TOWN OF CALEDON
PLANNING
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May 29, 2026

8181926 Canada Inc.
160 Avenue Labrosse
Point-Claire, Quebec
H9R 1A

Attention: Mr. Raj Chahal

Re: In-Situ Guelph Permeameter Infiltration Testing
Proposed Truck Parking Facility
12434 Dixie Road
Town of Caledon

Dear Sir:

As requested, we have completed in-situ infiltration testing and laboratory analysis for collected shallow soil samples in support of the proposed Low Impact Development (LID) stormwater management infrastructure planning and design at the captioned development site (the Subject Site). The assessment and findings are presented in the current letter report.

Background

The Subject Site is located at 12434 Dixie Road, in the Town of Caledon. A proposed infiltration infrastructure will be implemented to promote infiltration and to address future stormwater management planning and design for the captioned development.

This study was undertaken to verify the permeability and percolation times of the subsoil profile at the proposed location and the depth of the proposed LID measures in the Subject Site. The study will confirm the feasibility of subsoil for the design of infiltration infrastructure to manage collected stormwater runoff, for its redirection to the subsurface, to recharge groundwater, and to meet the stormwater management planning and design objectives for the proposed developed site.

Work Program

Soil Engineers Ltd. (SEL) conducted in-situ percolation testing at the proposed location and depth provided by the client. The tests were conducted at the approximate base of the proposed LID infiltration facilities and ±1.0 m below the proposed base. This test will more accurately determine the local infiltration rate and will assist in appropriately sizing the facility.

Our representative performed site visit on Oct. 23, 2020, to conduct the in-situ infiltration (percolation) testing. The in-situ infiltration (percolation) testing program was conducted at four (4) test locations. An augured hole was done within each test location at the indicated target depths, in the vicinity of the proposed LID infrastructures. The approximate test locations, where the in-situ

percolation tests were attempted are shown on **Drawing No. 1**, enclosed. The ground surface elevations at the test locations are provided in **Table 1**.

Table 1- Test Locations and Depths

Test No.	UTM Coordinates (m)		Ground Surface Elevation (masl)	Depth (mbgs)	Estimated Bottom Elevation (masl)
	Easting	Northing			
TP1	596007	4846963	±265.3	±3.0	±262.3
				±4.0	±261.3
TP2	595931	4846806	±267.7	±2.0	±265.7
				±3.0	±264.7
TP3	595807	4846858	±267.6	±2.0	±265.6
				±3.0	±264.6
TP4	595767	484658	±268.2	±3.0	±265.2
				±4.0	±264.2

Note: mbgs: metres below ground surface masl: metres above sea level

For this study, eight (8) in-situ infiltration tests were initiated within four (4) test locations; one (1) test at the bottom elevation for the proposed LID infrastructure, and one (1) test at a depth of ±1.0 meter below the bottom elevation for the proposed LID infrastructure. The in-situ infiltration percolation testing was performed using the Guelph Permeameter (GP) instrument (Model 2800K1). The in-situ tests were conducted at the approximate depths, ranging from ±2.0 m to ±4.0 m below the existing ground surface (mbgs) at elevations, ranging from ±261.3 to ±265.7 metres above sea level (masl).

Methodology

The Guelph Permeameter (GP) is a constant head infiltrometer instrument which operates using the Marriott Bottle principle, whereby a constant ponded head of water is allowed to infiltrate into the unsaturated surface soil via a small test hole augered to penetrate the shallow soil horizon. The constant water head for the instrument is maintained within the test hole by an air tube and its height setting within the instrument. A steady-state flow of water into the subsoil should result after a relatively short period, corresponding to the instrument's ponded water head setting. A higher ponded water head setting should result in a higher steady-state flow of water into the subsoil, than the previous, lower ponded water head setting.

The Field Saturated (fs) hydraulic conductivity (K) estimates for the soil are obtained using the mathematical equations established for the instrument, whereby two (2) steady-state flow measurements, corresponding to the two (2) ponded water head settings for the instrument, can be used as minimum information to estimate the field saturated hydraulic conductivity (K_{fs}) for the soil. The K_{fs} estimates can also be determined, using the one-ponded water head approach which corresponds to one steady-state water flow measurement into the subsoil.

It is critical to note that the K_{fs} and infiltration rates are two (2) different concepts and that translation from one parameter to another cannot be done through unit a of conversion. In accordance with the guidelines from the Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation Authority (CVC), the infiltration rates are based on the "Low Impact Development Stormwater Management Planning and Design Guide, Table C1", as provided in **Table 2**, below.

Table 2- Approximate Relationship between Kfs, Percolation Time and Infiltration Rate

Hydraulic Conductivity, K_{fs} (cm/Sec)	Percolation Time, T (min/cm)	Infiltration Rate, 1/T (mm/hr)
0.1	2	300
0.01	4	150
0.001	8	75
0.0001	12	50
0.00001	20	30
0.000001	50	12

K_{fs} – field saturated hydraulic conductivity
Source: Ontario Ministry of Municipal Affairs and Housing (OMMAH). 1997; Supplementary Guidelines to the Ontario Building Code 1997, SG-6 Percolation Time and Soil Description.

Infiltration Test Results and Discussion

The in-situ infiltration tests were conducted at depths, ranging from ±2.0 m to ±4.0 mbgs. Based on the visual observations in the field, the existing shallow subsoils beneath the site comprise:

- Earth fill, sandy silty till (some clay to clayey, trace of gravel)

The results from the attempted in-situ infiltration testing and review and interpretation of the soil grain size analyses for the collected sub-soil samples obtained at the testing depths are summarized in **Table 3**.

Table 3- Estimated Hydraulic Conductivity, Percolation Times, and Infiltration Rates

Test No.	Test and Depth (m)	Soil Type	Ponded Water Head Setting (cm)	Steady State Flow (cm^3/sec)	Grain Size Permeability Estimation (cm/sec)	In-situ testing of Hydraulic Conductivity (cm/sec)	Estimated Infiltration Rate (mm/hr)
TP1	A ±3.0	Sandy Silt, Till some clay to clayey, a trace of gravel	(H1) 7	0.0587	10^{-6} (Figure 1)	9.1×10^{-5}	45.1 (GP)
			(H2) 15	0.1174			
			Same as Above	Double Head Approach			
	B ±4.0	Sandy Silt, Till some clay to clayey, a trace of gravel	(H1) 15	0.0073	10^{-6} (Figure 2)	3.67×10^{-7}	10.3 (GP)
			(H2) 24	0.0093			
			Same as Above	Double Head Approach			
TP2	A ±2.0	Sandy Silt, Till some clay and gravel	(H1) 15	N/A	10^{-6} (Figure 3)	5.22×10^{-6}	21.0 (GP)
			(H2) 23	0.01174			
			Same as Above	Single Head Approach			
	B* ±3.0	Sandy Silt, Till some clay, and gravel	Minor Water Seepage at 2.5m				
TP3	A ±3.0	Sandy Silt, Till some clay, a trace of gravel	(H1) 15	N/A	10^{-6} (Figure 4)	4.39×10^{-6}	20.0 (GP)
			(H2) 23	0.0093			
			Same as Above	Single Head Approach			
	B ±4.0	Sandy Silt, Till some clay, a trace of gravel	(H1) 12	N/A	10^{-6} (Figure 5)	N/A	12.0 (GS)
			(H2) 24	N/A			
			Same as Above	-			
TP4	A ±3.0	Sandy Silt, Till some clay to clayey, a trace of gravel	(H1) 7	N/A	10^{-6} (Figure 56)	N/A	12.0 (GS)
			(H2) 21	N/A			
			Same as Above	-			
	B ±4.0	Sandy Silt, Till some clay, a trace of gravel	Water Seepage at 4.0m				

GS – Grain Size *GP-Guelph Permeameter* *N/A The test was not successful due to low permeable soil*

Based on the use of the Guelph Permeameter ponded water single head and double head settings and from the resulting steady-state flow measurements into the subsoil, the estimated filed saturated hydraulic conductivity for the subsoil ranges from 9.1 x 10^{-5} to 3.67 x 10^{-7} cm/sec at test locations Test location 1A, 1B, 2A, and 3A, respectively. **Appendix A** presents the findings of the GP tests.

Attempts were made to complete the in-situ infiltration tests at Test locations 2B, 3B, 4A and 4B. However, due to the low permeable soil and water seepage at the testing depths, the in-situ percolation test could not be successfully performed at the indicated depths, using the GP instrument.

Since the use of Guelph Permeameter was not successful at providing results at the testing locations, at the indicated depths, representative subsoil samples were also collected at the testing depths for follow-up, laboratory, grain size analysis as per Ministry of Transpiration (MTO) Laboratory Standards 602 and 702 to confirm the shallow subsoil sample texture classifications in order to interpret and estimate the soil's percolation (T) times and associated infiltration rates. The results for the soil grain size analyses for the collected soil samples, as performed in our laboratory is enclosed for your reference, **Appendix B (Figures 1** to **6)**, inclusive.

Based on the interpretation from the soil grain size analyses plots, as performed in our laboratory, the estimated permeability for the subsoil at the depths ranging between 2.0 to 4.0 m within the sandy silt till with some clay to clayey, a trace of gravel layers is 1.0 x 10^{-6} cm/sec. The infiltration rates will vary depending on the soil density and the amounts of sand and/or silt present in the native subsoils, and for the presence of any vertical soil structure fracturing, and/or macro pores.

General Comments

Toronto and Region Conservation Authority (TRCA) design manual, titled "Low Impact Development Stormwater Management Planning and Design Guide", a safety factor is to be incorporated in the determining of the infiltration rates for the design of LID infiltration infrastructure, such as infiltration galleries, soak away pits or similar technology that would be implemented as part of stormwater management planning and design for site development. A summary of the findings at each test location is presented below:

Test Location 1: The geometric mean for the field-saturated hydraulic conductivity estimates from the above in-situ infiltration testing performed at the test location is 5.8 x 10^{-6} cm/sec, and the resulting geometric mean infiltration rates from these tests are 21.6 mm/hr. The least permeable infiltration test result listed above is 10.3 mm/hr. The ratio of the geometric mean for the above infiltration rates divided by the lowest infiltration rate gives a factor of 3.1. Using Table C3 from the TRCA LID design manual, a comparison of the above ratio to values listed in the table indicates that the ratio falls within a range of 1.1 to 4.0. Therefore, the Safety Correction factor applicable to the calculated ratio for the measured infiltration rates is 3.5. Dividing the geometric mean infiltration rate determined from the infiltration tests by the applicable safety factor gives a design infiltration rate of 12.9 mm/hr and 2.9 mm/hr at the approximate base of the LID measures (1A) and ±1.0 m below the proposed base of the LID (1B), respectively. Considering the Geomean K_{fs}, it is 6.2 mm/hr, which can be incorporated into the final design for the proposed LID infiltration infrastructure.

Test Location 2: As previously mentioned, the in-situ percolation test was partially successful, the hydraulic conductivity estimates from the above in-situ infiltration testing performed at the test location 2A is 5.2 x 10^{-6} cm/sec, and the infiltration rate from this test is 21.0 mm/hr. Assuming a

Safety Correction factor of 3.5 as estimated at TP 1 location, and dividing the infiltration rate determined from the infiltration test by the applicable safety factor gives a design infiltration rate of 6.0 mm/hr at the approximate base of the LID measures (2A), which can be incorporated into the final design for the proposed LID infiltration infrastructure.

Test Location 3: As previously mentioned, the in-situ percolation test was partially successful, the hydraulic conductivity estimates from the above in-situ infiltration testing performed at the test location 3A is 4.39 x 10^{-6} cm/sec, and the infiltration rate from this test is 20.0 mm/hr. Assuming a Safety Correction factor of 3.5 as estimated at TP 1 location, and dividing the infiltration rate determined from the infiltration test by the applicable safety factor gives a design infiltration rate of 5.7 mm/hr at the approximate base of the LID measures (3A), which can be incorporated into the final design for the proposed LID infiltration infrastructure.

Test Location 4: As previously mentioned, the in-situ percolation test could not be completed at Test location 4A and 4B due to the occurrence of dense, low permeable subsoil at the testing location and at Test Location 4B due to water seepage at the testing depth. As such, the in-situ percolation test cannot be interpreted.

It is a common practice to maintain infiltration elevations at least 1.0 m above the highest groundwater level.

Any infiltration system infrastructure designed for the Subject Site should include an overflow valve to divert any excess runoff to a second infiltration gallery, or to the municipal storm sewer.

Closure

We trust that this correspondence addresses your current needs and ask that you contact the undersigned should you have any questions or require additional information.

Yours truly,
SOIL ENGINEERS LTD.

NA

PROFESSIONAL GEOSCIENTIST
NARJES ALIJANI
PRACTISING MEMBER
2386
May 29, 2026
ONTARIO

Bhawandeep Singh Brar, B.Sc.,
BSB/NA

Narjes Alijani, M.Sc., P.Geo.

ENCLOSURES

Test Pit Location Plan	Drawing 1
GP Test Findings	Appendix A
Grain Size Distribution Graphs	Appendix B

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DRAWING

REFERENCE NO. 2009-W189

595500

596000

596500

4847000

4846500

DJ Projects\2009-W189\

A Tributary of West Humber River

DIXIE ROAD

Existing Structures

Limit of Greenbelt

Environmental Study may be required

LOCATION (1) OF TESTING FOR POTENTIAL VEGETATED FILTER STRIPS/INFILTRATION TRENCH AT TESTING DEPTH OF 2.00m

LOCATION (2) OF TESTING FOR POTENTIAL PERFORATED PIPING SYSTEM AT DEPTH OF 3.00m

LOCATION (2) OF TESTING FOR POTENTIAL VEGETATED FILTER STRIPS/INFILTRATION TRENCH AT TESTING DEPTH OF 2.00m

LOCATION (1) OF TESTING FOR POTENTIAL PERFORATED PIPING SYSTEM AT DEPTH OF 3.00m

TP 1

TP 2

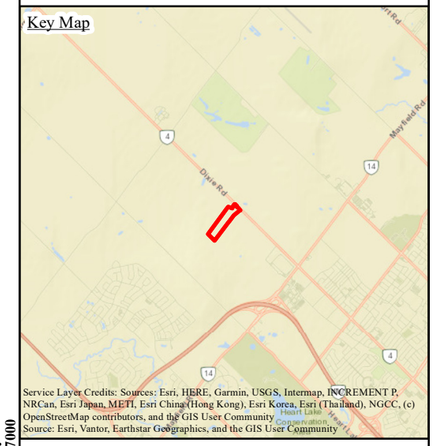
TP 3

TP 4

N

References: Ontario Ministry of Natural Resources and Forestry
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Key Map



Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

Legend

- Approximate Boundary of Subject Site
- Major Road
- Waterbody
- Watercourse
- Test Pit

Soil Engineers Ltd.

In-Situ Test Pit Location Plan

In-Situ Infiltration Testing
12434 Dixie Road
Town of Caledon

Reference No. 2009-W189

Date: May 29, 2026

Scale:

0 20 40 80 120 160 200

Metres

Drawing No. 1

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APPENDIX 'A'

GUELPH PERMEAMETER TESING FINDINGS

REFERENCE NO. 2009-W189

SOILMOISTURE Guelph Permeameter

Input
Result

Single Head Method (1)

Reservoir Cross-sectional area in cm²

(enter "35.22" for Combined and "2.16" for Inner reservoir): 35.22
Enter water Head Height ("H" in cm): 7
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.1000

Res Type 35.22
H 7
a 3
H/a 2.333
a* 0.12
C0.01 0.991
C0.04 1.04
C0.12 1.014
C0.36 1.014
C 1.014
R 0.100
Q 0.059
pi 3.142

α*= 0.12 cm⁻¹

C = 1.0139
Q = 0.0587

K_{fs} = 8.47E-05 cm/sec
5.08E-03 cm/min
8.47E-07 m/sec
2.00E-03 inch/min
3.33E-05 inch/sec

Φ_m = 7.05E-04 cm²/min

Single Head Method (2)

Reservoir Cross-sectional area in cm²

(enter "35.22" for Combined and "2.16" for Inner reservoir): 35.22
Enter water Head Height ("H" in cm): 15
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.2000

Res Type 35.22
H 15
a 3
H/a 5
a* 0.12
C0.01 1.51827
C0.04 1.62914
C0.12 1.66689
C0.36 1.66689
C 1.66689
R 0.200
Q 0.1174
pi 3.1415

α*= 0.12 cm⁻¹

C = 1.66689
Q = 0.1174

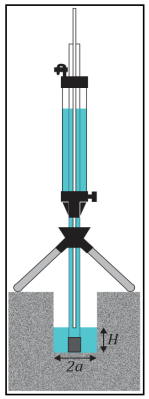
K_{fs} = 8.71E-05 cm/sec
5.23E-03 cm/min
8.71E-07 m/sec
2.06E-03 inch/min
3.43E-05 inch/sec

Φ_m = 7.26E-04 cm²/min

Average

K_{fs} = 8.59E-05 cm/sec
5.15E-03 cm/min
8.59E-07 m/s
2.03E-03 inch/min
3.38E-05 inch/sec

Φ_m = 7.16E-04 cm²/min



Double Head Method

Reservoir Cross-sectional area in cm²

(enter "35.22" for Combined and "2.16" for Inner reservoir): 35.22

Enter the first water Head Height ("H1" in cm): 7
Enter the second water Head Height ("H2" in cm): 15

Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

α*= 0.12 cm⁻¹

α= 0.1403

Steady State Rate of Water Level Change ("R1" in cm/min): 0.1000
Steady State Rate of Water Level Change ("R2" in cm/min): 0.2000

Q_1 = 0.0587

Q_2 = 0.1174

Res Type: 35.22
H1/a: 2.33333
H2/a: 5
C1-0.01: 0.99145
C2-0.01: 1.51827
C1-0.04: 1.03961
C2-0.04: 1.62914
C1-0.12: 1.0139
C2-0.12: 1.66689
C1-0.36: 1.0139
C2-0.36: 1.66689

C_1 = 1.0139

C_2 = 1.66689

G_1 = 0.0029

G_2 = 0.00222

G_3 = 0.04553

G_4 = 0.01724

K_{fs} = 9.10E-05 cm/sec
5.46E-03 cm/min
9.10E-07 m/sec
2.15E-03 inch/min
3.58E-05 inch/sec

Φ_m = 6.48E-04 cm²/min

Θ_{fs} = 0.65 cm³/cm³

Θ_i = 0.4 cm²/cm³

Sorptivity 0.0180 (cm min^-½)

Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α^* is microscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

Soil Texture-Structure Category	$\alpha^*(cm^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_2/a}{2.081 + 0.121\left(H_2/a\right)}\right)^{0.672}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091\left(H_1/a\right)}\right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091\left(H_2/a\right)}\right)^{0.683}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093\left(H_1/a\right)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093\left(H_2/a\right)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093\left(H_1/a\right)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093\left(H_2/a\right)}\right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm²/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm) , H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{\alpha^*}\right)}$ $\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)\alpha^* + 2\pi H_1}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_2 = \frac{H_1 C_2}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $K_{fs} = G_2Q_2 - G_1Q_1$ $G_3 = \frac{(2H_2^2 + a^2C_2)C_1}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $\Phi_m = G_3Q_1 - G_4Q_2$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	

Guelph Permeameter

Input
Result

Single Head Method (1)

Reservoir Cross-sectional area in cm²
(enter "35.22" for Combined and "2.16" for Inner reservoir): 35.22
Enter water Head Height ("H" in cm): 15
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.0125

Res Type	35.22	
H	15	
a	3	
H/a	5	
a*	0.12	
C0.01	1.518	
C0.04	1.629	
C0.12	1.667	
C0.36	1.667	
C	1.667	
R	0.013	
Q	0.007	
pi	3.142	

α*= 0.12 cm⁻¹
C = 1.66689
Q = 0.00734

K_{fs} = 5.45E-06 cm/sec
3.27E-04 cm/min
5.45E-08 m/sec
1.29E-04 inch/min
2.14E-06 inch/sec

Φ_m = 4.54E-05 cm²/min

Single Head Method (2)

Reservoir Cross-sectional area in cm²
(enter "35.22" for Combined and "2.16" for Inner reservoir): 35.22
Enter water Head Height ("H" in cm): 24
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.0160

Res Type	35.22	
H	24	
a	3	
H/a	8	
a*	0.12	
C0.01	1.91215	
C0.04	2.0893	
C0.12	2.19621	
C0.36	2.19621	
C	2.19621	
R	0.016	
Q	0.00939	
pi	3.1415	

α*= 0.12 cm⁻¹
C = 2.19621
Q = 0.00939

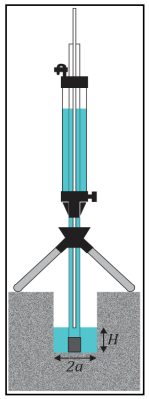
K_{fs} = 4.18E-06 cm/sec
2.51E-04 cm/min
4.18E-08 m/ses
9.87E-05 inch/min
1.64E-06 inch/sec

Φ_m = 3.48E-05 cm²/min

Average

K_{fs} = 4.81E-06 cm/sec
2.89E-04 cm/min
4.81E-08 m/s
1.14E-04 inch/min
1.89E-06 inch/sec

Φ_m = 4.01E-05 cm²/min



Double Head Method

Reservoir Cross-sectional area in cm²
(enter "35.22" for Combined and "2.16" for Inner reservoir): 35.22

Enter the first water Head Height ("H1" in cm): 15
Enter the second water Head Height ("H2" in cm): 24

Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

α*= 0.04 cm⁻¹
α= 0.0030

Steady State Rate of Water Level Change ("R1" in cm/min): 0.0125
Steady State Rate of Water Level Change ("R2" in cm/min): 0.0160

Q_1 = 0.00734
Q_2 = 0.00939

Res Type:	35.22
H1/a:	5
H2/a:	8
C1-0.01:	1.51827
C2-0.01:	1.91215
C1-0.04:	1.62914
C2-0.04:	2.0893
C1-0.12:	1.66689
C2-0.12:	2.19621
C1-0.36:	1.66689
C2-0.36:	2.19621

C_1 = 1.62914
C_2 = 2.0893
G_1 = 0.00193
G_2 = 0.00154
G_3 = 0.04736
G_4 = 0.0241

K_{fs} = 3.67E-07 cm/sec
2.20E-05 cm/min
3.67E-09 m/sec
8.67E-06 inch/min
1.45E-07 inch/sec

Φ_m = 1.21E-04 cm²/min

Θ_{fs} = 0.65 cm³/cm³

Θ_i = 0.4 cm²/cm³

Sorptivity 0.0078 (cm min^-½)

Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α^* is microscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

Soil Texture-Structure Category	$\alpha^*(cm^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_2/a}{2.081 + 0.121\left(H_2/a\right)}\right)^{0.672}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091\left(H_1/a\right)}\right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091\left(H_2/a\right)}\right)^{0.683}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093\left(H_1/a\right)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093\left(H_2/a\right)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093\left(H_1/a\right)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093\left(H_2/a\right)}\right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm²/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm) , H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{\alpha^*}\right)}$ $\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)\alpha^* + 2\pi H_1}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_2 = \frac{H_1 C_2}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $K_{fs} = G_2Q_2 - G_1Q_1$ $G_3 = \frac{(2H_2^2 + a^2C_2)C_1}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $\Phi_m = G_3Q_1 - G_4Q_2$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	

SOILMOISTURE® Guelph Permeameter

Input

Result

Single Head Method (1)

Reservoir Cross-sectional area in cm²

(enter "35.22" for Combined and "2.16" for Inner reservoir): 35.22

Enter water Head Height ("H" in cm): 7

Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.0000

Res Type	35.22		
H	7		
a	3	α*=	0.12 cm⁻¹
H/a	2.333		
a*	0.12	C =	1.0139
C0.01	0.991	Q =	0
C0.04	1.04		
C0.12	1.014	K_{fs} =	0.00E+00 cm/sec
C0.36	1.014		0.00E+00 cm/min
C	1.014		0.00E+00 m/sec
R	0.000		0.00E+00 inch/min
Q	0		0.00E+00 inch/sec
pi	3.142		
		Φ_m =	0.00E+00 cm²/min

Single Head Method (2)

Reservoir Cross-sectional area in cm²

(enter "35.22" for Combined and "2.16" for Inner reservoir): 35.22

Enter water Head Height ("H" in cm): 24

Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

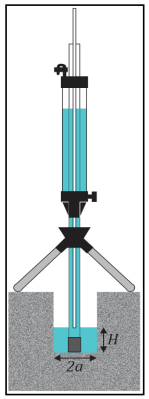
1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.0200

Res Type	35.22		
H	24		
a	3	α*=	0.12 cm⁻¹
H/a	8		
a*	0.12	C =	2.19621
C0.01	1.91215	Q =	0.01174
C0.04	2.0893		
C0.12	2.19621	K_{fs} =	5.22E-06 cm/sec
C0.36	2.19621		3.13E-04 cm/min
C	2.19621		5.22E-08 m/sec
R	0.020		1.23E-04 inch/min
Q	0.01174		2.06E-06 inch/sec
pi	3.1415		
		Φ_m =	4.35E-05 cm²/min

Average

K_{fs} =	2.61E-06	cm/sec
	1.57E-04	cm/min
	2.61E-08	m/s
	6.17E-05	inch/min
	1.03E-06	inch/sec
Φ_m =	2.18E-05	cm²/min



Double Head Method

Reservoir Cross-sectional area in cm²

(enter "35.22" for Combined and "2.16" for Inner reservoir): 35.22

Enter the first water Head Height ("H1" in cm): 15

Enter the second water Head Height ("H2" in cm): 23

Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R1" in cm/min): 0.0000

Steady State Rate of Water Level Change ("R2" in cm/min): 0.0200

		α*=	0.04 cm⁻¹
		α=	-0.0641
		Q_1 =	0
		Q_2 =	0.01174
Res Type:	35.22		
H1/a:	5	C_1 =	1.62914
H2/a:	7.66667		
C1-0.01:	1.51827	C_2 =	2.04504
C2-0.01:	1.87494		
C1-0.04:	1.62914	G_1 =	0.00217
C2-0.04:	2.04504		
C1-0.12:	1.66689	G_2 =	0.00178
C2-0.12:	2.14467		
C1-0.36:	1.66689	G_3 =	0.05113
C2-0.36:	2.14467		
		G_4 =	0.02771
		K_{fs} =	2.08E-05 cm/sec
			1.25E-03 cm/min
			2.08E-07 m/sec
			4.92E-04 inch/min
			8.21E-06 inch/sec
		Φ_m =	-3.25E-04 cm²/min
		Θ_{fs} =	0.65 cm³/cm³
		Θ_i =	0.4 cm²/cm³
		Sorptivity	#NUM! (cm min^-½)

Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α^* is microscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

Soil Texture-Structure Category	$\alpha^*(cm^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_2/a}{2.081 + 0.121\left(H_2/a\right)}\right)^{0.672}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091\left(H_1/a\right)}\right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091\left(H_2/a\right)}\right)^{0.683}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093\left(H_1/a\right)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093\left(H_2/a\right)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093\left(H_1/a\right)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093\left(H_2/a\right)}\right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm^2/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm) , H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{\alpha^*}\right)}$ $\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)\alpha^* + 2\pi H_1}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi\left(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1)\right)}$ $G_2 = \frac{H_1 C_2}{\pi\left(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1)\right)}$ $K_{fs} = G_2Q_2 - G_1Q_1$ $G_3 = \frac{(2H_2^2 + a^2C_2)C_1}{2\pi\left(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1)\right)}$ $G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi\left(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1)\right)}$ $\Phi_m = G_3Q_1 - G_4Q_2$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	

SOILMOISTURE Guelph Permeameter

Input
Result

Single Head Method (1)

Reservoir Cross-sectional area in cm²
(enter "35.22" for Combined and "2.16" for Inner reservoir): 35.22
Enter water Head Height ("H" in cm): 15
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.0000

Res Type	35.22		
H	15		
a	3	α*=	0.12 cm⁻¹
H/a	5		
a*	0.12	C =	1.66689
C0.01	1.518	Q =	0
C0.04	1.629		
C0.12	1.667	K_{fs} =	0.00E+00 cm/sec
C0.36	1.667		0.00E+00 cm/min
C	1.667		0.00E+00 m/sec
R	0.000		0.00E+00 inch/min
Q	0		0.00E+00 inch/sec
pi	3.142		
		Φ_m =	0.00E+00 cm²/min

Single Head Method (2)

Reservoir Cross-sectional area in cm²
(enter "35.22" for Combined and "2.16" for Inner reservoir): 35.22
Enter water Head Height ("H" in cm): 23
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

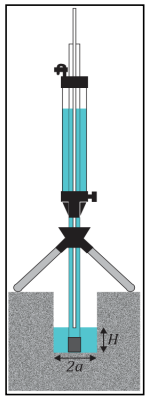
1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 0.0160

Res Type	35.22		
H	23		
a	3	α*=	0.12 cm⁻¹
H/a	7.66667		
a*	0.12	C =	2.14467
C0.01	1.87494	Q =	0.00939
C0.04	2.04504		
C0.12	2.14467	K_{fs} =	4.39E-06 cm/sec
C0.36	2.14467		2.63E-04 cm/min
C	2.14467		4.39E-08 m/sec
R	0.016		1.04E-04 inch/min
Q	0.00939		1.73E-06 inch/sec
pi	3.1415		
		Φ_m =	3.66E-05 cm²/min

Average

K_{fs} =	2.19E-06	cm/sec
	1.32E-04	cm/min
	2.19E-08	m/s
	5.18E-05	inch/min
	8.64E-07	inch/sec
Φ_m =	1.83E-05	cm²/min



Double Head Method

Reservoir Cross-sectional area in cm²
(enter "35.22" for Combined and "2.16" for Inner reservoir): 35.22

Enter the first water Head Height ("H1" in cm): 15
Enter the second water Head Height ("H2" in cm): 23

Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 2

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R1" in cm/min): 0.0000
Steady State Rate of Water Level Change ("R2" in cm/min): 0.0160

		Q_1 =	0
		Q_2 =	0.00939
Res Type:	35.22		
H1/a:	5	C_1 =	1.62914
H2/a:	7.66667		
C1-0.01:	1.51827	C_2 =	2.04504
C2-0.01:	1.87494		
C1-0.04:	1.62914	G_1 =	0.00217
C2-0.04:	2.04504		
C1-0.12:	1.66689	G_2 =	0.00178
C2-0.12:	2.14467		
C1-0.36:	1.66689	G_3 =	0.05113
C2-0.36:	2.14467		
		G_4 =	0.02771
		K_{fs} =	1.67E-05 cm/sec
			1.00E-03 cm/min
			1.67E-07 m/sec
			3.94E-04 inch/min
			6.56E-06 inch/sec
		Φ_m =	-2.60E-04 cm²/min
		Θ_{fs} =	0.65 cm³/cm³
		Θ_i =	0.4 cm²/cm³
		Sorptivity	#NUM! (cm min^-½)

Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α^* is microscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

Soil Texture-Structure Category	$\alpha^*(cm^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_2/a}{2.081 + 0.121\left(H_2/a\right)}\right)^{0.672}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091\left(H_1/a\right)}\right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091\left(H_2/a\right)}\right)^{0.683}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093\left(H_1/a\right)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093\left(H_2/a\right)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093\left(H_1/a\right)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093\left(H_2/a\right)}\right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm^2/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm) , H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{\alpha^*}\right)}$ $\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)\alpha^* + 2\pi H_1}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi\left(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1)\right)}$ $G_2 = \frac{H_1 C_2}{\pi\left(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1)\right)}$ $K_{fs} = G_2Q_2 - G_1Q_1$ $G_3 = \frac{(2H_2^2 + a^2C_2)C_1}{2\pi\left(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1)\right)}$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	$G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi\left(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1)\right)}$ $\Phi_m = G_3Q_1 - G_4Q_2$

Soil Engineers Ltd.
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FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

APPENDIX 'B'

GRAIN SIZE DISTRIBUTION GRAPH

REFERENCE NO. 2009-W189

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

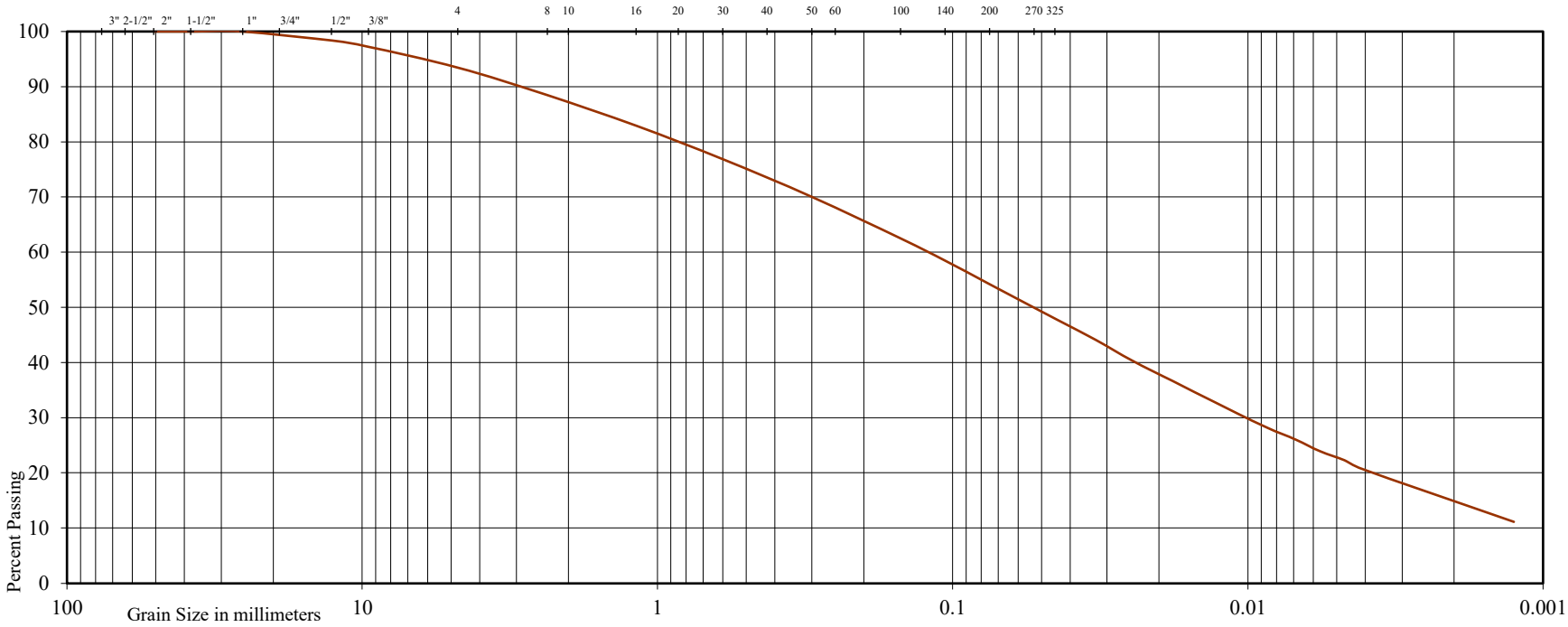
Reference No: 2009-W189

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Truck Parking Facility

Location: 12434 Dixie Road, Town of Caledon

Test Pit No: 1

Sample No:

Depth (m): 3.0

Elevation (m):

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = -

Estimated Permeability (cm./sec.) = 10^{-6}

Classification of Sample [& Group Symbol]: SANDY SILT, TILL

some clay to clayey, a trace of gravel

Figure: 1

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

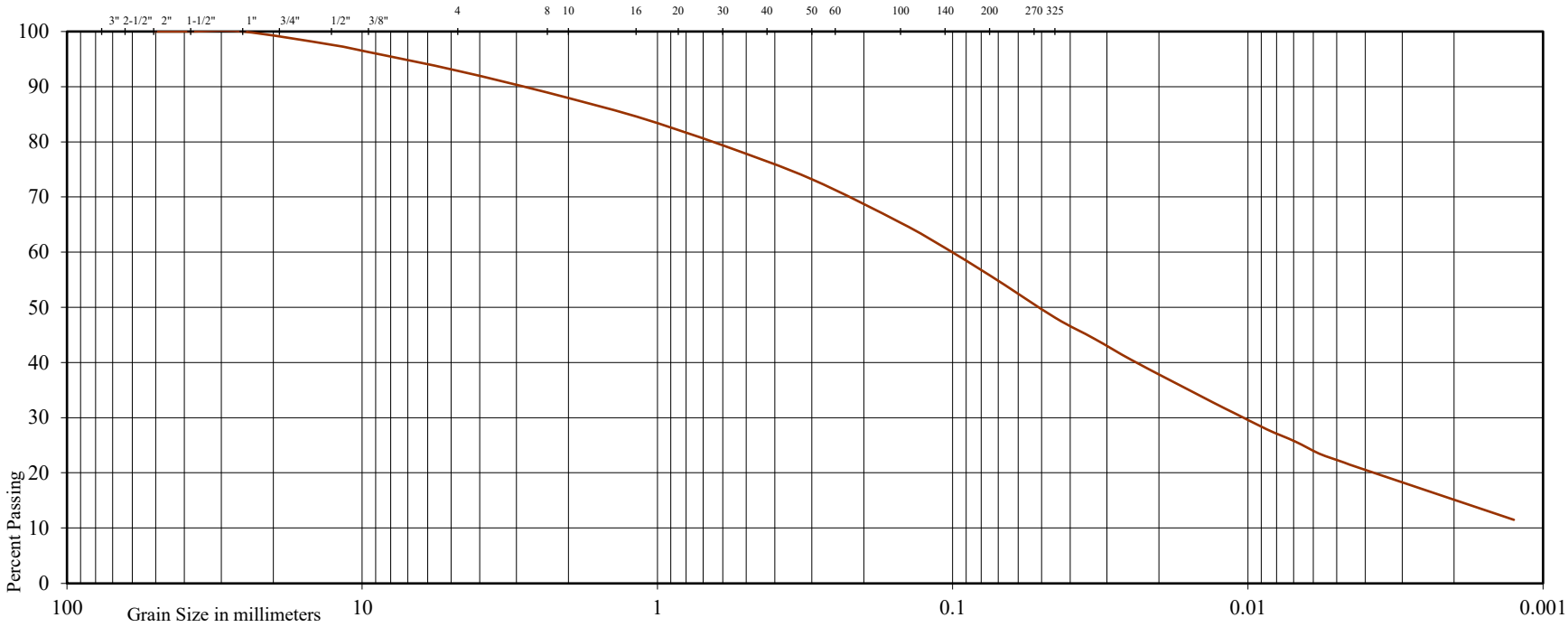
Reference No: 2009-W189

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Truck Parking Facility

Location: 12434 Dixie Road, Town of Caledon

Test Pit No: 1

Sample No:

Depth (m): 4.0

Elevation (m):

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = -

Estimated Permeability (cm./sec.) = 10^{-6}

Classification of Sample [& Group Symbol]: SANDY SILT, TILL
some clay to clayey, a trace of gravel

Figure: 2

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

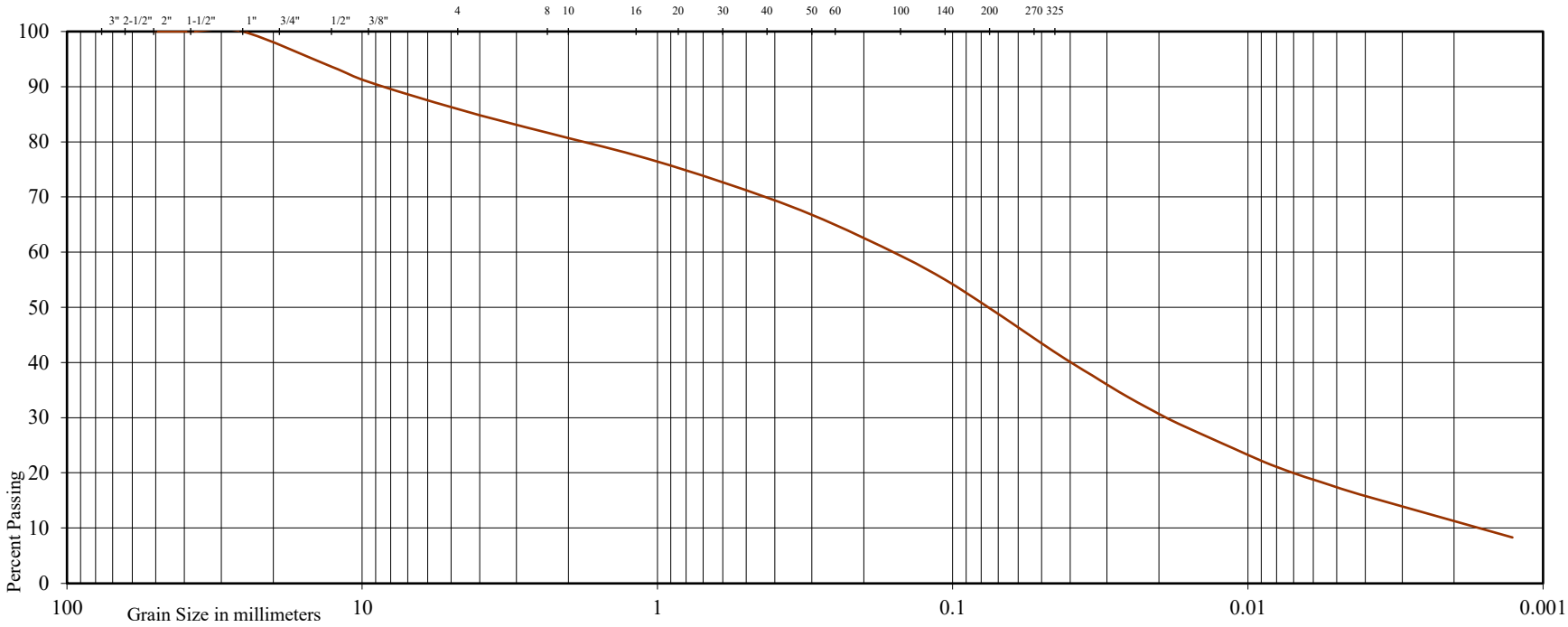
Reference No: 2009-W189

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UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Truck Parking Facility

Location: 12434 Dixie Road, Town of Caledon

Test Pit No: 2

Sample No:

Depth (m): 2.0

Elevation (m):

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = -

Estimated Permeability (cm./sec.) = 10^{-6}

Classification of Sample [& Group Symbol]: SANDY SILT, TILL
some clay and gravel

Figure: 3

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

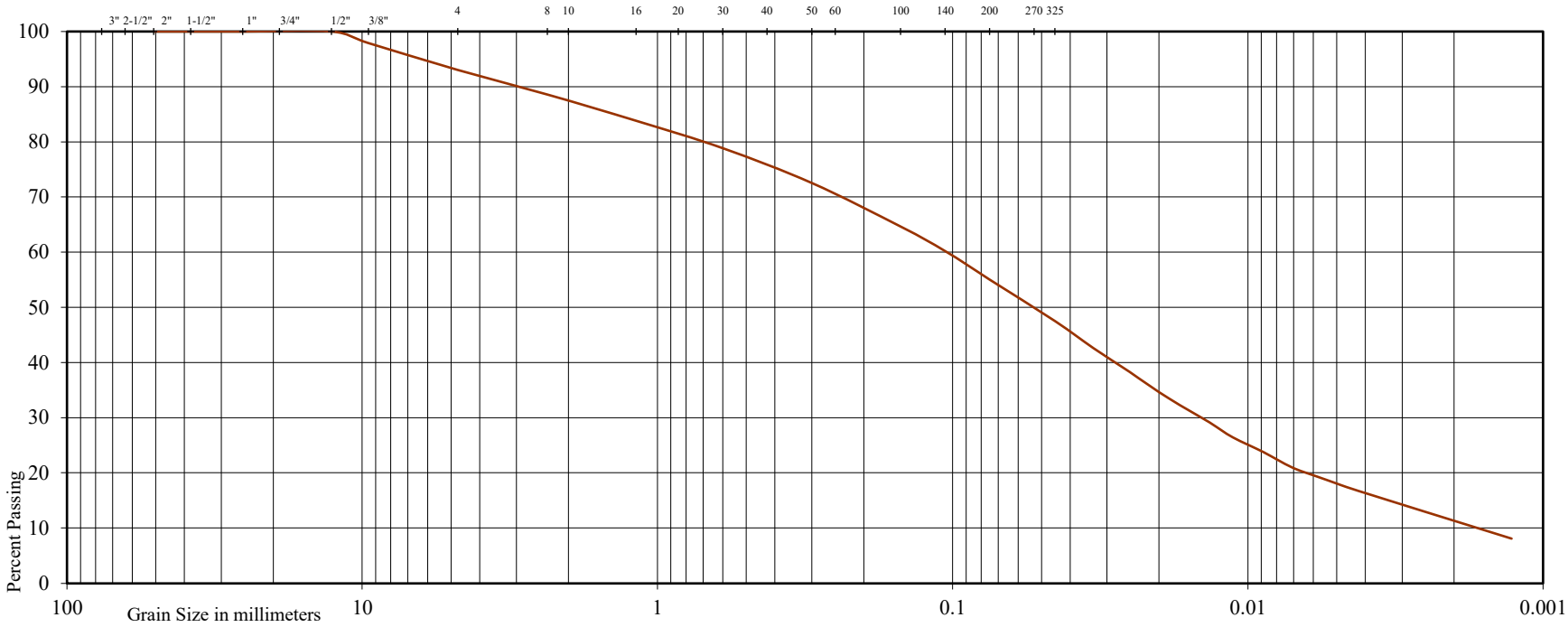
Reference No: 2009-W189

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UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Truck Parking Facility

Location: 12434 Dixie Road, Town of Caledon

Test Pit No: 3

Sample No:

Depth (m): 3.0

Elevation (m):

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = -

Estimated Permeability (cm./sec.) = 10^{-6}

Classification of Sample [& Group Symbol]: SANDY SILT, TILL
some clay, a trace of gravel

Figure: 4

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

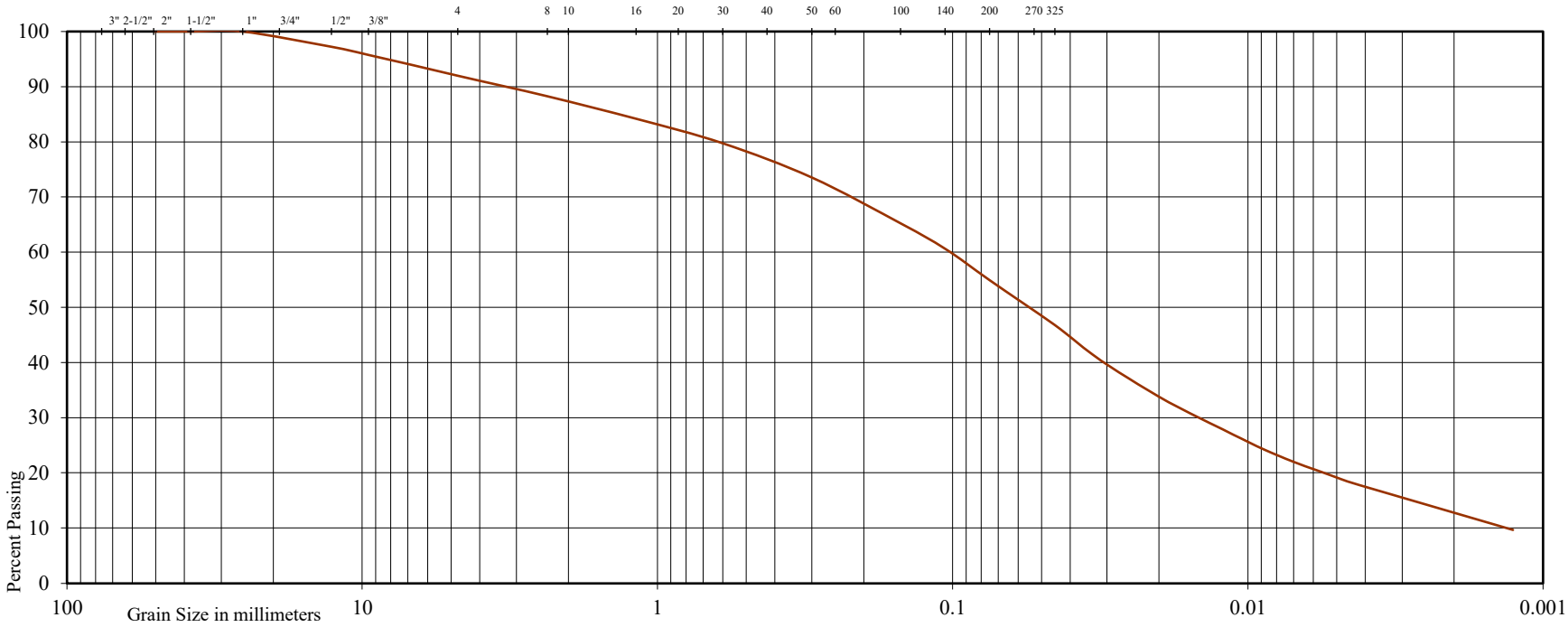
Reference No: 2009-W189

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UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Truck Parking Facility

Location: 12434 Dixie Road, Town of Caledon

Test Pit No: 3

Sample No:

Depth (m): 4.0

Elevation (m):

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = -

Estimated Permeability (cm./sec.) = 10^{-6}

Classification of Sample [& Group Symbol]: SANDY SILT, TILL
some clay, a trace of gravel

Figure: 5

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

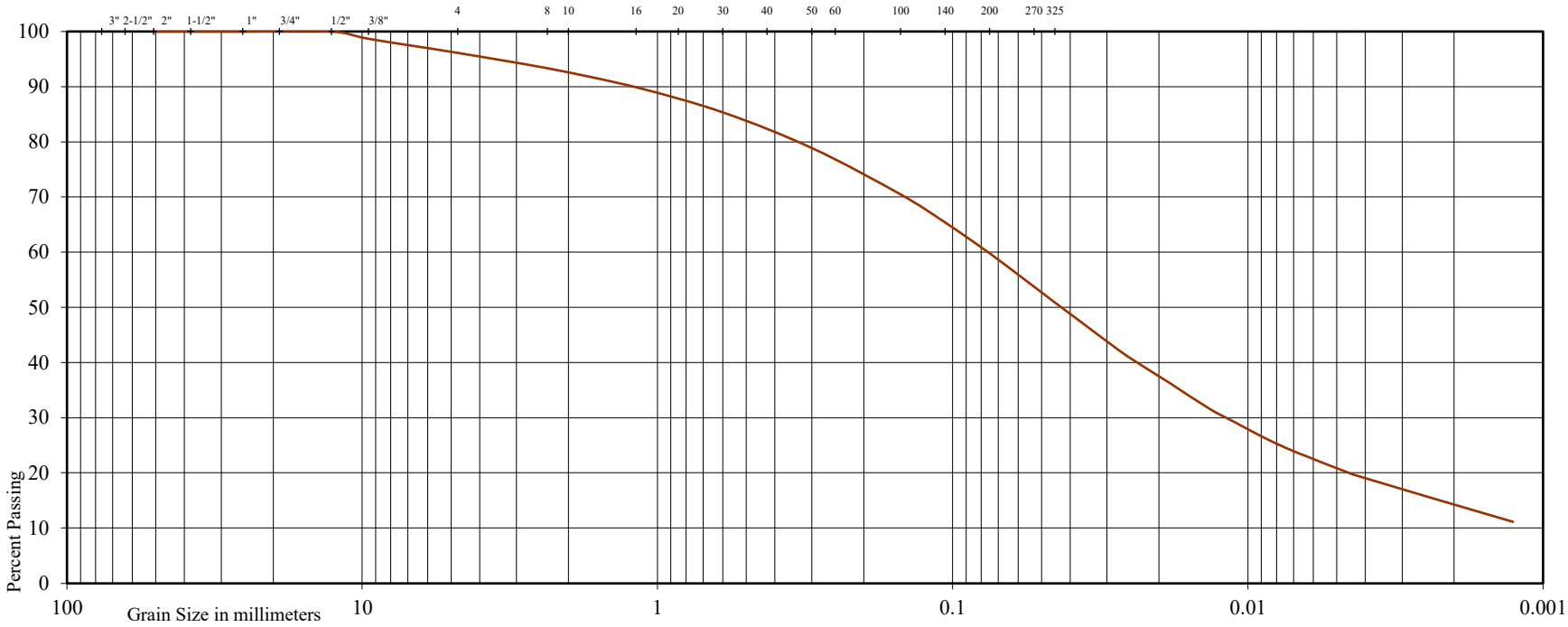
Reference No: 2009-W189

U.S. BUREAU OF SOILS CLASSIFICATION

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UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Truck Parking Facility

Location: 12434 Dixie Road, Town of Caledon

Test Pit No: 4

Sample No:

Depth (m): 3.0

Elevation (m):

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = -

Estimated Permeability (cm./sec.) = 10^{-6}

Classification of Sample [& Group Symbol]: SANDY SILT, TILL
some clay to clayey, a trace of gravel

Figure: 6