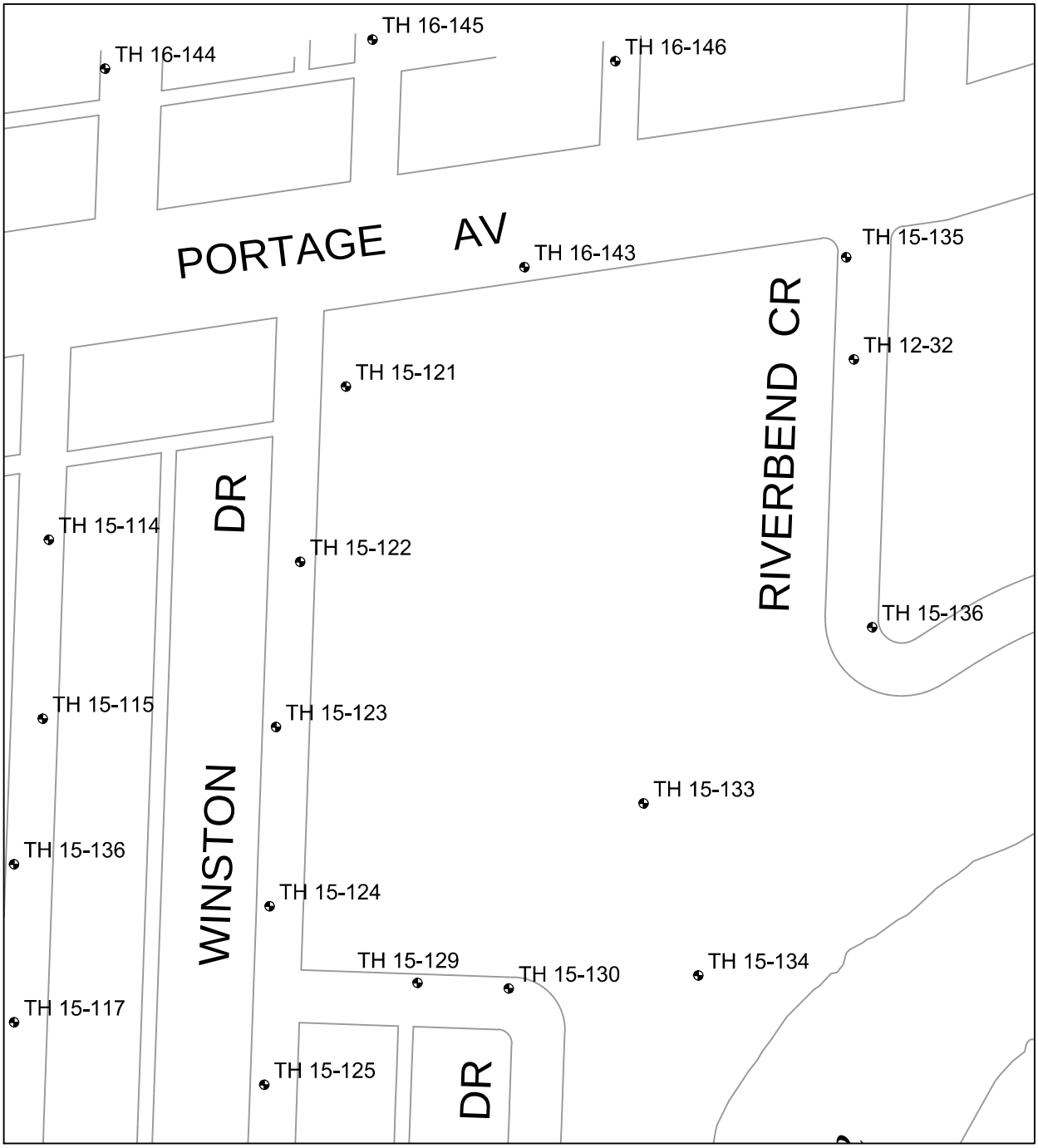
APPENDIX A

TEST HOLE LOGS

APPENDIX A - TEST HOLE LOGS



DYREGROV ROBINSON INC.
CONSULTING GEOTECHNICAL ENGINEERS

AUTHORIZED BY: AUTHORIZED
DATE: 26/10/16

CLIENT DRAWING NO.

NO.	DATE	DESCRIPTION	BY1 ISSUED BY

REVISIONS/ISSUE

CLIENT

TETRA TECH
Complex World
Clear Solutions

DRAWING DESCRIPTION

TEST HOLE LOCATION FOR FERRY ROAD
CSR WORKS CONTRACT 5E-1

DESIGNED BY:	DRAWN BY: GWC	DRAWING NO.	REV.
REVIEWED BY:	SCALE: NTS	FIGURE_1	00

EXPLANATION OF TERMS & SYMBOLS

Description				TH 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 ORGANIC SOILS			Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

	Asphalt		Glacial Till		Bedrock (Igneous)
	Concrete		Clay Shale		Bedrock (Limestone)
	Fill				Bedrock (Undifferentiated)

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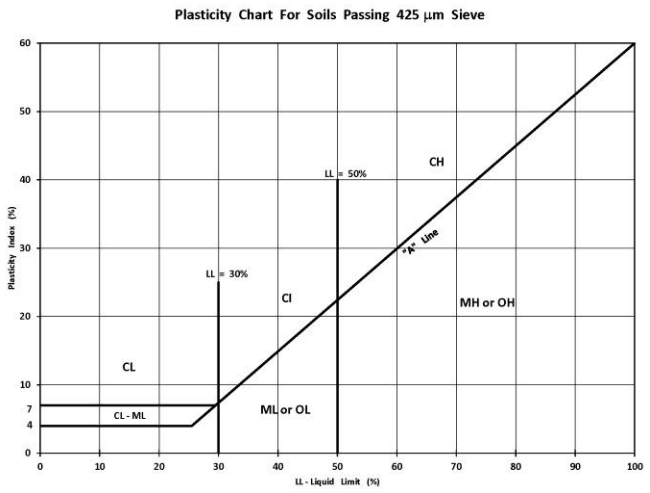

FRACTION		PARTICLE SIZE (mm) Min.	Max.	RELATIVE PROPORTIONS (by weight) Percent	Descriptor
Boulders		>300			
Cobbles		75	300	>35%	main fraction
Gravel	Coarse	19	75	35 - 50	"and"
	Fine	4.75	19		
Sand	Coarse	2.0	4.75	20 – 35	Adjective e.g. silty, clayey
	Medium	0.425	2.0		
	Fine	0.075	0.425	10 – 20	"some"
Silt (non-plastic) or Clay (plastic)		< 0.075 mm		1 - 10	"trace"

Soil Classification Example

Clay 50% (main fraction), Silt 25%, Sand 17%, Gravel 8%

Clay – silty, some sand, trace gravel

TERMS and SYMBOLS

Laboratory and field tests are identified as follows:

Unconfined Comp.: undrained shear strength (kPa or psf) derived from unconfined compression testing.

Torvane: undrained shear strength (kPa or psf) measured using a Torvane

Pocket Pen.: undrained shear strength (kPa or psf) measured using a pocket penetrometer.

Unit Weight bulk unit weight of soil or rock (kN/m^3 or pcf).

SPT – N Standard Penetration Test: The number of blows (N) required to drive a 51 mm O.D. split barrel sampler 300 mm into the soil using a 63.5 kg hammer with a free fall drop height of 760 mm.

DCPT Dynamic Cone Penetration Test. The number of blows (N) required to drive a 50 mm diameter cone 300 mm into the soil using a 63.5 kg hammer with a free fall drop height of 760 mm.

M/C insitu soil moisture content in percent

PL Plastic limit, moisture content in percent

LL Liquid limit, moisture content in percent

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

Su (kPa)	Su (psf)	CONSISTENCY
<12	250	very soft
12 – 25	250 – 525	soft
25 – 50	525 – 1050	firm
50 – 100	1050 – 2100	stiff
100 – 200	2100 – 4200	very stiff
200	4200	hard

The SPT - N of non-cohesive soil is related to compactness condition as follows:

N – Blows / 300 mm	COMPACTNESS
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50 +	very dense

References:

ASTM D2487 – Classification of Soils For Engineering Purposes (Unified Soil Classification System)

Canadian Foundation Engineering Manual, 4th Edition, Canadian Geotechnical Society, 2006

PROJECT: Ferry Road & Riverbend CSR Works	CLIENT: Tetra Tech WEI	TESTHOLE NO: **15-121**
LOCATION: Winston Drive - UTM 5526658 N, 628575 E		PROJECT NO.: 143691
CONTRACTOR: Paddock Drilling Ltd.	METHOD: BRAT 22R - 125 mm SSA diameter auger	ELEVATION (m): 235.405

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

ELEVATION (m)	DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #
235	0		CLAY (Fill) - trace sand, trace gravel		
			CLAY (silty) - black - stiff, moist - high plasticity - trace silt inclusions		G31
234	1		- mottled brown and grey below 1.5 m		G32
233	2				
232	3				G33
231	4		- till inclusions, trace sand, trace gravel below 4.3 m		G34
230	5				
229	6		SILT (Till) - trace sand, trace gravel - brown - compact, moist		G35
228	7				G36

◆ SPT N blows/300mm ◆
10 20 30 40 50 60 70

■ Unit Weight kN/m³ ■
12 14 16 18 20 22 24

LL M/C (%) PL
10 20 30 40 50 60 70

END OF TEST HOLE AT 7.5 m IN SILT (TILL) (AUGER REFUSAL)

Notes:
1. Frost to 1.5 m.
2. No sloughing or seepage observed.
3. Test hole backfilled with auger cuttings and bentonite chips.

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LOGGED BY: WG	COMPLETION DEPTH: 7.47 m
REVIEWED BY: GR	COMPLETION DATE: 27/2/15
PROJECT ENGINEER: Gil Robinson	

BH GEOTECH PLOTS -NEW ALT1 143691 5A_WINSTON AND AREA.GPJ DATA TEMPLATE - AUGUST 2, 2013.GDT 28/11/15

PROJECT: Ferry Road & Riverbend CSR Works	CLIENT: Tetra Tech WEI	TESTHOLE NO: **15-122**
LOCATION: Winston Drive - UTM 5526601 N, 628561 E		PROJECT NO.: 143691
CONTRACTOR: Paddock Drilling Ltd.	METHOD: BRAT 22R - drill rig, 125 mm SS Augers	ELEVATION (m): 235.293

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

ELEVATION (m)	DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #
235	0	CONCRETE - 175 mm thick		
		CLAY (silty) - black - stiff, moist - high plasticity, trace silt inclusions		G37
234	1			
		- mottled brown and grey below 1.5 m		G38
233	2			
232	3			T39
231	4			
				G40
230	5	SILT (Till) - trace sand, trace gravel - brown, compact		
229	6			G41
		- wet sand below 6.4 m		G42
228	7			

+ Torvane (Su) kPa +
10 20 30 40 50 60 70

▲ Unconfined Comp. (Su) kPa ▲
10 20 30 40 50 60 70

△ Pocket Pen. (Su) kPa △
10 20 30 40 50 60 70

◆ SPT N blows/300mm ◆
10 20 30 40 50 60 70

■ Unit Weight kN/m³ ■
12 14 16 18 20 22 24

LL M/C (%) PL
10 20 30 40 50 60 70

END OF TEST HOLE AT 7.3 m IN SILT (TILL) (AUGER REFUSAL)

Notes:
1. Frost to 1.5 m.
2. Seepage at 6.4 m from top of hole. Hole open to 5.8 m and water at 4.3 m from top of hole.
3. Test hole backfilled with auger cuttings and bentonite chips.
4. Cold patch filled over core.

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LOGGED BY: CR	COMPLETION DEPTH: 7.32 m
REVIEWED BY: GR	COMPLETION DATE: 27/2/15
PROJECT ENGINEER: Gil Robinson	

PROJECT: Ferry Road & Riverbend CSR Works	CLIENT: Tetra Tech WEI	TESTHOLE NO: **15-123**
LOCATION: Winston Drive - UTM 5526547 N, 628553 E		PROJECT NO.: 143691
CONTRACTOR: Paddock Drilling Ltd.	METHOD: BRAT 22R - drill rig, 125 mm SS Augers	ELEVATION (m): 235.225

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

ELEVATION (m)	DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #
235	0	CONCRETE - 175 mm thick		
		CLAY - silty - brown - stiff, moist		G198
234	1	SILT - brown - loose, wet		G199
233	2	CLAY - silty - mottled brown and grey - stiff, moist - high plasticity, trace silt inclusions		
232	3			G200
231	4			
230	5			G201
229	6	SILT (Till) - trace sand, trace gravel - grey - compact, moist		G202
228	7			

◆ SPT N blows/300mm ◆
10 20 30 40 50 60 70

■ Unit Weight kN/m³ ■
12 14 16 18 20 22 24

LL M/C (%) PL
10 20 30 40 50 60 70

END OF TEST HOLE AT 7.6 m IN SILT (TILL) (AUGER REFUSAL)

Notes:
1. Frost to 1.5 m.
2. No sloughing or seepage observed.
3. Test hole backfilled with auger cuttings and bentonite chips.
4. Cold patch placed over core.

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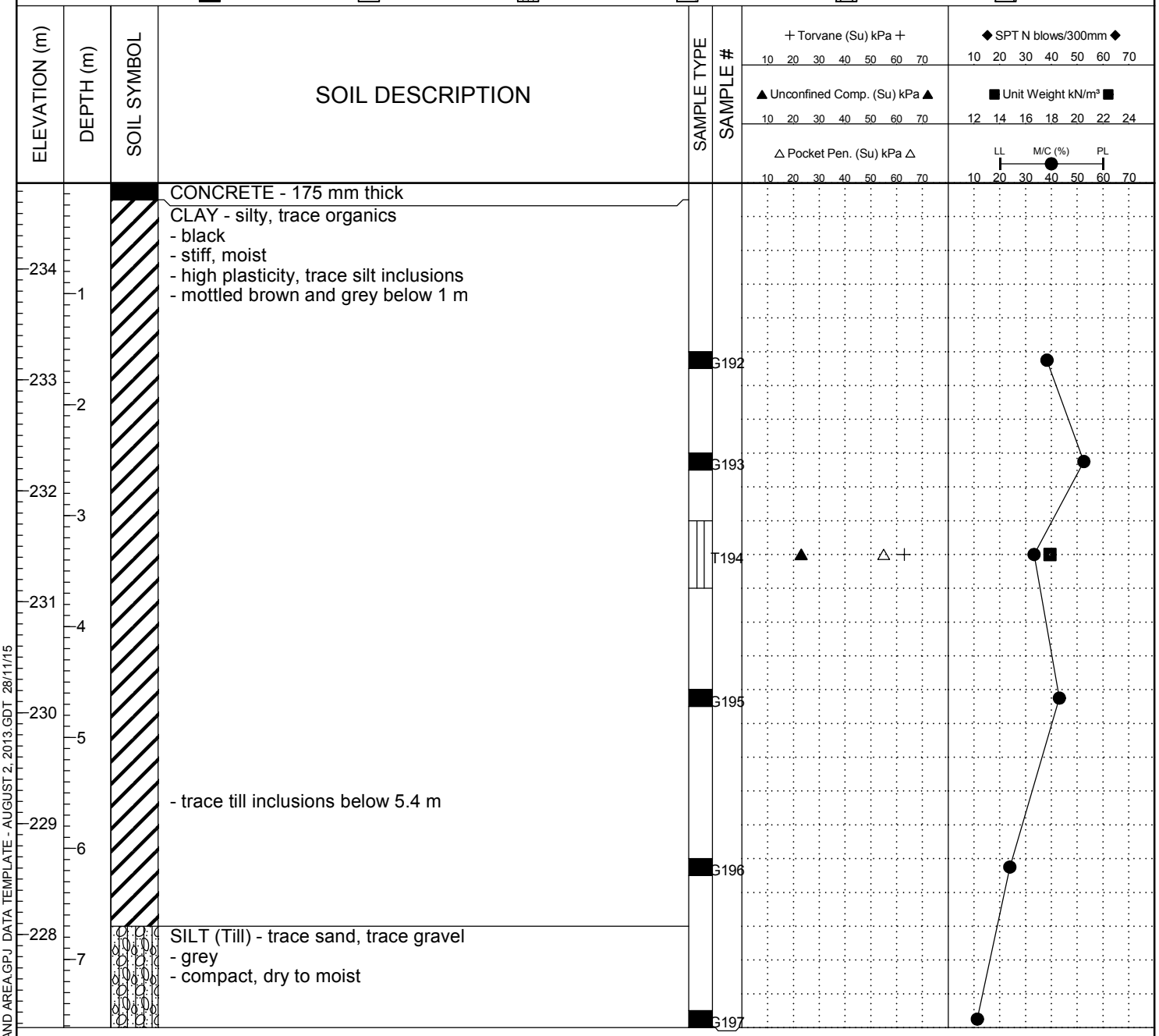
LOGGED BY: CR	COMPLETION DEPTH: 7.62 m
REVIEWED BY: GR	COMPLETION DATE: 18/2/15
PROJECT ENGINEER: Gil Robinson	

BH GEOTECH PLOTS -NEW ALT1 143691 5A_WINSTON AND AREA.GPJ DATA TEMPLATE - AUGUST 2, 2013.GDT 28/11/15

PROJECT: Ferry Road & Riverbend CSR Works	CLIENT: Tetra Tech WEI	TESTHOLE NO: **15-124**
LOCATION: Winston Drive - UTM 5526489 N, 628551 E		PROJECT NO.: 143691
CONTRACTOR: Paddock Drilling Ltd.	METHOD: BRAT 22R - drill rig, 125 mm SS Augers	ELEVATION (m): 234.931

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND



END OF TEST HOLE AT 7.6 m IN SILT (TILL)

Notes:
1. Frost to 1.5 m.
2. No sloughing or seepage observed.
3. Test hole backfilled with auger cuttings and bentonite chips.
4. Cold patch placed over core.

DYREGROV ROBINSON INC.
Consulting Geotechnical Engineers

LOGGED BY: CR	COMPLETION DEPTH: 7.62 m
REVIEWED BY: GR	COMPLETION DATE: 18/2/15
PROJECT ENGINEER: Gil Robinson	

BH GEOTECH PLOTS -NEW ALT1 143691 5A_WINSTON AND AREA.GPJ DATA TEMPLATE - AUGUST 2, 2013.GDT 28/11/15

PROJECT: Ferry Road & Riverbend CSR Works	CLIENT: Tetra Tech WEI	TESTHOLE NO: **15-129**
LOCATION: Parkside Drive - UTM 5526465 N, 628598 E		PROJECT NO.: 143691
CONTRACTOR: Paddock Drilling Ltd.	METHOD: BRAT 22R - drill rig, 125 mm SS Augers	ELEVATION (m): 234.687

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

ELEVATION (m)	DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #
234	0		CLAY - silty, trace organics - black - stiff, moist - high plasticity, trace silt inclusions		
233	1		- mottled brown and grey below 1.5 m	G	G158
232	2			G	G159
231	3			T	T160
230	4			G	G161
229	5				
228	6			G	G162
227	7		SILT (Till) - trace sand, trace gravel - grey - loose, wet	G	G163

+ Torvane (Su) kPa +
10 20 30 40 50 60 70

▲ Unconfined Comp. (Su) kPa ▲
10 20 30 40 50 60 70

△ Pocket Pen. (Su) kPa △
10 20 30 40 50 60 70

◆ SPT N blows/300mm ◆
10 20 30 40 50 60 70

■ Unit Weight kN/m³ ■
12 14 16 18 20 22 24

LL M/C (%) PL
10 20 30 40 50 60 70

END OF TEST HOLE AT 7.6 m IN SILT (TILL)

Notes:
1. Frost to 1.5 m.
2. No sloughing or seepage observed.
3. Test hole backfilled with auger cuttings and bentonite chips.
4. Cold patch placed over core.

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Consulting Geotechnical Engineers

LOGGED BY: CR	COMPLETION DEPTH: 7.62 m
REVIEWED BY: GR	COMPLETION DATE: 18/2/15
PROJECT ENGINEER: Gil Robinson	

BH GEOTECH PLOTS -NEW ALT1 143691 5A_WINSTON AND AREA.GPJ DATA TEMPLATE - AUGUST 2, 2013.GDT 28/11/15

PROJECT: Ferry Road & Riverbend CSR Works	CLIENT: Tetra Tech WEI	TESTHOLE NO: **15-130**
LOCATION: Parkside Drive - UTM 5526463 N, 628628 E		PROJECT NO.: 143691
CONTRACTOR: Paddock Drilling Ltd.	METHOD: BRAT 22R - drill rig, 125 mm SS Augers	ELEVATION (m): 234.124

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

ELEVATION (m)	DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #
			GRAVEL (Fill) - Limestone		
233	1		CLAY - silty, trace organics - black - stiff, moist - high plasticity, trace silt inclusions		
			- mottled brown and grey below 1.5 m	G	164
232	2				
231	3		- trace sand, trace gravel below 3 m	G	165
			- till inclusions below 3.6 m		
230	4				
				G	166
229	5				
			SILT (Till) - some sand, trace gravel - brown - wet, loose	G	167
228	6			G	168
227	7				
				G	169

◆ SPT N blows/300mm ◆
10 20 30 40 50 60 70

■ Unit Weight kN/m³ ■
12 14 16 18 20 22 24

LL M/C (%) PL
10 20 30 40 50 60 70

END OF TEST HOLE AT 7.6 m IN SILT (TILL)

Notes:
1. Frost to 1.5 m.
2. No sloughing or seepage observed.
3. Test hole backfilled with auger cuttings and bentonite chips.
4. Cold patch placed over core.

DYREGROV ROBINSON INC.
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LOGGED BY: CR	COMPLETION DEPTH: 7.62 m
REVIEWED BY: GR	COMPLETION DATE: 18/2/15
PROJECT ENGINEER: Gil Robinson	

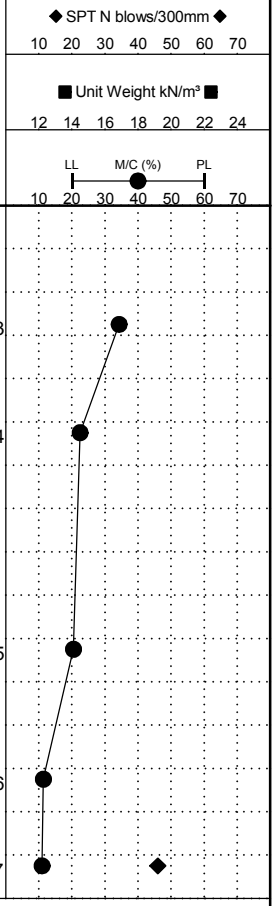
BH GEOTECH PLOTS -NEW ALT1 143691 5A_WINSTON AND AREA.GPJ DATA TEMPLATE - AUGUST 2, 2013.GDT 28/11/15

PROJECT: Ferry Road & Riverbend CSR Works	CLIENT: Tetra Tech WEI	TESTHOLE NO: **15-133**
LOCATION: Scott Park - UTM 5526523 N, 628671 E		PROJECT NO.: 143691
CONTRACTOR: Paddock Drilling Ltd.	METHOD: BRAT 22R - drill rig, 125 mm SS Augers	ELEVATION (m): 235.037

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

ELEVATION (m)	DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #
234	1	CLAY (silty) - brown - stiff moist - high plasticity, trace silt inclusions		G43
				G44
233	2	- trace till inclusions		
232	3			G45
231	4	SILT (Till) - brown - compact, dry to moist		G46
				S47



END OF TEST HOLE AT 4.9 m IN SILT (TILL) (AUGER REFUSAL)

Notes:
1. Frost to 1.5 m.
2. No sloughing or seepage observed.
3. Test hole backfilled with auger cuttings and bentonite chips.

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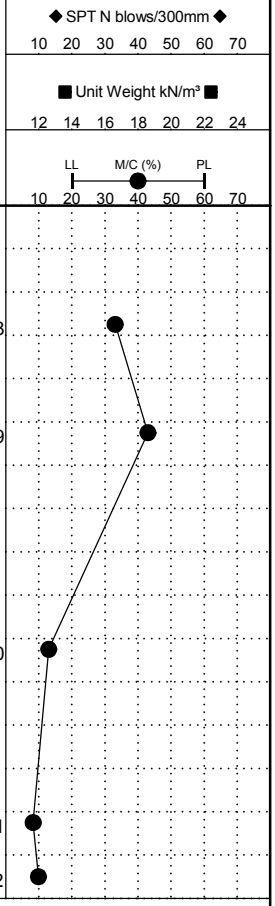
LOGGED BY: RB	COMPLETION DEPTH: 4.88 m
REVIEWED BY: GR	COMPLETION DATE: 25/2/15
PROJECT ENGINEER: Gil Robinson	

PROJECT: Ferry Road & Riverbend CSR Works	CLIENT: Tetra Tech WEI	TESTHOLE NO: **15-134**
LOCATION: Scott Park - UTM 5526467 N, 628689 E		PROJECT NO.: 143691
CONTRACTOR: Paddock Drilling Ltd.	METHOD: BRAT 22R - drill rig, 125 mm SS Augers	ELEVATION (m): 233.275

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

ELEVATION (m)	DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #
233	0		CLAY (silty) - brown - stiff, moist - high plasticity, trace silt inclusions		
				GRAB	G48
232	1		- trace till inclusions below 1.5 m	GRAB	G49
231	2				
230	3			GRAB	G50
			SILT (Till) - trace sand, trace gravel - brown, compact, dry		
229	4			GRAB	G51
				SPLIT SPOON	S52



END OF TEST HOLE AT 4.9 m IN SILT (TILL) (AUGER REFUSAL)

Notes:
1. Frost to 1.5 m.
2. No sloughing or seepage observed.
3. Test hole backfilled with auger cuttings and bentonite chips.

DYREGROV ROBINSON INC.
Consulting Geotechnical Engineers

LOGGED BY: WG	COMPLETION DEPTH: 4.88 m
REVIEWED BY: GR	COMPLETION DATE: 25/2/15
PROJECT ENGINEER: Gil Robinson	

BH GEOTECH PLOTS -NEW ALT1 143691 5A_WINSTON AND AREA.GPJ DATA TEMPLATE - AUGUST 2, 2013.GDT 28/11/15