



# ***Soil Engineers Ltd.***

CONSULTING ENGINEERS

GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE

90 WEST BEAVER CREEK ROAD, SUITE 100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

**BARRIE**  
TEL: (705) 721-7863  
FAX: (705) 721-7864

**MISSISSAUGA**  
TEL: (905) 542-7605  
FAX: (905) 542-2769

**OSHAWA**  
TEL: (905) 440-2040  
FAX: (905) 725-1315

**NEWMARKET**  
TEL: (905) 853-0647  
FAX: (905) 881-8335

**MUSKOKA**  
TEL: (705) 721-7863  
FAX: (705) 721-7864

**HAMILTON**  
TEL: (905) 777-7956  
FAX: (905) 542-2769

TOWN OF CALEDON  
PLANNING  
RECEIVED

March 12, 2026

## **A REPORT TO MOSAİK HOMES**

### **HYDROGEOLOGICAL STUDY**

#### **PROPOSED TOWNHOUSE DEVELOPMENT 12944 ALBION VAUGHAN ROAD**

#### **TOWN OF BOLTON**

**REFERENCE NO. 1708-W156**

**MARCH 6, 2026**

### **DISTRIBUTION**

Digital Copy – Humphries Planning Group Inc.

Digital Copy – Mosaik Homes

Digital Copy – Soil Engineers Ltd (Richmond Hill Office)



### **LIMITATIONS OF LIABILITY**

This report was prepared by Soil Engineers Ltd. (SEL) for the account of Mosaik Homes and for review by their designated agents, financial institutions and government agencies, and can be used for development approval purposes by the Town of Bolton and their peer reviewer and the Ontario Ministry of the Environment and Climate Change, who may rely on the results of the report. The material in it reflects the judgement of Daixi Zhang, B.Sc., G.I.T. and Narjes Alijani, M.Sc., P.Geo. Any use which a Third Party makes of this report and/or any reliance on decisions to be made based on it is the responsibility of such Third Parties. Soil Engineers Ltd. accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

One must understand that the mandate of Soil Engineers Ltd. is to obtain readily available current and past information pertinent to the subject site for a Hydrogeological Study only. No other warranty or representation, expressed or implied, as to the accuracy of the information is included or intended by this assessment. Site conditions are not static and this report documents site conditions observed at the time of the site reconnaissance.



**TABLE OF CONTENTS**

**1.0 EXECUTIVE SUMMARY .....1**

**2.0 INTRODUCTION .....3**

    2.1 Project Description..... 3

    2.2 Project Objectives ..... 4

    2.3 Scope of Work ..... 5

**3.0 METHODOLOGY .....6**

    3.1 Borehole Advancement and Monitoring Well Installation..... 6

    3.2 Groundwater Monitoring ..... 7

    3.3 Mapping of Ontario Water Well Records..... 7

    3.4 Monitoring Well Development and Single Well Response Tests ..... 8

    3.5 Review Summary of Concurrent Report ..... 9

**4.0 REGIONAL AND LOCAL SETTING .....10**

    4.1 Regional Geology ..... 10

    4.2 Physical Topography ..... 11

    4.3 Watershed Setting ..... 11

    4.4 Local Surface Water and Natural Features ..... 12

**5.0 SOIL LITHOLOGY .....13**

    5.1 Topsoil (All BH/MWs and boreholes)..... 13

    5.2 Earth Fill (Silty Sand Fill) (BHs 3 and 4 and BH/MW 5)..... 13

    5.3 Silty Clay (All BH/MWs and boreholes)..... 13

    5.3 Silty Clay Till (BH/MWs 1D, 1S and 2) ..... 14

**6.0 GROUNDWATER STUDY.....15**

    6.1 Review Summary of Concurrent Report ..... 15

    6.2 Review of Ontario Water Well Records ..... 15

    6.3 Groundwater Monitoring ..... 16

    6.4 Shallow Groundwater Flow Pattern..... 16

    6.5 Single Well Response Test Analysis ..... 17

**7.0 GROUNDWATER CONTROL DURING CONSTRUCTION.....18**

    7.1 Groundwater Control Methodology..... 18

    7.2 Groundwater Function of the Subject Site..... 19



Reference No. 1708-W156

iv

<b>8.0 CONCLUSION .....</b>	<b>20</b>
<b>9.0 REFERENCES.....</b>	<b>22</b>



**TABLES**

Table 3-1 - Monitoring Well Installation Details ..... 7  
Table 6-1 - Water Level Measurements ..... 18  
Table 6-2 - Summary of SWRT Results..... 20

**ENCLOSURES**

Borehole/Monitoring Well Logs ..... Figures 1 to 5  
Grain Size Distribution Graphs ..... Figures 6 to 8  
Site Location Plan..... Drawing No. 1  
Borehole and Monitoring Well Location Plan ..... Drawing No. 2  
MOECC Well Location Plan..... Drawing No. 3  
Quaternary and Surface Geology Map ..... Drawing No. 4  
Topographic Map..... Drawing No. 5  
Watershed Map ..... Drawing No. 6  
Natural Features and Protection Area Plan..... Drawing No. 7  
Cross-Section Key Plan ..... Drawing No. 8-1  
Geological Cross-Section (A-A') ..... Drawing No. 8-2  
Shallow Groundwater Flow Pattern Plan ..... Drawing No. 9

**APPENDICES**

MOECC Water Well Records Summary..... Appendix 'A'  
Results of Single Well Response Tests ..... Appendix 'B'



## 1.0 **EXECUTIVE SUMMARY**

Soil Engineers Ltd. has conducted a hydrogeological assessment for a site located at 12944 Albion Vaughan Road in the Town of Bolton. Surrounding land use includes residential subdivisions to the north, west, and south, and Albion Vaughan Road, residential properties and Nashville Conservation Reserve to the east. The site is currently occupied by a residential building and a commercial car maintenance shop.

The subject site lies within the physiographic region of Southern Ontario known as the South Slope on the drumlinized till plain physiographic feature. The site is underlain by the Halton Till unit, consisting predominantly of silt to silty clay matrix, high in matrix carbonate and being clast poor.

The subject site is located within the Main Humber Sub-watershed of the Humber River Watershed. A tributary of the Humber River is found east of the subject site, across Albion Vaughan Road. A wetland area is located approximately 300 m east of the subject site.

A review of the topography shows that the site is relatively flat, exhibiting a gentle decline in relief towards the southeast portion of the property.

This study has disclosed that beneath the layer of granular and earth fill, native soils underlying the subject site consists of silty clay and silty clay till.

The findings of this study confirm that the groundwater level elevations range from El. 238.06 m to El. 241.08 m, (i.e. 5.12 to 7.25 mbgs) and shallow groundwater flows towards the southeast.



Reference No. 1708-W156

2

The single well response tests yielded an estimated hydraulic conductivity (K) value of  $1.1 \times 10^{-7}$  m/sec for the silty clay till at the depth of the well screens. This result suggests that low groundwater seepage rates can be anticipated into open excavations below the water table.

Review of the proposed development plans indicates that the development will consist of townhouses with potential 1-level underground basement.

The shallow groundwater lies below the proposed invert elevation for servicing and below the 1-level underground structure (basement). As such, there will be no need for dewatering for proposed development. However, as the monitoring program was conducted during early fall when the groundwater levels typically, will be low, it is recommended that the groundwater be monitored during the spring in order to confirm the dry and safe excavation depths for construction.

The shallow groundwater table lies below the lowest proposed excavation level for the proposed development. As such, no impact on the groundwater function associated with the proposed development is anticipated.



## 2.0 **INTRODUCTION**

### 2.1 **Project Description**

In accordance with authorization from Goffredo Vitullo of Mosaik Homes, Soil Engineers Ltd. (SEL) has conducted a hydrogeological assessment for a proposed mixed residential and commercial development at 12944 Albion Vaughan Road in the Town of Bolton. The location of the site is shown on Drawing No. 1.

The subject site is located in the developed, northwest corner of the intersection of Albion Vaughan Road and Queensgate Boulevard. Surrounding land use includes residential subdivisions to the north, west, and south, and Albion Vaughan Road, residential properties and Nashville Conservation Reserve to the east. The site is currently occupied by a residential home and a commercial car maintenance shop.

This report summarizes the findings of the field study and the associated groundwater monitoring and testing programs, and provides a description and characterization of the interpreted hydrogeostratigraphy for the site and surrounding area. The current study provides preliminary recommendations for any construction-related, or permanent dewatering needs prior to detailed design.



## 2.2 **Project Objectives**

The major objectives of this Hydrogeological Study Report are as follows:

1. Establish the local hydrogeological setting for the site and local surrounding areas;
2. Interpretation of shallow groundwater flow and runoff patterns;
3. Identify zones of higher groundwater yield as potential sources for ongoing shallow groundwater seepage;
4. Characterizing the hydraulic conductivity (K) for the groundwater-bearing sub soil strata;
5. Prepare an interpreted hydrostratigraphic cross-section for the subject site;
6. Estimate the anticipated temporary dewatering flows that may be required to lower the water table to facilitate construction, or for any permanent, foundation drainage, following construction and;
7. Evaluate potential impacts to any groundwater receptors within the anticipated zone of influence of dewatering; and to develop preliminary estimation of the dewatering flow rates that may be required to facilitate excavation and construction



### 2.3 **Scope of Work**

The scope of work for the Hydrogeological Study is summarized below:

1. Installation of four (4) monitoring wells within the site's development footprint;
2. Monitoring well development and groundwater level measurements at the four (4) monitoring wells;
3. Performance of Single Well Response Tests (SWRTs) at the monitoring wells to estimate the hydraulic conductivity (K) for the groundwater-bearing subsoil at the depths of the well screens;
4. Describing the geological and hydrogeological setting for the site and local surrounding area; and,
5. Review of the findings of the previous geotechnical study; review of available engineering development plans and profiles for the proposed underground structure; assessing preliminary dewatering needs and estimation of any anticipated dewatering flows to lower the groundwater level for construction, or for any anticipated long-term foundation drainage.



### 3.0 **METHODOLOGY**

#### 3.1 **Borehole Advancement and Monitoring Well Installation**

Borehole drilling and monitoring well construction were conducted on September 27, 2017 and October 6 2017. The program consisted of the drilling of five (5) boreholes (BHs) and the installation of two (2) single monitoring wells (MW) and one (1) nested set of monitoring wells, one in each of three (3) selected boreholes. The locations of the boreholes/monitoring wells are shown on Drawing No. 2.

The drilling and monitoring well construction were completed by the licensed water well contractor, DBW Drilling Ltd., under the full-time supervision of a field technician from SEL, who also logged the soil strata encountered during borehole advancement and collected representative soil samples for soil classification. The boreholes were drilled using continuous flight power augers. Detailed descriptions of the encountered subsurface soil and groundwater conditions are presented on the borehole and monitoring well logs, on the enclosed Figures 1 to 5, inclusive.

The monitoring wells were constructed using 50-mm diameter PVC riser pipes and screens, which were installed in each of the boreholes in accordance with Ontario Regulation (O. Reg.) 903. All monitoring wells were provided with steel flush mount protective casings. The details of the monitoring well construction are provided on the enclosed Borehole Logs (Figures 1 to 5).



The UTM coordinates and ground surface elevations at the borehole/monitoring well locations, together with the monitoring well construction details, are provided on Table 3-1.

**Table 3-1 - Monitoring Well Installation Details**

Well ID	Installation Date	UTM Coordinates		Ground El. (masl)	Borehole Depth (mbgs)	Screen Interval (mbgs)	Casing Dia. (mm)
		East (m)	North (m)				
BH/MW 1S	October 6, 2017	603449.32	4858932.89	244.10	4.27	3.35-4.27	50
BH/MW 1D	October 6, 2017	603448.47	4858932.08	244.10	6.55	3.1-6.1	50
BH/MW 2	October 6, 2017	603424.90	4858983.00	246.20	8.08	4.57-7.62	50
BH/MW 5	October 6, 2017	603382.56	4858892.45	245.20	6.55	3.1-6.1	50

Notes:

mbgs -- metres below ground surface

masl -- metres above sea level

### 3.2 Groundwater Monitoring

The groundwater levels in the monitoring wells were measured manually on October 13, 20, and 30 2017.

### 3.3 Mapping of Ontario Water Well Records

SEL received the Ministry of Environment and Climate and Change (MOECC) Water Well Records (WWRs) for registered wells located on the subject site and within 500 m of the site boundaries (study area). The records indicate that thirteen (13) registered wells are located within the study area. The well locations are shown on Drawing No. 3, and the WWRs reviewed for this study are listed in Appendix 'A'.



### 3.4 **Monitoring Well Development and Single Well Response Tests**

The monitoring wells underwent development in preparation for single well response tests (SWRT) to estimate the hydraulic conductivity (K) for soil strata at the depths of the well screens. Well development involved the purging and removal of several casing volumes of groundwater from each monitoring well to remove remnants of clay, silt and other debris introduced into the wells during construction, and to induce the flow of fresh formation groundwater into the well screens, thereby improving the transmissivity of the strata formation at the well screen depths.

The K values derived from the SWRT's provide an indication of the yield capacity for the ground water-bearing strata and can be used to estimate the flow of groundwater through the water-bearing soil strata.

The SWRT involves the placement of a slug of known volume into the well, below the water table, to displace the groundwater level upward. The rate at which the water level recovers to static conditions (falling head) is tracked using a data logger/pressure transducer, and/or manually using a water level tape. The rate at which the water table recovers to static conditions is used to estimate the K value for the water-bearing formation at the well screen depth. BH/MW 2 underwent a SWRT on October 30, 2017. BH/MWs 1 and 5 did not contain enough water in the well to undergo a SWRT. The K estimates test results are provided in Appendix 'B', with a summary of the results provided in Table 6-2.



Reference No. 1708-W156

9

### 3.5 **Review Summary of Concurrent Report**

The following report prepared by SEL was reviewed in preparation of this hydrogeological study:

“A Report to Mosaik Homes., A Geotechnical Investigation for Proposed Townhouse Development, 12944 Albion Vaughan Road, Town of Bolton”, Reference No. 1708-S156, dated November 2017.



## 4.0 **REGIONAL AND LOCAL SETTING**

### 4.1 **Regional Geology**

The subject site lies within the physiographic region of Southern Ontario known as the South Slope, and is situated on Till Plains (Drumlinized). The South Slope which is the southern slope of the Oak Ridges Moraine, includes a land strip south of the Peel Plain. It rises 90 to 120 m in elevation to the line of contact with the moraine at elevations ranging from 240 to 300 masl. The south slope exhibits an average width of 9.6 to 11.3 km, extending from the Niagara Escarpment to the Trent River. It covers an area of approximately 2,400 km<sup>2</sup>. The south slope is smoothed, faintly drumlinized, and scarred at intervals by valleys and tributaries of the Rouge, Don, and Humber River systems (Chapman and Putnam, 1984).

The surface geological map of Ontario shows that the subject site is located on Halton Till, consisting predominantly of silt to silty clay matrix, high in matrix carbonate content and being clast-poor. Drawing No. 4, reproduced from Ontario Geological Survey (OGS) mapping, illustrates the quaternary surface soil geology for the site and surrounding area.

The underlying bedrock is comprised mainly of shale, limestone, dolostone and siltstone of the Georgian Bay formation which was deposited during the upper Ordovician epoch (Bedrock Geology of Ontario, 1993). The approximate elevation for bedrock beneath the site is about 154 masl.



#### 4.2 **Physical Topography**

A review of the topography shows that the subject site is relatively flat with a gentle decline in elevation towards the southeast limits of the property. Runoff from the site is expected to drain towards the southeast portion of the property. Based on the topographic map for the area and the ground surface elevations at the borehole and monitoring well locations, the elevation relief across the subject site is about 3.1 m. Drawing No. 5 shows the mapped topographical contours for the site and surrounding area.

#### 4.3 **Watershed Setting**

The subject site is located within the Main Humber sub-watershed portion of the Humber River Watershed. The Humber River watershed occupies an area of approximately 911 square kilometers, making it the largest watershed in the Greater Toronto Area. The headwaters of the Humber River begin within the Oak Ridges Moraine and the Niagara Escarpment. The River flows through many municipalities, including, but not limited to the Town of Caledon, The City of Vaughan, and the City of Toronto. It consists of five principal tributaries which are known as the Main Humber, West Humber, East Humber, Lower Humber, and Black Creek.

The Humber River Watershed is bounded to the west by the Mimico Creek Watershed and Etobicoke Creek Watershed, to the east by the Don River Watershed, and by the Rouge River Watershed, and to the south by the Waterfront Watershed. Drawing No. 6 shows the location of the subject site within the Humber River Watershed.



Reference No. 1708-W156

12

#### 4.4 **Local Surface Water and Natural Features**

A tributary of the Humber River is located approximately 30 m west of the subject site while Cold Creek is about 850 m north of the subject site. Large wooded areas are observed approximately 300 m north of the subject site. Wetlands that have not been evaluated under the Ontario Wetland Evaluation System (OWES) are found approximately 350m west of the site. The locations of the site and the noted natural features are shown on Drawing No. 7.



## 5.0 **SOIL LITHOLOGY**

This study has disclosed that beneath the topsoil and existing earth fill materials, the native soils underlying the subject site consists of silty clay and silty clay till.

Borehole logs from the concurrent geotechnical investigation report (SEL Reference No. 1708-S156) have been included in the interpreted geological cross-sections. A Key Plan and the interpreted geological cross-sections along the delineated north to south transects across the site are presented on Drawing Nos. 8-1 and 8-2.

### 5.1 **Topsoil** (All BH/MWs and boreholes)

Topsoil, 130 to 180 mm thick, was observed at the ground surface at all borehole locations.

### 5.2 **Earth Fill (Silty Sand Fill)** (BHs 3 and 4 and BH/MW 5)

Earth fill, approximately 0.6 m thick, was observed below the topsoil at BHs 3 and 4 and BH/MW 5. It consists of silty sand and having occasional topsoil inclusions with organic material. The estimated permeability for the silty sand fill, at BH/MW 2, at a depth of 0.3 mbgs is about  $10^{-4}$  m/sec. A grain size analysis was performed on one (1) sample, and the gradation is plotted on Figure 6.

### 5.3 **Silty Clay** (All BH/MWs and boreholes)

Silty clay was encountered at all BH and BH/MW locations, beneath the topsoil and earth fill horizons, at depths ranging between 0.1 and 0.7 m. The silty clay is brown, stiff to hard in texture with occasional wet sand and silt seams and layers. It changes to grey at a depth of approximately 3.0 to 3.2 m. The thickness of the silty clay till



extends from 0.7 m to the maximum investigated depth of 6.6 m at BHs 3, 4 and BH/MW 5. The moisture content for the unit ranges from 13% to 25%, indicating moist to saturated conditions. The estimated permeability for the silty clay, at BH/MW 2, at a depth of 2.5 mbgs is about  $10^{-7}$  m/sec. Grain size analyses were performed on two (2) samples, and the gradations are plotted on Figure 7.

### 5.3 Silty Clay Till (BH/MWs 1D, 1S and 2)

Silty clay till, was encountered beneath the silty clay layer at depths ranging between 3.8 and 3.9 mbgs and extends to the termination depth of the boreholes. The till is mostly grey, stiff to hard in texture with some sand and a trace of gravel. It changes from brown to grey at a depth of approximately 4.5 m at BH/MW 2. The moisture content for the unit ranges from 13% to 20%, indicating moist to saturated conditions. The estimated permeability for the silty clay till, at depths of 4.7 mbgs and 7.9 mbgs is about  $10^{-7}$  m/sec. Grain size analyses were performed on two (2) samples, and the gradations are plotted on Figure 8.



## 6.0 **GROUNDWATER STUDY**

### 6.1 **Review Summary of Concurrent Report**

A review of the findings from the concurrent geotechnical investigation report (SEL Reference No. 1701-S056) indicates that the investigation has disclosed that beneath a layer of top soil and earth fill, the site is underlain by a stratum of stiff to hard silty clay and silty clay till. All boreholes were dry upon completion and the yield for the silty clay is expected to be small and limited.

### 6.2 **Review of Ontario Water Well Records**

The Ministry of Environment and Climate Change (MOECC) water well records for the subject site and for the properties within a 500 m radius of the boundaries of the subject site (study area) were reviewed.

The records indicate that thirteen (13) wells are located within the study area. The locations of these wells, based on the UTM coordinates provided by the records, are shown on Drawing No 3. Details of the MOECC water well records that were reviewed are provided in Appendix 'A'.

A review of the final status and of the wells within the study area reveals that twelve (12) wells are registered as water supply wells and one (1) is registered as an abandoned-supply well.

A review of the first use of the well records reveals that twelve (12) are registered as domestic wells, and one (1) well is registered as having an unknown status.



### 6.3 Groundwater Monitoring

The groundwater levels in the monitoring wells were measured on four occasions over the study period, on the following dates; October 13, 20, and 30, 2017 to record the fluctuation of the groundwater table beneath the site. The recorded water levels and corresponding elevations are given in Table 6-1.

**Table 6-1 - Water Level Measurements**

Well ID		October 13, 2017	October 20, 2017	October 30, 2017	Fluctuation (m)
BH/MW 1S	mbgs	Dry	Dry	Dry	0
	masl	< 239.83	< 239.83	< 239.83	
BH/MW 1D	mbgs	Dry	6.04	5.93	0.29
	masl	< 238.00	238.06	238.17	
BH/MW 2	mbgs	7.25	6.45	5.12	2.13
	masl	238.95	239.75	241.08	
BH/MW 5	mbgs	Dry	Dry	5.85	> 0.25
	masl	< 239.10	< 239.10	239.35	

Notes

mbgs -- metres below ground surface

masl -- metres above sea level

As shown above, the groundwater levels at most of the BH/MWs exhibited a rising trend throughout the monitoring period, with the exception of BH/MW 1S, which remained dry for the entire monitoring period. The greatest fluctuation was observed at BH/MW 2 where the groundwater increased by 2.13 m over the monitoring period.

### 6.4 Shallow Groundwater Flow Pattern

As some of the monitoring wells were dry during the first and/or second monitoring events, the shallow groundwater flow pattern was interpreted only from the last



groundwater level readings measured on October 30, 2017 at BH/MWs 1D, 2 and 5. This interpretation suggests that groundwater flows mainly in a south/southeasterly direction. The interpreted shallow groundwater flow pattern for the subject site is illustrated on Drawing No. 9.

### 6.5 Single Well Response Test Analysis

BH/MW 2 underwent a single well response test (SWRT) to assess the hydraulic conductivity (K) for saturated aquifer soils at the depths of the well screens. SWRTs could not be completed at BH/MWs 1D and 5 due to insufficient water volumes in the well. The results of the SWRTs are presented in Appendix 'B', with a summary of the findings shown in Table 6-2.

**Table 6-2 - Summary of SWRT Results**

Well ID	Ground El. (masl)	Monitoring Well Depth (mbgs)	Borehole Depth (mbgs)	Screen Interval (mbgs)	Screened Soil Strata	Hydraulic Conductivity (K) (m/sec)
BH/MW 2	241.08	7.62	8.08	4.57-7.62	Silty Clay Till	$1.1 \times 10^{-7}$

Notes

mbgs -- metres below ground surface  
masl -- metres above sea level

As shown above, the K estimate for the silty clay till is  $1.1 \times 10^{-7}$  m/sec. The results of the SWRT provide an indication of the yield capacity for the groundwater-bearing soil strata at the depths of the screens. The above results suggest that the hydraulic conductivity for the groundwater-bearing soils at the depths of the well screens is low, with corresponding low anticipated groundwater seepage rates into open excavations, below the water table.



## 7.0 **GROUNDWATER CONTROL DURING CONSTRUCTION**

Preliminary development plans prepared by A.M. Candaras Associates Inc., dated November 2017, drawing No. G1, showing the finished floor elevations and the depths of the proposed servicing infrastructure were reviewed at the time of report preparation.

The groundwater levels recorded during the monitoring period ranged from 238.06 masl to 241.08 masl.

The finished floor elevation of the proposed townhouse development ranges from 246.19 m to 247.61 m. The invert elevation for servicing within the subject site ranges from El. 240.46 masl to 244.92 masl. If basements are proposed, an elevation of 243.19 m to 244.61 m, or  $\pm 3$  m below the finished floor elevation, was assumed.

The shallow groundwater lies below the proposed invert elevation for servicing and below the 1-level underground structure (basement). As such, there will be no need for dewatering for proposed development. However, as the monitoring program was conducted during early fall when the groundwater levels typically, will be low, it is recommended that the groundwater be monitored during the spring in order to confirm the dry and safe excavation depths for construction.

### 7.1 **Groundwater Control Methodology**

The shallow groundwater level lies below the lowest proposed excavation level for servicing and construction of the proposed 1-level underground structure (basement). As such, there will be no need to implement a groundwater control program, and, accordingly, no need to register for water-taking approval from an Environmental



Reference No. 1708-W156

19

Activity and Sector Registry (EASR), or to apply for a Permit to Take Water (PTTW) from the Ministry of Environment and Climate Change (MOECC).

## 7.2 **Groundwater Function of the Subject Site**

The shallow groundwater table lies below the lowest proposed excavation level for the proposed development. As such, no impact on the groundwater function associated with the proposed development is anticipated.



8.0 **CONCLUSION**

1. The subject site lies on mapped till plains within the physiographic region of Southern Ontario known as the South Slope.
2. Based on review of the surface geological map of Ontario, the subject site is underlain by the Halton Till unit, consisting predominantly of silt to silty clay matrix, high in matrix carbonate and being clast poor.
3. A review of the topography shows that the site is relatively flat, exhibiting a gentle decline in relief towards the southeast portion of the property.
4. The subject site is located within the Main Humber Sub-watershed of the Humber River Watershed.
5. This study has disclosed that beneath the layer of topsoil and earth fill, the native soils underlying the subject site consist of silty clay and silty clay till.
6. The findings of this study confirm that the groundwater level elevations range from El.238.06 to 241.08, (i.e. 5.12 to 7.25 mbgs) and shallow groundwater flows mainly towards the south/southeast.
7. The single well response test yielded an estimated hydraulic conductivity (K) value of  $1.10 \times 10^{-7}$  m/sec for the silty clay till at the depths of the well screens.
8. The Single Well Response Test (SWRT) result indicates that the hydraulic conductivity (K) estimate for the silty clay till at the well screen depths is  $1.10 \times 10^{-7}$  m/sec.
9. The shallow groundwater level lies below the lowest proposed excavation level for servicing and construction of the proposed 1-level underground structure (basement). As such, there will be no need to implement a groundwater control program, and, accordingly, no need to register for water-taking approval from an Environmental Activity and Sector Registry (EASR), or to apply for a Permit to Take Water (PTTW) from the Ministry of Environment and Climate Change (MOECC).



10. The shallow groundwater table lies below the lowest proposed excavation level for the proposed development. As such, no impact on the groundwater function associated with the proposed development is anticipated.

**SOIL ENGINEERS LTD.**

Daixi Zhang, B. Sc., G.I.T.  
Project Manager-Hydrogeological Services

Narjes Alijani, M.Sc., P.Geo.  
Department Manager-Hydrogeological Services





## 9.0 **REFERENCES**

1. The Physiography of Southern Ontario (Third Edition), L. J. Chapman and D. F. Putnam, 1984.
2. Bedrock Geology of Ontario, 1993, Data set 6, Ministry of Northern Development
3. D.P. Rogers, R.C. Ostry and P.F. Karrow, 1961, Metropolitan Toronto Bedrock Contours, Ontario Department of Mines, Preliminary Map 102.
4. Highland Creek Watershed Report Card, 2013, Toronto Region Conservation Authority.



# *Soil Engineers Ltd.*

CONSULTING ENGINEERS

GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE

---

90 WEST BEAVER CREEK ROAD, SUITE 100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

---

**BARRIE**  
TEL: (705) 721-7863  
FAX: (705) 721-7864

**MISSISSAUGA**  
TEL: (905) 542-7605  
FAX: (905) 542-2769

**OSHAWA**  
TEL: (905) 440-2040  
FAX: (905) 725-1315

**NEWMARKET**  
TEL: (905) 853-0647  
FAX: (905) 881-8335

**MUSKOKA**  
TEL: (705) 721-7863  
FAX: (705) 721-7864

**HAMILTON**  
TEL: (905) 777-7956  
FAX: (905) 542-2769

## **FIGURES 1 to 8**

## **BOREHOLE LOGS AND GRAIN SIZE DISTRIBUTION GRAPHS**

**REFERENCE NO. 1708-W156**

# LIST OF ABBREVIATIONS AND DESCRIPTION OF TERMS

The abbreviations and terms commonly employed on the borehole logs and figures, and in the text of the report, are as follows:

## SAMPLE TYPES

AS	Auger sample
CS	Chunk sample
DO	Drive open (split spoon)
DS	Denison type sample
FS	Foil sample
RC	Rock core (with size and percentage recovery)
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

## SOIL DESCRIPTION

Cohesionless Soils:

<u>'N'</u> (blows/ft)	<u>Relative Density</u>
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
over 50	very dense

Cohesive Soils:

## PENETRATION RESISTANCE

Dynamic Cone Penetration Resistance:

A continuous profile showing the number of blows for each foot of penetration of a 2-inch diameter, 90° point cone driven by a 140-pound hammer falling 30 inches.

Plotted as '—●—'

Undrained Shear Strength (ksf)

less than 0.25
0.25 to 0.50
0.50 to 1.0
1.0 to 2.0
2.0 to 4.0
over 4.0

'N' (blows/ft)

0 to 2
2 to 4
4 to 8
8 to 16
16 to 32
over 32

Consistency

very soft
soft
firm
stiff
very stiff
hard

Standard Penetration Resistance or 'N' Value:

The number of blows of a 140-pound hammer falling 30 inches required to advance a 2-inch O.D. drive open sampler one foot into undisturbed soil.

Plotted as '○'

WH	Sampler advanced by static weight
PH	Sampler advanced by hydraulic pressure
PM	Sampler advanced by manual pressure
NP	No penetration

Method of Determination of Undrained Shear Strength of Cohesive Soils:

x 0.0 Field vane test in borehole; the number denotes the sensitivity to remoulding

△ Laboratory vane test

□ Compression test in laboratory

For a saturated cohesive soil, the undrained shear strength is taken as one half of the undrained compressive strength

## METRIC CONVERSION FACTORS

1 ft = 0.3048 metres

1lb = 0.454 kg

1 inch = 25.4 mm

1ksf = 47.88 kPa



**Soil Engineers Ltd.**

CONSULTING ENGINEERS

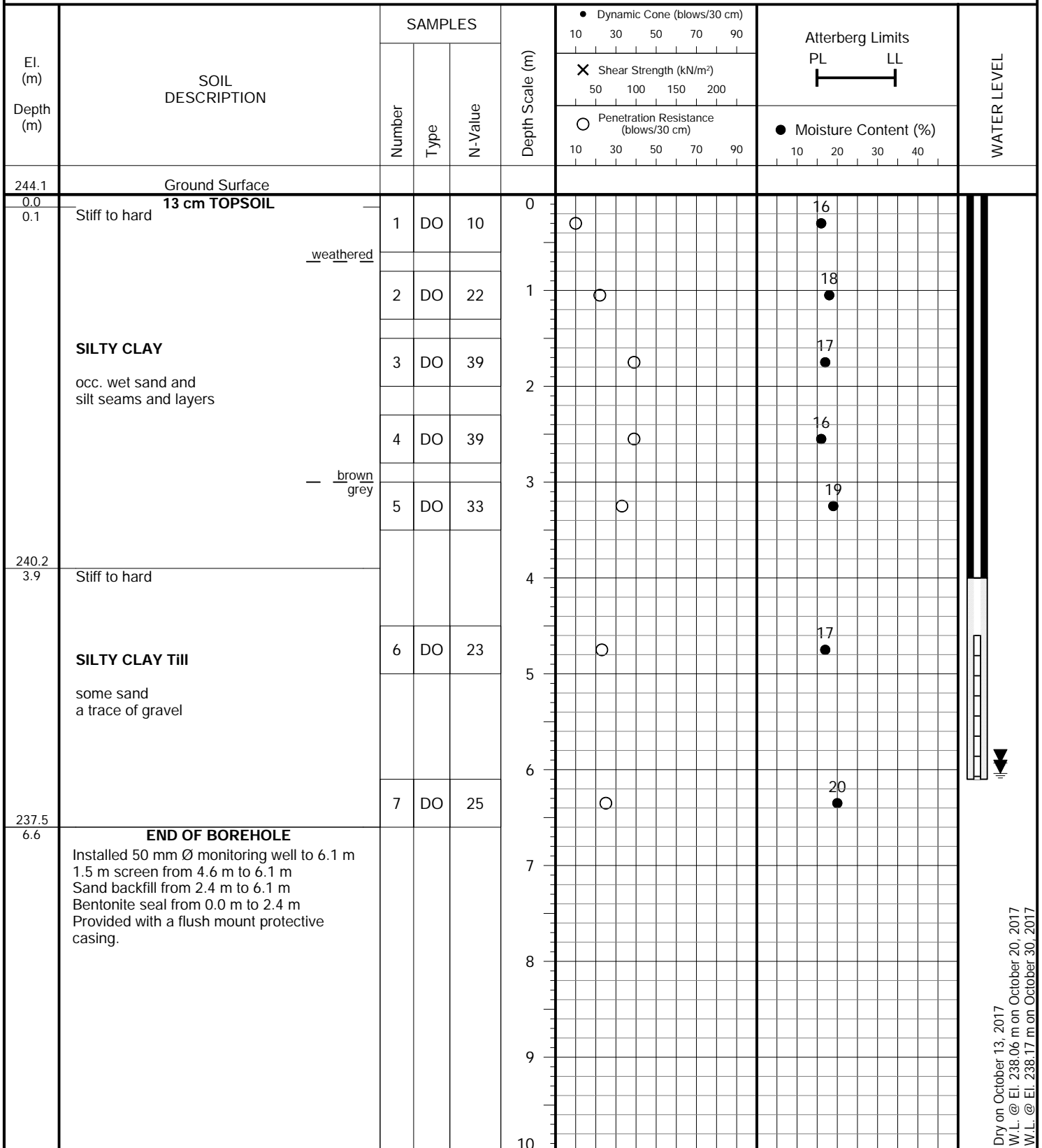
GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE

**PROJECT DESCRIPTION:** Proposed Townhouse Development

**METHOD OF BORING:** Flight-Auger

**PROJECT LOCATION:** 12944 Albion Vaughan Road, Town of Bolton

**DRILLING DATE:** September 27, 2017



Dry on October 13, 2017  
 W.L. @ El. 238.06 m on October 20, 2017  
 W.L. @ El. 238.17 m on October 30, 2017

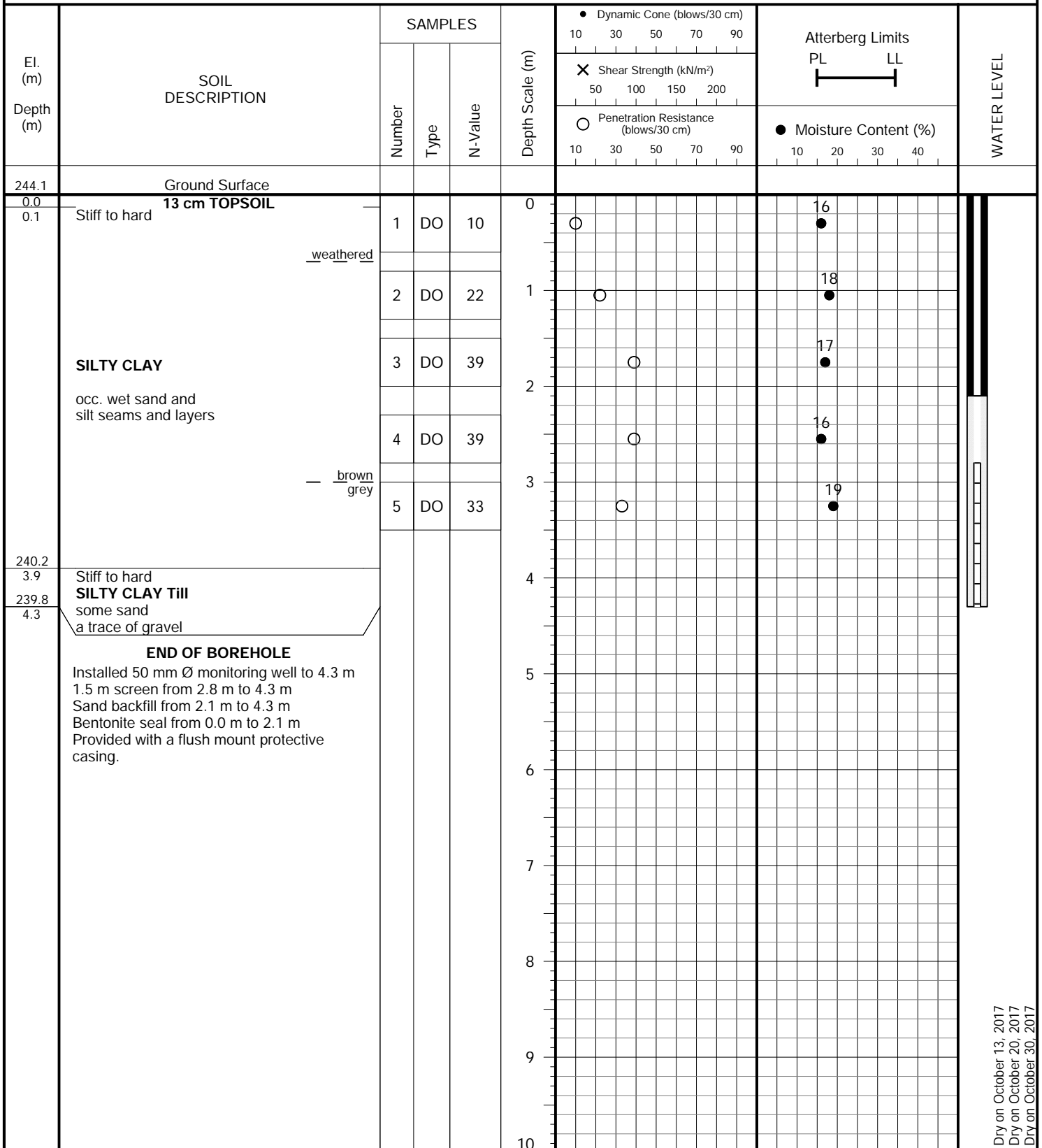


**PROJECT DESCRIPTION:** Proposed Townhouse Development

**METHOD OF BORING:** Flight-Auger

**PROJECT LOCATION:** 12944 Albion Vaughan Road, Town of Bolton

**DRILLING DATE:** September 27, 2017



Dry on October 13, 2017  
Dry on October 20, 2017  
Dry on October 30, 2017

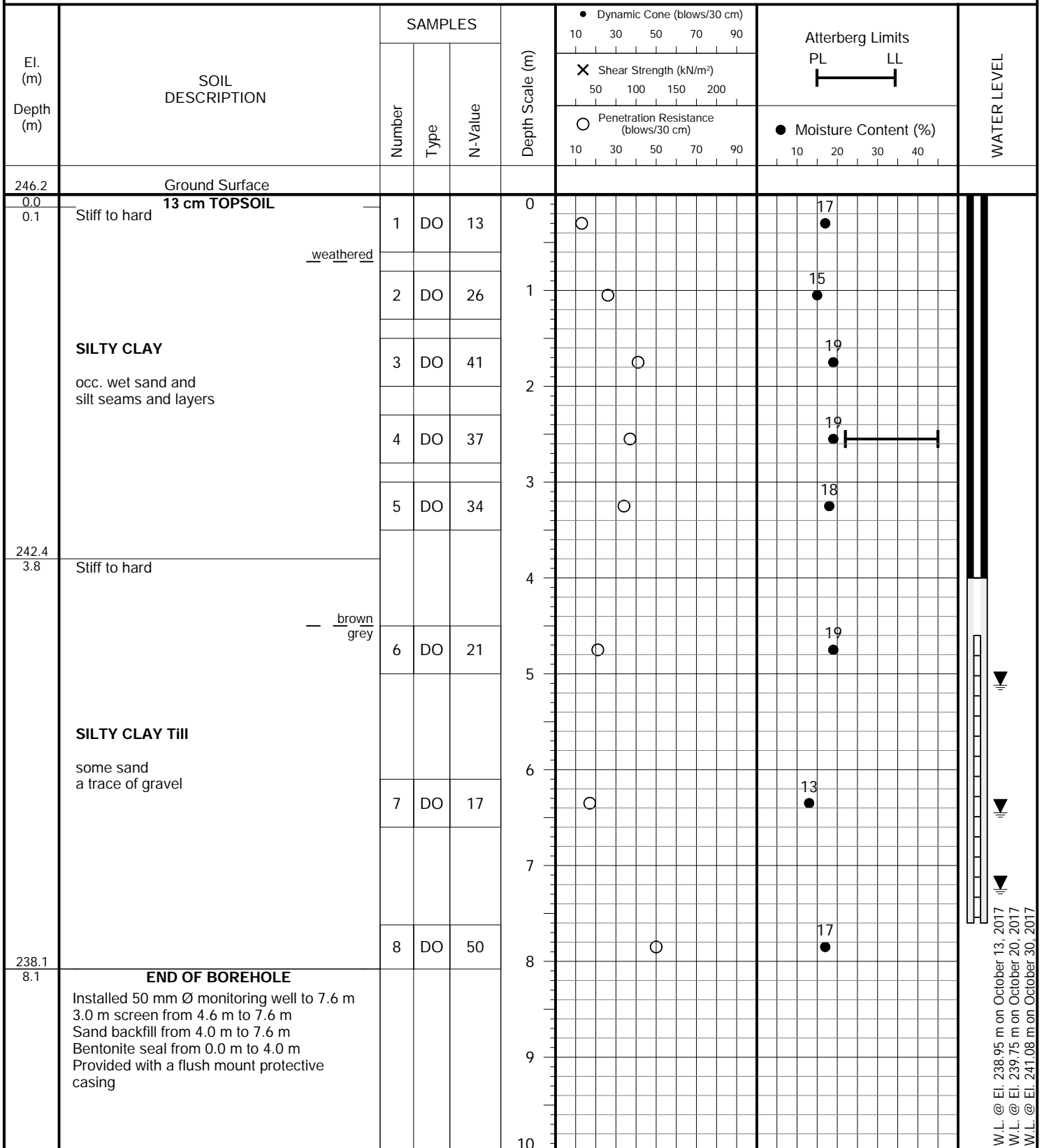


**PROJECT DESCRIPTION:** Proposed Townhouse Development

**METHOD OF BORING:** Flight-Auger

**PROJECT LOCATION:** 12944 Albion Vaughan Road, Town of Bolton

**DRILLING DATE:** September 27, 2017



W.L. @ El. 238.95 m on October 13, 2017  
 W.L. @ El. 239.75 m on October 20, 2017  
 W.L. @ El. 241.08 m on October 30, 2017

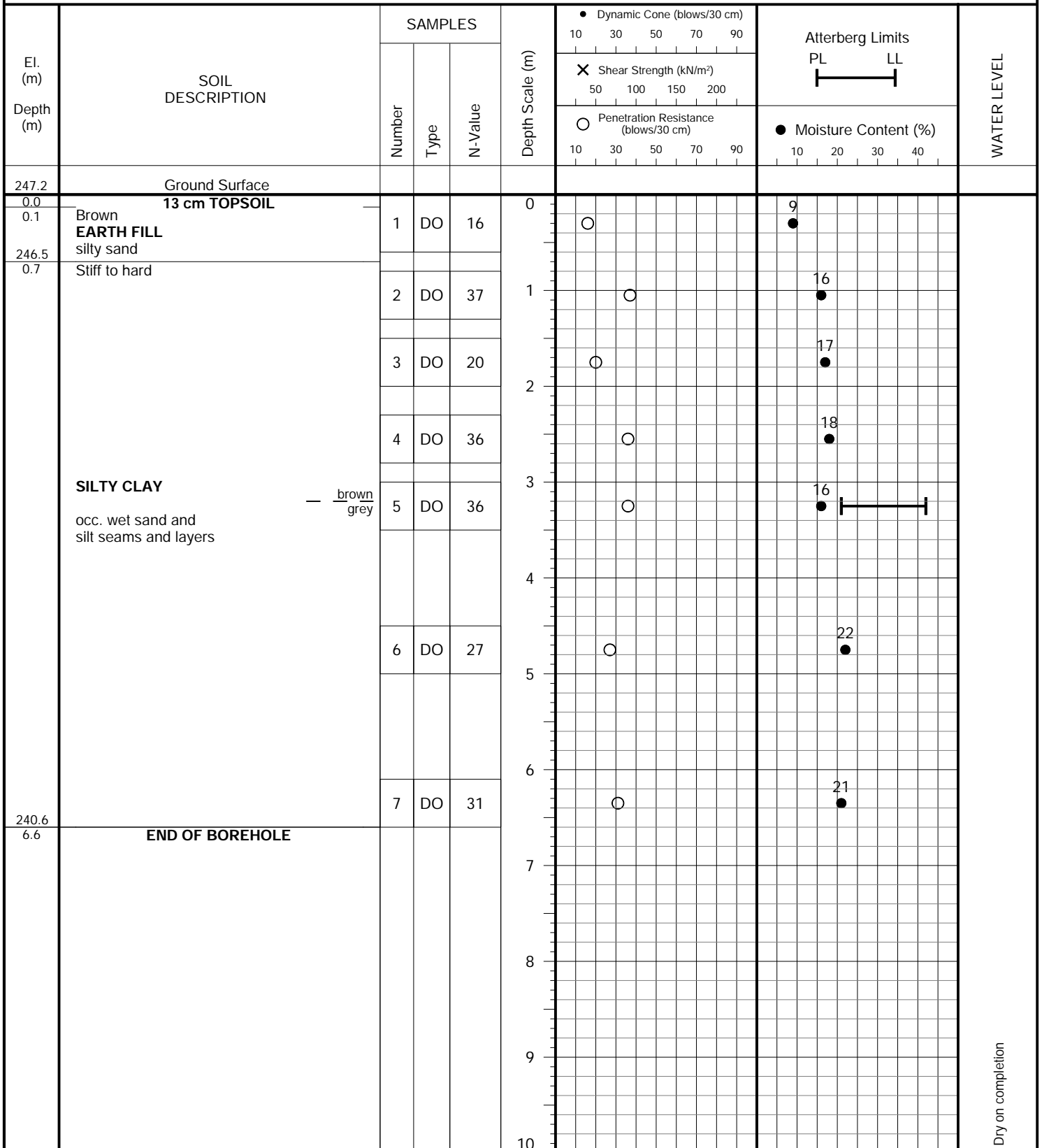


**PROJECT DESCRIPTION:** Proposed Townhouse Development

**METHOD OF BORING:** Flight-Auger

**PROJECT LOCATION:** 12944 Albion Vaughan Road, Town of Bolton

**DRILLING DATE:** September 27, 2017

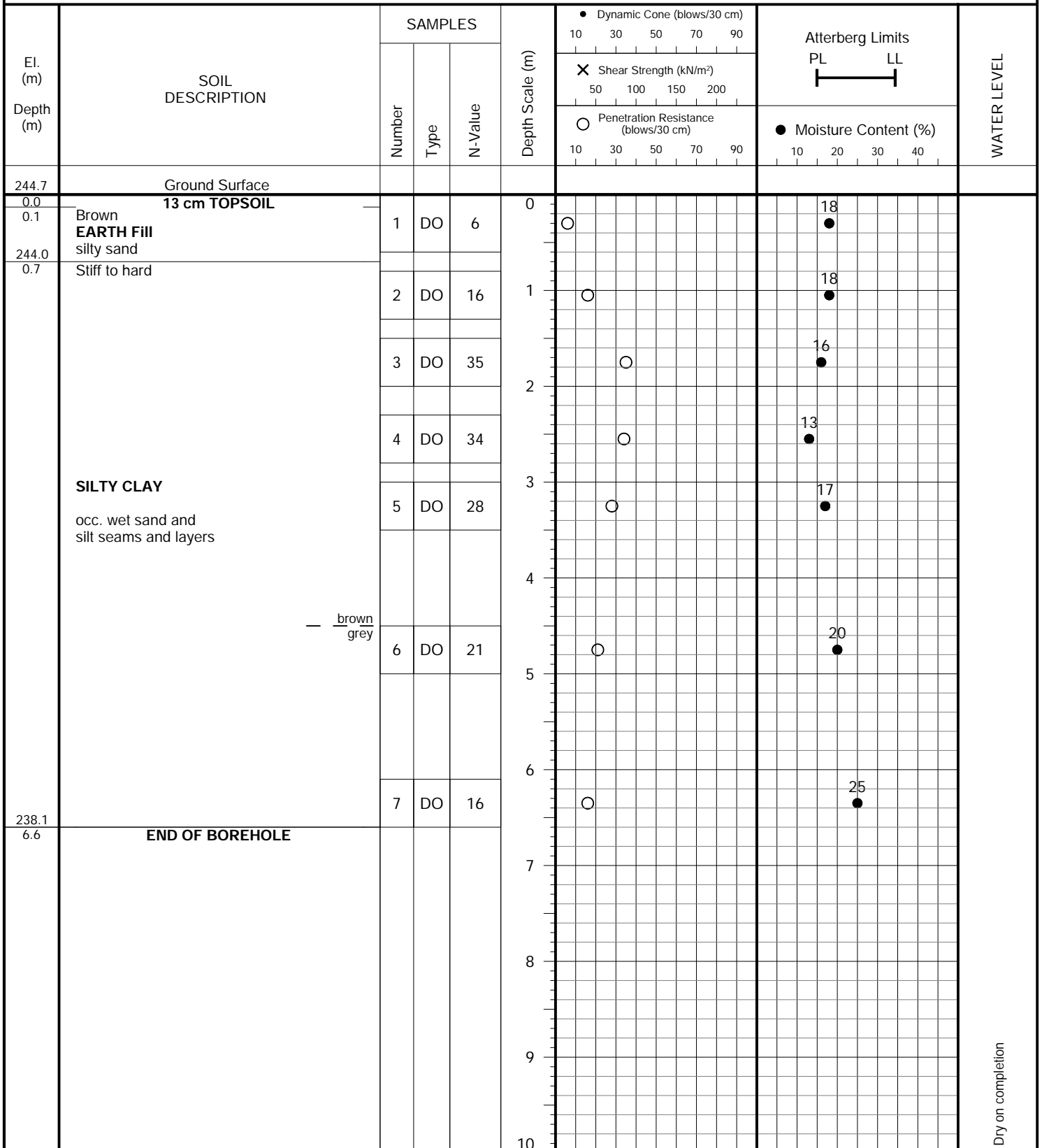


**PROJECT DESCRIPTION:** Proposed Townhouse Development

**METHOD OF BORING:** Flight-Auger

**PROJECT LOCATION:** 12944 Albion Vaughan Road, Town of Bolton

**DRILLING DATE:** September 27, 2017

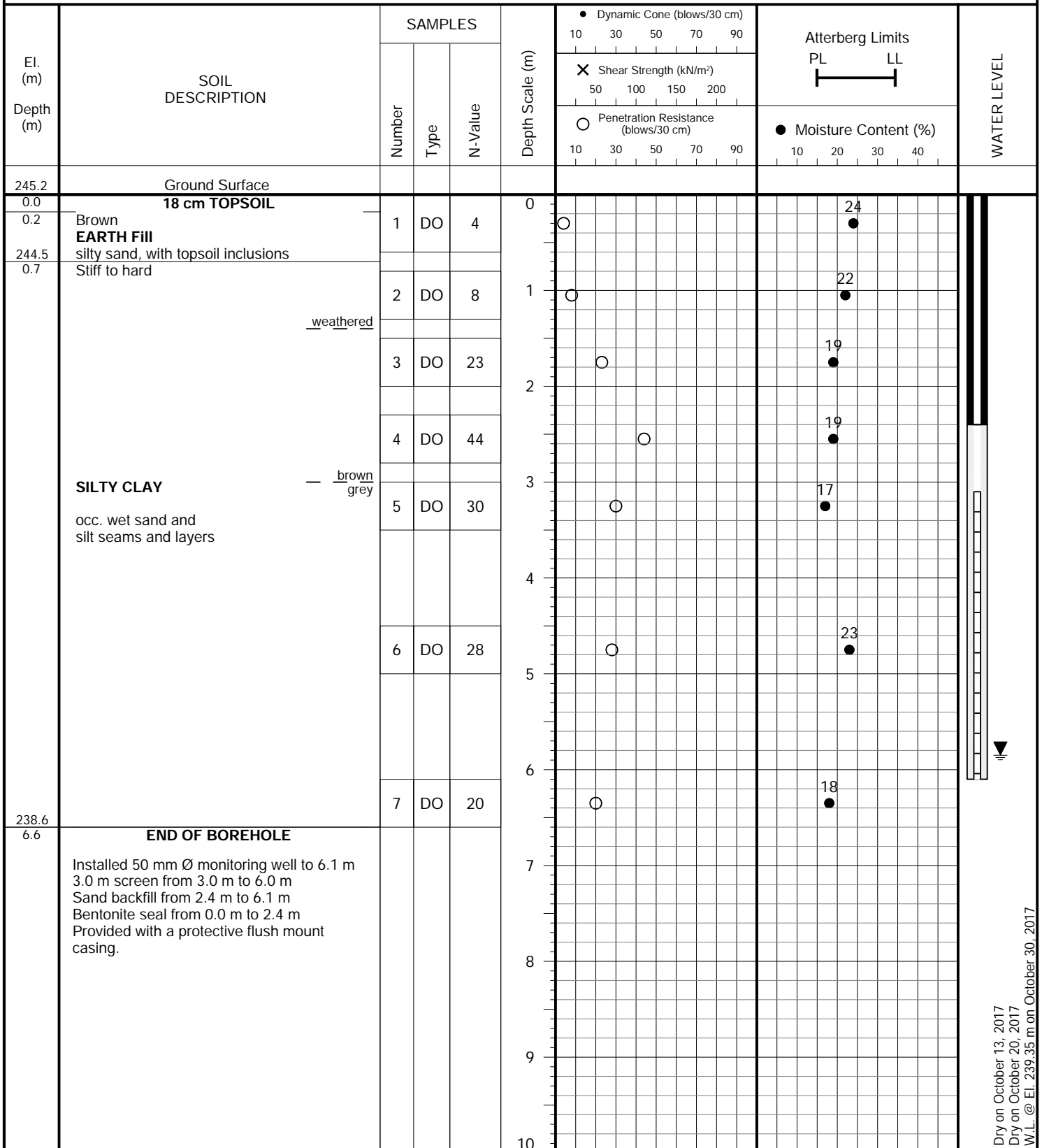


**PROJECT DESCRIPTION:** Proposed Townhouse Development

**METHOD OF BORING:** Flight-Auger

**PROJECT LOCATION:** 12944 Albion Vaughan Road, Town of Bolton

**DRILLING DATE:** September 27, 2017



Dry on October 13, 2017  
 Dry on October 20, 2017  
 W.L. @ El. 239.35 m on October 30, 2017



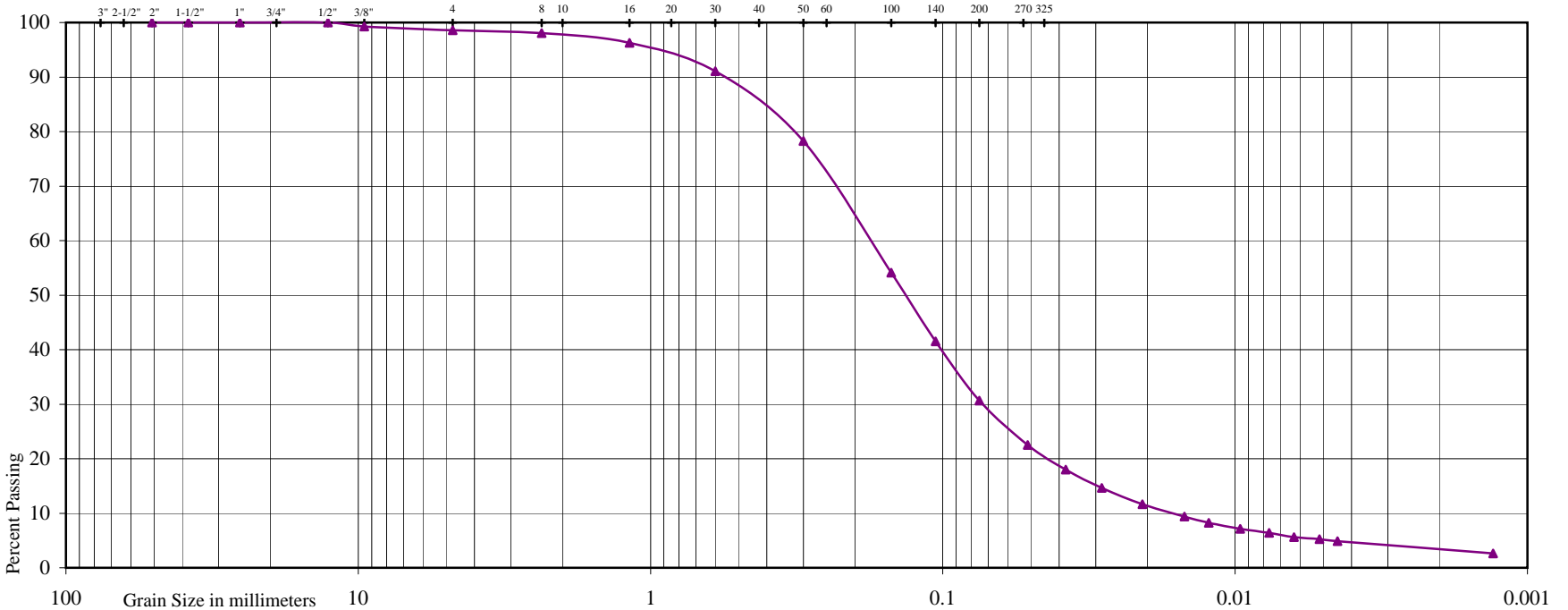


U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL			SAND				SILT	CLAY
COARSE	FINE		COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	





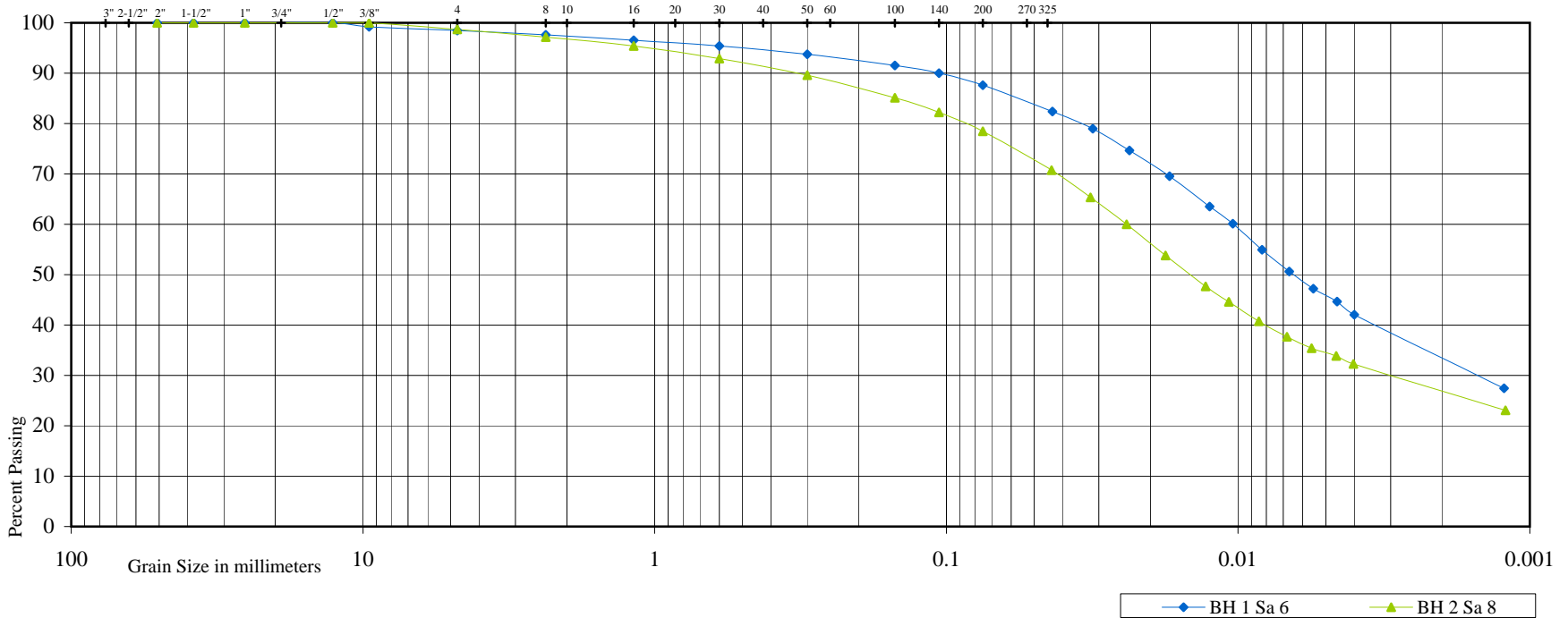


U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL			SAND				SILT	CLAY
COARSE	FINE		COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Townhouse Development  
 Location: 12944 Albion Vaughan Road, Town of Bolton

Borehole No: 1 2  
 Sample No: 6 8  
 Depth (m): 4.7 7.9  
 Elevation (m): 239.4 238.3

BH 1 Sa 6 Estimated Permeability (cm./sec.) =  $10^{-7}$   
 BH 2 Sa. 8 Estimated Permeability (cm./sec.) =  $10^{-7}$

Classification of Sample [& Group Symbol]: SILT CLAY TILL, some sand, a trace of gravel

Figure: 8



# *Soil Engineers Ltd.*

CONSULTING ENGINEERS

GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE

---

90 WEST BEAVER CREEK ROAD, SUITE 100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

---

**BARRIE**  
TEL: (705) 721-7863  
FAX: (705) 721-7864

**MISSISSAUGA**  
TEL: (905) 542-7605  
FAX: (905) 542-2769

**OSHAWA**  
TEL: (905) 440-2040  
FAX: (905) 725-1315

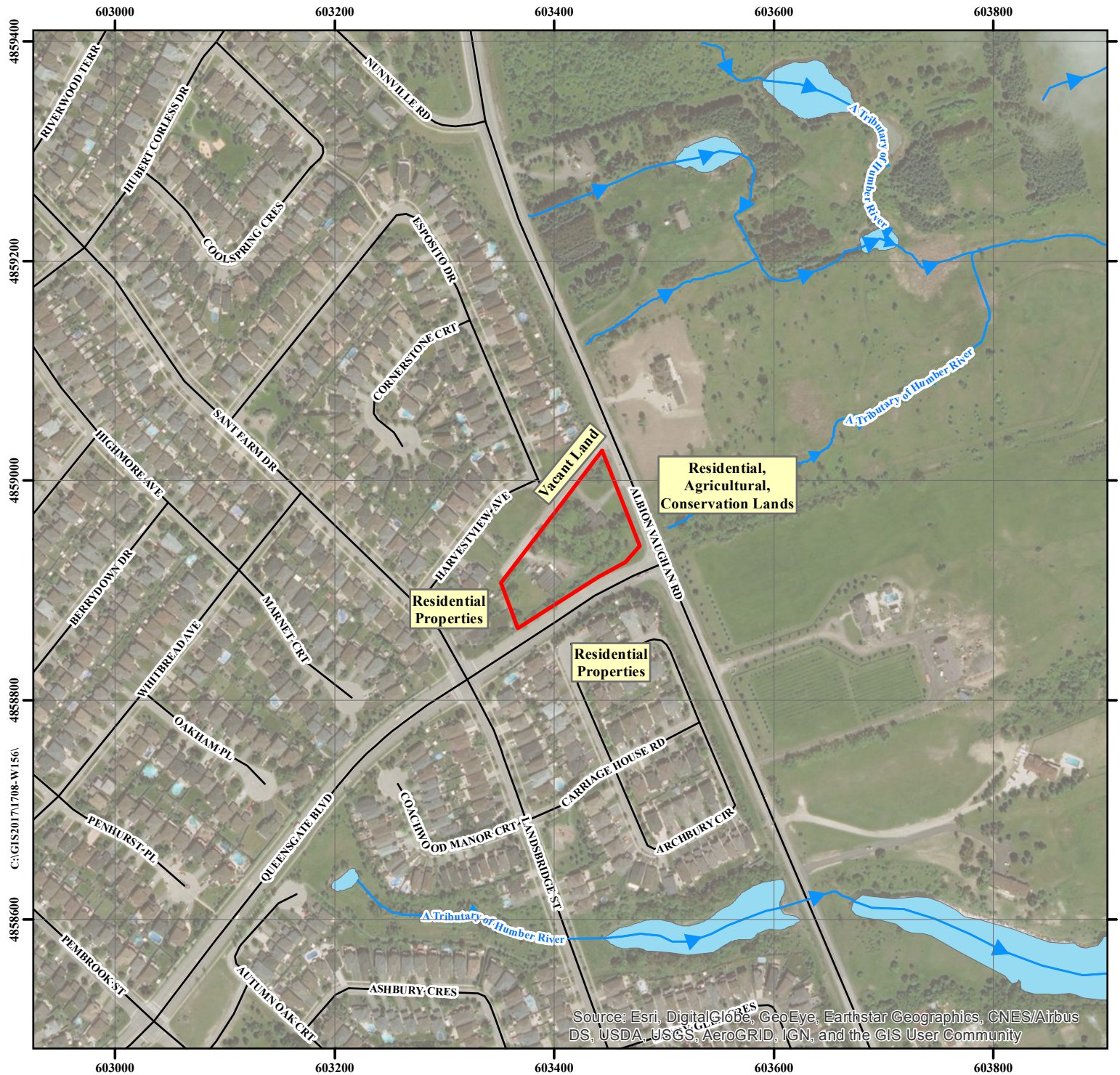
**NEWMARKET**  
TEL: (905) 853-0647  
FAX: (905) 881-8335





**MUSKOKA**  
TEL: (705) 721-7863  
FAX: (705) 721-7864

**HAMILTON**  
TEL: (905) 777-7956  
FAX: (905) 542-2769

## **DRAWINGS 1 to 9**

**REFERENCE NO. 1708-W156**



-  Approximate Boundary of Subject Site
-  Waterbody
-  Watercourse
-  Local Road



Title: Site Location Plan

Project:  
Hydrogeological Assessment  
Proposed Townhouse Development  
12944 Albion Vaughan Road  
Town of Bolton

Reference No. 1708-W156

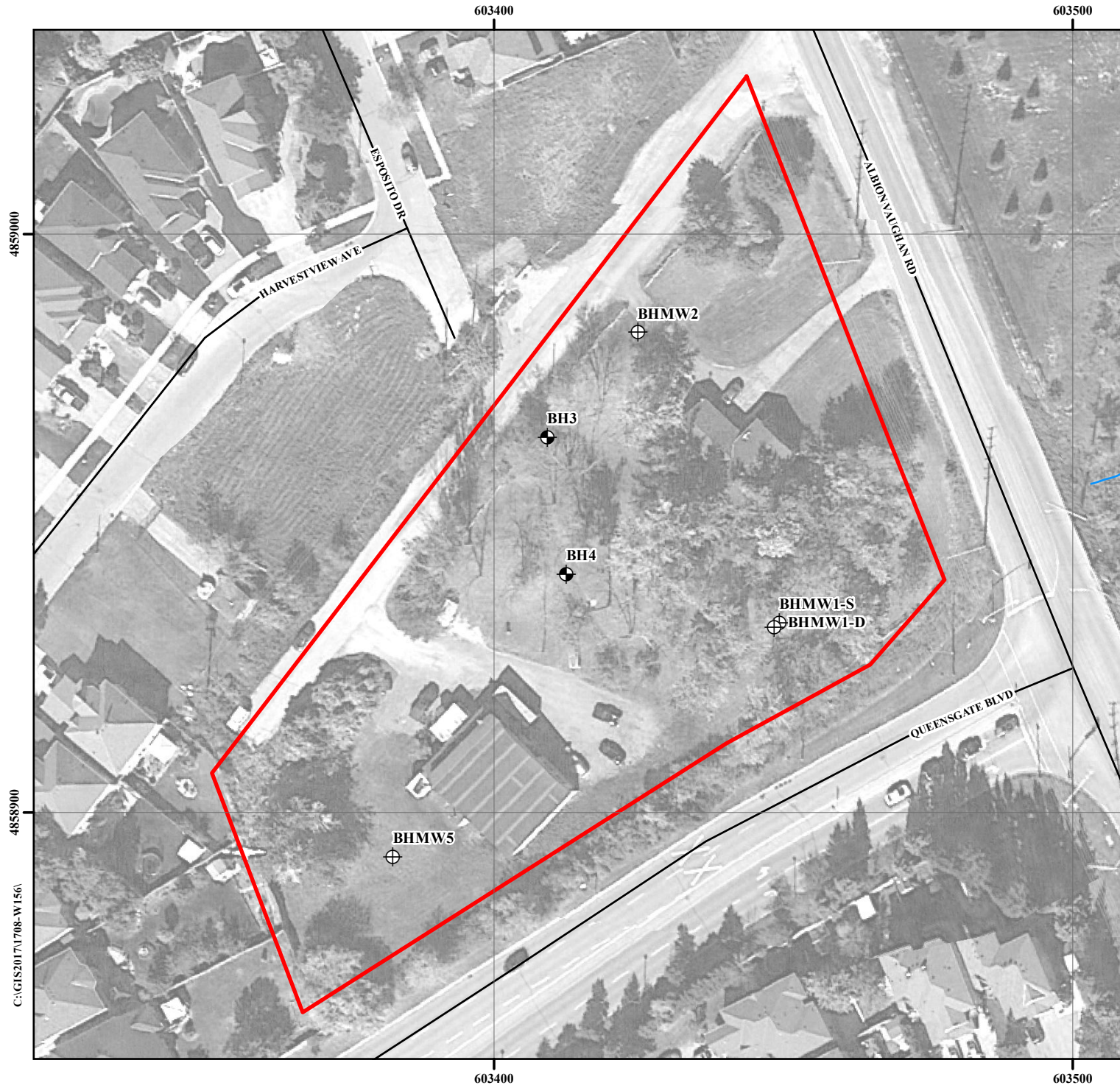
Date: September 25, 2017

Scale:  
0 25 50 100 150 200 250  
Metres

Drawing No. 1

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Source: Water Course, Ontario Ministry of Natural Resources and Forestry  
©Queen's Printer for Ontario  
Source: Water Body, Ontario Ministry of Natural Resources and Forestry  
©Queen's Printer for Ontario



N

- Approximate Boundary of Subject Site
- Borehole
- Borehole with Monitoring Well
- Watercourse
- Local Road

**Soil Engineers Ltd.**

Title: Borehole and Monitoring Well Location Plan

Project:  
Hydrogeological Assessment  
Proposed Townhouse Development  
12944 Albion Vaughan Road  
Town of Bolton

Reference No. 1708-W156

Date: September 25, 2017

Scale:  
Metres

Drawing No. 2

Source: Water Course, Ontario Ministry of Natural Resources and Forestry  
©Queen's Printer for Ontario  
Source: Water Body, Ontario Ministry of Natural Resources and Forestry  
©Queen's Printer for Ontario



- Approximate Boundary of Subject Site
- 500 metres from Subject Site Boundary
- Well Locations from MOECC Well Records
- Waterbody
- Watercourse
- Local Road

**Soil Engineers Ltd.**

Title: MOECC Well Location Plan

Project:  
 Hydrogeological Assessment  
 Proposed Townhouse Development  
 12944 Albion Vaughan Road  
 Town of Bolton

Reference No. 1708-W156

Date: September 25, 2017

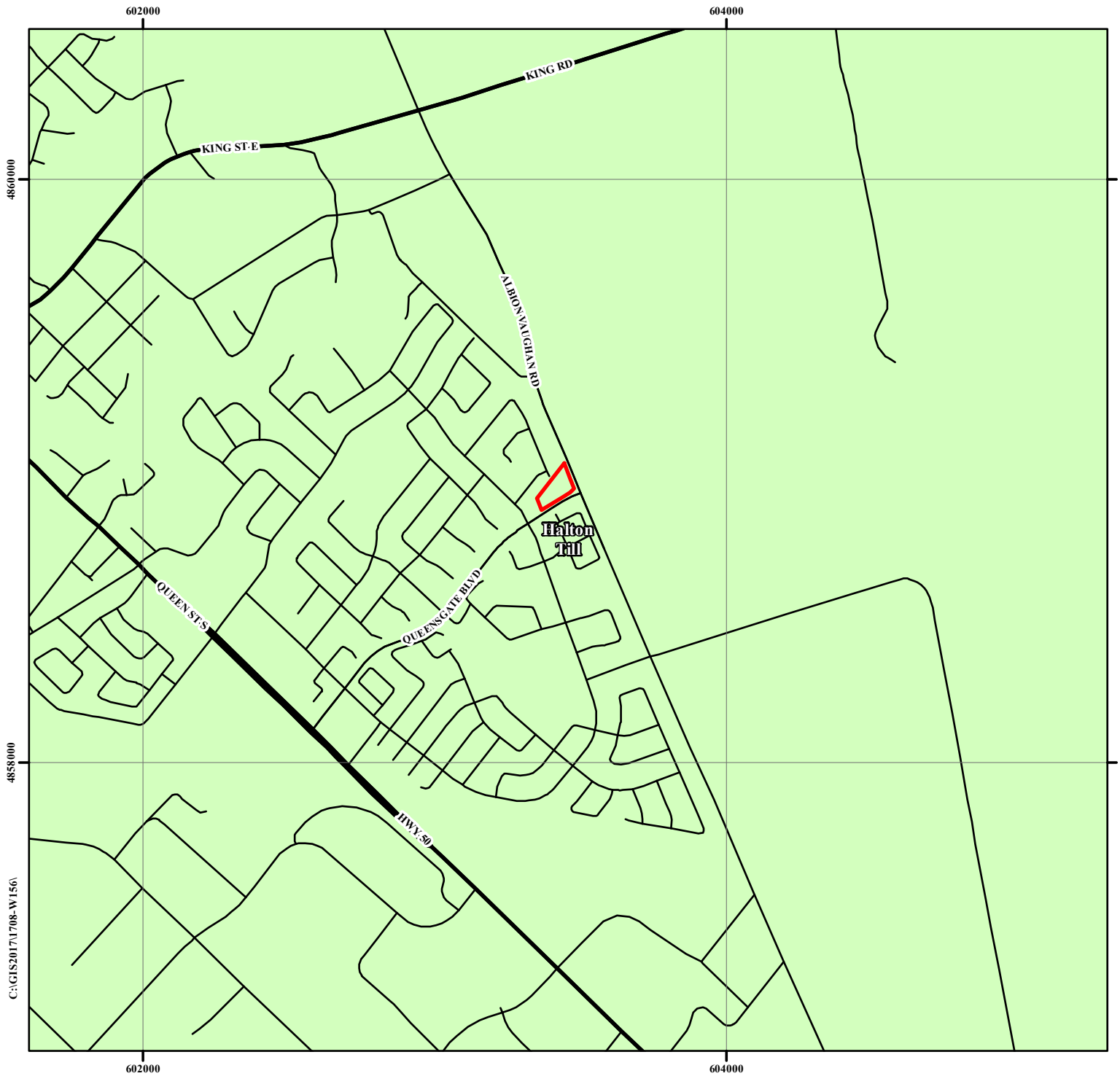
Scale:

Drawing No. 3




Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


Source: Water Course, Ontario Ministry of Natural Resources and Forestry  
 ©Queen's Printer for Ontario  
 Source: Water Body, Ontario Ministry of Natural Resources and Forestry  
 ©Queen's Printer for Ontario

C:\GIS\2017\1708-W156



N

 Approximate Boundary of Subject Site  
 Halton Till  
 Material: predominantly silt to silty clay matrix, high in matrix carbonate content and clast poor  
 Major Road


 **Soil Engineers Ltd.**

Title: Quarternary and Surface Geology Map

Project:  
 Hydrogeological Assessment  
 Proposed Townhouse Development  
 12944 Albion Vaughan Road  
 Town of Bolton

Reference No. 1708-W156

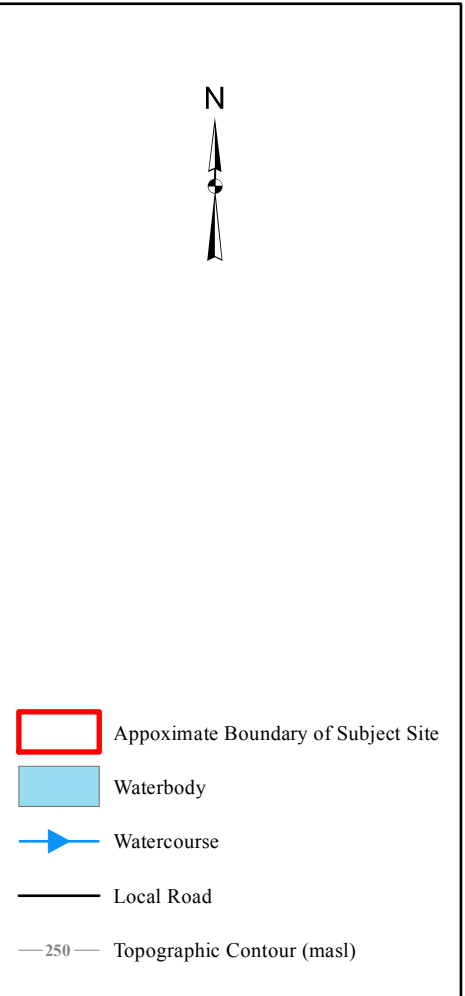
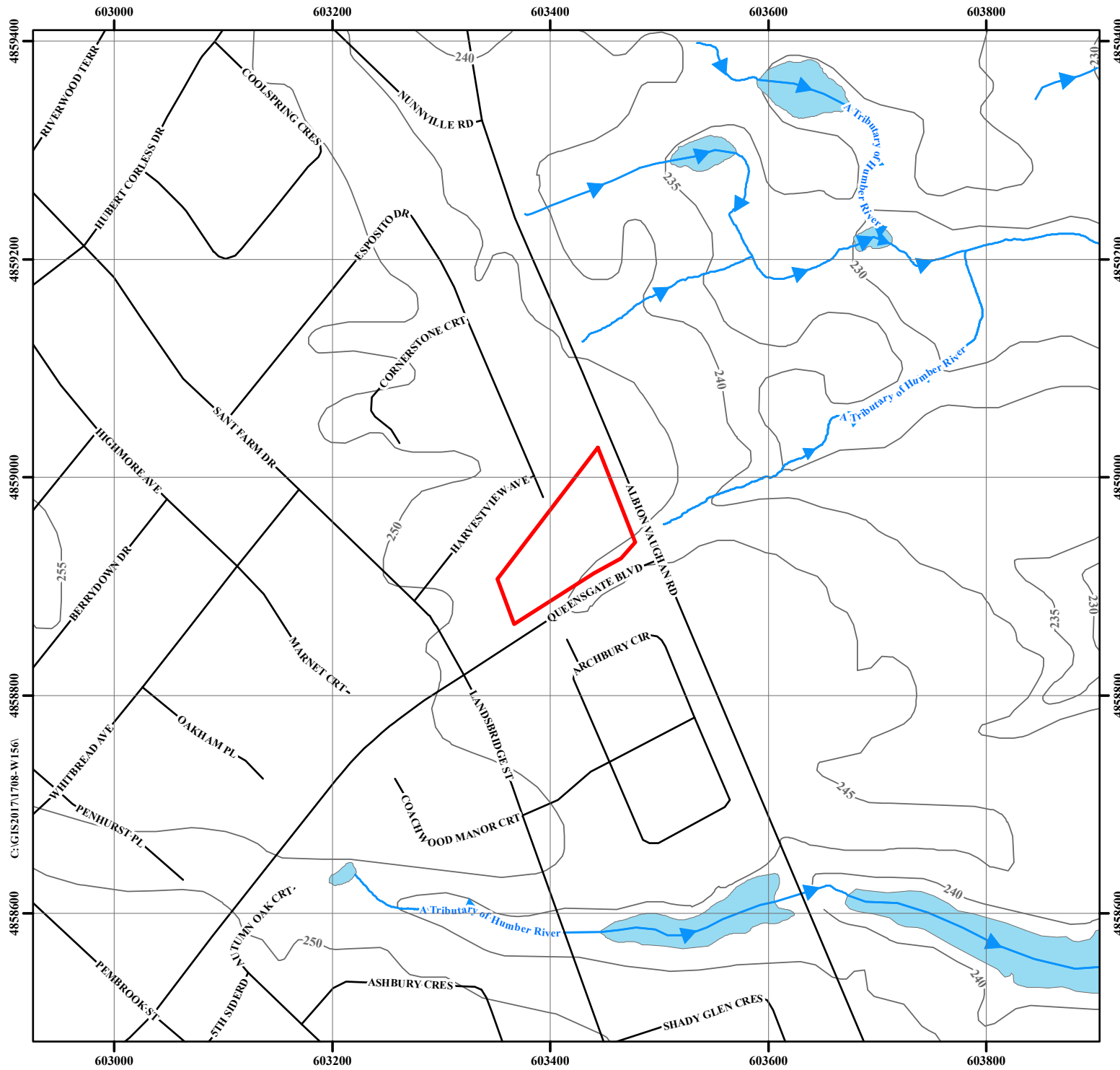
Date: September 25, 2017

Scale:  
  
 0 95 190 380 570 760 950  
 Metres

Drawing No. 4

C:\GIS\2017\1708-W156\

Source: Ontario Geological Survey, 1997,  
 Surface Geology of Ontario; Ontario Geological Survey,  
 Miscellaneous Released-Data 0014



- Approximate Boundary of Subject Site
- Waterbody
- Watercourse
- Local Road
- Topographic Contour (masl)

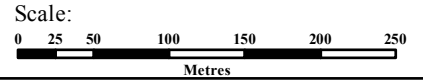


Title: Topographic Map

Project:  
 Hydrogeological Assessment  
 Proposed Townhouse Development  
 12944 Albion Vaughan Road  
 Town of Bolton

Reference No. 1708-W156

Date: September 25, 2017



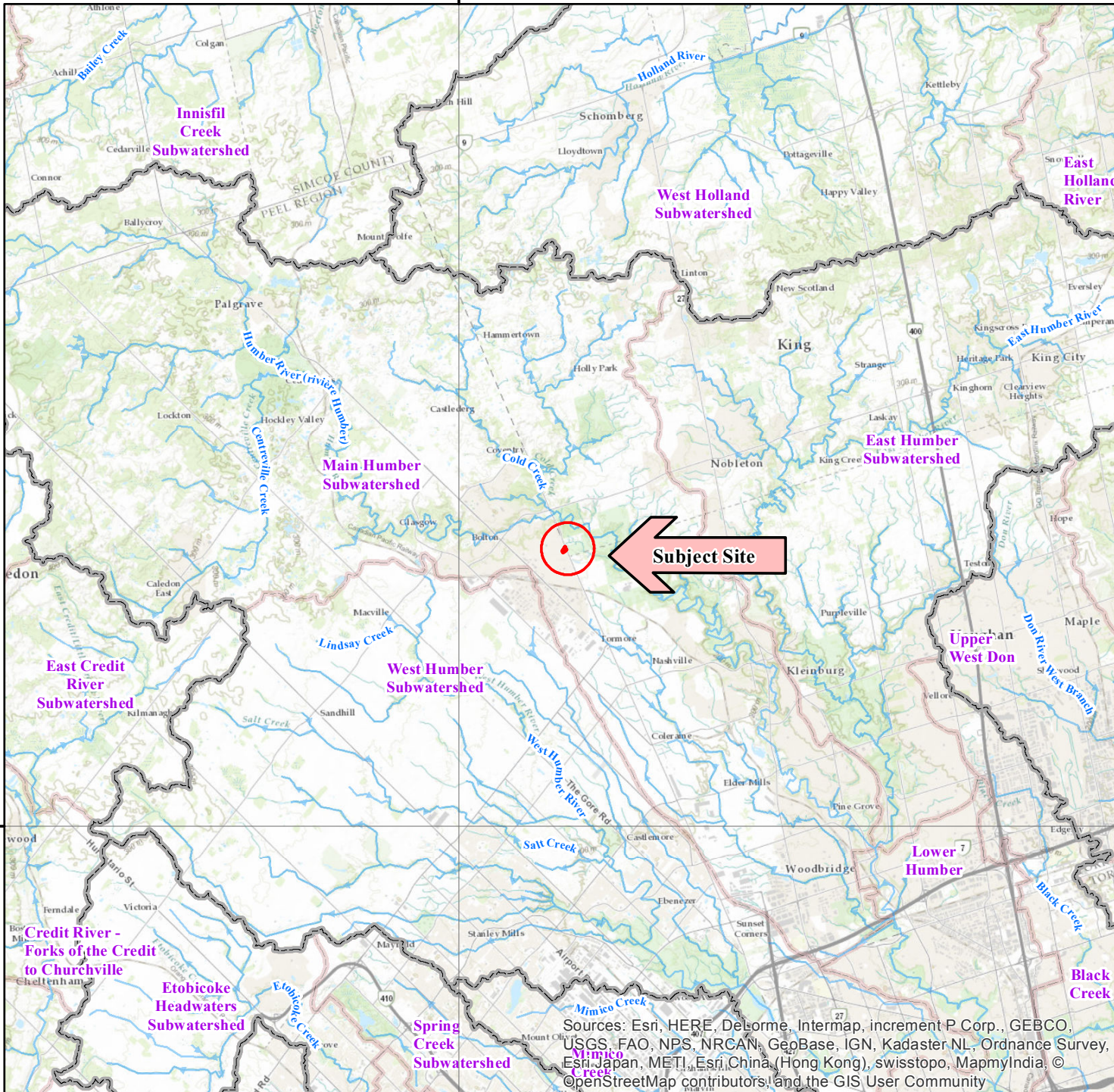
Drawing No. 5

C:\GIS2017\1708-W156\

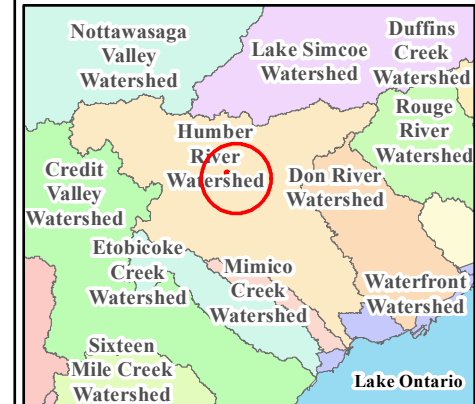
Source: Water Body, Ontario Ministry of Natural Resources and Forestry, 2015  
 ©Queen's Printer for Ontario, 2015  
 Source: Contour, Ontario Ministry of Natural Resources and Forestry, 2015  
 ©Queen's Printer for Ontario, 2015  
 Source: Water Course, Ontario Ministry of Natural Resources and Forestry, 2015  
 ©Queen's Printer for Ontario, 2015






# Humber River Subwatersheds

600000



## Watershed:



-  Approximate Boundary of the Subject Site
-  Watershed Boundaries
-  Water Body
-  Watercourse
-  Expressway/Major Road



Title: Watershed and Subwatershed Map

Project:  
Hydrogeological Assessment  
Proposed Townhouse Development  
12944 Albion Vaughan Road  
Town of Bolton

Reference No. 1708-W156

Date: September 25, 2017

Scale:  
0 6,000 12,000 24,000 36,000 48,000 60,000  
Metres

Drawing No. 6

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

this mapping was produced by SEL and should be used for information purposes only.  
Data sources used in its production are of varying quality and accuracy and all boundaries should be considered approximate.

C:\GIS2017\1708-W156

4850000

4850000

602000

603000

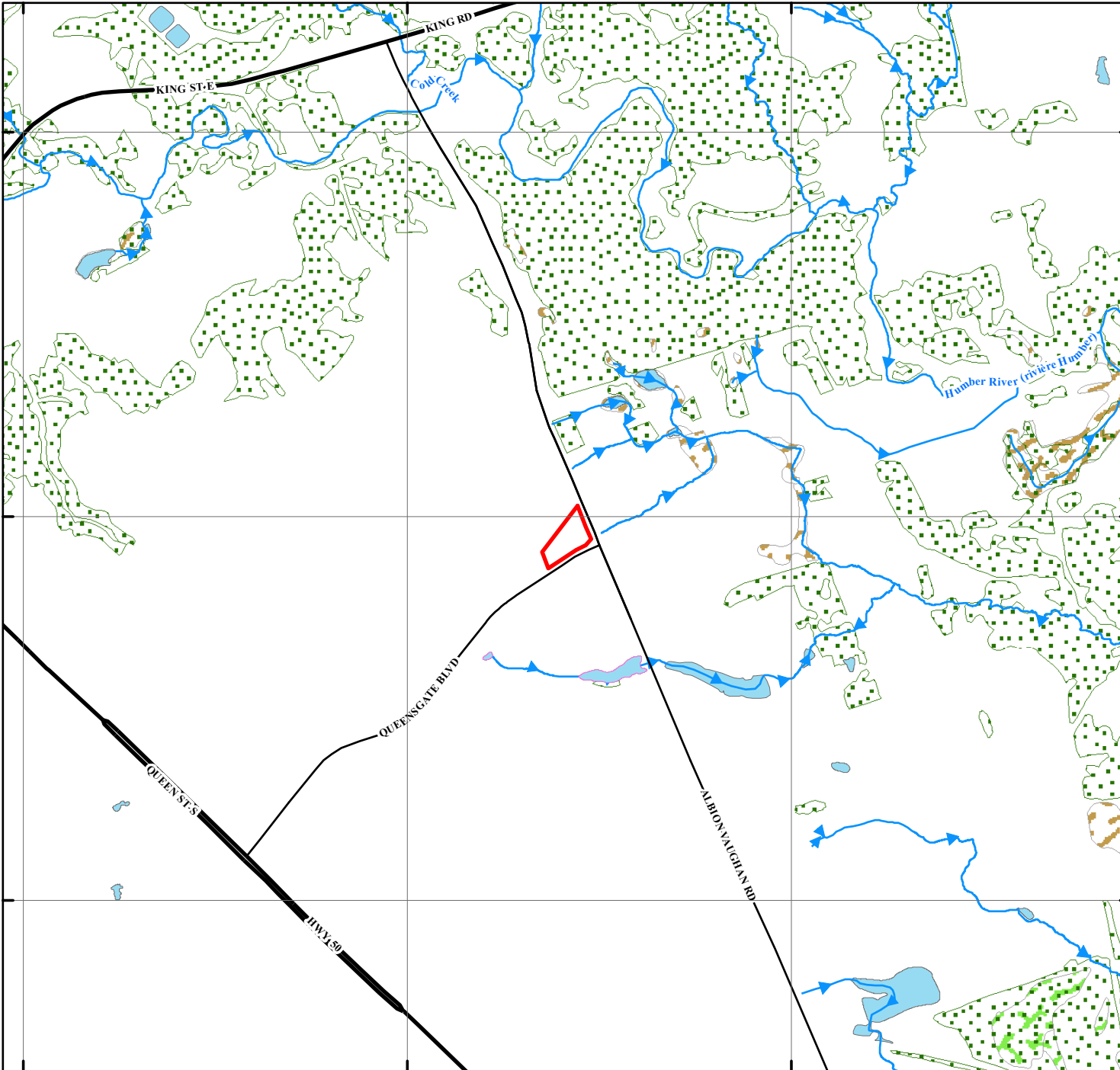
604000

4860000

4859000

4858000

C:\GIS\2017\1708-W156












4860000

4859000

4858000



-  Approximate Boundary of Subject Site
-  Wetland (classified as Other)
-  Wetland (Not Evaluated per OWES)
-  Wooded Area
-  Water Body
-  Stormwater Ponds - Re-established
-  Watercourse
-  Major Road
-  Local Road

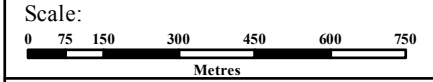


Title: Natural Features and Protection Area Plan

Project:  
Hydrogeological Assessment  
Proposed Townhouse Development  
12944 Albion Vaughan Road  
Town of Bolton

Reference No. 1708-W156

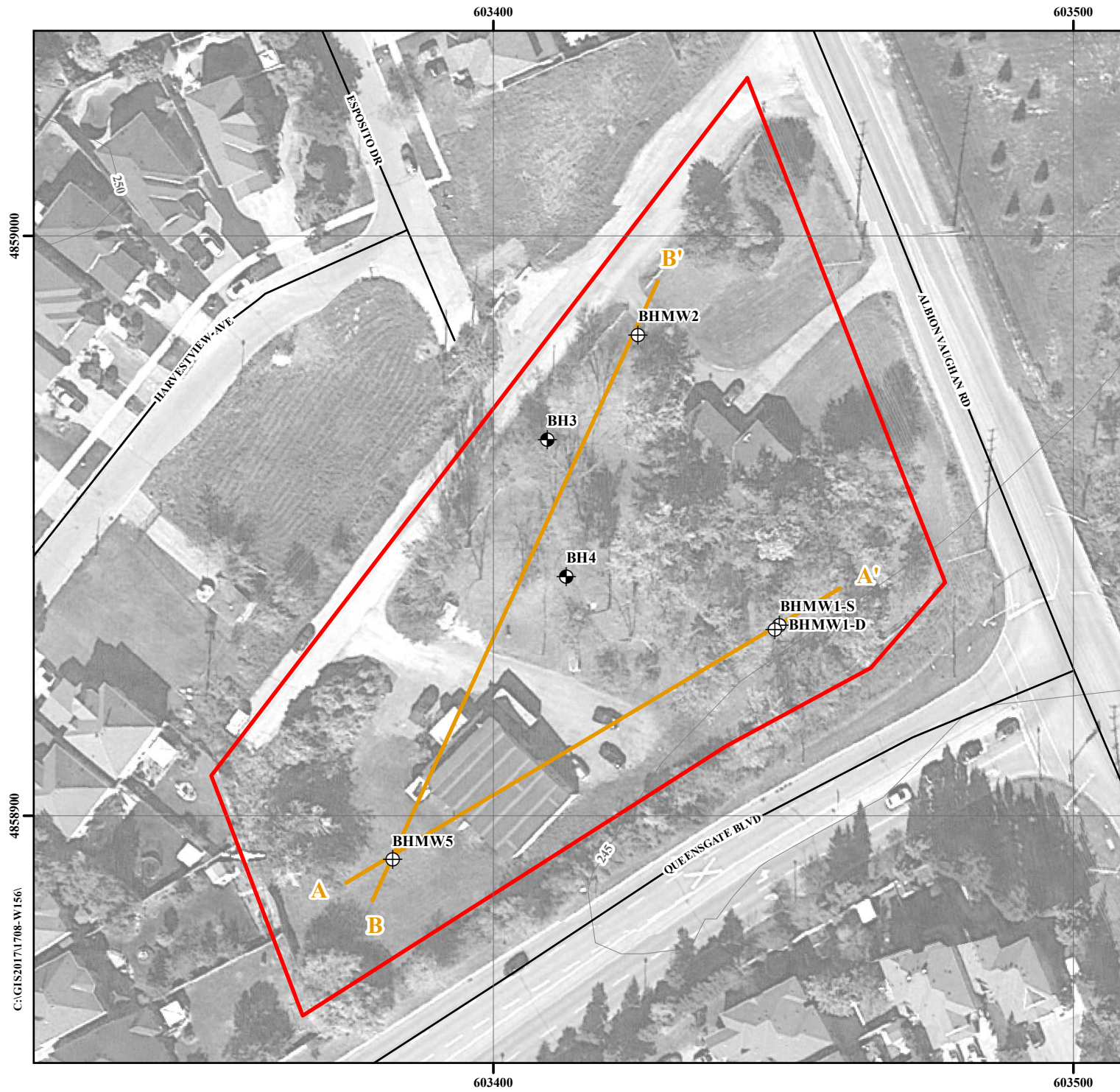
Date: September 25, 2017



Drawing No. 7

Contains information licensed under the Open Government Licence – Ontario, 2014 and 2015.  
Includes information: Provincial Park, Conservation Reserve, Area of Natural and Scientific Interest, Wetland, Niagara Escarpment Protection Area, Oak Ridges Moraine Conservation and Wilderness Areas  
Source: Ontario Ministry of Natural Resources and Forestry, 2015  
©Queen's Printer for Ontario, 2015

Source: Water Course, Ontario Ministry of Natural Resources and Forestry, 2015  
©Queen's Printer for Ontario, 2015  
Source: Water Body, Ontario Ministry of Natural Resources and Forestry, 2015  
©Queen's Printer for Ontario, 2015  
OWES: Ontario Wetland Evaluation System



N

Approximate Boundary of Subject Site  
 Borehole  
 Borehole with Monitoring Well  
 Local Road  
 Cross-Section Direction  
 245 Topographic Contour (masl)

**Soil Engineers Ltd.**

Title: Cross-Section Key Plan

Project:  
 Hydrogeological Assessment  
 Proposed Townhouse Development  
 12944 Albion Vaughan Road  
 Town of Bolton

Reference No. 1708-W156

Date: September 25, 2017

Scale:  

 0 5 10 20 30 40 50  
 Metres

Drawing No. 8-1

C:\GIS\2017\1708-W156

603400

4859000

4858900

603400

603500

4859000

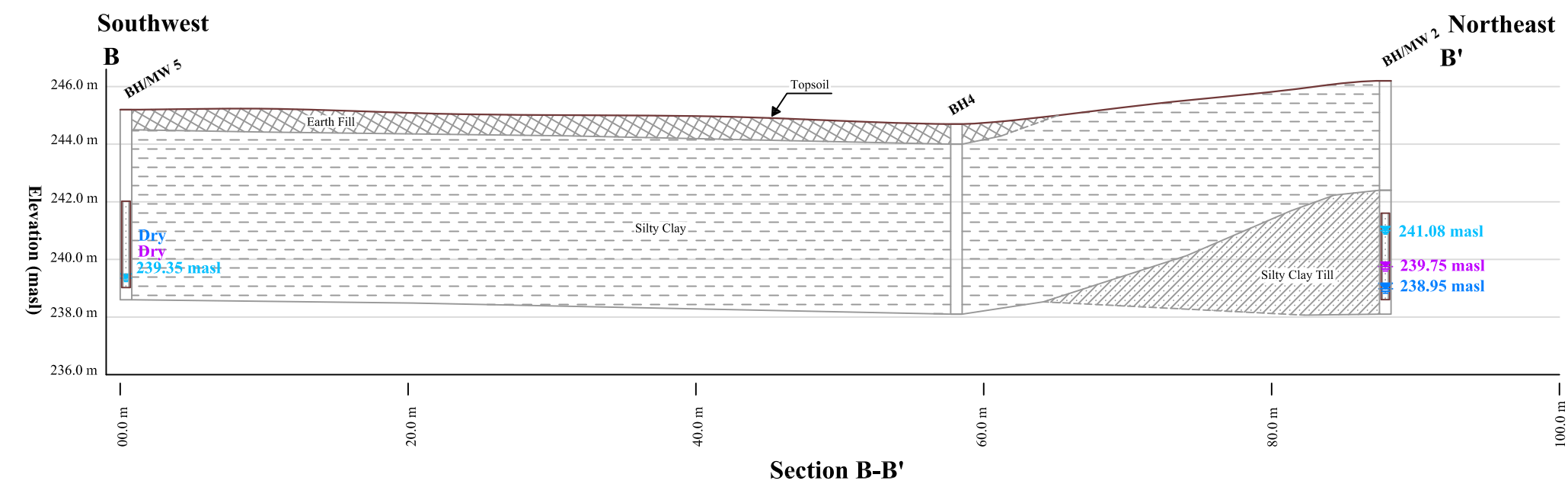
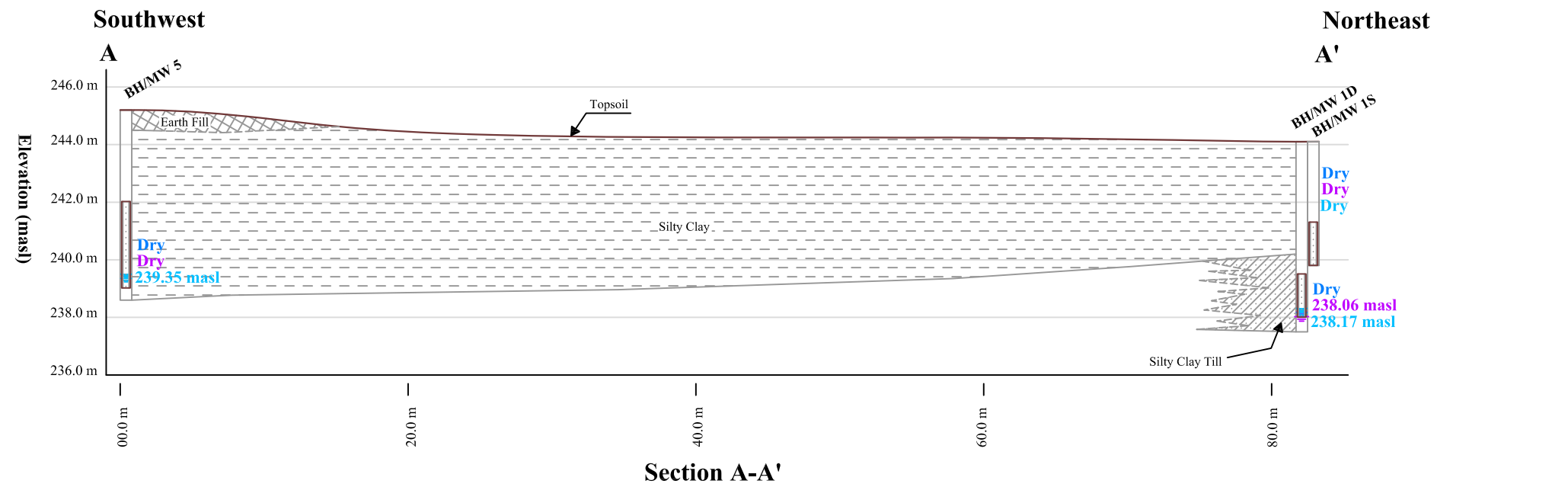
4858900

603500

Source: Water Body, Ontario Ministry of Natural Resources and Forestry, 2015  
 ©Queen's Printer for Ontario, 2015

Source: Contour, Ontario Ministry of Natural Resources and Forestry, 2015  
 ©Queen's Printer for Ontario, 2015

Source: Water Course, Ontario Ministry of Natural Resources and Forestry, 2015  
 ©Queen's Printer for Ontario, 2015



C:\Hydrog\Projects\1708-W156\Cross-section

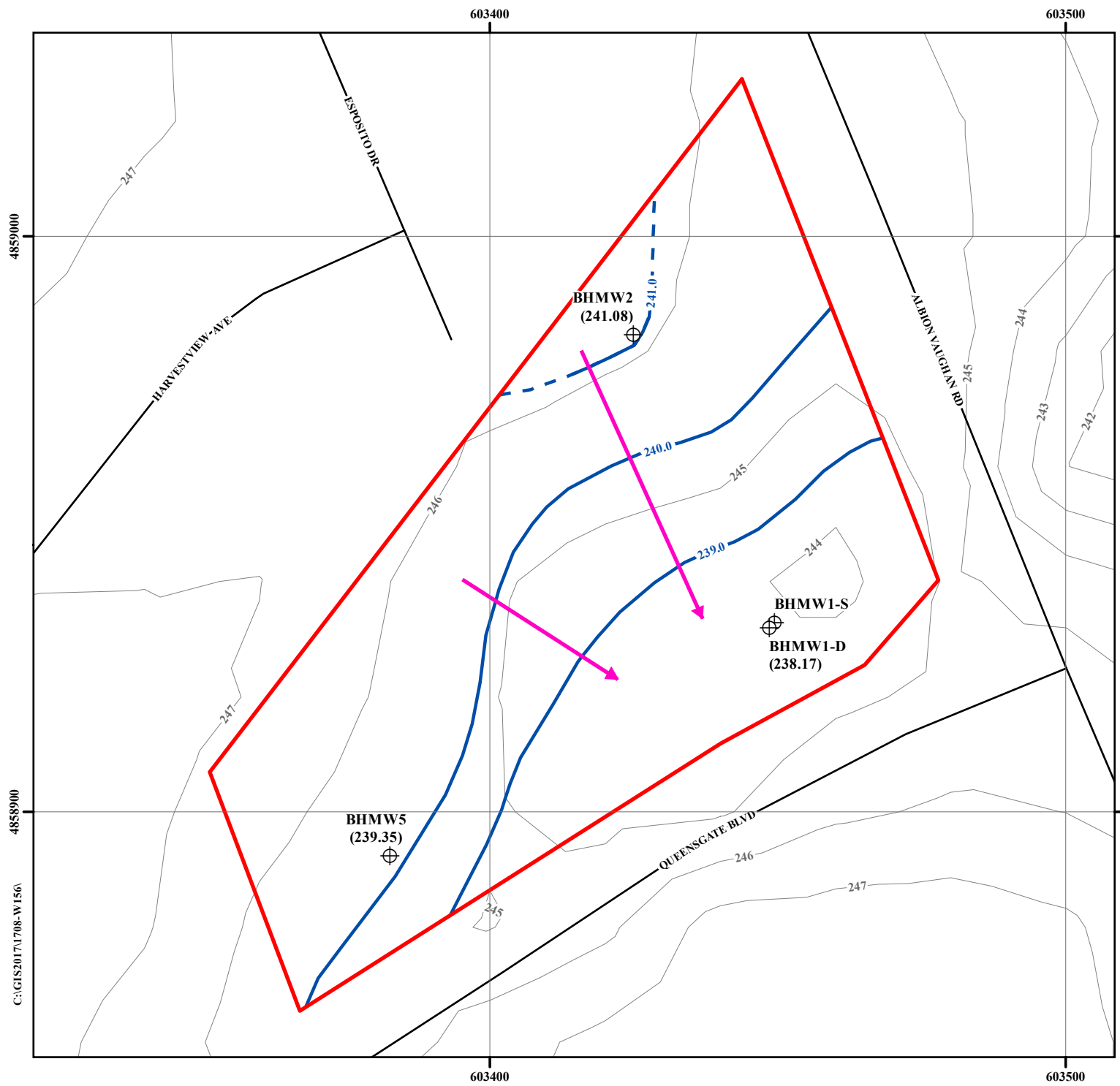
	Earth Fill		Water Table on October 13, 2017 Water Table on October 20, 2017 Water Table on October 30, 2017
	Silty Clay Till		
	Silty Clay		

**Soil Engineers Ltd.**  
CONSULTING SOIL, FOUNDATION & ENVIRONMENTAL ENGINEERS

Title: Geological Cross-Sections (A-A' and B-B')

Project: Hydrogeological Assessment  
Proposed Townhouse Development  
12944 Albion Vaughan Road, Town of Bolton

Reference No: 1708-W156	Date: January 2018	Scale: V 1:200	Scale: H 1:400	Drawing No. 8-2
----------------------------	-----------------------	-------------------	-------------------	--------------------



	Approximate Boundary of Subject Site
	Interpreted Shallow Groundwater Flow Direction
	Interpreted Shallow Groundwater Level Elevation (masl)
	Inferred Shallow Groundwater Level Elevation (masl)
	Local Road
	Topographic Contour (masl)
	239.53 Average Shallow Groundwater Level Elevation (masl)
Title: Shallow Groundwater Flow Pattern Plan	
Project:	
Hydrogeological Assessment Proposed Townhouse Development 12944 Albion Vaughan Road Town of Bolton	
Reference No. 1708-W156	
Date: September 25, 2017	
Scale:	
Drawing No. 9	

C:\GIS\2017\1708-W156\

603400

603500

4859000

4859000

4858900

4858900

603400

603500



# *Soil Engineers Ltd.*

CONSULTING ENGINEERS

GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE

---

90 WEST BEAVER CREEK ROAD, SUITE 100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

---

**BARRIE**  
TEL: (705) 721-7863  
FAX: (705) 721-7864

**MISSISSAUGA**  
TEL: (905) 542-7605  
FAX: (905) 542-2769

**OSHAWA**  
TEL: (905) 440-2040  
FAX: (905) 725-1315

**NEWMARKET**  
TEL: (905) 853-0647  
FAX: (905) 881-8335

**MUSKOKA**  
TEL: (705) 721-7863  
FAX: (705) 721-7864

**HAMILTON**  
TEL: (905) 777-7956  
FAX: (905) 542-2769

## **APPENDIX 'A'**

### **MOECC WATER WELL RECORDS SUMMARY**

**REFERENCE NO. 1708-W156**

## Ontario Water Well Records

WELL ID	MOECC WWR ID	Construction Method	Well Depth (m)**	Well Usage		Water Found (m)**	Static Water Level (m)**	Top of Screen Depth (m)**	Bottom of Screen Depth (m)**
				Final Status	First Use				
1	4900374	Cable Tool	87.78	Water Supply	Domestic	85.04	38.4	86.56	87.78
2	4905208	Rotary (Convent.)	101.80	Water Supply	Domestic	61.57	41.15	100.58	101.8
3	4903547	Boring	15.24	Abandoned-Supply	-	-	-	-	-
4	4903559	Cable Tool	86.26	Water Supply	Domestic	84.73	36.58	84.73	85.95
5	4900442	Cable Tool	88.39	Water Supply	Domestic	85.95	33.53	87.17	88.39
6	4903511	Cable Tool	74.98	Water Supply	Domestic	67.06	39.62	73.76	74.98
7	4900371	Boring	28.96	Water Supply	Domestic	22.86	22.86	-	-
8	6921416	Cable Tool	96.62	Water Supply	Domestic	96.62	32.61	95.40	96.62
9	6902575	Cable Tool	73.76	Water Supply	Domestic	71.63	27.43	72.24	73.46
10	7221971	Rotary (Convent.)	78.03	Water Supply	Domestic	75.59	33.53	75.59	78.03
11	6930407	Rotary (Convent.)	70.10	Water Supply	Domestic	68.00	34.13	66.44	70.10
12	6915455	Boring	21.03	Water Supply	Domestic	15.85	15.24	-	-
13	7190727	Rotary (Convent.)	54.25	Water Supply	Domestic	-	32.40	49.68	50.29

\*MOECC WWID: Ministry of Environment and Climate Change Water Well Records Identification

\*\*metres below ground surface



# *Soil Engineers Ltd.*

CONSULTING ENGINEERS

GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE

---

90 WEST BEAVER CREEK ROAD, SUITE 100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

---

**BARRIE**  
TEL: (705) 721-7863  
FAX: (705) 721-7864

**MISSISSAUGA**  
TEL: (905) 542-7605  
FAX: (905) 542-2769

**OSHAWA**  
TEL: (905) 440-2040  
FAX: (905) 725-1315

**NEWMARKET**  
TEL: (905) 853-0647  
FAX: (905) 881-8335

**MUSKOKA**  
TEL: (705) 721-7863  
FAX: (705) 721-7864

**HAMILTON**  
TEL: (905) 777-7956  
FAX: (905) 542-2769

## **APPENDIX 'B'**

### **SINGLE WELL RESPONSE TEST RESULTS**

**REFERENCE NO. 1708-W156**

### Falling Head Test (Slug Test)

Test Date: 30-Oct-17  
 Piezometer/Well No.: MW2  
 Ground level: 246.20 m  
 Screen top level: 241.63 m  
 Screen bottom level: 238.58 m  
 Test El. (at midpoint of screen): 240.11 m  
 Test depth (at midpoint of screen): 6.095 m  
 Screen length L= 3.05 m

Diameter of undisturbed portion c 2R= 0.22 m  
 Standpipe diameter 2r= 0.05 m  
 Initial unbalanced head Ho= -0.191 m  
 Initial water depth 5.12 m

Aquifer material: **SILTY CLAY TILL**

Shape factor  $F = \frac{2 \times 3.14 \times L}{\ln(L/R)} = 5.768005054 \text{ m}$

Permeability  $K = \frac{3.14 \times r^2}{F \times (t_2 - t_1)} \times \ln(H_1/H_2)$  (Bouwer and Rice Method)

$\frac{\ln(H_1/H_2)}{(t_2 - t_1)} = 0.000319176$

$K = 1.1E-05 \text{ cm/s}$   
 $1.1E-07 \text{ m/s}$

