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**FOUNDATION
INVESTIGATION AND DESIGN REPORT
OVERHEAD SIGNS
HIGHWAY 6 WIDENING
BETWEEN HIGHWAYS 403 AND 5
G.W.P. 19-95-01**

Submitted to:

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July 2006

001-1141F-8



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PART A

**FOUNDATION INVESTIGATION REPORT
OVERHEAD SIGNS
HIGHWAY 6 WIDENING BETWEEN HIGHWAYS 403 AND 5
G.W.P. 19-95-01**

Golder Associates

1.0 INTRODUCTION

Golder Associates Ltd. has been retained by URS Canada Inc. (URS) on behalf of the Ministry of Transportation, Ontario (MTO) to provide foundation engineering services for new bridge structures, a pedestrian tunnel, culverts, retaining walls, high fill embankments, high mast light poles, and overhead signs, associated with the widening of Highway 6 between Highways 403 and 5 near Dundas, Ontario.

This report addresses the foundations for seven overhead signs as part of this project. A foundation investigation has been carried out to determine the subsurface conditions in the vicinity of the following sign locations:

| <i>Overhead Sign No.</i> | <i>Approximate Location</i> |
|-------------------------------------|--|
| 1 | Station 10+530, Highway 6 SBL |
| 2 | Station 10+950, Highway 6 SBL |
| 3 | Station 11+160, Highway 6 NBL |
| 4 | Station 11+500, Highway 6 NBL |
| 5 | Station 11+825, Highway 6 SBL |
| 6 | Station 12+250, Highway 6 SBL |
| 7 | Station 12+430, Highway 6 SBL |

The terms of reference for the scope of work are outlined in Golder Associates' Proposal No. P01-1166, dated June 2000. The work has been carried out in accordance with Golder Associates' Quality Control Plan for Foundation Engineering Services, dated July 2000.

2.0 SITE DESCRIPTION

This 2.5 km length of Highway 6, between Highway 403 and Highway 5 (Dundas Street), is located within the City of Burlington in the Regional Municipality of Halton, and the Towns of Dundas and Flamborough in the New City of Hamilton.

Highway 6 crosses the Niagara escarpment south of Highway 5, in the vicinity of Old Guelph Road. The escarpment crest is at about Elevation 215 m; above the crest, the ground surface rises northward to about Elevation 220 m near the north limit of the project at Highway 5. Below the crest, the ground surface declines from Elevation 215 m to about Elevation 147 m in the vicinity of York Road, and about Elevation 133 m near the south limit of the project.

Above Old Guelph Road, near-vertical rock cuts up to a maximum height of about 20 m have been constructed on either side of Highway 6. The upper portions of the cut are comprised mainly of dolostones and limestones, and are sub-vertical. From just north of Old Guelph Road at about Station 12+375 to approximately Station 12+525, the lower portion of the cuts is oriented at approximately 1.5 horizontal to 1 vertical. These lower slopes increase in height from north to south as the existing highway cuts through the escarpment, varying from less than 2 m to 3 m high at Station 12+525, to about 10 m high immediately north of Old Guelph Road.

Immediately south of Old Guelph Road, Highway 6 has been constructed on embankment fill which is up to about 15 m in height.

3.0 INVESTIGATION PROCEDURES

Six boreholes (Boreholes E4, NW-4, and OHS-2003-2 to OHS-2003-5) were drilled in the vicinity of the proposed Overhead Signs No. 2 to 7 for this project, in November 2000, June 2003, September 2003 and October 2004. The locations of the boreholes are shown on Drawings 1 to 3. It is noted that it was not possible to drill a borehole at the location of Overhead Sign No. 1 at Station 10+530 of Highway 6 SBL, as there was insufficient shoulder room and a full lane closure was not permitted on either of the single-lane ramps. In order to determine the subsurface conditions at the location of Overhead Sign No. 1, observations were made of the embankment / ravine side slope and the performance of the roadway in this area, during a site reconnaissance by Golder in October 2004.

Five of the six boreholes were advanced to depths ranging from 11.1 m to 15.9 m with solid stem augers, using truck-mounted drill rigs supplied and operated by Master Soil Investigations Ltd. of Toronto, Ontario and Geo-Environmental Drilling Inc. of Milton, Ontario. Samples of the overburden were obtained at 0.75 m and 1.5 m intervals of depth using 50 mm outside diameter split-spoon samplers in accordance with the Standard Penetration Test (SPT) procedure. In the sixth borehole (Borehole OHS-2003-5), bedrock was encountered at about 1.5 m depth and augering was carried out to 3.5 m depth, followed by approximately 4 m of bedrock coring using NQ-sized coring equipment.

The water level in the open boreholes was observed throughout the drilling operations, and a 20 mm diameter standpipe piezometer was installed in Borehole OHS-2003-3 to monitor the groundwater level. Details of the piezometer installation are shown on this borehole record. Where no piezometer was installed, the boreholes were backfilled using bentonite pellets, mixed in places with soil cuttings; a surface seal of bentonite was placed in all of the boreholes.

The borehole investigations were supervised on a full-time basis by a member of Golder's staff who located the boreholes in the field, directed the drilling, sampling, and in situ testing operations, and logged the boreholes. The soil and bedrock samples were identified in the field, placed in labelled containers and transported to Golder's laboratory in Mississauga for further examination. Index and classification tests consisting of water content determinations, Atterberg limit testing and grain size distribution analyses were carried out on selected soil samples.

The borehole locations and ground surface elevations were determined relative to known surface features or to points staked in the field by Callon Dietz, Ontario Land Surveyors. The MTM NAD83 northing and easting coordinates for the boreholes, and the ground surface elevations referenced to geodetic datum, are shown on the borehole records and on Drawings 1 to 3.

| <i>Borehole No.</i> | <i>Ground Surface Elevation (m)</i> | <i>MTM NAD83 Northing (m)</i> | <i>MTM NAD83 Easting (m)</i> |
|--------------------------------|--|--|---|
| E4 | 183.5 | 4,796,199.8 | 271,473.0 |
| NW-4 | 137.0 | 4,795,282.4 | 272,415.8 |
| OHS-2003-2 | 144.6 | 4,795,408.7 | 272,307.8 |
| OHS-2003-3 | 146.4 | 4,795,685.8 | 272,039.7 |
| OHS-2003-4 | 155.9 | 4,795,889.7 | 271,792.4 |
| OHS-2003-5 | 195.2 | 4,796,324.5 | 271,381.9 |

4.0 SITE GEOLOGY AND STRATIGRAPHY

4.1 Regional Geological Conditions

This 2.5 km section of Highway 6 traverses the Niagara Escarpment, which separates the lower Iroquois Plain to the south from the Flamborough Plain to the north, as delineated in *The Physiography of Southern Ontario* (Chapman and Putnam, Third Edition, 1984). In the vicinity of the Escarpment itself, covering much of the study area for this project, the Halton Till of the Peel Plain physiographic region is present, according to the *Urban Geology of Canadian Cities* (Karrow and White, 1998).

The escarpment crest is located just north of Old Guelph Road, and well-jointed and bedded sedimentary bedrock consisting of dolostone, limestone, sandstone and shale is exposed in the existing Highway 6 cut. Typically, natural talus intermixed with rubbly glacial debris covers the lower slopes of the escarpment. Below the escarpment, the bedrock consists of shale.

The Halton Till of the Peel Plain physiographic region typically ranges in composition from a dense, reddish clayey silt till to a grey, plastic clayey silt to silty clay till. This Halton Till is the lowest and oldest soil deposit encountered in excavations in the area north of Hamilton, and it typically rests directly on the bedrock. Commonly, there is a transition zone of disturbed bedrock at the contact between the Halton Till and the shale.

4.2 Site Stratigraphy

The detailed subsurface soil and groundwater conditions encountered in the boreholes advanced during this investigation, together with the results of the laboratory tests carried out on selected soil samples, are given on the Records of Boreholes and on Figures 1 to 4 following the text of this report. The stratigraphic boundaries shown on the borehole records are inferred from non-continuous sampling, observations of drilling progress and the results of Standard Penetration Tests (SPTs). These boundaries, therefore, represent transitions between soil types rather than exact planes of geological change. The subsurface conditions will vary between and beyond the borehole locations.

The following table summarizes the subsurface conditions at the locations of the proposed Overhead Signs No. 1 to 7.

| <i>Sign No. and Location</i> | <i>Relevant Borehole</i> | <i>Summary of Subsurface Conditions</i> |
|---|-------------------------------------|---|
| 1 Stn 10+530 SBL | See Note Below | Road base fill overlying stiff to very stiff clayey silt fill / till. Shale bedrock may be present at about 6 m to 7 m depth, based on observation of the embankment / ravine side slopes at this location. |
| 2 Stn 10+950 SBL | NW-4 | About 4.5 m of compact/stiff embankment fill, overlying hard clayey silt till and till/residual soil below about 4.5 m depth (Elevation 132.5 m). |
| 3 Stn 11+160 NBL | OHS-2003-2 | About 3.1 m of stiff to very stiff clayey silt fill associated with the existing highway embankment, overlying stiff to hard clayey silt till. |
| 4 Stn 11+500 NBL | OHS-2003-3 | About 0.5 m of gravel fill, overlying very stiff to hard clayey silt till. |
| 5 Stn 11+825 SBL | OHS-2003-4 | About 4.1 m of generally firm to hard clayey silt fill associated with the existing highway embankment, overlying very stiff to hard clayey silt till and till/residual soil. |
| 6 Stn 12+250 SBL | E4 | Approximately 2.4 m of compact sand and gravel fill, overlying about 9 m of stiff to very stiff clayey silt fill, in turn underlain by hard clayey silt till at about 11.4 m depth (Elevation 172.1 m). |
| 7 Stn 12+430, NBL | OHS-2003-5 | About 1.1 m of sand and gravel fill, overlying about 0.4 m of very stiff clayey silt fill, in turn underlain by grey to red-brown shale bedrock. |

NOTE: It was not possible to drill a borehole at the location of Overhead Sign No. 1, as there was insufficient shoulder room and a full lane closure was not permitted on the single-lane ramps. In order to determine the subsurface conditions, observations were made of the embankment and ravine side slopes and the performance of the roadway in this area, during a site inspection in October 2004.

The following subsections provide further information on the subsoils and groundwater conditions encountered in the boreholes.

4.2.1 Embankment Fill

Fill, mainly associated with the existing Highway 6 embankment areas, was encountered in all of the boreholes. The fill varies in thickness from about 0.5 m in Borehole OHS-2003-3, to about 1.5 m in Borehole OHS-2003-5 (within the rock cut), to between 3.1 m and 11.4 m in the remaining boreholes which were advanced through the approach embankment for the existing CP Rail overhead structure and through the existing “high fill embankment” north of York Road.

Typically, the upper 0.5 m to 2.4 m of fill consists of sand and gravel containing trace silt and, in some places, cobbles. Below the sand and gravel, the fill generally consists of clayey silt containing trace to some sand and trace to some gravel, shale and limestone fragments. In the existing “high fill embankment” north of York Road (as encountered in Boreholes E4 and OHS-2003-4), some portions of the clayey silt fill appear to consist of recompacted, weathered shale. The results of grain size distribution tests conducted on three selected samples of the existing embankment fill are presented on Figure 1. Cobbles and boulders were inferred within the embankment fill during drilling, particularly within the “high fill embankment” section north of York Road, based on grinding of the augers and/or resistance to penetration of the sampler. Instances of heavy grinding and slow or difficult advance are noted on the borehole records. In addition, an approximately 0.3 m deep void was encountered within the clayey silt fill during sampling in one borehole (Borehole E4).

The measured Standard Penetration Test (SPT) “N” values within the existing embankment fill range from 14 to 56 blows per 0.3 m of penetration within the sand and gravel portions of the fill, and from 3 to more than 30 blows per 0.3 m of penetration in the cohesive portions of the fill. These results indicate that the relative density or consistency is variable, although the sand and gravel fill is typically compact and the clayey silt fill is typically stiff to hard. It is noted that higher SPT “N” values of about 40 to 80 blows per 0.3 m of penetration were also measured in the fill, but it is considered that these results were affected by the presence of gravel and / or cobbles within the sample zone.

Atterberg limit testing was carried out on three samples of the clayey silt embankment fill, and measured plastic limits of 16 to 18 per cent, liquid limits of 33 to 34 per cent, and corresponding plasticity indices of 15 to 18 per cent. These results, which are plotted on a plasticity chart on Figure 2, confirm that the cohesive portions of the fill consist of clayey silt of low plasticity.

4.2.2 Clayey Silt to Silty Clay Till and Till / Residual Soil

A deposit of brown to red-brown or grey-brown till was encountered in all of the boreholes below the existing fill. The till is typically comprised of clayey silt containing trace to some sand, and trace to some gravel, shale and limestone fragments. Below about 7.2 m and 10.7 m depth in Boreholes NW-4 and OHS-2003-4, the till grades to a residual soil deposit. The results of grain size distribution tests conducted on three samples of the clayey silt till are shown on Figure 3. It is noted that the till is glacially derived and should, therefore, be expected to contain cobbles and boulders, although no such obstructions were encountered within the till in the boreholes advanced as part of this investigation.

Atterberg limit testing was carried out on four samples of the till, and the results are plotted on a plasticity chart on Figure 4. This testing measured plastic limits of 16 to 17 per cent, and liquid limits of 31 to 40 per cent (but typically 31 to 34 per cent); the corresponding plasticity indices range from 14 to 23 per cent, but are typically between 14 and 18 per cent. These plasticity results indicate that the till is predominantly a clayey silt of low plasticity; however, some portions of the till grade to a silty clay of intermediate plasticity, as encountered in Borehole OHS-2003-2.

The clayey silt to silty clay till generally has a very stiff to hard consistency, based on measured SPT “N” values of 21 to greater than 100 blows per 0.3 m of penetration. Lower measured SPT “N” values of 12 and 13 blows per 0.3 m of penetration were measured immediately below the existing fill (i.e. immediately below the original ground surface) in Borehole OHS-2003-2, indicating that the upper layer of the till in this borehole has a stiff consistency.

4.2.3 Bedrock

North of Old Guelph Road, dolostone, limestone and shale bedrock is exposed in the highway cut through the Niagara escarpment.

Borehole OHS-2003-5 encountered bedrock at about 2 m depth, below the highway fill and clayey silt till/residual soil in this area. The borehole was advanced about 1.5 m into the bedrock by augering and split-spoon sampling, with measured SPT “N” values of 88 and greater than 100 blows per 0.3 m of penetration, after which about 4.1 m of bedrock coring was carried out. Based on the recovered split-spoon samples and rock core, the bedrock consists of grey to red-brown shale containing seams and interlayers of stronger limestone and dolostone.

4.3 Groundwater Conditions

All of the boreholes were dry on completion of overburden drilling operations, except at Borehole E4 where about 2 m of standing water was present at the base of the borehole.

A standpipe piezometer was installed in Borehole OHS-2003-3 to monitor the groundwater level across the site. The water level measured in this piezometer approximately six weeks after installation is summarized in the following table:

| <i>Borehole No.</i> | <i>Depth to Groundwater</i> | <i>Groundwater Elevation</i> | <i>Date of Measurement</i> |
|----------------------------|------------------------------------|-------------------------------------|-----------------------------------|
| OHS-2003-3 | 1.2 m | 145.2 m | November 1, 2003 |

Based on the measurement summarized above as well as groundwater monitoring information from other piezometers installed as part of the Highway 6 widening study, the stabilized groundwater level at the site is typically between 1.5 m and 3 m below the natural ground surface. The groundwater table is deeper in the vicinity of the Grindstone Creek channel and in the vicinity of the rail cut.

It should be noted that groundwater levels are expected to fluctuate seasonally and are expected to rise during wet periods of the year.

5.0 CLOSURE

This Foundation Investigation Report was prepared by Ms. Lisa Coyne, P.Eng., an Associate and geotechnical engineer with Golder. Mr. Fintan J. Heffernan, P.Eng., a Designated MTO Contact for Golder, conducted an independent review of the report.

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PART B

**FOUNDATION DESIGN REPORT
OVERHEAD SIGNS
HIGHWAY 6 WIDENING BETWEEN HIGHWAYS 403 AND 5
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6.0 ENGINEERING RECOMMENDATIONS

6.1 General

This section of the report provides foundation design recommendations for the proposed overhead signs. The recommendations are based on interpretation of the factual data obtained from the boreholes advanced during the subsurface investigation for this project. The interpretation and recommendations provided are intended only to provide the designers with sufficient information to design the proposed sign foundations. As such, where comments are made on construction they are provided only in order to highlight those aspects which could affect the planning of the project. Those requiring information on aspects of construction should make their own interpretation of the factual information provided as it may affect equipment selection, proposed construction methods, scheduling and the like.

6.2 Caisson Foundations for Overhead Signs

Caisson foundations for overhead sign supports should be designed in accordance with the requirements in MTO's *Sign Support Manual*. The *Sign Support Manual* includes a standard caisson foundation design (Section 4 and Standard Drawings SS118-3, SS118-4 and SS118-5), in which the caisson are extended 5 m below the design frost depth (i.e. a total length of 6.2 m below grade for this project), except where bedrock is encountered within this depth. The standard design is based on the following minimum soil conditions:

- **Case 1 (Cohesionless Soils):** Sand with a friction angle of 28 degrees surrounding the upper two-thirds of the portion of the caisson foundation below the frost depth, and sand with a friction angle of 30 degrees surrounding the lower third of the portion of the caisson below the design frost depth.
- **Case 2 (Cohesive Soils):** Soft clay with an undrained shear strength of 25 kPa surrounding the upper two-thirds of the portion of the caisson foundation below the frost depth, and "soft" clay with an undrained shear strength of 50 kPa surrounding the lower third of the portion of the caisson below the design frost depth.

The standard foundation design provided in MTO's *Sign Support Manual* does not apply to sites where extensive poor fill materials or materials softer than those of Case 2 are present. For such subsurface conditions, a site-specific design is required.

Based on the review of the subsurface information, the soils at the locations of Overhead Signs No. 1 to 6 have friction angles and/or undrained shear strengths that exceed the input parameters used in developing the standard and, therefore, the standard caisson foundation design is suitable for Overhead Signs No. 1 to 6. With respect to Overhead Sign No. 1, where inspection indicates that shale bedrock may be present at about 6 m to 7 m depth, it is considered that the possible

presence of shale bedrock at the base of this caisson will not affect the caisson design (i.e. the shale bedrock may be treated as a soil, with the standard caisson design length of 6.2 m adopted).

At the location of Overhead Sign No. 7, slightly weathered to fresh shale bedrock was encountered in the borehole at about 2 m depth below the existing Highway 6 surface. In accordance with Standard Drawing SS118-3 of MTO's *Sign Support Manual*, where bedrock is encountered at a depth, z (in metres), of less than 5 m below the bottom of the frost layer, the required depth of the foundation below the frost layer may be taken as:

$$z + (5 \text{ m} - z) / 2$$

Based on the above, the caissons for Overhead Sign No. 7 will be socketted approximately 2.7 m into the shale bedrock. The shale bedrock at this site should be expected to contain stronger interlayers of limestone and dolostone that could cause difficulty in the formation of the caisson sockets. It is recommended that an NSP be included in the Contract Documents to address the formation of the caisson sockets in the bedrock, as discussed further in Section 6.3.

6.3 Construction Considerations

It is recommended that a Non-Standard Special Provision (NSP) be included in the Contract Documents to warn the Contractor of the following items which are expected to affect the installation of the caisson foundations for the sign supports:

- **Caisson installation through Highway 6 embankment fill:** The existing Highway 6 embankment fill is variable, and includes zones of cohesionless soil, cobbles, boulders, and voids. It should be anticipated that caisson holes installed through the existing fill will have to be advanced using a temporary liner in order to avoid loss of ground. In addition, appropriate equipment and procedures will be required to penetrate obstructions (cobbles and boulders) that are present within the fill.
- **Formation of caisson sockets in bedrock:** North of Old Guelph Road, at the location of Overhead Sign No. 7, sockets for caisson foundations will be formed within the bedrock. Bedrock may also be encountered at depth at the location of Overhead Sign No. 1. The bedrock at these sign locations is predominantly shale; however, the shale formation is known to contain stronger limestone and dolostone interlayers. Consideration of the presence of limestone and dolostone layers must be made in the selection of the equipment for the caisson installation at these locations.

Sample NSSPs to address the above items are provided in Appendix A.

7.0 CLOSURE

This Foundation Design Report was prepared by Ms. Lisa Coyne, P.Eng., an Associate and geotechnical engineer with Golder. Mr. Fintan J. Heffernan, P.Eng., a Designated MTO Contact for Golder, conducted an independent review of the report.

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LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures and in the text of the report are as follows:

I. SAMPLE TYPE

| | |
|----|---------------------|
| AS | Auger sample |
| BS | Block sample |
| CS | Chunk sample |
| SS | Split-spoon |
| DS | Denison type sample |
| FS | Foil sample |
| RC | Rock core |
| SC | Soil core |
| ST | Slotted tube |
| TO | Thin-walled, open |
| TP | Thin-walled, piston |
| WS | Wash sample |

III. SOIL DESCRIPTION

(a) Cohesionless Soils

| Density Index (Relative Density) | N Blows/300 mm or Blows/ft. |
|-------------------------------------|--------------------------------|
| Very loose | 0 to 4 |
| Loose | 4 to 10 |
| Compact | 10 to 30 |
| Dense | 30 to 50 |
| Very dense | over 50 |

II. PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) drive open sampler for a distance of 300 mm (12 in.)

Consistency

| | <u>kPa</u> | <u>psf</u> |
|------------|------------|----------------|
| Very soft | 0 to 12 | 0 to 250 |
| Soft | 12 to 25 | 250 to 500 |
| Firm | 25 to 50 | 500 to 1,000 |
| Stiff | 50 to 100 | 1,000 to 2,000 |
| Very stiff | 100 to 200 | 2,000 to 4,000 |
| Hard | over 200 | over 4,000 |

(b) Cohesive Soils

c_u, s_u

Dynamic Cone Penetration Resistance; N_d :

The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure

PM: Sampler advanced by manual pressure

WH: Sampler advanced by static weight of hammer

WR: Sampler advanced by weight of sampler and rod

Piezo-Cone Penetration Test (CPT)

A electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

IV. SOIL TESTS

| | |
|----------|---|
| w | water content |
| w_p | plastic limit |
| w_l | liquid limit |
| C | consolidation (oedometer) test |
| CHEM | chemical analysis (refer to text) |
| CID | consolidated isotropically drained triaxial test ¹ |
| CIU | consolidated isotropically undrained triaxial test with porewater pressure measurement ¹ |
| D_R | relative density (specific gravity, G_s) |
| DS | direct shear test |
| M | sieve analysis for particle size |
| MH | combined sieve and hydrometer (H) analysis |
| MPC | Modified Proctor compaction test |
| SPC | Standard Proctor compaction test |
| OC | organic content test |
| SO_4 | concentration of water-soluble sulphates |
| UC | unconfined compression test |
| UU | unconsolidated undrained triaxial test |
| V | field vane (LV-laboratory vane test) |
| γ | unit weight |

Note: 1 Tests which are anisotropically consolidated prior to shear are shown as CAD, CAU.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. General

| | |
|-------------|---------------------------------------|
| π | 3.1416 |
| $\ln x$, | natural logarithm of x |
| \log_{10} | x or log x, logarithm of x to base 10 |
| g | acceleration due to gravity |
| t | time |
| F | factor of safety |
| V | volume |
| W | weight |

II. STRESS AND STRAIN

| | |
|--------------------------------|--|
| γ | shear strain |
| Δ | change in, e.g. in stress: $\Delta \sigma$ |
| ϵ | linear strain |
| ϵ_v | volumetric strain |
| η | coefficient of viscosity |
| ν | poisson's ratio |
| σ | total stress |
| σ' | effective stress ($\sigma' = \sigma - u$) |
| σ'_{vo} | initial effective overburden stress |
| $\sigma_1, \sigma_2, \sigma_3$ | principal stress (major, intermediate, minor) |
| σ_{oct} | mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$ |
| τ | shear stress |
| u | porewater pressure |
| E | modulus of deformation |
| G | shear modulus of deformation |
| K | bulk modulus of compressibility |

III. SOIL PROPERTIES

(a) Index Properties

| | |
|--------------------|--|
| $\rho(\gamma)$ | bulk density (bulk unit weight*) |
| $\rho_d(\gamma_d)$ | dry density (dry unit weight) |
| $\rho_w(\gamma_w)$ | density (unit weight) of water |
| $\rho_s(\gamma_s)$ | density (unit weight) of solid particles |
| γ' | unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$) |
| D_R | relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s) |
| e | void ratio |
| n | porosity |
| S | degree of saturation |

(a) Index Properties (continued)

| | |
|-----------|--|
| w | water content |
| w_l | liquid limit |
| w_p | plastic limit |
| I_p | plasticity index $= (w_l - w_p)$ |
| w_s | shrinkage limit |
| I_L | liquidity index $= (w - w_p) / I_p$ |
| I_C | consistency index $= (w_l - w) / I_p$ |
| e_{max} | void ratio in loosest state |
| e_{min} | void ratio in densest state |
| I_D | density index $= (e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density) |

(b) Hydraulic Properties

| | |
|---|--|
| h | hydraulic head or potential |
| q | rate of flow |
| v | velocity of flow |
| i | hydraulic gradient |
| k | hydraulic conductivity (coefficient of permeability) |
| j | seepage force per unit volume |

(c) Consolidation (one-dimensional)

| | |
|-------------|---|
| C_c | compression index (normally consolidated range) |
| C_r | recompression index (over-consolidated range) |
| C_s | swelling index |
| C_a | coefficient of secondary consolidation |
| m_v | coefficient of volume change |
| c_v | coefficient of consolidation |
| T_v | time factor (vertical direction) |
| U | degree of consolidation |
| σ'_p | pre-consolidation pressure |
| OCR | over-consolidation ratio $= \sigma'_p / \sigma'_{vo}$ |

(d) Shear Strength

| | |
|------------------|--|
| τ_p, τ_r | peak and residual shear strength |
| ϕ' | effective angle of internal friction |
| δ | angle of interface friction |
| μ | coefficient of friction $= \tan \delta$ |
| c' | effective cohesion |
| c_u, s_u | undrained shear strength ($\phi = 0$ analysis) |
| p | mean total stress $(\sigma_1 + \sigma_3)/2$ |
| p' | mean effective stress $(\sigma'_1 + \sigma'_3)/2$ |
| q | $(\sigma_1 + \sigma_3)/2$ or $(\sigma'_1 + \sigma'_3)/2$ |
| q_u | compressive strength $(\sigma_1 + \sigma_3)$ |
| S_t | sensitivity |

- Notes:**
- 1 $\tau = c' + \sigma' \tan \phi'$
 - 2 shear strength = (compressive strength)/2
 - * density symbol is ρ . Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density x acceleration due to gravity)

RECORD OF BOREHOLE No E4

1 OF 2

METRIC

PROJECT 001-1141F

W.P. 19-95-00

LOCATION N 4796199.8; E 271473.0

ORIGINATED BY AS

DIST Central HWY 6

BOREHOLE TYPE 108mm Diameter Solid Stem Augers

COMPILED BY LCC

DATUM Geodetic


DATE November 20-21, 2000

CHECKED BY LCC

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT w _p | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---------------|-------------|------------|---------|------|------------|----------------------------|-----------------|---|--|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | |
| | | | | | | | | 20 40 60 80 100 | | | | | | |
| | | | | | | | | 20 40 60 80 100 | | | | | | |
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Continued Next Page

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

| PROJECT 001-1141F | | | RECORD OF BOREHOLE No E4 | | | 2 OF 2 | | | METRIC | | | | |
|----------------------------------|--|---|--|------|-------------------------|------------------|--|-----------------|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|
| W.P. 19-95-00 | | | LOCATION N 4796199.8 ; E 271473.0 | | | ORIGINATED BY AS | | | | | | | |
| DIST Central HWY 6 | | | BOREHOLE TYPE 108mm Diameter Solid Stem Augers | | | COMPILED BY LCC | | | | | | | |
| DATUM Geodetic | | | DATE November 20-21, 2000 | | | CHECKED BY LCC | | | | | | | |
| SOIL PROFILE | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT W _P | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | | | "N" VALUES | 20 40 60 80 100 | | | | | |
| — CONTINUED FROM PREVIOUS PAGE — | | | | | | | | | | | | | |
| 167.7 | Clayey Silt, trace to some sand, gravel and shale fragments (TILL) |  | 10 | SS | 77 | | | | | | | | |
| 15.9 | End of Borehole | | | | | | | | | | | | |
| | Note: Water level in open borehole at 14m depth (Elevation 169.5m) on completion of drilling. | | | | | | | | | | | | |

RECORD OF BOREHOLE No NW-4

1 OF 1

METRIC

PROJECT 001-8059

W.P. 19-95-00

LOCATION N 4795282.4 : E 272415.8

ORIGINATED BY GD

DIST Central HWY 6

BOREHOLE TYPE 108 mm Diameter Solid Stem Augers

COMPILED BY KG

DATUM Geodetic

DATE Sept. 15, 2003

CHECKED BY LCC

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT w _p | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) | | | |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--------------|------------------|-------------|----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|-------------------|----|----|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | | | | | WATER CONTENT (%) | | |
| | | | | | | | | ○ UNCONFINED | + FIELD VANE | ● QUICK TRIAXIAL | × REMOULDED | 20 | | | | | | 40 | 60 | 80 |
| 137.0 | GROUND SURFACE | | | | | | | | | | | | | | | | | | | |
| 0.0 | Asphalt | | | | | | | | | | | | | | | | | | | |
| 0.2 | Sand and gravel, trace silt, containing cobbles (FILL) Compact Brown Moist | | 1 | SS | 27 | | | | | | | | | | | | | | | |
| | | | 2 | SS | 26 | | | | | | | | | | | | | | | |
| 135.5 | | | | | | | 130 | | | | | | | | | | | | | |
| 1.5 | Clayey silt, some sand and gravel, trace asphalt fragments, containing cobbles (FILL) Very dense Brown Moist | | 3 | SS | 55 | | 130 | | | | | | | | | | | | | |
| | | | 4 | SS | 50/08 | | | | | | | | | | | | | | | |
| 134.0 | | | | | | | 134 | | | | | | | | | | | | | |
| 3.1 | Clayey silt, some sand, trace gravel, containing rootlets (FILL) Firm to stiff Brown and grey Moist | | 5 | SS | 11 | | | | | | | | | | | | | | | |
| | | | 6 | SS | 8 | | 133 | | | | | | | | | | | | | |
| 132.5 | | | | | | | | | | | | | | | | | | | | |
| 4.5 | Clayey Silt to Silty Clay, trace sand and gravel (TILL) Hard Brown to grey-brown Moist | | 7 | SS | 34 | | 132 | | | | | | | | | 1 9 55 35 | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | 8 | SS | 47 | | 131 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| 129.8 | | | | | | | 130 | | | | | | | | | | | | | |
| 7.2 | Clayey Silt, some sand, trace gravel (TILL/RESIDUAL SOIL) Hard Red-brown Dry | | 9 | SS | 102/15 | | 129 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 128 | | | | | | | | | | | | | |
| 127.9 | | | | | | | | | | | | | | | | | | | | |
| 9.1 | Silty Clay, trace sand, containing silt seams (TILL/RESIDUAL SOIL) Hard Grey Moist | | 10 | SS | 87 | | 127 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| 126.3 | | | | | | | | | | | | | | | | | | | | |
| 126.0 | Clayey Silt, some sand, trace gravel (TILL/RESIDUAL SOIL) Hard Red-brown Moist | | 11 | SS | 62/15 | | | | | | | | | | | | | | | |
| 11.0 | End of Borehole | | | | | | | | | | | | | | | | | | | |
| | Notes | | | | | | | | | | | | | | | | | | | |
| | 1. Open borehole dry upon completion of drilling operations. | | | | | | | | | | | | | | | | | | | |

*MISS. MTO 001-8059 HWY6 NOISE BARRIER WALL GPJ ON MOT.GDT 28/4/95

RECORD OF BOREHOLE No OHS-2003-2

1 OF 1

METRIC

PROJECT 001-1141F

W.P. 19-95-00

LOCATION N 4795408.7 ; E 272307.8

ORIGINATED BY PKS

DIST Central HWY 6

BOREHOLE TYPE 108mm Diameter Solid Stem Augers

COMPILED BY JDR

DATUM Geodetic

DATE June 16, 2003

CHECKED BY LCC

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | | |
| | | | | | | | | 20 40 60 80 100 | | | | | | | |
| | | | | | | | | ○ UNCONFINED + FIELD VANE | | | | | | | |
| | | | | | | | | ● QUICK TRIAXIAL x REMOULDED | | | | | | | |
| | | | | | | | | 20 40 60 80 100 | | | | | | | |
| 144.6 | Road Surface | | | | | | | | | | | | | | |
| 0.0 | Asphalt | | | | | | | | | | | | | | |
| 0.2 | Sand and gravel (FILL) | | | | | | | | | | | | | | |
| 144.0 | | | | | | | | | | | | | | | |
| 0.6 | Clayey silt to silty clay, some sand, trace to some gravel and shale fragments (FILL) Stiff to very stiff Brown to grey-brown Moist | | 1 | SS | 25 | | 144 | | | | | | | | |
| | | | 2 | SS | 12 | | 143 | | | | | | | | |
| | | | 3 | SS | 11 | | 142 | | | | | | | | |
| 141.6 | | | 4 | SS | 13 | | 141 | | | | | | | | |
| 3.1 | Clayey Silt to Silty Clay, some sand, trace to some gravel and shale fragments (TILL) Stiff to hard Brown Moist | | 5 | SS | 13 | | 140 | | | | | | | | |
| | | | 6 | SS | 12 | | 139 | | | | | | | | |
| | | | | | | | 138 | | | | | | | | |
| | | | 7 | SS | 76 | | 136 | | | | | | | | |
| | | | | | | | 137 | | | | | | | | |
| | | | 8 | SS | 70 | | 135 | | | | | | | | |
| | | | | | | | 134 | | | | | | | | |
| | | | 9 | SS | 80 | | | | | | | | | | |
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RECORD OF BOREHOLE No OHS-2003-3

1 OF 1

METRIC

PROJECT 001-1141F

W.P. 19-95-00

LOCATION N 4795685.8 ; E 272039.7

ORIGINATED BY GPD

DIST Central HWY 6

BOREHOLE TYPE 108mm Diameter Solid Stem Augers

COMPILED BY JDR

DATUM Geodetic

DATE September 18, 2003

CHECKED BY LCC

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL | |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|-----------------------------|---------------------------------|-------------------------------------|--------------------------------|--|--|-------------------|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | | WATER CONTENT (%) |
| | | | | | | | | ○ UNCONFINED ● QUICK TRIAXIAL | + FIELD VANE × REMOULDED | | | | | | |
| 146.4 | Ground Surface | | | | | | | 20 40 60 80 100 | | | | | | | |
| 0.0 | Gravel, trace to some sand (FILL) | | 1 | SS | 26 | | | | | | | | | | |
| 145.9 | Compact Grey Dry | | | | | | | | | | | | | | |
| 0.5 | Clayey Silt, some sand, trace to some gravel (TILL) | | 2 | SS | 28 | | | | | | | | | | |
| | Very stiff to hard | | 3 | SS | 28 | | | | | | | | | | |
| | Brown Moist | | 4 | SS | 25 | | | | | | | | | | |
| | | | 5 | SS | 27 | | | | | | | | | | |
| | | | 6 | SS | 21 | | | | | | | | | | |
| | | | 7 | SS | 26 | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | 8 | SS | 27 | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | 9 | SS | 47 | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | Containing red shale fragments below approximately 9m depth | | 10 | SS | 23 | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | 11 | SS | 70/23 | | | | | | | | | | |
| 135.4 | End of Borehole | | | | | | | | | | | | | | |
| 11.1 | NOTES: 1. Borehole dry on completion of drilling operations. 2. Water level in piezometer measured at 1.2 m depth (Elevation 145.2 m) on November 1, 2003. | | | | | | | | | | | | | | |

MISS_MTO 0011141FAAMTO.GPJ ON_MOT.GDT 28/4/05

+³, X³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

RECORD OF BOREHOLE No OHS-2003-5

1 OF 1

METRIC

PROJECT 001-1141F

W.P. 19-95-00

LOCATION N 4796324.5 : E 271381.9

ORIGINATED BY GPD

DIST Central HWY 6

BOREHOLE TYPE 108mm Diameter Solid Stem Augers

COMPILED BY JDR

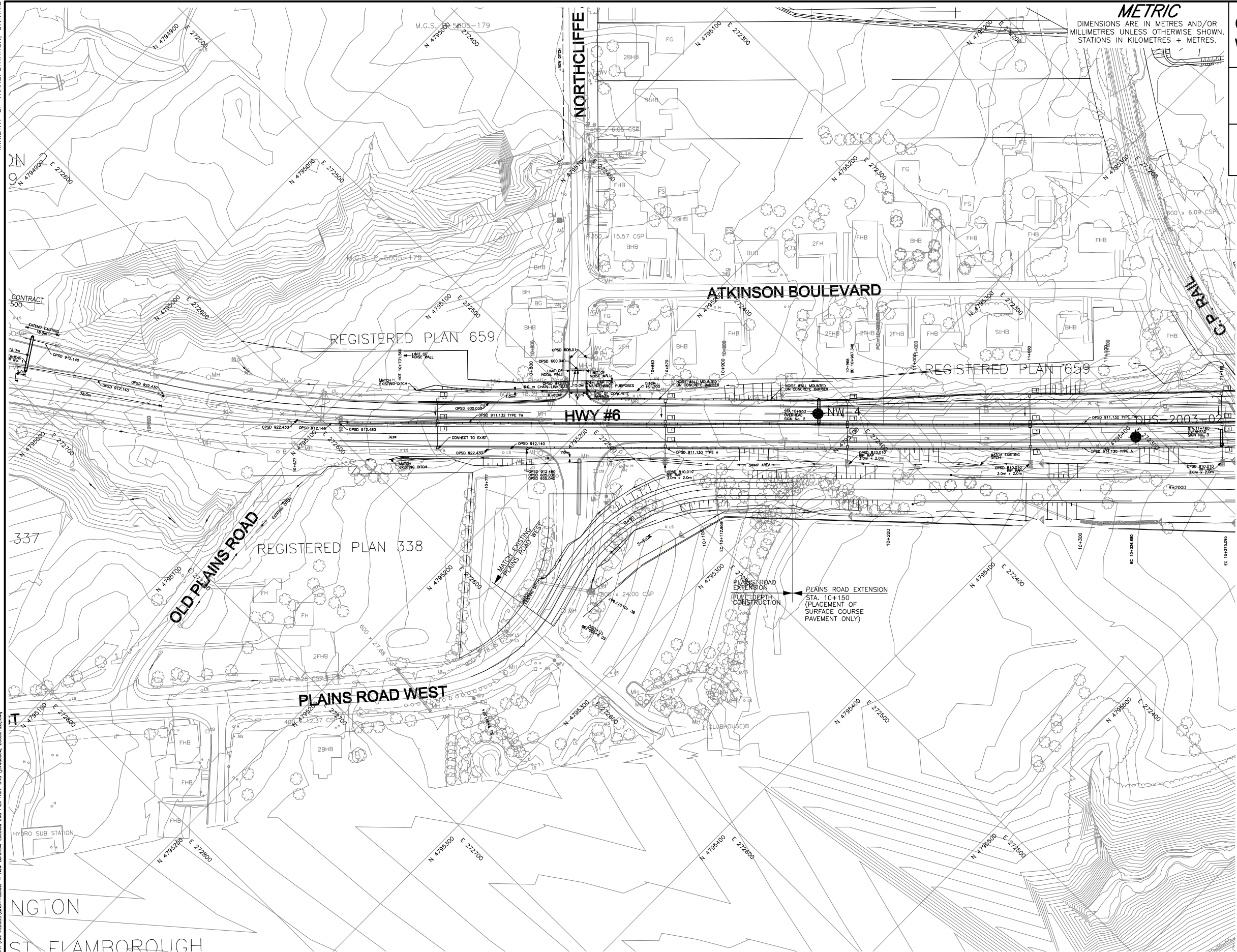
DATUM Geodetic

DATE 2/23/2004

CHECKED BY LCC

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---------------|--|------------|---------|------|------------|-------------------------|-----------------|--|--|--|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | | |
| 195.2 | Road Surface | | | | | | | | | | | | | | |
| 0.1 | Asphalt | | | | | | | | | | | | | | |
| 0.2 | Sand and gravel (FILL) Very dense Grey Dry | | | | | | | | | | | | | | |
| 194.1 | | | 1 | SS | 56 | | | | | | | | | | |
| 193.7 | Clayey silt, trace sand and gravel (FILL) Very stiff Grey-brown | | | | | | | | | | | | | | |
| 193.2 | Moist | | 2 | SS | 22 | | | | | | | | | | |
| 2.0 | Clayey Silt, trace sand, trace gravel and shale fragments (TILL/RESIDUAL SOIL) Very stiff Grey Moist | | | | | | | | | | | | | | |
| | Shale (BEDROCK) containing limestone / dolostone seams and interlayers Slightly weathered to fresh Grey to red-brown | | 3 | SS | 88 | | | | | | | | | | |
| | | | 4 | SS | 101/15 | | | | | | | | | | |
| | Bedrock cored between 3.5 m and 7.6 m depth. For bedrock coring details, refer to Record of Drillhole OHS-2003-5. | | | | | | | | | | | | | | |
| 187.6 | End of Borehole | | | | | | | | | | | | | | |
| 7.6 | NOTE: Borehole dry on completion of overburden drilling operations. | | | | | | | | | | | | | | |

+³, X³: Numbers refer to Sensitivity ○³% STRAIN AT FAILURE



METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

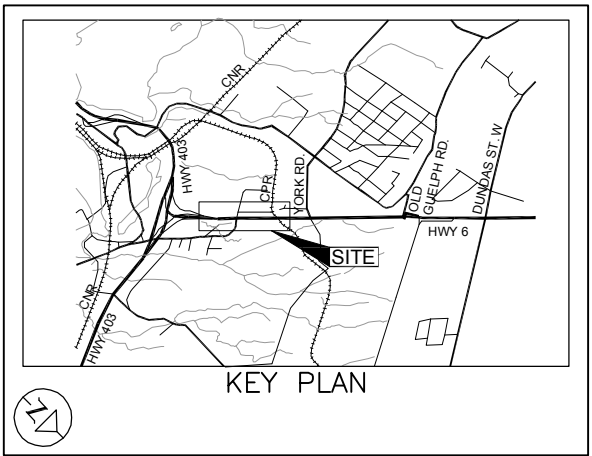
CONT No.
WP No. 19-95-01

HIGHWAY No 6
OVERHEAD SIGNS
BOREHOLE LOCATIONS

SHEET

Golder Associates

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



LEGEND

Borehole—Current Investigation

| No. | ELEVATION | CO-ORDINATES | |
|-------------|-----------|--------------|----------|
| | | NORTHING | EASTING |
| NW-4 | 137.0 | 4795282.4 | 272415.8 |
| OHS-2003-02 | 144.6 | 4795408.7 | 272307.8 |

NOTES

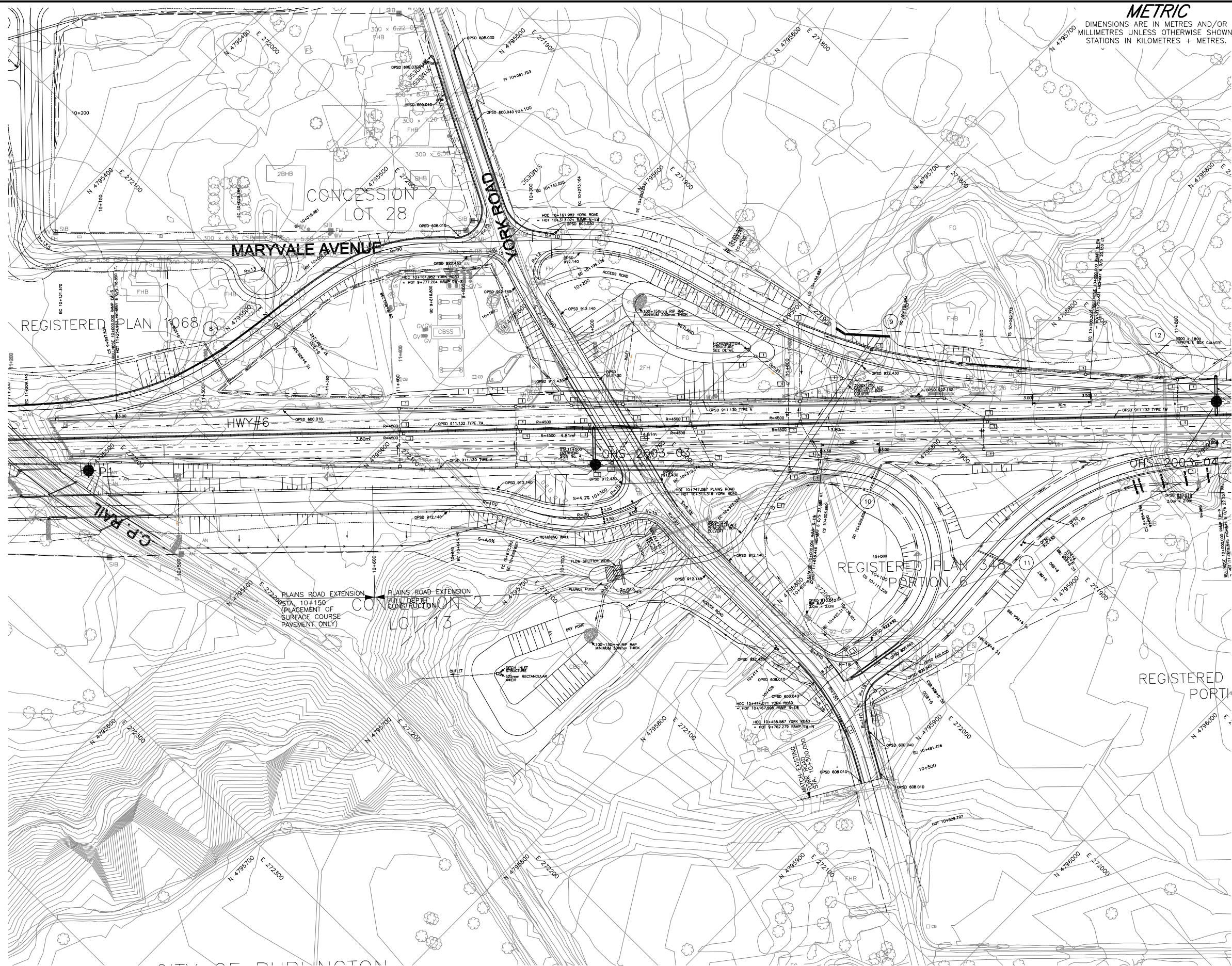
The proposed works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contract Documents.

The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS General Conditions.

For subsurface information only.

| REFERENCE | | | |
|--|--|--|--|
| Base plans provided in digital format by URS Canada Inc. | | | |

| NO. | DATE | BY | REVISION |
|-------------|-----------|-----------------------|----------|
| Geores No. | | | |
| HWY. 6 | | PROJECT NO. 001-1141F | DIST. |
| SUBM'D. PKS | CHKD. PKS | DATE: APRIL 2005 | SITE: |
| DRAWN: JDR | CHKD. PKS | APPD. LCC | DWG. 1 |



PLAN



METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

CONT No.
WP No. 19-95-01

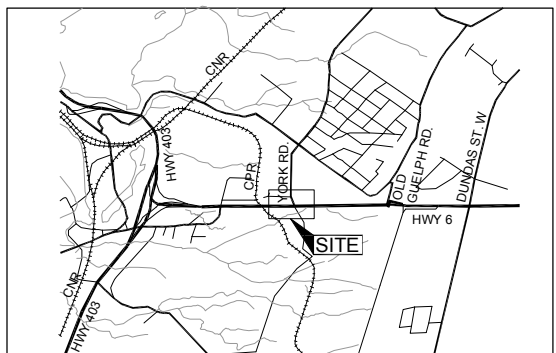


HIGHWAY No 6
OVERHEAD SIGNS
BOREHOLE LOCATIONS

SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN



LEGEND

● Borehole—Current Investigation

| No. | ELEVATION | CO-ORDINATES | |
|-------------|-----------|--------------|----------|
| | | NORTHING | EASTING |
| OHS-2003-03 | 146.4 | 4795685.8 | 272039.7 |
| OHS-2003-04 | 155.9 | 4795889.7 | 271792.4 |

NOTES

The proposed works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contract Documents.

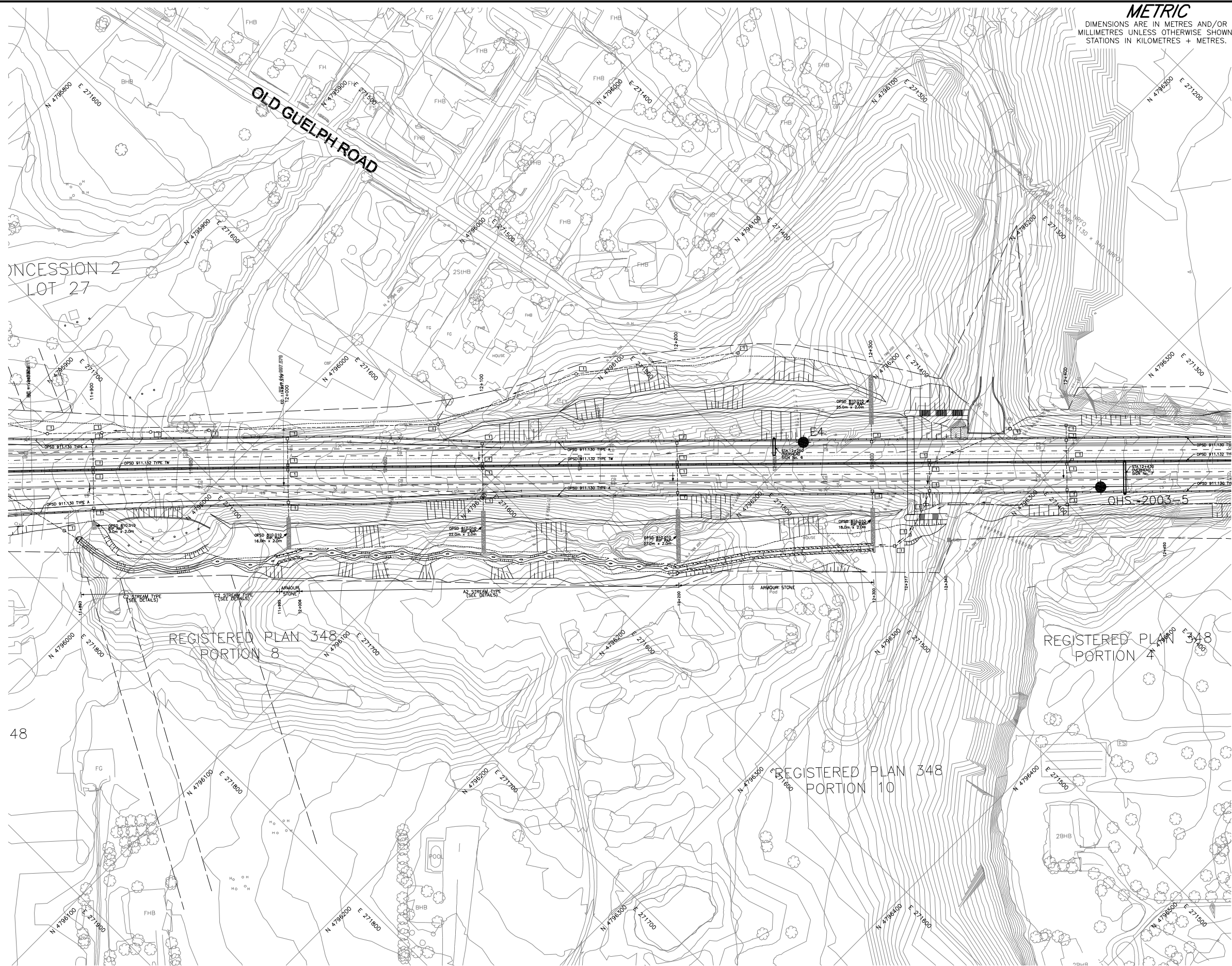
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For subsurface information only.

REFERENCE

Base plans provided in digital format by URS Canada Inc.

| NO. | DATE | BY | REVISION |
|-------------|-----------|-----------------------|----------|
| | | | |
| Geores No. | | | |
| HWY. 6 | | PROJECT NO. 001-1141F | DIST. |
| SUBM'D. PKS | CHKD. PKS | DATE: APRIL 2005 | SITE: |
| DRAWN: JDR | CHKD. PKS | APPD. LCC | DWG. 2 |



PLAN



METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No. 19-95-01

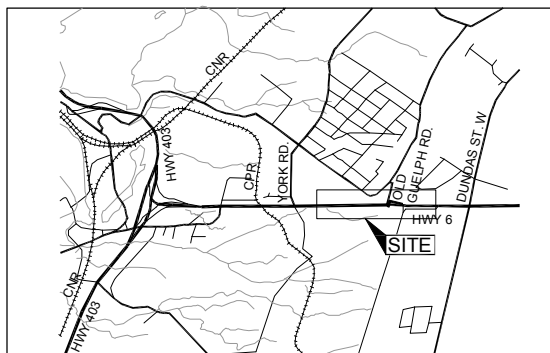


HIGHWAY No 6
OVERHEAD SIGNS
BOREHOLE LOCATIONS

SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN



LEGEND

● Borehole—Current Investigation

| No. | ELEVATION | CO-ORDINATES | |
|------------|-----------|--------------|----------|
| | | NORTHING | EASTING |
| E4 | 183.5 | 4796199.8 | 271473.0 |
| OHS-2003-5 | 195.2 | 4796324.5 | 271381.9 |

NOTES

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For subsurface information only.

REFERENCE

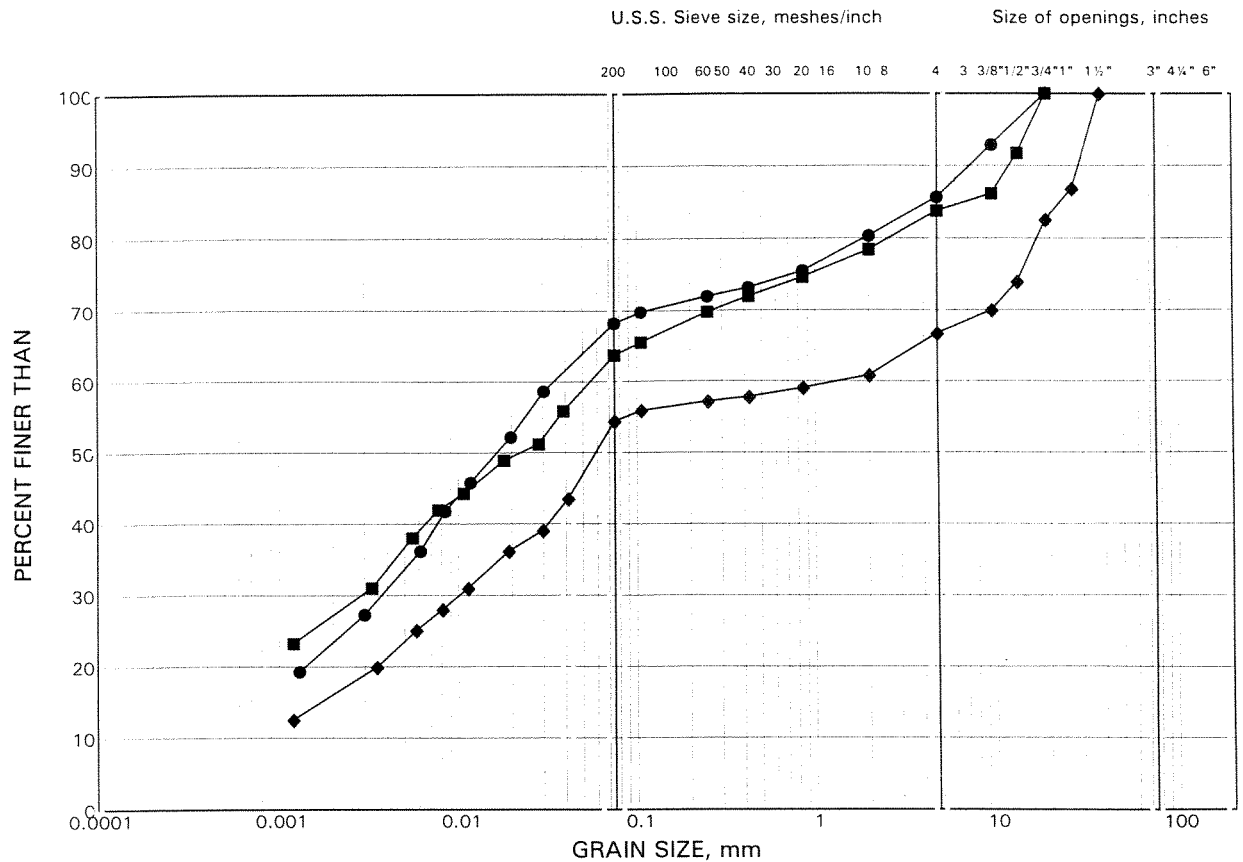
Base plans provided in digital format by URS Canada Inc.

| NO. | DATE | BY | REVISION |
|-------------|-----------|-----------------------|----------|
| | | | |
| Geocres No. | | | |
| HWY. 6 | | PROJECT NO. 001-1141F | DIST. |
| SUBM'D. PKS | CHKD. PKS | DATE: APRIL 2005 | SITE: |
| DRAWN: JDR | CHKD. PKS | APPD. LCC | DWG. 3 |

GRAIN SIZE DISTRIBUTION TEST RESULTS

Embankment Fill

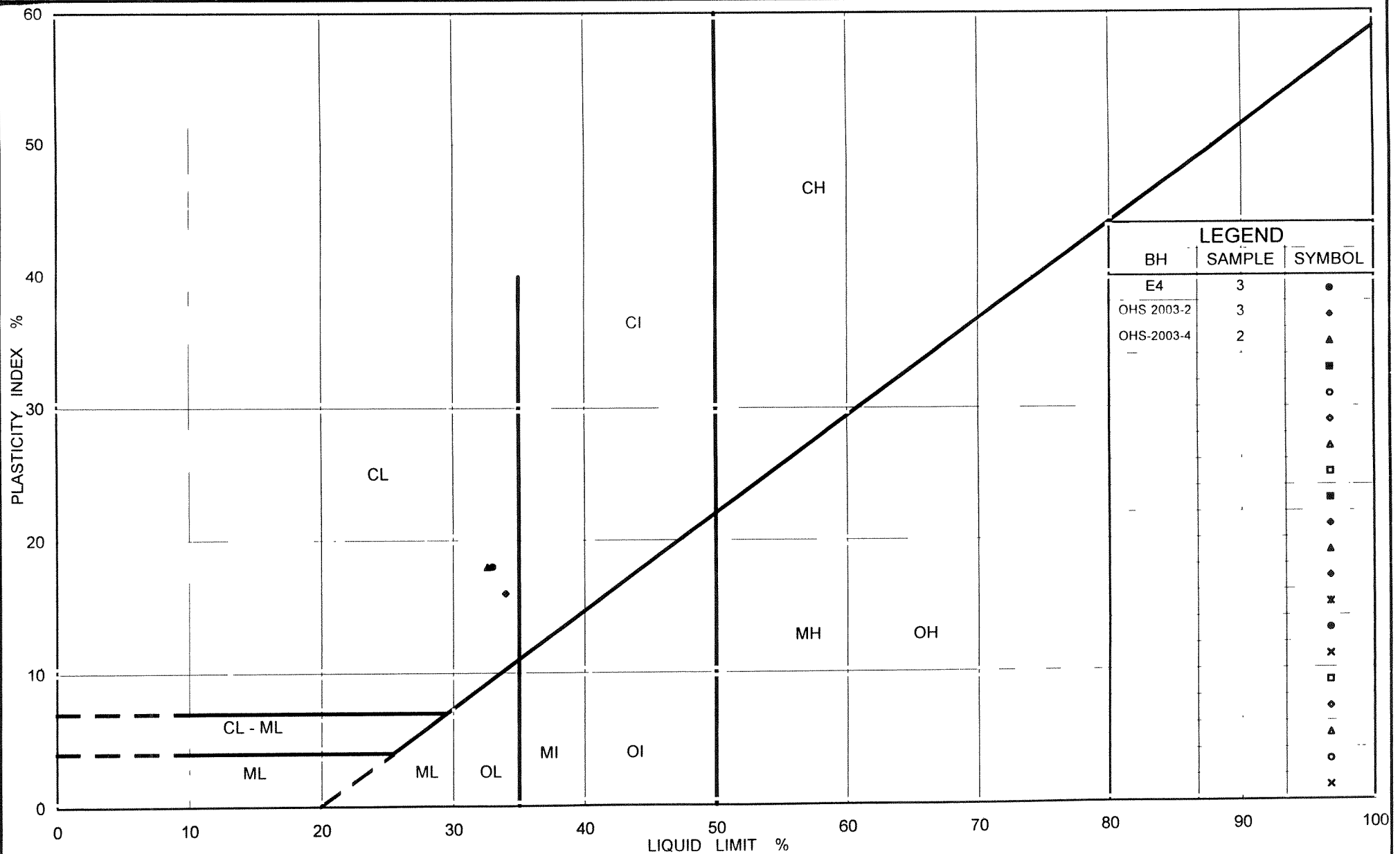
FIGURE 1



| | | | | | | |
|---------------------|-----------|--------|--------|-------------|--------|--------|
| SILT AND CLAY SIZES | FINE | MEDIUM | COARSE | FINE | COARSE | COBBLE |
| FINE GRAINED | SAND SIZE | | | GRAVEL SIZE | | SIZE |

LEGEND

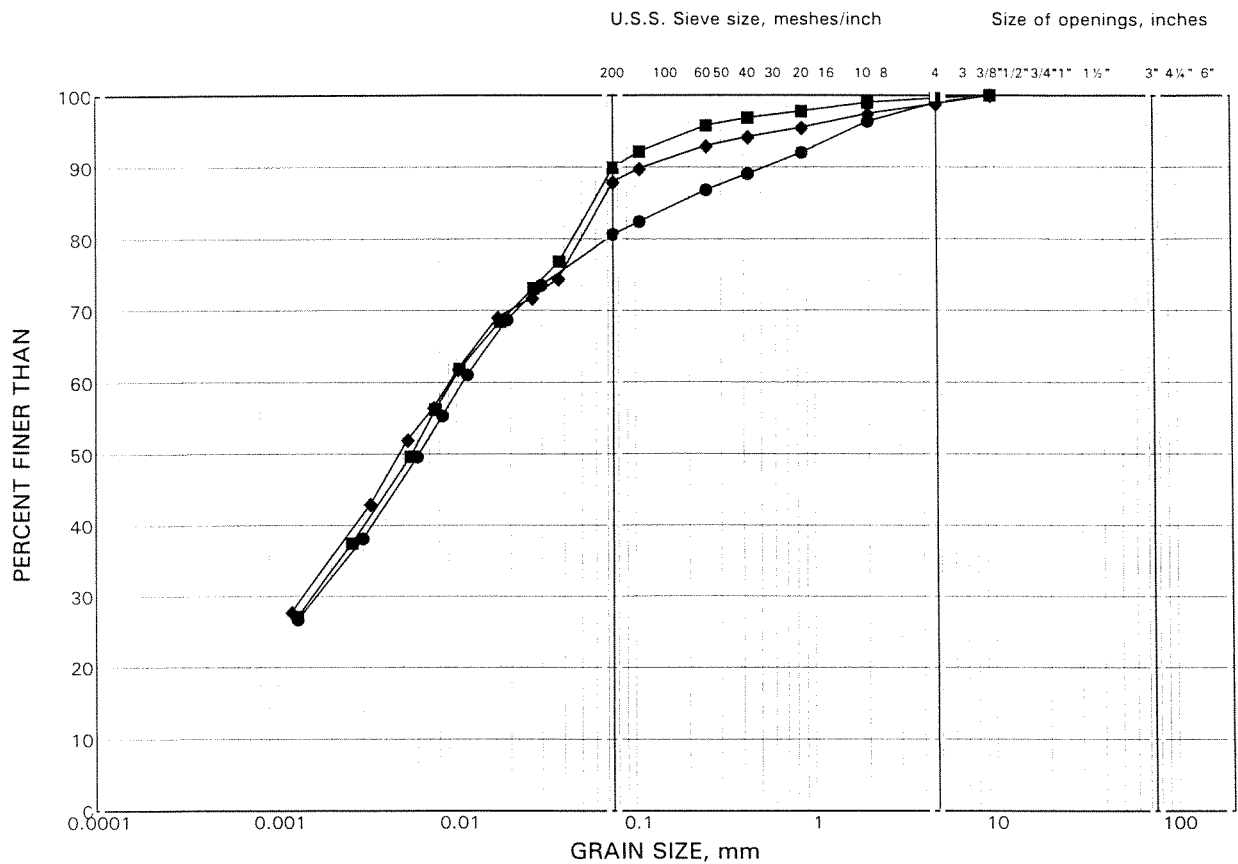
| SYMBOL | BOREHOLE | SAMPLE | ELEVATION (m) |
|--------|-------------|--------|---------------|
| ● | E-4 | 3 | 178.6 |
| ■ | OHS-2003-02 | 3 | 142.1 |
| ◆ | OHS-2003-04 | 2 | 154.2 |



GRAIN SIZE DISTRIBUTION TEST RESULTS

Clayey Silt to Silty Clay Till

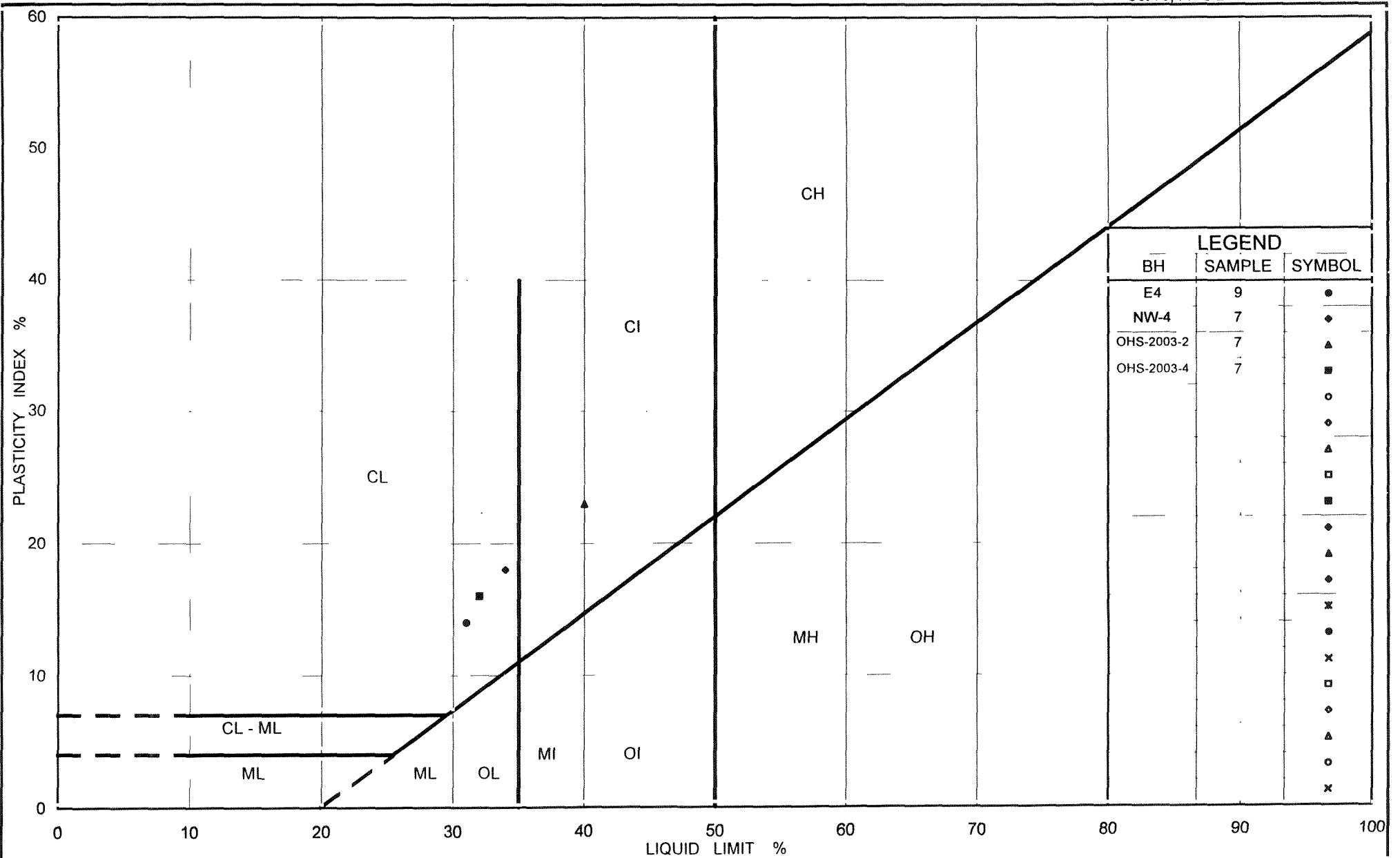
FIGURE 3



| | | | | | | |
|---------------------|-----------|--------|--------|-------------|--------|--------|
| SILT AND CLAY SIZES | FINE | MEDIUM | COARSE | FINE | COARSE | COBBLE |
| FINE GRAINED | SAND SIZE | | | GRAVEL SIZE | | SIZE |

LEGEND

| SYMBOL | BOREHOLE | SAMPLE | ELEVATION (m) |
|--------|-------------|--------|---------------|
| ● | E4 | 9 | 169.6 |
| ■ | NW-4 | 7 | 132.2 |
| ◆ | OHS-2003-04 | 7 | 149.6 |



APPENDIX A
NON-STANDARD SPECIAL PROVISIONS

OVERHEAD SIGNS – CAISSON INSTALLATION - ITEM NO.

Special Provision

1.0 Scope

The caisson foundations for some of the overhead signs will be installed through the existing Highway 6 embankment fill. The existing Highway 6 embankment fill is variable, and includes zones of cohesionless soil, cobbles, boulders, and voids. It should be anticipated that the caisson holes will have to be advanced using a temporary liner in order to avoid loss of ground. In addition, appropriate equipment and procedures will be required to penetrate obstructions (cobbles and boulders) that may be present within the fill.

2.0 Basis of Payment

Payment at the contract price for the above tender item shall include full compensation for all labour and materials to complete the work.

END OF SECTION

OVERHEAD SIGNS – CAISSON INSTALLATION - ITEM NO.

Special Provision

1.0 Scope

North of Old Guelph Road, at the location of Overhead Sign No. 7, sockets for caisson foundations will be formed within the bedrock. Bedrock may also be encountered at depth at the location of Overhead Sign No. 1. The bedrock at these sign locations is predominantly shale; however, the shale formation is known to contain stronger limestone and dolostone interlayers. Consideration of the presence of limestone and dolostone layers must be made in the selection of the equipment for the caisson installation at these locations.

2.0 Basis of Payment

Payment at the contract price for the above tender item shall include full compensation for all labour and materials to complete the work.

END OF SECTION