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Geotechnical Investigation – Proposed Residential Development

1000 and 1024 Dundas Street East, Mississauga, Ontario

Prepared for:

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1.0 INTRODUCTION AND SCOPE

Pinchin Ltd. (Pinchin) was retained by Ahmed Developments Inc. (Client) to conduct a Geotechnical Investigation and provide subsequent geotechnical design recommendations for the proposed residential development to be located at 1000 and 1024 Dundas Street East, Mississauga, Ontario (Site). The Site location is shown on Figure 1.

The following drawings prepared by WZMH Architects were provided to Pinchin and reviewed in preparation of this report:

- *Site Plan*, 1000-1024 Dundas, Mississauga, Ontario, Project No. 07395.000, Drawing No. 2, dated August 11, 2021;
- *P1 Parking Level*, 1000-1024 Dundas, Mississauga, Ontario, Project No. 07395.000, Drawing No. 3, dated August 11, 2021;
- *P2 Parking Level*, 1000-1024 Dundas, Mississauga, Ontario, Project No. 07395.000, Drawing No. 4, dated August 11, 2021; and
- *Building Sections*, 1000-1024 Dundas, Mississauga, Ontario, Project No. 07395.000, Drawing No. 10, dated August 11, 2021.

It is Pinchin's understanding that the proposed development is to consist of two mid-rise buildings (Building "A", 16-storey and Building "B", 20-storey), each extending from a common 4-storey podium. The proposed development will rest on two levels of underground parking.

Pinchin's geotechnical comments and recommendations are based on the results of the Geotechnical Investigation and our current understanding of the project scope. If the building layout or design should change, Pinchin should be contacted to confirm that the recommendations within the report are still valid.

The purpose of the Geotechnical Investigation was to delineate the subsurface conditions and soil engineering characteristics by advancing a total of six (6) sampled boreholes (Boreholes BH1 to BH6), at the Site.

The information gathered from the Geotechnical Investigation will allow Pinchin to provide geotechnical design recommendations for the proposed development.

Based on the results of the Geotechnical Investigation, the following geotechnical data and engineering design recommendations are provided herein:

- A review of relevant area geology and Site background information;
- A detailed description of the soil and groundwater conditions;
- Open cut excavations and/or shoring requirements (where necessary);
- Anticipated groundwater management;

- Lateral earth pressure coefficients and unit densities;
- Foundation design recommendations including soil bearing resistances at Ultimate Limit States (ULS) and Serviceability Limit States (SLS) design;
- Potential total and differential settlements;
- Seismic Site Classification for Seismic Site Response;
- Foundation frost protection and installation;
- Underground parking garage design; and
- Potential construction concerns.

Abbreviations terminology and principle symbols commonly used throughout the report, borehole logs and appendices are enclosed in Appendix I.

2.0 CONCURRENT WORK

Concurrently with this investigation, Pinchin is completing a Hydrogeological Assessment of the proposed development and a Phase Two Environmental Site Assessment (ESA) at the Site. The results of Hydrogeological Assessment and Phase Two ESA are provided under separate covers. The relevant geotechnical information from the above noted reports have been included within this report.

3.0 SITE DESCRIPTION AND GEOLOGICAL SETTING

The Site is located in southeast quadrant of the intersection of Dundas Street East and Tomken Road, and consists of a roughly rectangular shaped parcel of land with an area of approximately 2.15 acres. The Site is currently occupied with two commercial buildings, access driveways, at-grade asphalt parking lot and landscaped areas. The Site is relatively flat, with elevations ranging from 120.0 to 122.2 metres above sea level (masl) as measured at the borehole locations.

It is understood that the existing structures would be demolished to facilitate the redevelopment of the Site to include two mid-rise buildings (Building ”A”, 16-storey and Building “B”, 20-storey), each extending from a common 4-storey podium. The proposed development will then rest on a property-wide two-level underground parking structure.

Data obtained from the Ontario Geological Survey Maps, as published by the Ontario Ministry of Energy, Northern Development and Mines, indicates that the Site is located on coarse-textured glaciolacustrine deposits consisting of sand, gravel, minor silt and clay, foreshore and basinal deposits (Ontario Geological Survey 2010, Surficial geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128-REV). The underlying bedrock at this Site is of shale, limestone, dolostone and siltstone of Georgian Bay, Blue Mountain and Billings formation (Armstrong, D.K. and Dodge, J.E.P. 2007, Paleozoic geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 219).

4.0 GEOTECHNICAL FIELD INVESTIGATION AND METHODOLOGY

Pinchin completed the field investigations at the Site on October 18 to 20, 2021 by advancing a total of six (6) sampled boreholes throughout the Site. The boreholes were advanced to a depth of approximately 9.1 meters below ground surface (mbgs). The approximate spatial locations of the boreholes advanced at the Site are shown on Figures 2 and 3.

The boreholes were advanced with the use of a track-mounted drill rig which was equipped with standard soil sampling equipment. Soil samples were collected at regular intervals using a 51 mm outside diameter (OD) split spoon barrel in conjunction with Standard Penetration Tests (SPT) "N" values (ASTM D1586). The SPT "N" values were used to assess the compactness condition of the non-cohesive soil and to estimate the consistency of the cohesive soil. Groundwater observations and measurements were obtained from the open boreholes during and upon completion of drilling. The in-situ testing, groundwater observations and measurements recorded are included on the appended borehole logs.

Bedrock was proven in each borehole by core drilling with an HQ-size double tube diamond bit core barrel. The bedrock core specimens were measured in the field to determine the Rock Quality Designation (RQD) (ASTM 6032). The core samples were returned to our office for further visual examination and testing.

Monitoring wells were installed in each borehole to allow measurement of the groundwater levels. The monitoring wells were constructed using flush-threaded 50 mm diameter Trilock pipe with 3.0 meter long 10-slot well screens, delivered to the Site in ore-cleaned individually sealed plastic bags. The screen and riser pipes were not allowed to come into contact with the ground or drilling equipment prior to installation.

A completed well record was submitted to the Ontario Ministry of the Environment, Conservation and Parks (MECP) as per Ontario Regulation 903, as amended. A licensed well technician must properly decommission the monitoring wells prior to construction according to Regulation 903 of the Ontario Water Resources Act.

The borehole locations and ground surface elevations were surveyed by Pinchin using a Sokkia Model GCX2 Global Navigation Satellite System (GNSS) rover. The ground surface elevations are geodetic, based on GNSS and local base station telemetry with a precision static of less than 20 mm.

The field investigation was monitored by experienced Pinchin personnel. Pinchin logged the drilling operations and identified the soil samples as they were retrieved. The recovered soil samples were sealed into plastic bags and carefully transported to Pinchin's laboratory in Waterloo, Ontario for detailed analysis and testing. All soil samples were classified according to visual and index properties by the project engineer.

The field logging of the soil and groundwater conditions was performed to collect geotechnical engineering design information. The borehole logs include textural descriptions of the subsoil in

accordance with a modified Unified Soil Classification System (USCS) and indicate the soil boundaries inferred from non-continuous sampling and observations made during the borehole advancement. These boundaries reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The modified USCS classification is explained in further detail in Appendix I. Details of the soil and groundwater conditions encountered within the boreholes are included on the Borehole Logs within Appendix II.

5.0 SUBSURFACE CONDITIONS

5.1 Borehole Soil Stratigraphy

The following stratigraphy is based on the borehole findings. The summary provided below is for general guidance only. Detailed depths and elevations are given in the following subsections and appended borehole logs. In general, the three (3) main stratigraphic units are as follows:

- Asphalt pavement and earth fill materials extending to approximately 2.3 to 4.6 mbgs (i.e. Elevation 116.2 to 118.6 masl); overlying
- Compact sand deposit in Borehole BH5, extending to approximately 4.6 mbgs (i.e. Elevation 116.3 masl); and
- Shale bedrock of Georgian Bay Formation.

5.1.1 Pavement Structure

Flexible pavement structure, consisting of 80 to 150 mm thick asphaltic concrete underlain by 200 and 300 mm thick aggregate layer was encountered at the ground surface in each borehole.

5.1.2 Earth Fill

Earth fill materials, consisting of clayey silt and gravelly sand to sand, with trace amounts of organics, Styrofoam, red brick, stone and concrete fragments were encountered beneath the pavement structure in each borehole, and extended to depths of approximately 2.3 to 4.6 mbgs.

The cohesionless earth fill zone has a very loose to very dense (typically loose to compact) relative density based on SPT ‘N’ values of 2 to greater than 50 blows per 300 mm penetration of a split spoon sampler.

The cohesive earth fill zone has a soft to very stiff consistency based on SPT ‘N’ values of 2 to 16 blows per 300 mm penetration of a split spoon sampler. The in-situ moisture contents of the earth fill samples ranged from 6 to 28 percent by mass, indicating moist to wet conditions.

5.1.3 Sand

Native sand deposit with some amounts of silt and gravel was encountered beneath the earth fill zone in Borehole BH5 and extended to a depth of approximately 4.6 mbgs.

The sand deposit has a compact relative density based on SPT 'N' values of 21 and 22 blows per 300 mm penetration of a split spoon sampler. The in-situ moisture contents of the sand samples were 13 and 15 percent by mass, indicating generally moist to wet conditions.

5.1.4 Bedrock

Bedrock was encountered in each borehole at depths ranging from approximately 3.0 and 4.6 mbgs (elevations ranging from approximately 116.2 to 117.6 masl). 'HQ' size rock coring was completed on the shale bedrock in each borehole and confirmed shale bedrock with limestone interbeds up to 200 mm in thickness of the Georgian Bay formation. The depth and elevation of the bedrock at the borehole locations is summarized in the following table.

Borehole ID	Ground Surface Elevation (masl)	Depth to Bedrock (mbgs)*	Top of Bedrock Elevation (masl)*
BH1	122.2	4.6	117.6
BH2	120.0	3.0	117.0
BH3	120.8	4.6	116.2
BH4	120.5	3.0	117.5
BH5	120.9	4.6	116.3
BH6	120.8	4.6	116.2

*Inferred and confirmed top of bedrock

The Total Core Recovery (TCR) of the cored bedrock ranged from 90 to 100 percent and the Rock Quality Designation (RQD) ranged from 10 to 80 percent indicating very poor to good quality bedrock.

5.2 Groundwater Conditions

Groundwater observations and measurements were obtained in the open boreholes at the completion of drilling and are summarized on the appended borehole logs. Groundwater levels were measured in the monitoring wells installed in each borehole on November 11, 2021. The measured groundwater levels are summarized below:

Borehole ID	Water Level		Monitoring Well Screen Interval (mbgs)
	Depth (mbgs)	Elevation (masl)	
BH1	4.0	118.2	6.1 – 9.1
BH2	3.1	116.9	6.1 – 9.1
BH3	5.1	115.7	6.1 – 9.1

BH4	3.2	117.3	6.1 – 9.1
BH5	5.2	115.7	6.1 – 9.1
BH6	2.2	118.6	6.1 – 9.1

The groundwater level in the monitoring wells ranged from Elevation 115.7 to 118.6 masl. For geotechnical design purposes, the groundwater level may be taken at Elevation 118.5 ± masl.

Construction dewatering at adjacent sites, existing building drains or dewatering systems, and seasonal variations may cause significant changes to the depth of the groundwater table over time. Additional information pertaining to groundwater at the Site is discussed in the hydrogeological report by Pinchin provided under a separate cover.

6.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

6.1 General Information

The recommendations presented in the following sections of this report are based on the information available regarding the proposed construction, the limited results obtained from the geotechnical investigation, and Pinchin's experience with similar projects. Since the investigation only represents a portion of the subsurface conditions, it is possible that conditions may be encountered during construction that are substantially different than those encountered during the investigation. If these situations are encountered, adjustments to the design may be necessary. A qualified geotechnical engineer should be on-Site during the foundation preparation to ensure the subsurface conditions are the same/similar to what was observed during the investigation.

It is Pinchin's understanding that the proposed development is to consist of two mid-rise buildings (Building "A", 16-storey and Building "B", 20-storey), extending from a common 4-storey podium. The proposed development will then rest on two levels of underground parking. The Site is relatively flat, with elevations ranging from 120.0 to 122.2 masl as measured at the borehole locations, thus implying an average Site elevation of 121 ± masl. It is understood that the Finished Floor Elevation (FFE) for the second level underground parking (P2) will be set at 7.1 mbgs (i.e. Elevation 113.9 ± masl).

A total of six (6) boreholes (Boreholes BH1 to BH6) were advanced within the footprint of the proposed development. In general, the three (3) main stratigraphic units are as follows:

- Asphalt pavement and earth fill materials extending to approximately 2.3 to 4.6 mbgs (i.e. Elevation 116.2 to 118.6 masl); overlying
- Compact sand deposit in Borehole BH5, extending to approximately 4.6 mbgs (i.e. Elevation 116.3 masl); and
- Shale bedrock of Georgian Bay Formation.

The groundwater level in the monitoring wells ranged from Elevation 115.7 to 118.6 masl. For geotechnical design purposes, the groundwater level may be taken at Elevation 118.5 ± masl.

6.2 Excavations

As indicated above, it is understood that P2 FFE will be set at 7.1 mbgs (i.e. Elevation 113.9 ± masl).

Based on the subsurface information obtained from within the boreholes, it is anticipated that the excavated material will consist of earth fill materials, native sand and weathered to sound shale bedrock.

Where workers must enter trench excavations deeper than 1.2 m, the trench excavations should be suitably sloped and/or braced in accordance with the Occupational Health and Safety Act (OHSA), Ontario Regulation 213/91, Construction Projects, July 1, 2011, Part III - Excavations, Section 226. Alternatively, the excavation walls may be supported by either closed shoring, bracing, or trench boxes complying with sections 235 to 239 and 241 under O. Reg. 231/91, s. 234(1).

Based on the OHSA, the earth fill materials and native sand deposits encountered in the boreholes would be classified as Type 3 soils and all excavations through these soils must be cut back at 1 horizontal to 1 vertical from the base of the excavation. Excavations in the fill materials and native sand deposit extending below the groundwater table would be classified as Type 4 soil, and excavation side slopes need to be sloped back at 3 horizontal to 1 vertical from the base of the excavation.

In addition to compliance with the OHSA, the excavation procedures must also be in compliance to any potential other regulatory authorities, such as federal and municipal safety standards.

Fragments of shale and limestone may be encountered in the transition zone between the native soils/earth fill and the underlying bedrock. The bedrock below the Site, while predominantly shale, contains beds of ‘harder limestone’ and ‘shaley limestone’. It is possible that some thick layers of ‘hard limestone’ may be encountered in the bedrock during excavation. The risk and responsibility associated with the removal of such layers must be addressed in the contract documents for foundations, excavation, and shoring contractors, as applicable.

The bedrock in this area is typically weathered and can usually be removed with mechanical equipment, such as a large excavator and hydraulic hammer (hoe ram) and where required, with line drilling on close centres. Often a hydraulic hammer can be utilized to create an initial opening for the excavator bucket to gain access of the layered rock. The bedrock is known to contain vertical joints and near horizontal bedding planes. Therefore, some vertical and horizontal over break of the bedrock should be expected.

In addition, Pinchin recommends that a pre-excavation survey of all neighbouring properties be undertaken prior to conducting construction activities. The preconstruction survey will serve to protect the Client from claims unrelated to the construction activities in the development of this property.

Pinchin notes that, local contractors are familiar with excavating the local bedrock and have specialized knowledge and techniques for its removal. Depending on the block size and degree of weathering of the rock they may have a different approach than what is presented in the preceding paragraphs.

6.3 Shoring Requirements

Due to spatial limitations, it may not be feasible to slope the excavations back to a safe angle and therefore some support system will be required.

Temporary protective structures, bracing, anchors, and sheeting are the responsibility of the contractors and shall be designed by a Professional Engineer licensed in Ontario, in accordance with the Canadian Foundation Engineering Manual. All shoring, bracing, sheetpiling and cribbing shall meet all requirements of the Ontario Occupational Health and Safety Act and Regulations for Construction Projects and the Trench Excavators Protection Act. The shoring design must include appropriate factors of safety, and any possible surcharge loading must be taken into account. The support system must comply with sections 234 to 239 and 241 of Ontario Regulation 213/91.

No excavation shall extend below a line cast as one vertical and one horizontal from foundations of existing structures without adequate alternate support being provided.

The Site is immediately bounded by Dundas Street East to the west and commercial/industrial lots to the north, east and south. The sections along the perimeter of the Site need to be shored to preserve the integrity of the boundary conditions using a shoring system comprising of soldier piles and lagging, and/or a continuous interlocking caisson wall. The excavation for the proposed development can be supported using conventional soldier pile and lagging walls on the north, east and south sides of the excavation. For the section extending along Dundas Street East, considerations should be given to incorporate a rigid shoring system (consisting of continuous interlocking caisson wall) to preserve the integrity and support of the soil in a state approximating at-rest conditions.

The shoring system should be supported by pre-stressed anchors extending beneath the adjacent lands. Pre-stressed anchors are installed and stressed in advance of excavation to limit movement of the shoring system as much as is practically possible. The use of anchors on adjacent properties requires the consent of the adjacent land owners, expressed in encroachment agreements.

6.3.1 Lateral Earth Pressure

The shoring system may be designed as full cantilevers or the lateral loads can be taken up to the installation of internal bracing of rakers or tie back soil anchors.

The following parameters (un-factored) should be used for the design of the shoring system. It should be noted that these earth pressure coefficients assume that the back of the wall is vertical; condition of the ground surface behind the wall is assumed to be flat.

Soil Layer	Bulk Unit Weight (kN/m^3)	Angle of Internal Friction	Active Earth Pressure Coefficient	Passive Earth Pressure Coefficient
Earth Fill	18	28°	0.36	2.77
Native Sand	20	30°	0.33	3.00
Weathered Bedrock	26	38°	0.24	4.2
Slightly Weathered to Fresh Bedrock	26	44°	0.18	5.5

In addition to compliance with the OHSA, the excavation procedures must also be in compliance to any potential other regulatory authorities, such as federal and municipal safety standards.

If construction proceeds in winter months, the shoring system may require frost protection to prevent frost penetration behind the shoring system, which can result in unacceptable movements.

It is recommended that the contract have a performance specification, limiting movement. The presence of sensitive structures and infrastructure, anchor spacing, elevation, and the timing of the excavation and anchoring operations are critical in determining acceptable limits. A monitoring program for shored excavations is recommended.

6.3.2 Solider Pile and Caisson Toe Embedment

Soldier pile and caisson toes should extend a minimum of 2 meters into the sound bedrock of the Georgian Bay Formation. The factored ultimate vertical bearing capacity for the design of a pile, embedded in the sound bedrock, is 10,000 kPa. The factored ultimate lateral bearing capacity of the sound rock is 1,000 kPa.

It should be noted that due to the extensive and relatively deep wet and permeable fill materials at the Site, augered borings for soldier piles and caissons made through these soils could be unstable. As such, it may be necessary to advance temporarily cased holes to prevent caving and facilitate soldier pile and caisson installation.

The exposed bedrock surface deteriorates with time. Exposed excavation faces have been found to flake and recede as much as 300 mm with 12 months exposure. This recession generally takes the form of coin-size shale particles dropping from the face on a constant basis. The deteriorated rock loses internal integrity and bearing capability. Typically, the soldier piles and caissons are advanced at least 1 metre below the base of the excavation to accommodate such weathering.

6.4 Anticipated Groundwater Management

The recommendations within this section should be read in conjunction with the Hydrogeological Assessment Report.

The groundwater levels measured on November 11, 2021 in the monitoring wells ranged from Elevation 115.7 to 118.6 masl. For geotechnical design purposes, the groundwater level may be taken at Elevation 118.5 ± masl. As final elevations are unknown at this time, it is recommended that Pinchin review the following recommendations once building elevations have been set.

It is understood that the basement FFE will be set at 7.1 mbgs (i.e. Elevation 113.9 ± masl). As such excavations are anticipated to extend below the prevailing groundwater level and into the underlying weathered to sound Shale bedrock.

The weathered to sound bedrock is considered to be of low permeability, and will typically preclude significant free flow of water. The volume of water to be anticipated to flow from the bedrock into open excavations will depend on the discontinuities in the rock mass, for instance, fracture, fissure, etc. and therefore, may vary from location to location. The earth fill materials and native sand are however considered high permeability soils, and will permit the free-flow of water when wet. This seepage may be allowed to drain into the excavation and dewatered through use of conventional sump pump arrangements at the base of the excavation. Issues of delay in excavation due to localized seepage control must be addressed in the excavation contract.

A dewatering system installed by a specialist dewatering contractor will be required to lower the groundwater level prior to and during excavations. The design of the dewatering system should be left to the contractor's discretion, and the system should meet a performance specification to maintain and control the groundwater at least 0.30 m below the excavation base. After which, it is recommended that a 150 mm thick layer of lean concrete (mud mat) be poured on the exposed bedrock surface as soon as possible after excavation and approval to provide a working platform. It is recommended that Pinchin review the final grading plan to confirm this recommendation.

Seasonal variations in the water table should be expected, with higher levels occurring during wet weather conditions in the spring and fall and lower levels occurring during dry weather conditions. If construction commences during wet periods (typically spring or fall), there is a greater potential that the groundwater elevation could be higher and/or perched groundwater may be present. Any potential precipitation of perched groundwater should be able to be controlled from pumping from filtered sumps.

Prior to commencing excavations, it is critical that all existing surface water and potential surface water is controlled and diverted away from the Site to prevent infiltration and subgrade softening. At no time should excavations be left open for a period of time that will expose them to precipitation and cause subgrade softening.

All collected water is to discharge a sufficient distance away from the excavation to prevent re-entry. Sediment control measures, such as a silt fence should be installed at the discharge point of the dewatering system. The utmost care should be taken to avoid any potential impacts on the environment

It is the responsibility of the contractor to propose a suitable dewatering system based on the groundwater elevation at the time of construction. The method used should not adversely impact any nearby structures. Excavations for the P2 FFE to conventional design depths for the building foundations may require a Permit to Take Water or a submission to the Environmental Activity and Sector Registry (EASR). It is the responsibility of the contractor to make this application if required.

6.5 Foundation Design

It is Pinchin's understanding that the proposed development is to consist of two mid-rise buildings (Building "A", 16-storey and Building "B", 20-storey), each extending from a common 4-storey podium. The proposed development will rest on two-level underground parking. The average elevation of the Site may be taken as 121 ± masl, and the P2 FFE will be set at 7.1 mbgs (i.e. Elevation 113.9 ± masl).

Bedrock was encountered in each borehole at depths ranging from approximately 3.0 and 4.6 mbgs (elevations ranging from approximately 116.2 to 117.6 masl). 'HQ' size rock coring was completed on the shale bedrock in each borehole and confirmed shale bedrock with limestone interbeds up to 200 mm in thickness of the Georgian Bay Formation.

A summary of properties with respect to the shale within the Georgian Bay Formation was presented in the Ontario Ministry of Transportation and Communications document RR229, *Evaluation of Shales for Construction Projects* (March 1983), as follows:

	Uniaxial Compressive Strength (MPa)	Young's Modulus (GPa)	Dynamic Modulus (GPa)	Poisson's Ratio
Average	28	4	19	0.19
Range	8 to 41	0.5 to 12	6 to 38	0.1 to 0.25

Below Elevation 114 ± masl, spread footings established on the slightly weathered to sound bedrock (approximately 2.2 to 3.7 meter depth into the bedrock) may be designed using the following bearing resistance for 25 mm of settlement at Serviceability Limit States (SLS) and factored geotechnical bearing resistance at Ultimate Limit States (ULS):

Spread Footing Size	SLS	ULS
1 m x 1 m	5.0 MPa	5.0 MPa

Spread Footing Size	SLS	ULS
2 m x 2 m	5.0 MPa	5.0 MPa
3 m x 3 m	3.75 MPa	5.0 MPa
4 m x 4 m	2.75 MPa	5.0 MPa
Elevator Core Raft Foundations up to 40 m X 20 m	2.5 MPa	5.0 MPa

The bearing resistance values provided assumes the bedrock is cleaned of debris and any loose rock pieces. The bedrock should be cleaned with air or water pressure exposing the clean slightly weathered to sound bedrock. If construction proceeds during freezing weather conditions water should not be allowed to pool and freeze in bedrock depressions.

Prior to installing foundation formwork, and after cleaning, the bedrock is to be inspected by Pinchin to ensure the slightly weathered to fresh bedrock is consistent with the findings of this report.

The bedrock surface is to be relatively level with slopes not exceeding 5 degrees from the horizontal. Shale bedrock can weather when exposed to air or water. It is therefore recommended that a 150 mm thick layer of lean concrete (mud slab) be placed in the footing excavations immediately after excavation and inspection to protect the shale bedrock from weathering. All concrete should be installed and maintained above freezing temperatures as required by the concrete supplier.

If construction proceeds during freezing weather conditions, adequate temporary frost protection for the footing bases and concrete must be provided and maintained above freezing at all times.

6.5.1 Foundations Frost Protection & Foundation Backfill

Experience suggests that the temperature in nominally unheated underground parking with two or more levels below grade and normal ventilation provisions is not as severe as the ambient open-air condition. In Mississauga, the earth cover required to prevent frost effects on foundations in the lower parking levels need not be any greater than 1.2 metres, and unmonitored experience in a number of structures and industry practice indicate that perimeter foundations provided with a minimum of 600 mm of soil cover perform adequately as do the interior isolated foundations with 900 mm of soil cover.

Foundations located immediately adjacent to air shafts, entrance and exit doors shall be treated as exterior foundations and should be provided with a minimum of 1.2 m of soil cover or equivalent insulation to ensure that foundations are not affected by the cold air flow.

Where the foundations for heated buildings do not have the minimum 1.2 m of soil cover frost protection, they should be protected from frost with a combination of soil cover and rigid polystyrene insulation, such

as Dow Styrofoam or equivalent product. If required, Pinchin can provide appropriate foundation frost protection recommendations as part of the design review.

6.5.2 Site Classification for Seismic Site Response & Soil Behaviour

The following information has been provided to assist the building designer from a geotechnical perspective only. These geotechnical seismic design parameters should be reviewed in detail by the structural engineer and be incorporated into the design as required.

The seismic site classification has been based on the 2012 Ontario Building Code (OBC). The parameters for determination of Site Classification for Seismic Site Response are set out in Table 4.1.8.4.A of the OBC. The site classification is based on the average shear wave velocity in the top 30 m of the site stratigraphy. If the average shear wave velocity is not known, the site class can be estimated from energy corrected Standard Penetration Resistance (N60) and/or the average undrained shear strength of the soil in the top 30 m.

The boreholes advanced at this Site extended to approximately 9.1 mbgs. SPT “N” values within the native soil deposit was 21 and 22 blows per 300 mm. As such, based on Table 4.1.8.4.A of the OBC, this Site has been classified as Class C. A Site Class C has an average shear wave velocity (Vs) of between 360 and 760 m/s. There is a potential that the Site Class may be higher; however, shear wave velocity measurements would be required for the determination of a higher Site Classification, as per the OBC.

6.6 Underground Parking Garage Design

It is understood that the proposed development will rest on a common two-level underground parking structure. The P2 FFE will be set at 7.1 mbgs (i.e. Elevation 113.9 ± masl). For geotechnical design purposes, the groundwater level may be taken at Elevation 118.5 ± masl.

As such, the proposed development will have to be designed to resist hydrostatic uplift or be provided with underfloor and foundation wall drainage systems connected to a suitable frost-free outlet due to the groundwater levels at the Site. Additional recommendations for the dewatering volumes during operation of the building will be provided within the Hydrogeological Assessment Report.

The magnitude of the hydrostatic uplift may be calculated using the following formula:

$$P = \gamma \times d$$

Where:

P = hydrostatic uplift pressure acting on the base of the structure (kPa)

γ = unit weight of water (9.8 kN/m^3)

d = depth of base of structure below the design high water level (m)

The resistance of gross uplift of the structure can be increased by simply increasing the mass of the structure and thickness of the raft slab or by installing soil anchors.

Where the structure is made directly against a shored excavation, the shoring wall should be covered with a layer of MiraDRAIN 6000 drainage composite or equivalent, with a minimum 150 mm overlap between drainage boards. This drainage board is to be covered with a continuous bentonite membrane with all joints welded and inspected. The drainage board should be connected to a basement sump via discharge pipes that protrude through the concrete foundation wall at 2.5 m spacing. This piping must not connect to the interior underfloor draining system. Within the foundation walls, perimeter weeping drains should consist of a minimum 150 mm diameter fabric wrapped perforated drainage tile surrounded by 19 mm diameter clear stone (OPSS 1004) with a minimum cover of 150 mm on top and sides and 50 mm below the drainage tile connected to an interior sump pump systems. The water collected from the weeping tile should be directed away from the building to appropriate drainage areas; either through gravity flow or interior sump pump systems. All subsurface walls should be water proofed.

An underfloor drainage system is recommended. The underfloor drainage system should be installed beneath the slab and should be constructed in a similar fashion to the foundation drains and be connected to a suitable frost-free outlet or sump.

The details of this foundation wall and floor slab drainage system must be reviewed by Pinchin prior to submission to the contractor.

For calculating the lateral earth pressure, following values should be used. Depending on the design of the building, the earth pressure computations must take into account the groundwater level at the Site.

Soil Layer	Bulk Unit Weight (kN/m^3)	At-Rest Earth Pressure Coefficient
Earth Fill	18	0.53
Native Sand	20	0.50
Weathered Bedrock	26	0.35
Slightly Weathered to Sound Bedrock	26	0.30

6.7 Floor Slabs

It is Pinchin's understanding that the development will consist of two levels of underground parking. The P2 slab elevation is anticipated at a depth of 7.1 mbgs (i.e. Elevation 113.9 ± masl).

A conventional slab-on-grade basement floor may be installed on the underlying shale bedrock. Prior to the installation of the slab, all deleterious or loose materials should be removed.

Based on the in-situ soil conditions, it is recommended to establish the concrete floor slab on a minimum 200 mm thick layer of 19 mm clear stone Type I or Type II (OPSS 1004) or Granular "A" (OPSS 1010). Any required up-fill should consist of a Granular "B" Type I or Type II (OPSS 1010). It should be noted that 19 mm clear stone is vulnerable to fines migration from adjacent soils, if clear stone is to be used it should be protected by an appropriate filter cloth based on the gradation of the adjacent soils.

The installation of a vapour barrier may be required under the floor slab. If required, the vapour barrier should conform to the flooring manufacturer's and designer's requirements. Consideration may be given to carrying out moisture emission and/or relative humidity testing of the slab to determine the concrete condition prior to flooring installation.

The following table provides the unfactored modulus of subgrade reaction values for use in design of the floor slab:

Material Type	Modulus of Subgrade Reaction (kN/m^3)
Granular A (OPSS 1010)	85,000
Granular "B" Type I (OPSS 1010)	75,000
Granular "B" Type II (OPSS 1010)	85,000
19 Clear Stone (OPSS 1004)	30,000
Shale Bedrock	100,000

7.0 SITE SUPERVISION & QUALITY CONTROL

It is recommended that all geotechnical aspects of the project be reviewed and confirmed under the appropriate geotechnical supervision, to routinely check such items. This includes but is not limited to inspection and confirmation of the undisturbed natural subgrade material prior to subgrade preparation, pouring any foundations or footings, backfilling, or engineered fill installation to ensure that the actual conditions are not markedly different than what was observed at the borehole locations and geotechnical components are constructed as per Pinchin's recommendations.

Compaction quality control of engineered fill material (full-time monitoring) is recommended as standard practice, as well as regular sampling and testing of aggregates, asphalt, and concrete, to ensure that physical characteristics of materials for compliance during installation and satisfies all specifications presented within this report.

8.0 TERMS AND LIMITATIONS

This Geotechnical Investigation was performed for the exclusive use of Ahmed Developments Inc. (Client) in order to evaluate the subsurface conditions at 1000 and 1024 Dundas Street East, Mississauga, Ontario. Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practises in the field of geotechnical engineering for the Site. Classification and identification of soil, and geologic units have been based upon commonly accepted methods employed in professional geotechnical practice. No warranty or other conditions, expressed or implied, should be understood. Conclusions derived are specific to the immediate area of study and cannot be extrapolated extensively away from sample locations.

Performance of this Geotechnical Investigation to the standards established by Pinchin is intended to reduce, but not eliminate, uncertainty regarding the subgrade soil at the Site, and recognizes reasonable limits on time and cost.

Regardless how exhaustive a Geotechnical Investigation is performed, the investigation cannot identify all the subsurface conditions. Therefore, no warranty is expressed or implied that the entire Site is representative of the subsurface information obtained at the specific locations of our investigation. If during construction, subsurface conditions differ from then what was encountered within our test location and the additional subsurface information provided to us, Pinchin should be contacted to review our recommendations. This report does not alleviate the contractor, owner, or any other parties of their respective responsibilities.

This report has been prepared for the exclusive use of the Client and their authorized agents. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third parties. If additional parties require reliance on this report, written authorization from Pinchin will be required. Pinchin disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs. No other warranties are implied or expressed. Furthermore, this report should not be construed as legal advice.

Pinchin makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and these interpretations may change over time. Please refer to Appendix IV, Report Limitations and Guidelines for Use, which pertains to this report.

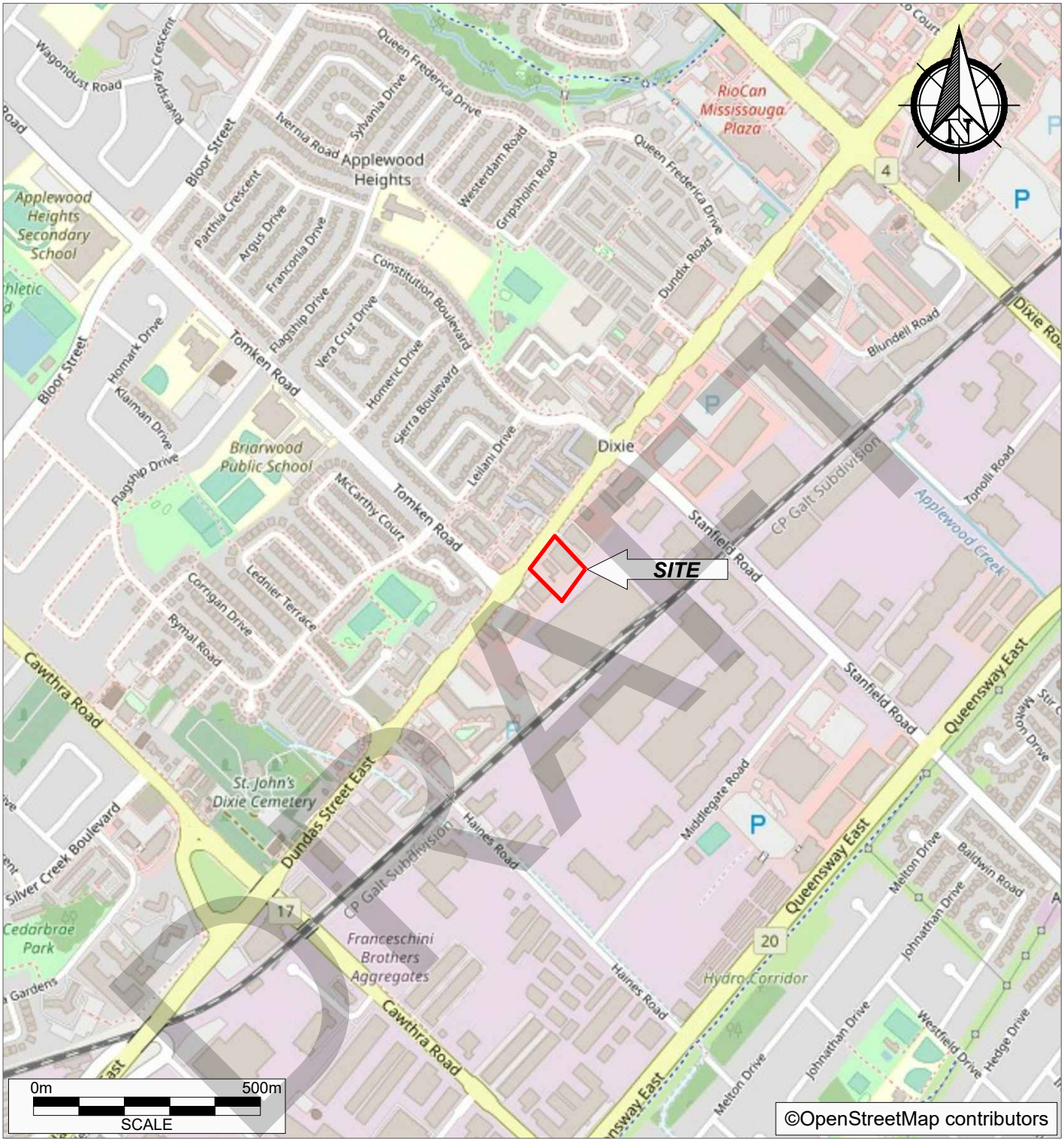
Specific limitations related to the legal and financial and limitations to the scope of the current work are outlined in our proposal, the attached Methodology and the Authorization to Proceed, Limitation of Liability and Terms of Engagement which accompanied the proposal.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

275471.003 DRAFT Geo Investigation 1000&1024 Dundas St E, Mississauga ON Nov 16 2021.docx

Template: Master Geotechnical Investigation Report – Ontario, GEO, April 1, 2020

FIGURES



PINCHIN

PROJECT NAME	GEOTECHNICAL INVESTIGATION
CLIENT NAME	AHMED DEVELOPMENTS INC.
PROJECT LOCATION	1000 AND 1024 DUNDAS STREET EAST, MISSISSAUGA, ONTARIO
FIGURE NAME	KEY MAP
FIGURE NO.	1
SCALE	AS SHOWN
PROJECT NO.	275471.003
DATE	NOV. 2021

N

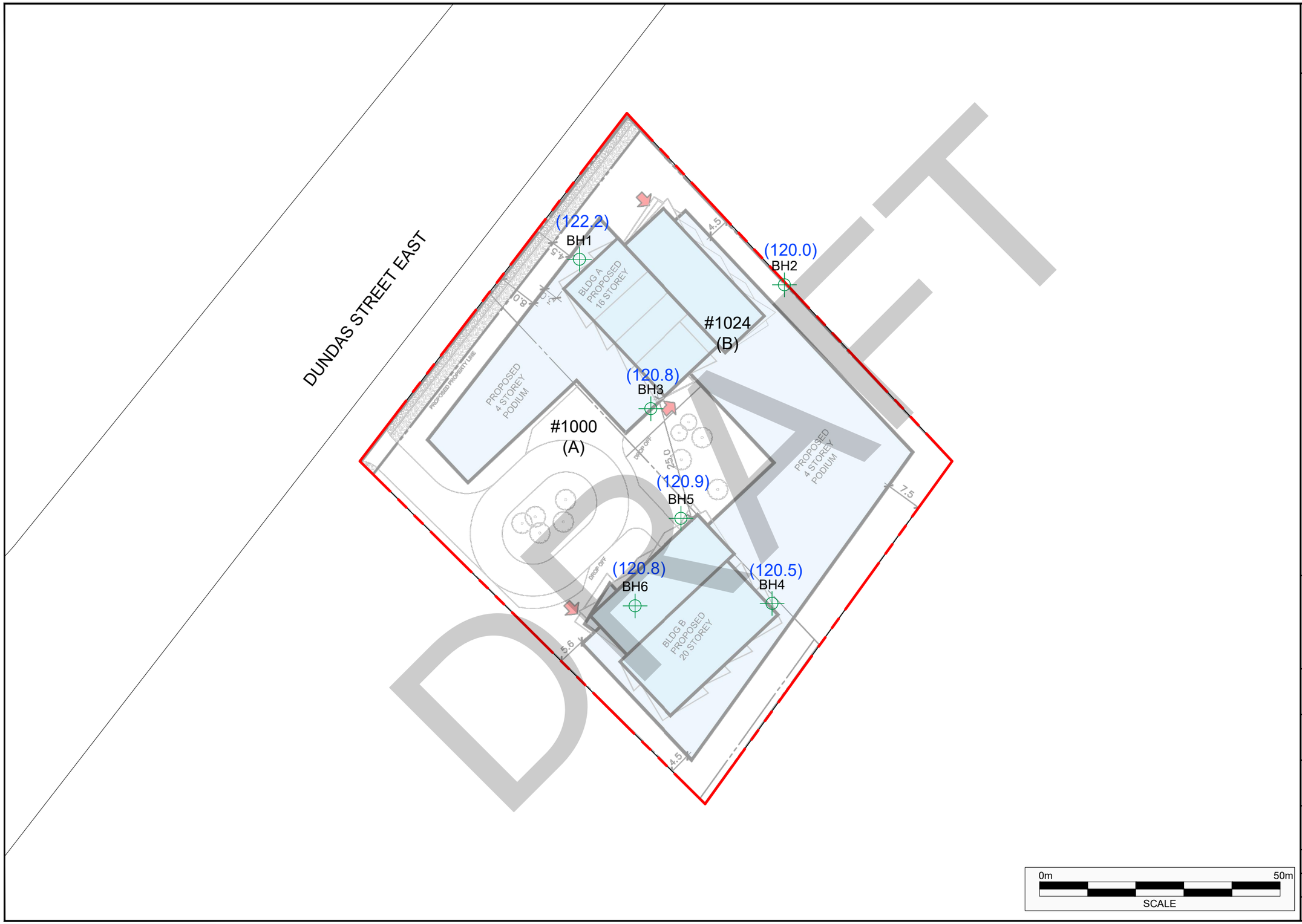
LEGEND

- SITE BOUNDARY
- SITE BUILDING
- MTR MULTI-TENANT RESIDENTIAL
- COM COMMERCIAL
- MTC MULTI-TENANT COMMERCIAL
- IND INDUSTRIAL
- BOREHOLE
- (#) GROUND ELEVATION IN masl
- masl METRES ABOVE SEA LEVEL

LEGEND IS COLOUR DEPENDENT. NON-COLOUR COPIES MAY ALTER INTERPRETATION.

PINCHIN

PROJECT NAME: GEOTECHNICAL INVESTIGATION	
CLIENT NAME: AHMED DEVELOPMENTS INC.	
PROJECT LOCATION: 1000 AND 1024 DUNDAS STREET EAST, MISSISSAUGA, ONTARIO	
FIGURE NAME: BOREHOLE LOCATION PLAN (EXISTING CONDITIONS)	
PROJECT NUMBER: 275471.003	SCALE: AS SHOWN
DRAWN BY: KP	REVIEWED BY: MB
DATE: NOV. 2021	FIGURE NUMBER: 2



N

LEGEND

SITE BOUNDARY

BOREHOLE

(#) GROUND ELEVATION IN masl

masl METRES ABOVE SEA LEVEL

LEGEND IS COLOUR DEPENDENT. NON-COLOUR COPIES MAY ALTER INTERPRETATION.

PINCHIN

PROJECT NAME: GEOTECHNICAL INVESTIGATION	
CLIENT NAME: AHMED DEVELOPMENTS INC.	
PROJECT LOCATION: 1000 AND 1024 DUNDAS STREET EAST, MISSISSAUGA, ONTARIO	
FIGURE NAME: BOREHOLE LOCATION PLAN (PROPOSED CONDITIONS)	
PROJECT NUMBER: 275471.003	SCALE: AS SHOWN
DRAWN BY: KP	REVIEWED BY: MB
DATE: NOV. 2021	FIGURE NUMBER: 3

APPENDIX I

Abbreviations, Terminology and Principle Symbols used in Report and Borehole Logs

ABBREVIATIONS, TERMINOLOGY & PRINCIPAL SYMBOLS USED

Sampling Method

AS	Auger Sample	**w**	Washed Sample
SS	Split Spoon Sample	**HQ**	Rock Core (63.5 mm diam.)
ST	Thin Walled Shelby Tube	**NQ**	Rock Core (47.5 mm diam.)
BS	Block Sample	**BQ**	Rock Core (36.5 mm diam.)

In-Situ Soil Testing

Standard Penetration Test (SPT), "N" value is the number of blows required to drive a 51 mm outside diameter spilt barrel sampler into the soil a distance of 300 mm with a 63.5 kg weight free falling a distance of 760 mm after an initial penetration of 150 mm has been achieved. The SPT, "N" value is a qualitative term used to interpret the compactness condition of cohesionless soils and is used only as a very approximation to estimate the consistency and undrained shear strength of cohesive soils.

Dynamic Cone Penetration Test (DCPT) is the number of blows required to drive a cone with a 60 degree apex attached to "A" size drill rods continuously into the soil for each 300 mm penetration with a 63.5 kg weight free falling a distance of 760 mm.

Cone Penetration Test (CPT) is an electronic cone point with a 10 cm2 base area with a 60 degree apex pushed through the soil at a penetration rate of 2 cm/s.

Field Vane Test (FVT) consists of a vane blade, a set of rods and torque measuring apparatus used to determine the undrained shear strength of cohesive soils.

Soil Descriptions

The soil descriptions and classifications are based on an expanded Unified Soil Classification System (USCS). The USCS classifies soils on the basis of engineering properties. The system divides soils into three major categories; coarse grained, fine grained and highly organic soils. The soil is then subdivided based on either gradation or plasticity characteristics. The classification excludes particles larger than 75 mm. To aid in quantifying material amounts by weight within the respective grain size fractions the following terms have been included to expand the USCS:

Soil Classification		Terminology	Proportion
Clay	< 0.002 mm		
Silt	0.002 to 0.06 mm	“trace”, trace sand, etc.	1 to 10%
Sand	0.075 to 4.75 mm	“some”, some sand, etc.	10 to 20%
Gravel	4.75 to 75 mm	Adjective, sandy, gravelly, etc.	20 to 35%
Cobbles	75 to 200 mm	And, and gravel, and silt, etc.	>35%
Boulders	>200 mm	Noun, Sand, Gravel, Silt, etc.	>35% and main fraction

Notes:

- Soil properties, such as strength, gradation, plasticity, structure, etcetera, dictate the soils engineering behaviour over grain size fractions; and
- With the exception of soil samples tested for grain size distribution or plasticity, all soil samples have been classified based on visual and tactile observations. The accuracy of visual and tactile observation is not sufficient to differentiate between changes in soil classification or precise grain size and is therefore an approximate description.

The following table outlines the qualitative terms used to describe the compactness condition of cohesionless soil:

Cohesionless Soil	
Compactness Condition	**SPT N-Index (blows per 300 mm)**
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

The following table outlines the qualitative terms used to describe the consistency of cohesive soils related to undrained shear strength and SPT, N-Index:

Cohesive Soil		
Consistency	**Undrained Shear Strength (kPa)**	**SPT N-Index (blows per 300 mm)**
Very Soft	<12	<2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

Note: Utilizing the SPT, N-Index value to correlate the consistency and undrained shear strength of cohesive soils is only very approximate and needs to be used with caution.

Soil & Rock Physical Properties

General

W Natural water content or moisture content within soil sample

γ Unit weight

γ' Effective unit weight

γ_d Dry unit weight

γ_{sat} Saturated unit weight

ρ Density

ρ_s Density of solid particles

ρ_w Density of Water

ρ_d Dry density

ρ_{sat} Saturated density e Void ratio

n Porosity

S_r Degree of saturation

E_{50} Strain at 50% maximum stress (cohesive soil)

Consistency

W_L	Liquid limit
W_P	Plastic Limit
I_P	Plasticity Index
W_S	Shrinkage Limit
I_L	Liquidity Index
I_C	Consistency Index
e_{max}	Void ratio in loosest state
e_{min}	Void ratio in densest state
I_D	Density Index (formerly relative density)

Shear Strength

C_u, S_u	Undrained shear strength parameter (total stress)
C'_d	Drained shear strength parameter (effective stress)
r	Remolded shear strength
τ_p	Peak residual shear strength
τ_r	Residual shear strength
ø'	Angle of interface friction, coefficient of friction = tan ø'

Consolidation (One Dimensional)

C_C	Compression index (normally consolidated range)
C_r	Recompression index (over consolidated range)
C_S	Swelling index
m_V	Coefficient of volume change
c_V	Coefficient of consolidation
T_V	Time factor (vertical direction)
U	Degree of consolidation
σ'_O	Overburden pressure
σ'_p	Preconsolidation pressure (most probable)
OCR	Overconsolidation ratio

Permeability

The following table outlines the terms used to describe the degree of permeability of soil and common soil types associated with the permeability rates**:**

Permeability (k cm/s)	Degree of Permeability	Common Associated Soil Type
$> 10^{-1}$	Very High	Clean gravel
10^{-1} to 10^{-3}	High	Clean sand, Clean sand and gravel
10^{-3} to 10^{-5}	Medium	Fine sand to silty sand
10^{-5} to 10^{-7}	Low	Silt and clayey silt (low plasticity)
$>10^{-7}$	Practically Impermeable	Silty clay (medium to high plasticity)

Rock Coring

Rock Quality Designation (RQD) is an indirect measure of the number of fractures within a rock mass, Deere et al. (1967). It is the sum of sound pieces of rock core equal to or greater than 100 mm recovered from the core run, divided by the total length of the core run, expressed as a percentage. If the core section is broken due to mechanical or handling, the pieces are fitted together and if 100 mm or greater included in the total sum**.**

RQD is calculated as follows:

$$\text{RQD (\%)} = \frac{\Sigma \text{ Length of core pieces} > 100 \text{ mm} \times 100}{\text{Total length of core run}}$$

The following is the Classification of Rock with Respect to RQD Value:

RQD Classification	RQD Value (%)
Very poor quality	**<25**
Poor quality	25 to 50
Fair quality	50 to 75
Good quality	75 to 90
Excellent quality	90 to 100

APPENDIX II

Pinchin's Borehole Logs

Log of Borehole: BH1 (MW)

Project #: 275471.003 **Logged By:** KS

Project: Geotechnical Investigation - Proposed Residential Development

Client: Ahmed Developments Inc.

Location: 1000 and 1024 Dundas Street East, Mississauga, Ontario

Drill Date: October 20, 2021 **Project Manager:** MYB

SUBSURFACE PROFILE

Depth (mbgs)	Description	Elevation (masl) / Depth (mbgs)
	Ground Surface	122.2
0	**Pavement Structure** Asphaltic concrete: 125 mm Aggregate layer: 300 mm	0.0 121.8 0.4
	Fill Brown gravelly sand, trace silt, loose, moist	121.4 0.8
1	Brown clayey silt, sandy, trace gravel, trace brick fragments, trace styrofoam, stiff to very stiff, moist	120.7 1.5
	trace organics	
2	Brown sand, some silt, trace gravel, trace red brick fragments, loose, moist	119.9 2.3
3	trace stone fragments, dense	119.2 3.0
4	**Inferred Bedrock** weathered bedrock with intermitted limestone/dolostone stringers (Georgian Bay Formation)	117.6 4.6
5		
6		116.1 6.1
7		114.6 7.6

Monitoring Well Details: Bentonite, Riser, Silica Sand

SAMPLE

Sample Type	Sampler Number	Recovery (%)	SPT N-Value	Water Content %
SS	1	20	6	16
SS	2	30	13	18
SS	3	30	16	11
SS	4	18	9	15
SS	5	40	31	11
SS	6	20	>50	6
HQ	1	100		

Standard Penetration N-Value (20, 40, 60)

Laboratory Analysis and Comments

Rig Type: Track-mount **Grade Elevation:** 122.2 masl.

Drilling Method: Split Spoon / Hollow Stem Auger, HQ-Rock Coring **Top of Casing Elevation:** N/A

Well Diameter: 51 mm **Sheet:** 1 of 2

mbgs - meters below ground surface
mbfs - meters below basement floor slab
masl - meters above sea level

Log of Borehole: BH1 (MW)

Project #: 275471.003 **Logged By:** KS

Project: Geotechnical Investigation - Proposed Residential Development

Client: Ahmed Developments Inc.

Location: 1000 and 1024 Dundas Street East, Mississauga, Ontario

Drill Date: October 20, 2021 **Project Manager:** MYB

SUBSURFACE PROFILE					SAMPLE						
Depth (mbgs)	Graphic Log	Description	Elevation (masl) / Depth (mbgs)	Monitoring Well Details	Sample Type	Sampler Number	Recovery (%)	SPT N-Value	Standard Penetration N-Value (20 40 60)	Water Content %	Laboratory Analysis and Comments
8		**Georgian Bay Formation** Grey shale, very thinly bedded to thinly bedded, weak, joints are horizontal, closed, planar; interbedded with limestone, light grey, strong			HQ	2	100				
9		Total Core Recovery: 100% Solid Core Recovery: 88% Rock Quality Designation: 30% ~5% Limestone	113.1 9.1	Screen							
10		Total Core Recovery: 100% Solid Core Recovery: 91% Rock Quality Designation: 60% ~5% Limestone									
11		End of Borehole									
12		Borehole terminated at approximately 9.1 mbgs. Water level and cave were not measured due to the presence of drill fluid.									
13		Water Level Reading Date Water Depth (mbgs) Nov. 11, 2021 4.0									
14											
15											

Rig Type: Track-mount **Grade Elevation:** 122.2 masl.

Drilling Method: Split Spoon / Hollow Stem Auger, HQ-Rock Coring **Top of Casing Elevation:** N/A

Well Diameter: 51 mm **Sheet:** 2 of 2

mbgs - meters below ground surface
mbfs - meters below basement floor slab
masl - meters above sea level

Log of Borehole: BH2 (MW)

Project #: 275471.003 **Logged By:** KS

Project: Geotechnical Investigation - Proposed Residential Development

Client: Ahmed Developments Inc.

Location: 1000 and 1024 Dundas Street East, Mississauga, Ontario

Drill Date: October 20, 2021 **Project Manager:** MYB

SUBSURFACE PROFILE					SAMPLE						
Depth (mbgs)	Graphic Log	Description	Elevation (masl) / Depth (mbgs)	Monitoring Well Details	Sample Type	Sampler Number	Recovery (%)	SPT N-Value	Standard Penetration N-Value (20 40 60)	Water Content %	Laboratory Analysis and Comments
		Ground Surface	120.0								
0		**Pavement Structure**	0.0								
		Asphaltic concrete: 100 mm	119.6		SS	1	60	25		6	
		Aggregate layer: 300 mm	0.4								
		Fill	119.3								
1		Brown sand and gravel, trace silt, compact, moist	0.8		SS	2	50	8		8	
		Brown sand, trace to some silt, pockets of clayey silt, loose, moist			SS	3	50	8		6	
2			117.8								
		Brown gravelly sand, trace silt, very dense, moist	2.3	Bentonite	SS	4	20	>50		6	
3			117.0								
		Inferred Bedrock	3.0		SS	5	10	>50		5	
		weathered bedrock with intermitted limestone/dolostone stringers (Georgian Bay Formation)									
4			115.5								
		Georgian Bay Formation	4.6								
5		Grey shale, very thinly bedded to thinly bedded, weak, joints are horizontal, closed, planar; interbedded with limestone, light grey, strong		Riser	HQ	1	90				
		Total Core Recovery: 90%									
6		Solid Core Recovery: 90%	113.9								
		Rock Quality Designation: 25%	6.1	Silica Sand							
		~3% Limestone									
7		Total Core Recovery: 98%			HQ	2	98				
		Solid Core Recovery: 93%									
		Rock Quality Designation: 78%									
		~5% Limestone	112.4								
			7.6								

Rig Type: Track-mount **Grade Elevation:** 120.0 masl.

Drilling Method: Split Spoon / Hollow Stem Auger, HQ-Rock Coring **Top of Casing Elevation:** N/A

Well Diameter: 51 mm **Sheet:** 1 of 2

mbgs - meters below ground surface
mbfs - meters below basement floor slab
masl - meters above sea level

Log of Borehole: BH2 (MW)

Project #: 275471.003 **Logged By:** KS

Project: Geotechnical Investigation - Proposed Residential Development

Client: Ahmed Developments Inc.

Location: 1000 and 1024 Dundas Street East, Mississauga, Ontario

Drill Date: October 20, 2021 **Project Manager:** MYB

SUBSURFACE PROFILE					SAMPLE						
Depth (mbgs)	Graphic Log	Description	Elevation (masl) / Depth (mbgs)	Monitoring Well Details	Sample Type	Sampler Number	Recovery (%)	SPT N-Value	Standard Penetration N-Value (20 40 60)	Water Content %	Laboratory Analysis and Comments
8		Total Core Recovery: 100% Solid Core Recovery: 100% Rock Quality Designation: 80% ~5% Limestone		Screen	HQ	3	100				
9			110.9								
		End of Borehole Borehole terminated at approximately 9.1 mbgs. Water level and cave were not measured due to the presence of drill fluid. Water Level Reading Date Water Depth (mbgs) Nov. 11, 2021 3.1	9.1								
10											
11											
12											
13											
14											
15											

Rig Type: Track-mount **Grade Elevation:** 120.0 masl.

Drilling Method: Split Spoon / Hollow Stem Auger, HQ-Rock Coring **Top of Casing Elevation:** N/A

Well Diameter: 51 mm **Sheet:** 2 of 2

mbgs - meters below ground surface
mbfs - meters below basement floor slab
masl - meters above sea level

Log of Borehole: BH3 (MW)

Project #: 275471.003 **Logged By:** KS

Project: Geotechnical Investigation - Proposed Residential Development

Client: Ahmed Developments Inc.

Location: 1000 and 1024 Dundas Street East, Mississauga, Ontario

Drill Date: October 19, 2021 **Project Manager:** MYB

SUBSURFACE PROFILE

Depth (mbgs)	Description	Elevation (masl) / Depth (mbgs)
	Ground Surface	120.8
0	**Pavement Structure** Asphaltic concrete: 150 mm Aggregate layer: 300 mm	0.0 120.4 0.4
	Fill Brown gravelly sand, trace silt, trace red brick fragments, pockets of clayey silt, compact, moist	120.1 0.8
1	Brown clayey silt, some sand to sandy, trace gravel, trace stone fragments, trace brick fragments, stiff, moist	119.3 1.5
2	dark brown, trace organics, soft	118.6 2.3
	Brown sand, trace silt, trace gravel, pockets of clayey silt, compact to dense, moist	
3	some silt, trace stone fragments, grey, wet	117.8 3.0
4		116.3 4.6
5	**Inferred Bedrock** weathered bedrock with intermitted limestone/dolostone stringers (Georgian Bay Formation)	
6		114.7 6.1
7		113.3 7.5

Graphic Log

Monitoring Well Details: Bentonite, Riser, Silica Sand

SAMPLE

Sample Type	Sampler Number	Recovery (%)	SPT N-Value	Water Content %
SS	1	30	19	10
SS	2	30	12	18
SS	3	20	3	25
SS	4	30	21	15
SS	5	30	40	7
SS	6	10	>50	13
HQ	1	98		

Standard Penetration N-Value: 20, 40, 60

Laboratory Analysis and Comments

Rig Type: Track-mount **Grade Elevation:** 120.8 masl.

Drilling Method: Split Spoon / Hollow Stem Auger, HQ-Rock Coring **Top of Casing Elevation:** N/A

Well Diameter: 51 mm **Sheet:** 1 of 2

mbgs - meters below ground surface
mbfs - meters below basement floor slab
masl - meters above sea level

Log of Borehole: BH3 (MW)

Project #: 275471.003 **Logged By:** KS

Project: Geotechnical Investigation - Proposed Residential Development

Client: Ahmed Developments Inc.

Location: 1000 and 1024 Dundas Street East, Mississauga, Ontario

Drill Date: October 19, 2021 **Project Manager:** MYB

SUBSURFACE PROFILE					SAMPLE						
Depth (mbgs)	Graphic Log	Description	Elevation (masl) / Depth (mbgs)	Monitoring Well Details	Sample Type	Sampler Number	Recovery (%)	SPT N-Value	Standard Penetration N-Value (20 40 60)	Water Content %	Laboratory Analysis and Comments
8		**Georgian Bay Formation** Grey shale, very thinly bedded to thinly bedded, weak, joints are horizontal, closed, planar; interbedded with limestone, light grey, strong			HQ	2	94				
9		Total Core Recovery: 98% Solid Core Recovery: 78% Rock Quality Designation: 37% ~2% Limestone	111.7 9.1	Screen							
10		Total Core Recovery: 94% Solid Core Recovery: 83% Rock Quality Designation: 37% ~2% Limestone									
		End of Borehole									
11		Borehole terminated at approximately 9.1 mbgs. Water level and cave were not measured due to the presence of drill fluid.									
12		Water Level Reading Date Water Depth (mbgs) Nov. 11, 2021 5.1									
13											
14											
15											

Rig Type: Track-mount **Grade Elevation:** 120.8 masl.

Drilling Method: Split Spoon / Hollow Stem Auger, HQ-Rock Coring **Top of Casing Elevation:** N/A

Well Diameter: 51 mm **Sheet:** 2 of 2

mbgs - meters below ground surface
mbfs - meters below basement floor slab
masl - meters above sea level

Log of Borehole: BH4 (MW)

Project #: 275471.003 **Logged By:** KS

Project: Geotechnical Investigation - Proposed Residential Development

Client: Ahmed Developments Inc

Location: 1000 and 1024 Dundas Street East, Mississauga, Ontario

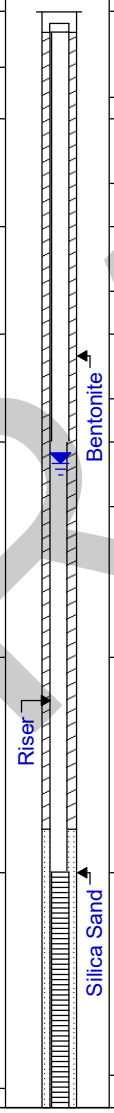
Drill Date: October 18, 2021 **Project Manager:** MYB

SUBSURFACE PROFILE

Depth (mbgs)	Description	Elevation (masl) / Depth (mbgs)
	Ground Surface	120.5
0	**Pavement Structure** Asphaltic concrete: 80 mm Aggregate layer: 300 mm	0.0 120.1 0.4
1	**Fill** Dark brown sand and gravel, some silt, compact, moist	119.7 0.8
	trace silt, trace gravel, pockets of clayey silt	119.0 1.5
2	trace brick fragments, loose, dark brown	118.2 2.3
	trace stone fragments, wet	117.5 3.0
3	**Inferred Bedrock** weathered bedrock with intermitted limestone/dolostone stringers (Georgian Bay Formation)	115.9 4.6
4	**Georgian Bay Formation** Grey shale, very thinly bedded to thinly bedded, weak, joints are horizontal, closed, planar; interbedded with limestone, light grey, strong	
5	Total Core Recovery: 95% Solid Core Recovery: 80% Rock Quality Designation: 10%	114.4 6.1
6	~2% Limestone Total Core Recovery: 100% Solid Core Recovery: 95% Rock Quality Designation: 30%	
7	~5% Limestone	112.9 7.6

Graphic Log

Monitoring Well Details



SAMPLE

Sample Type	Sampler Number	Recovery (%)	SPT N-Value	Water Content %
SS	1	10	20	12
SS	2	40	13	12
SS	3	5	10	12
SS	4	30	16	18
SS	5	50	>50	17
HQ	1	95		
HQ	2	100		

Standard Penetration N-Value (20, 40, 60)

Laboratory Analysis and Comments

Rig Type: Track-mount **Grade Elevation:** 120.5 masl.

Drilling Method: Split Spoon / Hollow Stem Auger, HQ-Rock Coring **Top of Casing Elevation:** N/A

Well Diameter: 51 mm **Sheet:** 1 of 2

mbgs - meters below ground surface
mbfs - meters below basement floor slab
masl - meters above sea level

Log of Borehole: BH4 (MW)

Project #: 275471.003 **Logged By:** KS

Project: Geotechnical Investigation - Proposed Residential Development

Client: Ahmed Developments Inc

Location: 1000 and 1024 Dundas Street East, Mississauga, Ontario

Drill Date: October 18, 2021 **Project Manager:** MYB

SUBSURFACE PROFILE					SAMPLE						
Depth (mbgs)	Graphic Log	Description	Elevation (masl) / Depth (mbgs)	Monitoring Well Details	Sample Type	Sampler Number	Recovery (%)	SPT N-Value	Standard Penetration N-Value (20 40 60)	Water Content %	Laboratory Analysis and Comments
8		Total Core Recovery: 100% Solid Core Recovery: 100% Rock Quality Designation: 40% ~5% Limestone		Screen	HQ	3	100				
9			111.4								
		End of Borehole Borehole terminated at approximately 9.1 mbgs. Water level and cave were not measured due to the presence of drill fluid. Water Level Reading Date Water Depth (mbgs) Nov. 11, 2021 3.2	9.1								
10											
11											
12											
13											
14											
15											

Rig Type: Track-mount **Grade Elevation:** 120.5 masl.

Drilling Method: Split Spoon / Hollow Stem Auger, HQ-Rock Coring **Top of Casing Elevation:** N/A

Well Diameter: 51 mm **Sheet:** 2 of 2

mbgs - meters below ground surface
mbfs - meters below basement floor slab
masl - meters above sea level

Log of Borehole: BH5 (MW)

Project #: 275471.003 **Logged By:** KS

Project: Geotechnical Investigation - Proposed Residential Development

Client: Ahmed Developments Inc.

Location: 1000 and 1024 Dundas Street East, Mississauga, Ontario

Drill Date: October 18, 2021 **Project Manager:** MYB

SUBSURFACE PROFILE

Depth (mbgs)	Description	Elevation (masl) / Depth (mbgs)
	Ground Surface	120.9
0	**Pavement Structure** Asphaltic concrete: 100 mm Aggregate layer: 300 mm	0.0 120.5 0.4
	Fill Brown gravelly sand, some silt, pockets of clayey silt, loose, moist	120.1 0.8
1	Brown sand, trace to some silt, trace clay, trace red brick fragments, trace organics, pockets of clayey silt, loose to compact, moist	
2		118.6
	Sand Brown sand, some silt, compact, wet	2.3
3	some gravel, grey	117.8 3.0
4		116.3
	Inferred Bedrock weathered bedrock with intermitted limestone/dolostone stringers (Georgian Bay Formation)	4.6
5		
6		114.8 6.1
7		113.3 7.6

Monitoring Well Details: Bentonite, Riser, Silica Sand

SAMPLE

Sample Type	Sampler Number	Recovery (%)	SPT N-Value	Water Content %
SS	1	40	4	9
SS	2	50	19	12
SS	3	5	7	6
SS	4	50	21	15
SS	5	50	22	13
SS	6	50	>50	6
HQ	1	100		

Standard Penetration N-Value (20, 40, 60)

Laboratory Analysis and Comments

Rig Type: Track-mount **Grade Elevation:** 120.9 masl.

Drilling Method: Split Spoon / Hollow Stem Auger, HQ-Rock Coring **Top of Casing Elevation:** N/A

Well Diameter: 51 mm **Sheet:** 1 of 2

mbgs - meters below ground surface
mbfs - meters below basement floor slab
masl - meters above sea level

Log of Borehole: BH5 (MW)

Project #: 275471.003 **Logged By:** KS

Project: Geotechnical Investigation - Proposed Residential Development

Client: Ahmed Developments Inc.

Location: 1000 and 1024 Dundas Street East, Mississauga, Ontario

Drill Date: October 18, 2021 **Project Manager:** MYB

SUBSURFACE PROFILE					SAMPLE						
Depth (mbgs)	Graphic Log	Description	Elevation (masl) / Depth (mbgs)	Monitoring Well Details	Sample Type	Sampler Number	Recovery (%)	SPT N-Value	Standard Penetration N-Value (20 40 60)	Water Content %	Laboratory Analysis and Comments
8		**Georgian Bay Formation** Grey shale, very thinly bedded to thinly bedded, weak, joints are horizontal, closed, planar; interbedded with limestone, light grey, strong			HQ	2	100				
9		Total Core Recovery: 100% Solid Core Recovery: 80% Rock Quality Designation: 10% ~10% Limestone	111.7 9.1	Screen							
10		Total Core Recovery: 100% Solid Core Recovery: 95% Rock Quality Designation: 40% ~13% Limestone									
11		End of Borehole									
12		Borehole terminated at approximately 9.1 mbgs. Water level and cave were not measured due to the presence of drill fluid. Water Level Reading Date Water Depth (mbgs) Nov. 11, 2021 5.2									
13											
14											
15											

Rig Type: Track-mount **Grade Elevation:** 120.9 masl.

Drilling Method: Split Spoon / Hollow Stem Auger, HQ-Rock Coring **Top of Casing Elevation:** N/A

Well Diameter: 51 mm **Sheet:** 2 of 2

mbgs - meters below ground surface
mbfs - meters below basement floor slab
masl - meters above sea level

Log of Borehole: BH6 (MW)

Project #: 275471.003 **Logged By:** KS

Project: Geotechnical Investigation - Proposed Residential Development

Client: Ahmed Developments Inc.

Location: 1000 and 1024 Dundas Street East, Mississauga, Ontario

Drill Date: October 19, 2021 **Project Manager:** MYB

SUBSURFACE PROFILE

Depth (mbgs)	Description	Elevation (masl) / Depth (mbgs)
	Ground Surface	120.8
0	**Pavement Structure** Asphaltic concrete: 100 mm Aggregate layer: 200 mm	0.0 120.5 0.3
	Fill Brown gravelly sand, some silt, loose, moist	120.0 0.8
1	Brown clayey silt, sandy, trace gravel, soft, moist	119.3 1.5
	Brown sand, some gravel, trace silt, very loose, moist	
2	Dark brown clayey silt, sandy, trace gravel, trace red brick fragments, soft to stiff, moist trace concrete pieces	118.5 2.3
3	Brown sand, some silt, trace gravel, trace organics, loose, wet	117.8 3.0
4		116.2 4.6
5	**Inferred Bedrock** weathered bedrock with intermitted limestone/dolostone stringers (Georgian Bay Formation)	
6		114.7 6.1
7		113.2 7.6

Graphic Log

Monitoring Well Details: Bentonite, Riser, Silica Sand

SAMPLE

Sample Type	Sampler Number	Recovery (%)	SPT N-Value	Water Content %
SS	1	50	9	14
SS	2	30	2	16
SS	3	5	2	13
SS	4	5	11	14
SS	5	60	5	28
SS	6	20	>50	10
HQ	1	100		

Standard Penetration N-Value (20, 40, 60)

Laboratory Analysis and Comments

Rig Type: Track-mount **Grade Elevation:** 120.8 masl.

Drilling Method: Split Spoon / Hollow Stem Auger, HQ-Rock Coring **Top of Casing Elevation:** N/A

Well Diameter: 51 mm **Sheet:** 1 of 2

mbgs - meters below ground surface
mbfs - meters below basement floor slab
masl - meters above sea level

Log of Borehole: BH6 (MW)

Project #: 275471.003 **Logged By:** KS

Project: Geotechnical Investigation - Proposed Residential Development

Client: Ahmed Developments Inc.

Location: 1000 and 1024 Dundas Street East, Mississauga, Ontario

Drill Date: October 19, 2021 **Project Manager:** MYB

SUBSURFACE PROFILE					SAMPLE						
Depth (mbgs)	Graphic Log	Description	Elevation (masl) / Depth (mbgs)	Monitoring Well Details	Sample Type	Sampler Number	Recovery (%)	SPT N-Value	Standard Penetration N-Value (20 40 60)	Water Content %	Laboratory Analysis and Comments
8		**Georgian Bay Formation** Grey shale, very thinly bedded to thinly bedded, weak, joints are horizontal, closed, planar; interbedded with limestone, light grey, strong			HQ	2	100				
9		Total Core Recovery: 100% Solid Core Recovery: 100% Rock Quality Designation: 40% ~8% Limestone	111.7 9.1	Screen							
10		Total Core Recovery: 100% Solid Core Recovery: 100% Rock Quality Designation: 50% ~10% Limestone									
11		End of Borehole Borehole terminated at approximately 9.2 mbgs. Water level and cave were not measured due to the presence of drill fluid.									
12		Water Level Reading Date Water Depth (mbgs) Nov. 11, 2021 2.2									
13											
14											
15											

Rig Type: Track-mount **Grade Elevation:** 120.8 masl.

Drilling Method: Split Spoon / Hollow Stem Auger, HQ-Rock Coring **Top of Casing Elevation:** N/A

Well Diameter: 51 mm **Sheet:** 2 of 2

mbgs - meters below ground surface
mbfs - meters below basement floor slab
masl - meters above sea level

APPENDIX III

Report Limitations and Guidelines for Use

REPORT LIMITATIONS & GUIDELINES FOR USE

This information has been provided to help manage risks with respect to the use of this report.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS AND PROJECTS

This report was prepared for the exclusive use of the Client and their authorized agents, subject to the conditions and limitations contained within the duly authorized work plan. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third parties. If additional parties require reliance on this report, written authorization from Pinchin will be required. Pinchin disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs. No other warranties are implied or expressed. Furthermore, this report should not be construed as legal advice.

SUBSURFACE CONDITIONS CAN CHANGE

This geotechnical report is based on the existing conditions at the time the study was performed, and Pinchin's opinion of soil conditions are strictly based on soil samples collected at specific test hole locations. The findings and conclusions of Pinchin's reports may be affected by the passage of time, by manmade events such as construction on or adjacent to the Site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations.

LIMITATIONS TO PROFESSIONAL OPINIONS

Interpretations of subsurface conditions are based on field observations from test holes that were spaced to capture a 'representative' snap shot of subsurface conditions. Site exploration identifies subsurface conditions only at points of sampling. Pinchin reviews field and laboratory data and then applies professional judgment to formulate an opinion of subsurface conditions throughout the Site. Actual subsurface conditions may differ, between sampling locations, from those indicated in this report.

LIMITATIONS OF RECOMMENDATIONS

Subsurface soil conditions should be verified by a qualified geotechnical engineer during construction. Pinchin should be notified if any discrepancies to this report or unusual conditions are found during construction.

Sufficient monitoring, testing and consultation should be provided by Pinchin during construction and/or excavation activities, to confirm that the conditions encountered are consistent with those indicated by the test hole investigation, and to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated. In addition, monitoring, testing and consultation by Pinchin should be completed to evaluate whether or not earthwork activities are completed in

accordance with our recommendations. Retaining Pinchin for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions. However, please be advised that any construction/excavation observations by Pinchin is over and above the mandate of this geotechnical evaluation and therefore, additional fees would apply.

MISINTERPRETATION OF GEOTECHNICAL ENGINEERING REPORT

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having Pinchin confer with appropriate members of the design team after submitting the report. Also retain Pinchin to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having Pinchin participate in pre-bid and preconstruction conferences, and by providing construction observation. Please be advised that retaining Pinchin to participation in any 'other' activities associated with this project is over and above the mandate of this geotechnical investigation and therefore, additional fees would apply.

CONTRACTORS RESPONSIBILITY FOR SITE SAFETY

This geotechnical report is not intended to direct the contractor's procedures, methods, schedule or management of the work Site. The contractor is solely responsible for job Site safety and for managing construction operations to minimize risks to on-Site personnel and to adjacent properties. It is ultimately the contractor's responsibility that the Ontario Occupational Health and Safety Act is adhered to, and Site conditions satisfy all 'other' acts, regulations and/or legislation that may be mandated by federal, provincial and/or municipal authorities.

SUBSURFACE SOIL AND/OR GROUNDWATER CONTAMINATION

This report is geotechnical in nature and was not performed in accordance with any environmental guidelines. As such, any environmental comments are very preliminary in nature and based solely on field observations. Accordingly, the scope of services do not include any interpretations, recommendations, findings, or conclusions regarding the, assessment, prevention or abatement of contaminants, and no conclusions or inferences should be drawn regarding contamination, as they may relate to this project. The term "contamination" includes, but is not limited to, molds, fungi, spores, bacteria, viruses, PCBs, petroleum hydrocarbons, inorganics, pesticides/insecticides, volatile organic compounds, polycyclic aromatic hydrocarbons and/or any of their by-products.

Pinchin will not be responsible for any consequential or indirect damages. Pinchin will only be held liable for damages resulting from the negligence of Pinchin. Pinchin will not be liable for any losses or damage if the Client has failed, within a period of two years following the date upon which the claim is discovered within the meaning of the Limitations Act, 2002 (Ontario), to commence legal proceedings against Pinchin to recover such losses or damage.