

PRELIMINARY GEOTECHNICAL INVESTIGATION BOVAIRD DRIVE FROM LAKE LOUISE / WORTHINGTON AVENUE TO PEEL / HALTON BOUNDARY, ONTARIO PROJECT No. 09-4360

Submitted to:

The Regional Municipality of Peel Works Department

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30 June 2011

TT93042





30 June 2011

TABLE OF CONTENTS

1.0	INTRO	ODUCTION	1
2.0	SITE	AND PROJECT DESCRIPTION	2
3.0	INVE	STIGATION PROCEDURES	3
	3.1	Geotechnical Investigation	3
	3.2	Pavement Condition Survey	7
4.0	SUB-	SURFACE CONDITIONS	8
	4.1	Asphaltic Concrete	9
	4.2	Topsoil	9
	4.3	Gravelly Sand / Sand and Gravel Fill	9
	4.4	Fill Soils	10
	4.5	Clayey Silt / Silty Clay Till	11
	4.6	Silt and Sand / Silty Sand / Sandy Silt Till	11
	4.7	Gravelly Sand	12
	4.8	Weathered Shale	12
	4.9	Groundwater Conditions	
5.0	DISC	USSION AND RECOMMENDATIONS	16
	5.1	Pavement Design Considerations	16
		5.1.1 Granular Base Equivalency (GBE)	17
		5.1.2 Existing and Forecasted Traffic Data	18
	5.2	Flexible Structural Pavement Design for New Pavement Widening	19
	5.3	Pavement Rehabilitation	22
	5.4	Construction Consideration	23
		5.4.1 New Hot Mix Layers	24
		5.4.2 Performance Graded Asphalt Cement (PGAC)	
		5.4.3 Tack Coat	24
		5.4.4 Transition Treatments	
	5.4.5	Reuse of Existing Sand and Gravel Fill and Soil Fill	
		5.4.6 Compaction	25
		5.4.7 Field Quality Assurance	
	5.5	Subgrade Preparation for Widening	
	5.6	Approach Embankment Widening at CN Rail	
	5.7	Drainage	
	5.8	Foundations	
		5.8.1 Concrete Culvert	
		5.8.2 Culverts	
	5.9	Excavation and Dewatering	
	5.10	Sewer Installation	
		5.10.1 Trenching	
		5.10.2 Pipe Bedding	
		5.10.3 Trench Backfill	
6.0	LIMIT	ED ENVIRONMENTAL ASSESSMENT	
	6.1	Methodology	38



30 June 2011

	6.2	Soil Assessment Criteria	39
	6.3	Chemical Analyses Results	
		6.3.1 pH	
		6.3.2 Inorganics	
		6.3.3 Petroleum Hydrocarbons	
		6.3.4 Ontario Regulation 558/00 Leachate Analyses	
	6.4	Laboratory QA/QC Program	
		Summary	
7.0		SURE	

REPORT LIMITATIONS

FIGURES

Figure No. 1 Site Location Plan
Figure Nos. 2A to 2C Borehole Location Plan

RECORD OF BOREHOLES

Explanation of Borehole Logs

Record of Boreholes (BH B1 to BH B7, BH B9 to BH B12, BH B15, BH B18 and BH B19; and BH BC 1 to BH BC3, BH BC3-W, BH BC 4 to BH BC 35)

APPENDICES

Appendix A: Laboratory Soil Test Results
Appendix B: Certificates of Analyses

Appendix C: Results of Pavement Condition Survey

Appendix D: Site Photographs



30 June 2011

1.0 INTRODUCTION

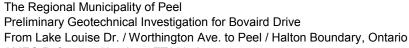
AMEC Earth & Infrastructure, a Division of AMEC Americas Limited ("AMEC"), Consulting Geotechnical, Construction Quality Control and Environmental Engineers, was retained by AMEC Earth & Infrastructure (Burlington), on behalf of the Regional Municipality of Peel, to conduct a preliminary geotechnical investigation for a section of Bovaird Drive from Lake Louise Drive / Worthington Avenue to Peel / Halton Boundary, Ontario. The investigation was required to provide geotechnical design information for completion of Class Environment Assessment study for the improvements of Bovaird Drive. The project limit is shown on Figure No. 1.

The purpose of this preliminary geotechnical investigation was to obtain information on the existing subsurface conditions along the Bovaird Drive section by means of a limited number of boreholes, in-situ tests and laboratory tests of soil samples. During the field work, a visual assessment of the existing pavement condition was made, and the existing pavement structure was measured in the boreholes. Based on AMEC's interpretation of the data obtained, recommendations are provided for road improvements which could include rehabilitation / reconstruction and possible widening works of the above mentioned road section, expansion of existing culverts, and installation of underground utilities.

This report contains the findings of AMEC's geotechnical investigation, together with recommendations and comments. These recommendations and comments are based on factual information and are intended only for use by the design engineers. The number of boreholes may not be sufficient to determine all the factors that may affect construction methods and costs. Subsurface and groundwater conditions between and beyond the boreholes may differ from those encountered at the borehole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The anticipated construction conditions are also discussed, but only to the extent that they may influence design decisions. Construction methods discussed, however, express AMEC's opinion only and are not intended to direct the contractors on how to carry out the construction. Contractors should also be aware that the data and their interpretation presented in this report may not be sufficient to assess all the factors that may have an effect upon the construction.

The report is prepared with the condition that the design will be in accordance with all applicable standards and codes, regulations of authorities having jurisdiction, and good engineering practice. Further, the recommendations and opinions in this report are applicable only to the proposed project as described above.

On-going liaison with AMEC during the final design and construction phase of the project is recommended to confirm that the recommendations in this report are applicable and/or correctly interpreted and implemented. Also, any queries concerning the geotechnical aspects of the proposed project should be directed to AMEC for further elaboration and/or clarification.





AMEC Reference Number: TT93042

30 June 2011

2.0 SITE AND PROJECT DESCRIPTION

The investigated section of Bovaird Drive is about 4.8 km long and extends from Lake Louise Drive / Worthington Avenue to Peel / Halton Boundary at Caseley Drive, Ontario, as shown in Figure No. 1.

Based on the Region of Peel Document 2009-139P, the key elements of the existing Bovaird Drive includes the following:

Section 1: Lake Louise Drive / Worthington Avenue to Mississauga Road

- Number of lanes: 2 / 4 Lanes
- Approximate length of this section: 2.0 km
- Culverts and bridge crossing:
 - Overpass bridge at CN Rail crossing
 - o Culvert across the Huttonville Creek, located on the east side of Mississauga Road;
- Designated right of way width: 45 m

Section 2: Mississauga Road to Peel / Halton Boundary (Caseley Drive)

Number of lanes: 2 Lanes

Approximate length: 2.83 km

Culverts and structure crossing: 30 culverts

Designated right of way width: 45 m

Based on the information available in the RFP, the proposed improvement of Bovaird Drive would include the following schemes:

- i) rehabilitation and possible widening of the roadway;
- ii) widening of the existing approach embankments at CN Rail crossing to accommodate possible bridge widening;
- iii) extension of existing concrete culvert across the Huttonville Creek at east of Mississauga Road; and
- iv) extension of a total of 30 culverts that exist either across this road stretch or at the edge (at entrance to side roads).



30 June 2011

3.0 INVESTIGATION PROCEDURES

3.1 Geotechnical Investigation

The field work was carried out from October 13 to 28, 2009, and consisted of advancing a total of 50 boreholes. The depths of boreholes ranged from 2.3 m to 13.0 m below the existing grade. Site plans showing the locations of the boreholes are presented in Figure Nos. 2A, 2B and 2C.

Prior to commencing the drilling work, a total of 53 borehole locations were established in the field by AMEC personnel as per AMEC proposal which included the following boreholes:

- 19 boreholes (BH B1 to BH B19) were located approximately at 250 m interval along the pavement / shoulder of the roadway.
- 34 boreholes (BH BC1 to BH BC34) were established for road crossings as follows:
 - o 2 boreholes at the location of existing bridge at CNR crossing;
 - 2 boreholes at the location of concrete culvert across the Hunttonville Creek at east of Mississauga Road; and
 - 30 boreholes (one each) at the existing culvert (concrete box and corrugated steel pipe) locations.

During the field work, the following addition and cancellation in the drilling program were made.

- Five (5) boreholes (BH B8, BH B13, BH B14, BH B16 and BH B17) were cancelled by AMEC due to their close proximity to culvert boreholes.
- Two boreholes were added at the request of the project hydrogeological team. These boreholes are as follows.
 - BH BC3-W was drilled beside Borehole BH BC3;
 - o Borehole BH BC35 was drilled about 19 m north of Bovaird Drive centre line (C/L).

Both Boreholes BH BC3-W and BH BC35 were augered through (without sampling) .

The borehole details are summarized in Table 3.1.



30 June 2011

Table 3.1- Borehole Details

	Table 3.1- Borehole Details									
Borehole No.	Location	NAD 83 UTM 17 Northing Easting Station (m) Geodetic Elevation (m)		Pavement / Shoulder	Offset ⁽¹⁾	Depth (m)				
	From Lake Louise Drive / Worthington Avenue to Mississauga Road									
BH B1	Roadway	N 4836994 E 595475	14 + 733	Not provided	Pavement	-13.6 m	4.6 m			
BH B2	Roadway	N 4836849 E 595432	14 + 584	245.8	Pavement	+0.1 m	5.0 m			
BH BC1	Culvert	N 4836617 E 595345	14 + 333	252.4	Pavement	- 12.0 m	11.0 m			
BH BC2	Culvert	N 4836556 E 595332	14 + 273	Not provided	Pavement	+5.1 m	11.1 m			
BH B3	Roadway	N 4836392 E 595160	14 + 004	245.5	Pavement	- 12.7 m	4.6 m			
BH B4	Roadway	N 4836270 E 595001	13 + 834	244.3	Pavement	+12.7 m	4.6 m			
BH B5	Roadway	N 4836132 E 594792	13 + 584	245.6	Pavement	- 9.9 m	4.6 m			
BH B6	Roadway	N 4835887 E 594627	13 + 289	243.1	Pavement	+9.6 m	4.9 m			
BH B7	Roadway	N 4835631 E 594408	13 + 952	239.2	Pavement	-9.1 m	4.7 m			
вн всз	Culvert	N 4835573 E 594358	12 + 876	238.1	Pavement	- 12.7 m	10.7 m			
BH BC3W	Culvert	N 4835573 E 594358	12 + 876	238.1	Pavement	- 12.7 m	4.6 m			
BH BC4	Culvert	N 4835579 E 594387	13 + 899	238.1	Shoulder	+6.3 m	10.7 m			
	Fro	m Mississauga	Road to Pee	l / Halton Bo	undary (Casele	y Drive)				
BH BC5	Culvert	N 4835483 E 594317	12 + 779	239.2	Pavement	+9.2 m	4.9 m			
BH B8	Roadway	N 4835461 E 594300	12 + 752	239.7	1	Borehole	e cancelled			
вн вс6	Culvert	N 4835452 E 594274	12 + 729	240.0	Shoulder	- 5.9 m	5.0 m			
ВН ВС7	Culvert	N 4835360 E 594219	12 + 876	240.7	Pavement	+6.1 m	5.0 m			
ВН В9	Roadway	N 4835345 E 594191	12 + 593	240.8	Shoulder	- 61 m	5.0 m			
BH BC8	Culvert	N 4835289 E 594164	12 + 533	241.1	Shoulder	+6.1 m	4.7 m			
вн вс9	Culvert	N 4835203 E 594100	12 + 425	241.6	Shoulder	+7.1 m	4.7 m			
BH B10		N 4835152 E 594062	12 + 361	241.7	Shoulder	+5.8 m	4.6 m			
BH BC10	Culvert	N 4834959 E 593954	12 + 140	238.1	Shoulder	+9.6 m	4.6 m			



30 June 2011

Borehole No.	Location	NAD 83 UTM 17 Northing Easting	Station (m)	Geodetic Elevation (m)	Pavement / Shoulder	Offset ⁽¹⁾	Depth (m)
BH B11	Roadway	N 4834941 E 593927	12 + 111	237.9	Shoulder	- 5.7 m	4.6 m
BH BC11	Culvert	N 4834784 E 593830	11 + 926	236.8	Shoulder	- 6.4 m	4. 7 m
BH B12	Roadway	N 4834706 E 593772	11 + 828	237.4	Shoulder	- 6.2 m	4.9 m
BH BC12	Culvert	N 4834691 E 593774	11 + 817	237.6	Shoulder	+5.5 m	5.0 m
BH BC13	Culvert	N 4834598 E 593705	11 + 702	237.9	Shoulder	+7.0 m	4.7 m
BH BC14	Culvert	N 4834549 E 593668	11 + 640	237.5	Shoulder	+7.7 m	4.7 m
BH BC15	Culvert	N 4834480 E 593614	11 + 553	236.7	Pavement	+7.3 m	4.9 m
BH BC16	Culvert	N 4834491 E 593603	11 + 555	236.8	Shoulder	- 8.0 m	5.0 m
BH B13	Roadway	N 4834505 E 593615	11 + 573	236.9	-	Borehole	e cancelled
BH BC17	Culvert	N 4834445 E 593588	11 + 509	236.3	Shoulder	+7.8 m	5.0 m
BH BC18	Culvert	N 4834447 E 593547	11 + 485	235.9	Pavement	- 25.6 m	4.7 m
BH BC19	Culvert	N 4834399 E 593552	11 + 451	236.4	Pavement	+7.6 m	6.1 m
BH BC20	Culvert	N 4834355;E 593500	11 + 385	237.8	Shoulder / Boulevard	- 6.8 m	4.7 m
BH BC21	Culvert	N 4834315 E 593469	11 + 333	238.9	N. Shoulder	- 7.0 m	4.6 m
BH BC22	Culvert	N 4834246 E 593437	11 + 260	239.6	Shoulder	9.3 m	4.9 m
BH B14	Roadway	N 4834268 E 593453	11 + 286	239.2	-	Borehole	e cancelled
BH BC23	Culvert	N 4834280 E 593438	11 + 287	239.0	Shoulder	- 10.6 m	4.6 m
BH BC24	Culvert	N 4834259 E 593423	11 + 261	239.6	Shoulder / Boulevard	+9.9 m	4.6 m
BH B15	Roadway	N 4834117 E 593322	11 + 089	240.0	Shoulder	+5.0 m	5.0 m
BH BC25	Culvert	N 4834070 E 593304	11 + 039	239.6	Shoulder	+8.9 m	6.2 m
BH BC26	Culvert	N 4833994 E 593228	10 + 932	239.5	Shoulder	- 6.3 m	4.7 m
BH BC27	Culvert	N 4833968 E 593209	10 + 900	239.5	Shoulder	- 5.8 m	4.6 m
BH BC28	Culvert	N 4833931 E 593205	10 + 868	239.0	Pavement	13.31 m	4.6 m



30 June 2011

Borehole No.	Location	NAD 83 UTM 17 Northing Easting	Station (m)	Geodetic Elevation (m)	Pavement / Shoulder	Offset ⁽¹⁾	Depth (m)
BH BC29	Culvert	N 4833893 E 593149	10 + 804	237.5	Shoulder	- 8.9 m	4.6 m
BH BC30	Culvert	N 4833863 E 593125	10 + 765	236.0	Pavement	- 9.3 m	4.6 m
BH B16	Roadway	N 4833874 E 593135	10 + 780	236.7	1	Borehole	cancelled
BH BC31	Culvert	N 4834505 E 593615	10 + 751	235.4	Pavement	+9.9 m	4.6 m
BH BC32	Culvert	N 4833810 E 593105	10 + 711	233.6	Shoulder	+6.6 m	4.6 m
вн всзз	Culvert	N 4833693 E 592987	10 + 546	224.9	Pavement	-16.9 m	5.0 m
BH B17	Roadway	N 4833674 E 593002	10 + 540	225.2	-	Borehole cancelled	
BH BC34	Culvert	N 4833689 E 593015	10 + 560	226.2	Pavement	+7.5 m	5.0 m
BH B18	Roadway	N 4833542 E 592850	10 + 339	214.7	Pavement	- 4.9 m	4.8 m
BH B19	Roadway	N 4833406 E 592572	10 + 027	201.2	Shoulder	+2.6 m	2.3 m
BH BC35	Off Bovaird Drive, on the north side	Not provided	15 m W. of Driveway #2838	Not provided	Shoulder / Boulevard	+19.2 m N. of C/L	13.0 m

^{(1) (-)} offset means the borehole was drilled on the left (north) side of the alignment, and (+) offset for the right (south) side

The boreholes were advanced by both track and truck-mounted power-auger drilling rigs using solid stem augers under the full-time supervision of experienced geotechnical personnel from AMEC. Soil samples were taken at 0.76 m intervals within the top 3 m depth and subsequently at 1.5 m intervals while performing the Standard Penetration Test (SPT) in accordance with ASTM D1586. This consisted of freely dropping a 63.5 kg (140 lbs.) hammer for a vertical distance of 0.76 m (30 inches) to drive a 51 mm (2 inches) diameter O.D. split-barrel (split spoon) sampler into the ground. The number of blows of the hammer required to drive the sampler into the relatively undisturbed ground by a vertical distance of 0.30 m (12 inches) was recorded as SPT 'N' value of the soil which provided an indication of the consistency of cohesive soils or compactness of non-cohesive soils. The results of the SPT are shown in the Record of Boreholes.

Prior to drilling work, the approximate locations of the boreholes were submitted to the Regional Municipality of Peel, c/o AMEC Earth and Environmental (Burlington) for approval. The boreholes were established in the field using local references by AMEC's field personnel. The coordinates (NAD 83 UTM 17 reference system) and existing ground surface elevations (geodetic) at the borehole locations as shown in Table 3.1 and on in the Record of Boreholes, were provided by AMEC Earth and Environmental (Burlington).



Groundwater levels, where encountered in the open boreholes, were measured at the completion of drilling. Seven monitoring wells were installed in Boreholes BH B11, BH BC3, BH BC3-W, BH BC4, BH BC10, BH BC11 and BH BC35 for monitoring of groundwater table required for the project hydrogeological study. Groundwater was observed in the monitoring wells on 17 March 2010 and shown in the Record of Boreholes.

All boreholes deeper than 3 m were backfilled with bentonite upon their completion. The locations of the boreholes drilled on the existing asphalt surface were repaired with 'cold patch'.

Soil samples collected from boreholes were transported to AMEC's Advanced Soil Laboratory in Scarborough (Toronto) for further review and laboratory testing on selected samples (i.e., water content determination, grain size analysis and Atterberg Limit test, when applicable). The results of the in-situ and laboratory tests are presented on the corresponding Record of Boreholes. The results of laboratory testing are provided in Appendix A.

Soil samples obtained during the geotechnical field drilling program were field screened for evidence of environmental impact. The field screening activities included a visual inspection of the soil samples and measuring the combustible organic vapor (COV) in the headspace of the soil samples with a portable hydrocarbon measuring device (Gastechtor 1238ME). Results of the field screening are shown in the Record of Boreholes.

3.2 Pavement Condition Survey

30 June 2011

AMEC completed a visual pavement condition survey along the investigated sections of Bovaird Drive to identify areas of distress as well as their degree of severity. The findings of the survey are summarized in Table 3.2. The Pavement Condition Survey sheets are attached in Appendix C. The pavement condition in some section reflects its age and probable increase in traffic loading that has resulted in the pavement condition being progressively deteriorated with time.

The identification and classification of the pavement distresses were in accordance with the MTO's Manual for Condition Rating of Flexible Pavements (SP024), August 1980. Photographs of typical existing pavement distresses/conditions are presented in Appendix D.

The existing pavement surface condition from Lake Louise Drive / Worthington Avenue to Mississauga Road (about 2.0 km) is considered to be in a 'Good Condition', except one midlane cracking of severe severity noted in the WB lane at location just east CNR Bridge, and few joint cracking of slight severity.

The existing pavement surface condition from Mississauga Road to Heritage Road (about 1.4 km) is considered to be in a 'Fair Condition' with intermediate to extensive raveling and aggregate loss, wheel track rutting, and various cracking of slight to severe severity.



30 June 2011

The existing pavement surface condition from Heritage Road to Peel / Halton Boundary (about 1.4 km) is considered to be in a 'Fair to Poor Condition' with intermediate to frequent raveling and aggregate loss, ripping and shoving and cracking of slight to moderate severity.

Table 3.2 - Pavement Condition Assessment of Boyaird Drive

Section	Predominant Distress	Rating
Lake Louise Drive / Worthington Avenue to Mississauga Road	- Slight /Few Single and Multiple Centreline Cracking - Very Severe/Few Random Midlane Cracking	Good Condition (2.0 km ±)
Mississauga Road to Heritage Road	 Slight/Intermittent Coarse Aggregate Loss (Ravelling) Moderate/ Frequent Rutting and Distortion Moderate/Frequent Single & Multiple Longitudinal Cracking Slight/Intermittent Alligator Longitudinal Cracking Moderate/ Frequent Single & Multiple Centreline Cracking Moderate/Frequent Centreline Cracking Slight /Intermittent Alligator Cracking Moderate/Frequent Random Midlane Cracking 	Fair Condition (1.4 km ±)
Heritage Road to Peel / Halton Boundary (Caseley Drive)	 Very Slight/Few Coarse Aggregate Loss (Ravelling) and Flushing Moderate/ Frequent Rutting and Distortion Moderate/Frequent Single & Multiple Longitudinal Cracking Slight/Intermittent Alligator Longitudinal Cracking Moderate/ Frequent Single & Multiple Centreline Cracking Very Slight/Frequent Alligator Cracking Slight/Intermittent Pavement Edge Cracking Single & Multiple with Alligator Cracking Severe/Extensive Transverse Cracking Single & Multiple Slight /Extensive Transverse Cracking with Alligator Cracking 	Fair to Poor Condition (1.4 km ±)

4.0 SUB-SURFACE CONDITIONS

The subsurface conditions along the investigated section of Bovaird Drive comprised surficial ground surface cover (topsoil, or gravelly sand/sand and gravel fill, or asphaltic concrete and gravelly sand / sand and gravel fill), underlain by various fill soils which were in turn underlain by native deposits (clayey silt / silty clay till, and /or silt and sand / sandy silt / silty sand till and /or silty sand / sand) to the depths of termination of majority of the boreholes. In several boreholes, the native deposits were underlain by weathered shale.

The stratigraphic units and groundwater conditions are discussed in brief in the following sections. The Records of Boreholes (in alphabetical order) are attached for detailed information.



Please note that the following summary is to assist the designers of the project with an understanding of the anticipated soil conditions across the site. However, it should be noted that the soil and groundwater conditions may vary between and beyond these locations.

4.1 Asphaltic Concrete

Asphaltic concrete, about 70 mm to 320 mm in thickness, was encountered in Boreholes BH B1 to BH B7, BH B9 to BH B12, BH B18, BH BC1, BH BC2, BH BC3, BH BC5, BH BC7, BH BC15, BH BC18, BH BC19, BH BC28, BH BC30, BH BC31, BH BC33 and BH BC34, drilled on the paved section of the roadway.

The thickness of asphaltic concrete could vary between and beyond the borehole locations.

4.2 Topsoil

30 June 2011

Topsoil, approximately 40 mm to 150 mm in thickness, was penetrated at the existing grade in Boreholes BH BC16, BH BC20, BH BC21, BH BC24, BH BC27 and BH BC35, drilled within the boulevard areas.

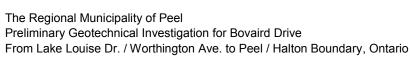
The topsoil consisted primarily of clayey silt, organic matters and rootlets. The thickness of topsoil could vary between and beyond the borehole locations.

4.3 Gravelly Sand / Sand and Gravel Fill

Gravelly sand / sand and gravel fill was encountered at grade in BH B9 to BH B12, BH B15, BH B19, BH BC4, BH BC6, BH BC8 to BH BC11, BH BC14, BH BC17, BH BC23, BH BC25, BH BC26, BH BC29, and BH BC32; underlying the asphaltic concrete in Boreholes BH B1 to BH B7, BH B18, BH BC1 to BH BC3, BH BC5, BH BC7, BH BC15, BH BC18, BH BC19, BH BC28, BH BC30, BH BC31, BH BC33 and BH BC34, and below topsoil in BH BC20, BH BC21, BH BC24, BH BC27 and BH BC35. In Borehole BH B15, gravelly sand / sand and gravel fill was at two depths, first at existing grade and then buried below clayey silt fill at about 2.9 m below grade. The gravelly sand / sand and gravel fill extended to depths varying from about 0.3 m to 4.0 m below the existing ground surface.

The gravelly sand / sand and gravel fill was brown in color, and contained a trace of silt to some silt in Boreholes BH B4, BH B11, BH BC 26 and BH BC27, a trace of asphalt / organic matter was noted. The SPT 'N' values of the gravelly sand / sand and gravel fill ranged widely from 4 to greater than 50 blows per 0.3 m. Higher SPT 'N' values might be due to the presence of cobbles / boulders. The water content values measured in the gravelly sand / sand and gravel fill ranged from 4 % to 8 %.

It should be noted that the thickness and the conditions of the gravelly sand / sand and gravel fill could vary significantly between and beyond the borehole locations.





AMEC Reference Number: TT93042

30 June 2011

Grain size analyses performed on three selected samples of gravelly sand / sand and gravel fill from Boreholes BH B1, BH B9 and BH B18 and the results are presented in Table 4.1.

Percent Distribution (%) Borehole Sample Depth **Figure Fines** No. No. (m) No. Gravel Sand (Silt and Clay) BH B1 SS1 0.3 - 0.812 34 54 A 1 BH B9 SS1 0.0 - 0.635 46 19 A 2 SS1 0.3 - 0.8 33 BH B18 51 16 A 3

Table 4.1 - Results of Grain size Analysis

The grain size distribution curves are presented in Figure Nos. A 1 to A 3, contained in Appendix A.

All granular samples can be classified as "**Gravelly Sand**", and generally meet the Granular B Type I requirements of OPSS, except for percent passing 75 µm sieve for all soil samples.

4.4 Fill Soils

Fill soils comprising clayey silt / silty clay and / or silty sand / sandy silt were encountered at different depths in all boreholes. It should be noted that the thickness and conditions of the fill could vary significantly between and beyond the borehole locations.

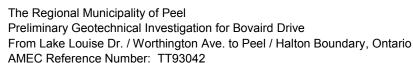
Clayey Silt / Silty Clay Fill

Clayey silt / silty clay fill was encountered underlying the gravelly sand / sand and gravel fill in Boreholes BH B1, BH B4, BH B9, BH B11, BH B12, BH B15, BH BC2, BH BC7, BH BC9, BH BC10, BH BC14, BH BC15, BH BC17, BH BC20, BH BC21, BH BC24, BH BC25 to BH BC30 and BH BC35; below sandy silt / silty sand / sand fill in Boreholes BH B2, BH B3, BH BC3 to BH BC5, BH BC13, BH BC18, BH BC19, BH BC22, and BH BC34. In Borehole BH BC2, the clayey silt / silty clay fill was encountered at two depths. The clayey silt / silty clay fill soil extended to the depths ranging from about 1.4 m to 11.0 m below the existing ground surface.

The clayey silt / silty clay fill was brown in colour, and contained a trace of gravel. Sporadic presence of a trace of organic matter / asphaltic concrete was noted several boreholes (BH B3, BH B5 and others) The SPT 'N' values of the clayey silt / silty clay fill ranged widely from 7 blows to greater than 38 blows per 0.3 m. The water contents measured in the clayey silt / silty clay fill ranged from 5 % to 20 %.

Silty Sand / Sandy Silt Fill

Silty sand / sandy silt fill was encountered at grade at Boreholes BH BC12, BH BC13 and BH BC22; below topsoil in Borehole BH BC16; underlying the gravelly sand / sand and gravel fill in





30 June 2011

Boreholes BH B2, BH B3, BH B5, BH B6, BH BC1, BH BC3 BH BC5, BH BC8, BH BC11, BH BC18, BH BC19, BH BC33 and BH BC34; below clayey silt / silty clay fill in Boreholes BH BC2, BH BC20 and BH BC24. The silty sand / sandy silt fill extended to depths varying from about 0.8 m to 9.4 m below the existing ground surface.

The silty sand / sandy silt fill was brown to reddish brown or grey in colour, and occasionally contained trace to some clay and a trace of gravel. Traces of organic matter / asphalt debris were noted in Boreholes BH B2, BH B5, BH B6, BH BC2, BH BC3, BH BC12 and BH BC13. The SPT 'N' values of the silty sand / sandy silt fill ranged from 7 to greater than 50 blows per 0.3 m. High SPT 'N' values possibly due to presence of gravel / cobbles / boulders. The water contents measured in the silty sand / sandy silt fill ranged from 10.8 % to 19.2 %.

4.5 Clayey Silt / Silty Clay Till

Clayey silt / silty clay till was encountered in Boreholes BH B1, BH B4, BH B5, BH B6, BH B7, BH B9, BH B11, BH B12, BH BC1, BH BC3, BH BC4, BH BC5, BH BC7 to BH BC9, BH BC11, BH BC12, BH BC15 to BH BC19, BH BC21 and BH BC26 to BH BC34. The clayey silt / silty clay till extended to depths ranging from 1.4 m to 11.0 m below the existing grade.

The till was brown to reddish brown in colour, and contained traces of sand and gravel. The SPT 'N' values of the clayey silt / silty clay till ranged widely from 11 blows to greater than 50 blows per 0.3 m, indicating a stiff to hard consistency. The water contents measured in the clayey silt / silty clay till ranged from 3% to 21%.

Grain size analysis and Atterberg Limit tests were also conducted on two samples of clayey silt till, and the results are shown in Table 4.2.

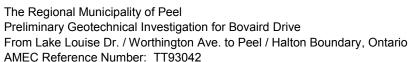
Borehole Sample		Donth	Grain Size Distribution			Atterberg Limit test			USCS		
	No.	No. Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit	Plastic Limit	Plasticity Index	Modified Group Symbol	
	BH B1	SS 5	3.0 - 3.5	6	24	44	26	29	14	15	CL
	BH 7	SS 2	1.5 - 2.0	1	21	49	29	34	14	20	CL

Table 4.2 - Grain Size Distribution Analysis and Atterberg Limit Test Results

The grain size distribution curves are presented in Figure No. A 4 and the plasticity chart is presented in Figure No. A 6, contained in Appendix A.

4.6 Silt and Sand / Silty Sand / Sandy Silt Till

Silt and sand / silty sand / sandy silt till was encountered in Boreholes BH B1 to BH B3, BH B6 to BH B10, BH B12, BH B18, BH B19, BH BC2, BH BC5 to BH BC15, BH BC17, BH BC20 to





30 June 2011

BH BC24, BH BC33 and BH BC34. The silt and sand / silty sand / sandy silt till extended to depths of 2.3 m and 11.1 m below the existing grade.

The silt and sand / silty sand / sandy silt till was brown to reddish brown in colour, and contained traces of clay and gravel. The SPT 'N' values of the silt and sand / silty sand / sandy silt till ranged from 11 to greater than 50 blows per 0.3 m, indicating a compact to very dense compactness condition. The water contents measured in the silt and sand / silty sand / sandy silt till ranged from 3 % to 21 %.

Two samples of silt and sand till were selected for grain size analysis, and the results are shown in Table 4.3.

Percent Distribution (%) Borehole Sample Depth No. No. (m) Gravel Silt Sand Clay SS2 0.3 - 0.89 BH B10 36 49 6 BH BC6 SS3 0.0 - 0.68 38 44 10

Table 4.3 - Results of Grain size Analysis

The grain size distribution curves are presented in Figure No. A 5, contained in Appendix A.

4.7 Gravelly Sand

Gravelly sand was encountered underlying the sandy silt till in Borehole BH BC6, and extended to the termination depth of the borehole. The gravelly sand was brown in color, and contained trace silt.

A single SPT 'N' value of the gravelly sand was 73 blows per 0.3 m, indicating a very dense compactness condition.

4.8 Weathered Shale

Weathered shale was encountered in nine (9) Boreholes (BH B3, BH BC3, BH BC4, BH BC20, BH BC21, BH BC24, BH BC30, BH BC31 and BH BC35). The SPT 'N' values measured in the weathered shale were greater than 50 blows per 0.3 m. It should be noted that the conditions of the weathered shale were not proven by rock coring.

The moisture contents of the weathered shale were measured ranged from 5 % to 13 %.

4.9 Groundwater Conditions

Where encountered, the recorded groundwater levels ranged from about 1.7 m to 4.9 m below the existing ground surface in open boreholes on completion of drilling.



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The Regional Municipality of Peel
Preliminary Geotechnical Investigation for Bovaird Drive
From Lake Louise Dr. / Worthington Ave. to Peel / Halton Boundary, Ontario
AMEC Reference Number: TT93042

AMEC Reference Number: TT93042 30 June 2011

Monitoring wells were installed in 7 boreholes (BH B11, BH BC3, BH BC3-W, BH BC4, BH BC10, BH BC11 and BH BC35) and groundwater levels were measured on 17 March 2010.

The results of the groundwater measurements are shown on the individual Record of Boreholes, and summarized in Table 4.4.

Table 4.4 - Groundwater Levels

lable 4.4 - Groundwater Levels						
	_ ,	Groundwater Level				
Borehole No.	Date	Depth below Existing Grade (m)	Geodetic Elevation (m)			
BH B1	13 October 2009	dry ⁽¹⁾	-			
BH B2	13 October 2009	dry ⁽¹⁾	-			
BH BC1	13 October 2009	dry ⁽¹⁾	-			
BH BC2	13 October 2009	dry ⁽¹⁾	-			
BH B3	13 October 2009	dry ⁽¹⁾	-			
BH B4	13 October 2009	dry ⁽¹⁾	-			
BH B5	14 October 2009	dry ⁽¹⁾	-			
BH B6	14 October 2009	4.9 ⁽¹⁾	238.2 ⁽¹⁾			
BH B7	14 October 2009	dry ⁽¹⁾	-			
BH BC3	14 October 2009	1.8 m ⁽¹⁾	236.3 ⁽¹⁾			
вп всз	17 March 2010	2.4 m ⁽²⁾	235.6 ⁽²⁾			
BH BC3-W	26 October 2009	dry ⁽¹⁾	_)			
2.1.20011	17 March 2010	2.7 m ⁽²⁾	235.4 ⁽²⁾			
BH BC4	14 October 2009	3.2 m ⁽¹⁾	234.9 ⁽¹⁾			
511501	17 March 2010	2.6 m ⁽²⁾	235.5 ⁽²⁾			
BH BC5	15 October 2009	3.0 m ⁽¹⁾	236.2 ⁽¹⁾			
BH BC6	14 October 2009	2.9 m ⁽¹⁾	237.1 ⁽¹⁾			
ВН ВС7	15 October 2009	4.4 m ⁽¹⁾	236.3 ⁽¹⁾			
BH B9	15 October 2009	4.4 m ⁽¹⁾	236.4 ⁽¹⁾			
BH BC8	15 October 2009	3.3 m ⁽¹⁾	237.8 ⁽¹⁾			
ВН ВС9	15 October 2009	3.5 m ⁽¹⁾	238.1 ⁽¹⁾			



30 June 2011

		Groundwater Level			
Borehole No.	Date	Depth below Existing Grade (m)	Geodetic Elevation (m)		
BH B10	15 October 2009	4.4 m ⁽¹⁾	237.3 ⁽¹⁾		
DIL DO10	15 October 2009	4.1 m ⁽¹⁾	234.0 ⁽¹⁾		
BH BC10	17 March 2010	1.8 m ⁽²⁾	236.3 ⁽²⁾		
BH B11	15 October 2009	2.4 m ⁽¹⁾	235.5 ⁽¹⁾		
DIL DC44	15 October 2009	3.5 m ⁽¹⁾	233.3 ⁽¹⁾		
BH BC11	17 March 2010	1.2 m ⁽²⁾	235.6 ⁽²⁾		
BH B12	15 October 2009	1.7 m ⁽¹⁾	235.7 ⁽¹⁾		
BH BC12	15 October 2009	4.3 m ⁽¹⁾	233.3 ⁽¹⁾		
BH BC13	15 October 2009	4.7 m ⁽¹⁾	233.0 ⁽¹⁾		
BH BC14	15 October 2009	dry ⁽¹⁾	-		
BH BC15	15 October 2009	dry ⁽¹⁾	-		
BH BC16	15 October 2009	dry ⁽¹⁾	-		
BH BC17	15 October 2009	dry ⁽¹⁾	-		
BH BC18	27 October 2009	dry ⁽¹⁾	-		
BH BC19	15 October 2009	dry ⁽¹⁾	-		
BH BC20	26 October 2009	dry ⁽¹⁾	-		
BH BC21	26 October 2009	dry ⁽¹⁾	-		
BH BC22	26 October 2009	dry ⁽¹⁾	-		
BH BC23	26 October 2009	dry ⁽¹⁾	-		
BH BC24	26 October 2009	dry ⁽¹⁾	-		
BH B15	28 October 2009	dry ⁽¹⁾	-		
BH BC25	28 October 2009	dry ⁽¹⁾	-		
BH BC26	28 October 2009	dry ⁽¹⁾	-		
BH BC27	28 October 2009	dry ⁽¹⁾	-		
BH BC28	28 October 2009	dry ⁽¹⁾	-		



30 June 2011

Groundwater Level Borehole No. Date Depth below **Geodetic Elevation** Existing Grade (m) (m) dry⁽¹⁾ BH BC29 28 October 2009 dry⁽¹⁾ BH BC30 28 October 2009 dry⁽¹⁾ BH B18 27 October 2009 drv⁽¹⁾ BH BC31 28 October 2009 dry⁽¹⁾ BH BC32 28 October 2009 220.8 m⁽¹⁾ 4.1 m⁽¹⁾ BH BC33 27 October 2009 221.9 m⁽¹⁾ 4.3 m⁽¹⁾ BH BC34 27 October 2009 dry⁽¹⁾ BH B18 27 October 2009 dry⁽¹⁾ BH B19 27 October 2009 dry⁽¹⁾ 27 October 2009 BH BC35 10.5 m ⁽²⁾ 17 March 2010 Not provided

in monitoring wells

It should be noted that the groundwater at the site would fluctuate seasonally and can be expected to be somewhat higher during the spring months and in response to major weather events.

in open boreholes on completion of drilling



30 June 2011

5.0 DISCUSSION AND RECOMMENDATIONS

In preparation of this report, the following appendices to RFP Document were considered.

- Appendix 7.9: Culvert and Structure Information.
- Appendix 7.10: On-going and future Capital project information.
- Appendix A: Existing Traffic Data prepared by ENTRA Consultants
- Bovaird Drive EA Study: Projected 2021 and 2031 AADT Volumes for Bovaird Drive

This preliminary geotechnical investigation is required to provide geotechnical information for completion of Class Environment Assessment and Preliminary Design for improvements of Bovaird Drive which could include the following schemes:

- Rehabilitation and possible widening of Bovaird Drive from Lake Louse Drive / Worthington Avenue to the Peel / Halton Boundary (approximately 4.8 km);
- Embankment widening for the bridge at CNR underpass location;
- Extension of existing concrete culvert across Huttonville Creek at east of Mississauga Road; and
- Extension of existing 30 culverts that exist either across this road stretch or at the edge (at entrance to side roads).

Based on the ground surface elevations at the borehole locations provided to AMEC, the highest and lowest ground surface elevations are 201 m \pm (at west project limit) and 246 m \pm (at east project limit). The surface topography along the road section is generally undulating.

At the time of writing this report, details of the proposed improvements are not available. General discussion and recommendations are provided in the following sections. These discussion and recommendations should be confirmed as and when final road profile and cross-sections are determined in the detail design phase.

5.1 Pavement Design Considerations

A total of 25 boreholes (BH B1 to BH B7, BH B9 to BH B12, BH B18, BH BC1, BH BC2, BH BC3, BH BC5, BH BC7, BH BC15, BH BC18, BH BC19, BH BC28, BH BC30, BH BC31, BH BC33 and BH BC34) were advanced on paved surface of Bovaird Drive. The boreholes encountered difference in composition of the existing pavement structure.

The measured asphaltic concrete thickness ranged from 170 mm to 320 mm (±). A granular base/subbase fill was encountered underlying the asphaltic concrete layer in all boreholes with the measured thickness ranging from 190 mm to 1980 mm (±).



30 June 2011

The investigation results indicated generally compacted base/subbase (gravelly sand / sand and gravel) for the existing roadway with SPT 'N' values ranging from 18 blows to greater than 50 blows per 0.3 m, i.e., a compact to very dense compactness, except at Boreholes BH BC1, BH BC7, BH BC31, BH BC33 and BH BC 34 drilled in the paved shoulder, where SPT 'N' values ranging from 12 blows to 17 blows per 0.3 m (compact) were encountered.

The investigation also revealed that clayey silt / silty clay or sandy silt / silty sand fill or native tills (silty clay / clayey silt or silty sand / sandy silt) formed the subgrade for the existing roadway. Considering the subgrade soils within the upper about 2 m of the road surface, the existing fill soils would generally provide competent subgrade support for rehabilitation / reconstruction indicated by the N-values of over 14 blows per 0.3 m. Isolated weak zones were noted in Boreholes BH B2, BH B3, BH BC3 about 1.5 to 2.0 m below the existing grade indicated by SPT N-values ranging from 9 blows to 11 blows per 0.3 m (loose to compact silty / sandy soils).

5.1.1 Granular Base Equivalency (GBE)

To assess the existing pavement structure, the in-situ Granular Base Equivalency (GBE) values have been estimated from the boreholes data using the following Equivalency Factors (based on Table 3.5 of the MTO Pavement Design and Rehabilitation Manual - Reconstruction Projects):

<u>Material</u>	Equivalency factor
Old HL	1.25
Old Granular Base	0.75
Old Granular Subbase	0.50
Old Granular Base/Sub-base/Concrete	0.625

For GBE calculation, total granular fill material thickness, measured in the boreholes, was considered as the granular base/subbase. The existing average GBE is summarized in Table 5.1.



AMEC Reference number.

30 June 2011

Table 5.1 - Existing Pavement Composition at Borehole Locations

Pavement Condition			Thi	Average	
		No of Boreholes	НМА	Granular Base/Subbase*	GBE (mm)
	Lak	ke Louise Drive / Worthington Aven	ue to Mississ	auga Road	
Good Condition (2.0 km ±)	Minimum Maximum Average	Boreholes BH B1 to BH B7 Pavement**	80 235 185	565 1,930 1,115	928
(2.0 KIII 1)	Average	BH BC1 to BH BC3	235 mm	1,430	1185
		Mississauga Rd to Herit	age Road		
Fair Condition	Minimum Maximum Average	Boreholes BH B9 to BH B11 Shoulder	-	800 1,400 950	594
(1.4 km ±)	Average	Boreholes BH BC5, BH BC7 and BH BC15**	100 mm	800	625
		Heritage Road to Case	ley Drive		
Fair to Poor	Minimum Maximum Average	Boreholes BH B15 & BH B19 Shoulder	-	600 900 750	469
Condition (1.4 km ±)	Average	Boreholes BH18, BH BC 18, BH BC19, BH BC28, BH BC31, BH BC33 and BH BC34**	140 mm	850	706

^{*} Combined thickness of existing Granular A and Granular B.

5.1.2 Existing and Forecasted Traffic Data

The traffic data represented as Average Annual Daily Traffic (AADT), percent growth rate, and percentage of commercial vehicles (%) for the year 2009, and projected 2021 and 2031 AADT volumes for 4 road sections of Bovaird Drive (Table 5.2) were provided to AMEC (Scarborough). The percent Growth Rate (r) for each road sections were calculated from the AADT of 2021 and 2031 and presented in Table 5.2. The Region of Peel indicated that the N-S Transportation Corridor will not be in place for the 2021 horizon year. Therefore, traffic analysis for the 2021 horizon year with the N-S Transportation Corridor in place has been removed.

Bovaird Drive is a major Regional Arterial Road and therefore, the percent truck was assumed as 10 as shown in Table 5.2.

^{**} HMA and granular thicknesses taken from the above boreholes to calculate the GBE after re-surfacing for the rehabilitation strategies.

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The Regional Municipality of Peel
Preliminary Geotechnical Investigation for Bovaird Drive
From Lake Louise Dr. / Worthington Ave. to Peel / Halton Boundary, Ontario
AMEC Reference Number: TT93042

30 June 2011

Table 5.2: Growth Rate for Boyaird Drive

Section	Road Classification	Trucks (%)	Growth Rate* (%)
Bovaird Drive, west of Worthington Avenue	Urban		1.00%
Bovaird Drive, west of Ashby Field Drive	Urban		1.00%
Bovaird Drive, west of Mississauga Road	Rural	Assumed 10%	2.00%
Bovaird Drive, west of Heritage Road	Rural		2.00%

^{*} Calculated from AADT of 2021 and 2031.

Table 5.3 showed the AADT and design loads in equivalent single axle loads (ESALs) all the 4 road sections. The AADT for construction year 2011 was determined by back-calculation using the traffic data (2009). The ESALs for each road section were calculated cumulatively over 20 years as described in the Ministry of Transportation Report "Procedures for Estimating Traffic Loads for Pavement Design, 1995". Also included in Table 5.3, the subgrade resilient modulus values and Superpave mix 'Category' corresponding to the traffic loadings (ESALs).

Table 5.3 - AADT and Equivalent Single Axle Loads (ESALs) for New Pavement Widening

Intersection	AADT Year 2011	Design ESALs for 20 Years	Subgrade Resilient Modulus, M _r (kPa)	Superpave Hot Mix Category
Bovaird Drive, west of Worthington Avenue	26,162	10,790,899	30,000	· Category D
Bovaird Drive, west of Ashby Field Drive	31,970	13,186,493	30,000	ESALs 10 to 30 Million
Bovaird Drive, west of Mississauga Road	26,182	19,218,936	30,000	Major arterial roads and transit routes.
Bovaird Drive, west of Heritage Road	24,747	18,165,572	35,000	and transit routes.

5.2 Flexible Structural Pavement Design for New Pavement Widening

After reviewing the field and laboratory test data, the minimum recommended pavement structural design for new pavement widening was determined in accordance with the MTO Pavement Design and Rehabilitation Manual Table 3.3 for traffic loading. The design loads, in equivalent single axle loads (ESAL's), were determined by using the average daily traffic (AADT) from 2009 and applying a growth rate to forecast the AADT for 2011 for each road section. The AADT values used to determine the minimum recommended pavement structural design are shown in Table 5.4.

The following parameters were chosen to calculate the required structural number (SN) and design of the flexible pavement using the AASHTO method, as described in the Ministry of Transportation Materials Information Report MI-183 "Adaptation and Verification of AASHTO Pavement Design Parameters for Ontario Conditions".

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The Regional Municipality of Peel
Preliminary Geotechnical Investigation for Bovaird Drive
From Lake Louise Dr. / Worthington Ave. to Peel / Halton Boundary, Ontario
AMEC Reference Number: TT93042
30 June 2011

AADT, % Comm Vehicles, Growth Rate Refer to Table 5-2; Design ESAL's Refer to Table 5-3; Structure Number (SN) Refer to Table 5-4; Mean subgrade resilient modulus Refer to Table 5-3; Initial serviceability, $P_i = 4.5$; Terminal serviceability, $P_t = 2.5$; Reliability level. R = 90 percent; Overall standard of deviation, $S_0 = 0.49$; HMA laver coefficient. $a_i = 0.42$; $a_i = 0.14;$ Granular A layer coefficient, Granular B layer coefficient, $a_i = 0.09$, Drainage coefficient for all layers, $m_i = 1.0$

The MTO method was compared to the 1993 AASHTO Guide for the Design of Pavement Structures and Analysis System (Darwin Software Program) for the given traffic loading converted to equivalent single axial loads (ESALs) cumulatively over 20 years as presented in Table 5.4. The GBE and Structural Number, SN (minimum SN shown in bracket) requirements are specified below for each roadway. However, the AASHTO method was the preferred method of design since it is tailored for the subgrade type and traffic loading.



30 June 2011

Table 5.4 - Recommended Minimum Structural Design for Road Widening

Intersection		Material Description	AASHTO'93 Darwin 3.1 AASHTO Software	MTO Pavement Design and Rehabilitation Manual
Bovaird Drive, west	1	Hot Mix Asphalt Concrete	185 mm	130 mm
of Worthington Avenue	2	Granular Base 'A'	150 mm	150 mm
7.1.0.1.00	3	Granular Subbase 'B'	600 mm	600-800 mm
AADT = 26,162;	SN	Structure Number (147 mm)	> 147 mm (ok).	n/a
ESALs~11M	GBE	Granular Base Equivalency	920 mm	810-945 mm
Total Pavement Thick	kness (m	m)	935 mm	880-1,080 mm
Bovaird Drive, west	1	Hot Mix Asphalt Concrete	190 mm	130 mm
of Ashby Field Drive	2	Granular Base 'A'	150 mm	150 mm
Dilve	3	Granular Subbase 'B'	600 mm	600-800 mm
AADT = 31,970;	SN	Structure Number (151 mm)	> 151 mm (ok).	n/a
ESALs~13.5M	GBE	Granular Base Equivalency	930 mm	810-945 mm
Total Pavement Thick	kness (m	m)	940 mm	880-1,080 mm
Bovaird Drive, west	1	Hot Mix Asphalt Concrete	200 mm	130 mm
of Mississauga Road	2	Granular Base 'A'	150 mm	150 mm
rtodd	3	Granular Subbase 'B'	600 mm	600-800mm
AADT = 26,182	SN	Structure Number (158 mm)	> 158 mm (ok).	n/a
ESALs~19.5M	GBE	Granular Base Equivalency	950 mm	810-945 mm
Total Pavement Thick	kness (m	m)	950 mm	880-1,080 mm
Bovaird Drive, west	1	Hot Mix Asphalt Concrete	200 mm	130 mm
of Heritage Road	2	Granular Base 'A'	150 mm	150 mm
AADT = 24,747	3	Granular Subbase 'B'	550 mm	450 mm
ESALs~18.5M	SN	Structure Number (150 mm)	> 150 mm (ok).	n/a
	GBE	Granular Base Equivalency	917 mm	710 mm
Total Pavement Thick	kness (m	m)	900 mm	730 mm

Based on the minimum pavement design presented in Table 5.4, the entire Bovaird Drive road section can be divided into three (3) sections as follows.



AMEC Reference Number: TT93042

30 June 2011

Section 1: Lake Louise Dr. / Worthington Ave. to Mississauga Road							
HM	Α		Traffic				
Туре	Thickness (mm)	PGAC	Category				
SP 12.5 FC2	40 mm	64-28	D				
SP 19.0 mm	50 mm	64-28	D				
SP 19.0 mm	50 mm	58-28	D				
SP 19.0 mm	50 mm	58-28	D				
Total HMA	190 mm	_					
Granular A	150 mm						
Granular B Type I	600 mm						

Section 2: Mississauga Road to Heritage Road							
HMA	_		Traffic				
Туре	Thickness (mm)	PGAC	Category				
SP 12.5 FC2	40 mm	64-28	D				
SP 19.0 mm	50 mm	64-28	D				
SP 19.0 mm	50 mm	58-28	D				
SP 19.0 mm	60 mm	58-28	D				
Total HMA	200 mm	=					
Granular A	150 mm						
Granular B Type I	600 mm						

Section 3:	to Caseley Drive			
HMA			Traffic	
Туре	Thickness (mm)	PGAC	Category	
SP 12.5 FC2	40 mm	64-28	D	
SP 19.0 mm	50 mm	64-28	D	
SP 19.0 mm	65 mm	58-28	D	
Total HMA	155 mm	-		
Granular A	150 mm			
Granular B Type I	500 mm			

5.3 Pavement Rehabilitation

The following three (3) rehabilitation strategies for Bovaird Drive sections is proposed based on the pavement condition (Table 5.5).

- 1. Milling and Overlay
- 2. Pulverization, Remixing & Resurfacing
- 3. Partial Depth Re-construction

The rehabilitation strategies were selected considering minimum user delay, cost and/or disruption to traffic. Consideration was also given to the visual condition assessment of the roads, the soil analysis, subgrade type, and calculated ESALs. Bovaird Drive intersects five (5) sideroads in rural and urban settings and sometimes constrained by the existing elevations of



30 June 2011

structures (i.e. existing curb and gutter is being replaced due to condition/offset). All asphalt mixtures and methods of construction shall conform to Regional Municipality of Peel Specifications and OPSS requirements.

Table 5.5 - Rehabilitation Strategies for Bovaird Drive

Target GBE for New Construction						
Section #1	Section #1 Lake Louise Dr. / Worthington Avenue to Ashby Field Drive (Urban)					
HMA = 190 mm Granular A = 150 mm Granular B = 600 mm	Rehabilitation Strategy: Mill and Overlay Mill 90 mm, complete base repair in rutted/distorted areas, and resurface with 90 mm HMA.	Yes				
Target GBE 930 mm	GBE after re-surfacing = 996 mm (No increase in grade).					
	Section #2 Mississauga Road to Heritage Road (Rural)					
HMA = 200 mm Granular A = 150 mm Granular B = 600 mm Target GBE 950 mm	Rehabilitation Strategy: Pulverization, Remixing & Resurfacing In-place pulverize the bituminous concrete to a depth of 150 mm into an equivalent depth of granular base material, grade, compact and resurface with 170 mm of HMA. (170 mm increase in grade). GBE after re-surfacing = 959 mm	No				
	Section #3 Heritage Road to Caseley Drive (Rural)					
HMA = 155 mm Granular A = 150 mm Granular B = 500 mm	Rehabilitation Strategy: Partial Depth Re-Construction In-place pulverize the bituminous concrete to a depth of 150 mm into an equivalent depth of granular base material, grade, compact and resurface with 155 mm of HMA. (155 mm increase in grade).	No				
Target GBE 793 mm	GBE after re-surfacing = 985 mm					

5.4 Construction Consideration

The pavement design considers that construction will be carried out during the drier time of the year and that the subgrade is stable. If the subgrade becomes excessively wet or rutted during construction activities, additional sub-base material may be required. The need for additional subbase material is best determined during construction. For the pavement to function properly, provision must be made for water to drain out of the granular course.

During paving operation, the mixture should be compressed uniformly by rolling the mixture as soon as it has been spread, as it will bear the roller, without checking or undue displacement. Start rolling longitudinally at the sides and proceed towards the centre of the pavement course, overlapping on successive trips by at least $\frac{1}{2}$ the width of the rear wheel. Where the width permits, roll the pavement diagonally in two directions, with the second diagonal rolling crossing the first lines.



Place the mixture as continuous as possible and pass the roller over the unprotected edge of the freshly laid mixture only when the laying of this course is to be discontinued for a length of time to allow the mixture to become chilled.

5.4.1 New Hot Mix Layers

30 June 2011

The following Superpave hot mixes should be used on Bovaird Drive and Sideroads:

- SP 9.5 mm leveling mix should be used to correct cross fall and/or provide crown shifts (if required).
- SP19 mm binder course and SP12.5FC2 surface course mix should be used to provide the highway with high durability and a highly skid resistant riding surface.

The shoulders will consist of 90 mm of hot mix, underlain by sufficient granular to match the base of granular below the adjacent driving lane.

Material Specification shall be as per OPSS Prov. 1151 April 2007 for Superpave and Stone Mastic Asphalt mixtures. For aggregates, the material specification shall be as per SP No.110F12 February 2007.

5.4.2 Performance Graded Asphalt Cement (PGAC)

The PGAC for this location shall be PGAC 58-28 (Zone 3). However; PGAC 64-28 will be used for surface course and top binder lift. The traffic Categories were 'C', and 'D' as presented in Table 5.3. Material Specification shall be as per OPSS Prov. 1101 April 2007.

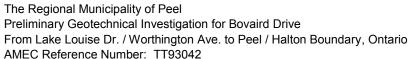
This PGAC has to satisfy the requirements of MP1 of SHRP Specifications for Superpave. It should be noted that PGAC is engineered asphalt cement with additives such as polymers or modifiers so as to accommodate a wide range of pavement temperatures. When PGAC is used, it is recommended that the steel-wheel rollers are thinly coated with light application of non-petroleum based wetting agent (soap solution) to reduce sticking of the mix to the compaction equipment.

5.4.3 Tack Coat

As per Ministry Policy, all milled surfaces, and binder course surfaces will be tack coated prior to resurfacing. Construction Specification shall be as per OPSS Prov. 308 April 2007.

5.4.4 Transition Treatments

At the limits of the project, a butt joint with the existing pavement is recommended. The butt joint between successive lifts of hot mix should be staggered a distance of between 10 and





30 June 2011

40m. Ensure that no joint location corresponds with a joint location in any other layer, along both the mainline and the side roads.

The maximum permissible cut and fill slopes should be in accordance with OPSD 205.010.

5.4.5 Reuse of Existing Sand and Gravel Fill and Soil Fill

Tested samples of existing sand and gravel fill showed that the materials do not meet the OPSS Granular A specifications (Section 4.3, Figure Nos. A 1 to A 3). The samples marginally fail to meet OPSS Granular B Type II specifications. The existing sand and gravel fill and various soil fills can be used as fill, provided that they are not contaminated with cohesive soils and/or organic matter during excavation. Such materials should be evaluated and monitored on site by a geotechnical engineer. Section 6.0 of this report provides environmental recommendations.

5.4.6 Compaction

In all areas, asphaltic concrete should be placed in maximum 50 mm lifts and compacted as per OPSS 310 November 2002, Table 8 (using Maximum Relative Density, MRD), while the granular base and subbase materials should be placed in 100 mm in loose lifts and compacted to at least 100% standard Proctor maximum dry density.

5.4.7 Field Quality Assurance

Plate samples of loose hot mix should be obtained for each paving day, and extraction/gradation and full Marshall compliance testing should be carried out on these samples. The finish surface shall be true to required profile and cross-section within 6 mm from required elevations and thickness. The surface shall show no depressions or bumps exceeding 3 mm under a 3.0 m long straight edge placed parallel to the road centre line.

5.5 Subgrade Preparation for Widening

The proposed improvements of Bovaird Drive are likely to include widening of the existing roadway. The widening could take place on both sides of the road section. It is likely that the proposed road surface elevation in the widened section would be close to the existing road surface.

The long term performance of pavement structure is highly dependent on the subgrade support conditions. To prepare the subgrade for road widening, the existing topsoil and vegetation should be stripped.

Based on the Record of Boreholes, the subgrade is likely to comprise various fill (clayey silt / silty clay fill, and sandy silt / silty sand fill) and / or native soils (clayey silt / silty clay till, and /or silt and sand / sandy silt / silty sand till and /or silty sand / sand). Isolated weak zones were encountered in Boreholes BH B2, BH B3, BH B7, BH BBC3, BH BC4, BH BC6, BH BC8, BH



30 June 2011

BC24, BH BC25, BH BC 30 and BH BC34 indicated by SPT N-values ranging from 6 blows to 11 blows per 0.3 m.

All loose / soft fill soils / deleterious materials, if exposed, should be removed from the area of the proposed roadways. The exposed subgrade should be proof-rolled with a heavy sheep-foot roller to identify weak areas and / or inspected by a geotechnical engineer. Any weak or excessively wet zones identified during proof-rolling should be sub-excavated and replaced with compacted competent material to establish stable and uniform conditions. Fill, if required for site grading in the widening areas, should be placed as engineered fill to provide competent subgrade. Prior to placement of engineered fill, the subgrade should be inspected and approved by a geotechnical engineer. The fill should be placed in lifts not exceeding 200 mm, and each lift should be uniformly compacted to at least 95 % of the material's Standard Proctor Maximum Dry Density (SPMDD), except for the top 0.6 m which should be compacted to at least 98% of SPMDD.

Subgrade preparation should not be done in the winter. Drainage layers and / or subdrains should be designed and installed to prevent any water accumulation under pavement surface at all times. The final subgrade surface should be sloped at least 3% to drain towards the subdrain system or drainage ditches as appropriate. Drainage requirements are also discussed in Section 5.7.

The subsoils at this site are generally fine grained which are considered frost susceptible. These soils will become weakened when wet. If site work is carried out during periods of wet weather, the subgrade will be easily disturbed. Under inclement weather conditions, an adequate granular working surface would be required to minimize disturbance and protect the integrity of the subgrade soils.

Construction traffic over exposed subgrade materials should be minimized, and temporary construction hauling routes established. If these routes coincide with future paved areas, adequately reinforced haul roads (increased thickness of granular base, geo-fabrics, etc.) should be constructed to reduce disturbance to the subgrade soils. These provisions are particularly important if the construction is scheduled during wet and cold seasons.

5.6 Approach Embankment Widening at CN Rail

The widening work, in order to accommodate new lanes for the overpass structure at CN Rail, will require filling over the existing embankment slope and beyond. The maximum height of existing road embankment is about 10 m. The height of embankment at the widening areas will likely be the same.

In order to the extend the embankment slope by constructing an earth slope, all topsoil, any deleterious material and soft/loose and other unsuitable soils should be removed from the footprint area of the embankment widening. The existing slope surface should be stripped to a



30 June 2011

minimum depth of 0.3 m. After stripping and slope preparation, the exposed subgrade should be inspected, approved and properly compacted from the surface, using a suitably sized compactor. An approved fill soils should be used for constructing the embankments. The fill should be placed as engineered fill in lifts not exceeding 200 mm, and each lift should be uniformly compacted to at least 95 % of the material's Standard Proctor Maximum Dry Density (SPMDD), except for the top 0.6 m which should be compacted to at least 98% of SPMDD.

Embankment construction should be in accordance with OPSS 501 and OPSS 206, as amended by Special Provision "Amendment to OPSS 206, December 1993", dated November 2002. Bonding between the existing embankment fill and new fill should be achieved by slope benching as per OPSD 208.010.

Proper erosion control measures should be implemented both during construction and permanently. Temporary erosion and sediment control must be provided in accordance with OPSS 577. Earth fill embankment slopes must be provided with permanent erosion protection in accordance with OPSS 571 and/or OPSS 572.

Provided that the extended earth-filled slope is constructed according to the above recommendations, the extended slope may be constructed at 2.5H:1V or flatter. A global stability analysis of slope should be carried out, once the detail design is available.

5.7 Drainage

Based on the typical cross sections 1 to 4 provided in Appendix 7.9 (Drawing No. 37495-D dated December 2005 prepared by Region of Peel Public Works), the investigated Bovaird Drive section is consisted of 2 / 4 lanes with mixed urban and rural setting (curbs and gutter and / or drainage ditch).

Adequate drainage should be provided both laterally and longitudinally along the length of the road section, as part of the road widening work.

Where a rural cross-section is proposed, the base granulars should extend across the full width of the roadway and should daylight in the ditches. If drainage through granular soils underneath pavement is considered not sufficient, subdrains should be installed.

Where an urban cross-section is proposed, a continuous subdrain system designed to freely drain into catch basins will be required. The drainage system should consist of a 150 mm diameter to be installed, below the roadbed level, along both sides to ensure effective drainage in accordance with OPSD 216.021. The sub-drain pipes should be surrounded by 20 mm size clear stone drainage zone of minimum 150 mm thickness, which should have non-woven geotextile with FOS of 75 - 150 μ m, Class II wraparound to minimize infiltration of fines in pipes which would reduce their effectiveness.



30 June 2011

A minimum slope of 2% should be maintained across the paved sections to ensure proper surface drainage.

Continuity of drainage through the granular road base and subbase layers should be maintained between the existing and new pavement structures. In this regard, the granular thickness for new pavement structure may have to be adjusted to match the granular fill encountered under the existing pavement.

5.8 Foundations

5.8.1 Concrete Culvert

Based on Appendix 7.9: Culvert and Structure Information and Drawing No. 37642-D dated December 2006 prepared by Region of Peel Public Works, the existing water crossing structure across the Huttonville Creek at east of Mississauga Road comprises a concrete culvert supported on conventional strip footings at about 3.6 m below the deck level.

Boreholes BH BC3 and BH BC4 were drilled on the opposite sides of the existing concrete culvert. The boreholes encountered fill soils extending to depths of about 5.5 m in Borehole BH BC3 and 4.0 m in Borehole BH BC4, below the road surface. Hard silty clay / clayey silt till was encountered below the fill soils. The top of weathered shale was encountered at about 6.0 m in Borehole BH BC3 and about 7.0 m in Borehole BH BC4.

Based on the investigation results, use of conventional spread / strip footings may be considered for supporting the footing for the proposed culvert extension. The footing could be founded within native till deposit and / or weathered shale.

The recommended footing depths, Geotechnical Reaction at Serviceability Limit State (SLS) and Geotechnical Resistance at Ultimate Limit State (ULS) for spread footings are given in Table 5.6 based on Boreholes BH BC3 and BH BC4.



30 June 2011

Table 5.6 - Geotechnical Reaction (SLS) and Resistance (ULS) Pressures

Borehole Number	Foundation Soil Strata	Approximate Depth below Existing Grade (m)	Geodetic Elevation (m)	Geotechnical Reaction at SLS (kPa)	Geotechnical Resistance at ULS ⁽¹⁾ (kPa)
вн всз	Very stiff clayey silt till	6.0 - 6.2 m (±)	232.0 -231.8 m (±)	200	300
BH BC3	Weathered shale	below 6.2 m (±)	below 231.8 m (±)	400	600
BH BC4	Hard silty clay / clayey silt till	4.7 - 7.0 m (±)	233.3 -231.0 m (±)	300	450
B11 BC4	Weathered shale	below 7.0 m (±)	below 231.0 m (±)	400	600

⁽¹⁾ A resistance factor of $\Phi = 0.5$ has been applied to the values provided

Both SLS and ULS values shown on Table 5.6 are applicable for a concentrically loaded spread footing founded on the soil type indicated. Detailed foundation analysis should be carried out to confirm the ULS / SLS values together with foundation settlement.

The geotechnical horizontal resistance (against sliding) for spread footings should be designed using a coefficient of friction between concrete and subgrade of 0.3 which includes a resistance factor of 0.8.

The minimum footing sizes, footing thickness, excavations and other footing requirements should be designed in accordance to the latest edition of the Canadian Highway Bridge Design Code.

The design frost penetration for the general area is 1.2 m. Therefore, a permanent soil cover of 1.2 m or its thermal equivalent is required for frost protection of foundations.

For footings designed and constructed in accordance with the above SLS values, total and differential settlements should be less than 25 mm and 20 mm, respectively.

For the concrete culvert extension, the footings should be founded at least to the same level of the footings of the existing culvert to avoid imposing additional loads on the existing footings. If the new footing is placed at lower level, the pressure from existing footing should be considered in design.

The new culvert footings will have to be protected against scour and erosion by providing riprap, vegetative cover, or equivalent. Scour protection should be designed by an experienced engineer.





30 June 2011

The excavations and dewatering for the construction of the footings should follow the procedures provided in Section 5.9. During construction, the groundwater level should be lowered by a minimum of 1 m below the footing founding level.

The footing subgrade should be inspected and evaluated by a geotechnical engineer prior to concreting to confirm that the footings are founded on competent subgrade capable of supporting the recommended design pressure.

5.8.2 Culverts

A total of 30 culverts exist between Mississauga Road and Peel / Halton boundary which may be extended to accommodate the possible widening of the investigated road section. The culverts are located either across the road alignment or at the edge (at entrance to side roads). Boreholes BH BC5 to BH BC34 were advanced at the locations of the culverts (Table 5.7).

The type and locations of the existing culverts, provided in Appendix 7.9 (Culvert and Structure Information) enclosed with the RFP, are summarized in Table 5.7. Based on Table 5.7, 26 culverts are corrugated steel pipe (CSP) type and four (4) are concrete box type.

Table 5.7 - Existing Culvert Data

Table 5.7 - Existing Culvert Data						
(Culvert	Station	Bore	Borehole		ert Invert
No.	Туре		No.	Elevation (m)	Depth (m)	Elevation (m)
1	CSP ⁽¹⁾	12 + 779	BH BC5	239.3 m	1.7 m (±)	237.6 m (±)
2	CSP ⁽¹⁾	12 + 729	BH BC6	240.0 m	1.2 m (±)	238.8 m (±)
3	CSP ⁽¹⁾	12 + 876	BH BC7	240.7 m	1.2 m (±)	239.5 m (±)
4	Concrete Box	12 + 533	BH BC8	241.1 m	2.2 m (±)	238.9 m (±)
5	CSP ⁽¹⁾	12 + 425	BH BC9	241.6 m	1.9 m (±)	239.7 m (±)
6	CSP ⁽¹⁾	12 + 361	BH BC10	238.1 m	1.8 m (±)	236.3 m (±)
7	Concrete box	12 + 111	BH BC11	236.8 m	1.9 m (±)	234.9 m (±)
8	CSP ⁽¹⁾	12 + 817	BH BC12	237.6 m	1.1 m (±)	236.5 m (±)
9	CSP ⁽¹⁾	11 + 702	BH BC13	237.9 m	1.4 m (±)	236.5 m (±)
10	CSP ⁽¹⁾	11 + 640	BH BC14	237.4 m	1.8 m (±)	235.6 m (±)
11	CSP ⁽¹⁾	11 + 553	BH BC15	236.7 m	2.2 m (±)	234.5 m (±)
12	CSP ⁽¹⁾	11 + 555	BH BC16	236.8 m	1.4 m (±)	235.4 m (±)



30 June 2011

Culvert		Station	Borehole		Culvert Invert	
No.	Туре		No.	Elevation (m)	Depth (m)	Elevation (m)
13	CSP ⁽¹⁾	11 + 509	BH BC17	236.3 m	1.6 m (±)	234.7 m (±)
14	CSP ⁽¹⁾	11 + 485	BH BC18	235.9 m	2.4 m (±)	233.5 m (±)
15	Concrete box	11 + 451	BH BC19	236.4 m	4.3 m (±)	232.1 m (±)
16	CSP ⁽¹⁾	11 + 385	BH BC20	237.8 m	1.1 m (±)	236.7 m (±)
17	CSP ⁽¹⁾	11 + 333	BH BC21	238.9 m	1.2 m (±)	237.7 m (±)
18	CSP ⁽¹⁾	11 + 260	BH BC22	239.6 m	1.2 m (±)	238.4 m (±)
19	CSP ⁽¹⁾	11 + 287	BH BC23	239.0 m	1.4 m (±)	237.6 m (±)
20	CSP ⁽¹⁾	11 + 261	BH BC24	239.6 m	1.5 m (±)	238.1 m (±)
21	Concrete box	11 + 039	BH BC25	239.6 m	4.7 m (±)	234.9 m (±)
22	CSP ⁽¹⁾	10 + 932	BH BC26	239.5 m	2.2 m (±)	237.3 m (±)
23	CSP ⁽¹⁾	10 + 900	BH BC27	239.5 m	1.9 m (±)	237.6 m (±)
24	CSP ⁽¹⁾	10 + 868	BH BC28	239.0 m	1.5 m (±)	237.5 m (±)
25	CSP ⁽¹⁾	10 + 804	BH BC29	237.5 m	1.0 m (±)	236.5 m (±)
26	CSP ⁽¹⁾	10 + 765	BH BC30	236.0 m	1.4 m (±)	234.6 m (±)
27	CSP ⁽¹⁾	10 + 751	BH BC31	235.3 m	1.6 m (±)	233.7 m (±)
28	CSP ⁽¹⁾	10 + 711	BH BC32	233.6 m	1.2 m (±)	232.4 m (±)
29	CSP ⁽¹⁾	10 + 546	BC 33	224.9 m	1.5 m (±)	223.4 m (±)
30	CSP ⁽¹⁾	10 + 560	BC 34	226.2 m	2.4 m (±)	223.8 m (±)

(1) CSP: corrugated steel pipe

Based on the subsoil conditions encountered at Boreholes BH BC5 to BH BC34 locations, the subsoil at culvert extension invert would likely comprise silty clay / clayey silt fill in the majority of the existing culverts. The culvert extension should be supported on properly prepared subgrade or competent undisturbed native soils.

A. Culvert Extension Founded on Existing Fill Soils

30 June 2011



If an extended culvert is to be founded on existing fill soils, the subgrade should be prepared as recommended below.

For subgrade preparation, it is recommended that the top 1 m of existing fill soils be removed and replaced with properly compacted fill. The replacement should extend at least 1.2 m beyond the outer edge of the culvert. Approved fill soils should be used for raising the grade.

Prior to placing the fill soils, the subgrade should be proof-rolled and any loose, soft, wet or unstable areas should be sub-excavated. The fill should be placed as engineered fill in lifts not exceeding 200 mm, and each lift should be uniformly compacted to at least 100 % of the material's Standard Proctor Maximum Dry Density (SPMDD). The work should be continuously supervised by a geotechnical engineer.

The SLS / ULS values for the existing fill prepared accordingly should be 100 kPa / 150 kPa respectively. Total and differential settlements of up to 25 mm and 20 mm should be considered in the foundation design.

The CSP culverts should be provided with granular bedding.

B. Culvert Extension Founded on Native Soils

The footings for concrete box culverts should be founded using conventional strip footing on undisturbed native till / weathered shale below the existing fill soils.

The recommended footing depths, Geotechnical Reaction at Serviceability Limit State (SLS) and Geotechnical Resistance at Ultimate Limit State (ULS) for strip / spread footings are given in Table 5.8 based on Boreholes BH BC5 to BH BC34.



30 June 2011

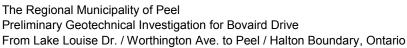
Table 5.8 - Geotechnical Reaction (SLS) and Resistance (ULS) Pressures

Borehole Number	Foundation Soil Strata	Approximate Depth below Existing Grade (m)	Geodetic Elevation (m)	Geotechnical Reaction at SLS (kPa)	Geotechnical Resistance at ULS ⁽¹⁾ (kPa)
BH BC5	Hard clayey silt till	3.1 m (±) and below	236.2 m (±) and below	300	450
BH BC6	Dense silt and sand / silty sand till	1.7 - 4.5 m (±)	238.3 -235.5 m (±)	200	300
	Very dense gravelly sand	below 4.5 m (±)	below 235.5 m (±)	300	450
BH BC7	Hard clayey silt till	1.6 m (±) and below	239.1 m (\pm) and below	300	450
BH BC 8	Very stiff silty clay / clayey silt till	3.1 - 4.1 m (±)	238.0 - 237.0 m (±)	200	300
БПВОО	Very dense sandy silt / silty sand till	below 4.1 m (±)	below 237.0 m (±)	300	450
	Very stiff clayey silt till	0.9 - 1.5 m (±)	240.7 - 240.1 m (±)	200	300
BH BC9	Hard clayey silt till	1.5 - 2.3 m (±)	240.1 - 239.3 m (±)	250	375
	Very dense silt and sand / silty sand till	below 2.3 m (±)	below 239.3 m (±)	300	450
BH BC10	Dense silt and sand / silty sand till	below 3.1 m (±)	below 235.0 m (±)	300	450
BH BC11	Very stiff clayey silt till	1.5 - 2.3 m (±)	235.3 - 234.5 m (±)	200	300
BITBOTT	Very dense silt and sand / silty sand till	below 2.3 m (±)	below 234.5 m (±)	300	450
BH BC12	Dense to very dense silt and sand / silty sand till	below 1.5 m (±)	below 236.1 m (±)	300	450
BH BC13	Dense to very dense silt and sand / silty sand till	below 2.3 m (±)	below 235.6 m (±)	300	450
BH BC14	Dense to very dense silt and sand / silty sand till	below 2.4 m (±)	below 235.0 m (±)	300	450
511.501.5	Hard clayey silt till	1.5 - 4.6 m (±)	235.3 - 232.1 m (±)	300	450
BH BC15	Very dense to very dense silt and sand / silty sand till	below 4.6 m (±)	below 232.1 m (±)	300	450
BH BC16	Hard clayey silt till	below 1.5 m (±)	below 235.3 m (±)	300	450
	Hard clayey silt till	2.3 - 4.6 m (±)	234.0 - 231.7 m (±)	300	450
BH BC17	Very dense to very dense silt and sand / silty sand till	below 4.6 m (±)	below 231.7 m (±)	300	450



30 June 2011

Borehole Number	Foundation Soil Strata	Approximate Depth below Existing Grade (m)	Geodetic Elevation (m)	Geotechnical Reaction at SLS (kPa)	Geotechnical Resistance at ULS ⁽¹⁾ (kPa)
BH BC 18	Hard silty clay / clayey silt till	below 1.5 m (±)	below 234.4 m (±)	300	450
BH BC 19	Hard clayey silt till	below 4.6 m (±)	below 231.8 m (±)	300	450
BH BC20	Very dense to very dense silt and sand / silty sand till	3.1 m (±) and below	234.7 m (±) and below	300	450
BH BC21	Very dense to very dense silt and sand / silty sand till	2.3 m (±) and below	236.5 m (±) and below	300	450
BH BC 22	Compact to very dense silt and sand / silty sand till	1.6 m (±) and below	238.0 m (±) and below	300	450
BH BC 23	Compact silt and sand / silty sand till	1.0 - 1.5 m (±)	238.0 - 237.5 m (±)	200	300
BH BC 23	Very dense silt and sand / silty sand till	below 1.5 m (±)	below 237.5 m (±)	300	450
BH BC24	Very dense silt and sand / silty sand till	2.6 m (±) and below	237.0 m (±) and below	300	450
BH BC25	Stiff clayey silt till	4.6 m - 6.1 m (±)	235.0 - 233.5 m (±)	125	180
BIT BO23	Hard clayey silt till	below 6.1 m (±)	below 233.5 m (±)	300	450
BH BC26	Hard clayey silt till	3.1 m (±) and below	236.4 m (±) and below	300	450
BH BC27	Hard clayey silt till	1.5 m (±) and below	238.0 m (±) and below	300	450
BH BC28	Hard silty clay / clayey silt till	2.0 m (±) and below	237.0 m (±) and below	300	450
BH BC29	Hard clayey silt till	1.5 m (±) and below	236.0 m (±) and below	300	450
DH DC20	Hard silty clay / clayey silt till	0.9 - 2.3 m (±)	235.3 - 233.7 m (±)	300	450
BH BC30	Weathered shale	below 2.3 m (±)	below 233.7 m (±)	400	600
BH BC31	Hard silty clay / clayey silt till	0.9 - 1.5 m (±)	234.4 - 233.8 m (±)	300	450
5115031	Weathered shale	below 1.5 m (±)	below 233.8 m (±)	400	600
BH BC32	Hard clayey silt till	1.5 m (±) and below	232.1 m (±) and below	300	450
BH BC33	Stiff to very stiff silty clay / clayey silt till	2.1 - 4.6 m (±)	below 222.6 - 220.3 m (±)	125	180





AMEC Reference Number: TT93042

30 June 2011

Borehole Number	Foundation Soil Strata	Approximate Depth below Existing Grade (m)	Geodetic Elevation (m)	Geotechnical Reaction at SLS (kPa)	Geotechnical Resistance at ULS ⁽¹⁾ (kPa)
	Very dense silt and sand / silty sand till	below 4.6 m (±)	below 220.3 m (±)	250	375
BH BC34	Hard silty clay / clayey silt till	3.5 - 4.5 m (±)	222.7 - 221.7 m (±)	50	75
DI1 0C34	Very dense silt and sand / silty sand till	below 4.5 m (±)	below 221.7 m (±)	50	75

⁽¹⁾ A resistance factor of Φ = 0.5 has been applied to the values provided

Recommendations provided in Section 5.8.1 shall apply.

5.9 Excavation and Dewatering

All excavations should be carried out in accordance with the Ontario Health and Safety Regulations. The soils to be excavated can be classified as follows:

Existing gravelly sand / sand and gravel fill	Type 3
Existing clayey silt / silty clay fill	Type 3
Existing sandy silt / silty sand fill	Type 3
Compact to very dense sand and silt / silty sand till	Type 2
Very dense gravelly sand	Type 2

Accordingly, a bank slope of 1H:1V is required in for excavations in Type 2 and Type 3 soils accordance with the Ontario Health and Safety Regulations. For Type 2 soils, a 1.2 m high vertical cut at the bottom of excavation may generally be constructed. However, a vertical cut in sandy soils under groundwater table may not be stable and flatter slopes or temporary shoring may be required. Near the ground surface, occasional 3H:1V slopes may be required due to loose/soft surficial soils. If open cut cannot be carried out, a shoring system (e.g. trench box) may be used to limit the extent of excavations, subject to engineering design and approval.

For all cut slopes / trenches, the stability of the cut slopes / trenches will have to be frequently monitored by the geotechnical engineer. If the cut slopes / trenches are subject to erosion (e.g., due to rainfall, high groundwater flow, etc.), slope stabilization measures (e.g., covering the slope / trench faces with plastic sheets, excavating flatter slope, etc.) will have to be implemented.

Stockpiles of excavated materials should be kept at least 3.0 m from the edge of the excavation to avoid slope instability, subject to confirmation by the geotechnical engineer. Care should also be taken to avoid overloading of any underground services/structures by stockpiles.

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The Regional Municipality of Peel
Preliminary Geotechnical Investigation for Bovaird Drive
From Lake Louise Dr. / Worthington Ave. to Peel / Halton Boundary, Ontario
AMEC Reference Number: TT93042

30 June 2011

No major excavation difficulties are foreseen in the existing soils, but allowance should be made for boulders and cobbles that occur randomly in glacial till deposit. The terms describing the compactness (loose, compact, dense, very dense) or consistency (stiff, very stiff, hard) of soil strata give an indication of the effort needed for excavation.

Based on the groundwater level measured during this investigation (Table 4.4), the bottom of excavations for culvert footings and utility trenches at or in the proximity of Boreholes BH B6, BH B9 to BH B11, BH BC3 to BH BC13, BH BC33 and BH BC34 locations would likely be below groundwater table. Water seepage in the silty clay / clayey silt fill and / or silty clay / clayey silt till should be manageable through gravity drainage and / or a filtered sump and pump system. However, a significant seepage is anticipated through the gravelly sand / sand and gravel fill,, sandy silt / silty sand fill, silt and sand / sandy silt / silty sand till and /or silty sand / sand deposits. Therefore, the use of a series of temporary filtered sumps and pumps, and probably well points may be required during construction. Test pits should be excavated to evaluate the appropriate method of dewatering prior to construction.

5.10 Sewer Installation

Based on the on-going and future capital projects list provided in Appendix 7.10, a total of seven watermain and sanitary sewer projects along and across Bovaird Drive are in different stages of design / Class EA / planning. The invert depths are not known at this time of writing this report.

The current boreholes, drilled along the Bovaird Drive, were primarily for preliminary pavement rehabilitation and widening purpose. General considerations for the sewer installation are discussed as follows. If sewers are to be installed below the borehole depths drilled, additional deeper boreholes will be required.

5.10.1 Trenching

Trench excavation should be carried out as per the Safety Regulations of the Province of Ontario. The boreholes show that the trenches will generally be dug through the existing gravelly sand / sand and gravel fill, silty clay / clayey silt fill, sandy silt / silty sand fill, clayey silt / silty clay till, and /or silt and sand / sandy silt / silty sand till and /or silty sand / sand. The soils are classified in Section 5.9 in accordance with the Ontario Health and Safety Regulations. Within these soils, above the groundwater table, the sides of excavations are expected to be temporarily stable at 1H:1V for Type 2 and Type 3 soils, provided the sewer pipes are installed and backfilled within a reasonable short period of time (i.e. within the day).

The excavation and dewatering requirements are discussed in Section 5.9. To prevent disturbance of the soil at the bedding level, groundwater, if encountered, must be lowered to at least 0.8 m below the invert of the trench, prior to installing the sewers and bedding. In no case should the pipes be placed on dilated or disturbed subsoil. Controlling the groundwater level to be at least 0.8 m below the invert of the trench should prevent the dilation or disturbance of the subgrade.



30 June 2011

5.10.2 Pipe Bedding

The boreholes showed that in their undisturbed state, generally the existing gravelly sand / sand and gravel fill, silty clay / clayey silt fill, sandy silt / silty sand fill, clayey silt / silty clay till, and /or silt and sand / sandy silt / silty sand till and /or silty sand / sand will provide adequate support for the proposed concrete sewer pipes and allow the use of normal Class 'B' Type bedding (i.e., compacted granular bedding material - OPSD-802.030). The recommended minimum thickness of granular bedding below the pipe is 150 mm. The thickness of the bedding may, however, have to be increased depending on the pipe diameter or if wet or weak subgrade conditions are encountered.

5.10.3 Trench Backfill

Based on the visual and tactile examination of the soil samples, the on-site excavated existing sand and gravel fill, silty sand fill, clayey silt fill, native silty sand till and silty may be reused as backfill in service trenches provided their moisture contents at the time of construction are at or near their optimum moisture contents. The clayey soils will likely be excavated in blocks and will be difficult to handle and compact. For use as backfill, the blocks will have to be reduced to smaller than 100 mm in size and placed in thin layers. The clayey soils have to be compacted using heavy equipment suitable for these soils. Unless the clayey soils are properly reduced in sizes and compacted in sufficiently thin lifts, post-construction settlements could occur.

The backfill should be placed in maximum 200 mm thick layers at or near (\pm 2 %) its optimum moisture content, and each layer should be compacted to at least 95 % Standard Proctor Maximum Dry Density (SPMDD). This value should be increased to at least 98 % within 0.6 m of the road subgrade surface.

Benching in according to Ontario Provincial Standard Drawing 208.010 should be provided for the backfill to be placed against deep excavated slope.

The excavated clayey and silty soils may require reconditioning (e.g., drying or wetting) prior to reuse. The on-site excavated clayey soils should not be used in confined areas (e.g., around catch-basins) where heavy compaction equipment cannot be operated. The use of good backfill (e.g. granular) together with an appropriate frost taper would be preferable in confined areas. Unsuitable material such as organic soils, boulders, cobbles, frozen soils, etc., should not be used for backfilling.

It is recommended that frost taper be provided at backfilled trenches to promote gradual transition from the frost-free materials to the frost susceptible natural soil, otherwise differential frost heaving may occur. Frost taper would not be necessary if the backfill material can be matched within the frost zone (i.e. within about 1.2 m depth below the finished grade) with subgrade-type material.



30 June 2011

6.0 LIMITED ENVIRONMENTAL ASSESSMENT

6.1 Methodology

An environmental soil screening and preliminary soil chemical analyses program was conducted as part of the geotechnical investigation to evaluate the environmental subsurface soil conditions across the study area with respect to *Ontario Regulation 153/04 Records of Site Condition, Part XV.1 of the Environmental Protection Act (EPA)* (*O.Reg. 153/04*). The objective of the program was to provide a preliminary assessment of the environmental subsurface soil conditions during the geotechnical drilling program including disposal options for surplus materials and evaluating the potential for contamination at the Site. The soil chemical analysis program was not intended to constitute a Phase II Environmental Site Assessment and does not provide comment on the overall environmental conditions at the site. Furthermore, the chemical analysis program will not support the preparation of a Record of Site Condition (RSC) under *O.Reg. 153/04* for the subject site.

To this end, soil samples obtained during the drilling program were field screened for evidence of environmental impact. The field screening activities included measuring the combustible organic vapours (COV) in the headspace of samples with a portable hydrocarbon surveyor instrument (Gastechtor 1238ME) and visual and olfactory field observations. The borehole locations were positioned at the Site as required by the geotechnical investigation.

No visual or olfactory evidence of environmental impact was observed in the fill and native soil samples recovered from the boreholes. The measured COV concentrations in all soil samples ranged from non-detectable to 70 parts per million (ppm). These concentrations are not necessarily indicative of significant impact by petroleum hydrocarbons. COV results are semi-quantitative at best and are generally only used for relative sample comparison purposes when selecting samples for laboratory analysis.

Based on the field screening results and to provide a general environmental assessment of the soil at the Site for potential environmental impact, and off-site management purposes, soil samples were submitted for analyses of the following parameters:

- Five (5) soil samples were submitted for analyses of petroleum hydrocarbon related parameters including benzene, toluene, ethylbenzene, xylenes (BTEX) and petroleum hydrocarbons (PHCs) in the F₁ to F₄ fractionation ranges. The samples submitted are identified as follows: BH1 SS4, BH5 SS2, BH9 SS3, BH11 SS2 and BC22 SS2.
- Five (5) soil samples were submitted for analyses of select metals and inorganic parameters including pH, electrical conductivity (EC), sodium absorption ratio (SAR). The samples are identified as follows: BH5 SS3, BBC4 SS4BC13 SS2, BC8 SS4 and BC20 SS2.



30 June 2011

 One (1) composite sample was submitted for analyses of Toxicity Characteristic Leachate Procedure (TCLP) under O.Reg.558/00 for parameters including benzo(a)pyrene and inorganics. The sample submitted was identified as COMP-1,

The chemical analysis of the soil sample was completed by AMEC's laboratory located in Mississauga, Ontario. AMEC's laboratory is accredited in accordance with the International Standard ISO/IEC 17025, Canadian Association for Laboratory Accreditation (CALA), membership number 2632, and has met the standards for proficiency testing developed by the Standards Council of Canada for parameters set out in the Soil, Ground Water and Sediment Standards.

6.2 Soil Assessment Criteria

The chemical analyses results were evaluated with respect to the:

- "Soil, Groundwater and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act", dated March 9, 2004 for:
 - Table 1 Full Depth Background Site Condition Standards for Agricultural or Other Property Use (*Table 1 SCS*). *Table 1 SCS* criteria would be applicable when assessing surplus soil for off-site management.
 - Table 2 Full Depth Generic Site Conditions Standards in a Potable Ground Water Condition, Coarse Textured Soils and Industrial/Commercial/Community Property Use, (*Table 3 SCS*). *Table 2 SCS* criteria would be applicable for assessment of soil conditions within the roadway.
- Schedule 4 Leachate Quality Criteria as listed under O.Reg. 558/00.

It should be noted that *O.Reg. 153/04* specifies that generic site condition standards can be applied only to sites were soil pH falls within the range of 5.0-9.0 for shallow soil (defined as soil less than 1.5m below grade) and 5.0-11.0 for subsurface soil (defined as soil greater than 1.5m below grade).

On 29 December 2009, the Ontario Government approved amendments to *O. Reg.153/04* under *O.Reg. 511/09*. As part of the amendments, new Standards were introduced, specifically the *Soil, Groundwater and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act,* dated 27 July 2009. The new 2009 Site Condition Standards for soil and groundwater reflect advances in science providing strengthened values based on updated toxicological information, new values that have been developed for several contaminants, and providing clarification to Standards which apply to sensitive site conditions. The 2009 SCS will come into effect for most Sites on 01 July 2011. The 18-month transition period allows for the gradual incorporation of the 2009 SCS into current environmental work. Nonetheless, as Site

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The Regional Municipality of Peel
Preliminary Geotechnical Investigation for Bovaird Drive
From Lake Louise Dr. / Worthington Ave. to Peel / Halton Boundary, Ontario
AMEC Reference Number: TT93042
30 June 2011

work was completed in 2009 and early 2010, it is assumed that for the purpose of this report that the application of the 2004 *O.Reg. 153/04* SCS is appropriate.

Results of the soil chemical analyses are presented in the following tables and summarized below and along with the applicable *Table 1 SCS* and *Table 2 SCS*. The Laboratory Certificates of Analyses are attached in Appendix A.

This Site classification is based on AMEC's understanding of Site conditions and project objectives at the time of the investigation. It is noted, however, that a Phase I Environmental Site Assessment (ESA) and a complete Phase II ESA have not been conducted by AMEC for the site.



AMEC Reference Number: TT93042

30 June 2011

6.3 Chemical Analyses Results

Table 5.1: Soil Chemical Analyses-Metals and Inorganic Parameters

Location				B5	BC4	BC8	BC13	BC20
Lab Number				09-16631	09-16632	09-16634	09-16633	09-16635
Sample ID				B5 SS3	BC4 SS4	BC8 SS4	BC13 SS2	BC20 SS2
Sample Depth (metres	5)			1.5-2.0	2.3-2.7	2.3-2.7	0.8-1.4	0.8-1.4
	Table 1	Table 2	MDL					
	SCS	SCS						
General Chemistry								
Conductivity (mS/cm)	0.47	1.4	0.01	<u>1.31</u>	<u>1.37</u>	<u>4.16</u>	<u>2.39</u>	<u>1.61</u>
pH (no units)	-	-	-	7.6	8.2	7.8	7.2	7.9
SAR (no units)	1.0	12	-	<u>10.4</u>	<u>13.7</u>	<u>34.6</u>	<u>9.73</u>	<u>29.9</u>
Metals								
Antimony	1.0	40	0.5	0.8	<	0.5	1.0	1.0
Arsenic	14	40	0.5	1.1	0.8	2.2	1.0	1.2
Barium	190	1500	0.5	87.1	19.9	53.3	84.3	80.3
Beryllium	1.2	1.2	0.2	0.8	٧	0.3	0.7	0.7
Cadmium	1.0	12	0.5	0.7	~	<	0.6	0.6
Chromium	67	750	1	23	6	11	20	20
Cobalt	19	80	1	9	3	4	9	10
Copper	56	225	1	27	14	16	28	24
Lead	55	1000	5	14	6	10	24	15
Mercury	0.16	10	0.05	<	<	<	<	<
Molybdenum	2.5	40	2	<	<	<	<	<
Nickel	43	150	5	19	6	9	17	16
Selenium	1.4	10	0.1	0.2	0.1	<	0.2	0.2
Silver	0.35	40	0.25	<	<	<	<	<
Thallium	2.5	32	0.5	<	<	<	<	<
Vanadium	91	200	5	29	11	17	28	29
Zinc	150	600	2	59	25	48	61	53

Notes: Ontario Regulation 153/04 Table 1 (Background) Site Condition Standards (SCS) for agricultural or other property use (Table 1 SCS). Table 1 SCS exceedences, if any, indicated in <u>BOLD</u>. Ontario Regulation 153/04 Table 2 (potable ground water) Site Condition Standards (SCS) for industrial/commercial/community land use and coarse textured soils (Table 2 SCS). Table 2 SCS exceedences, if any, indicated in <u>italics</u>. All values reported in µg/g (ppm) dry weight basis unless otherwise noted. "MDL" means method detection limit. "<" indicates not detected above the MDL as shown.



30 June 2011

Table 5.2: Soil Chemical Analyses Petroleum Hydrocarbon Parameters

Location				B1	B5	В9	B11	BC22
Lab Number				10-00929	10-00930	10-00931	10-00932	10-00933
Sample ID				B1 SS4	B5 SS2	B9 SS3	B11 SS2	BC22 SS2
Sample Depth (metres	s)			2.3-2.8	0.8-1.4	1.5-2.0	0.8-1.4	0.8-1.4
Parameters	Table 1	Table 2	MDL					
	SCS	SCS						
Benzene	0.002	0.24	0.001	0.001	0.001	0.001	0.001	0.001
Toluene	0.002	2.1	0.001	0.007	0.001	0.005	0.006	0.001
Ethylbenzene	0.002	0.28	0.001	0.006	0.005	0.003	0.025	0.001
m+p-Xylene	0.002	25	0.001	0.020	0.050	0.010	0.097	0.002
o-Xylene	0.002	25	0.001	<u>0.017</u>	0.007	0.007	<u>0.031</u>	<
PHC F1 less BTEX	-	230	10	<	<	<	<	<
PHC F2 (>C10-C16)	N/V	150	10	<	<	<	15	<
PHC F3 (>C16-C34)	N/V	1700	50	108	<	141	258	<
PHC F4 (>C34-C50)	N/V	3300	50	<	54	<	56	<

Notes: Ontario Regulation 153/04 Table 1 (Background) Site Condition Standards (SCS) for agricultural or other property use (Table 1 SCS). Table 1 SCS exceedences, if any, indicated in **BOLD**. Ontario Regulation 153/04 Table 2 (potable ground water) Site Condition Standards (SCS) for industrial/commercial/community land use and coarse textured soils (Table 2 SCS). Table 2 SCS exceedences, if any, indicated in *italics*. All values reported in µg/g (ppm) dry weight basis unless otherwise noted. "MDL" means method detection limit. "<" indicates not detected above the MDL as shown. "N/V" means no value.



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The Regional Municipality of Peel Preliminary Geotechnical Investigation for Bovaird Drive From Lake Louise Dr. / Worthington Ave. to Peel / Halton Boundary, Ontario

AMEC Reference Number: TT93042

30 June 2011

Table 5.3: Ontario Regulation 558/00 Leachate Analyses **Waste Classification**

Lab Number Sample ID	09-16636 COMP-1		
Parameter	Schedule 4 Leachate Criteria	MDL	
Arsenic	2.5	0.005	<
Barium	100	0.001	0.354
Boron	500	0.02	0.04
Cadmium	0.5	0.0005	0.0014
Chromium	5	0.001	<
Cyanide (Total)	20	0.2	<
Fluoride	150	5	<
Lead	5	0.002	<
Mercury	0.1	0.0001	<
Nitrate as N	1000	0.1	<
Nitrite as N	1000	0.1	<
Selenium	1	0.005	<
Silver	5	0.001	<
Uranium	10	0.01	<
Benzo(a)pyrene	0.001	0.0001	<

Notes: Ontario Regulation 558/00, Schedule 4 Leachate Criteria. All values reported in mg/L. "MDL" means method detection limit. "<" indicates not detected above MDL as shown. Schedule 4 exceedences, if any, indicated in BOLD.

Results of the analyses are summarized in the following sections.

6.3.1 pН

The reported pH results ranged between 7.2 and 8.2 and fall within the range of 5.0 to 9.0 for shallow soil and 5.0 to 11.0 for subsurface soil as specified for the application of Generic Site Condition Standards. The analytical results for pH have been summarized in Table 5.1.

6.3.2 **Inorganics**

The analytical results for inorganic parameters including selected metals, EC and SAR, along with the applicable Table 1 SCS and Table 2 SCS, have been summarized in Table 5.1. Results of the bulk analyses for general inorganic parameters reported all results to be below the applicable Table 1 SCS and Table 2 SCS criteria, with the following exceptions:

BH5 SS3 (1.5 to 2.0 m) exceeded the Table 1 SCS for EC and SAR;

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30 June 2011

- BC4 SS4 (2.3 to 2.7 m) exceeded the Table 1 SCS for EC and the Table 1 SCS and Table 2 SCS for SAR;
- BC8 SS4 (2.3 to 2.7 m) exceeded the Table 1 SCS and Table 2 SCS for EC and SAR;
- BC13 SS2 (0.8 to 1.4 m) exceeded the *Table 1 SCS* and *Table 2 SCS* for EC and the *Table 1 SCS* for SAR; and,
- BC20 SS2 (0.8 to 1.4 m) which exceeded the Table 1 SCS and Table 2 SCS for EC and SAR.

6.3.3 Petroleum Hydrocarbons

The analytical results for petroleum hydrocarbon parameters along with the applicable *Table 1 SCS* and *Table 2 SCS* are summarized in Table 5.2. Results of the analyses for BTEX and PHC F1-F4 reported all results to be below the applicable *Table 1 SCS* with the following exceptions:

- BH1 SS4 (2.3 to 2.8 m) exceeded the *Table 1 SCS* for toluene, ethylbenzene and xylenes;
- BH5 SS2 (0.8 to 1.4 m) exceeded the Table 1 SCS for ethylbenzene and xylenes;
- BH9 SS3 (1.5 to 2.0 m) exceeded the Table 1 SCS for toluene, ethylbenzene and xylenes; and,
- BH11 SS2 (0.8 to 1.4 m) exceeded the *Table 1 SCS* for toluene, ethylbenzene and xylenes.

Results of the analyses for BTEX and PHC F1-F4 reported all results to be below the applicable *Table 2 SCS*.

6.3.4 Ontario Regulation 558/00 Leachate Analyses

Results of the O.Reg.558/00 leachate Analyses indicate that all inorganic parameters and benzo(a)pyrene were below the applicable Schedule 4 Leachate criteria. The analytical results for the *O.Reg.558/00* Schedule 4 Leachate parameters along with the applicable Schedule 4 Leachate Criteria have been summarized in Table 5.3.



30 June 2011

The laboratory also incorporates various QA/QC procedures to ensure the accuracy of the laboratory results and assess the possibility of false positives attributed to analytical equipment contributions and laboratory control samples. The laboratory QA/QC includes the completion of laboratory blanks, blank spikes and replicates.

Based on the laboratory control samples, laboratory analysis, sample collection, sample storage, sample bottles and transportation of the samples to the laboratory, there does not appear to be any material effect on the quality of the data collected as part of this assessment.

The laboratory results for soil samples obtained during AMEC's investigation are considered to be valid. The results of the QA/QC analyses are included on the Laboratory Certificates of Analyses.

6.4 Laboratory QA/QC Program

The laboratory also incorporates various QA/QC procedures to ensure the accuracy of the laboratory results and assess the possibility of false positives attributed to analytical equipment contributions and laboratory control samples. The laboratory QA/QC includes the completion of laboratory blanks, blank spikes and replicates.

Based on the laboratory control samples, laboratory analysis, sample collection, sample storage, sample bottles and transportation of the samples to the laboratory, there does not appear to be any material effect on the quality of the data collected as part of this assessment.

The laboratory results for soil samples obtained during AMEC's investigation are considered to be valid. The results of the QA/QC analyses are included on the Laboratory Certificates of Analyses.

6.5 Summary

Based on the preliminary soil chemical analyses results, the following general soil comments are made:

- Levels of EC and/or SAR in all five (5) soil samples tested were elevated above the
 applicable Table 1 SCS and/or Table 2 SCS. As the boreholes were advanced within the
 road right of way, the EC and SAR levels are inferred to be the result of exposure to salt
 from road de-icing activities during winter. The standards established for EC and SAR are
 based on the protection of sensitive species of plants in agricultural settings and do not pose
 any significant risk to human health.
- Levels of toluene, ethylbenzne and/or xylenes were elevated above the applicable *Table 1 SCS* but were within the applicable *Table 2 SCS*.

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The Regional Municipality of Peel
Preliminary Geotechnical Investigation for Bovaird Drive
From Lake Louise Dr. / Worthington Ave. to Peel / Halton Boundary, Ontario
AMEC Reference Number: TT93042

30 June 2011

- Based on the one (1) O.Reg. 558/00 leachate sample collected, the material would be classified as non-hazardous for landfill disposal purposes.
- Evaluation of the subject soil for off-site uses indicate the material may not be suitable for
 use as general purpose fill at receiving sites based on exceedances of the applicable *Table*1 SCS for several parameters including EC, SAR, toluene, ethylbenzne and/or xylenes. The
 material may not be suitable for use as general purpose fill at receiving sites based on
 exceedances of the applicable *Table 2 SCS* for parameters including EC and SAR. The soil
 may be suitable for use on Sites where *Table 2 SCS* are appropriate below 1.5 m.
- The characterization and assessment was based on AMEC's understanding of Site conditions and available information at the time of the geotechnical investigation. A Phase I and Phase II ESA have not been conducted by AMEC for the Site and AMEC does not warrant that the analytical schedule addresses all of the potential environmental issues at the site. The results are not intended to provide a complete assessment of all soil conditions at the site. Further assessment and/or chemical analyses would be considered appropriate depending on the soil management option selected and/or receiver's requirements. As noted above, it is assumed that a RSC is not required for the site at this time. The scope of work as described, will not address all of the requirements of O.Reg 153/04 and supplementary work may be required in the event that an RSC is required in the future.



7.0 CLOSURE

The sub-soil information and recommendations contained in this report should be used solely for the purpose of providing geotechnical information for Class Environment Analysis study for the proposed Bovaird Drive.

It is recommended that AMEC be retained to review the recommendations for this specific applicability, once the details of the development are finalized and prior to the final design stage of the project. Additional borehole investigation may be required to fulfill the final design requirements.

The attached Report Limitations is an integral part of this report.

This report was prepared by Mohammad Mollah, M.Eng., P.Eng. (Senior Geotechnical Engineer), Regan Dahmer, B.Sc. (Environmental Project Manager) and Hoda Seddik, M.A.Sc., P.Eng. (Senior Asphalt & Pavement Engineer). The report was reviewed by Prapote Boonsinsuk, Ph.D., P.Eng. (Principal Geotechnical Engineer) and Michael J. Salter, C.E.T., (Senior Environmental Project Manager).

Sincerely,

AMEC Earth and Environmental, a Division of AMEC Americas Limited

Hode Seddile

Hoda Seddik, M.A.Sc., P.Eng. Senior Asphalt & Pavement Engineer Michael J. Salter, C.E.T. Senior Environmental Project Manager

Mohammad Mollah, M.Eng., P.Eng. Senior Geotechnical Engineer



AMEC Earth & Environmental, a Division of AMEC Americas Limited

REPORT LIMITATIONS

The conclusions and recommendations given in this report are based on information determined at the testhole locations. The information contained herein in no way reflects on the environmental aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Geotechnical Engineer be retained during the construction to confirm that the subsurface conditions across the site do not deviate materially from those encountered in the testholes.

The design recommendations given 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, we recommend that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

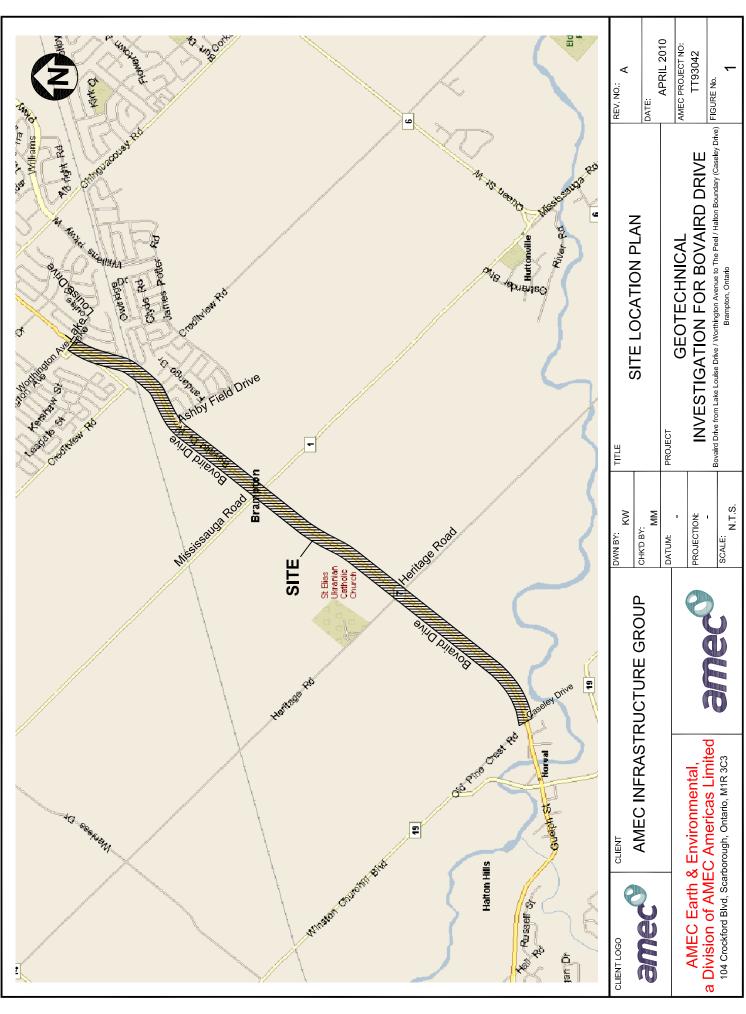
The comments made in this report relating to potential construction problems and possible methods of construction are intended only for the guidance of the designer. The number of testholes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.

The benchmark and elevations mentioned in this report were obtained strictly for use by this office in the geotechnical design of the project. They should not be used by any other party for any other purpose.

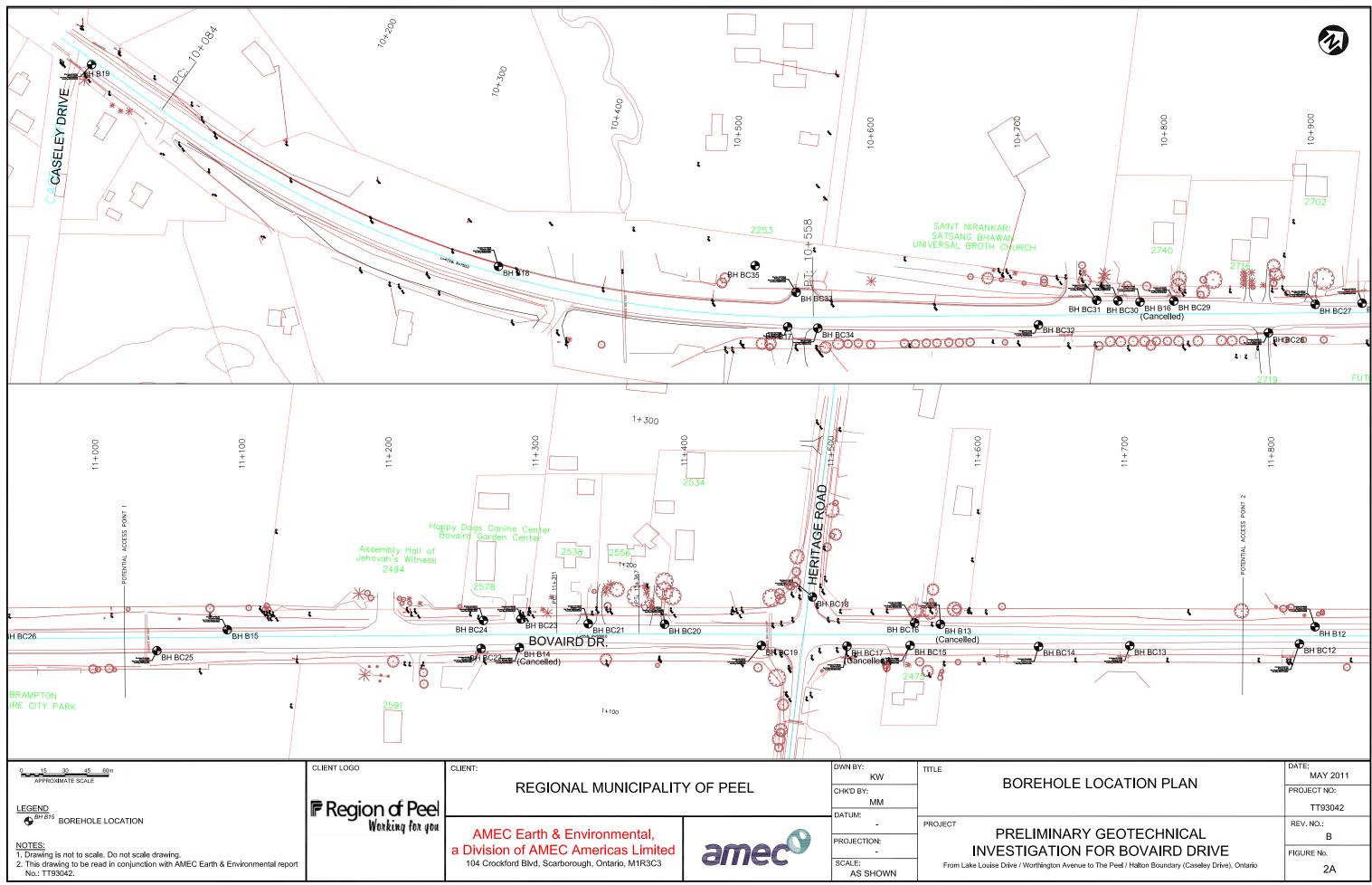
Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. AMEC Earth & Environmental accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

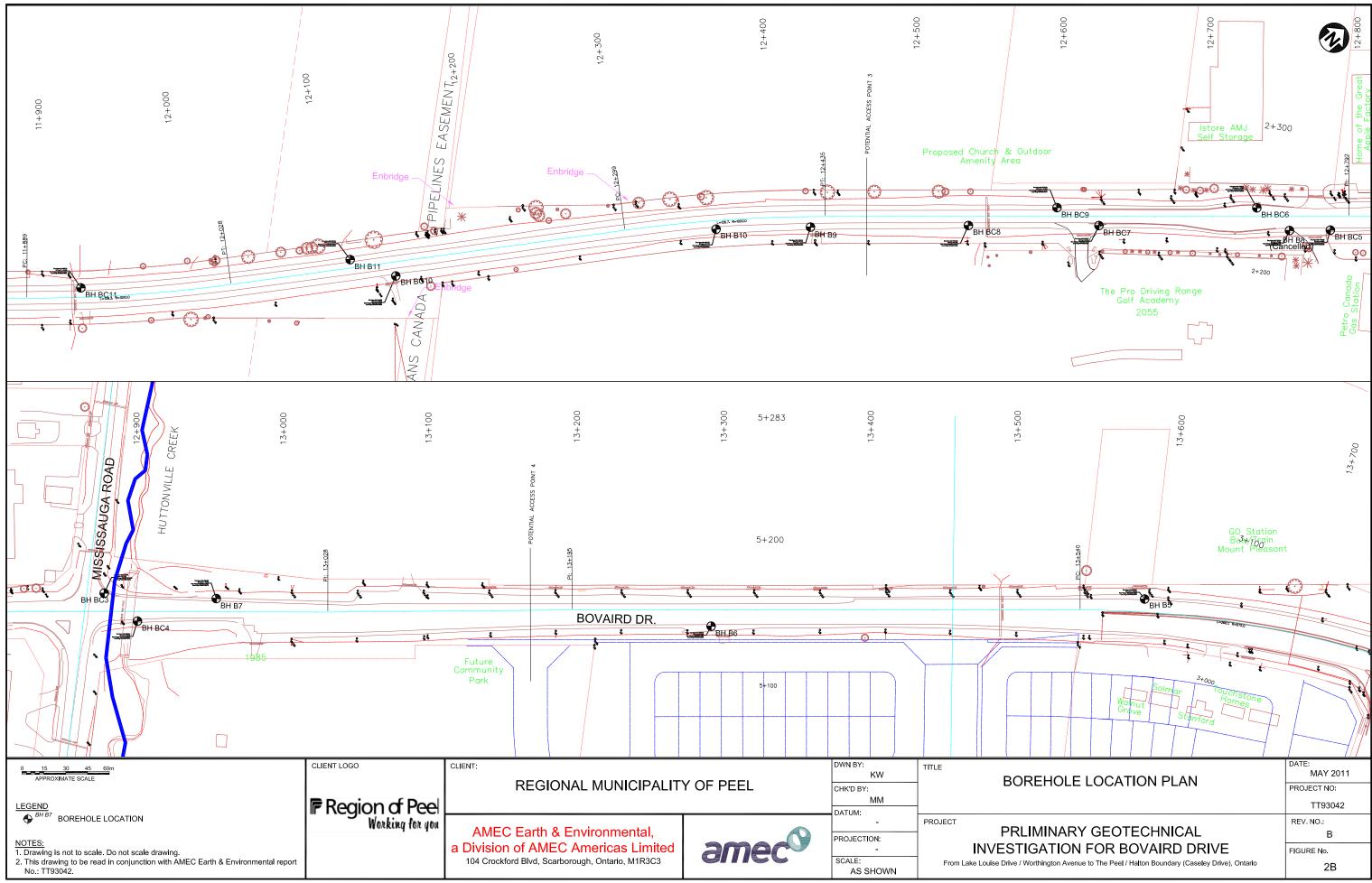


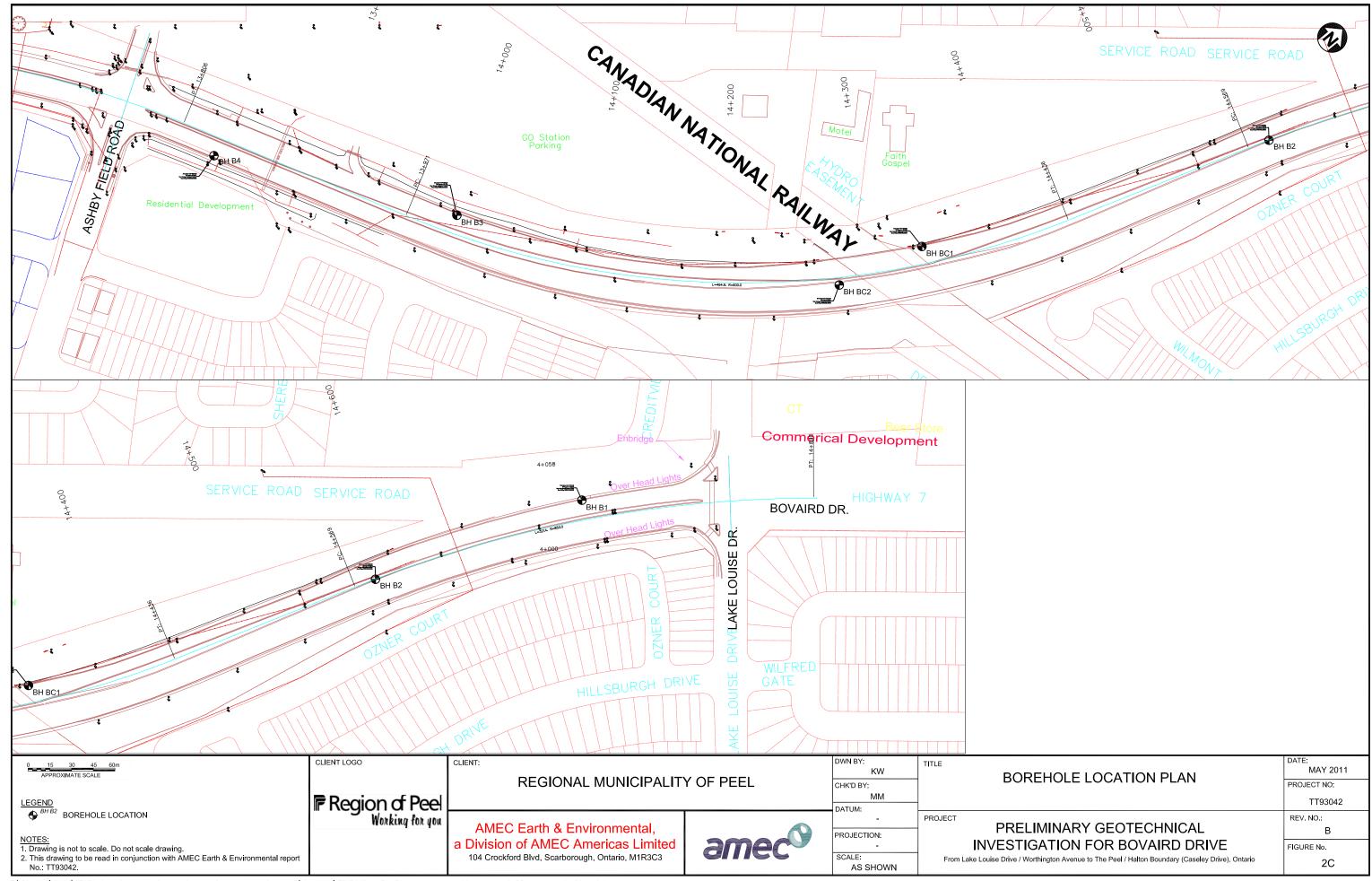
FIGURES



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RECORD OF BOREHOLES

BH B1 to BH B7, BH B9 to BH B12, BH B15, BH B18 & BH B19, BH BC1 to BC3, BH BC3-W, BH BC4 to BH BC35

EXPLANATION OF BOREHOLE LOG

This form describes some of the information provided on the borehole logs, which is based primarily on examination of the recovered samples, and the results of the field and laboratory tests. Additional description of the soil/rock encountered is given in the accompanying geotechnical report.

GENERAL INFORMATION

Project details, borehole number, location coordinates and type of drilling equipment used are given at the top of the borehole log.

SOIL LITHOLOGY

Elevation and Depth

This column gives the elevation and depth of inferred geologic layers. The elevation is referred to the datum shown in the Description column.

Lithology Plot

This column presents a graphic depiction of the soil and rock stratigraphy encountered within the borehole.

Description

This column gives a description of the soil stratums, based on visual and tactile examination of the samples augmented with field and laboratory test results. Each stratum is described according to the *Modified Unified Soil Classification System*.

The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined as follows (Ref. Canadian Foundation Engineering Manual):

Compactness of				
<u>Cohesionless</u> <u>Soils</u>	SPT N-Value*			
Very loose	0 to 4			
Loose	4 to 10			
Compact	10 to 30			
Dense	30 to 50			
Very Dense	> 50			

Consistency of	Undrained Shear Strength
Cohesive Soils	<u>kPa</u>
Very soft	0 to 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	Over 200

^{*} For penetration of less than 0.3 m, N-values are indicated as the number of blows for the penetration achieved (e.g. 50/25: 50 blows for 25 centimeter penetration).

Soil Sampling

Sample types are abbreviated as follows:

SS	Split Spoon	TW	Thin Wall Open (Pushed)	RC	Rock Core	GS	Grab Sample
AS	Auger Sample	TP	Thin Wall Piston (Pushed)	WS	Washed Sample	AR	Air Return Sample

Additional information provided in this section includes sample numbering, sample recovery and numerical testing results.

Field and Laboratory Testing

Results of field testing (e.g., SPT, pocket penetrometer, and vane testing) and laboratory testing (e.g., natural moisture content, and limits) executed on the recovered samples are plotted in this section.

Instrumentation Installation

Instrumentation installations (monitoring wells, piezometers, inclinometers, etc.) are plotted in this section. Water levels, if measured during fieldwork, are also plotted. These water levels may or may not be representative of the static groundwater level depending on the nature of soil stratum where the piezometer tips are located, the time elapsed from installation to reading and other applicable factors.

Comments

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MODIFIED * UNIFIED CLASSIFICATION SYSTEM FOR SOILS

*The soil of each stratum is described using the Unified Soil Classification System (Technical Memorandum 36-357 prepared by Waterways Experiment Station, Vicksburg, Mississippi, Corps of Engineers, U.S Army. Vol. 1 March 1953.) modified slightly so that an inorganic clay of "medium plasticity" is recognized.

			March 19	353.) modified slightly so that an inorganic clay of "medium plasticity" is recognized.	
	MAJOR DIVISION		GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
THE	HALF ION nm	CLEAN GRAVELS	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u = D_{00} > 4; C_C = (D_{00})^2 = 1 \text{ to } 3$ $D_{10} D_{10} X D_{00}$
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75μm)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm	(TRACE OR NO FINES)	GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
AN HALF	ELS MOI	DIRTY GRAVELS (WITH SOME OR	GM	SILTY GRAVELS, GRAVEL-SAND- SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 4
ORE TH. HAN 75µ	GRAV THE LA	MORE FINES)	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 7
SOILS (M	LF THE	CLEAN SANDS (TRACE OR NO	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = D_{60} > 6$; $C_C = (D_{30})^2 = 1 \text{ to } 3$ $D_{10} D_{10} X D_{60}$
AINED S	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	FINES)	SP	POORLY GRADED GRAVELS, GRAVEL- SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
ARSE GF	MORE 1	DIRTY SANDS (WITH SOME OR	SM	SILTY SANDS, SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 4
Ö		MORE FINES)	SC	CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75μm)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	W _L < 50%	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	
WEIGHT 8	SILTS B NEGLIG O	W _L > 50%	МН	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	CLASSIFICATION IS BASED UPON PLASTICITY CHART
HALF BY \ m)	CLAYS ABOVE "A" LINE NEGLIGBLE ORGANIC CONTENT	W _L < 30%	CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS	(SEE BELOW)
2E ТНАN НА 75µm)	, ABOVE GIBLE OI CONTEN	30% < W _L < 50%	CI	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	
ILS (MOF		W _L > 50%	СН	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
INED SO	SLITS & LOW "A" E	W _L < 50%	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	WHENEVER THE NATURE OF THE FINES CONTENT HAS NOT
FINE-GRA	ORGANIC SLITS & CLAYS BELOW "A" LINE	W _L > 50%	ОН	ORGANIC CLAYS OF HIGH PLASTICITY	BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER 'F', E.G SF IS A MIXTURE OF SAND WITH SILT OR CLAY
	HIGH ORGANIC SOILS		Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE

60

		SOIL COMPO	NENTS		
FRACTION	U.S STANDARD S	IEVE SIZE	DEFINING RANGES OF MII	S OF PERCENTA	
		PASSING	RETAINED	PERCENT	DESCRIPTOR
GRAVEL	COARSE	76 mm	19 mm	35-50 20-35	AND Y/EY
9	FINE	19 mm	4.75 mm	10-20	SOME
	COARSE	4.75 mm	2.00 mm	1-10	TRACE
SAND	MEDIUM	2.00 mm	425 μm		
	FINE	425 μm	75 µm		
	OR CLAY BASED ON ASTICITY)	75 µm			
		OVERSIZED M	ATERIAL		

ROUNDED OR SUBROUNDED: COBBLES 76 mm TO 200 mm BOULDERS > 200 mm

NOT ROUNDED: ROCK FRAGMENTS > 76 mm ROCKS > 0.76 CUBIC METRE IN VOLUME

 $W_{L} = 50$ 50 СН $W_{L} = 30$ Plasticity Index, I_P 'A' Line I_P = 0.73 (W_L - 20) CL CI MH OL ОН 10 CL-ML ML 0 0 70 80 Liquid Limit, W_L

Plasticity Chart for Soil Passing 425 Micron Sieve

Note 1: Soils are classified and described according to their engineering properties

Note 2: The modifying adjectives used to define the actual or estimated percentage range by weight of minor components are consistent with the Canadian Foundation Engineering Manual.

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R	ECORD	OF BOREHOLE	No	. <u>B</u>	H B	<u>1</u> C	:o-O	rd.	N48	<u> 369</u>	994	<u>, E</u>	<u>595</u>	<u> 47</u>	<u>5</u>							am	e	-0
Pro	ject Number:	TT93042							Drilling	Loca	ation:		ta 14 ·								L	ogged by:	JF	
	ject Client:	The Regional Municipalit							Drilling				150 mi				Augeri	ng				ompiled by:	SN	
	ject Name:	Geotechnical Investigatio											ruck N									eviewed by:	PB	
Pro	ect Location:	Bovaird Drive from Lake at Caseley Drive, Brampte			to Pe	el/Halte	on Bou	ındary	Date S	tarted	d:	<u>0</u>	oct 13,	09	_ Da	ite Co	mplete	ed: <u>O</u>	ct 13	3, 09	R	evision No.:	0, 5/	11/11
	LITH	OLOGY PROFILE		SC	DIL SA	MPLI	NG			F			STIN			inse pH	TES [®] Values			z		COMME	JTQ	
Lithology Plot	0	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEРТН (m)	ELEVATION (m)	∆ II ▲ F *U	PT [) Vane* ntact Remould Undrained	PPT	Nilcon Va Intac Rem Strength (kF	DCPT ane* at lould	▲ Li V P	Soil Va arts per 00 2 ower Ex V _P lastic	6 8 apour R million (00 30 kplosive W	leading ppm) 0 400 Limit (LEL W _L	-) - 1	NSTRUMENTATION NSTALLATION	 GR	& GRAIN S DISTRIBU (%)	ΙΖΕ	CL
	about 17	Surface Elevation: 0.0 m 70 mm ASPHALTIC CONCRETE	0.2	0,	0,		0,	-			20 .	10		<u> </u>		0 -	10 9	90						
	Gravell	grey Sand / Sand and Gravel FILL trace to some silt moist	<u>0.2</u> 	SS	1	100	36	- - - -	- - - -		<u> </u>				\$ 5						34	54	(12	2)
				SS	2	100	34	- - - 1 -	-1 -	-	0				₩ <u>5</u>									
			-	SS	3	83	50/15	 - - - -	- - -			50 O 15			∆ ₀ 0									
			<u>-2.1</u> 2.1	33	3		30/13	- - - 2 -	-2 —		* * * * * * * * * * * * * * * * * * *	15		0 0 0 0 0 0 0 0	6		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
	trac	grey Clayey Sitt FILL e organic matter and rootlets moist	2.1	SS	4	100	21	- - - -	- - - -		0				△40	- 20								
		brown Y CLAY / CLAYEY SILT TILL e sand to sandy, trace gravel very stiff moist	<u>-2.7</u> 2.7					- - - - 3	-3 -															
			-	SS	5	100	25	- - -	- - -		Ó			· · · · · · · · · · · · · · · · · · ·	■	I8 [●]					6	24	44	26
								- - - - 4	-4 —					· · · · · · · · · · · · · · · · · · ·										
	F	brown AND SAND / SILTY SAND TILL trace day and gravel trace shale fragments very dense moist	<u>-4.1</u> 4.1					- - -	- - - -		•	50												
<u>[3] [</u>	Note: The geo	End of Borehole detic elevation at existing grade wa provided to AMEC.	4.6 4.6 s not	SS	6	100	50/3				0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	3			9									
												•		•										

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 $\frac{\nabla}{\Xi}$ No freestanding groundwater measured in open borehole on completion of drilling.

R	ECORD	OF BOREHOLE	E No). <u>B</u>	H B	<u>2</u> C	o-C	rd.	N48	<u> 368</u>	349	, E	<u> 595</u>	432	<u>2</u>							am	e	20)
	ject Number:	TT93042							Drilling				a 14 +									ogged by:	JF	
Pro	ject Client:	The Regional Municipali							Drilling								ugeri	ng			c	Compiled by:	SN	
	ject Name:	Geotechnical Investigation							Drilling					/lount							F	Reviewed by:	PB	
Pro	ject Location:	Bovaird Drive from Lake at Caseley Drive, Brampt	Louis ton, Of	e Drive N.	to Pe	el/Halto	on Bou	ındary	Date S	Started	l:	<u>Oc</u>	ct 13,	09	_ Da	te Co	mplete	ed: <u>O</u>	ct 13	3, 09	F	Revision No.:	0, 5/	11/11
	LITH	OLOGY PROFILE		SC	DIL SA	MPLI	NG			F	IELD) TES	STIN	G			TES Values	TING		z		00141451	ıTO	
ology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	△ Ir	T [Vane* Itact Jemould	\Diamond	lcon Va Intact Remo	DCPT ane* t ould	2 △ pa 10 ▲ Lo	Soil Va arts per 00 20 ower Ex V _p	6 8 apour Ri million (p 0 30	eading opm) 0 400 Limit (LEL) W. Liquid)	INSTRUMENTATION INSTALLATION		COMMEN & GRAIN SI DISTRIBU' (%)	ZE	
=		Surface Elevation: 245.8 m 70 mm ASPHALTIC CONCRETE		Sa	Sa	å	SP	<u> </u>	ᆸ					a) 30			0 60		_	22	GR	SA	SI	CL
			24 <u>5.7</u> 0.2					Ŀ																
燚	Gravell	brown y Sand / Sand and Gravel FILL some silt	0.2					F																
$\overset{x}{\bowtie}$		moist		00		400	40								0									
$\overset{\otimes}{\otimes}$				SS	1	100	40	-	-			O												
$\overset{x}{\bowtie}$								-	245 -															
$\overset{x}{\bowtie}$								- 1																
$\overset{ imes}{ imes}$		trace cobbles / boulders		SS	2	100	32	- '			0				5									
$\overset{x}{\otimes}$					_			-			: . .				[····			•••••						
▓		brown	244.4 1.4					-																
$\overset{\otimes}{\otimes}$		Silty Sand FILL trace gravel moist						Ī																
$\overset{x}{lpha}$				SS	3	100	23	-		ł	0				10			:						
$\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}{\overset{x}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset$								F	244 –															
$\overset{x}{\bowtie}$								_ 2		ł														
$\overset{\otimes}{\otimes}$								-		-														
$\overset{\otimes}{\otimes}$		trace rootlets						‡		1														
❈			243.2	SS	4	100	10	-		0				4	5									
$\overset{\otimes}{\otimes}$		brown Clayey Silt FILL	2.6					-		1														
$\overset{\infty}{\otimes}$		trace sand and gravel moist						Ŀ	243 –	1														
$\overset{\infty}{\otimes}$								— з																
$\overset{\infty}{\otimes}$								-																
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₩		brown and grey	241.9 4.0					- - 4																
		ND SAND / SILTY SAND TILL trace clay and gravel						Ŀ		+														
		dense moist						-																
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				SS	6	100	40	ļ	241 –		(.			∆ ¹⁰									
9			240.8					- 5		-														
. 1.		End of Borehole	5.0					Ĭ																
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 $\stackrel{\textstyle \nabla}{=}$ No freestanding groundwater measured in open borehole on completion of drilling.

		OF BOREHOLI	E No	. <u>B</u>	H B	<u>3</u> C	:o-O	rd.							<u>)</u>							Č	ЭМ	e	-0
	ject Number:	TT93042	: D						Drilling				ta 14 ·			A							jed by:	JF CN	
	ject Client: ject Name:	The Regional Municipal Geotechnical Investigation			1 Drive	Class	FA Sti	ıdv	Drilling				50 mi ruck N				uger	ng					piled by: ewed by:	SN PB	
	ject Location:	Bovaird Drive from Lake											ct 13,				molet	ed: (Oct 13	3. 09			sion No.:		11/11
		at Caseley Drive, Bramp HOLOGY PROFILE	ton, ON	١.		MPLI		 	T				STIN		_		•	TING		-,	- T			<u>5, 5.</u>	
Lithology Plot	LIII	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	Ç SP MTO Δ Ir ▲ R	Pene T [Vane* Ntact Remould	tration	Testing Iilcon Va	DCPT ane* t ould	★ R 2 △ pa 10	Soil Va arts per 00 20 ower Ex	Values 6 8 apour F million (00 30	10 Reading ppm) 00 40 Limit (LE	12 00 EL) V _L	INSTRUMENTATION INSTALLATION		G	OMMEN & GRAIN SI STRIBUT (%)	ZE	
Ë	Geodetic Ground	Surface Elevation: 246.5 m		San	San	Rec	SPI	le le	H				trength (kF 60 8	a) 30		astic 0 4	ю е	Liqu 0 8		SNS	GR	t	SA	SI	CL
	about 2	00 mm ASPHALTIC CONCRETE	246.3					-																	
	Gravell	brown y Sand / Sand and Gravel FILL some silt moist	0.2	SS	1	83	34	- - -	246 –		Ó				O 93										
								- - - - 1			•														
		grey Silty Sand FILL	<u>245.3</u> 1.2	SS	2	67	9	- - -		0				4	70g										
		trace to some clay moist		SS	3	56	12	- -	245 -	0	0 0 0 0 0 0 0				10 10										
		brown	<u>244.4</u> 2.1					- 2 -			•	•		•											
	trace grave	Clayey Silt FILL el, pocket of sand, trace brick deb moist	oris .	SS	4	56	18	- - -	244 –))	0 0 0 0 0 0 0 0 0	•	0 0 0 0 0 0 0 0 0 0	∆ ⁵ o	6									
		brown	<u>243.6</u> 2.9					- - - - 3			•	•		•											
)	SIL	T AND SAND / SILTY SAND trace clay, trace gravel very dense moist		SS	5	92	50/15	- - -	•	-	•	50 O 15		4	8										
1								- - -	243 -		•														
))								- - - 4																	
		reddish brown WEATHERED SHALE	<u>242.2</u> 4.3					- - -			• • • • • • • • • • • •	• • • • • • • • • • • • • •		•											
			241.9	SS	6	100	50/5	-	242 -			.50 O			8										
		End of Borehole	4.6									5 5 6 6 6 6 7 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8			5										

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 $\frac{\nabla}{z}$ No freestanding groundwater measured in open borehole on completion of drilling.

		OF BOREHOLE	E No). <u>B</u>	BH E	<u>34</u> C	o-C	rd.					595 ta 14 -									ā	m	e	-0
	oject Number: oject Client:	TT93042 The Regional Municipali	ty of P	امما					Drilling Drilling				50 mi			tom /	Διιαρι	rina				Logged	•	SN	
	oject Olient.	Geotechnical Investigation			d Drive	Class	EA St	udv					uck N				-ugei	iiig				Review	-	PB	
	eject Location:	Bovaird Drive from Lake											ct 13,				omple	ted:	Oct 1	3. 09			n No.:		11/11
		at Caseley Drive, Brampt IOLOGY PROFILE	ton, Of	٧.		AMPLII		T	T				STIN				TES			,	_ T				
Lithology Plot	LIII	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	O SF MTC Δ III ▲ F	Pene PT () Vane' ntact Remould	tration	Testing ilcon Va	DCPT ane* tt ould	★ F 2 A p 1 A L V	Soil V arts pe 00 2 ower E	A Values 6 8 apour I r million 200 3 xplosive W	Readin (ppm) (pom) Limit (L	12 9 Iço .EL) W,	INSTRUMENTATION INSTALLATION		GF	MMEN & RAIN SI RIBU	ZE	
Ė	Geodetic Ground	Surface Elevation: 244.3 m		San	San	Rec	SPT	E.					rength (kF 60 8	Pa) 80		Plastic 20	40	Liq 60	uid 80	SNS	GR	8	SA	SI	CL
	about 2	20 mm ASPHALTIC CONCRETE	244.1					-																	
**	Gravell	brown y Sand / Sand and Gravel FILL	0.2					F	244 -]						: !		<u>.</u>							
		some silt moist		SS	1	100	57	- - -		<u> </u> 	•	•			0	•		•	•						
₩								ŀ																	
***				SS	2	100	65	_ 1 -					0		0										
$\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}}{}}}}}}}}}$	tra	ce asphaltic concrete debris	242.9					-	243 -						T										
▓		brown Clayey Silt FILL	1.4					1		1															
$\overset{x}{\overset{x}}{\overset{x}{\overset{x}{\overset{x}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}{\overset{x}}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\mathsf$	trac	trace sand and gravel e organic matter and rootlets						}		-				:		:									
₩		moist		SS	3	100	38	F]	(<u>.</u>			0			<u>.</u>							
$\overset{XX}{\overset{XX}{\overset{X}}{\overset{X}{\overset{X}}{\overset{X}{\overset{X}}{\overset{X}{\overset{X}}{\overset{X}{\overset{X}}{\overset{X}{\overset{X}}{\overset{X}{\overset{X}}{\overset{X}{\overset{X}}{\overset{X}}{\overset{X}}{\overset{X}}{\overset{X}}{\overset{X}{\overset{X}}{\overset{X}{\overset{X}}{\overset{X}{\overset{X}}{\overset{X}}{\overset{X}}{\overset{X}{\overset{X}}{\overset{X}}{\overset{X}}{\overset{X}}{\overset{X}}{\overset{X}}{\overset{X}}{\overset{X}}{\overset{X}}{\overset{X}}{\overset{X}}{\overset{X}}}{\overset{X}}}{\overset{X}{\overset{X}}{\overset{X}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}{\overset{X}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}{\overset{X}}{\overset{X}}}{\overset{X}}}}{\overset{X}}{\overset{X}}{\overset{X}}{\overset{X}}{\overset{X}}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}{\overset{X}}}{\overset{X}}}{\overset{X}}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}}{\overset{X}}}}{\overset{X}}{\overset{X}}}{\overset{X}}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}}{\overset{X}}}{\overset{X}}}{\overset{X}}}{\overset{X}$								- - 2		1															
XX		reddish brown	<u>242.2</u> 2.1					Ŀ				: 				: :									
		CLAYEY SILT TILL trace sand and gravel						F	242 –	1															
		hard moist		SS	4	100	71	-					0		5										
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		trace cobbles		SS	5	100	50/15	‡				50 O 15			0										
1								-	241 -			: :	· · · · ·	· · · · ·		: :	· · · · ·								
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Ц	\		239.7 4.6	- SS	6	0	50/1	ļ .			<u> </u>	50 1	<u></u>	: :		: :	<u></u>	<u></u>							
		pieces of shale End of Borehole																							
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 $\stackrel{\textstyle \nabla}{=}$ No freestanding groundwater measured in open borehole on completion of drilling.

R	ECORD	OF BOREHOLE	E No). <u>B</u>	H B	<u>5</u> C	:o-O	rd.	N48	<u>361</u>	132	, E	<u>594</u>	<u>792</u>	<u>2</u>							am	e	CO
	ject Number:	TT93042							Drilling				a 13 +									Logged by:	JF	5-4-3
	ject Client:	The Regional Municipal							Drilling	Meth	iod:		50 mr				Augei	ring				Compiled by:	<u>S</u> 1	
	ject Name:	Geotechnical Investigation							Drilling				uck N									Reviewed by:	PE	
⊃ro	ject Location:	Bovaird Drive from Lake at Caseley Drive, Bramp	Louise ton, Of	e Drive N.	to Pe	el/Halt	on Bou	ındary	Date S	Started	d:	<u>O</u>	ct 14,	09	_ Da	ite Co	omple	ted:	Oct 1	4, 09	-	Revision No.:	<u>0,</u>	5/11/11
	LITH	OLOGY PROFILE		SC	DIL SA	MPLI	NG			F			STIN	G			TES Values	TING	•	z		COMME	NTC	
ithology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	△ Ir	PT [Vane* ntact Remould	PPT Ni ◇	Icon Va	: ould	2 △ pi 11	Soil V arts pe 00 2	6 8 apour l r million 200 3	Reading (ppm) 800 4 Limit (L	ĒL) N _L ●	INSTRUMENTATION INSTALLATION		& GRAIN S DISTRIBU (%)	IZE TIO	N
5	Geodetic Ground	Surface Elevation: 245.6 m 20 mm ASPHALTIC CONCRETE	:	Š	ιχ	Ř	S	□		2	20 4	40 (30 8	0	2	20	40	60 8	30	ZZ	GR	SA	SI	CL
***			<u>245.4</u> 0.2					-																
$\overset{\otimes}{\otimes}$	Gravelly	brown / Sand / Sand and Gravel FILL some silt	0.2					-		-		· · · · ·						·····						
$\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}{\overset{x}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\mathsf$		moist		SS	1	100	37	-	245 -	1		<u>;</u>			\$5 3				•					
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$\overset{\otimes}{\otimes}$								-]						: }		<u>.</u>						
$\overset{\infty}{\otimes}$					_			- 1							5				•					
$\overset{\otimes}{\otimes}$				SS	2	89	38	-			(∆ ⁵ 4			<u>.</u>						
❈		brown	<u>244.2</u> 1.4					-		1									•					
$\overset{\otimes}{\otimes}$		Silty Sand FILL trace clay and gravel trace organic matter						-	244 -			 :								i l				
畿		moist		SS	3	100	28	-		1	0	:			Δ	70 22			•					
$\overset{\otimes}{\otimes}$								}		1						•		:						
$\overset{x}{\otimes}$								- 2 -			· •					: : :		<u>.</u>	}					
畿								-																
$\overset{\otimes}{\otimes}$				SS	4	100	35	-			0				△ ¹⁰ 0			<u>.</u>						
X		reddish brown	243.0 2.6	00	•	100	33	-	243 -	1					1	4			•					
X		CLAYEY SILT TILL trace sand and gravel hard						F		-								·····		i l				
1		moist						- - 3		}	•	•				•		:	•					
1		trace shale fragments		-00	_	400	05/00	ŀ		1				35	0_	•			•					
¥				SS	5	100	85/23	Ŀ			•	: 	2	5 O 4 23	0010	: : :								
X								-	242 -															
1								-	242									 :	•					
1	{							-		1						•			•					
X								- 4		1	•					•		· · · · · ·	•	Ì				
V								-		<u> </u>	•					•	:	: 	•					
K								Ē		-									•					
1			240.9	SS	6	100	50/8	-	241 -	ļ		50 O			0									
		End of Borehole	4.6									8			10									
																			•					
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	1			l				l			:	:	:	:	1	:			:					

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 $\frac{\nabla}{z}$ No freestanding groundwater measured in open borehole on completion of drilling.

R	ECORD	OF BOREHOLE	No	. <u>B</u>	H B	<u>6</u> C	o-O	rd.	N48	<u>35</u>	887	<u>, E</u>	<u>594</u>	628	<u> 8</u>						am	ec	O
Pro	ject Number:	TT93042							Drilling	Loc	ation:	_	ta 13 -							L	_ogged by:	JF	4
Pro	ject Client:	The Regional Municipalit	ty of P	eel					Drilling	Met	thod:	_1	50 mi	m So	lid St	em A	ugerir	ng		(Compiled by:	SN	
Pro	ject Name:	Geotechnical Investigation	n for E	Bovairo	d Drive	Class	EA Stu	udy	Drilling	Mad	chine:	<u>T</u> 1	ruck N	/lount	ted D	rill				F	Reviewed by:	PB	
Pro	ject Location:	Bovaird Drive from Lake at Caseley Drive, Brampt	Louise	e Drive N.	to Pe	el/Halto	on Bou	ındary	Date S	Starte	ed:	<u>o</u>	ct 14,	09	_ Da	te Cor	nplete	d: Oct 1	4, 09	F	Revision No.:	0, 5/11	1/11
	LITH	OLOGY PROFILE			DIL SA	MPLI	NG				FIEL	D TE	STIN	G		LAB		ING	z				
nology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	△	O Vane Intact Remoul	□ PPT * N d •	lilcon Va	DCPT ane* t ould	2 △ pi 11 ▲ U	ower Exp	6 8 pour Re million (pp 0 300	ading pm) 400 imit (LEL) W _L	INSTRUMENTATION INSTALLATION		COMMEN & GRAIN SI DISTRIBUT (%)	ZE	
=	Geodetic Ground	Surface Elevation: 243.1 m		Sa	Sa	å	SP	B	ᆸ	-				30 30		0 40	60		22	GR	SA	SI	CL
	about 2.	S IIII ASPIALIO CONCRETE	242.9					Ŀ	243 -														
\otimes	Gravell	brown / Sand / Sand and Gravel FILL	0.2					-			· į	<u> </u>		: :									
**		trace silt moist		SS	1	100	46	- - -				0			9 9								
❈		— — brown to grey	242.4 0.8					ļ		ł													
❈		Sandy Silt FILL trace clay and gravel						- - 1						· ·									
***		trace organic matter moist		SS	2	83	29	- - -	242 -	 	0		•		1º 9,	1	•	•					
		brown	24 <u>1.5</u> 1.7	SS	3	89	38	- - - -		- 1 1		 O			 ∆ ²⁰			•					
	SILT	Y CLAY / CLAYEY SILT TILL trace sand and gravel hard moist						- - - 2		 					<u>~</u> 12		••••	•					
								- - -	241 -] - - -					35								
				SS	4	100	40	- - -		- - - - -		0		•	∆ ³⁵	19		•					
fr		brown ND SAND / SILTY SAND TILL	240.2 2.9					- 3		+													
	SILIA	trace day and gravel very dense moist to wet		SS	5	100	68	- - -	240 -	- - - - -			0		∆ ²⁵ c	18							
	{							- - -]								•					
								- 4 -	239 -] 							••••	•					
) 								- - -						•				9					
		End of Borehole	238.3 4.9	SS	6	100	50/13	- - - <u>-</u> <u>-</u>	Z .			50 13		4	0) 20	- • • • • • • • • • • • • • • • • • • •	**********					
														6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6									

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 $\frac{\nabla}{2}$ Groundwater inferred or encountered during drilling on $\underline{10/14/2009}$ at a depth of: $\underline{4.9 \text{ m}}$

		OF BOREHOLE	No	. <u>B</u>	H B	<u>7</u> C	:o-O	rd.														91	n	ec	0
	ject Number:	The Regional Municipality	h, of D	and .					Drilling				<u>a 13 -</u> 50 mi			lom /	۸۰۰۰	ina				ogged by		JF SN	
	oject Client: oject Name:	The Regional Municipalit Geotechnical Investigatio			d Drive	Class	FA Str	ıdv	Drilling Drilling			_	uck N				Augei	ing				Compiled Reviewed	•	PB	
	eject Location:	Bovaird Drive from Lake										_	ct 14,				omple	ted:	Oct 1	4. 09		Revision I	•	0, 5/1	1/11
		at Caseley Drive, Brampt		٧.		MPLI		1	T				STIN		_		TES			.,					
Lithology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	O SF	Pene PT O Vane ntact Remould	etration	Testing ilcon Valentace Remo	DCPT ane* t ould	★ R 2 P 1 P	Soil V arts pe 00 2 ower E V _P	A Values 6 8 apour I r million 200 3 explosive W	Readir (ppm) (00 4 Limit (l	12 1g 400	NSTRUMENTATION NSTALLATION	GR	GRAI DISTRI	& N SIZ BUT %)	ZE	CL
_	about 8	Surface Elevation: 239.1 m 0 mm ASPHALTIC CONCRETE	23 <u>9.0</u> 0.1	0)	0)	<u> </u>	0)	-	239 -	_	40	40	<u>qu </u>	30		20	40	qu .	qu.						
	Gravell	brown y Sand / Sand and Gravel FILL some silt moist	0.1	SS	1	83	18	- - - -		-					0	· · · · · · · · · · · · · · · · · · ·									
		brown CLAYEY SILT TILL some sand to sandy	238.3 0.8					- - - - 1		<u> </u> 			•	•		•	•		•						
		e gravel and trace oxidation stiff moist	237.7	SS	2	89	15	- - -	238 -	c)	•			∆ ⁵ • -	•		•			1	21		49	29
	SILT A	brown NND SAND / SILTY SAND TILL trace clay and gravel very dense moist	1.4	SS	3	100	69	- - -					Ó	0 0 0 0 0 0 0 0 0 0	∆ ¹⁰	· · · · · · · · · · · · · · · · · · ·									
								- - 2 -	237 -				•	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		•	***************************************	•							
	<u>.</u>	trace cobbles / boulders		SS	4	100	80	- - -) <i>i</i>	Ö										
								- - - 3	236 -			54		0 0 0 0 0 0 0 0	, 5			•	•						
				SS	5	100	54/15	- - - -				54 15			Λ ₂	•									
								- - -				· · · · · · · · · · · · · · · · · · ·		* * * * * * * * * * * * * * * * * * *		· · · · · · · · · · · · · · · · · · ·		* * * * * * * * * * * * * * * * * * *	•						
7,,,0,,,								4 -	235 -					6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		•									
	(End of Borehole	234.4 4.7	SS	6	100	50/15	- - - -				50 O 15	· · · · · · · · · · · · · · · · · · ·	4	0		***************************************	•	•						
		LIN OI DOGING	4./									· · · · · · · · · · · · · · · · · · ·						· · · · · · · · · · · · · · · · · · ·							

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 $\stackrel{\textstyle \nabla}{=}$ No freestanding groundwater measured in open borehole on completion of drilling.

	ECORD iect Number:	OF BOREHOLI	E No	. <u>B</u>	H B	<u>9</u> C	O-0	rd.	N48				594′		<u> </u>						17	am ogged by:	e	CO
•	ject Client:	The Regional Municipal	ity of P	eel					Drilling				50 mm		lid Ste	em A	ugeri	ing				ompiled by:	SI	
	ject Name:	Geotechnical Investigati			d Drive	Class	EA Stu		Drilling				uck M				J#11	-3				eviewed by:	PE	
	ject Location:	Bovaird Drive from Lake	e Louise	e Drive									t 15, 0				mplete	ed: (Oct 1	5, 09		evision No.:		5/11/11
		at Caseley Drive, Bramp OLOGY PROFILE	ton, ON		OII SA	MPLI	NG			F	IFI D	TES	STING	;	<u> </u>	ΔR	TFS	TING	1					
Jy FIOL		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	(m)	ELEVATION (m)	Ç SP MTO Δ In	Peneti T Vane*	rationT PPT Nil	esting © Con Var	ICPT	★ Rin 2 △ pa 10	Soil Va irts per 0 20 wer Ex	Values 6 8 apour R million (00 30	10 Reading ppm) 00 40 Limit (LE	12 J 00	NSTRUMENTATION NSTALLATION	Ī	COMMEN & GRAIN S DISTRIBU	ΖE	
				sample	sample	Secove	N TAS	DEРТН (m)	ILEVA	*U			Remou		Pla	astic	-	Liqu	uid .	NSTRI	GR	(%) SA	SI	CL
▩	Geodetic Ground	Surface Elevation: 240.8 m brown Sand and Gravel FILL		S	S	<u>«</u>	S	_	<u>ш</u>	2	0 4	ο ε	0 80		. 20	0 4	0 6	0 8	0	==	un	<u> </u>	OI .	
××		some silt moist		SS	1	78	22	-		-	Ď			4	70						35	46		(19)
××			240.0					-		-														
**	tra	grey Silty Clay FILL ce sand and organic matter moist	0.8	SS	2	100	18	- - - 1	240)				_△ 25									
× × ×		HARK						-																
××		 trace rootlets						- - -		-														
***		u ace rootiets		SS	3	100	21	-	239 -	-	٥				△ ³⁵									
**************************************		brown	238.6 2.1					— 2 - -																
		trace sand and gravel hard moist		SS	4	100	31	- - -			0				∆ ¹⁰									
								- - -	238 -															
				SS	5	100	32	- 3 - -		-	Ó				0									
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1								-	237 -	-														
*/\\	, 		23 <u>6.6</u> 4.1					4 - -	•	-														
	GL1 P	trace gravel very dense wet						- Z	Z :	-														
0.~~				SS	6	100	58	} - -	236 –	-		C		4	0									
نل			235.7					- 5																
		End of Borehole	5.0																					
															•									
															•									

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 $\frac{\nabla}{2}$ Groundwater inferred or encountered during drilling on $\underline{10/15/2009}$ at a depth of: $\underline{4.4~\text{m}}$

	ECORD	OF BOREHOLE	No	. <u>B</u>	H B	<u> 10</u>	Co-	Ord	l. <u>N4</u>				=59		<u>62</u>							an Logged by:	16	C	y
	oject Number.	The Regional Municipality	of P	eel					Drilling				50 mr		lid St	em /	Διιαe	rina				Compiled by	: S	N	
	oject Olient:	Geotechnical Investigation			d Drive	Class	EA Stu	udv					uck N				ruge	illig				Reviewed by	_		_
	ject Location:	Bovaird Drive from Lake L											ct 15,				omple	ted:	Oct 1	5, 09		Revision No.		, 5/11/1	1
		at Caseley Drive, Brampto IOLOGY PROFILE	n, ON		DIL SA	MPI II	NG.	1	T		IFI I		STIN		_		TES								
Lithology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	O SF MTC Δ In ▲ F	Pene PT [O Vane* Intact Remould	tration PPT	Festing Filcon Value	DCPT ane* t	★ R 2 A p 1 A L V	Soil V arts pe ower E	d Value 6 & Zapour r million 200 : Explosive W	s Readi (ppm) 300 e Limit	ng 400	NSTRUMENTATION NSTALLATION		COMME & GRAIN : DISTRIBU (%)	SIZE UTIO	N	
♡	Geodetic Ground	Surface Elevation: 241.7 m brown	\dashv	ű	ιχ	Ř	S		<u> </u>		20 4	10	3 06	90	2	20	40	60	80	<u> </u>	GR	SA	SI		CL
		Sand and Gravel FILL trace to some silt moist		SS	1	83	34	- - -			O	• • • • • • • • •	0 0 0 0 0 0 0 0 0		,	· · · · · · · · · · · · · · · · · · ·									
燚			240.9					-	241 -	}								:							
	SILT	brown AND SAND / SILTY SAND TILL trace clay and gravel very dense moist	0.8	SS	2	100	70	- - - 1 -		-	0 0 0 0 0 0 0 0 0 0 0	• • • • • • • • • • • • • • • • • • •	0		o ₈	• • • • • • • • • • • • • • • • • • •					9	36	49		6
								-		1															
2				SS	3	100	50/15	-	240 -]		50 O 15			0 0										
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\prod	(— 2 -										<u>.</u>							
		reddish brown		SS	4	100	50/15	_				50	•		08	•									
			Ì					-		-					0										
	(-	239 -	ļ	•	: :				: : :		: :							
		brown						- - 3		ļ		::50													
				SS	5	100	50/13					50 13			9										
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								- -	238 —							:	<u></u>								
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		trace cobbles / boulders						- 2	Z : = .		•	•				•									
r			237.1	SS	6	100	50/5	- '	= .			.50 O				: :	<u>.</u>	<u>.</u>							
		End of Borehole	4.6								•	5	•			•	•								
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 $\frac{\nabla}{a}$ Groundwater inferred or encountered during drilling on $\underline{10/15/2009}$ at a depth of: $\underline{4.4 \text{ m}}$

R	ECORD	OF BOREHOLI	E No	. <u>B</u>	H B	<u> 11</u>	Co-(Ord.	<u>N4</u>	834	194 ⁻	1, I	<u> 59</u>	<u> 392</u>	<u> 27</u>								an	7	ec	O
	ject Number:	TT93042							Drilling				a 12 +										gged by:		<u>JF</u>	
Pro	ject Client:	The Regional Municipal							Drilling			_1	50 mn	n So	lid St	em A	ugeri	ng				Co	ompiled b	y:	SN	
Pro	ject Name:	Geotechnical Investigation	on for E	Bovairo	d Drive	Class	EA Stu	dy	Drilling	Mach	nine:	<u>Tı</u>	uck N	lount	ed Dr	ill						Re	eviewed b	y:	PB	
Pro	ject Location:	Bovaird Drive from Lake at Caseley Drive, Bramp	Louise	e Drive	to Pe	el/Halto	on Bou	ndary	Date S	tartec	l:	0	ct 15, (09	_ Da	te Co	mplete	ed: Oc	t 15,	09	_	Re	evision No).:	0, 5/11	/11
	LITH	IOLOGY PROFILE	1011, 01		DIL SA	MPLI	NG			F	IELD	TE	STIN	G			TES	ΓING								
Lithology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	∆ Ir ▲ F	Vane* ntact demould	PPT N ♦	ilcon Va Intact	: buld	2 Δ pa 10 Δ Lo	Soil Va arts per 00 20 ower Ex	6 8 pour R million (p 0 30	10 12 eading opm) 0 400 imit (LEL) W _L	:	INSTRUMENTATION INSTALLATION		[COMM & GRAIN DISTRIB (%	SIZ	E	
<u>=</u>	Geodetic Ground	Surface Elevation: 238.0 m		Sa	Sa	Se .	SP		ᆸ		0 4		60 8		2		0 6			ZZ T	= 3.	GR	SA	5	SI	CL
	so	grey Sand and Gravel FILL me silt, trace organic matter moist		SS	1	100	12	- - - -	- - - -	0					∕2 ¹⁵					all controllers.		with: benton	Well E 50 mm VC pipe (3.1 sand pack ite plug abo	slotte 0 m - (3.0 n	d 4.5 m) n - 4.5 m and, cap	n), ped
		trace clay some cobbles		SS	2	100	18	- - - - 1 -	237 -	(△30 △9 11				•••			wi	th flush-mo set in co	untec	I casing te.	
		grey Sitty Clay FILL trace sand and gravel trace organic matter moist	236.6 1.4	SS	3	100	9	- - - -	- - - -	0					△ ¹⁵ 0	6			•••							
		 brown						- 2 - -	236										•••							
			235.1	SS	4	100	7	- <u>-</u> - -	- - - -	0				,	^ ⁵	⁰ 29			•••							
犼	SILT	reddish brown Y CLAY / CLAYEY SILT TILL	2.9					- 3	235 —																	
	SILI	trace sand and gravel trace shale fragments hard damp		SS	5	100	71	- - - -	-				Ó		△ ¹⁵											
								- - - - - 4	234 —	-																
			233.3	SS	6	100	50/8	- - - -	- - - -	-		.50 O			Q											
		End of Borehole	4.6									8			9											

 $\frac{\nabla}{a}$ Groundwater inferred or encountered during drilling on $\underline{10/15/2009}$ at a depth of: $\underline{2.4 \text{ m}}$

RI	ECORD	OF BOREHOLE N	lo. <u>E</u>	3H E	<u> 312</u>	Co-	Ord	. <u>N4</u>	834	ŀ70	6, E	<u> 59</u>	<u>377</u>	<u>72</u>							am	e	O
Pro.	ject Number:	TT93042						Drilling	Loca	tion:	St	a 11 +	828							l	_ogged by:	JF	
	ject Client:	The Regional Municipality o	f Peel					Drilling	Meth	od:	_1	50 mn	n So	lid St	em A	ugeri	ng			(Compiled by:	SN	
	ject Name:	Geotechnical Investigation for	or Bovaii	rd Drive	Class	EA St	udy	Drilling	Mach	nine:	<u>Tr</u>	uck N	lount	ed Dr	ill					F	Reviewed by:	PB	
Pro	ject Location:	Bovaird Drive from Lake Lou at Caseley Drive, Brampton,	uise Driv ON.	e to Pe	el/Halt	on Bou	ındary	Date S	Started	l:	<u>O</u>	ct 15,	09	_ Da	te Co	mplete	ed: C	Oct 1	5, 09	. F	Revision No.:	0, 5/1	11/11
	LITH	OLOGY PROFILE	S	OIL SA	MPLI	NG			F			STIN	G	∦ Ri	LAB inse pH	TES [®]	TING	ì	z		COMMEN	ITC	
-IIIIOOGY FIOL	Goodatic Ground	DESCRIPTION Surface Elevation: 237.4 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	△ Ir ▲ R	Vane* ntact lemould	PPT Ni	lcon Va	ould a)	△ pa 10 ▲ Lo W	Soil Va arts per 00 21 ower Ex 1/ _p astic	Values 6 8 apour R million (00 30 cplosive W	teading ppm) 0 40 Limit (LE V Liqui	EL) V∟ ∎ iid	INSTRUMENTATION INSTALLATION	GR	GRAIN S DISTRIBU (%)	ZE	CL
_ XX	Geodetic Ground	brown Sand and Gravel FILL					-																
		trace to some silt moist	SS	1	100	19	- - -	237 —			•		4	700									
$\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}{\overset{x}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset$		236	3.6				-												i l				
	tra).8 SS	2	100	16	- - 1 -		0		• • • • • • • • • • • • • • • • • • •		4	v ⁰ 6	5				·				
*							- - - -	236 -	-														
**************************************	SILT	AND SAND / SILTY SAND TILL	5.6 SS 1.8	3	100	19	- - Z	Z .)				∆ ¹⁰ ¢	18								
		trace clay and gravel dense to very dense moist					2 - - -	205															
	•		SS	4	100	48	- - -	235 —			0			△ ²⁵ △12									
0		trace yellow stains					- - 3 -				• • • • • • • • • • • • • • • • • •												
H.			SS	5	100	64	- - -	234 -				Ó		△ ²⁰ 11	• • • •			• • • • •					
							- - -																
							4 - - -				- - - - - - - - - - - - - - - - - - -												
					L		F	233 -															
		grey 232 End of Borehole 2	SS 2.5	6	100	50/15	- - -		-		50 15			∆85 13									

 $\frac{\nabla}{2}$ Groundwater inferred or encountered during drilling on $\underline{10/15/2009}$ at a depth of: $\underline{1.7 \text{ m}}$

R	ECORD	OF BOREHOLE	E No	. <u>B</u>	H B	<u> 15</u>	Co-(Ord.	<u>N4</u>	834	<u> 111</u>	7, E	<u>593</u>	332	<u> 22</u>						ar	ne	?C	
Pro	ject Number:	TT93042							Drilling	Loca	tion:	Sta	a 11 +	089						L	ogged by		JF	
Pro	ject Client:	The Regional Municipal	ity of P	eel					Drilling	Meth	od:	_15	0 mm	Sol	id Ste	m Aı	ugering	1		0	Compiled I	oy:	SN	
Pro	ject Name:	Geotechnical Investigation	on for E	Bovairo	Drive	Class	EA Stu	ıdy	Drilling	Mach	nine:	Tru	ıck M	ounte	ed Dril	<u> </u>				F	Reviewed I	by: j	РВ	
Pro	ject Location:	Bovaird Drive from Lake at Caseley Drive, Bramp	Louise ton, ON	Drive I.	to Pe	el/Halto	n Bou	ndary	Date S	started	l:	<u>Oc</u>	t 28, 0	9	_ Date	e Con	npleted	Oct 2	8, 09	. F	Revision N	lo.: <u>(</u>), 5/11	<u>//11</u>
	LITH	OLOGY PROFILE		SC	IL SA	MPLI	NG			F			TING	}	L ★ Rin:		TESTI /alues	NG	Z		COMN	AENIT	c	
Lithology Plot	Geodetic Ground	DESCRIPTION Surface Elevation: 240.0 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	∆ In ▲ R	Vane* ntact emould	♦	on Var Intact Remou	ne* . uld)	2 S part 100	oil Vap	oour Rea nillion (ppr) 300 losive Lin W	ding 400 it (LEL) W _L Liquid 80	INSTRUMENTATION INSTALLATION	GR		& N SIZI BUTI(E ON	CL
$\overset{\otimes}{\otimes}$		brown Sand and Gravel FILL						_	-							:	:							
		trace to some silt moist	-	SS	1	71	31	- - - -	-		0				<u>*</u> 10 6									
		reddish brown Clayey Silt FILL trace sand, trace gravel moist	<u>239.1</u> 0.9	SS	2	100	16	- - - - 1 -	239 —	0					⁵ -10									
			-	SS	3	83	25	- - - -	-		Ó		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		\ ⁵ a.									
	trac	e to some asphaltic concrete	-					- - - 2 -	238		U				1 16									
			-	SS	4	33	30	- - - -	- - - -		0		0	2	5 4									
❈		brown	<u>237.1</u> 2.9					- 3	237 —															
		Sand and Gravel FILL trace silt and clay moist	-	SS	5	100	16	- 3 - - - -	- - - -	Ó					∆ ¹⁸ 11									
		grey	<u>236.0</u> 4.0					- - - - - 4	236 —						0 0 0 0 0 0 0									
		grey Sitty Clay FILL trace to some sand moist						- - - -	- - -						000000000000000000000000000000000000000		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
**	SILT	reddish brown Y CLAY / CLAYEY SILT TILL trace sand	235.1 4.9 234.9 5.0	SS	6	100	70	- - - - - 5	235 —	-		0 0 0 0 0 0	٥		∆ ⁵		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
_		hard End of Borehole																						

RI	ECORD	OF BOREHOLE No). <u>B</u>	H B	18	Co-	Ord.	<u>N4</u>	833	<u>354</u>	2, I	<u> 59</u>	285	<u>50</u>							am	ec	O
Pro	ject Number:	TT93042						Drilling	Loca	ition:	<u>St</u>	ta 10 -	339							[ogged by:	<u>JF</u>	
Pro	ject Client:	The Regional Municipality of P	eel					Drilling	Meth	od:	_1	50 mr	n So	lid St	em A	ugeri	ng			(Compiled by:	SN	
Pro	ject Name:	Geotechnical Investigation for E	Bovairo	d Drive	Class	EA St	udy	Drilling	Macl	nine:	Tr	ruck N	lount	ed Dr	ill					F	Reviewed by:	РВ	
Pro	ject Location:	Bovaird Drive from Lake Louise at Caseley Drive, Brampton, ON	e Drive	to Pe	el/Halte	on Bou	ındary	Date S	Started	d:	0	ct 27,	09	_ Da	te Co	mplete	ed: <u>C</u>	Oct 2	7, 09	F	Revision No.:	0, 5/11	/11
	LITH	OLOGY PROFILE		DIL SA	MPLII	NG			F	IELI) TE	STIN	G			TES [*] Values	TING	i	z				
ology Plot		DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	.EVATION(m)	△ II ▲ F	PT Vane ntact Remould	PPT N d d →	ilcon Va Intaci Remo	DCPT ane* t ould	2 △ pa 10 ▲ Lo	Soil Va arts per 00 20 ower Ex	6 8 pour R million (p 00 30	teading ppm) 00 40 Limit (LE V	EL) V _L ▶	INSTRUMENTATION INSTALLATION		GRAIN SI DISTRIBUT (%)	ZE	
⊨ ∣		Surface Elevation: 214.7 m	Sar	Sar	Rec	SP						trength (kP 60 8	a) 30	2	astic 0 4	0 6	Liqu 0 8		SS	GR	SA	SI	CL
**		brown 214.6 Sand and Gravel FILL trace to some silt moist					- - -	-															
**************************************			SS	1	100	25	 - -	214 —		Ó				Q6						33	51	(16)	
			SS	2	78	22	- - - 1 -	-		Ö				Q,									
× × ×		some gravel to gravelly		_			- - - -	-						.7									
			SS	3	100	50/15	- - -	213 -			50 15			O ₄									
**							2 	-		•													
0	t	ace gravel and trace clay trace cobbles / boulders very dense moist	SS	4	100	52/15	† - -	-			52 0 15			ô6				• • • • •					
							- - - - 3	212 -		•													
() () () () () () () () () () () () () (SS	5	100	50/15	- - -	-			50 O 15			⁹ 10									
	: 						- - - -	211 —	-														
	Į.						- - - 4	- - -	1														
	1						- - -		<u> </u>	•	•												
		209.9 End of Borehole 4.8	SS	6	100	50/8	-	210 —			50 O			Ç	20								
	Auger refusa	el on possible boulder at 4.8 m depth.								0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6											
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 $\frac{\nabla}{z}$ No freestanding groundwater measured in open borehole on completion of drilling.

RI	ECORD	OF BOREHOLE I	No. <u>B</u>	H B	<u> 19</u>	Co-(Ord.	<u>N4</u>	83 3	<u>340</u>	6, E	<u> </u>	257	<u> 72</u>						an	e	-0
	ect Number:	TT93042						Drilling				a 10 +							Lo	gged by:	<u>JF</u>	
Proj	ect Client:	The Regional Municipality	of Peel					Drilling	Meth	nod:	_1	50 mn	n Sol	lid Ste	m A	ugerin	ıg		C	ompiled by:	SN	
Proj	ect Name:	Geotechnical Investigation	for Bovairo	d Drive	Class	EA Stu	ıdy	Drilling	Mach	hine:	<u>Tr</u>	uck N	lount	ed Dri	II				R	eviewed by:	РВ	
Proj	ect Location:	Bovaird Drive from Lake Loat Caseley Drive, Brampton	ouise Drive	to Pe	el/Halto	on Bou	ndary	Date S	started	d:	<u>O</u>	ct 27,	09	_ Dat	e Cor	nplete	d: Oct 2	7, 09	R	evision No.:	0, 5/	11/11
	LITH	OLOGY PROFILE		DIL SA	MPLI	NG			F	IEL) TE	STIN	G			TEST	ING					
Lithology Plot	Geodetic Ground :	DESCRIPTION Surface Elevation: 201.3 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	∆ Ir ▲ F	PT [) Vane* ntact Remould Undrained	PPT Ni Ni Ni Ni Ni Ni Ni Ni Ni N	ilcon Va	: ould a)	△ pai 100 ▲ Lov W	Soil Value of the period of th	6 8 pour Re hillion (pr 0 300 blosive Li W	mit (LEL) W _L Liquid	INSTRUMENTATION INSTALLATION	[GR	COMME & GRAIN S DISTRIBL (%)	SIZE	CL
$\overset{\otimes}{\otimes}$		brown Sand and Gravel FILL					-			:	:						•					
		some silt moist	SS	1	100	25	- - - -	201		0	* * * * * * * * * * * * * * * * * * *			04.			•					
		reddish brown ND SAND / SILTY SAND TILL some gravel, trace clay compact to very dense moist	0.6 SS	2	100	14	- - - - 1	- - -	0	0 0 0 0 0 0 0 0 0 0 0				1 4								
							- - - -	200 -	-													
р (trace cobbles / boulders	SS	3	100	50/15	- - -	- - -	-	•	50 15			911								
0		19	98.9 SS	4	100	50/5	— 2 - -	199 —	- - -		50											
4.16		End of Borehole	2.3		100						5			:		:	•	1				
	Auger rerus:	al on possible boulder at 2.3 m depth.																				

RE	CORD	OF BOREHO	LE No	. <u>B</u>	H B	<u>C1</u>	Co-	O rd	l. <u>N</u> 4	83	<u>661</u>	7,	E59	953 ₄	<u>45</u>						am	ec	A
roje	ct Number:	TT93042							Drilling	Loca	ation:	St	a 14 -	334							Logged by:	JF	
roje	ct Client:	The Regional Munici	pality of P	eel					Drilling	Meth	od:	_1	50 mr	n So	lid St	em A	ugerir	ng			Compiled by:	SN	
roje	ct Name:	Geotechnical Investig	ation for E	Bovairo	d Drive	Class	EA St	udy	Drilling	Mac	hine:	Tr	uck N	lount	ed D	rill					Reviewed by:	РВ	
roje	ct Location:	Bovaird Drive from Lat Caseley Drive, Bra	ake Louis mpton. Of	e Drive N.	to Pe	el/Halte	on Bou	ındary	Date S	Started	d:	00	ct 13,	09	_ Da	ite Co	mplete	ed: Oct 1	3, 09	-	Revision No.:	0, 5/1	1/11_
	LITH	OLOGY PROFILE			IL SA	MPLII	NG			F	IEL) TE	STIN	G			TEST	TING	z				
Figure 99 - 101		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEРТН (m)	ELEVATION(m)	Δ II Δ F	PT [) Vane* ntact Remould Undrained	PPT Ni Ni Shear Str	Icon Va Intaci Remo	DCPT ane* t ould	2 △ pa 10 ▲ Lo V	Soil Va arts per 00 20 ower Ex V _p lastic	6 8 apour Remillion (p 00 300	eading ppm) 0 400 imit (LEL) W _L Liquid	NSTRUMENTATION NSTALLATION		COMMEN & GRAIN S DISTRIBU (%)	ZE TION	-
□ G	eodetic Ground : about 21	Surface Elevation: 252.4 m 0 mm ASPHALTIC CONCR	ETE	Š	ιχ	Ř	S		Ш	 	20 4	40 6	30 8	30	2	0 4	0 60	80	<i>≤</i> ∠	GR	SA	SI	CL
		brown Sand and Gravel FILL some silt moist	<u> 252.2</u> 0.2	SS	1	100	50/15	- - - - -	252 -	-	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	50 O 15		4	⁷ 0				·				
				SS	2	100	50/15	- - - - 1				50 15	0 0 0 0 0 0	Z	, O.								
								- - -	251 –	-	* * * * * * * * * * * * * * * * * * *	•	0 0 0 0 0										
		trace to some silt		SS	3	100	12	- - - - 2		0		· · · · · · · · · · · · · · · · · · ·	0	4	<u>^</u> 5			, , , , , , , , , , , , , , , , , , ,	٠				
് .		brown	<u>250.3</u> 2.1																				
		Sandy Silt FILL trace clay and gravel moist	2.1	SS	4	100	23	- - - -	250 —		O	· · · · · · · · · · · · · · · · · · ·	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	4	^ ⁵								
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				SS	5	89	42	- - -	249 –		•	٥		4	<u>^</u> 5								
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				SS	6	100	59	- - - 5 -				. (4	1								
								- - -	247 –														
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 $\stackrel{\textstyle \nabla}{=}$ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH BC1 Co-Ord. N4836617, E595345



Project Number: TT93042 Drilling Location: Sta 14 + 334 Logged by: JF

	LITHOLOGY PROFILE	SC	OIL SA	MPLI	NG			F	FIELI	D TE	STIN	IG		LAE	3 TE	STIN	G	,					
										etration			★ R	Rinse pl	H Value	es 8 1) 12	INSTRUMENTATION INSTALLATION		CO	MMEI &	NTS	
پ			per		ω		E	O SF				DCPT	Δр	Soil V arts pe	apour million	Read (ppm) 300	ng	ATA ON		GR	AN S	17F	
B B	DESCRIPTION	ک کو	l E	%)	/aln	Ê	NO.	MTC) Vane	N ♦	ilcon \	/ane*	1	00 2	200 xplosiv	300 e Limit	400 (LEL)	ATI		DIST	RIBU	TION	
logy		l e	l e	Ver)	ź	ΙĔ	₹	å F	Remoul	ı ě	Ren	nould	V	V _P	W	e Limit	W _L	RUI			(%)		
Lithology Plot		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	*(Undrained 20	i Shear Si 40	trength (k 60	Pa) 80	P	Plastic 20	40	60 L	iquid 80	NST	GR	S	A	SI	CL
$\overline{\mathbb{X}}$	brown Sandy Silt FILL	"	0,		0,	┢									70								
₩	Sandy Silt FILL trace day and gravel					Ţ]	:	:	:			:		:	:						
₩	moist	SS	7	100	43	-	-			Q			lo										
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911	CLAYEŸ SİLT TILL					╀	-																
Ш	trace sand and gravel very stiff to hard moist					-	-			<u>.</u>				: }									
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犐						[242 —	ļ		<u>.</u>		į	ļ				.j						
Ш	reddish brown					F	<u>-</u>	-															
						}	-]					
	trace cobbles / boulders		40	400	E0#5	<u> </u>	-	1		50_			o		:								
		SS	10	100	50/15	ļ.	-		:	50 15	:	:	Ť	:	:	:	:						
N.N.	241.4 End of Borehole 11.0					1					,			}		<u> </u>	·	1					
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	ECORD ect Number:	OF BOREHO	OLE No	. <u>B</u>	H B	C2	Co-	Orc	J. <u>N4</u> Drilling					59								ı	logged b	n	ec	O
	ect Number. ject Client:	The Regional Muni	icinality of P	ല					Drilling Drilling								tem ^	uger	inc				Logged L Compiled	-	<u>Jr</u> SN	
	ect Name:	Geotechnical Inves			1 Drive	Class	FΔ Sti	ıdv								ted D		ugei	iiig				Reviewed		PB	
	ject Location:	Bovaird Drive from	_									О.		t 13,				mnlet	ad. (Oct 13	2 00		Revision	-	0, 5/1	1/11
1 10		at Caseley Drive, B	rampton, ON	I.				i iuai y	Date	I											, 03	'	CEVISION	NO	0, 3/1	
	LITH	HOLOGY PROFILE	_	SC	DIL SA	MPLIN	NG			╀				TIN	G	★ R	LAB tinse pH	TES Values 6 8	TING	•	z		СОМ	MEN	TS	
Lithology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEРТН (m)	ELEVATION (m)	ΜΠ Δ ▲	SPT FO Va Intac Rem	ne* t ould	PPT Nilk	con Va Intact Remo	ould a)	△ p 11 ▲ L V	Soil Va arts per 00 2 ower Ex V _P	apour F million (00 3) oplosive W	Reading ppm) 00 40 Limit (LE	EL) V _L ∎id	NSTRUMENTATION NSTALLATION	GR	GRA DISTR	& IN SIZ IBUT (%)	ZE	CL
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RECORD OF BOREHOLE No. BH BC2 Co-Ord. N4836556, E595332



Project Number: TT93042 Drilling Location: Sta 14 + 273 Logged by: JF

	LITHOLOGY PROFILE	SC	DIL SA	MPLIN	lG			F	IEL) TE	STIN	G		LAB	TES	TING	;						
									Pene	tration1	esting		★ Ri 2	inse pH 4	Values 6 8	10	12	INSTRUMENTATION INSTALLATION		C	OMME	NTS	
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Plot	DESCRIPTION	ype	E E	(%)	alue	Ê	N N	МТС	Vane'	Ni	lcon Va	ane*	10	00 2	00 3	00 4	00	AEN		DIS	TRIBL	JTION	
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Lithology Plot		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)			Shear Str			PI	lastic		Liqu		VST VST,	GR		SA	SI	CL
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	End of Borehole 11.1														•								
	Note: The geodetic elevation at existing grade was not provided to AMEC.									:													
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	ECORD ect Number:	OF BOREH	OLE No	. <u>B</u>	H B	3C3	Co-	Orc	I. <u>N4</u>				E 5 9									an Logged by:	76	ec [©]
	ect Client:	The Regional Mu	nicipality of P	eel					Drilling							tem A	Auger	ing				Compiled b	y: \$	 SN
	ect Name:	Geotechnical Inve			d Drive	Class	EA Stu	udv	_						ted D		.u.go.	5				Reviewed b		РВ
	ect Location:	Bovaird Drive from	_						_				ct 14,				omplet	ed:	Oct 1	4. 09		Revision No), 5/11/11
		at Caseley Drive,	Brampton, Ol	l.				<u>,</u>	T											1, 00	_	. 101101011110		,
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Lithology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION(m)	Δ Ir ▲ F	PT [Vane* ntact Remould Undrained	PPT Ni ◇ ♦	Icon Va Intaci Remo	DCPT ane* t ould a)	△ pi 11 ▲ Li V	Soil Varts per 00 2 ower E V _P	6 8 apour F r million 200 3 explosive W	Reading (ppm) 00 4 Limit (L	g 00 EL) W _L uid	NSTRUMENTATION NSTALL ATION		& GRAIN DISTRIB (%	SIZI	E ON
_		Surface Elevation: 238.0 m 20 mm ASPHALTIC COM		o	_ o	12	o)		— _	+	20 4	10 (3 0	<u> 10</u>	2	20	40 (30 E	80		- 	<u> </u>		- OL
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		brown Sand and Gravel FILL trace silt moist		SS	1	78	29	- - - -			0	**************************************	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	4	0			**************************************				Well I 50 mm PVC pipe (7.6 with sand pack (bentonite plug abo with flush-mo	slotted m - 1 7.6 m ove sa	0.7 m) - 10.7 m), nd, capped
		brown Silty Sand FILL trace gravel moist	0.8	SS	2	83	19	- - 1 -	237 –	-				4	0				•	٠		set in co	ncrete	.
								- - - -	•	-			0 0 0 0 0 0											
	tra	ce clay and organic matt	er	SS	3	100	51	- - <u>Ş</u> - 2	Z = 236 -		· · · · · · · · · · · · · · · · · · ·	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	4	0			0 0 0 0 0 0 0 0 0	•					
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		grey Silty Clay FILL trace sand and gravel moist	2.6					- - - - - 3	235 –											, <u>Y</u>				
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		reddish brown CLAYEY SILT TILL trace sand and gravel very stiff moist	<u>232.5</u> 5.5					- - - - -		-	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0					
A div 104	C Earth & Envir ision of AMEC Ar Crockford Boulev borough, Ontario	nericas Limited	∑ Groundwa ∑ Groundwa								at a de _l .4 m	oth of:	<u>1.8 ı</u>	<u>n</u>		Cav	e in de	oth afte	er remo	oval of a	augers:	<u>4.4 m</u>		

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Explanation of Borehole Log'.

RECORD OF BOREHOLE No. BH BC3 Co-Ord. N4835573, E594358



Project Number: TT93042 Drilling Location: Sta 12 + 876 Logged by: JF

	LITHOLOGY PROFILE	S	OIL SA	MPLII	NG			F	IEL) TE	STIN	G		LAB	TES	TING							
									Pene	tration1	Гesting		★ F	Rinse pH 4	Values 6 8	10	12	INSTRUMENTATION INSTALLATION		C	OMME	NTS	
			Je.				Ξ	O SF			•			Soil Va	apour F	Reading ppm) 00 400	_	ξ×		_		CIZE	
Lithology Plot	DESCRIPTION	/pe	Sample Number	Recovery (%)	SPT 'N' Value	_	ELEVATION (m)	МТС) Vane*	. Ni	lcon Va	ane*		100 2	00 3	00 400)			DIS	RAN	JTION	
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plod		Sample Type	l du	8		DEРТН (m)	Š				rength (kP		۱,	Plastic	-0-	Liquid		STA					
三		Sa	Sa	& &	SP	30	<u> </u>	- 3	20 4	4 0 €	ξ0 E	30			4 0 €	0 80		Ξ̈́Ξ	GR		SA	SI	CL
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Ж	CLAYEY SILT TILL (continued) 231.8	SS	7	100	50/13	-	_			50 13			5										
	reddish brown 6.2 WEATHERED SHALE	1 ~	'	100	30/13	-	-			13			Î										
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司	End of Borehole 10.7	SS	10		50/0			····		0			 	:				_					
	Borehole BC-3W was advanced next to this borehole by augering and a monitoring well was installed in it.								:														
	by dagoning and a monitoring non-ride notation in it.																						
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Proj	ect Number:	TT93042							Drilling	Location:	Sta	12 + 876					Logged by:	JF
Proj	ect Client:	The Regional Municipal	ity of P	eel					Drilling	Method:	15	0 mm Sc	lid Stem A	Augerir	ng		Compiled by:	SN
Proj	ect Name:	Geotechnical Investigation	on for E	Bovair	d Drive	Class	EA St	udy	Drilling	Machine:	Tru	ck Mount	ed Drill				Reviewed by:	РВ
Proj	ect Location:	Bovaird Drive from Lake at Caseley Drive, Bramp	Louise	e Drive	to Pe	el/Halto	on Bou	ındary	Date S	Started:	<u>Oc</u>	26, 09	_ Date Co	omplete	d: Oct 2	26, 09	Revision No.:	0, 5/11/11
	LITH	OLOGY PROFILE			OIL SA	MPLI	NG			FIEL	D TES	TING		TEST	ING			
				_						etrationTe	-	★ Rinse pl-	6 8	10 12	NSTRUMENTATION NSTALLATION	COMMEN &	ITS	
<u>5</u>			be	Sample Number	(%	ne Ine		ELEVATION (m)	© SPT MTO Vane	PPT □ PPT	DCPTon Vane*	△ parts per	apour Re r million (pp 200 300	ading om) 1 400	NOT	GRAIN SI		
lology r	DESCRIPTION				le No	/ery (_ \ \ \	E) H	ATIC	△ Intact	\diamond	Intact Remould	▲ Lower Ex	xplosive Li W	mit (LEL) W _L		DISTRIBUT (%)	IION
⇒	Condetia Cround	Surface Elevation: 238.0 m		Sample Type	Samp	Recovery (%)	SPT 'N' Value	DEPTH (m)	EV		d Shear Stre 40 60		Plastic 20		Liquid 80	NST.	GR SA	SI CI
Ī	This borehole v	vas advanced next to Borehole Bo augering.	C 3 by	0,	0,		0,	_		1				10 GC				
	See	Borehole BC 3 for soil strata						-		-								
								-]	*****	•••••			• • • • • • • • • • • • • • • • • • • •		Well Deta 50 mm slot	
								-		-							PVC pipe (3.0 m with sand pack (3.0	ı - 4.6 m)
								-]		:			:		bentonite plug above with flush-mount	sand, capped ed casing
								}		-							set in concr	ete.
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 $\frac{\nabla}{z}$ No freestanding groundwater measured in open borehole on completion of drilling.

Groundwater depth observed on 17 March 2010 at a depth of: 2.7 m

R	ECORD	OF BOREH	IOLE No	. <u>B</u>	НВ	<u>C4</u>	Co-	-Orc	i. <u>N4</u>	83	<u>557</u>	'9, I	<u> 59</u> 4	438	<u>7</u>						am	ec	0
	ject Number:	TT93042							Drilling				a 12 + 8								_ Logged by:	JF	
	ject Client:	The Regional Mu	•						Drilling						d Stem	Auger	ring				Compiled by:	SN	
	ject Name:	Geotechnical Inve											uck Mo						4 00		_ Reviewed by:	PB	
Pro	ject Location:	Bovaird Drive from at Caseley Drive,	Brampton, ON	l.				ındary	Date S				t 14, 09		Date C		_		4, 09	_	Revision No.:	0, 5/11	1/11
	LITH	OLOGY PROFILI	E	SC	DIL SA	MPLI	NG			F			STING		Rinse p	H Values	TING		N O		COMME	NTS	
Lithology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	Δ Ir Δ F	PT [) Vane* ntact Remould Undrained	♦ Shear Str	© DO con Vane Intact Remoule	e* 4	Soil ' parts p 100 Lower W _P Plastic	Explosive W ————	Reading (ppm) 800 40 Limit (LE V Liqui	EL) V∟ id	NSTRUMENTATION NSTALLATION		GRAIN S DISTRIBU (%)	IZE	CL
$\stackrel{\neg}{\otimes}$		Surface Elevation: 238.0 m brown Sand and Gravel FILL	1	0)	0)	<u> </u>	0)	_	. ш	 	20 4	10 6	0 80	-	20	40	60 80	U	= 1 =		<u> </u>		
		some sitt moist	_ <u>_ 237.3</u> 0.6	SS	1	83	13	- - - -)				المراد المراد المراد المراد المراد المراد المراد المراد المراد المراد المراد المراد المراد المراد المراد المرا مناطقة المراد المراد المراد المراد المراد المراد المراد المراد المراد المراد المراد المراد المراد المراد المرا	h	Well Det 50 mm sk PVC pipe (3.0 n with sand pack (3. entonite plug above	tted n - 4.6 m) 1 m - 4.6 m	ned
		Silty Sand FILL trace to some gravel moist	0.0	SS	2	78	9	- - - - 1	237 -	0				<u>.</u>)						with flush-moun set in cond	ted casing	
				SS	3	89	38	- - -				3			5								
		grey Clayey Silt FILL trace sand	<u>235.8</u> 2.1		3	09	30	- - - 2 -	236 -														
		moist	235.1	SS	4	83	12	- - -		0					_35;				¥				
		grey Sitty Sand FILL trace clay moist to wet		SS	5	94	10	- - 3 -	235 -	0					∆ ⁴⁰					# # # #			
								- - - - - - -	234 —	-													
	SILT	reddish brown Y CLAY! CLAYEY SILT trace sand and gravel trace shale fragments hard moist	4.1 TILL					- - - -															
				SS	6	100	74	- - - 5 -	233 -				Ó		10								
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A di	EC Earth & Environision of AMEC An Crockford Bouleva	nericas Limited	∑ Groundwa	ter inferr	ed or en	ncountere	ed during	g drilling	on <u>10/14</u>	/2009 a	at a dep	oth of:	3.2 m		₽ Ca	ve in de	pth after	remo	oval of a	ugers:	3.2 m		

104 Crocktord boulevard Scarborough, Ontario Canada M1R 3C3 Tel +1(416) 751-6565 Fax +1(416) 751-7592 www.amec.com Continued on Next Page

RECORD OF BOREHOLE No. BH BC4 Co-Ord. N4835579, E594387



Project Number: TT93042 Drilling Location: Sta 12 + 899 Logged by: JF

	LITHOLOGY PROFILE	SC	OIL SA	MPLII	NG			F	IELD	TES	STIN	G		LAB	TES	TING	ì						
											esting		★ R	tinse pH	Values 6 8	10	12	INSTRUMENTATION INSTALLATION		C	ОММЕ	NTS	
			ē				Ē	O SP			•	DCPT	<u> </u>	Soil Va	apour F million (Reading	<u>;-</u>	ξz		_	&		
٦ot	DESCRIPTION	/pe	d m	%	alue	<u>-</u>	N N	мто	Vane*	Ni	lcon Va	ne*	Δ p	00 2	00 3	DD 4	00	AE S			RAN S TRIBU		
gy		l e		ēιζ	> >	드	¥	∆ Ir	ntact Remould	♦	Intact Remo	ould	▲ Li	ower Ex V _P	kplosive W	Limit (L	EL) N _L	SC N		סוס	(%)	TION	
Lithology Plot		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEРТН (m)	ELEVATION (m)	*(Undrained	Shear Str	ength (kPa	a)	P	lastic	-	Liq	. uid	STF ST/	00			OI.	OI.
Б ИИ	raddich brown	ιχ	Š	Ř	S	□		2	20 4	0 6	0 8	0	2	20 4	10 6	3 0	0	ZZ	GR		SA	SI	CL
9	reddish brown SILTY CLAY / CLAYEY SILT TILL					_	-		· · · · ·														
	trace sand and gravel trace shale fragments hard	SS	7	91	50/13	-	_			50 O 13		4	0										
\mathcal{W}	hard moist						-		:	. 13				•									
W						_	-	1															
1111						-	-	1															
						-	-		· · · · ·														
1111						-	_																
1911						- 7	231 —																
	reddish brown 7.0 WEATHERED SHALE					ļ '	-	1	:														
	WEATHER GIFTE					-	-	1															
						_	-		<u>.</u>														
						_	-	-															
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		SS	8	100	50/13	_	-	1	:	50 O 13			10	:		:							
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		SS	9	100	50/5		-		<u>.</u>	50 O 5		2	.0	· · · · ·									
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▤	227.3	_99	10	100	50/3	L		<u>.</u>	<u>:</u>	50 3	<u> </u>	<u></u>	<u>.</u>	<u>:</u>	<u> </u>	<u> </u>	<u> </u>						
	End of Borehole 10.7				00				:	3													
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RECC Project Nui		OF BOREHO	DLE No). <u>B</u>	H B	<u>8C5</u>	Co-	Orc	I. <u>N4</u> Drilling				E59		<u>17</u>							Log	am ged by:	ec	0
Project Clie	ent:	The Regional Munic	cipality of P	eel					Drilling	Met	nod:	_1	150 m	m So	lid St	em A	Auger	ing				Cor	npiled by:	SN	
Project Na	me:	Geotechnical Investi	igation for E	Bovairo	d Drive	Class	EA Stu	udy	Drilling	Mac	hine:	Ţ	ruck I	Mount	ted Dr	rill						Rev	riewed by:	РВ	
Project Loc	cation:	Boyaird Drive from	Lake Louise	e Drive	to Pe	el/Halte	on Bou	ındary	Date S	Starte	d:	<u>c</u>	Oct 15,	09	_ Da	te Co	mplet	ed:	Oct 1	5, 09	_	Rev	ision No.:	0, 5/1	1/11_
	LITH	at Caseley Drive, Br	ampton, ON		OIL SA	MPLI	NG			Π	FIELD) TE	STIN	IG		LAB	TES	TINC	3						
Lithology Plot	c Ground S	DESCRIPTION Surface Elevation: 239.3 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	O SI	Pene PT [O Vane* ntact Remould	tration PP	Testing T Nilcon V Intac Rem	DCPT ane* at	★ Ri 2 △ pa 10 ▲ Lo	Soil V Soil V arts per 00 2 ower E V _p	A Values 6 8 Apour F million 90 3 explosive W	Readin (ppm) 00 4 Limit (L	12 g Q0 EL) W,	INSTRUMENTATION INSTALLATION	GR	DI	COMMEN & GRAIN SI STRIBUT (%)	ZE	CL
	about 11 	0 mm ASPHALTIC CONC	RETE 239.2 0.1					-																	
		Sand and Gravel FILL some silt moist		SS	1	89	29	- - - - - -	239 -		0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	∆5		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
	– – – Sa	reddish brown Indy Silt / Silty Sand FILL trace clay moist	<u>238.2</u> 1.1	SS	2	100	32	- - 1 - - -	238 -		Ó	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		4	7 0		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
			<u>237.1</u> 21	SS	3	100	33	- - - - - 2			0				∆5			0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	· · · · · · · · · · · · · · · · · · ·						
		Clayey Silt FILL trace sand and gravel		SS	4	100	42	- - - - -	237 -			O		0	_5		0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
		brown CLAYEY SILT TILL trace sand and gravel hard moist	<u>236.4</u> 2.9					- 3 ^Z	Z =	- - - - -							•	0 0 0 0 0 0 0 0 0	• • • • • • • •						
		The Control of the Co		SS	5	100	36	- - - - - -	236 -			> p		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	∆10		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	**************************************						
	 Silt <i>a</i>	reddish brown ND SAND / SILTY SAND T trace day and gravel very dense moist to wet	<u>235.2</u> 4.1 1LL					- 4 - - - -	235 -			• • • • • • • • • • • • • • • • • • •					0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6							
		End of Borehole	234.4 4.9	SS	6	100	50/15	-		1		50 15			∆5		•	•							
AMEC Earth	a & Envir	onmental,	☑ Groundwa	tor info				delline	on 10/45	2000		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0				I Court	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	00000000000000000000000000000000000000	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	val of au	2000: 0				

	ECORD	OF BOREH	IOLE No). <u>B</u>	BH E	<u>8C6</u>	Co-	Orc	d. <u>N4</u>				E59		<u>74</u>							al ogged b	n	e	-0
	ject Number. ject Client:	The Regional Mu	inicinality of P	امما					Drilling				50 mr		lid St	tom /	اممالک	rina				Compiled	-	SN	
	ject Olient. ject Name:	Geotechnical Inve			d Drive	Class	FA Stı	ıdv					ruck N				lugo	nig				Reviewed	-	PB	
	ject Location:	Bovaird Drive fro								•		_	ct 14,				omple	ted:	Oct 1	4. 09		Revision I	•		11/11
	-	at Caseley Drive,	Brampton, Of	٧.		MPLII		T	1				STIN				TES			, · · ·					
Lithology Plot	LIIF	DESCRIPTION	.E	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	Ο SF MTC Δ I	Pene	tration	Testing	DCPT ane*	★ R 2 Δ p 1	Soil V arts pe 00 2 ower E	A Value 6 8 Apour la r million 200 3 Explosive W	Readin (ppm) Limit (L	12 19 100	NSTRUMENTATION NSTALLATION		GRA DISTR	& IN SI	ZE	
Litho	Geodetic Ground	Surface Elevation: 240.0 n	n	Sam	Sam	Reco	SPT	DEP	ELE				trength (kP 60 8	a) 30	P	Plastic	40		luid 80	INST	GR	SA		SI	CL
	Gravel	brown ly Sand / Sand and Gra some silt moist	vel FILL	SS	1	79	13	- - - - -				0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			<u>4</u> 5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
		brown AND SAND / SILTY SAN		SS	2	56	7	- - - 1 -	239 -	0	0 0 0 0 0 0 0 0 0				5										
	trai	ce to some clay, trace gr loose to dense moist	avel					- - - -			• • • • • • • • • • • • • • • • • • •	•				• • • • • • • • • • • • • • • • • • •		•							
				SS	3	100	32	- - - - 2	238 -		Ó	0 0 0 0 0 0 0 0			5	· · · · · · · · · · · · · · · · · · ·	•	•	•		8	38		44	10
	(SS	4	100	26	- - -			0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			∆35										
	(- § - §	237 -		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			, 35										
	(SS	5	100	10	- - - -		0	0 0 0 0 0 0 0 0 0 0 0	· · · · · · · · · · · · · · · · · · ·			Δω	- - - - - - - - - - - - - - - - - - -		· · · · · · · · · · · · · · · · · · ·							
) 			235.7					- - - 4 -	236 -	- - - - -	0 0 0 0 0 0 0 0 0 0					•				٠					
		brown GRAVELLY SAND trace to some silt very dense wet						- - -			0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0														
0.		End of Borehole	235.0 5.0	SS	6	100	73	- - - - 5	235 -		0	· · · · · · · · · · · · · · · · · · ·	0		△30	•	•	•	•						
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	EC Earth & Envi vision of AMEC A		∑ Groundwa	iter infen	red or er	ncountere	ed during	g drilling	on <u>10/14</u>	<u>/2009</u> a	at a dep	oth of:	2.9 r	<u>n</u>		Cav	e in de	pth afte	er remo	oval of aug	ers: <u>2.9</u>	<u>m</u>			

RECORD roject Number:	OF BOREHOLI	= NO). <u>B</u>	HE	<u>C/</u>	UO-	-Ord		183536 Location:		5 942 2 + 622				Logged by:	ec _{JF}
oject Client:	The Regional Municipal	ity of P	eel					Drilling	Method:	150	mm Sc	olid Stem Aug	ering		Compiled by:	SN
oject Name:	Geotechnical Investigati	on for E	Bovairo	d Drive	Class	EA Stu	udy	Drilling	Machine:	Truc	k Mount	ted Drill			Reviewed by:	РВ
oject Location:	Bovaird Drive from Lake			to Pe	el/Halto	on Bou	ındary	Date S	Started:	Oct 1	15, 09	_ Date Comp	leted: Oct 1	5, 09	Revision No.:	0, 5/11/11
LIT	at Caseley Drive, Bramp HOLOGY PROFILE	ton, Of		OII SA	MPLI	NG			FIFL) TEST	ING	LAB TE	STING	П		
	DESCRIPTION							(E) N	Pene O SPT	trationTest	ing DCPT	★ Rinse pH Valu 2 4 6 Soil Vapou Δ parts per millio 100 200	ies 8 10 12	NTATION	COMMEN & GRAIN SI	ZE
			Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEРТН (m)	ELEVATION (m)		♦ Ir ♦ R Shear Strength	temould n (kPa)	▲ Lower Explosi W _P W ■ OP	ive Limit (LEL) W _L Liquid	NSTRUMENTATION NSTALLATION	DISTRIBUT (%)	FION SI CL
Geodetic Ground	d Surface Elevation: 240.7 m 100 mm ASPHALTIC CONCRETE		0)	0)	<u> </u>	0)		ш	20	10 60	. 80	20 40	60 80	==	<u> </u>	<u> </u>
8	brown Sand and Gravel FILL	0.1					-		-							
	some silt moist						ţ		1					i l		
			SS	1	100	17	-		ď			483				
		239.9					ļ	240 -	-		:			Î		
	brown Clayey Silt FILL	0.8					1		1							
tra	ice to some sand, trace gravel moist						- - 1		-					Î		
			SS	2	100	18	-		o o			∆ ⁵ ¢ ₁₉				
		239.3					F		-					i l		
	brown CLAYEY SILT TILL	1.4					t]							
1	trace sand and gravel hard						}		-					i		
	moist		SS	3	100	34	Ĺ	239 -	0			△ ²⁵ 15				
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			SS	4	100	32	-		0			△ ¹⁶				
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1							F	237 -								
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[23 <u>6.6</u> 4.1					ļ [*]		-							
SILT	AND SAND / SILTY SAND TILL trace clay and gravel	7.1					Ė		ļ <u>.</u>							
	very dense moist to wet						-	<u> </u>	1							
							[]		ļ	<u>.</u>						
{			SS	6	100	61	Ŀ	236 -	1	Ö		∆ ¹⁵				
			33	"	100	01	-		<u> </u>							
:	End of Borehole	235.7 5.0					- 5				:					
											•					
					1		1		;	: :	;		: :	1 1		

 $\frac{\nabla}{a}$ Groundwater inferred or encountered during drilling on $\underline{10/15/2009}$ at a depth of: $\underline{4.4 \text{ m}}$

R	ECORD	OF BOREHOL	E No	. <u>B</u>	H B	<u>C8</u>	Co-	Orc	I. <u>N4</u>	83	<u>528</u>	9, I	<u> 594</u>	416	<u> 64</u>						am	e	CO
Pro	ject Number:	TT93042							Drilling	Loca	ition:	Sta	12 +	533						l	ogged by:	JF	
>rc	ject Client:	The Regional Municipa	ality of P	eel					Drilling	Meth	od:	_15	0 mm	Soli	id Ste	m Au	ugerin	ng		(Compiled by:	SN	
	ject Name:	Geotechnical Investigat	tion for E	Bovairo	d Drive	Class	EA Stu	udy	Drilling	Mach	nine:	Tre	ıck Mo	ounte	ed Dri	II				F	Reviewed by:	PB	
⊃rc	ect Location:	Bovaird Drive from Lak at Caseley Drive, Bram	ce Louise pton, ON	e Drive I.	to Pe	el/Halto	on Bou	ındary	Date S	tartec	d:	<u>Oc</u>	t 15, 0	9	Date	e Con	nplete	d: Oct 1	5, 09	. F	Revision No.:	0, 5	/11/11
	LITH	OLOGY PROFILE		SC	DIL SA	MPLI	NG			F			TING	ì	L ★ Rin 2	AB 1	TEST /alues	ING	 z		COMMEN	ITC	
Lithology Plot	Geodetic Ground §	DESCRIPTION Surface Elevation: 241.1 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEРТН (m)	ELEVATION (m)	∆ Ir ▲ F	PT [Vane* ntact Remould Undrained	♦	Do Con Van Intact Remoul ngth (kPa)	CPT e*	△ par 100 ▲ Lov W _F	Soil Vap ts per m 0 200 wer Expl	our Re nillion (pp) 300 losive Li W	ading om) 400 mit (LEL) W Liquid 80	INSTRUMENTATION INSTALLATION	GR	GRAIN S DISTRIBU (%)	ZE	CL
\bigotimes	1	brown Sand and Gravel FILL						-	241 -														
		trace to some silt moist	<u>240.5</u> 0.6	SS	1	83	34	- - - -	- - - -	-	Ó				0 5								
		trace to some gravel moist		SS	2	78	21	- - 1 -	240 —		Þ				5 ₀ 10			0					
*				SS	3	100	50/13	- - - -	- - -		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	50 O 13			,10 3								
	1	trace cobbles / boulders				100	00/10	- - - 2 -	239 —		6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	13			3			•					
				SS	4	100	5	- - - -	- - -	0	0 0 0 0 0 0 0 0 0 0 0				△40	8							
X	<u> </u>	brown	238.2 2.9						-														
		CLAY CLAYEY SILT TILL trace sand, trace gravel very stiff moist		SS	5	67	21	- - - - - - 3	238 — 238 — 7 - -		Ò				△ ³⁵ 17								
			237.0					- - - - 4	237 —		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0												
	SAN	reddish brown DY SILT / SILTY SAND TILL trace day and gravel very dense moist	4.1			400	50%-	- - -	- - - -		0 0 0 0 0 0 0 0 0 0 0 0	50 .O						•					
Ц	<u> </u>	trace cobbles / boulders End of Borehole	236.4 4.7	SS	6	100	50/15	-				15	:	\dashv	:	:	:	•					
											- 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0												

 $\frac{\nabla}{2}$ Groundwater inferred or encountered during drilling on $\underline{10/15/2009}$ at a depth of: $\underline{3.3\,\mathrm{m}}$

A

RI	ECORD	OF BOREHOLE	No	. <u>B</u>	H B	<u>C9</u>	Co-	Ord	l. <u>N4</u>	183	<u>520</u>	3, I	E 5 9	41	<u>00</u>							am	e	-0
	ject Number:	TT93042							Drilling				a 12 +									.ogged by:	JF	
	ject Client:	The Regional Municipality							Drilling						lid St		uger	ing				Compiled by:	SN	
	ject Name:	Geotechnical Investigation							Drilling						ed Dr							Reviewed by:	PB	
Pro	ject Location:	Bovaird Drive from Lake L at Caseley Drive, Brampto	ouise n, ON	Drive I.	to Pe	el/Halto	on Bou	ındary	Date S	Started	l:	<u>O</u>	t 15,	09	_ Da	te Co	mplet	ed: <u>C</u>	Oct 1	5, 09	F	Revision No.:	0, 5/	11/11
	LITH	OLOGY PROFILE		SC	IL SA	MPLI	NG			F			STIN	G	∳ R	LAB inse pH	TES Values	TING	ì	z		COMMEN	ITC	
unology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	△ In ▲ R	T [Vane* ntact demould Indrained	PPT Nii ♦ •	esting con Va Intact Remo	ould a)	△ pa 10 ▲ Lo W	Soil Va arts per 00 21 ower Ex 1/ _p astic	plosive W	Reading ppm) 00 40 Limit (LE	EL) V∟ ∎ iid	INSTRUMENTATION INSTALLATION	GR	COMMEN & GRAIN S DISTRIBU (%)	ZE	CL
፟፠	Geodetic Ground	Surface Elevation: 241.6 m brown Sand and Gravel FILL		0)	0)	ш	0)	-				0 (U G			0 -	0 (0 0	0			-		
		some silt moist	241.0 0.6	SS	1	94	27	- - - -	241 —	-	O				<u>^</u> 5									
		brown CLAYEY SILT TILL trace sand and gravel trace oxidation very stiff to hard moist	0.0	SS	2	89	24	- - - - 1		-	0			4	^ 5									
			-					- - -		- - - -														
			-	SS	3	100	67	- - - -	240 -	-			Ò	4	<u>^</u> 5									
		brown AND SILT / SANDY SILT TILL yravel, some cobbles / boulders	23 <u>9.5</u> 2.1					— 2 - -		- - - -														
		very dense moist		SS	4	100	50/15	- - -	239 -	- - - -		50 15			∆5									
				SS	5	100	50/13	- - - 3		-		50 13		4	<u>_</u> 5									
0								- - - <u> </u>		- - - -		13												
								- ⁻ - -	238 -	- - - -														
								- 4 - -																
		grey						_																
P.		Find of Domiticals	236.9	SS	6	100	50/10	<u> </u>	237 -			50 O 10												
		End of Borehole	4.7																					

 $\frac{\nabla}{\overline{z}}$ Groundwater inferred or encountered during drilling on $\underline{10/15/2009}$ at a depth of: $\underline{3.5 \text{ m}}$

	ECORD ect Number:	OF BOREHOL	E No	. <u>B</u>	H B	C10	<u>)</u> Co	-Or	d. <u>N</u>				, E5		<u>345</u>						an Logged by:	ec	0
	ect Client:	The Regional Municipa	lity of P	eel					Drilling						lid Ste	m Auc	erina				Compiled by		
	ect Name:	Geotechnical Investigat			d Drive	Class	FA Stu	ıdv							ted Dril		jornig				Reviewed by		
	ect Location:	Bovaird Drive from Lak											ct 15, (e Comp	oleted:	Oct	15. 09		Revision No.		 /11
		at Caseley Drive, Bramı	oton, ON	٧.					1										1	_		<u> </u>	
Lithology Plot	LIIF	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION(m)	O SF	Pene	tration	ilcon Va Intact	DCPT ine*	★ Rins 2 So A part 100 A Low W _P	se pH Val 4 6 oil Vapoo is per milli 200 ver Explos	ues 8 10 ur Readi on (ppm) 300 sive Limit) 12 ing 400	NSTRUMENTATION NSTATI ATION		COMME & GRAIN: DISTRIBI (%)	SIZE JTION	
Litho	Geodetic Ground	Surface Elevation: 238.1 m		Sam	San	Rec	SPT	DEP	E				tength (kPa 60 8)		Plas 20	stic 40	60 60	iquid 80	SNS	2	GR SA	SI	CL
		brown Sand and Gravel FILL trace silt moist	237.5	SS	1	78	22	- - - -	238 -		0	0 0 0 0 0 0 0 0 0			△30		0 0 0 0 0 0			المارية الموادية الم	Well Di 50 mm s PVC pipe (3. with sand pack (5	lotted 1 - 4.6 m) s.1 m - 4.6 m	
		brown Clayey Silt FILL trace sand and gravel trace organic matter moist	0.6	SS	2	78	21	- - - - 1 - -	237 —		Ò	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			△25						bentonite plug abov with flush-mou set in cor	nted casing	
				SS	3	56	16	- - - - - - - 2		- (0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			△25				Y				
			235.2	SS	4	67	12	- - - -	236	0	6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			△35								
	SILT	brown AND SAND / SANDY SILT TILL trace clay, trace gravel dense to very dense moist	2.9	SS	5	100	46	- - 3 - - -	235 -	-	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0			△50								
			233.6	00		400		- - - - - - - - -	Z 234 –	-		50											
		some cobbles / boulders End of Borehole	4.6	- 88	8	100	- OUT					1											

 $\frac{\nabla}{\overline{z}}$ Groundwater inferred or encountered during drilling on $\underline{10/15/2009}$ at a depth of: $\underline{4.1 \text{ m}}$

▼ Groundwater depth observed on <u>17 March 2010</u> at a depth of: <u>1.8 m</u>

	ECORD	OF BOREHOL	E No). <u>B</u>	H B	<u>C11</u>	<u>C</u>)-Oı	rd. <u>N</u>				, E5		<u>830</u>	<u>)</u>						a	7	ec	0)
	oject Number.	The Regional Municipa	lity of P	eel					Drilling				50 mm		lid St	em A	uaerii	na				Compiled		SN	
	oject Olient.	Geotechnical Investigati			d Drive	Class	EA Stu	ıdy					ruck M					-a				Reviewed	•	PB	
	ject Location:	Bovaird Drive from Lake	e Louis	e Drive								_	ct 15, (mplete	d: Oct	15, 0)9		Revision I	•	0, 5/11/	/11
		at Caseley Drive, Bramp IOLOGY PROFILE		٧.		MPLII							STING				TEST		Ť		- 				
Lithology Plot		DESCRIPTION Surface Elevation: 236.8 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION(m)	O SF MTC	Pene PT [O Vane' ntact Remould	tration	Testing F Illcon Vai Intact	DCPT ne* uld	★ Ri 2 △ pa 10 ▲ Lo	Soil Va Soil Va Power Exposure	Values 6 8 pour Remillion (p 00 300 plosive L W	10 12 eading pm) 0 400 imit (LEL) W _L Liquid		INSTALLATION	G	GRAI DISTRI (& N SIZ IBUT %)	Œ	CL
\bowtie		brown Sand and Gravel FILL						-		-		:							lle all						
		some silt moist		SS	1	83	27	- - - -		- - - - - -	Ó				<u>.</u>						be	50 m PVC pipe with sand pac entonite plug a	k (3.1 above s	ed 4.6 m) m - 4.6 m) and, capp), ped
		Silty Sand FILL wet		SS	2	0	31	- - - - 1	236 -	- - - - -	0				∆ 0 ₈			•				with flush- set in	mounte concre		
		brown CLAYEY SILT TILL	23 <u>5.4</u> 1.4					- -] - - -		•		• • • • •						¥i:					
	t	trace sand and gravel race rooflets and oxidation very stiff moist		SS	3	100	23	- - - - - 2	235 -		0				1 ⁰ 9 ₁₄										
	<u> </u>		23 <u>4.7</u> 2.1																						
)))		ND SAND / SANDY SILT TILL trace clay and gravel trace cobbles / boulders very dense moist to wet		SS	4	100	66	- - - -					0		10 ° 11										
ϕ								-	234 -																
) 	! ! ! !			SS	5	100	50/15	- 3 - -] 		50 15			∆°09										
								- <u>\</u> - - -	Z = 233 -										<u> </u>						
0								- 4 - -																	
) 			232.1	SS	6	100	50/15	- - -		-		50 O 15			∆ ⁰ -211										
		End of Borehole	4.7									0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0													
																		•							

 $\frac{\nabla}{2}$ Groundwater inferred or encountered during drilling on $\underline{10/15/2009}$ at a depth of: $\underline{3.5 \text{ m}}$

▼ Groundwater depth observed on <u>17 March 2010</u> at a depth of: <u>1.2 m</u>

Compiled by: SN Reviewed by: PB Revision No.: 0,5/11//11 COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
, 09 Revision No.: 0, 5/11/11
COMMENTS & LLO GRAIN SIZE
COMMENTS & GRAN SIZE
DISTRIBUTION
ISTALLI (%)
ZZ GR SA SI CL

 $\frac{\nabla}{a}$ Groundwater inferred or encountered during drilling on $\underline{10/15/2009}$ at a depth of: $\underline{4.3 \text{ m}}$

R	ECORD	OF BOREHOLE	No.	. <u>В</u>	H B	C13	Co	-Or	d. <u>N</u>	483	<u>345</u>	98.	E5	93	70 <u>5</u>)					am	e	-0
	ject Number:	TT93042							Drilling				a 11 +							l	_ogged by:	JF	
⊃ro	ject Client:	The Regional Municipality	of Pe	eel					Drilling	Meth	od:	_1	50 mm	Sol	lid Ste	em A	ugerii	ng		(Compiled by:	SN	
	ject Name:	Geotechnical Investigation							_				uck M								Reviewed by:	PB	
Pro	eject Location:	Bovaird Drive from Lake L at Caseley Drive, Brampton	ouise n, ON					ndary	Date S				t 15, 0				•	d: <u>Oct 1</u>	5, 09	. F	Revision No.:	0, 5/	11/11
	LITH	OLOGY PROFILE	_	SC	IL SA	MPLI	NG			F			STING	}	L ★ Rin	AB nse pH	TEST Values 6 8	ING	N N		COMMEN	ITS	
Lithology Plot	Geodetic Ground	DESCRIPTION Surface Elevation: 237.9 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	∆ In ▲ R *U	T [Vane* Itact emould Indrained	PPT Nii ◇ ♦	esting Con Var Intact Remou	ne* . uld)	△ pa 10 ▲ Lo W	Soil Var rts per r 0 20 wer Exp estic	pour Re nillion (p 0 300 blosive L W	eading pm) 0 400 imit (LEL) W _L Liquid	INSTRUMENTATION INSTALLATION	GR	GRAIN S DISTRIBU (%)	ΖE	CL
$\overset{\otimes}{\otimes}$		grey Silty Sand FILL						-							:			:					
		trace to some gravel moist	-	SS	1	83	22	- - - -	- - - -	-	٥				0								
	tra	ce day and organic matter		SS	2	78	17	- - 1 -	237 —	C					∆ ³⁵								
		brown Silty Clay FILL trace sand and gravel trace organic matter moist	23 <u>6.6</u> 1.4	SS	3	94	19	- - -	- - - -						△ ²⁵								
× ×	SILT/	brown ND SAND / SANDY SILT TILL	23 <u>5.8</u> 2.1					- 2 -	236	-							• • • • • • • • • • • • • • • • • • • •						
		trace clay and gravel dense to very dense moist to wet		SS	4	100	47	- - -	- - - -	-		0			∆ ²⁵			•					
	}	some cobbles / boulders						-	235 —														
			-	SS	5	100	50/15	— 3 - -	- - -			50 0 15			∆ ¹⁵								
									-					• • • • •									
								- 4 -	234 —								••••	•					
				SS	6	100	50/15	- - -	- - -	-		50											
4-14		End of Borehole	4.7			100	30/13	<u> </u>	<u>7</u>			15			000000000000000000000000000000000000000	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	000000000000000000000000000000000000000						
															6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6		000000000000000000000000000000000000000						

 $\frac{\nabla}{2}$ Groundwater inferred or encountered during drilling on $\underline{10/15/2009}$ at a depth of: $\underline{4.7 \text{ m}}$

R	ECORD	OF BOREHOLI	E No	. <u>B</u>	H B	C14	<u>l</u> Co	o-Or	d. <u>N</u>	483	<u>345</u>	49	<u>E5</u>	930	668	<u>}</u>						16	77	ec	
Pro	ject Number:	TT93042							Drilling	Loca	tion:	St	a 11 +	640							۱	_ogged b	y :	JF	
	ject Client:	The Regional Municipal							Drilling				50 mm				ugeri	ng				Compiled	-	SN	
	ject Name:	Geotechnical Investigati							Drilling				uck M									Reviewed	-	PB	
ro	ject Location:	Bovaird Drive from Lake at Caseley Drive, Bramp	e Louis oton, Ol	٧.				indary	Date S				t 15, C				•	ed: <u>O</u>	ct 15	5, 09	. !	Revision I	No.:	0, 5/1	1/11
	LITE	OLOGY PROFILE		SC	OIL SA	MPLI	NG			F		tration	STING	3	★ Ri	nse pH	TES Values 6 8	ΓΙΝG		N O		COM	MEN	TS	
imology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	∆ Ir ▲ R	T [Vane* ntact Remould Indrained	PPT Ni Ni Ni	-	ne* . uld)	△ pa 10 ▲ Lo W	Soil Va arts per 1 00 20 ower Ex 20 astic	pour R million (p 00 30 plosive l W	eading opm) 0 400 Limit (LEL) W Liquid)	INSTRUMENTATION INSTALLATION	GR	GRAI DISTRI	BUT %)		CL
❈	Geodetic Ground	Surface Elevation: 237.4 m brown Sand and Gravel FILL		0)	0)	<u> </u>	0)	-		1	20 -	(U (u a.	,	4	0 4	0 6	0 80		==					
		some silt moist	236.8	SS	1	100	22	- - -	237 —		Ó	• • • • • • • • • • • • • • • • • • •			∆ ¹⁵										
$\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}{\overset{x}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}}{\overset{x}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}$	 	grey Clayey Silt FILL	0.6					-	-																
		trace sand and gravel trace organic matter moist		SS	2	100	10	- - 1	- - -	0		•		• • • • •	△30										
								- - -	236 -		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0								• • • •						
				SS	3	100	15	- - - - 2	- - -	0		· · · · · · · · · · · · · · · · · · ·		••••	△ ⁴⁵				••••						
× ×			235.0					- - -	-										* * * *						
	SILT	brown AND SAND / SILTY SAND TILL trace clay and gravel hard moist	2.4	SS	4	100	43	- - - -	235		•	Ď			∆ ³⁵										
9								- 3	-		•														
	; 			SS	5	100	50/15	- -	-	-	• • • • • • • • • • • • • • • • • • •	50 15			∆ ¹⁵				• • • •						
þ								- - -	234		•								• • • •						
								- - - 4 -	- - -		•	•							•••						
o (<i>.</i>							- - -	233 —	-	•								• • • •						
			232.7	SS	6	100	50/15	-	-			50 15													
		End of Borehole	4.7																						

R	ECORD	OF BOREHOLE	E No). <u>B</u>	H B	C15	<u> C</u>	o-Or	d. <u>N</u>	148	<u>344</u>	<u>80.</u>	E59	936	14							am	e	CO
	ject Number:	TT93042							Drilling				11 +									ogged by:	JF	
Pro	ject Client:	The Regional Municipali							Drilling				0 mm				ugeri	ng			(Compiled by:	SN	
	oject Name:	Geotechnical Investigation							Drilling				ıck Mo									Reviewed by:	PB	
Pro	ject Location:	Bovaird Drive from Lake at Caseley Drive, Brampt	Louise ton, Of	e Drive N.	to Pe	el/Halto	on Bou	ındary	Date S	Startec	d:	<u>Oc</u>	t 15, 0	9	Dat	e Cor	mplete	ed: <u>O</u>	ct 1	5, 09	F	Revision No.:	0, 5	/11/11
	LITH	OLOGY PROFILE		SC	OIL SA	MPLI	NG			F	IELD	TES	STING	;	L ★ Rir	AB	TES [*] Values	TING		Z		00141451	ıTO	
nology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	△ Ir	T [Vane* ntact Remould	♦	esting Don Van Intact Remou	CPT	2	Soil Va rts per i 0 20 wer Ex	6 8 pour R million (p 0 30	eading opm) 0 400 Limit (LEI W	L)	INSTRUMENTATION INSTALLATION		COMMEN & GRAIN SI DISTRIBU' (%)	IZE TION	
	Geodetic Ground	Surface Elevation: 236.7 m 00 mm ASPHALTIC CONCRETE	236.6	Sa	Sa	- A	S	<u> </u>	<u> </u>				0 80		20		0 6			22	GR	SA	SI	CL
$\overset{\times}{\otimes}$		brown Sand and Gravel FILL some silt	0.1					-							3									
$\overset{\times}{\approx}$		moist		SS	1	94	33	-			0				5									
畿			236.0					-	236 -	-									• • • • •					
※		brown Clayey Silt FILL trace sand and gravel moist	0.8					_ _ 1											• • • • •					
$\overset{\otimes}{\otimes}$				SS	2	100	14	_		0					10									
***		brown	<u>235.4</u> 1.4							†	:													
		trace sand and gravel hard moist		SS	3	100	32	-	235 -	- -	0				5									
								_ 2											• • • • •					
								-							••••				• • • • •					
				SS	4	100	36	-		<u></u>	C				15				• • • • •					
								-	234 -	<u> </u>														
								- - 3			•													
				SS	5	100	51	-			•	0			∆ ³⁵	•								
								-]					••••	••••			• • • • •					
								-	233 -	<u> </u>					:				• • • • •					
			222.6					- - 4]					••••				••••					
f	SILT	brown ND SAND / SILTY SAND TILL trace clay and gravel	<u>232.6</u> 4.1					_											• • • • •					
		very dense moist						_											, ,					
 	<u> </u>		224.0	SS	6	100	50/15	-	232 -	-		50 O 15		4	₄ 15	9								
4 F		End of Borehole	231.9 4.9							1-			···					···:						
			7.0													9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
											•				•	•								
											•				•	•								

 $\frac{\nabla}{z}$ No freestanding groundwater measured in open borehole on completion of drilling.

R	ECORD	OF BOREHOLE No). <u>B</u>	BH B	C16	<u> C</u>	o-Or	d. <u>N</u>	148	34	<u>49</u>	1, E	<u>593</u>	360	<u>3</u>						am	e	CO
Pro	ject Number:	TT93042						Drilling	Loc	ation	1:	<u>Sta 1</u>	1 + 55	5						L	ogged by:	JF	
Pro	ject Client:	The Regional Municipality of F	Peel					Drilling	y Met	hod:		150	mm S	olid S	tem A	Auger	ing			0	Compiled by:	SN	
Pro	ject Name:	Geotechnical Investigation for	Bovair	d Drive	Class	EA Stu	udy	Drilling	g Mad	chine	:	Truci	K Mou	nted D	rill					F	Reviewed by:	PB	
Pro	ject Location:	Bovaird Drive from Lake Louis at Caseley Drive, Brampton, Ol	e Drive N.	e to Pe	el/Halto	on Bou	ındary	Date 9	Starte	ed:		Oct 1	5, 09	Da	ate Co	omplet	ed: (Oct 1	5, 09	F	Revision No.:	<u>0, 5</u>	/11/11
	LITH	OLOGY PROFILE	SC	OIL SA	MPLI	NG				FIEL	LD T	EST	ING			TES Values		;	z			.=-	
lology Plot		DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	▲	O Van Intact Remo	□ F ne* uld	Nilcon	DCPT Vane* tact emould	T	Soil Voarts per	6 8 apour F million 200 3 xplosive W	10 Reading (ppm) 00 40 Limit (LI	EL) N _L ●	INSTRUMENTATION INSTALLATION		COMMEN & GRAIN SI DISTRIBU' (%)	ZE	
<u>Ě</u>	Geodetic Ground	Surface Elevation: 236.8 m	San	San	Rec	SPT	DEF		Ľ	Undrain 20	ned She 40	ar Strength 60	1(kPa) 80	-		40 6	Liqu 30 8	uid 80	SSIS	GR	SA	SI	CL
	<u> </u>	about 40 mm TOPSOIL 236,7 brown 236,7 Sitty Sand FILL trace to some gravel moist	SS	1	89	16	-		- - - - -	0.			0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	△ ¹⁵	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·							
			SS	2	56	15	- - - - - 1	236 -	- - - - - -	O.				△10		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
							- - -																
		hard moist	SS	3	100	35	- - -	235 -			0			<u>^</u> 10									
							- 2 - -		-														
			SS	4	100	61	- - -	234 -				0		△20									
							- - - 3 -		-														
			SS	5	100	37	- - -		-		Q			5	•								
							- - -	233 -							•	•							
							- 4 - - -		- - - -														
							- - - -]														
1		grey	SS	6	100	36	ļ.	232 -	-		0			. .									
Ϋ́		End of Borehole 5.0					 5			•			0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		* * * * * * * * * * * * * * * * * * *	* * * * * * * * * * * * * * * * * * *							
															* * * * * * * * * * * * * * * * * * *	•	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9						

roject Number:	•	D- '					_	Location:	Sta 11 + 509		.		Logged by:	JF ON
roject Client: roject Name:	The Regional Municipality of Geotechnical Investigation for		d Drive	Class	EV 64-		_	Method: Machine:	150 mm So	olid Stem Auger	ring		Compiled by: Reviewed by:	SN PB
roject Name. roject Location							_		Oct 15, 09	_ Date Comple	ted: Oct 1	5 09	Revision No.:	0, 5/11/11
	at Caseley Drive, Brampton, C THOLOGY PROFILE	Ņ.	OIL SA			l l	Julio		TESTING	Т		, , , , , , , , , , , , , , , , , , , 	T TO VIOLOTT TO	0,0/11/11
	HOLOGY PROFILE	30	JIL SP		NG				ationTesting	★ Rinse pH Values 2 4 6 8	3	NO.	COMMEN	ITS
Condetia Crown	DESCRIPTION ad Surface Elevation: 236.3 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION(m)	© SPT □ MTO Vane* Δ Intact ▲ Remould	PPT • DCPT Nilcon Vane* Intact Remould Per Strength (kPa)	Soil Vapour I parts per million 100 200 3 Lower Explosive W Plastic	Reading (ppm) 300 400	NSTRUMENTATION NSTALLATION	& GRAIN SI DISTRIBU' (%)	
Geodetic Groun	brown Sand and Gravel FILL trace to some silt moist	ss	1	83	18	- - - -	236 —	Q		Δ5				
	Silty Clay FILL trace sand and gravel moist		2	0	22	- - - - - -	- - - -	٥		△ ²⁵				
						- - - - -	235 —							
X	trace organic matter		3	100	23	- - - - 2	- - - -	0		∆10		•		
	CLAYEY SILT TILL trace sand and gravel hard moist	SS	4	100	33	 - - - -	234 —	0		△ ²⁵				
	trace oxidation	SS	5	100	46	_ 3 _ 3 	233 —)	△30				
						- - - - - - 4	- - - -							
	grey 4: T AND SAND / SILTY SAND TILL trace clay and gravel very dense moist					- - - -	232 — -			, , , , , , , , , , , , , , , , , , ,				
	231. End of Borehole 5.6	SS	6	100	61	- - - 5	- - -		Ö	△45				
	Q.													

amec*
Logged by: JF
Compiled by: SN
Reviewed by: PB
09 Revision No.: 0, 5/11/11
z
NOUNCE COMMENTS & GRAN SIZE DISTRIBUTION (%) GR SA SI CL
GR SA SI CL

	ECORD	OF BOREHO	DLE No). <u>B</u>	H B	<u>C19</u>	<u>)</u> Co	o-Oı	rd. <u>N</u>), E5		<u>552</u>					ı	and and a second	n	ec	*
	ject Client:	The Regional Munic	ipality of P	eel					Drilling						lid Sten	n Aud	ering				Compiled t		SN	_
	ject Name:	Geotechnical Investi			d Drive	Class	EA Stu	ıdy				_			ed Drill						Reviewed I	•	PB	_
Pro	ject Location:	Bovaird Drive from			to Pe	el/Halte	on Bou	ındary	Date S	Starte	d:	<u>c</u>	Oct 15, 0)9	_ Date	Comp	leted:	Oct 1	5, 09		Revision N	0.:	0, 5/11/11	1
	LITE	at Caseley Drive, Bradon Aloud Property at Caseley Drive, Bradon	ampton, Of		DIL SA	MPLII	NG	Ι	<u> </u>	I	FIELI) TE	STING	,	LA	AB TE	STIN	G						_
Lithology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION(m)	Ο S MTC Δ	Pene PT O Vane' Intact Remould	etration PP * N	Testing T	DCPT ne* uld	★ Rinse 2 So parts 100 Lowe W _P Plast	e pH Val 4 6 oil Vapou s per milli 200 er Explos V tic	ues 8 10 Ir Readir on (ppm) 300 ive Limit (1,2 10g 400 LEL) W, 	NSTRUMENTATION NSTALLATION	GR	COMN & GRAIN DISTRIE (%	k 1 SIZ 3UT 6)	ZE ION	CL
		Surface Elevation: 236.4 m 00 mm ASPHALTIC CONCI	RETE	o)	S S	I.Y.	o	-	, ш	<u> </u>	20	40	60 80)	20	40	60	80	==	u.			Gi C	_
	L	grey Sand and Gravel FILL trace to some silt moist	_ <u></u>	SS	1	78	26	- - -	236 -	<u> </u>	0				_ 10	•								
		brown Silty Sand FILL	<u>_235.6</u> 0.8		'	70	20	- - -							3 0									
		trace clay moist		SS	2	94	20	1 - -		- - - -	0				∆2 ²⁵ 8									
				SS	3	28	17	- - -	235 -	- - - - - -		•		• • • • •	ø ₆ 35	•		•						
		· — —	<u>234.3</u> 2.1					- - - 2 -							0			•						
		Clayey Sift FILL trace sand and rootlets trace organic matter moist		SS	4	56	12	- - -	234 -	0					△ ⁶⁵ 17									
	 trac	grey Silty Sand FILL be organic matter and rootlets moist	<u>233.4</u> 3.0	ss	5	100	11	- - 3 -				•		• • • • •	∆80 ∆200									
		THOSE						- - - -	233 -															
		reddish brown CLAYEY SILT TILL	<u>232.3</u> 4.1					- 4 -																
		trace sand and gravel trace cobbles / boulders hard moist		SS	6	100	50/10	-	232 -			50 10			∆20 ∆28									
								- - - 5 - -	231 –			0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0												
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RECORD OF BOREHOLE No. BH BC19 Co-Ord. N4834399, E593552



Project Number: TT93042 Drilling Location: Sta 11 + 451 Logged by: JF

	LITHOLOGY PROFILE	SC	OIL SA	MPLIN	IG			FIELD TESTING	LAB TESTING	_	
								PenetrationTesting	★ Rinse pH Values 2 4 6 8 10 12	INSTRUMENTATION INSTALLATION	COMMENTS &
¥	DECORIDATION	ο D	Jber		<u>e</u>		Ē	O SPT □ PPT • DCPT	Soil Vapour Reading △ parts per million (ppm) 100 200 300 400	ION	GRAIN SIZE
y Pic	DESCRIPTION	Тур	Nun	% ~	Valu	Œ	힏	MTO Vane* Nilcon Vane* △ Intact	Lower Explosive Limit (LEL) W _P W U W U	IMEI	DISTRIBUTION
Lithology Plot		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)		•	TAL	(%)
Lith		San	San	Rec	SPT	J3G	ELE	*Undrained Shear Strength (kPa) 20 40 60 80	Plastic Liquid 20 40 60 80	SNI	GR SA SI CL
Ī.	230.3	SS	7	100	50/3	_	ب	50	Q		
	End of Borehole 6.1							3	3		
							230 —				
							230 —				
		1									

	ject Number:	OF BOREHOLE	_ 140	·. <u>12</u>	1110	<u></u>	<u>.</u>		Drilling				a 11 ·		<u> </u>	<u>'</u>					_ Lo	gged by:	JF	C
² ro	ject Client:	The Regional Municipali	ity of P	eel					Drilling	Met	nod:	_1	50 mr	n So	lid Ste	em A	ugeri	ng			_ Co	mpiled by:	SI	1
Pro	ject Name:	Geotechnical Investigation	on for E	Bovairo	d Drive	Class	EA Stu	udy	Drilling	Mac	hine:	<u>Tı</u>	uck N	lount	ed Dr	ill					_ Re	viewed by:	PI	3
Pro	ject Location:	Bovaird Drive from Lake at Caseley Drive, Brampt			to Pe	el/Halto	n Bou	ındary	Date S	Starte	d:	0	ct 26,	09	_ Dat	te Cor	nplete	ed: Oct	26, 09	_	Re	evision No.:	<u>0,</u>	5/11/11
	LITH	OLOGY PROFILE			DIL SA	MPLIN	NG			ļ	FIELD) TE	STIN	G				TING	7					
					ي ا				ج				Testing		★ Rin	4	6 8	10 12				COMME &	NTS	
imology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	△	O Vane* ntact Remould Undrained	♦ Shear S	ilcon Va Intaci Remo	t ould a)	▲ Lo W Pla	wer Exp	olosive I W	eading opm) 0 400 Limit (LEL) W. Liquid	NSTRUMENTATION NSTALLATION		D GR	GRAIN S DISTRIBU (%)		N
	Geodetic Ground S	Surface Elevation: 237.8 m Subout 50 mm TOPSOIL	237.8	Ŋ	S	œ	S		ш	 	20 4	0	8 06	30	. 20	0 4	0 6	0 80	1 ==	+	OK .	JA.	G	OL.
		brown Sand and Gravel FILL trace to some silt moist	. — U:1	SS	1	58	15	- - - -	- - - - -	-)		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		<u>√</u> 5									
		brown Silty Clay FILL	<u>236.7</u> 1.1	SS	2	56	8	- - 1 -	237	0					△ ³⁵									
***		trace sand and gravel very stiff moist						- - - -	- - -	-					0 0 0 0 0			0 0 0 0 0 0 0 0 0 0						
× ×			235.7	SS	3	100	22	- - - - 2	236	- - - - - -	Ö		0		∆ ²⁵									
		brown Sandy Silt FILL trace day and gravel moist	2.1	SS	4	100	26	- - -	-	- - - - - - - - -	0		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		△ ³⁵		000000000000000000000000000000000000000							
	SILT A	reddish brown ND SAND / SILTY SAND TILL	<u>234.9</u> 2.9					- - - 3	235 —									•						
		trace clay and gravel very dense moist		SS	5	67	81	- - - -	- - - -					Ď	∆ ⁴⁰									
								- - -	234 —															
								- 4 -	-				0		0 0 0 0 0									
		reddish brown WEATHERED SHALE	23 <u>3.4</u> 4.4 233.1	SS	6	100	50/10	- - -	- - -			50 O												
		End of Borehole	4.7			.50	- 00/10				• • • • • • • • • • • • • • • • • • •	10	6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0									
											0 0 0 0 0 0		6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6		9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

	ECORD ject Number:	OF BOREHOLE	No). <u>B</u>	H B	C21	Co		r d. <u>N</u> Drilling				<u>E5</u>		<u> 469</u>	<u> </u>					Logged by:)e	C
Pro	ject Client:	The Regional Municipali	ty of P	eel					Drilling				50 mn		lid Ste	em A	ugeri	ng			Compiled by:	SI	N
Pro.	ject Name:	Geotechnical Investigation	n for E	Bovair	d Drive	Class	EA Stu	ıdy	Drilling	Mac	hine:	<u>Tr</u>	uck M	lount	ed Dr	ill					Reviewed by:	PI	В
ro	ject Location:	Boyaird Drive from Lake			to Pe	el/Halto	on Bou	ındary	Date S	Starte	d:	0	ct 26, (09	_ Dat	te Cor	nplete	ed: Oct 2	6, 09	_	Revision No.:	<u>0,</u>	5/11/11
	LITH	at Caseley Drive, Brampt OLOGY PROFILE	on, Or		OIL SA	MPLIN	NG				FIELD) TE	STING	3	L	_AB	TES	ΓING					
											Pene	tration	Testing		★ Rin 2	4	6 8	10 12	NOL		COMME	NTS	3
III Ology Piot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	△ I ▲ F	O Vane* ntact Remould Undrained	l ♦ ShearSt	Icon Val Intact Remo	ne* uld a)	▲ Lo W	wer Exp	olosive L W O	eading ppm) 0 400 imit (LEL) W _L Liquid	NSTRUMENTATION NSTALLATION	GR	& GRAIN S DISTRIBU (%)		N
	Geodetic Ground S	Surface Elevation: 238.9 m bout 150 mm TOPSOIL		S	S	<u>~</u>	S	_	ш.	-	20 4	40 (<u> 80</u>	0	20	0 40	0 60) 80	22	Gr	. JA	OI .	- CL
*		brown Sand and Gravel FILL some silt moist	<u>238.7</u> 0.2	SS	1	63	4	- - -	-	1 0 · · ·				****2	<u>,</u> 0								
፠			238.2 0.7					Ė			:								Ì				
***	trace s	Sity Clay FILL and, gravel and organic matter moist	0.7	SS	2	0	7	- - - 1 -	238 -	0	0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0				∆ ¹⁰								
※		brown CLAYEY SILT TILL	<u>2</u> 37.5 1.4					- - -	-	<u> </u> 	•	· · · · · · · · · · · · · · · · · · ·			3								
		trace sand and gravel very stiff moist		SS	3	67	26	- - - - - 2	237 —		0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		∆ ¹⁵				·				
			236.7					- 1	-		<u>.</u>		: ::						ļ				
	SILT A	reddish brown ND SAND / SILTY SAND TILL trace clay and gravel	2.1					-										:					
		very dense moist		SS	4	100	50/13	-	-	1		50 13			<u>.</u> 10		•						
								- - -	236 -	ļ	•												
								— 3 -		ļ					:								
		some shale fragments		SS	5	91	50/13	-	-	1		50 13			△ ²⁰				ì				
								- - -	-	<u> </u> 													
		reddish brown	23 <u>4.9</u> 4.0					- - 4	235 -	<u> </u> 													
		WEATHERED SHALE						ţ		1						:	:	•					
								}		1					•••••		••••		1				
								-		ł		50			_ :								
		End of Borehole	234.2 4.6	SS	6	100	50/5	 	-	1		.50 5			5		••••	•	1				
	Au	ger refusal at 4.7 m depth.														•	•	•					
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RI	ECORD	OF BOREHOLE	No). <u>B</u>	H B	C22	2 Cc	o-Or	d. <u>N</u>	148	342	246	, E	593	43 ⁻	<u>7</u>					an	16	ec.)
oro]	ect Number:	TT93042							Drilling	Loc	ation:	<u>s</u>	ta 11 ·	+ 260							_ Logged by:	•	JF	_
^o ro	ject Client:	The Regional Municipalit	ty of P	eel					Drilling			_1	50 mi	m So	lid S	tem A	ugeri	ng			_ Compiled by:	: 5	SN	_
	ect Name:	Geotechnical Investigatio	n for E	Bovairo	d Drive	Class	EA St	udy	Drilling	g Mad	chine:	<u>T</u>	ruck N	lount	ted D	rill					_ Reviewed by:	: <u>I</u>	РВ	_
ro	ject Location:	Bovaird Drive from Lake at Caseley Drive, Brampto			to Pe	el/Halt	on Bou	ındary	Date S	Starte	ed:	<u>C</u>	ct 26,	09	_ D	ate Cor	mplete	ed: Oct	26, 09	_	Revision No.:	: <u>(</u>	0, 5/11/1 ⁻	<u></u>
	LITH	OLOGY PROFILE	J., J.		DIL SA	MPLI	NG				FIEL	D TE	STIN	G		LAB								
					_								Testing		2	Rinse pH	6 8	10 12	NSTRUMENTATION NSTALLATION		COMME &	:NT	S	
<u></u>		DESCRIPTION		be	mpei	(%	lue Ine		E Z	O S	SPT O Vane	* N	Γ ● Jilcon Va	DCPT	اِ ۵	SOII Va parts per i 100 20	pour R million (10 30	eading opm) 0 400	TNI A TNI NOIT		GRAIN S			
- KBC				le Ty	e N	ery (- \ - \ - \	E E	ATIO	Δ	Intact Remoul	<	Intac	t	A	Lower Ex	plosive W	Limit (LEL) W _L			DISTRIBU (%)		ON	
5				Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEРТН (m)	ELEVATION (m)		*Undraine	d Shear S	itrength (kF	Pa)		Plastic	•	Liquid	AST A		GR SA	SI		L
፟፠	Geodetic Ground	brown		0)	0)	14	0)		ш	 	20	40	60 8	80		20 4	0 6	0 80	+==	+	<u> </u>	_		_
終		Silty Sand FILL trace to some gravel moist						F]														
畿		Hos		SS	1	71	18	Ė			ġ	<u> </u>			0, ,	•			`					
$\overset{\times}{\otimes}$								-		-														
燹			238.9					t	239 -	<u> </u>	:	····		:		::								
畿		brown Clayey Silt FILL	0.7					-]														
❈		trace sand and rootlets moist		SS	2	56	12	-		- - - -	·	<u> </u>		·····	15	•								
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X		brown	238.2 1.4					-]														
ŀ	SILT	ND SAND / SILTY SAND TILL trace clay and gravel						╁	000		· į	<u> </u>												
ŀ		compact to very dense moist						F	238 -	1					△ ²⁵									
				SS	3	89	28	-			0	<u>.</u>		:	Δ									
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þ				SS	5	100	50/15	<u> </u>		1		50 O 15			<u>۱</u> ۰									
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l Ì	•			SS	6	83	50/15	F	235 -]		50 O 15			_10									
Ŀ		trace shale fragments	234.7					<u> </u>		╁	<u>.</u>	15	<u></u>	<u> </u>										
		End of Borehole	4.9																					
													:											
																			1					
											:	:						•						

	ect Number: TT93042						Drilling				a 11 + 287							Logged by:	<u>JF</u>	
	ect Client: The Regional Municipality of						Drilling				50 mm S			ugeri	ing			Compiled by:	SN	
	ect Name: Geotechnical Investigation for ect Location: Bovaird Drive from Lake Lo						Drilling				uck Mour ct 26, 09			molet	ed: Oct 2	e 00		Reviewed by: Revision No.:	PB 0, 5/1	14/44
Oje	at Caseley Drive, Brampton,	OŅ.				liluary	Date					_ [_]				1	- I	Revision No	0, 5/	11/11
T	LITHOLOGY PROFILE	S	OIL SA	MPLI	NG						STING Testing	* 2	Rinse pH	Values		NO		COMMEN	ITS	
6	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	△ In ▲ R	Vane* ntact demould	PPT N ♦	DCPTlcon Vane*Intact	<u>△</u>	Soil Va parts per 1 100 20 Lower Ex W _P Plastic	plosive W	10 12 Reading (ppm) 00 400 Limit (LEL) W Liquid (00 80	INSTRUMENTATION INSTALLATION	GR	& GRAIN SI DISTRIBU' (%)	ZE	CL
×	Geodetic Ground Surface Elevation: 239.0 m brown Sand and Gravel FILL	0)	0)	<u> </u>	0)	-			0 4		<u> </u>	1	40 4	0 0	0 qu			-		
***************************************	moist	SS	1	75	30	- - - -	-	- - - -	•			<u>\$</u> 5.								
XXX	brown SILT AND SAND / SILTY SAND TILL trace clay and gravel compact to very dense moist	8.1 0.9 SS	2	100	19	- - - 1 - - -	238 -	- - - -				∆10								
		SS	3	100	51	- - - - - - 2	237 —	-		0		Δ ³	5							
		SS	4	100	47	- - - - -	-			0		Δ25	5							
	some cobbles / boulders	SS	5	100	50/15	- - 3 -	236 -			50 O 15		<u></u> ∆10				٠				
						- - - -	- - - -	-												
						- 4 - -	235 -	-									Hard a	ugering		
	End of Borehole	4.4 4.6	6	100	50/3	_				50 3		0		• • • • •		-				

	ject Number:	OF BOREHOL			<u>.</u>	<u></u>	<u>.</u> J.		Drilling			St	a 11 +	261							Logged by:	<u>JF</u>	
Pro.	ject Client:	The Regional Municip							Drilling	Meth	nod:	_1	50 mn	n Sol	lid St	em A	ugeri	ng			Compiled by:	SN	
Proj	ject Name:	Geotechnical Investiga	ation for E	Bovair	d Drive	Class	EA Stu	udy	Drilling	Mac	hine:	<u>Tr</u>	uck M	lount	ed Dr	ill					Reviewed by:	PB	
Pro	ject Location:	Bovaird Drive from La at Caseley Drive, Bran			to Pe	el/Halto	on Bou	ındary	Date S	Started	d:	0	ct 26, (09	_ Dat	te Co	mplete	ed: Oct 2	6, 09	-	Revision No.:	0, 5	5/11/11
	LITH	OLOGY PROFILE			DIL SA	MPLI	NG			F	FIELD) TE	STING	G				TING	7				
					_				_				Testing		2	4	Values 6 8	10 12	IOIT.		COMME	NTS	
Inology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	∆ li ▲ F	O Vane* ntact Remould	♦	lcon Va Intact Remo	ne* uld	▲ Lo W	SOII Va airts per 00 20 ower Ex / _P astic	million (p 00 30 plosive l W	leading ppm) 10 400 Limit (LEL) W _L Liquid	NSTRUMENTATION NSTALLATION		GRAIN S DISTRIBU (%)		I
<u>,,,</u>	Geodetic Ground	Surface Elevation: 239.6 m bout 100 mm TOPSOIL		Sa	Sa	å	SP	8	ᆸ				60 8		2	0 4	0 6		ZZ	GF	R SA	SI	CL
		brown Gravel and Sand FILL moist	<u>239.5</u> 0.1	SS	1	63	7	- - -		- - - - -		•			<u>_</u> 5								
××××××××××××××××××××××××××××××××××××××		brown Silty Clay FILL trace sand and gravel	<u>_238.9</u> 0.7					- - -	239 -	- - -													
***		moist		SS	2	67	8	- 1 -	-	0					△15								
		brown Sandy Silt FILL trace clay moist	<u>238.2</u> 1.4					- - -	238 —			•							·				
××				SS	3	78	9	- - - - 2	-	0		•			∆ ¹⁵								
			007.0					- - -	- - -	- -		50			٥.								
X	SILT A	brown ND SAND / SILTY SAND TILL trace gravel very dense moist	<u>237.2</u> 2.4 -	SS	4	100	50/15	- - - -	237 -			50 15			△25								
		trace cobbles / boulders		SS	5	100	50/15	- - 3 -	-			50 O 15		4	∆ ⁵								
								- - -	-] - -													
933			235.6					- - -	236	ļ		· · · · · · · · · · · · · · · · · ·			•								
		reddish brown WEATHERED SHALE	<u> 200.0</u> 4.0					4 	-	-													
								-		1													
			235.0	SS	6	100	50/5		235 -		<u></u>	.50.			5			····.					
		End of Borehole	4.6									5 -											

 $\frac{\nabla}{\Xi}$ No freestanding groundwater measured in open borehole on completion of drilling.

R	ECORD	OF BOREHOLE No). <u>B</u>	BH E	3C25	5 Co	o-Or	rd. <u>N</u>	148	<u>340</u>	70	, E5	<u> 593</u>	<u> 304</u>	<u>1</u>						am	16	C
	ject Number:	TT93042						Drilling				a 11 -									Logged by:	J	
Pro	ject Client:	The Regional Municipality of P	eel					Drilling	Meth	od:	_1	50 mr	n So	lid St	tem A	uger	ing				Compiled by:	<u>s</u>	N
Pro	ject Name:	Geotechnical Investigation for E	Bovairo	d Drive	Class	EA St	udy	Drilling	Macl	nine:	<u>T</u> 1	uck N	lount	ted D	rill						Reviewed by:	<u>P</u>	В
Pro	ject Location:	Bovaird Drive from Lake Louise at Caseley Drive, Brampton, Of	e Drive	e to Pe	el/Halt	on Bou	ındary	Date S	Started	i:	0	ct 28,	09	_ Da	ate Co	mplet	ed: C	Oct 2	3, 09	-	Revision No.:	0	5/11/11
	LITH	IOLOGY PROFILE		OIL SA	MPLI	NG			F	IELD) TE	STIN	G				TING	i	z				
Lithology Plot	Goodatic Ground	DESCRIPTION Surface Elevation: 239.6 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION(m)	∆ II ▲ F	T [Vane* ntact Remould Indrained	PPT N ⇔ •	ilcon Va Intaci Remo rength (kP	t ould	2 △ pi 10 ▲ Li V	Soil Varts per 00 2 ower Ex	plosive W	10 Reading ppm) 00 40 Limit (LE	00 EL) V _L •	NSTRUMENTATION NSTALLATION	GR	COMME & GRAIN S DISTRIBU (%)	iZE	
$\overline{\otimes}$	Geodetic Ground	brown Sand and gravel FILL					-								:								
		trace silt moist	SS	1	67	30	- - - -	239 -	-	•	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	7	0	0 0 0 0 0 0 0 0 0 0 0								
			SS	2	78	18	- - - 1 -		- (•	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		4	ò									
		reddish brown 238.2 reddish brown 1.4 Silty Clay FILL trace sand, trace gravel moist	SS	3	67	13	-	238 -						0									
					o,	10	- - - 2 -		- - - - -	0 0 0 0 0 0		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0								
			SS	4	56	12	-	237 -		0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0		4	<u>,</u> 0	· · · · · · · · · · · · · · · · · · ·	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
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			SS	5	67	6	- - -		0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	4	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0							
		235.6					† - - -	236 -	 	6 6 6 6 6 6 6 6 6	• • • • • • • • • • • • • • •	6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6			• • • • • • • • • • • • • • • •	6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6							
		brown to reddish brown CLAYEY SILT TILL trace sand stiff to hard moist					4 - - -		-	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
#							Ė		1														
			SS	6	56	14	- - - -	235 -	- 0		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		4	<u>v</u> 0									
							- 5 - - -			0 0 0 0 0 0 0 0 0 0 0	- - - - - - - - - - - - - - - - - - -				- 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
							- - - -	234 -				0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0											

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 $\stackrel{\textstyle \nabla}{=}$ No freestanding groundwater measured in open borehole on completion of drilling.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Explanation of Borehole Log'.

RECORD OF BOREHOLE No. BH BC25 Co-Ord. N4834070, E593304



Project Number: TT93042 Drilling Location: Sta 11 + 039 Logged by: JF

LITHOLOG	Y PROFILE	SC	DIL SA	MPLIN	1G			FIELD TESTING	LAB TESTING			
									★ Rinse pH Values 2 4 6 8 10 12	INSTRUMENTATION	COMMEN &	TS
5 DECC	PIRTION	Φ	nber	(9)	ē		Ē		Soil Vapour Reading Description (ppm) Soil Vapour Reading Description (ppm) Soil Vapour Reading Description (ppm) Description (ppm) Soil Vapour Reading NO	GRAIN SI	ZE	
ESC.	RIPTION	Тур	Nun	۷ (%	Valu	Œ	힏	MTO Vane* Nilcon Vane* . Δ Intact ♦ Intact Δ Remould ♦ Remould	Lower Explosive Limit (LEL) W _P W W _L	- AÄF	DISTRIBUT	ION
ibolc		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEРТН (m)	ELEVATION (m)		• •	TATE TO THE	(%)	
Litho		San	San	Rec	SPT	DEF	ELE	*Undrained Shear Strength (kPa) 20 40 60 80	Plastic Liquid 20 40 60 80	SNI	GR SA	SI CL
Told DESC	ale fragments					_	_	50	\ 5	•		
lace sik	233.4	SS	7	100	50/15			50 15	7			
End of	f Borehole 6.2											
							233 —					

RI	ECORD	OF BOREHOL	E No	. <u>B</u>	H B	C26	<u>C</u>	o-Or	d. <u>N</u>	<u> 1483</u>	339	94.	E5	932	228	<u>3</u>						am	e	CO
•	ject Number:	TT93042							Drilling	Loca	tion:		a 10 +								L	ogged by:	JF	
Pro.	ject Client:	The Regional Municipal							Drilling				50 mn				uger	ing			c	Compiled by:	SN	
	ject Name:	Geotechnical Investigati							Drilling				uck N								F	Reviewed by:	PB	
Pro.	ject Location:	Bovaird Drive from Lake at Caseley Drive, Bramp			to Pe	el/Halto	on Bou	ındary	Date S	Started	l:	<u>Oc</u>	et 28,	09	_ Da	ite Co	mplet	ed: <u>O</u>	ct 28	8, 09	F	Revision No.:	0, 5	11/11
	LITH	OLOGY PROFILE		SC	IL SA	MPLI	NG			F	IEL	TES	STIN	O			TES Values	TING		z		00141451	.TO	
lology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	.EVATION (m)	∆ Ir	Vane* tact temould	♦	con Va	: ould	2 △ pa 10 ▲ Lo	Soil Va arts per 00 2 ower Ex	6 8 apour F million (00 3	10 reading ppm) 0 400 Limit (LEI W	_)	INSTRUMENTATION INSTALLATION		COMMEN & GRAIN SI DISTRIBU' (%)	ZE	
⊨	Geodetic Ground	Surface Elevation: 239.5 m		San	San	Rec	SPT	DEF	==				ength (kPa (0 8			lastic 0 4	1 0 €	Liquid 0 80		SNIS	GR	SA	SI	CL
		brown Sand and Gravel FILL moist		SS	1	75	30	- - - -	239 –		Φ				<u>5</u>									
		trace clay	- -	SS	2	100	20	- - - - 1 - -		- (ò			4	70									
	trac	ce asphaltic concrete debris	<u>-</u>	SS	3	100	30	- - - -	238	-	Ò			4	⁷ 0									
		grey Clayey Silt FILL ce sand and organic matter yellow stains moist	<u>237.4</u> 2.1	SS	4	100	18	- 2 - - - -	237 —	-	>			4	, 0		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
**		brown CLAYEY SILT TILL	<u>236.6</u> 2.9					- - - - - 3																
		trace sand hard damp	-	SS	5	100	32	- - - -	236 -		0			4	⁷ 0		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
								- - - - - 4									0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
	, ,	reddish brown						- - - -	235 —								0 0 0 0 0 0 0 0 0 0 0 0							
			234.8	SS	6	100	50/13	Ŀ				50 O 13		4	0									
*		End of Borehole	4.7																					

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 $\frac{\nabla}{z}$ No freestanding groundwater measured in open borehole on completion of drilling.

RI	ECORD	OF BOREHOLI	E No	. <u>B</u>	H B	C27	<u>7</u> Co	o-Or	d. <u>N</u>	483	339	<u>68.</u>	E5	<u> </u>	209	<u>)</u>						an	70	ec	y
•	ect Number:	TT93042							Drilling				a 10 +									ogged by:		JF	
	ect Client:	The Regional Municipal	lity of P	eel					Drilling			_15	50 mr	n So	lid St	em A	uger	ing			(Compiled by		SN	
	ect Name:	Geotechnical Investigati	on for E	Bovairo	Drive	Class	EA Stu	ıdy	Drilling	Mach	nine:	Tr	uck N	lount	ed Dı	rill					F	Reviewed by	:	PB	
Proj	ect Location:	Bovaird Drive from Lake at Caseley Drive, Bramp	e Louise oton, ON	e Drive	to Pe	el/Halte	on Bou	ındary	Date S	Started	:	<u>Oc</u>	t 28,	09	_ Da	te Co	mplet	ed: <u>C</u>	Oct 2	8, 09	F	Revision No.	:	0, 5/11/	<u>/11</u>
	LITH	OLOGY PROFILE		SC	IL SA	MPLI	NG			F	IELC	TES	STIN	G	J R	LAB	TES	TING	ì	z					
Imology Plot	On this Count	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	△ In ▲ R *U	T [Vane* Itact emould Indrained	♦ Shear Str	con Va Intact Remo	DCPT ane* buld	△ pa 10 ▲ Lo V	Soil Va arts per 00 20 ower Ex V _p lastic	plosive W	Reading ppm) 00 40 Limit (LE	EL) V∟ ∎ iid	INSTRUMENTATION INSTALLATION	GR	COMME & GRAIN S DISTRIBI (%)	SIZ	E	CL
::		Surface Elevation: 239.5 m bout 100 mm TOPSOIL	239.4	0)	0)		0)	-		- 1	0 4	U C	0 6	U		0 -	0 (0 0	0				_		
	trac	brown Sand and Gravel FILL te to some silt, trace rootlets moist	0.1	SS	1	75	8	- - -	239 —	0				Z	⁷ 0										
❈	٦ ٢	trace cobbles / boulders	238.8 0,7					ŀ		1															
		reddish brown Silty Clay FILL trace sand and gravel trace oxidation moist		SS	2	0	12	- - - 1 -		0				2	<u>,</u> 0										
▩			238.1					-																	
		reddish brown CLAYEY SILT TILL trace shale fragments hard damp	1.4	SS	3	100	38	- -	238 -	- - -	C			4	⁷ 0										
								_ _ 2 _		-															
				SS	4	100	50/15	- -	237 —	-		50 0 15		2	70										
								- -		-															
M								– 3		-		-50													
				SS	5	100	50/13	- - -		-		50 13		4	∆5										
								- -	236 -	-															
								- - - 4		-															
								- - -		-															
								_	235 -																
И		End of Borehole	234.9 4.6	SS	6	100	50/5					.50 .5			<u>,</u> 5										
		End of Boreliole	4.0																						

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 $\frac{\textstyle \frac{\textstyle \nabla}{\textstyle \Xi}}{\textstyle \Xi}$ No freestanding groundwater measured in open borehole on completion of drilling.

RI	ECORD	OF BOREHO	LE No	. <u>B</u>	H B	C28	3 Cc	-Or	d. <u>N</u>	1483	<u>339</u>	<u>31.</u>	E5	93	205	<u>5</u>						am	E	CC	9
	ject Number:	TT93042							Drilling	Loca	tion:	St	a 10 +	- 868							L	ogged by:	JI	F	_
	ject Client:	The Regional Municip	pality of P	eel					Drilling	Meth	od:	_1	50 mn	n So	lid St	em A	ugeri	ing			(Compiled by:	<u>s</u>	N	_
	ject Name:	Geotechnical Investiga	ation for E	Bovairo	d Drive	Class	EA Stu	ıdy	Drilling	Mach	nine:	Tr	uck N	lount	ed Di	rill					F	Reviewed by:	<u>P</u>	В	_
Pro	ject Location:	Bovaird Drive from La at Caseley Drive, Bran	ake Louise	e Drive N.	to Pe	el/Halte	on Bou	ndary	Date S	Started	l:	<u>O</u>	zt 28,	09	_ Da	te Co	mplet	ed: C	Oct 2	8, 09	F	Revision No.:	<u>0</u> .	, 5/11/11	_
	LITH	OLOGY PROFILE			DIL SA	MPLII	NG			F	IELC) TE	STIN	G	JL D	LAB	TES	TING	ì	z				_	
LIUODGY FIOL	Geodetic Ground	DESCRIPTION Surface Elevation: 239.0 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION(m)	△ In ▲ R	T [Vane* ntact demould Indrained	PPT Ni ♦ •	esting con Va Intact Remo ength (kPa	ould a)	△ pa 10	Soil Va arts per 00 20 ower Ex V _p lastic	plosive W	10 Reading (ppm) 00 40 Limit (LE V Liqu 80 8	EL) V _L ∎ iid	INSTRUMENTATION INSTALLATION	GR	COMMEI & GRAIN S DISTRIBU (%)	IZE		L
*	about 7	5 mm ASPHALTIC CONCRE brown	TE 238.9 0.1					-																	
$\overset{\otimes}{\otimes}$		Sand and Gravel FILL moist						-		1															
**				SS	1	100	29	- - -	•	-	0			4	0										
***								[- -	238 -	1															
$\overset{\times}{\overset{\times}{\overset{\times}{\overset{\times}{\overset{\times}{\overset{\times}{\overset{\times}{\overset{\times}$				SS	2	100	16	- 1 - - -	230 -	0				4	0										
× × ×		grey Silty Clay FILL trace sand moist	<u>237.5</u> 1.4					-		_															
%		reddish brown Y CLAY / CLAYEY SILT TILL trace shale fragments	<u>237.2</u> 1.8	SS	3	100	82	- - - 2	237 -			•		ک د ا	70										
		hard damp	<u>.</u>			100	5040	-		- - -		50			0										
				SS	4	100	50/13	-		- - -		50 O 13			7										
								- - - 3	236 -																
				SS	5	100	50/5	- - -	230			50 5		2	20										
								- - -		- - -															
								- - - - 4	235 —																
								-		- - -		•													
		End of Borehole	234.4 4.6	_SS_	6	100	50/3	-		-		50 3			<u>,</u> 5										
												~ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0													

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 $\frac{\nabla}{z}$ No freestanding groundwater measured in open borehole on completion of drilling.

RI	ECORD	OF BOREHOL	E No	. <u>B</u>	H B	C29	<u>)</u> Co	o-Or	d. <u>N</u>	483	338	<u>93.</u>	E5	93 ⁻	149	<u>)</u>						am	E	;C	9
	ject Number:	TT93042							Drilling				a 10 +									ogged by:		F	_
	ject Client:	The Regional Municipal							Drilling						lid St		uger	ing				Compiled by:	_	SN .	_
	ject Name:	Geotechnical Investigati							Drilling						ed Dr							Reviewed by:		В	_
ro	ject Location:	Bovaird Drive from Lake at Caseley Drive, Bramp	e Louise oton, ON	l.				indary	Date S				t 28,		_			ed: (8, 09	F	Revision No.:	<u>0</u>	, 5/11/11	<u></u>
	LITH	OLOGY PROFILE		SC	OIL SA	MPLI	NG			F			STIN		★ R	LAB inse pH	TES Values 6 8	TING	;	Z		COMME	NTS		
LILIOLOGY FIOL	Geodetic Ground	DESCRIPTION Surface Elevation: 237.5 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION(m)	∆ In ▲ R	Vane* tact emould	PPT Nil ♦ •	con Va Intact Remo	DCPT ane* culd a)	△ pa 10 10 M	Soil Va arts per 00 20 ower Ex V _p lastic	apour F million 00 3 oplosive W	Reading (ppm) 00 40 Limit (LI V	EL) N _L ●	INSTRUMENTATION INSTALLATION	GR	GRAIN S GRAIN S DISTRIBU (%)	iZE	E DN	iL
\otimes	Occupation Organia	brown Sand and Gravel FILL						-																	
		moist	236.9	SS	1	79	32	- - -	237 —	-	Φ.			z z	0										
$\stackrel{\leftrightarrow}{\otimes}$		dark grey Clayey Silt FILL	0.6					-]															
	trad	ce sand and organic matter moist	-	SS	2	78	14	- - 1	-	0				4	0		0 0 0 0 0 0 0 0 0								
$\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}{\overset{x}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}}{\overset{x}}{\overset{x}}}{\overset{x}}{\overset{x}$			236.1					-																	
Ĵ		reddish brown CLAYEY SILT TILL	1.4					-	236 -																
		trace shale fragments hard damp	-	SS	3	100	50/15	- - -	-	-		50 O 15		4	0		•								
								- - 2 -	-																
			-	SS	4	100	50/13	- - - -	235 —	-		50 O 13		4	0		•								
								- - - - 3	-	-							•								
1			ļ	SS	5	100	50/10	-		-		50 10		4	0		• • • • • • •								
K																									
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								4 - -																	
								F	-																
			232.9	SS	6	100	50/5	-	233 -	ļ		.50 O		2	0										
		End of Borehole	4.6	3		100	300					5					50 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6							
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 $\frac{\nabla}{z}$ No freestanding groundwater measured in open borehole on completion of drilling.

-	ect Number:	TT93042		.					Drilling				a 10 +								Logged by:	JF ON	
-	ect Client:	The Regional Municipa			- D	01	FA 04		Drilling				50 mm				ugerii	ng			Compiled by:	SN	
•	ect Name:	Geotechnical Investigati							Drilling				uck Mo								Reviewed by:	PB	
roj	ect Location:	Bovaird Drive from Lake at Caseley Drive, Bramp		Ν				ndary	Date S				t 28, 0		_ Da	ie Con	npiete	ed: Oct 2	8, 09	-	Revision No.:	0, 5/1	17/11
_	LITH	OLOGY PROFILE		SC	DIL SA	MPLI	NG			F			STING			LAB T		TING	Z		COMMEN	ITC	
					-i-				E	Ç SP		rationT) PPT	esting Di	ļ	2	4 6	8 6	10 12 eading	INSTRUMENTATION INSTALLATION		&		
<u> </u>		DESCRIPTION		ype	Sample Number	(%)	alne	£	ELEVATION (m)	мто	Vane*	Ni	con Van	- 1	△ pa	arts per n 0 200	nillion (p 0 300	eading opm) 0 400	ATIO		GRAIN SI DISTRIBU		
mology				Sample Type	ble N	Recovery (%)	SPT 'N' Value	DEPTH (m)	VAT		Remould	♦	Intact Remoul	- 1	▲ Lo W	/ _p	W	imit (LEL) W _L	IALL		(%)		
Ĭ	Geodetic Ground	Surface Elevation: 236.0 m		Sarr	Sarr	Rec	SPT	DEP	H		Indrained 9 20 4		ength (kPa) (0 80		PI 2	astic 0 40) 60	Liquid) 80	NS.	GR	SA	SI	CL
(X.)		omm ASPHALTIC CONCRETI Sand and Gravel FILL						-	_														
▩		some silt	0.1 235.7_					Ŀ	-	1													
▓		reddish brown Silty Clay FILL	0.3					-															
▩		trace sand moist	235.4	SS	1	56	10	Ŀ	-	0				4	0			:					
W	SILT	reddish brown CLAY / CLAYEY SILT TILL	0.6					-		-													
И	trac	e sand and shale fragments hard						t	-														
H		damp		- C	2		FOME	– 1	235 —	-		50 O 15			0								
Ħ				SS	2	83	50/15			1		15		أ	7	:	:						
И								-	-	-							:						
И]		50											
И				SS	3	100	50/8	-	-	-		.50. O 8		1	70								
									-														
W								-	-	-									Ì l				
H			233.9					— 2 _	234 —	1													
		grey to reddish brown WEATHERED SHALE	2.1					-	-	-					• • • • • • •		••••		Ì				
		damp		SS	4	100	50/13					50 13		4	0								
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				SS	5	100	50/8	-	200	-		-50 · · O 8		***	70				i l				
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								-				5 0											
=		End of Borehole	231.4 4.6	SS	6	100	50/3					50 3		••••	0				i				
																		•					
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 $\stackrel{\textstyle \nabla}{=}$ No freestanding groundwater measured in open borehole on completion of drilling.

	ect Number:	OF BOREHOLI	E No	. <u>B</u>	H B	IC31	<u> </u>	o-Or	d. <u>N</u> Drilling				E59		116	<u> </u>					L	am .ogged by:	e (C
ro	ject Client:	The Regional Municipal	ity of P	eel					Drilling	Metho	od:	_15	0 mm	Sol	id St	em A	luger	ing			(Compiled by:	SN	
ro	ect Name:	Geotechnical Investigati	on for E	Bovairo	d Drive	Class	EA Stu	udy	Drilling	Mach	ine:	Tr	ıck Mo	ounte	ed Dr	ill					F	Reviewed by:	PB	
ro	ject Location:	Bovaird Drive from Lake at Caseley Drive, Bramp	Louise	e Drive	to Pe	el/Halte	on Bou	ındary	Date S	started	:	00	t 28, 0	9	_ Da	te Co	mplet	ed: g	Oct 2	8, 09	F	Revision No.:	<u>0, 5</u>	/11/11
	LITH	OLOGY PROFILE	ion, or		DIL SA	MPLII	NG			F	IELD	TES	TING	;				TING	}	_ [
urology i lot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	O SPI MTO A In A Ri	Vane* tact emould ndrained \$	PPT Nil ♦ •	Don Van Intact Remou	ie* . Id	2 Δ pa 10 Δ Lo W	Soil Varts per 00 2 ower Ex 1 _p lastic	kplosive W O	Reading (ppm) 00 4 Limit (L	ĒL) W _L ⊕ uid	NSTRUMENTATION NSTALLATION	GR	COMMEN & GRAIN SI DISTRIBUT (%)	ZE	l CL
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 $\frac{\nabla}{z}$ No freestanding groundwater measured in open borehole on completion of drilling.

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 $\frac{\nabla}{z}$ No freestanding groundwater measured in open borehole on completion of drilling.

	ECORD ect Number:	OF BOREHOL TT93042	E No). <u>B</u>	H E	C33	<u>C</u>	o-Or	d. <u>N</u>				E5		<u>987</u>	<u>-</u>					1	am .ogged by:	e (C
•	ect Client:	The Regional Municipa	lity of P	Peel					Drilling	•			50 mr		lid St	em A	ugeri	ina				Compiled by:	SN	
-	ect Name:	Geotechnical Investigat			d Drive	Class	EA St	udv	-				uck N				.u.go.	5				Reviewed by:	PB	
	ect Location:	Bovaird Drive from Lak							•				ct 27,				mplet	ed: (Oct 2	7. 09		Revision No.:		/11/11
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(BOD)				Sample Type	Jple N	Recovery (%)	ž	DEРТН (m)	VAT		Remould	•	Intact Remo	ould	٧	V _p	W	·V	V _L	TALL		(%)		
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 $\frac{\nabla}{\pi}$ Groundwater inferred or encountered during drilling on $\underline{10/27/2009}$ at a depth of: $\underline{4.1~\text{m}}$

	ECORD	OF BOREHOLE	E No). <u>B</u>	H B	C34	<u>l</u> Co	o-Or		148336	89, E593 Sta 10 + 561				am Logged by:	ec®
	ject Client:	The Regional Municipal	ity of P	eel						Method:		olid Stem Auge	ering		Compiled by:	SN
	ject Name:	Geotechnical Investigation			d Drive	Class	EA Stu				Truck Moun				Reviewed by:	РВ
	ject Location:	Boyaird Drive from Lake			to Pe	el/Halto	on Bou	ındary	Date S	Started:	Oct 27, 09	Date Comple	eted: Oct 2	7, 09	Revision No.:	0, 5/11/11
	LITH	at Caseley Drive, Bramp OLOGY PROFILE	ton, ON		DIL SA	MPLI	NG	<u> </u>		FIELD	TESTING	LAB TE	STING			
Plot		DESCRIPTION			Sample Number			(E	ELEVATION(m)	Penetro	ationTesting PPT	★ Rinse pH Value	Reading 1 (ppm) 300 400	NSTRUMENTATION NSTALLATION	COMMEN & GRAIN SI DISTRIBUT	ZE
thology				Sample Type	√ eldι	Recovery (%)	SPT 'N' Value	DEРТН (m)	:VAT	△ Intact ▲ Remould	♦ Intact Remould	W _p W	W _L	TALL	(%)	
=======================================	Geodetic Ground S	Surface Elevation: 226.2 m 0 mm ASPHALTIC CONCRETE		San	San	Rec	SP	DE		*Undrained S	hear Strength (kPa) 60 80	Plastic 20 40	Liquid 60 80	NS NS	GR SA	SI CL
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	uace sa	firm moist						- - -		-			* * * * * * * * * * * * * * * * * * *			
			<u>221.9</u> 4.3					- 4 - <u>-</u>	222 – Z	-						
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11		End of Borehole	221.2 5.0					- 5	-							

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 $\frac{\nabla}{2}$ Groundwater inferred or encountered during drilling on $\underline{10/27/2009}$ at a depth of: $\underline{4.3 \, \mathrm{m}}$

RI	ECORD	OF BOREH	OLE No	. <u>B</u>	<u> </u>	C35	<u>5</u>															an	e	c [©]
Pro	ect Number:	TT93042							Drilling	Loca	tion:	Bł	BC3	5								Logged by:	JF	
Pro	ject Client:	The Regional Mur	nicipality of P	eel					Drilling	Meth	od:	_1:	50 mn	ı So	lid St	em A	ugeri	ing				Compiled by:	SN	<u> </u>
Pro	ect Name:	Geotechnical Inve	stigation for E	Bovairo	d Drive	Class	EA St	udy	Drilling	Mach	nine:	Tr	uck M	ount	ed Dr	ill						Reviewed by:	PE	3
Pro	ject Location:	Bovaird Drive from at Caseley Drive, I	n Lake Louise Brampton, ON	e Drive	to Pe	el/Halto	on Bou	ındary	Date S	Started	l:	<u>O</u>	t 27, (9	_ Da	te Co	mplet	ed: <u>O</u>	ct 27	, 09	_	Revision No.:	0,	5/11/11
	LITH	OLOGY PROFILE			DIL SA	MPLIN	NG			F	IELD) TE	STING	3		LAB	TES Values	TING		z				
Lithology Plot	Geodetic Ground	DESCRIPTION Surface Elevation: 0.0 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION(m)	∆ Ir ▲ F	T [Vane* Itact Iemould Indrained	PPT Ni ♦ •	esting Con Val Intact Remo ength (kPa	uld)	2 Δ pa 10 Δ Lo	Soil Valents per 100 20 20 20 20 20 20 20 20 20 20 20 20 2	plosive	10 1 Reading ppm) 00 400 Limit (LEL W Liquid)) d	INSTRUMENTATION INSTALLATION	G	COMME & GRAIN S DISTRIBU (%)	iZE	N
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		Sand and Gravel FILL some silt, trace clay moist		Α	1			- - - - - - 1	-1 —	-											v be	Well De 50 mm si PVC pipe (11.3 vith sand pack (11 entonite plug abow with flush-mour set in con	otted - 12.9 3 m - 1 sand, ited ca	m) (2.9 m), capped sing
	trac	 e organic matter and rootl	lets	Α	2			- - - - 2 - - - - -	-2 -2 - - - - - - - -															
			-4.0					-	-	-														
		brown to grey Clayey Silf FILL trace sand and gravel moist	4.0					- 4 - - - - -	-4 — - - -	-														
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AME	C Earth & Envir	ronmental,	∇ No freestar	ndina an	oundwate	er measi	ured in o	nen hor	ehole on	comple	ation of	drilling												

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Continued on Next Page

▼ Groundwater depth observed on <u>17 March 2010</u> at a depth of: <u>10.5 m</u>

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Explanation of Borehole Log'.

RECORD OF BOREHOLE No. BH BC35

Project Number: TT93042 Drilling Location: BH BC35 LITHOLOGY PROFILE **SOIL SAMPLING FIELD TESTING** LAB TESTING Rinse pH Values 2 4 6 8 10 12

Soil Vapour Reading parts per million (ppm) 100 200 400

Lower Explosive Limit (LEL) W. W. TRUMENTATION TALLATION **COMMENTS** 10 12 PenetrationTesting O SPT ☐ PPT ● DCPT ELEVATION (m) Sample Number **GRAIN SIZE** ithology Plot **DESCRIPTION** Sample Type Recovery (%) SPT 'N' Value MTO Vane* DISTRIBUTION DEPTH (m) △ Intact ▲ Remould (%) Liquid 80 Plastic * Undrained Shear Strength (kPa) NST NST SA SI CL 60 **6**0 brown to grey Clayey Silt FILL trace sand and gravel moist

Α 4 -8 8 5 Α 9 -9 10 -10 SS 6 56 32 0 reddish brown WEATHERED SHALE 11 -11 limestone seams damp 12 -12 100 50/5 Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Explanation of Borehole Log'. Scale: 1:32

RECORD OF BOREHOLE No. BH BC35



Project Number: TT93042 Drilling Location: BH BC35 Logged by: JF

LITHOLOGY PROFILE SOIL SAMPLING FIELD TESTING LAB TESTING	_	
PenetrationTesting * Rinse pH Values 2 4 6 8 10 12	INSTRUMENTATION INSTALLATION	COMMENTS &
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DESCRIPTION Q S S S S S S T T T T S S S S S S S S S	UME LAT	DISTRIBUTION (%)
Tall tall tall tall tall tall tall tall	STAI	
	ZZ	GR SA SI CL
-12.9 SS 8 0 50/5 0 0 5 5 5 5 6 6 6 6 6 6 6 6 6 6 6 6 6		
Auger refusal at 13.0 m depth.		



APPENDIX A LABORATORY SOIL TEST RESULTS

UNIFIED SOIL CLASSIFICATION SYSTEM



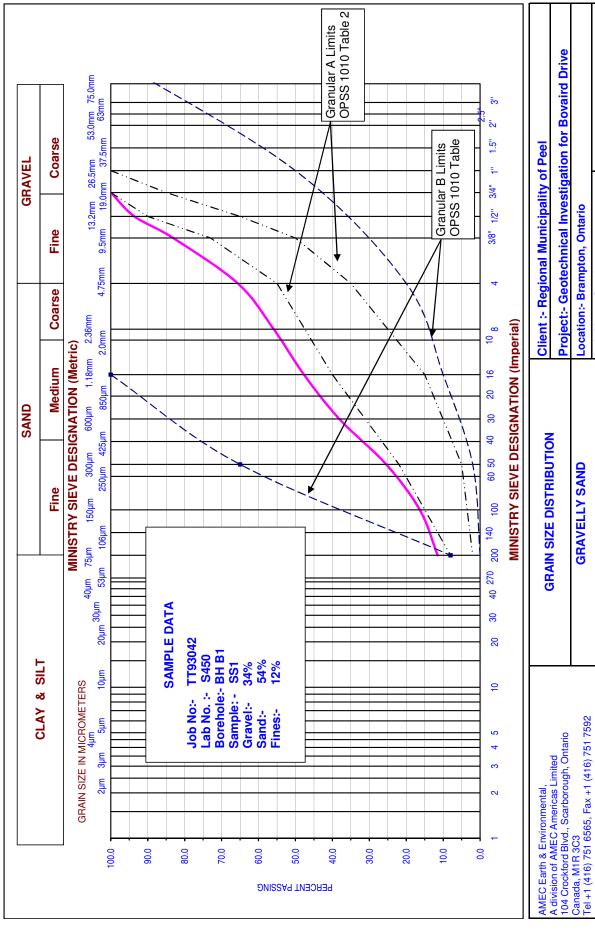


Figure No. A 1

Date :- 03 Dec 2009

-ocation:- Brampton, Ontario

GRAVELLY SAND some silt

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Lab No. :- S450

UNIFIED SOIL CLASSIFICATION SYSTEM



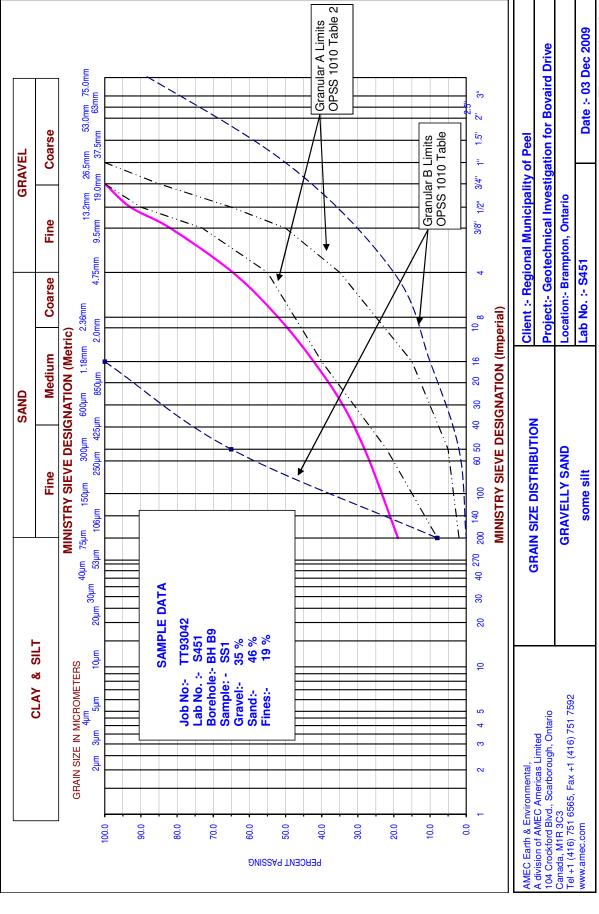


Figure No. A 2

UNIFIED SOIL CLASSIFICATION SYSTEM



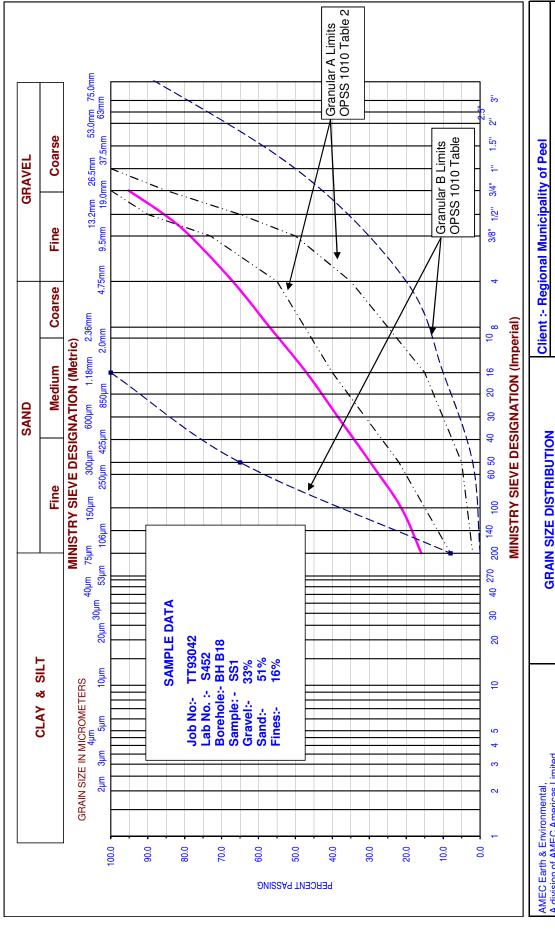


Figure No. A 3

Date :- 03 Dec 2009

Project:- Geotechnical Investigation for Bovaird Drive

-ocation:- Brampton, Ontario

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Lab No. :- S452



APPENDIX B CERTIFICATES OF ANALYSES



AMEC Earth and Environmental,

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Scarborough, Ontario M1R 3C3

Project Name:

Bovaird Dr. Class EA

TT 93042

Lab Ref.:

Sample Type: Soil

Page:

FN09-2683

Contact:

Project Number:

Siva Nadarajah

Final

Report Date: November 11, 2009

1 of 4

Received Date: November 02, 2009

CERTIFICATE OF ANALYSIS

BTEX, PHC (F1-F4)

Lab Number Sample ID Date Collected				09-16626 B1 SS4 NP	09-16626 B1 SS4 NP	09-16627 B5 SS2 NP	09-16628 B9 SS3 NP
Unit Parameters	Table 1 Agricultural or Other Property Use (µg/g)	Table 1 All Other Types of Property Uses (µg/g)	MDL (μg/g)	(µg/g)	(μg/g) (Replicate)	(µg/g)	(µg/g)
Benzene	0.002	0.002	0.001	<0.001	<0.001	<0.001	<0.001
Toluene	0.002	0.002	0.001	0.001	0.001	0.001	0.001
Ethylbenzene	0.002	0.002	0.001	0.001	0.002	<0.001	0.001
m+p-Xylene	0.000	0.000	0.001	0.004	0.005	0.001	0.003
o-Xylene	0.002	0.002	0.001	0.001	0.002	<0.001	0.001
PHC F1 (C6-C10)	N/V	N/V	10	<10	NR	<10	<10
PHC F1 less BTEX	-	-	10	<10	NR	<10	<10
PHC F2 (>C10-C16)	N/V	N/V	10	20	NR	<10	<10
PHC F3 (>C16-C34)	N/V	N/V	50	153	NR	89	<50
PHC F4 (>C34-C50)	N/V	N/V	50	<50	NR	227	<50
PHC F4G (Silica Gel)	-	-	600	NA	NA	NA	NA
BTEX Surrogate Recov	ery (%)			<u> </u>			
Dibromofluoromethane				97	95	94	95
Toluene-D8				93	92	100	91
4-Bromofluorobenzene				89	96	99	94
PHC F1 Surrogate Reco	overy (%)						
Difluorobenzene				101	NR	96	104
4-Bromofluorobenzene				96	NR	92	95
Trifluorotoluene				91	NR	82	99
PHC F2-F4 Surrogate R	ecovery (%)						
O-Terphenyl				102	NR	96	100
Moisture Content (%)		· · · · · · · · · · · · · · · · · · ·		19.8	NR	4.6	18.6

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Project Name:

Contact:

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104 Crockford Boulevard

Scarborough, Ontario M1R 3C3

Bovaird Dr. Class EA

Project Number: TT 93042

Siva Nadarajah

Report Date: November 11, 2009 Received Date: November 02, 2009

Page: 2

2 of 4

Final

Sample Type: Soil

Lab Ref.:

FN09-2683

CERTIFICATE OF ANALYSIS

BTEX, PHC (F1-F4)

Lab Number Sample ID Date Collected Unit				09-16629 B11 SS2 NP (μg/g)	09-16630 BC22 SS2 NP (μg/g)	09-16630 BC22 SS2 NP (µg/g)
Parameters	Table 1 Agricultural or Other Property Use (µg/g)	Table 1 All Other Types of Property Uses (µg/g)	MDL (µg/g)			(Replicate)
Benzene	0.002	0.002	0.001	0.004	<0.001	NR
Toluene	0.002	0.002	0.001	0.055	0.001	NR
Ethylbenzene	0.002	0.002	0.001	0.047	<0.001	NR
m+p-Xylene	0.002	0.002	0.001	0.093	0.001	NR
o-Xylene	7 0.002	0.002	0.001	0.016	<0.001	NR
PHC F1 (C6-C10)	N/V	N/V	10	<10	<10	<10
PHC F1 less BTEX	-	-	10	<10	<10	<10
PHC F2 (>C10-C16)	N/V	N/V	10	589	<10	<10
PHC F3 (>C16-C34)	N/V	N/V	50	4260	<50	<50
PHC F4 (>C34-C50)	N/V	N/V	50	695	<50	<50
PHC F4G (Silica Gel)	-	-	600	NA	NA	NA
BTEX Surrogate Recov	/ery (%)					
Dibromofluoromethane				100	96	NR
Toluene-D8				87	95	NR
4-Bromofluorobenzene				74	88	NR
PHC F1 Surrogate Rec	overy (%)					
Difluorobenzene	97	97	101			
4-Bromofluorobenzene	99	90	97			
Trifluorotoluene	94	89	97			
PHC F2-F4 Surrogate F	Recovery (%)					
O-Terphenyl .		•	-	97	71	101
Moisture Content (%)				11.5	13.5	NR

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Project Name:

Bovaird Dr. Class EA

Project Number:

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Contact:

Lab Ref.:

Sample Type: Soil

Page:

FN09-2683

Final

Report Date: November 11, 2009

3 of 4

Received Date: November 02, 2009

CERTIFICATE OF ANALYSIS

BTEX, PHC (F1-F4)

		Lab Blank	Blank Spike	Blank Spike Recovery (%)	Date of Extraction	Date of Analysis
Parameters	MDL (µg/g)	(µg/g)	(µg/g)	(70)		
Benzene	0.001	<0.001	0.131	105		
Toluene	0.001	<0.001	0.126	101	1	
Ethylbenzene	0.001	<0.001	0.123	98	03-Nov-09	05-Nov-09
m+p-Xylene	0.001	<0.001	0.246	98	1	,
o-Xylene	0.001	<0.001	0.129	103		
PHC F1 (C6-C10)	10	<10	93	93	22.11 22	
PHC F1 less BTEX	10	<10	70	92	03-Nov-09	06-Nov-09
PHC F2 (>C10-C16)	10	<10				
PHC F3 (>C16-C34)	50	<50	1050	105	03-Nov-09	07-Nov-09
PHC F4 (>C34-C50)	50	<50				
PHC F4G (Silica Gel)	600	-	-	-		
BTEX Surrogate Recove	ry (%)					water to the second sec
Dibromofluoromethane		106	103	103		
Toluene-D8		98	102	102	03-Nov-09	05-Nov-09
4-Bromofluorobenzene		106	99	99		
PHC F1 Surrogate Recov	very (%)					
Difluorobenzene		98	91	91		
4-Bromofluorobenzene		98	92	92	03-Nov-09	06-Nov-09
Trifluorotoluene		101	82	82		30
PHC F2-F4 Surrogate Re	covery (%)					
O-Terphenyl		101	117	117	03-Nov-09	07-Nov-09
Method Reference CCME, Tier 1, 2004						

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Suman Punani, C. Chem, Laboratory Manager

CHARTERED CAL/Q.C. Manager Cynthia Ridge, C. Ch**e**m.

SOCIATION OF T Suman Punani

CHEMIST

/gz



Client:	AMEC-Scarborough	Report Date:	November 11, 2009
Lab Ref:	FN09-2683	Page:	4 of 4
Sample/s average	temperature upon receipt	21.6 °C	
Reported in comp	liance to Ontario Regulation 153/04 red	quirements.	
N/V - No value der		•	
Analysis complies	with CCME PHC Tier 1 Method, 2004 a	and is validated for use in the lab	oratory.
	n descended to the baseline by C50.		
nC6 and nC10 res	ponse factors within 30% of response	factor for toluene.	
	C34 response factors within 10% of eac		
	ors within 70% of nC10 + nC16 + nC34		
Linearity is within	15%.	•	
Professional judge	ement, if requested, of what the materi	al is, based on information that is	s stated (product profiles,
retention times, pr	ofessional experience, etc.)		, ,
If F4 and F4G are i	reported, the greater of the two number	rs are to be used in application t	o guideline.
	d from PHC F2-F4.		
Extraction and ana	alysis limits for holding time were met.		
All values reported	d on dry weight basis and in ppm (µg/g) unless otherwise stated.	
	to the items tested.	,	
	~ GENER	AL COMMENTS ~	
MDL	Method Detection Limit		
ANR	Analysis not required		
NA	Analysis not applicable		
NP	Not Provided		

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NR

No Lab Replicate



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TT 93042

Received Date: November 02, 2009

Page:

1 of 3

Report Date: November 11, 2009

Sample Type: Solid/Reg.558 Leachate

Lab. Ref.:

FN09-2683

Contact:

Project Number:

Siva Nadarajah

Final

CERTIFICATE OF ANALYSIS

Ontario Regulation 558- TCLP Leachate (Benzo(a)Pyrene)

Lab Number Sample ID Date Collected Unit			09-16636 COMP-1 NP (mg/L)			
Parameter	Schedule 4 Leachate Criteria (mg/L)	MDL (mg/L)				
Benzo(a)pyrene	0.001	0.0001	<0.0001			
Surrogate Recovery (79					
Anthracene-d10	100					
Perylene-d12						



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Page:

2 of 3

Report Date: November 11, 2009

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Project Name:

Bovaird Dr. Class EA

Sample Type: Solid/Reg.558 Leachate

Project Number:

TT 93042

Lab. Ref.:

FN09-2683

Contact:

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CERTIFICATE OF ANALYSIS

Ontario Regulation 558- TCLP Leachate (Benzo(a)Pyrene)

		Leachate Blank (mg/L)	Blank Spike (mg/L)	Blank Spike Recovery (%)
Parameter	MDL (mg/L)			
Benzo(a)pyrene	0.0001	<0.0001	0.0018	92
Surrogate Recovery	(%)			
Naphthalene-d8		100	75	75
Anthracene-d10		102	101	101
Perylene-d12		97	100	100
Date of Extraction			04-Nov-09	
Date of Analysis		04-Nov-09		
Method References APHA 6410 B, 6440			10 B	

Analyst: S. Lam, C. Chem.

Suman Punani, C. Chem. Laboratory Manager

Cynthia Ridge, C. Chem. Q.A./Q.C. Manager

/gz

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Suman Punani



Client:	AMEC-Scarborough	Report Date:	November 11, 2009
Lab Ref:	FN09-2683	Page:	3 of 3
Samples averag	e temperature upon receipt	21.6 °C	
Reported in con	npliance to Ontario Regulation 558 - TCl	P Leachate requirements.	-
11	ted in ppm (mg/L) unless otherwise stat	ed.	
	~ GENERA	L COMMENTS ~	
MDL	Method Detection Limit		
ANR	Analysis not required		
NA	Analysis not applicable		
NP	Not Provided		
NR	No Lab Replicate		

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Project Name:

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Project Number:

TT 93042

Contact:

Siva Nadarajsh

Report Date: November 11, 2009

Received Date: November 02, 2009

Page:

1 of 3

Sample Type: Solid/Reg.558 Leachate

Lab. Ref.:

FN09-2683

Final

CERTIFICATE OF ANALYSIS

Ontario Regulation 558 - TCLP Leachate (Inorganics)

Lab Number Sample ID Date Collected Unit		iaco (iiioi gaii	09-16636 COMP-1 NP (mg/L)
Parameters	Schedule 4 Leachate Criteria (mg/L)	MDL · (mg/L)	
Arsenic	2.5	0.005	<0.005
Barium	100	0.001	0.354
Boron	500	0.02	0.04
Cadmium	0.5	0.0005	0.0014
Chromium	5	0.001	<0.001
Cyanide (Total)	20	0.2	<0.2
Fluoride	150	5	<5
Lead	5	0.002	<0.002
Mercury	0.1	0.0001	<0.0001
Nitrate as N	1000	0.1	<0.1
Nitrite as N	7 1000 [0.1	<0.1
Selenium	1	0.005	<0.005
Silver	5	0.001	<0.001
Uranium	10	0.01	<0.01
		•	
Initial pH	9.60		
Final pH	5.93		
TCLP Solution			2

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Project Name:

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Project Number:

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Siva Nadarajsh

Report Date: November 11, 2009

Received Date: November 02, 2009

Page:

2 of 3

Sample Type: Solid/Reg.558 Leachate

Lab. Ref.:

FN09-2683

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CERTIFICATE OF ANALYSIS

Ontario Regulation 558 - TCLP Leachate (Inorganics)

		Lab Blank (mg/L)	Q.C. Standard Actual (mg/L)	Q.C. Standard Expected (mg/L)	Date of Analysis	Method References
Parameters	MDL (mg/L)					
Arsenic	0.005	<0.005	0.006	0.006	03-Nov-09	Method 1311 / SM 3114 C
Barium	0.001	<0.001	0.531	0.500	06-Nov-09	Method 1311 / SM 3120
Boron	0.02	<0.02	0.96	1.00	06-Nov-09	Method 1311 / SM 3120
Cadmium	0.0005	<0.0005	0.476	0.500	06-Nov-09	Method 1311 / SM 3120
Chromium	0.001	<0.001	0.489	0.500	06-Nov-09	Method 1311 / SM 3120
Cyanide (Total)	0.2	<0.2	3.8	4.0	09-Nov-09	Method 1311/SM 4500 CN, C, E
Fluoride	5	<5	89	100	06-Nov-09	Method 1311 / SM 4110 C
Lead	0.002	<0.002	0.977	1.00	06-Nov-09	Method 1311 / SM 3120
Mercury	0.0001	<0.0001	0.0002	0.0002	05-Nov-09	Method 1311 / SM 3112 B
Nitrate as N	0.1	<0.1	4.2	4.2	06-Nov-09	Method 1311 / SM 4110 C
Nitrite as N	0.1	<0.1	0.5	0.5	06-Nov-09	Method 1311 / SM 4110 C
Selenium	0.005	<0.005	0.006	0.006	03-Nov-09	Method 1311 / SM 3114 C
Silver	0.001	<0.001	0.978	1.00	06-Nov-09	Method 1311 / SM 3120
Uranium	0.01	<0.01	0.97	1.00	06-Nov-09	Method 1311 / SM 3120
Initial pH					02-Nov-09	
Final pH					03-Nov-09	

Suman Punani, C. Chem. Laboratory Manager

Suman Punani

Cynthia Ridge, C. Chem Q.A/Q.C Manager

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Lab Ref:	FN09-2683	Page:	3 of 3
Samples average	e temperature upon receipt	21.6 °C	
Reported in com	pliance to Ontario Regulation 558 - TCI	P Leachate requirements.	
	ed in ppm (mg/L) unless otherwise stately to the items tested.	ed.	
	~ G	ENERAL COMMENTS ~	
MDL	Method Detection Limit		
ANR	Analysis not required		
NA	Analysis not applicable		
NP	Not Provided		
NR	No Lab Replicate		
L			

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Project Name:

Bovaird Dr. Class EA

Project Number:

TT 93042

Contact:

Siva Nadarajah

Report Date: November 11, 2009

Received Date: November 02, 2009

Page:

1 of 6

Sample Type:

Soil

Lab. Ref.:

FN09-2683

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CERTIFICATE OF ANALYSIS

Ontario Regulation 153/04 (Inorganics)

Lab Number Sample ID Date Collected					09-16631 B5 SS3 NP	09-16631 B5 SS3 NP	09-16632 BC4 SS4 NP
General Chemistry	Table 1 Agricultural or Other Property Use	Table 1 All Other Types of Property Uses	Unit	MDL		(Replicate)	
Conductivity	0.47	0.57	(mS/cm)	0.01	1.31	NR	1.37
рН	-	-	-	-	7.6	NR	8.2
SAR	1.0	2.4	-	-	10.4	10.3	13.7
Metals							
Antimony	1.0	1.0	(µg/g)	0.5	0.8	NR	<0.5
Arsenic	14	17	(µg/g)	0.5	1.1	NR	0.8
Barium	190	210	(µg/g)	0.5	87.1	NR	19.9
Beryllium	1.2	1.2	(µg/g)	0.2	0.8	NR	<0.2
Cadmium	1.0	1.0	(µg/g)	0.5	0.7	NR	<0.5
Chromium	67	71	(µg/g)	1	23	NR	6
Cobalt	19	21	(µg/g)	1	9	NR	3
Copper	56	85	(µg/g)	1	27	NR	14
Lead	55	120	(µg/g)	5	14	NR	6
Mercury	0.16	0.23	(µg/g)	0.05	< 0.05	NR	<0.05
Molybdenum	2.5	2.5	(µg/g)	2	<2	NR	<2
Nickel	43	43	(µg/g)	5	19	NR	6
Selenium	1.4	1.9	(µg/g)	0.1	0.2	NR	0.1
Silver	0.35	0.42	(µg/g)	0.25	<0.25	NR	<0.25
Thallium	2.5	2.5	(µg/g)	0.5	<0.5	NR	<0.5
Vanadium	91	91	(µg/g)	5	29	NR	11
Zinc	150	160	(µg/g)	2	59	NR	25

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Project Number: TT 93042

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Report Date: November 11, 2009 Received Date: November 02, 2009

Page:

2 of 6

Soil

Sample Type:

Lab. Ref.:

FN09-2683

Final

CERTIFICATE OF ANALYSIS

Ontario Regulation 153/04 (Inorganics)

Lab Number Sample ID Date Collected		,			09-16633 BC13 SS2 NP	09-16633 BC13 SS2 NP	09-16634 BC8 SS4 NP
General Chemistry	Table 1 Agricultural or Other Property Use	Table 1 All Other Types of Property Uses	Unit	MDL		(Replicate)	
Conductivity	0.47	0.57	(mS/cm)	0.01	2.39	NR	4.16
pН	-	-	-	-	7.2	7.2	7.8
SAR	1.0	2.4	-	_	9.73	NR	34.6
Metals							
Antimony	1.0	1.0	(µg/g)	0.5	1.0	NR	0.5
Arsenic	14	17	(µg/g)	0.5	1.0	NR	2.2
Barium	190	210	(µg/g)	0.5	84.3	NR	53.3
Beryllium	1.2	1.2	(µg/g)	0.2	0.7	NR	0.3
Cadmium	1.0	1.0	(µg/g)	0.5	0.6	NR	<0.5
Chromium	67	71	(µg/g)	. 1	20	NR	11
Cobalt	19	21	(µg/g)	1	9	NR	4
Copper	56	85	(µg/g)	1	28	NR	16
Lead	55	120	(µg/g)	5	24	NR	10
Mercury	0.16	0.23	(µg/g)	0.05	<0.05	NR	< 0.05
Molybdenum	2.5	2.5	(µg/g)	2	<2	NR	<2
Nickel	43	43	(µg/g)	5	17	NR	9
Selenium	1.4	1.9	(µg/g)	0.1	0.2	NR	<0.1
Silver	0.35	0.42	(µg/g)	0.25	<0.25	NR	<0.25
Thallium	2.5	2.5	(µg/g)	0.5	<0.5	NR	<0.5
Vanadium	91	91	(µg/g)	5	28	NR	17
Zinc	150	160	(µg/g)	2	61	NR	48

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Project Name:

Bovaird Dr. Class EA

Project Number:

TT 93042

Contact:

Siva Nadarajah

Report Date: November 11, 2009

Received Date: November 02, 2009

Page:

3 of 6

Sample Type:

Soil

Lab. Ref.:

FN09-2683

Final

CERTIFICATE OF ANALYSIS

Ontario Regulation 153/04 (Inorganics)

Lab Number Sample ID Date Collected		,			09-16635 BC20 SS2 NP	09-16635 BC20 SS2 NP
General Chemistry	Table 1 Agricultural or Other Property Use	Table 1 All Other Types of Property Uses	Unit	MDL		(Replicate)
Conductivity	0.47	0.57	(mS/cm)	0.01	1.61	1.59
рН	-	-	-	-	7.9	NR
SAR	1.0	2.4	-	-	29.9	NR
Metals						
Antimony	1.0	1.0	(µg/g)	0.5	1.0	0.8
Arsenic	14	17	(µg/g)	0.5	1.2	0.8
Barium	190	210	(µg/g)	0.5	80.3	81.4
Beryllium	1.2	1.2	(µg/g)	0.2	0.7	0.7
Cadmium	1.0	1.0	(µg/g)	0.5	0.6	0.6
Chromium	67	71	(µg/g)	1	20	21
Cobalt	19	21	(µg/g)	1	10	10
Copper	56	85	(µg/g)	1	24	24
Lead	. 55	120	(µg/g)	5	15	15
Mercury	0.16	0.23	(µg/g)	0.05	< 0.05	<0.05
Molybdenum	2.5	2.5	(µg/g)	2	<2	<2
Nickel	43	43	(µg/g)	5	16	17
Selenium	1.4	1.9	(µg/g)	0.1	0.2	0.2
Silver	0.35	0.42	(µg/g)	0.25	<0.25	<0.25
Thallium	2.5	2.5	(µg/g) .	0.5	<0.5	<0.5
Vanadium	91	91	(µg/g)	5	29	29
Zinc	150	160	(µg/g)	2	53	54

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a division of AMEC Americas Limited

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Scarborough, Ontario M1R 3C3

Project Name:

Bovaird Dr. Class EA

Project Number:

TT 93042

Contact:

Siva Nadarajah

Report Date: November 11, 2009

Received Date: November 02, 2009

Page:

4 of 6

Sample Type:

Soil

Lab. Ref.:

FN09-2683

Final

CERTIFICATE OF ANALYSIS

Ontario Regulation 153/04 (Inorganics)

			Lab Blank (µg/g)	Q.C. Standards Actual (mg/L)	Q.C. Standards Expected (mg/L)	Date of Analysis
General Chemistry	Unit	MDL				
Conductivity	(mS/cm)	0.01	<0.01	0.10	0.10	04-Nov-09
pH ·	-	-	7.1	6.0	6.0	04-Nov-09
SAR	-	-	-	1.39	1.35	07-Nov-09
Metals						
Antimony	(µg/g)	0.5	<0.5	1.05	1.00	05-Nov-09
Arsenic	(µg/g)	0.5	<0.5	1.01	1.00	05-Nov-09
Barium	(µg/g)	0.5	<0.5	0.52	0.50	05-Nov-09
Beryllium	(µg/g)	0.2	<0.2	0.51	0.50	05-Nov-09
Cadmium	(µg/g)	0.5	<0.5	0.52	0.50	05-Nov-09
Chromium	(µg/g)	1	<1	0.51	0.50	05-Nov-09
Cobalt	(µg/g)	1	<1	0.52	0.50	05-Nov-09
Copper	(µg/g)	1	<1	0.99	1.00	05-Nov-09
Lead	(µg/g)	5	<5	1.04	1.00	05-Nov-09
Mercury	(µg/g)	0.05	<0.05	0.002	0.002	06-Nov-09
Molybdenum	(µg/g)	2	<2	1.06	1.00	05-Nov-09
Nickel	(µg/g)	5	<5	1.03	1.00	05-Nov-09
Selenium	(µg/g)	0.1	<0.1	0.006	0.006	05-Nov-09
Silver	(µg/g)	0.25	<0.25	1.00	1.00	05-Nov-09
Thallium	(µg/g)	0.5	<0.5	1.04	1.00	05-Nov-09
Vanadium	(µg/g)	5	<5	0.50	0.50	05-Nov-09
Zinc	(µg/g)	2	<2	0.52	0.50	05-Nov-09

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Project Name:

Bovaird Dr. Class EA

Project Number:

TT 93042

Contact:

Siva Nadarajah

Report Date: November 11, 2009 Received Date: November 02, 2009

Page:

5 of 6

Sample Type:

Soil

Lab. Ref.:

FN09-2683

Final

CERTIFICATE OF ANALYSIS

Ontario Regulation 153/04 (Inorganics + Metals)

•			Method References
General Chemistry	Unit	MDL	
Conductivity	(mS/cm)	0.01	MOE 3137
рН	-	-	MOE 9045
SAR	-	-	SW 846, 3050, 6010C
Metals			
Antimony	(µg/g)	0.5	SW 846, 3050, 6010 C
Arsenic	(µg/g)	0.1	SW 846, 3050, 6010 C
Barium	(µg/g)	0.5	SW 846, 3050, 6010 C
Beryllium	(µg/g)	0.2	SW 846, 3050, 6010 C
Cadmium	(µg/g)	0.5	SW 846, 3050, 6010 C
Chromium	(µg/g)	1	SW 846, 3050, 6010 C
Cobalt	(µg/g)	1	SW 846, 3050, 6010 C
Copper	(µg/g)	1	SW 846, 3050, 6010 C
_ead	(µg/g)	5	SW 846, 3050, 6010 C
Mercury	(µg/g)	0.05	SW 846, 7741, 1994
Molybdenum	(µg/g)	2	SW 846, 3050, 6010 C
Vickel	(µg/g)	5	SW 846, 3050, 6010 C
Selenium	(µg/g)	0.1	SW 846, 3050, 7061
Silver	(µg/g)	0.25	SW 846, 3050, 6010 C
Γhallium	(µg/g)	0.5	SW 846, 3050, 6010 C
/anadium	(µg/g)	5	SW 846, 3050, 6010 C
Zinc	(µg/g)	2	SW 846, 3050, 6010 C

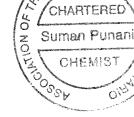
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/gz



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Client:	AMEC-Scarborough	Report Date:	November 11, 2009
Lab Ref:	FN09-2683	Page:	6 of 6
Samples avera	ge temperature upon receipt	21.6 °C	
Reported in co	mpliance to Ontario Regulation 153/0	4 requirements.	
N/V - No value	· ·		
All values repo	rted on dry weight basis.		
	only to the items tested.		•
			•
		~ GENERAL COMMENTS ~	
MDL	Method Detection Limit		
ANR	Analysis not required		
NA	Analysis not applicable		
NP	Not Provided		
NR	No Lab Replicate		



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Scarborough, Ontario M1R 3C3

Project Name:

Bovaird Drive Class EA

Bovana Birvo Glado E

Project Number: TT

TT 93042

Page: 1 of 4

Sample Type: Soil

Lab Ref.:

f.: FN10-103

Received Date: January 20, 2010

Contact:

Siva Nadarajah

Final

CERTIFICATE OF ANALYSIS

BTEX, PHC (F1-F4)

Lab Number					10-00929	10-00930	10-00931
Sample ID					B1 SS4	B5 SS2	B9 SS3
Date Collected					20-Jan-10	20-Jan-10	20-Jan-10
Parameters	Table 1 Agricultural or Other Property Use	Table 1 All Other Types of Property Uses	Unit	MDL			
Benzene	0.002	0.002	(µg/g)	0.001	0.001	0.001	0.001
Toluene	0.002	0.002	(µg/g)	0.001	0.007	0.001	0.005
Ethylbenzene	0.002	0.002	(µg/g)	0.001	0.006	0.005	0.003
m+p-Xylene	0.002	0.002	(µg/g)	0.001	0.020	0.050	0.010
o-Xylene	7 0.002	0.002	(µg/g)	0.001	0.017	0.007	0.007
PHC F1 (C6-C10)	N/V	N/V	(µg/g)	10	<10	<10	<10
PHC F1 less BTEX	·-	-	(µg/g)	10	<10	<10	<10
PHC F2 (>C10-C16)	N/V	N/V	(µg/g)	10	<10	<10	<10
PHC F3 (>C16-C34)	N/V	N/V	(µg/g)	50	108	<50	141
PHC F4 (>C34-C50)	N/V	N/V	(µg/g)	50	<50	57	<50
PHC F4G (Silica Gel)	-	-	(µg/g)	600	NA	NA	NA
BTEX Surrogate Recove	ery			·			•
Dibromofluoromethane			(%)		94	92	96
Toluene-D8			(%)		98	96	100
4-Bromofluorobenzene			(%)		95	99	95
PHC F1 Surrogate Reco	overy						
Difluorobenzene			(%)		97	98	96
4-Bromofluorobenzene			(%)		93	92	86
Trifluorotoluene			(%)		89	97	91
PHC F2-F4 Surrogate R	ecovery						
O-Terphenyl			(%)		84	80	90
Moisture Content			(%)		13.6	2.6	12.7

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Project Name:

Project Number:

Bovaird Drive Class EA

Sample Type: Soil

Page:

TT 93042

Lab Ref.:

FN10-103

Contact:

Siva Nadarajah

Final

Received Date: January 20, 2010

2 of 4

CERTIFICATE OF ANALYSIS

BTEX, PHC (F1-F4)

Lab Number					10-00932	10-00933 BC22 SS2	10-00933 BC22 SS2
Sample ID					B11 SS2		
Date Collected					20-Jan-10	20-Jan-10	20-Jan-10
Parameters	Table 1 Agricultural or Other Property Use	Table 1 All Other Types of Property Uses	Unit	MDL			(Replicate)
Benzene	0.002	0.002	(µg/g)	0.001	0.001	0.001	0.001
Toluene	0.002	0.002	(µg/g)	0.001	0.006	0.001	0.002
Ethylbenzene	0.002	0.002	(µg/g)	0.001	0.025	0.001	0.001
m+p-Xylene	0.002	0.002	(µg/g)	0.001	0.097	0.002	0.003
o-Xylene	7 0.002	0.002	(µg/g)	0.001	0.031	<0.001	<0.001
PHC F1 (C6-C10)	N/V	N/V	(µg/g)	10	<10	<10	NR
PHC F1 less BTEX	-	-	(µg/g)	10	<10	<10	NR
PHC F2 (>C10-C16)	N/V	N/V	(µg/g)	10	15	<10	<10
PHC F3 (>C16-C34)	N/V	N/V	(µg/g)	50	258	<50	<50
PHC F4 (>C34-C50)	N/V	N/V	(µg/g)	50	56	<50	<50
PHC F4G (Silica Gel)	- 1	-	(µg/g)	600	NA	NA	NA
BTEX Surrogate Recove	ery						
Dibromofluoromethane			(%)		100	96	97
Toluene-D8			(%)		102	103	102
4-Bromofluorobenzene			(%)		94	98	96
PHC F1 Surrogate Reco	very						
Difluorobenzene			(%)		96	98	NR
4-Bromofluorobenzene			(%)		88	88	NR
Trifluorotoluene			(%)		96	88	NR
PHC F2-F4 Surrogate Re	ecovery						
O-Terphenyl			(%)		90	82	94
Moisture Content			(%)	-	7.1	5.6	NR

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104 Crockford Boulevard

Scarborough, Ontario M1R 3C3

Project Name:

Bovaird Drive Class EA

Project Number:

TT 93042

Contact:

Siva Nadarajah

Report Date: January 28, 2010 Received Date: January 20, 2010

Page:

3 of 4

Sample Type: Soil

Lab Ref.:

FN10-103

Final

CERTIFICATE OF ANALYSIS

BTEX, PHC (F1-F4)			Lab Blank	Blank Spike	Blank Spike Recovery (%)	Date of Extraction	Date of Analysis
Parameters	Unit	MDL					
Benzene	(µg/g)	0.001	<0.001	0.109	87		
Toluene	(µg/g)	0.001	<0.001	0.107	85		
Ethylbenzene	(µg/g)	0.001	<0.001	0.101	81	21-Jan-10	26-Jan-10
m+p-Xylene	(µg/g)	0.001	<0.001	0.200	80		
o-Xylene	(µg/g)	0.001	<0.001	0.101	81		
PHC F1 (C6-C10)	(µg/g)	10	<10	92	92	21-Jan-10	25-Jan-10
PHC F1 less BTEX	(µg/g)	10	<10	65	100	21-Jan-10	20-0411-10
PHC F2 (>C10-C16)	(µg/g)	10	<10				
PHC F3 (>C16-C34)	(µg/g)	50	<50	1050	105	21-Jan-10	25-Jan-10
PHC F4 (>C34-C50)	(µg/g)	50	<50				
PHC F4G (Silica Gel)	(µg/g)	600	-	-	-	-	-
BTEX				·			
Surrogate Recovery	(%)						
Dibromofluoromethane	(%)		95	104	104		
Toluene-D8	(%)		100	106	106	21-Jan-10	26-Jan-10
4-Bromofluorobenzene			101	99	99		
PHC F1	(%)						
Surrogate Recovery	(%)						
Difluorobenzene	(%)		103	101	101		
4-Bromofluorobenzene			92	90	90	21-Jan-10	25-Jan-10
Trifluorotoluene			106	99	99		
PHC F2-F4	(%)				<u> </u>		
		-	 ` 			-	
Surrogate Recovery	(0/)		84	90	90	21-Jan-10	25-Jan-10
O-Terphenyl	(%)	<u> </u>	04] 30	1 30	21-Jan-10	20-0411910
Method Reference					CCME, Tier 1, 20	004	

Analysts: J. Evans, B. Sc.

M. Mak, C. Chem.

S. Shaula, B. Sc.

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Cynthia Ridge, C. Chem. Q.A./Q.C. Manager



Client:	AMEC - Scarborough	Report Date:	January 28, 2010
Lab Ref:	FN10-103	Page:	4 of 4
Sample/s average	temperature upon receipt	2°C	
Reported in comp	liance to Ontario Regulation 153/04 requ	uirements.	
N/V - No value der	ived.		
Analysis complies	with CCME PHC Tier 1 Method, 2004 ar	nd is validated for use in the labo	pratory.
The chromatogran	n descended to the baseline by C50.		
nC6 and nC10 res	oonse factors within 30% of response fa	actor for toluene.	
nC10, nC16 and n	C34 response factors within 10% of each	h other.	
C50 response fact	ors within 70% of nC10 + nC16 + nC34 a	average.	
Linearity is within	15%.		
Professional judge	ement, if requested, of what the materia	l is, based on information that is	stated (product profiles,
retention times, pr	ofessional experience, etc.)		
If F4 and F4G are r	eported, the greater of the two numbers	s are to be used in application to	guideline.
PAH not subtracte	d from PHC F2-F4.		
Extraction and ana	alysis limits for holding time were met.		
All values reported	d on dry weight basis and in ppm (μg/g)	unless otherwise stated.	
Results relate only	to the items tested.		
	~ GENER	AL COMMENTS ~	
MDL	Method Detection Limit		
ANR	Analysis not required		•
NA NA	Analysis not required Analysis not applicable		
NP	Not Provided		
NR	No Lab Replicate		
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APPENDIX C PAVEMENT CONDITION SURVEY

	LAKE LOUISE DRIVE / WO	RTHI	NGTO	ON A	VEN	UE 1	го мі	SSISS	AUGA	ROA	AD.	
			Sev	erity/	of I	Distr	ess	De	ensity	of D	istres	ss
			ght		te		evere	Few	Intermitte	Frequent	Extensiv	Througho ut
			Very Slight	Slight	Moderate	Severe	Very Severe	<10 %	10- 20 %	20- 50 %	50- 80 %	80- 100 %
	vement		1	2	3	4	5	1	2	3	4	5
	rface Defects							•		T		
	velling & Coarse Aggregate Loss	1										
	shing	2										
	rface Deformation		1	1	1	1	1		1	T	1	
	opling & Shoving	3										
	neel Track Rutting	4										
Dis	stortion	5										
	Longitudinal Wheel Track		1	1	1	1	1	1	1	Т	1	ı
	Single & Multiple	6										
	Alligator	7										
	Centreline		1				•	,	1	ı		
	Single & Multiple	8		√				√				
g	Alligator	9										
Cracking	Random Cracking	10					,					
rac	Midlane Cracking	11						V				
ပ	=											
	Single & Multiple	12										
	Alligator	13										
	Transverse											
	Single & Multiple	14										
	Alligator	15										

	MISSISSAL	IGA F	ROAD	то	HER	ITAC	SE RO	DAD				
			Sev	erity/	of I	Distr	ess	De	ensity	of D	istres	SS
			Very Slight	t	Moderate	ire	Very Severe	Kew V10	-01 Intermitte	-02 Frequent	-05 Extensiv	9 Througho
			Very	Slight	Mode	Severe	Very	%	20 %	50 %	80 %	100 %
Pa	vement		1	2	3	4	5	1	2	3	4	5
Su	rface Defects		•	•	•	•	•			•	•	
Ra	velling & Coarse Aggregate Loss	1										
	shing	2										
Su	rface Deformation											
	ppling & Shoving	3										
Wh	neel Track Rutting	4			$\sqrt{}$					V		
Dis	stortion	5								1		
	Longitudinal Wheel Track											
	Single & Multiple	6								1		
	Alligator	7										
	Centreline											
	Single & Multiple	8								1		
g	Alligator	9		$\sqrt{}$					V			
kin	Random Cracking	10										
ac	Alligator Random Cracking Midlane Cracking Pavement Edge	11			V					V		
ت	Pavement Edge		•	•		•	•	•	•	•	•	
	Single & Multiple	12		1					V			
	Alligator	13		V					V			
	Transverse				•		•	•	•			
	Single & Multiple	14									V	
	Alligator	15			1					V		

	HERITAGE RO	AD T	O PE	EL / I	HAL'	TON	BOU	NDAR	Y			
			Sev	erity/	of I	Distr	ess	De	ensity	of D	istres	ss
			light		ate		evere	Few	Intermitte		Extensiv	Througho ut
			Very Slight	Slight	Moderate	Severe	Very Severe	<10 %	10- 20 %	20- 50 %	50- 80 %	80- 100 %
	vement		1	2	3	4	5	1	2	3	4	5
	rface Defects		,	,	ı				,		T	
	velling & Coarse Aggregate Loss	1	√					V				
	shing	2						√				
	rface Deformation			,		,						
	opling & Shoving	3		$\sqrt{}$				√				
	neel Track Rutting	4			√					√		
Dis	stortion	5										
	Longitudinal Wheel Track											
	Single & Multiple	6										
	Alligator	7										
	Centreline											
	Single & Multiple	8								1		
D	Alligator	9	$\sqrt{}$							V		
ki	Random Cracking	10										
ac	Midlane Cracking	11				$\sqrt{}$				V		
ပ်	Alligator Random Cracking Midlane Cracking Pavement Edge					•	•	•		•	•	
	Single & Multiple	12							V			
	Alligator	13		$\sqrt{}$					V			
	Transverse			•		•	•		•	•		•
	Single & Multiple	14				$\sqrt{}$					V	
	Alligator	15		$\sqrt{}$							V	



APPENDIX D SITE PHOTOGRAPHS

APPENDIX D - PHOTOGRAPHIC RECORD



PROJECT NO. TT93042

PROJECT Preliminary Geotechnical Investigation for Bovaird Drive

LOCATION Brampton, Ontario ENCLOSURE 1



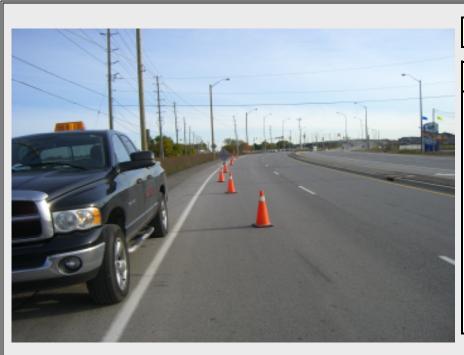
PHOTOGRAPH

1

Description

Bovaird Drive

Section
Lake Louise - Mississauga
Rd
(Looking West from CNR
Bridge)



PHOTOGRAPH

2

Description

Bovaird Drive
Section Lake
Louise Dr. - Mississauga
Road
(Looking West from BH
B5)

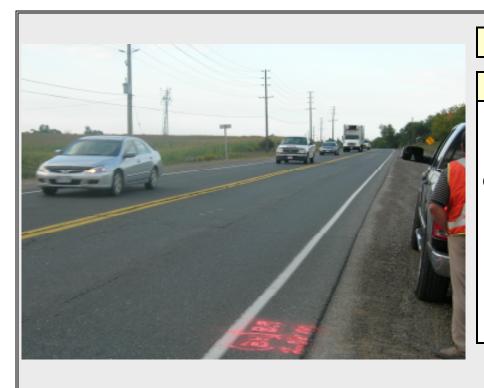
APPENDIX D- PHOTOGRAPHIC RECORD



PROJECT NO. TT93042

PROJECT Preliminary Geotechnical Investigation for Bovaird Drive

LOCATION Brampton, Ontario ENCLOSURE 2



PHOTOGRAPH

3

Description

Bovaird Drive

Section
Mississauga Rd - Heritage
Rd
(Looking West from BH B9)



PHOTOGRAPH

Description

Bovaird Drive

Section Mississauga Rd - Heritage Rd (Looking West from BH13)

APPENDIX D - PHOTOGRAPHIC RECORD



PROJECT NO. TT93042

PROJECT Geotechnical Investigation for Bovaird Drive

LOCATION Brampton, Ontario ENCLOSURE 3



PHOTOGRAPH

5

Description

Bovaird Drive

Section Heritage Rd - Caseley Dr. (Looking West from BH BC29)



PHOTOGRAPH

6

Description

Bovaird Drive

Section Heritage Rd - Caseley Dr. (Looking West from BH B18)