Geotechnical Investigation Report - 1683 Moore Drive and 1490 County Road 28, Fraserville, Ontario

September 2, 2021

Prepared for:
RIC (Moore Drive) Inc. & RIC (Highway 28) Inc.

Cambium Reference: 12579-001

CAMBIUM INC.

866.217.7900

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1.0 Introduction

RIC (Moore Drive) Inc. and RIC (Highway 28) Inc. (Client) retained Cambium Inc. (Cambium) to complete a geotechnical investigation at the properties at 1683 Moore Drive and 1490 County Road 28 in Fraserville, Ontario (Site). The Site consists of two approximately rectangular parcels of land comprising 45 acres at 1490 County Road 28 and 101 acres at 1683 Moore Drive. The land is currently used for agricultural purposes with some forested and wetland areas present and a residential dwelling on each parcel.

It is understood that these lands will be redeveloped as a residential subdivision, with a road network and residential dwellings. Cambium is currently completing natural environment studies to define the developable portions of the land as well as working with the Client to identify water supply and wastewater options for servicing the residential development. In addition, Phase I and II Environmental Site Assessment studies for due diligence purposes have been undertake by Cambium, with some of the field investigation work completed concurrently with the geotechnical field investigation. The results of these studies are provided by Cambium under separate cover.

The geotechnical investigation was completed to determine subsurface conditions at the Site in order to provide preliminary geotechnical recommendations for development. Some additional geotechnical work may be required once the development plan is refined and a site grading plan is developed.

A site map, including borehole locations, is included as Figure 1 of this report.

1.1 Physiographic and Geologic Setting

The Site is situated within a Sand Plain area within the Peterborough Drumlin Field Physiographic Region. The Peterborough Drumlin Field is characterized as a rolling glacial till plain with numerous drumlins and drumlinoid hills. The rock underlying this area is limestone of the Lindsay and Verulam Formations.

2.0 Methodology

2.1 Borehole Investigation

A borehole investigation was completed at the Site on July 26 and 27, 2021. A total of eight (8) boreholes, designated as BH201-21 through BH207-21 and BH301-21, were completed throughout the Site in accessible areas. The boreholes were augered to between 5.0 m and 8.2 meters below ground surface (mbgs), terminating in native soils. The borehole locations are shown on Figure 1.

Drilling and sampling 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 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 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 soils. Soil samples were collected at intervals of either 0.75 m or 1.5 m, depending on the depth of the drilling and the proposed ground elevation at the specific location. 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.

Monitoring wells were installed in boreholes BH201-21 and BH204-21 to allow for measurement of the static groundwater level and for use in the Phase II ESA investigation for groundwater sampling and determination of groundwater flow direction. All boreholes were backfilled and sealed in accordance with Ontario Regulation (O.Reg.) 903.

The prepared borehole logs are provided in Appendix A.

2.2 Physical Laboratory Testing

Physical laboratory testing, consisting of three (3) particle 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 from the boreholes. Results are presented in Appendix B and are discussed in Section 3.0 of this report.

3.0 Subsurface Conditions

Subsurface conditions at the Site are fairly consistent throughout, comprising a layer of topsoil / organic soil overlying silty sand soils, generally observed in a glacial till matrix, with varying proportions of gravel and clay. Bedrock was not encountered within the investigation depths.

The individual soil units are described in more detail below with borehole logs included in Appendix A.

3.1 Topsoil

A surficial layer of topsoil / organic rich silt soil overlies the Site. The topsoil thickness ranges from 300 mm to 600 mm, with an average thickness of 485 mm.

Assessments of organic matter content or other topsoil quality tests were beyond the scope of this study. It is noted that the number of test holes was small when compared to the area of the site. True delineation of the average topsoil thickness would require additional shallow test pits spaced in a relatively tight grid pattern.

3.2 Silty Sand

Native soils at the Site predominantly consist of silty sand containing a trace to some gravel and clay, consistent with a glacial till matrix. Within the upper 1.5 m of some of the boreholes the soil varies from sand with some silt to sandy silt, becoming consistently silty sand in texture below 1.5 m throughout the Site. Cobbles were observed within the silty sand matrix.

The silty sand was generally light brown in colour becoming grey below between 4.0 mbgs and 6.0 mbgs. The soil was described as moist to wet at the time of the investigation, with natural moisture content varying from 3% to 12% based on laboratory testing. The exception to this was borehole BH207-21, located north of the wetlands, where saturated soil conditions were observed below 1.5 mbgs.

The silty sand has a compact to very dense relative density based on SPT N values ranging from 12 to >50 blows for 305 mm of penetration. Compact relative density conditions (SPT N

between 10 and 30) were generally observed within the upper 1.5 mbgs to 3.0 mbgs, with dense to very dense (SPT N > 30) conditions observed below these depths.

Laboratory particle size distribution analyses were completed for three (3) samples of the subsurface soils recovered from the boreholes and depths identified in Table 1. The analysis results are summarized in Table 1 based on the Unified Soil Classification Scale (USCS). Full results are provided in Appendix B.

Table 1 Particle Size Distribution Analysis Results – Silty Sand

Borehole	Depth (mbgs)	Soil	Gravel %	Sand %	Silt %	Clay %	Moisture %
BH201-21	2.3-2.7	Silty sand	20	36	30	14	8
BH204-21	3.0-3.5	Sand and silt	11	40	36	13	8
BH206-21	2.3-2.7	Silty sand	20	36	32	12	7

3.3 Bedrock

Bedrock was not encountered within the investigation depths. All boreholes were terminated in silty sand soils at depth.

3.4 Groundwater

All of the boreholes remained open (no sloughing) on completion of drilling. Boreholes BH203-21 and BH301-21 were dry on completion while the remaining boreholes except BH207-21 observed groundwater seepage to depths of 5.8 mbgs to 6.8 mbgs on completion. Borehole BH207-21 was located north of a wetland area and observed groundwater seepage to 1.5 mbgs on completion of drilling. Throughout the investigation area grey soils were first encountered at depths varying from 4.0 mbgs to 6.0 mbgs.

At the time of writing of this report the groundwater level in the monitoring well in borehole BH204-21 was measured at 3.8 mbgs on August 4, 2021. In addition, the groundwater level was measured on July 26, 2021 in the monitoring well installed at 1490 Highway 28 (MW108-21) as part of the Phase II ESA at 1.83 mbgs.

Based on these observations, the shallow groundwater table at the Site appears to be at or below 3.8 mbgs, with potential exception for areas close to the wetland feature.

It is recommended that additional groundwater level measurements be taken at the monitoring wells during the changing seasons to understand the seasonal variation in the groundwater table at the Site.

It should be noted that groundwater levels may fluctuate seasonally and with large precipitation events.

4.0 Geotechnical Considerations

The following recommendations are based on 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. 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 Site Preparation

All vegetation and organic soils should be stripped from all areas of the Site under development. It is anticipated that some regrading of the Site will occur to accommodate the proposed development. Based on the currently investigation, the non-organic silty sand soils at the Site are acceptable to be reused as engineered fill during regrading operations, in accordance with recommendations provided in Section 4.5. Full time monitoring of the acceptability of subgrade soils in fill areas and compaction testing during placement of engineered fill by Cambium should be completed to ensure appropriate materials are used and that compaction requirements are met.

Once regrading is complete, the exposed subgrade should be proof-rolled and inspected by qualified geotechnical engineering personnel prior to the placement of any fill or bedding material. Any loose/soft soils identified at the time of proof-rolling that are unable to be uniformly compacted should be sub-excavated and removed. The excavations created through the removal of these materials should be backfilled with approved engineered fill consistent with the recommendations provided below.

The near surface silt soils can be very unstable if they are wet or saturated. Such conditions are common in the spring and late fall. Under these conditions, temporary use of granular fill, and possible reinforcing geotextiles, may be required to prevent severe rutting on construction access routes.

4.2 Frost Penetration

Based on climate data and design charts, the maximum frost penetration depth below the pavement at the site is estimated at 1.5 mbgs.

Footings for the proposed structures should be situated at or below this depth for frost protection or should be protected with insulation.

It is assumed that any pavement structure thickness will be less than 1.5 m, so grading and drainage are important for good pavement performance and life expectancy. Any services/utilities should be located below this depth or be appropriately insulated.

4.3 Excavations

All excavations must be carried out in accordance with the latest edition of the Occupational Health and Safety Act (OHSA). The compact native soils encountered above the groundwater table may be classified as Type 3 soils in accordance with OHSA, with unsupported side slopes no steeper than 1H:1V. while the dense to very dense glacial till soils above the groundwater table may be classified as Type 2 soils with vertical sides of 1.2 m depth then unsupported side slopes no steeper than 1H:1V. Below the groundwater table the dense to very dense glacial till soils may be classified as Type 3 soils.

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 excavation or if wet conditions are encountered, the side slopes should be flattened as required to maintain safe working conditions or the excavation sidewalls must be fully supported (shored).

4.4 Dewatering

The depth of the groundwater table at the Site varies between 1.8 mbgs and 3.8 mbgs, but appears to be at or below 3.8 mbgs for most of the Site, apart from areas adjacent to wetlands. Anticipating regrading of the Site, the depth to the groundwater table will change. However, for residential building construction, road construction, and service installation, it is anticipated that

most excavations will either continue to be above the groundwater table or may potentially encounter some groundwater seepage at the base. However, overall it appears very likely that groundwater seepage should be controllable with filtered sumps and pumps and a Permit to Take Water (PTTW) and registration on the Environmental Activity and Sector Registry (EASR) from the Ministry of the Environment, Conservation, and Parks (MOECP) should not be required as the amount of groundwater pumped is unlikely to exceed 50,000 L/day.

Completion of test excavations after regrading is completed is recommended to assess the groundwater table level and seepage prior to excavations for building foundations, roads, and services. The Client should also continue to measure the groundwater levels in the monitoring wells on Site to identify seasonal variability in the groundwater table.

It is noted that the elevation of the groundwater table will vary due to seasonal conditions and in response to heavy precipitation events.

4.5 Backfill and Compaction

Excavated topsoil from the Site is not appropriate for reuse as fill. Excavated native silty sand to sandy silt glacial till soils and gravelly sand soil may be appropriate for use as Site backfill, provided that the actual or adjusted moisture content at the time of construction is within range that permits compact to required densities. Any clay and silt, as identified in test pit TP102-20, is not appropriate for reuse as backfill.

Any engineered fill below foundations should be placed in lifts appropriate to the type of compaction equipment used, and be compacted to a minimum of 100% of standard Proctor maximum dry density (SPMDD), as confirmed by nuclear densometer testing. If native soils from the site are not used as engineered fill, imported material for engineered fill should consist of clean, non-organic soils, free of chemical contamination or deleterious material. The moisture content of the engineered fill will need to be close enough to optimum at the time of placement to allow for adequate compaction. Consideration could be given to using a material meeting the specifications of OPSS 1010 Granular B or an approved equivalent. Foundation wall and any buried utility backfill material should consist of free-draining imported granular material.

4.6 Foundation Design

We anticipate that some regrading of the Site will occur prior to construction of the proposed development. Given that understanding, soil bearing capacity has been provided for different materials, as it was encountered at different depths.

Overall, assuming the site is prepared as outlined above, the native subsoils are competent to support the proposed residential structures on conventional strip and spread footings. Any new exterior footings must be placed a minimum of 1.5 m below final adjacent grade for frost protection. Depending on the subgrade material for the footings, they can be designed for the allowable bearing capacities provided in Table 2. Any required grade raises due to regrading can be accomplished with engineered fill placed in accordance with the recommendations in Section 4.5.

Table 2 Bearing Capacity Estimates

Soil Type	Bearing Capacity (kPa)
Compact silty sand to sandy silt	150 kPa SLS 225 kPa ULS
Dense to very dense silty sand to sandy silt	200 kPa SLS 300 kPa ULS
Engineered Fill above loose to compact native soils	100 kPa SLS 150 kPa ULS
Engineered Fill above dense to very dense native soils	150 kPa SLS 180 kPa ULS

In addition to the recommendations above, the structures may be founded on approved engineered fill soils overlying native soils subject to the approval by Cambium. A minimum thickness of 1.2 m of engineered fill is recommended where it is placed on very loose to loose soils, if any. Structures founded on approved engineered fill soils may be designed for an allowable bearing capacity per Table 2.

The quality of the subgrade should be inspected by Cambium during construction, prior to constructing the footings, to confirm bearing capacity estimates and suitability of any engineered fill. Settlement potential at the above-noted SLS loadings is less than 25 mm and differential settlement should be less than 10 mm.

The quality of the subgrade should be inspected by Cambium during construction, prior to constructing the footings and placing engineered fill, to confirm bearing capacity estimates. Engineered fill should be placed and compacted as discussed in Section 4.5.

4.6.1 Modulus of Subgrade Reaction

The modulus of subgrade reaction for the different soils is provided below.

- Compact to silty sand to sandy silt 28,200 kN/m^3
- Dense to very dense silty sand 78,400 kN/m^3

4.7 Lateral Earth Pressures

Depending on the earthworks at the Site there may be retaining walls constructed. Any retaining walls should be founded in competent native soils and should be designed for the bearing capacities outlined in Table 2 depending on depth/elevation of the base of the wall.

Lateral earth pressure coefficients (K) are shown in Table 3. It is assumed that potential lateral loads will result from cohesionless, frictional materials, such as granular backfill.

Table 3 Lateral Earth Pressure Coefficients

K	
Ko (at rest)	0.42
Ka (active)	0.27
Kp (passive)	3.70

The coefficients provided in Table 3 assume that the surface of the granular backfill is horizontal against any proposed retaining wall, and the wall is vertical and smooth. Cambium should be contacted to provide updated lateral earth pressure coefficients should the assumptions differ to those noted and if the soil slopes at an angle against the retaining wall.

A unit weight of 22 kN/m^3 should be assumed for compacted granular backfill loadings.

4.8 Floor Slabs

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 percent of SPMDD.

4.9 Subdrainage

Geotextile wrapped perforated pipe subdrains set in a trench of clear stone and connected to a sump or other frost-free positive outlet are recommended around all basement footings. Based on the fact that groundwater was not observed throughout most of the investigation depths, subdrains are not required for slab on grade structures unless they are in the area of the wetland. However, given that the site may be regraded, if shallow water is observed during excavations and at seasonal wetter times, geotextile wrapped subdrains set in a trench of clear stone and connected to a sump or other frost-free positive outlet will be recommended below the floor slab and around the perimeter of building foundations.

4.10 Buried Utilities

Trench excavations should generally consider Type 3 soil conditions above the groundwater table which can be excavated with unsupported side slopes no steeper than 1H:1V.

Bedding and cover material for any services should consist of OPSS 1010-3 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 95 percent of SPMDD. The cover material shall be a minimum of 300 mm over the top of the pipe and compacted to 95 percent SPMDD, taking care not to damage the utility pipes during compaction.

4.11 Seismic Site Classification

The Ontario Building Code (OBC) specifies that the structures should be designed to withstand forces due to earthquakes. For the purpose of earthquake design, geotechnical information shall be used to determine the “Site Class”. Based on the explored soil properties and in

accordance with Table 4.1.8.4.A of the OBC (2006), it is recommended that Site Class “D” (stiff soil) be applied for structural design at the Site. This recommendation may be revisited depending on the regrading plans. It might be possible to achieve Site Class “C” if MASW testing was completed at the site. Cambium would be pleased to provide a quote for that work if necessary.

4.12 Pavement Design

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

The recommended pavement structure should satisfy applicable standards for parking and driving areas and should, as a minimum, consist of the pavement layers identified in Table 4. The recommended minimum pavement structure design has been developed for two (2) traffic loading scenarios; light duty and heavy duty. The heavy duty design is appropriate for areas where truck traffic is anticipated while the light duty design is appropriate for areas where no truck 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 (2 lifts)
Granular Base	150 mm OPSS 1010 Granular A	150 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 percent of SPMDD (ASTM D698) standard. The granular materials specified should conform to OPSS standards, as confirmed by appropriate materials testing.

Depending on the final site grades and impacts on the groundwater table due to the site earthworks and installed services, subdrains may be required beneath the pavement structure and curbs.

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.

4.13 Additional Investigations

Further geotechnical investigation may be required at the Site as development plans advance. Additional boreholes may be required in areas of substantial cut, if multi storey buildings are proposed as part of the development, or in areas such as borehole BH207-21 where shallow saturated soil conditions were observed. Cambium would be pleased to review future development plans and site grading plans with the Client to determine any additional geotechnical requirements.

4.14 Design Review and Inspections

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.

We 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 testing.

5.0 Closing

We trust the information in this report is sufficient for your current needs. If you have questions or comments regarding this document, please do not hesitate to contact the undersigned at (705) 742-7900.

Respectfully submitted,

Cambium Inc.

Jennifer Wales, P.Eng.
Project Manager – Geotechnical

Stuart Baird, M.Eng., P.Eng.
Director – Geotechnical Engineering

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6.0 Standard Limitations

Limited Warranty

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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.

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Personal Liability

The client expressly agrees that Cambium employees shall have no personal liability to the client with respect to a claim, whether in contract, tort and/or other cause of action in law. Furthermore, the client agrees that it will bring no proceedings nor take any action in any court of law against Cambium employees in their personal capacity.

Appended Figures

GEOTECHNICAL INVESTIGATION

RIC (MOORE DRIVE) INC. &
RIC (HIGHWAY 28) INC.
1382 Highway 28, 1490 Highway 28,
& 1683 Moore Drive,
Cavan, Ontario

LEGEND

- Borehole
- Monitoring Well
- Site (approximate)

Notes:
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources and Forestry 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
P.O. Box 325, 52 Hunter Street East
Peterborough, Ontario, K9H 1G5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

BOREHOLE LOCATION PLAN

Project No.:	12579-001	Date:	August 2021
		Rev.:	
Scale:	1:10,000	Projection:	NAD 1983 UTM Zone 17N
Created by:	MAT	Checked by:	JLW
Figure:	1		

O:\GIS\MXDs\12500-12999\12579-001 RIC (KDL Lands) Inc. - Site Development & Servicing Constraints - Kawartha Downs\2021-08-09 FIG 1 - Borehole Location Plan.mxd

Appendix A

Borehole Logs

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

Log of Borehole: BH/MW201-21

Client: RIC (KDL Lands) Inc. **Project Name:** Site Development & Servicing Constraints **Project No.:** 12579-001

Contractor: Canadian Environmental **Method:** Solid Stem Auger **Date Completed:** July 27, 2021

Location: Kawartha Downs, Fraserville, ON **UTM:** 17 T 707653E, 4898425N **Elevation:**

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
1 / -1										
0 / 0		TOPSOIL: 300 mm thick, dark brown, silt, some sand, dry to moist, no odour, no stain	1A	SS	100	4			Cap	
			1B	SS						
-1 / 1		SAND: Brown, sand, some silt, dry to moist, loose, no odour, no stain	2	SS	100	22				
		SANDY SILT: Light brown, sandy silt, trace gravel, dry to moist, dense, no odour, no stain	3	SS	40	23			Pipe	
-2 / 2		SILTY SAND: Light brown, silty gravelly sand, trace clay, moist, compact, no odour, no stain	4	SS	30	12			Bentonite Plug	GSA SS4: 20% Gravel 36% Sand 30% Silt 14% Clay
-3 / 3		-becomes moist to wet	5	SS	80	19				
-4 / 4		SILTY SAND: Grey, silty gravelly sand, trace clay, moist to wet, compact, no odour, no stain	6	SS	100	26				
-5 / 5										
-6 / 6		-becomes wet, very dense	7	SS	80	50/ 375			Sand Pack PVC Screen	Groundwater first encountered at 6.1 mbgs
-7 / 7										Borehole open and water level measured at 6.7 mbgs upon completion
-8 / 8		-becomes compact	8	SS	100	27			Cap	
-9 / 9		Borehole terminated at 8.1 mbgs in silty gravelly sand								

Logged By: J. Riseling **Input By:** J. Riseling

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Peterborough
Barrie
Oshawa
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T: 866-217-7900
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Log of Borehole: BH202-21

Client: RIC (KDL Lands) Inc. **Project Name:** Site Development & Servicing Constraints **Project No.:** 12579-001

Contractor: Canadian Environmental **Method:** Solid Stem Auger **Date Completed:** July 26, 2021

Location: Kawartha Downs, Fraserville, ON **UTM:** 17T 707575E, 4898635N **Elevation:**

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
0 / 0		TOPSOIL: 600 mm thick, dark brown, silt, some sand, dry to moist, no odour, no stain	1	SS	60	3				
-1 / 1		SANDY SILT: Light brown, sandy silt, trace gravel, moist, compact, no odour, no stain	2	SS	70	24				
-2 / 2		SILTY SAND: Light brown, silty sand, some gravel, trace clay, moist to wet, compact, no odour, no stain	3	SS	25	12				
			4	SS	100	15				
-3 / 3			5	SS	100	21				
-4 / 4		SILTY SAND: Grey, silty sand, some gravel, trace clay, dry to moist, dense, no odour, no stain	6	SS	75	43				Groundwater first encountered at 6.1 mbgs
-5 / 5										
-6 / 6		-becomes very dense	7	SS	100	50/ 375				Borehole open and water level measured at 6.1 mbgs upon completion
-7 / 7		Borehole terminated at 6.55 mbgs in silty sand								
-8 / 8										
-9 / 9										

Logged By: J. Riseling **Input By:** J. Riseling

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Log of Borehole: BH203-21

Client: RIC (KDL Lands) Inc.
Project Name: Site Development & Servicing Constraints
Project No.: 12579-001
Contractor: Canadian Environmental
Method: Solid Stem Auger
Date Completed: July 27, 2021
Location: Kawartha Downs, Fraserville, ON
UTM: 17T 707872E, 4898681N
Elevation:

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
0 / 0		TOPSOIL: 600 mm thick, dark brown, silt, some sand, dry to moist, no odour, no stain	1	SS	30	5				
-1 / 1		SILTY SAND: Light brown, silty gravelly sand, trace clay, moist to wet, dense, no odour, no stain	2	SS	70	46				
-2 / 2		-becomes very dense	3	SS	60	50/250				Possibly on a rock
-3 / 3		-becomes dense	4	SS	100	34				Cobbles throughout
-4 / 4			5	SS	90	37				Borehole open and dry upon completion
-5 / 5		-becomes very dense	6	SS	100	50/50				Auger refusal at 4.6 mbgs due to possible large boulder
-6 / 6		Borehole terminated at 5.0 mbgs in silty gravelly sand								
-7 / 7										
-8 / 8										
-9 / 9										

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Input By: J. Riseling

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Log of Borehole: BH/MW204-21

Client: RIC (KDL Lands) Inc. **Project Name:** Site Development & Servicing Constraints **Project No.:** 12579-001

Contractor: Canadian Environmental **Method:** Solid Stem Auger **Date Completed:** July 26, 2021

Location: Kawartha Downs, Fraserville, ON **UTM:** 17T 707905E, 4898870N **Elevation:**

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
1 / -1										
0 / 0		TOPSOIL: 600 mm thick, dark brown, silt, some sand, dry to moist, no odour, no stain	1	SS	40	5			Cap	
-1 / 1		SILTY SAND: Light brown, silty sand, some gravel, trace clay, dry to moist, dense, no odour, no stain	2	SS	60	48				
-2 / 2		-becomes compact, moist	3	SS	65	26			Pipe	
		SAND AND SILT: Light brown, sand and silt, some clay, some gravel, moist to wet, compact, no odour, no stain	4	SS	30	20			Bentonite Plug	
-3 / 3		-becomes dense	5	SS	100	42				
-4 / 4		-becomes very dense	6	SS	80	50/ 425				
-5 / 5			7	SS	100	50/ 275				GSA SS6: 11% Gravel 40% Sand 36% Silt 13% Clay
		SAND AND SILT: Grey, sand and silt, some clay, trace gravel, moist to wet, very dense, no odour, no stain	8	SS	100	50/ 125				
-6 / 6			9	SS	50	50/ 100			Sand Pack PVC Screen	Borehole open and water level measured at 6.8 mbgs upon completion
-7 / 7		SAND AND SILT: Grey, sand and silt, some clay, some gravel, moist to wet, very dense, no odour, no stain	10	SS	50	50/ 400				Groundwater first encountered at 6.85 mbgs
-8 / 8		SAND AND SILT: Grey, sand and silt, some clay, saturated, very dense, no odour, no stain	11	SS	70	50/ 175				
-9 / 9		Borehole terminated at 8.23 mbgs in sand and silt							Cap	

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Log of Borehole: BH205-21

Client: RIC (KDL Lands) Inc.
Project Name: Site Development & Servicing Constraints
Project No.: 12579-001
Contractor: Canadian Environmental
Method: Solid Stem Auger
Date Completed: July 28, 2021
Location: Kawartha Downs, Fraserville, ON
UTM: 17T 707867E, 4899039N
Elevation:

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
1 / -1										
0 / 0		TOPSOIL: 300 mm thick, dark brown, silt, some sand, dry to moist, no odour, no stain	1A	SS	75	5				
			1B	SS						
-1 / 1		SAND: Brown, sand, some silt, trace organics, dry to moist, loose, no odour, no stain	2	SS	100	20				
-2 / 2		SILTY SAND: Light brown, silty sand, some gravel, trace clay, dry to moist, compact, no odour, no stain	3	SS	40	9				
		-becomes loose	4	SS	0	18				No recovery for SS4
-3 / 3		-becomes compact								
		SILTY SAND: Light brown, silty gravelly sand, some clay, moist, compact, no odour, no stain	5	SS	80	22				
-4 / 4										
-5 / 5		-becomes moist to wet, dense	6	SS	100	37				Groundwater first encountered at 6.55 mbgs
-6 / 6										
		-becomes grey, very dense	7	SS	60	50/ 250				Borehole open and water level measured at 6.55 mbgs upon completion
-7 / 7		Borehole terminated at 6.55 mbgs in silty gravelly sand								
-8 / 8										
-9 / 9										

Logged By: J. Riseling
Input By: J. Riseling

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Log of Borehole: BH206-21

Client:	RIC (KDL Lands) Inc.	**Project Name:**	Site Development & Servicing Constraints	**Project No.:**	12579-001
Contractor:	Canadian Environmental	**Method:**	Solid Stem Auger	**Date Completed:**	July 28, 2021
Location:	Kawartha Downs, Fraserville, ON	**UTM:**	17T 708223E, 4899071N	**Elevation:**	

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
1 / -1										
0 / 0		TOPSOIL: 300 mm thick, dark brown, silt, some sand, dry to moist, no odour, no stain	1A	SS	100	5				
			1B	SS						
-1 / 1		SAND AND SILT: Brown, sand and silt, moist, loose, no odour, no stain	2	SS	60	13				
		SILTY SAND: Brown, silty sand, some gravel, trace clay, moist to wet, compact, no odour, no stain	3	SS	70	19				
-2 / 2		SILTY SAND: Light brown, silty gravelly sand, some clay, moist to wet, compact, no odour, no stain	4	SS	100	24				GSA SS4: 20% Gravel 36% Sand 32% Silt 12% Clay
-3 / 3			5	SS	70	27				Cobble throughout
-4 / 4										
-5 / 5		-becomes very dense	6	SS	100	61				Borehole open and water level measured at 5.8 mbgs upon completion
-6 / 6										
		-becomes grey, wet	7	SS	50	50/ 400				Groundwater first encountered at 6.25 mbgs
-7 / 7		Borehole terminated at 6.55 mbgs in silty gravelly sand								
-8 / 8										
-9 / 9										

Logged By: J. Riseling **Input By:** J. Riseling

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Log of Borehole: BH207-21

Client: RIC (KDL Lands) Inc. **Project Name:** Site Development & Servicing Constraints **Project No.:** 12579-001

Contractor: Canadian Environmental **Method:** Solid Stem Auger **Date Completed:** July 27, 2021

Location: Kawartha Downs, Fraserville, ON **UTM:** 17T 708017E, 4898795N **Elevation:**

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
0 / 0		TOPSOIL: 600 mm thick, dark brown, silt, some sand, dry to moist, no odour, no stain	1	SS	50	6				
-1 / 1		SILTY SAND: Light brown, silty sand, some gravel, trace clay, moist to wet, compact, no odour, no stain	2	SS	100	13				Groundwater first encountered at 1.5 mbgs
-2 / 2		SAND AND SILT: Light brown, sand and silt, some gravel, trace clay, saturated, compact, no odour, no stain	3	GS	0	17				Borehole open and water level measured at 1.5 mbgs upon completion
		-becomes dense	4	SS	50	33				
-3 / 3			5	SS	40	34				
-4 / 4										
-5 / 5		-becomes light brown/grey, very dense	6	SS	100	50/100				
-6 / 6										
-7 / 7		Borehole terminated at 6.55 mbgs in sand and silt	7	SS	100	50/50				
-8 / 8										
-9 / 9										

Logged By: J. Riseling **Input By:** J. Riseling

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Log of Borehole: BH301-21

Client: RIC (KDL Lands) Inc. **Project Name:** Site Development & Servicing Constraints **Project No.:** 12579-001

Contractor: Canadian Environmental **Method:** Solid Stem Auger **Date Completed:** July 26, 2021

Location: Kawartha Downs, Fraserville, ON **UTM:** 17T 707380E, 4898649N **Elevation:**

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
0 / 0		TOPSOIL: 600 mm thick, dark brown, silt, some sand, dry to moist, no odour, no stain	1	SS	25	7				
-1 / 1		SILTY SAND: Brown, silty sand, some gravel, trace organics, dry to moist, compact, no odour, no stain	2	SS	50	27				
-2 / 2		SILTY SAND: Light brown, silty sand, some gravel, trace clay, moist to wet, compact, no odour, no stain	3	SS	60	17				
		-becomes dense	4	SS	80	41				Cobble throughout
-3 / 3		SILTY SAND: Light brown, silty gravelly sand, some clay, dry to moist, very dense, no odour, no stain	5	SS	50	50/ 375				
-4 / 4										
-5 / 5		-becomes grey	6	SS	100	81				Borehole open and dry upon completion
-6 / 6										
		-becomes dry	7	SS	100	50/ 75				
-7 / 7		Borehole terminated at 6.55 mbgs in silty gravelly sand								
-8 / 8										
-9 / 9										

Logged By: J. Riseling **Input By:** J. Riseling

Appendix B

Physical Laboratory Testing Results

Grain Size Distribution Chart

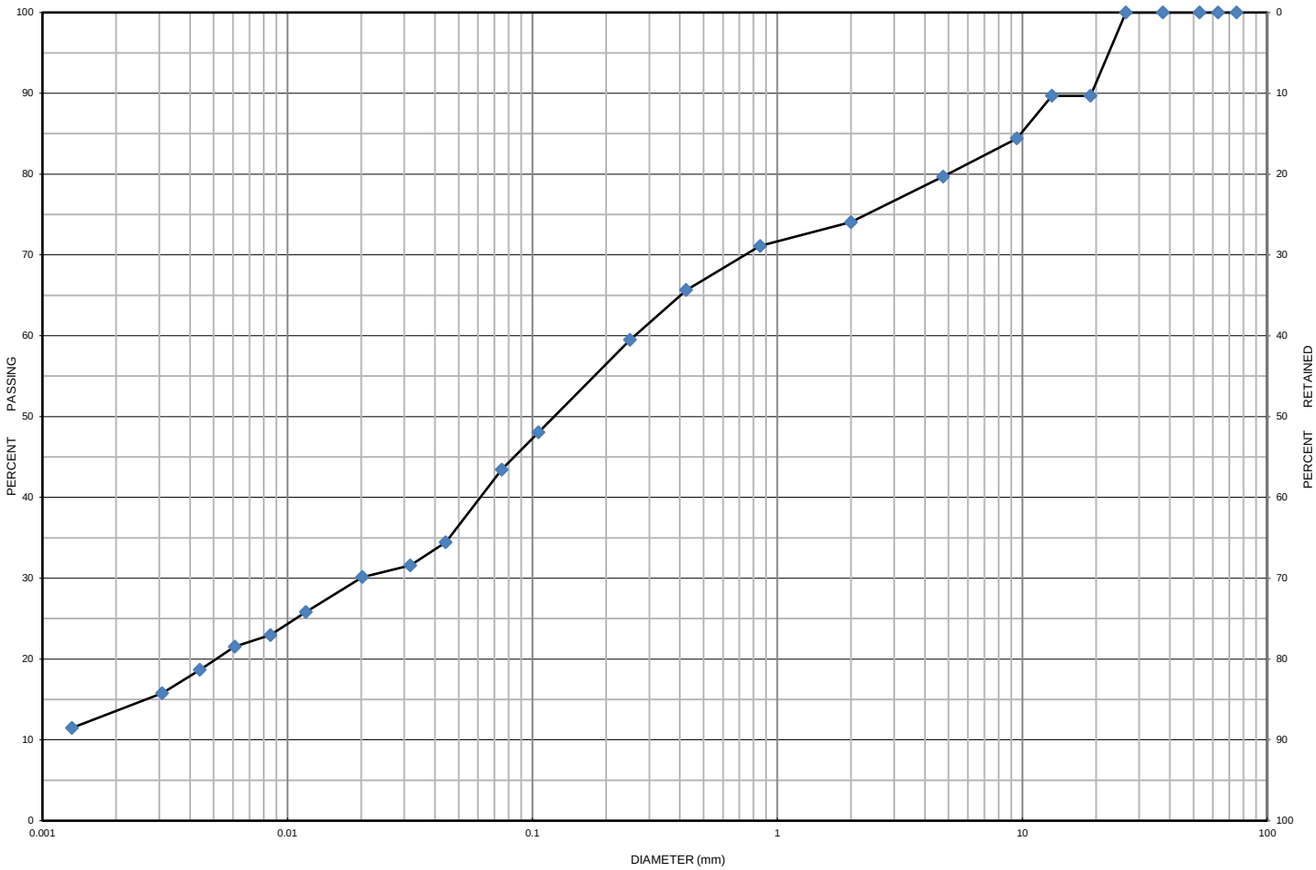
Project Number: *12579-001* **Client:** *RIC (KDL) Inc*

Project Name: *Kawartha Downs Site Development*

Sample Date: *July 30, 2021* **Sampled By:** *Josh Riseling - Cambium Inc.*

Location: *BH 201-21 SS 4* **Depth:** *2.3 m to 2.7 m* **Lab Sample No:** *S-21-0922*

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			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 201-21	SS 4	2.3 m to 2.7 m	20	36	30	14	8.3

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Gravelly Sand some Clay	SM	0.260	0.020	-	-	-

Additional information available upon request

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Grain Size Distribution Chart

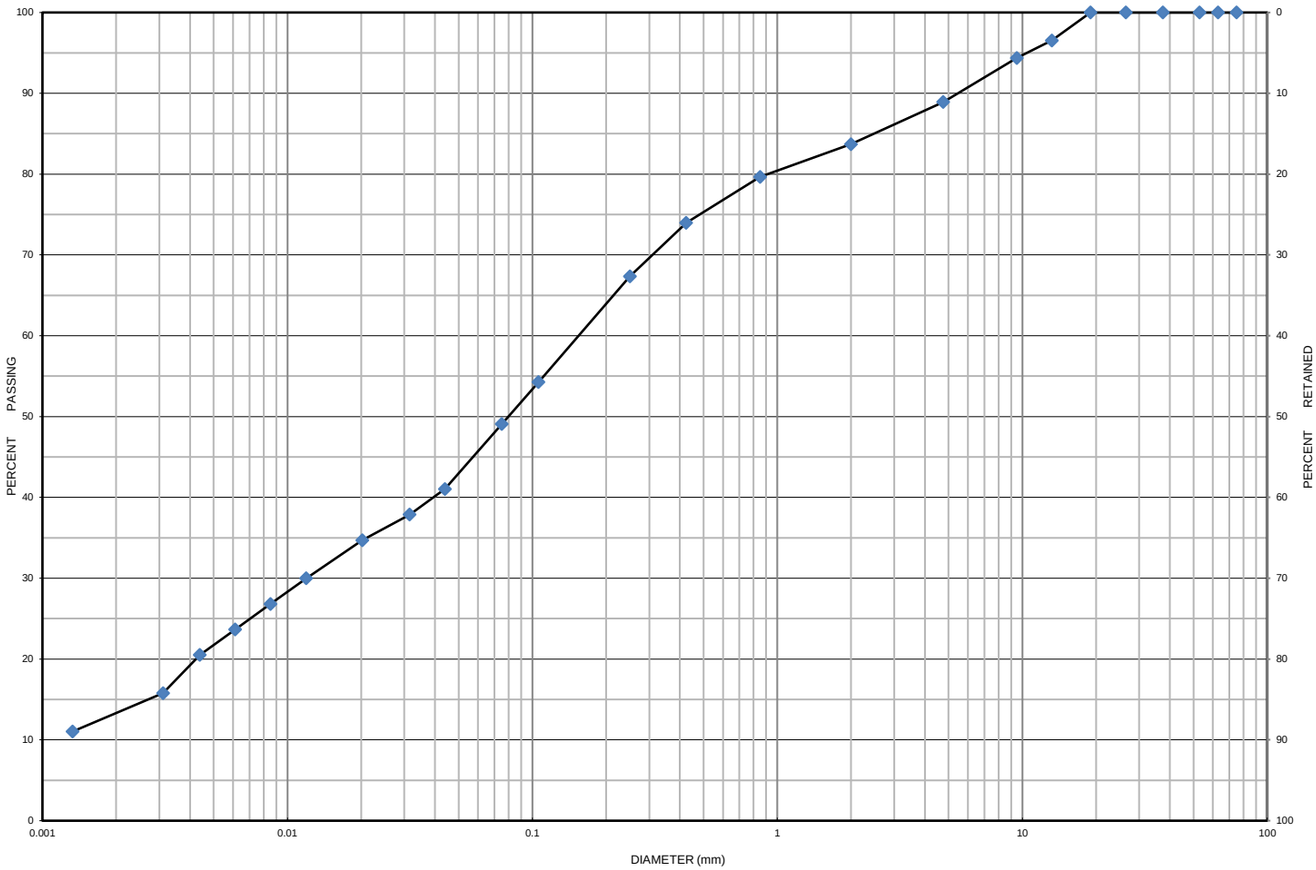
Project Number: *12579-001* **Client:** *RIC (KDL) Inc*

Project Name: *Kawartha Downs Site Development*

Sample Date: *July 30, 2021* **Sampled By:** *Josh Riseling - Cambium Inc.*

Location: *BH 204-21 SS 5* **Depth:** *3 m to 3.7 m* **Lab Sample No:** *S-21-0923*

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			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 204-21	SS 5	3 m to 3.7 m	11	40	36	13	7.7

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand and Silt some Clay some Gravel	SM	0.160	0.013	-	-	-

Additional information available upon request

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Grain Size Distribution Chart

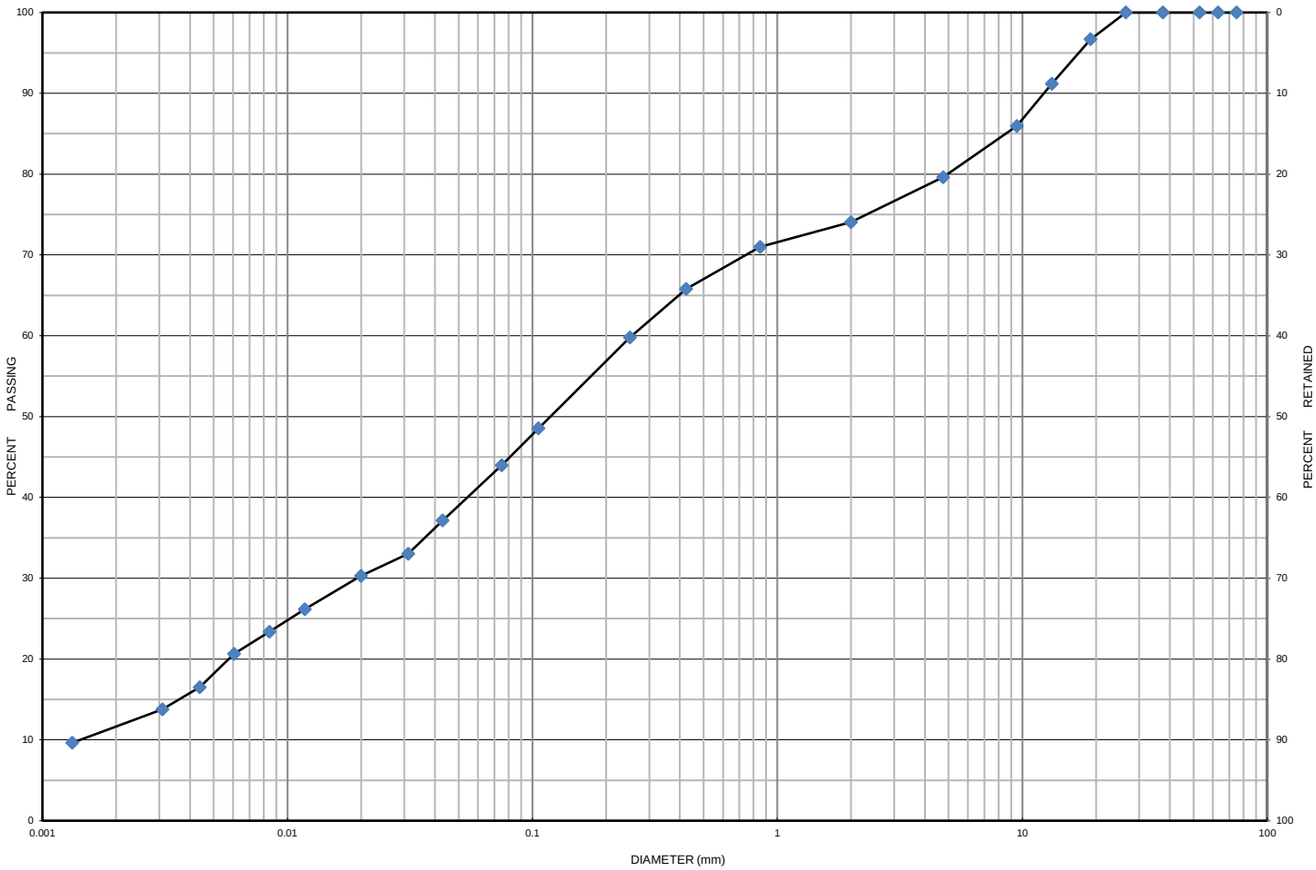
Project Number: *12579-001* **Client:** *RIC (KDL) Inc*

Project Name: *Kawartha Downs Site Development*

Sample Date: *July 30, 2021* **Sampled By:** *Josh Riseling - Cambium Inc.*

Location: *BH 206-21 SS 4* **Depth:** *2.3 m to 2.7 m* **Lab Sample No:** *S-21-0924*

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			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 206-21	SS 4	2.3 m to 2.7 m	20	36	32	12	7.0

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Gravelly Sand some Clay	SM	0.2500	0.0190	0.0015	166.67	0.96

Additional information available upon request

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