SOIL-MAT ENGINEERS & CONSULTANTS LTD.
130 LANCING DRIVE, HAMILTON, ONTARIO L8W 3A1
PHONE (905) 318-7440 TOLL FREE (800) 243-1922 FAX (905) 318-7455
E-MAIL: info@soil-mat.on.ca WEB SITE: www.soil-mat.on.ca

PROJECT NO.: SM 124423-G

May 17, 2012
Revised August 9, 2012

City of Hamilton
Public Works Department
Environment & Sustainable Infrastructure Division
Engineering Services Group, Design Section
320 – 77 James Street North
Hamilton, Ontario
L8R 2K3

Attention: Ms. Le' Ann Whitehouse Seely, OALA, CSL
Supervisor, Landscape Architectural Services (temporary)

GEOTECHNICAL INVESTIGATION
PROPOSED GORE MASTER PLAN PROJECT
GORE PARK ON KING STREET EAST
HAMILTON, ONTARIO

Dear Ms. Whitehouse Seely,

We have completed the fieldwork, laboratory testing and report preparation in general accordance with our proposal P-4677 dated December 23, 2011. Our findings at the six borehole locations are presented in the following paragraphs.

1. INTRODUCTION

We understand that the proposed Gore Master Plan Project will incorporate the reconstruction of the south leg of King Street East at Gore Park into a pedestrian only promenade using a concrete pavement structure, together with the relocation of some statutes and the construction of a memorial wall structure.

This report is based on the above summarised project, and on the assumption that the design and construction will be performed in accordance with applicable codes and standards. Any significant deviations from the proposed project design may void the recommendations given in this report. If significant changes are made to the proposed design, this office must be consulted to review the new design with respect to the results of this investigation.

2. PROCEDURE

A total of six [6] boreholes were advanced at the locations illustrated in the attached Drawing No. 1, Borehole Location Plan. The borings were put down uncased using solid stem continuous flight auger equipment on the dates of March 13, 15 and April 10, 2012, under the direction and supervision of a staff member of SOIL-MAT ENGINEERS & CONSULTANTS LTD. The boreholes were advanced using truck and trailer-mounted drill rig equipment to a depth of approximately 5 metres below the existing surface. On completion of drilling, all of the boreholes were backfilled in generally accordance with Ontario Regulation 903.

Representative samples of the subsoils were recovered from the borings at selected depth intervals using split barrel sampling equipment driven in accordance with the requirements of the ASTM test specification D1586, Standard Penetration Resistance Testing. After undergoing a general field examination, the soil samples were preserved and transported to the SOIL-MAT laboratory for visual, tactile, and olfactory classifications. Routine moisture content tests were performed on all soil samples recovered from the borings. In addition, two samples from each borehole were submitted to AGAT Laboratories Limited, ["AGAT"], [an accredited Canadian Environmental Laboratory] for laboratory analytical testing for Inorganic and Metal Scans for comparison to the Soil, Groundwater and Sediment Standards for Use Under Part XV.1 of the *Environmental Protection Act.* Three samples from within the roadway were also analysed for grain size, to evaluate the suitability of a permeable pavement scheme.

All surveying associated with laying out the boreholes in the field was conducted by representatives of SOIL-MAT ENGINEERS & CONSULTANTS LTD. approximately at the locations indicated on the provided site plan. Each borehole has been referenced to the existing ground surface at each location.

Details of the conditions encountered in the boreholes, together with the results of the field and laboratory tests, are presented in Borehole Log Nos. 2 through 6, inclusive, following the text of this report. Borehole No. 1 was found to be within the area of the abandoned underground washroom facilities, and therefore not sampled. It should be noted that the exact boundaries of these facilities are unknown to SOIL-MAT ENGINEERS & CONSULTANTS LTD., and should be determined as part of the design and construction operation. It is noted that the boundaries of soil types indicated on the borehole logs are inferred from non-continuous soil sampling and observations made during drilling. These boundaries are intended to reflect transition zones for the purpose of geotechnical design and should not be construed as the exact planes of geological change.

3. SUBSURFACE CONDITIONS

The subsurface conditions encountered in Borehole Nos. 2 to 6 inclusive are summarised as follows:

Pavement Structure

The existing pavement structure of the south leg of King Street East [Borehole Nos. 3 to 6 inclusive] was found to consist of a surficial layer of 75 millimetre thick interlocking brick overlying a compacted granular base ranging from approximately 400 to 530 millimetres in thickness. The pavement structure located on the pedestrian walking paths between the north and south legs of King Street East [Borehole No. 2] was found to consist of approximately 150 millimetres of concrete overlying approximately 375 millimetres of compacted granular base.

Fill Material

Beneath the pavement structure in all boreholes a heterogeneous fill material consisting of gravel, sand, silt and clay was encountered. This fill material was found to contain occasional brick and concrete rubble and to be in a loose to very dense state.

Sand

A brown sand was encountered to underlie the fill material at a depth of about 3.5 metres below grade. This sand was generally fine to medium in gradation and to contain a trace to some gravel. The sand was found to be in a loose to compact state.

Groundwater Observations

All boreholes were found to be dry upon completion of drilling. The static groundwater level in this area is expected to be well below the anticipated depths of construction.

4. EXCAVATIONS

Excavations for the reconstruction and/or installation of underground services are expected to extend to depths of up to about 2 to 3 metres below the existing grade. Excavations through the pavement structure and upper fill material should be relatively straightforward, with the sides remaining stable for the short construction period at 45 degrees to the horizontal. The excavation side slopes may slough to flatter slopes due to surface runoff. All excavations must comply with the current Occupational Health and Safety Act and Regulations for Construction Projects. Excavation slopes steeper than those required in the Safety Act must be supported or a trench box must be provided, and a senior geotechnical engineer from this office should monitor the work.

Some minor infiltration of groundwater into open excavations should be anticipated; however the volume of water to be controlled is expected to be relatively small. It should be possible to control any water that may seep into the excavations from surface runoff, perched in the pavement structure and fill material using conventional construction 'dewatering' techniques, such as pumping from sumps and ditches. More water should be expected when connections are made with existing services. Surface water should be directed away from the excavations.

Hydro poles and light standards within 2 metres of excavations should be provided with temporary support. Any other adjacent above or below ground structures, including utilities, structures, etc., should be assessed for potential support requirements during excavation.

5. BACKFILL CONSIDERATIONS

The excavated soils will consist of the pavement structure and upper fill material. Select portions of the granular road base and fill materials are considered suitable for use as trench backfill. The fill materials encountered are considered to be near or slightly below their optimum moisture content. Some moisture conditioning may be required depending upon the weather conditions at the time of construction. Dusting could be a problem during the dry summer months.

We note that where backfill material is placed near or slightly above its optimum moisture content, the potential for long-term settlements due to the ingress of groundwater and collapse of the fill structure is reduced. It is therefore very important that the placement moisture content of the backfill soils be within 3 percent of its standard Proctor optimum moisture content during placement and compaction to minimise long term subsidence [settlement] of the fill mass. Any imported fill required in service trenches or to raise the subgrade elevation should have its moisture content within 3 per cent of its optimum moisture content and meet the necessary environmental guidelines.

A representative of SOIL-MAT should on-site during the backfilling and compaction operations to monitor uniform compaction of the backfill material to project specification requirements. Close supervision is prudent in areas that are not readily accessible to compaction equipment, for instance near the end of compaction 'runs'. All trench backfill should be compacted to 95 per cent standard Proctor maximum dry density below one metre and to 100 per cent standard Proctor maximum dry density in the upper one metre level. A method should be developed to assess compaction efficiency employing the on-site compaction equipment and backfill materials during construction.

6. MANHOLES, CATCHBASINS AND VALVE CHAMBERS

It is anticipated that manholes, catchbasins, valve chambers, etc. will be founded on the sand fill material encountered at the borehole locations. It is imperative that these founding surfaces are within 3 percent of their optimum moisture content and compacted to 100 percent standard Proctor dry density, to ensure minimal settlements of these structures. Proper preparation of the founding soils will therefore accentuate the protrusion of these structures above the pavement surface is compaction of the fill around these structures is not adequate, causing settlement of the surrounding paved surfaces. Conversely, the pavement surfaces may rise above the valve chambers under frost action. To alleviate the potential for these types of differential movements, free-draining, non-frost susceptible material should be employed as backfill around the structures located within the roadway limits, and compacted to 100 percent of its standard Proctor density.

7. PAVEMENT CONSIDERATIONS

All areas to be paved must have a well compacted subgrade, free of any organic, debris, or otherwise unsuitable materials. The prepared subgrade must be proofrolled with 3 to 4 passes of a loaded tandem truck in the presence of a representative of SOIL-MAT ENGINEERS & CONSULTANTS LTD., immediately prior to the placement of the sub-base material. Any areas of distress revealed by this or other means should be subexcavated and replaced with suitable backfill material. Should pavement construction be undertaken during 'wet' periods of the year it should be anticipated that additional depth of base course material may be required.

Good drainage provisions will optimise the long-term performance of the pavement structure. The subgrade must be properly crowned and shaped to promote drainage to the subdrain system. Surface water should not be allowed to pond adjacent to the outer limits of the paved areas.

We understand that the proposed pavement structure, required to adequately support the loads associated with pedestrian purposes and for light service truck/vehicle traffic, will consist of a 200 millimetre concrete wearing surface. For this project we would recommend a minimum of 125 millimetres of Ontario Provincial Standard Specification

[OPSS] Granular 'A' base course to serve as a leveling layer. Should heavy traffic loads be expected the granular base layer may need to be increased to provide the requisite design life, with this office contacted to allow for review and any required design modifications. The concrete wearing surface should consist of a Canadian Standards Association [CSA] Class C-2 exposure concrete. The concrete should have a minimum compressive strength of 32 MPa and a maximum water:cement ratio of 0.45 and placed with a maximum slump of 100 millimetres. The concrete mix should be consolidated to provide a dense final product and provided with a 'coarse' broom surface texture to provide skid resistance. The concrete should be cured in accordance with current CSA requirements [such as an approved membrane curing compound immediately after texturing] and the surface sloped to promote surface drainage. Within 18 hours of the initial 'set' the concrete slab should be saw-cut to not less than one quarter its thickness. The joints should be cleaned and sealed with an approved silicone or rubberized joint sealant and maintained throughout the life of the pavement. Construction joints will be required at the end of each day's concrete placement. The construction joints should incorporate load transfer dowels that allow lateral movements. Traffic should be restricted from the concrete pavement for a minimum period of seven days or at least until the concrete has reached 75 percent of its design compressive strength. It is our opinion, that this design is suitable for use for this roadway section, provided that the subgrade has been prepared as specified and is good and firm before the sub-base course material is placed. If the subgrade is soft, remedial measures as discussed above may have to be implemented and/or the sub-base thickness may have to be increased. The granular base course should be compacted to OPSS or the City of Hamilton's requirements. A program of in-place density testing must be carried out to monitor that compaction requirements are being met. If construction is conducted under adverse weather conditions, additional subgrade preparation may be required.

8. STRUCTURE FOUNDATIONS

The proposed relocated statute structures and proposed memorial wall structure may be supported on conventional spread footings on a partial engineered fill mat. The existing fill material to a depth of about 0.4 metres below the design founding level should be subexcavated, the excavation base well compacted with a heavy vibratory plate, and replaced with a well graded granular product [such as an Ontario Provincial Standard Specification Granular 'A' material] and compacted to 100 percent of its standard Proctor density to provide support for the building foundations and the concrete floor slab. The engineered fill must extend laterally beyond the limits of the footings a minimum of 0.5 metres plus an allowance for a slope of compacted fill at one vertical to one horizontal to allow for a 'load spread' through the engineered fill. With the proposed structures constructed on a mat of engineered fill the foundations may be designed using a factored Ultimate Limit State [ULS] bearing capacity of 200 kPa. The allowable bearing stress at Serviceability Limit State [SLS] should be limited to 125 kPa [based on the total and differential settlements not exceeding 25 mm] provided that the footings are a minimum of 0.8 metres in width. The footings cast on the engineered fill mat may be designed using an unfactored angle of friction of 30 degrees.

All footings exposed to the environment must be provided with a minimum of 1.2 metres of earth cover or equivalent insulation to protect against frost damage. This frost protection would also be required if construction were undertaken during the winter months. All footings must be proportioned to satisfy the requirements of the Ontario Provincial Building Code, and be at least 800 mm wide if designed on the basis of the above recommended bearing capacities.

It is imperative that a soils engineer be retained from this office to provide geotechnical engineering services during the excavation and foundation construction phases of the project. This is to observe compliance with the design concepts and recommendations of this report and to allow changes to be made in the event that subsurface conditions differ from the conditions identified at the Borehole locations.

9. ENVIRONMENTAL CONSIDERATIONS

Two soil samples from each borehole were submitted to AGAT Laboratories Limited, ["AGAT"], [an accredited Canadian Environmental Laboratory] for laboratory analytical testing for metals and inorganics. The laboratory test results received in our Office were compared with the applicable standard from the Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the *Environmental Protection Act*, as follows:

- **Table 1**: Full Depth Background Site Condition.
- **Table 3**: Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition for an Industrial/ Commercial/ Community [ICC] property use.

The results of this laboratory testing are presented in the attached AGAT Certificates of Analysis [12T592360], and summarised in the attached Environmental Testing Summary Tables.

Based on our field observations and the analytical test results from AGAT, we offer the following comments:

Project No: SM 124423-G

Project: Gore Park

Location: Hamilton, Ontario

Client: City of Hamilton

Log of Borehole No. 6

Project Manager: John Monkman, P. Eng.

Borehole Location: See Drawing No. 1

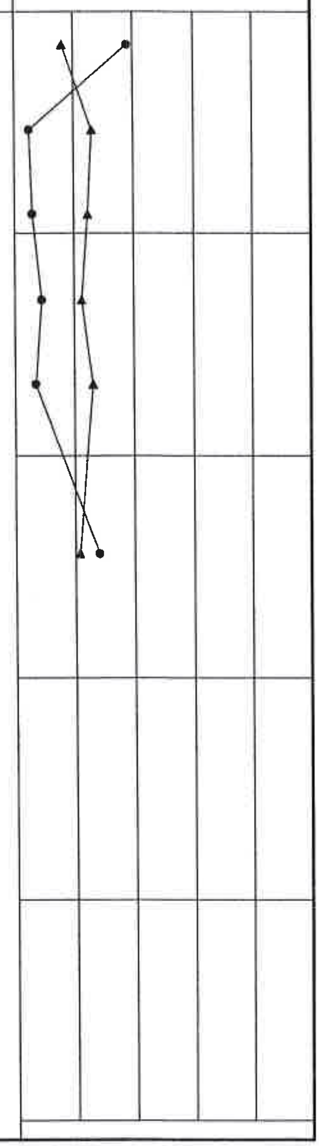
Soil-Mat

SUBSURFACE PROFILE / SAMPLE

Depth (m)	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0	0.00		Ground Surface								
	-0.47		***Pavement Surface*** Approximately 75 millimetre thick brick overlaying approximately 400 millimetres of compacted granular base.		SS	1	22 26 12 9	38			
			Silty Sand Fill Brown, some gravel and trace of gravel, occasional concrete and brick rubble, loose.		SS	2	4 3 3	5			
					SS	3	2 3 3	6			
					SS	4	3 4 5	9			
	-3.50				SS	5	4 4 3 3	7			
	-5.00		***Sand*** Brown, fine grained, traces of gravel.		SS	6	6 12 16	28			
			End of Borehole								

Moisture Content w% ▲ 10 20 30 40

Standard Penetration Test ● blows/300mm 20 40 60 80



NOTES:

1. Borehole was advanced using solid stem auger equipment on March 15, 2012 to termination at a depth of 5 metres.

2. Borehole 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers

Drill Date: March 15, 2012

Hole Size: 150 mm

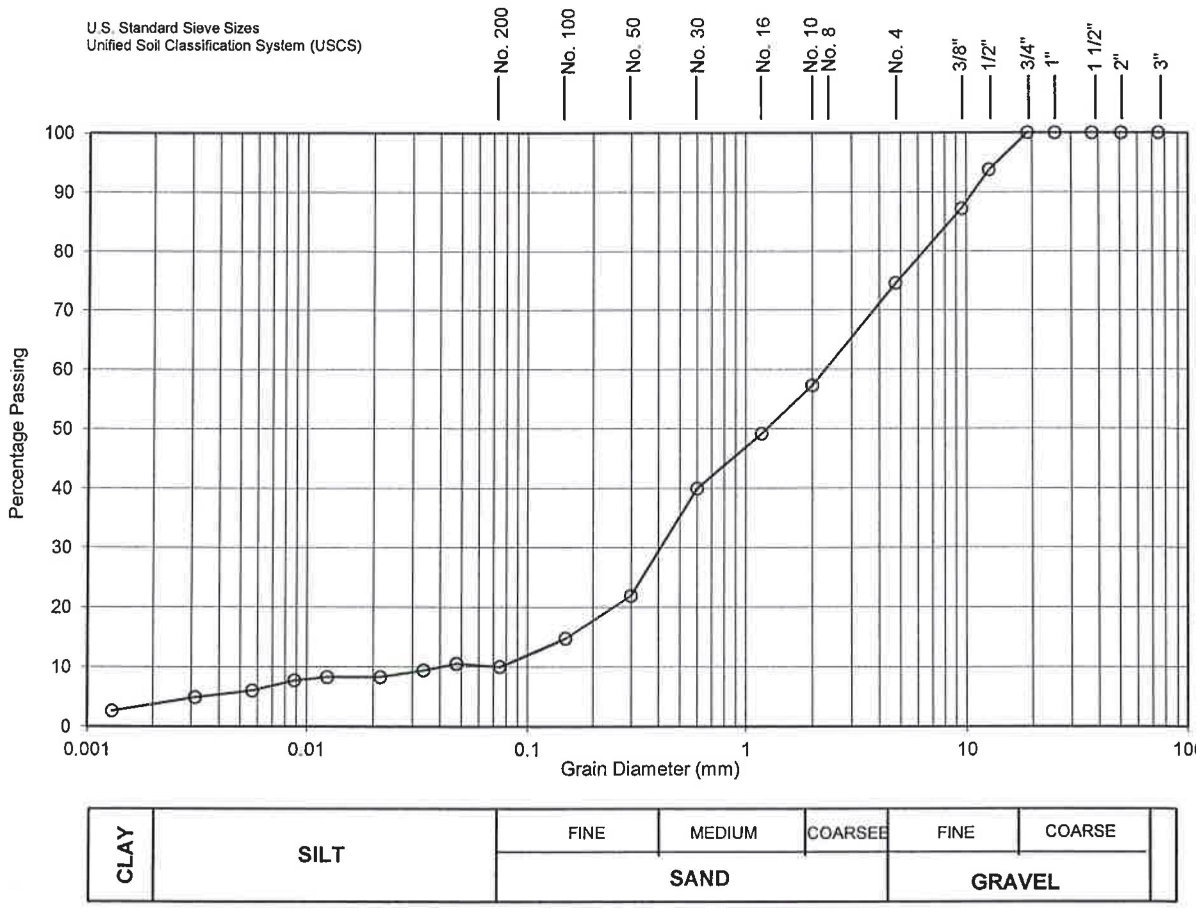
SOIL-MAT ENGINEERS & CONSULTANTS LTD.
130 Lancing Drive, Hamilton, ON L8W 3A1
Phone: (905) 318-7440 Fax: (905) 318-7455
e-mail: info@soil-mat.on.ca

Datum: Existing Road Surface

Checked by:

Sheet: 1 of 1

Mechanical & Hydrometer Analyses



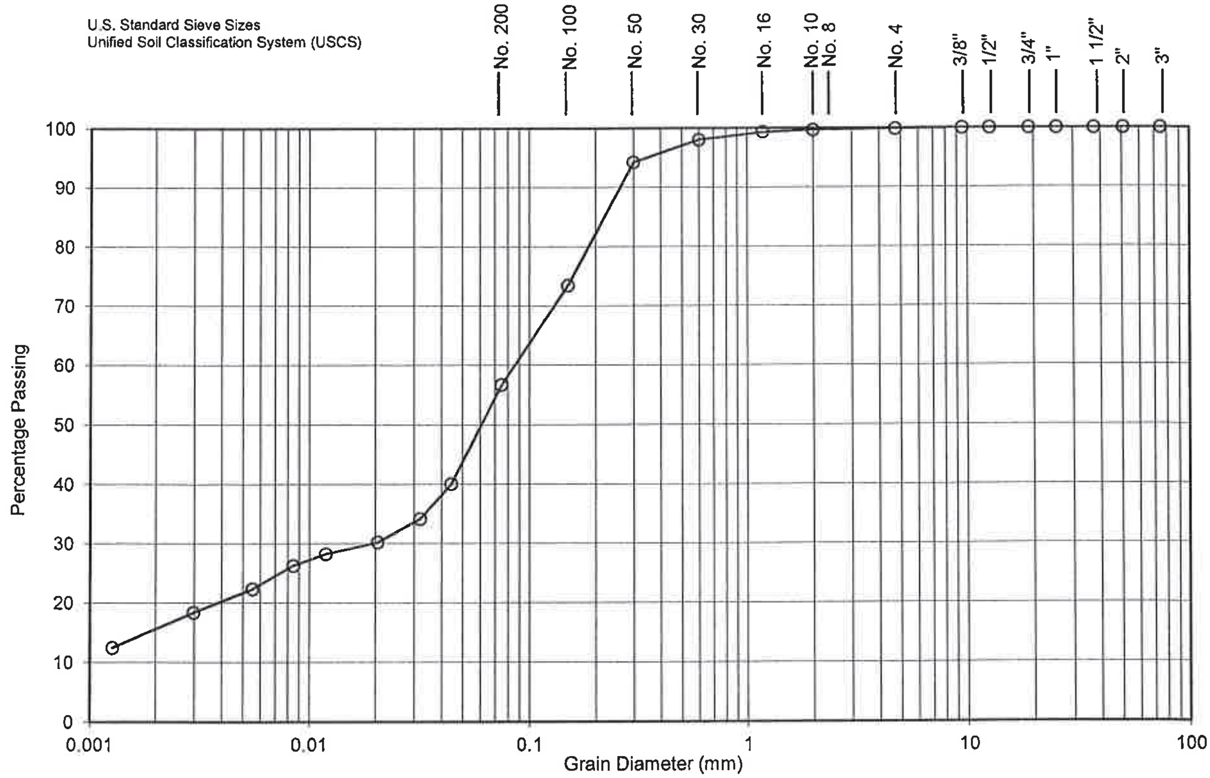
Sample No.:	3	Notes: Sample retreived by Soil-Mat Engineers & Consultants Ltd. laboratory on March 13, 2012			
Borehole No.:	3	Gore Park			
Depth [ft]:	n/a				
CLAY [%]:	4	Soil Description: **Brown Gravely SAND with trace Silt and Clay**			
SILT [%]:	6	**SW - Well graded sands, gravelly sands little or no fines.**			
SAND [%]:	64				
GRAVEL [%]:	26			Estimated Permeability, k [cm/s]	10^{-3}
D_{10} (Effective Diam. in mm):	**0.060**	Coefficient of Uniformity C_U:	**383.3**	Coefficient of Curvature C_C:	**0.1**

SOIL-MAT ENGINEERS & CONSULTANTS LTD.

City of Hamilton

April 24, 2012	**Grain Size Analysis No. 1**	**Project No.: SM 124423-T**

Mechanical & Hydrometer Analyses



CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSEE	FINE	COARSE

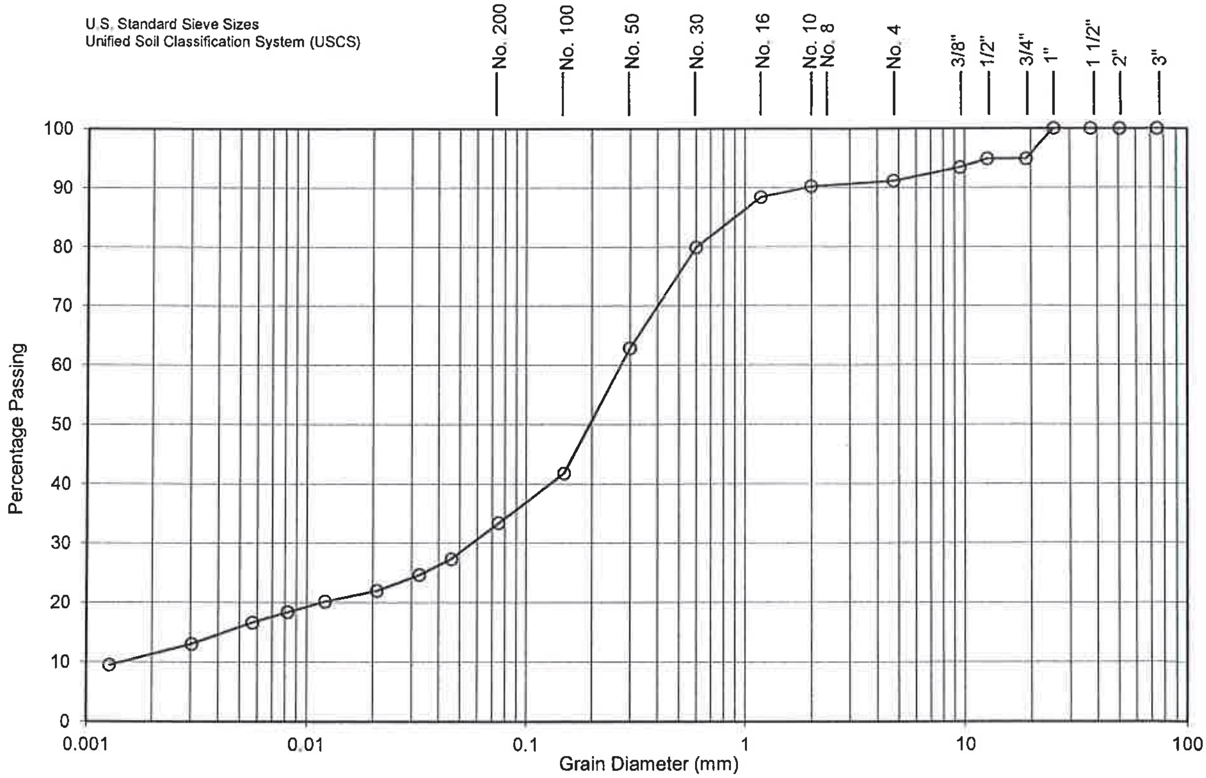
Sample No.:	3	Notes: Sample retreived by Soil-Mat Engineers & Consultants Ltd. laboratory on March 13, 2012			
Borehole No.:	5	Gore Park			
Depth [ft]:	n/a				
CLAY [%]:	16	Soil Description: **Brown SAND and SILT, with some CLAY**			
SILT [%]:	41	**ML - Inorganic silts and very fine sands, clayey silts with slight plasticity; to**			
SAND [%]:	43	**CL - Inorganic Clays of Low to medium plasticity, silty clays, lean clays**			
GRAVEL [%]:	0			Estimated Permeability, k [cm/s]	10^{-6}
D_{10} (Effective Diam. in mm):	**0.001**	Coefficient of Uniformity C_U:	**88.0**	Coefficient of Curvature C_C:	**5.0**

SOIL-MAT ENGINEERS & CONSULTANTS LTD.

City of Hamilton

April 24, 2012	**Grain Size Analysis No. 2**	**Project No.: SM 124423-T**

Mechanical & Hydrometer Analyses



CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSEE	FINE	COARSE

Sample No.:	3	Notes:	Sample retreived by Soil-Mat Engineers & Consultants Ltd. laboratory on March 13, 2012 Gore Park	
Borehole No.:	6			
Depth [ft]:	n/a			
CLAY [%]:	12	Soil Description:	**Brown Silty SAND withsome CLAY and trace Gravel** **SM - Silty sands, sand-silt mixtures** **SC - Clayey sands, sand-clay mixtures**	
SILT [%]:	21			
SAND [%]:	58			
GRAVEL [%]:	9		Estimated Permeability, k [cm/s]	10^{-6}
D_{10} (Effective Diam. in mm):	**0.001**	Coefficient of Uniformity C_U: **200.0**	Coefficient of Curvature C_C:	**8.0**

SOIL-MAT ENGINEERS & CONSULTANTS LTD.

City of Hamilton

April 24, 2012	**Grain Size Analysis No. 3**	**Project No.: SM 124423-T**

AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 12T592360
PROJECT NO: SM124423

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: SOIL MAT ENGINEERS & CONSULTANTS LT

ATTENTION TO: John Monkman

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE SAMPLED: Apr 10, 2012 | **DATE RECEIVED: Apr 18, 2012** | **DATE REPORTED: Apr 26, 2012** | **SAMPLE TYPE: Soil**

Parameter	Unit	G / S	RDL	BH2 SS2 3268491	BH2 SS4 3268492	BH3 SS2 3268493	BH3 SS4 3268494	BH4 SS2 3268495	BH4 SS3 3268496	BH5 SS2 3268497	BH5 SS4 3268498
Antimony	µg/g	1.3	0.8	<0.8	<0.8	0.9	<0.8	<0.8	0.8	<0.8	<0.8
Arsenic	µg/g	18	1	4	3	4	4	4	4	4	5
Barium	µg/g	220	2	26	19	80	70	108	71	42	36
Beryllium	µg/g	2.5	0.5	<0.5	<0.5	0.8	0.7	0.6	0.6	<0.5	<0.5
Boron	µg/g	36	5	7	6	16	16	19	21	7	9
Boron (Hot Water Soluble)	µg/g		0.10	0.15	0.12	0.76	0.85	0.66	0.88	0.35	0.15
Cadmium	µg/g	1.2	0.5	<0.5	<0.5	<0.5	0.8	<0.5	0.9	<0.5	<0.5
Chromium	µg/g	70	2	10	9	16	18	21	22	14	15
Cobalt	µg/g	21	0.5	6.2	6.0	5.4	4.9	4.5	4.3	7.7	8.4
Copper	µg/g	92	1	26	23	25	20	23	18	25	33
Lead	µg/g	120	1	15	7	54	64	**422**	80	18	9
Molybdenum	µg/g	2	0.5	<0.5	<0.5	1.4	1.2	1.5	1.6	0.9	0.6
Nickel	µg/g	82	1	12	11	11	11	10	11	14	17
Selenium	µg/g	1.5	0.4	<0.4	<0.4	0.6	0.6	0.6	<0.4	0.4	0.5
Silver	µg/g	0.5	0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/g	1	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Uranium	µg/g	2.5	0.5	<0.5	<0.5	0.8	0.8	0.8	0.8	<0.5	<0.5
Vanadium	µg/g	86	1	18	18	22	25	27	25	25	25
Zinc	µg/g	290	5	43	37	150	259	138	**317**	47	48
Chromium VI	µg/g	0.66	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cyanide	µg/g	0.051	0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Mercury	µg/g	0.27	0.10	<0.10	<0.10	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	0.57	0.005	0.570	0.477	**4.25**	**2.66**	**3.57**	**3.56**	**3.48**	**1.54**
Sodium Adsorption Ratio	N/A	2.4	N/A	**5.84**	**2.90**	**7.63**	**5.98**	**7.42**	**5.68**	**67.5**	**48.4**
pH, 2:1 CaCl2 Extraction	pH Units			7.80	7.87	10.9	9.98	10.7	9.91	8.21	8.30

Certified By: Elizabeth Polakowska

AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 12T592360
PROJECT NO: SM124423

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: SOIL MAT ENGINEERS & CONSULTANTS LT

ATTENTION TO: John Monkman

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE SAMPLED: Apr 10, 2012 **DATE RECEIVED: Apr 18, 2012** **DATE REPORTED: Apr 26, 2012** **SAMPLE TYPE: Soil**

Parameter	Unit	G / S	RDL	BH6 SS2 3268499	BH6 SS4 3268500
Antimony	µg/g	1.3	0.8	<0.8	<0.8
Arsenic	µg/g	18	1	5	5
Barium	µg/g	220	2	27	39
Beryllium	µg/g	2.5	0.5	<0.5	0.6
Boron	µg/g	36	5	10	10
Boron (Hot Water Soluble)	µg/g		0.10	0.56	0.48
Cadmium	µg/g	1.2	0.5	<0.5	<0.5
Chromium	µg/g	70	2	15	13
Cobalt	µg/g	21	0.5	8.8	8.0
Copper	µg/g	92	1	33	67
Lead	µg/g	120	1	11	20
Molybdenum	µg/g	2	0.5	0.5	<0.5
Nickel	µg/g	82	1	18	16
Selenium	µg/g	1.5	0.4	0.4	<0.4
Silver	µg/g	0.5	0.2	<0.2	<0.2
Thallium	µg/g	1	0.4	<0.4	<0.4
Uranium	µg/g	2.5	0.5	<0.5	<0.5
Vanadium	µg/g	86	1	24	23
Zinc	µg/g	290	5	46	58
Chromium VI	µg/g	0.66	0.2	<0.2	<0.2
Cyanide	µg/g	0.051	0.040	<0.040	<0.040
Mercury	µg/g	0.27	0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	0.57	0.005	**5.16**	**4.09**
Sodium Adsorption Ratio	N/A	2.4	N/A	**30.5**	**30.1**
pH, 2:1 CaCl2 Extraction	pH Units			7.80	8.41

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to T1(ALL) - Current

3268491-3268500 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By: Elizabeth Rolakowska

AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 12T592360

PROJECT NO: SM124423

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: SOIL MAT ENGINEERS & CONSULTANTS LT

ATTENTION TO: John Monkman

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
3268491	BH2 SS2	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	2.4	5.84
3268492	BH2 SS4	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	2.4	2.90
3268493	BH3 SS2	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	0.57	4.25
3268493	BH3 SS2	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	2.4	7.63
3268494	BH3 SS4	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	0.57	2.66
3268494	BH3 SS4	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	2.4	5.98
3268495	BH4 SS2	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	0.57	3.57
3268495	BH4 SS2	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Lead	120	422
3268495	BH4 SS2	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	2.4	7.42
3268496	BH4 SS3	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	0.57	3.56
3268496	BH4 SS3	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	2.4	5.68
3268496	BH4 SS3	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Zinc	290	317
3268497	BH5 SS2	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	0.57	3.48
3268497	BH5 SS2	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	2.4	67.5
3268498	BH5 SS4	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	0.57	1.54
3268498	BH5 SS4	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	2.4	48.4
3268499	BH6 SS2	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	0.57	5.16
3268499	BH6 SS2	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	2.4	30.5
3268500	BH6 SS4	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	0.57	4.09
3268500	BH6 SS4	T1(ALL) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	2.4	30.1

Results relate only to the items tested and to all the items tested

AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 12T592360
PROJECT NO: SM124423

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: SOIL MAT ENGINEERS & CONSULTANTS LT **ATTENTION TO: John Monkman**

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE SAMPLED: Apr 10, 2012 **DATE RECEIVED: Apr 18, 2012** **DATE REPORTED: Apr 26, 2012** **SAMPLE TYPE: Soil**

Parameter	Unit	G / S	RDL	BH2 SS2 3268491	BH2 SS4 3268492	BH3 SS2 3268493	BH3 SS4 3268494	BH4 SS2 3268495	BH4 SS3 3268496	BH5 SS2 3268497	BH5 SS4 3268498
Antimony	µg/g	40	0.8	<0.8	<0.8	0.9	<0.8	<0.8	0.8	<0.8	<0.8
Arsenic	µg/g	18	1	4	3	4	4	4	4	4	5
Barium	µg/g	670	2	26	19	80	70	108	71	42	36
Beryllium	µg/g	8	0.5	<0.5	<0.5	0.8	0.7	0.6	0.6	<0.5	<0.5
Boron	µg/g	120	5	7	6	16	16	19	21	7	9
Boron (Hot Water Soluble)	µg/g	2	0.10	0.15	0.12	0.76	0.85	0.66	0.88	0.35	0.15
Cadmium	µg/g	1.9	0.5	<0.5	<0.5	<0.5	0.8	<0.5	0.9	<0.5	<0.5
Chromium	µg/g	160	2	10	9	16	18	21	22	14	15
Cobalt	µg/g	80	0.5	6.2	6.0	5.4	4.9	4.5	4.3	7.7	8.4
Copper	µg/g	230	1	26	23	25	20	23	18	25	33
Lead	µg/g	120	1	15	7	54	64	**422**	80	18	9
Molybdenum	µg/g	40	0.5	<0.5	<0.5	1.4	1.2	1.5	1.6	0.9	0.6
Nickel	µg/g	270	1	12	11	11	11	10	11	14	17
Selenium	µg/g	5.5	0.4	<0.4	<0.4	0.6	0.6	0.6	<0.4	0.4	0.5
Silver	µg/g	40	0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/g	3.3	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Uranium	µg/g	33	0.5	<0.5	<0.5	0.8	0.8	0.8	0.8	<0.5	<0.5
Vanadium	µg/g	86	1	18	18	22	25	27	25	25	25
Zinc	µg/g	340	5	43	37	150	259	138	317	47	48
Chromium VI	µg/g	8	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cyanide	µg/g	0.051	0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Mercury	µg/g	3.9	0.10	<0.10	<0.10	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	1.4	0.005	0.570	0.477	**4.25**	**2.66**	**3.57**	**3.56**	**3.48**	**1.54**
Sodium Adsorption Ratio	N/A	12	N/A	5.84	2.90	7.63	5.98	7.42	5.68	**67.5**	**48.4**
pH, 2:1 CaCl2 Extraction	pH Units			7.80	7.87	10.9	9.98	10.7	9.91	8.21	8.30

Certified By: Elizabeth Rolakowska

Results relate only to the items tested and to all the items tested

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 12T592360
PROJECT NO: SM124423

CLIENT NAME: SOIL MAT ENGINEERS & CONSULTANTS LT

ATTENTION TO: John Monkman

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE SAMPLED: Apr 10, 2012 | DATE RECEIVED: Apr 18, 2012 | DATE REPORTED: Apr 26, 2012 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	BH6 SS2 3268499	BH6 SS4 3268500
Antimony	µg/g	40	0.8	<0.8	<0.8
Arsenic	µg/g	18	1	5	5
Barium	µg/g	670	2	27	39
Beryllium	µg/g	8	0.5	<0.5	0.6
Boron	µg/g	120	5	10	10
Boron (Hot Water Soluble)	µg/g	2	0.10	0.56	0.48
Cadmium	µg/g	1.9	0.5	<0.5	<0.5
Chromium	µg/g	160	2	15	13
Cobalt	µg/g	80	0.5	8.8	8.0
Copper	µg/g	230	1	33	67
Lead	µg/g	120	1	11	20
Molybdenum	µg/g	40	0.5	0.5	<0.5
Nickel	µg/g	270	1	18	16
Selenium	µg/g	5.5	0.4	0.4	<0.4
Silver	µg/g	40	0.2	<0.2	<0.2
Thallium	µg/g	3.3	0.4	<0.4	<0.4
Uranium	µg/g	33	0.5	<0.5	<0.5
Vanadium	µg/g	86	1	24	23
Zinc	µg/g	340	5	46	58
Chromium VI	µg/g	8	0.2	<0.2	<0.2
Cyanide	µg/g	0.051	0.040	<0.040	<0.040
Mercury	µg/g	3.9	0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	1.4	0.005	**5.16**	**4.09**
Sodium Adsorption Ratio	N/A	12	N/A	**30.5**	**30.1**
pH, 2:1 CaCl2 Extraction	pH Units			7.80	8.41

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to T3(ICC) - Current

3268491-3268500 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By: Elizabeth Rolakowska

AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 12T592360

PROJECT NO: SM124423

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: SOIL MAT ENGINEERS & CONSULTANTS LT

ATTENTION TO: John Monkman

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
3268493	BH3 SS2	T3(ICC) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	1.4	4.25
3268494	BH3 SS4	T3(ICC) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	1.4	2.66
3268495	BH4 SS2	T3(ICC) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	1.4	3.57
3268495	BH4 SS2	T3(ICC) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Lead	120	422
3268496	BH4 SS3	T3(ICC) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	1.4	3.56
3268497	BH5 SS2	T3(ICC) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	1.4	3.48
3268497	BH5 SS2	T3(ICC) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	12	67.5
3268498	BH5 SS4	T3(ICC) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	1.4	1.54
3268498	BH5 SS4	T3(ICC) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	12	48.4
3268499	BH6 SS2	T3(ICC) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	1.4	5.16
3268499	BH6 SS2	T3(ICC) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	12	30.5
3268500	BH6 SS4	T3(ICC) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	1.4	4.09
3268500	BH6 SS4	T3(ICC) - Current	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	12	30.1

Results relate only to the items tested and to all the items tested