BARBAY HOLDINGS INC.
201 MAPLEVIEW DRIVE
WEST, BARRIE, ON

GEOTECHNICAL INVESTIGATION

FEBRUARY 19, 2019

201 MAPLEVIEW DRIVE WEST, BARRIE, ON

GEOTECHNICAL INVESTIGATION

BARBAY HOLDINGS INC.

PROJECT NO.: 181-16808-00

DATE: FEBRUARY 19, 2019

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February 19, 2019

BARBAY HOLDINGS INC.
550 Bayfield Street
Barrie, ON
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Attention: Mr. P. Sadlon

Dear Mr. Sadlon,

Subject: 201 Mapleview Drive West, Barrie - Geotechnical Investigation

WSP Canada Inc. was retained to complete a geotechnical investigation at the above noted site. The purpose of the geotechnical investigation is to identify the subsurface conditions at select borehole locations and to provide design recommendations toward the proposed site development, as well as identify any potential constraints which may be encountered during construction.

Kind regards,

Kent Malcolm
Senior Geotechnical Engineer

Nick La Posta, P.Eng.
Team Lead - Environment

MKM/ham

WSP ref.: 181-16808-00

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February 19, 2019
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Senior Geotechnical Engineer

February 19, 2019
Date

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1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by Barbay Holdings Inc. to undertake a geotechnical investigation at 201 Mapleview Drive West, Barrie, Ontario. The location of the site is shown on the attached ***Site Location Plan - Figure 1.***

The scope of this geotechnical investigation was to obtain information about the subsurface conditions through the advancement of five (5) boreholes and based upon the findings of the boreholes ultimately provide recommendations herein pertaining to the following:

- Site preparation and grading;
- Appropriate foundation type, geotechnical resistances (ULS and SLS) and founding depth;
- Floor slab design and construction;
- General excavation, backfill and bedding requirements, and groundwater control;
- Preliminary infiltration rates; and,
- A preliminary pavement design.

This report deals with geotechnical issues only.

This report is provided based on the terms of reference presented above and on the assumption that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design.

The site investigation and recommendations follow generally accepted practice for Geotechnical Consultants in Ontario. The format and contents are guided by client specific needs and economics and do not conform to generalized standards for services. Laboratory testing follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for Barbay Holdings Inc. Third party use of this report without WSP consent is prohibited.

2 SITE BACKGROUND AND PROJECT DESCRIPTION

Based on information provided to our office, it is understood that the development comprises the construction of the following:

- A Show Room, Offices, Diagnostics Area and Car Wash (2 storeys);
- Exterior Show Room (2 storeys);
- Covered Car Display Area; and
- Associated roadways and parkland.

In addition, an infiltration area is anticipated in the rear gravel topped parking area.

The site is currently vacant and undeveloped.

The preliminary ISM Architects (Rev 2 dated December 2015) Site Plan and Elevations provided to our office are attached to this report in ***Appendix A***.

3 INVESTIGATION METHODOLOGY

The field investigation consisted of drilling five (5) boreholes (BH19-1 to BH19-5) at the site on February 4, 2019. The borehole locations are shown on the attached ***Borehole Location Plan - Figure 2***.

The boreholes were advanced to depths ranging between 3.5 metres below site grades (mbgs) and 5.0 mbgs. The boreholes were drilled with solid stem continuous flight auger equipment.

Drilling equipment was supplied and operated by a drilling sub-contractor under the direction and supervision of WSP personnel. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer in accordance with the Standard Penetration Test (ASTM D 1586) method. This sampling method recovers samples from the soil strata, and the number of blows required to drive the sampler a 0.3 m depth into the undisturbed soil (SPT 'N' values) gives an indication of the compactness condition or consistency of the sampled soil material. The SPT 'N' values are indicated on the ***Borehole Logs - Enclosures 1-5***.

Soil samples were visually classified in the field and re-evaluated by a senior engineer in our laboratory. All soil samples were tested for moisture contents. Laboratory Grain Size Analyses were carried out on representative samples and the results are provided in ***Enclosures 6-8.***

Water level observations were made during the drilling and in the open boreholes upon the completion of drilling operations. Standpipes were installed at two (2) borehole locations; WSP returned to the site on February 11, 2019 to obtain groundwater levels at the site.

4 SITE AND SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered are presented on the Borehole Logs and summarized in the following sections. It is noted that subsurface conditions can change between boreholes and the details provided below refer to soil conditions that were encountered at the borehole locations only.

4.1 GENERAL SUBSURFACE CONDITIONS

Based on the results of the field investigation and as the site was previously stripped, the subsurface conditions at the borehole locations generally comprised layers of non-cohesive and cohesive soil interlayered with non-cohesive and cohesive glacial till.

4.1.1 NON-COHESIVE SOIL

Non-cohesive materials were encountered at BH19-1 to BH19-4. The non-cohesive layers comprised silty sand to sand and silt. These soils were encountered at the surface of BH19-1 and BH19-3 extending to a depth of 0.7 meters below ground surface (mbgs), interlayered with till at BH19-1 and BH19-4 between 1.4 mbgs to 2.9 mbgs: at a depth of 4.1 mbgs at BH19-2 extending beyond the final depth investigated.

The non-cohesive soils were brown and moist to wet.

The measured SPT 'N' values in the non-cohesive soil deposit, where it was not frozen near the ground surface, ranged from 26 blows per 0.3 m of penetration to 57 blows per 0.3 m of penetration, indicating that the non-cohesive soils varied from compact to very dense, generally being compact becoming and dense with depth.

The natural moisture content of non-cohesive soils ranged between 7% and 19%.

A grain size analyses of a sample of the non-cohesive soil was completed and the gradation curve is presented in ***Enclosure 6***. A review of the grain size analyses indicates the following ranges of clay, silt, sand and gravel percentages:

- Gravel: 0%
- Sand: 94%
- Fines (Silt & Clay): 6%

4.1.2 COHESIVE SOIL

A cohesive deposit was encountered at all boreholes. The deposit comprised cohesive clayey silt to silty clay, at all boreholes. The cohesive soil was encountered as shallow as 0.7 mbgs at BH19-2 and at a depth of 4.1 mbgs at BH 19-1 and BH19-3 extending beyond the final depth investigated (5 mbgs).

The measured SPT 'N' values in the cohesive soils ranged from 14 blows per 0.3 m of penetration to 35 blows per 0.3 m of penetration, indicating that the cohesive ranged from stiff to hard.

The natural moisture content of cohesive soil ranged between 16% and 31%.

A grain size analyses of a sample of the cohesive soil was completed and the gradation curve is presented in ***Enclosure 7***. A review of the grain size analyses indicates the following ranges of clay, silt, sand and gravel percentages:

- Gravel: 2%
- Sand: 2%
- Silt: 33%
- Clay: 63%

4.1.3 GLACIAL TILL

A glacial till deposit was encountered at all boreholes. The till comprised both non-cohesive sand and silt, at all boreholes; as well as cohesive clayey silt at BH19-4 to a depth of 1.4 mbgs. The non-cohesive till was encountered at the surface of BH19-2 and BH19-5 extending to depths of 0.7 mbgs and 2.1 mbgs, respectively. Typically, a glacial till is a massive deposit that includes a wide range of particle sizes ranging from clay to boulders and is often interlayered with seams of less graded soil at sporadic depths as demonstrated at the various encounters in the boreholes advanced at this site. The till was brown at all locations. At the time of the investigation, the till was observed to range from moist to wet and based upon grinding of the augurs during drilling, boulders and cobbles are inferred to be present within the till deposit.

The measured SPT 'N' values in the cohesive till deposit were 26 blows per 0.3 m of penetration; while within the non-cohesive till deposit ranged from 19 blows per 0.3 m of penetration to 62 blows per 0.3 m of penetration, indicating that the till was either very stiff or varied from compact to very dense.

The natural moisture content of cohesive till ranged between 12% and 30%; while the non-cohesive till ranged between 8% and 21%.

A grain size analyses of a sample of the non-cohesive till deposit was completed and the gradation curve is presented in ***Enclosure 8***. A review of the grain size analyses indicates the following ranges of clay, silt, sand and gravel percentages:

- Gravel: 5%
- Sand: 64%
- Fines (Silt & Clay): 31%

4.2 GROUNDWATER

A summary of the groundwater levels observed at the site, both upon completion of the drilling of the boreholes, as well as in the standpipes installed in two of the boreholes, is summarized below.

BOREHOLE	DATE	GROUNDWATER DEPTH (MBGS)	MEASUREMENT SOURCE
BH19-1	February 4, 2019	4.3	Open Borehole
	February 11, 2019	2.9	Standpipe
BH19-2	February 4, 2019	4.3	Open Borehole
	February 11, 2019	3.9	Standpipe
BH19-3	February 4, 2019	Dry	Open Borehole
BH19-4	February 4, 2019	Dry	Open Borehole
BH19-5	February 4, 2019	Dry	Open Borehole

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events.

5 DISCUSSIONS/RECOMMENDATIONS

5.1 GENERAL

The following recommendations for the proposed site development are based on the information obtained from the borehole investigation and laboratory testing, which we believe fairly represents the subsurface conditions of the site. These recommendations are intended for the guidance of the design engineer to establish constructability and should not be construed as instructions to contractors. If significant differences in the subsurface conditions described above are found, we request to be contacted immediately to review and revise our findings and recommendations, if necessary.

The construction methods described in this report must not be considered as being specifications or recommendations to the prospective contractors, or as being the only suitable methods. Prospective contractors should evaluate all the information, obtain additional subsurface information as they might deem necessary and should select their construction methods, sequencing and equipment based on their own experience in similar ground conditions. The readers of this report are also reminded that the conditions are known only at the borehole locations and in view of the generally wide spacing of the boreholes, conditions may vary significantly between boreholes.

It is noted that, as no detailed design information was available at the time of this investigation, the information and recommendations provided below should be considered preliminary in nature only.

5.2 SITE BACKGROUND

As indicated above the proposed development comprises the construction of a two (2) storey automotive dealership and service garage surrounded by a parking lot.

The results of the geotechnical investigation indicate that the subsurface conditions at the site comprise inter layered cohesive, non-cohesive soil and glacial till. The soil ranged from compact to very dense and stiff to hard. Generally moist soil conditions were encountered during drilling becoming wet below a depth of 3.0 mbgs in BH19-1 and BH19-2. Groundwater was also encountered within the two (2) standpipes on February 11, 2019 as high as 2.9 mbgs.

5.3 SITE PREPARATION AND GRADING

Removal of any fill and/or organic matter encountered is required to facilitate the proposed development on the site. We note that fill was not encountered during the investigation; however, if fill is encountered, it may be reused in landscaping applications or as subgrade parking area fill. WSP should be contacted to review all proposed fill reuse on site. The existing fill in the proposed parking areas must be assessed during construction operations by confirmation sampling and proofroll to ascertain whether it should be removed and replaced in the proposed parking area.

After the completion of the required stripping and removal of unsuitable materials (fill and organic matter), if encountered, the sub-grade should be proof-rolled and inspected by experienced WSP geotechnical engineering personnel. The proof-rolling and compaction of the exposed sub-grade is recommended to be conducted using a vibratory compactor with a minimum static weight of 10 tonnes. The proof-rolling program should consist of a minimum of six (6) passes per unit area and be tested to assure that the sub-grade is compacted to a minimum of 98% of the exposed material's Standard Proctor Maximum Dry Density (SPMDD). Any loose/soft or wet areas identified at the time of proof-rolling that cannot be uniformly compacted are recommended to be sub-excavated and backfilled with approved fill**.**

Compacted fill may be required to develop the design grades and elevations or for use in other backfilling excavations created through the removal of unsuitable materials or soils as described above. The excavated native on-site materials may be re-used, subject that these are free of organic and other unsuitable materials and have adequate moisture content. Boulders or cobbles greater than 200 mm in size should be removed from the fill. Alternatively, Ontario Provincial Standard Specification (OPSS) Granular B – Type I, OPSS Select Subgrade Material (SSM), or an approved equal may be used at the site for engineered fill purposes.

All fill materials imported to the site must meet all applicable municipal, provincial and federal guidelines and requirements associated with environmental characterization of the materials.

Fill is to be placed in maximum 200 mm thick loose lifts under full time supervision of qualified WSP geotechnical personnel. Each lift is to be uniformly compacted to achieve the required degree of compaction.

5.4 FOUNDATION RECOMMENDATIONS

Details of the proposed development such as underside of footing elevations were not available at the time when this report was prepared. When this information is available, the recommendations provided herein should be reviewed by WSP to confirm that the recommendations are still valid based on the design information.

Based on the soil conditions encountered in the boreholes and provided that the site is prepared in accordance with the recommendations presented in this report, footings that are founded at a minimum depth of 0.6 mbgs into the undisturbed compact or stiff native soils may be designed based on a preliminary factored ultimate geotechnical resistance at Ultimate Limit States (ULS) of 225 kPa. A preliminary serviceability geotechnical resistance at

Serviceability Limit States (SLS) of 150 kPa may be used in the design of the foundations. An increased SLS capacity of 200 kPa (300 ULS) is available at a minimum depth of 1.5 mbgs.

Foundations designed to the specified bearing capacities at the serviceability limit states (SLS) are expected to settle less than 25 mm total and 19 mm differential.

5.4.1 GENERAL FOUNDATION COMMENTS

All footings exposed to seasonal freezing conditions should be provided with at least 1.5 m of earth cover or equivalent thermal insulation against frost. It is recommended to keep footings as high as possible to avoid or minimize penetration below groundwater levels while considering the minimum frost cover requirement.

Variations in the soil conditions are expected in between the borehole locations, and during construction, the geotechnical resistances should be confirmed by experienced WSP site personnel.

Where it is necessary to place footings at different levels, the upper footing must be founded below an imaginary 10 horizontal to 7 vertical line drawn up from the base of the lower footing. The lower footing must be installed first to help minimize the risk of undermining the upper foundations.

The silt and clay soils at the base of footings can be easily disturbed by construction machinery and foot traffic or lose their strength in contact with surface water. We recommend that an allowance be made for placing a 50-mm thick skim coat of low-strength concrete on the founding subgrade immediately after its approval, to prevent its disturbance by construction activities and from ground or surface water, where necessary.

During winter construction, foundations and slab on grades must not be poured on frozen soil. Foundations must be adequately protected at all times from cold weather and freezing conditions.

Near the existing buried utilities, all footings must be lowered to undisturbed native soils, or alternatively the services must be structurally bridged.

It should be noted that the recommended geotechnical resistances have been calculated by WSP from the borehole information for the preliminary design stage only. Additional input may be required as new design information becomes available and is refined. For example, more specific information is available with respect to conditions between boreholes when construction is underway. In this regard, the interpretation between boreholes and the recommendations of this report must therefore be checked through field inspections provided by WSP to validate the information for use during the construction stage.

5.5 FLOOR SLAB CONSTRUCTION AND DRAINAGE

The floor slabs can be placed on undisturbed native soils or on compacted fill. For bedding and moisture barrier purposes, a 200-mm thick layer of 19 mm clear crushed stone must be provided under the concrete basement floor slab. Where localized wet and/or fine-grained soil conditions exist, the moisture barrier should be separated from the subgrade by a geotextile fabric to avoid loss of soil/fines and settlement problems.

5.6 EARTHQUAKE CONSIDERATIONS

The parameters for determination of Site Classification for Seismic Site Response are set out in Table 4.1.8.4A of the Ontario Building Code (2012). The classification is based on the determination of the average shear wave velocity in the top 30 meters of the site stratigraphy, where shear wave velocity measurements have been taken or alternatively estimated based on rational analysis of un-drained shear strength or penetration resistance.

At this site, the subsurface conditions include compact to very dense non-cohesive soils and stiff to hard cohesive soils. We note that the boreholes only extended to a depth of about 5 mbgs. For seismic design purposes, the site designation for seismic analysis is Class D (OBC 4.1.8.4 Table 4.1.8.4.A.).

5.7 LATERAL EARTH PRESSURES

The lateral earth pressure for the design of retaining walls, foundation walls, shoring, or trench boxes can be estimated from the following expressions:

Below groundwater table:

$$P = K \{\gamma(h - h_w) + \gamma'(h_w) + q\} + \gamma_w h_w$$

K = Earth pressure coefficient;

γ = Unit weight of soil above groundwater table, in kN/m^3;

h = Height of restrained soil, in meters;

h_w = Height of soil below groundwater level, in meters;

γ_w = Unit weight of water; ($9.8\ kN/m^3$);

γ' = Submerged unit weight of soil above groundwater table, ($\gamma_{sat} - \gamma_w$) in kN/m^3;

q = Value of Surcharge (kPa)

Where the backfill is effectively drained to eliminate hydrostatic pressure on the wall the equation is simplified to:

$$P = K (\gamma h + q)$$

The suggested soil parameters (unfactored) for the retaining wall design and/or ground support systems are summarized below.

SOIL TYPE	UNIT WEIGHT γ (KN/M^3)	EFFECTIVE ANGLE OF INTERNAL FRICTION (Φ')	COEFFICIENT OF EARTH PRESSURE		
			ACTIVE K_A	AT REST K_O	PASSIVE K_P
Granular A	22	35	0.27	0.43	3.69
Granular B	21	32	0.31	0.47	3.25
Cohesive Deposits	18	30	0.33	0.50	3.00
Non-Cohesive Deposits	19	32	0.31	0.47	3.25
Glacial Till	21	34	0.28	0.44	3.54

Backfilling of the footing wall excavations is recommended to be placed in 200 mm thick lifts, uniformly compacted to 98% SPMDD to proposed sub-grade elevations.

5.8 TEMPORARY EXCAVATIONS AND GROUNDWATER CONTROL

The details for the proposed services installations are not available at the time of preparing this report. The recommendations provided below assume that conventional depths for services will be carried out (approximately three (3) to four (4) mbgs).

Based upon the subsurface conditions at the borehole locations, excavations can be carried out with heavy hydraulic back-hoes. It is recommended that provision be carried in the contract for the excavation and disposal of obstructions on site, including cobbles and boulders.

All temporary excavations must be carried out in accordance with the Occupational Health and Safety Act (OHSA). In accordance with OHSA, the till deposits would be classified as a Type 1 soil, the cohesive deposits as a Type 2 soil and the non-cohesive soil as a Type 3 soil. If space limitations exist due to adjacent structures or facilities, consideration could be given to the construction of a temporary support system to provide protection to the structures and/or facilities. All excavated spoil should be placed at least the depth of the trench away from the edge of the trench for safety reasons.

As noted above, each of the boreholes drilled at the site were dry to a depth of approximately 3.0 mbgs on completion; groundwater was observed at a depth of 2.9 mbgs in a standpipe installed at the site. In this regard, significant groundwater is not anticipated to be encountered in shallow (< 2.5 mbgs) temporary excavations and any localized dewatering can be completed with conventional filtered sump pumps.

5.9 PIPE BEDDING AND COVER

The soils above the groundwater level or properly dewatered soil, where excavations are extended below the groundwater level, will provide adequate support for the sewer pipes and allow the use of normal Class B type bedding. The recommended minimum thickness of granular bedding below the invert of the pipes is 150 mm. The thickness of the bedding may, however, must be increased depending on the pipe diameter or in accordance with local standards or if wet or weak subgrade conditions are encountered, especially when the soil at the trench base level consists of wet, dilatant silt.

The bedding material should consist of well graded granular material such as Granular ‘A’ or equivalent. The bedding material should be compacted to at least 95 percent of its SPMDD. After installing the pipe on the bedding, a granular surround of approved bedding material, which extends at least 300 mm above the obvert of the pipe, or as set out by the local authority or municipality, should be placed. It is recommended that WSP be on site during excavations to assess the suitability of the subgrade materials to support the pipes.

If localized wet trench conditions are encountered, a uniformly graded clear stone may be used provided a suitable, approved filter fabric (geotextile) is placed in conjunction with the clear stone. The geotextile must extend underneath the clear stone, along the sides of the trench, and wrapped on top of the clear stone such that **the clear stone is fully wrapped by the geotextile.** A minimum geotextile overlap of 1 m is required; alternatively stitching of the geotextile could be considered. **WSP should be on site on a full-time basis if this method is being considered.**

Localized, wet and unstable soils encountered within generally stable soil zones can be generally stabilized by ‘punching’ a 50 mm well graded crusher run limestone pad into the soft subgrade prior to bedding placement. The thickness of the ‘pad’ will depend on field conditions and should be examined by WSP personnel during the construction operations.

5.10 TRENCH BACKFILL

The excavated native soils can be used as construction backfill provided their moisture content at the time of placement is within 2% of the optimum moisture content. Boulders or cobbles greater than 200 mm in size should be removed from the trench backfill. Portions of the fill / reworked soils contained organic materials; any soils with organics should not be used as trench backfill.

For the non-cohesive soils, smooth drum type vibratory rollers are recommended. Cohesive soils, if encountered or imported to the site for engineered fill, should be compacted with sheepsfoot type vibratory compactors. The trench backfill should be placed in maximum 0.3 m lift thickness and compacted to at least 98 percent of its SPMDD. Trench backfilling operations should be avoided during freezing weather.

It is preferable that the native soils be re-used from approximately the position at which they are excavated so that frost response characteristics of the soils after construction remain essentially similar. If required, consideration may also be given to backfilling trenches with a well graded, compacted granular soil such as Granular 'B' material.

It should be noted that the excavated soils are subject to moisture content increase during wet weather which would make these materials too wet for the compaction requirements noted above. Stockpiles should therefore be covered with tarpaulins to help minimize moisture increases.

5.11 PRELIMINARY PAVEMENT DESIGN

The investigation has shown that the predominant subgrade soils encountered at the site, after stripping any fill, will likely comprise both non-cohesive and cohesive soil and compacted fill.

Prior to the placement of granular materials as part of the pavement structure, the subgrade should be prepared and heavily proof-rolled under the supervision of WSP. Any poorly performing areas should be sub-excavated and replaced with either granular earth fill approved by WSP or imported Granular B, Type I material conforming to the requirements of OPSS.

Based on the above, the following minimum pavement thickness is recommended:

PAVEMENT LAYER	COMPACTION REQUIREMENTS	DRIVEWAY	PARKING
Asphaltic Concrete	92.0 to 96.5% Maximum Relative Density (MRD)	40 mm HL 3	
		50 mm HL 4 / HL 8	50 mm HL 4
OPSS Granular A Base	100% SPMDD	150 mm	150 mm
OPSS Granular B	100% SPMDD	350 mm	300 mm

We note that the pavement design noted above should be considered preliminary only. If required, a more refined pavement structure design can be performed based on specific traffic data and design life requirements and will involve specific laboratory tests to determine frost susceptibility and strength characteristics of the subgrade soils, as well as specific data input from the client.

5.12 INFILTRATION CHARACTERISTICS

Graphical depictions of the laboratory grain size analyses performed on samples recovered from the boreholes are enclosed. Based on the gradation results, the materials encountered are tabulated below.

MATERIAL	BOREHOLE SAMPLE	PERCOLATION TIME PERMEABILTY (min/cm)
Silty Sand to Sand	BH19-1, Sample 4	4 to 8
Clayey Silt to Silty Clay	BH19-2, Sample 3	>50
Silty Sand Till	BH19-5, Sample 2	20 to 30

We note that the Percolation Time ("T" time) or Permeability of the subsoil sampled was estimated. The materials, as defined in the Ministry of the Environment Manual of Policy, Procedures and Guidelines for Onsite Sewage Systems, in the appendices 6.3.1 and 6.3.2, resemble a diverse soil with Permeability varying from Medium to Unacceptable.

We must state that these values are strictly for unsaturated samples.

The value is solely based on the grain size distribution analysis shown in appendices 6.3.1 and 6.3.2 in the Ministry of the Environment Manual of Policy, Procedures and Guidelines for Onsite Sewage Systems. Furthermore, the estimates provided is indicative of the sample in a disturbed state only. We must emphasize that factors between boreholes such as, but not limited to, structure, consistency, density, organic content and degree of saturation influence the estimates.

An accurate analysis of soil infiltration characteristic is best determined with on-site permeameter testing at the location and level of the proposed infiltration condition.

5.13 DESIGN REVIEW, TESTING AND INSPECTIONS

WSP requests to be afforded the opportunity to complete a final review of the proposed development discussed in this report to verify that geotechnical recommendations are appropriate. If not given this opportunity, we cannot assume liability for omissions, misinterpretations or deficiencies in our recommendations.

WSP should be contacted to provide geotechnical testing and inspections during construction operations. Exposed subgrade soils for all structures are to be inspected to confirm the material is stable and competent. Inspections of seepage and groundwater conditions during construction are also required, as discussed in this report. Testing and inspections for general QA/QC are to include sampling and laboratory testing of fill materials and asphalt, compaction testing for the placement of fill materials and asphalt, and field and laboratory testing of concrete (including mix design reviews).

FIGURES

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PROJECT: GEOTECHNICAL INVESTIGATION, 201 MAPLEVIEW DR. W., BARRIE, ONTARIO

CLIENT: BARBAY HOLDINGS

TITLE: SITE LOCATION PLAN

SCALE: 1: 6000

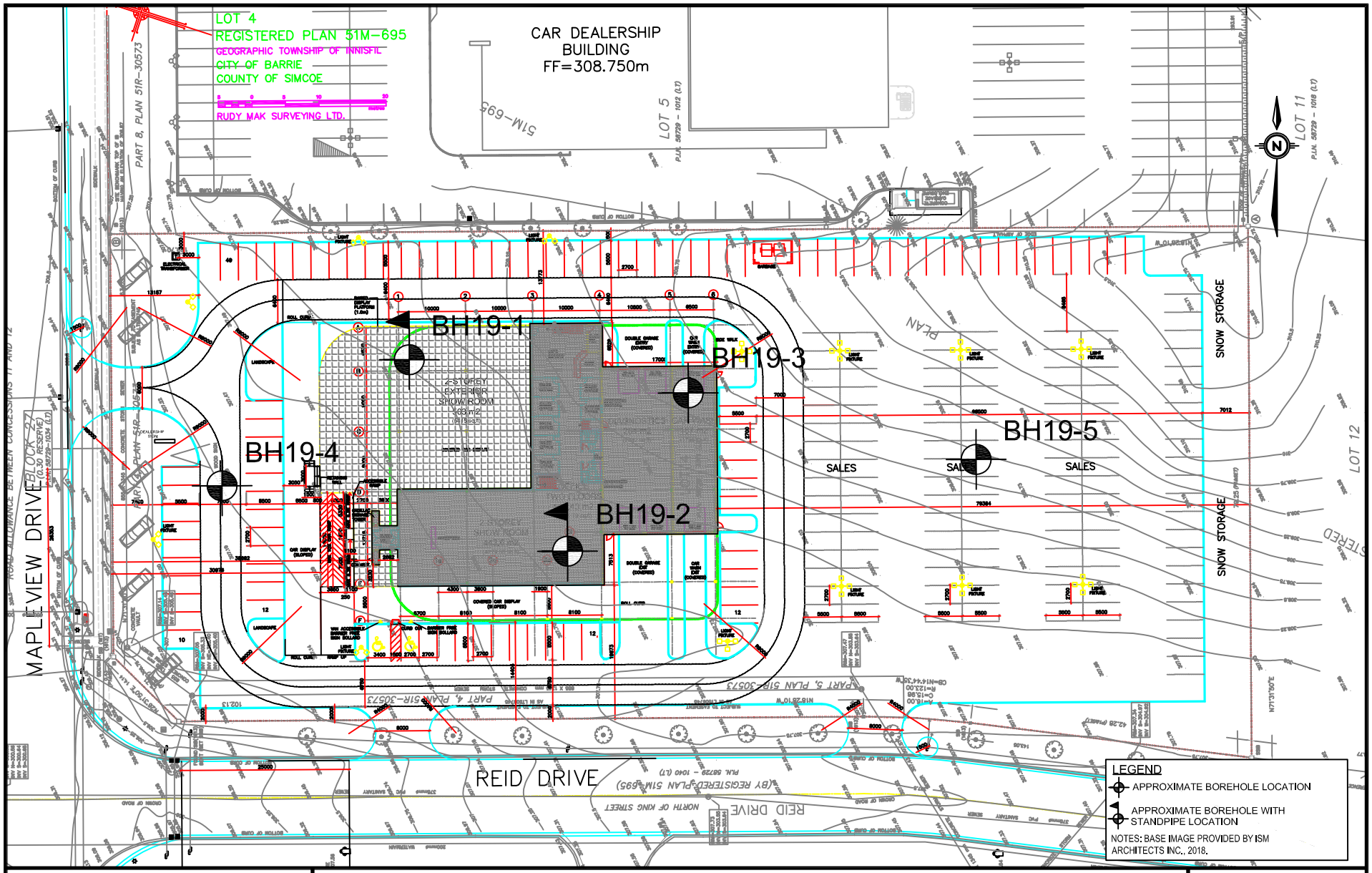
DATE: FEBRUARY / 2019

PROJECT NO: 181-16808-00

FIGURE NO: 1

REV. #

K:\PROJECTS\2018\181-16808-00 SADLON\SITE LOCATION PLAN_181-16808-00.dwg Feb 19, 2019-7:27am BY:(kaurel.tamasauskas)



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PROJECT: GEOTECHNICAL INVESTIGATION, 201 MAPLEVIEW DRIVE W., BARRIE, ONTARIO

CLIENT: BARBAY HOLDINGS

TITLE: BOREHOLE LOCATION PLAN

SCALE: 1:900

DATE: FEBRUARY / 2019

PROJECT NO: 181-16808-00

FIGURE NO: 2

REV. #

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ENCLOSURES

ENCLOSURES 1 - 5: BOREHOLE LOGS

ENCLOSURES 6 - 8: LABORATORY ANALYSES

LOG OF BOREHOLE 19-1

PROJECT: 201 Mapleview Drive
REF. NO.: 181-16808-00
CLIENT: Barbay Holdings
Method: Solid Stem Auger
ENCL NO.: 1
PROJECT LOCATION: 201 Mapleview Drive West, Barrie, Ontario
Diameter: 100 mm
DATUM: Geodetic
Date: Feb/04/2019
BH LOCATION: See Figure 2

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m
307.7	Ground Surface			
0.0	**SAND and SILT** *Frozen*, some gravel, brown, moist	1	SS	Frozen
307.0				
0.7	**SANDY SILT TILL** some clay, some gravel, moist, dense	2	SS	33
306.3				
1.4	**SILTY SAND to SAND** trace gravel, brown, moist to wet, compact to dense	3	SS	27
		4	SS	39
304.8				
2.9	**SAND and SILT TILL** trace gravel, trace clay, brown, moist, very dense	5	SS	62
303.6				
4.1	**SILTY CLAY** brown, moist, hard	6	SS	30
302.7				
5.0	End of borehole Note 1: Borehole was open with water measured at 4.3 meters below ground surface upon completion of drilling.			

GROUND WATER CONDITIONS: W. L. 304.8 m Feb 11, 2019

SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
(20 40 60 80 100)

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
0	94	(6)	

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE 19-2

PROJECT: 201 Mapleview Drive
REF. NO.: 181-16808-00
CLIENT: Barbay Holdings
Method: Solid Stem Auger
ENCL NO.: 2
PROJECT LOCATION: 201 Mapleview Drive West, Barrie, Ontario
Diameter: 100 mm
DATUM: Geodetic
Date: Feb/04/2019
BH LOCATION: See Figure 2

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m	ELEVATION
307.8	Ground Surface				
0.0	**SAND and SILT TILL** *Frozen*, some clay, trace gravel, brown, wet	1	SS	Frozen	307
307.1					
0.7	**CLAYEY SILT to SILTY CLAY** trace sand, trace gravel, brown, moist, stiff to very stiff	2	SS	19	
		3	SS	14	306
		4	SS	25	305
	Gravel seams, becoming wet	5	SS	26	
303.7					304
4.1	**SILTY SAND** brown, wet, very dense	6	SS	57	303
302.8					
5.0	End of borehole				

Note 1: Borehole was open with water measured at 4.3 meters below ground surface upon completion of drilling.

W. L. 303.9 m Feb 11, 2019

SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT
SHEAR STRENGTH (kPa)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
	2	2	33	63

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE 19-3

PROJECT: 201 Mapleview Drive
REF. NO.: 181-16808-00
CLIENT: Barbay Holdings
Method: Solid Stem Auger
ENCL NO.: 3
PROJECT LOCATION: 201 Mapleview Drive West, Barrie, Ontario
Diameter: 100 mm
DATUM: Geodetic
Date: Feb/04/2019
BH LOCATION: See Figure 2

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m
308.5	Ground Surface			
0.0 / 307.8	**SILTY SAND** *Frozen*, mixed with topsoil, trace gravel, brown, moist	1	SS	Frozen
0.7 / 306.4	**CLAYEY SILT to SILTY CLAY** trace sand, brown, moist, very stiff	2	SS	22
		3	SS	21
2.1 / 304.4	**SAND and SILT TILL** some gravel, trace clay, brown, moist, very dense	4	SS	53
		5	SS	55
4.1 / 303.5	**SILTY CLAY** brown, moist, hard	6	SS	30
5.0	End of borehole Note 1: Borehole was open and dry upon completion of drilling.			

GROUND WATER CONDITIONS

ELEVATION: 308, 307, 306, 305, 304

SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE 19-4

PROJECT: 201 Mapleview Drive
REF. NO.: 181-16808-00
CLIENT: Barbay Holdings
Method: Solid Stem Auger
ENCL NO.: 4
PROJECT LOCATION: 201 Mapleview Drive West, Barrie, Ontario
Diameter: 100 mm
DATUM: Geodetic
Date: Feb/04/2019
BH LOCATION: See Figure 2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m
307.3	Ground Surface				
0.0	**CLAYEY SILT TILL** *Frozen in upper 0.6m* some sand, trace gravel, brown, moist to wet, very stiff		1	SS	Frozen
1			2	SS	26
305.9					
1.4	**SILTY SAND** brown, moist, compact		3	SS	26
2					
305.2					
2.1	**CLAYEY SILT** some sand, brown, moist, very stiff		4	SS	15
304.4					
2.9	**SAND and SILT TILL** trace gravel, trace clay, brown, moist, compact		5	SS	19
3					
303.8					
3.5	End of borehole Note 1: Borehole was open and dry upon completion of drilling.				

GROUND WATER CONDITIONS

ELEVATION: 307, 306, 305, 304

SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

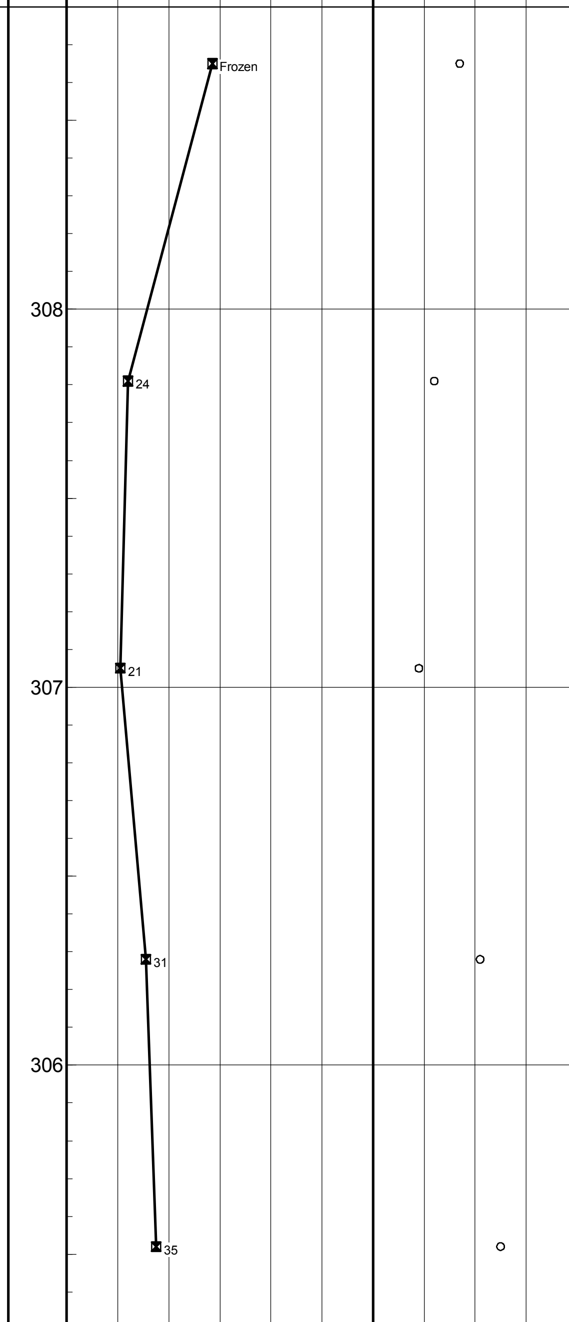
GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE 19-5

PROJECT: 201 Mapleview Drive
REF. NO.: 181-16808-00
CLIENT: Barbay Holdings
Method: Solid Stem Auger
ENCL NO.: 5
PROJECT LOCATION: 201 Mapleview Drive West, Barrie, Ontario
Diameter: 100 mm
DATUM: Geodetic
Date: Feb/04/2018
BH LOCATION: See Figure 2

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m^3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
308.8	Ground Surface							
0.0	**SILTY SAND TILL** *Frozen in upper 0.6m* trace gravel, trace clay, brown, moist, compact	1	SS	Frozen				
		2	SS	24				5 64 (31)
		3	SS	21				
306.7 / 2.1	**SILTY CLAY** brown, moist, hard	4	SS	31				
		5	SS	35				
305.3 / 3.5	End of borehole Note 1: Borehole was open and dry upon completion of drilling.							

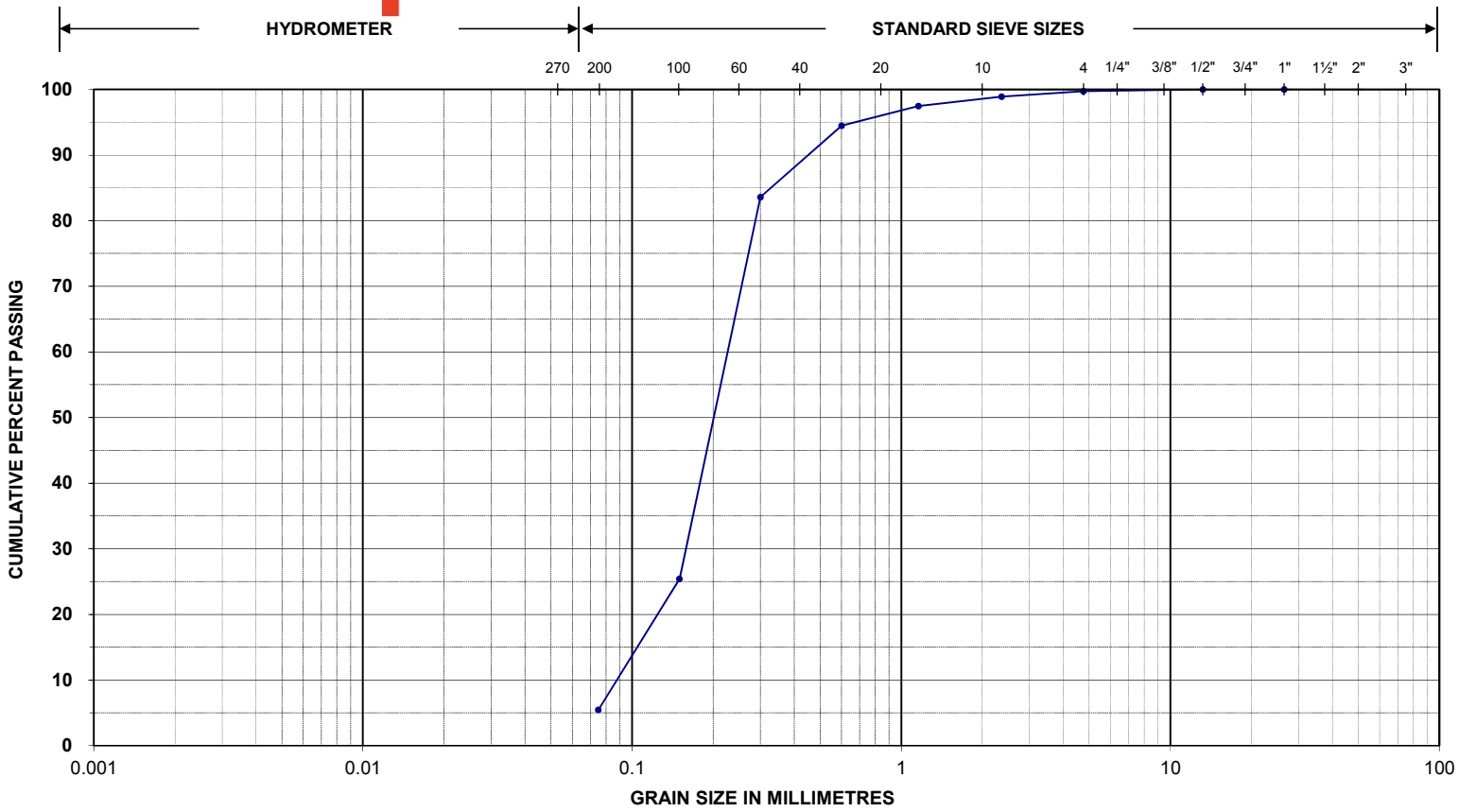
SPT & DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE (20 40 60 80 100)
PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L — WATER CONTENT (%) (10 20 30)



GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

PARTICLE SIZE DISTRIBUTION



Unified Classification System

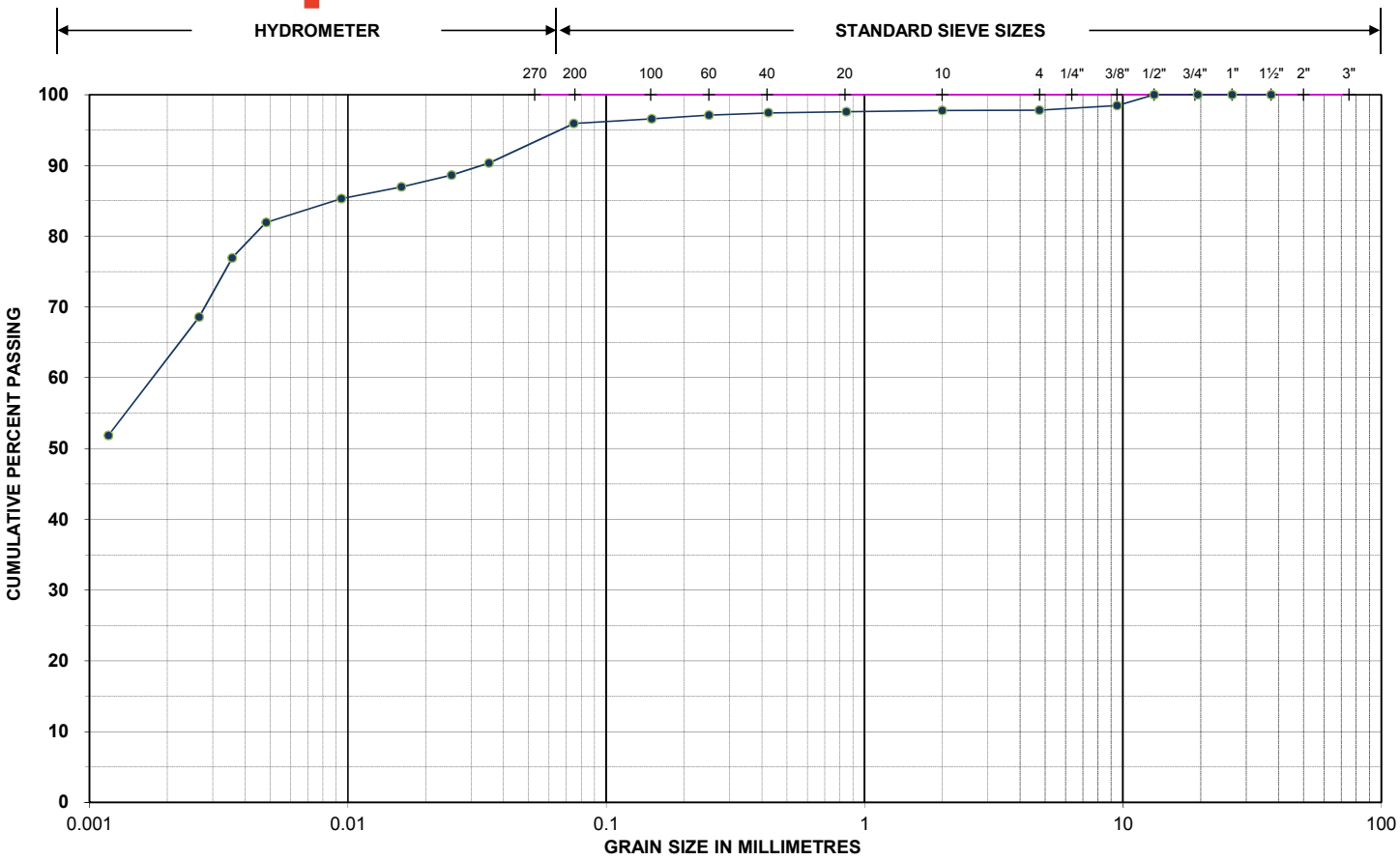
SILT AND CLAY	SAND	GRAVEL

Project Name:	201 Mapleview Drive, Barbay Holdings Inc.	**Project No.:**	181-16808-00
Location ID.:	BH19-1	**Sample No./Depth:**	SS4 / 2.3-2.7 m

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine
37.5 mm	100.0	**1.16 mm**	97.5
26.5 mm	100.0	**0.60 mm**	94.5
13.2 mm	100.0	**0.30 mm**	83.6
4.75 mm	99.7	**0.15 mm**	25.4
2.36 mm	98.9	**0.075 mm**	5.4

Enclosure No.: 6

PARTICLE SIZE DISTRIBUTION ASTM D422



Unified Classification System

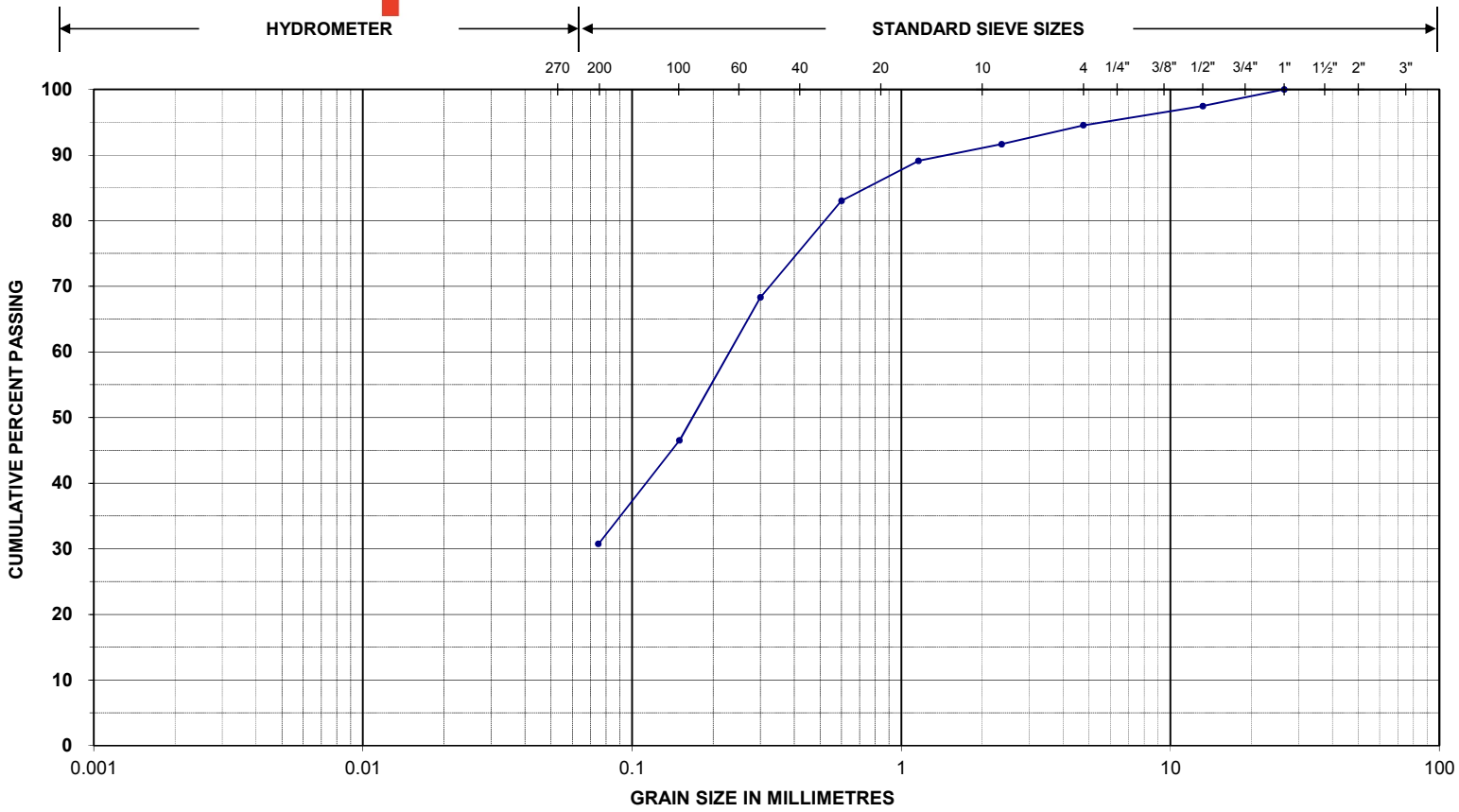
SILT AND CLAY	SAND	GRAVEL

Project Name:	201 Mapleview Drive, Barbay Holdings Inc.	**Project No.:**	181-16808-00
Location ID.:	BH19-2	**Sample No./Depth:**	SS3 / 1.5-2.0 m

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
26.5 mm	100.0	**0.850 mm**	97.6	**0.035**	90.3
13.2 mm	100.0	**0.425 mm**	97.4	**0.016**	87.0
9.50 mm	98.5	**0.250 mm**	97.1	**0.005**	82.0
4.75 mm	97.8	**0.106 mm**	96.6	**0.003**	68.6
2.00 mm	97.8	**0.075 mm**	95.9	**0.001**	51.9

Enclosure No.: 7

PARTICLE SIZE DISTRIBUTION



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

Project Name:	201 Mapleview Drive, Barbay Holdings Inc.	**Project No.:**	181-16808-00
Location ID.:	BH19-5	**Sample No./Depth:**	SS2 / 0.8-1.2 m

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine
37.5 mm	100.0	**1.16 mm**	89.1
26.5 mm	100.0	**0.60 mm**	83.0
13.2 mm	97.5	**0.30 mm**	68.3
4.75 mm	94.5	**0.15 mm**	46.5
2.36 mm	91.7	**0.075 mm**	30.7

Enclosure No.: 8

APPENDIX

APPENDIX A - ISM ARCHITECTS SITE PLAN & ELEVATIONS

TOPOGRAPHIC SURVEY OF
LOT 4
REGISTERED PLAN 51M-695
GEOGRAPHIC TOWNSHIP OF INNISFIL
CITY OF BARRIE
COUNTY OF SIMCOE

5 0 5 10 20
metres

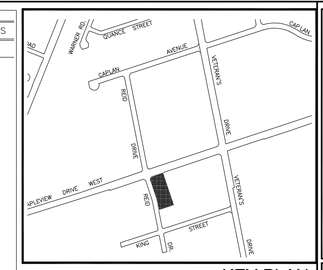
RUDY MAK SURVEYING LTD.

CAR DEALERSHIP
BUILDING
FF=308.750m

SITE INFORMATION	
PROPOSED USES	
AUTOMOTIVE SALES ESTABLISHMENT + CAR WASH	
TOTAL AREA OF SITE	12458.91 m2
COVERAGE OF BUILDING	2171.20 m2
TOTAL GROSS FLOOR AREA OF BUILDING	1410 m2
COVERAGE OF BUILDING TO SITE	17.43 %
AREA OF SITE COVERED BY ASPHALT	--
TOTAL % OF SITE COVERED BY ASPHALT	--
AREA OF LANDSCAPING	--
TOTAL % OF SITE COVERED BY LANDSCAPING	--

PARKING SPACES	REQUIRED	PROVIDED
1 PER 50m2 AUTO SALES	29	85
1 PER 70m2 CAR WASH	3	10
H.C. PARKING	2	2

LI (Bylaw 2009-141) ZONING STANDARDS		
STANDARD	REQUIRED	PROVIDED
LOT AREA	700 m2 (MIN)	12458.91 m2
LOT FRONTAGE	15.0 m (MIN)	63.03 m
FRONT YARD	7.0 m (MIN)	30.97 m
SIDE YARD - EAST (EM3)	3.0 m (MIN)	13.7 m
SIDE YARD - WEST	7.0 m (MIN)	14.40 m
REAR YARD	7.0 m (MIN)	79.3 m
BUILDING HEIGHT	14 m (MAX)	m
TOTAL LOT COVERAGE	60.0% (MAX)	17.43 %



KEY PLAN

ISM ARCHITECTS
174 Bayfield Street
Barrie, ON L4M 3B5
T: 705.726.2342 F: 705.725.5355
E: ian@ismarchitects.ca

No.	ISSUE/ REVISION	DATE
1	CLIENT REVIEW	NOV 27/15
2	CAR WASH ADD.	DEC 01/15
3	ADD SITE ENTRANCE	OCT 12/2016

STAMP
ONTARIO ASSOCIATION OF ARCHITECTS
IAN S. MALCOLM
LICENCE
2853

A Detail No.
B Sheet No. where detailed.

ORIENTATION
NORTH

CLIENT
PAUL SADLON

PROJECT
CADILLAC DEALERSHIP
MAPLEVIEW & REID DR.
BARRIE, ON

PROJECT INFORMATION

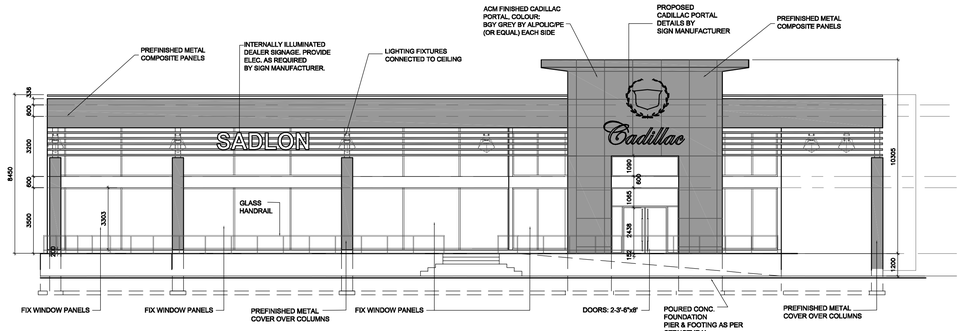
PROJECT No.:	153850
DRAWN BY:	MM
CHECKED BY:	ISM
DATE:	17.10.2016
SCALE:	AS NOTED

DRAWING
SITE PLAN

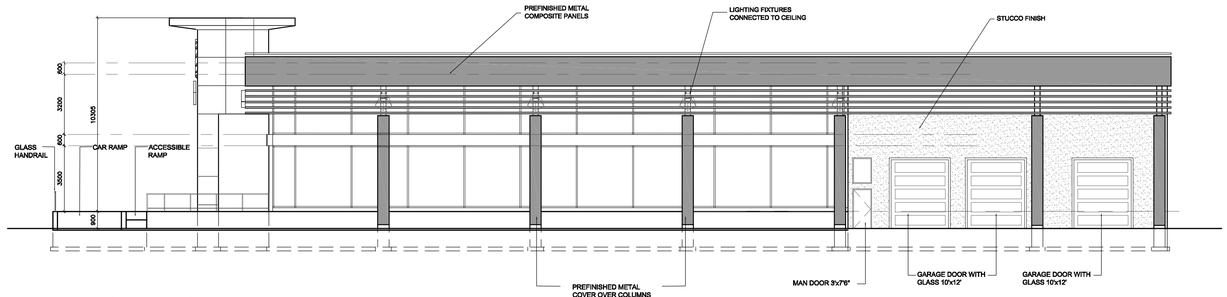
DRAWING No.
A100

SITE PLAN 1:250

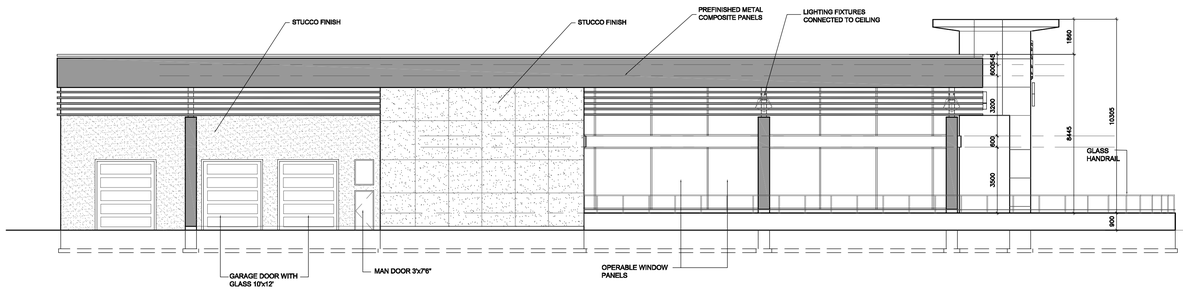
153853 CADILLAC DEALERSHIP SP4



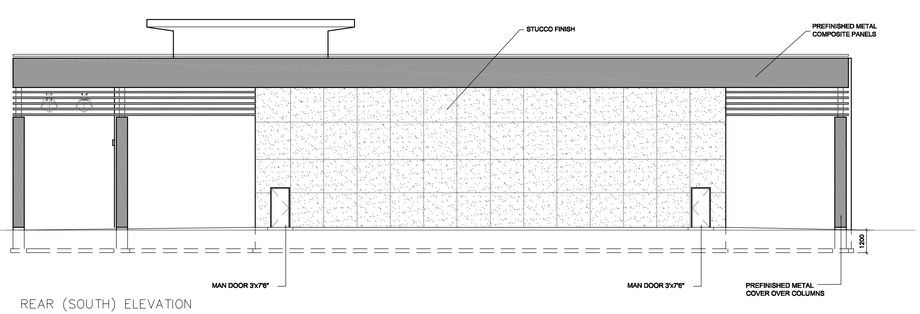
FRONT (MAPLEVIEW) ELEVATION



WEST (RAID DRIVE) ELEVATION



EAST ELEVATION



REAR (SOUTH) ELEVATION

ISM ARCHITECTS
174 Bayfield Street
Barrie, ON L4M 3B5
T: 705.726.2342 F: 705.725.5355
E: ian@ismarchitects.ca

No.	ISSUE/ REVISION	DATE
1	CLIENT REVIEW	NOV 27/15
2	CAR WASH ADD.	DEC 01/15
3	SITE PLAN SUBMISSION	OCT 17/2018

STAMP

ONTARIO ASSOCIATION OF ARCHITECTS
IAN S. MALCOLM
LICENCE
2853

ORIENTATION

CLIENT
PAUL SADLON

PROJECT
CADILLAC DEALERSHIP
MAPLEVIEW & REID DR.
BARRIE, ON

PROJECT INFORMATION

PROJECT No.:	153850
DRAWN BY:	MM
CHECKED BY:	ISM
DATE:	17.10.2018
SCALE:	AS NOTED

DRAWING
ELEVATIONS

DRAWING No.
A200