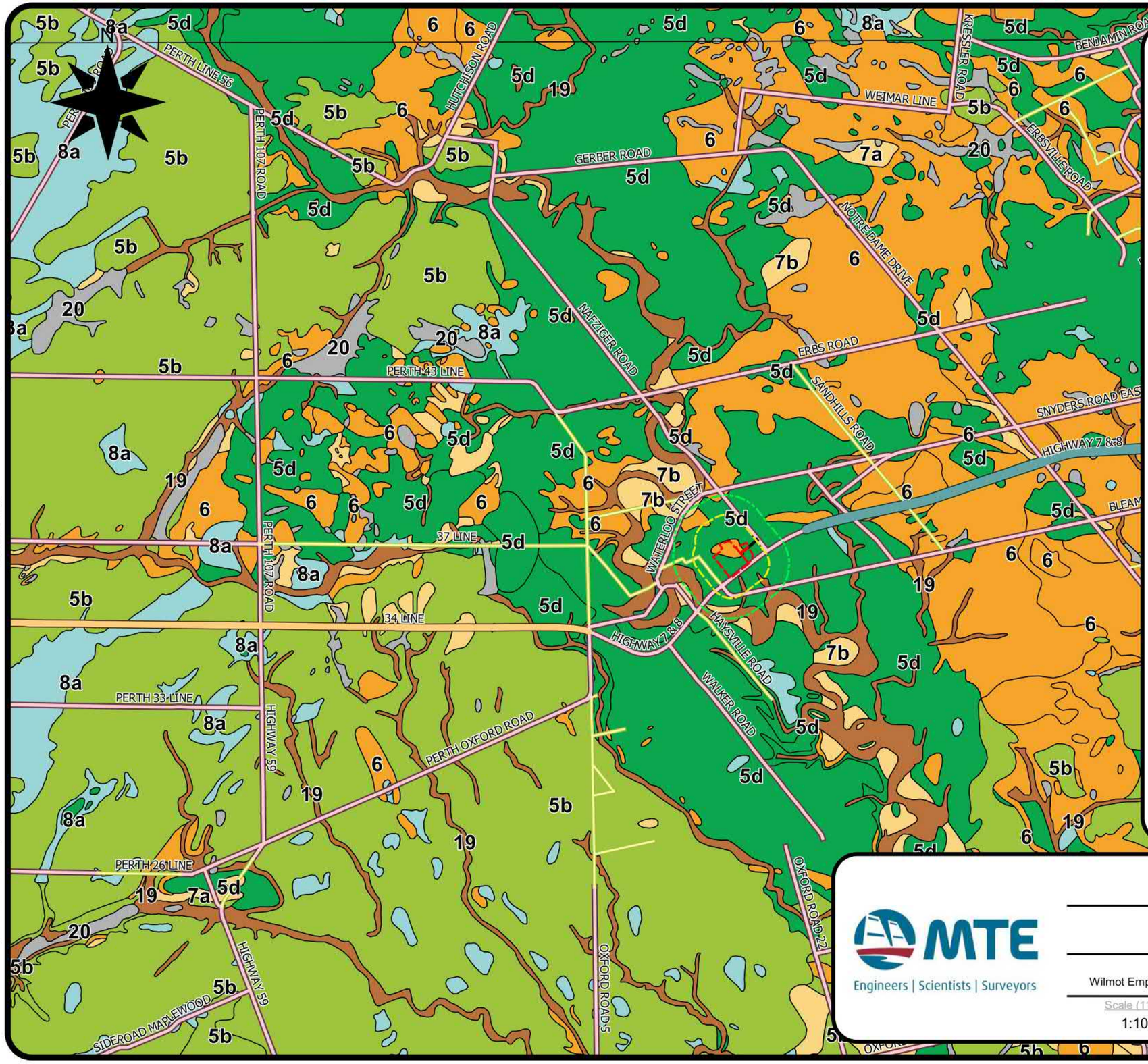

Legend

Boundaries

- Subject Lands Development Limit
- Study Area (500m Radius)
- Study Area (1000m Radius)

Roads

- Arterial
- Collector
- Expressway / Highway
- Freeway

Geology

Quaternary Geology

- 20. Organic Deposits: peat, muck, marl
- 19. Modern alluvial deposits: clay, silt, sand, gravel, may contain organic remains
- 8. Fine-textured glaciolacustrine deposits: silt and clay, minor sand and gravel
- 8a. Massive to well laminated
- 7. Glaciofluvial deposits: river deposits and delta topset facies
- 7a. Sandy deposits
- 7b. Gravelly deposits
- 6. Ice-contact stratified deposit: sand and gravel, minor silt, clay and till
- 6. Ice-contact stratified deposit: sand and gravel, minor silt, clay and till
- 5. Till:
- 5b. Stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain
- 5d. Clay to silt-textured till (derived from glaciolacustrine deposits or shale)

Data Sources:

Ontario Geological Survey, 2010. Surficial geology of Southern Ontario; Ontario Geological Survey - Miscellaneous Release Data 128 - Revised

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Quaternary Geology

Project Name			
Hydrogeological Investigation			
Site: Wilmot Employment Lands, New Hamburg		Client: Badenview Developments Inc. & New Hamburglrs Inc.	
Scale (11x17): 1:100,000	MTE Project No: 34896-104 & 39219-104	Date: Nov. 2018	Figure No: 6

Project No: 34896-104 & 39219-104 Q:\34896\104\Hydrogeology\34896-104 QGIS.qgs
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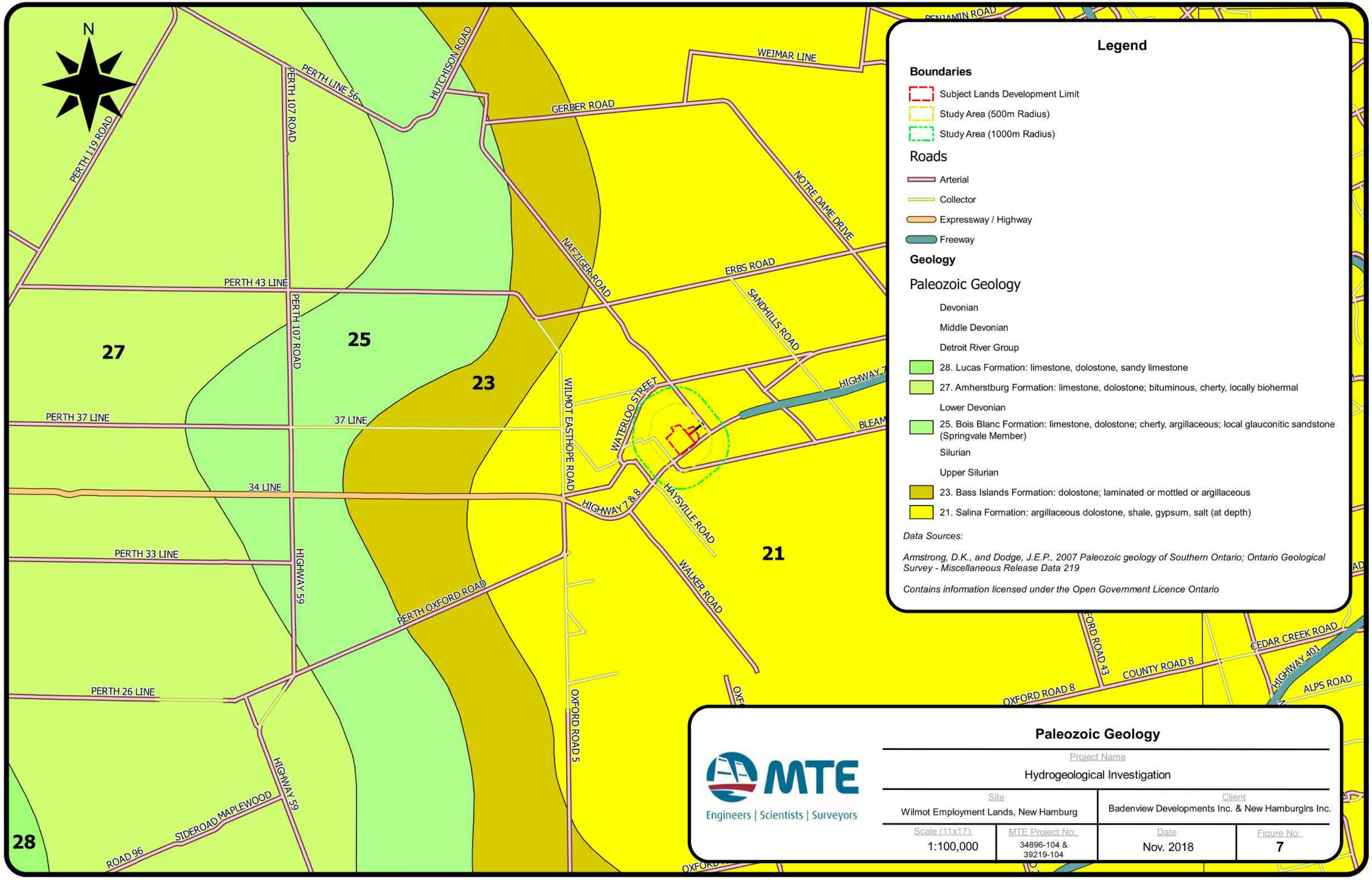

Legend

Boundaries

- Subject Lands Development Limit
- Study Area (500m Radius)
- Study Area (1000m Radius)

Roads

- Arterial
- Collector
- Expressway / Highway
- Freeway

Geology

Paleozoic Geology

Devonian

Middle Devonian

Detroit River Group

- 28. Lucas Formation: limestone, dolostone, sandy limestone
- 27. Amherstburg Formation: limestone, dolostone; bituminous, cherty, locally biohermal

Lower Devonian

- 25. Bois Blanc Formation: limestone, dolostone; cherty, argillaceous; local glauconitic sandstone (Springvale Member)

Silurian

Upper Silurian

- 23. Bass Islands Formation: dolostone; laminated or mottled or argillaceous
- 21. Salina Formation: argillaceous dolostone, shale, gypsum, salt (at depth)

Data Sources:

Armstrong, D.K., and Dodge, J.E.P., 2007 Paleozoic geology of Southern Ontario; Ontario Geological Survey - Miscellaneous Release Data 219

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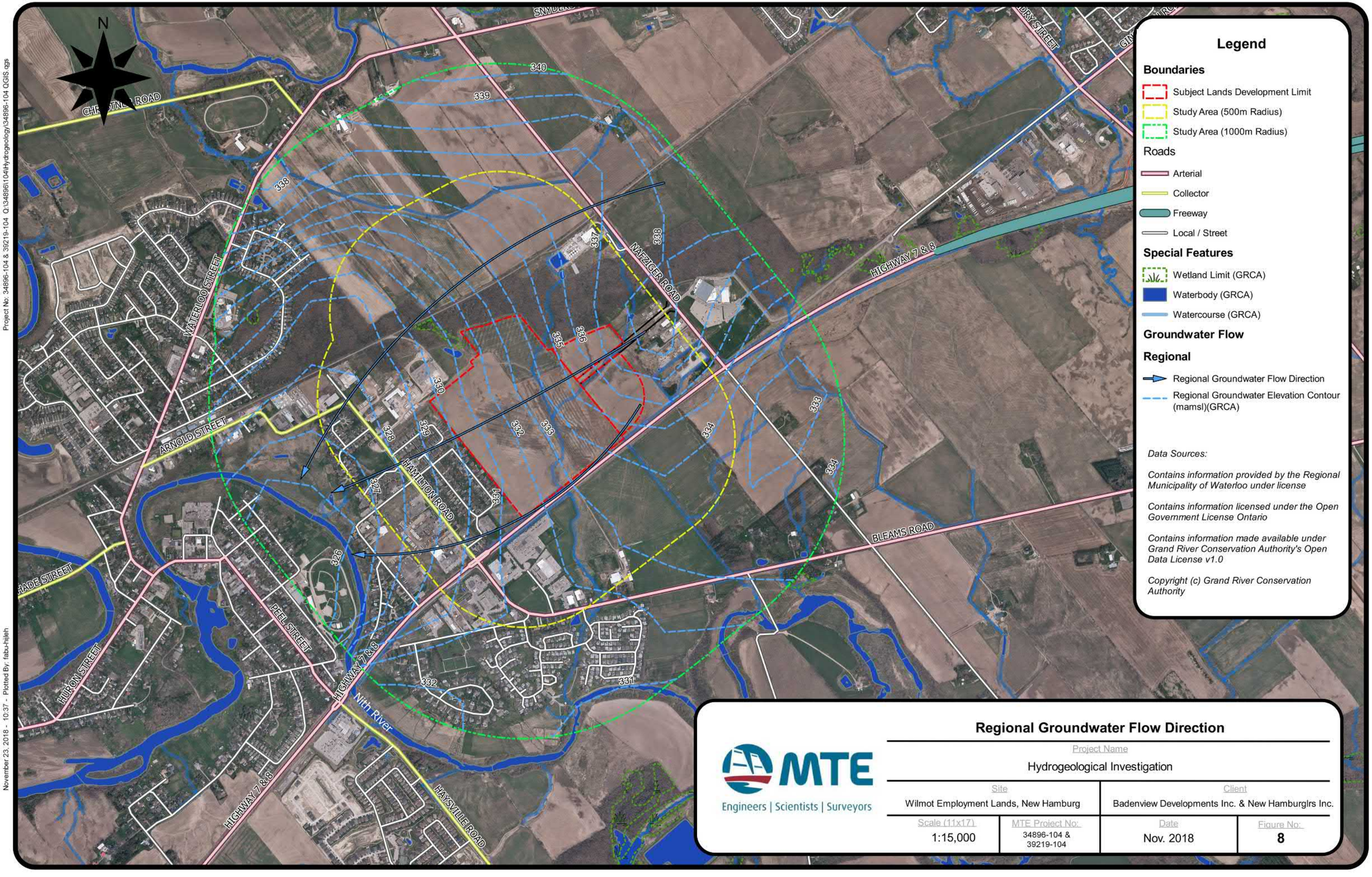
Engineers | Scientists | Surveyors

Paleozoic Geology

Project Name			
Hydrogeological Investigation			
Site: Wilmot Employment Lands, New Hamburg		Client: Badenview Developments Inc. & New HamburgIrs Inc.	
Scale (11x17): 1:100,000	MTE Project No: 34896-104 & 39219-104	Date: Nov. 2018	Figure No: 7

Project No: 34896-104 & 39219-104 Q:\34896\104\Hydrogeology\34896-104 QGIS.qgs
November 23, 2018 - 10:31 - Plotted By: fabu-hijleh
QEV6.0



Legend

Boundaries

- Subject Lands Development Limit
- Study Area (500m Radius)
- Study Area (1000m Radius)

Roads

- Arterial
- Collector
- Freeway
- Local / Street

Special Features

- Wetland Limit (GRCA)
- Waterbody (GRCA)
- Watercourse (GRCA)

Groundwater Flow

Regional

- Regional Groundwater Flow Direction
- Regional Groundwater Elevation Contour (mamsl)(GRCA)

Data Sources:

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Engineers | Scientists | Surveyors

Regional Groundwater Flow Direction

Project Name			
Hydrogeological Investigation			
Site: Wilmot Employment Lands, New Hamburg		Client: Badenview Developments Inc. & New Hamburglrs Inc.	
Scale (11x17): 1:15,000	MTE Project No: 34896-104 & 39219-104	Date: Nov. 2018	Figure No: 8

Project No: 34896-104 & 39219-104 Q:\34896\104\Hydrogeology\34896-104 QGIS.qgs
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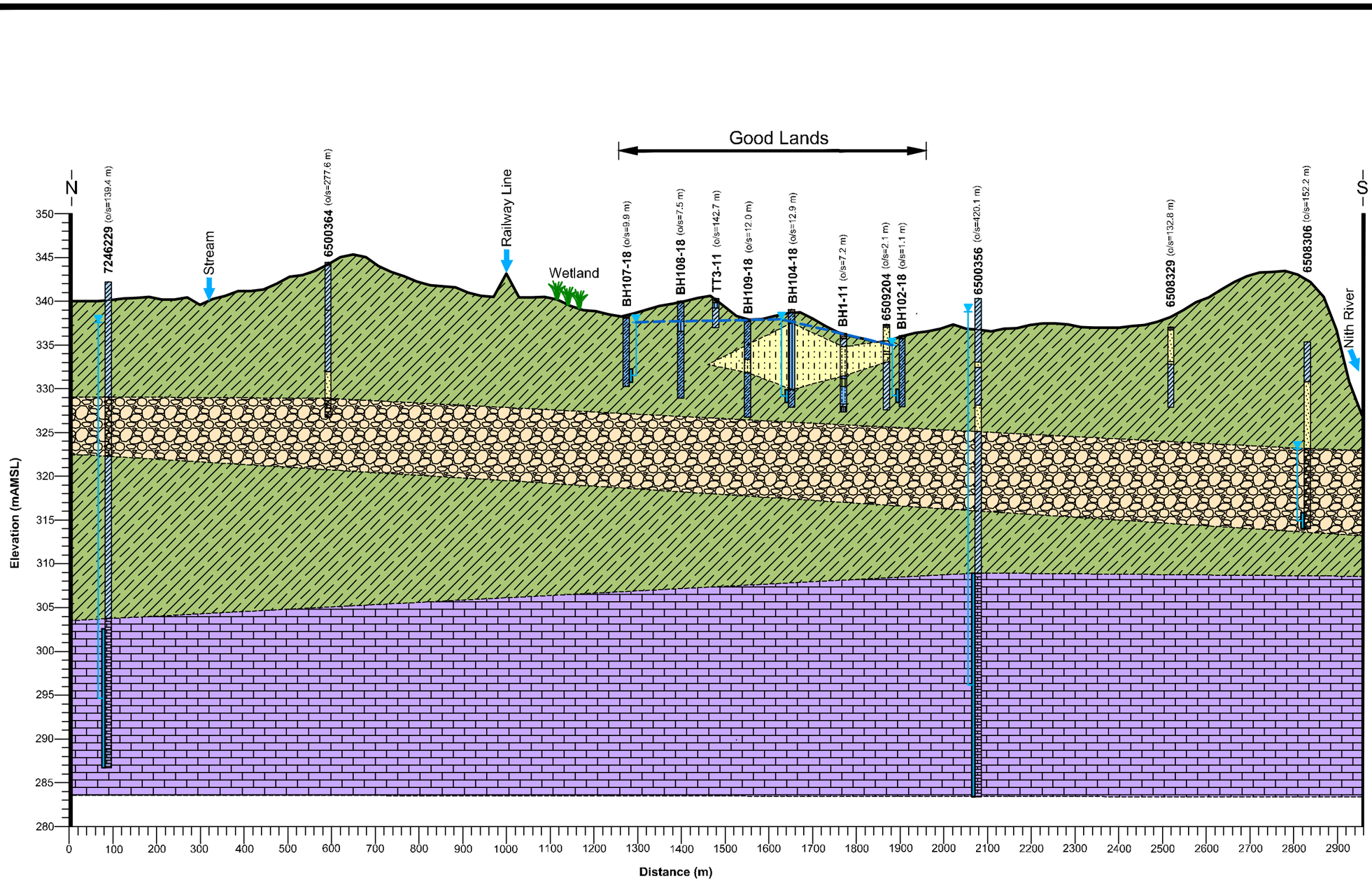


Legend

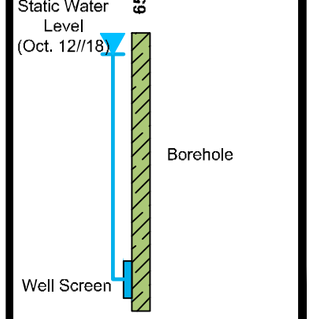
- Ground Surface (Inferred)
- Water Table (Interpreted)

Borehole Lithology

- Topsoil
- Silty Clay
- Clayey Silt
- Bedrock
- Gravel
- Silty Sand
- Sand
- Silt Till
- Silt
- Clay
- Sandy Silt

Interpreted Geology

- Clayey Silt/Silty Clay Till
- Silty Clay and Gravel
- Silty Sand
- Bedrock



Vertical Exaggeration (20X)

Notes:

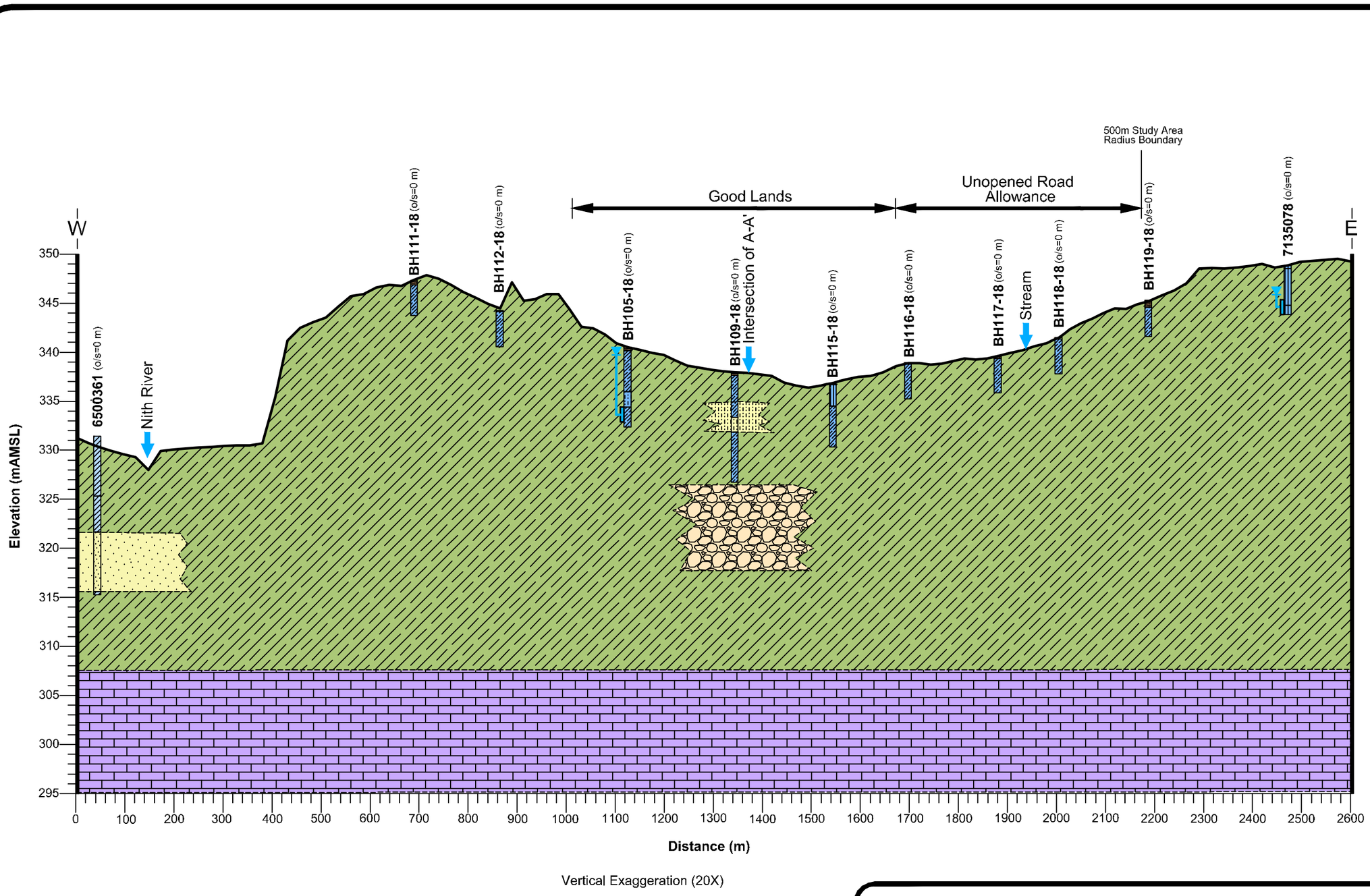
Geological sequence is based on professional interpretation from the soils encountered during drilling and geological descriptions provided from the MECP online well records database. Actual geological conditions may vary between the tested locations.

The interpreted groundwater surface has been projected on the geological cross-section. Differences between the groundwater surface and wells presented on the geological cross-section is a result of offset distances.

MTE
Engineers | Scientists | Surveyors

Regional Geological Cross-Section - A-A'

Project Name	
Hydrogeological Investigation	
Site: Wilmot Employment Lands & Highway 7 & 8 Lands	Client: Badenview Developments Inc. & New Hamburgirs Inc.
Scale (11x17): As shown	MTE Project No.: 34896-104
Date: Nov. 2018	Figure No.: 9



Vertical Exaggeration (20X)

Legend

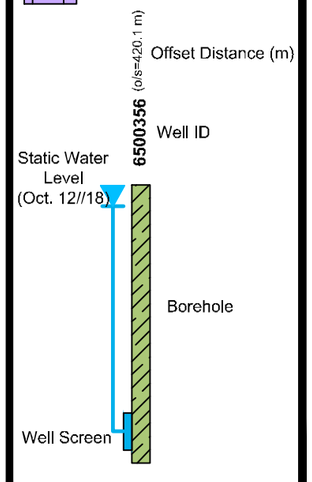
- Ground Surface (Inferred)
- Water Table (Interpreted)

Borehole Lithology

- Topsoil
- Silty Clay
- Clayey Silt
- Bedrock
- Gravel
- Silty Sand
- Sand
- Silt Till
- Silt
- Clay
- Sandy Silt

Interpreted Geology

- Clayey Silt/Silty Clay Till
- Silty Clay and Gravel
- Silty Sand
- Bedrock



Notes:

Insufficient groundwater table elevation information to display an inferred groundwater table on cross-section.

Geological sequence is based on professional interpretation from the soils encountered during drilling and geological descriptions provided from the MECP online well records database. Actual geological conditions may vary between the tested locations.

The interpreted groundwater surface has been projected on the geological cross-section. Differences between the groundwater surface and wells presented on the geological cross-section is a result of offset distances.

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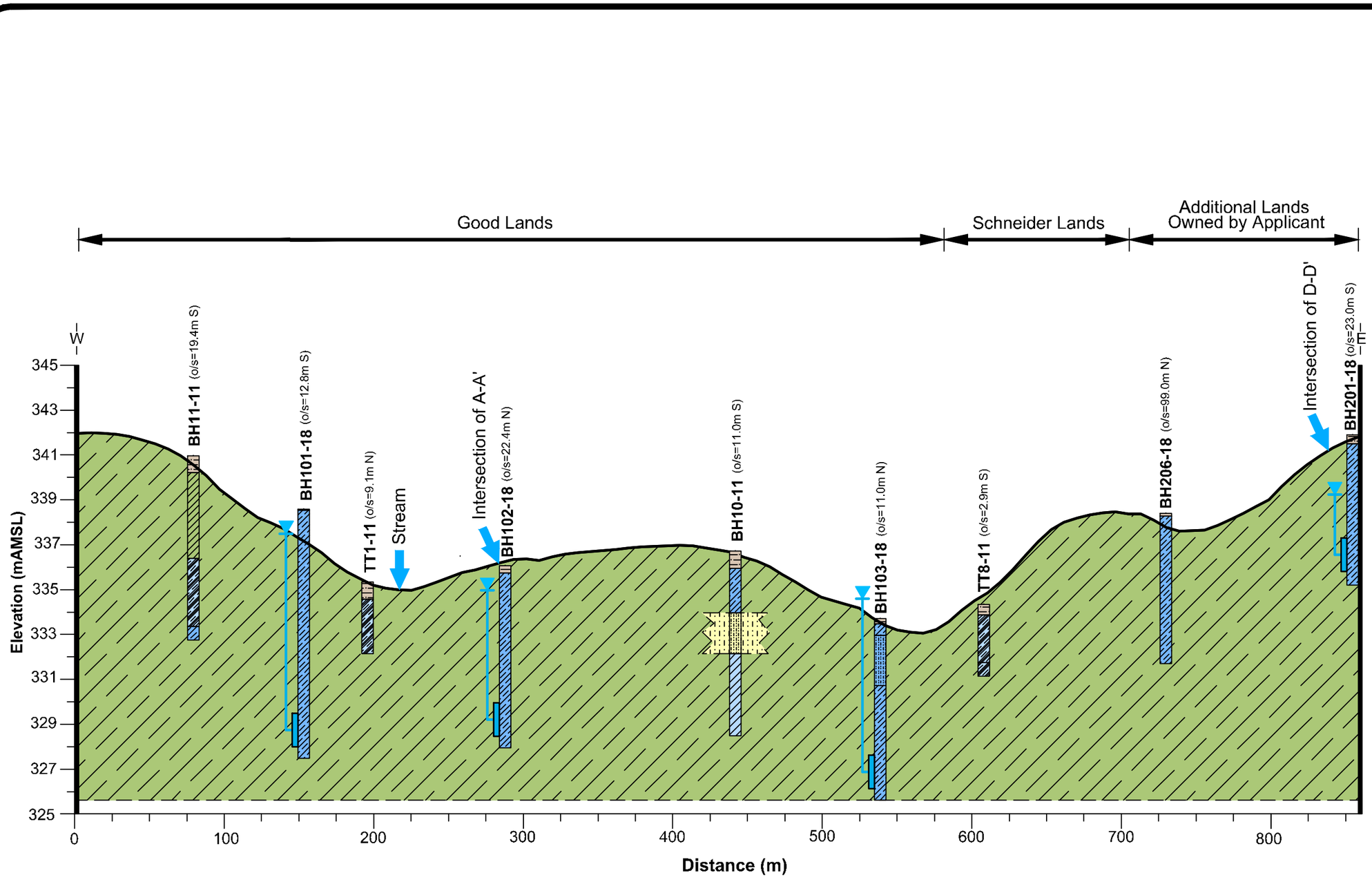
Regional Geological Cross-Section B-B'

Project Name	
Hydrogeological Investigation	
Site: Wilmot Employment Lands & Highway 7 & 8 Lands	Client: Badenview Developments Inc. & New Hamburglrs Inc.

Scale (11x17)	MTE Project No.	Date	Figure No.
As shown	34896-104	Nov. 2018	**10**

EV1.3



Vertical Exaggeration (15X)

Legend

- Ground Surface (Inferred)
- Water Table (Interpreted)

Borehole Lithology

- Topsoil
- Silty Clay
- Clayey Silt
- Bedrock
- Gravel
- Silty Sand
- Sand
- Silt Till
- Silt
- Clay
- Sandy Silt

Interpreted Geology

- Clayey Silt/Silty Clay Till
- Silty Clay and Gravel
- Silty Sand
- Bedrock

Offset Distance (m)

6500356 (o/s=420.1 m)

Well ID

Static Water Level (Oct. 12//18)

Borehole

Well Screen

Notes:

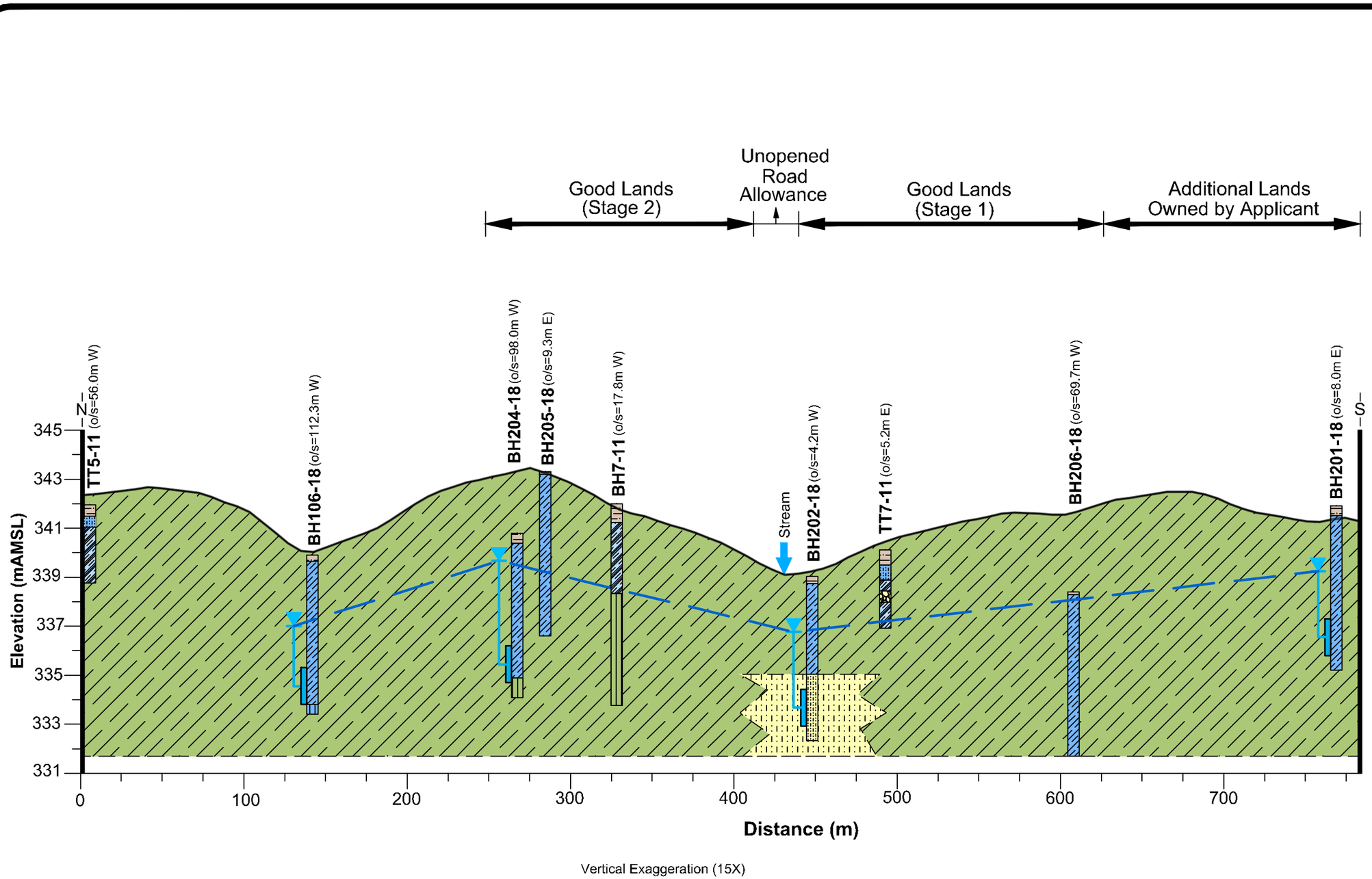
Geological sequence is based on professional interpretation from the soils encountered during drilling and geological descriptions provided from the MECP online well records database. Actual geological conditions may vary between the tested locations.

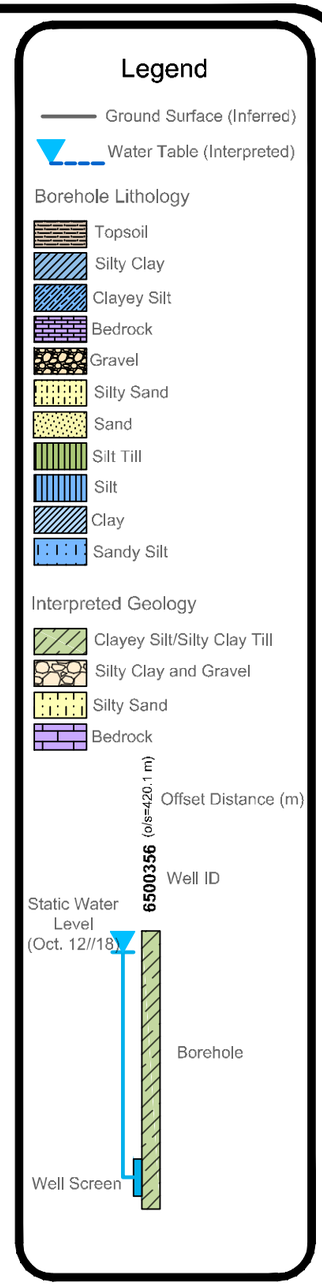
The interpreted groundwater surface has been projected on the geological cross-section. Differences between the groundwater surface and wells presented on the geological cross-section is a result of offset distances.

MTE Engineers | Scientists | Surveyors

Local Geological Cross-Section C-C'

Project Name			
Hydrogeological Investigation			
Site		Client	
Wilmot Employment Lands & Highway 7 & 8 Lands		Badenview Developments Inc. & New Hamburglrs Inc.	
Scale (11x17)	MTE Project No.	Date	Figure No.
As shown	34896-104	Nov. 2018	11





EV1.4

Notes:

Geological sequence is based on professional interpretation from the soils encountered during drilling and geological descriptions provided from the MECP online well records database. Actual geological conditions may vary between the tested locations.

The interpreted groundwater surface has been projected on the geological cross-section. Differences between the groundwater surface and wells presented on the geological cross-section is a result of offset distances.

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Local Geological Cross-Section D-D'

Project Name			
Hydrogeological Investigation			
Site		Client	
Wilmot Employment Lands & Highway 7 & 8 Lands		Badenview Developments Inc. & New Hamburglrs Inc.	
Scale (11x17)	MTE Project No.	Date	Figure No.
As shown	34896-104	Nov. 2018	**12**

N

BH203-18
GS = 344.165
GW = 338.31

BH106-18
GS = 339.87
GW = 337.03

BH107-18
GS = 338.443
GW = 337.65

BH204-18
GS = 340.813
GW = 339.67

BH202-18
GS = 339.154
GW = 336.79

BH201-18
GS = 341.941
GW = 339.24

BH105-18
GS = 340.361
GW = 339.71

BH104-18
GS = 338.961
GW = 337.97

BH103-18
GS = 333.699
GW = 334.61

BH102-18
GS = 336.032
GW = 334.99

BH101-18
GS = 338.592
GW = 337.51

339
337.5
338
339.5
338.5
338
337.5
337
336.5
336
335.5
335
334.5
339
339.5

NAFZIGER ROAD
HIGHWAY 7 &
CAPTAIN MCCALLUM DRIVE
HAMILTON ROAD
BOULLEE STREET
GOOD STREET
MAURICE STREET

Legend

Boundaries
- Subject Lands Development Limit
- Study Area (500m Radius)

Roads
- Arterial
- Collector
- Local / Street

Special Features
- Wetland Limit (GRCA)
- Waterbody (GRCA)
- Watercourse (GRCA)

Local Groundwater Flow

Monitoring Locations
- Monitoring Well
- Local Groundwater Flow Direction - Oct. 12, 2018
- Local Groundwater Table Elevation Contour (mamsl) Oct. 12, 2018

GS = Ground Surfae Elevation (mamsl)
GW = Groundwater Elevation (mamsl)

Data Sources:

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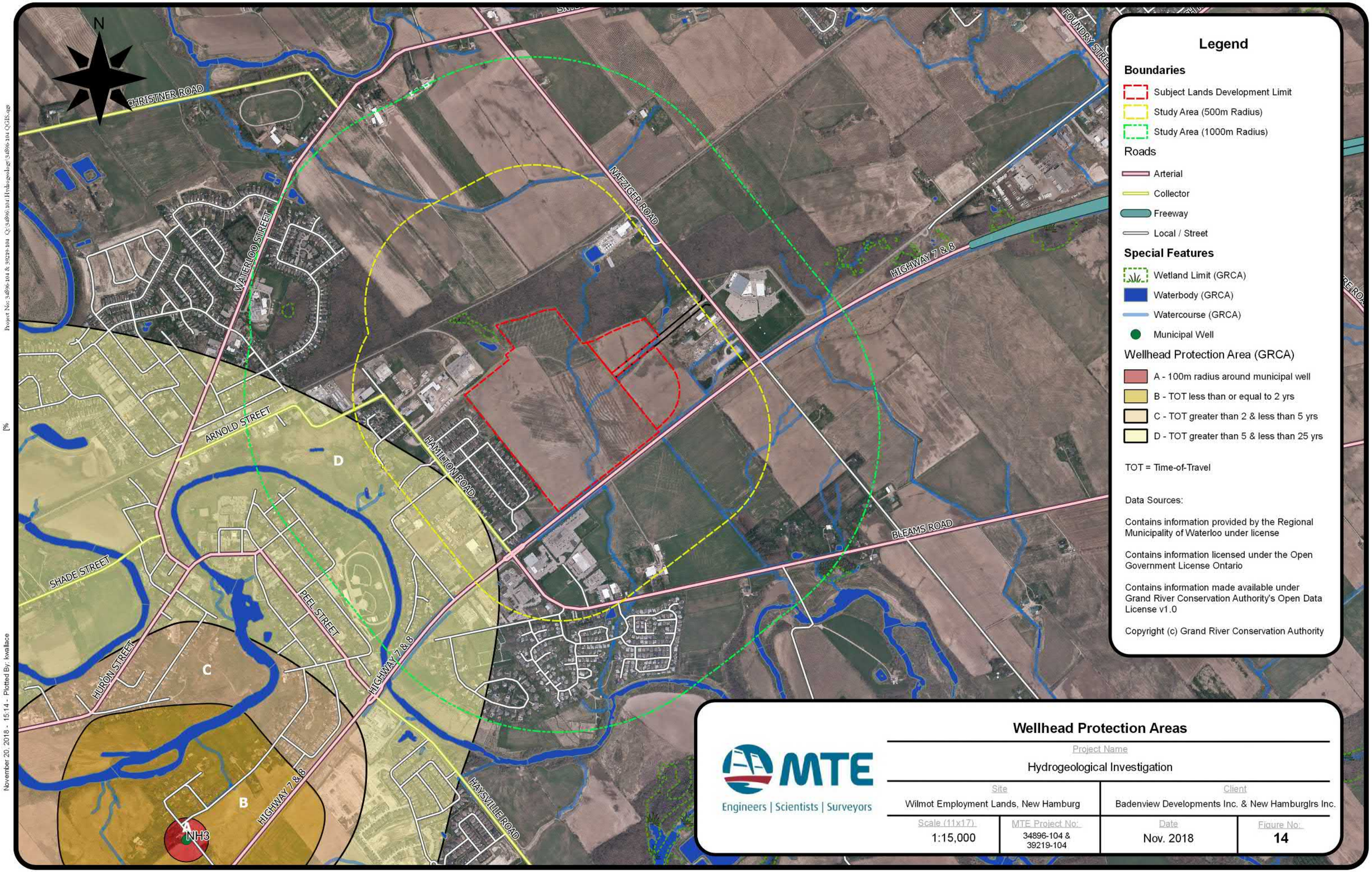
Local Groundwater Flow Interpretation - Oct. 12, 2018

Project Name			
Hydrogeological Investigation			
Site		Client	
Wilmot Employment Lands, New Hamburg		Badenview Developments Inc. & New HamburgIrs Inc.	
Scale (11x17)	MTE Project No:	Date	Figure No:
1:5,000	34896-104 & 39219-104	Nov. 2018	13



Legend

Boundaries

- Subject Lands Development Limit
- Study Area (500m Radius)
- Study Area (1000m Radius)

Roads

- Arterial
- Collector
- Freeway
- Local / Street

Special Features

- Wetland Limit (GRCA)
- Waterbody (GRCA)
- Watercourse (GRCA)
- Municipal Well

Wellhead Protection Area (GRCA)

- A - 100m radius around municipal well
- B - TOT less than or equal to 2 yrs
- C - TOT greater than 2 & less than 5 yrs
- D - TOT greater than 5 & less than 25 yrs

TOT = Time-of-Travel

Data Sources:

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Wellhead Protection Areas

Project Name			
Hydrogeological Investigation			
Site: Wilmot Employment Lands, New Hamburg		Client: Badenview Developments Inc. & New HamburgIrs Inc.	
Scale (11x17): 1:15,000	MTE Project No: 34896-104 & 39219-104	Date: Nov. 2018	Figure No: 14

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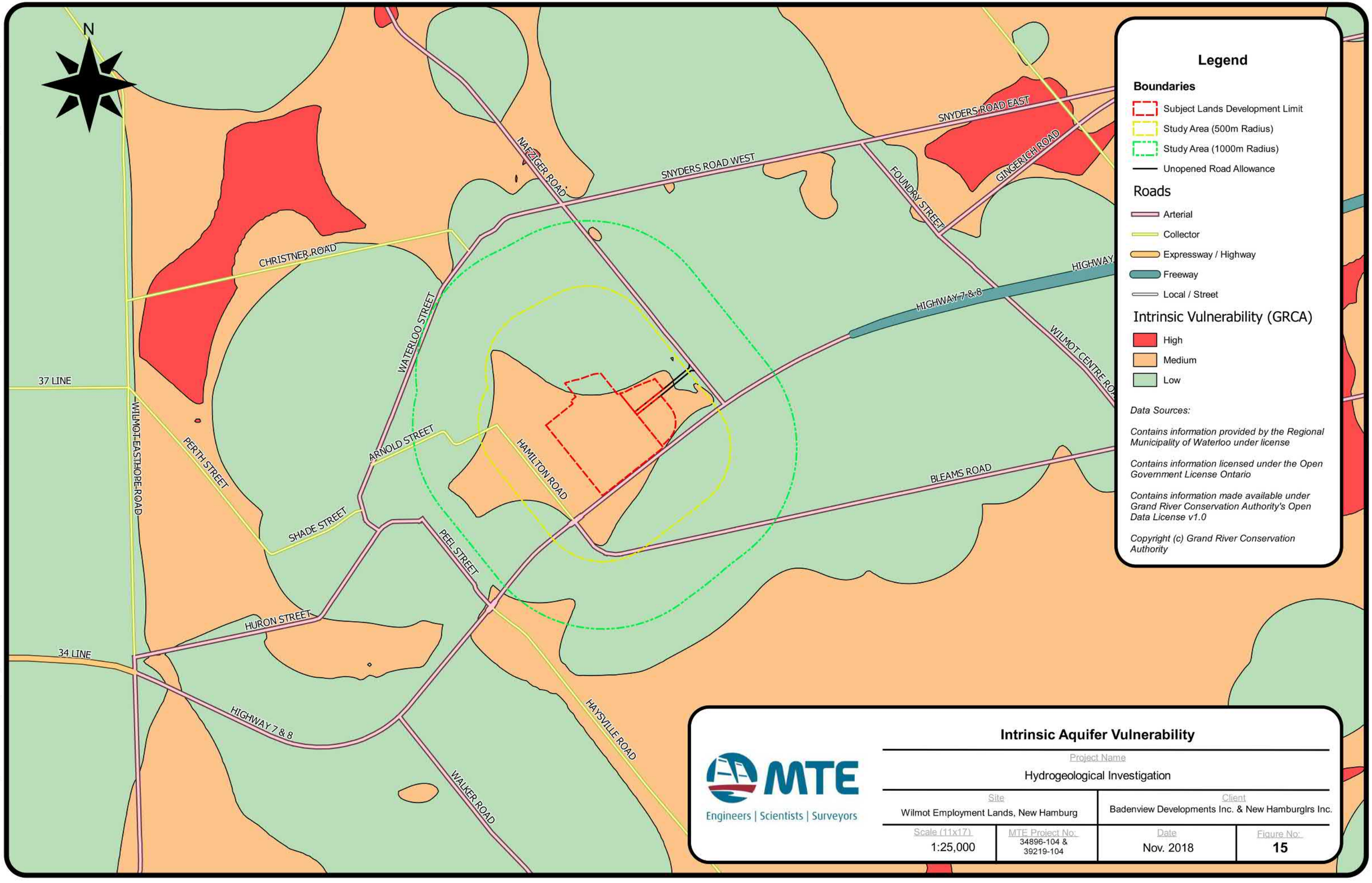
November 20, 2018 - 15:14 - Plotted By: kwallace



Project No: 34896-104 & 39219-104 Q:\34896\104\Hydrogeology\34896-104 QGIS.qgs

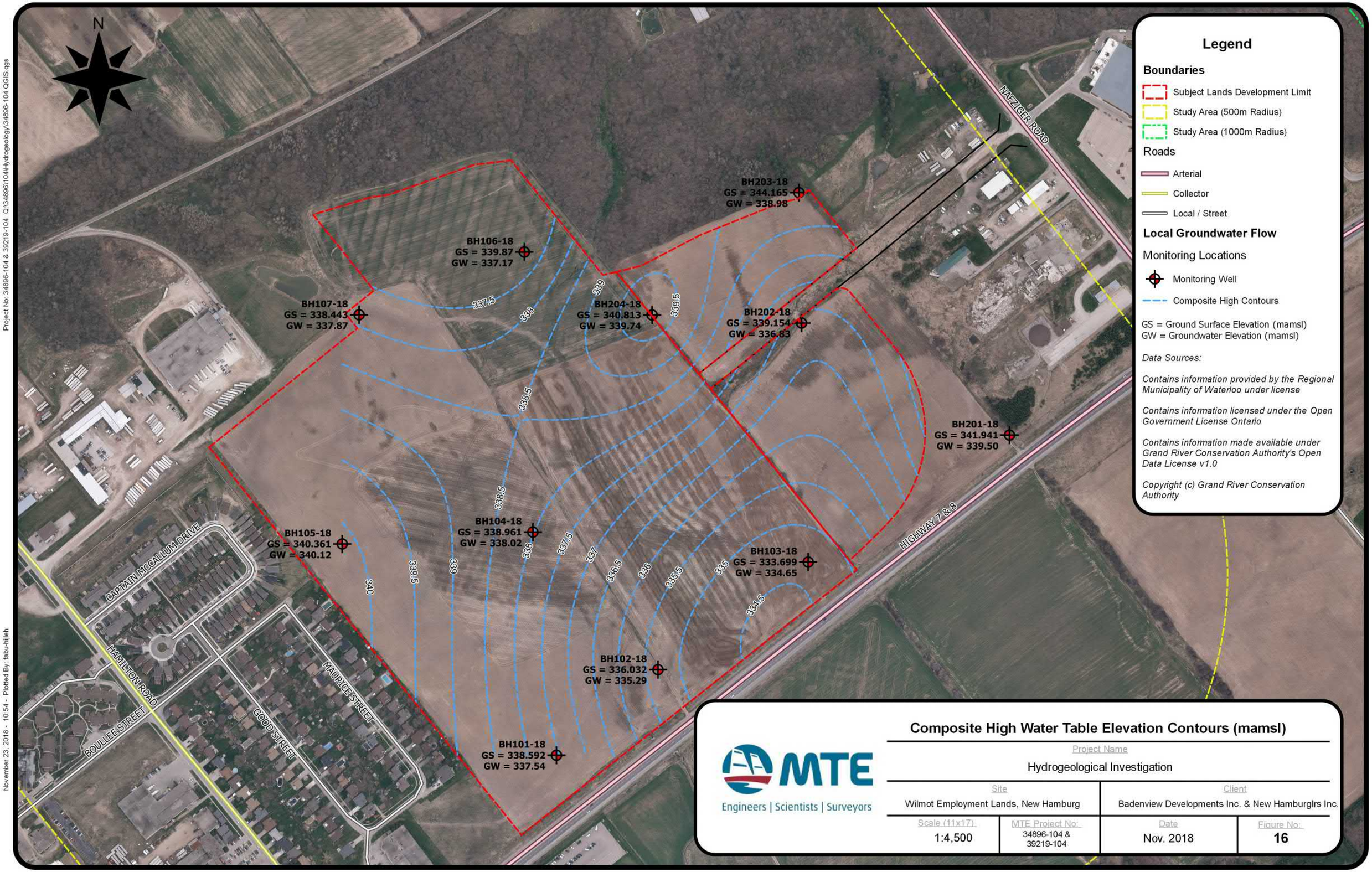
QEV12.0

November 23, 2018 - 10:48 - Plotted By: fabu-hijleh

Engineers | Scientists | Surveyors

Intrinsic Aquifer Vulnerability

Project Name			
Hydrogeological Investigation			
Site: Wilmot Employment Lands, New Hamburg		Client: Badenview Developments Inc. & New HamburgIrs Inc.	
Scale (11x17): 1:25,000	MTE Project No: 34896-104 & 39219-104	Date: Nov. 2018	Figure No: **15**



Project No: 34896-104 & 39219-104 Q:\34896\104\Hydrogeology\34896-104 QGIS.qgs

November 23, 2018 - 10:54 - Plotted By: fabu-hijleh

MTE
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Composite High Water Table Elevation Contours (mamsl)

Project Name			
Hydrogeological Investigation			
Site: Wilmot Employment Lands, New Hamburg		Client: Badenview Developments Inc. & New Hamburglrs Inc.	
Scale (11x17): 1:4,500	MTE Project No: 34896-104 & 39219-104	Date: Nov. 2018	Figure No: 16

TABLES

Table 1. Manual Groundwater Levels

ID	GOOD LANDS													
	BH101-18		BH102-18		BH103-18		BH104-18		BH105-18		BH106-18		BH107-18	
TOC Elevation (mAMSL)	339.44		336.79		334.64		339.74		341.27		340.75		339.21	
Stickup (m)	0.84		0.76		0.94		0.78		0.91		0.88		0.77	
Date	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs
8-Apr-18	1.87	1.03	1.65	0.89	7.632	6.69	1.45	0.67	1.65	0.74	3.585	2.71	1.36	0.59
10-Apr-18	1.87	1.03	1.74	0.98	7.55	6.61	1.50	0.72	nm	-	3.65	2.77	1.45	0.68
13-Apr-18	1.92	1.08	1.825	1.07	7.44	6.50	1.53	0.75	1.61	0.70	3.56	2.68	1.52	0.75
16-Apr-18	1.86	1.02	nm	-	nm	-	1.33	0.55	1.08	0.17	nm	-	1.23	0.46
2-May-18	1.812	0.98	1.885	1.13	7.28	6.34	1.64	0.86	1.64	0.73	3.545	2.67	1.53	0.76
16-May-18	1.93	1.10	2.00	1.24	5.50	4.56	1.86	1.08	1.76	0.85	3.59	2.71	1.65	0.88
1-Jun-18	2.37	1.53	2.27	1.51	2.93	1.99	2.80	2.02	2.60	1.69	3.60	2.72	2.15	1.38
17-Jul-18	3.96	3.12	2.89	2.13	0.32	-0.62	4.26	3.48	4.01	3.10	nm	-	3.50	2.73
20-Jul-18	nm	-	nm	-	nm	-	nm	-	nm	-	3.76	2.88	nm	-
10-Aug-18	nm	-	nm	-	nm	-	nm	-	nm	-	nm	-	nm	-
10-Oct-18	nm	-	nm	-	nm	-	nm	-	nm	-	nm	-	nm	-
12-Oct-18	1.93	1.09	1.80	1.04	0.025	-0.92	1.77	0.99	1.56	0.65	3.72	2.84	1.56	0.79

ID	SCHNEIDER LANDS							
	BH201-18		BH202-18		BH203-18		BH204-18	
TOC Elevation (mAMSL)	342.73		339.91		345.01		341.58	
Stickup (m)	0.79		0.76		0.84		0.76	
Date	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs	mbtoc	mbgs
8-Apr-18	ni	-	ni	-	ni	-	ni	-
10-Apr-18	ni	-	ni	-	ni	-	ni	-
13-Apr-18	ni	-	ni	-	ni	-	ni	-
16-Apr-18	ni	-	ni	-	ni	-	ni	-
2-May-18	ni	-	ni	-	ni	-	ni	-
16-May-18	ni	-	ni	-	ni	-	ni	-
1-Jun-18	ni	-	ni	-	ni	-	ni	-
17-Jul-18	ni	-	ni	-	ni	-	ni	-
20-Jul-18	ni	-	ni	-	ni	-	ni	-
10-Aug-18	3.955	3.17	3.18	2.42	6.31	5.47	2.27	1.51
10-Oct-18	3.27	2.48	3.15	2.39	6.3	5.46	1.92	1.16
12-Oct-18	3.49	2.70	3.12	2.36	6.7	5.86	1.91	1.15

Notes:

nm = not measured

ni = not installed

TOC = Top of Casing

mAMSL = meters above mean sea level

mbtoc = meters below top of casing

Monitoring well TOC and Ground Surface elevations surveyed October 29, 2018

Table 2. Groundwater Elevations (mAMSL)

ID	GOOD LANDS							SCHNEIDER LANDS			
	BH101-18	BH102-18	BH103-18	BH104-18	BH105-18	BH106-18	BH107-18	BH201-18	BH202-18	BH203-18	BH204-18
TOC Elevation (mAMSL)	339.44	336.79	334.64	339.74	341.27	340.75	339.21	342.73	339.91	345.01	341.58
Stickup (m)	0.84	0.72	0.90	0.69	0.79	0.82	0.81	0.82	0.86	0.80	0.78
GS Elevation (mAMSL)	338.59	336.03	333.70	338.96	340.36	339.87	338.44	341.94	339.15	344.17	340.81
8-Apr-18	337.57	335.14	327.01	338.29	339.63	337.16	337.85	-	-	-	-
10-Apr-18	337.57	335.05	327.09	338.24	-	337.10	337.76	-	-	-	-
13-Apr-18	337.52	334.97	327.20	338.21	339.67	337.19	337.69	-	-	-	-
16-Apr-18	337.58	-	-	338.41	340.19	-	337.98	-	-	-	-
2-May-18	337.62	334.91	327.36	338.10	339.64	337.20	337.68	-	-	-	-
16-May-18	337.50	334.79	329.14	337.88	339.51	337.16	337.56	-	-	-	-
1-Jun-18	337.07	334.52	331.71	336.94	338.67	337.15	337.06	-	-	-	-
17-Jul-18	335.48	333.90	334.32	335.48	337.26	-	335.71	-	-	-	-
20-Jul-18	-	-	-	-	-	336.99	-	-	-	-	-
10-Aug-18	-	-	-	-	-	-	-	338.77	336.73	338.70	339.31
10-Oct-18	-	-	-	-	-	-	-	339.46	336.76	338.71	339.66
12-Oct-18	337.51	334.99	334.61	337.97	339.71	337.03	337.65	339.24	336.79	338.31	339.67

Notes:

TOC = Top of Casing

mAMSL = meters above mean sea level

Table 3. Mini-Piezometer Water Elevations and Vertical Hydraulic Gradients

Date	Location	MP1		MP2		MP3	
	TOC Elevation	339.61		340.181		340.366	
		mbtoc	mamsl	mbtoc	mamsl	mbtoc	mamsl
16-May-18	Inside Level (IL) (m)	0.98	338.63	0.64	339.541	0.60	339.769
	Outside Level (OL) (m)	0.98	338.63	0.64	339.541	0.6	339.769
	Vertical Hydraulic Gradient (m/m)	0	-	0	-	0.0	-
1-Jun-18	Inside Level (IL) (m)	1.49	338.12	0.835	339.346	0.62	339.746
	Outside Level (OL) (m)	dry	-	dry	-	0.62	339.746
	Vertical Hydraulic Gradient (m/m)	-	-	-	-	0.0	-
12-Oct-18	Inside Level (IL) (m)	1.015	338.60	0.782	339.40	0.61	339.756
	Outside Level (OL) (m)	dry	-	dry	-	0.61	339.756
	Vertical Hydraulic Gradient (m/m)	-	-	-	-	0.0	340.366

Notes:

TOC = Top of Casing

mAMSL = meters above mean sea level

mbtoc = meters below top of casing

APPENDIX A

DRAFT PLAN OF SUBDIVISION

DRAFT PLAN OF SUBDIVISION

Legal Description

PART OF LOT 20, NORTH OF BLEAMS ROAD
PART OF LOT 20, SOUTH OF SNYDERS ROAD
TOWNSHIP OF WILMOT
REGIONAL MUNICIPALITY OF WATERLOO

Notes

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE SHOWN.
2. SITE BOUNDARY AND TOPOGRAPHIC BASE PLAN PREPARED BY MTE AUGUST 25, 2017 AND UPDATED JUNE 2018. BOUNDARY INFORMATION ALSO TAKEN FROM PLAN 58R-20194.
3. ADJACENT PARCEL FABRIC IS APPROXIMATE.

STAGE LINE

Owner's Certificate

I HEREBY AUTHORIZE MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED TO SUBMIT THIS PLAN FOR APPROVAL.

DATE: December 4, 2018

BADENVIEW DEVELOPMENT INC. (OWNER)

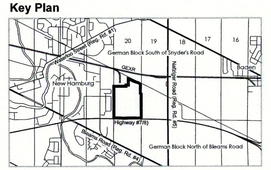
Surveyor's Certificate

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED ON THIS PLAN AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

DATE: NOV. 22, 2018

TREVOR D.A. McNEIL, OLS
(MTE OLS LTD.)

Key Plan



Subject Lands

SCALE: NTS

Source: Region of Waterloo SLRN

Additional Information Required Under Section 51(17) of the Planning Act R.S.O. 1990, c.P.13 as Amended

A. AS SHOWN	B. AS SHOWN	C. AS SHOWN
D. INDUSTRIAL, STORMWATER MANAGEMENT		
E. AS SHOWN	F. AS SHOWN	
G. AS SHOWN	H. MUNICIPAL WATER SUPPLY	I. SILTY CLAY LOAM
J. AS SHOWN	K. ALL SERVICES AS REQUIRED	L. AS SHOWN

Area Schedule 30T_____

	Stage 1		Stage 2	
Description	**Blocks**	**Area (ha)**	**Blocks**	**Area (ha)**
Industrial	1-4	16.822	1,2	14.650
Stormwater Management Facility	5	5.797		
Road Widening	6	0.631		
Future Development	7,8	0.349		
0.3m Reserve	9-12	0.007		
Roads		2.501		1.317
Sub-Total	**12**	**26.107**	**2**	**15.967**

	Total	
Description	**Blocks**	**Area (ha)**
Industrial	6	31.472
Stormwater Management Facility	1	5.797
Road Widening	1	0.631
Future Development	2	0.349
0.3m Reserve	4	0.007
Roads		3.818
	14	**42.074**

Revision No.	Date	Issued / Revision	By
2.	Nov. 22, 2018	For submission to Region;	DGS
1.	Nov. 5, 2018	For review by surveyor and client;	DGS

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
200-540 BINGEMANS CENTRE DR, KITCHENER, ON, N2B 3X9 | P: 519.576.3650 F: 519.576.0121 | WWW.MHBCPLAN.COM

Approval Stamp

Date	November 22, 2018
File No.	1159A
Plan Scale	1:2,000 (24x36)
Drawn By	D.G.S.
Checked By	P.C.

Project Wilmot Employment Lands

Applicant
Badenview Developments Inc.
P.O. Box 249 Breslau, ON
N0B 1M0
P: 519.648.2285

File Name DRAFT PLAN

Dwg No. 1 of 1

Scale Bar 0 10 25 50 75 100 125 150m

K:\1159A-Industrial Lands New Hamburg\DP\Draft Plan November22 2018.dwg

DRAFT PLAN OF SUBDIVISION

Legal Description

PART OF LOT 19, NORTH OF BLEAMS ROAD
TOWNSHIP OF WILMOT
REGIONAL MUNICIPALITY OF WATERLOO

Owner's Certificate

I HEREBY AUTHORIZE MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED TO SUBMIT THIS PLAN FOR APPROVAL.

DATE: Nov 23/18

NEW HAMBURGLRS INC. (OWNER)

Surveyor's Certificate

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED ON THIS PLAN AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

DATE: NOV. 22, 2018

TREVOR D.A. McNEIL, OLS
(MTE OLS LTD.)

Key Plan

Source: Region of Waterloo SLRN

Subject Lands

Additional Lands Owned by Applicant

SCALE: NTS

Additional Information Required Under Section 51(17) of the Planning Act R.S.O. 1990, c.P.13 as Amended

A. AS SHOWN	B. AS SHOWN	C. AS SHOWN
D. INDUSTRIAL	F. AS SHOWN	E. AS SHOWN
G. AS SHOWN	H. MUNICIPAL WATER SUPPLY	I. SILTY CLAY LOAM
J. AS SHOWN	K. ALL SERVICES AS REQUIRED	L. AS SHOWN

Area Schedule 30T_____

	Stage 1		Stage 2	
Description	**Blocks**	**Area (ha)**	**Blocks**	**Area (ha)**
Industrial	1-7	5.546	1-6	3.373
Emergency Access	8	0.092		
Roads		0.456		0.432
Sub-Total	**8**	**6.094**	**6**	**3.805**

	Total	
Description	**Blocks**	**Area (ha)**
Industrial	13	8.919
Emergency Access	1	0.092
Roads		0.888
	14	**9.899**

Notes

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE SHOWN.
2. SITE BOUNDARY AND TOPOGRAPHIC BASE PLAN PREPARED BY MTE, AUGUST 25, 2017 AND UPDATED JUNE 2018. BOUNDARY INFORMATION ALSO TAKEN FROM PLAN 58R-20194.
3. ADJACENT PARCEL FABRIC IS APPROXIMATE.

Revision No.	Date	Issued / Revision	By
2.	Nov. 22, 2018	For submission to Region;	DGS
1.	Nov. 5, 2018	For review by surveyor and client;	DGS

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
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Approval Stamp

Date	November 22, 2018
File No.	18157A
Plan Scale	1:1,250 (24x36)
Drawn By	D.G.S.
Checked By	P.C.
Project	Highway 7 and Nafziger Road
Other	

Applicant

New Hamburglrs Inc.
675 Riverbend Dr. Kitchener, ON
N2K 3S3
P: 519.571.8800

north

File Name DRAFT PLAN

Dwg No. 1 of 1

Scale Bar 0 10 25 50 75 100 125 150m

K:\18157A-New Hamburg-New Hamburglrs Inc\DP\Draft Plan November22 2018.dwg

APPENDIX B

BOREHOLE LOGS

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot lands

Borehole Number: BH1

Job Number: 34896-100

Drill Date: November 29, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Borehole
0.0	0.00	Ground Elevation							
0.0	0.00	**TOPSOIL**							
	-0.61								
2.0	0.61	**SILT CLAY** Light brown sandy silt and clay, fine grained, loose, moist, no staining or odour		1	SS	21			
4.0	-1.52								
6.0	1.52	**Silty SAND** Light brown silty sand, some clay @ 6', fine grained, stiff, moist to wet @ 7', saturated below 7', no staining or odour		2	SS	40			
8.0				3	SS	55			
10.0				4	SS	75			
12.0									
14.0									
16.0	-4.88			5	SS	63			
	4.88	**Sandy SILT** Grey sandy silt, trace clay, fine grained, stiff, saturated							
18.0		**SILT TILL** Grey sandy silt till, small stones, no staining or odour							
20.0	-6.10			6	SS	51			
	6.10	**Sandy SILT** Light grey sandy silt, some silty clay @ 22', fine grained, stiff, no staining or odur, wet, dry @ 22'							
22.0									
24.0									
26.0	-8.08			7	SS	31			
	8.08	**CLAY** Grey clay, trace silt, dry, no staining or odour							
28.0				8	SS	39			
	-8.99	**SILT**							
	8.99	Grey silt, fine grained, dry							
30.0									
32.0									
34.0									

Reviewed By: RBM

Method: Hollow Stem Auguring/Split Spoon

Notes:

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520 Bingemans Centre Drive
Kitchener, Ontario
N2B 3X9
(519) 743-6500

Logged By: YXM

Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot lands

Borehole Number: BH2

Job Number: 34896-100

Drill Date: November 30, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Borehole
0.0	0.00	Ground Elevation							
0.0	0.00	**TOPSOIL**							
	-0.61								
2.0	0.61	**SILT** Light brown clayey silt, fine grained, stiff, dry, no staining or odour. Light brown sandy silt @ 7'		1	SS	30			
4.0				2	SS	51			
6.0	-2.29								
2.0	2.29	**Silty CLAY** Grey-brown silty clay, fine grained, stiff, dry, no staining or odour		3	SS	42			
8.0	-3.05								
10.0	3.05	**CLAY** Grey clay, fine, stiff, dry, trace sand @ 17', no staining or odour		4	SS	23			
12.0									
4.0									
14.0									
16.0				5	SS	33			
18.0									
6.0									
20.0				6	SS	27			
22.0									
24.0									
26.0				7	SS	31			
8.0	-8.23								
28.0	8.23								
30.0									
32.0									
10.0									
34.0									

Reviewed By: RBM

Method: Hollow Stem Auguring/Split Spoon

Notes:

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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot lands

Borehole Number: BH3

Job Number: 34896-100

Drill Date: November 30, 2010

Depth (ft)	Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Borehole
0.0	0.0	0.00	Ground Elevation							
		0.00	**TOPSOIL**							
		-0.61								
2.0		0.61	**SILT** Light brown clayey silt, trace sand, dry, no staining or odour		1	SS	31			
4.0		-1.52								
6.0	2.0	1.52	**Sandy SILT** Light brown sandy silt with clay, fine grained, stiff, dry, slightly moist @ 8'		2	SS	49			
8.0					3	SS	38			
10.0		-3.05 3.05	**Silty CLAY** Grey silty clay with sand, fine grained, stiff, dy, no staining or odour		4	SS	32			
12.0	4.0	-3.66 3.66	**Silty SAND** Grey silty sand, trace clay seams, fine grained, stiff, no staining or odour, dry to wet		5	SS	45			
14.0										
16.0										
18.0										
20.0	6.0				6	SS	20			
22.0										
24.0										
26.0	8.0	-8.23 8.23			7	SS	54			
28.0										
30.0										
32.0	10.0									
34.0										

Reviewed By: RBM

Method: Hollow Stem Auguring/Split Spoon

Notes:

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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot lands

Borehole Number: BH4

Job Number: 34896-100

Drill Date: November 30, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Borehole
0.0	0.00	Ground Elevation							
	0.00	**TOPSOIL**							
	-0.61								
2.0	0.61	**SILT** Dark brown sandy silt with clay, light brown silty clay @ 4'dry, no staining or odour		1	SS	28			
4.0	-1.52								
6.0	1.52	**SILT TILL** Light brown clayey silt till, some small stones, dry, no staining or odour		2	SS	36			
	-2.13								
8.0	2.13	**Silty SAND** Light brown silty sand, loose, fine, moist to wet @8', light brown dry clay @ 9,		3	SS	23			
10.0	-3.05								
	3.05	**CLAY** Grey clay, trace silt, fine grained, stiff, no staining or odour, slightly moist		4	SS	21			
12.0									
14.0									
16.0				5	SS	23			
18.0									
20.0	-6.10								
	6.10	**Sandy SILT** Grey sandy silt, fine grained, saturated, no staining or odour		6	SS	49			
22.0									
24.0	-7.62								
	7.62	**CLAY** Grey clay, fine grained, stiff, no staining or odour, dry		7	SS	47			
26.0	-8.23								
	8.23								
28.0									
30.0									
32.0									
34.0									

Reviewed By: RBM

Method: Hollow Stem Auguring/Split Spoon

Notes:

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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot lands

Borehole Number: BH5

Job Number: 34896-100

Drill Date: December 01, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Borehole
0.0	0.00	Ground Elevation							
0.0	0.00	**TOPSOIL**							
	-0.61								
2.0	0.61	**Clayey SILT** Grey to light brown silt and clay, fine grained, soft, moist, no staining or odour		1	SS	27			
4.0	-1.52								
	1.52	**Silty CLAY** Light grey to grey silty clay, trace sand, fine grained, stiff, silty wet sand seam @ 21', damp to moist, no staining or odour		2	SS	35			
6.0									
8.0				3	SS	74			
10.0									
12.0				4	SS	32			
14.0									
16.0				5	SS	24			
18.0									
20.0				6	SS	24			
22.0									
24.0	-7.62								
26.0	7.62	**CLAY TILL** Grey silty clay till, trace sand, trace stone, stiff, moist to slight moist		7	SS	93			
	-8.23								
28.0	8.23								
30.0									
32.0									
34.0									

Reviewed By: RBM

Method: Hollow Stem Auguring/Split Spoon

Notes:

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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot lands

Borehole Number: BH6

Job Number: 34896-100

Drill Date: December 01, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Borehole
0.0	0.00	Ground Elevation							
0.0	0.00	**TOPSOIL**							
	-1.22			1	SS	16			
2.0	1.22	**Silty CLAY** Light brown silty clay, little sand, moist to very moist, no staining or odour		2	SS	14			
4.0	-2.44								
6.0	2.44	**Silty SAND** Light brown silty sand, some clay, wet		3	SS	29			
8.0	-3.05								
10.0	3.05	**Silty CLAY** Light grey silty clay, dry		4	SS	70			
12.0		**Silty SAND** Light brown silty sand, little clay, trace stone, slight wet							
14.0	-4.57								
16.0	4.57	**Silty CLAY** Greyish brown silty clay, some sand,fine grained, stiff slightly moist		5	SS	50			
18.0	-5.49								
20.0	5.49	**Silty SAND** Lihgt grey clayey silty sand, fine grained, slightly wet to saturated		6	SS	65			
22.0		**Silty CLAY** Grey silty clay, some sand, fine grained, stiff, moist							
24.0		**CLAY TILL** Grey sandy silty clay till, some stones, fien grained, stiff, damp to moist		7	SS	65			
26.0									
28.0									
30.0				8	SS	75			
32.0	-9.75								
34.0	9.75								

Reviewed By: RBM

Method: Hollow Stem Auguring/Split Spoon

Notes:

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N2B 3X9
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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot lands

Borehole Number: BH7

Job Number: 34896-100

Drill Date: December 01/02, 2010

Depth (ft / m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Borehole
0.0 / 0.0	0.00	Ground Elevation							
	0.00	**TOPSOIL**							
2.0	-0.76								
	0.76	**Silty CLAY** Light brown silty clay, little sand, stiff, damp to moist, no staining or odour		1	SS	52			
4.0									
6.0 / 2.0				2	SS	57			
8.0				3	SS	52			
10.0									
				4	SS	46			
12.0	-3.66								
	3.66	**SILT TILL** Light brown to grey clayey silt till, some sand, some small stones, fine grained, some pebbles @ 16', dry							
14.0 / 4.0									
16.0				5	SS	71			
18.0									
20.0 / 6.0				6	SS	92			
22.0									
24.0									
26.0 / 8.0				7	SS	50			
	-8.23								
	8.23								
28.0									
30.0									
32.0 / 10.0									
34.0									

Reviewed By: RBM

Method: Hollow Stem Auguring/Split Spoon

Notes:

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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot lands

Borehole Number: BH8

Job Number: 34896-100

Drill Date: December 01/02, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Borehole
0.0	0.00	Ground Elevation							
0.0	0.00	**TOPSOIL**							
	-0.76								
	0.76	**Silty CLAY** Light brown silty clay, trace sand, stiff, dry,gravelly sand with stones @ 16' no staining or odour		1	SS	30			
2.0				2	SS	55			
4.0				3	SS	35			
6.0									
8.0									
10.0									
12.0									
14.0									
16.0	-4.88			4	SS	125			
	4.88	**SILT TILL** Grey silt till, very stiff, dry, no staining or odour, light brown moist to wet silty sand @ 22'.							
18.0									
20.0				5	SS	50			
22.0									
24.0	-7.62								
	7.62	**SAND** Light brown sand, fine grained, stiff, saturated, moist silty clay @ 27', no staining or odour		6	SS	99			
26.0	-8.23								
	8.23								
28.0									
30.0									
32.0									
34.0									

Reviewed By: RBM

Method: Hollow Stem Auguring/Split Spoon

Notes:

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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot lands

Borehole Number: BH9

Job Number: 34896-100

Drill Date: December 01/02, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Borehole
0.0	0.00	Ground Elevation							
0.0	0.00	**TOPSOIL**							
	-1.07			1	SS	25			
2.0	1.07	**Sandy SILT** Light brown sandy silt with clay, some stones, moist, no staining or odour		2	SS	18			
4.0	-2.29								
6.0	2.29	**Silty CLAY** Grey silty clay, trace sand, soft, slightly moist, no staining or odour, water coming out @ 13'		3	SS	27			
8.0				4	SS	25			
10.0	-4.57								
12.0	4.57	**CLAY** Grey clay, soft, fine grained, slightly moist, no staining or odour		5	SS	30			
14.0									
16.0				6	SS	39			
18.0									
20.0				7	SS	42			
22.0									
24.0									
26.0	-8.23								
28.0	8.23								
30.0									
32.0									
34.0									

Reviewed By: RBM

Method: Hollow Stem Auguring/Split Spoon

Notes:

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Kitchener, Ontario
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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot lands

Borehole Number: BH10

Job Number: 34896-100

Drill Date: December 01/02, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Borehole
0.0	0.00	Ground Elevation							
0.0	0.00	**TOPSOIL**							
2.0	-0.76								
	0.76	**Clayey SILT** Light brown clayey silt, trace sand, fine grained, stiff, dry, no staining or odour		1	SS	34			
4.0				2	SS	64			
6.0	2.0								
8.0	-2.74			3	SS	54			
	2.74	**Silty SAND** Grey silty sand, fine grained, moist to wet, no staining or odour		4	SS	67			
10.0									
12.0	4.0								
14.0	-4.57								
	4.57	**CLAY** Grey clay, trace sand, soft, dry, no staining or odour		5	SS	33			
16.0									
18.0									
20.0	6.0			6	SS	53			
22.0									
24.0									
26.0	8.0			7	SS	41			
	-8.23								
	8.23								
28.0									
30.0									
32.0	10.0								
34.0									

Reviewed By: RBM

Method: Hollow Stem Auguring/Split Spoon

Notes:

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Logged By: YXM

Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot lands

Borehole Number: BH11

Job Number: 34896-100

Drill Date: December 03, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Borehole
0.0 ft / 0.0 m	0.00	Ground Elevation							
	0.00	**TOPSOIL**							
2.0	-0.76								
	0.76	**CLAY TILL** Light brown silty clay till with sand, stiff, dense, fine grained, dry, no staining or odour		1	SS	64			
4.0									
6.0 / 2.0				2	SS	50			
8.0				3	SS	41			
10.0									
12.0				4	SS	41			
14.0 / 4.0									
	-4.57								
	4.57	**Silty CLAY** Grey silt with some silt and sand, dense, fine grained, slightly moist to moist, no staining or odour		5	SS	20			
16.0									
18.0									
20.0 / 6.0				6	SS	38			
22.0									
24.0									
	-7.62								
	7.62	**Clayey SILT** Grey clayey silt with sand, stiff, fine grained, dry, no staining or odour		7	SS	85			
26.0 / 8.0	-8.23								
	8.23								
28.0									
30.0									
32.0									
34.0 / 10.0									

Reviewed By: RBM

Method: Hollow Stem Auguring/Split Spoon

Notes:

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Kitchener, Ontario
N2B 3X9
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Logged By: YXM

Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot lands

Borehole Number: BH12

Job Number: 34896-100

Drill Date: December 03, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Borehole
0.0	0.00	Ground Elevation							
0.0	0.00	**TOPSOIL**							
	-0.76								
	0.76	**CLAY TILL** Light brown silty clay till with sand, stiff, fine grained, dry, no staining or odour		1	SS	38			
2.0				2	SS	37			
	-1.98								
	1.98	**Sandy SILT** Light brown sandy silt, trace clay, dry,moist to wet @ 8', no staining or odour		3	SS	53			
	-2.74								
	2.74	**Silty CLAY** Light brown silty clay, moist to wet, no staining or odour		4	SS	35			
4.0		**Silty SAND** Grey silty sand with clay, fine grained, loose, moist, wet to saturated @ 16', no staining or odour		5	SS	52			
6.0	-6.40								
	6.40	**Silty CLAY** Grey silty clay, stiff, dense, fine grained, slightly moist, no staining or odour		6	SS	45			
8.0	-8.23			7	SS	56			
	8.23								
10.0									

Reviewed By: RBM

Method: Hollow Stem Auguring/Split Spoon

Notes:

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Kitchener, Ontario
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Logged By: YXM

Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot Lands

Test Trench Number: TT1

Job Number: 34896-100

Date: December 21, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	Headspace (ppm)	Comments
ft / m							
0.0 / 0.0	0.00	Ground Elevation					
	0.00	**TOPSOIL** Dark brown topsoil, rootlets, wood pieces, soft, damp					
2.0	-0.76						No seepage observed during excavation Caving @ 3 feet
	0.76	**Silty CLAY** Brown silty clay, sand seam @ 3-3.5 feet, soft, sticky, moist to very moist					
4.0							
6.0							
2.0							
8.0							
10.0	-3.20						
	3.20						
12.0							

Reviewed By: RBM

Method: Backhoe

Notes:

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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot Lands

Test Trench Number: TT2

Job Number: 34896-100

Date: December 21, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	Headspace (ppm)	Comments
0.0 ft / 0.0 m	0.00	Ground Elevation					
	0.00	**TOPSOIL** Dark brown topsoil, rootlets of corn, soft, damp					
	-0.46						
	0.46	**Clayey SILT** Brown silt and clay, some sand, damp to very moist,soft, no staining or odour					No seepage observed during excavation
2.0							
4.0	-1.37						
	1.37	**Silty CLAY** Brown silty clay, little sand, sticky, moist, no staining or odour					
6.0							
2.0 m							
8.0	-2.44						
	2.44	**Sandy SILT** Grey sandy silt, clayey, fine grained, moist to slight wet					
10.0							
	-3.35						
	3.35						
12.0							

Reviewed By: RBM

Method: Backhoe

Notes:

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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot Lands

Test Trench Number: TT3

Job Number: 34896-100

Date: December 21, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	Headspace (ppm)	Comments
ft m 0.0 0.0	0.00	Ground Elevation					
	0.00	**TOPSOIL** Dark brown topsoil, rootlets of corn, soft, damp					
	-0.46 0.46	**SILT** Brown ssandy clayey silt, loose, damp, no staining or odour					No seepage observed during excavation
	-1.07 1.07	**Silty CLAY** Brown to dark brown silty clay, little sand, hard, moist to damp, no staining or odour					
2.0							
4.0							
6.0							
2.0							
8.0							
10.0	-3.35 3.35						
12.0							

Reviewed By: RBM

Method: Backhoe

Notes:

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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot Lands

Test Trench Number: TT4

Job Number: 34896-100

Date: December 21, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	Headspace (ppm)	Comments
0.0	0.00	Ground Elevation					
	0.00	**TOPSOIL** Dark brown topsoil, rootlets, soft, damp					
	-0.46						
	0.46	**Silty CLAY** Brown silty clay, little sand, damp to moist, changing to grey below 8' and damp to dry with trace sand, no staining or odour					No seepage observed during excavation
2.0							
4.0							
6.0							
2.0							
8.0							
10.0							
	-3.35						
	3.35						
12.0							

Reviewed By: RBM

Method: Backhoe

Notes:

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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot Lands

Test Trench Number: TT5

Job Number: 34896-100

Date: December 21, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	Headspace (ppm)	Comments
0.0 ft / 0.0 m	0.00	Ground Elevation					
	0.00	**TOPSOIL** Dark brown topsoil, rootlets, soft, damp					
	-0.46						
	0.46	**Sandy SILT** Brown to dark brown sandy clayey silt, few big stones @ 2-2.5', trace gry sand @ 2.5' , no staining or odour					No seepage observed during excavation
2.0	-0.91						
	0.91	**Silty CLAY** Brown to dark brown silty clay, trace sand, hard, sticky, damp, no staining or odour					
4.0							
6.0							
2.0							
8.0							
10.0	-3.20						
	3.20						
12.0							

Reviewed By: RBM

Method: Backhoe

Notes:

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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot Lands

Test Trench Number: TT6

Job Number: 34896-100

Date: December 21, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	Headspace (ppm)	Comments
ft / m	0.00	Ground Elevation					
0.0 / 0.0	0.00	**TOPSOIL** Dark brown topsoil, rootlets, soft, damp					
	-0.46						
	0.46	**Silty CLAY** Brown silty clay, trace sand, sticky, trace stones @ 4'and getting hard and dry below 4', more stones and clayey @ 7', no staining or odour					No seepage observed during excavation
2.0							
4.0							
6.0							
2.0							
8.0							
10.0	-3.05						
	3.05						
12.0							

Reviewed By: RBM

Method: Backhoe

Notes:

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Logged By: YXM

Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot Lands

Test Trench Number: TT7

Job Number: 34896-100

Date: December 21, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	Headspace (ppm)	Comments
ft / m							
0.0 / 0.0	0.00	Ground Elevation					
	0.00	**TOPSOIL** Dark brown topsoil, rootlets, soft, damp					
2.0	-0.61 0.61	**Sandy SILT** Brown sandy clayey silt, gravelly, loose, dry to moist, no staining or odour					
4.0	-1.22 1.22	**Silty CLAY** Brown to dark brown silty clay, hard, sticky, damp to moist, no staining or odour					
6.0 / 2.0	-1.68 1.68	**SAND AND GRAVEL** Brown sand and gravel, some clay, saturated, no staining or odour					Seepage observed during excavation @6'
8.0	-2.13 2.13	**Silty CLAY** Brown silty clay, gravelly, moist, no staining or odour					
10.0	-3.20 3.20						
12.0							

Reviewed By: RBM

Method: Backhoe

Notes:

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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot Lands

Test Trench Number: TT8

Job Number: 34896-100

Date: December 21, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	Headspace (ppm)	Comments
0.0	0.00	Ground Elevation					
	0.00	**TOPSOIL** Dark brown topsoil, rootlets, soft, damp					
	-0.46 0.46	**Silty CLAY** Brown silty clay, little sand, stones @ and below 6' (few big boulders), damp to little moist, no staining or odour moist, getting dry and hard below 4', more stones @ 7', more clayey and sticky below 7', no staining or odour					No seepage observed during excavation
2.0							
4.0							
6.0							
2.0							
8.0	-2.59 2.59	Grey to dark grey silty clay, hard, damp					
10.0	-3.20 3.20						
12.0							

Reviewed By: RBM

Method: Backhoe

Notes:

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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot Lands

Test Trench Number: TT9

Job Number: 34896-100

Date: December 21, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	Headspace (ppm)	Comments
0.0 ft / 0.0 m	0.00	Ground Elevation					
	0.00	**TOPSOIL** Dark brown topsoil, rootlets, soft, damp					
	-0.46 / 0.46	**Sandy SILT** Brown sandy silt, clayey, fine grained, loose, damp, no staining or odour					No seepage observed during excavation
	-0.91 / 0.91	**Silty CLAY** Brown silty clay, little sand, soft, damp to slight moist					
2.0 m							
4.0							
6.0							
8.0							
10.0							
	-3.35 / 3.35						
12.0							

Reviewed By: RBM

Method: Backhoe

Notes:

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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot Lands

Test Trench Number: TT10

Job Number: 34896-100

Date: December 21, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	Headspace (ppm)	Comments
ft / m	0.00	Ground Elevation					
0.0 / 0.0	0.00	**TOPSOIL** Dark brown topsoil, rootlets, soft, damp					
	-0.46						
	0.46	**Clayey SILT** Brown clayey silt, some sand, loose, fine grained,moist to wet, no staining or odour					Seepage observed during excavation @ 3.5'
2.0							
	-1.22						
4.0	1.22	**Silty CLAY** Brown silty clay, little sand, soft, moist, no staining or odour					
6.0							
2.0							
8.0							
10.0	-3.20						
	3.20						
12.0							

Reviewed By: RBM

Method: Backhoe

Notes:

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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

Location: Wilmot Lands

Test Trench Number: TT11

Job Number: 34896-100

Date: December 21, 2010

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	Headspace (ppm)	Comments
0.0 (ft) / 0.0 (m)	0.00	Ground Elevation					
	0.00	**TOPSOIL** Dark brown topsoil, rootlets, soft, damp					
	-0.46 / 0.46	**Sandy SILT** Brown sandy silt, clayey, fine grained, loose, moist, no staining or odour					No seepage observed during excavation
4.0	-1.22 / 1.22	**SILT AND CLAY** Brown silt and clay, some sand, very moist, no staining or odour					
6.0 / 2.0 (m)	-2.13 / 2.13	**Clayey SILT** Grey clayey sandy silt, fine grained, loose, slight wet, no staining or odour					
8.0							
10.0	-3.35 / 3.35						
12.0							

Reviewed By: RBM

Method: Backhoe

Notes:

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Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

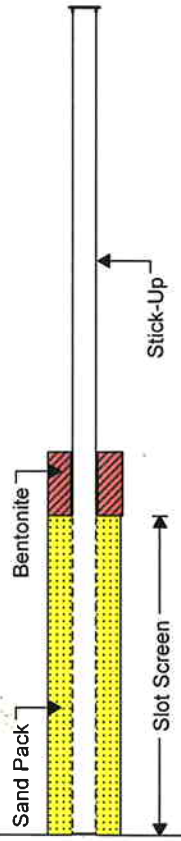
Location: Wilmot Lands

Mini-Piezometer: MP1-11

Job Number: 34896-100

Drill Date: January 11, 2011

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	Recovery (%)	Headspace (ppm)	Groundwater Observations and Well Details
ft / m								
-4.0 / 1.0								
-2.0 /								
0.0 /	0.00	Ground Elevation						
	0.00	**TOPSOIL**						
	-0.15 / 0.15	**Silty SAND** Brownish grey silty sand, some organics, some clay, wet						
	-0.30 / 0.30	**Silty CLAY** Grey silty clay, some sand, wet to moist						
2.0 /	-0.91 / 0.91							
4.0 /								
6.0 /								



Reviewed By: RBM

Method: Hand Augering

Notes:

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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

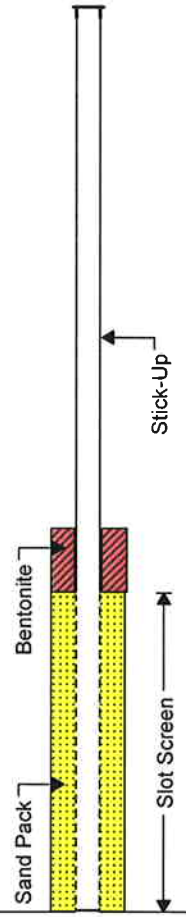
Location: Wilmot Lands

Mini-Piezometer: MP2-11

Job Number: 34896-100

Drill Date: January 11, 2011

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	Recovery (%)	Headspace (ppm)	Groundwater Observations and Well Details
ft / m								
-4.0								
-2.0								
0.0	0.00	Ground Elevation						
	0.00	**TOPSOIL**						
	-0.15 / 0.15	**Silty CLAY** Greyish brown silty clay, little to trace sand, very moist						
2.0	-0.61 / 0.61	**Clayey SILT** Greyish brown clayey silt, some sand, moist to wet						
	-0.84 / 0.84	**Silty CLAY** Grey silty clay, hard, moist						
	1.0							
4.0								



Reviewed By: RBM

Method: Hand Augering

Notes:

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Sheet: 1 of 1

Client: Wilmot Employment Lands

Project: Hydrogeological Investigations

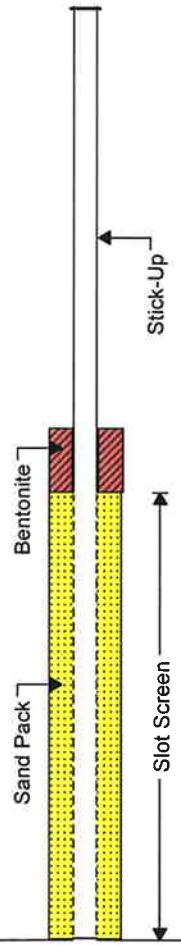
Location: Wilmot Lands

Mini-Piezometer: MP3-11

Job Number: 34896-100

Drill Date: January 11, 2011

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	Recovery (%)	Headspace (ppm)	Groundwater Observations and Well Details
ft / m								
-4.0								
-2.0								
0.0	0.00	Ground Elevation						
	0.00	**TOPSOIL**						
	-0.15 / 0.15	**Clayey SILT** Dark grey clayey silt, some sand, wet						
		Sandy SILT Brown sandy silt, some clay, moist to wet						
2.0		**Silty CLAY** Brown silty cly, some sand, trace stone, moist						
1.0	-1.07 / 1.07	**Silty SAND** Brown silty sand, clayey, wet						
4.0	-1.22 / 1.22							



Reviewed By: RBM

Method: Hand Augering

Notes:

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Sheet: 1 of 1

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 101

PROJECT Proposed Development - Wilmot Employment Lands
PML REF. 18KF009
LOCATION New Hamburg, Ontario
BORING DATE March 13, 2018
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN D. Brice

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
	SURFACE ELEVATION					
0.0	TOPSOIL: Dark brown clayey silt, frozen		1	SS	8	
	CLAYEY SILT: Very stiff brown clayey silt, trace sand, DTPL					
1.0			2	SS	19	
2.0			3	SS	25	
			4	SS	28	
3.0	3.0					
	becoming stiff, grey, APL		5	SS	9	
4.0						
			6	SS	10	
5.0						
6.0	6.1					
	becoming very stiff, occasional silt layers, wet		7	SS	21	
7.0						
			8	SS	18	
8.0						
9.0			9	SS	18	
10.0						
			10	SS	23	
11.0	11.1					
	BOREHOLE TERMINATED AT 11.1 m					
12.0						
13.0						
14.0						
15.0						

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Stickup Well Protector Set in Concrete
50 mm Plastic Riser
Bentonite Seal
Filter Sand
Slotted Screen

Water Level Readings:
Initial: 10.6 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 102

PROJECT Proposed Development - Wilmot Employment Lands
PML REF. 18KF009
LOCATION New Hamburg, Ontario
BORING DATE March 14, 2018
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN D. Brice

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
0.0		SURFACE ELEVATION				
0.0		TOPSOIL: Dark brown clayey silt topsoil, frozen		1	SS	6
0.33		CLAYEY SILT: Firm brown clayey silt, some sand, APL		2	SS	4
1.5		becoming stiff, layered with brown silt, some fine sand, wet		3	SS	14
				4	SS	25
3.0		becoming grey clayey silt, trace sand, DTPL, occasional sand partings		5	SS	13
				6	GS	
				7	SS	13
				8	SS	11
				9	SS	22
8.1		BOREHOLE TERMINATED AT 8.1 m				

ELEVATION SCALE

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Stickup Well Protector Set in Concrete
50 mm Plastic Riser
Bentonite Seal
Filter Sand
Slotted Screen

Water Level Readings:
Initial: Dry

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 103

PROJECT Proposed Development - Wilmot Employment Lands
PML REF. 18KF009
LOCATION New Hamburg, Ontario
BORING DATE March 14, 2018
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN D. Brice

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
	SURFACE ELEVATION				
0.25	TOPSOIL: Dark brown clayey silt, frozen		1	SS	6
0.76	CLAYEY SILT: Firm brown clayey silt, trace sand, moist				
1.5	SANDY SILT: Loose brown sandy silt, trace clay, moist		2	SS	8
	becoming compact, occasional clayey lenses		3	SS	11
			4	SS	16
3.0	CLAYEY SILT: Stiff grey clayey silt, trace sand, APL		5	SS	14
			6	GS	
			7	SS	12
			8	SS	13
8.1			9	SS	12
	BOREHOLE TERMINATED AT 8.1 m				

ELEVATION SCALE

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Stickup Well Protector Set in Concrete
50 mm Plastic Riser
Bentonite Seal
Filter Sand
Slotted Screen

Water Level Readings:
Initial: Dry

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 104

PROJECT Proposed Development - Wilmot Employment Lands
PML REF. 18KF009
LOCATION New Hamburg, Ontario
BORING DATE March 13, 2018
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN D. Brice

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
	SURFACE ELEVATION				
0.25	TOPSOIL: Dark brown clayey silt, frozen				
	CLAYEY SILT: Firm brown clayey silt, trace sand, moist		1	SS	8
			2	SS	13
1.5					
	SILTY SAND: Compact brown silty sand, wet		3	SS	12
			4	SS	15
3.0					
	becoming grey, occasional clayey lenses, saturated		5	SS	18
			6	SS	25
			7	SS	24
7.6					
	becoming dense		8	SS	31
9.1					
	SILT: Compact grey silt, some fine sand, trace clay, saturated, occasional clayey lenses		9	SS	21
			10	SS	26
11.1					
	BOREHOLE TERMINATED AT 11.1 m				

ELEVATION SCALE: 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Stickup Well Protector Set in Concrete
50 mm Plastic Riser
Bentonite Seal
Filter Sand
Slotted Screen

Water Level Readings:
Initial: 10.4 m

NOTES

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CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 105

PROJECT Proposed Development - Wilmot Employment Lands
PML REF. 18KF009
LOCATION New Hamburg, Ontario
BORING DATE March 14, 2018
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN D. Brice

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
	SURFACE ELEVATION					
0.0	TOPSOIL: Dark brown clayey silt, trace sand, frozen		1	SS	5	
0.36	CLAYEY SILT: Firm brown clayey silt, some sand, APL		2	SS	7	
1.0			3	SS	6	
2.0						
2.3	becoming stiff, grey, no zones		4	SS	12	
3.0			5	SS	12	
4.0						
4.5	SANDY SILT: Compact grey sandy silt, saturated, occasional clayey lenses		6	SS	16	
5.0						
6.0						
6.1	CLAYEY SILT: Very stiff grey clayey silt, trace sand, DTPL, occasional silt lenses, wet		7	SS	17	
7.0						
8.0			8	SS	19	
8.1	BOREHOLE TERMINATED AT 8.1 m					
9.0						
10.0						
11.0						
12.0						
13.0						
14.0						
15.0						

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Stickup Well Protector Set in Concrete
50 mm Plastic Riser
Bentonite Seal
Filter Sand
Slotted Screen

Water Level Readings:
Initial: 5.7 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 106

PROJECT Proposed Development - Wilmot Employment Lands
PML REF. 18KF009
LOCATION New Hamburg, Ontario
BORING DATE March 14, 2018
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN D. Brice

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q / DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ● (50 100 150 200 / 20 40 60 80)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30 40)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SURFACE ELEVATION									
0.25	TOPSOIL: Dark brown clayey silt, trace sand, frozen		1	SS						Stickup Well Protector Set in Concrete
	CLAYEY SILT: Very stiff brown clayey silt, trace sand, DTPL		2	SS						50 mm Plastic Riser
			3	SS						
			4	SS						Bentonite Seal
			5	SS						
4.5	becoming firm, grey, occasional silt layers, wet		6	SS						Filter Sand
										Slotted Screen
6.1										
6.5	SILT: Compact grey silt, some sand, trace clay, wet, occasional clayey layers		7	SS						
	BOREHOLE TERMINATED AT 6.5 m									Water Level Readings: Initial: 4.5 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 107

PROJECT Proposed Development - Wilmot Employment Lands
PML REF. 18KF009
LOCATION New Hamburg, Ontario
BORING DATE March 13, 2018
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN D. Brice

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SURFACE ELEVATION								
0.27	TOPSOIL: Dark brown clayey silt, trace sand, frozen		1	SS	8				Stickup Well Protector Set in Concrete
	CLAYEY SILT: Firm brown clayey silt, some sand, APL		2	SS	7				50 mm Plastic Riser
1.5	becoming stiff, layered with brown silt, some sand, trace clay, moist		3	SS	9				
2.3									
2.5	becoming very stiff/compact		4	SS	28				Bentonite Seal
	becoming grey, no layers		5	SS	25				
			6	SS	14				
6.0	becoming very stiff, occasional silt layers		7	SS	16				Filter Sand
									Slotted Screen
7.6	becoming stiff		8	SS	9				
8.1	BOREHOLE TERMINATED AT 8.1 m								Water Level Readings: Initial: 7.4 m

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q; 50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30 40
ELEVATION SCALE: 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0
SHEAR STRENGTH: 20 40 60 80

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 108

PROJECT Proposed Development - Wilmot Employment Lands
PML REF. 18KF009
LOCATION New Hamburg, Ontario
BORING DATE March 12, 2018
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN D. Brice

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
		SURFACE ELEVATION									
0.0											
	0.20	TOPSOIL: Dark brown clayey silt, trace sand, frozen		1	SS	10					
		CLAYEY SILT: Stiff brown clayey silt, trace sand, DTPL		2	SS	11					
1.0											
	1.5	becoming very stiff, occasional silty sand layers		3	SS	16					
2.0											
	2.3	SILT: Compact grey silt, some sand, trace clay, wet		4	SS	14					
3.0				5	SS	10					
	3.5	CLAYEY SILT: Stiff grey clayey silt, trace sand, APL									
4.0											
				6	SS	10					
5.0											
6.0											
				7	SS	15					
7.0											
	7.6	becoming APL, numerous silt layers, wet		8	SS	13					Sampler wet from 7.6 m to completion
8.0											
9.0				9	SS	17					
10.0											
11.0	11.1			10	SS	14					
		BOREHOLE TERMINATED AT 11.1 m									Upon completion of augering Open No free water
12.0											
13.0											
14.0											
15.0											

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 109

PROJECT Proposed Development - Wilmot Employment Lands
PML REF. 18KF009
LOCATION New Hamburg, Ontario
BORING DATE March 12, 2018
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN D. Brice

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q / DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SURFACE ELEVATION						50 100 150 200 / 20 40 60 80	10 20 30 40		
0.21	TOPSOIL: Dark brown clayey silt, some sand, frozen		1	SS	9					
	CLAYEY SILT: Firm brown clayey silt, trace sand, APL		2	SS	5					
			3	SS	4					
2.3	becoming stiff, DTPL, occasional sand seams, wet		4	SS	14					Sampler wet at 2.3 m
			5	SS	14					
4.5	SILTY SAND: Compact grey silty sand, trace clay, saturated		6	SS	26					Sampler wet at 4.5 m
6.0	CLAYEY SILT: Very stiff grey clayey silt, trace sand, APL		7	SS	20					
			8	SS	22					
8.1	occasional sand seams, wet		9	SS	17					Sampler wet at 8.1 m
			10	SS	14					
11.1	BOREHOLE TERMINATED AT 11.1 m									Upon completion of augering Open Free water at 6.0 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 111

PROJECT Proposed Development - Wilmot Employment Lands
PML REF. 18KF009
LOCATION New Hamburg, Ontario
BORING DATE March 26, 2018
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN D. Brice

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SURFACE ELEVATION									
0.45	FILL: 150 mm dark brown silt, over dark brown clayey silt, DTPL-APL		1	SS	10					
	CLAYEY SILT: Very stiff brown clayey silt, trace sand, trace gravel, DTPL		2	SS	15					
			3	SS	21					
2.9	becoming grey/brown, APL		4	SS	14					
3.6										Upon completion of augering Open No free water

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q; 50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●; 20 40 60 80
PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30 40

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 115

PROJECT Proposed Development - Wilmot Employment Lands
PML REF. 18KF009
LOCATION New Hamburg, Ontario
BORING DATE March 14, 2018
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN D. Brice

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SURFACE ELEVATION						+ FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q (50 100 150 200) × DYNAMIC CONE PENETRATION ● STANDARD PENETRATION TEST (20 40 60 80)	(10 20 30 40)		
0.15	TOPSOIL: Dark brown clayey silt, trace sand, frozen		1	SS	9					
	SILT: Loose brown silt, some sand, trace clay, moist		2	SS	6					
			3	SS	11					
2.3	CLAYEY SILT: Stiff brown clayey silt, trace sand, APL, occasional sand layers		4	SS	10					
3.0	becoming grey		5	SS	11					
4.5	becoming layered with grey silt, some sand, wet		6	SS	12					
6.5			7	SS	10					
	BOREHOLE TERMINATED AT 6.5 m									Upon completion of augering Open No free water

0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 201

PROJECT Proposed Development - Wilmot Employment Lands Eastside
PML REF. 18KF025
LOCATION New Hamburg, Ontario
BORING DATE June 6, 2018
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN W. Loghrin

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
	SURFACE ELEVATION				
0.0	TOPSOIL: Dark brown silt, moist		1	SS	7
0.40	CLAYEY SILT: Firm to stiff brown clayey silt, some sand, trace gravel, APL		2	SS	12
			3	SS	9
4.0	becoming firm grey occasional silt layers		4	SS	8
			5	SS	8
6.7	BOREHOLE TERMINATED AT 6.7 m				

ELEVATION SCALE

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

GAS READINGS ppm

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Stickup Well Protector Set in Concrete
Bentonite Seal
Filter Sand
Slotted Screen

Water Level Readings:
Initial: Dry
2018-06-15: 2.91 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 202

PROJECT Proposed Development - Wilmot Employment Lands Eastside
PML REF. 18KF025
LOCATION New Hamburg, Ontario
BORING DATE June 6, 2018
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN W. Loghrin

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
	SURFACE ELEVATION				
0.0	TOPSOIL: Dark brown silt, moist to wet		1	SS	5
0.30	CLAYEY SILT: Brown mottled clayey silt, some sand trace gravel, occasional wet sand layers, APL		2	SS	7
1.0					
2.0			3	SS	6
2.1	becoming hard, DTPL		4	SS	40
3.0			5	SS	30
4.0					
4.0	SILTY SAND: Dense brown silty fine sand, saturated		6	SS	54
5.0					
6.0			7	SS	44
6.7	BOREHOLE TERMINATED AT 6.7 m				
7.0					
8.0					
9.0					
10.0					
11.0					
12.0					
13.0					
14.0					
15.0					

ELEVATION SCALE

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

GAS READINGS ppm

GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Stickup Well Protector Set in Concrete
Bentonite Seal
Filter Sand
Slotted Screen

Free water at 3.5 m after SS6

Water Level Readings:
Initial: 3.5 m
2018-06-15: 2.28 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 203

PROJECT Proposed Development - Wilmot Employment Lands Eastside
PML REF. 18KF025
LOCATION New Hamburg, Ontario
BORING DATE June 6, 2018
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN W. Loghrin

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
	SURFACE ELEVATION				
0.0	TOPSOIL: Dark brown silt, moist		1	SS	9
0.35	CLAYEY SILT: Firm brown clayey silt, some sand, trace gravel, APL, occasional wet silt layers		2	SS	8
2.5	becoming grey		3	SS	6
			4	SS	9
			5	SS	10
6.7	BOREHOLE TERMINATED AT 6.7 m				

ELEVATION SCALE

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

GAS READINGS ppm

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Stickup Well Protector Set in Concrete
Bentonite Seal
Filter Sand
Slotted Screen

Water Level Readings:
Initial: Dry
2018-06-15: 6.12 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 204

PROJECT Proposed Development - Wilmot Employment Lands Eastside
PML REF. 18KF025
LOCATION New Hamburg, Ontario
BORING DATE June 9, 2018
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN W. Loghrin

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
	SURFACE ELEVATION				
0.0	TOPSOIL: Dark brown silt, moist		1	SS	9
0.40	CLAYEY SILT: Firm to very stiff brown clayey silt, some sand, trace gravel, APL to DTPL, occasional silt layers		2	SS	7
1.0					
2.0			3	SS	11
3.0			4	SS	13
4.0	becoming grey, occasional saturated silt layers				
4.0			5	SS	6
5.0					
5.9	SILT TILL: Very dense grey silt, some sand, some gravel, occasional cobble, occasional boulders, moist		6	SS	75
6.0					
6.7	BOREHOLE TERMINATED AT 6.7 m				
7.0					
8.0					
9.0					
10.0					
11.0					
12.0					
13.0					
14.0					
15.0					

ELEVATION SCALE

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

GAS READINGS ppm

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Stickup Well Protector Set in Concrete
Bentonite Seal
Filter Sand
Slotted Screen

Water Level Readings:
Initial: Dry
2018-06-15: 1.56 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 205

PROJECT Proposed Development - Wilmot Employment Lands Eastside
PML REF. 18KF025
LOCATION New Hamburg, Ontario
BORING DATE June 9, 2018
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN W. Loghrin

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q / DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ● (50 100 150 200 / 20 40 60 80)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30 40)	GAS READINGS ppm	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SURFACE ELEVATION									
0.0	TOPSOIL: Dark brown clayey silt, APL		1	SS	5					
	CLAYEY SILT: Very stiff brown clayey silt, some sand, trace gravel, DTPL									
1.0			2	SS	27					
2.0			3	SS	18					
			4	SS	14					
3.0			5	SS	12					
4.0										
	becoming grey, APL, occasional wet silt layers		6	SS	12					
5.0										
6.0			7	SS	16					
6.7	BOREHOLE TERMINATED AT 6.7 m									Upon completion of augering Open No free water
7.0										
8.0										
9.0										
10.0										
11.0										
12.0										
13.0										
14.0										
15.0										

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 206

PROJECT Proposed Development - Wilmot Employment Lands Eastside
PML REF. 18KF025
LOCATION New Hamburg, Ontario
BORING DATE June 9, 2018
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN W. Loghrin

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER O Q / DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	GAS READINGS ppm	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	SURFACE ELEVATION						20 40 60 80	10 20 30 40		
	TOPSOIL: Dark brown silt, moist		1	SS	4					
	CLAYEY SILT: Firm brown clayey silt, some sand, trace gravel, APL to DTPL		2	SS	9					
1.4	becoming hard, DTPL		3	SS	34					
2.0			4	SS	40					
2.9	becoming grey		5	SS	31					
4.0			6	SS	34					
5.0			7	SS	30					
6.0										
6.7	BOREHOLE TERMINATED AT 6.7 m									Upon completion of augering Open No free water
7.0										
8.0										
9.0										
10.0										
11.0										
12.0										
13.0										
14.0										
15.0										

NOTES

ID Number: TT1-18

Project: Hydrogeological Investigation

Project No: 34896-104 & 39219-104

Client: Badenview Developments Inc. & New Hamburglrs Inc.

Site Location: New Hamburg, ON

Date: 7/20/2018

Contractor: T. Musselman Excavating

Excavation Method: Track-Mounted Excavator

SUBSURFACE PROFILE				Soil Sample Lab Analysis	HEADSPACE
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) Depth (m)		VOC ppm (20 40 60 80); Hydrocarbon ppm (100 200 300 400)
0 / 0		Ground Surface	0.0		
		TOPSOIL Dark brown topsoil, rootlets, damp	0.0 -0.6		
2		**SANDY SILT** Brown sandy silt, some stones, damp to slightly moist	0.6 -1.2		
4		**SILTY SAND** Brown silty sand, trace clay, moist to very moist. Mottling observed at approximately 1.8 m.	1.2 -2.0		
6 / 2		increasing silt and moisture content	2.0 -2.7		
8		**SANDY SILT** Grey sandy silt, trace clay, very moist to wet	2.7 -3.0		
10		increasing sand content, wet	3.0		
12 / 4					
14			-4.4		
		Excavation Terminated	4.4		
16					
18					
20 / 6					
22					

Field Technician: FAH

Drafted by: KLW

Reviewed by: PAG

Notes: Excavation Dimensions: 2.5m L x 4.5m W x 4.7 m D

Pooling observed (upwelling) upon completion. Test trench collapse occurred within silty sand layer. Approximately 10-15cm at base after ~4.5 hours elapsed.

ID Number: TT2-18

Project: Hydrogeological Investigation

Project No: 34896-104 & 39219-104

Client: Badenview Developments Inc. & New Hamburglrs Inc.

Site Location: New Hamburg, ON

Date: 7/20/2018

Contractor: T. Musselman Excavating

Excavation Method: Track-Mounted Excavator

SUBSURFACE PROFILE				Soil Sample Lab Analysis	HEADSPACE
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) Depth (m)		VOC ppm (20 40 60 80); Hydrocarbon ppm (100 200 300 400)
0 / 0		Ground Surface	0.0		
		TOPSOIL Dark brown topsoil, rootlets, damp	0.0 -0.6		
2 /		**SAND** Brown fine-grained sand, some silt, damp	0.6 -0.9		
		Excavation Terminated	0.9		
4 /					
6 / 2					
8 /					
10 /					
12 /					
14 / 4					
16 /					
18 /					
20 / 6					
22 /					

Field Technician: FAH

Drafted by: KLW

Reviewed by: PAG

Notes: Test trench abandoned because tile drainage pipe encountered.

Sheet: 1 of 1

ID Number: TT3-18

Project: Hydrogeological Investigation

Project No: 34896-104 & 39219-104

Client: Badenview Developments Inc. & New Hamburglrs Inc.

Site Location: New Hamburg, ON

Date: 7/20/2018

Contractor: T. Musselman Excavating

Excavation Method: Track-Mounted Excavator

SUBSURFACE PROFILE				Soil Sample Lab Analysis	HEADSPACE
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) Depth (m)		VOC ppm (20 40 60 80); Hydrocarbon ppm (100 200 300 400)
0 / 0		Ground Surface	0.0		
		TOPSOIL Dark brown topsoil, rootlets, damp	0.0 -0.5		
2		**CLAYEY SILT TILL** Brown clayey silt till, some stones, some sand, damp	0.5 -1.2		
4		reduced sand content	1.2		
6 / 2					
8			-2.9		
10		transitioning to grey	2.9		
		SILTY CLAY TILL Grey silty clay till, damp			
12 / 4					
14			-4.6		
		SANDY SILT CLAY TILL Grey sandy silt clay till, damp to moist, seams of very high moisture	4.6 -4.9		
16		Excavation Terminated	4.9		
18					
20 / 6					
22					

Field Technician: FAH

Drafted by: KLW

Reviewed by: PAG

MTE

Sheet: 1 of 1

Notes: Excavation Dimensions: 2.1m L x 1.4m W x 4.9m D

No visible seepage or pooling upon completion. Slight pooling (unmeasureable) at base after ~4.75 hours elapsed.

ID Number: TT4-18

Project: Hydrogeological Investigation

Project No: 34896-104 & 39219-104

Client: Badenview Developments Inc. & New Hamburglrs Inc.

Site Location: New Hamburg, ON

Date: 7/20/2018

Contractor: T. Musselman Excavating

Excavation Method: Track-Mounted Excavator

SUBSURFACE PROFILE				Soil Sample Lab Analysis	HEADSPACE
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)		VOC ppm (20 40 60 80) / Hydrocarbon ppm (100 200 300 400)
0 / 0		Ground Surface	0.0		
		TOPSOIL Dark brown topsoil, rootlets, damp	0.0 -0.5		
2		**SAND** Light brown fine grained sand, trace silt, damp to slightly moist	0.5 -1.2		
4		**SILT TILL** Brown silt till, some clay, trace sand, trace stones, damp to moist	1.2 -2.1		
6 / 2		becoming moist to very moist and transitioning to grey	2.1 -3.0		
8		becoming very moist to saturated	3.0 -3.7		
10		grey, some sand, very moist to wet	3.7 -4.1		
12 / 4		Excavation Terminated	4.1		
14					
16					
18					
20 / 6					
22					

Field Technician: FAH

Drafted by: KLW

Reviewed by: PAG

MTE

Sheet: 1 of 1

Notes: Excavation Dimensions: 4.0m W x 2.7m L x 4.1m D

Minor pooling (upwelling) of water from center of excavation upon completion. Approximately 5-10cm of water at base after ~6.25 hours elapsed.

ID Number: TT5-18

Project: Hydrogeological Investigation

Project No: 34896-104 & 39219-104

Client: Badenview Developments Inc. & New Hamburglrs Inc.

Site Location: New Hamburg, ON

Date: 7/20/2018

Contractor: T. Musselman Excavating

Excavation Method: Track-Mounted Excavator

SUBSURFACE PROFILE				Soil Sample Lab Analysis	HEADSPACE
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) Depth (m)		VOC ppm (20 40 60 80); Hydrocarbon ppm (100 200 300 400)
0 / 0		Ground Surface	0.0		
		TOPSOIL Dark brown topsoil, rootlets, damp	0.0 -0.5		
2		**SAND** Light brown fine grained sand, trace silt, damp to slightly moist	0.5 -1.2		
4		**CLAYEY SILT TILL** Brown clayey silt till, damp	1.2 -1.8		
6 / 2		**SILTY CLAY TILL** Grey silty clay till, damp to slightly moist	1.8 -3.0		
8					
10		transitioning from moist to very moist	3.0 -4.0		
12					
14 / 4		wet below 4.0 m	4.0 -4.3		
		Excavation Terminated	4.3		
16					
18					
20 / 6					
22					

Field Technician: FAH

Drafted by: KLW

Reviewed by: PAG

MTE

Sheet: 1 of 1

Notes: Excavation Dimensions: 2.4m L x 1.4m W x 4.3m D

No visible seepage or pooling upon completion. Less than 5cm at base after ~5.5 hours elapsed.

ID Number: TT6-18

Project: Hydrogeological Investigation

Project No: 34896-104 & 39219-104

Client: Badenview Developments Inc. & New Hamburglrs Inc.

Site Location: New Hamburg, ON

Date: 10/25/2018

Contractor: T. Musselman Excavating

Excavation Method: Track-Mounted Excavator

SUBSURFACE PROFILE				Soil Sample Lab Analysis	HEADSPACE
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) Depth (m)		VOC ppm (20 40 60 80); Hydrocarbon ppm (100 200 300 400)
0 / 0		Ground Surface	0.0		
		TOPSOIL Dark brown silt topsoil, some clay, moist	0.0 -0.6		
2		**CLAYEY SILT TILL** Brown clayey silt till, trace stones, moist	0.6 -3.0		
4 / 2					
6					
8					
10		**SILTY CLAY TILL** Grey silty clay till, trace stones, moist to wet	3.0 -4.9		
12 / 4					
14					
16		Excavation Terminated	4.9		
18					
20 / 6					
22					

Field Technician: KLW

Drafted by: KLW

Reviewed by: PAG

Notes: Excavation dimensions - 1.8m W x 5.2 m L x 4.9m D

No water observed upon completion. Approximately 2.5cm of water at base after ~30 mins elapsed. Approximately 5cm of water at base after ~5 hours elapsed.

ID Number: TT7-18

Project: Hydrogeological Investigation

Project No: 34896-104 & 39219-104

Client: Badenview Developments Inc. & New Hamburglrs Inc.

Site Location: New Hamburg, ON

Date: 10/25/2018

Contractor: T. Musselman Excavating

Excavation Method: Track-Mounted Excavator

SUBSURFACE PROFILE				Soil Sample Lab Analysis	HEADSPACE
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) Depth (m)		VOC ppm (20 40 60 80); Hydrocarbon ppm (100 200 300 400)
0 / 0		Ground Surface	0.0		
0 – 2		**TOPSOIL** Dark brown silt topsoil, some clay, moist	0.0 -0.9		
2 – 10		**CLAYEY SILT TILL** Brown clayey silt till, trace stones, moist	0.9 -3.0		
10 – 22		**SILTY CLAY TILL** Grey silty clay till, trace stones, moist to wet	3.0 -6.4		
22		Excavation Terminated	6.4		

Field Technician: KLW

Drafted by: KLW

Reviewed by: PAG

MTE

Sheet: 1 of 1

Notes: Excavation dimensions - 1.8m W x 4.3m L x 6.4m D

No water observed upon completion. Small (unmeasureable) amount of water at base after ~3.25 hrs elapsed. Observations consistent after ~4.5 hours elapsed.

ID Number: TT8-18

Project: Hydrogeological Investigation

Project No: 34896-104 & 39219-104

Client: Badenview Developments Inc. & New Hamburglrs Inc.

Site Location: New Hamburg, ON

Date: 10/25/2018

Contractor: T. Musselman Excavating

Excavation Method: Track-Mounted Excavator

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Soil Sample Lab Analysis	HEADSPACE
			Ground Surface	0.0		VOC ppm 20 40 60 80; Hydrocarbon ppm 100 200 300 400
0	0		**TOPSOIL** Dark brown silt topsoil, trace to some clay, moist	0.0		
2				-0.9		
			SILT Brown silt, some clay, stoney, some cobbles, trace boulders, moist	0.9		
4						
6	2					
8						
10				-3.0		
			SANDY SILT Brown sandy silt, wet to saturated	3.0		
12						
	4					
14						
16						
				-5.5		
18			Excavation Terminated	5.5		
	6					
20						
22						

Field Technician: KLW

Drafted by: KLW

Reviewed by: PAG

MTE

Sheet: 1 of 1

Notes: Excavation dimensions - 1.8m W x 5.2m L x 6.4m D

Seepage into test trench observed from sidewalls below approximately 1.5m. Water flow into test trench observed at approximately 4.6m. Approximately 20cm of water at base after ~3 hours elapsed. Approximately 35.5cm of water at base after ~4 hours elapsed.

ID Number: TT9-18

Project: Hydrogeological Investigation

Project No: 34896-104 & 39219-104

Client: Badenview Developments Inc. & New Hamburglrs Inc.

Site Location: New Hamburg, ON

Date: 10/25/2018

Contractor: T. Musselman Excavating

Excavation Method: Track-Mounted Excavator

SUBSURFACE PROFILE				Soil Sample Lab Analysis	HEADSPACE
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) Depth (m)		VOC ppm (20 40 60 80); Hydrocarbon ppm (100 200 300 400)
0 / 0		Ground Surface	0.0		
		TOPSOIL Dark brown silt topsoil, some clay, moist	0.0 -0.9		
2		**CLAYEY SILT TILL** Brown clayey silt till, some stones, moist to wet	0.9		
4 / 2					
6					
8					
10			-3.4		
		some sand to sandy between 3.4m to 4.3m	3.4		
12 / 4					
14			-4.3		
		SILTY CLAY TILL Grey silty clay till, some stones, moist	4.3		
16					
18			-5.5		
		Excavation Terminated	5.5		
20 / 6					
22					

Field Technician: KLW

Drafted by: KLW

Reviewed by: PAG

MTE

Sheet: 1 of 1

Notes: Excavation dimensions - 1.8m W x 4.6m L x 5.5m D

No water observed upon completion. Approximately 2.5cm of water at base after ~2.5 hours elapsed. Approximately 5cm of water at base after ~4 hours elapsed.

ID Number: TT10-18

Project: Hydrogeological Investigation

Project No: 34896-104 & 39219-104

Client: Badenview Developments Inc. & New Hamburglrs Inc.

Site Location: New Hamburg, ON

Date: 10/25/2018

Contractor: T. Musselman Excavating

Excavation Method: Track-Mounted Excavator

SUBSURFACE PROFILE				Soil Sample Lab Analysis	HEADSPACE
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) Depth (m)		VOC ppm (20 40 60 80); Hydrocarbon ppm (100 200 300 400)
0 / 0		Ground Surface	0.0		
		TOPSOIL Dark brown silt topsoil, some clay, moist	0.0		
2			-0.9		
		CLAYEY SILT TILL Brown clayey silt till, some stones, moist	0.9		
4			-1.8		
6 / 2		**SILTY CLAY TILL** Grey silty clay till, some stones, some cobbles, moist	1.8		
8					
10					
12					
14 / 4					
16					
18			-5.5		
		Excavation Terminated	5.5		
20 / 6					
22					

Field Technician: KLW

Drafted by: KLW

Reviewed by: PAG

Notes: Excavation dimensions - 1.8m W x 4.6m L x 5.5m D

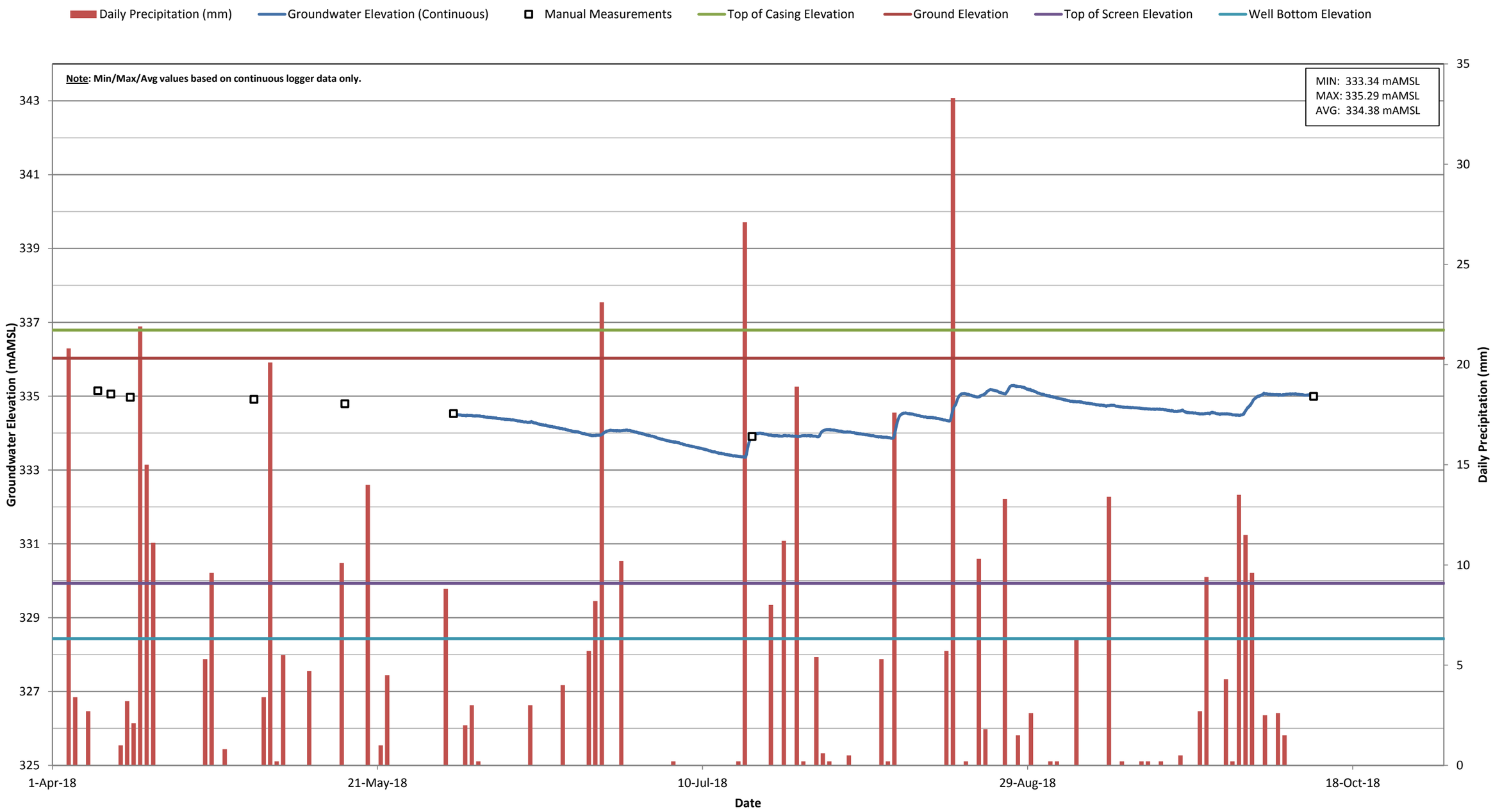
No water observed in test trench upon completion.
Approximately 2.5cm of water at base after ~2 hours elapsed.
Approximately 5cm of water at base after ~3.5 hours elapsed.

APPENDIX C

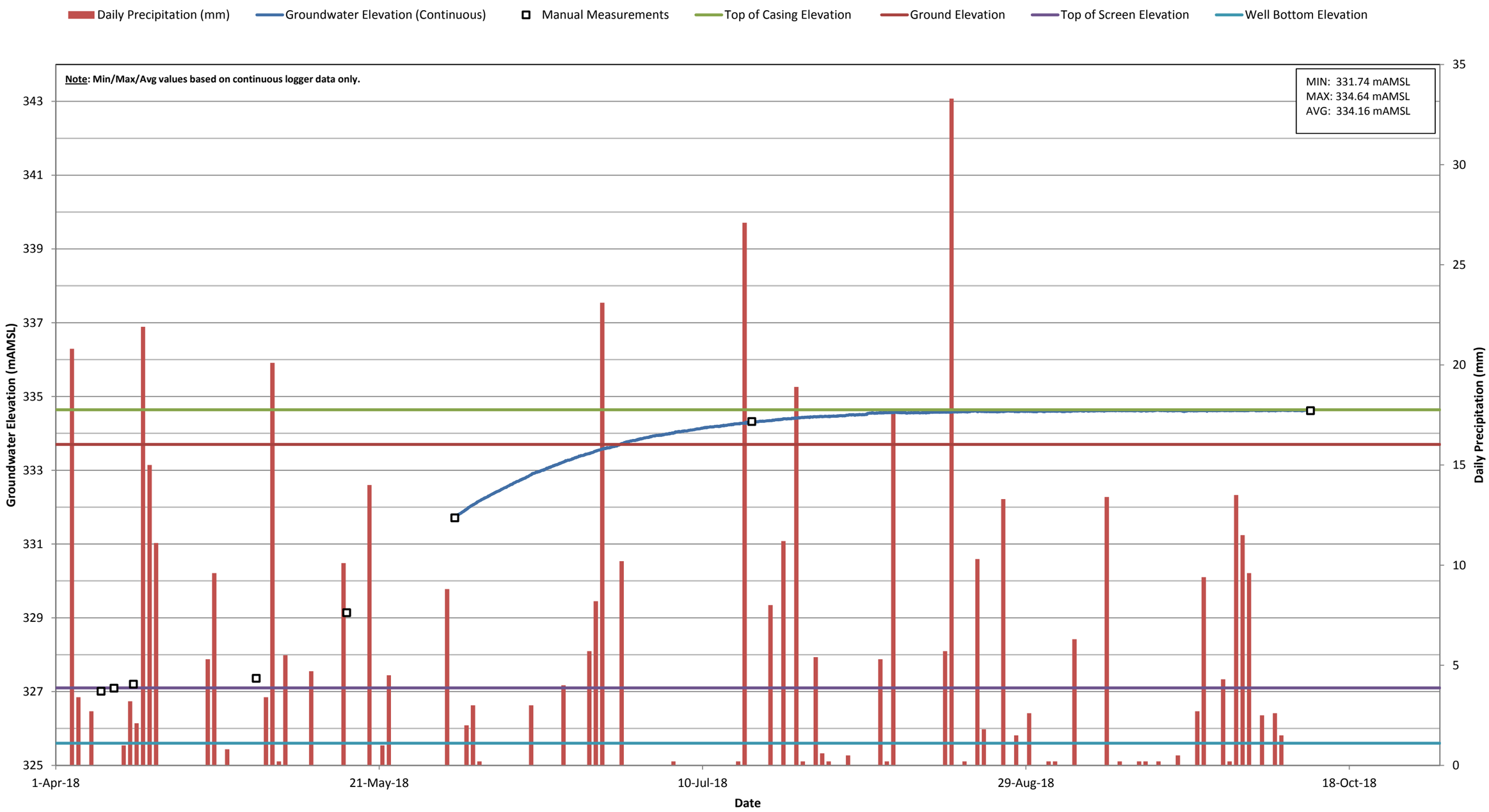
HYDROGRAPHS

Hydrograph 1: Groundwater Elevations (mAMSL) - BH101-18

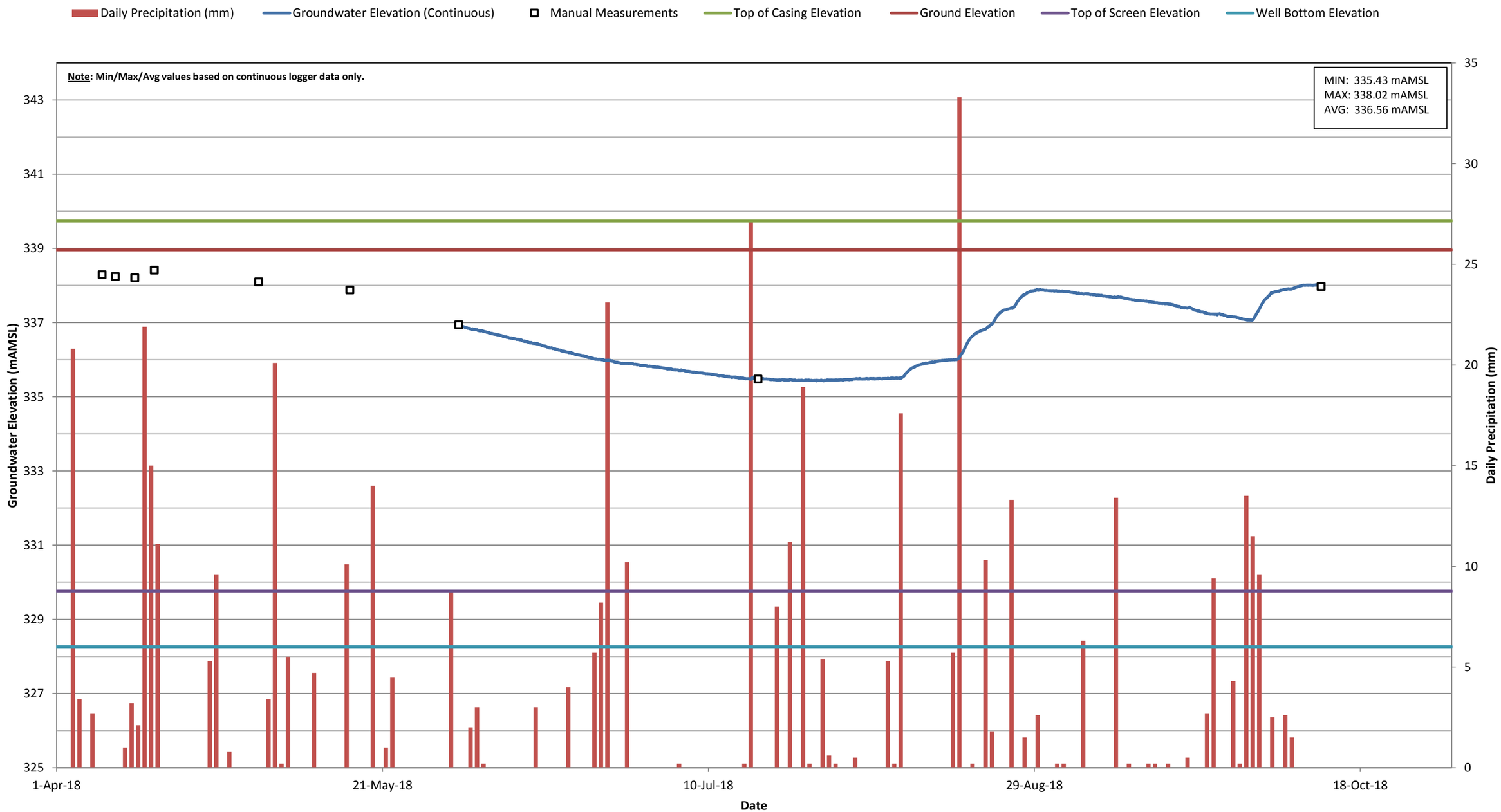
Hydrograph 2: Groundwater Elevations (mAMSL) - BH102-18



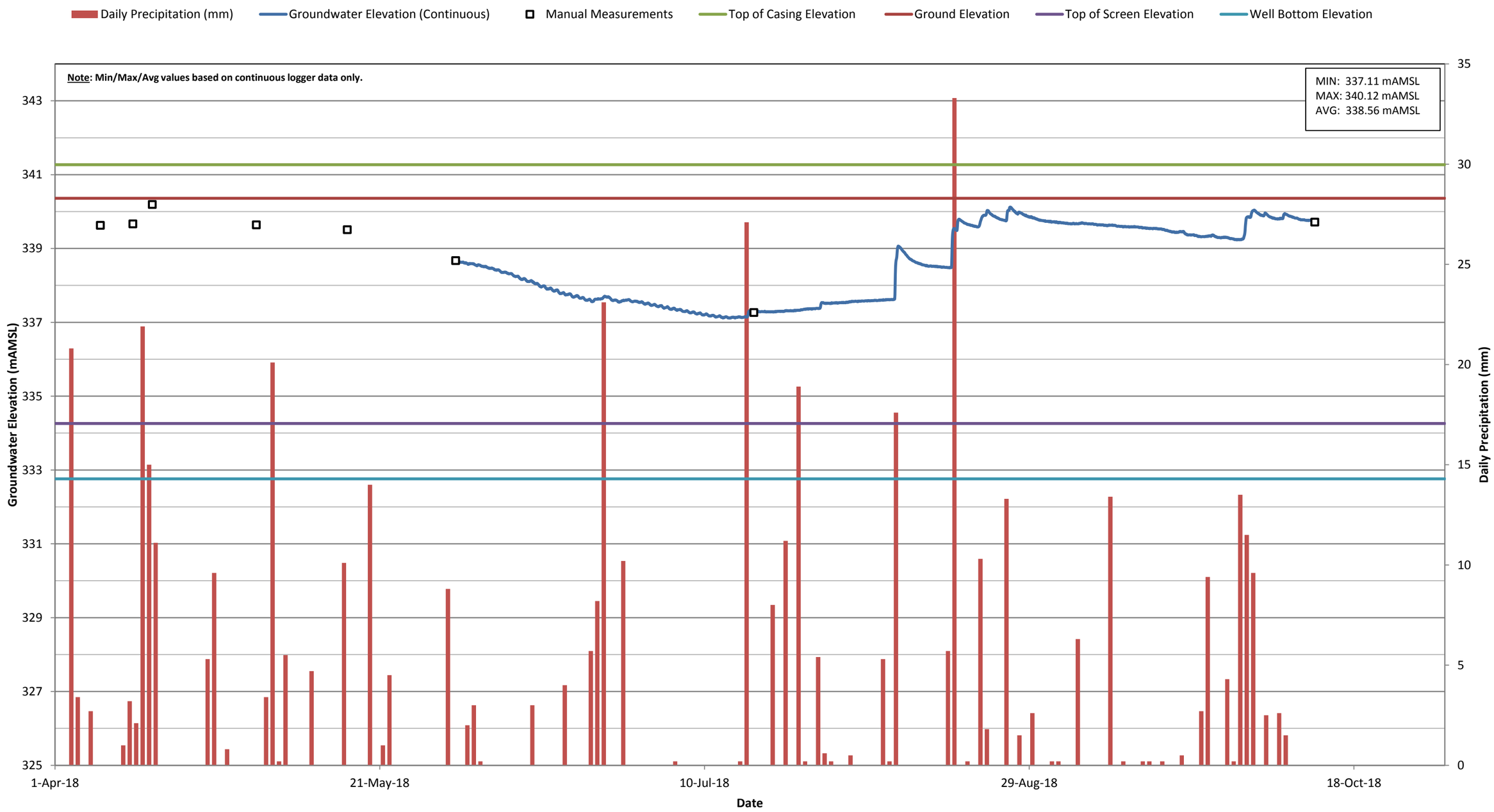
Hydrograph 3: Groundwater Elevations (mAMSL) - BH103-18



Hydrograph 4: Groundwater Elevations (mAMSL) - BH104-18

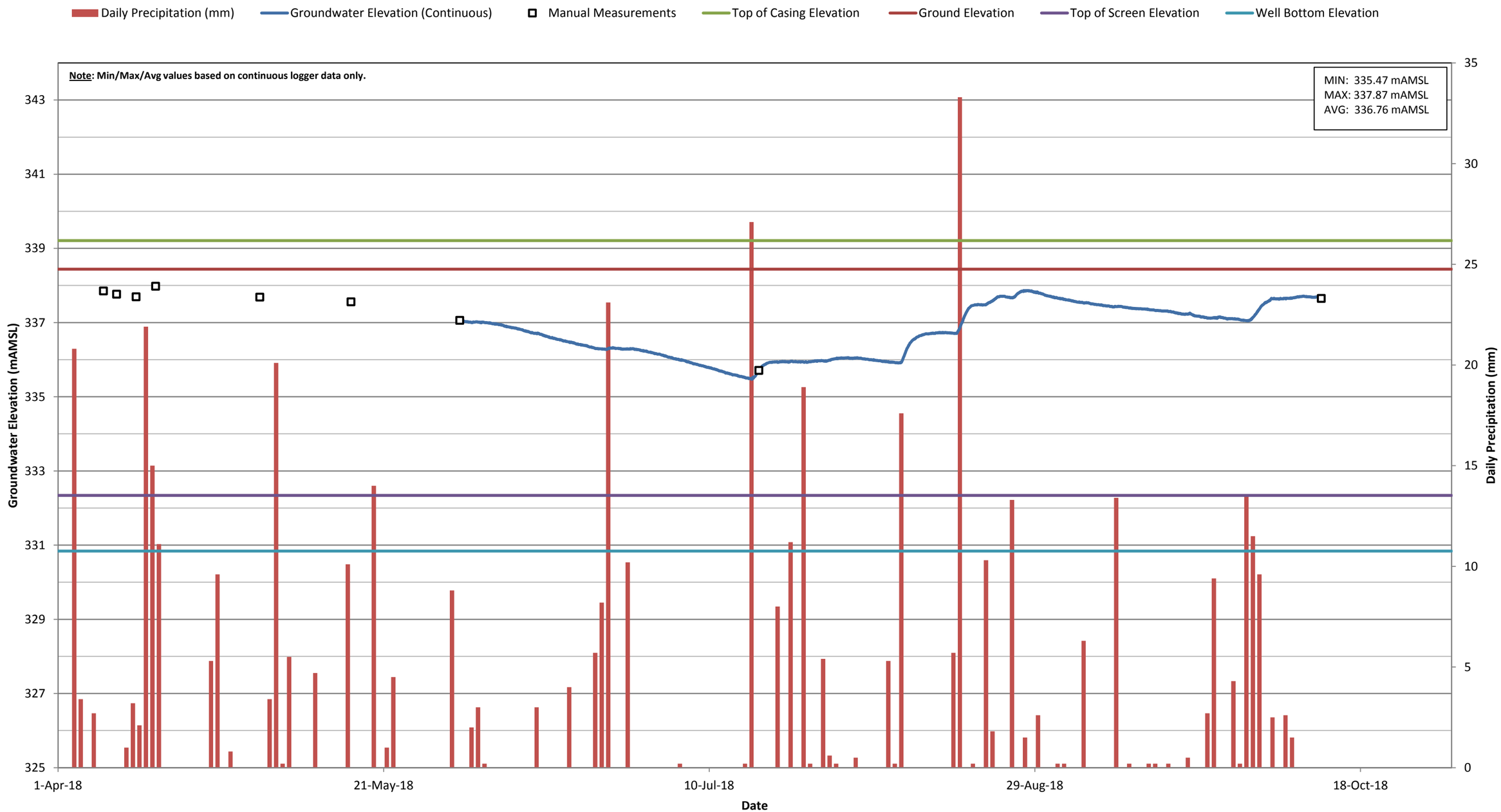


Hydrograph 5: Groundwater Elevations (mAMSL) - BH105-18

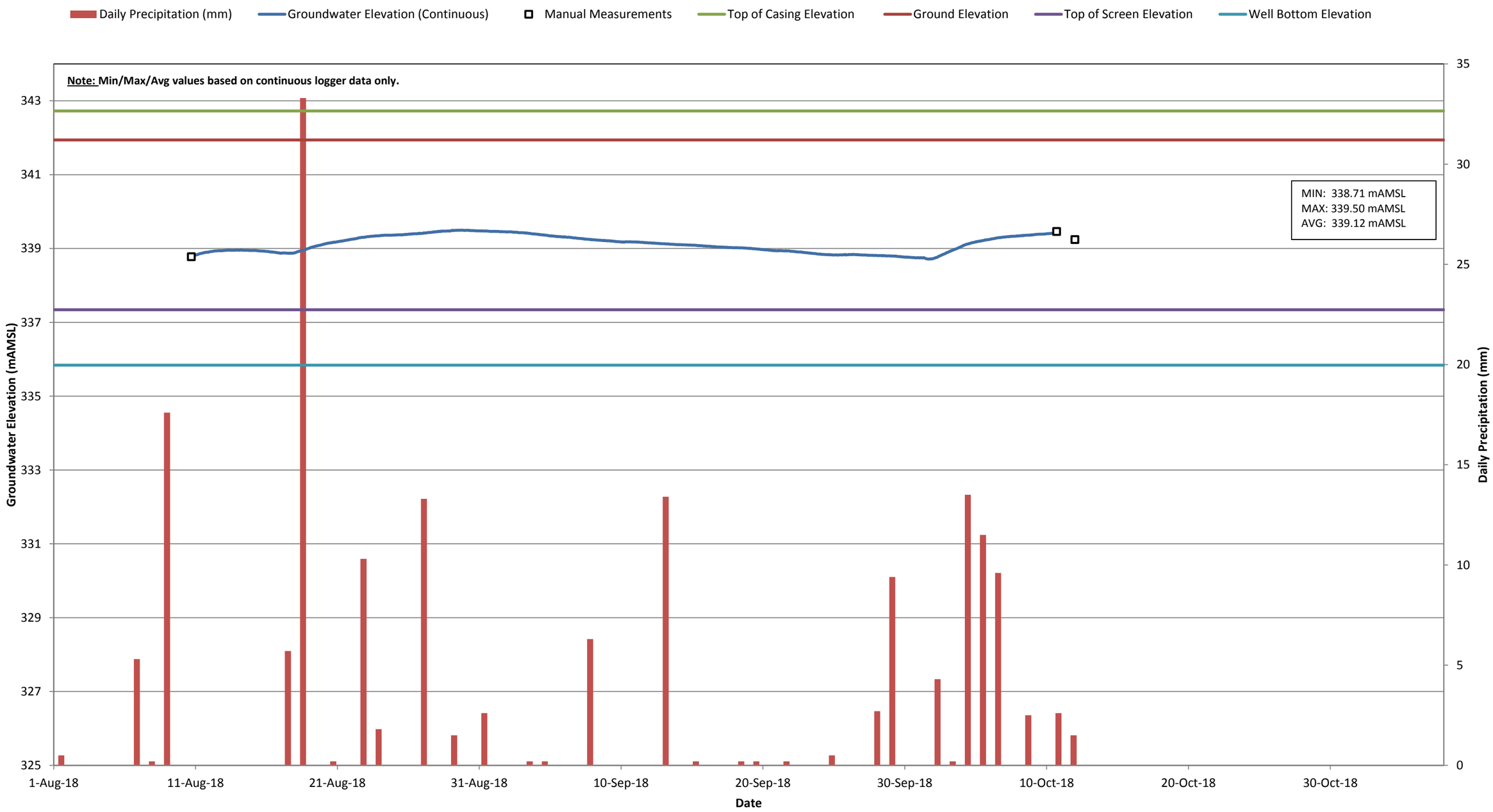


Hydrograph 6: Groundwater Elevations (mAMSL) - BH106-18

Hydrograph 7: Groundwater Elevations (mAMSL) - BH107-18

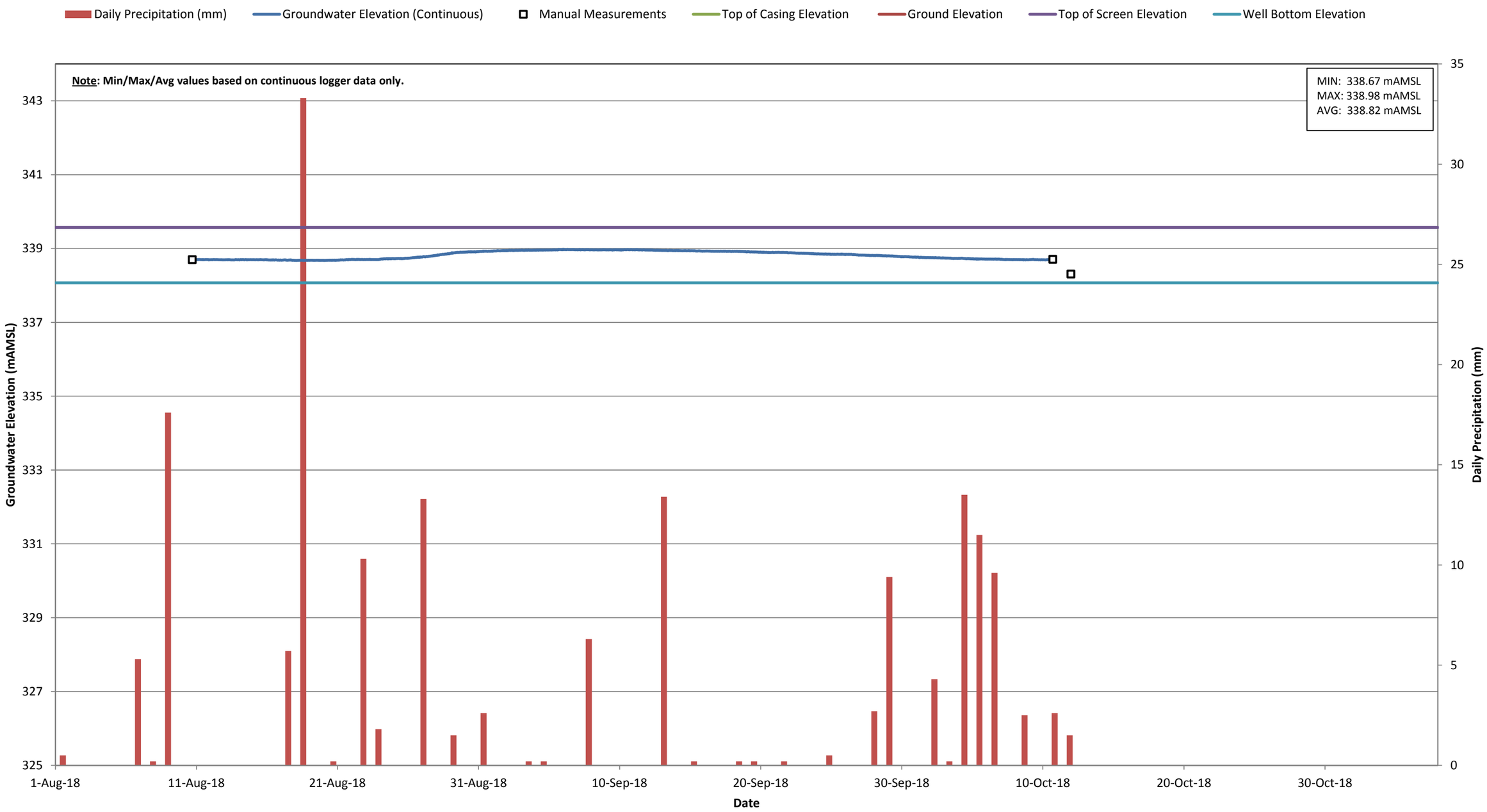


Hydrograph 8: Groundwater Elevations (mAMSL) - BH201-18

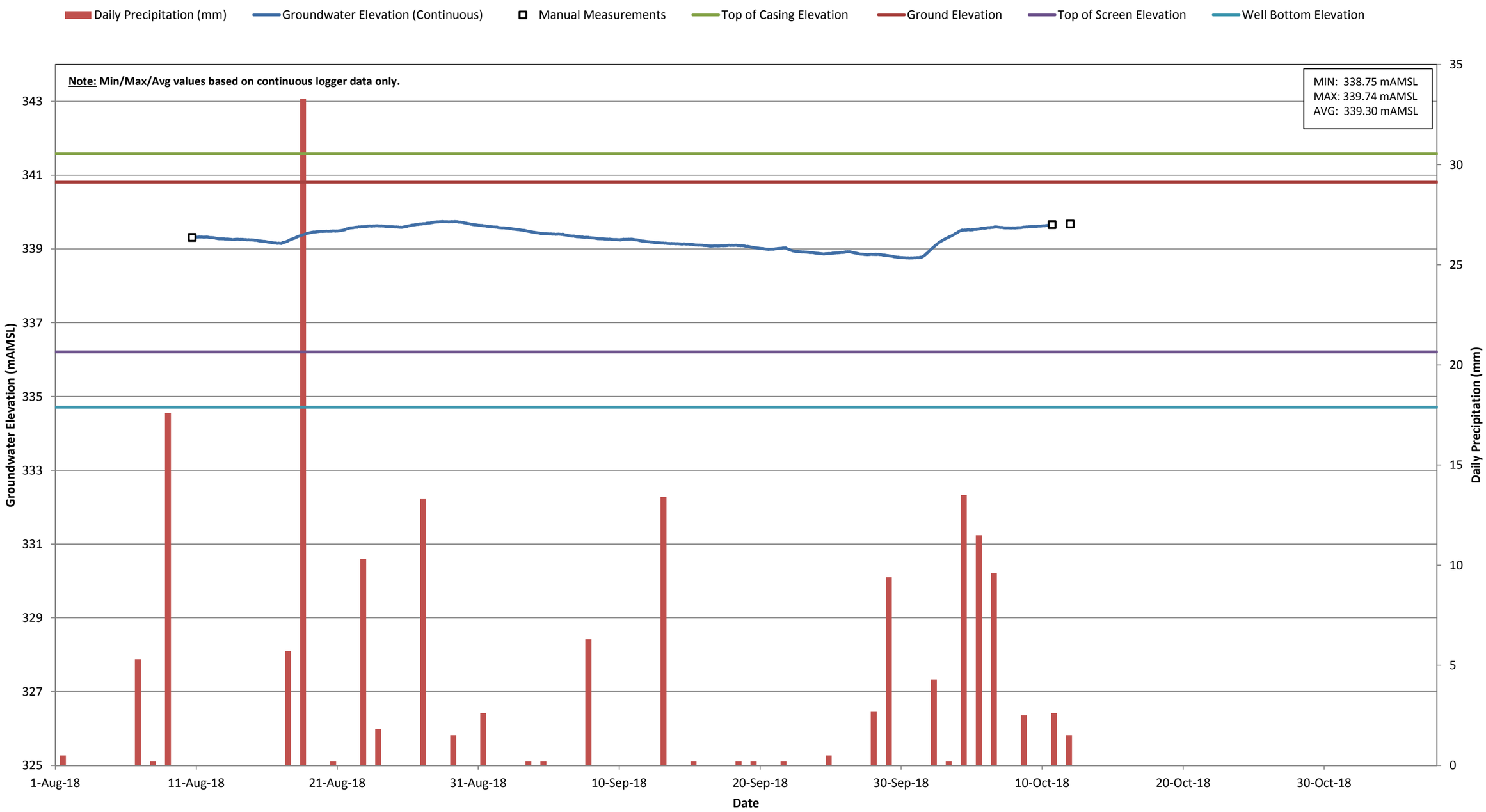


Hydrograph 9: Groundwater Elevations (mAMSL) - BH202-18

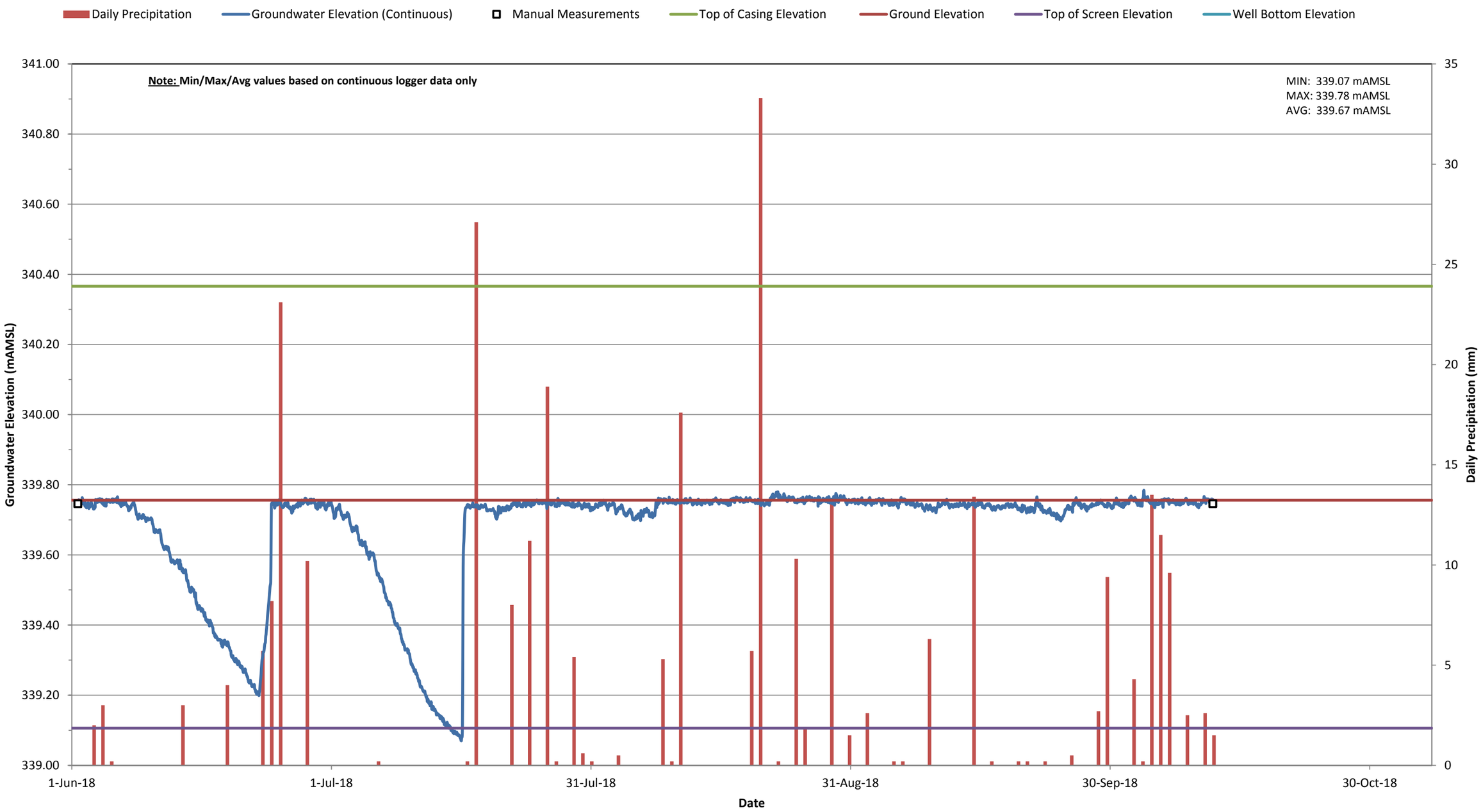
Hydrograph 10: Groundwater Elevations (mAMSL) - BH203-18



Hydrograph 11: Groundwater Elevations (mAMSL) - BH204-18



Hydrograph 12: Groundwater Elevations (mAMSL) - MP3-11

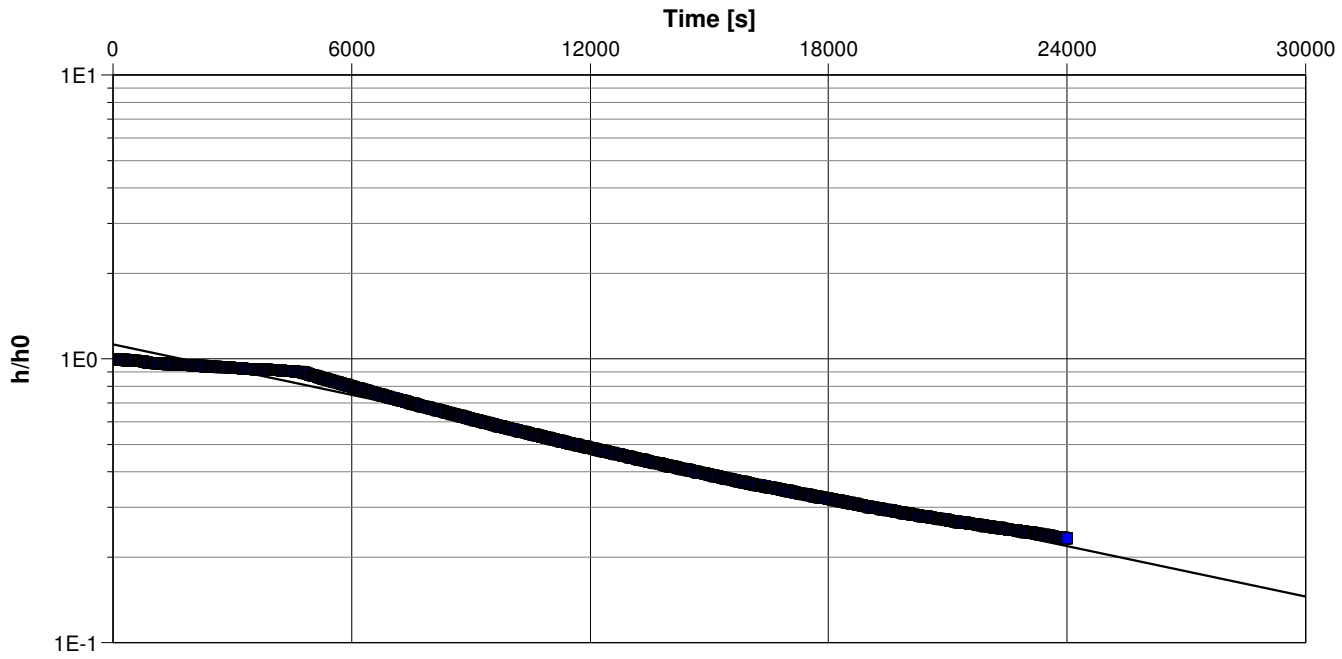


APPENDIX D

AQUIFER TEST © DATA SHEETS

	Slug Test Analysis Report	D
	Project: Wilmot Employment Lands	
	Number: 34896-104	
	Client: Badenview Developments Inc.	

Location: New Hamburg, Ontario	Slug Test: BH101-18 Recovery Test	Test Well: MW101-18
Test Conducted by: KLW		Test Date: 4/13/2018
Analysis Performed by: KLW	BH101-18 Recovery Test	Analysis Date: 4/18/2018
Aquifer Thickness: 2.61 m		

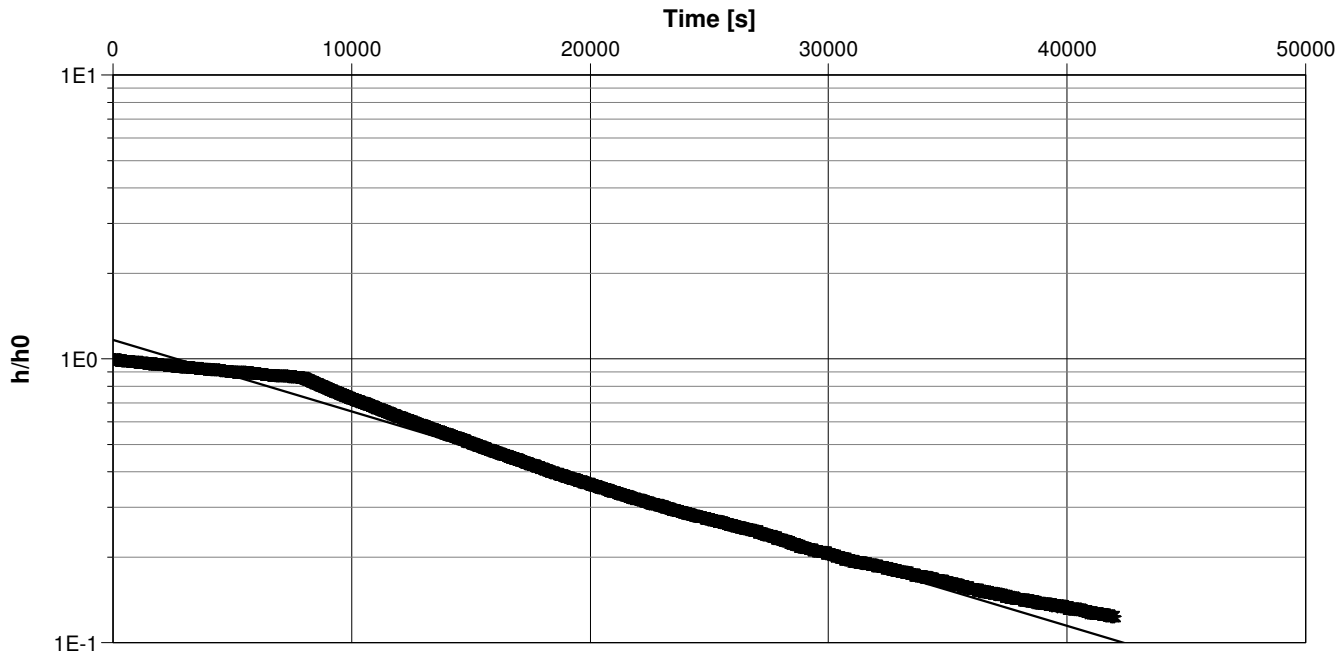


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW101-18	4.60×10^{-8}	

	Slug Test Analysis Report	D
	Project: Wilmot Employment Lands	
	Number: 34896-104	
	Client: Badenview Developments Inc.	

Location: New Hamburg, Ontario	Slug Test: BH102-18 Recovery Test	Test Well: MW102-18
Test Conducted by: KLW		Test Date: 4/13/2018
Analysis Performed by: KLW	BH102-18 Recovery Test	Analysis Date: 4/25/2018
Aquifer Thickness: 6.50 m		

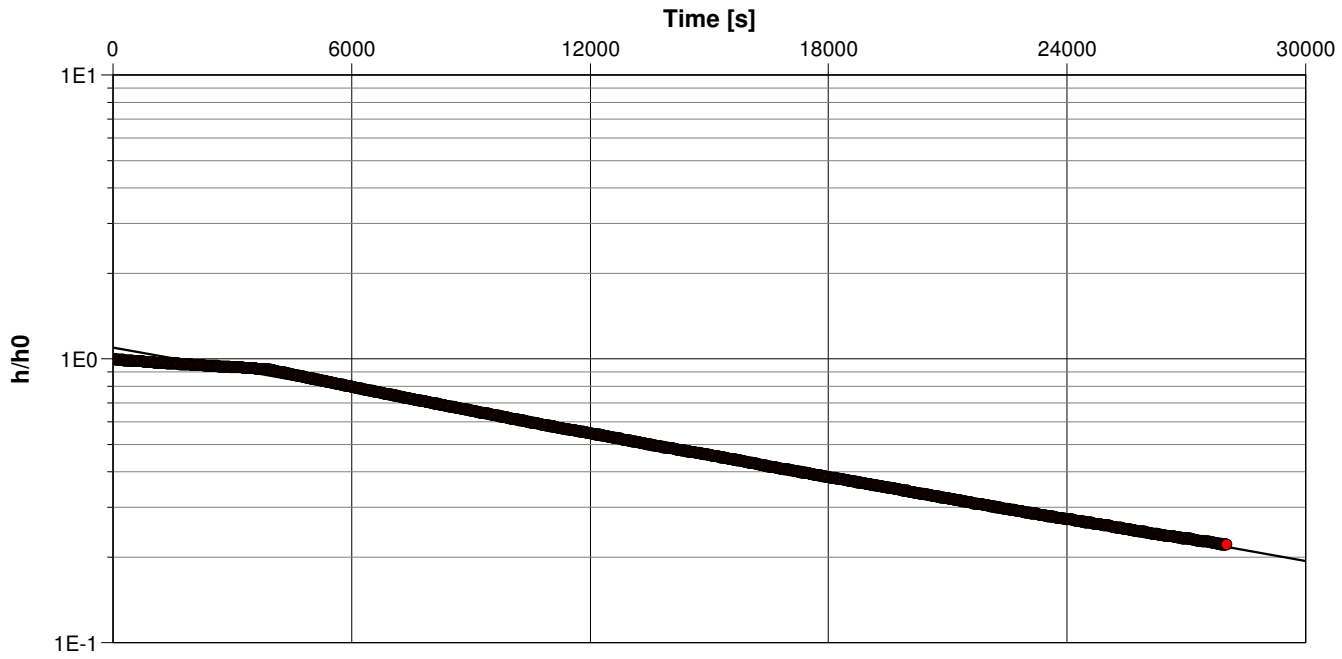


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW102-18	3.91×10^{-8}	

	Slug Test Analysis Report	D
	Project: Wilmot Employment Lands	
	Number: 34896-104	
	Client: Badenview Developments Inc.	

Location: New Hamburg, Ontario	Slug Test: BH104-18 Recovery Test	Test Well: MW104-18
Test Conducted by: KLW		Test Date: 4/13/2018
Analysis Performed by: KLW	BH104-18 Recovery Test	Analysis Date: 4/18/2018
Aquifer Thickness: 9.07 m		

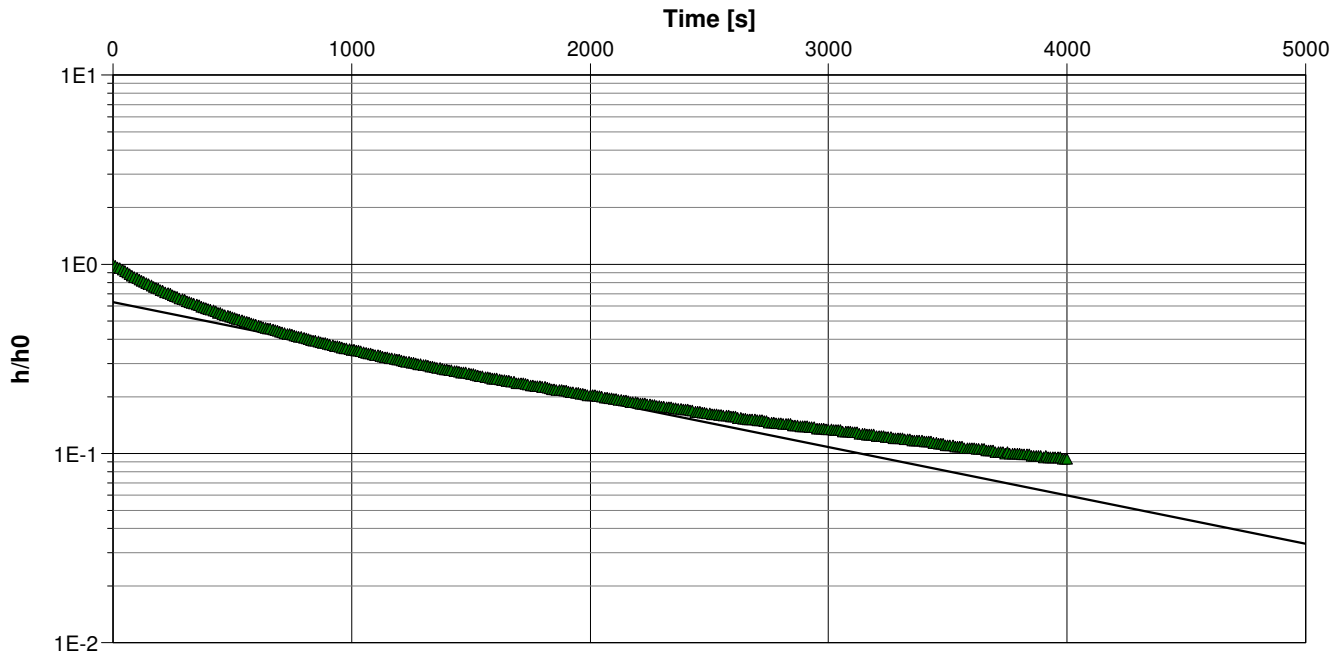


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW104-18	3.90×10^{-8}	

	Slug Test Analysis Report	D
	Project: Wilmot Employment Lands	
	Number: 34896-104	
	Client: Badenview Developments Inc.	

Location: New Hamburg, Ontario	Slug Test: BH105-18 Recovery Test	Test Well: MW105-18
Test Conducted by: KLW		Test Date: 4/13/2018
Analysis Performed by: KLW	BH105-18 Recovery Test 1	Analysis Date: 4/18/2018
Aquifer Thickness: 5.99 m		

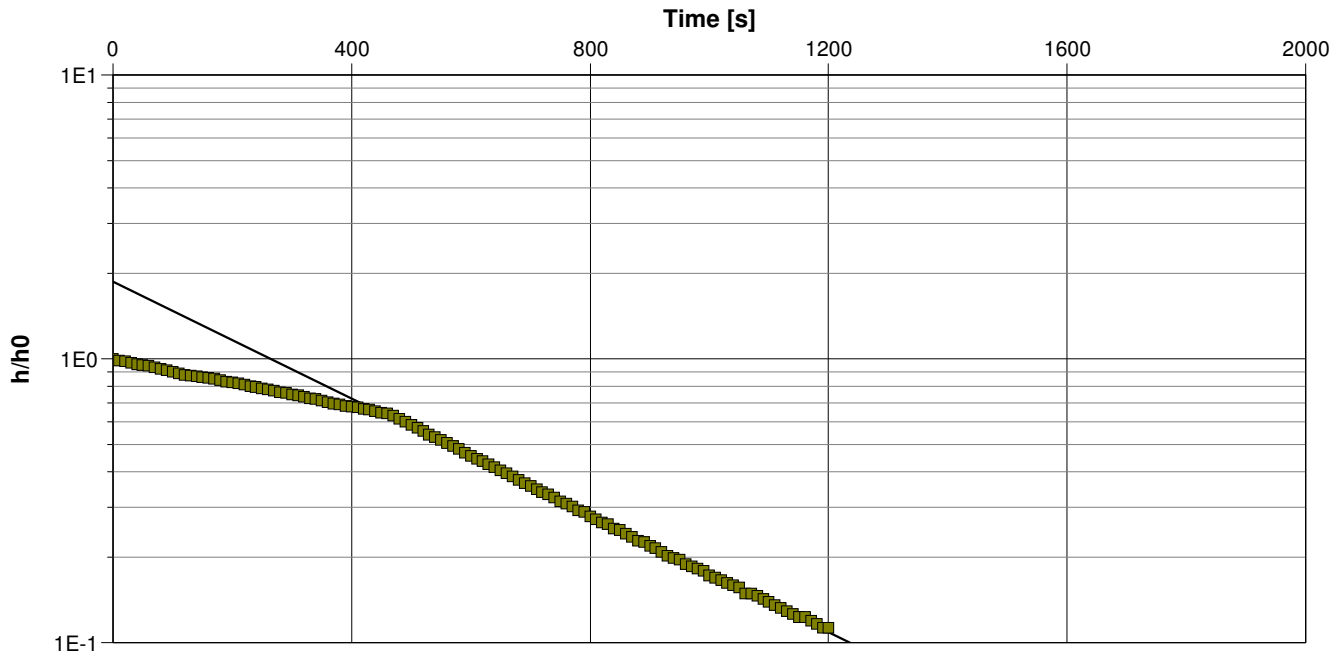


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW105-18	3.97×10^{-7}	

	Slug Test Analysis Report	C
	Project: Wilmot Employment Lands	
	Number: 34896-104	
	Client: Badenview Developments Inc.	

Location: New Hamburg, Ontario	Slug Test: BH106-18 Recovery Test	Test Well: MW106-18
Test Conducted by: KLW		Test Date: 4/13/2018
Analysis Performed by: KLW	BH106-18 Recovery Test	Analysis Date: 4/25/2018
Aquifer Thickness: 2.74 m		

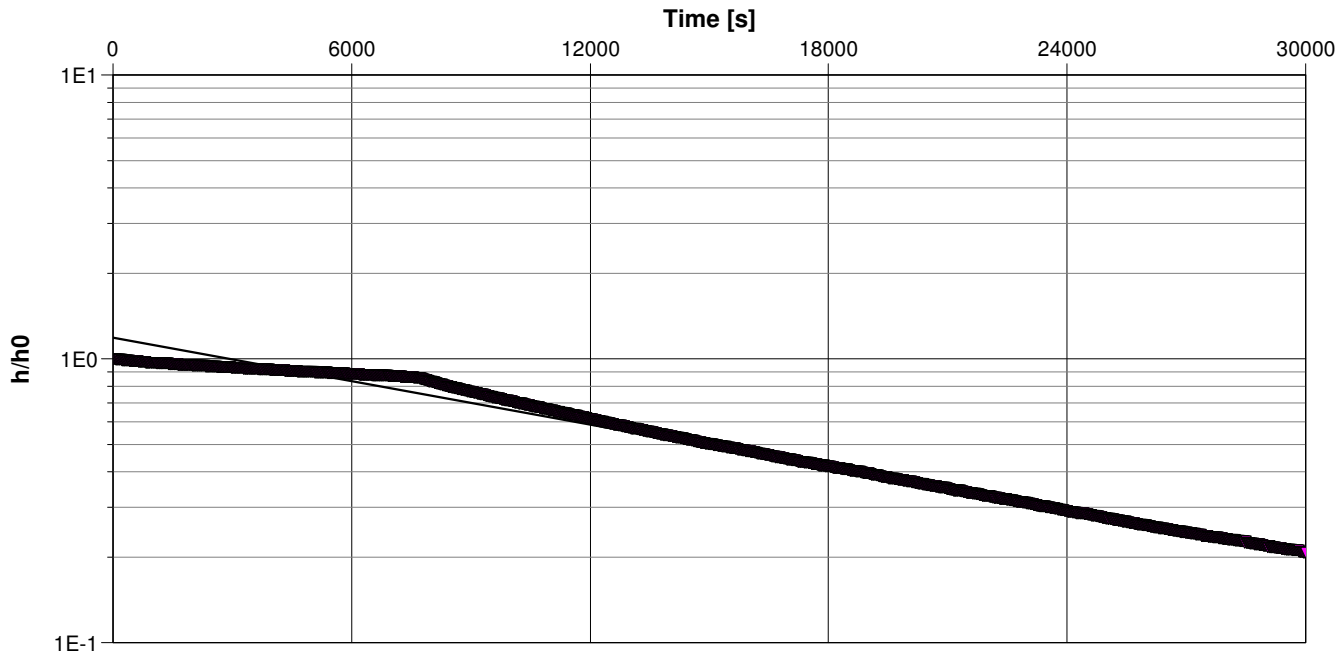


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW106-18	1.60×10^{-6}	

	Slug Test Analysis Report	D
	Project: Wilmot Employment Lands	
	Number: 34896-104	
	Client: Badenview Developments Inc.	

Location: New Hamburg, Ontario	Slug Test: BH107-18 Recovery Test	Test Well: MW107-18
Test Conducted by: KLW		Test Date: 4/13/2018
Analysis Performed by: KLW	BH107-18 Recovery Test	Analysis Date: 4/18/2018
Aquifer Thickness: 6.08 m		

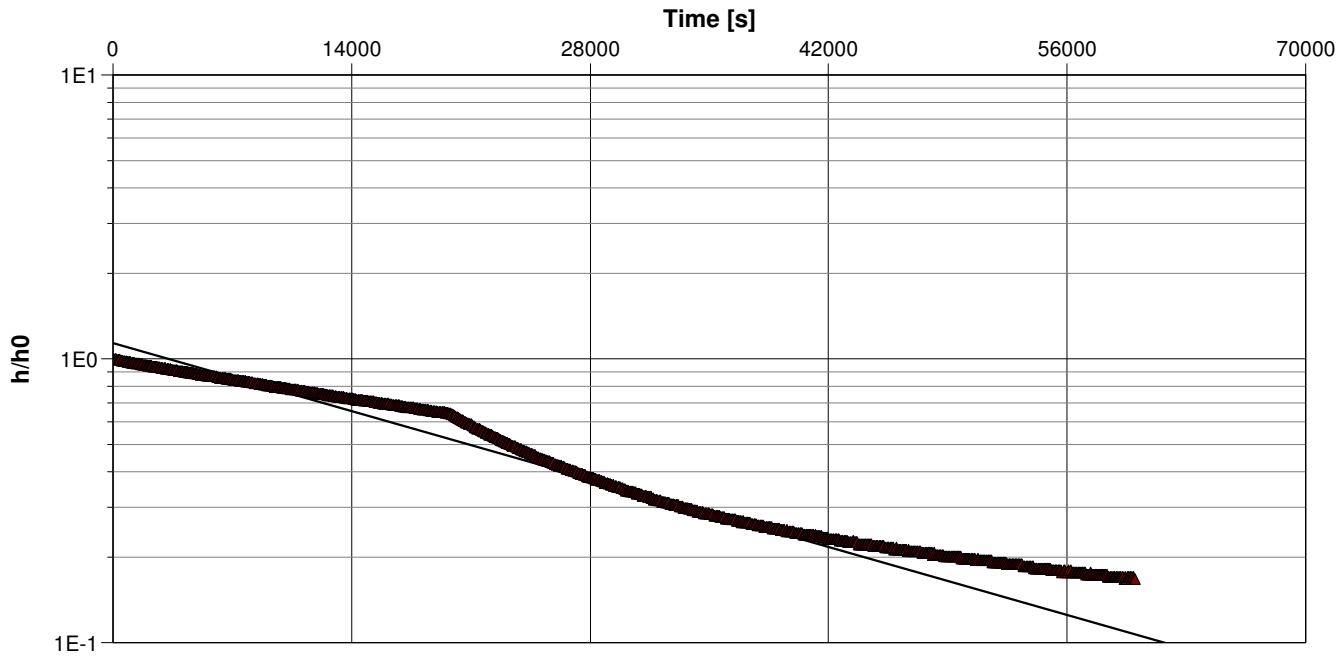


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW107-18	3.96×10^{-8}	

	Slug Test Analysis Report
	Project: Wilmot Employment Lands
	Number: 34896-104
	Client: Badenview Developments Inc.

Location: New Hamburg, Ontario	Slug Test: BH201-18 Recovery Test	Test Well: MW202-18
Test Conducted by: KLW		Test Date: 10/10/2018
Analysis Performed by: KLW	BH201-18 Recovery Test	Analysis Date: 10/14/2018
Aquifer Thickness: 2.83 m		

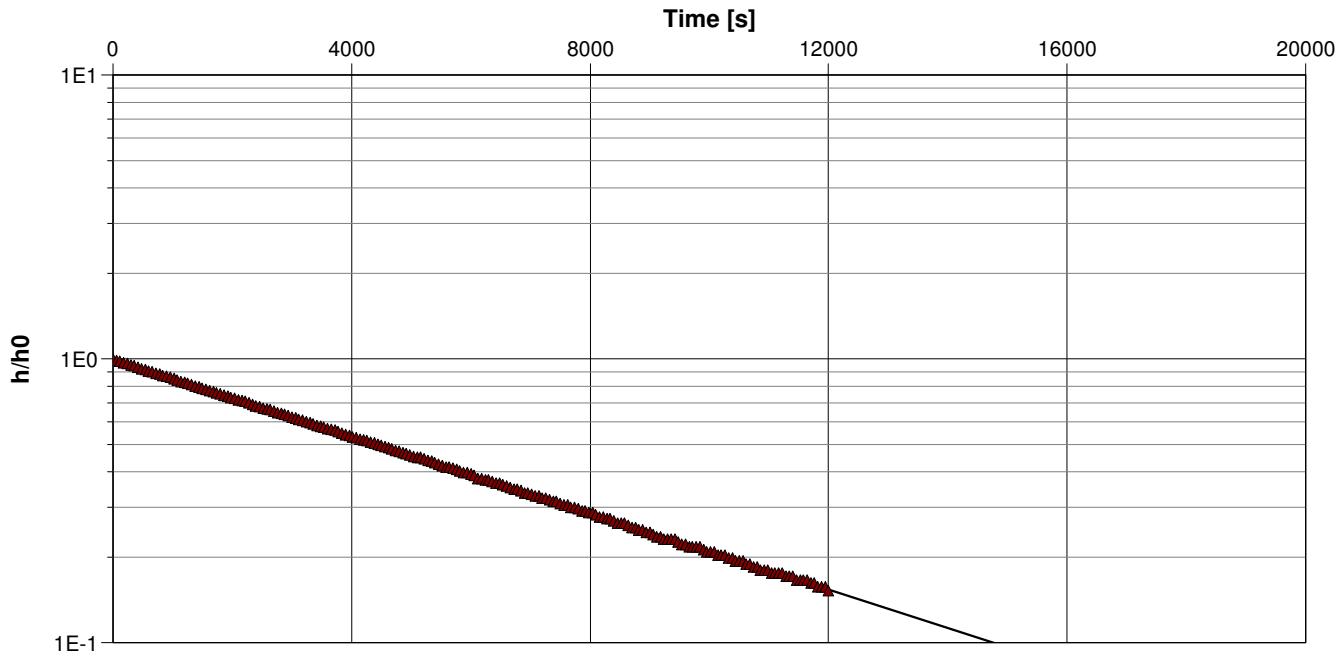


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
MW202-18	2.01×10^{-8}	

Slug Test Analysis Report	
Project: Wilmot Employment Lands	
Number: 34896-104	
Client: Badenview Developments Inc.	

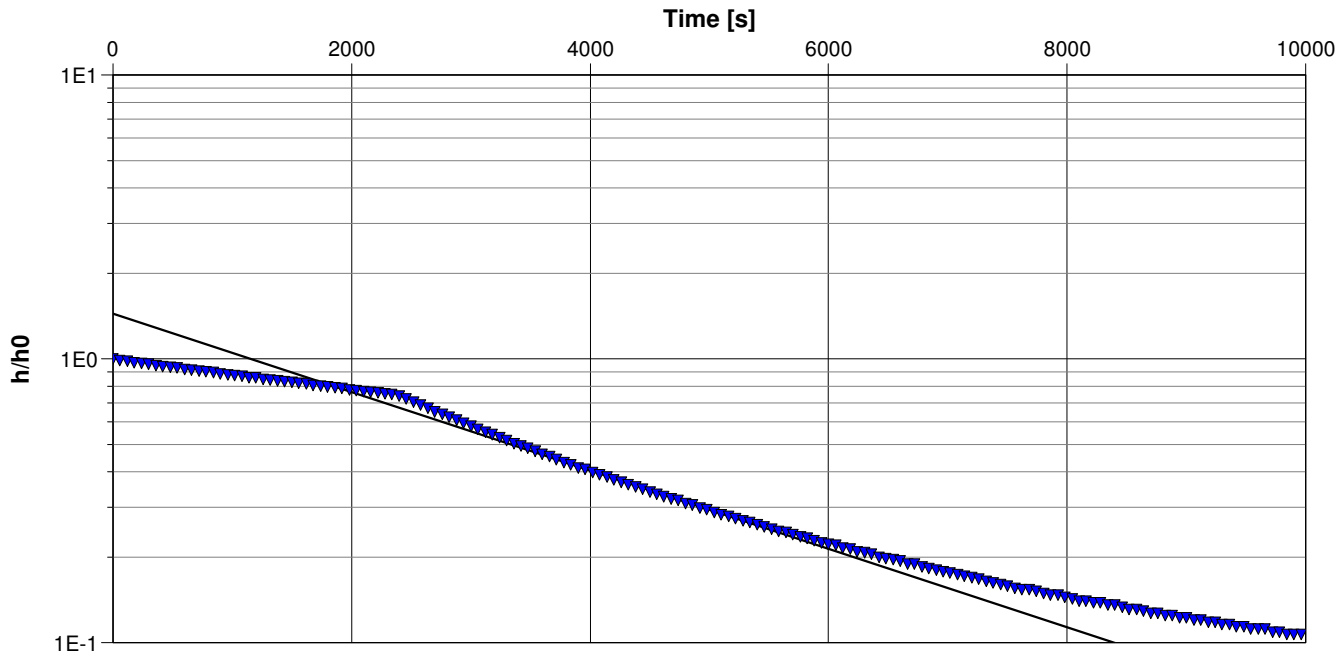
Location: New Hamburg, Ontario	Slug Test: BH202-18 Recovery Test	Test Well: MW202-18
Test Conducted by: KLW		Test Date: 10/10/2018
Analysis Performed by: KLW	BH202-18 Recovery Test	Analysis Date: 10/14/2018
Aquifer Thickness: 2.95 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW202-18	1.05×10^{-7}	

	Slug Test Analysis Report	
	Project: Wilmot Employment Lands	
	Number: 34896-104	
	Client: Badenview Developments Inc.	
Location: New Hamburg, Ontario	Slug Test: BH203-18 Recovery Test	Test Well: MW204-18
Test Conducted by: KLW		Test Date: 10/10/2018
Analysis Performed by: KLW	BH204-18 Recovery Test	Analysis Date: 10/14/2018
Aquifer Thickness: 4.18 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW204-18	2.15×10^{-7}	

APPENDIX E

GRAIN SIZE ANALYSIS

Peto MacCallum Ltd.
CONSULTING ENGINEERS

November 15, 2018

PML Ref.: 18KF009
Report: 2 (Revised)

Mr. Andrew Bingaman, C.E.T.
MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener, Ontario
N2B 3X9

Dear Mr. Bingaman

Geotechnical Investigation
Proposed Industrial Development
Wilmot Employment Lands
New Hamburg, Ontario

Please find enclosed the results of the particle size distribution analyses on samples submitted to our laboratory for the above referenced project.

Based on the laboratory test results and subsequent evaluation, the silt sample from Test Pit 1-18 would have an estimated hydraulic conductivity of $1x10^{-6}$m/sec, and an infiltration rate of 10 mm/hour. The clayey silt sample from Test Pit 5-18 would have an estimated hydraulic conductivity of less than $1x10^{-8}$ m/sec, and an infiltration rate of less than 0.1 mm/hour.

We trust that the enclosed results are sufficient for your immediate needs. If you have any questions or require further information, please do not hesitate to contact our office.

Sincerely

Peto MacCallum Ltd.

William Loghrin, P.Eng.
Project Engineer, Geotechnical Services

GM:sh

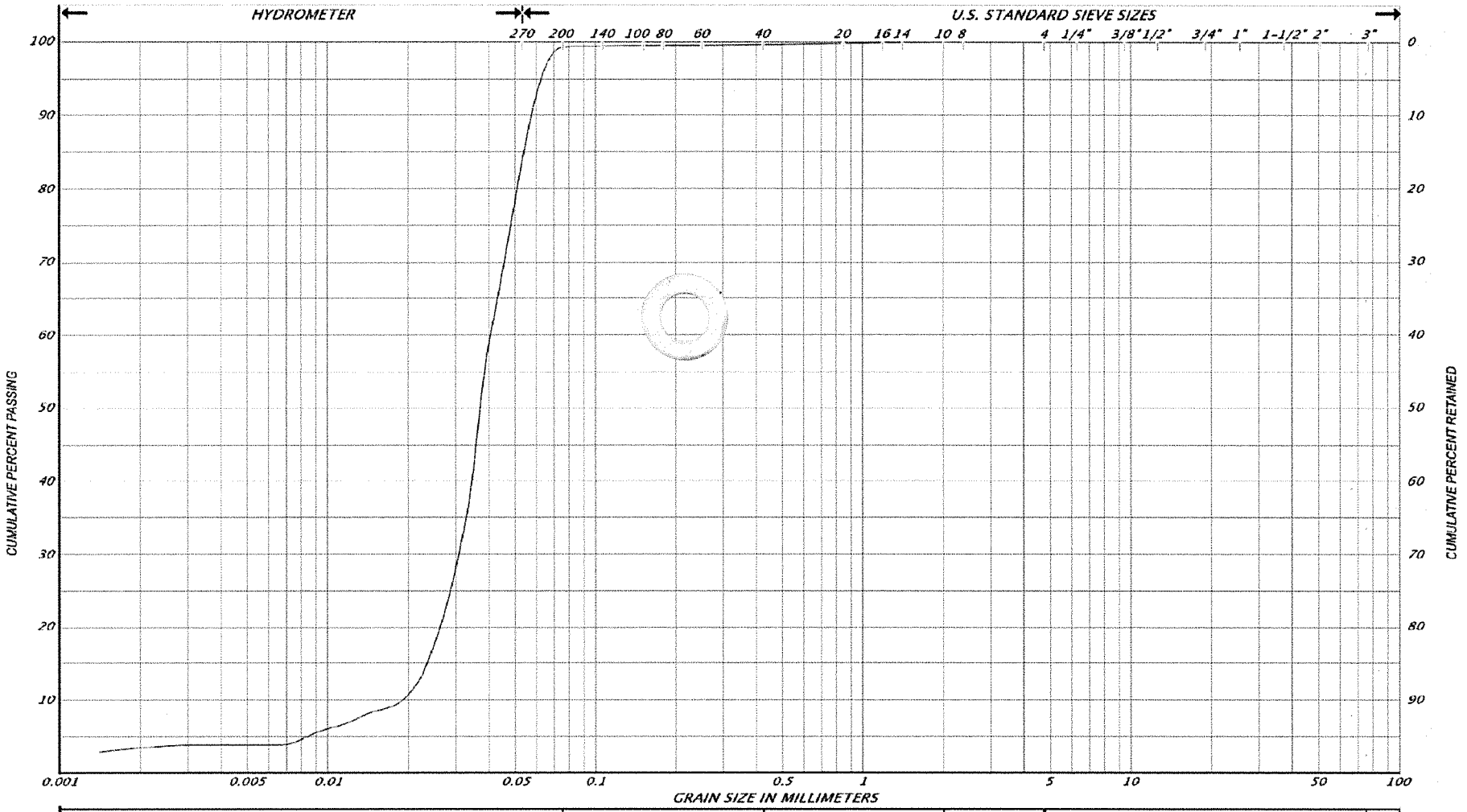
2 cc: MTE Consultants (+email)
1 cc: PML Kitchener

16 Franklin Street South, Kitchener, Ontario N2C 1R4
Tel: (519) 893-7500 Fax: (519) 893-0654
E-mail: kitchener@petomaccallum.com
BARRIE, COLLINGWOOD, HAMILTON, KITCHENER, LONDON, TORONTO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

PROJECT NO. 18KF009
FIGURE NO. 1

PARTICLE SIZE DISTRIBUTION CHART



SILT & CLAY				FINE	MEDIUM	COARSE	GRAVEL		COBBLES	UNIFIED
				SAND						
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	GRAVEL		COBBLES	M.I.T
	SILT			SAND						
CLAY	SILT			V.FINE	FINE	MED.	COARSE	GRAVEL		US BUREAU
				SAND						

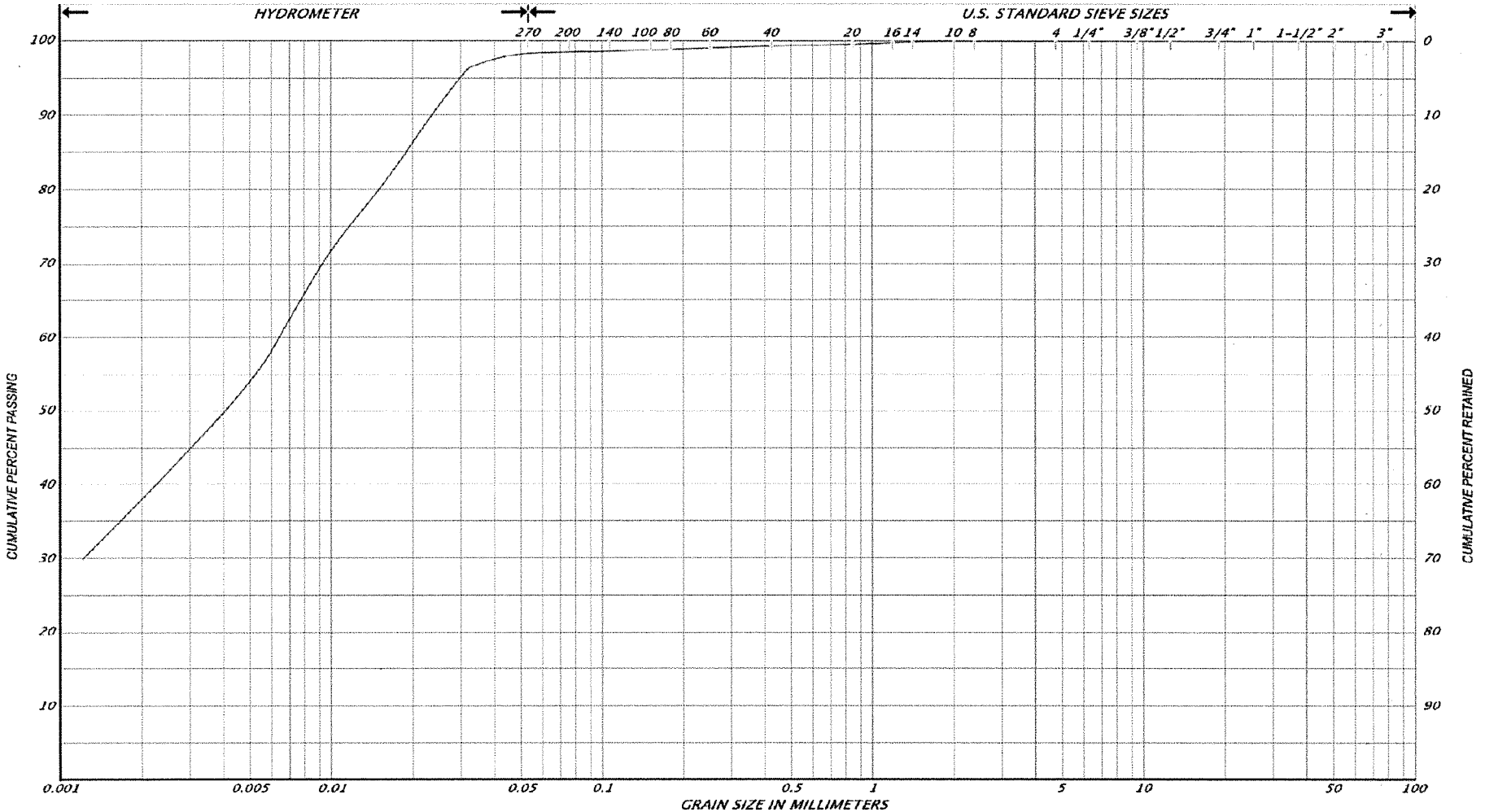
REMARKS: Test Pit 1-18, Sample 1, Depth 4 m

SILT

Peto MacCallum Ltd.
CONSULTING ENGINEERS

PROJECT NO. 18KF009
FIGURE NO. 2

PARTICLE SIZE DISTRIBUTION CHART



SILT & CLAY			FINE	MEDIUM	COARSE	GRAVEL		COB BLES	UNIFIED
			SAND						
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	GRAVEL		COBBLES	M.I.T
	SILT			SAND					
CLAY	SILT		V.FINE	FINE	MED.	COARSE	GRAVEL			US BUREAU
			SAND						

REMARKS: **Test** Pit 5-18, Sample 1, Depth 4 m

CLAYEY SILT