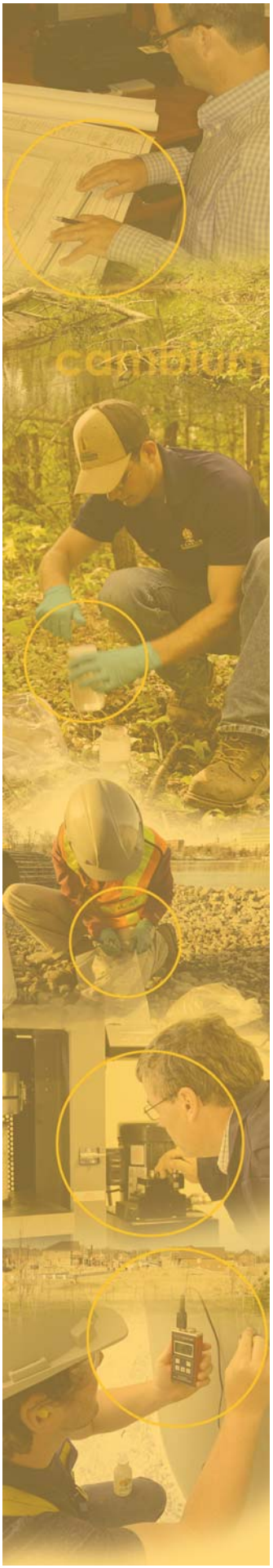

Geotechnical Investigation Report, 513 Dundas Street East, Whitby, Ontario

Cambium Reference No.: 6547-002

March 13, 2020

Prepared for: Kiya Developments Limited

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1.0 INTRODUCTION

Cambium Inc. (Cambium) was retained by Kiya Developments Ltd. (Client) to complete a geotechnical investigation in support of the design and construction of a proposed new development at a site located at civic addresses 513 Dundas Street East in Whitby, Ontario (Site).

The Site is located at the south side of Dundas Street East, between Garden Street and Reynolds Street and currently consists of a vacant, landscaped property in a mixed residential-commercial land use setting. The geotechnical investigation was required to confirm the subsurface conditions at the Site in order to provide geotechnical design parameters as input into the design and construction of proposed six-storey residential apartment and commercial building with underground parking garages as well as associated asphalt parking areas. A Site Plan, including borehole locations, is included as Figure 1 of this report.

This report presents the methodology and findings of the geotechnical investigation at the Site and addresses the requirements and constraints for the design and construction of the potential structures and associated infrastructure.

2.0 METHODOLOGY

2.1 BOREHOLE INVESTIGATION

Cambium completed a geotechnical investigation at the Site on February 26, 2018. A total of five (5) boreholes were advanced to a termination depth of between approximately 3.5 m below existing grade (mbeg) and 8.1 mbeg. The borehole locations are shown on Figure 1. Borehole elevations were surveyed relative to the top bolt of a fire hydrant on the north side of Dundas Street East in front of civic address 513, which has an elevation of 92.57 m based on a topographic survey of the site provided by the Client prepared by DFP Surveyors and dated May 11, 2017. These interpolated elevations are for analytical purposes only, and must be verified prior to finalizing any design or contract parameters upon which they are based.

Drilling and sampling for geotechnical boreholes was completed using a track-mounted drill rig operating under the supervision of a Cambium technician. The boreholes were advanced to the sampling depths by means of continuous flight hollow and solid stem augers with 50 mm O.D. split spoon samplers. Standard Penetration Test (SPT) N values were recorded for the sampled intervals as the number of blows required to drive a split spoon sampler 305 mm into the soil, using a 63.5 kg drop hammer falling 750 mm, as per ASTM D1586 procedures. The SPT N values are used in this report to assess consistency of cohesive soils and relative density of non-cohesive materials. Soil samples were collected at approximately 0.75 m intervals to 3.0 m depth and 1.5 m intervals beyond 3.0 m. The encountered soil units were logged in the field using visual and tactile methods, and samples were placed in labelled plastic bags for transport, future reference, possible laboratory testing, and storage. Open boreholes were checked for groundwater and general stability prior to backfilling.

Two (2) boreholes, BH102-18 and BH104-18, were outfitted with temporary standpipe piezometers for the purposes of determining the depth to the static groundwater table.

Borehole logs are provided in Appendix A. Site soil and groundwater conditions are described and geotechnical recommendations are discussed in the following sections of this report.

2.2 PHYSICAL LABORATORY TESTING

Physical laboratory testing, including two (2) particle size distribution analyses (LS-702,705), was completed on selected soil samples to confirm textural classification and to assess geotechnical parameters. Moisture content testing was completed on all soil samples. Testing results are presented in Appendix B and are discussed in Section 3.0.

2.3 ENVIRONMENTAL LABORATORY TESTING

Three (3) representative soil samples were submitted to AGAT Laboratories in Mississauga, Ontario, a Canadian Association of Laboratory Accreditation (CALA) certified environmental laboratory. The selected samples were taken from the following boreholes and were submitted for analysis of petroleum hydrocarbons (PHC F1-F4); volatile organic compounds (VOCs) including Benzene, Toluene, Ethylbenzene, and Xylene (BTEX); and, metals and inorganics.

- Borehole BH105-18, soil sample 2, from a depth of 0.8 m to 1.2 m
- Borehole BH102-18, soil sample 4, from a depth of 2.3 m to 2.7 m
- Borehole BH104-18, soil sample 3, from a depth of 1.5 m to 2.0 m

The environmental testing results are discussed in Section 3.6 and the laboratory Certificates of Analysis provided as Appendix C.

In addition, a composite soil sample was submitted to AGAT Laboratories for TCLP analysis of metals in inorganics under Ontario Regulation 558. These results are discussed in Section 3.6 and the laboratory Certificates of Analysis provided as Appendix C.

3.0 SUBSURFACE CONDITIONS

Based on the results of the borehole investigation, subsurface conditions at the Site generally consist of a surficial layer of topsoil overlying native gravelly silty sand to silty sand till, which is underlain by native silty sand to sand and gravel soils.

A more detailed description of the individual soil units is provided below and the borehole logs are included in Appendix A.

3.1 TOPSOIL

A surficial layer of topsoil approximately 760 mm in thickness was encountered at the ground surface at all borehole locations. An assessment of the organic matter content of the topsoil was beyond the scope of this study. Additional test holes spaced in a grid pattern would be required to more accurate delineate topsoil thickness across the Site.

3.2 GRAVELLY SILTY SAND TO SILTY SAND TILL

A layer of native gravelly silty sand to silty sand till was encountered below the surficial layer of topsoil at all borehole locations extending to a depth of between 4.6 mbeg and 7.6 mbeg at boreholes BH102-18 to BH104-18 and to the depth of borehole termination at approximately 3.5 mbeg at boreholes BH101-18 and BH105-18. The texture of this native material graded from gravelly silty sand with trace amounts of clay to silty sand with some clay and gravel.

This soil layer was generally brown at the depth of its initial encounter and became increasingly grey with depth. This soil was encountered in a moist to wet in-situ condition with moisture contents varying from 7% to 19%. The native till was encountered in a loose to very dense relative density based on SPT N values ranging from 4 to 50.

A laboratory particle size distribution analysis was completed for two (2) samples of the till material, taken from a depth of between 0.8 mbeg and 2.7 mbeg. The analysis results are summarized in Table 1 and provided in Appendix B.

Table 1 Summary of Particle Distribution Analyses Results for Native Till Soils

Borehole	Sample #	Depth (mbeg)	% Gravel	% Sand	% Silt	% Clay
BH101-18	SS 4	2.3 – 2.7	26	37	27	10
BH104-18	SS 2	0.8 – 1.2	15	38	32	15

3.3 SAND AND GRAVEL TO SILTY SAND

A layer of native sand and gravel to silty sand soil was encountered underlying the till layer at a depth of 4.6 mbeg to 7.6 mbeg at boreholes BH102-18 to BH104-18 extending to the depth of borehole termination at approximately 8.1 mbeg. The texture of this brown to grey soil graded from sand and gravel with some silt to silty sand with varying amounts of gravel.

This soil was encountered in a moist to wet in-situ condition with moisture contents varying from 6% to 16%. The sand and gravel to silty sand soil was encountered in a compact to very dense relative density based on SPT N values ranging from 14 to 88.

3.4 BEDROCK

No bedrock was encountered during the course of this investigation.

3.5 GROUNDWATER

Upon completion of drilling, groundwater was measured at a depth between 4.10 mbeg and 6.52 mbeg at boreholes BH102-18 to BH104-18; the remaining boreholes were found to be dry upon completion. Caving (sloughing) of the borehole walls upon completion of drilling was encountered at a depth of 7.60 mbeg at borehole BH104-18; the remaining boreholes were found to be dry upon completion.

Temporary standpipe piezometers were installed in boreholes BH102-18 and BH104-17 for the purposes of determining the depth to the static groundwater table. On March 1, 2018, the groundwater table was measured to be at a depth of 4.58 mbeg and 5.62 mbeg at boreholes BH102-18 and BH104-18 respectively, which corresponds to an elevation of 86.92 m at borehole BH102-18 and 87.10 m at borehole BH104-18.

The overall moisture content of the soils varied from 6% to 19%.

It should be noted that soil moisture and groundwater levels are affected by seasonal climatic conditions, due to changing precipitation and evaporation rates.

3.6 ENVIRONMENTAL TESTING RESULTS

The Ministry of the Environment and Climate Change (MOECC) document *Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act* (Ministry of the Environment, 2011), was referenced in determining the applicable criteria for the Site.

The samples were compared to Table 1, *Full Depth Background Site Condition Standards*, for Residential/ Parkland/ Institutional/ Industrial/ Commercial/ Community (RPIICC) Property Use to determine exceedances in concentrations of the analyzed parameters.

Three (3) soil samples were submitted to AGAT Laboratories for analysis of the parameters outlined in Section 2.3. The results of the soil analysis were compared to Table 1 Site Condition Standards of the *Standard* (Ministry of the Environment, 2011). The results are summarized on the Certificates of Analysis provided Appendix C and indicate the following:

- Petroleum Hydrocarbons (PHC F1-F4); parameters tested did not exceed Table 1 Site Condition Standards.
- Volatile Organic Compounds (VOCs); parameters tested did not exceed Table 1 Site Condition Standards.
- Metals and Inorganics; parameters tested did not exceed Table 1 Site Condition Standards.

One (1) additional composite soil sample was submitted to AGAT for O.Reg 558 (TCLP) analysis. The results of the TCLP analysis are summarized on the Certificate of Analysis provided in Appendix C and indicate the following:

- Metals and Inorganics; parameters tested did not exceed Schedule 4 criteria outlined in O.Reg. 558.

Based on the test results, the following handling options are available for soils sampled and tested under the program:

- Remain on-site to be appropriately reused as backfill or for re-grading, under the guidance of a Qualified Person (QP) as defined by the MOECC and as approved by a geotechnical engineer;
- Accepted by a Receiving Site with specifications for receipt of soil based on the above test results under the guidance of the receiving site's QP and Fill Management Plan, and subject to the municipality's fill bylaw;
- Disposed of at a waste disposal landfill appropriately certified by the MOECC. Additional testing may be required for O. Reg. 347 waste characterization analysis as directed by the Receiver.

It is noted that the chemical parameters tested and the number of samples do not meet the requirements of a Record of Site Condition and may not meet the requirements of the intended receiving site. This report should not be construed as an Environmental Site Assessment. Handling options provided herein are based solely on the chemical analysis of soils located and sampled at the site, at depths ranging from 0.8 m to 2.7 m depth, and do not represent acceptance or suitability of this material on behalf of the intended receiving site. Should conditions encountered or the proposed scope of work vary from those described in this report, Cambium should be notified to evaluate the need for further work.

4.0 GEOTECHNICAL CONSIDERATIONS

The following recommendations are based on the borehole information and are intended to assist designers. Recommendations should not be construed as providing instructions to contractors, who should form their own opinions about site conditions, particularly when it comes to groundwater seepage. It is possible that subsurface conditions beyond the borehole locations may vary from those observed. If significant variations are found before or during construction, Cambium should be contacted so that we can reassess our findings, if necessary.

4.1 GENERAL SITE PREPARATION

Existing topsoil, fill, and any organic matter identified or found shall be excavated and removed from beneath any areas of the Site to be developed. The stripped surface must be proof rolled and/or approved by Cambium prior to placement of additional fill or foundations.

Based on the recommended excavation depths for the foundation area, the subgrade material is expected to consist of compact to very dense gravelly silty sand to silty sand till. If engineered fill placement is required for the structure, it should be noted that when placing soil that will act as support for the foundation or floor slab, placement and compaction should occur during temperatures above freezing.

The in-situ moisture content of the samples was found to be in a generally moist to wet state potentially making the fine-textured native soils unstable in a wet or saturated condition. The use of approved granular soils such as OPSS 1010 Granular ‘B’ Type I shall be used to minimize construction delays as a result of wet or saturated conditions.

In areas of cut or minor fill where the proof roll and/ or inspection has identified unsuitable subgrade conditions, whether too soft or too wet, material is to be removed and replaced with an approved OPSS 1010 SSM or Granular ‘B’ Type I compacted material, under guidance of Cambium Staff.

4.2 FROST PENETRATION

Based on climate data and design charts, the maximum frost penetration depth below the existing surface at the Site is estimated at 1.2 m.

Exterior footings for the proposed structures should be situated at or below this depth for frost penetration or should be protected.

It is assumed that the pavement structure thickness will be less than 1.2 m, so grading and drainage are very important for good pavement performance and life expectancy. Any utilities should be located below this depth or be appropriately insulated.

4.3 EXCAVATIONS

Temporary excavations must be carried out in accordance with the latest edition of the Occupational Health and Safety Act (OHSA). As per the OHSA, excavations less than 1.2 m deep can have unsupported vertical walls. The soils encountered above the groundwater table may be generally be classified as Type 3 soils in accordance with OHSA, with unsupported side slopes no steeper than 1H:1V to the bottom of the excavation.

Excavation side slopes should be protected from exposure to precipitation and associated ground surface runoff and should be inspected regularly for signs of instability. If localized instability is noted during excavations or if wet conditions are encountered, the side slopes should be flattened as required to maintain safe working conditions or excavation sidewalls must be fully supported (shored).

4.4 DEWATERING

Upon completion of drilling, groundwater was measured at a depth between 4.10 mbeg and 6.52 mbeg at boreholes BH102-18 to BH104-18; the remaining boreholes were found to be dry upon completion. Caving (sloughing) of the borehole walls upon completion of drilling was encountered at a depth of 7.60 mbeg at borehole BH104-18; the remaining boreholes were found to be dry upon completion.

Temporary standpipe piezometers were installed in boreholes BH102-18 and BH104-17 for the purposes of determining the depth to the static groundwater table. On March 1, 2018, the groundwater table was measured to be at a depth of 4.58 mbeg and 5.62 mbeg at boreholes BH102-18 and BH104-18 respectively, which corresponds to an elevation of 86.92 m at borehole BH102-18 and 87.10 m at borehole BH104-18.

Overall, minimal to moderate groundwater seepage is anticipated during excavations and any groundwater seepage that is encountered should be controllable with filtered sumps and pumps. Registration on the Environmental Activity and Sector Registry (EASR) or a Permit to Take Water (PTTW) is likely not required from the Ministry of the Environment and Climate Change (MOECC) as pumping rates should not exceed 50,000 L/day or 400,000 L/day respectively. In order to reduce the amount of groundwater to be pumped from excavations, as necessary, the size of the excavation should be minimized and not left open for long periods of time. Greater quantities of groundwater seepage should be expected where excavations intersect more permeable layers within the native till soils.

It should be noted that the groundwater table is influenced by seasonal fluctuations and major precipitation events.

4.5 BACKFILL AND COMPACTION

An approved OPSS 1010 Granular ‘B’ Type I or Select Subgrade Material (SSM) shall be used for all upfill and/or backfill. This material will require moisture content adjustments depending on seasonal conditions.

Foundation wall backfill, both on the interior or exterior, and grade raises below the floor slab should be compacted to at least 98% of Standard Proctor Maximum Dry Density (SPMDD) using Granular 'B' Type I material complying with OPSS 1010.

All existing vegetation, topsoil, organic and non-organic fills, and any loose soils shall be removed down to a competent base. Backfill area must be approved by Cambium prior to placement of any new fill, to ensure the suitability of subgrade conditions.

4.5.1 ENGINEERED FILL

When the fill is treated as an engineered fill to support structural elements such as foundations and/or floor slabs the following is recommended for the construction of engineered fill:

I. Remove any and all existing vegetation, surficial topsoil/ organics, organic fills or fills and any loose soils to a competent subgrade for a suitable envelope;

II. The area of the engineered fill should extend horizontally 1 m beyond the outside edge of the foundations then extend downward at a 1:1 slope to the competent native soil;

III. The subgrade or base of the engineered fill area must be approved by Cambium prior to placement of any new fill, to ensure that suitability of subgrade condition;

IV. Place approved OPSS 1010 SSM or Granular 'B' Type I material at a moisture content at or near optimum moisture in suitable maximum 200 mm thick lifts, compacted to 100% of SPMDD. Any frost penetration into the fill material must be removed prior to placement of subsequent lifts of fill or reviewed by Cambium;

V. Full time testing and inspection of the engineered fill will be required for it to be used as a founding material, as outlined in Section 4.2.2.2 of the Ontario Building Code.

4.6 SEISMIC SITE CLASSIFICATION

The Ontario Building Code (OBC) specifies that the structures should be designed to withstand forces due to earthquakes. Based on the results of the geotechnical investigation, Cambium originally recommended that the site be classified as Site Class 'D' (*Stiff Soil*) for design in accordance with Table 4.1.8.4.A of the OBC.

Cambium was asked to perform a further investigation at the Site to see if it was possible to obtain a higher seismic site classification. On February 26, 2020 Geophysics GPR International Inc., contracted by Cambium, conducted a survey which included a multi-channel analysis of surface waves (MASW), micro-tremor array measurements (MAM) and refraction methods to generate a shear-wave velocity (V_s30) model for the Site.

The results from these surveys determined that the V_s30 ranged from 502 m/s to 714 m/s with an average of 608 m/s. According to the Table 4.1.8.4.A of the OBC, these values would fall into Site Class 'C' (*Very Dense Soil and Soft Rock*). With the results from the geotechnical investigation and from this survey, Cambium recommends that this site now be classified as Site Class 'C' for design in accordance with Table 4.1.8.4.A of the OBC.

4.7 FOUNDATION DESIGN

It is understood that the proposed residential and commercial building is planned with a basement slab at 88.10 masl. Assuming that the site is planned as outlined above, the native sub-soils are competent to support the proposed structures on conventional strip and spread footings, below the frost penetration depth.

Based on the field investigations, the foundations will be placed on undisturbed native gravelly silty sand to silty sand till soils

Table 2 provides the options for allowable bearing capacity based on the depth of excavation.

Table 2 Allowable Bearing Capacities

ALLOWABLE BEARING CAPCITY (kPa)		ELEVATION OF EXCAVATION (masl)				
ULS	**SLS**	**BH101-18**	**BH102-18**	**BH103-18**	**BH104-18**	**BH105-18**
225	**150**	90.05	90.00	90.61	91.22	91.77
300	**200**	89.26	87.50	89.00	88.50	90.90

Where OPSS 1010 SSM or Granular 'B' Type I granular material is utilized as an engineered fill up to underside of proposed footing elevation, the engineered fill may be designed for an allowable bearing capacity of 150 kPa at SLS and 225 kPa at ULS. Settlement potential at the above-noted SLS loadings is less than 25 mm and differential settlement should be less than 10 mm.

Interior footings in heated areas, if any, may be set on approved engineered fill or compact to very dense native till soils at a minimum depth of 0.55 m below the floor slab. Recommended maximum design loadings for interior footings set on engineered fill or native till are 150 kPa (SLS) and 225 kPa (ULS).

Under no circumstances will the foundations be placed directly on organic materials, loose, frozen subgrade, construction debris, or within ponded water. Footings and walls exposed to frost action shall be backfilled with OPSS 1010 Granular 'B' Type I granular material.

The quality of the subgrade shall be inspected by Cambium during construction, prior to constructing the footings and placing engineered fill, to confirm bearing capacity estimates. Engineered fill shall be placed and compacted as discussed in Section 0.

4.8 TEMPORARY SHORING

Consideration should be given to open cut excavations using OHSA requirements. If temporary shoring is required near restricted excavations along the southern and western portion, a soldier pile and lagging system with either a cantilever design or strut bracing to support lateral loads can be used. Soil properties for use in temporary shoring design are provided in Section 4.10. Alternative shoring systems, such as a caisson wall, would also be suitable for use at this Site though would likely be less time and cost efficient.

4.9 SOIL PROPERTIES FOR LATERAL EARTH PRESSURE

Based on the results of the geotechnical investigation, Cambium has developed parameters for soil properties for lateral earth pressure to be used in the design of foundation walls, retaining walls, and temporary shoring structures for excavation close to the adjacent property; these recommended parameters are provided in Table 3, below.

Table 3 Soil Properties for Lateral Earth Pressure

Soil Property	Native Till Soils	Native Sand Soils	Compacted Granular Fill
Friction Angle, Φ (º)	32	33	35
Cohesion, c_u (kPa)	5	0	0
Unit Weight, γ (kN/m^3)	21	21	21
Earth Pressure Coefficient at rest, k_o	0.47	0.46	0.43
Earth Pressure Coefficient active, k_a	0.31	0.29	0.27
Earth Pressure Coefficient passive, k_p	3.25	3.39	3.69

The following formula may be used to calculate active lateral thrust (Pa) on yielding retaining structures;

$$Pa= (H/2)(Ka)(\gamma H+2q)$$

where,

H = Height of retaining structure (m)

γ= unit weight of retained soil (kN/m^3)

q = surcharge (kPa)

4.10 FLOOR SLAB

Provided the area below the proposed buildings is prepared as discussed in Section 4.1, subsurface conditions will be acceptable for slab-on-grade floor slabs. Any soft loose areas identified would need to be subexcavated and replaced with compacted engineered fill.

To create a stable working surface, to distribute loadings, and for drainage purposes, the floor slabs should be constructed on a minimum of 200 mm of OPSS 1010 Granular A compacted to 98% of SPMDD.

Basement floor slabs should be underlain by 300 mm of 19 mm diameter crushed clear stone wrapped in geotextile. The clear stone will act as a drainage layer and should be hydraulically connected to the perimeter subdrains.

4.11 SUBDRAINAGE

Cambium recommends installation of perimeter perforated pipe sub-drains connected to the storm sewer or to an appropriate frost-free outlet for the footings of any building structure with underground levels where the foundation walls are not waterproofed to provide suitable foundation drainage in accordance with the Ontario Building Code. Subdrains are recommended below any asphalt pavement structure to ensure the longevity of the structure. If exterior concrete slab or curb sub-drains are chosen, they must be connected to a storm sewer or to an appropriate frost-free outlet. It is anticipated that the drainage system would consist of a system of catchbasins draining to storm sewers. In this regard, the subgrade should be carefully proof rolled to a smooth surface and sloped towards the catchbasins to prevent ponding or entrapment of water in the subbase.

Short lengths (5 m to 6 m) of perforated stub-drains should be provided at catchbasin locations. Consideration should also be given to providing continuous sub-drains along the sides of the access roads and perimeter edges of the parking areas to promote drainage of the granular materials, provided that the curbs direct overland flow. Curbs surrounding internal islands located at high points in the parking area do not require subgrade drains, provided that the traffic island is hard surfaced to prevent the infiltration of surface water. If the islands have planters that drain to grade or are landscaped, the subgrade drains along the curb should still be used. In addition, the perimeter of the paved areas should be graded to swales to collect overland flow from unpaved areas.

Stub-drains and sub-drains should be a minimum of 300 mm below the bottom of the granular subbase and connected to the catchbasins to provide positive drainage. The pavement subgrade drains should consist of 150 mm diameter geotextile wrapped perforated pipe, surrounded on all sides by at least 150 mm of clean free draining sand. The pipes should be placed such that the top of the sand filter is at subgrade level.

4.12 BURIED UTILITIES

Trench excavations above the groundwater table should generally consider Type 3 soil conditions, which require side slopes no steeper than 1H:1V to the bottom of the excavation. The bedding and cover material for any buried utilities should consist of OPSS 1010 Granular A or B Type II, placed in accordance with pertinent Ontario Provincial Standard Drawings (OPSD 802.013). The bedding and cover material shall be placed in maximum 200 mm thick lifts and should be compacted to at least 98% of SPMDD. The cover material shall be a minimum of 300 mm over the top of the pipe and compacted to 98% of SPMDD, taking care not to damage the utility pipes during compaction.

If wet or saturated conditions exist within any utility excavation, consideration should be given to using 19 mm diameter crushed clear stone wrapped in a geotextile filter fabric as pipe bedding.

4.13 PAVEMENT DESIGN

The performance of the pavement is dependent upon proper subgrade preparation. All topsoil and organic materials should be removed down to native material and backfilled with approved engineered fill or native material, compacted to 98% of SPMDD. The subgrade should be compacted, proof rolled, and inspected by a Geotechnical Engineer. Any areas where rutting or appreciable deflection is noted should be subexcavated and replaced with suitable fill. The fill should be compacted to at least 98% of SPMDD.

The recommended minimum pavement structure design has been developed for two (2) traffic loading scenario; light duty and heavy duty. The heavy duty design is appropriate for areas where heavy trucks and maintenance vehicles are anticipated to drive while the light duty design is appropriate for areas where no heavy traffic is anticipated. The recommended minimum pavement structure is provided in Table 4.

Table 4 Recommended Minimum Pavement Structure

Pavement Layer	Light Duty	Heavy Duty
Surface Course Asphalt	40 mm HL3 or HL4	40 mm HL3 or HL4
Binder Course Asphalt	50 mm HL8	90 mm HL8
Granular Base	150 mm OPSS 1010 Granular A	200 mm OPSS 1010 Granular A
Granular Subbase	300 mm OPSS 1010 Granular B	300 mm OPSS 1010 Granular B

Material and thickness substitutions must be approved by the Design Engineer.

The thickness of the subbase layer could be increased at the discretion of the Engineer, to accommodate site conditions at the time of construction, including soft or weak subgrade soil replacement.

Compaction of the subgrade should be verified by the Engineer prior to placing the granular fill. Granular layers should be placed in 150 mm maximum loose lifts and compacted to at least 98% of SPMDD (ASTM D698)

standard. The granular materials specified should conform to OPSS standards, as confirmed by appropriate materials testing.

Subdrains are recommended beneath the pavement structure, connecting to the storm sewer or an alternate frost-free outlet as outlined above, to extend the lifespan of the structure.

The final asphalt surface should be sloped at a minimum of 2 percent to shed runoff. Abutting pavements should be sawcut to provide clean vertical joints with new pavement areas.

4.14 DESIGN REVIEW AND INSPECTIONS

Cambium should be contacted to review and approve design drawings, prior to tendering or commencing construction, to ensure that all pertinent geotechnical-related factors have been addressed. It is important that onsite geotechnical supervision be provided at this Site for excavation and backfill procedures, deleterious soil removal, subgrade inspections, and compaction and concrete testing.

Cambium should be retained to complete testing and inspections during construction operations to examine and approve subgrade conditions, placement and compaction of fill materials, granular base courses, and asphaltic concrete.

5.0 CLOSING

Please note that this report is governed by the attached qualifications and limitations. If you have questions or comments regarding this document, please do not hesitate to contact the undersigned at 905-725-6280.

CAMBIUM INC.

Manisha Ahuja, P.E.
Senior Project Manager

Stuart Baird, M.Eng., P.Eng.
General Manager - Geotechnical

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Qualifications and Limitations

Limited Warranty

In performing work on behalf of a client, Cambium relies on its client to provide instructions on the scope of its retainer and, on that basis; Cambium determines the precise nature of the work to be performed. Cambium undertakes all work in accordance with applicable accepted industry practices and standards. Unless required under local laws, other than as expressly stated herein, no other warranties or conditions, either expressed or implied, are made regarding the services, work or reports provided.

Reliance on Materials and Information

The findings and results presented in reports prepared by Cambium are based on the materials and information provided by the client to Cambium and on the facts, conditions and circumstances encountered by Cambium during the performance of the work requested by the client. In formulating its findings and results into a report, Cambium assumes that the information and materials provided by the client or obtained by Cambium from the client or otherwise are factual, accurate and represent a true depiction of the circumstances that exist. Cambium relies on its client to inform Cambium if there are changes to any such information and materials. Cambium does not review, analyze or attempt to verify the accuracy or completeness of the information or materials provided, or circumstances encountered, other than in accordance with applicable accepted industry practice. Cambium will not be responsible for matters arising from incomplete, incorrect or misleading information or from facts or circumstances that are not fully disclosed to or that are concealed from Cambium during the provision of services, work or reports.

Facts, conditions, information and circumstances may vary with time and locations and Cambium's work is based on a review of such matters as they existed at the particular time and location indicated in its reports. No assurance is made by Cambium that the facts, conditions, information, circumstances or any underlying assumptions made by Cambium in connection with the work performed will not change after the work is completed and a report is submitted. If any such changes occur or additional information is obtained, Cambium should be advised and requested to consider if the changes or additional information affect its findings or results.

When preparing reports, Cambium considers applicable legislation, regulations, governmental guidelines and policies to the extent they are within its knowledge, but Cambium is not qualified to advise with respect to legal matters. The presentation of information regarding applicable legislation, regulations, governmental guidelines and policies is for information only and is not intended to and should not be interpreted as constituting a legal opinion concerning the work completed or conditions outlined in a report. All legal matters should be reviewed and considered by an appropriately qualified legal practitioner.

Site Assessments

A site assessment is created using data and information collected during the investigation of a site and based on conditions encountered at the time and particular locations at which fieldwork is conducted. The information, sample results and data collected represent the conditions only at the specific times at which and at those specific locations from which the information, samples and data were obtained and the information, sample results and data may vary at other locations and times. To the extent that Cambium 's work or report considers any locations or times other than those from which information, sample

results and data was specifically received, the work or report is based on a reasonable extrapolation from such information, sample results and data but the actual conditions encountered may vary from those extrapolations.

Only conditions at the site and locations chosen for study by the client are evaluated; no adjacent or other properties are evaluated unless specifically requested by the client. Any physical or other aspects of the site chosen for study by the client, or any other matter not specifically addressed in a report prepared by Cambium, are beyond the scope of the work performed by Cambium and such matters have not been investigated or addressed.

No Reliance

Cambium's services, work and reports are provided solely for the exclusive use of the client which has retained the services of Cambium and to which its reports are addressed. Cambium is not responsible for the use of its work or reports by any other party, or for the reliance on, or for any decision which is made by any party using the services or work performed by or a report prepared by Cambium without Cambium's express written consent. Any party that relies on services or work performed by Cambium or a report prepared by Cambium without Cambium's express written consent, does so at its own risk. No report of Cambium may be disclosed or referred to in any public document without Cambium's express prior written consent. Cambium specifically disclaims any liability or responsibility to any such party for any loss, damage, expense, fine, penalty or other such thing which may arise or result from the use of any information, recommendation or other matter arising from the services, work or reports provided by Cambium .

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Cambium is not responsible for any lost revenues, lost profits, cost of capital, or any special, indirect, consequential or punitive damages suffered by the client or any other party in reliance on any Cambium work or report. Cambium's total liability and responsibility to the client or any other person for any and all losses, costs, expenses, damages, claims, causes of action or other liability whatsoever which do or may result or arise from or be in relation to Cambium's services, work (or failure to perform services or work) or reports shall be limited to the invoiced charges for the work performed by Cambium.

Appended Figures

GEOTECHNICAL INVESTIGATION

KIYA DEVELOPMENTS LTD.

513 Dundas Street East,
Whitby, Ontario

LEGEND

- Borehole Locations
- Subject Property (Approximate)

<bol>Notes:</bol>
- 2016 aerial imagery obtained from the Durham Region Online GIS.
- Subject property is assumed and was obtained from the Town of Whitby online GIS.
- Site Grading Plan was obtained from D.G. Biddle & Associates Ltd. Project No. 116194 Drawing No. SG-1.
- Base mapping features are © Queen's Printer of Ontario, 2017 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

CAMBIUM

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Peterborough, Ontario, K9H 1G5
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www.cambium-inc.com

BOREHOLE LOCATION PLAN

Project No.:	6547-002	Date:	May 2018
		Rev.:	
Scale:	1:750	Projection:	NAD 1983 UTM Zone 17N
Created by:	CPM	Checked by:	SB
Figure:	1		

O:\GIS\project_MXDs\6500-6599\6547-002 Kiya Developments Ltd. - Geotech - 513 Dundas Street East, Whitby, ON\2018-05-31 Fig 1 - Borehole Location Plan.mxd

Appendix A

Borehole Logs

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH101-18

Client: Kiya Developments Ltd. **Project Name:** Geotechnical Investigation **Project No.:** 6547-001

Contractor: Pontil Drlling **Method:** Solid Stem Auger **Date Completed:** 2018-02-26

Location: 513 Dundas St E., Whitby **UTM:** 17T 665915 4860763 **Elevation:** 91.55 m

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
91 / 0		TOPSOIL: Topsoil (760 mm)	1	SS	83	3				
		TILL: Brown GRAVELLY SILTY SAND, trace CLAY, moist, compact	2	SS	100	13				
90 / 1										
			3	SS	100	28				
89 / 2		Dense								SS4 GSA: Gravel 26% Sand 37% Silt 27% Clay 10%
			4	SS	100	32				
88 / 3		Compact								Borehole was open and dry upon completion
			5	SS	100	17				
4		Borehole Terminated at 3.51 m Depth Upon Completion								

Logged By: K. Pedersen **Input By:** K. Pedersen

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH102-18

Client: Kiya Developments Ltd. **Project Name:** Geotechnical Investigation **Project No.:** 6547-001

Contractor: Pontil Drllling **Method:** Solid Stem Auger **Date Completed:** 2018-02-26

Location: 513 Dundas St E., Whitby **UTM:** 17T 665891 4860755 **Elevation:** 91.50 m

Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
91 / 0		TOPSOIL: Topsoil (760 mm)	1	SS	100	4			Cap	
		TILL: Brown to grey, SILTY SAND, some CLAY and GRAVEL, moist to wet, compact	2	SS	89	13				
90 / 1		Dense	3	SS	100	34				
89 / 2		Compact	4	SS	100	21			Bentonite Plug Pipe	
88 / 3			5	SS	100	21				
87 / 4		Very dense	6	SS	100	50				Groundwater measured at 4.10 m depth upon completion
86 / 5										Groundwater measured at 4.58 m depth on 2018-03-01
85 / 6		Compact	7	SS	78	24			Sand Pack PVC Screen	
84 / 7										Borehole was open upon completion
83 / 8		SAND and GRAVEL: Grey SAND and GRAVEL some SILT, wet, very dense	8	SS	50	50			Cap	
		Borehole Terminated at 8.08 m Depth Upon Completion								

Logged By: K. Pedersen **Input By:** K. Pedersen

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
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Log of Borehole: BH103-18

Client: Kiya Developments Ltd. **Project Name:** Geotechnical Investigation **Project No.:** 6547-001

Contractor: Pontil Drllling **Method:** Solid Stem Auger **Date Completed:** 2018-02-26

Location: 513 Dundas St E., Whitby **UTM:** 17T 665937 4860735 **Elevation:** 92.11 m

Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
92	0		TOPSOIL: Topsoil (760 mm)	1	SS	75	2				
91	1		TILL: Brown SILTY SAND, some CLAY and GRAVEL, moist, compact	2	SS	100	13				
			Moist to wet	3	SS	56	24				
90	2			4	SS	100	27				
89	3		Dense	5	SS	100	30				
88	4										
87	5		SILTY SAND: Brown to grey SILTY SAND, trace to some GRAVEL, moist to wet, compact	6	SS	100	14				
86	6			7	SS	100	26				Groundwater measured at 5.80 m depth upon completion
85	7										Borehole was open upon completion
84	8		Very dense	8	SS	82	65				
			Borehole Terminated at 8.08 m Depth Upon Completion								

Logged By: K. Pedersen **Input By:** K. Pedersen

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH104-18

Client: Kiya Developments Ltd. **Project Name:** Geotechnical Investigation **Project No.:** 6547-001

Contractor: Pontil Drllling **Method:** Solid Stem Auger **Date Completed:** 2018-02-26

Location: 513 Dundas St E., Whitby **UTM:** 17T 665938 4860681 **Elevation:** 92.72 m

Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
92 — 0		TOPSOIL: Topsoil (760 mm)	1	SS	100	3			Cap	
		TILL: Brown SILTY SAND, some CLAY and GRAVEL, wet, loose	2	SS	100	4				SS2 GSA: Gravel 15% Sand 38% Silt 32% Clay 15%
91 — 1		Compact	3	SS	100	28				
90 — 2		Brown to grey. Seams of wet SILTY SAND noted at 3.35 mbeg and 4.6 mbeg	4	SS	89	22			Bentonite Plug Pipe	
89 — 3			5	SS	100	27				
88 — 4		Dense	6	SS	100	47				
87 — 5										Groundwater measured at 5.62 m depth on 2018-03-01
86 — 6		SILTY SAND: Brown to grey SILTY SAND, trace to some GRAVEL, wet, dense. Increasing GRAVEL content with depth.	7	SS	89	35			Sand Pack PVC Screen	
85 — 7										Groundwater measured at 6.25 m depth upon completion
		Very dense	8	SS	78	88			Cap	Borehole caved to a depth of 7.60 m upon completion
84 — 8		Borehole Terminated at 8.08 m Depth Upon Completion								

Logged By: K. Pedersen **Input By:** K. Pedersen

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH105-18

Client: Kiya Developments Ltd. **Project Name:** Geotechnical Investigation **Project No.:** 6547-001

Contractor: Pontil Drllling **Method:** Solid Stem Auger **Date Completed:** 2018-02-26

Location: 513 Dundas St E., Whitby **UTM:** 17T 665937 4860731 **Elevation:** 92.57 m

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (10 20 30 40)	Well Installation	Remarks
92 / 0		TOPSOIL: Topsoil (760 mm)	1	SS	100	4				
91 / 1		TILL: Brown SILTY SAND, some CLAY and GRAVEL, moist, compact	2	SS	100	18				
			3	SS	100	15				
90 / 2										
			4	SS	100	23				
89 / 3			5	SS	100	29				Borehole was open and dry upon completion
		Borehole Terminated at 3.51 m Depth Upon Completion								
4										

Logged By: K. Pedersen **Input By:** K. Pedersen

Appendix B

Physical Laboratory Testing Results

Grain Size Distribution Chart

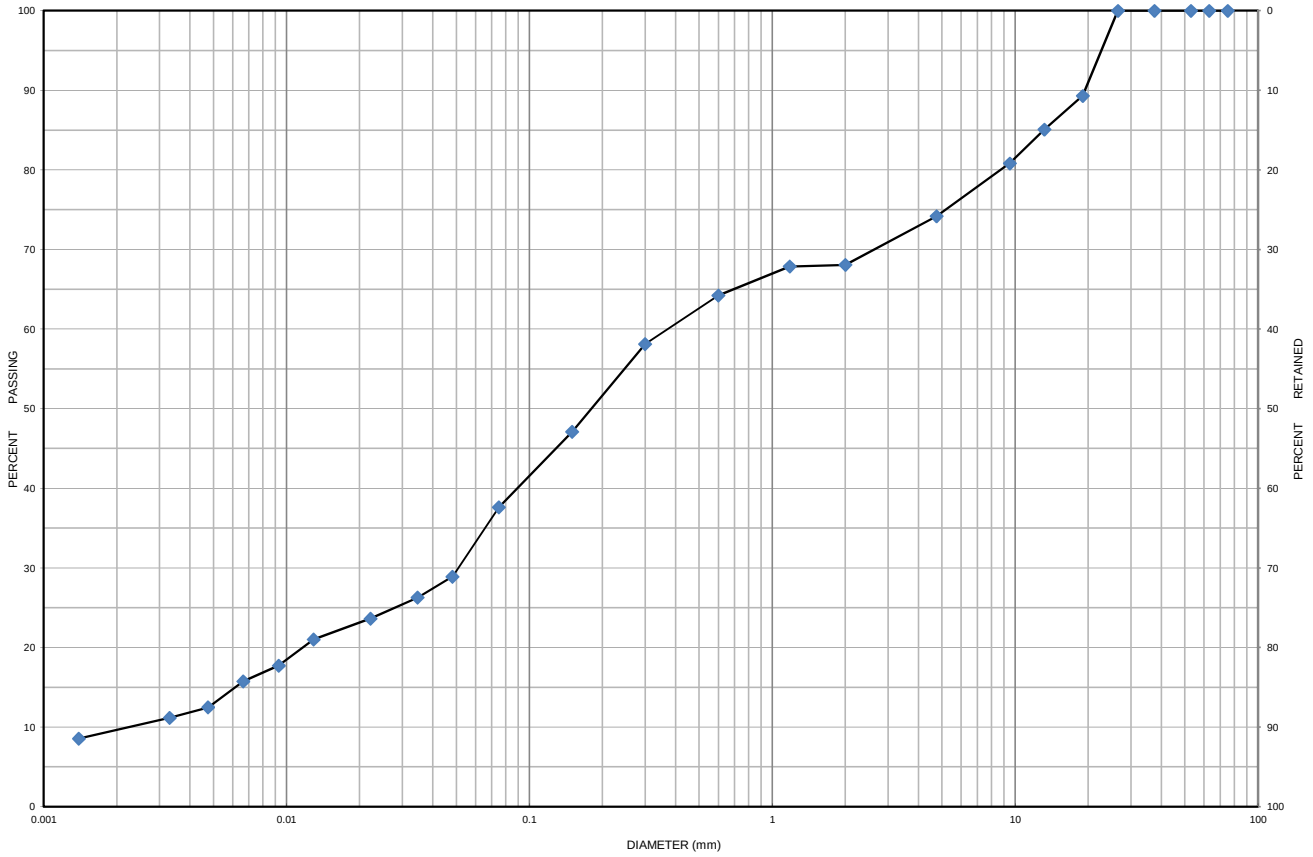
Project Number: *6547-002* **Client:** *Kiya Developments Ltd.*

Project Name: *513 Dundas Street East, Whitby, ON*

Sample Date: *February 26, 2018* **Sampled By:** *Kyle Pedersen - Cambium Inc.*

Location: *BH 101-18 SS 4* **Depth:** *2.3 m to 2.7 m* **Lab Sample No:** *S-18-0161*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Location	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 101-18	SS 4	2.3 m to 2.7 m	26	37	37		7.5

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Gravelly Silty Sand trace Clay	SM-SW	0.380	0.052	0.0024	158.33	2.96

Issued By: _____ *Date Issued:* *March 9, 2018*

(Senior Project Manager)

Cambium Inc. (Laboratory)

866.217.7900 | cambium-inc.com

701 The Queensway | Units 5-6 | Peterborough | ON | K9J 7J6

Grain Size Distribution Chart

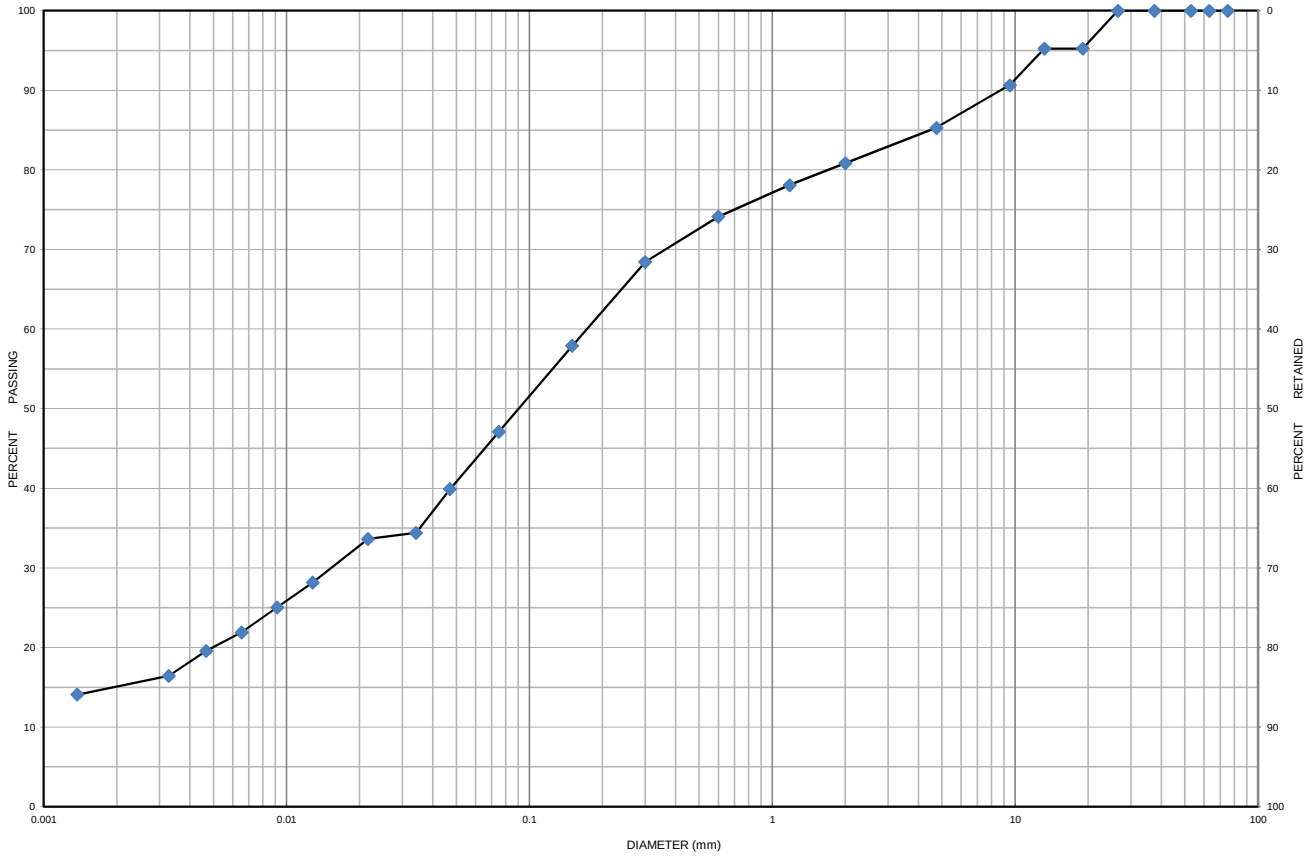
Project Number: *6547-002* **Client:** *Kiya Developments Ltd.*

Project Name: *513 Dundas Street East, Whitby, ON*

Sample Date: *February 26, 2018* **Sampled By:**

Location: *BH 104-18 SS 2* **Depth:** *0.8 m to 1.2 m* **Lab Sample No:** *S-18-0162*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Location	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 104-18	SS 2	0.8 m to 1.2 m	15	38	47		18.6

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Sand some Clay some Gravel	SM	0.180	0.0160	-	-	-

Issued By: _____ *Date Issued:* *March 9, 2018*

(Senior Project Manager)

Cambium Inc. (Laboratory)
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Appendix C

Environmental Laboratory Testing Results

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: CAMBIUM
843 KING ST. W. UNIT 8
OSHAWA, ON L1J2L4
(866) 217-7900

ATTENTION TO: Brandon McFarlane

PROJECT: 6547-001

AGAT WORK ORDER: 18T315415

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist

DATE REPORTED: Mar 07, 2018

PAGES (INCLUDING COVER): 14

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18T315415

PROJECT: 6547-001

CLIENT NAME: CAMBIUM

ATTENTION TO: Brandon McFarlane

SAMPLING SITE:513 Dundas Street East, Whitby

SAMPLED BY:K. Pedersen

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2018-02-27

DATE REPORTED: 2018-03-05

		SAMPLE DESCRIPTION:		BH105-18 SS2	BH102-18 SS4	BH104-18 SS3
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		2018-02-26	2018-02-26	2018-02-26
Parameter	Unit	G / S	RDL	9092070	9092078	9092079
Antimony	µg/g	1.3	0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	18	1	3	3	2
Barium	µg/g	220	2	53	49	66
Beryllium	µg/g	2.5	0.5	<0.5	<0.5	<0.5
Boron	µg/g	36	5	5	<5	<5
Boron (Hot Water Soluble)	µg/g	NA	0.10	<0.10	<0.10	<0.10
Cadmium	µg/g	1.2	0.5	<0.5	<0.5	<0.5
Chromium	µg/g	70	2	15	13	18
Cobalt	µg/g	21	0.5	7.1	6.5	8.8
Copper	µg/g	92	1	15	12	13
Lead	µg/g	120	1	7	6	6
Molybdenum	µg/g	2	0.5	<0.5	<0.5	<0.5
Nickel	µg/g	82	1	17	14	16
Selenium	µg/g	1.5	0.4	<0.4	<0.4	<0.4
Silver	µg/g	0.5	0.2	<0.2	<0.2	<0.2
Thallium	µg/g	1	0.4	<0.4	<0.4	<0.4
Uranium	µg/g	2.5	0.5	<0.5	<0.5	<0.5
Vanadium	µg/g	86	1	20	18	26
Zinc	µg/g	290	5	39	31	48
Chromium VI	µg/g	0.66	0.2	<0.2	<0.2	<0.2
Cyanide	µg/g	0.051	0.040	<0.040	<0.040	<0.040
Mercury	µg/g	0.27	0.10	<0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	0.57	0.005	0.108	0.118	0.102
Sodium Adsorption Ratio	NA	2.4	NA	0.114	0.265	0.141
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.77	7.81	7.80

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9092070-9092079 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
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CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
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Certificate of Analysis

AGAT WORK ORDER: 18T315415

PROJECT: 6547-001

CLIENT NAME: CAMBIUM

ATTENTION TO: Brandon McFarlane

SAMPLING SITE:513 Dundas Street East, Whitby

SAMPLED BY:K. Pedersen

O. Reg. 558 Metals and Inorganics

DATE RECEIVED: 2018-02-27

DATE REPORTED: 2018-03-06

		SAMPLE DESCRIPTION:		C1
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2018-02-26
Parameter	Unit	G / S	RDL	9092081
Arsenic Leachate	mg/L	2.5	0.010	<0.010
Barium Leachate	mg/L	100	0.100	0.345
Boron Leachate	mg/L	500	0.050	<0.050
Cadmium Leachate	mg/L	0.5	0.010	<0.010
Chromium Leachate	mg/L	5	0.010	<0.010
Lead Leachate	mg/L	5	0.010	<0.010
Mercury Leachate	mg/L	0.1	0.01	<0.01
Selenium Leachate	mg/L	1	0.010	<0.010
Silver Leachate	mg/L	5	0.010	<0.010
Uranium Leachate	mg/L	10	0.050	<0.050
Fluoride Leachate	mg/L	150	0.05	0.18
Cyanide Leachate	mg/L	20	0.05	<0.05
(Nitrate + Nitrite) as N Leachate	mg/L	1000	0.70	<0.70

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O. Reg. 558 - Schedule IV Leachate Quality Criteria
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
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CANADA L4Z 1Y2
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FAX (905)712-5122
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Certificate of Analysis

AGAT WORK ORDER: 18T315415

PROJECT: 6547-001

CLIENT NAME: CAMBIUM

ATTENTION TO: Brandon McFarlane

SAMPLING SITE:513 Dundas Street East, Whitby

SAMPLED BY:K. Pedersen

O. Reg. 153(511) - PHCs F1 - F4 (-BTEX) (Soil)

DATE RECEIVED: 2018-02-27

DATE REPORTED: 2018-03-05

				SAMPLE DESCRIPTION:	BH105-18 SS2	BH102-18 SS4	BH104-18 SS3
				SAMPLE TYPE:	Soil	Soil	Soil
				DATE SAMPLED:	2018-02-26	2018-02-26	2018-02-26
Parameter	Unit	G / S	RDL		9092070	9092078	9092079
F1 (C6 to C10)	µg/g	25	5		<5	<5	<5
F1 (C6 to C10) minus BTEX	µg/g	25	5		<5	<5	<5
F2 (C10 to C16)	µg/g	10	10		<10	<10	<10
F3 (C16 to C34)	µg/g	240	50		<50	<50	<50
F4 (C34 to C50)	µg/g	120	50		<50	<50	<50
Gravimetric Heavy Hydrocarbons	µg/g	120	50		NA	NA	NA
Moisture Content	%		0.1		9.8	13.0	15.1
Surrogate	Unit	Acceptable Limits					
Terphenyl	%	60-140			77	86	74

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9092070-9092079 Results are based on sample dry weight.
The C6-C10 fraction is calculated using toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified without the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.

Certified By: N Popowich

AGAT Laboratories
5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18T315415

PROJECT: 6547-001

CLIENT NAME: CAMBIUM

ATTENTION TO: Brandon McFarlane

SAMPLING SITE:513 Dundas Street East, Whitby

SAMPLED BY:K. Pedersen

O. Reg. 153(511) - VOCs (Soil)

DATE RECEIVED: 2018-02-27

DATE REPORTED: 2018-03-02

SAMPLE DESCRIPTION:				BH105-18 SS2	BH102-18 SS4	BH104-18 SS3
SAMPLE TYPE:				Soil	Soil	Soil
DATE SAMPLED:				2018-02-26	2018-02-26	2018-02-26
Parameter	Unit	G / S	RDL	9092070	9092078	9092079
Dichlorodifluoromethane	µg/g	0.05	0.05	<0.05	<0.05	<0.05
Vinyl Chloride	ug/g	0.02	0.02	<0.02	<0.02	<0.02
Bromomethane	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Trichlorofluoromethane	ug/g	0.25	0.05	<0.05	<0.05	<0.05
Acetone	ug/g	0.5	0.50	<0.50	<0.50	<0.50
1,1-Dichloroethylene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Methylene Chloride	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Trans- 1,2-Dichloroethylene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Methyl tert-butyl Ether	ug/g	0.05	0.05	<0.05	<0.05	<0.05
1,1-Dichloroethane	ug/g	0.05	0.02	<0.02	<0.02	<0.02
Methyl Ethyl Ketone	ug/g	0.5	0.50	<0.50	<0.50	<0.50
Cis- 1,2-Dichloroethylene	ug/g	0.05	0.02	<0.02	<0.02	<0.02
Chloroform	ug/g	0.05	0.04	<0.04	<0.04	<0.04
1,2-Dichloroethane	ug/g	0.05	0.03	<0.03	<0.03	<0.03
1,1,1-Trichloroethane	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Carbon Tetrachloride	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Benzene	ug/g	0.02	0.02	<0.02	<0.02	<0.02
1,2-Dichloropropane	ug/g	0.05	0.03	<0.03	<0.03	<0.03
Trichloroethylene	ug/g	0.05	0.03	<0.03	<0.03	<0.03
Bromodichloromethane	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Methyl Isobutyl Ketone	ug/g	0.5	0.50	<0.50	<0.50	<0.50
1,1,2-Trichloroethane	ug/g	0.05	0.04	<0.04	<0.04	<0.04
Toluene	ug/g	0.2	0.02	<0.02	<0.02	<0.02
Dibromochloromethane	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Ethylene Dibromide	ug/g	0.05	0.04	<0.04	<0.04	<0.04
Tetrachloroethylene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
1,1,1,2-Tetrachloroethane	ug/g	0.05	0.04	<0.04	<0.04	<0.04
Chlorobenzene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Ethylbenzene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
m & p-Xylene	ug/g		0.05	<0.05	<0.05	<0.05

Certified By: NPopowkolof

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Certificate of Analysis

AGAT WORK ORDER: 18T315415

PROJECT: 6547-001

CLIENT NAME: CAMBIUM

ATTENTION TO: Brandon McFarlane

SAMPLING SITE:513 Dundas Street East, Whitby

SAMPLED BY:K. Pedersen

O. Reg. 153(511) - VOCs (Soil)

DATE RECEIVED: 2018-02-27

DATE REPORTED: 2018-03-02

				SAMPLE DESCRIPTION:	BH105-18 SS2	BH102-18 SS4	BH104-18 SS3
				SAMPLE TYPE:	Soil	Soil	Soil
				DATE SAMPLED:	2018-02-26	2018-02-26	2018-02-26
Parameter	Unit	G / S	RDL		9092070	9092078	9092079
Bromoform	ug/g	0.05	0.05		<0.05	<0.05	<0.05
Styrene	ug/g	0.05	0.05		<0.05	<0.05	<0.05
1,1,2,2-Tetrachloroethane	ug/g	0.05	0.05		<0.05	<0.05	<0.05
o-Xylene	ug/g		0.05		<0.05	<0.05	<0.05
1,3-Dichlorobenzene	ug/g	0.05	0.05		<0.05	<0.05	<0.05
1,4-Dichlorobenzene	ug/g	0.05	0.05		<0.05	<0.05	<0.05
1,2-Dichlorobenzene	ug/g	0.05	0.05		<0.05	<0.05	<0.05
Xylene Mixture	ug/g	0.05	0.05		<0.05	<0.05	<0.05
1,3-Dichloropropene	µg/g	0.05	0.04		<0.04	<0.04	<0.04
n-Hexane	µg/g	0.05	0.05		<0.05	<0.05	<0.05
Surrogate	Unit	Acceptable Limits					
Toluene-d8	% Recovery	50-140			94	99	96
4-Bromofluorobenzene	% Recovery	50-140			91	90	88

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9092070-9092079 The sample was analysed using the high level technique. The sample was extracted using methanol, a small amount of the methanol extract was diluted in water and the purge & trap GC/MS analysis was performed. Results are based on the dry weight of the soil.

Certified By: N Popowkolof

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Quality Assurance

CLIENT NAME: CAMBIUM

AGAT WORK ORDER: 18T315415

PROJECT: 6547-001

ATTENTION TO: Brandon McFarlane

SAMPLING SITE:513 Dundas Street East, Whitby

SAMPLED BY:K. Pedersen

Soil Analysis

RPT Date:			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 558 Metals and Inorganics															
Arsenic Leachate	9099938		0.123	0.117	5.0%	< 0.010	104%	90%	110%	99%	80%	120%	85%	70%	130%
Barium Leachate	9099938		0.489	0.485	NA	< 0.100	92%	90%	110%	94%	80%	120%	94%	70%	130%
Boron Leachate	9099938		0.165	0.156	NA	< 0.050	108%	90%	110%	106%	80%	120%	86%	70%	130%
Cadmium Leachate	9099938		<0.010	<0.010	NA	< 0.010	108%	90%	110%	99%	80%	120%	92%	70%	130%
Chromium Leachate	9099938		<0.010	<0.010	NA	< 0.010	110%	90%	110%	109%	80%	120%	80%	70%	130%
Lead Leachate	9099938		<0.010	<0.010	NA	< 0.010	104%	90%	110%	102%	80%	120%	84%	70%	130%
Mercury Leachate	9099938		<0.01	<0.01	NA	< 0.01	104%	90%	110%	96%	80%	120%	104%	70%	130%
Selenium Leachate	9099938		<0.010	<0.010	NA	< 0.010	103%	90%	110%	92%	80%	120%	99%	70%	130%
Silver Leachate	9099938		<0.010	<0.010	NA	< 0.010	108%	90%	110%	115%	80%	120%	82%	70%	130%
Uranium Leachate	9099938		<0.050	<0.050	NA	< 0.050	105%	90%	110%	102%	80%	120%	89%	70%	130%
Fluoride Leachate	9099938		0.15	0.15	NA	< 0.05	104%	90%	110%	105%	90%	110%	110%	70%	130%
Cyanide Leachate	9090696		<0.05	<0.05	NA	< 0.05	101%	90%	110%	108%	90%	110%	107%	70%	130%
(Nitrate + Nitrite) as N Leachate	9099938		<0.70	<0.70	NA	< 0.70	100%	80%	120%	99%	80%	120%	93%	70%	130%
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	9091559		<0.8	<0.8	NA	< 0.8	109%	70%	130%	105%	80%	120%	77%	70%	130%
Arsenic	9091559		4	4	NA	< 1	110%	70%	130%	103%	80%	120%	102%	70%	130%
Barium	9091559		105	100	4.9%	< 2	105%	70%	130%	98%	80%	120%	91%	70%	130%
Beryllium	9091559		0.5	<0.5	NA	< 0.5	92%	70%	130%	110%	80%	120%	94%	70%	130%
Boron	9091559		<5	<5	NA	< 5	70%	70%	130%	104%	80%	120%	81%	70%	130%
Boron (Hot Water Soluble)	9091559		0.32	0.33	NA	< 0.10	106%	60%	140%	95%	70%	130%	94%	60%	140%
Cadmium	9091559		<0.5	<0.5	NA	< 0.5	104%	70%	130%	103%	80%	120%	102%	70%	130%
Chromium	9091559		16	16	0.0%	< 2	93%	70%	130%	100%	80%	120%	107%	70%	130%
Cobalt	9091559		8.0	8.0	0.0%	< 0.5	94%	70%	130%	99%	80%	120%	99%	70%	130%
Copper	9091559		22	22	0.0%	< 1	94%	70%	130%	100%	80%	120%	95%	70%	130%
Lead	9091559		10	10	0.0%	< 1	113%	70%	130%	92%	80%	120%	90%	70%	130%
Molybdenum	9091559		<0.5	<0.5	NA	< 0.5	102%	70%	130%	104%	80%	120%	103%	70%	130%
Nickel	9091559		17	16	6.1%	< 1	100%	70%	130%	99%	80%	120%	100%	70%	130%
Selenium	9091559		<0.4	0.6	NA	< 0.4	99%	70%	130%	101%	80%	120%	101%	70%	130%
Silver	9091559		<0.2	<0.2	NA	< 0.2	85%	70%	130%	104%	80%	120%	93%	70%	130%
Thallium	9091559		<0.4	<0.4	NA	< 0.4	92%	70%	130%	103%	80%	120%	104%	70%	130%
Uranium	9091559		0.5	0.6	NA	< 0.5	89%	70%	130%	93%	80%	120%	102%	70%	130%
Vanadium	9091559		21	20	4.9%	< 1	87%	70%	130%	96%	80%	120%	82%	70%	130%
Zinc	9091559		47	44	6.6%	< 5	95%	70%	130%	105%	80%	120%	103%	70%	130%
Chromium VI	9092079	9092079	<0.2	<0.2	NA	< 0.2	96%	70%	130%	98%	80%	120%	95%	70%	130%
Cyanide	9092070	9092070	<0.040	<0.040	NA	< 0.040	103%	70%	130%	91%	80%	120%	109%	70%	130%
Mercury	9091559		<0.10	<0.10	NA	< 0.10	102%	70%	130%	96%	80%	120%	99%	70%	130%
Electrical Conductivity	9091874		0.144	0.148	2.7%	< 0.005	98%	90%	110%	NA			NA		
Sodium Adsorption Ratio	9091874		0.080	0.081	1.2%	NA	NA			NA			NA		

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Quality Assurance

CLIENT NAME: CAMBIUM

AGAT WORK ORDER: 18T315415

PROJECT: 6547-001

ATTENTION TO: Brandon McFarlane

SAMPLING SITE:513 Dundas Street East, Whitby

SAMPLED BY:K. Pedersen

Soil Analysis (Continued)

RPT Date:			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
pH, 2:1 CaCl2 Extraction	9095695		7.63	7.34	3.9%	NA	99%	80%	120%						

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Amanjot Bhela

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Quality Assurance

CLIENT NAME: CAMBIUM

AGAT WORK ORDER: 18T315415

PROJECT: 6547-001

ATTENTION TO: Brandon McFarlane

SAMPLING SITE:513 Dundas Street East, Whitby

SAMPLED BY:K. Pedersen

Trace Organics Analysis

RPT Date:			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - PHCs F1 - F4 (-BTEX) (Soil)															
F1 (C6 to C10)	9093285		< 5	< 5	NA	< 5	99%	60%	130%	86%	85%	115%	98%	70%	130%
F2 (C10 to C16)	9087262		< 10	< 10	NA	< 10	91%	60%	130%	97%	80%	120%	75%	70%	130%
F3 (C16 to C34)	9087262		< 50	< 50	NA	< 50	96%	60%	130%	102%	80%	120%	87%	70%	130%
F4 (C34 to C50)	9087262		< 50	< 50	NA	< 50	100%	60%	130%	87%	80%	120%	88%	70%	130%
O. Reg. 153(511) - VOCs (Soil)															
Dichlorodifluoromethane	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	93%	50%	140%	115%	50%	140%	94%	50%	140%
Vinyl Chloride	9092078	9092078	< 0.02	< 0.02	NA	< 0.02	101%	50%	140%	113%	50%	140%	80%	50%	140%
Bromomethane	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	111%	50%	140%	113%	50%	140%	86%	50%	140%
Trichlorofluoromethane	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	100%	50%	140%	119%	50%	140%	82%	50%	140%
Acetone	9092078	9092078	< 0.50	< 0.50	NA	< 0.50	100%	50%	140%	108%	50%	140%	98%	50%	140%
1,1-Dichloroethylene	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	80%	50%	140%	102%	60%	130%	88%	50%	140%
Methylene Chloride	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	75%	50%	140%	98%	60%	130%	85%	50%	140%
Trans- 1,2-Dichloroethylene	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	73%	50%	140%	98%	60%	130%	78%	50%	140%
Methyl tert-butyl Ether	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	102%	50%	140%	95%	60%	130%	75%	50%	140%
1,1-Dichloroethane	9092078	9092078	< 0.02	< 0.02	NA	< 0.02	91%	50%	140%	95%	60%	130%	95%	50%	140%
Methyl Ethyl Ketone	9092078	9092078	< 0.50	< 0.50	NA	< 0.50	87%	50%	140%	99%	50%	140%	81%	50%	140%
Cis- 1,2-Dichloroethylene	9092078	9092078	< 0.02	< 0.02	NA	< 0.02	77%	50%	140%	106%	60%	130%	84%	50%	140%
Chloroform	9092078	9092078	< 0.04	< 0.04	NA	< 0.04	85%	50%	140%	102%	60%	130%	97%	50%	140%
1,2-Dichloroethane	9092078	9092078	< 0.03	< 0.03	NA	< 0.03	87%	50%	140%	100%	60%	130%	96%	50%	140%
1,1,1-Trichloroethane	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	79%	50%	140%	97%	60%	130%	87%	50%	140%
Carbon Tetrachloride	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	72%	50%	140%	102%	60%	130%	70%	50%	140%
Benzene	9092078	9092078	< 0.02	< 0.02	NA	< 0.02	83%	50%	140%	90%	60%	130%	78%	50%	140%
1,2-Dichloropropane	9092078	9092078	< 0.03	< 0.03	NA	< 0.03	80%	50%	140%	102%	60%	130%	85%	50%	140%
Trichloroethylene	9092078	9092078	< 0.03	< 0.03	NA	< 0.03	88%	50%	140%	98%	60%	130%	78%	50%	140%
Bromodichloromethane	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	87%	50%	140%	105%	60%	130%	91%	50%	140%
Methyl Isobutyl Ketone	9092078	9092078	< 0.50	< 0.50	NA	< 0.50	101%	50%	140%	95%	50%	140%	88%	50%	140%
1,1,2-Trichloroethane	9092078	9092078	< 0.04	< 0.04	NA	< 0.04	93%	50%	140%	110%	60%	130%	101%	50%	140%
Toluene	9092078	9092078	< 0.02	< 0.02	NA	< 0.02	88%	50%	140%	101%	60%	130%	82%	50%	140%
Dibromochloromethane	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	81%	50%	140%	101%	60%	130%	92%	50%	140%
Ethylene Dibromide	9092078	9092078	< 0.04	< 0.04	NA	< 0.04	87%	50%	140%	101%	60%	130%	92%	50%	140%
Tetrachloroethylene	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	88%	50%	140%	106%	60%	130%	80%	50%	140%
1,1,1,2-Tetrachloroethane	9092078	9092078	< 0.04	< 0.04	NA	< 0.04	101%	50%	140%	99%	60%	130%	89%	50%	140%
Chlorobenzene	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	89%	50%	140%	97%	60%	130%	82%	50%	140%
Ethylbenzene	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	99%	50%	140%	101%	60%	130%	71%	50%	140%
m & p-Xylene	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	81%	50%	140%	110%	60%	130%	84%	50%	140%
Bromoform	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	89%	50%	140%	101%	60%	130%	91%	50%	140%
Styrene	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	83%	50%	140%	92%	60%	130%	83%	50%	140%
1,1,2,2-Tetrachloroethane	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	101%	50%	140%	108%	60%	130%	106%	50%	140%
o-Xylene	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	83%	50%	140%	104%	60%	130%	88%	50%	140%

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Quality Assurance

CLIENT NAME: CAMBIUM
PROJECT: 6547-001
SAMPLING SITE:513 Dundas Street East, Whitby

AGAT WORK ORDER: 18T315415
ATTENTION TO: Brandon McFarlane
SAMPLED BY:K. Pedersen

Trace Organics Analysis (Continued)

RPT Date:			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
1,3-Dichlorobenzene	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	95%	50%	140%	85%	60%	130%	93%	50%	140%
1,4-Dichlorobenzene	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	81%	50%	140%	91%	60%	130%	81%	50%	140%
1,2-Dichlorobenzene	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	99%	50%	140%	92%	60%	130%	80%	50%	140%
1,3-Dichloropropene	9092078	9092078	< 0.04	< 0.04	NA	< 0.04	105%	50%	140%	98%	60%	130%	114%	50%	140%
n-Hexane	9092078	9092078	< 0.05	< 0.05	NA	< 0.05	89%	50%	140%	100%	60%	130%	88%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By: N Popnikolof

AGAT Laboratories

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Method Summary

CLIENT NAME: CAMBIUM

AGAT WORK ORDER: 18T315415

PROJECT: 6547-001

ATTENTION TO: Brandon McFarlane

SAMPLING SITE:513 Dundas Street East, Whitby

SAMPLED BY:K. Pedersen

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010B	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Arsenic Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Barium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Boron Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Cadmium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Chromium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Lead Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Mercury Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Selenium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Silver Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Uranium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Fluoride Leachate	INOR-93-6018	EPA SW-846-1311 & SM4500-F- C	ION SELECTIVE ELECTRODE
Cyanide Leachate	INOR-93-6052	EPA SW-846-1311 & MOE 3015 & SM 4500 CN- I	TECHNICON AUTO ANALYZER
(Nitrate + Nitrite) as N Leachate	INOR-93-6053	EPA SW 846-1311 & SM 4500 - NO3- I	LACHAT FIA

AGAT Laboratories

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CANADA L4Z 1Y2
TEL (905)712-5100
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http://www.agatlabs.com

Method Summary

CLIENT NAME: CAMBIUM

AGAT WORK ORDER: 18T315415

PROJECT: 6547-001

ATTENTION TO: Brandon McFarlane

SAMPLING SITE:513 Dundas Street East, Whitby

SAMPLED BY:K. Pedersen

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
F1 (C6 to C10)	VOL-91-5009	CCME Tier 1 Method, SW846 5035	P &T GC / FID
F1 (C6 to C10) minus BTEX	VOL-91-5009	CCME Tier 1 Method, SW846 5035	P & T GC / FID
F2 (C10 to C16)	VOL-91-5009	CCME Tier 1 Method	GC / FID
F3 (C16 to C34)	VOL-91-5009	CCME Tier 1 Method	GC / FID
F4 (C34 to C50)	VOL-91-5009	CCME Tier 1 Method	GC / FID
Gravimetric Heavy Hydrocarbons	VOL-91-5009	CCME Tier 1 Method	Balance
Moisture Content	VOL-91-5009	CCME Tier 1 Method, SW846 5035,8015	BALANCE
Terphenyl	VOL-91-5009	CCME Tier 1 Method	GC/FID
Dichlorodifluoromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Vinyl Chloride	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Bromomethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Trichlorofluoromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Acetone	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1-Dichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methylene Chloride	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Trans- 1,2-Dichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methyl tert-butyl Ether	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1-Dichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Cis- 1,2-Dichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Chloroform	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,1-Trichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Benzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,2-Dichloropropane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Trichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Bromodichloromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methyl Isobutyl Ketone	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,2-Trichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Toluene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Dibromochloromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Ethylene Dibromide	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Tetrachloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,1,2-Tetrachloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Chlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Ethylbenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
m & p-Xylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Bromoform	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Styrene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,2,2-Tetrachloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
o-Xylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,3-Dichlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Xylene Mixture	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,3-Dichloropropene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
n-Hexane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS

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Method Summary

CLIENT NAME: CAMBIUM

AGAT WORK ORDER: 18T315415

PROJECT: 6547-001

ATTENTION TO: Brandon McFarlane

SAMPLING SITE:513 Dundas Street East, Whitby

SAMPLED BY:K. Pedersen

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Toluene-d8	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS

AGAT Laboratories

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Mississauga, Ontario L4Z 1Y2
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webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Report Information:

Company: Cambium Inc.
Contact: Brandon McFarlane
Address: 843 King Street West - Unit 8
Oshawa, Ontario, L1J 2L4
Phone: 905-725-6280 Fax: 705-742-7907
Reports to be sent to:
1. Email: brandon.mcfarlane@cambium-inc.com
2. Email:

Project Information:

Project: 6547-001
Site Location: 513 Dundas Street East, Whitby
Sampled By: K. Pedersen
AGAT Quote #: 168035 PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐
Company:
Contact:
Address:
Email:

Regulatory Requirements:

☐ No Regulatory Requirement
(Please check all applicable boxes)

☑ Regulation 153/04
Table 1 *Indicate One*
☑ Ind/Com
☑ Res/Park
☐ Agriculture
Soil Texture *(Check One)*
☑ Coarse
☐ Fine

☐ Sewer Use
☐ Sanitary
☐ Storm
Region *Indicate One*
☐ MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
Indicate One

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on *Certificate of Analysis* ☑ Yes ☐ No

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Laboratory Use Only

Work Order #: 18T315415
Cooler Quantity: 1 Med Blue Ice
Arrival Temperatures: 2.5 | 2.0 | 1.6
Custody Seal Intact: ☐Yes ☐No ☐N/A
Notes:

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day
OR Date Required (Rush Surcharges May Apply):
Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*
For 'Same Day' analysis, please contact your AGAT CPM

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Y/N	Field Filtered - Metals, Hg, CrVI	O. Reg 153: Metals and Inorganics	O. Reg 153: All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (incl. Hydrides)	O. Reg 153: ORPs: ☐ B-HWS ☐ Cl ☐ CN ☐ Cr^{6+} ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR	O. Reg 153: Full Metals Scan	O. Reg 153: Regulation/Custom Metals	O. Reg 153: Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	O. Reg 153: Volatiles: ☑ VOC ☑ BTEX ☐ THM	O. Reg 153: PHCs F1 - F4	O. Reg 153: ABNs	O. Reg 153: PAHs	O. Reg 153: PCBs: ☐ Total ☐ Aroclors	O. Reg 153: Organochlorine Pesticides	O. Reg 153: TCLP: ☑ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 153: Sewer Use
BH105-18 SS2	Feb. 26/18	am	6	S		N		☑						☑	☑					
BH102-18 SS4	Feb. 26/18	am	6	S		N		☑						☑	☑					
BH104-18 SS3	Feb. 26/18	am	6	S		N		☑						☑	☑					
C1	Feb. 26/18	am	1	S		N													☑	

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
[signature]	02/27/18	5:31PM	Neil Namndiaju	Feb. 27/18	5:31 PM
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time

Page _____ of _____
N°:

Appendix D

MASW Survey Results

GEOPHYSICS GPR INTERNATIONAL INC.
6741 Columbus Road
Unit 14
Mississauga, Ontario
Canada L5T 2G9
Tel.: (905) 696-0656
Fax: (905) 696-0570
gprtor@gprtor.com
www.geophysicsgpr.com

March 5th, 2020 GPR file: T202034

Erick Thurston, P. Eng.
Project Manager
Cambium Inc.
843 King Street West
Oshawa, ON
L1J 2L4

RE: Shear-wave velocity sounding at 513 Dundas Street East, Whitby, Ontario

Dear Mr. Thurston:

Geophysics GPR International Inc. has been requested by Cambuim to carry out a shear-wave velocity sounding at the above site in Whitby. Figure 1 shows the location of the test profile.

The survey was performed on February 26th, 2020.

The investigation included the multi-channel analysis of surface waves (MASW), the micro-tremor array measurements (MAM) and the refraction methods to generate a shear-wave velocity model (Figure 4).

The following paragraphs describe the survey design, the principles of the test method, the methodology for interpreting the data, and provide a culmination of the results in table format.

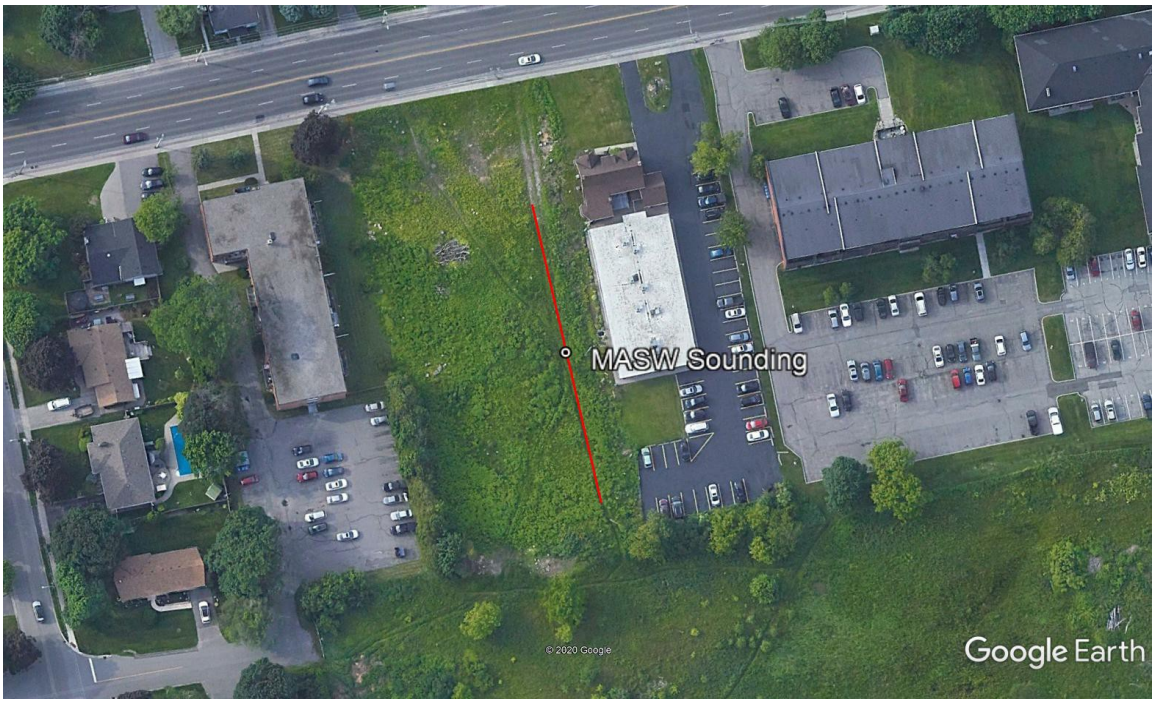


Figure 1: Approximate location of the shear-wave velocity sounding

MASW and MAM Surveys

Basic Theory

The Multi-channel Analysis of Surface Waves (MASW) and the Micro-tremor Array Measurements (MAM) are seismic methods used to evaluate the shear-wave velocities of subsurface materials through the analysis of the dispersion properties of Rayleigh surface waves ("ground roll"). The dispersion properties are measured as a change in phase velocity with frequency. Surface wave energy will decay exponentially with depth. Lower frequency surface waves will travel deeper and thus be more influenced by deeper velocity layering than the shallow higher frequency waves. Inversion of the Rayleigh wave dispersion curve yields a shear-wave (V_s) velocity depth profile (sounding). Figure 2 outlines the basic operating procedure for the MASW method. Figure 3 is an example image of a typical MASW record and resulting 1D V_s model. A more detailed description of the method can be found in the paper *Multi-channel Analysis of Surface Waves,* Park, C.B., Miller, R.D. and Xia, J. Geophysics, Vol. 64, No. 3 (May-June 1999); P. 800–808.

Survey Design

The geometry of an MASW survey is similar to that of a seismic refraction investigation (i.e. 24 geophones in a linear array). The fundamental principle involves intentionally generating an acoustic wave at the surface and digitally recording the surface waves from the moment of source impact with a linear series of geophones on the surface. This is referred to as an "active source" method. A sledge hammer was used as the primary energy source with traces being recorded at 6 locations: approximately 6 m off both ends, 25 to 30 m off both ends, and in

the middle of the spread. Data were collected with geophones spacing of 3m and 1m for a total of 10 shot records per sounding.

Unlike the refraction method, which produces a data point beneath each geophone, the shear-wave depth profile is the average of the bulk area within the middle third of the geophone spread.

The theoretical maximum depth of penetration (34.5m) is half of the maximum seismic array length (69 m), in practice the maximum depth of penetration is often influenced by the geology.

The MAM/passive survey used the same geophone array set up as for the MASW survey. Unlike the MASW survey, the MAM method is considered a "passive source" method in that there is no time break and the motions recorded are from ambient energy generated by cultural noise such as traffic, wind, wave motion, etc. Data collection for the passive method involves recording approximately 10 minutes of background "noise." The records generated by the MAM method contain lower frequency data, thus increasing the data resolution at greater depths of investigation. Typically the MAM results aid in clarifying the MASW results for depths greater than 20 m; however, the direction of noise propagation relative to the spread orientation can influence the results.

Interpretation Method and Accuracy of Results

The main processing sequence involved plotting, picking, and 1-D inversion of the MASW/MAM shot records using the SeisimagerSW™ software package. In theory, all MASW shot records should produce a similar shear-wave velocity profile. In practice, however, differences can arise due to energy dissipation and localized surface variations. The results of the inversion process are inherently non-unique and the final model must be judged to be geologically realistic. The inversion modelling also assumes that all layering is flat/horizontal and laterally uniform.

The results of the MASW/MAM tests are presented in chart format as Figure 4. The chart presents the 1-D shear wave velocity values from the inversion models of the passive and active seismic records.

The V_s30 values for the sounding are presented in Table 1. The V_s30 values are based on the harmonic mean of the shear wave velocities over the upper 30 m. The V_s30 value is calculated by dividing the total depth of interest (e.g. 30 m) by the sum of the time spent in each velocity layer up to that depth. This harmonic mean value reflects the equivalent single layer response.

The estimated error in the average V_s30 value determined through MASW tests is typically +/-10 to 15% for overburden sites. The shear-wave velocities modelled through the MASW method within bedrock have a higher estimated error.

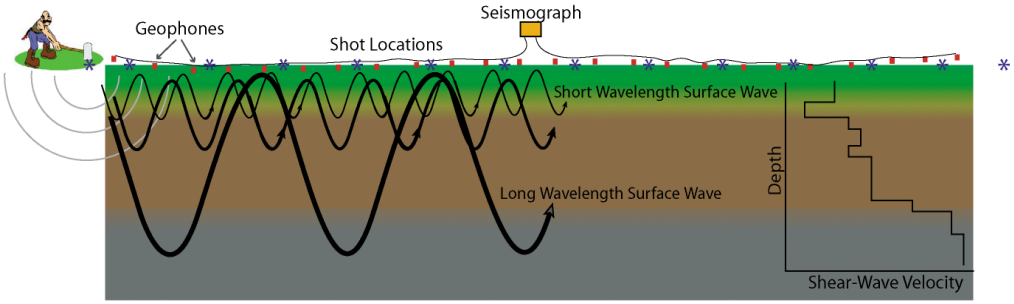
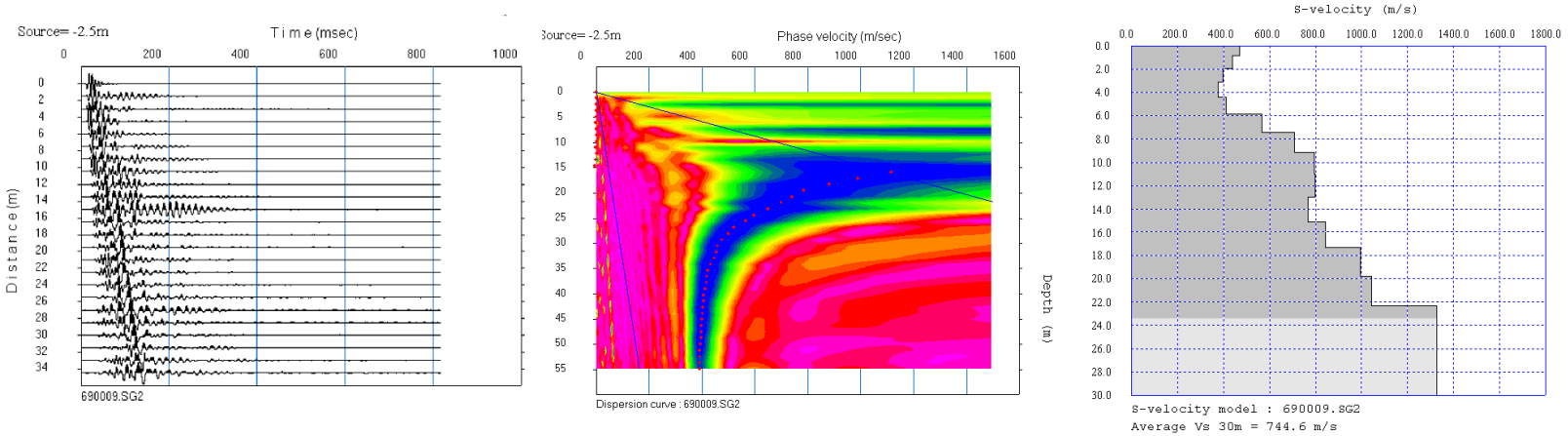


Figure 2: MASW Operating Principle



Raw Seismic Shot Record

Phase Velocity-Frequency Transformation indicating Dispersion Curve

1D Shear-Wave Velocity Profile from Inversion of Dispersion Curve

Figure 3: Example of a typical MASW shot record, phase velocity/frequency curve and resulting 1D shear-wave velocity model.

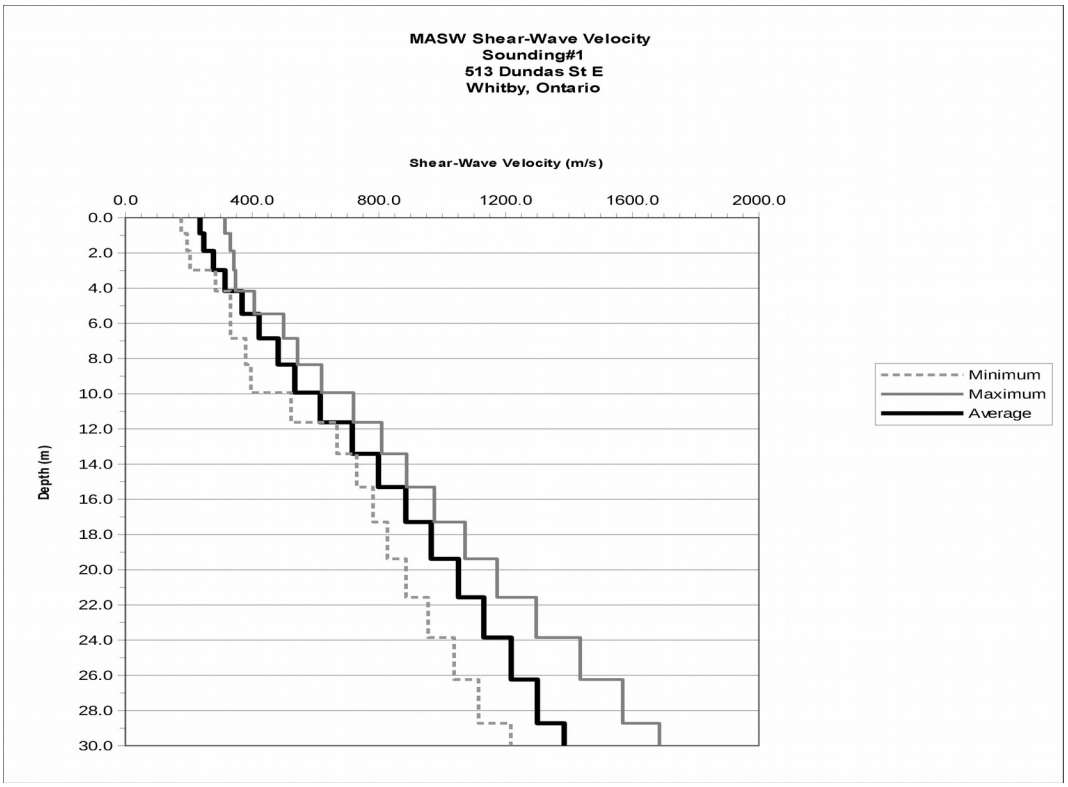


Figure 4: MASW Shear-wave Velocity Sounding

CONCLUSIONS

The approximate location of the shear-wave sounding is indicated in Figure 1.

The MASW shear-wave models are presented in Figure 4. The results are summarized in Table 1. The background seismic noise levels at this site were moderate. The quality of the seismic records and the resulting dispersion were good.

Simple critical distance calculations from refracted P-waves show that the water table could be approximately 4m deep. The shale bedrock could be approximately 19m deep.

No boreholes or geotechnical data were available at the time of this report.

Table 1: Calculated V_s30 values (m/s) from the MASW data (0 to 30m)

Sounding	Minimum	Average	Maximum	Site Class
1	502	**608**	714	**C**

The calculated average V_s30 values from the 1D MASW soundings collected was 608m/s +/-15% to 20%.

The V_s30 values calculated for the minimum and the maximum envelopes ranged from 502 to 714m/s.

Based on the average V_s30 values (as determined through the MASW method) and table 4.1.8.4.A of the National Building Code of Canada, 2015 Edition, the investigated area is site class "C" ($360 < V_S30 \leq 760$ m/s).

It must be noted that the site classification provided in this report is based solely on the V_s30 value as derived from the MASW method and that it can be superseded by other geotechnical information. This geotechnical information includes, but is not limited to, the presence of sensitive and/or liquefiable soils, more than 3m of soft clays, high moisture content, etc. The reader is referred to section 4.1.8.4 of the National Building Code of Canada, 2015 Edition for more information on the requirements for site classification.

This report has been written by Lhoucin Taghya, P.Geo.

Lhoucin Taghya, P.Geo.
Geophysicist

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