HADDAD GEOTECHNICAL INC.
*Geotechnical & Environmental Engineers*

# Geotechnical Investigation and Slope Stability Assessment
# Proposed Residential and Commercial Development
# at Pickering Harbour
# 591 Liverpool Road
# Pickering, Ontario

Prepared for:

Pickering Harbour Company Limited
c/o The Biglieri Group Ltd.
20 Leslie Street, Suite 121
Toronto, Ontario
M4M 3L4

Project: 15-11612

February 05, 2019

*151 Amber Street, Unit 17*
*Markham, Ontario, Canada L3R 3B3*
*(905) 475-0951*
*1-888-214-4285*
*Fax: (905) 475-8338*
*info@haddadgeo.com*

HADDAD GEOTECHNICAL INC.
*Geotechnical & Environmental Engineers*

February 05, 2019

Project: 16-11612

Pickering Harbour Company Limited
c/o The Biglieri Group Ltd.
20 Leslie Street, Suite 121
Toronto, Ontario
M4M 3L4

Attention: Ms. Melinda Holland of The Biglieri Group Ltd.

**Re: Geotechnical Investigation and Slope Stability Assessment**
**Proposed Residential and Commercial Development at Pickering Harbour**
**591 Liverpool Road**
**Pickering, Ontario**

Dear Sirs:

Further to our Geotechnical Investigation and Slope Stability Assessment report dated May 15, 2017, the updated version of the geotechnical report with the consideration of the new proposed conceptual site plan, are presented as follows.

We trust that the information presented in this report satisfies your present requirements. Should you require further information, please contact our office.

Yours very truly,
**HADDAD GEOTECHNICAL INC.**

D. Graham Fisher, M.E.Sc., P. Eng.

Encs.
Dist:
Pickering Harbour Company Limited
c/o The Biglieri Group Ltd. -2 (1 mail & 1 pdf)
Toronto and Region Conservation Authority -1 (pdf) ***
City of Pickering, Building Department -1 (pdf) ***
*** To be forwarded by client
File:1611612.591 Liverpool Drive.giss

*151 Amber Street, Unit 17* *(905) 475-0951* *Fax: (905) 475-8338*
*Markham, Ontario, Canada L3R 3B3* *1-888-214-4285* *info@haddadgeo.com*

**Geotechnical Investigation and Slope Stability Assessment**
**Proposed Residential and Commercial Development**
**at Pickering Harbour**
**591 Liverpool Road**
**Pickering, Ontario**

## 1. INTRODUCTION

### 1.1 Project

1. The conceptual plan, prepared by The Biglieri Group Ltd., indicates that the proposed residential and commercial development of the subject site will comprise the construction of two buildings with three to twenty-three storey.

2. It is also indicated that the proposed development of the subject site will comprise the construction of hard and soft landscaping, pedestrian promenade and private road.

3. It is understood that the existing structures on the site, including one-storey brick building, portable building, shed, etc., will be demolished.

4. Specific plans of the proposed development of the subject site were not available at the time of writing this report.

### 1.2 Purpose

The objectives of the subsurface investigation were to:

- provide subsurface information with regards to the types, thicknesses and variability of the subsoils underlying the area of the proposed building.
- establish groundwater conditions.
- assess stability of the slope in existing condition, effect of the proposed construction on the stability of the existing slope, position of long-term stable top of slope line.
- provide information for the design and construction of foundations, excavation, earthworks, permanent drainage provisions, floor construction, erosion control, sediment protection, etc. for the proposed buildings.

### 1.3 Site Description – Present

1. The property under consideration, 591 Liverpool Road, is located along the east (nominal) side of Liverpool Road, adjacent to Frenchman's Bay followed by Lake Ontario, in the City of Pickering. The UTM coordinates for the approximate centre of the site are 654,427 E and 4,852,971 N.

## 1. INTRODUCTION (cont'd)

### 1.3 Site Description – Present

2. It is also understood by client that the existing public parking at the southwest corner of the subject property, which is enclosed by Liverpool Road, Frenchman's Bay and subject site, will be attached to the subject property in the future.

3. At the time of our investigation, the subject property was occupied by a one storey brick building, underground decommission waste water facility, a portable building and a shed. Several boats and related equipment were observed at the subject site. The ground cover in the subject site, was observed to consist of gravel surface.

4. The topography of the subject site was observed relatively flat with ground sloping from north to south and west to east to the top of bank line which is located in the south and east sides of the subject site. Beyond this line, the land slopes gently to the base of the slope just at water's edge of Frenchman's Bay.

## 2. FIELD AND LABORATORY WORK

### 2.1 Fieldwork

1. It should be noted that as per the first conceptual plan prepared by The Biglieri Group Ltd., on November 2016, the drilling of fifteen boreholes was proposed by our office to determine the soil stratigraphy of the subject site. However, the drilling of ten boreholes were completed at the time of drilling operations due absence of permission for access public parking owner at the southwest corner of the subject site and also observation of underground structures such as pumping station. It is recommended that the drilling of five more Borehole Nos. 3, 4, 8, 13 and 15 and supplementary geotechnical investigation will be required in the future.

2. The fieldwork, carried out on February 13 to 16, 2017 consisted of the following:
   - Drilling of ten sampled boreholes, at the approximate locations as shown on the Site Plan, Drawing No. 1.
   - Installation of three monitoring wells for measurement of groundwater levels and sample of groundwater, at the approximate locations as shown on the Site Plan, Drawing No. 1.
   - Visual examination of condition of slopes and edge of water.

3. The approximate locations of the boreholes are presented on the Schematic Site Plan, Drawing No. 1. Detailed descriptions of the subsoils encountered in the boreholes are presented on the borehole logs, Drawing Nos. 2 to 12.

4. Borehole Nos. 1, 6, 7, 9 and 11 were located in the area of the proposed building No. 1 and Borehole Nos. 2, 5, 12 and 14 were located in the area or in close proximity to the footprint of the proposed Building No. 2.

5. Borehole Nos. 1, 2, 5, 6, 7, 9, 11, 12 and 14 were advanced to depths ranging from 4.9±m to 12.3±m below existing grades by using rubber track drilling equipment, with 100mm diameter, continuous flight augers. Samples were obtained with a split spoon sampler, driven by a 140-lb hammer, falling 30" (760mm).

## 2. FIELD AND LABORATORY WORK (cont'd)

### 2.1 Fieldwork (cont'd)

6. Borehole No. 10 was located in the area of the proposed pedestrian promenade and was advanced to 5.2±m depth below existing grade by using rubber track drilling equipment, with 100mm diameter, continuous flight augers. Samples were obtained with a split spoon sampler, driven by a 140-lb hammer, falling 30" (760mm).

7. Monitoring well, MW1, MW2 and MW3 were installed by Haddad Geotechnical Inc., adjacent to three sampled borehole locations (i.e. BH Nos. 1, 2 and 6) to depths 6±m, 5.8±m and 6.2±m below existing grades, respectively, at the approximate location as shown on the site plan, Drawing No. 1.

8. Coring of bedrock was conducted at Borehole No. 1, to depth of 18.15±m below existing grade. The coring was conducted in incremental runs of 1.2m to 1.7m. After each coring run the percent core recovery, and the Rock Quality Designation (R.Q.D.) were recorded.

9. The surface elevations at the Borehole locations are referenced to the top of the catch basin in the east side of the Liverpool Road and north side of the existing entrance of the subject site, elevation 76.98±m, as indicated on Site Plan Drawing No.1, as per the site survey plan prepared J. D. Barnes Limited.

### 2.2 Subsurface Conditions

#### 2.2.1 Surficial Materials and Fill

1. The surficial materials at Borehole Nos. 1, 2, 5, 11 and 14 were observed to consist of gravel surface and/or granular materials. The surficial materials at Borehole Nos. 7 and 9 were observed to consist of top soil and organic materials.

2. Fill materials, consisting of sand and gravels with some silt, and occasional organic stains, in moist to wet condition, very loose to medium compact state, being brown to dark brown with grey seams in colour, were encountered below the surficial materials at Borehole locations 6, 7, 9, 10 and 12 and below the upper fill materials at Borehole locations 1, 2, 5, 11 and 14.

3. These fill materials extended to depths ranging from 2.2±m to 4.2±m below existing grades.

4. Layers of dark brown to black peat and/or organic materials in wet condition were observed within fill materials at Borehole locations 1, 2, 9, 12 and 14.

#### 2.2.2 Natural Subsoils

1. Natural, stiff to very stiff, sandy clayey silt subsoils with trace gravels were observed to underlay the fill materials at Borehole location 1. The results of Standard Penetration Tests (SPT) in the sandy clayey silt subsoils indicated penetration resistance of 9 to 18 blows per 300mm.

**2. FIELD AND LABORATORY WORK** (cont'd)

**2.2 Subsurface Conditions** (cont'd)

**2.2.2 Natural Subsoils** (cont'd)

2. Natural, medium dense to very dense, silty sand subsoils with trace to some clay and trace to some gravels were observed to underlay the fill materials at Borehole locations 2, 5, 6, 10 to 12 and 14 and the upper native subsoils at Borehole locations 1 and 9. The results of Standard Penetration Tests (SPT) in the silty sand subsoils with trace to some clay and trace to some gravels indicated penetration resistance of 18 blows per 300mm to over 50 blows per 150mm.

3. Natural, medium dense to very dense, gravely silty sand subsoils with trace clay were observed to underlay the fill materials at Borehole locations 7 and 9 and the upper native subsoils at Borehole location 2. The results of Standard Penetration Tests (SPT) in the gravely silty sand subsoils indicated penetration resistance of 15 blows per 300mm to over 50 blows per 150mm.

4. Weathered shale bedrock and refusal of split spoon sampler was encounter to underlay the native subsoils at depths ranging from 7.6±m to 10.7±m below existing grades (i.e. elevations varying from 66.4±m to 69.2±m) at Borehole locations 1, 2, 5 to 7 and 9.

**2.2.3 Bedrock**

1. Coring of the bedrock was conducted below depth of 12.15±m below existing grade, at Borehole No. 1, using NXL core barrel, and NW casing.

2. The bedrock was observed to consist primarily of grey shale (Georgian Bay formation, Dundas unit), with limestone bands up to 65mm thickness.

3. The bedrock to depth 18.15±m (elevations 58.9±m) below existing grade at Borehole No. 1, indicated recoveries of 92% to 98% and R.Q.D. of less than 80%, being fair to good condition of the bedrock.

**2.3 Groundwater**

1. Monitoring well, MW1, MW2 and MW3 were installed by Haddad Geotechnical Inc., adjacent to three sampled borehole locations (i.e. BH Nos. 1, 2 and 6) to depths 6±m, 5.8±m and 6.2±m below existing grades, respectively, at the approximate location as shown on the site plan, Drawing No. 1.

2. Upon completion of drilling operations at Borehole Nos. 1, 2, 5, 6, 7, 9, 11, 12 and 14, water rose to the depths ranging from 1.2±m to 10.7±m below existing grade, as indicated on the borehole logs, Drawing Nos. 2, 4, 5, 6, 7, 8, 10, 11 and 12, respectively.

3. Following completion, Borehole No. 10 remained open and dry to full explored depth of 5.2±m below existing grade upon completion of drilling operations, with no indication of wet seams or groundwater table being encountered.

4. Table No.1, below, presents the elevations of groundwater at each of the Monitoring Wells locations approximate 5 and 12 weeks after borehole completion.

## 2. FIELD AND LABORATORY WORK (cont'd)

### 2.3 Groundwater (cont'd)

**Table No. 1**
**Elevations of Groundwater at Monitoring Well Locations**
**Reading Approximate Five and Twelve Weeks After Borehole Completion**

| Monitoring Well (BH) No. | Existing Grade Elevation, ±m | Reading on March 22, 2017 | | Reading on May 10, 2017 | | Soils |
|---|---|---|---|---|---|---|
| | | Depth, ±m | Groundwater Elevation at or below, ±m | Depth, ±m | Groundwater Elevation at or below, ±m | |
| MW1-BH1 | 77.07 | 2.3 | 74.8 | 1.45 | 75.6 | Fill Materials |
| MW2-BH2 | 77.1 | 1.86 | 75.2 | 0.32 | 76.8 | Fill Materials |
| MW3-BH6 | 77.07 | 1.87 | 75.2 | No Reading | | Fill Materials |

5. The observed static free water levels at Monitoring Well Nos. 1, 2 and 3 (Borehole Nos. 1, 2 and 6) approximate five and twelve weeks after borehole completion as presented in Table No. 1, above, at the subject site may be attributed the presence of free groundwater levels at or below 0.3±m to 2.3±m depths condition below existing grades in the fill materials, (i.e. elevations varying from 74.8±m to 76.8±m), as indicated on the Borehole logs, Drawing Nos. 2, 4 and 6.

6. The measured static water levels on March 22, 2017 are similar to water level of Frenchman's Bay and Lake Ontario adjacent to the site. The measurement of water levels on May 10, 2017 were conducted after several days of rainfall, and are representative of seasonal high ground water conditions.

### 2.4 Laboratory Work

1. The laboratory analysis of borehole samples carried out included the determination of moisture contents, with results as presented on the Borehole Logs.

2. The results of gradation analyses carried out on ten representative samples of the upper and lower native subsoils encountered in Borehole Nos. 1, 3, 5 to 7 and 9, 10 and 14, are presented on Drawing Nos. 13 to 15.

3. The results of the gradation analyses carried out on the upper native subsoils sample obtained from Borehole No. 1 indicated 4% gravels, 30% sand, 39% silt and 27% clay.

4. The results of the gradation analyses carried out on the upper and lower native subsoils samples obtained from Borehole Nos. 1, 5, 6, 9 and 10 indicated 8% to 17% gravels, 36% to 54% sand, 27% to 36% silt and 9% to 13% clay.

5. The results of the gradation analyses carried out on the upper and lower native subsoils samples obtained from Borehole Nos. 2, 7, 9 and 14 indicated 23% to 30% gravels, 43% to 60% sand, 10% to 24% silt and 3% to 6% clay.

## 2. FIELD AND LABORATORY WORK (cont'd)

### 2.5 Site Observations

1. The site survey plan prepared by J. D. Barnes Ltd. and our site visit indicated that Frenchman's Bay followed by Lake Ontario is located in the south and east sides of the subject site.

2. At the time of conducting our fieldwork, the ground cover of the subject site was observed to consist of gravel and asphalt surfaces. In addition, the ground cover at shore of the Frenchman's Bay along south and east sides of the subject site was observed to consist of marsh and hedges.

3. Our site visit indicated that a small shoreline stabilization structure such as armour stone wall, being approximately 1±m in height, was present along the west portion of the south side of the subject just at the water's edge of Frenchman's Bay.

4. On the basis of our visual examination, significant and active erosion was observed at the shore of the Frenchman's Bay along south and east sides of the subject site.

### 2.6 Examination of the Existing Slope

1. The topographic plan for the site, provide by J. D. Barnes Limited was examined (i.e., see Drawing No. 1). One typical section of the slope was plotted based on elevations presented on the plan, as presented on Drawing No. 16.

2. The site survey plan provided by J. D. Barnes Limited and our examination indicate that the slopes to have total height of approximately 1.5±m to 2±m from the top of slope in the south and east side of the subject site to the base of the slope just in water's edge of Frenchman's Bay followed by Lake Ontario.

3. Along Section A-A' average gradients were observed to be 4± horizontal to 1 vertical or flatter along the slope face towards the water's edge of Frenchman's Bay followed by Lake Ontario.

## 3. SLOPE STABILITY ANALYSIS

1. On the basis of the findings of the Boreholes and our site observations and with the consideration of the factor of safety, F.S.=1.5, against failure of the slope, it is our opinion that a stable slope gradient of 3 horizontal to 1 vertical will be applicable for the upper fill materials that were observed at the subject site.

2. Where the stable slope gradients, noted above, are greater than the existing grades at those locations, the existing grades are conservatively used to represent the stable slope gradient. This stable slope gradient for each layer is shown on the slope section, Drawing No. 16.

3. It should be noted that the above slope gradient for FS = 1.5 are based on soil characteristics only and do not take into account the stabilizing effect of the existing trees and their root systems.

## 4. DISCUSSION AND RECOMMENDATIONS

### 4.1. Slope Stability Assessment

1. On the basis of our slope stability analysis, as indicated above, stable slope gradient is assumed to be 3 horizontal to 1 vertical for the fill materials.

2. Our site visit indicated that Frenchman's Bay followed by Lake Ontario is located in close proximity to the bottom of slope towards the east and south sides of the subject site. A minimum erosion allowance of 30±m was applied to the water's edge of Frenchman's Bay followed by Lake Ontario that is prepared by J. D. Barnes Ltd. on Slope A-A', Drawing No. 16, based on Toronto and Region Conservation Authority (TRCA); The Living City Policies: Defining the Lake Ontario Shoreline Flood, Erosion and Dynamic Beach Hazards, (see Appendix "A").

3. The position of the long-term top of stable slope line (LTSTOS), defined as the intersection of the stable slope gradient with the existing grade on the tableland that are shown on Drawing No. 16 and in plan on Drawing No. 17.

4. The position of the long-term-stable top-of-slope line at the existing grade in the subject site, 591 Liverpool Road, falls along Section A-A' at a distance of approximately 35±m from the existing water's edge of Frenchman's Bay followed by Lake Ontario that is prepared by J. D. Barnes Ltd. to the west and/or northwest and/or north towards the Liverpool Road and subject site.

5. Our assessment indicates that the eastern and southern portions of the subject property is located within the erosion hazard limit of the existing slope in the east and south sides of the subject site. The current conceptual plan show that the southwest corner and also south side of the proposed Building No. 3 will be close to the LTSTOS, and that the proposed eastern and southern landscaping/public amenity and wide boardwalk will extend beyond the LTSTOS.

6. MNR suggests an access allowance be provided near slope crests and along one side of a lot, to permit access to slopes for emergency purposes to carry out stabilization works if necessary. On this basis, TRCA policy will require a minimum setback up to 15m from the LTSTOS for any new development.

7. It is our opinion that the construction of the proposed development beyond the Erosion Hazard Limit, will not endanger the integrity of the existing slope, provided the following measures are strictly observed:
   a. The foundations of the proposed development are advanced to competent, undisturbed, natural dense to very dense subsoils and/or very dense shale bedrock as described on Section 4.2 and 4.3, below.
   b. Under no circumstances should any fill, construction materials or debris be dumped on the surface of the slope, beyond the limits of the construction area. The above action will be detrimental to the existing vegetation, and may lead to local instability of the slopes.
   c. The existing vegetation on the slope, most notably within the boundaries of the subject site, should be maintained and encouraged to grow. Additional plantings, with species native to the Greater Toronto area, may be carried out to enhance the stability of the slope, and to protect against future development of erosion of the slope surface.

## 4. DISCUSSION AND RECOMMENDATIONS (cont'd)

### 4.1. Slope Stability Assessment (cont'd)

d. Runoff water should not be discharged directly, in a concentrated fashion, onto the slope. Any runoff from the ground surface and/or perimeter subsurface drainage should be discharged either into the municipal sewers or into an infiltration trench or dry well, located well away from the top of slope.
e. Prior to commencement of construction, a sedimentation control fence must be installed on the perimeter of the construction area, to minimize the effects of surface erosion on the surrounded area. A typical detail of a sedimentation control fence is shown on Drawing No. 18.

### 4.2 Geotechnical Design Considerations

1. The conceptual plan, prepared by The Biglieri Group Ltd., indicates that the proposed residential and commercial development of the subject site will comprise the construction of two buildings, hard and soft landscape, pedestrian promenade and private road.

2. Specific plans of the proposed development of the subject site were not available at the time of writing this report. As per the information available to the date of this report, it is anticipated that the proposed development, with three underground levels, will have a lowest floor level at approximately 9±m below the average elevation of the existing grade.

3. With the assumption of founding level for conventional spread foundations, at 1.2±m below the lowest floor level, this will situate the underside of footings approximate 10.2±m below the average elevation of the existing grade. On this basis, the underside of footings is assumed at 10.2±m below the average elevation of the existing grade, (i.e. elevation, 76.5±m – 10.2±m = 66.3±m) for the purpose of this report only. With the assumption of this elevation, this will require excavation approximate to depth of 10±m below existing grades.

4. The upper fill materials, encountered at each of the borehole locations, are not suitable for the support of foundations of permanent structures.

5. The shale bedrock encountered at and below elevations varying from 66.4±m to 69.2±m, within the explored depths at borehole locations 1, 2, 5 to 7 and 9, present excellent conditions for the support of conventional spread foundations.

6. Alternatively, structural raft foundation or drilled caisson foundations extended to the lower sound shale bedrock is an option to support the structural loads of the proposed twenty-three storey buildings, which should be reviewed by structural engineer.

7. The organic-stained fill materials are not acceptable for use as backfill up to underside of basecourse below the slab-on-grade or exterior pavement. Imported materials conforming to OPSS Select Subgrade designation should be used.

8. Prior to filling and/or backfilling, the exposed subgrade should be thoroughly cleaned to remove all loose, disturbed, top soil, organic materials prior to filling.

9. Any regrading carried out up to the underside of basecourses below supportive system for slab-on-grade and/or exterior pavement and/or added features should be carried out using only approved, free draining materials, placed in shallow lifts not exceeding 150mm and

**4. DISCUSSION AND RECOMMENDATIONS** (cont'd)

**4.2 Geotechnical Design Considerations** (cont'd)

compacted to at least 98% Standard Proctor maximum dry density in the thicknesses noted above.

10. Prior to excavation, it may be anticipated that positive dewatering measures will be necessary due to the presence of water levels ranging from 0.3±m to 2.3±m depths below existing grades in the fill materials at monitoring well locations 1, 2 and 3 in the borehole locations 1, 2 and 6, respectively. It is our opinion that the installation of a vacuum-point dewatering system will be necessary for excavation below existing grade.

11. Excavation up to 3±m below the surface to shale bedrock may be easily accomplished using backhoe requirement.

12. As the excavation for proposed underground levels will approach the limits of the property, it is anticipated that temporary shoring of the sides of excavation will be required. With the assumption of excavation approximate to depth of 10±m below existing grades, as described above, it is anticipated that temporary shoring should be required at the subject site. in addition, it will be necessary to evaluate the effects of the proposed excavation on any settlement-sensitive facilities below the adjacent street (i.e. Liverpool Road).

13. The depth of the existing footings of the buildings on the adjacent property to the north of the subject site should be verified prior to excavation below the above-noted levels. Excavation for new foundations of the proposed building must not extend below a line of influence drawn at 7 vertical to 10 horizontal from the base of footings of the adjacent buildings to the north of the subject site. If the foundations of adjacent structures lie above the line of influence of the excavation, measures such as perimeter continuous caisson wall may be considered.

14. Due to the high groundwater levels at the site and the proximity of Lake Ontario and Frenchman's Bay, it will be necessary to construct of water tight membrane surrounding the subject site. It is anticipated that the membrane will consist of continues cession wall. It is also anticipated that the proposed structure must be designed and constructed to resist hydro pressure uplift.

15. Due to the presence of water table levels at and below depths ranging from 0.3±m to 2.3±m below existing grades at the location of monitoring wells 1, 2 and 3 in the borehole locations 1, 2 and 6, it is recommended that several lines of underfloor drainage lines be installed below the lowest floor level, to keep the groundwater from causing hydrostatic pressure on the lowest floor level. It is also recommended that the waterproofing of the foundation walls of any underground levels of the proposed buildings will be necessary. The location and frequency of underfloor drainage lines may be reviewed upon examination of the subgrade by the geotechnical engineer, once general excavation is completed.

## 4. DISCUSSION AND RECOMMENDATIONS (cont'd)

### 4.3 Foundations

#### 4.3.1 Conventional Spread Foundations

1. Conventional spread foundations established on the very dense weathered shale bedrock encountered at and below elevations varying from 66.4±m to 69.2±m, within the explored depths at borehole locations 1, 2, 5 to 7 and 9, may be designed for a serviceability limit states (SLS) bearing pressure of 2000 kPa with total and differential settlements of less than 10mm. An ultimate limit states (ULS) bearing pressure of 3000 kPa may be assumed for the above footings.

2. The above-noted bearing pressures are applicable only for footings poured on undisturbed shale bedrock.

#### 4.3.2 Protection against Frost Action

1. Footings and/or grade beams for portions of the structure in exterior and unheated interior areas must be protected against frost action by at least 1.2m earth cover. This recommendation is also applicable to foundations in the areas of ventilation shafts of proposed underground parking structures.

2. During cold weather, the freshly placed concrete must be covered with insulating blankets to protect against freezing, as per OPSS 904. Ice and snow are to be removed from the base of the excavation in the area where concrete is to be placed and the concrete must not be placed on frozen soil.

#### 4.3.3 Earthquake Design Factors

1. For purpose of design of the proposed structure for earthquake loads and effects as per Table 4.1.8.4A, in the Ontario Building Code (2012), Site Class "B" conditions may be assumed for foundations established on very dense weathered shale bedrock at or below the anticipated elevations as described in Section 3.2.1.1 above.

2. The remaining parameters should be selected as per the Ontario Building Code.

#### 4.3.4 Rock Anchors

1. Due to the height of the proposed twenty-three storey building, it is anticipated that rock anchoring of foundations may be required to provide resistance to lateral (wind) loads, and also to provide resistance to uplift pressure due to observed high groundwater conditions at the subject site. An adhesional capacity of 600kPa (SLS) may be assumed for the portion of the rock anchors extending into the sound shale bedrock below elevations varying from 66.4±m to 69.2±m. The above adhesional capacity should be proven by means of at least one load test to verify load resistance to pull-out of the anchor to 200% of the above adhesional capacity.

## 4. DISCUSSION AND RECOMMENDATIONS (cont'd)

### 4.3 Foundations (cont'd)

#### 4.3.5 Foundation Notes

1. The above recommended bearing pressure for conventional spread foundations is valid only when the base of excavation for foundation have been thoroughly hand-cleaned to remove all loose, wet, organic and disturbed materials prior to pouring concrete.

2. The above recommendations apply only to the actual borehole locations. Variations may be present beyond these locations. Should significant variations become evident during construction, it may be necessary to re-evaluate the recommendations of this report.

3. The base of all excavations for foundations must be examined and approved by an engineer from our office prior to pouring concrete in order to verify the presence of competent, natural subsoils or bedrock to safely support the design loadings and to confirm adequate founding.

### 4.4 Excavation, Temporary Shoring and Earthworks

#### 4.4.1 General Excavation

1. In general, prior to excavation, it may be anticipated that positive dewatering measures will be necessary due to the presence of water levels ranging from 0.3±m to 2.3±m depths below existing grades in the fill materials at monitoring well locations 1, 2 and 3 in the borehole locations 1, 2 and 6, respectively. It is our opinion that the installation of a vacuum-point dewatering system will be necessary for excavation below existing grade.

2. Excavation must comply with Regulation 213/91 (Construction Projects) under the Ontario Occupational Health and Safety Act.

3. The upper fill materials, may be classified as Type 3 soils, the natural stiff to very stiff, sandy clayey silt subsoils and/or medium dense to very dense, silty sand subsoils and/or medium dense to very dense, gravely silty sand subsoils may be classified as Type 2 soils and shale bedrock may be classified as Type 1 soils as per the Ontario Occupational Health and Safety Act.

4. Within the confines of the project area, the sides of excavations in the upper fill materials and upper native subsoils encountered at the subject site, may be safely cut back 1 horizontal to 1 vertical. Vertical cuts may be safely accomplished with the weathered shale bedrock.

5. Where the above-noted safe cut side of excavation cannot be accomplished within the limits of the subject property, the installation of temporary shoring will be required. With the assumption of excavation approximate to depth of 10±m below existing grades, as described above, it is anticipated that temporary shoring should be required at the subject site. in addition, it will be necessary to evaluate the effects of the proposed excavation on any settlement-sensitive facilities below the adjacent street (i.e. Liverpool Road).

**4. DISCUSSION AND RECOMMENDATIONS** (cont'd)

**4.4 Excavation, Temporary Shoring and Earthworks** (cont'd)

**4.4.1 General Excavation** (cont'd)

6. Prior to commencement of construction, a sedimentation control fence must be installed on the perimeter of the construction area, to minimize the effects of surface erosion on the surrounding area. A typical detail of a sedimentation control fence is shown on Drawing No. 18.

**4.4.2 Temporary Shoring**

1. Where the above-noted safe cut side of excavation cannot be accomplished within the limits of the subject property, the installation of temporary shoring will be required. With the assumption of excavation approximate to depth of 10±m below existing grades, as described above, it is anticipated that temporary shoring should be required at the subject site.

2. The design of temporary shoring system must take into account the presence of any foundation of structures, underground facilities, utilities and services that may be present on the neighbouring properties which must be protected against lateral or downward movements. Where the above facilities are present within the active zone behind the shoring system appropriate parameters must be considered to avoid any harmful movements. The criteria for the adoption of active (i.e. $k_a$) condition and at rest condition (i.e. $k_o$) are given in the Canadian Foundation Engineering Manual (1992), Section 27.1.3.1 (1), as follows:
    i. If moderate wall movements can be permitted, active pressure may be computed using the coefficient of active earth pressure $k_a$.
    ii. If foundations of buildings or services exist at shallow depth at a distance less than H (height of wall) behind the top of the wall and not closer than 0.5H, the pressure should be computed using coefficient of earth pressure, $k = 0.5(k_a+k_o)$.
    iii. If services exist at a shallow depth at a distance less than 0.5H behind the top of the wall, pressure should be computed using the coefficient of earth pressure at rest, $k_o$.
    iv. Above the level of foundations, the earth pressure coefficient $k_a$ may be used.

3. Our recommendations for design of temporary shoring are presented in Appendix "B".

4. Due to the high groundwater levels at the site and the proximity of Lake Ontario and Frenchman's Bay, it is our opinion that temporary shoring system may consist of continuous caisson wall will be required at the subject site.

5. It is recommended that soldier piles are embedded below the base of excavation into natural, weathered shale bedrock.

**4.4.3 Earthworks**

1. Prior to filling and/or backfilling, the exposed subgrade should be thoroughly cleaned to remove all loose, wet, disturbed or organic materials prior to filling.

## 4. DISCUSSION AND RECOMMENDATIONS (cont'd)

### 4.4 Excavation, Temporary Shoring and Earthworks (cont'd)

#### 4.4.3 Earthworks (cont'd)

2. The organic-stained fill materials are not acceptable for use as backfill up to underside of basecourse below the supportive system for slab-on-grade and/or exterior pavement and/or added features.

3. Any regrading carried out up to the underside of basecourses below slab-on-grade or exterior pavement should be carried out using only approved, free draining materials, placed in shallow lifts not exceeding 150mm and compacted to at least 98% Standard Proctor maximum dry density.

4. The fill materials and natural subsoils with clay should not be re-used for backfilling below interior slab-on grade or exterior pavement but may be re-used as backfill below the proposed soft landscape area. Alternatively, imported materials conforming to OPSS Select Subgrade designation may also be used.

5. Backfilling and compaction operations should be inspected by an engineer or technologist from our office, with in-situ density tests carried out to verify that a satisfactory degree of compaction is achieved.

### 4.5 Design of Underground Perimeter Walls and Retaining Walls

1. Underground walls must be adequately damp-proofed and designed to resist an earth pressure, p, in kPa, at any depth, h, in metres, below grade, as given by the following expression:

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

where: $k$ = 0.3, the coefficient of lateral earth pressure
$\gamma$ = $21 kN/m^3$, the unit weight of the drained granular backfill materials to be retained by perimeter walls at other locations
$q$ = in kPa, the equivalent uniform vertical pressure of any surcharge acting

2. The above parameters assume that the retained soil (i.e. wall backfill materials) can be drained effectively to eliminate hydrostatic pressures on the wall as described in Section 4.6, below.

### 4.6 Subsurface Drainage Provisions

1. Underground walls must be positively damp-proofed with perimeter drainage provided to avoid the build-up of hydrostatic pressure on the walls and in addition, underfloor drains should be installed in a grid formation at a maximum spacing of 1.5m to prevent the build-up of hydrostatic pressure on the lowest basement and slab-on-grade in the lowest proposed underground level, as shown on Drawing No. 19. Waterproofing of the perimeter foundation walls up to the regional storm flood level is recommended.

2. Where perimeter foundation walls and retaining walls are to be poured directly against the lagging members of the temporary shoring, the drainage requirements are presented on Drawing No. 19.

## 4. DISCUSSION AND RECOMMENDATIONS (cont'd)

### 4.6 Subsurface Drainage Provisions (cont'd)

3. The above perimeter and underfloor drainage should be led to a positive frost-free sump from which the water can be pumped to an exterior dry well or the municipal sewers.

4. In additional to above, we also recommend that cleanouts are placed at strategic locations to allow for periodic cleaning and washing of the weeping tile of the perimeter drainage and below slab-on-grade to inhibit the clogging of the interior of the pipes.

5. design of the perimeter and subsurface drainage system should be carried out when the rock face at the base of the excavation is exposed at which time a more realistic estimate of total quantity and rate of groundwater flow may be assessed.

### 4.7 Floor Construction

1. Slab-on-grade type of floor construction may be considered for the lowest level and the part of ground level of the proposed structure.

2. The exposed subgrade should be thoroughly cleaned to remove all loose, organic and disturbed materials prior to filling. It is recommended that the placement of a non-woven geotextile be placed over the exposed subgrade to inhibit the migration of the lower, finer materials into the granular basecourses and subsurface drainage.

3. Any regrading carried out up to the underside of basecourses below slab-on-grade should be carried out using only approved, free draining materials, placed in shallow lifts not exceeding 150mm and compacted to at least 98% Standard Proctor maximum dry density. Regrading operations should be inspected by an engineer or technologist from our office, with in-situ density tests carried out to verify that a satisfactory degree of compaction is achieved.

4. Following the successful completion of regrading operations as described in Section 4.4.3, above, the slab-on-grade may be constructed over a minimum thickness of 200mm (8"), well-compacted Granular "A" or 19mm ($^3/_4$") crushed stone.

5. The slab-on-grade should be constructed independently of any structural members (i.e. walls, columns, etc.) by means of fibre board or an equivalent isolation compound. Saw cuts should be provided along column lines, with "diamond" cuts around columns, to minimize uncontrolled cracking of floor slab.

## 5. REPORT LIMITATIONS

1. The information provided and recommendations made in this report, in terms of the thickness, depth and type of subsoils encountered, groundwater levels, etc., are only applicable to the actual locations explored. Subsurface and groundwater conditions between and beyond the borehole locations may differ from those encountered at the borehole locations, and such conditions may become apparent during construction, which could not be detected or anticipated at the time of writing of this report. Should additional information become apparent upon excavation or construction, or further investigation, our office should be contacted so that the situation may be reassessed, and alternate recommendations made, if deemed necessary. It is recommended practice that the Geotechnical Engineer be retained during the construction to confirm that the subsurface conditions across the site do not deviate materially from those encountered in the boreholes.

2. The design recommendations given in this report are applicable only to the project described in the text, and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, it is our recommendation that Haddad Geotechnical Inc. be retained during the final design stage to verify that the design is consistent with our recommendations, and that the assumptions made in our analysis are valid.

3. The comments made in this report relating to potential construction problems and possible methods of construction are intended only for the guidance of the designer. 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. The report has been prepared in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.

4. The information provided and recommendations presented in this report reflect the best judgment of Haddad Geotechnical Inc. 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 or decisions to be based on it are the responsibility of that third party. Haddad Geotechnical Inc. accepts no responsibility for damages, if any suffered by any third party as a result of decisions made or actions based on this report.

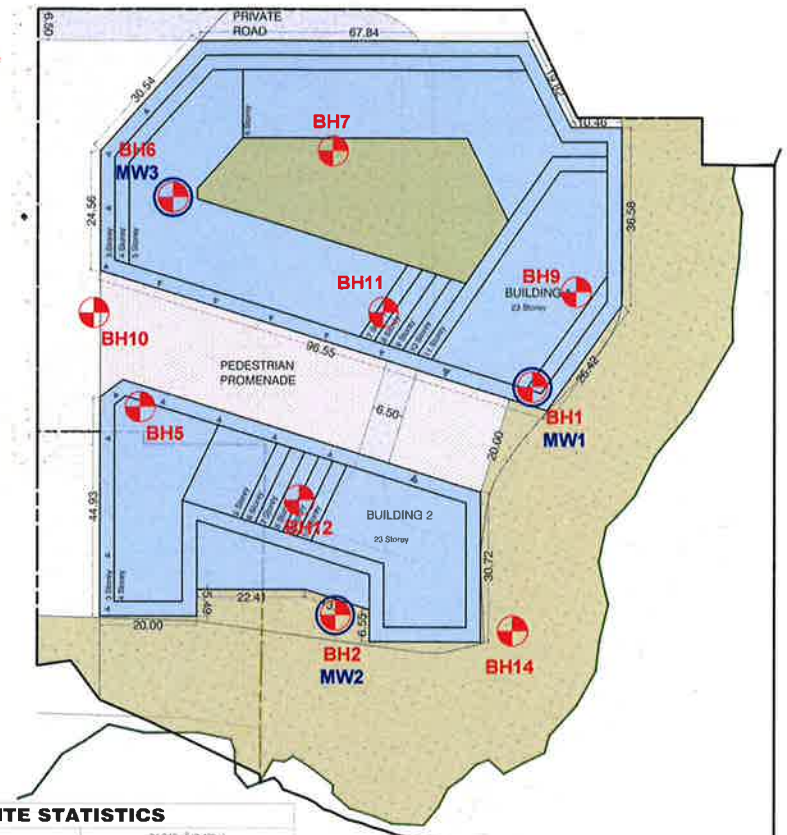
We trust that the information presented in this report satisfies your present requirements. Should you require further information, please contact our office.

Yours very truly,
**HADDAD GEOTECHNICAL INC.**

Damoon Kasemi, M.Sc., P. Eng.

D. Graham Fisher, M.E.Sc., P. Eng.
Encs.
Dist:
Pickering Harbour Company Limited -2 (1 mail & 1 pdf)
c/o The Biglieri Group Ltd.
Toronto and Region Conservation Authority -1 (pdf) ***
City of Pickering, Building Department -1 (pdf) ***
*** To be forwarded by client
File:1611612.591 Liverpool Drive.giss

Reference Point
Top of the catch basin at the east side of Liverpool Road and north side of entrance of the subject site, 76.98 ±m, as per the site plan provided by the client.




## SITE STATISTICS

| | |
|---|---|
| AREA | 24 248m² (2.42ha) |
| TOTAL AREA FROM 20m TOP OF BANK SETBACK | 14,660m² (1.46ha) |
| PROPOSED UNITS | 498 |
| UNITS PER HECTARE | 340 |

### BUILDING STATISTICS

| DESCRIPTION | COMMERCIAL (m²) | RESIDENTIAL (m²) | PUBLIC PARKADE (m²) |
|---|---|---|---|
| BUILDING 1 | - | - | - |
| FLOOR 1 | 1000 | - | 2016 |
| FLOOR 2-16 | - | 35,163 | - |
| BUILDING 2 | - | - | - |
| FLOOR 1 | 900 | - | 5171 |
| FLOOR 2-18 | - | 21,138 | - |
| TOTAL | 1900 | 56,274 | 7187 |

### PARKING STATISTICS

| DESCRIPTION | REQUIRED | PROPOSED UNDERGROUND (2 LEVELS) | PROPOSED ABOVEGROUND (1 LEVEL) |
|---|---|---|---|
| PUBLIC PARKING | 200 | 58 | 142 |
| PRIVATE PARKING | 539 | 539 | - |
| TOTAL PARKING | 739 | 739 | |
| PRIVATE PARKING BY USE | | | |
| RESIDENTIAL @ 0.95 SPACES PER UNIT | 473 | | |
| COMMERCIAL @ 3 SPACES PER 100m² | 66 | | |
| TOTAL | 539 | | |

**Pickering Harbour Concept Plan** | ADDRESS: Pickering Harbour | Project No: 15360 | March 22, 2019 | Designed By: VG+JS | THE BIGLIERI GROUP LTD. Planning | Development | Project Management

BH: APPROXIMATE LOCATION OF BOREHOLES

MW: APPROXIMATE LOCATION OF MONITORING WELLS

SCALE (APPROXIMATE)

0 25 50 75m


HADDAD GEOTECHNICAL INC.
151 Amber Street, Unit 17
Markham, Ontario, Canada, L3R 3B3
905-475-0951, fax: 905-475-8338
info@haddadgeo.com


# 591 LIVERPOOL ROAD, PICKERING

CONCEPTUAL SITE PLAN SHOWING APPROXIMATE LOCATIONS OF BOREHOLES & MONITORING WELLS

SCALE: AS INDICATED
DRAWN BY: DK

PROJECT: 16-11612
DRAWING No. 1
DATE: MARCH 26, 2019

# HADDAD GEOTECHNICAL INC.

Engineering Data Sheet For Borehole No. 1

Project No. 16-11612
Drawing No. 2

Project: Proposed Mixed-Use Development
Location: 591 LIVERPOOL ROAD, PICKERING
Hole Location: see Drawing No. 1
Hole Elevation & Datum: 77.07±m, see Note 1
Start Date: 15/02/2017 | End Date: 15/02/2017 | Field Supervision: SR/GA

Split Spoon
Auger Sample
Shelby Tube
Core Sample
51mm dia Cone
Pocket Penetrometer
Unconfined Compression
Water Level
Vane Test, Sensitivity
51mm dia Split Spoon
Gradation Analysis Completed M

| | Description | Elev. ±m | Depth ±m |
|---|---|---|---|
| BH -1 | GROUND SURFACE MW -1 | 77.07 | 0.0 |
| | GRAVEL SURFACE<br>GRANULAR MATERIALS<br>FILL - medium compact sand and silt, with some gravels, occ. organic stains, brown, moist to very moist | | 1.0 |
| | becomes clayey below 1.5±m depth | 75.6 (05/10/17) | |
| | Layer of dark brown to black Peat in wet condition between 2±m to 2.3±m depth | 74.8 (03/22/17) | 2.0 |
| | SANDY CLAYEY SILT - trace gravels stiff to very stiff, brown, very moist | 74 (upon borehole completion) | 3.0 |
| | | | 4.0 |
| | SILTY SAND - trace to some clay, trace gravels, very dense, brown, moist | 72.5 | 5.0 |
| | | | 6.0 |
| | | | 7.0 |
| | | | 8.0 |
| | SHALE - very dense, weathered, grey, moist | 67.9 | 9.0 |
| | | | 10.0 |
| | START OF CORING | 64.9 | 11.0 |
| | SHALE BEDROCK, grey, fractured, limestone bands with 5±mm thickness throughout | | 12.0 |
| | | | 13.0 |
| | CONTINUED ON DRAWING No. 3 | 63.3 | 14.0 |
| | | | 15.0 |

Strength and Penetration Resistance
C kPa
N (Standard Penetration Value) Blows/300mm
20 40 60 80

| Sample No. | "N" | Moisture Content % | Vapour Reading (ppm) |
|---|---|---|---|
| AS0 | – | 5.9 | 1.2 |
| SS1 | 27 | 5.8 | 0.9 |
| SS2 | 12 | 10.9 | 1.2 |
| SS3 | 15 | 19.9 | 1.1 |
| SS4 | 18 | 13.6 | 0.9 |
| SS5 | 9 | 13.8 | 1.8 |
| SS6 | 59 | 7.4 | 1.8 |
| SS7 | 58 | 6.2 | 3.2 |
| SS8 | 50/6" | 4.9 | 35.0 |
| SS9 | 50/3" | 4.2 | 28.1 |

| RUN NUMBER | RUN LENGTH, m | RECOVERY, % | R.Q.D., % | CORE SIZE / CASING | JOINT SYSTEM | COMMENTS |
|---|---|---|---|---|---|---|
| 1 | 1.70 | 96 | 66.0 | NXL /NW | | fair |

# HADDAD GEOTECHNICAL INC.

Project No. 16-11612
Drawing No. 3

Engineering Data Sheet For Borehole No. 1

Project: Proposed Mixed Use Development

Location: 591 LIVERPOOL ROAD, PICKERING

Hole Location: see Drawing No. 2

Hole Elevation & Datum: 77.07, see Note 1

Start Date: 15/02/2017 | End Date: 15/02/2017 | Field Supervision: SR

Split Spoon | Pocket Penetrometer
Auger Sample | Unconfined Compression
Shelby Tube | Water Level
Core Sample | Vane Test, Sensitivity
51mm dia Cone | 51mm dia Split Spoon
Gradation Analysis Completed M

| Description | Elev. ±m | Depth ±m | RUN NUMBER | RUN LENGTH, m | RECOVERY, % | R.Q.D., % | CORE SIZE / CASING | JOINT SYSTEM | COMMENTS - ROCK QUALITY | Sample No. | "N" | Moisture Content % | Headspace Vapours ppm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONTINUED FROM DRAWING No. 2 | 63.3 | 14.0 | | | | | | | | | | | |
| SHALE BEDROCK, grey, fractured, limestone bands with 5±mm thickness throughout | | 15.0 | 2 | 1.27 | 98 | 72.0 | NXL /NW | | fair | | | | |
| limestone band with 65±mm thickness observed within Run Number 3 | | 16.0 | 3 | 1.52 | 92 | 80.0 | NXL /NW | | good | | | | |
| | | 17.0 | 4 | 1.57 | 98 | 67.8 | NXL /NW | | fair | | | | |
| END OF CORED HOLE | 58.9 | 18.0 | | | | | | | | | | | |
| | | 19.0 | | | | | | | | | | | |
| | | 20.0 | | | | | | | | | | | |
| | | 21.0 | | | | | | | | | | | |
| | | 22.0 | | | | | | | | | | | |
| | | 23.0 | | | | | | | | | | | |
| | | 24.0 | | | | | | | | | | | |
| | | 25.0 | | | | | | | | | | | |
| | | 26.0 | | | | | | | | | | | |
| | | 27.0 | | | | | | | | | | | |
| | | 28.0 | | | | | | | | | | | |
| | | 29.0 | | | | | | | | | | | |

NOTES:
1. Elevation datum, referenced to local datum, top of the Catch Basin at the east side of the Liverpool Road and north side of entrance of the subject site, El. 76.98±m as indicated on Site Plan Drawing No.1, provided by the client.
2. Borehole caved to 11.6±m depth, water rose to 3±m below grade upon completion.
3. Monitoring well installed by Haddad Geotechnical Inc. to depth of 6±m below grade adjacent to the borehole and water level rose to 2.3 ±m and 1.45 ±m below grade after 34 and 84 days, as recorded, respectively.

# HADDAD GEOTECHNICAL INC.

Engineering Data Sheet For Borehole No. 2

Project No. 16-11612
Drawing No. 4

Project: Proposed Mixed-Use Development
Location: 591 Liverpool Road, Pickering
Hole Location: see Drawing No. 1
Hole Elevation & Datum: 77.1±m, see Note 1
Start Date: 13/02/2017 | End Date: 13/02/2017 | Field Supervision: SR

Split Spoon
Auger Sample
Shelby Tube
Core Sample
51mm dia Cone
Pocket Penetrometer
Unconfined Compression
Water Level
Vane Test, Sensitivity
51mm dia Split Spoon
Gradation Analysis Completed M

| | Description | Elev. ±m | Depth ±m | Sample No. | "N" | Moisture Content % | Vapour Reading (ppm) |
|---|---|---|---|---|---|---|---|
| BH2 | GROUND SURFACE MW2 | 77.1 | 0.0 | | | | |
| | GRAVEL SURFACE<br>FILL - loose to medium compact gravely sand with some silt, brown, moist | 76.8 (05/10/17) | | AS0 | – | 8.1 | |
| | FILL - medium compact silt and clay, with trace to some sand, occ. gravel, occ. roots, occ. organic stains, brown to grey, moist to very moist | | 1.0 | SS1 | 17 | 11.5 | 1.1 |
| | | 75.2 (03/22/17) | 2.0 | SS2 | 4 | 13.7 | 3.6 |
| | Layer of dark brown to black Peat in wet condition between 2.3±m to 2.5±m depth | | | SS3 | 7 | 10.7 | 30.2 |
| | | | 3.0 | SS4 | 33 | 8.7 | 17.9 |
| | | 73 | 4.0 | SS5 | 61 | 5.6 | 5.4 |
| | SILTY SAND - trace to some clay, trace gravels, very dense, occ. oxidized seams/pockets, brown, moist | 72.5 (upon borehole completion) | | SS6 | 50/6" | 8.7 | 5.9 |
| | | | 5.0 | | | | |
| | | 71 | 6.0 | | | | |
| | GRAVELLY SAND, some silt, trace clay, very dense, grey, moist to very moist | | | SS7 | 58 | 8.1 | 3.1 |
| | occ. shale fragments below 7.5±m depth | | 7.0 | | | | |
| | Layer of stiff to very stiff wet clay between 8±m to 8.2±m depth | | 8.0 | SS8 | 15 | 6.0 | 3.6 |
| | | | 9.0 | SS9 | 50/6" | 1.3 | 3.1 |
| | | | 10.0 | | | | |
| | SHALE - very dense, weathered, grey, moist | 66.4 | 11.0 | SS10 | 50/3" | 6.1 | 10.8 |
| | | | 12.0 | SS11 | 50/3" | - | 11.9 |
| | END OF BOREHOLE | 64.8 | | | | | |
| | | | 13.0 | | | | |
| | | | 14.0 | | | | |
| | | | 15.0 | | | | |

Strength and Penetration Resistance
C kPa
N (Standard Penetration Value) Blows/300mm
20 40 60 80

NOTES:
1. Elevation datum, referenced to local datum, top of the Catch Basin at the east side of the Liverpool Road and north side of entrance of the subject site, El. 76.98±m as indicated on Site Plan Drawing No.1, provided by the client .
2. Borehole caved to 5.8±m depth, water rose to 4.6±m below grade upon completion.
3. Monitoring well installed by Haddad Geotechnical Inc. to depth of 5.8±m below grade adjacent to the borehole and water level rose to 1.86±m and 0.32±m below grade after 36 and 86 days, as recorded, respectively.

# HADDAD GEOTECHNICAL INC.

Engineering Data Sheet For Borehole No. 5

Project No. 16-11612
Drawing No. 5

Project: Proposed Mixed-Use Development
Location: 591 Liverpool Road, Pickering
Hole Location: see Drawing No. 1
Hole Elevation & Datum: 76.33±m, see Note 1
Start Date: 16/02/2017 | End Date: 16/02/2017 | Field Supervision: SR

Split Spoon
Auger Sample
Shelby Tube
Core Sample
51mm dia Cone
Pocket Penetrometer
Unconfined Compression
Water Level
Vane Test, Sensitivity
51mm dia Split Spoon
Gradation Analysis Completed M

| Description | Elev. ±m | Depth ±m | Sample No. | "N" | Moisture Content % | Vapour Reading (ppm) |
|---|---|---|---|---|---|---|
| GROUND SURFACE | 76.33 | 0.0 | | | | |
| GRAVEL SURFACE<br>FILL - sand and gravel with some silt and some clay, dark brown very moist | | | AS0 | - | 5.9 | 3.5 |
| FILL - medium compact silt and clay, occ. gravel, occ. organic stains, dark brown to brown, moist to very moist | | 1.0 | SS1 | 13 | 22.2 | 2.1 |
| | | 2.0 | SS2 | 26 | 13.9 | 1.9 |
| | 74.1 | | | | | |
| SILTY SAND - some gravel, some clay, dense to very dense, occ. oxidized seams, brown, moist to very moist | | | M SS3 | 60 | 8.5 | 2.3 |
| | | 3.0 | SS4 | 50/6" | 7.7 | 2.5 |
| becomes grey below 4±m depth | | 4.0 | SS5 | 30 | 7.2 | 2.9 |
| occ. wet seams below 5±m depth | | 5.0 | SS6 | 43 | 6.2 | 3.4 |
| ▼ | 70.5 | | | | | |
| | | 6.0 | SS7 | 52 | 11.1 | 2.6 |
| | | 7.0 | | | | |
| | | 8.0 | SS8 | 50/6" | 9.1 | 3.5 |
| | 68.3 | | | | | |
| SHALE - very dense, weathered, grey, moist to very moist | | 9.0 | SS9 | 50/3" | 14.4 | 14.2 |
| | | 10.0 | SS10 | 50/2" | 12.6 | 20.1 |
| | | 11.0 | | | | |
| | | 12.0 | SS11 | 50/2" | 14.8 | 19.8 |
| END OF BOREHOLE | 64.1 | | | | | |
| | | 13.0 | | | | |
| | | 14.0 | | | | |
| | | 15.0 | | | | |

Strength and Penetration Resistance
c kPa
N (Standard Penetration Value) Blows/300mm
20 40 60 80

NOTES:
1. Elevation datum, referenced to local datum, top of the Catch Basin at the east side of the Liverpool Road and north side of entrance of the subject site, El. 76.98±m as indicated on Site Plan Drawing No.1, provided by the client.
2. Borehole caved to 11±m depth, water rose to 5.8±m below existing grade upon completion.

# HADDAD GEOTECHNICAL INC.

Engineering Data Sheet For Borehole No. 6

Project No. 16-11612
Drawing No. 6

Project: Proposed Mixed-Use Development
Location: 591 Liverpool Road, Pickering
Hole Location: see Drawing No. 1
Hole Elevation & Datum: 77.07±m, see Note 1
Start Date: 14/02/2017 | End Date: 14/02/2017 | Field Supervision: SR

Split Spoon
Auger Sample
Shelby Tube
Core Sample
51mm dia Cone
Pocket Penetrometer
Unconfined Compression
Water Level
Vane Test, Sensitivity
51mm dia Split Spoon
Gradation Analysis Completed M

| | Description | Elev. ±m | Depth ±m | Sample No. | "N" | Moisture Content % | Vapour Reading (ppm) |
|---|---|---|---|---|---|---|---|
| BH6 | GROUND SURFACE | 77.07 | 0.0 | | | | |
| | FILL - medium compact silt and clay with some sand, occ. gravel, occ. oxidized pockets, brown, moist to very moist | | | AS0 | – | 13.3 | 1.4 |
| | | | 1.0 | SS1 | 15 | 11.0 | 1.6 |
| | | 75.2 (03/22/17) | 2.0 | SS2 | 15 | 8.0 | 0.9 |
| | SILTY SAND - some gravel, trace to some clay, medium dense to dense, occ. shale fragments, occ. oxidized seams, brown, moist to very moist | 74.7 | | SS3 | 50/6" | 7.7 | 1.1 |
| | | 73.7 (upon borehole completion) | 3.0 | SS4 | 45 | 6.4 | 0.8 |
| | becomes grey below 3.5±m depth | | 4.0 | SS5 | 36 | 6.1 | 1.6 |
| | | | 5.0 | SS6 | 29 | 7.0 | 36.1 |
| | | | 6.0 | SS7 | 26 | 10.9 | 17.4 |
| | becomes very dense and occ. shale fragments below 7.5±m depth | | 7.0 | SS8 | 50/6" | 7.3 | 13.2 |
| | | 67.9 | 8.0 | | | | |
| | SHALE - very dense, weathered, grey, moist to very moist | | 9.0 | SS9 | 50/3" | 11.4 | 5.2 |
| | | | 10.0 | | | | |
| | | | 11.0 | SS10 | 50/2" | 10.2 | 8.2 |
| | END OF BOREHOLE | 64.9 | 12.0 | SS11 | 50/1" | 14.9 | 7.1 |
| | | | 13.0 | | | | |
| | | | 14.0 | | | | |
| | | | 15.0 | | | | |

Strength and Penetration Resistance
C kPa
N (Standard Penetration Value) Blows/300mm
20 40 60 80

NOTES:
1. Elevation datum, referenced to local datum, top of the Catch Basin at the east side of the Liverpool Road and north side of entrance of the subject site, El. 76.98±m as indicated on Site Plan Drawing No.1, provided by the client.
2. Borehole caved to 11±m depth, water rose to 3.35±m below grade upon completion.
3. Monitoring well installed by Haddad Geotechnical Inc. to depth of 6.2±m below grade adjacent to the borehole and water level rose to 1.87 ±m below grade after 35 days, as recorded.

# HADDAD GEOTECHNICAL INC.

Engineering Data Sheet For Borehole No. 7

Project No. 16-11612
Drawing No. 7

Project: Proposed Mixed-Use Development
Location: 591 Liverpool Road, Pickering
Hole Location: see Drawing No. 1
Hole Elevation & Datum: 76.86±m, see Note 1
Start Date: 14/02/2017 | End Date: 14/02/2017 | Field Supervision: SR

Split Spoon
Auger Sample
Shelby Tube
Core Sample
51mm dia Cone
Pocket Penetrometer
Unconfined Compression
Water Level
Vane Test, Sensitivity
51mm dia Split Spoon
Gradation Analysis Completed M

| Description | Elev. ±m | Depth ±m | Sample No. | "N" | Moisture Content % | Vapour Reading (ppm) |
|---|---|---|---|---|---|---|
| GROUND SURFACE | 76.86 | 0.0 | | | | |
| TOP SOIL<br>FILL - loose to medium compact silt and clay with some sand, occ. gravel, occ. organic stains, occ. oxidized seams, brown, very moist to wet | | 1.0 | AS0 | - | 21.9 | 25 |
| | | 2.0 | SS1 | 15 | 25.3 | 1.0 |
| | | | SS2 | 8 | 7.3 | 1.4 |
| | 74.2 | 3.0 | SS3 | 26 | 14.3 | 1.2 |
| GRAVELY SILTY SAND - trace clay, medium dense to dense, occ. oxidized seams, grey, moist | 73.8 | | SS4 | 23 | 2.9 | 1.3 |
| | | 4.0 | SS5 | 45 | 5.8 | 1.2 |
| occ. wet seams below 4.5±m depth | | 5.0 | SS6 | 46 | 5.6 | 2.6 |
| becomes very dense below 6±m depth | | 6.0 | SS7 | 50/6" | 5.1 | 2.4 |
| | 69.2 | 7.0 | | | | |
| SHALE - very dense, weathered, grey, moist to very moist | | 8.0 | SS8 | 50/6" | 4.3 | 3.6 |
| | | 9.0 | SS9 | 50/2" | 10.7 | 1.2 |
| | | 10.0 | | | | |
| | | 11.0 | SS10 | 50/2" | 10.3 | 2.3 |
| | | 12.0 | | | | |
| END OF BOREHOLE | 64.6 | | SS11 | 50/2" | 11.5 | 1.6 |
| | | 13.0 | | | | |
| | | 14.0 | | | | |
| | | 15.0 | | | | |

Strength and Penetration Resistance
C kPa
N (Standard Penetration Value) Blows/300mm
20 40 60 80

NOTES:
1. Elevation datum, referenced to local datum, top of the Catch Basin at the east side of the Liverpool Road and north side of entrance of the subject site, El. 76.98±m as indicated on Site Plan Drawing No.1, provided by the client.
2. Borehole open to 12.2±m depth and water rose to 3±m below existing grade upon completion.

# HADDAD GEOTECHNICAL INC.

Engineering Data Sheet For Borehole No. 9

Project No. 16-11612
Drawing No. 8

Project: Proposed Mixed-Use Development
Location: 591 Liverpool Road, Pickering
Hole Location: see Drawing No. 1
Hole Elevation & Datum: 77.19±m, see Note 1
Start Date: 13/02/2017 | End Date: 13/02/2017 | Field Supervision: SR

Split Spoon
Auger Sample
Shelby Tube
Core Sample
51mm dia Cone
Pocket Penetrometer
Unconfined Compression
Water Level
Vane Test, Sensitivity
51mm dia Split Spoon
Gradation Analysis Completed M

| Description | Elev. ±m | Depth ±m | Strength and Penetration Resistance C kPa / N (Standard Penetration Value) Blows/300mm 20 40 60 80 | Sample No. | "N" | Moisture Content % | Vapour Reading (ppm) |
|---|---|---|---|---|---|---|---|
| GROUND SURFACE | 77.19 | 0.0 | | | | | |
| TOP SOIL<br>FILL - loose to medium compact silt and clay with some sand, occ. gravel, occ. organic stains, occ. oxidized seams, dark brown, very moist to wet | | | | AS0 | - | 10.9 | 1.2 |
| | | 1.0 | | SS1 | 13 | 13.2 | 1.5 |
| Layers of dark brown to black Peat in wet condition below 4.5±m depth | | 2.0 | | SS2 | 14 | 16.2 | 1.6 |
| | | 3.0 | | SS3 | 7 | 23.7 | 1.8 |
| | | | | SS4 | 4 | 30.9 | 1.8 |
| | 73 | 4.0 | | SS5 | 27 | 13.9 | 1.5 |
| GRAVELY SILTY SAND - trace clay, medium dense to very dense, occ. shale fragments, occ. oxidized seams, brown to grey, moist | | 5.0 | | SS6 | 79 | 5.7 | 3.8 |
| | 71.1 | 6.0 | | SS7 | 50/6" | 4.3 | 1.7 |
| SAND & SILT - some gravel, some clay, very dense, occ. shale fragments, grey, moist | | 7.0 | | | | | |
| | | 8.0 | | SS8 | 50/6" | 7.1 | 4.3 |
| | 68 | 9.0 | | SS9 | 50/2" | 10.8 | 47.2 |
| SHALE - very dense, weathered, grey, moist to very moist | | 10.0 | | | | | |
| ▽ | 66.5 | | | SS10 | 50/2" | 4.0 | 20.6 |
| | | 11.0 | | | | | |
| END OF BOREHOLE | 65 | 12.0 | | SS11 | 50/1" | 12.4 | 3.8 |
| | | 13.0 | | | | | |
| | | 14.0 | | | | | |
| | | 15.0 | | | | | |

NOTES:
1. Elevation datum, referenced to local datum, top of the Catch Basin at the east side of the Liverpool Road and north side of entrance of the subject site, El. 76.98±m as indicated on Site Plan Drawing No.1, provided by the client.
2. Borehole open to 12.2±m depth and water rose to 10.7±m below existing grade upon completion.

# HADDAD GEOTECHNICAL INC.

Engineering Data Sheet For Borehole No. 10

Project No. 16-11612
Drawing No. 9

Project: Proposed Mixed-Use Development
Location: 591 Liverpool Road, Pickering
Hole Location: see Drawing No. 1
Hole Elevation & Datum: 77.1±m, see Note 1
Start Date: 16/02/2017 | End Date: 16/02/2017 | Field Supervision: SR

Split Spoon
Auger Sample
Shelby Tube
Core Sample
51mm dia Cone
Pocket Penetrometer
Unconfined Compression
Water Level
Vane Test, Sensitivity
51mm dia Split Spoon
Gradation Analysis Completed M

| Description | Elev. ±m | Depth ±m | Sample No. | "N" | Moisture Content % | Vapour Reading (ppm) |
|---|---|---|---|---|---|---|
| GROUND SURFACE | 77.1 | 0.0 | | | | |
| GRAVEL SURFACE<br>FILL - loose to medium compact silt and sand with some clay and trace gravels, occ. organic stains, occ. roots, brown, very moist | | | AS0 | - | 11.6 | 2.6 |
| | | 1.0 | SS1 | 16 | 13.5 | 1.7 |
| | | 2.0 | SS2 | 13 | 14.9 | 2.6 |
| | | | SS3 | 6 | 12.8 | 2.1 |
| | | 3.0 | SS4 | 22 | 7.5 | 2.1 |
| SILTY SAND - some gravel, some clay, medium dense, brown to grey, moist | 73.7 | 4.0 | SS5 | 18 | 9.8 | .2.1 |
| | | | SS6 | 31 | 7.7 | 2.1 |
| END OF BOREHOLE | 71.9 | 5.0 | | | | |
| NOTES:<br>1. Elevation datum, referenced to local datum, top of the Catch Basin at the east side of the Liverpool Road and north side of entrance of the subject site, El. 76.98±m as indicated on Site Plan Drawing No.1, provided by the client.<br>2. Borehole open and dry to 5.2±m depth, below existing grade upon completion. | | 6.0<br>7.0<br>8.0<br>9.0<br>10.0<br>11.0<br>12.0<br>13.0<br>14.0<br>15.0 | | | | |

Strength and Penetration Resistance
C kPa
N (Standard Penetration Value) Blows/300mm
20 40 60 80

# HADDAD GEOTECHNICAL INC.

Engineering Data Sheet For Borehole No. 11

Project No. 16-11612
Drawing No. 10

Project: Proposed Mixed-Use Development
Location: 591 Liverpool Road, Pickering
Hole Location: see Drawing No. 1
Hole Elevation & Datum: 76.41±m, see Note 1
Start Date: 14/02/2017 | End Date: 14/02/2017 | Field Supervision: SR

Split Spoon
Auger Sample
Shelby Tube
Core Sample
51mm dia Cone
Pocket Penetrometer
Unconfined Compression
Water Level
Vane Test, Sensitivity
51mm dia Split Spoon
Gradation Analysis Completed M

| Description | Elev. ±m | Depth ±m | Sample No. | "N" | Moisture Content % | Vapour Reading (ppm) |
|---|---|---|---|---|---|---|
| GROUND SURFACE | 76.41 | 0.0 | | | | |
| GRAVEL SURFACE<br>FILL - sand with some gravels, brown very moist to wet | | | AS0 | - | 7.4 | 1.1 |
| FILL - loose to medium compact silt and clay with some sand, occ. gravels, occ. oxidized pockets, brown, wet | 75.2 | 1.0 | SS1 | 12 | 14.6 | 1.2 |
| | | 2.0 | SS2 | 8 | 13.9 | 1.0 |
| | 73.8 | | SS3 | 20 | 12.9 | 1.4 |
| SILTY SAND - some gravel, some clay, medium dense to very dense, brown, moist | | 3.0 | SS4 | 85 | 8.3 | 1.4 |
| becomes grey below 4±m depth | | 4.0 | SS5 | 53 | 7.4 | 1.0 |
| occ. shale fragments below 4.5±m depth | | | SS6 | 50/6" | 4.3 | 1.5 |
| END OF BOREHOLE | 71.5 | 5.0 | | | | |
| | | 6.0 | | | | |
| | | 7.0 | | | | |
| | | 8.0 | | | | |
| | | 9.0 | | | | |
| | | 10.0 | | | | |
| | | 11.0 | | | | |
| | | 12.0 | | | | |
| | | 13.0 | | | | |
| | | 14.0 | | | | |
| | | 15.0 | | | | |

Strength and Penetration Resistance
C kPa
N (Standard Penetration Value) Blows/300mm
20 40 60 80

NOTES:
1. Elevation datum, referenced to local datum, top of the Catch Basin at the east side of the Liverpool Road and north side of entrance of the subject site, El. 76.98±m as indicated on Site Plan Drawing No.1, provided by the client.
2. Borehole caved to 1.2±m depth below existing grade and wet at its base upon completion.

# HADDAD GEOTECHNICAL INC.

Engineering Data Sheet For Borehole No. 12

Project No. 16-11612
Drawing No. 11

Project: Proposed Mixed-Use Development
Location: 591 Liverpool Road, Pickering
Hole Location: see Drawing No. 1
Hole Elevation & Datum: 76.84 ±m, see Note 1
Start Date: 13/02/2017 | End Date: 13/02/2017 | Field Supervision: SR

Split Spoon
Auger Sample
Shelby Tube
Core Sample
51mm dia Cone
Pocket Penetrometer
Unconfined Compression
Water Level
Vane Test, Sensitivity
51mm dia Split Spoon
Gradation Analysis Completed M

| Description | Elev. ±m | Depth ±m | Sample No. | "N" | Moisture Content % | Vapour Reading (ppm) |
|---|---|---|---|---|---|---|
| GROUND SURFACE | 76.84 | 0.0 | | | | |
| GRAVEL SURFACE<br>FILL - loose silt and clay with some sand, occ. gravels, occ. roots, occ. organic stains, brown to grey, moist to very moist | | | AS0 | - | 9.7 | 3.1 |
| | | 1.0 | SS1 | 15 | 11.9 | 7.9 |
| Layers of dark brown to black Peat in wet condition below 2±m depth | | 2.0 | SS2 | 9 | 17.0 | 3.2 |
| | | | SS3 | 10 | 14.2 | 16.4 |
| | 73.8 | 3.0 | | | | |
| | | | SS4 | 20 | 11.0 | 1.9 |
| | 73 | | | | | |
| SILTY SAND - some gravel, some clay, very dense, occ. shale fragments, brown to grey, moist | | 4.0 | SS5 | 60 | 7.1 | 50.6 |
| | | | SS6 | 50/6" | 7.8 | 1.1 |
| END OF BOREHOLE | 71.9 | 5.0 | | | | |
| | | 6.0 | | | | |
| | | 7.0 | | | | |
| | | 8.0 | | | | |
| | | 9.0 | | | | |
| | | 10.0 | | | | |
| | | 11.0 | | | | |
| | | 12.0 | | | | |
| | | 13.0 | | | | |
| | | 14.0 | | | | |
| | | 15.0 | | | | |

Strength and Penetration Resistance
C kPa
N (Standard Penetration Value) Blows/300mm
20 40 60 80

NOTES:
1. Elevation datum, referenced to local datum, top of the Catch Basin at the east side of the Liverpool Road and north side of entrance of the subject site, El. 76.98±m as indicated on Site Plan Drawing No.1, provided by the client.
2. Borehole open to 4.9±m depth and water rose to 3±m below existing grade upon completion.

# HADDAD GEOTECHNICAL INC.

Engineering Data Sheet For Borehole No. 14

Project No. 16-11612
Drawing No. 12

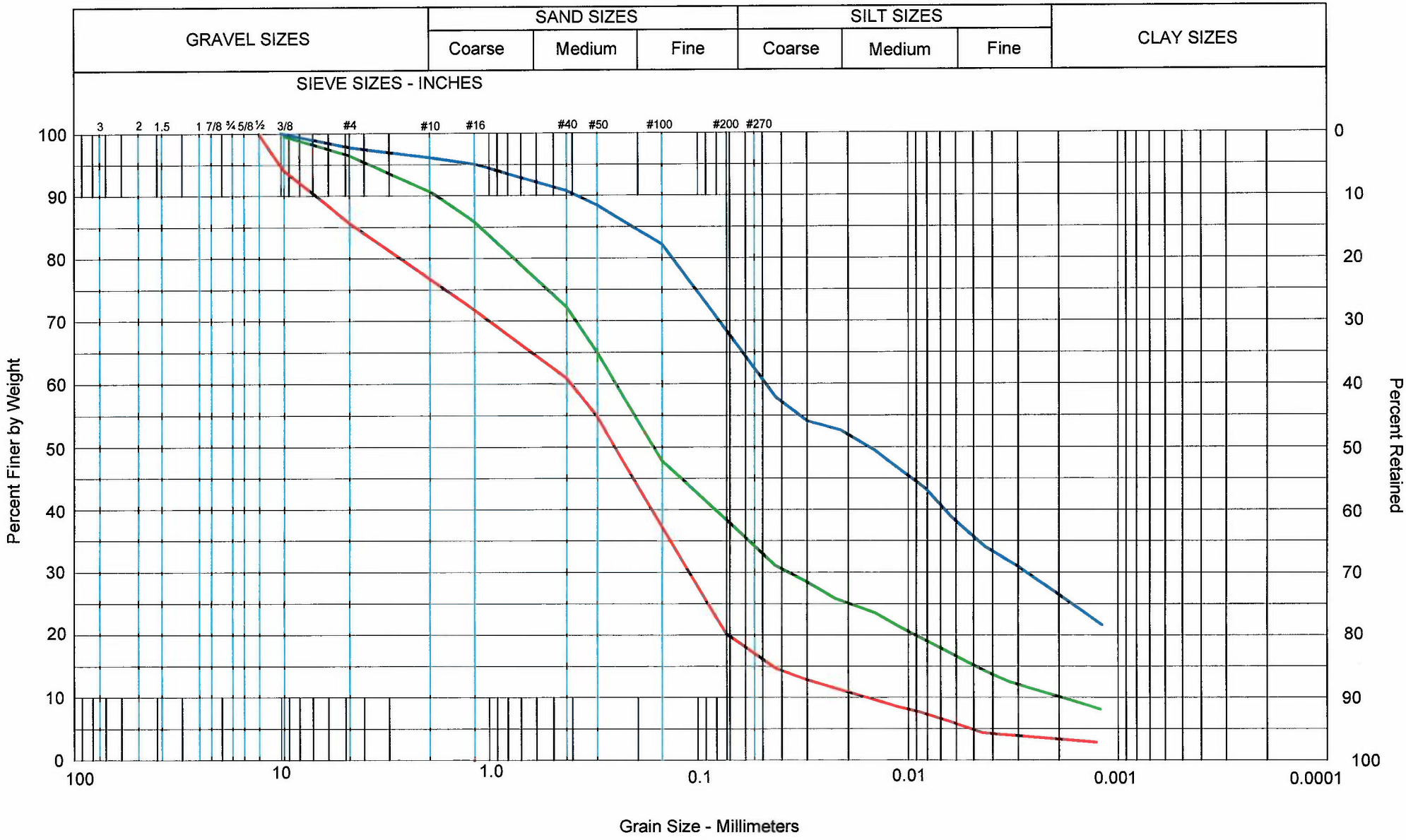
Project: Proposed Mixed-Use Development
Location: 591 Liverpool Road, Pickering
Hole Location: see Drawing No. 1
Hole Elevation & Datum: 77 ±m, see Note 1
Start Date: 13/02/2017 | End Date: 13/02/2017 | Field Supervision: SR

Split Spoon
Auger Sample
Shelby Tube
Core Sample
51mm dia Cone
Pocket Penetrometer
Unconfined Compression
Water Level
Vane Test, Sensitivity
51mm dia Split Spoon
Gradation Analysis Completed M

| Description | Elev. ±m | Depth ±m | Sample No. | "N" | Moisture Content % | Vapour Reading (ppm) |
|---|---|---|---|---|---|---|
| GROUND SURFACE | 77.0 | 0.0 | | | | |
| GRANULAR MATERIALS<br>FILL - loose to medium compact gravely sand with some silt, occ. organic stains, brown, very moist to wet | | | AS0 | - | 9.8 | 2.7 |
| | | 1.0 | M SS1 | 12 | 15.2 | 1.3 |
| | | 2.0 | SS2 | 8 | 13.4 | 2.6 |
| FILL - loose silt and clay with some sand, occ. gravels, occ. roots, occ. oxidized seams, brown to grey, very moist | | | SS3 | 6 | 30.4 | 2.4 |
| Layers of dark brown to black Peat in wet condition below 3±m depth | | 3.0 | SS4 | 7 | 38.9 | 2.8 |
| | 73 | 4.0 | SS5 | 31 | 8.8 | 4.2 |
| SILTY SAND - some gravel, some clay, medium dense to very dense, brown to grey, moist | 72.6 | | | | | |
| END OF BOREHOLE | 72 | 5.0 | SS6 | 50/6" | 8.1 | 0 |
| | | 6.0 | | | | |
| | | 7.0 | | | | |
| | | 8.0 | | | | |
| | | 9.0 | | | | |
| | | 10.0 | | | | |
| | | 11.0 | | | | |
| | | 12.0 | | | | |
| | | 13.0 | | | | |
| | | 14.0 | | | | |
| | | 15.0 | | | | |

Strength and Penetration Resistance
C kPa
N (Standard Penetration Value) Blows/300mm
20 40 60 80

NOTES:
1. Elevation datum, referenced to local datum, top of the Catch Basin at the east side of the Liverpool Road and north side of entrance of the subject site, El. 76.98±m as indicated on Site Plan Drawing No.1, provided by the client.
2. Borehole open to 5±m depth and water rose to 4.4±m below existing grade upon completion.




BH1 SS4 - (3±m to 3.6±m) (4% Gravel, 30% Sand, 39% Silt, 27% Clay)

BH1 SS7 - (6.1±m to 6.7±m) (9% Gravel, 54% Sand, 27% Silt, 10% Clay)

BH2 SS7 - (6.1±m to 6.7±m) (23% Gravel, 58% Sand, 16% Silt, 3% Clay)

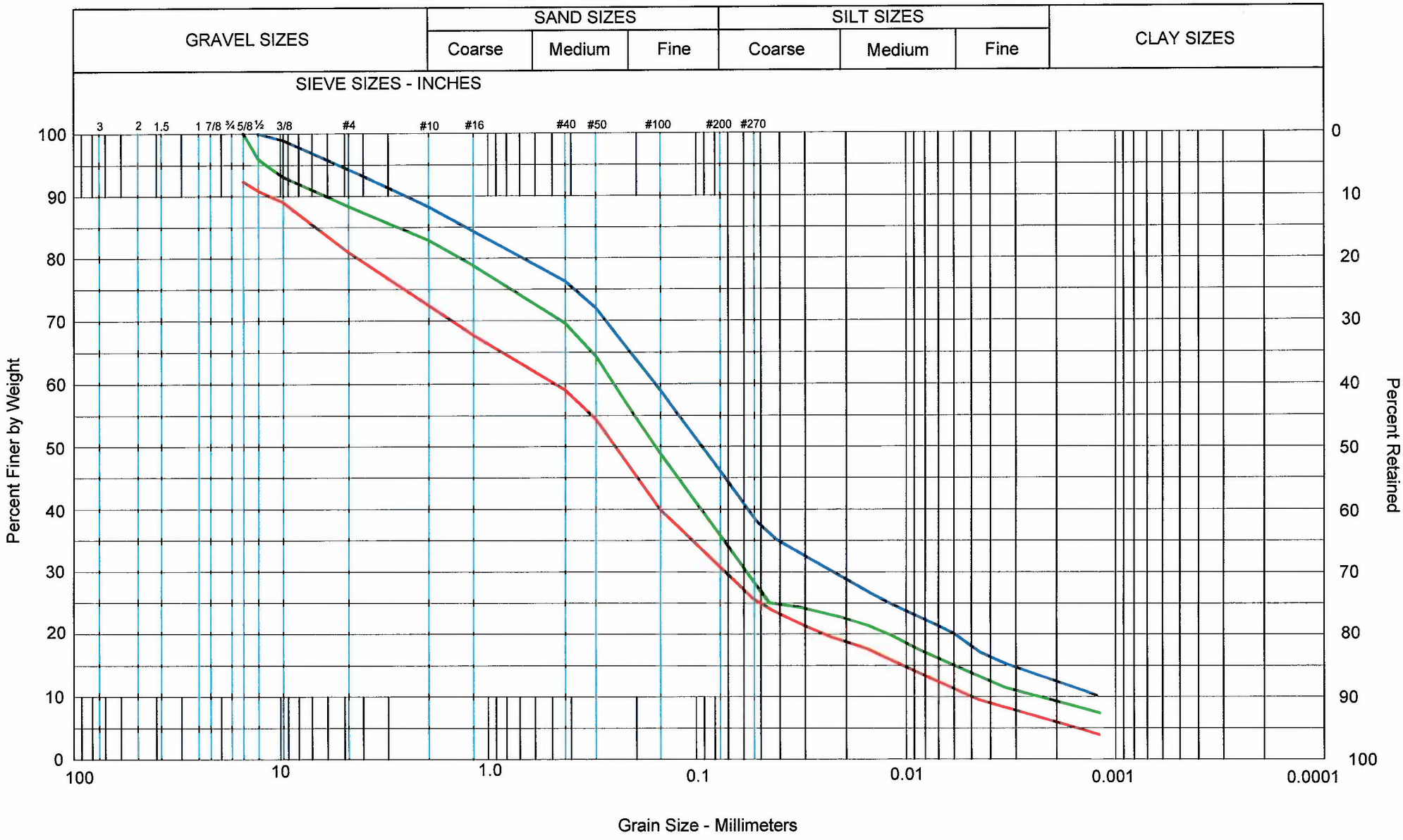
HADDAD GEOTECHNICAL INC.
151 Amber Street, Unit 17, 18
Markham, Ontario L3R 3B3
phone: 905-475-0951, fax: 905-475-8338
info@haddadgeo.com

591 LIVERPOOL ROAD, PICKERING

GRADATION ANALYSES A.S.T.M. D422
NATIVE SUBSOILS

SCALE: AS INDICATED
DRAWN BY: CF

PROJECT: 16-11612
DRAWING No. 13
DATE: MARCH 22, 2017




BH5 SS3 - (2.3±m to 2.9±m) (12% Gravel, 42% Sand, 33% Silt, 13% Clay)

BH6 SS4 - (3±m to 3.6±m) (17% Gravel, 47% Sand, 27% Silt, 9% Clay)

BH7 SS7 - (6±m to 6.6±m) (27% Gravel, 43% Sand, 24% Silt, 6% Clay)

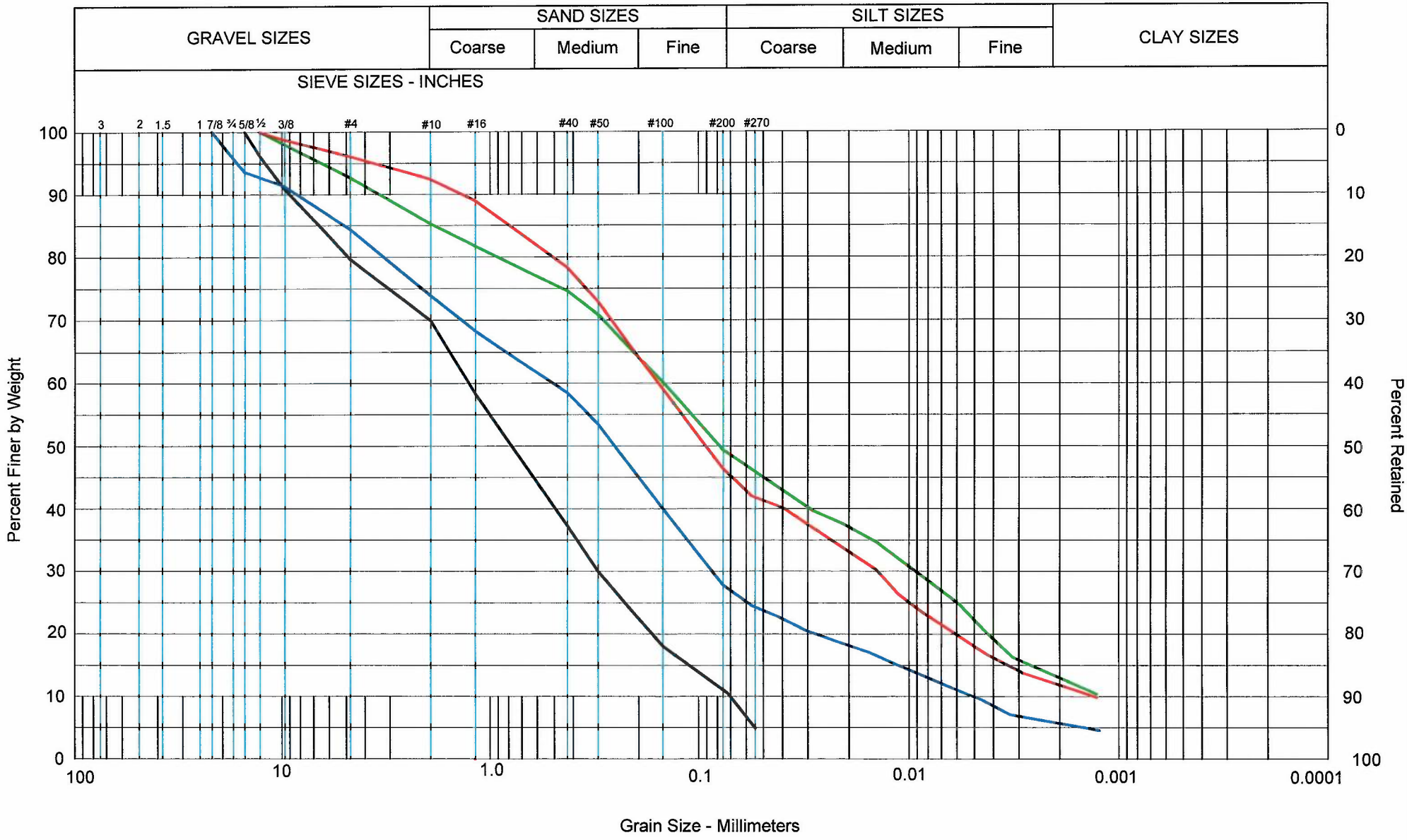
HADDAD GEOTECHNICAL INC.
151 Amber Street, Unit 17, 18
Markham, Ontario L3R 3B3
phone: 905-475-0951, fax: 905-475-8338
info@haddadgeo.com

591 LIVERPOOL ROAD, PICKERING

GRADATION ANALYSES A.S.T.M. D422
NATIVE SUBSOILS

SCALE: AS INDICATED
DRAWN BY: CF

PROJECT: 16-11612
DRAWING No. 14
DATE: MARCH 29, 2017




BH9 SS6 - (4.5±m to 5.1±m) (26% Gravel, 47% Sand, 21% Silt, 6% Clay)

BH9 SS8 - (7.5±m to 8±m) (15% Gravel, 36% Sand, 36% Silt, 13% Clay)

BH10 SS1 - (0.8±m to 1.4±m) (8% Gravel, 46% Sand, 34% Silt, 12% Clay)

BH14 SS1 - (0.8±m to 1.4±m) (30% Gravel, 60% Sand, 10% Silt)

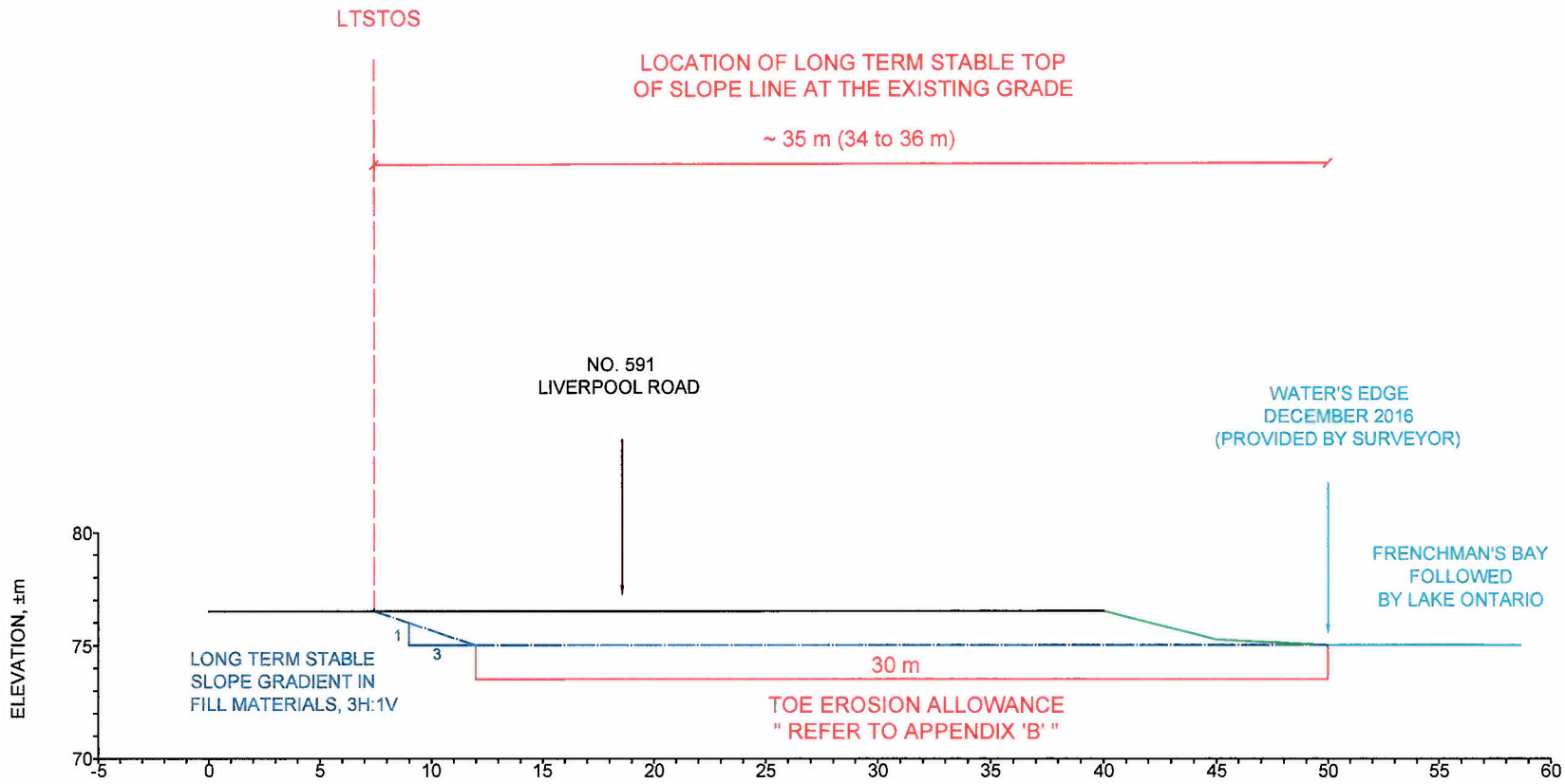
HADDAD GEOTECHNICAL INC.
151 Amber Street, Unit 17, 18
Markham, Ontario L3R 3B3
phone: 905-475-0951, fax: 905-475-8338
info@haddadgeo.com

591 LIVERPOOL ROAD, PICKERING

GRADATION ANALYSES A.S.T.M. D422
NATIVE SUBSOILS

SCALE: AS INDICATED
DRAWN BY: CF

PROJECT: 16-11612
DRAWING No. 15
DATE: MARCH 29, 2017




HORIZONTAL DISTANCE, ±m, THE EXISTING GRADE AT THE SUBJECT PROPERTY, 591 LIVERPOOL ROAD
TOWARDS EAST AND SOUTH TO FRENCHMAN'S BAY FOLLOWED BY LAKE ONTARIO

**Note:**
**100-year flood level and water's edge of Frenchman's Bay followed by Lake Ontario should be approved by TRCA.**

EXISTING GRADE (EXISTING SLOPE SECTION A-A')

LONG TERM STABLE SLOPE GRADIENT

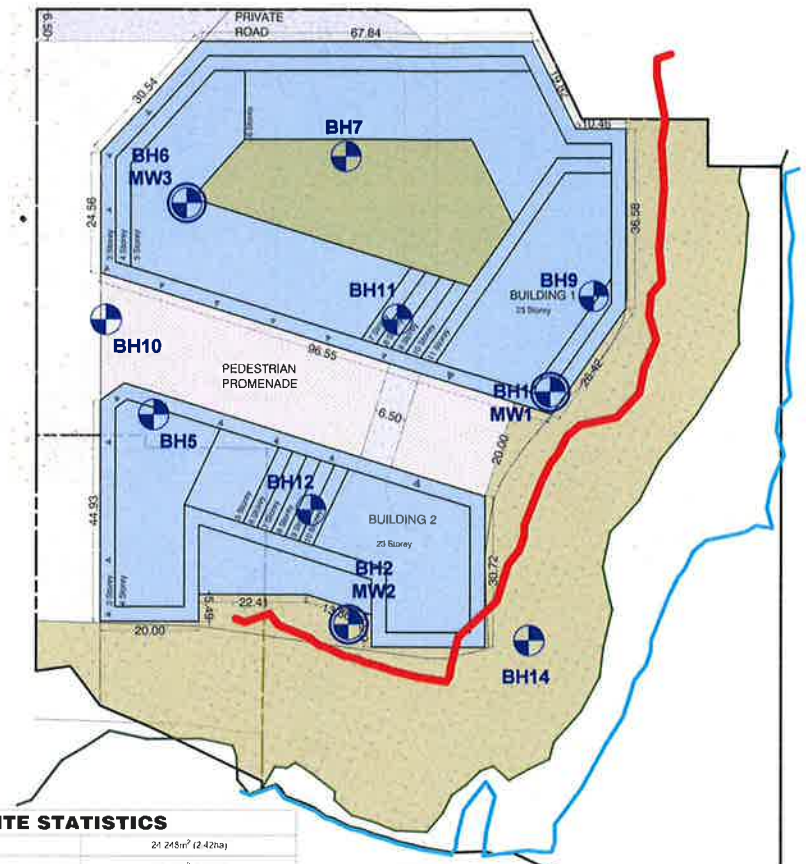

HADDAD GEOTECHNICAL INC.
151 Amber Street, Unit 17,18
Markham, Ontario, Canada, L3R 3B3
905-475-0-951; fax 905-475=-8338
info@haddadgeo.com


# 591 LIVERPOOL ROAD, PICKERING

## SLOPE SECTION A - A'

SCALE: AS INDICATED
DRAWN BY: DK

PROJECT: 16-11612
DRAWING No. 16
DATE: MAY 16, 2017




## SITE STATISTICS

| | |
|---|---|
| AREA | 24 245m² (2.42ha) |
| TOTAL AREA FROM 20m TOP OF BANK SETBACK | 14 660m² (1.46ha) |
| PROPOSED UNITS | 498 |
| UNITS PER HECTARE | 340 |

### BUILDING STATISTICS

| DESCRIPTION | COMMERCIAL (m²) | RESIDENTIAL (m²) | PUBLIC PARKADE (m²) |
|---|---|---|---|
| BUILDING 1 | - | - | - |
| FLOOR 1 | 1000 | - | 2916 |
| FLOOR 2-16 | - | 35 163 | - |
| BUILDING 2 | - | - | - |
| FLOOR 1 | 900 | - | 5171 |
| FLOOR 2-16 | - | 21,133 | - |
| TOTAL | 1900 | 56 274 | 7187 |

### PARKING STATISTICS

| DESCRIPTION | REQUIRED | PROPOSED UNDERGROUND (2 LEVELS) | PROPOSED ABOVE GROUND (1 LEVEL) |
|---|---|---|---|
| PUBLIC PARKING | 200 | 58 | 142 |
| PRIVATE PARKING | 539 | 539 | - |
| TOTAL PARKING | 739 | 739 | |
| PRIVATE PARKING BY USE | | | |
| RESIDENTIAL @ 0.95 SPACES PER UNIT | 473 | | |
| COMMERCIAL @ 3 SPACES PER 100m² | 66 | | |
| TOTAL | 539 | | |

**Pickering Harbour Concept Plan** | ADDRESS: Pickering Harbour | Project No: 15360 | March 22, 2019 | Designed By: VG / JS | THE BIGLIERI GROUP LTD. Planning | Development | Project Management

WATER 'S EDGE OF FRENCHMAN'S BAY FOLLOWED BY LAKE ONTARIO ( as provided by client)

APPROXIMATE LOCATION OF LONG TERM STABLE TOP OF SLOPE LINE

SCALE (APPROXIMATE)

0 25 50 75m

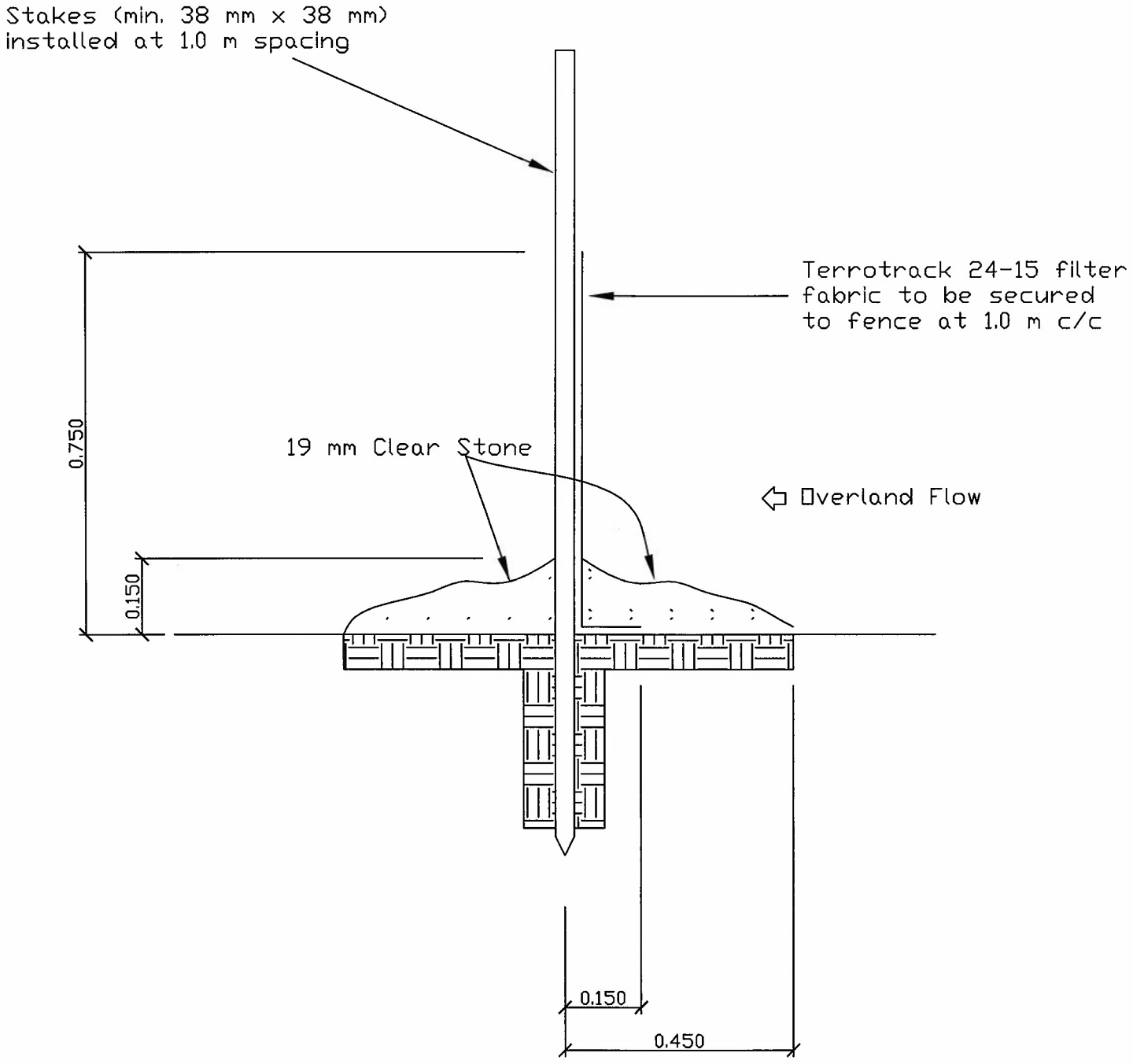

HADDAD GEOTECHNICAL INC.
151 Amber Street, Unit 17
Markham, Ontario, Canada, L3R 3B3
905-475-0951, fax: 905-475-8338
info@haddadgeo.com


# 591 LIVERPOOL ROAD, PICKERING

CONCEPTUAL SITE PLAN SHOWING APPROXIMATE LOCATION OF LONG TERM STABLE TOP OF SLOPE LINE

SCALE: AS INDICATED
DRAWN BY: DK

PROJECT: 16-11612
DRAWING No. 17
DATE: MARCH 26, 2019



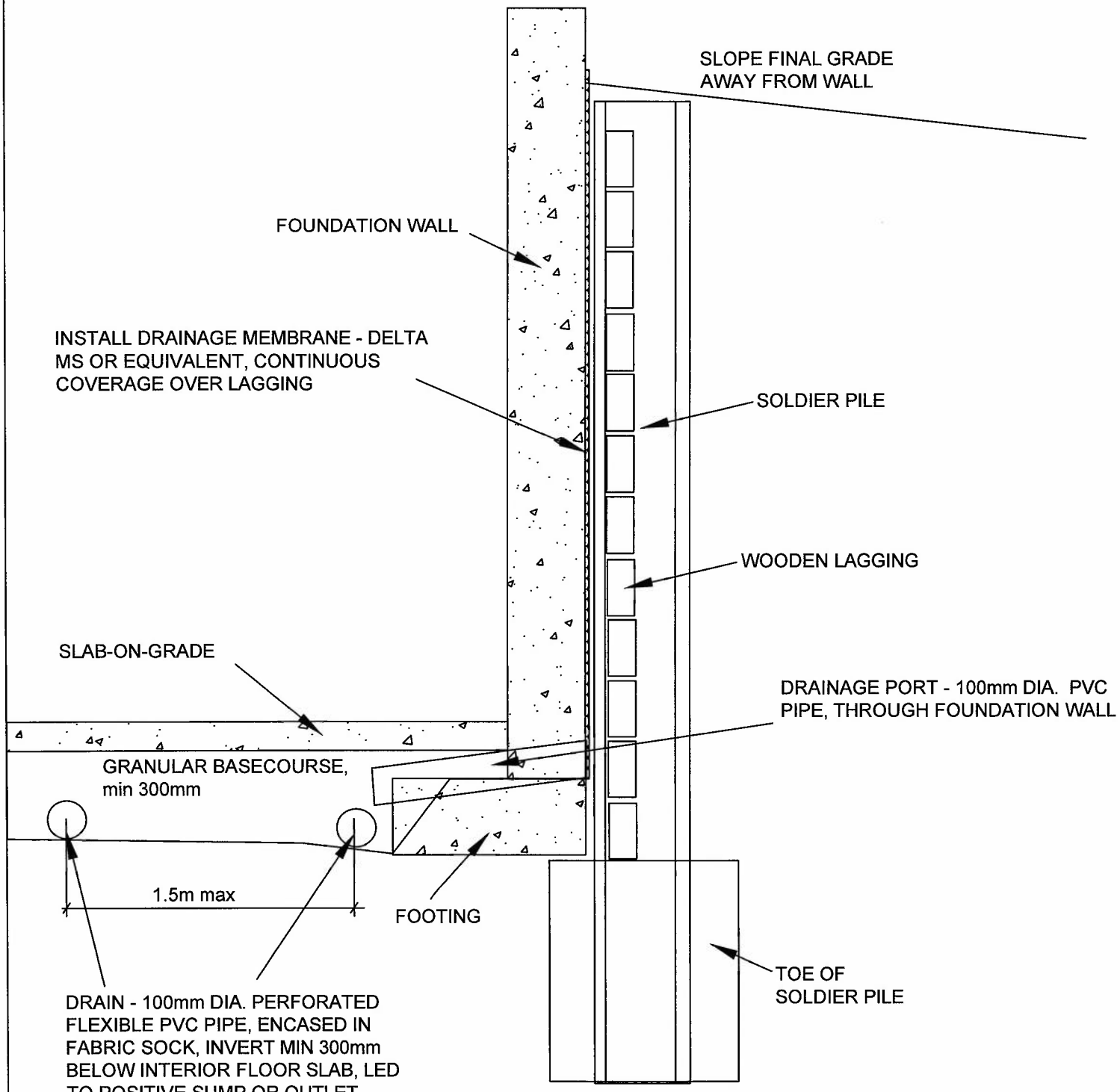

HADDAD GEOTECHNICAL INC.
151 Amber Street, Unit 17
Markham, Ontario, Canada, L3R 3B3
905-475-0951, fax: 905-475-8338
info@haddadgeo.com

591 LIVERPOOL ROAD, PICKERING

SCHEMATIC SECTION SHOWING
SEDIMENTATION CONTROL FENCE

SCALE: AS NOTED
DRAWN BY: GF

PROJECT: 16-11612
DRAWING No. 18
DATE: MAY 15, 2017




HADDAD GEOTECHNICAL INC.
151 Amber Street, Unit 17
Markham, Ontario, Canada L3R 3B3
905-475-0951, fax 905-475-8338
info@haddadgeo.com

591 LIVERPOOL ROAD, PICKERING

SECTION OF DRAINAGE MEASURES FOR PERIMETER FOUNDATION WALL POURED AGAINST SHORING

SCALE AS NOTED
DRAWN BY: dgf

PROJECT: 16-11612
DRAWING No. 19
DATE: MAY 15, 2017

# Appendix "A"

- Toronto and Region Conservation Authority (TRCA); The Living City Policies: Defining the Lake Ontario Shoreline Flood, Erosion and Dynamic Beach Hazards

## C.3 Defining Watercourses

Defining Watercoures

Watercourses are defined in Section 28(5) of the *Conservation Authorities Act* as:

***Watercourse*** means an identifiable depression in the ground in which a flow of water regularly or continuously occurs.

*Watercourses* may need to be confirmed by TRCA through field investigation. Within the *headwaters* of TRCA's *watersheds, watercourses* shall be determined in accordance with TRCA's "Evaluation, Classification, and Management of Headwater Drainage Features: Interim Guidelines."

## C.4 Defining the Lake Ontario Shoreline Flood, Erosion and Dynamic Beach Hazards

The shoreline of the Lake Ontario is continuously being reshaped through natural processes. The *Regulated Area* along the shoreline is defined by delineating the farthest landward extent of the flood hazard, *erosion hazard* and *dynamic beach hazard* and adding a 15 metre *allowance*.

### Lake Ontario Shoreline Flood Hazard

The shoreline flood hazard limit is the extent of the combined effect of the *100-year flood* level including an *allowance* for wave uprush and other water related hazards.

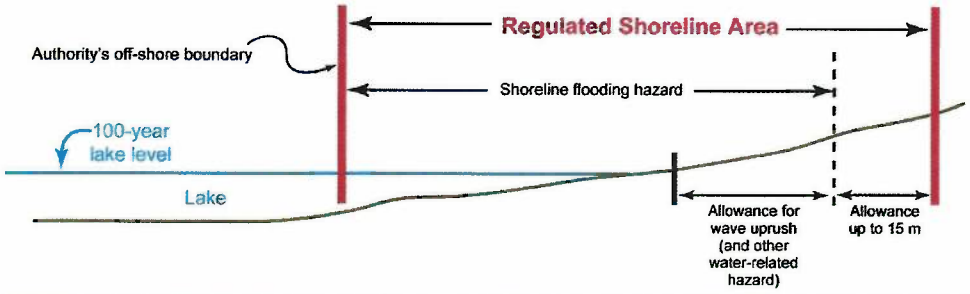



**Figure C.6**
Lake Ontario Shoreline Flood Hazard

### Lake Ontario Shoreline Erosion Hazard

The shoreline *erosion hazard limit* includes the following:

- *stable toe of slope* (as may be shifted as a result of erosion over a 100 year period);
- predicted *long term stable slope* projected from the *stable toe of slope*; and
- an *allowance* inland of 30 metres on the Great Lakes.

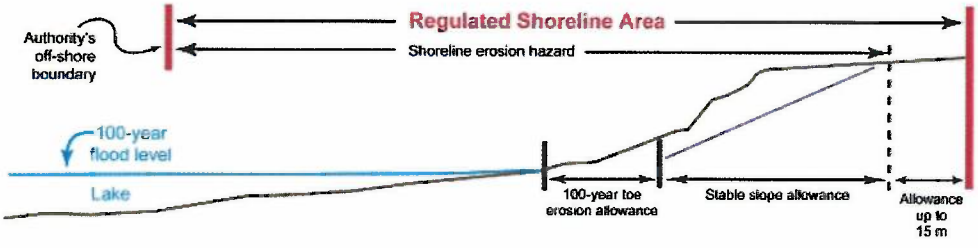



**Figure C.7**
Lake Ontario Shoreline Erosion Hazard

# Appendix "B"

## DESIGN OF TEMPORARY SHORING

Temporary shoring of the excavation, consisting of combination of continuous caisson walls and conventional soldier piles with wooden lagging warrant consideration for use on this project for the portion of excavation within the upper overburden soils, overlying the soil-rock interface.

The following presents our recommendations and comments for the design and construction of temporary shoring for this project.

With the assumption of three underground levels for the proposed development, this will require excavation approximate to depth of 10±m below existing grades as described on Section 4.2.2 of report.

The results of the subsurface investigation indicate the presence of 2.2±m to 4.2±m of very loose to medium compact fill materials underlain by natural stiff to very stiff sandy clayey silt and/or medium dense to very dense silty sand or gravely silty sand subsoils. The surface of weathered shale bedrock is encountered at depths ranging from 7.6±m to 10.7±m below existing grade.

### B1. Design of Temporary Shoring

With the approximate height of soil to be retained of 10±m (i.e. for three underground levels), it is recommended that a shoring system, comprising soldier piles with timber lagging be installed. Along the north and west sides of the site, continuous caisson walls may be required where proposed development will be located in close proximity to the property line. The above shoring system may be supported by earth-anchored tie-backs or raker struts.

**B1.1 Earth Pressure** - Soldier Piles and Lagging

A triangular pressure distribution envelope is assumed for the design of all supporting elements. It is assumed that the lagging does not extend below the base of excavation. The lateral pressure, p, in kPa, acting on a unit element at any depth h, in metres, below the surface of the retained soil, may be estimated from the following expression:

$$p = k\gamma H + kq$$

where: $\gamma$ = the unit weight of the soil being retained, in kN/m$^3$
$q$ = the equivalent uniform vertical pressure, in kPa, of any surcharge acting adjacent to the wall
$k$ = the earth pressure coefficient
= $k_a$, the active pressure coefficient, applicable where small movements may be tolerated in the retained soil
= $k_o$, the 'at-rest' earth pressure coefficient, where no movement in the retained soil can be permitted, such as the presence of buried services or foundations close to the wall

For this project, the following parameters may be assumed in the design of temporary shoring:

$\gamma = 21$ kN/m$^3$
$k_a = 0.3$
$k_o = 0.50$

It should be noted that the above parameters assume that the retained soil is drained to at least the base of excavation to eliminate hydrostatic pressures on the shoring system. At this site, the upper fill materials, and natural subsoils were found to be generally in very moist condition. The spaces behind the timber lagging should be backfilled with the native sand or equivalent free-draining material, in order to minimize the effects of hydrostatic pressure on the shoring.

### B1.2 Required Penetration of Soldier Piles

Excavation for three underground levels will terminate in the very dense weathered shale bedrock. It is recommended that soldier piles are embedded into the below the base of excavation into very dense weathered shale bedrock. The required depth of penetration of soldier piles, d, into the weathered shale bedrock may be estimated from the following expression:

$$P_a S L_1 = L_2 (P_p b + 2P_0 \tan \varphi)/F$$

where:

- $P_a$ = the total active (or at-rest) exerted by the retained soil on width of shoring equal to soldier pile spacing
  = $0.65 K_a \gamma_1 H^2$
- $P_p$ = $0.5 K_p \gamma_2 d^2$ = the lateral passive resistance developed by the very dense shale bedrock against the toe of the soldier pile
- S = soldier pile spacing, m
- H = height of retained soil, m
- b = width of soldier pile toe, m
- $L_1$ & $L_2$ = moment arms of $P_a$ & $P_p$, respectively about point 'A' - see Drawing No. B-1
- F = the appropriate factor of safety

The above expression is then resolved by trial and error process for determining the required penetration depth "d" of the soldier pile. For two or more raker or tie-back levels, a trapezoidal earth pressure distribution may be considered in resolving the required penetration depth "d" of the soldier pile.
For conditions at this site,

- $K_p = 4.0$ passive coefficient for the very dense, weathered shale bedrock
- $K_a = 0.30$ active coefficient for upper fill and natural subsoils
- $K_o = 0.5$ at rest condition, where no movement permitted
- $\gamma_1 = 21 kN/m^3$ unit weight for the upper fill, and natural, subsoils
- $\varphi = 30°$ for stiff to very stiff and/or medium dense to very dense native subsoils
- $P_0 = K_o \gamma_2 d^3 /6 \tan(45°-\varphi/2)$

### B1.3 Earth Anchored Tie-Backs

An estimate of the resistance generated by straight-sided rock-anchors may be made from the expression:

$Q_s = A_s . S$

where: $Q_s$ = ultimate anchor resistance in k.N.
$A_s = \pi DL$; the effective anchor shaft area in $m^2$ (as illustrated in diagram on Drawing C-2)
S = the working adhesion along the effective length "L" of the anchor shaft, in kPa.

For simplicity, the slip surface at this site (i.e. generally stiff to very stiff and/or medium dense to very dense native subsoils), is assumed to be plane from lower basement level, running up to 35° angle to the vertical (see Drawing C-2). Anchors must have their grouted portion at least 2m beyond the assumed slip plane and

the anchor shaft must not contain grout above the assumed slip plane. Grout must be forced out by air pressure from this zone and the space backfilled with sand.

For conditions at this site:

S = working adhesion over the area of the shaft along length "L" of the anchor may be used for estimating anchor length (minimum factor of safety FS=2)
= 25kPa for anchors within the upper, natural subsoils
= 200kPa for very dense, weathered shale bedrock

It is recommended that at least two (2) pull-out load tests per level to twice design load, should be performed to verify its capacity. The load testing should be done by pulling each anchor with a calibrated hydraulic jack while the movement of the end of the anchor is measured with a dial gauge (i.e. 1/1000 of mm per division), mounted on a tripod. Each load increment should be sustained until movement is less than 0.001mm. per minute for a period of five minutes. The plot of load versus strain is then used to verify the anchor capacity.

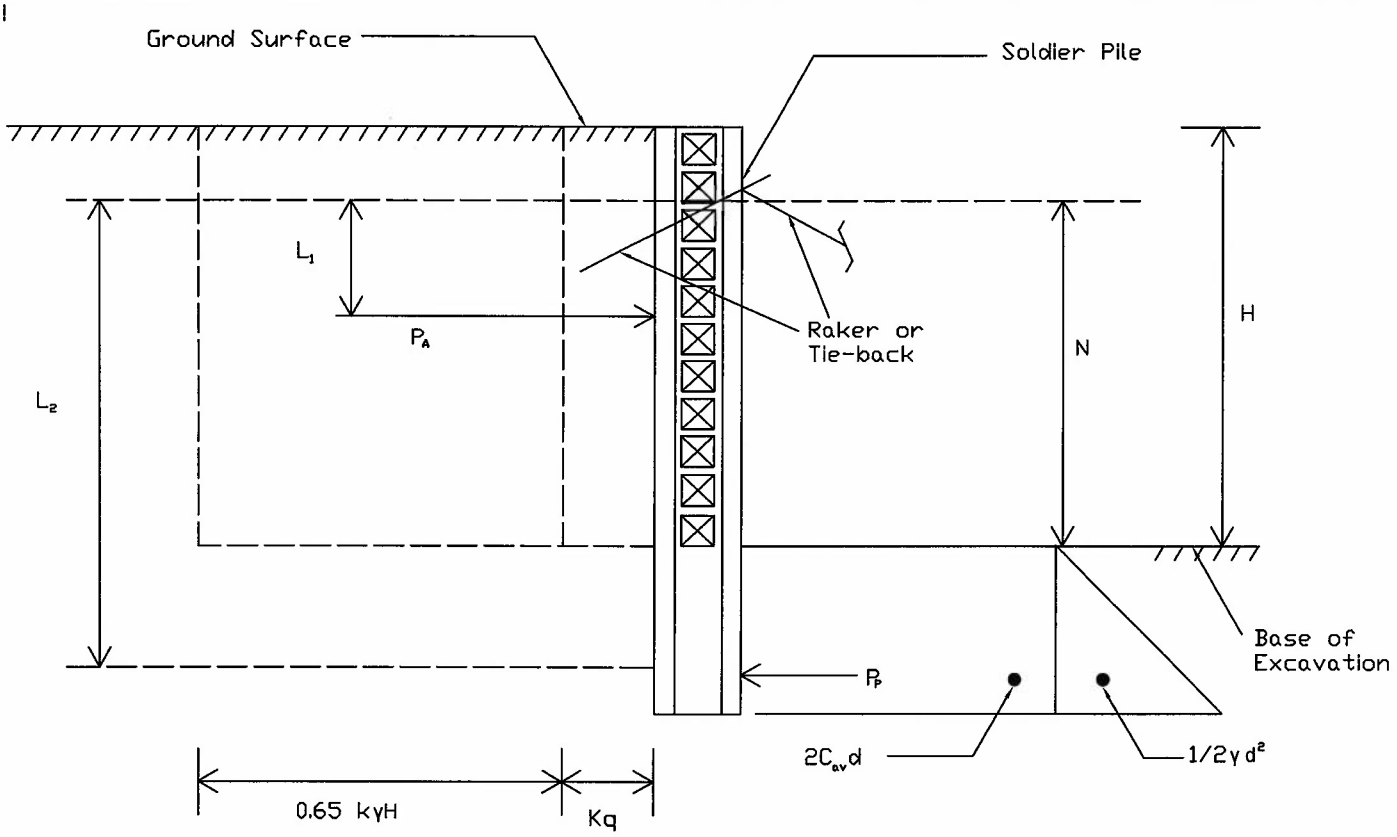
**B2. Comments**

1. The shoring plans for the project should be reviewed by our office prior to commencing construction.

2. The construction of the shoring system, including installation, load-testing and proof-loading of tie-backs should be carried out under full-time inspection by an engineer from our office.

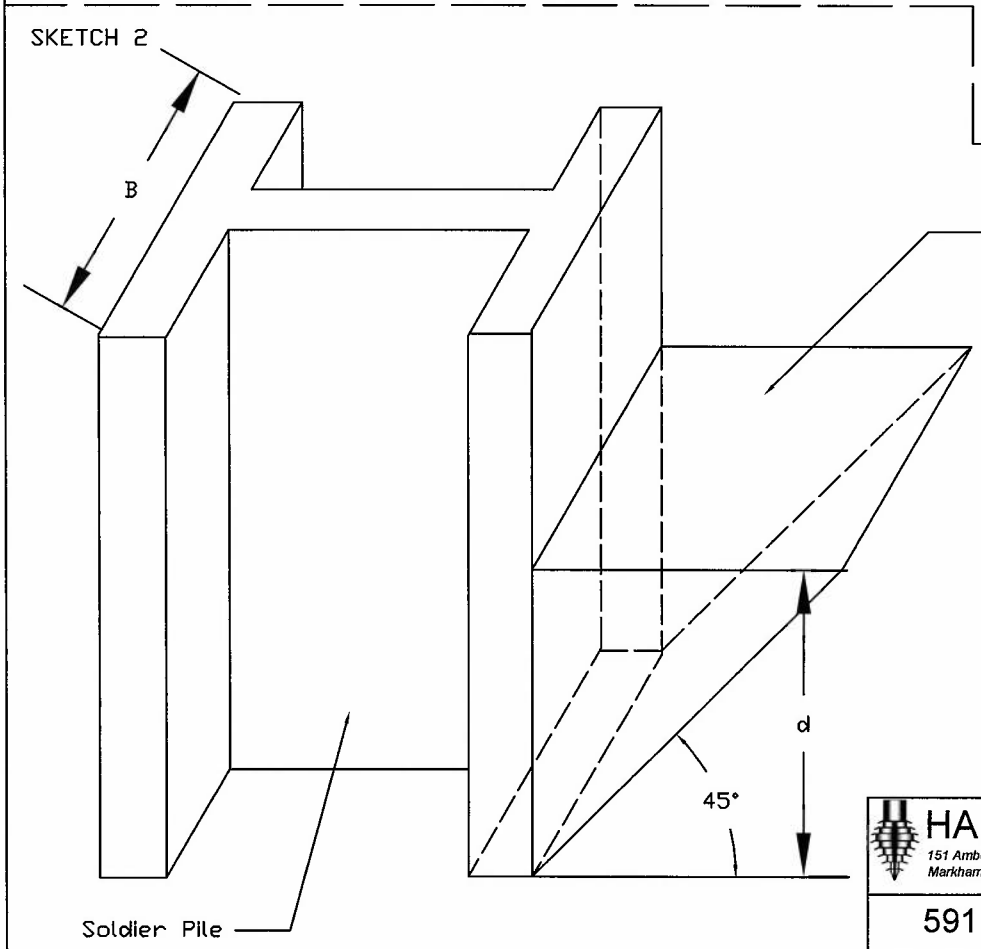
3. A program to monitor the movements of the lateral shoring should be carried out by the general contractor. This will include the installation of tell-tales on soldier piles with regular readings being taken. The results of the above monitoring should be reviewed regularly by an engineer from our office. Any excessive movements observed should be reported immediately to our office.

SKETCH 1




ASSUMED STRESS DIAGRAM

SKETCH 2




FAILURE WEDGE IN FRONT OF SOLDIER PILE

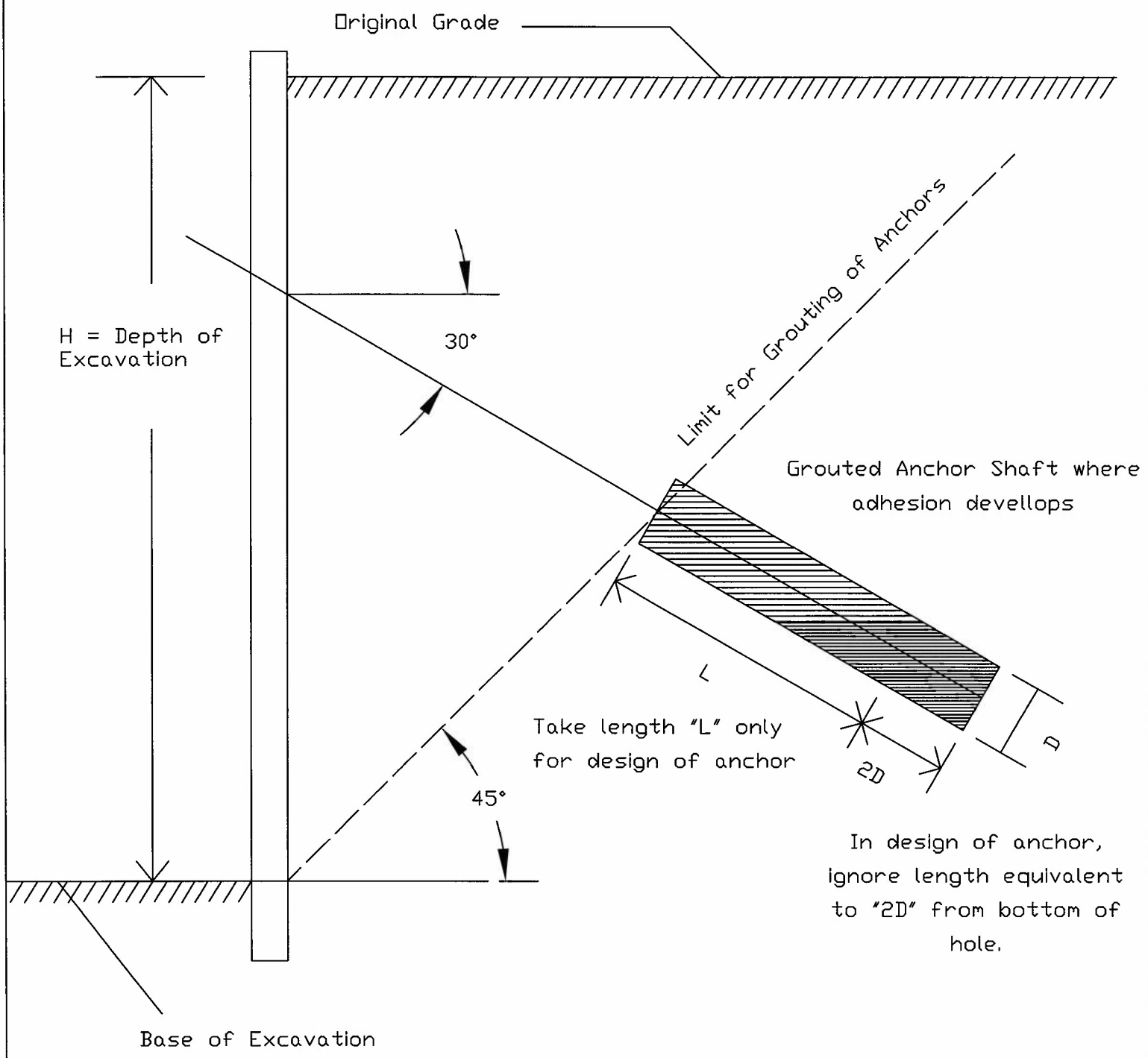
HADDAD GEOTECHNICAL INC.
151 Amber Street, Unit 17
Markham, Ontario, Canada, L3R 3B3
905-475-0951, fax: 905-475-8338
haddad.geotechnical@gmail.com

591 LIVERPOOL ROAD, PICKERING

SECTION SHOWING ASSUMED STREESES ON SOLDIER PILES

SCALE AS NOTED
DRAWN BY: dgf

PROJECT: 17-11612
DRAWING No. B-1
DATE: May 15, 2017




HADDAD GEOTECHNICAL INC.
151 Amber Street, Unit 17
Markham, Ontario, Canada, L3R 3B3
905-475-0951, fax: 905-475-8338
haddad.geotechnical@gmail.com

591 LIVERPOOL ROAD, PICKERING

DESIGN CONSIDERATIONS FOR ROCK-ANCHORED TIE-BACK SYSTEM

SCALE AS NOTED
DRAWN BY: dgf

PROJECT: 16-11612
DRAWING No.B-2
DATE: MAY 15, 2017