BOREHOLE LOG EXPLANATION FORM

This explanatory section provides the background to assist in the use of the borehole logs. Each of the headings used on the borehole log, is briefly explained.

DEPTH

This column gives the depth of interpreted geologic contacts in metres below ground surface.

STRATIGRAPHIC DESCRIPTION

This column gives a description of the soil based on a tactile examination of the samples and/or laboratory test results. Each stratum is described according to the following classification and terminology.

Soil Classification*		Terminology	Proportion
Clay	<0.002 mm		
Silt	0.002 to 0.06 mm	"trace" (e.g. trace sand)	<10%
Sand	0.06 to 2 mm	"some" (e.g. some sand)	10% - 20%
Gravel	2 to 60 mm	adjective (e.g. sandy)	20% - 35%
Cobbles	60 to 200 mm	"and" (e.g. and sand)	35% - 50%
Boulders	>200 mm	noun (e.g. sand)	>50%

* Extension of MIT Classification system unless otherwise noted.

The use of the geologic term "till" implies that both disseminated coarser grained (sand, gravel, cobbles or boulders) particles and finer grained (silt and clay) particles may occur within the described matrix.

The compactness of cohesionless soils and the consistency of cohesive soils are defined by the following:

COHESIONLESS SOIL		COHESIVE SOIL	
Compactness	Standard Penetration Resistance "N", Blows / 0.3 m	Consistency	Standard Penetration Resistance "N", Blows / 0.3 m
Very Loose	0 to 4	Very Soft	0 to 2
Loose	4 to 10	Soft	2 to 4
Compact	10 to 30	Firm	4 to 8
Dense	30 to 50	Stiff	8 to 15
Very Dense	Over 50	Very Stiff	15 to 30
		Hard	Over 30

The moisture conditions of cohesionless and cohesive soils are defined as follows.

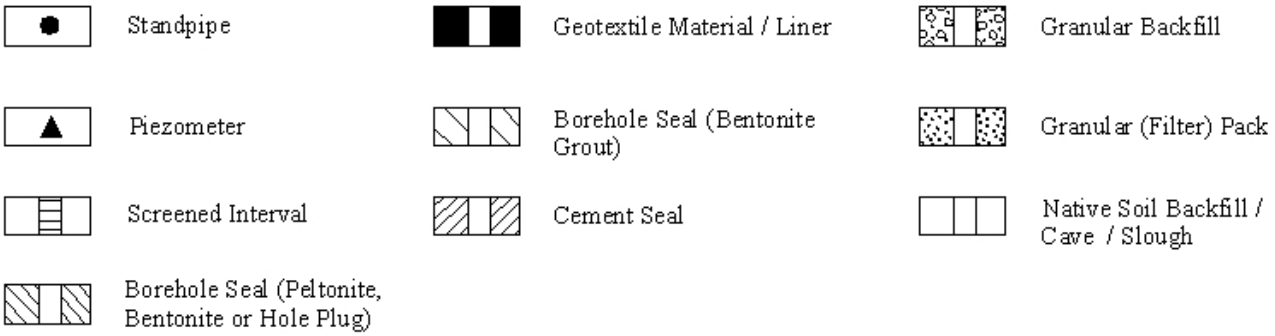
COHESIONLESS SOILS	COHESIVE SOILS		
Dry	DTPL	-	Drier Than Plastic Limit
Moist	APL	-	About Plastic Limit
Wet	WTPL	-	Wetter Than Plastic Limit
Saturated	MWTPL	-	Much Wetter Than Plastic Limit

STRATIGRAPHY

Symbols may be used to pictorially identify the interpreted stratigraphy of the soil and rock strata.

MONITOR DETAILS

This column shows the position and designation of standpipe and/or piezometer ground water monitors installed in the borehole. Also the water level may be shown for the date indicated.



Where monitors are placed in separate boreholes, these are shown individually in the "Monitor Details" column. Otherwise, monitors are in the same borehole. For further data regarding seals, screens, etc., the reader is referred to the summary of monitor details table.

SAMPLE

These columns describe the sample type and number, the "N" value, the water content, the percentage recovery, and Rock Quality Designation (RQD), of each sample obtained from the borehole where applicable. The information is recorded at the approximate depth at which the sample was obtained. The legend for sample type is explained below.

SS	=	Split Spoon	GS	=	Grab Sample
ST	=	Thin Walled Shelby Tube	CS	=	Channel Sample
AS	=	Auger Flight Sample	WS	=	Wash Sample
CC	=	Continuous Core	RC	=	Rock Core

$$\% \text{ Recovery} = \frac{\text{Length of Core Recovered Per Run}}{\text{Total Length of Run}} \times 100$$

Where rock drilling was carried out, the term RQD (Rock Quality Designation) is used. The RQD is an indirect measure of the number of fractures and soundness of the rock mass. It is obtained from the rock cores by summing the length of core recovered, counting only those pieces of sound core that are 100 mm or more in length. The RQD value is expressed as a percentage and is the ratio of the summed core lengths to the total length of core run. The classification based on the RQD value is given below.

RQD Classification	RQD (%)
Very poor quality	< 25
Poor quality	25 - 50
Fair quality	50 - 75
Good quality	75 - 90
Excellent quality	90 - 100

TEST DATA

The central section of the log provides graphs which are used to plot selected field and laboratory test results at the depth at which they were carried out. The plotting scales are shown at the head of the column.

Dynamic Penetration Resistance - The number of blows required to advance a 51 mm diameter, 60º steel cone fitted to the end of 45 mm OD drill rods, 0.3 m into the subsoil. The cone is driven with a 63.5 kg hammer over a fall of 750 mm.

Standard Penetration Resistance - Standard Penetration Test (SPT) "N" Value - The number of blows required to advance a 51 mm diameter standard split-spoon sampler 300 mm into the subsoil, driven by means of a 63.5 kg hammer falling freely a distance of 750 mm. In cases where the split spoon does not penetrate 300 mm, the number of blows over the distance of actual penetration in millimetres is shown as $\frac{xBlows}{mm}$

Water Content - The ratio of the mass of water to the mass of oven-dry solids in the soil expressed as a percentage.

W_P - Plastic Limit of a fine-grained soil expressed as a percentage as determined from the Atterberg Limit Test.

W_L - Liquid Limit of a fine-grained soil expressed as a percentage as determined from the Atterberg Limit Test.

REMARKS

The last column describes pertinent drilling details, field observations and/or provides an indication of other field or laboratory tests that were performed.

BOREHOLE NO. MW1

PROJECT NAME: DURHAM-YORK ENERGY CENTRE
PROJECT NO.: 111-26648-00
CLIENT: REGIONAL MUNICIPALITY OF DURHAM
DATE COMPLETED: Dec 20, 2011
BOREHOLE TYPE: 168 mm HOLLOW STEM AUGER
SUPERVISOR: EWT
GROUND ELEVATION: NOT DETERMINED
REVIEWER: SJT

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 680337
Northing: 4860451

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	CONE PENETRATION "N" VALUE / SHEAR STRENGTH	WATER CONTENT % (W_P – W_L)	REMARKS
0.0											
	TOPSOIL: BROWN TO DARK BROWN, SANDY SILT, LOOSE.										FROZEN TO 38 mm
0.3	SANDY SILT TILL: LIGHT GREY BECOMING BROWNISH GREY AT 4.6 m, SANDY SILT, SOME MEDIUM TO COARSE GRAVEL, TRACE CLAY, TRACE FINE GRAVEL BETWEEN 4.6 m AND 4.9 m, MOIST, VERY DENSE.			SS1	6		29				
1.0				SS2	24		100				
				SS3	51		100		51		
2.0				SS4	84		100		84		
3.0				SS5	105		100		105		
4.0				SS6	99		100		99		
				SS7	97		100		97		
5.0											
5.3	SANDY SILT TILL: GREY, SANDY SILT, TRACE TO SOME CLAY, TRACE FINE TO MEDIUM GRAVEL, MOIST, COMPACT.			SS8	34		96				
6.0				SS9	25		92				
7.0				SS10	43		88		43		
8.0				SS11	21		83				
8.2	BOREHOLE TERMINATED AT 8.2 m IN SANDY SILT TILL.										
9.0											
10.0											

GENIVAR GEOLOGIC B/W (M) WITH UTM 111-26648-00 100.GPJ JAGGER HIMS BASIC.GDT 1/23/13

GENIVAR

BOREHOLE NO. MW2A

PROJECT NAME: DURHAM-YORK ENERGY CENTRE
PROJECT NO.: 111-26648-00
CLIENT: REGIONAL MUNICIPALITY OF DURHAM
DATE COMPLETED: Dec 20, 2011
BOREHOLE TYPE: 168 mm HOLLOW STEM AUGER
SUPERVISOR: EWT
GROUND ELEVATION: NOT DETERMINED
REVIEWER: SJT

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 680628
Northing: 4860550

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	SAMPLE N VALUE	SAMPLE % WATER	SAMPLE % RECOVERY	SAMPLE RQD (%)	CONE PENETRATION "N" VALUE / SHEAR STRENGTH	WATER CONTENT % (W_P – W_L)	REMARKS
0.0											
0.2	TOPSOIL: DARK BROWN, SILT, SOME CLAY, MOIST.										
	CLAYEY SILT: LIGHT GREY, TRACE FINE TO MEDIUM GRAVEL, DTPL TO APL, VERY STIFF.			SS1	6		50				
1.0				SS2	19		100				
2.0				SS3	22		100				
				SS4	17		100				
3.0											
3.0	SILT TILL: LIGHT GREY BECOMING GREY AT 3.8 m, CLAYEY SILT SOME FINE SAND TO SILT, SOME CLAY, SOME FINE SAND, SOME TO TRACE FINE TO MEDIUM GRAVEL, MOIST, COMPACT.			SS5	17		100				
4.0				SS6	18		100				
				SS7	16		100				
5.0				SS8	13		100				
6.0				SS9	9		100				
6.9											
7.0	CLAYEY SILT: GREY, TRACE FINE TO MEDIUM GRAVEL, WTPL, STIFF.			SS10	12		100				
8.0				SS11	78		96		78		
8.4				SS12							REFUSAL OF SPOON AT 8.4 m
	SILT TILL: GREY, SOME FINE SAND, SOME CLAY, SOME MEDIUM TO COARSE GRAVEL, MOIST TO WET, DENSE.										
9.0				SS13	79		100		79		
9.2	BOREHOLE TERMINATED AT 9.2 m IN SILT TILL.										SS12 N VALUE: 29 FOR 150 mm, 50 FOR 50 mm
10.0											

GENIVAR GEOLOGIC B/W (M) WITH UTM 111-26648-00 100.GPJ JAGGER HIMS BASIC.GDT 1/23/13

GENIVAR

BOREHOLE NO. MW2B

PROJECT NAME: DURHAM-YORK ENERGY CENTRE
PROJECT NO.: 111-26648-00
CLIENT: REGIONAL MUNICIPALITY OF DURHAM
DATE COMPLETED: Dec 21, 2011
BOREHOLE TYPE: 168 mm HOLLOW STEM AUGER
SUPERVISOR: EWT
GROUND ELEVATION: NOT DETERMINED
REVIEWER: SJT

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 680631
Northing: 4860550

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	SAMPLE N VALUE	SAMPLE % WATER	SAMPLE % RECOVERY	SAMPLE RQD (%)	CONE PENETRATION "N" VALUE 10 20 30 / SHEAR STRENGTH	WATER CONTENT % 10 20 30 / W_P W_L	REMARKS
0.0											
0.2	TOPSOIL: DARK BROWN, SILT, SOME CLAY, MOIST.										
	CLAYEY SILT: LIGHT GREY, TRACE FINE TO MEDIUM GRAVEL, DTPL TO APL, VERY STIFF.			SS1	6		50				GEOLOGIC DETAILS AND N VALUES ARE FROM BOREHOLE MW2A.
1.0				SS2	19		100				
2.0				SS3	22		100				
3.0				SS4	17		100				
3.0	SILT TILL: LIGHT GREY BECOMING GREY AT 3.8 m, CLAYEY SILT SOME FINE SAND TO SILT, SOME CLAY, SOME FINE SAND, SOME TO TRACE FINE TO MEDIUM GRAVEL, MOIST, COMPACT.			SS5	17		100				
4.0				SS6	18		100				
5.0				SS7	16		100				
6.0				SS8	13		100				
6.1	BOREHOLE TERMINATED AT 6.1 m IN SILT TILL.										
7.0											
8.0											
9.0											
10.0											

GENIVAR GEOLOGIC B/W (M) WITH UTM 111-26648-00 100.GPJ JAGGER HIMS BASIC.GDT 1/23/13

GENIVAR

BOREHOLE NO. MW3A

PROJECT NAME: DURHAM-YORK ENERGY CENTRE
PROJECT NO.: 111-26648-00

CLIENT: REGIONAL MUNICIPALITY OF DURHAM
DATE COMPLETED: Dec 19, 2011

BOREHOLE TYPE: 168 mm HOLLOW STEM AUGER
SUPERVISOR: EWT

GROUND ELEVATION: NOT DETERMINED
REVIEWER: SJT

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 680420
Northing: 4860220

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	SAMPLE N VALUE	SAMPLE % WATER	SAMPLE % RECOVERY	SAMPLE RQD (%)	CONE PENETRATION "N" VALUE / SHEAR STRENGTH	WATER CONTENT % (W_P – W_L)	REMARKS
0.0											
0.2	TOPSOIL: DARK BROWN, SANDY SILT, TRACE CLAY, MOIST, LOOSE.			SS1	6		38				FROZEN TO 90 mm
	SANDY SILT TILL: LIGHT BROWN TO BROWN, FINE SAND AND SILT, SOME CLAY, TO SANDY SILT, SOME CLAY, TRACE TO SOME GRAVEL, MOIST, COMPACT.			SS2	6		75				
1.0											
				SS3	33		92				
2.0											
2.1	SILTY SAND:										
2.3	LIGHT BROWN, TRACE CLAY, SATURATED, COMPACT.										
	SANDY SILT TILL: BROWN BECOMING GREY AT 3.3 m, FINE SAND AND SILT, SOME CLAY, TO SANDY SILT, SOME CLAY, MOIST, LOOSE TO COMPACT.			SS4	43		88		43		
3.0											
3.3	CLAYEY SILT: GREY, SILTY CLAY TO CLAYEY SILT, TRACE TO SOME GRAVEL, WTPL, SOFT TO FIRM.			SS5	12		100				
4.0				SS6	13		100				
5.0				SS7	5		100				
5.3	SANDY SILT TILL: GREY, SILT AND SAND SOME CLAY, TO SANDY SILT, SOME GRAVEL, TRACE TO SOME CLAY, WET, LOOSE TO COMPACT.			SS8	10		96				
6.0				SS9	15		83				
7.0				SS10	8		54				
8.0				SS11	8		83				
				SS12	13		79				
9.0											
				SS13	13		75				
9.8	BOREHOLE TERMINATED AT 9.8 m IN SANDY SILT TILL.										
10.0											

GENIVAR GEOLOGIC B/W (M) WITH UTM 111-26648-00 100.GPJ JAGGER HIMS BASIC.GDT 1/23/13

GENIVAR

BOREHOLE NO. MW3B

PROJECT NAME: DURHAM-YORK ENERGY CENTRE
PROJECT NO.: 111-26648-00

CLIENT: REGIONAL MUNICIPALITY OF DURHAM
DATE COMPLETED: Dec 19, 2011

BOREHOLE TYPE: 168 mm HOLLOW STEM AUGER
SUPERVISOR: EWT

GROUND ELEVATION: NOT DETERMINED
REVIEWER: SJT

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 680421
Northing: 4860220

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	SAMPLE N VALUE	SAMPLE % WATER	SAMPLE % RECOVERY	SAMPLE RQD (%)	CONE PENETRATION "N" VALUE / SHEAR STRENGTH	WATER CONTENT % (W_P – W_L)	REMARKS
0.0											
0.2	TOPSOIL: DARK BROWN, SANDY SILT, TRACE CLAY, MOIST, LOOSE.			SS1	6		38				GEOLOGIC DETAILS AND N VALUES ARE FROM BOREHOLE MW3A.
	SANDY SILT TILL: LIGHT BROWN TO BROWN, FINE SAND AND SILT, SOME CLAY, TO SANDY SILT, SOME CLAY, TRACE TO SOME GRAVEL, MOIST, COMPACT.			SS2	6		75				
1.0											
				SS3	33		92				
2.0											
2.1	SILTY SAND: LIGHT BROWN, TRACE CLAY, SATURATED, COMPACT.										
2.3	SANDY SILT TILL: BROWN BECOMING GREY AT 3.3 m, FINE SAND AND SILT, SOME CLAY, TO SANDY SILT, SOME CLAY, MOIST, LOOSE TO COMPACT.			SS4	43		88		43		
3.0											
3.3	CLAYEY SILT: GREY, SILTY CLAY TO CLAYEY SILT, TRACE TO SOME GRAVEL, WTPL, SOFT TO FIRM.			SS5	12		100				
4.0				SS6	13		100				
5.0				SS7	5		100				
5.3	SANDY SILT TILL: GREY, SILT AND SAND SOME CLAY, TO SANDY SILT, SOME GRAVEL, TRACE TO SOME CLAY, WET, LOOSE TO COMPACT.			SS8	10		96				
6.0											
6.0	BOREHOLE TERMINATED AT 6.0 m IN SANDY SILT TILL.										
7.0											
8.0											
9.0											
10.0											

BOREHOLE NO. MW4

PROJECT NAME: DURHAM-YORK ENERGY CENTRE
PROJECT NO.: 111-26648-00
CLIENT: REGIONAL MUNICIPALITY OF DURHAM
DATE COMPLETED: Dec 21, 2011
BOREHOLE TYPE: 168 mm HOLLOW STEM AUGER
SUPERVISOR: EWT
GROUND ELEVATION: NOT DETERMINED
REVIEWER: SJT

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	SAMPLE N VALUE	SAMPLE % WATER	SAMPLE % RECOVERY	SAMPLE RQD (%)	CONE PENETRATION "N" VALUE 10 20 30 / SHEAR STRENGTH	WATER CONTENT % 10 20 30 / W_P W_L	UTM CO-ORDINATES / REMARKS
0.0											UTM Zone: 17 NAD: 83 Easting: 680661 Northing: 4860179
0.2	TOPSOIL: DARK BROWN, SANDY SILT, MOIST, LOOSE.										
	SILT AND SAND TILL: DARK BROWN, SANDY SILT TO SILT AND SAND, SOME GRAVEL, TRACE CLAY, MOIST, COMPACT.			SS1	26		38				
1.0				SS2	27		85				
1.5	SANDY SILT: DARK GREY TO LIGHT GREY, SOME TO TRACE CLAY, TRACE FINE TO MEDIUM GRAVEL, MOIST, COMPACT.			SS3	19		100				
2.0											
2.3	SANDY SILT TILL: GREY BECOMING DARK GREY AT 4.6 m, SOME GRAVEL, SOME TO TRACE CLAY, MOIST BECOMING MOIST TO WET AT 6.1 m, VERY DENSE.			SS4	69		100		69		
3.0				SS5	67		100		67		SS5 N VALUE: 67 FOR 150 mm
4.0				SS6	70		100		70		SS6 N VALUE: 70 FOR 150 mm
5.0				SS7	95		100		95		SS7 N VALUE: 45 FOR 150 mm, 50 FOR 25 mm
6.0				SS8	89		100		89		SS8 N VALUE: 39 FOR 150 mm, 50 FOR 125 mm
6.4	BOREHOLE TERMINATED AT 6.4 m IN SANDY SILT TILL.			SS9	105		100		105		SS9 N VALUE: 55 FOR 150 mm, 50 FOR 125 mm
7.0											
8.0											
9.0											
10.0											