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

Submitted to:

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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.

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
  - 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).

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:
  - 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;
  - 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.

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
BH BC3	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
From Mississauga Road to Peel / Halton Boundary (Caseley 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	-	Borehole cancelled	
BH BC6	Culvert	N 4835452 E 594274	12 + 729	240.0	Shoulder	- 5.9 m	5.0 m
BH BC7	Culvert	N 4835360 E 594219	12 + 876	240.7	Pavement	+6.1 m	5.0 m
BH B9	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
BH BC9	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

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 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 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

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	-	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
BH BC33	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

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.

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 Bovaird 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

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.

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.

Table 4.1 - Results of Grain size Analysis

Borehole No.	Sample No.	Depth (m)	Percent Distribution (%)			Figure No.
			Gravel	Sand	Fines (Silt and Clay)	
BH B1	SS1	0.3 - 0.8	34	54	12	A 1
BH B9	SS1	0.0 - 0.6	35	46	19	A 2
BH B18	SS1	0.3 - 0.8	33	51	16	A 3

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

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.

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

Borehole No.	Sample No.	Depth (m)	Grain Size Distribution				Atterberg Limit test			USCS Modified Group Symbol
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit	Plastic Limit	Plasticity Index	
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

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

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.

Table 4.3 - Results of Grain size Analysis

Borehole No.	Sample No.	Depth (m)	Percent Distribution (%)			
			Gravel	Sand	Silt	Clay
BH B10	SS2	0.3 - 0.8	9	36	49	6
BH BC6	SS3	0.0 - 0.6	8	38	44	10

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.

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

Borehole No.	Date	Groundwater Level	
		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 17 March 2010	1.8 m (1) 2.4 m (2)	236.3(1) 235.6(2)
BH BC3-W	26 October 2009 17 March 2010	dry(1) 2.7 m (2)	-) 235.4(2)
BH BC4	14 October 2009 17 March 2010	3.2 m (1) 2.6 m (2)	234.9(1) 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)
BH BC7	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)
BH BC9	15 October 2009	3.5 m (1)	238.1(1)

Borehole No.	Date	Groundwater Level	
		Depth below Existing Grade (m)	Geodetic Elevation (m)
BH B10	15 October 2009	4.4 m [1]	237.3[1]
BH BC10	15 October 2009	4.1 m [1]	234.0[1]
	17 March 2010	1.8 m [2]	236.3[2]
BH B11	15 October 2009	2.4 m [1]	235.5[1]
BH BC11	15 October 2009	3.5 m [1]	233.3[1]
	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]	-

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

[1] in open boreholes on completion of drilling [2] 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.

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 ± (at west project limit) and 246 m ± (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 (±).

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)**:**

Material	**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.

Table 5.1 - Existing Pavement Composition at Borehole Locations

Pavement Condition		No of Boreholes	Thickness (mm)		Average GBE (mm)
			HMA	Granular Base/Subbase*	
Lake Louise Drive / Worthington Avenue to Mississauga 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
	Average	BH BC1 to BH BC3	235 mm	1,430	1185
Mississauga Rd to Heritage Road					
Fair Condition (1.4 km ±)	Minimum Maximum Average	Boreholes BH B9 to BH B11 Shoulder	-	800 1,400 950	594
	Average	Boreholes BH BC5, BH BC7 and BH BC15**	100 mm	**800**	625
Heritage Road to Caseley Drive					
Fair to Poor Condition (1.4 km ±)	Minimum Maximum Average	Boreholes BH B15 & BH B19 Shoulder	-	600 900 750	469
	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.
** HMA and granular thicknesses taken from the above boreholes to calculate the GBE after re-surfacing for the rehabilitation strategies.

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.

Table 5.2: Growth Rate for Bovaird Drive

Section	Road Classification	Trucks (%)	Growth Rate* (%)
Bovaird Drive, west of Worthington Avenue	Urban	Assumed 10%	1.00%
Bovaird Drive, west of Ashby Field Drive	Urban		1.00%
Bovaird Drive, west of Mississauga Road	Rural		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** ESALs 10 to 30 Million Major arterial roads and transit routes.
Bovaird Drive, west of Ashby Field Drive	31,970	13,186,493	30,000	
Bovaird Drive, west of Mississauga Road	26,182	19,218,936	30,000	
Bovaird Drive, west of Heritage Road	24,747	18,165,572	35,000	

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".*

- 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, $S_o = 0.49$;
- HMA layer coefficient, $a_i = 0.42$;
- Granular A layer coefficient, $a_i = 0.14$;
- 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.

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 of Worthington Avenue AADT = 26,162; ESALs~11M	1	Hot Mix Asphalt Concrete	185 mm	130 mm
	2	Granular Base 'A'	150 mm	150 mm
	3	Granular Subbase 'B'	600 mm	600-800 mm
	SN	Structure Number (147 mm)	> 147 mm (ok).	n/a
	GBE	Granular Base Equivalency	**920 mm**	**810-945 mm**
Total Pavement Thickness (mm)			**935 mm**	**880-1,080 mm**
Bovaird Drive, west of Ashby Field Drive AADT = 31,970; ESALs~13.5M	1	Hot Mix Asphalt Concrete	190 mm	130 mm
	2	Granular Base 'A'	150 mm	150 mm
	3	Granular Subbase 'B'	600 mm	600-800 mm
	SN	Structure Number (151 mm)	> 151 mm (ok).	n/a
	GBE	Granular Base Equivalency	**930 mm**	**810-945 mm**
Total Pavement Thickness (mm)			**940 mm**	**880-1,080 mm**
Bovaird Drive, west of Mississauga Road AADT = 26,182 ESALs~19.5M	1	Hot Mix Asphalt Concrete	200 mm	130 mm
	2	Granular Base 'A'	150 mm	150 mm
	3	Granular Subbase 'B'	600 mm	600-800mm
	SN	Structure Number (158 mm)	> 158 mm (ok).	n/a
	GBE	Granular Base Equivalency	**950 mm**	**810-945 mm**
Total Pavement Thickness (mm)			**950 mm**	**880-1,080 mm**
Bovaird Drive, west of Heritage Road AADT = 24,747 ESALs~18.5M	1	Hot Mix Asphalt Concrete	200 mm	130 mm
	2	Granular Base 'A'	150 mm	150 mm
	3	Granular Subbase 'B'	550 mm	450 mm
	SN	Structure Number (150 mm)	> 150 mm (ok).	n/a
	GBE	Granular Base Equivalency	**917 mm**	**710 mm**
Total Pavement Thickness (mm)			**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.

Section 1: Lake Louise Dr. / Worthington Ave. to Mississauga Road			
HMA Type	Thickness (mm)	PGAC	Traffic 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 Type	Thickness (mm)	PGAC	Traffic 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: Heritage Road to Caseley Drive			
HMA Type	Thickness (mm)	PGAC	Traffic 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

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	Method of Rehabilitation	Remark Curb/ Gutter
Section #1 Lake Louise Dr. / Worthington Avenue to Ashby Field Drive (Urban)		
HMA = 190 mm Granular A = 150 mm Granular B = 600 mm **Target GBE 930 mm**	Rehabilitation Strategy: Mill and Overlay Mill 90 mm, complete base repair in rutted/distorted areas, and resurface with 90 mm HMA. GBE after re-surfacing = 996 mm (No increase in grade).	Yes
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 **Target GBE 793 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). GBE after re-surfacing = 985 mm	No

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 ½ 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

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

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

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

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 µm, Class II wraparound to minimize infiltration of fines in pipes which would reduce their effectiveness.

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.

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)
BH BC3	Very stiff clayey silt till	6.0 - 6.2 m (±)	232.0 -231.8 m (±)	200	300
	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
	Weathered shale	below 7.0 m (±)	below 231.0 m (±)	400	600

[1] A resistance factor of Φ = 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 rip-rap, vegetative cover, or equivalent. Scour protection should be designed by an experienced engineer.

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

Culvert		Station	Borehole		Culvert Invert	
No.	Type		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 (±)

Culvert		Station	Borehole		Culvert Invert	
No.	Type		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

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.

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 (±) 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
	Very dense sandy silt / silty sand till	below 4.1 m (±)	below 237.0 m (±)	300	450
BH BC9	Very stiff clayey silt till	0.9 - 1.5 m (±)	240.7 - 240.1 m (±)	200	300
	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
	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
BH BC15	Hard clayey silt till	1.5 - 4.6 m (±)	235.3 - 232.1 m (±)	300	450
	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
BH BC17	Hard clayey silt till	2.3 - 4.6 m (±)	234.0 - 231.7 m (±)	300	450
	Very dense to very dense silt and sand / silty sand till	below 4.6 m (±)	below 231.7 m (±)	300	450

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
	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
	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
BH BC30	Hard silty clay / clayey silt till	0.9 - 2.3 m (±)	235.3 - 233.7 m (±)	300	450
	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
	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

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
	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.

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.

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.

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 F_1 to F_4 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.

- 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

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.

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)				**1.5-2.0**	**2.3-2.7**	**2.3-2.7**	**0.8-1.4**	**0.8-1.4**
General Chemistry	**Table 1 SCS**	**Table 2 SCS**	**MDL**					
Conductivity (mS/cm)	0.47	1.4	0.01	**1.31**	**1.37**	***4.16***	***2.39***	***1.61***
pH (no units)	-	-	-	7.6	8.2	7.8	7.2	7.9
SAR (no units)	1.0	12	-	**10.4**	***13.7***	***34.6***	**9.73**	***29.9***
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	<	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 **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.

Table 5.2: Soil Chemical Analyses
Petroleum Hydrocarbon Parameters

Location				**B1**	**B5**	**B9**	**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)				**2.3-2.8**	**0.8-1.4**	**1.5-2.0**	**0.8-1.4**	**0.8-1.4**
Parameters	**Table 1 SCS**	**Table 2 SCS**	**MDL**					
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			0.001	**0.017**	**0.007**	**0.007**	**0.031**	<
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.

**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		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 pH

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;

- 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.

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.*

- 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

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.
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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.

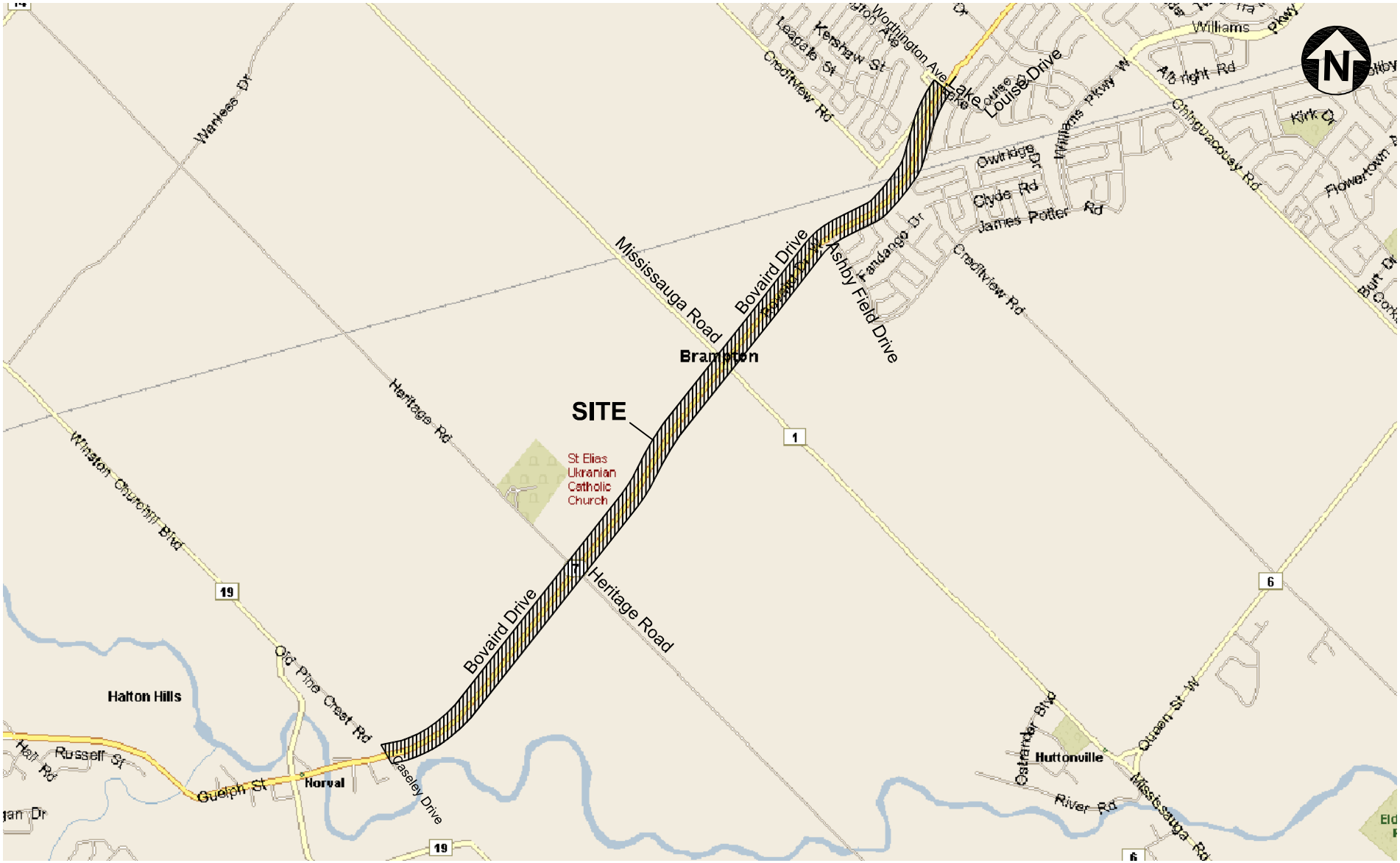
The design recommendations given in this report are applicable only to the project described in the text, and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final 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



CLIENT LOGO: amec	CLIENT: AMEC INFRASTRUCTURE GROUP	DWN BY: KW CHK'D BY: MM DATUM: - PROJECTION: - SCALE: N.T.S.	TITLE: SITE LOCATION PLAN PROJECT: GEOTECHNICAL INVESTIGATION FOR BOVAIRD DRIVE Bovaird Drive from Lake Louise Drive / Worthington Avenue to The Peel / Halton Boundary (Caseley Drive) Brampton, Ontario	REV. NO.: A DATE: APRIL 2010 AMEC PROJECT NO: TT93042 FIGURE No. 1

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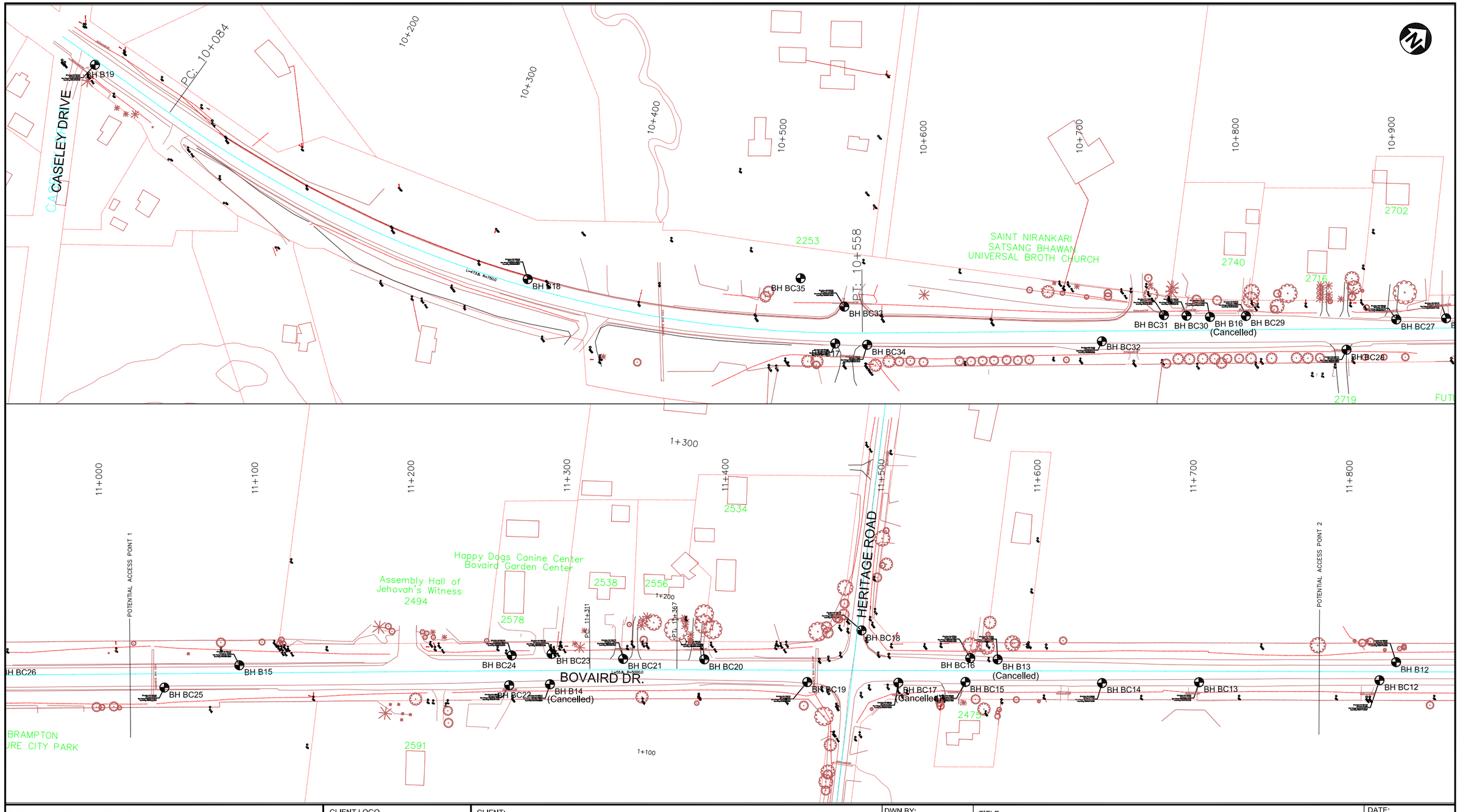

0 15 30 45 60m
APPROXIMATE SCALE

LEGEND

BH B15 BOREHOLE LOCATION

NOTES:
1. Drawing is not to scale. Do not scale drawing.
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DATUM:	-
PROJECTION:	-
SCALE:	AS SHOWN

TITLE

BOREHOLE LOCATION PLAN

PROJECT

PRELIMINARY GEOTECHNICAL INVESTIGATION FOR BOVAIRD DRIVE

From Lake Louise Drive / Worthington Avenue to The Peel / Halton Boundary (Caseley Drive), Ontario

DATE:	MAY 2011
PROJECT NO:	TT93042
REV. NO.:	B
FIGURE No.	2A

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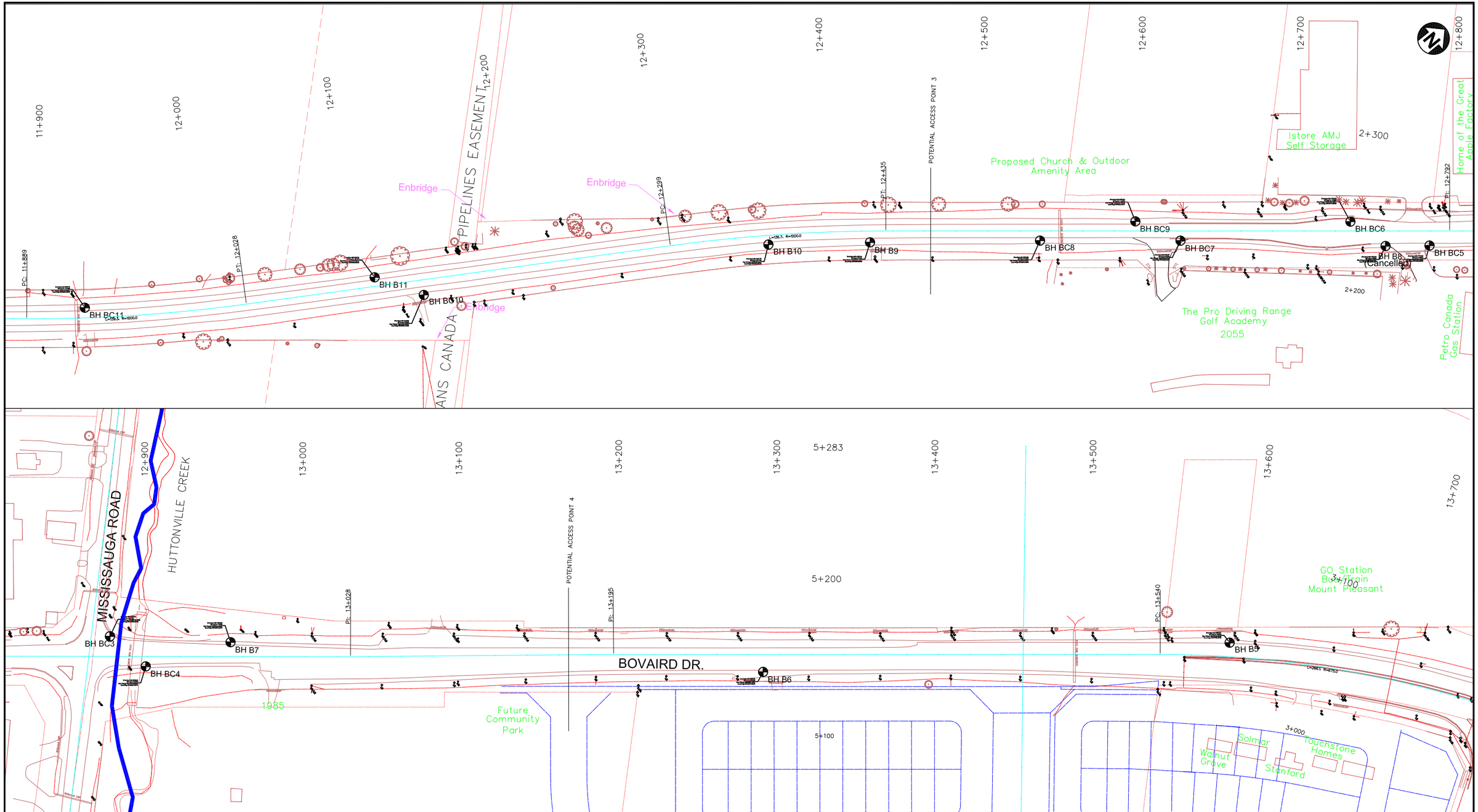

0 15 30 45 60m
APPROXIMATE SCALE

LEGEND
BH B7 BOREHOLE LOCATION

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PROJECTION:	-
SCALE:	AS SHOWN

TITLE
BOREHOLE LOCATION PLAN

PROJECT
PRLIMINARY GEOTECHNICAL INVESTIGATION FOR BOVAIRD DRIVE
From Lake Louise Drive / Worthington Avenue to The Peel / Halton Boundary (Caseley Drive), Ontario

DATE:	MAY 2011
PROJECT NO:	TT93042
REV. NO.:	B
FIGURE No.	2B

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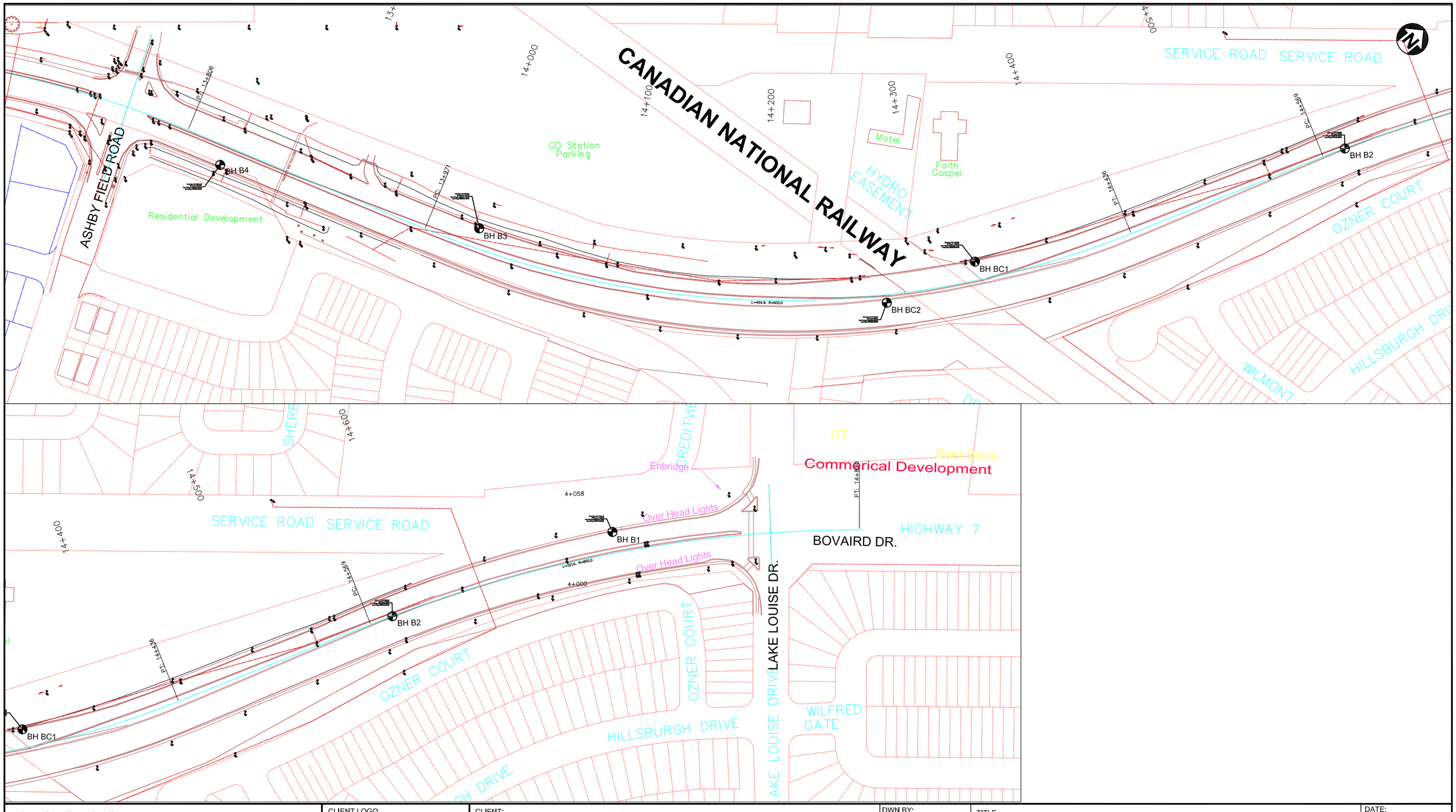

0 15 30 45 60m
APPROXIMATE SCALE

LEGEND
BH B2 BOREHOLE LOCATION

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PROJECTION:	-
SCALE:	AS SHOWN

TITLE
BOREHOLE LOCATION PLAN

PROJECT
PRELIMINARY GEOTECHNICAL INVESTIGATION FOR BOVAIRD DRIVE
From Lake Louise Drive / Worthington Avenue to The Peel / Halton Boundary (Caseley Drive), Ontario

DATE:	MAY 2011
PROJECT NO:	TT93042
REV. NO.:	B
FIGURE No.	2C

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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 Cohesionless Soils	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 Cohesive Soils	Undrained Shear Strength kPa
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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Revised: October 2011

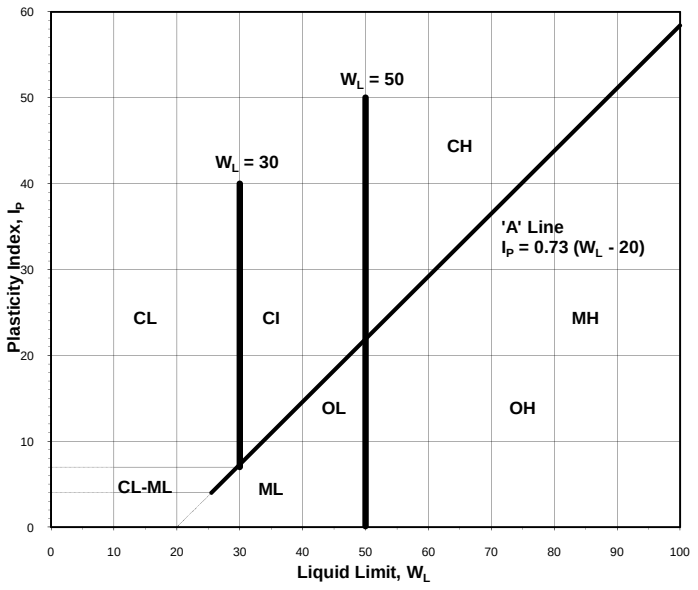
MODIFIED * UNIFIED CLASSIFICATION SYSTEM FOR SOILS

*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.

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75µm)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm	CLEAN GRAVELS (TRACE OR NO FINES)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 4$; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY GRAVELS (WITH SOME OR MORE FINES)	GM	SILTY GRAVELS, GRAVEL-SAND- SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 7
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (TRACE OR NO FINES)	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 6$; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3
			SP	POORLY GRADED GRAVELS, GRAVEL- SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY SANDS (WITH SOME OR MORE FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 4
			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	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)
		W_L > 50%	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	
	CLAYS ABOVE "A" LINE NEGLIGIBLE ORGANIC CONTENT	W_L < 30%	CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS	
		30% < W_L < 50%	CI	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	
		W_L > 50%	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	ORGANIC SLITS & CLAYS BELOW "A" LINE	W_L < 50%	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	WHENEVER THE NATURE OF THE FINES CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER "F", E.G SF IS A MIXTURE OF SAND WITH SILT OR CLAY
		W_L > 50%	OH	ORGANIC CLAYS OF HIGH PLASTICITY	
HIGH ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE

SOIL COMPONENTS					
FRACTION	U.S STANDARD SIEVE SIZE		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS		
GRAVEL	COARSE	PASSING	RETAINED	PERCENT	DESCRIPTOR
		76 mm	19 mm	35-50	AND
				20-35	Y/EY
	FINE	19 mm	4.75 mm	10-20	SOME
				1-10	TRACE
SAND	COARSE	4.75 mm	2.00 mm		
	MEDIUM	2.00 mm	425 µm		
	FINE	425 µm	75 µm		
FINES (SILT OR CLAY BASED ON PLASTICITY)		75 µm			
OVERSIZED MATERIAL					
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	

Plasticity Chart for Soil Passing 425 Micron Sieve



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

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.

RECORD OF BOREHOLE No. BH B1 Co-Ord. N4836994, E595475

Project Number:	TT93042	Drilling Location:	Sta 14 + 733	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 13, 09 Date Completed: Oct 13, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 0.0 m

Depth (m)	Elevation (m)	Description	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	GR	SA	SI	CL
		about 170 mm ASPHALTIC CONCRETE								
	0.2	grey **Gravelly Sand / Sand and Gravel FILL** trace to some silt moist	SS	1	100	36	34	54		(12)
1	-1		SS	2	100	34				
			SS	3	83	50/15				
2	-2									
	2.1	grey **Clayey Silt FILL** trace organic matter and rootlets moist	SS	4	100	21				
	2.7	brown **SILTY CLAY / CLAYEY SILT TILL** some sand to sandy, trace gravel very stiff moist	SS	5	100	25	6	24	44	26
3	-3									
4	-4									
	4.1	brown **SILT AND SAND / SILTY SAND TILL** trace clay and gravel trace shale fragments very dense moist								
	4.6	**End of Borehole**	SS	6	100	50/3				

Note: The geodetic elevation at existing grade was not provided to AMEC.

FIELD TESTING: Penetration Testing — SPT, PPT, DCPT; MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); *Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH B2 Co-Ord. N4836849, E595432

Project Number:	TT93042	Drilling Location:	Sta 14 + 583	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 13, 09 Date Completed: Oct 13, 09	Revision No.:	0, 5/11/11

Lithology Plot	DESCRIPTION (Geodetic Ground Surface Elevation: 245.8 m)		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT, PPT, DCPT); MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); *Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_L; Plastic 20 40 60 80 Liquid	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 170 mm ASPHALTIC CONCRETE	245.7										
	brown **Gravelly Sand / Sand and Gravel FILL** some silt moist	0.2	SS	1	100	40		245		0		
	trace cobbles / boulders		SS	2	100	32	1			5		
	brown **Silty Sand FILL** trace gravel moist	244.4 1.4	SS	3	100	23		244		10		
	--- trace rootlets	243.2	SS	4	100	10	2			5		
	brown **Clayey Silt FILL** trace sand and gravel moist	2.6	SS	5	100	13	3	243		5		
	brown and grey **SILT AND SAND / SILTY SAND TILL** trace clay and gravel dense moist	241.9 4.0	SS	6	100	40	4	242		10		
	End of Borehole	240.8 5.0					5	241				

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH B3 Co-Ord. N4836392, E595160

Project Number:	TT93042	Drilling Location:	Sta 14 + 004	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 13, 09 Date Completed: Oct 13, 09	Revision No.:	0, 5/11/11

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 246.5 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80	Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid; 20 40 60 80		GR SA SI CL
	about 200 mm ASPHALTIC CONCRETE											
		246.3										
	brown **Gravelly Sand / Sand and Gravel FILL** some silt moist	0.2	SS	1	83	34		246	0 3			
		245.3	SS	2	67	9	1		0 9			
	grey **Silty Sand FILL** trace to some clay moist	1.2	SS	3	56	12		245	0 8			
		244.4					2					
	brown **Clayey Silt FILL** trace gravel, pocket of sand, trace brick debris moist	2.1	SS	4	56	18		244	5 16			
		243.6										
	brown **SILT AND SAND / SILTY SAND** trace clay, trace gravel very dense moist	2.9	SS	5	92	50/15	3	243	50 15	0 6		
		242.2					4					
	reddish brown **WEATHERED SHALE**	4.3						242				
		241.9	SS	6	100	50/5			50 5	0 5		
	End of Borehole	4.6										

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▽ 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'.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH B4 Co-Ord. N4836270, E595001

Project Number:	TT93042	Drilling Location:	Sta 14 + 834	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 13, 09 Date Completed: Oct 13, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 244.3 m

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)
	about 220 mm ASPHALTIC CONCRETE						
	244.1 / 0.2						
	brown **Gravelly Sand / Sand and Gravel FILL** some silt moist	SS	1	100	57		244
		SS	2	100	65	1	
	trace asphaltic concrete debris						243
	242.9 / 1.4						
	brown **Clayey Silt FILL** trace sand and gravel trace organic matter and rootlets moist	SS	3	100	38		
	242.2 / 2.1					2	242
	reddish brown **CLAYEY SILT TILL** trace sand and gravel hard moist	SS	4	100	71		
	trace cobbles	SS	5	100	50/15	3	241
	239.7 / 4.6	SS	6	0	50/1	4	240
	pieces of shale **End of Borehole**						

FIELD TESTING

Penetration Testing: SPT, PPT, DCPT

MTO Vane*: Intact, Remould

Nilcon Vane*: Intact, Remould

*Undrained Shear Strength (kPa): 20, 40, 60, 80

Field test values: 0, 0, 0, 5, 50/15, 50/1

LAB TESTING

Rinse pH Values: 2, 4, 6, 8, 10, 12

Soil Vapour Reading: parts per million (ppm): 100, 200, 300, 400

Lower Explosive Limit (LEL)

W_p, W, W_l

Plastic, Liquid

20, 40, 60, 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH B5 Co-Ord. N4836132, E594792

Project Number:	TT93042	Drilling Location:	Sta 13 + 584	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 14, 09 Date Completed: Oct 14, 09	Revision No.:	0, 5/11/11

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 245.6 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80	Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR SA SI CL
	about 220 mm ASPHALTIC CONCRETE	245.4										
	brown Gravelly Sand / Sand and Gravel FILL some silt moist	0.2	SS	1	100	37		245		5 3		
			SS	2	89	38	1			5 4		
	brown Silty Sand FILL trace clay and gravel trace organic matter moist	244.2 1.4	SS	3	100	28		244		70 22		
			SS	4	100	35	2			10 14		
	reddish brown CLAYEY SILT TILL trace sand and gravel hard moist ..... trace shale fragments	243.0 2.6	SS	5	100	85/23	3	243		85 23 0 10		
							4	242				
		240.9	SS	6	100	50/8		241	50 8	0 10		
	End of Borehole	4.6										

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▽ 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'.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH B6 Co-Ord. N4835887, E594628

Project Number:	TT93042	Drilling Location:	Sta 13 + 289	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 14, 09 Date Completed: Oct 14, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 243.1 m

Depth	Description	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
	about 235 mm ASPHALTIC CONCRETE				
242.9					
0.2	brown Gravelly Sand / Sand and Gravel FILL trace silt moist	SS	1	100	46
242.4					
0.8	brown to grey Sandy Silt FILL trace clay and gravel trace organic matter moist	SS	2	83	29
241.5					
1.7	brown SILTY CLAY / CLAYEY SILT TILL trace sand and gravel hard moist	SS	3	89	38
		SS	4	100	40
240.2					
2.9	brown SILT AND SAND / SILTY SAND TILL trace clay and gravel very dense moist to wet	SS	5	100	68
		SS	6	100	50/13
238.3					
4.9	End of Borehole				

Groundwater inferred or encountered during drilling on 10/14/2009 at a depth of: 4.9 m

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Scale: 1 : 32

RECORD OF BOREHOLE No. BH B7 Co-Ord. N4835631, E594408

Project Number:	TT93042	Drilling Location:	Sta 13 + 952	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 14, 09 Date Completed: Oct 14, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 239.1 m

Lithology Plot	DESCRIPTION	Elevation	Thickness	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT, PPT, DCPT); MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); *Undrained Shear Strength (kPa)	LAB TESTING: Rinse pH Values; Soil Vapour Reading (parts per million (ppm)); Lower Explosive Limit (LEL); Plastic; Liquid	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
	about 80 mm ASPHALTIC CONCRETE	239.0	0.1													
	brown Gravelly Sand / Sand and Gravel FILL some silt moist			SS	1	83	18		239		0					
		238.3														
	brown CLAYEY SILT TILL some sand to sandy trace gravel and trace oxidation stiff moist		0.8	SS	2	89	15	1	238		5		1	21	49	29
		237.7														
	brown SILT AND SAND / SILTY SAND TILL trace clay and gravel very dense moist		1.4	SS	3	100	69	2	237		10					
	trace cobbles / boulders			SS	4	100	80				0					
				SS	5	100	54/15	3	236	54 15	5					
				SS	6	100	50/15	4	235	50 15	0					
		234.4														
	End of Borehole		4.7													

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH B9 Co-Ord. N4835345, E594191

Project Number:	TT93042	Drilling Location:	Sta 12 + 593	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09 Date Completed: Oct 15, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 240.8 m

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT, PPT, DCPT); MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); *Undrained Shear Strength (kPa)	LAB TESTING: Rinse pH Values; Soil Vapour Reading (parts per million (ppm)); Lower Explosive Limit (LEL); W_p, W, W_l; Plastic, Liquid	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
	brown **Sand and Gravel FILL** some silt moist	SS	1	78	22				0		35	46		(19)
	240.0													
	grey 0.8 **Silty Clay FILL** trace sand and organic matter moist	SS	2	100	18	1	240		25					
	--- trace rootlets	SS	3	100	21		239		35					
	238.6					2								
	brown 2.1 **CLAYEY SILT TILL** trace sand and gravel hard moist	SS	4	100	31		238		10					
		SS	5	100	32	3			0					
	236.6						237							
	brown 4.1 **SILT AND SAND / SILTY SAND TILL** trace gravel very dense wet					4								
		SS	6	100	58		236		0					
	235.7					5								
	End of Borehole 5.0													

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▽ Groundwater inferred or encountered during drilling on 10/15/2009 at a depth of: 4.4 m

Scale: 1 : 32

RECORD OF BOREHOLE No. BH B10 Co-Ord. N4835152, E594062

Project Number: TT93042 | Drilling Location: Sta 12 + 361 | Logged by: JF

Project Client: The Regional Municipality of Peel | Drilling Method: 150 mm Solid Stem Augering | Compiled by: SN

Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study | Drilling Machine: Truck Mounted Drill | Reviewed by: PB

Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON. | Date Started: Oct 15, 09 | Date Completed: Oct 15, 09 | Revision No.: 0, 5/11/11

Lithology Plot	DESCRIPTION (Geodetic Ground Surface Elevation: 241.7 m)	Elevation (m)	Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	GR	SA	SI	CL
	brown **Sand and Gravel FILL** trace to some silt moist			SS	1	83	34				
	240.9	241									
	brown 0.8 **SILT AND SAND / SILTY SAND TILL** trace clay and gravel very dense moist		1	SS	2	100	70	9	36	49	6
		240		SS	3	100	50/15				
	--- reddish brown		2	SS	4	100	50/15				
		239									
	--- brown		3	SS	5	100	50/13				
		238									
	--- trace cobbles / boulders wet		4								
	237.1			SS	6	100	50/5				
	End of Borehole 4.6										

FIELD TESTING: Penetration Testing — SPT, PPT, DCPT; MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); *Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

Groundwater inferred or encountered during drilling on 10/15/2009 at a depth of: 4.4 m

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Scale: 1 : 32

RECORD OF BOREHOLE No. BH B11 Co-Ord. N4834941, E593927

Project Number:	TT93042	Drilling Location:	Sta 12 + 111	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09 Date Completed: Oct 15, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 238.0 m

Depth (m)	Elevation (m)	Description	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Field Testing	Lab Testing	Instrumentation Installation
0	238.0	grey **Sand and Gravel FILL** some silt, trace organic matter moist	SS	1	100	12	SPT: 15, 6		Well Detail: 50 mm slotted PVC pipe (3.0 m - 4.5 m) with sand pack (3.0 m - 4.5 m), bentonite plug above sand, capped with flush-mounted casing set in concrete.
		--- trace clay ..... some cobbles	SS	2	100	18	SPT: 30, 11		
1	237								
	236.6								
	1.4	grey **Silty Clay FILL** trace sand and gravel trace organic matter moist	SS	3	100	9	SPT: 15, 16		
		--- brown							
2	236		SS	4	100	7	SPT: 5, 29		
	235.1								
	2.9	reddish brown **SILTY CLAY / CLAYEY SILT TILL** trace sand and gravel trace shale fragments hard damp							
3	235		SS	5	100	71	SPT: 15, 11		
4	234								
	233.3		SS	6	100	50/8	SPT: 50/8		
	4.6	**End of Borehole**							

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

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Groundwater inferred or encountered during drilling on 10/15/2009 at a depth of: 2.4 m

Scale: 1 : 32

RECORD OF BOREHOLE No. BH B12 Co-Ord. N4834706, E593772

Project Number:	TT93042	Drilling Location:	Sta 11 + 828	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09 Date Completed: Oct 15, 09	Revision No.:	0, 5/11/11

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 237.4 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80	Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown **Sand and Gravel FILL** trace to some silt moist		SS	1	100	19		237	0 9			
		236.6										
	grey **Silty Clay FILL** trace sand and organic matter moist	0.8	SS	2	100	16	1	236	0 15			
		235.6	SS	3	100	19			10 18			
	brown **SILT AND SAND / SILTY SAND TILL** trace clay and gravel dense to very dense moist	1.8					2					
			SS	4	100	48		235	25 12			
	trace yellow stains						3					
			SS	5	100	64		234	20 11			
	grey		SS	6	100	50/15	4	233	50 15	35 13		
		232.5										
	End of Borehole	4.9										

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▽ Groundwater inferred or encountered during drilling on 10/15/2009 at a depth of: 1.7 m

Scale: 1 : 32

RECORD OF BOREHOLE No. BH B15 Co-Ord. N4834117, E593322

Project Number: TT93042 | Drilling Location: Sta 11 + 089 | Logged by: JF

Project Client: The Regional Municipality of Peel | Drilling Method: 150 mm Solid Stem Augering | Compiled by: SN

Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study | Drilling Machine: Truck Mounted Drill | Reviewed by: PB

Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON. | Date Started: Oct 28, 09 | Date Completed: Oct 28, 09 | Revision No.: 0, 5/11/11

Lithology Plot	DESCRIPTION (Geodetic Ground Surface Elevation: 240.0 m)	Elev.	Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
	brown **Sand and Gravel FILL** trace to some silt moist			SS	1	71	31
	239.1						
	reddish brown 0.9 **Clayey Silt FILL** trace sand, trace gravel moist	239	1	SS	2	100	16
	--- trace to some asphaltic concrete			SS	3	83	25
		238	2				
				SS	4	33	30
	237.1						
	brown 2.9 **Sand and Gravel FILL** trace silt and clay moist	237	3	SS	5	100	16
	236.0						
	grey 4.0 **Silty Clay FILL** trace to some sand moist	236	4				
	235.1			SS	6	100	70
	reddish brown 4.9 **SILTY CLAY / CLAYEY SILT TILL** 234.9 trace sand 5.0 hard	235	5				
	End of Borehole						

FIELD TESTING: Penetration Testing — SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%) — GR SA SI CL

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH B18 Co-Ord. N4833542, E592850

Project Number:	TT93042	Drilling Location:	Sta 10 + 339	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 27, 09 Date Completed: Oct 27, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 214.7 m

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT / PPT / DCPT); MTO Vane* (Intact / Remould); Nilcon Vane* (Intact / Remould); *Undrained Shear Strength (kPa)	LAB TESTING: Rinse pH Values; Soil Vapour Reading (parts per million (ppm)); Lower Explosive Limit (LEL); Plastic / Liquid	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
	about 120 mm ASPHALTIC CONCRETE 214.6													
	brown 0.1 **Sand and Gravel FILL** trace to some silt moist	SS	1	100	25		214	20	6		33	51		(16)
		SS	2	78	22	1		20	7					
	some gravel to gravelly	SS	3	100	50/15		213	50/15	4					
	212.5					2								
	brown 2.1 **SILT AND SAND / SILTY SAND TILL** trace gravel and trace clay trace cobbles / boulders very dense moist	SS	4	100	52/15		212	52/15	6					
		SS	5	100	50/15	3		50/15	10					
	209.9	SS	6	100	50/8		211	50/8	20					
	End of Borehole 4.8					4	210							
	Auger refusal on possible boulder at 4.8 m depth.													

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH B19 Co-Ord. N4833406, E592572

Project Number: TT93042 | Drilling Location: Sta 10 + 027 | Logged by: JF

Project Client: The Regional Municipality of Peel | Drilling Method: 150 mm Solid Stem Augering | Compiled by: SN

Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study | Drilling Machine: Truck Mounted Drill | Reviewed by: PB

Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON. | Date Started: Oct 27, 09 | Date Completed: Oct 27, 09 | Revision No.: 0, 5/11/11

Lithology Plot	DESCRIPTION (Geodetic Ground Surface Elevation: 201.3 m)	Elevation	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT / PPT / DCPT)	LAB TESTING: Rinse pH Values	LAB TESTING: Soil Vapour Reading (parts per million (ppm))	LAB TESTING: Lower Explosive Limit (LEL)	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown **Sand and Gravel FILL** some silt moist		SS	1	100	25		201						
		200.6												
	reddish brown **SILT AND SAND / SILTY SAND TILL** some gravel, trace clay compact to very dense moist	0.6	SS	2	100	14	1	200						
	..... trace cobbles / boulders		SS	3	100	50/15			50/15					
							2							
		198.9	SS	4	100	50/5		199	50/5					
	End of Borehole	2.3												
	Auger refusal on possible boulder at 2.3 m depth.													

FIELD TESTING: Penetration Testing — ○ SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; *Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; △ Soil Vapour Reading parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

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

Project Number:	TT93042	Drilling Location:	Sta 14 + 334	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 13, 09 Date Completed: Oct 13, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 252.4 m

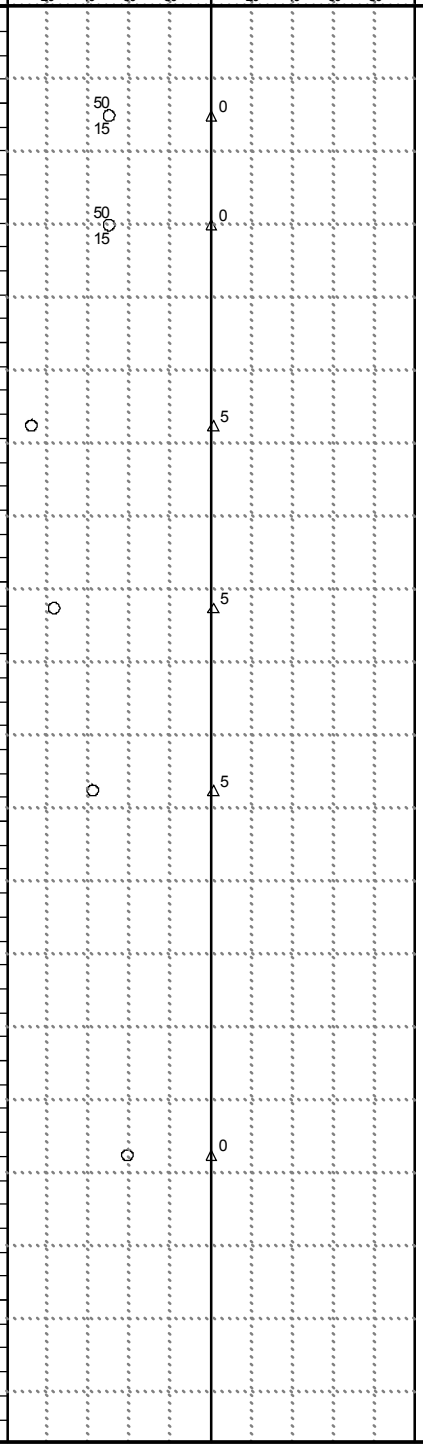
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)
	about 210 mm ASPHALTIC CONCRETE						
	252.2						
	brown 0.2 **Sand and Gravel FILL** some silt moist	SS	1	100	50/15		252
		SS	2	100	50/15	1	
							251
		SS	3	100	12		
	trace to some silt					2	
	250.3						
	brown 2.1 **Sandy Silt FILL** trace clay and gravel moist	SS	4	100	23		250
						3	
		SS	5	89	42		249
						4	
							248
		SS	6	100	59		
						5	
							247
						6	

FIELD TESTING

Penetration Testing: SPT ○ PPT □ DCPT ⬢

MTO Vane*: Intact △ Remould ▲ Nilcon Vane*: Intact ◇ Remould ◆

*Undrained Shear Strength (kPa) 20 40 60 80



LAB TESTING

★ Rinse pH Values 2 4 6 8 10 12

Soil Vapour Reading △ parts per million (ppm) 100 200 300 400

▲ Lower Explosive Limit (LEL) W_p W W_l

Plastic Liquid 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL

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▽ 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'.

Scale: 1 : 32

Continued on Next Page

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

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

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80	Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL); W_p W W_l; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown **Sandy Silt FILL** trace clay and gravel moist	SS	7	100	43	7	246		0		
		SS	8	100	42	8	245		0		
	243.0	SS	9	83	21	9	244		0		
	9.4 grey **CLAYEY SILT TILL** trace sand and gravel very stiff to hard moist					10	243				
	--- reddish brown						242				
	..... trace cobbles / boulders	SS	10	100	50/15			50 15	0		
	241.4 11.0 **End of Borehole**										

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 BC2 Co-Ord. N4836556, E595332

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

Project Client: The Regional Municipality of Peel | Drilling Method: 150 mm Solid Stem Augering | Compiled by: SN

Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study | Drilling Machine: Truck Mounted Drill | Reviewed by: PB

Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON. | Date Started: Oct 13, 09 | Date Completed: Oct 13, 09 | Revision No.: 0, 5/11/11

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 0.0 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80	Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR SA SI CL
	about 180 mm ASPHALTIC CONCRETE										
	-0.2										
	brown **Sand and Gravel FILL** trace silt 0.2	SS	1	83	42				0, 3, 4		
		SS	2	83	33	1	-1		0, 3		
	trace cobbles / boulders	SS	3	78	20				0, 5		
	-2.1					2	-2				
	brown **Clayey Silt FILL** trace sand, trace gravel moist 2.1	SS	4	917	15				5, 8		
						3	-3				
		SS	5	100	14				0, 20		
	-4.1					4	-4				
	brown **Silty Sand FILL** trace gravel trace asphaltic concrete debris moist 4.1	SS	6	100	33				5, 9		
						5	-5				
	-5.5										
	brown **Clayey Silt FILL** trace sand and gravel moist 5.5					6					

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

Continued on Next Page

RECORD OF BOREHOLE No. BH BC2 Co-Ord. N4836556, E595332

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

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80	Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown **Clayey Silt FILL** trace sand and gravel moist	SS	7	100	31	7	-7				
		SS	8	100	23	8	-8				
		SS	9	89	15	9	-9				
	-10.2 brown **Silt and Sand / Sandy Silt FILL** trace clay and gravel moist	SS	10	100	83	10	-10				
	-11.1 **End of Borehole** 11.1 Note: The geodetic elevation at existing grade was not provided to AMEC.					11	-11				

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 BC3 Co-Ord. N4835573, E594358

Project Number:	TT93042	Drilling Location:	Sta 12 + 876	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 14, 09 Date Completed: Oct 14, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 238.0 m

Depth	Description	Elevation	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
	about 320 mm ASPHALTIC CONCRETE	237.7				
0.3	brown **Sand and Gravel FILL** trace silt moist		SS	1	78	29
0.8	brown **Silty Sand FILL** trace gravel moist	237.3	SS	2	83	19
	trace clay and organic matter		SS	3	100	51
2.6	grey **Silty Clay FILL** trace sand and gravel moist	235.4	SS	4	78	11
			SS	5	100	12
5.5	reddish brown **CLAYEY SILT TILL** trace sand and gravel very stiff moist	232.5	SS	6	100	20

Penetration Testing: SPT, PPT, DCPT; MTO Vane* Intact, Remould; Nilcon Vane* Intact, Remould; *Undrained Shear Strength (kPa) 20 40 60 80

Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80

INSTRUMENTATION INSTALLATION

Well Detail:
50 mm slotted
PVC pipe (7.6 m - 10.7 m)
with sand pack (7.6 m - 10.7 m),
bentonite plug above sand, capped
with flush-mounted casing
set in concrete.

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

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Groundwater inferred or encountered during drilling on 10/14/2009 at a depth of: 1.8 m

Cave in depth after removal of augers: 4.4 m

Groundwater depth observed on 17 March 2010 at a depth of: 2.4 m

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

Continued on Next Page

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

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

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
	CLAYEY SILT TILL (continued) 231.8	SS	7	100	50/13			50/13	5		
	reddish brown 6.2										
	WEATHERED SHALE										
	trace limestone fragments										
	damp					7	231				
		SS	8	100	50/3			50/3			
						8	230				
		SS	9	100	50/1	9	229	50/1			
						10	228				
	227.4	SS	10		50/0			50/0			
	End of Borehole 10.7										
	Borehole BC-3W was advanced next to this borehole by augering and a monitoring well was installed in it.										

SOIL SAMPLING

FIELD TESTING: Penetration Testing — SPT, PPT, DCPT; MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid; 20 40 60 80

COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

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 MONITORING WELL No. BH BC3 - W Co-Ord. N4835573, E594358

Project Number:	TT93042	Drilling Location:	Sta 12 + 876	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 26, 09 Date Completed: Oct 26, 09	Revision No.:	0, 5/11/11

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 238.0 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80	Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR SA SI CL
	This borehole was advanced next to Borehole BC 3 by augering. See Borehole BC 3 for soil strata					1 2 3 4	237 236 235 234				Well Detail: 50 mm slotted PVC pipe (3.0 m - 4.6 m) with sand pack (3.0 m - 4.6 m), bentonite plug above sand, capped with flush-mounted casing set in concrete.
	233.4 4.6										

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▽ 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

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

Project Number:	TT93042	Drilling Location:	Sta 12 + 899	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 14, 09 Date Completed: Oct 14, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 238.0 m

Depth (m)	Elevation (m)	Description	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Lab Testing
		brown **Sand and Gravel FILL** some silt moist					
	237.3		SS	1	83	13	0
	0.6	brown **Silty Sand FILL** trace to some gravel moist					
1	237		SS	2	78	9	0
			SS	3	89	38	5
2	236						
	235.8						
	2.1	grey **Clayey Silt FILL** trace sand moist	SS	4	83	12	35
	235.1						
	2.9	grey **Silty Sand FILL** trace clay moist to wet					
3	235		SS	5	94	10	40
4	234						
	233.8						
	4.1	reddish brown **SILTY CLAY / CLAYEY SILT TILL** trace sand and gravel trace shale fragments hard moist					
			SS	6	100	74	10
5	233						
6	232						

Penetration Testing: SPT, PPT, DCPT
MTO Vane*: Intact, Remould
Nilcon Vane*: Intact, Remould
*Undrained Shear Strength (kPa) 20 40 60 80
Rinse pH Values 2 4 6 8 10 12
Soil Vapour Reading parts per million (ppm) 100 200 300 400
Lower Explosive Limit (LEL) W_p W W_l
Plastic Liquid 20 40 60 80

INSTRUMENTATION INSTALLATION

Well Detail:
50 mm slotted
PVC pipe (3.0 m - 4.6 m)
with sand pack (3.1 m - 4.6 m),
bentonite plug above sand, capped
with flush-mounted casing
set in concrete.

COMMENTS & GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

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Groundwater inferred or encountered during drilling on 10/14/2009 at a depth of: 3.2 m

Cave in depth after removal of augers: 3.2 m

Scale: 1 : 32

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 Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT ○, PPT □, DCPT ⬢); MTO Vane* (Intact △, Remould ▲); Nilcon Vane* (Intact ◇, Remould ◆); *Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading (parts per million (ppm)) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic 20 40 60 80 Liquid	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	reddish brown **SILTY CLAY / CLAYEY SILT TILL** trace sand and gravel trace shale fragments hard moist	SS	7	91	50/13	7	231	50 / 13	0		
	230.9 reddish brown **WEATHERED SHALE** 7.0	SS	8	100	50/13	8	230	50 / 13	10		
		SS	9	100	50/5	9	229	50 / 5	0		
	227.3 **End of Borehole** 10.7	SS	10	100	50/3	10	228	50 / 3			

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 BC5 Co-Ord. N4835483, E594317

Project Number:	TT93042	Drilling Location:	Sta 12 + 779	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09 Date Completed: Oct 15, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 239.3 m

Lithology Plot	DESCRIPTION	Elevation	Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Field Testing	Lab Testing	Instrumentation Installation	Comments & Grain Size Distribution (%) GR SA SI CL
	about 110 mm ASPHALTIC CONCRETE	239.2	0.0								
	grey **Sand and Gravel FILL** some silt moist	239.1	0.1	SS	1	89	29				
	reddish brown **Sandy Silt / Silty Sand FILL** trace clay moist	238.2	1.1	SS	2	100	32				
	brown **Clayey Silt FILL** trace sand and gravel	237.1	2.1	SS	3	100	33				
	brown **CLAYEY SILT TILL** trace sand and gravel hard moist	236.4	2.9	SS	4	100	42				
	reddish brown **SILT AND SAND / SILTY SAND TILL** trace clay and gravel very dense moist to wet	235.2	4.1	SS	5	100	36				
	End of Borehole	234.4	4.9	SS	6	100	50/15				

Groundwater inferred or encountered during drilling on 10/15/2009 at a depth of: 3.0 m

Cave in depth after removal of augers: 3.5 m

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Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC6 Co-Ord. N4835452, E594274

Project Number:	TT93042	Drilling Location:	Sta 12 + 729	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 14, 09 Date Completed: Oct 14, 09	Revision No.:	0, 5/11/11

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80	Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR	SA	SI	CL
	Geodetic Ground Surface Elevation: 240.0 m														
	brown **Gravelly Sand / Sand and Gravel FILL** some silt moist		SS	1	79	13				5					
			SS	2	56	7	1	239		5					
		238.9													
	brown **SILT AND SAND / SILTY SAND TILL** trace to some clay, trace gravel loose to dense moist	1.1													
			SS	3	100	32				5		8	38	44	10
							2	238							
			SS	4	100	26				35					
							3	237							
			SS	5	100	10				35					
							4	236							
		235.7													
	brown **GRAVELLY SAND** trace to some silt very dense wet	4.3													
			SS	6	100	73				30					
		235.0					5	235							
	End of Borehole	5.0													

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Groundwater inferred or encountered during drilling on 10/14/2009 at a depth of: 2.9 m

Cave in depth after removal of augers: 2.9 m

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC7 Co-Ord. N4835360, E594219

Project Number:	TT93042	Drilling Location:	Sta 12 + 622	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09 Date Completed: Oct 15, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 240.7 m

Lithology Plot	DESCRIPTION	Elev.	Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
	about 100 mm ASPHALTIC CONCRETE	240.6					
	brown **Sand and Gravel FILL** some silt moist	239.9	0.1	SS	1	100	17
	brown **Clayey Silt FILL** trace to some sand, trace gravel moist	239.3	0.8	SS	2	100	18
	brown **CLAYEY SILT TILL** trace sand and gravel hard moist	236.6	1.4	SS	3	100	34
				SS	4	100	32
				SS	5	100	30
	brown **SILT AND SAND / SILTY SAND TILL** trace clay and gravel very dense moist to wet	235.7	4.1	SS	6	100	61
	End of Borehole		5.0				

FIELD TESTING: Penetration Testing — SPT, PPT, DCPT; MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); *Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

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▽ Groundwater inferred or encountered during drilling on 10/15/2009 at a depth of: 4.4 m

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC8 Co-Ord. N4835289, E594164

Project Number:	TT93042	Drilling Location:	Sta 12 + 533	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09 Date Completed: Oct 15, 09	Revision No.:	0, 5/11/11

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 241.1 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	PenetrationTesting: SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80	Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown **Sand and Gravel FILL** trace to some silt moist	SS	1	83	34		241	50	0 5		
	240.5 0.6 brown **Silty Sand FILL** trace to some gravel moist	SS	2	78	21	1	240	50	5 10		
	trace cobbles / boulders	SS	3	100	50/13			50 13	10 3		
		SS	4	100	5	2	239	50	40 18		
	238.2 2.9 brown **SILTY CLAY / CLAYEY SILT TILL** trace sand, trace gravel very stiff moist	SS	5	67	21	3	238	50	35 17		
	237.0 4.1 reddish brown **SANDY SILT / SILTY SAND TILL** trace clay and gravel very dense moist					4	237				
	trace cobbles / boulders 236.4 **End of Borehole** 4.7	SS	6	100	50/15			50 15			

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▽ Groundwater inferred or encountered during drilling on 10/15/2009 at a depth of: 3.3 m

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC9 Co-Ord. N4835203, E594100

Project Number:	TT93042	Drilling Location:	Sta 12 + 425	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09 Date Completed: Oct 15, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 241.6 m

Depth	Description	Elevation	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
	brown **Sand and Gravel FILL** some silt moist		SS	1	94	27
0.6	241.0					
	brown **CLAYEY SILT TILL** trace sand and gravel trace oxidation very stiff to hard moist		SS	2	89	24
			SS	3	100	67
2.1	239.5					
	brown **SAND AND SILT / SANDY SILT TILL** trace gravel, some cobbles / boulders very dense moist		SS	4	100	50/15
			SS	5	100	50/13
	--- grey					
4.7	236.9		SS	6	100	50/10
	End of Borehole					

FIELD TESTING: Penetration Testing — SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%) — GR SA SI CL

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▽ Groundwater inferred or encountered during drilling on 10/15/2009 at a depth of: 3.5 m

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC10 Co-Ord. N4836617, E595345

Project Number:	TT93042	Drilling Location:	Sta 12 + 140	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09 Date Completed: Oct 15, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 238.1 m

Depth (m)	Elevation (m)	Description	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
0	238	brown **Sand and Gravel FILL** trace silt moist	SS	1	78	22
0.6	237.5	brown **Clayey Silt FILL** trace sand and gravel trace organic matter moist	SS	2	78	21
1	237					
			SS	3	56	16
2	236					
			SS	4	67	12
2.9	235.2	brown **SILT AND SAND / SANDY SILT TILL** trace clay, trace gravel dense to very dense moist	SS	5	100	46
3	235					
4	234					
4.6	233.6	some cobbles / boulders **End of Borehole**	SS	6	100	50/1

FIELD TESTING: Penetration Testing (SPT, PPT, DCPT); MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); *Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

Well Detail:
50 mm slotted PVC pipe (3.1 - 4.6 m) with sand pack (3.1 m - 4.6 m), bentonite plug above sand, capped with flush-mounted casing set in concrete.

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

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Groundwater inferred or encountered during drilling on 10/15/2009 at a depth of: 4.1 m

Groundwater depth observed on 17 March 2010 at a depth of: 1.8 m

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC11 Co-Ord. N4834784, E593830

Project Number:	TT93042	Drilling Location:	Sta 11 + 926	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09 Date Completed: Oct 15, 09	Revision No.:	0, 5/11/11

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 236.8 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80	Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR SA SI CL
	brown **Sand and Gravel FILL** some silt moist		SS	1	83	27				0 5		
		236.2										
	brown **Silty Sand FILL** wet	0.6	SS	2	0	31	1	236		0 8		
		235.4										
	brown **CLAYEY SILT TILL** trace sand and gravel trace rootlets and oxidation very stiff moist	1.4	SS	3	100	23	2	235		0 14		
		234.7										
	brown **SILT AND SAND / SANDY SILT TILL** trace clay and gravel trace cobbles / boulders very dense moist to wet	2.1	SS	4	100	66	3	234		0 11		
			SS	5	100	50/15		233	50 15	0 9		
			SS	6	100	50/15	4		50 15	0 11		
		232.1										
	End of Borehole	4.7										

Well Detail:
50 mm slotted
PVC pipe (3.1 m 4.6 m)
with sand pack (3.1 m - 4.6 m),
bentonite plug above sand, capped
with flush-mounted casing
set in concrete.

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▽ Groundwater inferred or encountered during drilling on 10/15/2009 at a depth of: 3.5 m

▼ Groundwater depth observed on 17 March 2010 at a depth of: 1.2 m

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC12 Co-Ord. N4834691, E593774

Project Number:	TT93042	Drilling Location:	Sta 11 + 817	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09 Date Completed: Oct 15, 09	Revision No.:	0, 5/11/11

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 237.6 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80	Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_L Plastic Liquid 20 40 60 80		GR SA SI CL
	brown **Silty Sand FILL** trace to some gravel moist	SS	1	89	12				0		
	-----						237				
	trace clay and organic matter	SS	2	56	12	1			0		
	236.2 brown 1.4 **SILT AND SAND / SANDY SILT TILL** trace clay and gravel dense to very dense moist to wet						236				
		SS	3	89	37	2			0		
		SS	4	100	62		235		5		
		SS	5	100	75	3			5		
							234				
						4					
		SS	6	100	65		233		5		
	232.6 **End of Borehole** 5.0					5					

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▽ Groundwater inferred or encountered during drilling on 10/15/2009 at a depth of: 4.3 m

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC13 Co-Ord. N4834598, E593705

Project Number: TT93042
Project Client: The Regional Municipality of Peel
Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study
Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.

Drilling Location: Sta 11 + 702
Drilling Method: 150 mm Solid Stem Augering
Drilling Machine: Truck Mounted Drill
Date Started: Oct 15, 09 Date Completed: Oct 15, 09

Logged by: JF
Compiled by: SN
Reviewed by: PB
Revision No.: 0, 5/11/11

Geodetic Ground Surface Elevation: 237.9 m

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT, PPT, DCPT); MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); *Undrained Shear Strength (kPa)	LAB TESTING: Rinse pH Values; Soil Vapour Reading (parts per million (ppm)); Lower Explosive Limit (LEL); Plastic; Liquid	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	grey **Silty Sand FILL** trace to some gravel moist	SS	1	83	22				0		
	---- trace clay and organic matter	SS	2	78	17	1	237		35		
	236.6 brown 1.4 **Silty Clay FILL** trace sand and gravel trace organic matter moist	SS	3	94	19				25		
	235.8 brown 2.1 **SILT AND SAND / SANDY SILT TILL** trace clay and gravel dense to very dense moist to wet	SS	4	100	47	2	236		25		
	some cobbles / boulders	SS	5	100	50/15	3	235	50 15	15		
	233.2 **End of Borehole** 4.7	SS	6	100	50/15	4	234	50 15			

▽ Groundwater inferred or encountered during drilling on 10/15/2009 at a depth of: 4.7 m

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Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC14 Co-Ord. N4834549, E593668

Project Number: TT93042
Project Client: The Regional Municipality of Peel
Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study
Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.

Drilling Location: Sta 11 + 640
Drilling Method: 150 mm Solid Stem Augering
Drilling Machine: Truck Mounted Drill
Date Started: Oct 15, 09 Date Completed: Oct 15, 09

Logged by: JF
Compiled by: SN
Reviewed by: PB
Revision No.: 0, 5/11/11

Geodetic Ground Surface Elevation: 237.4 m

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT, PPT, DCPT); MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); *Undrained Shear Strength (kPa)	LAB TESTING: Rinse pH Values; Soil Vapour Reading (parts per million (ppm)); Lower Explosive Limit (LEL); Plastic; Liquid	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown **Sand and Gravel FILL** some silt moist	SS	1	100	22						
	236.8						237				
	grey 0.6 **Clayey Silt FILL** trace sand and gravel trace organic matter moist	SS	2	100	10	1					
		SS	3	100	15		236				
	235.0					2					
	brown 2.4 **SILT AND SAND / SILTY SAND TILL** trace clay and gravel hard moist	SS	4	100	43		235				
		SS	5	100	50/15	3					
	232.7						234				
	End of Borehole 4.7	SS	6	100	50/15	4	233				

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC15 Co-Ord. N4834480, E593614

Project Number: TT93042
Project Client: The Regional Municipality of Peel
Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study
Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.

Drilling Location: Sta 11 + 552
Drilling Method: 150 mm Solid Stem Augering
Drilling Machine: Truck Mounted Drill
Date Started: Oct 15, 09 Date Completed: Oct 15, 09

Logged by: JF
Compiled by: SN
Reviewed by: PB
Revision No.: 0, 5/11/11

Geodetic Ground Surface Elevation: 236.7 m

Lithology Plot	DESCRIPTION	Elev.	Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
	about 100 mm ASPHALTIC CONCRETE	236.6					
	brown **Sand and Gravel FILL** some silt moist	236.0	0.1	SS	1	94	33
	brown **Clayey Silt FILL** trace sand and gravel moist	235.4	0.8	SS	2	100	14
	brown **CLAYEY SILT TILL** trace sand and gravel hard moist	232.6	1.4	SS	3	100	32
				SS	4	100	36
	brown **SILT AND SAND / SILTY SAND TILL** trace clay and gravel very dense moist	231.9	4.1	SS	5	100	51
				SS	6	100	50/15
	End of Borehole		4.9				

FIELD TESTING: Penetration Testing — SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC16 Co-Ord. N4834491, E593603

Project Number:	TT93042	Drilling Location:	Sta 11 + 555	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09 Date Completed: Oct 15, 09	Revision No.:	0, 5/11/11

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80	Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR	SA	SI	CL
	Geodetic Ground Surface Elevation: 236.8 m														
	about 40 mm TOPSOIL	236.7 / 0.0													
	brown Silty Sand FILL trace to some gravel moist		SS	1	89	16				15					
							1	236							
			SS	2	56	15				10					
		235.4 / 1.4													
	brown CLAYEY SILT TILL trace sand and gravel hard moist		SS	3	100	35		235		10					
							2								
			SS	4	100	61				20					
								234							
							3								
			SS	5	100	37				5					
							4	233							
	---- grey		SS	6	100	36		232		5					
		231.7					5								
	End of Borehole	5.0													

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

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RECORD OF BOREHOLE No. BH BC17 Co-Ord. N4834445, E593588

Project Number:	TT93042	Drilling Location:	Sta 11 + 509	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09 Date Completed: Oct 15, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 236.3 m

DESCRIPTION	Elevation	Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
brown **Sand and Gravel FILL** trace to some silt moist	235.7	0.6	SS	1	83	18
brown **Silty Clay FILL** trace sand and gravel moist			SS	2	0	22
trace organic matter			SS	3	100	23
brown **CLAYEY SILT TILL** trace sand and gravel hard moist	234.2	2.1	SS	4	100	33
trace oxidation			SS	5	100	46
grey **SILT AND SAND / SILTY SAND TILL** trace clay and gravel very dense moist	232.2	4.1	SS	6	100	61
End of Borehole	231.3	5.0				

FIELD TESTING: Penetration Testing — SPT, PPT, DCPT; MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); *Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC18 Co-Ord. N4834447, E593547

Project Number:	TT93042	Drilling Location:	Sta 11 + 485	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 27, 09 Date Completed: Oct 27, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 235.9 m

Lithology Plot	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT, PPT, DCPT); MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); *Undrained Shear Strength (kPa)	LAB TESTING: Rinse pH Values; Soil Vapour Reading (parts per million (ppm)); Lower Explosive Limit (LEL); Plastic; Liquid	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 110 mm ASPHALTIC CONCRETE	235.8										
	grey	0.1										
	Sand and Gravel FILL	235.6										
	trace to some silt	0.3										
	moist											
	brown											
	Silty Sand FILL		SS	1	94	27						
	trace gravel											
	moist											
		235.1										
	grey	0.8										
	Clayey Silt FILL		SS	2	22	23	1	235				
	trace sand and gravel											
	moist											
		234.5										
	brown to grey	1.4										
	SILTY CLAY / CLAYEY SILT TILL		SS	3	83	49/15			49 15			
	hard											
	damp						2	234				
	---											
	reddish brown		SS	4	100	50/15			50 15			
	trace gravel and shale fragments											
							3	233				
			SS	5	100	52/15			52 15			
							4	232				
		231.2	SS	6	100	50/13			50 13			
	End of Borehole	4.7										

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH BC19 Co-Ord. N4834399, E593552

Project Number: TT93042
Project Client: The Regional Municipality of Peel
Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study
Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.

Drilling Location: Sta 11 + 451
Drilling Method: 150 mm Solid Stem Augering
Drilling Machine: Truck Mounted Drill
Date Started: Oct 15, 09 Date Completed: Oct 15, 09

Logged by: JF
Compiled by: SN
Reviewed by: PB
Revision No.: 0, 5/11/11

Geodetic Ground Surface Elevation: 236.4 m

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT, PPT, DCPT); MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); *Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid; 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 200 mm ASPHALTIC CONCRETE										
	236.2										
	grey 0.2										
	Sand and Gravel FILL trace to some silt moist	SS	1	78	26		236		10, 3		
	235.6										
	brown 0.8										
	Silty Sand FILL trace clay moist	SS	2	94	20	1			25, 8		
		SS	3	28	17		235		35, 6		
	234.3					2					
	grey 2.1										
	Clayey Silt FILL trace sand and rootlets trace organic matter moist	SS	4	56	12		234		65, 17		
	233.4					3					
	grey 3.0										
	Silty Sand FILL trace organic matter and rootlets moist	SS	5	100	11		233		80, 20		
	232.3					4					
	reddish brown 4.1										
	CLAYEY SILT TILL trace sand and gravel trace cobbles / boulders hard moist	SS	6	100	50/10		232	50, 10	20, 8		
						5	231				
						6					

▽ No freestanding groundwater measured in open borehole on completion of drilling.

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Scale: 1 : 32

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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		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80	Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR	SA	SI	CL
	230.3	SS	7	100	50/3			50/3	0					
	End of Borehole 6.1						230							

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 BC20 Co-Ord. N4834356, E593500

Project Number:	TT93042	Drilling Location:	Sta 11 + 385	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 26, 09 Date Completed: Oct 26, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 237.8 m

Lithology Plot	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT, PPT, DCPT); MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); *Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic 20 40 60 80 Liquid	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 50 mm TOPSOIL	237.8 0.1										
	brown Sand and Gravel FILL trace to some silt moist		SS	1	58	15				5		
								237				
			SS	2	56	8	1			35		
		236.7 1.1										
	brown Silty Clay FILL trace sand and gravel very stiff moist											
			SS	3	100	22		236		25		
							2					
		235.7 2.1										
	brown Sandy Silt FILL trace clay and gravel moist		SS	4	100	26				35		
		234.9 2.9						235				
	reddish brown SILT AND SAND / SILTY SAND TILL trace clay and gravel very dense moist						3					
			SS	5	67	81				40		
								234				
							4					
		233.4 4.4										
	reddish brown WEATHERED SHALE											
		233.1	SS	6	100	50/10			50/10			
	End of Borehole	4.7										

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC21 Co-Ord. N4834315, E593469

Project Number:	TT93042	Drilling Location:	Sta 11 + 333	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 26, 09 Date Completed: Oct 26, 09	Revision No.:	0, 5/11/11

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 238.9 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80	Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80		GR SA SI CL
	about 150 mm TOPSOIL	238.7										
	brown **Sand and Gravel FILL** some silt moist	0.2	SS	1	63	4				0		
		238.2										
	grey **Silty Clay FILL** trace sand, gravel and organic matter moist	0.7	SS	2	0	7	1	238		10		
	brown **CLAYEY SILT TILL** trace sand and gravel very stiff moist	237.5 1.4	SS	3	67	26	2	237		15		
	reddish brown **SILT AND SAND / SILTY SAND TILL** trace clay and gravel very dense moist	236.7 2.1	SS	4	100	50/13			50/13	10		
	some shale fragments		SS	5	91	50/13	3	236	50/13	20		
	reddish brown **WEATHERED SHALE**	234.9 4.0					4	235				
	End of Borehole Auger refusal at 4.7 m depth.	234.2 4.6	SS	6	100	50/5			50/5	5		

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC22 Co-Ord. N4834246, E593437

Project Number: TT93042 | Drilling Location: Sta 11 + 260 | Logged by: JF

Project Client: The Regional Municipality of Peel | Drilling Method: 150 mm Solid Stem Augering | Compiled by: SN

Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study | Drilling Machine: Truck Mounted Drill | Reviewed by: PB

Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON. | Date Started: Oct 26, 09 | Date Completed: Oct 26, 09 | Revision No.: 0, 5/11/11

Geodetic Ground Surface Elevation: 239.6 m

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT ○ PPT □ DCPT ● DCPT); MTO Vane* (Intact △ Remould ▲); Nilcon Vane* (Intact ◇ Remould ◆); *Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown **Silty Sand FILL** trace to some gravel moist	SS	1	71	18					
	238.9 0.7									
	brown **Clayey Silt FILL** trace sand and rootlets moist	SS	2	56	12	1	239			
	238.2 1.4									
	brown **SILT AND SAND / SILTY SAND TILL** trace clay and gravel compact to very dense moist	SS	3	89	28		238			
						2				
		SS	4	78	36		237			
						3				
		SS	5	100	50/15			50 / 15		
							236			
						4				
	trace shale fragments 234.7	SS	6	83	50/15		235	50 / 15		
	End of Borehole 4.9									

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC23 Co-Ord. N4834280, E593438

Project Number: TT93042
Project Client: The Regional Municipality of Peel
Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study
Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.

Drilling Location: Sta 11 + 287
Drilling Method: 150 mm Solid Stem Augering
Drilling Machine: Truck Mounted Drill
Date Started: Oct 26, 09 Date Completed: Oct 26, 09

Logged by: JF
Compiled by: SN
Reviewed by: PB
Revision No.: 0, 5/11/11

Geodetic Ground Surface Elevation: 239.0 m

Lithology Plot	DESCRIPTION	Elevation	Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	ELEVATION (m)	DEPTH (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
	brown **Sand and Gravel FILL** moist			SS	1	75	30			SPT 50	Soil Vapour Reading 5		
		238.1	0.9										
	brown **SILT AND SAND / SILTY SAND TILL** trace clay and gravel compact to very dense moist			SS	2	100	19	238	1		Soil Vapour Reading 10		
				SS	3	100	51	237	2		Soil Vapour Reading 35		
				SS	4	100	47				Soil Vapour Reading 25		
	some cobbles / boulders			SS	5	100	50/15	236	3	SPT 50/15	Soil Vapour Reading 10		
		234.4	4.6	SS	6	100	50/3	235	4	SPT 50/3	Soil Vapour Reading 0		Hard augering
	End of Borehole												

Penetration Testing: SPT, PPT, DCPT
MTO Vane*: Intact, Remould
Nilcon Vane*: Intact, Remould
*Undrained Shear Strength (kPa) 20 40 60 80

Rinse pH Values 2 4 6 8 10 12
Soil Vapour Reading parts per million (ppm) 100 200 300 400
Lower Explosive Limit (LEL) W_p W W_L
Plastic Liquid 20 40 60 80

GR SA SI CL

▽ No freestanding groundwater measured in open borehole on completion of drilling.

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Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC24 Co-Ord. N4834259, E593423

Project Number: TT93042
Project Client: The Regional Municipality of Peel
Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study
Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.

Drilling Location: Sta 11 + 261
Drilling Method: 150 mm Solid Stem Augering
Drilling Machine: Truck Mounted Drill
Date Started: Oct 26, 09 Date Completed: Oct 26, 09

Logged by: JF
Compiled by: SN
Reviewed by: PB
Revision No.: 0, 5/11/11

Geodetic Ground Surface Elevation: 239.6 m

Lithology Plot	DESCRIPTION	Elev.	Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
	about 100 mm TOPSOIL	239.5	0.0				
	brown Gravel and Sand FILL moist		0.1	SS	1	63	7
		238.9	0.7				
	brown Silty Clay FILL trace sand and gravel moist			SS	2	67	8
		238.2	1.4				
	brown Sandy Silt FILL trace clay moist			SS	3	78	9
		237.2	2.4	SS	4	100	50/15
	brown SILT AND SAND / SILTY SAND TILL trace gravel very dense moist						
	trace cobbles / boulders			SS	5	100	50/15
		235.6	4.0				
	reddish brown WEATHERED SHALE						
		235.0	4.6	SS	6	100	50/5
	End of Borehole						

FIELD TESTING: Penetration Testing — SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%) — GR SA SI CL

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

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

Project Number:	TT93042	Drilling Location:	Sta 11 + 039	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 28, 09 Date Completed: Oct 28, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 239.6 m

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)
	brown **Sand and gravel FILL** trace silt moist	SS	1	67	30		
							239
		SS	2	78	18	1	
	238.2 reddish brown 1.4 **Silty Clay FILL** trace sand, trace gravel moist						
		SS	3	67	13		238
						2	
		SS	4	56	12		237
						3	
		SS	5	67	6		
							236
	235.6 brown to reddish brown 4.0 **CLAYEY SILT TILL** trace sand stiff to hard moist					4	
		SS	6	56	14		235
						5	
							234
						6	

FIELD TESTING: Penetration Testing — SPT, PPT, DCPT; MTO Vane* Intact, Remould; Nilcon Vane* Intact, Remould; *Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_L; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%) — GR SA SI CL

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

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

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

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80	Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR	SA	SI	CL
	trace shale fragments 233.4	SS	7	100	50/15			50 / 15	5					
	End of Borehole 6.2						233							

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 BC26 Co-Ord. N4833994, E593228

Project Number: TT93042 | Drilling Location: Sta 10 + 931 | Logged by: JF

Project Client: The Regional Municipality of Peel | Drilling Method: 150 mm Solid Stem Augering | Compiled by: SN

Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study | Drilling Machine: Truck Mounted Drill | Reviewed by: PB

Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON. | Date Started: Oct 28, 09 | Date Completed: Oct 28, 09 | Revision No.: 0, 5/11/11

Geodetic Ground Surface Elevation: 239.5 m

Depth (m)	Elevation (m)	Description	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
0	239.5	brown **Sand and Gravel FILL** moist	SS	1	75	30
		--- trace clay	SS	2	100	20
1	238.5	trace asphaltic concrete debris	SS	3	100	30
	237.4	2.1				
2		grey **Clayey Silt FILL** trace sand and organic matter yellow stains moist	SS	4	100	18
	236.6	2.9				
3		brown **CLAYEY SILT TILL** trace sand hard damp	SS	5	100	32
4	235.5	--- reddish brown	SS	6	100	50/13
	234.8	4.7				
		End of Borehole				

FIELD TESTING: Penetration Testing — SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%) — GR SA SI CL

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC27 Co-Ord. N4833968, E593209

Project Number:	TT93042	Drilling Location:	Sta 10 + 900	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 28, 09 Date Completed: Oct 28, 09	Revision No.:	0, 5/11/11

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 239.5 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80	Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 100 mm TOPSOIL	239.4										
	brown Sand and Gravel FILL trace to some silt, trace rootlets moist	0.1	SS	1	75	8		239	0	0		
	..... trace cobbles / boulders	238.8 0.7										
	reddish brown Silty Clay FILL trace sand and gravel trace oxidation moist		SS	2	0	12	1		0	0		
	reddish brown CLAYEY SILT TILL trace shale fragments hard damp	238.1 1.4	SS	3	100	38		238	0	0		
			SS	4	100	50/15	2	237	50/15	0		
			SS	5	100	50/13	3	236	50/13	5		
			SS	6	100	50/5	4	235	50/5	5		
	End of Borehole	234.9 4.6										

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▽ 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'.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC28 Co-Ord. N4833931, E593205

Project Number:	TT93042	Drilling Location:	Sta 10 + 868	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 28, 09 Date Completed: Oct 28, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 239.0 m

Depth	Elevation	Description	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
0.0	239.0	about 75 mm ASPHALTIC CONCRETE				
0.1	238.9	brown Sand and Gravel FILL moist				
			SS	1	100	29
			SS	2	100	16
1.4	237.5	grey Silty Clay FILL trace sand moist				
			SS	3	100	82
1.8	237.2	reddish brown SILTY CLAY / CLAYEY SILT TILL trace shale fragments hard damp				
			SS	4	100	50/13
			SS	5	100	50/5
4.6	234.4	End of Borehole	SS	6	100	50/3

FIELD TESTING: Penetration Testing (SPT, PPT, DCPT); MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); *Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC29 Co-Ord. N4833893, E593149

Project Number: TT93042
Drilling Location: Sta 10 + 804
Logged by: JF

Project Client: The Regional Municipality of Peel
Drilling Method: 150 mm Solid Stem Augering
Compiled by: SN

Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study
Drilling Machine: Truck Mounted Drill
Reviewed by: PB

Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.
Date Started: Oct 28, 09
Date Completed: Oct 28, 09
Revision No.: 0, 5/11/11

Geodetic Ground Surface Elevation: 237.5 m

Depth (m)	Description	Elevation (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
0	brown **Sand and Gravel FILL** moist	237	SS	1	79	32
0.6	dark grey **Clayey Silt FILL** trace sand and organic matter moist	236.9	SS	2	78	14
1.4	reddish brown **CLAYEY SILT TILL** trace shale fragments hard damp	236.1	SS	3	100	50/15
		235	SS	4	100	50/13
		234	SS	5	100	50/10
4.6	**End of Borehole**	232.9	SS	6	100	50/5

FIELD TESTING: Penetration Testing — SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL); W_p W W_l; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC30 Co-Ord. N4833863, E593125

Project Number: TT93042 | Drilling Location: Sta 10 + 765 | Logged by: JF

Project Client: The Regional Municipality of Peel | Drilling Method: 150 mm Solid Stem Augering | Compiled by: SN

Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study | Drilling Machine: Truck Mounted Drill | Reviewed by: PB

Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON. | Date Started: Oct 28, 09 | Date Completed: Oct 28, 09 | Revision No.: 0, 5/11/11

Geodetic Ground Surface Elevation: 236.0 m

Lithology Plot	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT ○ / PPT □ / DCPT ⬢); MTO Vane* (△ Intact / ▲ Remould); Nilcon Vane* (◇ Intact / ◆ Remould); *Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l; Plastic 20 40 60 80 Liquid	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 120 mm ASPHALTIC CONCRETE	235.9										
	Sand and Gravel FILL some silt	0.1 235.7										
	reddish brown Silty Clay FILL trace sand moist	0.3 235.4	SS	1	56	10			○	△ 0		
	reddish brown SILTY CLAY / CLAYEY SILT TILL trace sand and shale fragments hard damp	0.6										
			SS	2	83	50/15	1	235	50 ○ 15	△ 0		
			SS	3	100	50/8			50 ○ 8	△ 0		
		233.9					2	234				
	grey to reddish brown WEATHERED SHALE damp	2.1	SS	4	100	50/13			50 ○ 13	△ 0		
			SS	5	100	50/8	3	233	50 ○ 8	△ 0		
							4	232				
		231.4	SS	6	100	50/3			50 ○ 3	△ 0		
	End of Borehole	4.6										

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC31 Co-Ord. N4833852, E593116

Project Number:	TT93042	Drilling Location:	Sta 10 + 751	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 28, 09 Date Completed: Oct 28, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 235.3 m

Lithology Plot	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT, PPT, DCPT); MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); *Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 70 mm ASPHALTIC CONCRETE	235.2										
	brown **Sand and Gravel FILL** trace to some silt moist	0.1	SS	1	56	12		235		0		
		234.5										
	reddish brown **CLAYEY SILT TILL** trace sand and shale fragments hard damp	0.8	SS	2	78	58	1	234		0		
		233.9										
	grey **WEATHERED SHALE** trace limestone seams damp	1.4	SS	3	100	50/10			50 10	5		
			SS	4	100	50/8	2	233	50 8	5		
			SS	5	100	50/5	3	232	50 5	0		
	--- reddish brown						4	231				
		230.7	SS	6	100	50/5			50 5	10		
	End of Borehole	4.6										

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BH BC32 Co-Ord. N4833810, E593105

Project Number:	TT93042	Drilling Location:	Sta 10 + 711	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 28, 09 Date Completed: Oct 28, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 233.6 m

DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT / PPT / DCPT); MTO Vane* (Intact / Remould); Nilcon Vane* (Intact / Remould); *Undrained Shear Strength (kPa)	LAB TESTING: Rinse pH Values; Soil Vapour Reading (parts per million (ppm)); Lower Explosive Limit (LEL); Plastic / Liquid	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
brown **Sand and Gravel FILL** some silt moist	SS	1	79	25						
						233				
	SS	2	100	23	1					
232.2										
1.4 reddish brown **CLAYEY SILT TILL** trace sand trace shale fragments hard damp	SS	3	100	50/5		232	50/5			
					2					
	SS	4	100	50/5			50/5			
						231				
	SS	5	100	50/5	3		50/5	6		
						230				
					4					
229.0	SS	6	100	50/5		229	50/5	4		
End of Borehole 4.6										

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC33 Co-Ord. N4833693, E592987

Project Number:	TT93042	Drilling Location:	Sta 10 + 546	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 27, 09 Date Completed: Oct 27, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 224.9 m

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT, PPT, DCPT); MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); *Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 200 mm ASPHALTIC CONCRETE										
	224.7										
	brown 0.2 **Sand and Gravel FILL** trace to some silt moist	SS	1	83	18				0		
						1	224				
		SS	2	78	17				0		
	223.5										
	brown 1.4 **Sandy Silt FILL** trace clay and gravel moist	SS	3	56	12				0		
						2	223				
	222.8										
	brown 2.1 **SILTY CLAY / CLAYEY SILT TILL** trace sand and gravel trace oxidation stiff moist	SS	4	100	12				5		
						3	222				
		SS	5	100	18				10		
	220.9										
	brown to reddish brown 4.0 **SILT AND SAND / SILTY SAND TILL** trace clay and shale fragments hard wet					4	221				
		SS	6	100	70				10		
							220				
	219.9					5					
	End of Borehole 5.0										

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▽ Groundwater inferred or encountered during drilling on 10/27/2009 at a depth of: 4.1 m

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC34 Co-Ord. N4833689, E593015

Project Number:	TT93042	Drilling Location:	Sta 10 + 561	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 27, 09 Date Completed: Oct 27, 09	Revision No.:	0, 5/11/11

Geodetic Ground Surface Elevation: 226.2 m

Depth	Description	Elevation	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
	about 200 mm ASPHALTIC CONCRETE					
0.2	brown Sand and Gravel FILL some silt moist	226.0	SS	1	83	13
0.8	brown Silty Sand FILL trace gravel and organic matter moist	225.4	SS	2	78	7
1.7	brown to dark grey Silty Clay / Clayey Silt FILL trace sand and gravel trace organic matter moist	224.5	SS	3	67	12
			SS	4	89	11
3.4	brown SILTY CLAY / CLAYEY SILT TILL trace sand and trace cobbles / boulders firm moist	222.8	SS	5	56	6
4.3	brown SILT AND SAND / SILTY SAND TILL trace clay and gravel loose wet	221.9	SS	6	100	8
5.0	End of Borehole	221.2				

FIELD TESTING: Penetration Testing — SPT, PPT, DCPT; MTO Vane* Intact, Remould; Nilcon Vane* Intact, Remould; *Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%) — GR SA SI CL

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▽ Groundwater inferred or encountered during drilling on 10/27/2009 at a depth of: 4.3 m

Scale: 1 : 32

RECORD OF BOREHOLE No. BH BC35

Project Number:	TT93042	Drilling Location:	BH BC35	Logged by:	JF
Project Client:	The Regional Municipality of Peel	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 27, 09	Date Completed: Oct 27, 09	Revision No.: 0, 5/11/11

Geodetic Ground Surface Elevation: 0.0 m

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)
	about 150 mm TOPSOIL (0.0)						
	brown **Sand and Gravel FILL** some silt, trace clay moist	A	1			1	-1
	--- trace organic matter and rootlets	A	2			2	-2
						3	-3
	-4.0 brown to grey **Clayey Silt FILL** trace sand and gravel moist	A	3			4	-4
						5	-5
						6	

FIELD TESTING: Penetration Testing — SPT, PPT, DCPT; MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); *Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_L; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

Well Detail:
50 mm slotted
PVC pipe (11.3 - 12.9 m)
with sand pack (11.3 m - 12.9 m),
bentonite plug above sand, capped
with flush-mounted casing
set in concrete.

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL

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▽ No freestanding groundwater measured in open borehole on completion of drilling.

▼ Groundwater depth observed on 17 March 2010 at a depth of: 10.5 m

Scale: 1 : 32

Continued on Next Page

RECORD OF BOREHOLE No. BH BC35

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

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown to grey **Clayey Silt FILL** trace sand and gravel moist	A	4			7	-7				
		A	5			8	-8				
						9	-9				
						10	-10				
	-11.0	SS	6	56	32	11	-11				
	11.0 reddish brown **WEATHERED SHALE** limestone seams damp										
		SS	7	100	50/5	12	-12	50/5			

FIELD TESTING: Penetration Testing — SPT, PPT, DCPT; MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL); W_p W W_l; Plastic Liquid; 20 40 60 80

Scale: 1 : 32

Continued on Next Page

RECORD OF BOREHOLE No. BH BC35

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

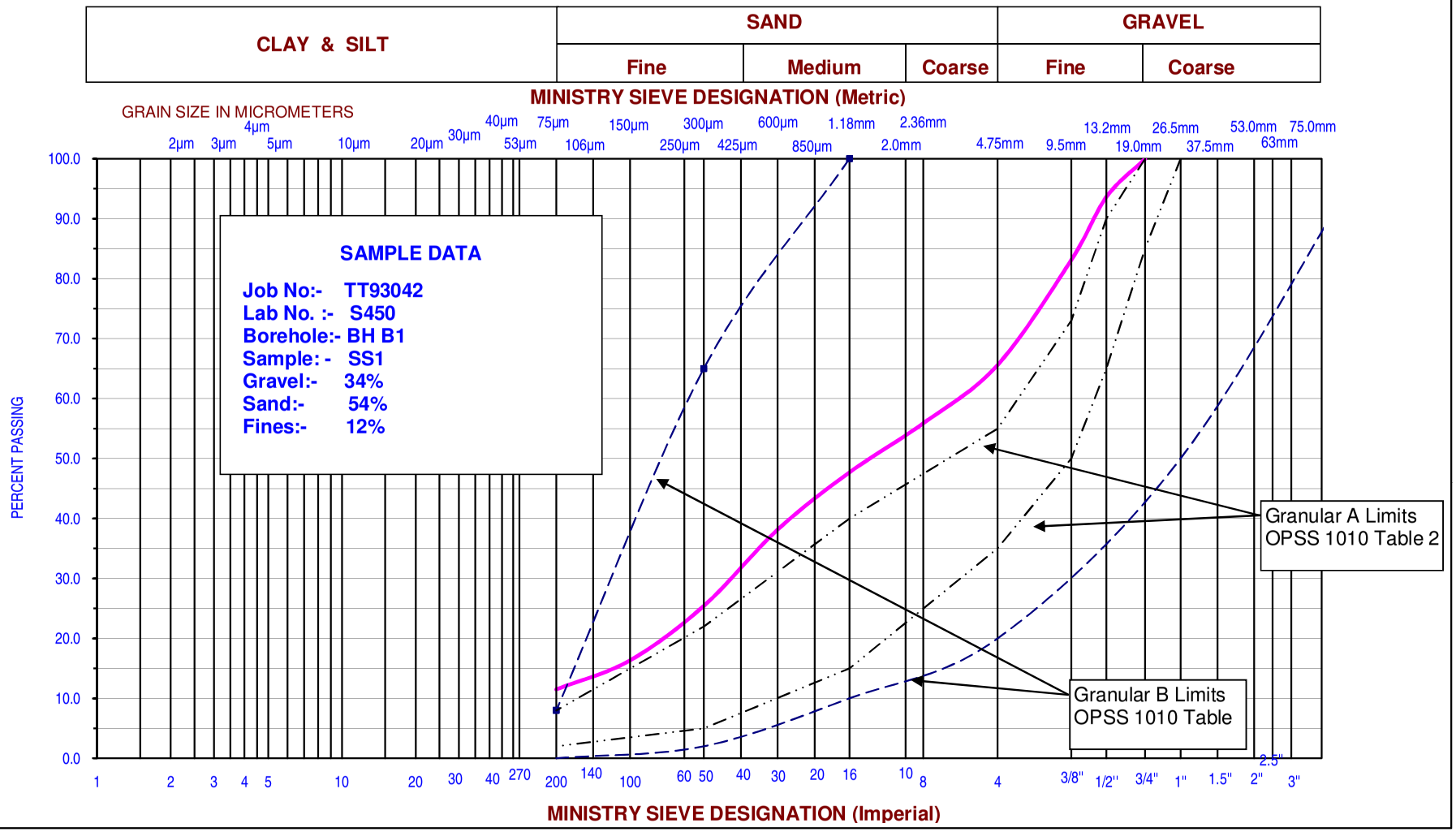
LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; *Undrained Shear Strength (kPa) 20 40 50 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR SA SI CL
	-12.9	SS	8	0	50/5			○ 5			
	End of Borehole 12.9						-13				
	Auger refusal at 13.0 m depth.										

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

APPENDIX A
LABORATORY SOIL TEST RESULTS

UNIFIED SOIL CLASSIFICATION SYSTEM



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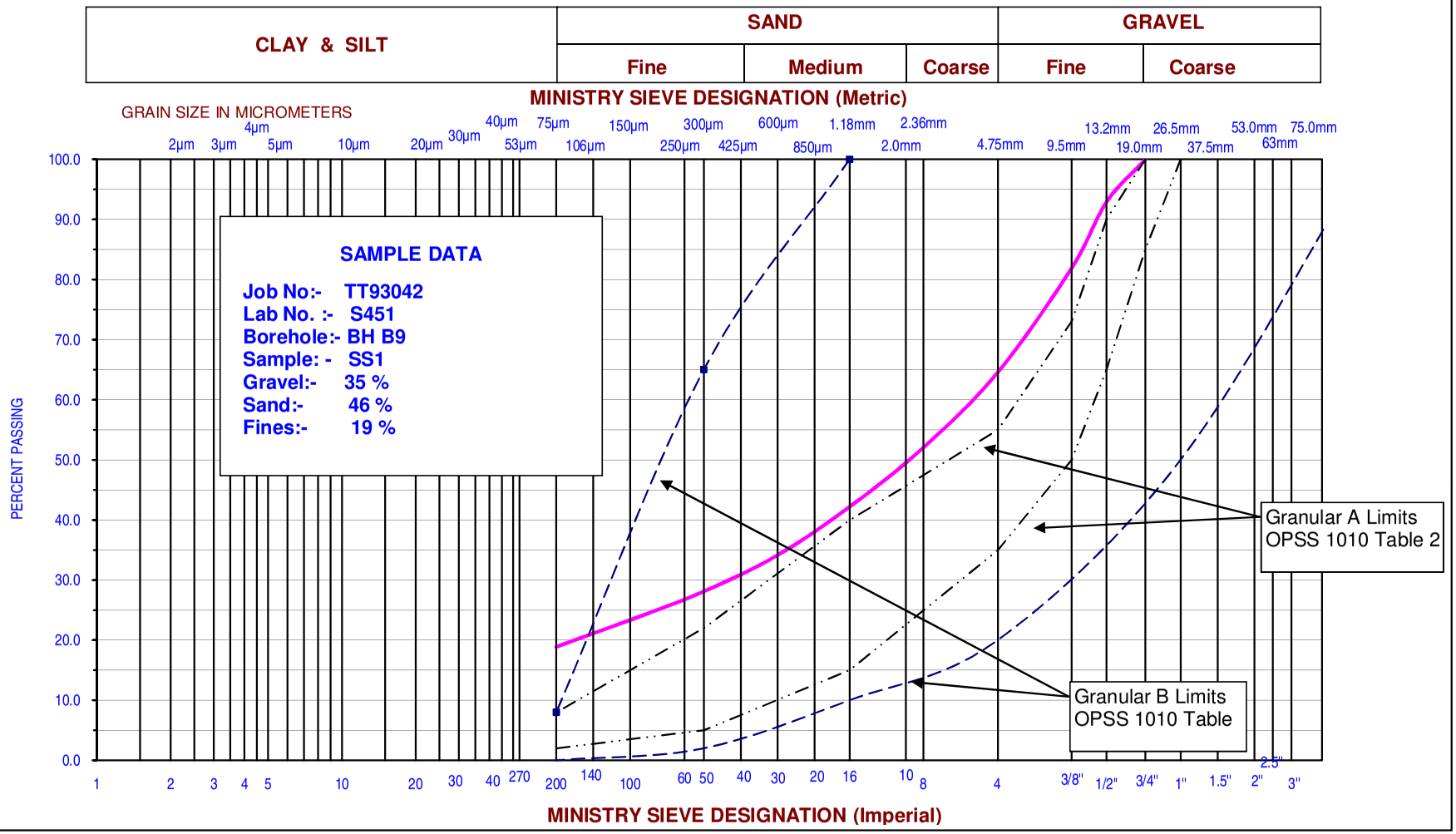
www.amec.com

GRAIN SIZE DISTRIBUTION	Client :- Regional Municipality of Peel
	Project:- Geotechnical Investigation for Bovaird Drive
GRAVELLY SAND	Location:- Brampton, Ontario
some silt	Lab No. :- S450 / Date :- 03 Dec 2009

Figure No. A 1

UNIFIED SOIL CLASSIFICATION SYSTEM



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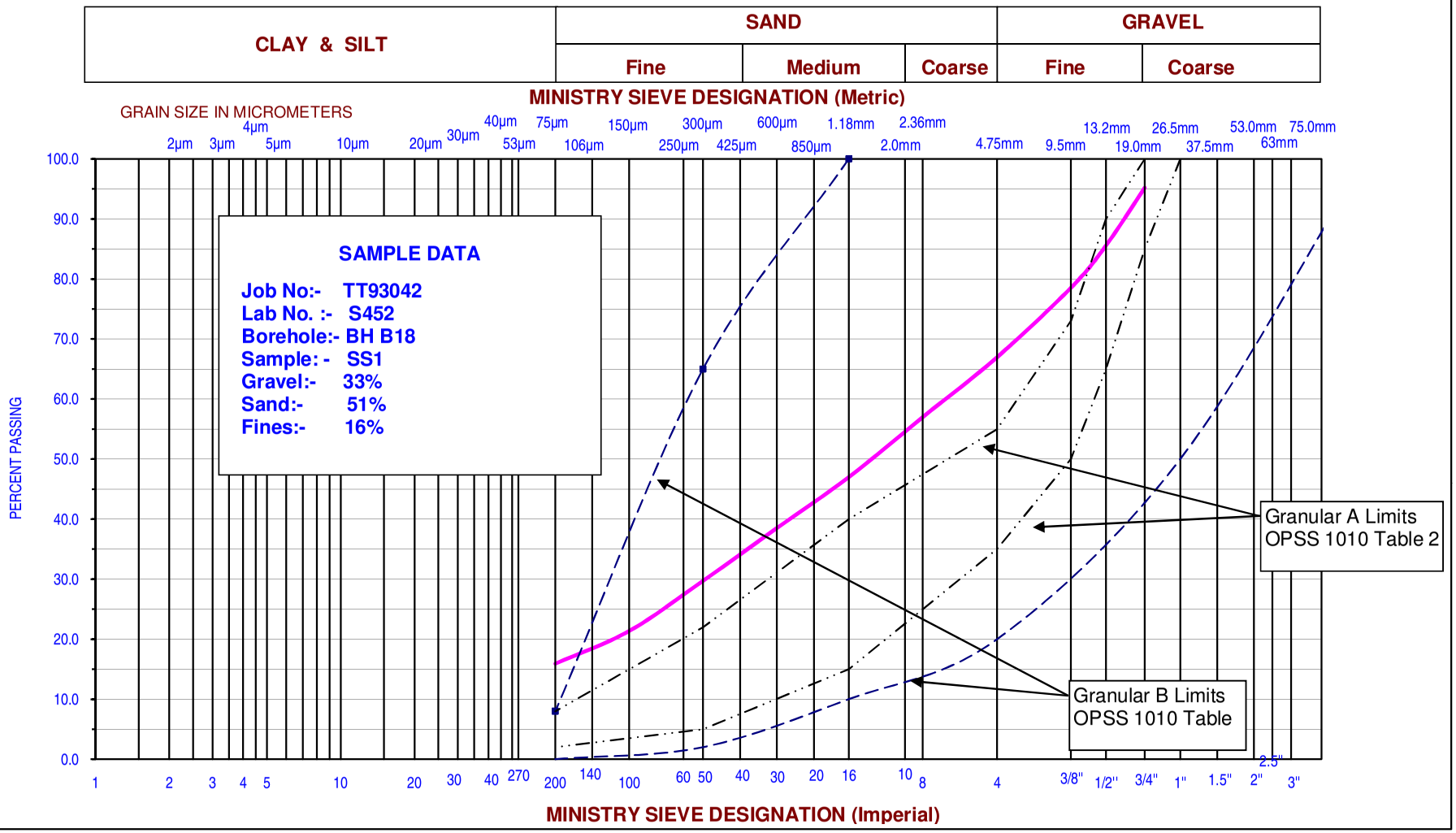
GRAIN SIZE DISTRIBUTION	Client :- Regional Municipality of Peel
	Project:- Geotechnical Investigation for Bovaird Drive
GRAVELLY SAND some silt	Location:- Brampton, Ontario
	Lab No. :- S451 — Date :- 03 Dec 2009

Figure No. A 2

UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION	Client :- Regional Municipality of Peel
	Project:- Geotechnical Investigation for Bovaird Drive
GRAVELLY SAND	Location:- Brampton, Ontario
some silt	Lab No. :- S452 / Date :- 03 Dec 2009

Figure No. A 3

APPENDIX B

CERTIFICATES OF ANALYSES

Client:	AMEC Earth and Environmental, a division of AMEC Americas Limited 104 Crockford Boulevard Scarborough, Ontario M1R 3C3	Report Date: Received Date:	November 11, 2009 November 02, 2009
		Page:	1 of 4
Project Name:	Bovaird Dr. Class EA	Sample Type:	Soil
Project Number:	TT 93042	Lab Ref.:	FN09-2683
Contact:	Siva Nadarajah		Final

CERTIFICATE OF ANALYSIS

BTEX, PHC (F1-F4)

Lab Number Sample ID Date Collected Unit				09-16626 B1 SS4 NP (µg/g)	09-16626 B1 SS4 NP (µg/g)	09-16627 B5 SS2 NP (µg/g)	09-16628 B9 SS3 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	<0.001	<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	0.002	0.002	0.001	0.004	0.005	0.001	0.003
o-Xylene			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 Recovery (%)							
Dibromofluoromethane				97	95	94	95
Toluene-D8				93	92	100	91
4-Bromofluorobenzene				89	96	99	94
PHC F1 Surrogate Recovery (%)							
Difluorobenzene				101	NR	96	104
4-Bromofluorobenzene				96	NR	92	95
Trifluorotoluene				91	NR	82	99
PHC F2-F4 Surrogate Recovery (%)							
O-Terphenyl				102	NR	96	100
Moisture Content (%)				19.8	NR	4.6	18.6

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Client:	AMEC Earth and Environmental, a division of AMEC Americas Limited 104 Crockford Boulevard Scarborough, Ontario M1R 3C3	Report Date:	November 11, 2009
		Received Date:	November 02, 2009
		Page:	2 of 4
Project Name:	Bovaird Dr. Class EA	Sample Type:	Soil
Project Number:	TT 93042	Lab Ref.:	FN09-2683
Contact:	Siva Nadarajah		Final

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			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 Recovery (%)						
Dibromofluoromethane				100	96	NR
Toluene-D8				87	95	NR
4-Bromofluorobenzene				74	88	NR
PHC F1 Surrogate Recovery (%)						
Difluorobenzene				97	97	101
4-Bromofluorobenzene				99	90	97
Trifluorotoluene				94	89	97
PHC F2-F4 Surrogate Recovery (%)						
O-Terphenyl				97	71	101
Moisture Content (%)				11.5	13.5	NR

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		Received Date:	November 02, 2009
		Page:	3 of 4
Project Name:	Bovaird Dr. Class EA	Sample Type:	Soil
Project Number:	TT 93042	Lab Ref.:	FN09-2683
Contact:	Siva Nadarajah		Final

CERTIFICATE OF ANALYSIS

BTEX, PHC (F1-F4)

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

Suman Punani, C. Chem
Laboratory Manager

Cynthia Ridge, C. Chem.
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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 compliance to Ontario Regulation 153/04 requirements.
N/V - No value derived.

Analysis complies with CCME PHC Tier 1 Method, 2004 and is validated for use in the laboratory.
The chromatogram descended to the baseline by C50.
nC6 and nC10 response factors within 30% of response factor for toluene.
nC10, nC16 and nC34 response factors within 10% of each other.
C50 response factors within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Professional judgement, if requested, of what the material is, based on information that is stated (product profiles, retention times, professional experience, etc.)
If F4 and F4G are reported, the greater of the two numbers are to be used in application to guideline.
PAH not subtracted from PHC F2-F4.
Extraction and analysis limits for holding time were met.

All values reported on dry weight basis and in ppm (µg/g) unless otherwise stated.
Results relate 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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Client:	AMEC Earth and Environmental, a division of AMEC Americas Limited 104 Crockford Boulevard Scarborough, Ontario M1R 3C3	Report Date: Received Date:	November 11, 2009 November 02, 2009
		Page:	1 of 3
Project Name:	Bovaird Dr. Class EA	Sample Type:	Solid/Reg.558 Leachate
Project Number:	TT 93042	Lab. Ref.:	FN09-2683
Contact:	Siva Nadarajah		Final

CERTIFICATE OF ANALYSIS

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

Lab Number			**09-16636**
Sample ID			**COMP-1**
Date Collected			**NP**
Unit			**(mg/L)**
Parameter	**Schedule 4 Leachate Criteria (mg/L)**	**MDL (mg/L)**	
Benzo(a)pyrene	0.001	0.0001	<0.0001
Surrogate Recovery (%)			
Naphthalene-d8			79
Anthracene-d10			100
Perylene-d12			100

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Client:	AMEC Earth and Environmental, a division of AMEC Americas Limited 104 Crockford Boulevard Scarborough, Ontario M1R 3C3	Report Date:	November 11, 2009
		Received Date:	November 02, 2009
		Page:	2 of 3
Project Name:	Bovaird Dr. Class EA	Sample Type:	Solid/Reg.558 Leachate
Project Number:	TT 93042	Lab. Ref.:	FN09-2683
Contact:	Siva Nadarajah		Final

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 B		

Analyst: S. Lam, C. Chem.

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Client:	AMEC-Scarborough	Report Date:	November 11, 2009
Lab Ref:	FN09-2683	Page:	3 of 3

Samples average temperature upon receipt: 21.6 °C

Reported in compliance to Ontario Regulation 558 - TCLP Leachate requirements.

All values reported in ppm (mg/L) unless otherwise stated.
Results relate 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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Client:	AMEC Earth and Environmental, a division of AMEC Americas Limited 104 Crockford Boulevard Scarborough, Ontario M1R 3C3	Report Date: Received Date: Page:	November 11, 2009 November 02, 2009 1 of 3
Project Name:	Bovaird Dr. Class EA	Sample Type:	Solid/Reg.558 Leachate
Project Number:	TT 93042	Lab. Ref.:	FN09-2683
Contact:	Siva Nadarajsh		Final

CERTIFICATE OF ANALYSIS

Ontario Regulation 558 - TCLP Leachate (Inorganics)

Lab Number			**09-16636**
Sample ID			**COMP-1**
Date Collected			**NP**
Unit			**(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		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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		Page:	2 of 3
Project Name:	Bovaird Dr. Class EA	Sample Type:	Solid/Reg.558 Leachate
Project Number:	TT 93042	Lab. Ref.:	FN09-2683
Contact:	Siva Nadarajsh		Final

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	

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Client:	AMEC-Scarborough	Report Date:	November 11, 2009
Lab Ref:	FN09-2683	Page:	3 of 3

Samples average temperature upon receipt: 21.6 °C

Reported in compliance to Ontario Regulation 558 - TCLP Leachate requirements.

All values reported in ppm (mg/L) unless otherwise stated.
Results relate 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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Client:	AMEC Earth and Environmental, a division of AMEC Americas Limited 104 Crockford Boulevard Scarborough, Ontario M1R 3C3	Report Date:	November 11, 2009
		Received Date:	November 02, 2009
		Page:	1 of 6
Project Name:	Bovaird Dr. Class EA	Sample Type:	Soil
Project Number:	TT 93042	Lab. Ref.:	FN09-2683
Contact:	Siva Nadarajah		Final

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
pH	-	-	-	-	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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		Page:	2 of 6
Project Name:	Bovaird Dr. Class EA	Sample Type:	Soil
Project Number:	TT 93042	Lab. Ref.:	FN09-2683
Contact:	Siva Nadarajah		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
pH	-	-	-	-	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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Client:	AMEC Earth and Environmental, a division of AMEC Americas Limited 104 Crockford Boulevard Scarborough, Ontario M1R 3C3	Report Date: Received Date:	November 11, 2009 November 02, 2009
		Page:	3 of 6
Project Name:	Bovaird Dr. Class EA	Sample Type:	Soil
Project Number:	TT 93042	Lab. Ref.:	FN09-2683
Contact:	Siva Nadarajah		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** **(Replicate)**
General Chemistry	**Table 1 Agricultural or Other Property Use**	**Table 1 All Other Types of Property Uses**	**Unit**	**MDL**		
Conductivity	0.47	0.57	(mS/cm)	0.01	1.61	1.59
pH	-	-	-	-	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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Client:	AMEC Earth and Environmental, a division of AMEC Americas Limited 104 Crockford Boulevard Scarborough, Ontario M1R 3C3	Report Date:	November 11, 2009
		Received Date:	November 02, 2009
		Page:	4 of 6
Project Name:	Bovaird Dr. Class EA	Sample Type:	Soil
Project Number:	TT 93042	Lab. Ref.:	FN09-2683
Contact:	Siva Nadarajah		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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Client:	AMEC Earth and Environmental, a division of AMEC Americas Limited 104 Crockford Boulevard Scarborough, Ontario M1R 3C3	Report Date: Received Date:	November 11, 2009 November 02, 2009
		Page:	5 of 6
Project Name:	Bovaird Dr. Class EA	Sample Type:	Soil
Project Number:	TT 93042	Lab. Ref.:	FN09-2683
Contact:	Siva Nadarajah		Final

CERTIFICATE OF ANALYSIS

Ontario Regulation 153/04 (Inorganics + Metals)

			Method References
General Chemistry	**Unit**	**MDL**	
Conductivity	(mS/cm)	0.01	MOE 3137
pH	-	-	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
Lead	(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
Nickel	(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
Thallium	(µg/g)	0.5	SW 846, 3050, 6010 C
Vanadium	(µg/g)	5	SW 846, 3050, 6010 C
Zinc	(µg/g)	2	SW 846, 3050, 6010 C

Suman Punani, C. Chem.
Laboratory Manager

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

/gz

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
Suman Punani
CHEMIST

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Client:	AMEC-Scarborough	Report Date:	November 11, 2009
Lab Ref:	FN09-2683	Page:	6 of 6

Samples average temperature upon receipt: 21.6 °C

Reported in compliance to Ontario Regulation 153/04 requirements.
N/V - No value derived.

All values reported on dry weight basis.
Results relate 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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Client:	AMEC Earth & Environmental, a division of AMEC Americas Limited 104 Crockford Boulevard Scarborough, Ontario M1R 3C3	Report Date: Received Date:	January 28, 2010 January 20, 2010
		Page:	1 of 4
Project Name:	Bovaird Drive Class EA	Sample Type:	Soil
Project Number:	TT 93042	Lab Ref.:	FN10-103
Contact:	Siva Nadarajah		Final

CERTIFICATE OF ANALYSIS

BTEX, PHC (F1-F4)

Lab Number **Sample ID** **Date Collected**					**10-00929** **B1 SS4** **20-Jan-10**	**10-00930** **B5 SS2** **20-Jan-10**	**10-00931** **B9 SS3** **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			(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 Recovery							
Dibromofluoromethane			(%)		94	92	96
Toluene-D8			(%)		98	96	100
4-Bromofluorobenzene			(%)		95	99	95
PHC F1 Surrogate Recovery							
Difluorobenzene			(%)		97	98	96
4-Bromofluorobenzene			(%)		93	92	86
Trifluorotoluene			(%)		89	97	91
PHC F2-F4 Surrogate Recovery							
O-Terphenyl			(%)		84	80	90
Moisture Content			(%)		13.6	2.6	12.7

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Client:	AMEC Earth & Environmental, a division of AMEC Americas Limited 104 Crockford Boulevard Scarborough, Ontario M1R 3C3	Report Date: Received Date:	January 28, 2010 January 20, 2010
		Page:	2 of 4
Project Name:	Bovaird Drive Class EA	Sample Type:	Soil
Project Number:	TT 93042	Lab Ref.:	FN10-103
Contact:	Siva Nadarajah		Final

CERTIFICATE OF ANALYSIS

BTEX, PHC (F1-F4)

Lab Number **Sample ID** **Date Collected**					**10-00932** **B11 SS2** **20-Jan-10**	**10-00933** **BC22 SS2** **20-Jan-10**	**10-00933** **BC22 SS2** **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			(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)	-	-	(µg/g)	600	NA	NA	NA
BTEX Surrogate Recovery							
Dibromofluoromethane			(%)		100	96	97
Toluene-D8			(%)		102	103	102
4-Bromofluorobenzene			(%)		94	98	96
PHC F1 Surrogate Recovery							
Difluorobenzene			(%)		96	98	NR
4-Bromofluorobenzene			(%)		88	88	NR
Trifluorotoluene			(%)		96	88	NR
PHC F2-F4 Surrogate Recovery							
O-Terphenyl			(%)		90	82	94
Moisture Content			(%)		7.1	5.6	NR

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Client:	AMEC Earth & Environmental, a division of AMEC Americas Limited 104 Crockford Boulevard Scarborough, Ontario M1R 3C3	Report Date:	January 28, 2010
		Received Date:	January 20, 2010
		Page:	3 of 4
Project Name:	Bovaird Drive Class EA	Sample Type:	Soil
Project Number:	TT 93042	Lab Ref.:	FN10-103
Contact:	Siva Nadarajah		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	21-Jan-10	26-Jan-10
Toluene	(µg/g)	0.001	<0.001	0.107	85		
Ethylbenzene	(µg/g)	0.001	<0.001	0.101	81		
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		
PHC F2 (>C10-C16)	(µg/g)	10	<10	1050	105	21-Jan-10	25-Jan-10
PHC F3 (>C16-C34)	(µg/g)	50	<50				
PHC F4 (>C34-C50)	(µg/g)	50	<50				
PHC F4G (Silica Gel)	(µg/g)	600	-	-	-	-	-
BTEX							
Surrogate Recovery	(%)						
Dibromofluoromethane	(%)		95	104	104	21-Jan-10	26-Jan-10
Toluene-D8	(%)		100	106	106		
4-Bromofluorobenzene			101	99	99		
PHC F1	(%)						
Surrogate Recovery	(%)						
Difluorobenzene	(%)		103	101	101	21-Jan-10	25-Jan-10
4-Bromofluorobenzene			92	90	90		
Trifluorotoluene			106	99	99		
	(%)						
PHC F2-F4							
Surrogate Recovery							
O-Terphenyl	(%)		84	90	90	21-Jan-10	25-Jan-10
Method Reference			CCME, Tier 1, 2004				

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Analysts: J. Evans, B. Sc.
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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 compliance to Ontario Regulation 153/04 requirements.
N/V - No value derived.

Analysis complies with CCME PHC Tier 1 Method, 2004 and is validated for use in the laboratory.
The chromatogram descended to the baseline by C50.
nC6 and nC10 response factors within 30% of response factor for toluene.
nC10, nC16 and nC34 response factors within 10% of each other.
C50 response factors within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Professional judgement, if requested, of what the material is, based on information that is stated (product profiles, retention times, professional experience, etc.)
If F4 and F4G are reported, the greater of the two numbers are to be used in application to guideline.
PAH not subtracted from PHC F2-F4.
Extraction and analysis limits for holding time were met.

All values reported on dry weight basis and in ppm (µg/g) unless otherwise stated.
Results relate 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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APPENDIX C

PAVEMENT CONDITION SURVEY

LAKE LOUISE DRIVE / WORTHINGTON AVENUE TO MISSISSAUGA ROAD											
		Severity of Distress					Density of Distress				
		Very Slight	Slight	Moderate	Severe	Very Severe	Few	Intermittent	Frequent	Extensive	Throughout
							<10 %	10-20 %	20-50 %	50-80 %	80-100 %
Pavement		1	2	3	4	5	1	2	3	4	5
Surface Defects											
Ravelling & Coarse Aggregate Loss	1										
Flushing	2										
Surface Deformation											
Rippling & Shoving	3										
Wheel Track Rutting	4										
Distortion	5										
Cracking	**Longitudinal Wheel Track**										
	Single & Multiple	6									
	Alligator	7									
	Centreline										
	Single & Multiple	8		√				√			
	Alligator	9									
	Random Cracking	10									
	Midlane Cracking	11					√	√			
	Pavement Edge										
	Single & Multiple	12									
	Alligator	13									
	Transverse										
	Single & Multiple	14									
	Alligator	15									

MISSISSAUGA ROAD TO HERITAGE ROAD											
		Severity of Distress					Density of Distress				
		Very Slight	Slight	Moderate	Severe	Very Severe	Few <10 %	Intermittent 10-20 %	Frequent 20-50 %	Extensive 50-80 %	Throughout 80-100 %
Pavement		1	2	3	4	5	1	2	3	4	5
Surface Defects											
Ravelling & Coarse Aggregate Loss	1		√					√			
Flushing	2										
Surface Deformation											
Rippling & Shoving	3										
Wheel Track Rutting	4			√					√		
Distortion	5			√					√		
Cracking	**Longitudinal Wheel Track**										
	Single & Multiple	6			√					√		
	Alligator	7		√					√			
	Centreline										
	Single & Multiple	8			√					√		
	Alligator	9		√					√			
	Random Cracking	10									
	Midlane Cracking	11			√					√		
	Pavement Edge										
	Single & Multiple	12		√					√			
	Alligator	13		√					√			
	Transverse										
	Single & Multiple	14				√				√		
	Alligator	15			√					√		

HERITAGE ROAD TO PEEL / HALTON BOUNDARY											
			Severity of Distress					Density of Distress				
			Very Slight	Slight	Moderate	Severe	Very Severe	Few <10 %	Intermittent 10-20 %	Frequent 20-50 %	Extensive 50-80 %	Throughout 80-100 %
Pavement			1	2	3	4	5	1	2	3	4	5
Surface Defects												
Ravelling & Coarse Aggregate Loss		1	√					√				
Flushing		2	√					√				
Surface Deformation												
Rippling & Shoving		3		√				√				
Wheel Track Rutting		4			√					√		
Distortion		5			√					√		
Cracking	**Longitudinal Wheel Track**											
	Single & Multiple	6			√					√		
	Alligator	7		√					√			
	Centreline											
	Single & Multiple	8			√					√		
	Alligator	9	√							√		
	Random Cracking	10										
	Midlane Cracking	11				√				√		
	Pavement Edge											
	Single & Multiple	12		√					√			
	Alligator	13		√					√			
	Transverse											
	Single & Multiple	14				√					√	
	Alligator	15		√							√	

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	4

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)