GEOCRES No: 31G5-207

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REPORT ON

FOUNDATION INVESTIGATION REPORT
ISLAND PARK DRIVE STRUCTURE REPLACEMENT
HIGHWAY 417
CONSTRUCTION STAGING AREA
W.P. 236-00-00

Submitted to:

McCormick Rankin Corporation
300-1145 Hunt Club Road
Ottawa, Ontario
K1V 0Y3

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December 2006

05-1120-210-2700-1

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by McCormick Rankin Corporation (MRC) on behalf of the Ministry of Transportation, Ontario (MTO) to carry out foundation investigations associated with the Island Park bridge in the City of Ottawa. The section of Highway 417 included in this assignment (W.P. 236-00-00) extends from approximately Merivale Road to approximately 200 m east of Island Park Drive.

Foundation investigation services are required for the following components under W.P. 236-00-00:

- Construction staging area for Island Park Drive (west of Merivale Road, north of Highway 417).

This report addresses the above staging area.

3.0 INVESTIGATION PROCEDURES

The field work for this subsurface investigation was carried out between October 10 and 13, 2006. During this period, three boreholes (Boreholes 06-201 to 06-203, inclusive) were put down at the locations shown on Drawing 1. The boreholes were advanced using a track mounted drill rig supplied and operated by Marathon Drilling Company Ltd. of Ottawa, Ontario. The boreholes were advanced to auger refusal at depths which vary from 9.9 m to 10.6 m below present ground surface. Borehole 06-202 was then cored an additional 3.1 m into the bedrock after practical refusal to augering had been reached.

The boreholes were drilled at the approximate locations of the proposed construction pads. Samples of the overburden were obtained at 0.6 m to 1.2 m intervals of depth using 50 mm outside diameter split-spoon samplers in accordance with the Standard Penetration Test (SPT) procedure. A piezometer was installed in Borehole 06-203 to monitor the groundwater level at the site.

The field work was supervised on a full-time basis by members of Golder's staff who located the boreholes in the field, directed the drilling, sampling, and in situ testing operations, and logged the boreholes. The soil and bedrock samples were identified in the field, placed in labelled containers and transported to Golder Associates' laboratory in Ottawa for further examination, and to Golder Associates' laboratory in Mississauga for testing. Index and classification tests consisting of water content determinations, Atterberg Limits testing and grain size distribution analyses were carried out on selected soil samples. Laboratory oedometer consolidation testing was carried out on one sample of the silty clay deposit.

The borehole locations were selected by McCormick Rankin Corporation (MRC) and located in the field by Golder staff relative to existing site features. The borehole elevations were determined by MRC from a digital terrain model, based on the locations provided by Golder. The borehole locations, including MTM NAD83 northing and easting coordinates and ground surface elevations referenced to geodetic datum, are summarized in the following table and are shown on Drawing 1.

Borehole Number	Borehole Location	MTM NAD83 Northing (m)	MTM NAD83 Easting (m)	Ground Surface Elevation (m)
06-201	Merivale Staging Area	5027905.2	364642.1	74.2
06-202	Merivale Staging Area	5027926.7	364620.8	74.5
06-203	Merivale Staging Area	5027961.7	364624.1	73.3

4.2.1 Topsoil

Topsoil ranging from about 0.2 m to 0.3 m in thickness was encountered at all of the boreholes.

4.2.2 Silty Sand

A very thin layer of silty sand, with traces of gravel at Borehole 06-202, ranging in thickness from about 0.1 m to 0.2 m, underlies the topsoil at all of the boreholes.

4.2.3 Clay to Silty Clay

The topsoil and silty sand are underlain by a deposit of silty clay to clay that is between 8.2 m and 9.1 m thick.

Weathered Clay Crust

The upper 2.6 m to 2.8 m of the silty clay to clay deposit has been weathered to a grey-brown crust. The measured SPT "N" values in this portion of the deposit ranged from 2 to 13 blows per 0.3 m of penetration. These test results indicate that the weathered crust has a stiff to very stiff consistency. The results of grain size distribution testing carried out on one selected sample of this material are provided on Figure 1.

The results of Atterberg limit testing on one selected sample of the weathered crust indicate a plasticity index of 47 percent and a liquid limit of 73 per cent. These results, summarized on the plasticity chart on Figure 2, confirm that this material is a clay of high plasticity. The measured natural water content of one sample of the weathered crust was 53 per cent.

Unweathered Silty Clay to Clay

The silty clay to clay below the depth of weathering is grey in colour. The results of grain size distribution testing carried out on one selected sample of this material are provided on Figure 3.

In the un-weathered silty clay, standard penetration test N values ranged from 'weight of hammer' to 'manual pressure' per 0.3 metres of penetration. The results of in situ vane testing in this material gave undrained shear strengths ranging from 34 to 65 kilopascals indicating a firm to stiff consistency. In situ vane testing carried out on remoulded silty clay gave undrained shear strengths ranging from 3 to 10 kilopascals, with corresponding sensitivities ranging from 5 to 11. A summary of the results of the in situ vane testing is provided on Figure 4.

surface. However, one measured SPT "N" value of greater than 100 blows per 0.3 m of penetration indicates the deposit to have a very dense relative density, though that result may reflect the cobble and boulder content, rather than the actual state of packing of the soil matrix. Grain size distribution test results obtained from one sample of the glacial till at Borehole 06-201 are shown on Figure 7. Since these results were obtained for a sample retrieved using a 50 mm diameter sampler, they do not reflect the cobble and boulder content of the deposit.

4.2.6 Limestone Bedrock

Limestone bedrock underlies the till deposit at Borehole 06-202. The surface of the bedrock was encountered at Elevation 64.1 m (10.4 m depth).

The limestone bedrock at the site is a member of the Gull River Formation; it is medium-strong and thinly- to medium-bedded. Rock Quality Designation (RQD) values measured on recovered bedrock core samples ranged from 20 to 85 per cent, increasing with depth. The discontinuities observed in the rock core are typically horizontal to sub-horizontal, associated with the bedding planes, although some vertical fracturing was noted in the upper bedrock. A description of some of the terms used in the description of the bedrock samples from this site is provided on the *Lithological and Geotechnical Rock Description Terminology* sheet which precedes the Record of Borehole sheets included with this report.

4.3 Groundwater Conditions

A piezometer was installed in Borehole 06-203 within the overburden, and the water level measured in that piezometer on October 20, 2006, ten days after installation, is given in the following table:

Borehole No.	Depth (m)	Elevation (m)
06-203	0.1	73.2

During the short time between completion of overburden drilling and the start of coring operations in Borehole 06-202 the water level was measured at 3.6 m depth below ground surface.

LIST OF ABBREVIATIONS

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

I. SAMPLE TYPE

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO	Drive open
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

II. PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:
The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) drive open Sampler for a distance of 300 mm (12 in.)

Dynamic Penetration Resistance; N_d:
The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) to drive Uncased a 50 mm (2 in.) diameter, 60^0 cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH:	Sampler advanced by hydraulic pressure
PM:	Sampler advanced by manual pressure
WH:	Sampler advanced by static weight of hammer
WR:	Sampler advanced by weight of sampler and rod

Peizo-Cone Penetration Test (CPT):
An electronic cone penetrometer with a 60^0 conical tip and a projected end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded Electronically at 25 mm penetration intervals.

III. SOIL DESCRIPTION

(a) Cohesionless Soils

Density Index (Relative Density)	N Blows/300 mm Or Blows/ft.
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

(b) Cohesive Soils

Consistency	C_u, S_u Kpa	C_u, S_u Psf
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1,000
Stiff	50 to 100	1,000 to 2,000
Very stiff	100 to 200	2,000 to 4,000
Hard	Over 200	Over 4,000

IV. SOIL TESTS

w	water content
w_p	plastic limited
w_l	liquid limit
C	consolidaiton (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, G_s)
DS	direct shear test
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	modified Proctor compaction test
SPC	standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V	field vane test (LV-laboratory vane test)
γ	unit weight

Note:
1. Tests which are anisotropically consolidated prior shear are shown as CAD, CAU.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	= 3.1416
ln x, natural logarithm of x	
$\log_{10}$ x or log x, logarithm of x to base 10	
g	Acceleration due to gravity
t	time
F	factor of safety
V	volume
W	weight

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma'$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
ν	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma''-u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1\sigma_2\sigma_3$	principal stresses (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1+\sigma_2+\sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight*)
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma'=\gamma-\gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s/\rho_w$) formerly (G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is p. Unit weight symbol is γ where $\gamma=\rho g$(i.e. mass density x acceleration due to gravity)

(a) Index Properties (cont'd.)

w	water content
w_l	liquid limit
w_p	plastic limit
I_p	plasticity Index=(w_l-w_p)
w_s	shrinkage limit
I_L	liquidity index=$(w-w_p)/I_p$
I_c	consistency index=$(w_l-w)/I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index-$(e_{max}-e)/(e_{max}-e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (overconsolidated range)
C_s	swelling index
C_a	coefficient of secondary consolidation
m_v	coefficient of volume change
c_v	coefficient of consolidation
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation pressure
OCR	Overconsolidation ratio=σ'_p/σ'_{vo}

(d) Shear Strength

$\tau_p\tau_r$	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction=tan δ
c'	effective cohesion
$c_u s_u$	undrained shear strength (ϕ=0 analysis)
p	mean total stress $(\sigma_1+\sigma_3)/2$
p'	mean effective stress $(\sigma'_1+\sigma'_3)/2$
q	$(\sigma_1-\sigma_3)/2$ or $(\sigma'_1-\sigma_3)/2$
q_u	compressive strength $(\sigma_1-\sigma_3)$
S_t	sensitivity

Notes: 1. $\tau=c'\sigma'\tan\phi'$

2. Shear strength=(Compressive strength)/2

LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERING STATE

Fresh: no visible sign of weathering

Faintly Weathered: weathering limited to the surface of major discontinuities.

Slightly weathered: penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material.

Moderately weathered: weathering extends throughout the rock mass but the rock material is not friable

Highly weathered: weathering extends throughout rock mass and the rock material is partly friable.

Completely weathered: rock is wholly decomposed and in a friable condition but the rock texture and structure are preserved.

BEDDING THICKNESS

Description	Bedding Plane Spacing
Very thickly bedded	>2 m
Thickly bedded	0.6 m to 2m
Medium bedded	0.2 m to 0.6 m
Thinly bedded	60 mm to 0.2 m
Very thinly bedded	20 mm to 60 mm
Laminated	6 mm to 20 mm
Thinly laminated	<6 mm

JOINT OR FOLIATION SPACING

Description	Spacing
Very wide	>3 m
Wide	1 – 3 m
Moderately close	0.3 – 1 m
Close	50 – 300 mm
Very close	<50 mm

GRAIN SIZE

Term	Size*
Very Coarse Grained	>60 mm
Coarse Grained	2 – 60 mm
Medium Grained	60 microns - 2mm
Fine Grained	2 – 60 microns
Very Fine Grained	<2 microns

Note: *Grains >60 microns diameter are visible to the naked eye.

O:\ Templates\Rock Description Terminology

CORE CONDITION

Total Core Recovery

The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run.

Solid Core Recovery (SCR)

The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.

Rock Quality Designation (RQD)

The percentage of solid drill core, greater than 100 mm length, recovered at full diameter, measured relative to the length of the total core run. RQD varies from 0% for completely broken core 100% for core in solid sticks.

DISCONTINUITY DATA

Fracture Index

A count of the number of discontinuities (physical separations) in the rock core, including both naturally occurring fractures and mechanically induced breaks caused by drilling.

Dip with Respect to (W.R.T.) Core Axis

The angle of the discontinuity relative to the axis (length) of the core. In a vertical borehole a discontinuity with a 90^0 angle is horizontal.

Description and Notes

An abbreviated description of the discontinuities, whether naturally occurring separations such as fractures, bedding planes and foliation planes or mechanically induced features caused by drilling such as ground or shattered core and mechanically separated bedding or foliation surfaces. Additional information concerning the nature information concerning the nature of fracture surfaces and infillings are also noted.

Abbreviations

B –	Bedding	Ca-	Calcite
FO-	Foliation/Schistosity	P-	Polished
CL -	Cleavage	S-	Slickensided
SH -	Shear Plane/Zone	SM-	Smooth
VN-	Vein	R-	Ridged/Rough
F -	Fault	ST-	Stepped
CO-	Contact	PL-	Planar
J -	Joint	FL-	Flexured
FR-	Fracture	UE-	Uneven
MF -	Mechanical	W-	Wavy
A-	Angular	C-	Curved
BP-	Bedding Plane	H-	Hackly
BL-	Blast Induced	SL-	Sludge Coated
ll	Parallel To	TCA-	To Core Axis
	Perpendicular To	STR-	Stress Induced

RECORD OF BOREHOLE No 06-201

1 OF 1 **METRIC**

PROJECT 05-1120-210-2700 | W.P. 4058-01-00 | DIST ____ HWY 417 | DATUM Geodetic

LOCATION N 5027905.2; E 364642.1 | BOREHOLE TYPE Power Auger 108mm I.D. Hollow Stem Auger | DATE Ocober 10, 2006

ORIGINATED BY D.J.S. | COMPILED BY J.M. | CHECKED BY M.I.C.

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (25 50 75)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
74.2	GROUND SURFACE										
0.0 / 73.9	TOPSOIL										
0.5	Silty SAND, Brown; Silty CLAY (Weathered Crust), Very stiff to stiff, Grey brown, Moist to wet		1	SS	9		74				
			2	SS	6		73				
71.1			3	SS	3		72				
3.1	Silty CLAY, Firm to stiff, Grey, Wet						71				
			4	SS	PM		70				
			5	SS	PM		69				
			6	SS	WH		68				
65.5							67				
8.7 / 64.9	Clayey SILT, trace gravel, Very loose, Grey, Wet						66				
9.3	Silty SAND, some gravel and clay (TILL), Very loose to very dense, Grey, Wet		7	SS	2		65				14 48 30 8
			8	SS	>100		64				
63.6 / 10.6	End of Borehole, Auger Refusal										

+3, ×3: Numbers refer to Sensitivity ○3% STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No 06-202 1 OF 1 METRIC

PROJECT 05-1120-210-2700 W.P. 4058-01-00 DIST HWY 417 DATUM Geodetic

LOCATION N 5027926.7; E 364620.8 BOREHOLE TYPE Power Auger 108mm I.D. Hollow Stem Auger DATE October 12, 2006

ORIGINATED BY D.J.S. COMPILED BY J.M. CHECKED BY M.I.C.

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 25 50 75	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
74.5	GROUND SURFACE						74				
0.0	TOPSOIL										
0.3	Silty SAND, trace gravel Brown										
	Silty CLAY (Weathered Crust) Very stiff to stiff Grey brown Moist to wet		1	SS	10		73				
			2	SS	7						
			3	SS	2		72				
71.4											
3.1	Silty CLAY, occasional sand seam with shells Firm to stiff Grey Wet					▽	71				
			4	SS	PM		70				0 0 36 64
			5	SS	WH		69				
			6	SS	WH		68				
65.2							67				
64.8	Clayey SILT, trace sand and gravel Very loose		7	SS	WH						
9.7	Grey Wet		8	SS	>50		66				
64.1	Sandy SILT, some gravel and clay with cobbles (TILL)		9	NQ RC	DD						
10.4	Loose to very dense Grey Wet						65				
	Limestone (BEDROCK) Slightly fractured and weathered Grey		10	NQ RC	DD		64				
63.3											
11.2	Limestone (BEDROCK) Fresh Grey Medium strong Bedrock cored between 10.4m 13.5m depth. For bedrock coring details refer to Record of Drillhole 06-202.		11	NQ RC	DD		63				
61.0							62				
13.5	End of Borehole Note: Water level in open borehole at 3.60m depth below ground surface upon completion of drilling.										

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

MISS_MTO 05-1120-210-2700.GPJ ON_MOT.GDT 10/26/06

PROJECT: 05-1120-210-2700

RECORD OF DRILLHOLE: 06-202

SHEET 1 OF 1

LOCATION: N 364620.8; E 5027926.7

DRILLING DATE: October 10, 2006

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME 55

DRILLING CONTRACTOR: Marathon Drilling

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	COLOUR & % RETURN	FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		ROCK SURFACE		64.10													
11	Rotary Drill NQ Core	Limestone (BEDROCK) Slightly fractured and weathered Grey		10.40													
				63.28	1												
12		Limestone (BEDROCK) Fresh Grey Medium strong		11.22													
13					2												
				61.00													
		End of Borehole		13.50													
14																	
15																	
16																	
17																	
18																	
19																	
20																	
21																	
22																	
23																	
24																	
25																	

MIS-RCK 001 05-1120-210-2700-ROCK.GPJ GLDR_CAN.GDT 10/24/06 J.M.

DEPTH SCALE
1 : 75

Golder Associates

LOGGED: D.J.S.
CHECKED: W.C.

Golder Associates

RECORD OF BOREHOLE No 06-203 1 OF 1 METRIC

PROJECT 05-1120-210-2700 | W.P. 4058-01-00 | DIST | HWY 417 | DATUM Geodetic

LOCATION N 5027961.7; E 364624.1 | BOREHOLE TYPE Power Auger 108mm I.D. Hollow Stem Auger | DATE October 10, 2006

ORIGINATED BY D.J.S. | COMPILED BY J.M. | CHECKED BY M.I.C.

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100): ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × REMOULDED	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (25 50 75)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
73.3	GROUND SURFACE										
0.0	TOPSOIL										
0.4	Silty SAND, Brown										
	Silty CLAY (Weathered Crust), Very stiff to stiff, Grey brown, Moist to wet		1	SS	13		73				
			2	SS	9		72				0 0 28 72
			3	SS	3		71				
70.2											
3.1	Silty CLAY with thin sand seams, Firm to stiff, Grey, Wet		4	TP	PH		70				
							69				
							68				
			5	SS	WH		67				
							66				
			6	SS	WH		65				
							64				
63.9											
9.5	Clayey SILT, trace sand and gravel, Very loose, Grey, Wet		7	SS	WH						
63.4											
9.9	End of Borehole, Auger Refusal										

Note: Water level in piezometer at 0.07m depth below ground surface on October 20, 2006.

$+^3, \times^3$: Numbers refer to Sensitivity $\circ^{3\%}$ STRAIN AT FAILURE

MISS_MTO 05-1120-210-2700.GPJ ON_MOT.GDT 10/26/06

HWY. 417

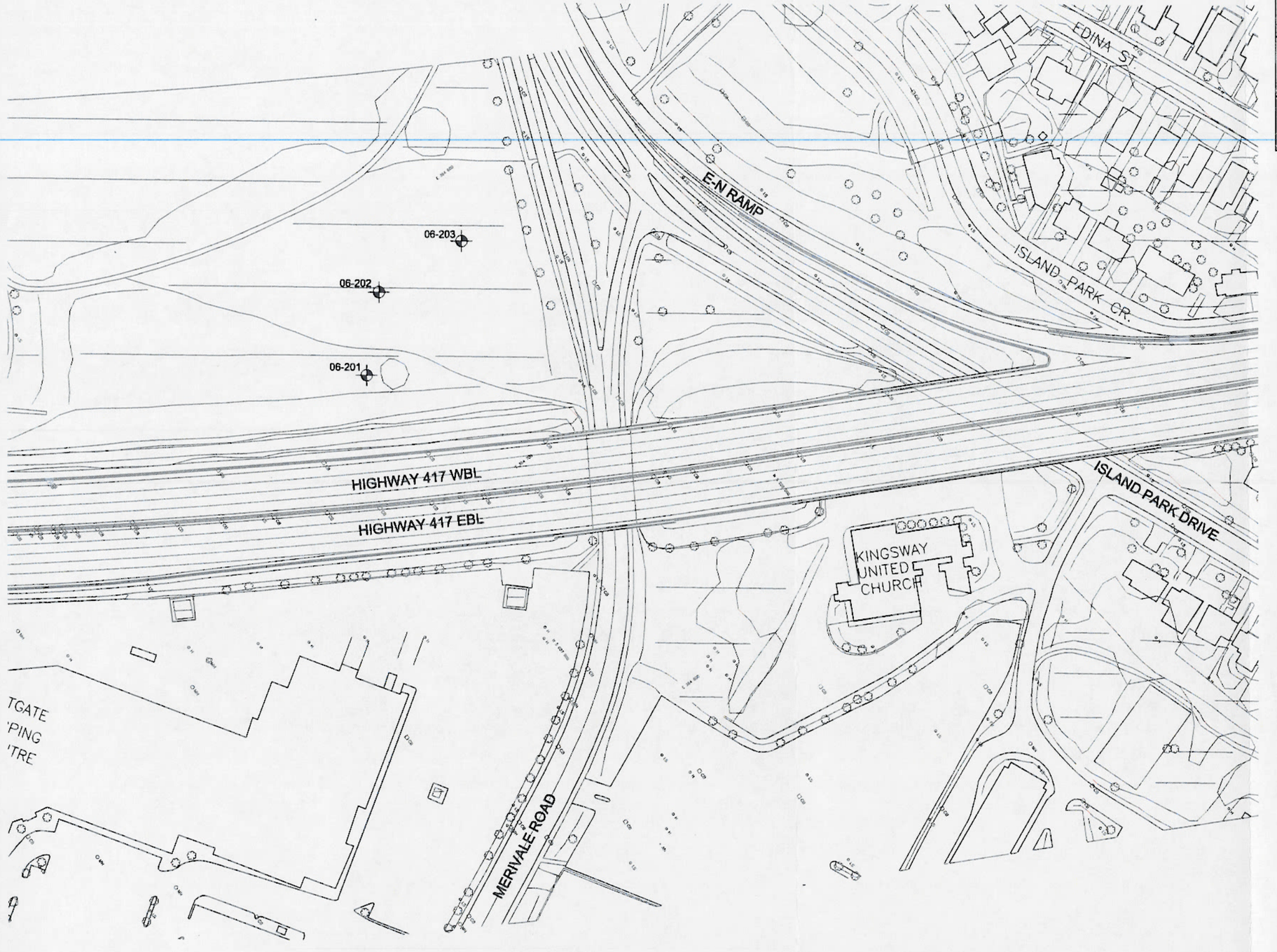
WP No. WP 4058-01-00

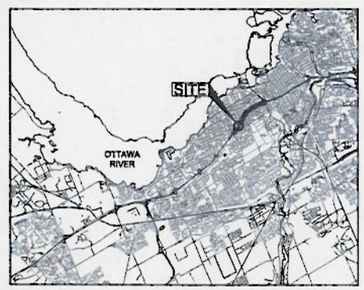
STAGING AREA 1
BOREHOLE LOCATIONS

SHEET

Golder Associates

Golder Associates Ltd.
OTTAWA, ONTARIO, CANADA





KEY PLAN

LEGEND

Borehole – Current Golder Associates Ltd. Investigation

No.	ELEVATION	LOCATION	
		NORTHING	EASTING
06-201	74.2	5027905.2	364642.1
06-202	74.5	5027926.7	364620.8
06-203	73.3	5027961.7	364624.1

NOTES

This drawing is for subsurface information only. Any surface details are for conceptual illustration.
The boundaries between soil strata have been established only at borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

Base plan provided in electronic format by McCormick Rankin Corporation

NO.	DATE	BY	REVISION

15 0 15 30
SCALE METRES

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

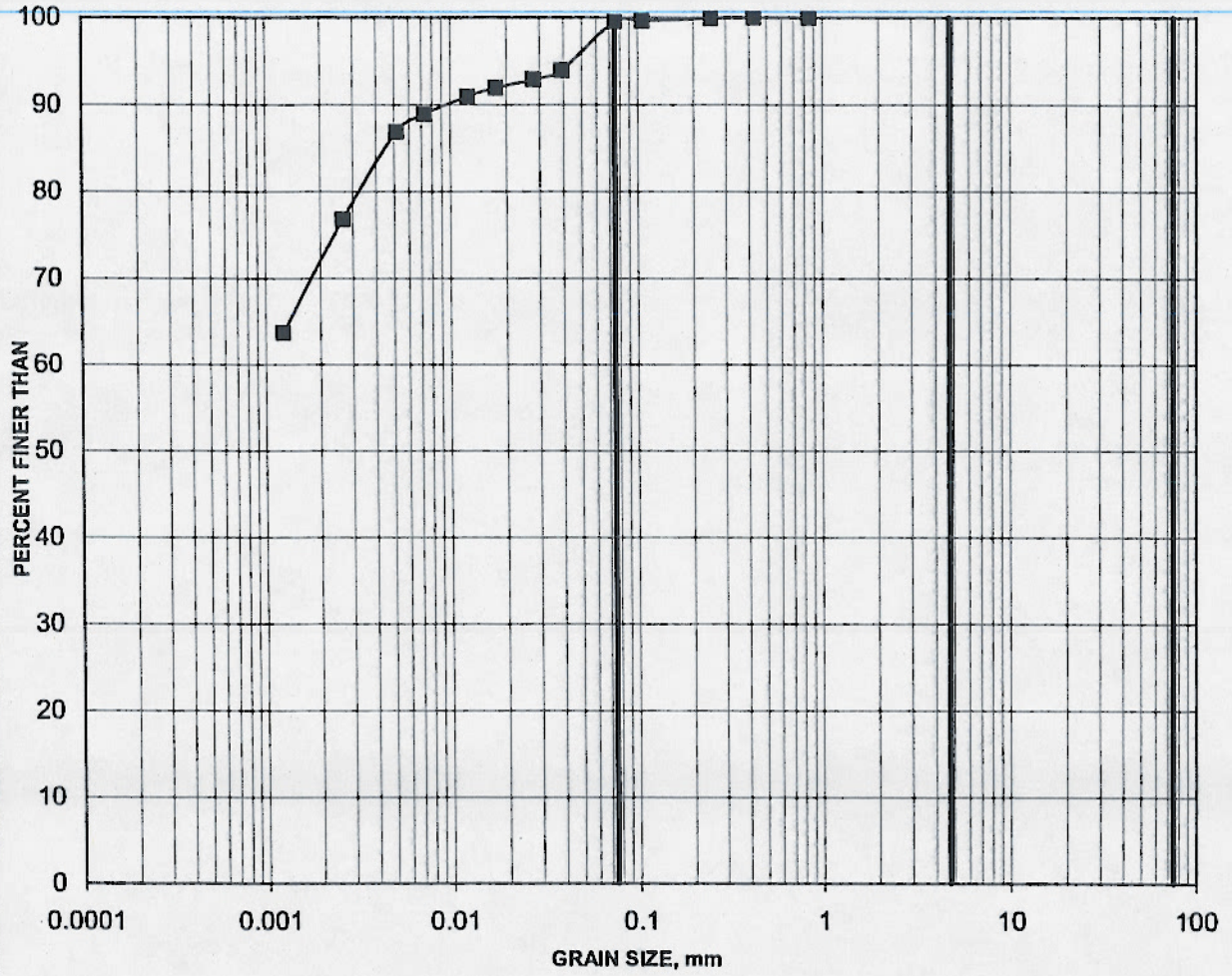
Geocres No.

HWY. 417		PROJECT NO. 05-1120-210-2700	DIST.
SUBM'D. W.C.	CHKD. M.I.C.	DATE: OCTOBER 2006	SITE:
DRAWN: J.M.	CHKD. W.C.	APPD.	DWG. 1

05-1120-210-2700-01.dwg

GRAIN SIZE DISTRIBUTION
Clay

FIGURE 1



Borehole	Sample	Depth (m)
06-203	2	1.5-2.1

Received:

Project: 051120210

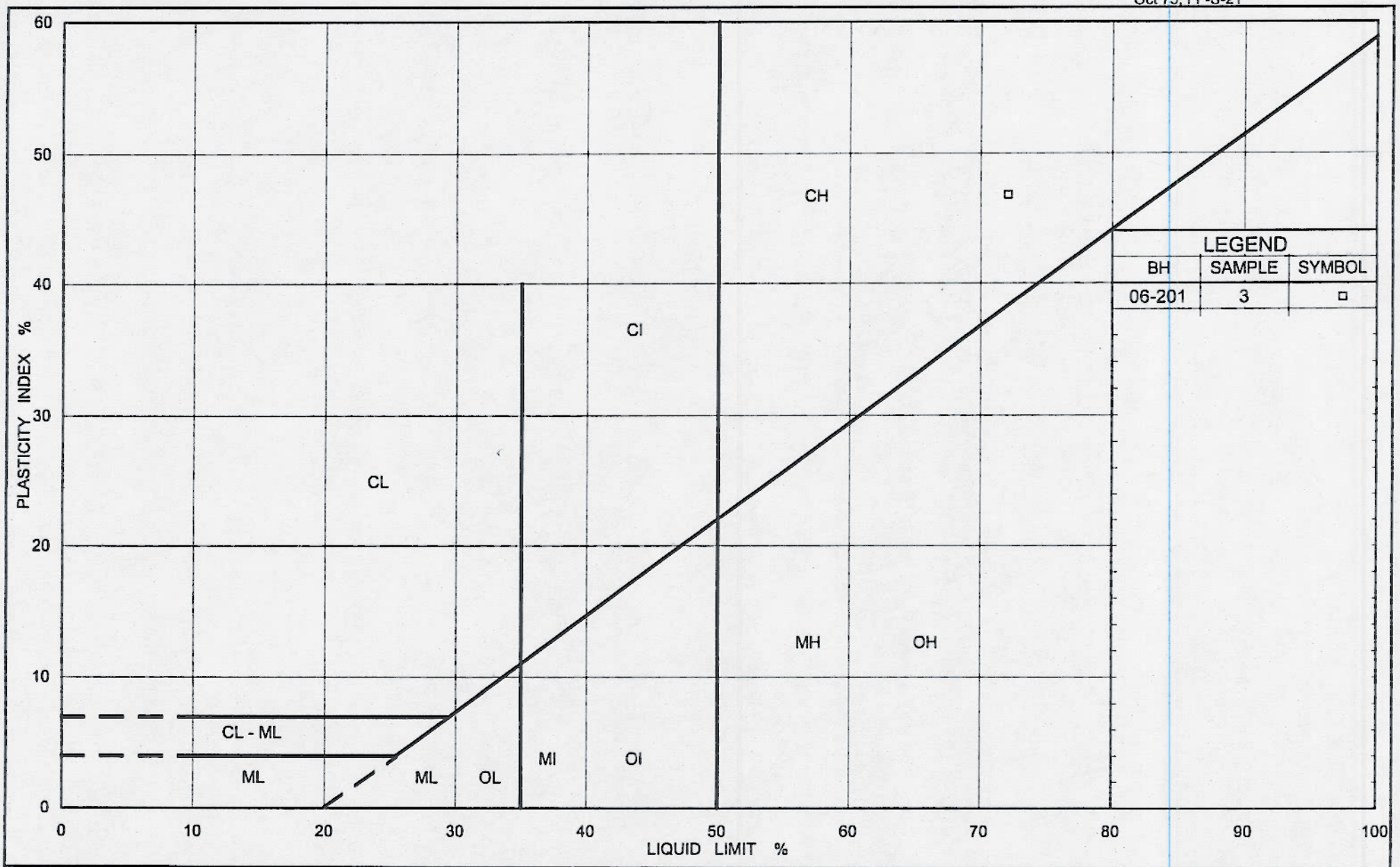
Golder Associates

4-Dec-06

Created by: MaD

Checked by: BaJ

Oct 75, FF-S-21



Ministry of Transportation
Ontario

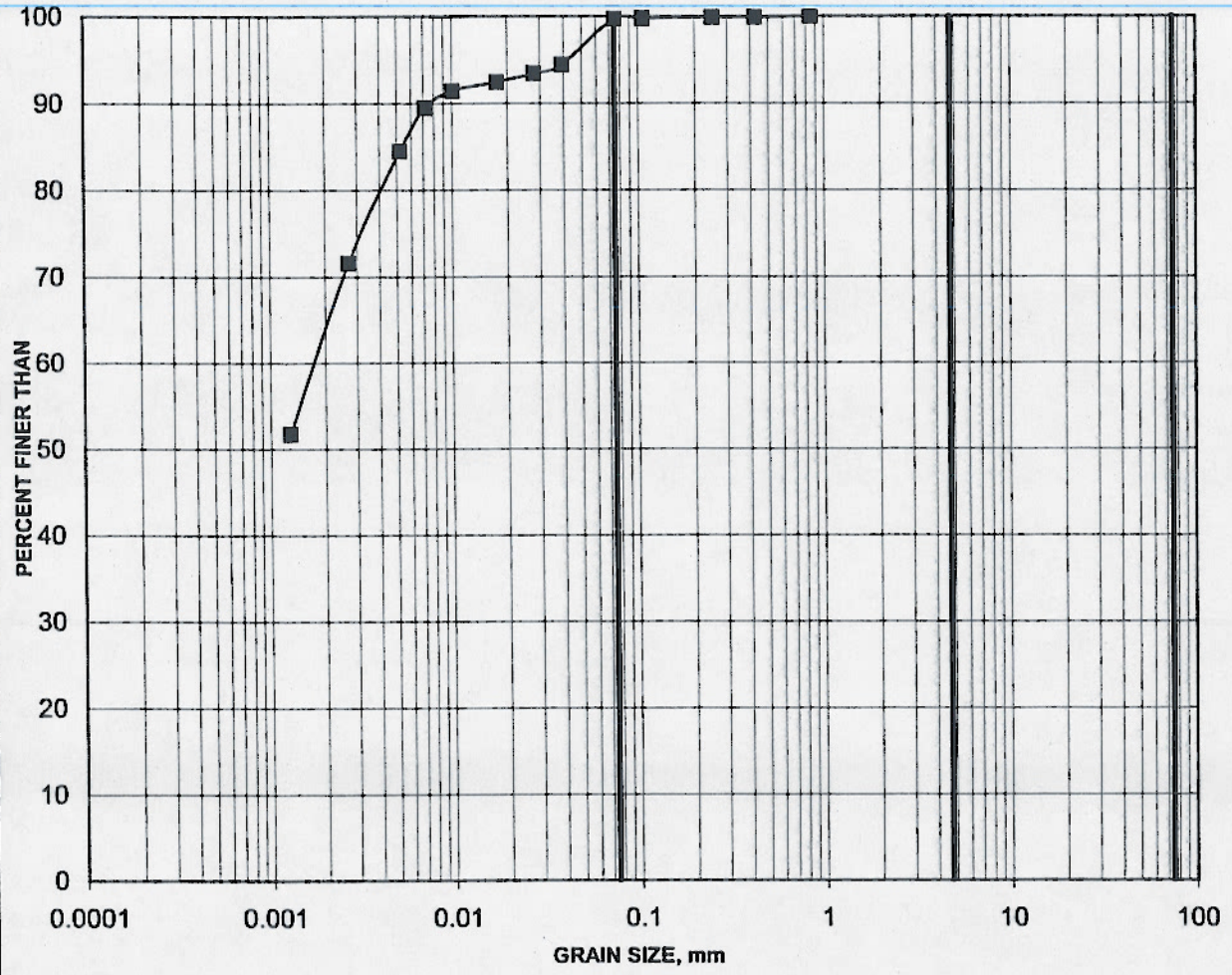
PLASTICITY CHART
Clay (Weathered Crust)

FIG No. 2

Project No. 05-1120-210

GRAIN SIZE DISTRIBUTION
Silty Clay

FIGURE 3



Borehole	Sample	Depth (m)
06-202	4	4.6-5.2

Received:

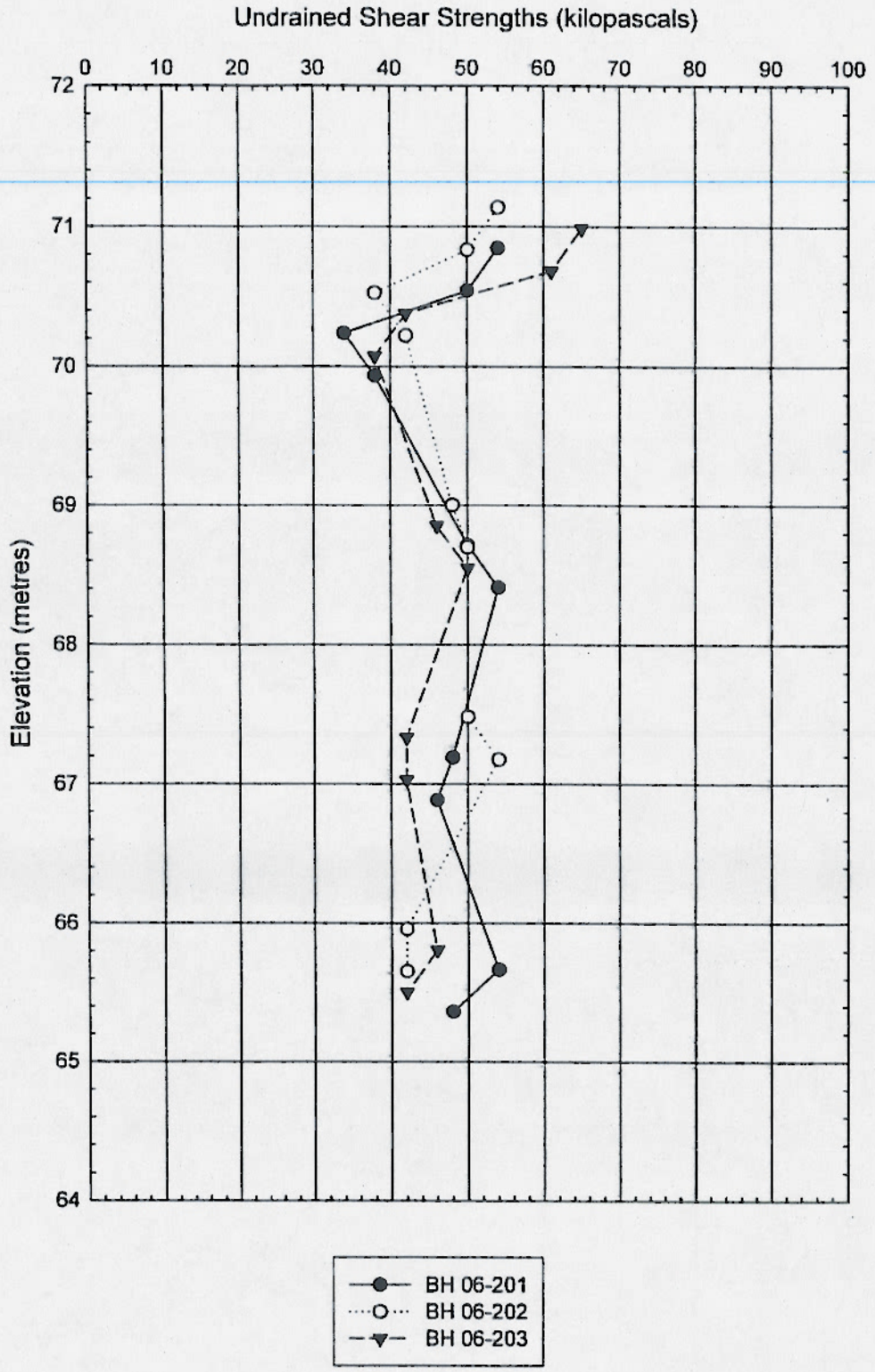
Project: 051120210

Golder Associates

4-Dec-06

Created by: MaD

Checked by: BaJ



Golder Associates
Ottawa, Ontario

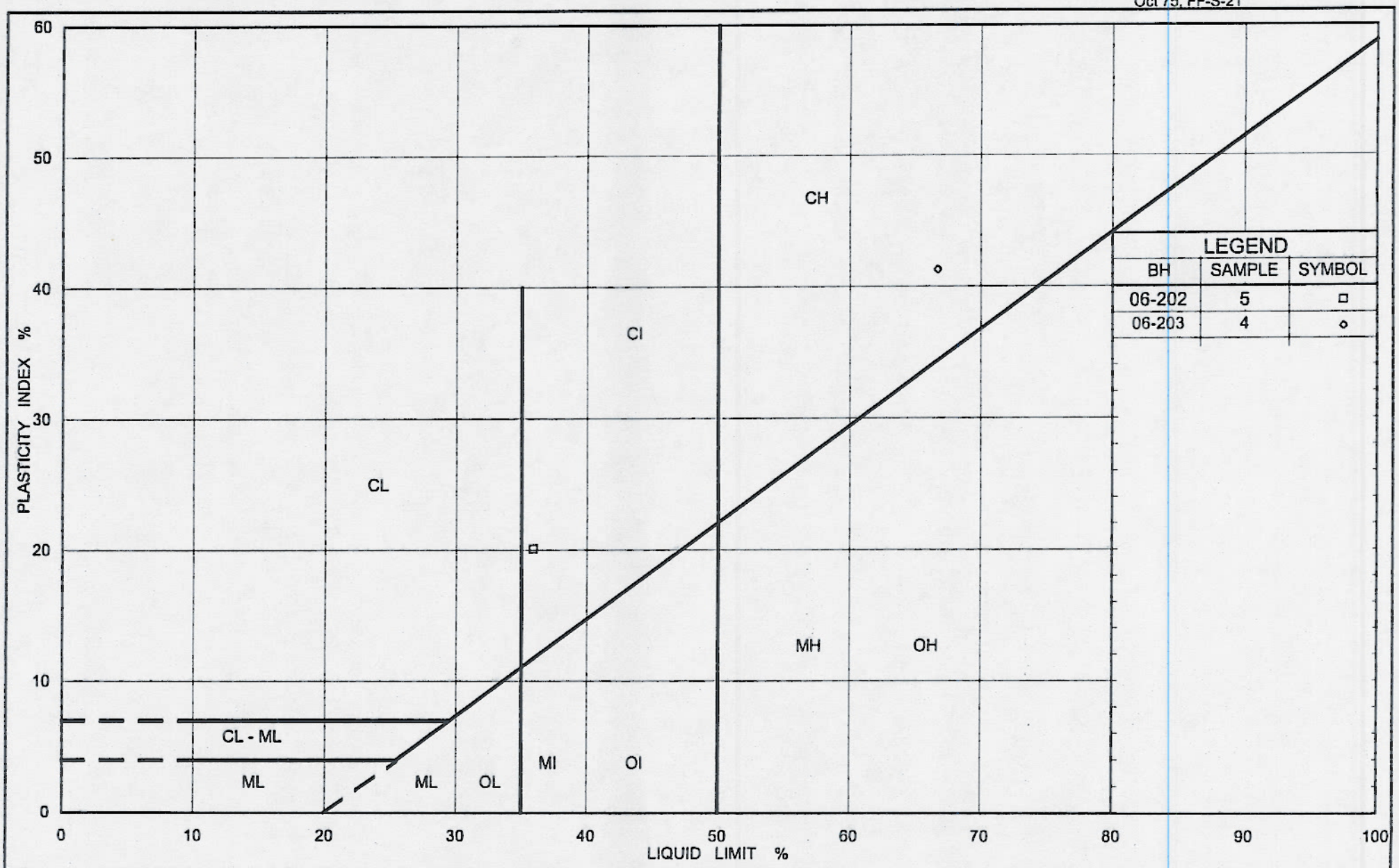
FILE No.	051120210-2700-04.dwg
PROJECT No.	05-1120-210
REV.	0
SCALE	AS SHOWN
DATE	OCT. 2006
DESIGN	
CADD	N.B.H.S.
CHECK	W.C.
REVIEW	

TITLE

MERIVALE STAGING AREA - SUMMARY OF UNDRAINED SHEAR STRENGTHS

FIGURE 4

Oct 75, FF-S-21

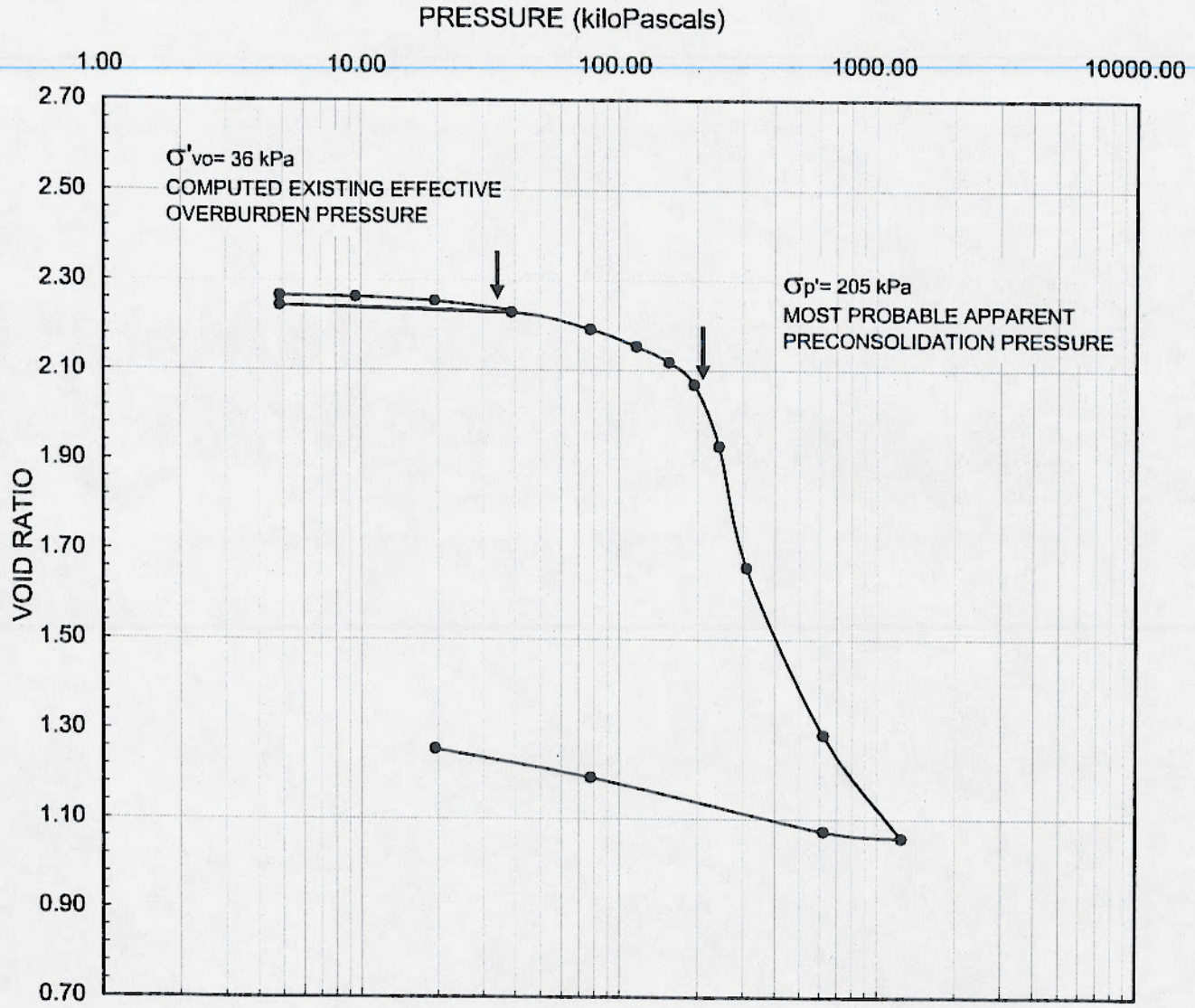


Ministry of Transportation
Ontario

PLASTICITY CHART
Silty Clay to Clay

FIG No. 5

Project No. 05-1120-210



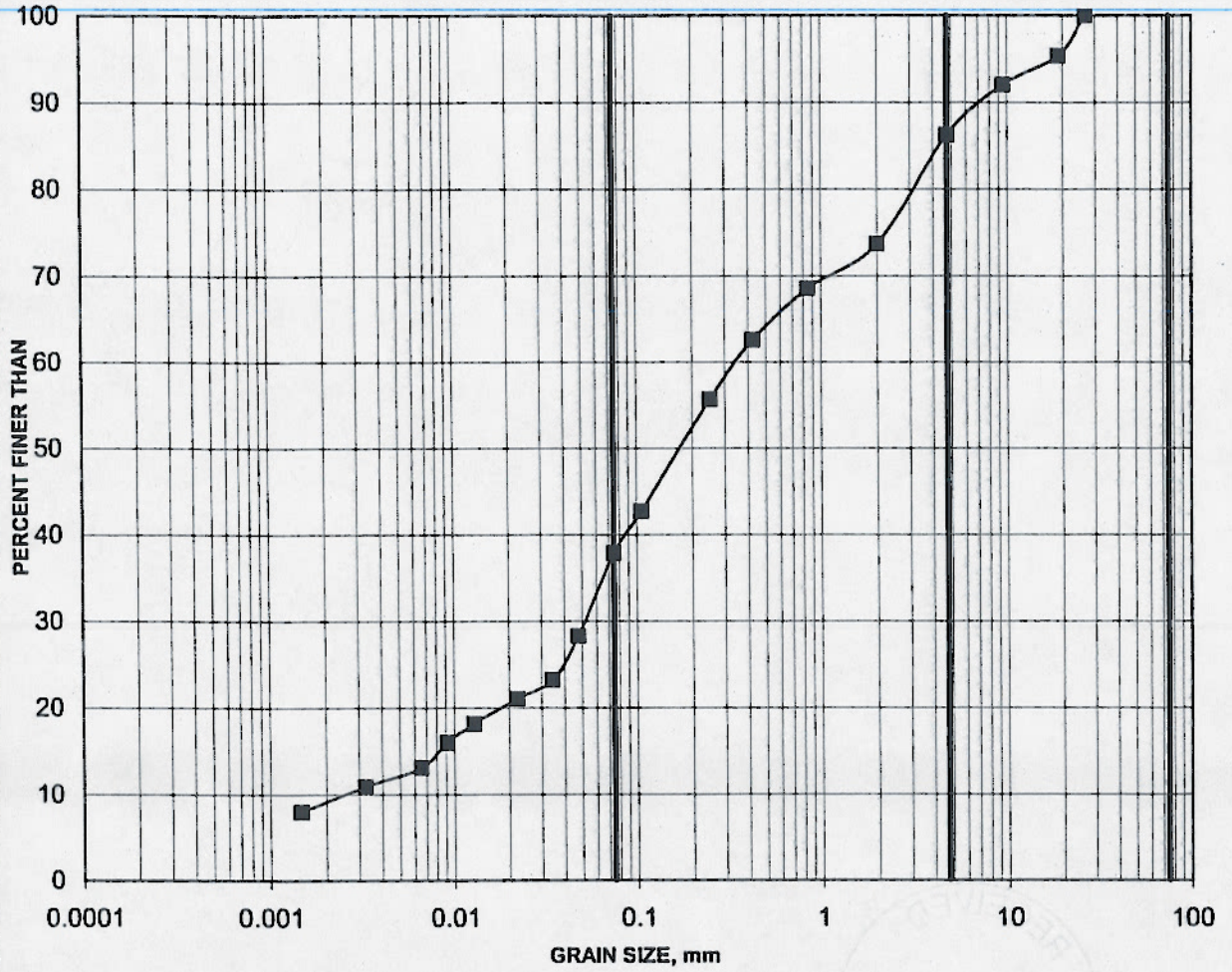
LEGEND

Borehole:	06-203	w_i = 78.9%	S_o = 98%
Sample:	4	w_f = 46.1%	C_c = 2.52
Depth (m):	4.70		C_r = 0.018

Golder Associates	SCALE: AS SHOWN	TITLE: CONSOLIDATION TEST RESULTS	
	DATE: 12/05/06		
	DESIGN: NA		
	CADD: NA		
FILE No.: Consolidation summary	CHECK:		
PROJECT No.: 05-1120-210 REV. 0	REVIEW:		FIGURE: 6

GRAIN SIZE DISTRIBUTION
Glacial Till

FIGURE 7



Borehole	Sample	Depth (m)
06-201	7	9.1-9.8

Received:

Project: 051120210

Golder Associates

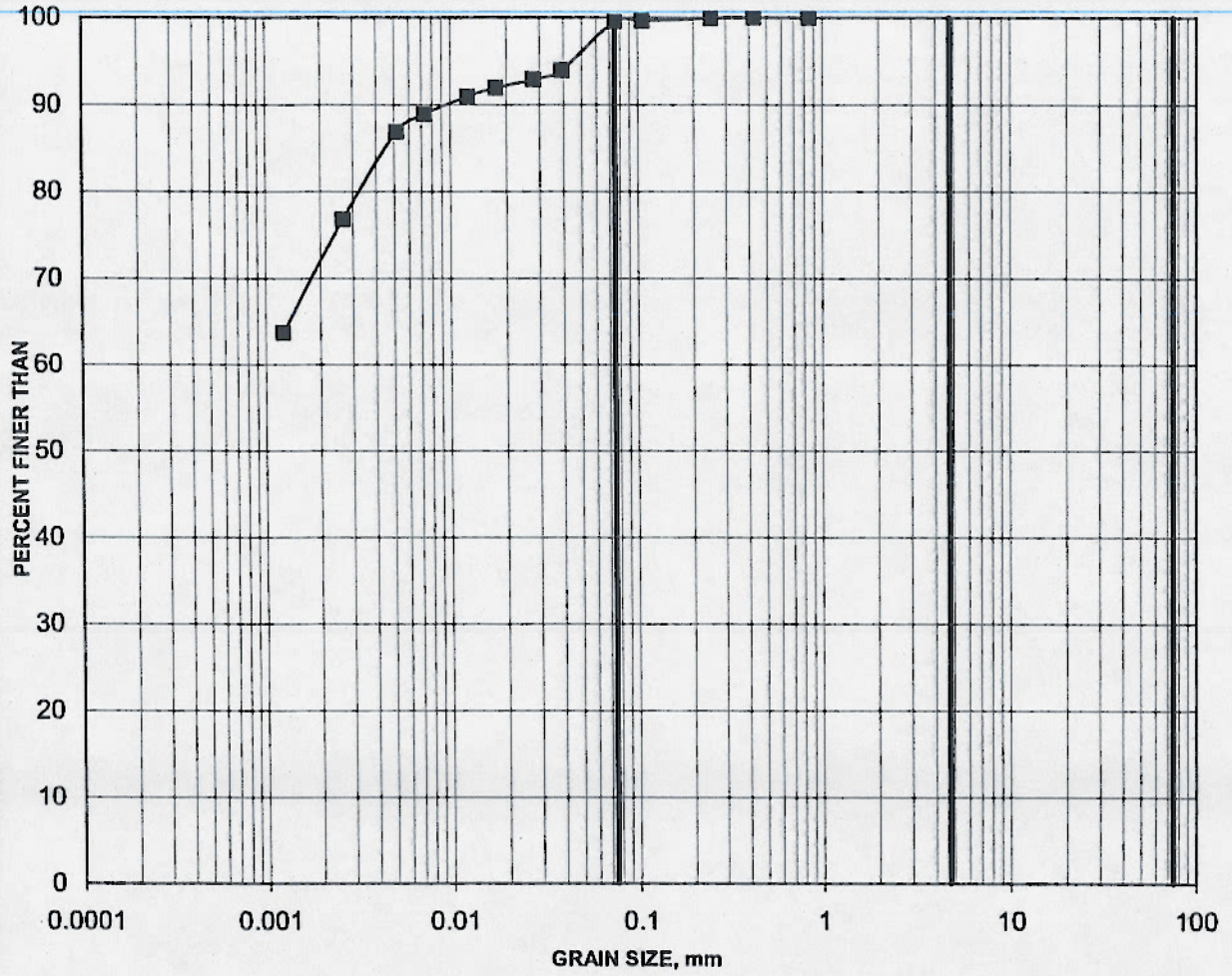
4-Dec-06

Created by: MaD

Checked by: BaJ

GRAIN SIZE DISTRIBUTION
Clay

FIGURE 1



Borehole	Sample	Depth (m)
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Received:

Project: 051120210

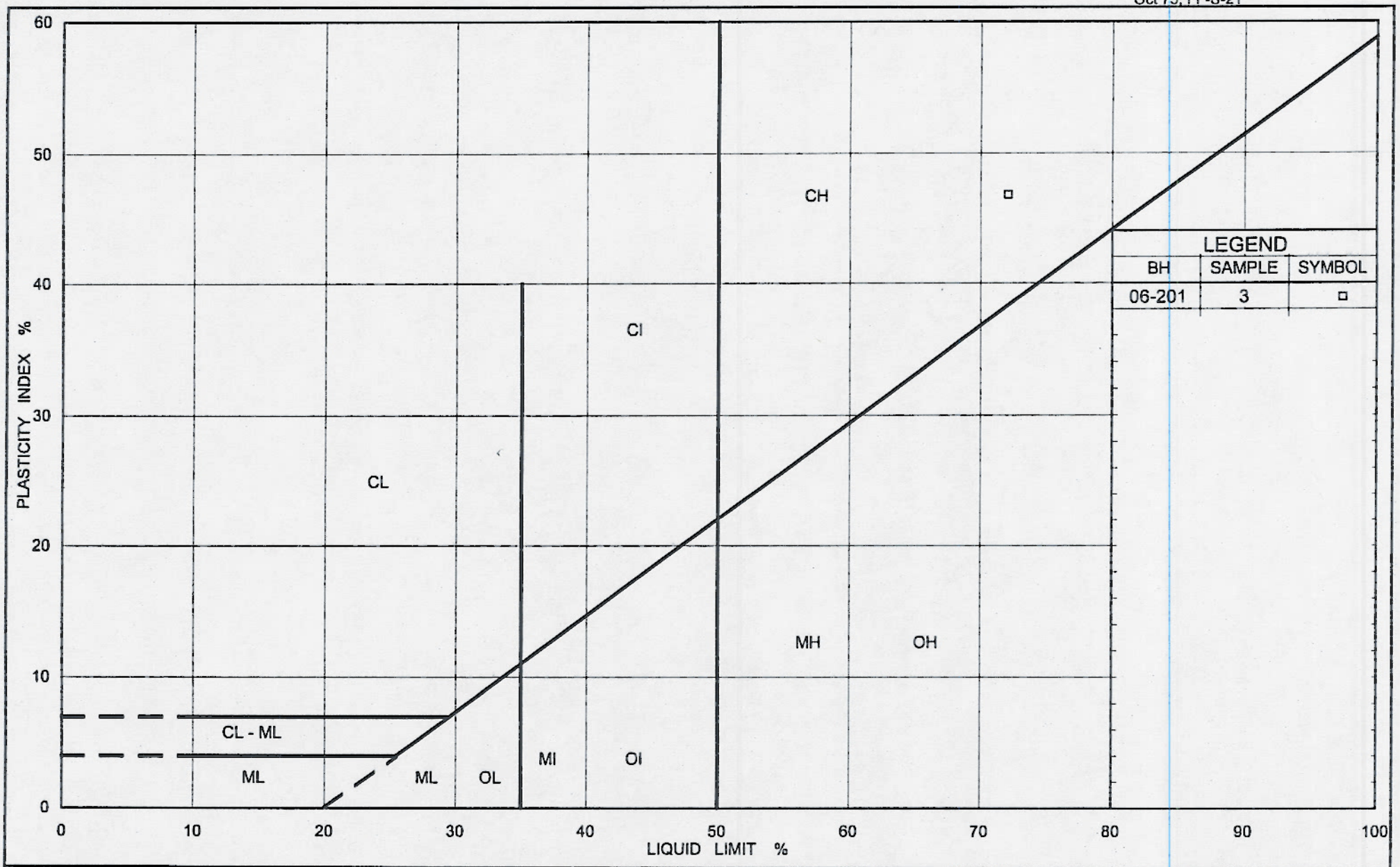
Golder Associates

4-Dec-06

Created by: MaD

Checked by: BaJ

Oct 75, FF-S-21



Ministry of Transportation
Ontario

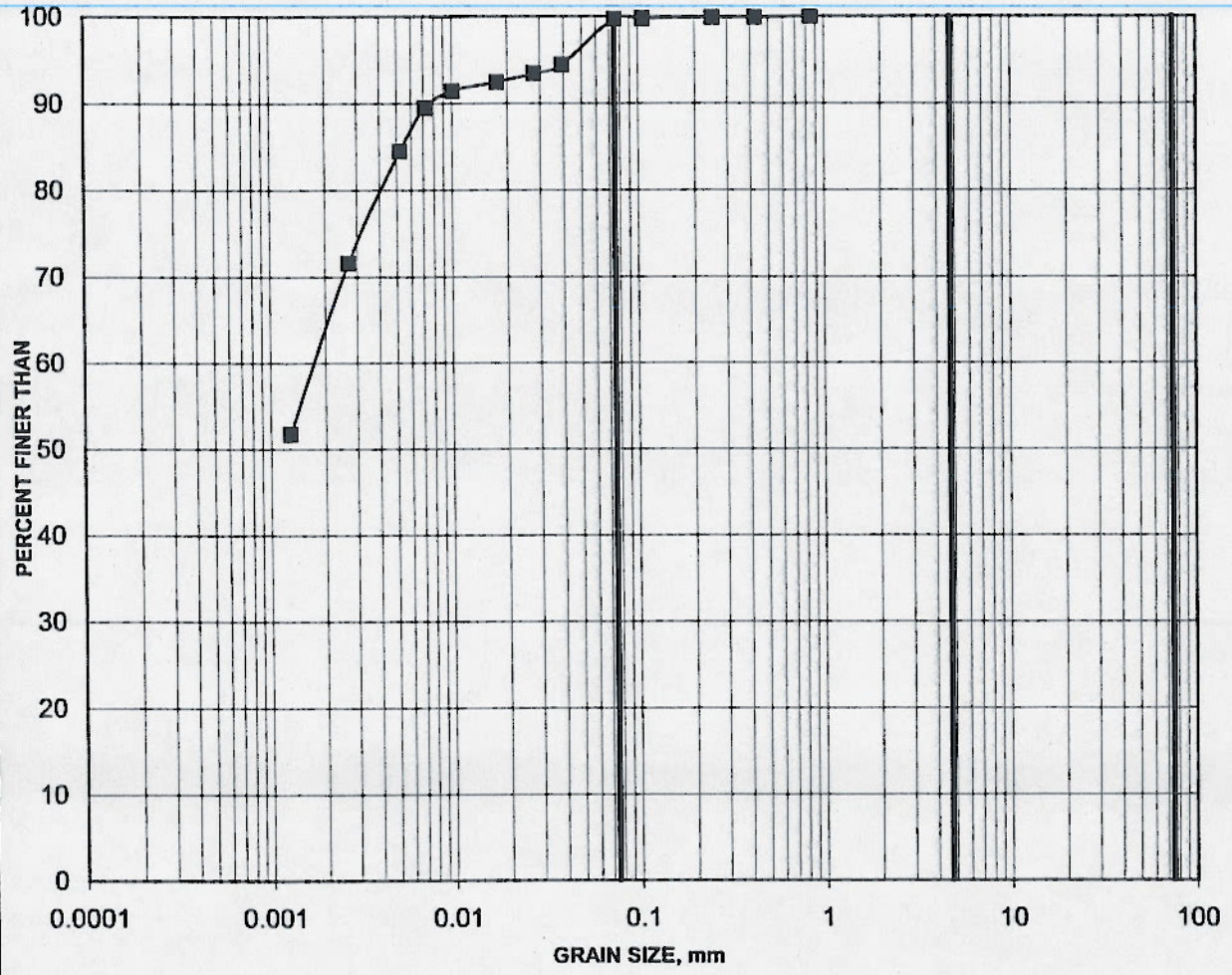
PLASTICITY CHART
Clay (Weathered Crust)

FIG No. 2

Project No. 05-1120-210

GRAIN SIZE DISTRIBUTION
Silty Clay

FIGURE 3



Borehole	Sample	Depth (m)
06-202	4	4.6-5.2

Received:

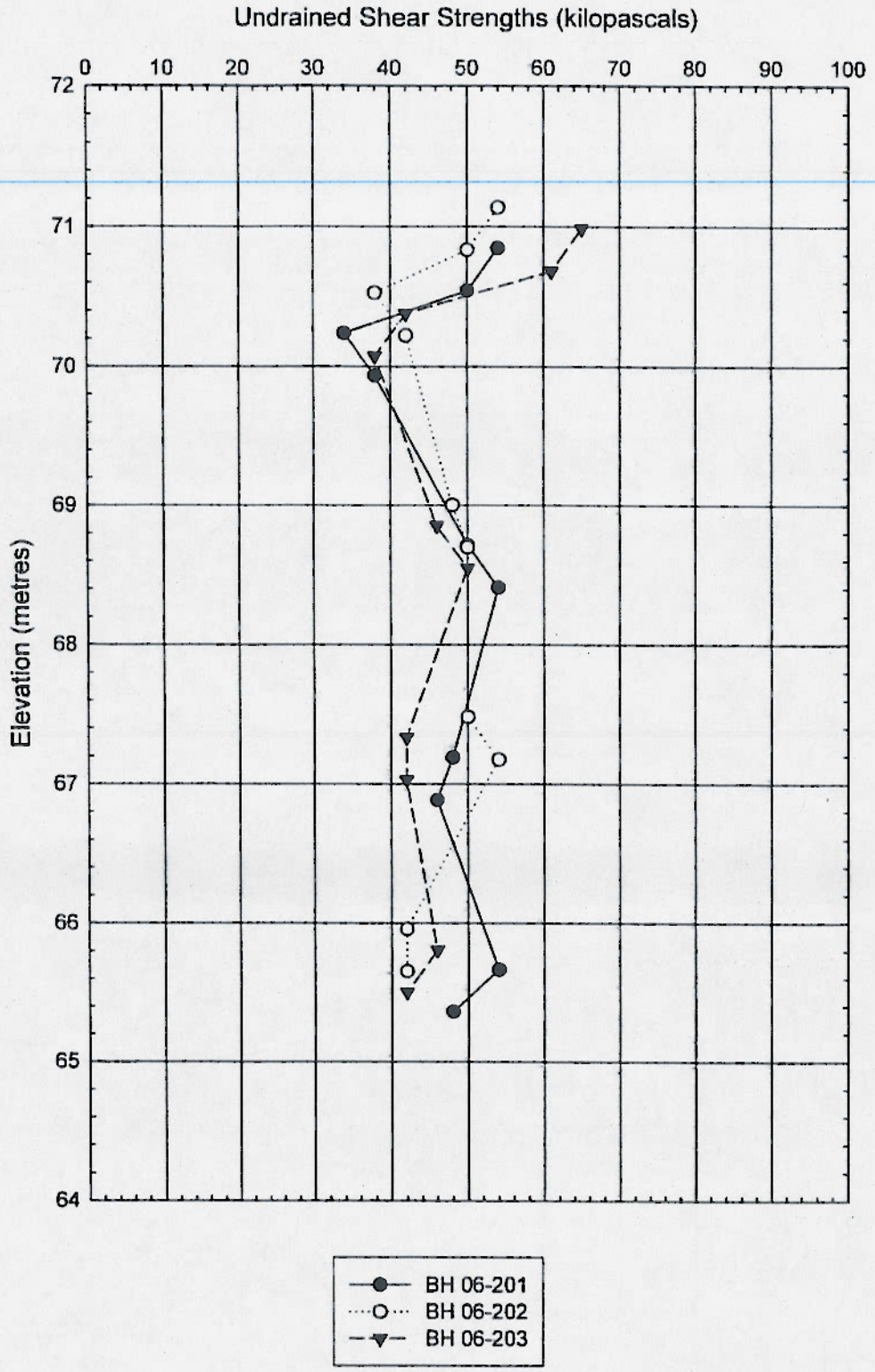
Project: 051120210

Golder Associates

4-Dec-06

Created by: MaD

Checked by: BaJ



Golder Associates
Ottawa, Ontario

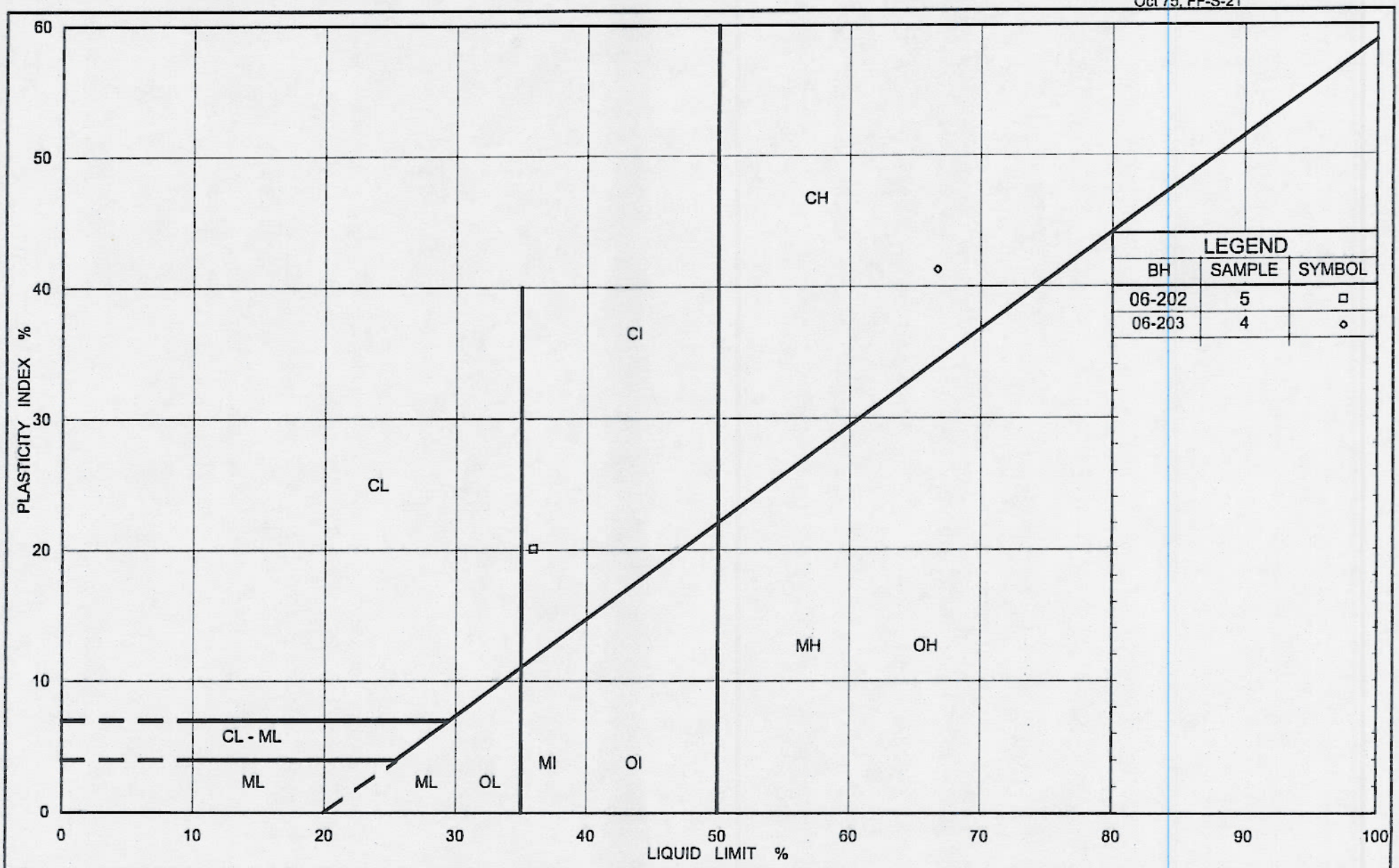
FILE No.	051120210-2700-04.dwg
PROJECT No.	05-1120-210
REV.	0
SCALE	AS SHOWN
DATE	OCT. 2006
DESIGN	
CADD	N.B.H.S.
CHECK	W.C.
REVIEW	

TITLE

MERIVALE STAGING AREA - SUMMARY OF UNDRAINED SHEAR STRENGTHS

FIGURE 4

Oct 75, FF-S-21

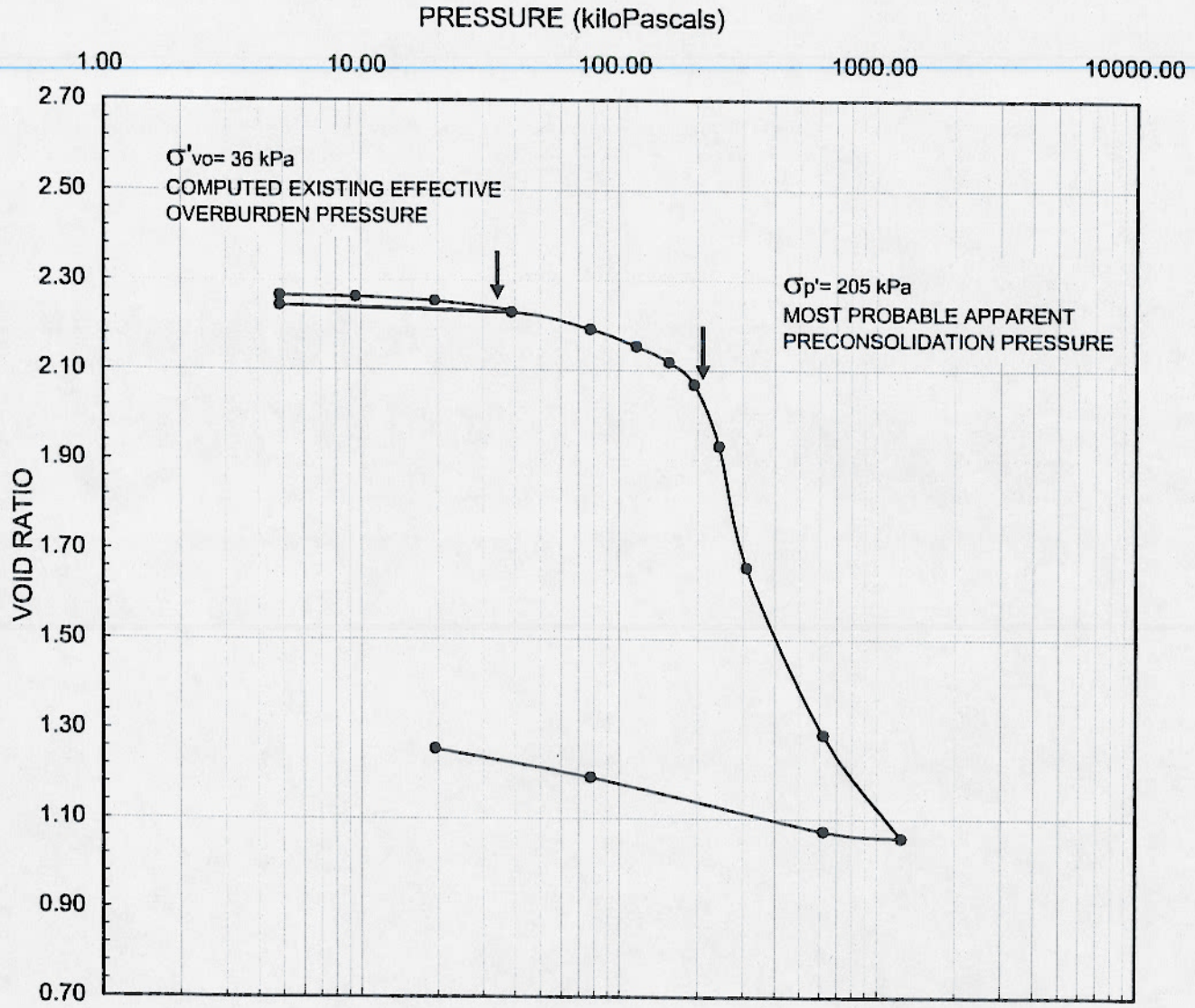


Ministry of Transportation
Ontario

PLASTICITY CHART
Silty Clay to Clay

FIG No. 5

Project No. 05-1120-210



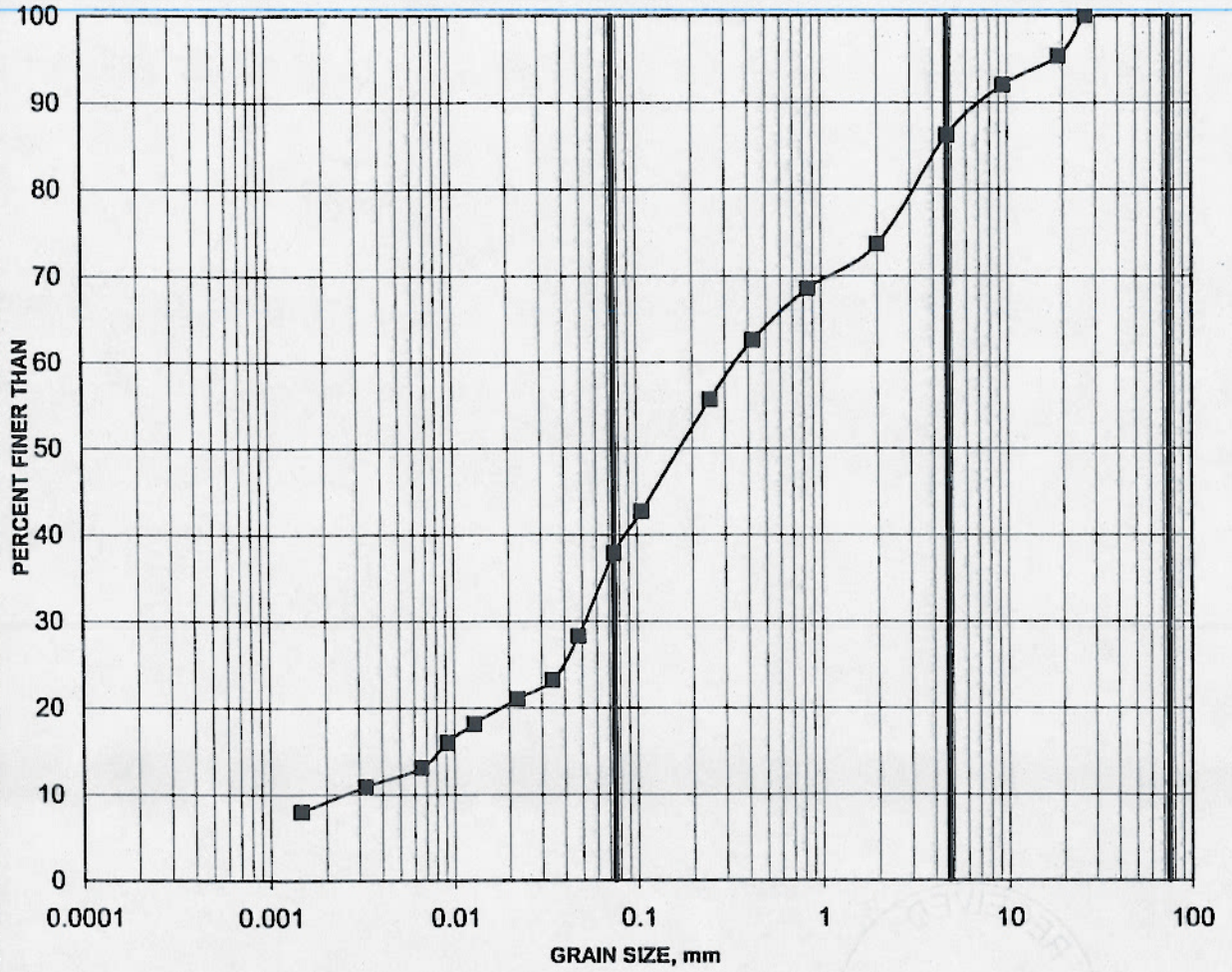
LEGEND

Borehole:	06-203	w_i = 78.9%	S_o = 98%
Sample:	4	w_f = 46.1%	C_c = 2.52
Depth (m):	4.70		C_r = 0.018

Golder Associates	SCALE: AS SHOWN	TITLE: CONSOLIDATION TEST RESULTS	
	DATE: 12/05/06		
	DESIGN: NA		
	CADD: NA		
FILE No.: Consolidation summary	CHECK:		
PROJECT No.: 05-1120-210 REV. 0	REVIEW:		FIGURE: 6

GRAIN SIZE DISTRIBUTION
Glacial Till

FIGURE 7



Borehole	Sample	Depth (m)
06-201	7	9.1-9.8

Received:

Project: 051120210

Golder Associates

4-Dec-06

Created by: MaD

Checked by: BaJ

HWY. 417

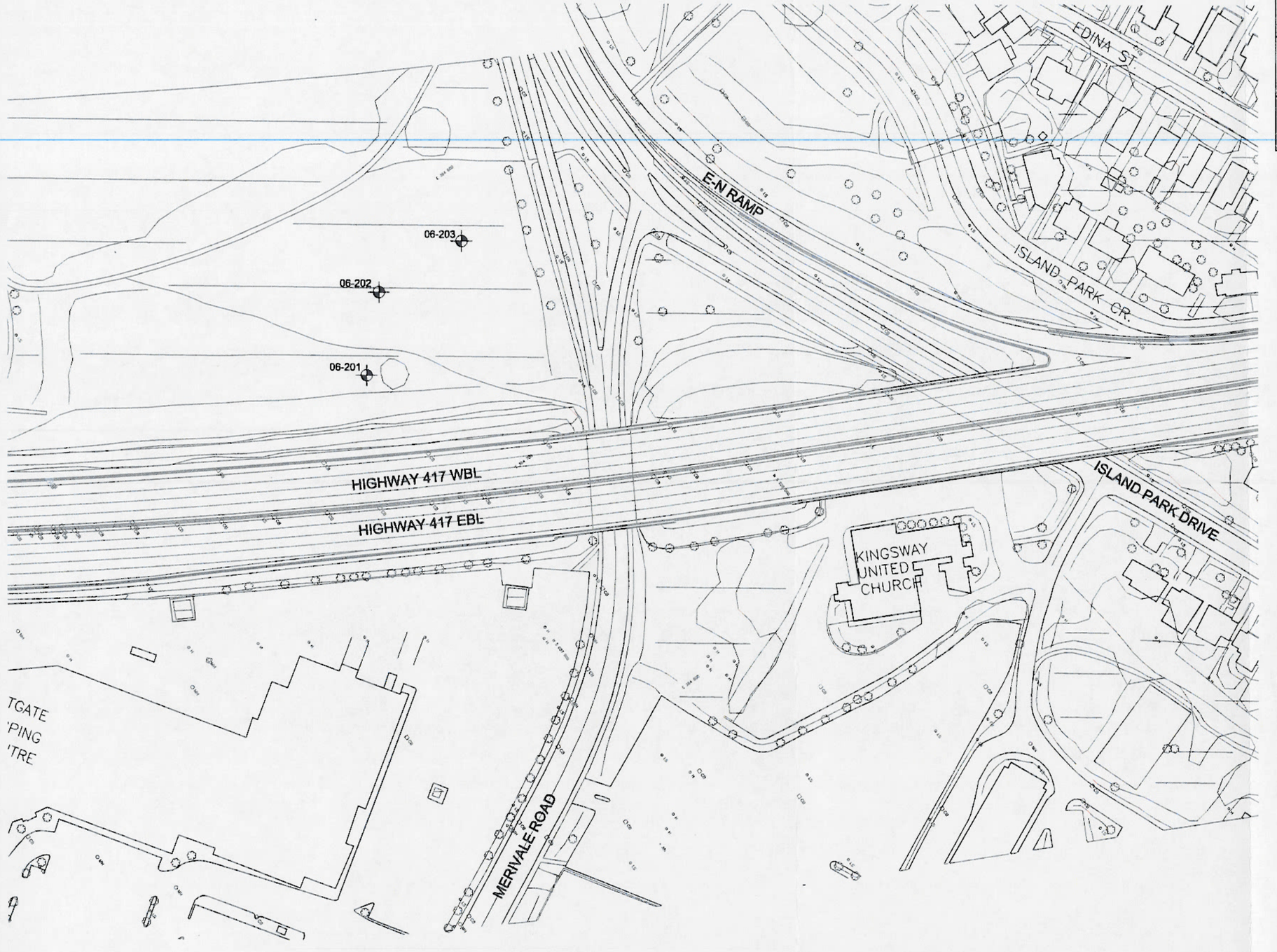
WP No. WP 4058-01-00

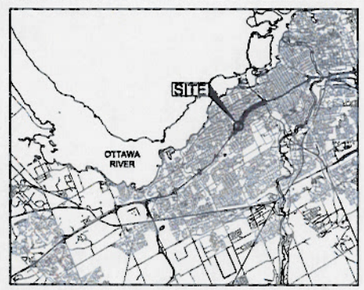
STAGING AREA 1
BOREHOLE LOCATIONS

SHEET

Golder Associates

Golder Associates Ltd.
OTTAWA, ONTARIO, CANADA





KEY PLAN

LEGEND

Borehole – Current Golder Associates Ltd. Investigation

No.	ELEVATION	LOCATION	
		NORTHING	EASTING
06-201	74.2	5027905.2	364642.1
06-202	74.5	5027926.7	364620.8
06-203	73.3	5027961.7	364624.1

NOTES

This drawing is for subsurface information only. Any surface details are for conceptual illustration.
The boundaries between soil strata have been established only at borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

Base plan provided in electronic format by McCormick Rankin Corporation

NO.	DATE	BY	REVISION

15 0 15 30
SCALE METRES

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

Geocres No.

HWY. 417		PROJECT NO. 05-1120-210-2700	DIST.
SUBM'D. W.C.	CHKD. M.I.C.	DATE: OCTOBER 2006	SITE:
DRAWN: J.M.	CHKD. W.C.	APPD.	DWG. 1

05-1120-210-2700-01.dwg