Geotechnical Investigation Report

Sanitary Sewer and Watermain Replacement in Kirwin Avenue, John Street, Little John Lane and Jaguar Valley Drive, Mississauga, Ontario

Final Report

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If tests have been carried out, the results of these tests are valid only for the sample described in this report.

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1 Introduction

Englobe Corp. (Englobe) was retained by Region of Peel to conduct a geotechnical investigation for the sanitary sewer and watermain replacement on Kirwin Avenue, John Street, Little John Lane and Jaguar Valley Drive, Mississauga, Ontario (hereinafter referred to as the “Site”).

The purpose of this geotechnical investigation was to determine the subsurface conditions at the borehole locations and from the findings in the boreholes make engineering recommendations for the proposed sanitary sewer and watermain replacement.

This report deals with the geotechnical aspect of the project only. The environmental assessments associated with O.Reg.406/19 will be submitted under separate covers.

2 Project Methodology

2.1 Field Investigation

Subsequent to obtaining public service clearances nine (9) boreholes (BH1 to BH7, BH14, and BH15) were drilled on Kirwin Avenue, four (4) boreholes (BH9 to BH12) were drilled on John Street, one (1) borehole (BH8) was drilled on Little John Lane, and one (1) borehole (BH13) was drilled on Jaguar Valley Drive to depth ranging from 4.1 to 9.5 meter below ground surface (mbgs).

Shale bedrock was encountered in boreholes BH1, BH12, and BH13 at the depth of ranging from 3.0 to 3.8 mbgs. The boreholes BH1 to BH15 were completed on December 8, 11, and 12, 2022 using continuous flight solid stem auger drilling equipment supplied and operated by Drilltech Drilling Limited under the continuous supervision of an Englobe field technician.

Subsoil samples were recovered from the boreholes at depth intervals of 0.76 m to 3 m depth and 1.5 m to the bottom of the boreholes using a 50 mm O.D. split-barrel sampler driven into the subsoil in accordance with the Standard Penetration Test procedure (ASTM D1586). The recovered subsoil samples were visually examined in the field and then preserved and transported to the Englobe Toronto laboratory for examination and testing.

Groundwater observations were carried out in the open boreholes upon completion of the field work. In addition, six (6) monitoring wells were installed in the boreholes.

The borehole locations were surveyed by Englobe using Sokkia GRX2 GNSS Receiver GPS connected to MAGNET Enterprise network referenced to UTM Zone 17T (NAD83) and presented in the attached Borehole Location Drawing in Appendix A. The information of the drilled boreholes is summarized in Table 1.

Table 1: Summary of Borehole Information

ROAD NAME	BH No.	COORDINATES (m)		GROUND SURFACE ELEVATION (masl)*	DEPTH OF BH (m)
		NORTHING	EASTING		
Kirwin Street	BH1	4826515.359	611443.5915	117.7	4.8
	BH2	4826652.267	611523.7336	118.0	6.7
	BH3	4826712.987	611587.7412	118.3	8.1
	BH4	4826759.71	611638.3213	117.0	6.5
	BH5	4826770.131	611752.4511	114.8	6.7
	BH6	4826755.96	611792.0351	114.0	9.5
	BH7	4826755.213	611792.7343	113.9	4.4
	BH14	4826655.055	611883.5684	113.3	4.4
	BH15	4826583.955	611959.644	112.6	4.4
John Street	BH9	4826902.118	611569.4055	116.9	4.4
	BH10	4826827.37	611513.2292	117.5	4.4
	BH11	4826760.57	611457.2588	118.7	4.4
	BH12	4826629.557	611347.7775	121.2	4.1
Little John Lane	BH8	4826796.441	611569.0087	118.0	4.4
Jaguar Valley Drive	BH13	4826640.205	611433.9776	118.9	4.2

*Meter Above Sea Level

2.2 Geotechnical Laboratory Tests

Soil samples recovered during this investigation were preserved and transported to the Englobe Toronto laboratory for additional testing. In the laboratory, each soil sample was examined as to its visual and textural characteristics by the Project Engineer. Moisture content determinations were carried out on all recovered soil samples. The results are plotted on the borehole logs attached in Appendix B.

Thirteen (13) grainsize analyses and Atterberg Limits were performed on selected soil samples. The geotechnical laboratory test results are provided in Appendix C of this report as well as presented on the respective borehole logs provided in Appendix B.

Fifteen (15) soil samples were collected during the geotechnical investigation and submitted to ALS Canada Ltd. Laboratories for soil corrosivity analysis. The results are presented in Appendix D.

Soil samples for other environmental testing were also collected during the geotechnical investigation as per soil sampling plan. Discussion on the environmental test results will be presented under separate environmental related reports.

3 Site and Subsurface Conditions

Kirwin Street, John Street, Little John Lane and Jaguar Valley Drive are located in the centre of Mississauga, Ontario.

The approximate borehole locations are shown on the attached Borehole Locations Drawings (Drawing 1) provided in Appendix A. The subsurface conditions in the geotechnical boreholes are presented in the individual Borehole Logs (Drawings 2 to 16 presented in Appendix B) and summarized for each road in the following paragraphs.

3.1 Kirwin Street

3.1.1 Pavement Conditions

Flexible pavement structure consisting of asphalt concrete followed by granular base and subbase was encountered at all boreholes drilled on Kirwin Street. The thickness of the asphalt concrete varied from 100 mm to 300 mm. The pavement structure thicknesses are summarized in Table 2.

Table 2: Summary of Pavement Structure (Kirwin Street)

BH No.	THICKNESS OF ASPHALT CONCRETE (mm)	THICKNESS OF GRANULAR BASE/SUBBASE (mm)
BH1	100	300
BH2	250	300
BH3	300	300
BH4	250	300
BH5	130	300
BH6	100	300
BH7	150	250
BH14	250	300
BH15	280	300

3.1.2 Subsoil Conditions

None (9) boreholes were drilled in Kirwin Street. The dominant subgrade soils under the pavement structure on Kirwin Street within the project limits were observed to consist of cohesionless deposit followed by till materials.

Fill: Fill material was encountered in BH5 to BH7, BH14, and BH15 underneath the pavement structure and extended to depth of ranging from 1.5 to 2.3 mbgs. In general, the fill was comprised of silty clay or silty sand with gravel with an in-situ moisture content of 8 to 22 percent. The recorded SPT 'N'-value ranged from 2 to 22 blows per 300 mm of penetration, indicating a very loose state for cohesionless soil and firm to very stiff consistency for cohesive soil.

The laboratory test result for one (1) soil sample from the fill material is presented in Appendix 3. A summary of testing for this material is briefly outlined in Table 3:

Table 3: Summary of Gradation Results – Fill

BH No.	SAMPLE NO.	GRAIN SIZE DISTRIBUTION ANALYSES (%)			
		GRAVEL	SAND	SILT	CLAY
BH14	SS3	26.2	61.6	9.8	2.4

Cohesionless Deposits: Cohesionless deposit was encountered directly below the pavement structure or below fill material in all boreholes drilled in Kirwin Street, extended to the depth of ranging from 3.0 mbgs to 6.1 mbgs. In general, the cohesionless deposits was comprised of silty sand/ silty sand with gravel/ silty clayey sand with gravel/ sand with gravel/ sand with silt/ sand with silt and gravel. The cohesionless deposit presented in a loose to very dense condition, having a SPT 'N'-value of 8 to over 50 blows per 300 mm of penetration. The in-situ moisture content of the cohesionless deposits varied from 4 to 40 percent.

The laboratory test results for five (5) soil samples from the cohesionless deposits are presented in Appendix 3. A summary of testing for this material is briefly outlined in Table 4:

Table 4: Summary of Gradation Results – Cohesionless Deposits

BH No.	SAMPLE NO.	GRAIN SIZE DISTRIBUTION ANALYSES (%)				ATTERBERG LIMITS TEST		
		GRAVEL	SAND	SILT	CLAY	PL	LL	PI
BH01	SS4	28.5	46.3	15.0	10.2	12.4	19.1	6.7
BH02	SS3	13.2	78.0	4.8	4.0	NP		
BH03	SS5	38.8	53.8	5.7	1.7	NP		
BH05	SS3	9.5	74.4	12.4	3.7	NP		
BH07	SS5	30.2	57.2	9.9	2.7	NP		

Sandy Clay/ Clayey Sand Till: Sandy clay/ clayey sand till deposit was encountered below the cohesionless deposits in borehole BH2 to BH6 and BH14, extended to the depth of ranging from 4.4 to 9.5 mbgs. The till deposit presented in a stiff to hard consistency, having a SPT 'N'-value of 12 to over 50 blows per 300 mm of penetration. The in-situ moisture content of the till deposits varied from 8 to 23 percent.

The laboratory test results for two (2) soil samples from the till deposits are presented in Appendix 3. A summary of testing for this material is briefly outlined in Table 5.

Table 5: Summary of Gradation Results – Sandy Clay/ Clayey Sand Till

BH No.	SAMPLE NO.	GRAIN SIZE DISTRIBUTION ANALYSES (%)				ATTERBERG LIMITS TEST		
		GRAVEL	SAND	SILT	CLAY	PL	LL	PI
BH04	SS6	7.2	27.1	32.9	32.8	16.5	27.3	10.8
BH06	SS8	8.3	53.6	24.1	14.0	14.0	22.0	8.0

Clay with Sand: Clay with sand was encountered in borehole BH15 extended to the depth of 4.4 mbgs. The deposit presented in a stiff, having a SPT 'N'-value of 14 blows per 300 mm of penetration. The in-situ moisture content of the till deposits was 18 percent.

The laboratory test results for one (1) soil sample from the deposits are presented in Appendix 3. A summary of testing for this material is briefly outlined in Table 6.

Table 6: Summary of Gradation Results – Clay with Sand

BH No.	SAMPLE NO.	GRAIN SIZE DISTRIBUTION ANALYSES (%)				ATTERBERG LIMITS TEST		
		GRAVEL	SAND	SILT	CLAY	PL	LL	PI
BH15	SS6	3.1	15.3	40.4	41.2	14.2	26.8	12.6

3.1.3 Soil Corrosivity Test Results

Nine (9) soil samples were collected during the geotechnical investigation and submitted to ALS Canada Ltd. Laboratory for soil corrosivity analysis. The results are presented in Appendix D and summarized in Table 7.

Table 7: Summary of Soil Corrosivity Tests – Kirwin Street

BH No.	Sample Number	Chloride, Leachable (mg/kg)	Sulfate, Leachable (mg/kg)
BH 01	SS5	124	43
BH 02	SS5	338	<11
BH 03	SS3	198	12
BH 04	SS3	64.9	11
BH 05	SS5	789	<11
BH 06	SS4	690	<11
BH 07	SS4	899	<11
BH 14	SS4	354	30
BH 15	SS4	520	<11

3.1.4 Groundwater Conditions

Groundwater measurements were conducted during and upon completion of boreholes drilling as well as in the installed monitoring well. The water level in borehole BH6 was 3.7 mbgs upon completion of drilling. The rest of the boreholes drilled on Kirwin Street were found dry upon completion of drilling. The results of groundwater measurement in the installed monitoring well are tabulated in Table 8 and are also shown in the respective borehole logs. Groundwater levels measured in the monitoring well on December 20, 2023.

Table 8: Groundwater Level Observations in Monitoring Well

BH NO.	WELL DEPTH (m)	DATE MEASURED	DEPTH OF GROUNDWATER TABLE (m)	ELEVATION OF GROUNDWATER TABLE (m)
BH1	4.8	2023/12/8 (measured upon borehole completion)	Dry	-
		2023/12/20	3.15	114.59
BH4	5.2	2023/12/8 (measured upon borehole completion)	Dry	-
		2023/12/20	3.20	113.77
BH6	9.5	2023/12/11 (measured upon borehole completion)	Dry	-
		2023/12/20	4.88	109.09
BH7	3.3	2023/12/11 (measured upon borehole completion)	Dry	-
		2023/12/20	Dry	-
BH15	3.9	2023/12/11 (measured upon borehole completion)	Dry	-
		2023/12/20	Dry	-

3.1.5 Bedrock Conditions

Shale bedrock was encountered at the borehole BH1 at approximate depth of 3.0 mbgs, corresponding to elevations of 114.7 m.

It should be noted that the soil overlying the bedrock contains weathered shale which could be augured and would give a false indication of the bedrock level. As such, the bedrock surface should not be considered accurate to better than ±0.5 m and some variations in the bedrock surface elevation across the site should be expected.

3.2 John Street

3.2.1 Pavement Conditions

Flexible pavement structure consisting of asphalt concrete followed by granular base and subbase was encountered at four (4) boreholes drilled on John Street (BH9 to BH12). The thickness of the asphalt concrete was between 150 to 200 mm. The pavement structure thicknesses are summarized in Table 9.

Table 9: Summary of Pavement Structure (John Street)

BH No.	THICKNESS OF ASPHALT CONCRETE (mm)	THICKNESS OF GRANULAR BASE/SUBBASE (mm)
BH9	150	400
BH10	150	300
BH11	150	300
BH12	200	300

3.2.2 Subsoil Conditions

The dominant subgrade soils under the pavement structure on John Street within the project limits were observed to consist of cohesionless deposit followed by till materials.

Cohesionless Deposits: Cohesionless deposit was encountered directly below the pavement structure in all boreholes drilled in John Street, extended to the depth of ranging from 2.3 mbgs to 4.3 mbgs. In general, the cohesionless deposits was comprised of silty sand/ sand with gravel. The cohesionless deposit presented in a loose to compact condition, having a SPT 'N'-value of 7 to 24 blows per 300 mm of penetration. The in-situ moisture content of the cohesionless deposits varied from 6 to 20 percent.

The laboratory test results for one (1) soil sample from the cohesionless deposits is presented in Appendix 3. A summary of testing for this material is briefly outlined in Table 10:

Table 10: Summary of Gradation Results – Cohesionless Deposits

BH No.	SAMPLE NO.	GRAIN SIZE DISTRIBUTION ANALYSES (%)				ATTERBERG LIMITS TEST		
		GRAVEL	SAND	SILT	CLAY	PL	LL	PI
BH10	SS2	10.6	77.0	8.7	3.7	NP		

Sandy Clay Till: Sandy clay till deposit was encountered below the cohesionless deposits in borehole BH9 extended to the depth of 4.4 mbgs. The till deposit presented in a very stiff to hard consistency, having a SPT 'N'-value of 22 to 32 blows per 300 mm of penetration. The in-situ moisture content of the till deposits was 13 percent.

The laboratory test results for one (1) soil sample from the till deposits is presented in Appendix 3. A summary of testing for this material is briefly outlined in Table 11.

Table 11: Summary of Gradation Results – Sandy Clay Till

BH No.	SAMPLE NO.	GRAIN SIZE DISTRIBUTION ANALYSES (%)				ATTERBERG LIMITS TEST		
		GRAVEL	SAND	SILT	CLAY	PL	LL	PI
BH09	SS5	5.6	36.7	27.6	30.1	16.0	26.9	10.9

Silty Clay: Silty clay was encountered in borehole BH10 to BH12 extended to the depth of ranging from 3.8 to 4.4 mbgs. The deposit presented in a stiff to hard consistency, having a SPT 'N'-value of 10 to more than 50 blows per 300 mm of penetration. The in-situ moisture content of the deposits varied from 8 to 20 percent.

3.2.3 Soil Corrosivity Test Results

Four (4) soil samples were collected during the geotechnical investigation and submitted to ALS Canada Ltd. Laboratory for soil corrosivity analysis. The results are presented in Appendix D and summarized in Table 12.

Table 12: Summary of Soil Corrosivity Tests – John Street

BH No.	Sample Number	Chloride, Leachable (mg/kg)	Sulfate, Leachable (mg/kg)
BH 09	SS4	27.0	<11
BH 10	SS5	139	34
BH 11	SS4	230	15
BH 12	SS3	378	56

3.2.4 Groundwater Conditions

Groundwater measurements were conducted during and upon completion of boreholes drilling as well as in the installed monitoring well. The all boreholes drilled on John Street were found dry upon completion of drilling. The results of groundwater measurement in the installed monitoring well are tabulated in Table 13, and are also shown in the respective borehole logs. Groundwater levels measured in the monitoring well on December 20, 2023.

Table 13: Groundwater Level Observations in Monitoring Well

BH NO.	WELL DEPTH (m)	DATE MEASURED	DEPTH OF GROUNDWATER TABLE (m)	ELEVATION OF GROUNDWATER TABLE (m)
BH11	3.8	2023/12/12 (measured upon borehole completion)	Dry	-
		2023/12/20	3.51	115.19

3.2.5 Bedrock Conditions

Shale bedrock was encountered at the boreholes BH12 at approximate depth of 3.8 mbgs, corresponding to elevation of 117.4 m.

It should be noted that the soil overlying the bedrock contains weathered shale which could be augured and would give a false indication of the bedrock level. As such, the bedrock surface should not be considered accurate to better than ±0.5 m and some variations in the bedrock surface elevation across the site should be expected.

3.3 Little John Lane

3.3.1 Pavement Conditions

Flexible pavement structure consisting of asphalt concrete followed by granular base and subbase was encountered at one (1) borehole drilled on Little John Lane (BH8). The thickness of the asphalt concrete was 130 mm. The pavement structure thicknesses are summarized in Table 14.

Table 14: Summary of Pavement Structure (Little John Lane)

BH No.	THICKNESS OF ASPHALT CONCRETE (mm)	THICKNESS OF GRANULAR BASE/SUBBASE (mm)
BH8	130	400

3.3.2 Subsoil Conditions

The dominant subgrade soils under the pavement structure on Little John Lane within the project limits were observed to consist of fill materials followed by cohesionless deposit and till materials.

Fill: Fill material was encountered in BH8 underneath the pavement structure and extended to depth of 2.3 mbgs. The fill was comprised of sand with gravel with an in-situ moisture content of 9 to 11 percent. The recorded SPT 'N'-value ranged from 4 to 5 blows per 300 mm of penetration, indicating a very loose to loose state.

Cohesionless Deposits: Cohesionless deposit was encountered below the fill material in boreholes BH8, extended to the depth of 3.8 mbgs. The cohesionless deposits was comprised of sand with silt. The cohesionless deposit presented in a compact condition, having a SPT 'N'-value of 12 to 14 blows per 300 mm of penetration. The in-situ moisture content of the cohesionless deposits varied from 15 to 24 percent.

The laboratory test results for one (1) soil sample from the cohesionless deposits is presented in Appendix 3. A summary of testing for this material is briefly outlined in Table 15:

Table 15: Summary of Gradation Results – Cohesionless Deposits

BH No.	SAMPLE NO.	GRAIN SIZE DISTRIBUTION ANALYSES (%)				ATTERBERG LIMITS TEST		
		GRAVEL	SAND	SILT	CLAY	PL	LL	PI
BH08	SS4	6.7	87.7	4.8	0.8	NP		

Sandy Clay Till: Sandy clay till deposit was encountered below the cohesionless deposits in borehole BH8 extended to the depth of 4.4 mbgs. The till deposit presented in hard consistency, having a SPT 'N'-value of 36 blows per 300 mm of penetration. The in-situ moisture content of the till deposits was 13 percent.

3.3.3 Soil Corrosivity Test Results

One (1) soil sample was collected during the geotechnical investigation and submitted to ALS Canada Ltd. Laboratory for soil corrosivity analysis. The results are presented in Appendix D and summarized in Table 16.

Table 16: Summary of Soil Corrosivity Tests – Little John Lane

BH No.	Sample Number	Chloride, Leachable (mg/kg)	Sulfate, Leachable (mg/kg)
BH 08	SS4	311	19

3.3.4 Groundwater Conditions

Groundwater measurements was conducted during and upon completion of borehole BH8 drilling. The borehole drilled on Little John Lane was found dry upon completion of drilling.

3.4 Jaguar Valley Drive

3.4.1 Pavement Conditions

Flexible pavement structure consisting of asphalt concrete followed by granular base and subbase was encountered at borehole BH13 drilled on Jaguar Valley Drive. The thickness of the asphalt concrete was 100 mm. The pavement structure thicknesses are summarized in Table 17.

Table 17: Summary of Pavement Structure (Jaguar Valley Drive)

BH No.	THICKNESS OF ASPHALT CONCRETE (mm)	THICKNESS OF GRANULAR BASE/SUBBASE (mm)
BH13	100	300

3.4.2 Subsoil Conditions

The predominant subgrade soils beneath the pavement structure on Jaguar Valley Drive, within the project limits, were observed to consist of cohesionless deposit, succeeded by till materials overlaying bedrock shale.

Cohesionless Deposits: Cohesionless deposit was encountered below the pavement structure in borehole BH13 drilled in Jaguar Valley Drive, extended to the depth of 3.0 mbgs. In general, the cohesionless deposits was comprised of silty sand/ sand with gravel. The cohesionless deposit presented in a dense to very dense condition, having a SPT 'N'-value of 30 to 50 blows per 300 mm of penetration. The in-situ moisture content of the cohesionless deposits varied from 3 to 4 percent.

Sandy Clay Till: Sandy clay till deposit was encountered below the cohesionless deposits in borehole BH13 extended to the depth of 3.8 mbgs. The till deposit presented in a very stiff consistency, having a SPT 'N'-value of 20 blows per 300 mm of penetration. The in-situ moisture content of the till deposits was 15 percent.

The laboratory test results for one (1) soil sample from the till deposits is presented in Appendix 3. A summary of testing for this material is briefly outlined in Table 18.

Table 18: Summary of Gradation Results – Sandy Clay Till

BH No.	SAMPLE NO.	GRAIN SIZE DISTRIBUTION ANALYSES (%)				ATTERBERG LIMITS TEST		
		GRAVEL	SAND	SILT	CLAY	PL	LL	PI
BH13	SS5	5.5	31.7	27.5	35.3	16.4	30.3	13.9

3.4.3 Soil Corrosivity Test Results

One (1) soil sample was collected during the geotechnical investigation and submitted to ALS Canada Ltd. Laboratory for soil corrosivity analysis. The results are presented in Appendix D and summarized in Table 7.

Table 19: Summary of Soil Corrosivity Tests – Jaguar Valley Drive

BH No.	Sample Number	Chloride, Leachable (mg/kg)	Sulfate, Leachable (mg/kg)
BH 13	SS4	185	<10

3.4.4 Groundwater Conditions

Groundwater measurements were conducted during and upon completion of borehole BH13 drilling. The boreholes BH13 drilled on Jaguar Valley Drive was found dry upon completion of drilling.

3.4.5 Bedrock Conditions

Shale bedrock was encountered at the boreholes BH13 at approximate depth of ranging from 3.8 mbgs, corresponding to elevation of 115.0 m.

It should be noted that the soil overlying the bedrock contains weathered shale which could be augured and would give a false indication of the bedrock level. As such, the bedrock surface should not be considered accurate to better than ±0.5 m and some variations in the bedrock surface elevation across the site should be expected.

4 Geotechnical Considerations and Recommendations

It is understood that the existing sanitary sewer and watermain will be replaced at a depth ranging from 2 to 5 mbgs. The soil conditions encountered at the borehole locations are generally consist of fill material followed by cohesionless deposits and silty clay till overlaying shale bedrock. Except for one borehole drilled on Kirwin Street (BH5), all other boreholes were found to be dry upon completion of drilling. The measured groundwater table from the installed monitoring wells is tabulated in Table 8, and Table 13.

4.1 Excavation and Backfilling

Excavations to the depths required for sanitary sewer or watermain installation are expected to be relatively straightforward. The pavement structure in the excavation area should be properly removed by saw-cutting and any existing granular base/subbase sub-excavated and disposed off-site. The investigation results suggest that excavations should be able to be carried out to the depths required for sanitary sewer or watermain installation using conventional excavation equipment. Excavation side slopes in the upper subsoils are expected to be excavated in vertical cuts, temporary shoring such as trench boxes will be required to support the excavation sidewalls and any surcharge loads that may be applied during the construction period.

Ground loss, raveling and/or loosing of soil may occur when using a trench box prior to its installation and while moving the box. To minimize the risk of trench side collapsing, caving and significant undermining of excavation, trench boxes need to be installed expediently and excavation should be done inside the box as the trench box is lowered.

All excavations must be carried out in accordance with the most recent Ontario Occupational Health and Safety Act (OHSA). The subsoils encountered at site as per OHSA criteria would typically be considered:

- Fill (very loose to loose cohesionless soil)- Type 4
- Fill (stiff to very stiff cohesive soil) – Type 3
- Moist very loose to loose cohesionless deposits – Type 4
- Moist compact to dense cohesionless deposits – Type 3
- Moist very dense cohesionless deposits – Type 2
- Moist, stiff sandy clay till/ silty clay- Type 3
- Moist, very stiff to hard sandy clay till/ silty clay- Type 2
- Weathered Shale – Type 2

All wet and/or disturbed material, or other obviously objectionable material such as organics, should be sub-excavated to the depths required for placement of the sanitary sewer/ watermain bedding.

In the planning of the trench's shoring and excavation, the presence of the adjacent existing buried service pipes should be considered. In addition to the stability of these existing adjacent pipes, which must be maintained without detrimental settlements, the backfill in these trenches and especially the granular bedding surrounding the existing service pipes, manholes, etc. may be a source of water, which, if encountered, must be dealt with.

Class "B" bedding is to be used as per City of Mississauga Standard 2112.09 for the sanitary sewer pipes and cover material shall confirm with City Standard 2112.10. Also, the bedding material for watermain should conform to the City of Mississauga bedding stone gradation requirements. The pipe bedding must then be placed surrounding and supporting the watermain pipe. If water is present in the trench excavation 19mm clear stone is to be used for bedding. The minimum bedding thickness should be 150 mm, but this should be increased as dictated by the pipe diameter and/or specifications. In addition, where the subgrade is wet (evidence of free water), the minimum bedding thickness should be increased to 250 mm.

The sanitary sewer/ watermain must be provided with at least 1.40 m of earth cover to provide adequate protection from frost effects. Alternatively, an appropriate insulation providing equivalent protection could also be considered where 1.40 m of earth cover cannot be consistently achieved.

It is preferable that the excavated soils to be re-used from approximately the position at which they are excavated so that frost response characteristics of the soils after construction remain essentially similar to presently existing. In cases where native backfill material is deemed unsuitable, the material used for backfilling in the trench should be OPSS granular "B" Type I. The backfill material should be placed in maximum 200 mm thick layers at or near (±2%) their optimum moisture content and each layer should be compacted to at last 95% SPMDD. The degree of compaction should be increased to 98% within the top 1.0 m of the subgrade. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc. should not be used for backfilling.

4.2 Trench Reinstatement

The existing road pavement structure should be reinstated as-per City of Mississauga standards. The granular sub-base/base materials should be compacted to at least 100% of their respective SPMDD. New granular material must match into the undersides of existing asphalt to ensure unimpeded cross drainage.

Following the completion of the sanitary sewer or watermain replacement, the trench reinstatement shall be completed by backfilling with unshrinkable fill or granular backfill to match the existing in accordance with OPSD 509.010.

It should be noted that differential performance, including differential frost-heaving, may occur between the reinstated and existing adjacent pavements if they have different material and structural compositions.

4.3 Kirwin Street and Cooksville Creek Crossing

The proposed installation of 250mm sanitary sewer under the Cooksville Creek will be installed by opencut method on the south side of the bridge. Based on the data from BH6 and BH7 (Appendix B), no shale bedrock was identified down to 9.5 mbgs on the north side of Cooksville Creek along Kirwin Street.

The available data implies that the proposed sanitary sewer and new manhole will be founded in clayey sand till close to creek. The soil along the creek banks may have higher moisture content and may cause bank instability at the time of excavation. We recommend shoring of excavations by trench boxes or steel closed tight sheeting system to minimize the disturbance to the creek's embankments.

4.3.1 Shoring Consideration

The lateral earth pressures (P), in kPa, acting on the shoring system, may be calculated using the equation below.

$$P = Ka (\gamma H + q)$$

where:

Ka= coefficient of active lateral earth pressure; use Ka= 0.30;

γ = bulk unit weight of the soil behind the shoring; use 21.0 kN/m^3;

H = height in meters at which the pressure is being calculated; and

q = surcharge adjacent to shoring system in kPa.

A minimum safety factor of 2.0 should be employed when analyzing the earth pressure.

4.4 Temporary Construction Dewatering

With the exception of one borehole on Kirwin Street (BH5), all other boreholes were found to be dry upon completion of drilling. The measured groundwater table from the installed monitoring wells were between 3.2 to 4.9 mbgs corresponding to Elevation of 109.1 to 114.6 m. The dominate soil encountered at the site were fill material (silty clay/ silty sand/ silty sand with gravel/ sand with gravel), cohesionless deposits (silty sand/ sand with silt/ sand with silt and gravel/ sand with gravel), clayey sand till, and silty clay. Shale bedrock was encountered at the boreholes BH1, BH12, and BH13 at approximate depth of ranging from 3.0 to 3.8 mbgs, corresponding to elevation of 114.7 to 117.4 m. Shale bedrock, sandy clay till and silty clay are expected to be nearly impervious and moisture contents indicated that subsoils were generally in moist condition. It is expected that seepage within the excavation depth should be controllable using sump pumps.

A hydrogeological investigation report prepared by others will address the groundwater impact and any dewatering that may be required during the construction period.

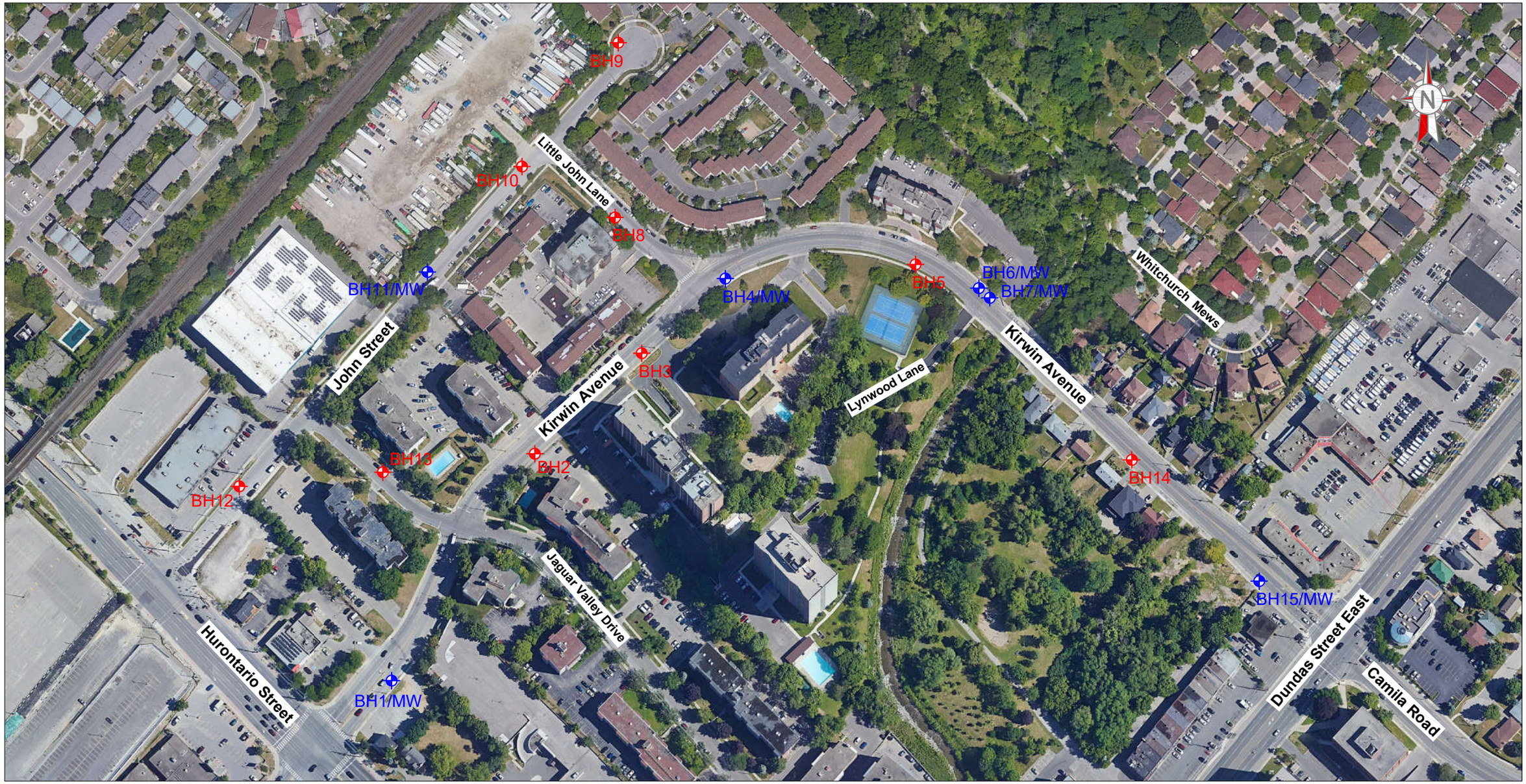
5 General Comments

The comments provided in this report have been developed for the use of Region of Peel and its designer. It should be noted that the soil boundaries indicated on the Borehole Logs are inferred from non-continuous sampling and observations during drilling and should not be interpreted as exact planes of geological change. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design. Also, the subsoil and groundwater conditions have been determined at the borehole locations only. Additional boreholes and/or test pits would be necessary to determine the localized conditions. Contractors bidding on, or undertaking the works, must conduct their own interpretations of the factual borehole data, and draw their own conclusions as to how the subsoil and groundwater conditions may affect their construction techniques, scheduling and costs.

It is further noted that, depending on the time of year the field work was completed, water levels should be expected to vary, perhaps significantly from those observed at the time of this investigation.

Appendix A
Borehole Location Plan

ENGLOBE



LEGEND:

- Borehole Location
- Borehole Location / Mornitoring Well

Project

Region of Peel

Sanitary Sewer / Watermain Replacement in Kirwin Avenue and John Street, Mississauga

KIRWIN AVENUE - From HURONTARIO STREET To DUNDAS STREET EAST
LITTLE JOHN LANE - From KIRWIN AVENUE To JHON STREET
JOHN STREET - From EAST CUL-DE-SAC To 20m WEST of JAGUAR VALLEY DRIVE
JAGUAR VALLEY DRIVE - From JOHN STREET To KIRWIN AVENUE

Title

Borehole Location Plan

ENGLOBE
1821, Albion Road, Unit 7
Toronto (Ontario) M9W 5W8
Telephone : 416.213.1060
Fax : 416.213.1070

Prepared	I. Lee	Discipline	GEOTECHNICAL	Project manager	H. Akbari	
Drawn	I. Lee	Scale	N.T.S.	Sequence no.	1 of 1	
Checked	H. Akbari	Date	2024/01/08			

Resp.	Project	Phase	Disc.	Type	Drawing no.	Rev.
01	02111839.024	0100	GE	D	1	00

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Appendix B
Borehole Logs

ENGLOBE

LOG OF No. BH-01

Englobe

Project No. 02111839.024 DRAWING No. 2

Project: 23-2126, 23-2129, 25-1310 - Kirwin Avenue and Little John Lane Sheet No. 1 of 1

Location: Kirwin Ave, 40m East of intersection with Hurontario St. 2.5m north of south curbline.

N 4,826,515.359 E 611,443.592

Date Drilled: 12/8/2023

Drill Type: Solid Stem Augers

Datum: Geodetic

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
			117.7	0
		ASPHALT: (100 mm)	0.1	
			117.6	
		SAND & GRAVEL: (Granular Base/ Subbase, 300 mm)	0.4	
			117.3	
		SILTY SAND: loose, brown, moist		1
			1.5	
		SILTY CLAYEY SAND WITH GRAVEL: compact to very dense, brown to grey, moist	116.2	2
		--GR: 29%, Sa: 46%, Si: 15%, Cl: 10%		
		-- shale fragments		
			3.0	3
		SHALE Bedrock: grey, highly weathered	114.7	
				4
			4.8	
		Terminated at 4.8 m	112.9	

Borehole advanced using continuous flight solid stem augering equipment on December 8, 2023 by Driltech Drilling Limited.

Standard Penetration Test N Value: 40 80 120 160
Shear Strength kPa: 50 100 150 200
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Sample No	Natural Unit Weight kN/m³	Percent of Fines, %	Shear Strength	Natural Moisture Content	Atterberg Limits
	AS1				4.9	
	SS2			8	7.8	
	SS3			18	15.8	
	SS4			60	6.0	12, 19.1
	SS5			50/125mm	6.3	
	SS6			50/125mm	6.4	

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open
12/20/2023	1.0	

Checked By: R. Mahdavi

Logged By: S.Ahsan

CLASSIFICATION LOG 02111839.024_KIRWIN_AVE.GPJ LOG A GWGL02.GDT 1/5/24

LOG OF No. BH-02

Englobe

Project No. 02111839.024 DRAWING No. 3

Project: 23-2126, 23-2129, 25-1310 - Kirwin Avenue and Little John Lane Sheet No. 1 of 1

Location: Kirwin Ave, in front of building # 3170. 2.5m north of south curbline.

N 4,826,652.267 E 611,523.734

Date Drilled: 12/8/2023

Drill Type: Solid Stem Augers

Datum: Geodetic

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		ASPHALT: (250 mm)	118.0	0
		SAND & GRAVEL: (Granular Base/ Subbase, 300 mm)	0.3 117.8	
		SAND WITH SILT: some gravel, trace clay, compact to very dense, brown, moist	0.6 117.5	
		--GR: 13%, Sa: 78%, Si: 5%, Cl: 4%		1
				2
				3
				4
				5
			6.1	6
		TILL: sandy clay, some silt, trace gravel, hard, grey, most	111.9	
		Terminated at 6.7 m	6.7 111.3	

Standard Penetration Test N Value: 40 80 120 160
Shear Strength: 50 100 150 200 kPa
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Sample No	Natural Unit Weight kN/m³	Percent of Fines, %	Shear Strength (kPa)	Natural Moisture Content %
	AS1				2.3
	SS2			28	4.1
	SS3			58	4.3
	SS4			24	4.8
	SS5			20	4.7
	SS6			12	16.4
	SS7			40	13.1

Borehole advanced using continuous flight solid stem augering equipment on December 8, 2023 by Driltech Drilling Limited.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open

CLASSIFICATION LOG 02111839.024_KIRWIN_AVE.GPJ LOG A GWGL02.GDT 1/5/24

Checked By: R. Mahdavi

Logged By: S.Ahsan

LOG OF No. BH-03

Englobe

Project No. 02111839.024 DRAWING No. 4

Project: 23-2126, 23-2129, 25-1310 - Kirwin Avenue and Little John Lane Sheet No. 1 of 2

Location: Kirwin Ave, in front of building # 3120. 2.5m north of south curbline.

N 4,826,712.987 E 611,587.741

Date Drilled: 12/8/2023

Drill Type: Solid Stem Augers

Datum: Geodetic

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH	Standard Penetration Test N Value / Shear Strength kPa	Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Sample No	Natural Unit Weight kN/m³	Percent of Fines, %
			118.3	0	40 80 120 160 / 50 100 150 200	20 40 60				
		ASPHALT: (300 mm)	0.3							
		SAND & GRAVEL: (Granular Base/ Subbase, 300 mm)	117.9							
			0.6							
		SAND WITH SILT AND GRAVEL: compact to very dense, brown, moist	117.6							
				1	28	4.8		SS2		
					56	4.2		SS3		
				2						
					26	4.3		SS4		
		--GR: 39%, Sa: 53%, Si: 6%, Cl: 2%		3	24	4.7		SS5		
			4.6	4						
		TILL: sandy clay, some silt, trace gravel, stiff to hard, brown, moist	113.7		12	21.9		SS6		
				5						
		-- turns grey								
				6	22	15.4		SS7		
				7						
		-- shale fragements			78/280mm	9.0		SS8		
				8						

2.4 (AS1)

Continued Next Page

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open

Checked By: R. Mahdavi

Logged By: S.Ahsan

CLASSIFICATION LOG 02111839.024_KIRWIN_AVE.GPJ LOG A GWGL02.GDT 1/5/24

LOG OF No. BH-03

Englobe

Project No. 02111839.024 DRAWING No. 4

Project: 23-2126, 23-2129, 25-1310 - Kirwin Avenue and Little John Lane Sheet No. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH m	Standard Penetration Test N Value / Shear Strength kPa	Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Sample No	Natural Unit Weight kN/m³	Percent of Fines, %
	xxxxx	Terminated at 8.1 m Borehole advanced using continuous flight solid stem augering equipment on December 8, 2023 by Driltech Drilling Limited.	110.2	8.1	40 80 120 160 50 100 150 200	20 40 60				

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open

Checked By: R. Mahdavi

Logged By: S.Ahsan

CLASSIFICATION LOG 02111839.024_KIRWIN_AVE.GPJ LOG A GWGL02.GDT 1/5/24

LOG OF No. BH-04

Englobe

Project No. 02111839.024 DRAWING No. 5

Project: 23-2126, 23-2129, 25-1310 - Kirwin Avenue and Little John Lane Sheet No. 1 of 1

Location: Kirwin Ave, at intersection with Little John Ln. 2m north of south curbline.

N 4,826,759.710 E 611,638.321

Date Drilled: 12/8/2023

Drill Type: Solid Stem Augers

Datum: Geodetic

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		ASPHALT: (250 mm)	117.0	0
			0.3	
		SAND & GRAVEL: (Granular Base/ Subbase, 300 mm)	116.7	
			0.6	
		SILTY SAND: compact, brown, moist	116.4	
			3.0	3
		TILL: sandy clay, some silt, trace gravel, stiff to hard, brown, most	113.9	
		-- turns grey --GR: 7%, Sa: 27%, Si: 33%, Cl: 33%		4
		-- shale fragments	6.5	6
		Terminated at 6.5 m	110.4	
		Borehole advanced using continuous flight solid stem augering equipment on December 8, 2023 by Driltech Drilling Limited.		

Standard Penetration Test N Value
Shear Strength kPa
Natural Moisture Content % Atterberg Limits (% Dry Weight)

SAMPLES	Sample No	Natural Unit Weight kN/m³	Percent of Fines, %	SPT (N)	Moisture / Atterberg
	AS1				6.2
	SS2			16	5.6
	SS3			14	7.6
	SS4			18	12.8
	SS5			12	22.8
	SS6			24	19.3 / 17.3
	SS7			80/280mm	7.7

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open
12/20/2023	1.0	

Checked By: R. Mahdavi

Logged By: S.Ahsan

CLASSIFICATION LOG 02111839.024_KIRWIN_AVE.GPJ LOG A GWGL02.GDT 1/5/24

LOG OF No. BH-05

Englobe

Project No. 02111839.024 DRAWING No. 6

Project: 23-2126, 23-2129, 25-1310 - Kirwin Avenue and Little John Lane Sheet No. 1 of 1

Location: Kirwin Ave, in front of building # 3121. 2.5m east of west curbline.

N 4,826,770.131 E 611,752.451

Date Drilled: 12/11/2023

Drill Type: Solid Stem Augers

Datum: Geodetic

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
			114.8	0
		ASPHALT: (130 mm)	0.1	
		SAND & GRAVEL: (Granular Base/ Subbase, 300 mm)	114.7	
		FILL: silty clay, some sand, trace gravel, brick fragments, very stiff, grey, moist	0.4 114.4	
			1.5	1
		SILTY SAND: trace gravel, trace clay, compact, brown, moist to wet --GR: 10%, Sa: 74%, Si: 12%, Cl: 4%	113.3	
▼			111.1	2
			4.6	3
		TILL: sandy clay, trace gravel, trace silt, hard, grey, moist	110.2	4
			6.7	5
		Terminated at 6.7 m	108.1	6
		Borehole advanced using continuous flight solid stem augering equipment on December 11, 2023 by Driltech Drilling Limited.		

Standard Penetration Test N Value
Shear Strength kPa: 40 80 120 160 / 50 100 150 200
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

Sample No	N	Natural Moisture Content %
AS1		4.7
SS2	22	11.2
SS3	30	9.6
SS4	30	11.5
SS5	12	39.4
SS6	34	9.7
SS7	48	15.4

Natural Unit Weight kN/m³

Percent of Fines, %

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	3.7	Open

Checked By: R. Mahdavi

Logged By: S.Ahsan

CLASSIFICATION LOG 02111839.024_KIRWIN_AVE.GPJ LOG A GWGL02.GDT 1/5/24

LOG OF No. BH-06

Englobe

Project No. 02111839.024 DRAWING No. 7

Project: 23-2126, 23-2129, 25-1310 - Kirwin Avenue and Little John Lane Sheet No. 1 of 2

Location: Kirwin Ave, 3m north of hydro pole#P06586. 2m west of east curbline.

N 4,826,755.960 E 611,792.035

Date Drilled: 12/11/2023

Drill Type: Solid Stem Augers

Datum: Geodetic

Split Spoon Sample ⊠
Auger Sample □
SPT (N) Value ●
Dynamic Cone Test —
Shelby Tube ■
Shear Strength by Vane Test S

Natural Moisture Content ×
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH	Standard Penetration Test N Value / Shear Strength kPa	Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Sample No	Natural Unit Weight kN/m³	Percent of Fines, %
			114.0	0	40 80 120 160 / 50 100 150 200	20 40 60				
		ASPHALT: (100 mm)	0.1 / 113.9							
		SAND & GRAVEL: (Granular Base/ Subbase, 300 mm)	0.4 / 113.6							
		FILL: silty clay, some sand, trace gravel, stiff, grey, moist				4.7		AS1		
				1	8	14.0		SS2		
					14	22.1		SS3		
				2						
		SAND WITH GRAVEL: compact, brown, moist	2.3 / 111.7		18	13.9		SS4		
				3	14	10.9		SS5		
				4						
		TILL: sandy clay, some silt, trace gravel, hard, grey, moist	4.6 / 109.4		34	21.5		SS6		
				5						
				6	70	9.3		SS7		
				7						
		TILL: clayey sand, some silt, trace gravel, hard, grey, moist	7.6 / 106.4		94/230mm	12.5 22.0		SS8		
				8						

Continued Next Page

Checked By: R. Mahdavi

Logged By: S.Ahsan

CLASSIFICATION LOG 02111839.024_KIRWIN_AVE.GPJ LOG A GWGL02.GDT 1/5/24

Time	Water Level (m)	Depth to Cave (m)
Upon Completion 12/20/2023	Dry 1.5	Open

LOG OF No. BH-06

Englobe

Project No. 02111839.024 DRAWING No. 7

Project: 23-2126, 23-2129, 25-1310 - Kirwin Avenue and Little John Lane Sheet No. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
		--GR: 8%, Sa: 54%, Si: 24%, Cl: 14% TILL: clayey sand, some silt, trace gravel, hard, grey, moist *(continued)*		8
				9
			9.5	
		Terminated at 9.5 m	104.5	
		Borehole advanced using continuous flight solid stem augering equipment on December 11, 2023 by Driltech Drilling Limited.		

Standard Penetration Test N Value

Shear Strength kPa: 40 80 120 160 / 50 100 150 200

Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

50/100mm

9.4

SAMPLES	Sample No	Natural Unit Weight kN/m³	Percent of Fines, %
⊠	SS9		

Time	Water Level (m)	Depth to Cave (m)
Upon Completion 12/20/2023	Dry 1.5	Open

CLASSIFICATION LOG 02111839.024_KIRWIN_AVE.GPJ LOG A GWGL02.GDT 1/5/24

Checked By: R. Mahdavi

Logged By: S.Ahsan

LOG OF No. BH-07

Englobe

Project No. 02111839.024 DRAWING No. 8

Project: 23-2126, 23-2129, 25-1310 - Kirwin Avenue and Little John Lane Sheet No. 1 of 1

Location: Kirwin Ave, 2m north of hydro pole#P06586. 2m west of east curbline.

N 4,826,755.213 E 611,792.734

Date Drilled: 12/11/2023

Drill Type: Solid Stem Augers

Datum: Geodetic

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
			113.9	0
		ASPHALT: (150 mm)	0.2	
		SAND & GRAVEL: (Granular Base/ Subbase, 250 mm)	113.8	
			0.4	
		FILL: silty clay, some sand, trace gravel, stiff, grey, moist	113.5	
				1
			1.5	
		SILTY SAND WITH GRAVEL: trace clay, compact, brown, moist	112.4	
				2
				3
		--GR: 30%, Sa: 57%, Si: 10%, Cl: 3%		
			4.4	4
		Terminated at 4.4 m	109.5	
		Borehole advanced using continuous flight solid stem augering equipment on December 11, 2023 by Driltech Drilling Limited.		

Standard Penetration Test N Value
Shear Strength kPa: 40 80 120 160 / 50 100 150 200

Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Sample No	Natural Unit Weight kN/m³	Percent of Fines, %	Shear Strength kPa	Natural Moisture Content %
	AS1				5.4
	SS2			8	21.1
	SS3			26	9.0
	SS4			24	12.7
	SS5			12	14.8
	SS6			16	12.9

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open
12/20/2023	Dry	

CLASSIFICATION LOG 02111839.024_KIRWIN_AVE.GPJ LOG A GWGL02.GDT 1/5/24

Checked By: R. Mahdavi

Logged By: S.Ahsan

LOG OF No. BH-08

Englobe

Project No. 02111839.024 DRAWING No. 9

Project: 23-2126, 23-2129, 25-1310 - Kirwin Avenue and Little John Lane Sheet No. 1 of 1

Location: Little John Ln, 50m south of intersection with John St. 2m east of west curbline.

N 4,826,796.441 E 611,569.009

Date Drilled: 12/12/2023

Drill Type: Solid Stem Augers

Datum: Geodetic

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
			118.0	0
		ASPHALT: (130 mm)	0.1	
		SAND & GRAVEL: (Granular Base/ Subbase, 400 mm)	117.9	
			0.5	
		FILL: sand with gravel, loose, brown, moist	117.5	
				1
				2
			2.3	
		SAND WITH SILT: trace gravel, trace clay, compact, brown, moist to wet --GR: 7%, Sa: 87%, Si: 5%, Cl: 1%	115.7	
				3
			3.8	
		TILL: sandy clay, some silt, trace gravel, hard, grey, moist	114.2	4
			4.4	
		Terminated at 4.4 m	113.6	

Borehole advanced using continuous flight solid stem augering equipment on December 12, 2023 by Driltech Drilling Limited.

Standard Penetration Test N Value
Shear Strength kPa: 40, 80, 120, 160; 50, 100, 150, 200
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20, 40, 60

SAMPLES	Sample No	Natural Unit Weight kN/m³	Percent of Fines, %	Natural Moisture Content %	Standard Penetration Test N Value
	AS1			4.8	
	SS2			9.2	5
	SS3			11.3	4
	SS4			15.5	14
	SS5			24.0	12
	SS6			13.0	36

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open

Checked By: R. Mahdavi

Logged By: S.Ahsan

CLASSIFICATION LOG 02111839.024_KIRWIN_AVE.GPJ LOG A GWGL02.GDT 1/5/24

LOG OF No. BH-09

Englobe

Project No. 02111839.024 DRAWING No. 10

Project: 23-2126, 23-2129, 25-1310 - Kirwin Avenue and Little John Lane Sheet No. 1 of 1

Location: John St, in front of house # 3175. 2m south of north curbline.

N 4,826,902.118 E 611,569.406

Date Drilled: 12/12/2023

Drill Type: Solid Stem Augers

Datum: Geodetic

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
			116.9	0
		ASPHALT: (150 mm)	0.2	
		SAND & GRAVEL: (Granular Base/ Subbase, 400 mm)	116.8	
			0.6	
		SILTY SAND: some clay, trace gravel, compact, brown, moist	116.4	1
			2.3	2
		TILL: sandy clay, some silt, trace gravel, very stiff to hard, grey, moist	114.6	
		--GR: 6%, Sa: 37%, Si: 27%, Cl: 30%		3
			4.4	4
		Terminated at 4.4 m	112.5	

Borehole advanced using continuous flight solid stem augering equipment on December 12, 2023 by Driltech Drilling Limited.

Standard Penetration Test N Value
Shear Strength kPa: 40, 80, 120, 160; 50, 100, 150, 200
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20, 40, 60

SAMPLES	Sample No	Natural Unit Weight kN/m³	Percent of Fines, %	Shear Strength	Natural Moisture Content / Atterberg Limits
	AS1				3.1
	SS2			24	5.9
	SS3			18	17.8
	SS4			22	13.4
	SS5			32	13.10 26.9
	SS6			24	12.8

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open

Checked By: R. Mahdavi

Logged By: S.Ahsan

CLASSIFICATION LOG 02111839.024_KIRWIN_AVE.GPJ LOG A GWGL02.GDT 1/5/24

LOG OF No. BH-10

Englobe

Project No. 02111839.024 DRAWING No. 11

Project: 23-2126, 23-2129, 25-1310 - Kirwin Avenue and Little John Lane Sheet No. 1 of 1

Location: John St, 18m west of hydro pole#P7572. 3m south of north curbline.

N 4,826,827.370 E 611,513.229

Date Drilled: 12/12/2023

Drill Type: Solid Stem Augers

Datum: Geodetic

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
			117.5	0
		ASPHALT: (150 mm)	0.2	
		SAND & GRAVEL: (Granular Base/ Subbase, 300 mm)	117.3	
			0.5	
		SILTY SAND: trace gravel, loose to compact, brown, moist --GR: 10%, Sa: 77%, Si: 9%, Cl: 4%	117.0	1
				2
				3
			3.8	
		SILTY CLAY: stiff, grey, moist	113.7	4
			4.4	
		Terminated at 4.4 m	113.1	

Borehole advanced using continuous flight solid stem augering equipment on December 12, 2023 by Driltech Drilling Limited.

Standard Penetration Test N Value
Shear Strength kPa: 40 80 120 160 / 50 100 150 200
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

Sample No	Shear Strength (kPa)	Natural Moisture Content %
AS1		2.8
SS2	11	7.0
SS3	10	8.8
SS4	7	19.5
SS5	10	15.5
SS6	10	20.3

Natural Unit Weight kN/m³

Percent of Fines, %

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open

Checked By: R. Mahdavi

Logged By: S.Ahsan

CLASSIFICATION LOG 02111839.024_KIRWIN_AVE.GPJ LOG A GWGL02.GDT 1/5/24

LOG OF No. BH-11

Englobe

Project No. 02111839.024 DRAWING No. 12

Project: 23-2126, 23-2129, 25-1310 - Kirwin Avenue and Little John Lane Sheet No. 1 of 1

Location: John St, in front of building # 6. 2m south of north curbline.

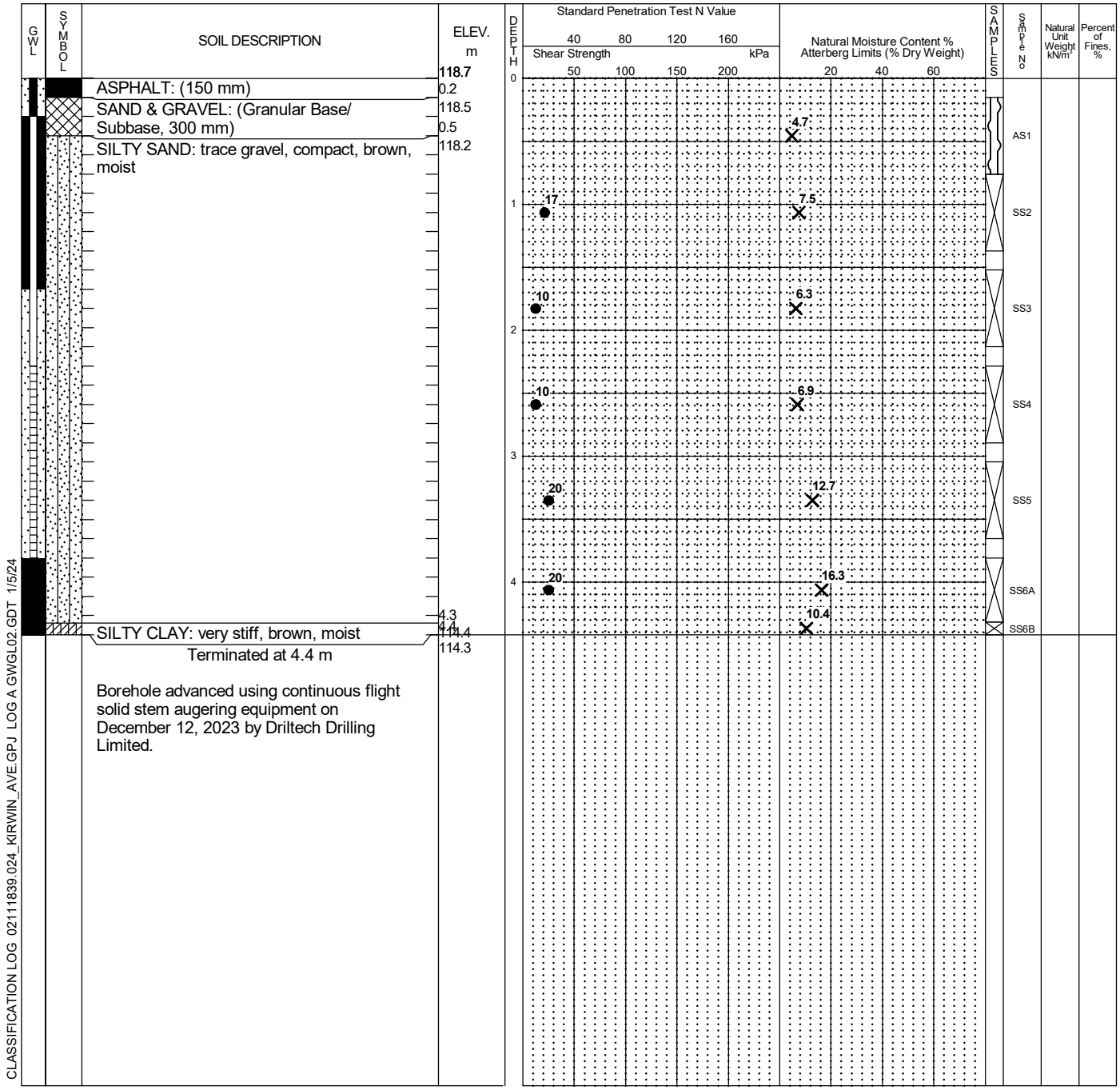
N 4,826,760.570 E 611,457.259

Date Drilled: 12/12/2023

Drill Type: Solid Stem Augers

Datum: Geodetic

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test



Borehole advanced using continuous flight solid stem augering equipment on December 12, 2023 by Driltech Drilling Limited.

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open
12/20/2023	1.1	

Checked By: R. Mahdavi

Logged By: S.Ahsan

CLASSIFICATION LOG 02111839.024_KIRWIN_AVE.GPJ LOG A GWGL02.GDT 1/5/24

LOG OF No. BH-12

Englobe

Project No. 02111839.024 DRAWING No. 13

Project: 23-2126, 23-2129, 25-1310 - Kirwin Avenue and Little John Lane Sheet No. 1 of 1

Location: John St, 13m east of hydro pole#P7578. 2m south of north curbline.

N 4,826,629.557 E 611,347.778

Date Drilled: 12/12/2023

Drill Type: Solid Stem Augers

Datum: Geodetic

Split Spoon Sample ⊠
Auger Sample □
SPT (N) Value ●
Dynamic Cone Test —
Shelby Tube ■
Shear Strength by Vane Test S

Natural Moisture Content ×
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test ▲

SOIL DESCRIPTION	ELEV. m	DEPTH
	121.2	0
ASPHALT: (200 mm)	0.2	
SAND & GRAVEL: (Granular Base/ Subbase, 300 mm)	121.0 / 0.5	
SAND WITH GRAVEL: compact, brown, moist	120.7	
		1
		2
	3.0	3
SILTY CLAY: trace sand, very stiff, brown, moist	118.2	
	3.8	
SHALE Bedrock: grey, weathered	117.4 / 4.1	4
Terminated at 4.1 m	117.1	

Borehole advanced using continuous flight solid stem augering equipment on December 12, 2023 by Driltech Drilling Limited.

Standard Penetration Test N Value
Shear Strength kPa: 40 80 120 160 / 50 100 150 200
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

Sample No	N	Natural Moisture Content %
AS1		4.4
SS2	16	8.1
SS3	11	7.4
SS4	14	7.6
SS5	18	19.3
SS6	50/100mm	8.3

Natural Unit Weight kN/m³

Percent of Fines, %

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open

Checked By: R. Mahdavi

Logged By: S.Ahsan

CLASSIFICATION LOG 02111839.024_KIRWIN_AVE.GPJ LOG A GWGL02.GDT 1/5/24

LOG OF No. BH-13

Englobe

Project No. 02111839.024 DRAWING No. 14

Project: 23-2126, 23-2129, 25-1310 - Kirwin Avenue and Little John Lane Sheet No. 1 of 1

Location: Jaguar Valley Dr, 47m south of intersection with John St. 3m west of east curbline.

N 4,826,640.205 E 611,433.978

Date Drilled: 12/12/2023

Drill Type: Solid Stem Augers

Datum: Geodetic

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
			118.9	0
		ASPHALT: (100 mm)	0.1	
		SAND & GRAVEL: (Granular Base/ Subbase, 300 mm)	118.8	
			0.4	
		SAND WITH GRAVEL: very dense, brown, damp to moist	118.4	
				1
			1.5	
		SILTY SAND: trace gravel, dense, brown, damp to moist	117.3	
				2
			3.0	3
		TILL: sandy clay, some silt, trace gravel, very stiff, brown, moist --GR: 5%, Sa: 32%, Si: 28%, Cl: 35%	115.8	
			3.8	
		SHALE Bedrock: grey, weathered	115.0	4
			4.2	
		Terminated at 4.2 m	114.6	

Borehole advanced using continuous flight solid stem augering equipment on December 12, 2023 by Driltech Drilling Limited.

Standard Penetration Test N Value
Shear Strength kPa: 40 80 120 160 | 50 100 150 200
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

Sample No	Shear Strength	Natural Moisture Content	Atterberg Limits
AS1		4.1	
SS2	50	3.6	
SS3	33	3.0	
SS4	30	3.1	
SS5	20	15.3	30.3
SS6	74/280mm	14.4	

SAMPLES | Sample No | Natural Unit Weight kN/m³ | Percent of Fines, %

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open

Checked By: R. Mahdavi

Logged By: S.Ahsan

CLASSIFICATION LOG 02111839.024_KIRWIN_AVE.GPJ LOG A GWGL02.GDT 1/5/24

LOG OF No. BH-14

Englobe

Project No. 02111839.024 DRAWING No. 15

Project: 23-2126, 23-2129, 25-1310 - Kirwin Avenue and Little John Lane Sheet No. 1 of 1

Location: Kirwin Ave, in front of house # 3066. 2.5m east of west curbline.

N 4,826,655.055 E 611,883.568

Date Drilled: 12/11/2023

Drill Type: Solid Stem Augers

Datum: Geodetic

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
			113.3	0
		ASPHALT: (250 mm)	0.3	
		SAND & GRAVEL: (Granular Base/ Subbase, 300 mm)	113.0	
			0.6	
		FILL: silty sand with gravel, trace clay, very loose, brown, moist	112.7	
		--GR: 26%, Sa: 62%, Si: 10%, Cl: 2%		1
				2
			2.3	
		SAND WITH GRAVEL: trace silt, dense, brown, moist	111.0	
				3
			3.8	
		TILL: sandy clay, some silt, trace gravel, very stiff, brown, most	109.5	4
			4.4	
		Terminated at 4.4 m	108.8	

Borehole advanced using continuous flight solid stem augering equipment on December 11, 2023 by Driltech Drilling Limited.

Standard Penetration Test N Value
Shear Strength kPa
Natural Moisture Content % Atterberg Limits (% Dry Weight)

SAMPLES	Sample No	Natural Unit Weight kN/m³	Percent of Fines, %	SPT (N)	Shear Strength kPa	Natural Moisture Content %
	AS1					5.7
	SS2			2		11.8
	SS3			4		7.8
	SS4			36		5.6
	SS5			40		5.4
	SS6			24		

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open

Checked By: R. Mahdavi

Logged By: S.Ahsan

CLASSIFICATION LOG 02111839.024_KIRWIN_AVE.GPJ LOG A GWGL02.GDT 1/5/24

LOG OF No. BH-15

Englobe

Project No. 02111839.024 DRAWING No. 16

Project: 23-2126, 23-2129, 25-1310 - Kirwin Avenue and Little John Lane Sheet No. 1 of 1

Location: Kirwin Ave, 35m north of intersection with Dundas St. 2m east of west curbline.

N 4,826,583.955 E 611,959.644

Date Drilled: 12/11/2023

Drill Type: Solid Stem Augers

Datum: Geodetic

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH
			112.6	0
		ASPHALT: (280 mm)	0.3	
		SAND & GRAVEL: (Granular Base/ Subbase, 300 mm)	112.3	
			0.6	
		FILL: silty sand, loose, brown, moist	112.0	
				1
			1.5	
		SAND WITH GRAVEL: trace silt, compact to very dense, moist	111.1	
				2
				3
			3.8	
		CLAY WITH SAND: some silt, trace gravel, stiff, grey, most --GR: 3%, Sa: 15%, Si: 41%, Cl: 41%	108.8	4
			4.4	
		Terminated at 4.4 m	108.2	

Borehole advanced using continuous flight solid stem augering equipment on December 11, 2023 by Driltech Drilling Limited.

Standard Penetration Test N Value
Shear Strength kPa
40 80 120 160
50 100 150 200

Natural Moisture Content % Atterberg Limits (% Dry Weight)
20 40 60

SAMPLES	Sample No	Natural Unit Weight kN/m³	Percent of Fines, %
	AS1		
	SS2		
	SS3		
	SS4		
	SS5		
	SS6		

Shear Strength: 4 (SS2), 28 (SS3), 50/125mm (SS4), 50/125mm (SS5), 14 (SS6)

Natural Moisture Content: 4.4 (AS1), 17.6 (SS2), 4.7 (SS3), 4.0 (SS4), 5.8 (SS5), 17.6 26.8 (SS6)

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	Dry	Open
12/20/2023	Dry	

Checked By: R. Mahdavi

Logged By: S.Ahsan

CLASSIFICATION LOG 02111839.024_KIRWIN_AVE.GPJ LOG A GWGL02.GDT 1/5/24

Appendix C
Geotechnical laboratory Test Results

ENGLOBE

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

PROJECT: 02111839.024 CLIENT/JOB NAME: Region of Peel CONTRACT NUMBER: -

ROS ID: 111131 PROJECT/LOCATION: Kirwin Avenue, Mississauga

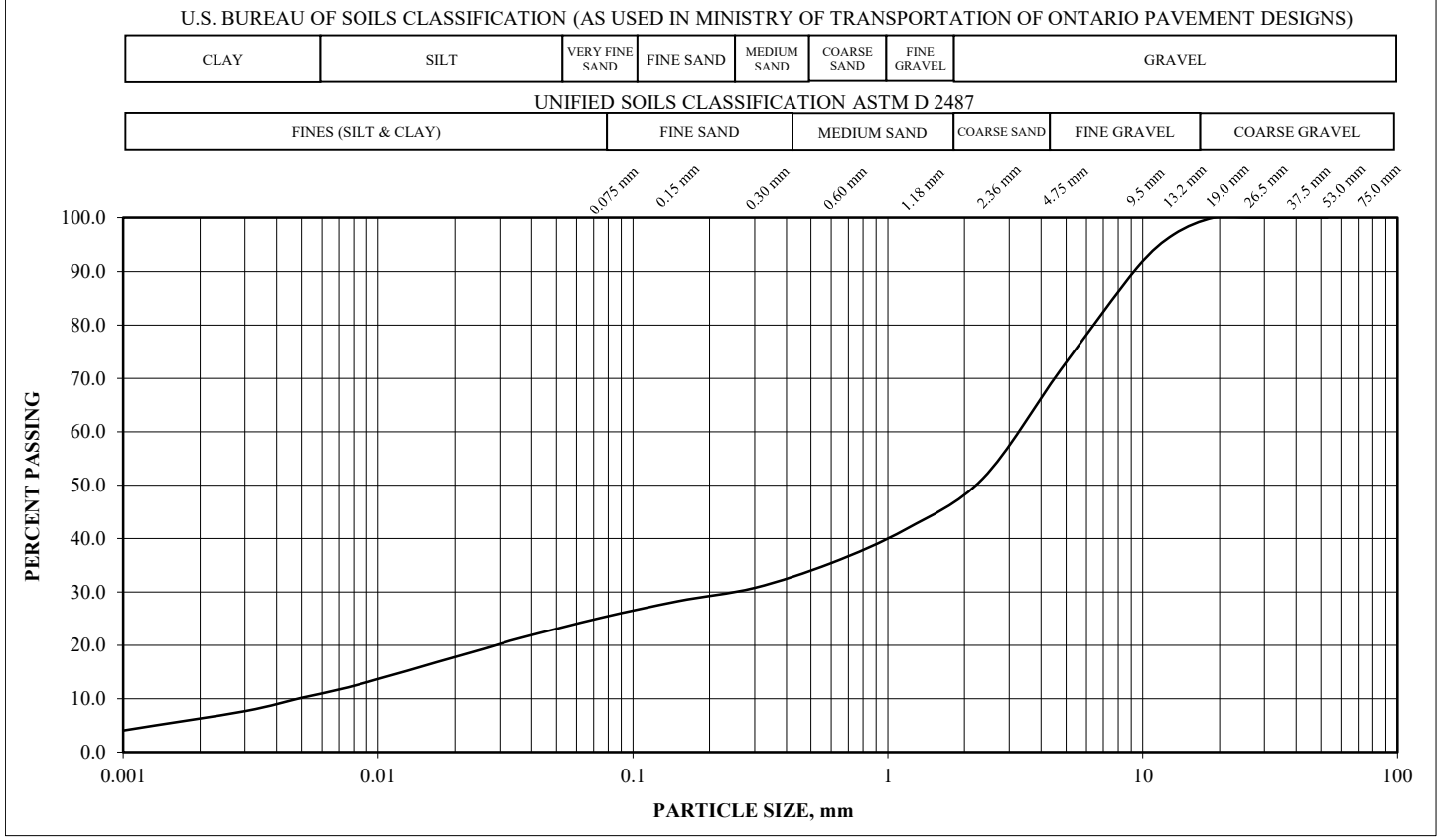
SAMPLING LOCATION:	BH1_SS4
SAMPLING DEPTH, m	-
SAMPLING METHOD:	Split Spoon
SAMPLED BY:	SA, Englobe
SAMPLE DESCRIPTION:	Gravelly Sandy with Silt and Clay
SAMPLING DATE:	2023-12-08
SAMPLE RECEIVED DATE:	2023-12-10

GRAIN SIZE PROPORTIONS, %

% GRAVEL (> 4.75 mm):	28.5
% SAND (75 µm to 4.75 mm):	46.3
% Silt (5 µm to 75 µm):	15.0
% Clay (<5 µm):	10.2
SUSCEPTIBILITY TO FROST HEAVING:	Low

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53.0	100.0	0.037	21.5
37.5	100.0	0.026	19.4
26.5	100.0	0.017	16.8
19.0	100.0	0.010	13.7
13.2	96.8	0.007	11.7
9.5	90.7	0.005	10.2
4.75	71.5	0.003	7.7
2.36	51.2	0.001	4.1
1.18	41.8	ATTERBERG LIMITS, %	
0.60	35.4		
0.30	30.8	Plastic Limit	12.4
0.15	28.3	Liquid Limit	19.1
0.075	25.2	Plastic Index	6.7

PARTICLE SIZE DISTRIBUTION, MTO LS-702



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

PROJECT: 02111839.024 CLIENT/JOB NAME: Region of Peel CONTRACT NUMBER: -

ROS ID: 111131 PROJECT/LOCATION: Kirwin Avenue, Mississauga

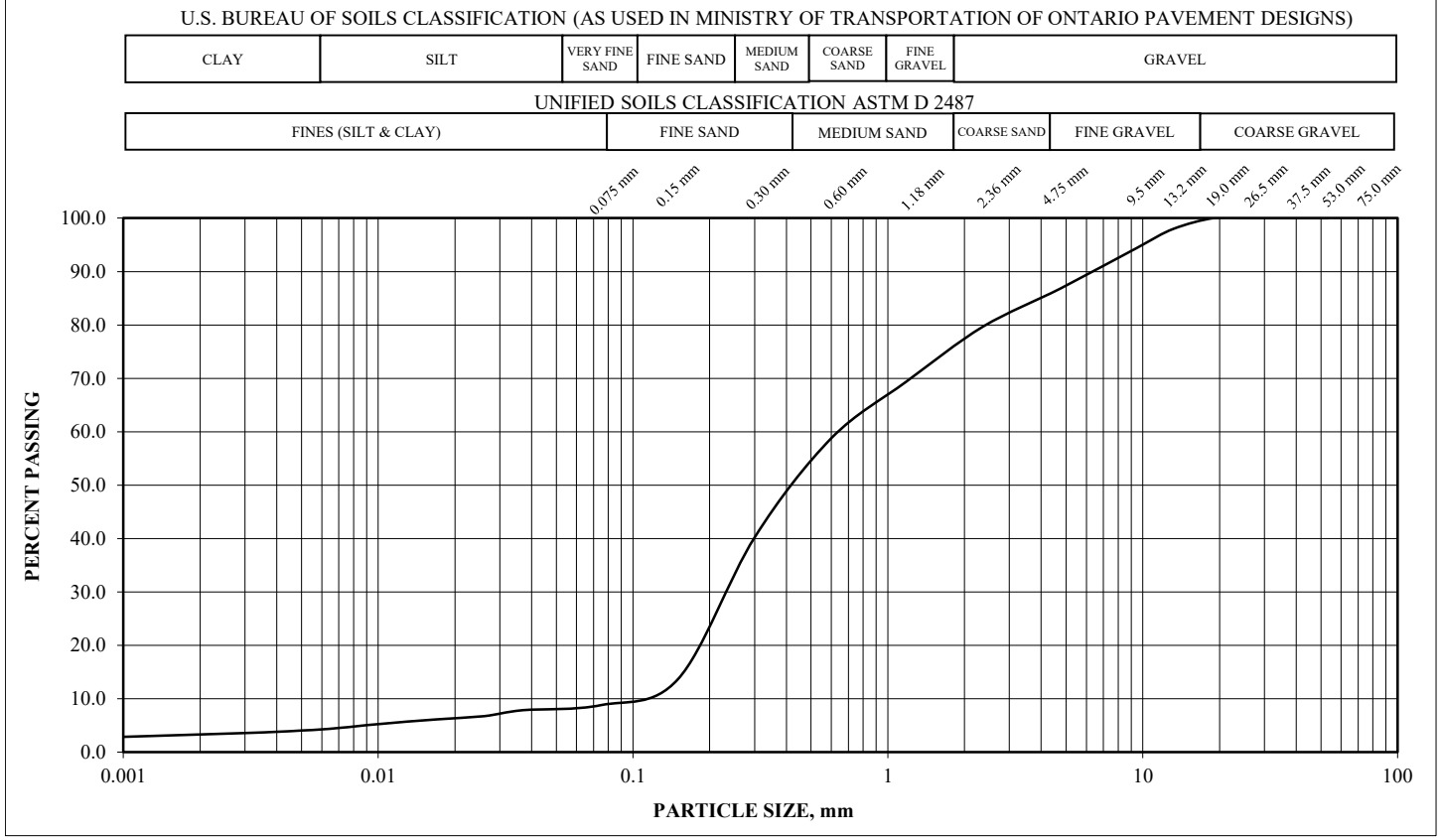
SAMPLING LOCATION:	BH2_SS3
SAMPLING DEPTH, m	-
SAMPLING METHOD:	Split Spoon
SAMPLED BY:	SA, Englobe
SAMPLE DESCRIPTION:	SANDY / with Gravel, trace Silt trace Clay
SAMPLING DATE:	2023-12-08
SAMPLE RECEIVED DATE:	2023-12-10

GRAIN SIZE PROPORTIONS, %

% GRAVEL (> 4.75 mm):	13.2
% SAND (75 µm to 4.75 mm):	78.0
% Silt (5 µm to 75 µm):	4.8
% Clay (<5 µm):	4.0
SUSCEPTIBILITY TO FROST HEAVING:	Low

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53.0	100.0	0.037	7.8
37.5	100.0	0.026	6.8
26.5	100.0	0.017	6.1
19.0	100.0	0.010	5.3
13.2	98.0	0.007	4.5
9.5	94.4	0.005	4.0
4.75	86.8	0.003	3.6
2.36	79.6	0.001	2.9
1.18	69.4	ATTERBERG LIMITS, %	
0.60	58.8		
0.30	40.3	Plastic Limit	
0.15	13.7	Liquid Limit	
0.075	8.8	Plastic Index	NP

PARTICLE SIZE DISTRIBUTION, MTO LS-702



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

PROJECT: 02111839.024 CLIENT/JOB NAME: Region of Peel CONTRACT NUMBER: -

ROS ID: 111131 PROJECT/LOCATION: Kirwin Avenue, Mississauga

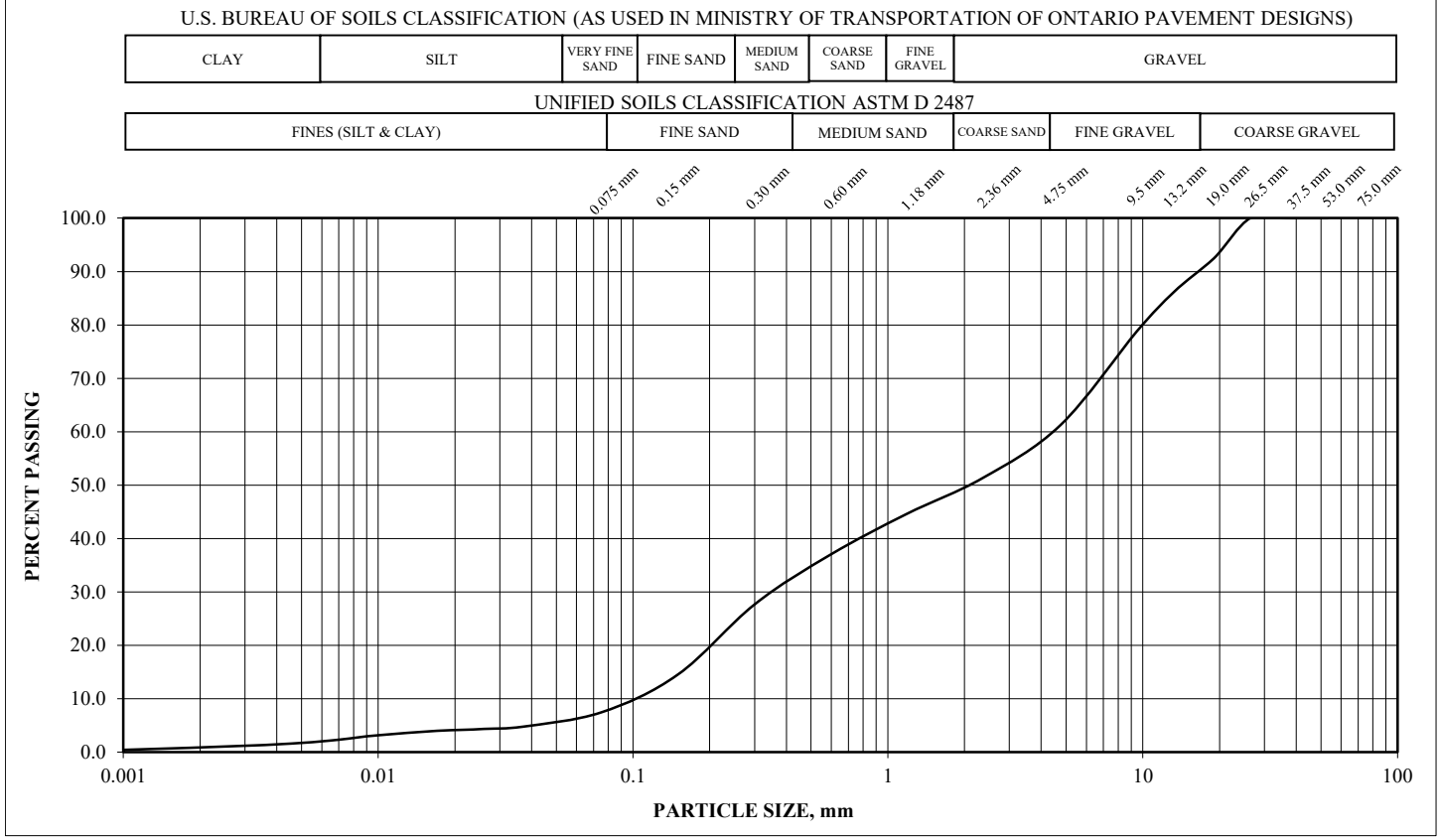
SAMPLING LOCATION:	BH3_SS5
SAMPLING DEPTH, m	-
SAMPLING METHOD:	Split Spoon
SAMPLED BY:	SA, Englobe
SAMPLE DESCRIPTION:	Gravelly Sandy, trace Silt trace Clay
SAMPLING DATE:	2023-12-08
SAMPLE RECEIVED DATE:	2023-12-10

GRAIN SIZE PROPORTIONS, %

% GRAVEL (> 4.75 mm):	38.8
% SAND (75 µm to 4.75 mm):	53.8
% Silt (5 µm to 75 µm):	5.7
% Clay (<5 µm):	1.7
SUSCEPTIBILITY TO FROST HEAVING:	Low

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53.0	100.0	0.037	4.8
37.5	100.0	0.026	4.3
26.5	100.0	0.017	4.0
19.0	92.5	0.010	3.2
13.2	86.1	0.007	2.3
9.5	78.8	0.005	1.7
4.75	61.2	0.003	1.2
2.36	51.3	0.001	0.4
1.18	44.6	ATTERBERG LIMITS, %	
0.60	37.1		
0.30	27.7	Plastic Limit	
0.15	14.5	Liquid Limit	
0.075	7.4	Plastic Index	NP

PARTICLE SIZE DISTRIBUTION, MTO LS-702



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

PROJECT: 02111839.024 CLIENT/JOB NAME: Region of Peel CONTRACT NUMBER: -

ROS ID: 111131 PROJECT/LOCATION: Kirwin Avenue, Mississauga

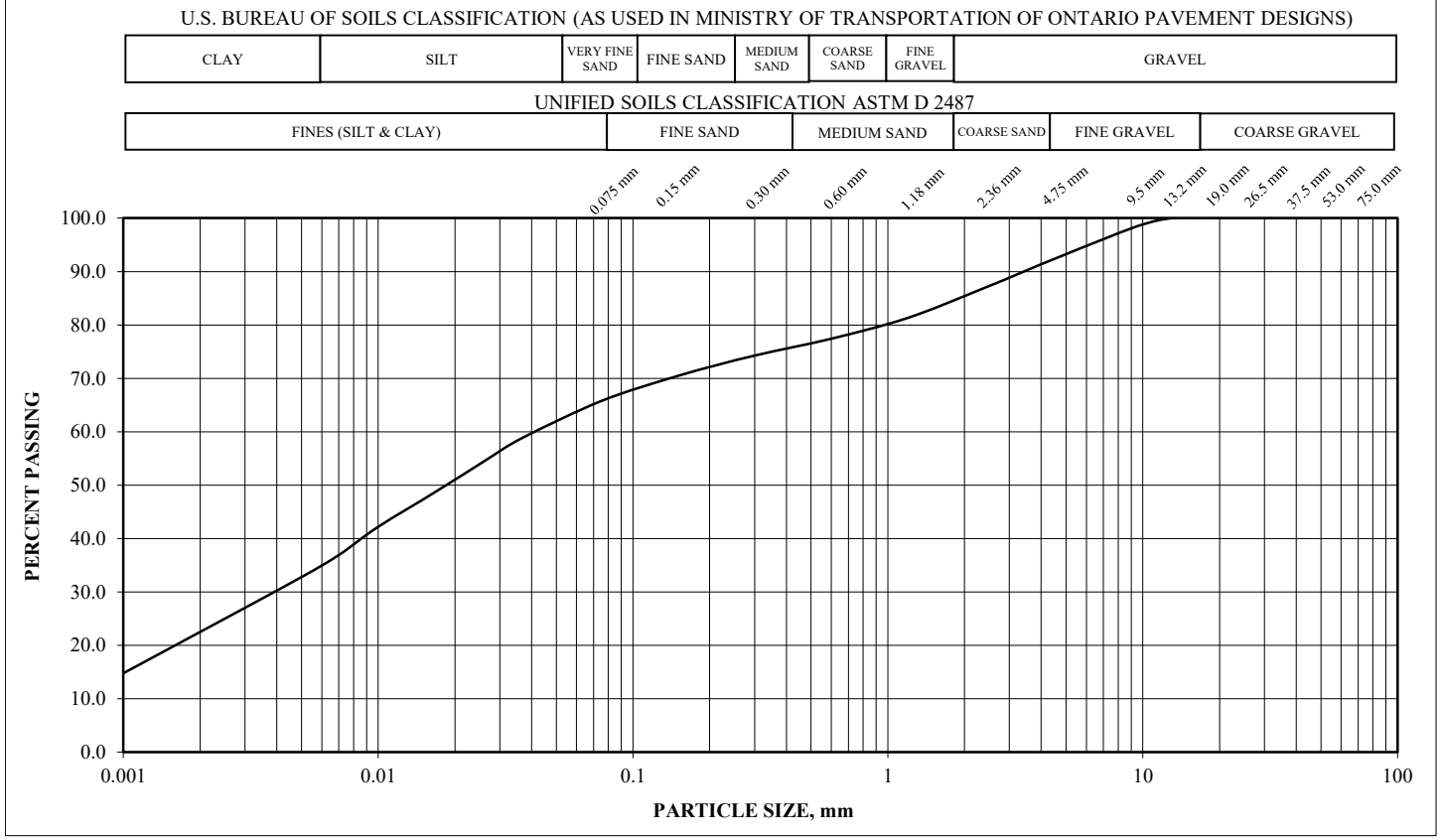
SAMPLING LOCATION:	BH4_SS6
SAMPLING DEPTH, m	-
SAMPLING METHOD:	Split Spoon
SAMPLED BY:	SA, Englobe
SAMPLE DESCRIPTION:	Sandy Silty Clay trace Gravel
SAMPLING DATE:	2023-12-08
SAMPLE RECEIVED DATE:	2023-12-10

GRAIN SIZE PROPORTIONS, %

% GRAVEL (> 4.75 mm):	7.2
% SAND (75 µm to 4.75 mm):	27.1
% Silt (5 µm to 75 µm):	32.9
% Clay (<5 µm):	32.8
SUSCEPTIBILITY TO FROST HEAVING:	Low

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53.0	100.0	0.037	58.9
37.5	100.0	0.026	54.4
26.5	100.0	0.017	48.9
19.0	100.0	0.010	42.2
13.2	100.0	0.007	36.9
9.5	98.4	0.005	32.8
4.75	92.8	0.003	27.0
2.36	86.8	0.001	14.8
1.18	81.2	ATTERBERG LIMITS, %	
0.60	77.4		
0.30	74.2	Plastic Limit	16.5
0.15	70.5	Liquid Limit	27.3
0.075	65.7	Plastic Index	10.8

PARTICLE SIZE DISTRIBUTION, MTO LS-702



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

PROJECT: 02111839.024 CLIENT/JOB NAME: Region of Peel CONTRACT NUMBER: -

ROS ID: 111159 PROJECT/LOCATION: Kirwin Avenue, Mississauga

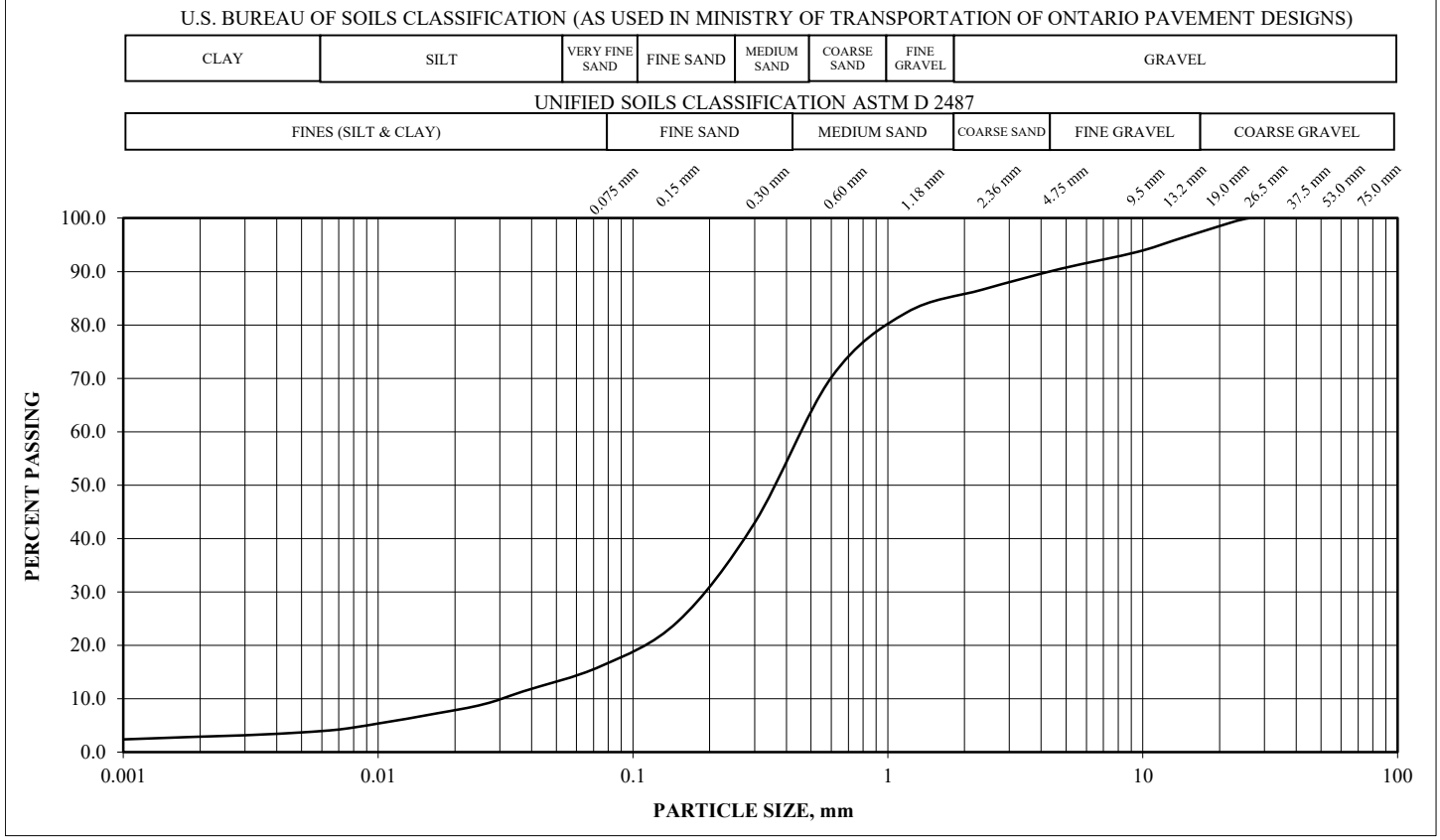
SAMPLING LOCATION:	BH5_SS3
SAMPLING DEPTH, m	-
SAMPLING METHOD:	Split Spoon
SAMPLED BY:	SA, Englobe
SAMPLE DESCRIPTION:	SANDY / with Silt, trace Clay, trace Gravel
SAMPLING DATE:	2023-12-11
SAMPLE RECEIVED DATE:	2023-12-13

GRAIN SIZE PROPORTIONS, %

% GRAVEL (> 4.75 mm):	9.5
% SAND (75 µm to 4.75 mm):	74.4
% Silt (5 µm to 75 µm):	12.4
% Clay (<5 µm):	3.7
SUSCEPTIBILITY TO FROST HEAVING:	Low

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53.0	100.0	0.037	11.4
37.5	100.0	0.026	9.0
26.5	100.0	0.017	7.3
19.0	98.1	0.010	5.4
13.2	95.8	0.007	4.3
9.5	93.7	0.005	3.7
4.75	90.5	0.003	3.2
2.36	86.6	0.001	2.4
1.18	82.3	ATTERBERG LIMITS, %	
0.60	70.2		
0.30	43.0	Plastic Limit	
0.15	24.5	Liquid Limit	
0.075	16.1	Plastic Index	Non- plastic

PARTICLE SIZE DISTRIBUTION, MTO LS-702



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

PROJECT: 02111839.024 CLIENT/JOB NAME: Region of Peel CONTRACT NUMBER: -

ROS ID: 111159 PROJECT/LOCATION: Kirwin Avenue, Mississauga

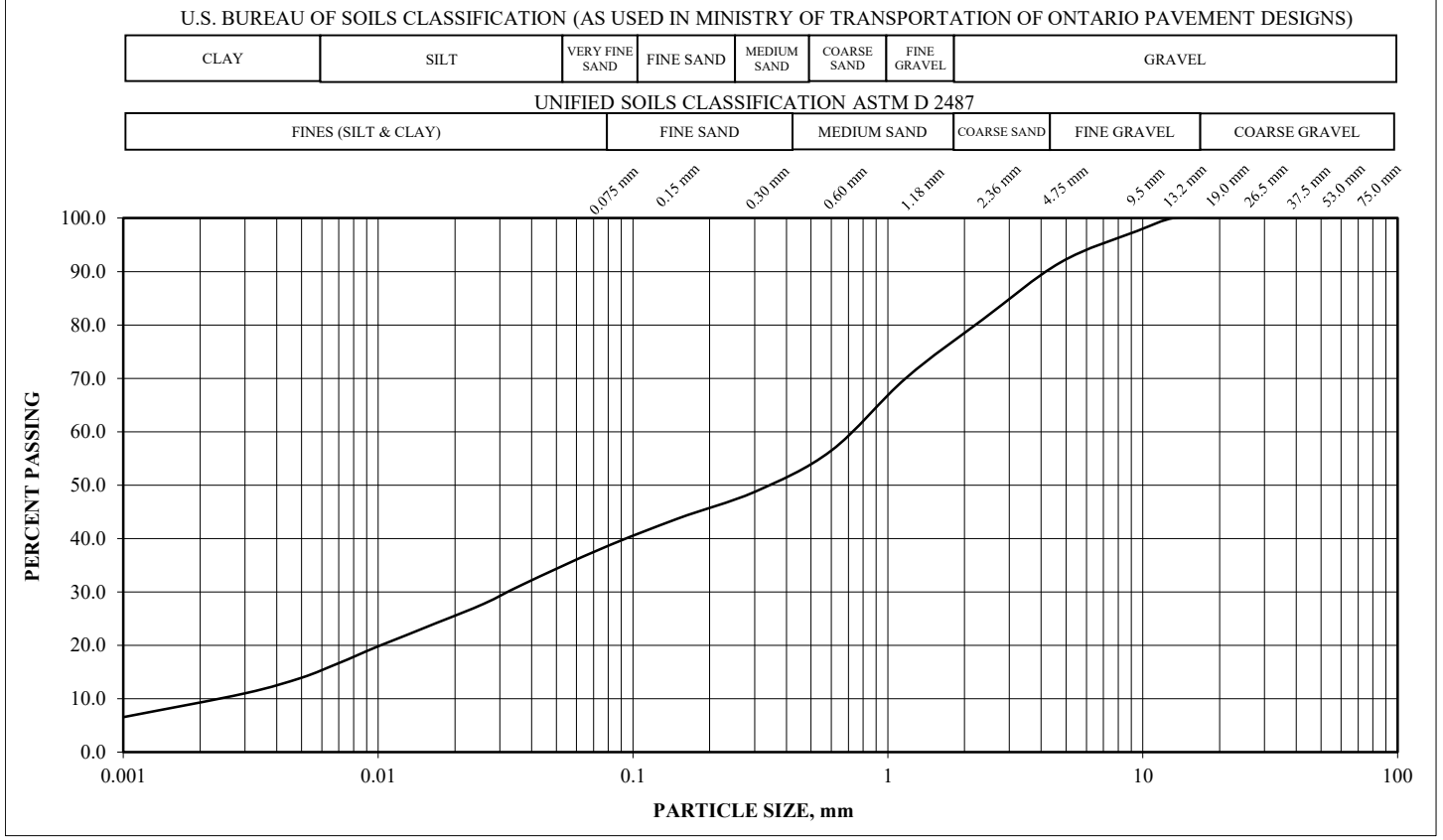
SAMPLING LOCATION:	BH6_SS8
SAMPLING DEPTH, m	-
SAMPLING METHOD:	Split Spoon
SAMPLED BY:	SA, Englobe
SAMPLE DESCRIPTION:	SANDY Silt with Clay, trace Gravel
SAMPLING DATE:	2023-12-11
SAMPLE RECEIVED DATE:	2023-12-13

GRAIN SIZE PROPORTIONS, %

% GRAVEL (> 4.75 mm):	8.3
% SAND (75 µm to 4.75 mm):	53.6
% Silt (5 µm to 75 µm):	24.1
% Clay (<5 µm):	14.0
SUSCEPTIBILITY TO FROST HEAVING:	Low

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53.0	100.0	0.037	31.4
37.5	100.0	0.026	27.8
26.5	100.0	0.017	24.2
19.0	100.0	0.010	19.8
13.2	100.0	0.007	16.7
9.5	97.6	0.005	14.0
4.75	91.7	0.003	11.0
2.36	81.0	0.001	6.6
1.18	70.1	ATTERBERG LIMITS, %	
0.60	56.5		
0.30	48.8	Plastic Limit	14.0
0.15	43.7	Liquid Limit	22.0
0.075	38.1	Plastic Index	8.0

PARTICLE SIZE DISTRIBUTION, MTO LS-702



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

PROJECT: 02111839.024 CLIENT/JOB NAME: Region of Peel CONTRACT NUMBER: -

ROS ID: 111159 PROJECT/LOCATION: Kirwin Avenue, Mississauga

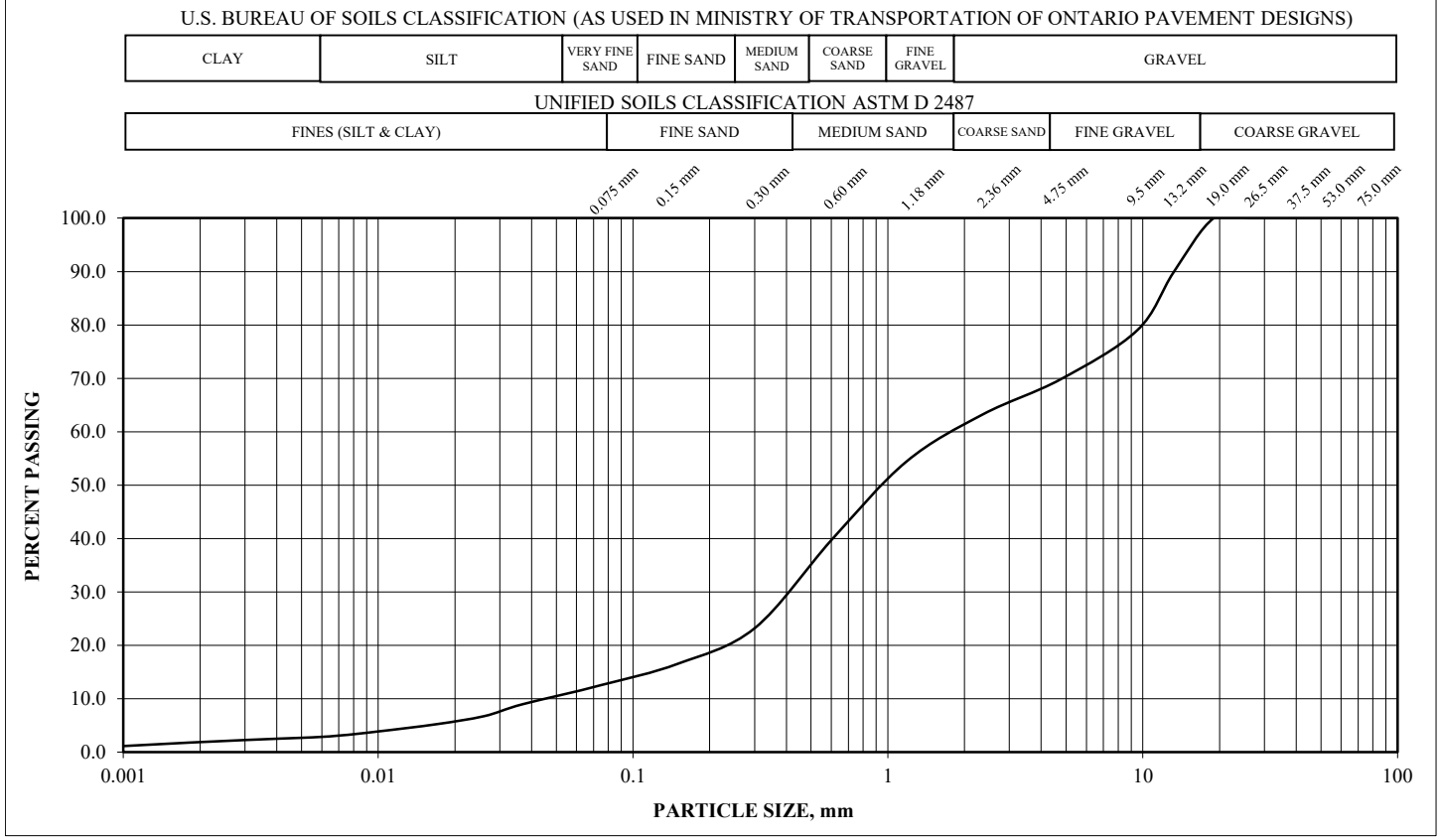
SAMPLING LOCATION:	BH7_SS5
SAMPLING DEPTH, m	-
SAMPLING METHOD:	Split Spoon
SAMPLED BY:	SA, Englobe
SAMPLE DESCRIPTION:	Gravelly Sandy, trace Silt, trace Clay
SAMPLING DATE:	2023-12-11
SAMPLE RECEIVED DATE:	2023-12-13

GRAIN SIZE PROPORTIONS, %

% GRAVEL (> 4.75 mm):	30.2
% SAND (75 µm to 4.75 mm):	57.2
% Silt (5 µm to 75 µm):	9.9
% Clay (<5 µm):	2.7
SUSCEPTIBILITY TO FROST HEAVING:	Low

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53.0	100.0	0.037	9.0
37.5	100.0	0.026	6.7
26.5	100.0	0.017	5.3
19.0	100.0	0.010	3.9
13.2	89.8	0.007	3.1
9.5	78.9	0.005	2.7
4.75	69.8	0.003	2.3
2.36	63.3	0.001	1.2
1.18	54.4	ATTERBERG LIMITS, %	
0.60	39.7		
0.30	23.2	Plastic Limit	
0.15	16.6	Liquid Limit	
0.075	12.5	Plastic Index	Non- plastic

PARTICLE SIZE DISTRIBUTION, MTO LS-702



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

PROJECT: 02111839.024 CLIENT/JOB NAME: Region of Peel CONTRACT NUMBER: -

ROS ID: 111190 PROJECT/LOCATION: Kirwin Avenue, Mississauga

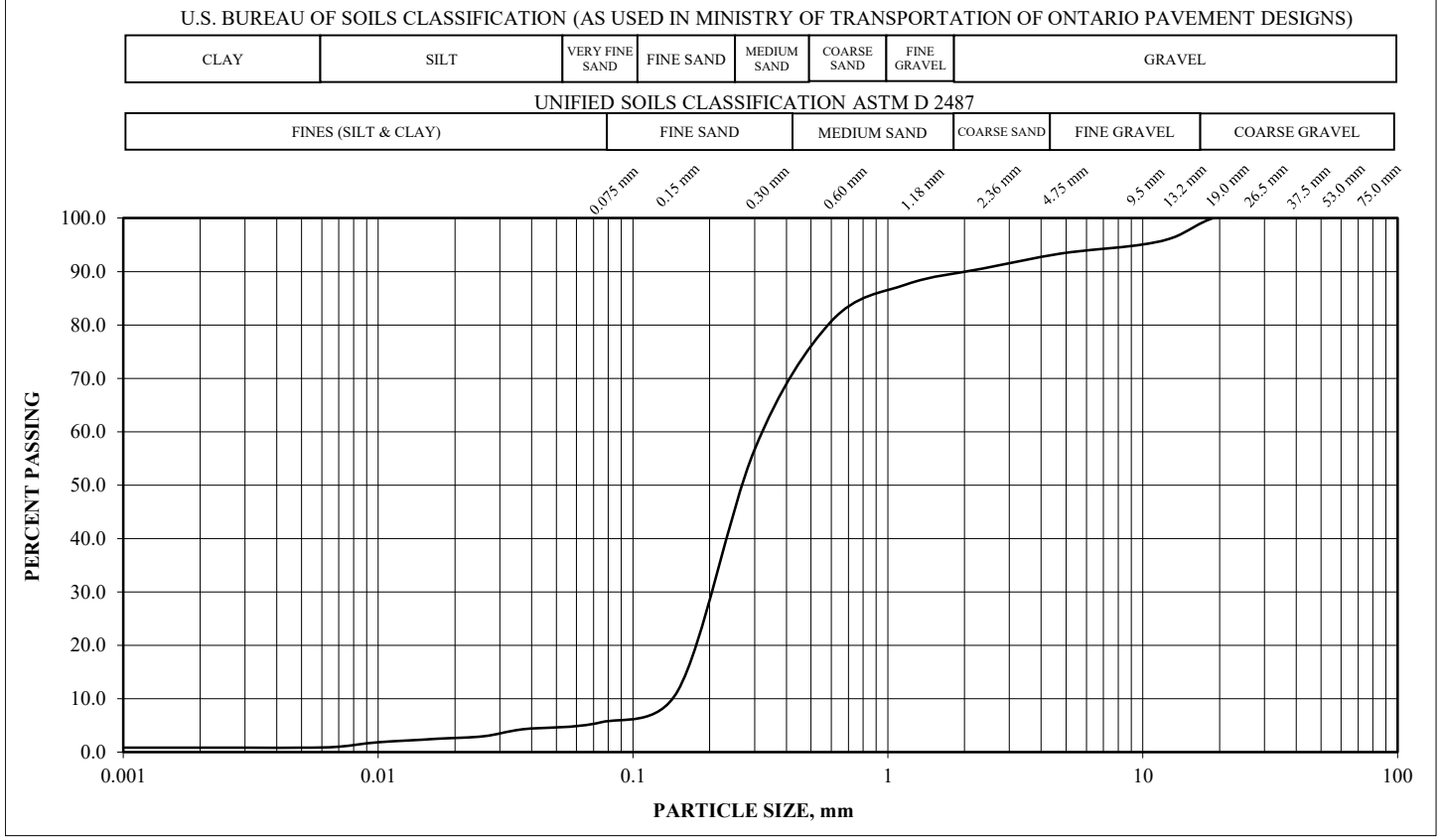
SAMPLING LOCATION:	BH8_SS4
SAMPLING DEPTH, m	-
SAMPLING METHOD:	Split Spoon
SAMPLED BY:	SA, Englobe
SAMPLE DESCRIPTION:	SANDY / trace Silt trace Gravel
SAMPLING DATE:	2023-12-12
SAMPLE RECEIVED DATE:	2023-12-13

GRAIN SIZE PROPORTIONS, %

% GRAVEL (> 4.75 mm):	6.7
% SAND (75 µm to 4.75 mm):	87.7
% Silt (5 µm to 75 µm):	4.8
% Clay (<5 µm):	0.8
SUSCEPTIBILITY TO FROST HEAVING:	Low

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53.0	100.0	0.037	4.3
37.5	100.0	0.026	3.0
26.5	100.0	0.017	2.5
19.0	100.0	0.010	1.9
13.2	96.4	0.007	1.0
9.5	94.9	0.005	0.8
4.75	93.3	0.003	0.8
2.36	90.5	0.001	0.8
1.18	87.6	ATTERBERG LIMITS, %	
0.60	80.6		
0.30	56.7	Plastic Limit	
0.15	11.5	Liquid Limit	
0.075	5.6	Plastic Index	

PARTICLE SIZE DISTRIBUTION, MTO LS-702



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

PROJECT: 02111839.024 CLIENT/JOB NAME: Region of Peel CONTRACT NUMBER: -

ROS ID: 111190 PROJECT/LOCATION: Kirwin Avenue, Mississauga

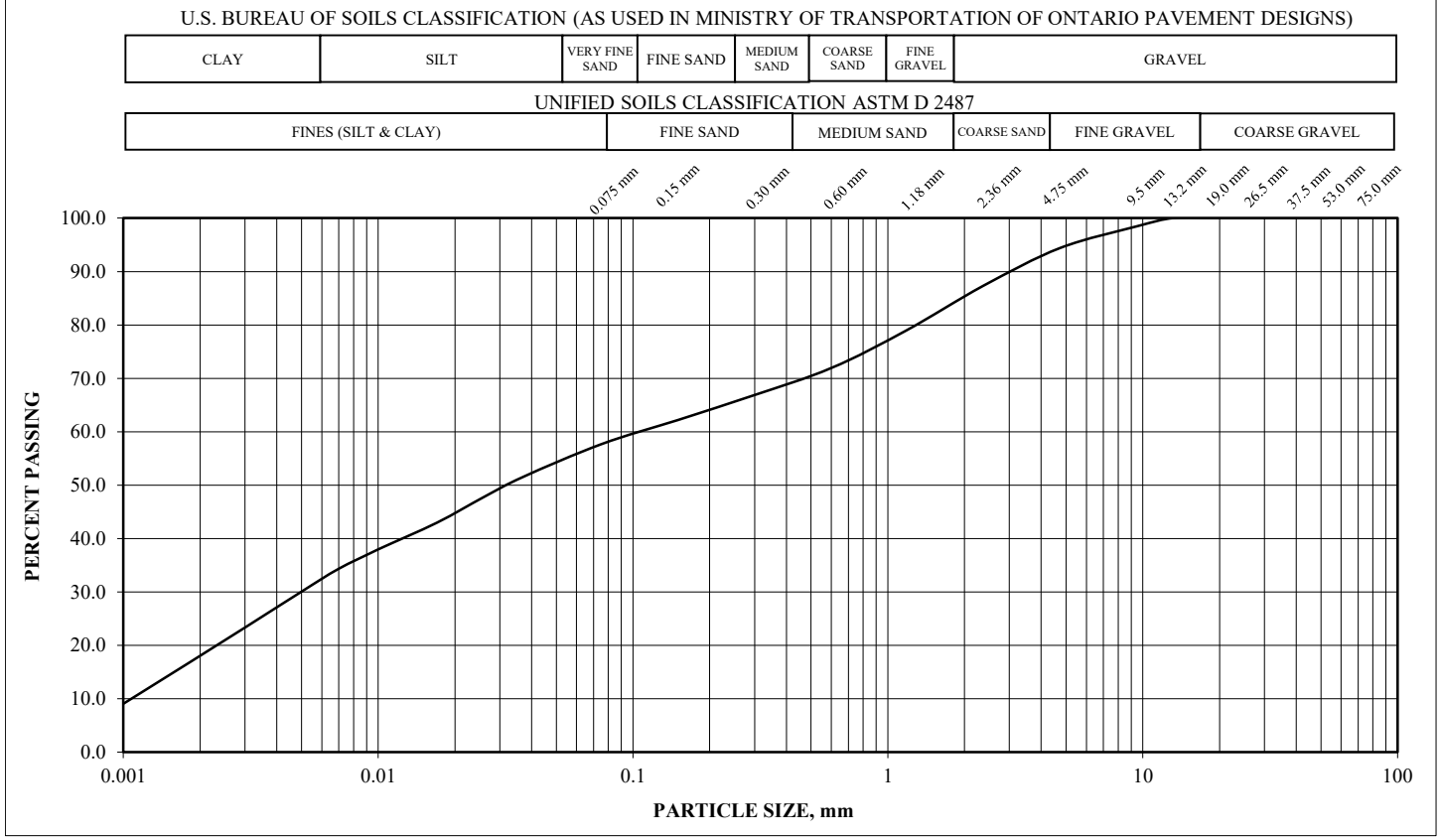
SAMPLING LOCATION:	BH9_SS5
SAMPLING DEPTH, m	-
SAMPLING METHOD:	Split Spoon
SAMPLED BY:	SA, Englobe
SAMPLE DESCRIPTION:	Sandy Silty Clay trace Gravel
SAMPLING DATE:	2023-12-12
SAMPLE RECEIVED DATE:	2023-12-13

GRAIN SIZE PROPORTIONS, %

% GRAVEL (> 4.75 mm):	5.6
% SAND (75 µm to 4.75 mm):	36.7
% Silt (5 µm to 75 µm):	27.6
% Clay (<5 µm):	30.1
SUSCEPTIBILITY TO FROST HEAVING:	Low

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53.0	100.0	0.037	51.5
37.5	100.0	0.026	47.8
26.5	100.0	0.017	43.0
19.0	100.0	0.010	37.9
13.2	100.0	0.007	34.3
9.5	98.5	0.005	30.1
4.75	94.4	0.003	23.3
2.36	87.3	0.001	9.1
1.18	78.9	ATTERBERG LIMITS, %	
0.60	71.9		
0.30	66.9	Plastic Limit	16.0
0.15	62.2	Liquid Limit	26.9
0.075	57.7	Plastic Index	10.9

PARTICLE SIZE DISTRIBUTION, MTO LS-702



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

PROJECT: 02111839.024 CLIENT/JOB NAME: Region of Peel CONTRACT NUMBER: -

ROS ID: 111190 PROJECT/LOCATION: Kirwin Avenue, Mississauga

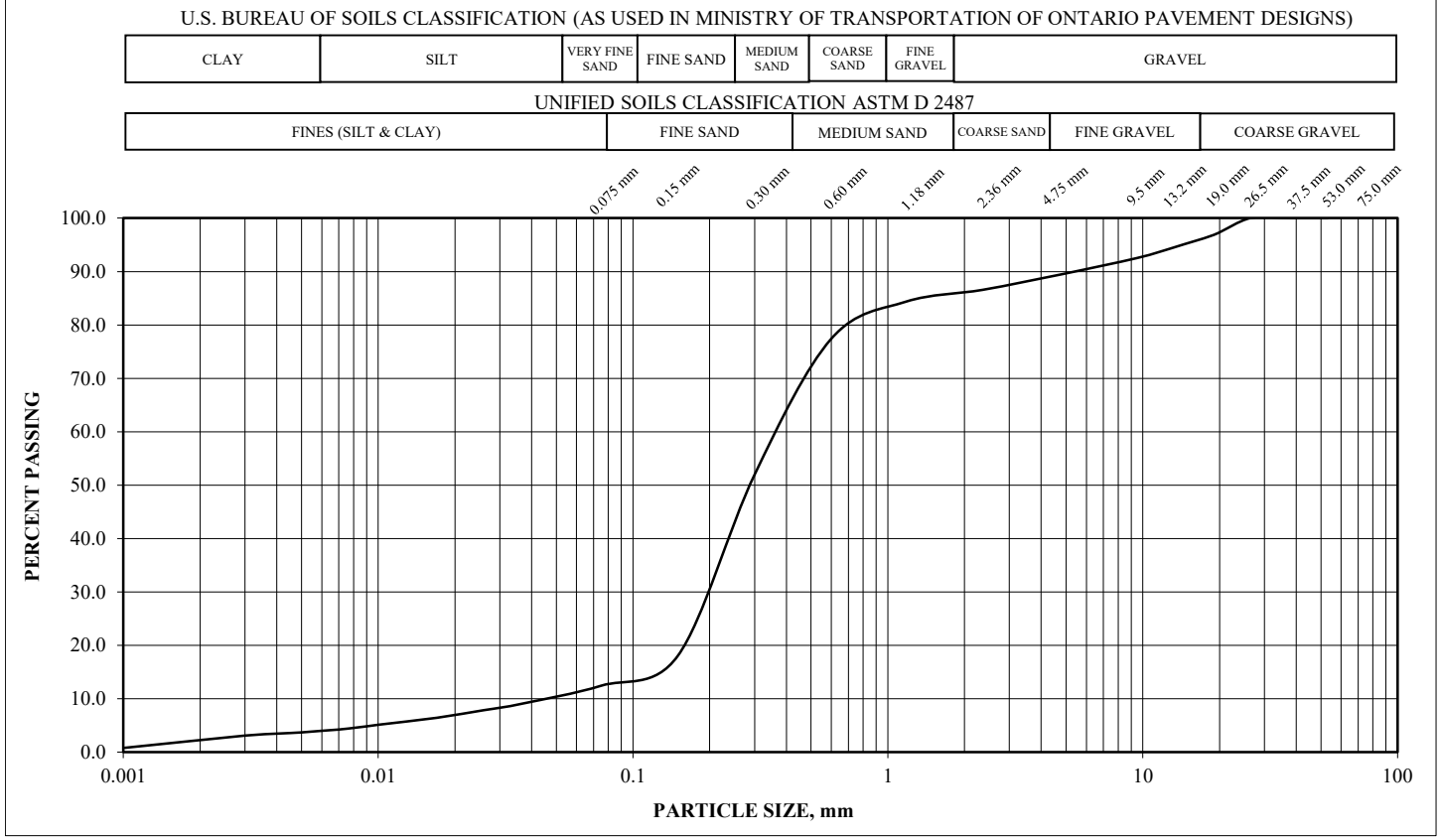
SAMPLING LOCATION:	BH10_SS2
SAMPLING DEPTH, m	-
SAMPLING METHOD:	Split Spoon
SAMPLED BY:	SA, Englobe
SAMPLE DESCRIPTION:	SANDY / with Gravel, trace Silt trace Clay
SAMPLING DATE:	2023-12-12
SAMPLE RECEIVED DATE:	2023-12-13

GRAIN SIZE PROPORTIONS, %

% GRAVEL (> 4.75 mm):	10.6
% SAND (75 µm to 4.75 mm):	77.0
% Silt (5 µm to 75 µm):	8.7
% Clay (<5 µm):	3.7
SUSCEPTIBILITY TO FROST HEAVING:	Low

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53.0	100.0	0.037	9.1
37.5	100.0	0.026	7.9
26.5	100.0	0.017	6.5
19.0	96.9	0.010	5.1
13.2	94.5	0.007	4.3
9.5	92.5	0.005	3.7
4.75	89.4	0.003	3.1
2.36	86.6	0.001	0.8
1.18	84.3	ATTERBERG LIMITS, %	
0.60	77.4		
0.30	52.0	Plastic Limit	
0.15	18.0	Liquid Limit	
0.075	12.4	Plastic Index	

PARTICLE SIZE DISTRIBUTION, MTO LS-702



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

PROJECT: 02111839.024 CLIENT/JOB NAME: Region of Peel CONTRACT NUMBER: -

ROS ID: 111190 PROJECT/LOCATION: Kirwin Avenue, Mississauga

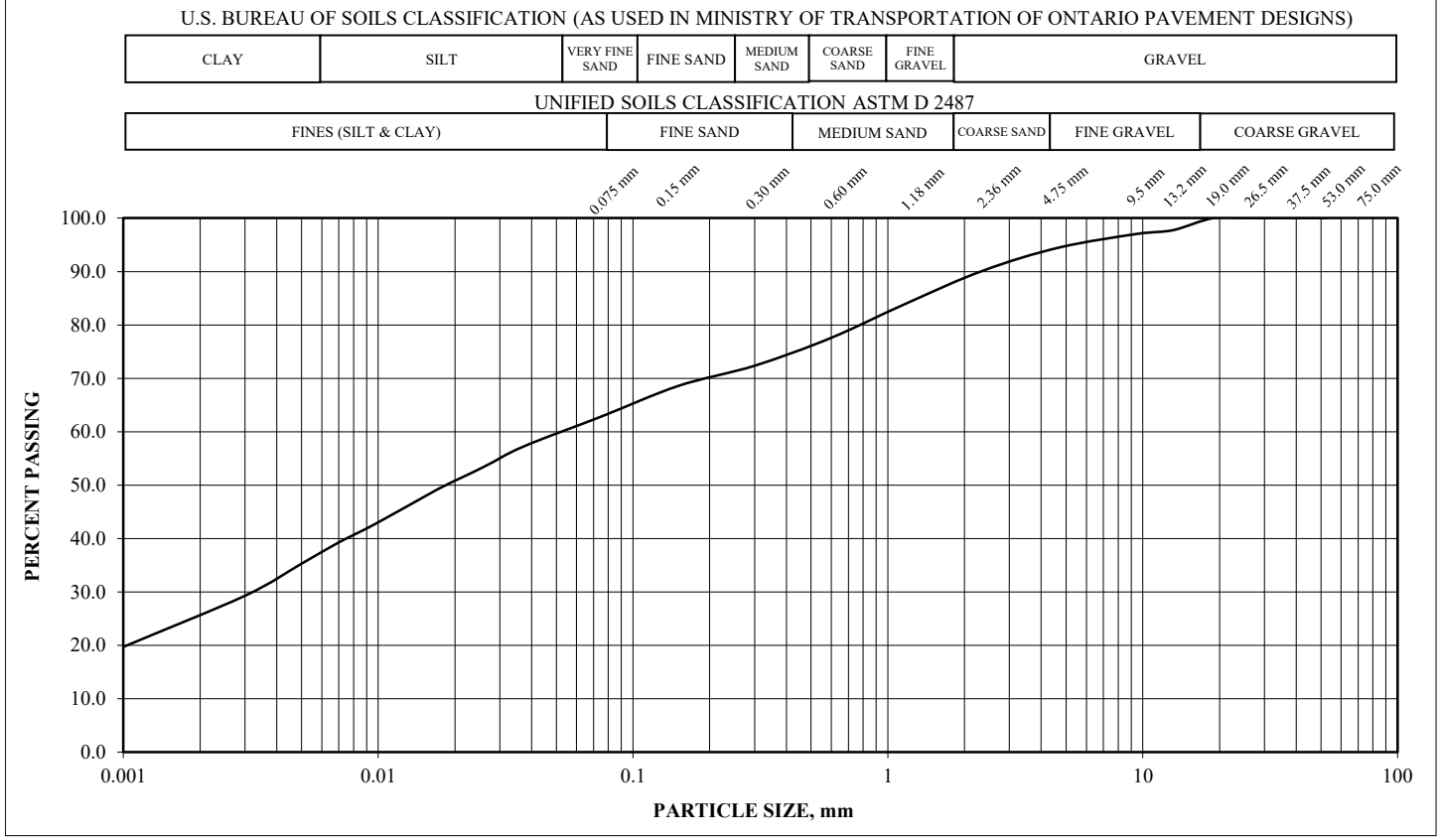
SAMPLING LOCATION:	BH13_SS5
SAMPLING DEPTH, m	-
SAMPLING METHOD:	Split Spoon
SAMPLED BY:	SA, Englobe
SAMPLE DESCRIPTION:	Sandy Silty Clay trace Gravel
SAMPLING DATE:	2023-12-12
SAMPLE RECEIVED DATE:	2023-12-13

GRAIN SIZE PROPORTIONS, %

% GRAVEL (> 4.75 mm):	5.5
% SAND (75 µm to 4.75 mm):	31.7
% Silt (5 µm to 75 µm):	27.5
% Clay (<5 µm):	35.3
SUSCEPTIBILITY TO FROST HEAVING:	Low

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53.0	100.0	0.037	57.2
37.5	100.0	0.026	53.4
26.5	100.0	0.017	49.1
19.0	100.0	0.010	43.0
13.2	97.8	0.007	39.3
9.5	97.0	0.005	35.3
4.75	94.5	0.003	29.3
2.36	90.1	0.001	19.7
1.18	84.0	ATTERBERG LIMITS, %	
0.60	77.6		
0.30	72.4	Plastic Limit	16.4
0.15	68.5	Liquid Limit	30.3
0.075	62.8	Plastic Index	13.9

PARTICLE SIZE DISTRIBUTION, MTO LS-702



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

PROJECT: 02111839.024 CLIENT/JOB NAME: Region of Peel CONTRACT NUMBER: -

ROS ID: 111159 PROJECT/LOCATION: Kirwin Avenue, Mississauga

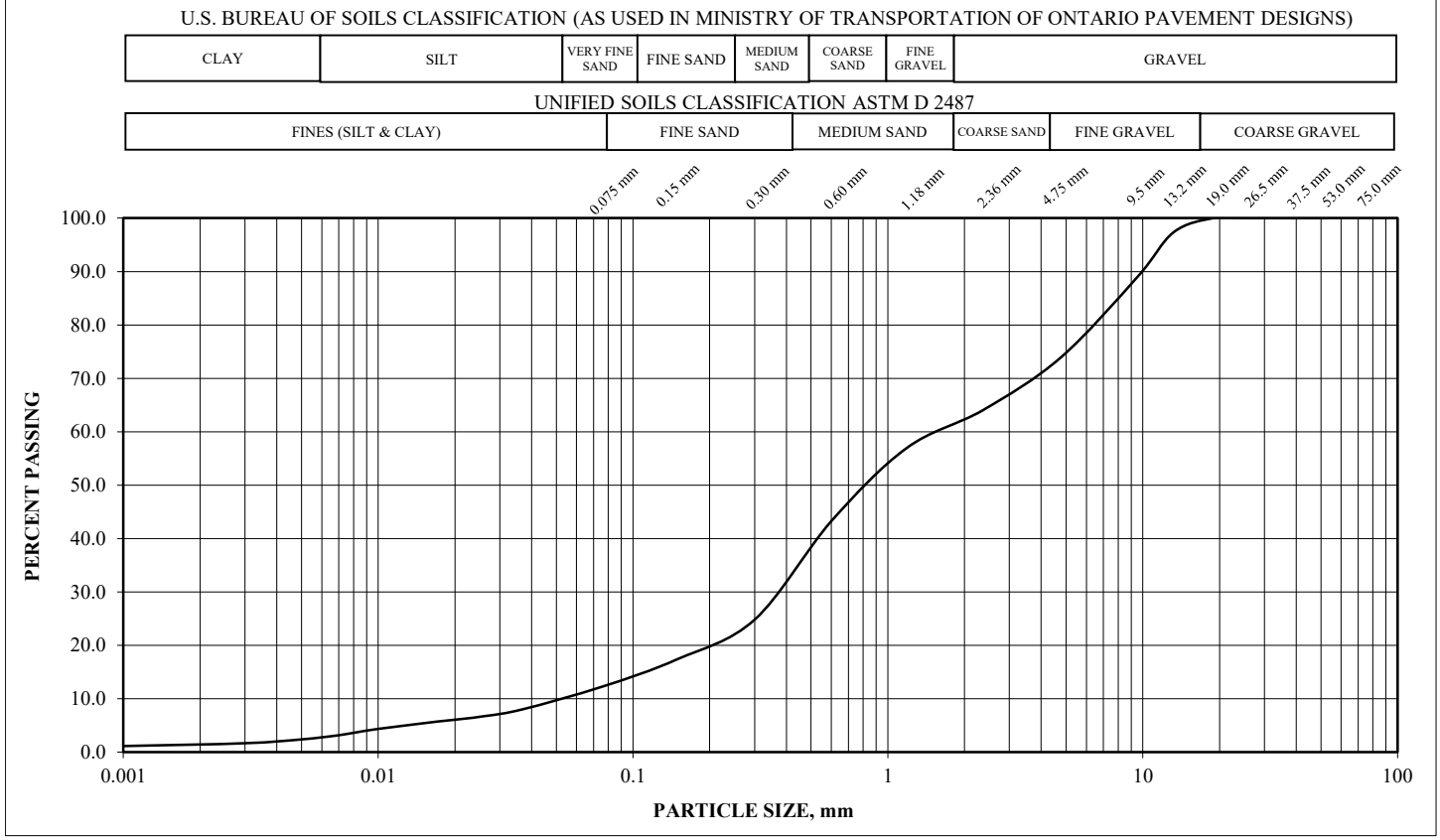
SAMPLING LOCATION:	BH14_SS3
SAMPLING DEPTH, m	-
SAMPLING METHOD:	Split Spoon
SAMPLED BY:	SA, Englobe
SAMPLE DESCRIPTION:	Gravelly Sandy, trace Silt, trace Clay
SAMPLING DATE:	2023-12-11
SAMPLE RECEIVED DATE:	2023-12-13

GRAIN SIZE PROPORTIONS, %

% GRAVEL (> 4.75 mm):	26.2
% SAND (75 µm to 4.75 mm):	61.6
% Silt (5 µm to 75 µm):	9.8
% Clay (<5 µm):	2.4
SUSCEPTIBILITY TO FROST HEAVING:	Low

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53.0	100.0	0.037	8.0
37.5	100.0	0.026	6.7
26.5	100.0	0.017	5.7
19.0	100.0	0.010	4.4
13.2	97.3	0.007	3.2
9.5	88.9	0.005	2.4
4.75	73.8	0.003	1.7
2.36	64.0	0.001	1.1
1.18	56.9	ATTERBERG LIMITS, %	
0.60	43.2		
0.30	24.8	Plastic Limit	
0.15	17.4	Liquid Limit	
0.075	12.2	Plastic Index	Non- plastic

PARTICLE SIZE DISTRIBUTION, MTO LS-702



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

PROJECT: 02111839.024 CLIENT/JOB NAME: Region of Peel CONTRACT NUMBER: -

ROS ID: 111159 PROJECT/LOCATION: Kirwin Avenue, Mississauga

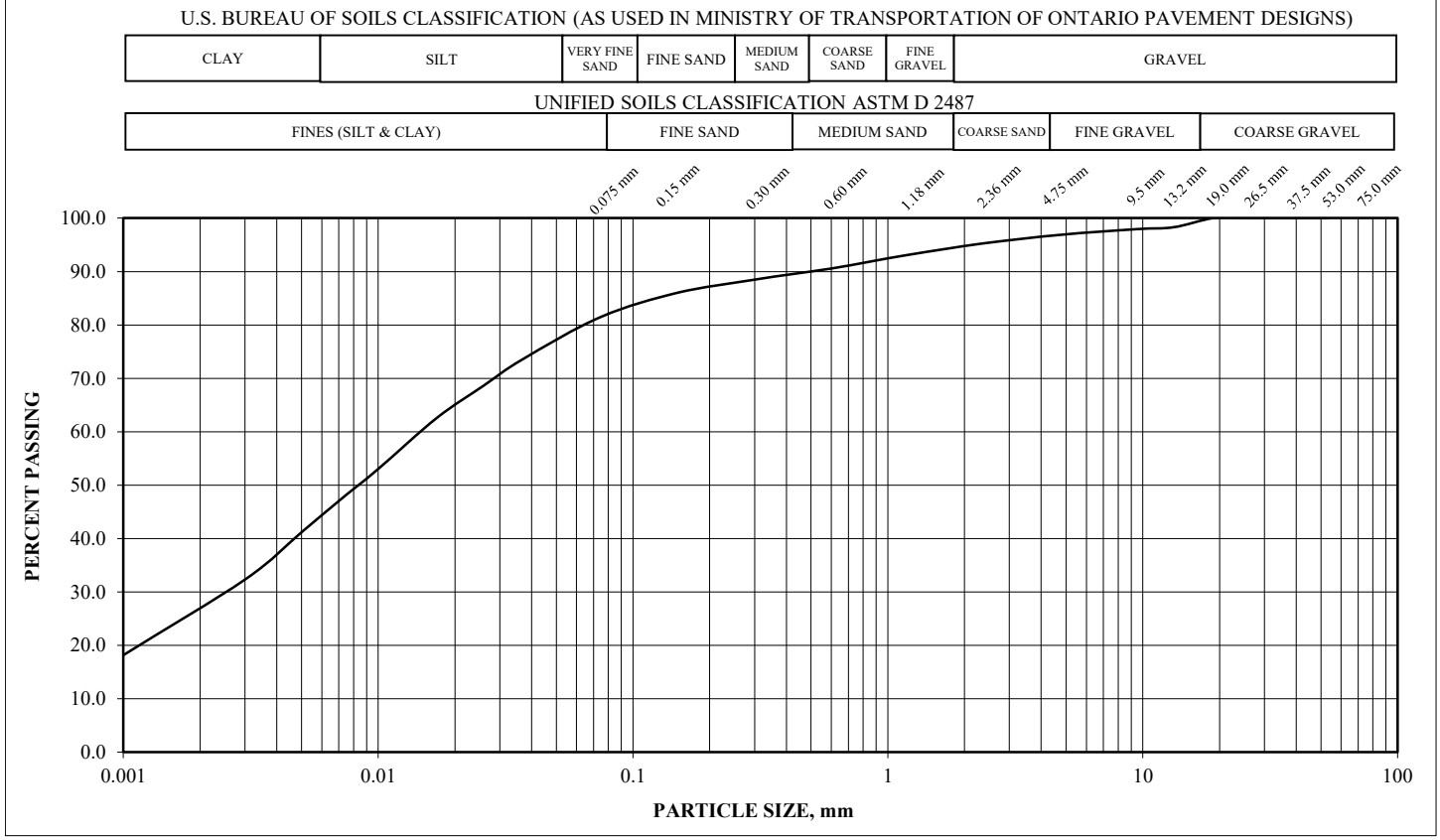
SAMPLING LOCATION:	BH15_SS6
SAMPLING DEPTH, m	-
SAMPLING METHOD:	Split Spoon
SAMPLED BY:	SA, Englobe
SAMPLE DESCRIPTION:	Silty Clay with Sand, trace Gravel
SAMPLING DATE:	2023-12-11
SAMPLE RECEIVED DATE:	2023-12-13

GRAIN SIZE PROPORTIONS, %

% GRAVEL (> 4.75 mm):	3.1
% SAND (75 µm to 4.75 mm):	15.3
% Silt (5 µm to 75 µm):	40.4
% Clay (<5 µm):	41.2
SUSCEPTIBILITY TO FROST HEAVING:	Moderate

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53.0	100.0	0.037	73.6
37.5	100.0	0.026	68.7
26.5	100.0	0.017	62.6
19.0	100.0	0.010	53.0
13.2	98.3	0.007	47.0
9.5	97.9	0.005	41.2
4.75	96.9	0.003	32.3
2.36	95.2	0.001	18.2
1.18	93.0	ATTERBERG LIMITS, %	
0.60	90.6		
0.30	88.5	Plastic Limit	14.2
0.15	86.0	Liquid Limit	26.8
0.075	81.5	Plastic Index	12.6

PARTICLE SIZE DISTRIBUTION, MTO LS-702



Appendix D
Corrosivity Testing Results

ENGLOBE

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CERTIFICATE OF ANALYSIS (GUIDELINE EVALUATION)

Work Order	: **WT2340486**	Page	: 1 of 4
Client	: **Englobe Corp.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Houshang Akbari	Account Manager	: Emily Smith
Address	: 1821 Albion Road, Unit #7 Toronto ON Canada M9W 5W8	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: ----	Telephone	: +1 519 886 6910
Project	: 2111839.024- KIRWIN AVE.	Date Samples Received	: 13-Dec-2023 14:25
PO	: 60635	Date Analysis Commenced	: 14-Dec-2023
C-O-C number	: ----	Issue Date	: 18-Dec-2023 16:41
Sampler	: CLIENT		
Site	: ----		
Quote number	: Peel - 2021-484P (Q87850)		
No. of samples received	: 15		
No. of samples analysed	: 15		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Guideline Comparison

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Josphin Masihi	Analyst	Centralized Prep, Waterloo, Ontario
Nik Perkio	Inorganics Analyst	Inorganics, Waterloo, Ontario

No Breaches Found

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.
Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guidelines are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Key : LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
mg/kg	milligrams per kilogram

>: greater than.
<: less than.
Red shading is applied where the result or the LOR is greater than the Guideline Upper Limit (or lower than the Guideline Lower Limit, if applicable).
For drinking water samples, Red shading is applied where the result for E.coli, fecal or total coliforms is greater than or equal to the Guideline Upper Limit.

Analytical Results Evaluation

Matrix: **Soil/Solid**

Analyte	CAS Number	Method/Lab	Unit	Client sample ID	BH1-SS5	BH2-SS5	BH3-SS3	BH4-SS3	BH5-SS5	BH6-SS4	BH7-SS4
				Sampling date/time	08-Dec-2023 00:00	08-Dec-2023 00:00	08-Dec-2023 00:00	08-Dec-2023 00:00	11-Dec-2023 00:00	11-Dec-2023 00:00	11-Dec-2023 00:00
				Sub-Matrix	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
					WT2340486-001	WT2340486-002	WT2340486-003	WT2340486-004	WT2340486-005	WT2340486-006	WT2340486-007
Physical Tests											
Moisture	----	E144/WT	%		5.62	4.51	5.51	7.36	10.4	10.8	11.4
Leachable Anions & Nutrients											
Chloride, leachable	16887-00-6	E235.Cl/WT	mg/kg		124	338	198	64.9	789	690	899
Sulfate, leachable	14808-79-8	E235.SO4/WT	mg/kg		43	<11	12	11	<11	<11	<11

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results Evaluation

Matrix: **Soil/Solid**

Analyte	CAS Number	Method/Lab	Unit	Client sample ID	BH8-SS4	BH9-SS4	BH10-SS5	BH11-SS4	BH12-SS3	BH13-SS4	BH14-SS4
				Sampling date/time	12-Dec-2023 00:00	12-Dec-2023 00:00	12-Dec-2023 00:00	12-Dec-2023 00:00	12-Dec-2023 00:00	12-Dec-2023 00:00	11-Dec-2023 00:00
				Sub-Matrix	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
					WT2340486-008	WT2340486-009	WT2340486-010	WT2340486-011	WT2340486-012	WT2340486-013	WT2340486-014
Physical Tests											
Moisture	----	E144/WT	%		4.96	13.0	12.8	4.61	6.89	2.99	12.4
Leachable Anions & Nutrients											
Chloride, leachable	16887-00-6	E235.Cl/WT	mg/kg		311	27.0	139	230	378	185	354
Sulfate, leachable	14808-79-8	E235.SO4/WT	mg/kg		19	<11	34	15	56	<10	30

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results Evaluation

Matrix: **Soil/Solid**

Analyte	CAS Number	Method/Lab	Unit	Client sample ID						
				BH15-SS4	**----**	**----**	**----**	**----**	**----**	**----**
				Sampling date/time	11-Dec-2023 00:00	----	----	----	----	----	----
				Sub-Matrix	Soil/Solid	----	----	----	----	----	----
				WT2340486-015	--------	--------	--------	--------	--------	--------
Physical Tests										
Moisture	----	E144/WT	%	6.56	----	----	----	----	----	----
Leachable Anions & Nutrients										
Chloride, leachable	16887-00-6	E235.Cl/WT	mg/kg	520	----	----	----	----	----	----
Sulfate, leachable	14808-79-8	E235.SO4/WT	mg/kg	<11	----	----	----	----	----	----

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Key:

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QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WT2340486**	Page	: 1 of 10
Client	: **Englobe Corp.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Houshang Akbari	Account Manager	: Emily Smith
Address	: 1821 Albion Road, Unit #7 Toronto ON Canada M9W 5W8	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: ----	Telephone	: +1 519 886 6910
Project	: 2111839.024- KIRWIN AVE.	Date Samples Received	: 13-Dec-2023 14:25
PO	: 60635	Issue Date	: 18-Dec-2023 16:49
C-O-C number	: ----		
Sampler	: CLIENT		
Site	: ----		
Quote number	: Peel - 2021-484P (Q87850)		
No. of samples received	: 15		
No. of samples analysed	: 15		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Anions & Nutrients : Leachable Chloride in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH10-SS5	E235.Cl	12-Dec-2023	14-Dec-2023	30 days	3 days	✓	15-Dec-2023	30 days	4 days	✓
Leachable Anions & Nutrients : Leachable Chloride in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH11-SS4	E235.Cl	12-Dec-2023	14-Dec-2023	30 days	3 days	✓	15-Dec-2023	30 days	4 days	✓
Leachable Anions & Nutrients : Leachable Chloride in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH12-SS3	E235.Cl	12-Dec-2023	14-Dec-2023	30 days	3 days	✓	15-Dec-2023	30 days	4 days	✓
Leachable Anions & Nutrients : Leachable Chloride in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH13-SS4	E235.Cl	12-Dec-2023	14-Dec-2023	30 days	3 days	✓	15-Dec-2023	30 days	4 days	✓
Leachable Anions & Nutrients : Leachable Chloride in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH8-SS4	E235.Cl	12-Dec-2023	14-Dec-2023	30 days	3 days	✓	15-Dec-2023	30 days	4 days	✓
Leachable Anions & Nutrients : Leachable Chloride in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH9-SS4	E235.Cl	12-Dec-2023	14-Dec-2023	30 days	3 days	✓	15-Dec-2023	30 days	4 days	✓
Leachable Anions & Nutrients : Leachable Chloride in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH14-SS4	E235.Cl	11-Dec-2023	14-Dec-2023	30 days	4 days	✓	15-Dec-2023	30 days	5 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Anions & Nutrients : Leachable Chloride in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH15-SS4	E235.Cl	11-Dec-2023	14-Dec-2023	30 days	4 days	✓	15-Dec-2023	30 days	5 days	✓
Leachable Anions & Nutrients : Leachable Chloride in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH5-SS5	E235.Cl	11-Dec-2023	14-Dec-2023	30 days	4 days	✓	15-Dec-2023	30 days	5 days	✓
Leachable Anions & Nutrients : Leachable Chloride in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH6-SS4	E235.Cl	11-Dec-2023	14-Dec-2023	30 days	4 days	✓	15-Dec-2023	30 days	5 days	✓
Leachable Anions & Nutrients : Leachable Chloride in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH7-SS4	E235.Cl	11-Dec-2023	14-Dec-2023	30 days	4 days	✓	15-Dec-2023	30 days	5 days	✓
Leachable Anions & Nutrients : Leachable Chloride in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH1-SS5	E235.Cl	08-Dec-2023	14-Dec-2023	30 days	7 days	✓	15-Dec-2023	30 days	8 days	✓
Leachable Anions & Nutrients : Leachable Chloride in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH2-SS5	E235.Cl	08-Dec-2023	14-Dec-2023	30 days	7 days	✓	15-Dec-2023	30 days	8 days	✓
Leachable Anions & Nutrients : Leachable Chloride in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH3-SS3	E235.Cl	08-Dec-2023	14-Dec-2023	30 days	7 days	✓	15-Dec-2023	30 days	8 days	✓
Leachable Anions & Nutrients : Leachable Chloride in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH4-SS3	E235.Cl	08-Dec-2023	14-Dec-2023	30 days	7 days	✓	15-Dec-2023	30 days	8 days	✓
Leachable Anions & Nutrients : Leachable Sulfate in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH10-SS5	E235.SO4	12-Dec-2023	14-Dec-2023	28 days	3 days	✓	15-Dec-2023	28 days	4 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Anions & Nutrients : Leachable Sulfate in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH11-SS4	E235.SO4	12-Dec-2023	14-Dec-2023	28 days	3 days	✓	15-Dec-2023	28 days	4 days	✓
Leachable Anions & Nutrients : Leachable Sulfate in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH12-SS3	E235.SO4	12-Dec-2023	14-Dec-2023	28 days	3 days	✓	15-Dec-2023	28 days	4 days	✓
Leachable Anions & Nutrients : Leachable Sulfate in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH13-SS4	E235.SO4	12-Dec-2023	14-Dec-2023	28 days	3 days	✓	15-Dec-2023	28 days	4 days	✓
Leachable Anions & Nutrients : Leachable Sulfate in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH8-SS4	E235.SO4	12-Dec-2023	14-Dec-2023	28 days	3 days	✓	15-Dec-2023	28 days	4 days	✓
Leachable Anions & Nutrients : Leachable Sulfate in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH9-SS4	E235.SO4	12-Dec-2023	14-Dec-2023	28 days	3 days	✓	15-Dec-2023	28 days	4 days	✓
Leachable Anions & Nutrients : Leachable Sulfate in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH14-SS4	E235.SO4	11-Dec-2023	14-Dec-2023	28 days	4 days	✓	15-Dec-2023	28 days	5 days	✓
Leachable Anions & Nutrients : Leachable Sulfate in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH15-SS4	E235.SO4	11-Dec-2023	14-Dec-2023	28 days	4 days	✓	15-Dec-2023	28 days	5 days	✓
Leachable Anions & Nutrients : Leachable Sulfate in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH5-SS5	E235.SO4	11-Dec-2023	14-Dec-2023	28 days	4 days	✓	15-Dec-2023	28 days	5 days	✓
Leachable Anions & Nutrients : Leachable Sulfate in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH6-SS4	E235.SO4	11-Dec-2023	14-Dec-2023	28 days	4 days	✓	15-Dec-2023	28 days	5 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Anions & Nutrients : Leachable Sulfate in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH7-SS4	E235.SO4	11-Dec-2023	14-Dec-2023	28 days	4 days	✓	15-Dec-2023	28 days	5 days	✓
Leachable Anions & Nutrients : Leachable Sulfate in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH1-SS5	E235.SO4	08-Dec-2023	14-Dec-2023	28 days	7 days	✓	15-Dec-2023	28 days	8 days	✓
Leachable Anions & Nutrients : Leachable Sulfate in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH2-SS5	E235.SO4	08-Dec-2023	14-Dec-2023	28 days	7 days	✓	15-Dec-2023	28 days	8 days	✓
Leachable Anions & Nutrients : Leachable Sulfate in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH3-SS3	E235.SO4	08-Dec-2023	14-Dec-2023	28 days	7 days	✓	15-Dec-2023	28 days	8 days	✓
Leachable Anions & Nutrients : Leachable Sulfate in Soil/Solid by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH4-SS3	E235.SO4	08-Dec-2023	14-Dec-2023	28 days	7 days	✓	15-Dec-2023	28 days	8 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH10-SS5	E144	12-Dec-2023	----	----	----		16-Dec-2023	----	4 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH11-SS4	E144	12-Dec-2023	----	----	----		16-Dec-2023	----	4 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH12-SS3	E144	12-Dec-2023	----	----	----		16-Dec-2023	----	4 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH13-SS4	E144	12-Dec-2023	----	----	----		16-Dec-2023	----	4 days	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH8-SS4	E144	12-Dec-2023	----	----	----		16-Dec-2023	----	4 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH9-SS4	E144	12-Dec-2023	----	----	----		16-Dec-2023	----	4 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH14-SS4	E144	11-Dec-2023	----	----	----		16-Dec-2023	----	5 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH15-SS4	E144	11-Dec-2023	----	----	----		16-Dec-2023	----	5 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH5-SS5	E144	11-Dec-2023	----	----	----		16-Dec-2023	----	5 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH6-SS4	E144	11-Dec-2023	----	----	----		16-Dec-2023	----	5 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH7-SS4	E144	11-Dec-2023	----	----	----		16-Dec-2023	----	5 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH1-SS5	E144	08-Dec-2023	----	----	----		16-Dec-2023	----	8 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH2-SS5	E144	08-Dec-2023	----	----	----		16-Dec-2023	----	8 days	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
			Preparation Date	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH3-SS3	E144	08-Dec-2023	----	----	----		16-Dec-2023	----	8 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH4-SS3	E144	08-Dec-2023	----	----	----		16-Dec-2023	----	8 days	

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Leachable Chloride in Soil/Solid by IC	E235.Cl	1276871	1	15	6.6	5.0	✓
Leachable Sulfate in Soil/Solid by IC	E235.SO4	1276872	1	15	6.6	5.0	✓
Moisture Content by Gravimetry	E144	1279653	1	18	5.5	5.0	✓
Laboratory Control Samples (LCS)							
Leachable Chloride in Soil/Solid by IC	E235.Cl	1276871	2	15	13.3	10.0	✓
Leachable Sulfate in Soil/Solid by IC	E235.SO4	1276872	2	15	13.3	10.0	✓
Moisture Content by Gravimetry	E144	1279653	1	18	5.5	5.0	✓
Method Blanks (MB)							
Leachable Chloride in Soil/Solid by IC	E235.Cl	1276871	1	15	6.6	5.0	✓
Leachable Sulfate in Soil/Solid by IC	E235.SO4	1276872	1	15	6.6	5.0	✓
Moisture Content by Gravimetry	E144	1279653	1	18	5.5	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Moisture Content by Gravimetry	E144 ALS Environmental - Waterloo	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Leachable Chloride in Soil/Solid by IC	E235.Cl ALS Environmental - Waterloo	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection using a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Anions are measured in the fluid that is observed in the upper layer.
Leachable Sulfate in Soil/Solid by IC	E235.SO4 ALS Environmental - Waterloo	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection using a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Anions are measured in the fluid that is observed in the upper layer.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach for Metals and Anions	EP441 ALS Environmental - Waterloo	Soil/Solid	In-House	This analysis is carried out using a leaching procedure which involves the gentle tumbling of the sample in a specified leaching solution (typically deionized water) for a specific length of time.

QUALITY CONTROL REPORT

Work Order	: **WT2340486**	Page	: 1 of 4
Client	: Englobe Corp.	Laboratory	: ALS Environmental - Waterloo
Contact	: Houshang Akbari	Account Manager	: Emily Smith
Address	: 1821 Albion Road, Unit #7 Toronto ON Canada M9W 5W8	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	:	Telephone	: +1 519 886 6910
Project	: 2111839.024- KIRWIN AVE.	Date Samples Received	: 13-Dec-2023 14:25
PO	: 60635	Date Analysis Commenced	: 14-Dec-2023
C-O-C number	: ----	Issue Date	: 18-Dec-2023 16:42
Sampler	: CLIENT ----		
Site	: ----		
Quote number	: Peel - 2021-484P (Q87850)		
No. of samples received	: 15		
No. of samples analysed	: 15		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Josphin Masihi	Analyst	Waterloo Centralized Prep, Waterloo, Ontario
Nik Perkio	Inorganics Analyst	Waterloo Inorganics, Waterloo, Ontario

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 1279653)											
WT2340486-001	BH1-SS5	Moisture	----	E144	0.25	%	5.62	5.98	6.23%	20%	----
Leachable Anions & Nutrients (QC Lot: 1276871)											
WT2340486-001	BH1-SS5	Chloride, leachable	16887-00-6	E235.Cl	5.4	mg/kg	124	137	9.54%	30%	----
Leachable Anions & Nutrients (QC Lot: 1276872)											
WT2340486-001	BH1-SS5	Sulfate, leachable	14808-79-8	E235.SO4	11	mg/kg	43	42	0.6	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 1279653)						
Moisture	----	E144	0.25	%	<0.25	----
Leachable Anions & Nutrients (QCLot: 1276871)						
Chloride, leachable	16887-00-6	E235.Cl	5	mg/kg	<5.0	----
Leachable Anions & Nutrients (QCLot: 1276872)						
Sulfate, leachable	14808-79-8	E235.SO4	10	mg/kg	<10	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 1279653)									
Moisture	----	E144	0.25	%	50 %	100	90.0	110	----
Leachable Anions & Nutrients (QCLot: 1276871)									
Chloride, leachable	16887-00-6	E235.Cl	5	mg/kg	500 mg/kg	98.7	80.0	120	----
Leachable Anions & Nutrients (QCLot: 1276872)									
Sulfate, leachable	14808-79-8	E235.SO4	10	mg/kg	500 mg/kg	97.5	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

Reference Material (RM) Report								
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method					
Leachable Anions & Nutrients (QCLot: 1276871)									
	RM	Chloride, leachable	16887-00-6	E235.Cl	432 mg/kg	97.8	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1276872)									
	RM	Sulfate, leachable	14808-79-8	E235.SO4	1070 mg/kg	106	70.0	130	----

Chain of Custody (COC) / Analytical Request Form

COC Number: 20 -

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Environmental Division
Waterloo
Work Order Reference
WT2340486

Telephone : +1 519 886 6910

Report To	Contact and company name below will appear on the final report
Company:	Englobe Corp.
Contact:	Houshang Akbari
Phone:	416 206 0319
	Company address below will appear on the final report
Street:	1821 Albion Rd. Unit 7, Toronto
City/Province:	Etobicoke/ON
Postal Code:	M9W 5W8
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	Englobe Corp.
Contact:	Houshang Akbari

Reports / Recipients	
Select Report Format:	☑ PDF ☐ EXCEL ☐ EDD (DIGITAL)
Merge QC/QCI Reports with COA	☐ YES ☐ NO ☐ N/A
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	houshang.akbari@englobecorp.com
Email 2	
Email 3	

Invoice Recipients	
Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	
Email 2	

Turnaround Time (TAT) Requested
☑ Routine [R] if received by 3pm M-F - no surcharges apply
☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum
☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum
☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum
☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum
☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. Addi fees may apply to rush requests on weekends, statutory holidays and n routine tests
Date and Time Required for all E&P TATs:
For all tests with rush TATs requested, please conta

Project Information	
ALS Account # / Quote #:	Q87850
Job #:	2111839.024 - Kirwin Ave.
PO / AFE:	60635
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (ALS use only):	ALS Contact:	Sampler:

Analysis Reque

Indicate Filtered (F), Preserved (P) or Filtered and P

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Sulphate & Chloride	PHC / BTEX	VOCs	PAHs	PCBs	mSPLP (Metals&Inorganics, VOCs)									SAMPLES ON HOL	EXTENDED STORAGE R	SUSPECTED HAZARD (s
	BH1-SS5	8-Dec-23		Soil	1	R																
	BH2-SS5	8-Dec-23		Soil	1	R																
	BH3-SS3	8-Dec-23		Soil	1	R																
	BH4-SS3	8-Dec-23		Soil	1	R																
	BH5-SS5	11-Dec-23		Soil	1	R																
	BH6-SS4	11-Dec-23		Soil	1	R																
	BH7-SS4	11-Dec-23		Soil	1	R																
	BH8-SS4	12-Dec-23		Soil	1	R																
	BH9-SS4	12-Dec-23		Soil	1	R																
	BH10-SS5	12-Dec-23		Soil	1	R																
	BH11-SS4	12-Dec-23		Soil	1	R																
	BH12-SS3	12-Dec-23		Soil	1	R																

Drinking Water (DW) Samples[1] (client use)	Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	
Are samples for human consumption/ use? ☐ YES ☐ NO	

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☐ ICE ☑ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
12-2	13.2	10.8	13-5, 11	8.6	9.1	4.4	9.1

SHIPMENT RELEASE (client use)		
Released by: Alfred Iskander	Date: 12/13/2023	Time:

INITIAL SHIPMENT RECEPTION (ALS use only)		
Received by: AM	Date: 12/13/2023	Time: 14:25

FINAL SHIPMENT RECEPTION (ALS use only)		
Received by:	Date: 13-Dec-23	Time: 16:00

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2020 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

SOL-175
SOL-#169 MT

Chain of Custody (COC) / Analytical Request Form

COC Number: 20 -

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Report To	Contact and company name below will appear on the final report
Company:	Englobe Corp.
Contact:	Houshang Akbari
Phone:	416 206 0319
	Company address below will appear on the final report
Street:	1821 Albion Rd. Unit 7, Toronto
City/Province:	Etobicoke/ON
Postal Code:	M9W 5W8
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	Englobe Corp.
Contact:	Houshang Akbari

Reports / Recipients

Select Report Format: ☑ PDF ☐ EXCEL ☐ EDD (DIGITAL)

Merge QC/QCI Reports with COA ☐ YES ☐ NO ☐ N/A

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax houshang.akbari@englobecorp.com

Email 2

Email 3

Invoice Recipients

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax

Email 2

Turnaround Time (TAT) Requested

☑ Routine [R] if received by 3pm M-F - no surcharges apply

☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum

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☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum

☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. Additional fees may apply to rush requests on weekends, statutory holidays and non-routine tests

AFFIX ALS BARCODE LABEL HERE (ALS use only)

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm am/pm

For all tests with rush TATs requested, please contact your AM to confirm availability.

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	Q87850	AFE/Cost Center:	PO#
Job #:	2111839.024 - Kirwin Ave.	Major/Minor Code:	Routing Code:
PO / AFE:	60635	Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (ALS use only):		ALS Contact:	Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Sulphate & Chloride	PHC / BTEX	VOCs	PAHs	PCBs	mSPLP (Metals&Inorganics, VOCs)	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	BH13-SS4	12-Dec-23		Soil	1	R								
	BH14-SS4	11-Dec-23		Soil	1	R								
	BH15-SS4	11-Dec-23		Soil	1	R								

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☐ ICE ☑ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
12-2	13-2	10-8	13-5, 11	8-6			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (ALS use only)			FINAL SHIPMENT RECEPTION (ALS use only)		
Released by: Alfred Iskander	Date: 12/13/2023	Time:	Received by: AM	Date: 12/13/2023	Time: 14:25	Received by:	Date: 13-Dec-23	Time: 16:10

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

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