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A REPORT TO
MILLFORD DEVELOPMENT LIMITED

A HYDROGEOLOGICAL STUDY FOR PROPOSED RESIDENTIAL DEVELOPMENT

NORTHEAST OF YONGE STREET AND EAGLE STREET

TOWN OF NEWMARKET

Reference No. 1102-W017

APRIL 2011

DISTRIBUTION

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1.0 INTRODUCTION

In accordance with written authorization dated February 9, 2011, from Ms. Angela Orsi of Millford Development Limited, a hydrogeological study was carried out for a property located east of Yonge Street, on the north side of Eagle Street, Town of Newmarket, for a proposed Residential Development.

The purpose of the study is to assess the baseline groundwater conditions at the site. This includes the following tasks:

- Mapping of groundwater flow patterns;
- Characterization of groundwater and surface water quality with respect to nutrients;
- Development of pre- and post-development water balances, and
- Provide comments on potential land development impacts to the watercourse (Western Creek) that traverses the north part of the site.

Our findings and recommendations are presented in this Report.

2.0 BACKGROUND

Previous site investigations include the following:

- Slope Stability and Geotechnical Investigation completed by Soil Engineers Ltd. (SEL) in 2004 (Report Reference No. 0409-S004, dated October 2004)
- Phase 1 Environmental Assessment completed by SEL in 2009 (Report Ref No. 0907-E017, dated July 31, 2009)
- Limited Phase 2 Environmental Site Assessment completed by SEL in 2009 (Report Reference No. 0907-E017, dated December 18, 2009).
- Environmental Impact Study (EIS) by Azimuth Environmental Consulting Inc. in 2008.
- Functional Servicing and Stormwater Management Report, Proposed Mixed Density Condominium Residential Development, Millford Development Limited, Town of Newmarket, by Masongsong Associates Engineering Ltd. March 2011.

2.1 Sources of Information

Information used to prepare this report was gathered from the following sources:

- Site visits to conduct water quality sampling at observation wells and the on-site watercourse (Western Creek);
- Completion of in situ slug tests at observation wells to estimate the hydraulic conductivity (K) of groundwater bearing soils;
- Collection and analysis of surficial soils to estimate infiltration of precipitation;
- Groundwater level measurements at the observation wells;

- Surveying the observation wells to determine their geodetic elevations;
- Review of climactic data from nearby weather stations to determine long-term averages for monthly temperature and precipitation;
- Review of the proposed development plans for the site.

3.0 SITE AND PROJECT DESCRIPTION

The subject property is located on the north side of Eagle Street, east of Yonge Street, and encompasses Part Lots 2 and 3, Registered Plan 49, in the Town of Newmarket. The municipal address of the site is 55 Eagle Street.

The site is currently a field covered with bushes and, weeds with some tree cover concentrated toward the northwest side of the property. The site comprises an area of approximately 5.0 ha. The ground surface of the tableland is gently sloping land, descending gently towards the northeast to the valley bordering the northern limits of the site. The bank height varies from 2.5± to 8.5± m and slopes down to a relatively flat flood plain that contains the Western Creek, a tributary of the East Holland River. The flat portion of the creek bank is most prominent towards the centre and east part of the site where the creek bank has developed into a meander belt. The meander belt is subject to periodic flooding. The adjacent lands are existing residential and commercial properties.

The proposed project consists of a 12-storey condominium apartment building, with 2 levels of underground parking and on-grade paved parking facilities, 38 townhouses and on-site stormwater management facilities. The project will be provided with full municipal services and access roadways.

4.0 FIELD WORK

4.1 Borehole Drilling and Observation Well Construction

The field work, consisting of 6 boreholes to depths ranging from 3.5 to 15.7 m, was performed between February 24 and March 1, 2011, at the locations shown on the Borehole and Monitoring Well Location Plan and Subsurface Profile, Drawing No. 1. The current boreholes have been numbered in the 100-series in order to differentiate them from the previous boreholes drilled in 2004 and 2009, the locations of which are also shown on Drawing No. 1.

The holes were advanced at intervals to the sampling depths by a track-mounted, continuous-flight power-auger machine equipped for soil sampling. Standard Penetration tests, using the procedures described on the enclosed "List of Abbreviations and Terms" were performed at the sampling depths. The test results are recorded as the Standard Penetration Resistance (or 'N' values) of the subsoil. The relative density of the granular strata and the consistency of the cohesive strata are inferred from the 'N' values. Split-spoon samples were recovered for soil classification and laboratory testing.

Detailed descriptions of the encountered subsurface conditions are presented on the Borehole Logs, figures 1 to 8, inclusive. The borehole logs from our previous investigations in 2004 and 2009 are included in Appendix 'A'.

In all six of the boreholes, a groundwater monitoring well, 50 mm in diameter, was installed. The wells were constructed with 1.5 m slotted screens and riser pipes, backfilled with appropriate filtering sand material, sealed with bentonite, and capped with a flush-mount, steel protective casings. The depths of the monitoring wells are shown on the borehole logs. The wells were installed to facilitate the groundwater level measurements, groundwater sampling and performance of in situ testing to estimate hydraulic conductivity of water-bearing soil.

Single-well installations were completed at BH 101 through BH 104. At Boreholes 105 and 106, located on the south bank of Western Creek, nested wells were constructed, with one shallow and one deep 50 mm diameter monitoring observation well comprising each nest. The wells were constructed using 1.5 m length slotted screens and riser pipes, backfilled with appropriate filtering sand material and bentonite to the ground surface. The well construction details are shown on the borehole logs.

The field work was supervised and the findings recorded by a Geo-Environmental Technician.

The elevation at each of the borehole locations was determined with reference to the top of a catch basin on the north side of Eagle Street where a geodetic elevation of 261.66 masl was previously determined from a Topographic Survey of Part of Lots 2 and 3, Registered Plan 49, dated February 25, 2003, prepared by Young and Young Surveying Inc.

4.2 **Water Quality Sampling and Analysis**

The groundwater levels in the wells were recorded on three separate occasions after installation. On each occasion, the following activities were also performed at the observation wells:

- Purging and development of observation wells prior to sampling;
- Groundwater sampling, and

- Performance of in situ single response slug tests to estimate hydraulic conductivity.

On March 3, 2011, each of the observation wells underwent development to remove stagnant groundwater, and remnants of drilling mud introduced to the wells during construction. This was accomplished by removing several litres of groundwater from each observation well using dedicated bailers.

Groundwater samples were collected from the observation wells on March 4, 2011, using dedicated bailers. At the time of sampling, the pH, electrical conductivity, total dissolved solids and temperature parameters for the groundwater were measured and recorded. These field measurements were made using a calibrated Hanna™ multi-metre water quality probe. The groundwater samples were maintained at a temperature of 4° C prior to submission to the analytical laboratory.

Surface water from Western Creek also underwent sampling and analysis for selected inorganic and nutrient parameters on March 4, 2011. At the time of sampling, field parameters for pH, electrical conductivity, total dissolved solids and temperature were also recorded.

The water quality was evaluated with respect to the Ontario Drinking Water Standard (ODWS), Regulation 153/04 (Table 3) for potable groundwater and the Provincial Water Quality Objectives (PWQO) for surface water.

4.3 Hydraulic Conductivity Testing

Hydraulic conductivity (K) estimates were determined for saturated soils at the depths of the observation well screens on March 8, 2011. Selected soil samples were obtained from the surface of the Western Creek bank to establish soil texture for the estimation of infiltration of precipitation. The soil textures were confirmed by grain size analysis, and the results are presented on Figures 9 and 10. The results of the grain size analyses from the 2004 geotechnical study were reviewed to establish infiltration properties at the surface of the table lands of the subject lands; the results (Figures 13 to 19 from the 2004 report) are included in Appendix 'B'.

The K tests were conducted by introducing a sand-filled slug cylinder, approximately 1 m in length, into the observation wells to displace the groundwater level upward. After the slug was introduced, the natural rate of groundwater recovery (i.e. falling groundwater head) to static conditions was measured using a pressure transducer data logger (Model: Solinst 3001™). The graphical interpretation of the groundwater level recovery was used to estimate the K for each well. The Bower-Rice method was used to interpret the recovery plots to estimate K.

5.0 SUBSURFACE CONDITIONS

The Town of Newmarket is situated on Schomberg Lake (glacial) clay plain where the drift has been partly eroded and filled, in places, with lacustrine clay, silt and sand. The mapped surficial soil for the site is shown on the Quaternary Geology Plan, Drawing 2.

As noted, detailed descriptions of the encountered subsurface conditions are presented on the Borehole Logs, comprising Figures 1 to 8, inclusive, and the revealed stratigraphy is plotted on the subsurface profile on Drawing No. 1. The hydrogeological interpretations are discussed herein.

Beneath the surficial topsoil and earth fill layers, the site is underlain by strata of sandy silt till and silty clay. In places, strata of silty sand and sandy silt till, and silt, were encountered. Our previous geotechnical study in 2004 identified an isolated layer of charcoal beneath the earth fill in the upper soil stratigraphy at Borehole 4. A second topsoil layer was found beneath the earth fill at Borehole 103 from the current investigation.

The boreholes advanced along the south bank of Western Creek revealed a thin veneer of topsoil overlying sand, silty sand and silty clay tills, and silty clay.

5.1 **Topsoil and Topsoil Fill** (All Boreholes)

The current investigation revealed surficial topsoil and earth fill layers ranging in thickness from 15 to 60 cm, and a second layer of topsoil up to 1.6 m thick was encountered beneath the earth fill at Borehole 103. The topsoil and earth fill are dark brown in colour, indicating that they contain appreciable amounts of roots and humus. The topsoil layer in the creek corridor (meander belt) is generally thinner than the topsoil horizons beneath the table lands, having a thickness of approximately 15 cm at both Boreholes 105 and 106.

5.2 **Earth Fill** (Boreholes 101, 102, 103 and 104)

The earth fill underlies the topsoil layer and measures 0 .3± to 2.7 ± m in thickness and it is amorphous. It consists mainly of silty clay and some silty sand with variable amounts of roots and topsoil inclusions.

The natural water content values of the earth fill range from 12% to 27%, with a median of 20%, showing that the fill is very moist to wet condition, being generally wet. The high water content is likely due to the presence of topsoil inclusions in the fill.

5.3 **Sandy Silt Till and Silty Sand Till** (Boreholes 101, 103, 104, and 105)

The sandy silt and silty sand till generally predominate the revealed soil stratigraphy. The tills consist of a random mixture of particle sizes ranging from clay to gravel, with the silt or sand being the predominant fractions. The soils are heterogeneous in structure, indicating they are glacial deposits. The tills contain occasional sand and silt seams and lenses.

The water content values of the sandy silt and silty sand till samples were determined and the results are plotted on the Borehole Logs. The values range from 7% to 15% with a median of 11%, showing that the tills are damp to moist, being generally moist.

The results of the grain size analyses for the silty sand till from our 2004 geotechnical investigation are included in Appendix 'B' (Figures 14 and 15). The results of the grain size analysis performed on one sample for our current study are presented on Figure 9.

5.4 **Silty Clay** (Boreholes 102 and 106)

The silty clay was encountered beneath the topsoil and silty clay fill at Borehole 102 and beneath the topsoil at Borehole 106 in the creek meander belt.

The silty clay found at the creek meander belt bank has a varved structure with silt layers, suggesting it is an alluvial deposit.

The water content was determined and the results are plotted on the Borehole Logs. The values range from 21% to 31%, with a median of 26%, showing that the silty clay is moist to very moist, being generally in a very moist condition.

Grain size analyses were performed on 2 representative samples of the silty clay for our 2004 investigation, and the results are included in Appendix 'B' (Figure 16). A grain size analysis was performed on one sample of silty clay from Borehole 106 in the meander belt, and the results are plotted on Figure 10.

5.5 **Silty Clay Till** (Boreholes 101, 102, 103, 104, and 105)

The clay till is heterogeneous and amorphous in structure, indicating that it is a glacial deposit. The clay till was found in all of the boreholes on the table land, and was present at a depth of approximately 1.0 m at Borehole 105 in the meander belt creek bank.

Hard resistance to auguring was encountered and occasional cobbles and boulders are embedded in the till at Boreholes 102 and 104.

The water content was determined and the results are plotted on the Borehole Logs. The values range from 8% to 19%, with a median of 14%, showing the silty clay till is moist to very moist, being generally moist.

A grain size analysis was performed ion one sample of the silty clay till in 2004; the results are included in Appendix 'B' (Figure 17).

5.6 **Silty Sand** (Boreholes 101 and 104)

The silty sand was encountered below the silty sand till at a depth of 2.3 m at Borehole 101 and beneath the buried topsoil at Borehole 104 at a depth of 3.0 m below the ground surface. Rock fragments were present in the silty sand in Borehole 101. At both boreholes, the silty sand deposits were less than 1 m thick and occurred at relatively shallow depths.

The water content was determined and the results are plotted on the Borehole Logs. The values range from 9% to 13%, with a median of 11%, showing that the silty sand is damp to moist, being generally moist.

A grain size analysis was performed on one sample of the silty sand in our 2004 geotechnical investigation, and the results is included in Appendix 'B' (Figure 18).

5.7 **Fine Sand** (Borehole 101)

The fine sand was found in the lower zone of the revealed stratigraphy beneath the silty sand till deposits at a depth of 15.2 m. It is described as wet and dense with and 'N' value of over 50. The sand was contacted at the termination depth of the borehole (15.4 m), and its thickness is unknown.

The determined water content of the sand is 9%, showing it is in a very moist condition. Due to the pervious nature of the sand, some of the water may have drained during sampling and the determined value may not represent the actual water content.

6.0 GROUNDWATER CONDITIONS

The groundwater levels in the monitoring wells were measured on three separate occasions, and the measured levels are given in Table 1 below:

Table 1 - Groundwater Levels

BH ID	Well Depth (mbgl)	Measured Water Level					
		March 3, 2011		March 8, 2011		March 22, 2011	
		Depth (mbgl)	El. (masl)	Depth (mbgl)	El. (masl)	Depth (mbgl)	El. (masl)
101	15.2	4.59	260.99	4.39	261.19	1.66	263.92
102	15.2	4.32	256.51	9.44	251.39	4.86	255.97
103	15.2	3.60	154.46	3.40	254.66	2.97	255.09
104	15.2	4.57	256.68	4.38	256.87	3.07	258.18
105(s)	1.5	-	-	0.85	253.51	0.68	253.68
105(d)	3.0	2.2	252.16	0.78	253.58	0.62	253.74
106(s)	1.5	-	-	0.27	252.90	0.18	252.99
106(d)	3.0	0.51	252.66	1.37	252.80	0.28	252.89

Notes: s – denotes shallow well installation
d – denotes deep well installation, mbgl – metres below existing grade level, masl – metres above sea level

Groundwater was detected at depths ranging from 0.5 to 4.6 m below the existing grade. Groundwater seepage was encountered at various depths and is mainly derived from infiltrated precipitation trapped in the fissures in the weathered soils, in the sand and silt seams and layers in the tills and clay.

The soil colour changes from brown to grey at depths ranging from 0.8 to 11.1 m below the ground surface. The previous geotechnical study (SEL, 2004) indicates that the transition occurs at the depth range of 5.8 to 11.4 m below the ground surface. Within the creek channel meander belt bank, the grey/brown transition occurs at much shallower levels, in the depth range of 0.8 to 2.3 m. The brown colour indicates that the soils have oxidized. Based on the water content profile and the above information, the permanent groundwater regime generally lies in the grey soils. However, in places, the seepage level encountered in the brown soils during augering indicates that perched groundwater derived from infiltration precipitation will occur at shallow depths in wet seasons. Any perched water at shallow depths is expected to drain quickly upon excavation. Therefore, any associated groundwater seepage from perched water in the till and clay soils should only persist for a short duration during excavation.

6.1 Shallow Groundwater Flow

The site plan illustrating the shallow groundwater flow patterns is shown on Drawing 3. Shallow groundwater flow generally follows the topographic relief, in this case migrating from southwest to northeast across the site in directions that are perpendicular to the groundwater elevation contours shown on Drawing 3.

Although groundwater shows some migration towards Western Creek, this is primarily due to the low elevation of the creek channel relative to the table lands. Review of the soil stratigraphy indicates the abundance of relatively impervious clays and tills that persist to depth elevations below the bottom of the Western Creek channel at most locations across the site.

6.2 Hydraulic Conductivity Estimates

The individual recovery response curves and K estimates are shown in Appendix ‘C’. The Bower Rice method was used to interpret the single response slug tests for the estimation of K. The K estimates are summarized in Table 2.

Table 2 - Hydraulic Conductivity (K) Estimates

BH ID.	Soil At Depth of Screen	Screen Elevation Interval (masl)	Hydraulic Conductivity Estimate (cm/s)
101	Silty Sand Till/Fine Sand	251.9 – 250.4	8.4×10^{-5}
102	Silty Clay till	247.1 – 245.6	$< 1.0 \times 10^{-6}$
103	Silty Sand till/Silty Clay Till	244.4 – 242.9	1.1×10^{-5}
105	Silty Clay till	252.9 – 251.4	1.7×10^{-6}
106	Silty Clay	251.7 – 250.2	2.8×10^{-6}

The hydraulic conductivity (K) tests suggest that groundwater yields from the clay and silty clay till will be minimal. The results suggest that the yield for the silty sand till/fine sand layers at MW101 will be moderately higher. It should be noted that the well screen for MW101 was installed at the bottom of the silty sand till and above a fine sand unit of unknown thickness, and the K test result for MW101 is more indicative of silty fine sand.

The hydraulic conductivity estimates for the surficial soils are based on the grain size distribution for the shallow soils, and, as noted, the gradations from the previous soil investigation in 2004 are included in Appendix 'B'. The results of the grain size analyses for the shallow soils within the meander belt creek bank are shown on Figures 9 and 10. The grain size distribution for the silty clay till and clay (near surface) suggests that the hydraulic conductivity will be in the range of 1.0×10^{-6} to 3.0×10^{-6} cm/s.

6.3 Aquifer Soils

The previous geotechnical study (SEL, 2004) suggested that the water-bearing sand deposit occurs at a depth of 10.0 or + m below the prevailing ground surface in

Boreholes 2 and 3, and a water-bearing silt deposit occurs at a depth of 3.0± m in Borehole 12, but that the presence of these two deposits is localized. The conclusions from the 2004 investigation have been confirmed by the current study, verifying that no significant, deep water-bearing sand deposits were encountered within the 15 m depth of the boreholes. Instead, isolated sands were contacted between depths of 2.3 m and 3 m depth at Boreholes 101 and 104, respectively. In the creek channel meander belt bank, a thin layer of surficial sand occurs below the topsoil to a depth of less than 1 m. Beneath the surficial topsoil and sand, silty clay till and alluvial clay persists beneath the bottom of the Western Creek channel. The presence of clay and till deposits below the bottom of the creek channel indicates that there is no significant aquifer in close proximity of the Western Creek channel bottom.

The hydraulic conductivity estimate for the silty sand till and fine sand at MW101 is about 9.0×10^{-5} cm/s, indicating that there may be some limited groundwater migration towards the creek beneath the table lands at the northwest part of the site. It should be noted that the lowest elevation for the bottom of the Western Creek channel near the northwest part of the site is at about 256.5 masl, which is significantly higher than the top of the fine sand (El 250.4 masl) encountered at MW101. The sand deposits at Borehole 2 (SEL, 2004) occur between the elevation range of 254.0 to 255.4 masl. A review of the soil stratigraphy for this part of the site suggests that the sand deposits beneath the northwest table lands are isolated, and may not contact the soils at the channel bottom of Western Creek at the west part of the site.

Within the creek channel meander belt, layers of silty clay till and clay occur beneath relatively shallow thin topsoil and surficial sand deposits. The water in the shallow sands of the creek channel meander belt bank is derived from precipitation and snow melt, and accompanying higher flows and flooding events in the Western

Creek. Beneath the surficial silt and sands of the creek channel meander belt bank, the clay and silty clay till deposits occur at relatively shallow depths, as shown at Boreholes 105 and 106. The till deposits are interpreted as being of glacial origin while the sand silt and clay deposits are interpreted as being alluvial deposits. The strong meander pattern for the Western Creek bank suggests that till and clay persist at shallow depths beneath the entire length of the Western Creek meander belt bank on site.

7.0 WATER QUALITY

Both groundwater and surface water were characterized as part of the study. Groundwater samples were obtained from the four deep observation wells at the table lands and from the two deeper nested well locations within the creek channel meander belt bank. In addition, two surface water samples were obtained from Western Creek. The surface water and groundwater samples were collected on March 4, 2011. The locations of the monitoring wells and the surface water sampling locations are shown on Drawing No. 4. The samples were submitted to Agat Laboratories for analyses for major nutrients and anions along with field parameters including pH, temperature and electrical conductivity. The results are presented on the Certificates of Analyses included in Appendix 'D'.

7.1 Groundwater Sample Results

The results of the groundwater quality testing are evaluated against the Ontario Drinking Water Standards (ODWS) and the Table 1 Potable Water Standards from O. Reg. 153/04. The results indicate that the samples meet the Table 1 criteria and the ODWS for nitrate, nitrite, and chloride. It should be noted that there are no ODWS or Table 1 potable water standards for the major nutrient parameters, including total phosphorous, ortho-phosphorus, Total Kjeldahl Nitrogen (TKN) and ammonia in groundwater. These nutrient parameters were analysed to evaluate potential impacts from groundwater on the surface water quality of the nearby Western Creek. To accomplish this, these nutrients were evaluated to the Provincial Water Quality Objectives (PWQO) which are applicable to surface water quality. To interpret potential groundwater impacts to surface water quality, groundwater results were also evaluated to the PWQO, where applicable, as summarized in Table 3 below.

Table 3 - Groundwater Quality Evaluation

Parameter	MW 101	MW 102	MW 103	MW 104	MW 105 (d)	MW 106 (d)	PWQO Standard
pH ¥	8.13	8.25	8.44	8.34	7.64	7.40	6.5 – 8-5
Temperature (° C) ¥	6.7	6.0	7.6	7.4	6.2	6.0	##
Electrical Conductivity (µs/cm) ¥	575	505	602	450	1,270	1,263	NV
Ammonia (mg/L)	0.03	0.12	0.04	0.08	<0.10	<0.10	NV
Chloride (mg/L)	65.0	57.3	35.7	36.5	175.0	90.1	250 **
Un-ionized Ammonia (mg/L) #	0.006	0.0028	0.0016	0.0026	0.0001	0.0001	0.02
Total Phosphorus (mg/L)	**0.05**	**0.05**	**0.05**	**0.06**	**0.06**	**0.10**	0.02
Ortho – Phosphorus (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	NV
Nitrate as N (mg/L)	<0.05	0.48	0.10	0.33	0.70	<0.05	2.9 *
Nitrite as N (mg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NV
TKN (mg/L)	0.13	0.69	0.20	0.23	0.72	0.17	NV

Notes: **bold** – exceeds standard
NV – no standard
¥ – field measurements
\# calculated parameter
** No PWQO guideline Groundwater standard used for comparison
* No PWQO guideline, Canadian Water Quality Guideline adopted for surface water
\## criteria varies for protection of aquatic habitat, is based on background temperature of receiving surface water body

The results indicate that background levels for total phosphorous marginally exceed the PWQO standard of 0.02 mg/L for protection of surface water against eutrophication. All of the other parameters analysed meet the PWQO where standards exist. Background levels of chloride suggest ubiquitous impacts from road salt applied during winter de-icing, although the levels in groundwater meet the applicable groundwater standards.

7.2 Surface Water Sample Results

The two surface water samples obtained from Western Creek underwent analysis for the same anions and major nutrients as the groundwater samples. The surface water quality results were evaluated against the PWQO as shown in Table 4, below.

Table 4 - Surface Water Quality Evaluation

Parameter	SE	SW	PWQO Standard
pH ¥	8.10	7.98	6.5 – 8-5
Temperature (° C) ¥	4.5	3.3	##
Electrical Conductivity (ms/cm) ¥	2,610	2,640	NV
Ammonia (mg/L)	0.02	0.03	NV
Chloride (mg/L)	**633**	**640**	250 **
Un-ionized Ammonia (mg/L) #	0.003	0.003	0.02
Total Phosphorus (mg/L)	**0.06**	**0.09**	0.02
Ortho – Phosphorus (mg/L)	<0.2	<0.2	NV
Nitrate as N (mg/L)	2.62	2.69	2.9 *
Nitrite as N (mg/L)	<0.10	<0.10	NV
TKN (mg/L)	0.62	0.69	NV

Notes: **bold** – exceeds standard
NV – no standard
¥ – field measurements
calculated parameter
* No PWQO standard, Canadian Water Quality Guideline adopted as standard for surface water
** No PWQO standard, therefore groundwater standard used for comparison
criteria varies for protection of aquatic habitat, is based on background temperature of receiving surface water body

The surface water results indicate that the quality marginally exceeds the PWQO standard for total phosphorous at both sample locations. These results are similar to the groundwater results and may represent ambient background conditions for surface water bodies in the area.

Background levels of chloride in the surface water samples exceed the Table 1 (Regulation 153/04) potable groundwater standard, however there is no PWQO for chloride in surface water. The elevated chloride results suggest ubiquitous impacts from road salt application for de-icing to surface water bodies during late winter and early spring. These levels are considered typical for urbanized areas.

8.0 GROUNDWATER/SURFACE WATER INTERACTION

Although Western Creek is located on the north slope of the Oak Ridges Moraine, and may receive groundwater input further upstream of the site, there is no significant input of groundwater to the creek from the subject site as confirmed from review of the soil stratigraphy from the borehole logs, and the assessment of hydraulic conductivity for water bearing soils.

Chloride concentrations for local groundwater are substantially less than those of surface water in Western Creek, further supporting the conclusion that there is minimal groundwater input to the on-site reach of Western Creek.

The water level elevations at the MW105 well nest, adjacent to the creek, suggest a very weak upward vertical hydraulic gradient for groundwater, and a weak downward gradient at the MW106 well nest further east. Given the impervious nature of the soils at both well nests, the contribution of groundwater to the creek appears to be minimal and insignificant.

9.0 WATER BALANCE

9.1 Pre-Development Water Balance

The water balance calculations for the site are based on the following equation:

$$P = ET + R + I + \Delta s$$

where: P = precipitation

ET= evapotranspiration

R = surface runoff

I = infiltration (groundwater recharge)

Δs = 0 change in groundwater storage

Precipitation

An Environment Canada meteorological station, from which long-term precipitation records are available, is present at the Bradford Muck Research Station about 10 km west of the site. The 30 year record of precipitation (1971 to 2000) is available from the Bradford Muck Research Facility (Station ID 6150863) which is situated at an elevation of 221 masl. The 30-year mean annual precipitation at this station is 815.4 mm/year. Therefore, a mean annual precipitation (P) of 815.4 mm/year has been used for the water balance calculations.

Although groundwater storage experiences gains and losses on a short-term basis, the net change in groundwater storage (Δs) on a long-term basis is generally zero. For this reason, the change in groundwater storage (Δs) is shown as zero and not included in the evaluation.

Evapotranspiration

In general, evapotranspiration (ET) refers to water loss from vegetated surfaces to the atmosphere. The term considers evaporation (e.g. from the soil surface) from man-made infrastructure (i.e. asphalt and concrete surfaces) and transpiration from plants and trees together because of the difficulties involved in separating these processes. Potential ET refers to the water loss from a vegetated surface to the atmosphere under conditions of unlimited water supply. The actual rate of evapotranspiration (AET) is generally less than the potential rate under dry conditions (e.g., during the summer season when there is a soil moisture deficit). Chart 40 from the Climate of the Great Lakes Basin (Environment Canada, 1972) suggests that actual evapotranspiration is about 546 mm/yr (21.5 in./yr) over the Bradford-Newmarket area. Simulations from the Thornthwaite and Mather model developed by the US Geologic Survey indicate that evapotranspiration ranges from 542 to 564 mm/year for soils having a moisture holding capacity ranging from -100 to -200 mm. This range agrees well with the Chart 40 mapped values. Variation in evapotranspiration typically depends on soil type and rooted vegetation. Surface soils are generally silts and clay while vegetation comprises primarily grass and deciduous trees. Much of the study area is vacant field overgrown with weeds, with some tree cover which is concentrated toward the north and west parts of the site. Therefore, due to the existing tree and grass cover, an evapotranspiration estimate of 550 mm/year was used for the water balance calculations. The 550 mm/year estimate used was the value determined by the Thornthwaite and Mather simulation model for soil having a moisture holding capacity of -150 mm.

Infiltration

Most of the site area is vacant land covered by vegetation. The land slope varies across the site due to the presence of the Western Creek valley that runs through the middle of the property. The slope has a strong influence on infiltration, as does the surficial soil texture. The site area is about 5.2 ha, being 45.5% gently sloping (rolling) table land, 29.9% moderately sloping land (hilly) for the creek valley side slopes, and 24.6 % relatively flat meander belt creek bank surfaces. The pre-development surface coverage in square metres, as subdivided based on slope and topography, is given in Table 5 below.

Table 5 - Topographic Area Coverage

Land Slope Type	Percentage of Site	Site Areal Coverage (m^2)
Tablelands – Gentle Slope	45.5 %	23,734
Creek Valley – Hilly Slope	29.9%	15,597
Meander Belt Creek Bank – Gentle to Flat Slope	24.6%	12,832

The difference between the amount of precipitation and evapotranspiration gives a water surplus of 265.4 mm/year. Depending on the existing surficial soil, vegetation cover and slope, a portion of the water surplus is available to recharge groundwater as infiltration, with the balance being runoff. Surficial soils range from silty clay till across the east part of the site to sandy silt and silty sand till across the western part of the site. It is expected that infiltration rates for the silty sand/ sandy silt till will be slightly higher than for the silty clay/clayey silt tills. The earth fill at the surface is a mixture of primarily silt and clay with some sand. To develop a conservative infiltration estimates, the earth fill has been classified along with silty clay till since most of the surficial fill in the 2004 SEL geotechnical logs is described as being silty clay. The percentage of site surface that can be classified into the two broad soil types is summarized in Table 6.

Table 6 - Surficial Soil Coverage

Surficial Soil Type	**Percentage of Site**	**Site Area Coverage (m^2)**
Silty Clay and Clayey Silt Till	51 %	26,603
Sandy Silt and Silty Sand Till	49 %	25,560

Based on the minor differences in surficial soil texture and taking into account the differences in land slope, infiltration factors have been developed for the site. The factors are adopted from the MOE guidance manual (MOEE, 1995) identifying hydrogeologic technical information required to support land development applications. The infiltration factors in the guidance manual consider surficial soil cover, slope and vegetative cover. The factors are applied to the water aforementioned determined surplus value of 265.4 mm/year to estimate infiltration rates for the site.

Table 7 - Selection Infiltration Factors

Soil Factor	**Slope Factor**	**Vegetative Cover Factor**
Impervious Clay **0.10**	Hilly Land (2 to 5 % slope) **0.10**	Cultivated fields 0.1
Clay and Loam (sand and silt) **0.20**	Rolling Land (0.3 to 0.4% slope) **0.20**	Woodland **0.20**
Open Sandy Loam (sand and silt) 0.30	Flat land (gentle slope) **0.30**	

The infiltration factors selected for the site are shown in bold in Table 7 to reflect the site's existing surficial soil, slope and vegetation conditions. The cumulative factors shown in Table 8 represent the sum for soil, slope and vegetative cover selected for the land coverage. When the cumulative factors are applied to the water surplus estimate of 265.4 mm/year, infiltration factors and estimates can be developed as summarized below in Table 8. Based on the aerial distribution for soils and topographic coverage, the site has been subdivided into 6 areas for the application of different infiltration rates.

Table 8 - Infiltration Estimates

Cumulative Infiltration Factor	Land Selection From Table 7	Infiltration Rate (mm/yr)	% of the Site
0.40	Impervious clays, woodland, hilly valley slopes	106.2	7.0
0.50	Impervious clay, woodland, rolling table land (gentle slope)	132.7	30.0
0.60	Impervious clay, woodland, flat creek bank land (minimal slope)	159.2	13.5
0.50	Clay and loam (sand/silt), woodland, hilly valley slopes	132.7	23.1
0.60	Clay and loam (sand/silt), woodland, table land (gentle slope)	159.2	15.2
0.70	Clay and loam (sand/silt), woodland, Flat creek bank land (minimal slope)	185.8	11.2

The groundwater recharge rates are calculated by applying the infiltration rates from Table 8 to the site areas where the rates apply. The calculated groundwater recharge estimates are then used to complete the water balance for the site. The remainder of the estimated 265.4 mm/year of surplus water leaves the site as runoff. The estimated runoff rate is calculated from the weighted difference between the water surplus multiplied by the site area and the overall calculated site recharge volume. The breakdown for the groundwater recharge rates and estimated runoff are shown in Table 9.

Table 9 - Groundwater Recharge and Runoff Estimates

Land Selection From Table 7	Site Area (m^2)	Calculated Groundwater Recharge (m^3/yr)	Estimated Runoff Volume (m^3/yr)
Impervious clays, woodland, hilly valley slopes	3,651.4	387.8	581.3
Impervious clay, woodland, rolling table land (gentle slope)	15,649	2,076.6	2,076.6
Impervious clay, woodland, flat creek bank land (minimal slope)	7,042.1	1,121.1	747.9
Clay and loam (sand/silt), woodland, hilly valley slopes	12,049.7	1,599	1,599
Clay and loam(sand/silt), woodland, table land (gentle slope)	7,928.8	1,262.3	842
Clay and loam (sand/silt), woodland, Flat creek bank land (minimal slope)	5,842.3	1,085.5	465
Totals	**52,163.3**	**7,532.3**	**6,311.8**

The pre-development recharge estimate for the site is the sum of the recharge volumes listed in Table 9, for an overall site estimate of 7,532.3 m^3/year. The weighted infiltration average for the site is determined by dividing the total site recharge (Table 9) by the total site area (5.2 ha), giving an estimate of 144.4 mm/year. Using the total site area (5.2 ha) and total runoff volume shown in Table 9, the calculated runoff rate for the site is 121 mm/yr. It should be noted that the total site runoff is exclusive of flow in Western Creek which is not included in the calculation since much of the flow passes through the site with minimal contribution from the site except for runoff.

The pre-development water balance in mm is shown as follows:

$$P\ (815.4) = ET\ (550) + R\ (121) + I\ (144.4) + \Delta s\ (0)$$

9.2 **Post - Development Water Balance**

The proposed development will comprise 38 townhomes, a 12-storey condominium building, and associated outdoor parking, roadways and sidewalks. The estimated site coverage by building structures, parking facilities and roadways is 12,640 m^2.

Runoff from the impermeable surfaces is typically directed to the storm water management facility at the east side of the site.

The loss of infiltration from construction of developed structures will amount to a water volume of about 3,355 m^3 /year under the assumption that all of the developed surfaces will be impermeable, such that the available water surplus here becomes available as runoff. The loss of infiltration and corresponding groundwater recharge equates to a weighted site infiltration value of 80.1 mm/year, a loss of 64.3 mm/year from the pre-development value, and the corresponding weighted site runoff will increase to 185.3 mm/year, a corresponding increase of 64.3 mm/year from the pre-development value.

9.3 **Maintaining Water Balance**

Efforts should be made to maintain the pre-development water balance where possible. Although the existing surficial soils comprise tills and fill having large fractions of silt and clay, they are unlikely to be suitable for infiltration of large quantities of storm water using lot level soak-away pits due to their expected slow percolation rates.

Alternatives to promote infiltration of storm water may include the following:

- Perforated pipes constructed beneath the parking lots and access roadways;
- Directing roof leaders and catch basin water to infiltration galleries;
- Use of permeable pavers in place of asphalt and concrete

These proposed efforts are unlikely to alleviate the requirement to construct a storm water management pond toward the east part of the site. In this regard, we concur with proposed "Alternative 1" from the Masongsong Associates Engineering Limited (MAE) Functional Servicing and Stormwater Management Report. Alternative 1 recommends two minor storm sewers to convey storm runoff to a proposed storm pond at the east end of the site.

Of the three alternatives mentioned above, construction of permeable pavers is the only practical one for the site, and might assist in promoting some infiltration to move the expected post development water balance closer to the pre-development water balance. However, even this measure will fall short of promoting enough infiltration to match the pre-development water balance. To maintain the stability of the slope at the north edge of the south table lands, any artificial infiltration measures should be set back from the crown of the slope bank.

10.0 CONCLUSIONS

The investigation has disclosed that beneath a topsoil or topsoil fill veneer or topsoil and earth fill layers, the site is underlain predominantly by strata of compact to very dense sandy silt till and stiff to hard, generally very stiff silty clay. Occasional strata of dense to very dense silty sand till, very dense fine to coarse sand, compact to dense silt, compact sandy silt and stiff to hard, generally very stiff silty clay till were encountered. An isolated layer of very loose charcoal remains was found beneath the earth fill in Borehole 4. The original topsoil layer was found beneath the earth fill in Boreholes 7, 11 and 12.

A sand deposit occurs at a depth of 10.0 or + m below the prevailing ground surface in Boreholes 2 and 3, and a silt deposit occurs at a depth of 3.0± m in Borehole 12 from the previous 2004 investigation a. The sand deposits occur at a depth of about 15+ m at Borehole 101 at the northwest part of the site. The sands are generally water bearing.

Groundwater was detected at depths ranging from about 0.5 to 4.6 m from the ground surface. Perched groundwater will likely occur at shallower depths in wet seasons.

The yield of groundwater from the tills and clay will be small and limited due to their low permeability. The yield from the silts and sand may be moderate for short durations since a review of the borehole findings indicates that these units are discontinuous.

The following conclusions are provided:

1. Shallow groundwater migrates northeasterly.

2. There is minimal contribution of groundwater to the flow in Western Creek due to deep and discontinuous nature of permeable soil units. These units are not interpreted as having significant contact with the base of the Creek channel.
3. A weak upward gradient for groundwater was identified at the MW105 nest, while a downward gradient was identified at the MW106 nest, indicating that the groundwater contribution from some areas of the site to Western Creek may be minimal at best, while the creek may be losing flow to groundwater at other areas of the site. Any groundwater loss or contribution to the creek flow will be minimal due to the prevalence of silt and clay soils at the depths of the creek channel.
4. The groundwater quality indicates marginally elevated phosphorous which exceeds the PWQO, while nitrate and unionized ammonia meet the Canadian Water Quality Guidelines and PWQO respectively.
5. Surface water quality at Western Creek meets the PWQO with the exception of marginally elevated total phosphorous.
6. Chloride levels appear marginally elevated in the surface water of Western Creek; however, these levels meet most municipal storm sewer use standards. The source of the impact is likely de-icing salts.
7. Chloride levels in groundwater meet the applicable standards from Table 1 of O. Reg. 153/04.
8. The development will be fully serviced for municipal sewage and potable water. As such, sources of nutrient impacts to ground or surface water resources can be limited.
9. The poor percolation properties for the surficial soils do not lend themselves for the establishment of lot level soak-away pits or communal infiltration galleries for the enhancement of post development infiltration. The percolation rates of the silty clay tills towards the east part of the site will be at or above 80 min/cm (~ 0.04 mm/hr). Likewise, the percolation rates for

the sandy silt till will be in the range of 40 to 60 min/cm (~0.4 mm/hr) and in the range of 20 to 35 min/cm (~4 mm/hr) for the silty sand till and silt towards the west part of the site. The expected percolation rates for all of these soils are substantially below the 15 mm/hour target infiltration rate for establishment of lot level soak-away pits and/or infiltration galleries.

10. The proposed development will cover approximately one third of the site, with the remainder left undeveloped and dedicated as natural area or parkland. Thirty-two new trees are proposed to be planted within the 6 m buffer from the top of bank. In addition, within the development footprint, a total of 100 deciduous and 36 coniferous trees are proposed as well as trees along Eagle Street. The planting of trees should improve infiltration on the site.
11. We concur with "Alternative 1" from the MAE Functional Servicing and Stormwater Management Report. The proposed storm water pond is located at the east side of the site and will serve the entire development. It will have sufficient capacity to provide quantity and quality controls for storm runoff in Accordance with the Town of Newmarket standards. The proposed adoption of bio-retention swales and end of pipe detention and erosion control measures could provide an added level of treatment for storm runoff generated from this development. Further details of the Alternative 1 design are provided in the MAE report.
12. It is understood that the proposed high-rise building will contain 2-levels of underground garage located in the vicinity of Boreholes 1, 2 and 3, and 101. The assumed bottom of excavation will be at a depth of 7.0± m below the prevailing ground surface, indicating that the subgrade will consist of glacial tills and will be at least 3.0± m above any isolated water-bearing sands. Therefore, any groundwater impact from construction is expected to be insignificant as no positive dewatering is anticipated during excavations for the foundation of the proposed condominium, or for underground services and basements of homes.

11.0 LIMITATIONS OF REPORT

It should be noted that no tests have been carried out during the current study to determine whether environmental contaminants are present in the soils. The previous 2009 SEL study addresses environmental quality of soil and groundwater. Therefore, this report deals only with a study of the hydrogeological aspects of the proposed project and the baseline quality of nutrient parameters in groundwater and surface water of Western Creek, and the pre and post development water balances.

This report was prepared by Soil Engineers Ltd. for the account of Millford Development Limited, and for review by their designated consultants and government agencies. The material in it reflects the judgement of Gavin O'Brien, M.Sc. P.Geo., and Denial Man, P.Eng., in light of the information available to it at the time of preparation. Any use which a Third Party makes of this report, or any reliance on decisions to be made based on it, are 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.

SOIL ENGINEERS LTD.

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GO/DM:dd

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PROVINCE OF ONTARIO

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:

1. SAMPLE TYPES

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

2. PENETRATION RESISTANCE/'N'

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 _______

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 'O'

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

3. SOIL DESCRIPTION

a) Cohesionless Soils:

'N' (Blows/ft)	Relative Density
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
over 50	very dense

b) Cohesive Soils:

Undrained Shear Strength (ksf)	'N' (Blows/ft)	Consistency
Less than 0.25	0 to 2	very soft
0.25 to 0.50	2 to 4	soft
0.50 to 1.0	4 to 8	firm
1.0 to 2.0	8 to 16	stiff
2.0 to 4.0	16 to 32	very stiff
over 4.0	over 32	hard

c) 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
1 lb. = 0.453 kg
1 inch = 25.4 mm
1 ksf = 47.88 kN/m^2

JOB NO: 1102-W017

LOG OF BOREHOLE NO: 101

FIGURE NO: 1A

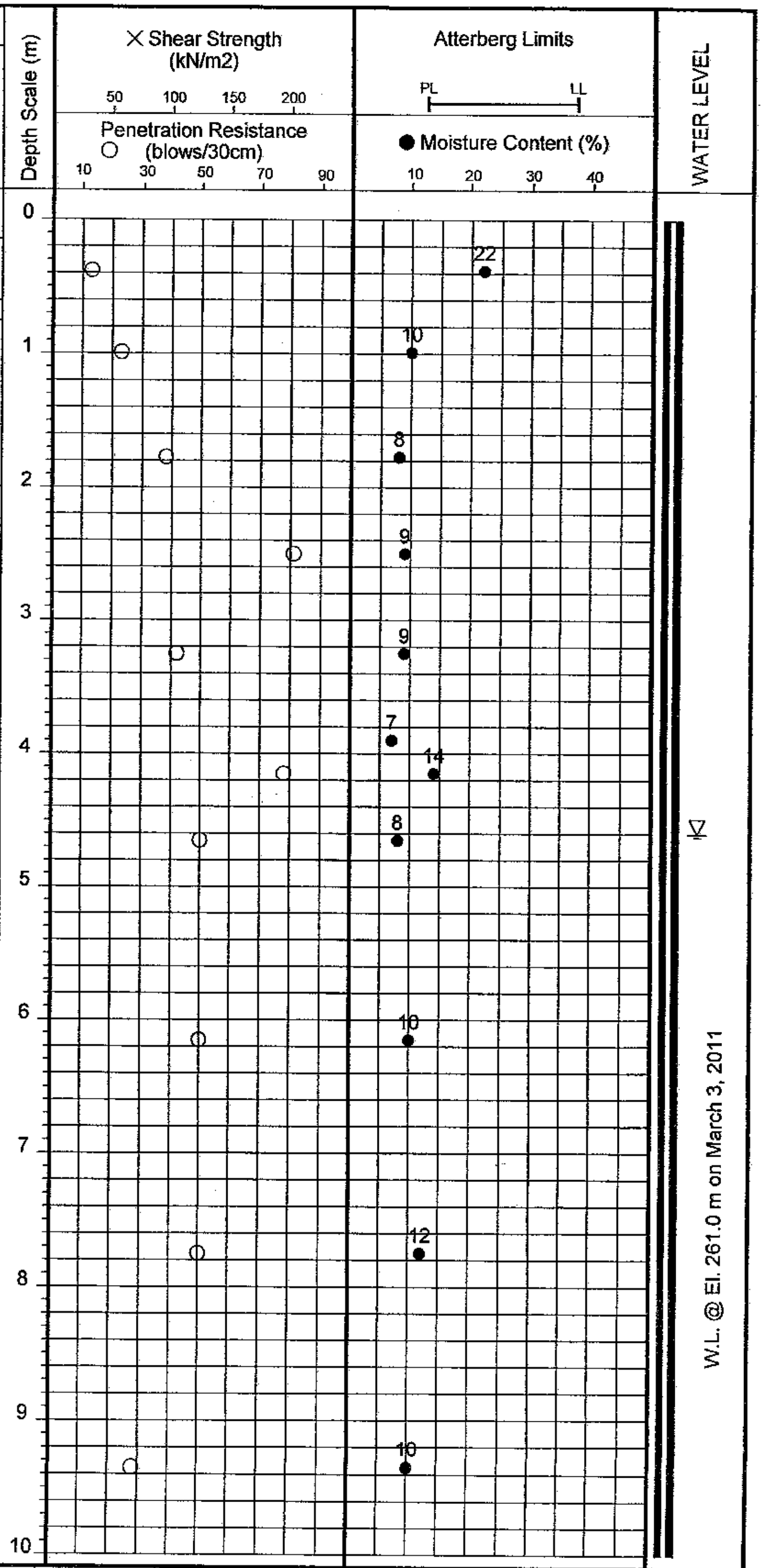
JOB DESCRIPTION: Hydrogeological Study

JOB LOCATION: Lots 2 & 3 Registered Plan 49, Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: February 25, 2011

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	Blows/30cm
0.0 265.6	Ground Surface **30 cm TOPSOIL, Fill**			
	Brown, moist **SILTY CLAY, Fill**	1	DO	13
0.6 265.0	Brown, very stiff **SILTY CLAY, Till** occ. sand and silt seams and layers, cobbles and boulders	2	DO	23
1.5 264.0	Brown, compact to very dense	3	DO	38
	rock fragments	4	DO	81
	SILTY SAND, Till	5	DO	42
	wet	6A	DO	-
	occ. sand and silt seams and layers, cobbles and boulders sand layer	6B	DO	78
		7	DO	50+
		8	DO	50+
	wet	9	DO	50+
		10	DO	28
10.0				



Soil Engineers Ltd.

JOB NO: 1102-W017

LOG OF BOREHOLE NO: 101

FIGURE NO: 1B

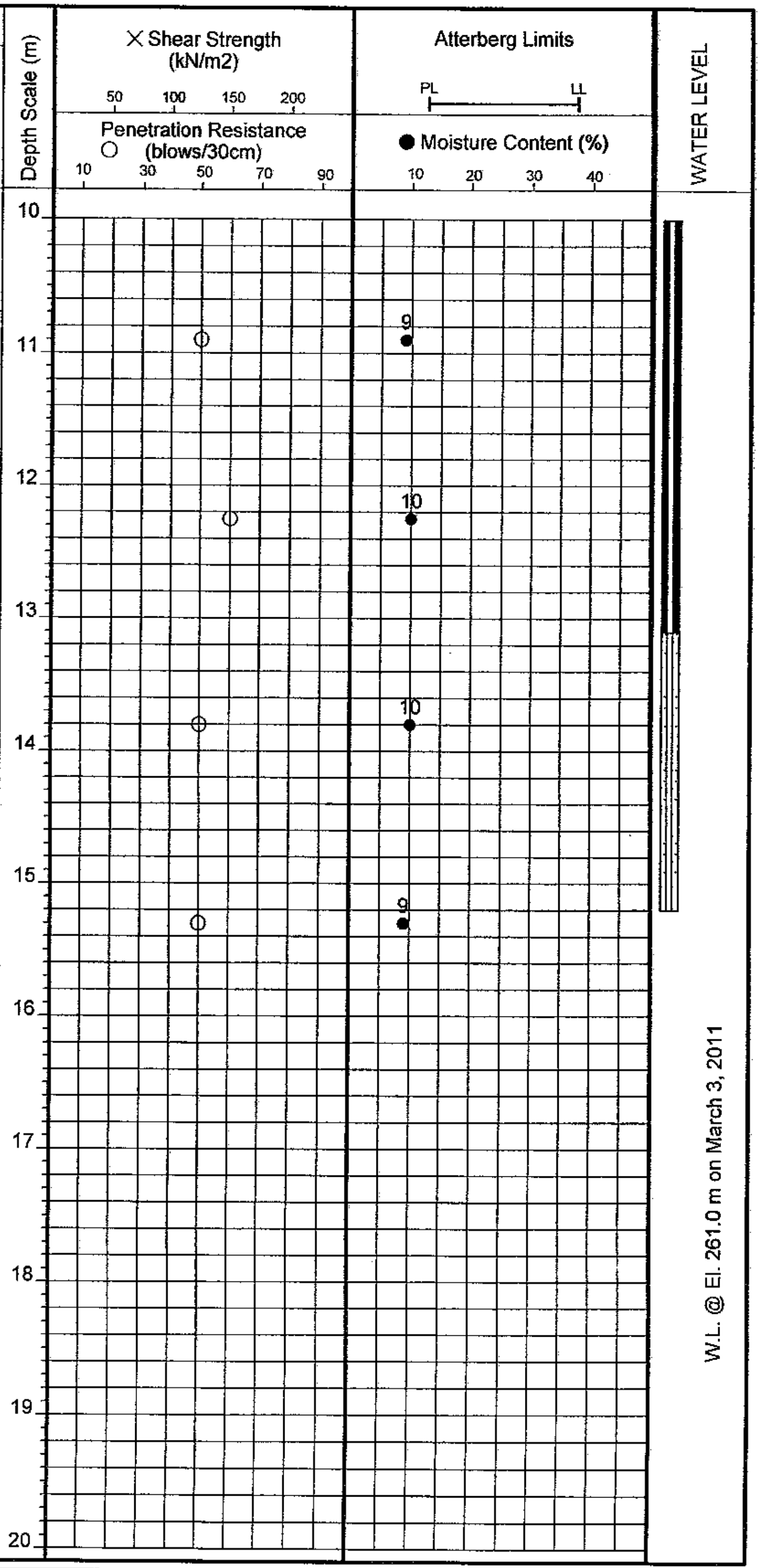
JOB DESCRIPTION: Hydrogeological Study

JOB LOCATION: Lots 2 & 3 Registered Plan 49, Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: February 25, 2011

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	Blows/30cm
10.0 255.6	Very dense			
	brown grey	11	DO	50+
	SILTY SAND, Till			
		12	DO	60
	occ. sand and silt seams and layers, cobbles and boulders			
		13	DO	50+
15.2 250.4 15.4	Grey, very dense, wet	14	DO	50+
250.2	**FINE SAND**			
	END OF BOREHOLE			
	Installed 50 mm diameter groundwater monitoring well to 15.2 m. Sand backfill from 13.1 to 15.2 m. Bentonite seal from 0.0 to 13.1 m, with a steel protective casing.			



Soil Engineers Ltd.

JOB NO: 1102-W017

LOG OF BOREHOLE NO: 102

FIGURE NO: 2A

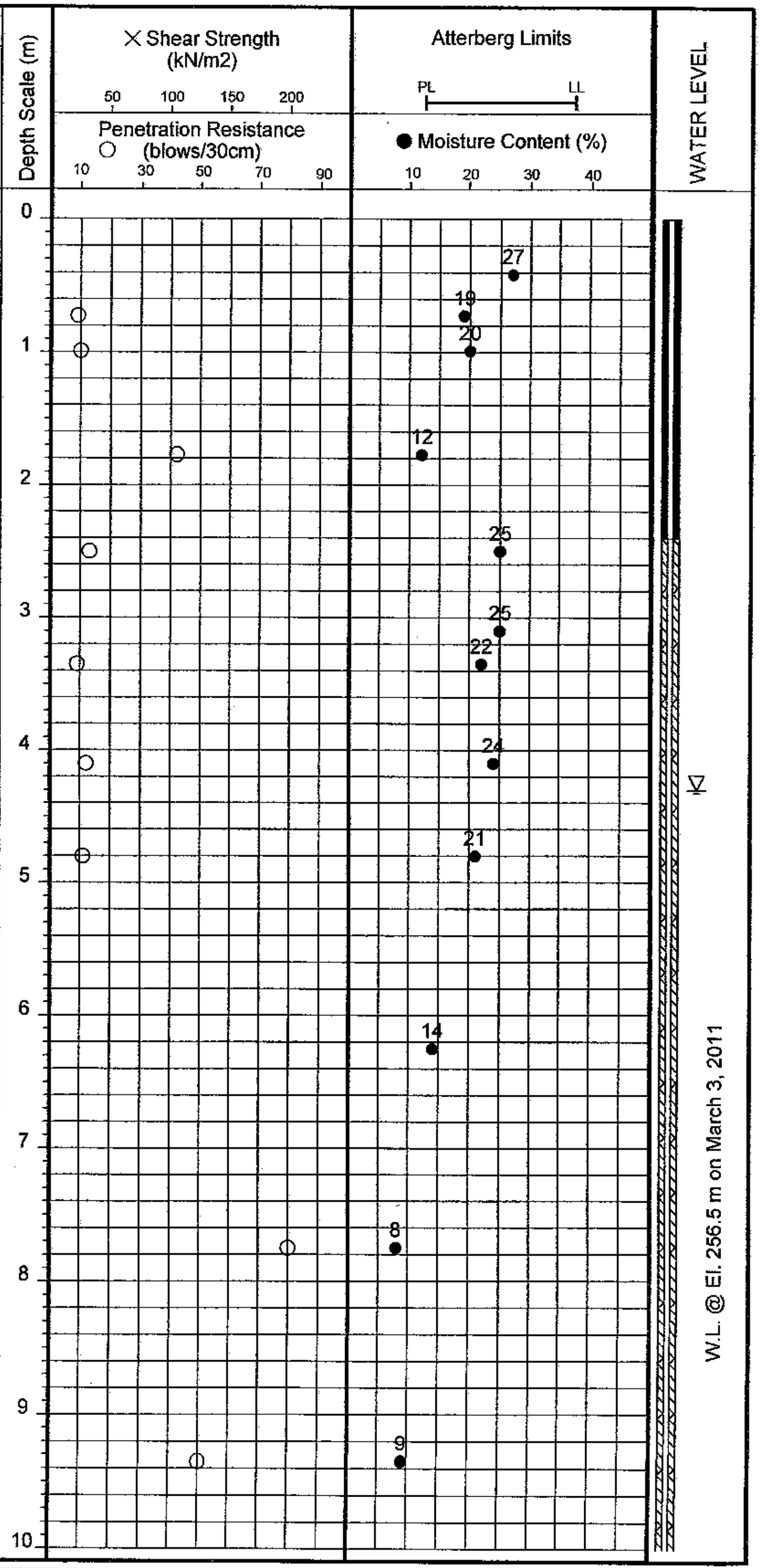
JOB DESCRIPTION: Hydrogeological Study

JOB LOCATION: Lots 2 & 3 Registered Plan 49, Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: February 24, 2011

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	Blows/30cm
0.0	Ground Surface			
260.8	**30 cm TOPSOIL, Fill**			
	Brown and grey	1A	DO	-
		1B	DO	9
	SILTY CLAY, Fill	2	DO	10
		3	DO	42
2.3 258.5	**TOPSOIL**	4	DO	13
	Brown, stiff			
	dark brown	5A	DO	-
		5B	DO	9
	SILTY CLAY			
	occ. silt seams and layers wet silt	6	DO	12
		7	DO	11
6.1 254.7	Hard	8	DO	-
	boulders			
	SILTY CLAY, Till			
		9	DO	80
	occ. sand and silt seams and layers, cobbles and boulders brown grey	10	DO	50+
10.0				



Soil Engineers Ltd.

JOB NO: 1102-W017

LOG OF BOREHOLE NO: 102

FIGURE NO: 2B

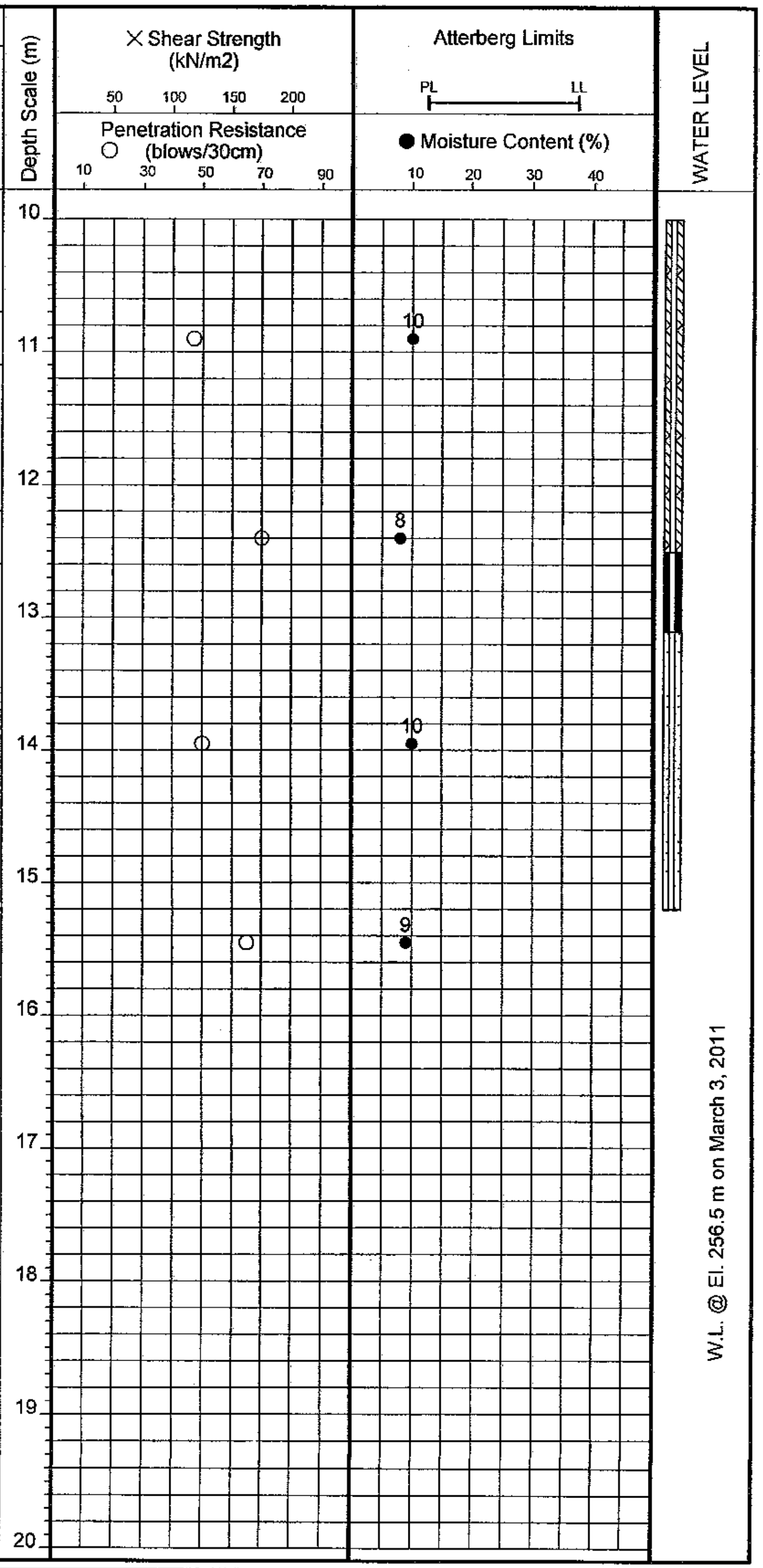
JOB DESCRIPTION: Hydrogeological Study

JOB LOCATION: Lots 2 & 3 Registered Plan 49, Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: February 24, 2011

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES		
		Number	Type	Blows/30cm
10.0 250.8	Grey, hard **SILTY CLAY, Till** occ. sand and silt seams and layers, cobbles and boulders	11	DO	47
		12	DO	70
		13	DO	50
		14	DO	65
15.7 245.1	**END OF BOREHOLE** Installed 50 mm diameter groundwater monitoring well to 15.2 m. Sand backfill from 13.1 to 15.2 m. Bentonite seal from 0.0 to 2.4 and 12.5 to 13.1 m. Grout from 2.4 to 12.5 m, with a steel protective casing.			



W.L. @ El. 256.5 m on March 3, 2011

Soil Engineers Ltd.

JOB NO: 1102-W017

LOG OF BOREHOLE NO: 103

FIGURE NO: 3A

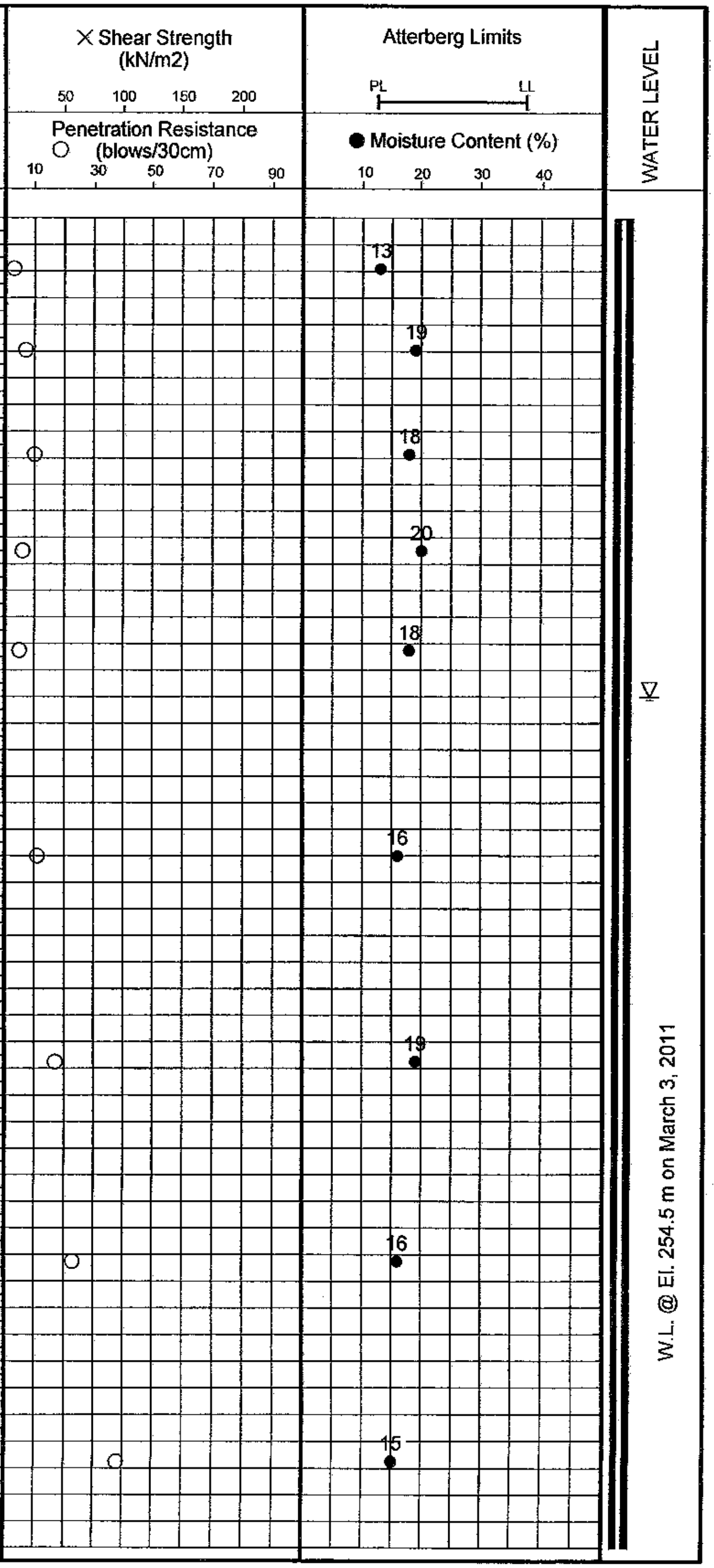
JOB DESCRIPTION: Hydrogeological Study

JOB LOCATION: Lots 2 & 3 Registered Plan 49, Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: February 28, 2011

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	Blows/30cm	Depth Scale (m)	Moisture Content (%)
0.0	Ground Surface				0	
258.0	**30 cm TOPSOIL, Fill**					
	Brown **SILTY SAND and SILTY CLAY, Fill** some organics traces of gravel and cobbles	1	DO	3		13
		2	DO	7	1	19
		3	DO	10	2	18
		4	DO	6		20
3.0 255.1	Black **TOPSOIL** occ. wood debris	5	DO	5	3	18
					4	
4.6 253.5	Stiff to hard **SILTY CLAY, Till** brown grey occ. sand and silt seams and layers, cobbles and boulders	6	DO	11	5	16
					6	
		7	DO	17	7	19
		8	DO	23	8	16
		9	DO	38	9	15
10.0					10	



W.L. @ El. 254.5 m on March 3, 2011

Soil Engineers Ltd.

JOB NO: 1102-W017

LOG OF BOREHOLE NO: 103

FIGURE NO: 3B

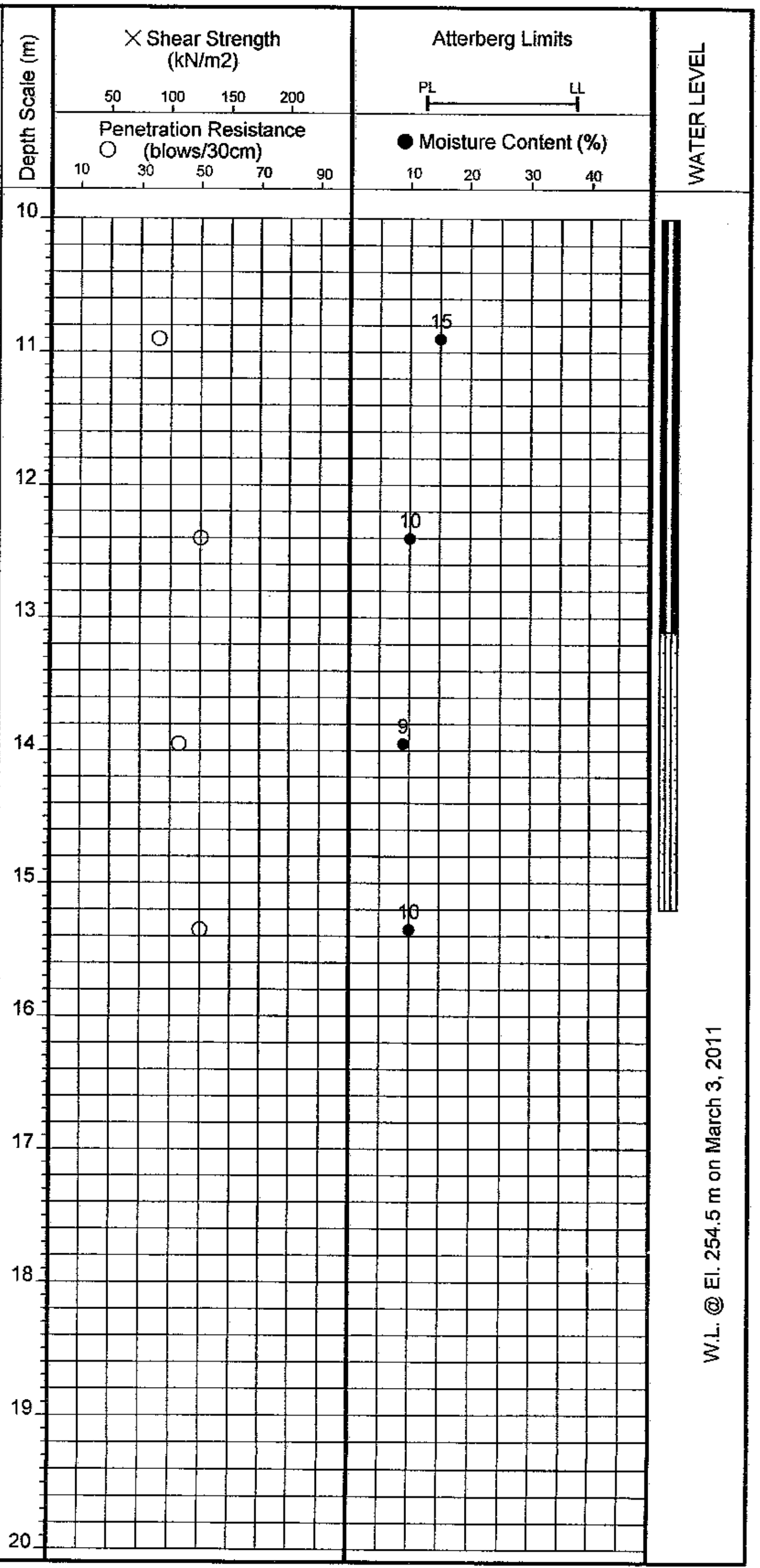
JOB DESCRIPTION: Hydrogeological Study

JOB LOCATION: Lots 2 & 3 Registered Plan 49, Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: February 28, 2011

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES		
		Number	Type	Blows/30cm
10.0 248.1	Grey, hard **SILTY CLAY, Till** occ. sand and silt seams and layers, cobbles and boulders	10	DO	36
12.2 245.9	Grey, very dense **SILTY SAND, Till** occ. silt and clay seams and layers, cobbles and boulders	11	DO	50+
13.7 244.4	Grey, hard **SILTY CLAY, Till** occ. sand and silt seams and layers, cobbles and boulders	12	DO	43
		13	DO	50+
15.5 242.6	**END OF BOREHOLE** Installed 50 mm diameter groundwater monitoring well to 15.2 m. Sand backfill from 13.1 to 15.2 m. Bentonite seal from 12.5 to 13.1 m, with a steel protective casing.			



JOB NO: 1102-W017

LOG OF BOREHOLE NO: 104

FIGURE NO: 4A

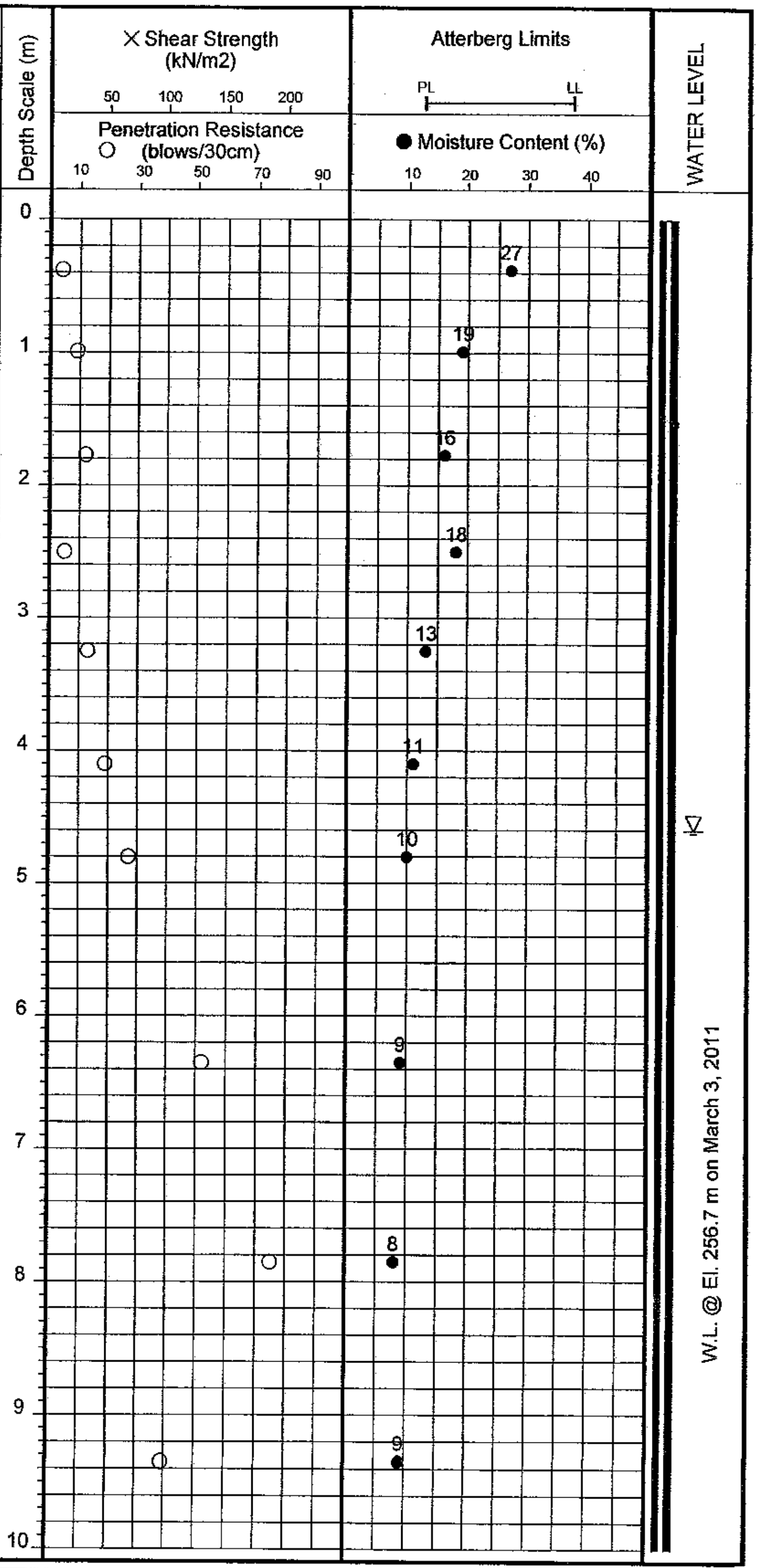
JOB DESCRIPTION: Hydrogeological Study

JOB LOCATION: Lots 2 & 3 Registered Plan 49, Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: March 1, 2011

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	Blows/30cm
0.0	Ground Surface			
261.2	Brown **SILTY CLAY, Fill**	1	DO	4
		2	DO	9
		3	DO	12
2.3 259.0	**TOPSOIL**	4	DO	5
	Brown, compact **SILTY FINE SAND**	5	DO	13
3.8 257.5	Brown, compact to very dense **SILTY SAND, Till** occ. silt and clay seams and layers, cobbles and boulders (due to refusal on augers, relocated borehole to 5ft south of original location and reaugered to 7.6 m)	6	DO	19
		7	DO	27
		8	DO	52
	boulder, refusal on augers			
		9	DC	75
9.1 252.2	Brown, hard **SILTY CLAY, Till** occ. sand and silt seams and layers, cobbles and boulders	10	DO	39
10.0	boulders			



Soil Engineers Ltd.

JOB NO: 1102-W017

LOG OF BOREHOLE NO: 104

FIGURE NO: 4B

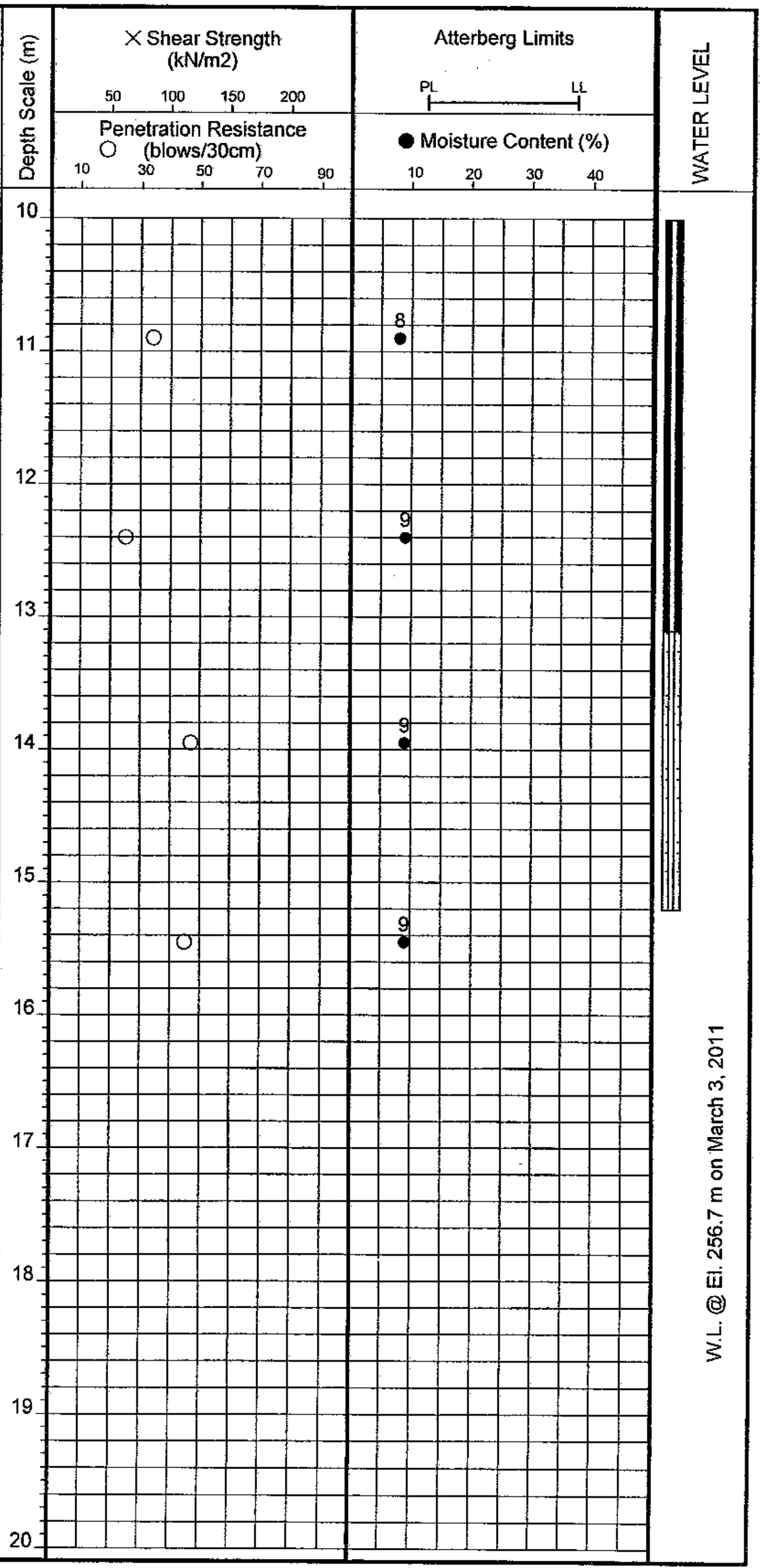
JOB DESCRIPTION: Hydrogeological Study

JOB LOCATION: Lots 2 & 3 Registered Plan 49, Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: March 1, 2011

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES Blows/30cm
10.0 251.3	Very stiff to hard boulders **SILTY CLAY, Till** occ. sand and silt seams and layers cobbles and boulders brown grey	11	DO	34
		12	DO	25
		13	DO	47
		14	DO	45
15.7 245.6	**END OF BOREHOLE** Installed 50 mm diameter groundwater monitoring well to 15.2 m. Sand backfill from 13.1 to 15.2 m. Bentonite seal from 12.3 to 13.1 m, with a steel protective casing.			



JOB NO: 1102-W017

LOG OF BOREHOLE NO: 105(d)

FIGURE NO: 5

JOB DESCRIPTION: Hydrogeological Study

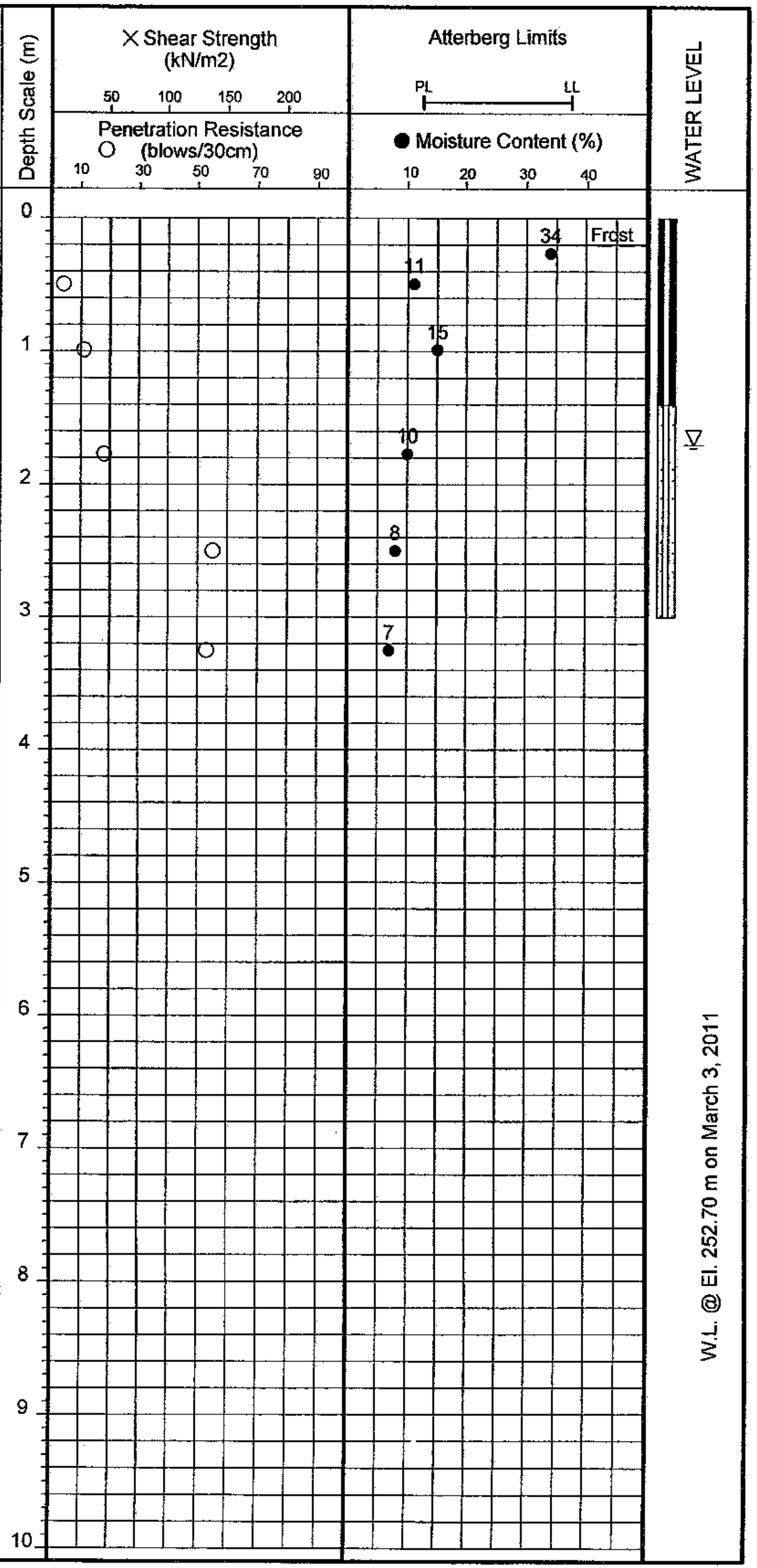
JOB LOCATION: Lots 2 & 3 Registered Plan 49, Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: March 1, 2011

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	Blows/30cm
0.0	Ground Surface			
254.3	**15 cm TOPSOIL**			
		1A	DO	-
	Brown, very loose **FINE TO MEDIUM SAND**	1B	DO	4
0.8 253.6	Brown, compact, wet **SILTY SAND, Till** occ. sand layers	2	DO	11
1.5 252.8	Very stiff to hard	3	DO	18
	SILTY CLAY, Till brown grey			
	occ. sand and silt seams and layers, cobbles and boulders	4	DO	55
		5	DO	53
3.5 250.9	**END OF BOREHOLE**			

Installed 50 mm diameter groundwater monitoring well to 3 m. Sand backfill from 1.4 to 3 m. Bentonite seal from 0.0 to 1.4 m, with a steel protective casing.



W.L. @ El. 252.70 m on March 3, 2011

Soil Engineers Ltd.

JOB NO: 1102-W017

LOG OF BOREHOLE NO: 105(s)

FIGURE NO: 6

JOB DESCRIPTION: Hydrogeological Study

JOB LOCATION: Lots 2 & 3 Registered Plan 49, Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: March 1, 2011

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES Blows/30cm	Depth Scale (m)
0.0 253.2	Ground Surface				0
	Augered to 1.5 m				1
1.5 251.7	**END OF BOREHOLE** Installed 50 mm diameter groundwater monitoring well to 1.5 m. Sand backfill from 0.61 to 1.5 m. Bentonite seal from 0.0 to 0.61 m, with a steel protective casing.				2
					3
					4
					5
					6
					7
					8
					9
					10

× Shear Strength (kN/m2): 50, 100, 150, 200

○ Penetration Resistance (blows/30cm): 10, 30, 50, 70, 90

Atterberg Limits: PL ├──┤ LL

● Moisture Content (%): 10, 20, 30, 40

WATER LEVEL

W.L. @ El. 253.7 m on March 3, 2011

Soil Engineers Ltd.

JOB NO: 1102-W017

LOG OF BOREHOLE NO: 106(d)

FIGURE NO: 7

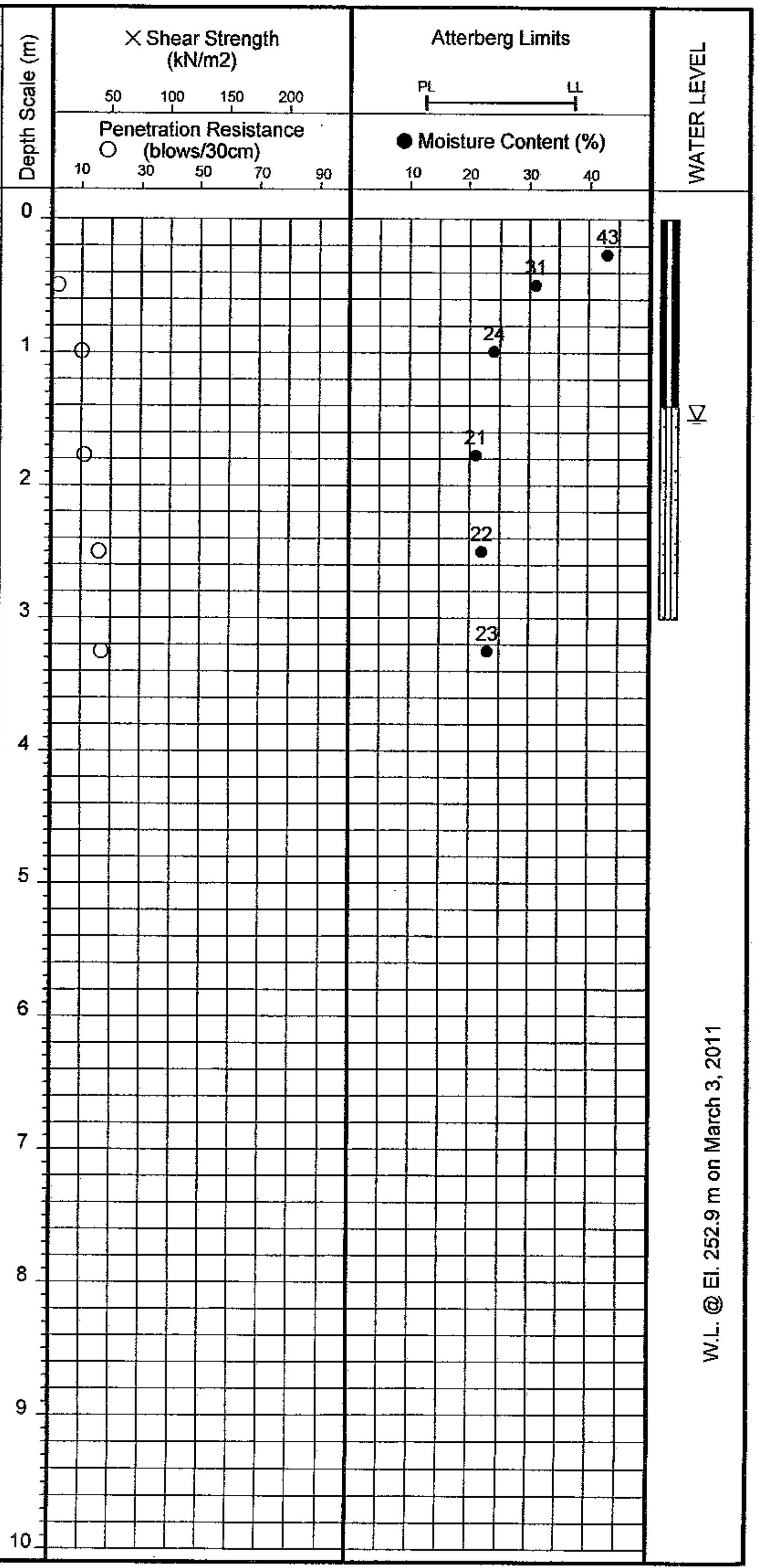
JOB DESCRIPTION: Hydrogeological Study

JOB LOCATION: Lots 2 & 3 Registered Plan 49, Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: March 1, 2011

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES Blows/30cm
0.0 254.3	Ground Surface			
	460 mm FLOOD DEPOSITS with topsoil and silty sand material	1A	DO	-
		1B	DO	2
	Very soft to very stiff brown grey	2	DO	10
	SILTY CLAY **(ALLUVIAL)**	3	DO	11
	occ. wet sand and silt seams and layers	4	DO	16
		5	DO	17
3.5 250.9	**END OF BOREHOLE** Installed 50 mm diameter groundwater monitoring well to 3 m. Sand backfill from 1.4 to 3 m. Bentonite seal from 0.0 to 1.2 m, with a steel protective casing.			



Soil Engineers Ltd.

JOB NO: 1102-W017

LOG OF BOREHOLE NO: 106(s)

FIGURE NO: 8

JOB DESCRIPTION: Hydrogeological Study

JOB LOCATION: Lots 2 & 3 Registered Plan 49, Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: March 1, 2011

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES Blows/30cm	Depth Scale (m)	× Shear Strength (kN/m2) 50 100 150 200 Penetration Resistance ○ (blows/30cm) 10 30 50 70 90	Atterberg Limits PL LL ● Moisture Content (%) 10 20 30 40	WATER LEVEL
0.0 253.2	Ground Surface **Augered to 1.5 m**				0 1			∇
1.5 251.7	**END OF BOREHOLE** Installed 50 mm diameter groundwater monitoring well to 1.5 m. Sand backfill from 0.61 to 1.5 m. Bentonite seal from 0.0 to 0.61 m, with a steel protective casing.				2 3 4 5 6 7 8 9 10			

W.L. @ El. 253.0 m on March 3, 2011

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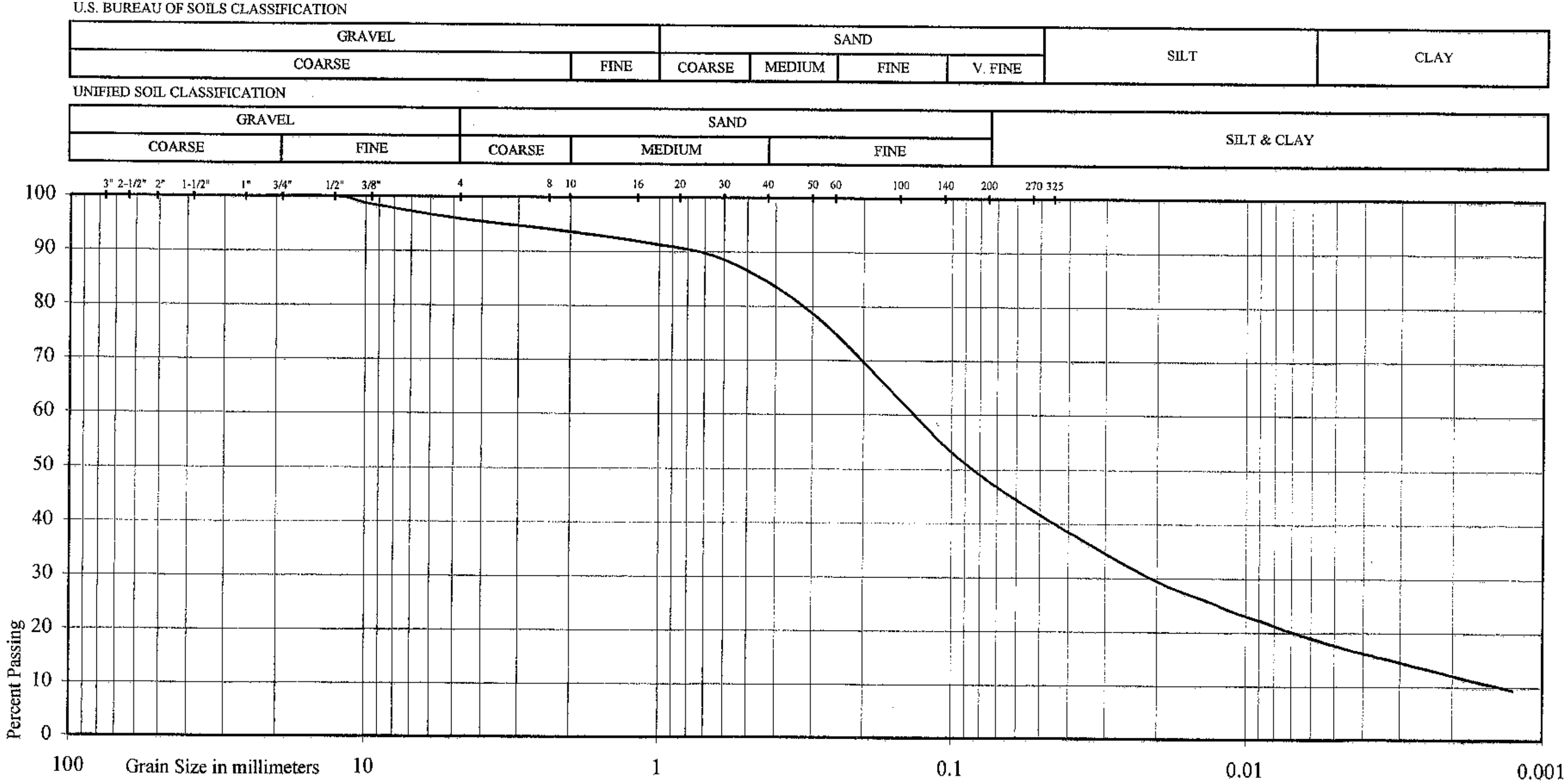
Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 1102-W017



Project: Hydrogeological Study

Location: Lots 2 and 3 Registered Plan 49, Town of Newmarket

Borehole No: 105

Sample No: 3

Depth (m): 1.9

Elevation (m): 252.5

Liquid Limit (%) = 20

Plastic Limit (%) = 14

Plasticity Index (%) = 6

Moisture Content (%) = 10

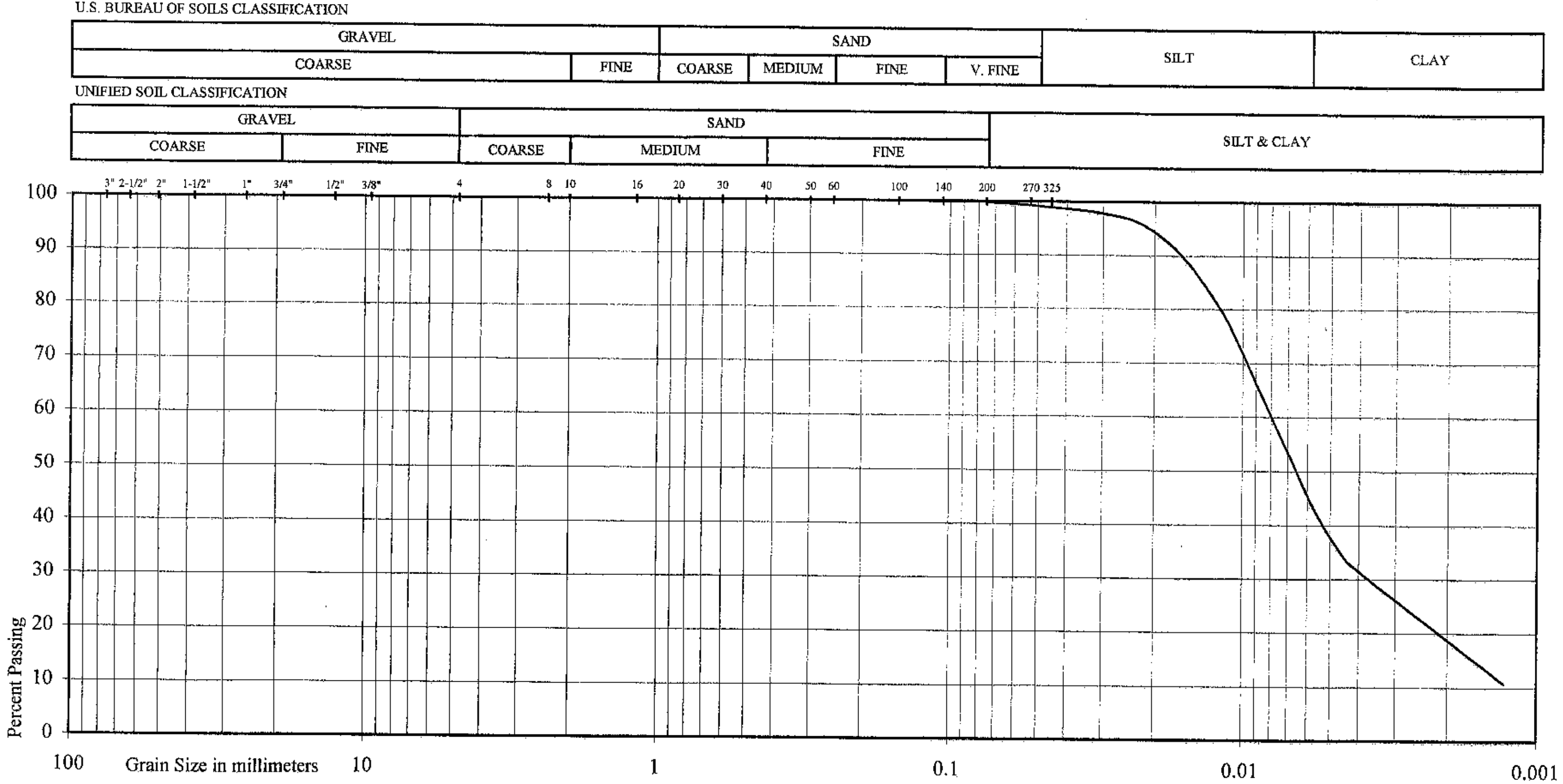
Estimated Permeability (cm./sec.) = 10^{-6}

Classification of Sample [& Group Symbol]: SILTY SAND, Till

Figure: 9

Soil Engineers Ltd. GRAIN SIZE DISTRIBUTION

Reference No: 1102-W017



Project: Hydrogeological Study

Location: Lots 2 and 3 Registered Plan 49, Town of Newmarket

Borehole No: 106

Sample No: 2

Depth (m): 0.5

Elevation (m): 253.9

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

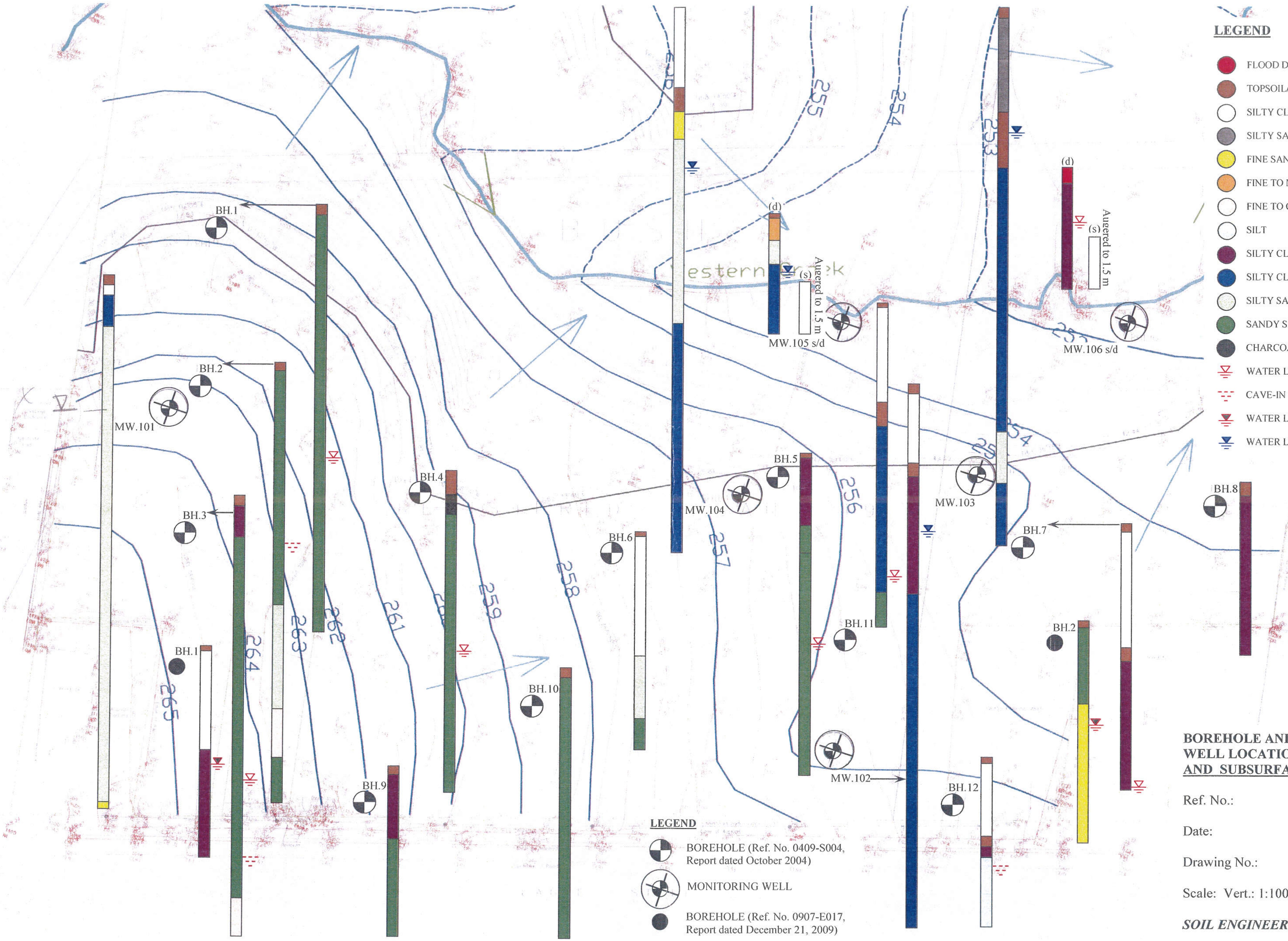
Moisture Content (%) = 24

Estimated Permeability

(cm./sec.) = 10^{-6}

Classification of Sample [& Group Symbol]: SILTY CLAY (ALLUVIAL)

Figure: 10



LEGEND

- 🔴 FLOOD DEPOSITS
- 🟤 TOPSOIL/TOPSOIL FILL
- ⚪ SILTY CLAY FILL
- ● SILTY SAND AND SILTY CLAY FIL
- 🟡 FINE SAND/SILTY FINE SAND
- 🟠 FINE TO MEDIUM SAND
- ⚪ FINE TO COARSE SAND
- ⚪ SILT
- 🟣 SILTY CLAY
- 🔵 SILTY CLAY TILL
- ⚪ SILTY SAND TILL
- 🟢 SANDY SILT/SANDY SILT TILL
- ⚫ CHARCOAL REMAINS
- ▽ WATER LEVEL
- ▽ CAVE-IN
- ▼ WATER LEVEL (on Oct. 1, 2009)
- ▼ WATER LEVEL (on Mar. 3, 2011)

LEGEND

- ◐ BOREHOLE (Ref. No. 0409-S004, Report dated October 2004)
- ⊕ MONITORING WELL
- ● BOREHOLE (Ref. No. 0907-E017, Report dated December 21, 2009)

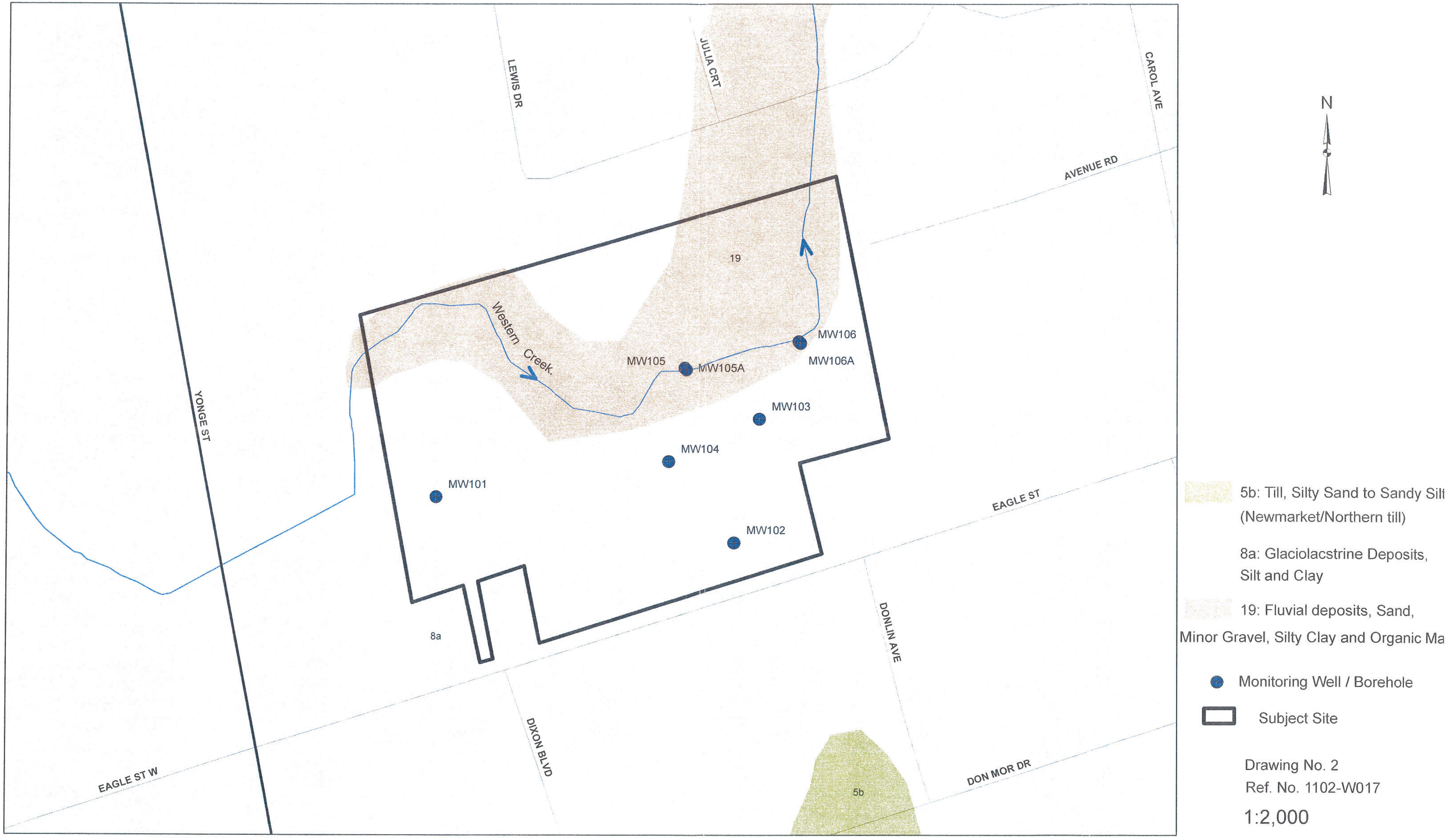
BOREHOLE AND MONITORING WELL LOCATION PLAN AND SUBSURFACE PROFILE

Ref. No.:	1102-W017
Date:	March 2011
Drawing No.:	1
Scale: Vert.: 1:100	Horiz.: 1:800

SOIL ENGINEERS LTD.

Quaternary (Surficial) Geology Plan

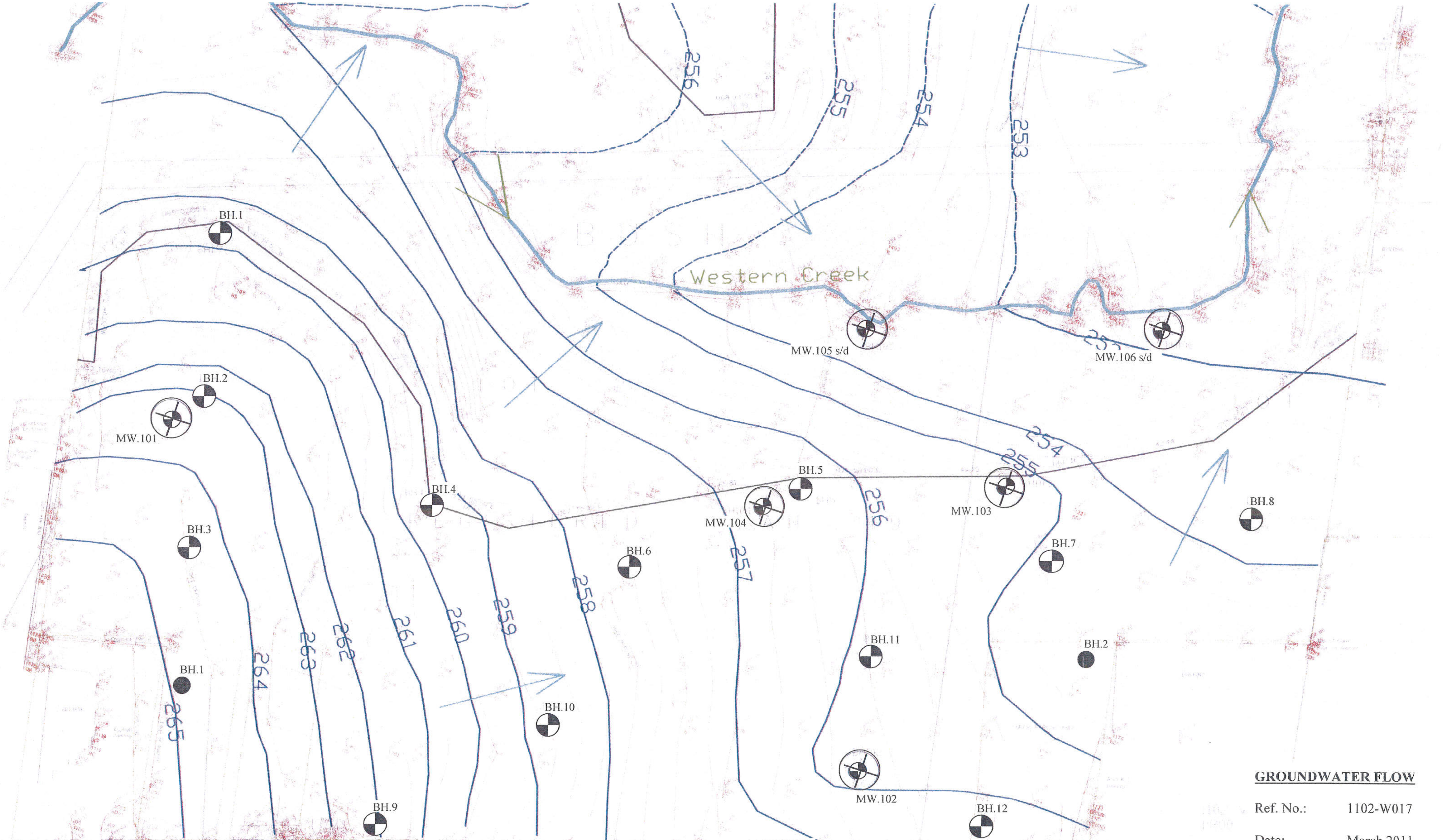
Town of Newmarket



Drawing No. 2
Ref. No. 1102-W017
1:2,000

Data have been taken from Ontario Ministry of Natural Resources and MOE Well Records
Projection NAD 1983 UTM Zone 17N

By M D Soil Engineers Ltd
GIS Department Date March 28, 2011



LEGEND

Inferred Groundwater El. Contour (masl)

Groundwater El. Contour (masl)

Groundwater flow direction

BOREHOLE (Ref. No. 0409-S004, Report dated October 2004)

MONITORING WELL

● BOREHOLE (Ref. No. 0907-E017, Report dated December 21, 2009)

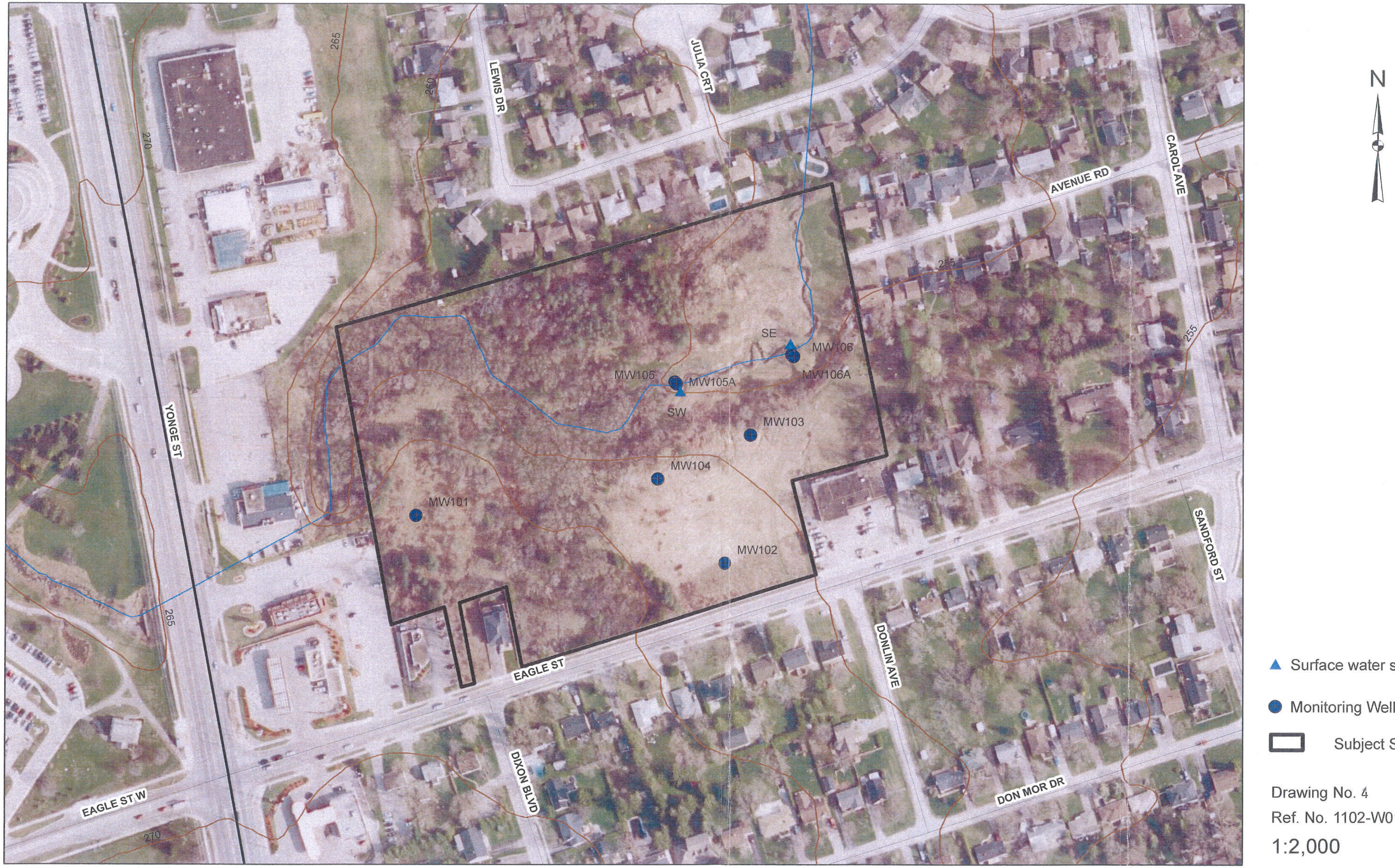
GROUNDWATER FLOW

Ref. No.:	1102-W017
Date:	March 2011
Drawing No.:	3
Scale:	Horiz.: 1:800

SOIL ENGINEERS LTD.

Monitoring Well and Surface Water Sample Locations

Town of Newmarket



▲ Surface water sample location

● Monitoring Well / Borehole

▭ Subject Site

Drawing No. 4
Ref. No. 1102-W017
1:2,000

Data have been taken from Ontario Ministry of Natural Resources and MOE Well Records
Projection: NAD 1983 UTM Zone 17N

By: M.D Soil Engineers Ltd
GIS Department Date:March 28, 2011

Soil Engineers Ltd.

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FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 623-4630	FAX: (905) 853-5484	FAX: (705) 684-8522	FAX: (905) 623-4630	FAX: (905) 542-2769

APPENDIX 'A'

BOREHOLE LOGS
(2004 AND 2009 SITE INVESTIGATION)

Reference No. 1102-W017

JOB NO.: 0409-S004

LOG OF BOREHOLE NO.: 1

FIGURE NO.: 1

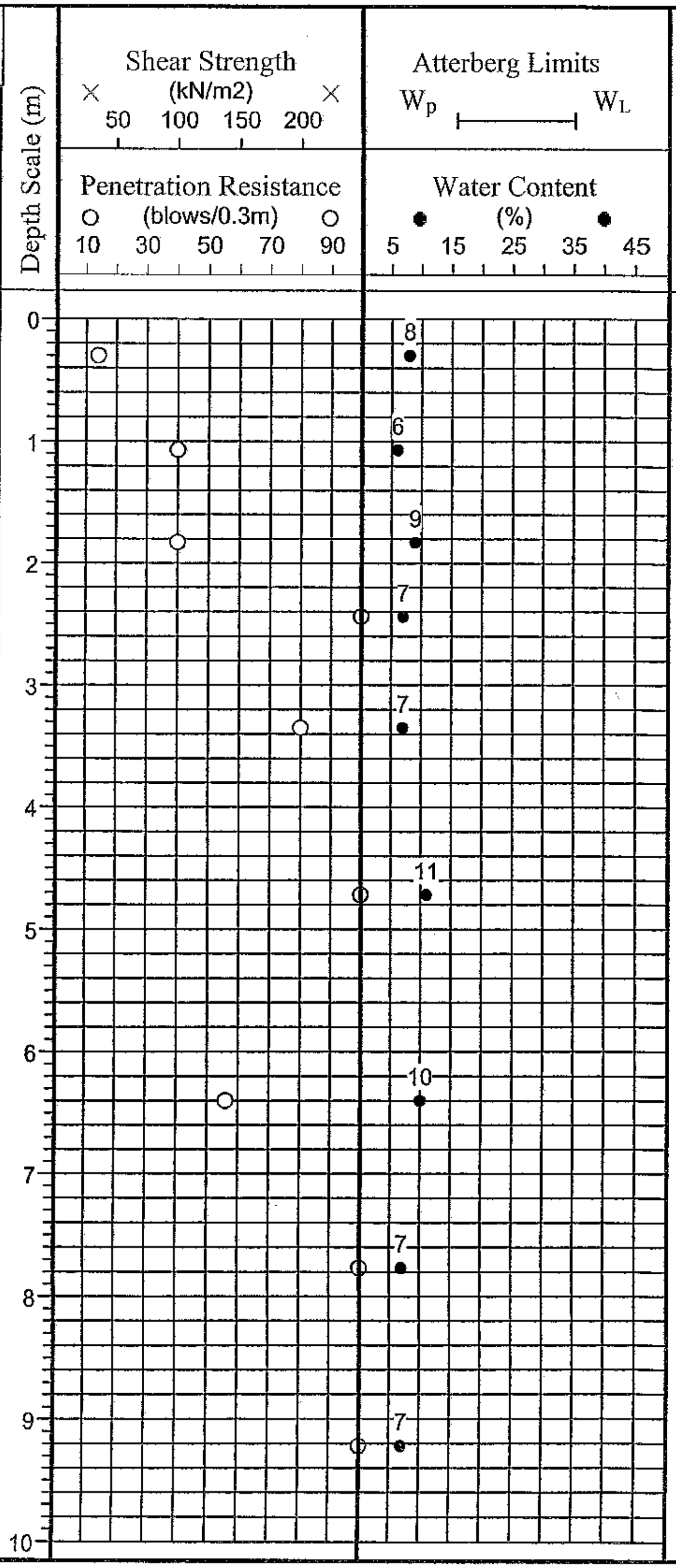
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: NE of Yonge St./Eagle St., Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: September 21, 2004

Elev. Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
264.5	Ground Surface			
0.0	**30cm TOPSOIL**			
		1	DO	14
	Compact to very dense	2	DO	40
		3	DO	40
		4	DO	100+
	SANDY SILT, Till	5	DO	80
		6	DO	100+
	traces of clay and gravel occ. silt seams	7	DO	56
	brown grey	8	DO	100+
		9	DO	100+
254.5 10.0	*Cont'd on Fig. 1A*			



WATER LEVEL

W.L. @ El. 257.2 m on completion

El.

Soil Engineers Ltd.

JOB NO.: 0409-S004

LOG OF BOREHOLE NO.: 1

FIGURE NO.: 1A

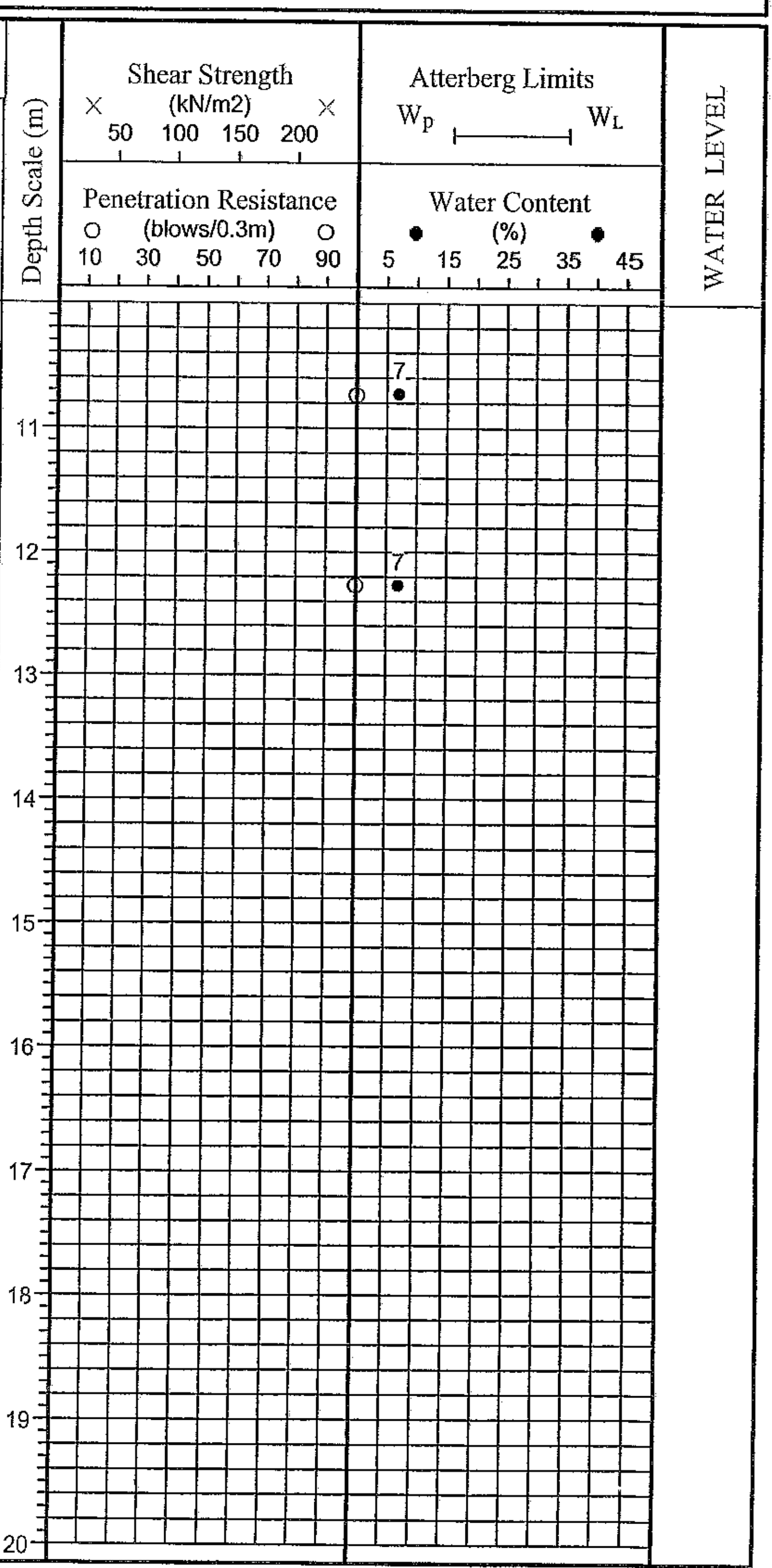
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: NE of Yonge St./Eagle St., Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: September 21, 2004

Elev. Depth (m)	SOIL DESCRIPTION (Cont'd)	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
254.5				
10.0	Very dense			
		10	DO	100+
	SANDY SILT, Till			
		11	DO	100+
252.2 12.3	**END OF BOREHOLE**			



Soil Engineers Ltd.

JOB NO.: 0409-S004

LOG OF BOREHOLE NO.: 2

FIGURE NO.: 2

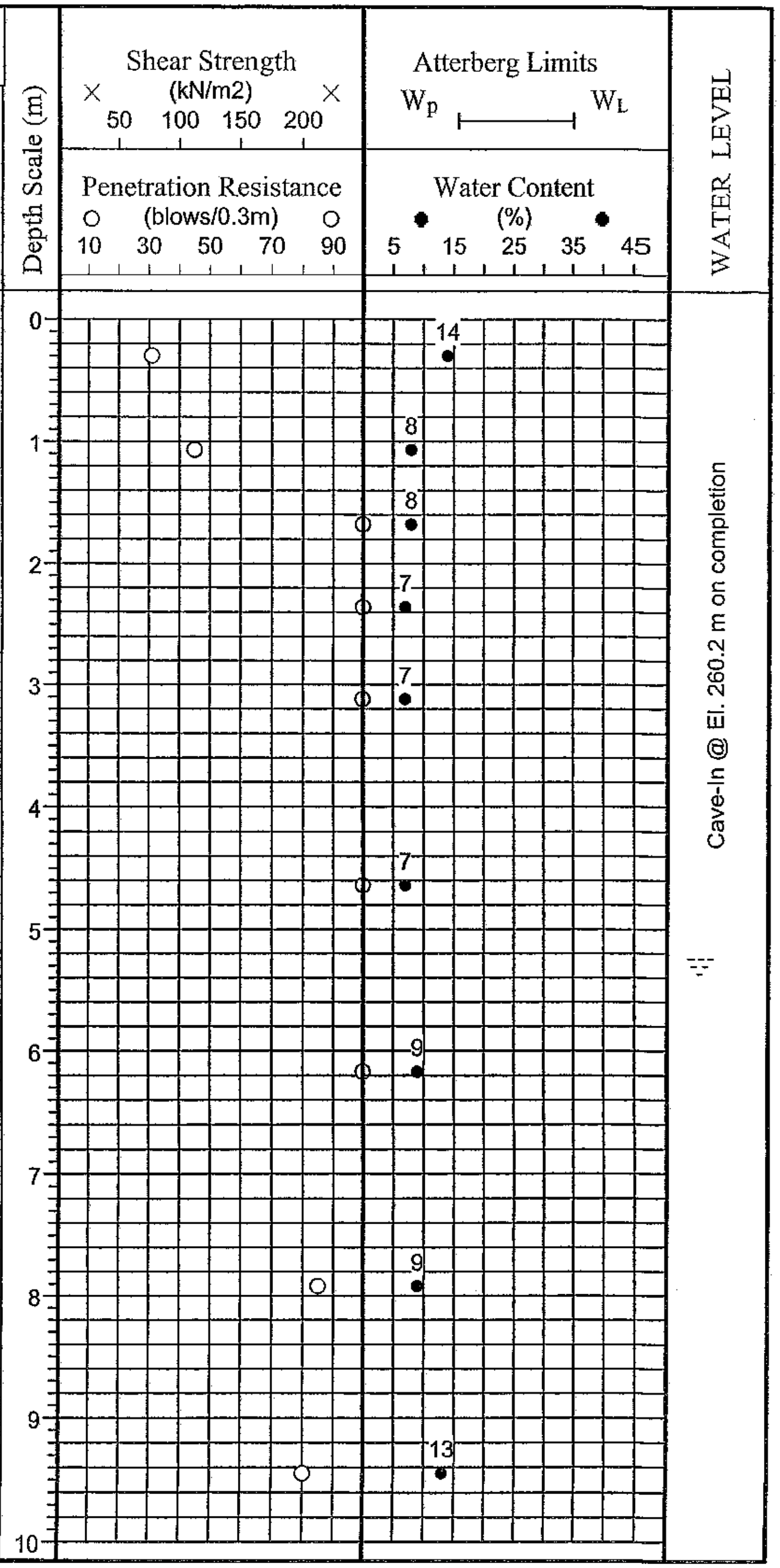
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: NE of Yonge St./Eagle St., Town of Newmarket

METHOD OF BORING: Flight-Aug er

DATE: September 21, 2004

Elev. Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
265.4 0.0	Ground Surface			
	25cm TOPSOIL	1	DO	31
	Brown, dense to very dense	2	DO	45
		3	DO	100+
	SANDY SILT, Till	4	DO	100+
		5	DO	100+
	a tr. of clay a tr. to some gravel	6	DO	100+
		7	DO	100+
258.4 7.0	Brown, very dense **SILTY SAND, Till**			
	a tr. of clay a tr. to some gravel occ. silt and sand lenses occ. cobbles and boulders	8	DO	85
		9	DO	80
255.4 10.0	*Cont'd on Fig. 2A*			



Cave-In @ El. 260.2 m on completion

Soil Engineers Ltd.

JOB NO.: 0409-S004

LOG OF BOREHOLE NO.: 2

FIGURE NO.:2A

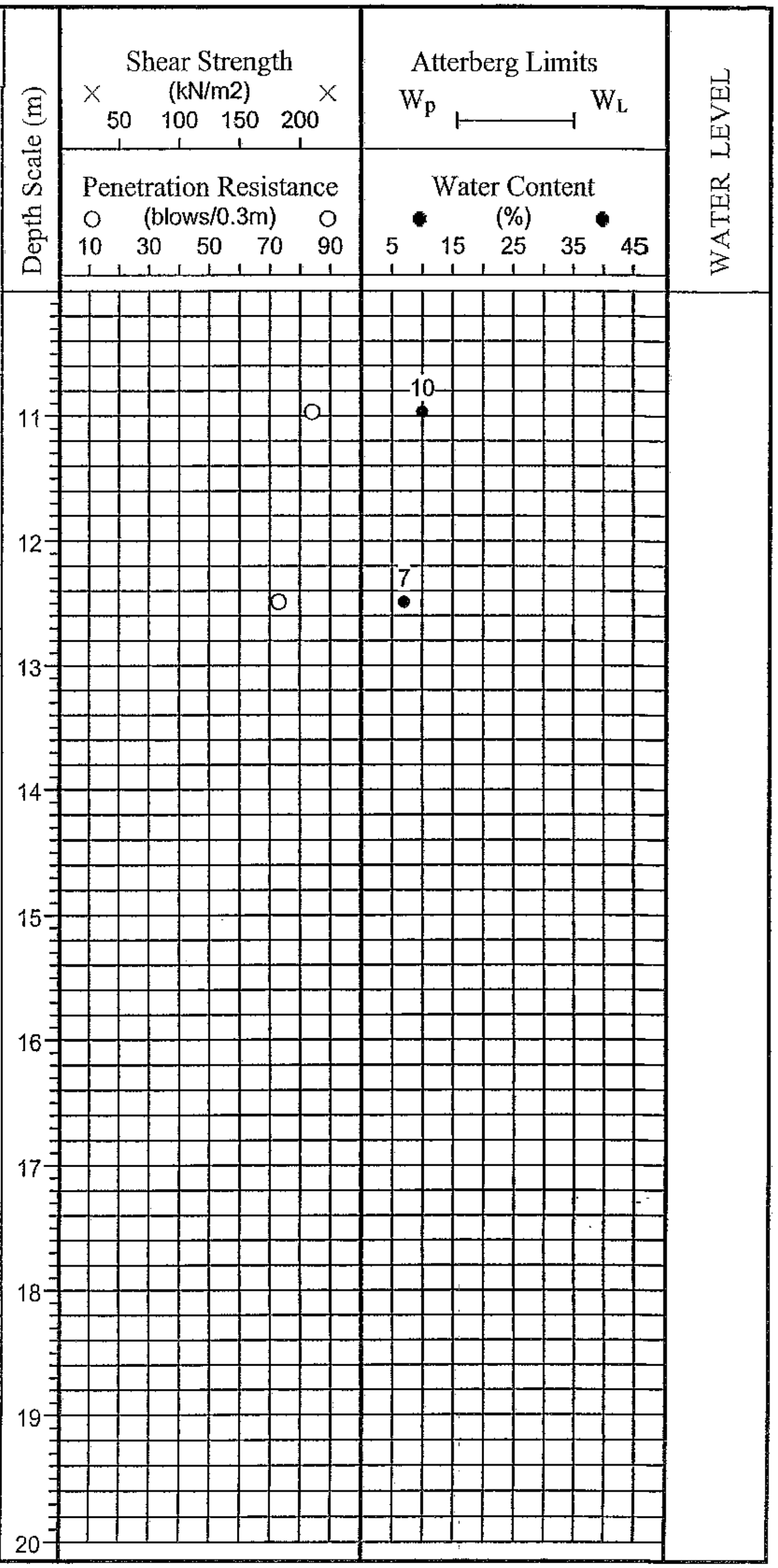
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: NE of Yonge St./Eagle St., Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: September 21, 2004

Elev. Depth (m)	SOIL DESCRIPTION (Cont'd)	SAMPLES		
		Number	Type	N-Value
255.4 10.0	Brown, very dense **FINE TO COARSE SAND** traces of clay and silt	10	DO	84
254.0 11.4	Grey, very dense **SANDY SILT, Till** traces and clay and gravel	11	DO	73
252.7 12.7	**END OF BOREHOLE**			



Soil Engineers Ltd.

JOB NO.: 0409-S004

LOG OF BOREHOLE NO.: 3

FIGURE NO.: 3

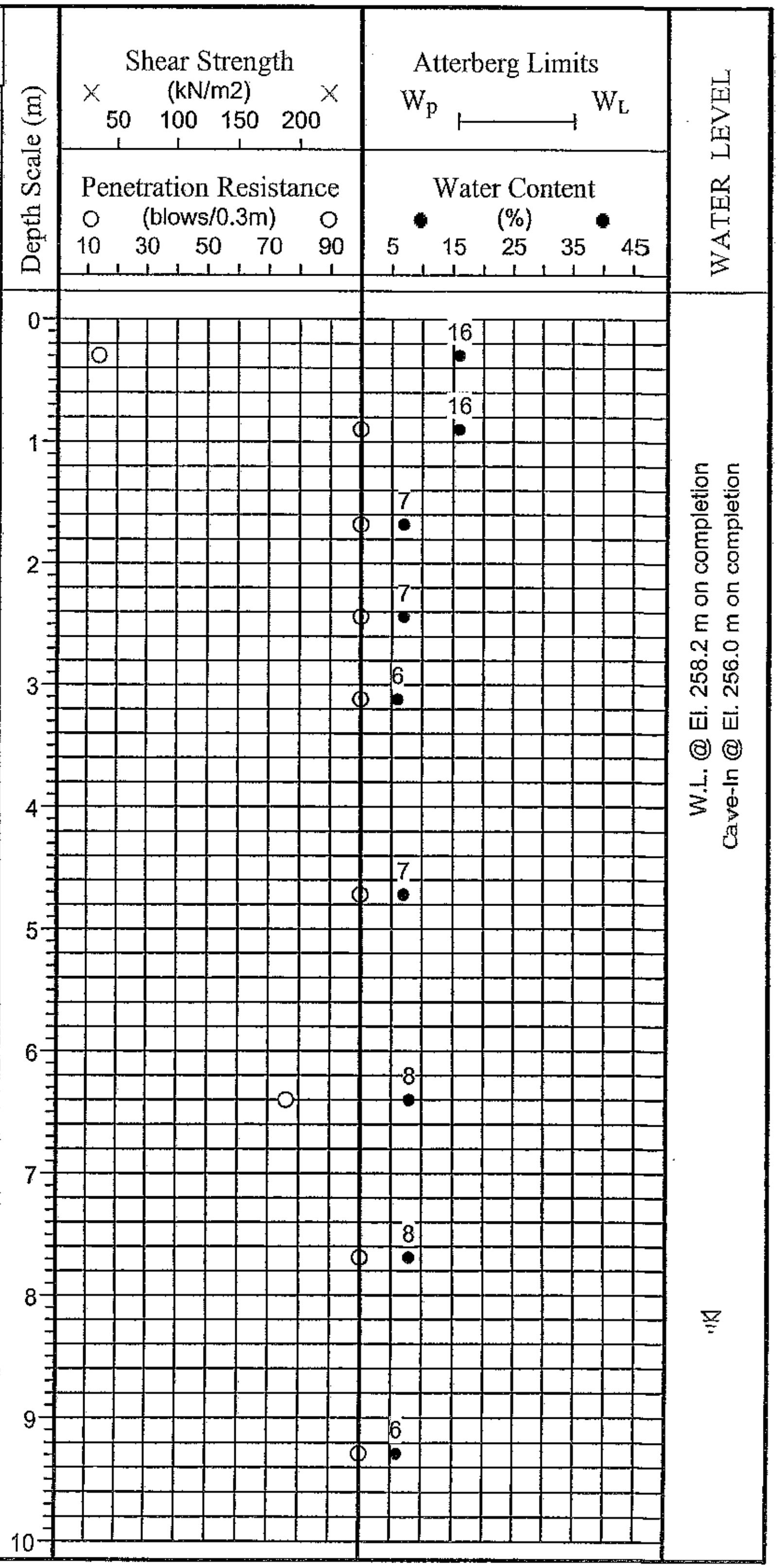
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: NE of Yonge St./Eagle St., Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: September 21, 2004

Elev. Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
266.4	Ground Surface			
0.0	**30cm TOPSOIL**	1	DO	14
	Brown, hard **SILTY CLAY** a tr. of gravel	2	DO	100+
265.2 1.2	Very dense	3	DO	100+
		4	DO	100+
		5	DO	100+
	SANDY SILT, Till			
		6	DO	100+
	a tr. of clay a tr. to some gravel occ. sand and silt seams	7	DO	76
	brown grey	8	DO	100+
		9	DO	100+
256.4 10.0	*Cont'd on Fig. 3A*			



W.L. @ El. 258.2 m on completion

Cave-In @ El. 256.0 m on completion

Soil Engineers Ltd.

JOB NO.: 0409-S004

LOG OF BOREHOLE NO.: 3

FIGURE NO.: 3A

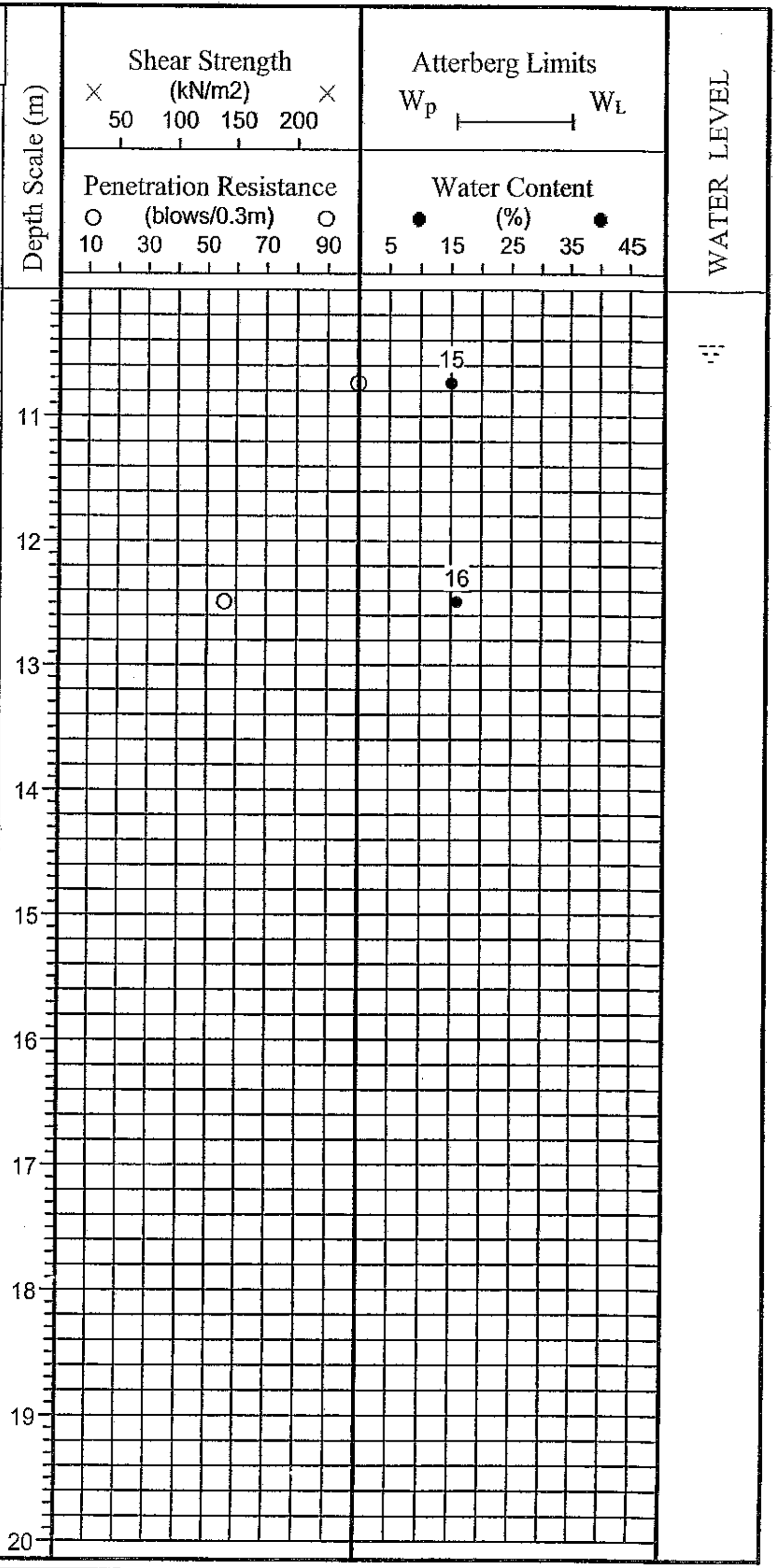
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: NE of Yonge St./Eagle St., Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: September 21, 2004

Elev. Depth (m)	SOIL DESCRIPTION (Cont'd)	SAMPLES		
		Number	Type	N-Value
256.4 10.0	**SANDY SILT, Till**	10	DO	100+
254.8 11.6	Brown, very dense **FINE TO COARSE SAND** traces of clay, silt and gravel	11	DO	56
253.7 12.7	**END OF BOREHOLE**			



JOB NO.: 0409-S004

LOG OF BOREHOLE NO.: 4

FIGURE NO.: 4

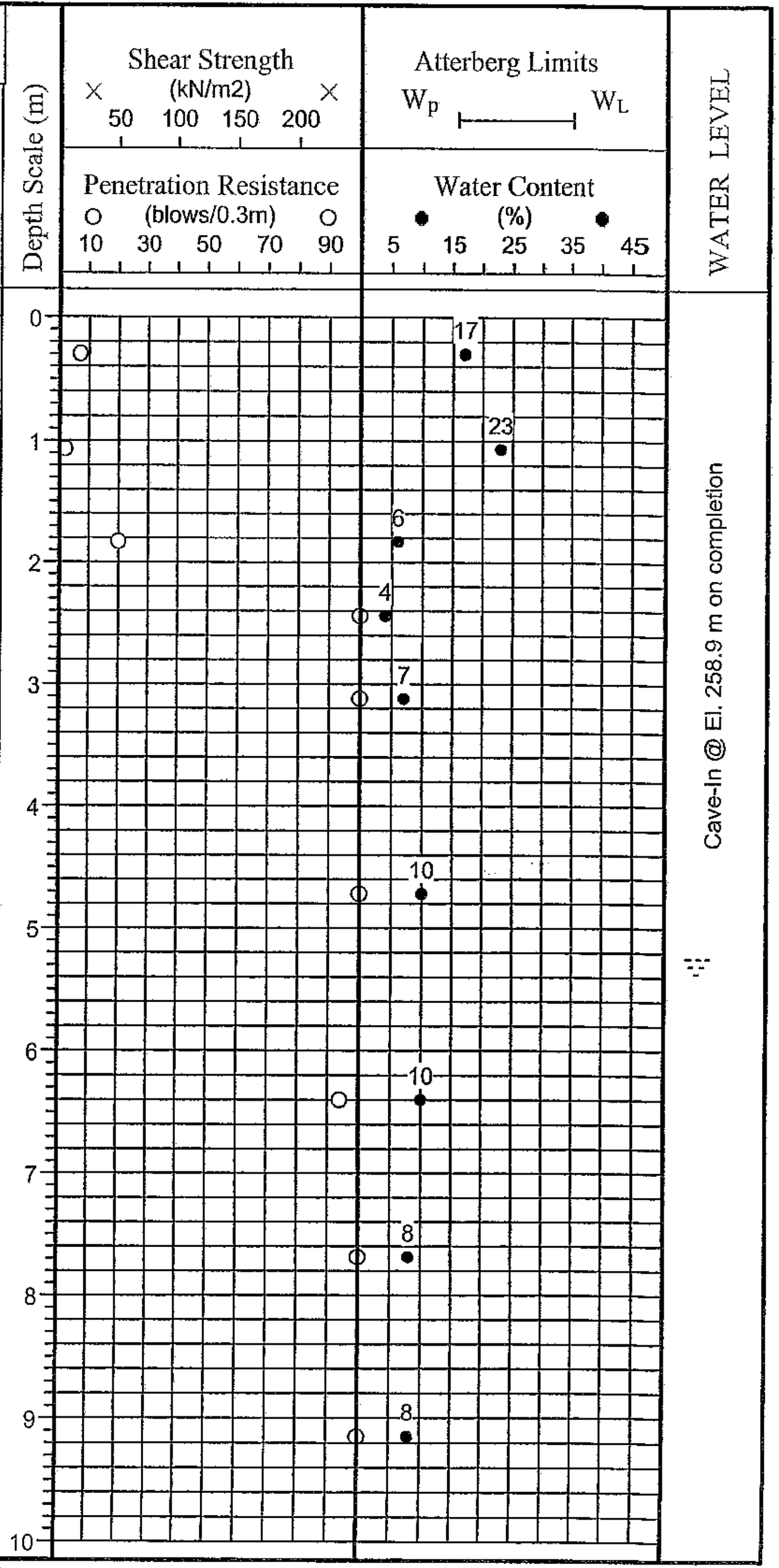
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: NE of Yonge St./Eagle St., Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: September 22, 2004

Elev. Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
264.1	Ground Surface			
0.0	**TOPSOIL, Fill**	1	DO	7
263.4 0.7	**CHARCOAL REMAINS**	2	DO	2
262.8 1.3	Compact to very dense	3	DO	20
		4	DO	100+
		5	DO	100+
	SANDY SILT, Till	6	DO	100+
		7	DO	94
	traces of clay and gravel occ. sand and silt seams			
	brown	8	DO	100+
	grey			
254.8 9.3	**END OF BOREHOLE**	9	DO	100+



JOB NO.: 0409-S004

LOG OF BOREHOLE NO.: 5

FIGURE NO.: 5

JOB DESCRIPTION: Proposed Residential Development

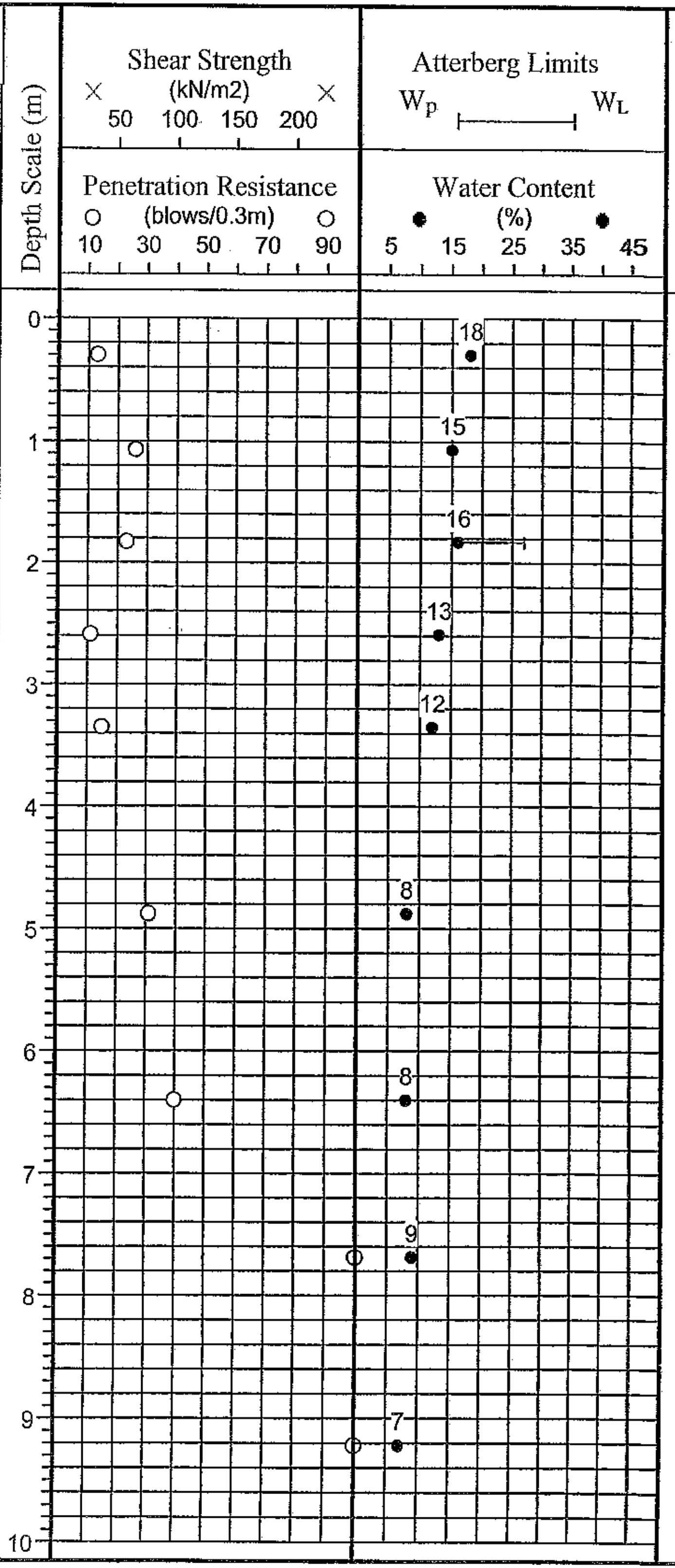
JOB LOCATION: NE of Yonge St./Eagle St., Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: September 22, 2004

Elev. Depth (m)	SOIL DESCRIPTION
260.3	Ground Surface
0.0	**15cm TOPSOIL**
	Brown, stiff to very stiff **SILTY CLAY** a tr. of sand
258.2 2.1	Brown, compact **SANDY SILT** a tr. of clay occ. silt seams
257.4 2.9	Brown, compact to very dense **SANDY SILT, Till** a tr. to some clay a tr. of gravel
251.0 9.3	**END OF BOREHOLE**

SAMPLES		
Number	Type	N-Value
1	DO	13
2	DO	26
3	DO	23
4	DO	11
5	DO	15
6	DO	31
7	DO	40
8	DO	100+
9	DO	100+



WATER LEVEL

W.L. @ El. 254.8 m on completion

Soil Engineers Ltd.

JOB NO.: 0409-S004

LOG OF BOREHOLE NO.: 6

FIGURE NO.: 6

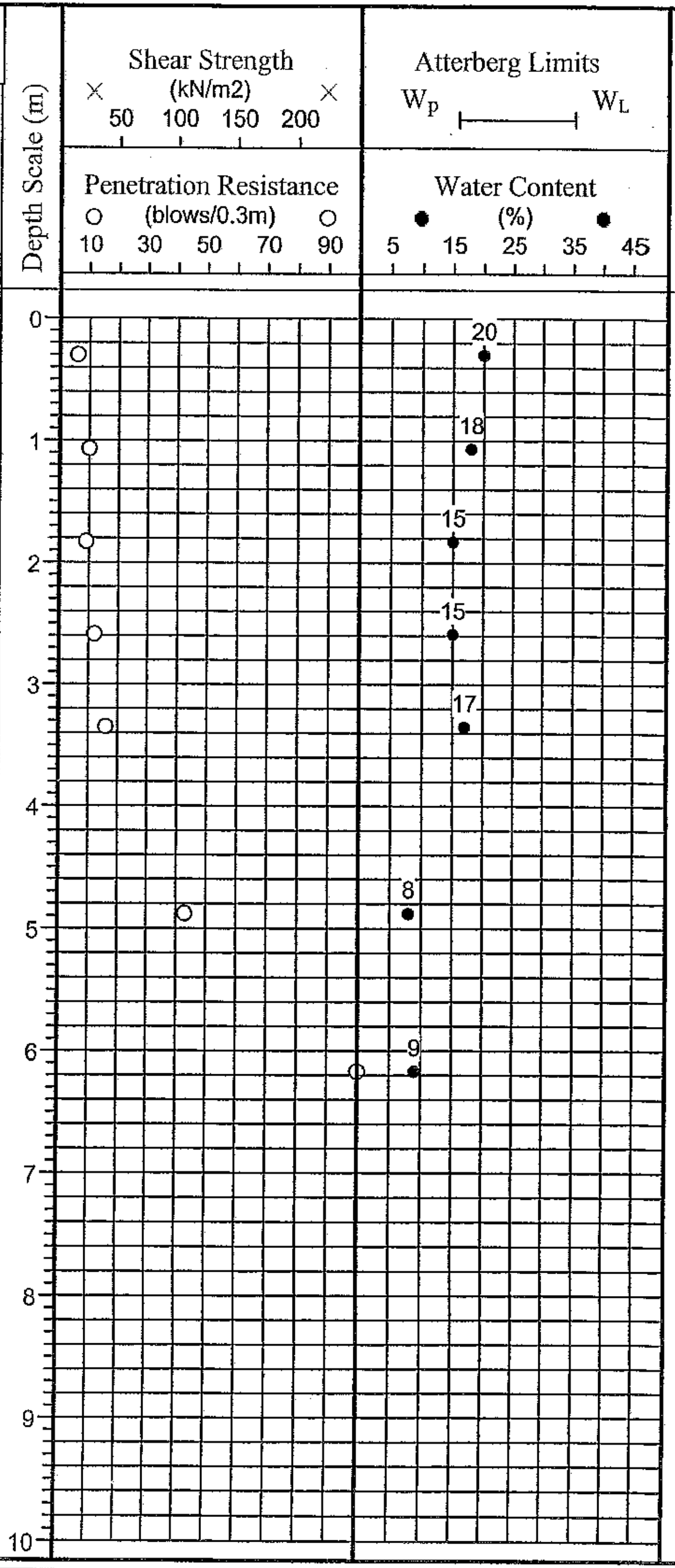
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: NE of Yonge St./Eagle St., Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: September 22, 2004

Elev. Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value	WATER LEVEL
263.5	Ground Surface				
0.0	**15cm TOPSOIL**	1	DO	6	Dry on completion
	Brown **SILTY CLAY, Fill** occ. roots, plant materials, topsoil inclusions	2	DO	10	
		3	DO	9	
		4	DO	12	
		5	DO	16	
259.9 3.6	Brown, dense **SILTY SAND, Till** traces of clay and gravel	6	DO	43	
258.1 5.4	Brown, very dense **SANDY SILT, Till** a tr. of clay, some gravel	7	DO	100+	
257.2 6.3	**END OF BOREHOLE**				



Soil Engineers Ltd.

JOB NO.: 0409-S004

LOG OF BOREHOLE NO.: 7

FIGURE NO.: 7

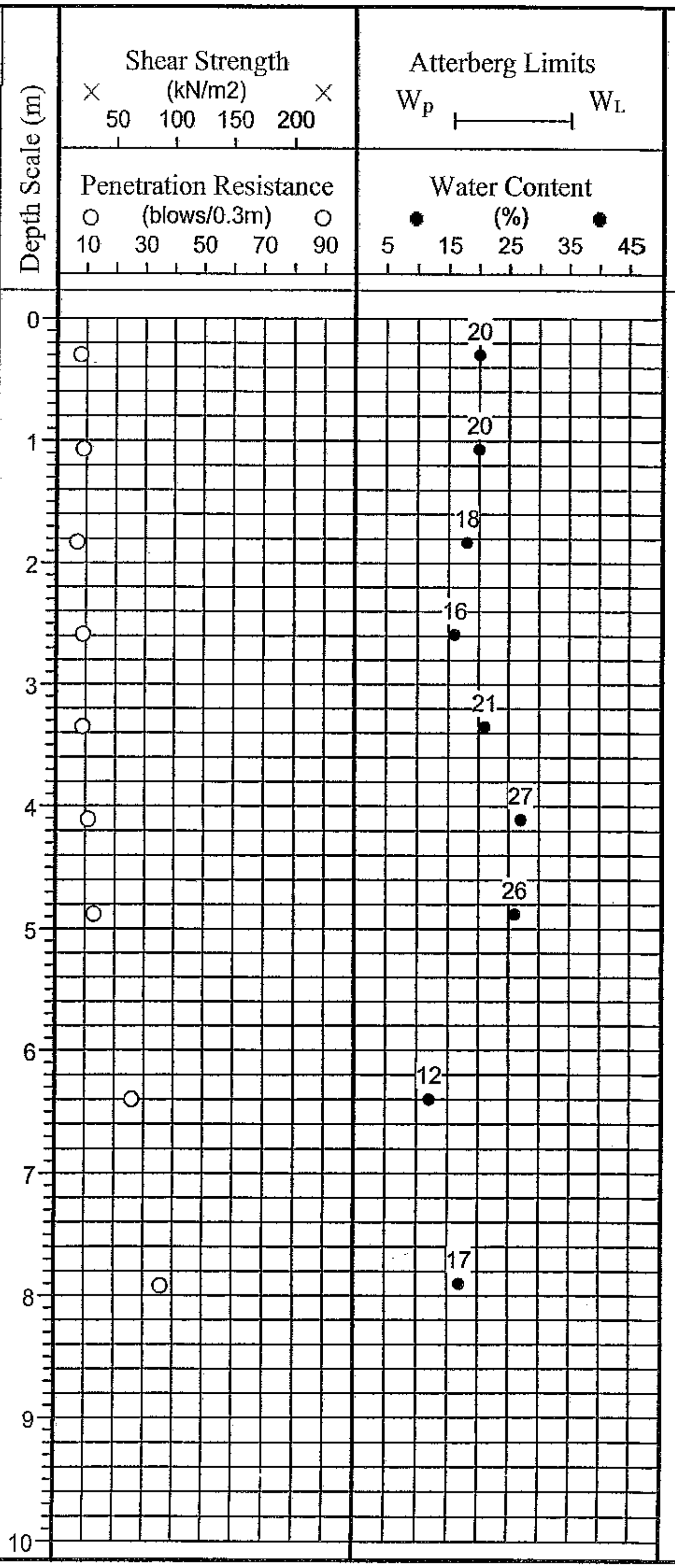
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: NE of Yonge St./Eagle St., Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: September 22, 2004

Elev. Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
258.4	Ground Surface			
0.0	**25cm TOPSOIL**			
		1	DO	8
	Brown			
		2	DO	9
	SILTY CLAY, Fill	3	DO	7
	occ. roots	4	DO	9
		5	DO	9
254.8 3.6	**TOPSOIL** occ. roots	6	DO	11
254.0 4.4	Stiff to hard			
		7	DO	13
	SILTY CLAY			
	brown grey			
		8	DO	26
	silty clay till layer			
		9	DO	36
250.3 8.1	**END OF BOREHOLE**			



WATER LEVEL

W.L. @ El. 250.8 m on completion

JOB NO.: 0409-S004

LOG OF BOREHOLE NO.: 8

FIGURE NO.: 8

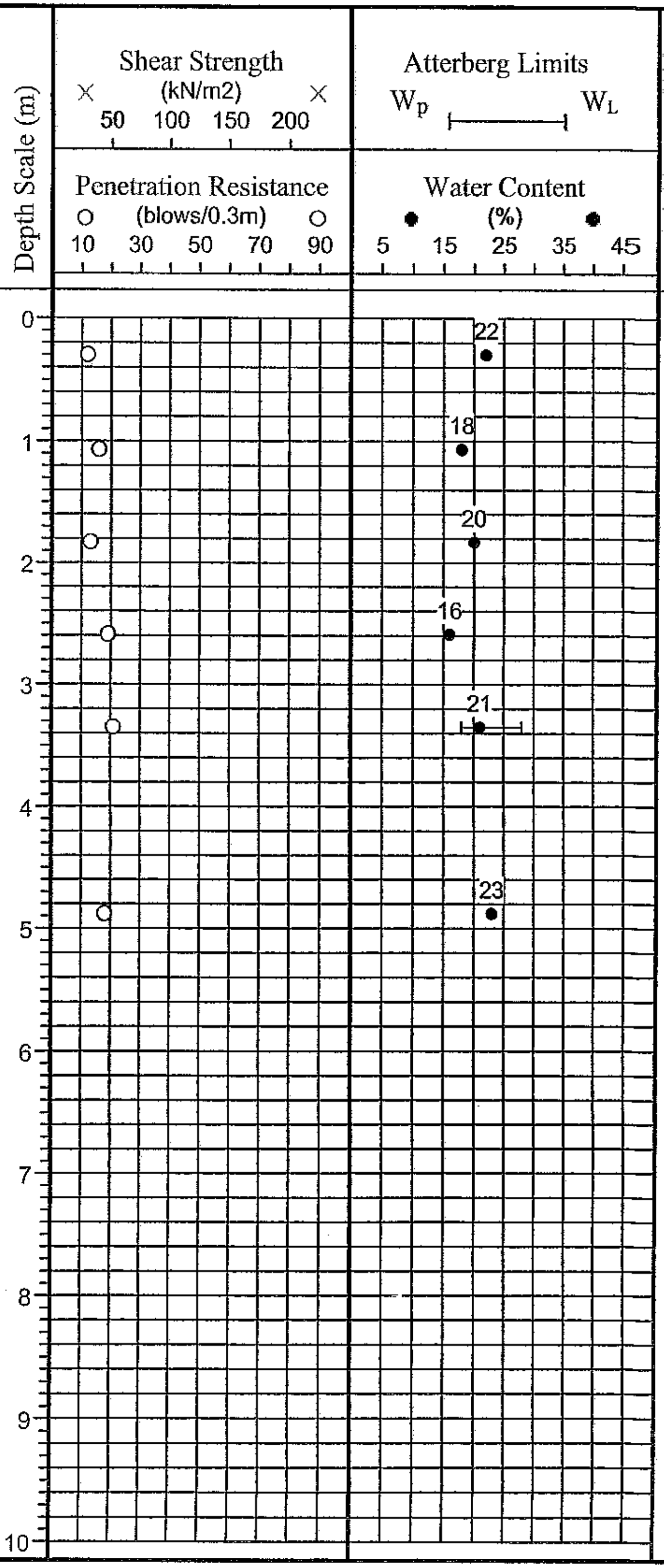
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: NE of Yonge St./Eagle St., Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: September 22, 2004

Elev. Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value	WATER LEVEL
257.1	Ground Surface				
0.0	**41cm TOPSOIL**	1	DO	12	
	Brown, stiff to very stiff	2	DO	16	Dry on completion
	SILTY CLAY	3	DO	13	
		4	DO	19	
	traces of sand and gravel occ. sand lenses	5	DO	21	
252.1		6	DO	18	
5.0	**END OF BOREHOLE**				



Soil Engineers Ltd.

JOB NO.: 0409-S004

LOG OF BOREHOLE NO.: 9

FIGURE NO.: 9

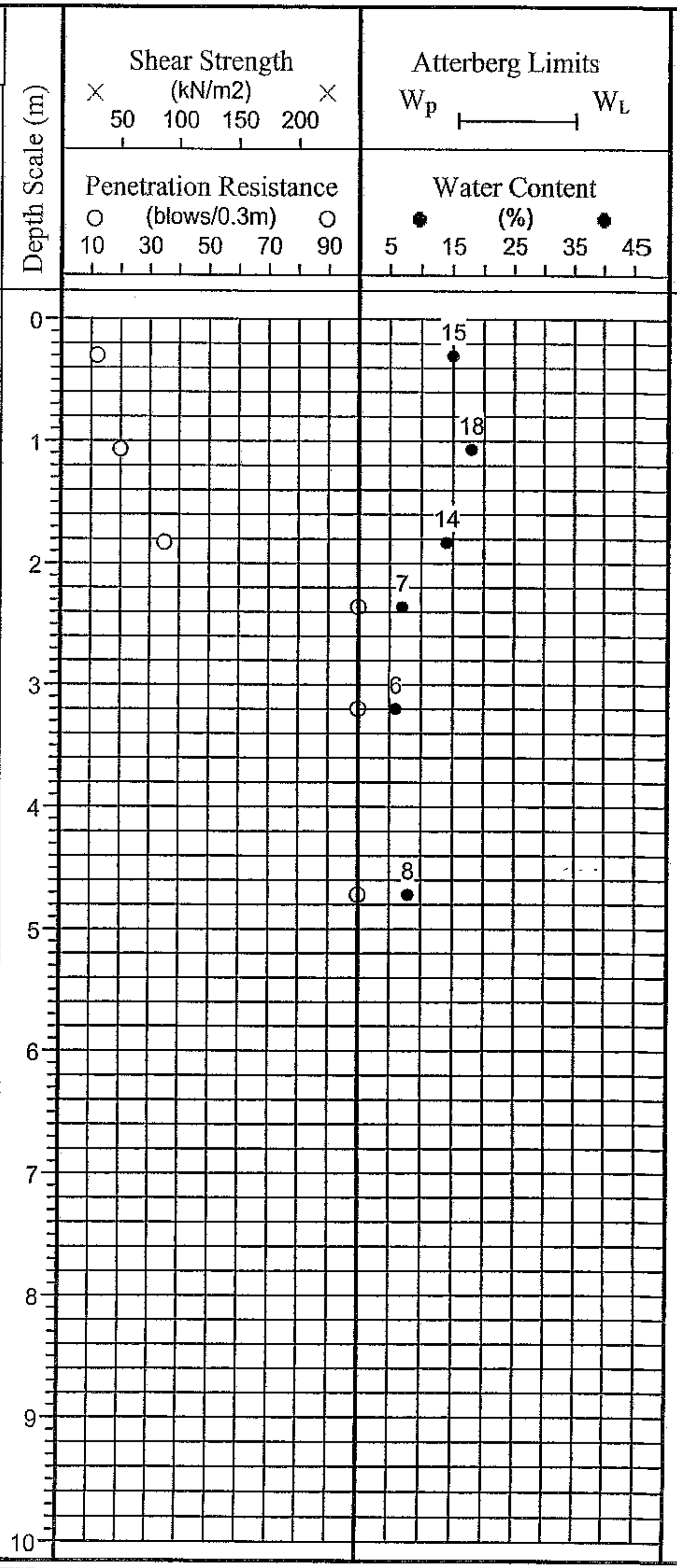
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: NE of Yonge St./Eagle St., Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: September 21, 2004

Elev. Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value	WATER LEVEL
267.5	Ground Surface				
0.0	**25cm TOPSOIL**	1	DO	12	Dry on completion
	Brown, stiff to hard **SILTY CLAY** a tr. of gravel	2 3	DO DO	20 35	
265.4 2.1	Brown, very dense **SANDY SILT, Till** tr. to some clay and gravel	4 5 6	DO DO DO	100+ 100+ 100+	
262.6 4.9	**END OF BOREHOLE**				



Soil Engineers Ltd.

JOB NO.: 0409-S004

LOG OF BOREHOLE NO.: 10

FIGURE NO.: 10

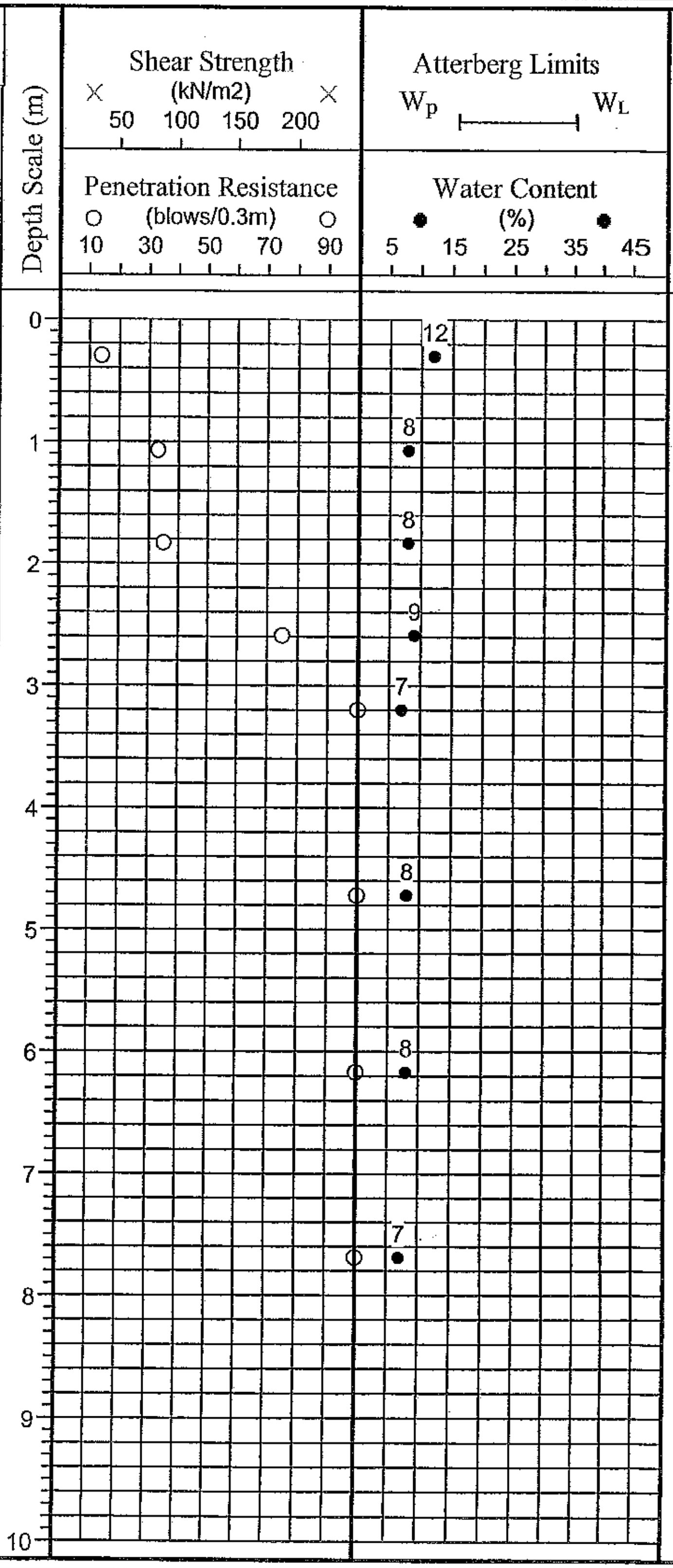
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: NE of Yonge St./Eagle St., Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: September 22, 2004

Elev. Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
265.5	Ground Surface			
0.0	**30cm TOPSOIL**	1	DO	14
	Brown, compact to very dense	2	DO	33
		3	DO	35
		4	DO	75
	SANDY SILT, Till	5	DO	100+
		6	DO	100+
	traces of clay and gravel	7	DO	100+
		8	DO	100+
257.7 7.8	**END OF BOREHOLE**			



WATER LEVEL

Dry on completion

Soil Engineers Ltd.

JOB NO.: 0409-S004

LOG OF BOREHOLE NO.: 11

FIGURE NO.: 11

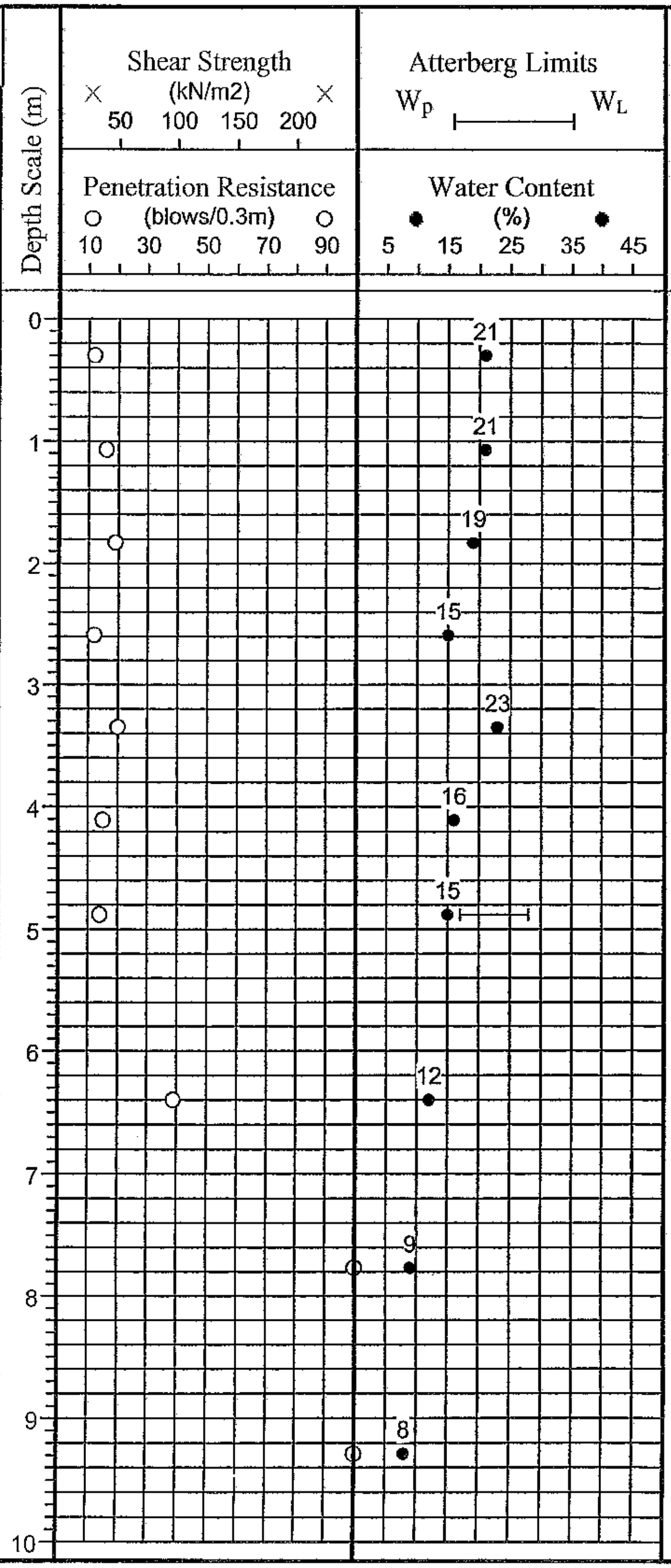
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: NE of Yonge St./Eagle St., Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: September 22, 2004

Elev. Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
260.5	Ground Surface			
0.0	**15cm TOPSOIL**	1	DO	12
	Brown **SILTY CLAY, Fill** occ. roots, topsoil inclusions some sand	2	DO	16
		3	DO	19
		4	DO	12
257.6 2.9	**TOPSOIL** occ. roots	5	DO	20
256.9 3.6	Stiff to hard **SILTY CLAY, Till** some sand to sandy a tr. to some gravel occ. cobbles and boulders brown grey	6	DO	15
		7	DO	14
		8	DO	39
		9	DO	100+
252.1 8.4	Grey, very dense **SANDY SILT, Till** some clay and gravel	10	DO	100+
251.1 9.4	**END OF BOREHOLE**			



WATER LEVEL

W.L. @ El. 252.6 m on completion

Soil Engineers Ltd.

JOB NO.: 0409-S004

LOG OF BOREHOLE NO.: 12

FIGURE NO.: 12

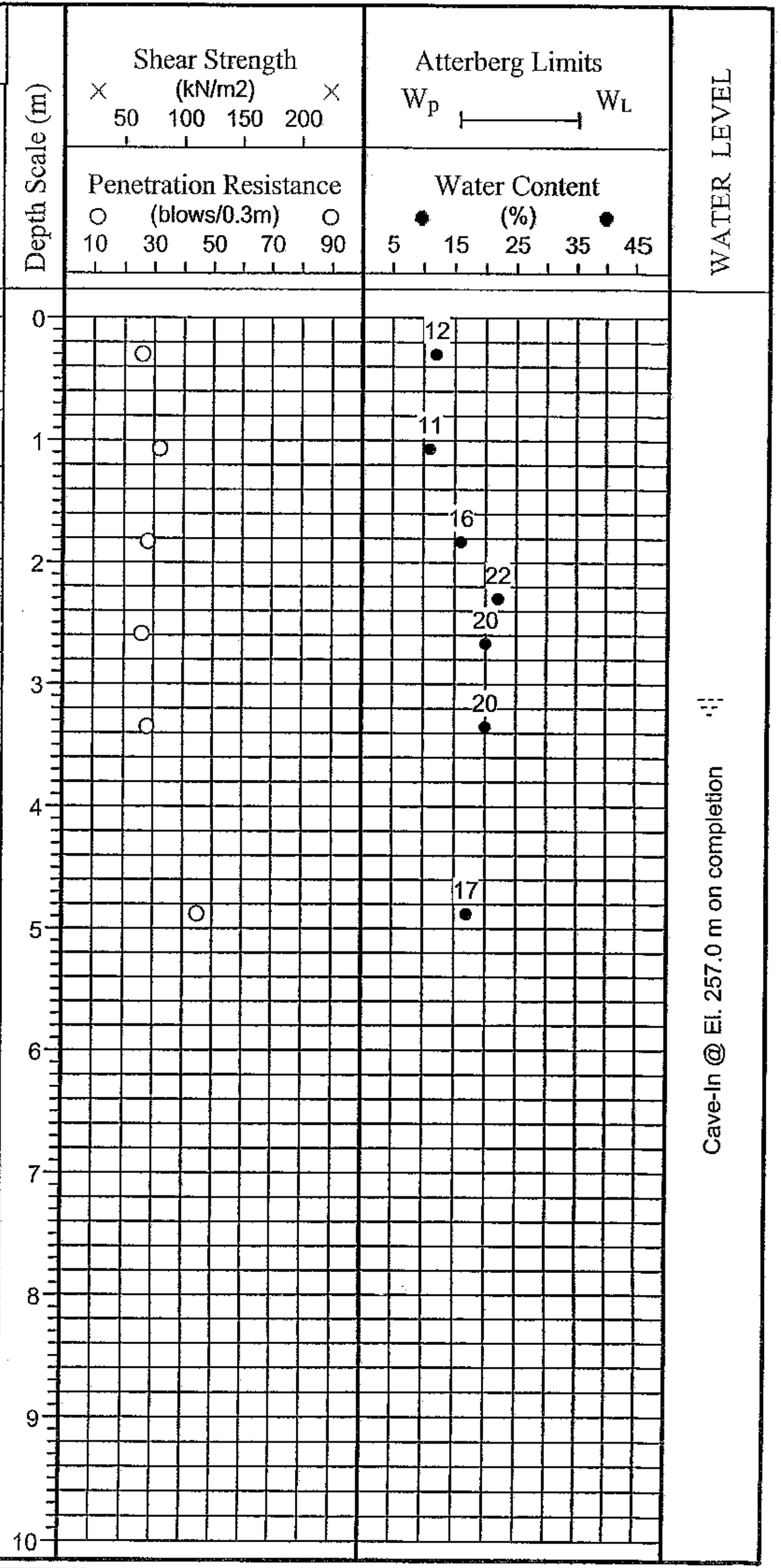
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: NE of Yonge St./Eagle St., Town of Newmarket

METHOD OF BORING: Flight-Auger

DATE: September 22, 2004

Elev. Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
260.1	Ground Surface			
0.0	**20cm TOPSOIL**	1	DO	26
	Brown **SILTY CLAY, Fill**	2	DO	32
		3	DO	28
257.8 2.3	**TOPSOIL**	4	DO	26
257.5 2.6	Brown, very stiff **SILTY CLAY**			
257.1 3.0	Brown, compact to dense **SILT** some clay traces of sand and gravel	5	DO	28
		6	DO	45
255.1 5.0	**END OF BOREHOLE**			



JOB NO: 0907-E017

LOG OF BOREHOLE NO: 1

FIGURE NO: 1

JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: 55 Eagle Street, Town of Newmarket

METHOD OF BORING: Geoprobe 7822 DT

DATE: September 29, 2009

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	Gas (ppm)	Depth Scale (m)
0.0	Ground Surface				0
	15 cm TOPSOIL, Fill Brown	1	DO	0	
		2	DO	0	1
	SILTY CLAY, Fill a tr. of topsoil inclusions a tr. of gravel	3	DO	5	
		4	DO	5	2
		5	DO	0	
3.0	Grey	6	DO	5	3
		7	DO	0	4
	SILTY CLAY a tr. of sand	8	DO	0	
		9	DO	5	5
		10	DO	0	
6.1	**END OF BOREHOLE** Installed 46 mm Ø standpipe to 6.1 m. Sand backfill from 2.7 to 6.1 m. Bentonite seal from 0.3 to 2.7 m. Concrete from 0.0 to 0.3 m. Provided with a lockable steel protective case.				6
					7
					8
					9
					10

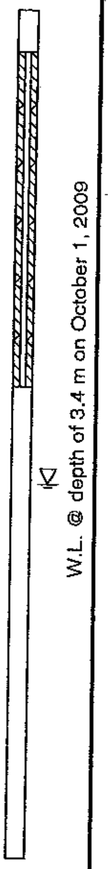
× Shear Strength (kN/m2)
50 100 150 200

○ Penetration Resistance (blows/0.3m)
10 30 50 70 90

Atterberg Limits
PL LL

● Moisture Content (%)
10 20 30 40

WATER LEVEL



W.L. @ depth of 3.4 m on October 1, 2009

Soil Engineers Ltd.

JOB NO: 0907-E017

LOG OF BOREHOLE NO: 2

FIGURE NO: 2

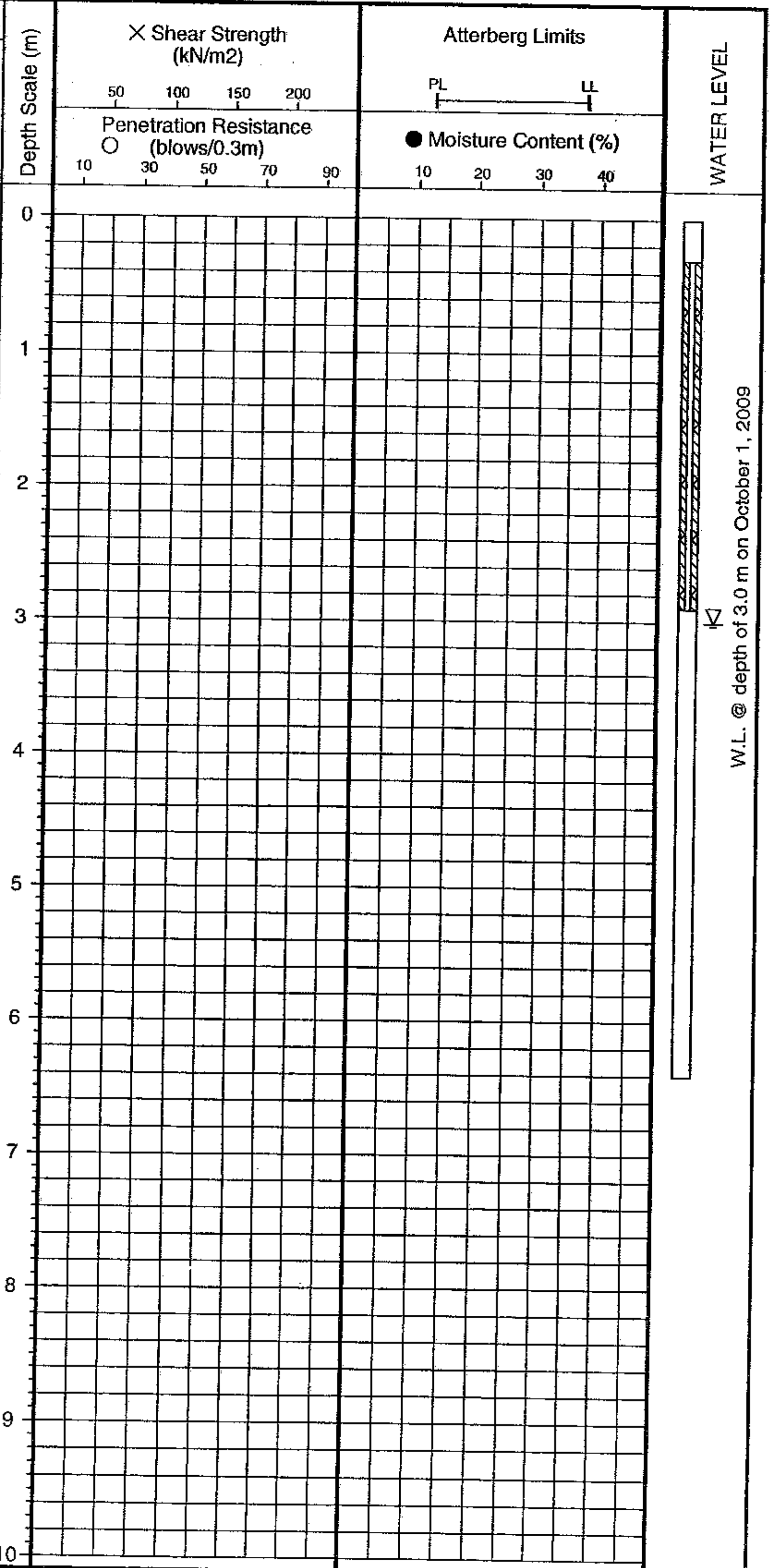
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: 55 Eagle Street, Town of Newmarket

METHOD OF BORING: Geoprobe 7822 DT

DATE: September 29, 2009

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	Gas (ppm)
0.0	Ground Surface			
	20 cm TOPSOIL Brown	1	DO	5
	SANDY SILT	2	DO	0
	a tr. of clay	3	DO	0
		4	DO	5
2.4		5	DO	5
	brown grey	6	DO	0
	SILTY FINE SAND a tr. of clay and gravel	7	DO	0
		8	DO	5
		9	DO	0
		10	DO	0
		11	DO	0
6.4	**END OF BOREHOLE** Installed 46 mm Ø standpipe to 6.4 m. Sand backfill from 2.9 to 6.1 m. Bentonite seal from 0.3 to 2.9 m. Concrete from 0.0 to 0.3 m. Provided with a lockable steel protective case.			



W.L. @ depth of 3.0 m on October 1, 2009

Soil Engineers Ltd.

JOB NO: 0907-E017

LOG OF BOREHOLE NO: 1

FIGURE NO: 1

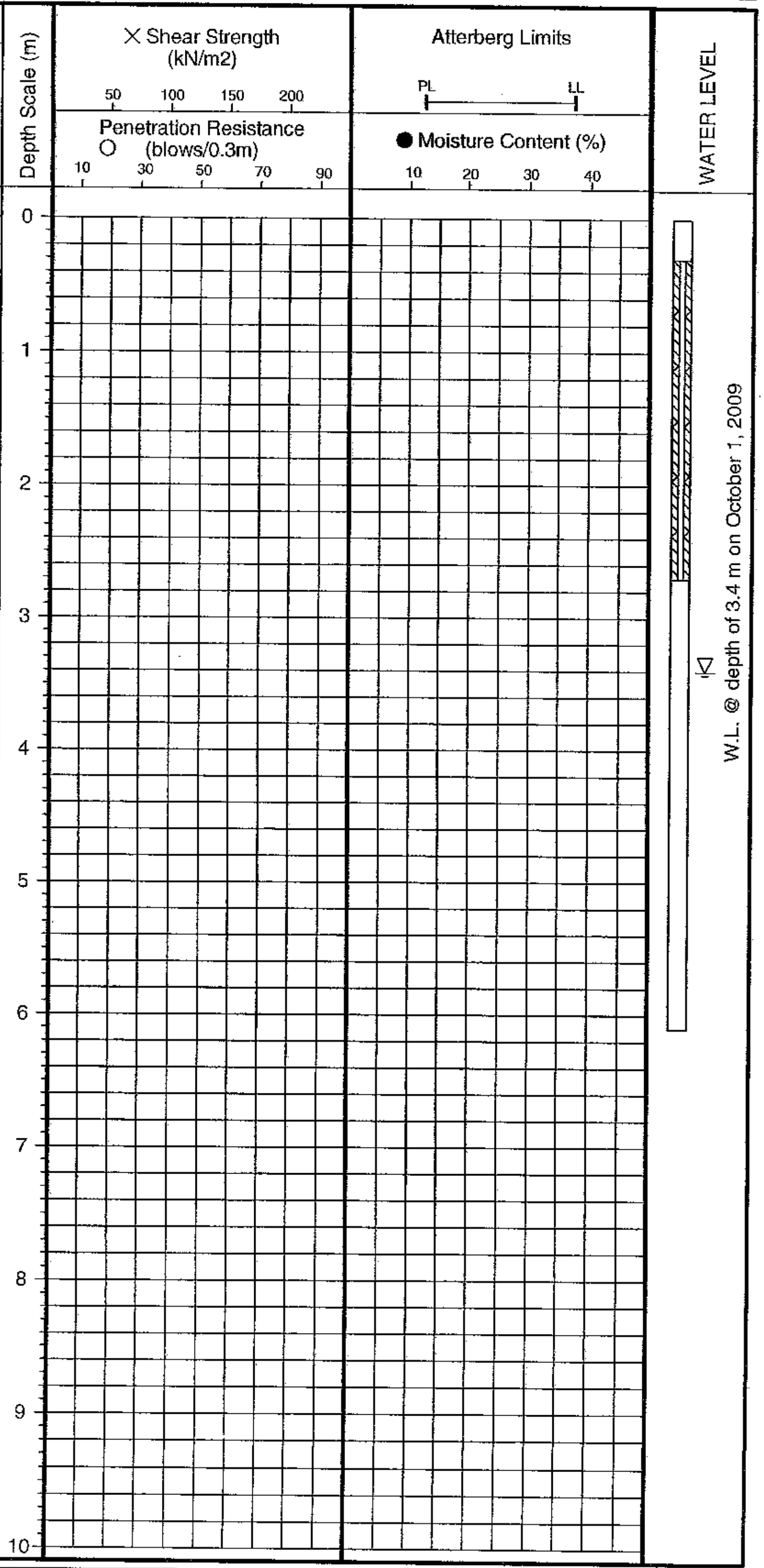
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: 55 Eagle Street, Town of Newmarket

METHOD OF BORING: Geoprobe 7822 DT

DATE: September 29, 2009

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES		
		Number	Type	Gas (ppm)
0.0	Ground Surface			
	15 cm TOPSOIL, Fill			
	Brown	1	DO	0
		2	DO	0
	SILTY CLAY, Fill a tr. of topsoil inclusions a tr. of gravel	3	DO	5
		4	DO	5
		5	DO	0
3.0	Grey	6	DO	5
		7	DO	0
	SILTY CLAY a tr. of sand	8	DO	0
		9	DO	5
		10	DO	0
6.1	**END OF BOREHOLE** Installed 46 mm Ø standpipe to 6.1 m. Sand backfill from 2.7 to 6.1 m. Bentonite seal from 0.3 to 2.7 m. Concrete from 0.0 to 0.3 m. Provided with a lockable steel protective case.			



Soil Engineers Ltd.

JOB NO: 0907-E017

LOG OF BOREHOLE NO: 2

FIGURE NO: 2

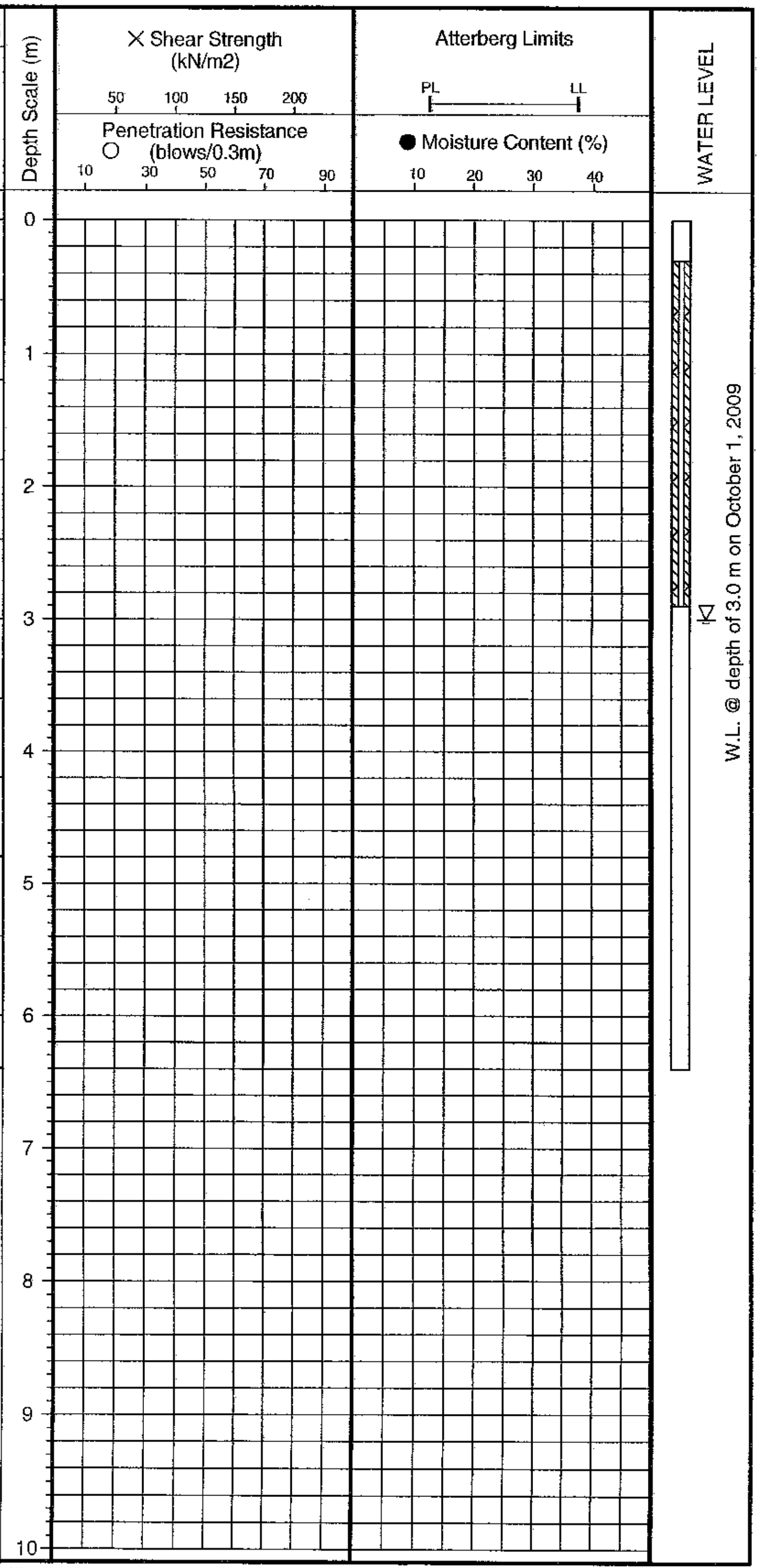
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: 55 Eagle Street, Town of Newmarket

METHOD OF BORING: Geoprobe 7822 DT

DATE: September 29, 2009

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES Gas (ppm)
0.0	Ground Surface			
	20 cm TOPSOIL Brown	1	DO	5
	SANDY SILT	2	DO	0
	a tr. of clay	3	DO	0
2.4		4	DO	5
	brown grey	5	DO	5
		6	DO	0
	SILTY FINE SAND a tr. of clay and gravel	7	DO	0
		8	DO	5
		9	DO	0
		10	DO	0
6.4		11	DO	0
	END OF BOREHOLE Installed 46 mm Ø standpipe to 6.4 m. Sand backfill from 2.9 to 6.1 m. Bentonite seal from 0.3 to 2.9 m. Concrete from 0.0 to 0.3 m. Provided with a lockable steel protective case.			



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FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 623-4630	FAX: (905) 853-5484	FAX: (705) 684-8522	FAX: (905) 623-4630	FAX: (905) 542-2769

APPENDIX 'B'

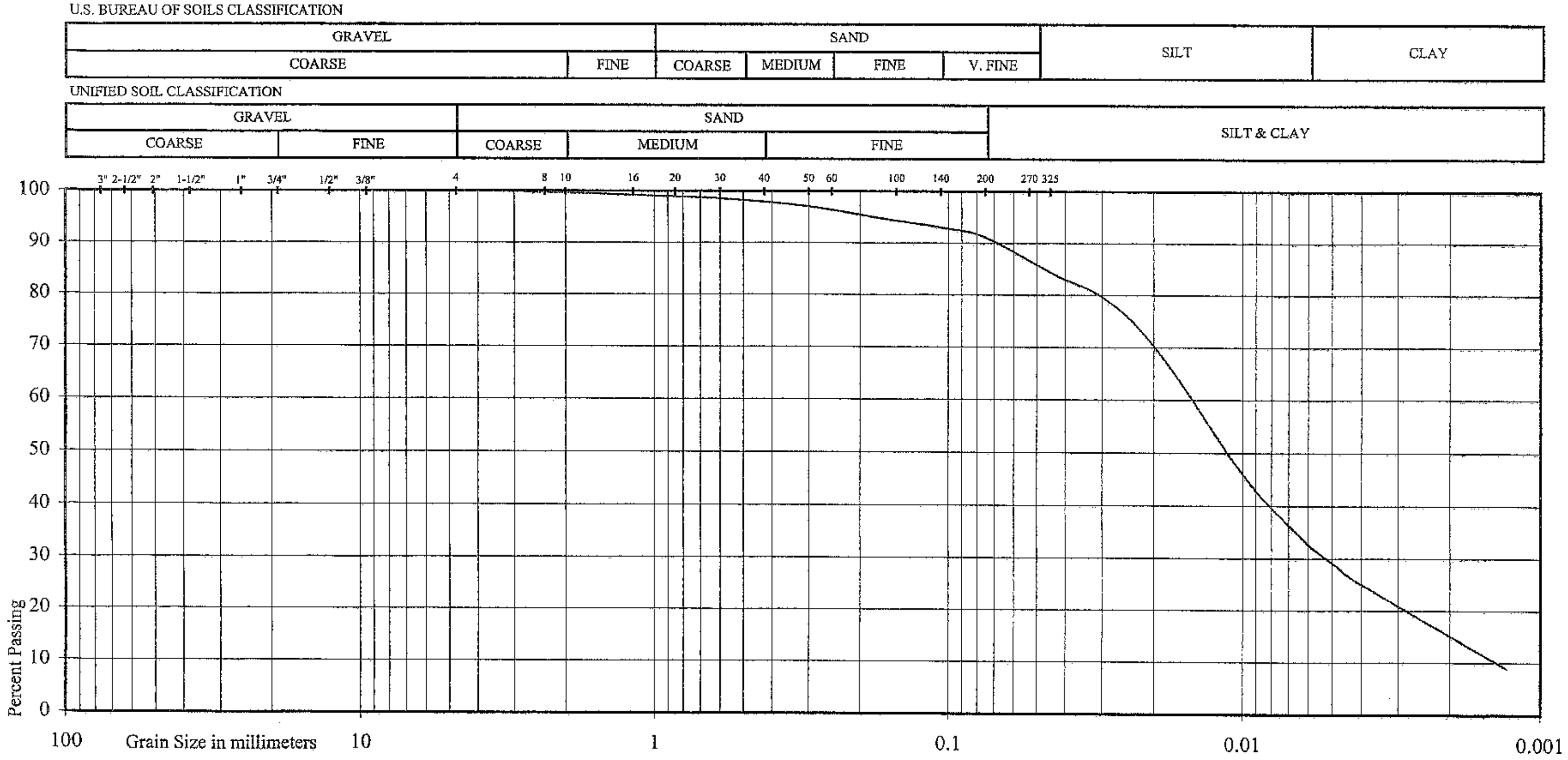
GRAIN SIZE DISTRIBUTION GRAPHS (2004 SOIL INVESTIGATION)

Reference No. 1102-W017

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 0409-S004



Project: Proposed Residential Development

Location: NE of Yonge St./Eagle St., Town of Newmarket

Borehole No: 11

Sample No: 2

Depth (m): 1.1

Elevation (m): 259.4

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = -

Estimated Permeability (cm./sec.) = 10^{-6}

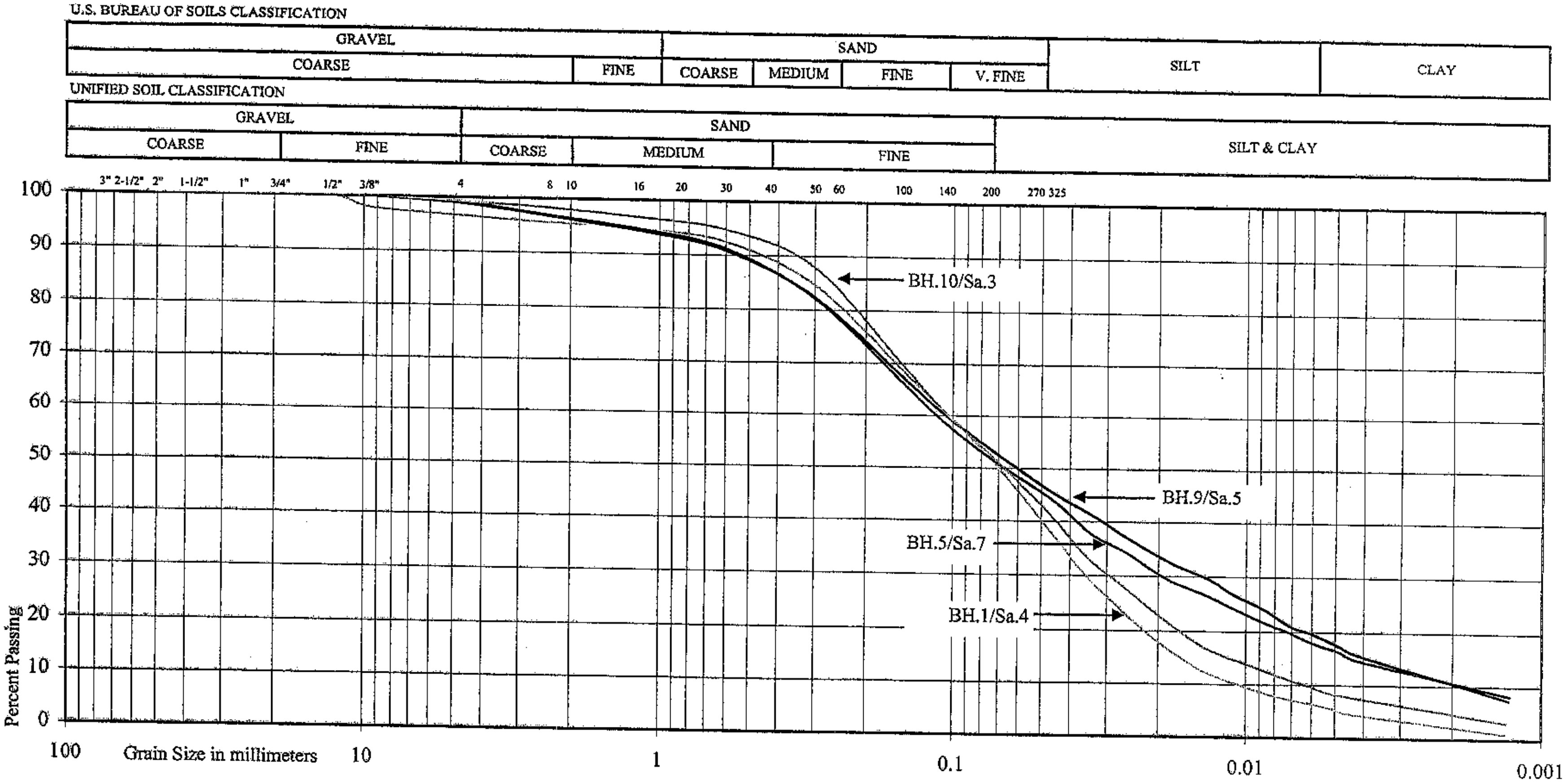
Classification of Sample [& Group Symbol]: SILTY CLAY, Fill

Figure: 13

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 0409-S004



Project:	Proposed Residential Development			
Location:	NE of Yonge St./Eagle St., Town of Newmarket			
Borehole No:	1	5	9	10
Sample No:	4	7	5	3
Depth (m):	2.4	6.4	3.2	1.8
Elevation (m):	262.1	253.9	264.3	263.7

BH./Sa.	1/4	5/7	9/5	10/3
Liquid Limit (%) =	-	-	-	-
Plastic Limit (%) =	-	-	-	-
Plasticity Index (%) =	-	-	-	-
Moisture Content (%) =	-	-	-	-
Estimated Permeability (cm./sec.) =	10^{-5}	10^{-6}	10^{-6}	10^{-5}

Classification of Sample [& Group Symbol]: SANDY SILT, Till

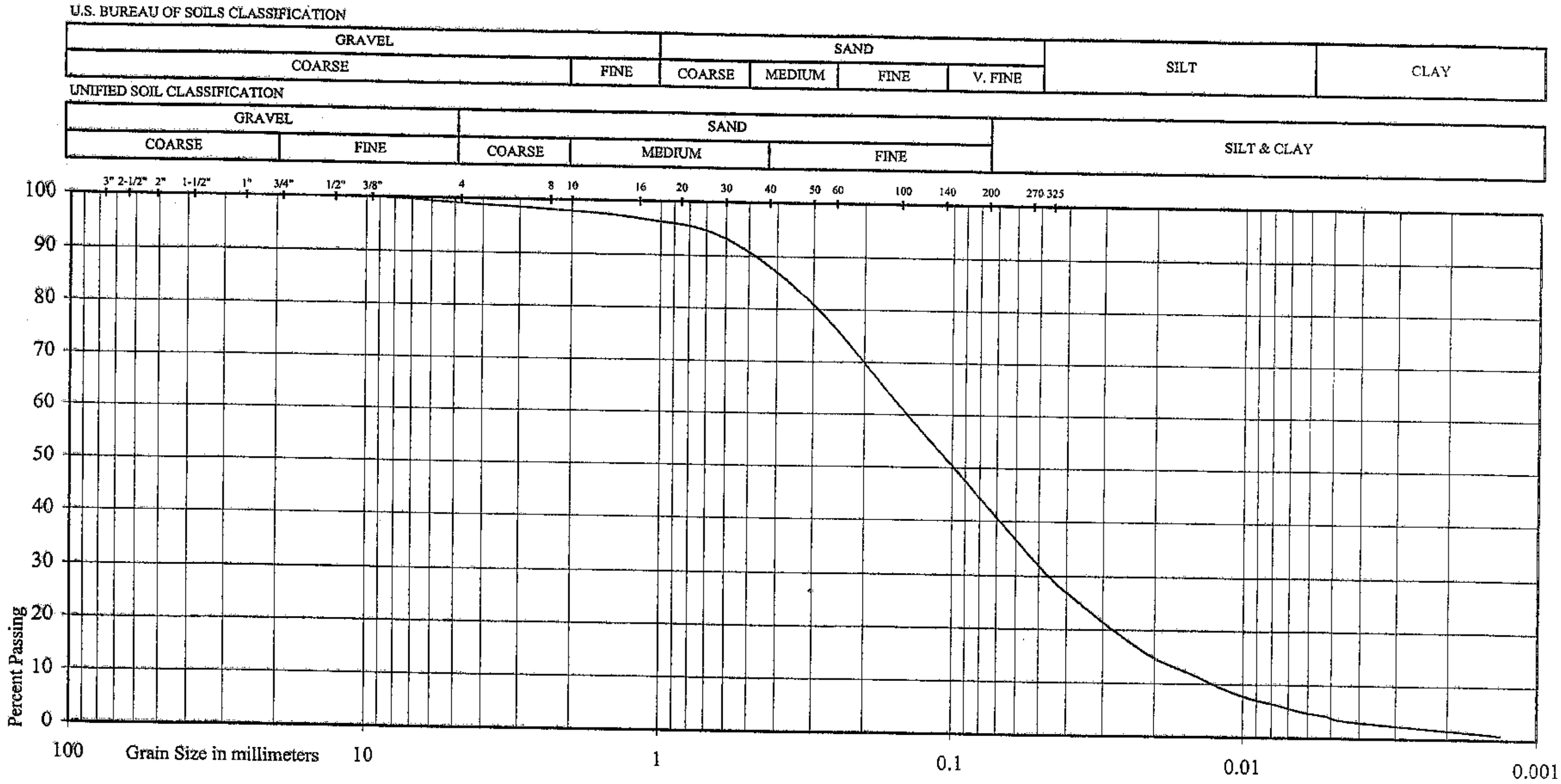
a tr. to some clay, a tr. of gravel

Figure: 14

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 0409-S004



Project: Proposed Residential Development

Location: NE of Yonge St./Eagle St., Town of Newmarket

Borehole No: 6

Sample No: 6

Depth (m): 4.9

Elevation (m): 258.6

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = -

Estimated Permeability (cm./sec.) = 10^{-4}

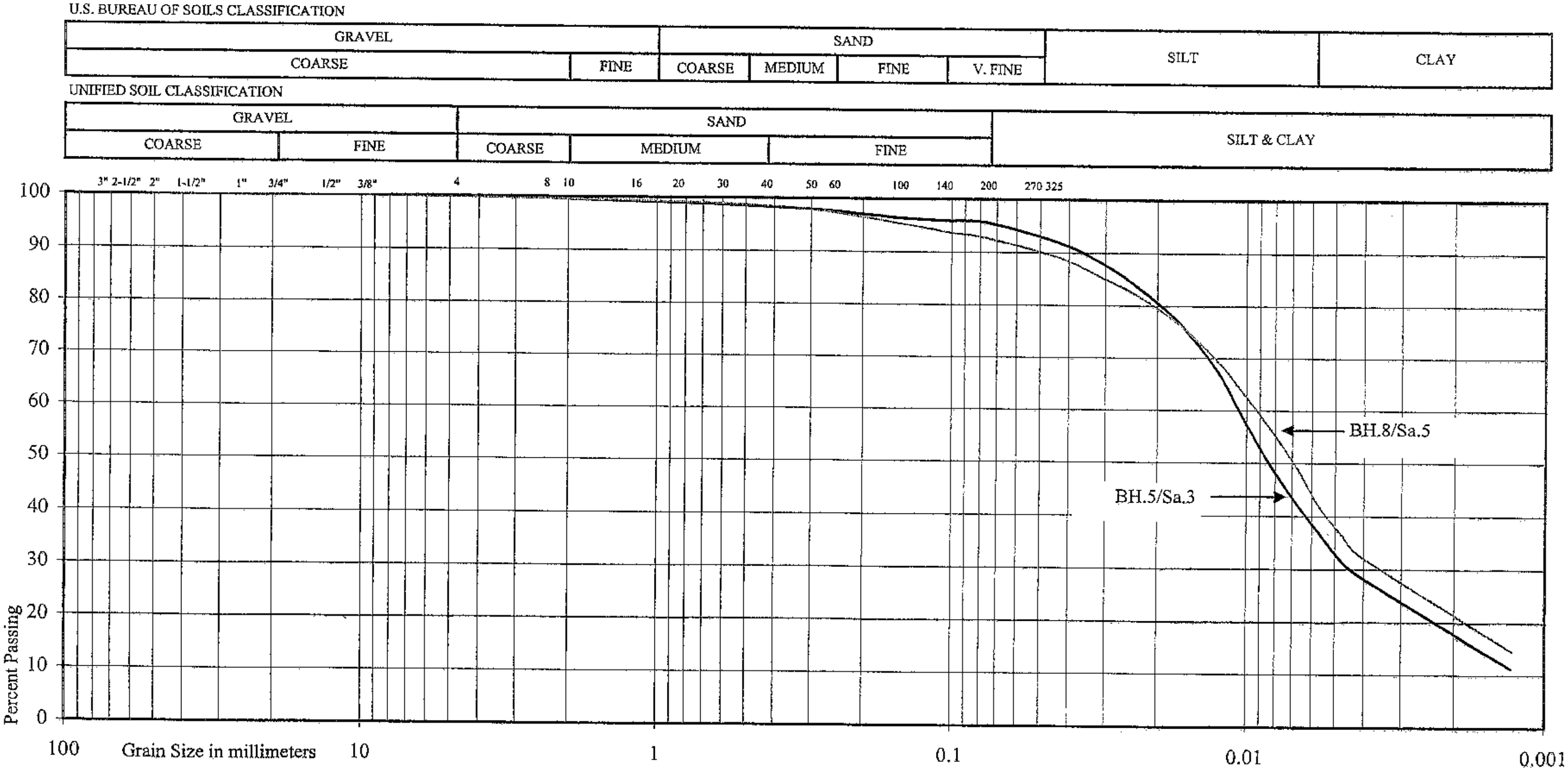
Classification of Sample [& Group Symbol]: SILTY SAND, Till
traces of clay and gravel

Figure: 15

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 0409-S004



Project: Proposed Residential Development
Location: NE of Yonge St./Eagle St., Town of Newmarket

Borehole No:	5	8
Sample No:	3	5
Depth (m):	1.8	3.3
Elevation (m):	258.5	253.8

BH./Sa.	5/3	8/5
Liquid Limit (%) =	26.9	28.2
Plastic Limit (%) =	16.8	18.0
Plasticity Index (%) =	10.1	10.2
Moisture Content (%) =	16	21
Estimated Permeability (cm./sec.) =	10^{-6}	

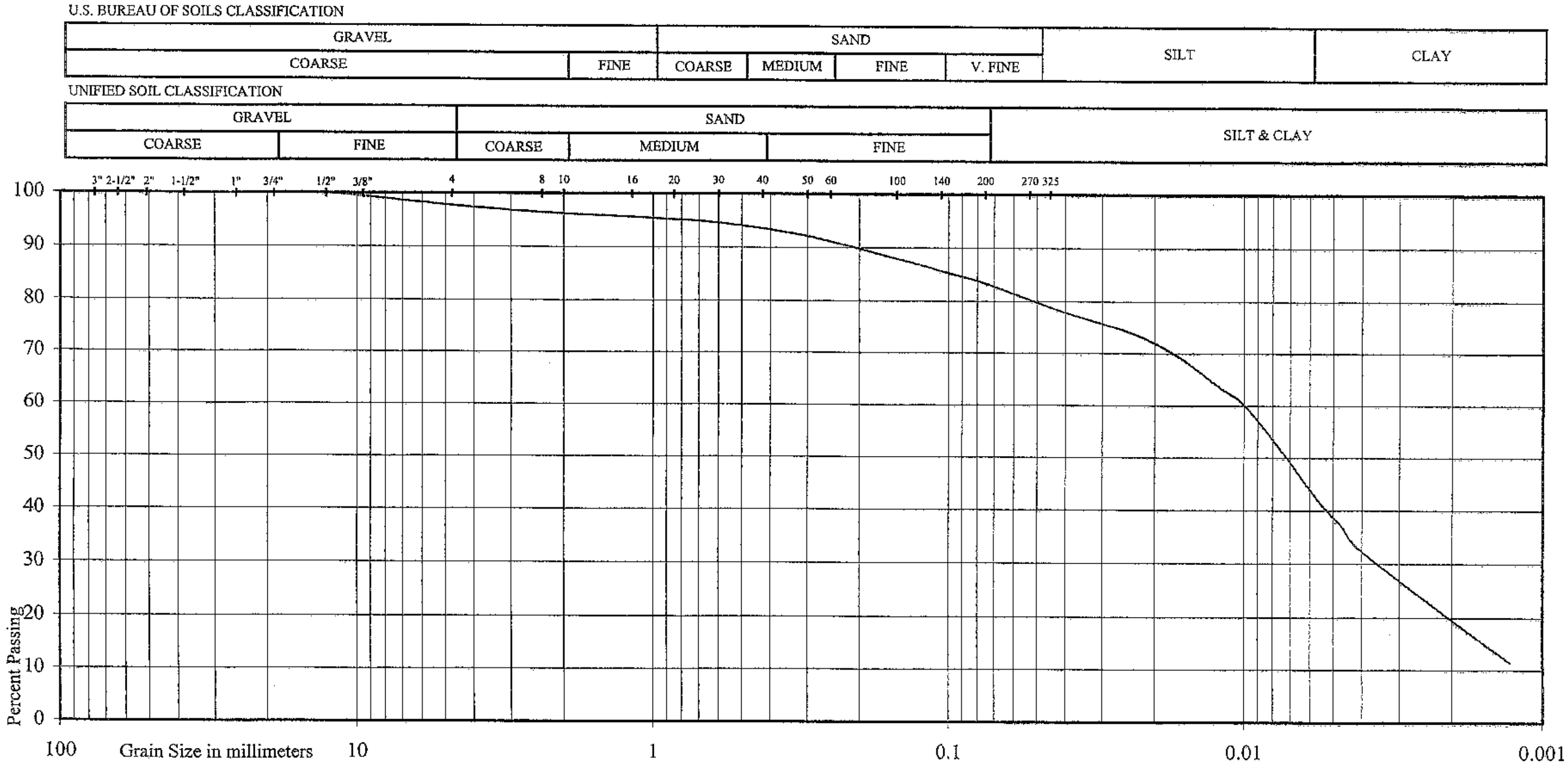
Classification of Sample [& Group Symbol]: SILTY CLAY
a tr. of sand

Figure: 16

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 0409-S004



Project: Proposed Residential Development

Location: NE of Yonge St./Eagle St., Town of Newmarket

Borehole No: 11

Sample No: 7

Depth (m): 4.9

Elevation (m): 255.6

Liquid Limit (%) = 28.2

Plastic Limit (%) = 17.7

Plasticity Index (%) = 10.5

Moisture Content (%) = 15

Estimated Permeability (cm./sec.) = 10^{-6}

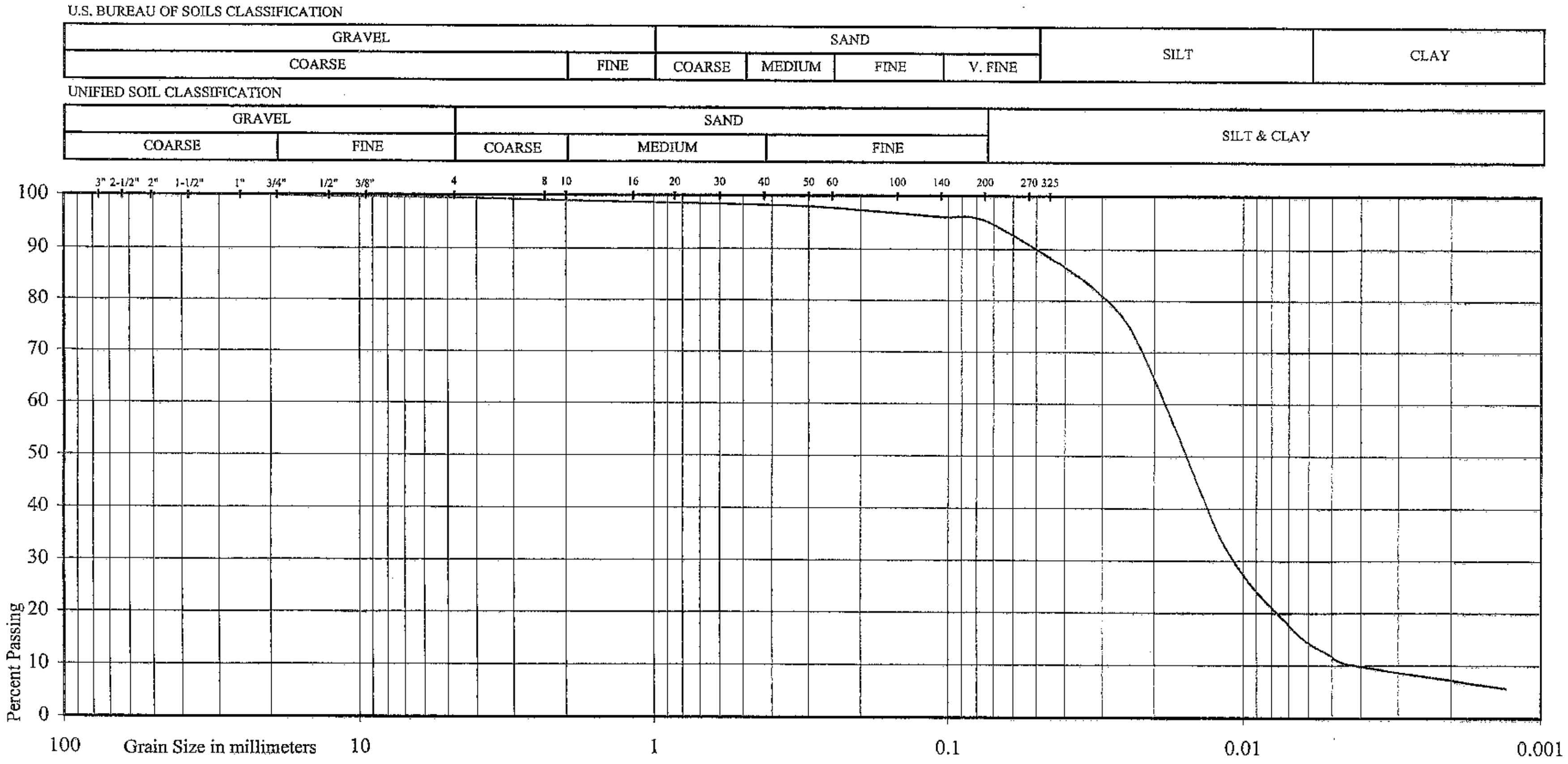
Classification of Sample [& Group Symbol]: SILTY CLAY, Till
some sand, a tr. of gravel

Figure: 17

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 0409-S004



Project: Proposed Residential Development
Location: NE of Yonge St./Eagle St., Town of Newmarket
Borehole No: 12
Sample No: 5
Depth (m): 3.3
Elevation (m): 256.8

Liquid Limit (%) = -
Plastic Limit (%) = -
Plasticity Index (%) = -
Moisture Content (%) = -
Estimated Permeability (cm./sec.) = 10^{-5}

Classification of Sample [& Group Symbol]: SILT
some clay, traces of sand and gravel

Figure: 18

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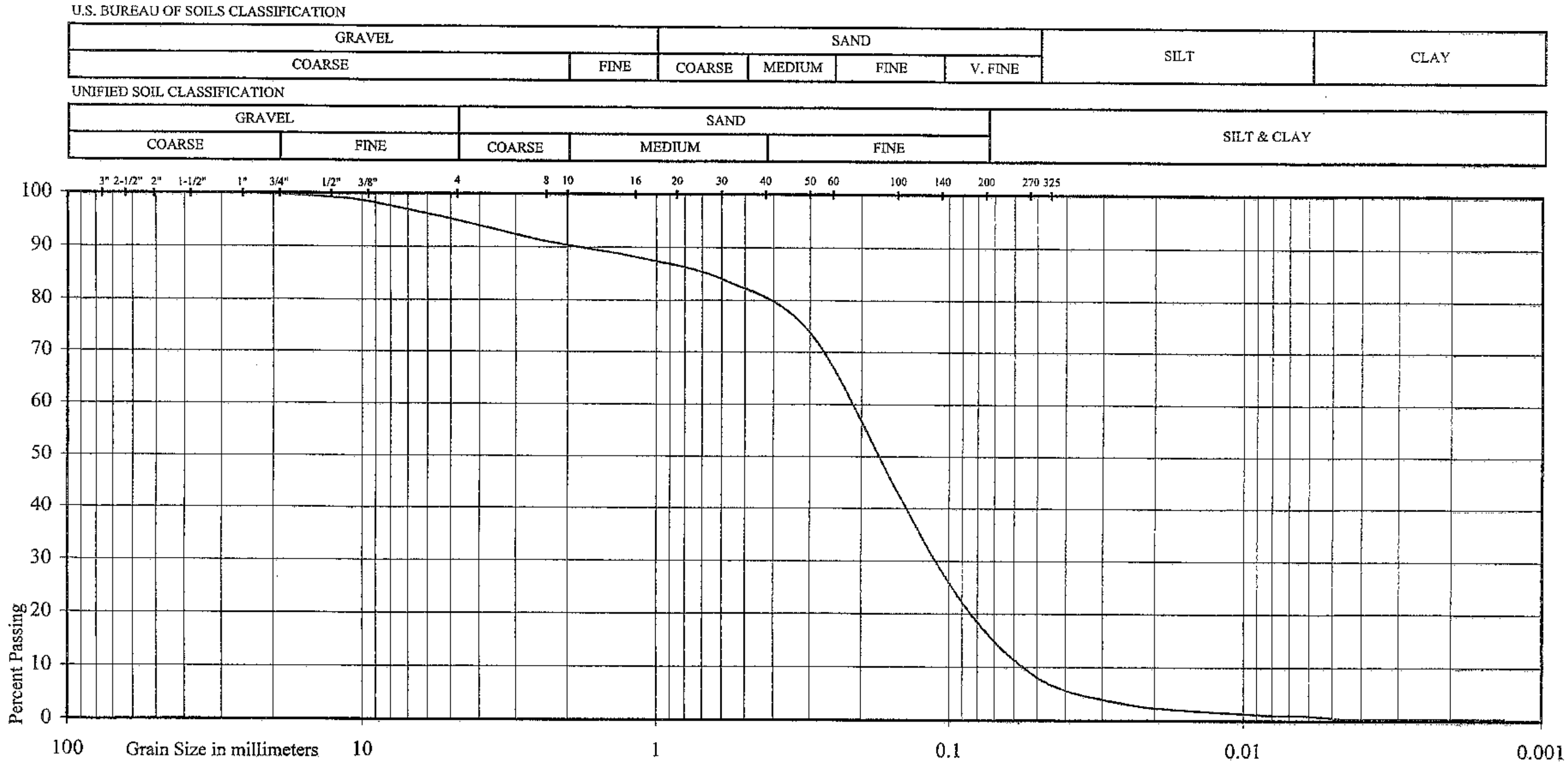
GRAIN SIZE DISTRIBUTION

Reference No: 0409-S004



Project: Proposed Residential Development

Location: NE of Yonge St./Eagle St., Town of Newmarket

Borehole No: 3

Sample No: 11

Depth (m): 12.5

Elevation (m): 253.9

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = -

Estimated Permeability (cm./sec.) = 10^{-3}

Classification of Sample [& Group Symbol]: FINE TO COARSE SAND
some silt, traces of clay and gravel

Figure: 19

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FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 623-4630	FAX: (905) 853-5484	FAX: (705) 684-8522	FAX: (905) 623-4630	FAX: (905) 542-2769

APPENDIX 'C'

RESULTS OF HYDRAULIC CONDUCTIVITY TESTS

Reference No. 1102-W017

Falling Head Test (Slug Test)

Test Date:		8-Mar-11
Piezometer/Well No.:		MW101
Ground level:		265.58 m
Screen top level:		251.88 m
Screen bottom level:		250.38 m
Test El. (at midpoint of screen):		251.13 m
Test depth (at midpoint of screen):		14.45 m
Screen length	L=	1.5 m
Diameter of undisturbed portion o	2R=	0.22 m
Standpipe diameter	2r=	0.05 m
Initial unbalanced head	Ho=	-0.3416 m
Initial water depth		5.43 m
Aquifer material:		**Silty sand till/finesand**

470	0.100995
1500	0.020785

Stable Water Level
5.43
Start Water Level
5.0884

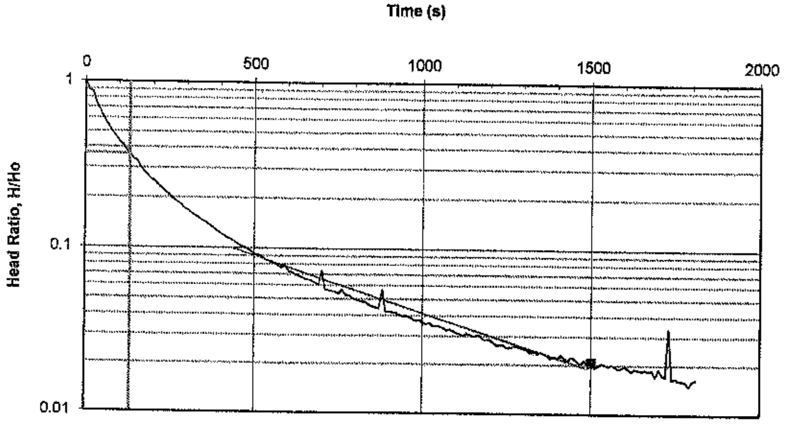
Shape factor $F = \dfrac{2 \times 3.14 \times L}{\ln(L/R)} = 3.607239$ m

Permeability $K = \dfrac{3.14 \times r2}{F \times (t2 - t1)} \times \ln(H1/H2)$ (Bouwer and Rice Method)

$$\frac{\ln(H1/H2)}{(t2 - t1)} = 0.00153482$$

K= **8.4E-05** cm/s
8.4E-07 m/s

0.072 m/day



Hvorslev interp

Tc .37 = 120 s

$$K = \frac{r2 \times \ln(L/R)}{2 \times L \times Tc}$$

K 4.54E-04 cm/s
4.54E-06 m/s
0.392 m/d

Soil Engineers Ltd.

Falling Head Test (Slug Test)

Test Date:		8-Mar-11	
Piezometer/Well No.:		MW102	
Ground level:		260.83	m
Screen top level:		247.13	m
Screen bottom level:		245.63	m
Test El. (at midpoint of screen):		246.38	m
Test depth (at midpoint of screen):		14.45	m
Screen length	L=	1.5	m
Diameter of undisturbed portion	2R=	0.22	m
Standpipe diameter	2r=	0.05	m
Initial unbalanced head	Ho=	-0.534	m
Initial water depth		2.36	m
Aquifer material:		**Silty Clay till**	

0	1
3000	1.077341

Stable Water Level
10.71
Start Water Level
10.176

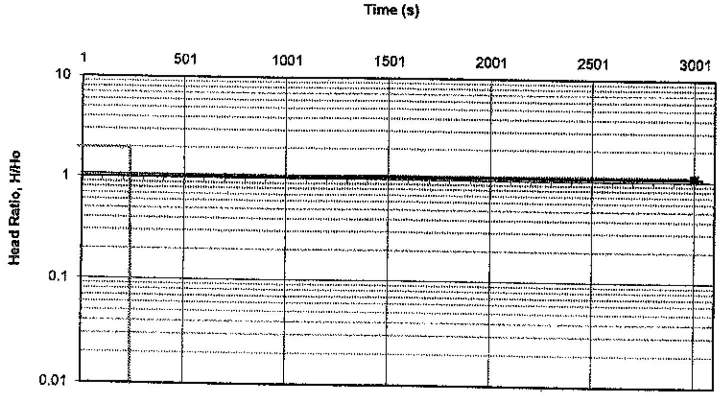
Shape factor $F= \frac{2 \times 3.14 \times L}{\ln(L/R)} = 3.607239$ m

Permeability $K= \frac{3.14 \times r2}{F \times (t2 - t1)} \times \ln (H1/H2)$ (Bouwer and Rice Method)

$\frac{\ln (H1/H2)}{(t2 - t1)} = -2.4832E-05$

K= **-1.4E-06** cm/s
-1.4E-08 m/s

-0.001 m/day



Hvorslev interp

Tc 37 = s

$K= \frac{r2 \times \ln (L/R)}{2 \times L \times Tc}$

K	#DIV/0!	cm/s
	#DIV/0!	m/s
	#DIV/0!	m/d

Soil Engineers Ltd.

Falling Head Test (Slug Test)

160	1	Stable Water Level	
3500	0.49902	4.33	
		Start Water Level	
		3.8196	

Test Date:		8-Mar-11	
Piezometer/Well No.:		MW103	
Ground level:		258.06	m
Screen top level:		244.36	m
Screen bottom level:		242.86	m
Test El. (at midpoint of screen):		243.61	m
Test depth (at midpoint of screen):		14.45	m
Screen length	L=	1.5	m
Diameter of undisturbed portion (	2R=	0.22	m
Standpipe diameter	2r=	0.05	m
Initial unbalanced head	Ho=	-0.5104	m
Initial water depth		2.73	m
Aquifer material:		**Silty clay till**	

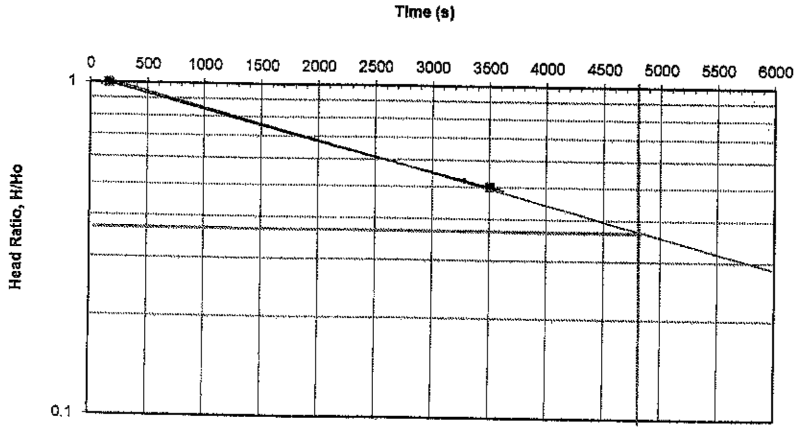
Shape factor F= $\dfrac{2 \times 3.14 \times L}{\ln(L/R)}$ = 3.607239 m

Permeability K= $\dfrac{3.14 \times r2}{F \times (t2 - t1)} \times \ln(H1/H2)$ (Bouwer and Rice Method)

$\dfrac{\ln(H1/H2)}{(t2 - t1)}$ = 0.00020812

K= **1.1E-05 cm/s**
1.1E-07 m/s

0.010 m/day



Hvorslev interp

Tc .37 = 4800 s

K= $\dfrac{r2 \times \ln(L/R)}{2 \times L \times Tc}$

K 1.13E-05 cm/s
1.13E-07 m/s
0.010 m/d

Soil Engineers Ltd.

Rising Head Test (Bail Test)

Test Date:		8-Mar-11	
Piezometer/Well No.:		MW105	
Ground level:		254.36	m
Screen top level:		252.86	m
Screen bottom level:		251.36	m
Test El. (at midpoint of screen):		252.11	m
Test depth (at midpoint of screen):		2.25	m
Screen length	L=	1.5	m
Diameter of undisturbed portion	2R=	0.22	m
Standpipe diameter	2r=	0.05	m
Initial unbalanced head	Ho=	-0.5374	m
Initial water depth		1.88	m
Aquifer material:		**silty clay till**	

0	1
2500	0.925568

Stable Water Level
1.88
Start Water Level
1.3426

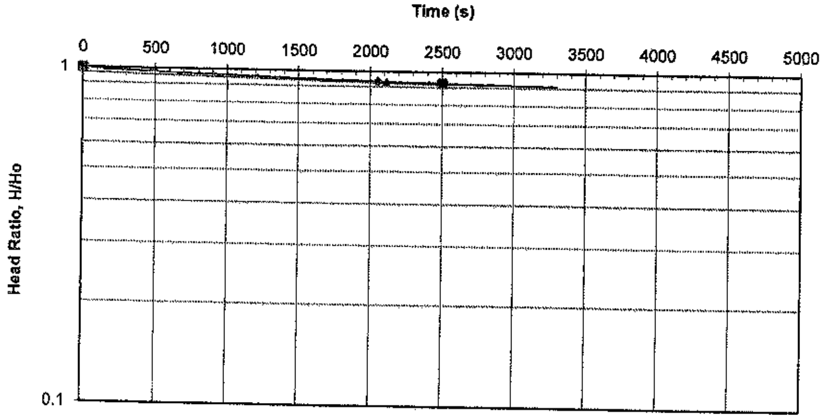
Shape factor F= $\frac{2 \times 3.14 \times L}{\ln(L/R)}$ = 3.607239 m

Permeability K= $\frac{3.14 \times r2}{F \times (t2 - t1)} \times \ln(H1/H2)$ (Bouwer and Rice Method)

$\frac{\ln(H1/H2)}{(t2 - t1)}$ = 3.0939E-05

K= **1.7E-06** cm/s
1.7E-08 m/s

0.001 m/day



Hvorslev interp

Tc 37 = s

K= $\frac{r2 \times \ln(L/R)}{2 \times L \times Tc}$

K	#DIV/0!	cm/s
	#DIV/0!	m/s
	#DIV/0!	m/d

Soil Engineers Ltd.

Rising Head Test (Bail Test)

Test Date:		8-Mar-11	
Piezometer/Well No.:		MW106	
Ground level:		253.17	m
Screen top level:		251.67	m
Screen bottom level:		250.17	m
Test El. (at midpoint of screen):		250.92	m
Test depth (at midpoint of screen):		2.25	m
Screen length	L=	1.5	m
Diameter of undisturbed portion	2R=	0.22	m
Standpipe diameter	2r=	0.05	m
Initial unbalanced head	Ho=	-0.5484	m
Initial water depth		2.52	m
Aquifer material:		Silty clay	

0	1
2500	0.880744

Stable Water Level
1.6
Start Water Level
1.0516

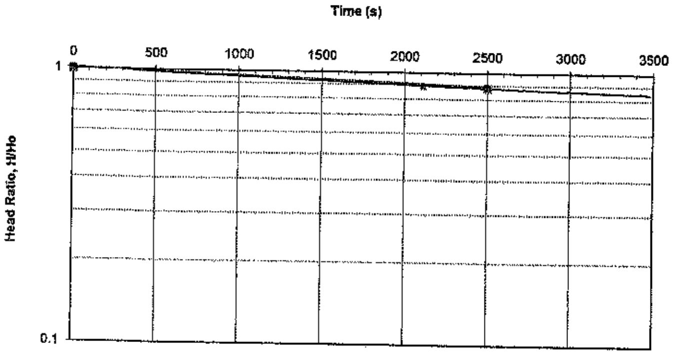
Shape factor $F= \dfrac{2 \times 3.14 \times L}{\ln(L/R)} = 3.607239$ m

Permeability $K= \dfrac{3.14 \times r2}{F \times (t2 - t1)} \times \ln(H1/H2)$ (Bouwer and Rice Method)

$\dfrac{\ln(H1/H2)}{(t2 - t1)} = 5.0795E\text{-}05$

K= 2.8E-06 cm/s
2.8E-08 m/s

0.002 m/day



Hvorslev interp

Tc 37 = 5000 s

$K= \dfrac{r2 \times \ln(L/R)}{2 \times L \times Tc}$

K	1.09E-05 cm/s
	1.09E-07 m/s
	0.009 m/d

Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE
100 NUGGET AVENUE, TORONTO, ONTARIO M1S 3A7 • TEL: (416) 754-8515 • FAX: (416) 754-8516

BARRIE	MISSISSAUGA	BOWMANVILLE	NEWMARKET	GRAVENHURST	PETERBOROUGH	HAMILTON
TEL: (705) 721-7863	TEL: (905) 542-7605	TEL: (905) 623-8333	TEL: (905) 853-0647	TEL: (705) 684-4242	TEL: (705) 748-0576	TEL: (905) 777-7956
FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 623-4630	FAX: (905) 853-5484	FAX: (705) 684-8522	FAX: (905) 623-4630	FAX: (905) 542-2769

APPENDIX 'D'

CERTIFICATIONS OF ANALYSES

Reference No. 1102-W017

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: SOIL ENGINEERS LIMITED
100 NUGGET AVENUE
TORONTO, ON M1S3A7

ATTENTION TO: Ahmed Al-Temimi

PROJECT NO: 1102-W017

AGAT WORK ORDER: 11T476388

WATER ANALYSIS REVIEWED BY: Elizabeth Polakowska, MSc (Animal Sci), PhD (Agri Sci), Inorganic Lab Supervisor

DATE REPORTED: Mar 10, 2011

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712 5100, or at 1-800-856-6261

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 11T476388

PROJECT NO: 1102-W017

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: SOIL ENGINEERS LIMITED

ATTENTION TO: Ahmed Al-Temimi

Monitoring Wells Parameters

DATE SAMPLED: Mar 04, 2011 **DATE RECEIVED: Mar 04, 2011** **DATE REPORTED: Mar 10, 2011** **SAMPLE TYPE: Water**

Parameter	Unit	G / S: A	G / S: B	RDL	SE 2287178	SW 2287188	RDL	MW101 2287190	MW102 2287192	MW103 2287195	MW104 2287200
pH	pH Units		(6.5-8.5)	NA	8.22	8.15	NA	8.02	8.18	8.16	8.21
Chloride	mg/L	250	(250)	0.2	633[>A]	640[>A]	0.10	65.0[<A]	57.3[<A]	35.7[<A]	36.5[<A]
Nitrate as N	mg/L	10	10.0	0.10	2.62[<A]	2.69[<A]	0.05	<0.05[<A]	0.48[<A]	0.10[<A]	0.33[<A]
Nitrite as N	mg/L	1	1.0	0.10	<0.10[<A]	<0.10[<A]	0.05	<0.05[<A]	<0.05[<A]	<0.05[<A]	<0.05[<A]
Ortho phosphate as P	mg/L			0.2	<0.2	<0.2	0.10	<0.10	<0.10	<0.10	<0.10
Ammonia as N	mg/L			0.02	0.02	0.03	0.02	0.03	0.12	0.04	0.08
Total Kjeldahl Nitrogen	mg/L			0.10	0.62	0.69	0.10	0.13	0.69	0.20	0.23
Total Phosphorus	mg/L			0.05	0.06	0.09	0.05	0.05	0.05	0.05	0.06

Parameter	Unit	G / S: A	G / S: B	RDL	MW105 2287206	MW106 2287208
pH	pH Units		(6.5-8.5)	NA	7.77	7.77
Chloride	mg/L	250	(250)	0.10	175[<A]	90.1[<A]
Nitrate as N	mg/L	10	10.0	0.05	0.70[<A]	<0.05[<A]
Nitrite as N	mg/L	1	1.0	0.05	<0.05[<A]	<0.05[<A]
Ortho phosphate as P	mg/L			0.10	<0.10	<0.10
Ammonia as N	mg/L			0.02	<0.02	<0.02
Total Kjeldahl Nitrogen	mg/L			0.10	0.72	0.17
Total Phosphorus	mg/L			0.05	0.06	0.10

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to T2(PGW), B Refers to O.Reg.169/03

2287178-2287188 The RDLs are adjusted to reflect the dilutions applied prior to analyses.

Certified By: Elizabeth Polakowska

AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 11T476388

PROJECT NO: 1102-W017

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MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
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http://www.agatlabs.com

CLIENT NAME: SOIL ENGINEERS LIMITED

ATTENTION TO: Ahmed Al-Temimi

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
2287178	SE	T2(PGW)	Monitoring Wells Parameters	Chloride	250	633
2287188	SW	T2(PGW)	Monitoring Wells Parameters	Chloride	250	640

Results relate only to the items tested

Quality Assurance

CLIENT NAME: SOIL ENGINEERS LIMITED
PROJECT NO: 1102-W017

AGAT WORK ORDER: 11T476388
ATTENTION TO: Ahmed Al-Temimi

Water Analysis

RPT Date: Mar 10, 2011			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Monitoring Wells Parameters															
pH	1	2287208	7.77	7.89	1.5%	N/A	100%	90%	110%						
Chloride	1	2287192	57.3	56.4	1.6%	< 0.10	98%	90%	110%	102%	90%	110%	95%	80%	120%
Nitrate as N	1	2287192	0.48	0.47	2.1%	< 0.05	98%	90%	110%	100%	90%	110%	103%	70%	130%
Nitrite as N	1	2287192	< 0.05	< 0.05	0.0%	< 0.05	NA	90%	110%	91%	90%	110%	108%	80%	120%
Ortho phosphate as P	1	2287192	< 0.10	< 0.10	0.0%	< 0.10	100%	90%	110%	109%	90%	110%	111%	80%	120%
Ammonia as N	1	2287208	< 0.02	< 0.02	0.0%	< 0.02	109%	90%	110%	98%	90%	110%	102%	80%	120%
Total Kjeldahl Nitrogen	1	2287178	0.62	0.55	12.0%	< 0.10	92%	80%	120%	96%	80%	120%	97%	70%	130%

Certified By: Elizabeth Rolakowska

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MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

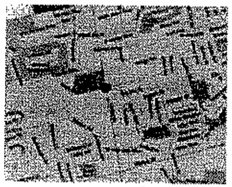
CLIENT NAME: SOIL ENGINEERS LIMITED

PROJECT NO: 1102-W017

AGAT WORK ORDER: 11T476388

ATTENTION TO: Ahmed Al-Temimi

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
pH	INOR-93-6000	SM 4500-H+ B	PC TITRATE
Chloride	INOR 1004	SM 4110 B	ION CHROMATOGRAPH
Nitrate as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Ortho phosphate as P	INOR 1004	SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INOR-93-6002	AQ2 EPA-103A & SM 4500 NH3-F	AQ-2 DISCRETE ANALYZER
Total Kjeldahl Nitrogen	INOR-93-6048	QuikChem 10-107-06-2-I & SM 4500-Norg D	LACHAT FIA
Total Phosphorus	INOR-93-6057	QuikChem 10-115-01-3-A & SM 4500-P I	LACHAT FIA



KEY PLAN NOT TO SCALE

SURVEY INFORMATION:

SURVEY INFORMATION IS TAKEN FROM A
COMPILED PLAN OF SURVEY ENTITLED:
PART OF LOTS 2 AND 3
REGISTERED PLAN 49
TOWN OF NEWMARKET
REGIONAL MUNICIPALITY OF YORK
PREPARED BY:
YOUNG & YOUNG SURVEYING INC., OLS
2 HOLLAND DRIVE, UNIT 5
BOLTON, ON L7E 1E1
DATED: JUNE 2010

PROPERTY AREA:

VALLEY LANDS	28 477 SM (306,526 SF)
BUFFER ZONE	2 114 SM (22,755 SF)
NET DEVELOPMENT AREA	19 742 SM (212,503 SF)
PROPOSED ROAD WIDENING	589 SM (6,340 SF)
TOTAL PROPERTY AREA	50 922 SM (548,124 SF)

PROJECT INFORMATION:

PARCEL A:

PROPOSED UNITS:	154
NET LOT AREA:	8,152.30 SM (87,750 SF; 2.01 AC)
PROPOSED DENSITY:	189 UNITS/HECTARE
GROSS FLOOR AREA GROUND FLOOR:	1,805.34 SM (19,432 SF)
GROSS FLOOR AREA PER LEVEL:	1,362.18 SM (14,662 SF)
PROPOSED FLOORS:	12
TOTAL G.F.A.:	16,789.32 SM (180,719 SF)
PROPOSED FLOOR SPACE INDEX:	2.08

CONDO UNIT TYPE SCHEDULE		# OF UNITS
GROUND FLOOR		0
FLOORS 2-12 (TYP. 14 UNITS/FLOOR)		
8 X 1BR UNITS	69.67-77.11 SM (750-830 SF)	88
6 X 2BR UNITS	92.90-120.77 SM (1,000-1,300 SF)	66
TOTAL NUMBER OF UNITS		154

PARKING:

VISITOR PARKING REQUIRED:
0.25 X NUMBER OF UNITS= 39 SPACES
VISITOR PARKING PROVIDED: 39 SPACES
RESIDENT PARKING REQUIRED:
1.5 SPACES/UNIT= 231 SPACES
RESIDENT PARKING PROVIDED: 231 SPACES TOTAL
(2 LEVELS UNDERGROUND GARAGE: 218 SPACES;
ON GRADE: 11 SPACES)

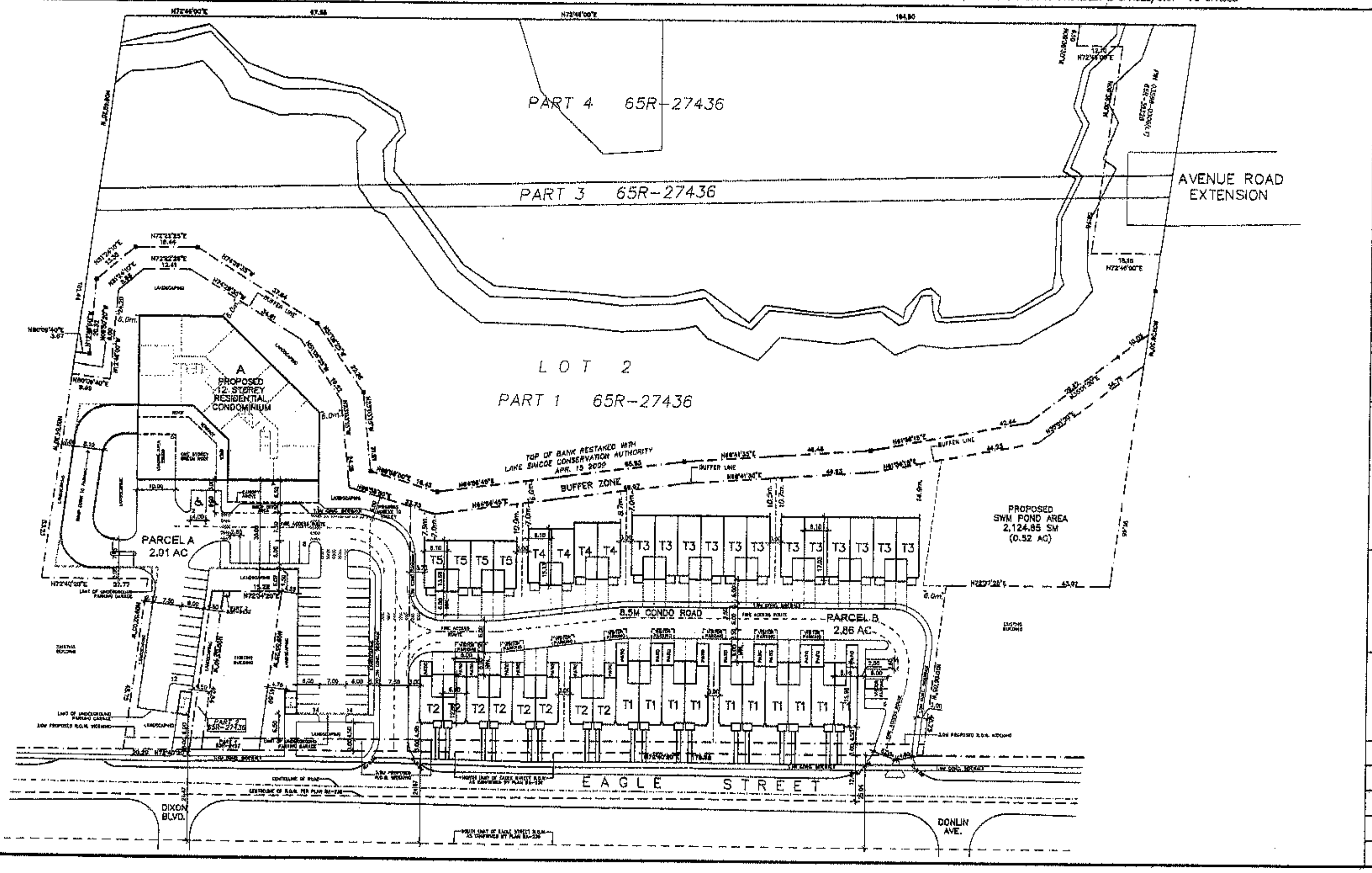
PARCEL B:

PROPOSED TOWNHOUSES:	38
NET LOT AREA:	11,591.28 SM (124,767 SF; 2.86 AC)
PROPOSED DENSITY:	33 UNITS/HECTARE

UNIT TYPE	PROPOSED UNIT SIZE	# OF UNITS
T1	148.65-157.93 SM (1,600-1,700 SF)	10
T2	111.48 SM (1,200 SF)	8
T3	157.93-167.22 SM (1,700-1,800 SF)	12
T4	139.35-148.65 SM (1,500-1,600 SF)	4
T5	120.77-130.06 SM (1,300-1,400 SF)	4
TOTAL NUMBER OF UNITS		38

PARKING:

VISITOR PARKING REQUIRED: 0.25 X NUMBER OF UNITS= 10 SPACES
VISITOR PARKING PROVIDED: 14 SPACES
RESIDENT PARKING REQUIRED: 2 SPACES/UNIT= 76 SPACES
RESIDENT PARKING PROVIDED: 2 SPACES/UNIT= 76 SPACES



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www.pda-architects.ca

NO:	REVISIONS:	ISSUED
1	REVISED	AUG 12/10

CLIENT:
MILLFORD DEVELOPMENTS

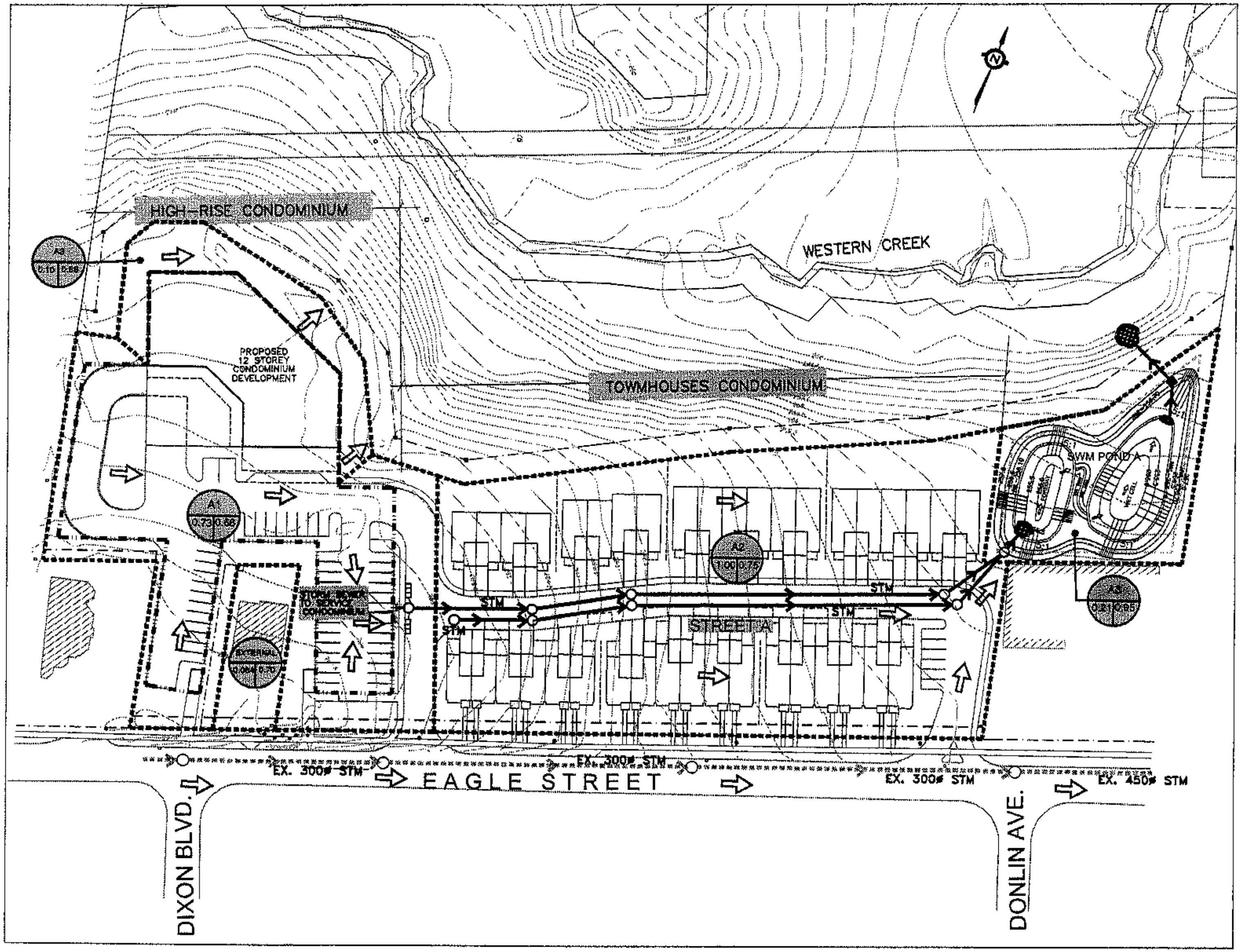
PROJECT:
PROPOSED CONDOMINIUM DEVELOPMENT
NEWMARKET, ON

SHEET TITLE:
SITE PLAN

PROJECT NO.
2524

SCALE: 1:500	DATE: SEE REV.
DRAWN: RS	SHEET NO:
CHECKED: JdeV	SP1
FILE NO. 2524	

M:\2524\2524_DWGS\100804\2524 SP1 100806.dwg Aug 12, 2010-4:49 pm



LEGEND:

A2 — Sub-Area No.
1.00 — Area (ha)
0.75 — Run Off Coefficient

PROPOSED STORM LINE

EXISTING STORM LINE

⇨ OVERLAND FLOW

DRAINAGE AREA

UNDERGROUND PARKING

SUPER CATCHBASIN FOR HIGHRISE CONDOMINIUM OVERLAND FLOW

POND STORAGE VOLUMES

COMP.	ELEV. (m)	REQ. VOL. (m^3)	PROV. VOL. (m^3)
P. POOL	256.10	390	450
EROSION	256.60	400	460
100 YEAR	256.70	660	730
TOTAL	257.00	1,170	1,180

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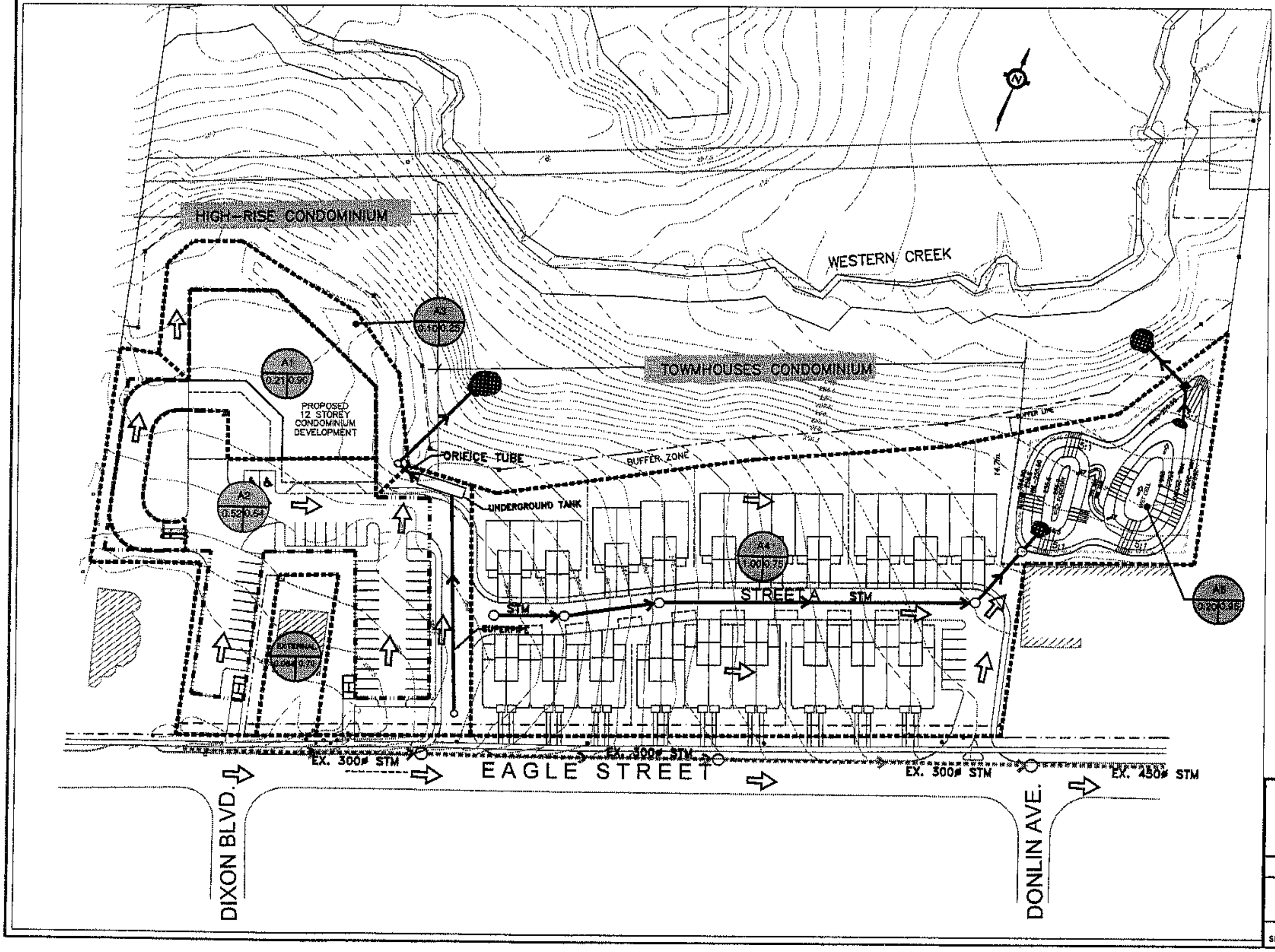
Consulting Engineers • Planners • Project Managers
1151 Denison Street • Unit 15 • Markham, Ontario • L3R 3Y4
Tel(905) 944-0162 • Fax(905) 944-0165 • E-Mail: maeng@maeng.ca

MILLFORD DEVELOPMENT LIMITED

PROPOSED SWM STRATEGY
OPTION 1

DATE:	SCALE	DESIGN BY:	DRAWN BY:	PROJECT No.	DWG. No.
SEP. 2010	NTS	JJM	MAEL/CAD	99598	STM1



POND STORAGE VOLUMES

COMP.	ELEV. (m)	REQ. VOL. (m³)	PROV. VOL. (m³)
P. POOL	255.90	240	310
EROSION	256.30	240	320
100 YEAR	256.55	500	660
TOTAL	256.80	740	970

MASONGSONG ASSOCIATES ENGINEERING LIMITED
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MILLFORD DEVELOPMENT LIMITED

PROPOSED SWM STRATEGY
OPTION 2

DATE:	SCALE	DESIGN BY:	DRAWN BY:	PROJECT No.	DWG. No.
SEP. 2010	NTS	JJM	MAEL/CAD	99598	STM2