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September 19, 2011

Mr. Randy Benoit
Manager of WPS HQ Project
Winnipeg Police Services
210-266 Graham Avenue
Winnipeg, Manitoba

Dear Sir,

Project No: 60162215 (409.19)

Regarding: Winnipeg Police Service Firearm Training Facility
Geotechnical Report

1. Introduction

AECOM Canada Ltd. (AECOM) has been retained by Winnipeg Police Services (WPS) to provide engineering services for the design of an outdoor firing range and associated facilities, including a single storey building, range-master tower, two storm water retention ponds, access road, parking area and earthen berm enclosure for the firing range.

This report summarizes the findings of a geotechnical investigation undertaken at the site and provides geotechnical recommendations related to the design and construction of the proposed facilities.

2. Geotechnical Investigation

The proposed site is located north of Wyper Road, and west of the Trans Canada Highway (Perimeter Highway) in Winnipeg. The property is currently utilized as cropland. The proposed site layout is shown on Figure 01 attached.

Twenty-five test holes were drilled at the proposed site between August 3-4, 2011. The approximate locations are shown on the attached test hole location plan, Figure 01.

The locations of the test holes were originally selected based on a preliminary site plan. The configuration and location of the building and other major structures were changed as the plans developed. Therefore the test holes that were drilled are no longer aligned with the proposed facilities. Due to the accelerated project schedule, and limited budget, it was determined by the project team that performing an additional investigation at the new building location would impact the project delivery schedule and therefore no additional investigation was completed for the new layout. Subsurface conditions in Winnipeg area are reasonably uniform and no major variations are

expected, however the project construction budget and schedule should allow for provisions in the event that adverse groundwater and/or subsurface conditions are encountered.

Detailed logs have been prepared for each test hole to record the description and relative position of the soil strata, the location of the samples, field and laboratory test results, drilling conditions, standpipe installation details and other pertinent information. The test hole logs are attached.

2.1 Subsurface Conditions

In descending order, the general soil profile is as follows,

- Topsoil
- Clay
- Silt Till

Topsoil
A relatively thin layer of topsoil was encountered at all test hole locations, up to 0.3 m thick.

Clay
Clay was encountered at all test hole location to a depth of 8.1 to 8.8 m below grade at the test hole locations. Generally, the clay is silty, moist, stiff, becoming soft with depth, and of high plasticity.

Till
Silt matrix till was encountered beneath the clay. The depth to auger refusal at the test hole locations ranged from 8.8 m to 10.2m

2.2 Groundwater Conditions

Four standpipe piezometers were installed at the locations of TH 11-08, 12, 21 and 26, to monitor the groundwater condition in the till. The groundwater levels are reported on the test hole logs. The groundwater levels range from elevation 235.27 m to 235.42 m at TH 11-12 and TH 11-08 respectively (measured Aug 10, 2011).

3. Foundation Alternatives

Driven Prestressed Precast Concrete (PPC) piles and cast in place friction piles are considered feasible alternatives to support the proposed buildings. Driven steel piles are considered not to be cost effective foundation alternative at this site. Shallow foundations are considered less suitable because of the depth to competent bearing stratum, long term settlement, associated excavation work, requirement for thermal insulation and potential impact on project schedule.

3.1 Driven Prestressed Precast Concrete (PPC)

The subsurface conditions at the site are suitable for driven PPC piles bearing into the dense glacial till. PPC piles can be designed on the basis of the conventional allowable capacities shown in Table 01 provided the piles are driven to the corresponding set criteria. The piles should be driven using a hammer with a rated energy of at least 40 kJ.

Table 01: Maximum Allowable Capacities for PPC Piles

PPC Pile Diameter (mm)	Maximum Allowable Capacity (kN)	Set Criteria (blows/25 mm)
300	450	5
350	625	8
400	800	12

Final set for driven PPC piles should be taken as three consecutive sets criteria as defined in the table above. PPC piles driven to the above criteria will develop the majority of their capacity from toe resistance, and therefore, no reduction in pile capacity is necessary for reasons related to group action. The design capacity of a pile group can be taken as the number of piles in the group multiplied by the allowable capacity per pile.

Further design and construction recommendations for PPC piles are summarized below:

- The weight of the embedded portion of the pile may be neglected in the design.
- The above allowable values pertain to soil resistance only. The pile cross sections must be designed to withstand the design loads and the driving forces during installation.
- Pile spacing should not be less than 2.5 pile diameters, measured center to center.
- Pre-boring not greater than 4 m may be use at all driven pile locations, to enhance pile plumbness and alignment, and to reduce the effects of pile heave during driving of adjacent piles. The diameter of the pre-bore hole should not exceed the nominal diameter of the pre-cast concrete pile. All piles should be driven continuously to the final set, once driving is initiated.
- All piles driven within 5 pile diameters should be monitored for heave and where heave is observed, the piles should be re-driven. Piles that are re-driven should be driven to the set criteria outlined above (i.e. re-drive piles for one full set).
- Any piles that are damaged, excessively out of plumb or refuse prematurely due to encountering boulders in the till may need to be replaced, pending a review of their load carrying capacity and expected settlement by a qualified geotechnical engineer.
- Where a steel follower is used to install the pre-cast concrete piles below ground surface, the set criteria may need to be adjusted to account for anticipated energy losses through the use of the follower. Adjustments to the set criteria should be determined by a qualified geotechnical engineer based on the site conditions, installation procedure and pile driving equipment.
- The driving of all piles should be documented by competent and knowledgeable geotechnical personnel.
- Sulphate resistant cement (Type HS) should be used for all concrete in contact with the soil.

- PDA testing is recommended to confirm efficiency of the pile driving system, assess driving stresses and evaluate pile capacity.

3.2 Cast-In-Place Friction Piles

Friction piles can be used to support lightly loaded structures. Frictional resistance from the top 3 m of the soil profile for exterior piles and the top 2 m of soil profile for the interior piles should not be counted towards the pile capacity due to potential volume change of soil and impact on soil/pile adhesion. The piles should not penetrate the till deposit to protect against groundwater infiltration, and the pile bore should be terminated at least 1.5 m above the clay/ till interface. Selection of the pile length should recognize the depth to till and the requirements to protect against upward seepage and hydraulic fracturing due to artesian water conditions in the till. Due to the location of the test holes in relation to the proposed building, the depth to till has not been determined at the final location of the proposed building. The shear strength tests were also performed on samples that are not in the immediate vicinity of the proposed building.

Table 02 provides values for the allowable unit skin friction resistance.

Table 02. Allowable Unit Skin Friction for Cast-In-Place Friction Piles

Zone (m below grade)	Allowable Skin Friction (kPa)
Exterior of Building	
0-3	0
3-7	12 kPa
Below 7 m	10 kPa
Interior of Building	
0-2	0
2-7	12 kPa
Below 7 m	10 kPa

Further design and construction recommendations for cast-in-place friction piles are summarized below:

- Minimum pile diameter of 600 mm is recommended.

- Pile spacing should not be less than 3 pile diameters, measured center to center.

- The embedded pile length should not be less than 6 m, however the pile length should be designed to provide adequate lateral and uplift resistance. Allowable uplift resistance equal 2/3 of the values shown in Table 02 can be used in the design. The pile design should include adequate steel reinforcement to withstand applicable loading conditions.

- Temporary sleeves may be required to protect against bore sloughing, and groundwater intrusion. The concrete should be placed immediately after completion of drilling.

- The pile bore should be pumped dry prior to concrete placement. If this cannot be achieved, the concrete should be placed using tremie methods.

- Sulphate resistant cement (Type HS) should be used for all concrete in contact with the soil.

- Pile installation should be documented by competent and knowledgeable geotechnical personnel.

4. Storm-water Retention Ponds

A cut slope of 6 Horizontal to 1 Vertical (6H:1V) is considered acceptable for the storm-water retention basins and is expected to perform satisfactorily. For stability reason, the crest of the cut slope (edges of the excavation) should be a minimum 8 m and 12 m away from the toe of the side and backstop berms respectively.

Base heave analysis considered the prevailing groundwater condition in the underlying till unit and the potential for hydraulic fracturing or heaving of the base of the excavation. The critical condition is during construction when there would be no water in the excavations. A factor of safety (FS) of 1.2 against base heave is considered acceptable for short term condition (during construction) and was used for the analysis. To maintain this design objective (FS = 1.2), the excavations for the storm-water retention ponds should not extend below elevation 233.2 m. The factor of safety against base heave will improve once the retention ponds are filled with water, therefore the ponds should be used as soon as practical. Every effort should be directed towards minimizing the duration of the excavation.

The excavation bottom will be below the measured groundwater levels in the till and the potential for upward seepage along existing natural fractures within the clay unit cannot be ruled out. Therefore requirements for construction dewatering should be allowed for in the construction budget and schedule.

Dewatering of the ponds after commissioning should be avoided due to concerns with cut slope stability and base heave. If complete dewatering of the ponds is required, the water level should be lowered at such a rate to protect against rapid drawdown effects . Rapid drawdown analysis has not been performed.

The potential for contamination of the aquifer by the retained water is beyond the scope of this report. An assessment by environmental and hydro-geological personnel is recommended.

5. Berms and Flood Protection Dikes

Three types of embankments are required at the site:

- 6.7 m high backstop berms, with a front face slope of 3H:2V
- 4.3 m high side berms, with a front face slope of 3H:2V
- Flood protection dikes, typically less than 1.5 m in height

The stability of the berm slopes was assessed using limit equilibrium slope stability analysis. A design objective factor of safety of 1.3 has been selected, taking into account the low consequence associated with slope instabilities if any. The parameters used in the analysis are summarized in

Table 03. The results of the stability assessment and the berm configurations are presented graphically in Appendix B and summarized in Table 04.

Table 03: Soil Parameters used in Stability Analysis

Material	Friction Angle (°)	Cohesion (kPa)	Unit Weight (kN/m^3)
Native Clay	14	5	17
Compacted Clay Fill	20	5	19
Sand	32	0	19

Table 04: Results of Stability Analysis

Case	Calculated FS
Backstop Berm	
Interior Slope	1.33
Sand Facing[1]	±1.0
Exterior Slope	1.34
Exterior Slope 12 m pond set back - during construction	1.26
Exterior Slope 12 m pond setback - normal pond level	1.31
Side Berm	
Interior Slope	1.31
Exterior Slope	1.37
Exterior Slope 8 m pond set back - during construction	1.23
Exterior Slope 8 m pond setback - normal pond level	1.30

[1]Stability of sand facing is near 1.0 because the required 3H:2V slope is near the angle of repose for loose sand.

Settlement of the berms is anticipated due to consolidation and elastic compression. The berm heights have been set so that the required minimum height should be maintained after the settlement has occurred.

The berms should be constructed of compacted clay. Organic soils should be removed beneath the footprint of the berms, and the surface of the sub grade should be scarified and compacted so that it is free of any soft areas. Sub grade improvement will be required under the steep slopes, a sub cut should be excavated to a depth of 0.6 m, and replaced with compacted clay material. The berm fill should be compacted to a minimum 95 percent of the Standard Procter maximum dry density (SPMDD).

If significant deformation (squeezing and bulking) of the subgrade occurs, compaction should be halted and an investigation undertaken to determine the cause of the deformation. If silt or silty material is encountered it should be overexcavated up to 0.75 m and bridged with geotextile and granular fill.

A 1 m thick facing of ballistic sand is required for the first 3 m above final grade, as a backstop behind the targets. This sand facing will be periodically removed and filtered to remove lead bullets. The 3H:2V slope of sand facing will be subject to surface ravelling, slumping, erosion and degradation due

to bullet impacts, precipitation, wind and other factors, and will require periodic maintenance. The 3H:2V facing of the backstop slope is a requirement of firing range design.

Drainage should be provided at the toe of the embankments and along the benches of the side and backstop berms to quickly remove surface water, and prevent any ponding of water on or against the berm.

The flood protection dikes should be constructed of compacted clay and have a minimum slope of 3H:1V and a minimum crest width of 1.5 m. Compaction of these dikes is necessary to provide effective flood protection. The subgrade should be prepared as described above.

6. Slabs-On-Grade

It is understood that a slab-on-grade floor system is preferred for economic and constructability reasons. While a structural floor is considered to provide better performance, a slab on grade floor system may be suitable for lightly loaded buildings where some movement of the floor is acceptable.

Floor slabs may be subjected to some vertical deformation due to swelling or shrinkage of the subgrade soil in response to changes in moisture content. Some settlement and differential settlement may also occur due to floor loading; uneven floor loading may lead to differential settlements. It is understood that the building will be heated during the winter months, and therefore, frost upheaval should not be a concern. The following are guidelines for design and construction of slab-on-grade:

1. The top 600 mm of the subgrade beneath the underside of the floor slab should be excavated and if found suitable can be used to backfill the subcut. The backfill should be placed in lift not to exceed 200 mm thick and compacted to a minimum 95 percent of SPMDD.

2. Precautions should be taken to prevent desiccation of clay subgrade during construction. If the soil does dry out, it should be dampened, scarified, and re-compacted to a minimum of 95 percent of Standard Proctor maximum dry density.

3. Any fill required to bring slab areas to design grade should consist of clean, inorganic material compacted to 95 percent of SPMDD.

4. A minimum of 150mm compacted thickness of clean free draining granular fill compacted to 98 percent of SPMDD should underlie the slab.

5. A vapour barrier below the slab is recommended, to minimize long term moisture change within the subgrade.

6. Competent subfloor drainage system should be provided for any portion of the slab which is constructed below the exterior grade.

7. The slab should be isolated from all fixed structural elements.

8. Light partitions bearing on the slab should be designed to permit vertical movement between the partition and the ceiling to minimize the possibility of damage if the slab heaves.

9. Control joints should be provided in the slab to reduce random cracking.

10. A minimum void space of 150 mm should be provided under grade beam system to minimize the effect of local soil movement.

7. Roadwork

The existing dirt road will be upgraded with a gravel surface and increased width to handle the anticipated vehicle types and volumes. The existing road embankment material is considered to be suitable sub-grade material for the upgraded roadway. The design of the pavement structure is being developed by others.

The slopes of the existing embankment should be benched prior to placing additional fill. Any topsoil encountered at the surface should be excavated and removed. The top 300 mm below the subgrade interface should be scarified and compacted to a minimum of 95 percent of SPMDD. If significant deformation (squeezing and bulking) of the subgrade occurs, compaction should be halted and an investigation undertaken to determine the cause of the deformation. If silt or silty material is encountered it should be over excavated up to 0.75 m and bridged with geotextile and granular fill. Side ditches should be provided on both sides to facilitate drainage and protect against saturation of the subgrade or pavement structure.

8. Parking Areas

Parking areas should be stripped of all organic material. The top 300 mm below the subgrade should be scarified and compacted to a minimum of 95 percent of SPMDD. If significant deformation (squeezing and bulking) of the subgrade occurs, compaction should be halted and an investigation undertaken to determine the cause of the deformation. A geotextile should be placed between the subgrade and subbase. The parking lot structure and on-site roadways should consist of 375 mm of granular sub base material, overlain by 150 mm of limestone base course. Parking lot grading should be designed so that surface water drains away from the parking lot, and does not drain or accumulate towards/under the pavement structure.

9. Closure

The findings and recommendations of this report were based on the results of the field and laboratory investigations. If conditions are encountered that appear to be different from those shown by the test holes drilled at this site and described in this report, or the assumptions stated herein are not in keeping with the design, this office should be notified in order that the recommendations can be reviewed and adjusted if necessary.

Soil conditions, by their nature, can be highly variable across a site. A contingency should be included in the construction budget to allow for the possibility of variation in soil conditions, which may result in modification of the design and construction procedures.

Sincerely,
AECOM Canada Ltd.

Submitted By:

Kendall Thiessen, P.Eng.
Geotechnical Engineer

PROVINCE OF MANITOBA
Sept 19, 2011
K. J.
THIESSEN
Member
2A708
REGISTERED PROFESSIONAL ENGINEER

Reviewed By:

Faris Khalil, P.Eng.
Manager, Geotechnical Engineering

Encl.

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The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("Consultant") for the benefit of the client ("Client") in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the "Agreement").

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- represents Consultant's professional judgement in light of the Limitations and industry standards for the preparation of similar reports
- may be based on information provided to Consultant which has not been independently verified
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued
- must be read as a whole and sections thereof should not be read out of such context
- was prepared for the specific purposes described in the Report and the Agreement
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time

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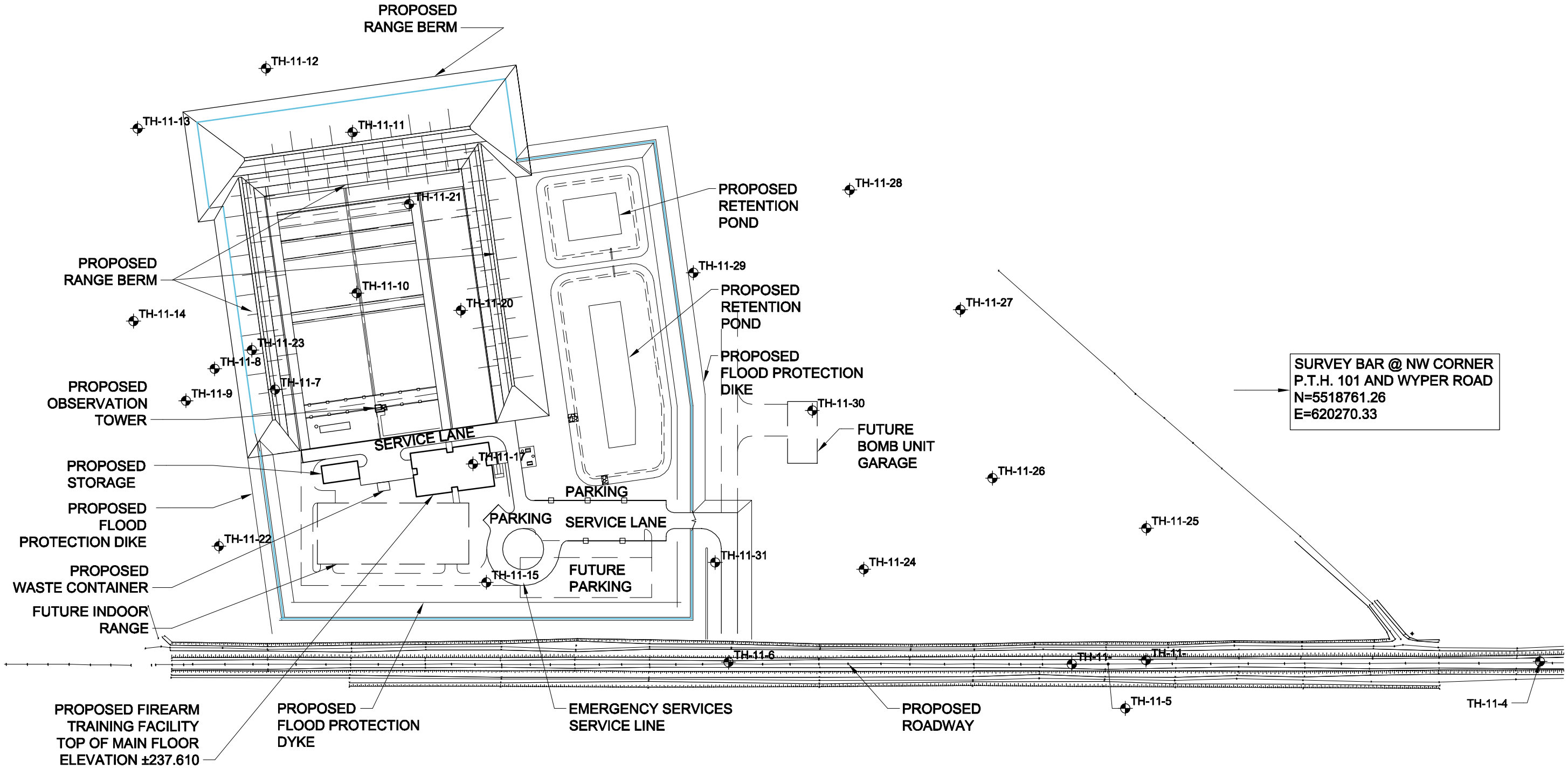
Figures



0 20 40 m SCALE 1:2000

LEGEND

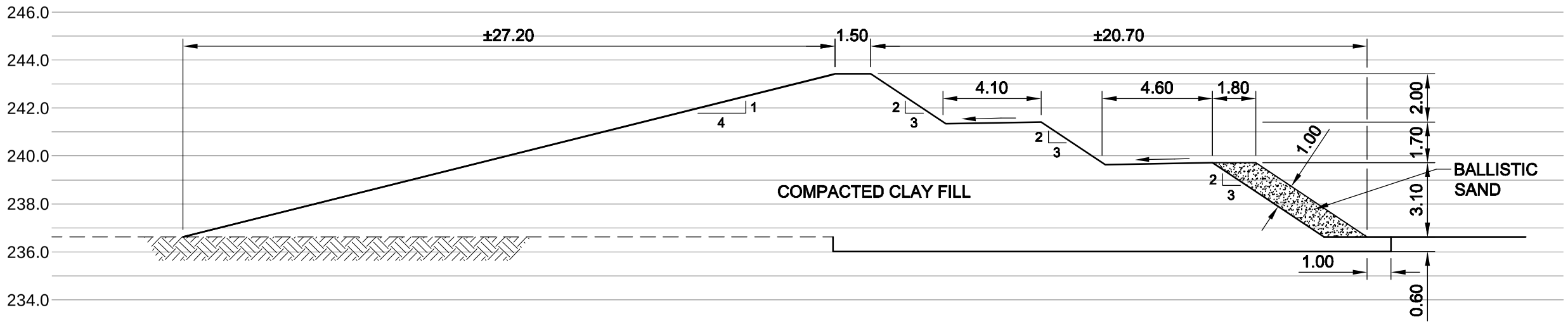
TEST HOLE LOCATION

AECOM

City of Winnipeg
Winnipeg Police Service
Firearm Training Facility

Wyper Road

Test Hole Location Plan
Figure-01



BACKSTOP SECTION

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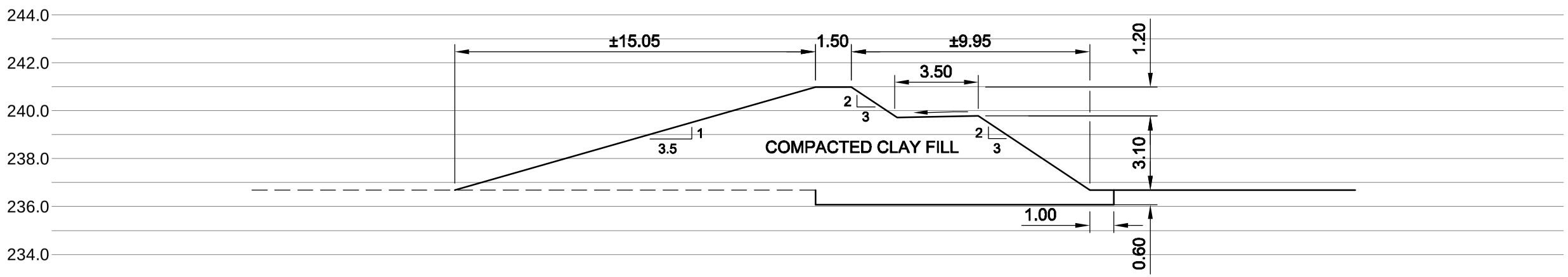


SIDE BERM SECTION

0 2 4 m SCALE 1:200

City of Winnipeg
Winnipeg Police Service Headquarters
Wyper Road
Berms

AECOM

Figure - 02

Appendix A

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.

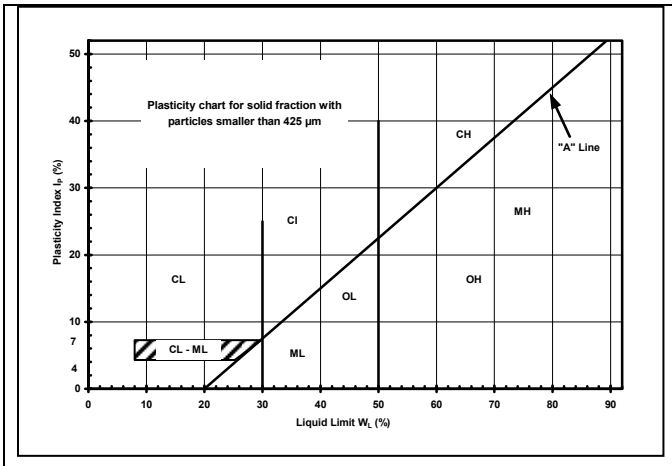
In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced 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				UMA 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)		AECOM
	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: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-04**
LOCATION: On Wyper Road - N 5518744.62 / E 620169.31		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 237.39

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
0		TOPSOIL- organic, black, dry							237
		CLAY (Fill) - silty, trace sand, trace gravel, grey, dry							
		CLAY - silty - brown, moist, stiff - high plasticity		G1					
1									
				G2					236
2									
		- firm below 2.4 m							235
3				G3					
		- dark brown below 3.1 m							234
4									
		- soft below 4.3 m		G4					233
		- brown to grey below 4.6 m							
5									232
6				G5					
		END OF TEST HOLE AT 6.1 m BELOW GROUND SURFACE IN CLAY. Notes: 1. No sloughing observered during drilling. 2. No seepage observed. 3. Test hole backfilled with bentonite and auger cuttings upon completion.							231
7									230
8									229
9									228
10									227
11									226
12									
12.5									225

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 6.10 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/3/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-05**
LOCATION: On Wyper Road - N 5518741.28 / E 619969.03		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 237.55

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
0		TOPSOIL - organics, black, dry						237
		CLAY (Fill) - silty, trace sand, trace gravel, trace rootlets, grey, dry						
		CLAY - silty	■	G6				
1		- grey, moist, stiff - high plasticity - trace rootlets						236
		- soft below 1.2 m	■	G7				
2								235
3			■	G8				
		- dark brown below 3.1 m						234
4								
			■	G9				233
5		- soft below 4.9 m						
								232
		- brown to grey below 5.6 m						
6			■	G10				
		END OF TEST HOLE AT 6.1 m BELOW GROUND SURFACE IN CLAY.						231
7		Notes: 1. No sloughing observered during drilling. 2. No seepage observed. 3. Test hole backfilled with bentonite and auger cuttings upon completion.						
								230
8								
								229
9								
								228
10								
								227
11								
								226
12								
12.5								

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

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 6.10 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/3/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-06**
LOCATION: On Wyper Road - N 5518738.02 / E 619762.84		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 237.82

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
0		TOPSOIL - organics, black, dry						
		CLAY (Fill) - silty, trace sand, trace gravel, trace rootlets, black, dry						
		CLAY - silty	GRAB	G11				237
1		- black, dry, very stiff to soft - high plasticity - trace rootlets	GRAB	G12				
		- trace rootlets						236
2		- brown, firm below 1.8 m						
			GRAB	G13				235
3								
		- brown to light grey below 3.7 m						234
4			GRAB	G14				
								233
5								
		- dark brown, soft below 5.5 m						232
6			GRAB	G15				
		END OF TEST HOLE AT 6.1 m BELOW GROUND SURFACE IN CLAY.						231
7		Notes: 1. No sloughing observered during drilling. 2. No seepage observed. 3. Test hole backfilled with bentonite and auger cuttings upon completion.						
								230
8								
								229
9								
								228
10								
								227
11								
								226
12								
12.5								

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

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 6.10 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/3/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-07**
LOCATION: N 5518864.77 / E 619538.64		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 236.92

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
0		TOPSOIL - organics, black, dry							
		CLAY - silty - black, moist, firm to stiff - high plasticity - trace rootlets							
1				G16					236
				T1					
2									235
		- brown to light grey below 2.3 m							
3				G16					234
4									233
		- firm below 4.3 m		G17					
5				T2					232
6				G18 G19					231
7		- soft to very soft below 7.0 m							230
				G20					
8				T3					229
		SILT- (Till) - silty, trace to some sand, trace gravel - brown, moist, compact - low to intermediate plasticity - becoming very dense with depth							
9				G21 S26	50/ 51mm			- 50 blows / 50 mm	228
		AUGER REFUSAL AT 9.45 m BELOW GROUND SURFACE IN SILT (Till). Notes: 1. No sloughing observered during drilling. 2. Seepage observed below 8.0 m. Water level at 2.6 m below ground at the end of drilling. 3. Test hole backfilled with bentonite and auger cuttings upon completion.							
10									227
11									226
12									225
12.5									

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 9.45 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/3/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-08**
LOCATION: N 5518881.09 / E 619514.45		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 237.00

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

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

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0		TOPSOIL - rootlets, black, dry						
		CLAY - silty - black, moist - high plasticity - trace rootlets						
1								236
				G27				
				T4				
2								235
		- light grey below 2.3 m						
3				G28				234
4		- brown below 3.8 m - firm below 4.0 m, becoming soft with depth						233
				G29				
				T5				
5								232
		- grey below 5.3 m						
6				G30				231
7								230
				G31A				
				T6				
8								229
		SILT- (Till) - silty, trace sand, trace gravel - brown, moist, loose - low plasticity						
9				G31B				228
				S32	7		- 4, 3, 4 blows/150 mm	
		AUGER REFUSAL AT 9.60 m BELOW GROUND SURFACE IN SILT (Till). Notes: 1. No sloughing observered during drilling. 2. Seepage observed below 7.8 m. Water level at 2.4 m below ground at end of drilling. 3. Installed 25 mm diameter standpipe piezometer well at 9.6 m. Complete with 1.5 m of screen and 1.1 m stick up, and flush-mount cover. Backfilled with sand to 7.77 m and bentonite to surface. Water level at el. 235.422 m on August 10, 2011.						
10								227
11								226
12								225
12.5								

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

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 9.60 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/3/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-09**
LOCATION: N 5518863.36 / E 619505.73		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 237.03

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
0		TOPSOIL - organics, rootlets, black, dry							
		CLAY - silty - dark grey, moist, stiff - high plasticity							
1				G33					236
				T7					
2									235
		- trace silt inclusion [<10 mm]							
3		- firm below 2.7 m		G34					234
4		- brown below 3.8 m							233
				G35					
5				T8					232
		- grey below 5.3 m							
6				G36					231
7									230
				G37					
8		- becoming soft below 8 m		T9					229
9		SILT- (Till) - silty, some clay, trace sand, trace gravel - dark brown, moist, loose to dense - low plasticity		G38					228
				S39	49			- 8, 36, 13 blows/150 mm	
10		AUGER REFUSAL AT 9.75 m BELOW GROUND SILT (Till). Notes: 1. No sloughing observered during drilling. 2. Seepage observed below 9.8 m. Water table at 3.35 m below ground. 3. Test hole backfilled with bentonite and auger cuttings upon completion.							227
11									226
12									225
12.5									

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 9.75 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/3/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-10**
LOCATION: N 5518912.87 / E 619588.43		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 236.93

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
0		TOPSOIL - organics, rootlets							236
		- black, dry							
		CLAY - silty							
1		- greyish brown, dry, stiff							
		- high plasticity		G40					
2									235
		- light grey to grey brown below 2.3 m							
		- firm to soft below 2.7 m							
3				G41A					234
4									233
				G41B					
				G42					
5									232
		- grey below 5.5 m							
6				G43					231
7									230
				G44					
8									229
		SILT- (Till) - silty, trace to some sand, trace to some gravel							
		- brown to light grey, moist, loose to compact							
9		- low plasticity		G45					228
		END OF TEST HOLE AT 9.14 m BELOW GROUND SURFACE IN SILT (Till).							
		Notes:							
		1. No sloughing observered during drilling.							
10		2. Seepage observed in till. Water level at 2.4 m below ground at end of drilling.							227
		3. Test hole backfilled with bentonite and auger cuttings upon completion.							
11									226
12									225
12.5									

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 9.14 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-11**
LOCATION: N 5519002.05 / E 619581.4		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 236.84

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
0		TOPSOIL - organics, rootlets - black, dry							236
1		CLAY - silty - light grey, dry, stiff to soft - high plasticity - trace rootlets	■	G46		●			235
2		- becoming firm to soft below 2.1 m							
3			■	G47		●			234
4									233
5			■	G48		●			232
6		- grey below 5.3 m	■	G49		●			231
7									230
8			■	G50		●			229
9		SILT- (Till) - silty, trace to some sand, trace to some gravel - brown, moist, very soft - low plasticity	■	G51		●			228
10		AUGER REFUSAL AT 8.84 m BELOW GROUND SURFACE IN SILT (Till). Notes: 1. No sloughing observered during drilling. 2. Seepage observed below 8.5 m. Water level at 2.4 m below ground at end of drilling. 3. Test hole backfilled with bentonite and auger cuttings upon completion.							227
11									226
12									225
12.5									

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 8.84 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-12**
LOCATION: N 5519032.99 / E 619527.39		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 236.80

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

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

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

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION
0	TOPSOIL - organics, rootlets, black, dry					
	CLAY - silty - light grey to brown, moist, stiff - intermediate to high plasticity					236
1			G52			
2			T10			235
3	- firm below 3.0 m, becoming soft with depth		G53			234
4	- grey with trace silt inclusions [<15 mm] below 3.8 m		G54			233
5	- trace gravel below 4.8 m					232
6			G55			231
7						230
8			G56			229
9	SILT- (Till) - silty, trace sand, trace gravel - brown, moist, loose - low plasticity		G57			228
10						227
11	AUGER REFUSAL AT 10.2 m BELOW GROUND SURFACE IN SILT (Till). Notes: 1. No sloughing observered during drilling. 2. Seepage observed below 8.7 m. Water level at 2.1 m below below ground at end of drilling. 3. Installed 25 mm diameter standpipe piezometer well at 10.2 m. Complete with 1.5 m of screen and 1.1 m stick up flush-mount cover. Backfilled with sand to 8.38 m and bentonite to surface. Water level at el. 235.26 m on August 10, 2011.					226
12						225
12.5						

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 10.21 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-13**
LOCATION: N 5519002.89 / E 619467.19		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 236.92

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
0		TOPSOIL - rootlets - grey to black, dry							
1		CLAY - silty - light grey to grey, dry, stiff - intermediate plasticity - brown below 1.1 m	■	G58					236
2									235
3			■	G59					234
4									233
5			■	G60					232
6		- dark grey to grey, firm below 5.33 m	■	G61					231
7		- soft below 6.8 m							230
8			■	G62					229
9		SILT- (Till) - silty, trace sand, trace gravel - light grey to grey, moist, loose - low plasticity	■	G63					228
10		AUGER REFUSAL AT 9.14 m BELOW GROUND SURFACE IN SILT (Till). Notes: 1. No sloughing observered during drilling. 2. No seepage observed. 3. Test hole backfilled with bentonite and auger cuttings upon completion.							227
11									226
12									225
12.5									

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 9.14 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-14**
LOCATION: N 5518907.81 / E 619467.19		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 237.08

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
0		TOPSOIL - rootlets, black to grey, dry							237
1		CLAY - silty - black, moist, stiff - high plasticity - trace organics - trace silt inclusions		G64					236
2		-brown, firm to soft below 1.8 m							235
3				G65					234
4									233
5				G66					232
6				G67					231
7		- dark grey below 6.8 m							230
8				G68					229
9		SILT- (Till) - clayey, trace sand, trace gravel - brown to light grey, moist, soft - low to intermediate plasticity		G69					228
10		END OF TEST HOLE AT 9.1 m BELOW GROUND SURFACE IN SILT (Till). Notes: 1. No sloughing observered during drilling. 2. Seepage observed below 8.5 m. Water level at 2.7 m below ground surface at end of drilling 3. Test hole backfilled with bentonite and auger cuttings upon completion.							227
11									226
12									225
12.5									

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 9.14 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-15**
LOCATION: N 5518777.37 / E 619656.19		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 237.04

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
0		TOPSOIL - black to grey, dry							
		CLAY - silty - grey, moist, very stiff - intermediate to high plasticity	■	G112		●			
1			■	G113		●			236
		END OF TEST HOLE AT 1.52 m BELOW GROUND SURFACE IN CLAY. Notes: 1. No sloughing observered during drilling. 2. No seepage observed. 3. Test hole backfilled with bentonite and auger cuttings upon completion.							
2									235
3									234
4									233
5									232
6									231
7									230
8									229
9									228
10									227
11									226
12									225
12.5									

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 1.52 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-17**
LOCATION: N 5518849.3 / E 619634.84		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 236.92

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
0		TOPSOIL - black, dry						
		CLAY - silty - dark grey, moist, very stiff	■	G114				
1		- becoming firm with depth - intermediate to high plasticity - trace rootlets	■	G115				236
		- grey to brown below 1.5 m - soft below 2.4 m						
2								235
3			■	G116				234
		END OF TEST HOLE AT 3.04 m BELOW GROUND SURFACE IN CLAY. Notes: 1. No sloughing observered during drilling. 2. No seepage observed. 3. Test hole backfilled with bentonite and auger cuttings upon completion.						
4								233
5								232
6								231
7								230
8								229
9								228
10								227
11								226
12								225
12.5								

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

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-20**
LOCATION: N 5518907.53 / E 619643.85		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 236.93

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
0		TOPSOIL - black, dry							
1		CLAY - silty - grey to black, moist, stiff, becoming firm with depth - intermediate to high plasticity - trace silt inclusions		G77		●			236
2									235
		- brown below 2.2 m							
3				G78		●			234
4									233
				G79		●			
5									232
		- brown to grey below 5.3 m							
6				G80		●			231
		END OF TEST HOLE AT 6.1 m BELOW GROUND SURFACE IN CLAY. Notes: 1. No sloughing observered during drilling. 2. No seepage observed. 3. Test hole backfilled with bentonite and auger cuttings upon completion.							
7									230
8									229
9									228
10									227
11									226
12									225
12.5									

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 6.10 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-21**
LOCATION: N 5518966.88 / E 619614.31		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 236.94

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

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

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
0		TOPSOIL - rootlets - black, dry							
		CLAY - silty - grey to black, moist, stiff to soft - intermediate to high plasticity							
1				G81					236
2									235
3				G82					234
4		- mottled brown and light grey below 3.8 m							233
				G83					
5		- grey below 5.2 m - soft below 5.5 m							232
6				G84					231
7									230
8		SILT (Till) - some clay, some sand. trace gravel - light grey, compact, low plasticity							229
9		AUGER REFUSAL AT 8.8 m BELOW GROUND SURFACE IN SILT (Till). Notes: 1. No sloughing observered during drilling. 3. Seepage observed from till. Water level at 2.1 m below ground surface at end of drilling. 4. Installed 25 mm diameter standpipe piezometer well at 8.8 m. Complete with 1.5 m of screen and 1.0 m stick up flush-mount cover. Backfilled with sand to 7.01 m and bentonite to surface. Water level at el. 235.30 on August 10, 2011.							228
10									227
11									226
12									225
12.5									

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 8.84 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-22**
LOCATION: N 5518792.47 / E 619512.2		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 236.79

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
0		TOPSOIL - organics, black, dry							
		CLAY - silty - grey to black, moist, stiff - intermediate to high plasticity - trace silt inclusions [<10 mm], trace rootlets - becoming firm with depth below 1.5 m	■	G85					236
1			■	G86					
2									235
		- dark brown to grey below 2.2 m							
3			■	G87					234
		END OF TEST HOLE AT 3 m BELOW GROUND SURFACE IN CLAY. Notes: 1. No sloughing observered during drilling. 2. No seepage observed. 3. Test hole backfilled with bentonite and auger cuttings upon completion.							
4									233
5									232
6									231
7									230
8									229
9									228
10									227
11									226
12									225
12.5									

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-23**
LOCATION: N 5518895.43 / E 619532.73		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 236.92

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
0		TOPSOIL - organics, black, dry							236
		CLAY - silty - brown, moist, stiff - high plasticity - becoming firm below 2 m - trace silt inclusions		G70					
1									
2									235
				G71					234
3									
4									233
				G72					232
5		- grey below 5.3 m							
6				G73					231
7		- soft below 7 m							230
				G74					229
8									
9		SILT- (Till) - silty, trace sand, trace gravel - light grey to grey, moist, very dense - low plasticity		G75					228
				S76	55				
10		AUGER REFUSAL AT 9.52 m BELOW GROUND SURFACE IN SILT (Till). Notes: 1. No sloughing observered during drilling. 2. Seepage observed below 8.7 m. Water Level at 2.4 m below ground at end of drilling. 3. Test hole backfilled with bentonite and auger cuttings upon completion.							227
11									226
12									225
12.5									

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 9.53 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-24**
LOCATION: N 5518779.82 / E 619850.32		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 236.75

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
0		TOPSOIL - organics, rootlets, black, dry						236
		CLAY - silty - dark grey to brown, moist, stiff - high plasticity	■	G88				
1			■	G89				235
2		- firm below 2.4 m						234
3			■	G90				233
		END OF TEST HOLE AT 3 m BELOW GROUND SURFACE IN CLAY. Notes: 1. No sloughing observered during drilling. 2. No seepage observed. 3. Test hole backfilled with bentonite and auger cuttings upon completion.						
4								232
5								231
6								230
7								229
8								228
9								227
10								226
11								225
12								
12.5								

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

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-25**
LOCATION: N 5518809.35 / E 619983.94		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 236.68

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
0		TOPSOIL - rootlets, black, dry							
		CLAY - silty - grey, moist, stiff - high plasticity	■	G91		●			236
1			■	G92		●			235
2		- firm below 2.4 m							234
3			■	G93		●			233
4		END OF TEST HOLE AT 3 m BELOW GROUND SURFACE IN CLAY. Notes: 1. No sloughing observered during drilling. 2. No seepage observed. 3. Test hole backfilled with bentonite and auger cuttings upon completion.							232
5									231
6									230
7									229
8									228
9									227
10									226
11									225
12									
12.5									

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-26**
LOCATION: N 5518838.05 / E 619889.14		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 236.69

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

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

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 TYPE	SAMPLE #	SPT (N)	COMMENTS	ELEVATION
0	TOPSOIL - rootlets, black, dry					236
	CLAY - silty - grey, moist, stiff to soft - high plasticity - trace silt inclusions [<15 mm]		G94			
1			G95			235
2	- mottled grey and brown, soft below 1.8 m					234
3			G96			233
4						232
5						231
6						230
7						229
8	SILT (Till) - some sand. trace gravel - compact, low plasticity					228
9	AUGER REFUSAL AT 8.8 m BELOW GROUND SURFACE IN CLAY. Notes: 1. No sloughing observered during drilling. 2. No seepage observed during drilling. 3. Installed 25 mm diameter standpipe piezometer well at 8.8 m. Complete with 1.5 m of screen and 1.0 m stick up flush-mount cover. Backfilled with sand to 7.01 m and bentonite to surface. Water level at el. 235.30 on August 10, 2011.					227
10						226
11						225
12						
12.5						

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-27**
LOCATION: N 5518912.59 / E 619887.46		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 236.74

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
0		TOPSOIL - organics, rootlets, black, dry							
		CLAY - silty - dark grey, moist, stiff to soft - high plasticity - trace silt inclusions [<10 mm] - light grey	■	G97		●			236
1			■	G98		●			
		- grey to ligh grey below 1.5 m							235
2									
									234
3			■	G99		●			
		END OF TEST HOLE AT 3 m BELOW GROUND SURFACE IN CLAY. Notes: 1. No Sloughing observered during drilling. 2. No seepage observed. 3. Test hole backfilled with bentonite and auger cuttings upon completion.							233
4									
									232
5									
									231
6									
									230
7									
									229
8									
									228
9									
									227
10									
									226
11									
									225
12									
12.5									

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-28**
LOCATION: N 5518973.07 / E 619832.32		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 236.82

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
0		TOPSOIL - organics, black, dry							
		CLAY - silty - mottled black and grey, moist, stiff becoming firm with depth - intermediate to high plasticity - trace silt inclusions [<10 mm]		G100					236
1				G101					
2		- brown below 2 m - soft below 2.3 m							235
3				G102					234
		END OF TEST HOLE AT 3 m BELOW GROUND SURFACE IN CLAY. Notes: 1. No Sloughing observered during drilling. 2. No seepage observed. 3. Test hole backfilled with bentonite and auger cuttings upon completion.							233
4									
5									232
6									231
7									230
8									229
9									228
10									227
11									226
12									225
12.5									

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-29**
LOCATION: N 5518938.75 / E 619757.49		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 236.64

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
0		TOPSOIL - black, dry							
		CLAY - silty - grey to dark grey, moist, stiff to soft - intermediate plasticity - trace silt inclusions [< 8 mm], trace rootlets	■	G103		●			236
1			■	G104		●			235
2		- brown brown below 2.2 m							234
3			■	G105		●			233
4		END OF TEST HOLE AT 3 m BELOW GROUND SURFACE IN CLAY. Notes: 1. No sloughing observered during drilling. 2. No seepage observed. 3. Test hole backfilled with bentonite and auger cuttings upon completion.							232
5									231
6									230
7									229
8									228
9									227
10									226
11									225
12									
12.5									

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-30**
LOCATION: N 5518861.39 / E 619810.94		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 236.70

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
0		TOPSOIL- black, dry							236
1		CLAY - silty - brown to black, dry, stiff to soft - high plasticity - trace silt inclusions [< 20 mm]	■	G106		●			
			■	G107		●			235
2		- grey below 2.2 m							234
3			■	G108		●			233
4		END OF TEST HOLE AT 3 m BELOW GROUND SURFACE IN CLAY. Notes: 1. No sloughing observered during drilling. 2. No seepage observed. 3. Test hole backfilled with bentonite and auger cuttings upon completion.							232
5									231
6									230
7									229
8									228
9									227
10									226
11									225
12									
12.5									

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

PROJECT: Wyper Road Firearms Training Facility	CLIENT: Winnipeg Police Services	TESTHOLE NO: **TH11-31**
LOCATION: N 5518795.85 / E 619772.68		PROJECT NO.: 60162215
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: Acker MP-5 125 mm SSA	ELEVATION (m): 236.87

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ◧ CORE

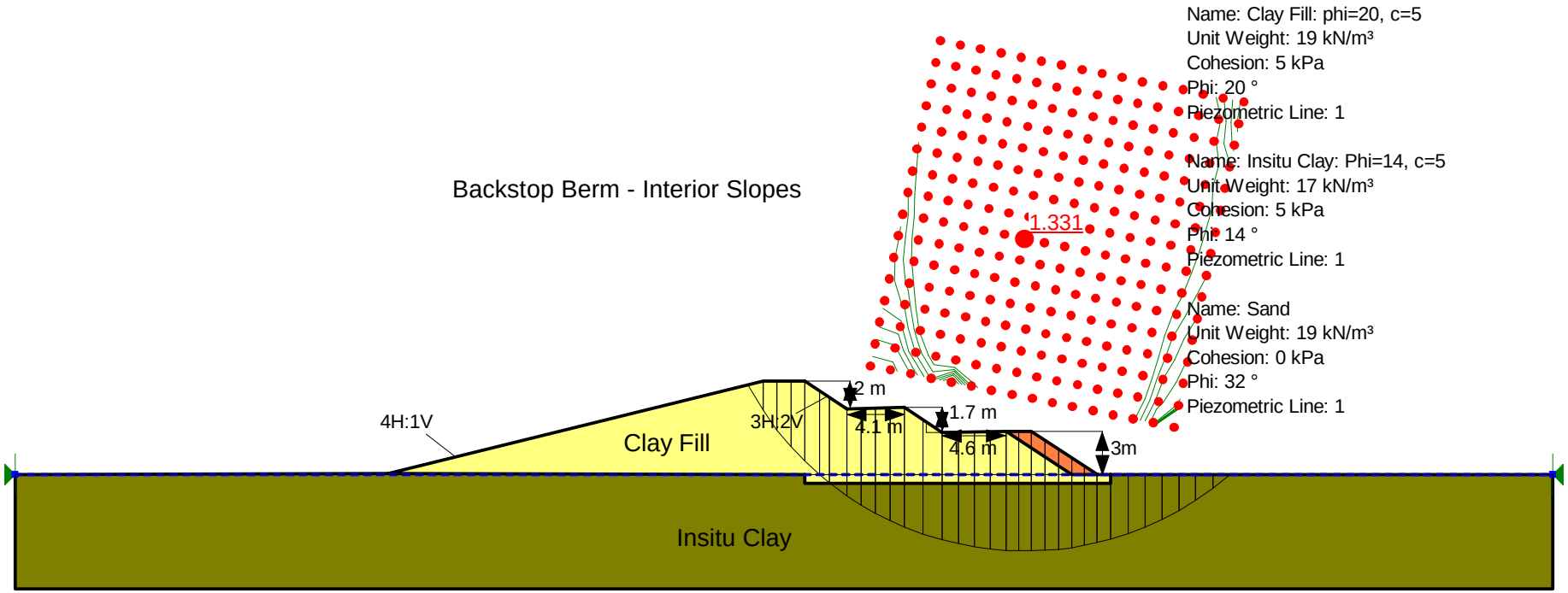
DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ⬘ Field Vane ⬘ (kPa) 50 100 150 200	COMMENTS	ELEVATION
0		TOPSOIL - black, dry							
		CLAY - silty - mottled dark grey to black, dry, very stiff to soft - intermediate plasticity	■	G109					236
1			■	G110					
2									235
		- brown below 2.3 m							
3			■	G111					234
		END OF TEST HOLE AT 3 m BELOW GROUND SURFACE IN CLAY. Notes: 1. No sloughing observered during drilling. 2. No seepage observed. 3. Test hole backfilled with bentonite and auger cuttings upon completion.							233
4									
5									232
6									231
7									230
8									229
9									228
10									227
11									226
12									225
12.5									

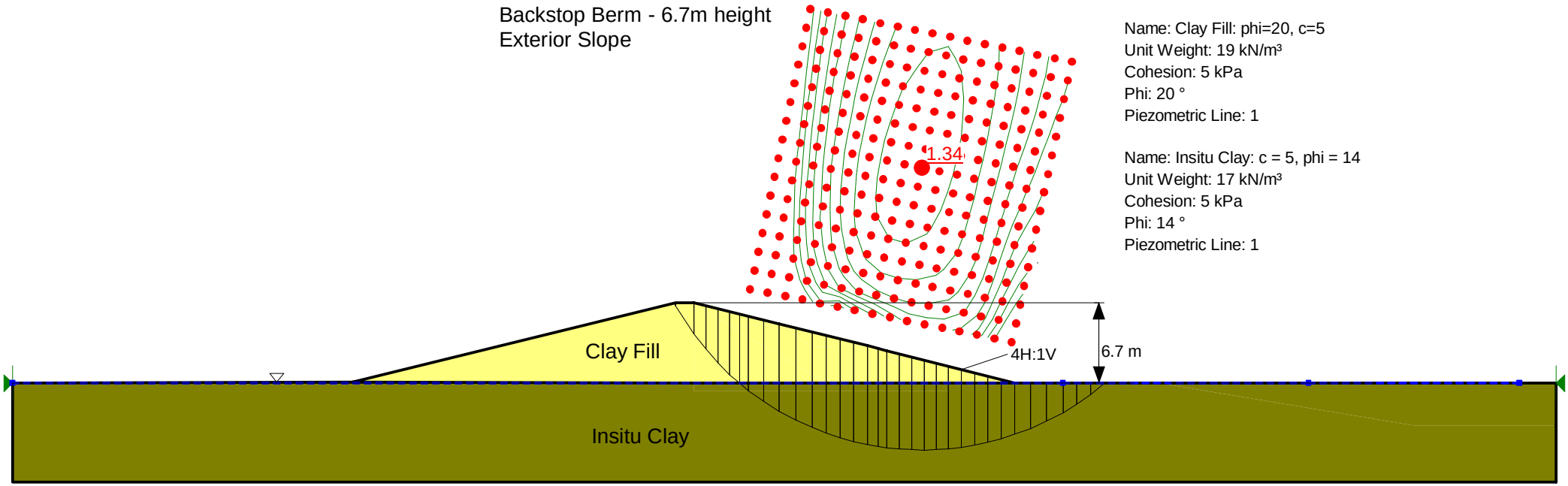
AECOM

LOGGED BY: M. Akhtar	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Kendall Thiessen	COMPLETION DATE: 8/4/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 60162215 BOREHOLE LOGS - WYPER RD.GPJ UMA WINN.GDT 9/16/11

Appendix B

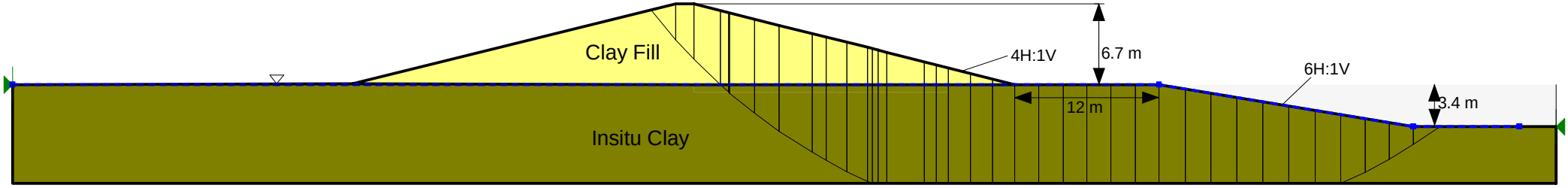

Backstop Berm - Interior Slopes
Name: Clay Fill: phi=20, c=5
Unit Weight: 19 kN/m³
Cohesion: 5 kPa
Phi: 20 °
Piezometric Line: 1
Name: Insitu Clay: Phi=14, c=5
Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 14 °
Piezometric Line: 1
Name: Sand
Unit Weight: 19 kN/m³
Cohesion: 0 kPa
Phi: 32 °
Piezometric Line: 1
1.331
2 m
4H:1V
3H:2V
4.1 m
1.7 m
4.6 m
3m
Clay Fill
Insitu Clay


Backstop Berm - 6.7m height
Exterior Slope
1.34
Name: Clay Fill: phi=20, c=5
Unit Weight: 19 kN/m³
Cohesion: 5 kPa
Phi: 20 °
Piezometric Line: 1
Name: Insitu Clay: c = 5, phi = 14
Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 14 °
Piezometric Line: 1
Clay Fill
4H:1V
6.7 m
Insitu Clay

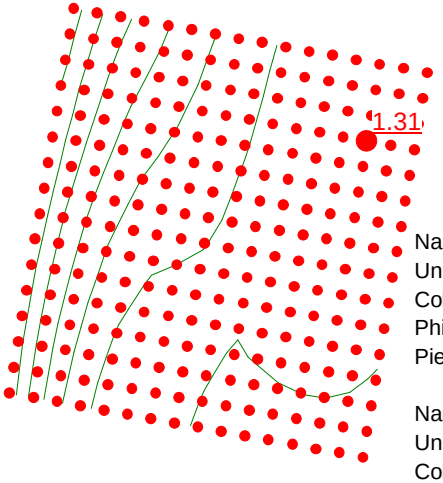
Backstop Berm - 6.7m height
Exterior Slope
Excavation 3.4 m below ground

Name: Clay Fill: phi=20, c=5
Unit Weight: 19 kN/m³
Cohesion: 5 kPa
Phi: 20 °
Piezometric Line: 1

Name: Insitu Clay: c = 5, phi = 14
Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 14 °
Piezometric Line: 1

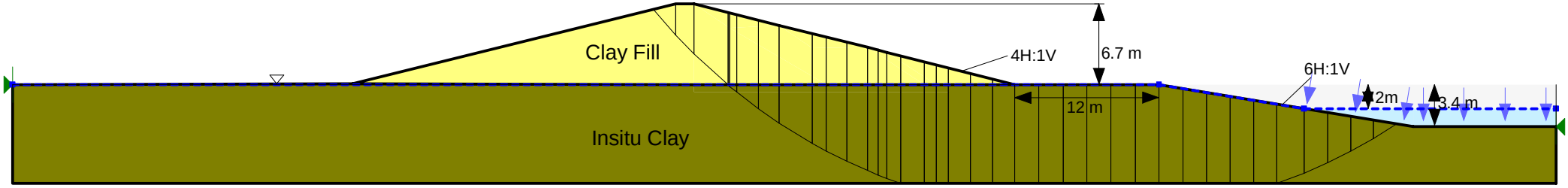


Backstop Berm - 6.7m height
Exterior Slope
Pond level 2 m below grade



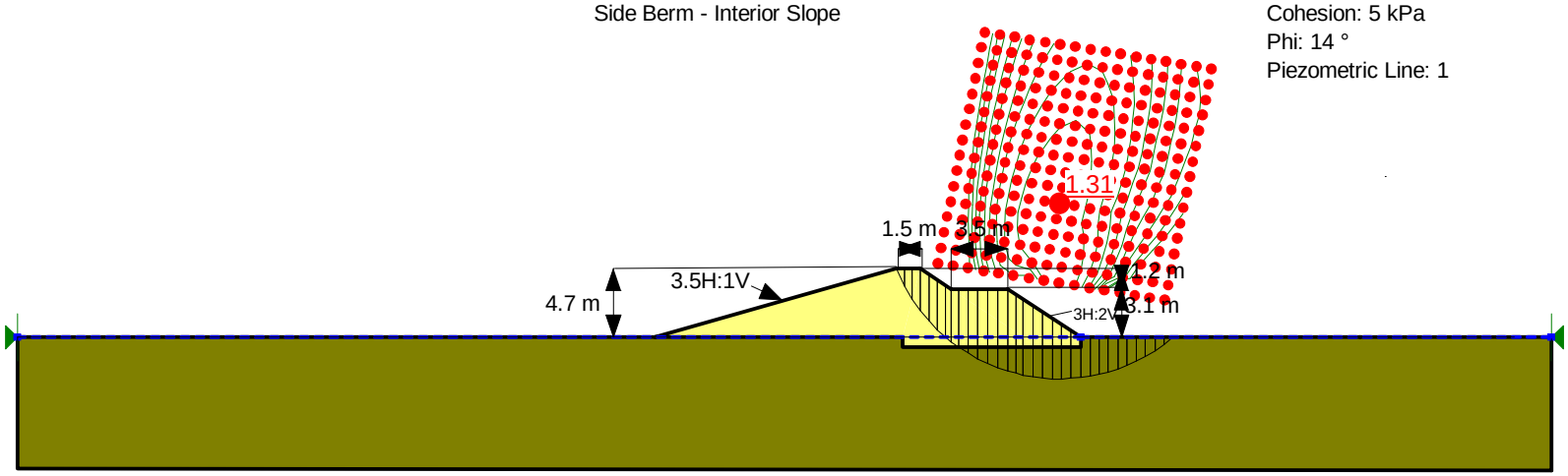
Name: Clay Fill: phi=20, c=5
Unit Weight: 19 kN/m³
Cohesion: 5 kPa
Phi: 20 °
Piezometric Line: 1

Name: Insitu Clay: c = 5, phi = 14
Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 14 °
Piezometric Line: 1

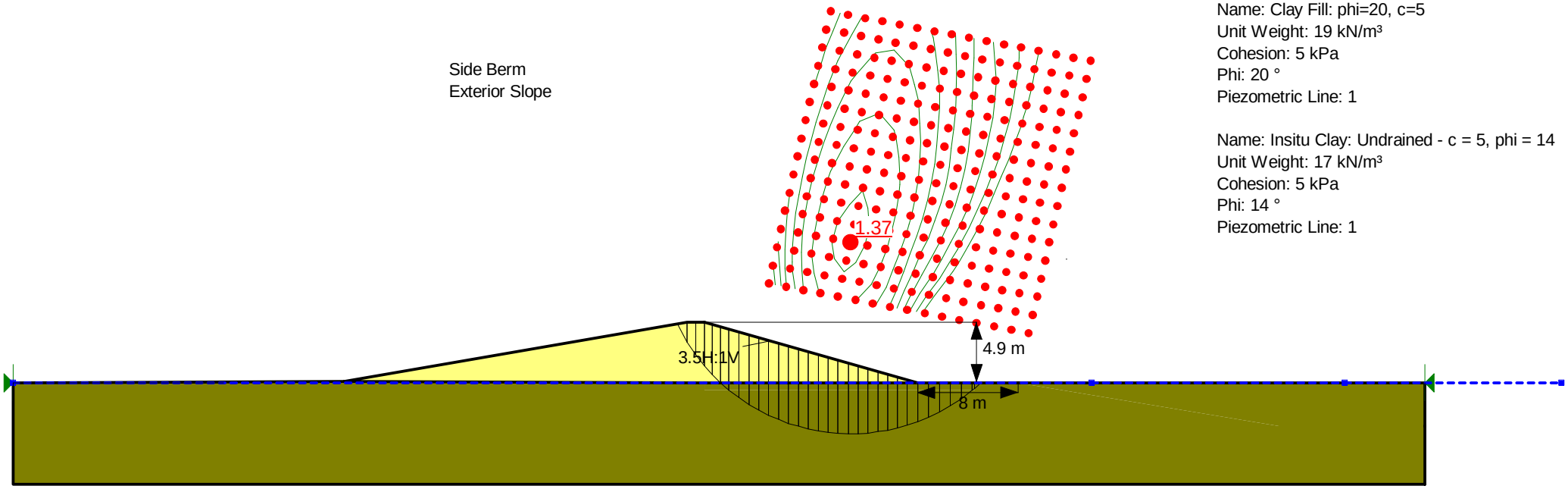


Name: Clay Fill: phi=20, c=5
Unit Weight: 19 kN/m³
Cohesion: 5 kPa
Phi: 20 °
Piezometric Line: 1

Name: Insitu Clay: c = 5, phi = 14
Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 14 °
Piezometric Line: 1



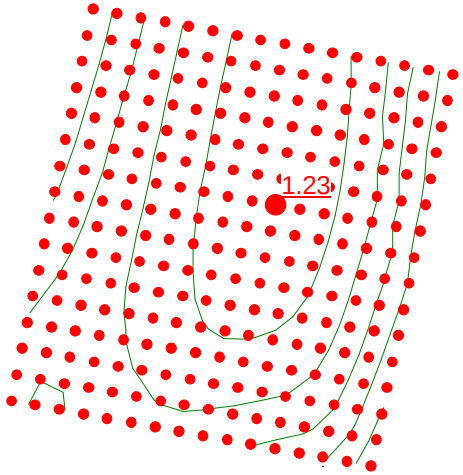
Side Berm
Exterior Slope



Name: Clay Fill: phi=20, c=5
Unit Weight: 19 kN/m³
Cohesion: 5 kPa
Phi: 20 °
Piezometric Line: 1

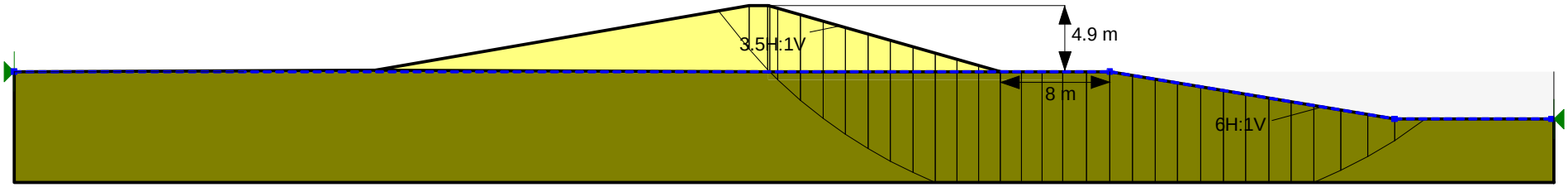
Name: Insitu Clay: Undrained - c = 5, phi = 14
Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 14 °
Piezometric Line: 1

Side Berm
Exterior Slope
Excavation 3.4 m below grade

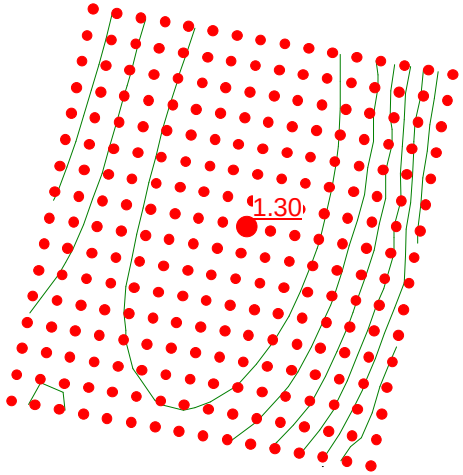


Name: Clay Fill: phi=20, c=5
Unit Weight: 19 kN/m³
Cohesion: 5 kPa
Phi: 20 °
Piezometric Line: 1

Name: Insitu Clay: Undrained - c = 5, phi = 14
Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 14 °
Piezometric Line: 1



Side Berm
Exterior Slope
Pond Level 2 m below grade



Name: Clay Fill: phi=20, c=5
Unit Weight: 19 kN/m³
Cohesion: 5 kPa
Phi: 20 °
Piezometric Line: 1

Name: Insitu Clay: Undrained - c = 5, phi = 14
Unit Weight: 17 kN/m³
Cohesion: 5 kPa
Phi: 14 °
Piezometric Line: 1