AllRock Consulting Ltd

15441 Mt. Pleasant Road
Caledon, ON

Geotechnical Investigation and Slope Stability Assessment

Project Number: 23265

2818963 Ontario Inc.

February 14, 2024

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Re: **Geotechnical Investigation and Slope Stability Assessment**
15441 Mount Pleasant Road,
Caledon, Ontario

Enclosed is our geotechnical investigation and slope stability assessment report for the above noted project, in accordance with our proposal dated September 19th, 2023. This report was prepared by Greg Davidson, P. Eng., and Scott Allen, P. Eng.

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation and slope stability assessment carried out for the proposed development of a new subdivision consisting of 8 rural estate residential lots at 15441 Mount Pleasant Road in Caledon, Ontario.

The purpose of the investigation was to identify the general subsurface conditions at the 15441 Mount Pleasant Road site by means of advancing boreholes and, based on the factual information obtained, to provide engineering guidelines on the geotechnical design aspects of the project, including construction considerations that could influence design decisions.

This investigation and assessment were carried out in general accordance with our proposal dated September 19th, 2023.

2.0 BACKGROUND

2.1 Project Description

The proposed development is planned for 15441 Mount Pleasant Road in Caledon, Ontario. The proposed plans include development of a new subdivision consisting of 8 rural estate residential lots.

It is noted that a Draft Plan of the proposed residential development was provided to AllRock for review.

3.0 SUBSURFACE INVESTIGATION

3.1 Geotechnical Investigation

The field work for this investigation was carried out on November 24 to 28th, 2023. During that time, ten (10) boreholes, numbered BH23-1, BH-23-2, BH23-4, BH23-6, BH23-7, BH23-8, BH23-9 as well as MW23-3, MW23-5, and MW23-10 were advanced to depths of about 8.5 metres to 9.1 metres below existing grade. The boreholes were advanced using a 150mm diameter solid stem auger on a geoprobe track drill rig, owned and operated by Terra Firma.

The borehole locations were selected by AllRock and positioned on-site relative to existing features. The field work was observed throughout by a member of our engineering staff who directed the drilling operations and logged the samples.

Standard penetration tests (SPT) were carried out in the boreholes and samples of the soils encountered were recovered using a 50mm diameter split spoon sampler, while groundwater conditions were monitored by visual observation.

Following completion of the field investigation, the soil samples were returned to our laboratory for examination by a geotechnical/materials engineer/technician. Selected samples were submitted for moisture content and grain size distribution testing.

The locations of the boreholes are shown on the Borehole Location Plan in Appendix A. The results of the boreholes are provided on the Borehole Logs in Appendix B. Laboratory testing results are provided in Appendix C.

3.2 Methodology

Materials and soil description have been made with reference to the following documents:

- Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) – ASTM D2487-06
- Standard Practice for the Description and Identification of Soils (Visual-Manual Procedure) – ASTM D2488-06

4.0 SUBSURFACE CONDITIONS

4.1 General

As previously indicated, the soil and groundwater conditions identified in the boreholes are given on the Borehole Logs in Appendix B. The logs indicate the subsurface conditions at these specific locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. The precision with which subsurface conditions are indicated depends on the method of exploration, the frequency and recovery of samples, the method of sampling, and the uniformity of the subsurface conditions. Subsurface conditions at other than the borehole locations may vary from the conditions encountered in the boreholes.

The soil descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil involves judgement and AllRock does not guarantee descriptions as exact but infers accuracy to the extent that is common in current geotechnical practice.

The groundwater conditions described in this report refer only to those observed at the place and time of observation noted in the report. It is noted that groundwater conditions can vary seasonally or because of construction activities in the area.

The following presents an overview of the subsurface conditions encountered in the boreholes advanced during this investigation.

4.2 Topsoil

A surficial layer of topsoil material was encountered in all boreholes. The topsoil can be described as brown to dark brown sandy silt/silty sand, with trace to some gravel and contains organic material. The topsoil has a thickness of about 100 millimetres.

4.3 Silts and Sands

Native deposits of sands and silts were encountered at all boreholes locations below the surficial topsoil, layer. The native sands ands silts can be described as brown clayey silt with some sand and trace gravel, grey to brown silty with varying amounts of sand, clay and gravel, brown sand and silt and brown, fine to coarse grained sand with trace gravel. All boreholes were terminated within the native sands and silts at depths ranging from about 8.5 to 9.2 metres below existing grade.

Standard penetration tests carried out in the native silts and sands gave N values ranging from 3 to greater than 50 blows per 0.3 metres of penetration, which reflects a loose to very dense relative density. It should be noted that this layer was observed to have become saturated at depths ranging about 1.5 to 4.6 metres below existing grade.

4.4 Auger Refusal

It is noted that auger refusal was encountered at Bh23-1 at a depth of about 8.5 metres below existing grade. It is noted that auger refusal can occur due to the presence of boulders or on the surface of bedrock. It is assumed that for this case, auger refusal likely occurred due to the presence of a boulder.

4.5 Gradation Analysis and Moisture Content

The results of grain size distribution carried out on selected samples are provided in Appendix C and summarized in Table 4.1.

Table 4.1 – Summary of Grain Size Distribution Testing

Location	Sample Number	Sample Depth (m)	Test Type	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH23-2	SS8	7.62-8.23	Hydro	1.0	12.0	55.8	31.2
MW23-3	SS9	8.38-8.99	Hydro	0.0	13.0	72.7	14.3
BH23-7	SS5	3.05-3.66	Hydro	0.0	39.0	53.8	7.2

BH23-8	SS7	7.38-7.99	Hydro	0.0	5.0	89.7	9.3
BH23-6	SS3	1.52-2.13	Grain	0.0	56.8	43.2	
BH23-8	SS6	4.57-5.33	Grain	3.9	18.0	78.1	
BH23-9	SS2	0.76-1.37	Grain	0.2	12.0	87.8	
MW23-10	SS1	0-0.61	Grain	1.9	39.6	58.5	

Moisture content analysis conducted on these samples yielded a moisture content of 15.4 to 22.6 percent moisture content.

4.6 Groundwater Level

The groundwater levels were measured in the well screen installed as part of this investigation on December 8th, 2023. The groundwater levels are summarized in Table 4.2.

Table 4.2 – Groundwater Levels

Location	Well Screen Formation	Date	Depth Below Surface Grade (metres)	Groundwater Elevation (masl)
MW 23-3	Native Silt	December 8, 2023	7.46	263.84
MW 23-5	Native Silt	December 8, 2023	6.04	264.59
MW 23-10	Native Silt	December 8, 2023	7.00	259.79

It should be noted that the groundwater levels may be higher during wet periods of the year such as the early spring or following periods of precipitation.

4.7 Soil Chemistry Relating to Corrosion

The results of chemical testing of four (4) soil samples are summarized in Table 4.3 and provided in Appendix C.

Table 4.3 – Summary of Chemistry Relating to Corrosion (Soil)

Borehole / Location	Sample Number	pH	Sulphate Content (percent)	Chloride Content (percent)	Electrical Conductivity (microsiemens per centimetre)	Electrical Resistivity (Ohm centimetres)
BH23-9	SS4	8.02	<0.01	0.002	0.14	7143
MW23-10	SS4	9.06	<0.01	0.010	0.32	3125
BH23-6	SS4	8.89	<0.01	<0.002	0.08	12500
BH23-4	SS4	8.26	<0.01	<0.002	0.11	9091
MW23-10	SS2	8.62	<0.01	0.003	0.10	10000
BH23-8	SS3	8.20	<0.01	0.002	0.12	8333

5.0 RECOMMENDATIONS AND GUIDELINES

5.1 General

The information in the following sections is provided for the guidance of the design engineers and is intended for the design of this project only. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

The professional services retained for this project include only the geotechnical aspects of the subsurface conditions.

The National Building Code of Canada 2020 Guidelines (hereafter NBCC 2020), the 2012 Ontario Building Code (OBC 2012) and the 4th edition of the Canadian Foundation Engineering Manual, 2006 (hereafter CFEM 2006) were considered for these recommendations. Based on the collected information from the boreholes advanced as part of this investigation, the geotechnical recommendations are presented in the following sections.

5.2 Proposed Residential Dwellings

5.2.1 Overburden Excavation

The excavation for the proposed dwellings will be carried out through topsoil and native sands and silts. The sides of the excavation should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Occupational Health and Safety Act. According to the act, soils at this site can be classified as Type 3. That is, open cut excavations within overburden deposits should be carried out with side slopes of 1 horizontal to 1 vertical, or flatter. Where excavation side slopes cannot be accommodated due to space constraints, a shoring system may be required. Additional guidelines for the design and selection of a suitable shoring system could be provided as the design progresses.

In the event that a granular pad is necessary below the foundations, the excavations should be sized to accommodate a pad of imported granular material which extends at least 0.6 metres horizontally beyond the edge of the footings and down and out from this point at 1 horizontal to 1 vertical, or flatter.

5.2.2 Groundwater and Pumping Management

Groundwater inflow, if any, from the overburden deposits should be controlled by pumping from filtered sumps within the excavation. It is not expected that short term pumping during excavation will have a significant effect on nearby structures and services. It is anticipated that groundwater inflow from the overburden deposits into the excavations could be handled from within the excavations.

It is noted that groundwater levels and surface water flows can increase during wet periods of the year such as the early spring or following periods of precipitation.

5.2.3 Subgrade Preparation and Placement of Engineered Fill

Any existing topsoil, organic material, fill, and/or weathered/disturbed soil should be removed from below the proposed structures.

Imported granular material (engineered fill) should be used to raise the grade in areas where the proposed founding level is above the level of the native soil, or where sub-excavation of material is required below proposed founding level. The engineered fill should consist of granular material meeting Ontario Provincial Standard Specifications (OPSS) requirements for Granular B Type II and should be compacted in maximum 200-millimetre-thick lifts to at least 99 percent of the standard Proctor maximum dry density. To allow spread of load beneath the footings, the engineered fill should extend horizontally at least 0.6 metres beyond the footings and then down and out from the edges

of the footings at 1 horizontal to 1 vertical, or flatter. The excavations should be sized to accommodate this fill placement.

5.2.4 Spread Footing Design

The topsoil and any fill material are not considered suitable for the support of the proposed structures or concrete floor slabs and should be removed from the proposed building areas.

For design purposes, footings bearing on native sands and silts or on a pad of engineered fill above native sands ands silts should be sized using a geotechnical reaction at Serviceability Limit State (SLS) of 80 kilopascals and a factored geotechnical resistance at Ultimate Limit State (ULS) of 120 kilopascals.

The post construction total and differential settlement of footings should be less than 25 and 20 millimetres respectively, provided that all loose or disturbed soil is removed from the bearing surface and provided that any engineered fill material is compacted to the required density.

5.2.5 Frost Protection of Foundations

All exterior footings should be provided with at least 1.4 metres of earth cover for frost protection purposes. Alternatively, the required frost protection could be provided by means of a combination of earth cover and extruded polystyrene insulation. Further details regarding the insulation of foundations could be provided at the detailed design stage, if necessary.

5.2.6 Foundation Wall Backfill and Drainage

In accordance with the Ontario Building Code, the following alternatives could be considered for drainage of the foundation walls:

- Damp proof the exterior of the foundation walls and backfill the walls with free draining, non-frost susceptible sand or sand and gravel such as that meeting OPSS requirements for Granular B Type I or II. OR
- Damp proof the exterior of the foundation walls and install an approved proprietary drainage system on the exterior of the foundation walls and backfill the walls with native material or imported soil. It is pointed out that the moisture content of the native material may be above the optimum moisture content for compaction. As such, in areas where hard surfacing will abut the buildings, it is suggested that imported sand or sand and gravel be used for foundation backfill material to reduce the potential for post construction settlement of the backfill and damage to the hard surfacing.

The backfill should be compacted in maximum 300 millimetres thick lifts to at least 95 percent of the standard Proctor dry density value using suitable vibratory compaction equipment.

A perforated plastic foundation drain with a surround of clear crushed stone should be installed on the exterior of the foundation walls. A nonwoven geotextile should be placed between the top of the clear stone and any sandy foundation wall backfill material to avoid loss of sand backfill into the voids in the clear stone (and possible post construction settlement of the ground around the houses). The top of the drain should be located below the bottom of the floor slab. The drain should outlet to a sump from which the water is pumped or should drain by gravity to a storm sewer or other suitable outlet.

5.2.7 Garage Foundation and Pier Backfill

The backfill against isolated (unheated) walls or piers should consist of free draining, non-frost susceptible material, such as sand/sand and gravel meeting OPSS Granular B Type I or II requirements. The backfill should be compacted in maximum 300 millimetres thick lifts to at least 95 percent of the standard Proctor dry density value using suitable vibratory compaction equipment. Other measures to prevent frost jacking of these foundation elements could be provided, if required.

5.2.8 Concrete Slab Support

To provide predictable settlement performance of the underground slab, all topsoil, fill material, disturbed soil, and other deleterious materials should be removed from the slab area.

The base for the floor slab should consist of 19-millimetre clear crushed stone. Allowance should be made for between 150 and 200 millimetres of base material. Nominal compaction of the clear stone is recommended to consolidate the material into place.

If clear crushed stone is used below the floor slab, underfloor drains are not considered essential provided that drains are installed to link any hydraulically isolated areas in the basement. The drains should outlet by gravity to a sump from which the water is pumped or drained by gravity to a storm sewer or other suitable outlet.

The ACI 302.1R-04 “Guide for Concrete Floor and Slab Construction” should be referenced for design purposes.

A polyethylene vapour retarder is recommended below the floor slabs.

5.2.9 Seismic Site Classification

According to Table 4.1.8.4.A of the Ontario Building Code, 2012, Site Class D should be used for the seismic design of the structures bearing on native soils or on engineered fill material over native soils.

In our opinion the soils at this site are not considered to be liquefiable or collapsible under seismic loads.

5.3 Site Services

5.3.1 General

Sections 5.3.2 to 5.3.4 only applies to sites services if the proposed development will be connect to municipal services and are not required if private well and septic systems are proposed.

5.3.2 Excavation

Based on the investigation, the excavations for the services within the site will be carried out through topsoil and native sands ands silts.

The sides of the excavations within overburden soils should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Occupational Health and Safety Act. According to the Act, the soils at this site can be classified as Type 3 soils. Therefore, for design purposes, allowance should be made for 1 horizontal to 1 vertical, or flatter, excavation slopes within the native soils at this site. As an alternative to sloping the excavations, all services installations could be carried out within a tightly fitting, braced steel trench box, which is specifically designed for this purpose.

The groundwater inflow should be controlled throughout the excavation and pipe laying operations by pumping from sumps within the excavation.

5.3.2.1 Groundwater Pumping

Possible groundwater inflow from the overburden deposits into the excavations could be controlled by pumping from filtered sumps within the excavations. It is not expected that short term pumping during excavation will have any significant affect on nearby structures and services.

The groundwater handling should be carried out in accordance with provincial and local regulations.

Suitable detention and filtration will be required before discharging water. The contractor should be required to submit an excavation and groundwater management plan for review.

5.3.2.2 Pipe Bedding and Cover

The bedding for the sanitary sewers, storm sewers and watermains should be in accordance with OPSD 802.010 and 802.031 for flexible and rigid pipes, respectively. The pipe bedding should consist of at least 150 millimetres of well graded crushed stone meeting OPSS requirements for Granular A. OPSS documents allow recycled asphaltic concrete and concrete to be used in Granular A and Granular B Type II material.

Since the source of recycled material cannot be determined, it is suggested that any granular materials used in the service trenches be composed of virgin (i.e., not recycled) material only.

Allowance should be made for subexcavation of any existing fill, organic deposits, or disturbed material encountered at subgrade level.

Allowance should be made to place a subbedding layer composed of 150 to 300 millimetres of OPSS Granular B Type II in areas where wet silty sand is encountered at the pipe subgrade level to reduce the potential for disturbance.

Cover material, from pipe spring line to at least 300 millimetres above the top of the pipe, should consist of granular material, such as OPSS Granular A.

The use of clear crushed stone should not be permitted for the installation of site services, since it could exacerbate groundwater lowering of the overburden materials due to “French Drain” effects.

The subbedding, bedding and cover materials should be compacted in maximum 200-millimetre-thick lifts to at least 98 percent of the standard Proctor maximum dry density using suitable vibratory compaction equipment.

5.3.3 Trench Backfill

The general backfilling procedures should be carried out in a manner that is compatible with the future use of the area above the service trenches.

In areas where the service trench will be located below or in close proximity to existing or future roadway areas, acceptable native materials should be used as backfill between the roadway subgrade level and the depth of seasonal frost penetration in order to reduce the potential for differential frost heaving between the area over the trench and the

adjacent section of roadway. Where native backfill is used, it should match the native materials exposed on the trench walls. Backfill below the zone of seasonal frost penetration could consist of either acceptable native material or imported granular material conforming to OPSS Granular B Type I. The depth of frost penetration in areas that are kept clear of snow and where trench backfill consists of broadly graded shattered rock fill or earth fill is expected to be about 1.5 metres. It is our experience, however, that the frost penetration can be as much as 1.8 metres when the trench backfill consists solely of relatively open graded rock fill. Where cover requirements are not practicable, the pipes could be protected from frost using a combination of earth cover and insulation. Further details regarding insulation could be provided, if required.

It is anticipated that most of the inorganic overburden materials encountered during the subsurface investigation will be acceptable for reuse as trench backfill. Topsoil or other organic material should be wasted from the trench. If blast rock is used as backfill within the service trench, it should be mostly 300 millimetres, or smaller, in size and should be well graded. To prevent ingress of fine material into voids in the blast rock, the upper surface of the blast rock should be covered with a thin layer of well graded crushed stone (e.g., OPSS Granular B Type II).

To minimize future settlement of the backfill and achieve an acceptable subgrade for the roadways, curbs, driveways, etc., the trench backfill should be compacted in maximum 300-millimetre-thick lifts to at least 95 percent of the standard Proctor dry density value. Rock fill should be placed in maximum 500-millimetre-thick lifts and compacted with a large drum roller, the haulage and spreading equipment, or a combination of both. The specified density for compaction of the backfill materials may be reduced where the trench backfill is not located below or in close proximity to existing or future areas of hard surfacing and/or structures.

5.4 Roadway Recommendations

5.4.1 Subgrade Preparation

In preparation for the proposed access roadway construction at this site, any surficial topsoil, fill material and any soft, wet, or deleterious materials should be removed from the proposed roadway and parking lot areas.

Any soft areas should be subexcavated and replaced with suitable (dry) earth borrow or well shattered and graded rock fill material that is frost compatible with the materials exposed on the sides of the area of subexcavation.

Similarly, should it be necessary to raise the roadway grades at this site, material which meets OPSS specifications for Select Subgrade Material, earth borrow, or well shattered and graded rock fill material may be used.

The select subgrade material or earth borrow should be placed in maximum 300-millimetre-thick lifts and compacted to at least 95 percent of the standard Proctor maximum dry density value using vibratory compaction equipment. Rock fill should also be placed in thin lifts and suitably compacted either with a large drum roller, the haulage and spreading equipment, or a combination of both.

Truck traffic should be avoided on the native soil subgrade and the trench backfill within the roadways especially under wet conditions.

Prior to placing granular material and/or grade material for the internal roads, the exposed subgrade should be inspected and approved by geotechnical personnel.

5.4.2 Pavement Structure

For the internal roadways, the following minimum pavement structure should be used:

- 90 millimetres of hot mix asphaltic concrete (40 millimetres of Superpave 12.5 (Traffic Level B) or HL3 over 50 millimetres of Superpave 19.0 (Traffic Level B)) or HL8, over
- 150 millimetres of OPSS Granular A base over
- 300 millimetres of OPSS Granular B, Type II subbase

The above pavement structure assumes that any trench backfill is adequately compacted, and that the access roadway and parking lot subgrade surfaces are prepared as described in this report. If the subgrade surfaces become disturbed or wetted due to construction operations or precipitation, the granular subbase thickness given above may not be adequate and it may be necessary to increase the thickness of the subbase and/or to incorporate a woven geotextile separator between the subgrade surfaces and the granular subbase material. The adequacy of the design pavement thickness should be assessed by geotechnical personnel at the time of construction.

If the granular pavement materials are to be used by construction traffic, it may be necessary to increase the thickness of the granular subbase layer, install a woven geotextile separator between the roadway subgrade surface and the granular subbase material, or a combination of both, to prevent pumping and disturbance to the subbase material. The contractor should be made responsible for their construction access.

5.4.3 Asphalt Cement Type

Performance grade PG 58-34 asphalt cement should be specified for Superpave asphaltic concrete mixes.

5.4.4 Pavement Transitions

As part of the roadway construction, the new pavement will abut the existing pavement at the existing municipal. The following is suggested to improve the performance of the joint between the new and the existing pavements:

- Neatly saw cut the existing asphaltic concrete;
- Remove the asphaltic concrete and slope the bottom of the excavation within the existing granular base and subbase at 1 horizontal to 1 vertical, or flatter, to avoid undermining the existing asphaltic concrete.
- To avoid cracking of the asphaltic concrete due to an abrupt change in the thickness of the roadway granular materials where new pavement areas join with the existing pavements, the granular depths should taper up or down at 5 horizontal to 1 vertical, or flatter, to match the existing pavement structure.
- Remove (mill off) 40 to 50 millimetres of the existing asphaltic concrete to a distance of 300 millimetres at the joint and tack coat the asphaltic concrete at the joint in accordance with the requirements in OPSS 310.

5.4.5 Pavement Drainage

Adequate drainage of the pavement granular materials and subgrade is important for the long-term performance of the pavement at this site. The subgrade surfaces should be crowned and shaped to drain to the ditches.

5.4.6 Granular Material Compaction

The granular base and subbase materials should be compacted in maximum 300-millimetre-thick lifts to at least 99 percent of the standard Proctor maximum dry density value.

6.0 SLOPE STABILITY ASSESSMENT

6.1 General

The slope stability analyses were carried out using SLIDE2, two-dimensional, slope stability program at the slope cross sections that was considered worst-case by AllRock's geotechnical engineering personnel based on the available site information. The chosen cross sections, Section A-A to Section H-H, inclusive, can be found on Figure 2.

6.2 Cross Sections

Eight (8) cross sections were surveyed by AllRock. One (1) cross section, which was considered to be worse case scenario was completed per lot. A summary of the cross section locations and corresponding boreholes is provided in Table 5.1.

Table 5.1 – Summary of Cross Sections

Section	Proposed Lot Number	Closest Borehole	Overall Length of Slope (m)	Overall Height of Slope (m)
'A-A'	Lot 2	MW23-5	47.30	1.63
'B-B'	Lot 3	23-6	26.50	1.13
'C-C'	Lot 1	23-4	16.11	2.57
'D-D'	Lot 7	23-9	33.50	5.00
'E-E'	Lot 8	MW23-10	25.23	1.00
'F-F'	Lot 6	23-8	72.36	6.02
'G-G'	Lot 5	23-7	66.00	5.68
'H-H'	Lot 4	MW23-3	22.16	1.48

6.3 Input Parameters

The soil conditions used in the stability analyses were based on the subsurface conditions that were encountered during drilling investigation and based on the borehole logs in Appendix B. The slopes were modeled as such, using typical soil strength parameters for the area. A summary of the assumed soil parameters are shown in Table 5.2.

Table 5.2 – Summary of Assumed Soil Parameters

Soil Type	Effective Angle of Internal Friction, φ (degrees)	Effective Cohesion, c'(kPa)	Unit Weight, γ (kN/m^3)
Sand and Silt	32	0	18

The results of the stability analysis are highly dependent on the assumed groundwater conditions; therefore, we have assumed that the slopes are fully saturated.

6.4 Factor of Safety

The slope stability analyses was carried out using conditions and slope profiles that attempt to model the slopes in question. It should be noted that the selected parameters and site conditions may not represent actual conditions across the entire slope, and the assumed conditions are therefore limited to the locations where borehole information could be obtained. For this slope stability assessment, groundwater has been assumed at surface elevation as a conservative method.

For the purposes of this study, a computed factor of safety of less than 1.0 to 1.3 is considered to represent a global stability bordering on failure to marginally stable, respectively; a factor of safety of 1.3 to 1.5 is considered to indicate global stability that is less likely to fail in the long term and provides a degree of confidence against failure ranging from marginal (1.3) to adequate (1.4 and greater) should conditions vary from the assumed conditions. A factor of safety of 1.5, or greater, is considered to indicate adequate long term stability. The slope stability analyses completed on Sections 'A-A' to Section 'H-H', inclusive, indicates that all existing slopes have a factor of safety of greater than 1.5 against overall failure and are considered to be stable. Slide analysis figures are provide in Appendix D.

6.5 Erosion Hazard Limit

In accordance with the Ministry of Natural Resources (MNR) Technical Guide "Understanding Natural Hazards" dated 2001, the horizontal distance from a slope to the safe setback line is called the 'Erosion Hazard Limit'. The area between the Erosion Hazard Limit (i.e., safe setback line) and the crest of the slope is called 'Hazard Lands'. In accordance with MNR policy, Hazard Lands should not be developed with permanent structures, roadway areas, or any other valuable infrastructure.

The Erosion Hazard Limit consists of the following three (3) components:

- Stable Slope Allowance: Portion of the setback that ensures safety, if slumping or slope failure occurs. For stable slopes (i.e., factor of safety above 1.5) the Stable Slope Allowance is not applicable.

- Toe Erosion Allowance: Portion of the setback that ensures safety of the top of the slope in the event that a watercourse erodes or weakens the toe of the slope.

- Erosion Access Allowance: Portion of the setback needed to ensure that there is a large enough safety zone for people and vehicles to enter and exit an area during

an emergency, such as a slope failure or flood. Typically, it is also included where construction vehicle access is required to repair a failed slope.

Based on the results of the slope stability analysis, the extent of the Hazard Lands, as defined by the MNR as follows:

1) The Stable Slope Allowance, as described in the MNR procedures, is the area between the crest of the slope and the location where a factor of safety of greater than 1.5 against slope failure is calculated. As all the existing factors of safety are greater than 1.5, the stable slope allowance is not required.

2) No active toe erosion has been observed and as the slopes are deemed to be globally stable in the long term, this allowance is not considered necessary.

As indicated above, an Erosion Access Allowance has not been included as the factor of safety is greater than 1.5. This is rationalized by the fact that the intent of the erosion access allowance is to permit entry and exit in the event of a failure and to allow access for repair equipment. If the slope is deemed to be globally stable in the long term, this access is not considered necessary.

Based on the above, the Hazard Lands based on this assessment is not applicable as the slopes are considered globally stable in the long term.

It is recommended that the final plans and finished grades for any proposed development adjacent to the slope be reviewed by the geotechnical engineer to ensure that the guidelines provided in this report have been interpreted as intended.

7.0 ADDITIONAL CONSIDERATIONS

7.1 Effects of Construction Induced Vibration

Some of the construction operations (such as excavation, granular material compaction, etc.) will cause ground vibration on and off on the site. The vibrations will attenuate with distance from the source but may be felt at nearby structures. Assuming that any excavating is carried out in accordance with the guidelines in this report, the magnitude of the vibrations will be much less than that required to cause damage to the nearby structures or services in good condition but may be felt at the nearby structures.

7.2 Soil Corrosion

The measured sulphate concentration in the samples of soil obtained from borehole MW23-2, MW23-3, BH23-4 and BH 23-9 were <0.01 to about 0.02 percent. According to the Canadian Standards Association “Concrete Materials and Methods of Concrete Construction” (CSA A23.1- 14 Table 3), the concentration of sulphate in the soil sample obtained is considered to have less than the minimum concentration for “moderate” sulfate exposure. For low exposure conditions, any concrete that will be in contact with the overburden soils could be batched with General Use (formerly Type 10) cement.

Other factors (structurally reinforced or non-structurally reinforced, freeze-thaw environment, chloride exposure, agricultural environment) should be considered in selecting the Class of Exposure and associated air entrainment and concrete mix proportions for any concrete.

Based on the resistivity and pH of the samples, the soil in this area can be classified as non-aggressive towards unprotected steel. The manufacturer of any buried steel elements that will be in contact with the soil should be consulted to ensure that the durability of the intended product is appropriate. It is noted that the corrosivity of the groundwater could vary throughout the year due to the application of de-icing chemicals.

7.3 Excess Soil Management Plan

This report does not constitute an excess soil management plan. The disposal requirements for excess soil from the site have not been assessed.

7.4 Abandonment of Standpipe Piezometers

All monitoring wells installed as part of this investigation should be decommissioned by a licensed well technician in accordance with Ontario Regulation 903. The well abandonment could be carried out in advance of or during construction.

7.5 Design Review and Construction Observation

It is recommended that the final design drawings be reviewed by the geotechnical engineer to ensure that the guidelines provided in this report have been interpreted as intended.

The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed excavations do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design. The subgrade surface for the

proposed dwellings and any roadways should be inspected by experienced geotechnical personnel to ensure that suitable materials have been reached and properly prepared. The placing and compaction of earth fill and imported granular materials should be inspected to ensure that the materials used conform to the grading and compaction specifications.

8.0 CLOSURE

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report, please do not hesitate to contact our office.

G. Davidson

Gregory Davidson, P.Eng.
VP – Geotechnical Lead
Project Manger – Ottawa

Scott Allen, P.Eng.
President
Geotechnical Engineer

AllRock Consulting Ltd
24 Brydon Drive, Unit #5
Toronto, ON M9W 5R6
1-844-440-7625
www.allrockconsulting.com

APPENDIX A

Borehole Location Plan

FIGURE TITLE:	KEY MAP
PROJECT:	GEOTECHNICAL INVESTIGATION
CLIENT:	2818963 ONTARIO INC.
ADDRESS:	15441 MT. PLEASANT ROAD, CALEDON, ON
PROJECT NO:	23265
APPROXIMATE SCALE:	NTS

AllRock Consulting Ltd

DATE: DEC. 2023	FIGURE NO.: 1
DRAWN BY: ES	CHECKED BY: GD

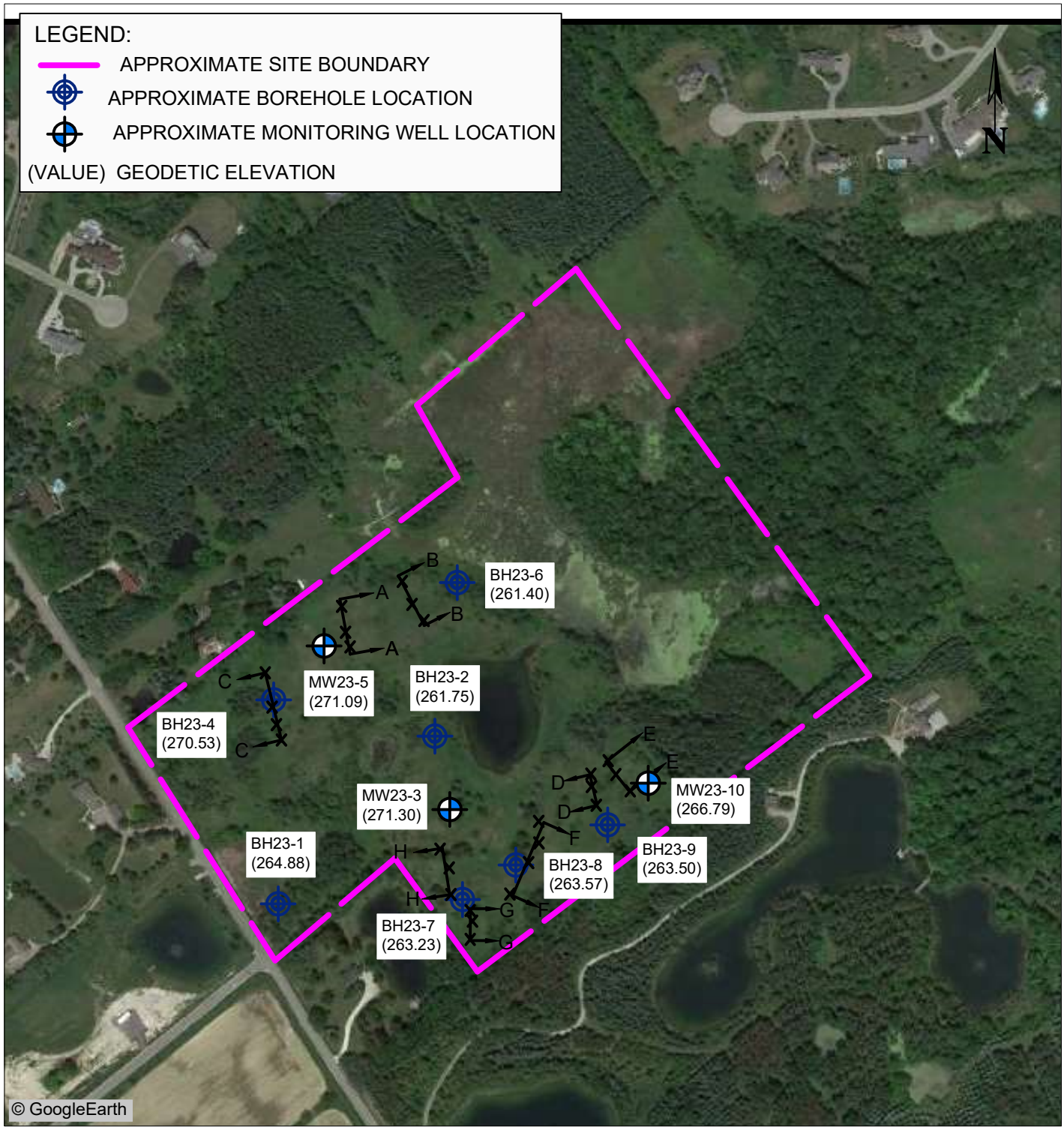

FIGURE TITLE:	BOREHOLE LOCATION PLAN
PROJECT:	GEOTECHNICAL INVESTIGATION
CLIENT:	2818963 ONTARIO INC.
ADDRESS:	15441 MT. PLEASANT ROAD, CALEDON, ON
PROJECT NO:	23265
APPROXIMATE SCALE:	NTS

AllRock Consulting Ltd

DATE: DEC. 2023	FIGURE NO.: 2
DRAWN BY: ES	CHECKED BY: GD

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APPENDIX B

Borehole Logs

BORING NUMBER BH23-1

AllRock Consulting

CLIENT 2818963 Ontario Inc.
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER 23265
PROJECT LOCATION 15441 Mt. Pleasant Road, Caledon, ON
DATE STARTED 23-11-27 **COMPLETED** 23-11-27
GROUND ELEVATION 264.88 m **HOLE SIZE** 150mm
DRILLING CONTRACTOR Terra Firma
GROUND WATER LEVELS:
DRILLING METHOD Solid Stem Auger
AT TIME OF DRILLING ---
LOGGED BY E. Syed **CHECKED BY** G. Davidson
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION
	SS 1	41	1-2-2-3 (4)		0.10 Dark Brown sandy silt,trace gravel, contains organic(TOPSOIL) 264.78 Brown CLAYEY SILT, some sand, trace gravel -Sample becomes wet at 1.5m
	SS 2	41	2-3-3-4 (6)		
2	SS 3	54	2-3-3-3 (6)		2.29 262.59
	SS 4	49	3-3-5-5 (8)		Grey SILT, some clay, trace sand
	SS 5	57	4-7-7-10 (14)		
4					
	SS 6	82	5-7-8-10 (15)		
6					
	SS 7	54	9-11-11-17 (22)		
8					
	SS 8	62	8-11-12-13 (23)		
	SS 9	79	10-14-19-31 (33)		8.54 256.34 End of Borehole -Auger Refusal Bottom of hole at 8.54 m.

BORING NUMBER BH23-2

AllRock Consulting

CLIENT 2818963 Ontario Inc.
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER 23265
PROJECT LOCATION 15441 Mt. Pleasant Road, Caledon, ON
DATE STARTED 23-11-27 **COMPLETED** 23-11-27
GROUND ELEVATION 261.75 m **HOLE SIZE** 150mm
DRILLING CONTRACTOR Terra Firma
GROUND WATER LEVELS:
DRILLING METHOD Solid Stem Auger
AT TIME OF DRILLING ---
LOGGED BY E. Syed **CHECKED BY** G. Davidson
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION
					0.10 Dark Brown sandy silt,trace gravel, contains organic(TOPSOIL) 261.65
	1	98	1-2-3-6 (5)		Brown CLAYEY SILT, some sand, trace gravel -Sample becomes wet at 1.5m
	2	98	3-5-8-11 (13)		
2	3	98	5-6-7-10 (13)		
	4	90	5-7-7-9 (14)		
	5	98	5-7-7-9 (14)		
4					4.47 257.28
	6	90	4-4-5-6 (9)		Grey SILT, some clay, trace sand
6					
	7	90	11-16-19-20 (35)		
8	8	98	3-3-3-5 (6)		
	9	79	3-3-7-8 (10)		9.15 252.60
					End of Borehole Bottom of hole at 9.14 m.

WELL NUMBER MW23-3

AllRock Consulting

CLIENT 2818963 Ontario Inc.
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER 23265
PROJECT LOCATION 15441 Mt. Pleasant Road, Caledon, ON
DATE STARTED 23-11-28 **COMPLETED** 23-11-28
GROUND ELEVATION 271.3 m **HOLE SIZE** 150mm
DRILLING CONTRACTOR Terra Firma
GROUND WATER LEVELS:
DRILLING METHOD Solid Stem Auger
AT TIME OF DRILLING ---
LOGGED BY E. Syed **CHECKED BY** G. Davidson
AT END OF DRILLING ---
NOTES
AFTER DRILLING 7.46 m / Elev 263.84 m

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	1	74	2-2-3-4 (5)		0.10 Dark Brown sandy silt,trace gravel, contains organic (TOPSOIL) 271.20 Brown SANDY SILT -Samples become wet at 4.57	Flushmount Cap
	2	84	2-2-3-4 (5)			
2	3	66	2-3-2-4 (5)			
	4	98	4-6-9-11 (15)			Backfill with Auger Cuttings 50 mm diameter pvc riser
	5	41	3-4-9-13 (13)			
4						
	6	98	6-9-11-13 (20)			Bentonite Seal
6					6.10 265.20 Grey SILT, trace sand and clay	
	7	90	7-12-12-15 (24)			
						Filter Sand 50 mm diameter pvc screen
8	8	33	8-11-7-9 (18)			
	9	41	4-7-10-11 (17)		9.15 262.15 End of Borehole Bottom of hole at 9.14 m.	

GENERAL BH / TP / WELL GINT LOGS-ERUMSYED-GREGDAVIDSON.GPJ GINT STD CANADA LAB.GDT 23-12-21

BORING NUMBER BH23-4

AllRock Consulting

CLIENT 2818963 Ontario Inc. **PROJECT NAME** Geotechnical Investigation

PROJECT NUMBER 23265 **PROJECT LOCATION** 15441 Mt. Pleasant Road, Caledon, ON

DATE STARTED 23-11-28 **COMPLETED** 23-11-28 **GROUND ELEVATION** 270.53 m **HOLE SIZE** 150mm

DRILLING CONTRACTOR Terra Firma **GROUND WATER LEVELS:**

DRILLING METHOD Solid Stem Auger **AT TIME OF DRILLING** ---

LOGGED BY E. Syed **CHECKED BY** G. Davidson **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	
	1	98	3-3-5-6 (8)		0.10 Dark Brown sandy silt,trace gravel, contains organic(TOPSOIL)	270.43
					Brown SANDY SILT	
	2	98	2-3-3-3 (6)			
2	3	98	3-3-3-2 (6)			
	4	90	3-4-10-12 (14)		3.05	267.48
	5	98	4-11-11-13 (22)		Grey to brown SILT, trace sand and clay -Samples become wet at 4.57	
4						
	6	90	7-20-22-48 (42)			
6						
	7	98	10-11-11-11 (22)			
8	8	98	9-11-13-14 (24)			
	9	98	10-10-17-20 (27)		9.15	261.38
					End of Borehole	
					Bottom of hole at 9.14 m.	

WELL NUMBER MW23-5

AllRock Consulting

CLIENT 2818963 Ontario Inc. **PROJECT NAME** Geotechnical Investigation

PROJECT NUMBER 23265 **PROJECT LOCATION** 15441 Mt. Pleasant Road, Caledon, ON

DATE STARTED 23-11-24 **COMPLETED** 23-11-24 **GROUND ELEVATION** 271.09 m **HOLE SIZE** 150mm

DRILLING CONTRACTOR Terra Firma **GROUND WATER LEVELS:**

DRILLING METHOD Solid Stem Auger **AT TIME OF DRILLING** ---

LOGGED BY E. Syed **CHECKED BY** G. Davidson **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** 6.50 m / Elev 264.59 m

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	1	98	1-1-3-4 (4)		0.10 Dark Brown sandy silt,trace gravel, contains organic (TOPSOIL) 270.99 Brown SANDY SILT -Samples become wet at 4.57	Flushmount Cap
	2	98	2-3-3-5 (6)			
2	3	90	2-3-3-6 (6)			
	4	90	5-6-7-14 (13)			Backfill with Auger Cuttings 50 mm diameter pvc riser
	5	90	9-10-11-20 (21)			
4					4.57 266.52 Grey to brown SILT, trace sand and clay	
	6	90	9-12-16-23 (28)			Bentonite Seal
6						
	7	98	10-12-14-25 (26)			
						Filter Sand 50 mm diameter pvc screen
8	8	98	18-26-39-35 (65)			
	9	98	10-30-20-18 (50)		9.15 261.94 End of Borehole Bottom of hole at 9.14 m.	

BORING NUMBER BH23-6

AllRock Consulting

CLIENT 2818963 Ontario Inc. **PROJECT NAME** Geotechnical Investigation

PROJECT NUMBER 23265 **PROJECT LOCATION** 15441 Mt. Pleasant Road, Caledon, ON

DATE STARTED 23-11-24 **COMPLETED** 23-11-24 **GROUND ELEVATION** 261.4 m **HOLE SIZE** 150mm

DRILLING CONTRACTOR Terra Firma **GROUND WATER LEVELS:**

DRILLING METHOD Solid Stem Auger **AT TIME OF DRILLING** ---

LOGGED BY E. Syed **CHECKED BY** G. Davidson **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION
					0.10 Dark brown silty sand, trace gravel (TOPSOIL) 261.30
	1	82	1-1-2-4 (3)		Brown SAND and SILT -Samples become wet at 4.57
	2	82	1-2-2-3 (4)		
2	3	74	3-3-2-3 (5)		
	4	82	5-5-6-7 (11)		
	5	82	3-4-6-7 (10)		
4					
	6	90	2-2-2-3 (4)		
6					
	7	98	2-2-4-3 (6)		
8	8	98	2-4-6-6 (10)		
	9	98	6-6-9-8 (15)		
					End of Borehole 9.50 251.90

Bottom of hole at 9.14 m.

BORING NUMBER BH23-7

AllRock Consulting

CLIENT 2818963 Ontario Inc. **PROJECT NAME** Geotechnical Investigation

PROJECT NUMBER 23265 **PROJECT LOCATION** 15441 Mt. Pleasant Road, Caledon, ON

DATE STARTED 23-11-24 **COMPLETED** 23-11-24 **GROUND ELEVATION** 263.23 m **HOLE SIZE** 150mm

DRILLING CONTRACTOR Terra Firma **GROUND WATER LEVELS:**

DRILLING METHOD Solid Stem Auger **AT TIME OF DRILLING** ---

LOGGED BY E. Syed **CHECKED BY** G. Davidson **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION
	1	74	1-1-2-2 (3)		0.10 Brown sand, trace gravel (TOPSOIL) 263.13 Brown fine to coarse grained sand, trace gravel
	2	84	1-2-2-1 (4)		1.52 261.71
2	3	66	1-1-2-4 (3)		Grey SAND and SILT, trace clay -Samples become wet at 3.05m
	4	98	4-5-5-7 (10)		
	5	41	4-6-6-10 (12)		
4					
	6	98	4-7-9-11 (16)		
6					
	7	90	11-11-11-18 (22)		
8	8	33	6-9-10-12 (19)		
	9	41	16-34-29-28 (63)		9.15 254.08
					End of Borehole Bottom of hole at 9.14 m.

BORING NUMBER BH23-8

AllRock Consulting

CLIENT 2818963 Ontario Inc.
PROJECT NAME Geotechnical Investigation
PROJECT NUMBER 23265
PROJECT LOCATION 15441 Mt. Pleasant Road, Caledon, ON
DATE STARTED 23-11-28 **COMPLETED** 23-11-28
GROUND ELEVATION 263.57 m **HOLE SIZE** 150mm
DRILLING CONTRACTOR Terra Firma
GROUND WATER LEVELS:
DRILLING METHOD Solid Stem Auger
AT TIME OF DRILLING ---
LOGGED BY E. Syed **CHECKED BY** G. Davidson
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION
	1	98	1-2-3-4 (5)		0.10 Brown sandy silt,trace gravel, contains organic(TOPSOIL 263.47 Brown CLAYEY SILT, some garvel, travel sand -Sample sbecome wet at 3.05m
	2	98	3-3-3-4 (6)		
2	3	90	3-3-4-5 (7)		
	4	98	3-6-6-9 (12)		
	5	98	4-8-10-13 (18)		
4					4.57 259.00 Grey to brown SILT, tarce sand and clay
	6	98	7-8-11-15 (19)		
6					
	8	98	8-14-10-15 (24)		
	7	90	8-10-11-12 (21)		
8					
	9	98	4-7-9-11 (16)		9.15 254.42 End of Borehole Bottom of hole at 9.14 m.

BORING NUMBER BH23-9

AllRock Consulting

CLIENT 2818963 Ontario Inc. **PROJECT NAME** Geotechnical Investigation

PROJECT NUMBER 23265 **PROJECT LOCATION** 15441 Mt. Pleasant Road, Caledon, ON

DATE STARTED 23-11-28 **COMPLETED** 23-11-28 **GROUND ELEVATION** 263.5 m **HOLE SIZE** 150mm

DRILLING CONTRACTOR Terra Firma **GROUND WATER LEVELS:**

DRILLING METHOD Solid Stem Auger **AT TIME OF DRILLING** ---

LOGGED BY E. Syed **CHECKED BY** G. Davidson **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** ---

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	
	1	98	1-2-3-3 (5)		0.10 Dark Brown sandy silt,trace gravel, contains organic (TOPSOIL)	263.40
					Brown SANDY SILT, trace gravel	
	2	98	2-4-6-8 (10)			
2	3	90	3-8-11-14 (19)		2.29	261.21
					Brown to grey silt, trace sand and clay (GLACIAL TILL)	
	4	98	6-7-5-7 (12)			
	5	98	3-9-10-10 (19)			
4						
	6	98	10-16-18-18 (34)			
6						
	8	98	9-14-16-20 (30)			
	7	90	8-5-14-20 (19)			
8						
	9	98	12-17-16-22 (33)		9.15	254.35
					End of Borehole	
					Bottom of hole at 9.14 m.	

WELL NUMBER MW23-10

AllRock Consulting

CLIENT 2818963 Ontario Inc. **PROJECT NAME** Geotechnical Investigation

PROJECT NUMBER 23265 **PROJECT LOCATION** 15441 Mt. Pleasant Road, Caledon, ON

DATE STARTED 23-11-27 **COMPLETED** 23-11-27 **GROUND ELEVATION** 266.79 m **HOLE SIZE** 150mm

DRILLING CONTRACTOR Terra Firma **GROUND WATER LEVELS:**

DRILLING METHOD Solid Stem Auger **AT TIME OF DRILLING** ---

LOGGED BY E. Syed **CHECKED BY** G. Davidson **AT END OF DRILLING** ---

NOTES **AFTER DRILLING** 7.00 m / Elev 259.79 m

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	1	90	1-3-3-6 (6)		0.10 Dark Brown sandy silt,trace gravel, contains organic (TOPSOIL) 266.69 Brown SAND and SILT	Flushmount Cap
	2	62	4-5-7-8 (12)			
2	3	82	4-6-7-9 (13)			
	4	70	4-5-6-8 (11)		3.05 263.74 Grey to brown SILT, trace sand and clay	Backfill with Auger Cuttings 50 mm diameter pvc riser
	5	66	5-6-8-13 (14)			
4						
	6	82	8-12-16-24 (28)			
6						Bentonite Seal
	8	98	6-18-20-32 (38)			
	7	98	12-12-14-28 (26)			Filter Sand 50 mm diameter pvc screen
8						
	9	98	8-9-9-12 (18)		9.15 257.64 End of Borehole Bottom of hole at 9.14 m.	

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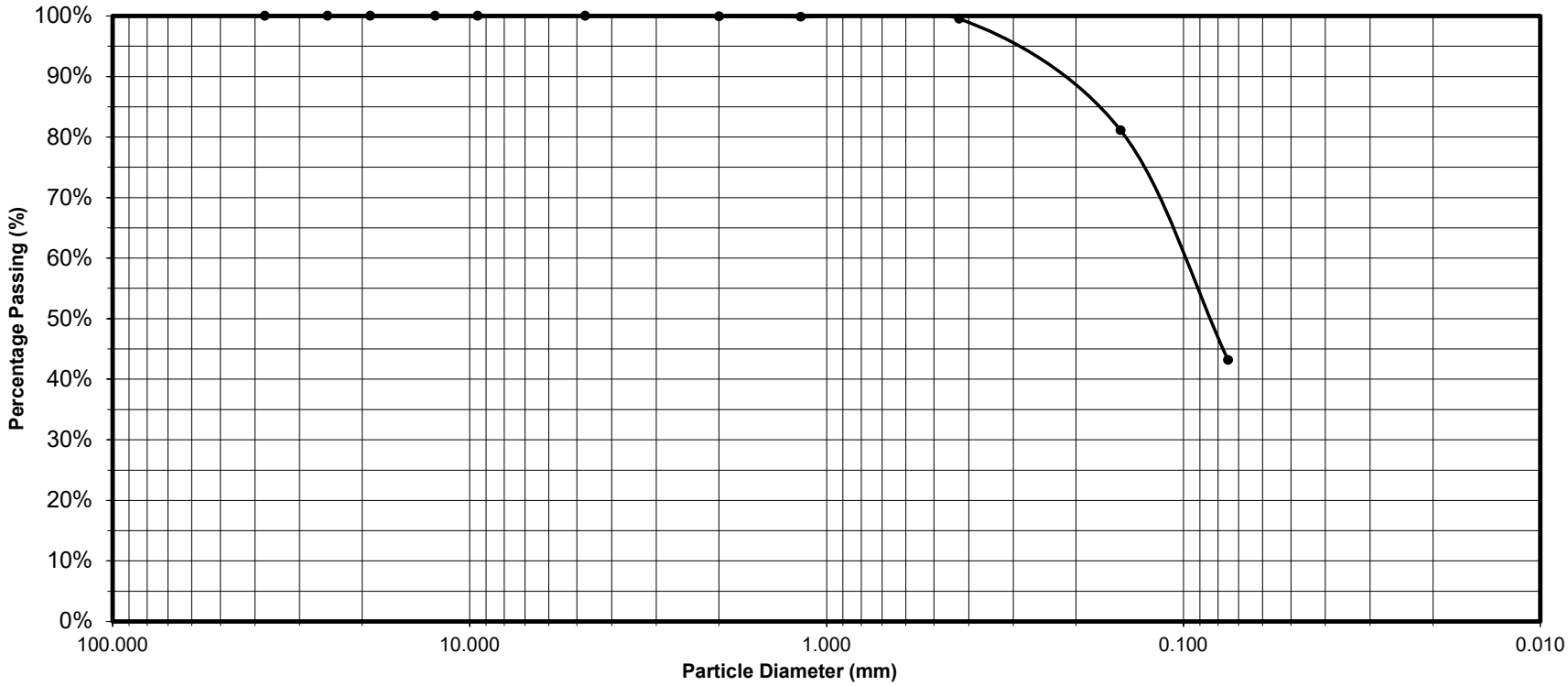
APPENDIX C

Laboratory Testing Results

Sieve Analysis
LS-602

AllRock Consulting Ltd
24 Brydon Drive, Unit #5
M9W 5R6, Toronto, Ont.

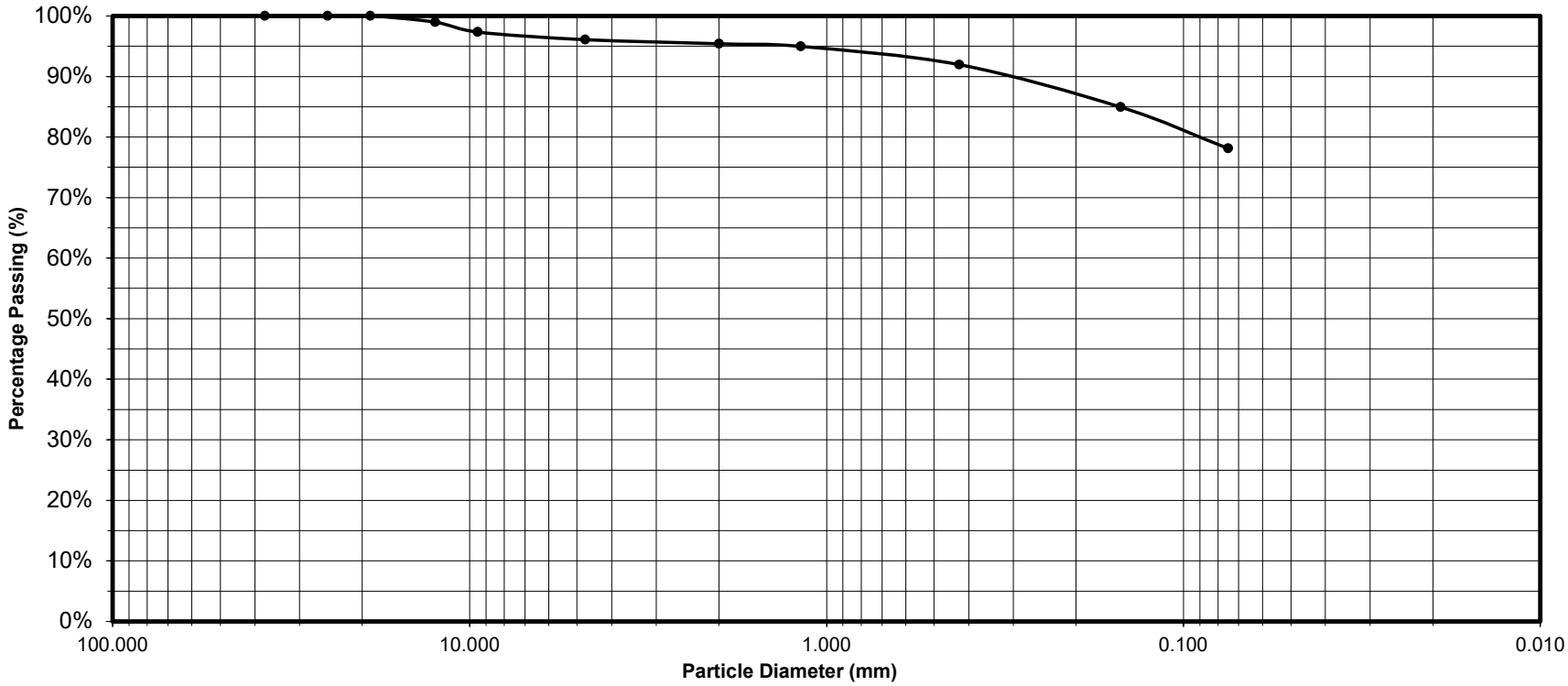
Project:	Geotechnical Investigation and Slope Stability Assessment	**Project Number**	23265
Client:	2818963 Ontario Inc.	**Sample Classification:**	
Sample No.	SS3	**Sample Depth**	1.52-2.13
Date Sampled	November 24, 2023	**Date Tested:**	December 7, 2023
		Moisture Content:	18.8%



Sieve Analysis
LS-602

AllRock Consulting Ltd
24 Brydon Drive, Unit #5
M9W 5R6, Toronto, Ont.

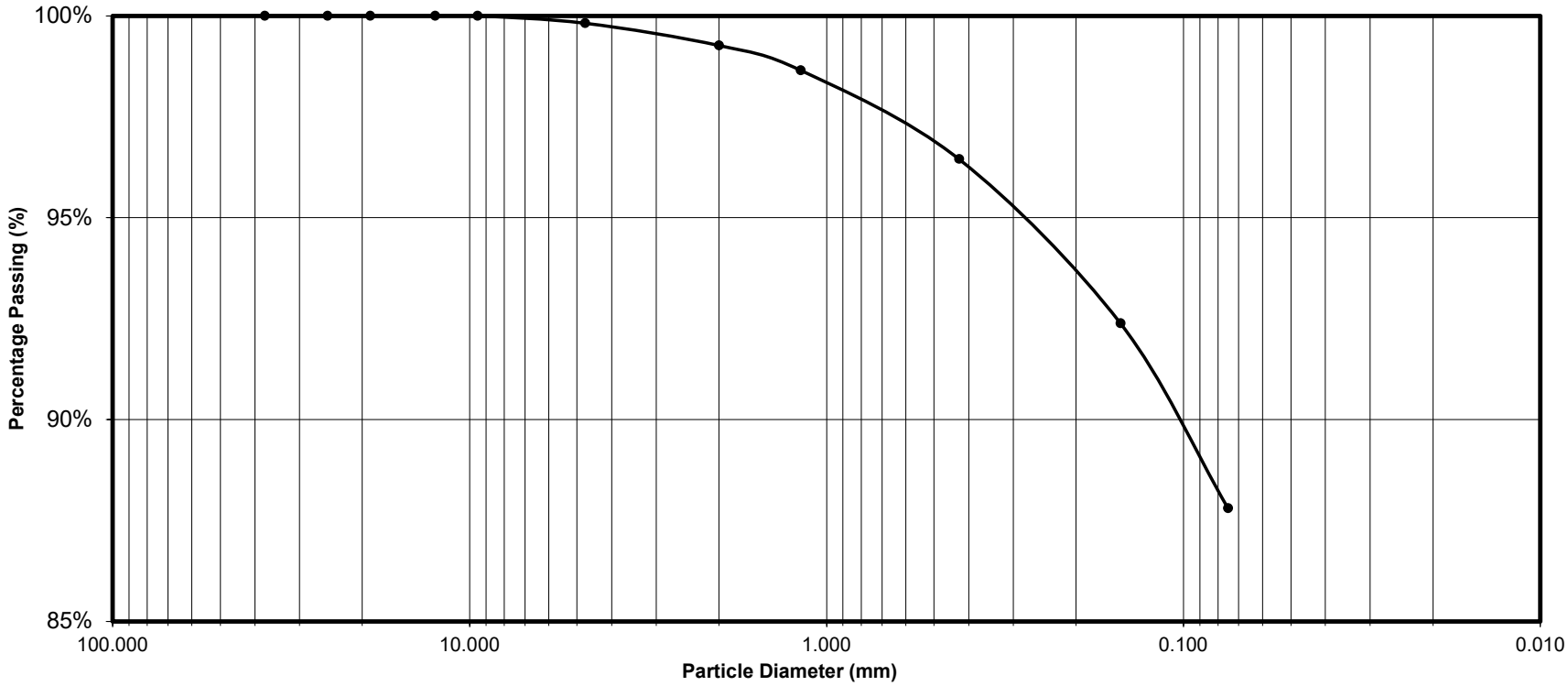
Project:	Geotechnical Investigation and Slope Stability Assessment	**Project Number**	23265
Client:	2818963 Ontario Inc.	**Sample Classification:**	
Sample No.	SS6	**Sample Depth**	4.57-5.33
Date Sampled	November 28, 2023	**Date Tested:**	December 7, 2023
		Moisture Content:	15.4%



Sieve Analysis
LS-602

AllRock Consulting Ltd
24 Brydon Drive, Unit #5
M9W 5R6, Toronto, Ont.

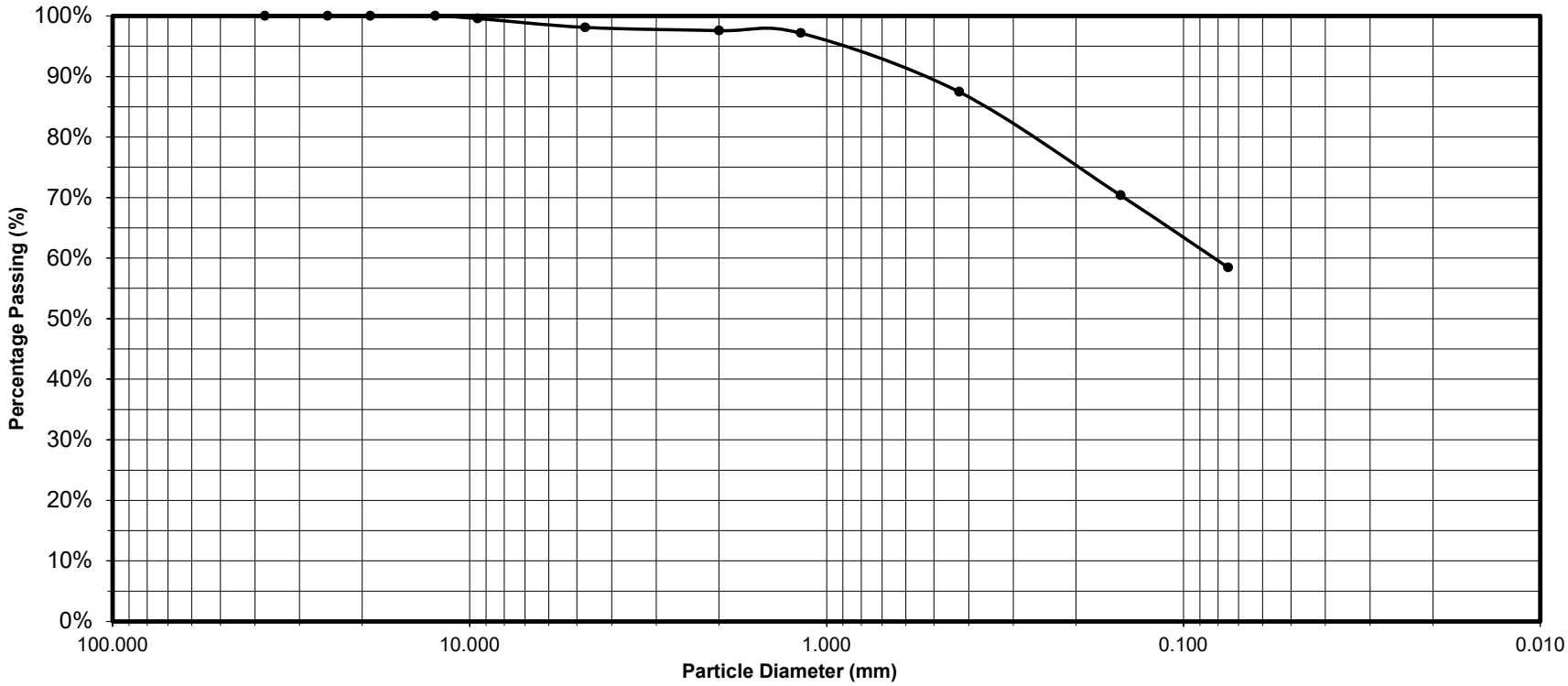
Project:	Geotechnical Investigation and Slope Stability Assessment	**Project Number**	23265
Client:	2818963 Ontario Inc.	**Sample Classification:**	
Sample No.	SS2	**Sample Depth**	0.76-1.37
Date Sampled	November 28, 2023	**Date Tested:**	December 7, 2023
		Moisture Content:	18.1%



Sieve Analysis
LS-602

AllRock Consulting Ltd
24 Brydon Drive, Unit #5
M9W 5R6, Toronto, Ont.

Project:	Geotechnical Investigation and Slope Stability Assessment	**Project Number**	23265
Client:	2818963 Ontario Inc.	**Sample Classification:**	
Sample No.	SS1	**Sample Depth**	0-0.61
Date Sampled	November 27, 2023	**Date Tested:**	December 7, 2023
		Moisture Content:	20.3%



AllRock Consulting Ltd

GRAIN SIZE ANALYSIS AND HYDROMETER TEST REPORT MTO LS-602, 702, AND 703/704

AllRock Consulting Ltd
24 Brydon Drive, Unit #5
Etobicoke, ON. M9W 5R6

Project Information	
Project Name:	Geotechnical Investigation and Slope Stability Assessment
Project No.:	23265
Client:	2818963 Ontario Inc.
Borehole / Test Pit No.:	BH23-2
Sample Depth:	7.62-8.23
Sample No.:	SS8
Sampled By:	E.Syed
Sample Description:	
Sample Natural M/C %:	16.2%
Date Sampled:	Monday, November 27, 2023
Tested By:	A. Patel
Date Tested:	Friday, December 15, 2023
Reviewed By:	G.Davidson

Grain Size Analysis		Hydrometer Analysis	
Sieve Size (mm)	% Passing	Diameter (mm)	% Passing
75.0	100%	0.036091286	75.8%
63.0	100%	0.026149327	72.6%
53.0	100%	0.017011827	68.7%
37.5	100%	0.010241705	62.4%
26.5	100%	0.007527205	56.2%
19.0	100%	0.005445489	52.2%
13.2	100%	0.002807541	42.8%
9.5	99%	0.001237513	31.2%
4.8	99%	ATTERBERG LIMITS, %	
2.0	99%	Plastic Limit	-
0.850	98%	Liquid Limit	-
0.425	98%	Plastic Index	-
0.250	97%		
0.106	91%		
0.075	87%		

PARTICLE SIZE DISTRIBUTION, MTO LS-702

AllRock Consulting Ltd

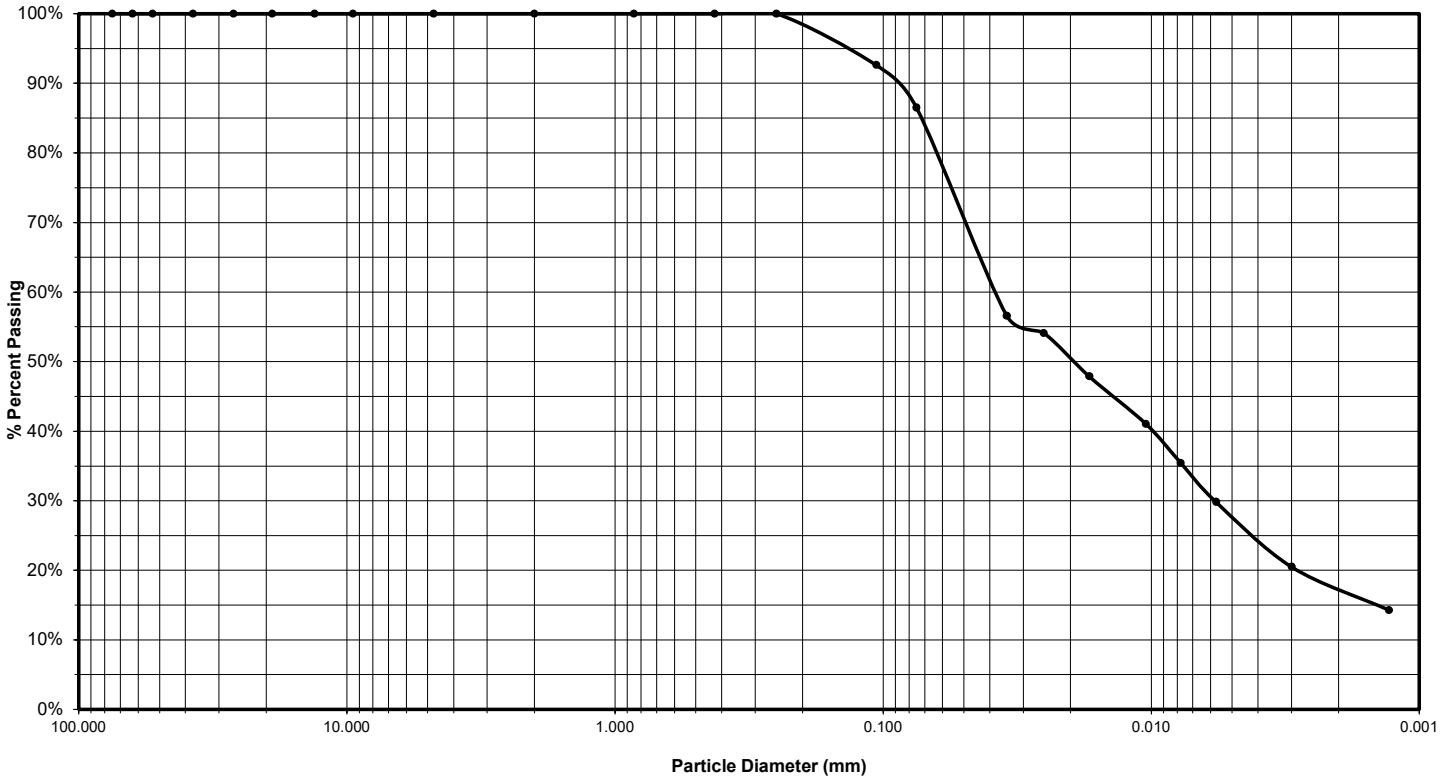
GRAIN SIZE ANALYSIS AND HYDROMETER TEST REPORT MTO LS-602, 702, AND 703/704

AllRock Consulting Ltd
24 Brydon Drive, Unit #5
Etobicoke, ON. M9W 5R6

Project Information	
Project Name:	Geotechnical Investigation and Slope Stability Assessment
Project No.:	23265
Client:	2818963 Ontario Inc.
Borehole / Test Pit No.:	BH23-3
Sample Depth:	8.38-8.99
Sample No.:	SS9
Sampled By:	E.Syed
Sample Description:	
Sample Natural M/C %:	21.5%
Date Sampled:	Tuesday, November 28, 2023
Tested By:	A. Patel
Date Tested:	Monday, December 11, 2023
Reviewed By:	G.Davidson

Grain Size Analysis		Hydrometer Analysis	
Sieve Size (mm)	% Passing	Diameter (mm)	% Passing
75.0	100%	0.034558041	56.6%
63.0	100%	0.025164195	54.1%
53.0	100%	0.017011827	47.9%
37.5	100%	0.010474104	41.0%
26.5	100%	0.007763348	35.4%
19.0	100%	0.005730868	29.8%
13.2	100%	0.002994247	20.5%
9.5	100%	0.001296876	14.3%
4.8	100%	ATTERBERG LIMITS, %	
2.0	100%	Plastic Limit	-
0.850	100%	Liquid Limit	-
0.425	100%	Plastic Index	-
0.250	100%		
0.106	93%		
0.075	87%		

PARTICLE SIZE DISTRIBUTION, MTO LS-702



AllRock Consulting Ltd

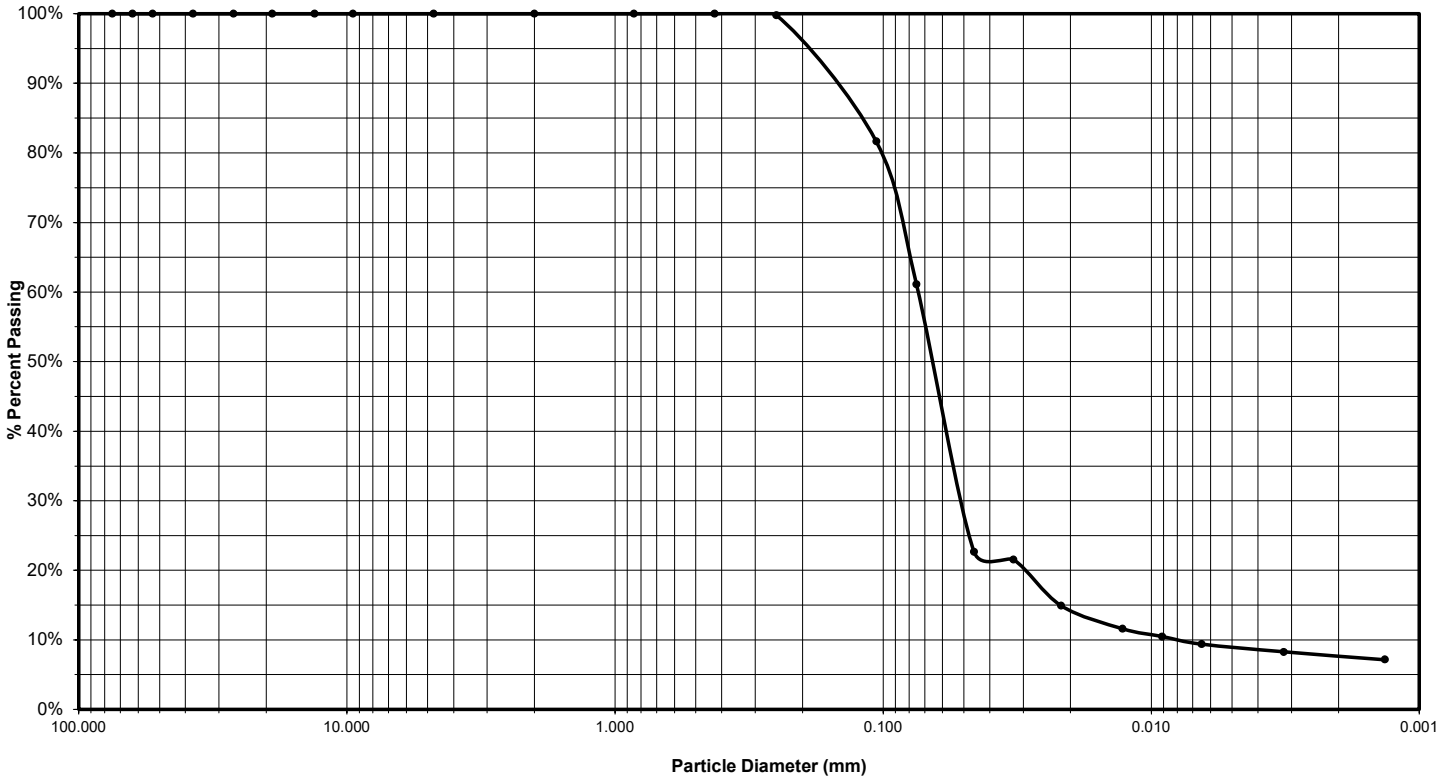
GRAIN SIZE ANALYSIS AND HYDROMETER TEST REPORT MTO LS-602, 702, AND 703/704

AllRock Consulting Ltd
24 Brydon Drive, Unit #5
Etobicoke, ON. M9W 5R6

Project Information	
Project Name:	Geotechnical Investigation and Slope Stability Assessment
Project No.:	23265
Client:	2818963 Ontario Inc.
Borehole / Test Pit No.:	BH23-7
Sample Depth:	3.05-3.66
Sample No.:	SS5
Sampled By:	E.Syed
Sample Description:	
Sample Natural M/C %:	22.6%
Date Sampled:	Friday, November 24, 2023
Tested By:	A. Patel
Date Tested:	Wednesday, December 13, 2023
Reviewed By:	G.Davidson

Grain Size Analysis		Hydrometer Analysis	
Sieve Size (mm)	% Passing	Diameter (mm)	% Passing
75.0	100%	0.045792442	22.6%
63.0	100%	0.032657735	21.5%
53.0	100%	0.021678103	14.9%
37.5	100%	0.012801103	11.6%
26.5	100%	0.009117988	10.5%
19.0	100%	0.006493893	9.4%
13.2	100%	0.003203964	8.3%
9.5	100%	0.001344344	7.2%
4.8	100%	ATTERBERG LIMITS, %	
2.0	100%	Plastic Limit	-
0.850	100%	Liquid Limit	-
0.425	100%	Plastic Index	-
0.250	100%		
0.106	82%		
0.075	61%		

PARTICLE SIZE DISTRIBUTION, MTO LS-702



AllRock Consulting Ltd

GRAIN SIZE ANALYSIS AND HYDROMETER TEST REPORT MTO LS-602, 702, AND 703/704

AllRock Consulting Ltd
24 Brydon Drive, Unit #5
Etobicoke, ON. M9W 5R6

Project Information	
Project Name:	Geotechnical Investigation and Slope Stability Assessment
Project No.:	23265
Client:	2818963 Ontario Inc.
Borehole / Test Pit No.:	BH23-8
Sample Depth:	7.38-7.99
Sample No.:	SS7
Sampled By:	E.Syed
Sample Description:	
Sample Natural M/C %:	16.6%
Date Sampled:	Monday, November 27, 2023
Tested By:	A. Patel
Date Tested:	Sunday, December 10, 2023
Reviewed By:	G.Davidson

Grain Size Analysis		Hydrometer Analysis	
Sieve Size (mm)	% Passing	Diameter (mm)	% Passing
75.0	100%	0.039892876	42.9%
63.0	100%	0.028841435	40.4%
53.0	100%	0.01920518	34.2%
37.5	100%	0.011638883	27.7%
26.5	100%	0.008432191	24.2%
19.0	100%	0.00611198	20.5%
13.2	100%	0.00312408	13.7%
9.5	100%	0.001334985	9.3%
4.8	100%	ATTERBERG LIMITS, %	
2.0	100%	Plastic Limit	-
0.850	100%	Liquid Limit	-
0.425	100%	Plastic Index	-
0.250	99%		
0.106	97%		
0.075	95%		

PARTICLE SIZE DISTRIBUTION, MTO LS-702

Certificate of Analysis

eurofins | Environment Testing

Client: All Rock Consulting Limited
24 Brydon Drive, Unit #5
Toronto, ON
M9W 5R6
Attention: Mr. Nathan Martin
Invoice to: AllRock Consulting Limited
PO#:

Report Number: 3003383
Date Submitted: 2023-11-22
Date Reported: 2023-11-29
Project:
COC #: 223608
Temperature (C): 3
Custody Seal:

Dear Nathan Martin:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

Raheleh Zafari, Environmental Chemist

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise stated
.
Eurofins Environment Testing Canada Inc. is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at https://directory.cala.ca/

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline or regulatory limits listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official guideline or regulation as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

Certificate of Analysis

Client: All Rock Consulting Limited
24 Brydon Drive, Unit #5
Toronto, ON
M9W 5R6
Attention: Mr. Nathan Martin
PO#:
Invoice to: AllRock Consulting Limited

Report Number: 3003383
Date Submitted: 2023-11-22
Date Reported: 2023-11-29
Project:
COC #: 223608

Inorganics

Analyte	Batch No	MRL	Units	Guideline	Lab I.D. 1711511	1711512	1711513	1711514
					Sample Matrix Soil153	Soil153	Soil153	Soil153
					Sample Type			
					Sample Date 2023-11-21	2023-11-21	2023-11-21	2023-11-21
					Sampling Time			
					Sample I.D. BH9 SS4	BH10 SS4	BH6 SS4	BH4 SS4
Chloride	452983	0.002	%		0.002	0.010	<0.002	<0.002
Electrical Conductivity	452949	0.05	mS/cm		0.14	0.32	0.08	0.11
pH	452949	2.00			8.02	9.06	8.89	8.26
Resistivity	452949	1	ohm-cm		7143	3125	12500	9091
SO4	452948	0.01	%		<0.01	<0.01	<0.01	<0.01

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: All Rock Consulting Limited
24 Brydon Drive, Unit #5
Toronto, ON
M9W 5R6
Attention: Mr. Nathan Martin
PO#:
Invoice to: AllRock Consulting Limited

Report Number: 3003383
Date Submitted: 2023-11-22
Date Reported: 2023-11-29
Project:
COC #: 223608

Quality Assurance Summary

Batch No	Analyte	Blank	QC % Rec	QC Limits	Spike % Rec	Spike Limits	Dup % RPD	Duplicate Limits
452948	SO4	<0.01 %	93	70-130	103		0	-50-50
452949	Electrical Conductivity	<0.05	99	90-110			0	0-10
452949	pH	6.68	99	90-110			0	0-1
452949	Resistivity							
452983	Chloride	<0.002 %	99	90-110			0	

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

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Client: All Rock Consulting Limited
24 Brydon Drive, Unit #5
Toronto, ON
M9W 5R6
Attention: Mr. Nathan Martin
PO#:
Invoice to: AllRock Consulting Limited

Report Number: 3003383
Date Submitted: 2023-11-22
Date Reported: 2023-11-29
Project:
COC #: 223608

Test Summary

Batch No	Analyte	Instrument	Prep aration Date	Analysis Date	Analyst	Method
452948	SO4	Manual	2023-11-29	2023-11-29	IP	AG SOIL
452949	Electrical Conductivity	Electrical Conductivity Mete	2023-11-29	2023-11-29	IP	Cond-Soil
452949	pH	pH Meter	2023-11-29	2023-11-29	IP	Ag Soil
452949	Resistivity	Calculation	2023-11-29	2023-11-29	IP	Resistivity - soil
452983	Chloride	Manual	2023-11-28	2023-11-29	AsA	C CSA A23.2-4B

Results relate only to the parameters tested on the samples submitted.
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Client: All Rock Consulting Limited
24 Brydon Drive, Unit #5
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M9W 5R6
Attention: Mr. Nathan Martin
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Invoice to: AllRock Consulting Limited

Report Number: 3003383
Date Submitted: 2023-11-22
Date Reported: 2023-11-29
Project:
COC #: 223608

CWS for Petroleum Hydrocarbons in Soil - Tier 1

Notes:

1. The laboratory method complies with CCME Tier 1 reference method for PHC in soil. It is validated for laboratory use.
2. Where the F1 fraction (C6 to C10) and BTEX are both measured, F1-BTEX is reported.
3. Where the F2 fraction (C10 to C16) and naphthalene are both measured, F2-naphthalene is reported.
4. Where the F3 fraction (C16 to C34) and PAHs* are both measured, F3-PAH is reported.
5. F4G is analyzed if the chromatogram does not descend to baseline before C50. Where F4 (C34 to C50) and F4G are both reported, the higher result is compared to the standard.
6. Unless otherwise stated in the sample comments, the following criteria have been met where applicable:

   - nC6 and nC10 response factors within 30% of response factor for toluene;
   - nC10, nC16, and nC34 response factors within 10% of each other;
   - C50 response factors within 70% of nC10 + nC16 + nC34 average; and,
   - Linearity is within 15%.

7. Unless otherwise stated in the sample comments, sampling requirements and analytical holding times have been met.
8. Gravimetric heavy hydrocarbons (F4G) cannot be added to the C6 and C50 hydrocarbons.
9. *PAHs = phenanthrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene and pyrene.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: All Rock Consulting Limited
24 Brydon Drive, Unit #5
Toronto, ON
M9W 5R6
Attention: Mr. Greg Davidson
PO#:
Invoice to: AllRock Consulting Limited

Report Number: 3003662
Date Submitted: 2023-12-01
Date Reported: 2023-12-05
Project: 23265
COC #: 225088

Dear Greg Davidson:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____
Raheleh Zafari, Environmental Chemist

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise indicated.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at: https://directory.cala.ca/.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is licensed by the Ontario Ministry of the Environment, Conservation, and Parks (MECP) for specific tests in drinking water (license #2318). A copy of the license is available upon request.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by the Ontario Ministry of Agriculture, Food, and Rural Affairs for specific tests in agricultural soils.

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

Certificate of Analysis

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Client: All Rock Consulting Limited
24 Brydon Drive, Unit #5
Toronto, ON
M9W 5R6
Attention: Mr. Greg Davidson
PO#:
Invoice to: AllRock Consulting Limited

Report Number: 3003662
Date Submitted: 2023-12-01
Date Reported: 2023-12-05
Project: 23265
COC #: 225088

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1712906 Soil 2023-11-30 BH10 SS2	1712907 Soil 2023-11-23 BH8 SS3
Anions	Cl	0.002	%			0.003	0.002
	SO4	0.01	%			<0.01	<0.01
General Chemistry	Electrical Conductivity	0.05	mS/cm			0.10	0.12
	pH	2.00				8.62	8.20
	Resistivity	1	ohm-cm			10000	8333

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

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Client: All Rock Consulting Limited
24 Brydon Drive, Unit #5
Toronto, ON
M9W 5R6
Attention: Mr. Greg Davidson
PO#:
Invoice to: AllRock Consulting Limited

Report Number: 3003662
Date Submitted: 2023-12-01
Date Reported: 2023-12-05
Project: 23265
COC #: 225088

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 453158 **Analysis/Extraction Date** 2023-12-04 **Analyst** IP **Method** Cond-Soil			
Electrical Conductivity	<0.05 mS/cm	100	90-110
pH	6.61	99	90-110
Resistivity			
Run No 453230 **Analysis/Extraction Date** 2023-12-05 **Analyst** IP **Method** AG SOIL			
SO4	<0.01 %	93	70-130
Run No 453269 **Analysis/Extraction Date** 2023-12-05 **Analyst** AsA **Method** C CSA A23.2-4B			
Chloride	<0.002 %	98	90-110

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

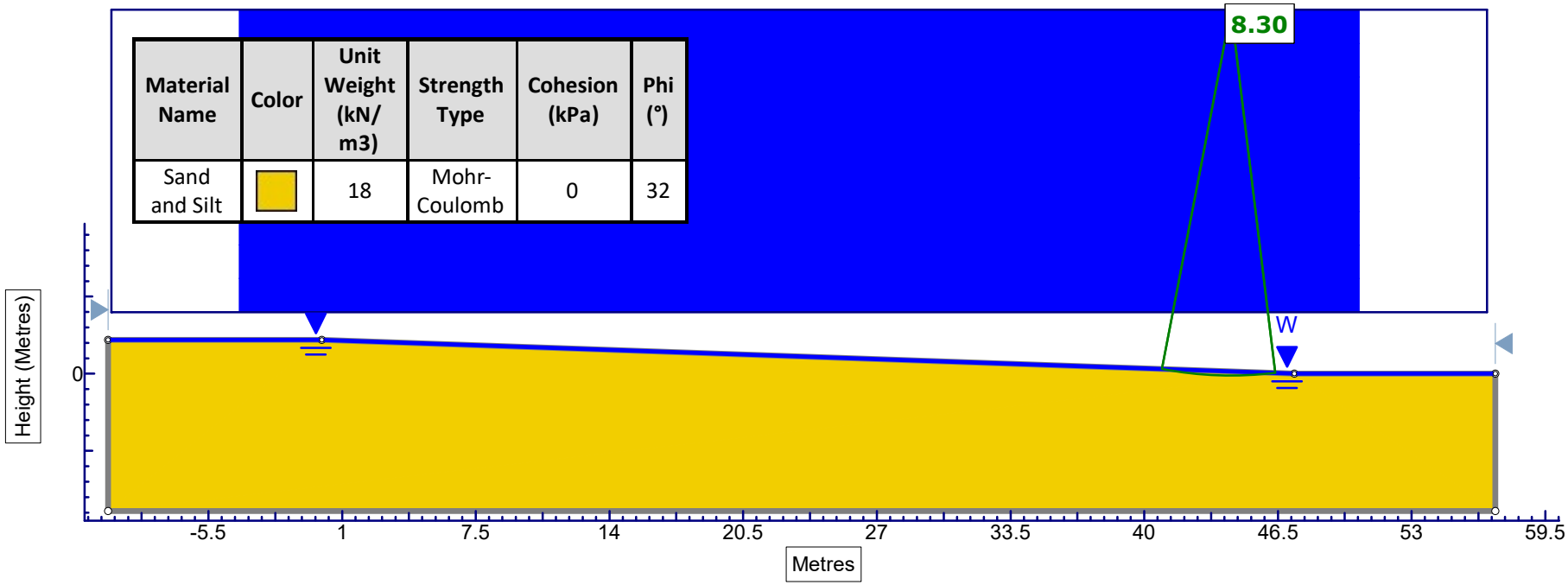
AllRock Consulting Ltd
24 Brydon Drive, Unit #5
Toronto, ON M9W 5R6
1-844-440-7625
www.allrockconsulting.com

APPENDIX D

Slide Analysis Figures

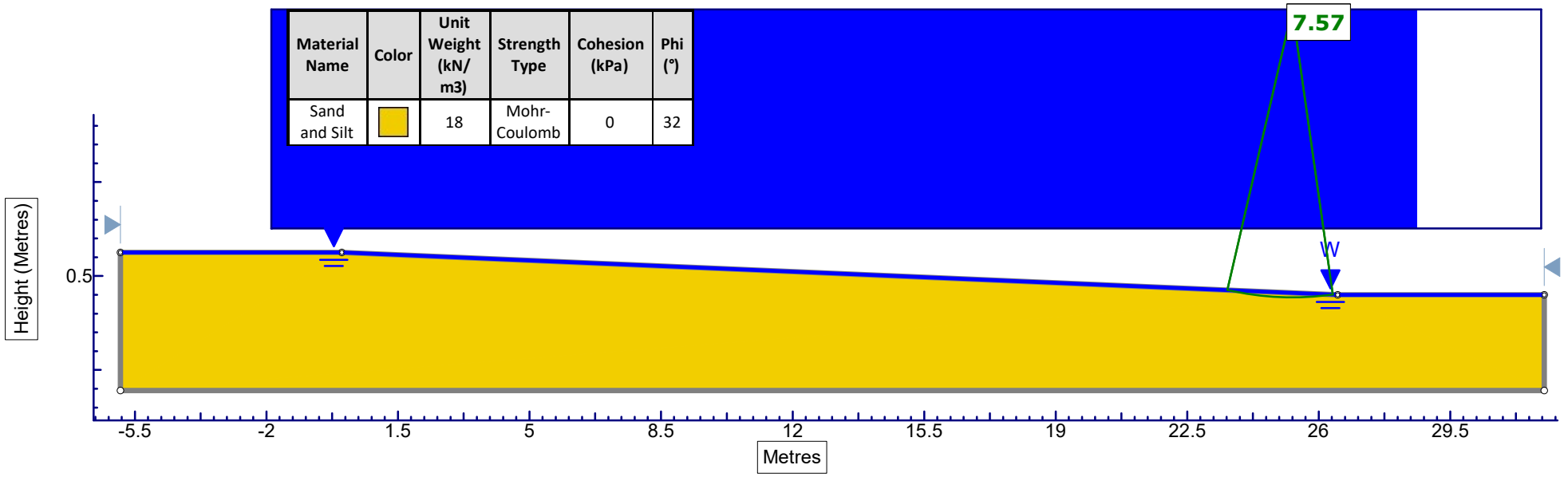
Section A-A

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)
Sand and Silt		18	Mohr-Coulomb	0	32

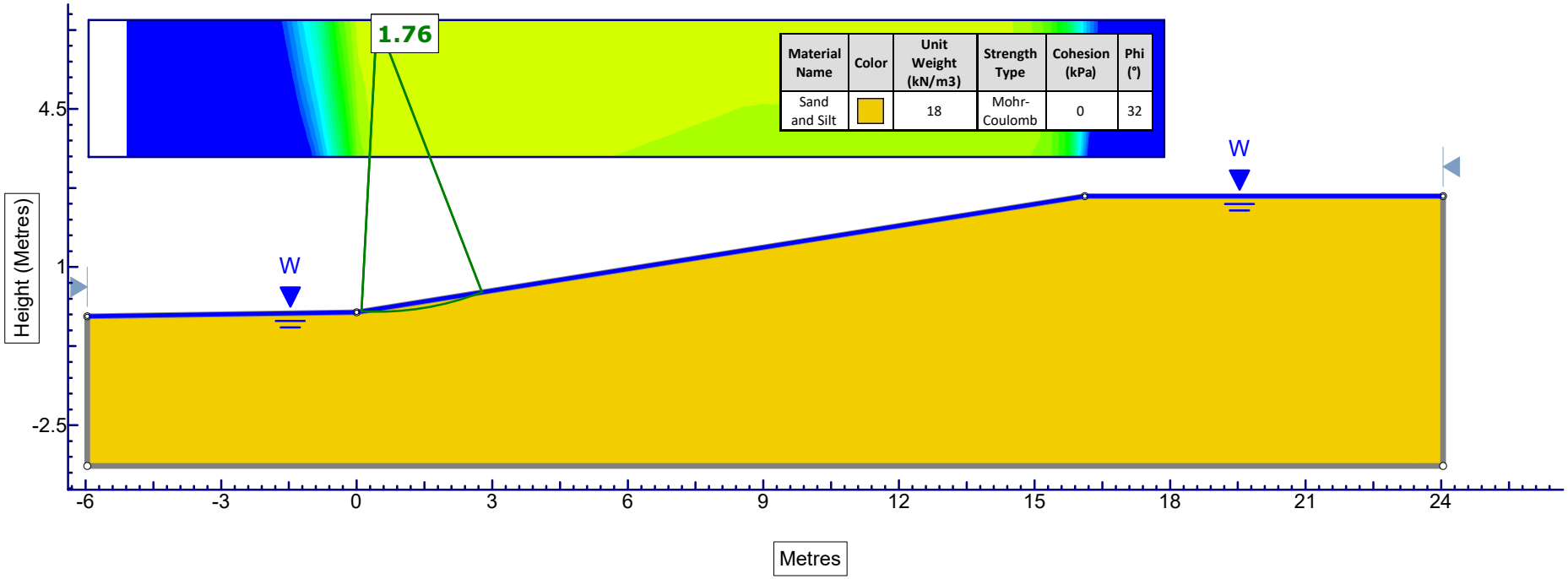


Section B-B

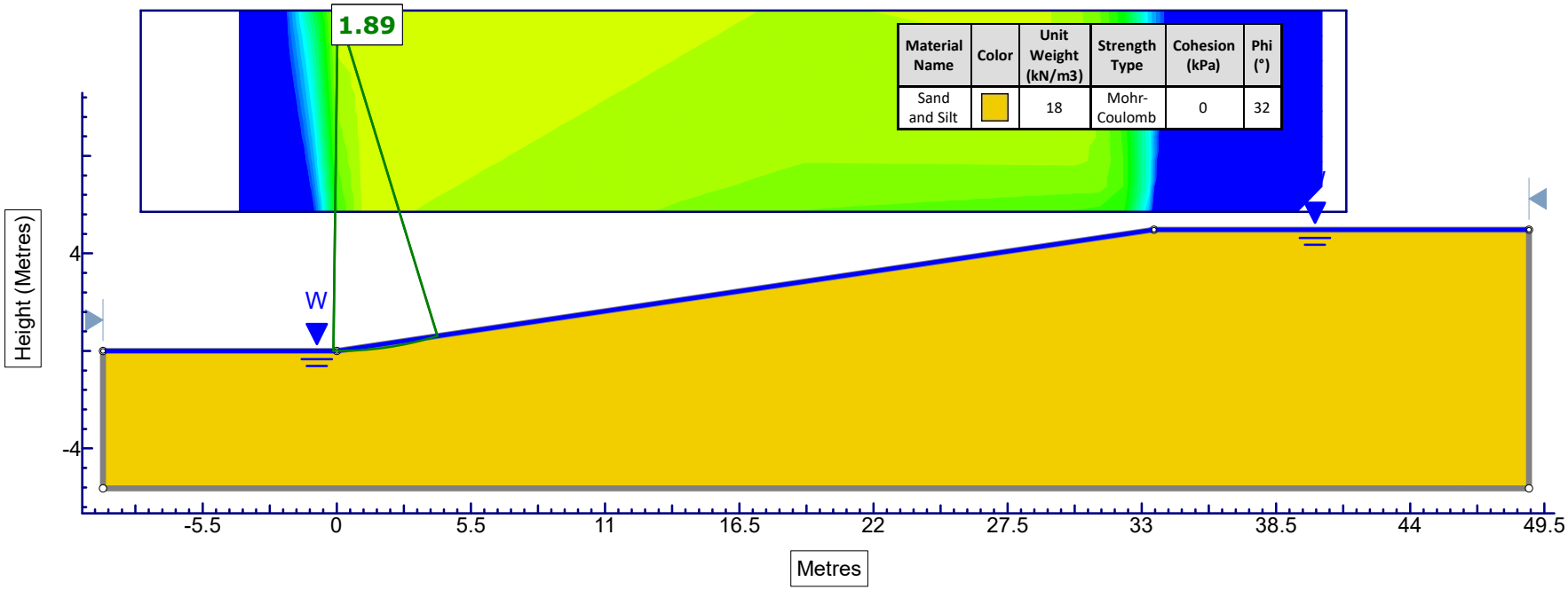
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)
Sand and Silt		18	Mohr-Coulomb	0	32



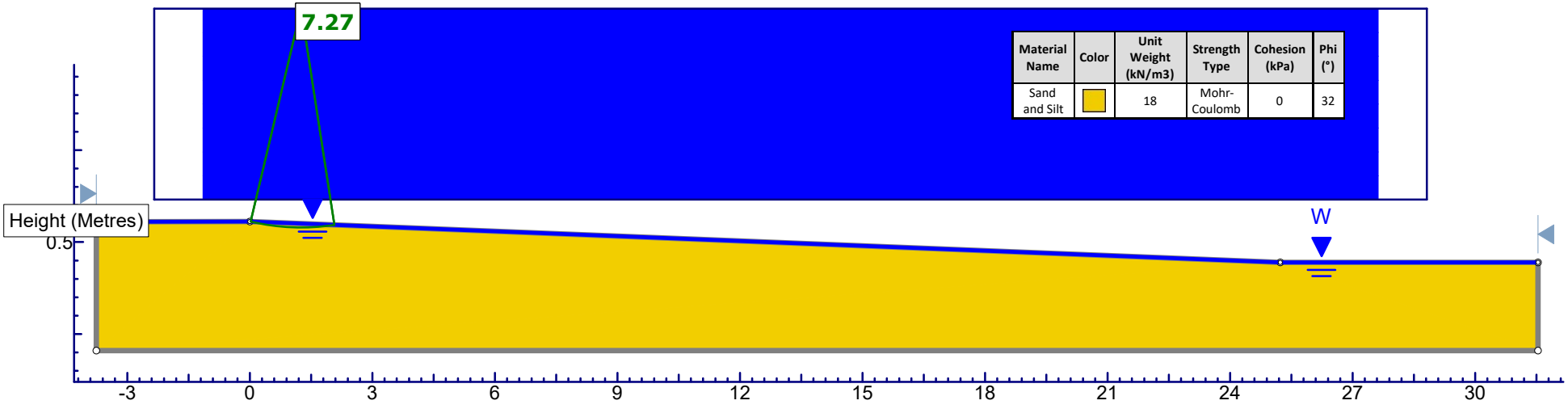
Section C-C


1.76
Material Name
Color
Unit Weight (kN/m3)
Strength Type
Cohesion (kPa)
Phi (°)
Sand and Silt
18
Mohr-Coulomb
0
32
W
W
Height (Metres)
4.5
1
-2.5
-6
-3
0
3
6
9
12
15
18
21
24
Metres

Section D-D


1.89
Material Name
Color
Unit Weight (kN/m3)
Strength Type
Cohesion (kPa)
Phi (°)
Sand and Silt
18
Mohr-Coulomb
0
32
W
Height (Metres)
4
-4
-5.5
0
5.5
11
16.5
22
27.5
33
38.5
44
49.5
Metres

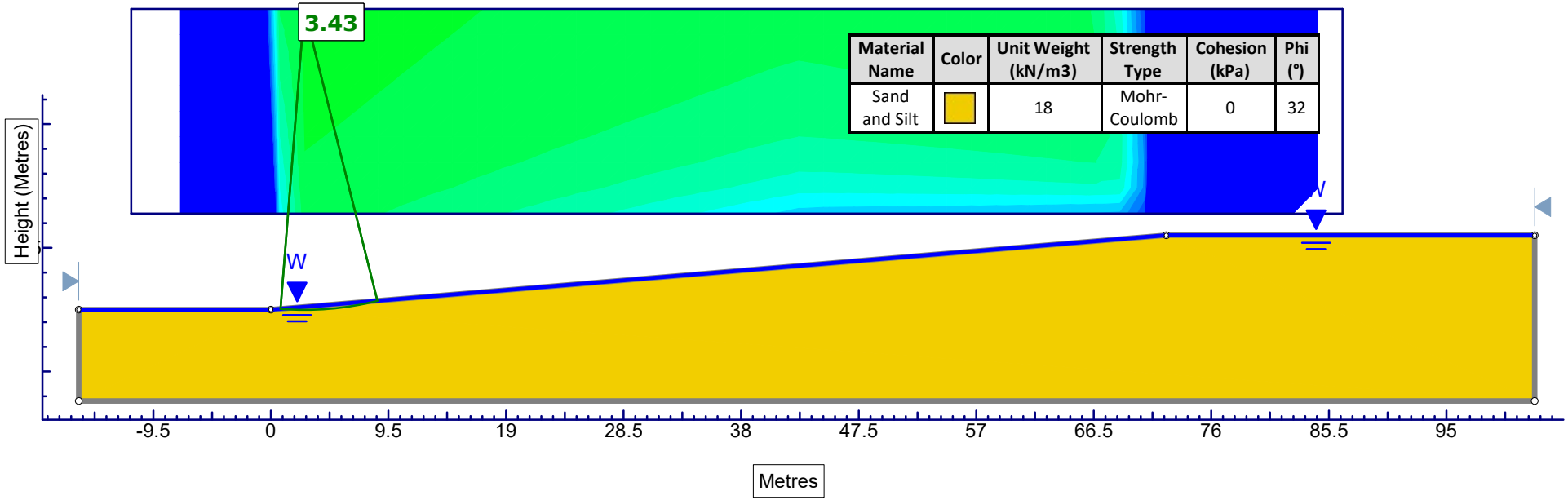
Section E-E



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)
Sand and Silt		18	Mohr-Coulomb	0	32

Metres

Section F-F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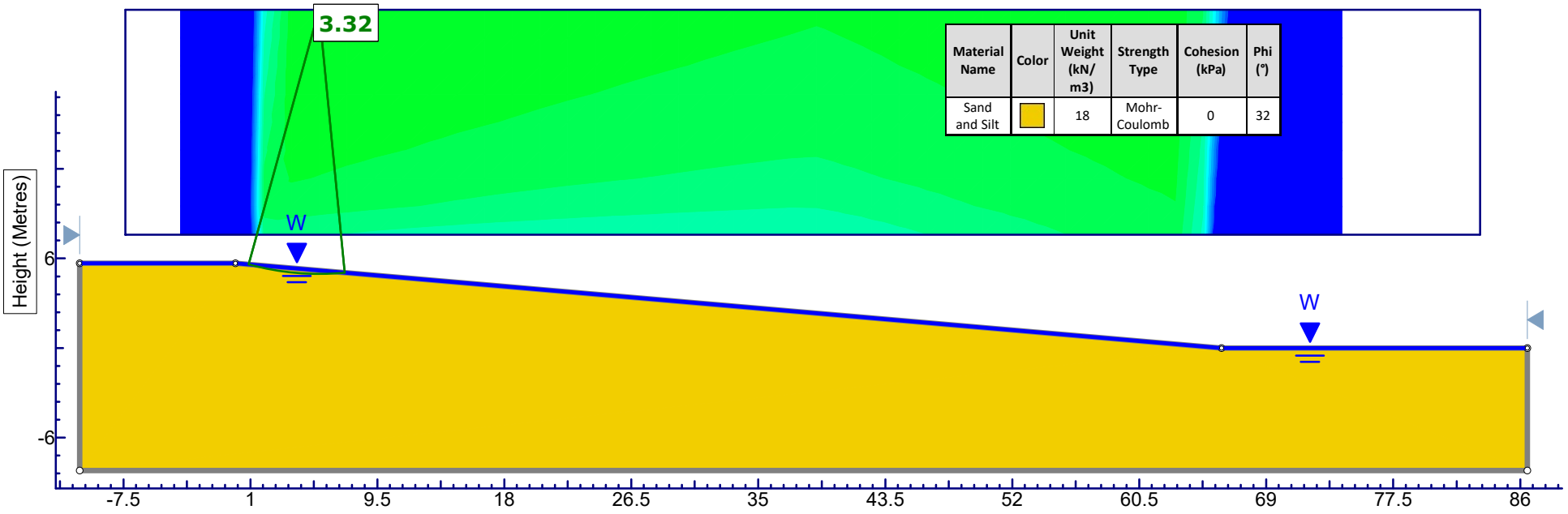
Material Name
Color
Unit Weight (kN/m3)
Strength Type
Cohesion (kPa)
Phi (°)
Sand and Silt
18
Mohr-Coulomb
0
32
W
W
Height (Metres)
-9.5
0
9.5
19
28.5
38
47.5
57
66.5
76
85.5
95
Metres

Section G-G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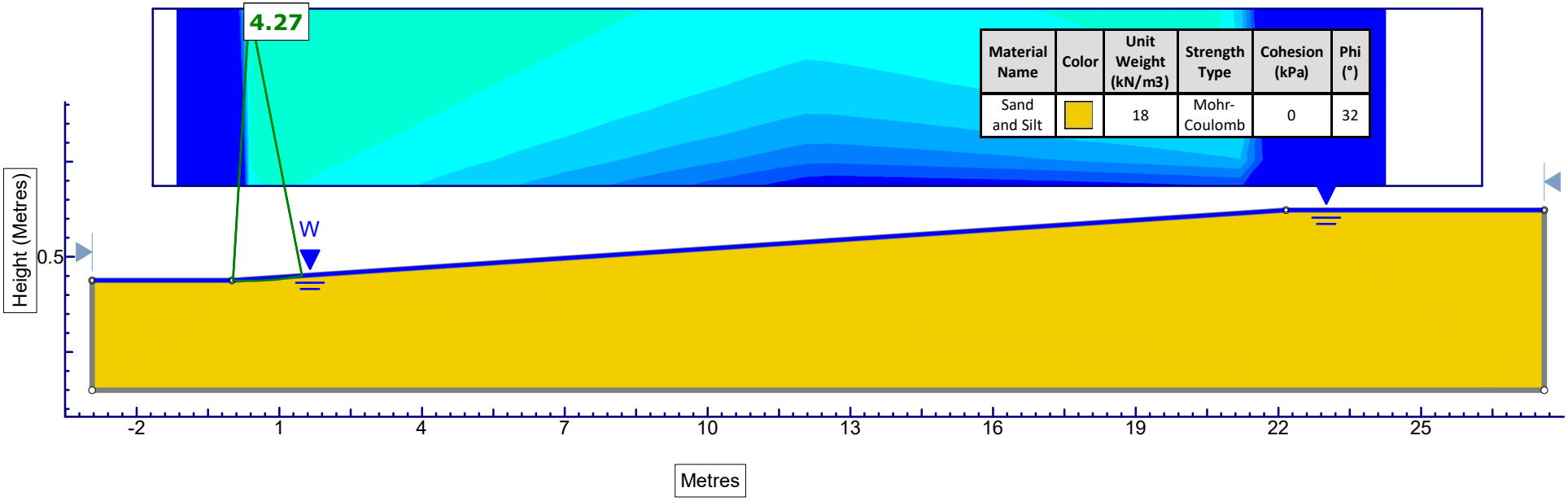
Material Name
Color
Unit Weight (kN/m3)
Strength Type
Cohesion (kPa)
Phi (°)
Sand and Silt
18
Mohr-Coulomb
0
32
W
W
Height (Metres)
6
-6
-7.5
1
9.5
18
26.5
35
43.5
52
60.5
69
77.5
86
Metres

Section H-H


4.27
W
Material Name
Color
Unit Weight (kN/m3)
Strength Type
Cohesion (kPa)
Phi (°)
Sand and Silt
18
Mohr-Coulomb
0
32
Height (Metres)
0.5
-2
1
4
7
10
13
16
19
22
25
Metres