CORAL SOPHIA HOUSING INC.

113 & 117 BAYFIELD STREET & 6,8 & 12 SOPHIA STREET EAST, BARRIE, ONTARIO

GEOTECHNICAL INVESTIGATION

MARCH 04, 2021

113 & 117 BAYFIELD STREET & 6,8 & 12 SOPHIA STREET EAST, BARRIE, ONTARIO

GEOTECHNICAL INVESTIGATION

CORAL SOPHIA HOUSING INC.

PROJECT NO.: 191-04694-00 (UPDATE)
DATE: MARCH 04, 2021

WSP
UNITS C AND D
561 BRYNE DRIVE
BARRIE, ON, CANADA L4N 9Y3

T: +1 705 735-9771
F: +1 705 735-6450
WSP.COM

March 04, 2021

Coral Sophia Housing Inc.
4810 Dufferin Street, Suite E
Toronto, ON
M3H 5S8

Dear Mr. Savino,

Subject: 113 & 117 Bayfield Street and 6, 8, & 12 Sophia Street East, Barrie, Ontario - 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 the borehole locations and to provide design recommendations toward the design of the proposed development, as well as identify any potential geotechnical related constraints which may be encountered during construction.

Kind regards,

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

Kent Malcolm, P.Eng.
Senior Geotechnical Engineer

NLP/KM/ham

WSP ref.: 191-04694-00 (Update)

UNITS C AND D
561 BRYNE DRIVE
BARRIE, ON, CANADA L4N 9Y3

T: +1 705 735-9771
F: +1 705 735-6450
wsp.com

TABLE OF CONTENTS

DRAWINGS

ENCLOSURES

APPENDICES

1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by Coral Sophia Housing Inc. (CSHI) to provide a Geotechnical Investigation for a proposed multi-storey, mixed-use development located at 113 & 117 Bayfield Street and 6, 8, & 12 Sophia Street East in the City of Barrie, Ontario. The location of the site is shown on the ***Site Location Plan - Figure 1.***

The scope of this geotechnical investigation was to obtain information about the subsurface conditions through the advancement of six (6) boreholes and based upon the findings of the boreholes ultimately provide recommendations herein pertaining to the following:

- General soil conditions;
- Soil parameters for excavations;
- Excavation and backfill;
- Water levels and preliminary comments for an EASR or PTTW;
- Soil bearing capacity; and,
- Site seismic classification.

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.

2 SITE BACKGROUND AND PROJECT DESCRIPTION

The site is currently vacant; however, based on air photography a series of houses formerly occupied the site. The houses have since been demolished and the site is relatively flat. The site is bound by an existing building to the north, Drury Lane to the east, Sophia Street to the south, and Bayfield Street to the west.

Based on the project drawings provided to our office, the proposed development comprises an eight-storey mixed-use building. The building will be constructed as a slab-on-grade structure with no underground parking. The project drawings are included in ***Appendix A.***

3 INVESTIGATION METHODOLOGY

The field investigation consisted of drilling six (6) boreholes (BH19-01, BH/MW19-02, BH19-03, BH19-04, BH/MW19-05 and BH/MW19-06) at the site on April 24 and 25, 2019. The locations of each site are shown on the attached ***Borehole Location Plan – Figure 2.***

The boreholes were advanced to depths ranging between 5.2 metres below site grades (mbgs) to 9.8 mbgs. The boreholes were drilled with hollow 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 1-6***.

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 ***Laboratory Results - Enclosures 7-12.***

Water level observations were made during the drilling and in the open boreholes upon the completion of drilling operations. Monitoring wells were installed at three (3) borehole locations; WSP returned to the site after the drilling operations to obtain groundwater levels at the site.

4 SITE AND SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered are presented on the Borehole Logs ***(Enclosures 1-6)*** 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, the subsurface conditions at the borehole locations generally comprised a topsoil or pavement structure overlying fill materials. The fill is underlain by native soils including glacial till and non-cohesive deposits.

4.1.1 ASPHALT / TOPSOIL / FILL

Asphalt was encountered in Boreholes BH/MW19-02, BH19-03, and BH/MW19-06. Topsoil was encountered in Boreholes BH19-1 and BH/MW19-05. The asphalt / topsoil thicknesses at each of the borehole locations is summarized below.

Table 4-1 Summary of Surface Cover Thickness

BOREHOLE	TOPSOIL THICKNESS (cm)	ASPHALT THICKNESS (cm)
BH19-01	20	
BH/MW19-02		13
BH19-03		10
BH/MW19-05	10	
BH/MW19-06		5

Fill materials were encountered in each of the borehole locations; a summary is provided below.

Table 4-2 Summary of Fill Thickness

BOREHOLE	DEPTH OF TOP OF FILL (MBGS)	DEPTH OF BOTTOM OF FILL (MBGS)	FILL THICKNESS (M)	TYPE OF SOIL
BH19-01	0.2	3.0	2.8	Sand to Silty Sand Fill
BH/MW19-02	0.1	2.2	2.1	Sand to Sandy Silt Fill
BH19-03	0.1	2.2	2.1	Sand to Silty Sand Fill
BH19-04	0.0	0.7	0.7	Silty Sand Fill
	0.7	1.5	0.8	Silty Clay Fill
	1.5	2.2	0.7	Sandy Silt Fill
BH/MW19-05	0.1	2.2	2.1	Sand to Sandy Silt Fill
BH/MW19-06	0.1	1.5	1.4	Sand to Sandy Silt Fill
	1.5	2.2	0.7	Clayey Silt Fill

It should be noted that topsoil/fill quantities should not be calculated from the borehole information, as large variations in depth may exist between boreholes. A detailed topsoil/fill layer thickness survey is required to determine an accurate evaluation of quantity.

The measured SPT 'N' values in the fill deposits ranged between 3 blows per 0.3 m of penetration and 28 blows per 0.3 m of penetration, indicating that the compactness of the fill varied significantly indicating that the fill was likely placed without uniform compactive effort.

The natural moisture content of the fill ranged between 12% and 30%.

A grain size analysis of three (3) samples of the fill materials was completed and the gradation curves are presented in ***Enclosures 7 - 9***. A review of the grain size analyses indicates the following ranges of gravel, sand and fines percentages:

- Gravel: 1% to 9%
- Sand: 27% to 68%
- Fines (Silt & Clay): 23% to 69%

4.1.2 GLACIAL TILL

Glacial till was encountered in all the boreholes, underlying the fill and non-cohesive deposits. The till ranged between silty sand to sandy silt to sandy clayey silt till. The till was brown to grey, moist to wet, with trace amounts of gravel. Boulders and cobbles are inferred to be present within the till deposit based upon resistance to augering. The till deposit extended beyond the final depth investigated at all boreholes.

The measured SPT 'N' values in the non-cohesive till deposits ranged between 18 blows per 0.3 m of penetration to greater than 50 blows per 0.3 m of penetration, indicating that the till varied from compact to very dense.

The natural moisture content of the till soils ranged between 7% and 18%.

A grain size analysis of three (3) samples of the till deposit was completed and the gradation curves are presented in ***Enclosures 10-12***. A review of the grain size analysis indicates the following ranges of clay, silt, sand and gravel percentages:

- Gravel: 0% to 2%
- Sand: 19% to 51%
- Silt: 33% to 63%
- Clay: 14% to 18%

4.1.3 NON-COHESIVE DEPOSITS

Non-cohesive deposits, ranging between silty sand to sandy silt, were encountered between the fill materials and the glacial till in three (3) of the boreholes. The non-cohesive layers were brown, moist, and contained variable amounts of clay.

The measured SPT 'N' values in the non-cohesive layers ranged from 27 blows per 0.3 m of penetration to 36 blows per 0.3 m of penetration, indicating that the non-cohesive soil varies from compact to dense.

The natural moisture content of the non-cohesive soils ranged between 15% and 18%.

4.2 GROUNDWATER

A summary of the groundwater conditions encountered at the site are summarized below.

Table 4-3 Summary of Groundwater Levels

BOREHOLE	DATE	GROUNDWATER DEPTH (MBGS)	GROUNDWATER ELEVATION (M)	MEASUREMENT SOURCE
BH19-01	April 25, 2019	9.1	--	Open Borehole
BH/MW19-02	April 24, 2019	3.87	232.2	Open Borehole
	May 2, 2019	1.61	234.5	Monitoring Well
	May 15, 2019	1.24	234.9	Monitoring Well
	June 25, 2019	1.50	234.6	Monitoring Well
	Sept 13, 2019	1.96	234.1	Monitoring Well
BH19-03	April 25, 2019	3.3	--	Open Borehole
BH19-04	April 24, 2019	4.3	--	Open Borehole
BH/MW19-05	April 24, 2019	1.86	233.8	Open Borehole
	May 2, 2019	3.42	232.3	Monitoring Well
	May 15, 2019	3.44	232.3	Monitoring Well
	June 25, 2019	3.67	232.0	Monitoring Well
	Sept 13, 2019	4.24	231.5	Monitoring Well
BH/MW19-06	April 25, 2019	1.36	235.2	Open Borehole
	May 2, 2019	0.73	235.9	Monitoring Well
	May 15, 2019	0.82	235.8	Monitoring Well
	June 25, 2019	1.39	235.2	Monitoring Well
	Sept 13, 2019	2.81	233.8	Monitoring Well

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.

5.2 SITE BACKGROUND

Based on the project drawings provided to our office, the proposed development comprises an eight-storey mixed-use building. The building will be a slab-on-grade building with no underground parking; the Level 1 floor elevation is 237.00 m. The project drawings are included in ***Appendix A***.

The results of the geotechnical investigation indicate that the subsurface conditions at the site comprise topsoil / asphalt overlying fill; the fill extended to a maximum depth of 3.0 mbgs. The fill is underlain by native compact to very dense glacial till and compact to dense non-cohesive deposits. Groundwater was encountered in each of the boreholes and was measured as high as 0.7 mbgs in the monitoring well installed in Borehole BH19-6.

5.3 SITE PREPARATION AND GRADING

Removal of all asphalt, topsoil, and fill materials will be required to facilitate future development of the site. To further refine the fill thicknesses and extents across the site, it is recommended that a test pit program be completed at the site by WSP prior to construction. Regarding the reuse of the site topsoil and fill, these materials may be reused in landscaping applications or other non-structural fill applications. WSP should be contacted to review all proposed topsoil and fill reuse on site.

After the completion of the required stripping and removal of all unsuitable materials, 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 engineered fill consistent with the recommendations provided in ***Appendix B***.

Where engineered fill is required to develop the design grades and elevations or for use in backfilling excavations created through the removal of unsuitable materials or soils as described above, the excavated on-site materials may be re-used, subject that these are free of organic and other unsuitable materials and have appropriate moisture

content. Boulders or cobbles greater than 200 mm in size should be removed from the fill prior to or during placement.

Alternatively, Ontario Provincial Standard Specification (OPSS) Granular B – Type I, OPSS Select Subgrade Material (SSM) or approved equal may be used.

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.

Engineered fill is to be placed in maximum 200 mm thick loose lifts under full time supervision of qualified geotechnical personnel. Each lift is to be uniformly compacted to achieve a minimum of 100% of the material's SPMDD. Additional information related to the placement and compaction of engineered fill can be found in ***Appendix B***.

5.4 PRELIMINARY FOUNDATION RECOMMENDATIONS

Based on the project drawings, the footings will be constructed at an elevation of 235.5 m, about 1.5 m below the proposed elevation of the level 1 floor slab (Elevation 237.0 m).

Based on the results of the field investigation, a conventional shallow foundation system could be considered to support the proposed building. However, we note that fill was encountered in each of the boreholes and the depth of the fill extended beneath the proposed footing elevation. As such, the footings must be lowered to the native soils beneath the fill soils at the site. The fill depths in each of the boreholes are provided in Section 4.1.1.

Footings founded on the compact to dense, non-cohesive soils or glacial till, at the depths and approximate elevations provided in Table 5-1, may be designed based on a factored ultimate geotechnical resistance at Ultimate Limit States (ULS) of 300 kPa. A serviceability geotechnical resistance at Serviceability Limit States (SLS) of 225 kPa may be used in the design of the foundations.

Table 5-1 Summary of Suitable Founding Soil Levels

BOREHOLE NO.	EXISTING GROUND SURFACE ELEVATION (M)	APPROXIMATE DEPTH TO 225 KPA FOUNDING SOIL (M)	APPROXIMATE ELEVATION TO 225 KPA FOUNDING SOIL (M)
BH19-01	236.2	3.1	233.1
BH/MW19-02	236.1	2.8	233.3
BH19-03	235.8	2.3	233.5
BH19-04	235.9	2.3	233.6
BH/MW19-05	235.7	2.3	233.4
BH/MW19-06	236.6	2.3	234.3

Footings for small structures founded on engineered fill placed in accordance the document provided in ***Appendix B*** may be designed based on a factored ultimate geotechnical resistance at ULS of 225 kPa and a serviceability geotechnical resistance at SLS of 150 kPa.

The above noted resistances have been calculated on footing sizes ranging from 0.4 m to 1.5 m in width; as noted above, once the foundation sized are finalized, WSP will need to re-assess and confirm the above noted values.

5.4.1 GENERAL FOUNDATION COMMENTS

All foundations 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.

During winter construction, foundations and slab on grades must not be poured on frozen soil. Foundations must be adequately protected always 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 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 on the basis of rational analysis of un-drained shear strength or penetration resistance.

It is our opinion that the Average Standard Penetration Resistance (N_{60}) can be taken as 15 and 50. Therefore for seismic design purposes, the site designation for seismic analysis is Class D (OBC 4.1.8.4 Table 4.1.8.4.A.).

5.6 FLOOR SLAB CONSTRUCTION AND DRAINAGE

As noted above, the FFE for the concrete slab for Level 1 is Elevation 237.0 m. As part of the floor slab construction, it is recommended that the existing fills not be left in place and that any existing fills be removed and replaced as compacted fill beneath the proposed slab. 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 wet and/or fine-grained soil conditions exist, the sub drains and moisture barrier should be separated from the subgrade by a geotextile fabric to avoid loss of soil/fines and settlement problems. The exterior below-grade walls of the structure should be waterproofed to mitigate groundwater inflows.

5.7 LATERAL EARTH PRESSURES

The lateral earth pressure for the design of retaining walls, shoring, or trench boxes can be estimated from the following expression; the expression assumes that the perimeter drainage system prevents the build-up of any hydrostatic pressure behind the wall.

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

Where:

p	=	Lateral earth pressure in kPa acting at depth h
K	=	Earth pressure coefficient, assuming vertical walls and horizontal backfill for permanent construction
γ	=	Unit weight of backfill
h	=	Depth to point of interest in metres
q	=	Equivalent value of surcharge on the ground surface in kPa

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

Table 5-2 Soil Parameters

SOIL TYPE	UNIT WEIGHT γ (kN/m^3)	EFFECTIVE ANGLE OF INTERNAL FRICOTION friction (Φ')	COEFFICIENT OF EARTH PRESSURE		
			Active Ka	At rest Ko	Passive Kp
Granular A	22	35	0.27	0.43	3.69
Granular B	21	32	0.31	0.47	3.25
Non-Cohesive Till Deposits	21	32	0.31	0.47	3.25
Non-Cohesive Deposits	19	32	0.31	0.47	3.25

It is essential that imported free-draining OPSS Granular 'B' type fill be used as backfill against foundation walls. Backfilling of the footing wall excavations is recommended to be placed in 200 mm thick lifts, uniformly compacted to 100% 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 3 m to 5 m below existing site grades).

Based upon the subsurface conditions at the borehole locations, excavations can be carried out with a heavy hydraulic backhoe. It is recommended that provision be carried in the contract for the excavation and disposal of obstructions on site, including cobbles and boulders, which can be prevalent in glacial till material.

All temporary excavations must be carried out in accordance with the Occupational Health and Safety Act (OHSA). In accordance with OHSA, the fill and the sandy silt / sand would be classified 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 the groundwater level was encountered as high as 0.7 mbgs at the site. As such, there is the potential for dewatering to be required at the site and an Environmental Activity and Sector Registry (EASR) or a Permit to Take Water (PTTW) may be required for the excavations in areas of the site. It should be noted that the

requirements for a PTTW, issued by the Ontario Ministry of the Environment and Climate Change (MOECC) have recently changed; daily water takings of 50 m^3/day require registration of the MOECC EASR database, and daily water takings of 400 m^3/day require a PTTW. Additional comments regarding the need for an EASR or a PTTW are being provided in greater detail in the hydrogeological assessment completed by WSP.

5.9 PIPE BEDDING AND COVER

The soils above the groundwater level, or properly dewatered if encountered 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, have to 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, which is noted to be present at this site. The bedding material should consist of well graded granular material such as Granular 'A' or equivalent. 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.

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.

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.

Alternatively, if longer stretches of unstable soils are encountered, Class 'A' bedding could be considered. The rigid concrete bedding (lean mix concrete) should be laid from manhole to manhole to mitigate the potential for differential settlement.

Where the sewer pipe is placed in water bearing soils below the water table, the joints connecting the sewer sections should be very well sealed to prevent piping of fines into the sewer pipe and manhole catch basin risers.

5.10 TRENCH BACKFILL

The excavated 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. It is noted that some portions of the native materials contained organic material; in this regard, WSP personnel should be on site to review soils that are being considered for reuse.

For the granular soils, smooth drum type vibratory rollers are recommended. Cohesive soils, if encountered, 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 the site grading, will be engineered fill or existing fill materials.

Prior to the placement of granular materials as part of the pavement structure, the subgrade, in particular in the existing fill areas, 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 and assuming that traffic usage will be residential minor local or local, the following minimum pavement thickness is recommended:

Table 5-3 Pavement Structure Thickness

PAVEMENT LAYER	COMPACTION REQUIREMENTS	LIGHT DUTY PARKING (CARS)	HEAVY DUTY PAVEMENT (DELIVERY TRUCKS)
Asphaltic Concrete	92.0 to 96.5% Maximum Relative Density (MRD)	50 mm HL 4	40 mm HL 3 or HL 4
			50 mm HL 8
OPSS Granular A Base	100% SPMDD	150 mm	150 mm
OPSS Granular B	100% SPMDD	300 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 DCC.

6 CONCLUSIONS

In general, based on the results of the field investigation and the proposed 8 storey development, the site conditions are considered to be generally feasible for the proposed development.

6.1 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).

DRAWINGS

DRAWING 1: SITE LOCATION PLAN
DRAWING 2: BOREHOLE LOCATION PLAN

126 DON HILLOCK DRIVE, UNIT 2
AURORA, ONTARIO CANADA L4G 0G9
TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

PROJECT: Geotechnical Investigation
113 & 117 BAYFIELD STREET
and 6, 8, & 12 SOPHIA STREET
EAST, BARRIE, ONTARIO

TITLE: SITE LOCATION PLAN

CLIENT: CORAL SOPHIA HOUSING INC.

SCALE: 1:20,000

DRAWN BY: TP

CHECKED BY: LL

PROJECT NO: 191-04694-00

DATE: JUNE 2019

FIGURE NO: 1

REV.: -

Document Path: T:\191-04694-00\MXD\191-04694-00 200 Figure 1 Location Map.mxd

wsp

126 DON HILLOCK DRIVE, UNIT 2
AURORA, ONTARIO CANADA L4G 0G9
TEL.: 905-750-3080 | FAX: 905-727-0463 | WWW.WSP.COM

LEGEND

- APPROXIMATE SITE BOUNDARY
- BOREHOLE LOCATION
- MONITORING WELL LOCATION

N
W E
S

10 5 0 10 Metres

Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

CLIENT:

CORAL SOPHIA HOUSING INC.

PROJECT:

HYDROGEOLOGICAL STUDY
113-117 BAYFIELD STREET
BARRIE, ONTARIO

PROJECT NO:	DATE:
191-04694-00	MARCH 2021

DESIGNED BY: -

DRAWN BY: T.P.

CHECKED BY: LL

FIGURE NO:	SCALE:
2	1:400

TITLE:

BOREHOLE LOCATIONS

DISCIPLINE:

ENVIRONMENT

ISSUE:	REV.:
	-

Document Path: T:\191-04694-00\MXD\191-04694-00 200 Figure 9 BH Locations.mxd

ENCLOSURES

ENCLOSURES 1 - 6: BOREHOLE LOGS
ENCLOSURES 7 – 12: LABORATORY RESULTS

LOG OF BOREHOLE BH19-01

PROJECT: 113 - 117 Bayfield Street

CLIENT: Coral Sophia Housing Inc.

PROJECT LOCATION: 113 - 117 Bayfield Street, Barrie, ON

DATUM: Relative

BH LOCATION: N 4916268 E 604145

Method: Hollow Stem Auger

Diameter: 203 mm

Date: Apr-25-2019

REF. NO.: 191-04694-00

ENCL NO.: 1

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
236.2	Ground Surface							
0.0 / 236.0	**TOPSOIL:** trace gravel, black, moist							
0.2	**SAND to SILTY SAND FILL:** trace gravel, black and brown, moist, very loose to compact		1	SS	21		236	
			2	SS	4		235	9 68 (23)
			3	SS	3			
233.2			4	SS	10		234	
3.0	**SILTY SAND TILL to SANDY SILT TILL:** trace gravel, some clay, brown to gray, moist, dense to very dense		5	SS	49		233	
			6	SS	95		232	
230.3							231	
5.9	**SANDY CLAYEY SILT TILL:** trace gravel, gray, moist, hard		7	SS	91		230	
			8	SS	74		229	
			9	SS	114		228	
226.5							227	
9.8	**END OF BOREHOLE** Notes: 1) Water level 9.1mbgs upon completion							

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)

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE MW19-02

PROJECT: 113 - 117 Bayfield Street

CLIENT: Coral Sophia Housing Inc.

PROJECT LOCATION: 113 - 117 Bayfield Street, Barrie, ON

DATUM: Relative

BH LOCATION: N 4916293 E 604146

Method: Hollow Stem Auger

Diameter: 203 mm

Date: Apr-24-2019

REF. NO.: 191-04694-00

ENCL NO.: 2

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
236.1	Ground Surface					
236.0	**ASPHALT**- 13 cm				236	
0.1	**SAND to SANDY SILT FILL:** trace to some gravel, brown, moist to wet, loose	1	SS	10	Cement	
		2	SS	9	235	
		3	SS	10	W. L. 234.8 m May 15, 2019 W. L. 234.0 m Jun 25, 2019 Feb 05, 2019	
233.9					234	
2.2	**SILTY SAND TILL:** trace to some gravel, brown and gray, moist to wet, compact to very dense	4	SS	18	Holeplug	
		5	SS	36	233	
					W. L. 232.2 m Apr 24, 2019	
		6	SS	59	231	
		7	SS	64	230	2 49 35 14
					229 Sand	
228.6					Screen	
7.5	**SANDY CLAYEY SILT TILL:** gray, moist, hard	8	SS	75	228	
		9	SS	38	227	
226.3						
9.8	**END OF BOREHOLE**					

Notes:
1) 50mm dia. monitoring well installed upon completion, screened 6.1 to 9.1 mbgs.
2) Water Level Readings:
Shallow well

Date	W. L. Depth (mBGL)
April 24, 2019	3.9
May 2, 2019	1.6
May 15, 2019	1.2
June 25, 2019	1.5
Sept 13, 2019	2.0

SOIL PROFILE | SAMPLES | GROUND WATER CONDITIONS | STRATA PLOT

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)

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE BH19-03

PROJECT: 113 - 117 Bayfield Street

CLIENT: Coral Sophia Housing Inc.

PROJECT LOCATION: 113 - 117 Bayfield Street, Barrie, ON

DATUM: Relative

BH LOCATION: N 4916282 E 604168

Method: Hollow Stem Auger

Diameter: 203 mm

Date: Apr-25-2019

REF. NO.: 191-04694-00

ENCL NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	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
235.8	Ground Surface											
235.7 0.0	**ASPHALT** - 10 cm											
0.1	**SAND to SILTY SAND FILL:** trace gravel, trace clay, dark brown, moist, compact to loose		1	SS	24							
			2	SS	5		235					
233.6			3	SS	5		234					1 54 33 12
2.2	**SILTY SAND TILL:** brown, moist, compact		4	SS	24							
			5	SS	31		233					
231.5							232					
4.3	**SANDY CLAYEY SILT TILL:** gray, moist, hard		6	SS	41		231					
230.6												
5.2	**END OF BOREHOLE** Notes: 1) Water level 3.3mbgs upon completion											

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE BH19-04

PROJECT: 113 - 117 Bayfield Street

CLIENT: Coral Sophia Housing Inc.

PROJECT LOCATION: 113 - 117 Bayfield Street, Barrie, ON

DATUM: Relative

BH LOCATION: N 4916307 E 604168

Method: Hollow Stem Auger

Diameter: 203 mm

Date: Apr-24-2019

REF. NO.: 191-04694-00

ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	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
235.9	Ground Surface											
0.0	**SILTY SAND FILL:** trace gravel, brown, moist, loose		1	SS	9				○			
235.2												
0.7	**SILTY CLAY FILL:** trace gravel, brown, moist, firm		2	SS	7		235		○			
1												
234.4												
1.5	**SANDY SILT FILL:** trace gravel, some clay to clayey, brown, moist, loose		3	SS	6		234		○			4 27 47 22
2												
233.7												
2.2	**SANDY SILT to SILTY SAND:** trace to some clay, brown, moist, dense		4	SS	36				○			
232.9							233					
3.0	**SANDY CLAYEY SILT TILL:** brown to gray, moist, hard		5	SS	31				○			
4							232					
5			6	SS	24		231		○			
230.7												
5.2	**END OF BOREHOLE** Notes: 1) Water level 4.3mbgs upon completion											

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE MW19-05

PROJECT: 113 - 117 Bayfield Street
CLIENT: Coral Sophia Housing Inc.
PROJECT LOCATION: 113 - 117 Bayfield Street, Barrie, ON
DATUM: Relative
BH LOCATION: N 4916295 E 604189

Method: Hollow Stem Auger
Diameter: 203 mm
Date: Apr-24-2019

REF. NO.: 191-04694-00
ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	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
235.7	Ground Surface											
~~235.6~~ 0.1	**TOPSOIL:** black, moist		1	SS	12		Cement					
	SAND to SANDY SILT FILL: trace gravel, trace to some clay, compact to loose		2	SS	3		235					
233.5			3	SS	4	▽	234 W. L. 233.8 m Apr 24, 2019					
2.2	**SANDY SILT:** brown, moist, dense		4	SS	32		233 Holeplug					
232.7												
3.0	**SILTY CLAYEY SAND TILL:** trace to some gravel, brown to gray, moist, very dense		5	SS	80	▽ ▽	W. L. 232.3 m May 15, 2019 Jun 25, 2019					
			6	SS	78		231					1 51 24 24
			7	SS	81		230					
							229 Sand Screen					
			8	SS	78		227					
225.9			9	SS	50/ 280mm		226					
9.8	**END OF BOREHOLE**											

Notes:
1) 50mm dia. monitoring well installed upon completion, screened 6.1 to 9.1 mbgs.
2) Water Level Readings:
Shallow well

Date	W. L. Depth (mBGL)
April 24, 2019	1.9
May 2, 2019	3.4
May 15, 2019	3.4
June 25, 2019	3.7
Sept 13, 2019	4.2

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

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

LOG OF BOREHOLE MW19-06

PROJECT: 113 - 117 Bayfield Street
CLIENT: Coral Sophia Housing Inc.
PROJECT LOCATION: 113 - 117 Bayfield Street, Barrie, ON
DATUM: Relative
BH LOCATION: N 4916327 E 604180

Method: Hollow Stem Auger
Diameter: 203 mm
Date: Apr-25-2019

REF. NO.: 191-04694-00
ENCL NO.: 6

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	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
236.6	Ground Surface											
236.5	**ASPHALT**- 5 cm											
0.1	**SAND to SANDY SILT FILL:** trace gravel, tace clay, gray, moist, compact		1	SS	28		Cement					
							236					
			2	SS	15		W. L. 235.9 m W. L. 235.8 m May 15, 2019					
1 235.1							Holeplug W. L. 235.2 m Apr 25, 2019					
1.5	**CLAYEY SILT FILL:** some sand, brown, moist, firm		3	SS	7							
2 234.4												
2.2	**SANDY SILT:** brown, moist, compact		4	SS	27		234					
3			5	SS	31		233					
4 232.4												
4.2	**SANDY CLAYEY SILT TILL:** brown to gray, moist, hard						Sand Screen					
			6	SS	42							0 19 63 18
5							231					
6			7	SS	37							
229.9							230					
6.7	**END OF BOREHOLE**											

Notes:
1) 50mm dia. monitoring well installed upon completion, screened 3.1 to 6.1 mbgs.
2) Water Level Readings:
Shallow well

Date	W. L. Depth (mBGL)
April 25, 2019	1.4
May 2, 2019	0.7
May 15, 2019	0.8
June 25, 2019	1.4
Sept 13, 2019	2.8

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

Particle Size Distribution Report

% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	8.5	2.3	16.0	50.4	22.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
19mm	100.0		
16mm	98.0		
13.2mm	96.8		
9.5mm	94.0		
4.75mm	91.5		
2mm	89.2		
0.850mm	83.6		
0.425mm	73.2		
0.250mm	55.7		
0.106mm	29.7		
0.075mm	22.8		

* (no specification provided)

Soil Description

Sand, some silt and clay, trace gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 2.4569 D_{85}= 1.0047 D_{60}= 0.2817
D_{50}= 0.2122 D_{30}= 0.1075 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Sampled by KH on Apr.25, 2019
F.M.=1.57

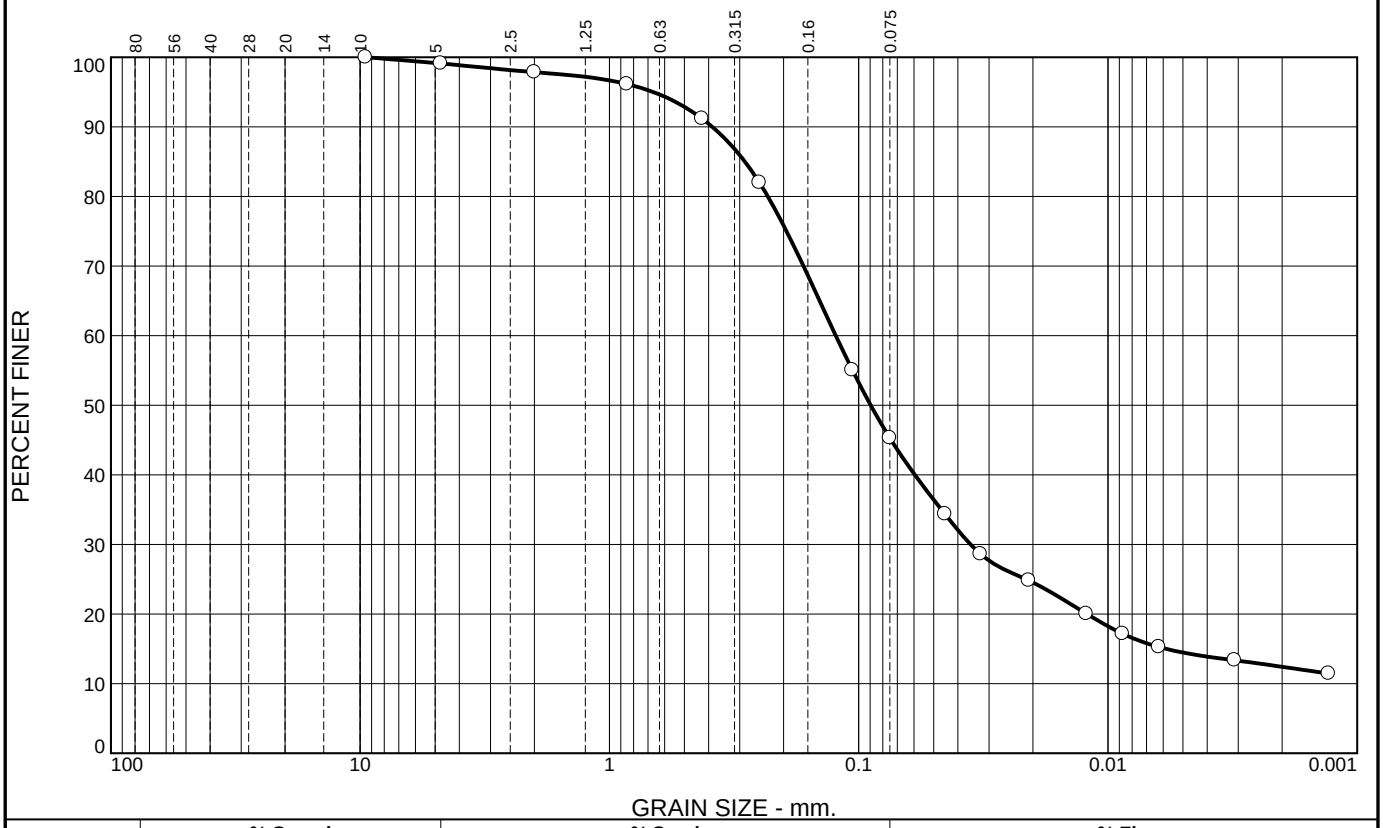
Location: BH19-1 SS2
Sample Number: MM-7285

Date: May.16, 2019

Client: Coral Sophia Housing Inc.
Project: Geotechnical Investigation for 117 Bayfield Street, Barrie, ON

Project No: 191-04694-00 **Figure** 7

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.9	1.2	6.7	45.9	32.9	12.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
9.5mm	100.0		
4.75mm	99.1		
2mm	97.9		
0.850mm	96.1		
0.425mm	91.2		
0.250mm	82.0		
0.106mm	55.1		
0.075mm	45.3		
0.0451 mm.	34.4		
0.0325 mm.	28.6		
0.0208 mm.	24.8		
0.0122 mm.	20.1		
0.0087 mm.	17.2		
0.0062 mm.	15.3		
0.0031 mm.	13.4		
0.0013 mm.	11.5		

* (no specification provided)

Soil Description

Silty sand, some clay, trace gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3864 D_{85}= 0.2860 D_{60}= 0.1235
D_{50}= 0.0894 D_{30}= 0.0356 D_{15}= 0.0058
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Sampled by KH on Apr.25, 2019
F.M.=0.59

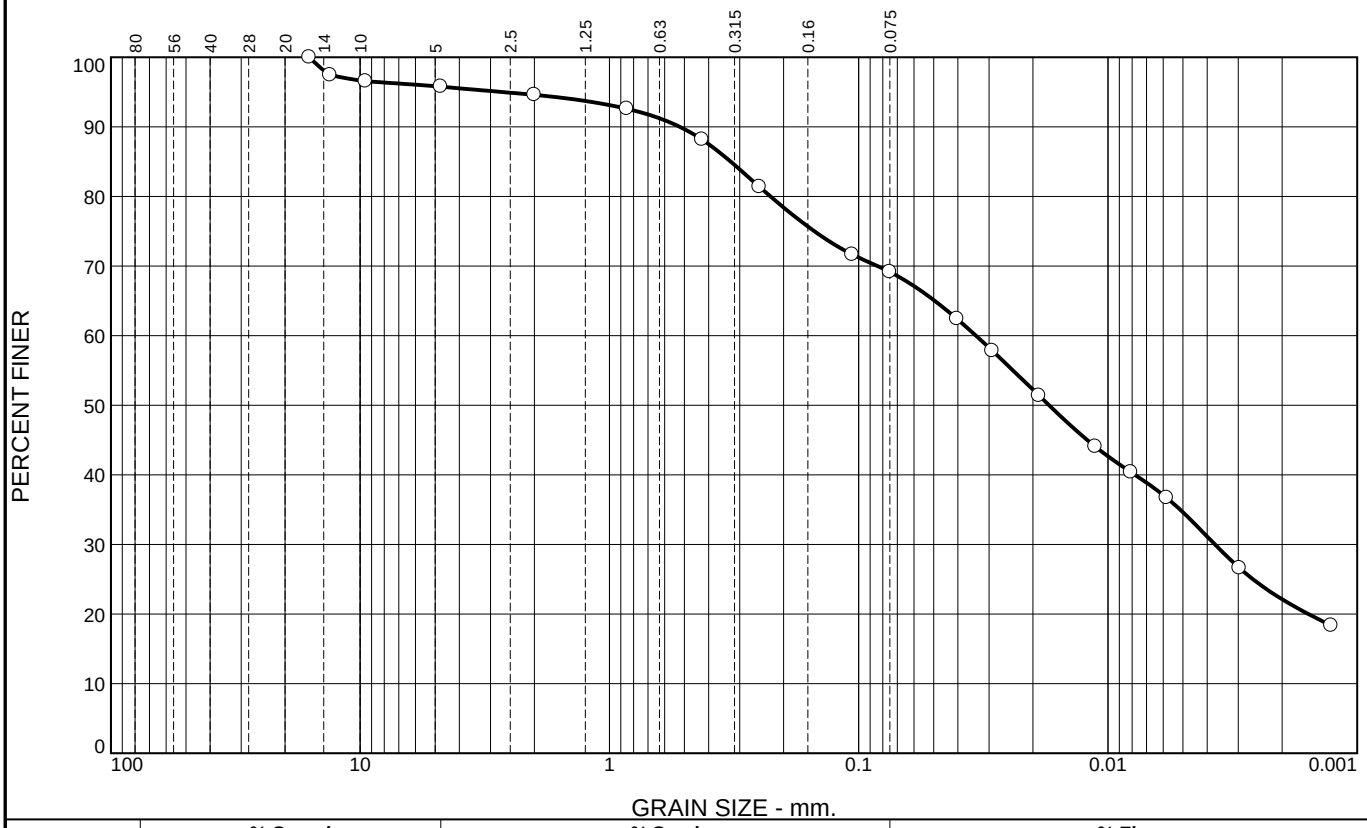
Location: BH19-3 SS3
Sample Number: MM-7287

Date: May.16, 2019

Client: Coral Sophia Housing Inc.
Project: Geotechnical Investigation for 117 Bayfield Street, Barrie, ON

Project No: 191-04694-00 **Figure** 8

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.2	1.2	6.4	19.0	47.1	22.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
16mm	100.0		
13.2mm	97.4		
9.5mm	96.5		
4.75mm	95.8		
2mm	94.6		
0.850mm	92.6		
0.425mm	88.2		
0.250mm	81.4		
0.106mm	71.7		
0.075mm	69.2		
0.0403 mm.	62.4		
0.0291 mm.	57.8		
0.0189 mm.	51.4		
0.0112 mm.	44.1		
0.0081 mm.	40.4		
0.0058 mm.	36.7		
0.0030 mm.	26.6		
0.0013 mm.	18.4		

* (no specification provided)

Soil Description

Clayey sandy silt, trace gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.5211 D_{85}= 0.3261 D_{60}= 0.0338
D_{50}= 0.0172 D_{30}= 0.0037 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Sampled by KH on Apr.24, 2019
F.M.=0.69

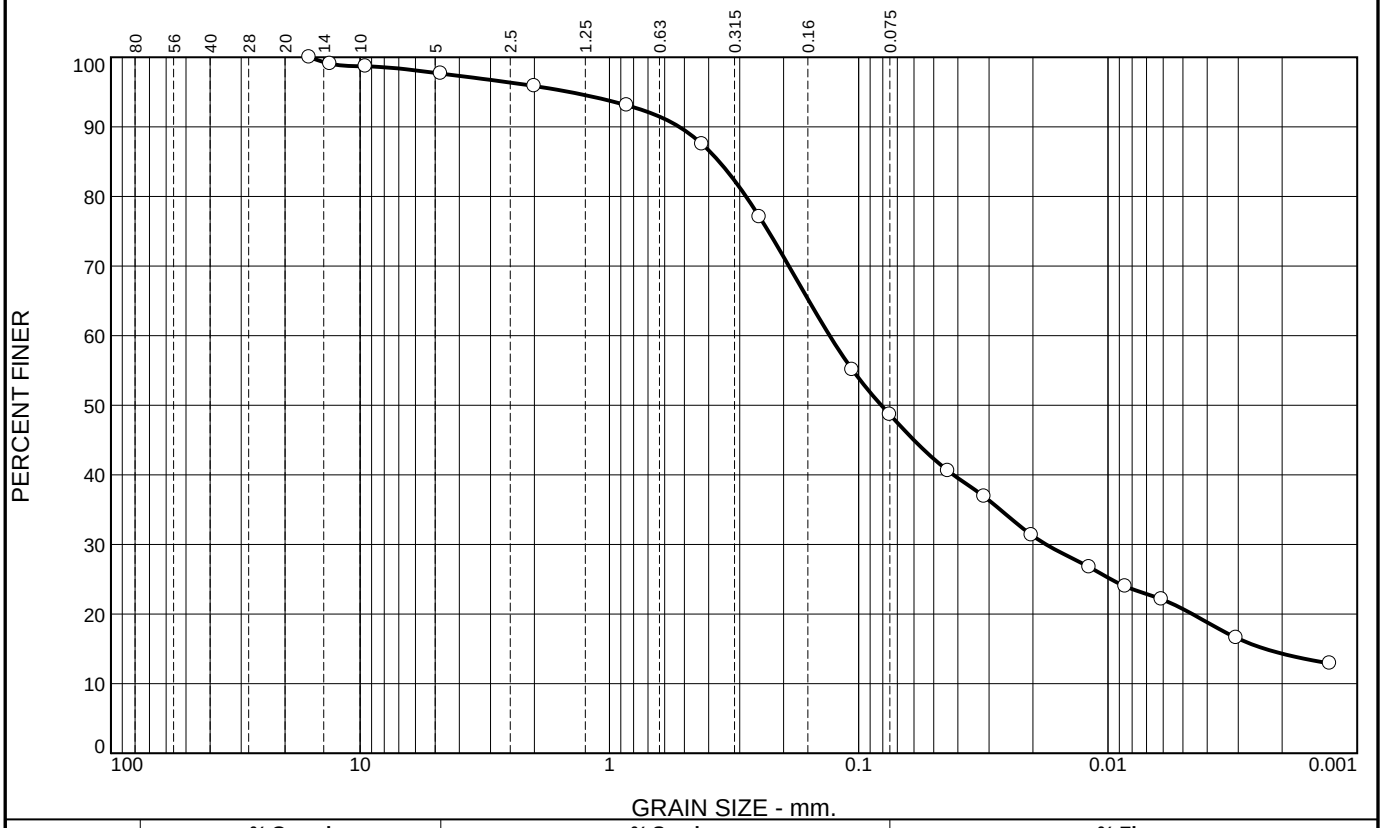
Location: BH19-4 SS3
Sample Number: MM-7288

Date: May.16, 2019

Client: Coral Sophia Housing Inc.
Project: Geotechnical Investigation for 117 Bayfield Street, Barrie, ON

Project No: 191-04694-00 **Figure** 9

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.3	1.8	8.4	38.8	34.4	14.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
16mm	100.0		
13.2mm	99.1		
9.5mm	98.7		
4.75mm	97.7		
2mm	95.9		
0.850mm	93.1		
0.425mm	87.5		
0.250mm	77.1		
0.106mm	55.1		
0.075mm	48.7		
0.0438 mm.	40.6		
0.0314 mm.	36.9		
0.0202 mm.	31.4		
0.0119 mm.	26.7		
0.0085 mm.	24.0		
0.0061 mm.	22.1		
0.0031 mm.	16.6		
0.0013 mm.	12.9		

* (no specification provided)

Soil Description

Silty sand, some clay, trace gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.5248 D_{85}= 0.3627 D_{60}= 0.1307
D_{50}= 0.0811 D_{30}= 0.0177 D_{15}= 0.0023
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Sampled by KH on Apr.24, 2019
F.M.=0.77

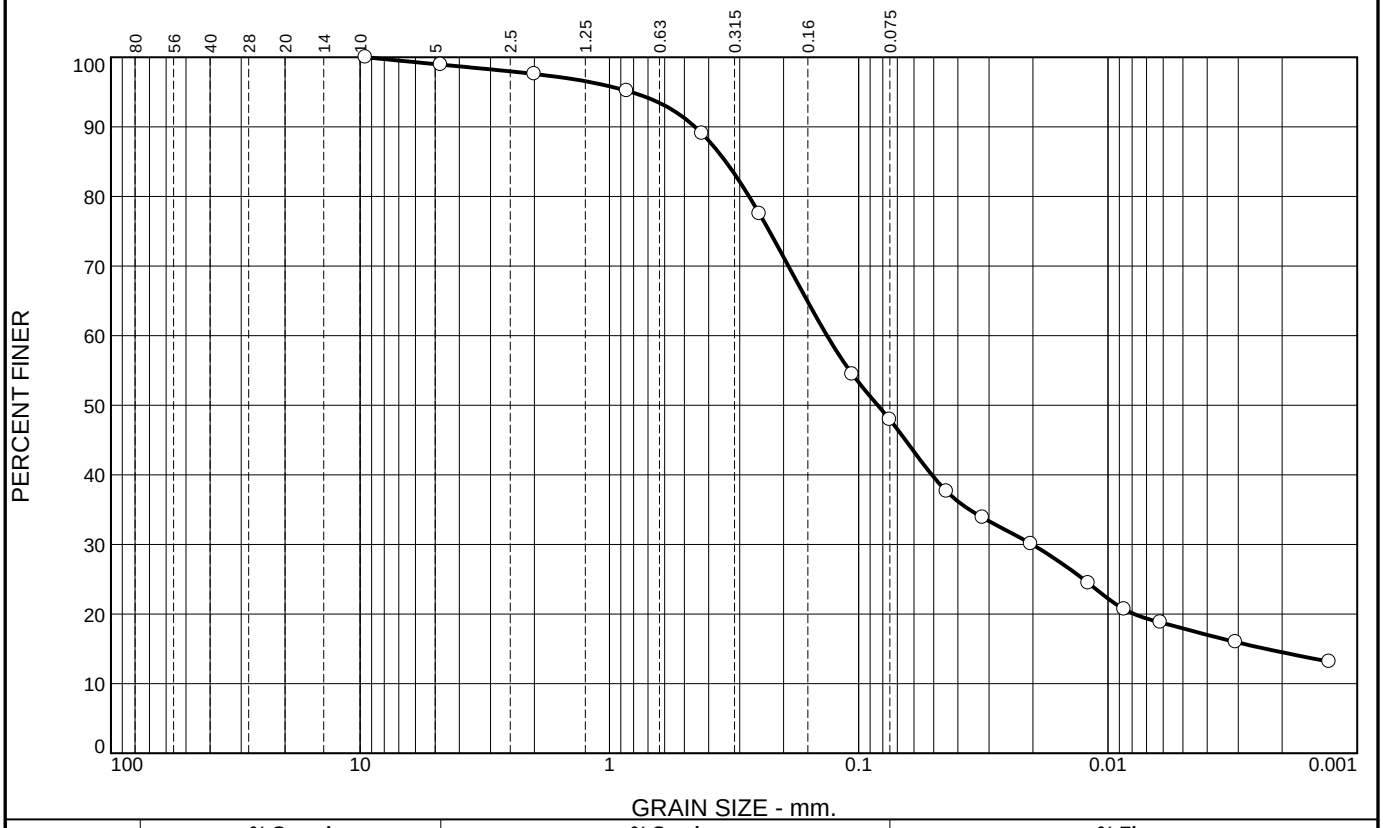
Location: MW19-2 SS7
Sample Number: MM-7286

Date: May.16, 2019

Client: Coral Sophia Housing Inc.
Project: Geotechnical Investigation for 117 Bayfield Street, Barrie, ON

Project No: 191-04694-00 **Figure** 10

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.1	1.3	8.6	41.0	33.5	14.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
9.5mm	100.0		
4.75mm	98.9		
2mm	97.6		
0.850mm	95.2		
0.425mm	89.0		
0.250mm	77.5		
0.106mm	54.4		
0.075mm	48.0		
0.0444 mm.	37.6		
0.0318 mm.	33.9		
0.0204 mm.	30.1		
0.0120 mm.	24.5		
0.0086 mm.	20.7		
0.0062 mm.	18.8		
0.0031 mm.	16.0		
0.0013 mm.	13.2		

* (no specification provided)

Soil Description

Silty sand, some clay, trace gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4533 D_{85}= 0.3414 D_{60}= 0.1339
D_{50}= 0.0837 D_{30}= 0.0201 D_{15}= 0.0023
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Sampled by KH on Apr.24, 2019
F.M.=0.69

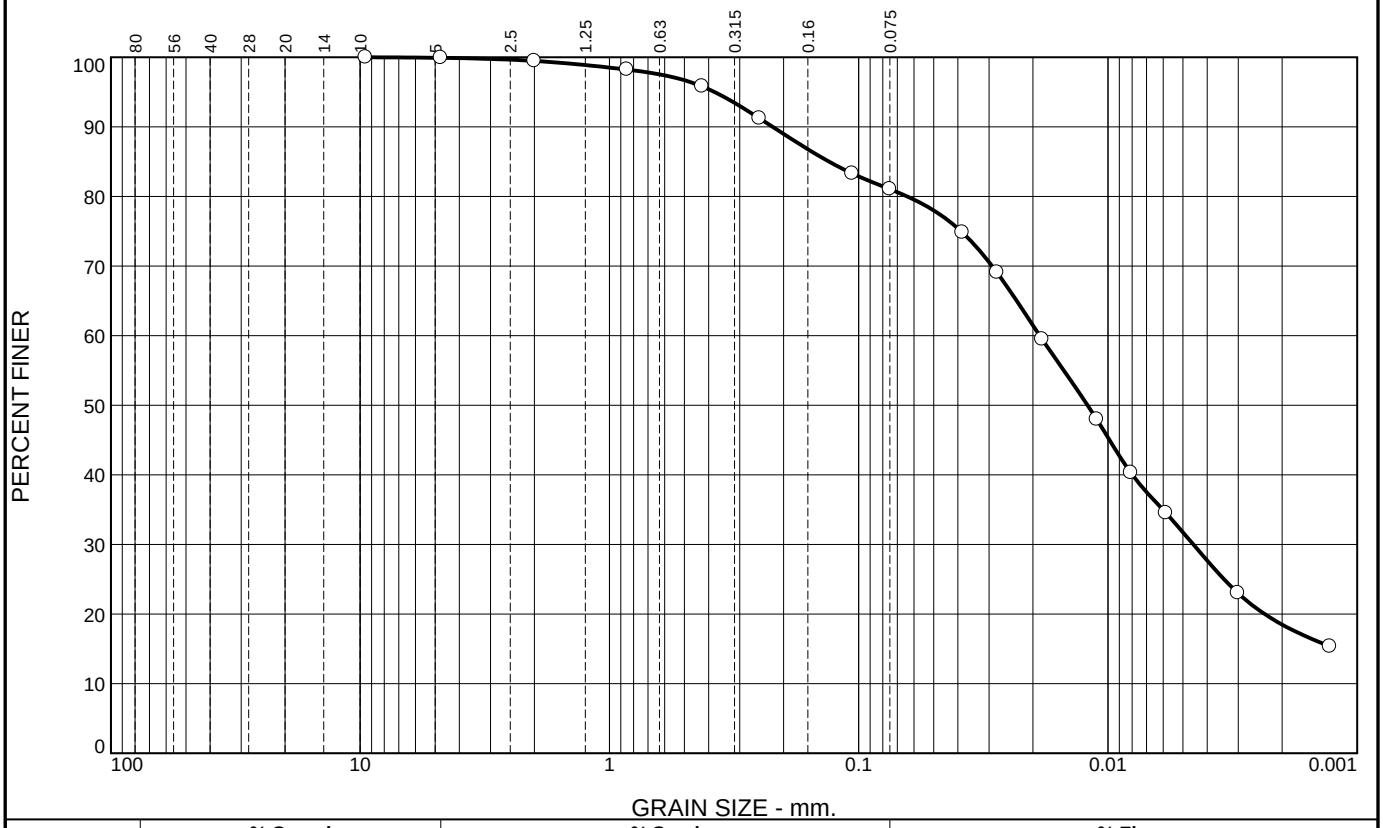
Location: MW19-5 SS6
Sample Number: MM-7289

Date: May.16, 2019

Client: Coral Sophia Housing Inc.
Project: Geotechnical Investigation for 117 Bayfield Street, Barrie, ON

Project No: 191-04694-00 **Figure** 11

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	0.4	3.7	14.7	62.6	18.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
9.5mm	100.0		
4.75mm	99.9		
2mm	99.5		
0.850mm	98.2		
0.425mm	95.8		
0.250mm	91.2		
0.106mm	83.3		
0.075mm	81.1		
0.0384 mm.	74.8		
0.0279 mm.	69.1		
0.0184 mm.	59.5		
0.0111 mm.	48.0		
0.0081 mm.	40.3		
0.0059 mm.	34.5		
0.0030 mm.	23.0		
0.0013 mm.	15.4		

* (no specification provided)

Soil Description

Silt, some sand, some clay, trace gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2213 D_{85}= 0.1314 D_{60}= 0.0188
D_{50}= 0.0121 D_{30}= 0.0045 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Sampled by KH on Apr.25, 2019
F.M.=0.25

Location: MW19-6 SS6
Sample Number: MM-7290

Date: May.16, 2019

Client: Coral Sophia Housing Inc.
Project: Geotechnical Investigation for 117 Bayfield Street, Barrie, ON

Project No: 191-04694-00 **Figure** 12

APPENDIX

A PROJECT DRAWINGS

DMS - 113 BAYFIELD STREET

PROPOSED 8 STOREY RESIDENTIAL DEVELOPMENT

BARRIE, ONTARIO

17-005

February 11th, 2020

KIRKOR ARCHITECTS + PLANNERS

DMS - 113 BAYFIELD STREET

113 Bayfield Street, Barrie, ON

N

N

CONTEXT PLAN

17-005
February 11th, 2020

KIRKOR ARCHITECTS + PLANNERS

DMS - 113 BAYFIELD STREET

113 Bayfield Street, Barrie, ON

DMS- 113 Bayfield St. Residential Development

Barrie, Ontario

Project Statistics

December 2, 2019 — Project No. 17-005

1.0 Site Area

	acres	sq.m.	sq.ft.
Area Excluding Potential Widening	0.89	3,609.66	38,854
Potential Road Widening	0.03	119.26	1,284
Total Site Area	**0.92**	**3,728.92**	**40,138**

2.0 GFA

(excludes storage, parking, stairwell, elevator, trash chute, trash room, storage for mechanical / electrical equipments & amenity areas)

2.1 **Proposed GFA**

			floors		sq.m.	sq.m.	sq.ft.
Level	1	*(Lobby, Office & Units)*	1	x	850.00	850.00	9,149
Level	2	*(Elev. Lobby / Vest.)*	1	x	33.93	33.93	365
Level	3		1	x	1,162.00	1,162.00	12,508
Level	4 to 6		3	x	1,336.32	4,008.96	43,152
Levels	7 to 8		2	x	1,174.00	2,348.00	25,274
Total Proposed GFA						**8,402.89**	**90,448**

Above Ground Parking - Not Included In Proposed GFA

			floors		sq.m.	sq.m.	sq.ft.
Level	1	*(Parking Area)*	1	x	1,413.94	1,413.94	15,220
Level	2	*(Parking Area)*	1	x	2,003.97	2,003.97	21,571
Total Parking GFA						**3,417.91**	**36,791**

3.0 FSI

Total GFA	÷	Site Area		FSI
8,402.89 sq.m.		3,728.92 sq.m.	*Including Potential Road Widening Area*	**2.25**
8,402.89 sq.m.		3,609.66 sq.m.	*Excluding Potential Road Widening Area*	**2.33**

4.0 Unit Count

Proposed Units in Proposed Building

*(*15% of suites to be fully accessible)*

4.1

Floor Levels		floors		1BR	1BR+D	2BR	2BR+D	Units
Level	1	1	x	0	0	5	1	6
Level	3	1	x	2	10	1	3	16
Levels	4 to 6	3	x	2	14	1	3	60
Levels	7 to 8	2	x	0	0	3	10	26
Total Proposed Units				8	52	15	33	**108**
				7%	*48%*	*14%*	*31%*	*100%*

5.0 Amenity Area

Indoor Amenity Provided

5.1

	sq.m.	sq.m.	sq.ft.
Level 1 - Lobby / Lounge	85.00	85.00	915
Level 3 - Amenity Room	199.09	199.09	2,143
Total Indoor Amenity Provided		**284.09**	**3,058**

Outdoor Amenity Provided

5.2

	sq.m.	sq.m.	sq.ft.
Level 3 - Outdoor Amenity	368.92	368.92	3,971
Total Outdoor Amenity Provided		**368.92**	**3,971**

6.0 Vehicular Parking

Parking Spaces as per Transportation Report

6.1

	ratio	units	Parking Spaces
Required Residential / Visitor Parking	0.85	x 108	92
Total Parking Spaces Required			**92**

Net Parking Spaces Provided

6.3

	resident	Parking Spaces
Level 1	32	45
Level 2	60	69
Total Net Parking Spaces	**92**	**114**

Barrier-Free Parking Spaces Provided

6.4

	Type A	Type B	Parking Spaces
Level 1	1	1	2
Level 2	1	1	2
Total Barrier-Free Parking Spaces	**2**	**2**	**4**

7.0 Bicycle Parking

Bicycle & Scooter Parking Provided

7.1

	spaces	Parking Spaces
Scooter Storage (Long Term)	7	7
Bicycle Short-Term (Surface)	10	10
Bicycle Long-Term	56	56
Total Bicycle Parking Provided		**66**

8.0 Lot Coverage

	sq.m.	sq.ft.	%
Proposed Building Coverage	1,616.00	17,394	43%
Landscape Coverage Excluding Potential Widening	1,830.70	19,705	49%
Potential Road Widening	119.26	1,284	3%
Paving Coverage	162.96	1,754	4%
Site Area Including Potential Widening	**3,728.92**	**40,138**	**100%**

PROJECT STATISTICS

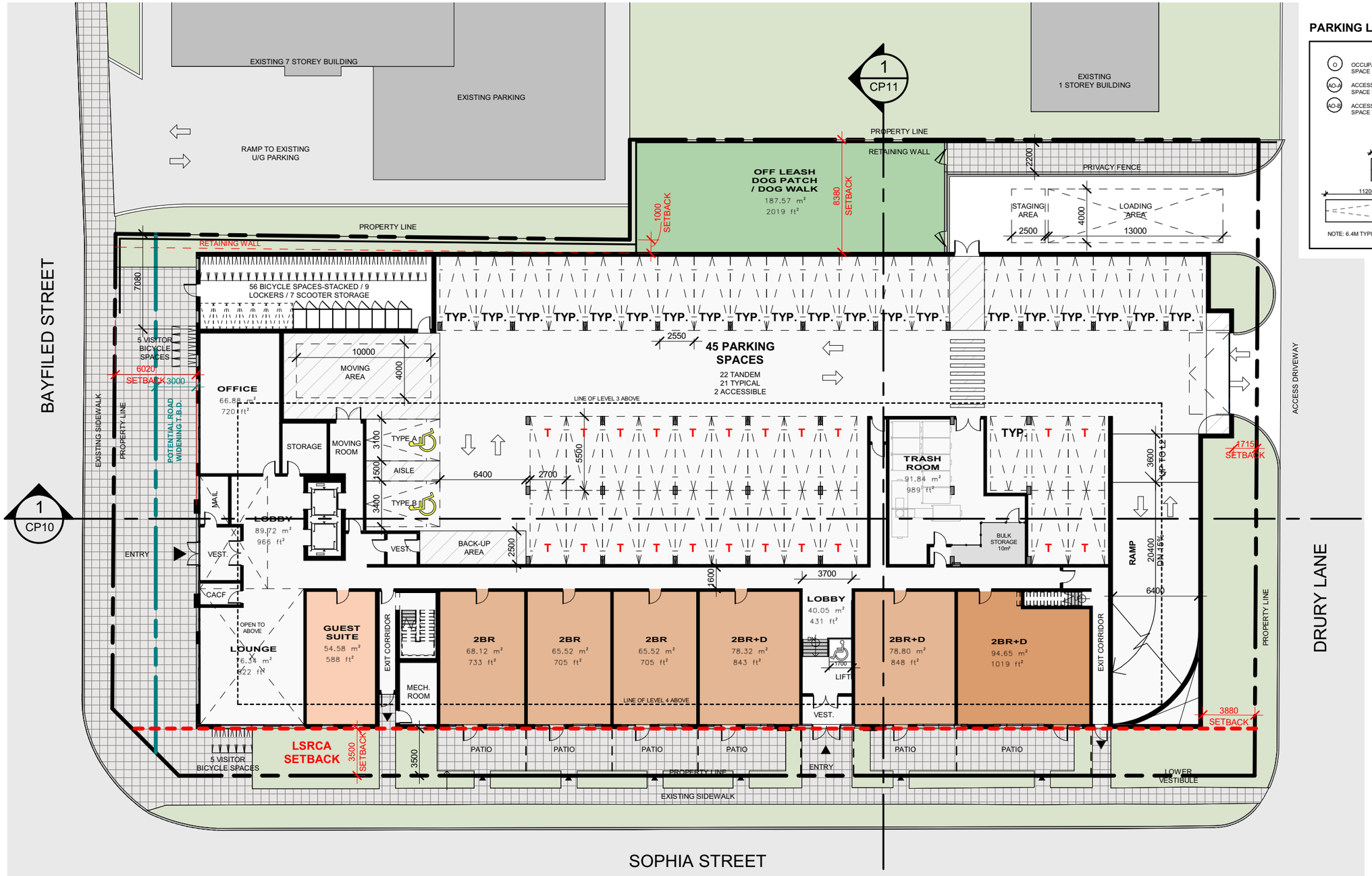
17-005

February 3rd, 2020

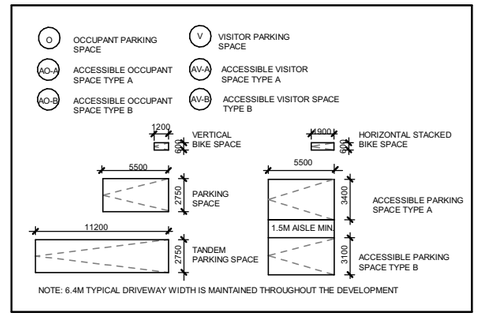
KIRKOR ARCHITECTS + PLANNERS

DMS - 113 BAYFIELD STREET

113 Bayfield Street, Barrie, ON



PARKING LEGEND



LEVEL 1 FLOOR PLAN

1:300

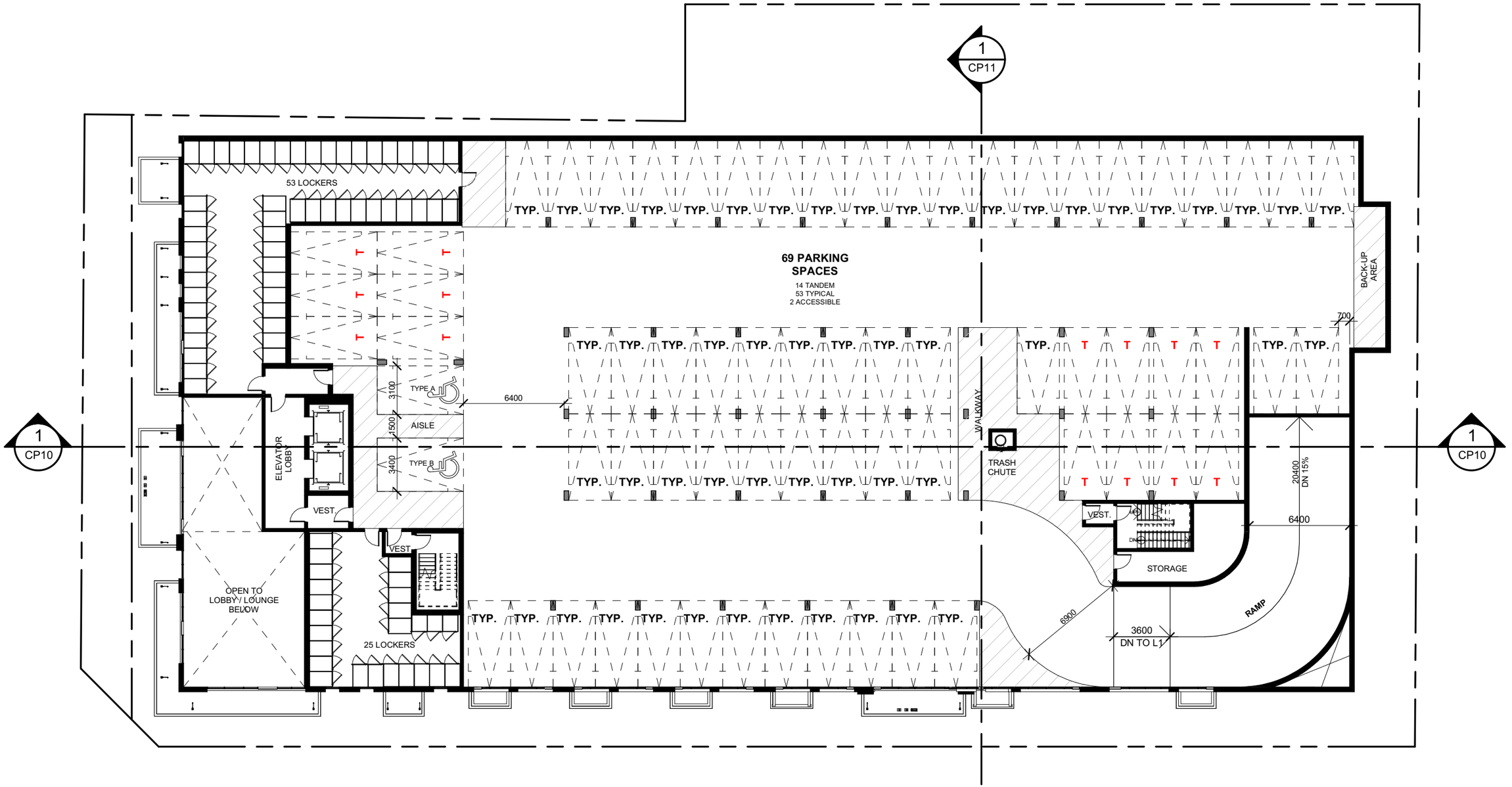
17-005

February 11th, 2020

KIRKOR ARCHITECTS + PLANNERS

DMS - 113 BAYFIELD STREET

113 Bayfield Street, Barrie, ON



LEVEL 2 FLOOR PLAN

1:250

17-005

February 11th, 2020

KIRKOR ARCHITECTS + PLANNERS

DMS - 113 BAYFIELD STREET

113 Bayfield Street, Barrie, ON

LEVEL 3 FLOOR PLAN

1:250

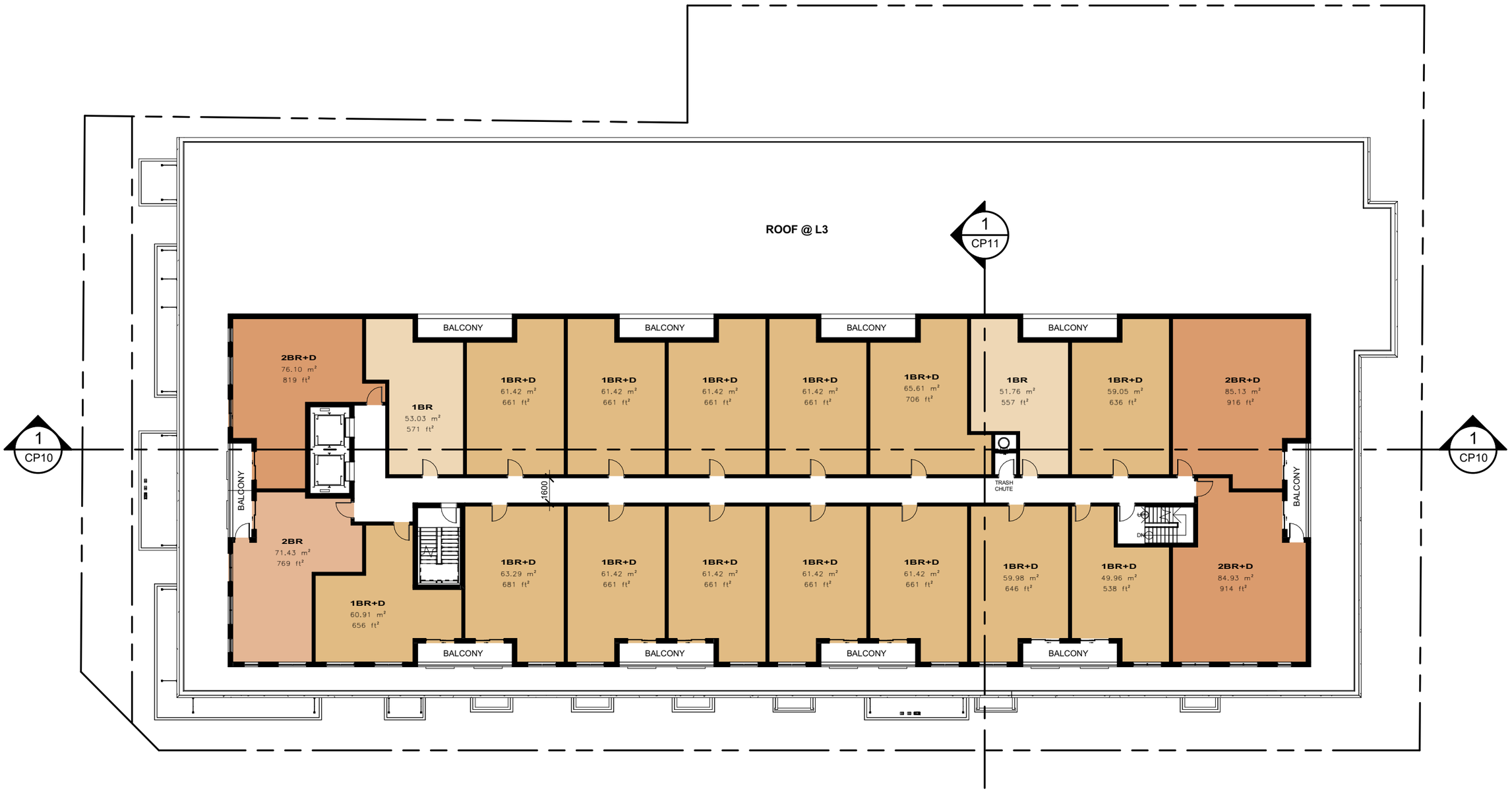
17-005

February 11th, 2020

KIRKOR ARCHITECTS + PLANNERS

DMS - 113 BAYFIELD STREET

113 Bayfield Street, Barrie, ON



LEVEL 4-6 FLOOR PLAN

1:250

17-005

February 11th, 2020

KIRKOR ARCHITECTS + PLANNERS

DMS - 113 BAYFIELD STREET

113 Bayfield Street, Barrie, ON

LEVEL 7-8 FLOOR PLAN

1:250

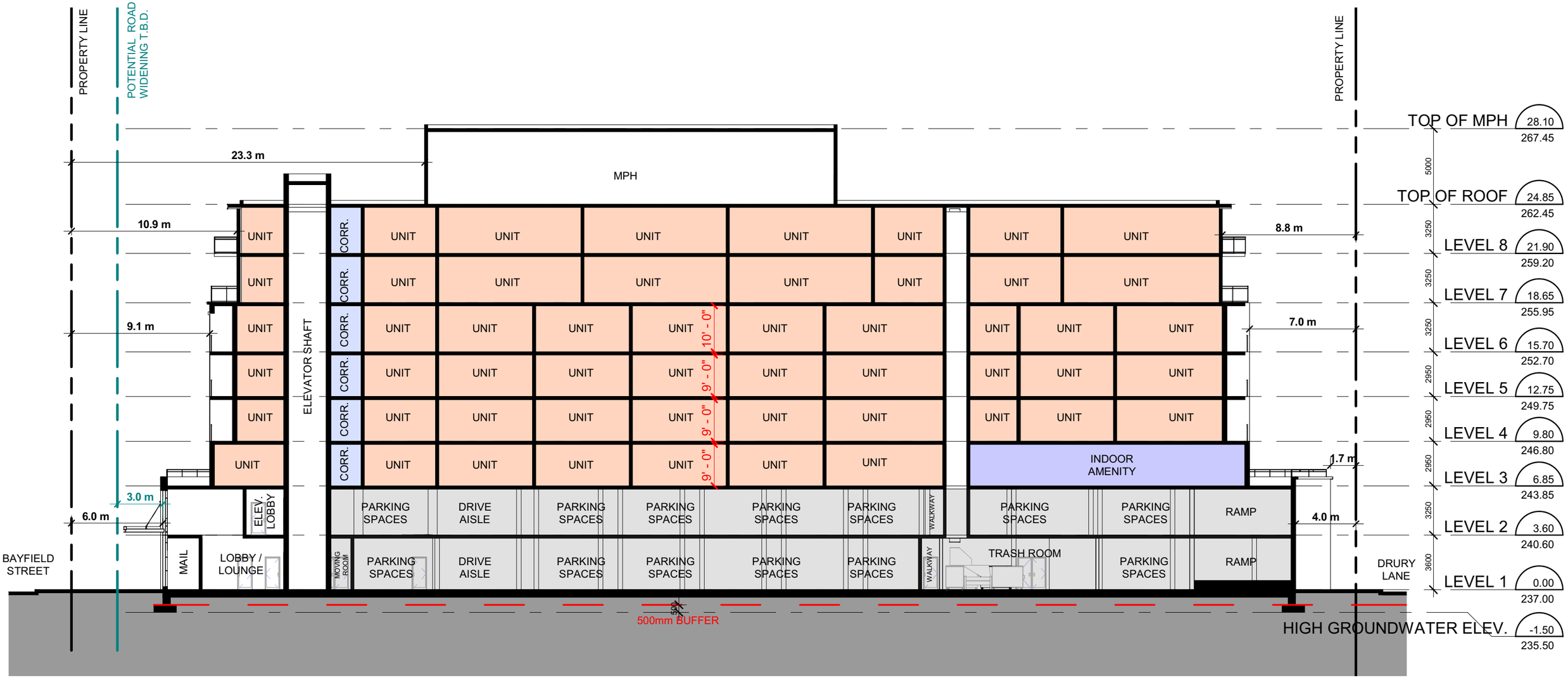
17-005

February 11th, 2020

KIRKOR ARCHITECTS + PLANNERS

DMS - 113 BAYFIELD STREET

113 Bayfield Street, Barrie, ON



LONGITUDINAL SECTION

1:250

17-005

February 3rd, 2020

KIRKOR ARCHITECTS + PLANNERS

APPENDIX

B ENGINEERED FILL

GENERAL REQUIREMENTS FOR ENGINEERED FILL

Compacted imported soil that meets specific engineering requirements and is free of organics and debris and that has been continually monitored on a full-time basis by a qualified geotechnical representative is classified as engineered fill. Engineered fill that meets these requirements and is bearing on suitable native subsoil can be used for the support of foundations.

Imported soil used as engineered fill can be removed from other portions of a site or can be brought in from other sites. In general, most of Ontario soils are too wet to achieve the 100% Standard Proctor Maximum Dry Density (SPMDD) and will require drying and careful site management if they are to be considered for engineered fill. Imported non-cohesive granular soil is preferred for all engineered fill. For engineered fill, we recommend use of OPSS Granular 'B' sand and gravel fill material.

Adverse weather conditions such as rain make the placement of engineered fill to the required degree of density difficult or impossible; engineered fill cannot be placed during freezing conditions, i.e. normally not between December 15 and April 1 of each year.

The location of the foundations on the engineered fill pad is critical and certification by a qualified surveyor that the foundations are within the stipulated boundaries is mandatory. Since layout stakes are often damaged or removed during fill placement, offset stakes must be installed and maintained by the surveyors during the course of fill placement so that the contractor and engineering staff are continually aware of where the engineered fill limits lie. Excavations within the engineered fill pad must be backfilled with the same conditions and quality control as the original pad.

To perform satisfactorily, engineered fill requires the cooperation of the designers, engineers, contractors and all parties must be aware of the requirements. The minimum requirements are as follows, however, the geotechnical report must be reviewed for specific information and requirements.

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained from and samples must be provided to the geotechnical engineer for review, and approval before filling begins.

2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.

3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and WSP Canada Inc. Without this confirmation no responsibility for the performance of the structure can be accepted by WSP Canada Inc. Survey drawing of the pre and post fill location and elevations will also be required.

4. The area must be stripped of all topsoil and fill materials. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a WSP Canada Inc. engineer prior to placement of fill.

5. The approved engineered fill material must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Engineered fill should not be placed during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur and should be evaluated prior to placing the fill.

6. Full-time geotechnical inspection by WSP Canada Inc. during placement of engineered fill is required. Work cannot commence or continue without the presence of the WSP Canada Inc. representative.

7. The fill must be placed such that the specified geometry is achieved. Refer to the attached sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.

8. A bearing capacity of 150 kPa at SLS (225 kPa at ULS) can be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and footings must be provided with nominal steel reinforcement.

9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

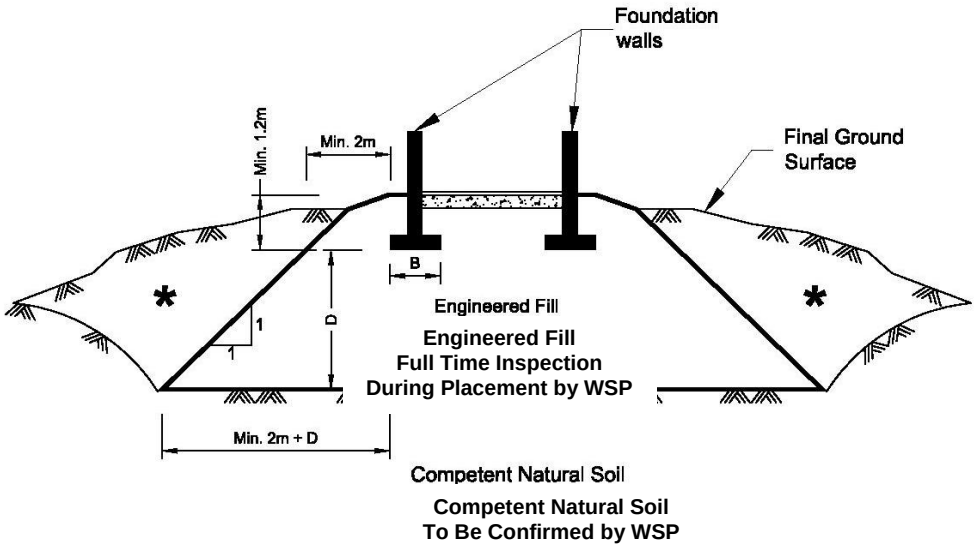
10. After completion of the engineered fill pad a second contractor may be selected to install footings. The prepared footing bases must be evaluated by engineering staff from WSP Canada Inc. prior to footing concrete placements. All excavations must be backfilled under full time supervision by WSP Canada Inc. to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of WSP Canada Inc.

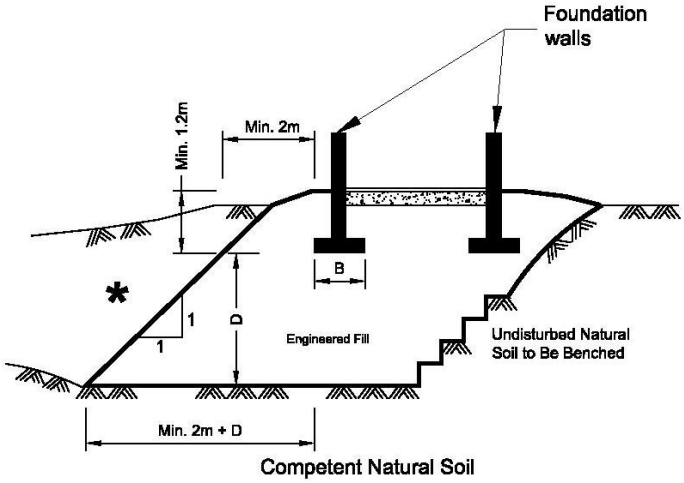
11. After completion of compaction, the surface of the engineered fill pad must be protected from disturbance from traffic, rain and frost. During the course of fill placement, the engineered fill must be smooth-graded, proof-rolled and sloped/crowned at the end of each day, prior to weekends and any stoppage in work in order to promote rapid runoff of rainwater and to avoid any ponding surface water. Any stockpiles of fill intended for use as engineered fill must also be smooth-bladed to promote runoff and/or protected from excessive moisture take up.

12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.

13. The geometry of the engineered fill as illustrated in these General Requirements is general in nature. Each project will have its own unique requirements. For example, if perimeter sidewalks are to be constructed around the building, then the projection of the engineered fill beyond the foundation wall may need to be greater.

14. These guidelines are to be read in conjunction with WSP Canada Inc. report attached.





* **Backfill in this area to be as per WSP report.**