FINAL
PAVEMENT DESIGN REPORT
IMPROVEMENTS TO WILLIAMS PARKWAY
FROM NORTH PARK DRIVE TO TORBRAM ROAD
CITY OF BRAMPTON, ONTARIO
CITY OF BRAMPTON - RFP 2022-026

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1.0 GENERAL DATA

1.1 Terms of Reference

Terraprobe (an Englobe company) carried out the geotechnical investigation and pavement design for the preliminary design of this project as a sub-consultant to Parsons Inc. (Parsons). This project involves the rehabilitation of an approximately 3.6 km section of Williams Parkway to upgrade pavement service life. It is understood that platform widening will not be needed, and the current 4-lane cross-section will remain in place. Additionally, any necessary construction staging will be developed as part of the detailed design and is not a part of the present assignment.

This study includes geotechnical investigations and pavement design recommendations for the following project components:

- Rehabilitation of an approximately 3.6 km section of Williams Parkway between North Park Drive/Howden Blvd intersection and Torbram Road Intersection; and
- Construction of Multi-Use Path (MUP) on both sides of the road within the project limits.

1.2 Project Limits

Based on the provided information by Parsons, the west project limit is positioned at the North Park Drive/Howden Blvd intersection (Sta.0+000), and the east project limit terminates about 90 m east of the Torbram Road Intersection (Sta. 3+620). Refer to Figure 1 for a site location plan illustrating the project limits.

Based on the provided traffic volume and field investigation results of the existing pavement structure, the project has been divided into two sections for pavement analysis and design purposes. The sections and limits are listed in the below table.

Roadway Section	Limits		Length (km)
	From	To	
Williams Parkway EB/WB Section 1	From N Park Dr/Howden Blvd Intersection (Sta. 0+000)	Bramalea Road Intersection (Sta. 2+150)	2.15
Williams Parkway EB/WB Section 2	Bramalea Road Intersection (Sta. 2+150)	Torbram Road Intersection (Sta. 3+620)	1.47
Total Length (km)			3.62

For the purposes of this report, the Williams Parkway main lanes are described as Eastbound (EB) and Westbound (WB).

2.0 TRAFFIC VOLUMES

Traffic volumes were provided by Parsons through an email dated June 13, 2023. It should be noted that at the time of preparation of this report, AADT (Annual Average Daily Traffic) data was not available from the City. As such, AADT has to be estimated using the peak hour volumes from the traffic analysis

conducted by Parsons for the Williams Parkway EA. Based on the direction provided by Parsons, as a standard practice, AADT was estimated by multiplying the work peak hour volumes by 10 (for a conservative estimate. It should be noted that FHWA has a guideline that the peak hour design volume is usually 8-12% of the AADT, and 10% is typically accepted.

As part of the provided traffic data, existing (2022) and future (2031) Turning Movement Count (TMC) for AM/PM peak traffic volumes of the intersecting sideroads and Heavy Vehicle (HV) percentages have been reviewed and summarized to choose appropriate traffic volumes for Williams Parkway within the project limits.

The table below presents a summary of 2022 and 2031 highest PM peak traffic volumes on the westbound and eastbound directions of Williams Parkway, which were extrapolated from 2022 TMC and 2031 TMCs figures and AM/PM HV percentage of Parsons Traffic Study Report.

Road Component	**Williams Parkway EB**		**Williams Parkway WB**	
Traffic Data	**Section 1**	**Section 2**	**Section 1**	**Section 2**
Peak Traffic Volume Present 2022 (Segment from individual Section with maximum traffic volume)	984 – PM (Between Dixie Rd and Mansfield Str. W)	782 – PM (Between Bramalea Rd and Glenridge Rd)	1,479 – PM (Between Howden Blvd and Dixie Rd)	1,092 – PM (Between Bramalea Rd and Glenridge Rd)
Peak Traffic Volume Projected 2031 (Segment from individual Section with maximum traffic volume)	1,074 – PM (Between Dixie Rd and Mansfield Str. W)	854 – PM (Between Bramalea Rd and Glenridge Rd)	1,614 – PM (Between Howden Blvd and Dixie Rd)	1,188 – PM (Between Bramalea Rd and Glenridge Rd)
AADT* (2022)	9,840	7,820	14,790	10,920
Average PM/AM** Heavy Vehicle %	4%	4%	4%	4%
Annual Growth Rate ***	0.98%	0.98%	0.98%	0.98%

* AADT is estimated using the highest Peak Hour traffic volume 2022 PM and multiplying by 10.

** Ranging from 1% to 7% on AM and PM peak hours.

*** Annual Growth Rate was calculated from existing (2022) and projected (2031) traffic volumes.

3.0 PAVEMENT PERFORMANCE (EXISTING CONDITIONS)

A visual pavement condition evaluation of the existing pavement was carried out along both sections of Williams Parkway. The survey was conducted in accordance with the procedures outlined in MTO's *SP-024 Manual "Condition Rating of Flexible Pavement Distress* Manifestations" and the observed pavement distresses are summarized in the following table.

Section	**Typical Distresses**	**Pavement Condition**
Williams Parkway Section 1 EB Lanes	▪ Extensive to throughout slight to moderate ravelling/coarse aggregate loss; ▪ Frequent very slight to slight wheel track rutting; ▪ Frequent very slight to moderate wheel track cracking with occasional alligator cracking; ▪ Intermittent very slight to slight longitudinal centerline paving joint cracking; ▪ Intermittent very slight to slight pavement edge cracking; ▪ Intermittent to frequent very slight to moderate meander and midline cracking;	Fairly good

Section	Typical Distresses	Pavement Condition
	▪ Intermittent slight to moderate half, full and multiple transverse cracking; and ▪ Intermittent slight map cracking with depression.	
Williams Parkway Section 1 WB Lanes	▪ Extensive to throughout very slight to slight ravelling/coarse aggregate loss; ▪ Intermittent very slight to slight wheel track rutting; ▪ Intermittent very slight to moderate wheel track cracking with occasional alligator cracking; ▪ Frequent very slight longitudinal centerline cracking; ▪ Intermittent slight to moderate pavement edge cracking with alligator cracking; ▪ Few to intermittent very slight to slight meander and midline cracking; ▪ Intermittent slight to moderate half, full and multiple transverse cracking with occasional alligatoring; and ▪ Few slight map cracking with very slight depression.	Fair to good
Williams Parkway Section 2 EB Lanes	▪ Extensive slight ravelling and coarse aggregate loss with few patched potholes; ▪ Frequent very slight to moderate wheel track rutting; ▪ Frequent slight to moderate longitudinal wheel track cracking with alligator cracking; ▪ Extensive moderate longitudinal centerline cracking with occasional alligator cracking. Most of the longitudinal centerline cracking are routed and sealed; ▪ Frequent to extensive moderate to severe pavement edge cracking with slight to severe alligator cracking and depression; ▪ Intermittent to frequent very slight to moderate meander and midline cracking with few alligator cracking; ▪ Extensive to throughout slight to moderate half, full and multiple transverse cracking with intermittent alligator cracking; ▪ Intermittent slight map cracking with localized depression; ▪ Localized depression with alligator cracking around catch basin; and ▪ Few localized asphalt patches/HMA resurfacing.	Fair to Poor
Williams Parkway Section 2 WB Lanes	▪ Extensive slight ravelling and coarse aggregate loss with few patched potholes; ▪ Frequent very slight to severe wheel track rutting; ▪ Frequent slight to severe longitudinal wheel track cracking with alligator cracking; ▪ Extensive moderate longitudinal centerline cracking with occasional alligator cracking. Most of the longitudinal centerline cracking are routed and sealed; ▪ Frequent moderate to very severe pavement edge cracking with moderate to severe alligator cracking and depression; ▪ Frequent very slight to moderate meander and midline cracking with few alligator cracking; ▪ Extensive to throughout slight to moderate half, full and multiple transverse cracking with intermittent alligator cracking; ▪ Intermittent slight to severe map cracking with localized depression; ▪ Localized depression with alligator cracking around catch basin; and ▪ Few localized asphalt patches/HMA resurfacing.	Fair to Poor

The pavement surface drainage at the subject site appears to be in a satisfactory condition to provide adequate drainage. Observations along the roadway sections indicate that water on the pavement surface generally follows the existing pavement grades and is being directed to the concrete curb and gutter to catch basins. However, at some localized locations, the drainage is impaired by pavement surface distresses, along with unsealed/poorly sealed cracks/patched potholes, allowing surface water to infiltrate into the pavement, mostly near the catch basins and pavement edges in Section 2. The catch basins were observed to be in a fair condition (with cracking/depression noted around some catch basins).

The site photographs are included in Appendix C, showing the typical pavement distresses observed.

4.0 FIELD INVESTIGATIONS AND LABORATORY TESTING

4.1 Surveying

Stationing of the project was not staked out in the field. However, Terraprobe's staff collected GPS coordinates of all the boreholes and recorded positional data for each individual borehole provided in the Borehole Logs in Appendix A.

4.2 Fieldwork

The field investigations were carried out on September 14, 29 & 30 and also on October 3 to 7, 11 & 19, 2022, after clearing all underground utilities. The work was performed in accordance with the lane closure times specified by the City of Brampton and MTO Central Region Traffic Office requirements.

Truck and track-mounted drill rigs were used to drill the boreholes by a specialist drilling contractor who was observed on a full-time basis by members of Terraprobe's technical staff. Terraprobe's technical staff logged the boreholes and processed the recovered soil and granular samples for transport to Terraprobe's laboratory for further examination and testing. The subsurface stratigraphy and ground water conditions observed in the boreholes were logged and are presented in Appendix A. The locations of the boreholes are illustrated in Figure 2-1 through Figure 2-15. n.

Details of the field investigation are presented below.

- Borehole drilling and sampling through the existing lanes, boulevard areas/near to the existing sidewalk, as well as the Chinguacousy Trail, watercourse crossing locations (Etobicoke Creek and Torbram Road) of Williams Parkway in both directions. Samples of the underlying granular material and subgrade soils were collected during the field investigations. These samples were subjected to a detailed visual inspection, and selected samples were subjected to laboratory testing;
- Soil samples were obtained at regular intervals of depth as part of the Standard Penetration Test (SPT) procedure, and any shallow ground water conditions in the open boreholes were recorded during drilling.
- Installation of two water wells as part of the fieldwork; and
- Visual pavement condition evaluation of Williams Parkway within the project limits. Pavement general distresses were observed and summarized in Section 3.

Borehole and pavement core counts are summarized in the table below.

Feature	Location	Direction	No. of Boreholes	Maximum Borehole Depth (m)
Williams Parkway Pavement	North Park Drive to Torbram Rd	EB	18	2.0
		WB	14	2.0
Boulevard	North Park Drive to Torbram	EB/WB	30	3.7
Watercourse Crossings	Etobicoke Creek	4	4	10.7
	Torbram Road	4	4	7.7
Total			70	

4.3 Laboratory Testing

The following laboratory tests and/or examinations were carried out at Englobe's Brampton Laboratory:

- Moisture content (LS-701) of selected subgrade and soil samples; and
- Particle Size Analysis (LS-702 & 602) on the granular and soil samples.

All tests were completed in accordance with the materials testing requirements and procedures outlined in the Laboratory Testing Manual of the Ministry of Transportation. Laboratory test results are included in the borehole logs in Appendix A. The grain size distribution curves are presented in Appendix B.

5.0 SOIL AND PAVEMENT DATA

The soil and pavement conditions are briefly described below.

5.1 Williams Parkway Pavement Structure

The pavement structure of Williams Parkway eastbound and westbound is summarized in the following table.

Location	Section No.	Pavement Structure Layer Thickness (mm)		
		AC*	Granular	Total
Williams Parkway Eastbound	Section 1	150** (130 – 180)	455 (230 – 830)	605 (365 – 980)
	Section 2	145 (100 – 170)	445 (390 – 555)	590 (530 – 710)
Williams Parkway Westbound	Section 1	151 (140 – 185)	300 (195*** – 560)	550 (345 –700)
	Section 2	140 (120 – 160)	455 (355 – 575)	595 (485 – 695)

* AC: Asphaltic Concrete.

** 150(130-180) represents the average thickness and the minimum and maximum (within the brackets).

*** 195 mm granular base layer was observed in borehole BH P7. This thin outlier was not considered in the average thickness calculation.

**** Borehole BHP32 was advanced just east of Torbram Road intersection on WB LTL of Williams Parkway. 195 mm AC over 350 mm granular base/subbase material was observed. This data was not considered in the average thickness calculation.

5.2 Granular Material

One sample from combined granular base/subbase material was tested for grain size distribution. The testing was completed on borehole BH EC2 (Williams Parkway WB, curb lane). The results of grain size distribution conducted on the tested samples are shown in Figure B1 and Figure B2 in Appendix B.

The tested sample did not satisfy the current OPSS.MUNI 1010 gradation specification requirements for Granular A (too fine on all the sieve sizes). The tested sample also did not meet the OPSS.MUNI 1010 gradation specification for Granular B Type I (19 % passing on 75 µm sieve; too fine). The moisture content of the tested sample was 4 percent.

5.3 Subgrade Soil

The results of the borehole investigation indicate that the majority of the subgrade soils consist of a sandy silt to silt and clayey silt material within the project limits. Classification of the soil samples based on the laboratory testing carried out on 15 selected soil samples, as well as subgrade/subsurface soil conditions, are summarized in the below table.

Soil Type	Tested samples	Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Frost Susceptibility
Sandy Silt	9	37	39 - 54	12 - 18	6 - 30	LSFH to MSFH
Silty Sand to Sand and Silt	2	44 - 57	34 - 44	7 - 11	15 - 32	LSFH
Silt	3	12 - 20	43 - 56	12 - 15	11 - 25	LSFH to MSFH
Clayey Silt	1	24	48	27	19	LSFH

The results of particle size analysis conducted on the tested samples are shown in Figure B3 through Figure B11 in Appendix B. Based on the particle size analysis, the subgrade soils have a low to moderate frost susceptibility (LSFH to MSFH) with moist to wet conditions.

5.4 Ground Water Conditions

Two groundwater monitoring wells were installed at the locations of Borehole BH TC3 and BH EC1 as part of the investigation. The un-stabilized groundwater table was observed in the four boreholes (BH TC2, BH TC3, BH TC4 and BH EC4) at depths ranging from 4.0 to 5.6 mbgs (meter below ground surface).

The installed monitoring well in borehole BH EC1 was observed to be dry upon completion. The stabilized water table were recorded on February 5, 2024, for the both monitoring wells in order of 2.7 and 0.3 m in BH TC3 and BH EC1, respectively. The table below provides the depth of stabilized and un-stabilized groundwater tables. It should be noted that groundwater levels fluctuate seasonally and in response to weather conditions.

Borehole No.	Location	Condition	Water Level (mbgs)	Date	Soil type
BH TC2	Watercourse Crossing-Torbram Rd	Unstabilized / Upon Completion	4.0 m	October 3, 2022	Clayey Silt
BH TC3	Watercourse Crossing-Torbram Rd	Unstabilized / Upon Completion	5.6 m	September 14, 2022	Below the Silt soil in inferred Bedrock
		stabilized	2.7 m	February 5, 2024	Silt, Some sand, some gravel, some clay
BH TC4	Watercourse Crossing-Torbram Rd	Unstabilized / Upon Completion	3.7 m	September 15, 2022	Sandy Silt with rock fragments
BH EC4	Watercourse Crossing-	Unstabilized / Upon Completion	5.2 m	October 19, 2022	Sandy Silt some clay/Glacial Till

Borehole No.	Location	Condition	Water Level (mbgs)	Date	Soil type
	Etobicoke Creek				
BH EC1	Watercourse Crossing- Etobicoke Creek	Unstabilized / Upon Completion	Dry	October 19, 2022	Sandy Silt some clay/Glacial Till
		stabilized	0.3 m	February 5, 2024	Below the topsoil, sandy silt trace clay and rootlets

The majority of the subgrade soil samples recovered were in a dry to moist or damp state, however wet soils were observed in four locations. The table below provides the wet soil locations observed in four boreholes.

Borehole No.	Location	Observed Wet soil at completion of borehole Depth (m)	Soil type
BH EC1	Watercourse Crossing- Etobicoke Creek	Wet @ 0.8 – 2.0	Sandy Silt
BH EC4	Watercourse Crossing- Etobicoke Creek	Wet @ 0.7 – 3.2	Sandy Silt Some Clay
BH TC1	Watercourse Crossing- Torbram Rd	Wet @ 2.0 – 4.6	Sandy Silt to Silt
BH TC4	Watercourse Crossing- Torbram Rd	Wet @ 0. 2 – 2.7	Sandy Silt Some Clay

It should be noted that this observation refers to the seepage conditions in the boreholes at the time of auguring and is highly influenced by the prevailing weather. The local groundwater levels are expected to fluctuate, being higher during wet periods (i.e. spring thaw) and lower during the drier summer months.

5.5 Topsoil

Topsoil was observed within eastbound and westbound boulevard boreholes of Williams Parkway. The topsoil thickness along the eastbound boulevard area varies from 100 mm to 180 mm, with an average thickness of 145 mm. For the westbound boulevard area, the topsoil thickness also varies from 100 mm to 180 mm, with an average thickness of 140 mm.

5.6 Bedrock

Bedrock was observed at six locations. The table below provides the location and depth of inferred Bedrock.

Borehole No.	Location	Observed bedrock Depth from ground surface (m)
BH TC1	Watercourse Crossing-Torbram Rd	From 4.6 m to the bottom of the borehole (6.1 m)
BH TC2	Watercourse Crossing-Torbram Rd	From 5.3 m to the bottom of the borehole (6.9 m)
BH TC3	Watercourse Crossing-Torbram Rd	From 3.8 m to the bottom of the borehole (6.1 m)
BH TC4	Watercourse Crossing-Torbram Rd	From 5.3 m to the bottom of the borehole (7.7 m)
BH EC1	Watercourse Crossing-Etobicoke Creek	From 4.6 m to the bottom of the borehole (6.5 m)
BH EC2	Watercourse Crossing-Etobicoke Creek	From 9.1 m to the bottom of the borehole (10.7 m)

6.0 ALIGNMENT AND GRADELINE

As per information provided by Parsons, Williams Parkway, within the project limits, is not expected to have any changes of the existing alignment/grade. Additionally, widening of the platform is not expected at this time.

7.0 PAVEMENT DESIGNS

The pavement structures were designed based on the traffic data provided by Parsons and the data obtained from the field investigations. The following references and guidelines were used for the pavement designs.

- MTO *"Adaptation and Verification of AASHTO Pavement Design Guide for Ontario Conditions, MI-183"*, March 19, 2008; and
- American Association of State Highway and Transportation Officials, *"AASHTO Guide for Design of Pavement Structures"*, 1993.

7.1 Equivalent Single Axle Loads (ESAL)s Calculations

The equivalent single axle loads (ESAL)s for the design lane of Williams Parkway was calculated using the traffic data presented in Section 2 above. The input parameters for the design lane ESAL calculation were derived from MTO publication MI-183 'The Adaptation and Verification of AASHTO Pavement Design Guide for Ontario Conditions' and 'Procedures for Estimating Traffic Loads for Pavement Design,1995'. The table below presents the input parameters used to calculate ESALs on the eastbound and westbound lanes of Williams Parkway for Section 1 and Section 2. The detailed ESAL calculations are provided in Table D1 through Table D4 in Appendix D.

Traffic Volume and Pavement Design Parameters	Williams Parkway EB		Williams Parkway WB	
	Section 1	Section 2	Section 1	Section 2

		From N Park Dr/Howden Blvd to Bramalea Rd	From Bramalea Rd to Torbram Rd	From N Park Dr/Howden Blvd to Bramalea Rd	From Bramalea Rd to Torbram Rd
Provided Traffic Volume	PM Peak Traffic Volume Present - (2022)	984	782	1,479	1,092
	PM Peak Traffic Volume Projected - (2031)	1,074	854	1,614	1,188
	AADT (2022)	9,840*	7,820*	14,790*	10,920*
	AADT (2024) – Design Year	10,034	7,974	15,081	11,135
	Annual Growth Rate	0.98%	0.98%	0.98%	0.98%
	Commercial Vehicle %	4%	4%	4%	4%
Pavement Design Parameters	Truck Factor	1.31	1.31	1.31	1.31
	Directional Split	100%	100%	100%	100%
	Lane Distributional Factor (LDF)	0.9	0.9	0.8	0.9
	Cumulative ESALs for 4-Year Design Period	-	-	936,700	778,100
	Cumulative ESALs for 5-Year Design Period	880,600	699,900	-	-
	Cumulative ESALs for 9-Year Design Period	-	-	2,160,200	1,794,300
	Cumulative ESALs for 11-Year Design Period	1,995,600	-	-	-
	Cumulative ESALs for 12-Year Design Period	-	1,738,900	-	-
	Cumulative ESALs for 13-Year Design Period			3,182,800	
	Cumulative ESALs for 14-Year Design Period	2,578,200	-	-	2,861,400
	Cumulative ESALs for 15-Year Design Period	-	2,206,300	-	-
	Cumulative ESALs for 20-Year Design Period	3,795,700	3,016,400	5,071,100	4,212,400
Ontario Traffic Category		C			

* AADT (Annual Average Daily Traffic) is estimated using the highest Peak Hour traffic volume 2022 PM and multiplying by 10. For further details, please refer to Section 2 of this report.

7.2 AASHTO Design Parameters

The pavement design parameters selected for the pavement designs are summarized in the following table.

Design Parameters	Values
Initial/Terminal Serviceability Index	p_i = 4.4 p_t = 2.2
Loss in Serviceability index	2.2
Reliability (%) & Standard Deviation	R = 87% SD = 0.44
Design Period (years)	9-20 Years
Estimated Elastic Modulus of Subgrade Soil (MPa)	25 – Sandy Silt (LSFH-MSFH)
Layer Coefficients of Hot Mix Asphalt (HMA)	New HMA = 0.42 Existing HMA = 0.28
Layer Coefficients of Granular Materials	New Gran A = 0.14 New Granular B Type I = 0.09 Combined existing granular base and subbase materials = 0.11
Drainage Coefficient of Granular Materials	m = 1.0 for new granular base & subbase) m= 0.9 for existing granular base & subbase

Table below presents the typical pavement structure selected to carry out the pavement analysis for rehabilitation purposes.

Location	Section No.	Pavement Layer Thickness (mm)			
		AC	Granular	Total	Existing SN
Williams Parkway EB	Section 1	150	455	605	87
	Section 2	145	445	590	85
Williams Parkway WB	Section 1	150	400	550	82
	Section 2	140	455	595	84

7.3 Pavement Design Consideration

Based on correspondences with Parsons, the following constraints were taken into consideration when developing and choosing feasible pavement rehabilitation strategies:

- Grade raise is restricted (to be minimal or zero);
- Roadway platform widening is not required;
- Pavement design for construction staging and strengthening are not required; and
- In-place recycling options such as CIR and CIREAM are not a preferred option by the client;

7.4 Williams Parkway Main Lanes Design Options

The results of field investigation, laboratory testing and pavement structural analysis indicate that the existing pavements are structurally inadequate for the traffic load and rehabilitation is required to restore their functional serviceability (including ride, etc.) and extend their overall service life.

Based on the above, a limited range of pavement rehabilitation options were considered, including conventional partial depth mill and overlay with 40-60 mm grade raise (Option 1), full depth asphalt concrete removal and overlay with zero grade raise (Option 2), partial depth mill and overlay with zero grade raise (Option 3) and full depth re-construction with new pavement structure (meeting the City of Brampton design standard) with zero grade raise (Option 4).

The pavement was designed based on the provided traffic data, design ESALs, existing pavement condition and selected pavement design parameters. The rehabilitation options are summarized in the table below, and AASHTO pavement design sheets are provided in Table D5 through Table D20 in Appendix D.

Location	Section No	Pavement Layer Thickness (mm)				
		Option	Design Life (Yrs)	Grade Raise (mm)	Required SN (mm)	Achieved SN (mm)
Williams Parkway EB	1	Option 1: Mill 80 mm & Pave 120 mm HMA Over Existing 70 mm HMA and 455 Existing Granular Materials	11	40	114.2	115.0
		Option 2: Full depth Asphalt Removal & Pave 180 HMA Over Existing 425 Existing Granular Materials	14	0	118.3	117.7

Location	Section No	Pavement Layer Thickness (mm) Option	Design Life (Yrs)	Grade Raise (mm)	Required SN (mm)	Achieved SN (mm)
		Option 3: Mill 100 mm & Pave 100 mm HMA Over Existing 50 mm HMA and 455 Existing Granular Materials	5	0	101.8	101.0
		Option 4: Re-Construction with 750 mm new pavement structure (150 HMA over, 150 Granular Base and 450 Granular Subbase)	20	0	124.7	124.5
	2	Option 1: Mill 80 mm & Pave 120 mm HMA Over Existing 65 mm HMA and 445 Existing Granular Materials	12	40	112.1	112.7
		Option 2: Full depth Asphalt Removal & Pave 180 HMA Over Existing 410 Existing Granular Materials	15	0	115.8	116.2
		Option 3: Mill 100 mm & Pave 100 mm HMA Over Existing 45 mm HMA and 445 Existing Granular Materials	5	0	98.5	98.7
		Option 4: Re-Construction with 750 mm new pavement structure (150 HMA over, 150 Granular Base and 450 Granular Subbase)	20	0	121	124.5
Williams Parkway WB	1	Option 1: Mill 60 mm & Pave 120 mm HMA Over Existing 90 mm HMA and 400 Existing Granular Materials	9	60	115.5	115.2
		Option 2: Partial Depth Re-construction to a depth of 340 mm and Pave with 190 HMA over new 150 Granualr Based over 210 mm Existing Granular Material	13	0	121.8	121.6
		Option 3: Mill 100 mm & Pave 110 mm HMA Over Existing 50 mm HMA and 400 Existing Granular Materials	4	10	102.7	99.8
		Option 4: Re-Construction with 770 mm new pavement structure (170 HMA over, 150 Granular Base and 450 Granular Subbase)	20	0	130	133
	2	Option 1: Mill 70 mm & Pave 120 mm HMA Over Existing 70 mm HMA and 455 Existing Granular Materials	9	50	112.6	115.0
		Option 2: Full depth Asphalt Removal & Pave 190 HMA Over Existing 405 Existing Granular Materials	14	0	120.1	119.9
		Option 3: Mill 100 mm & Pave 110 mm HMA	4	10	100.0	102.4

Location	Section No	Pavement Layer Thickness (mm)				
		Option	Design Life (Yrs)	Grade Raise (mm)	Required SN (mm)	Achieved SN (mm)
		Over Existing 40 mm HMA and 455 Existing Granular Materials				
		Option 4: Re-Construction with 760 mm new pavement structure (160 HMA over, 150 Granular Base and 450 Granular Subbase)	20	0	126.5	128.7

7.5 City of Brampton Pavement Design Requirement

The following are the minimum pavement structure specifications for a Parkway road classification based on the City of Brampton Standard Drawing No. 206 (Rev.17, dated July 2019):

HMA Surface Course	40 mm High stability HL3 or HL1
HMA Binder Course	85 mm HL8 / 100 mm for all new Subdivision Rds
Granular Base	150 mm Granular A / 130 mm 20 mm CRL
Granular Subbase	450 mm Granular B / 350 mm 50 mm CRL
Total Pavement Structure Thickness	**725 mm**
Required Structural Number (SN)	**114 mm**

As provided in the above sections, the average thickness of the total existing pavement structure on Sections 1 and 2 of Williams Parkway varies from 550 mm to 605 mm, with an existing SN of 82 mm to 87 mm. In general, design Option 1 and Option 2 satisfy the required structural number (SN) for the minimum pavement structure City of Brampton standard and Design Option 4 meets the minimum pavement structure thickness and the required structural number of the City of Brampton design standard. However, design Option 3 does not meet the required structural number of the City of Brampton.

8.0 RECOMMENDATIONS

The pavement was designed based on the provided traffic data and design ESALs and the selected pavement design parameters considering zero grade raise. The recommended design options are summarized as follows.

8.1 Rehabilitation of Williams Parkway

It is understood that due to grade raise restrictions, the rehabilitation strategy in Option 1 is not a preferred design option and has been eliminated. As such, design Option 2, Option 3 and Option 4 were considered for both segments of Williams Parkway.

In our opinion, Option 3 is not a preferred design option due to having a shorter design life. Additionally, would not treat the full depth of asphalt distressed areas and also because of the presence of a thin asphalt layer (approx. 20-40 mm) after milling operations. The distressed asphalt has a high likelihood of breaking up during the milling process and would not withstand the construction traffic either.

8.1.1 Williams Parkway Section 1

Williams Parkway Eastbound Lanes Rehabilitation

Option 2: Full-depth asphalt removal and Pave 180 mm HMA – Zero Grade Raise

- Remove the full depth of existing asphalt concrete and partial depth of underneath granular in full width to accommodate 180 mm new asphalt;
- Proof roll the exposed granular, any localized soft material should be excavated to the top of the subgrade and replaced with a new granular A base placed in lift thickness of 150 mm or less and compacted to 100 percent Standard Proctor Maximum Dry Density, noting that excessive rolling using heavy rollers and/or dynamic compaction can lead to subgrade softening;
- Regrade the exposed surface with new Granular 'A' as required;
- Pave 70 mm HL8/HDBC hot-mix asphalt binder course lower lift;
- Pave 70 mm HL8/HDBC hot-mix asphalt binder course upper lift; and
- Pave 40 mm HL1 hot-mix asphalt surface course,

This design option will provide a design life of over 14 years.

Option 3: 100 mm Partial Depth Asphalt Removal and Pave 100 mm HMA – Zero Grade Raise

- Remove the existing asphalt concrete to a depth of 100 mm;
- Perform inspection of the milled surface, treat all moderate to severe cracks and alligator cracking distressed areas prior to paving;
- Pave 60 mm HL8/HDBC hot-mix asphalt binder course; and
- Pave 40 mm HL1 hot-mix asphalt surface course.

This design option will provide a 5 to 6-year design life.

Option 4: Full Depth Re-construction with new 750 mm new pavement Structure – Zero Grade Raise

- Remove the existing pavement and underneath subgrade to a minimum depth of 750 mm;
- Proof-roll the exposed subgrade to identify localized "weak zones/soft area". In weak areas sub-excavate to competent subgrade and replace with new Granular B Type I and compact to 100% of the materials' Standard Proctor Maximum Dry Density (SPMDD). Provide the minimum 3% crossfall/slope towards subdrains. Noting that excessive rolling using heavy rollers and/or dynamic compaction can lead to subgrade softening;
- Place a minimum of 450 mm Granular B Type I and provide minimum 2% crossfall/slope towards subdrains;
- Place 150 mm Granular A and provide minimum 2% crossfall/slope towards subdrains;
- Pave 55 mm HL8/HDBC hot-mix asphalt binder course lower lift;

— Pave 55 mm HL8/HDBC hot-mix asphalt binder course upper lift; and

— Pave 40 mm HL1 hot-mix asphalt surface course.

This design option will provide a 20 year design life.

Williams Parkway Westbound Lanes Rehabilitation

Option 2: Partial Depth Re-Construction to a depth of 340 mm – Zero Grade Raise

— Remove full depth of existing asphalt concrete and partial depth of underneath granular in full width to accommodate 340 mm new pavement structure;

— Proof-roll the exposed granular surface to identify localized “weak zones/soft area”. In weak areas sub-excavate to competent subgrade and replace with new Granular A and compact to 100% material ’s SPMDD. Provide the minimum 3% crossfall/slope towards subdrains.

— Place 150 mm new Granular ‘A’ and regrade to provide required as required;

— Pave 70 mm HL8/HDBC hot-mix asphalt binder course lower lift;

— Pave 70 mm HL8/HDBC hot-mix asphalt binder course upper lift;

— Pave 50 mm HL1 hot-mix asphalt surface course,

This design option will provide a design life of over 13 years.

Option 3: 100 mm Partial Depth Asphalt Removal and Pave 110 mm HMA – 10 mm Grade Raise

— Remove the existing asphalt concrete to a depth of 100 mm;

— Perform inspection of the milled surface, treat all moderate to severe cracks and alligator cracking distressed areas prior to paving;

— Pave 70 mm HL8/HDBC hot-mix asphalt binder course; and

— Pave 40 mm HL1 hot-mix asphalt surface course.

This this design option will provide a design life of about 4 years.

Option 4: Full Depth Re-construction with 770 mm new pavement Structure – Zero Grade Raise

— Remove the existing pavement and underling subgrade to a minimum depth of 770 mm;

— Proof-roll the exposed subgrade material to identify “weak zones/soft area”. In weak areas sub-excavate to competent subgrade and replace with new Granular B Type I and compact to 100% of the materials’ Standard Proctor Maximum Dry Density (SPMDD). Provide the minimum 3% crossfall/slope towards subdrains. Noting that excessive rolling using heavy rollers and/or dynamic compaction can lead to subgrade softening;

— Place a minimum of 450 mm Granular B Type I with minimum 2% crossfall/slope towards subdrains;

— Place 150 mm Granular A with minimum 2% crossfall/slope towards subdrains;

— Pave 60 mm HL8/HDBC hot-mix asphalt binder course lower lift;

— Pave 60 mm HL8/HDBC hot-mix asphalt binder course upper lift; and

— Pave 50 mm HL1 hot-mix asphalt surface course.

This design option will provide a 20 year design life.

8.1.2 Williams Parkway Section 2

Williams Parkway Eastbound Lanes Rehabilitation

Option 2: Full depth asphalt removal and Pave 180 mm HMA – Zero Grade Raise

— Remove full depth of existing asphalt concrete and partial depth of underneath granular in full width to accommodate 180 mm new asphalt;

— Proof roll the exposed granular, any localized soft material should be excavated to the top of the subgrade and replaced with new Granular A material placed in lift thickness of 150 mm or less and compacted to 100 percent of the material's SPMDD noting that excessive rolling using heavy rollers and/or dynamic compaction can lead to subgrade softening;

— Regrade the exposed surface with new Granular 'A' as required;

— Pave 70 mm HL8/HDBC hot-mix asphalt binder course lower lift;

— Pave 70 mm HL8/HDBC hot-mix asphalt binder course upper lift; and

— Pave 40 mm HL1 asphalt surface course.

This design option will provide a design life of over 15 years.

Option 3: 100 mm Partial Depth Asphalt Removal and Pave 100 mm HMA – Zero Grade Raise

— Remove the existing asphalt concrete to a depth of 100 mm;

— Perform inspection of the milled surface, treat all moderate to severe cracks and alligator cracking distressed areas prior to paving;

— Pave 60 mm HL8/HDBC asphalt binder course; and

— Pave 40 mm HL1 asphalt surface course.

This design option will provide a design life of 5 to 6 years.

Option 4: Full Depth Re-construction with new 750 mm new pavement Structure – Zero Grade Raise

— Remove the existing pavement and underneath subgrade to a minimum depth of 750 mm;

— Proof-roll the exposed subgrade to identify localized "weak zones/soft area". In weak areas sub-excavate to competent subgrade and replace with new Granular B Type I and compact to 100% of the materials' Standard Proctor Maximum Dry Density (SPMDD). Provide the minimum 3% crossfall/slope towards subdrains. Noting that excessive rolling using heavy rollers and/or dynamic compaction can lead to subgrade softening;

- Place a minimum of 450 mm Granular B Type I and provide minimum 2% crossfall/slope towards subdrains;
- Place 150 mm Granular A and provide minimum 2% crossfall/slope towards subdrains;
- Pave 55 mm HL8/HDBC hot-mix asphalt binder course lower lift;
- Pave 55 mm HL8/HDBC hot-mix asphalt binder course upper lift; and
- Pave 40 mm HL1 hot-mix asphalt surface course.

This design option will provide a 20 year design life.

Westbound Lanes of Williams Parkway

Option 2: Full depth asphalt removal and Pave 190 mm HMA – Zero Grade Raise

- Remove full depth of existing asphalt concrete and partial depth of underneath granular in full width to accommodate 190 mm new asphalt;
- Proof roll the exposed granular, any localized soft material should be excavated to the top of the subgrade and replaced with new Granular A material placed in lift thickness of 150 mm or less and compacted to 100 percent Standard Proctor Maximum Dry Density noting that excessive rolling using heavy rollers and/or dynamic compaction can lead to subgrade softening;
- Regrade the exposed surface with new Granular 'A' as required;
- Pave 70 mm HL8/HDBC hot-mix asphalt binder course lower lift;
- Pave 70 mm HL8/HDBC hot-mix asphalt binder course top lift;
- Pave 50 mm HL1 hot-mix asphalt surface course; and

This design option will provide a design life of over 14 years.

Option 3: 100 mm Partial Depth Asphalt Removal and Pave 110 mm HMA – 10 mm Grade Raise

- Remove the existing asphalt concrete to a depth of 100 mm;
- Perform inspection of the milled surface, treat all moderate to severe cracks and alligator cracking distressed areas prior to paving;
- Pave 70 mm HL8//HDBC hot-mix asphalt binder course; and
- Pave 40 mm HL1 hot-mix asphalt surface course.

This deign option will provide about a design life of 4 years.

Option 4: Full Depth Re-construction with new 760 mm new pavement Structure – Zero Grade Raise

- Remove the existing pavement and underneath subgrade to a minimum depth of 760 mm;
- Proof-roll the exposed subgrade to identify localized "weak zones/soft area". In weak areas sub-excavate to competent subgrade and replace with new Granular B Type I and compact to 100% of the materials' Standard Proctor Maximum Dry Density (SPMDD). Provide the minimum 3% crossfall/slope

towards subdrains. Noting that excessive rolling using heavy rollers and/or dynamic compaction can lead to subgrade softening;

- Place a minimum of 450 mm Granular B Type I and provide minimum 2% crossfall/slope towards subdrains;
- Place 150 mm Granular A and provide minimum 2% crossfall/slope towards subdrains;
- Pave 60 mm HL8/HDBC hot-mix asphalt binder course lower lift;
- Pave 60 mm HL8/HDBC hot-mix asphalt binder course upper lift; and
- Pave 40 mm HL1 hot-mix asphalt surface course.

This design option will provide a 20 year design life.

8.2 Multi-Use Path (MUP)

An asphalt Multi-Use Path (MUP) shall be constructed as per the City of Brampton Standard Drawing No. L511 dated September 2014.

The recommended pavement structure is as follows:

Hot Mix Asphalt	HL3A	75 mm
Granular Base Course	Granular A/19 mm CRL	200 mm

With minimum 98% Standard Proctor Density (SPD) and 2% cross slope

Over Compacted subgrade 98% SPD for disturbed subgrade or 95% SPD on undisturbed subgrade with 2% cross slope.

8.3 Pavement Material Types

The following hot mix types are considered suitable for this project:

- HL1 Surface Course for Roadway
- HL3 Surface Course for MUP; and
- HL8/ HDBC Binder Course for Roadway

These mixes should be produced and constructed in accordance with OPSS.MUNI 1150 and Traffic Category C and OPSS.MUNI 310 requirements. Granular A (granular base course) and Granular B Type I (granular sub-base course) materials shall comply with the requirements of OPSS.MUNI 1010.

8.4 Asphalt Cement Grade and Traffic Category

Performance graded asphalt cement PG 64-28 conforming to OPSS. PROV 1101 requirements is recommended for the HMA surface course and upper binder course. Asphalt cement PG 64-28 is recommended for the mid and the lower binder courses. Traffic Category C shall be considered for all mix designs.

8.5 Tack Coat

SS1 Tack Coat must be applied to all existing or milled surfaces and between all new lifts of hot mix asphalt, as well as the surface of padding and levelling courses where needed. Tack coat should be applied to the surface of all binder courses, as per OPSS 308.

8.6 Transition and Key-In Details

Pavement transitions are required from the new pavement to the existing pavement. A suggested transverse joint detail and the transition between the new and existing pavement is provided in Figure E1, Appendix E. Longitudinal pavement key-in details are provided in Figure E2, Appendix E. All joints shall be constructed in accordance with OPSS.PROV 313 and Special Provision SSP 103F03.

8.7 Organic Material Removal and Wet Soils

Any organic material within the MUP construction sections should be removed to a minimum depth of 400 mm and backfilled with approved material. In general, the exposed sub-grade or exposed granular surface after full depth asphalt removal shall be proof rolled to identify “weak zones/soft areas” under the supervision of a qualified geotechnical engineer. In weak areas, the excavation should be carried out to a competent subgrade and replaced with new Granular B Type I or fill material (subject to QC approval) and compacted to 100% of the materials’ Standard Proctor Maximum Dry Density (SPMDD). The minimum depth of soft spot repairs is typically 400 mm.

9.0 DRAINAGE

The provision of adequate subsurface and surface drainage is critical to the structural performance of pavements. Prior to undertaking any pavement rehabilitation work, the roadway subdrains should be carefully assessed, noting that the provision of proper drainage is fundamental to the performance of the roadway to mitigate frost-related movements and minimize seasonal loss of subgrade support (subgrade softening in spring).

The surface of the completed pavement should be provided with a minimum centre-to-edge cross-fall of 2%.

10.0 OTHER DESIGN FEATURES

10.1 Excavations

All excavations shall be carried out in accordance with the Occupational Health and Safety Act (OHSA). For the purposes of the OHSA, the fill and native soils at this site are classified as Type 3 soils.

10.2 Stripping

For estimating purposes, assume an average topsoil thickness of 140 mm. Full depth removal of the topsoil and any other deleterious material is required prior to the construction of the MUP. Assume that approximately 90% of the topsoil can be re-used for landscaping purposes.

10.3 Frost Penetration

For design purposes, assume a frost penetration depth of 1.4 m.

11.0 ENVIRONMENTAL SOIL QUALITY TEST RESULTS

A number of sub-soil/granular samples were selected for environmental and chemical analyses to determine their environmental quality. A total of twelve (12) soil samples (five granular samples from the pavement boreholes and seven soil samples from the boulevard boreholes) were analysed by AGAT for Metals, Inorganics and EC/SAR parameters as set out in O. Reg. 153(511) to assess the environmental quality of the soils and to assist in determining off-site disposal options. AGAT Report (dated November 3, 2022) of chemical characterization of soils and the laboratory test results are presented in Appendix H of this report.

A summary of the submitted samples and respective tests is provided in the below table, with the parameters exceeding O.Reg. 153/04 standards indicated. As noted, eleven (11) out of the twelve (12) tested samples exceeded the applicable Ministry of Environment, Conservation and Parks MECP Standards for salts-related parameters (Electric Conductivity (EC), Sodium Adsorption Ratio (SAR) and Lead & Zinc ant one location. The elevated SAR value can likely be attributed to the use of road salt on the roadway pavement structure.

Roadway/ Location	Sample No	Depth (mm)	Material Type	Summary of Environmental Analysis		
				O. Reg. 153(511)		Exceedances
				Metals & Inorganics	Electrical Conductivity (EC) and Sodium Adsorption Ratio (SAR)	O.Reg.153/04 Table 1
Pavement Boreholes	BH P3	150 - 480	Granular	✓	✓	EC, SAR
	BH EC3	150 - 610	Granular	✓	✓	EC, SAR
	BH P19	140 - 550	Granular	✓	✓	EC, SAR
	BH P24	140 - 585	Granular	✓	✓	EC, SAR
	BH P32	195 - 545	Granular	✓	✓	EC, SAR
Boulevard Boreholes	BH EC1	00 - 600	Soil	✓	✓	EC, SAR, Lead, Zinc
	BH TC2	00 - 600	Soil	✓	✓	-
	BH B5	00 - 600	Soil	✓	✓	SAR
	BH B15	750 - 1200	Soil	✓	✓	EC, SAR
	BH B26	750 - 1200	Soil	✓	✓	EC, SAR
	BH P19	750 - 1200	Soil	✓	✓	EC, SAR
	BH P32	750 - 1200	Soil	✓	✓	EC, SAR

12.0 STATEMENT OF LIMITATIONS

The comments provided in this report have been developed for the use of Parsons Inc. and City of Brampton. The analyses and recommendations provided in this report are based on field measurements and observations made by Terraprobe and Englobe technical staff.

The geotechnical recommendations provided in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known at the time of report preparation, we recommend that we be retained during the final design stage to verify that the geotechnical recommendations have been correctly interpreted in the design. Also, if any further clarification and/or elaboration are needed concerning the geotechnical aspects of the project, Englobe should be contacted. We recommend that we be retained during construction to confirm that the subsurface conditions do not deviate materially from those encountered in the test holes and to ensure that our recommendations are properly understood.

The geotechnical recommendations provided in this report are intended for the use of the owner and its retained designer. They are not intended as specifications or instructions to contractors. Any use which a contractor makes of this report, or decisions made based on it, are the responsibility of the contractor. The contractor must also accept the responsibility for means and methods of construction, seek additional information if required, and draw their own conclusions as to how the subsurface conditions may affect their work. Englobe accepts no responsibility and denies any liability whatsoever for any damages arising from improper or unauthorized use of the report or parts thereof.

It is important to note that the geotechnical investigation involves a limited sampling of the site gathered at specific test locations and the conclusions in this report are based on this information gathered. The subsurface geotechnical, hydrogeological, environmental, and geologic conditions between and beyond the test holes will differ from those encountered at the test holes. Also, such conditions are not uniform and can vary over time. Should subsurface conditions be encountered which differ materially from those indicated at the test holes, we request that we be notified to assess the additional information and determine whether or not changes should be made as a result of the conditions. It should also 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. 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

This report can only be used for the purposes stated therein. Any use of the report must take into consideration the object and scope of the mandate by virtue of which the report was prepared, as well as the limitations and conditions specified therein and the state of scientific knowledge at the time the report was prepared. Englobe Corp. provides no warranty and makes no representations other than those expressly contained in the report.

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

Englobe Corp.'s subcontractors who have carried out on-site or laboratory work are duly assessed according to the purchase procedure of our quality system.

For further information, please contact your project manager.

Englobe Corp.

Siamak Gholamin, P.Eng.
Senior Pavement Engineer

Richard Korczak, MASc., P.Eng.
Director of Operations

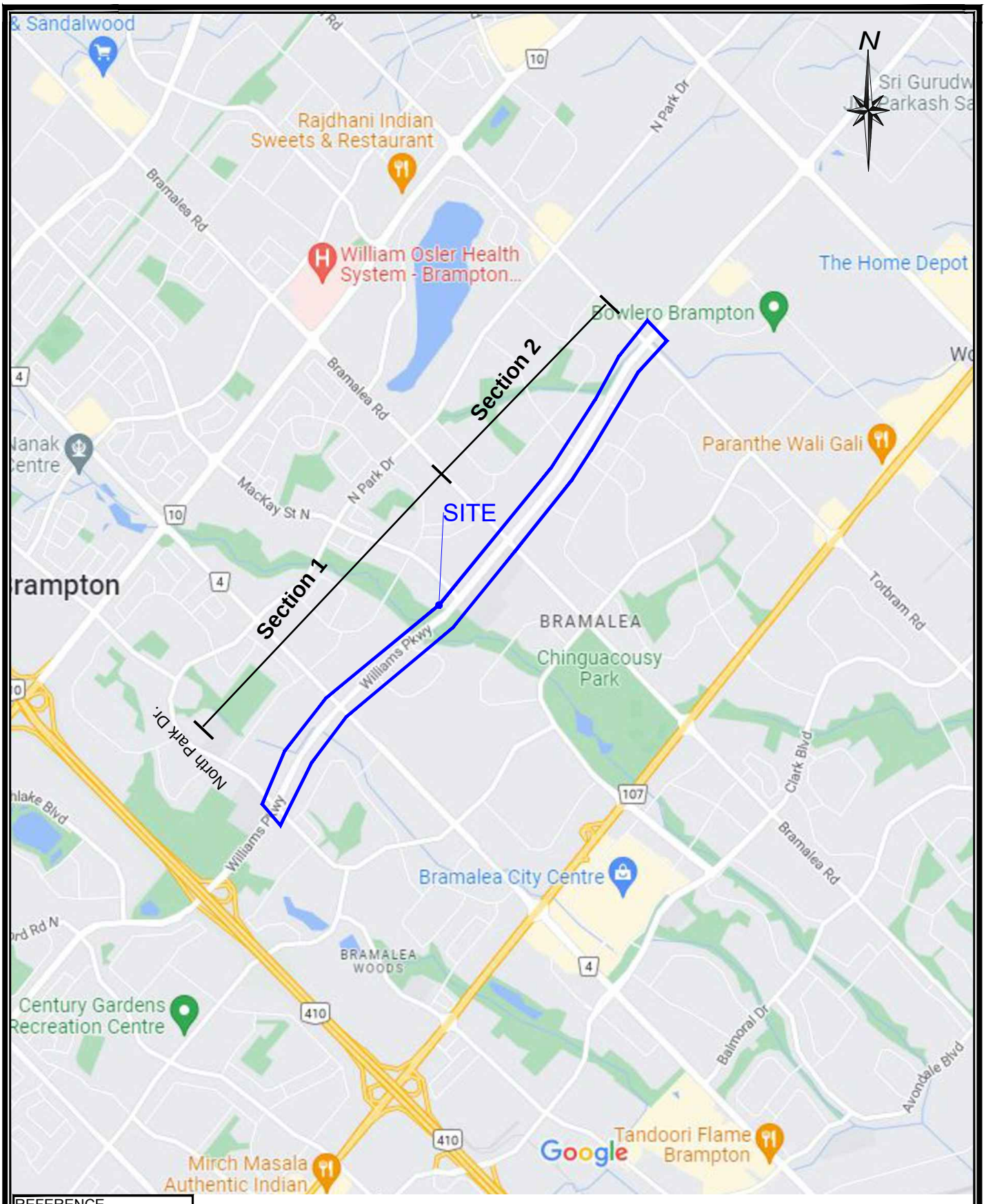
Seth Zhang, M.Eng., M.Sc., P.Eng.
Senior Geotechnical Engineer

FIGURES

Site Location Plan

&

Borehole Location Plans



eNGLOBe	Title: **SITE LOCATION PLAN**	FIGURE : 1
	File. No.: 1-22-0499-01	

REFERENCE
Image © 2022 Google Earth

LEGEND
Approximate Borehole Location

SCALE 1:600 4 0 10m

eNGLOBe

Title: **BOREHOLE LOCATION PLAN**

File No. 1-22-0499-01

FIGURE : 2-1

REFERENCE
Image © 2022 Google Earth

LEGEND
Approximate Borehole Location

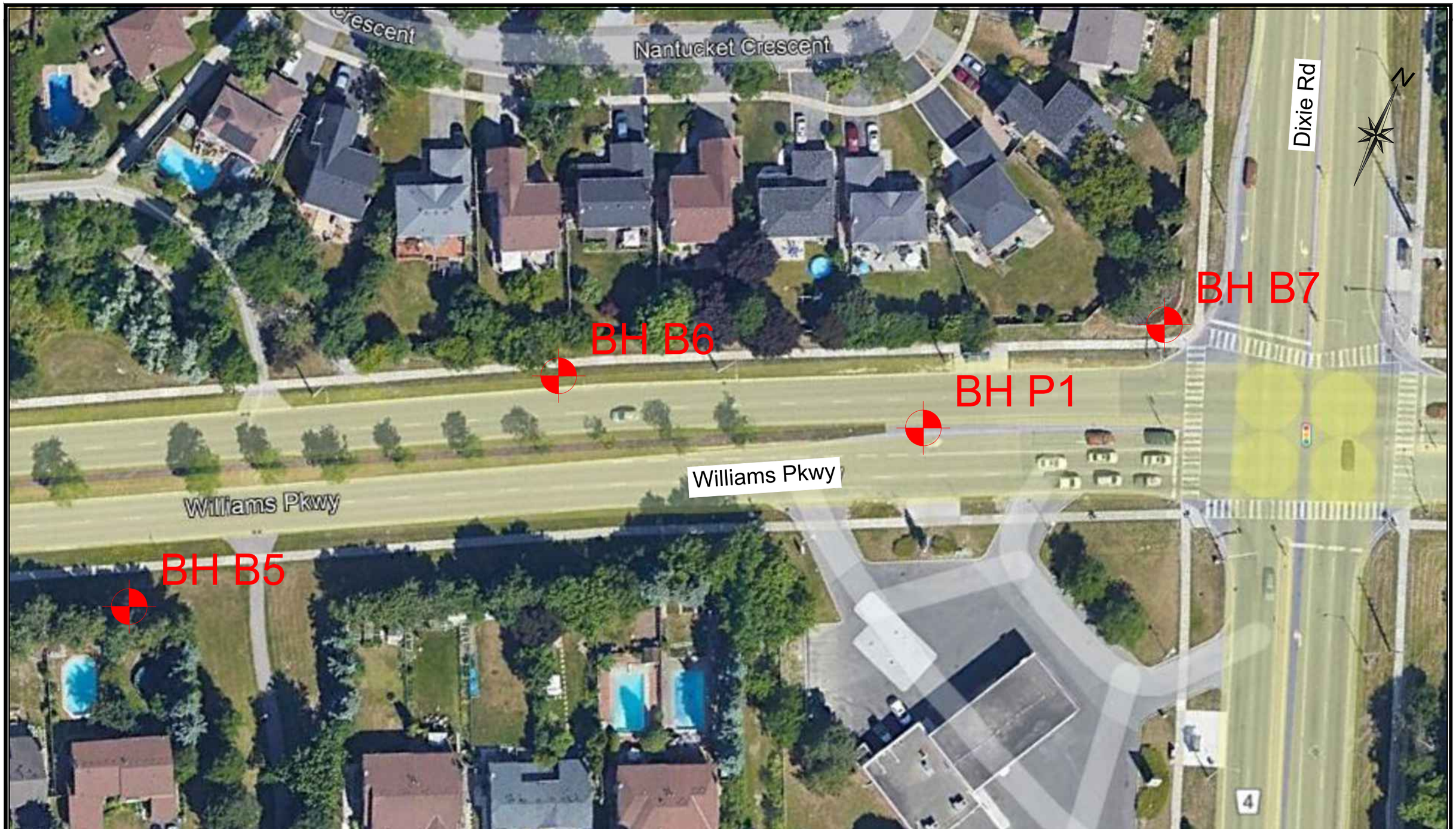
SCALE 1:600 4 0 10m

eNGLOBe

Title: **BOREHOLE LOCATION PLAN**

File No. 1-22-0499-01

FIGURE : 2-2



REFERENCE
Image © 2022 Google Earth

LEGEND
Approximate Borehole Location

SCALE 1:600 4 0 10m

eNGLOBe

Title: **BOREHOLE LOCATION PLAN**

File No. 1-22-0499-01

FIGURE : 2-3

REFERENCE
Image © 2022 Google Earth

LEGEND
Approximate Borehole Location

SCALE 1:600 4 0 10m

eNGLOBe

Title: **BOREHOLE LOCATION PLAN**

File No. 1-22-0499-01

FIGURE : 2-4

REFERENCE
Image © 2022 Google Earth

LEGEND
Approximate Borehole Location

SCALE 1:600 4 0 10m

eNGLOBe

Title: **BOREHOLE LOCATION PLAN**

File No. 1-22-0499-01

FIGURE : 2-5

REFERENCE
Image © 2022 Google Earth

LEGEND
Approximate Borehole Location

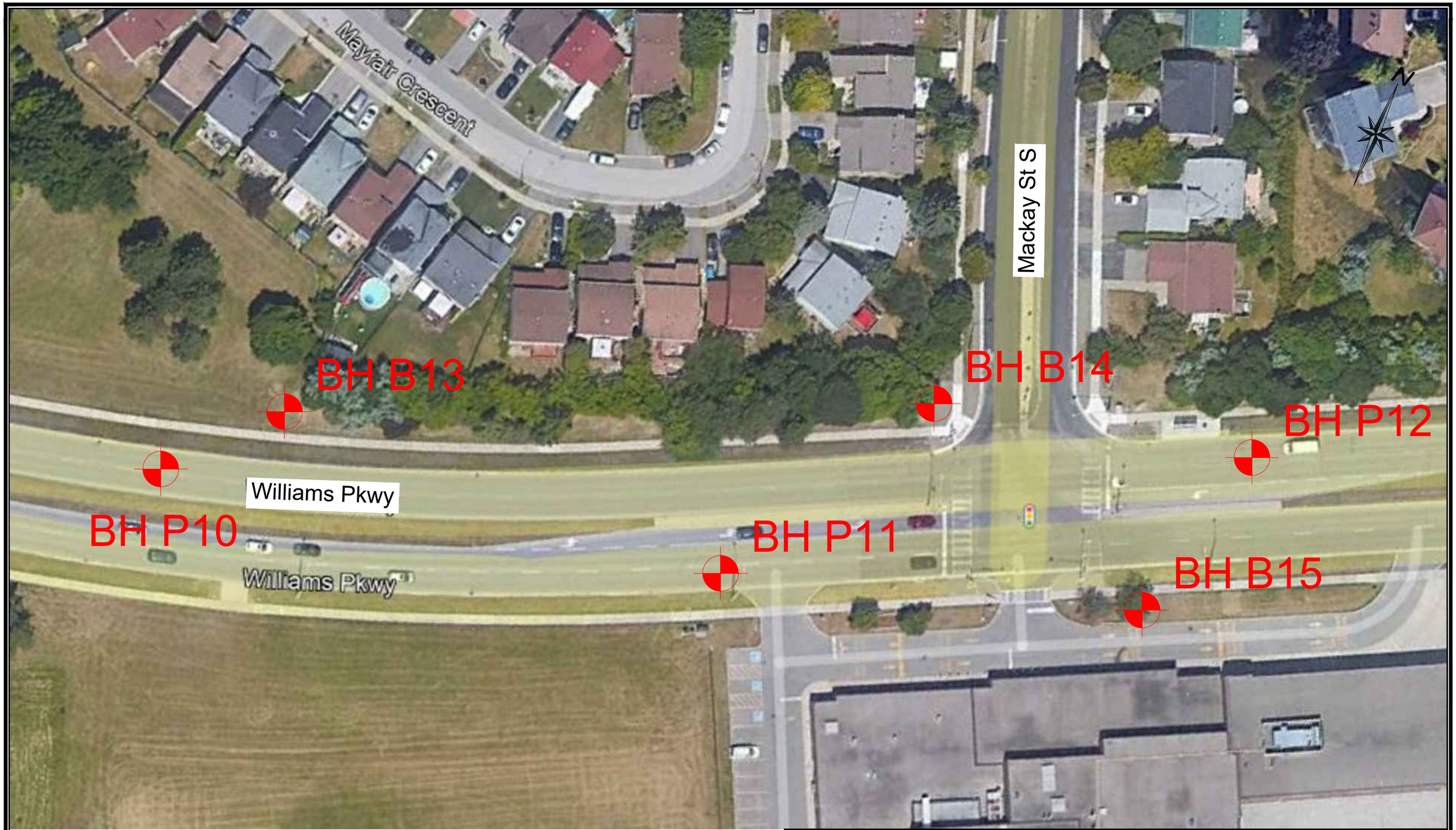
SCALE 1:600 4 0 10m

ENGLOBE

Title: **BOREHOLE LOCATION PLAN**

File No. 1-22-0499-01

FIGURE : 2-6



REFERENCE
Image © 2022 Google Earth

LEGEND
Approximate Borehole Location

SCALE 1:600 4 0 10m

eNGLOBe

Title: **BOREHOLE LOCATION PLAN**

File No. 1-22-0499-01

FIGURE : 2-7

REFERENCE
Image © 2022 Google Earth

LEGEND
Approximate Borehole Location

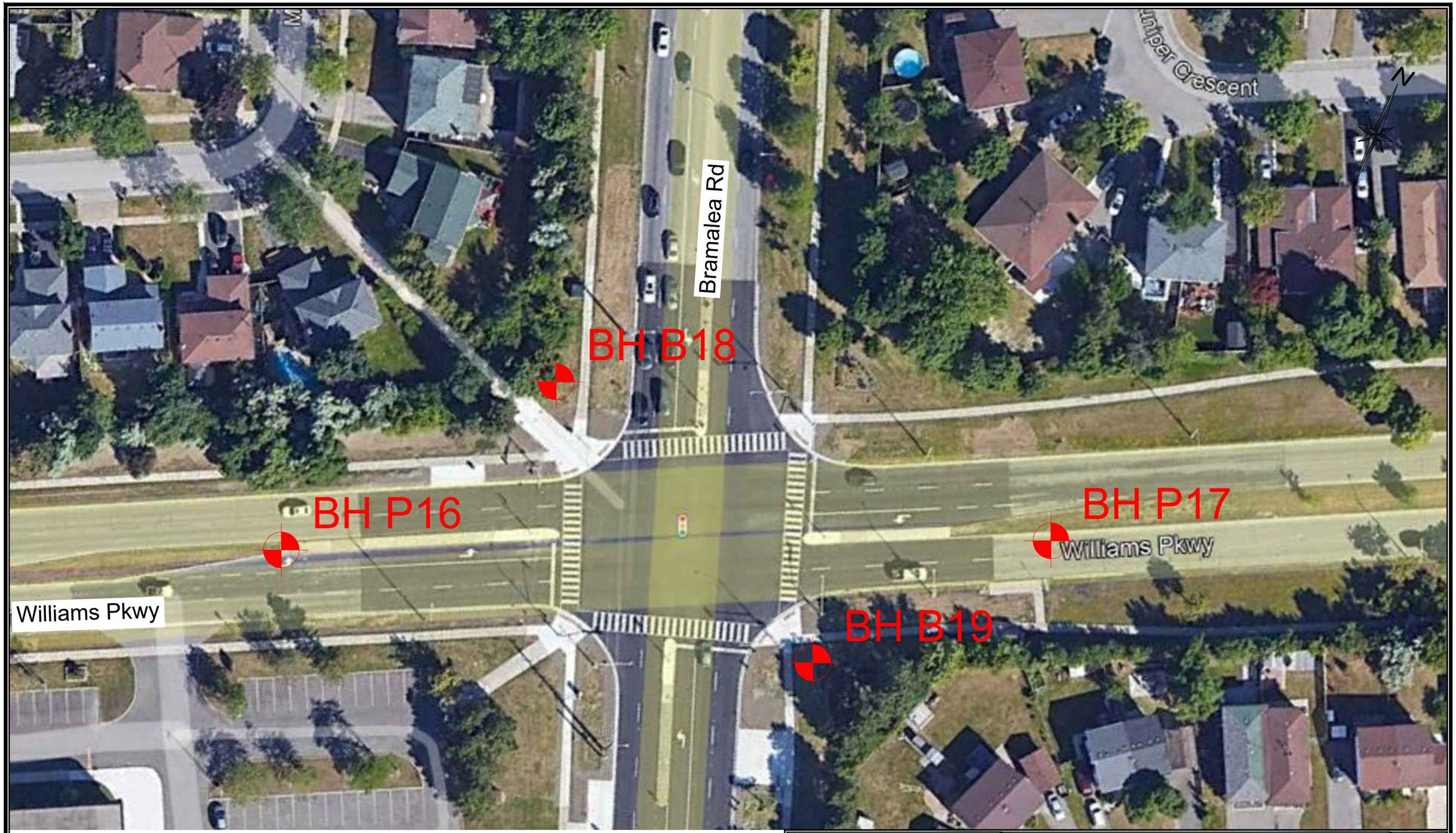
SCALE 1:600 4 0 10m

eNGLOBe

Title: **BOREHOLE LOCATION PLAN**

File No. 1-22-0499-01

FIGURE : 2-8



REFERENCE
Image © 2022 Google Earth

LEGEND
Approximate Borehole Location

SCALE 1:600 4 0 10m

eNGLOBe

Title: **BOREHOLE LOCATION PLAN**

File No. 1-22-0499-01

FIGURE : 2-9

REFERENCE
Image © 2022 Google Earth

LEGEND
Approximate Borehole Location

SCALE 1:600 4 0 10m

eNGLOBe

Title: **BOREHOLE LOCATION PLAN**

File No. 1-22-0499-01

FIGURE : 2-10

REFERENCE
Image © 2022 Google Earth

LEGEND
Approximate Borehole Location

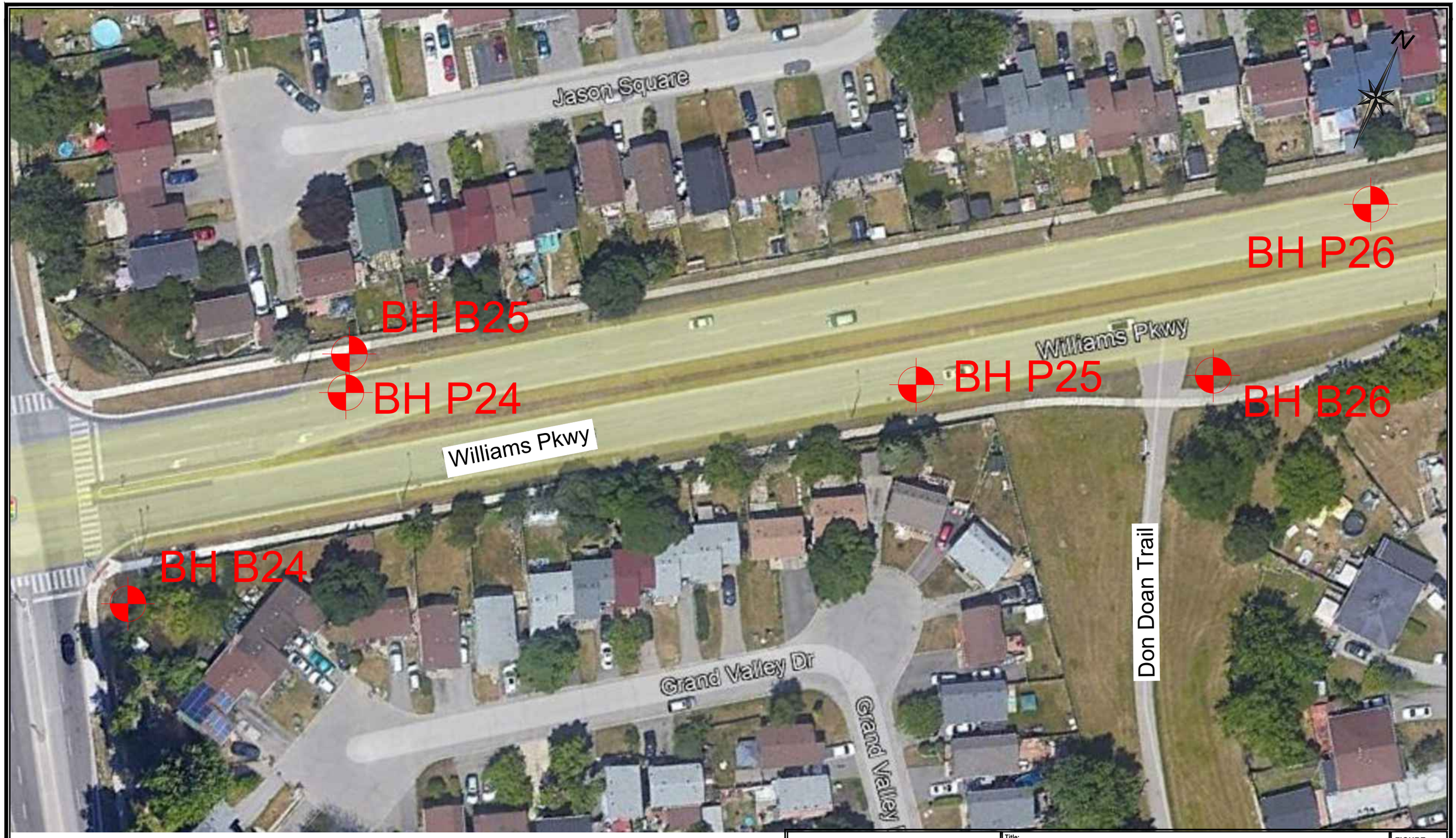
SCALE 1:600 4 0 10m

eNGLOBe

Title: **BOREHOLE LOCATION PLAN**

File No. 1-22-0499-01

FIGURE : 2-11



REFERENCE
Image © 2022 Google Earth

LEGEND
Approximate Borehole Location

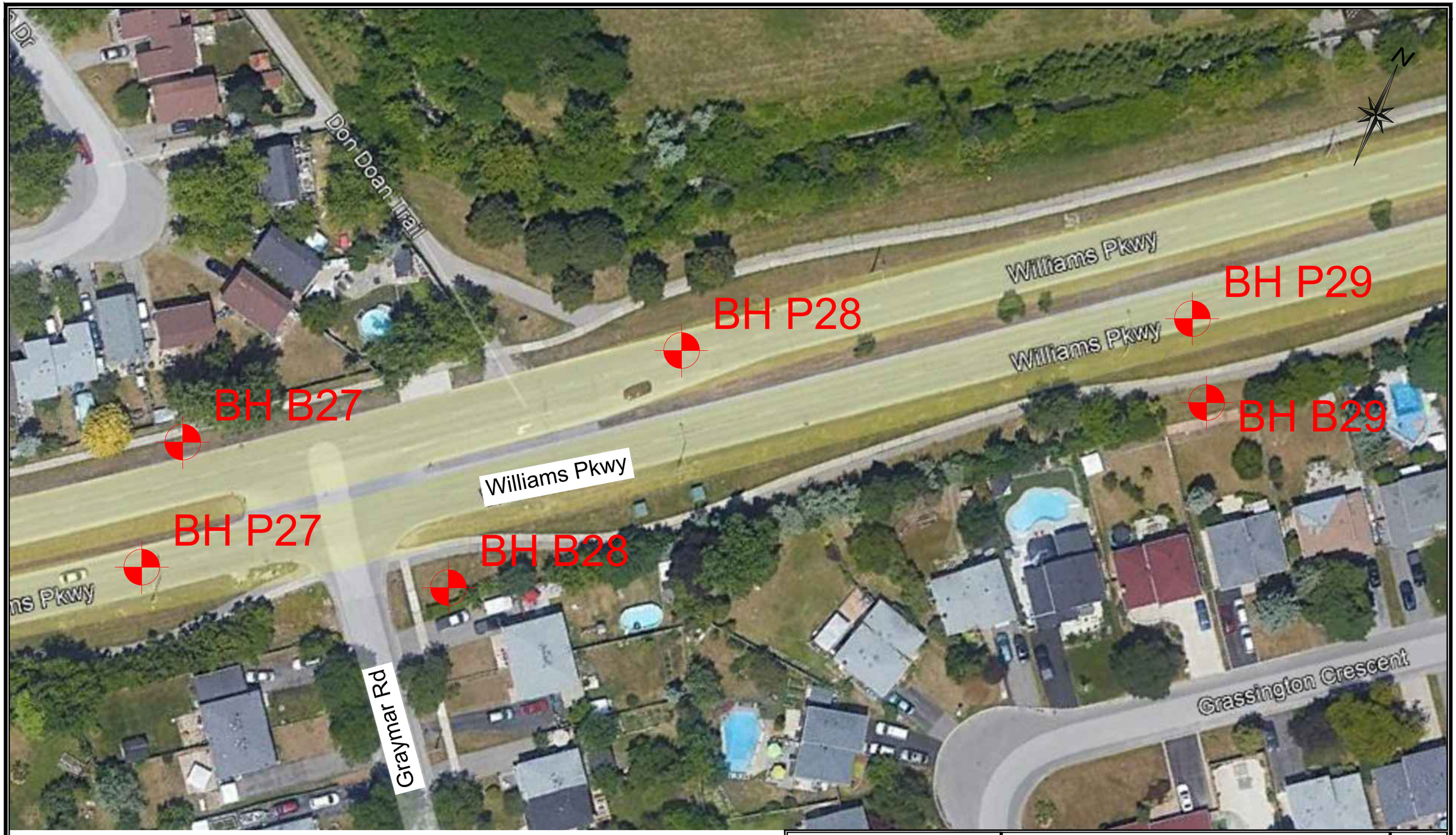
SCALE 1:600 4 0 10m

eNGLOBe

Title: **BOREHOLE LOCATION PLAN**

File No. 1-22-0499-01

FIGURE : 2-12



REFERENCE
Image © 2022 Google Earth

LEGEND
Approximate Borehole Location

SCALE 1:600 4 0 10m

eNGLOBe

Title: **BOREHOLE LOCATION PLAN**

File No. 1-22-0499-01

FIGURE : 2-13

REFERENCE
Image © 2022 Google Earth

LEGEND
Approximate Borehole Location

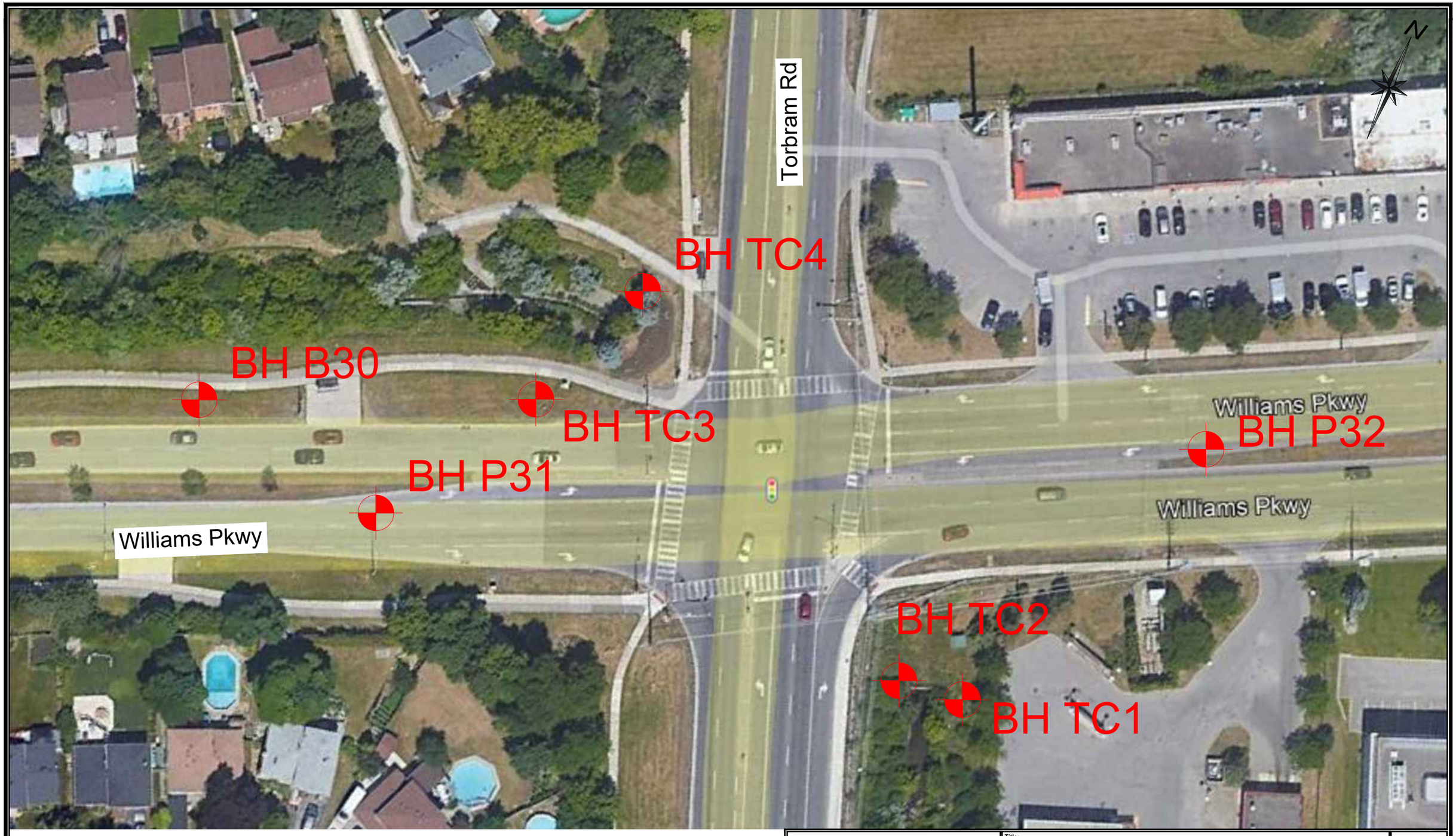
SCALE 1:600 4 0 10m

eNGLOBe

Title: **BOREHOLE LOCATION PLAN**

File No. 1-22-0499-01

FIGURE : 2-14



REFERENCE
Image © 2022 Google Earth

LEGEND
Approximate Borehole Location

SCALE 1:600 4 0 10m

eNGLOBe

Title: **BOREHOLE LOCATION PLAN**

File No. 1-22-0499-01

FIGURE : 2-15

APPENDIX A
Borehole Logs
&
Pavement Core Data

Accep	acceptable
Agg	aggregate
Amor	amorphous
Asph	asphalt
BH	borehole
Bl	blue
Bld (y)	boulder (y)
Blds	boulders
Blk	black
Br	brown
BR	bedrock
BU	break up
CF	channel face
Cl (y)	clay (ey)
Co	coarse
Cob	cobbles
Comp	compact
Conc	concrete
Contam	contaminated
Cord	corduroy
Cr	crushed
D	dense
Decomp	decomposed
Dk	dark
D_R	relative density
E	earth
F	fine
FB	frost boil
FH	frost heave
Fib	fibrous
Fr Wat	free water
Gr (y)	gravel (ly)
Gran	granular
Grn	green
Gry	grey
H	heavy
Hi	highly
HM	hot mix
HP	high plasticity
Ip	plasticity index
L	loose
Liq	liquid
Lo	loam
Lt	light
Matl	material
Max	maximum
MDD	maximum dry density
Med	medium
Mod	moderate
Mott	mottled
MP	medium plasticity
Mrl	marl
Mul	mulch
MWD	maximum wet density
NFP	no further progress
NFP (blds)	no further progress (boulders)
Num	numerous
Ob	overburden
Occ	occasional
Ora	orange
Org	organic
Org M	organic matter
Pavt	pavement
Pedo	pedological
Pen Mac	penetration macadam
Poss	possible
PST	prime and surface treated
Psty	polystyrene
Quant	quantity
Reinf	reinforced
RF	rock fill
RSS	remoulded shear strength
Sa (y)	sand (y)
Sat	saturated
SH	shale
Sh Rk	shot rock
Si (y)	silt (y)
Sl (y)	slight (ly)
SP	slight plasticity
SSM	select subgrade material
St	sensitivity
Stn (y)	stone (y)
Stks	streaks
Surf	surface
Temp	temperature
TH	test hole
TP	test pit
Tps	topsoil
Tr	trace
Unreinf	unreinforced
USS	undisturbed shear strength
Varv	varved
VF	very fine
w	field moisture content
W	with
W_L	liquid limit
Wd (y)	wood (y)
Weath	weathered
Wopt	optimum moisture content
Wp	plastic limit
WT	water table
Yel	yellow

SUSCEPTIBILITY TO FROST HEAVING

HSFH – High
MSFH – Medium
LSFH – Low

ONTARIO PROVINCIAL STANDARD DRAWING

ABBREVIATIONS

GEOTECHNICAL

Nov 2006 | Rev 1

OPSD 100.060

LOG OF BOREHOLE B1

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: September 30, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 600977, N: 4841580 (UTM 17T) Elevation Datum : Geodetic

Rig type : Mini Mole Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
	229.3	**GROUND SURFACE**					
0	229.1	180mm **TOPSOIL**					229
	0.2	**FILL**, clayey silt, trace sand, trace gravel, stiff to very stiff, brown, moist		1	SS	13	
1				2	SS	24	228
	227.8						
	1.5	**CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist		3	SS	34	
2				4	SS	46	227
3				5	SS	75	226
	225.6						
	3.7	**END OF BOREHOLE**					

Penetration Test Values (Blows / 0.3m): Dynamic Cone — 10, 20, 30, 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40, 80, 120, 160

Moisture / Plasticity: Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL) — 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE B2

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	:
Date started	: October 4, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 600997, N: 4841709 (UTM 17T) Elevation Datum : Geodetic

Rig type : Geoprobe Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
	229.4	**GROUND SURFACE**				
	229.2	150mm **ASPHALTIC CONCRETE**				
	0.2					
	229.1	150mm **GRANULAR BASE**		1	SS	23
	0.3					
	228.8	300mm **GRANULAR SUBBASE**, sand and gravel		2	SS	13
	0.6					
	228.2	**FILL**, clayey silt, trace sand, trace gravel, stiff, brown, moist		3	SS	32
	1.2	**CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist				
				4	SS	37
				5	SS	50
	225.7					
	3.7	**END OF BOREHOLE**				

Elevation Scale (m): 229, 228, 227, 226

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit: PL, MC, LL: 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE B3

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: September 30, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601088, N: 4841828 (UTM 17T) Elevation Datum : Geodetic

Rig type : Mini Mole Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
	229.0	**GROUND SURFACE**					
0		125mm **TOPSOIL**		1	SS	14	
	228.4	**FILL**, clayey silt, trace sand, trace gravel, stiff, brown, moist					
	0.6						
1		**CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist		2	SS	37	228
				3	SS	53	227
2				4	SS	33	
3		...sandy		5	SS	69	226
	225.3						
	3.7						

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10 20 30 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40 80 120 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit; PL MC LL: 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE B4

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: September 30, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601084, N: 4841895 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	228.3	**GROUND SURFACE**				
	228.0	125mm **TOPSOIL**				
	0.3	**FILL**, clayey silt, trace sand, trace gravel, very stiff, brown, moist		1	SS	16
1		**CLAYEY SILT**, trace sand, trace gravel, very stiff to hard, brown, moist		2	SS	55
	226.8					
	1.5	**SANDY SILT**, trace clay, trace gravel, very dense, brown to grey, moist		3	SS	84
2	225.8			4	SS	100 / 75mm
	2.5	**END OF BOREHOLE**				

Borehole was dry and open upon completion of drilling.

Elevation Scale (m): 228, 227, 226

Penetration Test Values (Blows / 0.3m): Dynamic Cone — 10, 20, 30, 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40, 80, 120, 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit — PL, MC, LL — 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE B5

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: September 30, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601194, N: 4841980 (UTM 17T) Elevation Datum : Geodetic

Rig type : Mini Mole Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	227.5	**GROUND SURFACE**				
		125mm **TOPSOIL**		1	SS	19
	226.9	**FILL**, clayey silt, trace sand, trace gravel, very stiff, brown, moist				
1	0.6	**CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist		2	SS	73
				3	SS	90
2	225.2					
	2.3	**SANDY SILT**, trace clay, trace gravel, very dense, brown to grey, moist		4	SS	100 / 200mm
3				5	SS	69
	223.8					
	3.7	**END OF BOREHOLE**				

Elevation Scale (m): 227, 226, 225, 224

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit; PL, MC, LL: 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE B6

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: September 30, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601213, N: 4842061 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value	Elevation Scale (m)
0	228.4	**GROUND SURFACE**					
		100mm **TOPSOIL**		1	SS	25	228
		CLAYEY SILT, trace sand, trace gravel, very stiff to hard, brown, moist		2	SS	90	227
2				3	SS	55	
				4	SS	55	226
3	225.4						
	3.0 / 224.9	**SANDY SILT**, trace clay, trace gravel, very dense, brown, moist		5	SS	100 / 250mm	225
	3.5	**END OF BOREHOLE**					

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL): 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE B7

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	:
Date started	: October 6, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601277, N: 4842139 (UTM 17T) Elevation Datum : Geodetic

Rig type : Geoprobe, track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value	Elevation Scale (m)
	230.4	**GROUND SURFACE**					
0	230.2	150mm **TOPSOIL**		1	SS	29	230
	0.2	**FILL**, clayey silt, trace sand, trace gravel, firm to very stiff, brown, moist		2	SS	8	
1	228.9						229
	1.5	**CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist (GLACIAL TILL)		3	SS	40	
2				4	SS	59	228
	227.4						
3	3.0	**SILTY SAND**, trace clay, trace gravel, very dense, brown, moist		5	SS	100 / 250mm	227
	226.9						
	3.5	**END OF BOREHOLE**					

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL): 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE B8

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: September 29, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601357, N: 4842166 (UTM 17T) Elevation Datum : Geodetic

Rig type : Mini Mole Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	231.3	**GROUND SURFACE**				
0	231.1	150mm **TOPSOIL**				
	0.2	**FILL**, clayey silt, trace sand, trace gravel, very stiff, brown, moist		1	SS	30
1	230.2			2	SS	19
	1.1	**CLAYEY SILT**, trace sand, trace gravel, very stiff to hard, brown, moist		3	SS	27
2						
				4	SS	96 / 275mm
3	228.0			5	SS	50 / 100mm
	3.3	**END OF BOREHOLE**				

Elevation Scale (m): 231, 230, 229

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit; PL, MC, LL: 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE B9

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: September 29, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601406, N: 4842272 (UTM 17T) Elevation Datum : Geodetic

Rig type : Mini Mole Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value	Elevation Scale (m)
	231.3	**GROUND SURFACE**					
0	231.1 0.2	150mm **TOPSOIL**		1	SS	31	231
	230.7 0.6	**FILL**, clayey silt, trace sand, trace gravel, hard, brown, moist					
1		**CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist (GLACIAL TILL)		2	SS	44	230
				3	SS	70	
2							229
				4	SS	62	
3							
	227.9 3.4			5	SS	100 / 150mm	228

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10 20 30 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40 80 120 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit: PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE B10

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: September 29, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601522, N: 4842332 (UTM 17T) Elevation Datum : Geodetic

Rig type : Mini Mole Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
	227.5	**GROUND SURFACE**					
0	227.3	150mm **TOPSOIL**					
	0.2			1	SS	38	
	226.9	**FILL**, clayey silt, trace sand, trace gravel, hard, brown, moist					227
	0.6						
1		**CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist		2	SS	87	
				3	SS	136	226
2	225.5			4	SS	100 / 25mm	
	2.0						

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40
Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE B11

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: September 29, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601611, N: 4842475 (UTM 17T) Elevation Datum : Geodetic

Rig type : Mini Mole Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	225.1	**GROUND SURFACE**				
0	224.9	150mm **TOPSOIL**		1	SS	14
	0.2					
	224.5	**FILL**, clayey silt, trace sand, trace gravel, stiff, brown, moist				
	0.6			2	SS	46
1		**CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist				
				3	SS	32
2						
				4	SS	100 / 150mm
3				5	SS	103 / 200mm
	221.7					
	3.4					

Elevation Scale (m): 225, 224, 223, 222

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit; PL, MC, LL: 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE B12

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: September 29, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601718, N: 4842514 (UTM 17T) Elevation Datum : Geodetic

Rig type : Mini Mole Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value	Elevation Scale (m)
	224.2	**GROUND SURFACE**					
0		100mm **TOPSOIL**		1	SS	37	224
		CLAYEY SILT, trace sand, trace gravel, very stiff to hard, brown, moist					
1				2	SS	42	223
2				3	SS	46	222
				4	SS	80	
3				5	SS	29	221
	220.5						
	3.7	**END OF BOREHOLE**					

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10 20 30 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40 80 120 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit: PL MC LL 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE B13

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	:
Date started	: October 4, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601887, N: 4842692 (UTM 17T) Elevation Datum : Geodetic

Rig type : Geoprobe Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value	Elevation Scale (m)
	223.4	**GROUND SURFACE**					
0	223.2	150mm **TOPSOIL**					223
	0.2	**FILL**, clayey silt, trace sand, trace gravel, stiff to very stiff, brown, moist		1	SS	15	
1				2	SS	24	222
				3	SS	18	
2	221.1						
	2.3	**FILL**, silty sand, compact, brown, moist		4	SS	13	221
3	220.1			5	SS	12	
	219.9	**CLAYEY SILT**, trace sand, trace gravel, brown, moist					220
	3.5	**END OF BOREHOLE**					

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL): 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE B14

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: October 4, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601961, N: 4842774 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	223.3	**GROUND SURFACE**				
	223.1 / 0.2	180mm **TOPSOIL**				
		FILL, clayey silt, trace sand, trace gravel, firm to very stiff, brown, moist		1	SS	19
1				2	SS	12
				3	SS	7
2	221.0 / 2.3	**CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist		4	SS	100 / 75mm
3	219.8 / 3.5	**END OF BOREHOLE**		5	SS	98

Borehole was dry and open upon completion of drilling.

Elevation Scale (m): 223, 222, 221, 220

Penetration Test Values (Blows / 0.3m): Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

LOG OF BOREHOLE B15

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: October 5, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602009, N: 4842776 (UTM 17T) Elevation Datum : Geodetic

Rig type : Geoprobe Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	223.8	**GROUND SURFACE**				
		125mm **TOPSOIL**		1	SS	11
		FILL, clayey silt, trace sand, trace gravel, stiff to very stiff, brown, moist		2	SS	20
1	222.3					
	1.5	**CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist		3	SS	37
2				4	SS	38
3	220.3			5	SS	40
	3.5	**END OF BOREHOLE**				

Elevation Scale (m): 223, 222, 221

Penetration Test Values (Blows / 0.3m): Dynamic Cone — 10, 20, 30, 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40, 80, 120, 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit — PL, MC, LL — 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE B16

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: October 4, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602081, N: 4842920 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
	223.8	**GROUND SURFACE**				
0	223.6 / 0.2	150mm **TOPSOIL**		1	SS	12
	223.2 / 0.6	**FILL**, clayey silt, trace sand, trace gravel, stiff, brown, moist				
1		**CLAYEY SILT**, trace sand, trace gravel, very stiff to hard, brown, moist		2	SS	21
				3	SS	18
2				4	SS	26
3				5	SS	41
	220.3 / 3.5	**END OF BOREHOLE**				

Borehole was dry and open upon completion of drilling.

Elevation Scale (m): 223, 222, 221

Penetration Test Values (Blows / 0.3m): Dynamic Cone — 10, 20, 30, 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40, 80, 120, 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit — PL, MC, LL — 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE B17

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: October 4, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602150, N: 4843005 (UTM 17T) Elevation Datum : Geodetic

Rig type : Geoprobe Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	223.1	**GROUND SURFACE**				
	222.9 / 0.2	150mm **TOPSOIL**		1	SS	13
	222.5 / 0.6	**FILL**, clayey silt, trace sand, trace gravel, stiff, brown, moist		2	SS	38
1		**CLAYEY SILT**, trace sand, trace gravel, very stiff to hard, brown, moist		3	SS	19
2				4	SS	33
3	219.6 / 3.5			5	SS	45

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Elevation Scale (m): 223, 222, 221, 220

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit; PL, MC, LL: 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE B18

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	:
Date started	: October 6, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602227, N: 4843115 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	222.9	**GROUND SURFACE**				
		100mm **TOPSOIL**		1	SS	13
	222.3 (0.6)	**FILL**, clayey silt, trace sand, trace gravel, stiff, brown, moist				
1		**CLAYEY SILT**, trace sand, trace gravel, very stiff to hard, brown, moist		2	SS	27
				3	SS	21
2				4	SS	31
3				5	SS	68
	219.4 (3.5)	**END OF BOREHOLE**				

Elevation Scale (m): 222, 221, 220

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit; PL, MC, LL: 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE B19

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: October 5, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602289, N: 4843114 (UTM 17T) Elevation Datum : Geodetic

Rig type : Geoprobe Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
	222.6	**GROUND SURFACE**				
0	222.4	150mm **TOPSOIL**		1	SS	12
	0.2					
	222.0	**FILL**, clayey silt, trace sand, trace gravel, stiff, brown, moist				
	0.6			2	SS	28
1		**CLAYEY SILT**, trace sand, trace gravel, very stiff to hard, brown, moist				
				3	SS	27
2						
				4	SS	38
3				5	SS	57
	219.1					
	3.5	**END OF BOREHOLE**				

Borehole was dry and open upon completion of drilling.

Elevation Scale (m): 222, 221, 220

Penetration Test Values (Blows / 0.3m): Dynamic Cone — 10, 20, 30, 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40, 80, 120, 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit — PL, MC, LL — 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE B20

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	:
Date started	: October 6, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602343, N: 4843241 (UTM 17T) Elevation Datum : Geodetic

Rig type : Geoprobe Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value	Elevation Scale (m)
	223.7	**GROUND SURFACE**					
0		100mm **TOPSOIL**		1	SS	12	
	223.1 / 0.6	**FILL**, clayey silt, trace sand, trace gravel, stiff, brown, moist					223
1		**CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist		2	SS	31	
				3	SS	31	222
2				4	SS	35	
							221
3				5	SS	37	
	220.0 / 3.7	**END OF BOREHOLE**					

Penetration Test Values (Blows / 0.3m): Dynamic Cone — 10, 20, 30, 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40, 80, 120, 160

Moisture / Plasticity: Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL) — 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE B21A

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: October 5, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602455, N: 4843321 (UTM 17T) Elevation Datum : Geodetic

Rig type : Geoprobe Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	224.0	**GROUND SURFACE**				
	223.8	150mm **TOPSOIL**				
	0.2	**FILL**, clayey silt, trace sand, trace gravel, stiff, brown, moist		1	SS	14
1				2	SS	14
	222.5					
	1.5	**CLAYEY SILT**, trace sand, trace gravel, very stiff to hard, brown, moist		3	SS	22
2				4	SS	26
3				5	SS	39
	220.5					
	3.5	**END OF BOREHOLE**				

Elevation Scale (m): 223, 222, 221

Penetration Test Values (Blows / 0.3m): Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE B22

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: October 5, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602545, N: 4843435 (UTM 17T) Elevation Datum : Geodetic

Rig type : Geoprobe Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
	224.7	**GROUND SURFACE**				
0	224.5	150mm **TOPSOIL**		1	SS	15
	0.2					
	224.1	**FILL**, silty sand, trace gravel, compact, brown, moist				
	0.6			2	SS	18
1		**FILL**, clayey silt, trace sand, trace gravel, very stiff, brown, moist				
	223.2					
	1.5	**CLAYEY SILT**, trace sand, trace gravel, very stiff to hard, brown, moist		3	SS	26
2						
				4	SS	36
3						
	221.2			5	SS	48
	3.5	**END OF BOREHOLE**				

Borehole was dry and open upon completion of drilling.

Elevation Scale (m): 224, 223, 222

Penetration Test Values (Blows / 0.3m): Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE B23

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: October 5, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602620, N: 4843557 (UTM 17T) Elevation Datum : Geodetic

Rig type : Geoprobe Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value	Elevation Scale (m)
	222.6	**GROUND SURFACE**					
0	222.4 0.2	160mm **ASPHALTIC CONCRETE**					
	222.2 0.4	220mm **GRANULAR BASE**		1	SS	32	
	222.0 0.6	200mm **GRANULAR SUBBASE**, sand and gravel		2	SS	18	
1		**CLAYEY SILT**, trace sand, trace gravel, very stiff to hard, brown, moist		3	SS	27	222
2							221
				4	SS	40	220
3	219.1 3.5			5	SS	49	

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit: PL, MC, LL: 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE B24

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	:
Date started	: October 3, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602672, N: 4843632 (UTM 17T) Elevation Datum : Geodetic

Rig type : Geoprobe Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	221.4	**GROUND SURFACE**				
	221.2 / 0.2	150mm **TOPSOIL**				
	220.8 / 0.6	**FILL**, clayey silt, trace sand, trace gravel, stiff, brown, moist		1	SS	12
1		**CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist		2	SS	42
2				3	SS	38
				4	SS	48
3				5	SS	44
	217.7 / 3.7					

Elevation Scale (m): 221, 220, 219, 218

Penetration Test Values (Blows / 0.3m): Dynamic Cone — 10, 20, 30, 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40, 80, 120, 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit — PL, MC, LL — 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE B25

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 19, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602666, N: 4843686 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	220.6	**GROUND SURFACE**				
0	220.4	180mm **TOPSOIL**		1	SS	9
	0.2	**FILL**, sandy silt, trace gravel, trace clay, trace rootlets, loose to dense, brown, dry to damp		2	SS	32
1	219.1					
	1.5	**SANDY SILT**, trace gravel, trace clay, compact to dense, brown, damp		3	SS	22
2				5	SS	34
	217.6					
3	3.0	**CLAYEY SILT**, trace gravel, very stiff, brown, damp		6	SS	25
	217.1	(GLACIAL TILL)				
	3.5					

Elevation Scale (m): 220, 219, 218

Penetration Test Values (Blows / 0.3m): Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE B26

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: October 6, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602768, N: 4843790 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	218.1	**GROUND SURFACE**				
	217.9	150mm **TOPSOIL**				
	0.2	**FILL**, clayey silt, trace sand, trace gravel, stiff, brown, moist		1	SS	10
1				2	SS	12
	216.6					
	1.5	**CLAYEY SILT**, trace sand, trace gravel, very stiff to hard, brown, moist		3	SS	25
2				4	SS	32
3				5	SS	42
	214.6					
	3.5	**END OF BOREHOLE**				

Elevation Scale (m): 218, 217, 216, 215

Penetration Test Values (Blows / 0.3m): Dynamic Cone — 10, 20, 30, 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40, 80, 120, 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit — PL, MC, LL — 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE B27

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 19, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602795, N: 4843901 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	215.9	**GROUND SURFACE**				
0	215.7 / 0.2	165mm **TOPSOIL**		1	SS	9
		FILL, sandy silt, trace gravel, trace clay, trace rootlets, loose to compact, brown, damp		2	SS	22
1	214.4 / 1.5	**SANDY SILT**, trace gravel, trace clay, dense to very dense, brown, damp		3	SS	32
				4	SS	35
2						
3	212.4 / 3.5	**END OF BOREHOLE**		5	SS	107

Borehole was dry and open upon completion of drilling.

Elevation Scale (m): 215, 214, 213

Penetration Test Values (Blows / 0.3m): Dynamic Cone — 10, 20, 30, 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40, 80, 120, 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit — PL, MC, LL — 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE B28

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: October 4, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602846, N: 4843916 (UTM 17T) Elevation Datum : Geodetic

Rig type : Geoprobe Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	215.2	**GROUND SURFACE**				
	215.0	180mm **TOPSOIL**				
	0.2	**FILL**, clayey silt, trace sand, trace gravel, very stiff, brown, moist		1	SS	24
1				2	SS	18
				3	SS	15
2	212.9					
	2.3	**CLAYEY SILT**, trace sand, trace gravel, very stiff to hard, brown, moist		4	SS	23
3				5	SS	84
	211.7					
	3.5	**END OF BOREHOLE**				

Elevation Scale (m): 215, 214, 213, 212

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit: PL, MC, LL: 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE B29

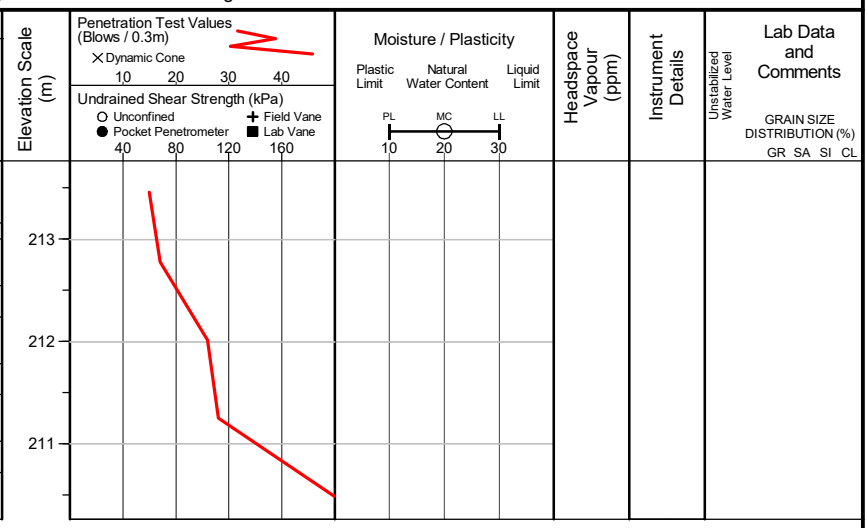
Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	:
Date started	: October 6, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602903, N: 4844036 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
	213.8	**GROUND SURFACE**				
0	213.6 / 0.2	150mm **TOPSOIL**		1	SS	15
	213.2 / 0.6	**FILL**, clayey silt, trace sand, trace gravel, very stiff, brown, moist				
1		**CLAYEY SILT**, trace sand, trace gravel, very stiff to hard, brown, moist		2	SS	17
				3	SS	26
2				4	SS	28
3				5	SS	70
	210.3 / 3.5	**END OF BOREHOLE**				

Borehole was dry and open upon completion of drilling.



Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE B30

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: October 4, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602971, N: 4844194 (UTM 17T) Elevation Datum : Geodetic

Rig type : Geoprobe Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value	Elevation Scale (m)
	212.2	**GROUND SURFACE**					
0	212.0	150mm **TOPSOIL**		1	SS	19	212
	0.2						
	211.6	**FILL**, clayey silt, trace sand, trace gravel, very stiff, brown, moist					
	0.6			2	SS	20	
1		**CLAYEY SILT**, trace sand, trace gravel, very stiff to hard, brown, moist					211
				3	SS	80	
2							210
				4	SS	87	
3							
	208.8			5	SS	100 / 200mm	209
	3.4						

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10 20 30 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40 80 120 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit: PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE EC1

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 19, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601806, N: 4842626 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
	219.7	**GROUND SURFACE**				
0	219.5	165mm **TOPSOIL**		1	SS	6
	0.2	**FILL**, sandy silt, trace rootlets, trace clay, trace gravel, loose, brown, damp				
	218.9			2	SS	27
1	0.8	**SANDY SILT**, some clay, trace gravel, compact to very dense, grey, wet (GLACIAL TILL)				
				3	SS	71
2				4	SS	68
				5	SS	73
3				6	SS	100 / 100mm
	215.1					
4	4.6	**INFERRED BEDROCK**		7	SS	59
				8	SS	100 / 150mm
5						
				9	SS	100 / 75mm
6	213.2			10	SS	100 / 50mm
	6.5	**END OF BOREHOLE**				

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Elevation Scale (m): 219, 218, 217, 216, 215, 214

Moisture / Plasticity — Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL): 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%)

	GR	SA	SI	CL
6	31	49	14	
1	32	51	16	

Borehole was dry and open upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Feb 5, 2024	2.7	217.0

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE EC2

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: September 14, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

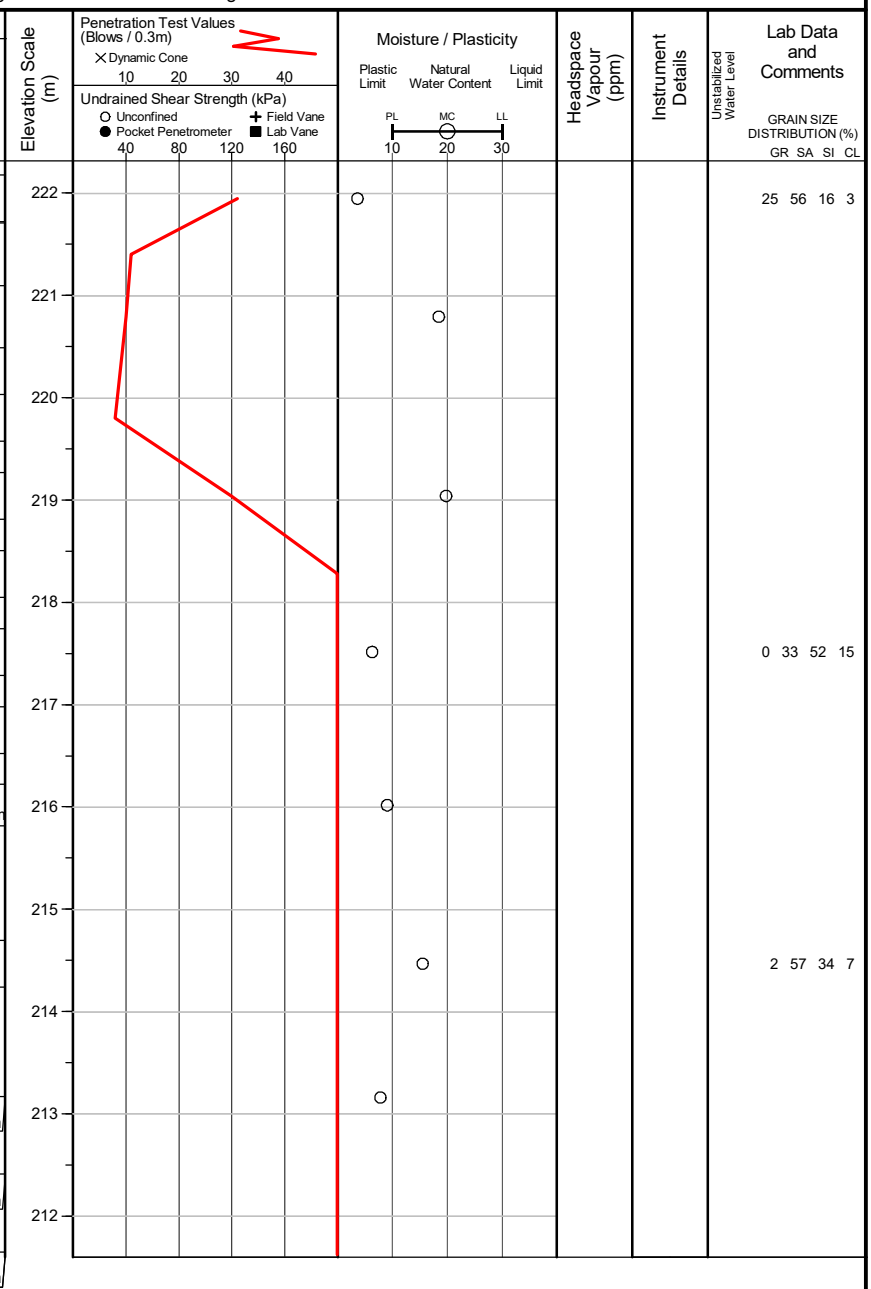
Position : E: 601800, N: 4842610 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	222.3	**GROUND SURFACE**				
	221.9 / 0.4	140mm **ASPHALTIC CONCRETE**				
	221.6 / 0.7	260mm **GRANULAR BASE**		1	SS	31
1	221.2 / 1.1	300mm **GRANULAR SUBBASE**, gravelly sand, dense, brown, moist		2	SS	11
		FILL, silty sand, trace gravel, compact, brown, moist		3	SS	10
2		Clayey silt, trace sand, trace gravel, stiff, brown, moist		4	SS	8
3	218.9 / 3.4			5	SS	30
		CLAYEY SILT, trace sand, trace gravel, hard, brown, moist		6	SS	78
4	217.7 / 4.6			7	SS	140
5		**SANDY SILT**, some clay, very dense, brown, moist		8	SS	102
6				9	SS	105 / 250mm
7	214.7 / 7.6					
	214.4 / 7.9	**SILTY SAND**, trace clay, trace gravel, very dense, brown, moist		10	SS	92
8		**CLAYEY SILT**, sandy, trace gravel, shale fragments, hard, grey, moist (GLACIAL TILL)				
9	213.2 / 9.1	**INFERRED BEDROCK**		11	SS	100 / 25mm
10				12	SS	100 / 50mm
	211.6 / 10.7			13	SS	100 / 50mm

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.



Unstabilized Water Level	Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments	GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
				25 56 16 3
				0 33 52 15
				2 57 34 7

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE EC3

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 4, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601822, N: 4842614 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0	222.3	**GROUND SURFACE**					222						
	222.1	150mm **ASPHALTIC CONCRETE**											
	0.2	460mm **GRANULAR BASE/ SUBBASE**, sand and gravel, dense, brown, dry		1	SS	56							
	221.7						221						
1	0.6	**FILL**, sandy clayey silt, trace gravel, firm to very stiff, brown, damp		2	SS	31							
				3	SS	10							
2							220						
				4	SS	5							1 24 48 27
3				5	SS	27	219						
	218.5												
4	3.8	**SANDY SILT**, some clay, trace gravel, very dense, grey, dry to damp (GLACIAL TILL)		6	SS	66	218						
				7	SS	79							
5							217						
				8	SS	129							8 31 45 16
6				9	SS	95	216						
7	214.7						215						
	7.6	(WEATHERED/DISTURBED)		10	SS	49							
8				11	SS	100 / 75mm	214						
9				12	SS	100 / 50mm	213						
	212.7												
	9.6	**END OF BOREHOLE**		13	SS	100 / 25mm							

Penetration Test Values (Blows / 0.3m): × Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined ✚ Field Vane ● Pocket Penetrometer ■ Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit | Natural Water Content | Liquid Limit; PL MC LL; 10 20 30

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE EC4

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 19, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601826, N: 4842597 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	219.4	**GROUND SURFACE**				
0	219.2	55mm **ASPHALTIC CONCRETE**		1	SS	12
	0.2	125mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, wet				
1		**SAND AND SILT**, some clay, trace gravel, compact to very dense, grey, wet to dry (GLACIAL TILL)		2	SS	24
				3	SS	56
2						
				4	SS	30
3	216.4					
	3.0	(WEATHERED/DISTURBED)		5	SS	42
				6	SS	100 / 125mm
4						
				7	SS	100 / 100mm
5						
	213.5			8	SS	100 / 75mm
	5.9	**END OF BOREHOLE**				

Elevation Scale (m): 219, 218, 217, 216, 215, 214

Penetration Test Values (Blows / 0.3m): × Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined ● Pocket Penetrometer + Field Vane ■ Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit | Natural Water Content | Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%)

	GR	SA	SI	CL
1	33	54	12	
1	44	44	11	

Unstabilized water level measured at 5.2 m below ground surface; borehole was open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE P1

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 11, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601262, N: 4842099 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
0	**229.8**	**GROUND SURFACE**					
		140mm **ASPHALTIC CONCRETE**					
	229.2	440mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	26	
	0.6	**FILL**, sandy silt, trace clay, trace gravel, loose, brown, moist		2	SS	6	
1	228.3						
	1.5	**SANDY SILT**, trace gravel, compact, brown, damp		3	SS	25	
	227.8	(GLACIAL TILL)					
	2.0						

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10 20 30 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40 80 120 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit; PL MC LL: 10 20 30

Headspace Vapour (ppm) | Instrument Details | Unstabilized Water Level | Lab Data and Comments | GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P2

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 5, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601367, N: 4842191 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	231.4	**GROUND SURFACE**				
		140mm **ASPHALTIC CONCRETE**				
	230.9	320mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, dry		1	SS	21
	0.5					
1		**FILL**, sandy silt, trace gravel, trace clay, compact, brown, damp		2	SS	14
	229.9					
	1.5					
	229.4	**SANDY SILT**, trace gravel, trace clay, dense, brown, damp		3	SS	39
	2.0	(GLACIAL TILL)				

Elevation Scale (m): 231, 230

Penetration Test Values (Blows / 0.3m): ×Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined ● Pocket Penetrometer + Field Vane ■ Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit | Natural Water Content | Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P3

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 4, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601385, N: 4842237 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	231.8	**GROUND SURFACE**				
	231.6 0.2	150mm **ASPHALTIC CONCRETE**				
	231.3 0.5	330mm **GRANULAR BASE/SUBBASE**, sand and gravel, dense, brown, damp		1	SS	48
1		**FILL**, sandy silt, trace gravel, compact, brown, damp		2	SS	14
	230.3 1.5	**SANDY SILT**, trace gravel, trace cinders, compact, brown, damp		3	SS	29
	229.8 2.0	**END OF BOREHOLE**				

Elevation Scale (m): 231, 230

Penetration Test Values (Blows / 0.3m): Dynamic Cone — 10, 20, 30, 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40, 80, 120, 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit — PL, MC, LL — 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE P4

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 5, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601462, N: 4842297 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0	**229.3**	**GROUND SURFACE**											
	228.9 / 0.4	135mm **ASPHALTIC CONCRETE**					229						
		230mm **GRANULAR BASE/SUBBASE**, sand and gravel, compact, brown, damp		1	SS	28							
1		**FILL**, sandy silt, trace gravel, trace clay, compact, brown, damp		2	SS	15							
	227.8 / 1.5						228						
	227.3 / 2.0	**SANDY SILT**, trace gravel, trace clay, very dense, brown, damp (GLACIAL TILL)		3	SS	78							

Penetration Test Values (Blows / 0.3m): × Dynamic Cone — 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined ● Pocket Penetrometer + Field Vane ■ Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL) — 10 20 30

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P5

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 4, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601517, N: 4842354 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	227.1	**GROUND SURFACE**				
		145mm **ASPHALTIC CONCRETE**				
	226.7					
	0.4	275mm **GRANULAR BASE/ SUBBASE**, sand and gravel, dense, brown, damp		1	SS	31
1		**FILL**, sandy silt, trace gravel, compact, brown, damp		2	SS	10
	225.6					
	1.5	**SANDY SILT**, trace gravel, very dense, brown, dry		3	SS	62
	225.1	(GLACIAL TILL)				
	2.0					

Elevation Scale (m): 227, 226

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit; PL, MC, LL: 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE P6

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 5, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601569, N: 4842393 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value	Elevation Scale (m)
0	**225.9**	**GROUND SURFACE**					
	225.7	165mm **ASPHALTIC CONCRETE**					
	0.2 / 225.3	455mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	19	
	0.6	**FILL**, sandy silt, trace gravel, trace clay, compact, brown, damp		2	SS	12	225
1	224.4						
	1.5 / 223.9	**SANDY SILT**, trace gravel, compact, brown, damp		3	SS	28	
	2.0	(GLACIAL TILL)					224

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10 20 30 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40 80 120 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit: PL MC LL; 10 20 30

Headspace Vapour (ppm) | Instrument Details | Unstabilized Water Level | Lab Data and Comments | GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P7

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 4, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601617, N: 4842470 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0	**224.5**	**GROUND SURFACE**											
	224.3 0.2	150mm **ASPHALTIC CONCRETE**											
	224.2 0.3	195mm **GRANULAR BASE/ SUBBASE**, sand and gravel, dense, brown, damp		1	SS	39	224						
1		**FILL**, sandy silt, trace gravel, trace clay, compact, brown, damp		2	SS	13							
	223.0 1.5						223						
	222.5 2.0	**SANDY SILT**, trace gravel, very dense, brown, damp (GLACIAL TILL)		3	SS	85							

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P8

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 5, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601671, N: 4842500 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	224.2	**GROUND SURFACE**				
		140mm **ASPHALTIC CONCRETE**				
	223.7	380mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	25
1	0.5	**FILL**, sandy silt, trace clay, trace gravel, compact, brown, damp		2	SS	15
	222.7					
	1.5	**SANDY SILT**, trace gravel, compact, brown, damp		3	SS	19
	222.2	(GLACIAL TILL)				
	2.0					

Elevation Scale (m): 224, 223

Penetration Test Values (Blows / 0.3m): Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P9

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 4, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

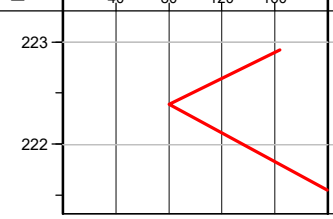
Position : E: 601730, N: 4842560 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	223.3	**GROUND SURFACE**				
0	223.1	165mm **ASPHALTIC CONCRETE**				
	0.2					
	222.7	445mm **GRANULAR BASE/ SUBBASE**, sand and gravel, dense, brown, damp		1	SS	41
	0.6					
1		**FILL**, sandy silt, trace gravel, trace clay, compact, brown, damp		2	SS	20
	221.8					
	1.5					
	221.3	**SANDY SILT**, trace gravel, very dense, brown, damp		3	SS	63
	2.0					

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.



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LOG OF BOREHOLE P10

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 4, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601878, N: 4842672 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
0	222.5	**GROUND SURFACE**					
	222.3	185mm **ASPHALTIC CONCRETE**					
	0.2						
	221.9	420mm **GRANULAR BASE/ SUBBASE**, sand and gravel, dense, brown, damp		1	SS	36	
	0.6						
1		**FILL**, sandy silt, trace clay, trace gravel, compact, brown, moist		2	SS	11	222
	221.0						
	1.5						
	220.5	**FILL**, clayey silt, trace gravel, trace sand, stiff, grey, moist		3	SS	10	221
	2.0						

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10 20 30 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40 80 120 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit: PL MC LL 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P11

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 5, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 601958, N: 4842726 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
0	**223.0**	**GROUND SURFACE**					
	222.8	175mm **ASPHALTIC CONCRETE**					
	0.2						
	222.4	405mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	36	
	0.6						
1		**FILL**, sandy silt, trace clay, trace gravel, compact, brown, damp		2	SS	14	222
	221.5						
	1.5						
	221.0	**SANDY SILT**, trace gravel, trace cinders, very dense, brown, damp		3	SS	34	
	2.0	(GLACIAL TILL)					

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10 20 30 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40 80 120 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit: PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P12

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 11, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602000, N: 4842809 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	223.4	**GROUND SURFACE**				
		140mm **ASPHALTIC CONCRETE**				
	222.9	320mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	17
	0.5					
1		**FILL**, sandy silt, trace gravel, trace clay, compact, brown, damp		2	SS	15
	221.9					
	1.5	**SANDY SILT**, trace gravel, dense, brown, damp		3	SS	31
	221.4	(GLACIAL TILL)				
	2.0					

Elevation Scale (m): 223, 222

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit; PL, MC, LL: 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE P13

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 5, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602077, N: 4842872 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	223.1	**GROUND SURFACE**				
		150mm **ASPHALTIC CONCRETE**		1	SS	53
		830mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp				
1	222.1			2	SS	39
	1.0	**SANDY SILT**, trace gravel, trace clay, loose, brown, damp				
				3	SS	9
	221.1					
	2.0	**END OF BOREHOLE**				

Borehole was dry and open upon completion of drilling.

Elevation Scale (m): 223, 222

Penetration Test Values (Blows / 0.3m): × Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined ● Pocket Penetrometer + Field Vane ■ Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit PL 10 | Natural Water Content MC 20 | Liquid Limit LL 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE P14

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 11, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602112, N: 4842947 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments
0	**222.8**	**GROUND SURFACE**						Dynamic Cone: 10 20 30 40; Unconfined / Pocket Penetrometer / Field Vane / Lab Vane: 40 80 120 160	Plastic Limit / Natural Water Content / Liquid Limit: PL MC LL; 10 20 30				GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
		150mm **ASPHALTIC CONCRETE**											
	222.3 0.5	360mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	21							
1		**FILL**, sandy silt, trace gravel, trace clay, compact, brown, damp		2	SS	13	222						
	221.3 1.5	**SANDY SILT**, trace gravel, trace clay, dense, brown, damp		3	SS	31	221						
	220.8 2.0	**END OF BOREHOLE**											

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P15

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 5, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602172, N: 4842989 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0	**222.4**	**GROUND SURFACE**											
	222.2 / 0.2	180mm **ASPHALTIC CONCRETE**											
	221.8 / 0.6	610mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	65	222						
1		**FILL**, sand and gravel to gravelly, loose very dense, brown, damp		2	SS	39							
							221						
	220.4 / 2.0			3	SS	8							

Penetration Test Values (Blows / 0.3m): Dynamic Cone — 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit — PL MC LL — 10 20 30

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P16

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 11, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602215, N: 4843061 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
0	222.1	**GROUND SURFACE**					222	Dynamic Cone 10 20 30 40; Unconfined / Pocket Penetrometer / Field Vane / Lab Vane 40 80 120 160	Plastic Limit / Natural Water Content / Liquid Limit PL MC LL 10 20 30			Unstabilized Water Level; GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
		130mm **ASPHALTIC CONCRETE**										
	221.6	405mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	17						
1	0.5	**SANDY SILT**, trace gravel, trace clay, compact, brown, damp		2	SS	13	221					
				3	SS	12						
	220.1											
	2.0	**END OF BOREHOLE**										

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE P17

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 5, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602301, N: 4843158 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	222.5	**GROUND SURFACE**				
		150mm **ASPHALTIC CONCRETE**				
	222.0	390mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	24
	0.5	**FILL**, sandy silt, trace gravel, trace clay, compact, brown, damp		2	SS	13
1	221.0					
	1.5	**SANDY SILT**, trace gravel, trace cinders, dense, brown, damp		3	SS	31
	220.5	(GLACIAL TILL)				
	2.0					

Elevation Scale (m): 222, 221

Penetration Test Values (Blows / 0.3m): Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P18

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 11, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602349, N: 4843237 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	223.1	**GROUND SURFACE**				
		140mm **ASPHALTIC CONCRETE**				
	222.6	400mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	23
	0.5	**FILL**, sandy silt, trace gravel, trace clay, compact, brown, damp		2	SS	14
1	221.6					
	1.5	**SANDY SILT**, trace gravel, trace clay, dense, brown, damp		3	SS	33
	221.1	(GLACIAL TILL)				
	2.0					

Elevation Scale (m): 223, 222

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit; PL, MC, LL: 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE P19

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 6, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602423, N: 4843297 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0	**223.6**	**GROUND SURFACE**											
		140mm **ASPHALTIC CONCRETE**											
	223.1	410mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	30							
	0.5												
1		**FILL**, sandy silt, trace gravel, compact, brown, damp		2	SS	17	223						
	222.1												
	1.5												
	221.6	**SANDY SILT**, trace gravel, compact, brown, damp		3	SS	24	222						
	2.0												

Penetration Test Values (Blows / 0.3m): × Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined ● Pocket Penetrometer + Field Vane ■ Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit | Natural Water Content | Liquid Limit; PL MC LL; 10 20 30

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P20

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 7, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602479, N: 4843398 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0	**224.2**	**GROUND SURFACE**					224	Dynamic Cone 10 20 30 40; Unconfined, Pocket Penetrometer, Field Vane, Lab Vane 40 80 120 160	Plastic Limit, Natural Water Content, Liquid Limit PL MC LL 10 20 30				
		140mm **ASPHALTIC CONCRETE**											
	223.6 0.6	470mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	27							
1		**FILL**, sandy silt, trace gravel, trace clay, compact, brown, damp		2	SS	11	223						
	222.7 1.5												
	222.2 2.0	**SANDY SILT**, trace gravel, dense, brown, damp (GLACIAL TILL)		3	SS	30							

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P21

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 6, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602535, N: 4843440 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	224.3	**GROUND SURFACE**				
		140mm **ASPHALTIC CONCRETE**				
	223.8	390mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	33
	0.5					
1		**FILL**, sandy silt, trace clay, trace gravel, compact, brown, damp		2	SS	10
	222.8					
	1.5					
	222.3	**SANDY SILT**, trace clay, trace gravel, compact, brown, damp		3	SS	26
	2.0					

Elevation Scale (m): 224, 223

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit; PL, MC, LL: 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P22

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 7, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602562, N: 4843513 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
0	223.4	**GROUND SURFACE**					
		130mm **ASPHALTIC CONCRETE**					
	222.9	355mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	17	223
	0.5						
1		**FILL**, sandy silt, trace clay, compact, brown, damp		2	SS	13	
	221.9						222
	1.5	**SANDY SILT**, trace gravel, dense, brown, damp		3	SS	35	
	221.4	(GLACIAL TILL)					
	2.0						

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10 20 30 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40 80 120 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit: PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P23

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 6, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602630, N: 4843584 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0	**221.9**	**GROUND SURFACE**											
		150mm **ASPHALTIC CONCRETE**											
	221.3	410mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	28							
1	0.6	**FILL**, sandy silt, trace clay, trace gravel, trace cinders, compact, brown, damp		2	SS	12	221						
	220.4												
	1.5	**SANDY SILT**, trace gravel, trace cinders, compact, brown, damp		3	SS	28							
	219.9 2.0	(GLACIAL TILL)					220						

Penetration Test Values (Blows / 0.3m): Dynamic Cone — 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit — PL MC LL — 10 20 30

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE P24

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 7, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602669, N: 4843683 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	220.4	**GROUND SURFACE**				
		140mm **ASPHALTIC CONCRETE**				
	219.8	445mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	44
	0.6	**FILL**, sandy silt, trace clay, trace gravel, compact, brown, dry		2	SS	13
1	218.9					
	1.5	**SANDY SILT**, trace gravel, compact, brown, dry		3	SS	29
	218.4	(GLACIAL TILL)				
	2.0					

Elevation Scale (m): 220, 219

Penetration Test Values (Blows / 0.3m): Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P25

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 6, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602735, N: 4843752 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0	**218.7**	**GROUND SURFACE**											
		130mm **ASPHALTIC CONCRETE**		1	SS	63							
	218.1	430mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp											
1	0.6	**FILL**, sandy silt, trace clay, trace gravel, compact, brown, damp		2	SS	9	218						
	217.2												
	1.5	**SANDY SILT**, trace gravel, dense, brown, damp		3	SS	24	217						
	216.7	(GLACIAL TILL)											
	2.0												

Penetration Test Values (Blows / 0.3m): × Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined ● Pocket Penetrometer + Field Vane ■ Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit | Natural Water Content | Liquid Limit; PL MC LL; 10 20 30

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P26

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 7, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602761, N: 4843832 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
0	**217.0**	**GROUND SURFACE**					217
		120mm **ASPHALTIC CONCRETE**		1	SS	36	
	216.3	575mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp					
1	0.7	**FILL**, sandy silt, trace clay, trace gravel, compact, brown, damp		2	SS	12	216
				3	SS	24	
	215.0						
	2.0	**END OF BOREHOLE**					

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10 20 30 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40 80 120 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit; PL MC LL: 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE P27

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 6, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602805, N: 4843883 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0	**215.9**	**GROUND SURFACE**											
	215.7 / 0.2	155mm **ASPHALTIC CONCRETE**											
		555mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	36							
	215.2 / 0.7	**SANDY SILT**, trace clay, trace gravel, loose to compact, brown, damp		2	SS	9	215						
1													
	213.9 / 2.0			3	SS	11	214						

Penetration Test Values (Blows / 0.3m): Dynamic Cone — 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit — PL MC LL — 10 20 30

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P28

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 7, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602840, N: 4843974 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	214.3	**GROUND SURFACE**				
	214.1	155mm **ASPHALTIC CONCRETE**				
	0.2					
	213.7	445mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	40
	0.6					
1		**FILL**, sandy silt, trace gravel, trace clay, compact, brown, damp		2	SS	15
	212.8					
	1.5					
	212.3	**SANDY SILT**, trace gravel, very dense, brown, damp		3	SS	54
	2.0	(GLACIAL TILL)				

Elevation Scale (m): 214, 213

Penetration Test Values (Blows / 0.3m): Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P29

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 6, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602897, N: 4844038 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	213.4	**GROUND SURFACE**				
		100mm **ASPHALTIC CONCRETE**		1	SS	54
	212.8	540mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp				
1	0.6	**SANDY SILT**, trace gravel, trace clay, loose to compact, brown, damp		2	SS	17
	211.4			3	SS	9
	2.0	**END OF BOREHOLE**				

Elevation Scale (m): 213, 212

Penetration Test Values (Blows / 0.3m): Dynamic Cone — 10, 20, 30, 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40, 80, 120, 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit — PL, MC, LL — 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE P30

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 7, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 602930, N: 4844136 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
0	**212.5**	**GROUND SURFACE**					
	212.3	160mm **ASPHALTIC CONCRETE**					
	0.2 / 211.9	425mm **GRANULAR BASE/ SUBBASE**, sand and gravel, compact, brown, damp		1	SS	13	212
	0.6	**FILL**, sandy silt, trace clay, trace gravel, compact, brown, damp		2	SS	15	
1	211.0						211
	1.5 / 210.5	**SANDY SILT**, trace gravel, trace clay, dense, brown, damp (GLACIAL TILL)		3	SS	39	
	2.0						

Penetration Test Values (Blows / 0.3m): × Dynamic Cone — 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined ● Pocket Penetrometer + Field Vane ■ Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL) — 10 20 30

Headspace Vapour (ppm) | Instrument Details | Unstabilized Water Level | Lab Data and Comments | GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P31

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 6, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 603003, N: 4844205 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0	**211.6**	**GROUND SURFACE**											
	211.4 / 0.2	170mm **ASPHALTIC CONCRETE**											
	211.0 / 0.6	440mm **GRANULAR BASE/ SUBBASE**, sand gravel, dense, brown, damp		1	SS	48							
1	210.1 / 1.5	**FILL**, sandy silt, trace gravel, trace clay, trace cinders, compact, brown, damp		2	SS	15	211						
	209.6 / 2.0	**SANDY SILT**, trace gravel, trace clay, compact, brown, damp		3	SS	22	210						

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE P32

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 7, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 603093, N: 4844314 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0	**211.0**	**GROUND SURFACE**											
	210.8 / 0.2	195mm **ASPHALTIC CONCRETE**											
	210.5 / 0.5	350mm **GRANULAR BASE/ SUBBASE**, sand and gravel, very dense, brown, damp		1	SS	50							
1		**SANDY SILT**, trace gravel, trace clay, compact, brown, damp		2	SS	14	210						
	209.0 / 2.0			3	SS	27	209						

Penetration Test Values (Blows / 0.3m): Dynamic Cone — 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit — PL MC LL — 10 20 30

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE TC1

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 3, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 603094, N: 4844255 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
	211.0	**GROUND SURFACE**					211
0		125mm **TOPSOIL**		1	SS	17	
		FILL, sandy silt, some clay, trace gravel, loose to very dense, brown, dry to wet		2	SS	62	210
1				3	SS	41	
2							209
				4	SS	9	
3	208.0						208
	3.0	**SILT**, some sand, some clay, trace gravel, dense, grey, moist to wet		5	SS	46	
4				6	SS	47	207
	206.4						
	4.6	...shale fragments		7	SS	100 / 125mm	
5		**INFERRED BEDROCK**		8	SS	100 / 50mm	206
6	204.9						205
	6.1	**END OF BOREHOLE**		9	SS	100 / 25mm	

Penetration Test Values (Blows / 0.3m): Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
5	34	43	18
9	20	56	15

Borehole was dry and open upon completion of drilling.

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE TC2

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: DH
Date started	: October 3, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

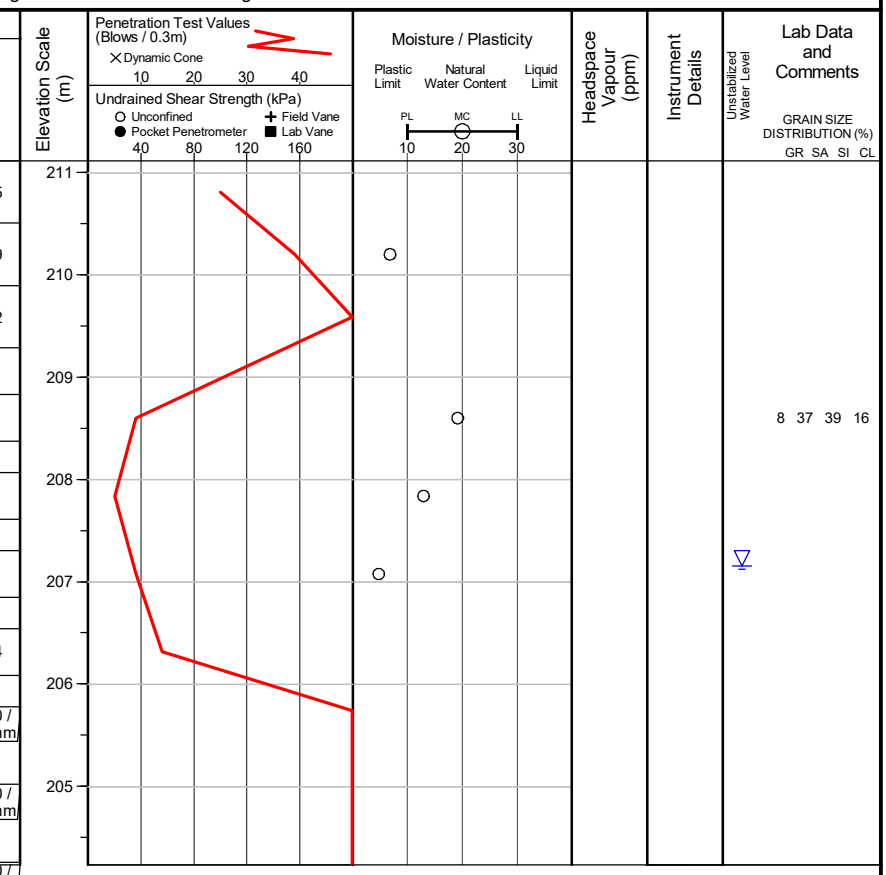
Position : E: 603084, N: 4844249 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	211.1	**GROUND SURFACE**				
0		125mm **TOPSOIL**		1	SS	25
		FILL, silt and sand, some clay, trace gravel, loose to very dense, brown to grey, dry to damp		2	SS	39
1				3	SS	52
2				4	SS	9
3	208.1					
	3.0	Clayey silt, trace gravel, trace sand, firm, grey, moist		5	SS	5
	207.3					
4	3.8	**CLAYEY SILT**, trace gravel, trace sand, trace shale fragments, stiff to hard, grey, dry to damp		6	SS	9
				7	SS	14
5	205.8					
	5.3	**INFERRED BEDROCK**		8	SS	100 / 75mm
6				9	SS	100 / 50mm
	204.2					
	6.9			10	SS	100 / 25mm

END OF BOREHOLE

Unstabilized water level measured at 4.0 m below ground surface; borehole was open upon completion of drilling.



file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE TC3

Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: September 14, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 603005, N: 4844241 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	212.0	**GROUND SURFACE**				
		125mm **TOPSOIL**		1	SS	35
		FILL, sandy silt, some clay, some gravel, dense, brown, wet				
	211.2 (0.8)	**SILT**, some sand, some clay, some gravel, dense, brown, moist		2	SS	30
				3	SS	43
				4	SS	42
		...shale fragments, very dense		5	SS	57
	208.2 (3.8)	**INFERRED BEDROCK**		6	SS	100 / 125mm
				7	SS	50 / 150mm
				8	SS	100 / 75mm
	205.9 (6.1)	**END OF BOREHOLE**		9	SS	100 / 50mm

Elevation Scale (m): 211, 210, 209, 208, 207, 206

Penetration Test Values (Blows / 0.3m): Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%)

	GR	SA	SI	CL
1	13	25	45	17
5	13	18	54	15

Unstabilized water level measured at 5.6 m below ground surface; borehole was open upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Feb 5, 2024	0.3	211.7

file: 1-22-0499 bh logs.gpj

LOG OF BOREHOLE TC4

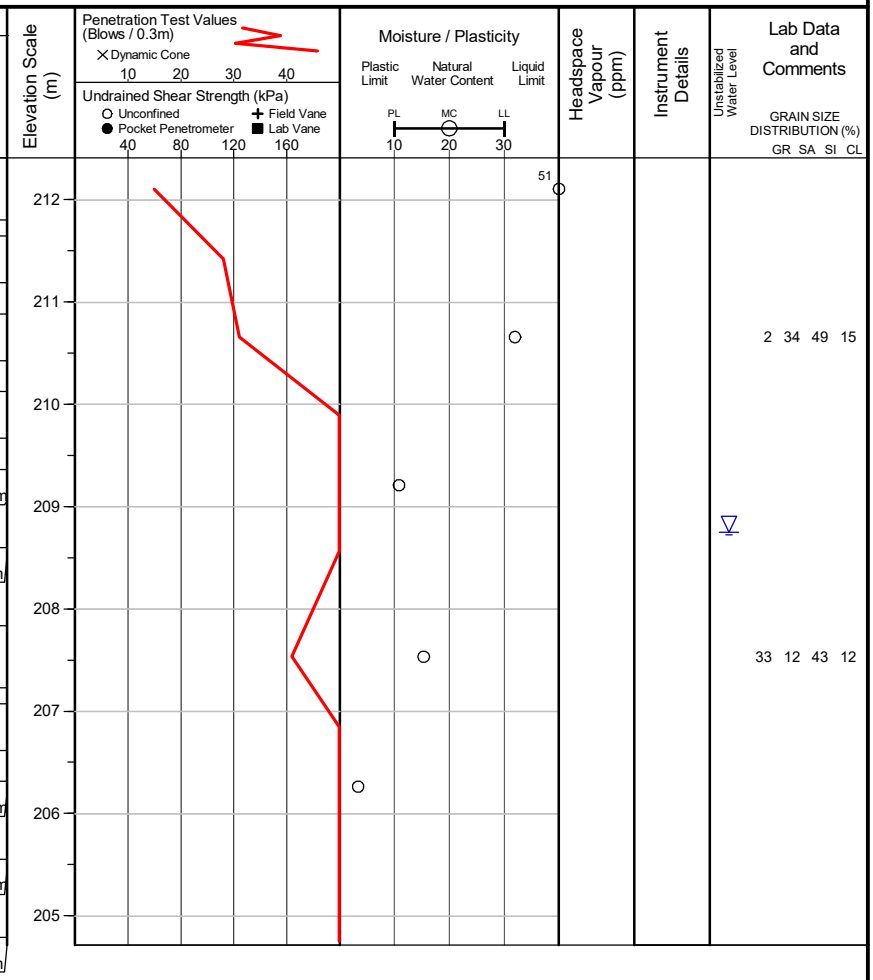
Project No.	: T1220499.000	Client	: Parsons Inc.	Originated by	: SM
Date started	: September 15, 2022	Project	: Williams Parkway Improvements	Compiled by	: SD
Sheet No.	: 1 of 1	Location	: Brampton, Ontario	Checked by	: RM

Position : E: 603006, N: 4844264 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	212.4	**GROUND SURFACE**				
		100mm **TOPSOIL**		1	SS	15
		FILL, clayey silt, trace sand, trace gravel, very stiff, brown, wet				
	211.6 / 0.8	**SANDY SILT**, some clay, trace gravel, compact to very dense, brown, moist to wet (GLACIAL TILL)		2	SS	28
				3	SS	31
		...sandy silt		4	SS	100
				5	SS	100 / 150mm
		...rock fragments		6	SS	100 / 75mm
		...gravely silt, some sand, some clay, dense		7	SS	41
	207.1 / 5.3	**INFERRED BEDROCK**		8	SS	90
				9	SS	100 / 100mm
				10	SS	100 / 100mm
	204.7 / 7.7	**END OF BOREHOLE**		11	SS	100 / 75mm

Unstabilized water level measured at 3.7 m below ground surface; borehole was open upon completion of drilling.



Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

2 34 49 15

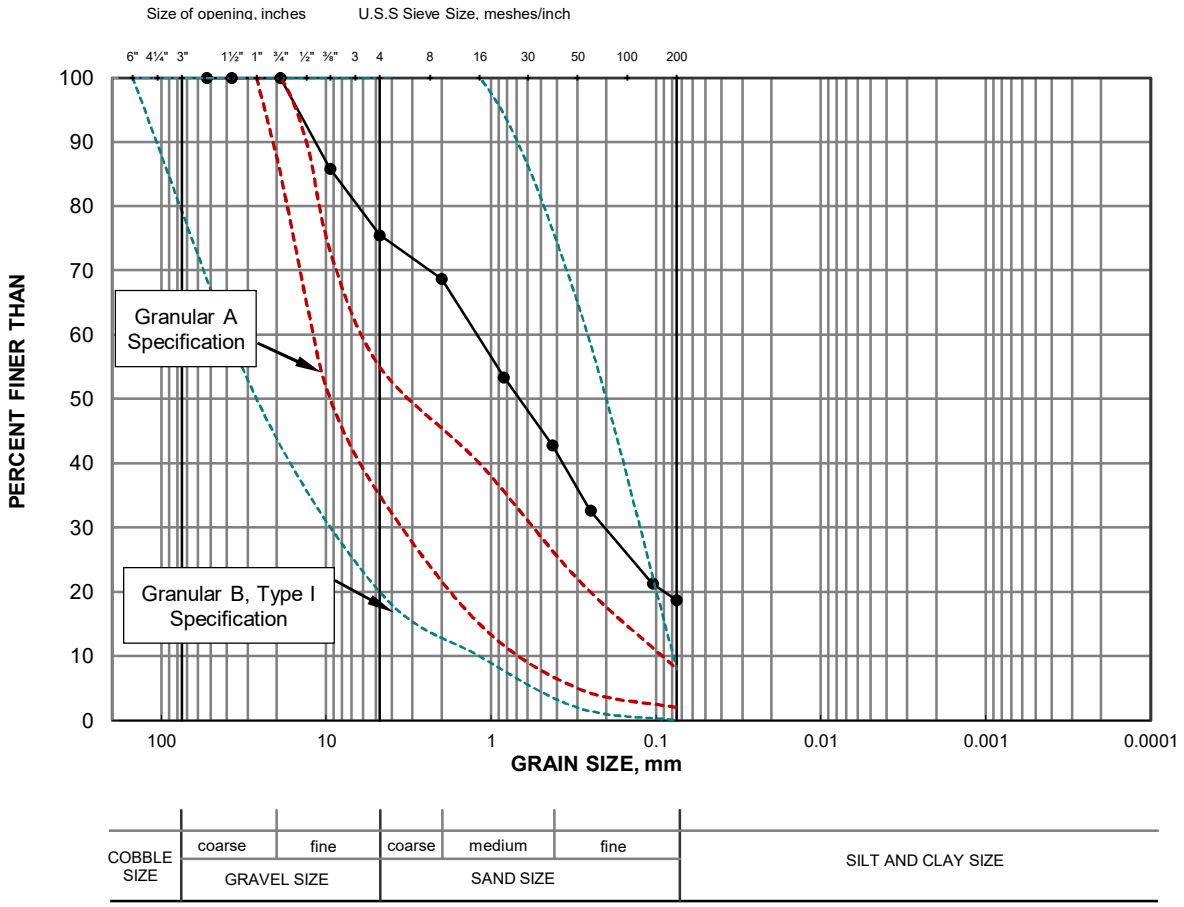
33 12 43 12

file: 1-22-0499 bh logs.gpj

APPENDIX B
Laboratory Test Results

GRAIN SIZE DISTRIBUTION	FIGURE B1

GRANULAR BASE/SUBBASE - Williams Parkway Main lane



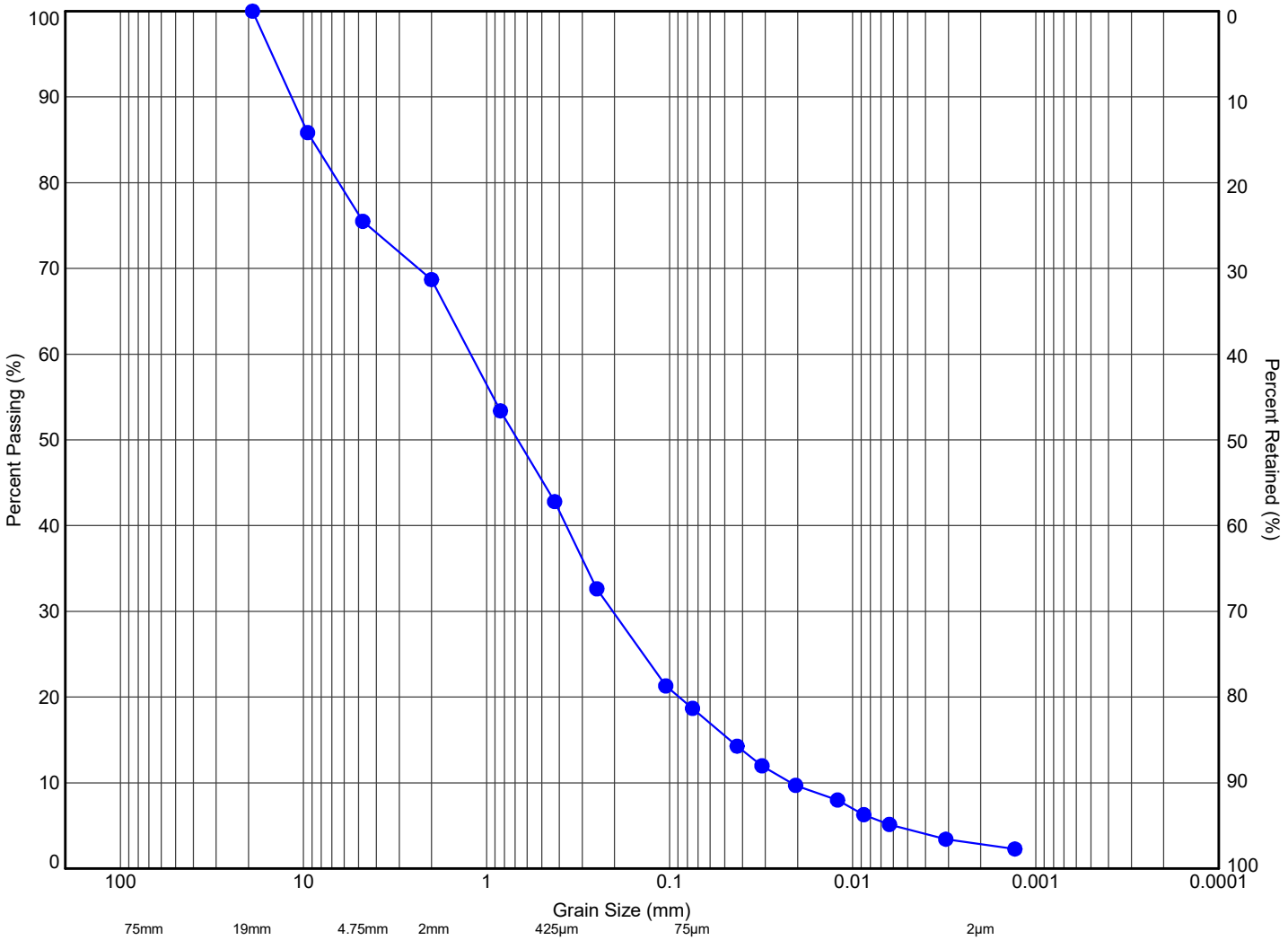
LEGEND

SYMBOL	LOCATION	BORHOLE NO.	LANE NO.	DEPTH (m)
●	Williams Pkwy	BH EC2	WB - Curb Lane	0.40

Project No: T1220499.000
Date: Nov. 2022

Prepared by : SD
Checked by : RA/SG

FIGURE B2



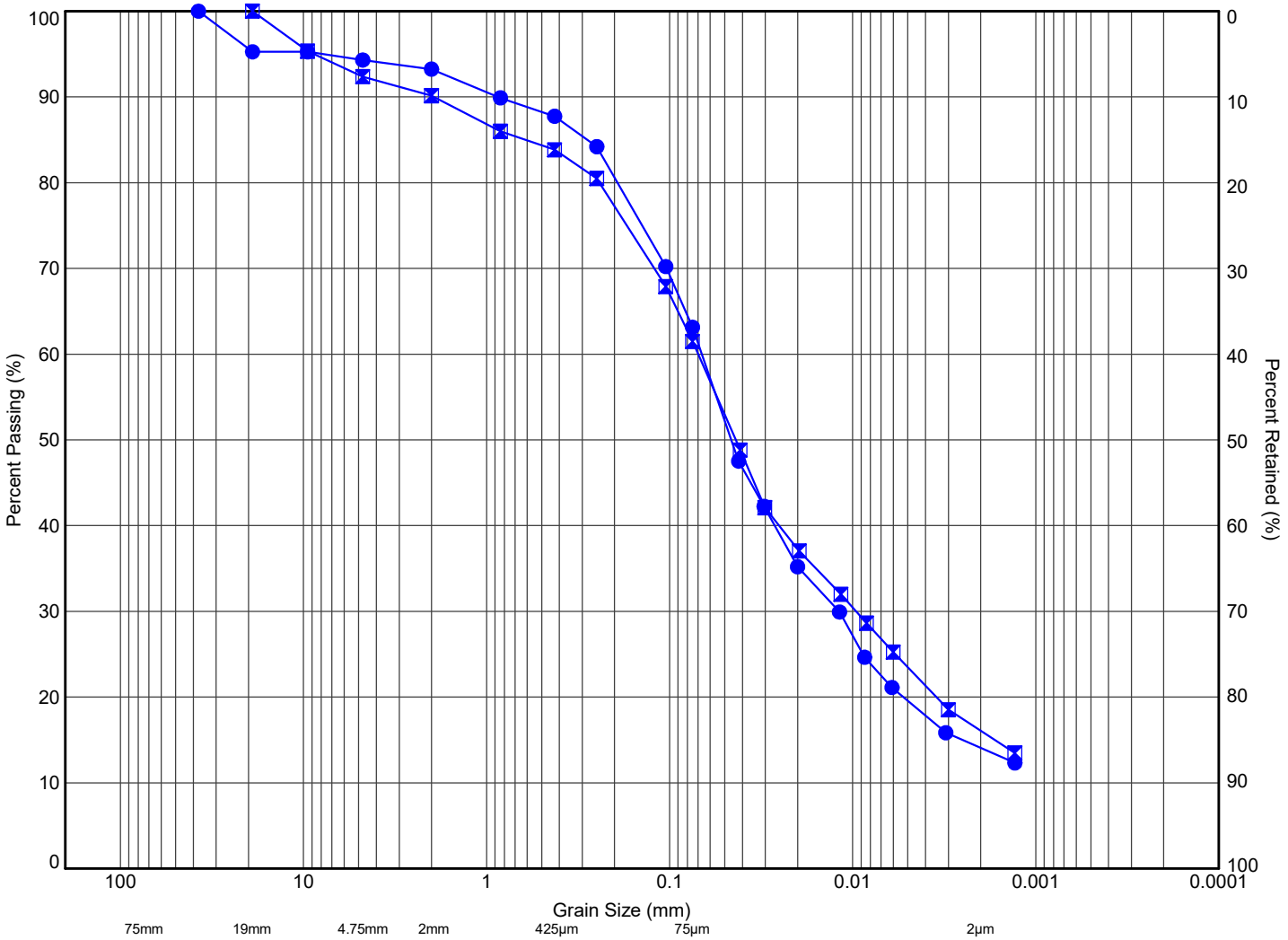
	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**EC2**	SS1	0.4	221.9	25	56	16	3	

eNGLOBe

Title: **GRAIN SIZE DISTRIBUTION**
FILL, GRAVELLY SAND

File No.: **1-22-0499-01**

FIGURE B3



	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**EC1**	SS4	2.5	217.2	6	31	49	14	
⊠	**EC3**	SS8	5.6	216.7	8	31	45	16	

eNGLOBe

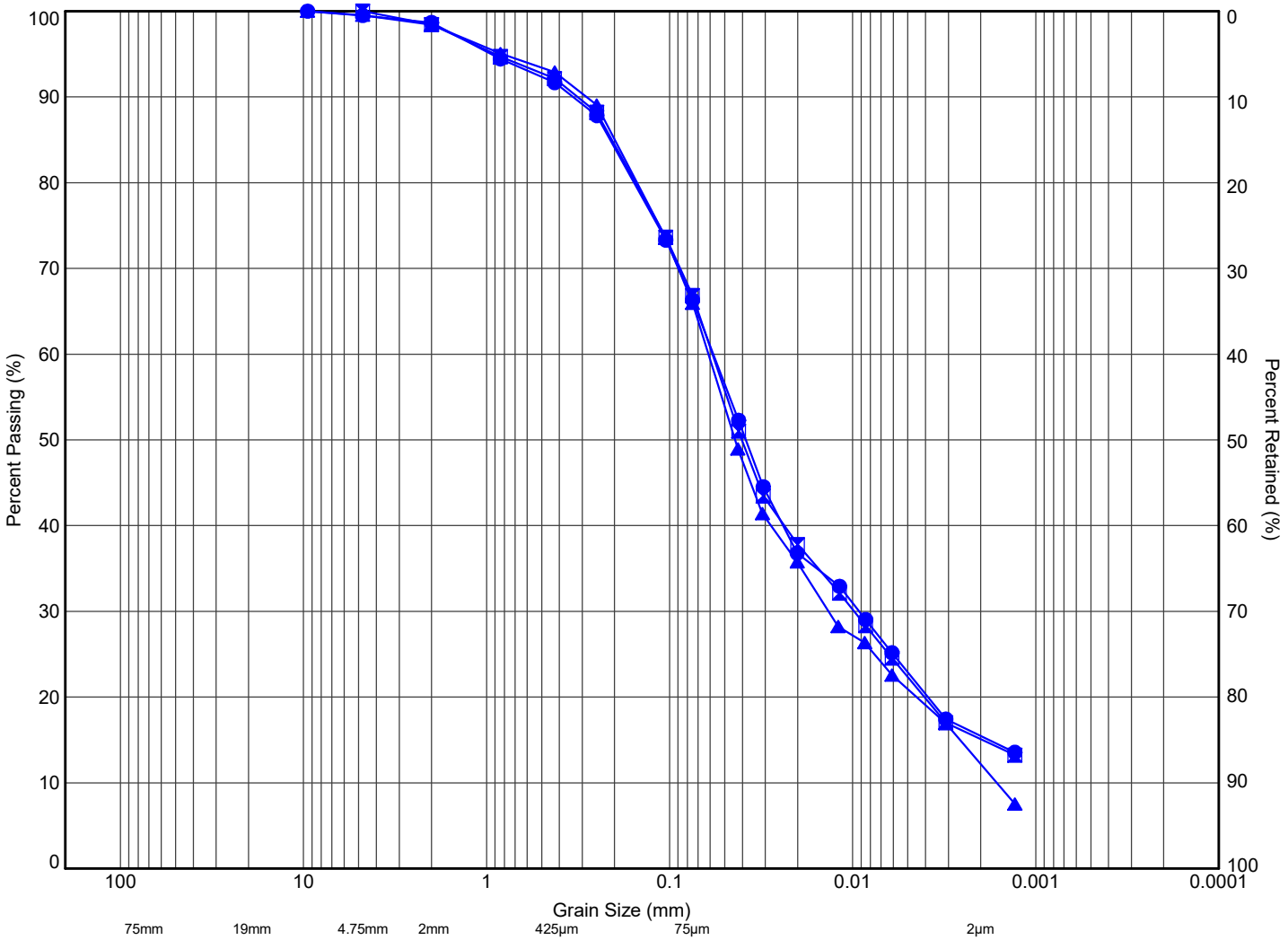
Title:

GRAIN SIZE DISTRIBUTION
SANDY SILT

File No.:

1-22-0499-01

FIGURE B4



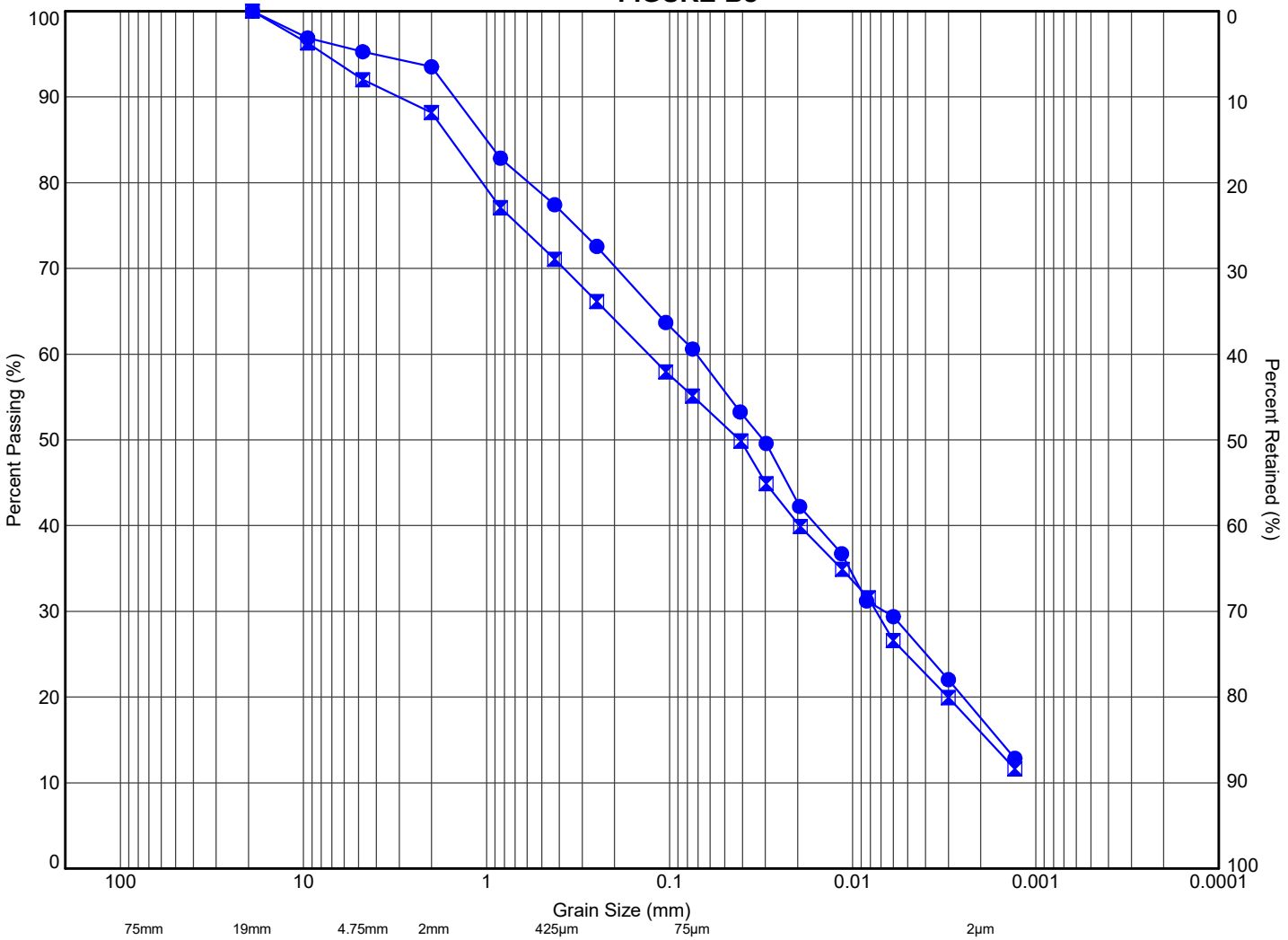
	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**EC1**	SS6	3.9	215.8	1	32	51	16	
⊠	**EC2**	SS7	4.8	217.5	0	33	52	15	
▲	**EC4**	SS2	0.9	218.5	1	33	54	12	

eNGLOBe

Title: **GRAIN SIZE DISTRIBUTION**
SANDY SILT

File No.: **1-22-0499-01**

FIGURE B5



	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**TC1**	SS4	2.5	208.5	5	34	43	18	
⊠	**TC2**	SS4	2.5	208.6	8	37	39	16	

eNGLOBe

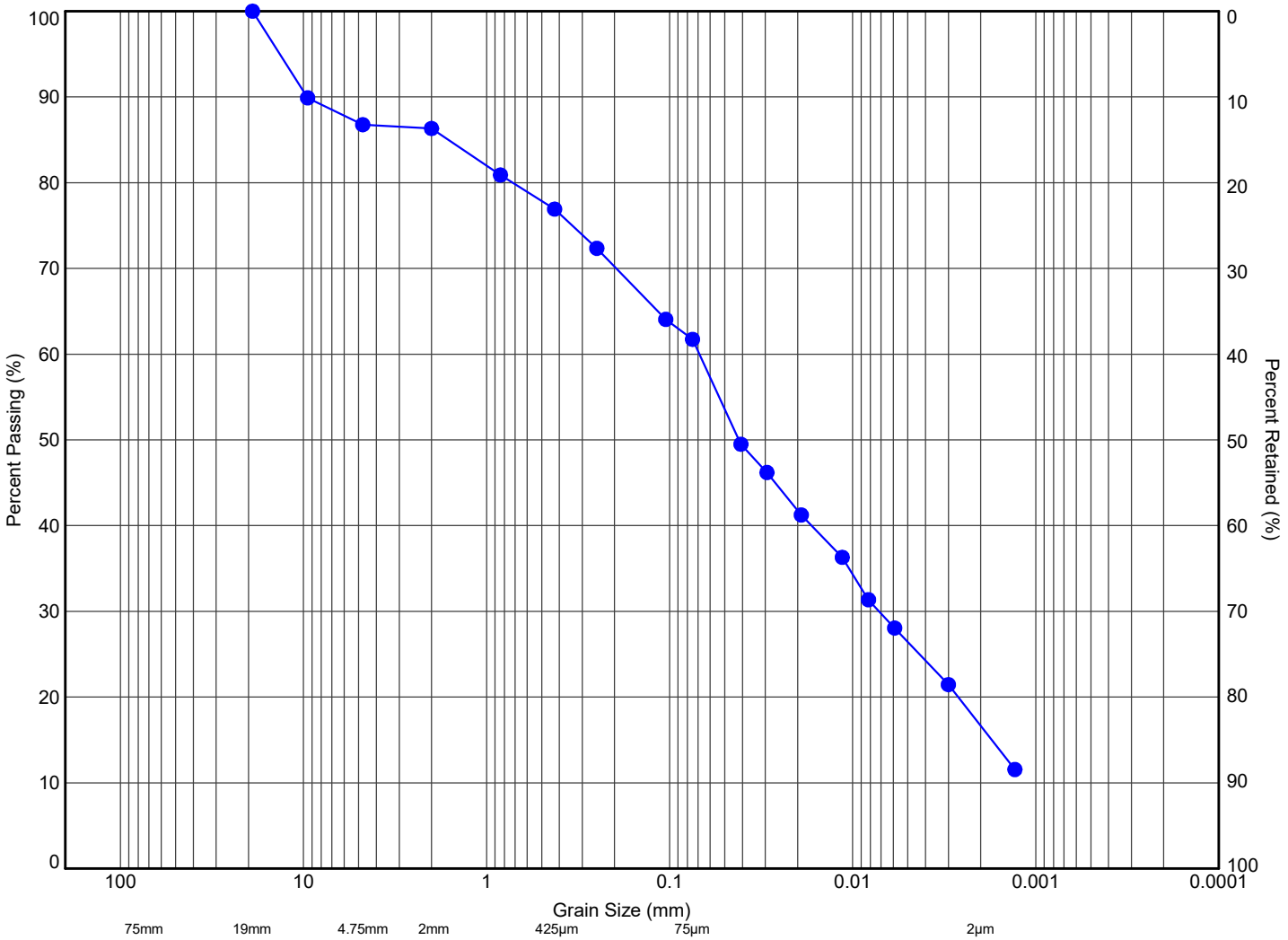
Title:

GRAIN SIZE DISTRIBUTION
FILL, SANDY SILT

File No.:

1-22-0499-01

FIGURE B6



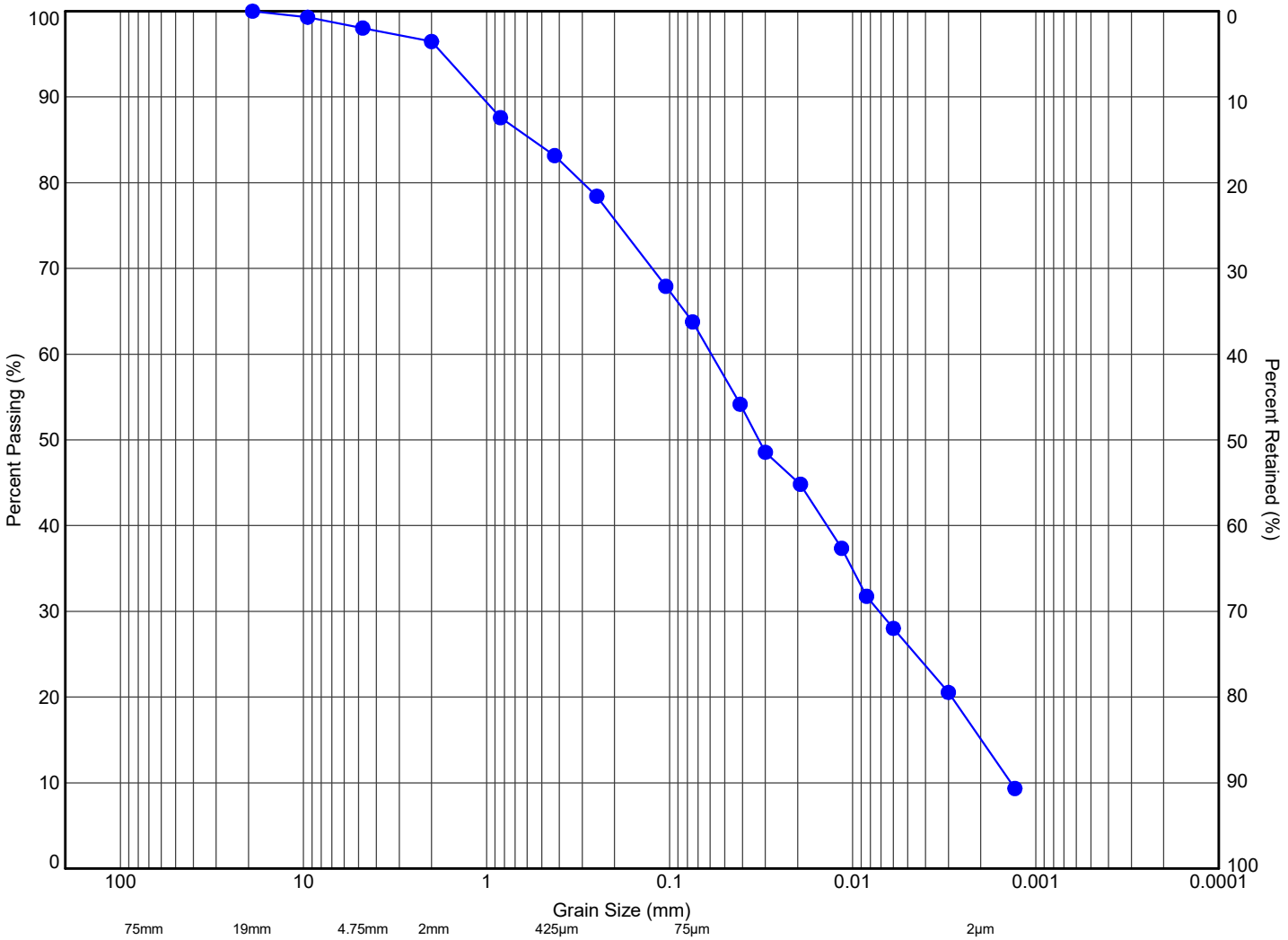
	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**TC3**	SS1	0.3	211.7	13	25	45	17	

ENGLOBE

Title: **GRAIN SIZE DISTRIBUTION**
FILL, SANDY SILT

File No.: **1-22-0499-01**

FIGURE B7



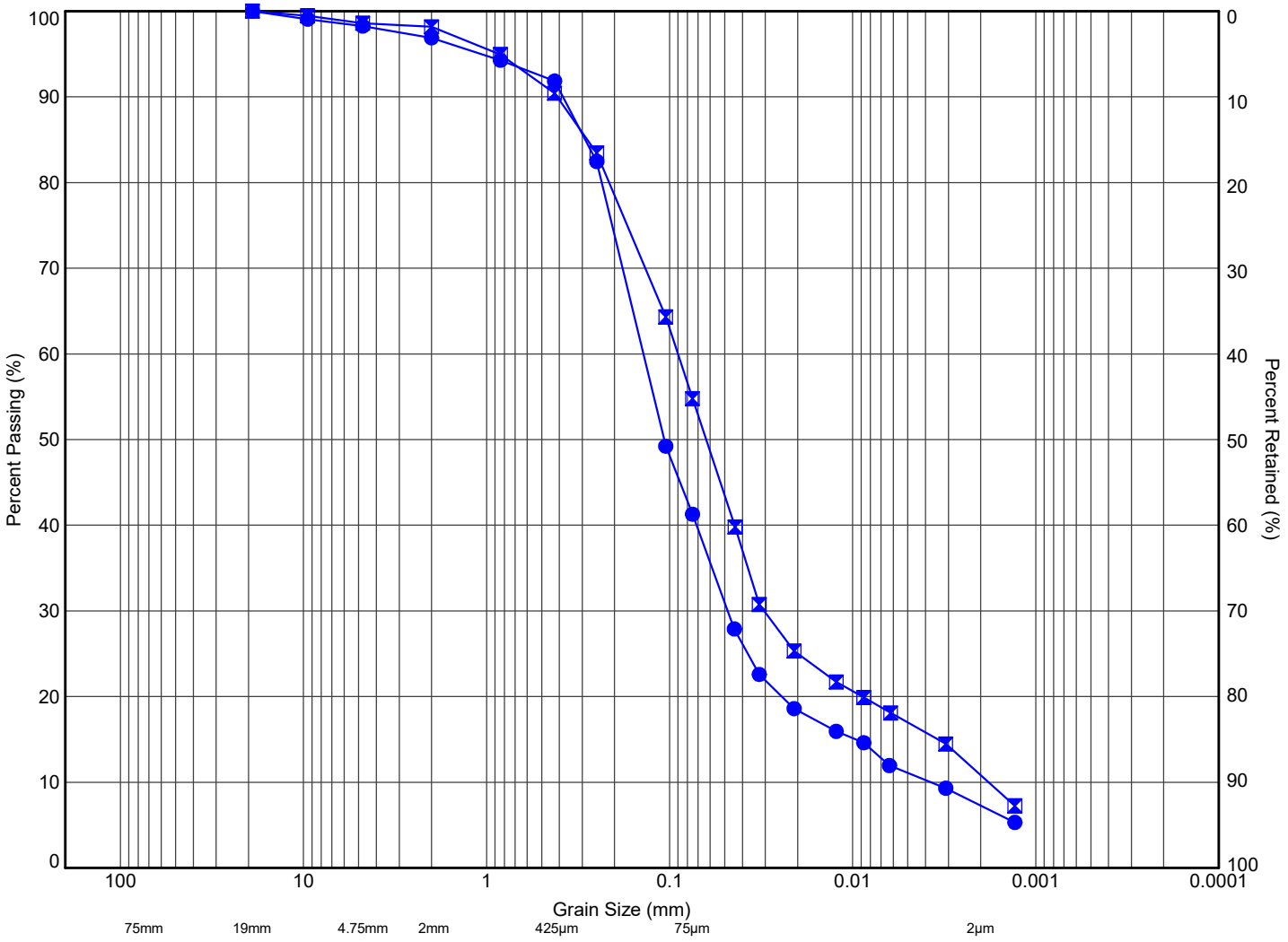
	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**TC4**	SS3	1.8	210.7	2	34	49	15	

eNGLOBe

Title: **GRAIN SIZE DISTRIBUTION**
SANDY SILT

File No.: **1-22-0499-01**

FIGURE B8



	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**EC2**	SS10	7.8	214.5	2	57	34	7	
⊠	**EC4**	SS4	2.5	216.9	1	44	44	11	

eNGLOBe

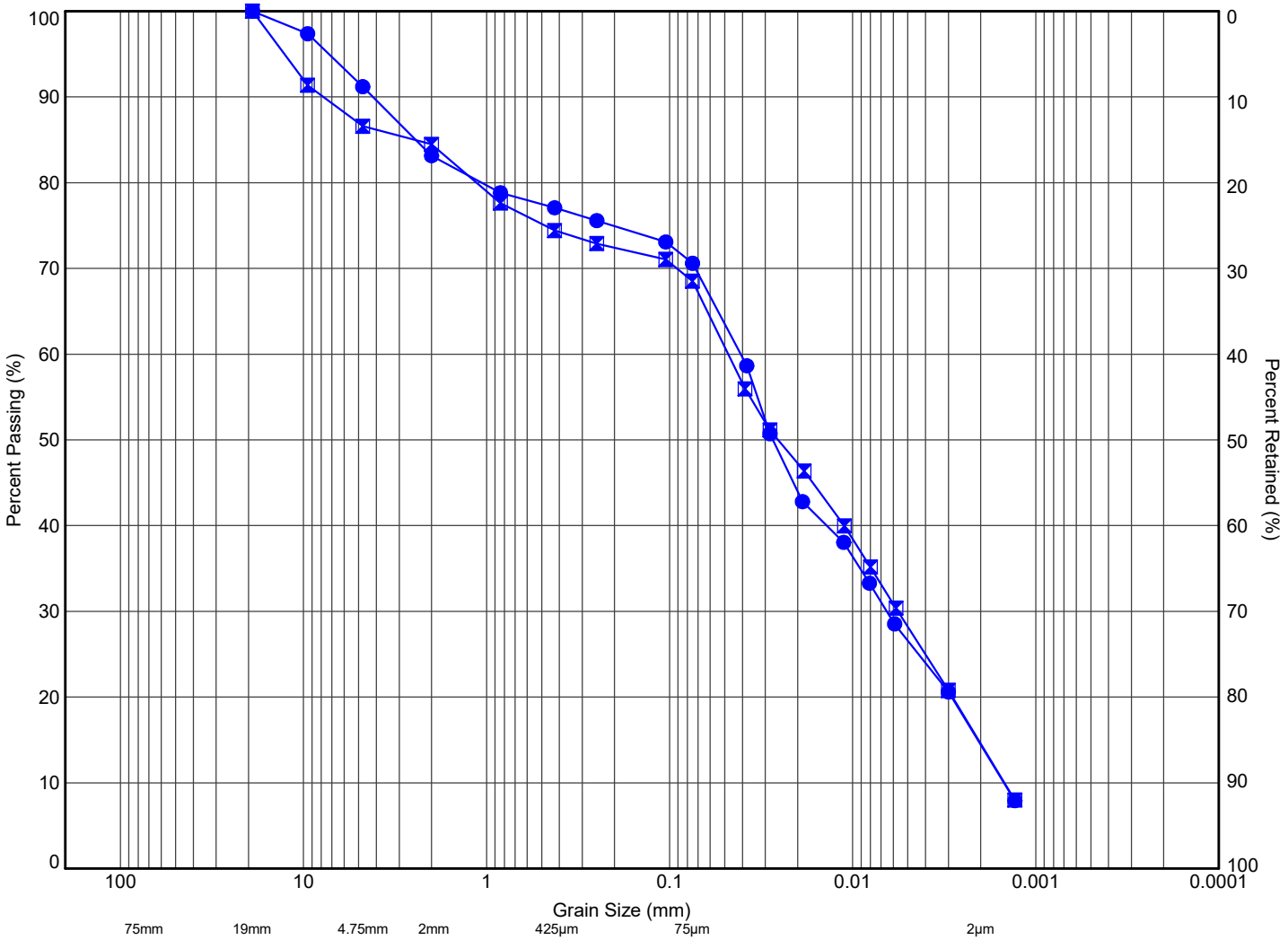
Title:

GRAIN SIZE DISTRIBUTION
SILTY SAND - SILT AND SAND

File No.:

1-22-0499-01

FIGURE B9



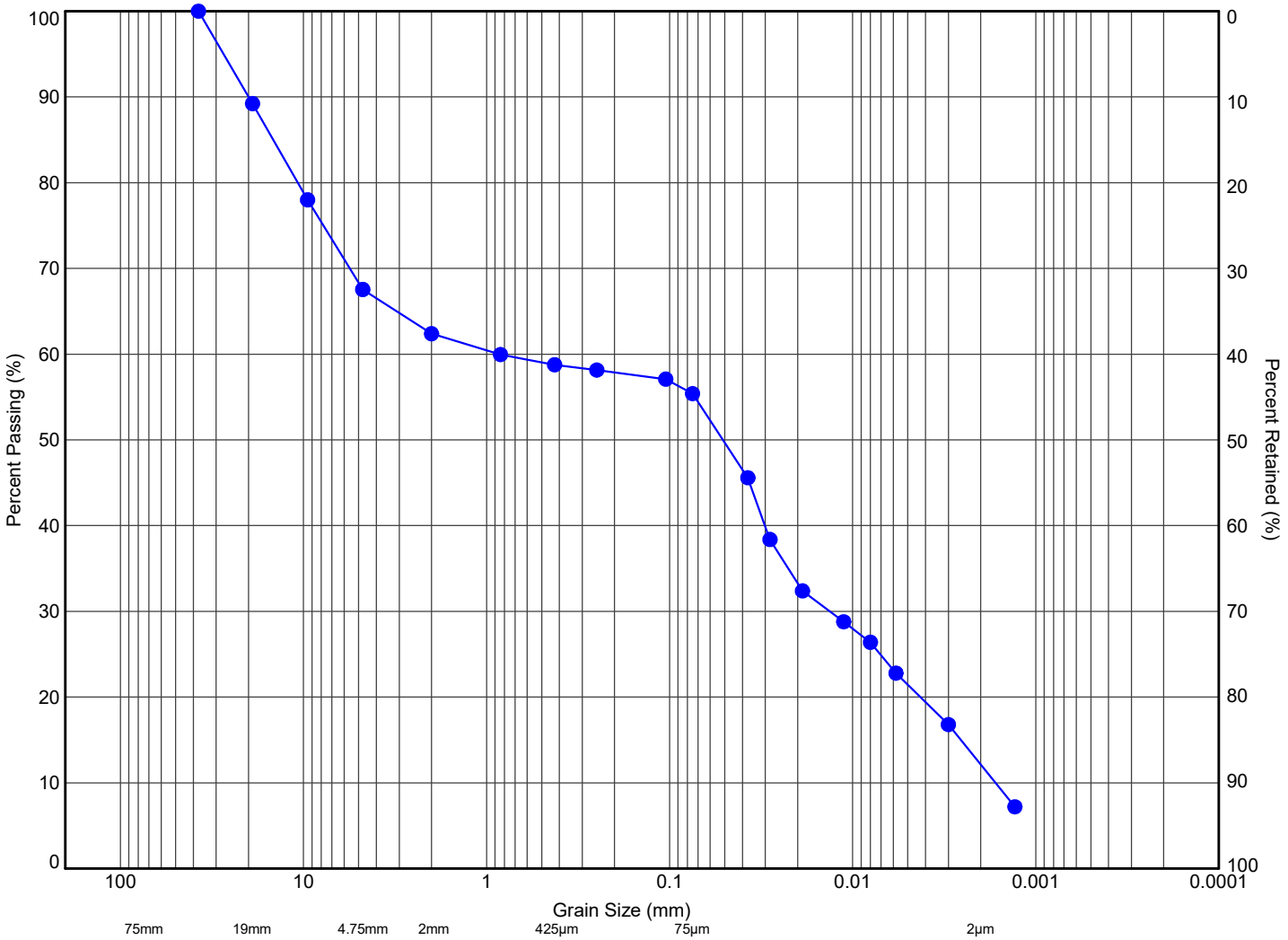
	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**TC1**	SS6	4.0	207.0	9	20	56	15	
⊠	**TC3**	SS5	3.3	208.7	13	18	54	15	

eNGLOBe

Title: **GRAIN SIZE DISTRIBUTION**
SILT

File No.: **1-22-0499-01**

FIGURE B10

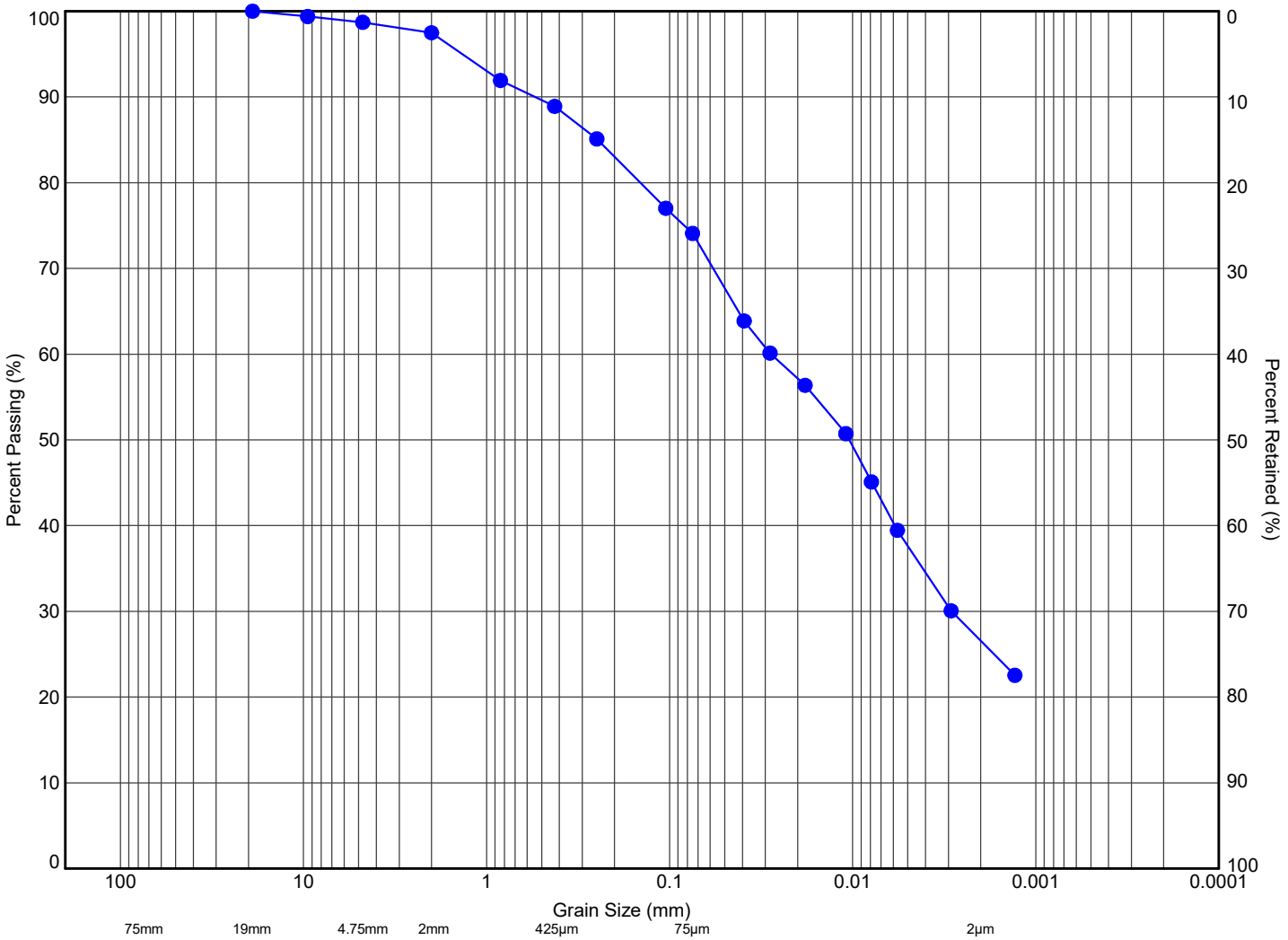


	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**TC4**	SS7	4.9	207.5	33	12	43	12	

Title: **GRAIN SIZE DISTRIBUTION**
SILT

File No.: **1-22-0499-01**

FIGURE B11



	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**EC3**	SS4	2.5	219.7	1	24	48	27	

eNGLOBe

Title: **GRAIN SIZE DISTRIBUTION**
FILL, CLAYEY SILT

File No.: **1-22-0499-01**

APPENDIX C
Pavement Distresses Typical Photographs

SITE PHOTOGRAPHS	FIGURE C1

Photo 1: William Parkway, Section 1 - EB, Looking south - Location of BH P8
slight to moderate severity outer wheel cracking, slight to moderate wheel track rutting, slight meander and midline cracking;

Photo 2: William Parkway, Section 1 - EB, Looking East - Location of BH EC3
Full width slight to moderate transverse cracking, slight wheel track rutting, slight meander and midline cracking, slight depression around Catch basin with alligator cracking and pavement edge cracking

Project No. :	1-22-0499-01	Prepared by :	..
Date :	2022-23-08	Checked by :	SG

SITE PHOTOGRAPHS	FIGURE C2

Photo 3: William Parkway, Section 1 - WB, Looking East - Location of BH P10
slight to moderate transverse cracking, moderate wheel track cracking and alligator cracking slight wheel track rutting and slight meander cracking

Photo 4: William Parkway, Section 1 - WB, Looking East - Location of BH EC2
slight to moderate transverse cracking, slight wheel track rutting, slight to moderate meander and midline cracking;

Project No. : 1-22-0499-01
Date : 2022-23-08

ENGLOBE

Prepared by : AT
Checked by : SG

SITE PHOTOGRAPHS	FIGURE C3

Photo 5: William Parkway, Section 2 - EB, Looking East - Location of BH P17
slight transverse cracking, moderate to severe wheel track cracking with alligator cracking slight to moderate wheel track rutting, moderate meander cracking, moderate pavement edge cracking and alligator cracking and depression and longitudinal centerline multiple cracking

Photo 5: William Parkway, Section 2 - EB, Looking East - Location of BH P29
moderate transverse cracking, slight wheel track rutting, slight to moderate meander cracking, severe to moderate pavement edge cracking and alligator cracking with depression and longitudinal multiple centerline cracking.

Project No. : 1-22-0499-01
Date : 2022-23-08

ENGLOBE

Prepared by : AT
Checked by : SG

SITE PHOTOGRAPHS	FIGURE C4

Photo 7: William Parkway, Section 2 - WB, Looking West - Location of BH P20
Modaret transverse cracking, moderate wheel track cracking with alligator cracking slight to moderate wheel track rutting, severe pavement edge cracking and alligor cracking and depression and longitudinal centerline multiple cracking

Photo 8: William Parkway, Section 2 - WB, Looking West - Location of BH P22
Slight transverse cracking, slight to moderate wheel track cracking with alligator cracking ,slight wheel track rutting, modaearte to severe pavement edge cracking with alligor cracking and depression and longitudinal centerline cracking

APPENDIX D
Pavement Design Data

Table D1: TRAFFIC DATA AND ESTIMATED ESALs

William Parkway Eastbound Rehabiliation, Section 1
Between N Park Drive/Howden Blvd and Bramalea Rd

YEAR	AVERAGE ANNUAL DAILY TRAFFIC	No. OF LANES	ESTIMATED CUMULATIVE ANNUAL ESALs
2022	9,840	2	-
2023	9,936	2	-
2024	10,034	2	172,700
2025	10,132	2	347,100
2026	10,231	2	523,200
2027	10,332	2	701,000
2028	10,433	2	880,600
2029	10,535	2	1,061,900
2030	10,638	2	1,245,000
2031	10,743	2	1,429,900
2032	10,848	2	1,616,600
2033	10,954	2	1,805,200
2034	11,062	2	1,995,600
2035	11,170	2	2,187,900
2036	11,280	2	2,382,100
2037	11,390	2	2,578,200
2038	11,502	2	2,776,200
2039	11,614	2	2,976,100
2040	11,728	2	3,178,000
2041	11,843	2	3,381,900
2042	11,959	2	3,587,800
2043	12,076	2	3,795,700
Directional Factor (DF) =			1.00
Lane Distribution Factor (LDF) =			0.9
Combined Truck Factor (CTF) =			1.310
Percent Trucks =			4.0%
Traffic Growth Rate =			0.98%
Days Per Year For Truck Traffic =			365
Number of Lanes in one Direction =			2

Table D2: TRAFFIC DATA AND ESTIMATED ESALs

William Parkway Eastbound Rehabiliation, Section 2
Between Bramalea Rd and Torbram Rd

YEAR	AVERAGE ANNUAL DAILY TRAFFIC	No. OF LANES	ESTIMATED CUMULATIVE ANNUAL ESALs
2022	7,820	2	-
2023	7,897	2	-
2024	7,974	2	137,300
2025	8,052	2	275,900
2026	8,131	2	415,900
2027	8,211	2	557,200
2028	8,291	2	699,900
2029	8,372	2	844,000
2030	8,455	2	989,500
2031	8,537	2	1,136,500
2032	8,621	2	1,284,900
2033	8,706	2	1,434,800
2034	8,791	2	1,586,100
2035	8,877	2	1,738,900
2036	8,964	2	1,893,200
2037	9,052	2	2,049,000
2038	9,141	2	2,206,300
2039	9,230	2	2,365,200
2040	9,321	2	2,525,600
2041	9,412	2	2,687,600
2042	9,504	2	2,851,200
2043	9,597	2	3,016,400
Directional Factor (DF) =			1.00
Lane Distribution Factor (LDF) =			0.9
Combined Truck Factor (CTF) =			1.310
Percent Trucks =			4.0%
Traffic Growth Rate =			0.98%
Days Per Year For Truck Traffic =			365
Number of Lanes in one Direction =			2

Table D3: TRAFFIC DATA AND ESTIMATED ESALs

William Parkway Weastbound Rehabiliation, Section 1
Between N Park Drive/Howden Blvd and Bramalea Rd

YEAR	AVERAGE ANNUAL DAILY TRAFFIC	No. OF LANES	ESTIMATED CUMULATIVE ANNUAL ESALs
2022	14,790	2	-
2023	14,935	2	-
2024	15,081	2	230,800
2025	15,229	2	463,800
2026	15,378	2	699,100
2027	15,529	2	936,700
2028	15,681	2	1,176,600
2029	15,835	2	1,418,900
2030	15,990	2	1,663,600
2031	16,147	2	1,910,700
2032	16,305	2	2,160,200
2033	16,465	2	2,412,100
2034	16,626	2	2,666,500
2035	16,789	2	2,923,400
2036	16,954	2	3,182,800
2037	17,120	2	3,444,700
2038	17,288	2	3,709,200
2039	17,457	2	3,976,300
2040	17,628	2	4,246,000
2041	17,801	2	4,518,400
2042	17,975	2	4,793,400
2043	18,151	2	5,071,100
Directional Factor (DF) =			1.00
Lane Distribution Factor (LDF) =			0.8
Combined Truck Factor (CTF) =			1.310
Percent Trucks =			4.0%
Traffic Growth Rate =			0.98%
Days Per Year For Truck Traffic =			365
Number of Lanes in one Direction =			1

Table D4: TRAFFIC DATA AND ESTIMATED ESALs

William Parkway Weastbound Rehabiliation, Section 2
Between Bramalea Rd and Torbram Rd

YEAR	AVERAGE ANNUAL DAILY TRAFFIC	No. OF LANES	ESTIMATED CUMULATIVE ANNUAL ESALs
2022	10,920	2	-
2023	11,027	2	-
2024	11,135	2	191,700
2025	11,244	2	385,300
2026	11,354	2	580,700
2027	11,466	2	778,100
2028	11,578	2	977,400
2029	11,691	2	1,178,700
2030	11,806	2	1,381,900
2031	11,922	2	1,587,100
2032	12,039	2	1,794,300
2033	12,157	2	2,003,600
2034	12,276	2	2,214,900
2035	12,396	2	2,428,300
2036	12,518	2	2,643,800
2037	12,640	2	2,861,400
2038	12,764	2	3,081,100
2039	12,889	2	3,303,000
2040	13,015	2	3,527,000
2041	13,143	2	3,753,200
2042	13,272	2	3,981,700
2043	13,402	2	4,212,400
Directional Factor (DF) =			1.00
Lane Distribution Factor (LDF) =			0.9
Combined Truck Factor (CTF) =			1.310
Percent Trucks =			4.0%
Traffic Growth Rate =			0.98%
Days Per Year For Truck Traffic =			365
Number of Lanes in one Direction =			1

Table D5

1993 AASHTO Flexible Pavement Design

AASHTO Version 3.0
Englobe Corp.

Project	1-22-0499-01
Location	William Parkway EB
Date / Time	2023-11-16 13:40
Analyser	SG

Rehabilitation of Williams Parkway EB , Section 1
Option 1: Mill 80 mm and pave 120 mm - 11 Yrs Design Life - 40 mm GR

Flexible Design Input Parameters

Design Lane 18-kip ESALs Over Initial Performance Period	1,995,600	
Initial Serviceability	4.4	
Terminal Serviceability	2.2	
Reliability Level	87	%
Overall Standard Deviation	0.44	
Roadbed Soil Resilient Modulus	25.00	MPa
Calculated Design Structural Number	114.2	mm

Specified Layer Design

Layer	Material Description	Struct. Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di) (mm)	Calculated SN (mm)
1	New AC	0.42	1	120.00	50.40
2	Existing AC	0.28	1	70.00	19.60
3	Existing Gran Material	0.11	0.9	455.00	45.05
Total	-	-	-	645.00	115.0

Table D6

1993 AASHTO Flexible Pavement Design

AASHTO Version 3.0
Englobe Corp.

Project	1-22-0499-01
Location	William Parkway EB
Date / Time	2023-11-16 18:07
Analyser	SG

Rehabilitation of Williams Parkway EB , Section 1
Option 2: Full depth Asphalt removal and Pave 180 mm HMA-14 Yrs - Zero GR

Flexible Design Input Parameters

Design Lane 18-kip ESALs Over Initial Performance Period	2,578,200	
Initial Serviceability	4.4	
Terminal Serviceability	2.2	
Reliability Level	87	%
Overall Standard Deviation	0.44	
Roadbed Soil Resilient Modulus	25.00	MPa
Calculated Design Structural Number	118.3	mm

Specified Layer Design

Layer	Material Description	Struct. Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di) (mm)	Calculated SN (mm)
1	New AC	0.42	1	180.00	75.60
2	Existing AC	0.28	1		
3	Existing Gran Material	0.11	0.9	425.00	42.08
Total	-	-	-	605.00	117.7

Table D7

1993 AASHTO Flexible Pavement Design

AASHTO Version 3.0
Englobe Corp.

Project	1-22-0499-01
Location	William Parkway EB
Date / Time	2023-11-16 13:51
Analyser	SG

Rehabilitation of Williams Parkway EB , Section 1
Option 3: Mill 100 mm and pave 100 mm - 5 Yrs Design Life - Zero GR

Flexible Design Input Parameters

Design Lane 18-kip ESALs Over Initial Performance Period	880,600	
Initial Serviceability	4.4	
Terminal Serviceability	2.2	
Reliability Level	87	%
Overall Standard Deviation	0.44	
Roadbed Soil Resilient Modulus	25.00	MPa
Calculated Design Structural Number	101.8	mm

Specified Layer Design

Layer	Material Description	Struct. Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di) (mm)	Calculated SN (mm)
1	New AC	0.42	1	100.00	42.00
2	Existing AC	0.28	1	50.00	14.00
3	Existing Gran Material	0.11	0.9	455.00	45.05
Total	-	-	-	605.00	101.0

Table D8
1993 AASHTO Flexible Pavement Design

AASHTO Version 3.0
Englobe Corp.

Project	1-22-0499-01
Location	William Parkway EB
Date / Time	2024-02-08 11:14
Analyser	SG

Rehabilitation of Williams Parkway EB , Section 1
Option 4: Full depth re-construction - 20 Yrs Design Life - Zero GR

Flexible Design Input Parameters

Design Lane 18-kip ESALs Over Initial Performance Period	3,795,700	
Initial Serviceability	4.4	
Terminal Serviceability	2.2	
Reliability Level	87	%
Overall Standard Deviation	0.44	
Roadbed Soil Resilient Modulus	25.00	MPa
Calculated Design Structural Number	125	mm

Specified Layer Design

Layer	Material Description	Struct. Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di) (mm)	Calculated SN (mm)
1	New AC	0.42	1	150.00	63.00
2	New Gran Base	0.14	1	150.00	21.00
3	New Gran Subbase	0.09	1	450.00	40.50
Total	-	-	-	750.00	125

Table D9

1993 AASHTO Flexible Pavement Design

AASHTO Version 3.0
Englobe Corp.

Project	1-22-0499-01
Location	William Parkway EB
Date / Time	2023-11-16 18:08
Analyser	SG

Rehabilitation of Williams Parkway EB , Section 2
Option 1: Mill 80 mm & pave 110 mm 12 Yrs Design Life- 40 mm GR

Flexible Design Input Parameters

Design Lane 18-kip ESALs Over Initial Performance Period	1,738,900	
Initial Serviceability	4.4	
Terminal Serviceability	2.2	
Reliability Level	87	%
Overall Standard Deviation	0.44	
Roadbed Soil Resilient Modulus	25.00	MPa
Calculated Design Structural Number	112.1	mm

Specified Layer Design

Layer	Material Description	Struct. Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di) (mm)	Calculated SN (mm)
1	New AC	0.42	1	120.00	50.40
2	Existing AC	0.28	1	65.00	18.20
3	Existing Gran Material	0.11	0.9	445.00	44.06
Total	-	-	-	630.00	112.7

Table D10

1993 AASHTO Flexible Pavement Design

AASHTO Version 3.0
Englobe Corp.

Project	1-22-0499-01
Location	William Parkway EB
Date / Time	2023-11-16 18:09
Analyser	SG

Rehabilitation of Williams Parkway EB , Section 2
Option 2: Full depth Asphalt Removal & Pave 180 mm - 15 Yrs Design Life- Zero GR

Flexible Design Input Parameters

Design Lane 18-kip ESALs Over Initial Performance Period	2,206,300	
Initial Serviceability	4.4	
Terminal Serviceability	2.2	
Reliability Level	87	%
Overall Standard Deviation	0.44	
Roadbed Soil Resilient Modulus	25.00	MPa
Calculated Design Structural Number	115.8	mm

Specified Layer Design

Layer	Material Description	Struct. Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di) (mm)	Calculated SN (mm)
1	New AC	0.42	1	180.00	75.60
2	Existing AC	0.28	1		
3	Existing Gran Material	0.11	0.9	410.00	40.59
Total	-	-	-	590.00	116.2

Table D11

1993 AASHTO Flexible Pavement Design

AASHTO Version 3.0
Englobe Corp.

Project	1-22-0499-01
Location	William Parkway EB
Date / Time	2023-11-16 13:57
Analyser	SG

Rehabilitation of Williams Parkway EB , Section 2
Option 3: Mill 100 mm & pave 100 mm 5 Yrs Design Life- Zero GR

Flexible Design Input Parameters

Design Lane 18-kip ESALs Over Initial Performance Period	699,900	
Initial Serviceability	4.4	
Terminal Serviceability	2.2	
Reliability Level	87	%
Overall Standard Deviation	0.44	
Roadbed Soil Resilient Modulus	25.00	MPa
Calculated Design Structural Number	98.5	mm

Specified Layer Design

Layer	Material Description	Struct. Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di) (mm)	Calculated SN (mm)
1	New AC	0.42	1	100.00	42.00
2	Existing AC	0.28	1	45.00	12.60
3	Existing Gran Material	0.11	0.9	445.00	44.06
Total	-	-	-	590.00	98.7

Table D12
1993 AASHTO Flexible Pavement Design

AASHTO Version 3.0
Englobe Corp.

Project	1-22-0499-01
Location	William Parkway EB
Date / Time	2024-02-08 11:19
Analyser	SG

Rehabilitation of Williams Parkway EB , Section 2
Option 4: Full depth re-construction - 20 Yrs Design Life - Zero GR

Flexible Design Input Parameters

Design Lane 18-kip ESALs Over Initial Performance Period	3,016,400	
Initial Serviceability	4.4	
Terminal Serviceability	2.2	
Reliability Level	87	%
Overall Standard Deviation	0.44	
Roadbed Soil Resilient Modulus	25.00	MPa
Calculated Design Structural Number	121	mm

Specified Layer Design

Layer	Material Description	Struct. Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di) (mm)	Calculated SN (mm)
1	New AC	0.42	1	150.00	63.00
2	New Gran Base	0.14	1	150.00	21.00
3	New Gran Subbase	0.09	1	450.00	40.50
Total	-	-	-	750.00	124.5

Table D13
1993 AASHTO Flexible Pavement Design

AASHTO Version 3.0
Englobe Corp.

Project	1-22-0499-01
Location	William Parkway WB
Date / Time	2023-11-16 18:16
Analyser	SG

Rehabilitation of Williams Parkway WB , Section 1
Option 1: Mill 60 mm & Pave 120 mm - 9 Yrs Design Life- 60 mm GR

Flexible Design Input Parameters

Design Lane 18-kip ESALs Over Initial Performance Period	2,160,200	
Initial Serviceability	4.4	
Terminal Serviceability	2.2	
Reliability Level	87	%
Overall Standard Deviation	0.44	
Roadbed Soil Resilient Modulus	25.00	MPa
Calculated Design Structural Number	115.5	mm

Specified Layer Design

Layer	Material Description	Struct. Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di) (mm)	Calculated SN (mm)
1	New AC	0.42	1	120.00	50.40
2	Existing AC	0.28	1	90.00	25.20
3	Existing Gran Material	0.11	0.9	400.00	39.60
Total	-	-	-	610.00	115.2

Table D14

1993 AASHTO Flexible Pavement Design

AASHTO Version 3.0
Englobe Corp.

Project	1-22-0499-01
Location	William Parkway WB
Date / Time	2023-11-16 18:16
Analyser	SG

Rehabilitation of Williams Parkway WB , Section 1
Option 2: Full depth Asphlat Remova and Pave 210 mm -13 Yrs Design Life-0 mm GR

Flexible Design Input Parameters

Design Lane 18-kip ESALs Over Initial Performance Period	3,182,800	
Initial Serviceability	4.4	
Terminal Serviceability	2.2	
Reliability Level	87	%
Overall Standard Deviation	0.44	
Roadbed Soil Resilient Modulus	25.00	MPa
Calculated Design Structural Number	121.8	mm

Specified Layer Design

Layer	Material Description	Struct. Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di) (mm)	Calculated SN (mm)
1	New AC	0.42	1	210.00	88.20
2	Existing AC	0.28	1		
3	Existing Gran Material	0.11	0.9	340.00	33.66
Total	-	-	-	550.00	121.9

Table D15

1993 AASHTO Flexible Pavement Design

AASHTO Version 3.0
Englobe Corp.

Project	1-22-0499-01
Location	William Parkway WB
Date / Time	2023-11-16 14:08
Analyser	SG

Rehabilitation of Williams Parkway WB , Section 1
Option 3: Mill 100 mm & Pave 110 mm - less than 4 Yrs Design Life-10 mm GR

Flexible Design Input Parameters

Design Lane 18-kip ESALs Over Initial Performance Period	936,700	
Initial Serviceability	4.4	
Terminal Serviceability	2.2	
Reliability Level	87	%
Overall Standard Deviation	0.44	
Roadbed Soil Resilient Modulus	25.00	MPa
Calculated Design Structural Number	102.7	mm

Specified Layer Design

Layer	Material Description	Struct. Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di) (mm)	Calculated SN (mm)
1	New AC	0.42	1	110.00	46.20
2	Existing AC	0.28	1	50.00	14.00
3	Existing Gran Material	0.11	0.9	400.00	39.60
Total	-	-	-	560.00	99.8

Table D16
1993 AASHTO Flexible Pavement Design

AASHTO Version 3.0
Englobe Corp.

Project	1-22-0499-01
Location	William Parkway EB
Date / Time	2024-02-08 11:22
Analyser	SG

Rehabilitation of Williams Parkway WB , Section 1
Option 4: Full depth re-construction - 20 Yrs Design Life - Zero GR

Flexible Design Input Parameters

Design Lane 18-kip ESALs Over Initial Performance Period	5,071,100	
Initial Serviceability	4.4	
Terminal Serviceability	2.2	
Reliability Level	87	%
Overall Standard Deviation	0.44	
Roadbed Soil Resilient Modulus	25.00	MPa
Calculated Design Structural Number	130	mm

Specified Layer Design

Layer	Material Description	Struct. Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di) (mm)	Calculated SN (mm)
1	New AC	0.42	1	170.00	71.40
2	New Gran Base	0.14	1	150.00	21.00
3	New Gran Subbase	0.09	1	450.00	40.50
Total	-	-	-	770.00	133

Table D17

1993 AASHTO Flexible Pavement Design

AASHTO Version 3.0
Englobe Corp.

Project	1-22-0499-01
Location	William Parkway WB
Date / Time	2023-11-16 18:17
Analyser	SG

Rehabilitation of Williams Parkway WB , Section 2
Option 1: Mill 70 mm & Pave 120 mm - 9 Yrs Design Life- 50 mm GR

Flexible Design Input Parameters

Design Lane 18-kip ESALs Over Initial Performance Period	1,794,300	
Initial Serviceability	4.4	
Terminal Serviceability	2.2	
Reliability Level	87	%
Overall Standard Deviation	0.44	
Roadbed Soil Resilient Modulus	25.00	MPa
Calculated Design Structural Number	112.6	mm

Specified Layer Design

Layer	Material Description	Struct. Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di) (mm)	Calculated SN (mm)
1	New AC	0.42	1	120.00	50.40
2	Existing AC	0.28	1	70.00	19.60
3	Existing Gran Material	0.11	0.9	455.00	45.05
Total	-	-	-	645.00	115.0

Table D18

1993 AASHTO Flexible Pavement Design

AASHTO Version 3.0
Englobe Corp.

Project	1-22-0499-01
Location	William Parkway WB
Date / Time	2023-11-16 18:17
Analyser	SG

Rehabilitation of Williams Parkway WB , Section 2
Option 2: Full depth Asphalt Removal and Pave 190 mm -14 Yrs Design Life-0 mm GR

Flexible Design Input Parameters

Design Lane 18-kip ESALs Over Initial Performance Period	2,861,400	
Initial Serviceability	4.4	
Terminal Serviceability	2.2	
Reliability Level	87	%
Overall Standard Deviation	0.44	
Roadbed Soil Resilient Modulus	25.00	MPa
Calculated Design Structural Number	120.1	mm

Specified Layer Design

Layer	Material Description	Struct. Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di) (mm)	Calculated SN (mm)
1	New AC	0.42	1	190.00	79.80
2	Existing AC	0.28	1		
3	Existing Gran Material	0.11	0.9	405.00	40.10
Total	-	-	-	595.00	119.9

Table D19
1993 AASHTO Flexible Pavement Design

AASHTO Version 3.0
Englobe Corp.

Project	1-22-0499-01
Location	William Parkway WB
Date / Time	2023-11-16 18:26
Analyser	SG

Rehabilitation of Williams Parkway WB , Section 2
Option 3: Mill 100 mm & Pave 110 mm - Less than 5 Yr Design Life- 10 mm GR

Flexible Design Input Parameters

Design Lane 18-kip ESALs Over Initial Performance Period	778,100	
Initial Serviceability	4.4	
Terminal Serviceability	2.2	
Reliability Level	87	%
Overall Standard Deviation	0.44	
Roadbed Soil Resilient Modulus	25.00	MPa
Calculated Design Structural Number	100.0	mm

Specified Layer Design

Layer	Material Description	Struct. Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di) (mm)	Calculated SN (mm)
1	New AC	0.42	1	110.00	46.20
2	Existing AC	0.28	1	40.00	11.20
3	Existing Gran Material	0.11	0.9	455.00	45.05
Total	-	-	-	605.00	102.4

Table D20
1993 AASHTO Flexible Pavement Design

AASHTO Version 3.0
Englobe Corp.

Project	1-22-0499-01
Location	William Parkway EB
Date / Time	2024-02-08 11:26
Analyser	SG

Rehabilitation of Williams Parkway WB , Section 2
Option 4: Full depth re-construction - 20 Yrs Design Life - Zero GR

Flexible Design Input Parameters

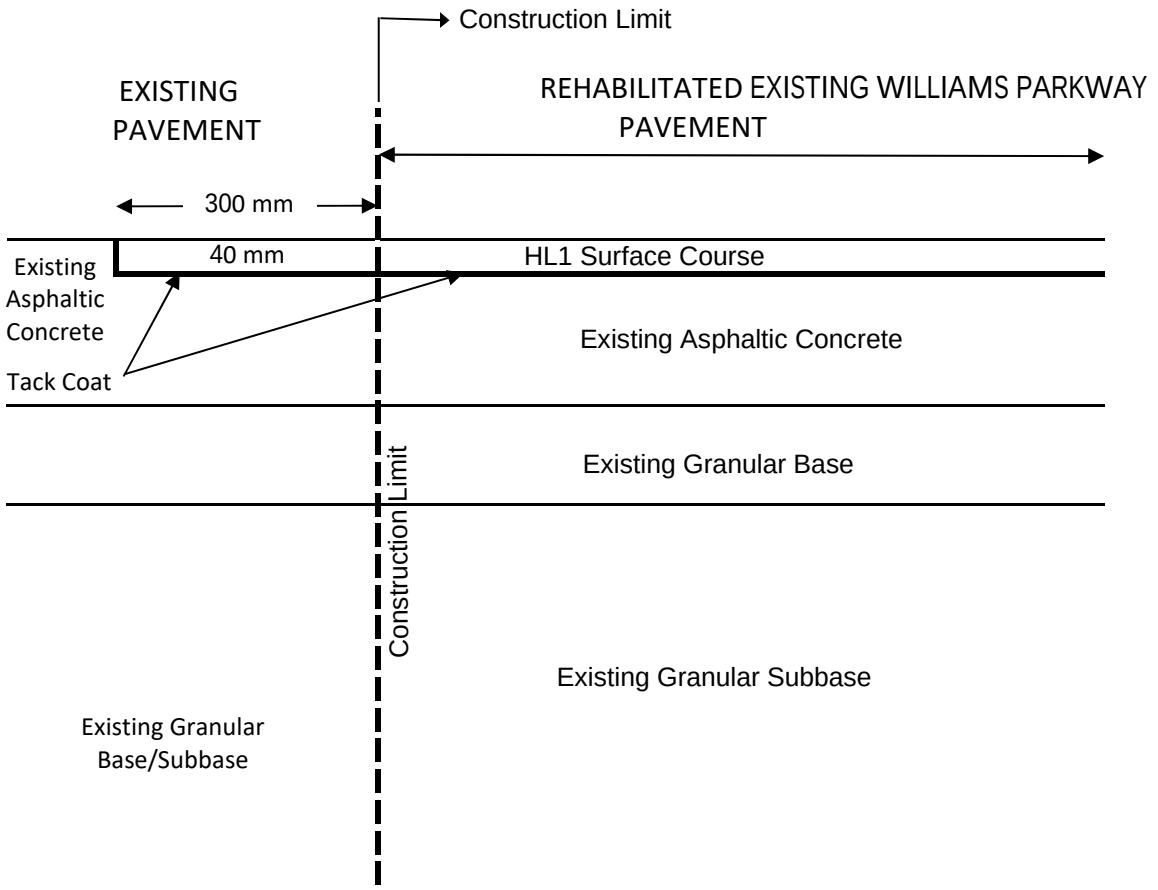
Design Lane 18-kip ESALs Over Initial Performance Period	4,212,400	
Initial Serviceability	4.4	
Terminal Serviceability	2.2	
Reliability Level	87	%
Overall Standard Deviation	0.44	
Roadbed Soil Resilient Modulus	25.00	MPa
Calculated Design Structural Number	126.5	mm

Specified Layer Design

Layer	Material Description	Struct. Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di) (mm)	Calculated SN (mm)
1	New AC	0.42	1	160.00	67.20
2	New Gran Base	0.14	1	150.00	21.00
3	New Gran Subbase	0.09	1	450.00	40.50
Total	-	-	-	760.00	128.7

APPENDIX E
Pavement Tie-in Details

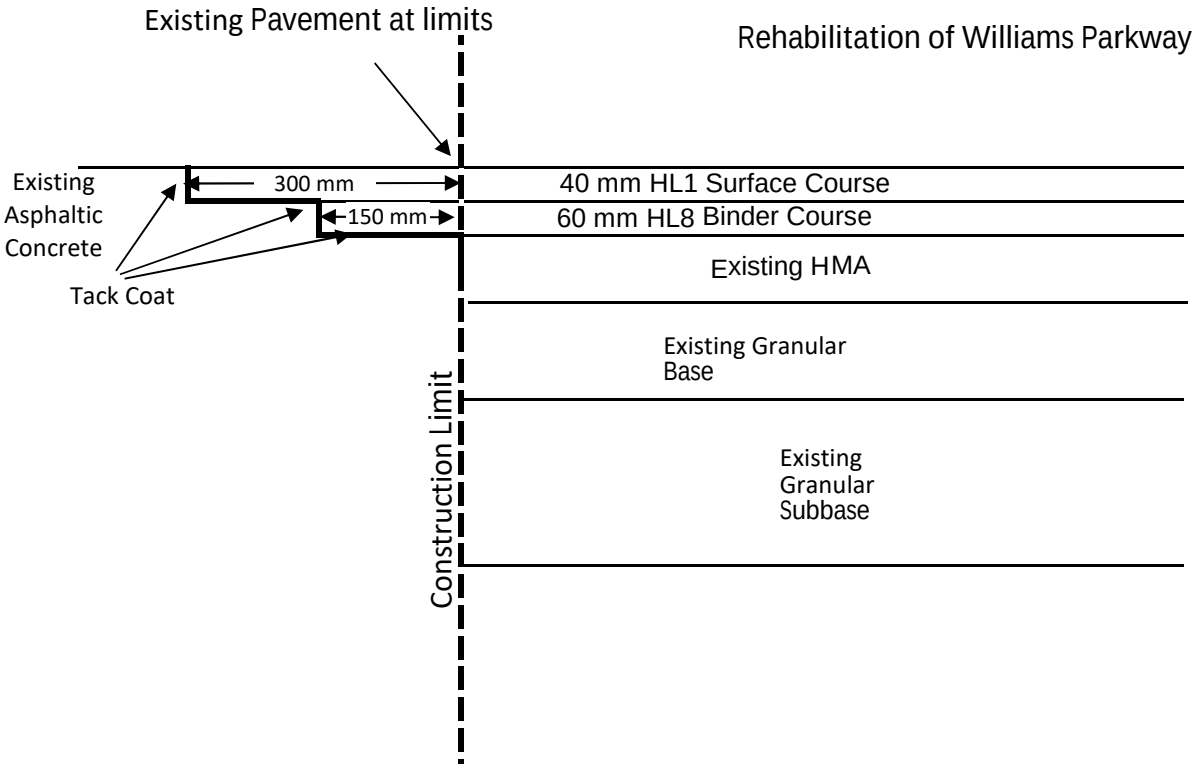
TIE-IN DETAILS



TRANSVERSE JOINT DETAILS

* All joints shall be constructed in accordance with OPSS 313/SP 103F03.

TYPICAL **TIE-IN DETAILS**- OPTION 3 Rehab.



LONGITUDINAL JOINT TIE-IN DETAIL

* All joints shall be constructed in accordance with OPSS 313/SP 103F03.

APPENDIX F
Environmental/Chemical Analyses Test Report
AGAT Report (Nov. 3,2022)

AGAT Laboratories

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

CLIENT NAME: TERRAPROBE INC.
11 INDELL LANE
BRAMPTON, ON L6T3Y3
(905) 796-2650
ATTENTION TO: Sepideh Monfared
PROJECT: Williams Parkway Improvements
AGAT WORK ORDER: 22T963358
SOIL ANALYSIS REVIEWED BY: Jacky Zhu, Spectroscopy Technician
DATE REPORTED: Nov 03, 2022
PAGES (INCLUDING COVER): 9
VERSION*: 1

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

Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
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- *The test results reported herewith relate only to the samples as received by the laboratory.*
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AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 22T963358

PROJECT: Williams Parkway Improvements

CLIENT NAME: TERRAPROBE INC.

ATTENTION TO: Sepideh Monfared

SAMPLING SITE:

SAMPLED BY:

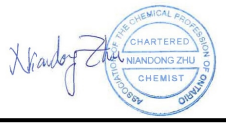
O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2022-10-28

DATE REPORTED: 2022-11-03

SAMPLE DESCRIPTION:				BH P3, Granular, (150mm-480mm)	BH EC3, Granular, (150mm-610mm)	BH P19, Granular, (140mm-550mm)	BH P24, Granular, (140mm-585mm)	BH P32, Granular, (195mm-545mm)	BH EC1, SS1, (0'-2')	BH TC2, SS1, (0'-2')	BH B5, SS1, (0'-2')
SAMPLE TYPE:				Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
DATE SAMPLED:				2022-10-04	2022-10-04	2022-10-07	2022-10-07	2022-10-11	2022-10-19	2022-10-03	2022-09-30
Parameter	Unit	G / S	RDL	4467242	4467250	4467251	4467252	4467254	4467255	4467256	4467257
Antimony	µg/g	1	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	11	1	3	4	8	5	4	6	5	5
Barium	µg/g	210	2.0	17.3	42.4	35.6	55.6	49.2	79.6	76.6	85.8
Beryllium	µg/g	2.5	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.5	0.6	0.8
Boron	µg/g	36	5	7	7	6	7	6	8	10	7
Boron (Hot Water Soluble)	µg/g	NA	0.10	<0.10	0.12	<0.10	0.10	<0.10	0.40	0.22	0.20
Cadmium	µg/g	1	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	µg/g	67	5	7	9	10	13	10	23	23	24
Cobalt	µg/g	19	0.5	3.7	5.3	5.3	7.0	5.1	8.8	12.2	11.0
Copper	µg/g	62	1.0	14.3	25.9	27.7	33.9	25.7	35.6	29.8	21.7
Lead	µg/g	45	1	10	7	14	8	6	**49**	18	14
Molybdenum	µg/g	2	0.5	<0.5	<0.5	0.5	0.5	0.7	0.8	<0.5	<0.5
Nickel	µg/g	37	1	6	9	9	12	8	18	22	20
Selenium	µg/g	1.2	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Silver	µg/g	0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Thallium	µg/g	1	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Uranium	µg/g	1.9	0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.57	0.80
Vanadium	µg/g	86	0.4	14.6	16.9	19.6	22.0	15.6	27.7	33.6	37.0
Zinc	µg/g	290	5	40	34	33	43	29	**645**	76	68
Chromium, Hexavalent	µg/g	0.66	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cyanide, WAD	µg/g	0.051	0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Mercury	µg/g	0.16	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Electrical Conductivity (2:1)	mS/cm	0.47	0.005	**1.41**	**0.622**	**2.02**	**1.22**	**0.996**	**0.716**	0.292	0.318
Sodium Adsorption Ratio (2:1) (Calc.)	N/A	1	N/A	**21.8**	**7.42**	**26.0**	**13.6**	**16.9**	**4.04**	0.966	**1.60**
pH, 2:1 CaCl2 Extraction	pH Units		NA	8.23	8.28	8.01	8.28	8.32	7.78	7.76	7.69

Certified By:



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Certificate of Analysis

AGAT WORK ORDER: 22T963358

PROJECT: Williams Parkway Improvements

CLIENT NAME: TERRAPROBE INC.

ATTENTION TO: Sepideh Monfared

SAMPLING SITE:

SAMPLED BY:

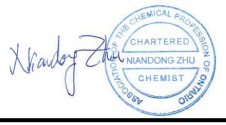
O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2022-10-28

DATE REPORTED: 2022-11-03

Parameter	Unit	G / S	RDL	BH B15, SS2, (2 1/2'-4') Soil 2022-10-04 4467258	BH B26, SS2, (2 1/2'-4') Soil 2022-10-06 4467259	BH P19, SS2, (2'-4') Soil 2022-10-07 4467260	BH P32, SS2, (2'-4') Soil 2022-10-11 4467261
Antimony	µg/g	1	0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	11	1	7	4	6	6
Barium	µg/g	210	2.0	113	82.3	101	81.1
Beryllium	µg/g	2.5	0.4	1.1	0.6	0.7	0.6
Boron	µg/g	36	5	9	10	11	9
Boron (Hot Water Soluble)	µg/g	NA	0.10	0.14	0.56	<0.10	0.13
Cadmium	µg/g	1	0.5	<0.5	<0.5	<0.5	<0.5
Chromium	µg/g	67	5	35	22	24	20
Cobalt	µg/g	19	0.5	15.3	9.6	13.6	11.5
Copper	µg/g	62	1.0	30.1	24.0	32.2	31.9
Lead	µg/g	45	1	14	9	10	7
Molybdenum	µg/g	2	0.5	<0.5	<0.5	<0.5	<0.5
Nickel	µg/g	37	1	33	19	26	21
Selenium	µg/g	1.2	0.8	<0.8	<0.8	<0.8	<0.8
Silver	µg/g	0.5	0.5	<0.5	<0.5	<0.5	<0.5
Thallium	µg/g	1	0.5	<0.5	<0.5	<0.5	<0.5
Uranium	µg/g	1.9	0.50	0.62	0.62	0.72	<0.50
Vanadium	µg/g	86	0.4	47.4	32.2	34.8	29.4
Zinc	µg/g	290	5	79	51	60	52
Chromium, Hexavalent	µg/g	0.66	0.2	<0.2	<0.2	<0.2	<0.2
Cyanide, WAD	µg/g	0.051	0.040	<0.040	<0.040	<0.040	<0.040
Mercury	µg/g	0.16	0.10	<0.10	<0.10	<0.10	<0.10
Electrical Conductivity (2:1)	mS/cm	0.47	0.005	**1.10**	**3.48**	**2.24**	**1.96**
Sodium Adsorption Ratio (2:1) (Calc.)	N/A	1	N/A	**7.48**	**32.8**	**8.82**	**23.4**
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.66	7.88	7.99	8.05

Certified By:



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Certificate of Analysis

AGAT WORK ORDER: 22T963358

PROJECT: Williams Parkway Improvements

CLIENT NAME: TERRAPROBE INC.

ATTENTION TO: Sepideh Monfared

SAMPLING SITE:

SAMPLED BY:

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

DATE RECEIVED: 2022-10-28

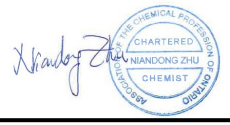
DATE REPORTED: 2022-11-03

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

4467242-4467261 EC was determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio. SAR is a calculated parameter.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



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Exceedance Summary

AGAT WORK ORDER: 22T963358

PROJECT: Williams Parkway Improvements

CLIENT NAME: TERRAPROBE INC.

ATTENTION TO: Sepideh Monfared

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
4467242	BH P3, Granular, (150mm-480mm)	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity (2:1)	mS/cm	0.47	1.41
4467242	BH P3, Granular, (150mm-480mm)	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio (2:1) (Calc.)	N/A	1	21.8
4467250	BH EC3, Granular, (150mm-610mm)	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity (2:1)	mS/cm	0.47	0.622
4467250	BH EC3, Granular, (150mm-610mm)	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio (2:1) (Calc.)	N/A	1	7.42
4467251	BH P19, Granular, (140mm-550mm)	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity (2:1)	mS/cm	0.47	2.02
4467251	BH P19, Granular, (140mm-550mm)	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio (2:1) (Calc.)	N/A	1	26.0
4467252	BH P24, Granular, (140mm-585mm)	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity (2:1)	mS/cm	0.47	1.22
4467252	BH P24, Granular, (140mm-585mm)	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio (2:1) (Calc.)	N/A	1	13.6
4467254	BH P32, Granular, (195mm-545mm)	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity (2:1)	mS/cm	0.47	0.996
4467254	BH P32, Granular, (195mm-545mm)	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio (2:1) (Calc.)	N/A	1	16.9
4467255	BH EC1, SS1, (0'-2')	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity (2:1)	mS/cm	0.47	0.716
4467255	BH EC1, SS1, (0'-2')	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Lead	µg/g	45	49
4467255	BH EC1, SS1, (0'-2')	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio (2:1) (Calc.)	N/A	1	4.04
4467255	BH EC1, SS1, (0'-2')	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Zinc	µg/g	290	645
4467257	BH B5, SS1, (0'-2')	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio (2:1) (Calc.)	N/A	1	1.60
4467258	BH B15, SS2, (2 1/2'-4')	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity (2:1)	mS/cm	0.47	1.10
4467258	BH B15, SS2, (2 1/2'-4')	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio (2:1) (Calc.)	N/A	1	7.48
4467259	BH B26, SS2, (2 1/2'-4')	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity (2:1)	mS/cm	0.47	3.48
4467259	BH B26, SS2, (2 1/2'-4')	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio (2:1) (Calc.)	N/A	1	32.8
4467260	BH P19, SS2, (2'-4')	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity (2:1)	mS/cm	0.47	2.24
4467260	BH P19, SS2, (2'-4')	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio (2:1) (Calc.)	N/A	1	8.82
4467261	BH P32, SS2, (2'-4')	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity (2:1)	mS/cm	0.47	1.96
4467261	BH P32, SS2, (2'-4')	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio (2:1) (Calc.)	N/A	1	23.4

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Quality Assurance

CLIENT NAME: TERRAPROBE INC.

AGAT WORK ORDER: 22T963358

PROJECT: Williams Parkway Improvements

ATTENTION TO: Sepideh Monfared

SAMPLING SITE:

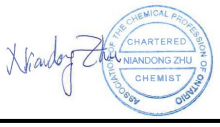
SAMPLED BY:

Soil Analysis

RPT Date: Nov 03, 2022			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	4467242	4467242	<0.8	<0.8	NA	< 0.8	107%	70%	130%	93%	80%	120%	84%	70%	130%
Arsenic	4467242	4467242	3	3	NA	< 1	123%	70%	130%	112%	80%	120%	111%	70%	130%
Barium	4467242	4467242	17.3	17.4	0.6%	< 2.0	106%	70%	130%	98%	80%	120%	110%	70%	130%
Beryllium	4467242	4467242	<0.4	<0.4	NA	< 0.4	98%	70%	130%	104%	80%	120%	108%	70%	130%
Boron	4467242	4467242	7	6	NA	< 5	96%	70%	130%	104%	80%	120%	117%	70%	130%
Boron (Hot Water Soluble)	4467242	4467242	<0.10	<0.10	NA	< 0.10	94%	60%	140%	93%	70%	130%	101%	60%	140%
Cadmium	4467242	4467242	<0.5	<0.5	NA	< 0.5	93%	70%	130%	105%	80%	120%	105%	70%	130%
Chromium	4467242	4467242	7	7	NA	< 5	115%	70%	130%	116%	80%	120%	123%	70%	130%
Cobalt	4467242	4467242	3.7	3.7	0.0%	< 0.5	120%	70%	130%	114%	80%	120%	116%	70%	130%
Copper	4467242	4467242	14.3	13.4	6.5%	< 1.0	105%	70%	130%	113%	80%	120%	107%	70%	130%
Lead	4467242	4467242	10	10	0.0%	< 1	112%	70%	130%	111%	80%	120%	103%	70%	130%
Molybdenum	4467242	4467242	<0.5	<0.5	NA	< 0.5	116%	70%	130%	112%	80%	120%	119%	70%	130%
Nickel	4467242	4467242	6	6	0.0%	< 1	113%	70%	130%	110%	80%	120%	110%	70%	130%
Selenium	4467242	4467242	<0.8	<0.8	NA	< 0.8	107%	70%	130%	110%	80%	120%	108%	70%	130%
Silver	4467242	4467242	<0.5	<0.5	NA	< 0.5	110%	70%	130%	105%	80%	120%	96%	70%	130%
Thallium	4467242	4467242	<0.5	<0.5	NA	< 0.5	112%	70%	130%	106%	80%	120%	101%	70%	130%
Uranium	4467242	4467242	<0.50	<0.50	NA	< 0.50	116%	70%	130%	108%	80%	120%	109%	70%	130%
Vanadium	4467242	4467242	14.6	13.7	6.4%	< 0.4	125%	70%	130%	112%	80%	120%	121%	70%	130%
Zinc	4467242	4467242	40	44	9.5%	< 5	114%	70%	130%	112%	80%	120%	114%	70%	130%
Chromium, Hexavalent	4457152		<0.2	<0.2	NA	< 0.2	96%	70%	130%	87%	80%	120%	110%	70%	130%
Cyanide, WAD	4468385		<0.040	<0.040	NA	< 0.040	104%	70%	130%	102%	80%	120%	107%	70%	130%
Mercury	4467242	4467242	<0.10	<0.10	NA	< 0.10	115%	70%	130%	108%	80%	120%	109%	70%	130%
Electrical Conductivity (2:1)	4465720		0.945	0.980	3.6%	< 0.005	106%	80%	120%						
Sodium Adsorption Ratio (2:1) (Calc.)	4465720		11.5	11.4	0.9%	NA									
pH, 2:1 CaCl2 Extraction	4475680		5.58	5.51	1.3%	NA	101%	80%	120%						

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.
Duplicate NA: results are under 5X the RDL and will not be calculated.

Certified By:



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Method Summary

CLIENT NAME: TERRAPROBE INC.

AGAT WORK ORDER: 22T963358

PROJECT: Williams Parkway Improvements

ATTENTION TO: Sepideh Monfared

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Arsenic	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Barium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Beryllium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Boron	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	modified from EPA 6010D and MSA PART 3, CH 21	ICP/OES
Cadmium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Chromium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Cobalt	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Copper	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Lead	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Molybdenum	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Nickel	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Selenium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Silver	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Thallium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Uranium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Vanadium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Zinc	MET 93 -6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Chromium, Hexavalent	INOR-93-6068	modified from EPA 3060 and EPA 7196	SPECTROPHOTOMETER
Cyanide, WAD	INOR-93-6052	modified from ON MOECC E3015, SM 4500-CN- I, G-387	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	modified from EPA 7471B and SM 3112 B	ICP-MS
Electrical Conductivity (2:1)	INOR-93-6075	modified from MSA PART 3, CH 14 and SM 2510 B	PC TITRATE
Sodium Adsorption Ratio (2:1) (Calc.)	INOR-93-6007	modified from EPA 6010D & Analytical Protocol	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6075	modified from EPA 9045D, MCKEAGUE 3.11 E3137	PC TITRATE

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Chain of Custody Record

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

Laboratory Use Only
Work Order #: 22T963358
Cooler Quantity: 1 large
Arrival Temperatures: 9.1 | 9.3 | 9.7
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes: On Ice

Report Information:
Company: Terraprobe
Contact: Sepideh D. Monfared
Address: 11 Indell Lane, Brampton
Phone: 905-796-2650 Fax:
Reports to be sent to:
1. Email: smonfared@terraprobe.ca
2. Email:

Project Information:
Project: Williams Parkway Improvements
Site Location: Brampton
Sampled By:
AGAT Quote #: PO: 1-22-0499
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:
Bill To Same: Yes ☒ No ☐
Company:
Contact:
Address:
Email:

Regulatory Requirements:
(Please check all applicable boxes)

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

☐ Excess Soils R406
Table ____ (Indicate One)
☐ Regulation 558
☐ CCME

☐ Sewer Use
☐ Sanitary ☐ Storm
____ (Region)
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
____ (Indicate One)

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

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

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

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

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC (Y/N)	O. Reg 153: Metals & Inorganics	O. Reg 153: Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	O. Reg 153: BTEX, F1-F4 PHCs	O. Reg 153: PAHs	O. Reg 153: PCBs	O. Reg 153: VOC	O. Reg 153: Aroclors	O. Reg 558: Landfill Disposal Characterization TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406: Excess Soils SPLP Rainwater Leach ☐ Metals ☐ VOCs ☐ SVOCs	O. Reg 406: Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Corrosivity: Include Moisture ☐ Sulphide ☐	Potentially Hazardous or High Concentration (Y/N)
BH P3, Granular, (150mm - 480mm)	Oct 4, 2022	AM/PM	1	S			X											
BH EC3, Granular, (150mm - 610mm)	Oct 4, 2022	AM/PM	1	S			X											
BH P19, Granular, (140mm - 550mm)	Oct 7, 2022	AM/PM	1	S			X											
BH P24, Granular, (140mm - 525mm)	Oct 7, 2022	AM/PM	1	S			X											
BH P32, Granular, (195mm - 545mm)	Oct 11, 2022	AM/PM	1	S			X											
BH EC1, SS1, (0'-2')	Oct 19, 2022	AM/PM	1	S			X											
BH TC2, SS1, (0'-2')	Oct 3, 2022	AM/PM	1	S			X											
BH B5, SS1 (0'-2')	Sep 30, 2022	AM/PM	1	S			X											
BH B15, SS2 (2½'-4')	Oct 4, 2022	AM/PM	1	S			X											
BH B26, SS2 (2½'-4')	Oct 6, 2022	AM/PM	1	S			X											
BH P19, SS2, (2'-4')	Oct 7, 2022	AM/PM	1	S			X											

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Dario Halari	27/10/22		Anthony Basilio		'22 OCT 28 12:58 PM
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
					Page ____ of ____
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
					N°: T-135080

AGAT Laboratories
5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

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

Laboratory Use Only

Work Order #:

Cooler Quantity:

Arrival Temperatures:

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes:

Report Information:

Company: Terraprobe
Contact: Sepideh D. Monfared
Address: 11 Indell Lane Brampton
Phone: Fax:
Reports to be sent to:
1. Email: simon.fared@terraprobe.ca
2. Email:

Project Information:

Project: Williams Parkway Improvement
Site Location: Brampton
Sampled By:
AGAT Quote #: PO: 1-22-0499
Please note: if quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

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

Regulatory Requirements:

(Please check all applicable boxes)

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

☐ Excess Soils R406
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Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

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

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

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For 'Same Day' analysis, please contact your AGAT CPM

Sample Matrix Legend

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

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC (Y/N)	O. Reg 153: Metals & Inorganics	O. Reg 153: Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	O. Reg 153: BTEX, F1-F4 PHCs Analyze F4G if required ☐ Yes ☐ No	O. Reg 153: PAHs	O. Reg 153: PCBs	O. Reg 153: VOC	O. Reg 558: Landfill Disposal Characterization TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406: Excess Soils SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs	O. Reg 406: Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Salt - EC/SAR	Potentially Hazardous or High Concentration (Y/N)
BH P32, SS2 (2'-4')		11/10/22 AM PM	1	S			X										
		AM PM															
		AM PM															
		AM PM															
		AM PM															
		AM PM															
		AM PM															
		AM PM															
		AM PM															
		AM PM															
		AM PM															
		AM PM															

Samples Relinquished By (Print Name and Sign): Drew Haslam	Date: 27/10/22	Time: 2	Samples Received By (Print Name and Sign):	Date:	Time:
Samples Relinquished By (Print Name and Sign):	Date:	Time:	Samples Received By (Print Name and Sign):	Date:	Time:
Samples Relinquished By (Print Name and Sign):	Date:	Time:	Samples Received By (Print Name and Sign):	Date:	Time:

Page ____ of ____

N°: