410061

GEOTECHNICAL INVESTIGATION
PROPOSED URBAN DEVELOPMENT
65 AND 105 RIPPLEWOOD ROAD
CAMBRIDGE, ONTARIO

for

MR. TOBY BARICK
c/o CAMBRIDGE ENGINEERING AND
PLANNING CONSULTANTS LIMITED

5685G1.R01
July 2005

Naylor
Engineering
Associates Ltd.

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5685G1.R01

July 4, 2005

Mr. Toby Barick
c/o Cambridge Engineering and
Planning Consultants Limited
15 Cambridge Street
Cambridge, Ontario
N1R 3R8

Attention: Mr. Jim Collishaw

Dear Sir:

Re: Geotechnical Investigation
Proposed Urban Development
65 and 105 Ripplewood Road
Cambridge, Ontario

Naylor Engineering Associates Ltd. is pleased to submit this report for the geotechnical investigation recently carried out for the above referenced project. This work was authorized by Mr. Jim Collishaw of Cambridge Engineering and Planning Consultants Limited on April 25, 2005, following submission of a detailed proposal.

The project involves the proposed residential development of a 40.1 ha property located at 65 and 105 Ripplewood Road in the City of Cambridge, as shown on Drawing 1 appended.

The purpose of the geotechnical investigation was to determine the subsurface soil and groundwater conditions throughout the property in order to provide recommendations for site grading, site servicing, houses, pavement design, and stormwater infiltration.

Concurrently with this investigation, Naylor Engineering Associates Ltd. carried out Phase 1 and 2 Environmental Site Assessments (ESA) of the property. The Phase 2 ESA was conducted at 105 Ripplewood Road and comprised seven boreholes (Boreholes 1 to 7) drilled to depths between 3.5 and 5.0 m below existing grade. The results of the Phase 1 and 2 ESAs are provided in our Reports 5685E1.R01, 5685E2.R01 and 5685E2.R02. The borehole logs are appended.

Fieldwork

The fieldwork for the geotechnical investigation involved the excavation of twenty-one test pits (Test Pits 1 to 21) to depths between 2.2 and 3.0 m, at the locations shown on Drawing 2, appended.

The test pits were excavated with a rubber tire backhoe supplied and operated by CDH Excavating. Soil samples were recovered from the test pits at regular intervals.

The boreholes for the Phase 2 ESA at 105 Ripplewood Road were advanced with a CME-55 track-mounted drillrig equipped with continuous flight hollow stem augers supplied and operated by a specialist drilling contractor.

Soil samples were recovered from the boreholes at regular 0.75 and 1.50 m depth intervals using a 50 mm O.D. split spoon sampler in accordance with the Standard Penetration Test (SPT) procedure. The SPT N-values recorded are plotted on the appended borehole logs.

Groundwater observations were carried out in the test pits during and upon completion of excavating. The test pits remained open for several hours after completion of the excavating to monitor groundwater seepage and allow for groundwater levels to stabilize. The observations and measurements are summarized on the test pit logs.

Monitoring wells were installed in Boreholes 1 through 7 to allow measurement of groundwater levels and the collection of groundwater samples. The monitoring wells were constructed using flush-threaded 50 mm diameter Trilock pipe with 1.5 or 3.0 m long 10-slot well screens, delivered to the site pre-cleaned in individually sealed plastic bags. The screen and riser pipes were not allowed to come into contact with the ground or any drilling equipment prior to installation. Groundwater measurements are summarized on the borehole logs.

Upon completion of drilling, the test pits were backfilled with excavated soil. The boreholes were backfilled and sealed in accordance to Ontario Regulation 903. The monitoring wells were installed and tagged by a licensed well drilling contractor. The monitoring wells must also be decommissioned by a licensed well drilling contractor within six months of last use (groundwater measurement, water sampling, etc.) and certainly before construction.

Combustible Soil Vapour (CSV) headspace (the air space between the top of the soil and the top of the jar) testing was carried out on soil samples obtained from Boreholes 1 through 7 and Test Pit 6 using a Gastechtor 1238-ME Hydrocarbon Surveyor. The samples were allowed to equilibrate for approximately 1 hour at 20°C prior to measurement. For this testing, headspace readings were taken by inserting the instrument probe through foil liners which were placed over the jars at the time of sampling. The instrument measures total combustible gas using catalytic oxidation of sample gas on a platinum filament. Combustion of hydrocarbons raises the temperature of the filament and the resulting change in electrical resistivity is converted to an analog concentration reading. The resulting CSV readings are summarized on the individual borehole logs provided with this report.

The fieldwork for the geotechnical investigation was supervised throughout by a member of our geotechnical engineering staff who directed the excavating and sampling procedures; drilling and SPT testing; documented the soil stratigraphies; observed and measured groundwater; installed the monitoring wells; recorded headspace readings; and cared for the recovered soil samples.

The borehole and test pit locations (except Test Pits 1, 2, 9, 10, 18, 19 and 21) were surveyed by Cambridge Engineering and Planning Consultants Limited and provided to us in AutoCAD format. The elevations are related to geodetic datum.

All soil samples secured during this investigation were returned to our laboratory for moisture content tests (ASTM D2216) (LS-701); the results of which are plotted on the test pit and borehole logs.

The soil samples will be stored for a period of four months from the date of sampling. After this time, they will be discarded unless prior arrangements have been made for longer storage.

Summarized Conditions

Site Description

As shown on the appended Site Plan, Drawing 2, the subject site borders the north side of Ripplewood Road. Except as noted, the subject site is bounded on all sides by residential and/or agricultural properties. A metal recycler/wrecker located at 2155 Main Street East borders the north property boundary of the 105 Ripplewood property (northeast corner of the subject site). A high power hydro-electric power easement is also located along the west side of the 65 Ripplewood Road property (west side of the subject site).

The subject property is situated in a rural area located in the southeast portion of the City of Cambridge. The site consists of agricultural parcels and associated residential/barn structures.

Site vegetation comprises cornfields, heavily wooded areas, and marsh/bog areas throughout the property. The property consists of gently rolling terrain with ponded water in the low areas. The topographic relief at the site is about 8 m. Tributaries of Moffat Creek traverse land located west of the property and likely influence the local direction of groundwater flow.

Photographs of the site taken in May 2005 are provided in Appendix A, appended.

Subsoil Conditions

We refer to the appended test pit and borehole logs for detailed soil descriptions and stratigraphies, results of moisture content testing and groundwater observations and measurements. The soil stratigraphy generally comprises topsoil overlying silt and glacial till. Fill was encountered in the area of the existing buildings and localized sand deposits were encountered at the southwest corner and the north end of the site.

Fill was encountered surficially in Boreholes 2, 3, 4 and 5 and Test Pit 6 and ranges in thickness from 0.1 to 1.8 m. The fill ranges in composition from silty sand with some gravel to silt (topsoil) with trace sand and clay. Debris such as Portland cement concrete, asphaltic concrete, glass, scrap metal and pieces of leather was encountered in the fill at Boreholes 3 and 4 and Test Pit 6. The fill generally has a loose relative density based on SPT N-values ranging from 2 to 12 blows per 300 mm penetration of the split spoon sampler. The fill is moist to very moist based on moisture contents ranging from 9 to 12%.

Topsoil was encountered surficially at all test hole locations drilled/excavated away from the building areas. The topsoil thickness ranges from 150 to 600 mm. Buried topsoil was encountered beneath the fill at Boreholes 2 and 4 and is 400 to 450 mm thick. The topsoil comprises dark brown silt and was moist to very moist at the time of sampling.

Organic peat was contacted surficially at Test Pits 4 and 16. The peat is 450 to 500 mm thick and was wetter than the plastic limit (WTPL) at the time of excavating.

Silt was encountered below the topsoil at Test Pits 3, 5, 7, 8, 9, 14 and 16 and ranges in thickness from 0.6 to 1.6 m where a lower limit exists. The silt extends below the termination depths of Test Pits 7, 14 and 16. The silt composition ranges from clayey silt with trace sand to sandy silt. The silt is cohesive at Test Pits 5 and 16 and has insitu moisture contents of 18 to 23% indicating about the plastic limit (APL) conditions. The non-cohesive silt is moist to saturated based on insitu moisture contents ranging from 13 to 28%.

Sand was contacted below the topsoil at Test Pits 11 and 15; below the silt at Test Pit 3; and below the glacial till at Test Pits 4 and 10. The sand extends below the termination depths of all the test pits in which it was contacted. The sand composition ranges from silty sand to sand with some gravel and trace silt. The sand is typically moist based on insitu moisture contents of 7 and 11%. The sand unit at Test Pit 4 was saturated.

Glacial till was contacted in all the boreholes and test pits except Test Pits 3, 7, 11, 14, 15 and 16. The glacial till extends below the termination depths of all of the test pits and boreholes in which it was contacted except Test Pits 4 and 10. The glacial till ranges in composition from silt with some sand and trace clay to silty sand with some gravel and cobbles. The upper 1.0 m of the glacial till generally has a loose relative density based on SPT N-values ranging from 5 to 9 blows per 300 mm penetration of the split spoon sampler. The lower glacial till generally has a compact relative density based on SPT N-values ranging from 8 to 27 blows per 300 mm. The till is moist to wet based on insitu moisture contents ranging from 8 to 23%. Sand seams occur throughout the till and contain groundwater.

Groundwater

Groundwater observations and measurements carried out in the open test pits and monitoring wells are provided on the appended borehole logs. Groundwater measurements taken in the monitoring wells indicate groundwater levels ranging from 0.5 to 2.8 m below the ground surface. The variable groundwater levels indicate perched groundwater conditions; however, the stabilized groundwater table is inferred to be at a depth of greater than 5.0 m below existing grades in most areas of the site. Local variations and seasonal fluctuations in the groundwater level would be expected.

Organic Vapours

Combustible Soil Vapour (CSV) headspace testing was carried out on the retrieved soil samples using a Gastechtor 1238-ME hydrocarbon monitor that was operated in the methane elimination mode. The soil samples contained headspace concentrations 0 to 70 ppm.

Discussion and Recommendations

The project involves the proposed residential development on a 40.1 ha parcel of land located at 65 and 105 Ripplewood Road in the southeast end of Cambridge, Ontario. The residential development will include numerous fully serviced residential lots and blocks, local streets, and SWM facilities.

The subsurface stratigraphy at the site generally comprises fill and/or topsoil overlying native deposits of silt, sand, and glacial till. Perched groundwater occurs between 0.5 and 2.8 m below existing grades at the site.

Based on the results of this geotechnical investigation, the subsurface conditions at the site are generally favourable for development; however, the localized fill deposits and poorly drained wet areas will affect site grading.

The following subsections of the report provide preliminary geotechnical recommendations for site grading, site servicing, residential buildings, pavement design, and water infiltration. It is recommended that a detailed geotechnical investigation with exploratory boreholes be carried out during the final design stage.

Site Grading

Grading of the property will be required to prepare the land for construction of the proposed residential development. In general, it will be necessary to raise grades in the low-lying areas located along the east and west sides of the site using soil cut from central portion of the property.

The developed areas at the center of both 65 and 105 Ripplewood Road contains loose fill and buried topsoil. The fill and topsoil are not suitable for construction and must be removed. The foundations and floor slabs of any demolished buildings must also be removed, and existing wells decommissioned.

In calculating the approximate quantity of fill, topsoil and peat to be removed, we refer to the borehole and test pit logs and Table 1 appended. The topsoil material could be used for landscaping fill, to raise grades in the rear yards of the house lots; however, the existing fill should be disposed of in an appropriate manner in accordance with Ministry of Environment Regulations (see Naylor Engineering Associates Ltd. Phase 1 and 2 ESA Reports). The peat could be mixed with topsoil and used for landscaping fill.

Following removal of the organic soils and fill materials, the exposed subgrade should be inspected by Naylor Engineering Associates Ltd. The fill used to raise grades should be placed in maximum 300 mm thick lifts and compacted to the following minimum percentages of standard Proctor maximum dry density (SPMDD):

Fill Use	Minimum Compaction Required
Structural fill to support houses	98% SPMDD
Subgrade fill beneath pavements	95% SPMDD
Bulk fill in landscaped areas	90% SPMDD

The major soil likely to be generated from the cut areas of the property is glacial till with occasional silt and sand layers. Based on the results of insitu moisture contents and standard Proctor moisture-density tests, the majority of the soil will be well-suited for reuse as pavement subgrade fill and structural fill provided that the grading work is carried out during relatively dry weather. If work is carried out during wet weather, then the glacial till will only be suitable for use as road subgrade fill.

Where structural fill is placed on a wet subgrade, we suggest that only the medium sand material be used for the bottom few lifts. Also, the initial lift may be up to 750 mm thick in order to ensure trafficability and minimize compaction problems associated with instability of the subgrade caused by vibratory equipment.

The structural fill should extend at least 1.0 m beyond the footing edge of any residential building and down to the subgrade level at a slope of 45° to the horizontal. A typical detail for structural fill placement beneath house foundations is shown on Drawing 3, appended.

Full-time inspection by experienced geotechnical personnel should be carried out during fill placement and compaction to carefully monitor the placement and verify the compaction by insitu density testing.

Site Servicing

Following site grading operations, the subdivision will be serviced to provide the individual lots with full municipal services. It is recommended that exploratory boreholes be done once the invert levels for the sewers are known. The following paragraphs are for preliminary design.

Temporary excavations to conventional depths for installation of underground pipes at this site must comply with Regulation 213/91 (Construction Projects) under the Ontario Occupational Health and Safety Act. The predominant soils encountered in the boreholes would be classified as Type 2 soils and may be cut near vertical in the lower 1.2 m, and must be trimmed back at about 1 horizontal to 1 vertical above (exclusive of groundwater effects).

No major groundwater problems are envisaged for shallow trenches and any minor groundwater infiltration should be handled using conventional sump pumping techniques. Groundwater seepage should be expected from localized waterbearing sand deposits. The trench side slopes must be trimmed back to 2 horizontal to 1 vertical in areas where waterbearing sand is exposed.

The subgrade soils beneath the watermain and sewer pipes will comprise native mineral soils or compacted fill placed during the site grading operations. No bearing problems are anticipated for flexible or rigid pipes founded in the native deposits or compacted imported soils. The bedding should be placed in accordance with Ontario Provincial Standard Drawings.

The trenches above the specified pipe bedding should be backfilled with approved inorganic on- site soils placed in 300 mm thick lifts and compacted to at least 95% SPMDD. Based on the results of insitu moisture content tests carried out on the native overburden deposits, the majority of the on-site excavated materials will be compactable to the required density.

To minimize potential problems, backfilling operations should follow closely after excavation so that only a minimal length of trench is exposed. Care should be taken to protect side slopes of excavations by diverting surface run-off away from the excavations. If construction extends into the winter, then the backfilling operations should be planned so that exposure of the backfill material to frost is kept to a minimum and to ensure that frozen material is not used as backfill.

Frequent inspection and compaction testing by experienced geotechnical personnel should be carried out to examine and approve backfill materials, and to verify that the specified degree of compaction has been achieved.

Residential Buildings

House footings constructed on approved structural fill or undisturbed native mineral soil may be designed using the minimum footing sizes provided in the Ontario Building Code.

As noted earlier in the subsection 'Site Grading', the structural fill may generally be constructed with imported inorganic soils following the removal of all topsoil and fill material and approval of the subgrade. The structural fill should be placed as shown on Drawing 3, appended.

All founding surfaces for residential dwellings on structural fill should be inspected by Naylor Engineering Associates Ltd. personnel prior to placing concrete. The purpose of the inspection is to ensure that the subgrade soils are capable of supporting the house foundations, and to confirm that the house envelopes do not extend beyond the limits of the structural fill pads.

The subgrade soils are considered to be frost susceptible and must be protected from freezing at all times, including during construction. The exterior footings or footings in unheated areas should be provided with a minimum 1.20 m of earth cover upon final grading for frost protection.

House basements at this site must be provided with perimeter weeping tile systems as per the Ontario Building Code. The drain tile or pipe should be laid on undisturbed or well-compacted soil so that the top of the tile or pipe is below the bottom of the basement floor slab. The weeping tile must drain to a suitable frost-free outlet or sump as per City requirements.

The basement floor levels must be designed at least 0.75 m above the stabilized groundwater level as per City of Cambridge requirements. Based on the results of this investigation the groundwater table is more than 5.0 m below existing grades except in the lowest depressions, and should not affect the house basements. The Site Grading Plans should be checked by Naylor Engineering Associates Ltd. to confirm satisfactory conditions for house basements.

The portion of the exterior basement walls below finished ground level should be damp-proofed as per the Ontario Building Code. The basement wall backfill should be graded to allow drainage away from the foundation. A detail for basement wall drainage is provided on Drawing 4, appended.

The subgrade for the basement floor slabs should comprise undisturbed native soil or well-compacted fill. A minimum 100 mm thick layer of coarse clean granular material shall be placed beneath slabs in houses as per the Ontario Building Code.

Pavement Design

The existing surficial topsoil must be removed before constructing the new pavements. Following removal of the topsoil, the subgrade should be proof-rolled and inspected by a geotechnical engineer. Any subgrade fill required to raise grades should comprise approved inorganic mineral soil placed in 300 mm thick lifts compacted to minimum 95% SPMDD.

The following pavement component thicknesses are recommended based on the proposed pavement usage, and the frost susceptibility and strength of the subgrade soils.

Pavement Component	Collector Streets	Local Streets
Asphaltic Concrete	100 mm	90 mm
Granular 'A' Base	150 mm	125 mm
Granular 'B' Subbase	400 mm	300 mm

The pavement design considers that construction will be carried out during the drier time of the year and that the subgrade is stable, as determined by proof-rolling inspected by a geotechnical engineer. If the subgrade is wet and unstable, additional granular subbase will be required.

Samples of both the Granular 'A' and Granular 'B' aggregates should be checked for conformance to OPSS 1010 prior to utilization on-site and during construction. The Granular 'B' subbase and the Granular 'A' base must be compacted to 100% SPMDD as verified by insitu density testing.

The asphaltic concrete should comprise a binder layer of HL4 and a surface layer of HL3. It is recommended that the compacted thicknesses be 60 mm of HL4 binder and 40 mm of HL3 surface for the collector streets, and 55 mm of HL4 binder and 35 mm of HL3 surface for local streets. These pavement designs should be re-evaluated after the subdivision street layout has been completed.

The asphaltic concrete paving materials should conform to the requirements of OPSS 1150. The asphaltic concrete should be placed and compacted in accordance with OPSS 310.

The silt subgrade soils at the site have poor natural drainage and therefore we recommend that subdrains be installed beneath the low areas of the streets and connected to the catchbasins. The purpose of the subdrains is to remove excess subsurface water in order to improve overall pavement serviceability and increase the pavement life. A detail for a typical pavement subdrain is provided on Drawing 5, appended.

Groundwater Recharge Rates

Based on the results of this geotechnical investigation, the major soil unit at the site is glacial till. The texture of the glacial till ranges from silt with some sand and trace clay to silty sand with some gravel and cobbles. The approximate pre-development recharge rate for the glacial till is 125 mm/yr (from Table 3, Chapter 4.5, *MOEE Hydrogeological Technical Information Requirements for Land Development Applications, April 1995*). This does not take into account factors such as topography and vegetation. It is expected that recharge rates will be lower on the hills due to runoff, and higher in the low areas due to depression focused recharge. The net effective depression focused recharge would be about 20 mm/yr for the runoff areas surrounding the enclosed hollows.

At-Source Infiltration

The estimated hydraulic conductivity of the native glacial till soil is between 10^{-4} and 10^{-5} cm/s, which corresponds to an infiltration rate of between 1 and 5 mm/h. The recommended minimum infiltration rate for soakaway pits and infiltration galleries is 15 mm/h. It is our opinion that the soils at the site are not suitable for conventional at-source stormwater infiltration, based on the low hydraulic conductivity.

It is important to note that the geotechnical investigation involves a limited sampling of the site gathered at specific test hole locations and the conclusions in this report are based on this information gathered. This report is preliminary in nature and we recommend that more detailed subsurface investigation, including additional boreholes, be carried out prior to completion of detailed design and construction.

We trust that this report is suitable for your present requirements and we thank you for this opportunity to have provided geotechnical engineering services. If you have any questions or require further geotechnical consultation, please do not hesitate to contact our office.

Respectfully submitted,

for Christopher Fleck, B.A.Sc.

Dennis Kelly, P.Eng.
Senior Geotechnical Engineer

LICENSED PROFESSIONAL ENGINEER
D. J. KELLY
July 4/05
PROVINCE OF ONTARIO

Encl. List of Abbreviations
Encl. Table 1 – Summary of Fill and Topsoil Thicknesses
Encl. Borehole Logs – Borehole Logs 1 to 7 (NEA Report 5685E2.R02)
Encl. Test Pit Logs – Test Pits 1 through 21
Encl. Drawing 1 – Location Plan
Encl. Drawing 2 – Site Plan
Encl. Drawing 3 – Structural Fill Pad Detail
Encl. Drawing 4 – Basement Drainage Detail
Encl. Drawing 5 – Pavement Subdrain Detail
Encl. Appendix A – Site Photographs

LIST OF ABBREVIATIONS

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

Sample Types	
AS	auger sample
CS	chunk sample
RC	rock core
SS	split spoon
TW	thin-walled, open
WS	wash sample

Soil Tests and Properties	
SPT	Standard Penetration Test
UC	unconfined compression
FV	field vane test
ø	angle of internal friction
γ	unit weight
w_p	plastic limit
w	water content
w_l	liquid limit
I_L	liquidity index
I_p	plasticity index
PP	pocket penetrometer

Penetration Resistances	
Dynamic Penetration Resistance	The number of blows by a 63.5 kg (140 lb.) hammer dropped 0.76 m (30 in.) required to drive a 50 mm (2 in.) diameter 60 ° cone a distance 0.30 m (12 in.). The cone is attached to 'A' size drill rods and casing is not used.
Standard Penetration Resistance, N (ASTM D1586)	The number of blows by a 63.5 kg (140 lb.) hammer dropped 0.76 m (30 in.) required to drive a standard split spoon sampler 0.30 m (12 in.)
WH	sampler advanced by static weight of hammer
PH	sampler advanced by hydraulic pressure
PM	sampler advanced by manual pressure

Soil Description

Cohesionless Soils	**SPT 'N' Value**	**D_r (%)**
Relative Density (D_r)	(blows per 0.30 m)	
Very Loose	0 to 4	0 to 20
Loose	4 to 10	20 to 40
Compact	10 to 30	40 to 60
Dense	30 to 50	60 to 80
Very Dense	over 50	80 to 100

Cohesive Soils	Undrained Shear Strength (C_u)	
Consistency	**kPa**	**psf**
Very Soft	less than 12	less than 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1000
Stiff	50 to 100	1000 to 2000
Very Stiff	100 to 200	2000 to 4000
Hard	over 200	over 4000

DTPL	Drier than plastic limit
APL	About plastic limit
WTPL	Wetter than plastic limit

TABLE 1

SUMMARY OF FILL AND TOPSOIL THICKNESSES

Proposed Urban Development
65 and 105 Ripplewood Drive
Cambridge, Ontario

Test Hole Number	Topsoil and Fill Thicknesses (mm)
Borehole 1	400
Borehole 2	450
Borehole 3	600
Borehole 4	2000
Borehole 5	1800
Borehole 6	450
Borehole 7	450
Test Pit 1	400
Test Pit 2	200
Test Pit 3	400
Test Pit 4	450 (Peat)
Test Pit 5	400
Test Pit 6	900
Test Pit 7	300
Test Pit 8	450
Test Pit 9	350
Test Pit 10	400
Test Pit 11	450
Test Pit 12	150
Test Pit 13	300
Test Pit 14	350
Test Pit 15	250
Test Pit 16	500 (Peat)
Test Pit 17	600
Test Pit 18	400
Test Pit 19	450
Test Pit 20	350
Test Pit 21	350

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Borehole Number: 1

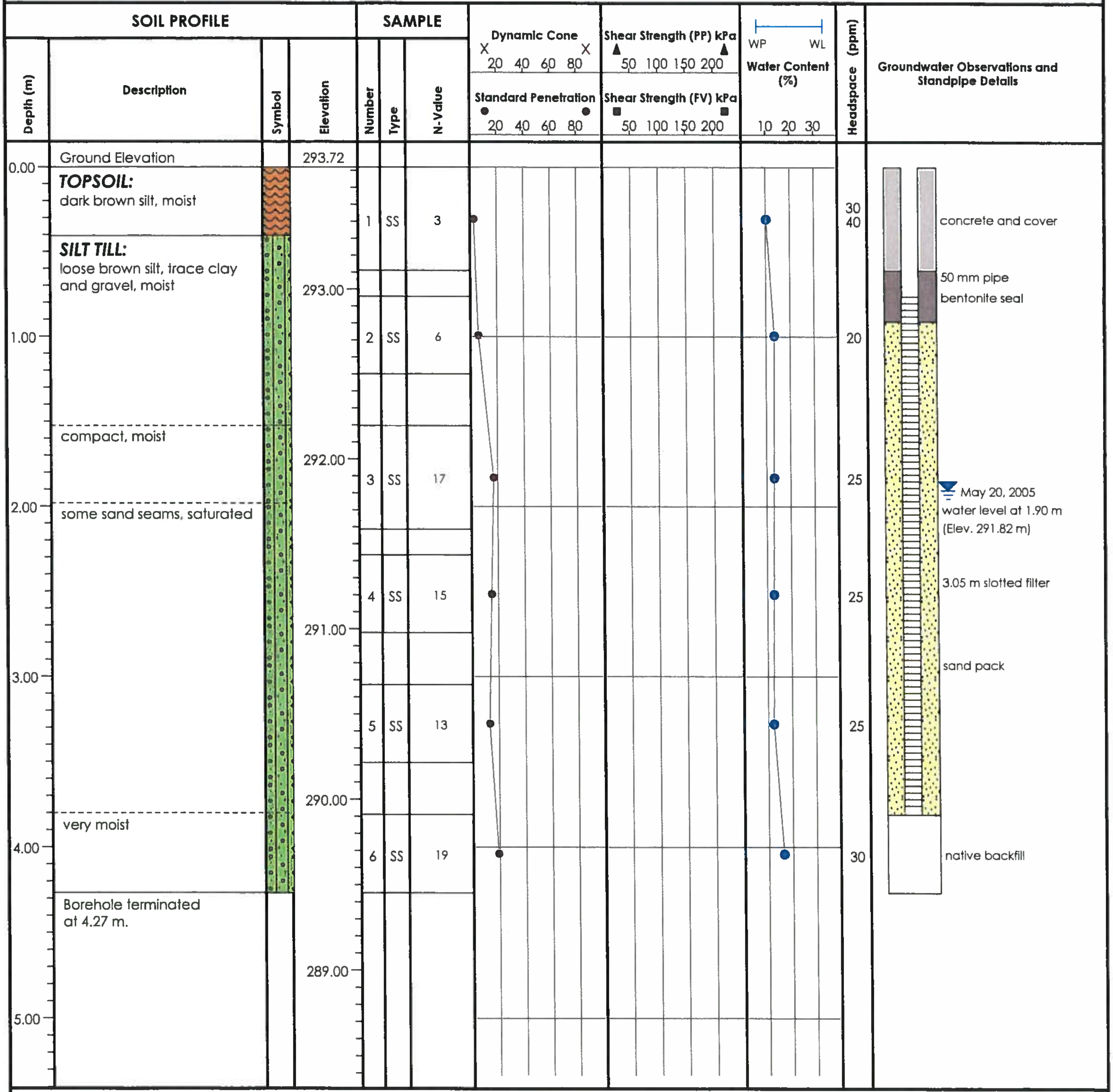
Ground Elevation: *293.72 m*

Project: *Phase 2 ESA, Proposed Urban Development*

Location: *105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685E2*

Drill Date: *May 16, 2005*



Reviewed by: *J.L.*

Field Tech.: *R.M.*

Drafted by: *A.G._03a*

Drill Method: *Hollow Stem Auger*

Sheet: *1 of 1*

Notes: *Auger sample taken from 0.00 to 0.46 m.*
Headspace readings expressed in parts per million (ppm).

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Borehole Number: 2

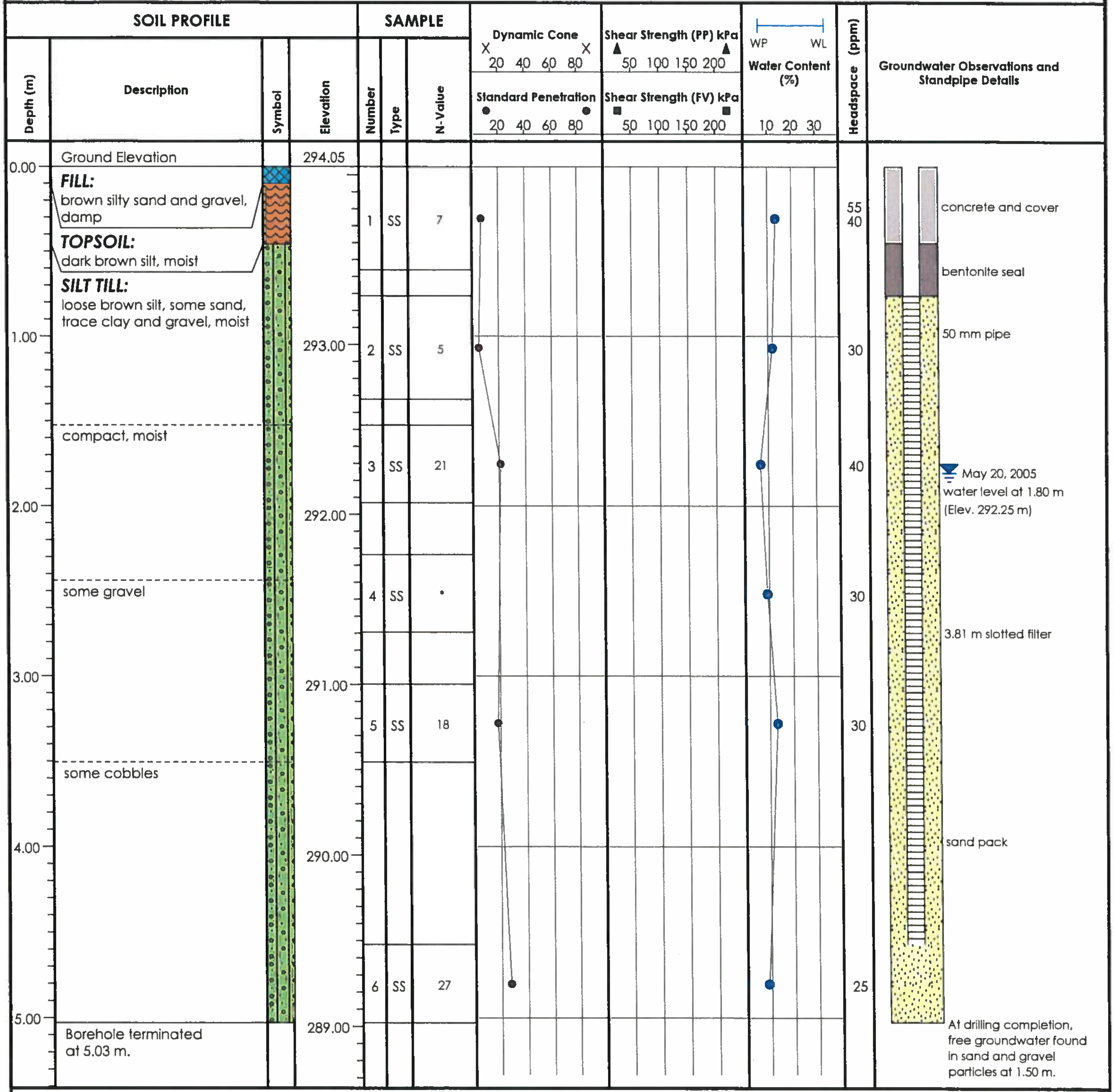
Ground Elevation: *294.05 m*

Project: *Phase 2 ESA, Proposed Urban Development*

Job No.: *5685E2*

Location: *105 Ripplewood Road, Cambridge, Ontario*

Drill Date: *May 16, 2005*



Ground Elevation 294.05

FILL:
brown silty sand and gravel, damp

TOPSOIL:
dark brown silt, moist

SILT TILL:
loose brown silt, some sand, trace clay and gravel, moist

compact, moist

some gravel

some cobbles

Borehole terminated at 5.03 m.

Number	Type	N-Value	Headspace (ppm)
1	SS	7	55 40
2	SS	5	30
3	SS	21	40
4	SS	*	30
5	SS	18	30
6	SS	27	25

concrete and cover

bentonite seal

50 mm pipe

May 20, 2005
water level at 1.80 m
(Elev. 292.25 m)

3.81 m slotted filter

sand pack

At drilling completion, free groundwater found in sand and gravel particles at 1.50 m.

Reviewed by: *J.L.*

Field Tech.: *R.M.*

Drafted by: *A.G._03a*

Drill Method: *Hollow Stem Auger*

Sheet: *1 of 1*

Notes: *Auger sample taken from 0.00 to 0.46 m. * Sampler driving on gravel.*
Headspace readings expressed in parts per million (ppm).

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Borehole Number: 3

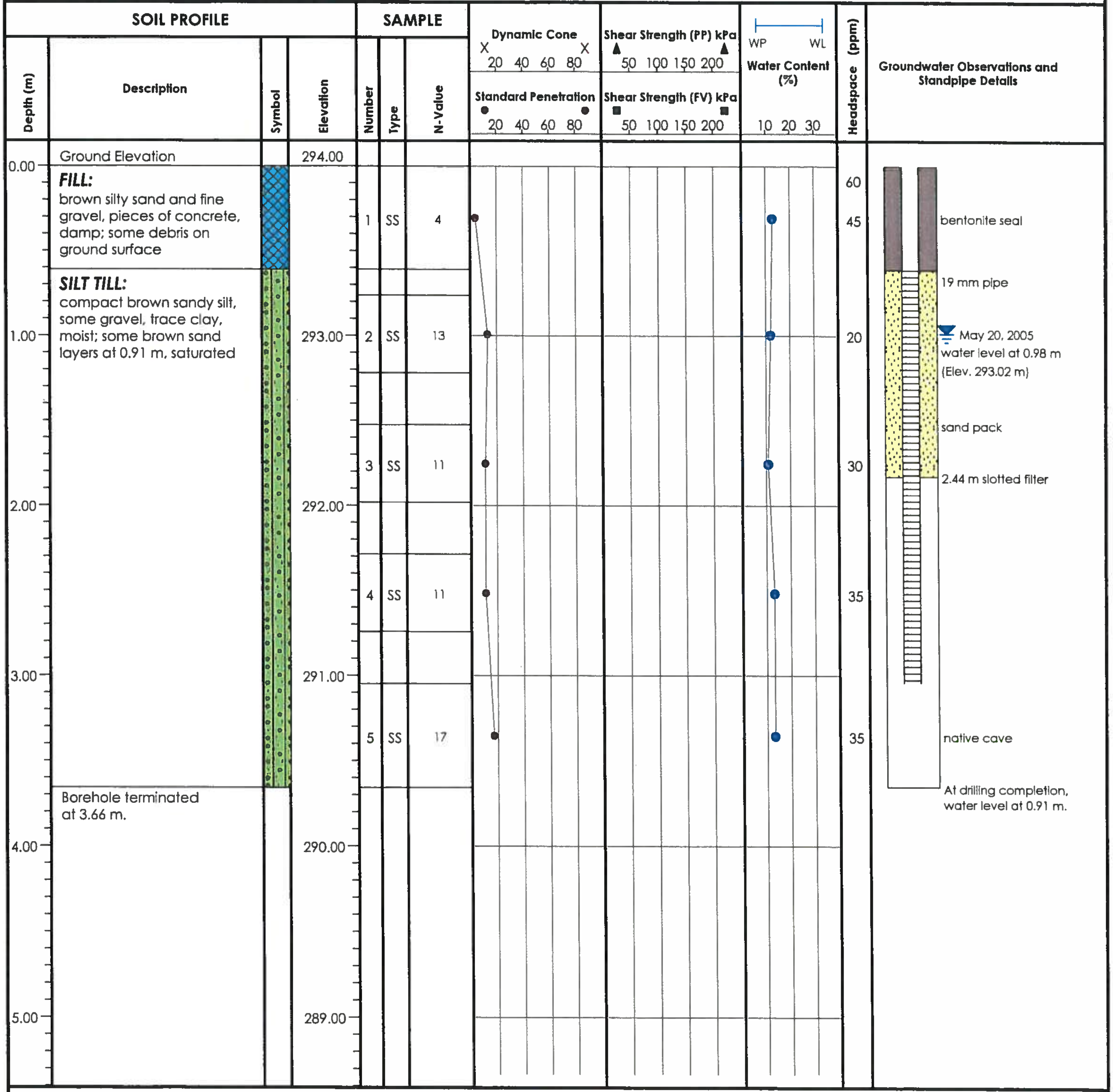
Ground Elevation: *294.00 m*

Project: *Phase 2 ESA, Proposed Urban Development*

Location: *105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685E2*

Drill Date: *May 16, 2005*



Ground Elevation 294.00

FILL:
brown silty sand and fine gravel, pieces of concrete, damp; some debris on ground surface

SILT TILL:
compact brown sandy silt, some gravel, trace clay, moist; some brown sand layers at 0.91 m, saturated

Borehole terminated at 3.66 m.

Number	Type	N-Value	Headspace (ppm)
			60
1	SS	4	45
2	SS	13	20
3	SS	11	30
4	SS	11	35
5	SS	17	35

bentonite seal

19 mm pipe

May 20, 2005
water level at 0.98 m
(Elev. 293.02 m)

sand pack

2.44 m slotted filter

native cave

At drilling completion, water level at 0.91 m.

Reviewed by: *J.L.*

Field Tech.: *R.M.*

Drafted by: *A.G._03a*

Drill Method: *Solid Stem Auger*

Sheet: *1 of 1*

Notes: *Auger sample taken from 0.00 to 0.15 m.*
Headspace readings expressed in parts per million (ppm).

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Borehole Number: 4

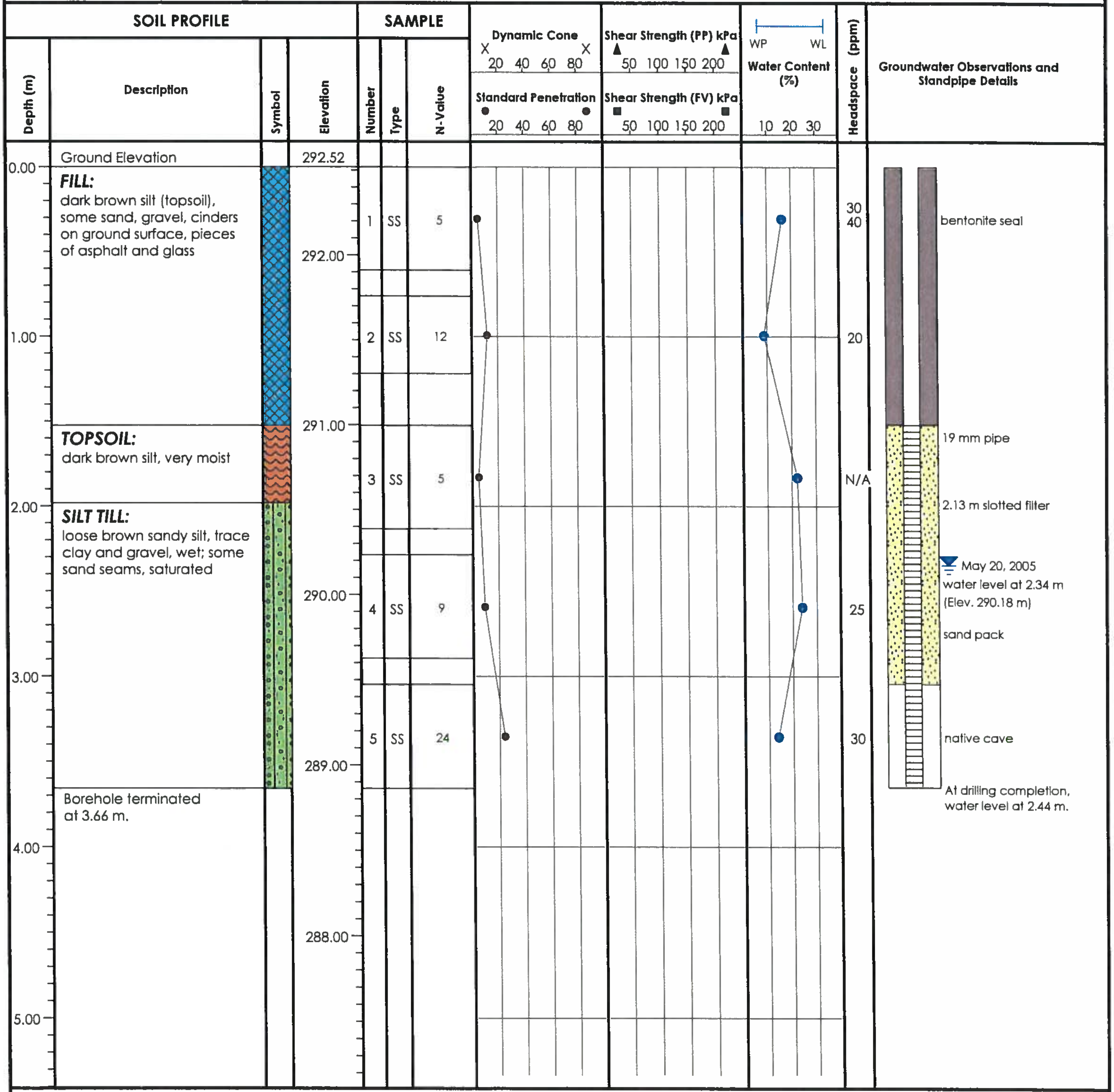
Ground Elevation: *292.52 m*

Project: *Phase 2 ESA, Proposed Urban Development*

Location: *105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685E2*

Drill Date: *May 16, 2005*



Depth (m)	Description	Elevation
	Ground Elevation	292.52
0.00	**FILL:** dark brown silt (topsoil), some sand, gravel, cinders on ground surface, pieces of asphalt and glass	
	TOPSOIL: dark brown silt, very moist	
2.00	**SILT TILL:** loose brown sandy silt, trace clay and gravel, wet; some sand seams, saturated	
	Borehole terminated at 3.66 m.	

Number	Type	N-Value	Headspace (ppm)
1	SS	5	30 40
2	SS	12	20
3	SS	5	N/A
4	SS	9	25
5	SS	24	30

May 20, 2005 water level at 2.34 m (Elev. 290.18 m)

At drilling completion, water level at 2.44 m.

Reviewed by: *J.L.*

Field Tech.: *R.M.*

Drafted by: *A.G._03a*

Drill Method: *Solid Stem Auger*

Sheet: *1 of 1*

Notes: *Auger sample taken from 0.00 to 0.15 m.*

Headspace readings expressed in parts per million (ppm).

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Borehole Number: 5

Ground Elevation: *294.81 m*

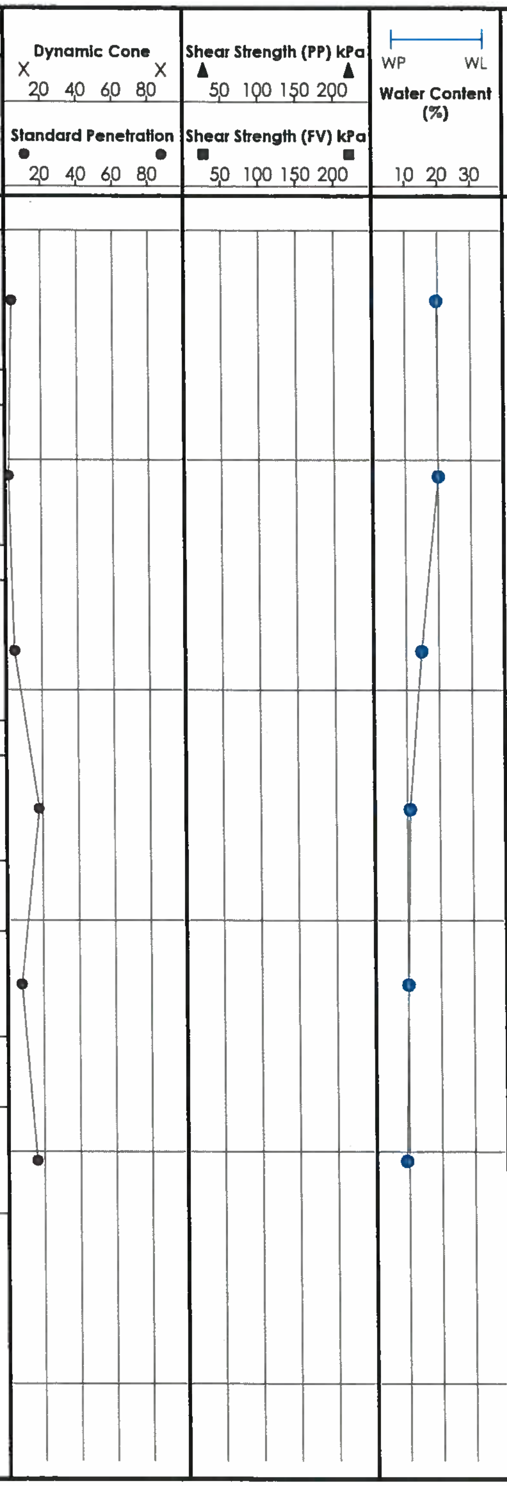
Project: *Phase 2 ESA, Proposed Urban Development*

Location: *105 Ripplewood Road, Cambridge, Ontario*

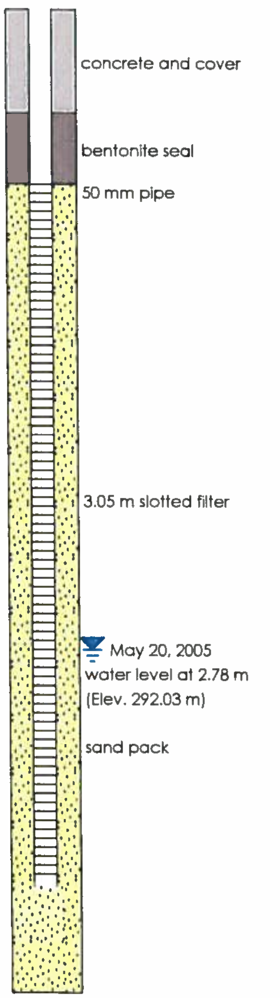
Job No.: *5685E2*

Drill Date: *May 16, 2005*

Depth (m)	Description	Elevation	Number	Type	N-Value	Headspace (ppm)
	Ground Elevation	294.81				
0.00	***FILL:*** dark brown silt (topsoil), very moist		1	SS	4	55 45
		294.00				
1.00	very loose brown silt, trace sand and clay, moist		2	SS	2	40
	SILT TILL: loose to compact brown silt, some sand, trace clay and gravel, moist	293.00	3	SS	5	40
2.00			4	SS	18	30
	boulders	292.00				
3.00			5	SS	8	70
	brown sand layers, saturated	291.00				
4.00			6	SS	16	50
	Borehole terminated at 4.27 m.					
		290.00				
5.00						



Groundwater Observations and Standpipe Details


concrete and cover

bentonite seal

50 mm pipe

3.05 m slotted filter

May 20, 2005 water level at 2.78 m (Elev. 292.03 m)

sand pack

Reviewed by: *J.L.*

Field Tech.: *R.M.*

Drafted by: *A.G._03a*

Drill Method: *Hollow Stem Auger*

Sheet: *1 of 1*

Notes: *Auger sample taken from 0.00 to 0.46 m. Borehole moved1.2 m north upon auger refusal on boulders. Headspace readings expressed in parts per million*

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Borehole Number: *6*

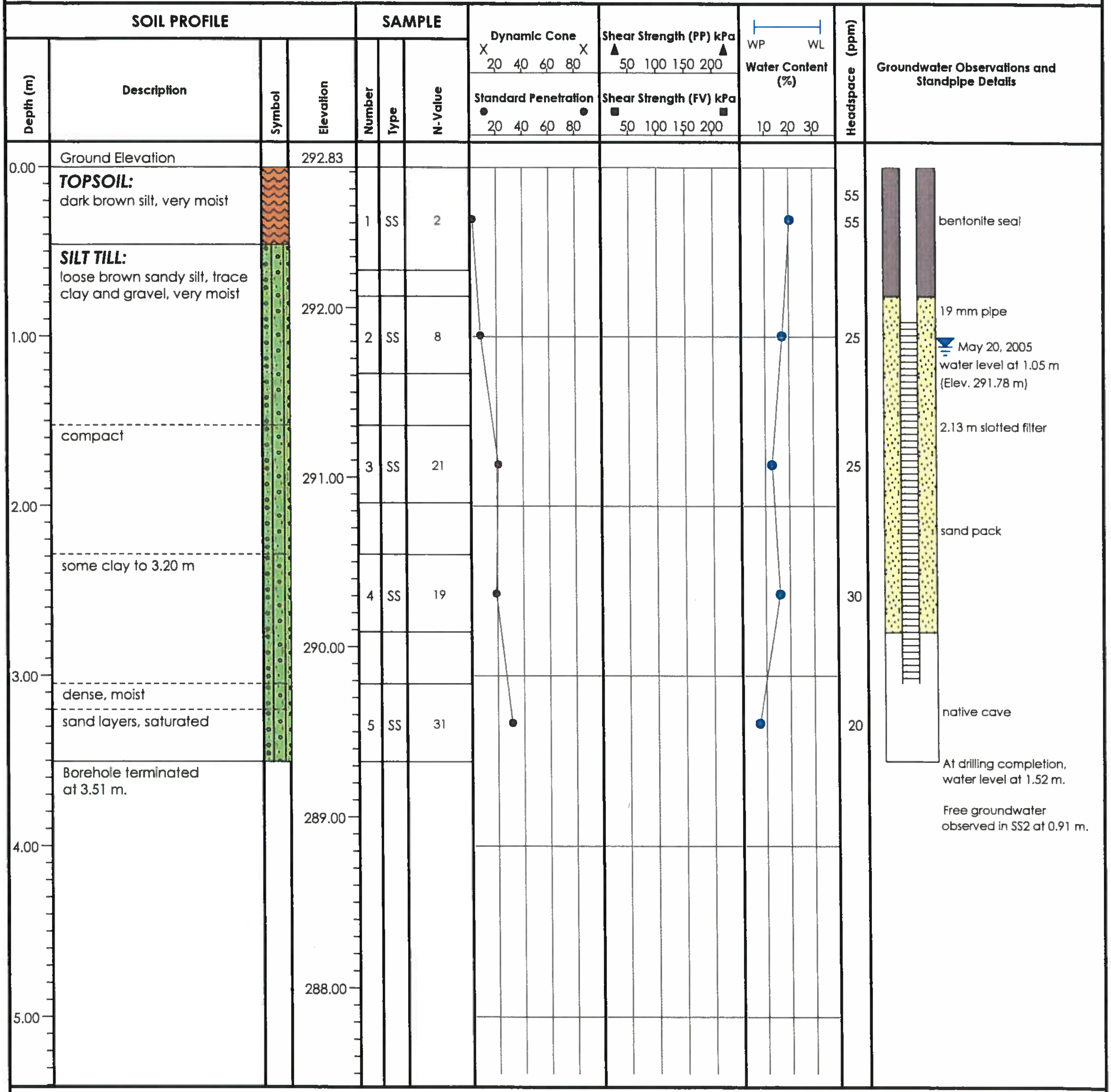
Ground Elevation: *292.83 m*

Project: *Phase 2 ESA, Proposed Urban Development*

Location: *105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685E2*

Drill Date: *May 16, 2005*



Ground Elevation 292.83

TOPSOIL:
dark brown silt, very moist

SILT TILL:
loose brown sandy silt, trace clay and gravel, very moist

compact

some clay to 3.20 m

dense, moist

sand layers, saturated

Borehole terminated at 3.51 m.

Number	Type	N-Value	Headspace (ppm)
			55
1	SS	2	55
2	SS	8	25
3	SS	21	25
4	SS	19	30
5	SS	31	20

May 20, 2005
water level at 1.05 m
(Elev. 291.78 m)

At drilling completion, water level at 1.52 m.

Free groundwater observed in SS2 at 0.91 m.

Reviewed by: *J.L.*

Field Tech.: *R.M.*

Drafted by: *A.G._03a*

Drill Method: *Solid Stem Auger*

Sheet: *1 of 1*

Notes: *Auger sample taken from 0.00 to 0.30 m.*
Headspace readings expressed in parts per million (ppm).

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Borehole Number: 7

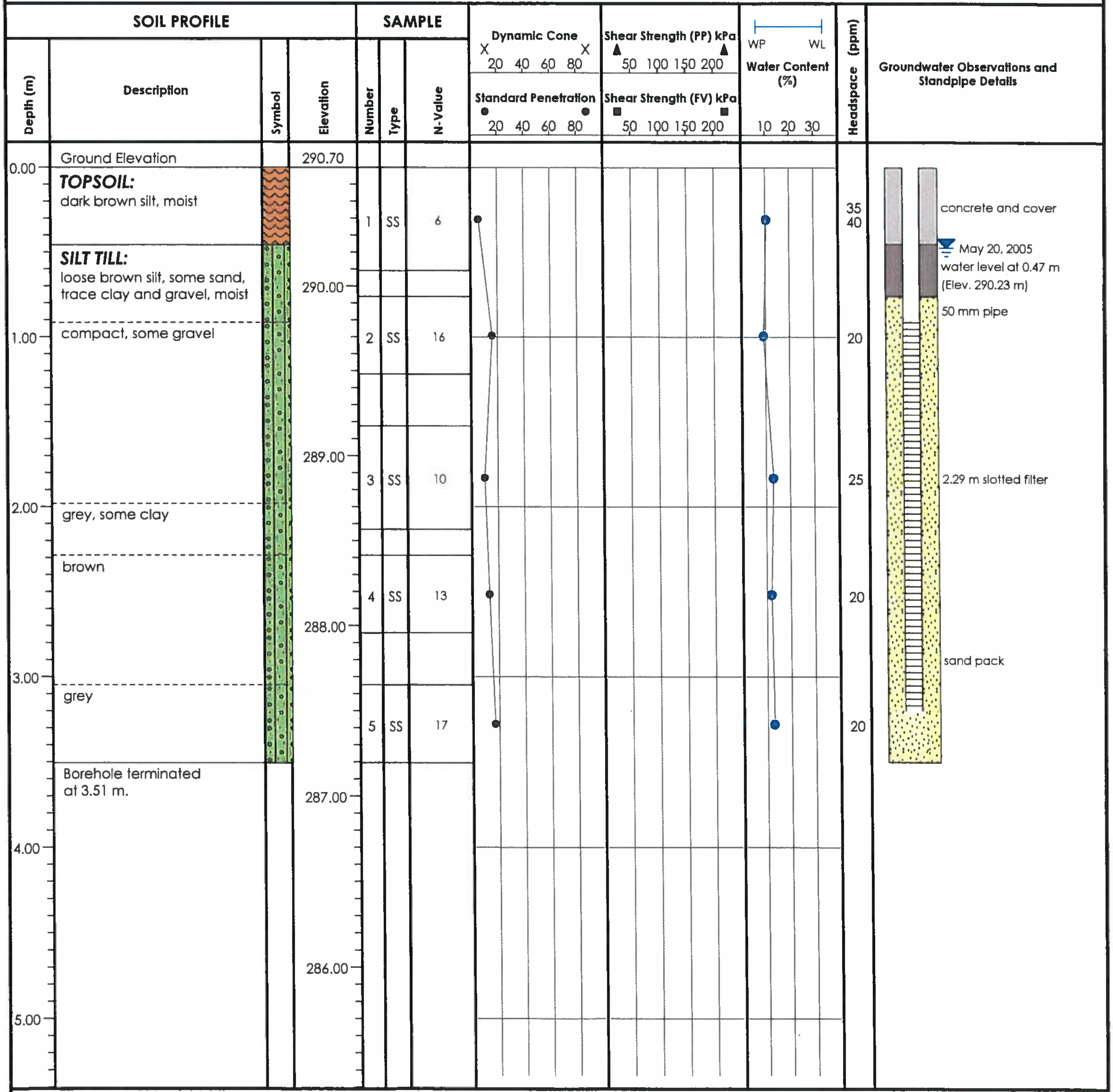
Ground Elevation: *290.70 m*

Project: *Phase 2 ESA, Proposed Urban Development*

Location: *105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685E2*

Drill Date: *May 16, 2005*



Ground Elevation 290.70

TOPSOIL: dark brown silt, moist

SILT TILL: loose brown silt, some sand, trace clay and gravel, moist

compact, some gravel

grey, some clay

brown

grey

Borehole terminated at 3.51 m.

Number	Type	N-Value	Headspace (ppm)
1	SS	6	35 40
2	SS	16	20
3	SS	10	25
4	SS	13	20
5	SS	17	20

Reviewed by: *J.L.*

Field Tech.: *R.M.*

Drafted by: *A.G._03a*

Drill Method: *Hollow Stem Auger*

Sheet: *1 of 1*

Notes: *Auger sample taken from 0.00 to 0.46 m.*
Headspace readings expressed in parts per million (ppm).

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Test Pit Number: 1

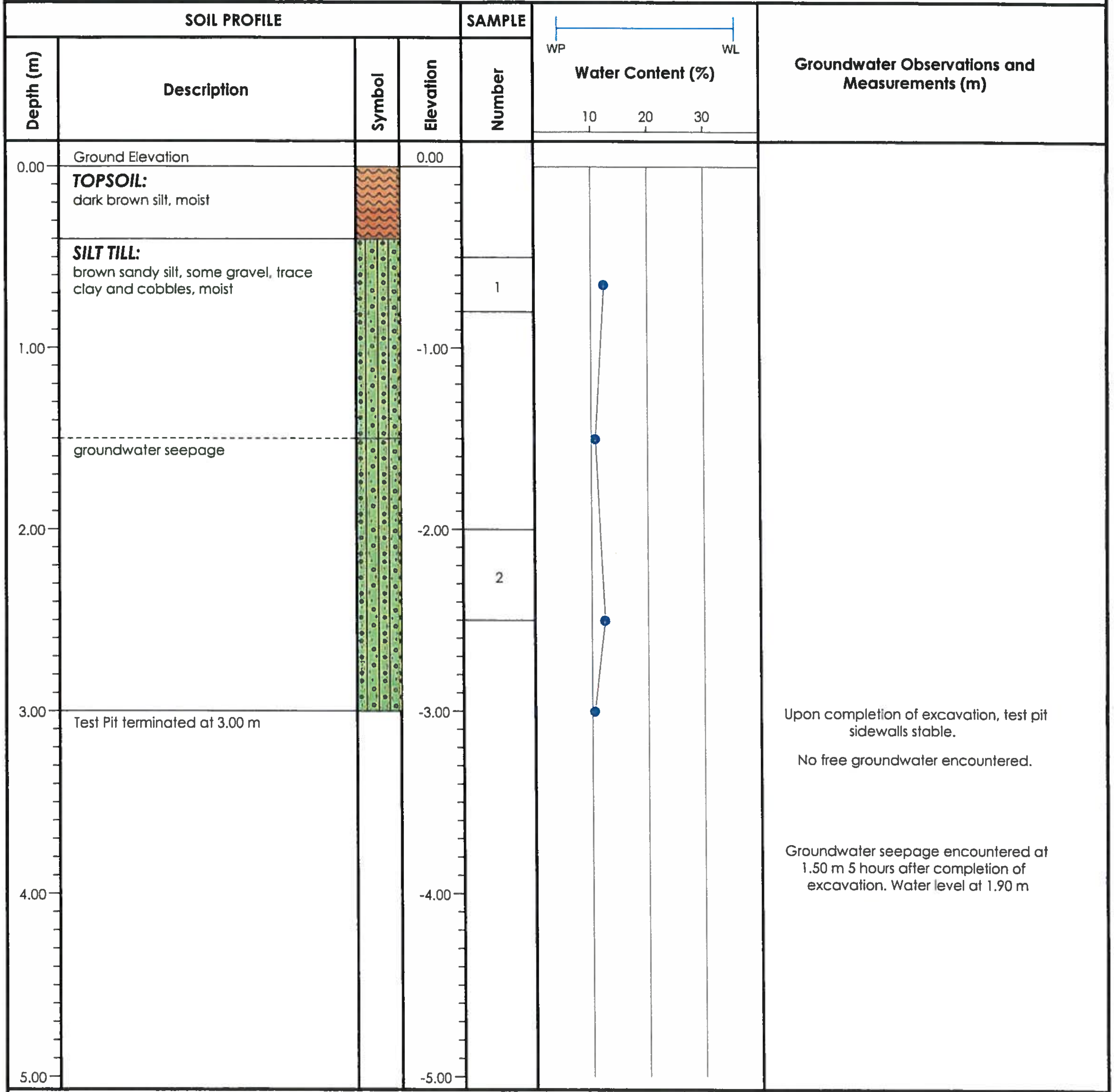
Ground Elevation: *N/A*

Project: *Proposed Urban Development*

Job No.: *5685G1*

Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Excavation Date: *May 13, 2005*



Ground Elevation

TOPSOIL:
dark brown silt, moist

SILT TILL:
brown sandy silt, some gravel, trace clay and cobbles, moist

groundwater seepage

Test Pit terminated at 3.00 m

Upon completion of excavation, test pit sidewalls stable.

No free groundwater encountered.

Groundwater seepage encountered at 1.50 m 5 hours after completion of excavation. Water level at 1.90 m

Reviewed by: *CF*

Field Tech: *RM*

Notes:

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

Naylor
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Associates Ltd.
CONSULTING ENGINEERS

Test Pit Number: 2

Ground Elevation: *N/A*

Project: *Proposed Urban Development*

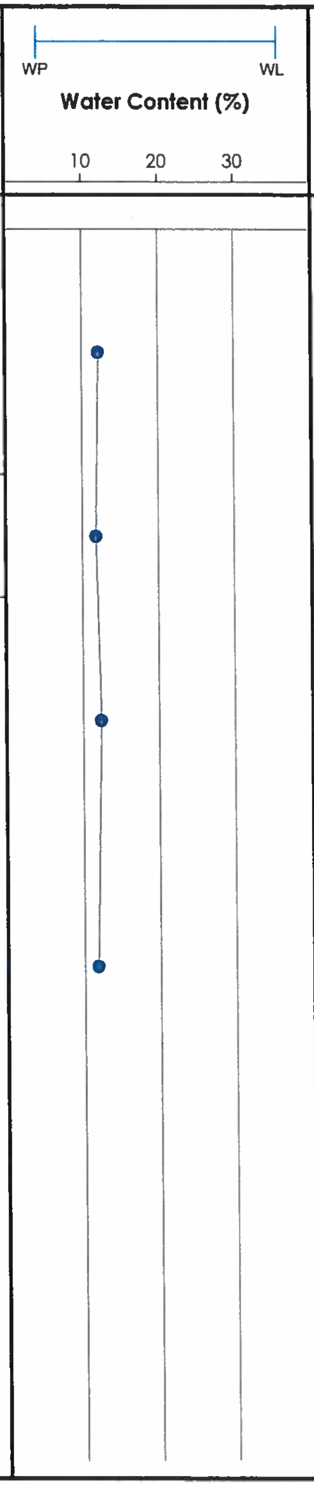
Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685G1*

Excavation Date: *May 13, 2005*

SOIL PROFILE

Depth (m)	Description	Symbol	Elevation	SAMPLE Number
0.00	Ground Elevation		0.00	
	TOPSOIL: dark brown silt, moist	▨		
	SILT TILL: brown sandy silt, some gravel and cobbles, trace clay, moist	🟩		
1.00	some boulders	🟩	-1.00	
		🟩		1
2.00		🟩	-2.00	
3.00	Test Pit terminated at 3.00 m		-3.00	
4.00			-4.00	
5.00			-5.00	



Groundwater Observations and Measurements (m)

Upon completion of excavation, test pit sidewalls stable.

No free groundwater encountered.

No groundwater seepage encountered 5 hours after completion of excavation.

Reviewed by: *CF*

Field Tech: *RM*

Notes:

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

Naylor Engineering Associates Ltd
CONSULTING ENGINEERS

Test Pit Number: 3

Ground Elevation: *291.27 m*

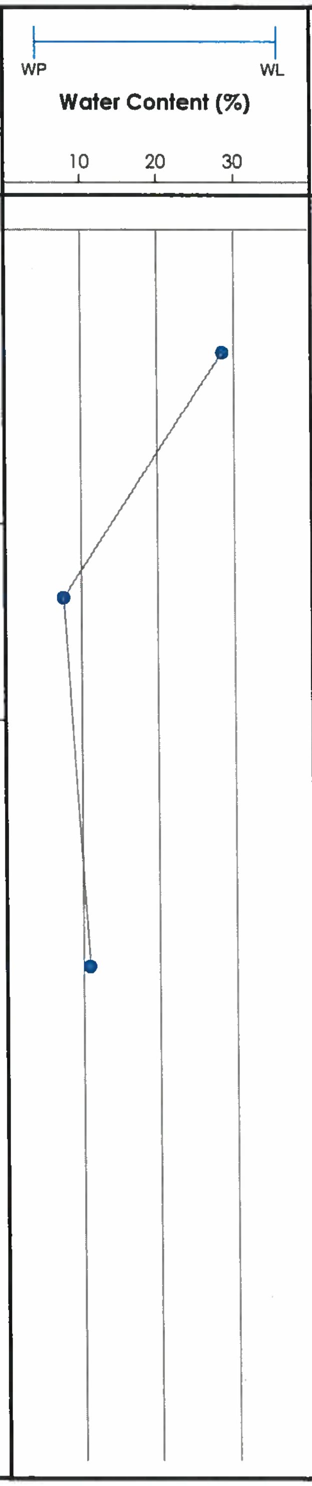
Project: *Proposed Urban Development*

Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685G1*

Excavation Date: *May 13, 2005*

Depth (m)	SOIL PROFILE Description	Symbol	Elevation	SAMPLE Number
	Ground Elevation		291.27	
0.00	***TOPSOIL:*** dark brown silt, very moist	🟧	291.00	
	SILT: brown silt, some clay, trace sand, wet	🟩		
1.00	***SAND:*** brown fine to coarse sand, some silt, gravel, cobbles and boulders, moist	🟨	290.00	1
2.00			289.00	
3.00	Test Pit terminated at 3.00 m		288.00	
4.00			287.00	
5.00				



Groundwater Observations and Measurements (m)

Upon completion of excavation, test pit sidewalls stable.

No free groundwater encountered.

No groundwater seepage encountered

4.5 hours after completion of excavation.

Reviewed by: *CF*

Field Tech: *RM*

Notes:

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Test Pit Number: 4

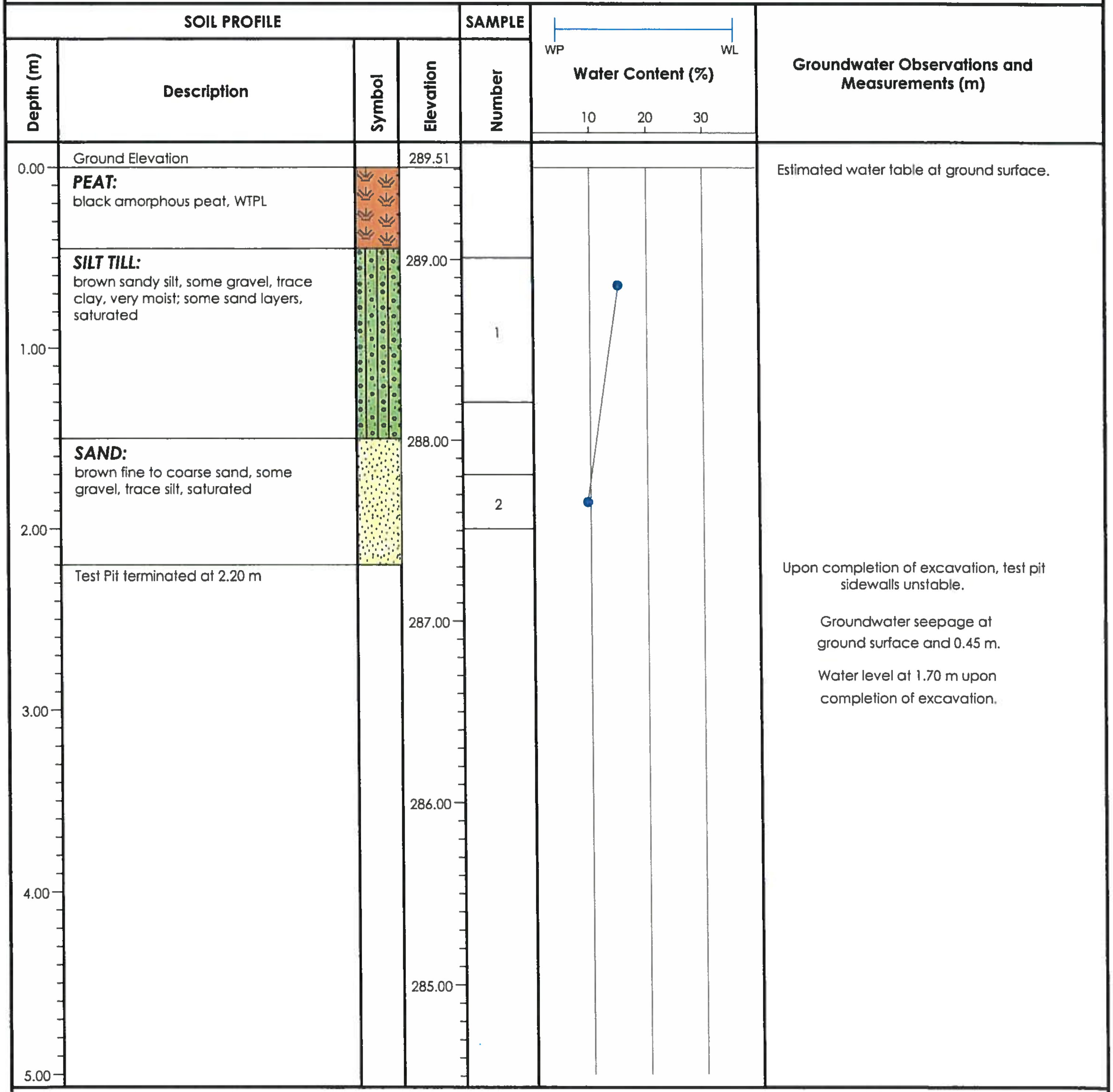
Ground Elevation: *289.51 m*

Project: *Proposed Urban Development*

Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685G1*

Excavation Date: *May 13, 2005*



Ground Elevation

PEAT:
black amorphous peat, WTPL

SILT TILL:
brown sandy silt, some gravel, trace clay, very moist; some sand layers, saturated

SAND:
brown fine to coarse sand, some gravel, trace silt, saturated

Test Pit terminated at 2.20 m

Estimated water table at ground surface.

Upon completion of excavation, test pit sidewalls unstable.

Groundwater seepage at ground surface and 0.45 m.

Water level at 1.70 m upon completion of excavation.

Reviewed by: *CF*

Field Tech: *RM*

Notes:

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

Naylor
Engineering
Associates Ltd.
CONSULTING ENGINEERS

Test Pit Number: 5

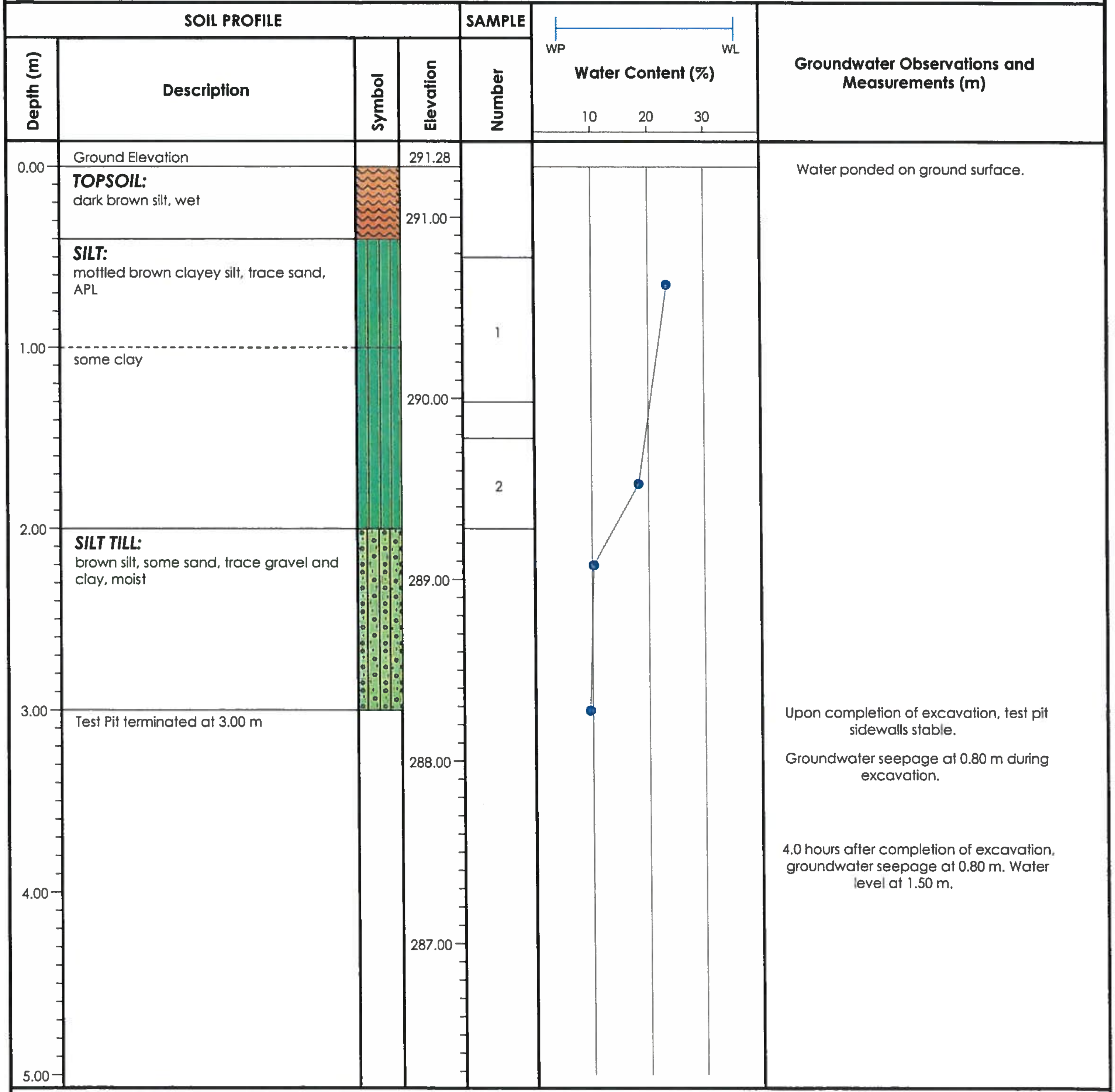
Ground Elevation: *291.28 m*

Project: *Proposed Urban Development*

Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685G1*

Excavation Date: *May 13, 2005*



Depth (m)	Description	Elevation
	Ground Elevation	291.28
0.00	***TOPSOIL:*** dark brown silt, wet	
	SILT: mottled brown clayey silt, trace sand, APL	
1.00	some clay	
2.00	***SILT TILL:*** brown silt, some sand, trace gravel and clay, moist	
3.00	Test Pit terminated at 3.00 m	

Groundwater Observations and Measurements (m)

Water ponded on ground surface.

Upon completion of excavation, test pit sidewalls stable.

Groundwater seepage at 0.80 m during excavation.

4.0 hours after completion of excavation, groundwater seepage at 0.80 m. Water level at 1.50 m.

Reviewed by: *CF*

Field Tech: *RM*

Notes:

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

Naylor
Engineering
Associates Ltd
CONSULTING ENGINEERS

Test Pit Number: 6

Ground Elevation: *296.89 m*

Project: *Proposed Urban Development*

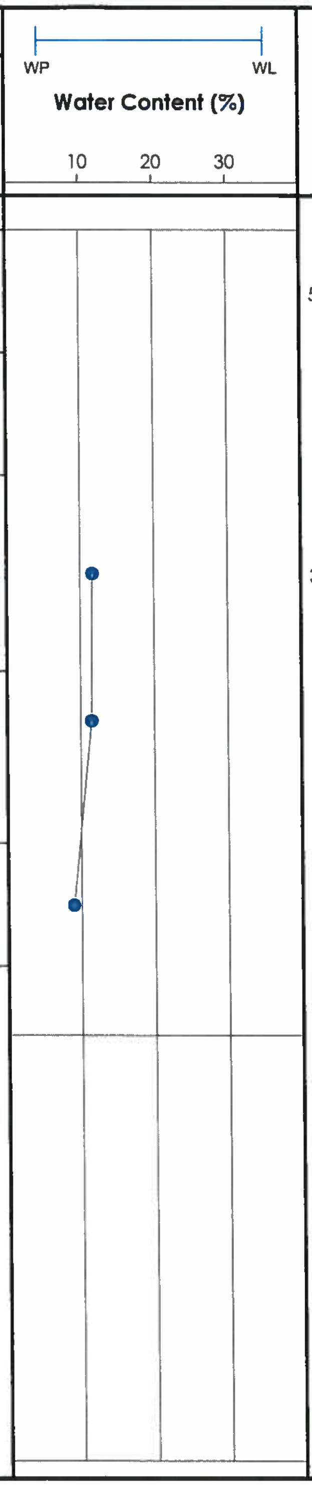
Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685G1*

Excavation Date: *May 13, 2005*

SOIL PROFILE

Depth (m)	Description	Symbol	Elevation	SAMPLE Number	Headspace
	Ground Elevation		296.89		
0.00	***FILL:*** dark brown silt (topsoil), frequent cobbles and boulders, pieces of scrap metal, glass and leather, moist	▨		1	50ppm
0.89	***SAND TILL:*** brown silty sand, some gravel and cobbles, very moist	🟩	296.00	2	30ppm
				3	30ppm
3.00	Test Pit terminated at 3.00 m		293.89		



Groundwater Observations and Measurements (m)

Upon completion of excavation, test pit sidewalls unstable from 0.00 to 1.00 m.

No free groundwater encountered.

Reviewed by: *CF*

Field Tech: *RM*

Notes:

Sheet: *1 of 1*

Drafted by: *DC (00R)*

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Test Pit Number: 7

Ground Elevation: *290.70 m*

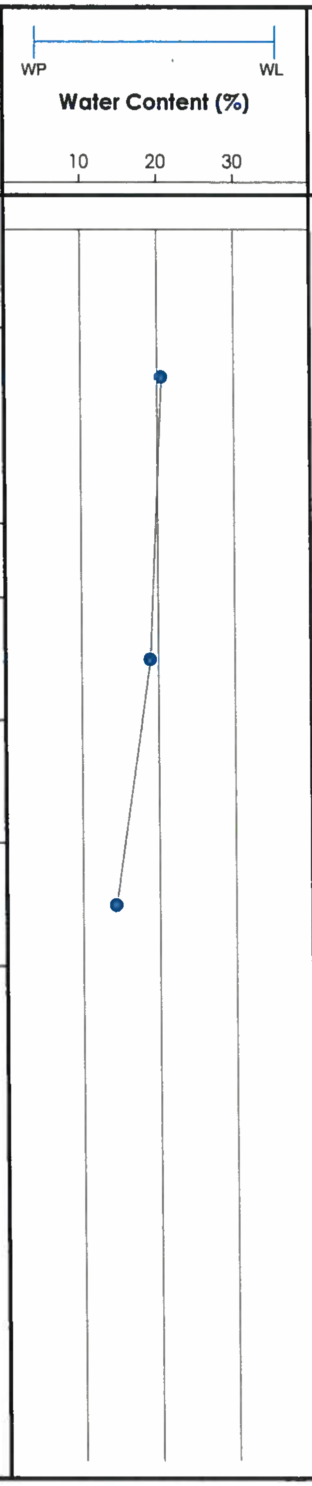
Project: *Proposed Urban Development*

Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685G1*

Excavation Date: *May 13, 2005*

SOIL PROFILE				SAMPLE	
Depth (m)	Description	Symbol	Elevation	Number	Groundwater Observations and Measurements (m)
	Ground Elevation		290.70		
0.00	***TOPSOIL:*** dark brown silt, moist	🟧			
	SILT: brown silt, trace sand and clay, wet; some sand seams and layers, saturated	🟩			
			290.00	1	
1.00					
			289.00	2	
2.00					
	brown sandy silt, saturated	🟩			
			288.00	3	
3.00	Test Pit terminated at 3.00 m				Upon completion of excavation, test pit sidewalls unstable. Groundwater seepage between ground surface and 0.80 m during excavation.
			287.00		
4.00					
			286.00		
5.00					



Reviewed by: *CF*

Field Tech: *RM*

Notes:

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Test Pit Number: 8

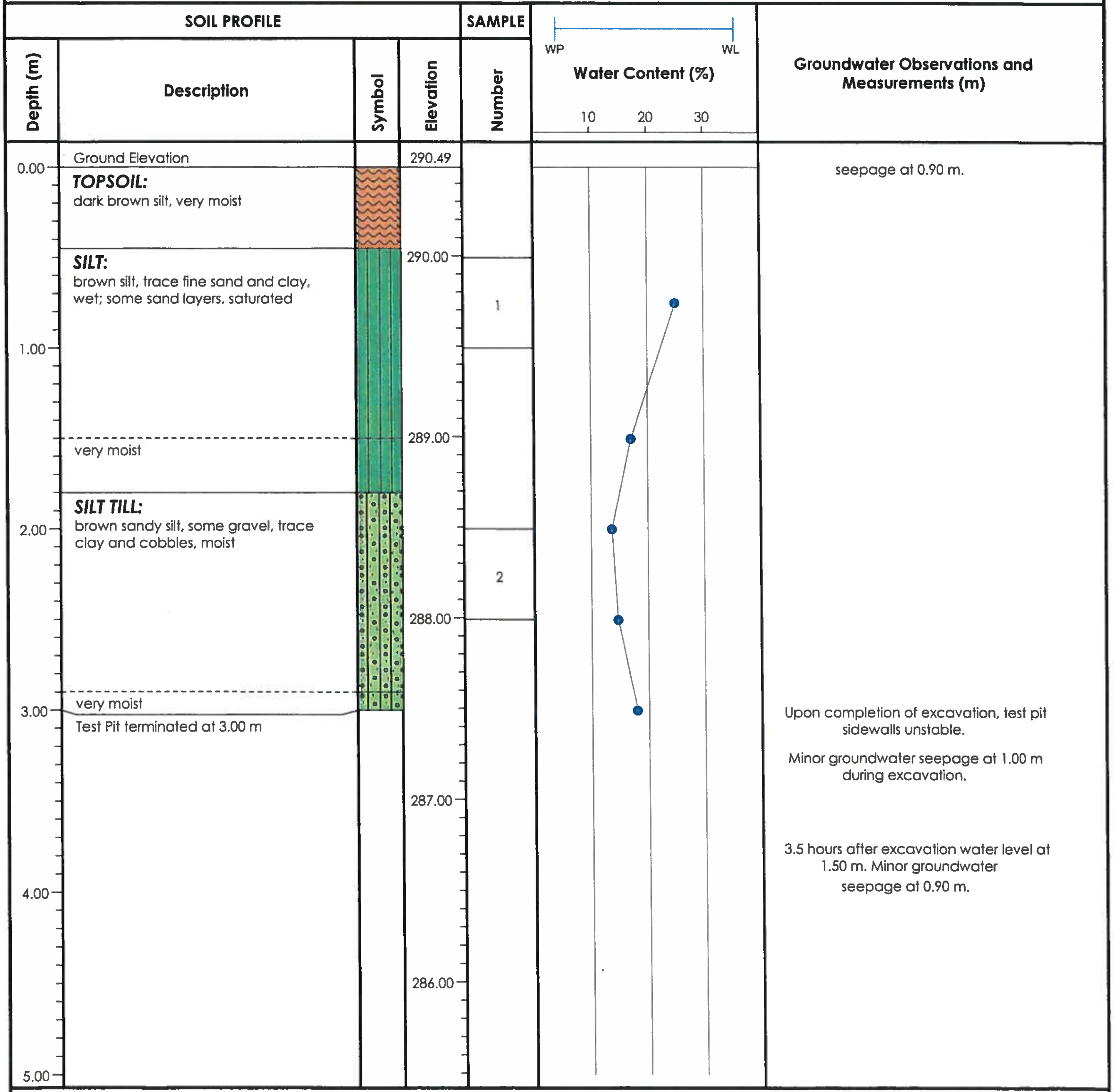
Ground Elevation: *290.49 m*

Project: *Proposed Urban Development*

Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685G1*

Excavation Date: *May 13, 2005*



Ground Elevation

TOPSOIL:
dark brown silt, very moist

SILT:
brown silt, trace fine sand and clay, wet; some sand layers, saturated

very moist

SILT TILL:
brown sandy silt, some gravel, trace clay and cobbles, moist

very moist

Test Pit terminated at 3.00 m

seepage at 0.90 m.

Upon completion of excavation, test pit sidewalls unstable.

Minor groundwater seepage at 1.00 m during excavation.

3.5 hours after excavation water level at 1.50 m. Minor groundwater seepage at 0.90 m.

Reviewed by: *CF*

Field Tech: *RM*

Notes: *Bulk sample taken from 0.80 to 1.20 m.*

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

Naylor
Engineering
Associates Ltd.
CONSULTING ENGINEERS

Test Pit Number: *9*

Ground Elevation: *N/A*

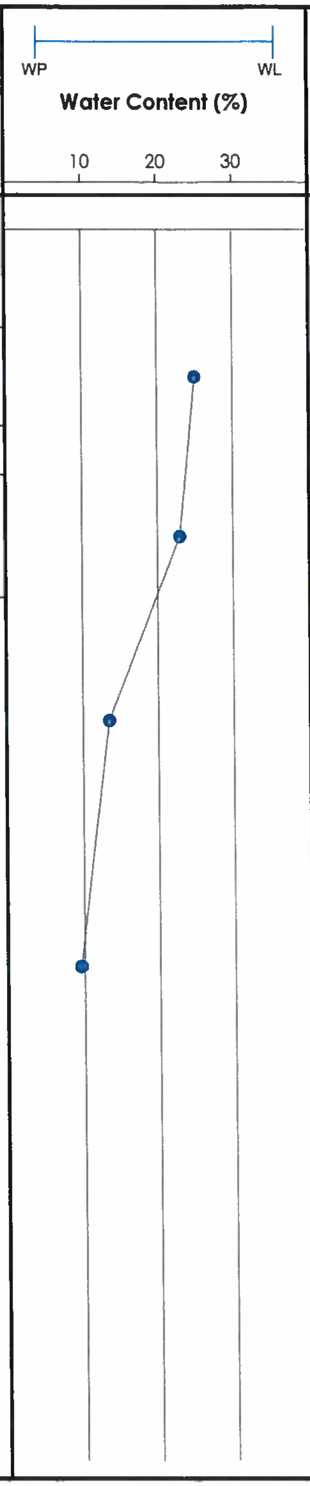
Project: *Proposed Urban Development*

Job No.: *5685G1*

Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Excavation Date: *May 13, 2005*

Depth (m)	Description	Elevation	Sample Number
	Ground Elevation	0.00	
0.00	***TOPSOIL:*** dark brown silt, moist		
	SILT: brown silt, some clay, APL		1
1.00	***SILT TILL:*** brown silt, some sand, trace clay, moist; some sandy silt layers, saturated	-1.00	2
2.00		-2.00	
3.00	Test Pit terminated at 3.00 m	-3.00	
4.00		-4.00	
5.00		-5.00	



Groundwater Observations and Measurements (m)

Upon completion of excavation, test pit sidewalls stable.

No free groundwater encountered.

3.5 hours after excavation water level at 2.60 m. Minor groundwater seepage at 1.60 m.

Reviewed by: *CF*

Field Tech: *RM*

Notes:

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Test Pit Number: 10

Ground Elevation: *N/A*

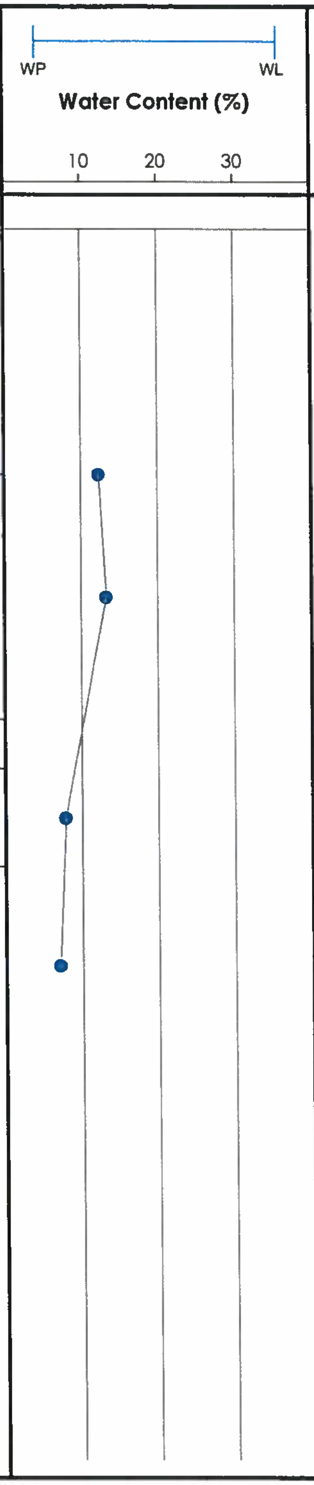
Project: *Proposed Urban Development*

Job No.: *5685G1*

Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Excavation Date: *May 13, 2005*

Depth (m)	SOIL PROFILE Description	Symbol	Elevation	SAMPLE Number	Groundwater Observations and Measurements (m)
	Ground Elevation		0.00		
0.00	***TOPSOIL:*** dark brown silt, moist	🟫			
	SILT TILL: brown sandy silt, some gravel, trace clay, moist	🟩			
1.00			-1.00	1	
2.00			-2.00		
	SAND: brown fine to coarse sand, some gravel, trace silt, moist	🟨		2	
3.00	Test Pit terminated at 3.00 m		-3.00		Upon completion of excavation, test pit sidewalls stable. No free groundwater encountered. 3.0 hours after excavation water level at 2.30 m. Minor groundwater seepage at 1.60 m.
4.00			-4.00		
5.00			-5.00		



Reviewed by: *CF*

Field Tech: *RM*

Notes:

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

Naylor Engineering Associates Ltd
CONSULTING ENGINEERS

Test Pit Number: 11

Ground Elevation: *290.68 m*

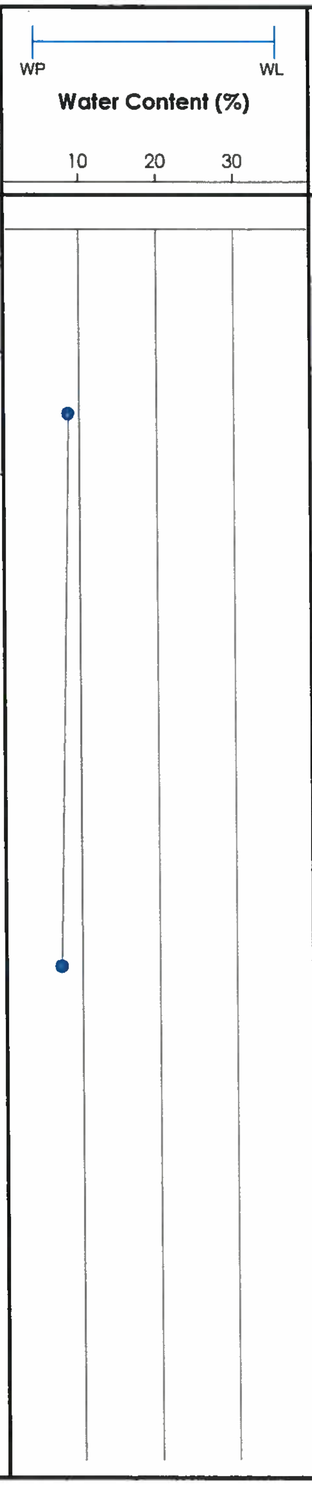
Project: *Proposed Urban Development*

Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685G1*

Excavation Date: *May 13, 2005*

SOIL PROFILE				SAMPLE
Depth (m)	Description	Symbol	Elevation	Number
	Ground Elevation		290.68	
0.00	***TOPSOIL:*** dark brown silt, moist			
	SAND: brown silty sand, some gravel, frequent cobbles and boulders, moist		290.00	1
1.00				
			289.00	
2.00				
	wet			
			288.00	
3.00	Test Pit terminated at 3.00 m			
			287.00	
4.00				
			286.00	
5.00				



Groundwater Observations and Measurements (m)

Upon completion of excavation, test pit sidewalls stable.

No free groundwater encountered.

3.0 hours after excavation water level at 2.55 m. Minor groundwater seepage at 2.35 m.

Reviewed by: *CF*

Field Tech: *RM*

Notes:

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

Naylor Engineering Associates Ltd
CONSULTING ENGINEERS

Test Pit Number: 12

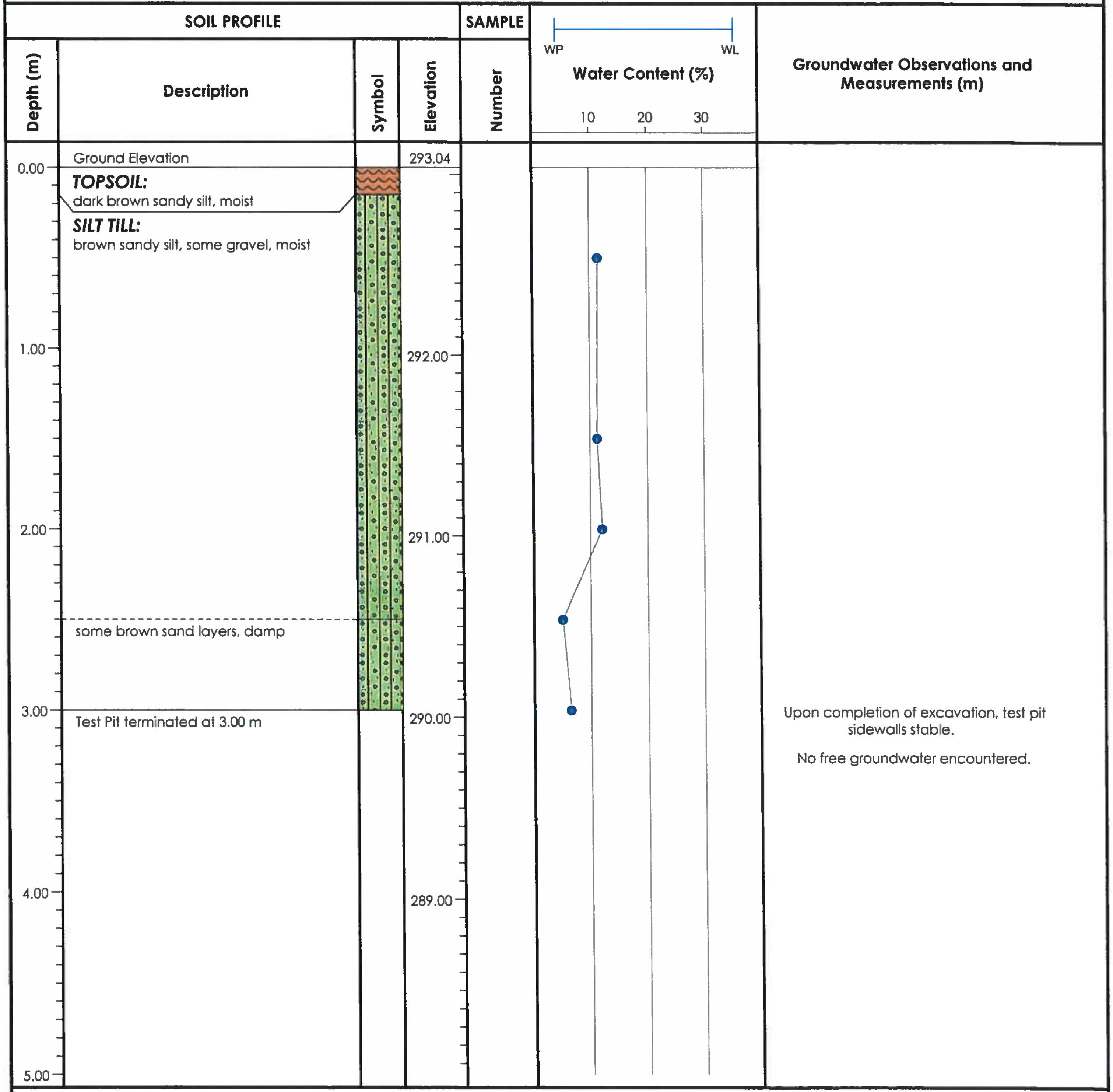
Ground Elevation: *293.04 m*

Project: *Proposed Urban Development*

Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685G1*

Excavation Date: *May 13, 2005*



Ground Elevation

TOPSOIL:
dark brown sandy silt, moist

SILT TILL:
brown sandy silt, some gravel, moist

some brown sand layers, damp

Test Pit terminated at 3.00 m

Upon completion of excavation, test pit sidewalls stable.

No free groundwater encountered.

Reviewed by: *CF*

Field Tech: *RM*

Notes: *Bulk sample taken from 1.00 to 2.00 m.*

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

Naylor
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Associates Ltd.
CONSULTING ENGINEERS

Test Pit Number: 13

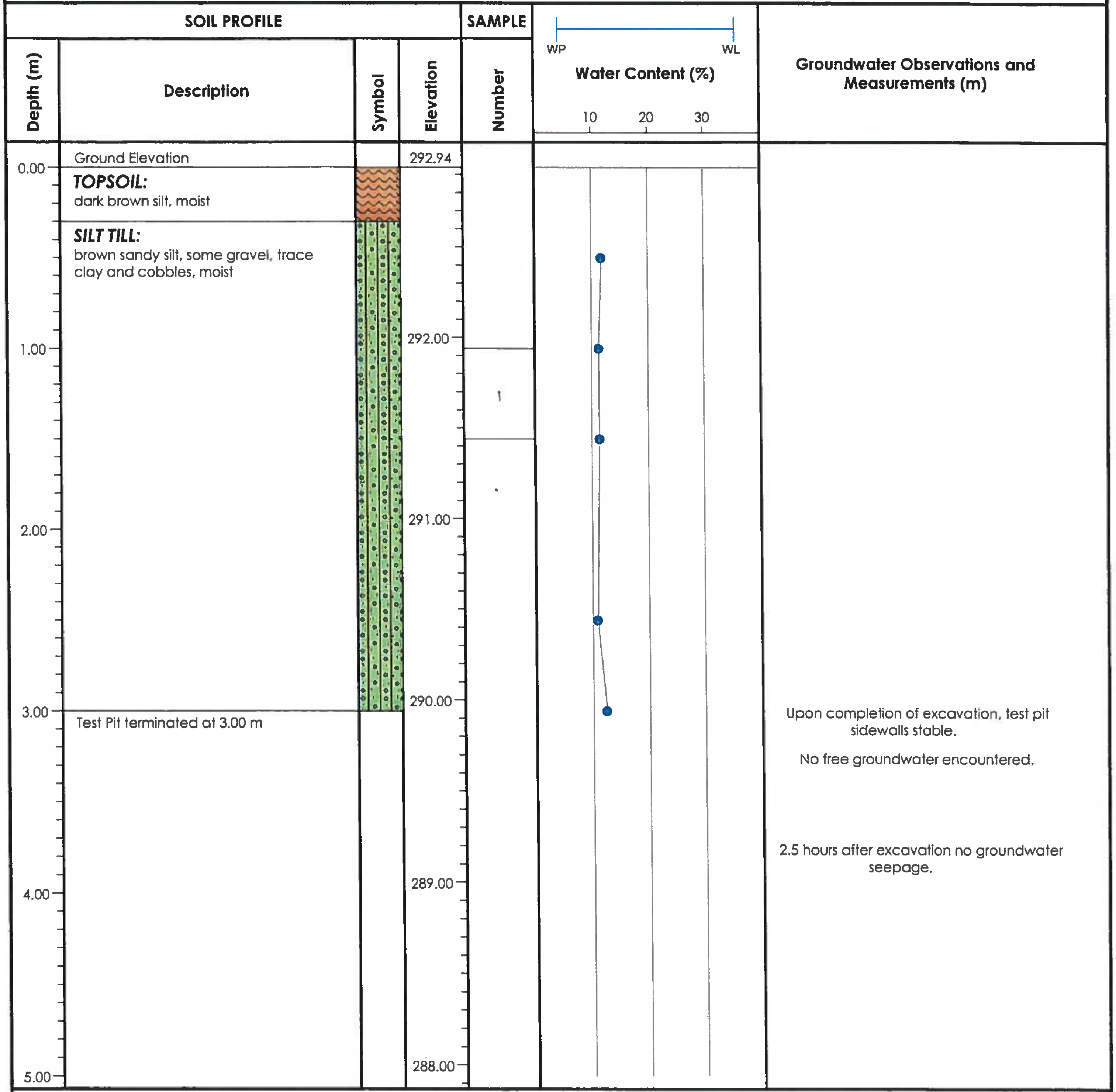
Ground Elevation: *292.94 m*

Project: *Proposed Urban Development*

Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685G1*

Excavation Date: *May 13, 2005*



Ground Elevation

TOPSOIL:
dark brown silt, moist

SILT TILL:
brown sandy silt, some gravel, trace clay and cobbles, moist

Test Pit terminated at 3.00 m

Upon completion of excavation, test pit sidewalls stable.

No free groundwater encountered.

2.5 hours after excavation no groundwater seepage.

Reviewed by: *CF*

Field Tech: *RM*

Notes:

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Test Pit Number: 14

Ground Elevation: *290.75 m*

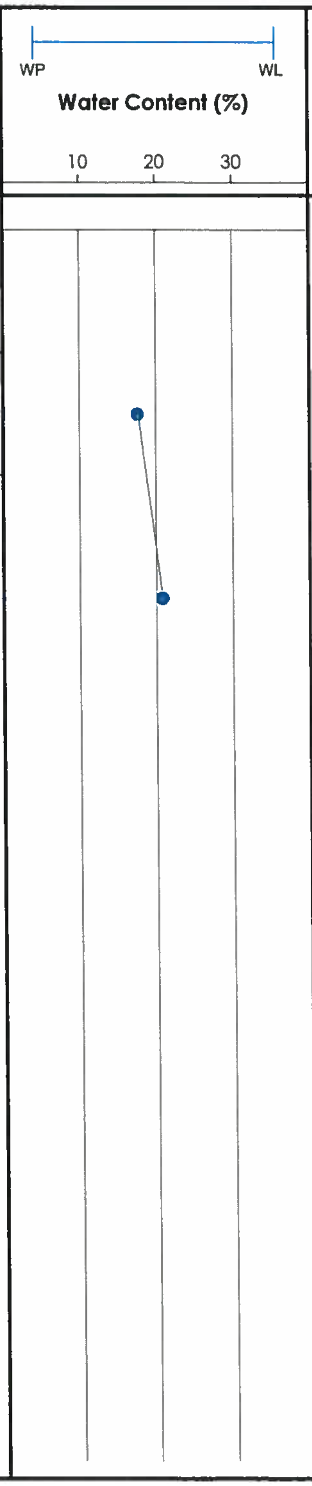
Project: *Proposed Urban Development*

Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685G1*

Excavation Date: *May 13, 2005*

SOIL PROFILE				SAMPLE
Depth (m)	Description	Symbol	Elevation	Number
	Ground Elevation		290.75	
0.00	***TOPSOIL:*** dark brown silt, moist	▨		
	SILT: brown silt, some clay, trace sand, very moist to wet	▥	290.00	1
	trace clay	▥		
1.00		▥		
	Test Pit terminated at 1.50 m			
			289.00	
2.00				
			288.00	
3.00				
			287.00	
4.00				
			286.00	
5.00				



Groundwater Observations and Measurements (m)

Upon completion of excavation, test pit sidewalls stable.

No free groundwater encountered.

Reviewed by: *CF*

Field Tech: *RM*

Notes:

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

Naylor
Engineering
Associates Ltd.
CONSULTING ENGINEERS

Test Pit Number: 15

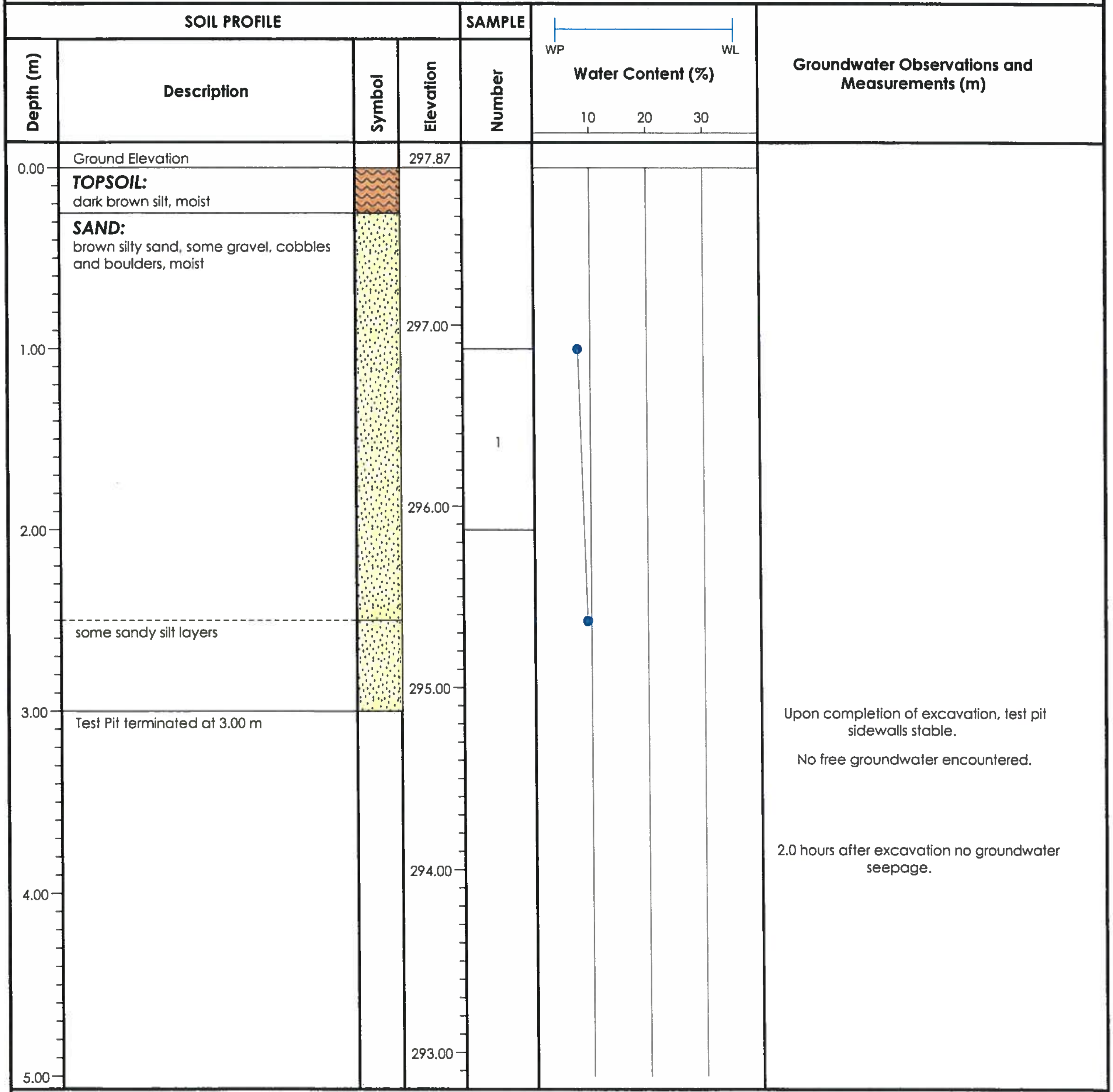
Ground Elevation: *297.87 m*

Project: *Proposed Urban Development*

Location: *65 and 105 Ripplewood Drive, Cambridge, Ontario*

Job No.: *5685G1*

Excavation Date: *May 13, 2005*



Ground Elevation

TOPSOIL:
dark brown silt, moist

SAND:
brown silty sand, some gravel, cobbles and boulders, moist

some sandy silt layers

Test Pit terminated at 3.00 m

Upon completion of excavation, test pit sidewalls stable.

No free groundwater encountered.

2.0 hours after excavation no groundwater seepage.

Reviewed by: *CF*

Field Tech: *RM*

Sheet: *1 of 1*

Notes:

Drafted by: *DC (00Q)*

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Test Pit Number: 16

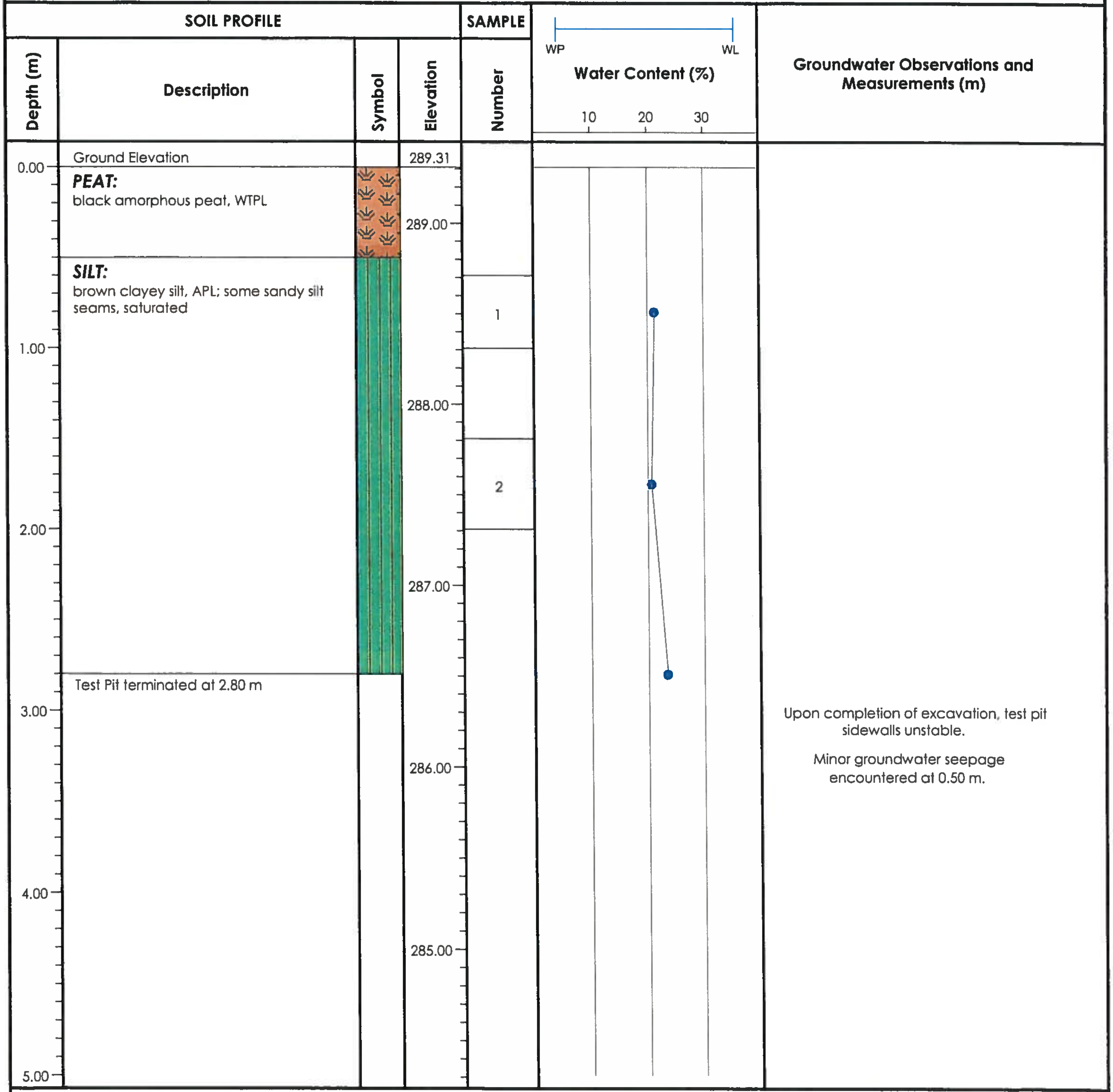
Ground Elevation: *289.31 m*

Project: *Proposed Urban Development*

Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685G1*

Excavation Date: *May 13, 2005*



Ground Elevation

PEAT:
black amorphous peat, WTPL

SILT:
brown clayey silt, APL; some sandy silt seams, saturated

Test Pit terminated at 2.80 m

Upon completion of excavation, test pit sidewalls unstable.

Minor groundwater seepage encountered at 0.50 m.

Reviewed by: *CF*

Field Tech: *RM*

Notes:

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

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Test Pit Number: 17

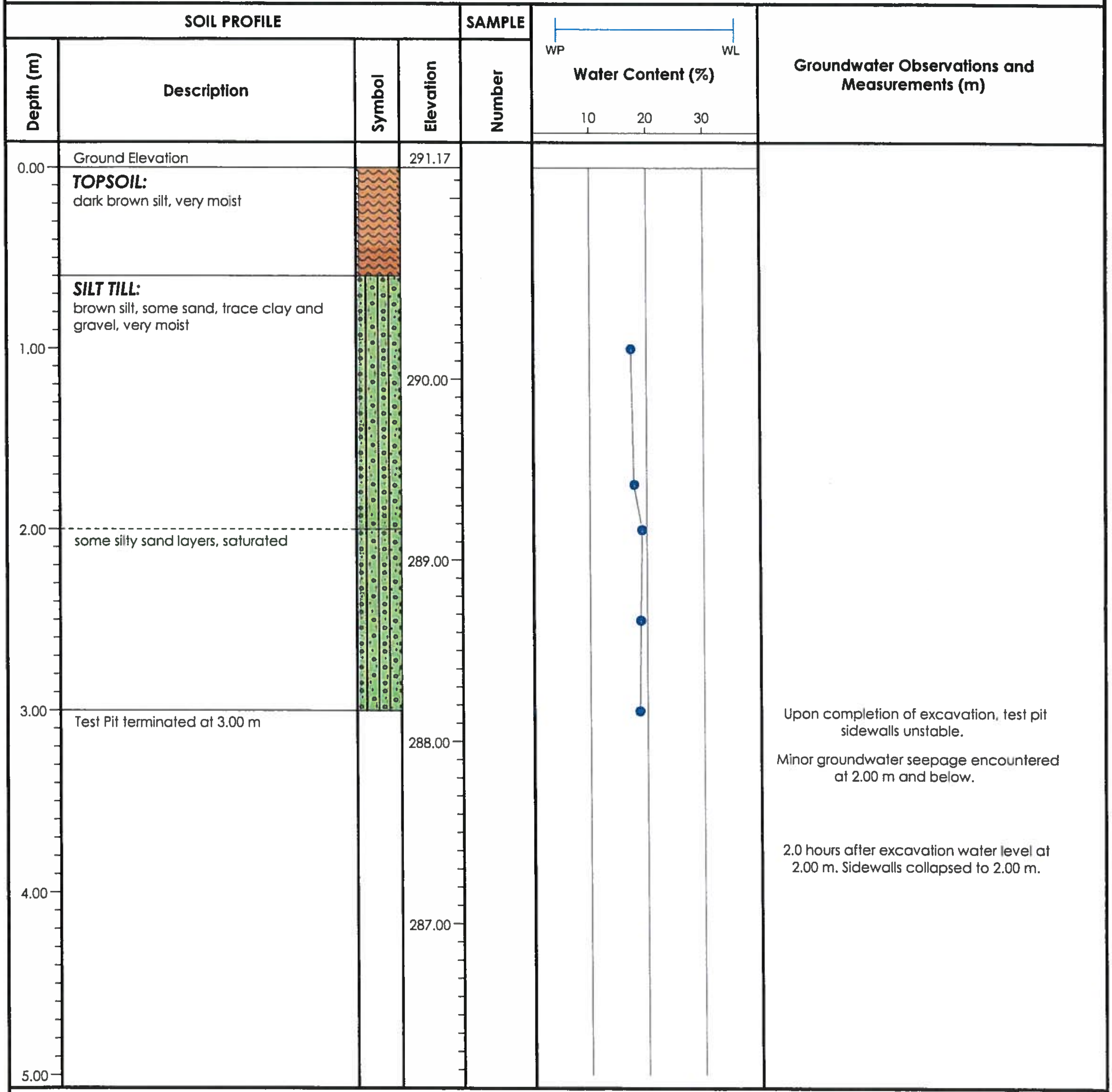
Ground Elevation: *291.17 m*

Project: *Proposed Urban Development*

Job No.: *5685G1*

Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Excavation Date: *May 13, 2005*



Ground Elevation

TOPSOIL:
dark brown silt, very moist

SILT TILL:
brown silt, some sand, trace clay and gravel, very moist

some silty sand layers, saturated

Test Pit terminated at 3.00 m

Upon completion of excavation, test pit sidewalls unstable.

Minor groundwater seepage encountered at 2.00 m and below.

2.0 hours after excavation water level at 2.00 m. Sidewalls collapsed to 2.00 m.

Reviewed by: *CF*

Field Tech: *RM*

Notes: *Bulk sample taken from 1.50 to 2.00 m.*

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

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Test Pit Number: 18

Ground Elevation: *N/A*

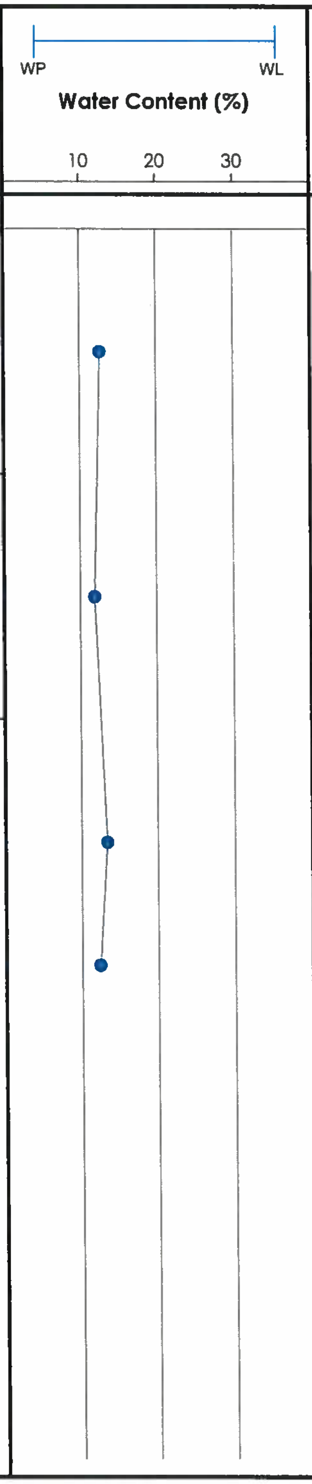
Project: *Proposed Urban Development*

Job No.: *5685G1*

Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Excavation Date: *May 13, 2005*

SOIL PROFILE				SAMPLE		
Depth (m)	**Description**	**Symbol**	**Elevation**	**Number**	**Water Content (%)**	**Groundwater Observations and Measurements (m)**
	Ground Elevation		0.00			
0.00	***TOPSOIL:*** dark brown silt, moist					
	SILT TILL: brown sandy silt, some gravel, moist					
1.00			-1.00			
				1		
2.00			-2.00			
3.00	Test Pit terminated at 3.00 m		-3.00			Upon completion of excavation, test pit sidewalls unstable at 2.00 m and below. No free groundwater encountered.
4.00			-4.00			
5.00			-5.00			



Reviewed by: *CF*

Field Tech: *RM*

Notes:

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

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Test Pit Number: 19

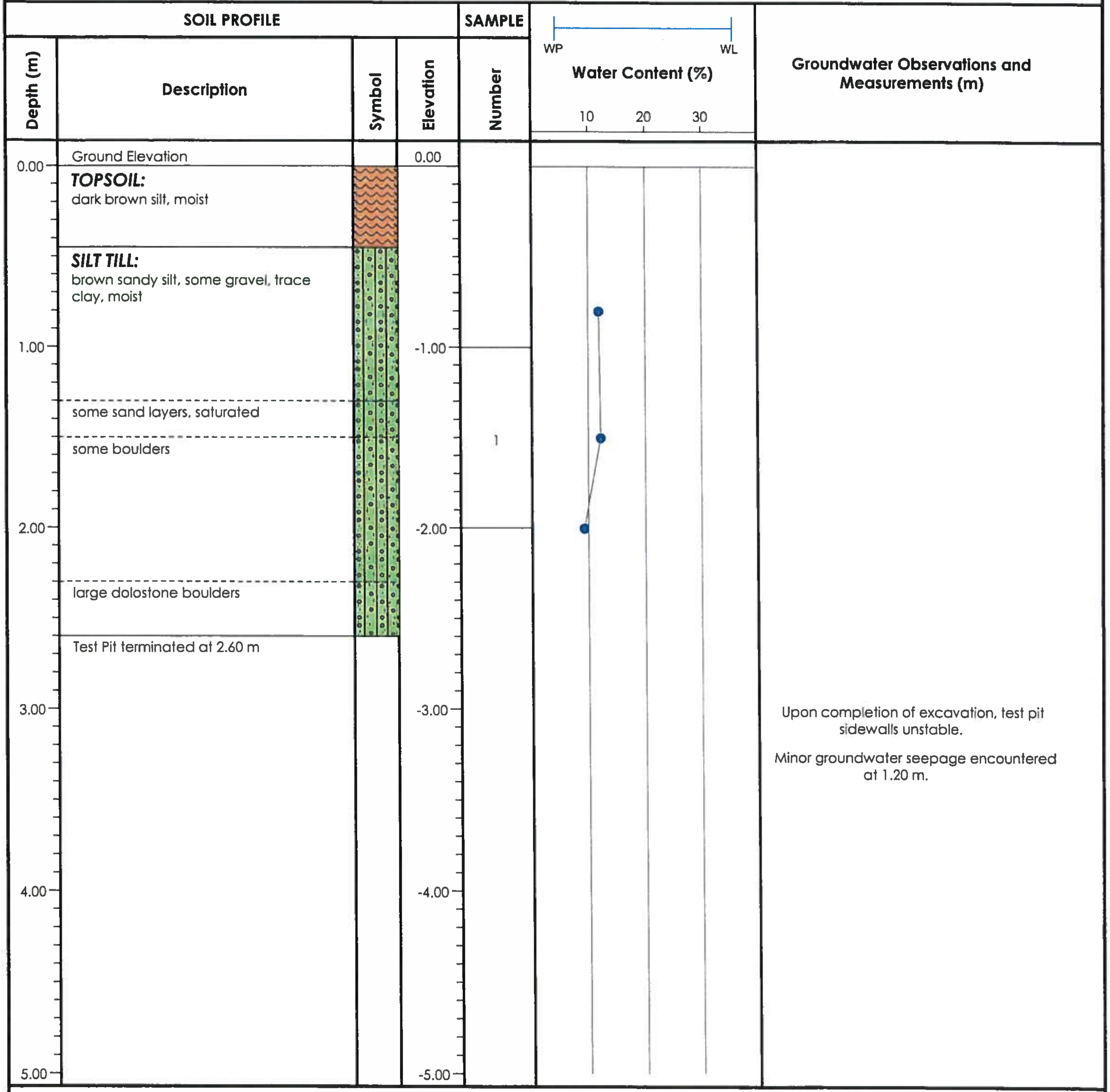
Ground Elevation: *N/A*

Project: *Proposed Urban Development*

Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685G1*

Excavation Date: *May 13, 2005*



Ground Elevation

TOPSOIL:
dark brown silt, moist

SILT TILL:
brown sandy silt, some gravel, trace clay, moist

some sand layers, saturated

some boulders

large dolostone boulders

Test Pit terminated at 2.60 m

Upon completion of excavation, test pit sidewalls unstable.

Minor groundwater seepage encountered at 1.20 m.

Reviewed by: *CF*

Field Tech: *RM*

Notes:

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

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Test Pit Number: 20

Ground Elevation: *292.07 m*

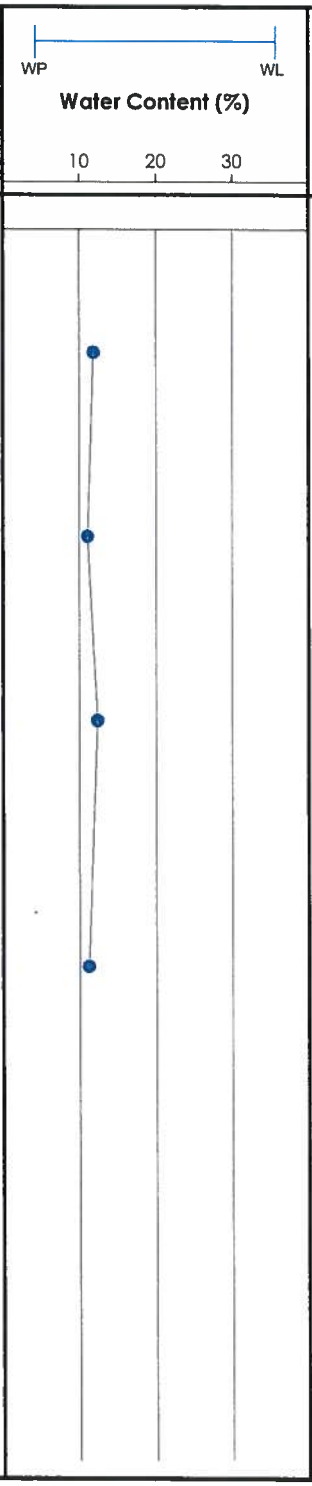
Project: *Proposed Urban Development*

Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685G1*

Excavation Date: *May 13, 2005*

SOIL PROFILE				SAMPLE
Depth (m)	Description	Symbol	Elevation	Number
	Ground Elevation		292.07	
0.00	***TOPSOIL:*** dark brown silt, moist	▨		
	SILT TILL: brown sandy silt, some gravel, moist	▨		
1.00			291.00	
2.00			290.00	
3.00	Test Pit terminated at 3.00 m		289.00	
4.00			288.00	
5.00				



Groundwater Observations and Measurements (m)

Upon completion of excavation, test pit sidewalls unstable.

No free groundwater encountered.

1 hour after completion of excavation water level at 2.50 m. Minor groundwater seepage at 2.30 m.

Reviewed by: *CF*

Field Tech: *RM*

Notes: *Bulk sample taken from 1.00 to 1.50 m.*

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

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Test Pit Number: 21

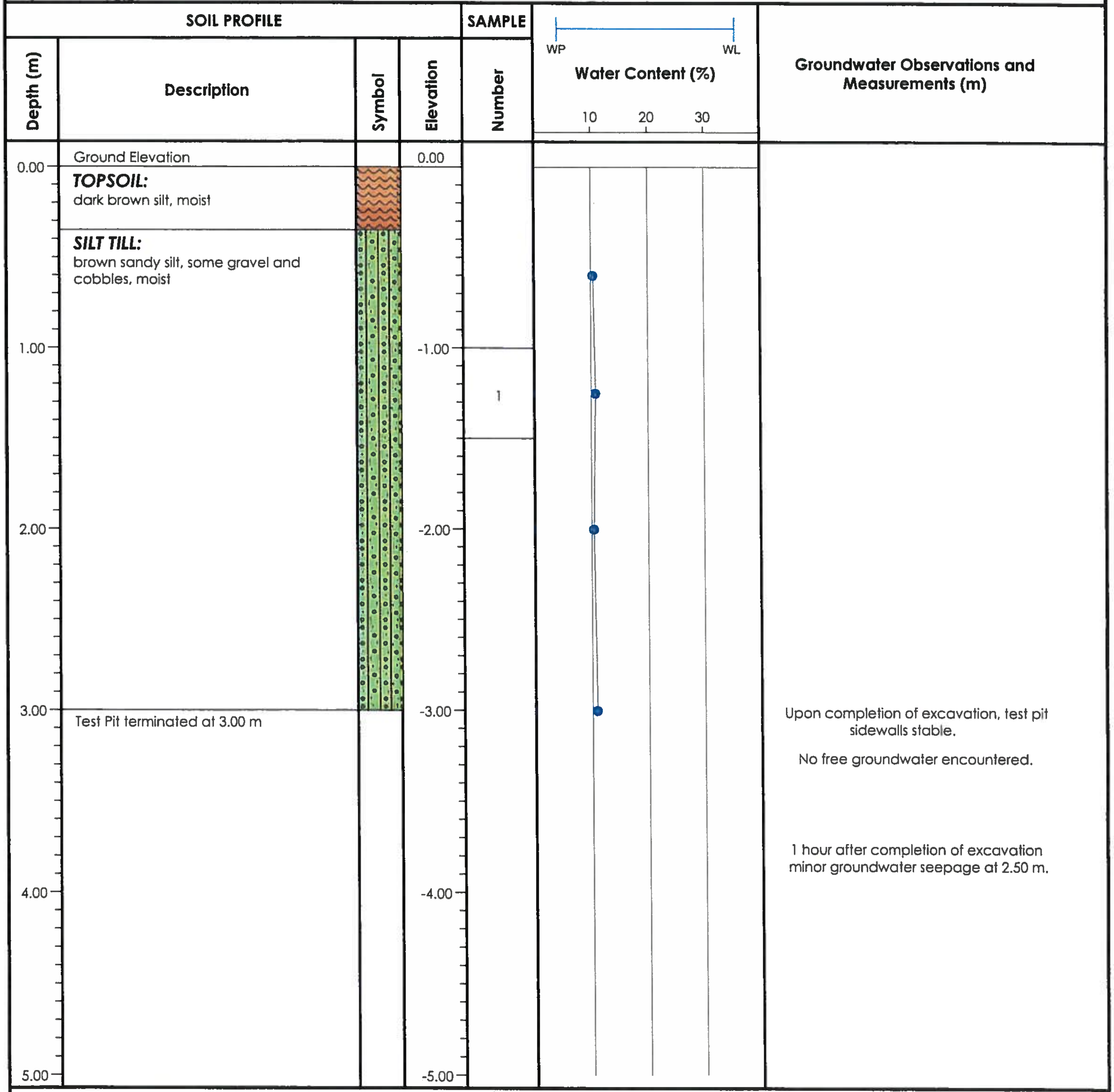
Ground Elevation: *N/A*

Project: *Proposed Urban Development*

Location: *65 and 105 Ripplewood Road, Cambridge, Ontario*

Job No.: *5685G1*

Excavation Date: *May 13, 2005*



Ground Elevation

TOPSOIL:
dark brown silt, moist

SILT TILL:
brown sandy silt, some gravel and cobbles, moist

Test Pit terminated at 3.00 m

Upon completion of excavation, test pit sidewalls stable.

No free groundwater encountered.

1 hour after completion of excavation minor groundwater seepage at 2.50 m.

Reviewed by: *CF*

Field Tech: *RM*

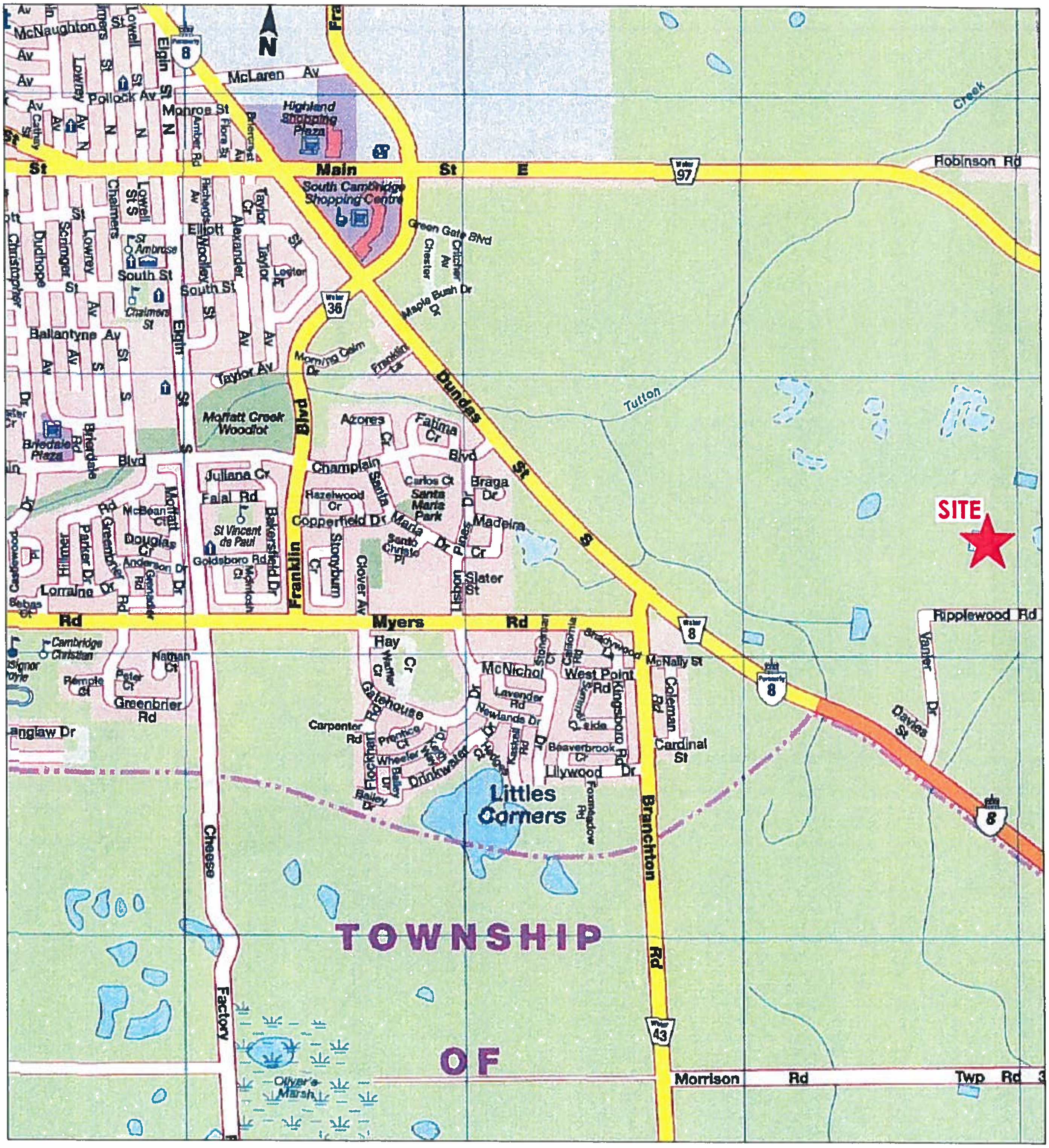
Notes:

Sheet: *1 of 1*

Drafted by: *DC (00Q)*

NORTH

No.	Revisions	Date
0	**Report Issued**	**July 2005**
1		
2		
3		



Drawing Reference: Base drawing provided on page 49 of MapArt's Kitchener-Waterloo Map Book.

Proposed Urban Development

65 and 105 Ripplewood Road

Cambridge, Ontario

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LOCATION PLAN

Date	Scale	Job No.	Drawing No.
July 2005	**1:20000**	**5685G1**	**1**

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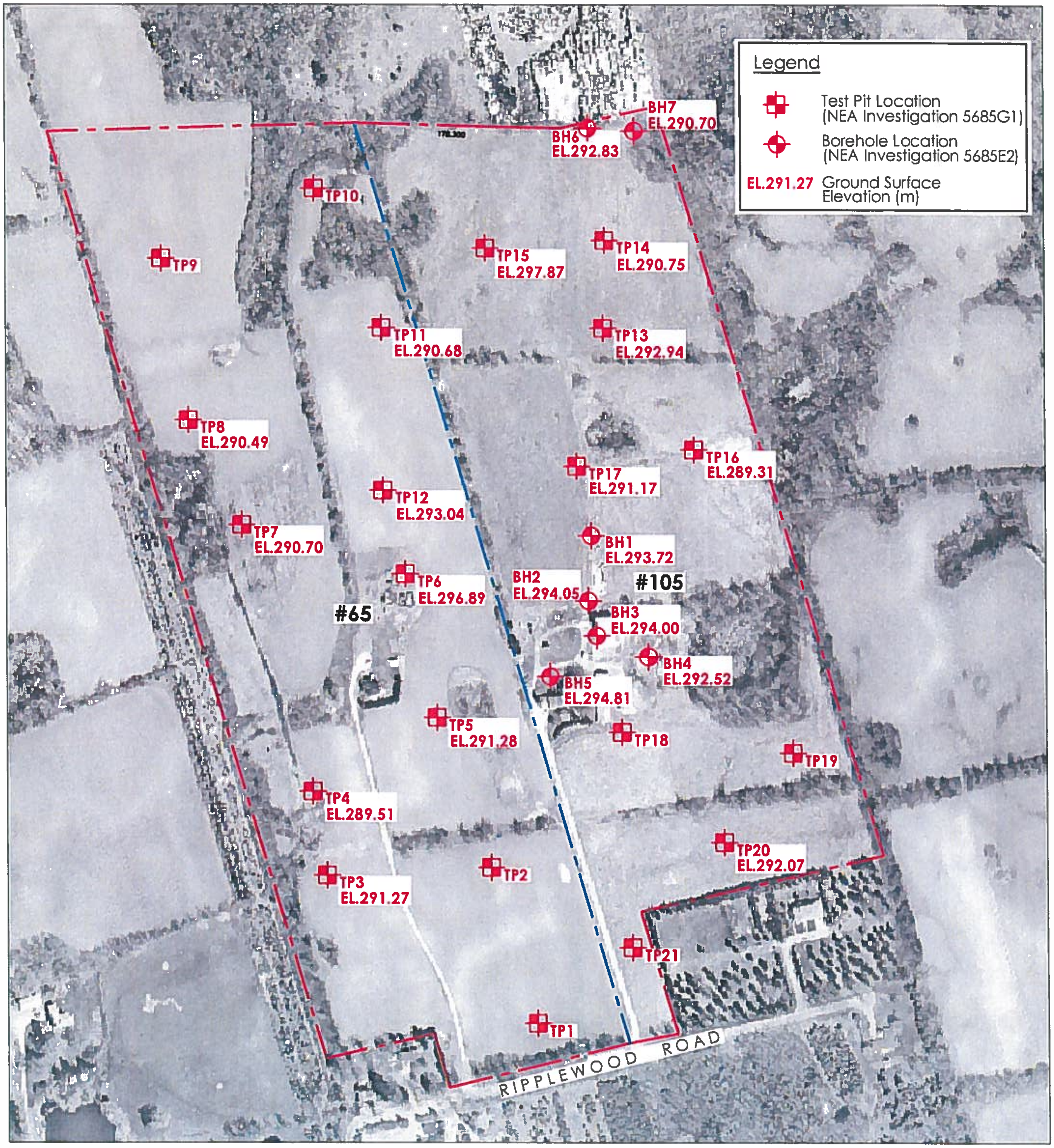
May 18, 2005

Note:
Locations of Test Pits 1, 2, 9, 10, 18, 19 and 21 are approximate based on available information. Exact Test Pit locations must be verified in the field.

NORTH

No.	Revisions	Date
0	**Report Issued**	**July 2005**
1		
2		
3		



Drawing Reference: Base drawing provided Region of Waterloo 2000 Aerial Photograph.

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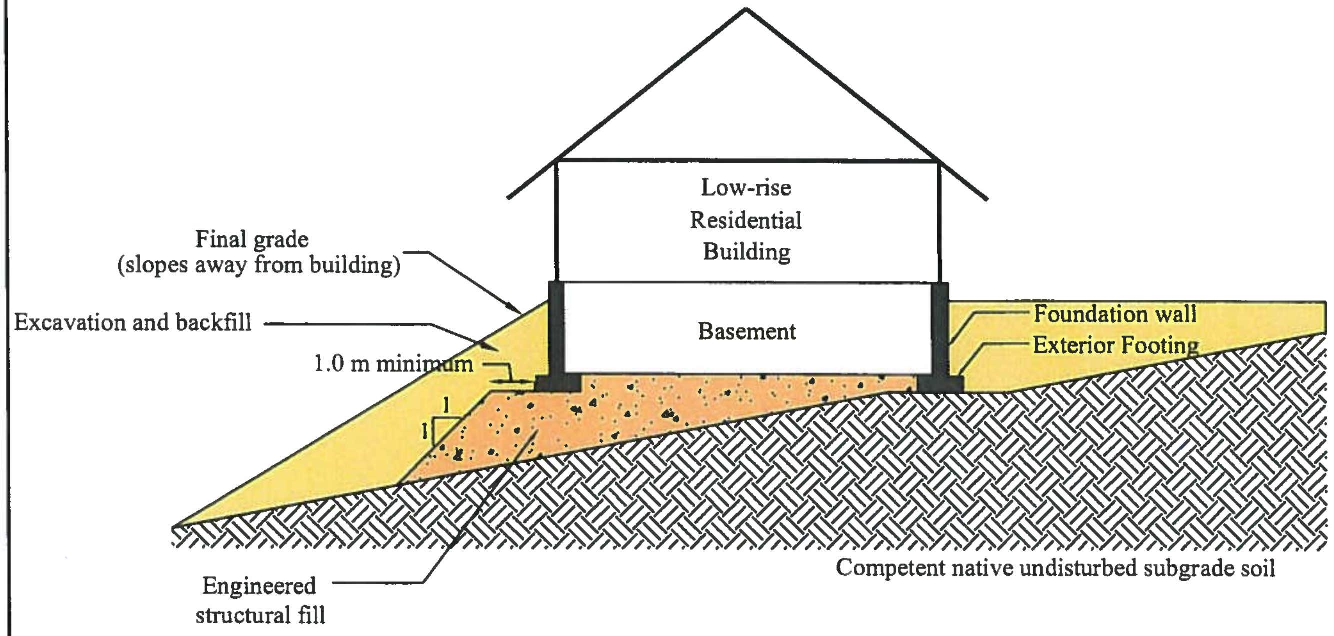
May 18, 2005

Proposed Urban Development **65 and 105 Ripplewood Road** **Cambridge, Ontario**	Naylor Engineering Associates Ltd. CONSULTING ENGINEERS	**SITE PLAN**

Date	Scale	Job No.	Drawing No.
July 2005	**1:5000**	**5685G1**	**2**



GENERAL REQUIREMENTS FOR ENGINEERED STRUCTURAL FILL

1. The area must be excavated of all pre-existing loose fill, topsoil, and/or organic soil until competent native undisturbed soil is reached.

2. The excavation should allow for the structural fill to extend 1.0 m beyond the outside edge of the building footings and down to the approved subgrade soil at a slope of 1 horizontal to 1 vertical (45 °).

3. The subgrade below the engineered fill should be inspected and approved by a geotechnical engineer prior to fill construction. Fill placement and compaction operations to be carried out under full-time geotechnical supervision.

4. The structural fill should comprise sand and gravel aggregate placed in 300 mm thick lifts and compacted to at least 98% Standard Proctor Maximum Dry Density (SPMDD). The exterior backfill should consist of approved inorganic soil also placed in 300 mm thick lifts and compacted to minimum 95% SPMDD.

5. Exterior footings should be provided with minimum 1.2 m of soil cover for frost protection.

6. All excavations must be carried out in conformance with the current Ontario Occupational Health and Safety Act and Regulations 213/91 for construction projects.

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STRUCTURAL FILL PAD DETAIL

Date	Scale	Job No.	Drawing No.
July 2005	NTS	5685G1	3

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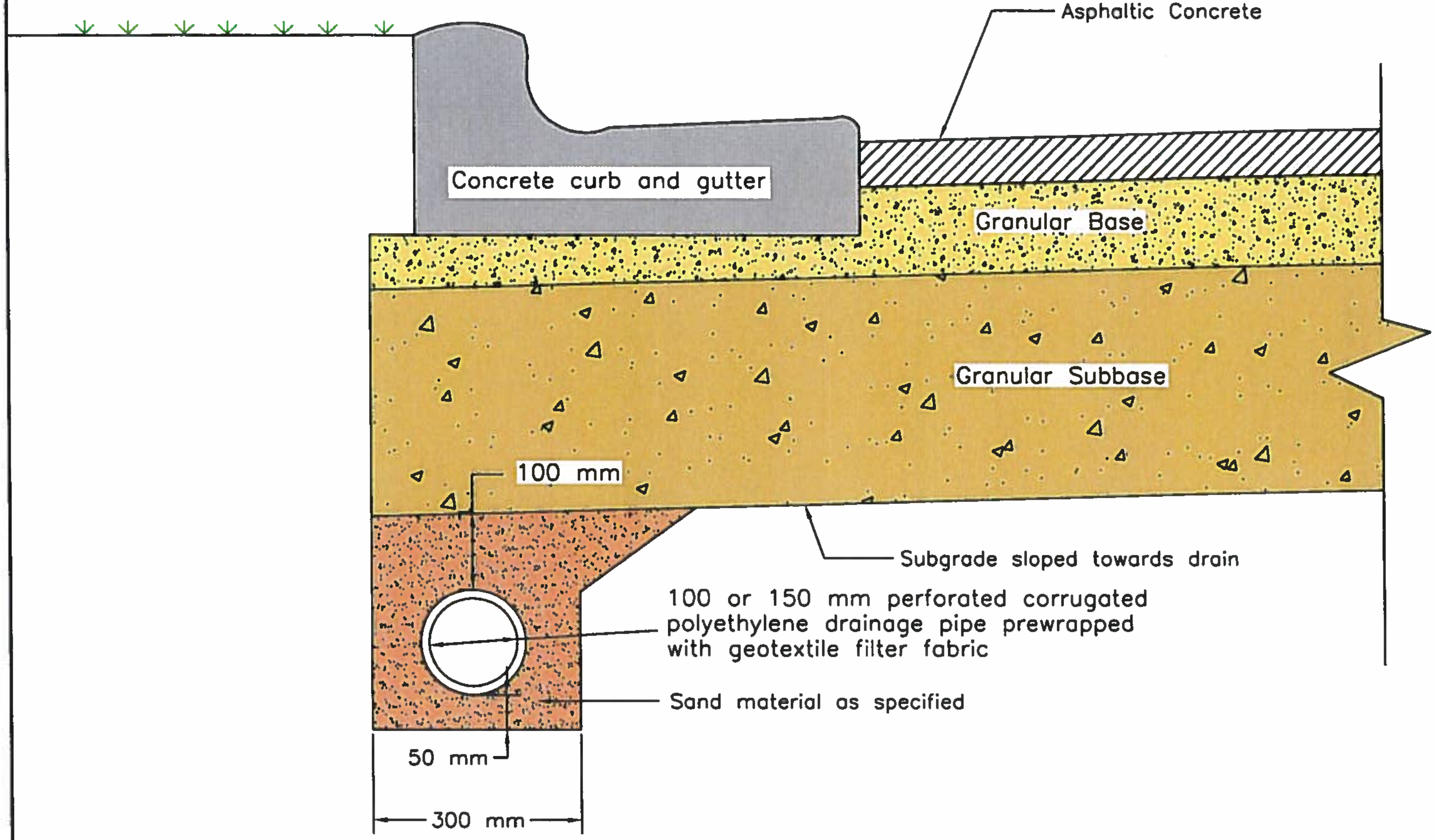
June 30, 2005 (dc)



GENERAL REQUIREMENTS FOR PAVEMENT SUBDRAINS

1. Perforated corrugated polyethylene drainage pipe shall meet the requirements of OPSS 1840.
2. Pipe filter fabric conforming to OPSS 1860 for geotextile Class 1 with a filtration opening size of 150 to 450 microns shall be supplied on all sections of perforated pipe.
3. The open upstream ends of pipes should be capped.
4. Subdrain pipes to be set on at least 1% grade draining to a positive frost-free outlet. If the subdrains are outletted to a ditch then the last 1.5 m of the outlet pipe should consist of a corrugated galvanized steel pipe equipped with a rodent gate.
5. Bedding and backfill material shall be concrete sand meeting the gradation requirements of OPSS 1002 (Fine Aggregate for Concrete).

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TYPICAL PAVEMENT SUBDRAIN DETAIL

Date	Scale	Job No.	Drawing No.
July 2005	NTS	5685G1	4

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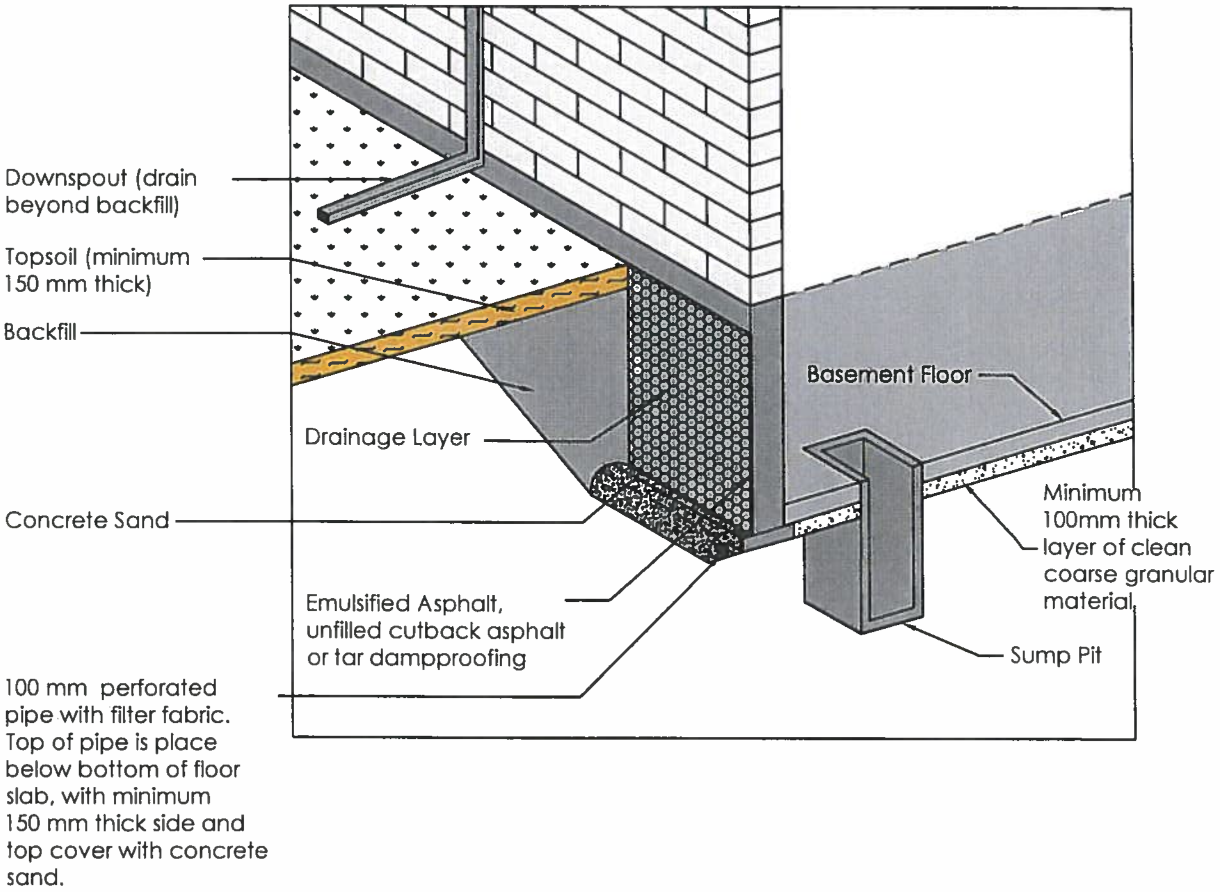
June 30, 2005

BASEMENT DRAINAGE



GENERAL REQUIREMENTS FOR BASEMENT DRAINAGE

1. Perforated corrugated polyethylene drainage pipe shall meet the requirements of OPSS 1840.

2. Pipe filter fabric conforming to OPSS 1860 for geotextile Class 1 with a filtration opening size of 150 to 450 microns shall be supplied on all sections of perforated pipe.

3. Pipe bedding material shall be concrete sand meeting gradation requirements of OPSS 1002 (Fine aggregate for Concrete).

4. Do not use any heavy compaction equipment within 450 mm of the wall.

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(dc)
June 30, 2005

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TYPICAL BASEMENT DRAINAGE DETAIL

Date	Scale	Job No.	Drawing No.
July 2005	**NTS**	**5685G1**	**5**

Appendix A

Site Photographs

Photo 1: Looking north across the site from Test Pit 3.

Photo 2: Looking north across the site from Test Pit 8.

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Photo 3: Looking northwest across the site from Test Pit 8.

Photo 4: Looking south from Test Pit 9.

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