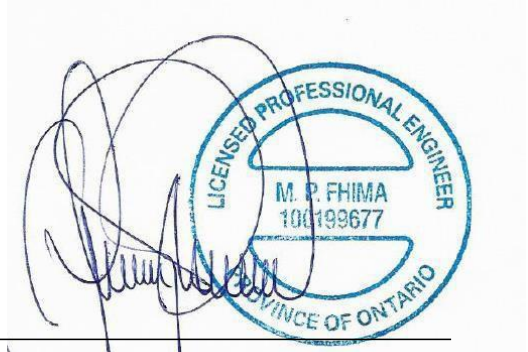
1199 NEWMARKET HOLDINGS INC.
GEOTECHNICAL INVESTIGATION

Property located at 1195, Newmarket Street in Ottawa, Ontario
N/Ref.: 13340

ORTAM groupe
RBQ : 8353-4917-04

Prepared by :



Pascal Fhima, Eng., P. Eng.
President and CEO

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ORTAM groupe
RBQ : 8353-4917-04

Revised: June 15, 2022
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Mr. Stanley Zipkin
1199 NEWMARKET HOLDINGS INC.
A-3488 Côte-des-Neiges Road
Montreal, Quebec
H3H 2M6

Object: **GEOTECHNICAL STUDY**
Commercial Building of one (1) storey without basement
Property located at 1195, Newmarket Street in Ottawa, Ontario

N/Ref: 13340

Mr. Zipkin,

Following the mandate you granted us, we are pleased to present you our report of the geotechnical study conducted for the Property mentioned above.

We thank you for giving us the opportunity to serve you and hope to engage in future collaborations. Should any further queries arise, please do not hesitate to communicate with us.

Trusting everything is to your complete satisfaction, we remain yours truly.

GROUPE ORTAM INC.

LICENSED PROFESSIONAL ENGINEER
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PROVINCE OF ONTARIO

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APPENDICES

1. INTRODUCTION

Mr. Stanley Zypkin of 1199 Newmarket Holdings INC. retained the services of GROUPE ORTAM Inc. (ORTAM), in order to carry out a geotechnical study for a commercial building construction project. The proposed site area for the project is located at property located at 1195, Newmarket Street in Ottawa, Ontario. The site location plan is presented in Appendix 1.

The proposed project consists in construction of a commercial building of one (1) storey without basement.

The objective of this geotechnical study in the framework of this mandate was to determine the nature and the properties of the soils as well as the bedrock and the groundwater level, if encountered, in view of the foundation design. This report describes the field and laboratory works conducted, presents the results obtained and provide geotechnical recommendations and general comments relating to the above mentioned project.

The report includes appendices as well: a borehole location plan (Appendix 1), boring log (Appendix 2), laboratory testing results (Appendix 3).

This report is subject to certain limiting conditions that result from the inherent nature of geological, geotechnical and hydrogeological profiles of the sites investigated using boreholes. The scope of the study undertaken and its limitations are elucidated at the end of this report. These limiting conditions make up an integral part of this report and the readers are encouraged to become familiar with these conditions in order to facilitate their understanding, interpretation and use of the present document.

2. SITE AND PROJECT DESCRIPTION

2.1 SITE DESCRIPTION

The site is located at 1195, Newmarket Street in Ottawa, Ontario. The site is trapezoidal in shape and covers an area of approximately 10 885 square meters (m^2). The property is currently occupied by a commercial building. Considering the Newmarket Street as oriented East-West, the property is bordered to the North by the railway, to the South by Newmarket Street, to the East and to the West by commercial buildings.

One storey building with no basement is present on the eastern part of the property.

2.2 PROJECT DESCRIPTION

The project involves the construction of a commercial building with of one (1) floor without basement.

3. METHODS OF INVESTIGATION

3.1 FIELD INVESTIGATION

The field work, was carried out on August 27th, 2019 and involved the implementation of seven (7) boreholes identified as BH1 to BH7. The location of the boreholes is shown on the enclosed plan (Appendix 1). Boreholes were carried out by means of an auger drill rig to the maximum depth of 6.9 meters below the existing grades. The field work was carried out under the constant supervision of our geotechnical personnel.

The Standard Penetration Test (SPT) is performed by driving a standard split spoon sampler into the ground by blows from a drop hammer of mass 63.5 Kg falling 760 mm. The Sample is driven 600 mm into the soil at the bottom of the borehole, and the number of blows needed for the tube to penetrate each 150 mm up to a depth of 600 mm is recorded. The sum of the number of blows required for the second and third 150 mm of penetration is reported as the SPT blowcount value, commonly termed "Standard Penetration Resistance" or the “N-value”. The N-value provides an indication of the relative density of the subsurface granular soil.

The soil samples have been carefully described on site as well as in our laboratory, by a soil specialist.

The field work included a survey of the boreholes and some important points of the site. The reference point (BM) of the survey is the top of the sump of the municipal sewer system located at the corner of Newmarket Street and Bantree street. An arbitrary elevation of 30 m was given to this reference point (see Appendix 1).

All soil samples recovered from the boreholes not used for laboratory tests will be kept for a period of three (3) months from the date of this report, after which they will be destroyed unless otherwise requested by the client.

3.2 LABORATORY TESTING

In order to determine some of the geotechnical characteristics of the soils, and to complete the technical information gathered during fieldwork, the following laboratory testing was carried out on a representative soil sample recovered from the conducted surveys:

– ten (10) sieve analyses;

– three (3) hydrometer analyses;

– two (2) determinations of the liquid and plastic limits (ASTM D4318);

– six (6) chemical analyses for basic chemical analysis related to potential sulphate attack on buried concrete elements and corrosion of buried ferrous elements.

Test results are presented in sections 4 and 5.10 of this report. All the geotechnical laboratory test reports are enclosed in appendices 3 and 5.

4. STRATIGRAPHY OF SUBSOIL AND GROUND WATER CONDITIONS

4.1 STRATIGRAPHY OF SUBSOIL

Details of different soil layers encountered in the borehole locations are presented in the borehole logs in Appendix 2.

In summary, the soils encountered (from the top to the bottom) are described as follows:

4.1.1 FILL MATERIALS

Fill materials encountered in the boreholes consist mostly of medium dense heterogeneous mixture of sand, silt and gravel. At the location of Borehole BH7, fill materials consist of crushed stone type MG-20. This fill

layer, with a thickness ranges between 0.3 m and 1.8 m, is wet and probably contains stones and blocks. It should be noted that, at some places, the fill material can be deeper or shallower

4.1.2 NATIVE SOIL

a) Organic soil

Directly below the fill materials at the location of boreholes BH5, an organic soil was encountered at the depth and elevation shown in table 2. This black layer, with a thickness of 0,3 m is humid.

b) Cohesive soil deposit

Beneath the fill layer at the location of boreholes BH1 and BH6, the native soil composed of a clayey silt with traces of sand (BH1) and of a clay and silt with traces of sand (BH6). This cohesive soil is wet, stiff in consistency and has a thickness of 0.5 and 1.9 m, at the location of BH6 and BH1 respectively. A summary of the geotechnical tests performed on the clay deposit are presented in the following Table 1 and 2, while the detailed laboratory results can be found in Appendix 3. This test includes particles size analysis, water content determination (Wn), Atterberg Limits (LL, PL, and IP, IL).

Table 1- Results of sieve and hydrometer analysis tests

Description	Water content (%)	Clay < 2 µm (%)	Silt < 80 µm and > 2 µm (%)	Sand < 5 mm and > 80 µm (%)	Gravel > 5 mm (%)	Sample	Borehole
Clayey silt, traces of sand	36	29	67	3	0	SS-3	BH1
Clay and silt, traces of sans		48	47	5	0	SS2B	BH6

Table 2- Laboratory test results

BOREHOLE N°	SAMPLE N°	DEPTH (M)	Wn (%)	ATTERBERG LIMITS (%)			
				LL	PL	IP	IL
BH2	SS-3	1.20 – 1.80	25	33	22	11	0,2
BH6	CF-2B	1.10 – 1.20	30	51	23	28	02

Based on the Atterberg limits, the deposit has the characteristics of ***a clay with low plasticity (CL).***

c) Granular soil deposit

Directly under the cohesive soil at the location of borehole BH1 and BH6, under the organic soil layer at the location of borehole BH5 and directly under the fill materials at the location of the other boreholes, the native soil encountered at the depth and elevation shown in table 4 is composed mainly of sand and silt with some gravel and traces of clay. This granular soil is saturated and compact to dense in density and has a thickness that ranges between 0.5 (BH6) and 2.6 m (BH4).

Locally at the location of boreholes BH2 and BH3, the upper part of the granular soil is saturated and loose in density. A summary of the geotechnical tests performed on the clay deposit are presented in the following Table 3, while the detailed laboratory results can be found in Appendix 3. These tests include water content and particles size analysis by sieve and by hydrometer.

Table 1 below recapitulates the results obtained and details are presented in Appendix 3 of this report.

Table 3- Results of sieve and hydrometer analysis tests

Borehole	Sample	Gravel > 5 mm (%)	Sand < 5 mm and > 80 µm (%)	Silt < 80 µm and > 2 µm (%)	Clay < 2 µm (%)	Water content, Wn (%)	Description
BH1	SS-4B	0	40	46	14	11.8	Silt and sand, some clay
BH2	SS-4	15	46	40		9.6	Sand and silt, some gravel
BH2	SS-5	30	32	38		7.9	Sandy gravelly silt
BH3	SS-3	2	84	14		16.3	Sand some silt, traces of
BH4	SS-4	4	45	51		11.9	Silt and sand, traces of gravel
BH5	SS-3	15	47	38		8.3	Sand and silt, some gravel
BH6	SS-2A	0	91	9		11.6	Sand, traces of silt
BH7	SS3	15	49	36		-	Sand and silt, some gravel

4.1.3 BEDROCK

The bedrock was encountered at the depth and elevation presented in table 1. Samples of the rock recovered as cores are composed of clay limestone with a rock quality designation index (RQD) ranging between 55% and 90%, corresponding to a rock of poor quality to excellent quality.

It should be noted that the bedrock elevations may vary across the site due to irregularity of the bedrock surface.

Table 4 below presents an overview of the depth and elevation of each subsoil stratum encountered at the borehole location.

Table 4- Stratigraphic Summary

BOREHOLE/ ELEVATION	DEPTH AND ELAVATION (m)					
	FILL DEPOSIT	**ORGANIC SOIL**	**NATURAL INORGANIC SOIL**		DEPTH OF BEDROCK	**END OF BOREHOLE**
			COHESIVE SOIL	GRANULAR SOIL (TILL)		
BH1/28.8	0.0 – 0.3 (28.8 – 28.5)	-	0.3 – 2.2 (28.5 – 26.6)	2.2 – 4.0 (26.6 – 24.8)	4,0 (24.8)	6.9 (21.9)
BH2/29.0	0.0 – 0.3 (29.0 – 28.7)	-	-	0.3 – 2.8 (28.7 – 26.2)	2.8 (26.2)	4.5 (24.5)
BH3/28.8	0.0 – 1,8 (28.8– 27.0)	-	-	1.8 – 2.4 (27.0 – 26.4)	2.4 (26.4)	5.4 (23.4)
BH4/29.0	0.0 – 0.6 (29.0 – 28.4)	-	-	0.6 – 3.2 (28.4 – 25.8)	3.2 (25.8)	4.5 (24.5)
BH5/28.2	0.0 – 0.9 (28.2 – 27.3)	0.9 – 1.2 (27.3 – 27.0)	-	1.2 – 1.8 (27.0 – 26.4)	1.8 (26.4)	3.0 (25.2)
BH6/28.9	0.0 – 1,1 (28.9– 27.8)	-	1.1– 1.6 (27.8 – 27.3)	1.6 – 2.1 (27.3 – 26.8)	2.1 (26.8)	2.1 (26.8)
BH7/28.7	0.0 – 1,8 (28.7– 26.9)	-	-	1.8 – 2.7 (26.9– 26.0)	2.7 (26.0)	2.7 (26.0)

4.2 GROUNDWATER CONDITIONS

For measuring groundwater levels, five (5) piezometers were installed in boreholes BH1 to BH5. Table 2 below shows the depths and the elevations of water table measured in boreholes BH1 to BH5, in August 2019.

Updated values based on City recommendations – Bench mark **BM** is now: **68.32 meters**

Table 5- Depth and elevation of water table

	WATER LEVEL MEASURED AUGUST, 2019		
	DEPTH (m)	**ELEVATION (m)**	**UPDATED ELEVATION (m) February 2022**
BH1 (28.8)	1.6	**27.1**	**66.52**
BH2 (29.0)	2.0	**27.0**	**66.32**
BH3 (28.8)	1.8	**27.0**	**66.32**
BH4 (29.0)	2.1	**26.9**	**66.22**
BH5 (28.9)	**1.9**	**27.0**	**66.32**

It should be noted that groundwater levels are, however, expected to fluctuate and can be found at higher or lower elevations during other periods of the year according to the prevailing weather conditions.

5. DISCUSSION AND RECOMMANDATIONS

It is understood that the proposed project will consist of the construction of commercial building of one (1) floor without basement. Based upon the results obtained from the borehole location and assuming them to be representative at subsurface conditions across the entire site, the following recommendations are offered for the proposed project.

5.1 ELEVATIONS

Taking into account the topography of the site and architecture plans, the following elevations are proposed:

- **Ground level around the building:** **68.32 m**
- Finished ground floor: 68.62 m
- Base of the foundations: 66.82 m
- Groundwater level (August 2019): 66.42 m
- Groundwater level (for calculation): 66.82 m
- Depth of bedrock: between 64.12 and 66.12 m

5.2 SPECIFIC GEOTECHNICAL CONCERNS RELATED TO THE SITE

5.2.1 ESSENTIALPROBLEMS

Specific geotechnical problems related to the site are as follow:

1. The Site is covered with backfill materials that reaches a thickness of 1.8 m at the location of boreholes BH3 and BH7.
2. Presence of an organic soil at the depth of 0.9 m (elevation 66.62 m), in borehole BH5.
3. The bedrock is shallow and at the depth ranging between 1.8 and 4.0 m.
4. The soil at the base of the foundations is heterogeneous. Part of the foundations will be on controlled backfill materials, another part on clayey silt and another again on till deposit.

5.3 FOUNDATIONS SYSTEM

Given the characteristics of the soil encountered at the location of the boreholes, and assuming these soil conditions are representative of the overall subsurface conditions of the Site, the Site is suitable to support conventional Spread and Strip footing foundations. Part of these foundations will be placed on a clayey silt layer, another one on a till layer or on a controlled backfill layer.

5.3.1 SHALLOW FOUNDATIONS

Shallow foundations are the very first choice of foundation. They are, first and foremost, cheap and easy to construct compared to other alternatives, such as pile foundations and mat foundations.

Foundations can also be placed directly on the bedrock, encountered between 64.12 and 66.12 meters of depth.

5.3.1.1 Bearing capacity

Section 4.1.3 of the "National Building Code 2010" (NBC 2010) requires that the design of foundations is achieved using the limit states method, namely the ultimate limit states (ULS) and serviceability limit states (SLS).

The ultimate limit state defines a limiting stress that should not be exceeded by any conceivable or anticipated loading during the design life of a foundation. The serviceability limit states define a limiting deformation or settlement of a foundation, which, if exceeded, will impair the function of the structure that is supports.

At the ultimate limit state, stresses at the base of foundations, due to factored loads "$\alpha_n S_n$" should be less than the weighted soil resistance "ΦR" ($\alpha_n S_n < \Phi R$).

The coefficients α_n are greater than 1 and the coefficient Φ is less than 1.

a) Bearing capacity at the ultimate limit state

The bearing capacity at the ultimate limit state was calculated using the shear test parameters of cohesion and angle of internal friction and the soil density of the specimens extracted from the boreholes. The following well known Terzaghi equation with correction terms can be used to calculate the ultimate bearing capacity of conventional spread and strip footing foundations.

$$q_{ult} = CN_cS_c + \gamma_o D_f N_q S_q + 0.5\gamma_1 B\, N_\gamma S_\gamma$$

$S_c=S_q=1+(B/L)(N_q/N_c)$ and

$S_\gamma=1-0.4(B/L)$

Where:

γ_o - Unit weight of soil above foundation level in kN/m³.
γ_1 - Unit weight of soil below foundation level in kN/m³.
C, Ø - Strength parameters of the soil below foundation level in KN/m² and degrees respectively.
B - Width of foundation in (m).
L - Length of foundation in (m).
D_f - Depth of foundation (m)
Nc, , Nq, Nγ - Bearing capacity coefficients dependent on the angle of internal friction of the soil below foundation level.
Sc, , Sq, Sγ - Correction terms dependent on the geometry of foundations.

The ultimate bearing capacity should be calculated using the following geotechnical parameters.

- γ_o = 18 KN/m³.
- γ_1 = 18 KN/m³.
- Cu= 0 kPa
- Ø = 32°.
- D_f =1.5 m
- Nc – Nq – Nγ = 34.3 – 22.1 – 19.5

The ultimate bearing capacity values presented in table 6 are provided as a guideline for the structural engineer. In Ultimate Limit States design (ULS), the factored ultimate bearing capacity obtained with the factor Φ equal to **0.5** must be compared to the design ultimate load combinations. The structural engineer should verify that the design factored load (ultimate load combinations) does not exceed the factored geotechnical resistance (Φq_{ult}).

Table 3 below shows the values of the bearing capacity at the ULS and SLS, depending on the width of the foundations.

b) **Bearing capacity at the serviceability limit state**

In general, the bearing capacity at the serviceability limit state is the pressure that limits settlements to 25 mm. However, considering the homogeneous of the soil layers, for this specific project, the bearing

capacity at the serviceability limit state indicated in the table 6 below is the stresses that will cause settlements of 30 mm, with differential settlement less than 19 mm.

Table 6 - Bearing capacity in the Ultimate Limit State (ULS) and Serviceability Limit State (SLS)

Type of footing	Width (m)	Ultimate limit state (kPa)		Serviceability limit state (kPa)
		q_{ultime}	ULS (ϕq_{ultime})	
Strip footing	0.6	350	175	200
	0.9	370	190	160
	1.2	400	200	140
	1.5	430	215	125
	1.8	490	245	110
Spread footing	1.0	544	270	330
	1.2	554	277	275
	1.5	570	285	230
	2.0	596	295	185
	2.5	620	310	160

***Notes**: It is important to note that only the axial loads are considered for these stress levels at the base of the foundation. In the case of the eccentric loads, the eccentricity "e" must be less than one sixth of the width "B" of the foundations (e <B/6) and the maximum stress at the base of the foundation must be lower than the bearing capacity in SLS. The bearing capacity is checked by taking into account the fictitious width B equal to: B '= B-2Xe.*

5.3.1.2 Total and differential settlement

For the bearing capacities at the Serviceability Limit State given in Table 3 above, the total settlement could be lower than 25 mm. However, differential settlement will be lower than the allowable value of 19 mm.

5.3.1.3 Minimum width of the footing

The minimum width of footings is as follow:

Strip footing : B_{min}= 0.6 m

Spread footing : B_{min}= 1.0 m

5.3.1.4 Reinforced concrete foundations

Due to the the characteristics of soil deposits under the foundations and the presence of the clay layer, footings will be of reinforced concrete with reinforcing steel percentage minimum ρ_{min} equal to:

$$\rho_{min} = \left(\frac{A_a}{A_b}\right)_{min} = \frac{1.4}{f_y}$$

f_y is the ultimate strength of the steel.

A_a and A_b are respectively the total area of the reinforcement steel and the area of the concrete.

5.4 SLAB ON GRADE

A conventional concrete slab, built on the ground and structurally separated from the foundation walls, can be used in the framework of this project. We recommend the following procedures for the preparation of the ground underneath the slab:

- The fill materials and the organic soils in place should be removed. All disturbed soil beneath the floor slab should also be removed.
- The slab on grade will be brought to the required elevation (see section 5.1) using only well grade granular materials placed in a thin layer not exceeding 300 mm, compacted to at least 95% of the Modified Proctor (PM) of the dry density. The last layer (base course) under the slab will be composed of crushed stones MG-20 of minimal thickness of 300 mm and compacted to a minimum of 95% of the PM.
- The granular materials that will be used as foundation under the slab will have to be DB certified. It should respect the requirements of the Bureau de Normalisation du Québec (BNQ) Standard 2560-500, should not contain any sulphurous minerals such as pyrite and should not consist of shale.
- Before pouring the concrete slab, a polyethylene membrane (0.15 mm thick) should be placed between the concrete and the granular backfill.
- Before pouring the concrete, the exposed grade should be inspected by a qualified soil engineer. Any soft spots or areas of disturbed soil must be removed and replaced with suitable compacted materials.

Following the above recommendation, the slab on grade could be design using a reaction modulus of 45MN/m.

5.5 FROST PROTECTION

The method recommended in the Canadian Foundation Engineering Manual 4th Edition (2013) was used to estimate the depth of frost penetration in the Ottawa area. This method involves the following modified Bergrenn equation, described by Aldrich (1956), Sanger (1963) and Johnston (1981):

$$X = \lambda \frac{\sqrt{2k_f I_s}}{L_s}$$

Where :

X = frost penetration deptn;

– Is = freezing index;

– kf = thermal conductivity of the frozen ground;

– Ls = latent heat of the soil;

– λ = coefficient without unit.

The freezing index for Ottawa has been estimated to be 1000 degrees-days Celcius with a standard deviation of 143 degrees-days Celcius, obtained from BNQ 1809-300/2018. Based on this data, the calculated depth of frost will be in order of 1.80 m.

5.5.1 Building foundation

To limit the effects of frost penetration, a minimum depth of soil cover of 1.5 m is required for perimeter footings of heated structures.

5.5.2 Underground services

The underground services should be located below the depth of frost penetration of 1,8m in accordance with City of Ottawa specifications.

5.6 EXCAVATION AND SLOPE STABILITY

- The contractor will have to take all necessary precautions in order to ensure the stability of the excavation slopes. Based on the borehole results, stable temporary slopes above the groundwater level in the clayey silt soil or fill materials layer could be excavated with slopes of **1V:2H**.
    - Note: For submerged soil, the slope should be **1V:4H.**
- During the excavation, no excavated materials should be piled, nor machinery or equipment be placed, closer than the distance equivalent to the depth of the excavations.
- No vertical un-braced excavations should be performed in the soil.
- The exposed subsoil should be protected against erosion from water runoff or rain.
- An examination of the slopes should be carried out by a qualified geotechnical engineer during the construction. The stability of the slopes remains the responsibility of the contractor.

Given the fact that the basement will occupy almost the entire area of the property, it will not be possible to respect the safe excavation slopes. Table 5 below shows the Soil parameters for the calculation of the retaining walls.

5.7 SITE DRAINAGE

All grades must provide effective drainage away from the building during and after construction. This report is based on effective drainage for the life of the building and cannot be relied upon if effective drainage is not maintained. To maintain effective drainage, the contractor should respect the short-term and long-term drainage recommendations.

5.7.1 DEWATERING

Based on the boreholes results, it is anticipated that excavation will be below the groundwater. underground water problems are foreseen for excavations that could exceed 1.6 m below existing grades. Groundwater control during excavation may be achieved by conventional sump pump techniques. However, it should be left to the contractor to determine the methods of dewatering necessary to meet the project requirements.

Dewatering effort will depend on number of factors such as excavation depth, season and weather conditions, the length of time the excavation will be open.

5.7.2 LONG-TERM DRAINAGE

Since there is no basement, the French drain on the perimeter of the foundation is not required. However, the trench excavation will be backfilled with a free-draining granular material, which may contain less than ***5% of fine grained and erodible materials.***

5.8 PROJECT SITE SEISMICITY AND LIQUEFACTION

5.8.1 SITE SEISMIC CONSIDERATION

As defined by Table 4.1.8.4.A "Site Classification for Seismic Site Response" of the CNBC 2010, the Site classification for seismic response is "C".

5.8.2 LIQUEFACTION POTENTIAL OF SUB-SOILS

Granular saturated soils tend to lose strength and turn into a liquid-like state when subjected to vibration caused by an earthquake, pile driving or installation of anchors. Given the characteristics of the soil at the base of the foundation, this compact to dense layer of Silt and Till has a low risk of liquefaction.

5.8.3 SWELLING AND SHRINKAGE OF THE CLAY LAYER

During the long periods of dry season, the presence of trees on the site and its surroundings could cause the shrinkage of the clay layer. This will cause differential settlements of shallow foundations. For shallow foundations, the trees should not be planted near the structures (buildings and parking lots).

5.9 WINTER CONSTRUCTION

The subsoils encountered across the site are frost susceptible and freezing conditions could cause problems for the structure. The following recommendations are presented as preventive measures:

- During winter construction, exposed surfaces meant to support floor slabs must be protected against freezing by means of heating, loose straw and tarpaulins, etc.
- Care must be taken so that the sidewalks or asphalt pavement do not interfere with the opening of doors when the soils are subject to frost heave. This problem may be minimized by any one of several means such as:
    - keeping the doors well above the outside grade,
    - installing a structural slab at the doors,
    - using well-graded backfill and positive drainage.

- The trenches for exterior underground services should be excavated with shallow transition slopes in order to minimize the abrupt change in density between the granular backfill, which is relatively not frost-susceptible, and the more frost-susceptible native soils.

5.10 PARKING LOT

5.10.1 Excavation

At the location of the parking areas, all organic soils and fill materials should be excavated, and the structure of pavement must be built in accordance with the recommendations below.

5.10.2 FLEXIBLE PAVEMENT

LIGHT TRAFIC (for non-truck) routes the composition should be constructed as follow:

40mm
70mm
150mm granular A
150mm granular B (Subbase is Granular B - Type II as specified in TS 1010)

For a total of 410mm

For HEAVY TRAFFIC routes the composition should be constructed as follow:

40mm
120mm
150mm granular A
200mm granular B (Subbase is Granular B - Type II as specified in TS 1010)

For a total of 510mm

Note:

1) ***The granular materials of the base course and the wearing course should conform to OPSS 1003 and OPSS 1150 and the hot mix asphalt should be formulated according to MTO Laboratory Testing Manual.***

2) ***See Appendix 4 for Pavement Structural Design requirements***

3) ***Trenches for the construction of sumps should be closed with granular materials free from excessive dust (including coatings), clay or silt, and deleterious materials, such as organics, shale, wood etc.***

5.10.3 LONG TERM DRAINAGE OF PAVEMENT

- To minimize the infiltration of surface water into the pavement, a good surface drainage is required. The pavement should be constructed so as to give to the surface of the pavement, a slope of at least 2% to allow drainage of rainwater to sumps.
- The sumps should be installed at appropriate locations and connected to the municipal sewer system.
- Manholes should be installed whenever the drain lines are changed.

5.10.4 FROST PROTECTION

The minimum total thickness of the pavement structures proposed is 770 mm. This structure will provide the recommended partial protection against frost in the Ottawa area for a local type pavement according to the AASHTO criteria.

5.11 CORROSION AND CEMENT TYPE

- A chemical analysis of the soils found on Site was performed on December 14th, 2021, in order to identify if any special building materials or construction techniques are required to reduce corrosive action on the foundation. Six (6) samples were submitted to EUROFINS Ontario for basic chemical analysis related to potential sulphate attack on buried concrete elements and corrosion of buried ferrous elements. The results of this testing are provided in Appendix 5.

- The results indicate that concrete made with Type GU Portland cement should be acceptable for substructures. The results also indicate a potential for corrosion of exposed ferrous metal.

6. QUALITATIVE CONTROL

It is recommended to proceed with a qualitative control of the various steps of the construction in order to ensure the quality of the project.

The excavation work, backfilling and compacting should be supervised in order to ensure that all disturbed soils are adequately excavated at the location of the building and that the controlled fill material is adequate to support the floor slab.

During the construction, vibrations must be controlled to ensure that they are not exceeding the safe limits beyond which liquefaction of the clay layer may cause structural damage to the existing buildings in the vicinity of the construction works.

ORTAM should be retained to provide supervision and testing services during grading, excavation, foundation construction and other geotechnical construction phases of the project.

7. LIMITATIONS OF THE INVESTIGATION

The conclusions of the geotechnical investigation are based on the results of the surveys conducted as well as on our present comprehension of the project.

It is important to emphasize that a geotechnical study consists of point sampling of a site and that the recommendations provided derive from the results obtained at the locations of the surveys only.

It is therefore presumed that these soil conditions are representative of the overall subsurface conditions of the site. Consequently, in the event that the conditions encountered during the work differ from those observed at the location of the surveys, we would appreciate to be immediately informed in order to allow us to modify our recommendations accordingly.

It is also recommended that ORTAM be permitted to review the final shop drawings and specifications in order to verify the items of construction related to geotechnical aspects. If not given the privilege of making such a review, ORTAM will assume no responsibility for misinterpretation of the recommendations of this report.

The information contained in this report is meant for geotechnical purposes only and has no bearing on the environmental aspect of the site.

8. PERSONNEL

Field work has been performed by J. Martin. This report was written by Pascal Fhima, Senior Engineer.

9. QUALIFICATIONS OF THE PERSONNEL

As President, CEO, Mr. Pascal Fhima, Eng., possesses over 21 years' experience in Environmental Site Assessments Phase I, Environmental Site Characterizations Phase II, Environmental Site Rehabilitation Phase IV, Environmental Audit of asbestos/mold/pyrite, Geotechnical studies, Cost evaluation, Building appraisals, Thermography, etc. His credentials include over 150 projects in geotechnical engineering and materials science, beyond 1000 projects in building science and over 5,000 environmental projects, completed since the establishment of ORTAM GROUP INC. (ORTAM).

10. REFERENCES

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2. Code national du bâtiment
3. Denis Leboeuf, cours GCI-10199, Reconnaissance des sols, Conception et calcul des fondations superficielles, Université Laval, Département de génie civil, septembre 2002.
4. Richard D. Woods, Dynamic Effets of Pile Installations on Adjacent Structures, National academy press, Washington D.C., 1997
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8. Serges Leroueil, Tavenas, F. et Bihan, J-P, *Propriétés caractéristiques des argiles de l'Est du Canada,* Revue canadienne de géotechnique, vol. 4, novembre 1983, pp 681-705;
9. Silvestri Vincenzo, Cours 3420, Fondation et mécanique des sols, École Polytechnique de Montréal, Département de génie civil, janvier 1984;
10. Ontario Provincial Standard Specifications, Material
    OPSS 1003 Aggregates - Hot Mix Asphalt
    OPSS 1101 Performance Graded Asphalt Cement
    OPSS 1103 Emulsified Asphalt
    OPSS 1150 Hot Mix Asphalt
    OPSS 1151 Superpave and Stone Mastic Asphalt Mixtures
11. Ontario Ministry of Transportation Publications
    MTO Laboratory Testing Manual:
    LS-261 Preparation of Marshall Specimens
    LS-262 Bulk Relative Density of Compacted Bituminous Mixtures
    LS-263 Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
    LS-264 Theoretical Maximum Relative Density of Bituminous Paving Mixtures
    LS-265 Percent Air Voids in Compacted Dense Bituminous Pavement Mixtures
    LS-282 Quantitative Extraction of Asphalt Cement and Analysis of Extracted Aggregate from Bituminous Paving Mixtures
    LS-287 The Determination of Percent Compaction of Compacted Bituminous Paving Mixture (MRD Method)
    LS-292 Quantitative Determination of Asphalt Cement Content by Ignition and Analysis of Remaining Aggregate from Bituminous Paving Mixtures
    LS-306 Bulk Relative Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
12. ASTM International
    D 6752-03e1 Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Automatic Vacuum Sealing Method

13. **American Association of State Highway and Transportation Officials (AASHTO)**

M320-05 Standard Specification for Performance Graded Asphalt Binder
M323-07 Standard Specification for Superpave Volumetric Mix Design
T166-07 Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens
T209-05 Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
T275-07 Bulk Specific Gravity of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens

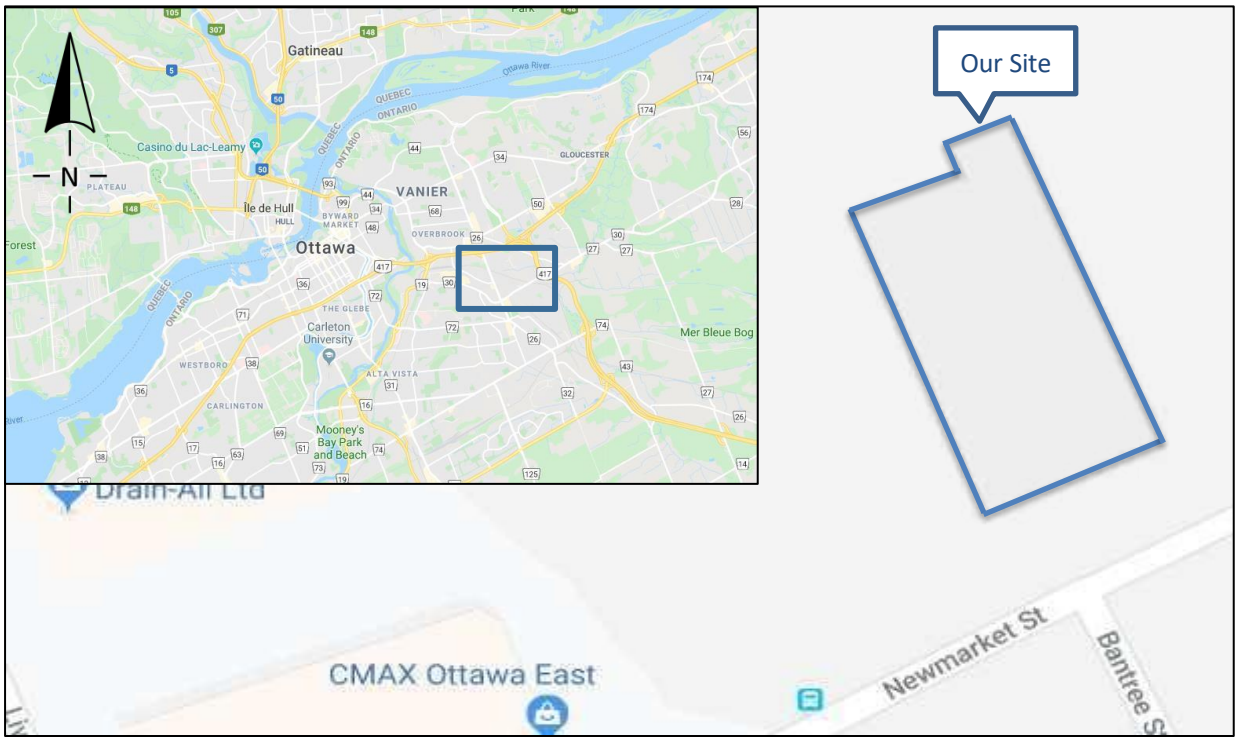
APPENDICES

APPENDIX 1

- Site location
- Location of boreholes

SITE LOCATION

GENERAL SITE LOCATION



Source: Google Map

LOCATION OF BOREHOLES

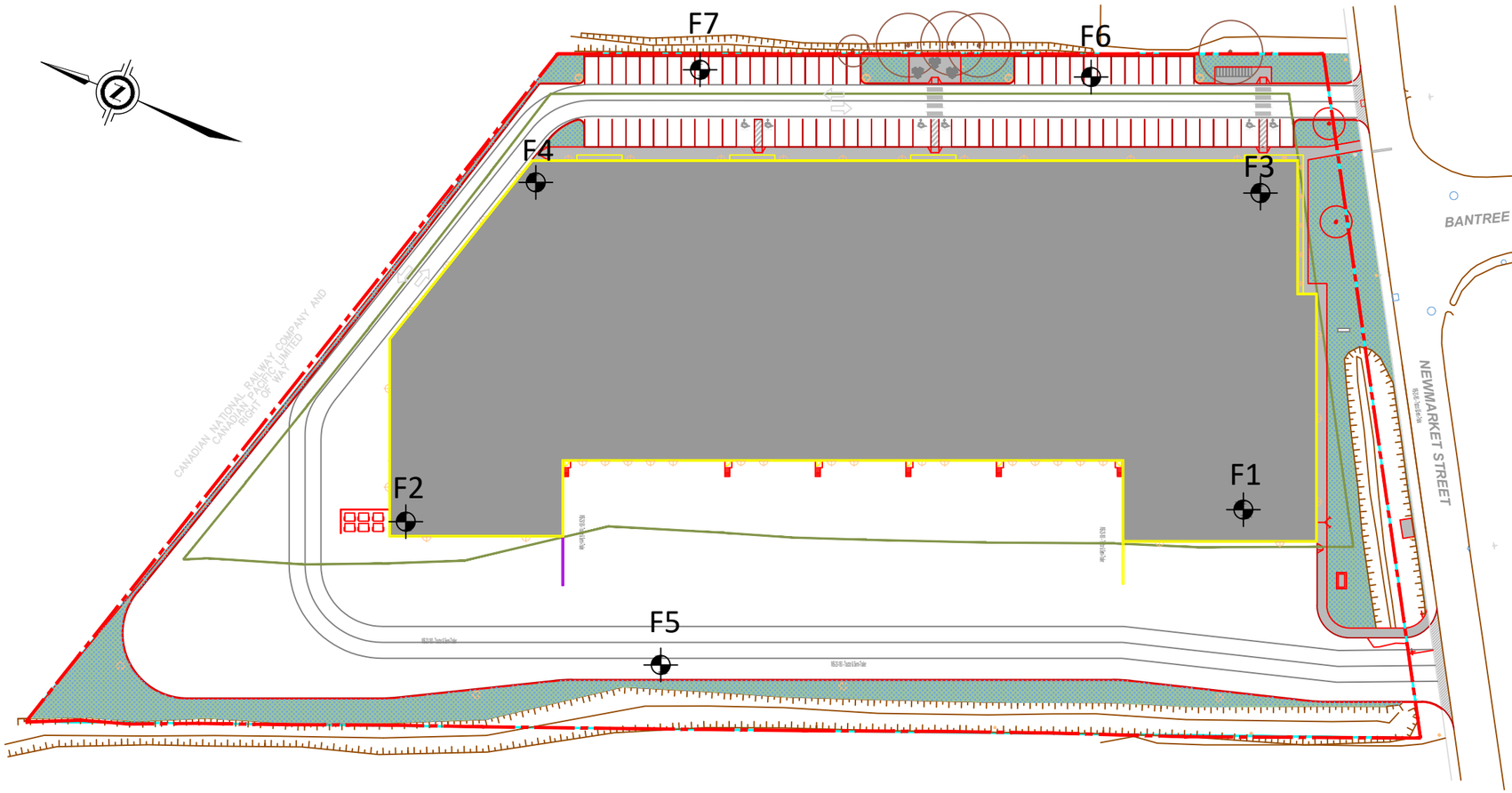


Photo by Google map

Legend

- Property limit

- Boreholes proposed by ORTAM in May, 2022
  F1 to F4 : 8 m of depth with pen test
  F5 to F8 : 3 m of depth

NOT FOR CONSTRUCTION

Sources

- This plan was completed based on the site plan.

ORTAM groupe
RBQ : 8353-4917-04
1200, Louvain Street West
Montreal, Quebec, H4N 1G5
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Project

GEOTECHNICAL STUDY

Property located at 1195 Newmarket Street in Ottawa, ON

Client

1199 NEWMARKET HOLDINGS INC.
A-3488, Côte-des-Neiges Road, Montreal, Quebec H3H 2M6

Prepared :	P. Fhima Eng.	O/Ref.:	18551
Drawing :	H.Sun	File name :	D07-12-21-0114
Verified :	P. Fhima Eng.	Date :	05-04-2022
Accepted :	P. Fhima Eng.	Scale :	1 : 1000

Drawing title

SURVEY LOCATION

Figure

1

APPENDIX 2

- Boreholes Logs

ORTAM groupe
RBQ : 8353-4917-04

Client : 1199 NEWMARKET HOLDINGS INC.

Dossier : 13340

RAPPORT DE FORAGE

Projet : Warehouse Newmarket

Site : 1195, Newmarket street, Ottawa

Forage no.: *F-1*
Date : 2019-08-27
Équipement : Foreuse à tarière Mobile Drill
Supervisé par : D. Héon

Type d'échantillon
CF : Cuillère fendue
TM : Tube à paroi mince
TE : Tube d'échantillonnage
CR : Carrotage au diamant
VR : Manuel

État de l'échantillon
Remanié
Intact
Perdu
Forage au diamant

Graphique
▲ : N (pen. standard)
△ : Nc (pen. dynamique)
▼ : C_u (laboratoire)
▽ : C_{ur} (laboratoire)
● : C_u (chantier)
○ : C_{ur} (chantier)

Évidence de contamination
Olfactive/Visuelle
Inexistant
Faible
Moyen
Fort

Coordonnées
Arbitraire
X : ---
Y : ---
Z : 28,8 m

Niveau d'eau

Date	Niveau	Élév.
2019-09-02	1,6 m	27,1 m

PROFONDEUR - m	NIVEAU - m / PROF. - m	DESCRIPTION	TYPE et NUMÉRO	ÉTAT	SOUS-ÉCHANTILLON	RÉCUPÉRATION	N, Nc ou RQD	ESSAIS DE LABORATOIRE et RÉSULTATS IN SITU
	28,8	*Surface du sol actuel*						
	0,0	Asphalte (120 mm).						
	28,6	Remblai : Sable avec un peu de silt, d'argile et de	CF-1		A	50	20	
	0,1	gravier. Traces de sols organiques.			B			
	28,5	Silt argileux avec traces de sable. Turquoise.	CF-2			100	9	
1	**0,3**	Oxydé. Humide. Consistance ferme.	CF-3			100	11	IP = 11 AG
2	26,6		CF-4		A	65	24	
	2,2	Till : Silt et sable avec un peu d'argile. Gris.			B			AG
		Saturé. Compacité moyenne à très dense.	CF-5			50	22	
3			CF-6			100	R	
	24,8		CF-7			100	R	
4	**4,0**	Roc : Calcaire argileux. Bonne à excellente qualité.						
			CR-1			90	85	
5								
6			CR-2			100	90	
	21,9							
7	**6,9**	Fin du forage.						

NIVEAU D'EAU - m : 1,6 m

OLFACTIF VISUEL

N ou Nc (coups/300 mm) : 50 100

RÉSISTANCE AU CISAILLEMENT NON-DRAINÉ (kPa) : 50 100

TENEUR EN EAU et LIMITES (%) : w_P w w_L ; 20 40 60 80

REMARQUES : Tube ouvert installé à 6,6 m de profondeur.

Compilé par : J. Martin

ORTAM groupe
RBQ : 8353-4917-04

Client : 1199 NEWMARKET HOLDINGS INC.

Dossier : 13340

RAPPORT DE FORAGE

Projet : Warehouse Newmarket

Site : 1195, Newmarket street, Ottawa

Forage no.: *F-2*
Date : 2019-08-27
Équipement : Foreuse à tarière Mobile Drill
Supervisé par : D. Héon

Type d'échantillon
- **CF :** Cuillère fendue
- **TM :** Tube à paroi mince
- **TE :** Tube d'échantillonnage
- **CR :** Carrotage au diamant
- **VR :** Manuel

État de l'échantillon
- Remanié
- Intact
- Perdu
- Forage au diamant

Graphique
- ▲ : N (pen. standard)
- △ : Nc (pen. dynamique)
- ▼ : C_u (laboratoire)
- ▽ : C_{ur} (laboratoire)
- ● : C_u (chantier)
- ○ : C_{ur} (chantier)

Évidence de contamination
Olfactive/Visuelle
- Inexistant
- Faible
- Moyen
- Fort

Coordonnées
Arbitraire
X : ---
Y : ---
Z : 29,0 m

Niveau d'eau

Date	Niveau	Élév.
2019-09-02	2,0 m	27,0 m

PROFONDEUR - m	NIVEAU - m / PROF. - m	DESCRIPTION	TYPE et NUMÉRO	ÉTAT	SOUS-ÉCHANTILLON	RÉCUPÉRATION	N, Nc ou RQD	OLFACTIF VISUEL
	29,0	*Surface du sol actuel*						
	0,0 / 28,7	Remblai de till : Sable et silt graveleux. Brun. Compacité très dense.	CF-1		A	85	66	
	0,3	Sable et silt avec traces d'argile et de gravier. Brun. Oxydé. Humide. Compacité lâche.			B			
1	27,8		CF-2			65	8	
	1,2	Till : Sable et silt avec un peu de gravier. Gris. Humide et localement saturé. Compacité moyenne à très dense.	CF-3			85	24	
	27,2							
	1,8	Devient gris.	CF-4			85	42	
2	26,6							
	2,4	Devient silt sableux et graveleux.	CF-5			100	R	
	26,2							
	2,8	Roc : Calcaire argileux. Mauvaise à moyenne qualité.	CR-1			90	55	
3								
4			CR-2			100	45	
	24,5							
	4,5	Fin du forage.						
5								
6								
7								

NIVEAU D'EAU - m : 2,0 m

N ou Nc (coups/300 mm) : 50 100

RÉSISTANCE AU CISAILLEMENT NON-DRAINÉ (kPa) : 50 100

ESSAIS DE LABORATOIRE et RÉSULTATS IN SITU : AG (CF-4), AG (CF-5)

TENEUR EN EAU et LIMITES (%) : w_P w w_L ; 20 40 60 80

REMARQUES : Tube ouvert installé à 4,2 m de profondeur.

ORTAM groupe
RBQ : 8353-4917-04

Client : 1199 NEWMARKET HOLDINGS INC.

Dossier : 13340

RAPPORT DE FORAGE

Projet : Warehouse Newmarket

Site : 1195, Newmarket street, Ottawa

Forage no.: *F-3*
Date : 2019-08-27
Équipement : Foreuse à tarière Mobile Drill
Supervisé par : D. Héon

Type d'échantillon
- **CF :** Cuillère fendue
- **TM :** Tube à paroi mince
- **TE :** Tube d'échantillonnage
- **CR :** Carrotage au diamant
- **VR :** Manuel

État de l'échantillon
- Remanié
- Intact
- Perdu
- Forage au diamant

Graphique
- ▲ : N (pen. standard)
- △ : Nc (pen. dynamique)
- ▼ : C_u (laboratoire)
- ▽ : C_{ur} (laboratoire)
- ● : C_u (chantier)
- ○ : C_{ur} (chantier)

Évidence de contamination
Olfactive/Visuelle
- Inexistant
- Faible
- Moyen
- Fort

Coordonnées
Arbitraire
X : ---
Y : ---
Z : 28,8 m

Niveau d'eau

Date	Niveau	Élév.
2019-09-02	1,8 m	27,0 m

PROFONDEUR - m	NIVEAU - m / PROF. - m	DESCRIPTION	SYMBOLE	NIVEAU D'EAU - m	TYPE et NUMÉRO	ÉTAT	SOUS-ÉCHANTILLON	RÉCUPÉRATION	N, Nc ou RQD	OLFACTIF VISUEL	N ou Nc (coups/300 mm) 50 100 / RÉSISTANCE AU CISAILLEMENT NON-DRAINÉ (kPa) 50 100	ESSAIS DE LABORATOIRE et RÉSULTATS IN SITU	TENEUR EN EAU et LIMITES (%) w_P w w_L 20 40 60 80
	28,8	*Surface du sol actuel*											
1	**0,0**	Remblai probable : Sable avec un peu de silt et traces de gravier. Brun. Humide. Traces de sols organiques.			CF-1			50	8				
					CF-2			35	6				
	27,6 **1,2**	Devient très humide.			CF-3			65	6			AG	
	27,0 **1,8**						A						
2	26,9 **1,9**	Silt et sable avec un peu d'argile. Brun. Oxydé. Humide. Compacité lâche.		1,8 m	CF-4		B	50	R				
	26,4 **2,4**	Till : Sable et silt avec un peu de gravier et traces d'argile. Gris. Saturé. Compacité moyenne à très dense.											
3		Roc : Calcaire argileux. Moyenne à excellente qualité.			CR-1			90	65				
4													
					CR-2			90	90				
5	23,4												
	5,4	Fin du forage.											
6													
7													

REMARQUES : Tube ouvert installé à 5,1 m de profondeur.

ORTAM groupe
RBQ : 8353-4917-04

Client : 1199 NEWMARKET HOLDINGS INC.

Dossier : 13340

RAPPORT DE FORAGE

Projet : Warehouse Newmarket

Site : 1195, Newmarket street, Ottawa

Forage no.: *F-4*
Date : 2019-08-27
Équipement : Foreuse à tarière Mobile Drill
Supervisé par : D. Héon

Type d'échantillon
- **CF :** Cuillère fendue
- **TM :** Tube à paroi mince
- **TE :** Tube d'échantillonnage
- **CR :** Carrotage au diamant
- **VR :** Manuel

État de l'échantillon
- Remanié
- Intact
- Perdu
- Forage au diamant

Graphique
- ▲ : N (pen. standard)
- △ : Nc (pen. dynamique)
- ▼ : C_u (laboratoire)
- ▽ : C_{ur} (laboratoire)
- ● : C_u (chantier)
- ○ : C_{ur} (chantier)

Évidence de contamination
Olfactive/Visuelle
- Inexistant
- Faible
- Moyen
- Fort

Coordonnées
Arbitraire
X : ---
Y : ---
Z : 29,0 m

Niveau d'eau

Date	Niveau	Élév.
2019-09-02	2,1 m	26,9 m

PROFONDEUR - m	NIVEAU - m / PROF. - m	DESCRIPTION	SYMBOLE	NIVEAU D'EAU - m	ÉCHANTILLONS: TYPE et NUMÉRO	ÉTAT	SOUS-ÉCHANTILLON	RÉCUPÉRATION	N, Nc ou RQD	OLFACTIF VISUEL	N ou Nc (coups/300 mm) 50 100 — RÉSISTANCE AU CISAILLEMENT NON-DRAINÉ (kPa) 50 100	ESSAIS DE LABORATOIRE et RÉSULTATS IN SITU	TENEUR EN EAU et LIMITES (%) w_P w w_L 20 40 60 80
	29,0	*Surface du sol actuel*											
0	**0,0**	Remblai granulaire : Sable et gravier silteux. Brun. Compacité très dense.			CF-1			100	76				
	28,4												
1	**0,6**	Sable et silt avec traces d'argile et de gravier. Brun. Oxydé. Humide à très humide. Compacité moyenne.			CF-2			65	12				
	27,8												
	1,2	Till : Silt et sable avec traces de gravier. Gris. Saturé. Compacité moyenne à très dense.			CF-3			50	23				
	27,2												
2	**1,8**	Devient très humide.		2,1 m	CF-4			65	40			AG	
					CF-5			100	61				
3	25,8				CF-6			100	R				
	3,2	Partie supérieure du roc. Friable.											
4					CF-7			35	R				
	24,5				CF-8			100	R				
	4,5	Fin du forage. Refus sur le roc sain probable.											
5													
6													
7													

REMARQUES : Tube ouvert installé à 4,2 m de profondeur.

Compilé par : J. Martin

ORTAM groupe
RBQ : 8353-4917-04

Client : 1199 NEWMARKET HOLDINGS INC.

Dossier : 13340

RAPPORT DE FORAGE

Projet : Warehouse Newmarket

Site : 1195, Newmarket street, Ottawa

Forage no.: *F-5*
Date : 2019-08-27
Équipement : Foreuse à tarière Mobile Drill
Supervisé par : D. Héon

Type d'échantillon
CF : Cuillère fendue
TM : Tube à paroi mince
TE : Tube d'échantillonnage
CR : Carrotage au diamant
VR : Manuel

État de l'échantillon
Remanié
Intact
Perdu
Forage au diamant

Graphique
▲ : N (pen. standard)
△ : Nc (pen. dynamique)
▼ : C_u (laboratoire)
▽ : C_{ur} (laboratoire)
● : C_u (chantier)
○ : C_{ur} (chantier)

Évidence de contamination
Olfactive/Visuelle
Inexistant
Faible
Moyen
Fort

Coordonnées
Arbitraire
X : ---
Y : ---
Z : 28,2 m

Niveau d'eau

Date	Niveau	Élév.

PROFONDEUR - m	NIVEAU - m / PROF. - m	DESCRIPTION	SYMBOLE	NIVEAU D'EAU - m	ÉCHANTILLONS TYPE et NUMÉRO	ÉTAT	SOUS-ÉCHANTILLON	RÉCUPÉRATION	N, Nc ou RQD	OLFACTIF VISUEL	N ou Nc (coups/300 mm) 50 100 / RÉSISTANCE AU CISAILLEMENT NON-DRAINÉ (kPa) 50 100	ESSAIS DE LABORATOIRE et RÉSULTATS IN SITU	TENEUR EN EAU et LIMITES (%) w_P w w_L 20 40 60 80
	28,2	*Surface du sol actuel*											
	0,0	Remblai granulaire : Sable et silt graveleux. Brun. Compacité très dense.			CF-1			65	64				
	27,3				CF-2			35	9				
1	**0,9**	Terre végétale. Brun foncé.											
	27,0												
	1,2	Till : Sable et silt avec un peu de gravier. Gris. Saturé. Compacité moyenne à très dense.		▼ 1,5	CF-3			85	R			AG	
	26,4				CF-4			50	R				
2	**1,8**	Partie supérieure du roc.											
					CF-5			50	R				
	25,2												
3	**3,0**	Fin du forage.											
4													
5													
6													
7													

REMARQUES : Nappe phréatique estimée : 1,5 m (élévation : 26,7 m).

Compilé par : J. Martin

ORTAM groupe
RBQ : 8353-4917-04

Client : 1199 NEWMARKET HOLDINGS INC.

Dossier : 13340

RAPPORT DE FORAGE

Projet : Warehouse Newmarket

Site : 1195, Newmarket street, Ottawa

Forage no.: *F-6*
Date : 2019-08-27
Équipement : Foreuse à tarière Mobile Drill
Supervisé par : D. Héon

Type d'échantillon
- **CF :** Cuillère fendue
- **TM :** Tube à paroi mince
- **TE :** Tube d'échantillonnage
- **CR :** Carrotage au diamant
- **VR :** Manuel

État de l'échantillon
- Remanié
- Intact
- Perdu
- Forage au diamant

Graphique
- ▲ : N (pen. standard)
- △ : Nc (pen. dynamique)
- ▼ : C_u (laboratoire)
- ▽ : C_{ur} (laboratoire)
- ● : C_u (chantier)
- ○ : C_{ur} (chantier)

Évidence de contamination
Olfactive/Visuelle
- Inexistant
- Faible
- Moyen
- Fort

Coordonnées
Arbitraire
X : ---
Y : ---
Z : 28,9 m

Niveau d'eau

Date	Niveau	Élév.
2019-09-02	1,9 m	27,0 m

PROFONDEUR - m	NIVEAU - m / PROF. - m	DESCRIPTION	SYMBOLE	NIVEAU D'EAU - m	TYPE et NUMÉRO	ÉTAT	SOUS-ÉCHANTILLON	RÉCUPÉRATION	N, Nc ou RQD	OLFACTIF / VISUEL	N ou Nc (coups/300 mm) 50 100 — RÉSISTANCE AU CISAILLEMENT NON-DRAINÉ (kPa) 50 100	ESSAIS DE LABORATOIRE et RÉSULTATS IN SITU	TENEUR EN EAU et LIMITES (%) w_P w w_L 20 40 60 80
	28,9	*Surface du sol actuel*											
	0,0 28,6	Remblai : Sable fin à moyen graveleux avec un peu de silt. Humide.			CF-1		A	85	18				
	0,3	Remblai probable : Sable avec traces de silt. Oxydé. Humide. Compacité moyenne.					B						
1	27,8				CF-2		A	65	10			AG	
	1,1	Argile et silt avec traces de sable. Turquoise. Oxydé. Humide. Compacité moyenne.					B					IP = 28 AG	
	27,3				CF-3		A	100	19				
	1,6	Till : Sable et silt avec un peu de gravier et traces d'argile. Gris. Saturé. Compacité moyenne à très dense.					B						
2	26,8				CF-4			100	R				
	2,1	Fin du forage. Refus sur le roc probable.		1,9									
3													
4													
5													
6													
7													

REMARQUES : Tube ouvert installé à la base du forage.

Compilé par : J. Martin

ORTAM groupe
RBQ : 8353-4917-04

Client : 1199 NEWMARKET HOLDINGS INC.

Dossier : 13340

RAPPORT DE FORAGE

Projet : Warehouse Newmarket

Site : 1195, Newmarket street, Ottawa

Forage no.: *F-7*
Date : 2019-08-27
Équipement : Foreuse à tarière Mobile Drill
Supervisé par : D. Héon

Type d'échantillon
CF : Cuillère fendue
TM : Tube à paroi mince
TE : Tube d'échantillonnage
CR : Carrotage au diamant
VR : Manuel

État de l'échantillon
Remanié
Intact
Perdu
Forage au diamant

Graphique
▲ : N (pen. standard)
△ : Nc (pen. dynamique)
▼ : C_u (laboratoire)
▽ : C_{ur} (laboratoire)
● : C_u (chantier)
○ : C_{ur} (chantier)

Évidence de contamination
Olfactive/Visuelle
Inexistant
Faible
Moyen
Fort

Coordonnées
Arbitraire
X : ---
Y : ---
Z : 28,7 m

Niveau d'eau

Date	Niveau	Élév.

PROFONDEUR - m	NIVEAU - m / PROF. - m	DESCRIPTION	SYMBOLE	NIVEAU D'EAU - m	ÉCHANTILLONS TYPE et NUMÉRO	ÉTAT	SOUS-ÉCHANTILLON	RÉCUPÉRATION	N, Nc ou RQD	OLFACTIF VISUEL	N ou Nc (coups/300 mm) 50 100 / RÉSISTANCE AU CISAILLEMENT NON-DRAINÉ (kPa) 50 100	ESSAIS DE LABORATOIRE et RÉSULTATS IN SITU	TENEUR EN EAU et LIMITES (%) w_P w w_L 20 40 60 80
	28,7	*Surface du sol actuel*											
	0,0	Pierre concassée de type MG-20. Présence de débris d'asphalte.			CF-1			100	R				
	28,1												
1	**0,6**	Remblai : Sable et silt avec un peu de gravier. Brun. Humide. Compacité dense.			CF-2			50	36				
				▼ 1,5	CF-3			100	37			AG	
	26,9												
2	**1,8**	Till : Sable et silt avec un peu de gravier. Gris. Humide. Compacité très dense.			CF-4			85	51				
					CF-5			100	R				
	26,0												
3	**2,7**	Fin du forage. Refus sur le roc probable.											
4													
5													
6													
7													

REMARQUES : Nappe phréatique estimée : 1,5 m (élévation : 27,2 m).

ORTAM groupe
RBQ : 8353-4917-04

NOTES EXPLICATIVES SUR LES RAPPORTS DE SONDAGE

DESCRIPTION ET CLASSIFICATION DES SOLS ET DU ROC :

CLASSIFICATION	
Argile	<0,002 mm
Silt	0,002 a 0,08 mm
Sable	0,08 a 5 mm
Gravier	5 a 80 mm
Cailloux	80 a 300 mm
Blocs	> 300 mm

TERMINOLOGIE	
"traces"	< 10 %
"un peu"	10-20 %
adjectif (silteux, sableux)	20-35 %
nom (silt, sable)	> 35 %

COMPACITE DES SOLS GRANULAIRES	INDICE DE PENETRATION STANDARD "N" (coups/300 mm)
Tres lache	< 4
Lache	4-10
Compact ou moyenne	10-30
Dense	30-50
Tres dense	> 50

CONSISTANCE DES SOLS COHERENTS	RESISTANCE AU CISAILLEMENT C_u (kPa)
Tres molle	< 12
Molle	12-25
Ferme	25-50
Raide	50-100
Tres raide	100-200
Dure	> 200

INDICE DE LA QUALITE DU ROC	
VALEUR "RQD"	QUALITATIF
< 25	tres mauvais
25-50	mauvais
50-75	moyen
75-90	bon
> 90	excellent

ELEVATION :

Niveau geodesique ou arbitraire du terrain a l'emplacement du sondage. Le point geodesique ou arbitraire utilise est defini dans le rapport.

PROFONDEUR :

Profondeur des differents contacts geologiques a partir de la surface du terrain.

ORTAM groupe
RBQ : 8353-4917-04

NOTES EXPLICATIVES SUR LES RAPPORTS DE SONDAGE (suite)

STRATIGRAPHIE :

Chaque formation geologique est decrite selon la terminologie d'usage. Le contact entre les formations geologiques est identifie par une ligne pleine lorsque la profondeur est bien definie ou par une ligne en pointille. La precision du contact est relatif a la methode d'echantillonnage et le pourcentage de recuperation.

ECHANTILLONS :

ETAT

La position, la longueur et l'etat de chaque echantillon sont montres dans cette colonne.
Les symboles suivants sont utilises pour definir l'etat de l'echantillon.

 : Remanie  : Intact  : Perdu  : Carotte de roc

TYPE ET NUMERO

Le type d'echantillonneur utilise est defini par l'abreviation indique ci-apres. La numerotation est continue pour chacun des types.

CF : Cuillere fendue
TM : Tube a paroi mince
VR : Vrac
TE : Tube d'echantillonnage
CR : Carottier diamante
CFE, VRE, TEE : Echantillonnage environnemental

ESSAIS DE CHANTIER :

N : Indice de penetration standard
R : Refus a l'enfoncement
k : permeabilite
N_C : Indice de penetration dynamique au cone
C_u : Resistance au cisaillement non draine
RQD : Indice de la qualite du roc

RECUPERATION :

La recuperation de l'echantillon est le rapport exprime en pourcentage de la longueur recuperee dans l'echantillonneur a la longueur enfoncee.

RESULTATS DES ESSAIS :

Cette colonne contient a la profondeur correspondante, les essais effectues au chantier ou en laboratoire. Les resultats de ces essais sont soit presentes dans cette colonne, dans le rapport ou dans les certificats des essais de laboratoire.

ESSAIS DE LABORATOIRE :

I_P : Indice de plasticite
w_L : Limite liquide
w_P : Limite plastique
AG : Analyse granulo-sedimentometrique
w : Teneur en eau
γ : Poids volumique
CS : Cone Suedois
CHIM : Analyse chimique
a_P' : Pression de preconsolidation

APPENDIX 3

- Laboratory testing results

ORTAM groupe
RBQ : 8353-4917-04

CERTIFICAT DE LABORATOIRE - SOL

ANALYSE GRANULOMÉTRIQUE DES SOLS INORGANIQUES

BNQ 2501-025/2013

CLIENT: 1199 NEWMARKET HOLDINGS INC. **DOSSIER:** 13340

PROJET: 1195, Newmarket street, Ottawa **ANALYSE NO:** 19-478-1

DONNÉES GÉNÉRALES			
Description:	Silt argileux avec traces de sable	Prélevé le: 2019-08-27	Par: D. H.
Provenance:	F-1 / CF-3	Analysé le: 2019-09-11	Par: A. P.

ANALYSE GRANULOMÉTRIQUE	
112 mm	100
80 mm	100
56 mm	100
40 mm	100
28 mm	100
20 mm	100
14 mm	100
10 mm	100
5 mm	100
2,5 mm	100
1,25 mm	100
630 µm	100
315 µm	100
160 µm	100
80 µm	96,8

RÉSUMÉ DES ESSAIS	
Argile %	29
Silt %	67
Sable %	3
Gravier %	0

REMARQUES
Teneur en eau : 36 %

SÉDIMENTOMÉTRIE

TEMPS (MIN)	DIAMÈTRE (MM)	% PASSANT
0,5	0,057	95,9
1	0,041	94,1
2	0,029	91,0
5	0,019	82,3
15	0,011	68,7
30	0,008	57,5
60	0,006	48,9
120	0,004	41,5
240	0,003	34,7
480	0,002	31,6
1440	0,001	24,1

COURBE GRANULOMÉTRIQUE

Préparé par: Joël Martin

ORTAM groupe
RBQ : 8353-4917-04

CERTIFICAT DE LABORATOIRE - SOL

ANALYSE GRANULOMÉTRIQUE DES SOLS INORGANIQUES

BNQ 2501-025/2013

CLIENT: 1199 NEWMARKET HOLDINGS INC. **DOSSIER:** 13340

PROJET: 1195, Newmarket street, Ottawa **ANALYSE NO:** 19-478-2

DONNÉES GÉNÉRALES

Description:	Silt et sable avec un peu d'argile	Prélevé le:	2019-08-27	Par: D. H.
Provenance:	F-1 / CF-4B	Analysé le:	2019-09-11	Par: A. P.

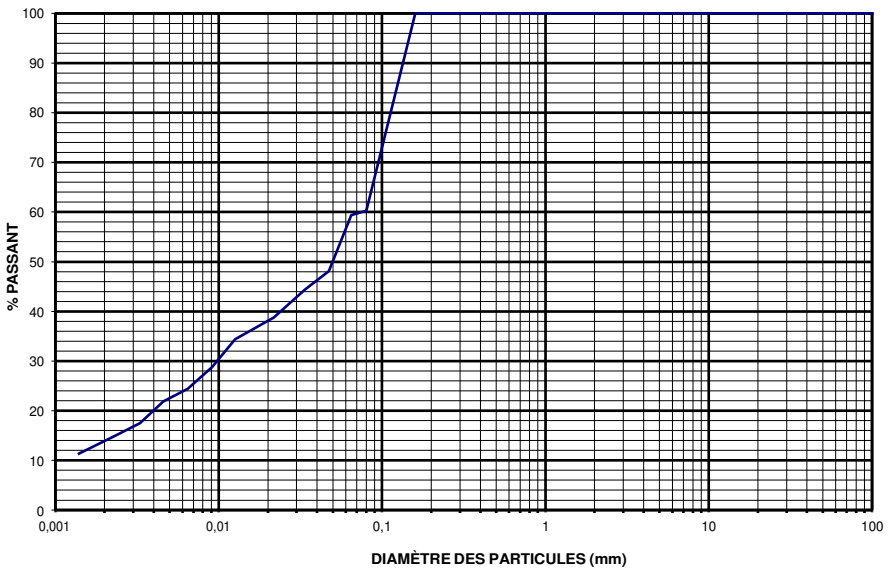
ANALYSE GRANULOMÉTRIQUE

112 mm	100
80 mm	100
56 mm	100
40 mm	100
28 mm	100
20 mm	100
14 mm	100
10 mm	100
5 mm	100
2,5 mm	100
1,25 mm	100
630 µm	100
315 µm	100
160 µm	100
80 µm	60,3

SÉDIMENTOMÉTRIE

TEMPS (MIN)	DIAMÈTRE (MM)	% PASSANT
0,5	0,065	59,4
1	0,047	48,1
2	0,034	44,4
5	0,022	38,8
15	0,013	34,4
30	0,009	28,8
60	0,006	24,4
120	0,005	21,9
240	0,003	17,5
480	0,002	15,0
1440	0,001	11,3

COURBE GRANULOMÉTRIQUE



RÉSUMÉ DES ESSAIS

Argile %	14
Silt %	46
Sable %	40
Gravier %	0

REMARQUES

Teneur en eau : 11,8 %

Préparé par: Joël Martin

ORTAM groupe
RBQ : 8353-4917-04

CERTIFICAT DE LABORATOIRE - SOL

ANALYSE GRANULOMÉTRIQUE DES SOLS INORGANIQUES

BNQ 2501-025/2013

CLIENT: 1199 NEWMARKET HOLDINGS INC. **DOSSIER:** 13340

PROJET: 1195, Newmarket street, Ottawa **ANALYSE NO:** 19-478-3

DONNÉES GÉNÉRALES			
Description:	Sable et silt avec un peu de gravier	Prélevé le: 2019-08-27	Par: D. H.
Provenance:	F-2 / CF-4	Analysé le: 2019-09-11	Par: A. P.

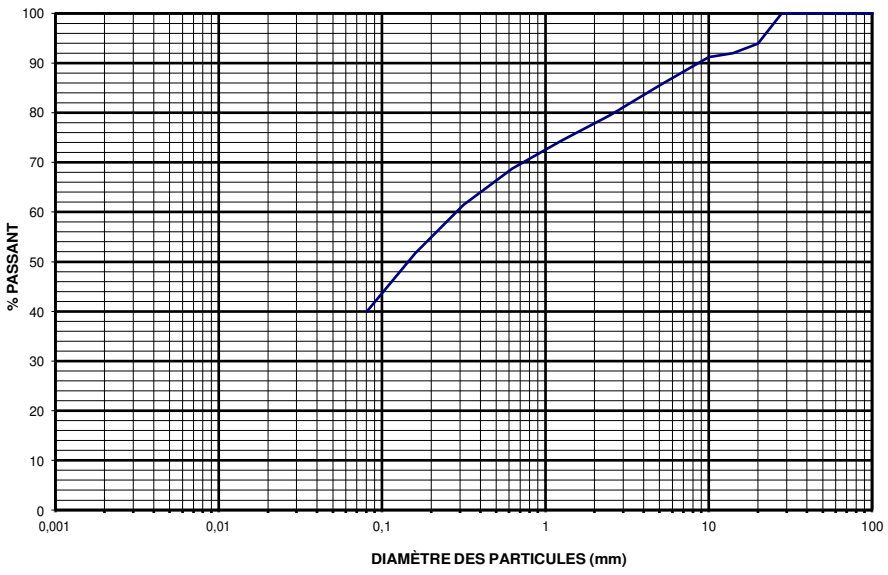
ANALYSE GRANULOMÉTRIQUE	
112 mm	100
80 mm	100
56 mm	100
40 mm	100
28 mm	100
20 mm	94
14 mm	92
10 mm	91
5 mm	85
2,5 mm	80
1,25 mm	74
630 µm	69
315 µm	61
160 µm	52
80 µm	39,8

RÉSUMÉ DES ESSAIS	
Argile %	0
Silt %	40
Sable %	46
Gravier %	15

REMARQUES
Teneur en eau : 9,6 %

SÉDIMENTOMÉTRIE		
TEMPS (MIN)	DIAMÈTRE (MM)	% PASSANT
0,5		
1		
2		
5		
15		
30		
60		
120		
240		
480		
1440		

COURBE GRANULOMÉTRIQUE



Préparé par: Joël Martin

ORTAM groupe
RBQ : 8353-4917-04

CERTIFICAT DE LABORATOIRE - SOL

ANALYSE GRANULOMÉTRIQUE DES SOLS INORGANIQUES

BNQ 2501-025/2013

CLIENT: 1199 NEWMARKET HOLDINGS INC. **DOSSIER:** 13340

PROJET: 1195, Newmarket street, Ottawa **ANALYSE NO:** 19-478-4

DONNÉES GÉNÉRALES			
Description:	Silt sableux et graveleux	Prélevé le: 2019-08-27	Par: D. H.
Provenance:	F-2 / CF-5	Analysé le: 2019-09-11	Par: A. P.

ANALYSE GRANULOMÉTRIQUE	
112 mm	100
80 mm	100
56 mm	100
40 mm	100
28 mm	100
20 mm	100
14 mm	89
10 mm	84
5 mm	70
2,5 mm	64
1,25 mm	58
630 µm	54
315 µm	49
160 µm	44
80 µm	37,7

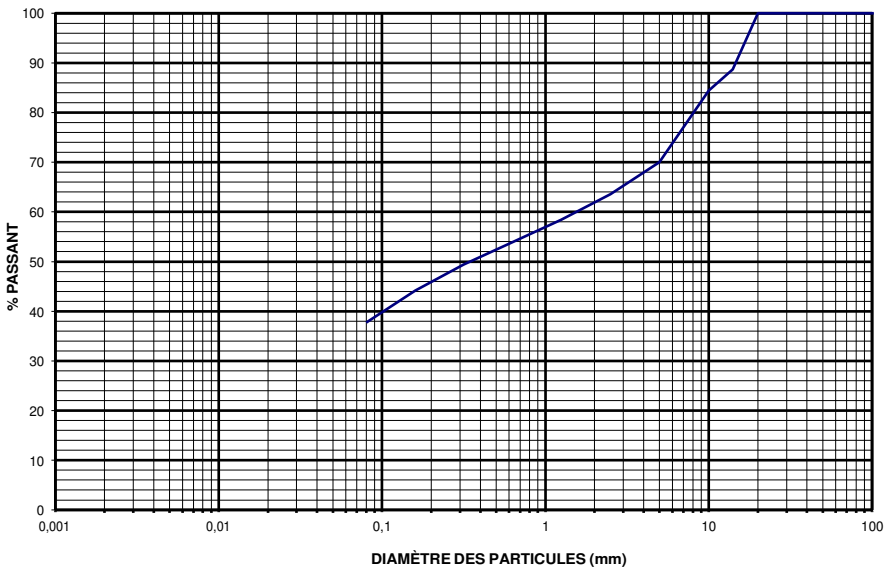
RÉSUMÉ DES ESSAIS	
Argile %	0
Silt %	38
Sable %	32
Gravier %	30

REMARQUES
Teneur en eau : 7,9 %

SÉDIMENTOMÉTRIE

TEMPS (MIN)	DIAMÈTRE (MM)	% PASSANT
0,5		
1		
2		
5		
15		
30		
60		
120		
240		
480		
1440		

COURBE GRANULOMÉTRIQUE



Préparé par: Joël Martin

ORTAM groupe
RBQ : 8353-4917-04

CERTIFICAT DE LABORATOIRE - SOL

ANALYSE GRANULOMÉTRIQUE DES SOLS INORGANIQUES

BNQ 2501-025/2013

CLIENT: 1199 NEWMARKET HOLDINGS INC. **DOSSIER:** 13340

PROJET: 1195, Newmarket street, Ottawa **ANALYSE NO:** 19-478-5

DONNÉES GÉNÉRALES			
Description:	Sable avec un peu de silt et traces de gravier	Prélevé le: 2019-08-27	Par: D. H.
Provenance:	F-3 / CF-3	Analysé le: 2019-09-11	Par: A. P.

ANALYSE GRANULOMÉTRIQUE	
112 mm	100
80 mm	100
56 mm	100
40 mm	100
28 mm	100
20 mm	100
14 mm	100
10 mm	99
5 mm	98
2,5 mm	96
1,25 mm	93
630 µm	83
315 µm	62
160 µm	31
80 µm	13,8

RÉSUMÉ DES ESSAIS	
Argile %	0
Silt %	14
Sable %	84
Gravier %	2

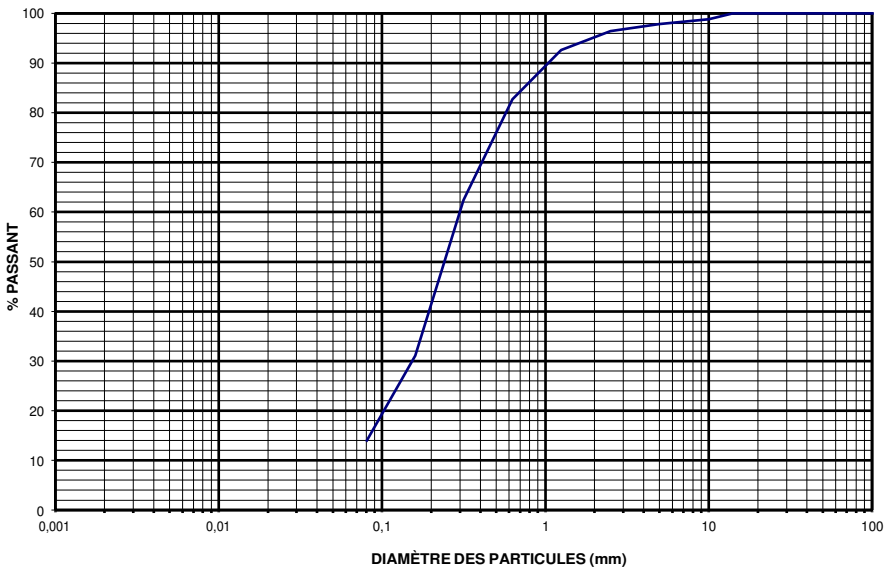
REMARQUES

Teneur en eau : 16,3 %

SÉDIMENTOMÉTRIE

TEMPS (MIN)	DIAMÈTRE (MM)	% PASSANT
0,5		
1		
2		
5		
15		
30		
60		
120		
240		
480		
1440		

COURBE GRANULOMÉTRIQUE



Préparé par: Joël Martin

ORTAM groupe
RBQ : 8353-4917-04

CERTIFICAT DE LABORATOIRE - SOL

ANALYSE GRANULOMÉTRIQUE DES SOLS INORGANIQUES

BNQ 2501-025/2013

CLIENT: 1199 NEWMARKET HOLDINGS INC. **DOSSIER:** 13340

PROJET: 1195, Newmarket street, Ottawa **ANALYSE NO:** 19-478-6

DONNÉES GÉNÉRALES			
Description:	Silt et sable avec traces de gravier	Prélevé le: 2019-08-27	Par: D. H.
Provenance:	F-4 / CF-4	Analysé le: 2019-09-11	Par: A. P.

ANALYSE GRANULOMÉTRIQUE	
112 mm	100
80 mm	100
56 mm	100
40 mm	100
28 mm	100
20 mm	100
14 mm	100
10 mm	99
5 mm	96
2,5 mm	92
1,25 mm	88
630 µm	83
315 µm	76
160 µm	66
80 µm	51,2

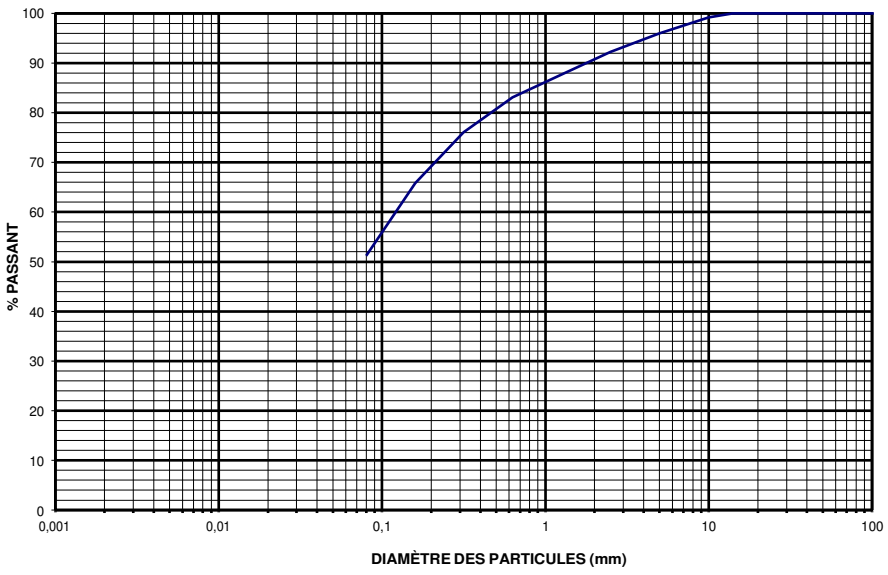
SÉDIMENTOMÉTRIE		
TEMPS (MIN)	DIAMÈTRE (MM)	% PASSANT
0,5		
1		
2		
5		
15		
30		
60		
120		
240		
480		
1440		

RÉSUMÉ DES ESSAIS	
Argile %	0
Silt %	51
Sable %	45
Gravier %	4

REMARQUES

Teneur en eau : 11,9 %

COURBE GRANULOMÉTRIQUE



Préparé par: Joël Martin

ORTAM groupe
RBQ : 8353-4917-04

CERTIFICAT DE LABORATOIRE - SOL

ANALYSE GRANULOMÉTRIQUE DES SOLS INORGANIQUES

BNQ 2501-025/2013

CLIENT: 1199 NEWMARKET HOLDINGS INC. **DOSSIER:** 13340

PROJET: 1195, Newmarket street, Ottawa **ANALYSE NO:** 19-478-7

DONNÉES GÉNÉRALES			
Description:	Sable et silt avec un peu de gravier	Prélevé le: 2019-08-27	Par: D. H.
Provenance:	F-5 / CF-3	Analysé le: 2019-09-11	Par: A. P.

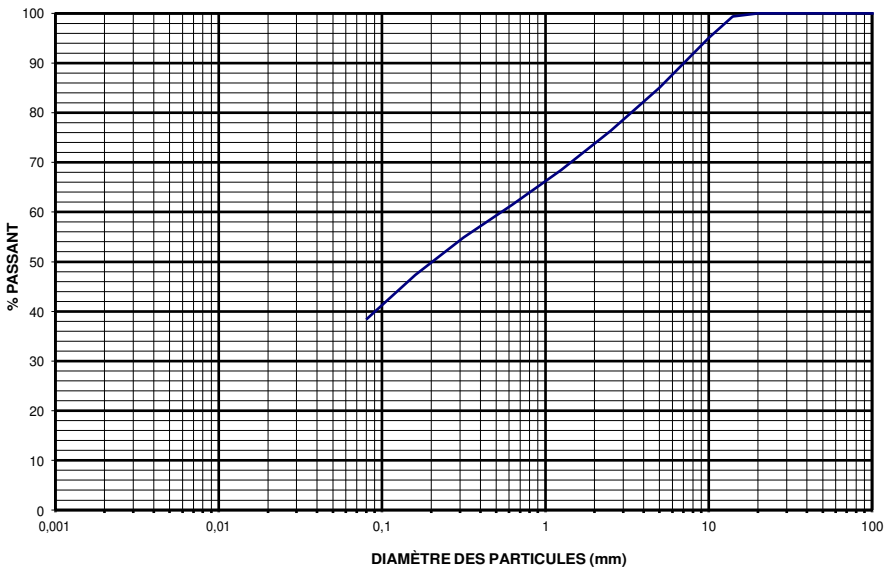
ANALYSE GRANULOMÉTRIQUE	
112 mm	100
80 mm	100
56 mm	100
40 mm	100
28 mm	100
20 mm	100
14 mm	99
10 mm	95
5 mm	85
2,5 mm	76
1,25 mm	68
630 µm	62
315 µm	55
160 µm	47
80 µm	38,4

RÉSUMÉ DES ESSAIS	
Argile %	0
Silt %	38
Sable %	47
Gravier %	15

REMARQUES
Teneur en eau : 8,3 %

SÉDIMENTOMÉTRIE		
TEMPS (MIN)	DIAMÈTRE (MM)	% PASSANT
0,5		
1		
2		
5		
15		
30		
60		
120		
240		
480		
1440		

COURBE GRANULOMÉTRIQUE



Préparé par: Joël Martin

ORTAM groupe
RBQ : 8353-4917-04

CERTIFICAT DE LABORATOIRE - SOL

ANALYSE GRANULOMÉTRIQUE DES SOLS INORGANIQUES

BNQ 2501-025/2013

CLIENT: 1199 NEWMARKET HOLDINGS INC. **DOSSIER:** 13340

PROJET: 1195, Newmarket street, Ottawa **ANALYSE NO:** 19-478-8

DONNÉES GÉNÉRALES			
Description:	Sable avec traces de silt	Prélevé le: 2019-08-27	Par: D. H.
Provenance:	F-6 / CF-2A	Analysé le: 2019-09-11	Par: A. P.

ANALYSE GRANULOMÉTRIQUE	
112 mm	100
80 mm	100
56 mm	100
40 mm	100
28 mm	100
20 mm	100
14 mm	100
10 mm	100
5 mm	100
2,5 mm	100
1,25 mm	100
630 µm	99
315 µm	90
160 µm	39
80 µm	8,6

RÉSUMÉ DES ESSAIS	
Argile %	0
Silt %	9
Sable %	91
Gravier %	0

REMARQUES
Teneur en eau : 11,6 %

SÉDIMENTOMÉTRIE

TEMPS (MIN)	DIAMÈTRE (MM)	% PASSANT
0,5		
1		
2		
5		
15		
30		
60		
120		
240		
480		
1440		

COURBE GRANULOMÉTRIQUE

Préparé par: Joël Martin

ORTAM groupe
RBQ : 8353-4917-04

CERTIFICAT DE LABORATOIRE - SOL

ANALYSE GRANULOMÉTRIQUE DES SOLS INORGANIQUES

BNQ 2501-025/2013

CLIENT: 1199 NEWMARKET HOLDINGS INC. **DOSSIER:** 13340

PROJET: 1195, Newmarket street, Ottawa **ANALYSE NO:** 19-478-9

DONNÉES GÉNÉRALES

Description:	Argile et silt avec traces de sable	Prélevé le:	2019-08-27	Par: D. H.
Provenance:	F-6 / CF-2B	Analysé le:	2019-09-11	Par: A. P.

ANALYSE GRANULOMÉTRIQUE

112 mm	100
80 mm	100
56 mm	100
40 mm	100
28 mm	100
20 mm	100
14 mm	100
10 mm	100
5 mm	100
2,5 mm	100
1,25 mm	100
630 µm	100
315 µm	100
160 µm	100
80 µm	95,3

SÉDIMENTOMÉTRIE

TEMPS (MIN)	DIAMÈTRE (MM)	% PASSANT
0,5	0,058	95,0
1	0,042	88,1
2	0,030	85,0
5	0,019	80,6
15	0,011	73,8
30	0,008	70,6
60	0,006	66,9
120	0,004	61,9
240	0,003	56,3
480	0,002	50,0
1440	0,001	39,4

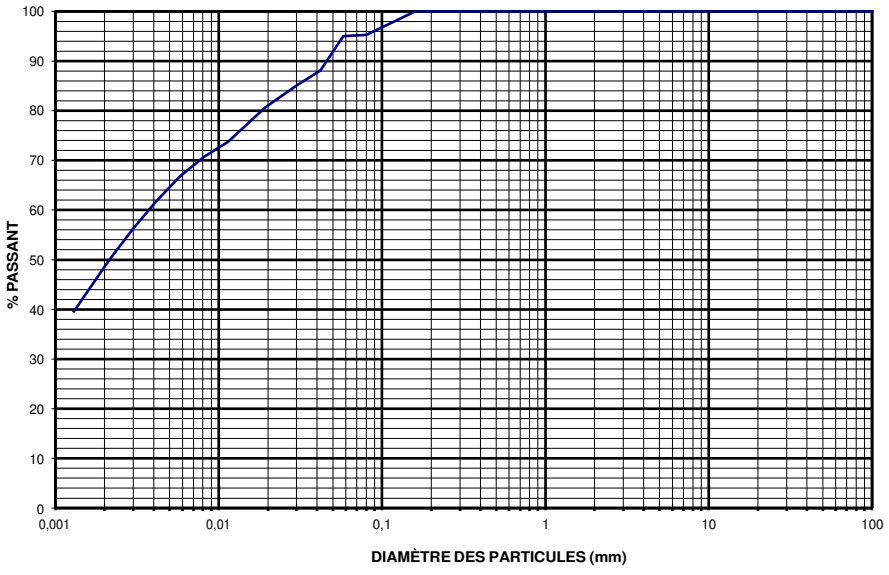
RÉSUMÉ DES ESSAIS

Argile %	48
Silt %	47
Sable %	5
Gravier %	0

REMARQUES

Teneur en eau : 29,5 %

COURBE GRANULOMÉTRIQUE



Préparé par: Joël Martin

ORTAM groupe
RBQ : 8353-4917-04

CERTIFICAT DE LABORATOIRE - SOL

ANALYSE GRANULOMÉTRIQUE DES SOLS INORGANIQUES

BNQ 2501-025/2013

CLIENT: 1199 NEWMARKET HOLDINGS INC. **DOSSIER:** 13340

PROJET: 1195, Newmarket street, Ottawa **ANALYSE NO:** 19-478-10

DONNÉES GÉNÉRALES			
Description:	Sable et silt avec un peu de gravier	Prélevé le: 2019-08-27	Par: D. H.
Provenance:	F-7 / CF-3	Analysé le: 2019-09-11	Par: A. P.

ANALYSE GRANULOMÉTRIQUE	
112 mm	100
80 mm	100
56 mm	100
40 mm	100
28 mm	100
20 mm	92
14 mm	92
10 mm	90
5 mm	85
2,5 mm	79
1,25 mm	73
630 µm	67
315 µm	59
160 µm	48
80 µm	36,1

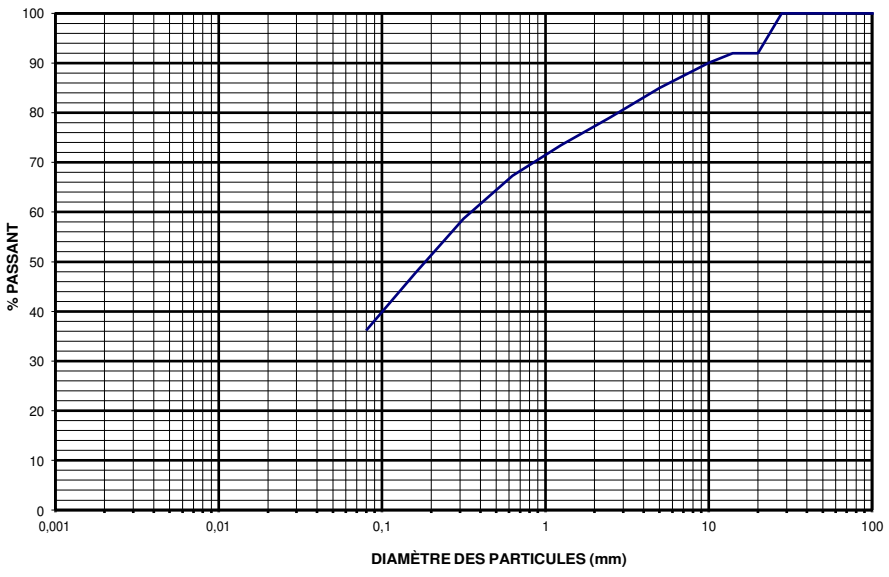
RÉSUMÉ DES ESSAIS	
Argile %	0
Silt %	36
Sable %	49
Gravier %	15

REMARQUES

SÉDIMENTOMÉTRIE

TEMPS (MIN)	DIAMÈTRE (MM)	% PASSANT
0,5		
1		
2		
5		
15		
30		
60		
120		
240		
480		
1440		

COURBE GRANULOMÉTRIQUE



Préparé par: Joël Martin

RBQ : 8353-4917-04

ABAQUE DE PLASTICITÉ

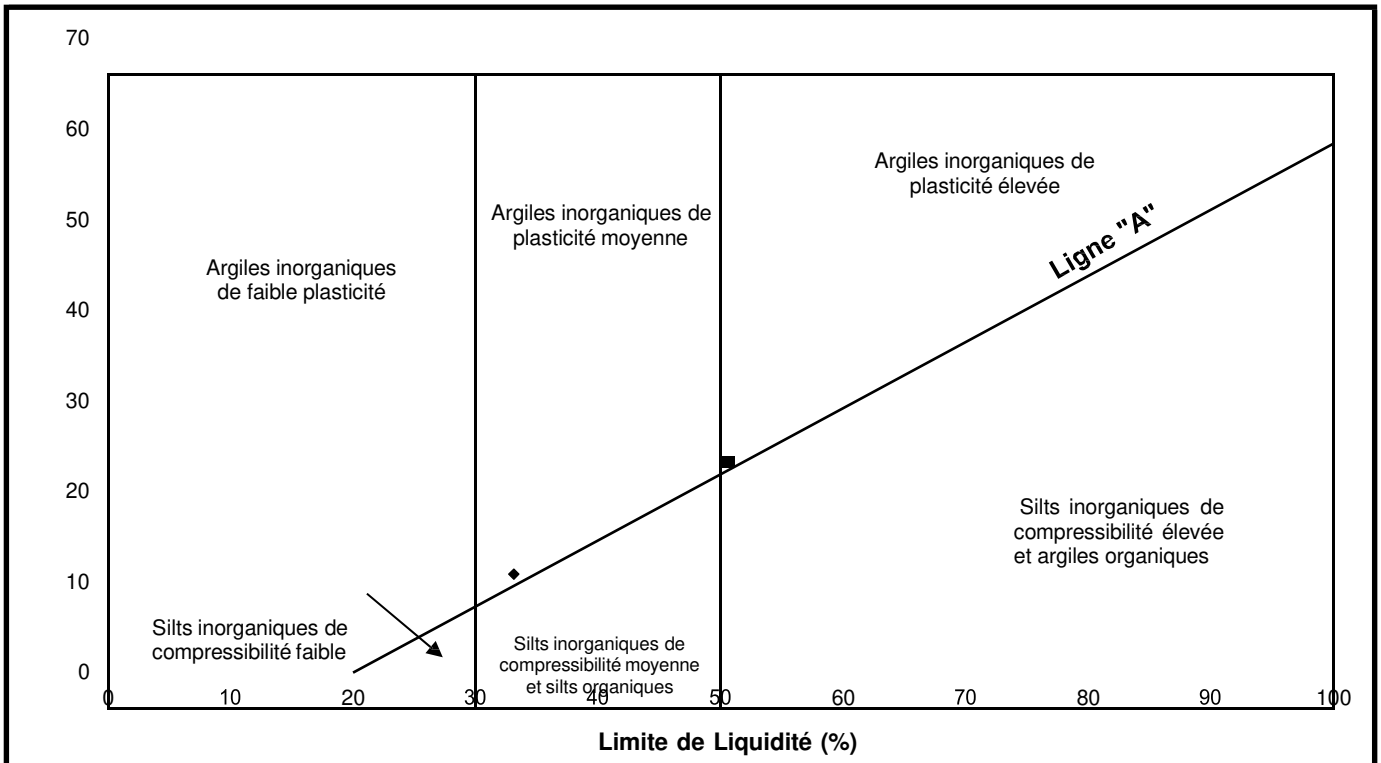
(Compilation des résultats)

CLIENT: **1199 NEWMARKET HOLDINGS INC.**

PROJET: **Warehouse Newmarket**

SITE: **1195, Newmarket street, Ottawa**

DOSSIER: **13340**



Compilé par: Joël Martin

APPENDIX 4

- Pavement Structural Design Requirements

Pavement Structural Design Matrix – Minimum Requirements
City of Toronto

		30,000		40, 000		50,000		60,000		75,000	
		30 MPa	50 MPa	30 MPa	50 MPa	30 MPa	50 MPa	30 MPa	50 MPa	30 MPa	50 MPa
Major Arterial	Non-Truck Routes (5% Commercial Vehicles)	40 mm SP12.5 FC2 D 110 mm SP19.0 D 150 mm Granular A 200 mm Granular B* 500 mm Total	40 mm SP12.5 FC2 D 90 mm SP19.0 D 150 mm Granular A 200 mm Granular B* 480 mm Total	40 mm SP12.5 FC2 D 125 mm SP19.0 D 150 mm Granular A 200 mm Granular B* 515 mm Total	40 mm SP12.5 FC2 D 100 mm SP19.0 D 150 mm Granular A 200 mm Granular B* 490 mm Total	40 mm SP12.5 FC2 D 135 mm SP19.0 D 150 mm Granular A 200 mm Granular B* 525 mm Total	40 mm SP12.5 FC2 D 110mm SP19.0 D 150 mm Granular A 200 mm Granular B* 500 mm Total	40 mm SP12.5 FC2 D 145 mm SP19.0 D 150 mm Granular A 200 mm Granular B* 535 mm Total	40 mm SP12.5 FC2 D 120 mm SP19.0 D 150 mm Granular A 200 mm Granular B* 510 mm Total	40 mm SP12.5 FC2 D 155mm SP19.0 D 150 mm Granular A 200 mm Granular B* 545 mm Total	40 mm SP12.5 FC2 D 125 mm SP19.0 D 150 mm Granular A 200 mm Granular B* 515 mm Total
	Truck Routes (7.5% Commercial Vehicles)	40 mm SP12.5 FC2 D 130 mm SP19.0 D 150 mm Granular A 250 mm Granular B* 570 mm Total	40 mm SP12.5 FC2 D 110 mm SP19.0 D 150 mm Granular A 250 mm Granular B* 550 mm Total	40 mm SP12.5 FC2 D 150 mm SP19.0 D 150 mm Granular A 250 mm Granular B 590 mm Total	40 mm SP12.5 FC2 D 130 mm SP19.0 D 150 mm Granular A 250 mm Granular B* 570 mm Total	40 mm SP12.5 FC2 D 155 mm SP19.0 D 150 mm Granular A 250 mm Granular B* 595 mm Total	40 mm SP12.5 FC2 D 135 mm SP19.0 D 150 mm Granular A 250 mm Granular B* 575 mm Total	40 mm SP12.5 FC2 E 160 mm SP19.0 E 150mm Granular A 250 mm Granular B* 600 mm Total	40 mm SP12.5 FC2 E 145 mm SP19.0 E 150 mm Granular A 250 mm Granular B* 585 mm Total	40 mm SP12.5 FC2 E 170 mm SP19.0 E 150 mm Granular A 250 mm Granular B* 610 mm total	40 mm SP12.5 FC2 E 150 mm SP19.0 E 150 mm Granular A 250 mm Granular B* 590 mm Total
	Truck Routes (10% Commercial Vehicles)	40 mm SP12.5 FC2 D 150 mm SP19.0 D 150 mm Granular A 250 mm Granular B* 590 mm Total`	40 mm SP12.5 FC2 D 125 mm SP19.0 D 150 mm Granular A 250 mm Granular B* 565 mm Total	40 mm SP12.5 FC2 D 160 mm SP19.0 D 150 mm Granular A 250 mm Granular B* 600 mm Total	40 mm SP12.5 FC2 D 135 mm SP19.0 D 150 mm Granular A 250 mm Granular B* 575 mm Total	40 mm SP12.5 FC2 E 170 mm SP19.0 E 150 mm Granular A 250 mm Granular B 610 mm Total	40 mm SP12.5 FC2 E 145 mm SP19.0 E 150 mm Granular A 250 mm Granular B* 585 mm Total	40 mm SP12.5 FC2 E 175 mm SP19.0 E 150 mm Granular A 250 mm Granular B* 615 mm Total	40 mm SP12.5 FC2 E 155 mm SP19.0 E 150 mm Granular A 250 mm Granular B* 595 mm Total	40 mm SP12.5 FC2 E 185 mm SP19.0 E 150 mm Granular A 250 mm Granular B* 625 mm Total	40 mm SP12.5 FC2 E 165 mm SP19.0 E 150 mm Granular A 250 mm Granular B* 605 mm Total

		20,000		25,000	
		30 MPa	50 MPa	30 MPa	50 MPa
Minor Arterial	Non-Truck Routes (4% Commercial Vehicles)	40 mm SP12.5 FC1 C 95 mm SP19.0 D 150 mm ranular A 150 mm Granular B* 435 mm Total	40 mm SP12.5 FC1 C 80 mm SP19.0 D 150 mm Granular A 150 mm Granular B* 420 mm Total	40 mm SP12.5 FC1 C 105 mm SP19.0 D 150 mm Granular A 150 mm Granular B* 445 mm Total	40 mm SP12.5 FC1 C 85 mm SP19.0 D 150 mm Granular A 150 mm Granular B* 425 mm Total
	Truck Routes (7.5% Commercial Vehicles)	40 mm SP12.5 FC1 C 135 mm SP19.0 D 150 mm Granular A 150 mm Granular B* 475 mm Total	40 mm SP12.5 FC1 C 110 mm SP19.0 D 150 mm Granular A 150 mm Granular B* 450 mm Total	40 mm SP12.5 FC1 C 140 mm SP19.0 D 150 mm Granular A 150 mm Granular B* 480 mm Total	40 mm SP12.5 FC1 C 120 mm SP19.0 D 150 mm Granular A 150 mm Granular B* 460 mm Total

		5,000		7,500		10,000		15,000	
		30 MPa	50 MPa	30 MPa	50 MPa	30 MPa	50 MPa	30 MPa	50 MPa
Collector	Comm./Ind. (5% Commercial Vehicles)			40 mm SP12.5 B 105 mm SP19.0 B 150 mm Granular A 150 mm Granular B* 445 mm Total	40 mm SP12.5 B 75 mm SP19.0 B 150 mm Granular A 150 mm Granular B* 415 mm Total	40 mm SP12.5 B 115 mm SP19.0 B 150 mm Granular A 150 mm Granular B* 455 mm Total	40 mm SP12.5 B 85 mm SP19.0 B 150 mm Granular A 150 mm Granular B* 425 mm Total	40 mm SP12.5 B 125 mm SP19.0 B 150 mm Granular A 150 mm Granular B* 465 mm Total	40 mm SP12.5 B 95 mm SP19.0 B 150 mm Granular A 150 mm Granular B* 435 mm Total
	Residential (3% Commercial Vehicles)	40 mm SP12.5 B 70 mm SP19.0 B 150 mm Granular A 150 mm Granular B* 410 mm Total	40 mm SP12.5 B 60 mm SP19.0 B 150 mm Granular A 150 mm Granular B* 400 mm Total	40 mm SP12.5 B 85 mm SP19.0 B 150 mm Granular A 150 mm Granular B* 425 mm Total	40 mm SP12.5 B 60 mm SP19.0 B 150 mm Granular A 150 mm Granular B* 400 mm Total	40 mm SP12.5 B 95 mm SP19.0 B 150 mm Granular A 150 mm Granular B* 435 mm Total	40 mm SP12.5 B 60 mm SP19.0 B 150 mm Granular A 150 mm Granular B* 400 mm Total		

	2,500		3,000		4,500	
	Local Residential (3% Commercial Vehicles)		Local Industrial (10% Commercial Vehicles)		Local Throughway (3% Commercial Vehicles)	
	30 MPa	50 MPa	30 MPa	50 MPa	30 MPa	50 MPa
Local	40 mm SP12.5 B 60 mm SP19.0 B 150 mm Granular A 150 mm Granular B* 400 mm Total		40 mm SP12.5 B 80 mm SP19.0 B 150 mm Granular A 150 mm Granular B* 420 mm Total	40 mm SP12.5 B 60 mm SP19.0 B 150 mm Granular A 150 mm Granular B* 400 mm Total	40 mm SP12.5 B 60 mm SP19.0 B 150 mm Granular A 150 mm Granular B* 400 mm Total	

	All Traffic & Subgrade
Composite Pavements – Major Arterial	40 mm Surface layer** 50 mm Base layer** 250 mm PCC Concrete 150 mm Granular A 490 mm Total
Composite Pavements – Minor Arterial - Bus/Truck Route	40 mm SP12.5 FC1 C 50 mm SP19.0 D 250 mm PCC Concrete 150 mm Granular A 490 mm Total
Composite Pavements – Local Collector - Bus/Truck Route	50 mm SP12.5 B 200 mm PCC Concrete 150 mm Granular A 400 mm Total
Composite Pavements – Local Collector - Non Bus/Truck Route	50 mm SP12.5 B 150 mm PCC Concrete 150 mm Granular A 350 mm Total

Notes:

AADT
Subgrade

* Subbase is Granular B - Type II as specified in TS 1010
** Surface and base layer asphalt mixe types for Major Arterial composite pavements should be selected based on the AADT as prescribed for flexible pavements

Designers shall use the pavement structural design matrix as minimum layer thickness during pavement design and analysis. Layer thickness may need to be increased based on the higher traffic volume, higher truck percentage or in situ resilient modulus.

APPENDIX 5

- Certificate of analysis of soils tested for corrosive action

Certificate of Analysis

Client: Groupe Ortam
1200, rue de Louvain O.
Montreal, QC
H4N 1G5
Attention: Mr. Tony Novembre
PO#:
Invoice to: Groupe Ortam

Report Number: 1968657
Date Submitted: 2021-12-14
Date Reported:
Project:
COC #: 215800

Dear Tony Novembre:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____
Sarah Horner, Inorganics Technician

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise indicated.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at: http://www.cala.ca/scopes/2602.pdf.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is licensed by the Ontario Ministry of the Environment, Conservation, and Parks (MECP) for specific tests in drinking water (license #2318). A copy of the license is available upon request.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by the Ontario Ministry of Agriculture, Food, and Rural Affairs for specific tests in agricultural soils.

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

Certificate of Analysis

eurofins | Environment Testing

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Attention: Mr. Tony Novembre
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Invoice to: Groupe Ortam

Report Number: 1968657
Date Submitted: 2021-12-14
Date Reported:
Project:
COC #: 215800

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.			
					1601839 Soil 2021-12-13 1M Bottom	1601840 Soil 2021-12-13 1M Top	1601841 Soil 2021-12-13 2M Bottom	1601842 Soil 2021-12-13 2M Top
Anions	Cl	0.002	%		<0.002	<0.002	0.006	0.002
	SO4	0.01	%		0.03	<0.01	0.01	0.02
General Chemistry	Electrical Conductivity	0.05	mS/cm		0.25	0.19	0.26	0.22
	pH	2.00			8.33	8.37	7.97	9.07
	Resistivity	1	ohm-cm		4170	5260	4000	4760
Sulphide-Soil	S2-				in-progress	in-progress	in-progress	in-progress

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.			
					1601843 Soil 2021-12-13 3M Bottom	1601844 Soil 2021-12-13 3M Top	1601845 Soil 2021-12-13 4M Bottom	1601846 Soil 2021-12-13 4M Top
Anions	Cl	0.002	%		N.R.	0.020	0.007	0.014
	SO4	0.01	%		0.01	0.01	0.01	<0.01
General Chemistry	Electrical Conductivity	0.05	mS/cm		0.31	0.63	0.34	0.37
	pH	2.00			8.40	7.45	8.38	8.33
	Resistivity	1	ohm-cm		3230	1610	3030	2780
Sulphide-Soil	S2-				in-progress	in-progress	in-progress	in-progress

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

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1200, rue de Louvain O.
Montreal, QC
H4N 1G5
Attention: Mr. Tony Novembre
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Invoice to: Groupe Ortam

Report Number: 1968657
Date Submitted: 2021-12-14
Date Reported:
Project:
COC #: 215800

					Lab I.D.	1601847
					Sample Matrix	Soil
					Sample Type	
					Sampling Date	2021-12-13
					Sample I.D.	4.6M
Group	**Analyte**	**MRL**	**Units**	**Guideline**		
Anions	Cl	0.002	%			0.007
	SO4	0.01	%			<0.01
General Chemistry	Electrical Conductivity	0.05	mS/cm			0.26
	pH	2.00				8.44
	Resistivity	1	ohm-cm			4000
Sulphide-Soil	S2-					in-progress

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

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Date Reported:
Project:
COC #: 215800

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 414211 **Analysis/Extraction Date** 2021-12-16 **Analyst** MW **Method** Cond-Soil			
Electrical Conductivity	<0.05 mS/cm	99	90-110
pH	7.18	100	90-110
Resistivity			
Run No 414227 **Analysis/Extraction Date** 2021-12-16 **Analyst** MW **Method** C CSA A23.2-4B			
Chloride	<0.002 %		90-110
Run No 414230 **Analysis/Extraction Date** 2021-12-16 **Analyst** MW **Method** AG SOIL			
SO4	<0.01 %	100	70-130

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range