APPENDIX K

PRELIMINARY GEOTECHNICAL INVESTIGATION

PRELIMINARY GEOTECHNICAL INVESTIGATION
CLASS ENVIRONMENTAL ASSESSMENT STUDY
DUNDAS STREET WIDENING BRANT STREET / CEDAR SPRINGS TO PROUDFOOT TRAIL, BURLINGTON / OAKVILLE, HALTON REGION, ONTARIO

Report Submitted

To

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TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out by Thurber Engineering Ltd. (Thurber) as part of a Class Environmental Assessment for a proposed widening of Dundas Street between Brant Street / Cedar Springs Road to 500m west of Appleby Line and East of Appleby Line from the CNR overpass to Proudfoot Trail, in the City of Burlington and Town of Oakville, Ontario.

The purpose of this investigation was to obtain subsurface information along the roadway corridor and based on the findings, to provide preliminary geotechnical recommendations for roadway widening and reconstruction to six through lanes; incorporating culvert extensions at all watercourses and possible widening or replacement of Bronte Creek Tansley Bridge and widening of the CNR Overhead Bridge structures.

The geotechnical investigation was carried out in general accordance with Thurber's revised proposal letter No. 107-4973 dated October 31, 2008.

The contents of this report are subject to the Statement of General Conditions attached at the end of the text. The reader's attention is specifically drawn to these conditions as it is essential that they be followed for the proper use and interpretation of this report.

2.0 PROJECT AND SITE DESCRIPTION

2.1 Existing Roadway

Dundas Street between Brant Street / Cedar Springs Road and Proudfoot Trail is part of a major arterial road typically comprising a four-lane undivided rural cross-section and is under the jurisdiction of Halton Region.

The lands on the south side of Dundas Street contain residential and commercial developments. The lands to the north are extensively rural but are being developed in some areas. Undeveloped forest land also exists adjacent to Bronte Creek.

Grades along Dundas Street are gently undulating with elevations ranging from approximately 220 m in the west to 130 m at Bronte Creek. Drainage generally flows southeast.

Concrete and CSP culverts are present under the roadway at several locations along Dundas Street.

The study area is located within the South Slope physiographic region. The geology generally comprises a till plain consisting of clayey silt to silty clay (Halton Till) overlying shale bedrock. Recent alluvial deposits are contained within the creek valleys. The western extent of the site is bound by the Niagara Escarpment.

2.2 Proposed Works

The study area is 12.75 km along Dundas Street, confined between Brant Street / Cedar Springs Road and Proudfoot Trail and spans the boundary between the local municipalities of Burlington and Oakville. The proposed road improvements in the study area may include a combination of the following:

- Widening the existing roadway to six through lanes including two lanes for Bus Rapid Transit (BRT)
- Replacement / rehabilitation or extension of culverts at all watercourse crossings
- Introduction of traffic signals at future proposed development intersections
- Possible improvements at various intersections within the study area
- Improvements to the vertical and horizontal alignments where necessary.

3.0 INVESTIGATION PROCEDURES

3.1 Field Investigation

The field investigation was carried out during the period July 27 to August 17, 2009 and comprised 25 boreholes drilled at locations along Dundas Street, at proposed culvert extension locations, and at proposed bridge widening locations. The borehole locations are shown on Drawings 19-1351-142-1 to 19-1351-142-8, Appendix A, and are briefly described in Table 3.1.

Table 3.1 – Borehole Locations and Depths

Borehole Designation	Number of Boreholes	Location	Borehole Depths (m)
Pavement	6	Six boreholes drilled in the center of the outside lane in both directions	3.7
Culverts	15	On shoulder or at culvert inlet / outlet.	3.8 to 8.5
Structures	4	Boreholes at abutments of CN Railway and Bronte Creek bridges	5.5 to 14.1

The borehole locations were established by Thurber relative to existing site features. The locations and ground surface elevations at the culvert boreholes were subsequently tied in by GPS to within 0.5m both horizontally and vertically.

Borehole locations were marked in the field, cleared of utilities and road occupancy permits were obtained prior to commencement of drilling. Traffic control was provided during pavement coring and drilling on the roadways. Boreholes were advanced using a rubber tracked D50 Turbo drill rig and a truck mounted D90 drill rig supplied and operated by Walker Drilling Limited, Utopia, Ontario.

Solid stem augers were employed to advance the boreholes, and soil samples were obtained in conjunction with the Standard Penetration Test (SPT) at regular intervals. Two boreholes were extended 3.1 to 5.2 m into bedrock using HQ rock coring equipment.

The field investigation was carried out under the full-time supervision of Thurber technical staff. All boreholes were logged in the field. Soil samples were identified, placed in labelled containers and transported back to Thurber's laboratory for further examination and testing.

The recovered rock core samples were logged in the field, packaged in core boxes with moist paper towel and parafilm wrap, and transported back to our laboratory for further examination and testing.

Groundwater conditions in the open boreholes were noted during drilling. Coring operations introduced water into the boreholes and therefore observation of groundwater in the bedrock was not possible at rock core locations. Piezometers were installed in selected boreholes to measure stabilized groundwater levels. Groundwater monitoring was undertaken on August 5 and October 2, 2009.

Upon completion, all boreholes were backfilled deactivated in accordance with MOE Regulation 903 on October 2, 2009.

Results of the field drilling, sampling and testing are presented on the Record of Borehole sheets in Appendix B. Cores of the existing asphalt and concrete pavement were recovered from 6 locations for visual examination and confirmation of the pavement thickness. The core diameter was 190 mm. Each core hole was backfilled with cold mix asphalt after completion.

The asphalt and core lengths and descriptions are documented in Table D2, included in Appendix D.

3.2 Laboratory Testing

Geotechnical laboratory testing consisted of natural moisture content determinations, visual classification and description of all soil samples. Grain size distribution analyses were carried out on selected samples of the pavement granular materials and subgrade soils. Atterberg Limits testing was also carried out on samples of the subgrade material exhibiting plasticity.

Point Load tests were conducted on selected samples of rock core to assess the compressive strength. Point Load Tests were possible only on less weathered shale or higher strength limestone interbed samples as the highly weathered shale cores tended to split or disintegrate along bedding planes, and were not representative tests.

Results of the geotechnical laboratory testing are presented on the Record of Borehole sheets, Appendix B, and in plots in Appendix C.

4.0 SUBSURFACE CONDITIONS

A generalized description of the subsurface conditions encountered in the cores and boreholes drilled at the site is given below. The Record of Borehole sheets in Appendix B provide detailed descriptions of the soil conditions at specific locations drilled. An overall description of the stratigraphy is given in the following paragraphs however the factual data presented in the borehole logs governs any interpretation of the site conditions. It should be recognized that soil conditions may vary between and beyond borehole locations.

The subsurface stratigraphy encountered in the boreholes generally comprises a surficial pavement structure overlying silty clay fill which in turn was underlain by silty clay till to silty sand till, resting on shale bedrock.

Although not encountered in boreholes, local experience elsewhere on Dundas Street indicates buried asphalt and granular layers may be present where recent pavement was placed over older roadway.

4.1 Pavement Structure

The thickness of the pavement structure components revealed in the boreholes, as well as the estimated Granular Base Equivalency (GBE), is summarized in Table 4.1.

Table 4.1 – Existing Pavement Thickness

Pavement Component	Thickness (mm)		
	Minimum	Maximum	Median Value
Asphalt	150	180	155
Granular Base	500	1010	735
Total Thickness	650	1190	890

From knowledge of previous investigations along Dundas Street it is understood that road widening involved placement of granulars directly over the old asphalt layer.

4.2 Fill

4.2.1 Granular Fill

Granular fill varying from sand and gravel to silt and sand was encountered in boreholes drilled through the roadway pavement structure. N-values obtained in

the granular fill typically ranged from 11 to 35 blows/0.3 m (compact to dense), with occasional values of 61 to 79 blows/0.3 m of penetration. Moisture contents ranged from 8 and 24%. The thickness of the granular fill ranged from 0.5 to 2.0 m. Results of grain size analyses conducted on the granular fill are presented on Figure C1.

4.2.2 Silty Clay Fill

Silty clay fill was encountered below the pavement structure in approximately 75% of the boreholes. The thickness of the fill ranged from 1.6 to 6.6 m. Standard Penetration Test N-values obtained in the clay fill typically ranged from about 3 to 21blows/0.3 m. Higher values of 62 to 100 blows/0.1 m were occasionally encountered, indicating possible cobbles or bedrock fragments in the fill. Moisture contents ranged from 5 to 25%, with a mean value of 14%.

The results of grain size distribution analyses conducted on samples of the clay fill are presented on Figure C2 of Appendix C. Atterberg Limits testing conducted on samples of the clay fill (Figure B7) indicates medium plasticity.

4.3 Silty Clay Till

Silty clay till or silty clay was encountered below the units noted above. Thicknesses of this unit where encountered, varied from 2.2 m to greater than 5 m. The consistency of the clay till typically varied from very stiff to hard, with N-values ranging from 15 blows/0.3m to 100 blows for less than 0.15 m of penetration.

The results of grain size distribution analyses conducted on samples of the silty clay till are presented on Figures C2 to C4 of Appendix C. The results of Atterberg Limits testing, presented on Figures C6 and C7 of Appendix C, indicate the till varies from low to medium plasticity. Moisture contents ranged from 8 to 25%, typically about 12%.

4.4 Sandy Silt to Silty Sand Till

Silty sand to sandy silt till was encountered below the silty clay fill in boreholes (09-03, 04, 06, 07, 08, 16, 17 & 20). The upper boundary of the cohesionless till was encountered at depths of 2.2 to 3.0 m. The till is very dense, with N-values typically greater than 100 blows for less than 0.3 m penetration.

The results of grain size distribution analyses conducted on samples of the silt and sand till are presented on Figure C5 of Appendix C. Moisture contents ranged from 7 to 16%, typically about 9%.

Till soils frequently contain cobbles, boulders and shale pieces, and these should be anticipated when excavating during construction.

4.5 Shale Bedrock

Shale bedrock was encountered in eight boreholes at depths of 1.7 to 11.1 m. Two boreholes (09-08 & 09-10) were advanced between 3.1 and 5.2 m into shale bedrock by rock coring methods. The bedrock surface elevation encountered in the boreholes is summarized in Table D2, Appendix D.

The shale bedrock comprises reddish-brown, thinly bedded shale of the Queenston Formation. The bedrock core contains occasional layers of grey limestone, typically in the order of 25 to 75 mm thick. In general, the shale varied from highly weathered and weak in borehole 09-10 to slightly weathered and moderately strong in borehole 09-08.

The total core recovery (TCR) ranged from 0 to 87% for each run and the solid core recovery (SCR) ranged from 75 to 100%. The Rock Quality Designation (RQD) of the rock cores ranged from 0 to 100, indicating a very poor to excellent quality rock.

The results of point load tests conducted on selected rock cores indicate a range of Unconfined Compressive Strength (UCS) values between 3 to 40 MPa. It must be noted however that point load tests were possible only on less weathered shale or higher strength limestone samples as the more typical weathered shale cores tended to disintegrate or split under point loading.

4.6 Groundwater Levels

The depths and elevations of water levels measured in the piezometers installed in the boreholes are summarized in Table D1 of Appendix D. The recorded levels are short-term readings and seasonal fluctuations are to be expected. The groundwater level may be at a higher elevation after the spring snowmelt or after periods of heavy rainfall.

5.0 GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

This section provides geotechnical recommendations for widening and reconstruction of the pavement structures within the project limits, design and construction of culvert extensions and replacements, and installation of underground municipal services. Management strategies for disposal of excess excavated materials during construction are also discussed.

The recommendations are based on the subsurface soil and groundwater conditions encountered during the investigation. The soil conditions may vary between and beyond the borehole locations. Additional boreholes are recommended to address key locations during the detailed design phase.

5.1 CN Bridge and Bronte Creek Bridge Widening

Widening Dundas Street to six through lanes will require the widening of the existing CN Bridge. The Bronte Creek structure may be replaced or in part replaced. Two boreholes were advanced at each location as an initial assessment of subsurface conditions. The borehole locations and stratigraphic profiles at the bridge locations are shown on Drawing 19-1351-142-8.

Driven steel piles may be used to provide foundation support to the widened structures. Alternatively, consideration may be given to using augered caissons that are designed to be founded within the hard or glacial till or shale. The use of spread footings founded on the native, hard or very dense glacial tills is technically feasible, but not recommended due to the relatively large heights of the resulting abutment walls, and the likely requirement of groundwater control during construction. Major advantages and disadvantages of each of these alternatives are outlined in the following.

Driven Steel Piles

- Sub-excavation and dewatering is anticipated during construction.
- A granular pad will need to be constructed at each abutment location to facilitate pile driving.
- Pre-bored (pilot) holes through the tills (inherently containing cobbles and boulders) will be required to facilitate pile installation and to reduce noise and vibration during pile driving.
- Vibration during pile driving may cause settlement of adjacent structures where loose materials are present.

Augered Caissons

- Relatively high bearing resistance can be achieved when socketted into the hard or very dense glacial tills or shale bedrock.
- Augering equipment may need to penetrate through cobbles and boulders, hard or very dense zones within the glacial tills.
- Temporary liners and/or dewatering measures may be required to maintain stability of the caisson excavation and to allow construction in the dry.
- Ground movement may be induced adjacent to caissons.

Spread Footings

- Dewatering and/or shoring are likely required during footing construction.
- The resulting height of the abutment walls may be large.

5.1.1 Axial Resistance

For limit states design (CHBDC 2006), it is recommended that the following geotechnical resistances be used to design steel HP 310 x 110 piles driven or founded on the hard glacial till or shale bedrock.

Driven Piles

- Factored Geotechnical Resistance at Ultimate Limit State (ULS) of 1,800 kN per pile.
- Geotechnical Resistance at Serviceability Limit State (SLS) of 1,600 kN per pile, corresponding to a pile head settlement of 10 mm.

Socketted Caissons (3 m into shale)

- Factored Geotechnical Resistance at ULS of 2,500 kN (0.9 m Ø caisson).
- The SLS condition does not apply to piles founded on bedrock.

5.1.2 Approach Embankments

It is understood that the existing approach fills were designed to have an inclination of 2H : 1V at the side slopes and adjacent to the walls of the perched abutments.

New fill will need to be placed on the existing slopes for construction of the new abutments. Provided that the new fill is placed as recommended in this report, the slope inclinations of 2H : 1V or flatter at the side slopes and adjacent to the abutment walls, respectively, should remain stable at their respective locations. Foundation settlements that would be induced by the placement of new fill is considered negligible.

The existing valley slope at Bronte Creek may have stability issues and care should be taken to minimize fill to the valley slope. Consideration may be given to proprietary designed mechanically stabilized slopes or reinforced earth slopes.

5.1.3 Construction Considerations

All excavations should be carried out in accordance with the latest edition of the Ontario Occupational Health and safety Act (OHSA), its regulations and other applicable local regulations. For the purposes of assessing slope inclination and excavation support requirements in compliance with OHSA, the following soil types would apply to the subsurface stratigraphy encountered at the borehole locations :

Existing fills	Type 3
Silty Clay (above groundwater)	Type 2
Clayey Silt to Silty Clay Till (above and below groundwater)	Type 2
Sandy Silt to Sand and Silt Till (below groundwater)	Type 3

Where required, excavation is expected to be carried out through existing fills, the surficial silty clay and the upper portion of the glacial tills.

In order to assess the permeability of the soils and dewatering requirement during construction, pump test(s) and/or slug test(s) in monitoring wells is recommended during detailed design.

5.2 Culverts

Based on the borehole data, the subgrade below the culverts is expected to consist of silty clay or clay till overlying shale bedrock.

The native clay, clay till and shale is considered suitable for support of the culvert extensions, replacement culvert and head walls. The founding material and bearing resistance adopted for design will depend upon the actual founding level of the existing structure, which has not been defined at the time of report

preparation. The extensions should be founded at similar elevations as the existing culverts such that the latter will not be undermined. Engineered fill may be used to raise the subgrade to the desired invert elevations or where higher geotechnical resistances are required. The design founding level may also depend on hydrologic, hydraulic and other requirements.

The design should include the provision of soil cover of 1.2 m, or its thermal equivalent, to the headwall/wing wall footings for frost protection purposes.

5.2.1 Geotechnical Resistances

The geotechnical resistances for box culvert headwall/wingwall design depend on the subsurface conditions within the culvert extension and new culvert footprint. Based on the current borehole information for foundations set on very stiff clay till or silt and sand till, the following parameters can be used for preliminary design:

Table 5.1 – Culvert Foundation Capacity

Factored Geotechnical Resistance at ULS (kPa)	Geotechnical Resistance at SLS (kPa)
225	150

The above geotechnical resistances are based on a footing width of at least 0.9m, and are for vertical, concentric loads only. Effects of load inclination and eccentricity should be taken into account as illustrated in the CHBDC (2006).

5.2.2 Erosion and Scour Protection

Erosion protection should be provided at the new culvert inlet and outlet areas. Vegetation cover, riprap or other protective measures should be established on

the adjacent embankment to protect against surficial erosion and seepage-induced material loss. The structure foundations should be positioned below the maximum anticipated depth of scour. Design of the scour and erosion protection measures must consider hydrologic/hydraulic concerns and should be carried out by stream engineering specialists experienced in these fields. Design should include concrete cut off or clay seal to prevent erosion adjacent to the culvert.

5.2 Utilities and Sewer

Excavation for open cut installation of sewer and watermain may extend through the roadway pavement structure, embankment fill material, and into the native clay till deposits or into the underlying shale bedrock.

All temporary excavations must be carried out in accordance with the current Occupational Health and Safety Act (OHSA) of Ontario and local regulations. Where space restrictions preclude excavation of inclined slopes, service installation may be carried out using a suitable shoring system.

Use of a hydraulic excavator should be suitable for trench excavation. Provision should be made for handling and removal of the pavement materials, possible obstructions in the fill, and cobbles, boulders or chunks of shale and limestone in the till soils during excavation.

The upper 0.5 m of the shale is highly weathered and excavation should be possible using heavy excavation equipment and rippers, supplemented by pneumatic rock breakers where thick layers of hard material are encountered. The shale below this depth is harder and less weathered, and intensive use of pneumatic/hydraulic breakers or other methods of loosening the bedrock will likely

be required. Additional investigation using bedrock coring methods is recommended where deep excavation is proposed.

Water was measured at depths of 0.1 to 6.6 m in the piezometers installed in the boreholes. Considering the consistency and relatively low permeability of the soils excavated in the boreholes, dewatering using filtered sumps and pumps is considered feasible.

Sewer and watermain design should take into account protective measures that may be required for crossing below any existing gas lines, hydro lines, watermains, structures and other buried facilities that may exist in the vicinity of the work areas. This will require discussions with relevant utility providers and design and temporary protection and support of the particular utility. During construction, the utility providers may require that their representative(s) be on site on a full time basis.

5.3 Sewer bedding

It is recommended that pipe bedding and cover should be in accordance with current Region of Halton or OPS Specifications.

5.4 Trench Backfill

It is anticipated that the excavated materials will consist of the granular road fill, sand and silty clay fill and the native silty clay and silty sand tills, and weathered shale.

Excavated soils would generally be considered suitable as trench backfill outside travelled portions of the roadway if free from organics, debris and other deleterious

material and at a moisture content suitable for compaction. Such fill should be placed in loose lifts not exceeding 200 mm and compacted to 98% of the Standard Proctor Maximum Dry Density (SPMDD) at ± 2% of Optimum Moisture Content (OMC).

Excavated shale is prone to deterioration and is difficult to compact especially in narrow trenches, and is therefore not suitable for trench backfill. It should be stockpiled or hauled offsite.

Under any travelled portions of the roadways, parking areas and locations adjacent to utilities, adequate compaction of the backfill is required. It is therefore recommended that granular materials meeting the gradation requirements of OPSS Granular B, Type 1(modified) be used as backfill in these areas. The backfill materials should be placed in loose lifts not exceeding 200 mm and be compacted to at least 98% of its SPMDD.

5.6 Pavement Design

Based on a 2021 projected AADT of 39 000 and up to 8 % truck traffic, the recommended pavement section (with minimum layer thickness) for the new widening along Dundas Street is as follows:

Material	Thickness (mm)
HL1 – Asphalt (High Stability Surface Course) / SP 12.5	50
HDBC – Asphalt (Heavy Duty Binder Course) / SP 19.0	100
19 mm Crusher Run Limestone Base	150
50 mm Crusher Run Limestone Type II Sub-Base	600
Total Pavement thickness	900

The sub-base thickness of 600 mm indicated above is a minimum recommended value which may be increased as necessary to match existing subgrade elevations adjacent to widened areas.

If grade adjustments permit, rehabilitation and upgrading of the existing pavement by placement of an asphalt overlay is considered to be feasible, provided it is accepted that increased maintenance may be required in comparison to new construction. The following overlay design is recommended for preliminary purposes:

Option 1 Conventional		**Option 2 Superpave**	
Mill	50 mm	Mill	50mm
Hot Mix HL1	40 mm	SP12.5	40 mm
Hot mix HDBC	80 mm	SP19.0	80 mm

Alternatively, the entire asphalt and granular pavement structure may be removed to expose the clayey subgrade. Subsequent to subgrade proof-rolling, new granular and asphalt materials may be placed and compacted to the required specifications.

It is recommend that recycled concrete and recycled asphalt not be used in the granular base and sub base layers. Crushed limestone aggregate is recommended. Crushed limestone aggregate is preferred to recycled products made from concrete or asphalt because of advantages relating to durability, better construction control, and consistency of product.

5.7 Management of Excess Excavated Soils and Groundwater

Soil and groundwater testing has not been carried out as part of this investigation. It is recommended that during the detailed design environmental analytical tests are undertaken to determine disposal requirements.

5.8.1 Hydrocarbon Impacted Soil

One sample retrieved in Borehole 09-02 at 1.7 m hydrocarbon stain and odour. This borehole is located adjacent to a former service station site.

A more detailed sampling regime is recommended during the detailed design phase to locally delineate the extent and level of hydrocarbon impacted soil at this location.

STATEMENT OF GENERAL CONDITIONS

1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering or environmental consulting practices in this area. No other warranty, expressed or implied, is made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purpose that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT. WE WILL CONSENT TO ANY REASONABLE REQUEST BY THE CLIENT TO APPROVE THE USE OF THIS REPORT BY OTHER PARTIES AS "APPROVED USERS". The contents of the Report remain our copyright property and we authorize only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of the Report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make the Report, or any portion thereof, available to any party without our written permission. Any use which a third party makes of the Report, or any portion of the Report, are the sole responsibility of such third parties. We accept no responsibility for damages suffered by any third party resulting from unauthorized use of the Report.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgemental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

(see over...)

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of persons providing information.

6. RISK LIMITATION

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause an accidental release of those substances. In consideration of the provision of the services by us, which are for the Client's benefit, the Client agrees to hold harmless and to indemnify and defend us and our directors, officers, servants, agents, employees, workmen and contractors (hereinafter referred to as the "Company") from and against any and all claims, losses, damages, demands, disputes, liability and legal investigative costs of defence, whether for personal injury including death, or any other loss whatsoever, regardless of any action or omission on the part of the Company, that result from an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project. This indemnification shall extend to all Claims brought or threatened against the Company under any federal or provincial statute as a result of conducting work on this Project. In addition to the above indemnification, the Client further agrees not to bring any claims against the Company in connection with any of the aforementioned causes.

7. SERVICES OF SUBCONSULTANTS AND CONTRACTORS

The conduct of engineering and environmental studies frequently requires hiring the services of individuals and companies with special expertise and/or services which we do not provide. We may arrange the hiring of these services as a convenience to our Clients. As these services are for the Clients' benefit, the Client agrees to hold the Company harmless and to indemnify and defend us from and against all claims arising through such hirings to the extent that the Client would incur had he hired those services directly. This includes responsibility for payment for services rendered and pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. In particular, these conditions apply to the use of drilling, excavation and laboratory testing services.

8. CONTROL OF WORK AND JOBSITE SAFETY

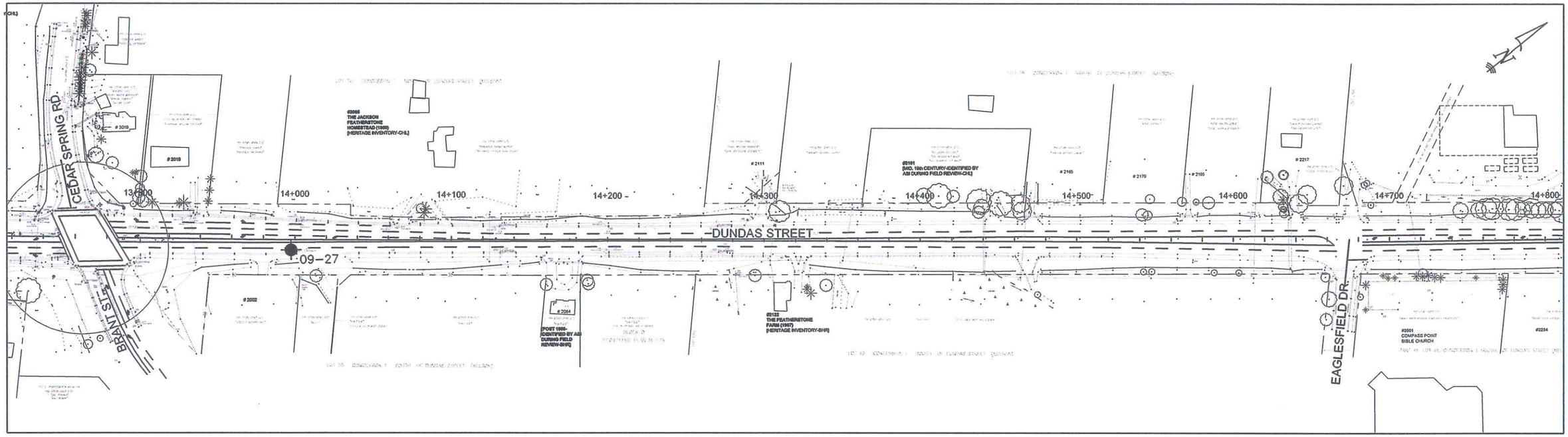
We are responsible only for the activities of our employees on the jobsite. The presence of our personnel on the site shall not be construed in any way to relieve the Client or any contractors on site from their responsibilities for site safety. The Client acknowledges that he, his representatives, contractors or others retain control of the site and that we never occupy a position of control of the site. The Client undertakes to inform us of all hazardous conditions, or other relevant conditions of which the Client is aware. The Client also recognizes that our activities may uncover previously unknown hazardous conditions or materials and that such a discovery may result in the necessity to undertake emergency procedures to protect our employees as well as the public at large and the environment in general. These procedures may well involve additional costs outside of any budgets previously agreed to. The Client agrees to pay us for any expenses incurred as the result of such discoveries and to compensate us through payment of additional fees and expenses for time spent by us to deal with the consequences of such discoveries. The Client also acknowledges that in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed and the Client agrees that notification to such bodies by us will not be a cause of action or dispute.

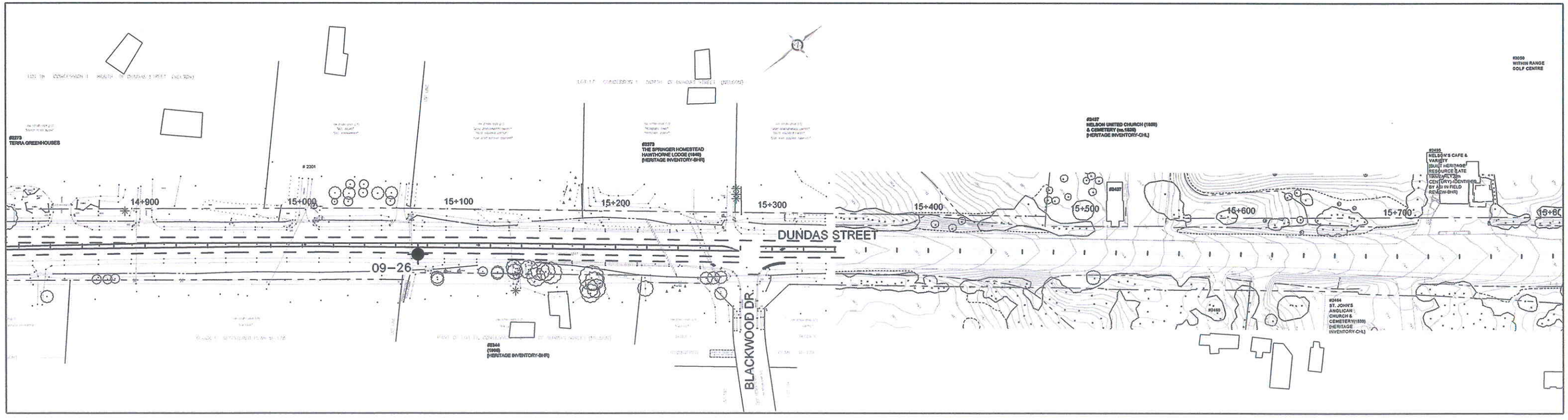
9. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on our interpretation of conditions revealed through limited investigation conducted within a defined scope of services. We cannot accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes decisions made to either purchase or sell land.

APPENDIX A

BOREHOLE LOCATION DRAWINGS





BASE PLAN PROVIDED BY

McCormick Rankin Corporation

Geo-technical Investigation for
Class EA Study, Dundas St.
Brant St. to Proudfoot Trail

19-1351-142

THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

ENGINEER:	DRAWN:	APPROVED:
TJH/SMS	AN	SMS
DATE:	SCALE:	DRAWING No.
JUNE 2010	1:2500	19-1351-142-1

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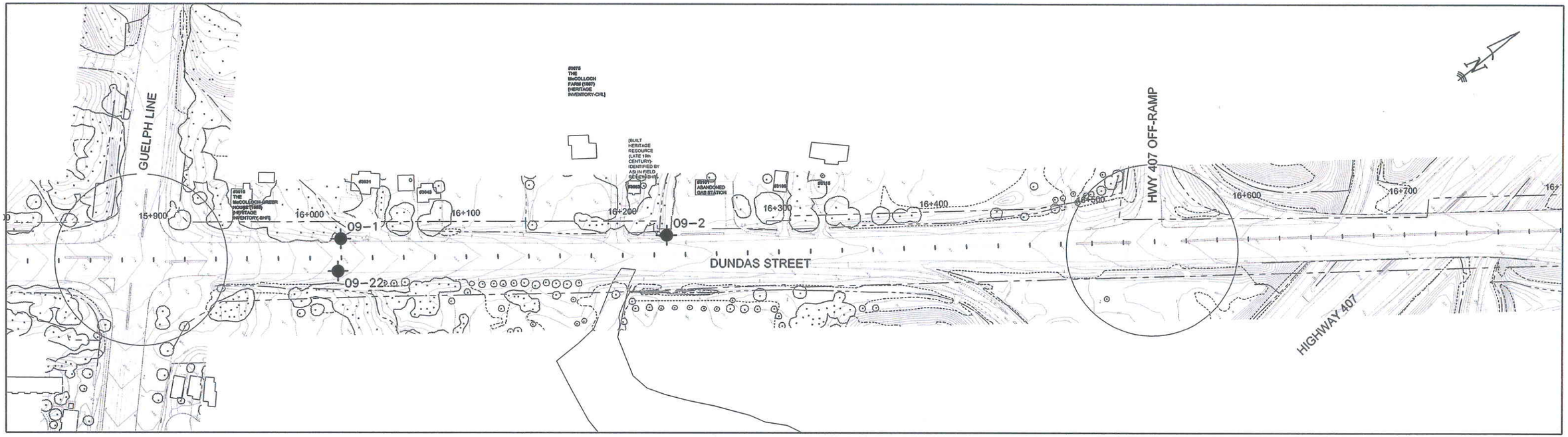

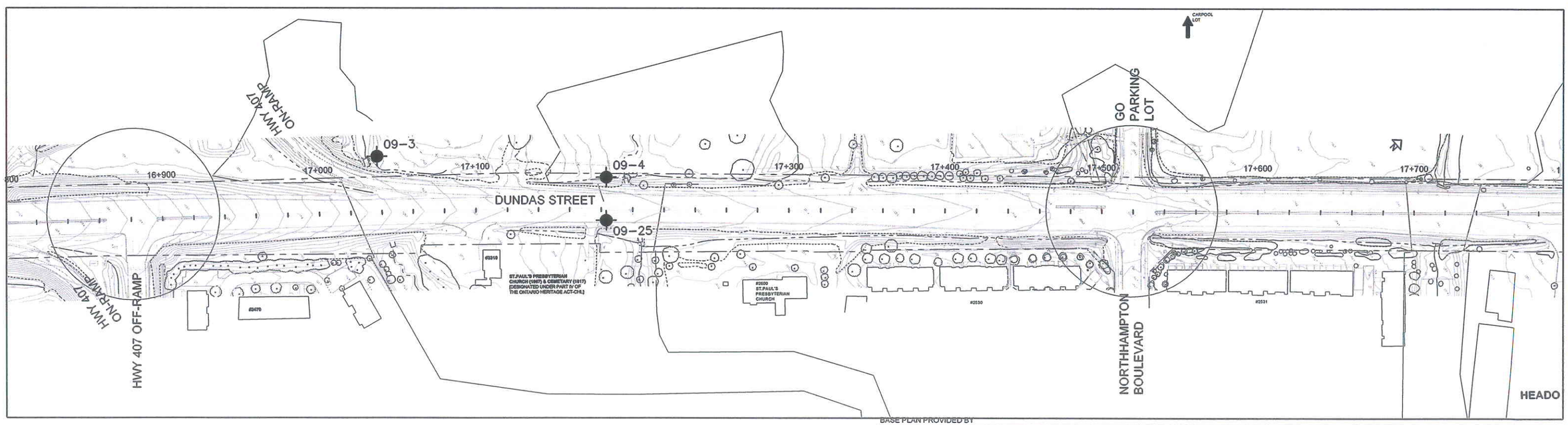

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Geo-technical Investigation for
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19-1351-142

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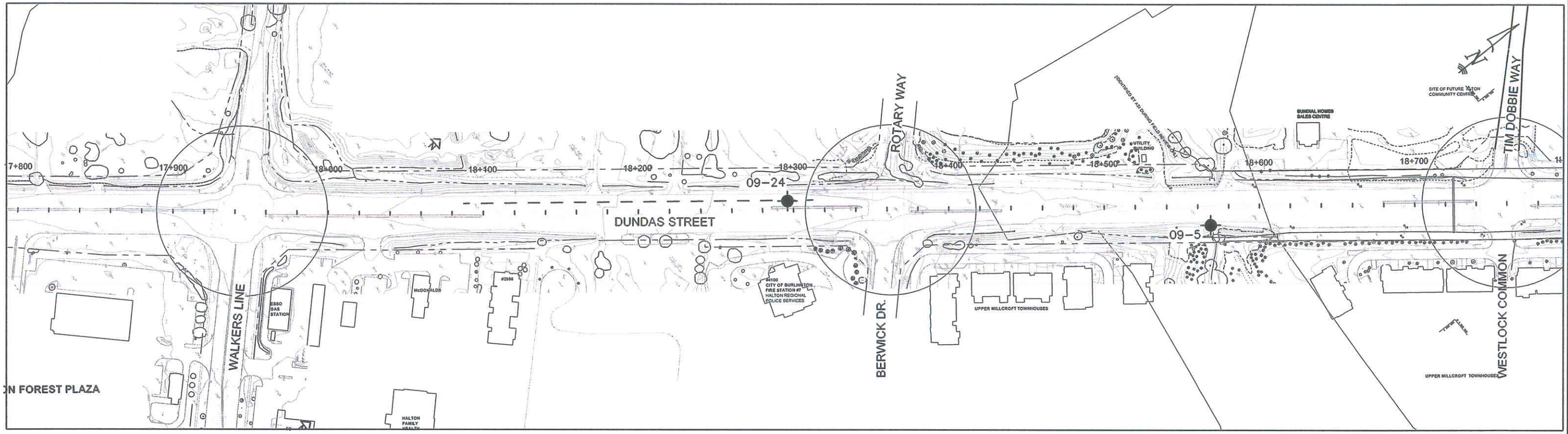

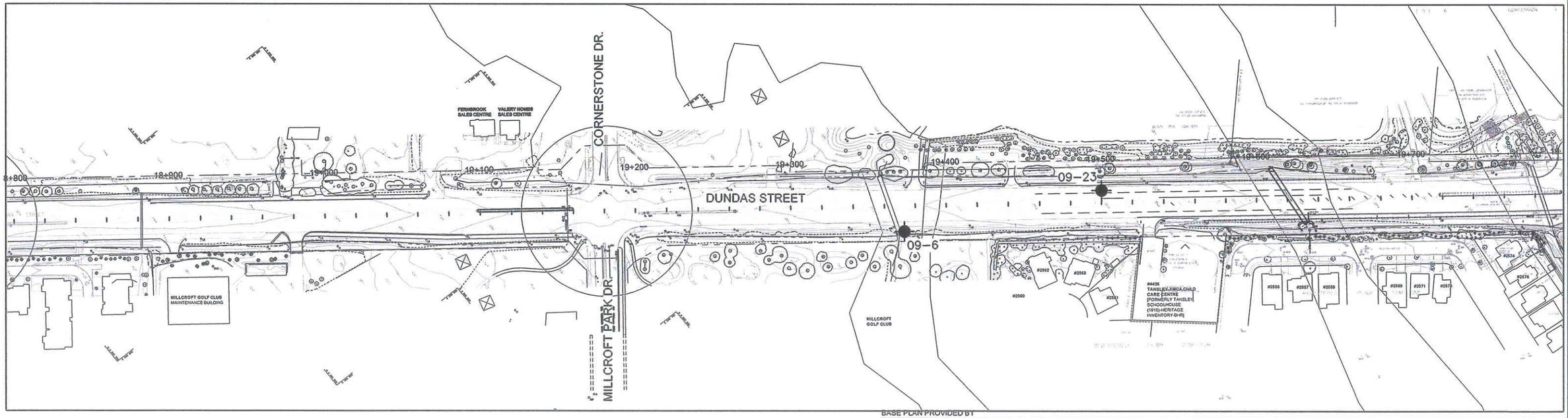

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19-1351-142

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DATE:	SCALE:	DRAWING No.
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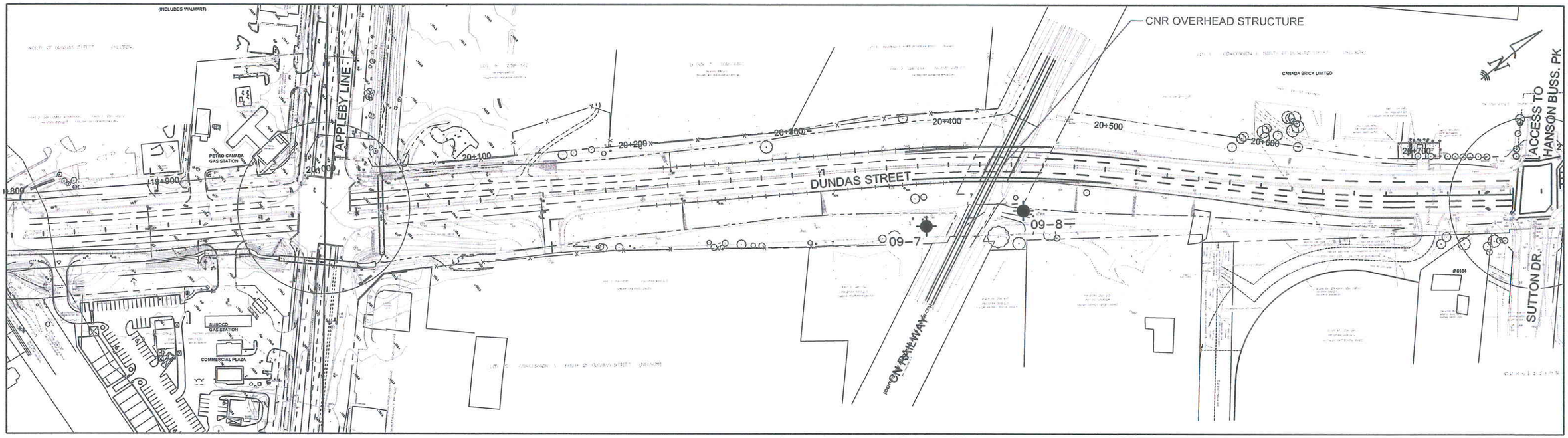

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19-1351-142

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DATE:	SCALE:	DRAWING No.
JUNE 2010	1:2500	19-1351-142-4

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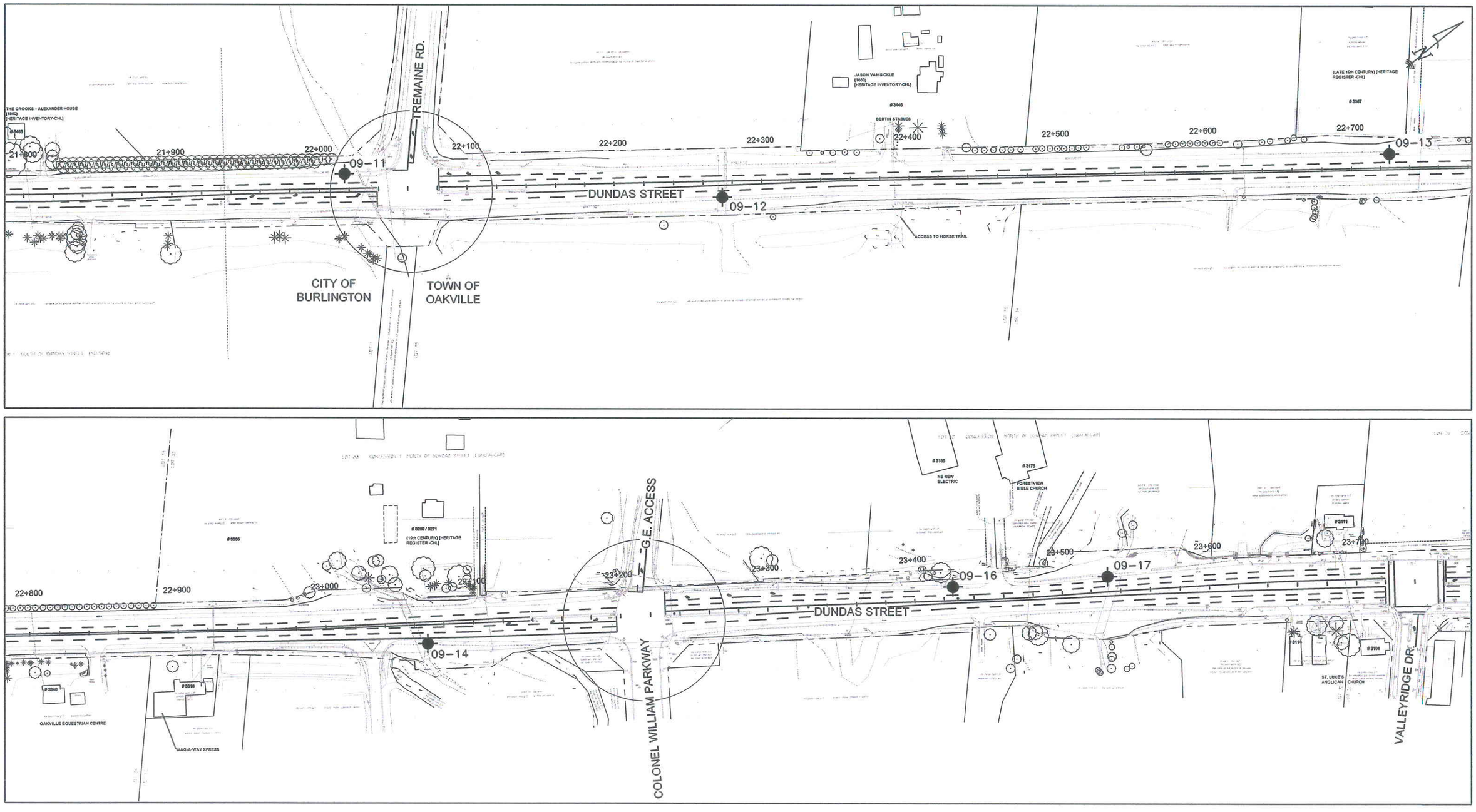

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19-1351-142

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JUNE 2010	1:2500	19-1351-142-5

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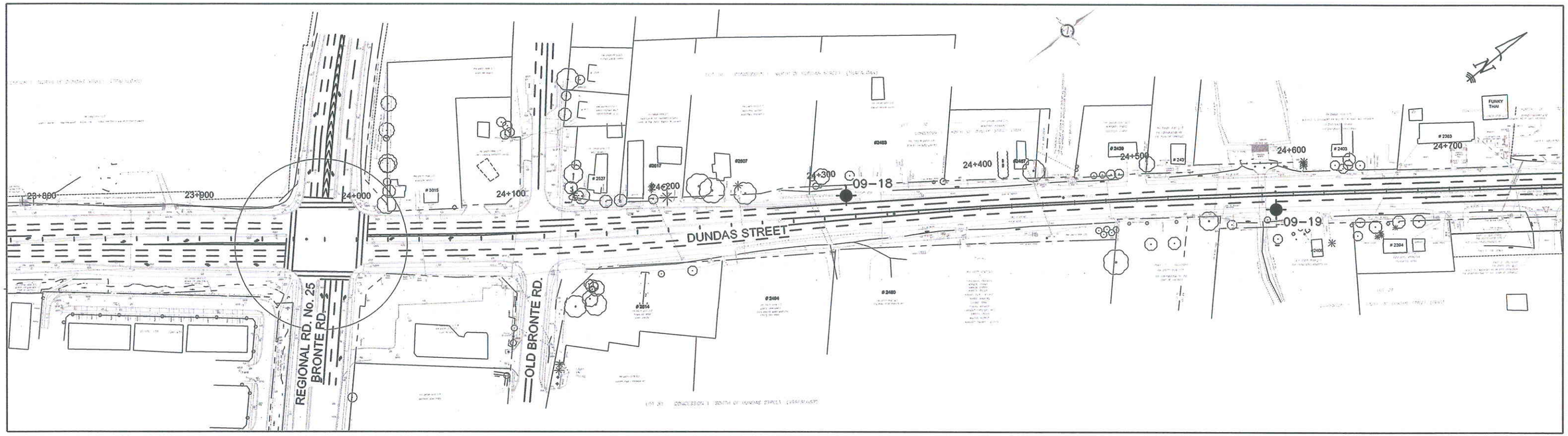

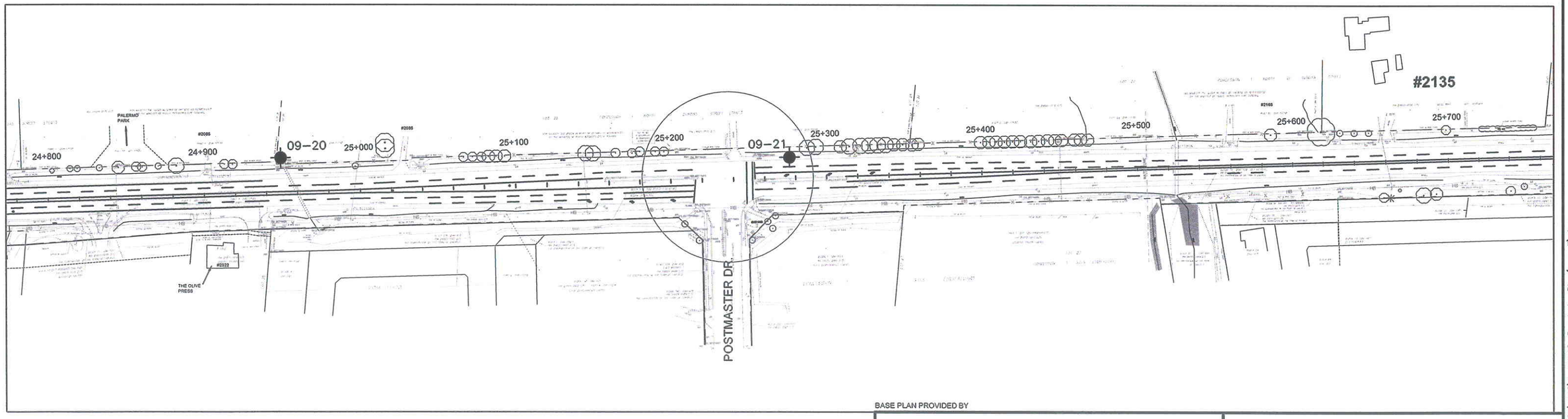

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Geo-technical Investigation for
Class EA Study, Dundas St.
Brant St. to Proudfoot Trail

19-1351-142

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ENGINEER:	DRAWN:	APPROVED:
TJH/SMS	AN	SMS
DATE:	SCALE:	DRAWING No.
JUNE 2010	1:2500	19-1351-142-6

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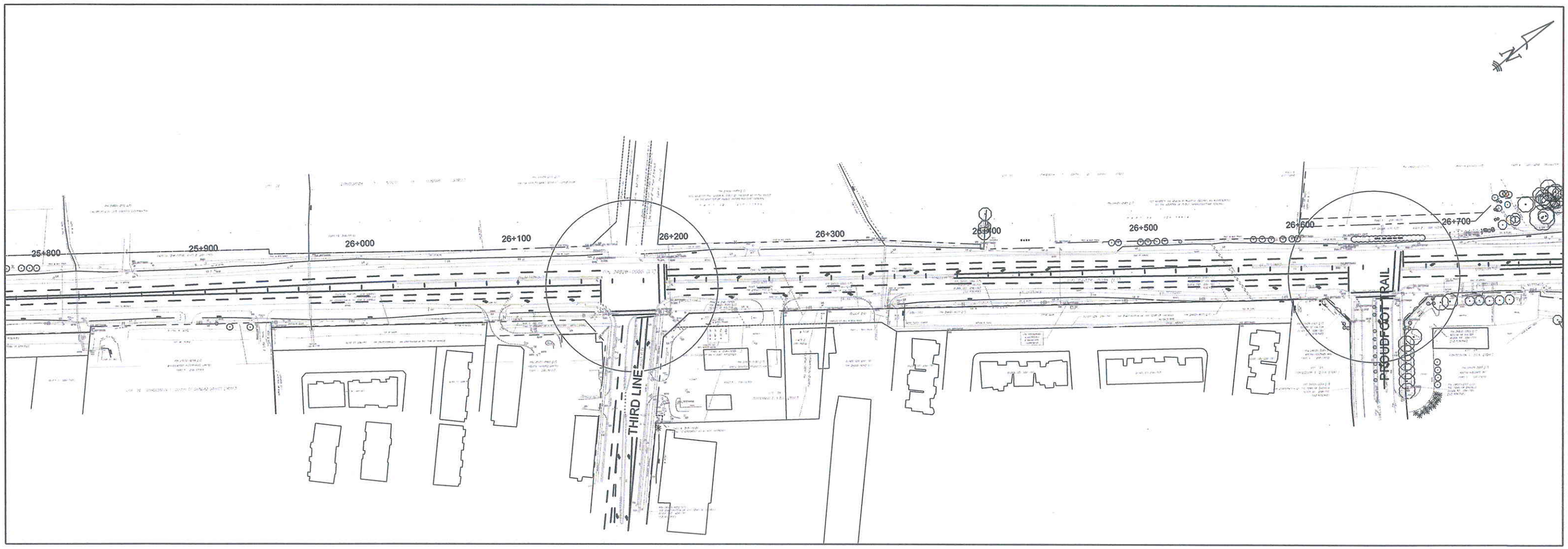

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Brant St. to Proudfoot Trail

19-1351-142

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TJH/SMS	AN	SMS
DATE:	SCALE:	DRAWING No.
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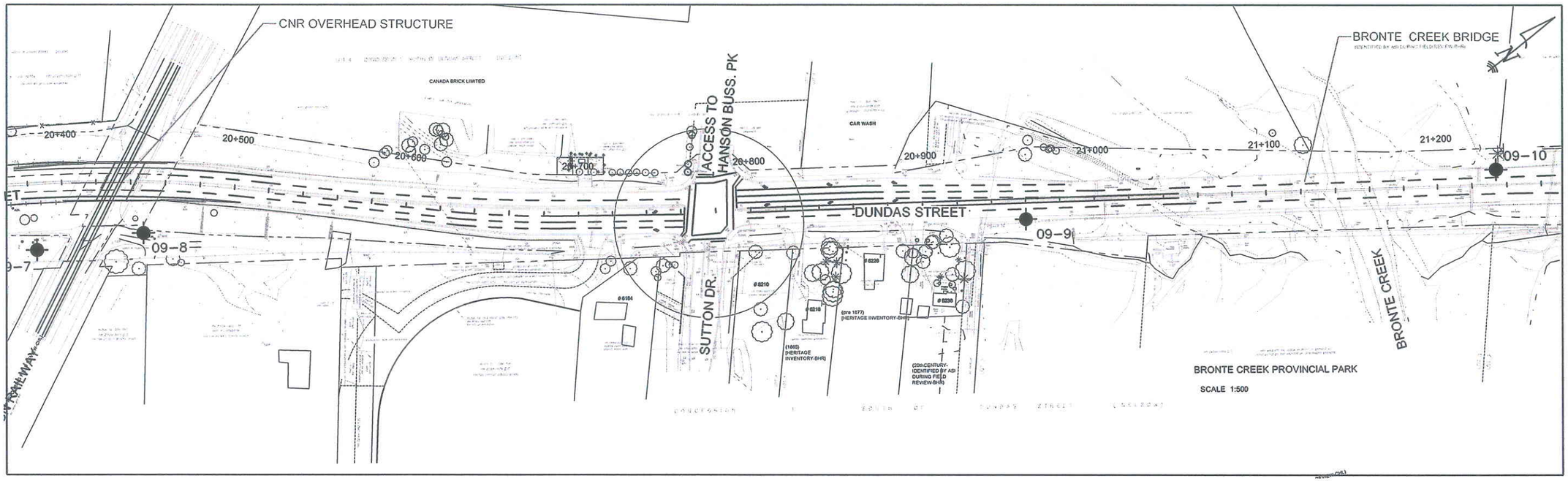

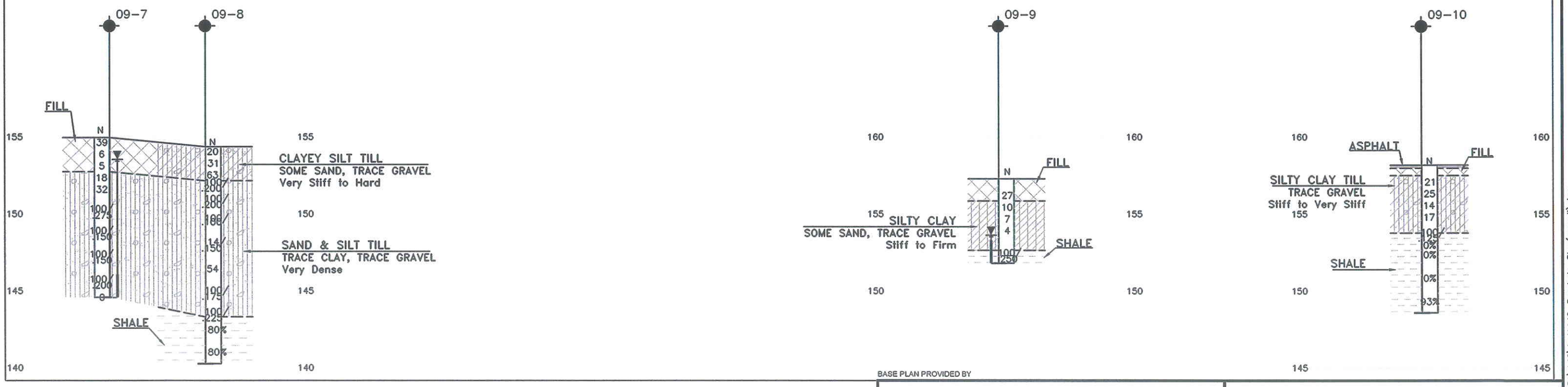

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Geo-technical Investigation for
Class EA Study, Dundas St.
Brant St. to Proudfoot Trail

19-1351-142

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ENGINEER:	DRAWN:	APPROVED:
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DATE:	SCALE:	DRAWING No.
JUNE 2010	1:2500	19-1351-142-8

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APPENDIX B

RECORD OF BOREHOLE SHEETS

SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT[(1)] 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

1) Laboratory Triaxial Testing
2) Field Insitu Vane Testing
3) Laboratory Vane Testing
4) SPT value
5) Pocket Penetrometer

4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT "N" VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE

SS Split Spoon Sample WS Wash Sample AS Auger (Grab) Sample
TW Thin Wall Shelby Tube Sample TP Thin Wall Piston Sample
PH Sampler Advanced by Hydraulic Pressure PM Sampler Advanced by Manual Pressure
WH Sampler Advanced by Self Static Weight RC Rock Core SC Soil Core

$$\text{Sensitivity} = \frac{\text{Undisturbed Shear Strength}}{\text{Remoulded Shear Strength}}$$

$\blacktriangledown$ Water Level

C_{pen} Shear Strength Determination by Pocket Penetrometer

(1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.

(2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

UNIFIED SOILS CLASSIFICATION

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS $W_L < 50\%$	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. ($W_L < 30\%$).
		CI	Inorganic clays of medium plasticity, silty clays. ($30\% < W_L < 50\%$).
		OL	Organic silts and organic silty-clays of low plasticity.
	SILTS AND CLAYS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			

EXPLANATION OF ROCK LOGGING TERMS

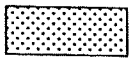
ROCK WEATHERING CLASSIFICATION

Fresh (FR)	No visible signs of weathering.
Fresh Jointed (FJ)	Weathering limited to the surface of major discontinuities.
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.
Moderately Weathered (MW)	Weathering extends throughout the rock mass, but the rock material is not friable.
Highly Weathered (HW)	Weathering extends throughout the rock mass and the rock is partly friable.
Completely Weathered (CW)	Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.

SYMBOLS


CLAYSTONE


SILTSTONE


SANDSTONE


COAL


Bedrock (general)

DISCONTINUITY SPACING

Bedding	Bedding Plane Spacing
Very thickly bedded	Greater than 2m
Thickly bedded	0.6 to 2m
Medium bedded	0.2 to 0.6m
Thinly bedded	60mm to 0.2m
Very thinly bedded	20 to 60mm
Laminated	6 to 20mm
Thinly Laminated	Less than 6mm

TERMS

Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.
Rock Quality Designation: (RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a percentage of total core run length.
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen
Fracture Index: (FI)	Frequency of natural fractures per 0.3m of core run.

STRENGTH CLASSIFICATION

Rock Strength	Approximate Uniaxial Compressive Strength (MPa)	(psi)	Field Estimation of Hardness*
Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail

THURBER

RECORD OF BOREHOLE 09-01

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : July 30, 2009
COMPLETED : July 30, 2009

Project No. 19-1351-142

SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		168.02				
	Solid Stem Augers	**ASPHALT:** (50mm)		0.00				N 4 803 527.5 E 594 058.8
		SAND, some gravel, some clay, brown, moist		167.34	1	AS		
1		**CLAY**, silty, some sand, trace gravel, brown: (FILL)		0.69	1	SS	5	
2					2	SS	6	
3				164.97	3	SS	3	
		CLAY, silty, some sand, trace gravel, soft to hard, reddish brown: (TILL)(CL)		3.05	4	SS	19	Grain Size Analysis: Gr 0%/ Sa 14%/ Si 55%/ Cl 31%
4								
5		trace to some gravel			5	SS	38	
6					6	SS	53	
7								
8					7	SS	51	
		END OF BOREHOLE AT 8.2m. BOREHOLE OPEN AND WET UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		159.79 8.23				
9		WATER LEVEL READINGS: DATE / DEPTH (m) / ELEV. (m) Aug 05, 09 7.59 160.43 Oct 02, 09 3.79 164.23						
10								
11								
12								
13								
14								

SHEAR STRENGTH: Cu, KPa (nat V - ♣, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160
WATER CONTENT, PERCENT wp w wl 10 20 30 40
DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100
ADDITIONAL LAB. TESTING
PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date) October 2, 2009

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-02

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : July 30, 2009
COMPLETED : July 30, 2009

Project No. 19-1351-142

SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲; 40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		164.32							
		ASPHALT: (50mm)		0.00				N 4 803 691.4 E 594 187.7			
		SAND, gravelly, grey, moist			1	AS					
				163.63							
1		**CLAY**, silty, some sand, trace gravel, brown: (FILL)		0.69	1	SS	3				
2		Hydrocarbon stain and odour at 1.7m			2	SS	3				▼
				162.11							
		CLAY, silty, trace sand, trace gravel, very stiff to hard, reddish brown: (TILL)(CL)		2.21	3	SS	25	Grain Size Analysis: Gr 2%/ Sa 21%/ Si 55%/ Cl 22%			
3											
4	Solid Stem Augers				4	SS	45				
5					5	SS	74				
6					6	SS	100/ 0.125				
7											
				156.60	7	SS	100/ 0.100				
8		END OF BOREHOLE AT 7.7m. BOREHOLE OPEN AND DRY. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		7.71							
9		WATER LEVEL READINGS: DATE / DEPTH (m) / ELEV. (m): Aug 05, 09 — 1.47 — 162.85; Oct 02, 09 — 1.82 — 162.50									
10											
11											
12											
13											
14											

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date) October 2, 2009

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-03

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : July 29, 2009
COMPLETED : July 29, 2009

Project No. 19-1351-142
SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		156.35				
0	Solid Stem Augers	**CLAY**, silty, some sand, trace gravel, rootlets, brown: (FILL)		0.00	1	SS	7	N 4 804 350.4 E 594 658.1
1					2	SS	6	Grain Size Analysis: Gr 0%/ Sa 13%/ Si 61%/ Cl 26%
		CLAY, silty, some sand, some gravel, very dense, brown, moist: (TILL)		154.91 1.45				
2					3	SS	26	
					4	SS	50	
3					5	SS	100/ 0.200	
4		**SILT**, sandy, some clay, trace gravel, very dense: (TILL)		152.37 3.99				
5					6	SS	100	Grain Size Analysis: Gr 4%/ Sa 30%/ Si 50%/ Cl 16%
		END OF BOREHOLE AT 5.8m. BOREHOLE OPEN AND DRY. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		150.56 5.79	7	SS	100/ 0.150	
6		WATER LEVEL READINGS: DATE / DEPTH (m) / ELEV. (m) Aug 05, 09 / 5.64 / 150.71 Oct 02, 09 / 5.42 / 150.93						
7								
8								
9								
10								
11								
12								
13								
14								

SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160
WATER CONTENT, PERCENT wp w wl 10 20 30 40
DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100
ADDITIONAL LAB. TESTING
PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date) October 2, 2009

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-04

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : July 29, 2009
COMPLETED : July 29, 2009

Project No. 19-1351-142
SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲; 40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		154.55							
0	Solid Stem Augers	**CLAY**, silty, trace sand, trace gravel, rootlets, stiff to hard, brown: (TILL)(CL/CI)		0.00	1	SS	3	N 4 804 456.3 E 594 760.3			
1					2	SS	15	Grain Size Analysis: Gr 0%/ Sa 17%/ Si 50%/ Cl 33%			
2					3	SS	35				
				152.34							
		SAND and **SILT**, some clay, very dense: (TILL)		2.21							
3					4	SS	64				
					5	SS	100/ 0.200				
4											
5					6	SS	100/ 0.250				
					7	SS	100/ 0.150	Grain Size Analysis: Gr 9%/ Sa 37%/ Si 47%/ Cl 7%			
6		occasional cobble									
7											
					8	SS	100/ 0.200				
8				146.58							
		END OF BOREHOLE AT 8.0m. BOREHOLE OPEN AND DRY UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		7.97							
9		WATER LEVEL READINGS: DATE / DEPTH (m) / ELEV. (m) Aug 05, 09 0.10 154.45 Oct 02, 09 0.06 154.49									
10											
11											
12											
13											
14											

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date) October 2, 2009

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-05

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : July 30, 2009
COMPLETED : July 30, 2009

Project No. 19-1351-142
SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) / WATER CONTENT, PERCENT (wp, w, wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		153.91							
0	Solid Stem Auegrs	**SAND**, some gravel, grey, moist: (FILL)		0.00	1	AS		N 4 805 515.1 E 595 653.8			
1					1	SS	20				
				152.46							
		CLAY, silty, sandy, trace gravel, trace organics, brown, moist: (FILL)(CL)		1.45	2	SS	8				
2											
					3	SS	9	Grain Size Analysis: Gr 1%/ Sa 21%/ Si 49%/ Cl 29%			
3					4	SS	7				
4				149.79							
		SILT, some clay, some sand, very dense, reddish brown, moist: (TILL)		4.11	5	SS	100/ 0.300				
5											
6					6	SS	100/ 0.225				
7											
				146.16	7	SS	100/ 0.125				
				7.75							
8		END OF BOREHOLE AT 7.7m. BOREHOLE OPEN AND WATER LEVEL AT 7.0m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.									
9		WATER LEVEL READINGS: DATE / DEPTH (m) / ELEV. (m) Aug 05, 09 / 2.09 / 151.81 Oct 02, 09 / 2.09 / 151.8									
10											
11											
12											
13											
14											

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date) October 2, 2009

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-06

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : July 30, 2009
COMPLETED : July 30, 2009

Project No. 19-1351-142
SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp wi w 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		152.92							
		CLAY, silty, trace sand, trace to some gravel, rootlets, brown, moist: (FILL)		0.00	1	AS		N 4 806 147.0 E 596 151.8			
1					1	SS	8				
2					2	SS	5				
					3	SS	7				
3	Solid Stem Augers			149.95							
		SILT and **SAND**, trace to some clay, some gravel, dense to very dense, reddish brown, moist: (TILL)		2.97	4	SS	30	Grain Size Analysis: Gr 10%/ Sa 42%/ Si 42%/ Cl 6%			
4											
5					5	SS	28				
6					6	SS	87				
7											
				145.15	7	SS	100/				
8		END OF BOREHOLE AT 7.8m. BOREHOLE OPEN AND WET. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		7.77			0.150				
9		WATER LEVEL READINGS: DATE / DEPTH (m) / ELEV. (m) Aug 05, 09 2.66 150.26 Oct 02, 09 2.42 150.50									
10											
11											
12											
13											
14											

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date) October 2, 2009

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-07

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : July 29, 2009
COMPLETED : July 29, 2009

Project No. 19-1351-142
SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) / WATER CONTENT, PERCENT (wp, w, wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		154.94							
0	Solid Stem Augers	**CLAY**, silty, trace sand, some gravel, brown, cobble sized concrete pieces: (FILL)		0.00	1	AS	39	N 4 806 953.6 E 596 761.8			
1					1	SS	6				
2				152.73	2	SS	5				
		SILT and **SAND**, trace to some clay, trace to some gravel, compact to very dense, brown, moist: (TILL)		2.21	3	SS	18				
3					4	SS	32				
4											
5					5	SS	100/ 0.275				
6					6	SS	100/ 0.150	Grain Size Analysis: Gr 12%/ Sa 46%/ Si 37%/ Cl 5%			
7		occasional cobble									
					7	SS	100/ 0.150				
8											
9					8	SS	100/ 0.200				
10				144.58	9	SS	0				
		END OF BOREHOLE AT 10.4m. BOREHOLE OPEN AND WET UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		10.36							
11		WATER LEVEL READINGS: DATE / DEPTH (m) / ELEV. (m) Aug 05, 09 1.23 153.71 Oct 02, 09 1.42 153.52									
12											
13											
14											

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date) October 2, 2009

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-08

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : July 28, 2009
COMPLETED : July 28, 2009

Project No. 19-1351-142
SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲; 40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		154.35							
		SILT, clayey, some sand, trace gravel, very stiff to hard, brown, moist: (TILL)		0.00	1	SS	20	N 4 807 007.9 E 596 792.8			
1					2	SS	31				
		Brownish red			3	SS	63				
2				152.14							
		SILT and **SAND**, trace clay, trace gravel, very dense, red, moist: (TILL)		2.21	4	SS	100/ 0.200				
3					5	SS	100/ 0.200	Grain Size Analysis: Gr 4%/ Sa 34%/ Si 54%/ Cl 8%			
4											
					6	SS	100/ 0.100				
5											
6					7	SS	14/ 0.150				
7											
		Becoming wet			8	SS	54	Grain Size Analysis: Gr 0%/ Sa 14%/ Si 77%/ Cl 9%			
8											
9					9	SS	100/ 0.175				
10											
					10	SS	100/ 0.225				
11				143.30							
		SHALE, slightly weathered, medium strong, laminated, red, interbedded with thin limestone layers		11.05							
12					1	RUN		TCR=100%, SCR=87%, RQD=80% UCS=27MPa			
13					2	RUN		TCR=100%, SCR=80%, RQD=80% UCS=40MPa			
		Sub-horizontal fractures Vertical fractures from 13.7m to 14.1m									
14				140.26							
		END OF BOREHOLE AT 14.1m. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.		14.10							

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date)

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-09

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : July 27, 2009
COMPLETED : July 27, 2009

Project No. 19-1351-142
SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) / WATER CONTENT, PERCENT (wp, w, wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		157.28							
0	Solid Stem Augers	**SAND**, silty, trace gravel, brown, grey, moist: (FILL)		0.00	1	AS		N 4 807 411.8 E 597 107.5			
1					1	SS	27				
				155.84							
		CLAY, silty, some sand, trace gravel, stiff to firm, brown, moist: (POSSIBLE FILL)(CL)		1.45	2	SS	10				
2											
					3	SS	7	Grain Size Analysis: Gr 0%/ Sa 19%/ Si 50%/ Cl 31%			
3		Occasional cobble									
					4	SS	4				
4											
				152.63							
		SHALE, weathered, laminated, red		4.65	5	SS	100/ 0.250				
5											
				151.80							
		END OF BOREHOLE AT 5.5m, UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		5.49							
6		WATER LEVEL READINGS: DATE / DEPTH (m) / ELEV. (m): Aug 05, 09 / 3.59 / 153.69; Oct 02, 09 / 3.63 / 153.65									
7											
8											
9											
10											
11											
12											
13											
14											

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date) October 2, 2009

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-10

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : July 27, 2009
COMPLETED : July 27, 2009

Project No. 19-1351-142
SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲; 40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		158.18							
		ASPHALT: (200mm)		0.00							
		SILT and **SAND**, trace gravel, brown red, dry: (FILL)		157.98 0.20	1	AS		N 4 807 642.9 E 597 256.3			
				157.50							
1		**CLAY**, silty, trace gravel, trace to some organics, coarse sand lenses, stiff to very stiff, brown black, moist: (TILL)		0.69	1	SS	21				
2					2	SS	25	Grain Size Analysis: Gr 1%/ Sa 18%/ Si 61%/ Cl 20%			
3					3	SS	14				
4					4	SS	17				
				153.76							
		SHALE, highly weathered, red, very weak to weak, laminated, occasional thin grey limestone layer (25mm - 75mm), sub-horizontal fractures		4.42	5	SS	100/				
5					1	RUN	0.125	TCR=0%, SCR=0%, RQD=0%			
6					2	RUN		TCR=87%, SCR=77%, RQD=0% UCS=3MPa			
7					3	RUN		TCR=100%, SCR=75%, RQD=0% UCS=3MPa			
8											
9					4	RUN		TCR=100%, SCR=100%, RQD=93% UCS=12MPa			
				148.58							
10		END OF BOREHOLE AT 9.6m. BOREHOLE OPEN AND DRY. BOREHOLE BACKFILLED WITH HOLEPLUG TO 0.2m, THEN COLD PATCH TO SURFACE.		9.60							
11											
12											
13											
14											

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date)

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-12

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : July 30, 2009
COMPLETED : July 30, 2009

Project No. 19-1351-142

SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲; 40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		153.81							
	Solid Stem Augers	**SAND**, some gravel, brown, moist: (FILL)		0.00	1	AS		N 4 808 443.7 E 597 918.7			
				153.04							
1		**CLAY**, silty, occasional cobble, brown, wet: (FILL)		0.76	1	SS	11				
2					2	SS	100/ 0.100				
					3	SS	4				
3				150.83							
		CLAY, silty, some sand, trace gravel, firm, brown: (CL)		2.97	4	SS	6	Grain Size Analysis: Gr 0%/ Sa 14%/ Si 46%/ Cl 40%			
4											
				149.39							
		SHALE, weathered, red		4.42							
5					5	SS	100/ 0.225				
6				147.71							
		END OF BOREHOLE AT 6.1m. BOREHOLE OPEN AND WET. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		6.10	6	SS	100/ 0.00				
7											
		WATER LEVEL READINGS: DATE / DEPTH (m) / ELEV. (m): Aug 05, 09 — 2.79 — 151.01; Oct 02, 09 — 3.03 — 150.77									
8											
9											
10											
11											
12											
13											
14											

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date) October 2, 2009

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-13

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : July 31, 2009
COMPLETED : July 31, 2009

Project No. 19-1351-142
SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m
		GROUND SURFACE		150.86			
		GRAVEL: (50mm)		0.00			
		SAND, some gravel, reddish brown, moist: (FILL)			1	AS	
1		**CLAY**, silty, trace sand, trace gravel, brown, moist: (FILL)		149.80 1.07	1	SS	11
2		occasional rootlets			2	SS	4
3					3	SS	7
					4	SS	9
4		**SILT**, some clay, trace gravel, hard, reddish brown. moist: (TILL)		146.75 4.11			
5					5	SS	100/ 0.125
6		END OF BOREHOLE AT 6.1m. BOREHOLE OPEN AND WET. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		144.74 6.12	6	SS	100/ 0.025
7		WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Aug 05, 09 2.62 148.24 Oct 02, 09 3.00 147.86					
8							
9							
10							
11							
12							
13							
14							

Solid Stem Augers

COMMENTS
DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

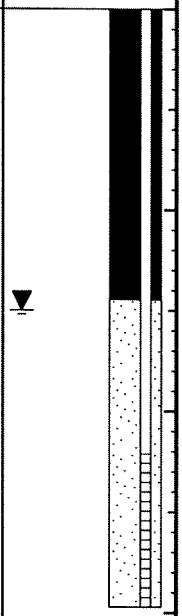
N 4 808 815.2 E 598 179.3

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date) October 2, 2009

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-14

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : August 4, 2009
COMPLETED : August 4, 2009

Project No. 19-1351-142
SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲; 40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		147.82							
		SAND, gravelly, grey, moist: (FILL)		0.00	1	AS		N 4 809 073.5 E 598 405.2			
1					1	SS	22				
				146.37							
		SILT, clayey, some sand, trace gravel, occasional sand lenses, rootlets, brown, moist: (FILL)		1.45	2	SS	8				
2				145.59							
		CLAY, silty, trace to some sand, trace gravel, trace organics and sand lenses, moist: (FILL)		2.23	3	SS	11				
3					4	SS	9				
4	Solid Stem Augers										
5					5	SS	9				
				142.18							
		CLAY, silty, sandy, trace gravel, firm, reddish brown, moist: (Cl)		5.64							
6					6	SS	6	Grain Size Analysis: Gr 0%/ Sa 22%/ Si 57%/ Cl 21%			
7				140.66							
		SHALE, red, highly weathered		7.16	7	SS	100/ 0.075				
8											
				139.29	8	SS	50/ 0.00				
		END OF BOREHOLE AT 8.5m. BOREHOLE OPEN AND DRY. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		8.53							
9											
		WATER LEVEL READINGS: DATE / DEPTH (m) / ELEV. (m) Aug 05, 09 6.41 141.41 Oct 02, 09 6.58 141.24									
10											
11											
12											
13											
14											

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date) October 2, 2009

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-16

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : July 31, 2009
COMPLETED : July 31, 2009

Project No. 19-1351-142
SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		145.74				
0	Solid Stem Augers	**SAND**, gravelly, grey, moist: (FILL)		0.00	1	AS		N 4 809 375.6 E 598 598.3
1				144.53	1	SS	10	
		CLAY, silty, sandy, trace gravel, brown, moist: (FILL)		1.22				
2					2	SS	5	
					3	SS	9	
3				142.77				
		CLAY, silty, sandy, trace gravel, hard, moist: (TILL)(Cl)		2.97	4	SS	51	Grain Size Analysis: Gr 2%/ Sa 27%/ Si 45%/ Cl 26%
4								
5					5	SS	45	
		SILT, some clay, trace gravel, occasional cobble fragments, hard, reddish brown, moist: (TILL)		140.11 5.64				
6					6	SS	63	
7								
8					7	SS	52	
		END OF BOREHOLE AT 8.2m. BOREHOLE OPEN AND WATER LEVEL AT 4.6m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		137.52 8.23				
9		WATER LEVEL READINGS: DATE / DEPTH (m) / ELEV. (m) Aug 05, 09 / 1.53 / 144.21 Oct 02, 09 / 3.21 / 142.53						
10								
11								
12								
13								
14								

COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH: Cu, KPa (nat V - ✤ rem V - ● Q - ✖ Cpen ▲) (40 80 120 160)

WATER CONTENT, PERCENT (wp w wl) (10 20 30 40)

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date) October 2, 2009

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-17

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : July 31, 2009
COMPLETED : July 31, 2009

Project No. 19-1351-142
SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		146.93				
	Solid Stem Augers	**SAND**, gravelly, grey, moist: (FILL)		0.00	1	AS		N 4 809 461.9 E 598 658.5
1					1	SS	16	
		CLAY, silty, some sand, trace gravel, brown, moist to wet: (FILL)		145.61 1.32				
2					2	SS	21	
					3	SS	11	
3					4	SS	16	
4								
5					5	SS	8	
6					6	SS	10	
7								
8		**SILT**, some clay, trace sand, trace gravel, very stiff to hard, reddish brown, moist: (TILL)		139.01 7.92	7	SS	29	
9					8	SS	77	
		END OF BOREHOLE AT 9.6m. BOREHOLE OPEN AND WET. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		137.33 9.60				
10								
11		WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Aug 05, 09 6.54 140.39 Oct 02, 09 6.61 140.32						
12								
13								
14								

COMMENTS
DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✤ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date) October 2, 2009

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-18

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : August 4, 2009
COMPLETED : August 4, 2009

Project No. 19-1351-142

SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲; 40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		153.25							
		TOPSOIL: (125mm)		0.00				N 4 810 087.6 E 599 128.7			
		SAND, gravelly, grey, moist: (FILL)			1	SS	17				
1					2	SS	15				
				151.81							
		CLAY, silty, trace sand, trace gravel, trace organics, brown black, moist: (FILL)		1.45	3	SS	7				
2				150.89							
	Solid Stem Augers	**CLAY**, silty, some sand, trace gravel, occasional limestone fragments, very stiff to hard, reddish brown, moist		2.36	4	SS	28				
3					5	SS	30	Grain Size Analysis: Gr 2%/ Sa 16%/ Si 54%/ Cl 28%			
4											
				148.38	6	SS	100/				
5		**SHALE**, highly weathered, red, with thin limestone bands		4.88			0.275				
6				147.16	7	SS	50/				
		END OF BOREHOLE AT 6.1m. BOREHOLE OPEN AND DRY. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		6.10			0.00				
7											
		WATER LEVEL READINGS: DATE / DEPTH (m) / ELEV. (m) Aug 05, 09 2.20 151.05 Oct 02, 09 2.27 150.98									
8											
9											
10											
11											
12											
13											
14											

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date) October 2, 2009

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-19

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : August 4, 2009
COMPLETED : August 4, 2009

Project No. 19-1351-142
SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲; 40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		154.70							
0	Solid Stem Augers	**SAND**, gravelly, brown, moist: (FILL)		0.00	1	AS		N 4 810 296.3 E 599 307.4	○		
1					1	SS	11		○		
				153.25							
		CLAY, silty, trace sand, trace gravel, stiff, brown, moist: (FILL)		1.45	2	SS	4		○		
2											▼
				151.95	3	SS	8		○		
		SHALE, highly weathered, red with thin blue grey limestone bands		2.74							
3					4	SS	100/ 0.175		○ ○		
				151.04							
		END OF BOREHOLE AT 3.7m. BOREHOLE OPEN AND DRY UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		3.66							
4		WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Aug 05, 09 2.31 152.38 Oct 02, 09 Piezo Destroyed									
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date) August 5, 2009

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-20

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : August 4, 2009
COMPLETED : August 4, 2009

Project No. 19-1351-142
SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m
		GROUND SURFACE		156.45			
	Solid Stem Augers	**CLAY**, silty, trace sand, trace gravel, brown, moist: (FILL)		0.00	1	SS	5
				155.77			
1		**SILT**, clayey, trace sand, trace gravel, stiff, reddish brown, moist: (TILL)		0.69	2	SS	14
				154.78	3	SS	100/ 0.150
2		**SHALE**, highly weathered, red, wet, with occasional thin limestone bands		1.68			
					4	SS	71
3					5	SS	100/ 0.075
				152.62	6	SS	100/ 0.025
4		END OF BOREHOLE AT 3.8m> BOREHOLE OPEN AND WET. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		3.83			
5		WATER LEVEL READINGS: DATE / DEPTH (m) / ELEV. (m) Aug 05, 09 1.69 154.76 Oct 02, 09 2.52 153.93					
6							
7							
8							
9							
10							
11							
12							
13							
14							

COMMENTS
N 4 810 603.8 E 599 499.5
DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ● Q - ✖
rem V - ● Cpen ▲
40 80 120 160
WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS
▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)
▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date) October 2, 2009

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-21

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : August 4, 2009
COMPLETED : August 4, 2009

Project No. 19-1351-142
SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		157.61				
	Solid Stem Augers	**SAND**, gravelly, grey, moist: (FILL)		0.00	1	AS		N 4 810 858.6 E 599 704.1
1		**CLAY**, silty, trace sand, trace gravel, brown, moist: (FILL)		156.54 1.07	1	SS	8	
2					2	SS	6	
		CLAY, silty, some sand, trace gravel, stiff to very stiff, mottled brown grey, moist: (TILL)(CL)		155.40 2.21	3	SS	14	Grain Size Analysis: Gr 1%/ Sa 19%/ Si 51%/ Cl 29%
3					4	SS	28	
4		END OF BOREHOLE AT 4.1m. BOREHOLE OPEN AND DRY. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		153.49 4.11	5	SS	50/ 0.00	
5		WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Aug 05, 09 3.47 154.13 Oct 02, 09 2.32 155.28						
6								
7								
8								
9								
10								
11								
12								
13								
14								

SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲)
40 80 120 160
WATER CONTENT, PERCENT (wp, w, wl)
10 20 30 40
DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date) October 2, 2009

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-22

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : August 17, 2009
COMPLETED : August 17, 2009

Project No. 19-1351-142
SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		156.85				
		ASPHALT: (150mm)		0.00				
		SAND and **GRAVEL**, trace silt, reddish brown: (FILL)			1	SS	61	Grain Size Analysis: Gr 42%/ Sa 49%/ Si & Cl 9%
				156.09				
1	Solid Stem Augers	**SILT**, clayey, trace sand, trace gravel, stiff to hard, reddish brown: (TILL)		0.76	2	SS	41	
2					3	SS	24	
3					4	SS	14	
					5	SS	22	
				153.19				
4		END OF BOREHOLE AT 3.7m. BOREHOLE OPEN AND DRY. BOREHOLE BACKFILLED WITH CUTTINGS TO 3.5m, THEN 0.2m ASPHALT TO SURFACE.		3.66				
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								

COMMENTS
DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date)

LOGGED : JM
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-23

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : August 17, 2009
COMPLETED : August 17, 2009

Project No. 19-1351-142

SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) / WATER CONTENT, PERCENT (wp, w, wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		157.18				DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	40 80 120 160 / wp w wl 10 20 30 40		
		ASPHALT: (150mm)		0.00							
	Solid Stem Augers	**SAND**, some silt, some gravel, brown, moist: (FILL)		156.42	1	SS	38	Grain Size Analysis: Gr 17%/ Sa 66%/ Si & Cl 17%	O		
1		**CLAY**, silty, some sand, trace gravel, stiff to hard, brown: (TILL)		0.76	2	SS	26		O		
2					3	SS	14		O		
3					4	SS	32		O		
					5	SS	26		O		
				153.52							
4		END OF BOREHOLE AT 3.7m. BOREHOLE OPEN AND DRY. BOREHOLE BACKFILLED WITH CUTTINGS TO 0.2m, THEN COLD PATCH TO SURFACE.		3.66							
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date)

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-24

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : August 17, 2009
COMPLETED : August 17, 2009

Project No. 19-1351-142
SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲; 40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		156.91							
		ASPHALT: (180mm)		0.00							
		SAND, some gravel, brown, moist: (FILL)			1	SS	26	Grain Size Analysis: Gr 15%/Sa 70%/Si & Cl 15%	O		
1		**CLAY**, silty, trace sand, trace gravel, stiff to hard, brown, moist		155.99 0.91	2	SS	9		O		
2					3	SS	23		O		
3					4	SS	32		O		
					5	SS	28		O		
4		END OF BOREHOLE AT 3.7m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO 0.2m, THEN COLD PATCH TO SURFACE.		153.25 3.66							
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date)

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-25

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : August 17, 2009
COMPLETED : August 17, 2009

Project No. 19-1351-142

SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲; 40 80 120 160) / WATER CONTENT, PERCENT (wp w wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		156.50							
		ASPHALT: (150mm)		0.00							
		SAND, some silt, trace gravel, reddish brown, moist: (FILL)		155.84	1	SS	18	Grain Size Analysis: Gr 2%/ Sa 84%/ Si & Cl 14%			
1		**CLAY**, silty, trace sand, some to trace gravel, firm, reddish brown		0.66	2	SS	8				
				154.98							
2		**SILT**, clayey, trace sand, trace gravel, very stiff, reddish brown: (TILL)		1.52	3	SS	20				
				154.21							
		CLAY, silty, trace sand, trace gravel, hard, reddish brown: (TILL)		2.29	4	SS	50				
3											
					5	SS	38				
				152.84							
4		END OF BOREHOLE AT 3.7m. BOREHOLE OPEN AND DRY. BOREHOLE BACKFILLED WITH CUTTINGS TO 3.5m, THEN 0.2m ASPHALT TO SURFACE.		3.66							
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date)

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-26

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : August 17, 2009
COMPLETED : August 17, 2009

Project No. 19-1351-142
SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m
		GROUND SURFACE					
		ASPHALT: (150mm)		0.00			
		SAND, gravelly, very dense, grey to brown, moist: (FILL)		0.15	1	SS	62
1					2	SS	26
		CLAY, silty, trace sand, trace gravel, firm to very stiff, reddish brown: (TILL)		1.22			
2	Solid Stem Augers				3	SS	18
					4	SS	7
3							
					5	SS	5
4					6	SS	7
5					7	SS	23
		END OF BOREHOLE AT 5.2m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOEHOLE BACKFILLED WITH CUTTINGS TO 0.2m, THEN COLD PATCH TO SURFACE.		5.18			
6							
7							
8							
9							
10							
11							
12							
13							
14							

COMMENTS
DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

Grain Size Analysis:
Gr 36%/ Sa 46%/ Si & Cl 18%

SHEAR STRENGTH: Cu, KPa
nat V - ✚ rem V - ●
Q - ✖ Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date)

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

RECORD OF BOREHOLE 09-27

PROJECT : Dundas St, Brant Street to Proudfoot Trail
LOCATION : City of Burlington/Town of Oakville
STARTED : August 17, 2009
COMPLETED : August 17, 2009

Project No. 19-1351-142

SHEET 1 OF 1
DATUM

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE						
		ASPHALT: (225mm)		0.00				
	Solid Stem Augers	**SAND**, some gravel, brown, moist: (FILL)		0.23	1	SS	56	
1					2	SS	79/0.225	Grain Size Analysis: Gr 27%/Sa 64%/ Si & Cl 9%
		SILT, clayey, some sand, trace gravel, brown: (FILL)		1.37				
2					3	SS	15	
		CLAY, silty, some sand, trace gravel, firm to hard, reddish brown: (TILL)		2.21	4	SS	7	
3					5	SS	32	
		END OF BOREHOLE AT 3.7m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO 0.2m, THEN COLD PATCH TO SURFACE.		3.66				
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								

SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160
WATER CONTENT, PERCENT (wp, w, wl) 10 20 30 40
COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100
ADDITIONAL LAB. TESTING
PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

▼ DEEP/DUAL INSTALLATION
WATER LEVEL (date)

LOGGED : LG
CHECKED : TH

THURBER

THURBER2S 1142.GPJ 4/13/10

APPENDIX C

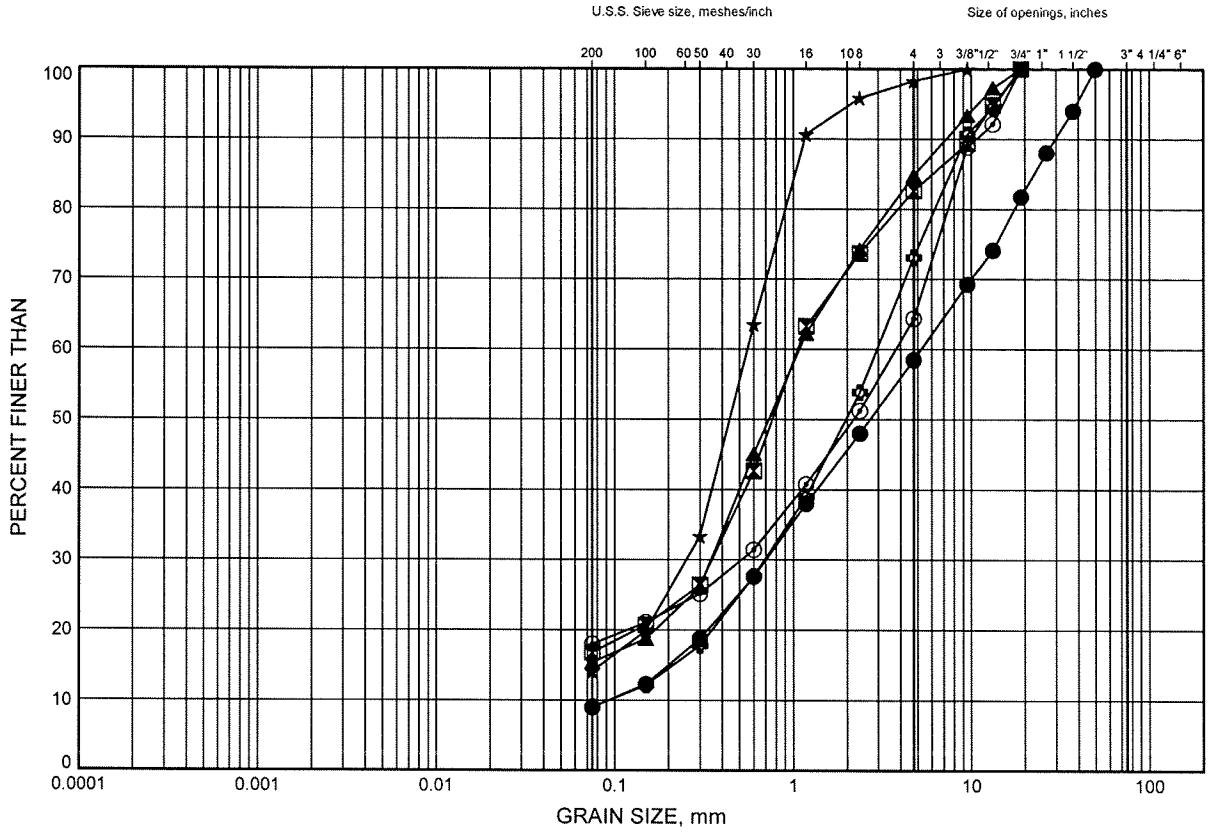
GEOTECHNICAL LABORATORY TEST RESULTS

Dundas St, Brant Street to Proudfoot Trail

GRAIN SIZE DISTRIBUTION

FIGURE C1

GRANULAR FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-22	0.46	156.39
⊠	09-23	0.46	156.72
▲	09-24	0.46	156.45
★	09-25	0.41	156.09
⊙	09-26	0.46	
✿	09-27	0.95	

W.P.# 19-1351-142
Prepared By AN
Checked By TH

THURBER

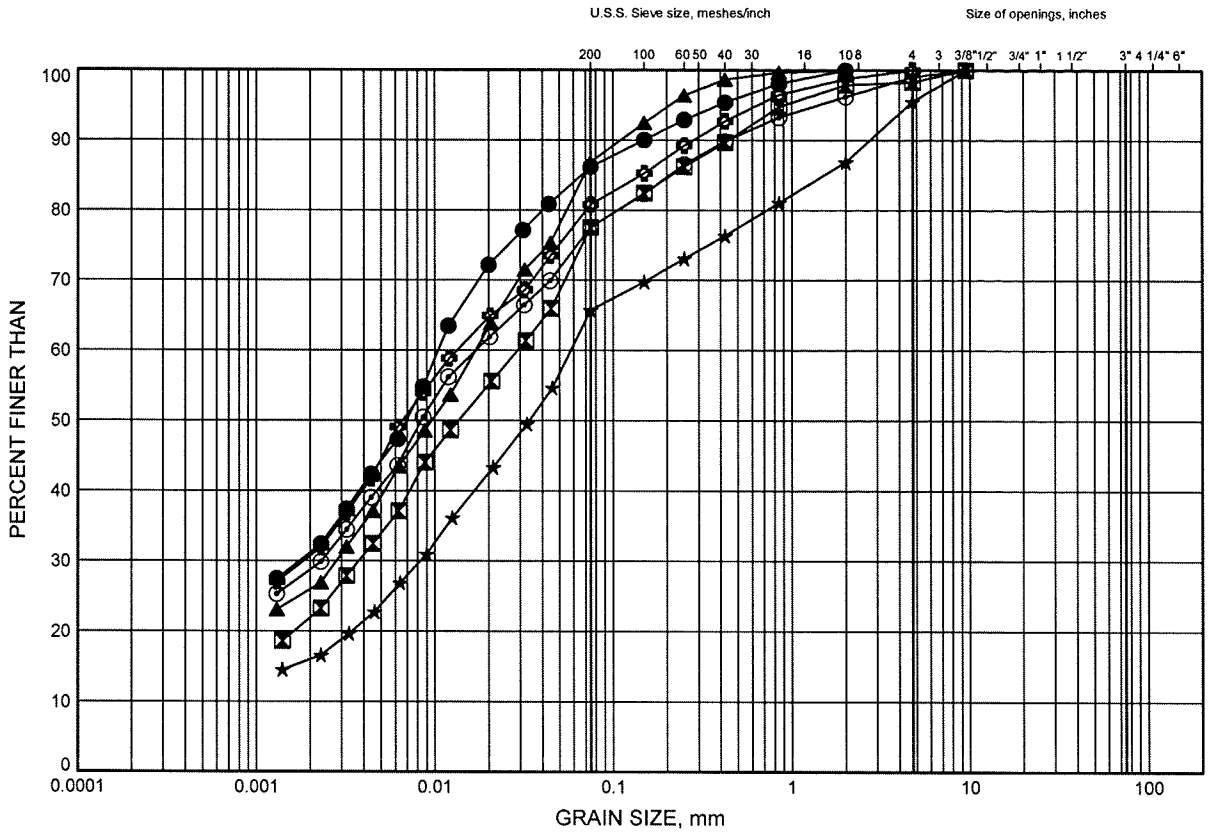
GRAIN SIZE DISTRIBUTION - THURBER 1142.GPJ 4/13/10

Dundas St, Brant Street to Proudfoot Trail

GRAIN SIZE DISTRIBUTION

FIGURE C2

SILTY CLAY TILL/SILTY CLAY FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-01	3.35	164.67
⊠	09-02	2.59	161.73
▲	09-03	1.07	155.29
★	09-03	4.80	151.55
⊙	09-05	2.59	151.32
✿	09-09	2.59	154.69

W.P.# 19-1351-142

Prepared By AN

Checked By TJH

THURBER

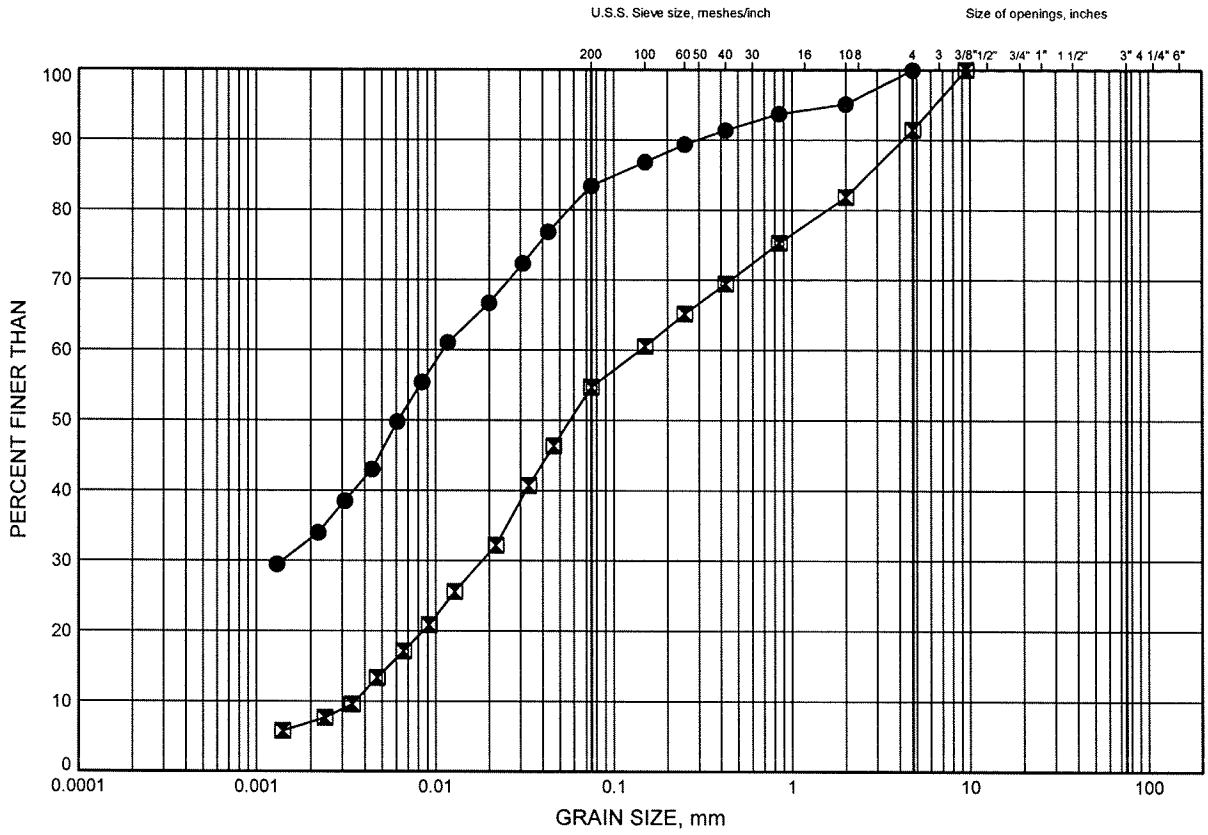
GRAIN SIZE DISTRIBUTION - THURBER 1142.GPJ 4/14/10

Dundas St, Brant Street to Proudfoot Trail

GRAIN SIZE DISTRIBUTION

FIGURE C3

SILTY CLAY



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-04	1.07	153.49
⊠	09-04	5.56	148.99

W.P.# 19-1351-142

Prepared By AN

Checked By TJH

THURBER

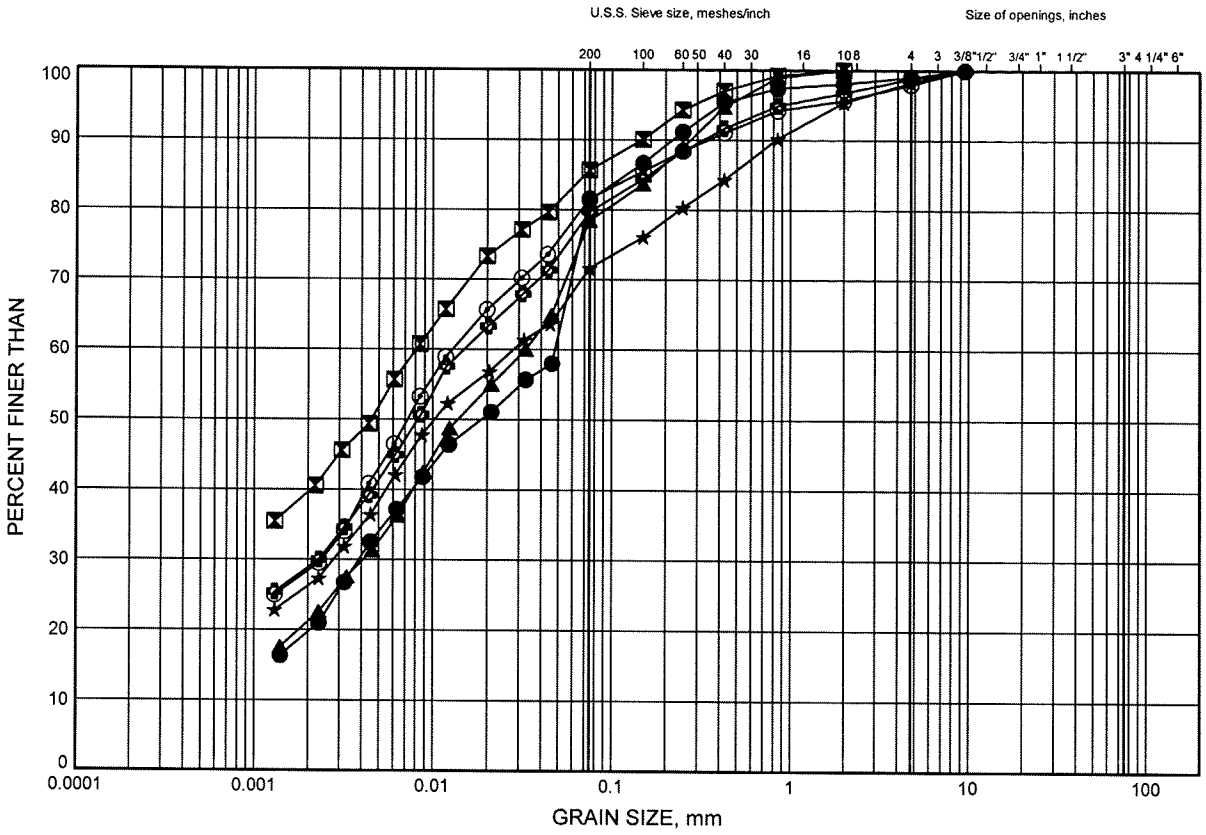
GRAIN SIZE DISTRIBUTION - THURBER 1142.GPJ 4/14/10

Dundas St, Brant Street to Proudfoot Trail

GRAIN SIZE DISTRIBUTION

FIGURE C4

SILTY CLAY TILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-10	1.83	156.35
⊠	09-12	3.35	150.45
▲	09-14	6.40	141.42
★	09-16	3.35	142.39
⊙	09-18	3.35	149.90
✿	09-21	2.59	155.02

W.P.# 19-1351-142
Prepared By AN
Checked By TJH

THURBER

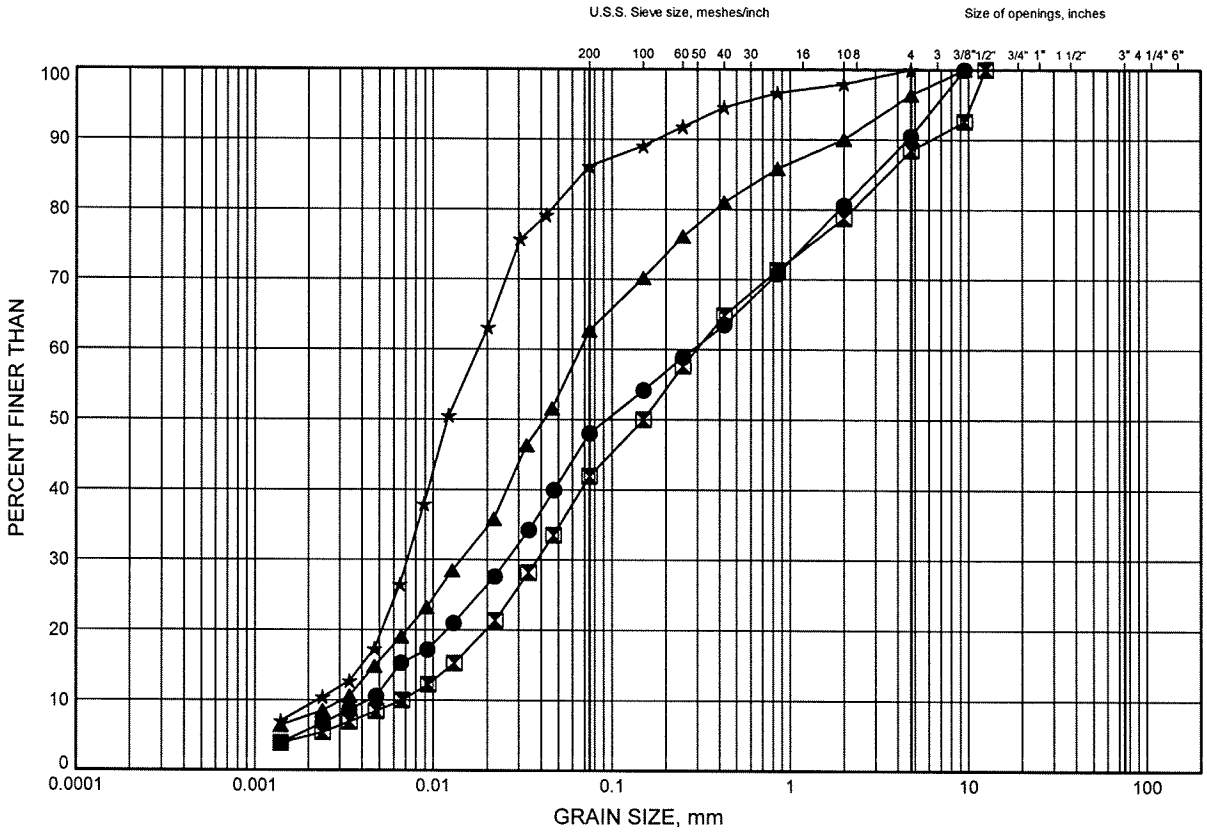
GRAIN SIZE DISTRIBUTION - THURBER 1142.GPJ 4/14/10

Dundas St, Brant Street to Proudfoot Trail

GRAIN SIZE DISTRIBUTION

FIGURE C5

SILT & SAND TILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-06	3.35	149.57
⊠	09-07	6.17	148.77
▲	09-08	3.22	151.13
★	09-08	7.92	146.43

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Prepared By AN
Checked By TJH

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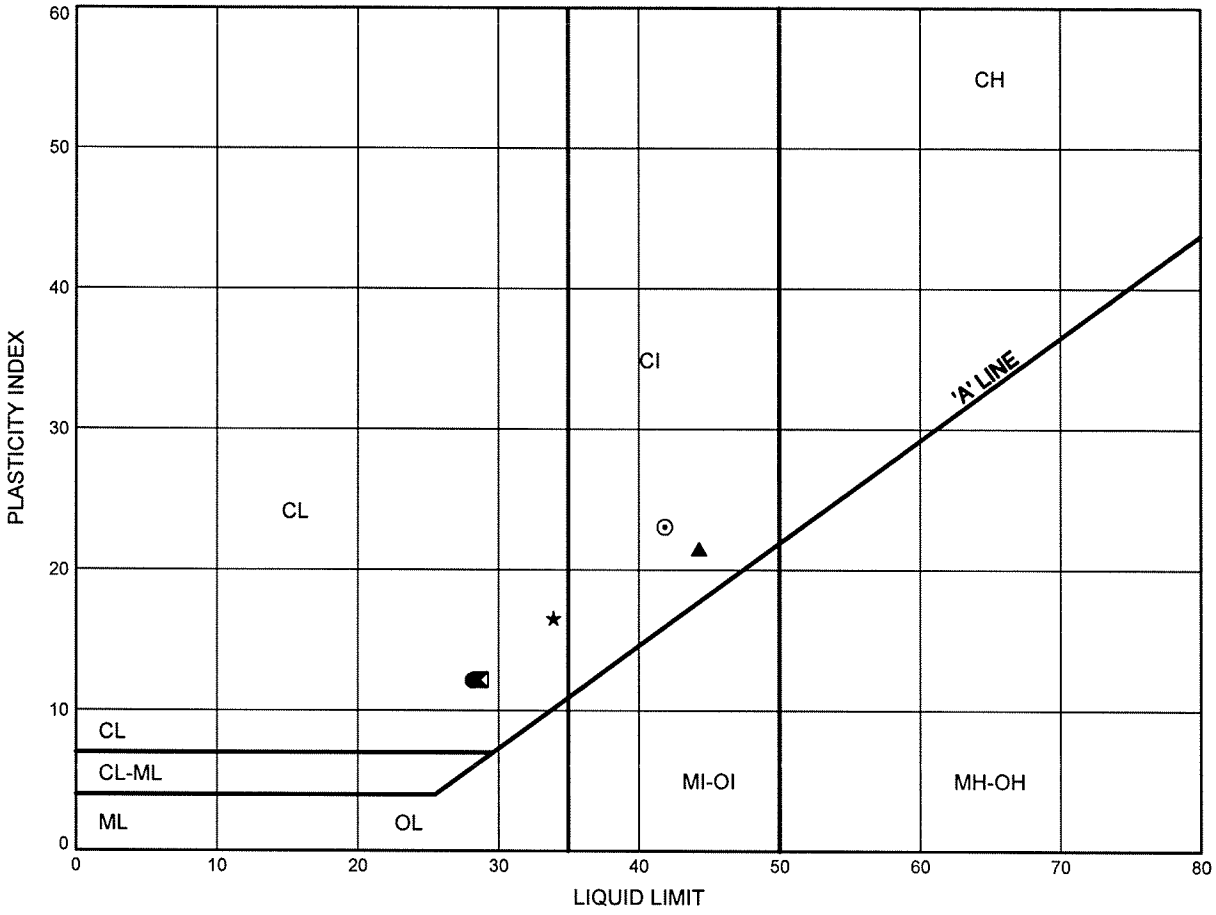
GRAIN SIZE DISTRIBUTION - THURBER 1142.GPJ 4/14/10

Dundas St, Brant Street to Proudfoot Trail

ATTERBERG LIMITS TEST RESULTS

FIGURE C6

SILTY CLAY TILL/SILTY CLAY FILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	09-01	3.35	164.67
⊠	09-02	2.59	161.73
▲	09-03	1.07	155.29
★	09-05	2.59	151.32
⊙	09-09	2.59	154.69

Date April 2010

Project 19-1351-142

THURBER

Prep'd AN

Chkd. TJH

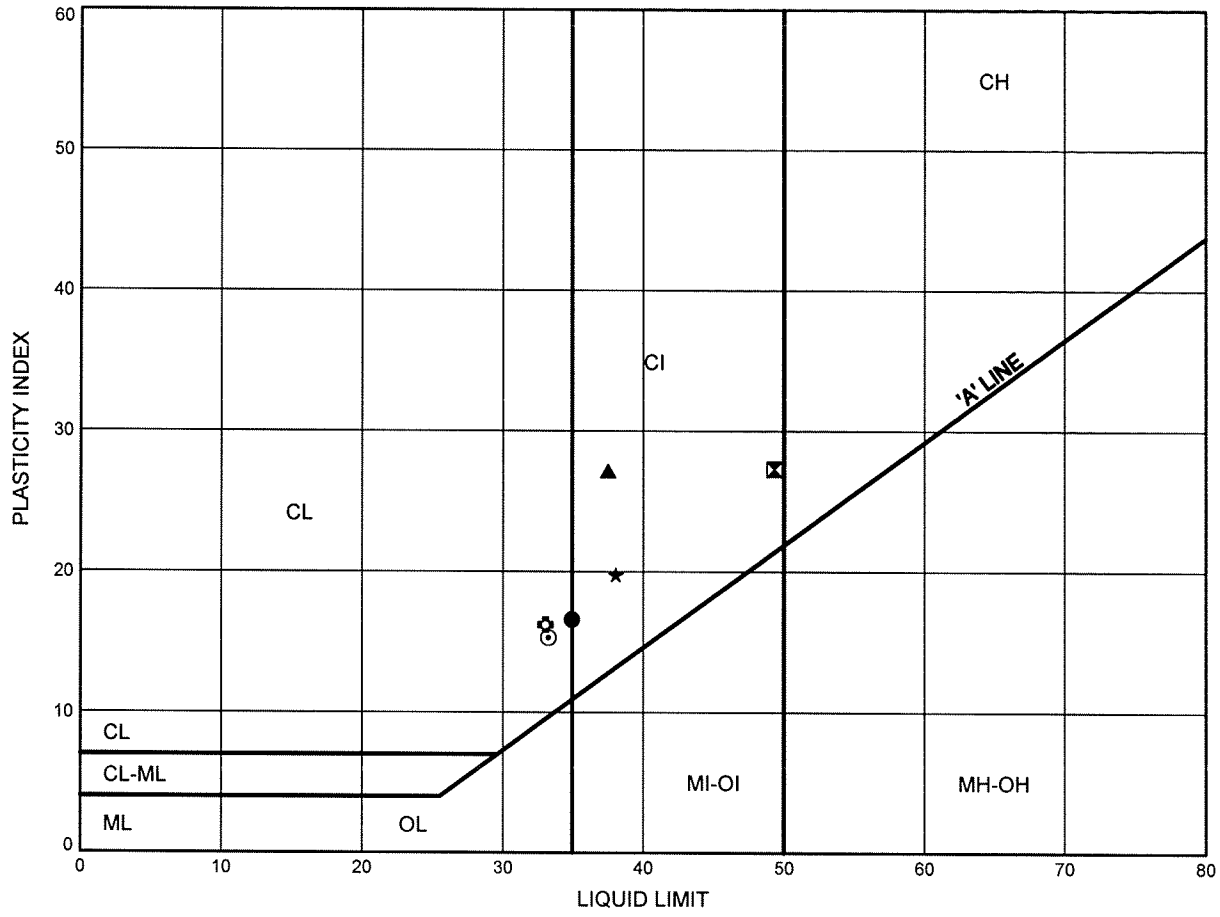
THURBALT 1142.GPJ 4/14/10

Dundas St, Brant Street to Proudfoot Trail

ATTERBERG LIMITS TEST RESULTS

FIGURE C7

SILTY CLAY & SILTY CLAY TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	09-04	1.07	153.49
⊠	09-12	3.35	150.45
▲	09-14	6.40	141.42
★	09-16	3.35	142.39
⊙	09-18	3.35	149.90
✿	09-21	2.59	155.02

Date April 2010

Project 19-1351-142

THURBER

Prep'd AN

Chkd. TJH

THURBALT 1142.GPJ 4/14/10

APPENDIX D

TABLES

Table D1 - Water Levels in Piezometers

Dundas Street Widening

Brant Street / Cedar Springs to Proudfoot Trail

Borehole	Measured Water Level Depth (m)	
	Aug 5, 2009	Oct 2, 2009
BH 09-01	7.59	3.79
BH 09-02	1.47	1.82
BH 09-03	5.64	5.42
BH 09-04	0.10	0.06
BH 09-05	2.09	2.09
BH 09-06	2.66	2.42
BH 09-07	1.23	1.42
BH 09-09	3.59	3.63
BH 09-12	2.79	3.03
BH 09-13	2.62	3.00
BH 09-14	6.41	6.58
BH 09-16	1.53	3.21
BH 09-17	6.54	6.61
BH 09-18	2.20	2.27
BH 09-19	2.31	2.31
BH 09-20	1.69	2.52
BH 09-21	3.47	2.32

Table D2 - Shale Bedrock Levels

Dundas Street Widening

Brant Street / Cedar Springs to Proudfoot Trail

Borehole	Shale Bedrock		
	Depth (m)	Elevation (m)	Cored (m)
BH 09-08	11.05	143.30	3.0
BH 09-09	4.65	152.63	-
BH 09-10	4.42	153.76	5.1
BH 09-14	7.16	140.66	-
BH 09-19	2.74	151.95	-
BH 09-20	1.68	154.78	-