TERRAPEX

WELLDALE LIMITED PARTNERSHIP

GEOTECHNICAL INVESTIGATION REPORT 1186-1196 WELLINGTON STREET WEST

Ottawa, Ontario

Revised November 4, 2021

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TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

Terrapex Environmental Ltd. **(Terrapex)** was retained by Welldale Limited Partnership (Client, Owner) to carry out a Geotechnical Investigation for the proposed mixed-use residential/commercial redevelopment (Project) located at 1186-1196 Wellington Street West (Site) in Ottawa, Ontario.

The terms of reference for this Geotechnical Investigation were documented in the **Terrapex** proposal dated January 15, 2021. Agreement and authorization dated March 24, 2021 to proceed with the investigation was received from Mr. Paul Baron on behalf of the Client.

Terrapex is pleased to present the results of this Geotechnical Investigation. This Geotechnical Investigation report is subject to the limitations shown in Section 8.0. The report is prepared for the sole use of the Client, and any reliance on it by any third party, is the responsibility of such third party.

This report presents the results of the investigation performed in accordance with the general terms of reference outlined above. It is understood that the Project will be performed in accordance with applicable codes and standards within its jurisdiction.

The fieldwork for the geotechnical investigation was conducted in conjunction with the fieldwork for Phase II Environmental Site Assessment (ESA), and Hydrogeological Investigation. The Phase II ESA, and Hydrogeological Investigation reports are submitted under separate covers.

2.0 SITE AND PROJECT DESCRIPTION

2.1 SITE DESCRIPTION

The Site for the Project is located at the southwest corner of the intersection on Wellington Street West and Parkdale Avenue, and presently comprises three separate adjacent properties with municipal addresses of 1186, 1188 and 1194 Wellington Street West. The properties were reportedly originally developed circa 1902 for institutional use and have remained occupied since then.

Current Site usage includes:

- An asphaltic parking lot at 1186 Wellington Street West;
- A Rexall Pharmacy and office building at 1188 Wellington Street West; and,
- The Cornerstone House of Refuge Apostolic Church at 1194 Wellington Street West.

The existing ground surface at the Site is relatively flat with no slopes with elevations near 65.2 to 65.8 meters above sea level (masl). The location of the Site is shown on the Site Location Plan attached as Figure 1 at the end of this report.

2.2 PROJECT DESCRIPTION

Our understanding of the Project is based on the information and files provided by the Client. It is understood by **Terrapex** that the Client is proposing to demolish all of the existing structures and construct a single mixed-use (residential and commercial) building ranging between one and eighteen storeys in height with maximum three levels of underground parking, which will extend to the limits of the property.

At the time of submission of our proposal and field investigations, the Client had provided **Terrapex** with the following documents:

- Concept Study (1186-1194 Wellington St. West, dated March 2021), by Dialog Design (Architect);
- Topographic Survey of Lots A, B, C, & D, Registered Plan 58 (Project No.: 161614215-111, dated April 26, 2021), by Stantec Geomatics Ltd.;
- Geotechnical Investigation, Proposed Multi-Storey Building (Project No.: PG5379-1, dated July 24, 2020), by Paterson Group;
- Phase I Environmental Site Assessment (Project No.: PE4953-1, dated July 16, 2020), by Paterson Group; and,
- Phase II Environmental Site Assessment (Project No.: PE4953-2, dated July 29, 2020), by Paterson Group.

Based on the concept study and discussions with the Client, we understand that the redevelopment will include three levels of underground parking garage that will extend to the property limits, to approximate depths of 9 to 12 meters below the ground surface (mbgs), and an elevator pit to 16 mbgs. We also understand that the Client had previously retained a geotechnical consultant, Paterson Group, to complete a geotechnical investigation for the Project. Based on our review of the Geotechnical Investigation report by Paterson Group, a total of six (6) boreholes were drilled to a maximum depth of 7.6 mbgs, and as such, is considered to be insufficient for the proposed redevelopment.

The Architect's concept plan is attached at the end of this report for reference in Appendix III, and the six (6) boreholes from Paterson Group's geotechnical investigation are shown on Figure 2; General Site Layout, and included in Appendix I Borehole Logs.

3.0 SCOPE OF WORK

The scope of work for this Geotechnical Investigation was documented in the **Terrapex** proposal, and included the following:

- **Terrapex** obtained a City of Ottawa road cut permit;
- **Terrapex** retained a private underground utility subcontractor to provide both public and private utility clearances;
- **Terrapex** retained a drilling subcontractor and drilled the following boreholes:

    - Five (5) boreholes to 16 mbgs. Three (3) of these boreholes were instrumented with monitoring wells; and,
    - One (1) borehole to 20 mbgs.
- **Terrapex** supervised the drilling and logged the soil and rock conditions at the borehole locations based on the recovered soil and rock samples;
- **Terrapex** developed the three (3) monitoring wells and recorded the groundwater levels in the monitoring wells;
- **Terrapex** recorded the geodetic coordinates and elevations for the boreholes;
- **Terrapex** completed geotechnical tests in our laboratory; and
- **Terrapex** prepared this Geotechnical Investigation Report based on the findings from the field investigations and laboratory testing.

4.0 FIELDWORK

The fieldwork for this investigation was carried out during the period April 19 through 22, and May 20, 2021. It consisted of advancing six (6) boreholes labelled as MW105, BH107, BH108, BH110, MW112, and MW113. **Terrapex** also advanced an additional seven (7) boreholes for the Phase II ESA, reported under a separate cover. The locations of the **Terrapex** boreholes and Paterson Group boreholes for this Geotechnical Investigation are shown on the General Site Layout attached as Figure 2 at the end of this report.

George Downing Estate Drilling Ltd., a geotechnical drilling subcontractor, performed the geotechnical drilling work. The boreholes were advanced using truck and track mounted drill rigs outfitted with continuous flight augers. Standard penetration tests (SPT) were carried out in the course of advancing the boreholes within the overburden soil to take representative samples and to measure penetration index values (N-values) to characterize the condition of the various soil materials. The number of blows of the striking hammer required to drive the split spoon sampler to 300 mm depth was recorded and these are presented on the logs as penetration index values. The unconfined shear strength of clayey soils was measured using pocket penetrometers (PP). Advancement into the bedrock was performed by using casings and NQ or HQ double-walled wireline diamond coring methods. The boreholes were backfilled with bentonite hole-plug as required.

Results of SPT, undrained shear strengths, and descriptions of the rock cores are shown on the borehole log sheets attached in Appendix I of this report.

The monitoring wells for this investigation were developed, and groundwater level observations were made. The results of the groundwater level measurements in the open boreholes and monitoring wells are discussed in Section 6.8 of this report.

The locations and ground surface elevations of the boreholes were recorded by **Terrapex** field staff using a Trimble R12 GPS device; coordinates and elevations are referenced to the UTM NAD 1983 Zone 18 North coordinate system.

The fieldwork for this project was carried out under the supervision of an experienced geotechnical technician who laid out the location of the boreholes in the field, arranged locates of buried services, supervised the field drilling, sampling and in situ testing, observed groundwater conditions, recorded borehole coordinates and elevations, and prepared the field borehole logs.

5.0 GEOTECHNICAL LABORATORY TESTS

The soil and rock core samples retained from the boreholes were properly sealed, labelled and brought to our laboratory for visual classification and laboratory testing. The results of the classification, water contents, and SPT are presented on the borehole log sheets attached in Appendix I of this report.

The laboratory testing component for this investigation consisted of the following tests:

- Moisture content on all the soil samples;
- Grain-size analyses on three (3) soil samples;
- Unconfined compressive strength tests on ten (10) rock samples; and,
- Unit weight on ten (10) rock samples.

The result of the laboratory tests are presented in Section 6 and attached at the end of this report in Appendix II.

6.0 SUBSURFACE SOIL AND GROUNDWATER CONDITIONS

The subsurface soil conditions encountered in the **Terrapex** and Paterson Group boreholes are summarized in Tables 6-1 and 6-2 below and briefly discussed in the following subsections. Full details of the subsurface soil and groundwater conditions in the boreholes are provided on the borehole log sheets attached in Appendix I at the end of this report.

Table 6-1: Summary of Subsurface Conditions – Terrapex Boreholes

Inferred Soil Layer	Boreholes					
	MW105 mbgs El. (masl)	BH107 mbgs El. (masl)	BH108 mbgs El. (masl)	BH110 mbgs El. (masl)	MW112 mbgs El. (masl)	MW113 mbgs El. (masl)
Asphalt	65 mm	76 mm	76 mm	100 mm	76 mm	-
Concrete	-	-	-	-	-	150 mm
Granular Base	0.1 to 0.6 (65.2 to 64.7)	0.1 to 0.6 (65.5 to 65.0)	0.1 to 0.6 (65.2 to 64.7)	0.1 to 0.6 (65.3 to 64.8)	0.1 to 0.7 (65.6 to 64.8)	0.2 to 0.7 (65.6 to 65.1)
FILL	0.6 to 3.2 (64.7 to 62.1)	0.6 to 3.2 (65.0 to 62.4)	0.6 to 3.1 (64.7 to 62.2)	-	0.7 to 1.0 (64.8 to 64.5)	0.7 to 1.1 (65.1 to 64.7)

Silty Clay	-	-	-	0.6 to 1.2 (64.8to 64.2)	1.0 to 2.2 64.5 to 63.3)	1.1 to 2.3 (64.7 to 63.5)
Silt / Clayey Silt	-	-	-	1.2 to 3.3 (64.2 to 62.1)	-	-
Sandy Silt	-	-	-	-	2.2 to 3.8 (63.3 to 61.7)	2.3 to 3.8 (63.5 to 62.0)
Silty Sand	-	-	-	-	3.8 to 4.8 (61.7 to 60.7)	3.8 to 5.1 (62.0 to 60.7)
Bedrock	3.2 to 16.2* (62.1 to 49.1)	3.2 to 16.0* (62.4 to 49.6)	3.1 to 20.3* (62.2 to 45.0)	3.3 to 16.0* (62.1 to 49.4)	4.8 to 16.4* (60.7 to 49.1)	5.1 to 16.0* (60.7 to 49.8)

* Borehole terminated at the indicated depth

Table 6-2: Summary of Subsurface Conditions – Paterson Group Boreholes

Inferred Soil Layer	**Boreholes**					
	BH 1 mbgs El. (masl)	**BH 2 mbgs El. (masl)**	**BH 3 mbgs El. (masl)**	**BH 4 mbgs El. (masl)**	**BH 5 mbgs El. (masl)**	**BH 6 mbgs El. (masl)**
Asphalt	100 mm	100 mm	100 mm	100 mm	80 mm	100 mm
Granular Base	0.1 to 0.6 (65.7 to 65.2)	0.1 to 0.7 (65.6 to 65.0)	0.1 to 0.6 (65.4 to 64.9)	0.1 to 0.6 (65.4 to 64.9)	0.1 to 0.5 (65.7 to 65.3)	0.1 to 0.5 (65.5 to 65.1)
FILL	0.6 to 1.5 (65.2 to 64.3)	0.7 to 3.3 (65.0 to 62.4)	0.6 to 1.5 (64.9 to 64.0)	0.6 to 2.1 (64.9 to 63.4)	-	0.5 to 1.5 (65.1 to 64.1)
Silty Clay	1.5 to 2.3 (64.3 to 63.5)	-	-	-	-	1.5 to 2.1 (64.1 to 63.5)
Silt / Clayey Silt	2.3 to 3.4 (63.5 to 62.4)	-	-	-	-	-
Silty Sand	-	-	1.5 to 3.3 (64.0 to 62.2)	2.1 to 3.5** (63.4 to 62.0)	0.5 to 3.2 (65.3 to 62.6)	-
Bedrock	3.4 to 7.6* (62.4 to 58.2)	3.3 to 7.3* (62.4 to 58.4)	3.3 to 7.0* (62.2 to 58.5)	-	3.2 to 7.0* (62.6 to 58.8)	2.1 to 6.8* (63.5 to 58.8)

* Borehole terminated at the indicated depth

** Practical refusal at the indicated depth

The following paragraphs present a description and commentary on the properties of the various soil and rock materials contacted in the boreholes.

It should be noted that the boundaries of soil types indicated on the borehole logs represent the materials encountered at the discrete borehole locations only. These boundaries are intended to reflect transition zones for the purpose of geotechnical design, and therefore, should not be construed as exact planes of geological change.

6.1 ASPHALT, CONCRETE, AND GRANULAR BASE

The **Terrapex** Boreholes MW105, BH107, BH108, BH110, and MW112 were located on existing

asphalt pavement; the thickness of the asphalt measured in the boreholes ranged from 65 to 100 mm. The Paterson Group Boreholes BH 1 through BH 6 were located on existing asphalt pavement; the thickness of the asphalt measured in the boreholes ranged from 80 to 100 mm.

In the **Terrapex** Borehole MW113, a layer of concrete was present at the surface; the thickness of the concrete was about 150 mm.

In all the boreholes, the asphalt and/or concrete were underlain by a layer of granular base course material consisting of silty sand to sand and gravel. The thickness of the granular base course ranged between approximately 400 to 600 mm. The recorded SPT N-value in the granular base ranged from 9 to 29 indicating a loose to compact condition. This granular base layer was brown to grey in colour, and was recovered in a damp state with moisture contents ranging from 2 to 3 %. The granular base course extended from approximately 0.1 to 0.7 mbgs, corresponding to approximate elevations El. 65.7 to 64.7 meters above sea level (masl).

Terrapex carried out one (1) grain size analysis on the granular base. The laboratory test result of the representative granular base sample is presented in the table below, and attached in Appendix II. Based on the grain size distribution, the tested sample can be described as sand and gravel with some fines.

Table 6-3: Summary of Grain Size Analyses in Granular Base

Sample ID	Sample Depth (mbgs)	% Gravel	% Sand	% Silt	% Clay
MW112 SS1	0.2 – 0.8	42	42	16	

6.2 FILL

A layer of FILL soil was present below the granular base in all boreholes except Borehole BH110. It consisted of sand to sandy silt with trace to some grave, and trace clay. It was brown in colour, and damp in appearance with moisture contents ranging from 3 to 9 %. The recorded SPT N-value in the FILL ranged from 6 to 17 indicating a compact degree of compactness. The FILL extended from approximately 0.5 to 3.3 mbgs, corresponding to approximate elevations El. 65.2 to 62.1 masl.

Terrapex carried out one (1) grain size analysis on the FILL. The laboratory test result of the representative FILL sample is presented in the table below, and attached in Appendix II. Based on the grain size distribution, the tested sample can be described as sand with trace fines, and trace gravel.

Table 6-4: Summary of Grain Size Analyses in FILL

Sample ID	Sample Depth (mbgs)	% Gravel	% Sand	% Silt	% Clay
MW105 SS3	1.2 – 1.8	8	82	10	

6.3 SILTY CLAY

In the **Terrapex** boreholes BH110, MW112, and MW113, and Paterson Group boreholes BH 1 and BH 6, a layer of silty clay was encountered below the FILL material. The silty clay was brown to grey in colour, and recovered in a damp state with moisture contents ranging from 16 to 39 %. The recorded SPT N-value in the silty clay ranged from 5 to 18 and PP values ranged from 96 to over 200 kPa, indicating a stiff to hard consistency. The silty clay extended to approximate depths of 1.2 to 2.3 mbgs, corresponding to approximate elevations El. 64.2 to 63.3 masl.

6.4 SILT / CLAYEY SILT

In the **Terrapex** Borehole BH110 and Paterson Group Borehole BH 1, a layer of silt / clayey silt with some gravel, and trace to some sand was encountered below the silty clay. The silt / clayey silt was brown in colour, and recovered in a moist state with a moisture content value of 16 %. The recorded SPT N-value in the silt / clayey silt ranged from 11 to 38 and a PP value of 196 kPa, indicating a very stiff consistency. The silt / clayey silt extended to approximate depths of 3.3 to 3.4 mbgs, corresponding to approximate elevations El. 62.4 to 62.1 masl.

6.5 SANDY SILT

In the **Terrapex** Boreholes MW112 and MW113, a layer of sandy silt with trace to some gravel, and trace clay was encountered below the silty clay. The sandy silt was brown to grey in colour, and recovered in a damp to moist state with moisture contents ranging from 6 to 24 %. The recorded SPT N-value in the sandy silt ranged from 2 to 36 and PP values of 49 to 196 kPa, indicating a firm to very stiff consistency. The sandy silt extended to an approximate depth of 3.8 mbgs, corresponding to approximate elevations El. 62.0 to and 61.7 masl.

6.6 SILTY SAND

In the **Terrapex** Boreholes MW112 and MW113 and Paterson Group Boreholes BH 3 through BH 5, a layer of silty sand with trace to some gravel, and trace clay was encountered below the sandy silt or FILL. The silty sand was brown to grey in colour, and recovered in a wet state with moisture contents ranging from 9 to 17 %. The recorded SPT N-value in the silty sand ranged from 3 to 26, indicating a very loose to compact degree of compactness. The silty sand extended to approximate depths of 3.5 to 5.1 mbgs, corresponding to approximate elevations El. 62.0 to 60.7 masl. The Paterson Group Borehole BH 4 was terminated in this layer.

Terrapex carried out one (1) grain size analysis on the silty sand. The laboratory test result of the representative silty sand sample is presented in the table below, and attached in Appendix II. Based on the grain size distribution, the tested sample can be described as silty sand with trace clay, and trace gravel.

Table 6-5: Summary of Grain Size Analyses in Silty Sand

Sample ID	Sample Depth (mbgs)	% Gravel	% Sand	% Silt	% Clay
MW112 SS6	3.8 – 4.4	4	68	28	

6.7 BEDROCK

Bedrock was encountered and cored in all the **Terrapex** boreholes, and all the Paterson Group boreholes except Borehole BH 4. The rock was described as limestone; medium strong to strong at the top, becoming strong to very strong with depth, slightly weathered, and was of very poor to good quality at the top, becoming of excellent quality with depth based on the Rock Quality Designation (RQD) with minimal joints, clay seams, and fracturing, if any. The top of the rock was encountered at depths ranging from 2.1 to 5.1 mbgs, corresponding to approximate elevations El. 63.5 to 60.7 masl.

The **Terrapex** boreholes were terminated in the rock at depths ranging from 16.0 to 20.3 mbgs, corresponding to approximate elevations El. 49.8 to 45.0 masl.

Terrapex completed unit weight and unconfined compressive strength tests on rock core samples from all boreholes. The results of the laboratory tests on representative rock core samples are presented in the table below.

Table 6-6: Summary of Unconfined Compressive Strength on Rock Samples

Sample ID	Sample Depth (mbgs)	Unit Weight (kN/m^3)	Unconfined Compressive Strength (MPa)
MW112	9.2 – 9.5	25.0	26.6
BH107	9.5 – 9.7	27.4	81.6
BH110	9.6 – 9.8	24.2	77.1
BH107	11.9 – 12.1	27.1	103.4
MW105	11.9 – 12.2	27.0	63.7
MW113	11.9 – 12.3	26.9	63.3
MW113	13.4 – 13.7	25.1	89.1
MW105	13.9 – 14.2	26.8	67.0
BH108	16.0 – 16.3	26.8	52.3
BH108	18.2 – 18.5	27.9	73.0

6.8 GROUNDWATER

For this Geotechnical Investigation, **Terrapex** installed a total of three (3) monitoring wells in Boreholes MW105, MW112, and MW113; Paterson Group installed a total of five (5) monitoring

wells in Boreholes BH 1, BH 2, BH 3, BH 5, and BH 6. The groundwater level measurements are presented in the table below.

Table 6-7: Summary of Groundwater Conditions

Monitoring Well Location	Well Screen Details		Groundwater Observations	
	Screened Interval mbgs (masl)	Screened Material	Water Level mbgs (masl)	Date
Paterson Group Monitoring Wells				
BH 1	4.6 – 7.6 (61.2 – 58.2)	Limestone Bedrock	4.2 (61.5)	July 3, 2020
			4.0 (61.7)	June 7, 2021
BH 2	4.3 – 7.3 (61.4 – 58.4)	Limestone Bedrock	4.3 (61.4)	July 3, 2020
			4.0 (61.7)	June 7, 2021
BH 3	4.0 – 7.0 (61.5 – 58.5)	Limestone Bedrock	4.0 (61.5)	July 3, 2020
			3.8 (61.7)	June 7, 2021
BH 5	4.0 – 7.0 (61.8 – 58.8)	Limestone Bedrock	4.3 (61.5)	July 3, 2020
			4.0 (61.8)	June 7, 2021
BH 6	3.8 – 6.8 (61.8 – 58.8)	Limestone Bedrock	4.3 (61.3)	July 3, 2020
			4.0 (61.6)	June 7, 2021
Terrapex Monitoring Wells				
MW105	13.2 – 16.2 (52.1 – 49.1)	Limestone Bedrock	3.7 (61.5)	June 7, 2021
MW112	13.1 – 16.1 (52.4 – 49.4)	Limestone Bedrock	4.2 (61.3)	June 7, 2021
MW113	13.0 – 16.0 (52.8 – 49.8)	Limestone Bedrock	4.8 (61.0)	June 7, 2021

It should be noted that groundwater levels are subject to seasonal fluctuations. A higher groundwater level condition will likely develop in the spring during the thaw and following significant rainfall events.

7.0 GEOTECHNICAL RECOMMENDATIONS AND GUIDELINES

Based on this Geotechnical Investigation Report and our understanding of the Project, the Site is considered to be suitable for the proposed redevelopment.

The following geotechnical recommendations and guidelines are based on our current understanding of the Project. Any changes to the Project will require a review to assess the impact on the recommendations given herein. This geotechnical report is based on the factual data obtained from the boreholes advanced at the Site by **Terrapex**, and are intended for use by the Client and Designers only. Contractors bidding on this project or conducting work associated with this Project should make their own interpretation of the factual data and/or carry out their own investigations.

Important factors to be considered for the design and construction of the proposed Project are expected to include the following:

- **Pre-Design Geotechnical Investigation Report:** At the time of this report, the Client had not provided **Terrapex** with the design details for this Project. It is our understanding that the Project is currently in the pre-design stages, and this Geotechnical Investigation Report is preliminary in nature;

- **Deep Excavations:** All excavations for this Project will need to be completed and maintained in accordance with the requirements of the Occupational Health and Safety Act (OHSA) Regulations for Construction, as discussed in section 7.2 of this report. Designers and Contractors should review the geometry of planned excavations including depths and sloping requirements. Excavations will extend to approximate depths of 9 to 16 mbgs, into bedrock. The Client should retain Contractors with significant experience working on similar projects. Contractors will need to asses the use of Engineered Shoring methods versus open cut methods;

- **Construction Dewatering:** Excavations for this Project will penetrate through the silts and sands into bedrock, below the groundwater. The Client and Contractors are referred to the **Terrapex** Hydrogeological Investigation report submitted under separate cover.

On the basis of the **Terrapex** boreholes, laboratory tests, and subsurface conditions encountered in the boreholes, the following comments and recommendations are provided.

7.1 SITE PREPARATION

7.1.1 General Grading and Interference with Existing Underground Utilities

Grading of the Site will need to be conducted in the early stages of construction. This will provide a positive control of surface water, directing it away from excavations and subgrades. Subgrades will need to be protected from surface water runoff or groundwater accumulation.

The Designers will need to review the location of proposed excavation and compare to with location of all the existing underground utilities. During construction, existing utilities that will be exposed will need to be rerouted, supported, or removed.

7.1.2 Subgrade Preparation for Footings on Rock

Subgrade preparation for footings founded on rock will involve the removal of all loose bedrock. Any pieces of rock that can be easily manipulated by conventional excavation equipment should be removed, as directed by the Geotechnical Engineer. Final subgrade surfaces should be brushed and/or air blown clean, and dry. The exposed bedrock surface should be examined and approved by the Geotechnical Engineer to confirm the competency of foundation to support the design bearing pressures.

Additional excavation of fractured rock to achieve a sound bedrock subgrade may be necessary; it is recommended that a unit price item for additional rock excavation and replacement with concrete fill be incorporated into the tender documents.

All footing subgrades must be approved by the Geotechnical Engineer.

7.2 EXCAVATIONS

The excavations for this Project are anticipated to extend to approximate depths of 9 to 16 mbgs, and may consist of open cut excavations and/or Engineered Shoring. All excavations must be carried out in accordance with the OHSA. The following recommendations for excavations should be considered a supplement to, and not a replacement of the OHSA requirements.

7.2.1 Open Excavations

In the case that open excavations are used during construction, the following OHSA recommendations should be considered:

- The existing FILL on Site would be considered “Type 3 Soils” according to OHSA. “Type 3 Soils” must be sloped from its bottom with a slope having a minimum gradient of 1H:1V. Excavations into the fill soils should be relatively straightforward with conventional excavation equipment;
- The native soils would generally be considered “Type 3 Soil” according to OHSA. “Type 3 Soils” must be sloped from its bottom with a slope having a minimum gradient of 1H:1V. However, if excavations proceed below the water table, become wet or muddy, or exhibit signs of seepage, they would become a “Type 4 Soil”. Excavations in “Type 4 Soils” must be sloped from its bottom with a slope having a minimum gradient of 3H:1V. Excavations into the native soils should be relatively straightforward with conventional excavation equipment;
- For excavations through multiple soil types, the side slope geometry is governed by the soil with the highest number designation. Excavation side-slopes should not be unduly left exposed to inclement weather.
- Vertical cuts into the bedrock will be possible. However, the exposed rock surface should be inspected by the Geotechnical Engineer to ensure stability, particularly at areas where groundwater seepage occurs from the rock. Remedial works such as steel mesh, shotcrete should be implemented if deemed necessary.

Where workers must enter excavations extending deeper than 1.2 m below grade, the excavation side-walls must be suitably sloped and/or braced in accordance with OHSA and Regulations for Construction Projects.

For excavations into bedrock, there may be an upper weathered rock zone that may require some shoring depending on the degree of weathering. The bedrock quality and site-specific requirements need to be assessed during construction by the Geotechnical Engineer. For planning purposes, a weathered bedrock is recommended to be treated as a “Type 2 Soil”. Sound rock would generally be self-supporting.

Bedrock excavation will require line drilling, pneumatic, or hydraulic breakers such as hoe-rams or heavy excavation equipment equipped for rock excavation. Controlled blasting techniques may also need to be used, subject to the laws and blasting restrictions that are in effect for the area. Designers are referred to the OPSS.MUNI 120 and the City of Ottawa Special Provision F-1201 specifications for the use of explosives. In general, these documents require a blasting plan to be prepared by a Blasting Engineer. They also require conducting pre-condition surveys on nearby buildings, dwellings, utilities, structures, water wells, and facilities likely to be affected by the blast, within a minimum 75 m of the location where explosives are to be used. Vibration monitoring during the blasting in nearby structures or infrastructure will be required. In addition, monitoring of all trunk sewers and large watermains (in excess of 400 mm diameter) will be required coupled with pre and post CCTV sewer surveys.

7.2.2 Excavations Adjacent to Infrastructure and Surrounding Properties

Designers and Contractors will need to review the geometry of the planned excavations regarding requirements for depths and sloping. This will need to be compared to the location of existing adjacent infrastructure to ensure they are not undermined. Undermining can be prevented by ensuring that excavations do not penetrate below an imaginary line constructed outwards and downwards at a slope of 10H:7V from the toe of existing or proposed footings. If the limitations of undermining cannot be met, then an engineered shoring or underpinning systems will be required.

Based on the existing groundwater depths and soils on Site, effects to adjacent buildings and infrastructure due to groundwater removal and temporary engineered shoring during excavations is considered to be negligible.

7.2.3 Temporary Engineered Shoring

Due to the anticipated depth of excavation, Designers and Contractors may consider the use of temporary Engineered Shoring systems through the overburden soils and the upper weathered layer of bedrock. Such systems may include soldier piles, slide rail systems, sheet piles, etc. The appropriate method should be selected by the Project Designers and Contractors, and the temporary Engineered Shoring system will need to be designed by a Professional Engineer considering the following aspects:

- Lateral earth pressures,
- Loads from any adjacent structures, or infrastructure being retained,
- Seismic loadings,
- Freeze-thaw action on the face of the excavations,
- Expansion and contraction of shoring elements,
- Pre-stressing loads, or post tensioning loads on tie backs,
- Possible surcharge loads throughout construction (i.e., trucks, equipment, stockpiles, etc.), and
- Vibrations caused by construction methods.

It is recommended that the Client retain Contractors and Designers who have significant experience with similar deep excavations and soil conditions. The lateral pressure parameters to assist Designers and Contractors are discussed in Section 7.8.

7.2.4 Construction Dewatering

As part of this Geotechnical Investigation, **Terrapex** installed three (3) monitoring wells; the groundwater levels for the three (3) **Terrapex** monitoring wells and five (5) Paterson Group monitoring wells are provided in section 6.8.

Based on the monitoring well observations, the water levels encountered at the Site were approximately 3.7 to 4.8 mbgs, corresponding to approximate elevations El. 61.8 to 61.0 masl. As excavations for this Project will extend to depths ranging from 9 to 16 mbgs below the groundwater, dewatering during construction will be required.

Both surface water and groundwater seepage are anticipated in the excavation and will need to be controlled. Water quantities will depend on seasonal conditions, depths of excavations, presence and lateral extents of fractured rock zones, and the duration that excavations are left open. Groundwater will travel easily through the fill material, and especially near the fill-native interface. The same is likely at the soil-rock interface and through fractured rock zones. Existing utility trenches which join or intersect the excavations may act as a drain and supply off-Site water into the excavations. These may need to be plugged at the outset of construction in an attempt to mitigate this possibility.

Comprehensive construction dewatering techniques should be used during excavation for the building, such as pumping from sumps, and/or ditches. Dewatering measures beyond conventional sump pump techniques such as a positive dewatering systems to temporarily lower the static groundwater level may be required.

Due to the existing groundwater depths, and our understanding of the Project, a ministry of the Environment, Conservation, and Parks (MECP) permit to take water (PTTW) may be necessary if more than 400,000 L/day of groundwater is to be pumped. The necessary study, application, and approval process would likely take approximately six (6) months to complete.

For volumes ranging from 50,000 to 400,000 L/day, an Environmental Site Activity Registry (EASR) application will be required. The EASR application along with a Water Taking and Discharge Plan by a qualified person (QP) as stipulated under O.Reg. 63/16 would generally take one (1) month to complete.

If water taking does not meet the criteria of the prescribed activity set out in the regulation, the water taking cannot be registered on the EASR and may require a PTTW.

The Client and Contractors bidding this Project are recommended to review the **Terrapex** Hydrogeological Investigation for this Site.

7.3 FROST PROTECTION

The design frost depth for the City of Ottawa is 1.8 mbgs. All foundations, for unheated or isolated structures, underground utilities, which are exposed to freezing conditions within the overburden soils must be provided with a minimum of 1.8 m of soil cover for frost protection. For fully heated structures, this depth can be reduced to 1.5 m.

Where an adequate depth of soil cover cannot be provided, an equivalent insulation detail should be designed or approved by a Geotechnical Engineer; this will need to be designed or pre-approved prior to placement of any foundations or underground utilities.

7.4 SEISMIC SITE CLASSIFICATION

In accordance with Ontario Building Code (OBC-2012), structures designed under Part Four of the code must be designed to resist a minimum earthquake force. The parameters for determination of the Site Classification for Seismic Site Response are set out in Table 4.1.8.4.A of the OBC-2012.

Based on the results of the field drilling, and the subsurface stratigraphy as revealed in the boreholes, **Terrapex** recommends that the building be designed to **"Site Class B"** with footings placed on bedrock, as per table 4.1.8.4.A of the OBC-2012, and subject to the limitations of the Code.

It is possible to prove an increased Site Class of 'A', however, additional geophysical testing by using shear wave velocity would be required. An increased Site Class can often result in significant design savings especially for large structures and structures with post-disaster importance.

7.5 LIQUEFACTION INDUCED SETTLEMENT

As the foundations for the proposed development will be founded on bedrock, the potential for liquefaction induced settlement for the building structure would not be applicable.

7.6 FOUNDATIONS

Based on our understanding of the Project, we are anticipating that the foundations for the proposed structures will be founded on rock, at approximate depths ranging from 9 to 16 mbgs.

For concrete pads and/or strip footings founded on sound bedrock, the recommended factored bearing capacity under Ultimate Limit State (ULS) conditions would be 5.0 MPa. This includes a geotechnical resistance factor of $\Phi = 0.5$. Under Serviceability Limit States (SLS) conditions, there is no recommended bearing capacity as settlement under the ULS condition is expected to be nil.

All foundation subgrades must be reviewed and approved by the Geotechnical Engineer prior to

placement of concrete.

7.7 RESISTANCE TO FOUNDATION UPLIFT

Resistance to foundation uplift or overturning forces can be provided by considering the dead weight of the structures and backfill soils, increasing the dead weight of the structure using additional concrete, or with the use of additional rock anchors.

In the case that grouted rock anchors are considered, rock anchors may be designed based on a frictional stress between grout and intact limestone bedrock; a conservative allowable working stress value of 1 MPa may be used to calculate the length of the required bond zone. The bond zone must be entirely within sound bedrock; below the weathered zone.

In order to mobilize the shear stress in the rock, the load at the top of the anchor must be properly transferred through the upper bedrock to the bond zone to prevent progressive grout fail and ensure proper performance. Therefore, a "free length" is required through the foundation element, the weathered rock zone, and down to the bond zone.

The mass of rock mobilized by a rock anchor may be assumed to be based upon a 60^{o} cone drawn upward from a point located at the lower one-third point of the bond zone and spaced such that the theoretical cones do not overlap. Designers should review the spacing of anchors and take into account of any overlapping cones (i.e. avoid doubling-up on rock mass calculations for overlapping cones). The bulk unit weight of bedrock may be assumed to be approximately 26 kN/m^3. The corresponding buoyant unit weight would be approximately 16 kN/m^3. It is recommended that Designers consider the water level to be near the surface, and therefore, use submerged unit weights for the rock mass calculations.

7.8 LATERAL EARTH PRESSURES

The following soil parameters used in the determination of earth pressure acting on basement walls and temporary Engineered Shoring are defined and provided below.

Table 7-1: Defined Lateral Earth Pressure Soil Parameters

Parameter	Definition	Units
Φ’	Angle of Internal Friction	degrees
γ	Bulk Density	kN/m^3
S_u	Undrained Shear Strength	kPa
K_a	active earth pressure coefficient (Rankine)	dimensionless
K_o	at-rest earth pressure coefficient (Rankine)	dimensionless
K_p	passive earth pressure coefficient (Rankine)	dimensionless
K_{ae}	active earth pressure coefficient (Mononobe-Okabe)	dimensionless
K_{pe}	passive earth pressure coefficient (Mononobe-Okabe)	dimensionless

7.8.1 Static Conditions

The appropriate un-factored static condition values for use in the design of structures subject to unbalanced earth pressures at this Site are tabulated as follows:

Table 7-2: Lateral Earth Pressure Soil Parameter Values – Static Conditions

Soil	Parameter					
	Φ'	γ	S_u	K_a	K_p	K_0
FILL	28°	20	-	0.36	2.77	0.53
Silty Clay	25º	17	98	0.41	2.46	0.58
Silt / Clayey Silt	27°	19	198	0.38	2.66	0.55
Sandy Silt	28°	19	49	0.36	2.77	0.53
Silty Sand	29°	20	-	0.35	2.88	0.52
Bedrock	36°	26	-	0.26	3.85	0.41
New Compacted Granular Backfill OPSS 1010 "Granular B, Type I"	32°	22	-	0.31	3.25	0.47

For yielding retaining walls, the active earth pressure coefficients, K_a, is recommended to be used. The resultant of the applicable static or at-rest force is assumed to act at 1/3H above the base of the wall where H is the Height of the wall.

7.8.2 Dynamic Conditions

Below grade walls subjected to lateral forces due to seismic forces can be designed using the pseudo-static approach using the Mononobe-Okabe equations, shown in Section 24.9 of CFEM-2006. In these formulas, there are both geotechnical and geometric components.

The total active thrust under seismic loading (P_{ae}) is recommended to be expressed as follows:

$P_{ae} = ½ K_{ae} \gamma H^2 \times (1- k_v)$

Where: H = Height of the wall, K_{ae} = horizontal component of active earth pressure coefficient including effects of earthquake loading,

k_v = Vertical component of the earthquake acceleration typically a range of 2/3 x k_h to 1/3 k_h is considered but a value closer to 2/3 x k_h is recommended

k_h = Horizontal component of the earthquake acceleration, typically Peak Ground Acceleration (PGA) or a factor thereof is used. The Site Class-adjusted PGA for the Site is 0.222 g at Site Class B, where g is the acceleration due to gravity.

For passive earthquake pressure (P_{pe}) the following equation can be used:

$P_{pe} = ½ K_{pe}\gamma H^2 x (1- k_v)$

Where: K_{pe} = horizontal component of passive earth pressure coefficient including effects of earthquake loading

The above equation includes both the active pressures under static (P_a) as well as the increased force due to seismic forces. The active force under static conditions is assumed to act at a point of (0.3 x H) above the base and the seismic force is assumed to act near (0.6 x H) above the base, where H is the height of the wall. Therefore, the point of application for P_{ae} may be calculated from the following:

$h = [(0.33HxP_a) + (0.6H x P_e)]/ P_{ae}$

The following soil parameters are presented to assist Designers in designing retaining walls for this Site under seismic conditions using the pseudo-static approach:

Table 7-3: Lateral Earth Pressure Soil Parameter Values – Dynamic Conditions

Soil	Parameter				
	Φ'	**γ**	**S_u**	**K_{ae}**	**K_{pe}**
FILL	28°	20	-	0.51	1.17
Silty Clay	25º	17	98	0.58	1.18
Silt / Clayey Silt	27°	19	198	0.54	1.18
Sandy Silt	28°	19	49	0.51	1.17
Silty Sand	29°	20	-	0.49	1.17
Bedrock	36°	26	-	0.38	1.14
New Compacted Granular Backfill OPSS 1010 "Granular B, Type I"	32°	22	-	0.44	1.16

7.9 BASEMENT SLAB ON GRADE

It is important to note that **Terrapex** has not been provided with the design for the floor slab loadings. **Terrapex** is assuming that a typical floor slab loading of a maximum 24 kPa would be applicable. The bedrock subgrade for the floor slab will need to prepared by the Contractor and reviewed and approved by the Geotechnical Engineer prior to placement of Engineered Fill.

Subgrade preparation should include the removal of any disturbed or loose rock. Any unsuitable subgrade areas will need to be sub-excavated and replaced with suitable Engineered Fill material compacted to 98 % of its Standard Proctor Maximum Dry Density (SPMDD).

A capillary moisture barrier consisting of a layer of 19 mm clear stone at least 200 mm thick compacted to a dense state should underlie the slab.

For design purposes and based upon a properly prepared native subgrade surface covered with 200 mm of 19 mm clear stone, a typical preliminary modulus of subgrade reaction appropriate for the slab design would be approximately 40,000 kN/m^3 on bedrock.

7.10 PERIMETER DRAINAGE AND WATERPROOFING

Sub-floor weeping pipes 100 mm in diameter must be placed under the basement slab-on-grade at a maximum spacing of 8 m (subject to confirmation at the time of construction). The weeping tiles must be covered with a minimum of 150 mm of clear stone. They should be placed a minimum of 0.5 m below the basement floor slab, above the founding level of the footings.

The exterior basement walls of the proposed building will be poured up against the shored or, grouted walls of the excavation, prefabricated drainage sheets (Terradrain 600 or equivalent) must be placed continuously against the excavation / shoring walls. These should drain through drainage ports in the walls into a perimeter solid pipe and channel all the water into the sump pits in the building. The maximum spacing of the drainage ports must not exceed 6 m, subject to confirmation at the time of construction.

The perimeter foundation and sub-floor drains must be connected to a positive frost free outlet from which the water can be removed, or connected to a sump located in the lowest level of the basement. The water from the sump must be pumped out to a suitable discharge point.
The installation of the perimeter and sub-floor drains as well as the outlet must conform to the applicable plumbing code requirements.

Based on the elevation of the water table we recommend a water proofing membrane such as a WR Meadows MEL-ROL PRECON or equivalent for walls. These types of membranes adhere to the concrete and provide a waterproof seal between the membrane and poured concrete. Water stops should be installed at cold joints in the foundation walls and floor-wall joint.

The near surface soils at this site are susceptible to frost effects which would have the potential to deform hard landscaping adjacent to the building. At locations where the building is expected to have flush entrances, care must be taken in detailing the exterior slabs / sidewalks, providing insulation / drainage / non-frost susceptible backfill to maintain the flush threshold during freezing weather conditions.

7.11 UNDERGROUND UTILITIES

7.11.1 Pipe Bedding and Cover

The following are recommendations for the service trench bedding and cover materials.

- Bedding for buried utilities should consist of an OPSS 1010 "Granular A" or "Granular B Type II" material and placed in accordance with municipal requirements;
- The cover material should be a service sand material or an OPSS 1010 "Granular A";

- Pipe bedding and backfill for flexible pipes should be undertaken in accordance with OPSD 802.010;
- The bedding and cover materials should be compacted to a minimum of 95% SPMDD. Bedding and cover details should follow the applicable governing design detail (i.e. City of Ottawa, OPSD), and
- No frozen material should be used for bedding or cover.

7.11.2 Backfill

Backfill above the cover for the underground sewers should be in accordance with the following recommendations:

- The existing FILL material and native soils may be used as backfill material with the approval of the Geotechnical Engineer. Imported suitable pit-run sandy soil material such an OPSS 1010 “Granular B Type I” would also be suitable for use as service backfill material as well; and,
- The backfill should be placed and compacted in uniform lift thickness compatible with the selected compaction equipment and not thicker than 300 mm. Each lift should be compacted to a minimum of 95% of its SPMDD.

7.12 CHEMICAL CHARACTERIZATION OF SUBSURFACE SOIL

Due to the proposed depth of the foundations for the redevelopment being in bedrock, corrosion potential for concrete is considered to be negligible. Accordingly, conventional GU or MS Portland cement may be used in the construction of the proposed concrete elements.

7.13 CONSTRUCTION INSPECTIONS AND MONITORING

The recommendations presented in this report are based on the assumption that adequate and satisfactory inspections and monitoring during construction by qualified geotechnical personnel will be provided. This will include:

- Review and approval of all subgrade and footing base inspections by geotechnical staff;
- Part time compaction testing of bedding, and cover soils;
- Periodic testing of concrete; and,
- Proof testing and performance testing of rock anchors.

8.0 LIMITATIONS

The conclusion and recommendations in this report are based on information determined at the inspection locations. Soil and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction which could not be detected or anticipated at the time of the soil investigation. The design recommendations given in this report are applicable only to the project described in the text. Since all details of the design may not be known to us, in our analysis certain assumptions had to be made as set out in this report. The actual conditions may, however, vary from those assumed, in which case changes and modifications may be required to our recommendations.

This report was prepared for Welldale Limited Partnership by Terrapex Environmental Ltd. The material in it reflects Terrapex Environmental Ltd. judgement in light of the information available to it at the time of preparation. Any use which a Third Party makes of this report, or any reliance on decisions which the Third Party may make based on it, are the sole responsibility of such Third Parties.

The comments given in this report on potential construction problems and possible methods are intended for the guidance of the design engineer, only. The number of inspection locations may not be sufficient to determine all the factors that may affect construction methods and costs. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work.

Respectfully submitted,
TERRAPEX ENVIRONMENTAL LTD.

CO810.00
LICENSED PROFESSIONAL ENGINEER
A. G. MOHAMMAD
100173142
Nov. 24, 2021
PROVINCE OF ONTARIO

Amer Mohammad, P. Eng.
Geotechnical Project Manager

Vic Nersesian, P. Eng.
Vice President, Geotechnical Services

FIGURES

Figure 1: Site Location

Figure 2: General Site Layout

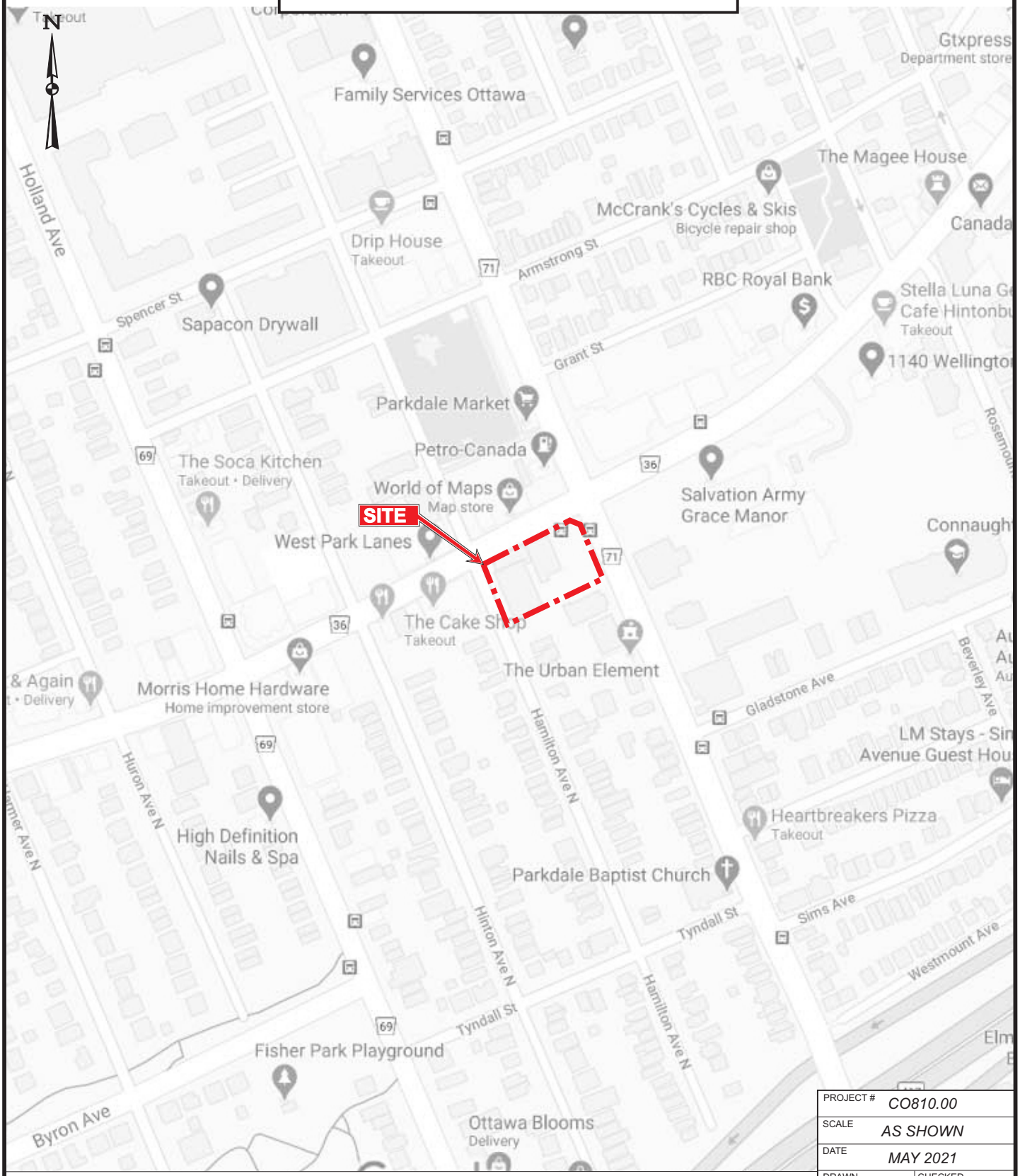
TERRAPEX

SITE LOCATION

1186-1196 WELLINGTON STREET WEST
OTTAWA, ONTARIO

CLIENT

WELLDALE LIMITED PARTNERSHIP



SOURCE: GOOGLE MAPS, 2020

PROJECT #	CO810.00
SCALE	AS SHOWN
DATE	MAY 2021
DRAWN	EM/ AB
CHECKED	
DRAWING #	FIGURE 1

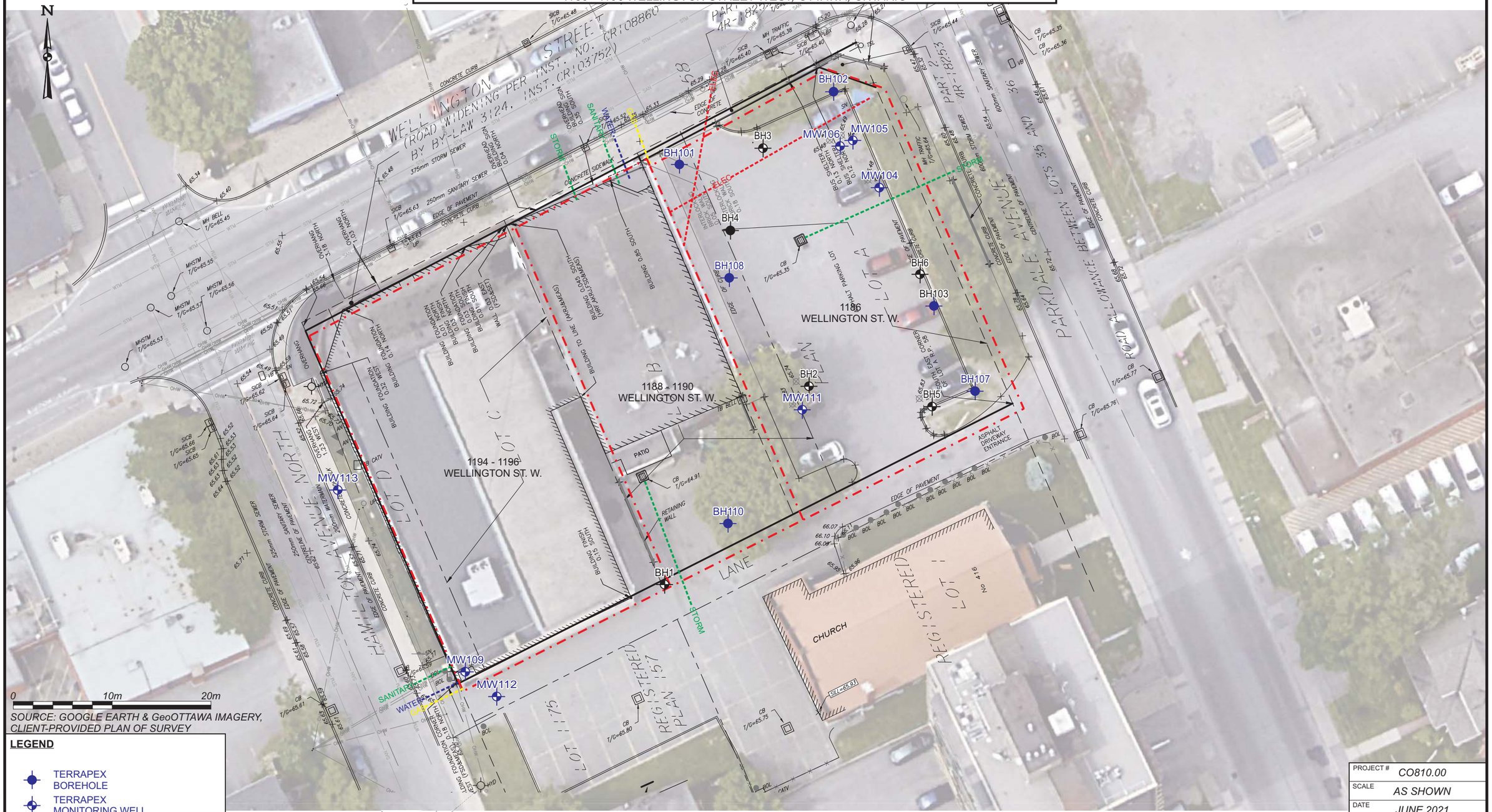
TERRAPEX

GENERAL SITE LAYOUT

1186 - 1196 WELLINGTON STREET WEST, OTTAWA, ONTARIO

CLIENT

WELLDALE LIMITED PARTNERSHIP



LEGEND

- TERRAPEX BOREHOLE
- TERRAPEX MONITORING WELL
- PATERSON GROUP MONITORING WELL
- PATERSON GROUP BOREHOLE

PROJECT #	CO810.00
SCALE	AS SHOWN
DATE	JUNE 2021
DRAWN	JOB
CHECKED	KWB
DRAWING #	FIGURE 2A

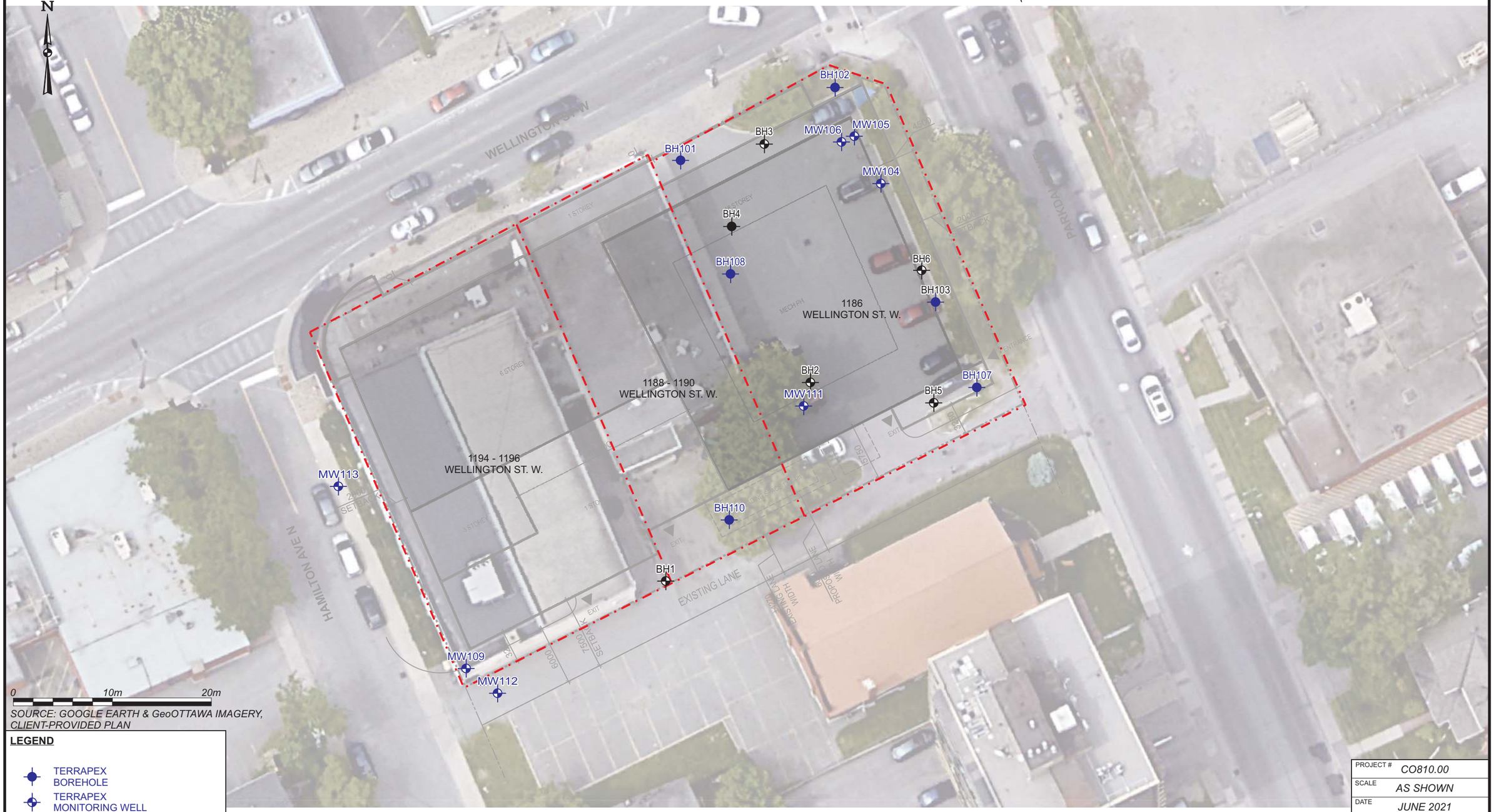
TERRAPEX

GENERAL SITE LAYOUT
CONCEPTUAL SITE PLAN

1186 - 1196 WELLINGTON STREET WEST, OTTAWA, ONTARIO

CLIENT

WELLDALE LIMITED PARTNERSHIP



SOURCE: GOOGLE EARTH & GeoOTTAWA IMAGERY, CLIENT-PROVIDED PLAN

LEGEND

- TERRAPEX BOREHOLE
- TERRAPEX MONITORING WELL
- PATERSON GROUP MONITORING WELL
- PATERSON GROUP BOREHOLE

PROJECT #	CO810.00
SCALE	AS SHOWN
DATE	JUNE 2021
DRAWN	JOB
CHECKED	KWB
DRAWING #	FIGURE 2B

APPENDIX I
BOREHOLE LOGS

CLIENT: WELLDALE LIMITED PARTNERSHIP	PROJECT NO.: CO810.00		**RECORD OF: MW105**
ADDRESS: 1186 - 1196 WELLINGTON STREET WEST	STATION:		
CITY/PROVINCE: OTTAWA, ONTARIO	NORTHING (m): 5029248	EASTING (m): 365144	ELEV. (m) 65.3
CONTRACTOR: GEORGE DOWNING ESTATE DRILLING	METHOD: CME 55 HOLLOW STEM AUGER		
BOREHOLE DIAMETER (cm): 20	WELL DIAMETER (cm): 5	SCREEN SLOT #: 10	SAND TYPE: QUARTZ	SEALANT TYPE: BENTONITE

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) / N-VALUE (Blows/300mm)	WATER CONTENT (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		ASPHALT (65 mm)	0	65	13		1		50	<10 ppm	PAHs; M+I		
		COMPACT, DAMP, GREY SAND AND GRAVEL (FILL)	0.5										
		COMPACT, DAMP, BROWN, SAND (FILL)	1	64.5	16	2.9	2		67	<10 ppm			
		TRACE GRAVEL	1.5	64	11	4.6	3		63	<10 ppm			
		LOOSE	2	63.5	6	5.6	4		67	<10 ppm			
		MOIST	2.5	63									
		AUGER REFUSAL ON ASSUMED BEDROCK	3	62.5	8	8.3	5		71	<10 PPM	PHCs		
		VERY STRONG, SLIGHTLY WEATHERED LIMESTONE, POOR QUALITY BASED ON RQD	3.5	62			6		40	<10 ppm			
		STRONG, GOOD QUALITY BASED ON RQD	4	61.5			1						TCR: 100% SCR: 85% RQD: 48% GROUNDWATER MEASURED AT 3.7 m.
			4.5	61									
			5	60.5			2						TCR: 97% SCR: 90% RQD: 90%
		VERY STRONG	5.5	60									
			6	59.5									
			6.5	59			3						TCR: 97% SCR: 90% RQD: 90%
		STRONG, EXCELLENT QUALITY BASED ON RQD	7	58.5									
			7.5	58									
			8	57.5			4						TCR: 100% SCR: 100% RQD: 100%
		VERY STRONG	8.5	57									
			9	56.5									
				56									

TERRAPEX

LOGGED BY: EB	DRILLING DATE: 20-APR-21
INPUT BY: JM	MONITORING DATE: 07-JUN-21
REVIEWED BY: AM	PAGE 1 OF 2

CLIENT: WELLDALE LIMITED PARTNERSHIP	PROJECT NO.: CO810.00	**RECORD OF: MW105**
ADDRESS: 1186 - 1196 WELLINGTON STREET WEST	STATION:	
CITY/PROVINCE: OTTAWA, ONTARIO	NORTHING (m): 5029248	EASTING (m): 365144 ELEV. (m) 65.3
CONTRACTOR: GEORGE DOWNING ESTATE DRILLING	METHOD: CME 55 HOLLOW STEM AUGER	
BOREHOLE DIAMETER (cm): 20	WELL DIAMETER (cm): 5	SCREEN SLOT #: 10 SAND TYPE: QUARTZ SEALANT TYPE: BENTONITE

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) ▲ PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		STRONG	9.5	55.5			5						TCR: 100% SCR: 100% RQD: 100%
			10	55									
			10.5	54.5									
			11	54			6						TCR: 100% SCR: 100% RQD: 100%
			11.5	53.5									
		FAIR QUALITY BASED ON RQD	12	53									UCS = 63.7 MPa
			12.5	52.5			7						TCR: 66% SCR: 66% RQD: 66%
			13	52									
		EXCELLENT QUALITY BASED ON RQD	13.5	51.5									
			14	51			8						TCR: 98% SCR: 98% RQD: 98% UCS = 67.0 MPa
			14.5	50.5									
			15	50									
			15.5	49.5			9						TCR: 100% SCR: 100% RQD: 100%
			16										
		END OF BOREHOLE											

TERRAPEX

LOGGED BY: EB	DRILLING DATE: 20-APR-21
INPUT BY: JM	MONITORING DATE: 07-JUN-21
REVIEWED BY: AM	PAGE 2 OF 2

CLIENT: WELLDALE LIMITED PARTNERSHIP	PROJECT NO.: CO810.00	**RECORD OF: BH107**
ADDRESS: 1186 - 1196 WELLINGTON STREET WEST	STATION:	
CITY/PROVINCE: OTTAWA, ONTARIO	NORTHING (m): 5029222	EASTING (m): 365157 ELEV. (m) 65.6
CONTRACTOR: GEORGE DOWNING ESTATE DRILLING	METHOD: CME 55 HOLLOW STEM AUGER	
BOREHOLE DIAMETER (cm): 20	WELL DIAMETER (cm):	SCREEN SLOT #: SAND TYPE: SEALANT TYPE:

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) / N-VALUE (Blows/300mm)	WATER CONTENT (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		ASPHALT (76 mm)	0	65.5									
		COMPACT, DAMP, BROWN, SAND AND GRAVEL (FILL)	0.5	65	25	2.2	1		45	-			
		COMPACT, MOIST, BROWN, SAND (FILL), TRACE GRAVEL	1	64.5	13	5.5	2		67	-			
		LOOSE	1.5	64	8	4.9	3		75	-	M+I		
		VERY STIFF, MOIST, BROWN, SANDY SILT, TRACE CLAY, TRACE GRAVEL (FILL)	2	63.5	10	8.3	4		63				PP=171 kPa
		SOME GRAVEL	2.5	63	-	5.7	5						PP=171 kPa
		AUGER REFUSAL ON ASSUMED BEDROCK	3	62.5									
		MEDIUM STRONG, SLIGHTLY WESTHERED LIMESTONE, GOOD QUALITY BASED ON RQD	3.5	62			1						TCR: 100% SCR: 80% RQD: 75%
		STRONG, FAIR QUALITY BASED ON RQD	4	61.5									
			4.5	61			2						TCR: 95% SCR: 55% RQD: 73%
			5	60.5									
		EXCELLENT QUALITY BASED ON RQD	5.5	60									
			6	59.5			3						TCR: 98% SCR: 93% RQD: 93%
			6.5	59									
			7	58.5									
			7.5	58			4						TCR: 100% SCR: 100% RQD: 100%
			8	57.5									
		FRESH	8.5	57									
			9	56.5									

TERRAPEX

LOGGED BY: EB	DRILLING DATE: 20-APR-21
INPUT BY: JM	MONITORING DATE:
REVIEWED BY: AM	PAGE 1 OF 2

CLIENT: WELLDALE LIMITED PARTNERSHIP	PROJECT NO.: CO810.00	**RECORD OF: BH107**
ADDRESS: 1186 - 1196 WELLINGTON STREET WEST	STATION:	
CITY/PROVINCE: OTTAWA, ONTARIO	NORTHING (m): 5029222	EASTING (m): 365157 ELEV. (m) 65.6
CONTRACTOR: GEORGE DOWNING ESTATE DRILLING	METHOD: CME 55 HOLLOW STEM AUGER	
BOREHOLE DIAMETER (cm): 20	WELL DIAMETER (cm):	SCREEN SLOT #: SAND TYPE: SEALANT TYPE:

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) ▲ PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		STRONG, SLIGHTLY WEATHERED	9.5	56			5						TCR: 100% SCR: 100% RQD: 100% UCS = 81.6 MPa
			10	55.5									
			10.5	55			6						TCR: 100% SCR: 98% RQD: 98%
			11	54.5									
		VERY STRONG, GOOD QUALITY BASED ON RQD	11.5	54									
			12	53.5									UCS = 103.4 MPa
			12.5	53			7						TCR: 100% SCR: 95% RQD: 90%
		EXCELLENT QUALITY BASED ON RQD	13	52.5									
			13.5	52									
			14	51.5			8						TCR: 100% SCR: 100% RQD: 95%
		GOOD QUALITY BASED ON RQD	14.5	51									
			15	50.5									
			15.5	50			9						TCR: 91% SCR: 89% RQD: 83%
		END OF BOREHOLE											

TERRAPEX	LOGGED BY: EB	DRILLING DATE: 20-APR-21
	INPUT BY: JM	MONITORING DATE:
	REVIEWED BY: AM	PAGE 2 OF 2

CLIENT: WELLDALE LIMITED PARTNERSHIP	PROJECT NO.: CO810.00	**RECORD OF: BH108**
ADDRESS: 1186 - 1196 WELLINGTON STREET WEST	STATION:	
CITY/PROVINCE: OTTAWA, ONTARIO	NORTHING (m): 5029234	EASTING (m): 365131 — ELEV. (m) 65.3
CONTRACTOR: GEORGE DOWNING ESTATE DRILLING	METHOD: CME 55 HOLLOW STEM AUGER	
BOREHOLE DIAMETER (cm): 20 — WELL DIAMETER (cm):	SCREEN SLOT #: — SAND TYPE:	SEALANT TYPE:

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) ● / N-VALUE (Blows/300mm) ▲	WATER CONTENT (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		ASPHALT (76 mm)	0	65	17		1		25	<10 ppm	PAHs; M+I		
		COMPACT, DAMP, BROWN, SAND AND GRAVEL (FILL)	0.5										
		STIFF, DAMP, BROWN, SANDY SILT (FILL) TRACE CLAY, TRACE GRAVEL	1	64.5	8	8.6	2		46	<10 ppm			PP=98 kPa
		VERY STIFF	1.5	64	8		3		58	<10 ppm	PHCs		BLACK STAINING PP=196 kPa (duplicate BH108-13)
		VERY STIFF, DAMP, BROWN, SILT, SOME SAND, TRACE CLAY, SOME GRAVEL (FILL)	2	63.5	8	7.5	4		58	<10 ppm			PP=171 kPa
		AUGER REFUSAL ON ASSUMED BEDROCK	2.5	63		11.1	5		21	<10 ppm			PP=171 kPa
		STRONG, SLIGHTLY WEATHERED, LIMESTONE, FAIR QUALITY BASED ON RQD	3	62.5	3	10.7	6						
		MODERATLY WEATHERED	3.5	62			1						TCR: 97% RQD: 64% SCR: 47%
		SLIGHTLY WEATHERED, GOOD QUALITY BASED ON RQD	4	61.5									
			4.5	61									
			5	60.5			2						TCR: 88% RQD: 67% SCR: 29%
			5.5	60									
			6	59.5									
		FRESH, EXCELLENT QUALITY BASED ON RQD	6.5	59			3						TCR: 96% RQD: 89% SCR: 81%
			7	58.5									
			7.5	58									
			8	57.5			4						TCR: 100% RQD: 100% SCR: 100%
		SLIGHTLY WEATHERED	8.5	57									
			9	56.5									
				56									

TERRAPEX

LOGGED BY: EB	DRILLING DATE: 21-APR-21
INPUT BY: JM	MONITORING DATE:
REVIEWED BY: AM	PAGE 1 OF 3

CLIENT: WELLDALE LIMITED PARTNERSHIP	PROJECT NO.: CO810.00	**RECORD OF: BH108**
ADDRESS: 1186 - 1196 WELLINGTON STREET WEST	STATION:	
CITY/PROVINCE: OTTAWA, ONTARIO	NORTHING (m): 5029234	EASTING (m): 365131 ELEV. (m) 65.3
CONTRACTOR: GEORGE DOWNING ESTATE DRILLING	METHOD: CME 55 HOLLOW STEM AUGER	
BOREHOLE DIAMETER (cm): 20	WELL DIAMETER (cm):	SCREEN SLOT #: SAND TYPE: SEALANT TYPE:

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) ▲ PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		VERY STRONG, GOOD QUALITY BASED ON RQD	9.5	55.5			5						TCR: 100% RQD: 100% SCR: 100%
			10										
			10.5	55									
			11	54.5			6						TCR: 97% RQD: 97% SCR: 97%
			11.5	54									
			12	53.5									
			12.5	53			7						TCR: 100% RQD: 100% SCR: 100%
			13	52.5									
			13.5	52									
			14	51.5			8						TCR: 98% RQD: 94% SCR: 98%
			14.5	51									
			15	50.5									
			15.5	50			9						TCR: 88% RQD: 88% SCR: 88%
		STRONG, EXCELLENT QUALITY BASED ON RQD	16	49.5									UCS=52.3 MPa
			16.5	49									
			17	48.5			10						TCR: 98% RQD: 98% SCR: 98%
			17.5	48									
			18	47.5									
			18.5	47			11						UCS=73.0 MPa TCR: 100% RQD: 95% SCR: 92%

TERRAPEX

LOGGED BY: EB	DRILLING DATE: 21-APR-21
INPUT BY: JM	MONITORING DATE:
REVIEWED BY: AM	

CLIENT: WELLDALE LIMITED PARTNERSHIP	PROJECT NO.: CO810.00	**RECORD OF: BH108**
ADDRESS: 1186 - 1196 WELLINGTON STREET WEST	STATION:	
CITY/PROVINCE: OTTAWA, ONTARIO	NORTHING (m): 5029234	EASTING (m): 365131 ELEV. (m) 65.3
CONTRACTOR: GEORGE DOWNING ESTATE DRILLING	METHOD: CME 55 HOLLOW STEM AUGER	
BOREHOLE DIAMETER (cm): 20	WELL DIAMETER (cm):	SCREEN SLOT #: SAND TYPE: SEALANT TYPE:

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) ▲ PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		VERY STRONG, GOOD QUALITY BASED ON RQD	19	46.5			12						TCR: 92% RQD: 83% SCR: 59%
			19.5	46									
		END OF BOREHOLE	20	45.5									

TERRAPEX

LOGGED BY: EB	DRILLING DATE: 21-APR-21
INPUT BY: JM	MONITORING DATE:
REVIEWED BY: AM	

CLIENT: WELLDALE LIMITED PARTNERSHIP	PROJECT NO.: CO810.00	**RECORD OF: BH110**
ADDRESS: 1186 - 1196 WELLINGTON STREET WEST	STATION:	
CITY/PROVINCE: OTTAWA, ONTARIO	NORTHING (m): 5029209	EASTING (m): 365132 — ELEV. (m) 65.4
CONTRACTOR: GEORGE DOWNING ESTATE DRILLING	METHOD: CME 55 HOLLOW STEM AUGER	
BOREHOLE DIAMETER (cm): 20 — WELL DIAMETER (cm):	SCREEN SLOT #: — SAND TYPE:	SEALANT TYPE:

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) ● / N-VALUE (Blows/300mm) ▲	WATER CONTENT (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		ASPHALT (100 mm)	0	65	29								
		COMPACT, DAMP, BROWN, SAND AND GRAVEL (FILL)	0.5				1		63	-	PAHs; M+I		
		VERY STIFF, DAMP, BROWN, SILTY CLAY, TRACE SAND, TRACE GRAVEL	1	64.5	18	21.0	2		75	-			PP=196 kPa
		VERY STIFF, MOIST, BROWN, SILT, SOME CLAY, TRACE SAND	1.5	64	11	15.6	3		63	-			PP=196 kPa
		VERY STIFF, MOIST, BROWN, CLAYEY SILT, SOME SAND, SOME GRAVEL	2	63.5	13	5.0	4		67	-			PP=196 kPa
		VERY STIFF, DAMP	2.5	63									
		AUGER REFUSAL ON ASSUMED BEDROCK	3	62.5	38	5.7	5		67	-			PP=196 kPa
		VERY STRONG, SLIGHTLY WEATHERED LIMESTONE, POOR QUALITY BASED ON RQD	3.5	62		8.7	6						
		STRONG, GOOD QUALITY BASED ON RQD	4	61.5			1						TCR: 95% RQD: 37% SCR: 42%
			4.5	61									
			5	60.5			2						TCR: 89% RQD: 77% SCR: 86%
		EXCELLENT QUALITY BASED ON RQD	5.5	60									
			6	59.5			3						TCR: 96% RQD: 91% SCR: 57%
			6.5	59									
			7	58.5									
			7.5	58			4						TCR: 100% RQD: 95% SCR: 67%
			8	57.5									
			8.5	57									
			9	56.5			5						

TERRAPEX

LOGGED BY: EB	DRILLING DATE: 21-APR-21
INPUT BY: JM	MONITORING DATE:
REVIEWED BY: AM	PAGE 1 OF 2

CLIENT: WELLDALE LIMITED PARTNERSHIP	PROJECT NO.: CO810.00	**RECORD OF: BH110**
ADDRESS: 1186 - 1196 WELLINGTON STREET WEST	STATION:	
CITY/PROVINCE: OTTAWA, ONTARIO	NORTHING (m): 5029209	EASTING (m): 365132 ELEV. (m) 65.4
CONTRACTOR: GEORGE DOWNING ESTATE DRILLING	METHOD: CME 55 HOLLOW STEM AUGER	
BOREHOLE DIAMETER (cm): 20	WELL DIAMETER (cm):	SCREEN SLOT #: SAND TYPE: SEALANT TYPE:

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) ▲ PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		VERY STRONG	9.5	56									TCR: 100% RQD: 100% SCR: 30% UCS=77.1 MPa
			10	55.5									
			10.5	55									
			11	54.5			6						TCR: 100% RQD: 97% SCR: 100%
			11.5	54									
			12	53.5									
			12.5	53			7						TCR: 100% RQD: 100% SCR: 100%
			13	52.5									
			13.5	52									
			14	51.5			8						TCR: 100% RQD: 100% SCR: 100%
			14.5	51									
			15	50.5									
			15.5	50			9						TCR: 97% RQD: 91% SCR: 100%
				49.5									
		END OF BOREHOLE											

TERRAPEX

LOGGED BY: EB	DRILLING DATE: 21-APR-21
INPUT BY: JM	MONITORING DATE:
REVIEWED BY: AM	PAGE 2 OF 2

CLIENT: WELLDALE LIMITED PARTNERSHIP	PROJECT NO.: CO810.00	**RECORD OF: MW112**
ADDRESS: 1186 - 1196 WELLINGTON STREET WEST	STATION:	
CITY/PROVINCE: OTTAWA, ONTARIO	NORTHING (m): 5029212	EASTING (m): 365092 — ELEV. (m) 65.5
CONTRACTOR: GEORGE DOWNING ESTATE DRILLING	METHOD: CME 55 HOLLOW STEM AUGER	
BOREHOLE DIAMETER (cm): 20 — WELL DIAMETER (cm): 5	SCREEN SLOT #: 10 — SAND TYPE: SILICA	SEALANT TYPE: BENTONITE

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) ● / N-VALUE (Blows/300mm) ▲	WATER CONTENT (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		ASPHALT (76 mm)	0	65.5									
		COMPACT, DAMP, GREY, SAND AND GRAVEL (FILL)	0.5	65		2.8	1		75				
		VERY STIFF, BROWN, SILTY CLAY, TRACE SAND	1	64.5	6	16	2		71				
		STIFF	1.5	64									
			2	63.5	5	27.7	3		67				
		FIRM, MOIST, BROWN, SANDY SILT TRACE CLAY	2.5	63	2	14.8	4		46				
		TRACE GRAVEL	3	62.5									
			3.5	62	10	5.9	5		25				
		LOOSE, GREY, WET, SILTY SAND, TRACE GRAVEL	4	61.5	5	9.4	6		63				GROUNDWATER MEASURED AT 4.2 m
		COMPACT AUGER REFUSAL ON ASSUMED BEDROCK	4.5	61	26	17.3	7		58				
		STRONG, SLIGHTLY WEATHERED LIMESTONE, POOR QUALITY BASED ON RQD	5	60.5			1						TCR: 79% SCR: 33% RQD: 32%
			5.5	60									
		VERY STRONG, GOOD QUALITY BASED ON RQD	6	59.5									
			6.5	59			2						TCR: 95% SCR: 93% RQD: 78%
			7	58.5									
		STRONG, EXCELLENT QUALITY BASED ON RQD	7.5	58									
			8	57.5									
			8.5	57			3						TCR: 98% SCR: 96% RQD: 95%
			9	56.5									

TERRAPEX

LOGGED BY: EB	DRILLING DATE: 20-MAY-21
INPUT BY: JM	MONITORING DATE: 07-JUN-21
REVIEWED BY: AM	PAGE 1 OF 2

CLIENT: WELLDALE LIMITED PARTNERSHIP	PROJECT NO.: CO810.00	**RECORD OF: MW112**
ADDRESS: 1186 - 1196 WELLINGTON STREET WEST	STATION:	
CITY/PROVINCE: OTTAWA, ONTARIO	NORTHING (m): 5029212	EASTING (m): 365092 ELEV. (m) 65.5
CONTRACTOR: GEORGE DOWNING ESTATE DRILLING	METHOD: CME 55 HOLLOW STEM AUGER	
BOREHOLE DIAMETER (cm): 20 WELL DIAMETER (cm): 5	SCREEN SLOT #: 10 SAND TYPE: SILICA	SEALANT TYPE: BENTONITE

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) ▲ PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		MEDIUM STRONG, GOOD QUALITY BASED ON RQD	9.5	56									UCS = 26.6 MPa
			10	55.5									
			10.5	55			4						TCR: 91% SCR: 85% RQD: 85%
		STRONG, EXCELLENT QUALITY BASED ON RQD	11	54.5									
			11.5	54									
			12	53.5			5						TCR: 100% SCR: 100% RQD: 100%
		VERY STRONG, FRESH	12.5	53									
			13	52.5									
			13.5	52			6						TCR: 100% SCR: 100% RQD: 100%
		SLIGHTLY WEATHERED, GOOD QUALITY BASED ON RQD	14	51.5									
			14.5	51			7						TCR: 87% SCR: 85% RQD: 85%
		FRESH, EXCELLENT QUALITY BASED ON RQD	15	50.5									
			15.5	50			8						TCR: 100% SCR: 100% RQD: 100%
			16	49.5									
		END OF BOREHOLE											

TERRAPEX

LOGGED BY: EB	DRILLING DATE: 20-MAY-21
INPUT BY: JM	MONITORING DATE: 07-JUN-21
REVIEWED BY: AM	PAGE 2 OF 2

CLIENT: WELLDALE LIMITED PARTNERSHIP	PROJECT NO.: CO810.00	**RECORD OF: MW113**
ADDRESS: 1186 - 1196 WELLINGTON STREET WEST	STATION:	
CITY/PROVINCE: OTTAWA, ONTARIO	NORTHING (m): 5029191	EASTING (m): 365108 ELEV. (m) 65.8
CONTRACTOR: GEORGE DOWNING ESTATE DRILLING	METHOD: CME 55 HOLLOW STEM AUGER	
BOREHOLE DIAMETER (cm): 20	WELL DIAMETER (cm): 5	SCREEN SLOT #: 10 SAND TYPE: SILICA SEALANT TYPE: BENTONITE

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) / N-VALUE (Blows/300mm)	WATER CONTENT (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		CONCRETE (150 mm)	0	65.5	9	2.3	1		42				
		LOOSE, DAMP, BROWN, SAND AND GRAVEL (FILL)	0.5										
		LOOSE, DAMP, BROWN, SAND, TRACE SILT, TRACE GRAVEL	1	65	7	20.8	2			58			PP=200+ kPa
		HARD, DAMP, GREY, SILTY CLAY, TRACE SAND, TRACE GRAVEL	1.5	64.5									
			2	64	16	30.4	3		75				PP=200+ kPa
		STIFF, MOIST, BROWN, SANDY SILT	2.5	63.5	5	23.6	4		79				
		VERY STIFF, DAMP, BROWN/GREY, SANDY SILT, TRACE CLAY, SOME GRAVEL	3	63									
			3.5	62.5	36	5.8	5		71				
		LOOSE, WET, GREY, SILTY SAND, TRACE TO SOME GRAVEL	4	62	8	14.7	6		50				
		COMPACT	4.5	61.5									
		AUGER REFUSAL ON ASSUMED BEDROCK	5	61	15	8.8	7		63				GROUNDWATER MEASURED AT 4.8 m
		STRONG, SLIGHTLY WEATHERED LIMESTONE, GOOD QUALITY BASED ON RQD	5.5	60.5			1						TCR: 100% SCR: 87% RQD: 87%
			6	60									
			6.5	59.5			2						TCR: 90% SCR: 81% RQD: 40%
			7	59									
			7.5	58.5			3						TCR: 100% SCR: 93% RQD: 86%
			8	58									
		EXCELLENT QUALITY BASED ON RQD	8.5	57.5			4						TCR: 100% SCR: 100% RQD: 100%
			9	57									
				56.5									

TERRAPEX

LOGGED BY: EB	DRILLING DATE: 20-MAY-21
INPUT BY: JM	MONITORING DATE: 07-JUN-21
REVIEWED BY: AM	PAGE 1 OF 2

CLIENT: WELLDALE LIMITED PARTNERSHIP	PROJECT NO.: CO810.00	**RECORD OF: MW113**
ADDRESS: 1186 - 1196 WELLINGTON STREET WEST	STATION:	
CITY/PROVINCE: OTTAWA, ONTARIO	NORTHING (m): 5029191	EASTING (m): 365108 ELEV. (m) 65.8
CONTRACTOR: GEORGE DOWNING ESTATE DRILLING	METHOD: CME 55 HOLLOW STEM AUGER	
BOREHOLE DIAMETER (cm): 20	WELL DIAMETER (cm): 5	SCREEN SLOT #: 10 SAND TYPE: SILICA SEALANT TYPE: BENTONITE

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) ▲ PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		VERY STRONG	9.5	56									
			10										
				55.5			5						TCR: 91% SCR: 91% RQD: 91%
			10.5										
				55									
			11										
		STRONG		54.5									
			11.5										
				54									
			12				6						TCR: 98% SCR: 98% RQD: 98% UCS = 63.3 MPa
				53.5									
			12.5										
				53									
			13										
				52.5									
			13.5										
				52			7						UCS = 89.1 MPa TCR: 100% SCR: 100% RQD: 100%
			14										
				51.5									
			14.5										
				51									
			15										
				50.5			8						TCR: 100% SCR: 100% RQD: 100%
			15.5										
				50									
			16										
		END OF BOREHOLE											

TERRAPEX

LOGGED BY: EB	DRILLING DATE: 20-MAY-21
INPUT BY: JM	MONITORING DATE: 07-JUN-21
REVIEWED BY: AM	PAGE 2 OF 2

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1186, 1188, 1194 and 1196 Wellington Street West
Ottawa, Ontario

DATUM Geodetic

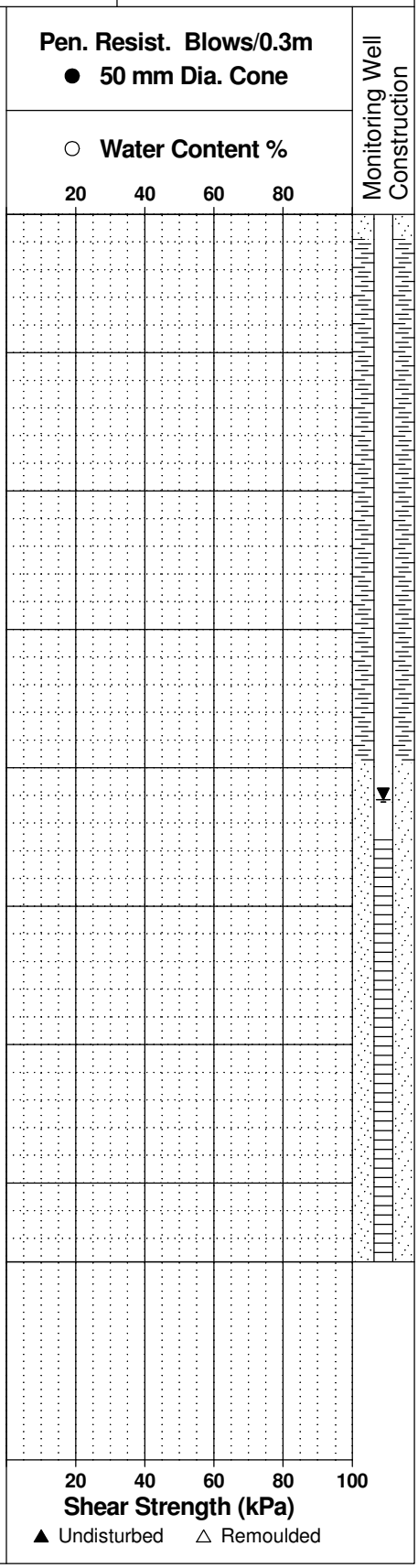
FILE NO. PG5379

REMARKS

HOLE NO. BH 1

BORINGS BY CME-55 Low Clearance Drill **DATE** June 23, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	65.77
Asphaltic concrete 0.10							
FILL: Brown silty sand with crushed stone 0.59		AU	1				
FILL: Brown silty clay, trace sand and gravel 1.52		SS	2	75	9	1	64.77
Very stiff, brown **SILTY CLAY** 2.29		SS	3	71	11	2	63.77
GLACIAL TILL: Compact to dense, brown silty and with clay, some gravel, trace cobbles 3.40		SS	4	62	24	3	62.77
		SS	5	21	50+		
		RC	1	98	23	4	61.77
BEDROCK: Very poor to excellent quality, grey limestone		RC	2	98	58	5	60.77
		RC	3	100	100	6	59.77
7.57						7	58.77
End of Borehole							
(GWL @ 4.23m - July 3, 2020)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1186, 1188, 1194 and 1196 Wellington Street West
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5379

REMARKS

HOLE NO. BH 2

BORINGS BY CME-55 Low Clearance Drill **DATE** June 23, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	65.70
Asphaltic concrete 0.10		AU	1				
FILL: Brown silty sand with crushed stone 0.71		SS	2	42	8	1	64.70
FILL: Brown silty sand, trace clay and gravel		SS	3	67	7	2	63.70
		SS	4	8	10		
3.25		SS	5	100	50+	3	62.70
		RC		94	67	4	61.70
BEDROCK: Fair to excellent quality, grey limestone		RC	2	93	90	5	60.70
		RC	3	100	100	6	59.70
7.26						7	58.70
End of Borehole							
(GWL @ 4.27m - July 3, 2020)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**
○ **Water Content %**

20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1186, 1188, 1194 and 1196 Wellington Street West
Ottawa, Ontario

DATUM Geodetic

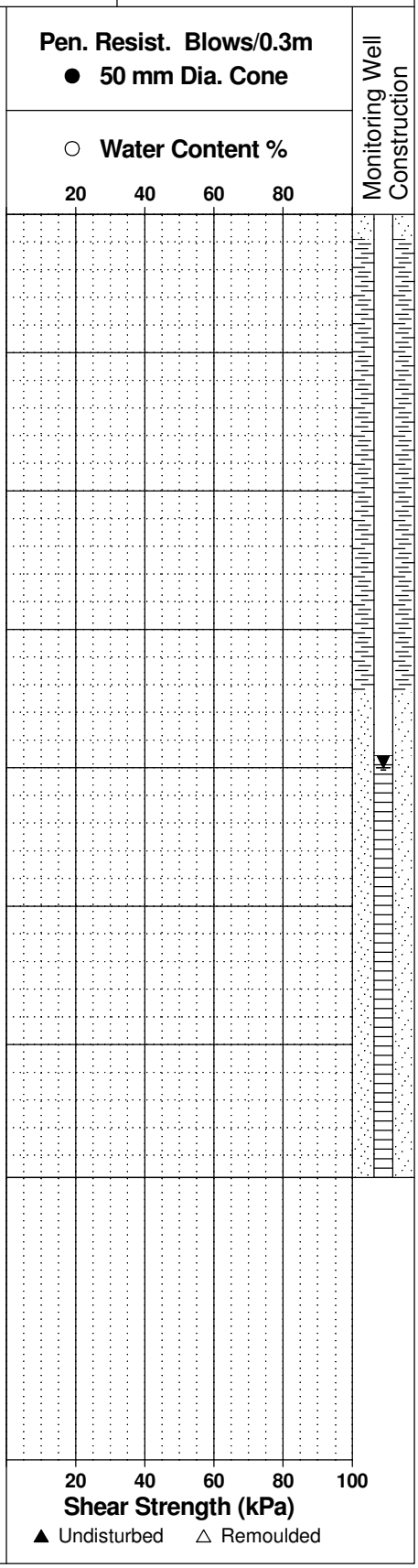
FILE NO. PG5379

REMARKS

HOLE NO. BH 3

BORINGS BY CME-55 Low Clearance Drill **DATE** June 23, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Asphaltic concrete 0.10						0	65.52
FILL: Brown silty sand with crushed stone 0.60		AU	1				
FILL: Brown silty sand, trace clay and gravel		SS	2	42	17	1	64.52
1.52		SS	3		8	2	63.52
GLACIAL TILL: Loose to dense, brown silty sand, trace clay and gravel		SS	4	50	5		
3.28		SS	5		50+	3	62.52
BEDROCK: Poor to excellent quality, grey limesotne		RC	1	100	46	4	61.52
		RC	2	100	76	5	60.52
		RC	3	100	100	6	59.52
6.96							
End of Borehole							
(GWL @ 4.00m - July 3, 2020)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1186, 1188, 1194 and 1196 Wellington Street West
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5379

REMARKS

HOLE NO. BH 4

BORINGS BY CME-55 Low Clearance Drill **DATE** June 23, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE									
Asphaltic concrete 0.10						0	65.49		
FILL: Brown silty sand with crushed stone 0.60		AU	1						
		SS	2	58	11	1	64.49		
FILL: Brown silty sand, trace clay and gravel 2.13		SS	3	38	11	2	63.49		
GLACIAL TILL: Loose to dense, brown silty sand with clay and gravel		SS	4	100	6				
		SS	5	30	50+	3	62.49		
3.50									
End of Borehole									
Practical refusal to augering at 3.50m depth									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1186, 1188, 1194 and 1196 Wellington Street West
Ottawa, Ontario

DATUM Geodetic

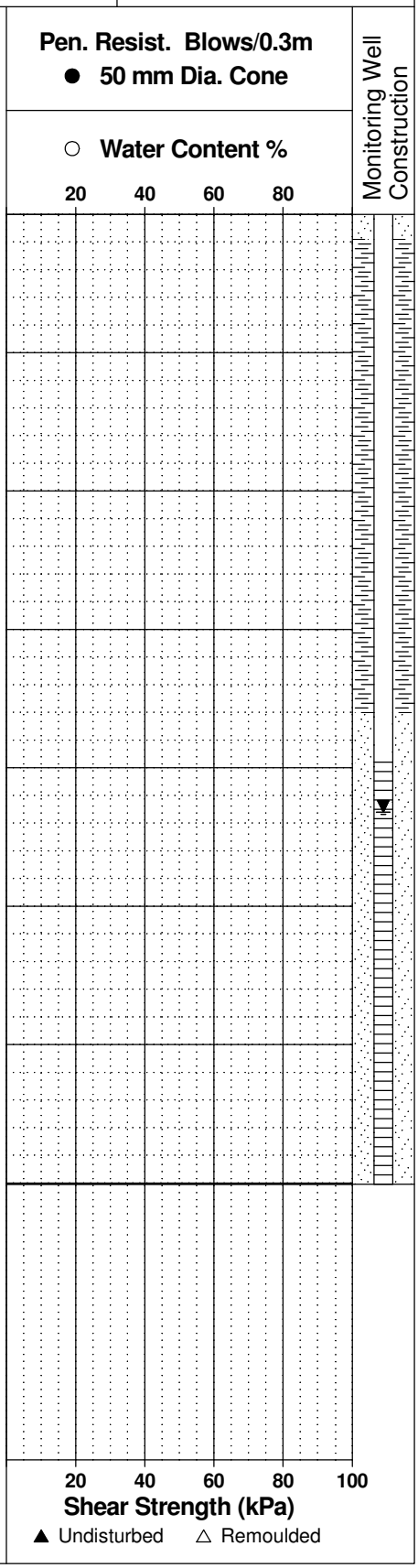
FILE NO. PG5379

REMARKS

HOLE NO. BH 5

BORINGS BY CME-55 Low Clearance Drill **DATE** June 24, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	65.82
Asphaltic concrete 0.08 **FILL:** Brown silty sand with crushed stone 0.53		AU	1				
		SS	2	62	14	1	64.82
Compact, brown **SILTY SAND**		SS	3	50	12	2	63.82
2.13							
GLACIAL TILL: Brown silty sand with clay and gravel		SS	4	33	3		
3.15		SS	5	25	50+	3	62.82
		RC	1	93	41	4	61.82
BEDROCK: Poor to excellent quality, grey limestone						5	60.82
		RC	2	100	60	6	59.82
		RC	3	100	92		
7.01						7	58.82
End of Borehole							
(GWL @ 4.32m - July 3, 2020)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1186, 1188, 1194 and 1196 Wellington Street West
Ottawa, Ontario

DATUM Geodetic

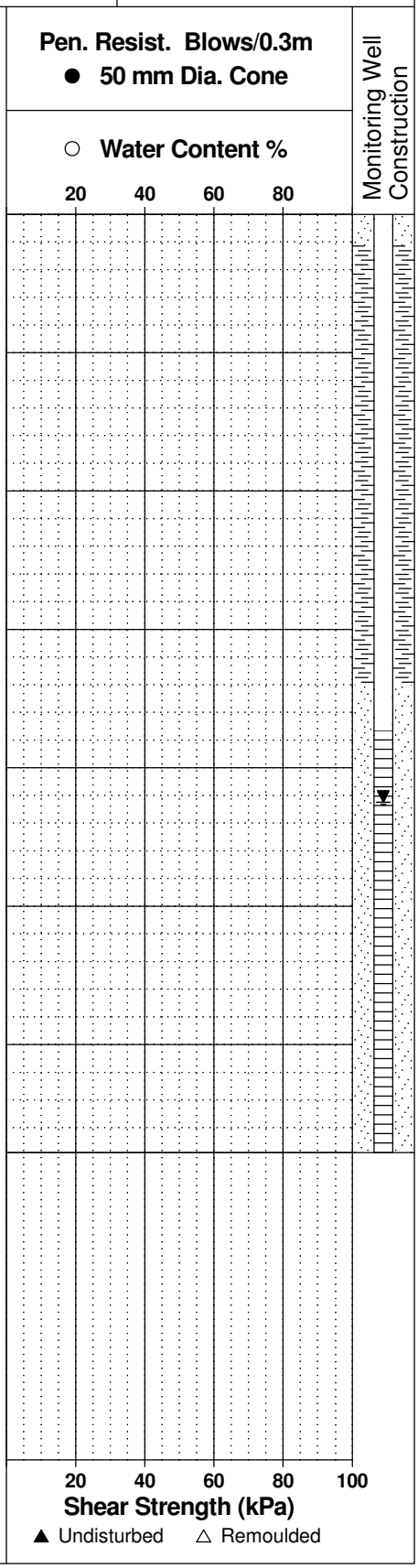
FILE NO. PG5379

REMARKS

HOLE NO. BH 6

BORINGS BY CME-55 Low Clearance Drill **DATE** June 23, 2020

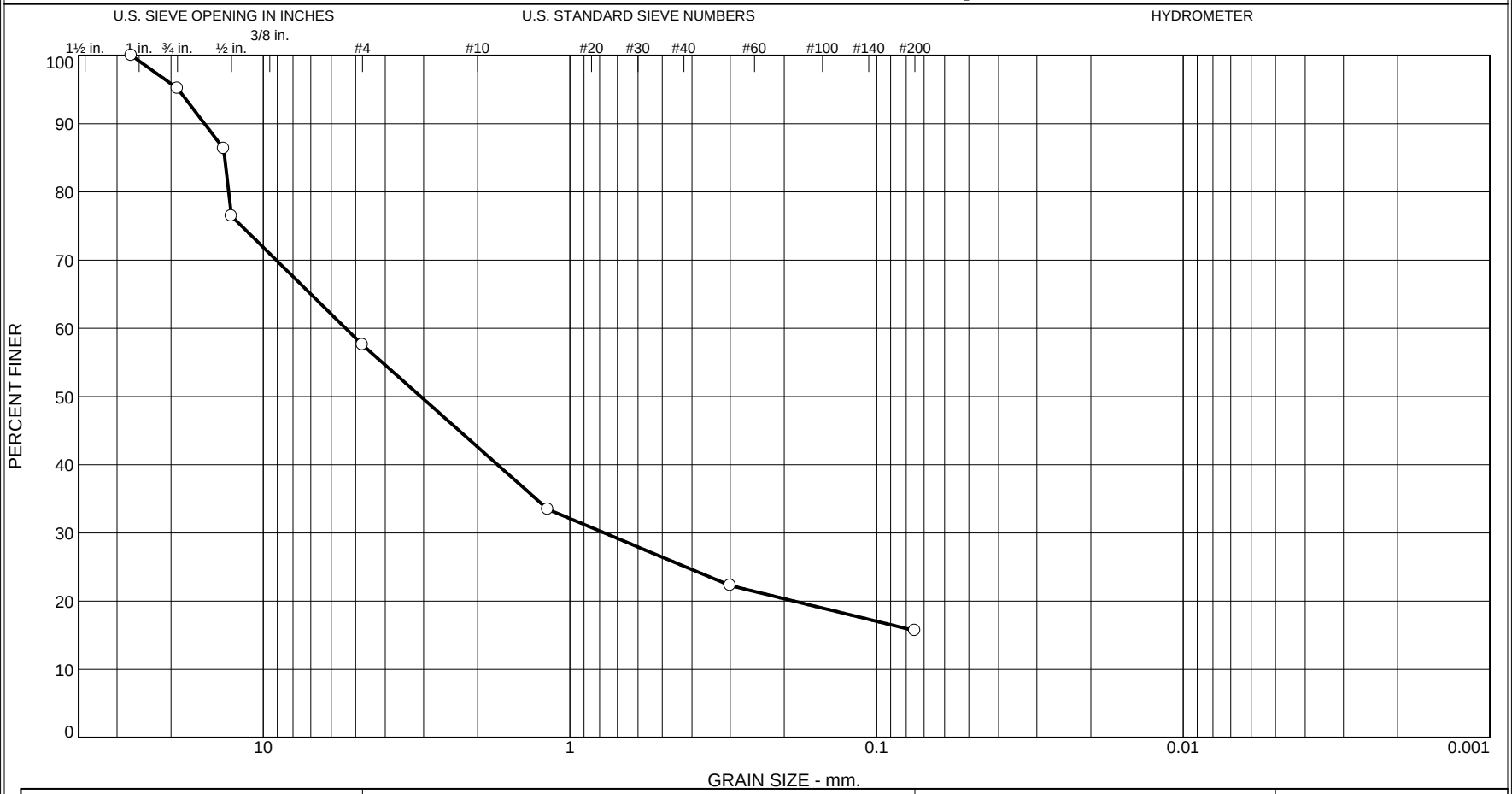
SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	65.59
Asphaltic concrete 0.10							
FILL: Brown silty sand with crushed stone 0.48		AU	1				
FILL: Brown silty sand, some gravel		SS	2	67	17	1	64.59
1.52							
GLACIAL TILL: Brown silty clay with sand and gravel 2.13		SS	3	58	10	2	63.59
		RC	1	74	21	3	62.59
		RC	2	91	65	4	61.59
BEDROCK: Very poor to excellent quality, grey limestone						5	60.59
		RC	3	92	75		
						6	59.59
		RC	4	100	94		
6.78							
End of Borehole							
(GWL @ 4.25m - July 3, 2020)							



APPENDIX II

GEOTECHNICAL LABORATORY TEST RESULTS

Particle Size Distribution Report



% Gravel	% Sand	% Silt	% Clay
42	42	16	

Identification	Date Sampled	Date Received	Date Tested
Loc.: 1186-1194 Wellington Street West, Ottawa, ON. Depth: 0.2 - 0.8 m Sample No.: MW112, SS1	May 20, 2021	May 20, 2021	June 2, 2021

Client Welldale Limited Partnership

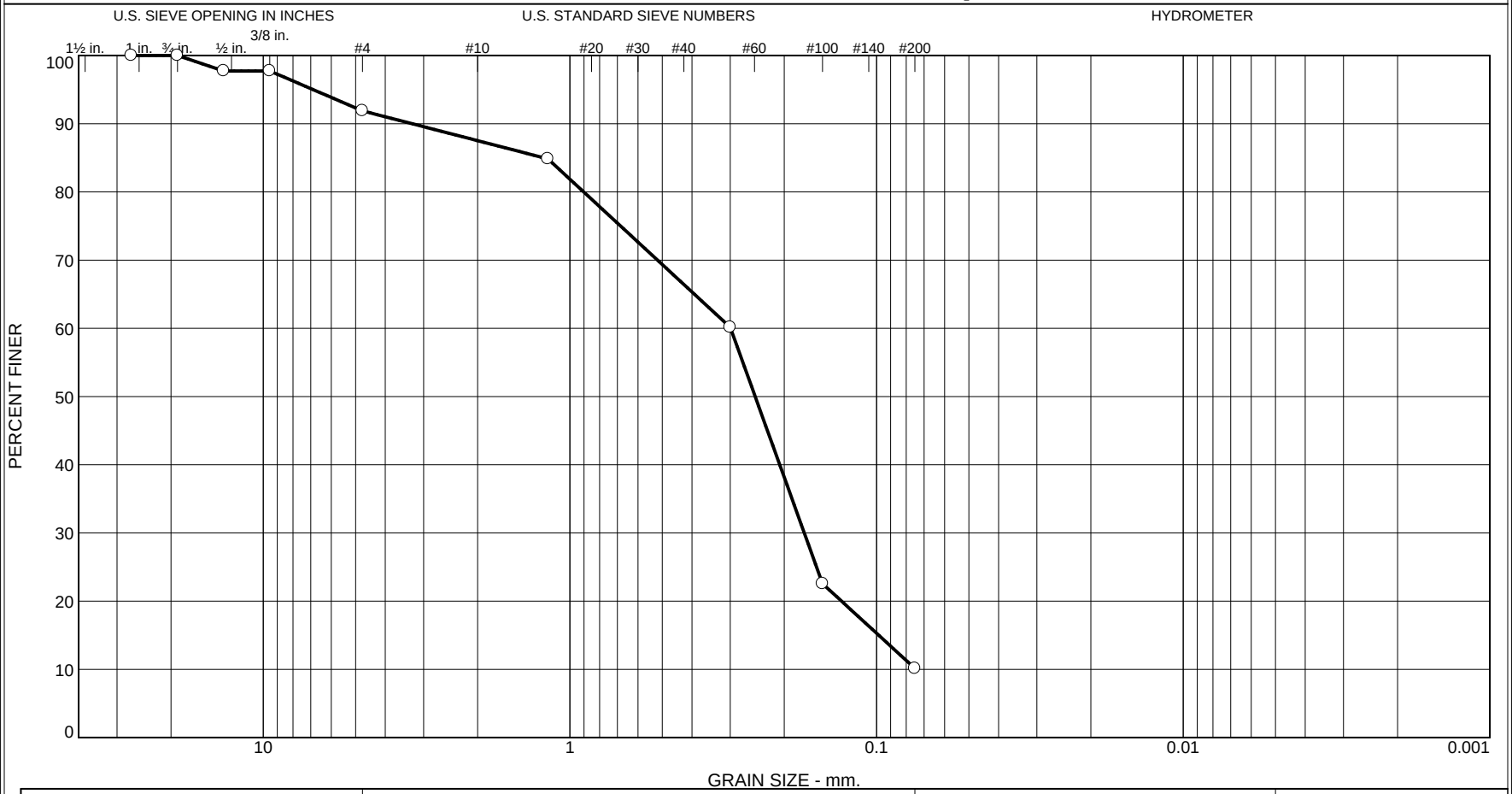
Project 1186-1194 Wellington Street West

Project No. CO810.00 Figure 2

Terrapex

Tested By: AM

Particle Size Distribution Report



% Gravel	% Sand	% Silt	% Clay
8	82	10	

Identification	Date Sampled	Date Received	Date Tested
Loc.: 1186-1194 Wellington Street West, Ottawa, ON. Depth: 1.2 - 1.8 m Sample No.: MW105, SS3	April 20, 2021	April 20, 2021	June 2, 2021

Client Welldale Limited Partnership

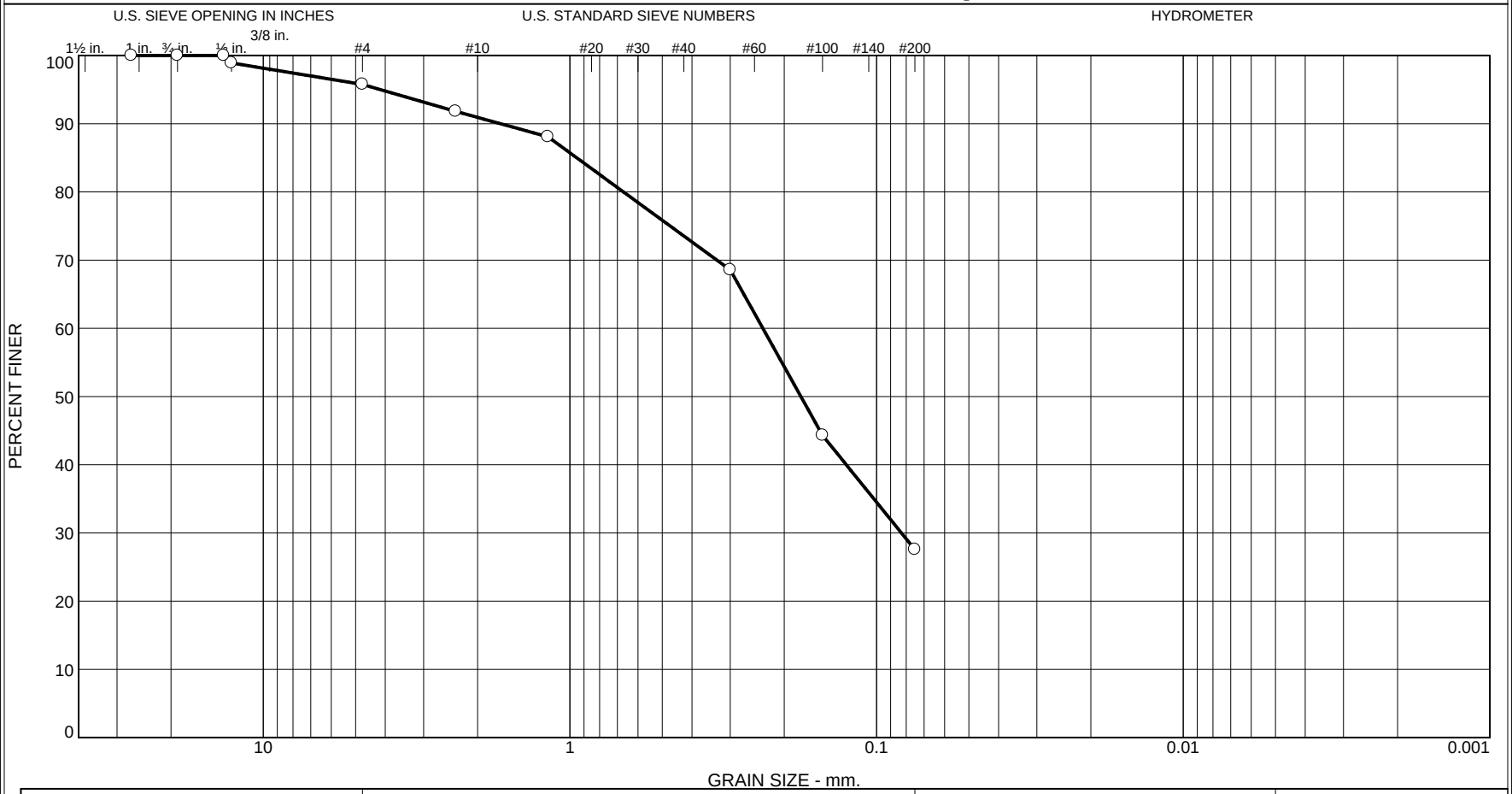
Project 1186-1194 Wellington Street West

Project No. CO810.00 Figure 1

Terrapex

Tested By: AM

Particle Size Distribution Report



% Gravel	% Sand	% Silt	% Clay
4	68	28	

Identification	Date Sampled	Date Received	Date Tested
Loc.: 1186-1194 Wellington Street West, Ottawa, ON. Depth: 4.0 - 4.6 m Sample No.: MW112, SS6	May 20, 2021	May 20, 2021	June 2, 2021

Client Welldale Limited Partnership

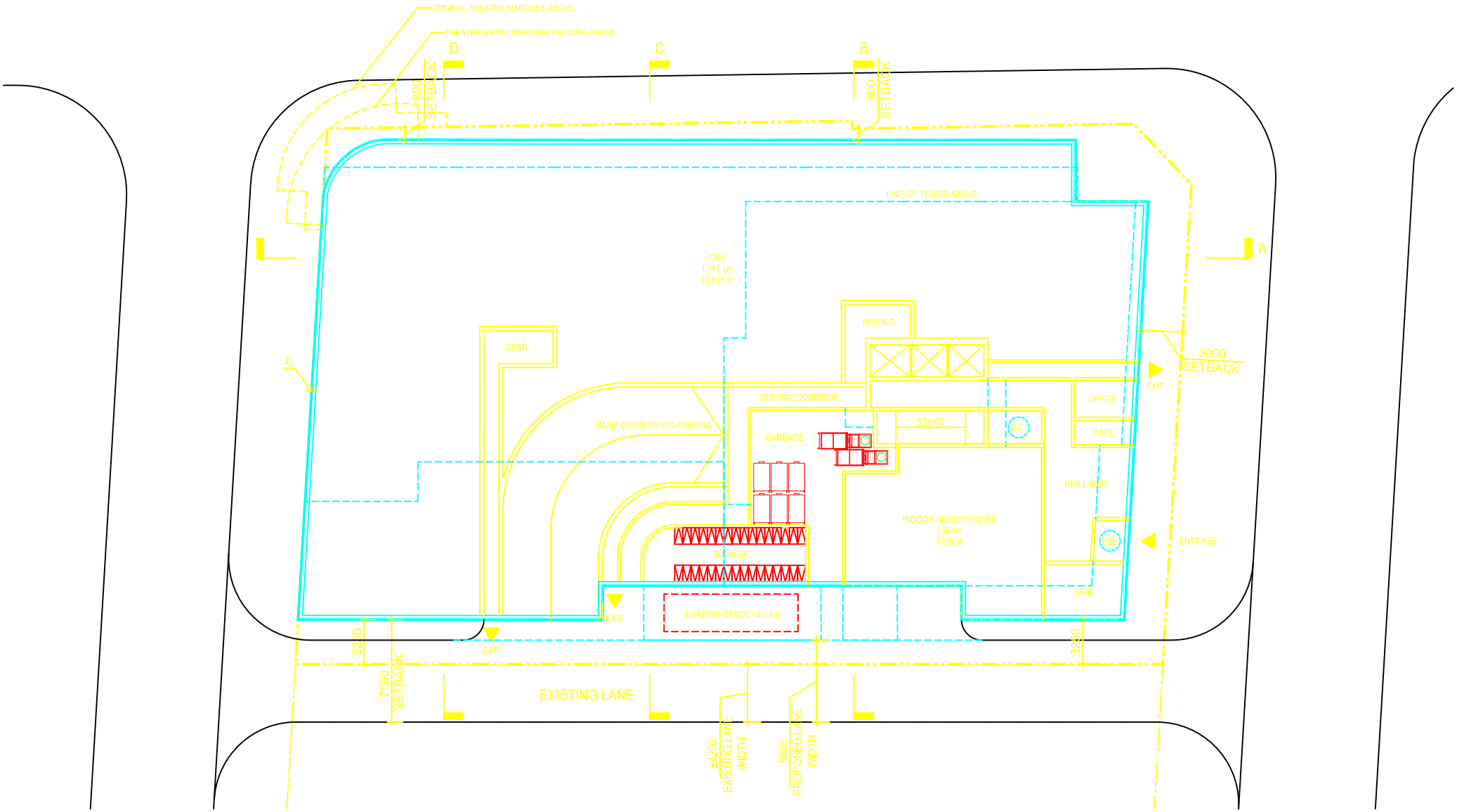
Project 1186-1194 Wellington Street West

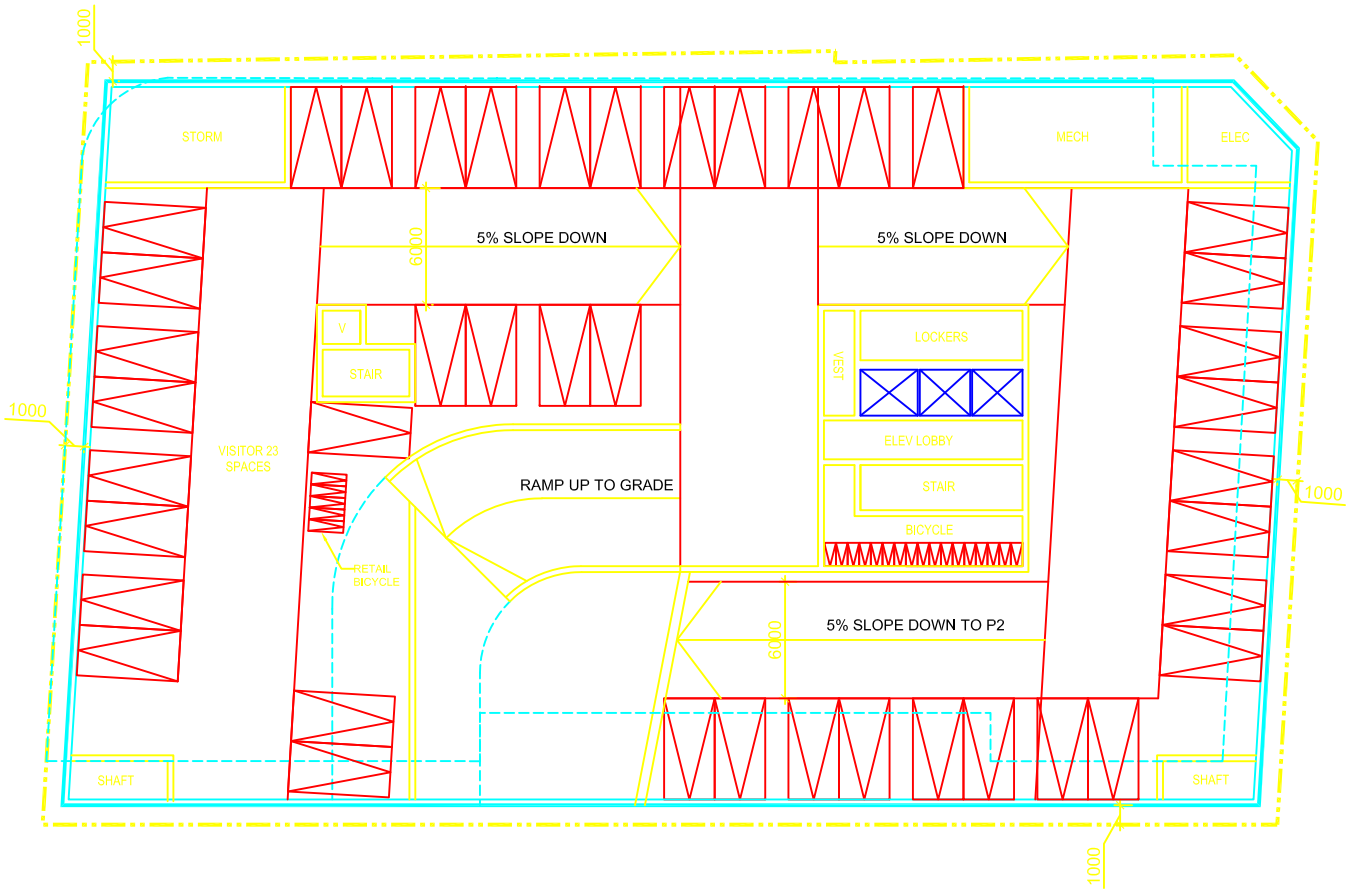
Project No. CO810.00 Figure 3

Terrapex

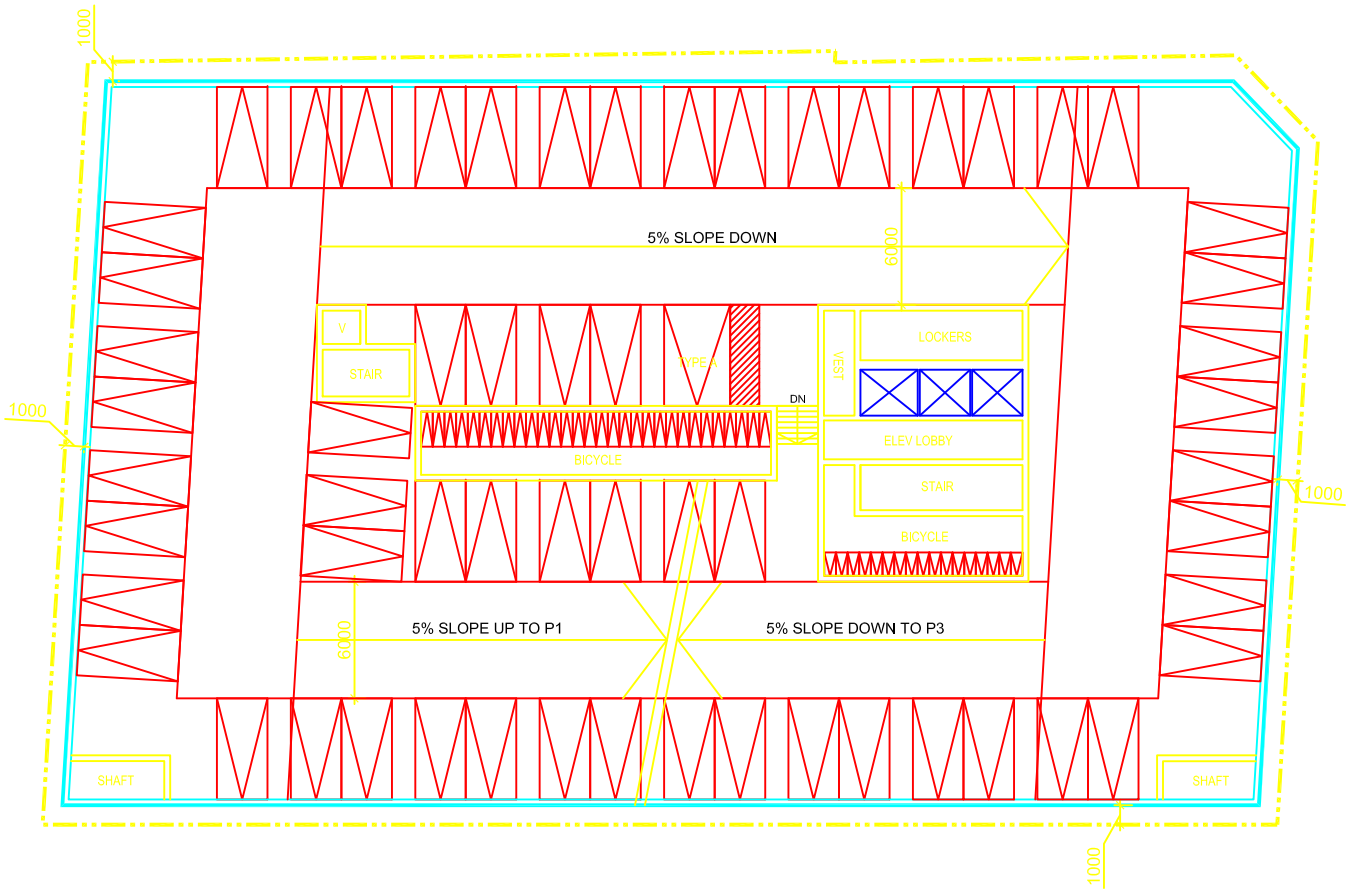
Tested By: AM

APPENDIX III
CONCEPT STUDY

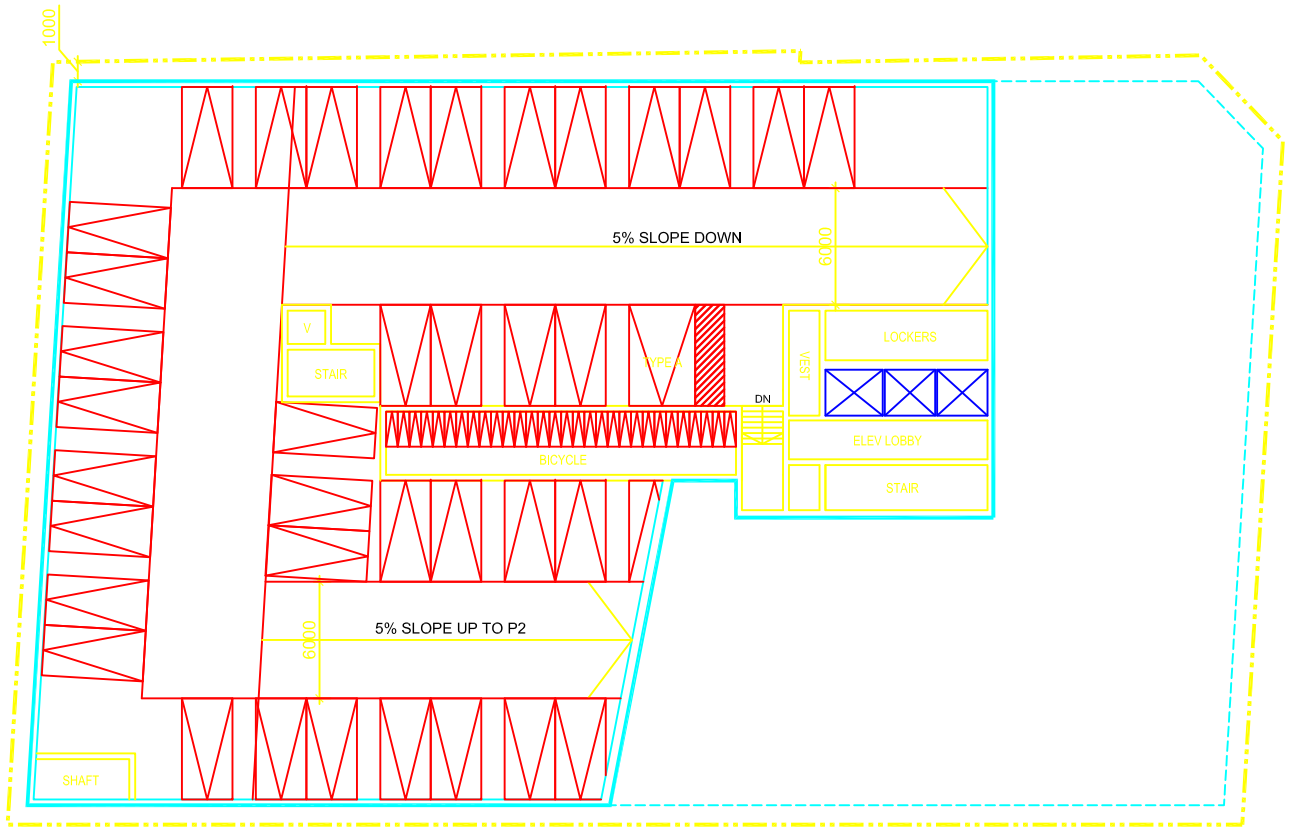

ORIGINAL THEATRE MARQUEE ABOVE
THEATRE ENTRY MARQUEE FEATURE ABOVE
D
C
B
800
SETBACK
800
SETBACK
LINE OF TOWER ABOVE
A
CRU
1,172 sm
12,615 sf
MOVING
STAIR
0
3000
SETBACK
EXIT
SERVICE CORRIDOR
OFFICE
RAMP DOWN TO U/G PARKING
STAIRS
WC
GARBAGE
CACF
RES LOBBY
INDOOR AMENITY (GYM)
158 sm
1700 sf
WES
ENTRACE
BICYCLE
MAIL
EXIT
LOADING SPACE 13 x 4m
3250
EXIT
3250
7500
SETBACK
EXISTING LANE
±4270
EXISTING LANE
WIDTH
6000
PROPOSED LANE
WIDTH


1000
STORM
MECH
ELEC
6000
5% SLOPE DOWN
5% SLOPE DOWN
V
STAIR
LOCKERS
VEST
1000
VISITOR 23 SPACES
ELEV LOBBY
STAIR
RAMP UP TO GRADE
1000
BICYCLE
RETAIL BICYCLE
6000
5% SLOPE DOWN TO P2
SHAFT
SHAFT
1000

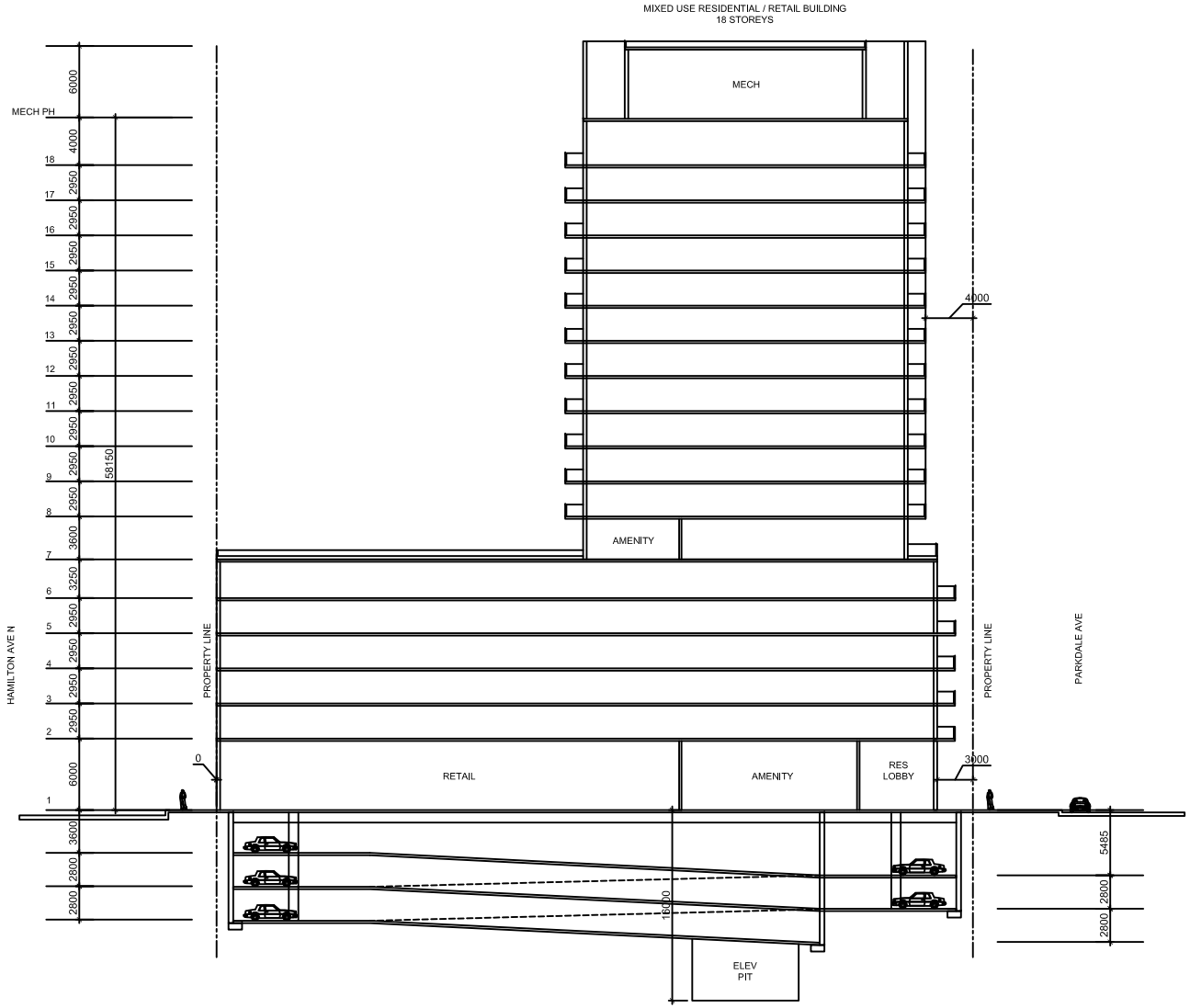
LEVEL P1


1000
5% SLOPE DOWN
6000
V
STAIR
TYPE A
VEST
LOCKERS
DN
1000
BICYCLE
ELEV LOBBY
STAIR
1000
BICYCLE
6000
5% SLOPE UP TO P1
5% SLOPE DOWN TO P3
SHAFT
SHAFT
1000

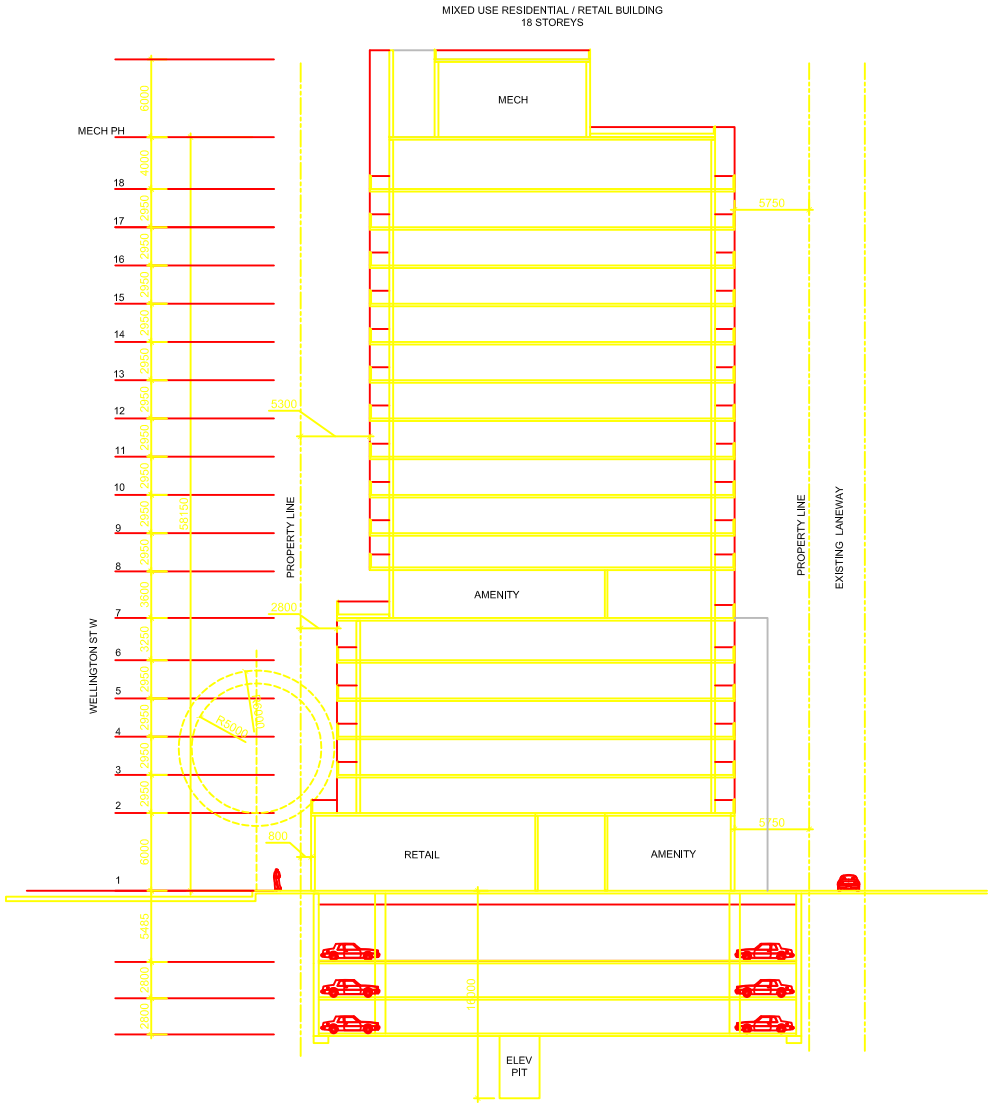
LEVEL P2


1000
5% SLOPE DOWN
6000
V
STAIR
TYPE A
VEST
LOCKERS
DN
ELEV LOBBY
BICYCLE
STAIR
5% SLOPE UP TO P2
6000
SHAFT

LEVEL P3


MIXED USE RESIDENTIAL / RETAIL BUILDING
18 STOREYS
MECH
MECH PH
6000
4000
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
2950
3600
3250
58150
4000
AMENITY
HAMILTON AVE N
PROPERTY LINE
PROPERTY LINE
PARKDALE AVE
0
3000
RETAIL
AMENITY
RES
LOBBY
3600
2800
2800
5485
2800
2800
16000
ELEV
PIT

SECTION A


MIXED USE RESIDENTIAL / RETAIL BUILDING
18 STOREYS
MECH
MECH PH
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
6000
4000
2950
3600
3250
5485
2800
5750
5300
2800
800
PROPERTY LINE
PROPERTY LINE
EXISTING LANEWAY
WELLINGTON ST W
AMENITY
RETAIL
AMENITY
R5000
16000
ELEV
PIT

SECTION B