

Final Geotechnical Report Multi-Level Building at 250 Parkdale Avenue Ottawa, ON

Prepared for: **Richcraft Group of Companies** 2280 St. Laurent Blvd, Ottawa, ON K1G 4K1

Prepared by: Stantec Consulting Ltd. 2781 Lancaster Rd., Suite 200 Ottawa, ON K1B 1A7

Project No. 122410780

May 2012

Table of Contents

1.0	INTROD	JCTION	. 1
2.0	SITE DE	SCRIPTION AND BACKGROUND	. 1
3.0	SCOPE	OF WORK	. 1
		OF INVESTIGATION	
		S OF INVESTIGATION FACE INFORMATION Surficial Materials Bedrock	. 3 . 3
5.2	GROUNI	DWATER	. 4
6.0	DISCUS	SION AND RECOMMENDATIONS	. 5
6.1	6.1.1	ADING AND PREPARATION Building Footprint Paved Areas	. 5
		TIONS	
		SITE CLASSIFICATION	
6.5	PIPE BE	DWATER CONTROL DDING AND BACKFILL	. 7
6.6	6.6.1 6.6.2	ARY EXCAVATIONS AND BACKFILLING Excavations in Soil Excavations in Bedrock	. 8 . 8
	6.6.3 6.6.4 6.6.5	Groundwater Earth Pressures on Shoring Systems Rock Anchors	. 8
	6.6.6	Foundation Backfill	
		TYPE AND CORROSION POTENTIAL	
		NT STRUCTURE RECOMMENDATIONS	-
		ONS MONITORING AND PRE-CONSTRUCTION SURVEYS	
6.10	ICLOSUR	Έ	12

List of Tables

Table 5.1:	Unconfined Compressive Strength of Rock Cores	4
	Geotechnical Bearing Resistance for Foundations on Bedrock	
Table 6.2:	Shear Wave Velocity Information of Selected Boreholes	7
Table 6.3:	Lateral Earth Pressure Parameters	9
Table 6.4:	Unfactored Friction Coefficients	9
Table 6.5:	pH, Sulphate, Chloride and Resistivity Analysis Results	10
Table 6.6:	Recommended Pavement Design	10

Stantec

FINAL GEOTECHNICAL REPORT May 2012

APPENDICES

APPENDIX A	Statement of General Conditions
APPENDIX B	Key Plan
	Borehole Location Plan
	V _{S30} Measurement Location Plan
	Fault Location Plan
APPENDIX C	Symbols and Terms Used on Borehole Records
	Borehole Records
	Field Core Logs
	Bedrock Core Photos
APPENDIX D	Laboratory Test Results
APPENDIX E	Rock Anchor: Resistance to Rock Mass Failure

1.0 Introduction

This report presents the results of the Geotechnical Investigation and recommendations carried out for the proposed 28-storey building near the corner of Parkdale Ave. & Scott St., Ottawa, ON. This building will include five below grade parking levels.

The work was carried out in general accordance with our Proposal Number 1224-B11221, dated December 5, 2011.

This report has been prepared specifically and solely for the project described herein. It presents the factual results of the investigation and provides geotechnical recommendations for the design and construction of the proposed building.

2.0 Site Description and Background

It is understood that the proposed 28-storey building is to be located at the southwest corner of Parkdale Avenue and Scott Street. The building is approximately 85 m high and has five underground parking levels. The finish floor elevation of the ground floor has been assumed to be near elevation 62.70 m. The finish floor elevation of the first parking level has been assumed to be near elevation 59.70 m and the finish floor elevation of the fifth parking level is estimated to be 47.7 m. The site area is approximately 1,157 m² and the total gross building floor area (above grade) is approximately 16,357 m².

The location of the proposed building is shown on Drawing No. 1 in Appendix B.

Surficial soil maps indicate the soil conditions in the area consist of fill/glacial till over shallow bedrock within 3 m of ground surface.

3.0 Scope of Work

The scope of work for this investigation included the following:

- Advance five boreholes. Two boreholes were cored to the depths of approximately 16.5 m and 19.7 m below the ground surface. Three boreholes were terminated on shallow bedrock confirmed by auger refusal.
- Install two monitoring wells to measure groundwater levels.
- Survey the ground surface elevations at the borehole locations with reference to a geodetic benchmark.
- Complete a geotechnical laboratory testing program to characterize the soil and rock.

May 2012

- Prepare a Geotechnical Report outlining the field observations, laboratory results and providing geotechnical recommendations for design and construction of the proposed building including:
 - Bearing capacity of rock for shallow foundations;
 - Lateral earth pressures for shoring systems;
 - Seismic site classification in accordance with 2006 Ontario Building Code;
 - Design recommendations for rock anchors extending to bedrock;
 - Groundwater levels and construction dewatering requirements.

4.0 Method of Investigation

4.1 GEOTECHNICAL FIELD INVESTIGATION

Prior to carrying out the investigation, Stantec Consulting Limited (SCL) personnel marked out the proposed borehole locations at the site. As a component of our standard procedures and due diligence, Stantec arranged to have the borehole locations cleared of both private and public underground utilities.

The field drilling program was carried out on January, 12 and 13, 2012. The five boreholes were advanced, at the locations shown on Drawing No. 2 in Appendix B, with a truck mounted CME 55 auger drill rig. The subsurface stratigraphy encountered in each borehole was recorded in the field by SCL personnel while performing Standard Penetration Tests (SPT). Split spoon samples were collected for surficial fill materials. Bedrock was cored with HQ size coring equipment in boreholes MW 12-3 and MW 12-4 to the depths of 16.5 m and 19.7 m below the ground surface respectively.

Following the investigation, all boreholes were backfilled with augered material. 50 mm diameter monitoring wells were installed in two holes, MW12-3 and MW12-4. Monitoring well MW12-3 was installed to 16.5 m below ground surface and MW 12-4 was installed to 19.7 m below ground surface.

Samples were returned to the laboratory and subjected to detailed visual examination and additional classification by a geotechnical engineer. Selected samples were tested for moisture content, particle size analysis, and intact rock core strength. Groundwater samples collected from the monitoring wells were submitted to Paracel Laboratories to measure pH, resistivity, chlorides, and sulphate content. Results of this testing are shown in Appendix D and on the Borehole and Test Pit Record in Appendix C.

Samples will be stored for a period of one (1) month after issuance of this report unless we are otherwise directed by the client.

Borehole locations were surveyed in the field by Stantec personnel using a Trimble Geo XH GPS. Geodetic ground surface elevations were obtained for all the boreholes and are accurate to 0.1 m.

The ground surface elevations at the borehole locations are shown on the Borehole Records included in Appendix C.

5.0 Results of Investigation

5.1 SUBSURFACE INFORMATION

The subsurface conditions observed in the boreholes are presented in detail on the Borehole Records, Field Core Logs, and Bedrock Core Photos in Appendix C. An explanation of the symbols and terms used to describe the Borehole and Test Pit Records is also provided in Appendix C. In general, the observed stratigraphy consisted of fill material underlain by shallow bedrock.

A general overview of the soil, rock and groundwater conditions encountered in the boreholes is provided below.

5.1.1 Surficial Materials

Asphalt was encountered at the surface of all the boreholes. The asphalt varied from 25 mm to 76 mm in thickness.

Fill materials were observed in all the boreholes and varied from 0.4 m to 1.5 m in thickness. This material generally consisted of silty sand with gravel with some bricks and rock fragments. The moisture content of this material ranged from 10% to 12%. Gradation tests performed on this material show 13% to 46% gravel, 37% to 54% sand, and 15% to 32% fines (silt and clay). This material can be classified as a silty sand with gravel (SM) and silty gravel with sand (GM), according to the Unified Soil Classification System (USCS).

5.1.2 Bedrock

Limestone with shaly partings bedrock was encountered in all the boreholes. The depth to top of bedrock ranged from 0.4 m to 1.5 m below ground surface. The limestone had very close to wide joint spacing which had generally flat orientation. The rock was unweathered with shale partings.

Generally bedrock quality was good to excellent however the top portion of borehole MW 12-3 (down to 1.3 m depth) was observed to be fair quality. The Rock Quality Designation (RQD) varied from 61% to 100%. The unconfined compressive strength of the rock, which is summarized in Table 5.1, ranged from 77 MPa to 173 MPa. Rock Core logs and photos of the rock core are shown in Appendix C.

Borehole	Depth (m)	Unconfined Compressive Strength (MPa)
	5.2	172.8
M/M/ 10.2	9.7	183.9
MW 12-3	12.8	132.3
	15.8	77.2
	5.2	162.9
	9.8	140.4
MW 12-4	14.3	137.7
	19.0	135.8

Table 5.1: Unconfined Compressive Strength of Rock Cores

5.2 **GROUNDWATER**

Groundwater was measured by means of monitoring wells installed in boreholes MW 12-3 and MW 12-4. Groundwater was measured on January 25 and February 3, 2012. At monitoring wells MW 12-3 and MW 12-4, the groundwater level was measured at 9.60 m and 7.76 m below ground surface.

Fluctuation in the groundwater level due to seasonal variations or in response to a particular precipitation event should be anticipated.

6.0 Discussion and Recommendations

The following geotechnical issues should be considered during design activities:

- Conventional spread footings founded on bedrock are appropriate for the design of the multi-storey building at this site.
- Groundwater was encountered at depths within the proposed depth of construction. It is anticipated that surface water run-off and groundwater can be controlled with sump and pump methods during construction.
- The bedrock on this site consists of limestone, with a measured unconfined compressive strength ranging between 77 MPa to 173 MPa which suggest strong to very strong rock.
- The Soluble sulphate concentrations show that a low degree of sulphate attack is expected for concrete in contact with soil and groundwater. Type GU Portland Cement should therefore be suitable for use in concrete at this site.
- The recommended Site Classification for Seismic Site Response for the site is Site Class A in accordance with 2006 Ontario Building Code.

6.1 SITE GRADING AND PREPARATION

6.1.1 Building Footprint

Footings should be founded on sound bedrock. Exposed bedrock surfaces should be free of loose bedrock, soil, water, bedrock irregularities, bedrock pinnacles and sloping surfaces. Hand cleaning and pressure washing of the bearing areas to remove any loose materials will be required to achieve the recommended bearing pressure.

Temporary frost protection should be provided for all footings if construction is carried out under winter conditions.

Prepared subgrade surfaces should be inspected by experienced geotechnical personnel prior to placement of either Structural Fill or concrete.

Structural Fill should conform to the requirements of OPSS Granular A. Structural Fill placed beneath building should contain no recycled materials such as concrete or asphalt. It should be compacted in lifts no thicker than 300 mm to at least 100% Standard Proctor Maximum Dry Density (SPMDD). This material should be tested and approved by a Geotechnical Engineer prior to delivery to the site.

Earth removals should be inspected by a geotechnical engineer to ensure that all unsuitable materials are removed prior to placement of fill or concrete. Inspection and testing services will be critical to ensure that all fill and concrete used is suitable and is placed competently.

6.1.2 Paved Areas

All vegetation, topsoil, existing asphalt and other deleterious material should be removed from beneath pavement areas. The subgrade should be proof rolled in the presence of geotechnical

personnel. All soft areas revealed during proof rolling or subgrade inspections should be excavated to a maximum depth of 500 mm and replaced with compacted OPSS Granular B Type II.

6.2 FOUNDATIONS

The foundations for the proposed building may be supported on spread footings provided that the foundation preparation work described in Section 6.1 above is carried out. Spread footings should be placed on clean undisturbed sound bedrock.

Table 6.1 provides Geotechnical Bearing Resistances for shallow foundations on bedrock.

Foundation Type	Footing Width (m)	Geotechnical Resistance, ULS, (kPa)		
Strip Footing	1.0 to 3.0	4500		
Square Footing	1.0 to 3.0	5500		

Table 6.1: Geotechnical Bearing Resistance for Foundations on Bedrock

The factored geotechnical bearing resistance at ultimate limit states (ULS) incorporates a resistance factor of 0.5. The settlement of foundations founded on bedrock is expected to be negligible and therefore, the geotechnical reaction at Serviceability Limit States (SLS) is not provided for footings on bedrock.

The design frost depth is 1.8 m. All exterior spread footings and footings for unheated structures should be protected from frost action by a minimum soil cover of 1.8 m or equivalent insulation. Perimeter footings should be protected by a minimum soil cover of 1.5 m or equivalent insulation. Perimeter footings and interior footings within 1.5 m of perimeter walls of heated structures should be protected by a minimum soil cover of 1.5 m or equivalent insulation. Where proposed footings have insufficient soil cover for frost protection, the use of insulation will be required.

The base of all footing excavations should be inspected by a geotechnical engineer prior to placing concrete to confirm the design pressures and to ensure that there is no disturbance of the founding soils.

Where construction is undertaken during winter conditions, all footing subgrades should be protected from freezing. Foundation walls and columns should be protected against heave due to soil adfreeze.

6.3 SEISMIC SITE CLASSIFICATION

Existing $V_{s_{30}}$ measurements around the study site were reviewed to determine the site class according to the 2006 Ontario Building Code. The measurements were obtained from the geological Survey of Canada Surficial Boreholes for the National Capital Area. The data is accessible through the Carleton University website called the Interactive Surface Geography Map for the City of Ottawa. The selected boreholes are illustrated in Drawing No. 3 in Appendix B and the corresponding shear wave velocity information is shown in Table 6.2. This Table provides the average shear wave velocity in top 30 m for the studied sites (V_{s30}).

Based on V_{s30} values, the recommended site classification for seismic site response for the building is Site Class A in accordance with Table 4.1.8.4.A of the 2006 Ontario Building Code. It is noted that Table 6.2 presents V_{s30} values from surface, the underside of the foundations will be near elevation 47.7 m which would result in a higher V_{s30}.

Borehole Name	Borehole ID	Bedrock Depth (m)	V _{s30} (m/sec)	Bedrock Velocity Range (m/sec)
а	UGE05680	1.83	1856	1466-2239
b	UGE00469	1.52	1902	1509-2288
С	UGE05646	1.25	1944	1549-2333

 Table 6.2: Shear Wave Velocity Information of Selected Boreholes

The location of the proposed building and known faults was evaluated. Drawing No. 4 in Appendix B shows the location of the nearest faults. The drawing indicates that the proposed building is not located on a fault.

6.4 GROUNDWATER CONTROL

The groundwater level within monitoring wells MW12-3 and MW 12-4 was measured at elevations of 50.7 m and 53.2 m respectively. The proposed below grade parking levels will be below the groundwater level. The design of the below grade parking levels should consider the groundwater level. The below grade levels could be designed to be waterproof or a subdrain system could be provided. The subdrains should be founded at least 400 mm below the underside of the floor slab and should be connected to a frost free outlet. If subdrains are proposed, the floor slab should be supported on a 400 mm thick layer of clear stone for drainage.

6.5 PIPE BEDDING AND BACKFILL

Bedding for utilities should be placed in accordance with the pipe design requirements. It is recommended that a minimum of 150 mm to 200 mm of OPSS Granular A be placed below the pipe invert as bedding material. Granular pipe backfill placed above the invert should consist of Granular A material. A minimum of 300 mm vertical and side cover should be provided. These materials should be compacted to at least 95% of SPMDD.

Backfill for service trenches in landscaped areas may consist of excavated material replaced and compacted in lifts. Where the service trenches extend below paved areas, the trench should be backfilled with OPSS Select Subgrade Material (SSM) from the top of the pipe cover to within 1.2 m of the proposed pavement surface, placed in lifts and compacted to at least 95% of SPMDD. The material used within the upper 1.2 m and below the subgrade line should be similar to that exposed in the trench walls to prevent differential frost heave, placed in lifts and compacted to at least 95% of SPMDD. Different abutting materials within this zone will require a 3 horizontal to 1 vertical frost taper in order to minimize the effects of differential frost heaving.

Excavations for catch basins and manholes should be backfilled with compacted granular material. A 3 horizontal to 1 vertical frost taper should be built within the upper 1.2 m. The joints between catch basin or manhole sections must be wrapped with non-woven geotextile.

It should be noted that reuse of the site generated material will be highly dependent on the material's moisture content at time of placement.

Backfill should be compacted in lifts not exceeding 300 mm.

6.6 TEMPORARY EXCAVATIONS AND BACKFILLING

6.6.1 Excavations in Soil

The shallow silty sand fill (maximum encountered thickness of 1.3 m) present at the site is considered a Type 3 soil in accordance with the Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects. Temporary excavations in the overburden may be supported or should be sloped at 1 horizontal to 1 vertical from the base of the excavation and as per the requirements of OHSA. Alternatively, sheet piling or other support methods will be required. Excavations should be inspected regularly for signs of instability and flattened as required. The excavation support system should be designed to resist loads from traffic and foundations from adjacent structures.

6.6.2 Excavations in Bedrock

Drilling and blasting and hoe ramming techniques will be required to excavate bedrock. Temporary excavation in bedrock may be carried out at near vertical slopes, provided the trench sides are cleared of loose rock prior to workers entering the trench. If the bedrock is overly fractured such that the loose rock cannot be entirely removed, a temporary rock catchment system such as a wire mesh system should be used. The catchment system should be designed to contain and/or prevent loose rock particles from falling on workers within the excavation.

Bedrock excavation sidewalls adjacent to existing building foundations should be supported to ensure the stability of the existing buildings.

6.6.3 Groundwater

Groundwater was encountered during this geotechnical investigation within the depths of the anticipated excavations.

Though soils and bedrock permeability measurements were not included as part of this investigation, it is expected that dewatering of the excavations will be possible using conventional sump and pump techniques. It should be noted that groundwater elevations fluctuate seasonally. Dewatering of the excavation is not anticipated to cause settlement of soils due to groundwater lowering in the vicinity of the site.

6.6.4 Earth Pressures on Shoring Systems

Earth pressures will need to be considered in the design of shoring systems for temporary excavations during construction. Table 6.3 gives the coefficients of lateral earth pressure for shoring systems. These values are based on the assumption that a horizontal back slope will be utilized behind the shoring system.

Parameter	Native Fill	OPSS Granular A	OPSS Granular B Type
Unit Weight (kN/m ³)	19	22.0	21.2
Angle of Internal Friction, Φ	32°	40°	35°
Coefficient of Passive Earth Pressure, K _p	3.25	4.60	3.69
Coefficient of at Rest Earth Pressure, K₀	0.47	0.36	0.43
Coefficient of Active Earth Pressure, K _a	0.31	0.22	0.27

Table 6.3: Lateral Earth Pressure Parameters

Sliding resistance can be calculated using the following unfactored friction coefficients, outlined in Table 6.4.

Table 6.4: Unfactored Friction Coefficients

Condition	Unfactored Friction Coefficient
Between Concrete and Structural Fill	0.55
Between Concrete and Clean Bedrock	0.6

6.6.5 Rock Anchors

Rock anchors could be used to ensure stability of temporary shoring system and resist uplift forces. For the design of rock anchors extending into bedrock, the following design parameters may be considered for the rock mass.

- A rock to grout working bond stress of 1000 kPa may be used for holes grouted with nonshrink grout having a minimum compressive strength of 30 MPa.
- The minimum fixed anchor length (i.e. the length over which the rock to grout bond stress is developed) should be no less than 3 m.
- The unbounded length of anchor should be equal to the height of the rock cone and less half the bonded length.

To ensure against the possibility of a rock mass failure, the following design parameters should be used:

- Submerged Unit weight of rock = 16 kN/m3
- A 90° (apex angle) failure cone with the apex located at the midpoint of the bonded length as shown on the sheet titled "Rock Anchor: Resistance to Rock Mass Failure" in Appendix E.

The bond stress used by the contractor for design should be confirmed by full scale testing of anchors.

6.6.6 Foundation Backfill

Backfill within the footprint of the proposed buildings should consist of OPSS Granular A compacted to 100% SPMDD. Exterior foundation backfill should consist of a material meeting the requirements of OPSS Select Subgrade Material (SSM).

Exterior foundation backfill shall be placed in lifts no thicker than 300 mm and compacted using suitable compaction equipment to at least 95% of SPMDD. Care should be taken immediately adjacent to the foundation walls to avoid over-compaction of the soil which could result in damage to the walls.

6.7 CEMENT TYPE AND CORROSION POTENTIAL

One representative groundwater sample was submitted to Paracel Laboratories Ltd. in Ottawa, Ontario, for pH, chloride, sulphate and resistivity testing. The test results are summarized in Table 6.5.

Borehole No.	рН	Sulphate (µg/g)	Resistivity (0.01 ohm.m)	Chloride (µg/g)
MW12-4	6.9	179	1.83	1950

Table 6.5: pH, Sulphate, Chloride and Resistivity Analysis Results

One concentration of soluble sulphate provides an indication of the degree of sulphate attack that is expected for concrete in contact with soil and groundwater at the site. The soluble sulphate is 179 μ g/g. Soluble sulphate concentrations less than 1000 μ g/g generally indicate that a low degree of sulphate attack is expected for concrete in contact with soil and groundwater. Type GU Portland Cement should therefore be suitable for use in concrete at this site.

The pH, resistivity and chloride concentration provide an indication of the degree of corrosiveness of the sub-surface environment. The soil pH was 6.9 which is within what is considered the normal range for soil pH of 5.5 to 9.0. The pH levels of the tested soil do not indicate a highly corrosive environment. The test results provided in the Table 6.5 can be used to aid in the selection of coatings and corrosion protection systems for buried steel objects.

6.8 PAVEMENT STRUCTURE RECOMMENDATIONS

It has been assumed that the parking areas will be used mostly by passenger vehicles and the access roads will be used by delivery trucks and fire vehicles.

The subgrade in paved areas should be prepared as described in Section 6.1 above. The following minimum pavement structures are recommended:

Material	Heavy Duty Parking Access Roads	Standard Duty Parking Area
SP 12.5 Asphaltic Concrete	40 mm	50 mm
SP 19 Asphaltic Concrete	50 mm	-
Granular Base Course, OPSS Granular A	150 mm	150 mm
Granular Subbase Course, OPSS Granular B Type II	400 mm	300 mm

 Table 6.6: Recommended Pavement Design

It is estimated that the service life prior to major rehabilitation for the above pavement structures is 20 years provided they are properly maintained. The pavement surface and the underlying subgrade should be graded to direct runoff water towards suitable drainage.

All granular materials should be tested and approved by a geotechnical engineer prior to delivery to the site. Both base and subbase materials should be compacted to at least 100% SPMDD. Asphalt should be compacted to at least 97% Marshal bulk density.

It is recommended that the lateral extent of the subbase and base layers not be terminated in a vertical fashion immediately behind the curb line. A taper with a grade of 5 horizontal to 1 vertical is recommended in the subgrade line to minimize differential frost heave problems under sidewalks.

6.9 VIBRATIONS MONITORING AND PRE-CONSTRUCTION SURVEYS

The required construction activities for the proposed building will generate some vibrations that will be perceptible to nearby residents. The vibrations are expected to be greatest during bedrock excavation by blasting/mechanical methods. It is recommended that pre-construction surveys of all structures be carried out in accordance with OPSS 120 "General Specifications for the Use of Explosives".

It is recommended that construction vibrations generally be limited to a maximum peak particle velocity as outlined in OPSS 120. Should there be structures in the area sensitive to vibrations, more stringent specifications should be developed by a vibration specialist. For instance, the particle velocity should be limited to 10 mm/sec if there is a historic building in the area. Vibration monitoring should be carried out prior to and throughout the construction period.

No blasting should be carried out within a distance of 200 m from any water storage reservoir, pumping station, water works transformer station or water storage tank without prior approval by the owner of the facility.

6.10 CLOSURE

Use of this report is subject to the Statement of General Conditions provided in Appendix A. It is the responsibility of Richcraft, who is identified as "the Client" within the Statement of General Conditions, and its agents to review the conditions and to notify Stantec should any of these note be satisfied. The Statement of General Conditions addresses the following:

- Use of the report
- Basis of the report
- Standard of care
- Interpretation of site conditions
- Varying of unexpected site conditions
- Planning, design or construction

This report has been prepared by Kasgin Khaheshi Banab and reviewed by Chris McGrath.

Respectfully submitted,

STANTEC CONSULTING LIMITED

KAAHESHI

Kasgin Khaheshi Banab, PhD, E.I.T. Geotechnical Engineering

Chris McGrath, P.Eng. Associate - Geotechnical Engineer



v:\01224\active\1224107xx\122410780\report 2_scott\geotech report_final_scott.docx



Statement of General Conditions

<u>USE OF THIS REPORT</u>: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec Consulting Ltd. and the Client. Any use which a third party makes of this report is the responsibility of such third party.

<u>BASIS OF THE REPORT</u>: The information, opinions, and/or recommendations made in this report are in accordance with Stantec Consulting Ltd.'s present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec Consulting Ltd. is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

<u>STANDARD OF CARE</u>: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

<u>INTERPRETATION OF SITE CONDITIONS</u>: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec Consulting Ltd. at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

<u>VARYING OR UNEXPECTED CONDITIONS</u>: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec Consulting Ltd. must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec Consulting Ltd. will not be responsible to any party for damages incurred as a result of failing to notify Stantec Consulting Ltd. that differing site or subsurface conditions are present upon becoming aware of such conditions.

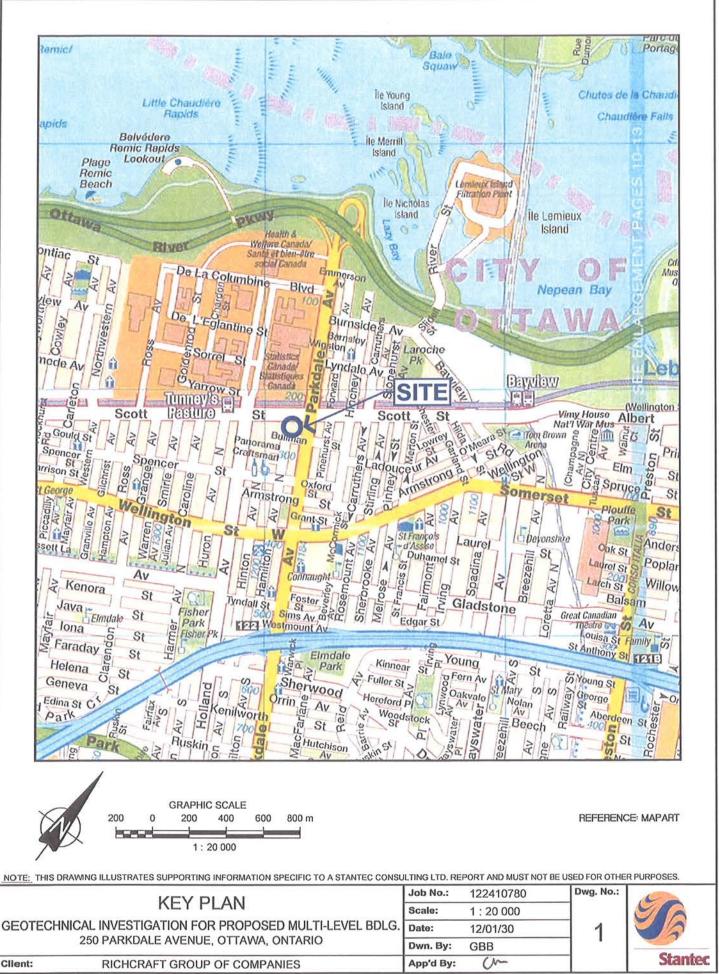
<u>PLANNING, DESIGN, OR CONSTRUCTION</u>: Development or design plans and specifications should be reviewed by Stantec Consulting Ltd., sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec Consulting Ltd. cannot be responsible for site work carried out without being present.



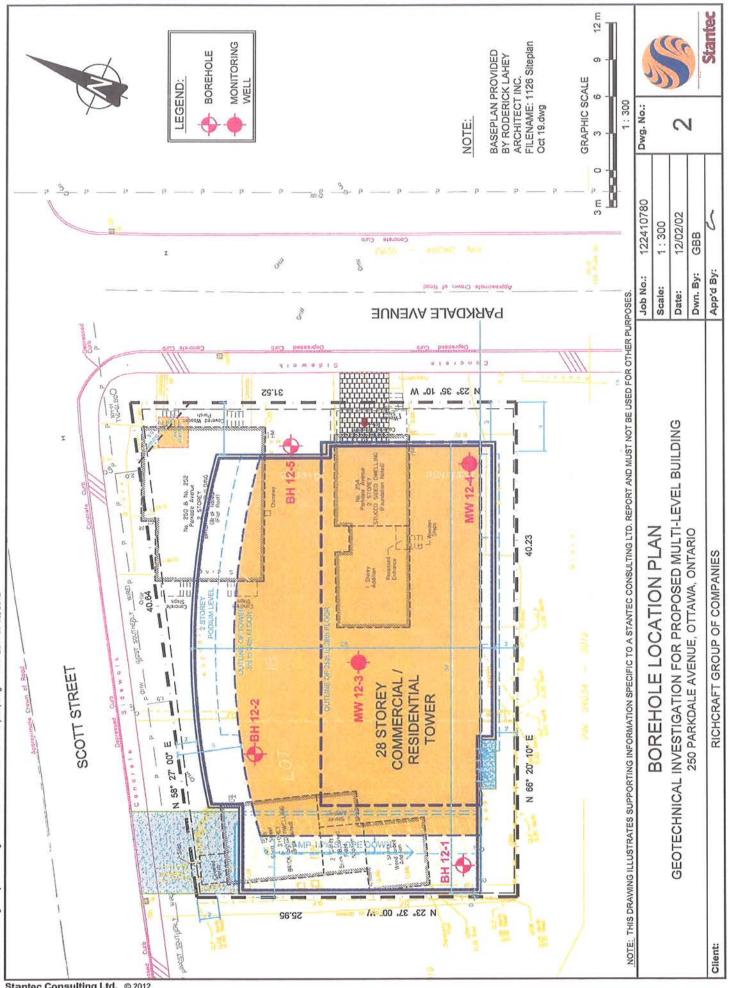
APPENDIX B

Key Plan Borehole Location Plan V_{S30} Measurement Location Plan

Fault Location Plan

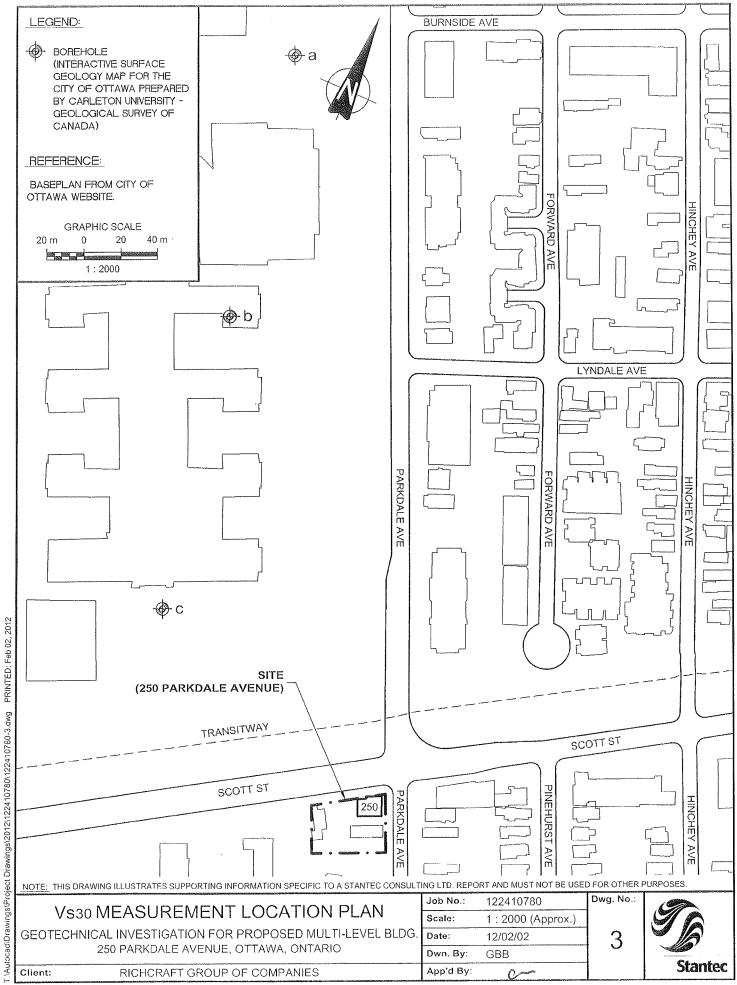


Stantec Consulting Ltd. © 2012

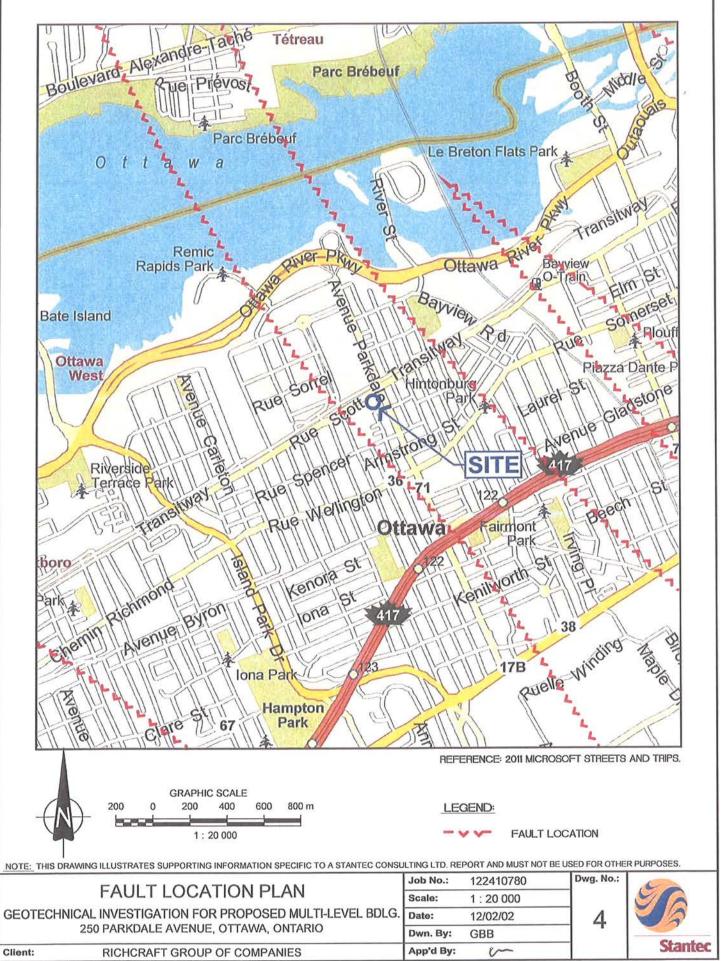


T:NutocadIDrawings\Project Drawings\2012\122410780\122410780\22410780-2 (250).dwg PRINTED: Feb 02, 2012

Stantec Consulting Ltd. @ 2012



Stantec Consulting Ltd. © 2012



Stantec Consulting Ltd. © 2012

APPENDIX C

Symbols and Terms Used on Borehole Records Borehole Records Field Core Logs Bedrock Core Photos

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Topsoil	- mixture of soil and humus capable of supporting vegetative growth	
Peat - mixture of visible and invisible fragments of decayed organic matter		
Till	- unstratified glacial deposit which may range from clay to boulders	
Fill	- material below the surface identified as placed by humans (excluding buried services)	

Terminology describing soil structure:

Desiccated	- having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	 having cracks, and hence a blocky structure
Varved	- composed of regular alternating layers of silt and clay
Stratified	- composed of alternating successions of different soil types, e.g. silt and sand
Layer	- > 75 mm in thickness
Seam	- 2 mm to 75 mm in thickness
Parting	- < 2 mm in thickness

Terminology describing soil types:

The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488). The classification excludes particles larger than 76 mm (3 inches). The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):

Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	> 20%

Terminology describing compactness of cohesionless soils:

The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test N-Value (also known as N-Index). A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

Terminology describing consistency of cohesive soils:

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests.

Consistensy	Undrained S	hear Strength
Consistency	kips/sq.ft.	kPa
Very Soft	<0.25	<12.5
Soft	0.25 - 0.5	12.5 - 25
Firm	0.5 - 1.0	25 - 50
Stiff	1.0 - 2.0	50 – 100
Very Stiff	2.0 - 4.0	100 - 200
Hard	>4.0	>200



ROCK DESCRIPTION

Terminology describing rock quality:

RQD	Rock Mass Quality
0-25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

Rock quality classification is based on a modified core recovery percentage (RQD) in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be due to close shearing, jointing, faulting, or weathering in the rock mass and are not counted. RQD was originally intended to be done on NW core; however, it can be used on different core sizes if the bulk of the fractures caused by drilling stresses are easily distinguishable from *in situ* fractures. The terminology describing rock mass quality based on RQD is subjective and is underlain by the presumption that sound strong rock is of higher engineering value than fractured weak rock.

Terminology describing rock mass:

Spacing (mm)	Joint Classification	Bedding, Laminations, Bands
> 6000	Extremely Wide	-
2000-6000	Very Wide	Very Thick
600-2000	Wide	Thick
200-600	Moderate	Medium
60-200	Close	Thin
20-60	Very Close	Very Thin
<20	Extremely Close	Laminated
<6	-	Thinly Laminated

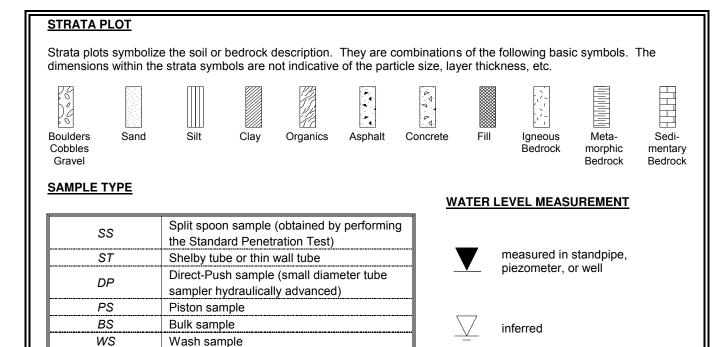
Terminology describing rock strength:

Strength Classification	Unconfined Compressive Strength (MPa)
Extremely Weak	< 1
Very Weak	1 – 5
Weak	5 – 25
Medium Strong	25 – 50
Strong	50 – 100
Very Strong	100 – 250
Extremely Strong	> 250

Terminology describing rock weathering:

Term	Description
Fresh	No visible signs of rock weathering. Slight discolouration along major discontinuities
Slightly Weathered	Discolouration indicates weathering of rock on discontinuity surfaces. All the rock material may be discoloured.
Moderately Weathered	Less than half the rock is decomposed and/or disintegrated into soil.
Highly Weathered	More than half the rock is decomposed and/or disintegrated into soil.
Completely Weathered	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.





RECOVERY

HQ, NQ, BQ, etc.

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

Rock core samples obtained with the use of

standard size diamond coring bits.

N-VALUE

Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (64 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (305 mm) into the soil. For split spoon samples where insufficient penetration was achieved and N-values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N value corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to A size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (305 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

S	Sieve analysis						
Н	Hydrometer analysis						
k	Laboratory permeability						
Ŷ	Unit weight						
Gs	Specific gravity of soil particles						
CD	Consolidated drained triaxial						
CU	Consolidated undrained triaxial with pore pressure						
00	measurements						
UU	Unconsolidated undrained triaxial						
DS	Direct Shear						
С	Consolidation						
Q_u	Unconfined compression						
	Point Load Index (Ip on Borehole Record equals						
Iρ	$I_p(50)$ in which the index is corrected to a reference						
	diameter of 50 mm)						

Ţ	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
Ŷ	Falling head permeability test using casing
Ţ	Falling head permeability test using well point or piezometer



E.	🖗 St	antec	B	H 12-1	of 1							
с	LIENT	Richcraft Group of Companies	<u>s</u>							BOREHOLE No		
1		250 Parkdale Ave Ottawa, O										
D	ATES: BC	RING January 12, 2012 w	ATER L	EVE	:L					DATUM		etic
2				/EL		SA T	MPLES		50		.50 200	
DEPTH (m)	(W) NO LE SOIL DESCRIPTION		STRATA PLOT	WATER LEVEL	ш	BER	RECOVERY (mm)	CUE CUE				VL
DEF	ELEV		STRA	WATE	ТҮРЕ	NUMBER	RECOV (mr	N-VALUE OR RQD	WATER CONTENT & DYNAMIC PENETRA	ATTERBERG LIMITS	→ → → → → → → → → → → → → → → → → → →	ł
									STANDARD PENETR	ATION TEST, BLOWS/0.3	3m 🗶	
- 0 -	61.00 60.9	\51 mm ASPHALT	- (🗙				<u> </u>		10 20 3	0 40 50 6	0 70 80	90
	00.9	FILL: brown silty sand with	' 🛞									
		gravel, some rock fragments			00	1		50/				
- 1 -					SS	1		50/ 50mm	<u> </u>			
	59.5									area Area bran Area		
		End of borehole										
- 2 -		Auger refusal on inferred										
		bedrock										
- 3 -												τi
- 4 -												IIE
- 5 -												
- 6 -											1 1	
											1 1 1	
											1 1 1	
- 7 -									┃╎┊┇╎┃╎╎╎╎╏╽╎╎ ┝┼╎╧┊╪╞ ┼┼╎╎╏╏╏╎	╎╎║║║╎╢╢╎╢╎╢╎╢ ┿╋╪╋╋╋╋╋	╏┥╺╞┥ ╋	╵╵╵╞╴ ┝┿┿┾╴
												
- 8 -												╘┥┽┠╴
- 9 -												
								and a second data from				
-10-		L			LL	L	L	!	□ Field Vane T	est. kPa		
		☑ Inferred Groundwater Level	_						C Remoulded V	/ane Test, kPa	App'd	_
1	Groundwater Level Measured in Standpipe							△ Pocket Penet	rometer Test, kPa	Date		

STAN-GEO 122410780_PARKDALE_SCOTT.GPJ SMART.GDT 2/3/12

الح	Stantec BOREHOLE RECORD										H 12-	-2	
	LIENT	Richcraft Group of Companies					, .		·			BH 12-2	
1		250 Parkdale Ave Ottawa, ON							PROJECT No				
	ATES: BO	RING <u>January 12, 2012</u> WA	TER L	EVE	L				1	DATUM		Geodetic	
	Ê		-			SA	MPLES		UNDR 50	RAINED SHEAR STREN	GTH - kPa 50	200	
(îu) T	ON (r		PLO	LEVE		6	۲	шo			+		
DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	ТҮРЕ	NUMBER	RECOVERY (mm)	N-VALUE OR RQD	WATER CONTENT 8	ATTERBERG LIMITS	₩p I	w ^W L	
	ELE		STI	W	H	PZ	REC		DYNAMIC PENETRA	TION TEST, BLOWS/0.3m	•	*	
	(2.0.6		_						1	RATION TEST, BLOWS/0.3		•	
- 0 -	63.96	25 mm ASPHALT	Γ							30 40 50 6	50 70	80 90	
		FILL : brown to dark brown silty	' 🛞										
	63.3	_sand with gravel	<u>بر</u>	X									
- 1 -		End of borehole											
		Auger refusal on inferred											
+ -		bedrock											
- 2 -													
- 3 -			ļ										
- 4 -													
- 5 -	- - 												
+ -													
- 6 -									<mark>┠┼┼┼┼┼┼┼┼</mark> ┼┼┼┼┼┼ ╿╿╏╏┊┨╎┧╿╛╹┨┊┆╵	┿ <mark>┥╌╽╴┇╴┇╴╡╸╡╸┇╴┇╴┇╸╡╸╡╴┇╴┇╸┇╸</mark>	╋┿┾╋╋╋ ╡╎╏╏╏╏		
											3		
- 7 -									┠┼╎╎╽╎┼┼┼┼┼	╋┥╡┫╡ ╋╋	╊┽╅┼┊<mark>╋</mark>╋		
											1 I.		
											{ 1		
- 8 -										╡┇┇╏╏╏ ┿╋╋╋╋╋╋╋╋╋╋╋╋╋╋╋		<u> </u>	
+ -											IIII I	111111	
- 9 -											F 1		
-10-				1				<u> </u>					
		☑ Inferred Groundwater Level							□ Field Vane T □ Remoulded V	i est, kPa Vane Test, kPa	App'd _		
	Groundwater Level Measured in Standpipe								trometer Test, kPa	Date _			

STAN-GEO 122410780_PARKDALE_SCOTT.GPJ SMART.GDT 2/3/12

Stantec MONITORING WELL RECORD MW 12-3 CLIENT Richcraft Group of Companies BOREHOLE No. _____ MW 12-3 LOCATION 250 Parkdale Ave.- Ottawa, ON PROJECT No. 122410780

1 of 2

DATES: BORING January 12, 2012 WATH				EVE	L		Febr	uary 3.	6, 2012 DATUM Geode	t <u>ic</u>		
				SAMPLES			MPLES		UNDRAINED SHEAR STRENGTH - kPa			
Ê	(L)		PLOT	Ъ.					- 50 100 150 200			
DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	Id ∀	WATER LEVEL		2	ERY (Щд				
Ē	EVA.		STRATA	E	түре	NUMBER	RECOVERY (mm)	N-VALUE OR RQD	WATER CONTENT & ATTERBERG LIMITS			
			ST	Ž		ž	REC	<u>5</u> 0	DYNAMIC PENETRATION TEST, BLOWS/0.3m			
									STANDARD PENETRATION TEST, BLOWS/0.3m			
- 0 -	60.32		}						10 20 30 40 50 60 70 80	90		
	60.3	64 mm ASPHALT								i E		
		FILL : brown silty gravel with								E		
	7 0 4	sand, some brick			DC	,				: -		
	59.4	I MESTONE with shake	. 🗱		BS	1				ÌF		
		LIMESTONE with shaly partings			HQ	1	100%	61%		_		
		partings										
		-Grey										
- 2 -		-Fair to excellent rock mass										
		quality			HQ	2	98%	88%				
		-Close to wide spacing								· 🗖		
		-Strong intact rock strength										
- 3 -		-Unweathered										
[]		-Fractured dip 0 to 20°										
		See Field Come Long for Justicity 1								· -		
[]		See Field Core Log for detailed description of rock core			HQ	3	100%	100%				
4		description of rock core										
										1		
			F			<u> </u>				i F		
			\square									
- 5 -										Ē		
[]					HQ	4	100%	94%				
							l			1		
										· -		
- 6 -												
										i E		
			F							· E		
[]			μ μ		НQ	5	99%	82%				
- 7 -										¦È.		
[']							ļ			iÈ		
										· -		
										· •		
- 8 -										! F		
$\begin{bmatrix} \circ \end{bmatrix}$			\square		НQ	6	91%	85%		iE		
										- H-		
- 9 -										1		
["]												
										· •		
[]				Ţ	HQ	7	100%	100%		1E		
-10			F			Ľ	10070	10070				
									Field Vane Test, kPa			
									Remoulded Vane Test, kPa App'd	-		
		▼ Groundwater Level Measured in S	tandp	oipe					△ Pocket Penetrometer Test, kPa Date	-		
							1.					

Ĭ	s St		NTC)F	UN	G V	WEI	LLR	ECORD	MV	V 12-3
	JENT	Richcraft Group of Companies 250 Parkdale Ave Ottawa, ON								BOREHOLE No.	
			TER LE	VE	т				, 2012	PROJECT No.	
	DC	Mino <u>Junuary 12, 2012</u> WA			L		MPLES			INED SHEAR STRENGT	
Ê	(m)		Б	VEL			1		50	100 15	
DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	ТҮРЕ	NUMBER	RECOVERY (mm)	N-VALUE OR RQD	WATER CONTENT & .	ATTERBERG LIMITS	₩ _P W W _L
	цГ		°.	3		z	RE	żΟ		ION TEST, BLOWS/0.3m ATION TEST, BLOWS/0.3m	*
									10 20 30		70 80 90
-10+		LIMESTONE with shaly									
		partings		-							
		-Grey									
~11-		-Excellent rock mass quality -Close to wide spacing			НQ	8	100%	99%			
		-Strong intact rock strength									
		-Unweathered -Fractured dip 0 to 20°									
-12-		-Tractured up 0 to 20									
- 1											
				-	НQ	9	100%	100%			
-13-				:							
	-										
							ļ				
-14-]					НQ	10	100%	96%			
					עח	10	100%	90%			
-15-											
					HQ	11	100%	100%			
-16-											
	43.9										
		End of borehole									
-17-		Monitoring well installed									┍┿┇╘┥╏┦╎╿╸┨╎╎┆ ╎┊┇╏┊┇╢╎╎
								:			
-											
-18-									<mark>╴╊╌┾╵┽╡╶┝╌┾┽╦╍┽╉╍╬╶┟╴</mark> ┨║╎╎╎┇╏╎║┇╹╏┃╏╏		
-19-											
-20 +			<u>_</u>			ł	1	I	□ Field Vane Te	::::::::::::::::::::::::::::::::::::::	
		↓ Inferred Groundwater Level ↓							□ Remoulded V	•	App'd

△ Pocket Penetrometer Test, kPa Date _

STAN-GEO 122410760_PARKDALE_SCOTT.GPJ SMART.GDT 2/3/12

I Groundwater Level Measured in Standpipe

MONITORING WELL RECORD

MW 12-4

CI	LIENT	Richcraft Group of Companies							BOREHOLE No MW 12	<u>-4</u>
LC	DCATION	250 Parkdale Ave Ottawa, ON							PROJECT No12241078	<u>30</u>
D	ATES: BO	RING January 13, 2012 WAT	ER L	EVE	L		Janu	ary 25	5, 2012 DATUM Geodet	<u>ic</u>
						SA	MPLES		UNDRAINED SHEAR STRENGTH - kPa	
((m)		5	Ē			l	[- 50 100 150 200	
DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL		R	RECOVERY (mm)	щą		
EPT	TAV	SOLE DESCRIPTION	RAT	TER	ТҮРЕ	NUMBER	mm)	N-VALUE OR RQD	WATER CONTENT & ATTERBERG LIMITS	
	ELE		ST	NA N	-	Z	REC)	Ϋ́ Ğ	DYNAMIC PENETRATION TEST, BLOWS/0.3m	
									STANDARD PENETRATION TEST, BLOWS/0.3m	
- 0 -	60.97								10 20 30 40 50 60 70 80	90
	60.9	25 mm ASPHALT	[🕅							ÏF
	60.6	¬FILL : dark brown silty sand	۲							ΪĒ
-		with gravel, trace bricks								ļ
-1-		LIMESTONE with shaly			HQ	1	100%	78%		Ĩ
		partings								1
		~					 			ΪĒ
-		-Grey								
2		-Good to excellent rock mass								iF
		quality -Very close to wide spacing			HQ	2	91%	83%		¦⊧
		-Strong intact rock strength								įĘ
		-Unweathered								
- 3 -		-Fractured dip 0 to 20°								ļŀ
			Ш							iÈ
		See Field Core Log for detailed								<u> </u> }
		description of rock core	Ē		HQ	3	100%	87%		ίĒ
- 4 -										+
										iE
					-					ł
										įĘ
- 5 -										╬
					HQ	4	97%	100%		!E
										¦È
										ļĘ
- 6 -									[┷] <mark>┫╫╎┼╬╬╬╫╫╗╇╬╗╎╎╎╏╎╎╎╎╎╎╎╎╎╎╎╎╎╎╴</mark>	. 1
										۱F
					HQ	5	100%	93%		
- 7 -									┢┾┶┽┼┤┥╏╎╎╏┥┿┺┶╬╎╪╅╬┽┥╋╘┼┥┥╌╖╸	ιE
-										
-			F						╺┥┼┊┼┼╏┟┦╏┇╎┍╽┊╽╷╞╎╽╞╎┟╎┟╎╎╎╎╎╎╎╎╎╎╎╎	1 E.
-				Ţ						
- 8 -			T						╶ <u>┠┼┼╆┼╞╄┼┺┊╞┼┾╞╞╪╪</u> ╪┽┿╋┼┿┝╞┾┼┼	Ŧ
-					HQ	6	95%	95%		С.
-										ļĒ
										iÈ
- 9 -				4						Ŧ
										١Ē
-										
			\square	4	HQ	7	100%	100%	6	
-10-				n		I	I	I	 Field Vane Test, kPa 	4
		☑ Inferred Groundwater Level							 Remoulded Vane Test, kPa App'd 	
		✓ Groundwater Level Measured in S	Standi	pipe					Δ Pocket Penetrometer Test, kPa Date	_
L				•						

Stantec

% SI	tantec	MONITORING WELL RECORD	MW	12-4
CLIENT	Richcraft Group	of Companies	BOREHOI E No	MV

2 of 3

	_IENT	Richcraft Group of Companies							BOREHOLE No MW 12-4
		250 Parkdale Ave Ottawa, ON							PROJECT No. 122410780
D/	ATES: BO	RING January 13, 2012 WAT	TER Li	EVE	L		Janu	<u>ary 25</u>	, 2012 DATUM Geodetic
	Ê		F			SA	MPLES		UNDRAINED SHEAR STRENGTH - kPa 50 100 150 200
DEPTH (m)	ELEVATION (m)		STRATA PLOT	WATER LEVEL		£	RY	шо	l
DEPT	EVAT	SOIL DESCRIPTION	RATH	TER	ТҮРЕ	NUMBER	RECOVERY (mm)	N-VALUE OR RQD	WP W WL WATER CONTENT & ATTERBERG LIMITS H
ц.	ELE		ST	۸v	F	N	REC (Ϋ́ς	DYNAMIC PENETRATION TEST, BLOWS/0.3m
			_						STANDARD PENETRATION TEST, BLOWS/0.3m
-10 -		LIMESTONE with shaly			Π				
1		partings							
			E						
-11-		-Grey -Good to excellent rock mass							
		quality	F		HQ	8	98%	98%	
		-Very close to wide spacing				Ŭ	2070	10/0	
-		-Strong intact rock strength -Unweathered	H						
-12-		-Fractured dip 0 to 20°							
-		See Field Core Log for detailed			HQ	9	100%	100%	
-13-		description of rock core	\square			,	10076	10070	
-									
					.				
-									
-14-									
			F		НQ	10	98%	98%	
-									
-15-									
1									
-16-			\square		HQ	11	100%	89%	
1									
-17-			F						
- 1					НQ	12	97%	94%	
1			H						
-18-									┠┿┿╪╄╋┿┽╎╎┠╎╎┼┟┠╎┼┥╋╎╎╏╎╎╎┥╋┧┥┥┥┥
					1				
			Þ						
-19-			\square		HQ	13	100%	100%	
-19-]						~~		100/0	
1	41.3	End of borehole	- =		Ц				
-20 -	1			<u> </u>	1	I	I	l	 Field Vane Test, kPa
		♀ Inferred Groundwater Level							 Remoulded Vane Test, kPa App'd
		▼ Groundwater Level Measured in S	tandp	oipe					△ Pocket Penetrometer Test, kPa Date

	IENT		<u>craft (</u>	-		-																							[W	
	CATION TES: BO								EVE	r		Jani	Jary 25	5. 20	012)				P	RO. 14 T	JEC TIM	1 T.N	۱ 0 .				<u>122</u>	<u>41</u> lec	<u>v</u> de
T	.125. DC						WA11			——————————————————————————————————————		MPLES	<u>, , , , , , , , , , , , , , , , , , , </u>	T									_				- kPa			
(יווי) בידינים	ELEVATION (m)		SOI	L DESC	RIPTIC	DN		STRATA PLOT	WATER LEVEL	ТҮРЕ	NUMBER	RECOVERY (mm)	N-VALUE OR RQD		DYN	IAMI	CON C PI	ENE	TRA	101	ERE	ST, I	BLO	wits ws/0).3m		W _P	C	20 	0 W
;e+											ļ			ļ	1	0	2	20	2	30	4	10	5	i0	6	0	70	,	80	
1		Mor	itoring	g well i	nstall	ed																								
₩																														
4																														
5																	11										- 1			
9. 1.1.1.1.1.1.1																								1						
ببينيابيعين																1									H					
7																		li												
8																														
9-1 1 1 1 1 1 1																													1	

ġ	ا کھ کھ	antec	BO	RI	EHO)L]	E RI	ECO	RD	E	BH 12-5
1	LIENT	Richcraft Group of Companies								BOREHOLE No.	<u>BH 12-5</u>
1		250 Parkdale Ave Ottawa, Ol									<u>122410780</u>
D	ATES: BC	RING January 12, 2012 W	ATER L	EVE	L		MPLES		UNDF	AINED SHEAR STRE	
Ê	(m) N		LOT	EVEL			l		50	100	150 200
DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	ТҮРЕ	NUMBER	RECOVERY (mm)	N-VALUE OR ROD	WATER CONTENT &	ATTERBERG LIMITS	' ₩ _P w ['] ₩ _L ∔ I
Δ			STF	WA.		INN	а Ш С С С С	2 K 2 K		ATION TEST, BLOWS/0.3	
	62.89									RATION TEST, BLOWS/0 30 40 50	60 70 80 90
	62.8	76 mm ASPHALT									
		FILL : brown to dark brown silt gravel with sand, some rock	' ^y 👹								
-1-	61.7	fragments			SS	1		50/			
		End of borehole						152mm			
		Auger refusal on inferred									
- 2 -		bedrock									
- 3 -											
- 4 -											
- 5 -											
- - 											
- 6 -											
										1 1 1 1	
- 7 -										┝╉┼┼┼┼╉┟╄┼┾╋┼┾┼	┿ ┋╎┥╎┊ <u></u> ┟┽┠┿╋╋┽┨┼ ┋ ╸
											1 111 111 111
- 8 -										┇ <mark>╸╷╻╷╕</mark> ╎╷╽╻╻╏╻┆╽	┇ <mark>╡┇┇┇┇┇</mark> ┇┇┇┇┇ <mark>╴</mark> ╋╋╋╋╋╋╋╋╋╋╋╋╋╋╋╋╋╋╋
-										1 1 1	
_ 9 _											
- 9 -											
-10							Į				
		고 Inferred Groundwater Level								Vane Test, kPa	App'd
		Groundwater Level Measured in	n Standp	oipe					△ Pocket Pene	trometer Test, kPa	Date

STAN-GEO 122410780_PARKDALE_SCOTT.GPJ SMART.GDT 2/3/12

Ĵ.														
	Stantec													
		Richc	sraft Gr	Richcraft Group of Companies						ā	Project No.:	Vo.:	122410780	
		Parko	Parkdale at Scott	t Scott						۵	Date:		January 12, 2012	
Contractor:										à	Borehole No.:	e No.:	MW 12-3 (page 1	1 of 3)
										ĭ	Logger:		Bridgit Bocage	
	ВΥ					Ę			DISCONTINUITIES	LINNIL	TIES			
RUN NO.	№ СОВЕ ВЕСОЛ	% вор	DEPTH TO	GENERAL DESCRIPTION (Rock Type/s, %, Colour, Texture, etc.)	STRENGTH	меатневии	NO. OF SETS	S/3dyt	ΝΟΙΤΑΤΝΞΙΆΟ	SPACING	ROUGHNESS АРЕRTURE		OCCASIONAL FEATURES	DRILLING OBSERVATIONS
								8	F V0	VC/M	RU	1 		
HQ 1	100	61	1.35	Grey Limestone		Э							Shale Partings	
			, ,			=	, ,				RU	+ +		
Z ZHUZ	4X	× ×	7.84	drey Limestone		>	v 1		>	الآلا	5	-		
								В	Р	M/W	RU			
HQ 3	100	100	4.37	Grey Limestone		∍							Shale Partings	
												_		
							T_	6			ßU			
HQ 4	100	94	5.89	Grey Limestone		>	7	е 2	>	Z/M	RU 	⊢ 		
			STREN	L STRENGTH (MPa)	DISCONTINUITY TYPE		비		- 8	ORIENTATION	NOL			EILLING
Str	EH = Extremely Strong = > 250 VS = Very Strong = 100-250	ng = > 2 00-250	250	VW = Very Weak = 1-5 B = Be EW = Extremely Weak = <1 J = Cro	B = Bedding Joint J = Cross Joint	nt		". "	F = Flat = 0-20 ⁰ D = Dipping = 20-50 ⁰	0-20° ng = 20	-500		T = Tight, Hard O = Oxidized	Ţ
liur a	S = Strong = 50-100 MS = Medium Strong = 25-50	g = 25-5	50	F = Fault S = Shear	F = Fault S = Shear Plane			>	= n-Ver	tical = :	~50°		SA = Slightly Altered, Clay Free S = Sandy, Clay Free	ered, Clay Free ^E ree
يد. ا	W = Weak = 5 - 25							i	ROUGHNESS	ROUG	ROUGHNESS		Si = Sandy, Silty, Minor Clay NC = Non-softening Clay	Minor Clay ning Clay
ath Sath	<u>WEATHERING</u> U = Unweathered = No Signs	<u>ING</u> No Sign	SC	= M/	VW = Very Wide = >3m	<u>ING</u> e = >3m	-	RP	RP = Rough Planar	gh Plan;	ulating ar		SC = Swelling, Soft Clay	oft Clay
ly = erat	S = Slightly = Oxidized M = Moderately = Discoloured	ed iscoloui	red	> = N	W = Wide = 1-3 m M = Moderate = 0.3-1 m	= 0.3-1 i	E	N S S	su = smooth Unuu SP = Smooth Planar	oun un oth Plai	su = smooth unuulating SP = Smooth Planar			
y =)	H = Highly = Friable C = Completely = Soil-like	il-like		C = C <	C = Close = 5-30 cm VC = Very Close = <5 cm	0 cm := <5 cr	Ę	<u>Р</u>	= Slick	ensided ensided	LU = Slickensided Undulating LP = Slickensided Planar	iting		

S	č

Stantec

Project: **Client:**

Contractor:

Richcraft Group of Companies Parkdale at Scott

Field Core Log

122410780

Project No.:

		•	-								I			:		
Project:	ę	-	rark(Parkdale at Scott	20011					i.	ł	Date;	10	-	January 12, 2012	
Contractor:	ctor:	•									1	Bore	Borehole No.:	Vo.:	MW 12-3 (page 2 of 3)	2 of 3)
											Ļ	Logger:	er:		Bridgit Bocage	
		۶RY								DISC	ONTIN	DISCONTINUITIES				
DEPTH FROM	ои иля.	% сове весо∧і	א מס	DEPTH TO	GENERAL DESCRIPTION (Rock Type/s, %, Colour, Texture, etc.)	etc.)	RENGTH	WEATHERING		иоітатизіяо	SPACING	волениега	АРЕЯТИВЕ	LILLING	OCCASIONAL FEATURES	DRILLING OBSERVATIONS
									8	ш	C/M	RP		н		
5.89	HQ 5	66	82	7.42	Grey Limestone			۲ 	8	>	υ	л. В		⊢	Shale Partings	
								-	<u></u>	<u>ц</u>	C/M	RU/RP		F		
7.42	HQ 6	91	85	8.94	Grey Limestone					· · · ·					Shale Partings	
							1		8	<u>ц</u>	c/M	C/M RM/RP		F		
8.94	HQ 7	100	100	10.47	Grey Limestone			U 1								
									m	ш	VC/ℕ	VC/M RU/RP		⊢		
10.47	HQ 8	100	66	11.96	Grey Limestone			 ⊃								
				STRENG	STRENGTH (MPa)	DISCOL	DISCONTINUITY TYPE	Υ ΤΥΡΕ			ORIEN	ORIENTATION			EILLING	NG
EH = E)	EH = Extremely Strong = > 250	y Stron	1g = > 2	50	VW = Very Weak = 1-5	B = Bedding Joint	ig Joint			F ≈ Fla	F = Flat = 0-20 ⁰	Jo 20 100			T = Tight, Hard	
S = Strc	v5 = Very Strong = 100-250 S = Strong = 50-100	ng = 10)-100	Nc2-UL		EW = EXtremely weak = < 1	J = Cross Joint F = Fault	JUIC			1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	pping = /ertica	U = UIPPING = 20-50° V = n-Vertical = >50°			U = Uxlaizea SA = Slightly Altered, Clay Free	ed, Clay Free
MS = N	MS = Medium Strong = 25-50	Strong	; = 25-5	20		S = Shear Plane	lane								S = Sandy, Clay Free	ee .
≫ ≈ >	W ≈ Weak = 2.2	c7 -	1								RO I dano	BUI - Bouch Underlag	<u>SS</u>		<pre>>I = Sandy, Slity, Minor Clay NC = Non-softening Clay</pre>	Vinor Clay ng Clav
n = Un	<u> </u>	<u>WEALHERING</u> athered = No 5	NG Jo Sign:	ŝ		<u>SPACING</u> VW = Verv Wide = >3m	<u> v Wide =</u>	-3m		$RP = R_{c}$	RP = Rough Planar	anar	Ď		SC = Swelling, Soft Clay	t Clay
S = Slig	S = Slightly = Oxidized	vidized	, ~~			W = Wide = 1-3 m	= 1-3 m			SU = SI	mooth	SU = Smooth Undulating	ting			
¥ ₩ ₩	M = Moderately = Discoloured	ily = Dis intere	scolour	ed		M = Moderate = 0.3-1 m	rate = 0	.3-1 m		SF = SI	SP = Smooth Planar LU = Slickensided Ur	SP = Smooth Planar LU = Slickensided Undulating	dulatin	5		
	н = нівліу = ггіаріе C = Completelv = Soil-like	/ = Soil-	-like			U = Ulose = 5-30 cm VC = Verv Close = <5 cm	: >-30 Cf Close = <	5 cm		LP = Sli	ickensi	LP = Slickensided Planar	nar	•		

V:\01224\active\1224107XX\122410780\Report 2_Scott\Core log and photos\field_core_logs_Version2.xlsx

Page 2 of 7

S	Stantec
---	---------

Project: Client:

Log
Core
Field

	Parkdale at Scott	Parkdale at Scott	Date: Borehole No.:	122410/80 January 12, 2012 MW 12-3 (page 3 of 3) Bridgit Rocage
DEPTH TO		GENERAL DESCRIPTION (Rock Type/s, %, Colour, Texture, etc.) STRENGTH WEATHERING	TYPE/S	OCCASIONAL DRILLING FEATURES OBSERVATIONS
100 13.46	(n	Grey Limestone U 1	B F M/W RU T	Lost water @ 39'3" Water appeared at approx 41'
96 14.96	i ()	Grey Limestone U 1	B F C/M SU T	Lost water @ approx. 44'2"
100 16,46	1 10	Grey Limestone U 1	B F M SU	
EH = Extremely Strong = > 250 VS = Very Strong = 100-250 S = Strong = 50-100 MS = Medium Strong = 25-50 W = Weak = 5 - 25 W = U = Unweathered = No Signs S = Slightly = Oxidized M = Moderately = Discoloured H = Highly = Friable C = Completely = Soil-like		STRENGTH (MPa) DISCONTINULITY TYPE 0 VW = Very Weak = 1-5 B = Bedding Joint 0 VW = Very Weak = <1	<u>ORIENTATION</u> F = Flat = 0-20° D = Dipping = 20-50° V = n-Vertical = >50° KU = Rough Undulating RP = Rough Planar SU = Smooth Planar LP = Slickensided Undulating LP = Slickensided Planar	FILLING T = Tight, Hard O = Oxidized SA = Sightly Altered, Clay Free S = Sandy, Clay Free Si = Sandy, Silty, Minor Clay NC = Non-softening Clay SC = Swelling, Soft Clay

V:\01224\active\1224107XX\122410780\Report 2_Scott\Core log and photos\field_core_logs_Version2.xlsx

Project: Richcraft Group of Companies Project: P				
Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second Effection Image: Second	Projec Date:	ct No.:	122410780 January 13, 2012	
No. CORE R. R. R. COVERTION No. OF SETS R. UN NO. CORE K. R. R. R. COVERTION NO. OF SETS M. NO. 78 1.42 Grey Limestone U 1 H. D. 78 1.42 Grey Limestone U 1 H. D. 83 2.92 Grey Limestone U 1 B H. D. 91 83 2.92 Grey Limestone U 1 H. D. 91 83 2.92 Grey Limestone U 1 H. D. 91 83 2.92 Grey Limestone U 1 H. D. 91 100 0 Grey Limestone U 1 1 H. D. 97 100 0 Grey Limestone U 1 1 M. Extremely Strong = 250 WW = Very Weak = 1-5 B B B M. Extremely Strong = 250 WW = Streenely Weak = 1-5 B B B M. Extremely Weak = 5-25 WW = Streenely Weak = 3-3 S S S	Bor	Borehole No.: M Logger: Br	MW 12-4 (page 1 of 4) Bridgit Bocage	l of 4)
No. CORE RECOVE Merch THERING RUN NO. % ROD Merch THERING % ROD Merch THERING RUN NO. % ROD 78 1.42 Grey Limestone U 1 HQ.1 100 78 1.42 Grey Limestone U 1 B HQ.2 91 83 2.92 Grey Limestone U 1 D HQ.3 100 87 4.42 Grey Limestone U 1 1 D HQ.3 100 87 4.42 Grey Limestone U U 1 B HQ.3 100 87 4.42 Grey Limestone U U 1 D FixeNGTHIMPal 0 0 Grey Limestone U U 1 D B BGGONTINUTY TAPE Corp Strong = 2550 VW = Very Weak = 1-5 B BGGONTINUTY TAPE E E E D D D D D D D D E E E E E E E E	DISCONTINUITIES	S		
HQ 1100781.42Grey LimestoneU1BHQ 291832.92Grey LimestoneU2BHQ 291832.92Grey LimestoneU2BHQ 3100874.42Grey LimestoneU12BHQ 4971000Grey LimestoneU11BExtremely Strong = 250VW = Very Weak = 1-5B = Bedding JointU11Extremely Strong = 250VW = Extremely Weak = <1		АРЕЯТИВЕ БИІЦІЙ	OCCASIONAL DRIL FEATURES OBSERV	DRILLING OBSERVATIONS
HQ.1100781.42Grey LimestoneU1HQ.291832.92Grey LimestoneU2 $\frac{B}{B}$ HQ.3100874.42Grey LimestoneU2 $\frac{B}{B}$ HQ.3100874.42Grey LimestoneU1 $\frac{B}{B}$ HQ.49710000Grey LimestoneU1 $\frac{B}{B}$ HQ.49710000Grey LimestoneU1 $\frac{B}{B}$ Extremely Strong = 100-250VW = Very Weak = 1-5B = Bedding JointJintImage: SeconTINUITY TYPECong = 50-100WW = Very Weak = 1-5B = Bedding JointJintJintJintMedium Strong = 100-250EW = Extremely Weak = <1				
HQ<291832:92Grey LimestoneU2BHQ<3			Shale P	Shale Partings
HQ.291832.92Grey LimestoneU2BHQ.3100874.42Grey LimestoneU2BHQ.3100874.42Grey LimestoneU1BHQ.4971000Grey LimestoneU1BHQ.49710000Grey LimestoneU1BKremely Strong = 250WW = Very Weak = 1-5B = Bedding JointJ = Cross JointKremely Strong = 100-250EW = Extremely Weak = <1				
HQ 3100874.42Grey LimestoneU2BHQ 49710000Grey LimestoneU1 $\frac{1}{2}$ $\frac{1}{2}$ HQ 49710000Grey LimestoneU1 $\frac{1}{2}$ $\frac{1}{2}$ Extremely Strong = 2550VW = Very Weak = 1-5E = Bedding JointJISCONTINUITY TYPEExtremely Strong = 25-50VW = Very Weak = <1	V C/M	T	Shale P	Shale Partings
HQ 3100874.42Grey LimestoneU2BHQ 49710000Grey LimestoneU1BHQ 49710000Grey LimestoneU1BExtremely Strong = 50-1005TRENGTH (MPa)NW = Very Weak = 1-5B = Bedding JointHYPEExtremely Strong = 50-100VW = Very Weak = <1				
HQ 3100874.42Grey LimestoneU2BHQ 49710006rey LimestoneU1BHQ 49710006rey LimestoneU1Extremely Strong = 250VW = Very Weak = 1-5B = Bedding JointVery Strong = 100-250EW = Extremely Weak = <1		T		
HQ.4 97 100 0 Grey Limestone U 1 Extremely Strong = > 250 VW = Very Weak = 1-5 B = Bedding Joint Extremely Strong = 25-50 VW = Very Weak = <1		-	Shale P	Shale Partings
$ \left HQ.4 \right \begin{array}{ c c } 97 \\ 100 \\ 0 \\ \hline \\$				
HQ.4971000Grey LimestoneU1Extremely Strong = > 250VW = Very Weak = 1-5B = Bedding JointExtremely Strong = 100-250VW = Very Weak = <1	_	+		ulto Doutin
STRENGTH (MPa) DISCONTINUITY TYPE 5 = > 250 VW = Very Weak = 1-5 B = Bedding Joint 0-250 EW = Extremely Weak = <1				Silale rai uligo
 \$= > 250 VW = Very Weak = 1-5 \$= 250 EW = Extremely Weak = <1 \$= 5 = 50 \$= 25 - 50 \$= 25 - 50 \$= Shear Plane \$= Shear Plane \$= SpaciNG \$W = Very Wide = >3m \$W = Wide = 1-3 m 	ORIENTATION	N	EILLING	ING
D-250 EW = Extremely Weak = < 1 J = Cross Joint F = Fault S = Shear Plane S = Shear Plane VW = Very Wide = >3m W = Wide = 1-3 m	$F = Flat = 0-20^{\circ}$		T = Tight, Hard	
E = Fault = 25-50 S = Shear Plane S = Shear Plane VW = Very Wide = >3m V = Wide = 1-3 m	D = Dipping = 20-5(00	0 = Oxidized	
$\frac{1}{100} = \frac{1}{100} = \frac{1}$	V = n-Vertical = >5(20	SA = Slightly Altered, Clay Free S = Sandy, Clay Free	red, Clay Free ree
IG D Signs W = Wide = -3m W = Wide = 1-3 m	ROUGHNESS	IESS	Si = Sandy, Silty, Minor Clay	Minor Clay
	RU = Rough Undulating RP = Rough Planar SU = Smooth Undulating SP = Smooth Planar	ating lating r	NC = Non-softening Clay SC = Swelling, Soft Clay	ing Clay ft Clay
M = Moderately = Discoloured H = Highly = Friable C = Close = 5-30 cm LP = Slicken C = Completely = Soil-like	LU = Slickensided Undulating LP = Slickensided Planar	Indulating lanar		

V:\01224\active\1224107XX\122410780\Report 2_Scott\Core log and photos\field_core_logs_Version2.xlsx

a ser and the set first states to an firm of the set

Page 1 of 1

Field Core Log

Stantec

		.2	: 2 of 4)			DRILLING OBSERVATIONS		Shale Partings			Shale Partings		Shale Partings			Shale Partings	rd FilLING		SA = Slightly Altered, Clay Free	Free	, Minor Clay ning Clav	oft Clay			
	122410780	January 13, 2012	MW 12-4 (page 2 of 4)	Bridgit Bocage		OCCASIONAL FEATURES											<u>Fil</u> T = Tight, Hard	0 = Oxidized	SA = Slightly Alt	S = Sandy, Clay Free	Si = Sandy, Silty, Minor Clay NC = Non-softening Clav	SC = Swelling, Soft Clay			
	•					LILLING	Т		_	-		⊢			T									50	
	sct No		hole N	:e		ЭЯ∪ТЯЭ٩А															នា ន	20	ing	dulating	Idf
	Proje Date: Boreł Logge		Project No.: Date: Borehole No.: Logger:			ROUGHNESS	RU			SU/SF		M/W SU/RU			su/RU			20-50°	$V = n-Vertical = >50^{\circ}$		ROUGHNESS	ко = коиgn Unaulaung RP = Rough Planar	SU = Smooth Undulating	LU = Slickensided Undulating	LP = Silckensided Planar
			DISCONTINUITIES	SPACING	c/M			M/M		M/W			c/W		F = Flat = 0-20°	bing =	ertical		ROL	ки = коиgn Unauia RP = Rough Planar	SU = Smooth Undula SP = Smooth Planar	ckensic	rkensig		
			DISCO	ΝΟΙΤΑΤΝΞΙΆΟ	щ			u		ш			ц.		л 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	D = Dip	u = N			RP = Ro RP = Ro	SU = Sn SP = Sm	LU = Sli			
					түре/з	8			В		æ			В						-		0, 0	,		
						NO. OF SETS					сц					PE					c	-	E	E	
					¢.	меатневии		⊃			⊃		∍			⊃		-				NG P 230	5 . E	= 0.3-1) cm	= <5 ci
						STRENGTH											<u>Discontinuity Type</u> B = Bedding Joint J = Cross Joint F = Fault S = Shear Plane W = Vide = 1-3 m M = Moderate = 0.3-1 m		lerate = = 5-30	y Close					
	Richcraft Group of Companies	Scott				GENERAL DESCRIPTION (Rock Type/s, %, Colour, Texture, etc.)		Grey Limestone			Grey Limestone		Grey Limestone			Grey Limestone	STRENGTH (MPa) 0 vov = Verv Weak = 1-5 0 vov 8 = 8edr	=<1		S = Shea			W = Wid	M = Moderate = 0.3 C = Close = 5-30 cm	VC = Very Close = <5 cm
	aft Gr	ale at (DEPTH TO		7.47			8.97		10.54			12.04	STRENC	2		~				ŋ	
	Richcr	Parkdale at Scott				% KOD		97			95		100			86	<u>S</u> EH - Extremely Strong = > 250	6 - 7 4J		= 25-5(<u>NG</u> o ^{Ciane}	10 21812	coloure	like
<u>fec</u>	-1	- 1	. 1		ки	% сове весо∧і		100			95		100			98	Strong	y Ju Ul (10 = 20	-100	Strong	- 25	WEATHERING	xidized	ly = Dis iable	/ = Soil-
Stantec			tor:			'ON NUA		HQ 5			HQ 6		HQ 7			HQ 8	trameh.	IN Stroi	ng = 50	ledium	ak = 5	WEA WEA	ntly = 0	derate ۱۱۷ = Fri	npletely
¥1	Client:	Project:	Contractor:			DEPTH FROW		5.92			7.47		8.97			10.54		VS = Very Strong = 100-250	S = Strong = 50-100	MS = Medium Strong = 25-50	W = Weak = 5 - 25	WEATHERING	S = Slightly = Oxidized	M = Moderately = Discoloured H = Highly = Friable	C = Completely = Soil-like

V:\01224\active\1224107XX\122410780\Report 2_Scott\Core log and photos\field_core_logs_Version2.xisx

Allowed Short States



Field Core Log

Client: Richard: Group of Companies Project: Project: 232410780 Contractor: Parciale at Scott Barrow 13, 2012 Barrow 13, 2012 Contractor: Parciale at Scott Barrow 14, 2012 Barrow 13, 2012 Contractor: Parciale at Scott Barrow 14, 2012 Barrow 14, 2012 Contractor: Parciale at Scott Barrow 14, 2012 Barrow 14, 2012 Contractor: Contractor: Parciale at Scott Barrow 14, 124 Contractor: Contractor: Parciale at Scott Barrow 14, 124 Contractor: Contractor: Contractor: Barrow 14, 124 Contractor: Contractor: Contractor: Barrow 14, 124 Contractor: Contractor: Contractor: Contractor: Contractor: Contractor: Contractor: Contractor: Contractor: Contractor: Contractor: Contractor: Contractor: Contractor: Contractor: Contractor: Contractor: Contractor: Contractor: Contractor: Contractor: Contractor	D M	Stantec	tec										Field Core Log	ore Log
Partner Date: Date: <thdate:< th=""> Date: Date: <</thdate:<>	Client:		-	Richc	sraft Gro	oup of Companies			19 10 10 10 10 10 10 10 10 10 10 10 10 10	Pro	ject N		122410780	
Logger: Logger: Eridit Bocage % % QC % RQD D	Contra	: ctor:	-	Park	dale at :	Scott					te: rehole	No.:	MW 12-4 (nage	2 3 of 4)
Поли Поли <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>ro Lo</td><td>gger:</td><td></td><td>Bridgit Bocage</td><td>(</td></t<>										ro Lo	gger:		Bridgit Bocage	(
No. Cork RR (C) (NO.K Type/5, %, Colour, Texture, etc.) FT MTHE (RINC (ROCK) (Rock Type/5, %, Colour, Texture, etc.) SSET IS (ROCK) (Rock Type/5, %, Colour, Texture, etc.) SSET IS (ROCK) (Rock Type/5, %, Colour, Texture, etc.) SSET IS (ROCK) (R			793						DISCONT	INUITI	ES			
HQ310010013.54Grey LimestoneU1BF M/W RUTSHQ39815.06Grey LimestoneU1BF M/W RUTS10989815.06Grey LimestoneU1BF N/W RUTS111008916.64Grey LimestoneU1BF $V/C/M$ RUTS111008916.64Grey LimestoneU1BF $V/C/M$ RUTS111008916.64Grey LimestoneU11BF $V/C/M$ RUS111008916.64Grey LimestoneU11BF $V/C/M$ RUS111008916.64Grey LimestoneU11BF $V/C/M$ TS111008916.64Grey LimestoneU11BF $V/C/M$ RUTS12979418.16Grey LimestoneU11BF $V/C/M$ RUTS12979418.16Grey LimestoneU11BF $V/C/M$ RUTS13979418.16Grey LimestoneU11BF $V/C/M$ RUTS14 <td>№ОЯЭ НТЧЭО</td> <td>RUN NO.</td> <td>% сове весолі</td> <td>% BQD</td> <td>DEPTH TO</td> <td>аткеиетн</td> <td></td> <td>түре/з</td> <td></td> <td></td> <td></td> <td>EIFRING</td> <td>OCCASIONAL FEATURES</td> <td>DRILLING OBSERVATIONS</td>	№ОЯЭ НТЧЭО	RUN NO.	% сове весолі	% BQD	DEPTH TO	аткеиетн		түре/з				EIFRING	OCCASIONAL FEATURES	DRILLING OBSERVATIONS
HQ310013.54Grey LimestoneU1IIIIHQ9815.06Grey LimestoneU1 $\frac{1}{10}$								В				⊢ 		
HQ9815.06Grey LimestoneU1BFM/W RP/RUT108915.64Grey LimestoneU1BFV/MRUTHQ911008916.64Grey LimestoneU1BFV/MRUT111008916.64Grey LimestoneU1BFV/MRUTSHQ9113.16Grey LimestoneU1BFV/MRUTSHQ9418.16Grey LimestoneU1BFV/MRUTSHQ9418.16Grey LimestoneU1BFV/MRUTSHQ9418.16Grey LimestoneU11PPTSHQ9418.16Grey LimestoneU11FFTSStrenety Strong = 250EW = Extremely Weak = 1-5BBBECoss JointVTTTSever Strong = 100-250EW = Extremely Weak = 4-1JJCoss JointVNFFFTSever Strong = 25-00EW = Extremely Weak = 4-1JJCoss JointVNFFFFFFFFFFFFFFFFFFFFFF	12.04	HQ 9		100	13.54	Grey Limestone							Shale Partings	
HQ 10989815.06Grey LimestoneU1IIIIHQ 111008916.64Grey LimestoneU1BFVC/MRUTSHQ 11979418.16Grey LimestoneU1BFVC/MRUTSHQ 12979418.16Grey LimestoneU1BFVC/MRUTSHQ 12979418.16Grey LimestoneU1BFVC/MRUTSHQ 12979418.16Grey LimestoneU11BFVC/MRUTSHQ 12979418.16Grey LimestoneU11BFVC/MRUTSHQ 12979418.16Grey LimestoneU11FFTSAremely Strong = 250WW = Very Weak = 1.5B = Bedding JointD = Dipping = 20-50°FF </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td><u> </u></td> <td></td> <td>/W RP/</td> <td>2</td> <td> <u> -</u></td> <td></td> <td></td>								<u> </u>		/W RP/	2	<u> -</u>		
HQ108916.64Grey LimestoneU1BFVC/MRUTSi111008916.64Grey LimestoneU1 $\frac{1}{12}$ $\frac{1}{1$	13.54	Å 6	98	86 86	15.06	Grey Limestone			+				Shale Partings	
111008916.64Grey LimestoneU1PNHQ979418.16Grey LimestoneU1BF VC/M RUTHQ979418.16Grey LimestoneU1BF VC/M RUTSTRENGTH (MPal 12STRENGTH (MPal stremely Strong = >250EW = Extremely Weak = 1-5DISCONTINUITY TYPEORIENTATION TYPEstremely Strong = >250EW = Extremely Weak = <1		Ç					ļ	8						
HQ 1297 949418.16Grey LimestoneU1 $B = F VC/M RU $ T12979418.16Grey Limestone $U $ 1 $B = F VC/M RU $ $T $ STRENGTH (MPa)STRENGTH (MPa)STRENGTH (MPa)DISCONTINUITY TYPE $CRENTATION$ Stremely Strong = 250VW = Very Weak = 1-5 $B = Bedding JointE = Fiat = 0-20^{\circ}etry Strong = 100-250EW = Extremely Weak = <1$	15.06	11	100	68 68	16.64	Grey Limestone							Shale Partings	
STRENGTH (MPa)DISCONTINUITY TYPEORIENTATION> 250VW = Very Weak = 1-5 $B = Bedding Joint$ $F = Flat = 0-20^{\circ}$ > 250VW = Very Weak = <1	16.64	НД 12	97	94	18.16	Grey Limestone		8				H	Shale Partings	
> 250VW = Very Weak = 1-5B = Bedding JointF = Flat = 0-20°50EW = Extremely Weak = <1					STRFNG		TYPE		ORI	ENTATIO				ING
OEW = Extremely weak = <1 $J = -Closs JointJ = -Clos$	EH = E	tremel	V Stron	16 = 2 20 - 10	150	ery Weak = 1-5 B =			F = Flat = C D = Dinnin)-20° « - 20 E	2		T = Tight, Hard	
5-50S = Shear PlaneROUGHNESS5-50 $\underline{SPACING}$ $\underline{RU} = Rough Undulating$ SP = Rough Undulating $\underline{VW} = Very Wide = >3m$ $RP = Rough Planar$ gns $VW = Very Wide = 1-3 m$ $SU = Smooth Undulating$ w = Wide = 1-3 m $SU = Smooth Undulating$ bured $M = Moderate = 0.3-1 m$ $SP = Smooth Planar$ $C = Close = 5-30 cm$ $LP = Slickensided Undulating$ $VC = Very Close = <5 cm$ $LP = Slickensided Planar$	s = Str	ang = 51	0-100	062-00					V = n-Vert	g = 20-7	00		SA = Slightly Alte	rred, Clay Free
SPACING gnsRU = Rough Undulating RP = Rough PlanargnsVW = Very Wide = >3mRP = Rough PlanarVW = Very Wide = 1-3 mSU = Smooth Undulating SP = Smooth PlanarNuredM = Moderate = 0.3-1 mSP = Smooth PlanarDuredC = Close = 5-30 cmLU = Slickensided Undulating LP = Slickensided Planar	MS = N W = W	4edium eak = 5	i Stron€ - 25	g = 25-t	00	S = Shear Plane			1444	ROUGHI	VESS		S = Sandy, Clay F Si = Sandy, Silty,	ree Minor Clay
w = woe = 1-0 m M = Moderate = 0.3-1 m C = Close = 5-30 cm VC = Very Close = <5 cm	nu = 0 - 213	WE/ weathe	ATHERI red = N	<u>NG</u> Vo Sign	S	SPACING VW = Very Wide = >3 W = Wide = 1.3 m	3m		RU = Roug RP = Rough SU = Smoo	h Undul n Planar th Undu	ating Ilating		NC = Non-soften SC = Swelling, So	ing Clay ft Clay
	H Hi€	oderate hly = Fr npletel	ely = Di riable y = Soil	scolou -like	red	M = Moderate = 0.3- C = Close = 5-30 cm VC = Very Close = <5	1 m	—	SP = Smoo LU = Slicke LP = Slickeı	th Plana nsided (nsided P	r Jndulati Ianar	ng		

V:\01224\active\1224107XX\122410780\Report 2_Scott\Core log and photos\field_core_logs_Version2.xlsx

Field Core Log

		2012 366 4 of 4)	36 4 01 4 <i>]</i> 36		AL DRILLING OBSERVATIONS	St			FILLING T = Tight, Hard O = Oxidized SA = Slightly Altered, Clay Free S = Sandy, Clay Free S = Sandy, Silty, Minor Clay NC = Non-softening Clay SC = Swelling, Soft Clay
	122410780	January 13, 2012 MM/ 12-4 (nage 4 of 4)	Bridgit Bocage		OCCASIONAL FEATURES	Shale Partings			FILLING T = Tight, Hard O = Oxidized SA = Slightly Altered, Cl S = Sandy, Clay Free Si = Sandy, Silty, Minor NC = Non-softening Clay SC = Swelling, Soft Clay
	:t No.: ole No.: r:				EILLING	F			- -
					АРЕЯТИЯЕ				ng SS dulating nar
	Proje			CRIENTATION F = Flat = 0.20° D = Dipping = 20-50° V = n-Vertical = >50° RU = Rough Undulating RU = Rough Planar SU = Smooth Planar LU = Slickensided Undulating LP = Slickensided Planar					
	,		,	DISCONTINUITIES	SPACING	3			Provide a contraction of the second of the s
				DISC	οκιεντατιον	ш			F = Flat D = Dip D = Dip D = Dip D = Dip C = Dip C = Dip C = Dip C = C S = S S = S =
					TYPE/S	m			
				 	NO. OF SETS				
					MEATHERING	⊃			UITY TY UITY TY Int Int Int Int Int Int Int Int Int Int
					STRENGTH		 		<u>DISCONTINUITY TYPE</u> Bedding Joint Cross Joint Fault Shear Plane = Very Wide = >3m Moderate = 0.3-1 m Close = 5-30 cm = Very Close = <5 cm
	Richcraft Group of Companies	. 31011			GENERAL DESCRIPTION (Rock Type/s, %, Colour, Texture, etc.)	L Grey Limestone			STRENGTH (MPa) DISCONTINUITY TYPE 0 VW = Very Weak = 1-5 $B = Bedding Joint$ 0 VW = Very Weak = <1
	Richcraft Group o	זמוב מר	- - -		DEPTH TO	19.71			ed s co so se co s
	Richc				א אסט %	100			 EH = Extremely Strong = > 250 VS = Very Strong = 100-250 S = Strong = 50-100 MS = Medium Strong = 25-50 W = Weak = 5 - 25 U = Unweathered = No Signs S = Slightly = Oxidized M = Moderately = Discoloured H = Highly = Friable C = Completely = Soil-like
ntec				ВЛ	% СОВЕ ВЕСОЛЕ	100			emely Strong = Strong = 100-: 3 = 50-100 dium Strong = : k = 5 - 25 wEATHERING eathered = No 5 y = Oxidized erately = Disco letely = Soil-lik letely = Soil-lik
Stantec	io ide	د بردامر:	•		кли ио.	13 HQ			EH = Extremely Strong = > 2 VS = Very Strong = 100-250 S = Strong = 50-100 MS = Medium Strong = 25- ⁵ W = Weak = 5 - 25 U = Unweathered = No Sign S = Slightly = Oxidized M = Moderately = Discoloui H = Highly = Friable C = Completely = Soil-like
;	Client: Proiec*	Contractor:	* 5 8		DEPTH FROM	18.16			EH = E VS = V S = Str MS = h W = W W = U U = U H = Hig C = Coi

V:\01224\active\1224107XX\122410780\Report 2_Scott\Core log and photos\field_core_logs_Version2.xlsx

Page 7 of 7

Field Core Log

·

Stantec

	Project No.: 12	2410780		Rockcore
	Project Name:		opment	Photographs
Stantec		Parkuale Devel 2 2 2 2 2 2 2 2 2 2 2 2 2	opment	
Rock Core Photo No.:	1 Borehole:	MW 12-3	Depth: 0.89 -	- 3.40 m
		122410780 MW 12-3 3.4 _5.28 m		
Rock Core Photo No.:	2 Borehole:	MW 12-3	Depth: 3.40 -	- 5.28 m

S	Proie	ect No.: 12	22410780		Deskasse
				anmont	Rockcore Photographs
Stantec	Proje	ect name:	Parkdale Devel	opment	
			ине Синкие ими 122410780 МW 12-3 5.28 – 7.42 m		
Rock Core Photo No.:	3	Borehole:	MW 12-3	Depth: 5.28	– 7.42 m
			MW 12-3 7.42 -10.17 m		
Rock Core Photo No.:	4	Borehole:	MW 12-3	Depth: 7.42	– 10.17 m

			22410780		Rockcore
Stantec	Proje	ct Name:	Parkdale Devel	opment	Photographs
			Arrent and a second and a secon		
Rock Core Photo No.:	5	Borehole:	MW 12-3	Depth: 10.17	– 13.08 m
			122410780 MW 12-3 13.08 – 15.44 m		
Rock Core Photo No.:	6	Borehole:	MW 12-3	Depth: 13.08	– 15.44 m

5	Proje	ect No.: 12	22410780		Rockcore
Stantec	Proje	ect Name:	: Parkdale Deve	lopment	Photographs
			2 www.comming.com 2 mm 2 mm		
Rock Core Photo No.:	7	Borehole:	MW 12-3	Depth: 15.44	– 16.46 m
			122410780 MW 12-4 0.41 - 2.92 m		
Rock Core Photo No.:	8	Borehole:	MW 12-4	Depth: 0.41 -	– 2.92 m

	Proje	ect No.: 12	224107	80			Rockcore
Stantec	Proje	ect Name:	Parkd	ale Develo	opment		Photographs
				And Andrewski (1997) Andrewski (1997) Andrewsk			
Rock Core Photo No.:	9	Borehole:	MW 12		Depth:	0.00	5.92 m
				122410780 MW 12-4 5.92 -8.97 m			
Rock Core Photo No.:	10	Borehole:	MW 12	-4	Depth:	5.92 –	8.97 m

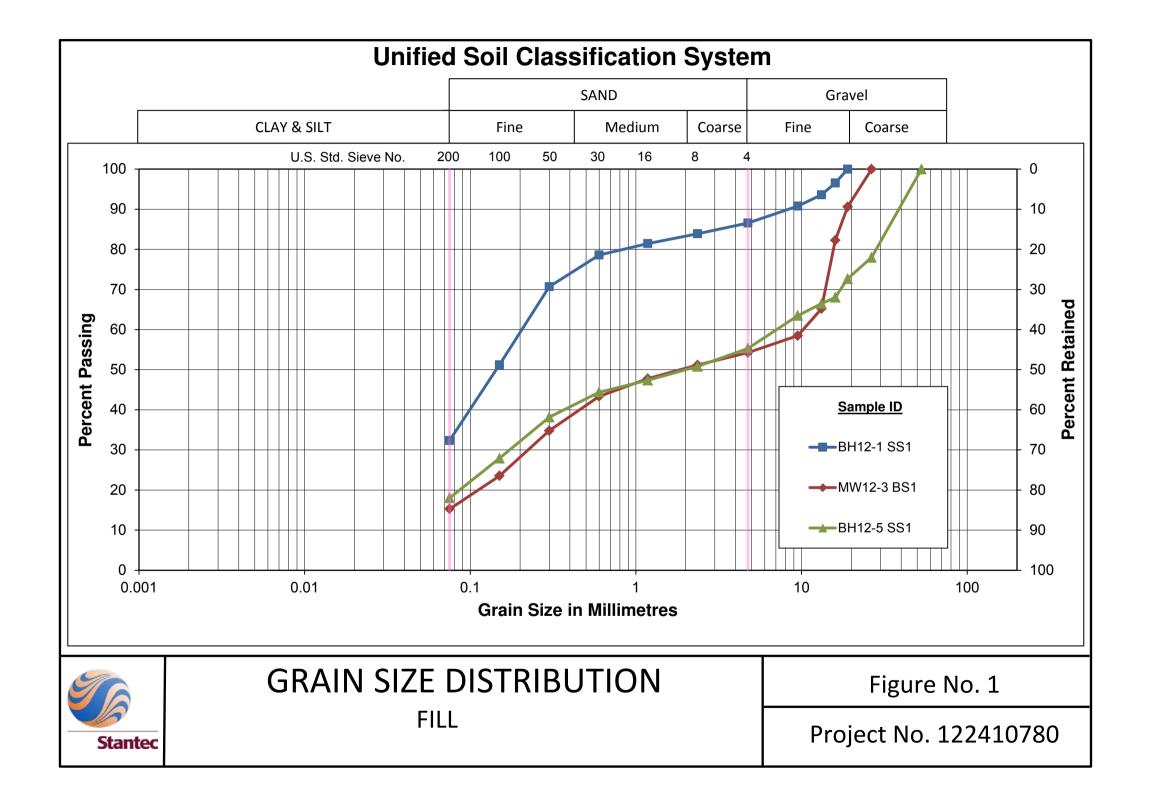
	Project No.: 122410780 Project Name: Parkdale Development				Rockcore
Stantec					Photographs
			аланананананананананананананананананана		
Rock Core Photo No.	: 11	Borehole:	MW 12-4	Depth: 8.97	′ – 12.04 m
			122410780 MW 12-4 12.04 - 15.06 m		
Rock Core Photo No.	: 12	Borehole:	MW 12-4	Depth: 12.0	04 – 15.06 m

	Droio	ot No + 11	00440790		
	Project No.: 122410780 Project Name: Parkdale Development			Rockcore	
Stantec				lopment	Photographs
			Auera Canada a Angela A		
Rock Core Photo No.:	13	Borehole:	MW 12-4	Depth: 15.06	6 – 17.88 m
			122410780 MW 12-4 17.88 –19.71 m		
Rock Core Photo No.: V:\01224\active\1224107XX\12	14 2410780\R	Borehole: Report 2_Scott\Co	MW 12-4 ore log and photos\photo_	-	3 – 19.71 m _{docx}

Stantec FINAL GEOTECHNICAL REPORT May 2012

APPENDIX D

Laboratory Test Results





2781 Lancaster Rd. Suite 200 Ottawa, Ontario K1J 1A7 Tel: (613) 738-0708 Fax: (613) 738-0721

ASTM-D7012

Compressive Strength and Elastic Moduli of Intact Rock Core Speciments under Varying States of Stress and Temperatures. Method C: Unconfined Compressive of Intact Rock Core Speciments. D4543/ Preparation

Client: Richcraft Group of Companies Inc.

Project: Parkdale Development

Date Drilled: January 9 to 12, 2012

Cored By: Bridgit Bocage

Project No.: <u>122410780</u> Date Rec'd: <u>13-Jan-12</u>

Date Tested: 24-Jan-12

Tested By: Denis Rodriguez

Sample Location	MW12-3 HQ-4 4.4 to 5.9 M	MW12-3 HQ-7 8.9 to 10.5 M	MW12-3 HQ-9 12 to 13.5 M	MW12-3 HQ-11 15 to 16.5 M
Physical Description	As per Geo-tech Report	As per Geo-tech Report	As per Geo-tech Report	As per Geo-tech Report
Average Diameter (mm) (<47.0)	63.00	63.00	63.00	63.00
Specimen Length (mm)	154.00	152.00	146.00	153.00
L/D Ratio (2.0-2.5)	2.44	2.41	2.32	2.43
Failure Load (lbs)	121087	128881	92745	54076
Compressive Strength (Mpa)	172.8	183.9	132.3	77.2
Straightness by Procedure S1 (<0.02inch)	<0.02	<0.02	<0.02	<0.02
Flatness by Procedure FP2 (<0.001inch)	<0.001	<0.001	<0.001	<0.001
Parallelism by Procedure FP2 (<0.25°)	0.075	0.079	0.154	0.058
Perpendicularity by Procedure P2 (<0.0043)	<0.0043	<0.0043	<0.0043	<0.0043
Moisture Condition	As-Received	As-Received	As-Received	As-Received
Description of Break D7012/11.1.13	Well formed cone @ one end and vertical cracking	Vertical cracking	Vertical cracking	Vertical cracking

Reviewed by: Brian Prost

Date: January 26/2012



2781 Lancaster Rd. Suite 200 Ottawa, Ontario K1J 1A7 Tel: (613) 738-0708 Fax: (613) 738-0721

ASTM-D7012

Compressive Strength and Elastic Moduli of Intact Rock Core Speciments under Varying States of Stress and Temperatures. Method C: Unconfined Compressive of Intact Rock Core Speciments. D4543/ Preparation

Client: Richcraft Group of Companies Inc.

Project: Parkdale Development

Date Drilled: January 9 to 12, 2012

Cored By: Bridgit Bocage

Project No.: 122410780

Date Rec'd: 13-Jan-12

Date Tested: 24-Jan-12

Tested By: Denis Rodriguez

	Sample Location	MW12-4 HQ-4 4.4 to	MW12-4 HQ-7 9.0 to 10.5 M	MW12-4 HQ-10 13.5 to 15.0 M	MW12-4 HQ-13 18.2 to 19.7 M
	Physical Description	As per Geo-tech Report	As per Geo-tech Report	As per Geo-tech Report	As per Geo-tech Report
	Average Diameter (mm) (<47.0)	63.00	63.00	63.00	63.00
	Specimen Length (mm)	152.00	154.00	150.00	151.00
	L/D Ratio (2.0-2.5)	2.41	2.44	2.38	2.40
	Failure Load (Ibs)	114177	98397	96497	95178
	Compressive Strength (Mpa)	162.9	140.4	137.7	135.8
	Straightness by Procedure S1 (<0.02inch)	<0.02	<0.02	<0.02	<0.02
	Flatness by Procedure FP2 (<0.001inch)	<0.001	<0.001	<0.001	<0.001
	Parallelism by Procedure FP2 (<0.25°)	-0.064	0.052	0.127	-0.039
	Perpendicularity by Procedure P2 (<0.0043)	<0.0043	<0.0043	<0.0043	<0.0043
	Moisture Condition	As-Received	As-Received	As-Received	As-Received
	Description of Break D7012/11.1.13	Vertical cracking	Well formed cone @ one end with vertical cracking		Vertical cracking

Reviewed by: Brian Ormost

Date: January 26/2012

Stantec FINAL GEOTECHNICAL REPORT May 2012

APPENDIX E

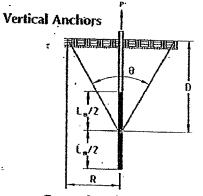
Rock Anchor: Resistance to Rock Mass Failure

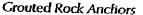
Required Safety Factor for Resistance to Rock Mass Failure: $W_R / P \ge 2.0$

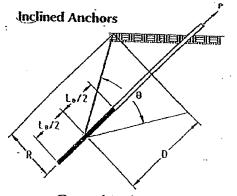
Design Considerations:

ŝ

Use 60° or 90° apex angle as per recommendations in the 1. geotechnical report







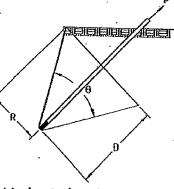
Grouted Rock Anchors

Р

 Y_R

θ

Mechanical Rock Anchors



Mechanical Rock Anchors

1.4.1

- Resultant of maximum axial anchor forces -----
- D Height of rock cone ----
- R Radius of rock cone =
- θ Appex angle = La
 - **Bond** length ==

Submerged unit weight of bedrock ==

Weight of rock cone ($W_R = \frac{1}{3}\Pi R^2 D \gamma_R$) ₩_R ==