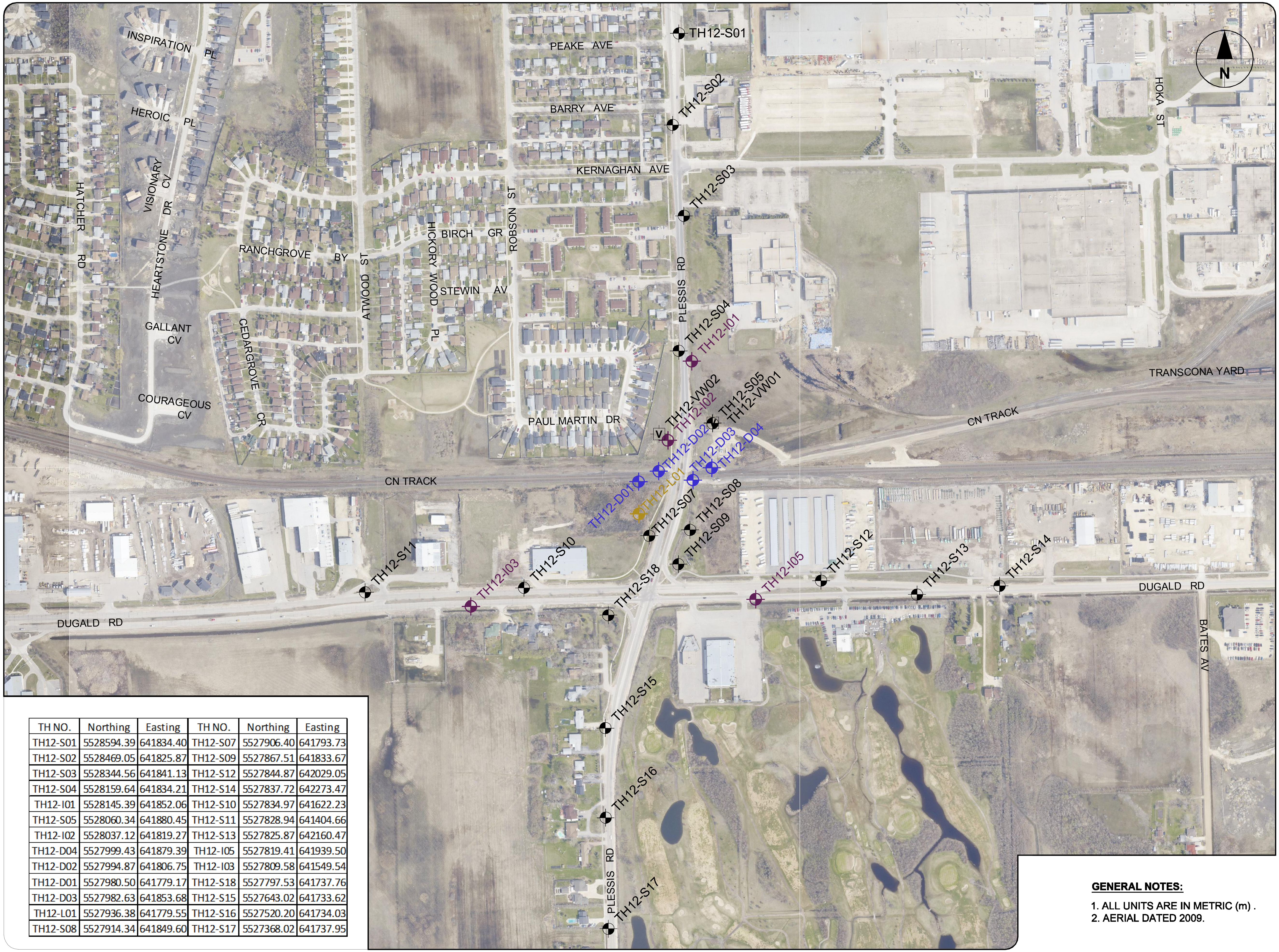
APPENDIX ‘A’

GEOTECHNICAL INFORMATION



TH NO.	Northing	Easting	TH NO.	Northing	Easting
TH12-S01	5528594.39	641834.40	TH12-S07	5527906.40	641793.73
TH12-S02	5528469.05	641825.87	TH12-S09	5527867.51	641833.67
TH12-S03	5528344.56	641841.13	TH12-S12	5527844.87	642029.05
TH12-S04	5528159.64	641834.21	TH12-S14	5527837.72	642273.47
TH12-I01	5528145.39	641852.06	TH12-S10	5527834.97	641622.23
TH12-S05	5528060.34	641880.45	TH12-S11	5527828.94	641404.66
TH12-I02	5528037.12	641819.27	TH12-S13	5527825.87	642160.47
TH12-D04	5527999.43	641879.39	TH12-I05	5527819.41	641939.50
TH12-D02	5527994.87	641806.75	TH12-I03	5527809.58	641549.54
TH12-D01	5527980.50	641779.17	TH12-S18	5527797.53	641737.76
TH12-D03	5527982.63	641853.68	TH12-S15	5527643.02	641733.62
TH12-L01	5527936.38	641779.55	TH12-S16	5527520.20	641734.03
TH12-S08	5527914.34	641849.60	TH12-S17	5527368.02	641737.95

P:\60273041000-CADD\02-SHEETS\B\60273041-20-SHT-B-001_RX.dwg

GENERAL NOTES:

1. ALL UNITS ARE IN METRIC (m) .
2. AERIAL DATED 2009.

Winnipeg

PLESSIS ROAD UNDERPASS STUDY

TEST HOLE LOCATION PLAN

⊕	SHALLOW TEST HOLE
⊕	INTERMEDIATE TEST HOLE
⊕	DEEP TEST HOLE
⊕	LIFT STATION TEST HOLE
V	VIBRATING WIRE PIEZOMETER

AECOM

DILLON CONSULTING

0 37.5 75 150m

SCALE: 1:5000

B-001

AECOM Canada Ltd.

GENERAL STATEMENT

NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

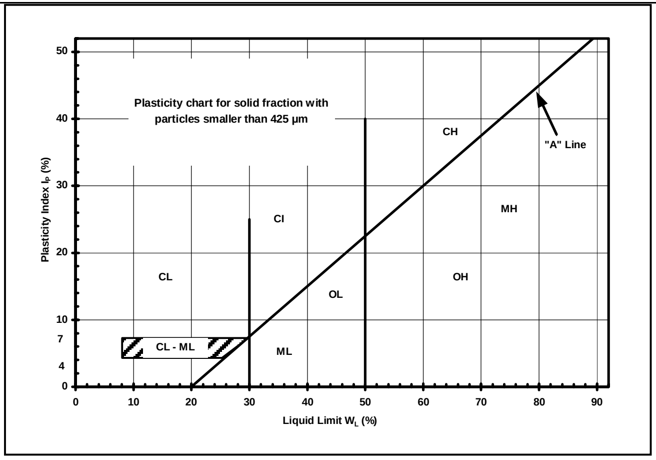
In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

EXPLANATION OF FIELD & LABORATORY TEST DATA

Description				AECOM Log Symbols	USCS Classification	Laboratory Classification Criteria			
						Fines (%)	Grading	Plasticity	Notes
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines	▨	GW	0-5	$C_U > 4$ $1 < C_C < 3$		Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4<W_P<7$ $C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
			Poorly graded gravels, sandy gravels, with little or no fines	▨	GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels	▨	GM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey gravels, clayey sandy gravels	▨	GC	> 12		Atterberg limits above "A" line or $W_P<7$	
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines	▨	SW	0-5	$C_U > 6$ $1 < C_C < 3$		
			Poorly graded sands, gravelly sands, with little or no fines	▨	SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures	▨	SM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey sands, sand-clay mixtures	▨	SC	> 12		Atterberg limits above "A" line or $W_P<7$	
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L<50$	Inorganic silts, silty or clayey fine sands, with slight plasticity	▥	ML			Classification is Based upon Plasticity Chart	
		$W_L>50$	Inorganic silts of high plasticity	▥	MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L<30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays	▨	CL				
		$30<W_L<50$	Inorganic clays and silty clays of medium plasticity	▨	CI				
		$W_L>50$	Inorganic clays of high plasticity, fat clays	▨	CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L<50$	Organic silts and organic silty clays of low plasticity	▥	OL				
		$W_L>50$	Organic clays of high plasticity	▨	OH				
HIGHLY ORGAINIC SOILS			Peat and other highly organic soils	≋	Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

■	Asphalt	▦	Till		
⬚	Concrete	▩	Bedrock (Undifferentiated)		
▩	Fill	▦	Bedrock (Limestone)		

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	“y” or “ey” *
	Medium	2.00	0.425		
	Fine	0.425	0.075	10-20	some
Silt (non-plastic) or Clay (plastic)		< 0.075 mm		1-10	trace

* for example: gravelly, sandy clayey, silty

Definition of Oversize Material

COBBLES: 76mm to 300mm diameter
BOULDERS: >300mm diameter

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

q_u	-	undrained shear strength (kPa) derived from unconfined compression testing.
T_v	-	undrained shear strength (kPa) measured using a torvane
pp	-	undrained shear strength (kPa) measured using a pocket penetrometer.
L_v	-	undrained shear strength (kPa) measured using a lab vane.
F_v	-	undrained shear strength (kPa) measured using a field vane.
γ	-	bulk unit weight (kN/m^3).
SPT	-	Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
DPPT	-	Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
w	-	moisture content (W_L, W_P)

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

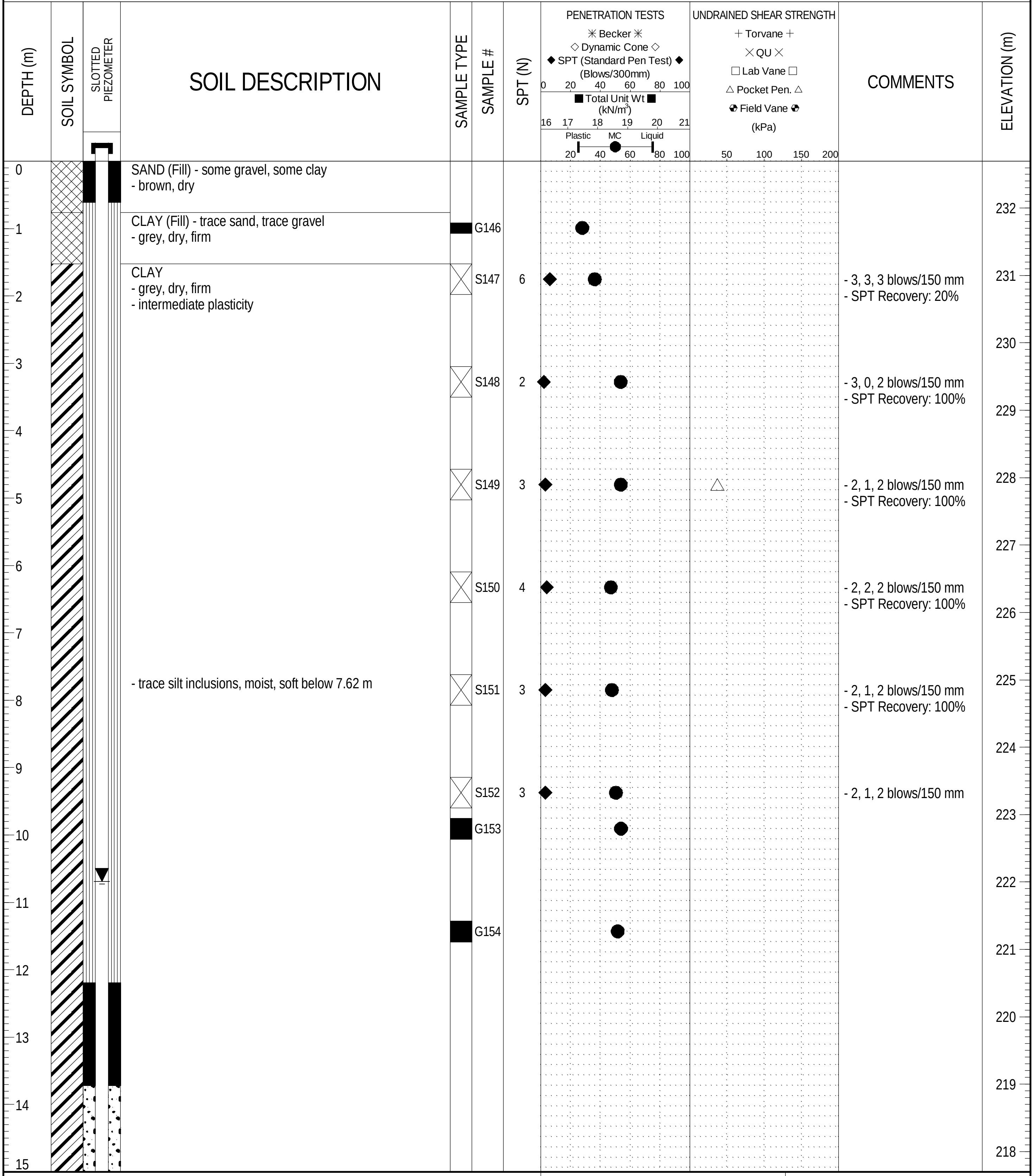
Su (kPa)	**CONSISTENCY**
<12	very soft
12 – 25	soft
25 – 50	medium or firm
50 – 100	stiff
100 – 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	**COMPACTNESS**
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-D01
LOCATION: Plessis South Bound/CN Rail Intersection, West Shoulder Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Mobile B-40, 125 mm SSA	ELEVATION (m): 232.70

SAMPLE TYPE	■ GRAB	▥ SHELBY TUBE	☒ SPLIT SPOON	☰ BULK	▨ NO RECOVERY	▮ CORE
BACKFILL TYPE	■ BENTONITE	⁘ GRAVEL	▥ SLOUGH	⁘ GROUT	▨ CUTTINGS	⁘ SAND



SAND (Fill) - some gravel, some clay
- brown, dry

CLAY (Fill) - trace sand, trace gravel
- grey, dry, firm

CLAY
- grey, dry, firm
- intermediate plasticity

- trace silt inclusions, moist, soft below 7.62 m

SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS
■	G146		
☒	S147	6	- 3, 3, 3 blows/150 mm - SPT Recovery: 20%
☒	S148	2	- 3, 0, 2 blows/150 mm - SPT Recovery: 100%
☒	S149	3	- 2, 1, 2 blows/150 mm - SPT Recovery: 100%
☒	S150	4	- 2, 2, 2 blows/150 mm - SPT Recovery: 100%
☒	S151	3	- 2, 1, 2 blows/150 mm - SPT Recovery: 100%
☒	S152	3	- 2, 1, 2 blows/150 mm
■	G153		
■	G154		

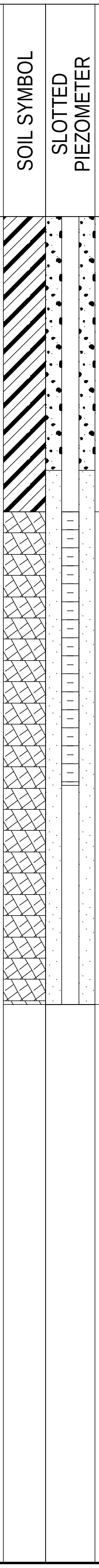
LOGGED BY: Sam O.	COMPLETION DEPTH: 23.77 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/26
PROJECT ENGINEER: Zeyad Shukri	

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-D01
LOCATION: Plessis South Bound/CN Rail Intersection, West Shoulder Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Mobile B-40, 125 mm SSA	ELEVATION (m): 232.70

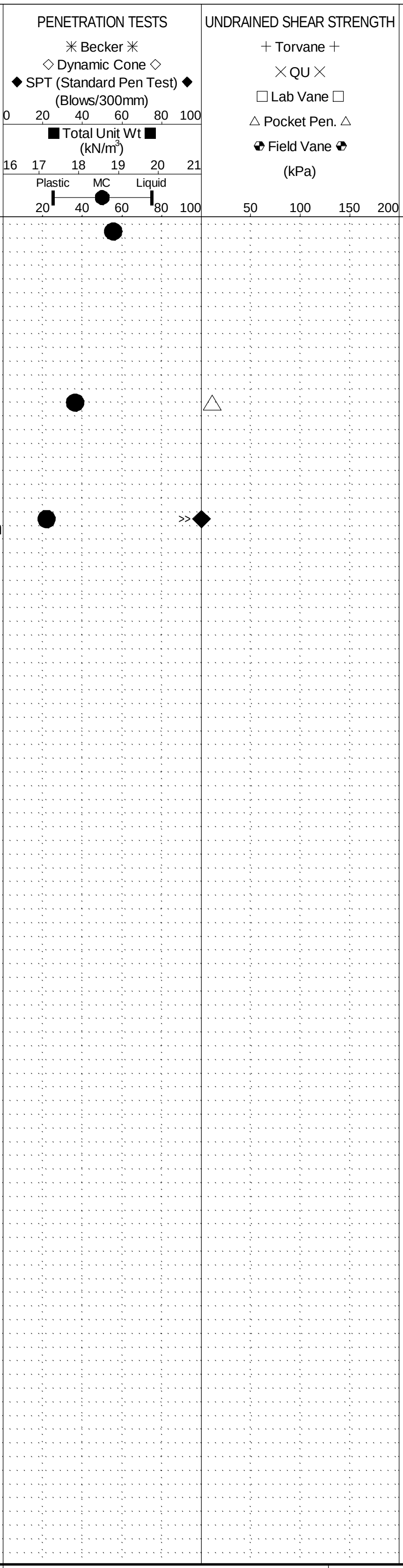
SAMPLE TYPE	■ GRAB	▥ SHELBY TUBE	☒ SPLIT SPOON	☰ BULK	◿ NO RECOVERY	▌ CORE
BACKFILL TYPE	■ BENTONITE	⁘ GRAVEL	▥ SLOUGH	▩ GROUT	▨ CUTTINGS	⁘ SAND

DEPTH (m): 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

ELEVATION (m): 217 216 215 214 213 212 211 210 209 208 207 206 205 204 203



SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS
	■	G155		
- some sand, trace gravel	■	G156		
LIMESTONE DOLOMITIC (Bedrock) - light grey to white, mottled yellow, core angle: 90 degrees - fine to medium grained, no foliation - moderately close spacing, rough undulating joints, slightly altered joints - R2 to R3 (weak to medium strong) - fossiliferous, vuggy - fractured to 20.73 m below ground surface	☒	S157	55/ 152mm	- 55 blows/150 mm
	▌	C1		- C1 RQD: 9% - Core Recovery: 45%
	▌	C2		- C2 RQD: 71% - Core Recovery: 87%
	▌	C3		- C3 RQD: 96% - Core Recovery: 100%



END OF TEST HOLE AT 23.77 m IN BEDROCK

Notes:

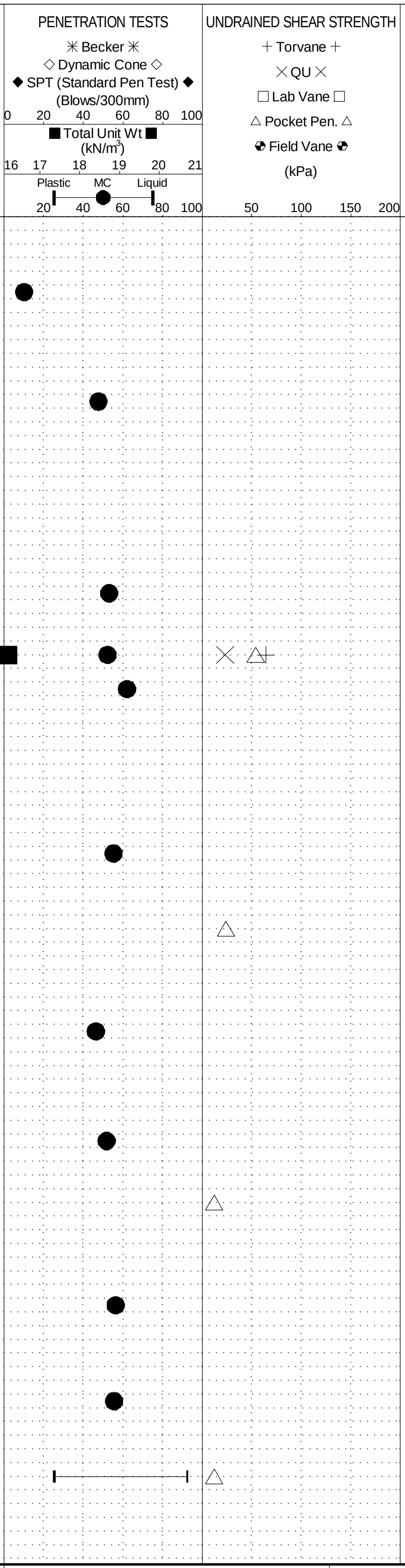
1. Power auger refusal at 19.20 m below ground surface on BEDROCK.
2. HQ coring below 19.20 m.
3. Seepage observed at 18.41 m below ground surface.
4. Installed 25 mm diameter standpipe piezometer (SP12-02) to 21.34 m with 3.05 m of screen bottom, and 0.90 m stick-up. Above ground protective casing installed.
5. Test hole backfilled with sand up to 17.83 m, grouted from 17.83 to 13.72 m, plugged with bentonite to 12.19 m, backfilled with auger cuttings to 0.61 m and sealed with bentonite to ground surface.
6. Ground water monitoring:
    - October 26, 2012 at 11.50 m (Elev. 221.20 m)
    - December 03, 2012 at 9.60 m (Elev. 223.10 m)
    - April 15, 2013 at 10.19 m (Elev. 222.50 m)
    - June 20, 2013 at 10.69 m (Elev. 222.0 m)

AECOM	LOGGED BY: Sam O.	COMPLETION DEPTH: 23.77 m
	REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/26
	PROJECT ENGINEER: Zeyad Shukri	Page 2 of 2

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-D02
LOCATION: Plessis South Bound/CN Rail Intersection, West Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Mobile B-40, 125 mm SSA	ELEVATION (m): 232.99

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◺ NO RECOVERY ▮ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0	☒	SAND - gravelly, trace organics - brown to black, moist to wet, loose to compact					
			■	G96			
1							232
	▨	CLAY - grey, moist to wet, stiff					
2			■	G97			231
3							230
		- trace roots, black, wet, toxic odour, steel bar debris up to 3.96 m					
4		- trace organics, moist to wet	■	G99			229
			▥	T100			
5			■	G101			228
6							227
7		- soft, wet below 7.01 m	■	G102			226
8			▥	T103			225
9		- trace silt inclusions (< 5 mm dia.)	■	G104			224
10			■	G105			223
11			▥	T106			222
12			■	G107			221
13			■	G108			220
14			▥	T109			219
15							



LOGGED BY: Sam O.	COMPLETION DEPTH: 21.95 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/22
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 2

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

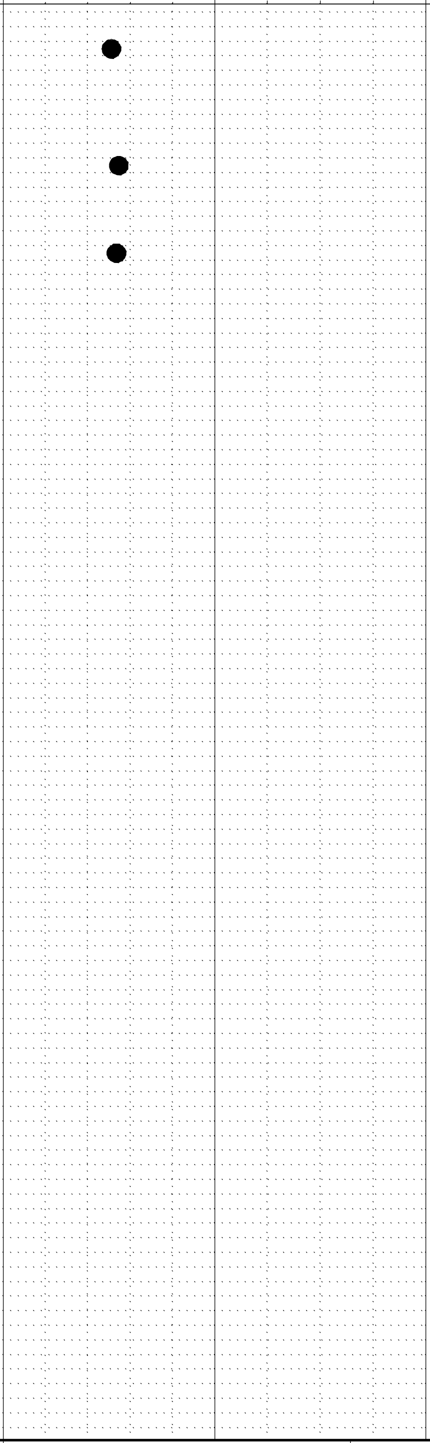
PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-D02
LOCATION: Plessis South Bound/CN Rail Intersection, West Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Mobile B-40, 125 mm SSA	ELEVATION (m): 232.99

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◿ NO RECOVERY ▮ CORE

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
15	▨						
			■	G110			
16							217
			■	G111			
17							216
			■	G112			
18							215
19		LIMESTONE (Bedrock) - light grey to white, core angle: 90 degrees - fine to medium grained, no foliation - close spacing, rough undulating joints, slightly altered joints - R2 to R3 (weak to medium strong) - fossiliferous, filled vuggs - high calcium limestone	▮	C1		- C1 RQD: 26% - Core Recovery: 66%	214
20							213
21			▮	C2		- C2 RQD: 72% - Core Recovery: 100%	212
22		END OF TEST HOLE AT 21.95 m IN BEDROCK Notes: 1. Power auger refusal at 18.90 m below ground surface on BEDROCK. 2. HQ coring below 18.90 m. 3. Test hole grouted up to 13.72 m, plugged with bentonite from 13.72 to 12.80 m and backfilled with auger cuttings to ground surface.					211
23							210
24							209
25							208
26							207
27							206
28							205
29							204
30							



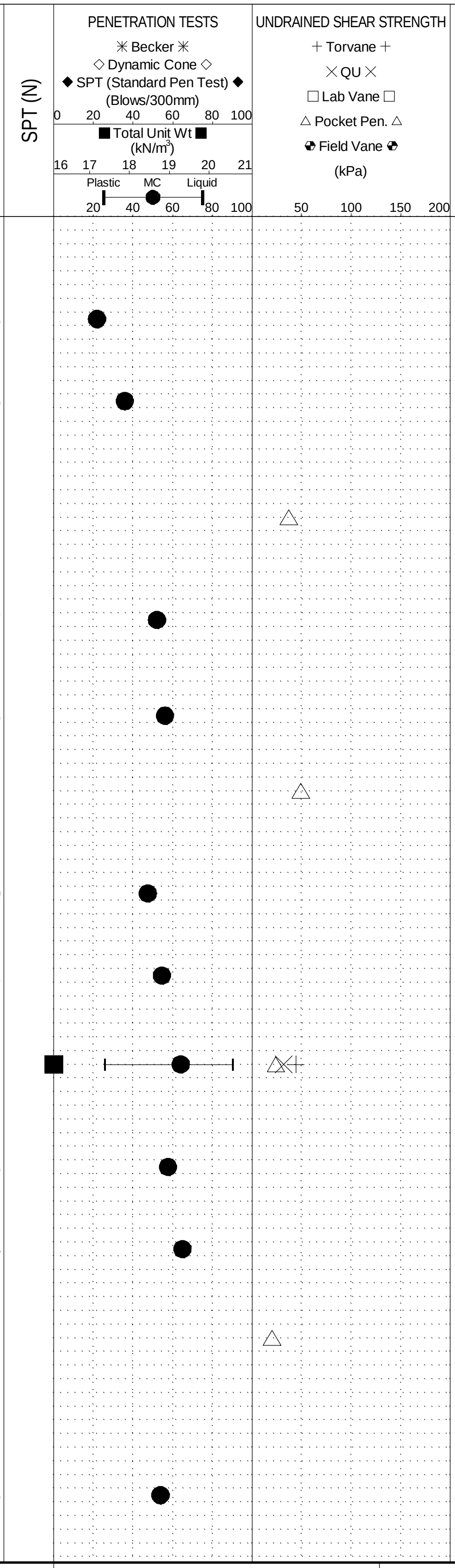
AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 21.95 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/22
PROJECT ENGINEER: Zeyad Shukri	Page 2 of 2

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-D03
LOCATION: Plessis North Bound/CN Rail Intersection, East Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Mobile B-40, 125 mm SSA	ELEVATION (m): 233.28

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◸ NO RECOVERY ▌ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	ELEVATION (m)
0	SAND (Fill) - some gravel - dark brown, moist to dry			233
1	CLAY (Fill) - some sand, trace gravel - black to brown, moist to dry	■	G113	232
2	CLAY - dark brown, dry, firm - intermediate plasticity	■	G115	231
3	- some silt, light brown	▥	T116	230
4		■	G117	229
5	- grey, firm to stiff	■	G118	228
6	- moist to wet, soft below 6.01 m	▥	T119	227
7		■	G120	226
8		■	G121	225
9		▥	T122	224
10	- firm to soft below 9.60 m	■	G123	223
11		■	G124	222
12		▥	T125	221
13				220
14		■	G126	219
15				



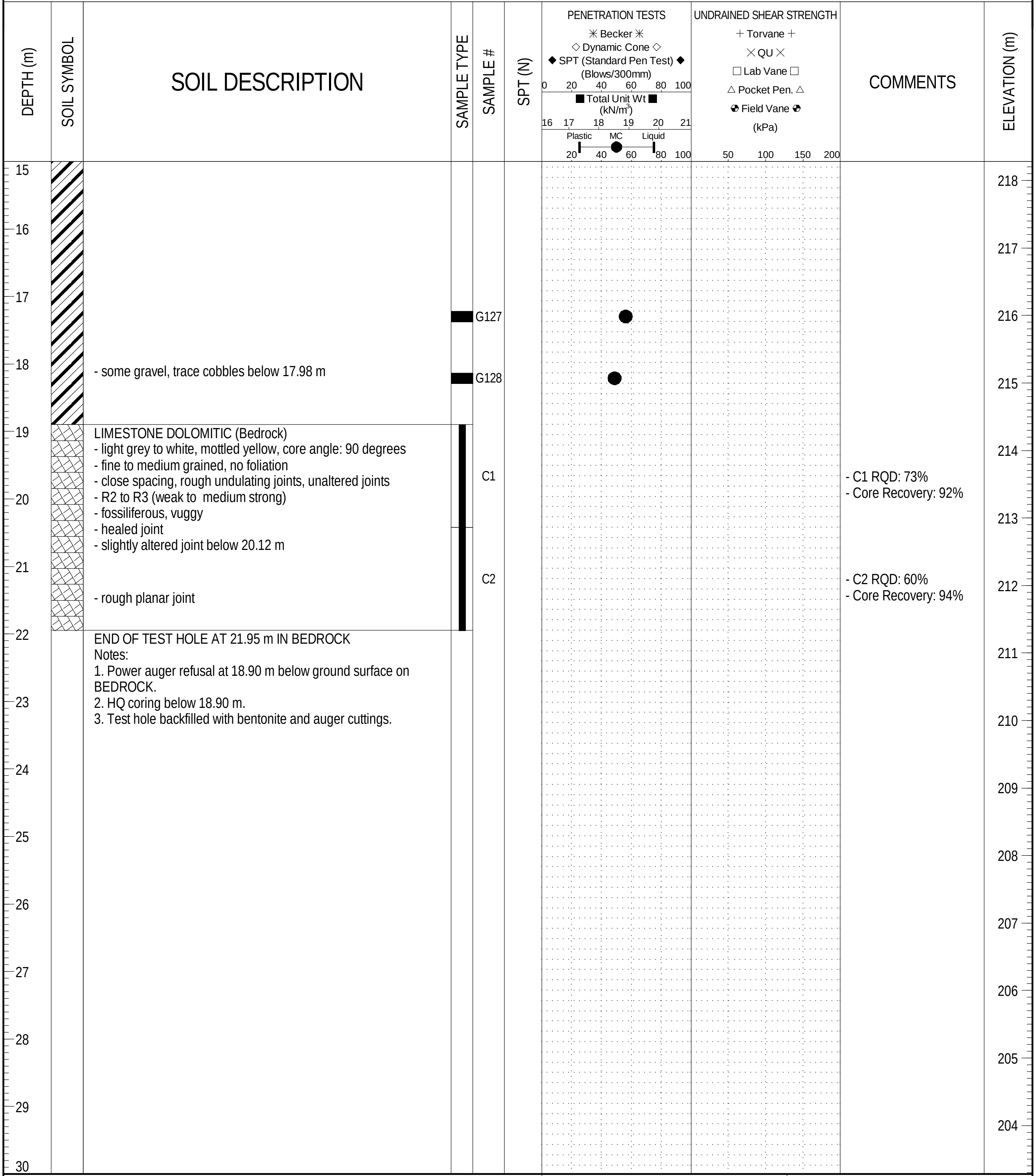
COMMENTS

LOGGED BY: Sam O.	COMPLETION DEPTH: 22.25 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/23
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 2

PROJECT: Plessis Road Underpass
CLIENT: City of Winnipeg
TESTHOLE NO: TH12-D03
LOCATION: Plessis North Bound/CN Rail Intersection, East Shoulder
PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.
METHOD: Mobile B-40, 125 mm SSA
ELEVATION (m): 233.28

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◸ NO RECOVERY ▮ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS	UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION (m)
			■	G127		●			
		- some gravel, trace cobbles below 17.98 m	■	G128		●			
		LIMESTONE DOLOMITIC (Bedrock) - light grey to white, mottled yellow, core angle: 90 degrees - fine to medium grained, no foliation - close spacing, rough undulating joints, unaltered joints - R2 to R3 (weak to medium strong) - fossiliferous, vuggy - healed joint - slightly altered joint below 20.12 m	▮	C1				- C1 RQD: 73% - Core Recovery: 92%	
		- rough planar joint	▮	C2				- C2 RQD: 60% - Core Recovery: 94%	
		END OF TEST HOLE AT 21.95 m IN BEDROCK Notes: 1. Power auger refusal at 18.90 m below ground surface on BEDROCK. 2. HQ coring below 18.90 m. 3. Test hole backfilled with bentonite and auger cuttings.							

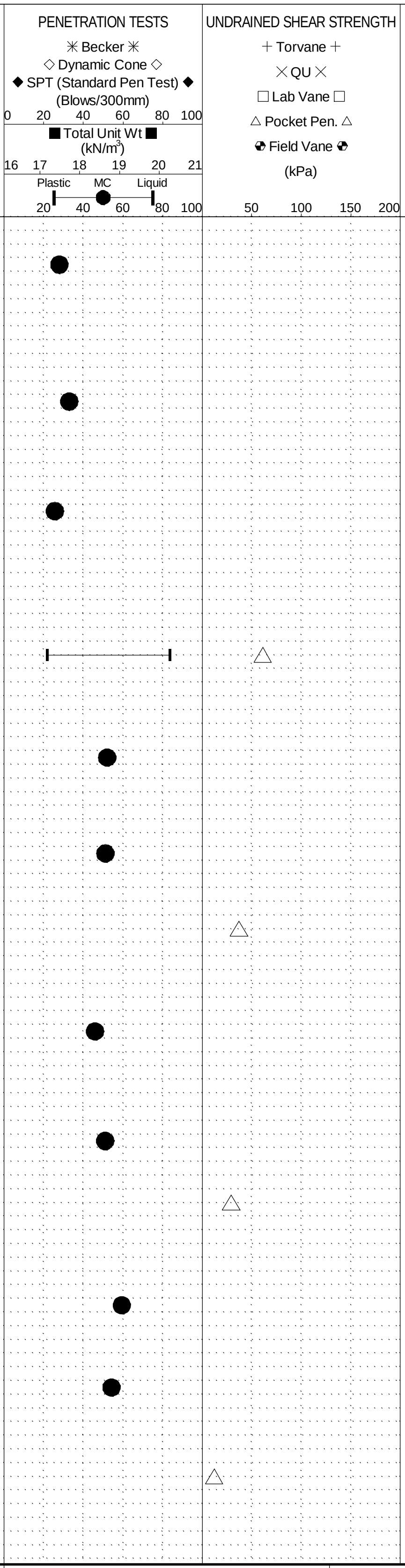


LOGGED BY: Sam O.
REVIEWED BY: Omer Eissa
PROJECT ENGINEER: Zeyad Shukri
COMPLETION DEPTH: 22.25 m
COMPLETION DATE: 12/10/23

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-D04
LOCATION: Plessis North Bound/CN Rail Intersection, East Shoulder Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Mobile B-40, 175 mm HSA	ELEVATION (m): 233.08

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◿ NO RECOVERY ▮ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0	TOPSOIL - some gravel, trace sand - black, dry					
		■	G129			
1	CLAY - grey, dry, firm - intermediate plasticity					232
2		■	G131			231
	SILT - light brown, moist to wet, soft					
3		■	G132			230
4	CLAY - grey, dry, stiff - intermediate plasticity					229
5		▥	T133		Gravel: 0%, Sand: 6.6%, Silt: 21.4%, Clay: 72.0%	228
6	- firm below 6.01 m	■	G134			227
7		■	G135			226
8		▥	T136			225
9	- trace silt inclusions, moist to wet, soft below 9.14 m	■	G137			224
10		■	G138			223
11		▥	T139			222
12		■	G140			221
13		■	G141			220
14		▥	T142			219
15						

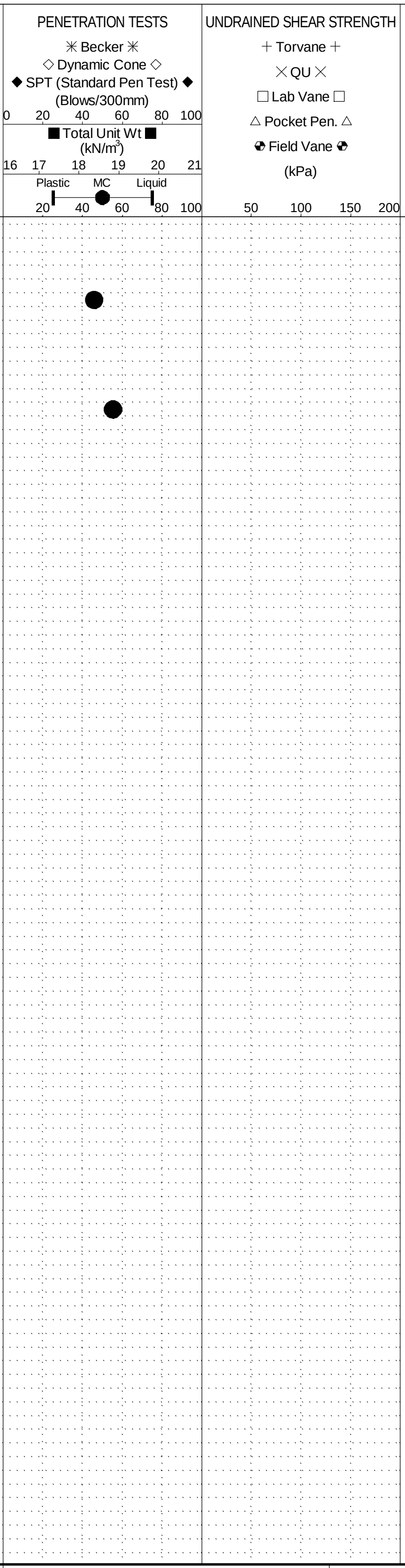


AECOM	LOGGED BY: Sam O.	COMPLETION DEPTH: 23.77 m
	REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/24
	PROJECT ENGINEER: Zeyad Shukri	Page 1 of 2

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-D04
LOCATION: Plessis North Bound/CN Rail Intersection, East Shoulder Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Mobile B-40, 175 mm HSA	ELEVATION (m): 233.08

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◿ NO RECOVERY ▌ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
15	▨						
16	▨		■	G143			217
17	▨	- trace gravel, wet below 16.76 m	■	G144			216
18	☒	LIMESTONE (Bedrock) - light grey to white, core angle: 90 degrees - fine to medium grained, no foliation - moderately close spacing, rough undulating joints, unaltered joints - R2 to R3 (weak to medium strong) - fossiliferous, filled vuggs - high calcium limestone - rough planar joint	▌	C1		- C1 RQD: 33% - Core Recovery: 82%	215
19	☒		▌				214
20	☒		▌	C2		- C2 RQD: 35% - Core Recovery: 100%	213
21	☒		▌	C3		- C3 RQD: 45% - Core Recovery: 100%	212
22	☒		▌				211
23	☒		▌	C4		- C4 RQD: 99% - Core Recovery: 100%	210
24		END OF TEST HOLE AT 23.77 m IN BEDROCK Notes: 1. Power auger refusal at 17.68 m below ground surface on BEDROCK. 2. HQ coring below 17.68 m. 3. Seepage observed at 16.76 m below ground surface. 4. Test hole backfilled with bentonite and auger cuttings.					209
25							208
26							207
27							206
28							205
29							204
30							

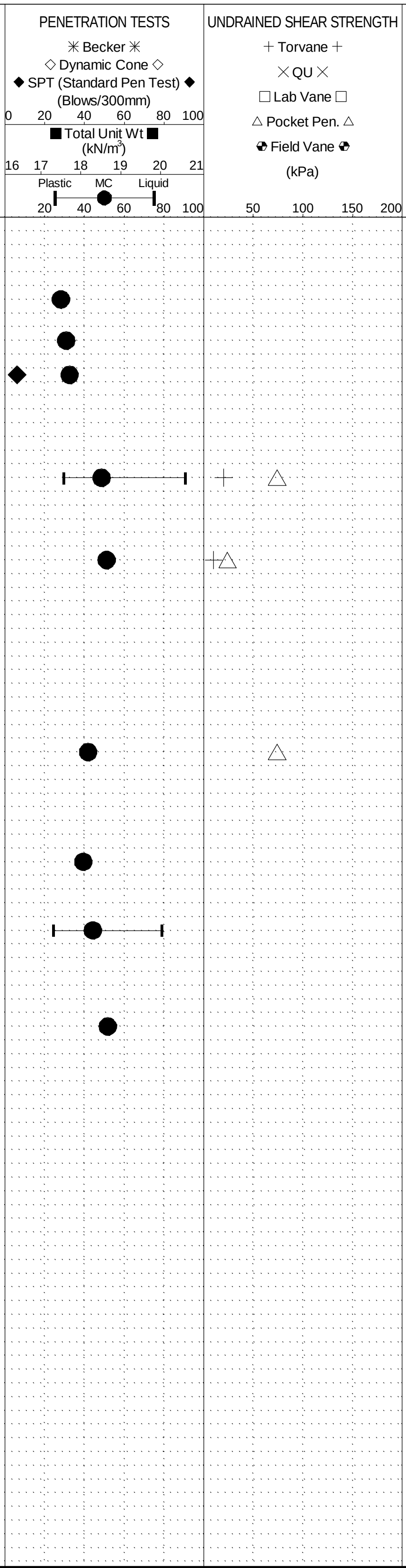


LOGGED BY: Sam O.	COMPLETION DEPTH: 23.77 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/24
PROJECT ENGINEER: Zeyad Shukri	Page 2 of 2

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-I01
LOCATION: Plessis Road North Bound, East Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 231.78

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ⧄ NO RECOVERY ▌ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0	FILL - clayey, some silt, trace sand - light brown to grey, moist, loose to compact					
1	CLAY - silty, trace sand - brown to grey, moist, soft to stiff - high plasticity	■	G7			231
		■	G8			
		☒	S9	6	- 3,3,3 blows/150 mm	230
2	- grey below 2.1 m					
3		■	G10		Gravel: 0%, Sand: 1.0%, Silt: 12.5%, Clay: 86.5%	229
4	- stiff below 4.0 m	■	G11			228
5						227
6		■	G12			226
7		■	G13			225
8		▥	T14			224
9		■	G15			223
10	END OF TEST HOLE AT 9.14 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings upon completion.					222
11						221
12						220
13						219
14						218
15						217

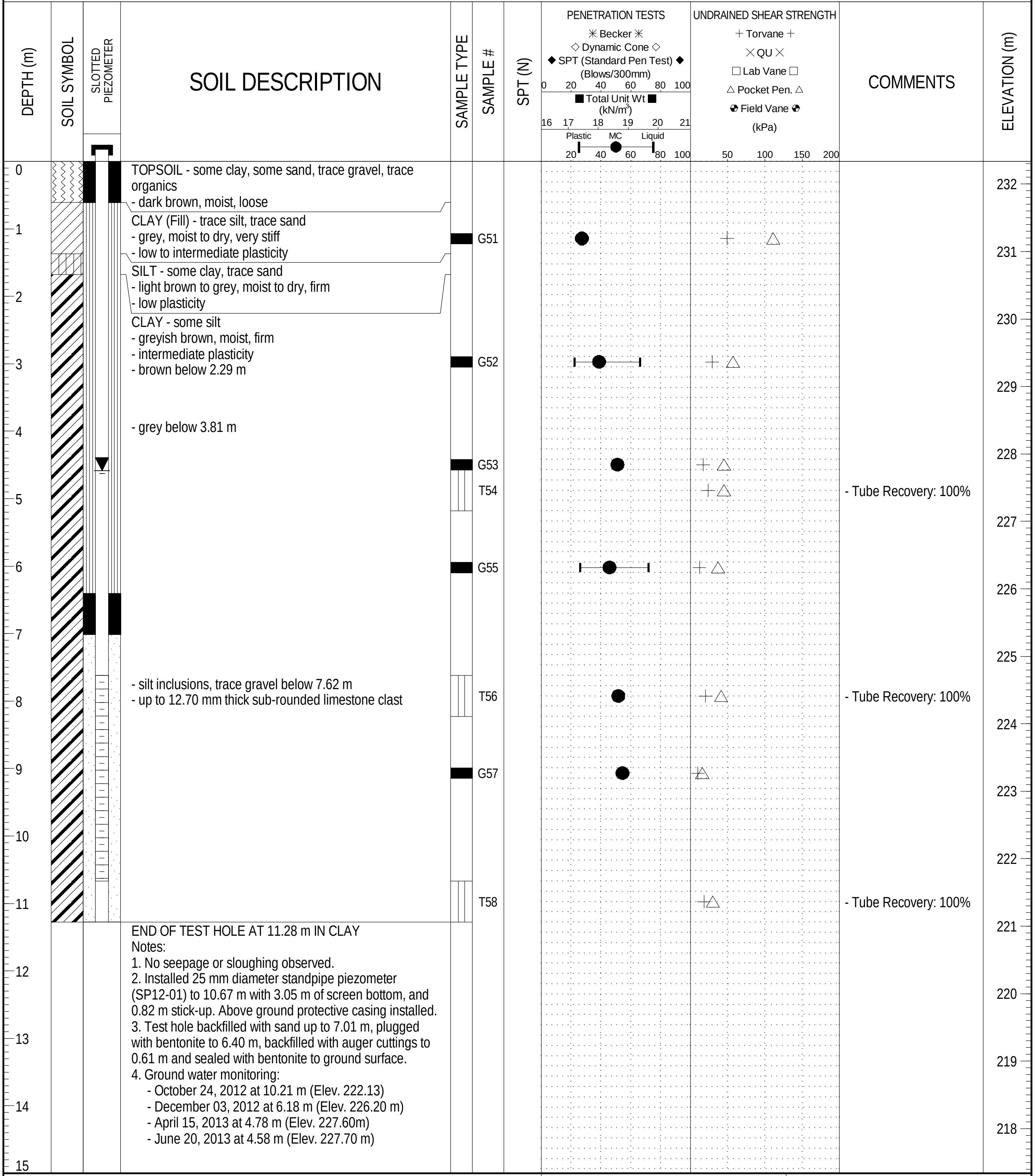


AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 9.14 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/9
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-I02
LOCATION: Plessis Road South Bound, West Shoulder Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.34

SAMPLE TYPE	■ GRAB	▥ SHELBY TUBE	☒ SPLIT SPOON	☰ BULK	▨ NO RECOVERY	▌ CORE
BACKFILL TYPE	■ BENTONITE	⁚ GRAVEL	▥ SLOUGH	▞ GROUT	▨ CUTTINGS	⁚ SAND



SOIL DESCRIPTION

TOPSOIL - some clay, some sand, trace gravel, trace organics
- dark brown, moist, loose

CLAY (Fill) - trace silt, trace sand
- grey, moist to dry, very stiff
- low to intermediate plasticity

SILT - some clay, trace sand
- light brown to grey, moist to dry, firm
- low plasticity

CLAY - some silt
- greyish brown, moist, firm
- intermediate plasticity
- brown below 2.29 m

- grey below 3.81 m

- silt inclusions, trace gravel below 7.62 m
- up to 12.70 mm thick sub-rounded limestone clast

END OF TEST HOLE AT 11.28 m IN CLAY
Notes:
1. No seepage or sloughing observed.
2. Installed 25 mm diameter standpipe piezometer (SP12-01) to 10.67 m with 3.05 m of screen bottom, and 0.82 m stick-up. Above ground protective casing installed.
3. Test hole backfilled with sand up to 7.01 m, plugged with bentonite to 6.40 m, backfilled with auger cuttings to 0.61 m and sealed with bentonite to ground surface.
4. Ground water monitoring:
- October 24, 2012 at 10.21 m (Elev. 222.13)
- December 03, 2012 at 6.18 m (Elev. 226.20 m)
- April 15, 2013 at 4.78 m (Elev. 227.60m)
- June 20, 2013 at 4.58 m (Elev. 227.70 m)

COMMENTS

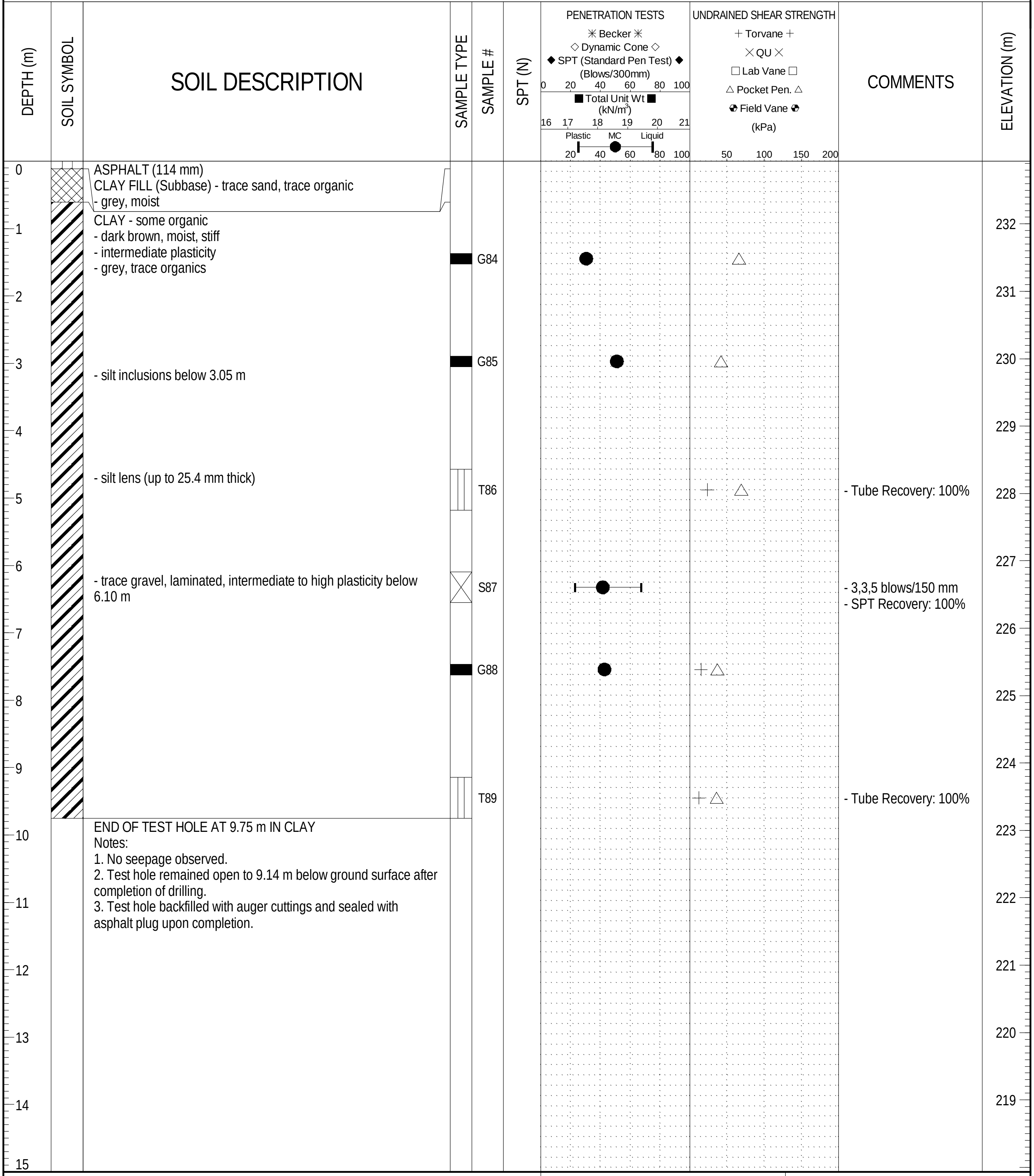
- Tube Recovery: 100% (T54)
- Tube Recovery: 100% (T56)
- Tube Recovery: 100% (T58)

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 11.28 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/10
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-I03
LOCATION: Dugald Road East Bound, Curb Lane		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.93

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◪ NO RECOVERY ▮ CORE



Depth (m)	Soil Description	Sample #	Comments
0	ASPHALT (114 mm) CLAY FILL (Subbase) - trace sand, trace organic - grey, moist		
0.7	CLAY - some organic - dark brown, moist, stiff - intermediate plasticity - grey, trace organics	G84	
3	- silt inclusions below 3.05 m	G85	
4.7	- silt lens (up to 25.4 mm thick)	T86	- Tube Recovery: 100%
6.2	- trace gravel, laminated, intermediate to high plasticity below 6.10 m	S87	- 3,3,5 blows/150 mm - SPT Recovery: 100%
7.5		G88	
9.4		T89	- Tube Recovery: 100%

END OF TEST HOLE AT 9.75 m IN CLAY

Notes:

1. No seepage observed.
2. Test hole remained open to 9.14 m below ground surface after completion of drilling.
3. Test hole backfilled with auger cuttings and sealed with asphalt plug upon completion.

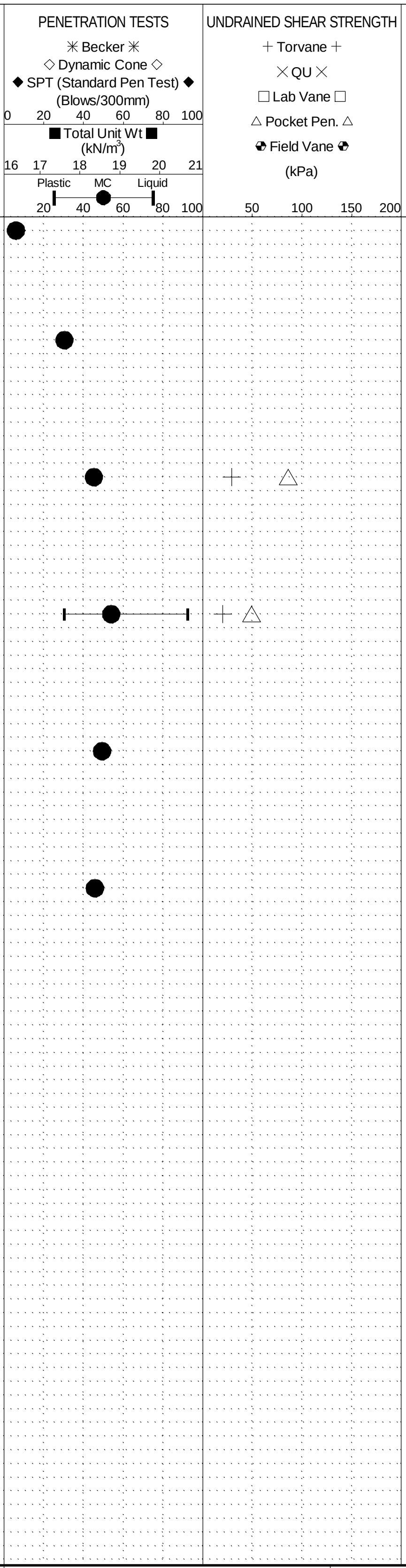
AECOM	LOGGED BY: Sam O.	COMPLETION DEPTH: 9.75 m
	REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/11/10
	PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-I05
LOCATION: Dugal Road East Bound, South Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 229.94

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◿ NO RECOVERY ▌ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0	☒	Sand and Gravel (Fill) - trace silt - brown, moist, compact	■	G16			
	▨	CLAY - trace silt - brown to black, moist, stiff - intermediate plasticity - silty to 1.52 m - some silt, brownish grey to grey below 1.52 m	■ ■ ■ ■ ■	G17 G18 G19 G20 G21			229 228 227 226 225 224 223
		END OF TEST HOLE AT 7.62 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings upon completion.					222 221 220 219 218 217 216

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15



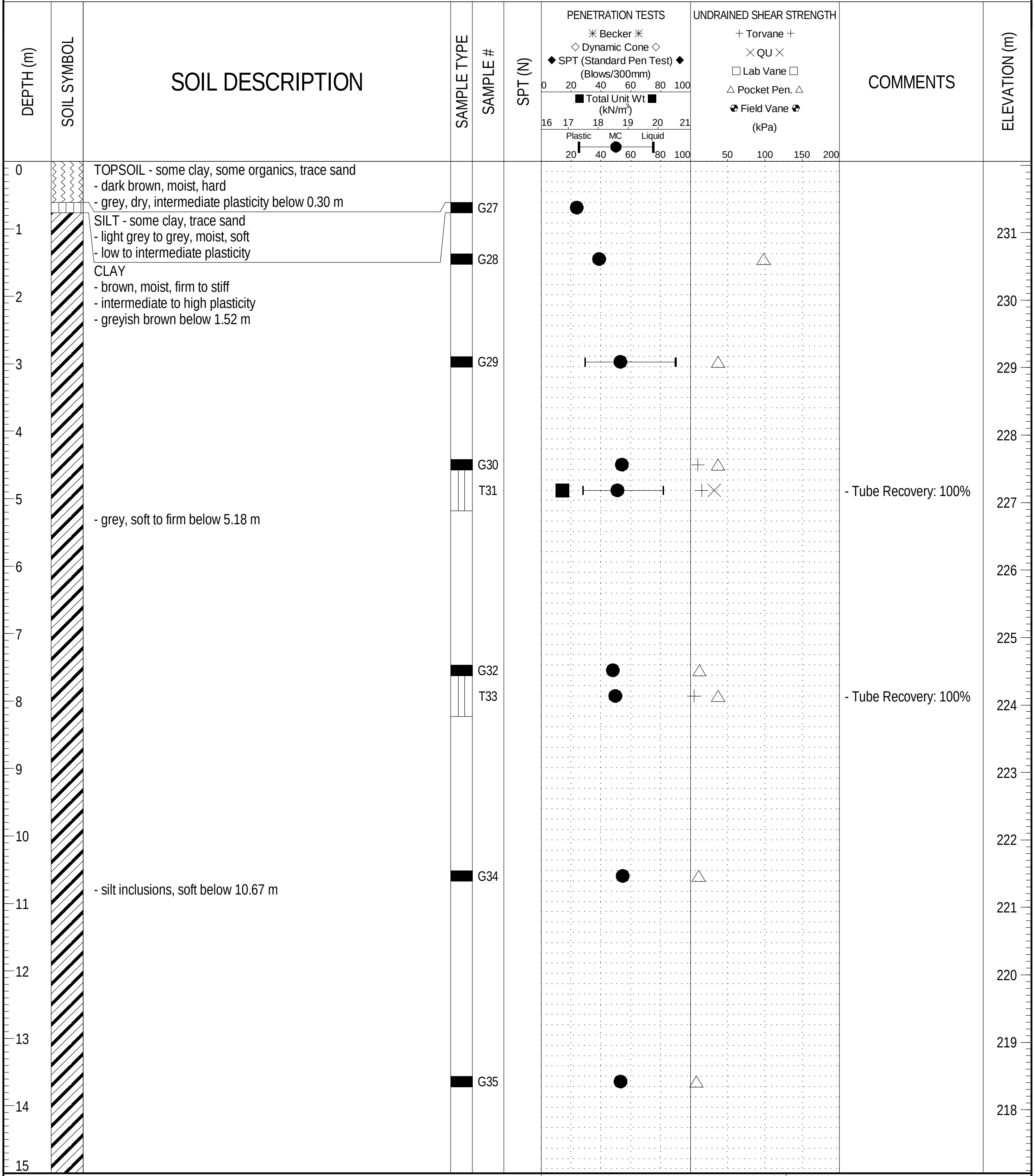
LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 7.62 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/9
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-L01
LOCATION: East of Plessis Road		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.06

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◿ NO RECOVERY ▮ CORE



TOPSOIL - some clay, some organics, trace sand
- dark brown, moist, hard
- grey, dry, intermediate plasticity below 0.30 m

SILT - some clay, trace sand
- light grey to grey, moist, soft
- low to intermediate plasticity

CLAY
- brown, moist, firm to stiff
- intermediate to high plasticity
- greyish brown below 1.52 m

- grey, soft to firm below 5.18 m

- silt inclusions, soft below 10.67 m

T31	- Tube Recovery: 100%
T33	- Tube Recovery: 100%

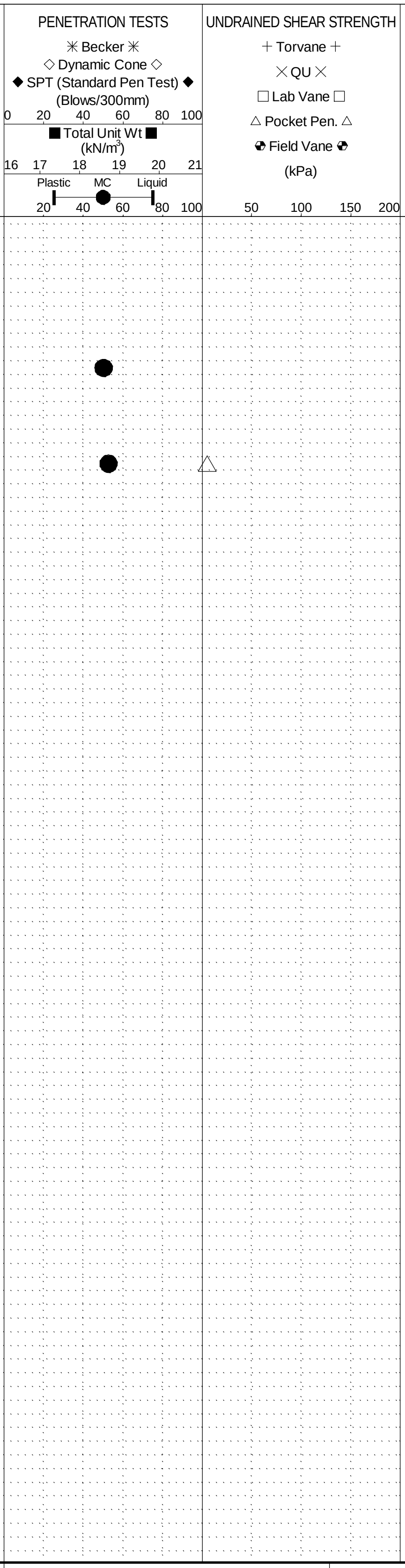
AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 17.98 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/10
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 2

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-L01
LOCATION: East of Plessis Road		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.06

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◿ NO RECOVERY ▮ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
15	▨						
16	▨						216
	▨		■	G36			
17	▨						215
	▨	- limestone cobble up to 0.08 m thick	■	G37			
18		END OF TEST HOLE AT 17.98 m ON BEDROCK Notes: 1. Power auger refusal at 17.98 m below ground surface on BEDROCK. 2. Seepage observed at 10.97 m below ground surface. 3. Test hole remained open to 12.80 m below ground surface after completion of drilling. 4. Test hole backfilled with auger cuttings upon completion.					214
19							213
20							212
21							211
22							210
23							209
24							208
25							207
26							206
27							205
28							204
29							203
30							

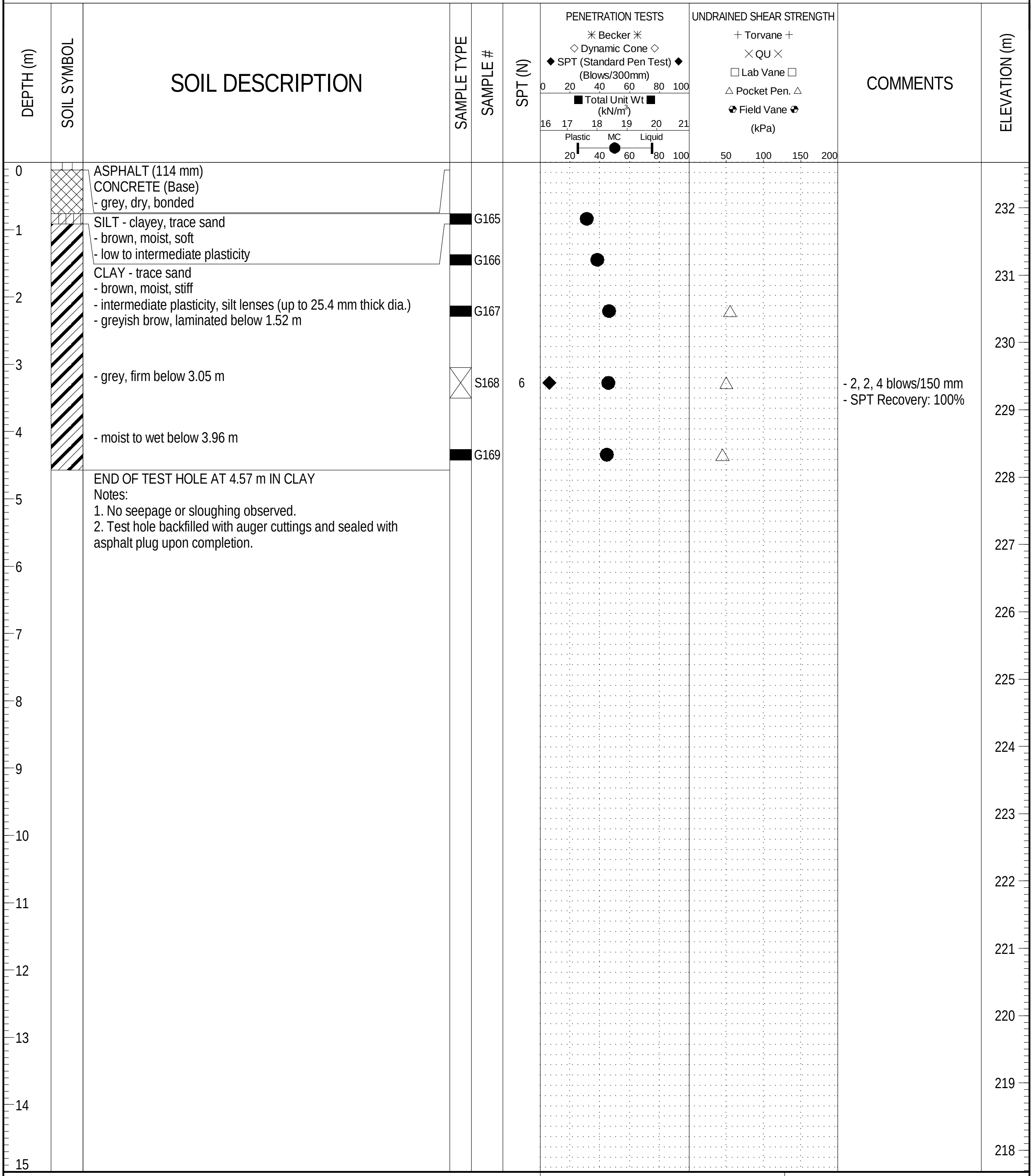


AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 17.98 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/10
PROJECT ENGINEER: Zeyad Shukri	

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S01
LOCATION: Plessis Road North Bound, Curb Lane		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.68

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◺ NO RECOVERY ▐ CORE



ASPHALT (114 mm)
CONCRETE (Base)
- grey, dry, bonded

SILT - clayey, trace sand
- brown, moist, soft
- low to intermediate plasticity

CLAY - trace sand
- brown, moist, stiff
- intermediate plasticity, silt lenses (up to 25.4 mm thick dia.)
- greyish brow, laminated below 1.52 m

- grey, firm below 3.05 m

- moist to wet below 3.96 m

END OF TEST HOLE AT 4.57 m IN CLAY
Notes:
1. No seepage or sloughing observed.
2. Test hole backfilled with auger cuttings and sealed with asphalt plug upon completion.

COMMENTS (S168):
- 2, 2, 4 blows/150 mm
- SPT Recovery: 100%

LOGGED BY: Sam O.	COMPLETION DEPTH: 4.57 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/31
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S02
LOCATION: Plessis Road South Bound, Curb Lane		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.39

SAMPLE TYPE: ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◿ NO RECOVERY ▮ CORE

SOIL DESCRIPTION

ASPHALT (114 mm)

CONCRETE (Base)
- grey, dry, bonded

FILL (Subbase) - some clay, some sand, trace gravel
- greyish black, moist, firm

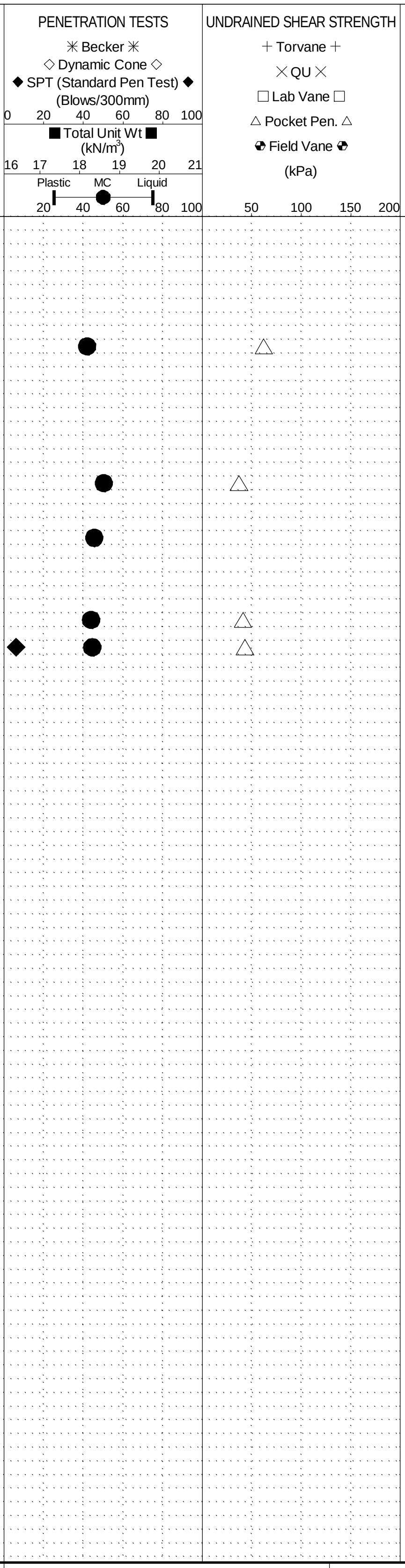
CLAY
- brown, moist, stiff
- intermediate plasticity, laminated
- silt inclusions, firm below 3.05 m
- silty sand pocket
- greyish brown, trace gravel, trace oxidation below 3.66 m

END OF TEST HOLE AT 5.03 m IN CLAY

Notes:
1. No seepage or sloughing observed.
2. Test hole backfilled with auger cuttings and sealed with asphalt plug upon completion.

SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS
■	G170		
■	G171		
■	G172		
■	G173		
☒	S174	6	- 2, 2, 4 blows/150 mm - SPT Recovery: 100%

DEPTH (m)	ELEVATION (m)
0	232
1	231
2	230
3	229
4	228
5	227
6	226
7	225
8	224
9	223
10	222
11	221
12	220
13	219
14	218
15	



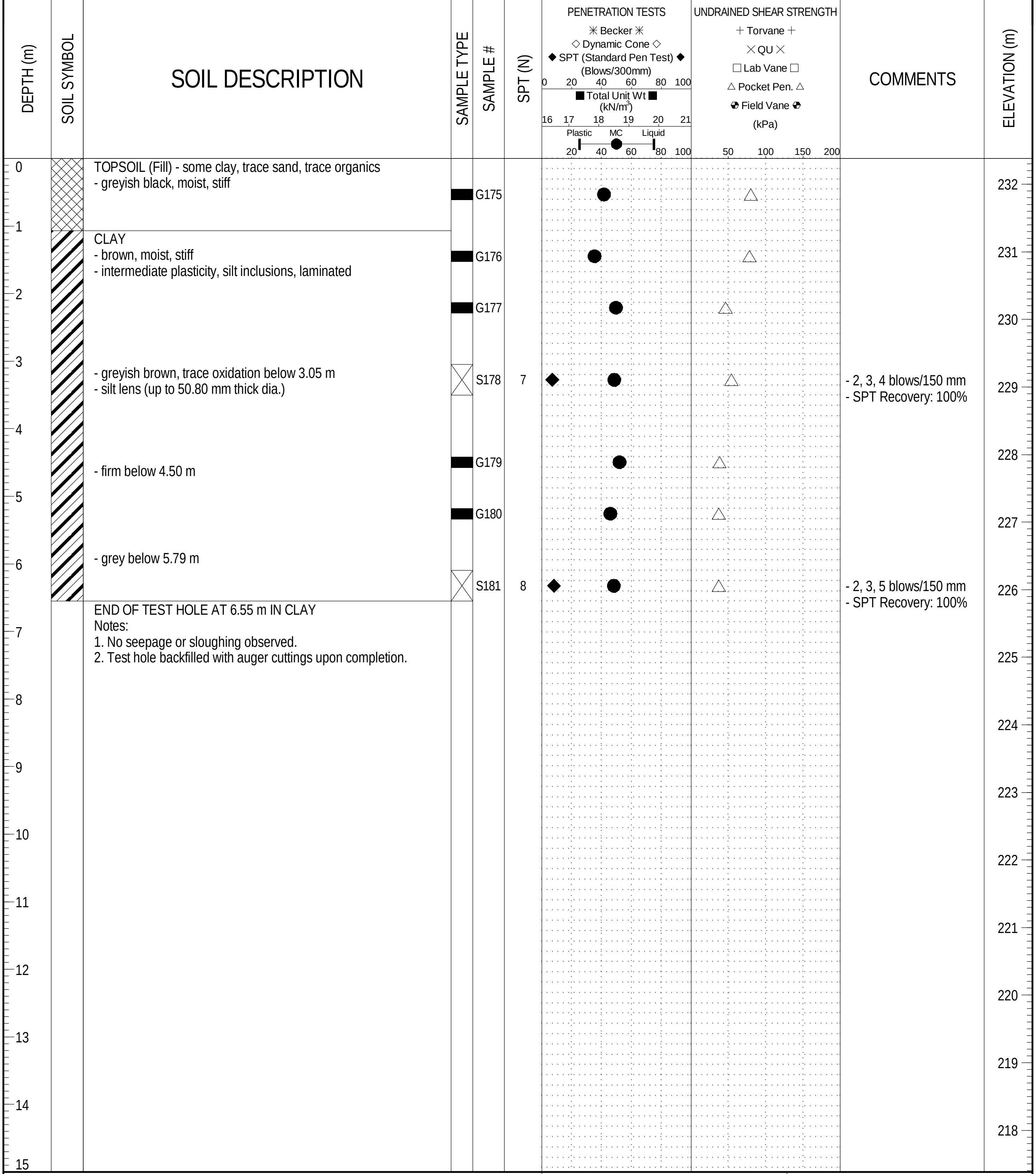
LOGGED BY: Sam O.	COMPLETION DEPTH: 5.03 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/31
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

AECOM

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S03
LOCATION: Plessis Road North Bound, East Shoulder Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.38

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◩ NO RECOVERY ▮ CORE

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS
TOPSOIL (Fill) - some clay, trace sand, trace organics - greyish black, moist, stiff	■	G175		
CLAY - brown, moist, stiff - intermediate plasticity, silt inclusions, laminated	■	G176		
	■	G177		
- greyish brown, trace oxidation below 3.05 m - silt lens (up to 50.80 mm thick dia.)	☒	S178	7	- 2, 3, 4 blows/150 mm - SPT Recovery: 100%
- firm below 4.50 m	■	G179		
	■	G180		
- grey below 5.79 m	☒	S181	8	- 2, 3, 5 blows/150 mm - SPT Recovery: 100%
END OF TEST HOLE AT 6.55 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings upon completion.				



LOGGED BY: Sam O.	COMPLETION DEPTH: 6.55 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/31
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

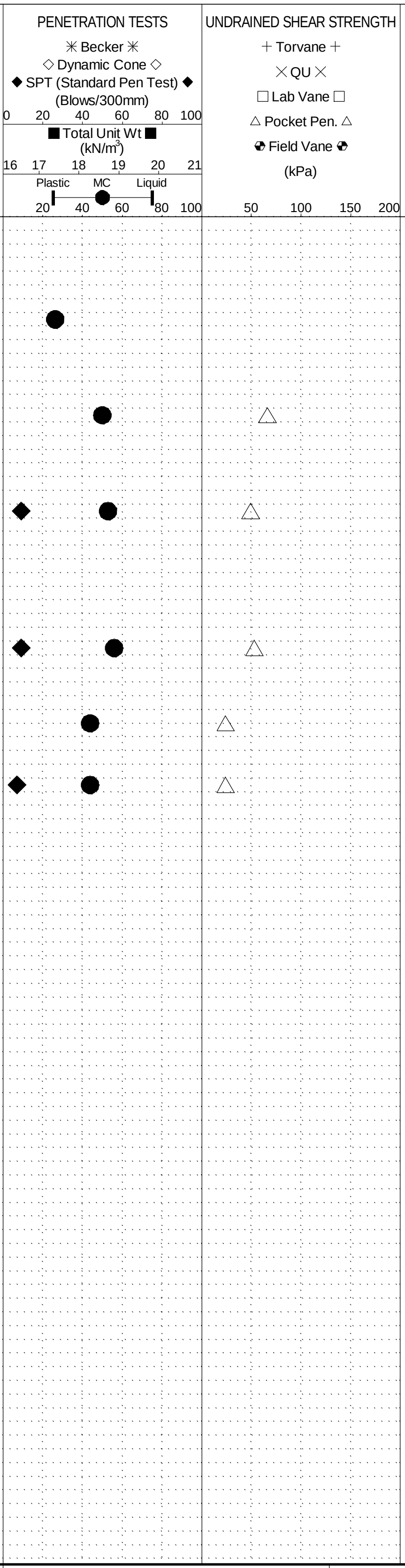
PROJECT: Plessis Road Underpass | CLIENT: City of Winnipeg | TESTHOLE NO: TH12-S04

LOCATION: Plessis Road South Bound, West Shoulder Lawn | PROJECT NO.: 60273041

CONTRACTOR: Maple Leaf Drilling Ltd. | METHOD: Track Mounted MP5, 125 mm SSA | ELEVATION (m): 231.85

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◪ NO RECOVERY ▮ CORE

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS
TOPSOIL (Fill) - some clay, some organics, trace sand - dark brown, moist, soft				
SILT - some clay, trace organics - brown, moist, soft - low to intermediate plasticity	■	G182		
CLAY - brown, moist, stiff - intermediate plasticity, laminated	■	G183		
- greyish brown, trace oxidation below 2.74 m - silt lens (up to 50.80 mm thick dia.)	☒	S184	9	- 2, 4, 5 blows/150 mm - SPT Recovery: 100%
	☒	S185	9	- 2, 4, 5 blows/150 mm - SPT Recovery: 100%
- grey, soft to firm below 5.03 m	■	G186		
- silt inclusions, trace sand below 5.79 m	☒	S187	7	- 2, 3, 4 blows/150 mm - SPT Recovery: 100%
END OF TEST HOLE AT 6.55 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings upon completion.				



DEPTH (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

ELEVATION (m): 231 230 229 228 227 226 225 224 223 222 221 220 219 218 217

AECOM

LOGGED BY: Sam O. | COMPLETION DEPTH: 6.55 m

REVIEWED BY: Omer Eissa | COMPLETION DATE: 12/10/31

PROJECT ENGINEER: Zeyad Shukri

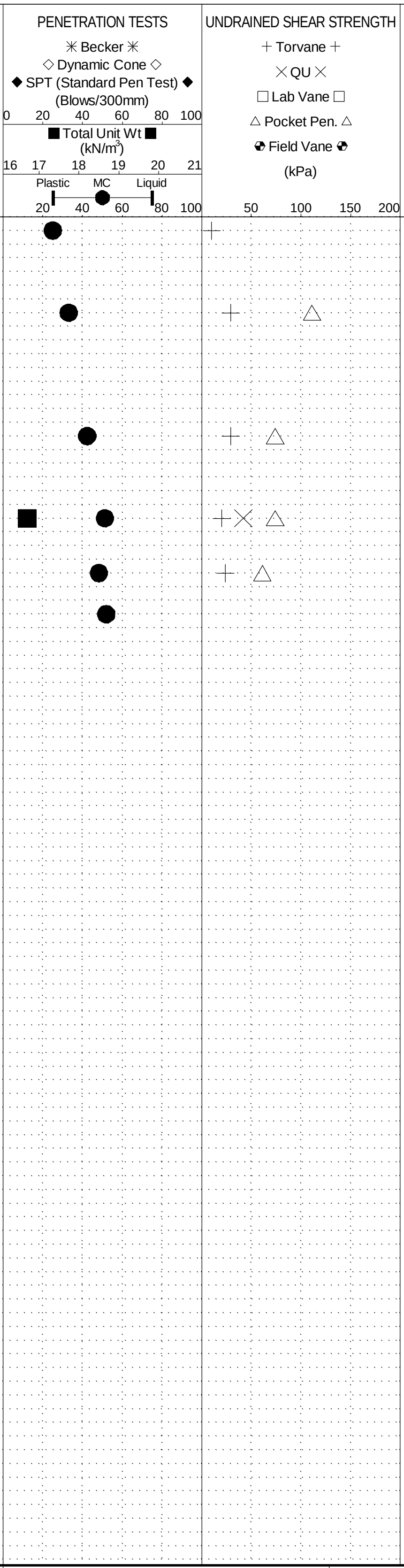
PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S05
LOCATION: Plessis Road North Bound, East Shoulder Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.23

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◿ NO RECOVERY ▮ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0		TOPSOIL - organic, trace roots - black, moist	■	G1			232
		CLAY - trace sand, trace silt - brownish grey, moist, stiff to very stiff - intermediate plasticity - brown, wet, stiff, high plasticity below 1.8 m	■ ■ ▥ ■ ■	G2 G3 T4 G5 G6			
4.57		END OF TEST HOLE AT 4.57 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings upon completion.					

DEPTH (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

ELEVATION (m): 232 231 230 229 228 227 226 225 224 223 222 221 220 219 218

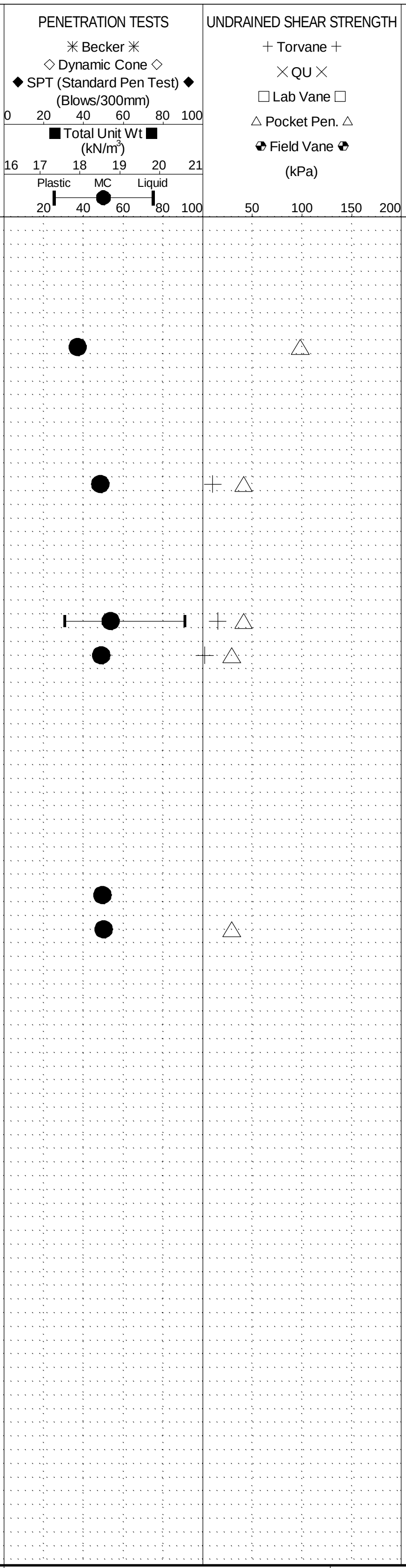


LOGGED BY: Sam O.	COMPLETION DEPTH: 4.57 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/9
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S07
LOCATION: Plessis Road South Bound, West Shoulder Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.19

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◿ NO RECOVERY ▮ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0	☒	FILL - sandy, some gravel, some clay - brown, moist to dry, very stiff					232
	▥	SILT - some clay, trace sand - light grey to grey, moist, soft to firm - low plasticity					
1							231
	▨	CLAY - brown, moist to dry, stiff - intermediate plasticity	■	G38			
2		- trace oxidation, silt inclusions below 2.28 m					230
3			■	G39			229
		- greyish brown - grey, firm below 3.20 m					
4							228
			■	G40		Gravel: 0%, Sand: 0%, Silt: 12.4%, Clay: 87.6%	
			▥	T41		- Tube Recovery: 100%	
5							227
6		- moist to wet, soft below 6.01 m					226
7							225
			■	G42			
8			▥	T43		- Tube Recovery: 100%	224
		END OF TEST HOLE AT 8.23 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings upon completion.					
9							223
10							222
11							221
12							220
13							219
14							218
15							

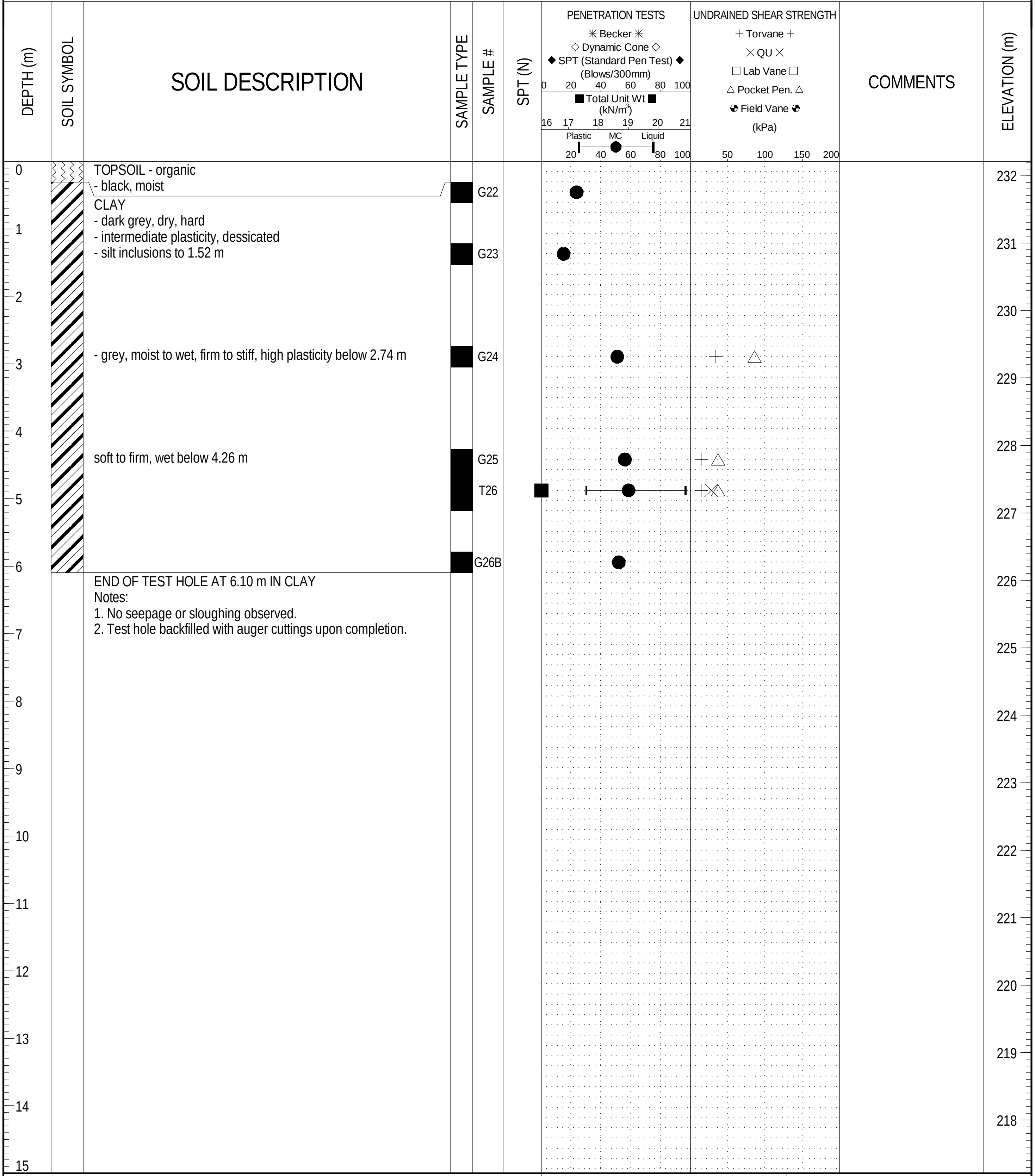


AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 8.23 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/10
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

PROJECT: Plessis Road Underpass
CLIENT: City of Winnipeg
TESTHOLE NO: TH12-S08
LOCATION: Plessis Road North Bound, East Shoulder
PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.
METHOD: Track Mounted MP5, 125 mm SSA
ELEVATION (m): 232.21

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◺ NO RECOVERY ▮ CORE



TOPSOIL - organic
- black, moist

CLAY
- dark grey, dry, hard
- intermediate plasticity, dessicated
- silt inclusions to 1.52 m

- grey, moist to wet, firm to stiff, high plasticity below 2.74 m

soft to firm, wet below 4.26 m

END OF TEST HOLE AT 6.10 m IN CLAY
Notes:
1. No seepage or sloughing observed.
2. Test hole backfilled with auger cuttings upon completion.

LOGGED BY: Sam O.
REVIEWED BY: Omer Eissa
PROJECT ENGINEER: Zeyad Shukri
COMPLETION DEPTH: 6.10 m
COMPLETION DATE: 12/9/10

LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S09
LOCATION: Plessis/Dugald Intersection, North East Corner Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Mobile B-40, 125 mm SSA	ELEVATION (m): 232.26

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◿ NO RECOVERY ▮ CORE

DEPTH (m) | SOIL SYMBOL | SOIL DESCRIPTION | SAMPLE TYPE | SAMPLE # | SPT (N) | COMMENTS | ELEVATION (m)

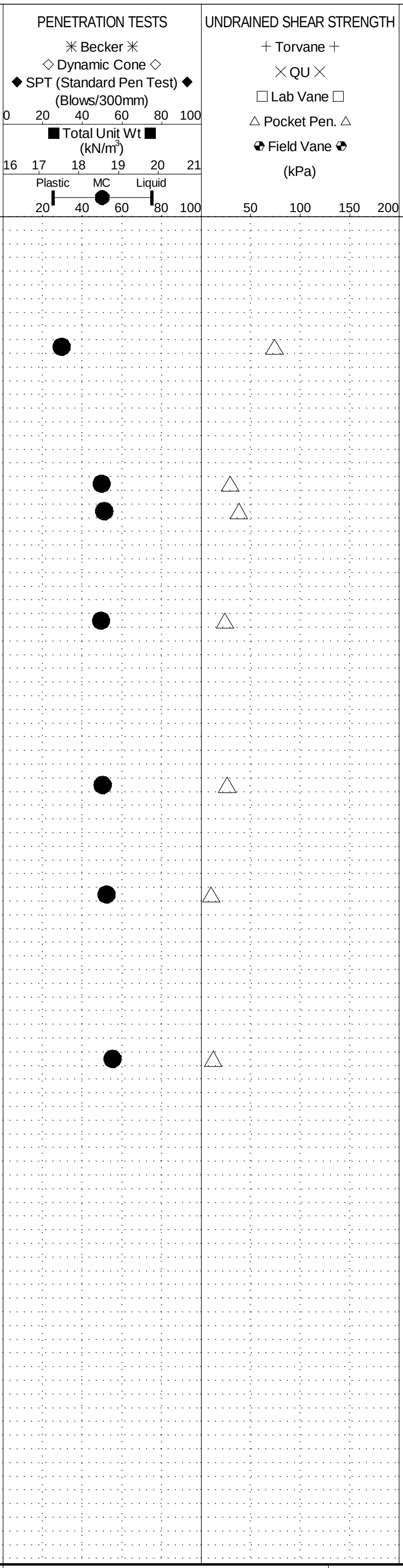
SOIL DESCRIPTION

TOPSOIL - some clay, some organics, trace sand
- dark brown, moist

CLAY - trace sand
- brown, moist, stiff
- intermediate plasticity
- silt lens (25.4 mm thick)
- greyish brown, silt inclusions, firm, trace oxidation below 1.52 m
- grey, intermediate to high plasticity below 3.35 m

END OF TEST HOLE AT 9.60 m IN CLAY
Notes:
1. No seepage or sloughing observed.
2. Test hole backfilled with auger cuttings and sealed with bentonite at ground surface upon completion.

SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS
■	G158		
■	G159		
☒	S160		- 1, 2, 3 blows/150 mm - SPT Recovery: 100%
■	G161		
☒	S162		- 1, 2, 3 blows/150 mm - SPT Recovery: 100%
■	G163		
☒	S164		- 1, 2, 3 blows/150 mm - SPT Recovery: 100%



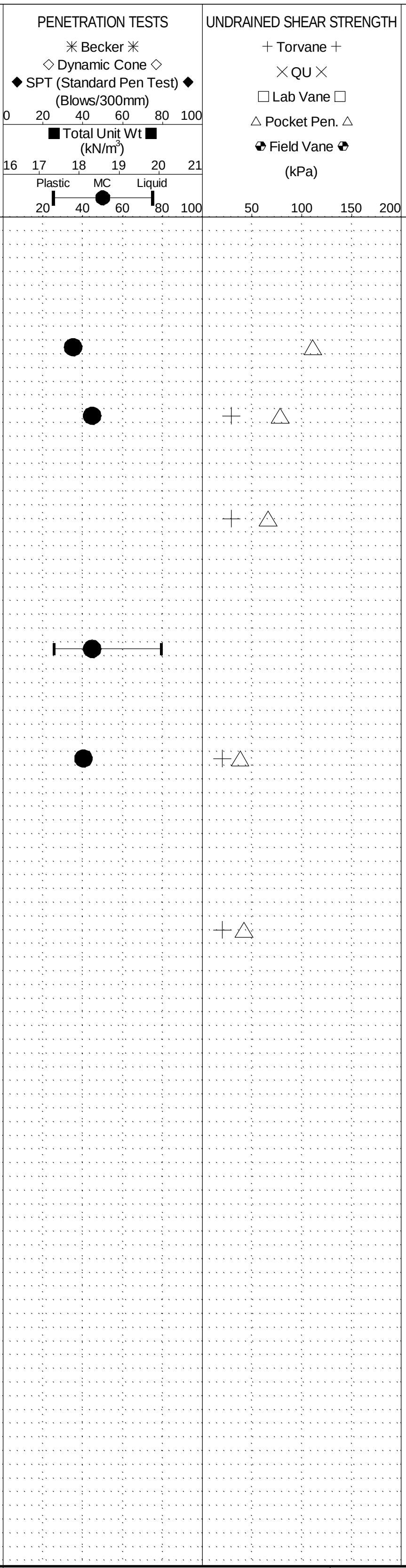
AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 9.60 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/27
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S10
LOCATION: Dugald Road West Bound, Curb Lane		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 233.07

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◩ NO RECOVERY ▌ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0	ASPHALT (114 mm) SAND and GRAVEL Fill (Base) - brown, dry, loose					233.07
1	CLAY (Fill) - trace sand - grey, moist to dry, very stiff - intermediate plasticity	■	G74			232
2	CLAY - brown, moist, stiff - intermediate plasticity	■	G75			231
3	- silt inclusions, laminated, trace oxidation below 2.13 m	▥	T76		- Tube Recovery: 100%	230
4						229
5		☒	S77		- 3,3,4, blows/150 mm - SPT Recovery: 100% Gravel: 0%, Sand: 0%, Silt: 32.5%, Clay: 67.5%	228
6	- brown to grey, soft to firm	■	G78			227
7						226
8	- grey, moist, intermediate to high plasticity below 7.62 m - silt lens (up to 25.4 mm thick)	▥	T79		- Tube Recovery: 100%	225
9	END OF TEST HOLE AT 8.23 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings and sealed with asphalt plug upon completion.					224
10						223
11						222
12						221
13						220
14						219
15						

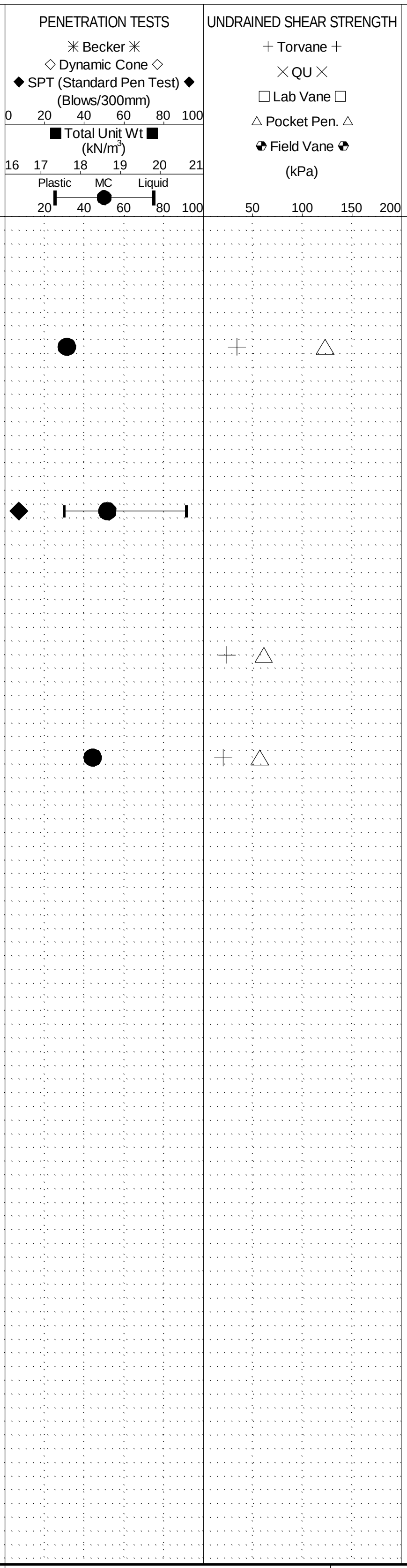


LOGGED BY: Sam O.	COMPLETION DEPTH: 8.23 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/11
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S11
LOCATION: Dugald Road West Bound, North Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.65

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◿ NO RECOVERY ▐ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS
0	SAND and GRAVEL (Fill) - trace clay, trace organics - brown, dry, loose				
0.6	CLAY - trace sand, trace gravel - grey, moist, stiff - intermediate plasticity				
1.45	- silt inclusions, silt lens (up to 51 mm thick) below 1.52 m	■	G80		
3.3		☒	S81	7	- 2,3,4 blows/150 mm - SPT Recovery: 100%
4.27	- greyish brown, trace oxidation, laminated below 4.27 m				
4.85		▥	T82		- Tube Recovery: 100%
6.0		■	G83		
6.10	END OF TEST HOLE AT 6.10 m IN CLAY Notes: 1. No seepage observed. 2. Test hole remained open to 4.57 m below ground surface after completion of drilling. 3. Test hole backfilled with auger cuttings upon completion.				



DEPTH (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

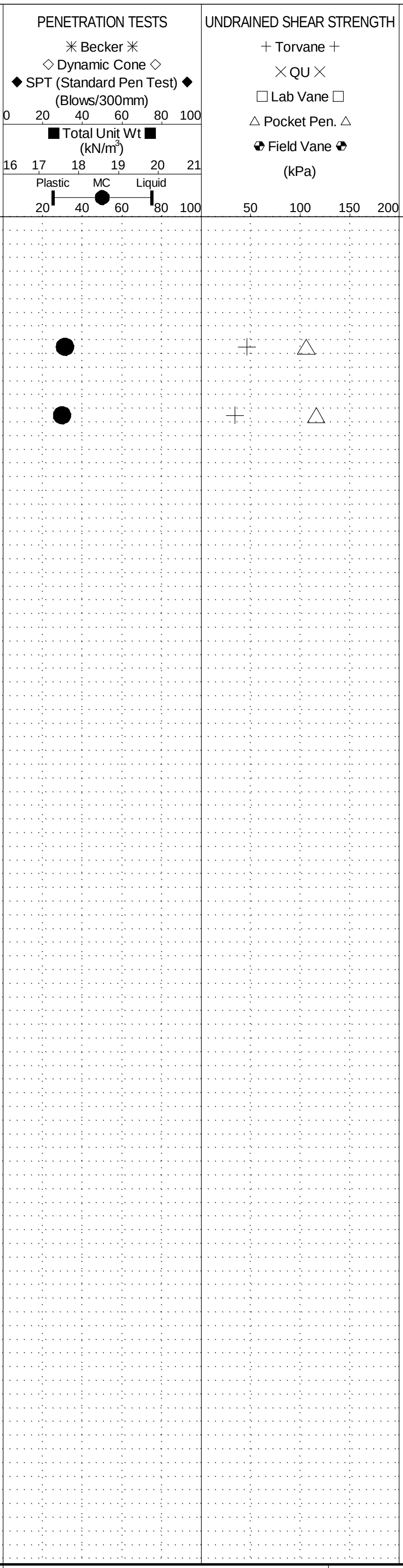
ELEVATION (m): 232 231 230 229 228 227 226 225 224 223 222 221 220 219 218

LOGGED BY: Sam O.	COMPLETION DEPTH: 6.10 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/11/10
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S12
LOCATION: Dugald Road West Bound, North Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.99

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◺ NO RECOVERY ▐ CORE

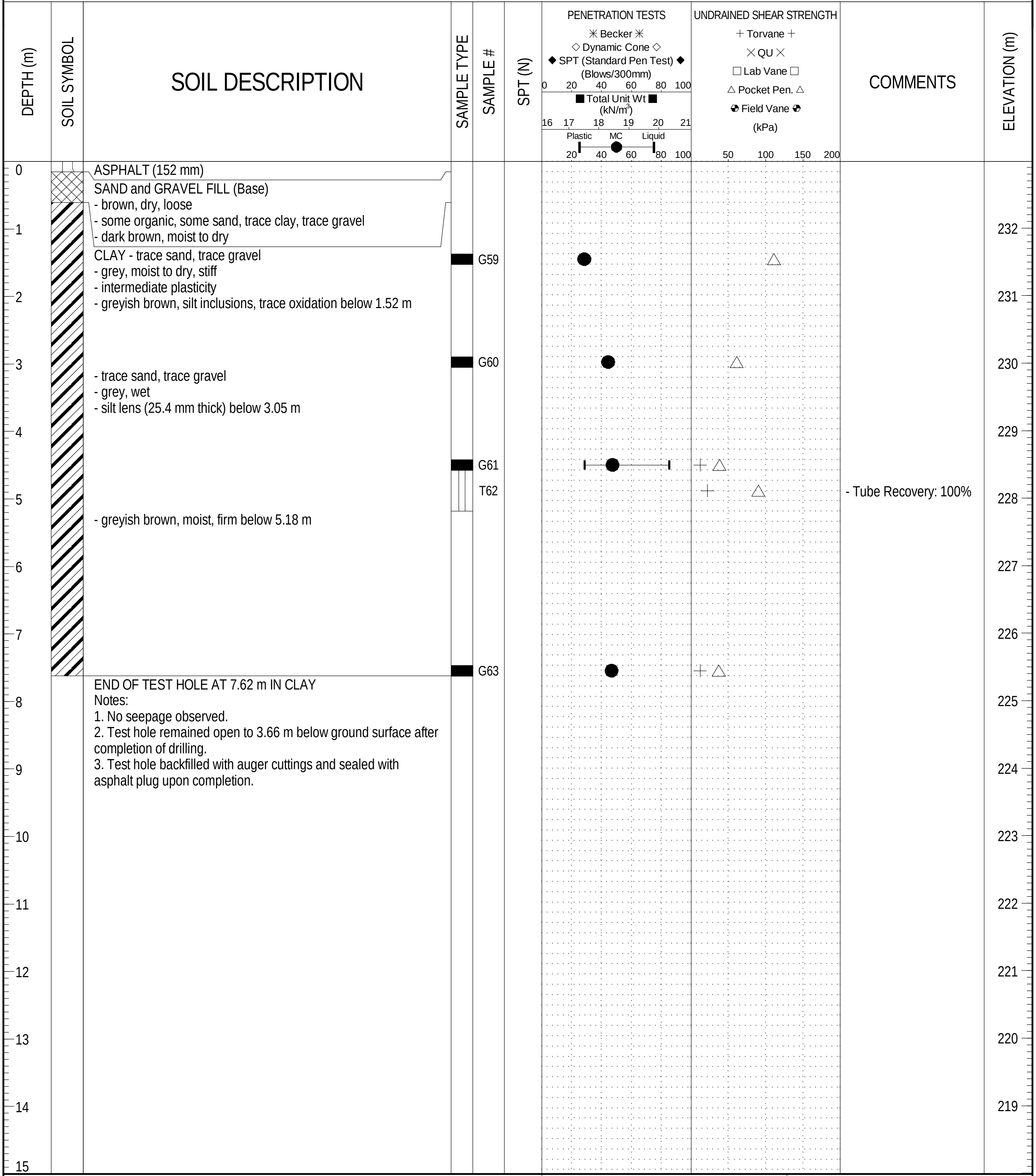
DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION (m)
0	☒	SAND and GRAVEL (Fill) - trace clay, trace organics - brown, moist, loose						
	▨	CLAY (Fill) - trace gravel, trace sand - grey, moist to dry, stiff to very stiff - intermediate plasticity						
1								232
			■	G71		● + △		
2								231
			■	G72		● + △		
		- brown, very stiff, intermediate to high plasticity - silt seam (0.61 m thick) - grey, wet, oxidized - low plasticity						
3			▥	T73				230
		END OF TEST HOLE AT 3.35 m IN CLAY Notes: 1. Seepage observed at 0.30 m below ground surface. 2. No sloughing observed. 3. Test hole backfilled with auger cuttings and sealed with bentonite upon completion.						
4								229
5								228
6								227
7								226
8								225
9								224
10								223
11								222
12								221
13								220
14								219
15								



LOGGED BY: Sam O.	COMPLETION DEPTH: 3.35 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/11
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S13
LOCATION: Dugald Road East Bound, Curb Lane		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.99

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◿ NO RECOVERY ▮ CORE



ASPHALT (152 mm)

SAND and GRAVEL FILL (Base)
- brown, dry, loose
- some organic, some sand, trace clay, trace gravel
- dark brown, moist to dry

CLAY - trace sand, trace gravel
- grey, moist to dry, stiff
- intermediate plasticity
- greyish brown, silt inclusions, trace oxidation below 1.52 m

- trace sand, trace gravel
- grey, wet
- silt lens (25.4 mm thick) below 3.05 m

- greyish brown, moist, firm below 5.18 m

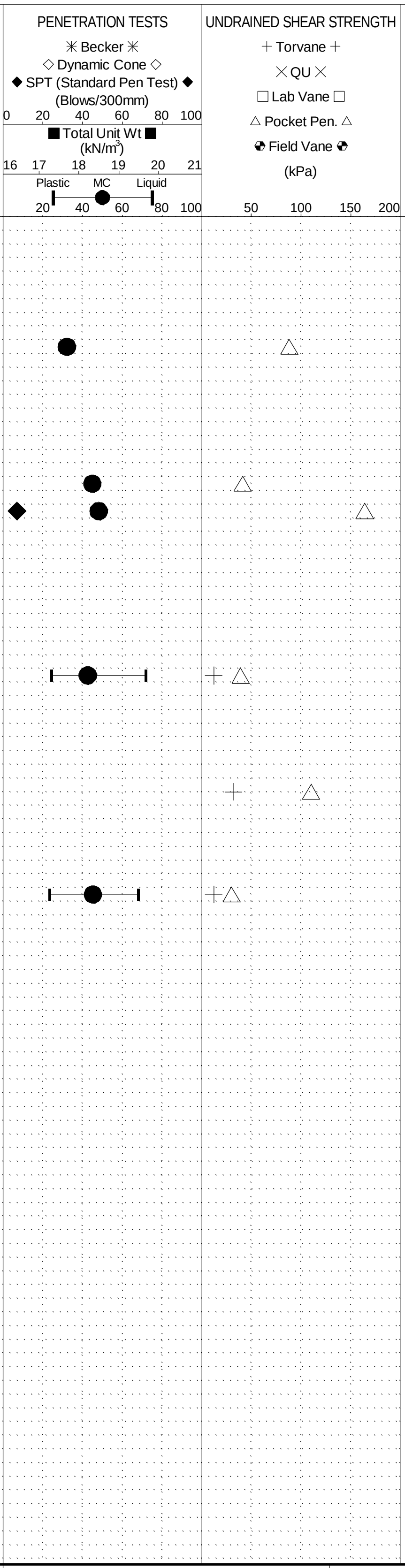
END OF TEST HOLE AT 7.62 m IN CLAY
Notes:
1. No seepage observed.
2. Test hole remained open to 3.66 m below ground surface after completion of drilling.
3. Test hole backfilled with auger cuttings and sealed with asphalt plug upon completion.

LOGGED BY: Sam O.	COMPLETION DEPTH: 7.62 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/11
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S14
LOCATION: Dugald Road West Bound, North Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 233.28

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◺ NO RECOVERY ▌ CORE

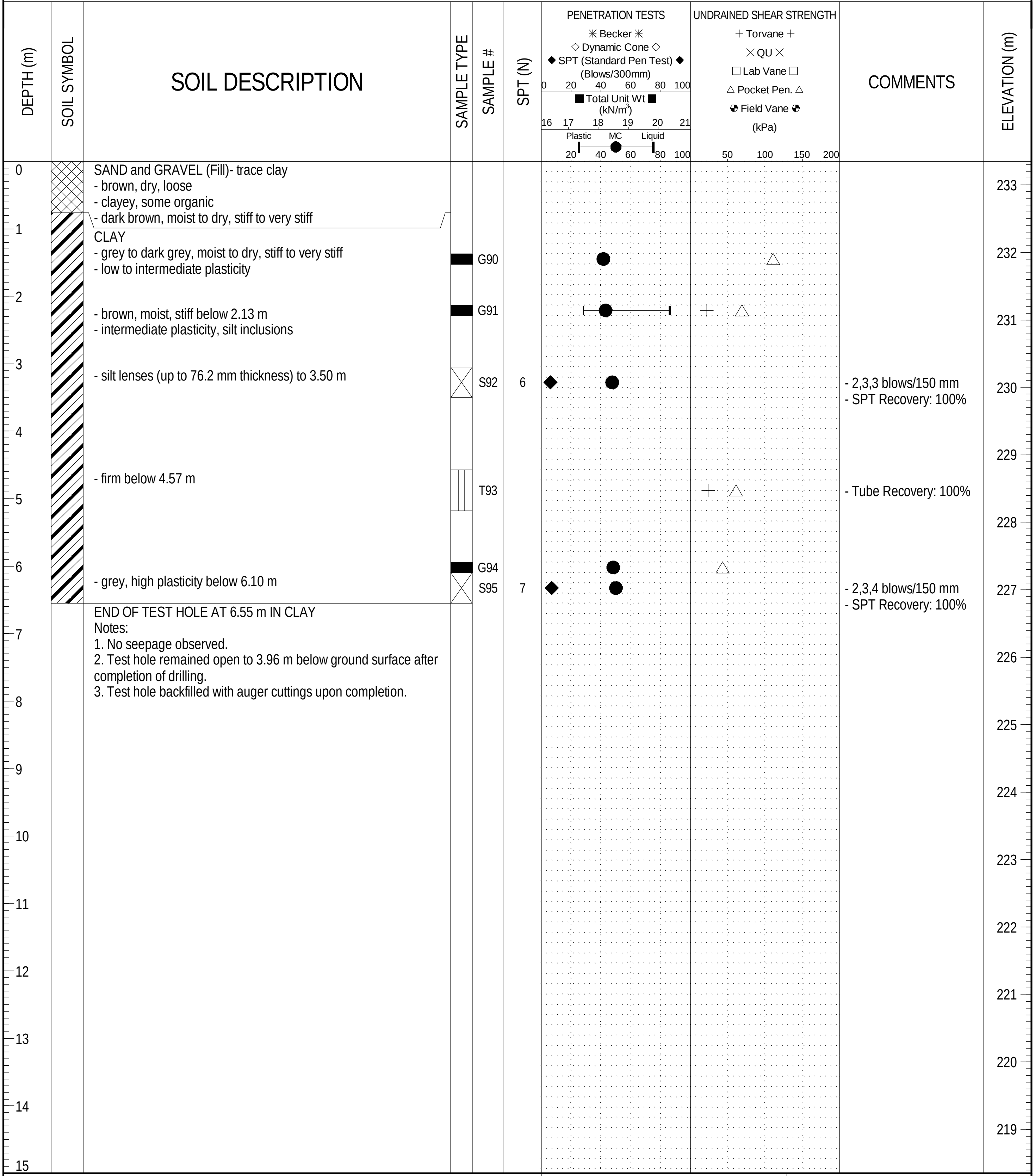
DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0	SAND and GRAVEL (Fill)- trace clay, trace organics - brown, dry, loose					233
0.5	CLAY (Fill) - trace sand - grey, moist to dry, stiff to very stiff - intermediate plasticity					
1.5		GRAB	G65			232
1.5	CLAY - brown, moist, stiff - intermediate plasticity, silt inclusions - silt lens (up to 0.61 m thick), trace oxidation below 2.29 m					231
3		GRAB	G66			
3.3	- trace sand - grey, moist, firm to stiff below 3.35 m	SPLIT SPOON	S67	7	- 3,3,4 blow/150 mm - SPT Recovery: 100%	230
4.6	- trace silt, greyish brown, laminated below 4.57 m					229
5.1		GRAB	G68			228
6.4	- grey - sand lenses (0.02 m thick) up to 7.16 m	SHELBY TUBE	T69		- Tube Recovery: 100%	227
7.5		GRAB	G70			226
7.62	END OF TEST HOLE AT 7.62 m IN CLAY Notes: 1. No seepage observed. 2. Test hole remained open to 3.66 m below ground surface after completion of drilling. 3. Test hole backfilled with auger cuttings upon completion.					225



LOGGED BY: Sam O.	COMPLETION DEPTH: 7.62 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/11
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S15
LOCATION: Plessis Road South Bound, West Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 233.35

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◪ NO RECOVERY ▮ CORE



SAND and GRAVEL (Fill)- trace clay
- brown, dry, loose
- clayey, some organic
- dark brown, moist to dry, stiff to very stiff

CLAY
- grey to dark grey, moist to dry, stiff to very stiff
- low to intermediate plasticity
- brown, moist, stiff below 2.13 m
- intermediate plasticity, silt inclusions
- silt lenses (up to 76.2 mm thickness) to 3.50 m
- firm below 4.57 m
- grey, high plasticity below 6.10 m

END OF TEST HOLE AT 6.55 m IN CLAY
Notes:
1. No seepage observed.
2. Test hole remained open to 3.96 m below ground surface after completion of drilling.
3. Test hole backfilled with auger cuttings upon completion.

SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS
■	G90		
■	G91		
☒	S92	6	- 2,3,3 blows/150 mm - SPT Recovery: 100%
▥	T93		- Tube Recovery: 100%
■	G94		
☒	S95	7	- 2,3,4 blows/150 mm - SPT Recovery: 100%

AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 6.55 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/11
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

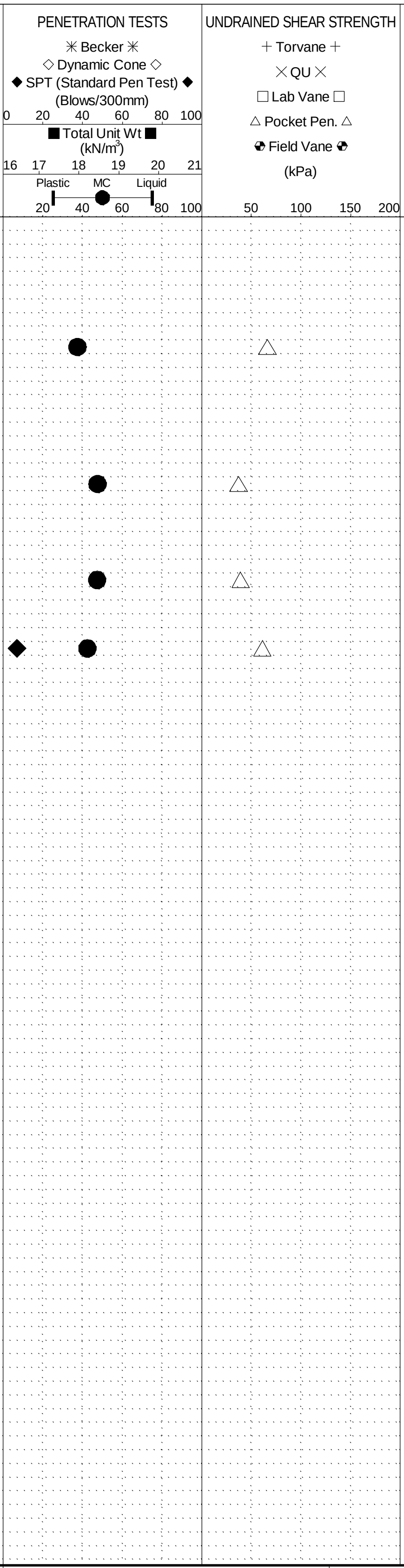
PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S16
LOCATION: Plessis Road South Bound, West Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 233.55

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◪ NO RECOVERY ▮ CORE

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS
SAND and GRAVEL (Fill) - trace clay, trace organics - brown, moist, loose to compact				
CLAY (Fill) - trace organics, trace sand - dark brown to black, moist, stiff - low to intermediate plasticity	■	G188		
CLAY - trace sand - brown, moist, firm to stiff - intermediate plasticity, silt inclusions, laminated	■	G189		
- silt lens (up to 76.20 mm thick) - trace oxidation below 3.51 m	■	G190		
- grey, below 4.57 m	☒	S191	7	- 2, 3, 4 blows/150 mm - SPT Recovery: 100%
END OF TEST HOLE AT 5.03 m IN CLAY Notes: 1. No seepage or sloughing observed. 2. Test hole backfilled with auger cuttings upon completion.				

DEPTH (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

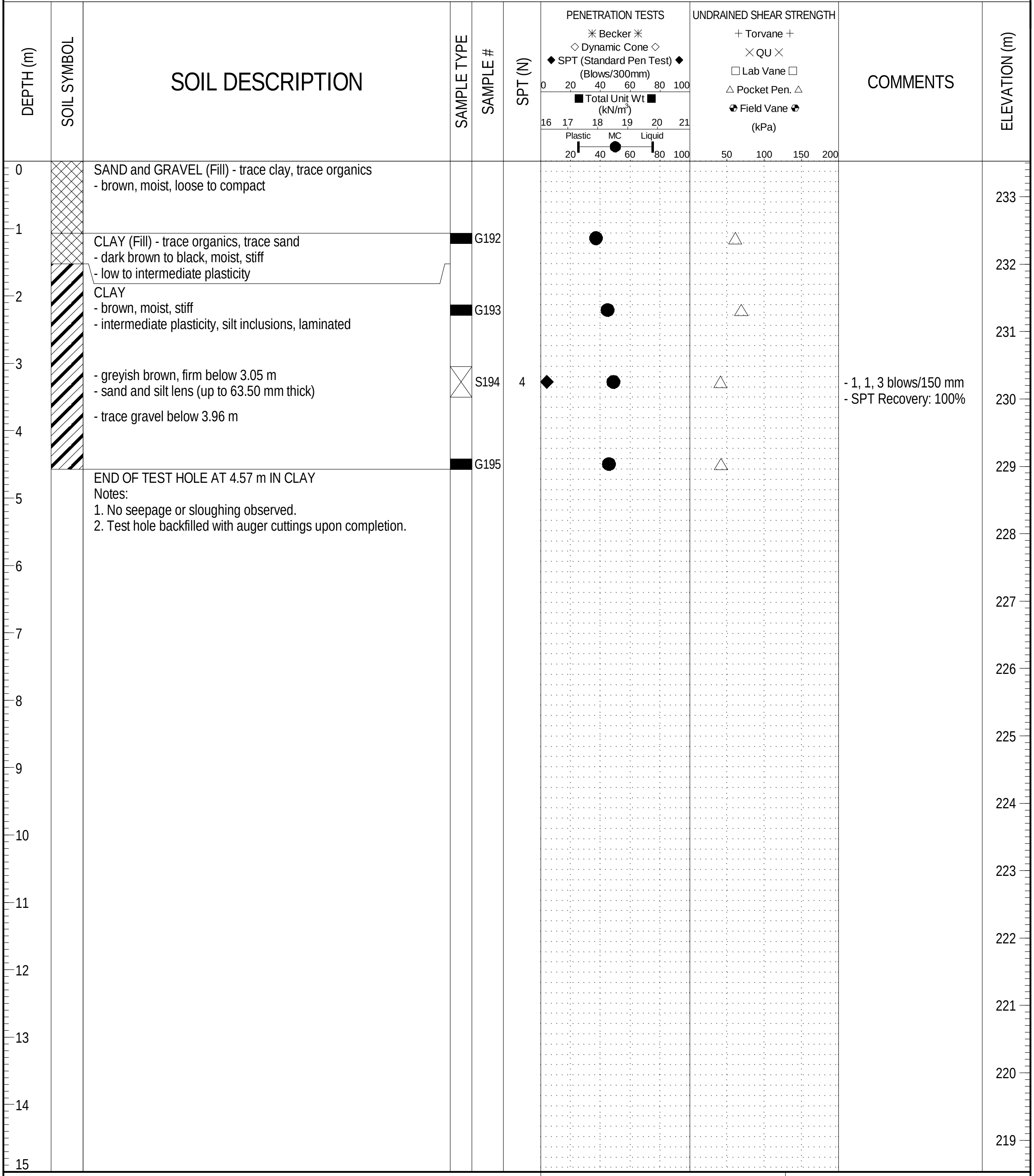
ELEVATION (m): 233 232 231 230 229 228 227 226 225 224 223 222 221 220 219



LOGGED BY: Sam O.	COMPLETION DEPTH: 5.03 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/31
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S17
LOCATION: Plessis Road South Bound, West Shoulder		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 233.53

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ▱ NO RECOVERY ▮ CORE



SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS
SAND and GRAVEL (Fill) - trace clay, trace organics - brown, moist, loose to compact				
CLAY (Fill) - trace organics, trace sand - dark brown to black, moist, stiff - low to intermediate plasticity	■	G192		
CLAY - brown, moist, stiff - intermediate plasticity, silt inclusions, laminated	■	G193		
- greyish brown, firm below 3.05 m - sand and silt lens (up to 63.50 mm thick)	☒	S194	4	- 1, 1, 3 blows/150 mm - SPT Recovery: 100%
- trace gravel below 3.96 m				
	■	G195		

END OF TEST HOLE AT 4.57 m IN CLAY

Notes:

1. No seepage or sloughing observed.
2. Test hole backfilled with auger cuttings upon completion.

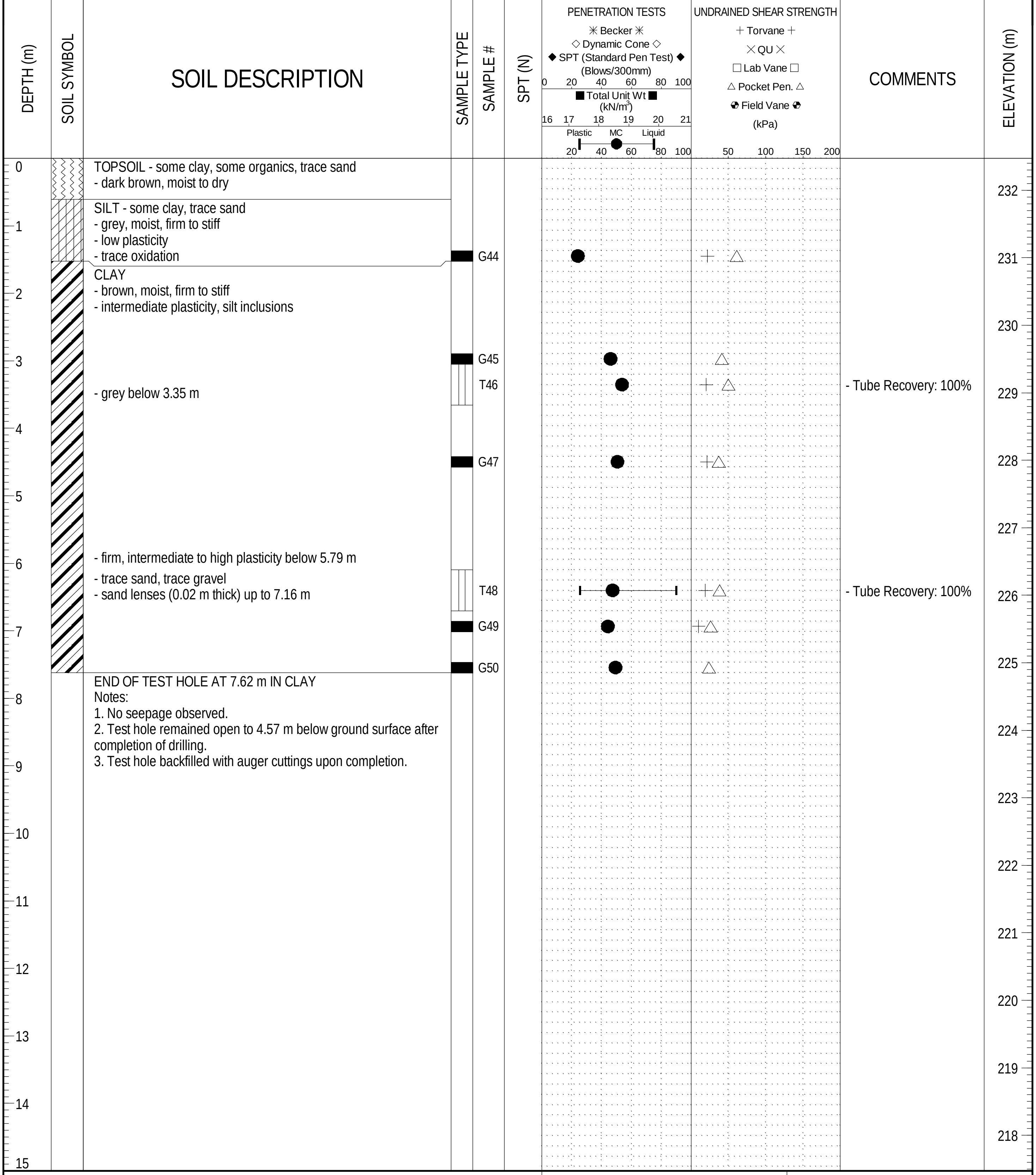
AECOM

LOGGED BY: Sam O.	COMPLETION DEPTH: 4.57 m
REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/31
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-S18
LOCATION: Plessis/Dugald Intersection, South West Corner Lawn		PROJECT NO.: 60273041
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Track Mounted MP5, 125 mm SSA	ELEVATION (m): 232.47

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◸ NO RECOVERY ▮ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION (m)
0		TOPSOIL - some clay, some organics, trace sand - dark brown, moist to dry					
		SILT - some clay, trace sand - grey, moist, firm to stiff - low plasticity - trace oxidation	GRAB	G44			
		CLAY - brown, moist, firm to stiff - intermediate plasticity, silt inclusions	GRAB	G45			
		- grey below 3.35 m	SHELBY TUBE	T46		- Tube Recovery: 100%	
			GRAB	G47			
		- firm, intermediate to high plasticity below 5.79 m - trace sand, trace gravel - sand lenses (0.02 m thick) up to 7.16 m	SHELBY TUBE	T48		- Tube Recovery: 100%	
			GRAB	G49			
			GRAB	G50			
		END OF TEST HOLE AT 7.62 m IN CLAY Notes: 1. No seepage observed. 2. Test hole remained open to 4.57 m below ground surface after completion of drilling. 3. Test hole backfilled with auger cuttings upon completion.					



LOG OF TEST HOLE TEST HOLE LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/16

	LOGGED BY: Sam O.	COMPLETION DEPTH: 7.62 m
AECOM	REVIEWED BY: Omer Eissa	COMPLETION DATE: 12/10/10
	PROJECT ENGINEER: Zeyad Shukri	Page 1 of 1

P:\60273041\000-CADD\02-SHEETS\B\60273041-FIG-00-0000-B-TestholeLocPlan.dwg

AECOM

DILLON CONSULTING

Winnipeg

PLESSIS UNDERPASS STUDY

Supplemental Testhole Location Plan

0 37.5 75 150m

SCALE: 1:5000

B-002

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: **TH13-B01**
LOCATION: Plessis East Abutment, N: 5528000.9 E: 641834.1		PROJECT NO.: 60273041
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Track Mounted Acker SS 3, 125 mm SSA	ELEVATION (m): 233.54

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◺ NO RECOVERY ▌ CORE

DEPTH (m) | SOIL SYMBOL | SOIL DESCRIPTION | SAMPLE TYPE | SAMPLE # | SPT (N) | PENETRATION TESTS | UNDRAINED SHEAR STRENGTH | COMMENTS | ELEVATION

SAND and GRAVEL (Fill) - some silt, some clay
- brown, moist, compact

CLAY - trace gravel
- brown, moist , firm
- high plasticity

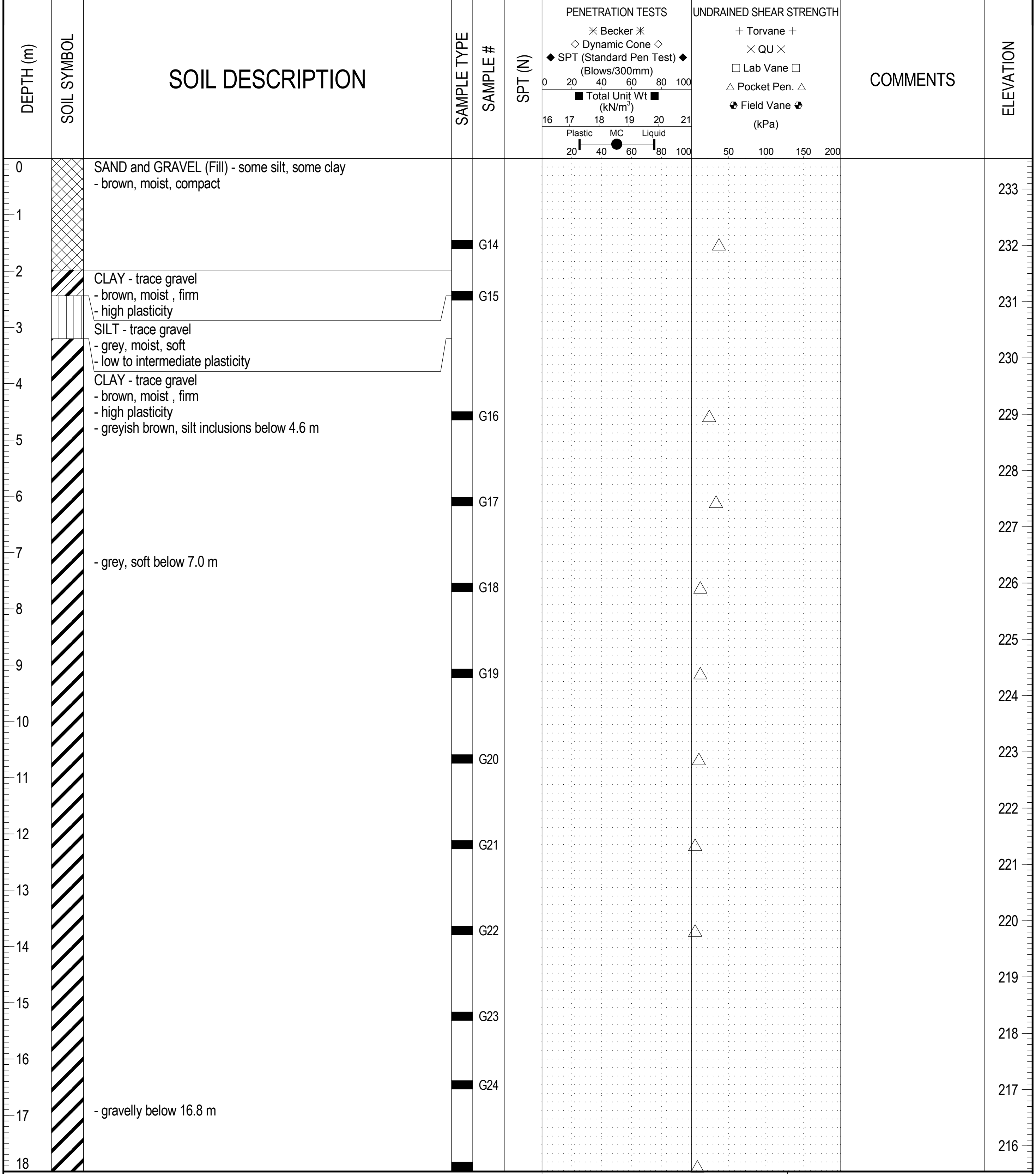
SILT - trace gravel
- grey, moist, soft
- low to intermediate plasticity

CLAY - trace gravel
- brown, moist , firm
- high plasticity
- greyish brown, silt inclusions below 4.6 m

- grey, soft below 7.0 m

- gravelly below 16.8 m

Samples: G14, G15, G16, G17, G18, G19, G20, G21, G22, G23, G24



LOGGED BY: Sam Oshati	COMPLETION DEPTH: 24.69 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 7/30/13
PROJECT ENGINEER: Zeyad Shukri	

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: **TH13-B01**
LOCATION: Plessis East Abutment, N: 5528000.9 E: 641834.1		PROJECT NO.: 60273041
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Track Mounted Acker SS 3, 125 mm SSA	ELEVATION (m): 233.54

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◪ NO RECOVERY ▮ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ● Field Vane ● (kPa) 50 100 150 200	COMMENTS	ELEVATION
18		LIMESTONE (Bedrock) - light grey to white, core angle: 90 degrees - fine to medium grained, no foliation - close to moderately close spacing, rough undulating joints, unaltered joints - R2 to R3 (weak to medium strong) - fossiliferous - fractured to 20.1 m (Elev. 213.4) below ground surface - competent rock (RQD > 70%) below 20.1 m	▮	G25 C1				C1 RQD: 22%Core Recovery: 64%	215
19			▮	C2				C2 RQD: 51%Core Recovery: 88%	214
20			▮						213
21			▮	C3				C3 RQD: 79%Core Recovery: 92%	212
22			▮	C4				C4 RQD: 79%Core Recovery: 94%	211
23			▮						210
24			▮	C5				C5 RQD: 93%Core Recovery: 98%	209
25		END OF TEST HOLE AT 24.69 m IN BEDROCK Notes: 1. Power auger refusal at 18.05 m below ground surface on BEDROCK. 2. HQ coring below 18.05 m. 3. Test hole sealed with bentonite up to 3.05 m and grouted from 3.05 to ground surface.							208
26									207
27									206
28									205
29									204
30									203
31									202
32									201
33									200
34									199
35									198
36									

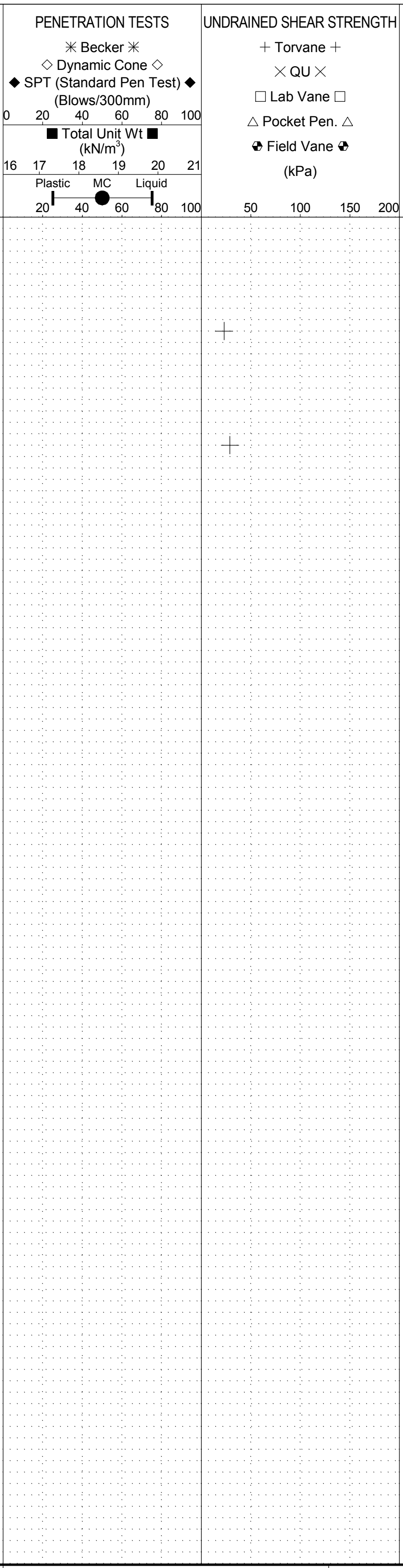
AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 24.69 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 7/30/13
PROJECT ENGINEER: Zeyad Shukri	Page 2 of 2

PROJECT: Plessis Road Underpass
CLIENT: City of Winnipeg
TESTHOLE NO: **TH13-B02**
LOCATION: Plessis North Pier, N: 5527999.0 E: 641663.6
PROJECT NO.: 60273041
CONTRACTOR: Paddock Drilling Ltd.
METHOD: Track Mounted Acker SS 3, 125 mm SSA
ELEVATION (m): 232.96

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◿ NO RECOVERY ▐ CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION
0	ASPHALT (300 mm)					
	SAND and GRAVEL (Base) - light brown, dry, compact - medium to coarse grained					
1						232
	CLAY (Fill) - some gravel, some sand, trace organics - brown, moist, firm - Intermediate plasticity	■	G1			
2						231
3		■	G2			230
	ORGANICS - wood chips - brown to black, moist to wet - hydrocarbon (diesel fuel)	■	G3			
4						229
		■	G4			
5	CLAY - greyish brown, moist, firm - high plasticity					228
6		■	G5			227
7						226
	- grey, trace silt inclusions, soft below 7.62 m	■	G6			
8						225
9						224
		■	G7			
10						223
		■	G8			
11	- trace gravel below 11 m					222
12						221
		■	G9			
13						220
		■	G10			
14						219
15						218
		■	G11			
16		■	G12			217
17						216
	- silty, wet, some gravel	■	G13			
18						



LOGGED BY: Sam Oshati
COMPLETION DEPTH: 26.21 m
REVIEWED BY: Zeyad Shukri
COMPLETION DATE: 7/31/13
PROJECT ENGINEER: Zeyad Shukri

PROJECT: Plessis Road Underpass | CLIENT: City of Winnipeg | TESTHOLE NO: **TH13-B02**

LOCATION: Plessis North Pier, N: 5527999.0 E: 641663.6 | PROJECT NO.: 60273041

CONTRACTOR: Paddock Drilling Ltd. | METHOD: Track Mounted Acker SS 3, 125 mm SSA | ELEVATION (m): 232.96

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◿ NO RECOVERY ▌ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ● Field Vane ● (kPa) 50 100 150 200	COMMENTS	ELEVATION
18	▧	- cobbly, some boulders below 17.7 m							
19	▨	LIMESTONE (Bedrock) - light grey, core angle: 90 degrees - fine to medium grained, no foliation - close to moderately close spacing, rough undulating joints, unaltered joints - R2 to R3 (weak to medium strong) - fossiliferous, vuggy to 21.6 m - fractured to 21.6 m (Elev. 211.4) below ground surface	▌	C1				C1 RQD: 40%Core Recovery: 70%	214
20	▨		▌						213
21	▨		▌	C2				C2 RQD: 48%Core Recovery: 93%	212
22	▨	- competent rock (RQD > 70%) below 21.6 m - mottled yellow to 21.95 m	▌						211
23	▨		▌	C3				C3 RQD: 75%Core Recovery: 92%	210
24	▨		▌	C4				C4 RQD: 81%Core Recovery: 90%	209
25	▨		▌	C5				C5 RQD: 85%Core Recovery: 96%	208
26	▨	END OF TEST HOLE AT 26.21 m IN BEDROCK Notes: 1. Power auger refusal at 18.5 m below ground surface on BEDROCK. 2. HQ coring below 18.5 m. 3. Seepage observed at 17.5 m below ground surface. 4. Test hole grouted up to 18.3 m and sealed with bentonite to ground surface.							207
27									206
28									205
29									204
30									203
31									202
32									201
33									200
34									199
35									198
36									

LOGGED BY: Sam Oshati | COMPLETION DEPTH: 26.21 m

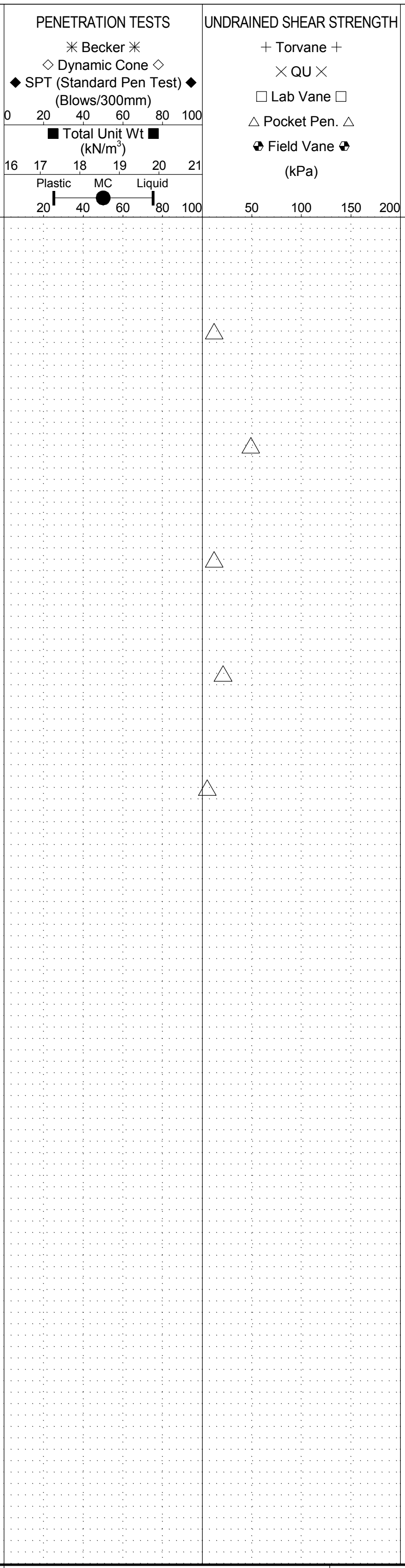
REVIEWED BY: Zeyad Shukri | COMPLETION DATE: 7/31/13

PROJECT ENGINEER: Zeyad Shukri

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: **TH13-B03**
LOCATION: Plessis South Pier, N: 5527960.9 E: 641831.2		PROJECT NO.: 60273041
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Track Mounted Acker SS 3, 125 mm SSA	ELEVATION (m): 233.64

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◸ NO RECOVERY ▮ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION
0	■	ASPHALT (381 mm)					
	☒	SAND and GRAVEL (Base) - brown, moist to dry, compact					233
1	☒	CLAY (Fill) - some silt, some sand, trace gravel, trace organics - brown, moist, soft to firm	■	G26			232
2	▨	CLAY - silty - brown, dry, soft to firm - high plasticity, silt inclusions					231
3	▨		■	G27			230
4	▨						
5	▨	- greyish brown below 4.6 m	■	G28			229
6	▨	- grey, soft, trace gravel below 6.1 m	■	G29			228
7	▨						227
8	▨		■	G30			226
9	▨						225
10	▨						224
11	▨		■	G31			223
12	▨		■	G32			222
13	▨						221
14	▨		■	G33			220
15	▨		■	G34			219
16	▨						218
17	▨	- wet below 16.8 m	■	G35			217
18	▨						216



AECOM

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 24.69 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 8/1/13
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 2

PROJECT: Plessis Road Underpass | CLIENT: City of Winnipeg | TESTHOLE NO: **TH13-B03**

LOCATION: Plessis South Pier, N: 5527960.9 E: 641831.2 | PROJECT NO.: 60273041

CONTRACTOR: Paddock Drilling Ltd. | METHOD: Track Mounted Acker SS 3, 125 mm SSA | ELEVATION (m): 233.64

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◿ NO RECOVERY ▌ CORE

PENETRATION TESTS
✳ Becker ✳
◇ Dynamic Cone ◇
◆ SPT (Standard Pen Test) ◆
(Blows/300mm)
0 20 40 60 80 100
■ Total Unit Wt ■
(kN/m^3)
16 17 18 19 20 21
Plastic MC Liquid
20 40 60 80 100

UNDRAINED SHEAR STRENGTH
+ Torvane +
× QU ×
☐ Lab Vane ☐
△ Pocket Pen. △
⊕ Field Vane ⊕
(kPa)
50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION
18			■	G36			215
19		LIMESTONE (Bedrock) - light grey to white, core angle: 90 degrees - fine to medium grained, no foliation - close to moderately close spacing, rough undulating joints, unaltered joints - R2 to R3 (weak to medium strong) - fossiliferous, vuggy - fractured to 21.6 m (Elev. 212.0) below ground surface	■	G37			
20			▌	C1		C1 RQD: 15%Core Recovery: 45%	214
21			▌	C2		C2 RQD: 62%Core Recovery: 97%	213
22		- competent rock (RQD > 70%) below 21.6 m					212
23			▌	C3		C3 RQD: 78%Core Recovery: 99%	211
24			▌	C4		C4 RQD: 83%Core Recovery: 97%	210
25		END OF TEST HOLE AT 24.69 m IN BEDROCK Notes: 1. Power auger refusal at 19.2 m below ground surface on BEDROCK. 2. HQ coring below 19.2 m. 3. Seepage observed at 16.8 m below ground surface. 4. Test hole sealed with bentonite up to 19.8 m and grouted from 19.8 m to ground surface.					209
26							208
27							207
28							206
29							205
30							204
31							203
32							202
33							201
34							200
35							199
36							198

AECOM

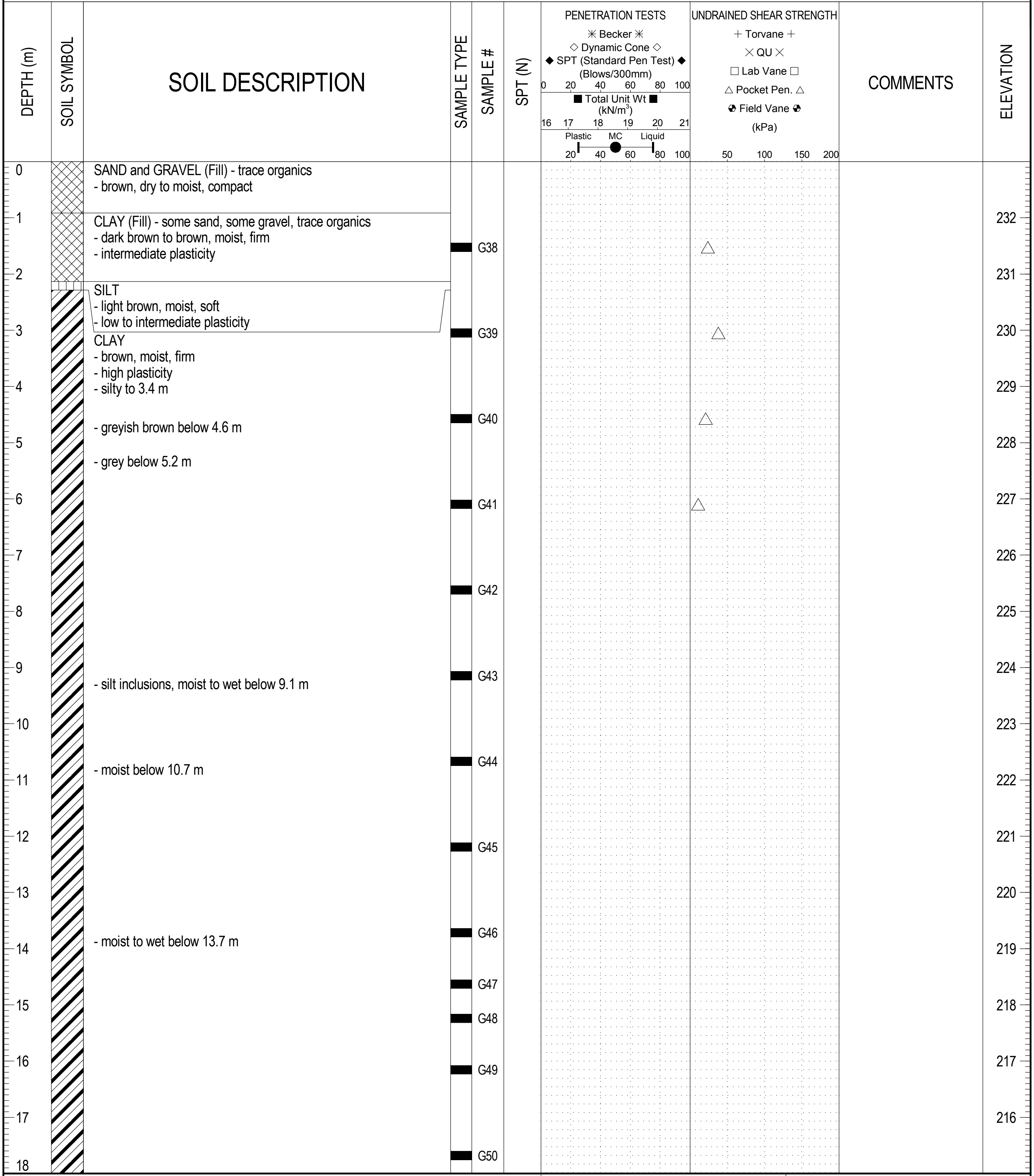
LOGGED BY: Sam Oshati | COMPLETION DEPTH: 24.69 m

REVIEWED BY: Zeyad Shukri | COMPLETION DATE: 8/1/13

PROJECT ENGINEER: Zeyad Shukri

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: **TH13-B04**
LOCATION: Plessis West Abutment, N: 5527982.0 E: 641811.9		PROJECT NO.: 60273041
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Track Mounted Acker SS 3, 125 mm SSA	ELEVATION (m): 233.00

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◪ NO RECOVERY ▮ CORE



SAND and GRAVEL (Fill) - trace organics
- brown, dry to moist, compact

CLAY (Fill) - some sand, some gravel, trace organics
- dark brown to brown, moist, firm
- intermediate plasticity

SILT
- light brown, moist, soft
- low to intermediate plasticity

CLAY
- brown, moist, firm
- high plasticity
- silty to 3.4 m

- greyish brown below 4.6 m

- grey below 5.2 m

- silt inclusions, moist to wet below 9.1 m

- moist below 10.7 m

- moist to wet below 13.7 m

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 30.78 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 8/2/13
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 2

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: **TH13-B04**
LOCATION: Plessis West Abutment, N: 5527982.0 E: 641811.9		PROJECT NO.: 60273041
CONTRACTOR: Paddock Drilling Ltd.	METHOD: Track Mounted Acker SS 3, 125 mm SSA	ELEVATION (m): 233.00

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ☰ BULK ◿ NO RECOVERY ▌ CORE

PENETRATION TESTS: ✳ Becker ✳; ◇ Dynamic Cone ◇; ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane +; × QU ×; ☐ Lab Vane ☐; △ Pocket Pen. △; ⊕ Field Vane ⊕ (kPa) 50 100 150 200

DEPTH (m)	SOIL DESCRIPTION	SAMPLE #	SPT (N)	COMMENTS	ELEVATION
18					
19	LIMESTONE (Bedrock) - light grey to white, core angle: 90 degrees - fine to medium grained, no foliation - close to moderately close spacing, rough undulating joints, unaltered joints	G51 C1		C1 RQD: 56%Core Recovery: 75%	214
20	- R2 to R3 (weak to medium strong) - fossiliferous				213
21	- fractured to 20.1 m (Elev. 212.9) below ground surface - competent rock below 20.1 m - mottled yellow to 21.8 m	C2		C2 RQD: 82%Core Recovery: 96%	212
22		C3		C3 RQD: 92%Core Recovery: 98%	211
23					210
24		C4		C4 RQD: 78%Core Recovery: 95%	209
25		C5		C5 RQD: 64%Core Recovery: 75%	208
26	- ripple marks to 26.4 m				207
27		C6		C6 RQD: 80%Core Recovery: 98%	206
28		C7		C7 RQD: 81%Core Recovery: 99%	205
29					204
30		C8		C8 RQD: 94%Core Recovery: 99%	203
31	END OF TEST HOLE AT 30.78 m IN BEDROCK Notes: 1. Power auger refusal at 18.9 m below ground surface on BEDROCK.				202
32	2. HQ coring below 18.9 m. 3. Seepage observed at 15.24 m below ground surface. 4. sloughing observed at 19.8 m below ground surface in rock.				201
33	5. Test hole grouted up to 19.8 m and sealed with bentonite from 19.8 m to ground surface.				200
34					199
35					198
36					

LOGGED BY: Sam Oshati	COMPLETION DEPTH: 30.78 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 8/2/13
PROJECT ENGINEER: Zeyad Shukri	Page 2 of 2

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Memorandum

To Eric Loewen, P.Eng

CC

Subject Summary of Test Caisson Investigation - Plessis Road Underpass Project

From Zeyad Shukri

Date September 5, 2013

Project Number 60273041 (404.19.1.1)

A test caisson was advanced to verify the design assumptions, examine the feasibility of construction and assist in the selection of adequate equipment and proper construction practices. The drilling took place during the period between July 5th and July 9th, 2013. The test caisson was advanced on the west shoulder of Plessis Road south of the existing CN railway right-of-way as shown in Figure 1, Appendix A. Drilling was carried out by Subterranean (Manitoba) Ltd. using a track-mounted Soilmec SR-65 piling rig equipped with a 940 mm diameter flight auger and 760 mm core barrel. Due to the size and heavy weight of the drill rig, a pad was constructed using granular rock fill to support the weight of the equipment. The test caisson was advanced through the overburden with augers to practical refusal near the bedrock surface at a depth of 17.8 m below surface or approximate elevation 214.7 m. The core barrel was then employed to core into the bedrock to a termination depth of 78.5 feet (23.9 m) below ground surface or approximate elevation of 208.6 m.

The caisson was sleeved with an outer safety casing 4 feet (1.2 m) in diameter. The outer safety casing extended from ground surface to a depth of 25 feet (7.6 m) below surface. An inner sleeve was inserted into the test caisson to protect the walls of the test hole at deeper depths. The inner sleeve was 36 inch (0.91 m) in diameter and extended into the weathered zone of the bedrock to a depth of 69 feet (21 m) below surface. The rock socket below depth 69 feet (21 m) was advanced without the use of a sleeve or casing to support the side walls of the caisson.

The soil stratigraphy at the test caisson location consisted of a thin layer of topsoil underlain by a thick lacustrine clay deposit extending to approximately 17.8 m below ground surface. The clay was firm to soft in consistency and of high plasticity. Limestone bedrock was encountered at 17.8 m below ground surface. No noticeable till layer was observed between the clay deposit and the limestone bedrock. The top 3.8 m of the bedrock was weathered (poor quality) and consisted of highly permeable rubble and fractured rock. Competent bedrock (fair quality) was encountered at a depth of 21.6 m below ground surface or approximate elevation of 210.9 m. A detailed log showing the soil stratums encountered is provided in Appendix A. Photos taken during the drilling are attached in Appendix B.

Very significant water inflow in the test caisson was observed from the weathered bedrock zone. The water in the test caisson stabilized at 10.6 m below the ground surface upon completion of drilling (i.e. elevation of 221.9 m). The test caisson was backfilled with 30 MPa concrete from termination depth up to 11.5 m below ground surface. Stabilized fill was used to backfill the hole from the depth of 11.5 m up to ground surface.

Caisson advancement was completed in approximately 12 hours of drilling. Additional time was required for site preparation including a granular pad placement at the caisson location, carrying out a pumping test post drilling and backfilling the caisson with concrete and stabilized fill.

For production caissons, the uncased socket length should be a minimum of one socket diameter within sound, competent bedrock. The minimum shaft diameter of the rock socket should not be less than 760 mm and the maximum diameter should be selected to suit the locally available coring equipment. The rock sockets should not be spaced closer than 2.5 socket diameters, centre to centre.

To summarize, based on observations from the test caisson drilling, the following practices are recommended for the installation of the bridge caissons:

- Sleeving from ground surface to the bedrock contact as a minimum, and sufficiently into the significantly weathered bedrock as required to maintain a stable excavation.

- Due to difficulties noted when retrieving the rock cores from the bottom of the caisson, a special core barrel was necessary to crush the rock core in the hole prior to retrieving the core to surface making it difficult to evaluate the quality of the cores. The special core barrel may be needed to crush the rock cores during construction.

- Video inspection of the test caisson is recommended to confirm the quality of the rock socket due to the encountered difficulties of evaluating the quality of the recovered cores in the test caisson. However, if pumping of groundwater to inspect the socket would tend to destablilize the excavation due to pumping of fine sand through the fractured zone, an alternate method to retrieve the intact portions of the socket core should be utilized. This should be combined with maintaining an excess water head inside the inner casing and probing the base of the socket with a weighted steel probe bar after cleaning and immediately before tremie concrete placement.

- The Soilmec SR-65 or equivalent drill rig is capable of drilling deep caissons to the required depth in a time-efficient manner.

- Tremie placement of concrete will be required due to the large amount of water seepage from the bedrock aquifer.

- The depth to competent bedrock is expected to vary across the site and it should be recognized that the test holes advanced at the bridge abutment and pier locations are more representative of expected ground conditions at those locations.

The geotechnical report dated March 2013 should be consulted for additional information and full geotechnical recommendations. We trust the information provided herein is sufficient for your purposes.

Please don't hesitate to contact me should you have any questions or concerns.

Submitted by:

Zeyad Shukri, M.Sc
Senior Geotechnical Engineer

Elliott E. Drumright

Elliott E. Drumright, P.E.
Associate Engineer

Reviewed by:

PROVINCE OF MANITOBA
P. C.
CHANG
Member
33883
REGISTERED PROFESSIONAL ENGINEER

Patrick C. Chang. P.E., P.Eng.
Senior Project Engineer

Appendix A

Figure 1 / Logs

AECOM

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Winnipeg

**PLESSIS
UNDERPASS STUDY**

Testhole Location Plan

0 37.5 75 150m

SCALE: 1:5000

B-002

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AECOM Canada Ltd.

GENERAL STATEMENT

NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

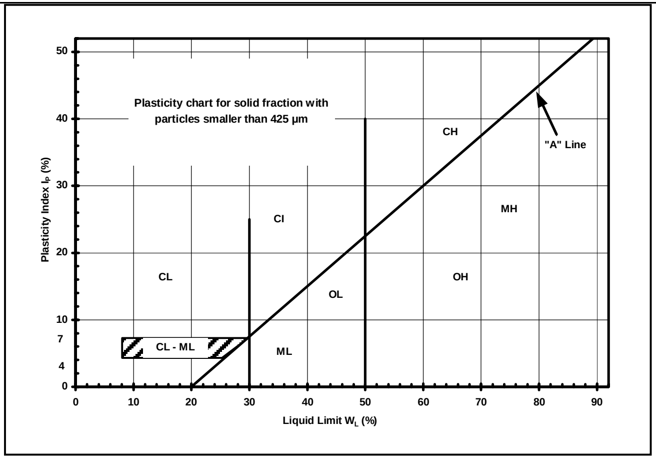
In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

EXPLANATION OF FIELD & LABORATORY TEST DATA

Description				AECOM Log Symbols	USCS Classification	Laboratory Classification Criteria			
						Fines (%)	Grading	Plasticity	Notes
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines	△	GW	0-5	$C_U > 4$ $1 < C_C < 3$		Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4<W_P<7$ $C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
			Poorly graded gravels, sandy gravels, with little or no fines	▲	GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels	▥	GM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey gravels, clayey sandy gravels	▧	GC	> 12		Atterberg limits above "A" line or $W_P<7$	
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines	⁘	SW	0-5	$C_U > 6$ $1 < C_C < 3$		
			Poorly graded sands, gravelly sands, with little or no fines	○	SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures	▥	SM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey sands, sand-clay mixtures	▨	SC	> 12		Atterberg limits above "A" line or $W_P<7$	
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L<50$	Inorganic silts, silty or clayey fine sands, with slight plasticity	▥	ML			Classification is Based upon Plasticity Chart	
		$W_L>50$	Inorganic silts of high plasticity	▮	MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L<30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays	▨	CL				
		$30<W_L<50$	Inorganic clays and silty clays of medium plasticity	▨	CI				
		$W_L>50$	Inorganic clays of high plasticity, fat clays	▨	CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L<50$	Organic silts and organic silty clays of low plasticity	┆	OL				
		$W_L>50$	Organic clays of high plasticity	▨	OH				
HIGHLY ORGAINIC SOILS			Peat and other highly organic soils	≋	Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

■	Asphalt	⁘	Till		
⬚	Concrete	▧	Bedrock (Undifferentiated)		
▩	Fill	▦	Bedrock (Limestone)		

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	“y” or “ey” *
	Medium	2.00	0.425		
	Fine	0.425	0.075	10-20	some
Silt (non-plastic) or Clay (plastic)		< 0.075 mm		1-10	trace

* for example: gravelly, sandy clayey, silty

Definition of Oversize Material

COBBLES: 76mm to 300mm diameter
BOULDERS: >300mm diameter

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

q_u - undrained shear strength (kPa) derived from unconfined compression testing.

T_v - undrained shear strength (kPa) measured using a torvane

pp - undrained shear strength (kPa) measured using a pocket penetrometer.

L_v - undrained shear strength (kPa) measured using a lab vane.

F_v - undrained shear strength (kPa) measured using a field vane.

γ - bulk unit weight (kN/m^3).

SPT - Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.

DPPT - Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.

w - moisture content (W_L, W_P)

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

Su (kPa)	**CONSISTENCY**
<12	very soft
12 – 25	soft
25 – 50	medium or firm
50 – 100	stiff
100 – 200	very stiff
200	hard

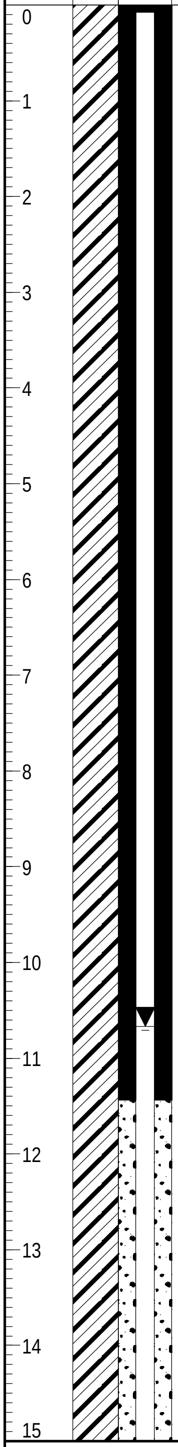
The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	**COMPACTNESS**
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: Test Caisson
LOCATION: Plessis South Bound/CN Rail Intersection, West of Sidewalk		PROJECT NO.: 60273041
CONTRACTOR: Subterranean (Manitoba) LTD.	METHOD: Track Mounted Soilmec SR-65	ELEVATION (m): 232.50

SAMPLE TYPE	■ GRAB	▥ SHELBY TUBE	☒ SPLIT SPOON	☰ BULK	▨ NO RECOVERY	▌ CORE
BACKFILL TYPE	■ BENTONITE	⁘ GRAVEL	▥ SLOUGH	⁘ GROUT	▨ CUTTINGS	⁘ SAND

DEPTH (m)	SOIL SYMBOL	BACKFILL DETAILS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ● Field Vane ● (kPa) 50 100 150 200	COMMENTS	ELEVATION (m)
0			CLAY - brown, moist, stiff - high plasticity, silt lenses							232
3.66			- greyish brown below 3.66 m							
5.49			- grey, soft to firm below 5.49 m							



LOGGED BY: Sam O.	COMPLETION DEPTH: 23.93 m
REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 13/7/9
PROJECT ENGINEER: Zeyad Shukri	Page 1 of 2

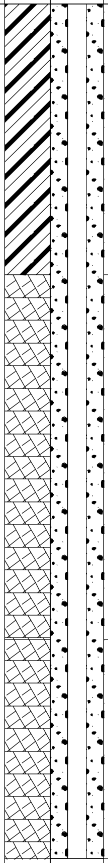
AECOM

LOG OF TEST HOLE TEST CAISSON LOGS-PRU-60273041 - UPDATED.GPJ UMA WINN.GDT 13/10/17

PROJECT: Plessis Road Underpass	CLIENT: City of Winnipeg	TESTHOLE NO: Test Caisson
LOCATION: Plessis South Bound/CN Rail Intersection, West of Sidewalk		PROJECT NO.: 60273041
CONTRACTOR: Subterranean (Manitoba) LTD.	METHOD: Track Mounted Soilmec SR-65	ELEVATION (m): 232.50

SAMPLE TYPE	■ GRAB	▥ SHELBY TUBE	☒ SPLIT SPOON	☰ BULK	▨ NO RECOVERY	▌ CORE
BACKFILL TYPE	■ BENTONITE	⁚ GRAVEL	▥ SLOUGH	⁛ GROUT	▨ CUTTINGS	⁚ SAND

DEPTH (m)	SOIL SYMBOL	BACKFILL DETAILS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ● Field Vane ● (kPa) 50 100 150 200	COMMENTS	ELEVATION (m)



Depth (m): 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

- wet below 16.76 m

- fractured rock, cobbles and boulders below 17.53 m

LIMESTONE (Bedrock) - weathered
- light grey to white
- fine to medium grained, no foliations
- R2, weak strength rock
- suspected cavity (< 0.5 m)
- fractured to 20.9 m below ground surface

- competent rock at 21.6 m below ground surface, R3 (medium strong)
- light grey to white
- fine to medium grained, no foliations
- Rough planar joints

END OF TEST CAISSON AT 23.9 m IN BEDROCK
Notes:
1. bedrock encounterd at 17.8 m below ground surface.
2. Seepage observed at 16.7 m below ground surface, static water level at 10.7 m below ground surface.
3. 0.76 m diameter coring below 17.8 m.
4. Test caisson backfilled with concrete up to 11.4 m, plugged with stabilized fill from 11.4 to ground surface.

Elevation (m): 217 216 215 214 213 212 211 210 209 208 207 206 205 204 203

AECOM	LOGGED BY: Sam O.	COMPLETION DEPTH: 23.93 m
	REVIEWED BY: Zeyad Shukri	COMPLETION DATE: 13/7/9
	PROJECT ENGINEER: Zeyad Shukri	Page 2 of 2

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204 284 2040 fax

Memorandum

To	Bob Paetsch	Page	1
CC	Brent Knezacek		
Subject	CN Railway Detour Stability Analysis		
From	Omer Eissa		
Date	April 22th, 2013	Project Number	60273041

Introduction

AECOM was retained by the City of Winnipeg to provide preliminary design including geotechnical engineering services for the proposed Plessis Road Underpass in Winnipeg, Manitoba. As part of the works, the CN railway tracks crossing Plessis Road will have to be relocated south of the existing crossing for the duration of the bridge construction. The location of the railway detour (shoofly) in relation to the underpass and bridge structure is shown in the drawing labelled Draft CR-01 attached in Appendix A. This memorandum summarizes the stability analysis results for the proposed CN railway detour embankment at the location of the bridge construction.

The proposed CN railway embankment is seven (7) meters wide at the top of the embankment and consists of railway ties over a ballast layer of 0.47 m thickness. A sub-ballast layer lies under the ballast layer and extends from a thickness of 0.3 m at the centre of the embankment with a cross fall of 1:40 towards the edges of the embankment. The shoofly is expected to perform as a temporary detour for the duration of the bridge construction. The shoofly embankment is located approximately 17 m measured from the centreline of the south existing CN track to the centreline of the north detour track. Proposed shoofly plan and cross-sections are shown in Figure CS-16 attached in Appendix A.

Stability Modelling

The proposed shoofly embankment shown in Figure CS-16 was modelled using the soil strength parameters presented in Table -01 below.

Table 01: Strength Parameters for Slope Stability Analysis

Material	Unit Weight (kN/m)	Cohesion (kPa)	Angle of Internal Friction (°)	Modulus of Elasticity (kPa)	Poisson's Ratio
Ballast	20	0	40	115,000	0.33
Sub-ballast	20	0	40	115,000	0.33
Granular Fill	19	0	38	100,000	0.33
Native Clay	17	5	17	6000	0.4

The analysis was conducted using the Sigma/W and Slope/W Geo Studio software. A stepped analysis showing each stage of the construction was modelled in Sigma/W. The purpose of a stepped or (treed) analysis is to import the soil stress state from the initial in-situ model and recalculate the soil stress redistribution and pore-water response for each construction stage. The embankment loading was modelled according to the CN memo dated 2011, November 22, titled "Design Criteria for the Shoring Walls submitted by the Consultant". The surcharge due to the Cooper-E90 loading as per AREMA-2010 was modelled as a 90 kips axle load at 5 ft spacing over an 8-ft-long tie for a resulting surcharge of approximately 110 kPa. A Slope/W stability analysis was conducted for the critical stage of construction where the detour embankment is loaded with Cooper E90 train loads nearby the bridge excavation (Case-05e). Table-02 below lists and describes the cases of stability modelling representing the stages of embankment and bridge construction.

Water conditions were modelled in the in-situ Sigma/W model based on the site groundwater monitoring results. The groundwater table measured on site between December 2012, to April 2013 fluctuated between elevations 226.5 to 228.2 m. Groundwater was modelled in the in-situ model at elevation 229 m.

Table 02: List and Description of Modelling Stages

Analysis ID	Analysis Type	Construction Condition
Case-01a	Sigma/W- In Situ	Initial Condition
Case-02b	Sigma/W- Stress Redistribution	Detour Excavation
Case-03c	Sigma/W- Stress Redistribution	Embankment fill Placement
Case-04d	Sigma/W- Stress Redistribution	Bridge Excavation + Embankment Loading
Case- 05e	Slope/W – Stress Imported Analysis	Slope Stability with imported stress conditions from Case-04d
Case-02	Slope/W – Morgenstern-Price Analysis	Slope Stability without imported stress conditions

Analysis results are presented graphically in Figures 01- 06 attached in Appendix A.

Analysis Results

An adequate factor of safety (FS) against slope instability must be achieved for short term and long term conditions of the detour embankment. A design factor of safety of at least 1.5 is considered satisfactory for the long term condition of an unloaded embankment. For the case of the loaded embankment with one or two train loads, a factor of safety of at least 1.3 is considered adequate.

The embankment as shown in Figure CS16 did not meet the design target factors of safety against slope instability. A well-compacted granular layer of 1.0 m thickness was therefore incorporated into the embankment between the sub-ballast and subgrade layers. The granular fill can be regarded as an extension of the sub-ballast layer with respect to material type and compaction criteria. The purpose of this layer is to replace weaker subgrade material as well as function as a pad to distribute the embankment load onto a larger area of the subgrade. Factors of safety for the embankment after extending the sub-ballast layer, i.e.: inclusion of the granular layer, are presented in Table-03. Figures outlining individual analysis results are attached in Appendix A.

Table-03 Factor of Safety Against Slope Instability

Case	Loading Conditions	Computed F.S	Design F.S
Case-05e	North track loaded	1.36	1.3
	South track loaded	1.63	1.3
	Both tracks loaded	1.35	1.3
	No train loads	1.86	1.5
Case-02	North track loaded	1.31	1.3
	South track loaded	1.59	1.3
	Both tracks loaded	1.31	1.3
	No train loads	1.97	1.5

We trust the information provided is sufficient for your purposes. Please don't hesitate to contact the undersigned should you have any questions or concerns.

Prepared by,

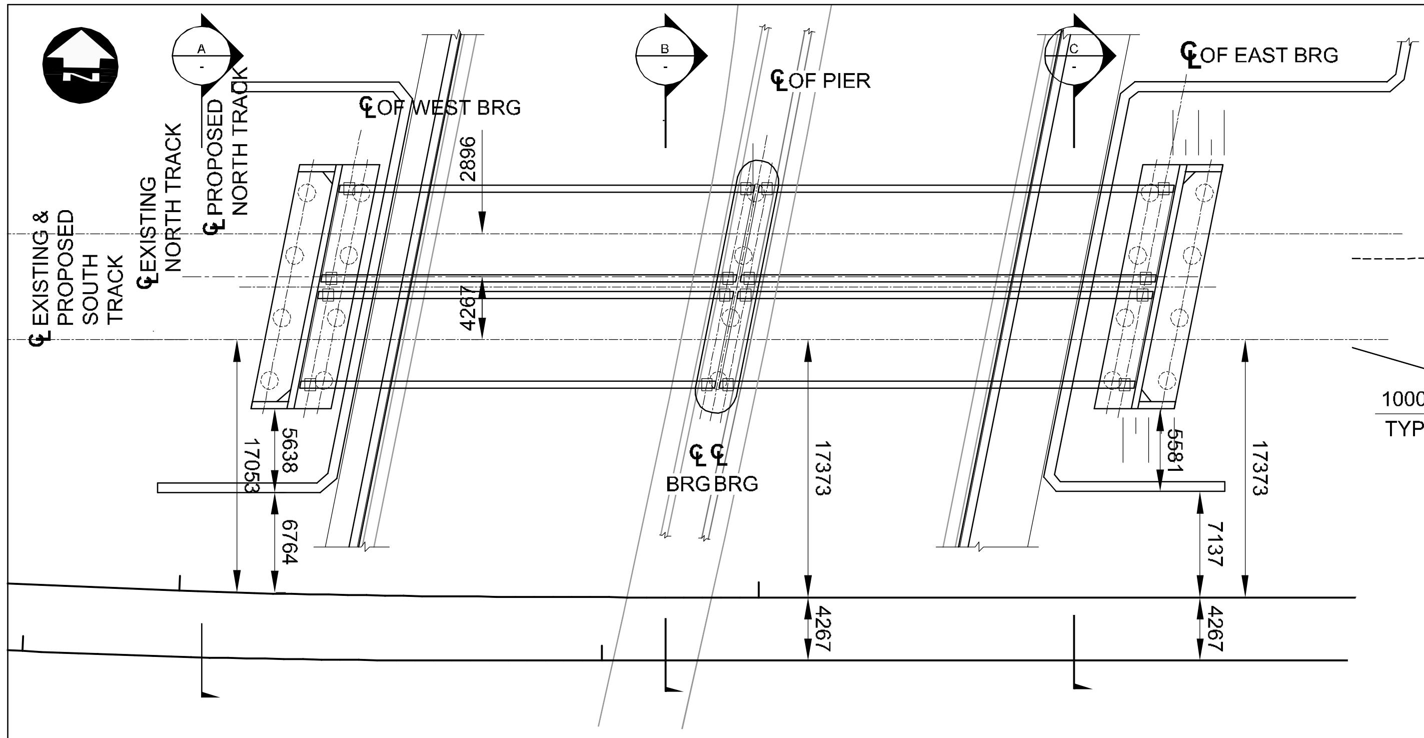
Omer Eissa, P.Eng
Geotechnical Engineer

Reviewed by,

Zeyad Shukri
Senior Geotechnical Engineer

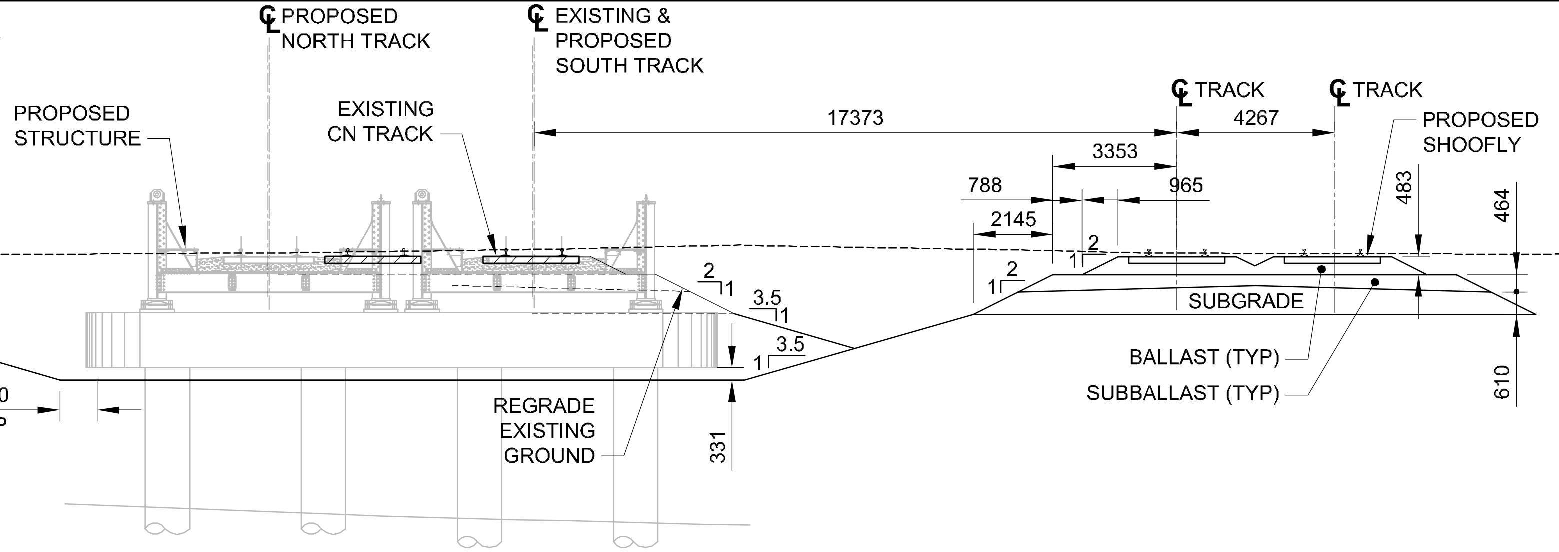
Appendix A

Figures



PLAN

Scale 1:500



B | SECTION

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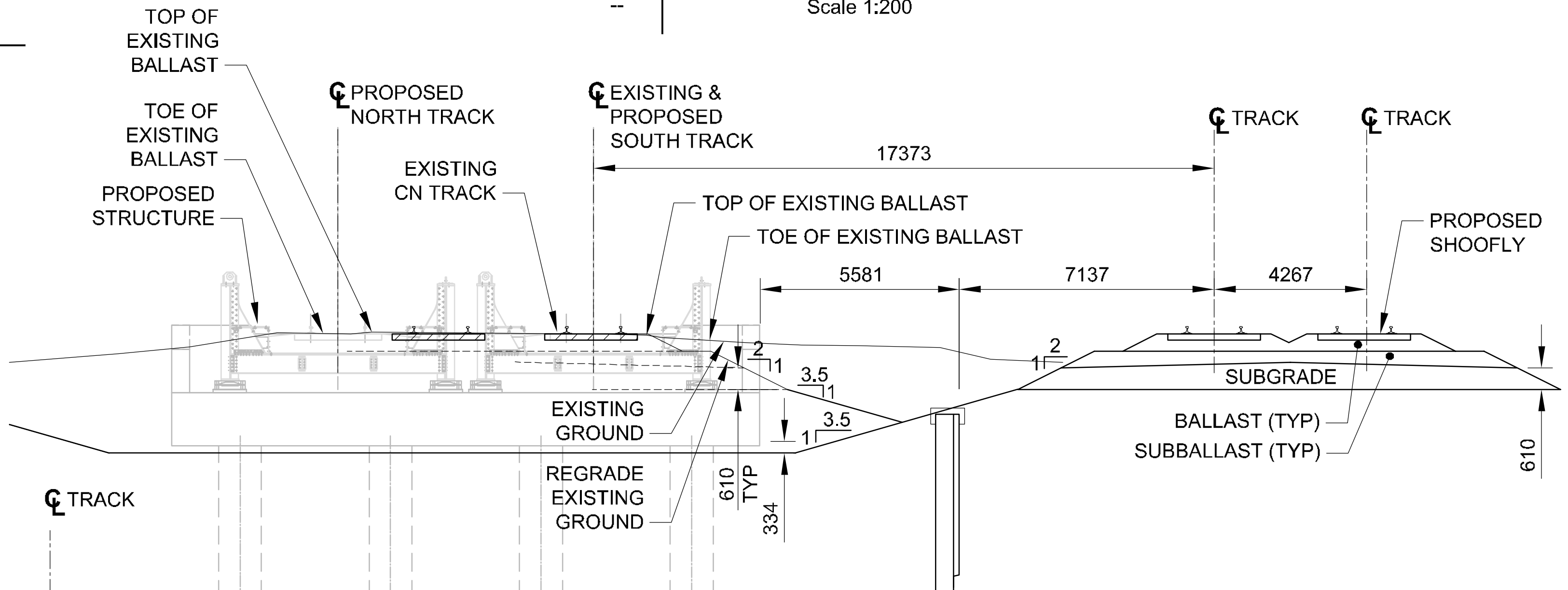
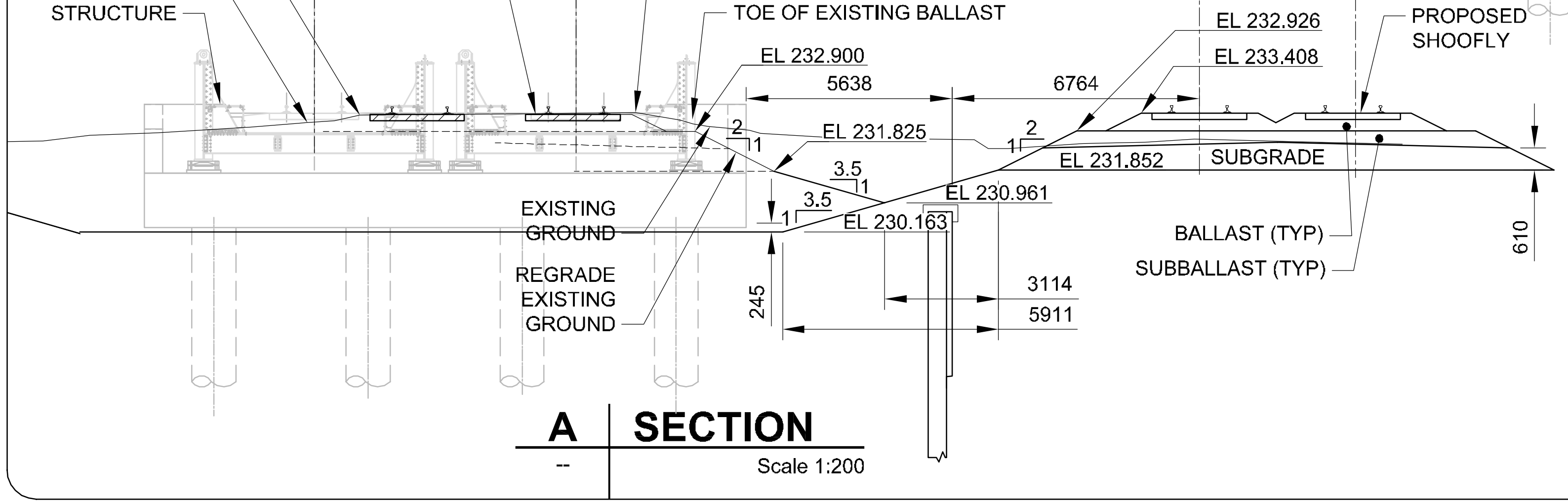


C | SECTION

-- Scale 1:200



A | SECTION

-- Scale 1:200

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AECOM

DILLON CONSULTING

Winnipeg

PLESSIS UNDERPASS STUDY

2 SPAN SINGLE TRACK TPG OPTION
SOUTH TRACK ALIGNMENT

FIGURE CS16

PLESSIS ROAD UNDERPASS STUDY

TRACK SHOOFLY SOUTH OPTION

━━	CROSSING PLANKS
━━	CENTERLINE PROP TRACK
CP 000	CONTROL POINT
━ ━ ━	RAILWAY R/W
←	EXISTING DITCH FLOW ARROW
>——<	EXISTING CULVERT
●━	POWER SWITCH
━●	PROPOSED POWER SWITCH
PP	OVERHEAD POWER LINE WITH POLE
CNT	OVERHEAD CNT LINE WITH POLE
	BLOWER
– – – –	RAIL REMOVE /REALIGN

ISSUED FOR

INFORMATION

Issue Date: 2013/03/11

DRAFT

GENERAL NOTES:

1. ALL DIMENSIONS ARE IMPERIAL AND METRIC EQUIVALENCE ARE IN BRACKETS.
2. ALL PROPERTY LINES ARE PROVIDED FOR INFORMATION PURPOSES ONLY.
3. AERIAL DATED 2009.

NOTE:
BASE PLAN SCHEMATIC IS FOR INFORMATION ONLY. ALL EXISTING INFORMATION NOT VERIFIED BY SURVEY. EXACT ELEMENTS OF PROPOSAL MAY BE ADJUSTED DURING DETAILED DESIGN.

AECOM

DILLON CONSULTING

0 7.5 15 30m

SCALE: 1:1000

DRAFT CR-001

Figure 1:

Name: Sigma - Insitu
Kind: SIGMA/W
Method: Insitu

Name: Clay
Model: Linear Elastic
Effective Young's Modulus (E'): 6000 kPa
Poisson's Ratio: 0.4
Insitu Ko: 0.66666667
Unit Weight: 17 kN/m³

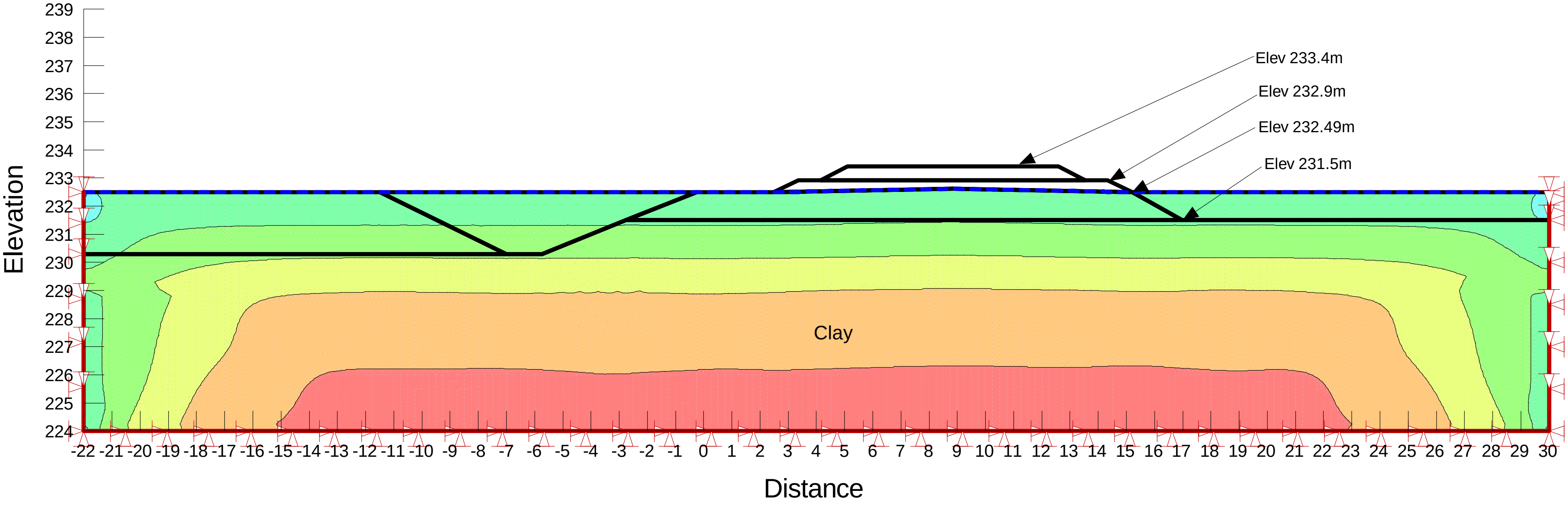


Figure 2:

Name: ShooFly Excavation
Kind: SIGMA/W
Method: Load/Deformation

Name: Clay
Model: Linear Elastic
Effective Young's Modulus (E'): 6000 kPa
Poisson's Ratio: 0.4
Unit Weight: 17 kN/m³

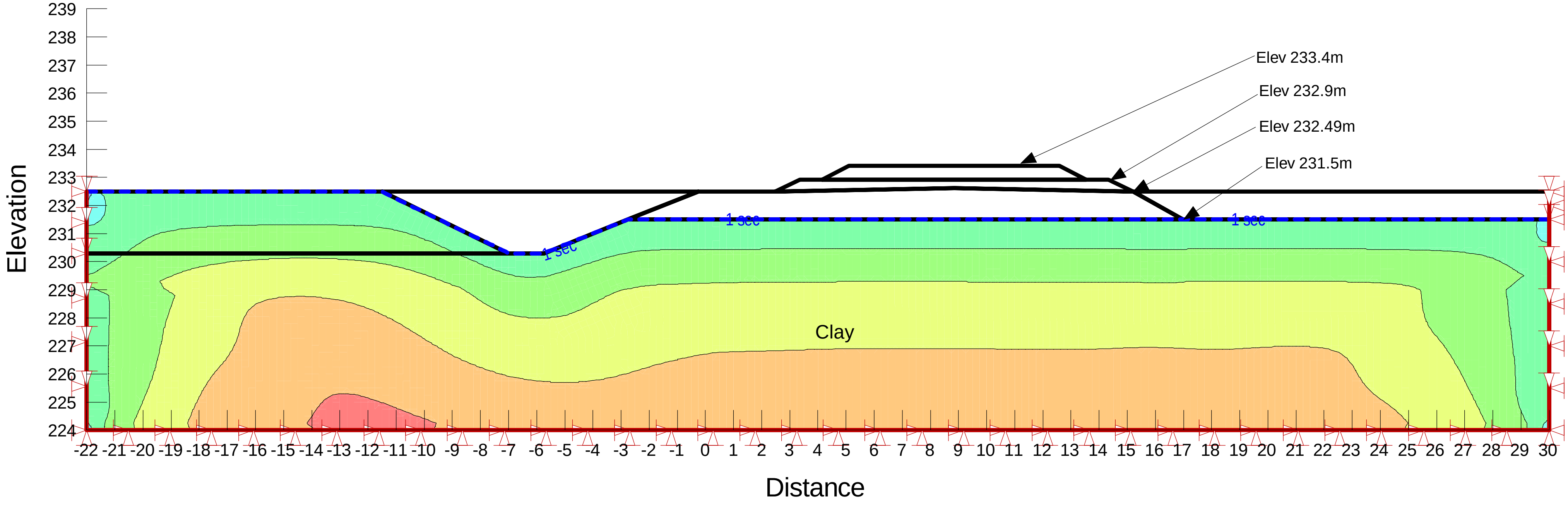


Figure 3:

Name: Embankment Fill
Kind: SIGMA/W
Method: Load/Deformation

Name: Clay
Model: Linear Elastic
Effective Young's Modulus (E'): 6000 kPa
Poisson's Ratio: 0.4
Unit Weight: 17 kN/m³

Name: Ballast
Model: Linear Elastic
Effective Young's Modulus (E'): 120000 kPa
Poisson's Ratio: 0.334
Unit Weight: 20 kN/m³

Name: Granular
Model: Linear Elastic
Effective Young's Modulus (E'): 100000 kPa
Poisson's Ratio: 0.334
Unit Weight: 19 kN/m³

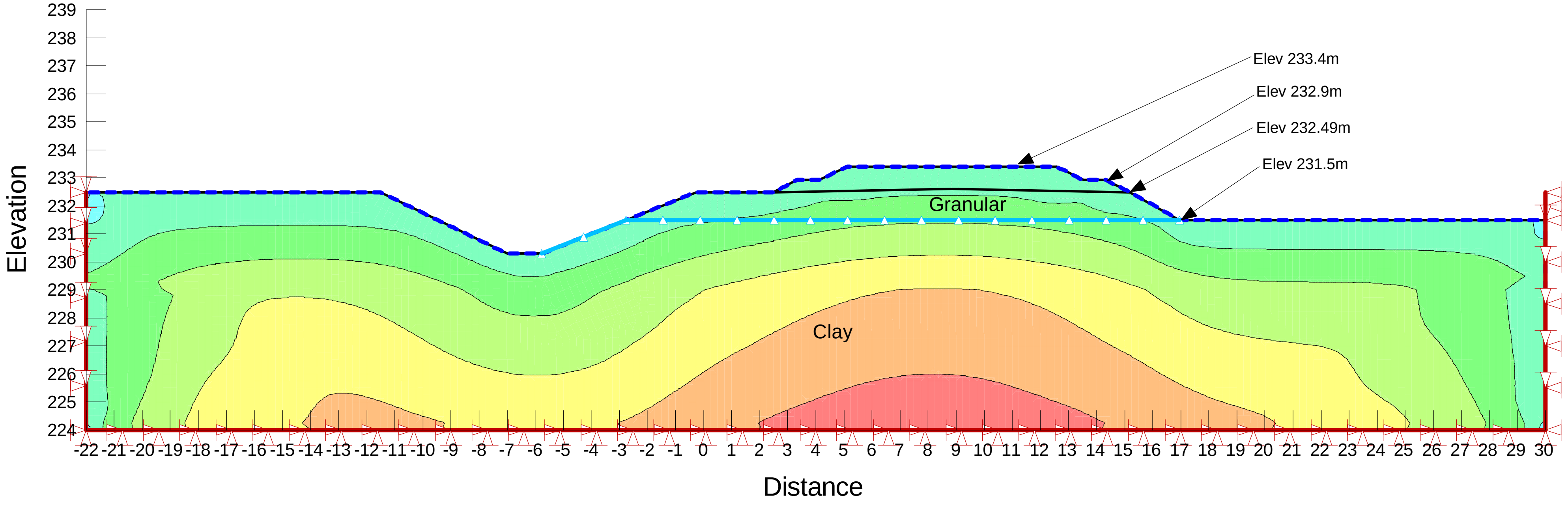


Figure 4:

Name: Bridge Excavation and Surcharge Loading
Kind: SIGMA/W
Method: Load/Deformation
Load Condition: Two Surcharge loads of 110 kPa

Name: Clay
Model: Linear Elastic
Effective Young's Modulus (E'): 6000 kPa
Poisson's Ratio: 0.4
Unit Weight: 17 kN/m³

Name: Ballast
Model: Linear Elastic
Effective Young's Modulus (E'): 120000 kPa
Poisson's Ratio: 0.334
Unit Weight: 20 kN/m³

Name: Granular
Model: Linear Elastic
Effective Young's Modulus (E'): 100000 kPa
Poisson's Ratio: 0.334
Unit Weight: 19 kN/m³

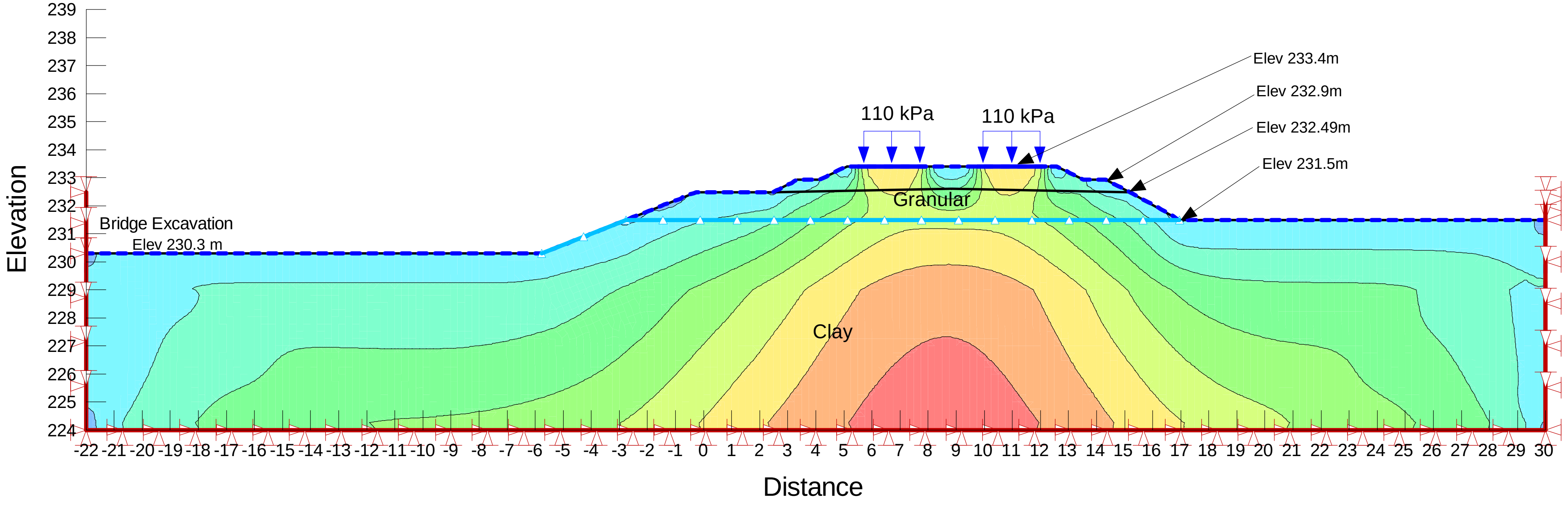


Figure 5:
Name: Bridge Excavation Stability Analysis
Kind: SLOPE/W
Method: SIGMA/W Stress
Loading Condition: Surcharge loads of 110 kPa on each Track

Unit Weight: 17 kN/m^3
Cohesion: 5 kPa
Phi: 17 °
Phi-B: 0 °

Name: Ballast
Model: Mohr-Coulomb
Unit Weight: 20 kN/m^3
Cohesion: 0 kPa
Phi: 40 °
Phi-B: 0 °

Name: Granular
Model: Mohr-Coulomb
Unit Weight: 19 kN/m^3
Cohesion: 0 kPa
Phi: 38 °
Phi-B: 0 °

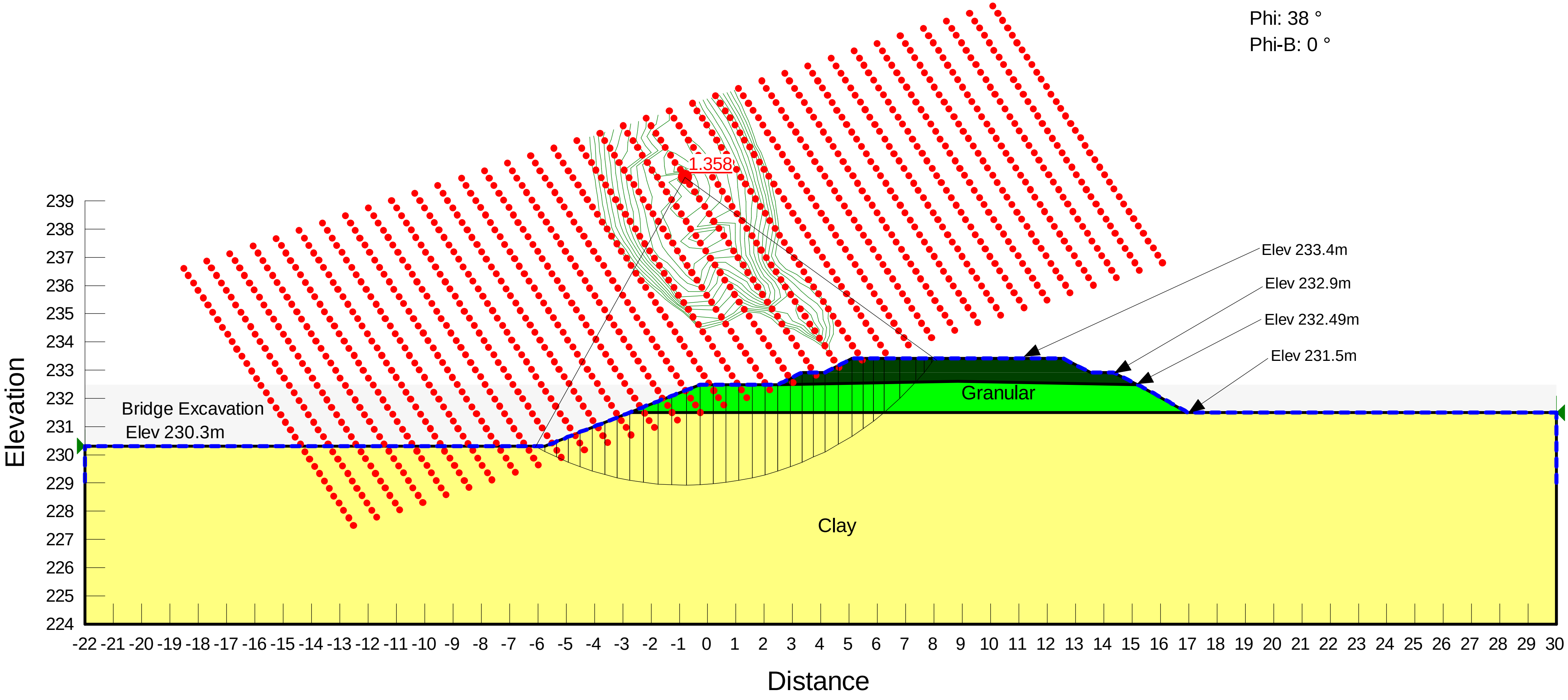


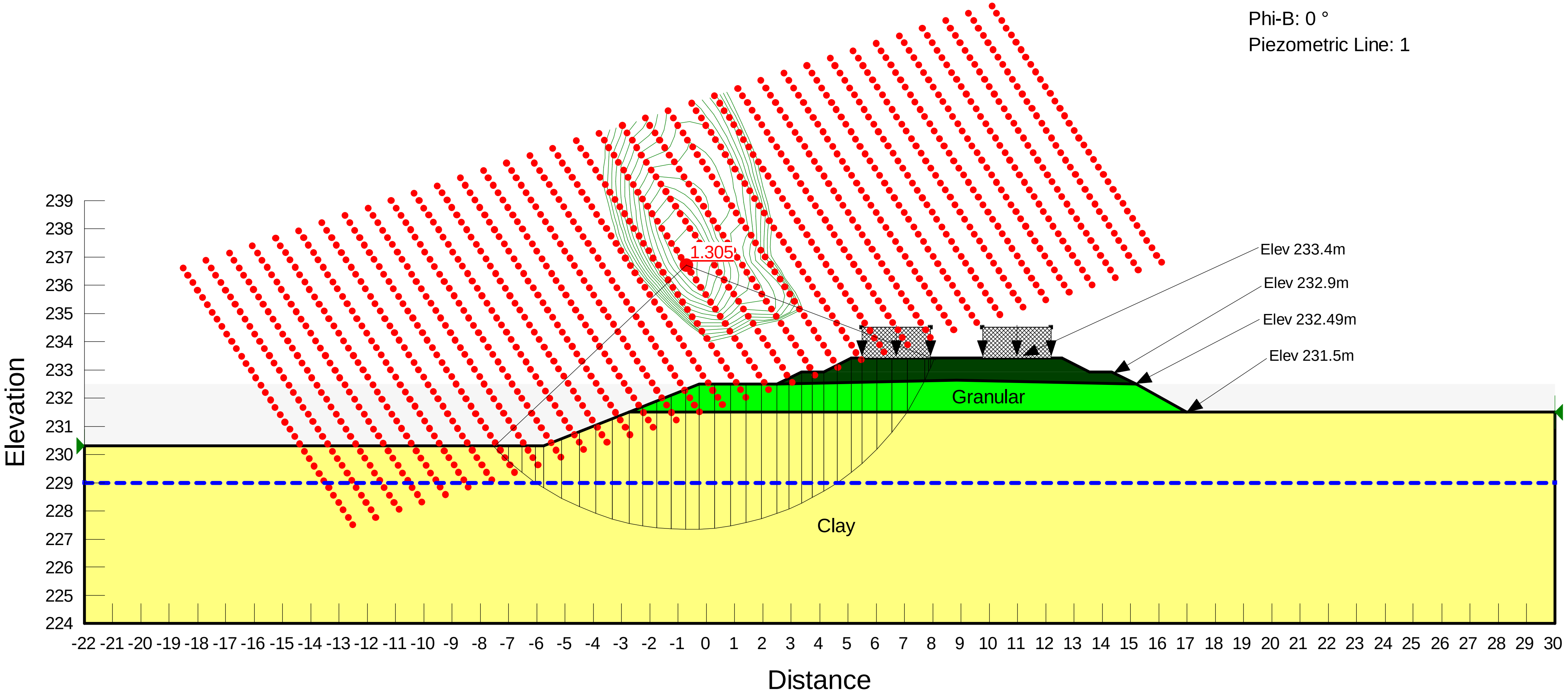
Figure 6:

Name: Stability Analysis
Kind: SLOPE/W
Method: Morgenstern-Price
Loading Condition: Surcharge loads of 110 kPa on each Track

Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 17 °
Phi-B: 0 °
Piezometric Line: 1

Name: Ballast
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Phi: 40 °
Phi-B: 0 °
Piezometric Line: 1

Name: Granular
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion: 0 kPa
Phi: 38 °
Phi-B: 0 °
Piezometric Line: 1



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Memorandum

To	Brent Knezacek	Page	1
CC	Tanya Worms		
Subject	CN Railway Detour Stability Analysis		
From	Mustafa Alkiki		
Date	October 31, 2013	Project Number	60273041 (404.19.2)

Introduction

AECOM was retained by the City of Winnipeg to provide a detailed design including geotechnical engineering services for the proposed Plessis Road Underpass in Winnipeg, Manitoba. As part of the project, the existing CN railway tracks crossing Plessis Road will have to be relocated south of the existing crossing for the duration of the bridge construction. The location of the railway detour (shoofly) in relation to the underpass and bridge structure is shown in the attached drawing Number CS-0005, Appendix A. In addition, we understand that excavation work will be carried out at the junction between the railway detour and Plessis Road. This memorandum summarizes the stability analysis results for the proposed CN railway detour embankment at the bridge location and further at the intersection with Plessis Road.

The proposed CN railway embankment is approximately 7.46 meters wide at the top of the embankment and consists of railway ties over a ballast layer of 0.48 m thickness. A sub-ballast layer lies under the ballast layer and extends from a thickness of 0.3 m at the centre of the embankment with a cross fall of 1:40 towards the edges of the embankment. A well-compacted granular layer of 1.0 m thickness lies between the sub-ballast and subgrade layers. The shoofly is expected to perform as a temporary detour for the duration of the bridge construction. The shoofly embankment is located approximately 17 m from the centerline of the south existing CN track to the centerline of the north detour track. The proposed shoofly plan and cross-sections are shown in Figures CS-0004 and CS-0005, attached in Appendix A.

Stability Modelling

The proposed shoofly embankment shown in Figures CS-004 and CS-0005 was modelled using the soil strength parameters presented in Table 01, below.

Table 01: Strength Parameters for Slope Stability Analysis

Material	Unit Weight (kN/m)	Cohesion (kPa)	Angle of Internal Friction (°)	Modulus of Elasticity (kPa)	Poisson's Ratio
Ballast	20	0	40	120,000	0.25
Sub-ballast	20	0	40	120,000	0.25
Granular Fill	19	0	38	100,000	0.33
Native Clay	17	5	18	6,000	0.4

The analysis was conducted using Sigma/W and Slope/W Geo Studio software. A stepped analysis showing each stage of the construction was modelled in Sigma/W. The purpose of a stepped (or treed) analysis is to import the soil stress state from the initial in-situ model and recalculate the soil stress redistribution and pore-water response for each construction stage. The embankment loading was modelled according to the CN memorandum dated November 22, 2011 and titled "Design Criteria for the Shoring Walls submitted by the Consultant". The surcharge due to the Cooper-E90 loading as per AREMA-2010 was modelled as a 90 kips axle load at 5 ft spacing over an 8-ft-long tie for a resulting surcharge of approximately 110 kPa. A Slope/W stability analysis was conducted for the critical stage of construction where the detour embankment is loaded with Cooper E90 train loads nearby the bridge excavation. Three cases were considered in the analysis:

Case 1: A maximum excavation depth up to +230 m was modeled with side slope of 2:1 (north side excavation).
Case 2: A maximum excavation depth up to +226 m and side slope of 4:1 (north side excavation).
Case 3: A maximum excavation depth up to +228.5 m and side slope of 4:1 (south side excavation).

Table 02, below, lists and describes the cases of stability modelling representing the stages of embankment and bridge construction.

Water conditions were modelled in the in-situ Sigma/W model based on the site groundwater monitoring results. The groundwater table measured on-site between December 2012 and June 2013 fluctuated between elevations of 226.5 to 228.2 m. Groundwater was modelled in the in-situ model at elevation 228 m.

Table 02: List and Description of Modelling Stages

Analysis ID	Analysis Type	Construction Condition
Case-01a	Sigma/W- In Situ	Initial Condition
Case-01b	Sigma/W- Stress Redistribution	Detour Excavation
Case-01c	Sigma/W- Stress Redistribution	Embankment Fill Placement
Case-01d	Sigma/W- Stress Redistribution	Bridge Excavation + Embankment Loading
Case- 01e	Slope/W – Stress Imported Analysis	Slope Stability with Imported Stress Conditions from Case-01d
Case- 01f	Slope/W – Morgenstern-Price Analysis	Slope Stability without Imported Stresses
Case-02a	Sigma/W- Stress Redistribution	Roadside Excavation + Embankment Loading
Case-02b	Slope/W – Stress Imported Analysis	With Imported Stress Conditions from Case-02a
Case-02c	Slope/W – Morgenstern-Price Analysis	Slope Stability without Imported Stresses

Analysis ID	Analysis Type	Construction Condition
Case-03a	Sigma/W- Stress Redistribution	Roadside Excavation + Embankment Loading
Case-03b	Slope/W – Stress Imported Analysis	With Imported Stress Conditions from Case-03a
Case-03c	Slope/W – Morgenstern-Price Analysis	Slope Stability without Imported Stresses

Analysis results are presented graphically in Figures 01 through 012, attached in Appendix A.

Analysis Results

An adequate factor of safety (FS) against slope instability must be achieved for short- and long- term conditions of the detour embankment. A design factor of safety of at least 1.5 is considered satisfactory for the long-term condition of an unloaded embankment. For the case of the loaded embankment with one or two train loads, a factor of safety of at least 1.3 is considered adequate.

For Case 1, the embankment as shown in Figures CS-004 and CS-005 meets the design target factors of safety against slope instability. Stability analysis for Case 2, as shown in Figure 10 in Appendix A, meets the design target factors of safety by utilizing a platform of 7.5 m wide at + 230 m and then excavating with 4:1 slope to the final level of +226 m along Plessis Road. Figure 10 shows the dimensions of the proposed geometry required to fulfill design factors of safety for Case 2. Stability analysis for Case 3 revealed that in order to meet the design factor of safety against slope instability, a 2.74 m wide buttress should be placed to maintain the native granular soil, and the excavation can be extended with a 4:1 slope to the final level of +228.5 along Plessis Road. Factors of safety for the three cases are presented in Table 03. Figures outlining individual analysis results are attached in Appendix A.

Table 03: Factor of Safety Against Slope Instability

Case	Loading Conditions	Computed F.S	Design F.S	Figure No.
Case-01e	North track loaded	1.32	1.3	-
	South track loaded	1.58	1.3	-
	Both tracks loaded	1.33	1.3	05
	No train loads	1.64	1.5	-
Case-01f	North track loaded	1.31	1.3	-
	South track loaded	1.66	1.3	-
	Both tracks loaded	1.31	1.3	06
	No train loads	1.73	1.5	-
Case-02b	North track loaded	1.38	1.3	-
	South track loaded	1.45	1.3	-
	Both tracks loaded	1.32	1.3	08
	No train loads	1.60	1.5	-
Case-02c	North track loaded	1.35	1.3	-
	South track loaded	1.43	1.3	-
	Both tracks loaded	1.33	1.3	09
	No train loads	1.52	1.5	-
Case-03b	Both tracks loaded	1.33	1.3	11
Case-03c	Both tracks loaded	1.32	1.3	12
	No train loads	1.83	1.5	-

We trust the information provided is sufficient for your purposes. Please don't hesitate to contact the undersigned should you have any questions or concerns.

Prepared by,

Mustafa Alkiki, EIT
Geotechnical Engineer-In-Training

Reviewed by,

Zeyad Shukri, M.Sc.
Senior Geotechnical Engineer

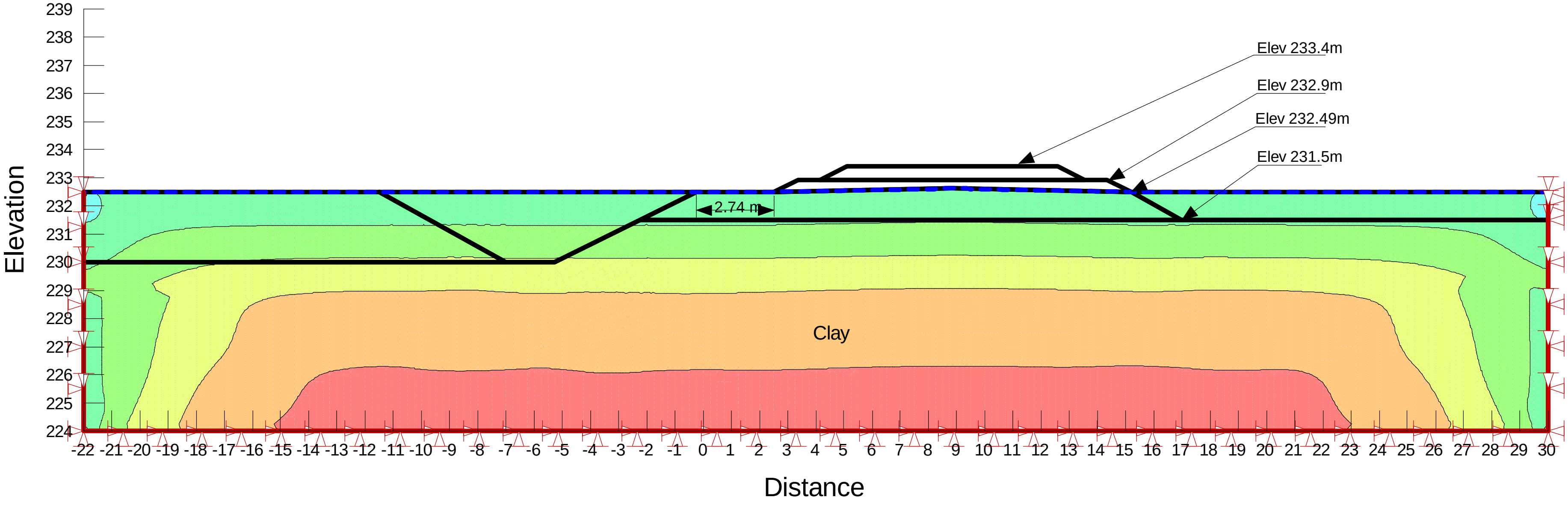
Patrick C. Chang, P.E., P.Eng.
Senior Project Engineer

Appendix A

Figures

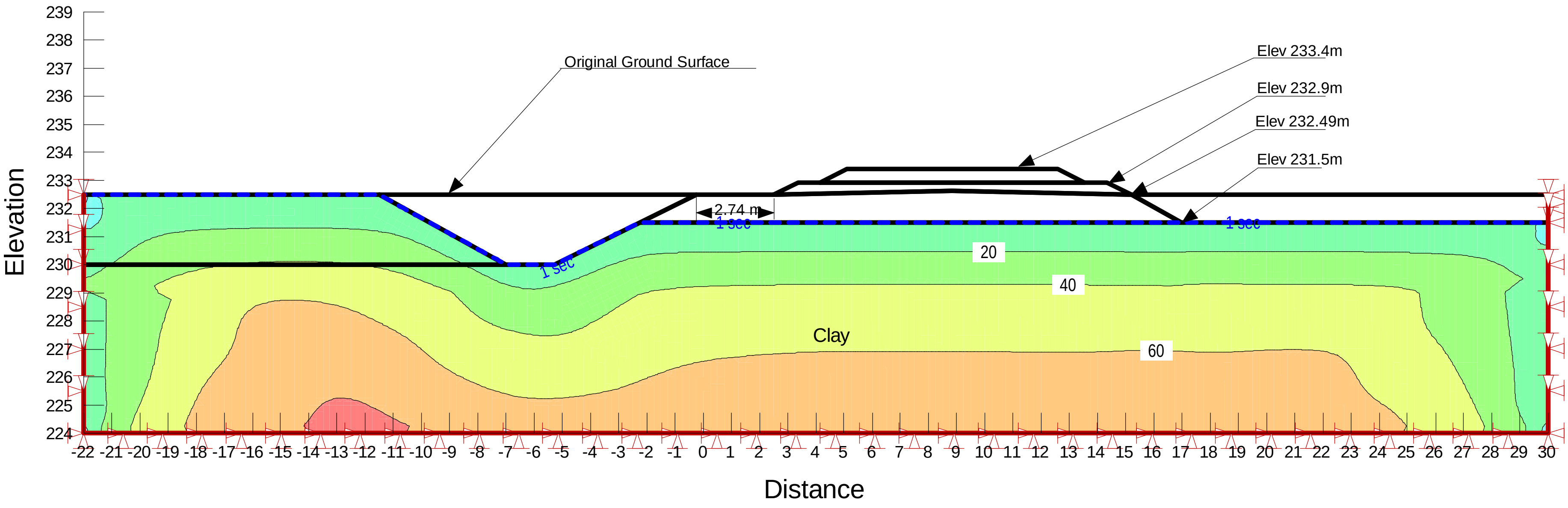
Plessis Rd Underpass
Name: Sigma - In-situ
Method: Method: Insitu
Kind: SIGMA/W
Figure 01: Case 01a

Name: Clay
Model: Linear Elastic
Effective Young's Modulus (E'): 6000 kPa
Poisson's Ratio: 0.4
Insitu Ko: 0.66666667
Unit Weight: 17 kN/m³



Plessis Rd Underpass
Name: ShooFly Excavation
Method: Method: Load/Deformation
Kind: SIGMA/W
Figure 02: Case 01b

Name: Clay
Model: Linear Elastic
Effective Young's Modulus (E'): 6000 kPa
Poisson's Ratio: 0.4
Unit Weight: 17 kN/m³

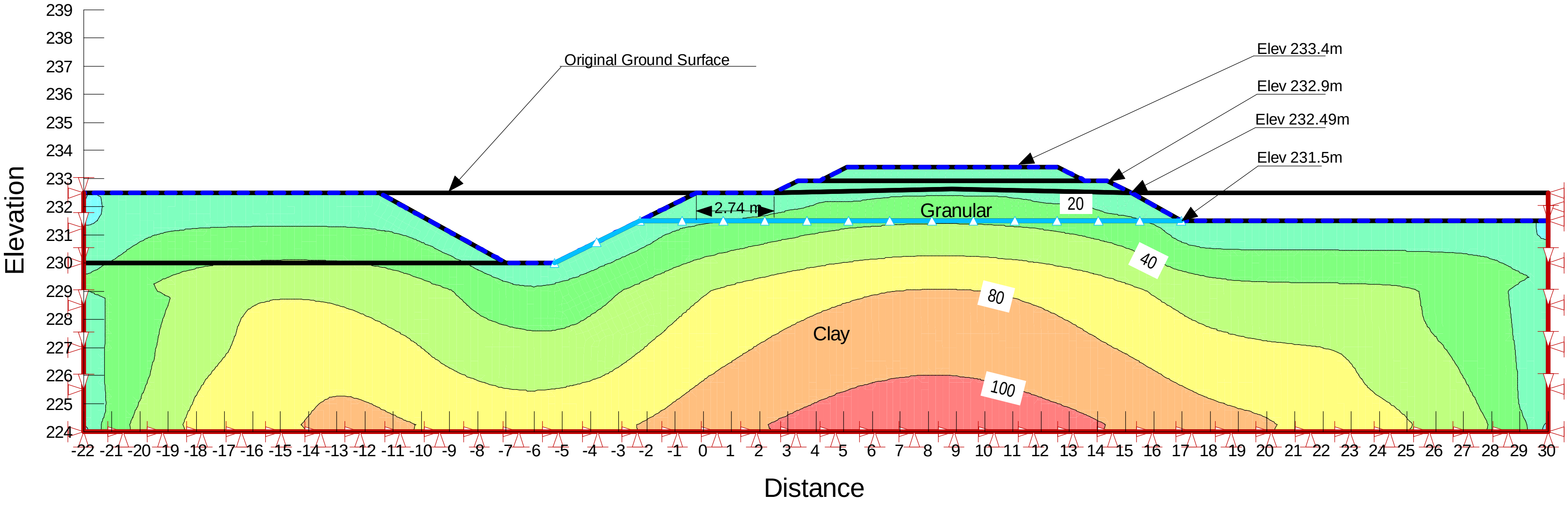


Plessis Rd Underpass
Name: Embankment Fill Placement
Method: Method: Load/Deformation
Kind: SIGMA/W
Figure 03: Case 01c

Name: Clay
Model: Linear Elastic
Effective Young's Modulus (E'): 6000 kPa
Poisson's Ratio: 0.4
Unit Weight: 17 kN/m³

Name: Ballast
Model: Linear Elastic
Effective Young's Modulus (E'): 120000 kPa
Poisson's Ratio: 0.25
Unit Weight: 20 kN/m³

Name: Granular
Model: Linear Elastic
Effective Young's Modulus (E'): 100000 kPa
Poisson's Ratio: 0.334
Unit Weight: 19 kN/m³

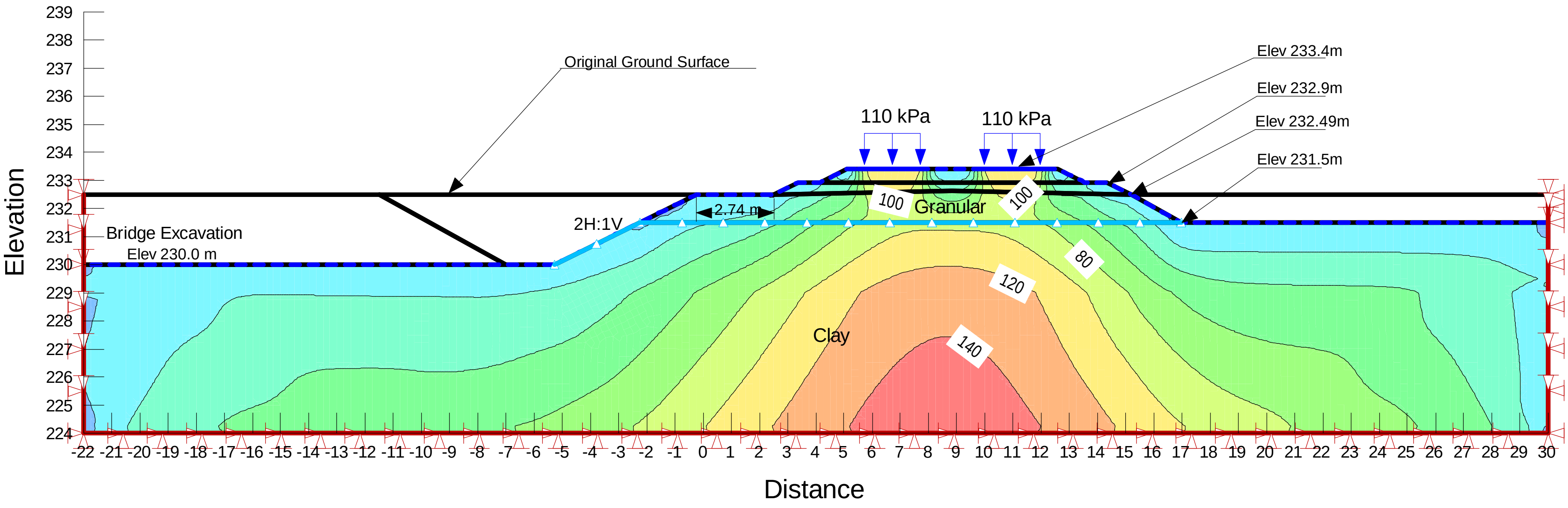


Plessis Rd Underpass
Name: Bridge Excavation and Surcharge Loading
Method: Method: Load/Deformation
Kind: SIGMA/W
Figure 04: Case 01d

Name: Clay
Model: Linear Elastic
Effective Young's Modulus (E'): 6000 kPa
Poisson's Ratio: 0.4
Unit Weight: 17 kN/m³

Name: Ballast
Model: Linear Elastic
Effective Young's Modulus (E'): 120000 kPa
Poisson's Ratio: 0.25
Unit Weight: 20 kN/m³

Name: Granular
Model: Linear Elastic
Effective Young's Modulus (E'): 100000 kPa
Poisson's Ratio: 0.334
Unit Weight: 19 kN/m³

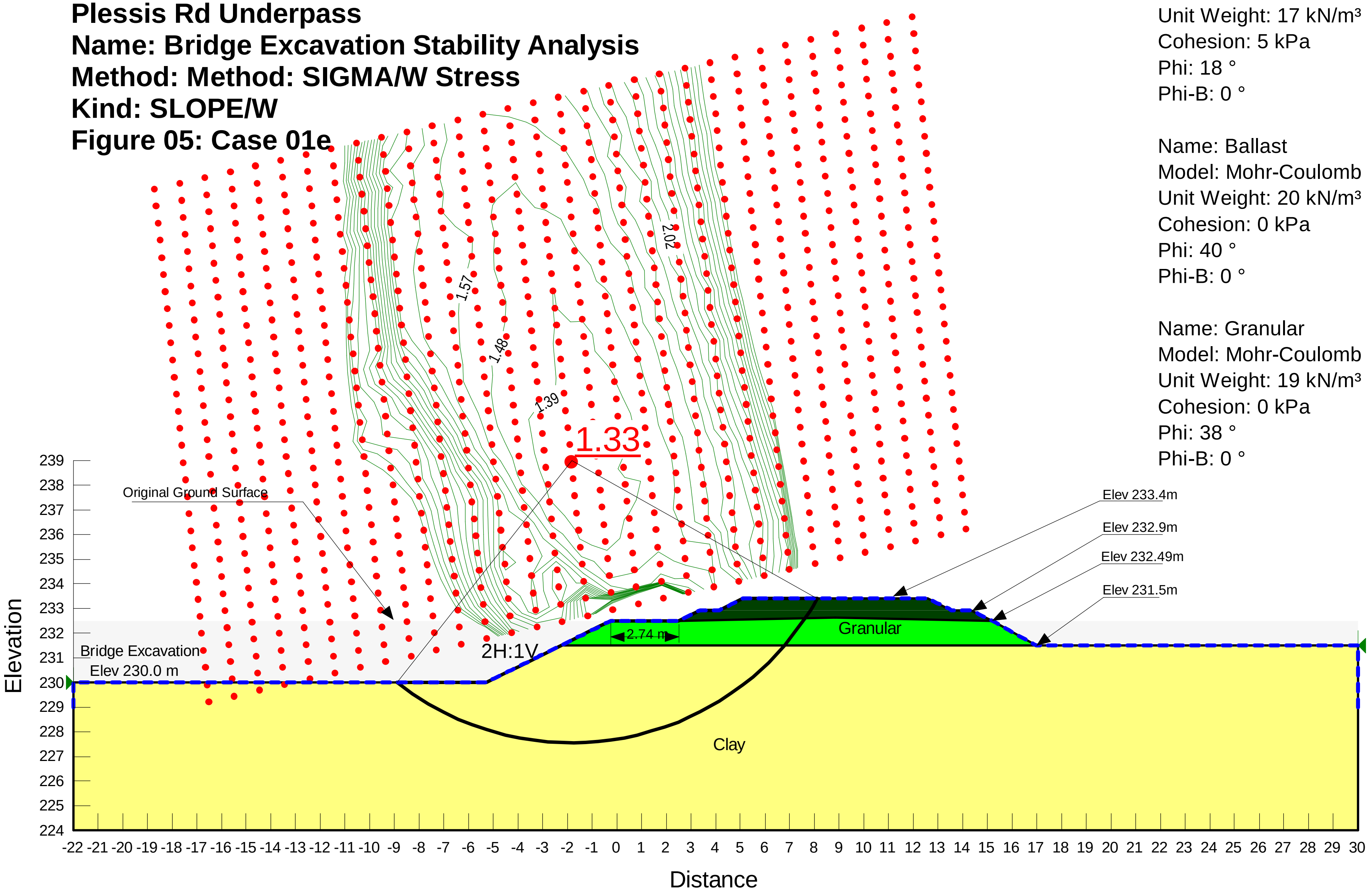


Plessis Rd Underpass
Name: Bridge Excavation Stability Analysis
Method: Method: SIGMA/W Stress
Kind: SLOPE/W
Figure 05: Case 01e

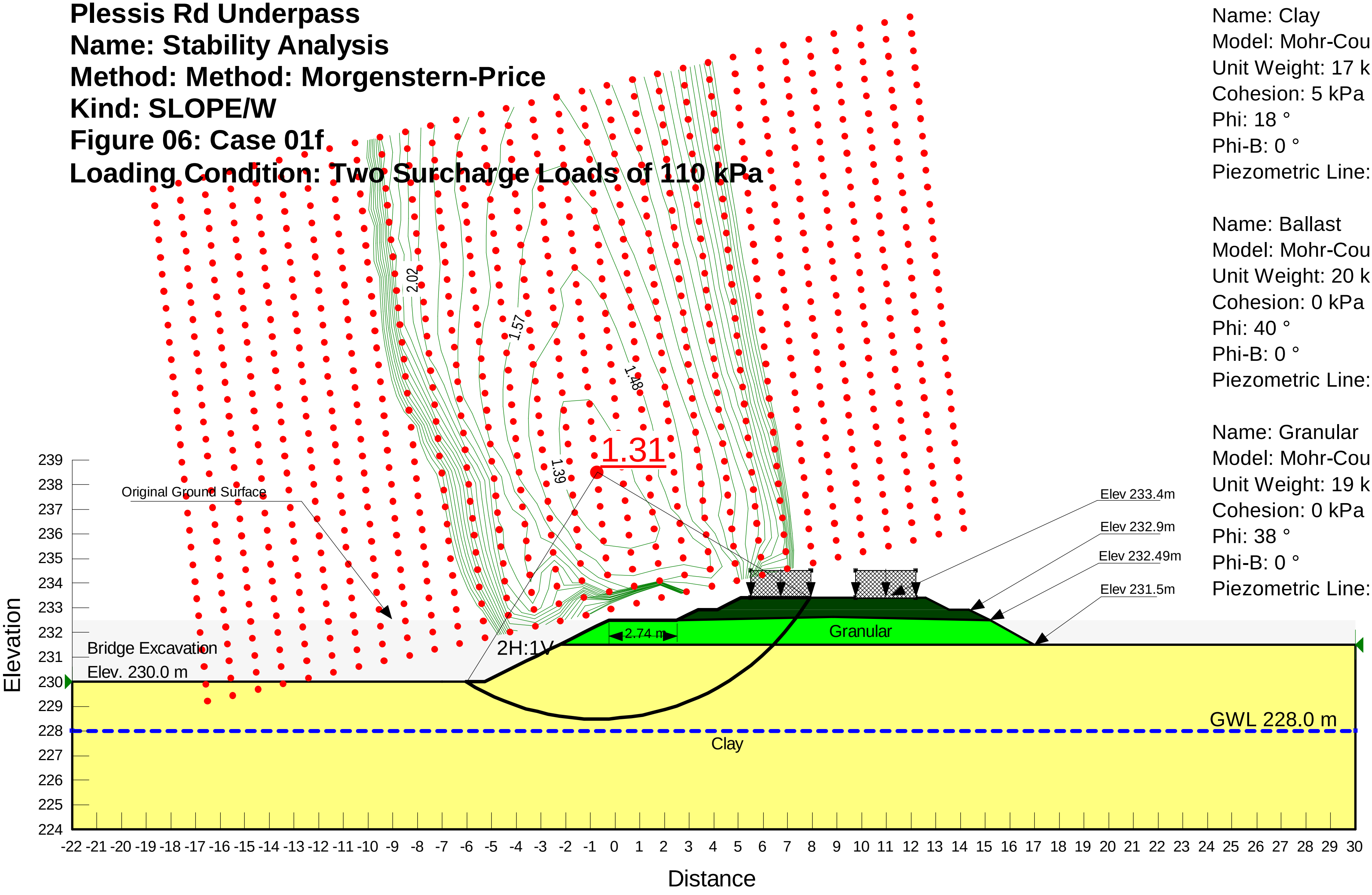
Name: Clay
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 18 °
Phi-B: 0 °

Name: Ballast
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Phi: 40 °
Phi-B: 0 °

Name: Granular
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion: 0 kPa
Phi: 38 °
Phi-B: 0 °



Plessis Rd Underpass
Name: Stability Analysis
Method: Method: Morgenstern-Price
Kind: SLOPE/W
Figure 06: Case 01f
Loading Condition: Two Surcharge Loads of 110 kPa



Name: Clay
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 18 °
Phi-B: 0 °
Piezometric Line: 1

Name: Ballast
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Phi: 40 °
Phi-B: 0 °
Piezometric Line: 1

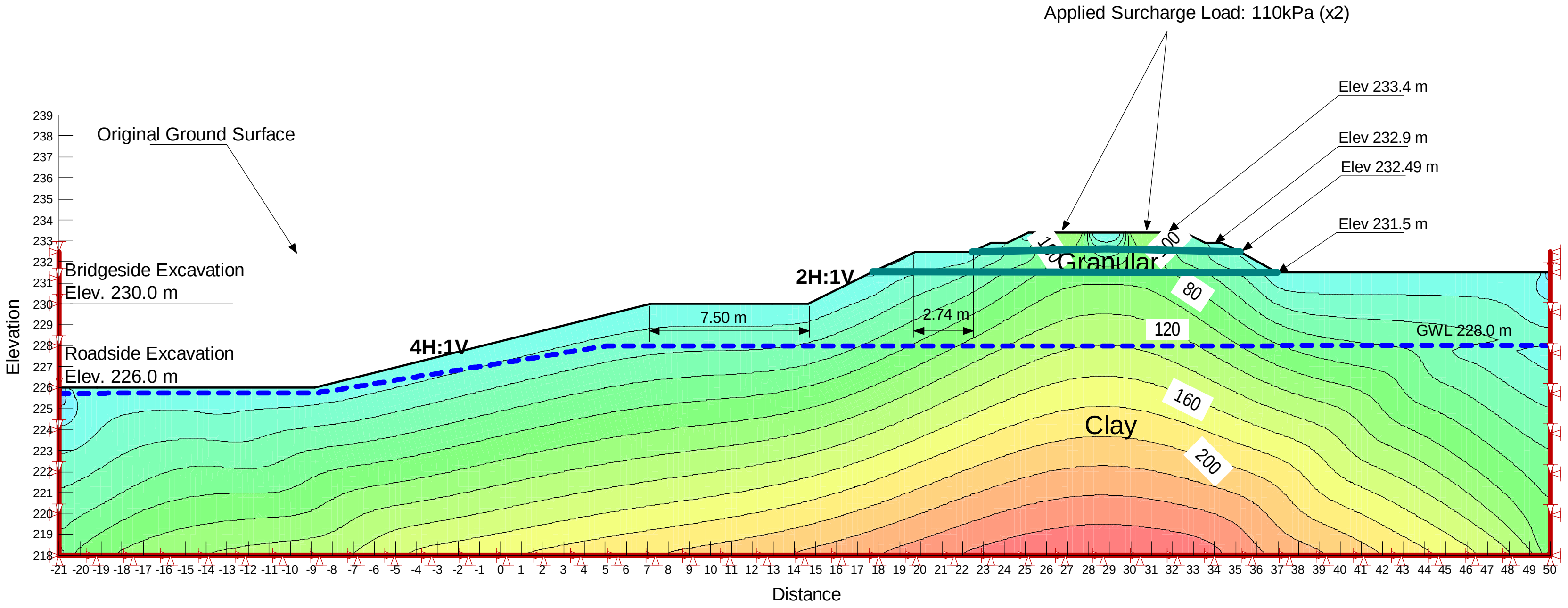
Name: Granular
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion: 0 kPa
Phi: 38 °
Phi-B: 0 °
Piezometric Line: 1

Plessis Rd Underpass
Name: Roadside Excavation and Embankment Loading
Kind: SIGMA/W
Method: Load/Deformation
Loading Condition: Surcharge loads of 110 kPa on each Track
Figure 07: Case 02a

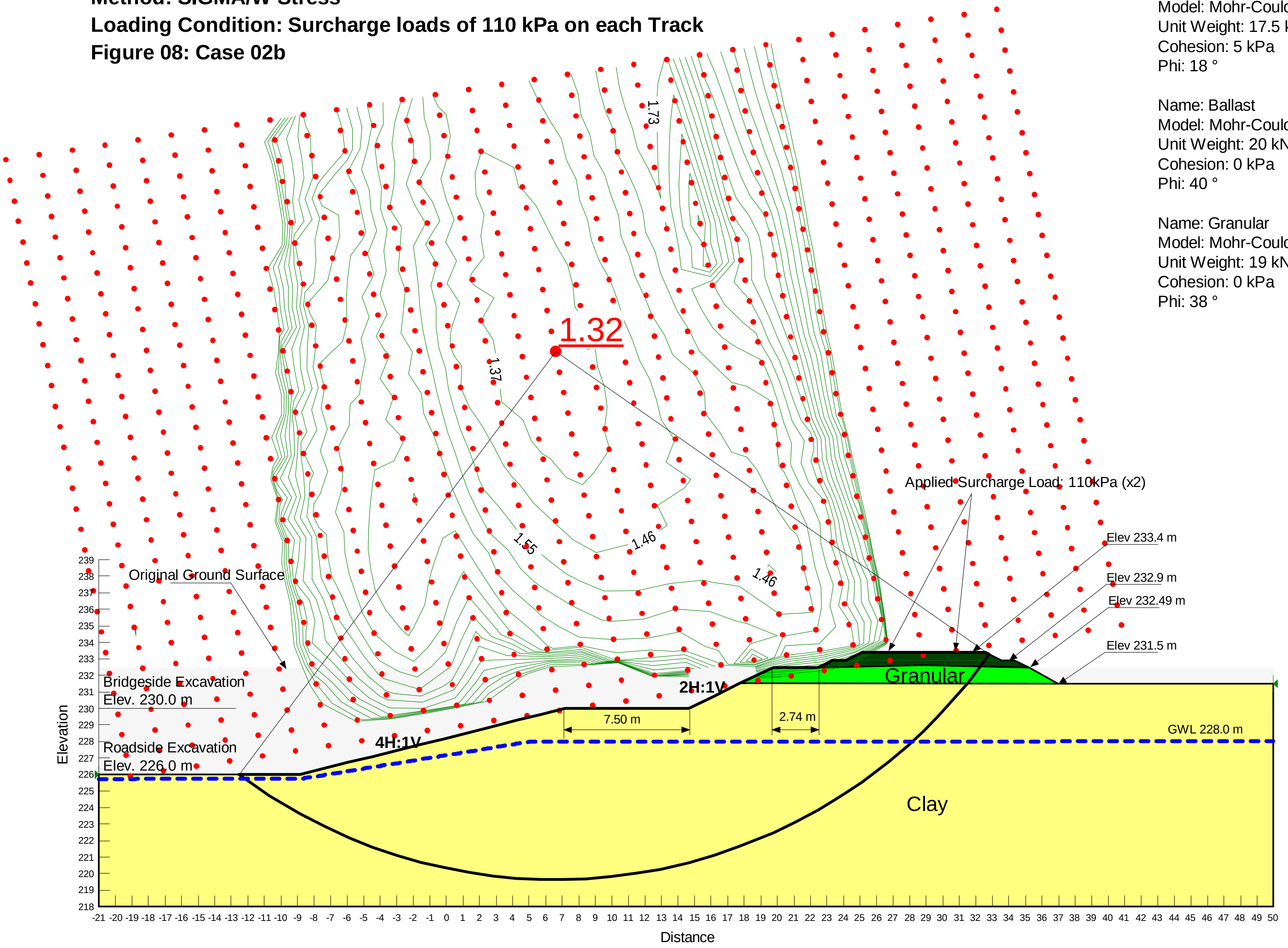
Name: Clay
Model: Linear Elastic
Effective Young's Modulus (E'): 6000 kPa
Poisson's Ratio: 0.4
Insitu Ko: 0.66666667
Unit Weight: 17 kN/m³

Name: Ballast
Model: Linear Elastic
Effective Young's Modulus (E'): 120000 kPa
Poisson's Ratio: 0.25
Insitu Ko: 0.33333333
Unit Weight: 20 kN/m³

Name: Granular
Model: Linear Elastic
Effective Young's Modulus (E'): 100000 kPa
Poisson's Ratio: 0.334
Insitu Ko: 0.5015015
Unit Weight: 19 kN/m³



Plessis Rd Underpass
Name: Roadside Excavation Stability Analysis
Kind: SLOPE/W
Method: SIGMA/W Stress
Loading Condition: Surcharge loads of 110 kPa on each Track
Figure 08: Case 02b

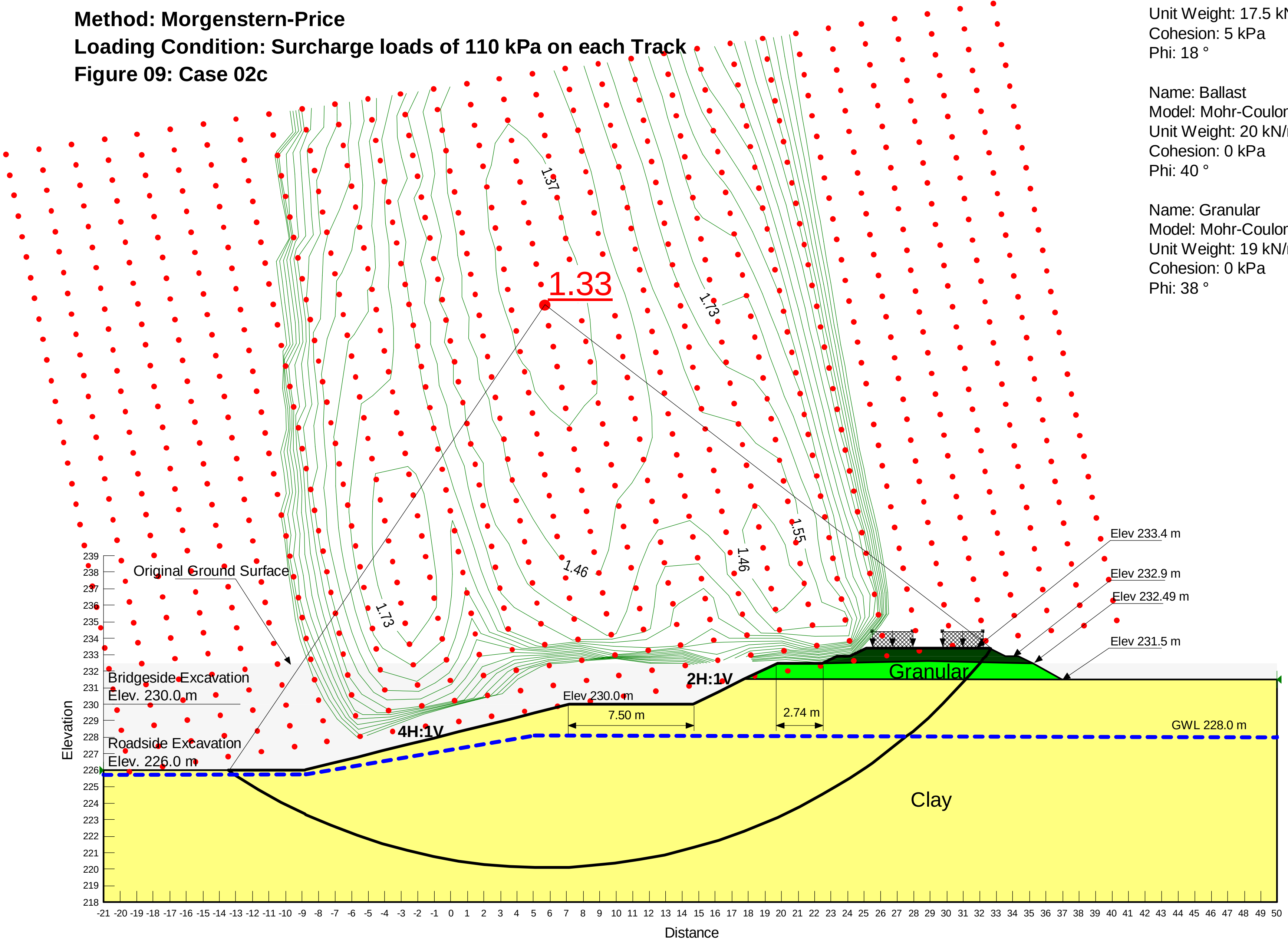


Name: Clay
Model: Mohr-Coulomb
Unit Weight: 17.5 kN/m³
Cohesion: 5 kPa
Phi: 18 °

Name: Ballast
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Phi: 40 °

Name: Granular
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion: 0 kPa
Phi: 38 °

Plessis Rd Underpass
Name: Stability Analysis
Kind: SLOPE/W
Method: Morgenstern-Price
Loading Condition: Surcharge loads of 110 kPa on each Track
Figure 09: Case 02c

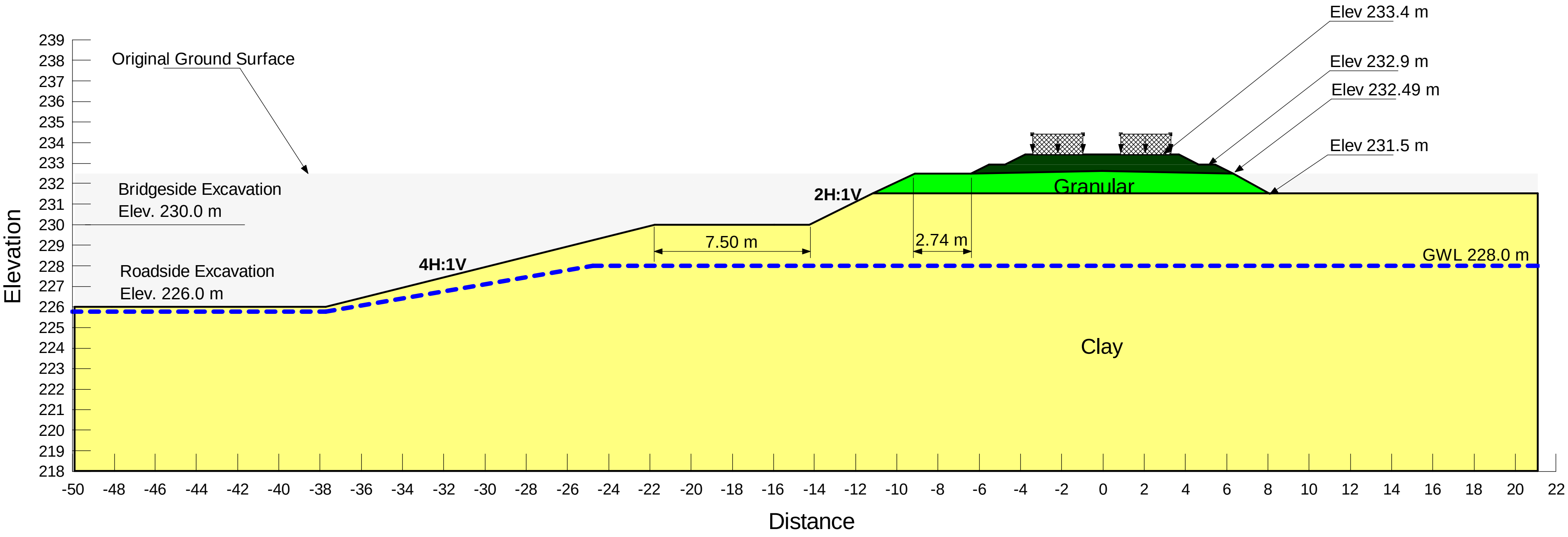


Name: Clay
Model: Mohr-Coulomb
Unit Weight: 17.5 kN/m³
Cohesion: 5 kPa
Phi: 18 °

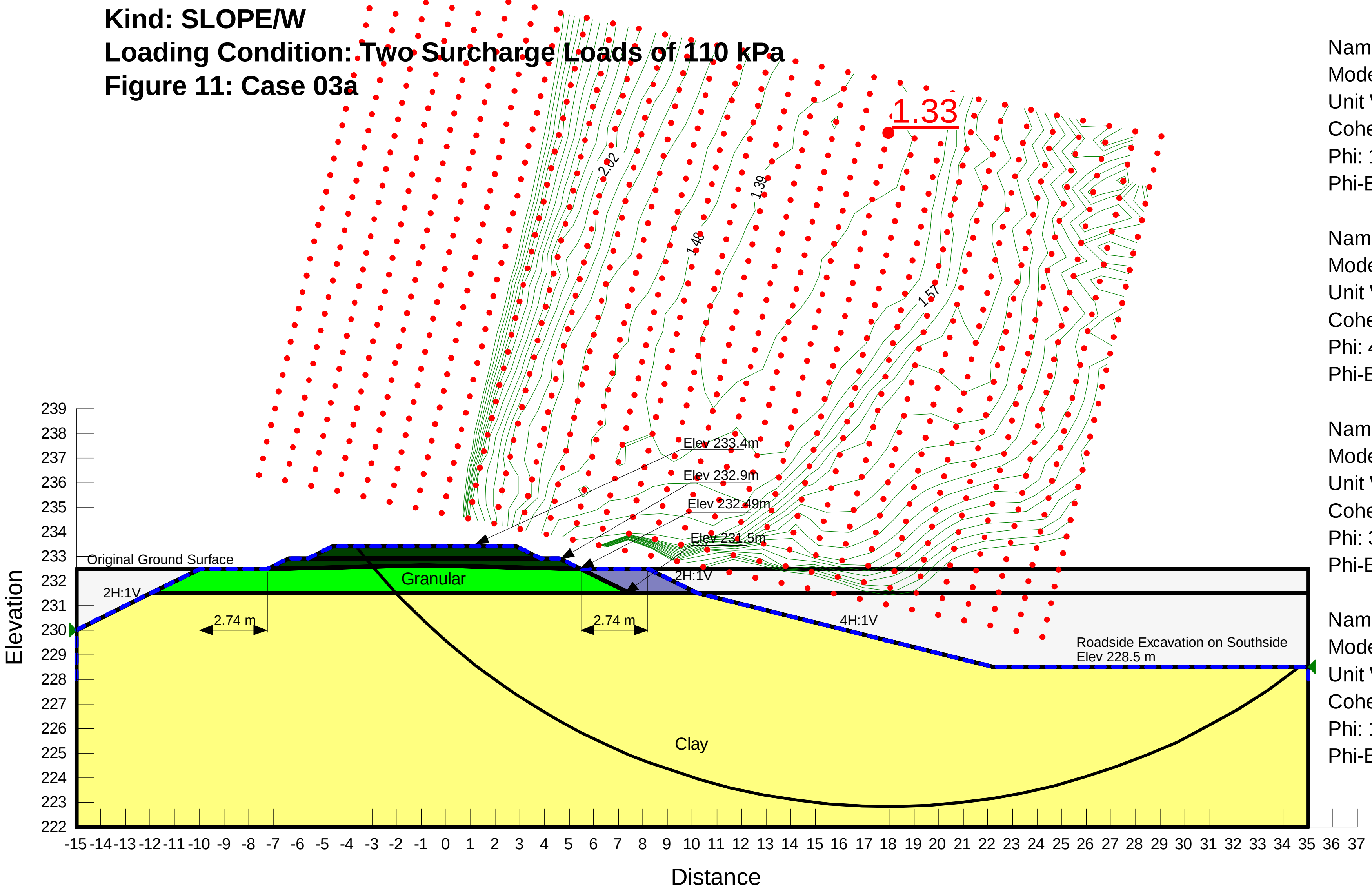
Name: Ballast
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Phi: 40 °

Name: Granular
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion: 0 kPa
Phi: 38 °

Plessis Rd Underpass
Name: Stability Analysis
Figure 10: Geometry for Case 02



Plessis Rd Underpass
Name: Roadside Excavation Stability Analysis
Method: Method: SIGMA/W Stress
Kind: SLOPE/W
Loading Condition: Two Surcharge Loads of 110 kPa
Figure 11: Case 03a



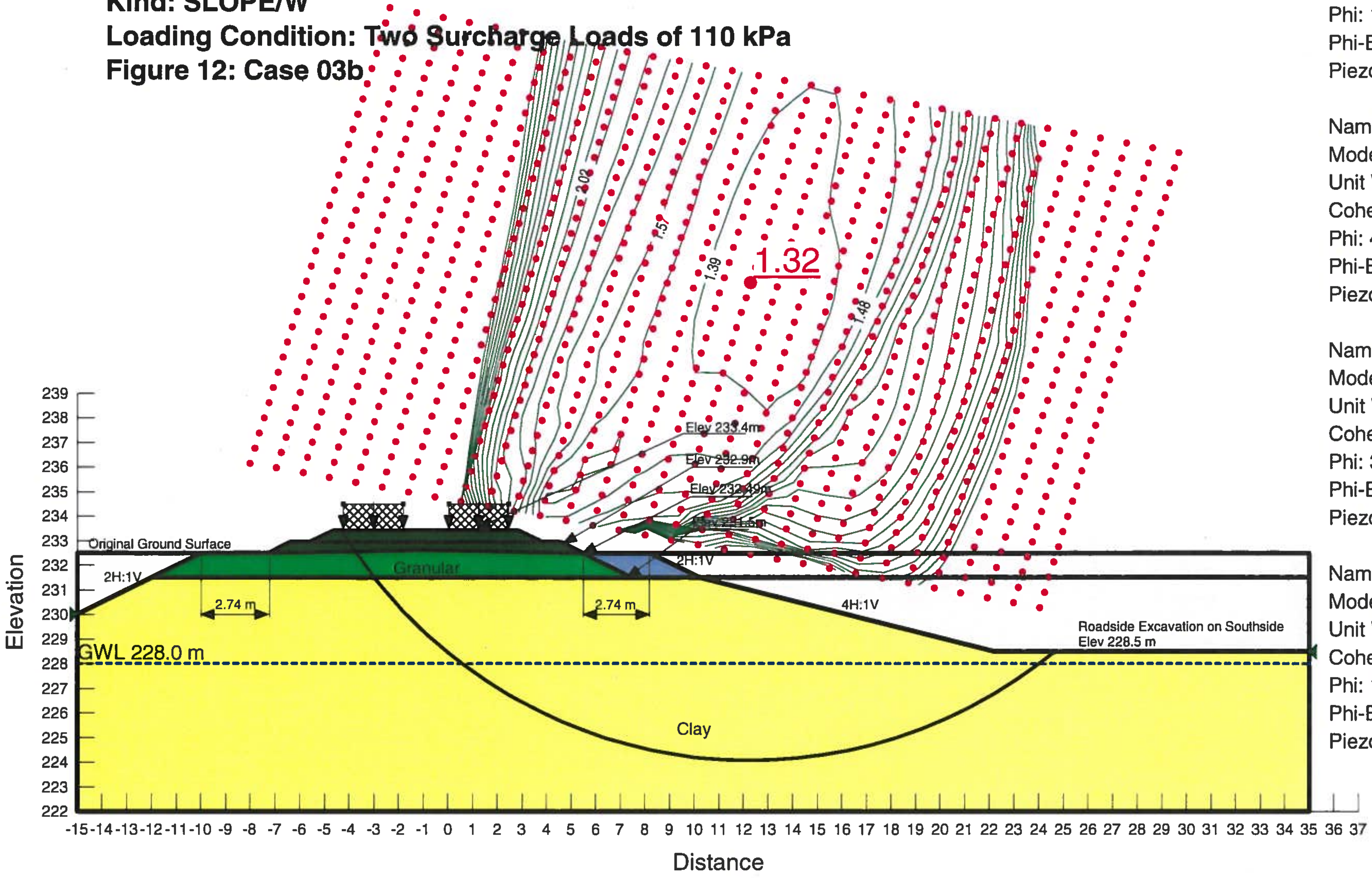
Name: Clay
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 18 °
Phi-B: 0 °

Name: Ballast
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Phi: 40 °
Phi-B: 0 °

Name: Granular
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion: 0 kPa
Phi: 38 °
Phi-B: 0 °

Name: Clay Fill
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 3 kPa
Phi: 15 °
Phi-B: 0 °

Plessis Rd Underpass
Name: Stability Analysis - Roadside Excavation on Southside
Method: Method: Morgenstern-Price
Kind: SLOPE/W
Loading Condition: Two Surcharge Loads of 110 kPa
Figure 12: Case 03b

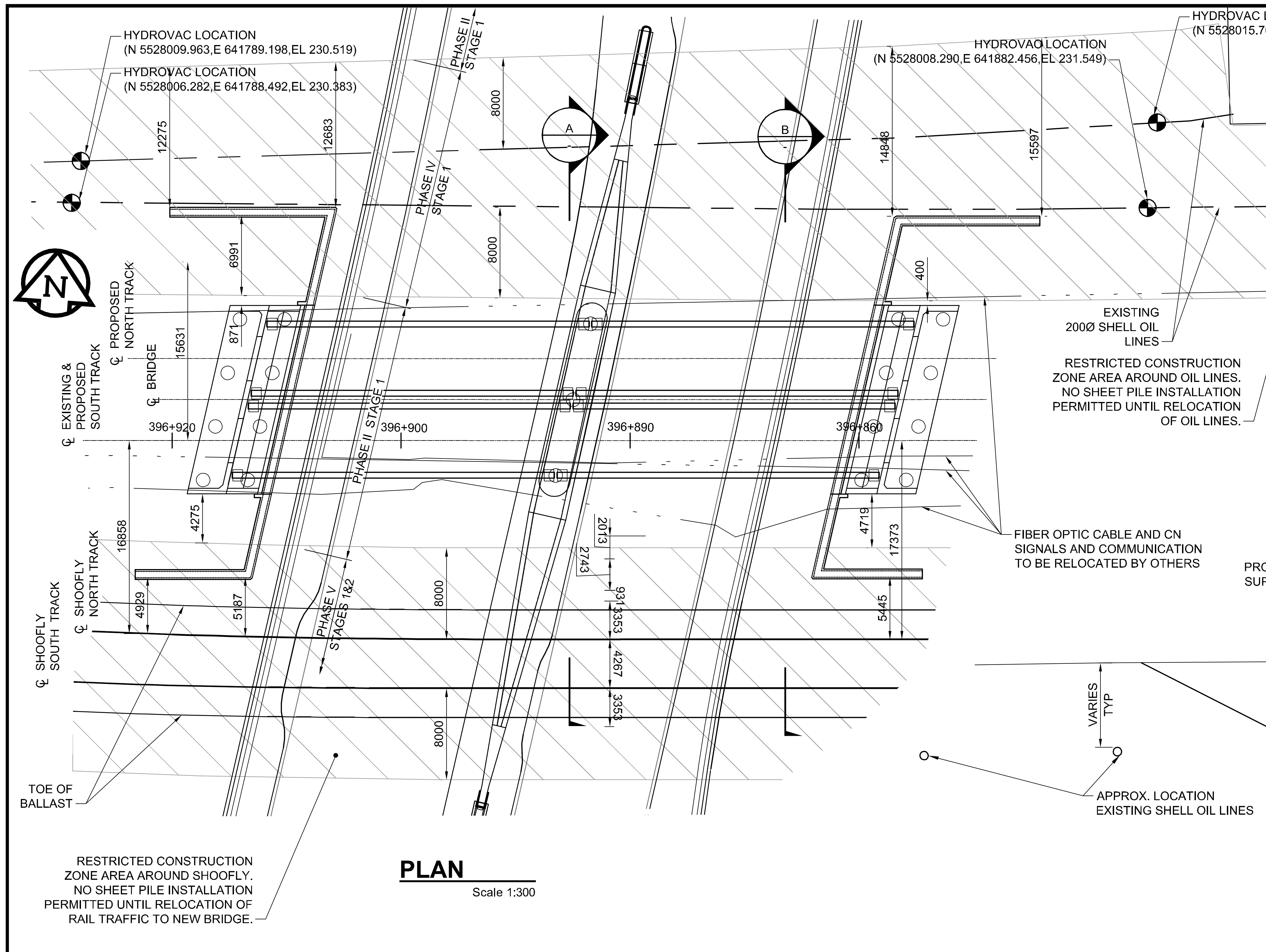


Name: Clay
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 18 °
Phi-B: 0 °
Piezometric Line: 1

Name: Ballast
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Phi: 40 °
Phi-B: 0 °
Piezometric Line: 1

Name: Granular
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion: 0 kPa
Phi: 38 °
Phi-B: 0 °
Piezometric Line: 1

Name: Clay Fill
Model: Mohr-Coulomb
Unit Weight: 17 kN/m³
Cohesion: 3 kPa
Phi: 15 °
Phi-B: 0 °
Piezometric Line: 1

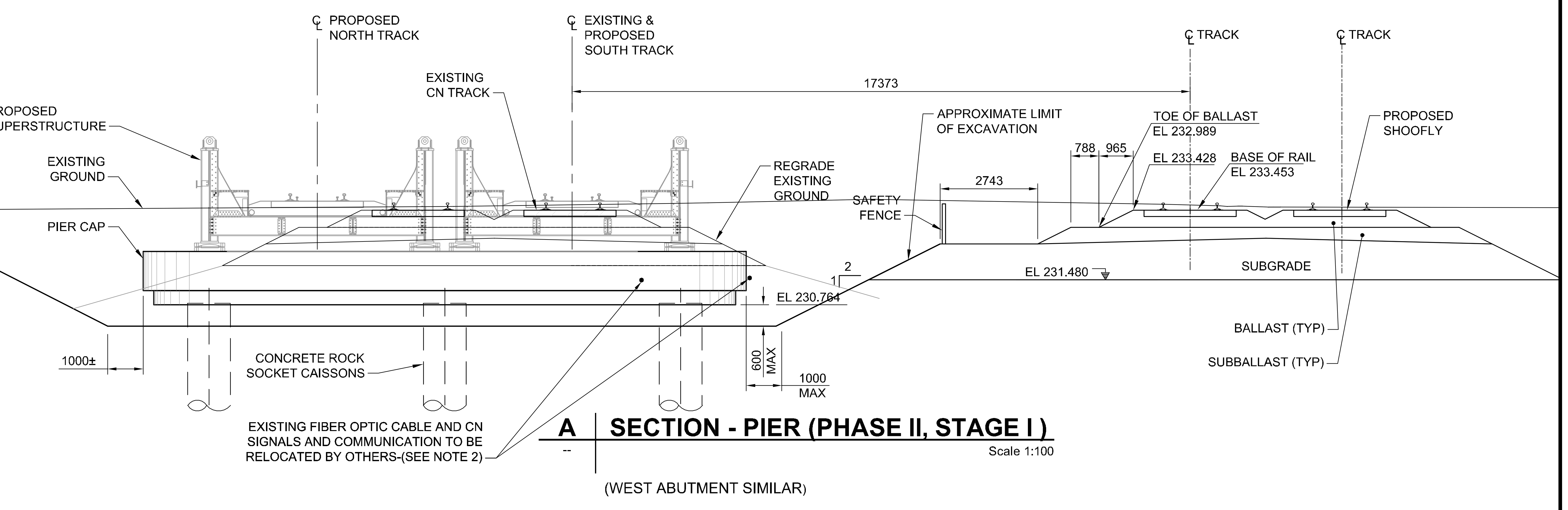


PLAN
Scale 1:300

PROPOSED SEQUENCE OF WORK

BRIDGE PHASE II STAGE 1:

1. RAILWAY SHOOFLY (TEMPORARY DETOUR) CONSTRUCTED BY OTHERS.
2. RELOCATE RAIL TRAFFIC TO SHOOFLY BY OTHERS.
3. EXCAVATE FOR ABUTMENT AND PIER CONSTRUCTION TO LIMITS NOTED.
4. CONSTRUCT DRILLED CONCRETE CAISSONS, ABUTMENTS AND PIER CAP.
5. INSTALL STEEL SHEETPILES FOR UPPER AND LOWER RETAINING WALLS UNDER PROPOSED GIRDERS/SUPERSTRUCTURE. NO ADDITIONAL EXCAVATION ALLOWED BETWEEN SHOOFLY AND BRIDGE OR OVER OIL LINES.
6. CONTRACTOR TO PROVIDE PROTECTION OVER OIL LINES AS REQUIRED.
7. INSTALL SHEETPILES NORTH OF OIL LINE AND RESTRICTED CONSTRUCTION ZONE.



A | **SECTION - PIER (PHASE II, STAGE I)**
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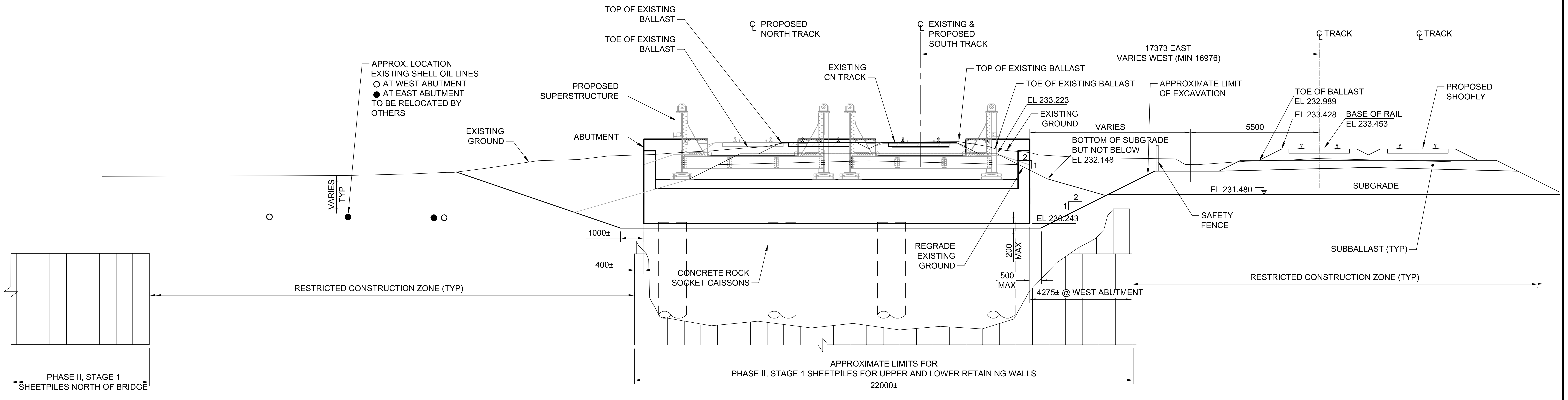
Scale 1:100

(WEST ABUTMENT SIMILAR)



B | **SECTION - EAST ABUTMENT (PHASE II, STAGE I)**
--
Scale 1:100

(WEST ABUTMENT SIMILAR)

NOTES:
1. HYDRO EXCAVATION MAY BE REQUIRED FOR OIL LINES, FIBRE OPTIC CABLE AND CN SIGNALS AND COMMUNICATIONS.
2. SEE PLAN FOR APPROXIMATE LOCATION OF FIBER OPTIC CABLE AND CN SIGNALS AND COMMUNICATION.
3. SEE SPECIFICATIONS FOR OVERALL PROJECT PHASES AND STAGES.

BID OPPORTUNITY NO. 712-2013

APEGM
Certificate of Authorization
AECOM Canada Ltd.
No. 4671 Date: 2013/10/15

LOCATION APPROVED
UNDERGROUND STRUCTURES
SUPV. U/G STRUCTURES COMMITTEE DATE

NOTE:
LOCATION OF UNDERGROUND STRUCTURES AS SHOWN ARE BASED ON THE BEST INFORMATION AVAILABLE. BUT NO GUARANTEE IS GIVEN THAT ALL EXISTING UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL SERVICES MUST BE OBTAINED FROM THE INDIVIDUAL UTILITIES BEFORE PROCEEDING WITH CONSTRUCTION.

B.M.
ELEV.

NO.	REVISIONS	DATE	BY
0	ISSUED FOR TENDER	2013/10/15	KC

AECOM

DESIGNED BY	FT/ZS	CHECKED BY	EBL
DRAWN BY	DJH	APPROVED BY	EBL
HOR. SCALE:	AS NOTED	RELEASED FOR CONSTRUCTION BY:	
VERTICAL:	AS NOTED		
DATE	2013-06-04	DATE	

ENGINEER'S SEAL

CONSULTANT DRAWING NO.
60273041-01-CS-004

Winnipeg
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT

PLESSIS ROAD TWINNING AND GRADE
SEPARATION AT CN REDDITT SUBDIVISION
CONTRACT 3

BRIDGE STAGING PLAN - SHEET 1

CITY DRAWING NUMBER
P-3346-2004
SHEET 04 OF 37

CS-0004

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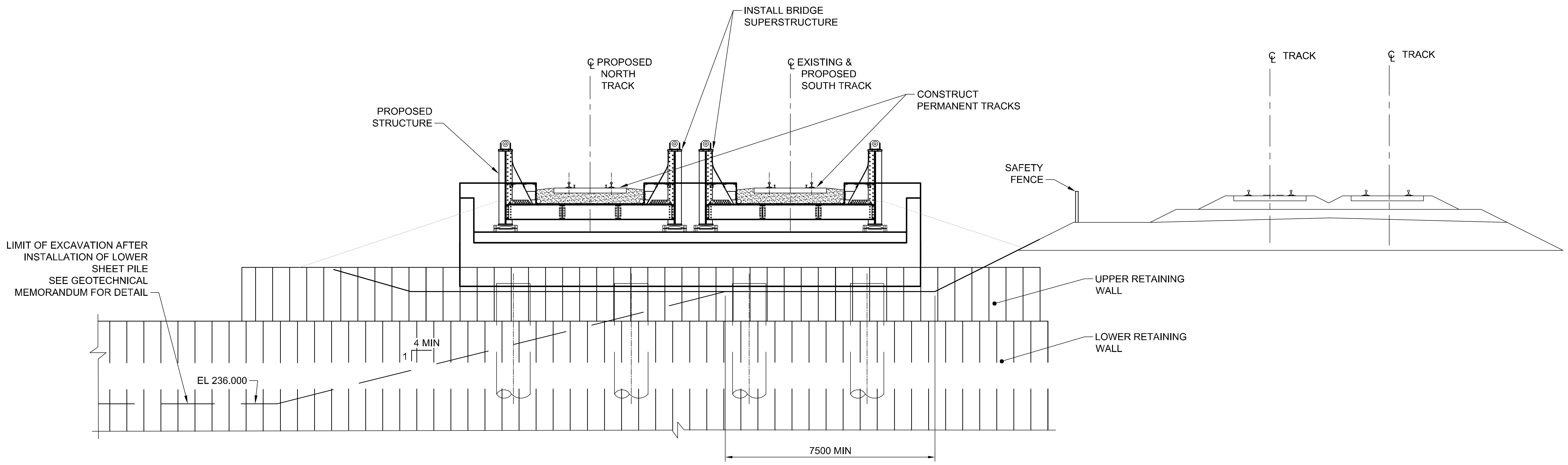


A | SECTION - EAST ABUTMENT (PHASE IV, STAGE I)

CS-0004

Scale 1:100

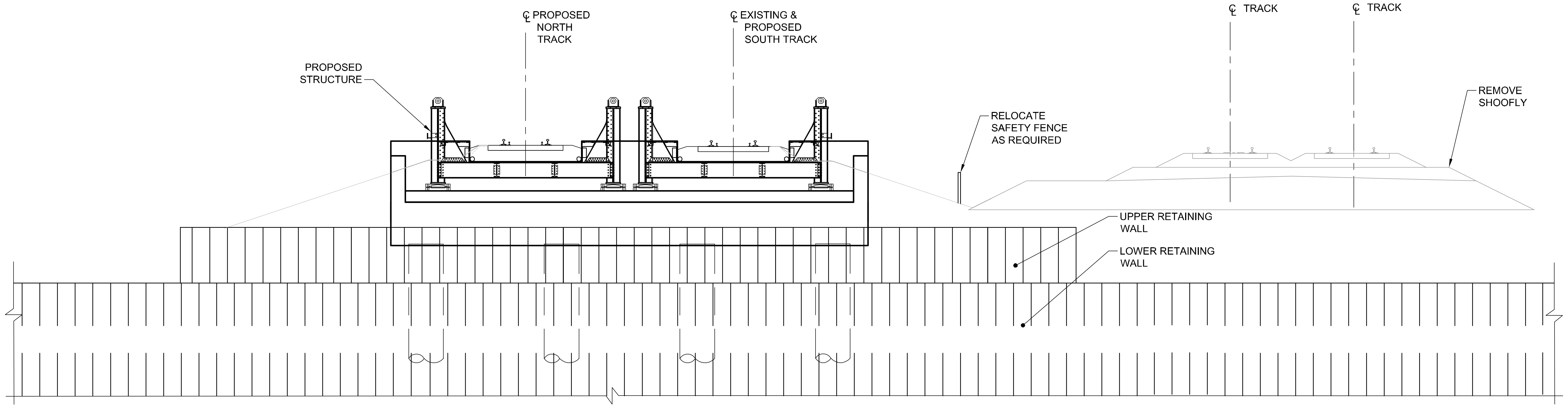
(WEST ABUTMENT SIMILAR)

PROPOSED SEQUENCE OF WORK

BRIDGE PHASE IV, STAGE I:

1. INSTALL SUPERSTRUCTURE (BEARINGS, STEEL TPG SPANS, TRAINMAN'S WALKWAY, WATERPROOFING).
2. CONSTRUCT PERMANENT TRACKS OVER BRIDGE AND APPROACHES.
3. RELOCATE RAIL TRAFFIC TO NEW STRUCTURE, PUT MAIN TRACKS BACK INTO SERVICE.
4. RELOCATE FIBRE OPTIC CABLE AND CN SIGNALS AND COMMUNICATION ONTO NEW BRIDGE BY OTHERS.
5. INSTALL SHEET PILES IN RESTRICTED CONSTRUCTION ZONE NORTH OF BRIDGE AFTER OIL LINES RELOCATED BY OTHERS.

2013–10–23



A | SECTION - EAST ABUTMENT (PHASE V, STAGE I & 2)

CS-0004

Scale 1:100

(WEST ABUTMENT SIMILAR)

PROPOSED SEQUENCE OF WORK

BRIDGE PHASE V, STAGE I & 2:

1. REMOVE TEMPORARY RAILWAY SHOOFLY.
2. EXCAVATE BENEATH BRIDGE STRUCTURE.
3. INSTALL STEEL SHEETPILES SOUTH OF BRIDGE STRUCTURE.

APEGM
Certificate of Authorization
AECOM Canada Ltd.
No. 4671 Date: 2013/10/15

BID OPPORTUNITY NO. 712-2013

LOCATION APPROVED
UNDERGROUND STRUCTURES

SUPV. U/G STRUCTURES COMMITTEE DATE

NOTE:
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B.M.
ELEV.

NO.	REVISIONS	DATE	BY
0	ISSUED FOR TENDER	2013/10/15	KC

AECOM

DESIGNED BY	FT/ZS	CHECKED BY	EBL
DRAWN BY	DJH	APPROVED BY	EBL
HOR. SCALE:	AS NOTED	RELEASED FOR CONSTRUCTION BY:	
VERTICAL:	AS NOTED		
DATE	2013-06-04	DATE	

ENGINEER'S SEAL

CONSULTANT DRAWING NO.
60273041-01-CS-005

Winnipeg
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT

PLESSIS ROAD TWINNING AND GRADE
SEPARATION AT CN REDDITT SUBDIVISION
CONTRACT 3

CITY DRAWING NUMBER
P-3346-2005

SHEET 05 OF 37

BRIDGE STAGING PLAN - SHEET 2

CS-0005

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