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August 16, 2023

2744529 Ontario Inc - York River Subdivision
196 Colborne Road
L'Amable, ON K0L 2L0

Attn: Fraser Young

Re: Response to Peer Review – Hydrogeological Assessment Report, Woodcox Road Subdivision, Bancroft, Ontario
Cambium Reference: 11849-001

Dear Mr. Young,

Cambium Inc. (Cambium) is pleased to provide 2744529 Ontario Inc - York River Subdivision (Client) with this response to peer review comments regarding our report (Report) titled *"Hydrogeological Assessment Report, Woodcox Road Subdivision, Bancroft, Ontario"* dated February 22, 2022.

Greer Galloway Consulting Engineers (Greer Galloway) reviewed the Report in a letter dated January 24, 2023; the following is a summary of their comments:

1. Greer Galloway notes that while varying the pumping rate does not follow Guideline D-5-5, that the decision was reasonable for the context of the situation.
2. Detectable levels of total coliform bacteria were periodically found in each well during the water quality sampling program. It was noted by Cambium that the source of the total coliform was unknown and recommended that disinfection be provided for TW-2. Greer Galloway notes that total coliform bacteria are often encountered in wells and at low levels such as those found at the subject site it is not possible to determine whether the bacteria are resident within the aquifer or whether they were introduced during the sampling procedure.

   Recommendation: Cambium should consider the potential presence of bacteria within the bedrock aquifer and make a determination whether disinfection (typically UV) should be recommended for all lots on the proposed subdivision.

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3. Cambium carried out predictive modelling for nitrate as per MECP Guideline D-5-4. Greer Galloway noted that shallow groundwater at the site will enter the York River and that nitrate is not the critical parameter under this scenario. Instead, phosphorous loading and its potential ecological effects should be considered along with a determination whether specific septic system designs should be required for the proposed subdivision.

   Recommendation: The Consultant should assess the potential impact of phosphorous loading to the subsurface adjacent to the York River. Comment should be provided regarding the potential for specific septic system designs (e.g., raised systems with tiles constructed on iron and alumina-enriched B-horizon soils) to reduce phosphorous loading and whether such system designs are recommended for the subject site.

4. Cambium assessed nitrate loading in accordance with Guideline D-5-4 but did not comment on the suitability of the site (soils and lot sizes) for the construction of conventional in-ground Class 4 systems and that the lots are sufficiently large to meet Ontario Building Code setbacks.

   Recommendation: Comment on the type of septic systems suitable for the proposed development along with any site-specific requirements. Confirm that the proposed lots are large enough to accommodate such systems along with an appropriate reserve area.

5. Greer Galloway notes that determining yield by multiplying a well's specific capacity by the available drawdown is only useful for the portion of the well bore above the main water producing zone(s). It is suggested that the Report be revised to avoid wording that could lead non-expert readers to over-estimate the potential yield of their wells.

6. Elevated turbidity was reported during the re-sampling event for each of the wells, which was attributed to the high-volume pumping rate used for the re-test. It was concluded that the high measured turbidity is not representative of conditions under long-term use. Greer Galloway agrees

with the interpretation and notes that turbidity typically declines under regular pumping.

7. Elevated hardness was reported from each well and Cambium recommended a water softener to reduce hardness. Greer Galloway suggests that the recommendation be revised to note that hardness can be reduced using water softening systems but to remove the positive recommendation that such systems be installed.

The following are Cambium's responses to the above comments:

Comment #1

Noted. No further action is required at this time.

Comment #2

Noted. Cambium offers the following revised wording for a portion of Section 4.1.2 of the Report:

"…Total coliforms were detected in three of the analyzed groundwater samples. The test wells were disinfected and the groundwater was resampled to confirm the concentrations of total coliform.

During the resampling event, total coliform was detected in TW2 but was below detection in TW1, TW3 and TW4. It should be noted that the method detection limit was raised to 2 cfu/100mL for TW1 and TW2 by the laboratory. Total coliforms were not detected in TW2 during the first round of sampling; however, were detected at 12 cfu/100 mL during the resampling event. The source of total coliform is unknown at this time; however, it is possible that that the bacteria is present in the bedrock aquifer. Due to the low levels of total coliforms detected in each well during at least one sampling event, it is recommended that a disinfection unit (e.g. Ultra-Violet Treatment) be utilized for each of the wells supplying the proposed residential development. A water treatment specialist should be consulted for appropriate treatment options...."

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Comment #3

Cambium offers the following phosphorus loading assessment to address the concern of phosphorus as a contaminant from the wastewater treatment systems on York River:

The Reasonable Use Concept was considered for phosphorus accounting for the sewage systems at the Site.

Following the prevailing grade for the property, the direction of the shallow unconfined groundwater flow is assumed to be to the east-northeast towards York River. As such, phosphorus is the contaminant of concern for the Site and the focus of the water resources assessment.

For the phosphorus assessment, all of the proposed lots are within 300 m of the surface water were included in the assessment, as shown on Figure 2 of the Report, which encompasses 163,800 m^2 in area in total; however, as per the mass balance nitrate loading (within Section 5.0 of the Report), a surface area of 147,523.5 m^2 was used due to the removal of impervious road surfaces. There are 20 proposed lots within 300 m of the surface water. These undeveloped lots were assumed to be developed for a 4-bedroom dwelling so a value of 1,000 L/day (from Ministry D-5-4) was assigned to each lot.

A mass balance assessment was completed and determined that a phosphorus load of 1.6 mg/L would be calculated to enter the River (assuming only dilution). Following the Ministry's guidance that phosphorus is attenuated over 300 m from a surface water receiver, it is assumed that some attenuation would occur for the wastewater systems within 300 m. As such, the distance from each lot (within 300 m) to the lake edge was approximately measured. Considering the average distance of the lots (within 300 m) from the lake, a 68% rate of attenuation was calculated, which would equate to a phosphorus load of 0.43 mg/L, from all of the lots within 300 m from the Lake (existing and to be developed). A summary of these calculations are appended to this letter.

Since the receiving water body is a river, there is no phosphorus concentrations data available through the Ontario Lake Partner site; however, the average

concentration of nearby downstream lakes (Clark Lake, L'Amable Lake, and Bay Lake) is 6.1 µg/L, which indicates that the waterbodies downstream of the Site are a Policy 1 receiver. Therefore, it was inferred that York River is also categorized as a Policy 1 receiver (as defined by Ministry B-1-5 guidelines).

It was confirmed with the Hasting Highlands Official Plan that York River is not a critical habitat or at capacity for phosphorus, nor are any of the nearby downstream waterbodies to the Site. Additionally, the Site is not situated within the Bay of Quinte Watershed and therefore, the phosphorus management strategy developed through the Bay of Quinte Remedial Action Plan does not apply to the Site.

Considering that the anticipated loading rate of phosphorus to the lake is less than 1 mg/L assuming the 68% attenuation rate, it is deemed to not be a significant input of phosphorus to the York River. Furthermore, the phosphorus loading would occur from multiple (20) small wastewater systems spread throughout the 300 m assessment area, each with a small effluent plume, instead of a single plume from one large communal wastewater system (as this phosphorus loading was modelled). This would result in multiple small and dilute plumes from the Site. As such, it is anticipated that a greater rate of attenuation of phosphorus within the native soils would occur than the theoretical rate which was calculated above.

Comment #4

Cambium confirms that the nitrate loading assessment was calculated assuming an individual conventual wastewater treatment system for each lot. Cambium offers the following conceptual wastewater system assessment to illustrate that the lots are sufficiently sized to accommodate a conventional wastewater system:

Residential lot sizing as applied to subdivisions requires that the lots are sized to include a Class 4 conventional sewage system, including a separate replacement area. Furthermore, the sewage system should be sized for a minimum daily sewage flow of 2,000 L (as per the sewage loading rates for a 4-bedroom house in the Ontario Building Code (OBC) (Ontario Ministry of Municipal Affairs and Housing, 1997)).

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The surficial soil investigation (in Section 2.2 of the Report) consisted of 9 test pits excavated to a depth of 1.4 to 2.0 m and 4 boreholes drilled to a depth of 6.6 mbgs (see geotechnical investigation (Cambium, 2022)). Grain size analysis (sieve/hydrometer) was completed on 3 representative soil samples, with the result percolation (T-Time) rate ranging between 18 and 20 cm/min (see attached laboratory results). As such, a loading rate of 10 L/m^2/day was assumed to be required for any septic systems to be constructed on the Site. The following table presents the required area for the sewage systems, assuming a daily sewage flow rate of 2,000 L.

Soil Percolation Rate (T)	Loading Rate (L/m^2/day)	Daily Sewage Flow (Litres)	Sewage System Area (m^2) [m^2 x 2]
1<T<20	10	2,000	400
20<T<35	8	2,000	500
35<T<50	6	2,000	667
T >50	4	2,000	1000

Considering a loading rate of 10 L/m^2/day, each lot would require an area of 400 m^2 for the sewage system and reserve area. Lot areas range from 4,000 m^2 to 5,135 m^2, averaging 4,185 m^2. The required sewage system area represents an average of 9% of the lot area, with up to 10% for the smallest lot and only 8% of the largest. Therefore, it is deemed that there is adequate space for the required sewage systems for each of the lots.

Comment #5

Noted. Cambium offers the following revised Section 4.1.1 of the Report:

Well Specific Capacities and Yields

The Specific Capacity of a well is given by the maximum sustainable pumping rate (yield) divided by the measured final drawdown in the well. It can be used to provide the design pumping rate or maximum yield for the well. It usually varies with the duration of pumping as pumping time increases the specific capacity decreases. Accordingly, the specific capacities were estimated for all four test wells as below Table 1.

Table 1 Well Specific Capacities and Yields based on Pumping Tests

Well	Pumping Rate (L/min)	Available Drawdown (m)	Measured Final Drawdown (m)	Specific Capacity (L/min/m of drawdown)	Maximum Yield of the Well (L/min)
Test Well 1	15	13.7	10.7	1.4	21
Test Well 2	15	5.0	4.4	3.4	51
Test Well 3	22	4.9	4.3	5.1	25
Test Well 4	36	3.7	3.7	9.7	36

Maximum yield of the well can be calculated using specific capacity multiplied by the maximum available drawdown. The calculated maximum yield does not account for any wellbore storage below the main water producing zone(s) and therefore may over-estimate the maximum yield. This is a theoretical value and has not been proven via in-situ quantitative solutions.

Therefore, as summarized above, all the wells can be described as moderate-capacity wells, except Test Well 1. However, given the minimum rate required is only 13.7 L/min for a residential dwelling as per D-5-5, Test Well 1 can be described as an adequate yielding well for a single residential dwelling.

Comment #6

Noted. No further action is required at this time.

Comment #7

Noted. Cambium offers the following revised wording for a portion of Section 4.1.2 of the Report:

"…Hardness was elevated in the groundwater samples from all four test wells, likely resulting from elevated concentrations of calcium and magnesium which is typical of groundwater in bedrock aquifers. Typically, elevated hardness at these concentrations can be treated through conventional water softener systems, if desired, to reduce taste and pipe scaling..."

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August 16, 2023

Closing

We trust that the information in this letter properly addresses the peer review comments made by Greer Galloway. If you have any questions regarding the contents of this letter, please contact the undersigned.

Best regards,

Cambium Inc.

Nicole Heikoop, M.Sc., GIT
Project Coordinator

Kevin Warner, M.Sc., P. Geo (Ltd).
Manager – Water and Wastewater

KDW

Encl. *Phosphorus Loading Calculations*
Grain Size Analysis

P:\11800 to 11899\11849-001 Ecostructure - Hydro & Geo - Woodcox Rd Subdivision\Deliverables\REPORT - Hydrogeo\Peer Review Response\2023-07-27 LTR, Response to Peer Review, Woodcox Road Subdivison.docx

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Woodcox Rd

				# Lots
				20
Total Area	163800	m2	A: Dilution Area (m2)	147,523.54
Non Permeable Area	16276.46	m2	I: Infiltration Factor	0.6
			Hilly, silty sand to silty clay, woodland	

S: Surplus (m/d)	0.001001
AxS: Volume of surplus water/d (m3/d)	147.67
AxSxI: Volume of Available dilution water/d (m3/d)	88.60264
(AxS)x(1-I): Volume of run-off water/d (m3/d)	59.06843

	Nitrogen		Phosphorous
Ct	7.45	mg/L	1.55
Qe	20000	L/d	20000
Ce	40	mg/L	8
Qi	88,603	L/d	88,603
Ci	0.1	mg/L	0.1
Qt	108,603		108,603

Total WW flow			
Available recharge dilution (k)	0.25	m3/m2	Ch 22 (250mm annual dilution prec. Rate (k)
Area available for dilution (A)	147,524	m²	Land area 52.4 ha
Total available dilution (VA)	36881	m3	$VA=(D_R*k)$
Background P	0	mg/L	
Estimated Peak Daily Flow	20000	L/d	
Annual Sewage Volume (VS)	7300	m3/yr	
Total Volume of Water (VT)	44181	m3/yr	
Effluent TP conc.	8.0	mg/L	
TP load	58.4	kg/yr	assumes no attenuation
Unattenuated Diluted TP conc @ Lake	1.3	mg/L	assumes no attenuation
Distance to Lake	203	m	average distance from lake
Attenuation Ratio	68%		% of 300 m assumed for total attenuation
Attenuated load	18.9	kg/yr	
Attenuated Diluted TP conc @ Lake	0.43	mg/L	

Grain Size Distribution Chart

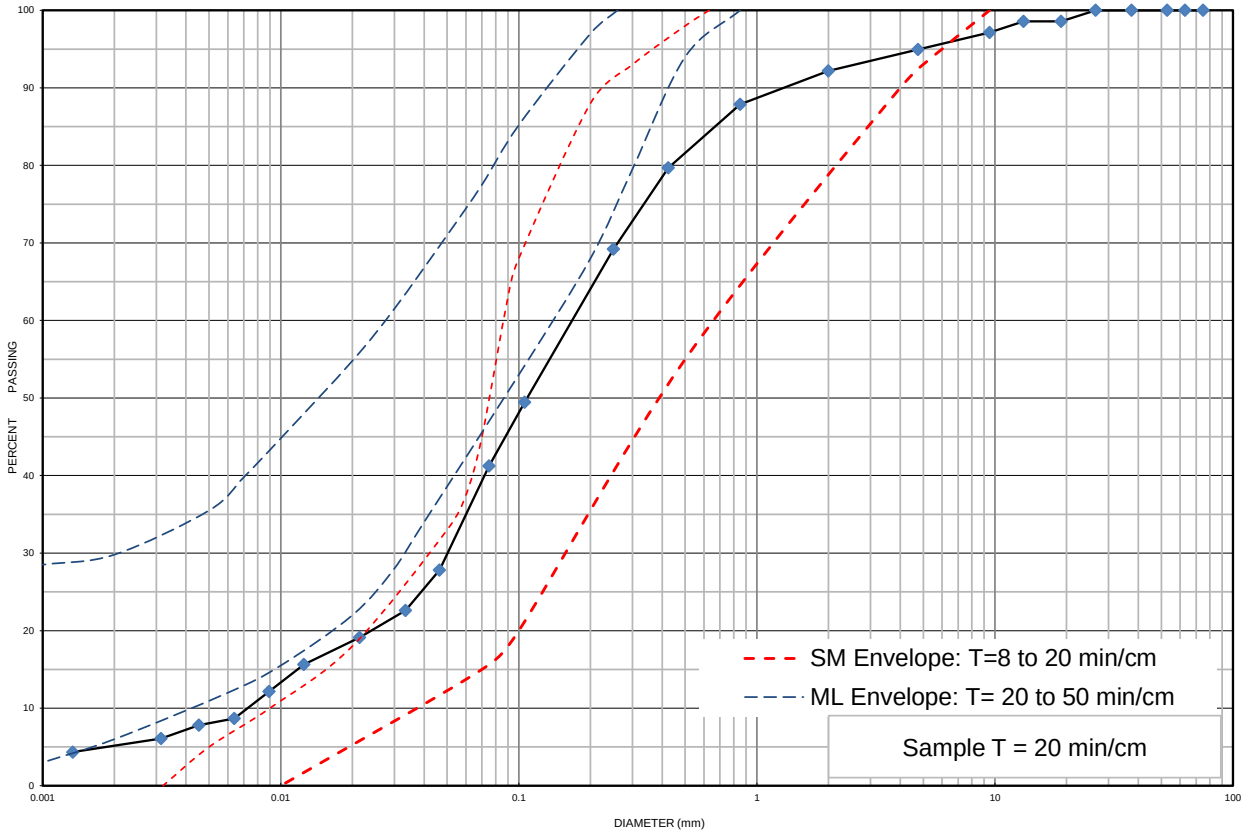
Project Number: *11849-001* **Client:** *2744529 Ontario Inc (York River Subdivision)*

Project Name: *EIS - Subdivision Woodcox Road Bancroft*

Sample Date: *March 2, 2021* **Sampled By:** *Josh Riseling - Cambium Inc.*

Location: *BH 101-21 SS 3* **Depth:** *1.5 m to 2 m* **Lab Sample No:** *S-22-0005*

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 101-21	SS 3	1.5 m to 2 m	5	54	36	5	10.3

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand and Silt trace Gravel trace Clay	SM	0.1650	0.0510	0.0073	22.60	2.16

Additional information availabe upon request

Issued By: _____ *Date Issued:* *June 7, 2023*

(Senior Project Manager)

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Grain Size Distribution Chart

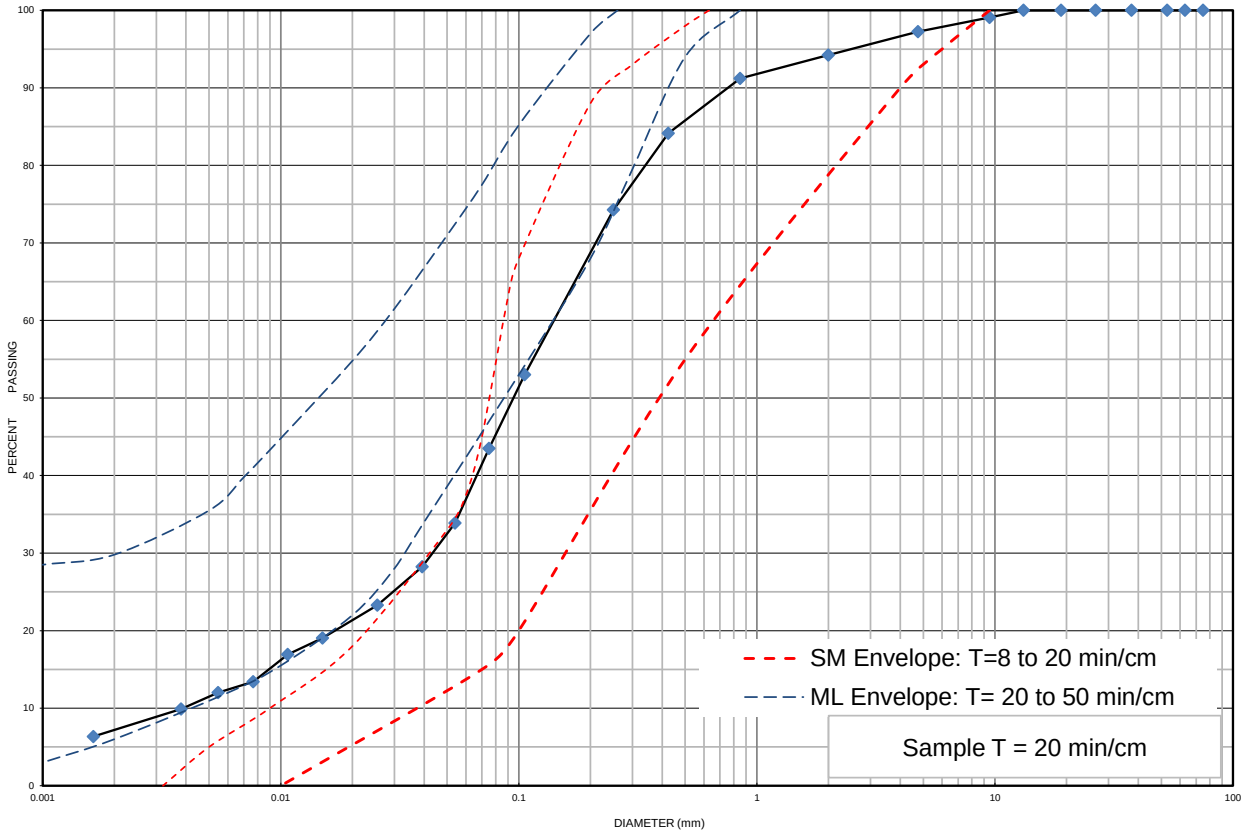
Project Number: *11849-001* **Client:** *2744529 Ontario Inc (York River Subdivision)*

Project Name: *EIS - Subdivision Woodcox Road Bancroft*

Sample Date: *March 2, 2021* **Sampled By:** *Josh Riseling - Cambium Inc.*

Location: *BH 103-21 SS 4* **Depth:** *2.3 m to 2.7 m* **Lab Sample No:** *S-22-0006*

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 103-21	SS 4	2.3 m to 2.7 m	3	54	36	7	7.3

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand and Silt trace Clay trace Gravel	SM	0.1450	0.0460	0.0041	35.37	3.56

Additional information availabe upon request

Issued By: _____ *Date Issued:* *June 7, 2023*

(Senior Project Manager)

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Grain Size Distribution Chart

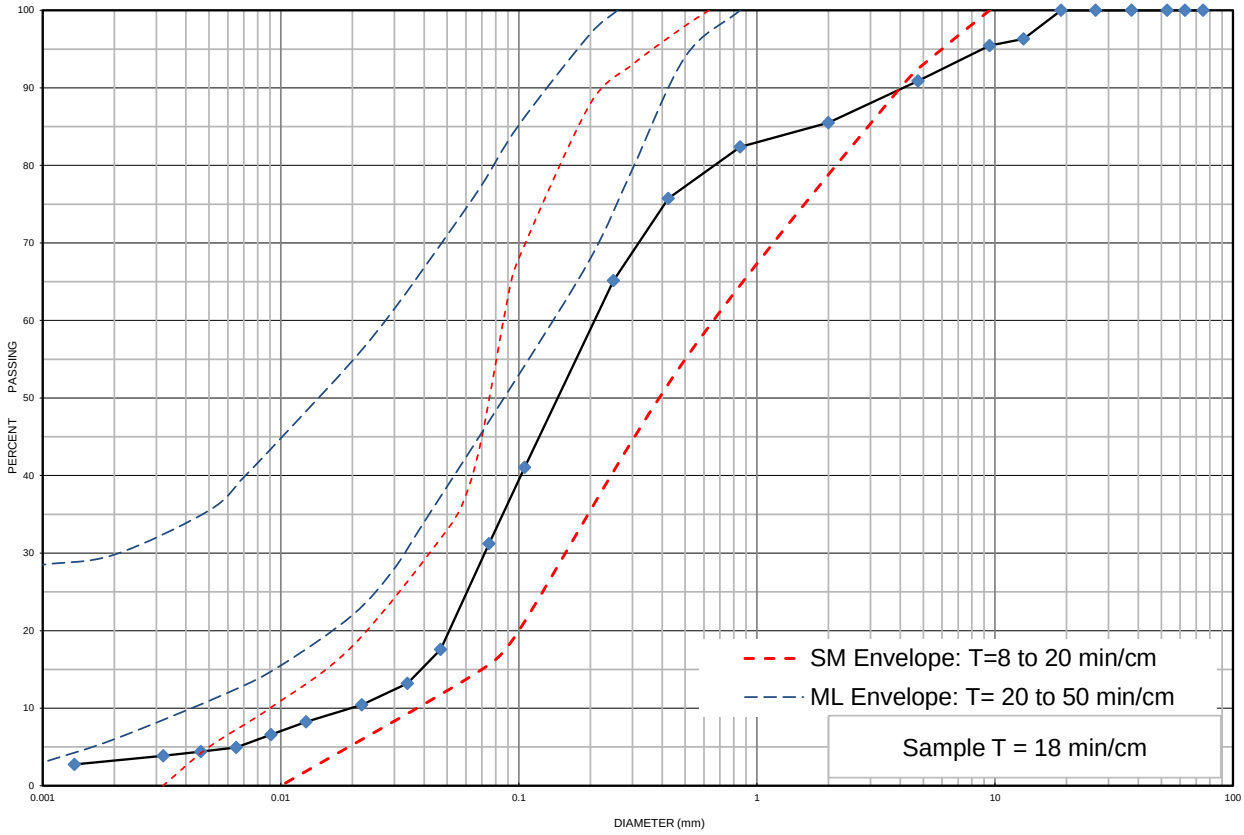
Project Number: *11849-001* **Client:** *2744529 Ontario Inc (York River Subdivision)*

Project Name: *EIS - Subdivision Woodcox Road Bancroft*

Sample Date: *March 2, 2021* **Sampled By:** *Josh Riseling - Cambium Inc.*

Location: *BH 104-21 SS 3* **Depth:** *1.5 m to 2 m* **Lab Sample No:** *S-22-0007*

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 104-21	SS 3	1.5 m to 2 m	9	60	28	3	5.4

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Sand trace Gravel trace Clay	SM	0.215	0.072	0.020	10.75	1.21

Additional information availabe upon request

Issued By: _____ *Date Issued:* *June 7, 2023*

(Senior Project Manager)

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