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HWY. No. 69LOCATION Embankments over Deep  
SwampsNo of PAGES -       

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. \_\_\_\_\_REMARKS: \_\_\_\_\_  
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**REPORT ON**

**FOUNDATION INVESTIGATION AND DESIGN  
EMBANKMENTS CROSSING DEEP SWAMPS  
FOUR LANING OF THE PARRY SOUND BYPASS**

**G.W.P. 209-97-00  
MTO DISTRICT 52**

Submitted to:  
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May 1999



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**PART A – FIELD INVESTIGATION**

**EMBANKMENTS CROSSING DEEP SWAMPS  
FOUR LANING OF THE PARRY SOUND BYPASS**

**G.W.P. 209-97-00  
MTO DISTRICT 52**

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## 1.0 INTRODUCTION

Golder Associates Ltd. has been retained by Cole, Sherman & Associates (Cole, Sherman) on behalf of the Ministry of Transportation, Ontario (MTO) to carry out a foundation investigation along the alignment of the proposed embankments over areas of deep swamps for the northbound and southbound lanes of the proposed Highway 69. The embankment design forms part of the Parry Sound Bypass project, which involves four laning of a section of Highway 69 from Badger Road northerly 10 km to Sequin River. The locations of the particular sections of the embankment along alignment of new Highway 69, where foundation input was required are summarized in Table 1, attached.

The purpose of this investigation is to determine the subsurface conditions within the sites of the proposed embankments crossing the swamps by drilling boreholes, and carrying out in-situ tests and laboratory tests on selected samples. Based on our interpretation of the data obtained, recommendations on the geotechnical aspects of design of the proposed works are provided. Comments are also provided on anticipated construction problems where they may affect design of the proposed structure.

The proposed horizontal and vertical alignment for Highway 69 were provided initially to us on the 1:5000 plan and profile for the route planning study drawings and subsequently during the design study phase on the design / contract drawings prepared by Cole, Sherman.

The terms of reference for the scope of work are outlined in our proposal letter P71-1494, dated November 26, 1997 and letters dated July 6, 1998 and April 16, 1999 outlining the scope of additional investigation to be carried out within the swamp areas. The work was carried out in accordance with our Quality Control Plan for Foundation Design Services, dated March 03, 1998.

## **2.0 SITE DESCRIPTION**

The site is located in the vicinity and to the east of the existing Highway 69, south of Parry Sound, Ontario, and is within the MTO District 52, Huntsville. The existing Highway 69, from Badger Road northerly to the Sequin River, is presently a two lane undivided highway.

The topography within the study area is extremely variable. The ground surface along the proposed highway alignment undulates between areas of steep rock ridges and low lying swamp. Where the existing highway extends through the swamp areas, the road embankment is typically of relatively low height.

### 3.0 INVESTIGATION PROCEDURES

The field work for this investigation was carried out between May 13, 1998 and June 2, 1998, on December 19 and 20, 1998 and between February 24 and April 23, 1999. At this time, twenty-six (26) boreholes were drilled within the areas of the proposed swamp crossings. Where access was possible, the investigation was carried out using a bombardier mounted CME 55 drill rig supplied and operated by Marathon Drilling Inc. of Ottawa. Boreholes in the deep swamp areas were advanced using portable drilling equipment mounted on platforms or floating rafts.

Soil samples were obtained at regular intervals of depth using 50 mm outside diameter split-spoon samplers in accordance with Standard Penetration Test (SPT) procedures. In-situ vane testing was carried out in the boreholes to obtain the undrained shear strength of the peat and the underlying silty clay deposit. Groundwater conditions in the open holes were observed throughout the drilling operations.

The field work was supervised on a full-time basis by members of our technical staff who located the boreholes in the field, directed the drilling, sampling and in-situ testing operations, and logged the borings. The soil samples were identified in the field, placed in labeled containers and transported back to our laboratory in Mississauga for further examination. Index, classification and consolidation tests were carried out on selected samples.

The as-drilled borehole locations were determined by our field personnel based on the highway chainages as staked in the field and offset from the centerline of the median. The borehole locations are summarized in Table 1.



## **4.0 GENERAL SITE GEOLOGY AND STRATIGRAPHY**

### **4.1 Site Geology**

From published geologic information, the site is located in the physiographic region known as the Laurentian Highlands which forms the southernmost part of the Canadian Precambrian Shield (Geology of Ontario; OGS Special Volume 4). The Laurentian Highlands comprises a southeast-trending, slightly elevated region underlain by Precambrian bedrock, which was eroded to form an undulating surface with frequent rounded knobs and ridges. The terrain comprises large expanses of intrusive and metamorphic rocks such as gneisses and gneissic or massive granitic rocks. The rocks are geologically complex with considerable folding, intrusive activity, regional metamorphism and faulting. The local physiography is characterized by shallow overburden consisting mainly of outwash sand and gravel and irregular, variable bedrock surface with frequent rock outcrops and shallow bedrock. Since irregular bedrock surface is typical in the area, terrain with organic deposits is widespread.

### **4.2 Site Stratigraphy**

The detailed subsurface soil and groundwater conditions encountered in the boreholes, together with the results of the laboratory tests carried out on selected soil samples, are given on the attached Record of Borehole sheets on Figure 1 and in Appendix B, following the text of this report. The stratigraphic boundaries shown on the Record of Borehole sheets are inferred from non-continuous sampling and, therefore, represent transitions between soil types rather than exact planes of geological change. Subsoil conditions will vary between and beyond the borehole locations. The borehole information was supplemented by the information obtained from the probeholes carried out as part of the geotechnical investigation. Relevant probehole information is included in Appendix A, which follows text of this report.

A detailed description of the subsurface conditions as encountered at the boreholes put down within each swamp crossing is provided in the following sections.

**Station 18+100 to Station 18+300**

Eleven (11) boreholes, numbered 98-1A to 98-1E and 99A to 99E were put down within this swamp area as shown on Drawing N111101E, attached. Three (3) boreholes were located along the existing highway embankment and eight (8) boreholes were put down at the selected locations within the swamp area.

In summary, the soils encountered in the boreholes put down within the swamp consist of organic deposits underlain by very soft to soft silty clay. The boreholes put down through the existing highway embankment encountered the organic and silty clay deposits below the sand and gravel fill / road structure at some borehole locations. At other locations, organic deposits were not evident.

In the boreholes put down within the swamp area and outside of the existing embankment, the base of the peat was encountered between 6.1 m and 7.2 m depth. The peat is fibrous to approximately 4 m depth then becomes amorphous. The peat is underlain by as much as 4.3 m of very soft to soft silty clay. The in-situ vane testing carried out within the silty clay indicates undrained shear strength varying typically between 5 kPa and 15 kPa. The consolidation testing was carried out on one sample of the silty clay collected from Borehole 98-1C. The results of the testing are attached in Appendix B, for reference. A compression index  $C_c = 1.0$  was obtained for the silty clay sample.

Boreholes 99A to 99C were put down through the existing road embankment. The road embankment fill consists of sand and gravel with trace silt and variable amount of cobbles / rockfill. A layer of cobble / rockfill was encountered between 0.9 m and 2 m depth in Borehole 99C. The base of the road embankment fill was encountered at about 4.6 m, 8.4 m and 5.8 m depth in Boreholes 99A to 99C, respectively. In Borehole 99A, the embankment fill is underlain by about 2.7 m of peat extending to the bedrock surface inferred from resistance to auger penetration at about 7.3 m depth. In Borehole 99B, the fill is underlain by a native sand extending to about 10.1 m depth to bedrock surface and in Borehole 99C, about 1.8 m of peat and 1.1 m of silty clay underlie the fill. Occasional layers of sand were encountered in the peat deposit.

Standing water to about 0.3 m depth was noted in the boreholes drilled to the east of the existing embankment and the water level was encountered at ground surface in the boreholes located to the west of the existing embankment. In the boreholes put down through the road embankment the water level was encountered between 1.5 m and 2.4 m depth during drilling.

**Station 18+600 to Station 18+690**

2

Three (3) boreholes, numbered 98-2A to 98-2C were drilled within this swamp area as shown on Drawing N111102E, attached. In summary, the soils encountered in the boreholes put down within the swamp consist of peat underlain by a very soft to firm silty clay and clayey silt extending to as much as 7.3 m depth.

In the boreholes put down within the swamp area, the base of the peat was encountered between 2.7 m and 3.2 m depth. The peat is fibrous and becomes amorphous with depth. The peat is underlain by very soft to firm silty clay and clayey silt. The in-situ vane testing carried out within the silty clay and clayey silt indicates undrained shear strength varying typically between 10 kPa and 45 kPa. Interlayers of sand and silty sand were encountered within the cohesive deposit.

Refusal to further auger penetration was encountered in Boreholes 98-2A and 98-2B at about 5.9 m and 7.3 m depth, probably on bedrock. Borehole 98-2C was terminated at about 5.3 m depth.

Standing water to about 0.15 m depth was noted in Borehole 98-2A drilled to the east of the existing embankment and the water level was encountered at ground surface in Boreholes 98-2B and 98-2C.

**Station 20+895 to Station 21+380**

3

Five (5) boreholes numbered HF-1A to HF-1E, were drilled within this area as shown on Drawing N111104, where a high embankment is proposed. The soils encountered in the boreholes consist of topsoil overlying the surficial deposit of sand, silty sand and silt, which in turn is underlain by silty clay and sand. The topsoil varies from 80 mm to 300 mm in thickness.

The surficial granular deposit is typically very loose to loose and extends to the depths ranging from 1.4 m to 1.7 m. Underlying the surficial granular deposit is a soft to firm silty clay to clayey silt. No silty clay was encountered in Borehole HF-1A. In-situ vane testing carried out in the silty clay indicates undrained shear strength ranging between 15 kPa and 38 kPa. Consolidation testing carried out on one (1) sample of silty clay collected from Borehole HF-1B indicate a compression index  $C_c$  of about 1.0. The results of the consolidation testing are included into Appendix B, following text of this report. The silty clay layer in the boreholes varies in thickness from about 0.5 m to 4.3 m. The base of the silty clay layer was encountered between 1.8 m and 5.8 m depth at the borehole locations. The silty clay is underlain by a relatively thin layer of silty sand extending to the bedrock surface. The bedrock was inferred from refusal to further auger penetration at depths ranging from 1.7 m to 6.4 m.

Borehole HF-1A was dry on completion of drilling. Water level in the remainder of the boreholes ranged from 0.3 m to 1.8 m below ground surface during drilling operations.

#### Station 25+995 to Station 10+020

Two (2) boreholes, numbered SW98-5A and SW98-5B were drilled within this swamp area as shown on Drawing N111105E, attached. The soils encountered in the boreholes consist of about 1.1 m to 1.7 m of peat underlain by a very soft to soft silty clay and sand deposits. The silty clay is underlain by about 0.6 m of loose sand in Borehole SW98-5A. The boreholes were terminated at about 3.1 m and 1.5 m depths on bedrock surface, which was inferred by resistance to further auger penetration.

Water level in open boreholes was noted to be at ground surface during drilling operations.

#### Station 24+390 to Station 24+615

One (1) borehole, numbered SW98-3A was drilled within this area as shown on Drawing N111103E, attached. The soils encountered in the borehole consist of extensive granular deposits of sand and silty sand extending to the surface of the bedrock inferred from resistance to auger penetration at 17.1 m depth.

The probeholes put down as part of the geotechnical investigation within this area encountered up to 1.8 m of peat. The peat is underlain by very loose sand and silt which in turn is underlain by bedrock.

**Station 11+795 to Station 11+850**

Two (2) boreholes, numbered SW98-4A and SW98-4B were drilled within this swamp area as shown on Drawing N111106E, attached. The swamp is covered by about 0.6 m deep water. The soils encountered in the boreholes consist of about 0.1 m to 0.5 m of peat underlain by a very soft to firm clayey silt to silty clay and silty sand deposits. The clayey silt to silty clay extends to depths between 1.1 m and 3.7 m. In both boreholes, a layer of sand about 0.6 m in thickness underlies the silty clay. Bedrock was inferred from resistance to auger penetration at 1.7 m and 4.3 m depths.

**Station 10+790 to Station 10+920 (McDougall Road)**

Two (2) boreholes, numbered 101 and 102 were drilled within this swamp area as shown on Drawing N111107E, attached. The soils encountered in the boreholes consist of about 4.7 m to 5.8 m of peat underlain by sand to silty sand deposits.

The peat is fibrous and becomes amorphous with depth. The peat is underlain by a very loose to compact sand and silty sand deposit. The granular deposit extends to the depths of 8.2 m and 9.0 m investigated in the boreholes.

Water level in the open boreholes was encountered at about ground surface during drilling.

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**PART B – FOUNDATION DESIGN**  
**EMBANKMENTS CROSSING DEEP SWAMPS**  
**FOUR LANING OF THE PARRY SOUND BYPASS**  
**G.W.P. 209-97-00**  
**MTO DISTRICT 52**

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## 5.0 ENGINEERING RECOMMENDATIONS

### 5.1 General

This section of the report provides our recommendations on the geotechnical aspects of design of the Highway 69 embankments based on our interpretation of the factual information obtained during the investigation. It should be noted that the interpretation and recommendations are intended for use only by the design engineer. Where comments are made on construction they are provided only in order to highlight those aspects which could affect the design 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 method and scheduling.

The works described in this report are associated with the highway embankments crossing the swamp areas. The proposed horizontal and vertical alignment for Highway 69 embankments crossing the swamps were initially provided to us on the 1:5000 Route Planning Study drawings and subsequently during the design study on the design / contract drawings prepared by Cole, Sherman.

### 5.2 Embankment Construction Techniques

*why but?*

Generally, highway construction over swamp areas can be carried out with sub-excavation of the full depth of organic and soft clayey deposits in accordance with OPSD 203.010, where no more than 6 m of sub-excavation is required. The embankment loading imposed on the thick deposits of peat and silty clay would induce large settlement if these deposits were left in place. The swamp locations, sub-excavation depths and the proposed swamp treatment are listed in Table 2, attached.

Two main swamps requiring special consideration are located between Stations 18+100 and 18+300 and Stations 18+600 and 18+690. At these two locations, full depth excavation could impact on the adjacent existing highway embankment unless special precautions are undertaken.

The proposed construction staging for the highway construction within these swamp areas assumes that the Northbound Lanes will be built first with a temporary tie-in to the existing



Highway 69 at Station 18+700. The two lane crossover from the existing Highway 69 to the new Northbound Lanes is proposed between Station 17+800 to 18+200.

In summary, the following are the key aspects for the embankment design:

- 1) The sub-excavation must be carried out in strips with base width no greater than 3 m.
- 2) The base of the strip excavation must not encroach any further towards the existing embankment than a line drawn down at 1.25 H:1V from the shoulder / crest of the existing embankment to the base of the excavation.
- 3) The strip excavations should be made perpendicular to the existing embankment with backfilling of each strip being carried out prior to excavation of the next strip.
- 4) The strip excavation should be carried out such that the works always proceed away from the existing embankment.

Based on our review of projects elsewhere and discussions with contractors, we suggest the following procedures be considered for these two swamps.

The work should start on either side of each swamp crossing by constructing a leveled surface on the exposed bedrock or competent ground. Initially, a hydraulic backhoe could be used to start excavation. The backhoe operations could be supplemented by dragline operation. It is understood that dragline equipment has been used successfully to depths of 13 m for highway construction in this Region of Ontario in the recent past.

Sufficient trucks will be necessary to bring in fill and haul the excavated material on a continuous basis. The excavated peat may be stockpiled and used subsequently to flatten the side slopes of the rockfill embankments, if needed. Any mudwave developed during fill placement of one strip should be removed prior to the excavation of the next strip and end dumping.

#### 5.2.1 Swamp between Station 18+100 and Station 18+300

Removal of the peat and silty clay deposits to its full depth under the Northbound and Southbound Lanes embankment is required. The subsurface conditions through the swamp will

be variable. The thickness of the peat as encountered is as much as 7 m along the majority of the swamp crossing. The peat is typically underlain by very soft to soft silty clay up to 4 m in thickness. Based on the borehole information, the overall depth of peat and clay to be excavated will be as much as 11.5 m and typically about 10 m.

### Northbound Lanes

For the Northbound Lanes construction, the excavation can be carried out as follows:

- work can be carried out from both ends of the swamp, working towards the center;
- removal of the peat and silty clay deposits for the entire section of the roadway should be carried out in short sections perpendicular to the highway alignment with the base of the excavation / trench not wider than 3 m;
- the excavation should be carried out such that the base of the excavation is maintained outside a zone defined by a line drawn downward at 1.25 horizontal to 1 vertical (1.25H:1V) from the toe of the existing highway to the base of the excavation;
- excavation and backfilling operations should be carried out simultaneously in a manner that the excavation is not left open for more than 3 m in length at any given time.

It should be noted that full excavation of the silty clay in accordance with OPSP 203.010 will not be possible due to the proximity of the existing and proposed embankments and the conditions anticipated under the existing embankment. There will be a wedge within the median of the highway, about 4 m in width on each side of the median, where the silty clay and possibly the peat cannot be removed due to intersection of the 1.25H:1V excavation limit requirements. It is considered that leaving the wedge of soft materials in place between the embankments should not jeopardize the embankment stability. Consideration should be given to surcharging the median area after construction of the Northbound Lanes to consolidate, as much as possible, the wedge of material left in place.

It is anticipated that the initial settlements will be quite large during end dumping of the rockfill. In addition, in spite of careful excavation methods, some pockets of peat and silty clay may be entrapped at the base of the rockfill, inducing settlements. It is our recommendation that the rockfill embankment be preloaded and surcharged with 2.0 m of either rockfill or alternatively, Granular B which is heavier than rockfill. After completion of embankment construction, the

Granular B material could be re-used as granular base course elsewhere on the project at a later stage of the project. If rockfill is used as a surcharge material, once the surcharge is removed, the backfill could be used to flatten the rock embankment side slopes or used somewhere else on the project. Both materials are equally suitable for preloading purposes, and the final choice should be based on economical considerations. If the preloading and surcharging method is used, most of the differential settlements should occur during the construction period, prior to the paving operation.

### **Southbound Lanes**

The three (3) boreholes put down along the edge of the existing highway embankment indicate that the peat and silty clay underlying the existing embankment was not fully removed at all locations. Furthermore, at the locations where these deposits were apparently fully removed to the firm bottom, the removal extends only under the traveled portion of the road embankment / pavement width. Since the grade of the proposed SBL embankment will be about 2.5 m to 3.5 m higher than the existing embankment grade, the additional loading imposed on the peat and silty clay deposits still in place could induce relatively large differential settlement. Therefore, it is recommended that the existing embankment fill, peat and silty clay deposit be fully removed and the new embankment fill be placed on the firm base (bedrock or sand).

The construction procedures as described for the construction of the Northbound Lanes may generally be used for construction of the Southbound Lanes with the following considerations:

- The excavation in strips should be carried out such that the base of the excavation is maintained outside a zone defined by a line drawn downward at 1H:1V from the toe of the new NBL embankment.
- Care will be required at the lower depths of the excavation close to the base of the excavation carried out for the NBL embankment construction to ensure that the toe of the rockfill backfill is not undermined.

#### **5.2.1 Swamp between Stations 18+600 and Station 18+690**

The existing highway embankment is about 5.5 m in height. Based on the borehole and probehole information, there is up to about 3.5 m of peat and as much as 4 m of soft clay within

the area of the proposed embankments. The subsurface conditions throughout the swamp will be variable and the overall depth of peat and silty clay will be as much as 7.5 m.

It is understood that the Northbound Lanes embankment will be built first with a temporary tie-in to the existing Highway 69 at Station 18+700. In general, the tie-in will be within the limits of this swamp and the construction of the NBL embankment will therefore be immediately adjacent to and encroaching on the existing embankment.

Removal of the peat and silty clay deposits to its full depth under the new highway embankments is required. It is not possible to sub-excavate fully under the shoulder of the existing highway embankment for construction of the NBL without installation of the temporary works to support the paved / traveled width of the existing embankment. There is a restriction on how close the strip excavation can encroach on the existing embankment shoulders and there will still be significant quantities of peat and silty clay that remains under the paved width.

Consideration should therefore be given to the use of lightweight fill above the general swamp area to build a temporary NBL embankment between about Stations 18+600 to 18+690. There will be differential settlement occurring during this temporary embankment use; both across the road and along the road in this area. The differential settlement will be a consequence of the gradual encroachment of the new NBL embankment over the side slope of the existing embankment; this will induce variable loading conditions and consequently variable settlements. The use of lightweight fill will reduce these differential settlements and will also improve the stability conditions during the sub-excavation process for the SBL embankment. Surcharging and / or preloading of the NBL embankment will likely not be of much benefit in this case where the intent is to go back and fully remove the organic / clay deposits.

Given the configuration of the existing and new highway embankments and the anticipated variable subsurface conditions, the recommended construction techniques are described below.

#### **Northbound Lanes**

The organic / clay deposits are present under the side slopes of the existing embankment. For the Northbound Lanes construction, the excavation can be carried out as follows:

- The excavation should be carried out in strips formed perpendicular to the existing embankment with the base of the excavation / trench not wider than 3 m.
- The excavation should be carried out such that the base of the strip excavation is maintained outside a zone defined by a line drawn downward at 1.25 horizontal to 1 vertical from the toe of the existing highway embankment to the base of the excavation.
- The sub-excavation should be backfilled with rockfill up to the general ground level within the swamp using the continuous backfilling as identified above for the Swamp between Stations 18+100 and 18+300. Lightweight fill should be used to raise embankment level to the design grade.

After construction and diversion of the traffic to the completed SBL, the rockfill and lightfill should be removed and full sub-excavation of the pre-existing embankment fill, organic and silty clay deposits should be carried out to construct the new NBL embankment according to OPSP 203.010. The sub-excavation should extend into the rockfill area as placed during the initial construction stage. The sub-excavation should be backfilled with rockfill up to the design level and surcharged, as described for the Swamp between Stations 18+100 and 18+300.

#### **Southbound Lanes**

Full removal of the peat and silty clay deposits for the entire section of the roadway will be required.

The excavation should be carried out in strips formed perpendicular to the existing embankment with the base of the excavation / trench not wider than 3 m. The construction procedures, as described for the construction of the Northbound Lanes between Stations 18+100 and 18+300, may generally be used for construction of the embankment for the Southbound Lanes. The excavation should be carried out such that the base of the excavation is maintained outside a zone defined by a line drawn at 1.25H: 1V from the toe of the proposed NBL embankment.

The work should be carried out such that the toe of the NBL embankment is not undermined. The completed rockfill embankment should be surcharged with 2 m of Granular B Type II for a minimum of 2 months.

**GOLDER ASSOCIATES LTD.**

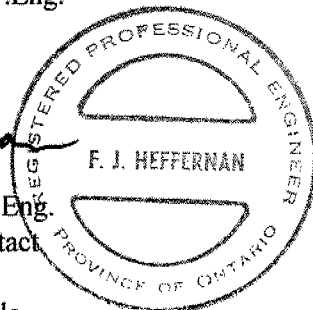
Anna M. Piascik, P.Eng.  
Geotechnical Engineer



for Anne S. Poschmann, P.Eng.  
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Fintan J. Heffernan, P.Eng.  
Designated MTO Contact



AMP/ASP/FJH/amp/clg  
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**TABLE 1****SUMMARY OF SWAMP LIMITS AND BOREHOLE LOCATIONS**

| <i>Swamp Limits</i>                                    | <i>Borehole Number</i> | <i>Borehole Location</i> |
|--|------------------------|--------------------------|
| 18+100 - 18+300<br><i>near<br/>exit<br/>embankment</i> | 98-1A                  | 18+250, 20 m Rt          |
|  | 98-1B                  | 18+200, 55 m Rt          |
|  | 98-1C                  | 18+200, 20 m Rt          |
|  | 98-1D                  | 10+200, 7 m Rt           |
|  | 98-1E                  | 18+200, 7 m Lt           |
|  | 99A                    | 18+220, 19 m Lt          |
|  | 99B                    | 18+170, 19 m Lt          |
|  | 99C                    | 18+140, 20 m Lt          |
|  | 99D                    | 18+130, 33 m Lt          |
|  | 99E                    | 18+130, 35 m Lt          |
|  | 99F                    | 18+140, 8 m Lt           |
|  | 98-2A                  | 18+650, 32 m Rt          |
| 18+600 - 18+690<br><i>near<br/>exit<br/>embankment</i> | 98-2B                  | 18+638, 15 m Lt          |
|  | 98-2C                  | 18+638, 17 m Rt          |
| 20+895 - 21+380  | HF-1A                  | 21+115, 20 m Rt          |
|  | HF-1B                  | 21+080, 20 m Lt          |
|  | HF-1C                  | 21+050, 29 m Rt          |
|  | HF-1D                  | 21+000, 18 m Rt          |
|  | HF-1E                  | 21+050, 19 m Lt          |
| 24+390 - 24+615  | SW98-3A                | 24+525, 25 m Rt          |
| 25+995 - 10+060  | SW98-5A                | 26+025, 19 m Lt          |
|  | SW98-5B                | 10+060, 28 m Lt          |
| 11+795 - 11+850  | SW98-4A                | 11+825, 19 m Rt          |
|  | SW98-4B                | 11+825, 19 m Lt          |
| 10+790 - 10+920<br>(McDougall Road)                    | 101                    | 10+850, 2 m Lt           |
|  | 102                    | 10+875, 3 m Lt           |

WORD S/FINAL.DAT/1100/981-1111/1999/81111ET1

**TABLE 2****SUMMARY OF SWAMP LIMITS AND TREATMENT OF THE FOUNDATION SOILS**

| Swamp Number / Limits              | Proposed Max Embankment Height * (m) | Anticipated Maximum Excavation Depth (m) | Underlying Strata      | Recommended Treatment  | Comments  |
|------------------------------------|--------------------------------------|--|------------------------|--|---|
| <b>Highway 69 Northbound Lanes</b> |                                      |  |                        |  |   |
| 18+100 - 18+300                    | 5.0 - 5.5                            | 11.5                                     | Sand and bedrock       | ✓ Full sub-excavation of peat and silty clay   | <ul style="list-style-type: none"> <li>Construction staging proposed</li> <li>Excavation of organics and silty clay to be carried out in strips</li> </ul>  |
| 18+600 - 18+690                    | 7.0                                  | 7.5                                      | Sand and bedrock       | ✓ Full sub-excavation of peat and silty clay   | <ul style="list-style-type: none"> <li>Construction staging proposed</li> <li>Excavation of organics and silty clay to be carried out in strips and the temporary embankment constructed</li> <li>Complete excavation and construction NBL after completion of SBL</li> </ul> |
| 20+895 - 21+640                    | 6.0 - 26.5                           | 6.0                                      | Sand and bedrock       | OPSD 203.010   | -   |
| 24+390 - 24+615                    | 6.0 - 20.0                           | 1.8                                      | Sand and bedrock       | OPSD 203.010   | • Silty clay deposit to be sub-excavated  |
| 25+995 - 10+060                    | 4.0 - 7.0                            | 2.5                                      | Sand                   | OPSD 203.010   | -   |
| 11+795 - 11+850                    | 2 - 4                                | 4  | Silty sand and bedrock | OPSD 203.010   | -   |
| <b>Highway 69 Southbound Lanes</b> |                                      |  |                        |  |   |
| 18+100 - 18+300                    | 2.5 - 3.5                            | 11.5                                     | Bedrock                | OPSD 203.010<br>Full sub-excavation of the existing embankment fill required due to presence of peat and soft silty clay underlying embankment | <ul style="list-style-type: none"> <li>Construction staging proposed</li> <li>Existing embankment fill thickness varies from 4.5 m to 8.4 m</li> <li>About 3 m of peat and soft silty clay underlie the embankment fill in places</li> </ul>                                  |
| 18+600 - 18+690                    | 7.0                                  | 7.5                                      | Silty sand and bedrock | OPSD 203.010   | <ul style="list-style-type: none"> <li>Construction staging proposed</li> <li>Excavation of organics and silty clay to be carried out in strips</li> </ul>  |
| 20+895 - 21+640                    | 6.0 - 26.5                           | 6.0                                      | Sand and bedrock       | OPSD 203.010   | • Silty clay deposit to be sub-excavated  |
| 24+390 - 24+615                    | 6.0 - 20.0                           | 1.8                                      | Sand and bedrock       | OPSD 203.010   | -   |
| 25+995 - 10+060                    | 4.0 - 7.0                            | 2.5                                      | Sand                   | OPSD 203.010   | -   |
| 11+795 - 11+850                    | 2 - 4                                | 4  | Silty sand and bedrock | OPSD 203.010   | -   |



May 1999

981-1111 / 8000

**TABLE 2**

**SUMMARY OF SWAMP LIMITS AND TREATMENT OF THE FOUNDATION SOILS**

| <i>Swamp<br/>Number / Limits</i>               | <i>Proposed<br/>Max<br/>Embankment<br/>Height *</i><br>(m) | <i>Anticipated<br/>Maximum<br/>Excavation<br/>Depth</i><br>(m) | <i>Underlying Strata</i> | <i>Recommended Treatment</i> | <i>Comments</i> |
|--|--|--|--------------------------|------------------------------|-----------------|
| <b>Badger Road</b>                             |  |  |                          |                              |                 |
| 11+760 - 11+880                                | 4  | 7.5  | Silty sand and bedrock   | OPSD 203.010                 | -               |
| S-E/W RAMP<br>(Badger Road)<br>19+670 - 19+720 | 7  | 5.0  | Sand                     | OPSD 203.010                 | -               |
| <b>McDougall Road</b>                          |  |  |                          |                              |                 |
| 10+790 - 10+920                                | 2 - 6  | 6.0  | Sand and silty sand      | OPSD 203.010                 | -               |

**NOTE:** \* Height above the existing ground surface

WORD S/FINALDAT/1100/981-1111/1999/81111ET2

## 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        |
| DO | Drive open          |
| 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         |

### 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.).

#### Dynamic Penetration Resistance; $N_6$ :

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):

An electronic cone penetrometer with a 60° conical tip and a projected end area of 10 cm<sup>2</sup> 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.

### III SOIL DESCRIPTION

#### (a) Cohesionless Soils

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

#### (b) Cohesive Soils

| Consistency | $C_u, S_u$<br>kPa | psf            |
|-------------|-------------------|----------------|
| 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     |

### 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 <sup>1</sup>                                       |
| CIU             | consolidated isotropically undrained triaxial test with porewater pressure measurement <sup>1</sup> |
| $D_R$           | 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 <sub>4</sub> | concentration of water-soluble sulphates  |
| UC              | unconfined compression test   |
| UU              | unconsolidated undrained triaxial test  |
| V               | field vane test (LV-laboratory vane test)   |
| $\gamma$        | 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

|                             |                             |
|-----------------------------|-----------------------------|
| $\pi$                       | = 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

|                                |  |
|--------------------------------|--|
| $\gamma$                       | shear strain   |
| $\Delta$                       | change in, e.g. in stress: $\Delta \sigma$                                 |
| $\epsilon$                     | linear strain  |
| $\epsilon_v$                   | volumetric strain  |
| $\eta$                         | coefficient of viscosity   |
| $\nu$                          | Poisson's ratio  |
| $\sigma$                       | total stress   |
| $\sigma'$                      | effective stress ( $\sigma' = \sigma - u$ )                                |
| $\sigma'_{vo}$                 | initial effective overburden stress  |
| $\sigma_1, \sigma_2, \sigma_3$ | principal stresses (major, intermediate, minor)                            |
| $\sigma_{oct}$                 | mean stress or octahedral stress<br>= $(\sigma_1 + \sigma_2 + \sigma_3)/3$ |
| $\tau$                         | 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  |
| $\gamma'$          | 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  |
| *                  | Density symbol is $\rho$ . Unit weight symbol is $\gamma$ where $\gamma = \rho g$ (i.e. mass density x acceleration due to gravity) |

#### (a) Index Properties (con't.)

|           |  |
|-----------|--|
| 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 = $(e_{max} - e) / (e_{max} - e_{min})$<br>(formerly relative density) |

#### (c) 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                        |

#### (d) Consolidation (one-dimensional)

|             |  |
|-------------|--|
| $C_c$       | compression index (normally consolidated range)      |
| $C_r$       | recompression index (overconsolidated range)         |
| $C_s$       | swelling index                                       |
| $C_\alpha$  | 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                              |
| $\sigma'_p$ | pre-consolidation pressure                           |
| OCR         | Overconsolidation ratio = $\sigma'_p / \sigma'_{vo}$ |

#### (e) Shear Strength

|                  |  |
|------------------|--|
| $\tau_p, \tau_r$ | peak and residual shear strength                             |
| $\phi'$          | effective angle of internal friction                         |
| $\delta$         | angle of interface friction                                  |
| $\mu$            | 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

6020SW1A.BHS

W.P. 209-97-00  
 DIST. 52, HWY 69  
 LOCATION: Sta. 18+250, 20m Rt

# RECORD OF BOREHOLE 98-1A

BORING DATE: MAY 14, 1998

SHEET 1 OF 1

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                                 | SOIL PROFILE  |             | SAMPLES               |          |          | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |                |                    |        | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |                        |   |    | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |  |
|-----------------------|---|---|-------------|-----------------------|----------|----------|---|----------------|--------------------|--------|------------------------------------|------------------------|---|----|----------------------------|---|--|
|                       |   | DESCRIPTION   | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER   | TYPE     | BLOWS/0.3m                                    | SHEAR STRENGTH |                    |        |                                    | WATER CONTENT, PERCENT |   |    |                            |   |  |
|                       |   |   |             |                       |          |          |   | Cu, kPa        | nat V -<br>rem V - | +<br>⊕ | Q - ●<br>U - ○                     | Wp                     | W | Wi |                            |   |  |
|                       |   |   |             |                       |          |          |   | 10             | 20                 | 30     | 40                                 |                        |   |    |                            |   |  |
| 0                     | TRIPOD HILT ROTARY DRILLING<br>8W 76mm CASING | WATER SURFACE   |             |                       |          |          |   |                |                    |        |                                    |                        |   |    |                            |   |  |
|                       |   | Ground surface  |             | 0.00                  |          |          |   |                |                    |        |                                    |                        |   |    |                            |   |  |
|                       |   |   |             | 0.15                  |          |          |   |                |                    |        |                                    |                        |   |    |                            |   |  |
| 1                     |   | Peat<br>Fibrous becoming amorphous below<br>approx. 4m depth<br>Very loose<br>Dark brown to black |             |                       |          |          |   |                |                    |        |                                    |                        |   |    |                            |   |  |
|                       |   |   |             |                       | 1        | 50<br>DO | PM  |                |                    |        |                                    |                        |   |    |                            |   |  |
| 2                     |   |   |             |                       |          |          |   |                |                    |        |                                    |                        |   |    |                            |   |  |
|                       |   |   |             |                       | 2        | 50<br>DO | PM  |                |                    |        |                                    |                        |   |    |                            |   |  |
| 3                     |   |   |             |                       |          |          |   |                |                    |        |                                    |                        |   |    |                            |   |  |
|                       |   |   |             |                       |          |          |   |                |                    |        |                                    |                        |   |    |                            |   |  |
| 4                     |   |   |             |                       | 3        | 50<br>DO | PM  |                |                    |        |                                    |                        |   |    |                            |   |  |
|                       |   |   |             |                       |          |          |   |                |                    |        |                                    |                        |   |    |                            |   |  |
| 5                     |   |   |             |                       |          |          |   |                |                    |        |                                    |                        |   |    |                            |   |  |
|                       |   |   |             | 4                     | 50<br>DO | PM       |   |                |                    |        |                                    |                        |   |    |                            |   |  |
| 6                     |   |   |             |                       |          |          |   |                |                    |        |                                    |                        |   |    |                            |   |  |
|                       |   |   |             |                       |          |          |   |                |                    |        |                                    |                        |   |    |                            |   |  |
| 7                     |   | Silty Clay, trace sand, trace organics<br>Very soft<br>Grey                                       |             | 6.40                  | 5        | 50<br>DO | PM  |                |                    |        |                                    |                        |   |    |                            |   |  |
|                       |   |   |             | 6.71                  |          |          |   |                |                    |        |                                    |                        |   |    |                            |   |  |
| 8                     |   | Sand, trace silt<br>Very loose<br>Grey  |             |                       | 6        | 50<br>DO | WH  |                |                    |        |                                    |                        |   |    |                            |   |  |
|                       |   |   |             |                       |          |          |   |                |                    |        |                                    |                        |   |    |                            |   |  |
| 9                     |   | End of borehole<br>Refusal to further auger<br>penetration<br>Probably on Bedrock                 |             | 8.41                  |          |          |   |                |                    |        |                                    |                        |   |    |                            |   |  |
|                       |   | Hammer weight of 32 kg<br>used to obtain samples.   |             |                       |          |          |   |                |                    |        |                                    |                        |   |    |                            |   |  |
| 10                    |   |   |             |                       |          |          |   |                |                    |        |                                    |                        |   |    |                            |   |  |

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DRS

CHECKED: AP

DATA INPUT: PS MAY 25/98

SOIL#6

6020SW18 BHS

W.P. 209-97-00

## RECORD OF BOREHOLE 98-1B

SHEET 1 OF 1

DIST. 52, HWY 69



BORING DATE: MAY 14, 1998

DATUM:

LOCATION: Sta. 18+200, 55m Rt

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                        | SOIL PROFILE  |   | SAMPLES               |          | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |            |                |                    | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |                |                        |    | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |         |  |
|-----------------------|--------------------------------------|---|---|-----------------------|----------|---|------------|----------------|--------------------|------------------------------------|----------------|------------------------|----|----------------------------|---|---------|--|
|                       |                                      | DESCRIPTION   | STRATA PLOT   | ELEV.<br>DEPTH<br>(m) | NUMBER   | TYPE  | BLOWS/0.3m | SHEAR STRENGTH |                    |                                    |                | WATER CONTENT, PERCENT |    |                            |   |         |  |
|                       |                                      |   |   |                       |          |   |            | Cu, kPa        | nat V -<br>rem V - | +<br>⊗                             | Q - ●<br>U - ○ | Wp                     | W  |                            |   | Wl      |  |
|                       |                                      |   |   |                       |          |   |            | 10             | 20                 | 30                                 | 40             | 20                     | 40 | 60                         | 80  |         |  |
| 0                     |                                      | WATER LEVEL   |   |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |         |  |
|                       |                                      | WATER   |   | 0.00                  |          |   |            |                |                    |                                    |                |                        |    |                            |   |         |  |
|                       |                                      |   |   | 0.15                  |          |   |            |                |                    |                                    |                |                        |    |                            |   |         |  |
| 1                     | ROTARY WASH BORING<br>BW 76mm CASING | Peat<br>Fibrous becoming amorphous below<br>approx. 4m depth<br>Dark brown to black |   |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |         |  |
|                       |                                      |   |   | 1                     | 50<br>DO | PM  |            |                |                    |                                    |                |                        |    |                            |   |         |  |
| 2                     |                                      |   |   |                       | 2        | 50<br>DO                                      | PM         |                |                    |                                    |                |                        |    |                            |   | ○ > 905 |  |
|                       |                                      |   |   |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |         |  |
| 3                     |                                      |   |   |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |         |  |
|                       |                                      |   |   |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |         |  |
| 4                     |                                      |   |   |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |         |  |
|                       |                                      |   |   |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |         |  |
| 5                     |                                      |   |   |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |         |  |
|                       |                                      |   |   |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |         |  |
| 6                     |                                      |   |   |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |         |  |
|                       |                                      |   |   |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |         |  |
| 7                     |                                      | Clayey Silt, trace sand, trace<br>organics<br>Soft<br>Grey                          |  | 6.20                  |          |   |            |                |                    |                                    |                |                        |    |                            | ○ > 144.4                                     |         |  |
|                       |                                      |   |   |                       |          |   |            |                |                    |                                    |                |                        |    |                            | ○ > 103.4                                     |         |  |
| 8                     |                                      | End of borehole<br>Refusal to further auger<br>penetration<br>Probably on Bedrock   |   | 7.32                  |          |   |            |                |                    |                                    |                |                        |    |                            |   |         |  |
| 9                     |                                      |   |   |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |         |  |
| 10                    |                                      |   |   |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |         |  |

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DRS

CHECKED: AP

DATA INPUT: ps may 25/98

SOILM6

6020SW1C.BHS

W.P. 209-97-00  
 DIST. 52, HWY 69  
 LOCATION: Sta. 18+200, 20m Rt

# RECORD OF BOREHOLE 98-1C

BORING DATE: MAY 20, 1998

SHEET 1 OF 2

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD | SOIL PROFILE  |                                      | SAMPLES        |            | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |                                       | HYDRAULIC CONDUCTIVITY,<br>K, cm/s |  | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |
|-----------------------|---------------|---|--------------------------------------|----------------|------------|---|---------------------------------------|------------------------------------|--|----------------------------|---|
|                       |               | DESCRIPTION   | STRATA PLOT<br>ELEV.<br>DEPTH<br>(m) | NUMBER<br>TYPE | BLOWS/0.3m | SHEAR STRENGTH<br>Cu, kPa                     | WATER CONTENT, PERCENT<br>Wp   W   Wl |                                    |  |                            |   |
| 0                     |               | WATER SURFACE   |                                      |                |            |   |                                       |                                    |  |                            |   |
|                       |               | WATER   | 0.00<br>0.13                         |                |            |   |                                       |                                    |  |                            |   |
| 1                     |               |   |                                      |                |            |   |                                       |                                    |  |                            |   |
| 2                     |               |   |                                      | 1              | 50 DO PM   |   |                                       |                                    |  |                            | > 475   |
| 3                     |               |   |                                      |                |            |   |                                       |                                    |  |                            |   |
| 4                     |               | Peat<br>Fibrous becoming amorphous below<br>approx. 4m depth<br>Very loose<br>Dark brown to black |                                      |                |            |   |                                       |                                    |  |                            |   |
| 5                     |               |   |                                      | 2              | 50 DO PM   |   |                                       |                                    |  |                            | > 639   |
| 6                     |               |   |                                      |                |            |   |                                       |                                    |  |                            |   |
| 7                     |               |   |                                      | 3              | 50 DO PM   |   |                                       |                                    |  |                            | > 875.5                                       |
| 8                     |               |   | 8.84                                 |                |            |   |                                       |                                    |  |                            |   |
| 9                     |               |   |                                      | 4              | 50 DO WH   |   |                                       |                                    |  |                            | > 110.1                                       |
| 10                    |               | Silty Clay, trace sand, trace<br>organics<br>Very soft<br>Grey                                    |                                      |                |            |   |                                       |                                    |  |                            |   |
|                       |               | Note:<br>Rod and split spoon sunk to 9m<br>depth  |                                      | 5              | 50 TO PM   |   |                                       |                                    |  |                            | C<br>MH                                       |
|                       |               |   |                                      |                |            |   |                                       |                                    |  |                            | Unit weight = 15.5 kN/m3                      |
|                       |               | CONTINUED ON NEXT PAGE  |                                      |                |            |   |                                       |                                    |  |                            |   |

DATA INPUT: ps may 25/98

SOIL M6

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DRS

CHECKED: AP

60205W1C BHS

W.P. 209-97-00  
 DIST. 52, HWY 69  
 LOCATION: Sta. 18+200, 20m Rt

# RECORD OF BOREHOLE 98-1C

BORING DATE: MAY 20, 1998

SHEET 2 OF 2

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                        | SOIL PROFILE                           |             | SAMPLES               |                | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |                | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |                    | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |                        |            |   |    |   |
|-----------------------|--------------------------------------|--|-------------|-----------------------|----------------|---|----------------|------------------------------------|--------------------|----------------------------|---|------------------------|------------|---|----|---|
|                       |                                      | DESCRIPTION                            | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER<br>TYPE | BLOWS/0.3m                                    | SHEAR STRENGTH |                                    |                    |                            |   | WATER CONTENT, PERCENT |            |   |    |   |
|                       |                                      |  |             |                       |                |   | Cu, kPa        |                                    | nat V -<br>rem V - |                            |   | +<br>⊕                 | Q -<br>U - | ⊙ | Wp | W |
| 10                    | ROTARY WASH BORING<br>BW 76mm CASING | CONTINUED FROM PREVIOUS PAGE           |             |                       | 56             | PM  |                |                                    |                    |                            |   |                        |            |   |    |   |
|                       |                                      | Silty Clay, trace sand, trace organics |             |                       |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |
|                       |                                      | Very soft                              |             |                       |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |
|                       |                                      | Grey                                   |             | 10.36                 |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |
|                       |                                      | Silty Sand, trace gravel               |             |                       |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |
|                       |                                      | Compact                                |             |                       |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |
|                       |                                      | Dense                                  |             |                       |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |
|                       |                                      | Grey                                   |             | 10.97                 |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |
|                       |                                      | End of Borehole                        |             |                       |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |
|                       |                                      | Refusal to further auger penetration   |             |                       |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |
|                       |                                      | Probably on Bedrock                    |             |                       |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |
| 12                    |                                      |  |             |                       |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |
| 13                    |                                      |  |             |                       |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |
| 14                    |                                      |  |             |                       |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |
| 15                    |                                      |  |             |                       |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |
| 16                    |                                      |  |             |                       |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |
| 17                    |                                      |  |             |                       |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |
| 18                    |                                      |  |             |                       |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |
| 19                    |                                      |  |             |                       |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |
| 20                    |                                      |  |             |                       |                |   |                |                                    |                    |                            |   |                        |            |   |    |   |

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DRS

CHECKED: AP

DATA INPUT: ps may 25/98

SOIL/66

W.P. 209-97-00  
DIST. 52, HWY 69  
LOCATION: 10+200, 7m LL

# RECORD OF BOREHOLE 98-1D

BORING DATE: FEB.24/99

SHEET 1 OF 2

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES  | BORING METHOD                                 | SOIL PROFILE   |             | SAMPLES               |        | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |            |                |                    | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |            |                        |    | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |   |    |
|------------------------|---|--|-------------|-----------------------|--------|---|------------|----------------|--------------------|------------------------------------|------------|------------------------|----|----------------------------|---|---|----|
|                        |   | DESCRIPTION  | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER | TYPE  | BLOWS/0.3m | SHEAR STRENGTH |                    |                                    |            | WATER CONTENT, PERCENT |    |                            |   |   |    |
|                        |   |  |             |                       |        |   |            | Cu, kPa        | nat V -<br>rem V - | +<br>⊕                             | Q -<br>U - | ⊙<br>○                 | Wp |                            |   | W | Wt |
| 0                      |   | GROUND SURFACE   |             | 0.00                  |        |   |            |                |                    |                                    |            |                        |    |                            |   |   |    |
| 1                      |   | Peat, fibrous, becoming amorphous<br>below about 5m depth<br>Very loose<br>Black |             |                       |        |   |            |                |                    |                                    |            |                        |    |                            |   |   |    |
| 2                      |   |  |             |                       |        |   |            |                |                    |                                    |            |                        |    |                            |   |   |    |
| 3                      |   |  |             |                       |        |   |            |                |                    |                                    |            |                        |    |                            |   |   |    |
| 4                      |   |  |             |                       |        |   |            |                |                    |                                    |            |                        |    |                            |   |   |    |
| 5                      | MANUAL DRILLING<br>63.5mm I.D. PLASTIC CASING |  |             |                       |        |   |            |                |                    |                                    |            |                        |    |                            |   |   |    |
| 6                      |   |  |             |                       |        |   |            |                |                    |                                    |            |                        |    |                            |   |   |    |
| 7                      |   |  |             |                       |        |   |            |                |                    |                                    |            |                        |    |                            |   |   |    |
| 8                      |   |  |             |                       |        |   |            |                |                    |                                    |            |                        |    |                            |   |   |    |
| 9                      |   | Silty Clay<br>Very soft<br>Grey  |             |                       |        |   |            |                |                    |                                    |            |                        |    |                            |   |   |    |
| 10                     |   |  |             |                       |        |   |            |                |                    |                                    |            |                        |    |                            |   |   |    |
| CONTINUED ON NEXT PAGE |   |  |             |                       |        |   |            |                |                    |                                    |            |                        |    |                            |   |   |    |

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DJM

CHECKED: ASP



W.P. 209-97-00  
DIST. 52, HWY 69  
LOCATION: 10+200, 7m Lt.

# RECORD OF BOREHOLE 98-1D

BORING DATE: FEB.24/99

SHEET 2 OF 2

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                                 | SOIL PROFILE                 |             | SAMPLES               |        | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |            | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |                              | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |                        |   |
|-----------------------|---|------------------------------|-------------|-----------------------|--------|---|------------|------------------------------------|------------------------------|----------------------------|---|------------------------|---|
|                       |   | DESCRIPTION                  | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER | TYPE  | BLOWS/0.3m | SHEAR STRENGTH                     |                              |                            |   | WATER CONTENT, PERCENT |   |
|                       |   |                              |             |                       |        |   |            | Cu, kPa                            | nat V - +<br>rem V - @ U - O |                            |   | Wp                     | W |
| 10                    | MANUAL DRILLING<br>83.5mm I.D. PLASTIC CASING | CONTINUED FROM PREVIOUS PAGE |             |                       |        |   |            |                                    |                              |                            |   |                        |   |
|                       |   | Sand<br>Very loose<br>Grey   |             | 10.38                 |        |   |            |                                    |                              |                            |   |                        |   |
|                       |   | Silty Clay<br>Firm<br>Grey   |             | 10.60                 | 7      | 50<br>DO                                      |            |                                    |                              |                            |   |                        |   |
| 11                    |   | Silty Sand<br>Loose<br>Grey  |             | 11.28                 | 8      | 50<br>DO                                      |            |                                    |                              |                            |   |                        |   |
|                       |   | END OF BOREHOLE              |             |                       |        |   |            |                                    |                              |                            |   |                        |   |
| 12                    |   |                              |             |                       |        |   |            |                                    |                              |                            |   |                        |   |
| 13                    |   |                              |             |                       |        |   |            |                                    |                              |                            |   |                        |   |
| 14                    |   |                              |             |                       |        |   |            |                                    |                              |                            |   |                        |   |
| 15                    |   |                              |             |                       |        |   |            |                                    |                              |                            |   |                        |   |
| 16                    |   |                              |             |                       |        |   |            |                                    |                              |                            |   |                        |   |
| 17                    |   |                              |             |                       |        |   |            |                                    |                              |                            |   |                        |   |
| 18                    |   |                              |             |                       |        |   |            |                                    |                              |                            |   |                        |   |
| 19                    |   |                              |             |                       |        |   |            |                                    |                              |                            |   |                        |   |
| 20                    |   |                              |             |                       |        |   |            |                                    |                              |                            |   |                        |   |

Note:  
Water level in  
open borehole at  
ground surface  
during drilling.

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DJM

CHECKED: ASP

W.P. 209-87-00  
DIST. 52, HWY 69  
LOCATION: Sta. 10+200, 7m Rt.

# RECORD OF BOREHOLE 98-1E

BORING DATE: FEB.24/99

SHEET 1 OF 2

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                                 | SOIL PROFILE  |             | SAMPLES               |          | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |            |                |    | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |    |                         |    | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |  |  |
|-----------------------|---|---|-------------|-----------------------|----------|---|------------|----------------|----|------------------------------------|----|-------------------------|----|----------------------------|---|--|--|
|                       |   | DESCRIPTION   | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER   | TYPE  | BLOWS/0.3m | SHEAR STRENGTH |    |                                    |    | WATER CONTENT, PERCENT  |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            | Cu, kPa        |    | nat V - + Q - ●<br>rem V - ⊕ U - ○ |    | Wp  -----  W  -----  Wt |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            | 20             | 40 | 60                                 | 80 | 20                      | 40 | 60                         | 80  |  |  |
| 0                     | MANUAL DRILLING<br>63.5mm I.D. PLASTIC CASING | ICE SURFACE   |             | 0.00                  |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   | Ice   |             | 0.30                  |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   | Water   |             | 0.60                  |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
| 1                     |   | Peat, fibrous becoming amorphous<br>below approx. 4m depth<br>Very loose<br>Dark brown to black |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
| 2                     |   |   |             | 1                     | 50<br>DO | PM  |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
| 3                     |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             | 2                     | 50<br>DO | PM  |            |                |    |                                    |    |                         |    |                            | >1540.9                                       |  |  |
| 4                     |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
| 5                     |   |   | 3           | 50<br>DO              | PM       |   |            |                |    |                                    |    |                         |    | >912.3                     |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
| 6                     |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   | 4           | 50<br>DO              | PM       |   |            |                |    |                                    |    |                         |    | >713                       |   |  |  |
| 7                     |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             | 7.00                  |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
| 8                     | Silty Clay, trace sand<br>Very soft<br>Grey   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   | 5           | 75<br>TO              | PM       |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
| 9                     |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
| 10                    |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |
|                       |   |   |             |                       |          |   |            |                |    |                                    |    |                         |    |                            |   |  |  |

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: SB

CHECKED: AP

W.P. 209-97-00

## RECORD OF BOREHOLE 98-1E

SHEET 2 OF 2

DIST. 52, HWY 69

BORING DATE: FEB.24/99

DATUM:

LOCATION: Sta. 10+200, 7m Ft.

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                                 | SOIL PROFILE  |             | SAMPLES               |        | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |            |                |                    | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |                |                        |   | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |    |  |
|-----------------------|---|---|-------------|-----------------------|--------|---|------------|----------------|--------------------|------------------------------------|----------------|------------------------|---|----------------------------|---|----|--|
|                       |   | DESCRIPTION   | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER | TYPE  | BLOWS/0.3m | SHEAR STRENGTH |                    |                                    |                | WATER CONTENT, PERCENT |   |                            |   |    |  |
|                       |   |   |             |                       |        |   |            | Cu, kPa        | nat V -<br>rem V - | +<br>⊕                             | Q - ●<br>U - ○ | Wp                     | W |                            |   | Wi |  |
| 10                    | MANUAL DRILLING<br>83.5mm I.D. PLASTIC CASING | CONTINUED FROM PREVIOUS PAGE  |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |   |    |  |
|                       |   | -becoming firm below 10m depth  |             |                       |        |   |            | ⊕              | +                  |                                    |                |                        |   |                            |   |    |  |
|                       |   | Layer of sand between 10.36m and 10.60m depth.  |             |                       | 7      | 50 DO   | WH         |                |                    |                                    |                |                        |   |                            |   |    |  |
| 11                    |   | Silty Clay, trace sand  |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |   |    |  |
|                       |   | Very soft   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |   |    |  |
|                       |   | Grey  |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |   |    |  |
|                       |   | Silty Sand  |             |                       | 8      | 50 DO   | 8          |                |                    |                                    |                |                        |   |                            |   |    |  |
|                       |   | Loose   |             | 11.28                 |        |   |            |                |                    |                                    |                |                        |   |                            |   |    |  |
|                       |   | Grey  |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |   |    |  |
| 12                    |   | END OF BOREHOLE<br>REFUSAL TO FURTHER<br>AUGER PENETRATION<br>PROBABLY ON BEDROCK               |             | 11.52                 |        |   |            |                |                    |                                    |                |                        |   |                            |   |    |  |
|                       |   | Hammer weight of 32 kg used to<br>obtain samples and blows/0.3m<br>refer to this hammer weight. |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |   |    |  |
| 13                    |   |   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |   |    |  |
| 14                    |   |   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |   |    |  |
| 15                    |   |   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |   |    |  |
| 16                    |   |   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |   |    |  |
| 17                    |   |   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |   |    |  |
| 18                    |   |   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |   |    |  |
| 19                    |   |   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |   |    |  |
| 20                    |   |   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |   |    |  |

Note:  
Water level in  
open borehole at  
ground surface  
during drilling.

DEPTH SCALE

1 to 50

LOGGED: SB

CHECKED: AP

Golder Associates

6023SW2A.BHS

W.P. 209-97-00  
 DIST. 52, HWY 69  
 LOCATION: Sta. 18+650, 32m Rt

# RECORD OF BOREHOLE 98-2A

BORING DATE: MAY 22, 1998

SHEET 1 OF 1

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD | SOIL PROFILE  |                                      | SAMPLES |          | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |                           |                                    |  | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |  |  |   | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |
|-----------------------|---------------|---|--------------------------------------|---------|----------|---|---------------------------|------------------------------------|--|------------------------------------|--|--|---|----------------------------|---|
|                       |               | DESCRIPTION   | STRATA PLOT<br>ELEV.<br>DEPTH<br>(m) | NUMBER  | TYPE     | BLOWS/0.3m                                    | SHEAR STRENGTH<br>Cu, kPa | nat V - + Q - ●<br>rem V - ⊕ U - ○ |  |                                    |  |  | WATER CONTENT, PERCENT<br>Wp ——— W ——— Wi |                            |   |
| 0                     |               | WATER SURFACE   |                                      |         |          |   |                           |                                    |  |                                    |  |  |   |                            |   |
|                       |               | Ground surface  | 0.00                                 |         |          |   |                           |                                    |  |                                    |  |  |   |                            |   |
|                       |               |   | 0.15                                 |         |          |   |                           |                                    |  |                                    |  |  |   |                            |   |
| 1                     |               | Peat<br>Fibrous to amorphous<br>Very loose to loose<br>Dark brown                 |                                      | 1       | 50<br>DO | PM  |                           |                                    |  |                                    |  |  |   |                            |   |
| 2                     |               |   |                                      |         |          |   |                           |                                    |  |                                    |  |  |   |                            |   |
| 3                     |               | Silty Clay, trace sand, trace<br>organics<br>Soft<br>Grey                         | 2.74                                 | 2       | 50<br>DO | PM  |                           |                                    |  |                                    |  |  |   |                            |   |
| 4                     |               | Sand<br>Loose<br>Grey   | 3.28                                 |         |          |   |                           |                                    |  |                                    |  |  |   |                            |   |
| 5                     |               |   | 3.81                                 |         |          |   |                           |                                    |  |                                    |  |  |   |                            |   |
| 6                     |               | Silty Clay<br>Soft to firm<br>Brown   |                                      | 3       | 50<br>DO | PM  |                           |                                    |  |                                    |  |  |   |                            |   |
| 7                     |               |   |                                      |         |          |   |                           |                                    |  |                                    |  |  |   |                            |   |
| 8                     |               | Silty Sand<br>Compact<br>Grey   | 5.79                                 | 4       | 50<br>DO | 10/<br>13                                     |                           |                                    |  |                                    |  |  |   |                            |   |
| 9                     |               | End of Borehole<br>Refusal to further auger<br>penetration<br>Probably on Bedrock | 5.94                                 |         |          |   |                           |                                    |  |                                    |  |  |   |                            |   |
| 10                    |               |   |                                      |         |          |   |                           |                                    |  |                                    |  |  |   |                            |   |

Note:  
Water level 0.15m  
above ground  
surface.

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DRS

CHECKED: AP

DATA INPUT: ps may 25/99

SOIL M6

W.P. 209-97-00  
DIST. 52, HWY 69  
LOCATION: 18+638, 15m Lt.

# RECORD OF BOREHOLE 98-2B

BORING DATE: FEB.25/99

SHEET 1 OF 1

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                                 | SOIL PROFILE   |             | SAMPLES               |        | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |            |                |    | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |    |                        |    | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |             |  |
|-----------------------|---|--|-------------|-----------------------|--------|---|------------|----------------|----|------------------------------------|----|------------------------|----|----------------------------|---|-------------|--|
|                       |   | DESCRIPTION  | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER | TYPE  | BLOWS/0.3m | SHEAR STRENGTH |    |                                    |    | WATER CONTENT, PERCENT |    |                            |   |             |  |
|                       |   |  |             |                       |        |   |            | nat V - +      |    | Q - ●                              |    | rem V - ⊕ U - ○        |    |                            |   | Wp — W — Wt |  |
|                       |   |  |             |                       |        |   |            | 20             | 40 | 60                                 | 80 | 20                     | 40 | 60                         | 80  |             |  |
| 0                     | MANUAL DRILLING<br>83.5mm I.D. PLASTIC CASING | GROUND SURFACE   |             | 0.00                  |        |   |            |                |    |                                    |    |                        |    |                            |   |             |  |
| 1                     |   | Peat<br>Fibrous<br>Loose<br>Black  |             |                       |        |   |            | ⊕              | +  |                                    |    |                        |    |                            |   |             |  |
| 2                     |   |  |             |                       | 1      | 50<br>DO                                      | 4          | ⊕              | +  |                                    |    |                        |    |                            |   |             |  |
| 3                     |   |  |             |                       |        |   |            | ⊕              | +  |                                    |    |                        |    |                            |   |             |  |
| 4                     |   | Clayey Silt, trace organics, occ.<br>sandy silt and organic silt<br>layers<br>Firm<br>Grey |             | 3.17                  | 2      | 50<br>DO                                      | 6          | ⊕              | +  |                                    |    |                        |    |                            |   |             |  |
| 5                     |   | Silty Clay<br>Firm<br>Grey   |             | 3.98                  | 3      | 50<br>DO                                      |            | ⊕              | +  |                                    |    |                        |    |                            |   |             |  |
| 6                     |   | Silty Sand<br>Very loose<br>Grey   |             | 4.82                  | 4      | 50<br>DO                                      | 1          |                |    |                                    |    |                        |    |                            |   |             |  |
| 7                     |   | Silty Clay, occ. silty sand<br>layers<br>Very soft to firm<br>Grey/brown                   |             | 5.03                  | 5      | 50<br>DO                                      | 1          | ⊕              | +  |                                    |    |                        |    |                            |   |             |  |
| 8                     |   | END OF BOREHOLE<br>REFUSAL TO FURTHER AUGER<br>PENETRATION PROBABLY ON<br>BEDROCK          |             | 7.25                  |        |   |            | ⊕              | +  |                                    |    |                        |    |                            |   |             |  |
| 9                     |   | Hammer weight of 32 kg used<br>to obtain samples.  |             |                       |        |   |            |                |    |                                    |    |                        |    |                            |   |             |  |

Note:  
Water level at  
ground surface  
during drilling.

Note:  
Water level at  
ground surface  
during drilling.

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DJM

CHECKED: ASP

DATA INPUT: PS MAY 25/99

SOIL46

W.P. 209-97-00  
DIST. 52, HWY 69  
LOCATION: 18+638, 17m Rt.

# RECORD OF BOREHOLE 98-2C

BORING DATE: FEB.26/99

SHEET 1 OF 1

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD   | SOIL PROFILE                              |             | SAMPLES               |          | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |            |                |                    | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |                |                        |   | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |   |   |
|-----------------------|---|---|-------------|-----------------------|----------|---|------------|----------------|--------------------|------------------------------------|----------------|------------------------|---|----------------------------|---|---|---|
|                       |   | DESCRIPTION                               | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER   | TYPE  | BLOWS/0.3m | SHEAR STRENGTH |                    |                                    |                | WATER CONTENT, PERCENT |   |                            |   |   |   |
|                       |   |   |             |                       |          |   |            | Cu, kPa        | nat V -<br>rem V - | +                                  | Q - ●<br>U - ○ | Wp                     | W |                            |   | W | W |
| 0                     | MANUAL DRILLING<br>63.5mm I.D. PLASTIC CASING                         | GROUND SURFACE                            |             | 0.00                  |          |   |            |                |                    |                                    |                |                        |   |                            |   |   |   |
| 1                     |   | Peat<br>Fibrous<br>Loose<br>Black         |             |                       |          |   | ⊕          | +              |                    |                                    |                |                        |   |                            |   |   |   |
|                       |   |   |             |                       |          |   |            | ⊕              | +                  |                                    |                |                        |   |                            |   |   |   |
| 2                     |   |   |             | 1                     | 50<br>DO | MH  |            |                |                    |                                    |                |                        |   |                            |   |   |   |
|                       |   |   |             |                       |          |   |            | ⊕              | +                  |                                    |                |                        |   |                            |   |   |   |
|                       |   |   |             |                       |          |   |            | ⊕              | +                  |                                    |                |                        |   |                            |   |   |   |
| 3                     |   | Clayey Silt with organics<br>Soft<br>Grey |             |                       |          |   |            |                |                    |                                    |                |                        |   |                            |   |   |   |
|                       |   |   |             |                       |          |   |            |                |                    |                                    |                |                        |   |                            |   |   |   |
| 4                     |   |   |             | 2                     | 50<br>DO | PM  |            |                |                    |                                    |                |                        |   |                            |   |   |   |
|                       |   |   |             |                       |          |   |            |                |                    |                                    |                |                        |   |                            |   |   |   |
|                       |   |   |             |                       |          |   |            |                |                    |                                    |                |                        |   |                            |   |   |   |
| 5                     | Silty Clay, some silt, occ. silt<br>/sand layers<br>Very soft<br>Grey |   |             |                       |          |   |            |                |                    |                                    |                |                        |   |                            |   |   |   |
|                       |   |   |             |                       |          |   |            |                |                    |                                    |                |                        |   |                            |   |   |   |
| 6                     |   |   | 3           | 50<br>DO              |          |   |            |                |                    |                                    |                |                        |   |                            |   |   |   |
|                       |   |   |             |                       |          |   |            |                |                    |                                    |                |                        |   |                            |   |   |   |
|                       |   |   |             |                       |          |   |            |                |                    |                                    |                |                        |   |                            |   |   |   |
| 7                     | END OF BOREHOLE   |   |             |                       |          |   |            |                |                    |                                    |                |                        |   |                            |   |   |   |
|                       |   |   |             |                       |          |   |            |                |                    |                                    |                |                        |   |                            |   |   |   |
| 8                     |   |   | 4           | 50<br>DO              | PM       |   |            |                |                    |                                    |                |                        |   |                            |   |   |   |
|                       |   |   |             |                       |          |   |            |                |                    |                                    |                |                        |   |                            |   |   |   |
|                       |   |   |             |                       |          |   |            |                |                    |                                    |                |                        |   |                            |   |   |   |
| 9                     | Hammer weight 32 kg used to<br>obtain samples.                        |   |             |                       |          |   |            |                |                    |                                    |                |                        |   |                            |   |   |   |
| 10                    |   |   | 5           | 50<br>DO              | PM       |   |            |                |                    |                                    |                |                        |   |                            |   |   |   |

Note:  
Water level at  
ground surface  
during drilling.

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DJM

CHECKED: ASP

60203SW98A.BHS  
DATA INPUT: ps MAY 25/99  
SOILM6

W.P. 209-97-00  
DIST. 52, HWY 69  
LOCATION: Sta. 24+525, 25m Rt

# RECORD OF BOREHOLE SW98-3A

BORING DATE: MAY 14, 1998

SHEET 1 OF 2

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES  | BORING METHOD                          | SOIL PROFILE  |                | SAMPLES               |        | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |            |                |  | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |  |                        |  | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |   |  |
|------------------------|--|---|----------------|-----------------------|--------|---|------------|----------------|--|------------------------------------|--|------------------------|--|----------------------------|---|---|--|
|                        |  | DESCRIPTION   | STRATA<br>PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER | TYPE  | BLOWS/0.3m | SHEAR STRENGTH |  |                                    |  | WATER CONTENT, PERCENT |  |                            |   |   |  |
|                        |  |   |                |                       |        |   |            | Cu, kPa        |  | nat V - +<br>rem V - ⊗ ⊙           |  | Wp                     |  |                            |   | W |  |
| 0                      |  | GROUND SURFACE  |                | 0.00                  |        |   |            |                |  |                                    |  |                        |  |                            |   |   |  |
| 1                      |  | Silty Sand, trace gravel, trace roots<br>Very loose<br>Grey |                |                       | 1      | 50 DO   | 3          |                |  |                                    |  |                        |  |                            |   |   |  |
| 2                      |  |   |                |                       | 2      | 50 DO   | 2          |                |  |                                    |  |                        |  |                            |   |   |  |
| 3                      |  | Sand, trace silt, trace gravel<br>Loose to compact<br>Brown |                | 1.52                  | 3      | 50 DO   | 8          |                |  |                                    |  |                        |  |                            |   |   |  |
| 4                      |  |   |                |                       | 4      | 50 DO   | 9          |                |  |                                    |  |                        |  |                            |   |   |  |
| 5                      | CME 55 BOMBARDIER<br>HOLLOW STEM AUGER |   |                |                       | 5      | 50 DO   | 5          |                |  |                                    |  |                        |  |                            |   |   |  |
| 6                      |  |   |                |                       | 6      | 50 DO   | 23         |                |  |                                    |  |                        |  |                            |   |   |  |
| 7                      |  |   |                |                       |        |   |            |                |  |                                    |  |                        |  |                            |   |   |  |
| 8                      |  |   |                |                       | 7      | 50 DO   | 14         |                |  |                                    |  |                        |  |                            |   |   |  |
| 9                      |  |   |                |                       |        |   |            |                |  |                                    |  |                        |  |                            |   |   |  |
| 10                     |  |   |                |                       | 8      | 50 DO   | 17         |                |  |                                    |  |                        |  |                            |   |   |  |
| CONTINUED ON NEXT PAGE |  |   |                |                       |        |   |            |                |  |                                    |  |                        |  |                            |   |   |  |

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DRS

CHECKED: AP

6020SW3A BHS  
DATA INPUT: 25 MAY 25/98  
SOIL#6

W.P. 209-87-00  
DIST. 52, HWY 69  
LOCATION: Sta. 24+525, 25m Pt

# RECORD OF BOREHOLE SW98-3A

BORING DATE: MAY 14, 1998

SHEET 2 OF 2

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                          | SOIL PROFILE  |             | SAMPLES               |                              | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |  | HYDRAULIC CONDUCTIVITY,<br>K, cm/s |  | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |                        |  |
|-----------------------|--|---|-------------|-----------------------|------------------------------|---|--|------------------------------------|--|----------------------------|---|------------------------|--|
|                       |  | DESCRIPTION   | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER<br>TYPE<br>BLOWS/0.3m | SHEAR STRENGTH                                |  |                                    |  |                            |   | WATER CONTENT, PERCENT |  |
|                       |  |   |             |                       |                              | Cu, kPa                                       |  | nat V - + Q - ●<br>rem V - @ U - ○ |  |                            |   | Wp  -----  W           |  |
| 10                    | CME 55 BOMBARDIER<br>HOLLOW STEM AUGER | CONTINUED FROM PREVIOUS PAGE  |             |                       |                              |   |  |                                    |  |                            |   |                        |  |
|                       |  | Sand, trace silt, trace gravel<br>Loose to compact<br>Brown                       |             |                       |                              |   |  |                                    |  |                            |   |                        |  |
| 11                    |  |   |             | 9                     | 50<br>DO                     | 28  |  |                                    |  |                            |   |                        |  |
| 12                    |  |   |             |                       |                              |   |  |                                    |  |                            |   |                        |  |
| 13                    |  |   |             | 10                    | 50<br>DO                     | 24  |  |                                    |  |                            |   |                        |  |
| 14                    |  | Sand, some gravel, occ. cobbles<br>Compact to very dense<br>Brown to grey         |             |                       |                              |   |  |                                    |  |                            |   |                        |  |
| 15                    |  |   |             |                       |                              |   |  |                                    |  |                            |   |                        |  |
| 16                    |  |   |             |                       |                              |   |  |                                    |  |                            |   |                        |  |
| 17                    |  |   |             | 11                    | 50<br>DO                     | 71  |  |                                    |  |                            |   |                        |  |
| 18                    |  | End of Borehole<br>Refusal to further auger<br>penetration<br>probably on Bedrock |             |                       |                              |   |  |                                    |  |                            |   |                        |  |
| 19                    |  |   |             |                       |                              |   |  |                                    |  |                            |   |                        |  |
| 20                    |  |   |             |                       |                              |   |  |                                    |  |                            |   |                        |  |

Note:  
Water level at  
1.5m depth on  
completion of  
drilling.

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DRS

CHECKED: AP



60203W4A.BHS

W.P. 209-97-00  
 DIST. 52, HWY 69  
 LOCATION: Sta. 11+825, 19m Rt

# RECORD OF BOREHOLE SW98-4A

BORING DATE: MAY 20, 1998

SHEET 1 OF 1

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                             | SOIL PROFILE   |                                      | SAMPLES |          | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |                                    | HYDRAULIC CONDUCTIVITY,<br>K, cm/s        |  | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |
|-----------------------|---|--|--------------------------------------|---------|----------|---|------------------------------------|---|--|----------------------------|---|
|                       |   | DESCRIPTION  | STRATA PLOT<br>ELEV.<br>DEPTH<br>(m) | NUMBER  | TYPE     | SHEAR STRENGTH<br>Cu, kPa                     | nat V - + Q - ●<br>rem V - ⊕ U - ○ | WATER CONTENT, PERCENT<br>Wp ——— W ——— Wl |  |                            |   |
| 0                     | TRIPOD HILTI ROTARY DRILLING<br>BW CASING | WATER SURFACE  |                                      |         |          |   |                                    |   |  |                            |   |
|                       |   | Water  | 0.00                                 |         |          |   |                                    |   |  |                            |   |
|                       |   | Peat<br>Fibrous<br>Loose   | 0.27                                 |         |          |   |                                    |   |  |                            |   |
| 1                     |   | Clayey Silt, trace sand<br>Firm<br>Gray  | 0.79                                 | 1       | SO<br>DO |   |                                    |   |  |                            |   |
|                       |   | Silty Sand<br>Compact<br>Gray to reddish brown   | 1.10                                 |         | 20       |   |                                    |   |  |                            |   |
| 2                     |   | End of Borehole<br>Refusal to further auger<br>penetration<br>probably on Bedrock                  | 1.70                                 |         |          |   |                                    |   |  |                            |   |
| 3                     |   | Hammer weight 32 kg used to<br>obtain soil samples and blows/<br>0.3m refer to this hammer weight. |                                      |         |          |   |                                    |   |  |                            |   |
| 4                     |   |  |                                      |         |          |   |                                    |   |  |                            |   |
| 5                     |   |  |                                      |         |          |   |                                    |   |  |                            |   |
| 6                     |   |  |                                      |         |          |   |                                    |   |  |                            |   |
| 7                     |   |  |                                      |         |          |   |                                    |   |  |                            |   |
| 8                     |   |  |                                      |         |          |   |                                    |   |  |                            |   |
| 9                     |   |  |                                      |         |          |   |                                    |   |  |                            |   |
| 10                    |   |  |                                      |         |          |   |                                    |   |  |                            |   |

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DRS

CHECKED: AP

DATA INPUT: ps MAY 25/98  
 SOLM6

W.P. 209-87-00  
DIST. 52, HWY 69  
LOCATION: Sta. 11+825, 19m Lt

# RECORD OF BOREHOLE SW98-4B

BORING DATE: MAY 20, 1998

SHEET 1 OF 1

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                            | SOIL PROFILE   |             | SAMPLES      |        |          | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |                |                    |   | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |                        |   |    | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |  |
|-----------------------|--|--|-------------|--------------|--------|----------|---|----------------|--------------------|---|------------------------------------|------------------------|---|----|----------------------------|---|--|
|                       |  | DESCRIPTION  | STRATA PLOT | ELEV.        | NUMBER | TYPE     | BLOWS/0.3m                                    | SHEAR STRENGTH |                    |   |                                    | WATER CONTENT, PERCENT |   |    |                            |   |  |
|                       |  |  |             | DEPTH<br>(m) |        |          |   | Cu, kPa        | nat V -<br>rem V - | + | Q - ●<br>U - ○                     | Wp                     | W | Wt |                            |   |  |
| 0                     | TRIPOD MULTIROTARY DRILLING<br>BW CASING | WATER SURFACE  |             | 0.00         |        |          |   |                |                    |   |                                    |                        |   |    |                            |   |  |
|                       |  | Water  |             |              |        |          |   |                |                    |   |                                    |                        |   |    |                            |   |  |
|                       |  | Peat<br>Fibrous  |             | 0.61<br>0.70 | 1      | 50<br>DO | 4   |                |                    |   |                                    |                        |   |    |                            |   |  |
| 1                     |  |  |             |              |        |          |   |                |                    |   |                                    |                        |   |    |                            |   |  |
| 2                     |  | Clayey Silt to Silty clay,<br>trace sand<br>Soft to stiff<br>Grey                            |             |              | 2      | 50<br>DO | 4   |                |                    |   |                                    |                        |   |    |                            |   |  |
| 3                     |  |  |             |              |        |          |   |                |                    |   |                                    |                        |   |    |                            |   |  |
| 4                     |  | Silty Sand<br>Dense<br>Grey  |             | 3.66         | 3      | 50<br>DO | 36  |                |                    |   |                                    |                        |   |    |                            |   |  |
| 5                     |  | End of Borehole<br>Refusal to further auger<br>penetration<br>probably on Bedrock            |             | 4.27         |        |          |   |                |                    |   |                                    |                        |   |    |                            |   |  |
| 6                     |  | Hammer weight 32 kg used to<br>obtain samples and blows/0.3m<br>refer to this hammer weight. |             |              |        |          |   |                |                    |   |                                    |                        |   |    |                            |   |  |
| 7                     |  |  |             |              |        |          |   |                |                    |   |                                    |                        |   |    |                            |   |  |
| 8                     |  |  |             |              |        |          |   |                |                    |   |                                    |                        |   |    |                            |   |  |
| 9                     |  |  |             |              |        |          |   |                |                    |   |                                    |                        |   |    |                            |   |  |
| 10                    |  |  |             |              |        |          |   |                |                    |   |                                    |                        |   |    |                            |   |  |

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DRS

CHECKED: AP

6020SW5A BHS

W.P. 209-87-00  
 DIST. 52, HWY 69  
 LOCATION: Sta. 26+025, 19m Lt

# RECORD OF BOREHOLE SW98-5A

BORING DATE: MAY 29, 1998

SHEET 1 OF 1

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                            | SOIL PROFILE  |             | SAMPLES               |        | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |            |                |    | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |    |                        |    | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |                         |   |
|-----------------------|--|---|-------------|-----------------------|--------|---|------------|----------------|----|------------------------------------|----|------------------------|----|----------------------------|---|-------------------------|---|
|                       |  | DESCRIPTION   | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER | TYPE  | BLOWS/0.3m | SHEAR STRENGTH |    |                                    |    | WATER CONTENT, PERCENT |    |                            |   |                         |   |
|                       |  |   |             |                       |        |   |            | Cu, kPa        |    | nat V - +<br>rem V - @             |    | Q - ●<br>U - ○         |    |                            |   | Wp  -----  W  -----  Wt |   |
|                       |  |   |             |                       |        |   |            | 20             | 40 | 60                                 | 80 | 20                     | 40 | 60                         | 80  |                         |   |
| 0                     | TRIPOD HILT ROTARY DRILLING<br>BW CASING | GROUND SURFACE  |             | 0.00                  |        |   |            |                |    |                                    |    |                        |    |                            |   |                         |   |
| 1                     |  | Peat<br>Fibrous<br>Loose<br>Dark brown to black                                   |             |                       | 1      | 50<br>DO                                      | 7          |                |    |                                    |    |                        |    |                            |   |                         | ○ > 845   |
| 2                     |  | Silty Sand<br>Grey  |             | 1.71<br>1.83          |        |   |            |                |    |                                    |    |                        |    |                            |   |                         |   |
|                       |  | Silty Clay, trace sand<br>Very soft<br>Grey                                       |             |                       | 2      | 50<br>DO                                      | WH         |                |    |                                    |    |                        |    |                            |   |                         |   |
|                       |  | Sand, some gravel<br>Loose<br>Grey  |             | 2.44                  |        | 3   | 50<br>DO   | WH             |    |                                    |    |                        |    |                            |   |                         |   |
| 3                     |  | End of Borehole<br>Refusal to further auger<br>penetration<br>probably on Bedrock |             | 3.05                  |        |   |            |                |    |                                    |    |                        |    |                            |   |                         | Note:<br>Water level in<br>open hole at<br>ground surface<br>during drilling. |
| 4                     |  |   |             |                       |        |   |            |                |    |                                    |    |                        |    |                            |   |                         |   |
| 5                     |  |   |             |                       |        |   |            |                |    |                                    |    |                        |    |                            |   |                         |   |
| 6                     |  |   |             |                       |        |   |            |                |    |                                    |    |                        |    |                            |   |                         |   |
| 7                     |  |   |             |                       |        |   |            |                |    |                                    |    |                        |    |                            |   |                         |   |
| 8                     |  |   |             |                       |        |   |            |                |    |                                    |    |                        |    |                            |   |                         |   |
| 9                     |  |   |             |                       |        |   |            |                |    |                                    |    |                        |    |                            |   |                         |   |
| 10                    |  |   |             |                       |        |   |            |                |    |                                    |    |                        |    |                            |   |                         |   |

Note:  
Water level in  
open hole at  
ground surface  
during drilling.

> 645

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DRS

CHECKED: AP

DATA INPUT: ps MAY 25/99

SOIL M6

6020SW5B.BHS

W.P. 209-97-00  
 DIST. 52, HWY 69  
 LOCATION: Sta. 10+060, 28m Lt

# RECORD OF BOREHOLE SW98-5B

BORING DATE: MAY 29, 1998

SHEET 1 OF 1

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                            | SOIL PROFILE   |             | SAMPLES               |        | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |            | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |                                    | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |                        |   |
|-----------------------|--|--|-------------|-----------------------|--------|---|------------|------------------------------------|------------------------------------|----------------------------|---|------------------------|---|
|                       |  | DESCRIPTION  | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER | TYPE  | BLOWS/0.3m | SHEAR STRENGTH                     |                                    |                            |   | WATER CONTENT, PERCENT |   |
|                       |  |  |             |                       |        |   |            | Cu, kPa                            | nat V - + Q - ●<br>rem V - ⊕ U - ○ |                            |   | Wp                     | W |
| 0                     | TRIPOD HILT ROTARY DRILLING<br>BW CASING | GROUND SURFACE   |             | 0.00                  |        |   |            |                                    |                                    |                            |   |                        |   |
|                       |  | Peat<br>Fibrous<br>Black   |             |                       |        |   |            |                                    |                                    |                            |   |                        |   |
| 1                     |  | Silty Clay, trace sand, occ. sand<br>seam<br>Soft<br>Grey                      |             | 1.07                  | 1      | 50<br>DO                                      | WH         |                                    |                                    |                            |   |                        |   |
| 2                     |  | End of Borehole<br>Refusal to further auger<br>penetration<br>Probably Bedrock |             | 1.48                  |        |   |            |                                    |                                    |                            |   |                        |   |
| 3                     |  |  |             |                       |        |   |            |                                    |                                    |                            |   |                        |   |
| 4                     |  |  |             |                       |        |   |            |                                    |                                    |                            |   |                        |   |
| 5                     |  |  |             |                       |        |   |            |                                    |                                    |                            |   |                        |   |
| 6                     |  |  |             |                       |        |   |            |                                    |                                    |                            |   |                        |   |
| 7                     |  |  |             |                       |        |   |            |                                    |                                    |                            |   |                        |   |
| 8                     |  |  |             |                       |        |   |            |                                    |                                    |                            |   |                        |   |
| 9                     |  |  |             |                       |        |   |            |                                    |                                    |                            |   |                        |   |
| 10                    |  |  |             |                       |        |   |            |                                    |                                    |                            |   |                        |   |

Note:  
Water level in  
open hole at  
ground surface  
during drilling.

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DRS

CHECKED: AP

DATA INPUT: ps mar 9/99

SOL 16

6020HF1A.BKS

W.P. 209-97-00  
 DIST. 52, HWY 69  
 LOCATION: Sta. 21+115, 20m Rt

# RECORD OF BOREHOLE HF-1A

BORING DATE: MAY 20, 1998

SHEET 1 OF 1

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                                   | SOIL PROFILE  |             | SAMPLES               |        | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |            | HYDRAULIC CONDUCTIVITY,<br>K, cm/s |                              | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |                        |   |
|-----------------------|---|---|-------------|-----------------------|--------|---|------------|------------------------------------|------------------------------|----------------------------|---|------------------------|---|
|                       |   | DESCRIPTION   | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER | TYPE  | BLOWS/0.3m | SHEAR STRENGTH                     |                              |                            |   | WATER CONTENT, PERCENT |   |
|                       |   |   |             |                       |        |   |            | Cu, kPa                            | nat V - +<br>rem V - @ U - O |                            |   | Wp                     | W |
| 0                     | CME 55 BOMBARDIER<br>100mm OD HOLLOW STEM AUGER | GROUND SURFACE  |             | 0.00                  |        |   |            |                                    |                              |                            |   |                        |   |
|                       |   | Topsoil   |             | 0.13                  | 1      | 50<br>00                                      | 4          |                                    |                              |                            |   |                        |   |
|                       |   | Silty Sand, trace gravel<br>Loose<br>Dark brown                                   |             |                       |        |   |            |                                    |                              |                            |   |                        |   |
| 2                     |   | End of Borehole<br>Refusal to further auger<br>penetration<br>Probably on Bedrock |             | 1.70                  | 2      | 50<br>00                                      | 0          |                                    |                              |                            |   |                        |   |
| 3                     |   |   |             |                       |        |   |            |                                    |                              |                            |   |                        |   |
| 4                     |   |   |             |                       |        |   |            |                                    |                              |                            |   |                        |   |
| 5                     |   |   |             |                       |        |   |            |                                    |                              |                            |   |                        |   |
| 6                     |   |   |             |                       |        |   |            |                                    |                              |                            |   |                        |   |
| 7                     |   |   |             |                       |        |   |            |                                    |                              |                            |   |                        |   |
| 8                     |   |   |             |                       |        |   |            |                                    |                              |                            |   |                        |   |
| 9                     |   |   |             |                       |        |   |            |                                    |                              |                            |   |                        |   |
| 10                    |   |   |             |                       |        |   |            |                                    |                              |                            |   |                        |   |

Note:  
Borehole dry on  
completion of  
drilling.

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DRS

CHECKED: AP

DATA INPUT: PS MAY 25/99

SOLM6

6020HF1B.BHS  
DATA INPUT: PS MAY 25/99  
SOL166

W.P. 209-97-00  
DIST. 52, HWY 69  
LOCATION: Sta. 21+080, 20m Lt

# RECORD OF BOREHOLE HF-1B

BORING DATE: MAY 20, 1998

SHEET 1 OF 1

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                                   | SOIL PROFILE  |             |                       | SAMPLES |          | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |                |                    |   | HYDRAULIC CONDUCTIVITY,<br>K, cm/s |                        |   |    | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |  |
|-----------------------|---|---|-------------|-----------------------|---------|----------|---|----------------|--------------------|---|------------------------------------|------------------------|---|----|----------------------------|---|--|
|                       |   | DESCRIPTION   | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER  | TYPE     | BLOWS/0.3m                                    | SHEAR STRENGTH |                    |   |                                    | WATER CONTENT, PERCENT |   |    |                            |   |  |
|                       |   |   |             |                       |         |          |   | Cu, kPa        | nat V -<br>rem V - | + | Q - ●<br>U - ○                     | Wp                     | W | Wt |                            |   |  |
| 0                     | CME 55 BOMBARDIER<br>108mm OD HOLLOW STEM AUGER | GROUND SURFACE  |             | 0.00                  |         |          |   |                |                    |   |                                    |                        |   |    |                            |   |  |
|                       |   | Topsoil   |             | 0.15                  | 1       | 50<br>DO | 3   |                |                    |   |                                    |                        |   |    |                            |   |  |
| 1                     |   | Sand<br>Very loose<br>Brown   |             |                       |         |          |   |                |                    |   |                                    |                        |   |    |                            |   |  |
| 2                     |   | Silty Clay, trace sand<br>Soft to firm<br>Brown and Grey                          |             | 1.52                  | 2       | 50<br>DO | 4   |                |                    |   |                                    |                        |   |    |                            |   |  |
| 3                     |   | -120mm of brown sand at 1.82m<br>depth  |             |                       | 3       | 50<br>DO | PH  |                |                    |   |                                    |                        |   |    |                            |   |  |
| 4                     |   |   |             |                       |         |          |   |                |                    |   |                                    |                        |   |    |                            |   |  |
| 5                     |   | Silty Sand<br>Loose<br>Grey   |             | 4.57                  | 4       | 50<br>DO | 3   |                |                    |   |                                    |                        |   |    |                            |   |  |
| 6                     |   | End of Borehole<br>Refusal to further<br>auger penetration<br>probably on Bedrock |             | 5.28                  |         |          |   |                |                    |   |                                    |                        |   |    |                            |   |  |
| 7                     |   |   |             |                       |         |          |   |                |                    |   |                                    |                        |   |    |                            |   |  |
| 8                     |   |   |             |                       |         |          |   |                |                    |   |                                    |                        |   |    |                            |   |  |
| 9                     |   |   |             |                       |         |          |   |                |                    |   |                                    |                        |   |    |                            |   |  |
| 10                    |   |   |             |                       |         |          |   |                |                    |   |                                    |                        |   |    |                            |   |  |

Unit Weight = 15.3 kN/m3

Note:  
Water level in  
open borehole at  
about 1.8m depth  
during drilling.

C  
MH  
Unit Weight = 15.3 kN/m3

Note:  
Water level in  
open borehole at  
about 1.8m depth  
during drilling.

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DRS

CHECKED: AP

W.P. 208-97-00  
DIST. 52, HWY 69  
LOCATION: 21+050, 29m Rt.

# RECORD OF BOREHOLE HF-1C

BORING DATE: FEB.27/99

SHEET 1 OF 1

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                                 | SOIL PROFILE  |                                      | SAMPLES  |          | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |                                    | HYDRAULIC CONDUCTIVITY,<br>k, cm/s                |  | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |
|-----------------------|---|---|--------------------------------------|----------|----------|---|------------------------------------|---|--|----------------------------|---|
|                       |   | DESCRIPTION   | STRATA PLOT<br>ELEV.<br>DEPTH<br>(m) | NUMBER   | TYPE     | SHEAR STRENGTH<br>Cu, kPa                     | nat V - + Q - ●<br>ram V - ⊕ U - ○ | WATER CONTENT, PERCENT<br>Wp  -----  W  -----  Wi |  |                            |   |
| 0                     | MANUAL DRILLING<br>63.5mm I.D. PLASTIC CASING | GROUND SURFACE  |                                      |          |          |   |                                    |   |  |                            |   |
|                       |   | Topsoil   | 0.00                                 |          |          |   |                                    |   |  |                            |   |
|                       |   | Silty Sand, trace topsoil   | 0.08                                 |          |          |   |                                    |   |  |                            |   |
|                       |   | Grey  | 0.23                                 |          |          |   |                                    |   |  |                            |   |
|                       |   | Sand with occ. clayey silt<br>interlayers<br>Compact<br>Brown/grey                |                                      | 1        | 50<br>DO | 8   |                                    |   |  |                            |   |
| 1                     |   | Clayey Silt<br>Very soft<br>Brown/grey  | 1.37                                 |          |          |   |                                    |   |  |                            |   |
|                       |   |   | 2                                    | 50<br>DO | 8        |   |                                    |   |  |                            |   |
| 2                     |   | Sandy Silt, trace clay<br>Compact<br>Grey   | 1.77                                 |          |          |   |                                    |   |  |                            |   |
|                       |   |   | 3                                    | 50<br>DO | 32       |   |                                    |   |  |                            |   |
|                       |   | END OF BOREHOLE<br>Refusal to further<br>auger penetration<br>probably on Bedrock | 2.40                                 |          |          |   |                                    |   |  |                            |   |
| 3                     |   |   |                                      |          |          |   |                                    |   |  |                            |   |
| 4                     |   |   |                                      |          |          |   |                                    |   |  |                            |   |
| 5                     |   |   |                                      |          |          |   |                                    |   |  |                            |   |
| 6                     |   |   |                                      |          |          |   |                                    |   |  |                            |   |
| 7                     |   |   |                                      |          |          |   |                                    |   |  |                            |   |
| 8                     |   |   |                                      |          |          |   |                                    |   |  |                            |   |
| 9                     |   |   |                                      |          |          |   |                                    |   |  |                            |   |
| 10                    |   |   |                                      |          |          |   |                                    |   |  |                            |   |

Note:  
Water level in  
open borehole at  
about 1.8m depth  
during drilling.

Hammer weight of 32 kg used to  
obtain samples and blows/0.3m  
refer to this hammer weight.

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DJM

CHECKED: AP

W.P. 209-97-00  
DIST. 52, HWY 69  
LOCATION: 21+000, 18m Rt.

# RECORD OF BOREHOLE HF-1D

BORING DATE: FEB.27/99

SHEET 1 OF 1

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                                 | SOIL PROFILE  |             | SAMPLES               |        | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |            |                |                    | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |                |                        |    | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |    |  |
|-----------------------|---|---|-------------|-----------------------|--------|---|------------|----------------|--------------------|------------------------------------|----------------|------------------------|----|----------------------------|---|----|--|
|                       |   | DESCRIPTION   | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER | TYPE  | BLOWS/0.3m | SHEAR STRENGTH |                    |                                    |                | WATER CONTENT, PERCENT |    |                            |   |    |  |
|                       |   |   |             |                       |        |   |            | Cu, kPa        | nat V -<br>rem V - | +                                  | Q - ●<br>U - ○ | Wp                     | W  |                            |   | Wi |  |
|                       |   |   |             |                       |        |   |            | 20             | 40                 | 60                                 | 80             | 20                     | 40 | 60                         | 80  |    |  |
| 0                     | MANUAL DRILLING<br>63.5mm I.D. PLASTIC CASING | GROUND SURFACE  |             |                       |        |   |            |                |                    |                                    |                |                        |    |                            |   |    |  |
|                       |   | Topsoil   |             | 0.00                  |        |   |            |                |                    |                                    |                |                        |    |                            |   |    |  |
|                       |   | Silty Sand, trace clay<br>Brown/grey, mottled   |             | 0.30                  |        |   |            |                |                    |                                    |                |                        |    |                            |   |    |  |
| 1                     |   | Silt, trace clay, occ. sand<br>layers<br>Loose<br>Grey  |             | 0.78                  | 1      | 50<br>DO                                      | 5          |                |                    |                                    |                |                        |    |                            |   |    |  |
|                       |   |   |             | 1.52                  | 2      | 50<br>DO                                      | PM         |                |                    |                                    |                |                        |    |                            |   |    |  |
| 2                     |   |   |             |                       | 3      | 50<br>DO                                      | PM         |                |                    |                                    |                |                        |    |                            |   |    |  |
|                       |   | Silty Clay, occ. silty sand<br>layers<br>Soft<br>Grey   |             |                       | 4      | 50<br>DO                                      | WH         |                |                    |                                    |                |                        |    |                            |   |    |  |
| 3                     |   |   |             |                       |        |   |            |                |                    |                                    |                |                        |    |                            |   |    |  |
| 4                     |   |   |             |                       | 5      | 50<br>DO                                      | PM         |                |                    |                                    |                |                        |    |                            |   |    |  |
| 5                     |   |   |             |                       |        |   |            |                |                    |                                    |                |                        |    |                            |   |    |  |
| 6                     |   | Silty Sand<br>Compact<br>Grey   |             | 5.78                  | 7      | 50<br>DO                                      | 10         |                |                    |                                    |                |                        |    |                            |   |    |  |
|                       |   | END OF BOREHOLE   |             | 6.40                  |        |   |            |                |                    |                                    |                |                        |    |                            |   |    |  |
| 7                     |   | Hammer weight of 32 kg used to<br>obtain samples and blows/0.3m<br>refer to this hammer weight. |             |                       |        |   |            |                |                    |                                    |                |                        |    |                            |   |    |  |
| 8                     |   |   |             |                       |        |   |            |                |                    |                                    |                |                        |    |                            |   |    |  |
| 9                     |   |   |             |                       |        |   |            |                |                    |                                    |                |                        |    |                            |   |    |  |
| 10                    |   |   |             |                       |        |   |            |                |                    |                                    |                |                        |    |                            |   |    |  |

Note:  
Water level in  
open borehole at  
0.3m depth on  
completion of  
drilling.

Note:  
Water level in  
open borehole at  
0.3m depth on  
completion of  
drilling.

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DJM

CHECKED: AP



W.P. 209-97-00  
DIST. 52, HWY 69  
LOCATION: 21+050, 19m LL

# RECORD OF BOREHOLE HF-1E

BORING DATE: FEB.28/99

SHEET 1 OF 1

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                                 | SOIL PROFILE  |             |                       | SAMPLES |          | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |                |    |                               | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |                         |    |    | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |  |
|-----------------------|---|---|-------------|-----------------------|---------|----------|---|----------------|----|-------------------------------|------------------------------------|-------------------------|----|----|----------------------------|---|--|
|                       |   | DESCRIPTION   | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER  | TYPE     | BLOWS/0.3m                                    | SHEAR STRENGTH |    |                               |                                    | WATER CONTENT, PERCENT  |    |    |                            |   |  |
|                       |   |   |             |                       |         |          |   | Cu, kPa        |    | nat. V - +<br>rem V - @ U - O |                                    | Wp  -----  W  -----  Wi |    |    |                            |   |  |
|                       |   |   |             |                       |         |          |   | 20             | 40 | 60                            | 80                                 | 20                      | 40 | 60 | 80                         |   |  |
| 0                     | MANUAL DRILLING<br>63.5mm I.D. PLASTIC CASING | GROUND SURFACE  |             |                       |         |          |   |                |    |                               |                                    |                         |    |    |                            |   |  |
|                       |   | Topsoil   |             | 0.00                  |         |          |   |                |    |                               |                                    |                         |    |    |                            |   |  |
|                       |   |   |             | 0.18                  |         |          |   |                |    |                               |                                    |                         |    |    |                            |   |  |
|                       |   | Silty Sand, occ. clayey silt<br>seams<br>Loose<br>Brown/grey                                    |             |                       | 1       | SO<br>DO | 19  |                |    |                               |                                    |                         |    |    |                            |   |  |
| 1                     |   |   |             | 1.22                  |         |          |   |                |    |                               |                                    |                         |    |    |                            |   |  |
|                       |   | Clayey Silt<br>Brown  |             | 1.37                  |         |          |   |                |    |                               |                                    |                         |    |    |                            |   |  |
|                       |   | Silty Sand<br>Very loose<br>Grey  |             | 1.68                  | 2       | SO<br>DO | 5   |                |    |                               |                                    |                         |    |    |                            |   |  |
| 2                     |   |   |             |                       | 3       | SO<br>DO | 2   |                |    |                               |                                    |                         |    |    |                            |   |  |
|                       |   | Silty Clay, occ. silty sand<br>layers<br>Soft to firm<br>Brown to grey                          |             |                       | 4       | SO<br>DO | 2   |                |    |                               |                                    |                         |    |    |                            |   |  |
| 3                     |   |   |             |                       |         |          |   |                |    |                               |                                    |                         |    |    |                            |   |  |
| 4                     |   |   |             |                       |         |          |   |                |    |                               |                                    |                         |    |    |                            |   |  |
|                       |   | Silty Sand, trace gravel<br>Very loose to compact<br>Grey                                       |             | 4.57                  | 5<br>DO | 12       |   |                |    |                               |                                    |                         |    |    |                            |   |  |
| 5                     |   |   |             |                       | 6<br>DO | 40       |   |                |    |                               |                                    |                         |    |    |                            |   |  |
|                       |   | END OF BOREHOLE<br>Refusal to further<br>auger penetration<br>probably on Bedrock               |             | 5.15                  |         |          |   |                |    |                               |                                    |                         |    |    |                            |   |  |
| 6                     |   |   |             |                       |         |          |   |                |    |                               |                                    |                         |    |    |                            |   |  |
|                       |   | Hammer weight of 32 kg used to<br>obtain samples and blows/0.3m<br>refer to this hammer weight. |             |                       |         |          |   |                |    |                               |                                    |                         |    |    |                            |   |  |
| 7                     |   |   |             |                       |         |          |   |                |    |                               |                                    |                         |    |    |                            |   |  |
| 8                     |   |   |             |                       |         |          |   |                |    |                               |                                    |                         |    |    |                            |   |  |
| 9                     |   |   |             |                       |         |          |   |                |    |                               |                                    |                         |    |    |                            |   |  |
| 10                    |   |   |             |                       |         |          |   |                |    |                               |                                    |                         |    |    |                            |   |  |

Note:  
Water level in  
open borehole at  
0.6m depth on  
completion of  
drilling.

Note:  
Water level in  
open borehole at  
0.6m depth on  
completion of  
drilling.

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DJM

CHECKED: AP

N800098A BHS

W.P. 209-97-00  
 DIST. 52, HWY 69  
 LOCATION: Sta. 18+220, 14m Lt

# RECORD OF BOREHOLE 99A

BORING DATE: APRIL 22/99

SHEET 1 OF 1

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD | SOIL PROFILE |             | SAMPLES      |        |      | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |                |               |         | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |                        |            |    | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |   |
|-----------------------|---------------|--------------|-------------|--------------|--------|------|---|----------------|---------------|---------|------------------------------------|------------------------|------------|----|----------------------------|---|---|
|                       |               | DESCRIPTION  | STRATA PLOT | ELEV.        | NUMBER | TYPE | BLOWS/0.3m                                    | SHEAR STRENGTH |               |         |                                    | WATER CONTENT, PERCENT |            |    |                            |   |   |
|                       |               |              |             | DEPTH<br>(m) |        |      |   | Cu, kPa        | nat V -<br>20 | +<br>40 | rem V -<br>60                      | ⊕<br>80                | ⊙<br>U - ⊙ | Wp |                            |   | W |

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DATA INPUT: PS MAY 25/99  
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W.P. 209-97-00  
DIST. 52, HWY 69  
LOCATION: Sta. 18+170, 14m Lt.

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PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD | SOIL PROFILE   |   | SAMPLES      |        | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |            |                |                    | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |                |                        |   | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |  |  |
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|                       |               | DESCRIPTION  | STRATA PLOT   | ELEV.        | NUMBER | TYPE  | BLOWS/0.3m |                |                    |                                    |                |                        |   |                            |   |  |  |
|                       |               |  |   | DEPTH<br>(m) |        |   |            | SHEAR STRENGTH |                    |                                    |                | WATER CONTENT, PERCENT |   |                            |   |  |  |
|                       |               |  |   |              |        |   |            | Cu, kPa        | nat V -<br>rem V - | +                                  | Q - ●<br>U - ○ | Wp — W — Wi            |   |                            |   |  |  |
|                       |               |  |   |              |        |   |            | 20 40 60 80    |                    |                                    |                | 20 40 60 80            |   |                            |   |  |  |
| 0                     |               | GROUND SURFACE   |   | 0.00         |        |   |            |                |                    |                                    |                |                        |   |                            |   |  |  |
|                       |               | Sand and gravel, trace silt, some<br>cobbles<br>Loose to very dense<br>Brown<br>(FILL) |    |              | 1      | 50<br>DO                                      | 8          |                |                    |                                    |                | ○                      |   |                            |   |  |  |
| 1                     |               |  |   |              | 2      | 50<br>DO                                      | 54         |                |                    |                                    |                |                        | ○ |                            |   |  |  |
|                       |               |  |   |              |        | 3   | 50<br>DO   | 45             |                    |                                    |                |                        |   |                            |   |  |  |
| 2                     |               |  |   |              |        | 4   | 50<br>DO   | 40             |                    |                                    |                |                        |   |                            |   |  |  |
|                       |               |  |   |              |        | 5   | 50<br>DO   | 13             |                    |                                    |                |                        | ○ |                            |   |  |  |
| 3                     |               |  |   |              |        |   |            |                |                    |                                    |                |                        |   |                            |   |  |  |
| 4                     |               |  |   | 3.81         |        |   |            |                |                    |                                    |                |                        |   |                            |   |  |  |
|                       |               | Sand and gravel, occ. cobbles/<br>rockfill<br>Loose to compact<br>Brown<br>(FILL)      |  |              | 6      | 50<br>DO                                      | 2          |                |                    |                                    |                | ○                      |   |                            |   |  |  |
| 5                     |               |  |   |              | 7      | 50<br>DO                                      | 2          |                |                    |                                    |                |                        |   |                            |   |  |  |
|                       |               |  |   |              |        | 8   | 50<br>DO   | 8              |                    |                                    |                |                        | ○ |                            |   |  |  |
| 6                     |               |  |   |              |        | 9   | 50<br>DO   | 10             |                    |                                    |                |                        |   | ○                          |   |  |  |
|                       |               |  |   |              |        | 10  | 50<br>DO   | 11             |                    |                                    |                |                        |   |                            |   |  |  |
| 7                     |               |  |   |              |        |   |            |                |                    |                                    |                |                        |   |                            |   |  |  |
|                       |               |  |   |              |        |   |            |                |                    |                                    |                |                        |   |                            |   |  |  |
| 8                     |               |  |   |              |        |   |            |                |                    |                                    |                |                        |   |                            |   |  |  |
|                       |               |  |   | 8.38         |        |   |            |                |                    |                                    |                |                        |   |                            |   |  |  |
|                       |               | Sand, some gravel, some silt<br>Loose to compact<br>Gray                               |  |              | 12     | 50<br>DO                                      | 5          |                |                    |                                    |                | ○                      |   |                            |   |  |  |
| 9                     |               |  |   |              |        | 13  | 50<br>DO   | 23             |                    |                                    |                |                        |   |                            |   |  |  |
| 10                    |               | CONTINUED ON NEXT PAGE   |   |              |        |   |            |                |                    |                                    |                |                        |   |                            |   |  |  |

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: SB

CHECKED: AP

N800098B BHS  
SOILM6  
DATA INPUT: PS MAY 25/99

W.P. 208-97-00  
DIST. 52, HWY 69  
LOCATION: Sta. 18+170, 14m Lt

# RECORD OF BOREHOLE 99B

BORING DATE: APRIL 22/99

SHEET 2 OF 2

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD | SOIL PROFILE  |             | SAMPLES               |        | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |            |                |                    | HYDRAULIC CONDUCTIVITY,<br>K, cm/s |                |                        |   | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION  |    |  |
|-----------------------|---------------|---|-------------|-----------------------|--------|---|------------|----------------|--------------------|------------------------------------|----------------|------------------------|---|----------------------------|--|----|--|
|                       |               | DESCRIPTION   | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER | TYPE  | BLOWS/0.3m | SHEAR STRENGTH |                    |                                    |                | WATER CONTENT, PERCENT |   |                            |  |    |  |
|                       |               |   |             |                       |        |   |            | Cu, kPa        | nat V -<br>rem V - | +<br>⊕                             | Q - ●<br>U - ○ | Wp                     | W |                            |  | Wi |  |
| 10                    |               | CONTINUED FROM PREVIOUS PAGE  |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            | Note:<br>Water level in<br>open borehole at<br>1.5m depth on<br>completion of<br>drilling. |    |  |
|                       |               | END OF BOREHOLE<br>REFUSAL TO FURTHER AUGER<br>PENETRATION PROBABLY ON<br>BEDROCK |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |  |    |  |
| 11                    |               |   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |  |    |  |
| 12                    |               |   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |  |    |  |
| 13                    |               |   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |  |    |  |
| 14                    |               |   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |  |    |  |
| 15                    |               |   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |  |    |  |
| 16                    |               |   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |  |    |  |
| 17                    |               |   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |  |    |  |
| 18                    |               |   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |  |    |  |
| 19                    |               |   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |  |    |  |
| 20                    |               |   |             |                       |        |   |            |                |                    |                                    |                |                        |   |                            |  |    |  |

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: SB

CHECKED: AP

W.P. 209-87-00  
DIST. 52, HWY 69  
LOCATION: Sta. 18+140, 20m Lt.

# RECORD OF BOREHOLE 99C




BORING DATE: APRIL 23/99

SHEET 1 OF 1

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                           | SOIL PROFILE  |   |              | SAMPLES  |          |            | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |                    |   |        | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |          |    |   | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |    |
|-----------------------|---|---|---|--------------|----------|----------|------------|---|--------------------|---|--------|------------------------------------|----------|----|---|----------------------------|---|----|
|                       |   | DESCRIPTION   | STRATA PLOT   | ELEV.        | NUMBER   | TYPE     | BLOWS/0.3m | SHEAR STRENGTH                                |                    |   |        | WATER CONTENT, PERCENT             |          |    |   |                            |   |    |
|                       |   |   |   | DEPTH<br>(m) |          |          |            | Cu, kPa                                       | nat V -<br>rem V - | + | ⊗<br>⊕ | ○<br>●                             | U -<br>○ | Wp | W |                            |   | Wi |
| 0                     |   | GROUND SURFACE  |   | 0.00         |          |          |            |   |                    |   |        |                                    |          |    |   |                            |   |    |
| 1                     | CME 55 BOMBARDIER<br>HOLLOW STEM AUGERS | Sand and gravel, trace silt,<br>trace cobbles<br>Layer of cobbles/rockfill between<br>0.9m and 2.0m depth<br>Very loose to loose<br>Brown<br>(FILL) |   |              |          |          |            |   |                    |   |        |                                    |          |    |   |                            |   |    |
| 2                     |   |   |   | 1            | 50<br>DO | 58       |            |   |                    |   |        |                                    |          |    |   |                            |   |    |
| 3                     |   |   |   |              |          |          |            |   |                    |   |        |                                    |          |    |   |                            |   |    |
| 4                     |   |   |   | 2            | 50<br>DO | 6        |            |   |                    |   |        |                                    |          |    |   |                            |   |    |
| 5                     |   |   |   | 3            | 50<br>DO | 3        |            |   |                    |   |        |                                    |          |    |   |                            |   |    |
| 6                     |   | Peat<br>Fibrous<br>Loose<br>Dark brown  |  | 5.79         |          |          |            |   |                    |   |        |                                    |          |    |   |                            |   |    |
| 7                     | 4                                       |   |   | 50<br>DO     | 3        |          |            |   |                    |   |        |                                    |          |    |   |                            |   |    |
| 8                     |   | Silty Clay, trace sand<br>Very soft<br>Grey   |  | 7.62         | 5        | 50<br>DO | WH         |   |                    |   |        |                                    |          |    |   |                            |   |    |
| 9                     |   |   |   |              |          |          |            |   |                    |   |        |                                    |          |    |   |                            |   |    |
| 10                    |   | END OF BOREHOLE<br>REFUSAL TO FURTHER AUGER<br>PENETRATION PROBABLY ON<br>BEDROCK   |   | 8.70         |          |          |            |   |                    |   |        |                                    |          |    |   |                            |   |    |

Note: Water level in open borehole at 2.4m depth on completion of drilling.

Note:  
Water level in  
open borehole at  
2.4m depth on  
completion of  
drilling.

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: SB

CHECKED: AP

W.P. 209-97-00  
DIST. 52, HWY 69  
LOCATION: Sta. 18+130, 33m Lt.

# RECORD OF BOREHOLE 99D

BORING DATE: APRIL 21&22/99

SHEET 1 OF 1

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                           | SOIL PROFILE  |             |                       | SAMPLES  |          | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |    |                    |        | HYDRAULIC CONDUCTIVITY,<br>K, cm/s |    |  |   | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |
|-----------------------|---|---|-------------|-----------------------|----------|----------|---|----|--------------------|--------|------------------------------------|----|--|---|----------------------------|---|
|                       |   | DESCRIPTION   | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER   | TYPE     | SHEAR STRENGTH                                |    |                    |        | WATER CONTENT, PERCENT             |    |  |   |                            |   |
|                       |   |   |             |                       |          |          | Cu, kPa                                       |    | nat V -<br>rem V - | +<br>⊕ | Q - ●<br>U - ○                     | Wp |  | W |                            |   |
| 0                     | CME 55 BOMBARDIER<br>HOLLOW STEM AUGERS | WATER SURFACE   |             |                       |          |          |   |    |                    |        |                                    |    |  |   |                            |   |
|                       |   | Water   |             | 0.00                  |          |          |   |    |                    |        |                                    |    |  |   |                            |   |
|                       |   | Peat, fibrous becoming amorphous<br>below approximately 4m depth<br>Very loose<br>Dark brown to black |             | 0.15                  | 1        | 50<br>DO | PM  |    |                    |        |                                    |    |  |   |                            |   |
| 1                     |   |   |             |                       | 2        | 50<br>DO | 2   |    |                    |        |                                    |    |  |   |                            | >775  |
|                       |   |   |             |                       |          |          |   |    |                    |        |                                    |    |  |   |                            |   |
|                       |   |   |             |                       | 3        | 50<br>DO | 1   |    |                    |        |                                    |    |  |   |                            | >1940   |
| 2                     |   |   |             |                       |          |          |   |    |                    |        |                                    |    |  |   |                            |   |
|                       |   |   |             |                       |          |          |   | ⊕+ |                    |        |                                    |    |  |   |                            |   |
|                       |   |   |             |                       |          |          |   | ⊕  |                    |        |                                    |    |  |   |                            |   |
| 3                     |   |   |             |                       |          |          |   |    |                    |        |                                    |    |  |   |                            |   |
|                       |   |   |             | 4                     | 50<br>DO | WH       |   |    |                    |        |                                    |    |  |   |                            |   |
| 4                     |   |   |             |                       |          |          | ⊕+  |    |                    |        |                                    |    |  |   |                            |   |
|                       |   |   |             |                       |          |          | ⊕   |    |                    |        |                                    |    |  |   |                            |   |
| 5                     |   |   |             |                       | 5        | 50<br>DO | PM  |    |                    |        |                                    |    |  |   | >530.6                     |   |
|                       |   |   |             |                       |          |          | ⊕+  |    |                    |        |                                    |    |  |   |                            |   |
|                       |   |   |             |                       |          |          | ⊕+  |    |                    |        |                                    |    |  |   |                            |   |
| 6                     |   |   |             | 6.10                  | 6        | 50<br>DO | WR  |    |                    |        |                                    |    |  |   |                            |   |
|                       |   |   |             |                       |          |          |   |    |                    |        |                                    |    |  |   |                            |   |
| 7                     |   | Silty Clay, trace sand<br>Very soft<br>Grey   |             |                       |          |          | ⊕+  |    |                    |        |                                    |    |  |   |                            |   |
|                       |   |   |             |                       |          |          | ⊕   |    |                    |        |                                    |    |  |   |                            |   |
| 8                     |   |   |             |                       | 7        | 50<br>DO | WR  |    |                    |        |                                    |    |  |   |                            |   |
|                       |   |   |             |                       |          |          |   |    |                    |        |                                    |    |  |   |                            |   |
|                       |   |   |             |                       |          |          | ⊕+  |    |                    |        |                                    |    |  |   |                            |   |
|                       |   |   |             |                       |          |          | ⊕   |    |                    |        |                                    |    |  |   |                            |   |
| 9                     |   | Sand and Gravel, trace silt and<br>clay<br>Dense<br>Grey  |             | 9.30                  | 8        | 50<br>DO | 31  |    |                    |        |                                    |    |  |   |                            |   |
|                       |   |   |             |                       |          |          |   |    |                    |        |                                    |    |  |   |                            |   |
| 10                    |   | END OF BOREHOLE   |             | 9.75                  |          |          |   |    |                    |        |                                    |    |  |   |                            |   |

Note:  
Water level 0.15m  
above the peat  
surface.

Note:  
Water level 0.15m  
above the peat  
surface.

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: SB

CHECKED: AP

W.P. 209-97-00  
DIST. 52, HWY 69  
LOCATION: Sta. 18+130, 35m Lt.

# RECORD OF BOREHOLE 99E

BORING DATE: APRIL 20/99

SHEET 1 OF 2

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES  | BORING METHOD                           | SOIL PROFILE  |                                      | SAMPLES        |            | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |                                       | HYDRAULIC CONDUCTIVITY,<br>k <sub>v</sub> cm/s |  | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |
|------------------------|---|---|--------------------------------------|----------------|------------|---|---------------------------------------|--|--|----------------------------|---|
|                        |   | DESCRIPTION   | STRATA PLOT<br>ELEV.<br>DEPTH<br>(m) | NUMBER<br>TYPE | BLOWS/0.3m | SHEAR STRENGTH<br>Cu, kPa                     | WATER CONTENT, PERCENT<br>Wp   W   Wl |  |  |                            |   |
| 0                      | CME 55 BOMBARDIER<br>HOLLOW STEM AUGERS | GROUND SURFACE  | 0.00                                 | 1              | 50 DO      | 22  |                                       |  |  |                            |   |
| 1                      |   | Sand and gravel, trace silt,<br>trace clay, trace organics<br>Compact<br>Brown  |                                      | 2              | 50 DO      | 11  |                                       |  |  |                            |   |
| 2                      |   |   |                                      | 3              | 50 DO      | 5   |                                       |  |  |                            |   |
| 3                      |   |   |                                      | 4              | 50 DO      | 2   |                                       |  |  |                            |   |
| 4                      |   |   |                                      | 5              | 50 DO      | 1   |                                       |  |  |                            |   |
| 5                      |   |   |                                      | 6              | 50 DO      | PM  |                                       |  |  |                            |   |
| 6                      |   | peat, fibrous becoming amorphous<br>below approximately 4m depth,<br>trace sand, trace clay<br>Very loose to loose<br>Dark brown to black |                                      | 7              | 50 DO      | PM  |                                       |  |  |                            |   |
| 7                      |   |   |                                      | 8              | 50 DO      | PM  |                                       |  |  |                            |   |
| 8                      |   |   |                                      | 9              | 50 DO      | PM  |                                       |  |  |                            |   |
| 9                      |   |   |                                      | 10             | 50 DO      | WH  |                                       |  |  |                            |   |
| 10                     |   | Silty Clay, trace sand, occ. sand<br>layer<br>Very soft to soft<br>Grey   | 6.10                                 |                |            |   |                                       |  |  |                            |   |
| CONTINUED ON NEXT PAGE |   |   |                                      |                |            |   |                                       |  |  |                            |   |

Note:  
Water level in  
open borehole at  
ground surface.

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: SB

CHECKED: AP

W.P. 209-97-00  
DIST. 52, HWY 69  
LOCATION: Sta. 18+130, 35m Lt.

# RECORD OF BOREHOLE 99E

BORING DATE: APRIL 20/99

SHEET 2 OF 2

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD                           | SOIL PROFILE  |                                      | SAMPLES        |            | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m                   |                                       | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |  | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |
|-----------------------|---|---|--------------------------------------|----------------|------------|---|---------------------------------------|------------------------------------|--|----------------------------|---|
|                       |   | DESCRIPTION   | STRATA PLOT<br>ELEV.<br>DEPTH<br>(m) | NUMBER<br>TYPE | BLOWS/0.3m | SHEAR STRENGTH<br>Cu, kPa<br>nat V - + Q - ●<br>rem V - ⊗ U - ○ | WATER CONTENT, PERCENT<br>Wp — W — Wi |                                    |  |                            |   |
| 10                    | CME 55 BOMBARDIER<br>HOLLOW STEM AUGERS | CONTINUED FROM PREVIOUS PAGE  |                                      |                |            |   |                                       |                                    |  |                            |   |
|                       |   | Silty Clay, trace sand, occ. sand<br>layer<br>Very soft to soft<br>Grey |                                      |                |            | ⊗ +   |                                       |                                    |  |                            |   |
|                       |   | Silty Sand, trace clay, trace<br>gravel<br>Dense<br>Grey                | 10.67                                | 11             | 50<br>DO   | 38  | ⊗ +                                   |                                    |  |                            |   |
| 11                    |   | END OF BOREHOLE   | 11.13                                |                |            |   |                                       |                                    |  |                            |   |
| 12                    |   |   |                                      |                |            |   |                                       |                                    |  |                            |   |
| 13                    |   |   |                                      |                |            |   |                                       |                                    |  |                            |   |
| 14                    |   |   |                                      |                |            |   |                                       |                                    |  |                            |   |
| 15                    |   |   |                                      |                |            |   |                                       |                                    |  |                            |   |
| 16                    |   |   |                                      |                |            |   |                                       |                                    |  |                            |   |
| 17                    |   |   |                                      |                |            |   |                                       |                                    |  |                            |   |
| 18                    |   |   |                                      |                |            |   |                                       |                                    |  |                            |   |
| 19                    |   |   |                                      |                |            |   |                                       |                                    |  |                            |   |
| 20                    |   |   |                                      |                |            |   |                                       |                                    |  |                            |   |

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: SB

CHECKED: AP



W.P. 209-97-00  
DIST. 52, HWY 69  
LOCATION: Sta. 18+140, 8m Lt.

# RECORD OF BOREHOLE 99F

BORING DATE: APRIL 23/99

SHEET 1 OF 2

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD  | SOIL PROFILE  |             | SAMPLES               |          | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |            | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |                              | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |                        |   |
|-----------------------|--|---|-------------|-----------------------|----------|---|------------|------------------------------------|------------------------------|----------------------------|---|------------------------|---|
|                       |  | DESCRIPTION   | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER   | TYPE  | BLOWS/0.3m | SHEAR STRENGTH                     |                              |                            |   | WATER CONTENT, PERCENT |   |
|                       |  |   |             |                       |          |   |            | Cu, kPa                            | nat V - +<br>rem V - @ U - O |                            |   | Wp                     | W |
|                       |  |   |             |                       |          |   |            |                                    |                              |                            |   |                        |   |
| 0                     | CME 55 BOMBARDIER<br>HOLLOW STEM AUGERS                        | GROUND SURFACE  |             | 0.00                  |          |   |            |                                    |                              |                            |   |                        |   |
|                       |  | Water   |             |                       |          |   |            |                                    |                              |                            |   |                        |   |
|                       |  | Peat, fibrous becoming amorphous<br>below 4m depth, trace sand<br>Very loose<br>Dark brown to black |             | 0.30                  | 1        | 50<br>DO                                      | 2          |                                    |                              |                            |   | >665.5                 |   |
| 1                     |  |   |             |                       | 2        | 50<br>DO                                      | 3          |                                    |                              |                            |   | >596.5                 |   |
| 2                     |  |   |             |                       |          |   |            | @ +                                |                              |                            |   |                        |   |
|                       |  |   |             |                       |          |   |            | @ +                                |                              |                            |   |                        |   |
| 3                     |  |   |             | 3                     | 50<br>DO | PM  |            |                                    |                              |                            |   |                        |   |
|                       |  |   |             |                       |          |   |            | @ +                                |                              |                            |   |                        |   |
| 4                     |  |   |             |                       |          |   |            | @ +                                |                              |                            |   |                        |   |
|                       |  |   |             | 4                     | 50<br>DO | WR  |            |                                    |                              |                            |   | >795.5                 |   |
| 5                     |  |   |             |                       |          |   |            | @                                  |                              |                            |   |                        |   |
|                       |  |   |             |                       |          |   |            | @                                  |                              |                            |   |                        |   |
| 6                     |  |   |             | 5                     | 50<br>DO | PM  |            |                                    |                              |                            | >251.3  |                        |   |
|                       |  |   |             |                       |          |   | @          |                                    |                              |                            |   |                        |   |
| 7                     |  |   |             |                       |          |   | @ +        |                                    |                              |                            |   |                        |   |
|                       | Silty Clay, trace sand, trace<br>organics<br>Very soft<br>Grey |   | 7.16        | 6                     | 50<br>DO | WH  |            |                                    |                              |                            |   |                        |   |
| 8                     |  |   |             |                       |          | @   |            |                                    |                              |                            |   |                        |   |
|                       |  |   |             |                       |          | @   |            |                                    |                              |                            |   |                        |   |
| 9                     |  |   |             | 7                     | 50<br>DO | WR  |            |                                    |                              |                            |   |                        |   |
|                       | Silty Sand, trace clay, trace<br>gravel<br>Dense<br>Grey       |   | 9.29        |                       |          |   |            |                                    |                              |                            |   |                        |   |
| 10                    |  |   |             | 8                     | 50<br>DO | 31  | @ +        |                                    |                              |                            |   |                        |   |
|                       | CONTINUED ON NEXT PAGE   |   |             |                       |          |   |            |                                    |                              |                            |   |                        |   |

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: SB

CHECKED: AP

W.P. 209-87-00  
DIST. 52, HWY 69  
LOCATION: Sta. 18+140, 8m Lt.

# RECORD OF BOREHOLE 99F

BORING DATE: APRIL 23/99

SHEET 2 OF 2

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | SOIL PROFILE<br>DESCRIPTION   | STRATA<br>ELEV.<br>DEPTH<br>(m) | SAMPLES    |      | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m | HYDRAULIC CONDUCTIVITY,<br>k, cm/s | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |
|-----------------------|---|---------------------------------|------------|------|---|------------------------------------|----------------------------|---|
|                       |   |                                 | NUMBER     | TYPE |   |                                    |                            |   |
|                       |   |                                 | BLOWS/0.3m |      |   |                                    |                            |   |
| 10                    | CONTINUED FROM PREVIOUS PAGE  |                                 |            |      |   |                                    |                            |   |
| 10.05                 | END OF BOREHOLE<br>REFUSAL TO FURTHER AUGER<br>PENETRATION PROBABLY ON<br>BEDROCK |                                 |            |      |   |                                    |                            |   |
| 11                    |   |                                 |            |      |   |                                    |                            |   |
| 12                    |   |                                 |            |      |   |                                    |                            |   |
| 13                    |   |                                 |            |      |   |                                    |                            |   |
| 14                    |   |                                 |            |      |   |                                    |                            |   |
| 15                    |   |                                 |            |      |   |                                    |                            |   |
| 16                    |   |                                 |            |      |   |                                    |                            |   |
| 17                    |   |                                 |            |      |   |                                    |                            |   |
| 18                    |   |                                 |            |      |   |                                    |                            |   |
| 19                    |   |                                 |            |      |   |                                    |                            |   |
| 20                    |   |                                 |            |      |   |                                    |                            |   |

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: SB

CHECKED: AP

N8000101 BHS

W.P. 209-97-00  
 DIST. 52, HWY 69  
 LOCATION: 10+850, 2.0m Lt

# RECORD OF BOREHOLE 101

BORING DATE: DEC.19&20/98

SHEET 1 OF 1

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD   | SOIL PROFILE  |             | SAMPLES               |          | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |            |                |                    | HYDRAULIC CONDUCTIVITY,<br>K, cm/s |                |                        |    | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |    |  |
|-----------------------|---|---|-------------|-----------------------|----------|---|------------|----------------|--------------------|------------------------------------|----------------|------------------------|----|----------------------------|---|----|--|
|                       |   | DESCRIPTION   | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER   | TYPE  | BLOWS/0.3m | SHEAR STRENGTH |                    |                                    |                | WATER CONTENT, PERCENT |    |                            |   |    |  |
|                       |   |   |             |                       |          |   |            | Cu, kPa        | nat V -<br>rem V - | +                                  | Q - ●<br>U - ○ | Wp                     | W  |                            |   | Wi |  |
|                       |   |   |             |                       |          |   |            | 20             | 40                 | 60                                 | 80             | 20                     | 40 | 60                         | 80  |    |  |
| 0                     | PORTABLE DRILLING EQUIPMENT<br>63.5mm I.D. PLASTIC CASING | GROUND SURFACE  |             | 0.00                  |          |   |            |                |                    |                                    |                |                        |    |                            |   |    |  |
| 1                     |   | Peat<br>Fibrous becoming amorphous below<br>3.7m depth<br>Very loose<br>Dark brown to black |             |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |    |  |
| 2                     |   |   |             | 1                     | 50<br>00 | WH  |            |                |                    |                                    |                |                        |    |                            |   |    |  |
| 3                     |   |   |             |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |    |  |
| 4                     |   |   |             |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |    |  |
| 5                     |   |   |             |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |    |  |
| 6                     |   | Sand, trace silt and gravel<br>Loose<br>Grey  |             |                       | 5.79     | 4   | 50<br>00   | 3              |                    |                                    |                |                        |    |                            |   |    |  |
| 7                     |   |   |             |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |    |  |
| 8                     |   | Sandy Silt, trace clay<br>Loose<br>Grey   |             |                       | 7.01     | 6   | 50<br>00   | 9              |                    |                                    |                |                        |    |                            |   |    |  |
| 9                     |   |   |             |                       |          |   |            |                |                    |                                    |                |                        |    |                            |   |    |  |
| 10                    |   | END OF BOREHOLE<br>REFUSAL TO FURTHER AUGER<br>PENETRATION PROBABLY ON<br>BEDROCK           |             | 8.17                  |          |   |            |                |                    |                                    |                |                        |    |                            |   |    |  |

Note:  
Water level in  
open borehole at  
0.1m depth below  
ground surface  
during drilling.

Note:  
 Water level in  
 open borehole at  
 0.1m depth below  
 ground surface  
 during drilling.

DATA INPUT: PS MAY 25/99

SOILM6

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: DJM

CHECKED: AP

NE000102 BHS

DATA INPUT: PS MAY 25/99  
SOILM6

W.P. 209-97-00  
DIST. 52, HWY 69  
LOCATION: 10+875, 3.0m LT.

# RECORD OF BOREHOLE 102

BORING DATE: DEC.20/98

SHEET 1 OF 1

DATUM:

PROJECT: 981-1111



| DEPTH SCALE<br>METRES | BORING METHOD | SOIL PROFILE  |             | SAMPLES               |        | DYNAMIC PENETRATION<br>RESISTANCE, BLOWS/0.3m |            |                |  | HYDRAULIC CONDUCTIVITY,<br>K, cm/s |  |                        |  | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |   |  |
|-----------------------|---------------|---|-------------|-----------------------|--------|---|------------|----------------|--|------------------------------------|--|------------------------|--|----------------------------|---|---|--|
|                       |               | DESCRIPTION   | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER | TYPE  | BLOWS/0.3m | SHEAR STRENGTH |  |                                    |  | WATER CONTENT, PERCENT |  |                            |   |   |  |
|                       |               |   |             |                       |        |   |            | Cu, kPa        |  | c <sub>u</sub> , kPa               |  | W <sub>p</sub>         |  |                            |   | W |  |
| 0                     |               | GROUND SURFACE  |             | 0.00                  |        |   |            |                |  |                                    |  |                        |  |                            |   |   |  |
| 1                     |               | Peat<br>Fibrous, becoming amorphous below<br>approximately 2.4m depth<br>Loose to very loose<br>Dark brown to black |             |                       |        |   |            |                |  |                                    |  |                        |  |                            |   |   |  |
| 2                     |               |   |             |                       |        |   |            |                |  |                                    |  |                        |  |                            |   |   |  |
| 3                     |               |   |             |                       |        |   |            |                |  |                                    |  |                        |  |                            |   |   |  |
| 4                     |               |   |             |                       |        |   |            |                |  |                                    |  |                        |  |                            |   |   |  |
| 5                     |               | Sand, trace gravel<br>Loose to compact<br>Grey  |             | 4.72                  |        |   |            |                |  |                                    |  |                        |  |                            |   |   |  |
| 6                     |               |   |             |                       |        |   |            |                |  |                                    |  |                        |  |                            |   |   |  |
| 7                     |               |   |             |                       |        |   |            |                |  |                                    |  |                        |  |                            |   |   |  |
| 8                     |               |   |             |                       |        |   |            |                |  |                                    |  |                        |  |                            |   |   |  |
| 9                     |               | END OF BOREHOLE   |             | 9.00                  |        |   |            |                |  |                                    |  |                        |  |                            |   |   |  |
| 10                    |               | Hammer weight of 32 kg used to<br>obtain samples and blows/0.3m<br>refer to this hammer weight.                     |             |                       |        |   |            |                |  |                                    |  |                        |  |                            |   |   |  |

Note:  
Water level in  
open borehole at  
0.1m depth below  
ground surface.

DEPTH SCALE

1 to 50

Golder Associates

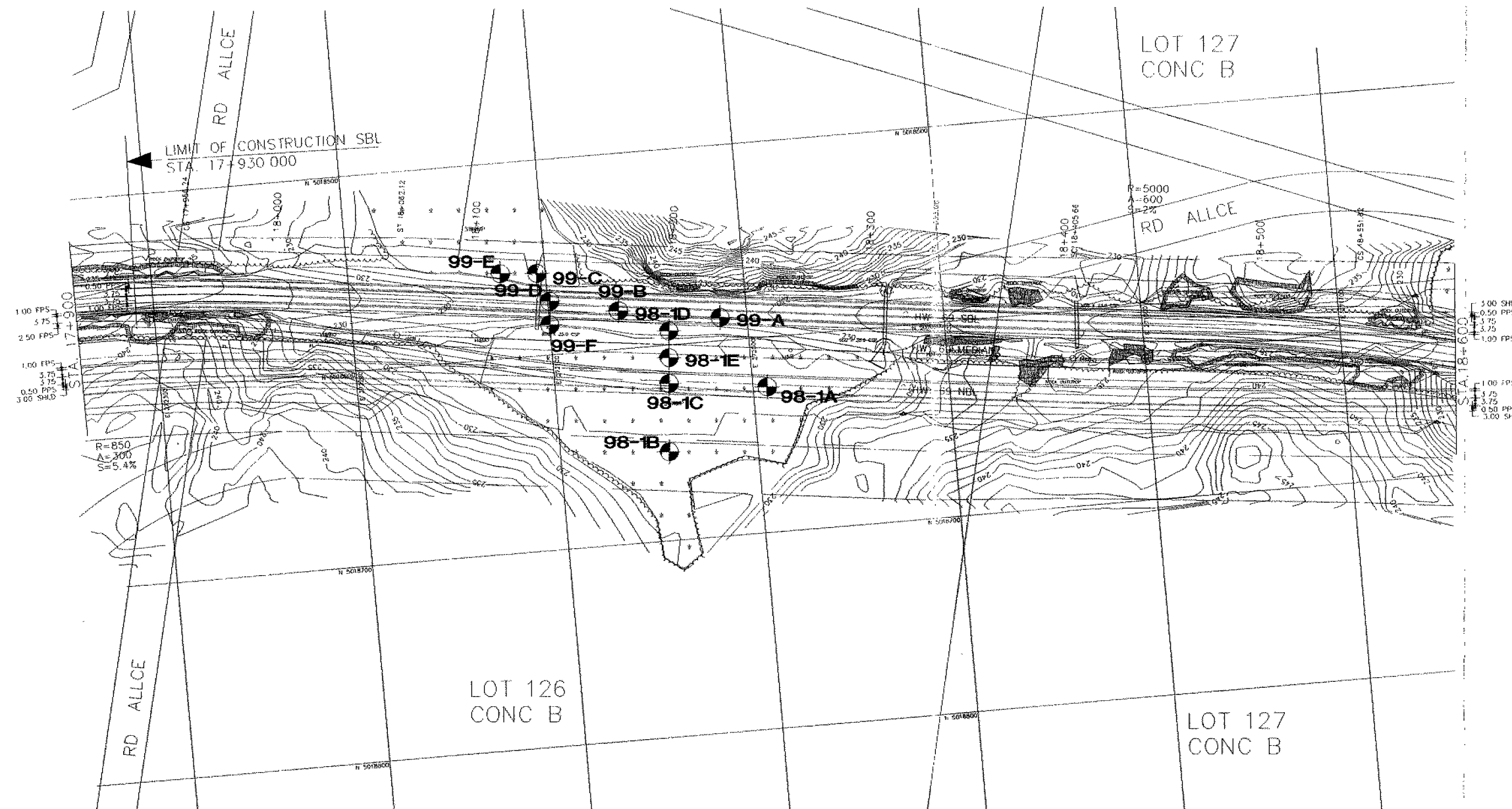
LOGGED: DJM

CHECKED: AP



1

6.1m - 7.2m peak  
underlain by 4.3m sh/ clay

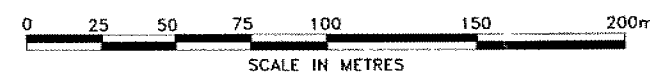


| LEGEND |   |             |         |
|--------|---|-------------|---------|
|        | Bore Hole                               |             |         |
| N      | Blows/0.3m (Std. Pen. Test, 475 j/blow) |             |         |
| Cone   | Blows/0.3m (60° Cone, 475 j/blow)       |             |         |
|        | WL at time of investigation             |             |         |
| No.    | ELEVATION                               | COORDINATES |         |
|        |   | STATION     | OFFSET  |
| 98-1A  | N/A                                     | 18+250      | 20m Rt. |
| 98-1B  | N/A                                     | 18+200      | 55m Rt. |
| 98-1C  | N/A                                     | 18+200      | 20m Rt. |
| 98-1D  | N/A                                     | 10+200      | 7m Lt.  |
| 98-1E  | N/A                                     | 18+200      | 7m Rt.  |
| 99-A   | N/A                                     | 18+220      | 14m Lt. |
| 98-B   | N/A                                     | 18+170      | 14m Lt. |
| 98-C   | N/A                                     | 18+140      | 20m Lt. |
| 98-D   | N/A                                     | 18+130      | 33m Lt. |
| 98-E   | N/A                                     | 18+110      | 35m Lt. |
| 98-F   | N/A                                     | 18+140      | 8m Lt.  |

**NOTES**

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

**PLAN**



| NO.         | DATE                  | BY               | REVISION      |
|-------------|-----------------------|------------------|---------------|
|             |                       |                  |               |
|             |                       |                  |               |
|             |                       |                  |               |
| Geocres No. |                       |                  |               |
| HWY 69      | PROJECT NO.: 981-1111 | DIST.            |               |
| SUBM'D. AMP | CHKD: ASP             | DATE: 1999 05 25 | SITE          |
| DRAWN: JFC  | CHKD. AMP             | APPD.            | DWG. N111101E |



HWY 69  
Sta. 18+600 to Sta. 19+300  
BORE HOLE LOCATIONS

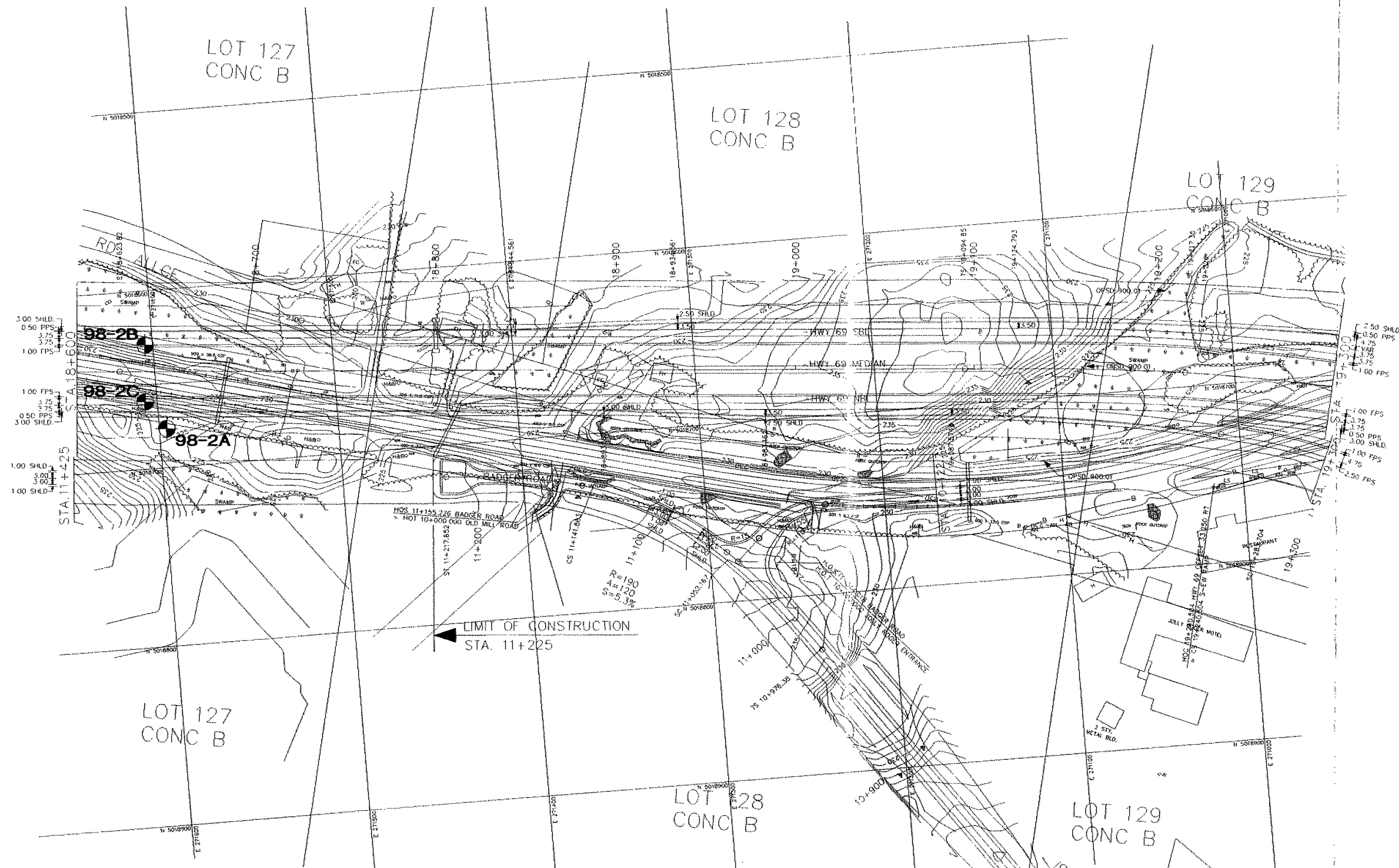
SHEET



**Golder Associates Ltd.**  
MISSISSAUGA, ONTARIO, CANADA

2

2.7m - 3.2m deep  
underlain by soft silty clay



**LEGEND**

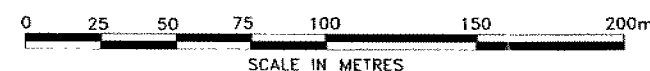
- Bore Hole
- N Blows/0.3m (Std. Pen. Test. 475 j/blow)
- Cone Blows/0.3m (60° Cone, 475 j/blow)
- WL at time of investigation

| No.   | ELEVATION | COORDINATES |         |
|-------|-----------|-------------|---------|
|       |           | STATION     | OFFSET  |
| 98-2A | N/A       | 18+650      | 32m Rt  |
| 98-2B | N/A       | 18+638      | 15m Lt. |
| 98-2C | N/A       | 18+638      | 17m Rt. |

**NOTES**

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

**PLAN**

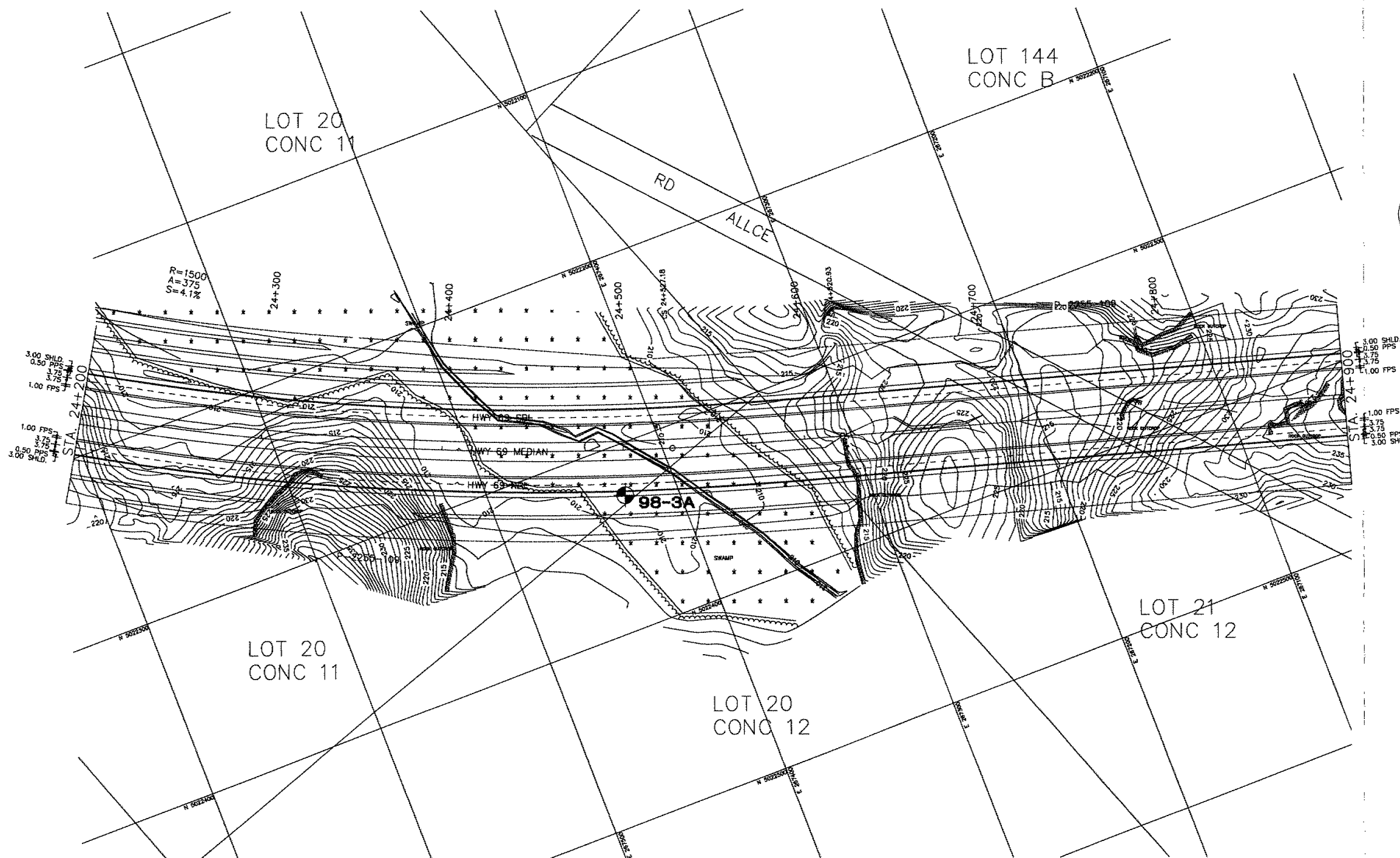


SCALE IN METRES

| NO. | DATE | BY | REVISION |
|-----|------|----|----------|
|     |      |    |          |

Geocres No.

|             |                       |                  |
|-------------|-----------------------|------------------|
| HWY 69      | PROJECT NO.: 981-1111 | DIST.            |
| SUBM'D. AMP | CHKD: ASP             | DATE: 1999 05 25 |
| DRAWN: JFC  | CHKD. AMP             | APPD.            |
|             |                       | DWG. N111102E    |



1.8m Peat  
4

LEGEND

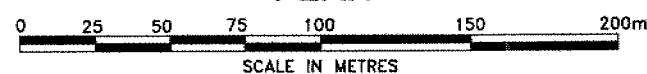
- Bore Hole
- N Blows/0.3m (Std. Pen. Test, 475 j/blow)
- Cone Blows/0.3m (60° Cone, 475 j/blow)
- WL at time of investigation

| No.   | ELEVATION | COORDINATES |        |
|-------|-----------|-------------|--------|
|       |           | STATION     | OFFSET |
| 98-3A | N/A       | 24+525      | 25m Rt |

NOTES

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

PLAN



| NO. | DATE | BY | REVISION |
|-----|------|----|----------|
|     |      |    |          |
|     |      |    |          |

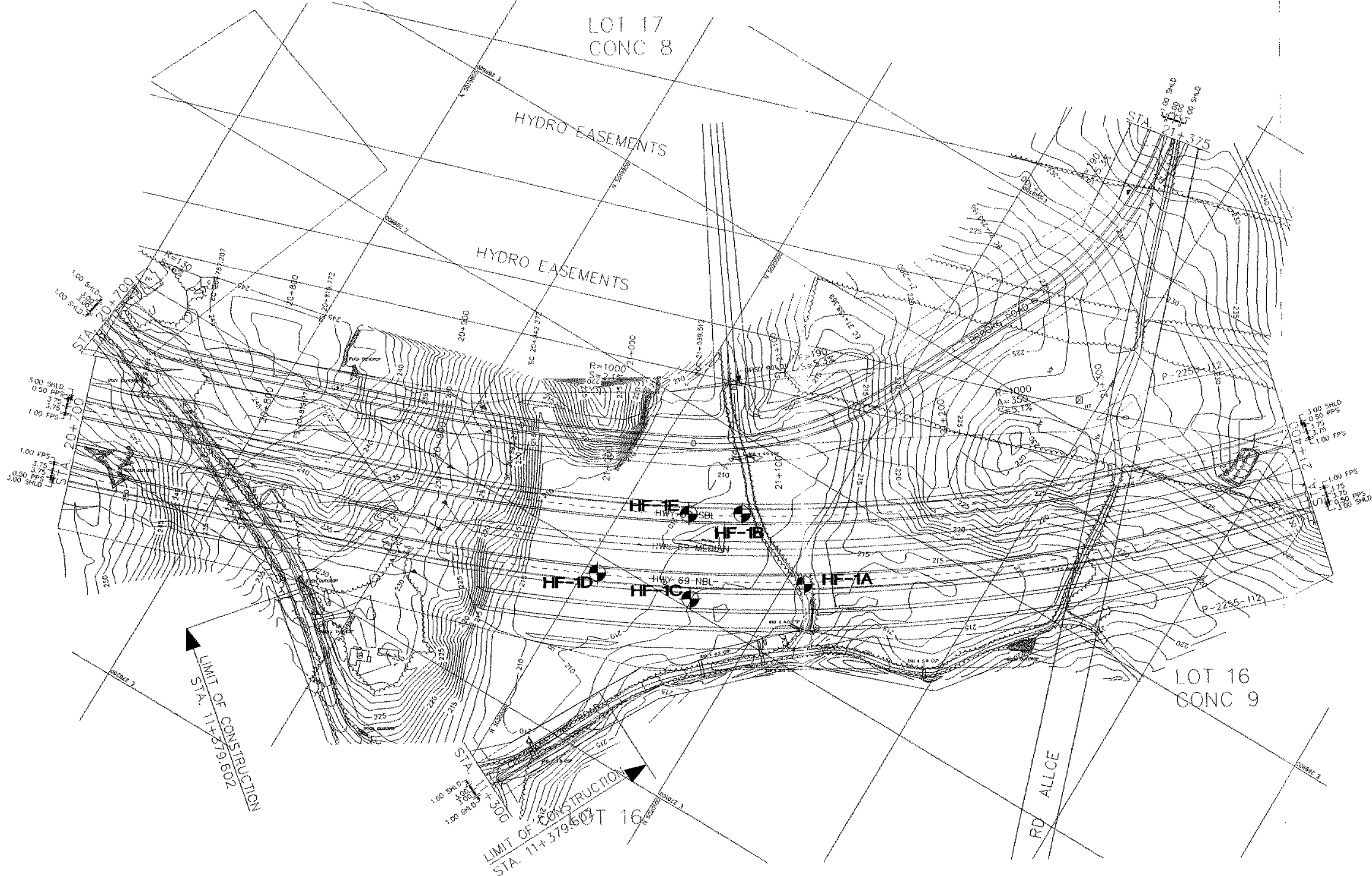
Geocres No.

|             |                       |                  |
|-------------|-----------------------|------------------|
| HWY 69      | PROJECT NO.: 981-1111 | DIST.            |
| SUBM'D. AMP | CHKD: ASP             | DATE: 1999 05 25 |
| DRAWN: JFC  | CHKD. AMP             | APPD.            |
|             |                       | DWG. N111104E    |





3  
no peat.  
soft, silty clay  
1.8m to 5.8m.



**LEGEND**

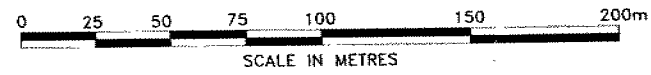
- Bore Hole
- Blows/0.3m (Std. Pen. Test. 475 j/blow)
- Cone Blows/0.3m (60° Cone. 475 j/blow)
- WL at time of investigation

| No.   | ELEVATION | COORDINATES |         |
|-------|-----------|-------------|---------|
|       |           | STATION     | OFFSET  |
| HF-1A | N/A       | 21+115      | 20m Rt  |
| HF-1B | N/A       | 21+080      | 20m Lt. |
| HF-1C | N/A       | 21+050      | 29m Rt. |
| HF-1D | N/A       | 21+000      | 18m Lt. |
| HF-1E | N/A       | 21+050      | 19m Lt. |

**NOTES**

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

**PLAN**

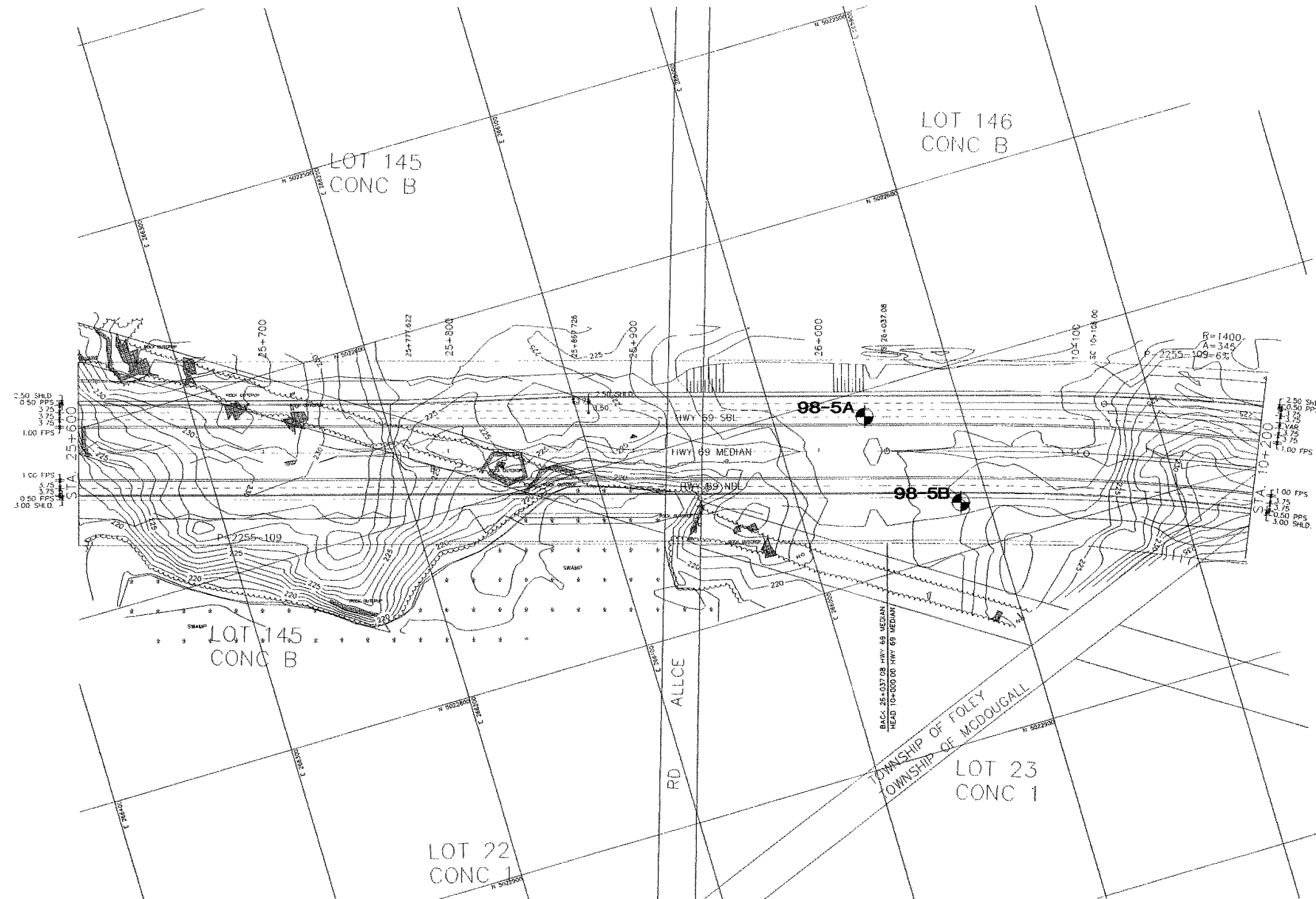


| NO. | DATE | BY | REVISION |
|-----|------|----|----------|
|     |      |    |          |
|     |      |    |          |
|     |      |    |          |

Geocres No.

|             |                       |                  |
|-------------|-----------------------|------------------|
| HWY 69      | PROJECT NO.: 981-1111 | DIST.            |
| SUBM'D. AMP | CHKD: ASP             | DATE: 1999 05 25 |
| DRAWN: JFC  | CHKD: AMP             | APPD.            |
|             |                       | SITE             |
|             |                       | DWG. N111104E    |





PLAN



LEGEND

- Bore Hole
- N Blows/0.3m (Std. Pen. Test, 475 j/blow)
- Cone Blows/0.3m (60° Cone, 475 j/blow)
- WL at time of investigation

| No.   | ELEVATION | COORDINATES |        |
|-------|-----------|-------------|--------|
|       |           | STATION     | OFFSET |
| 98-5A | N/A       | 11+825      | 19m Rt |
| 98-5B | N/A       | 10+060      | 28m Lt |

NOTES

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

| NO. | DATE | BY | REVISION |
|-----|------|----|----------|
|     |      |    |          |

Geocres No.

|             |                       |                  |
|-------------|-----------------------|------------------|
| HWY 69      | PROJECT NO.: 981-1111 | DIST.            |
| SUBM'D. AMP | CHKD: ASP             | DATE: 1999 05 25 |
| DRAWN: JFC  | CHKD. AMP             | APPD.            |
|             |                       | DWG. N111105E    |



6

0.1m to 0.5m peat  
underlying 1.1 to 3.7m  
soft malpais/  
silt/clay

LEGEND

- Bore Hole
- N Blows/0.3m (Std. Pen. Test, 475 j/blow)
- Cone Blows/0.3m (60° Cone, 475 j/blow)
- WL at time of investigation

| No.   | ELEVATION | COORDINATES |        |
|-------|-----------|-------------|--------|
|       |           | STATION     | OFFSET |
| 98-4A | N/A       | 11+825      | 19m Rt |
| 98-4B | N/A       | 11+825      | 19m Lt |

NOTES

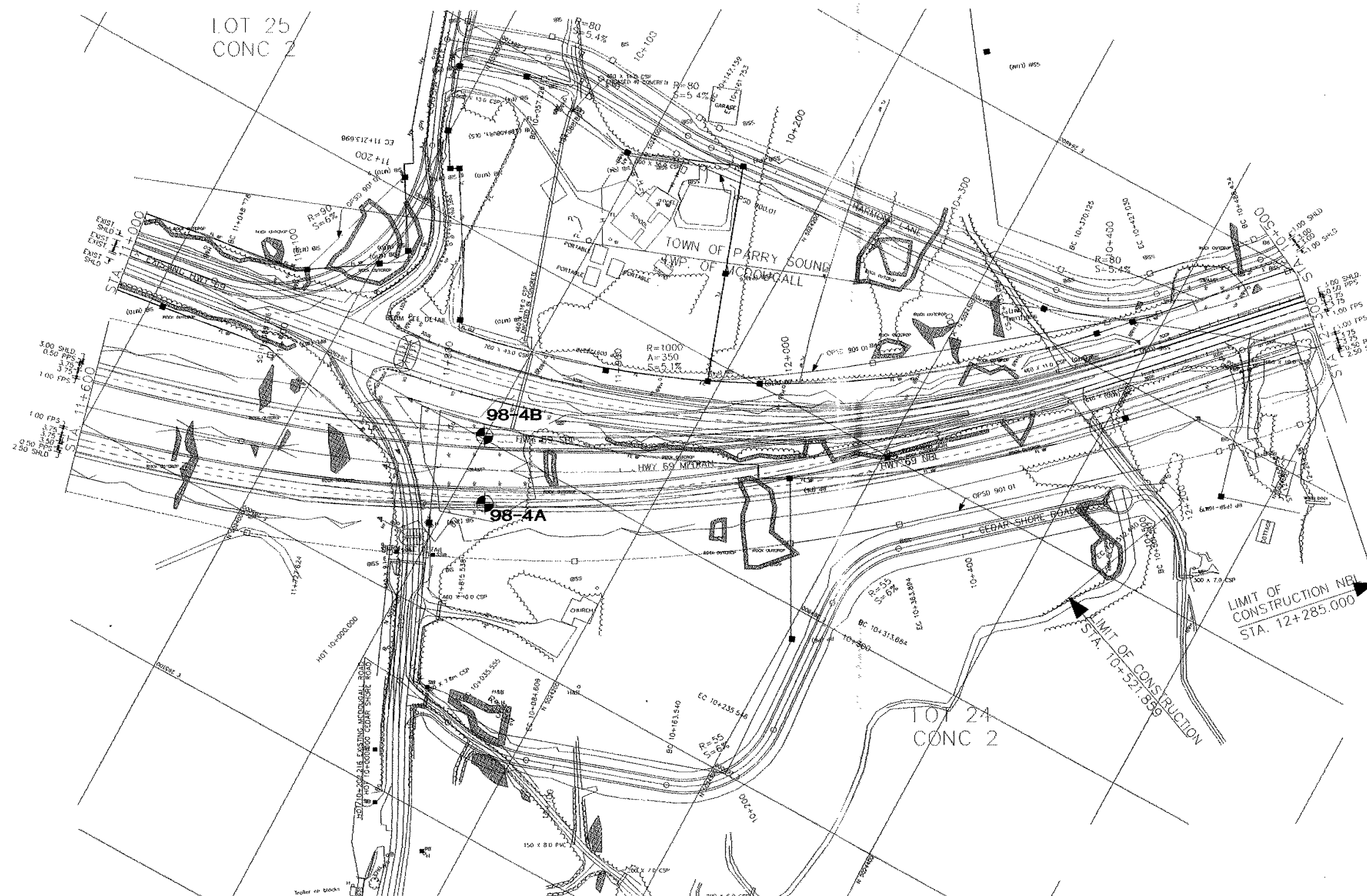
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

| NO. | DATE | BY | REVISION |
|-----|------|----|----------|
|     |      |    |          |
|     |      |    |          |
|     |      |    |          |

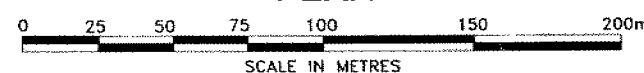
Geocres No.

|             |                       |                  |
|-------------|-----------------------|------------------|
| HWY 69      | PROJECT NO.: 981-1111 | DIST.            |
| SUBM'D. AMP | CHKD. ASP             | DATE: 1999 05 25 |
| DRAWN: JFC  | CHKD. AMP             | APPD.            |
|             |                       |                  |

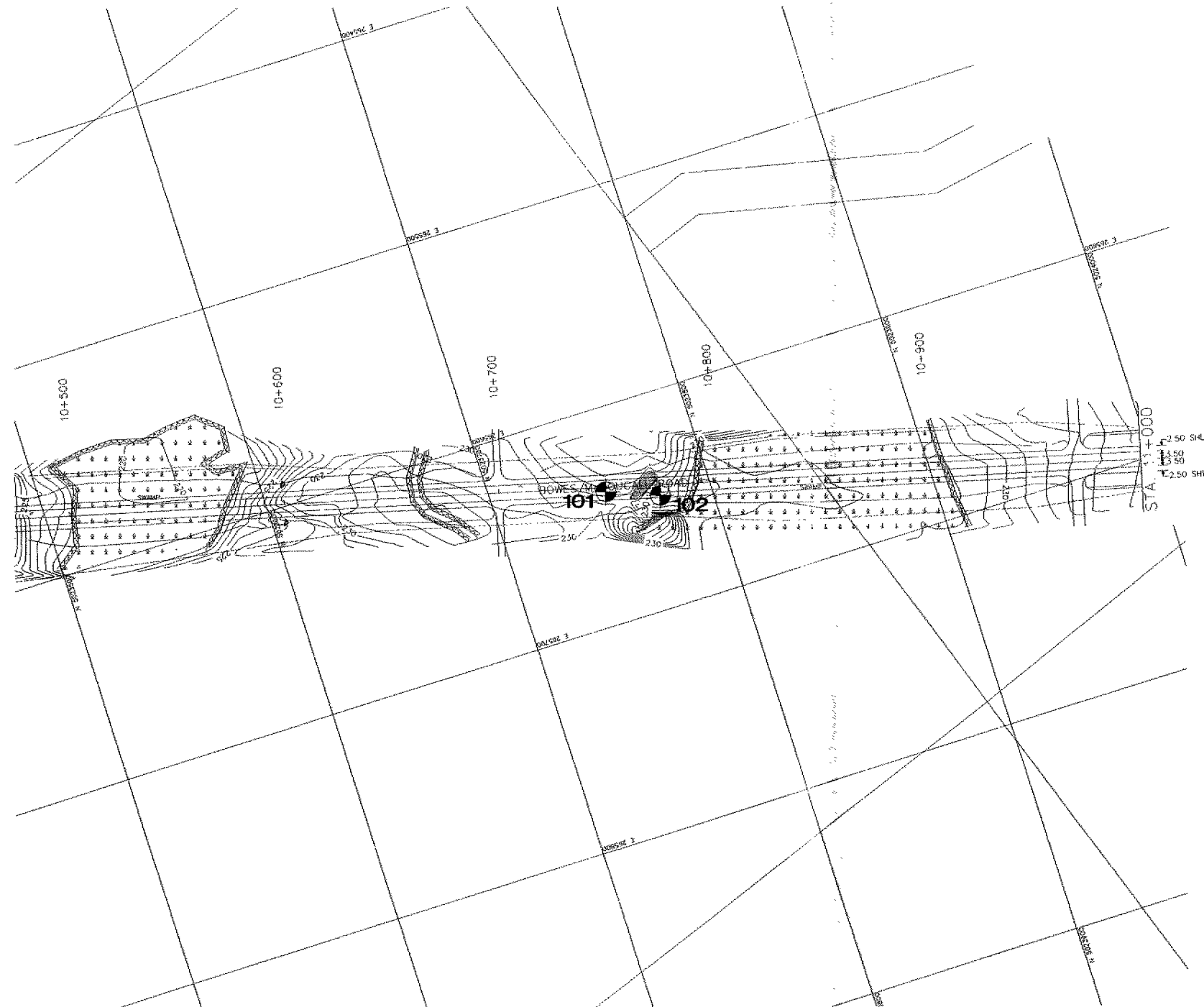
DWG. N111106E



PLAN



SCALE IN METRES



PLAN



7  
47m to 5.8m Peal.

LEGEND

- Bore Hole
- N Blows/0.3m (Std. Pen. Test. 475 j/blow)
- Cone Blows/0.3m (60° Cone, 475 j/blow)
- WL at time of investigation

| No.   | ELEVATION | COORDINATES |        |
|-------|-----------|-------------|--------|
|       |           | STATION     | OFFSET |
| 98-3A | N/A       | 24+525      | 25m Rt |

NOTES

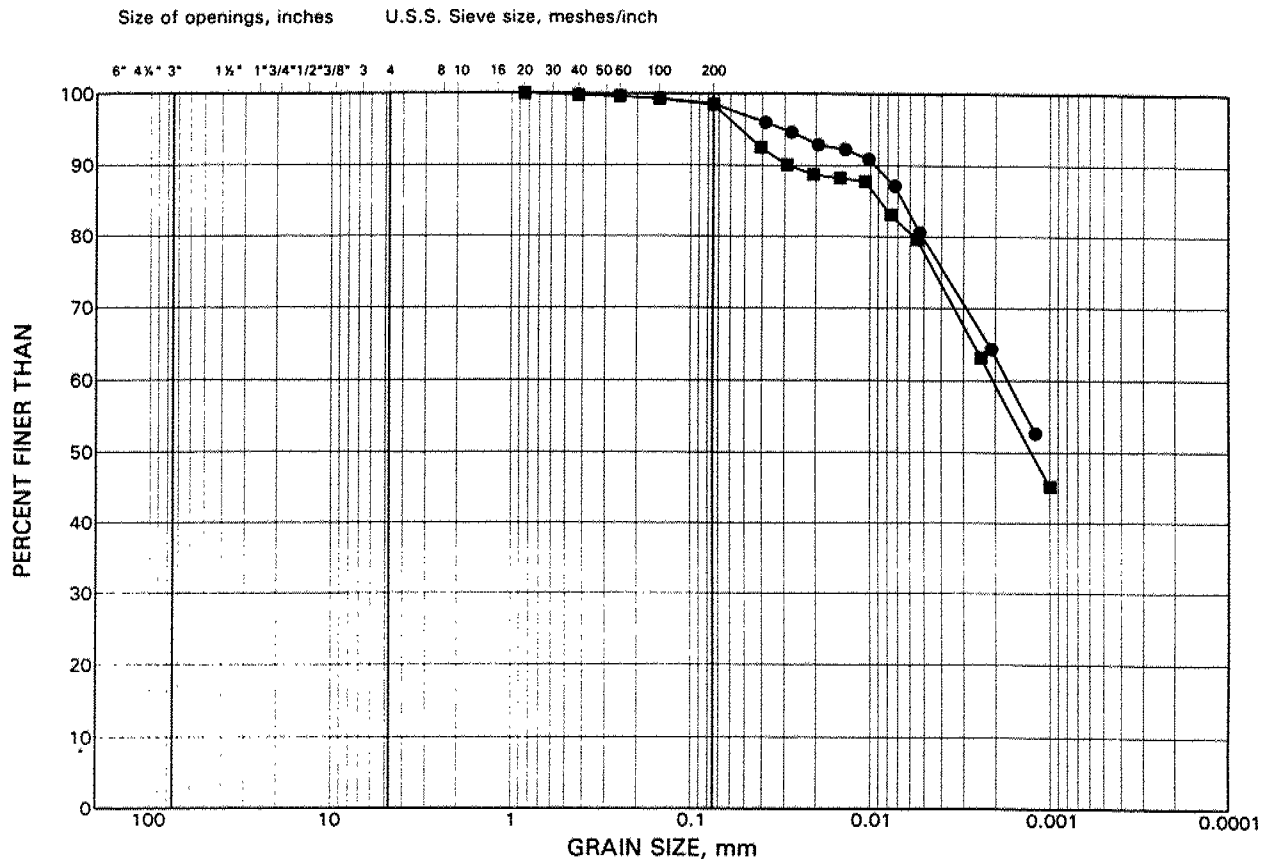
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

|             |              |                  |               |
|-------------|--------------|------------------|---------------|
| NO.         | DATE         | BY               | REVISION      |
|             |              |                  |               |
| Geocres No. |              |                  |               |
| HWY 69      | PROJECT NO.: | 981-1111         | DIST.         |
| SUBM'D. AMP | CHKD: ASP    | DATE: 1999 05 25 | SITE          |
| DRAWN: JFC  | CHKD: AMP    | APPD.            | DWG. N111107E |

# GRAIN SIZE DISTRIBUTION

## Silty Clay

FIGURE 1



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

### LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH(m) |
|--------|----------|--------|----------|
| •      | 98-1C    | 5      | -        |
| ■      | HF-1B    | 3      | -        |



## **APPENDIX A**

### **RELEVANT GEOTECHNICAL INFORMATION**

**PAVEMENT DESIGN REPORT  
HIGHWAY 69, W.P. 209-97-00  
FOUR LANING OF THE PARRY SOUND BY-ASS  
TOWN OF PARRY SOUND  
DISTRICT 52, HUNTSVILLE**

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

18+050 19.00 Rt C/L D+2.70 HA

0 - 150 Si Tps  
150 - 900 Si W F Sa, Moist  
- 900 NFP BR

18+050 27.00 Rt C/L D+4.00 HA

0 - 150 Si Tps  
150 - 800 Si W F Sa, Moist  
- 800 NFP BR

18+050 11.00 Rt C/L D+300 HA

0 - 150 Si Tps  
150 - 600 Si Tr F Sa, Wet  
600 - 700 F Sa, Wet  
- 700 NFP BR

18+060 27.00 Rt C/L D+3.30 HA

0 - 150 Si Tps  
150 - 600 Si W F Sa  
600 - 1.50 F-Med Sa W Gr

18+060 19.00 Rt C/L D+2.10 HA

0 - 150 Si Tps  
150 - 1.20 Si W F Sa, Wet  
- 1.20 NFP BR

18+060 11.00 Rt C/L D+400 HA

0 - 150 Si Tps  
150 - 1.50 F Sa, Wet

18+100 19.00 Rt C/L D-0 HA

0 - 100 Si Tps  
100 - 2.00 Si Tr Sa & Cl, Wet  
- 2.00 NFP Sloughing

18+100 27.00 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 1.20 Si W Cl, Wet  
- 1.20 NFP BR

18+100 11.00 Rt C/L D-0 HA

0 - 150 Wat  
150 - 2.00 Si Tr Sa, Wet  
- 2.00 NFP Sloughing

18+125 11.00 Rt C/L D-0 HA

0 - 200 Wat  
200 - 3.20 Muckamor  
- 3.20 NFP BR

18+125 19.00 Rt C/L D-0 HA

0 - 100 Wat  
100 - 2.70 Muckamor  
- 2.70 NFP BR

18+125 27.00 Rt C/L D+200 HA

0 - 150 Si Tps  
150 - 300 Si W F Sa, Fr Wat @ 200  
- 300 NFP BR

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111

July, 1998

18+250 30.00 Rt C/L D-0 PA

0 - 150 Wat  
150 - 6.70 Muckamor  
6.70 - 8.40 Sa Tr Si  
- 8.40 NFP BR

18+250 31.00 Rt C/L D-0 HA

0 - 250 Wat  
250 - 7.60 Muckamor

18+275 27.00 Rt C/L D+800 HA

0 - 150 Si Tps  
- 150 NFP BR

18+275 19.00 Rt C/L D-0 HA

0 - 300 Wat  
300 - 1.00 Muckamor  
- 1.00 NFP BR

18+275 11.00 Rt C/L D-0 HA

0 - 100 Wat  
100 - 4.00 Muckamor

18+300 19.00 Rt C/L D-500 HA

0 - 2.50 Muckamor  
2.50 - 2.70 Si, Wet, Firm  
- 2.70 NFP

18+300 11.00 Rt C/L D-500 HA

0 - 100 Wat  
100 - 3.00 Muckamor  
- 3.00 NFP Blds

18+300 27.00 Rt C/L D-0 HA

0 - 150 Si Tps  
- 150 NFP BR

18+310 27.00 Rt C/L D+1.10 HA

0 - 150 Si Tps  
150 - 400 Si Tr Sa  
- 400 NFP Blds

18+310 11.00 Rt C/L D-300 HA

0 - 150 Si Tps  
150 - 1.80 F-Med Sa Tr Si, Fr Wat @ 300

18+310 19.00 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 400 F-Med Sa Tr Si  
- 400 NFP Blds

18+320 11.00 Rt C/L D-300 HA

0 - 150 Si Tps  
150 - 1.00 Si Tr F Sa, Wet  
- 1.00 NFP BR

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

18+470 11.00 Rt C/L D+700 HA

0 - 50 Moss  
- 50 NFP BR

18+490 19.00 Rt C/L D+1.50 HA

0 - 150 Si Tps  
150 - 400 Si Tr F Sa  
- 400 NFP Blds

18+490 27.00 Rt C/L D+1.80 HA

0 - 100 Si Tps  
- 100 NFP BR

18+490 11.00 Rt C/L D+600 HA

0 - 50 Moss  
- 50 NFP BR

18+510 27.00 Rt C/L D+3.60 HA

- 0 BR

18+510 19.00 Rt C/L D+3.30 HA

0 - 100 Si Tps  
100 - 300 Si W F Sa, Moist  
- 300 NFP BR

18+510 11.00 Rt C/L D+2.00 HA

- 0 BR

18+530 27.00 Rt C/L D+3.50 HA

- 0 BR

18+530 19.00 Rt C/L D+2.50 HA

0 - 100 Si Tps W Blds  
100 - 250 Si W F Sa  
250 - 800 F-Med Sa Tr Si, Wet  
800 - 900 F-Med Sa W Gr  
- 900 NFP Blds

18+530 11.00 Rt C/L D+1.20 HA

0 - 150 Si Tps  
150 - 400 Si W F Sa, Moist  
- 400 NFP BR

18+550 11.00 Rt C/L D+1.50 HA

- 0 BR

18+550 27.00 Rt C/L D+200 HA

0 - 100 Si Tps W Blds  
100 - 300 Si W F Sa, Moist  
- 300 NFP BR

18+550 19.00 Rt C/L D+1.90 HA

0 - 100 Si Tps  
- 100 NFP BR

18+570 27.00 Rt C/L D+240 HA

0 - 80 Si Tps  
- 80 NFP BR



**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

18+570 19.00 Rt C/L D+2.40 HA

0 - 150 Si Tps  
- 150 NFP BR

18+570 11.00 Rt C/L D+200 HA

0 - 150 Si Tps  
150 - 600 Si Tr F Sa  
- 600 NFP BR

18+580 11.00 Rt C/L D-0 HA

0 - 100 Si Tps  
100 - 250 F Sa W Si  
- 250 NFP BR

18+580 19.00 Rt C/L D-300 HA

0 - 150 Si Tps  
150 - 400 Si W F Sa  
- 400 NFP BR

18+580 27.00 Rt C/L D-500 HA

0 - 150 Si Tps  
150 - 900 Si W F Sa  
- 900 NFP BR

18+590 27.00 Rt C/L D-2.70 HA

0 - 150 Si Tps  
150 - 800 Si W F Sa  
- 800 NFP Blds

18+590 19.00 Rt C/L D+3.00 HA

0 - 150 Si Tps  
150 - 800 Si Tr F Sa, Moist  
- 800 NFP Blds

18+590 11.00 Rt C/L D-2.00 HA

- 0 RF

18+600 27.00 Rt C/L D-5.00 HA

0 - 150 Si Tps  
150 - 800 Si W Cl  
800 - 1.00 Si W Cl Tr Co Sa  
1.00 - 1.10 Si Tr Cl  
- 1.10 NFP Blds

18+600 11.00 Rt C/L D-3.00 HA

- 0 RF

18+600 19.00 Rt C/L D-5.20 HA

0 - 100 Si Tps  
100 - 800 Si Tr F Sa, Fr Wat @ 200  
800 - 1.60 Si W Cl, Moist, Firm  
1.60 - 1.70 F-Med Sa Tr Gr, Wet  
- 1.70 NFP Blds

18+625 27.00 Rt C/L D-6.00 HA

0 - 50 Wat  
50 - 800 Muckamor  
800 - 1.00 F-Med Sa Tr Gr, Firm  
- 1.00 NFP

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

18+625 11.00 Rt C/L D-400 HA

0 - 250 F-Med Sa Tr Gr Tps  
- 250 NFP RF

18+625 19.00 Rt C/L D-4.50 HA

- 0 RF

18+650 19.00 Rt C/L D-2.00 HA

0 - 300 F-Med Sa Tr Gr Tps  
- 300 NFP RF

18+650 27.00 Rt C/L D-5.00 HA

- 0 RF

18+650 11.00 Rt C/L D-0 PA

0 - 240 Asph  
240 - 390 Cr Gr  
390 - 1.30 F-Med Sa Tr Gr  
- 1.30 NFP RF

18+670 16.00 Rt C/L D+1.00 PA

0 - 140 Asph  
140 - 290 Cr Gr  
290 - 2.10 F-Med Sa Tr Gr Tr RF  
- 2.10 NFP RF  
\*50% extra material  
required to backfill hole.

18+670 27.00 Rt C/L D-600 HA

0 - 350 F Sa Tr Gr Tps  
- 350 NFP RF

18+670 11.00 Rt C/L D-0 PA

0 - 330 Asph  
330 - 480 Cr Gr  
480 - 900 F-Med Sa Tr Gr  
- 900 NFP Sh Rk

18+690 11.00 Rt C/L D+4.00 PA

0 - 350 Asph  
350 - 550 Cr Gr  
550 - 1.10 F-Med Sa W Gr  
- 1.10 NFP RF

18+690 27.00 Rt C/L D+1.20 HA

0 - 150 Si Tps  
150 - 500 Si Tr F Sa  
- 500 NFP RF

18+690 19.00 Rt C/L D+1.60 PA

0 - 300 Asph  
300 - 450 Cr Gr  
450 - 700 F-Med Sa Tr Gr  
- 700 NFP RF

18+710 19.00 Rt C/L D+2.50 PA

0 - 360 Asph  
360 - 510 Cr Gr  
510 - 1.10 F-Med Sa Tr Gr  
- 1.10 NFP RF

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

18+710 27.00 Rt C/L D+2.50 HA

0 - 150 Si Tps  
150 - 300 Cr Gr  
300 - 1.90 F-Med Sa Tr Gr Tr Sh Rk  
- 1.90 NFP Sh Rk  
\*75% extra material required  
to backfill hole.

18+750 19.00 Rt C/L D+1.20 PA

0 - 200 Asph  
200 - 330 Cr Gr  
330 - 1.60 F-Med Sa W Gr OCC RF  
- 1.60 NFP RF  
\*20% extra material required  
to backfill hole.

18+710 11.00 Rt C/L D+2.50 PA

0 - 210 Asph  
210 - 410 Cr Gr  
410 - 3.40 F-Med Sa W Gr W RF  
3.40 - 5.00 Si W F Sa Tr Gr, Moist  
- 5.00 NFP  
\*50% extra material required  
to backfill hole.

18+750 27.00 Rt C/L D+2.00 PA

0 - 340 Asph  
340 - 480 Cr Gr  
480 - 1.90 F-Med Sa Tr Gr  
- 1.90 NFP BR  
\*50 % extra material required  
to backfill hole.

18+730 27.00 Rt C/L D+2.00 PA

0 - 270 Asph  
270 - 420 Cr Gr  
420 - 800 F-Med Sa Tr Gr  
- 800 NFP Sh Rk

18+750 11.00 Rt C/L D+300 HA

0 - 150 Si Tps  
150 - 800 F Sa Tr Si, Wet  
- 800 NFP BR

18+730 19.00 Rt C/L D+2.00 PA

0 - 380 Asph  
380 - 570 Cr Gr  
570 - 800 F-Med Sa W Gr  
- 800 NFP Sh Rk

18+780 0.30 Rt C/L D-0 HA

0 - 500 Wat  
500 - 800 Muckamor  
800 - 1.00 Si Tr Sa, Wet  
- 1.00 NFP Blids

18+800 27.00 Rt C/L D+900 PA

0 - 200 Asph  
200 - 400 Cr Gr  
400 - 800 F-Med Sa W Gr  
- 800 NFP RF

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

20+800 19.00 Rt C/L D-1.00 HA

0 - 100 Cr Gr  
100 - 400 F-Med Sa W Gr  
- 400 NFP Blds

20+800 11.00 Rt C/L D-300 HA

0 - 150 Cr Gr  
150 - 300 F-Med Sa Tr Gr  
- 300 NFP Blds

20+810 11.00 Rt C/L D-900 HA

0 - 1.50 F-Med Sa W Gr

20+810 19.00 Rt C/L D-1.00 HA

0 - 150 Cr Gr  
150 - 350 F-Med Sa W Gr  
- 350 NFP Blds

20+810 27.00 Rt C/L D-1.40 HA

0 - 100 Cr Gr  
100 - 400 F-Med Sa W Gr  
- 400 NFP Blds

20+850 11.00 Rt C/L D-1.00 HA

0 - 150 Si Tps  
150 - 200 Si Tr F Sa, Moist  
- 200 NFP BR

20+850 19.00 Rt C/L D-2.30 HA

0 - 150 Si Tps  
150 - 300 Si Tr F Sa, Moist  
- 300 NFP BR

20+850 27.00 Rt C/L D-4.50 HA

0 - 150 Si Tps  
- 150 NFP BR

20+900 11.00 Rt C/L D-0 HA

0 - 80 Moss  
- 80 NFP BR

20+900 19.00 Rt C/L D-500 HA

0 - 150 Si Tps  
150 - 300 Si Tr F Sa, Moist  
- 300 NFP Blds

20+900 27.00 Rt C/L D-900 HA

0 - 150 Si Tps  
150 - 400 Si Tr F Sa, Moist  
- 400 NFP Blds

20+950 19.00 Rt C/L D-1.50 HA

0 - 150 Si Tps  
150 - 400 Si Tr F Sa, Wet  
- 400 NFP Blds

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111

July, 1998

20+950 27.00 Rt C/L D-2.10 HA

0 - 200 Si Tps  
- 200 NFP Blds

20+950 11.00 Rt C/L D-1.00 HA

0 - 150 Si Tps  
150 - 350 Si Tr F Sa  
- 350 NFP Blds

20+950 43.00 Rt C/L D-2.80 HA

0 - 150 Si Tps  
150 - 350 Si Tr F Sa, Wet  
- 350 NFP Blds

21+000 0.30 Rt C/L D-0 HA

0 - 150 Si Tps, Fr Wat @ 100  
150 - 1.20 Si W F Sa  
1.20 - 1.60 Si Tr F Sa & Cl  
- 1.60 NFP Sloughing

21+000 19.00 Rt C/L D-0 HA

0 - 150 Si Tps, Fr Wat @ 100  
150 - 1.30 Si W F Sa Tr Cl  
- 1.30 NFP Sloughing

21+000 27.00 Rt C/L D-0 HA

0 - 150 Si Tps, Fr Wat @ 100  
150 - 1.30 Si W F Sa Tr Cl  
- 1.30 NFP Sloughing

21+000 61.00 Rt C/L D+300 HA

0 - 80 Si Tps  
80 - 400 Si Tr Cl, Fr Wat @ 400  
400 - 2.50 Cl Tr Si  
- 2.50 NFP Sloughing

21+050 0.30 Rt C/L D-0 HA

0 - 150 Si Tps  
- 150 NFP BR

21+050 19.00 Rt C/L D-300 HA

0 - 50 Si Tps  
50 - 400 Si W F Sa Tr Cl, Fr Wat @ 100  
400 - 600 Cl Tr Si, Firm  
- 600 NFP Sloughing

21+050 27.00 Rt C/L D-300 HA

0 - 100 Si Tps  
100 - 1.00 Si W F Sa Tr Cl, Wet,  
Fr Wat @ 200  
1.00 - 1.10 Cl Tr Si, Firm  
- 1.10 NFP Sloughing

21+050 61.00 Rt C/L D-400 HA

0 - 150 Si Tps  
150 - 200 Si W Cl, Fr Wat @ 200  
200 - 2.80 Cl Tr Si, Firm  
2.80 - 2.90 Si W F Sa, Wet  
- 2.90 NFP Sloughing

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111

July, 1998

21+100 19.00 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 1.70 Si Tr F Sa, Fr Wat @ 200  
1.70 - 1.90 F-Med Sa Tr Si  
1.90 - 2.40 F Sa W Si  
- 2.40 NFP Sloughing

21+100 61.00 Rt C/L D-0 HA

0 - 500 F-Med Sa Tr Gr  
- 500 NFP Blds

21+100 27.00 Rt C/L D-0 HA

0 - 150 Si Tps, Fr Wat @ 100  
150 - 1.20 Si Tr F Sa, Wet  
1.20 - 1.70 F Sa Tr Si  
1.70 - 2.00 Si Tr Cl  
- 2.00 NFP Sloughing

21+150 59.00 Rt C/L D+1.20 HA

0 - 50 Moss  
- 50 NFP BR

21+150 0.30 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 500 Si Tr F Sa  
- 500 NFP BR

21+150 27.00 Rt C/L D-1.00 HA

0 - 100 Si Tps  
100 - 800 Si Tr Cl, Wet  
800 - 1.30 Si W Cl  
- 1.30 NFP Sloughing

21+150 19.00 Rt C/L D-900 HA

0 - 150 Si Tps  
150 - 1.50 Cl, Moist, Firm  
1.50 - 1.60 Cl W Si, Moist, Fr Wat @ 1.60  
- 1.60 NFP BR

21+200 0.30 Rt C/L D-0 HA

0 - 50 Moss  
- 50 NFP BR

21+200 19.00 Rt C/L D-1.30 HA

0 - 150 Si Tps  
150 - 1.20 Si Tr F Sa, Wet  
1.20 - 1.50 Si, Wet, Fr Wat @ 1.50  
- 1.50 NFP Sloughing

21+200 27.00 Rt C/L D-1.40 HA

0 - 100 Si Tps, Fr Wat @ 50  
100 - 1.40 Si Tr F Sa, Wet  
- 1.40 NFP Sloughing

21+200 59.00 Rt C/L D-1.10 HA

0 - 500 F-Med Sa Tr Gr  
- 500 NFP Blds

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

21+250 27.00 Rt C/L D-1.20 HA

0 - 150 Si Tps, Fr Wat @ 50  
150 - 1.30 Si Tr F Sa, Wet  
- 1.30 NFP Sloughing

21+250 55.00 Rt C/L D-800 HA

0 - 100 Si Tps  
100 - 1.10 Si W F Sa  
- 1.10 NFP Blds

21+250 19.00 Rt C/L D-700 HA

0 - 150 Si Tps  
150 - 1.30 Si Tr F Sa, Wet  
- 1.30 NFP Sloughing

21+250 0.30 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 1.50 Cl W Si, Wet  
1.50 - 1.60 Si Tr Cl, Wet, Fr Wat @ 1.60  
- 1.60 NFP BR

21+300 19.00 Rt C/L D-600 HA

0 - 150 Si Tps  
150 - 1.00 Si Tr F Sa, Wet  
- 1.00 NFP BR

21+300 27.00 Rt C/L D-800 HA

0 - 150 Si Tps  
150 - 700 Si W F Sa  
- 700 NFP BR

21+300 11.00 Rt C/L D-300 HA

0 - 100 Si Tps  
100 - 1.30 Si Tr F Sa, Wet, Fr Wat @ 500  
- 1.30 NFP BR

21+350 27.00 Rt C/L D-700 HA

0 - 150 Si Tps  
150 - 700 Si Tr F Sa  
- 700 NFP BR

21+350 11.00 Rt C/L D-200 HA

0 - 150 Si Tps  
- 150 NFP BR

21+350 19.00 Rt C/L D-500 HA

0 - 150 Si Tps  
150 - 800 Si Tr Cl, Moist  
- 800 NFP BR

21+400 27.00 Rt C/L D+600 HA

0 - 100 Si Tps  
- 100 NFP BR

21+400 19.00 Rt C/L D+300 HA

0 - 150 Si Tps  
- 150 NFP Blds

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

24+200 19.00 Rt C/L D-200 HA

0 - 200 Si Tps  
- 200 NFP BR

24+250 27.00 Rt C/L D+600 HA

0 - 100 Si Tps  
100 - 400 Si W F Sa  
- 400 NFP BR

24+250 11.00 Rt C/L D+200 HA

0 - 150 Si Tps  
150 - 1.30 F-Med Sa Tr Gr, Wet  
- 1.30 NFP Blds

24+250 19.00 Rt C/L D+300 HA

0 - 150 Si Tps  
150 - 1.00 F-Med Sa, Wet  
- 1.00 NFP Blds

24+300 19.00 Rt C/L D+1.20 HA

0 - 150 Si Tps  
150 - 700 F Sa W Si, Moist  
- 700 NFP BR

24+300 27.00 Rt C/L D+1.60 HA

0 - 150 Si Tps  
150 - 600 F Sa W Si, Moist  
- 600 NFP BR

24+300 11.00 Rt C/L D+700 HA

0 - 150 Si Tps  
150 - 650 F Sa Tr Si, Moist  
- 650 NFP Blds

24+350 11.00 Rt C/L D+2.00 HA

0 - 150 Si Tps  
- 150 NFP BR

24+350 19.00 Rt C/L D+4.00 HA

0 - 150 Si Tps  
- 150 NFP BR

24+350 27.00 Rt C/L D+6.00 HA

0 - 100 Si Tps  
- 100 NFP BR

24+400 0.30 Rt C/L D-0 HA

0 - 50 Moss  
50 - 2.00 Muckamor, Fr Wat @ 100  
2.00 - 2.10 Si Tr F Sa, Wet, Firm  
- 2.10 NFP

24+400 11.00 Rt C/L D-0 HA

0 - 50 Moss  
50 - 1.40 Muckamor, Fr Wat @ 100  
1.40 - 1.50 Si W F Sa, Wet, Firm  
- 1.50 NFP



**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

24+400 19.00 Rt C/L D+300 HA

0 - 150 Si Tps  
- 150 NFP BR

24+400 27.00 Rt C/L D+2.10 HA

0 - 150 Si Tps  
- 150 NFP BR

24+425 0.30 Rt C/L D-0 HA

0 - 50 Moss  
50 - 1.20 Muckamor, Fr Wat @ 100  
1.20 - 1.30 Si W F Sa, Wet, Firm  
- 1.30 NFP

24+425 19.00 Rt C/L D-0 HA

0 - 150 Si Tps W Org, Fr Wat @ 150  
150 - 1.60 Muckamor  
1.60 - 1.70 Si Tr F Sa, Wet, Firm  
- 1.70 NFP

24+425 27.00 Rt C/L D+200 HA

0 - 150 Si Tps  
150 - 1.80 F Sa W Si, Fr Wat @ 200  
- 1.80 NFP Sloughing

24+450 27.00 Rt C/L D+200 HA

0 - 150 Si Tps  
150 - 1.10 Si Tr F Sa, Fr Wat @ 300  
- 1.10 NFP Sloughing

24+450 11.00 Rt C/L D-0 HA

0 - 1.00 Muckamor, Fr Wat @ 100  
1.00 - 1.10 Si Tr F Sa, Wet, Firm  
- 1.10 NFP

24+450 19.00 Rt C/L D-0 HA

0 - 150 Si Tps W Org, Fr Wat @ 150  
150 - 300 Si Tr F Sa  
300 - 1.00 F Sa Tr Si, Wet  
- 1.00 NFP Sloughing

24+475 11.00 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 1.30 Muckamor, Fr Wat @ 200  
1.30 - 1.40 Si Tr F Sa, Wet, Firm  
- 1.40 NFP

24+475 19.00 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 1.20 Muckamor, Fr Wat @ 200  
1.20 - 1.30 Si Tr F Sa, Wet, Firm  
- 1.30 NFP

24+475 27.00 Rt C/L D+200 HA

0 - 150 Si Tps  
150 - 1.50 Si W F Sa, Fr Wat @ 400  
- 1.50 NFP Sloughing

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

24+500 19.00 Rt C/L D-0 HA

0 - 100 Si Tps, Fr Wat @ 25  
100 - 1.20 Muckamor  
1.20 - 1.30 Si Tr F Sa, Wet, Firm  
- 1.30 NFP

24+500 27.00 Rt C/L D-0 HA

0 - 150 Si Tps W Org, Fr Wat @ 100  
150 - 1.10 Si Tr F Sa  
- 1.10 NFP Sloughing

24+500 11.00 Rt C/L D-0 HA

0 - 150 Si Tps, Fr Wat @ 100  
150 - 1.20 Muckamor  
1.20 - 1.30 Si Tr F Sa, Wet, Firm  
- 1.30 NFP

24+500 0.30 Rt C/L D-0 HA

0 - 150 Si Tps, Fr Wat @ 100  
150 - 2.10 Muckamor  
2.10 - 2.20 Si Tr F Sa, Wet, Firm  
- 2.20 NFP

24+525 0.30 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 700 Muckamor, Fr Wat @ 200  
700 - 710 Si Tr F Sa, Firm  
- 710 NFP

24+525 38.00 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 1.00 Muckamor  
1.00 - 1.10 Si Tr F Sa, Firm  
- 1.10 NFP

24+525 19.00 Rt C/L D-0 HA

0 - 300 Wat  
300 - 1.00 Muckamor  
1.00 - 1.10 Si Tr F Sa, Firm  
- 1.10 NFP

24+550 19.00 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 1.10 Muckamor, Fr Wat @ 300  
1.10 - 1.20 Si Tr F Sa, Firm  
- 1.20 NFP

24+550 40.00 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 1.10 Si W F Sa, Fr Wat @ 300  
1.10 - 2.00 F Sa W Si  
- 2.00 NFP Sloughing

24+600 27.00 Rt C/L D-400 HA

0 - 150 Si Tps  
150 - 1.10 Si W F Sa, Fr Wat @ 700  
1.10 - 2.10 F Sa W Si, Wet  
- 2.10 NFP Sloughing

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111

July, 1998

24+600 19.00 Rt C/L D-200 HA

0 - 150 Si Tps  
150 - 1.30 Si W F Sa, Fr Wat @ 800  
1.30 - 2.30 F Sa W Si, Wet  
- 2.30 NFP Sloughing

24+600 11.00 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 1.40 Si W F Sa, Fr Wat @ 1.00  
1.40 - 2.50 F Sa W Si, Wet  
- 2.50 NFP Sloughing

24+650 11.00 Rt C/L D+200 HA

0 - 150 Si Tps  
150 - 300 Si Tr F Sa  
- 300 NFP BR

24+650 19.00 Rt C/L D+500 HA

0 - 150 Si Tps  
150 - 700 Si Tr F Sa  
- 700 NFP BR

24+650 27.00 Rt C/L D+500 HA

0 - 50 Moss  
- 50 NFP BR

24+700 11.00 Rt C/L D+500 HA

0 - 150 Si Tps  
150 - 400 Si Tr F Sa  
- 400 NFP BR

24+700 19.00 Rt C/L D+700 HA

0 - 50 Si Tps  
- 50 NFP BR

24+700 27.00 Rt C/L D+900 HA

0 - 50 Si Tps  
- 50 NFP BR

24+750 27.00 Rt C/L D+400 HA

0 - 150 Si Tps  
150 - 800 F Sa W Si  
- 800 NFP Blds

24+750 11.00 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 1.40 F Sa W Si, Wet  
- 1.40 NFP Blds

24+750 19.00 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 800 F Sa W Si  
- 800 NFP Blds

24+800 27.00 Rt C/L D+1.00 HA

0 - 150 Si Tps  
- 150 NFP Blds

24+800 11.00 Rt C/L D+300 HA

0 - 200 Si Tps  
- 200 NFP Blds

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

25+520 19.00 Rt C/L D-0 HA

0 - 100 Si Tps  
100 - 700 Si Tr F Sa, Wet  
- 700 NFP BR

25+520 27.00 Rt C/L D-0 HA

0 - 100 Si Tps  
100 - 300 Si Tr F Sa, Moist  
- 300 NFP BR

25+520 11.00 Rt C/L D-0 HA

0 - 100 Si Tps  
100 - 500 Si W F Sa, Wet  
- 500 NFP BR

25+530 27.00 Rt C/L D-0 HA

0 - 100 Si Tps  
100 - 900 Si Tr F Sa, Wet, Fr Wat @ 800  
- 900 NFP Blds

25+530 19.00 Rt C/L D-0 HA

0 - 100 Si Tps  
100 - 400 Si Tr F Sa, Wet  
- 400 NFP BR

25+530 11.00 Rt C/L D-0 HA

0 - 100 Si Tps  
100 - 1.50 F Sa Tr Si, Wet, Fr Wat @ 600

25+540 27.00 Rt C/L D-0 HA

0 - 100 Si Tps  
100 - 500 Si W F Sa, Wet  
- 500 NFP Blds

25+540 19.00 Rt C/L D-100 HA

0 - 100 Si Tps  
100 - 1.50 Si W F Sa, Wet, Fr Wat @ 500

25+540 11.00 Rt C/L D-0 HA

0 - 100 Si Tps  
100 - 1.30 Si W F Sa Tr Gr, Wet,  
Fr Wat @ 500  
- 1.30 NFP Blds

25+550 11.00 Rt C/L D-0 HA

0 - 100 Si Tps  
100 - 1.50 Si W F Sa, Wet, Fr Wat @ 500

25+550 19.00 Rt C/L D-0 HA

0 - 100 Si Tps  
100 - 1.10 Si W F Sa, Wet, Fr Wat @ 300  
- 1.10 NFP Blds

25+550 27.00 Rt C/L D-0 HA

0 - 100 Si Tps  
100 - 800 Si W F Sa, Wet  
- 800 NFP Blds

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

25+600 11.00 Rt C/L D-0 HA

0 - 100 Si Tps  
100 - 400 Si Tr F Sa  
- 400 NFP Blds

25+600 19.00 Rt C/L D-0 HA

0 - 100 Si Tps  
100 - 1.50 F-Med Sa Tr Gr & Si, Wet,  
Fr Wat @ 800  
- 1.50 NFP Blds

25+600 27.00 Rt C/L D-0 HA

0 - 100 Si Tps  
100 - 900 F-Med Sa Tr Si, Wet  
900 - 1.30 F Sa W Si, Wet, Fr Wat @ 1.00  
1.30 - 1.50 F Sa Tr Gr, Wet  
- 1.50 NFP Sloughing

25+610 19.00 Rt C/L D-2.10 HA

0 - 100 Si Tps  
100 - 1.50 F-Med Sa Tr Gr & Si, Moist

25+610 27.00 Rt C/L D-2.40 HA

0 - 100 Si Tps  
100 - 600 F-Med Sa Tr Si, Wet  
- 600 NFP Blds

25+610 11.00 Rt C/L D-1.80 HA

0 - 100 Si Tps  
100 - 400 Si Tr F Sa  
- 400 NFP BR

25+620 27.00 Rt C/L D-2.40 HA

0 - 150 Si Tps  
150 - 700 F-Med Sa Tr Si, Wet  
- 700 NFP Blds

25+620 19.00 Rt C/L D-2.10 HA

0 - 100 Si Tps  
100 - 1.50 F Sa Tr Si, Wet

25+620 11.00 Rt C/L D-1.80 HA

0 - 200 Si Tps  
- 200 NFP BR

25+630 19.00 Rt C/L D-2.10 HA

0 - 100 Si Tps  
100 - 500 Si Tr F Sa, Moist  
- 500 NFP Blds

25+630 27.00 Rt C/L D-2.10 HA

0 - 100 Si Tps  
100 - 600 Si Tr F Sa, Wet  
- 600 NFP BR

25+630 11.00 Rt C/L D-2.00 HA

0 - 100 Si Tps  
100 - 400 Si Tr F Sa  
- 400 NFP BR

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

25+640 27.00 Rt C/L D-500 HA

0 - 50 Moss  
- 50 NFP BR

25+640 19.00 Rt C/L D-300 HA

0 - 500 Si Tps  
- 500 NFP BR

25+640 11.00 Rt C/L D-0 HA

0 - 100 Si Tps  
100 - 300 Si Tr F Sa, Wet  
- 300 NFP Blds

25+660 19.00 Rt C/L D-0 HA

0 - 100 Si Tps  
100 - 300 Si Tr F Sa, Moist  
- 300 NFP BR

25+660 27.00 Rt C/L D-200 HA

0 - 100 Si Tps  
- 100 NFP BR

25+660 11.00 Rt C/L D-0 HA

0 - 50 Si Tps  
- 50 NFP BR

25+680 11.00 Rt C/L D-300 HA

0 - 150 Si Tps  
150 - 300 Si Tr F Sa, Wet  
- 300 NFP BR

25+680 19.00 Rt C/L D-0 HA

0 - 50 Si Tps  
- 50 NFP BR

25+680 27.00 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 400 Si Tr F Sa, Wet  
- 400 NFP BR

25+700 11.00 Rt C/L D-200 HA

0 - 50 Moss  
- 50 NFP BR

25+700 19.00 Rt C/L D-200 HA

0 - 150 Si Tps  
- 150 NFP BR

25+700 27.00 Rt C/L D-0 HA

0 - 100 Si Tps  
- 100 NFP BR

25+720 11.00 Rt C/L D-300 HA

0 - 50 Si Tps  
- 50 NFP BR

25+720 19.00 Rt C/L D-300 HA

0 - 50 Si Tps  
- 50 NFP BR

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

25+720 27.00 Rt C/L D-300 HA

0 - 300 Si Tps, Wet  
- 300 NFP BR

25+740 19.00 Rt C/L D+200 HA

0 - 100 Si Tps  
- 100 NFP BR

25+740 27.00 Rt C/L D-300 HA

0 - 50 Si Tps  
- 50 NFP BR

25+740 11.00 Rt C/L D+100 HA

0 - 150 Si Tps  
- 150 NFP BR

25+760 11.00 Rt C/L D-0 HA

0 - 150 Si Tps  
- 150 NFP BR

25+760 19.00 Rt C/L D+100 HA

0 - 150 Si Tps  
- 150 NFP Blds

25+760 27.00 Rt C/L D+200 HA

0 - 50 Si Tps  
- 50 NFP BR

25+780 11.00 Rt C/L D+300 PA

0 - 150 Si Tps  
150 - 1.35 F-Med Sa W Si Tr Blds & Cob  
& Gr  
1.35 - 1.90 F Sa W Si, Wet @ 1.90  
1.90 - 2.60 F-Med Sa W Si Tr Blds & Cob  
& Gr  
- 2.60 NFP BR

25+780 19.00 Rt C/L D+600 PA

0 - 150 Si Tps  
150 - 1.80 Si W F Sa Tr Blds & Cob & Gr  
1.80 - 2.13 F-Med Sa Tr Blds & Cob & Gr  
& Si  
- 2.13 NFP BR

25+780 27.00 Rt C/L D+200 HA

0 - 150 Si Tps  
150 - 600 Si Tr F Sa, Moist  
- 600 NFP Blds

25+800 19.00 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 800 Si Tr F Sa & Cl, Moist  
- 800 NFP Blds

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

25+800 11.00 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 1.30 Si Tr Gr & F Sa, Wet,  
Fr Wat @ 800\*  
1.30 - 1.40 Si W F Sa, Wet  
1.40 - 1.80 F Sa Tr Si, Wet  
- 1.80 NFP Blds

\* Sample Depth = 500 - 800

w = 18 %

25+800 27.00 Rt C/L D-0 HA

0 - 200 Si Tps  
200 - 800 Si Tr F Sa, Wet  
- 800 NFP Blds

25+820 11.00 Rt C/L D-200 HA

0 - 50 Moss  
- 50 NFP BR

25+820 19.00 Rt C/L D-600 HA

0 - 50 Moss  
- 50 NFP BR

25+820 27.00 Rt C/L D-800 HA

0 - 50 Moss  
- 50 NFP BR

25+840 11.00 Rt C/L D-100 HA

0 - 50 Moss  
- 50 NFP BR

25+840 27.00 Rt C/L D-5.00 HA

0 - 150 Si Tps  
- 150 NFP Blds

25+840 19.00 Rt C/L D-1.80 HA

- 0 BR

25+850 19.00 Rt C/L D-5.00 HA

0 - 50 Moss  
50 - 150 Si Tps  
- 150 NFP Blds

25+850 11.00 Rt C/L D-3.70 HA

- 0 BR

25+850 27.00 Rt C/L D-5.00 HA

0 - 3.00 Muckamor  
- 3.00 NFP BR

25+860 27.00 Rt C/L D-5.00 HA

0 - 3.00 Muckamor  
- 3.00 NFP BR



**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

25+860 19.00 Rt C/L D-5.00 HA

0 - 100 Wat  
100 - 1.70 Muckamor  
- 1.70 NFP BR

25+860 11.00 Rt C/L D-1.30 HA

0 - 50 Moss  
- 50 NFP Blds

25+870 11.00 Rt C/L D-2.00 HA

- 0 BR

25+870 19.00 Rt C/L D-4.80 HA

0 - 1.10 Muckamor  
- 1.10 NFP BR

25+870 27.00 Rt C/L D-5.00 HA

0 - 1.10 Muckamor  
- 1.10 NFP BR

25+875 11.00 Rt C/L D-3.00 HA

- 0 BR

25+875 19.00 Rt C/L D-4.80 HA

0 - 50 Wat  
50 - 1.10 Muckamor\*  
- 1.10 NFP BR

\* Sample Depth = 500 - 800

w = 1155 %

25+875 27.00 Rt C/L D-5.00 HA

0 - 80 Wat  
80 - 1.20 Muckamor  
- 1.20 NFP BR

25+900 11.00 Rt C/L D-1.00 HA

- 0 BR

25+900 27.00 Rt C/L D-3.00 HA

0 - 150 Wat  
150 - 2.00 Muckamor  
- 2.00 NFP BR

25+900 19.00 Rt C/L D-3.00 HA

0 - 200 Moss  
- 200 NFP BR

25+925 11.00 Rt C/L D-4.00 HA

0 - 50 Moss  
- 50 NFP BR

25+925 27.00 Rt C/L D-3.00 HA

0 - 900 Muckamor  
- 900 NFP BR

25+925 19.00 Rt C/L D-2.40 HA

0 - 50 Moss  
- 50 NFP BR

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

25+940 27.00 Rt C/L D-2.00 HA

- 0 BR

25+940 11.00 Rt C/L D-1.20 HA

0 - 100 Si Tps  
- 100 NFP BR

25+940 19.00 Rt C/L D-2.10 HA

0 - 100 Si Tps  
100 - 600 Si W F Sa  
- 600 NFP BR

25+950 19.00 Rt C/L D-1.60 HA

0 - 150 Si Tps  
150 - 600 Si W F Sa  
- 600 NFP Blds

25+950 11.00 Rt C/L D-1.00 HA

0 - 100 Si Tps  
- 100 NFP BR

25+950 27.00 Rt C/L D-300 HA

0 - 150 Si Tps  
- 150 NFP BR

25+960 27.00 Rt C/L D+400 HA

- 0 BR

25+960 11.00 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 600 Si W F Sa  
- 600 NFP BR

25+960 19.00 Rt C/L D+1.00 HA

0 - 100 Si Tps  
100 - 800 Si W F Sa  
- 800 NFP Blds

25+980 27.00 Rt C/L D+700 HA

0 - 300 Si Tps W Org  
- 300 NFP Blds

25+980 19.00 Rt C/L D+400 HA

0 - 300 Si Tps W Org  
300 - 1.00 Si Tr F Sa & Org  
- 1.00 NFP Blds

25+980 11.00 Rt C/L D+200 HA

0 - 300 Si Tps W Org  
300 - 1.00 Si Tr F Sa & Org  
- 1.00 NFP Blds

26+000 19.00 Rt C/L D+400 HA

0 - 150 Si Tps  
- 150 NFP BR

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

26+000 27.00 Rt C/L D+400 HA

0 - 150 Si Tps  
150 - 250 Si Tr F Sa  
- 250 NFP BR

26+000 11.00 Rt C/L D-0 HA

0 - 400 Wat  
400 - 1.40 Muckamor  
1.40 - 1.50 F Sa W Si, Wet  
- 1.50 NFP BR

26+025 11.00 Rt C/L D-0 HA

0 - 100 Wat  
100 - 1.00 Muckamor  
1.00 - 1.20 F Sa Tr Si, Wet  
- 1.20 NFP BR

26+025 19.00 Rt C/L D-0 HA

0 - 50 Wat  
50 - 1.00 Muckamor  
1.00 - 1.20 F-Med Sa Tr Si, Wet  
- 1.20 NFP BR

26+025 27.00 Rt C/L D+200 HA

0 - 150 Si Tps  
- 150 NFP BR

10+010 27.00 Rt C/L D+400 HA

0 - 150 Si Tps  
150 - 450 Si Tr F Sa  
- 450 NFP BR

10+010 19.00 Rt C/L D+200 HA

0 - 150 Si Tps  
150 - 600 Si W F Sa  
- 600 NFP Blds

10+010 11.00 Rt C/L D-0 HA

0 - 200 Si Tps  
200 - 500 Si Tr F Sa  
- 500 NFP Blds

10+020 27.00 Rt C/L D+300 HA

0 - 150 Si Tps  
150 - 300 Si W F Sa  
- 300 NFP BR

10+020 11.00 Rt C/L D+200 HA

0 - 200 Si Tps  
- 200 NFP BR

10+020 19.00 Rt C/L D+300 HA

0 - 150 Si Tps  
150 - 250 Si Tr F Sa  
- 250 NFP BR

10+040 19.00 Rt C/L D+300 HA

0 - 150 Si Tps  
- 150 NFP BR

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

10+040 11.00 Rt C/L D+200 HA

0 - 150 Si Tps  
150 - 400 Si Tr F Sa  
- 400 NFP Blds

10+040 27.00 Rt C/L D-0 HA

0 - 250 Si Tps  
- 250 NFP BR

10+060 27.00 Rt C/L D+300 HA

0 - 150 Si Tps  
150 - 600 Si Tr F Sa  
- 600 NFP BR

10+060 19.00 Rt C/L D+300 HA

0 - 50 Moss  
- 50 NFP BR

10+060 11.00 Rt C/L D+200 HA

0 - 100 Si Tps  
- 100 NFP BR

10+080 27.00 Rt C/L D+200 HA

0 - 150 Si Tps  
150 - 500 Si Tr F Sa  
- 500 NFP BR

10+080 19.00 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 400 Si Tr F Sa  
- 400 NFP BR

10+080 11.00 Rt C/L D-0 HA

0 - 150 Si Tps  
150 - 400 Si W F Sa, Wet  
- 400 NFP Blds

10+100 19.00 Rt C/L D+300 HA

0 - 150 Si Tps  
150 - 1.10 Si Tr F Sa & Cl  
- 1.10 NFP BR

10+100 11.00 Rt C/L D+100 HA

0 - 150 Si Tps  
150 - 1.40 Cl W F Sa Tr Si, Fr Wat @ 1.40  
1.40 - 1.50 F Sa Tr Gr & Cl  
- 1.50 NFP BR

10+100 27.00 Rt C/L D+400 HA

0 - 150 Si Tps  
150 - 400 Si Tr F Sa  
- 400 NFP BR

10+120 11.00 Rt C/L D+200 HA

0 - 150 Si Tps  
150 - 250 Si W F Sa  
- 250 NFP BR

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

11+760 11.00 Rt C/L D+200 HA

0 - 100 Si Tps  
- 100 NFP BR

11+770 11.00 Rt C/L D-0 HA

0 - 150 Si Tps  
- 150 NFP BR

11+770 19.00 Rt C/L D+300 HA

0 - 50 Si Tps  
- 50 NFP BR

11+770 27.00 Rt C/L D-0 HA

0 - 100 Si Tps  
- 100 NFP BR

11+780 11.00 Rt C/L D-100 PA

0 - 80 Asph  
80 - 700 F-Med Sa Tr Gr & Si  
- 700 NFP RF

11+780 19.00 Rt C/L D-200 HA

0 - 70 Asph  
70 - 1.50 F-Med Sa Tr Gr & Si  
- 1.50 NFP RF

11+780 27.00 Rt C/L D-300 PA

0 - 60 Asph  
60 - 1.40 F-Med Sa Tr Gr & Si  
- 1.40 NFP RF

11+790 11.00 Rt C/L D-0 HA

- 0 RF

11+790 27.00 Rt C/L D+2.00 HA

0 - 100 Si Tps  
100 - 1.10 F-Med Sa W Gr  
- 1.10 NFP RF

11+790 19.00 Rt C/L D+1.30 HA

0 - 400 F-Med Sa W Gr  
- 400 NFP RF

11+800 29.00 Rt C/L D-0 HA

0 - 250 Wat  
250 - 800 Muckamor  
800 - 900 F Sa Tr Si, Firm  
- 900 NFP

11+800 19.00 Rt C/L D-0 HA

0 - 300 Wat  
300 - 1.00 Muckamor  
1.00 - 1.30 F Sa Tr Si, Firm  
- 1.30 NFP

11+800 9.00 Rt C/L D-0 HA

0 - 300 Wat  
300 - 900 Muckamor  
- 900 NFP

**Northbound Lanes**

Station 17+320 to 26+025 (Seguin Twp.) and 10+000 to 12+280 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

**11+825 11.00 Rt C/L D-0 HA**

0 - 250 Wat  
250 - 800 Muckamor  
800 - 900 F Sa W Si, Firm

**11+825 31.00 Rt C/L D-0 HA**

0 - 200 Wat  
200 - 700 Muckamor  
700 - 900 F Sa Tr Si & Cl, Firm  
- 900 NFP

**11+825 19.00 Rt C/L D-0 PA**

0 - 225 Wat  
225 - 1.05 Cl W Si Tr Sa, Stiff  
1.05 - 2.00 F Sa W Si, Firm  
- 2.00 NFP Blds

**11+850 33.00 Rt C/L D+400 HA**

0 - 150 Si Tps  
150 - 700 F-Med Sa Tr Si  
- 700 NFP Blds

**11+850 19.00 Rt C/L D-0 HA**

0 - 150 Wat  
150 - 800 Muckamor  
- 800 NFP

**11+850 5.00 Rt C/L D-0 HA**

0 - 600 Wat  
600 - 900 Muckamor  
- 900 NFP Blds

**11+890 11.00 Rt C/L D-200 HA**

0 - 150 Si Tps  
150 - 300 Si Tr F Sa  
- 300 NFP BR

**11+890 19.00 Rt C/L D-200 HA**

0 - 150 Si Tps  
150 - 400 Si Tr F Sa  
- 400 NFP BR

**11+890 27.00 Rt C/L D-0 HA**

0 - 150 Si Tps  
150 - 500 Si Tr F Sa  
- 500 NFP Blds

**11+900 27.00 Rt C/L D-200 HA**

0 - 150 Si Tps  
- 150 NFP BR

**11+900 11.00 Rt C/L D-600 HA**

0 - 100 Si Tps  
100 - 400 Si Tr F Sa  
- 400 NFP BR

**Southbound Lanes**

Station 17+320 to 26+030 (Seguin Twp.) and 10+000 to 12+300 (McDougall Twp.),  
Referenced to C/L of Median

981-1111

July, 1998

17+900 20.00 Lt C/L D-3.50 PA

0 - 430 Asph  
430 - 620 Cr Gr  
620 - 1.10 F-Med Sa Tr Gr  
- 1.10 NFP BR

18+000 20.00 Lt C/L D-500 PA

0 - 370 Asph  
370 - 570 Cr Gr  
570 - 850 F-Med Sa Tr Gr  
- 850 NFP Sh Rk

17+900 14.00 Lt C/L D-350 PA

0 - 380 Asph  
380 - 560 Cr Gr  
560 - 900 F-Med Sa Tr Gr  
- 900 NFP Sh Rk/BR

18+050 20.00 Lt C/L D-1.25 PA

0 - 410 Asph  
410 - 600 Cr Gr  
600 - 900 F-Med Sa Tr Gr  
- 900 NFP RF

17+950 20.00 Lt C/L D-5.50 PA

0 - 400 Asph  
400 - 610 Cr Gr  
610 - 1.20 F-Med Sa Tr Gr  
- 1.20 NFP BR

18+050 14.00 Lt C/L D+1.00 PA

0 - 360 Asph  
360 - 540 Cr Gr  
540 - 1.00 F-Med Sa Tr Gr  
1.00 - 1.40 F-Med Sa W Si  
- 1.40 NFP Sh Rk

17+950 14.00 Lt C/L D-550 PA

0 - 350 Asph  
350 - 540 Cr Gr  
540 - 1.10 F-Med Sa Tr Gr  
- 1.10 NFP Sh Rk

18+100 14.00 Lt C/L D+1.00 PA

0 - 430 Asph  
430 - 580 Cr Gr  
580 - 1.30 F-Med Sa Tr Gr  
- 1.30 NFP Sh Rk

18+000 14.00 Lt C/L D-300 PA

0 - 330 Asph  
330 - 520 Cr Gr  
520 - 1.10 F-Med Sa Tr Gr  
- 1.10 NFP Sh Rk

18+100 20.00 Lt C/L D-1.00 PA

0 - 500 Asph  
500 - 700 Cr Gr  
700 - 1.00 F-Med Sa Tr Gr  
- 1.00 NFP RF

**Southbound Lanes**

Station 17+320 to 26+030 (Seguin Twp.) and 10+000 to 12+300 (McDougall Twp.),  
Referenced to C/L of Median

981-1111

July, 1998

18+150 14.00 Lt C/L D+1.30 PA

0 - 460 Asph  
460 - 610 Cr Gr  
610 - 900 F-Med Sa Tr Gr  
- 900 NFP BR

18+250 20.00 Lt C/L D+1.20 PA

0 - 300 Asph  
300 - 490 Cr Gr  
490 - 900 F-Med Sa Tr Gr  
- 900 NFP BR

18+150 20.00 Lt C/L D-1.30 PA

0 - 630 Asph  
630 - 820 Cr Gr  
820 - 1.30 F-Med Sa Tr Gr  
- 1.30 NFP RF

18+300 14.00 Lt C/L D+500 PA

0 - 400 Asph  
400 - 550 Cr Gr  
550 - 750 F-Med Sa Tr Gr  
- 750 NFP Sh Rk

18+200 14.00 Lt C/L D+1.10 PA

0 - 460 Asph  
460 - 610 Cr Gr  
610 - 1.00 F-Med Sa Tr Gr  
- 1.00 NFP Sh Rk

18+300 20.00 Lt C/L D+900 PA

0 - 390 Asph  
390 - 590 Cr Gr  
590 - 1.00 F-Med Sa Tr Gr  
- 1.00 NFP BR

18+200 20.00 Lt C/L D+800 PA

0 - 310 Asph  
310 - 510 Cr Gr  
510 - 900 F-Med Sa Tr Gr  
- 900 NFP BR

18+350 14.00 Lt C/L D-1.80 PA

0 - 370 Asph  
370 - 520 Cr Gr  
520 - 800 F-Med Sa Tr Gr  
- 800 NFP BR

18+250 14.00 Lt C/L D+1.50 PA

0 - 440 Asph  
440 - 580 Cr Gr  
580 - 1.00 F-Med Sa Tr Gr  
- 1.00 NFP BR

18+350 20.00 Lt C/L D-1.10 PA

0 - 310 Asph  
310 - 500 Cr Gr  
500 - 550 F-Med Sa Tr Gr  
- 550 NFP BR



**Southbound Lanes**

Station 17+320 to 26+030 (Seguin Twp.) and 10+000 to 12+300 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

18+550 19.00 Lt C/L D-2.30 HA

0 - 100 Si Tps  
100 - 300 F Sa Tr Si  
- 300 NFP BR

18+570 27.00 Lt C/L D+600 HA

0 - 100 Si Tps  
100 - 400 Si W F Sa  
- 400 NFP BR

18+570 19.00 Lt C/L D+1.30 HA

- 0 BR

18+570 11.00 Lt C/L D+500 PA

0 - 330 Asph  
330 - 530 Cr Gr  
530 - 1.10 F-Med Sa Tr Gr  
- 1.10 NFP BR

18+570 5.50 Lt C/L D+500 PA

0 - 410 Asph  
410 - 560 Cr Gr  
560 - 1.00 F-Med Sa Tr Gr  
- 1.00 NFP BR

18+580 27.00 Lt C/L D-0 HA

- 0 BR

18+580 19.00 Lt C/L D+1.00 HA

- 0 BR

18+590 27.00 Lt C/L D-4.50 HA

0 - 200 Wat  
200 - 500 Muckamor  
500 - 600 Si Tr F Sa, Firm  
- 600 NFP

18+590 2.00 Lt C/L D-0 PA

0 - 330 Asph  
330 - 480 Cr Gr  
480 - 600 F-Med Sa Tr Gr  
- 600 NFP BR

18+590 19.00 Lt C/L D-2.50 HA

- 0 RF

18+600 19.00 Lt C/L D-2.70 HA

- 0 RF

18+600 27.00 Lt C/L D-4.50 HA

0 - 300 Wat  
300 - 1.50 Muckamor  
1.50 - 1.60 F Sa Tr Si, Firm  
- 1.60 NFP

18+600 11.00 Lt C/L D-400 HA

0 - 100 Si Tps  
100 - 400 F-Med Sa Tr Gr  
- 400 NFP RF

**Southbound Lanes**

Station 17+320 to 26+030 (Seguin Twp.) and 10+000 to 12+300 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

18+625 33.00 Lt C/L D-4.50 HA

0 - 50 Wat  
50 - 4.50 Muckamor  
4.50 - 6.00 Si W Cl, Wet, Soft  
- 6.00 NFP

18+625 19.00 Lt C/L D-4.50 HA

0 - 500 Muckamor  
- 500 NFP RF

18+625 11.00 Lt C/L D-2.00 HA

0 - 100 Si Tps  
- 100 NFP RF

18+650 30.00 Lt C/L D-4.00 HA

0 - 300 Wat  
300 - 3.70 Muckamor  
- 3.70 NFP Blds

18+650 32.00 Lt C/L D-4.00 PA

0 - 150 Wat  
150 - 2.74 Muckamor  
2.74 - 3.28 Cl W Si Tr Sa Tr Org, Soft, Wet  
3.28 - 3.81 Sa, Loose, Wet  
3.81 - 5.79 Cl W Si, Firm  
5.79 - 5.84 Sa W Si, Compact  
- 5.84 NFP BR

18+650 19.00 Lt C/L D-4.00 HA

0 - 5.70 Muckamor  
5.70 - 6.20 Si W Cl, Wet, Soft

18+650 11.00 Lt C/L D-3.00 HA

0 - 80 Si Tps  
- 80 NFP RF

18+675 11.00 Lt C/L D-3.50 HA

0 - 1.40 Muckamor  
1.40 - 2.00 Si W F Sa Tr Cl & Org  
2.00 - 2.80 F Sa W Si, Firm  
- 2.80 NFP

18+675 27.00 Lt C/L D-300 HA

0 - 100 Si Tps  
100 - 500 Si W F Sa  
- 500 NFP Blds

18+675 19.00 Lt C/L D-3.50 HA

0 - 900 Muckamor, Fr Wat @ 0  
900 - 1.10 Si Tr Sa & Cl  
1.10 - 1.30 Si W Cl Tr F Sa  
- 1.30 NFP Blds

18+700 11.00 Lt C/L D-400 HA

0 - 100 Si Tps, Fr Wat @ 100  
100 - 1.30 Si W F Sa  
1.30 - 1.80 Cl W Si, Moist, Stiff  
- 1.80 NFP Sloughing

**Southbound Lanes**

Station 17+320 to 26+030 (Seguin Twp.) and 10+000 to 12+300 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

18+700 27.00 Lt C/L D+2.00 HA

0 - 100 Si Tps  
100 - 1.00 Si Tr F Sa, Wet, Fr Wat @ 300  
- 1.00 NFP BR

18+700 19.00 Lt C/L D+1.50 HA

0 - 100 Wd Chips  
100 - 1.70 Si Tr F Sa & Cl, Wet  
1.70 - 1.90 Si W Gr & F Sa, Wet  
- 1.90 NFP BR

18+720 19.00 Lt C/L D+500 HA

0 - 50 Si Tps  
50 - 300 F-Med Sa, Wet  
300 - 600 Si W F Sa, Wet, Fr Wat @ 400  
600 - 900 Si W F Sa Tr Gr, Wet  
- 900 NFP BR

18+720 27.00 Lt C/L D+1.50 HA

0 - 150 Si Tps  
150 - 500 Si Tr F Sa  
- 500 NFP BR

18+720 11.00 Lt C/L D+400 HA

0 - 150 Si Tps  
150 - 400 F-Med Sa Tr Si  
- 400 NFP BR

18+740 11.00 Lt C/L D+1.50 HA

0 - 150 Si Tps  
150 - 400 Si Tr F Sa  
400 - 1.20 Si Tr F Sa & Cl  
- 1.20 NFP Blds

18+740 27.00 Lt C/L D+1.80 HA

0 - 50 Cr Gr  
50 - 300 F Sa W Si Tr Gr  
300 - 600 F Sa Tr Gr & Si  
- 600 NFP BR

18+740 19.00 Lt C/L D+1.70 HA

0 - 100 Si Tps  
100 - 500 Si Tr F Sa  
500 - 650 Si  
- 650 NFP BR

18+750 27.00 Lt C/L D+1.50 HA

0 - 100 Si Tps  
100 - 900 Si Tr F Sa  
- 900 NFP Blds

18+750 19.00 Lt C/L D+1.40 HA

0 - 150 Cr Gr  
150 - 800 F-Med Sa Tr Si  
800 - 850 F-Med Sa Tr Gr & Si  
- 850 NFP BR

**Southbound Lanes**

Station 17+320 to 26+030 (Seguin Twp.) and 10+000 to 12+300 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

20+840 27.00 Lt C/L D+600 HA

0 - 100 Si Tps  
100 - 400 Si Tr F Sa, Moist  
- 400 NFP BR

20+870 27.00 Lt C/L D+1.30 HA

0 - 150 Si Tps  
150 - 500 Si Tr F Sa, Moist  
- 500 NFP BR

20+840 19.00 Lt C/L D+400 HA

0 - 100 Si Tps  
100 - 300 Si Tr F Sa, Moist  
- 300 NFP BR

20+870 11.00 Lt C/L D+400 HA

0 - 150 Si Tps  
150 - 500 Si Tr F Sa, Moist  
- 500 NFP Blds

20+840 11.00 Lt C/L D+300 HA

0 - 100 Si Tps  
- 100 NFP BR

20+870 19.00 Lt C/L D+800 HA

0 - 100 Si Tps  
100 - 300 Si Tr F Sa, Moist  
- 300 NFP BR

20+860 19.00 Lt C/L D+2.40 HA

0 - 150 Si Tps  
150 - 600 Si Tr F Sa, Moist  
- 600 NFP BR

20+880 27.00 Lt C/L D+1.50 HA

0 - 150 Si Tps  
150 - 600 Si Tr F Sa, Moist  
- 600 NFP BR

20+860 27.00 Lt C/L D+2.70 HA

0 - 150 Si Tps  
150 - 300 Si Tr F Sa, Moist  
- 300 NFP BR

20+880 11.00 Lt C/L D+700 HA

0 - 150 Si Tps  
150 - 800 Si Tr F Sa, Wet  
800 - 900 Si Tr Gr & F Sa, Wet  
- 900 NFP BR

20+860 11.00 Lt C/L D+2.00 HA

0 - 150 Si Tps  
150 - 600 Si Tr F Sa, Moist  
- 600 NFP BR

20+880 19.00 Lt C/L D+900 HA

0 - 150 Si Tps  
150 - 800 Si Tr F Sa, Wet  
- 800 NFP BR

**Southbound Lanes**

Station 17+320 to 26+030 (Seguin Twp.) and 10+000 to 12+300 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

20+890 11.00 Lt C/L D-0 HA

0 - 150 Si Tps  
150 - 500 Si Tr F Sa, Moist  
- 500 NFP Blds

20+890 19.00 Lt C/L D-300 HA

0 - 150 Si Tps  
150 - 400 Si Tr F Sa, Moist  
- 400 NFP BR

20+890 27.00 Lt C/L D-0 HA

0 - 150 Si Tps  
- 150 NFP BR

20+900 19.00 Lt C/L D-600 HA

0 - 150 Si Tps  
150 - 900 Si Tr F Sa, Moist  
- 900 NFP BR

20+900 27.00 Lt C/L D-500 HA

0 - 150 Si Tps  
150 - 800 Si Tr F Sa, Moist  
- 800 NFP BR

20+900 11.00 Lt C/L D-0 HA

0 - 150 Si Tps  
150 - 900 Si Tr F Sa, Moist  
- 900 NFP BR

20+950 19.00 Lt C/L D+2.10 HA

0 - 150 Si Tps  
- 150 NFP BR

20+950 27.00 Lt C/L D+2.00 HA

0 - 150 Si Tps  
150 - 400 Si Tr F Sa, Moist  
- 400 NFP BR

20+950 11.00 Lt C/L D+400 HA

0 - 200 Si Tps  
- 200 NFP BR

21+000 19.00 Lt C/L D-0 HA

0 - 150 Si Tps, Fr Wat @ 100  
150 - 1.30 Si W F Sa Tr Cl  
- 1.30 NFP Sloughing

21+000 27.00 Lt C/L D-0 HA

0 - 150 Si Tps  
150 - 1.30 Si W F Sa Tr Cl  
- 1.30 NFP Sloughing

21+000 61.00 Lt C/L D+11.50 HA

0 - 80 Si Tps  
- 80 NFP BR

**Southbound Lanes**

Station 17+320 to 26+030 (Seguin Twp.) and 10+000 to 12+300 (McDougall Twp.),  
Referenced to C/L of Median

981-1111

July, 1998

21+050 19.00 Lt C/L D-500 HA

0 - 150 Si Tps  
150 - 1.30 Si Tr F Sa, Wet, Fr Wat @ 300  
1.30 - 1.90 Cl Tr Si, Firm  
- 1.90 NFP BR

21+050 27.00 Lt C/L D-500 HA

0 - 150 Si Tps  
150 - 1.70 F Sa W Si, Wet, Fr Wat @ 300  
- 1.70 NFP BR

21+050 61.00 Lt C/L D-0 HA

0 - 150 Si Tps  
- 150 NFP BR

21+100 0.30 Lt C/L D-0 HA

0 - 150 Si Tps  
150 - 1.80 F Sa W Si, Fr Wat @ 300  
- 1.80 NFP Sloughing

21+100 61.00 Lt C/L D+100 HA

0 - 150 Si Tps  
150 - 1.60 F Sa Tr Si, Wet, Fr Wat @ 200  
- 1.60 NFP Sloughing

21+100 19.00 Lt C/L D-0 HA

0 - 150 Si Tps  
150 - 1.40 F Sa Tr Si, Wet, Fr Wat @ 300  
- 1.40 NFP Sloughing

21+100 27.00 Lt C/L D-100 HA

0 - 150 Si Tps  
150 - 1.40 F Sa Tr Si, Wet, Fr Wat @ 300  
- 1.40 NFP Sloughing

21+150 19.00 Lt C/L D-200 HA

0 - 150 Si Tps  
150 - 1.40 Si Tr F Sa, Moist  
- 1.40 NFP BR

21+150 27.00 Lt C/L D+100 HA

0 - 100 Si Tps  
100 - 1.10 Si Tr F Sa, Moist  
- 1.10 NFP BR

21+150 46.00 Lt C/L D+400 HA

0 - 150 Si Tps  
150 - 1.20 Si Tr F Sa, Moist  
- 1.20 NFP BR

21+200 27.00 Lt C/L D+3.00 HA

0 - 400 Si Tps  
- 400 NFP BR

21+200 11.00 Lt C/L D+1.80 HA

0 - 150 Si Tps  
- 150 NFP BR

**Southbound Lanes**

Station 17+320 to 26+030 (Seguin Twp.) and 10+000 to 12+300 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

21+200 19.00 Lt C/L D+2.30 HA

0 - 150 Si Tps  
- 150 NFP BR

21+250 11.00 Lt C/L D+2.00 HA

0 - 50 Moss  
- 50 NFP BR

21+250 19.00 Lt C/L D+2.80 HA

0 - 150 Si Tps  
- 150 NFP BR

21+250 27.00 Lt C/L D+3.00 HA

0 - 150 Si Tps  
- 150 NFP BR

21+300 11.00 Lt C/L D+100 HA

0 - 100 Si Tps  
100 - 500 Si Tr Sa  
- 500 NFP Blds

21+300 19.00 Lt C/L D+300 HA

0 - 500 F-Med Sa W Gr  
- 500 NFP Blds

21+300 27.00 Lt C/L D+600 HA

0 - 400 F-Med Sa W Gr  
- 400 NFP BR

21+350 11.00 Lt C/L D+400 HA

0 - 50 Moss  
- 50 NFP BR

21+350 19.00 Lt C/L D+500 HA

0 - 150 Si Tps  
150 - 500 Si Tr Sa  
- 500 NFP BR

21+350 27.00 Lt C/L D+400 HA

0 - 150 Si Tps  
150 - 500 Si Tr Sa  
- 500 NFP BR

21+400 27.00 Lt C/L D+200 HA

0 - 150 Si Tps  
150 - 1.10 Si Tr F Sa  
- 1.10 NFP BR

21+400 11.00 Lt C/L D+100 HA

0 - 150 Si Tps  
150 - 700 Si W F Sa  
- 700 NFP BR

21+400 19.00 Lt C/L D+200 HA

0 - 150 Si Tps  
- 150 NFP BR

**Southbound Lanes**

Station 17+320 to 26+030 (Seguin Twp.) and 10+000 to 12+300 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

24+250 11.00 Lt C/L D-400 HA

0 - 150 Si Tps  
150 - 1.30 F-Med Sa Tr Si, Wet,  
Fr Wat @ 300  
1.30 - 2.00 F-Med Sa Tr Gr & Si, Wet  
- 2.00 NFP Sloughing

24+250 19.00 Lt C/L D-500 HA

0 - 150 Si Tps  
150 - 1.50 F-Med Sa Tr Si, Wet,  
Fr Wat @ 300  
1.50 - 2.00 F-Med Sa Tr Gr & Si, Wet  
- 2.00 NFP Sloughing

24+250 27.00 Lt C/L D-500 HA

0 - 150 Si Tps  
150 - 1.30 F-Med Sa Tr Si, Fr Wat @ 300  
1.30 - 2.00 F-Med Sa Tr Gr & Si, Wet  
- 2.00 NFP Sloughing

24+300 19.00 Lt C/L D-2.00 HA

0 - 150 Si Tps  
150 - 1.20 Si W F Sa, Wet, Fr Wat @ 350  
1.20 - 1.40 F Sa W Si, Wet  
- 1.40 NFP Sloughing

24+300 11.00 Lt C/L D-1.80 HA

0 - 150 Si Tps  
150 - 7(X) F Sa, Wet  
- 7(X) NFP Blds

24+300 27.00 Lt C/L D-2.00 HA

0 - 50 Moss  
50 - 2.00 Muckamor, Fr Wat @ 100  
2.00 - 2.10 Si Tr F Sa, Wet  
- 2.10 NFP

24+300 50.00 Lt C/L D-2.00 HA

0 - 50 Moss  
50 - 3.80 Muckamor, Fr Wat @ 100  
3.80 - 3.90 Si Tr F Sa, Wet, Firm  
- 3.90 NFP

24+350 11.00 Lt C/L D-800 HA

0 - 150 Si Tps  
150 - 300 Si W F Sa  
- 300 NFP Blds

24+350 19.00 Lt C/L D-1.70 HA

0 - 150 Si Tps  
150 - 400 Si W F Sa  
- 400 NFP Blds

24+350 27.00 Lt C/L D-2.20 HA

0 - 150 Si Tps  
150 - 500 Si W F Sa, Wet  
- 500 NFP Blds



**Southbound Lanes**

Station 17+320 to 26+030 (Seguin Twp.) and 10+000 to 12+300 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

**24+400 19.00 Lt C/L D-0 HA**

0 - 50 Moss  
50 - 2.20 Muckamor, Wet  
2.20 - 2.30 Si Tr F Sa, Wet, Firm  
- 2.30 NFP

**24+400 49.00 Lt C/L D-0 HA**

0 - 50 Moss  
50 - 3.60 Muckamor, Fr Wat @ 100  
3.60 - 3.70 Si W F Sa, Wet, Firm  
- 3.70 NFP

**24+425 19.00 Lt C/L D-0 HA**

0 - 450 Wat, Fr Wat @ 50  
450 - 1.80 Muckamor  
1.80 - 1.90 Si W F Sa, Wet, Firm  
- 1.90 NFP

**24+425 49.00 Lt C/L D-0 HA**

0 - 100 Wat  
100 - 2.10 Muckamor  
2.10 - 2.20 Si W F Sa, Wet, Firm  
- 2.20 NFP

**24+450 49.00 Lt C/L D-0 HA**

0 - 300 Si Tps W Org, Fr Wat @ 200  
300 - 2.60 Muckamor  
2.60 - 2.70 Si Tr F Sa, Wet, Firm  
- 2.70 NFP

**24+450 0.30 Lt C/L D-0 HA**

0 - 50 Moss  
50 - 1.80 Muckamor, Fr Wat @ 100  
1.80 - 1.90 Si Tr F Sa, Wet, Firm  
- 1.90 NFP

**24+450 19.00 Lt C/L D-0 HA**

0 - 300 Wat  
300 - 2.10 Muckamor  
2.10 - 2.20 Si Tr F Sa, Wet, Firm  
- 2.20 NFP

**24+475 19.00 Lt C/L D-0 HA**

0 - 150 Si Tps W Org  
150 - 1.50 Muckamor, Fr Wat @ 200  
1.50 - 1.60 Si Tr F Sa, Wet, Firm  
- 1.60 NFP

**24+475 49.00 Lt C/L D-0 HA**

0 - 300 Si Tps W Org, Fr Wat @ 300  
300 - 2.00 Muckamor  
2.00 - 2.10 Si Tr F Sa, Wet, Firm  
- 2.10 NFP

**24+500 19.00 Lt C/L D-0 HA**

0 - 250 Si Tps W Org, Fr Wat @ 200  
250 - 2.20 Muckamor  
2.20 - 2.30 Si Tr F Sa, Wet, Firm  
- 2.30 NFP

**Southbound Lanes**

Station 17+320 to 26+030 (Seguin Twp.) and 10+000 to 12+300 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

24+500 47.00 Lt C/L D-0 HA

0 - 150 Si Tps, Fr Wat @ 150  
150 - 2.00 Muckamor  
2.00 - 2.10 F-Med Sa, Firm  
- 2.10 NFP

24+550 27.00 Lt C/L D+400 HA

0 - 100 Si Tps  
100 - 1.30 F Sa W Si  
1.30 - 1.40 Si W F Sa, Wet  
1.40 - 2.50 Si Tr F Sa, Wet  
- 2.50 NFP BR

24+525 19.00 Lt C/L D-0 HA

0 - 150 Si Tps  
150 - 1.30 Muckamor, Fr Wat @ 200  
1.30 - 1.40 F Sa Tr Si, Firm  
- 1.40 NFP

24+550 0.30 Lt C/L D-0 HA

0 - 150 Si Tps  
150 - 1.20 Muckamor, Fr Wat @ 200  
1.20 - 1.35 Si Tr F Sa, Firm  
- 1.35 NFP

24+525 38.00 Lt C/L D-0 HA

0 - 150 Si Tps  
150 - 1.00 Muckamor, Fr Wat @ 200  
1.00 - 1.40 F Sa W Si, Firm  
- 1.40 NFP

24+600 27.00 Lt C/L D-100 HA

0 - 150 Si Tps  
150 - 300 Si Tr F Sa & Org, Wet  
- 300 NFP BR

24+550 11.00 Lt C/L D-0 HA

0 - 1.00 Muckamor, Fr Wat @ 250  
1.00 - 1.10 Si Tr F Sa, Firm  
- 1.10 NFP

24+600 11.00 Lt C/L D+100 HA

0 - 150 Si Tps  
150 - 2.50 F Sa W Si, Fr Wat @ 1.80  
- 2.50 NFP Sloughing

24+550 19.00 Lt C/L D-0 HA

0 - 150 Si Tps  
150 - 600 Muckamor, Fr Wat @ 250  
600 - 1.30 F Sa W Si, Firm  
- 1.30 NFP

24+600 19.00 Lt C/L D+100 HA

0 - 150 Si Tps  
150 - 2.30 F Sa W Si, Fr Wat @ 1.70  
- 2.30 NFP Sloughing

**Southbound Lanes**

Station 17+320 to 26+030 (Seguin Twp.) and 10+000 to 12+300 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

25+950 27.00 Lt C/L D-300 HA

0 - 150 Si Tps  
150 - 300 Si Tr F Sa  
- 300 NFP Blds

25+960 19.00 Lt C/L D-500 HA

0 - 150 Si Tps  
- 150 NFP Blds

25+960 11.00 Lt C/L D-1.00 HA

0 - 100 Si Tps  
- 100 NFP Blds

25+960 27.00 Lt C/L D-500 HA

0 - 150 Si Tps  
150 - 1.00 Si W F Sa, Wet  
- 1.00 NFP Blds

25+970 19.00 Lt C/L D-200 HA

0 - 150 Si Tps  
150 - 700 Si W F Sa  
- 700 NFP Blds

25+970 27.00 Lt C/L D-500 HA

0 - 150 Si Tps  
150 - 500 Si Tr F Sa, Wet  
- 500 NFP Blds

25+970 11.00 Lt C/L D-100 HA

0 - 200 Si Tps  
200 - 700 Si W F Sa  
- 700 NFP Blds

25+980 11.00 Lt C/L D-300 HA

0 - 200 Si Tps  
200 - 350 Si Tr F Sa, Moist  
- 350 NFP Blds

25+980 19.00 Lt C/L D-400 HA

0 - 100 Wat  
100 - 800 Muckamor  
- 800 NFP BR

25+980 27.00 Lt C/L D-500 HA

0 - 100 Wat  
100 - 1.10 Muckamor  
- 1.10 NFP BR

26+000 19.00 Lt C/L D-0 HA

0 - 1.00 Muckamor, Fr Wat @ 50  
1.00 - 1.10 F-Med Sa Tr Si, Wet, Firm  
- 1.10 NFP

26+000 27.00 Lt C/L D-0 HA

0 - 100 Wat  
100 - 800 Muckamor  
800 - 850 F-Med Sa Tr Si, Wet, Firm  
- 850 NFP

**Southbound Lanes**

Station 17+320 to 26+030 (Seguin Twp.) and 10+000 to 12+300 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

26+000 11.00 Lt C/L D-0 HA

0 - 1.30 Muckamor, Fr Wat @ 50  
1.30 - 1.40 Si W F Sa, Wet, Firm  
- 1.40 NFP

26+025 19.00 Lt C/L D-0 HA

0 - 50 Wat  
50 - 1.40 Muckamor  
- 1.40 NFP

26+025 27.00 Lt C/L D-0 HA

0 - 100 Wat  
100 - 1.10 Muckamor  
1.10 - 1.20 F-Med Sa, Wet, Firm  
- 1.20 NFP

26+025 11.00 Lt C/L D-0 HA

0 - 50 Wat  
50 - 1.00 Muckamor  
1.00 - 1.10 F-Med Sa Tr Si, Wet, Firm  
- 1.10 NFP

26+030 11.00 Lt C/L D-0 HA

0 - 1.20 Muckamor  
1.20 - 1.30 F-Med Sa W Si, Wet, Firm  
- 1.30 NFP BR

26+030 19.00 Lt C/L D-0 HA

0 - 100 Wat  
100 - 1.60 Muckamor  
1.60 - 1.75 F Sa W Si Tr Cl, Wet  
1.75 - 1.85 Cl W F Sa Tr Si, Wet  
1.85 - 1.95 F-Med Sa W Si, Wet  
- 1.95 NFP BR

26+030 27.00 Lt C/L D-0 HA

0 - 1.10 Muckamor  
1.10 - 1.30 F Sa W Cl Tr Si, Wet, Firm  
- 1.30 NFP

10+010 27.00 Lt C/L D-0 HA

0 - 100 Wat  
100 - 1.30 Muckamor  
1.30 - 1.40 F-Med Sa Tr Si, Wet, Firm  
- 1.40 NFP

10+010 19.00 Lt C/L D-0 HA

0 - 200 Wat  
200 - 1.80 F Sa W Si Tr Cl, Wet, Firm  
- 1.80 NFP Sloughing

10+010 11.00 Lt C/L D-0 HA

0 - 100 Wat  
100 - 1.30 Muckamor  
1.30 - 1.50 F Sa W Si, Wet, Firm  
- 1.50 NFP

**Southbound Lanes**

Station 17+320 to 26+030 (Seguin Twp.) and 10+000 to 12+300 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

10+035 27.00 Lt C/L D-0 HA

0 - 150 Wat  
150 - 1.10 Muckamor  
1.10 - 1.20 Si Tr F Sa, Firm  
- 1.20 NFP

10+060 19.00 Lt C/L D-200 HA

0 - 100 Wat  
100 - 500 Muckamor  
500 - 600 Si Tr F Sa & Cl, Firm  
- 600 NFP

10+035 19.00 Lt C/L D-0 HA

0 - 100 Wat  
100 - 700 Muckamor  
700 - 750 Si Tr F Sa  
- 750 NFP BR

10+060 27.00 Lt C/L D-200 HA

0 - 150 Wat  
150 - 600 Muckamor  
600 - 700 Si W F Sa, Firm  
- 700 NFP

10+035 11.00 Lt C/L D-0 HA

0 - 150 Si Tps  
150 - 500 Si W F Sa, Wet  
- 500 NFP Blds

10+085 27.00 Lt C/L D-100 HA

0 - 100 Wat  
100 - 1.40 Muckamor  
1.40 - 1.50 Si W F Sa Tr Cl, Firm  
- 1.50 NFP

10+060 28.00 Lt C/L D-200 HA

0 - 1.10 Muckamor  
1.10 - 1.37 Cl W Si, Wet, Soft  
1.37 - 1.46 F-Med Sa W Gr, Wet  
- 1.46 NFP BR

10+085 19.00 Lt C/L D-100 HA

0 - 50 Moss, Fr Wat @ 50  
50 - 1.50 Muckamor  
1.50 - 1.60 Si W F Sa, Firm  
- 1.60 NFP

10+060 11.00 Lt C/L D-100 HA

0 - 150 Si Tps  
150 - 400 Si W F Sa, Wet  
- 400 NFP BR

10+085 11.00 Lt C/L D-200 HA

0 - 150 Si Tps  
150 - 500 Cl Tr F Sa & Si  
500 - 700 Si W F Sa Tr Cl  
- 700 NFP Blds

**Southbound Lanes**

Station 17+320 to 26+030 (Seguin Twp.) and 10+000 to 12+300 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

11+760 19.00 Lt C/L D-300 HA

0 - 100 Si Tps  
100 - 600 Si Tr F Sa  
- 600 NFP BR

11+780 19.00 Lt C/L D+250 PA

0 - 600 F-Med Sa Tr Gr Tr Si\*  
- 600 NFP RF

\* Sample Depth = 200 - 400

11+770 27.00 Lt C/L D+900 PA

0 - 150 Asph  
150 - 500 F-Med Sa Tr Gr & Si  
- 500 NFP RF

Passing 26.5 mm = 100 %  
4.75 mm = 74 %  
2.00 mm = 63 %  
425 um = 44 %  
75 um = 6 %  
w = 1 %  
Acceptable Granular B, Type I

11+770 11.00 Lt C/L D+500 HA

- 0 RF

11+770 19.00 Lt C/L D-0 HA

0 - 300 F Sa W Gr  
- 300 NFP RF

11+780 27.00 Lt C/L D-0 HA

- 0 RF

11+780 11.00 Lt C/L D+100 PA

0 - 130 Asph  
130 - 600 F-Med Sa Tr Gr & Si  
- 600 NFP RF

11+790 27.00 Lt C/L D-1.80 HA

0 - 200 Wat  
200 - 750 Muckamor  
- 750 NFP RF

11+790 11.00 Lt C/L D-1.80 HA

0 - 200 Wat  
200 - 1.00 Muckamor  
- 1.00 NFP RF

11+790 19.00 Lt C/L D-1.80 HA

0 - 200 Wat  
200 - 900 Muckamor  
- 900 NFP RF

**Southbound Lanes**

Station 17+320 to 26+030 (Seguin Twp.) and 10+000 to 12+300 (McDougall Twp.),  
Referenced to C/L of Median

981-1111  
July, 1998

11+800 11.00 Lt C/L D-0 HA

0 - 700 Wat  
700 - 800 Muckamor  
800 - 1.05 Cl W Si, Firm

11+800 19.00 Lt C/L D-0 HA

0 - 300 Wat  
300 - 460 Muckamor  
460 - 750 Cl W Si  
750 - 1.05 F Sa W Si, Firm

11+800 25.00 Lt C/L D-0 HA

0 - 700 Wat  
700 - 900 Muckamor  
900 - 1.20 Cl W Si, Firm

11+825 27.00 Lt C/L D-0 HA

0 - 900 Wat  
900 - 1.80 Muckamor  
- 1.80 NFP

11+825 11.00 Lt C/L D-0 HA

0 - 800 Wat  
800 - 950 Muckamor  
950 - 1.15 Cl W Si  
1.15 - 1.20 F Sa W Si, Firm

11+825 25.00 Lt C/L D-0 HA

0 - 880 Wat  
880 - 1.10 Muckamor  
1.10 - 1.50 Cl W Si, Firm

11+825 19.00 Lt C/L D-0 PA

0 - 600 Wat  
600 - 700 Muckamor  
700 - 3.66 Cl W Si Tr Sa, Wet, Stiff  
3.66 - 4.27 F Sa W Si, Wet, Comp  
- 4.27 NFP Blds

11+850 19.00 Lt C/L D-0 HA

0 - 100 Wat  
100 - 500 Muckamor  
500 - 600 F Sa Tr Si & Cl, Firm  
- 600 NFP

11+850 32.00 Lt C/L D+1.50 HA

- 0 RF

11+850 6.00 Lt C/L D-0 HA

0 - 300 Wat  
300 - 650 Muckamor  
650 - 800 F Sa Tr Si & Cl, Firm  
- 800 NFP

11+880 54.00 Lt C/L D-0 HA

0 - 300 F-Med Sa Tr Gr & Si  
- 300 NFP BR

**APPENDIX B**  
**CONSOLIDATION TEST RESULTS**



# CONSOLIDATION SUMMARY

FIGURE B-1

|          |          |                        |               |                |          |
|----------|----------|------------------------|---------------|----------------|----------|
| PROJECT  | 981-1111 | SPECIFIC GRAVITY       | 2.63 measured | DATE STARTED   | 98-07-23 |
| BOREHOLE | 98-1C    | AREA(mm <sup>2</sup> ) | 1932.21       | DATE COMPLETED | 98-07-23 |
| SAMPLE   | 5        | SOLIDS HT.2HS          | 4.195         |                |          |
| DEPTH, m | 9.1-10.1 | DRY WEIGHT, g          | 21.32         |                |          |

| Load<br>kPa | Corr.<br>Height<br>mm | Void<br>Ratio | Average<br>Height<br>mm | t90<br>sec | t50<br>sec | cv,<br>t90<br>cm <sup>2</sup> /s | k<br>cm/S | mv<br>m <sup>2</sup> /kN |
|-------------|-----------------------|---------------|-------------------------|------------|------------|----------------------------------|-----------|--------------------------|
| 0.00        | 12.600                | 2.003         | 12.600                  |            |            |                                  |           |                          |
| 15.80       | 12.224                | 1.914         | 12.412                  | 120        |            | 2.72E-03                         | 5.04E-07  | 1.89E-03                 |
| 20.00       | 12.120                | 1.889         | 12.172                  | 110        |            | 2.86E-03                         | 5.50E-07  | 1.97E-03                 |
| 40.00       | 11.462                | 1.732         | 11.791                  | 51         |            | 5.78E-03                         | 1.48E-06  | 2.61E-03                 |
| 80.00       | 10.119                | 1.412         | 10.791                  | 410        |            | 6.02E-04                         | 1.57E-07  | 2.66E-03                 |
| 159.80      | 8.960                 | 1.136         | 9.540                   | 160        |            | 1.21E-03                         | 1.36E-07  | 1.15E-03                 |
| 320.10      | 8.069                 | 0.923         | 8.515                   | 45         |            | 3.42E-03                         | 1.48E-07  | 4.41E-04                 |
| 640.20      | 7.370                 | 0.757         | 7.720                   | 66         |            | 1.91E-03                         | 3.25E-08  | 1.73E-04                 |
| 1280.30     | 6.789                 | 0.618         | 7.080                   | 25         |            | 4.25E-03                         | 3.00E-08  | 7.20E-05                 |
| 2603.20     | 6.265                 | 0.493         | 6.527                   | 40         |            | 2.26E-03                         | 6.96E-09  | 3.14E-05                 |
| 640.20      | 6.416                 | 0.529         | 6.341                   |            |            |                                  |           | 6.11E-06                 |
| 80.00       | 6.759                 | 0.611         | 6.588                   |            |            |                                  |           | 4.86E-05                 |
| 15.80       | 7.036                 | 0.677         | 6.898                   |            |            |                                  |           | 3.42E-04                 |

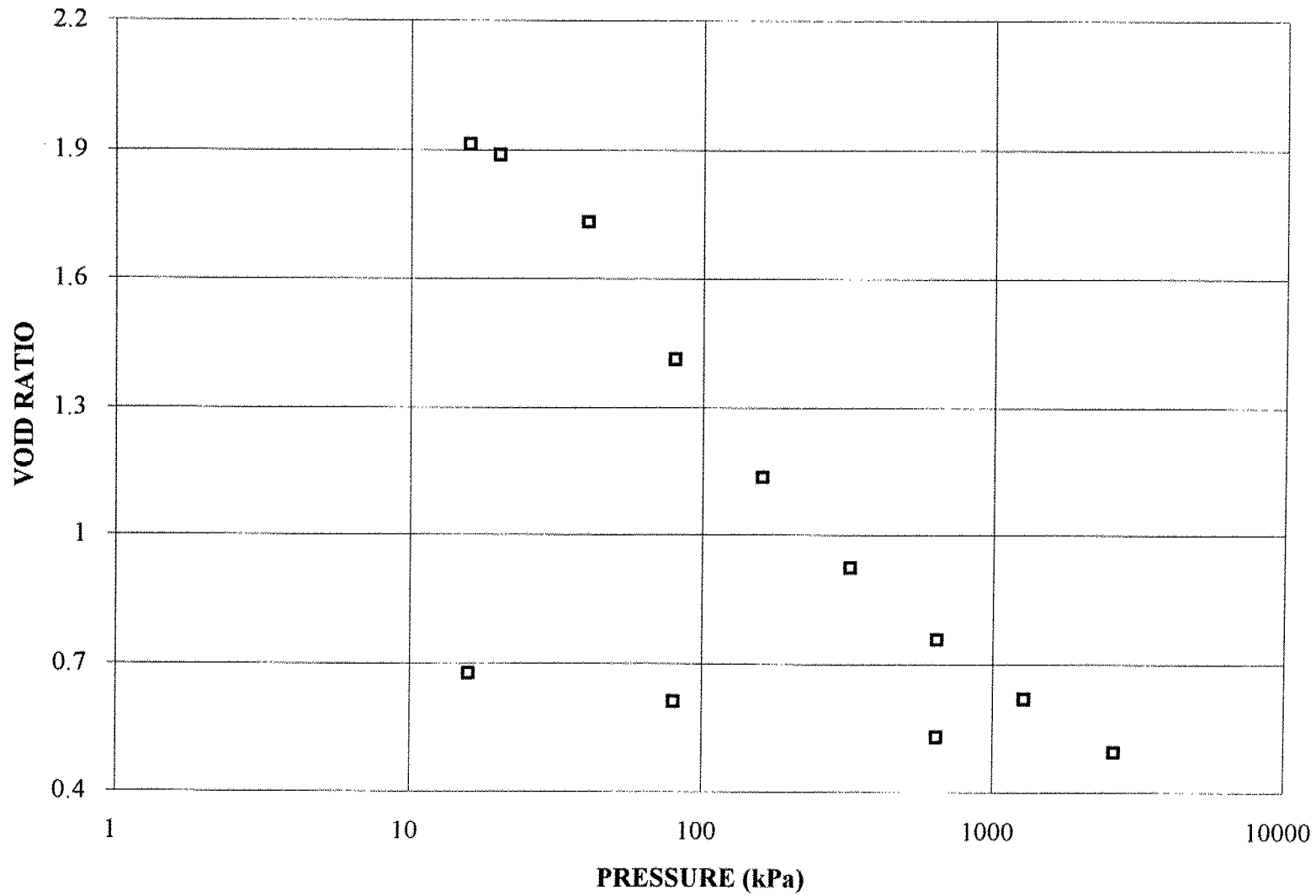
Notes:

k calculated using Cv based on t90 values.

|                          |       |                                    |       |
|--------------------------|-------|------------------------------------|-------|
| Water Content %, initial | 80.6  | Liquid Limit, %                    | 56.0  |
| Water Content %, final   | 35.6  | Plastic Limit, %                   | 22.3  |
|                          |       | Plastic Index, %                   | 33.7  |
| Original Volume, cc      | 24.35 | Liquidity Index                    | 1.730 |
| Volume of Solids, cc     | 8.11  |                                    |       |
| Volume of Voids, cc      | 16.24 | Unit Weight, kN/m <sup>3</sup>     | 15.51 |
| Degree of Saturation, %  | 105.8 | Dry Unit Weight, kN/m <sup>3</sup> | 8.59  |

CONSOLIDATION TEST  
VOID RATIO VS. LOG. PRESSURE

FIGURE B-2



# CONSOLIDATION SUMMARY

FIGURE B-3

|          |          |                        |         |     |         |          |                |          |
|----------|----------|------------------------|---------|-----|---------|----------|----------------|----------|
| PROJECT  | 981-1111 | SPECIFIC GRAVITY       |         |     | 2.64    | measured | DATE STARTED   | 98-07-23 |
| BOREHOLE | HF-1B    | AREA(mm <sup>2</sup> ) |         |     | 3151.98 |          | DATE COMPLETED | 98-07-23 |
| SAMPLE   | 3        | SOLIDS HT.2HS          |         |     | 6.599   |          |                |          |
| DEPTH, m | 3.0-3.7  | DRY WEIGHT, g          |         |     | 54.91   |          |                |          |
|          | Corr.    | Void                   | Average |     |         | cv.      | k              | mv       |
| Load     | Height   | Ratio                  | Height  | t90 | t50     | t90      |                |          |
| kPa      | mm       |                        | mm      | sec | sec     | cm2/s    | cm/S           | m2/kN    |
| 0.00     | 19.090   | 1.893                  | 19.090  |     |         |          |                |          |
| 9.70     | 18.915   | 1.866                  | 19.003  | 49  |         | 1.56E-02 | 1.45E-06       | 9.45E-04 |
| 19.40    | 18.730   | 1.838                  | 18.823  | 55  |         | 1.37E-02 | 1.34E-06       | 9.99E-04 |
| 38.81    | 18.468   | 1.799                  | 18.599  | 36  |         | 2.04E-02 | 1.41E-06       | 7.07E-04 |
| 77.62    | 18.048   | 1.735                  | 18.258  | 21  |         | 3.37E-02 | 1.87E-06       | 5.67E-04 |
| 155.23   | 15.742   | 1.386                  | 16.895  | 60  |         | 1.01E-02 | 1.54E-06       | 1.56E-03 |
| 310.46   | 13.448   | 1.038                  | 14.595  | 764 |         | 5.91E-04 | 4.48E-08       | 7.74E-04 |
| 620.93   | 11.959   | 0.812                  | 12.704  | 211 |         | 1.62E-03 | 3.99E-08       | 2.51E-04 |
| 1241.86  | 10.812   | 0.638                  | 11.386  | 160 |         | 1.72E-03 | 1.63E-08       | 9.68E-05 |
| 2483.71  | 10.136   | 0.536                  | 10.474  | 13  |         | 1.79E-02 | 5.00E-08       | 2.85E-05 |
| 1241.86  | 10.234   | 0.551                  | 10.185  |     |         |          |                | 4.13E-06 |
| 310.46   | 10.556   | 0.600                  | 10.395  |     |         |          |                | 1.81E-05 |
| 9.70     | 11.160   | 0.691                  | 10.858  |     |         |          |                | 1.05E-04 |

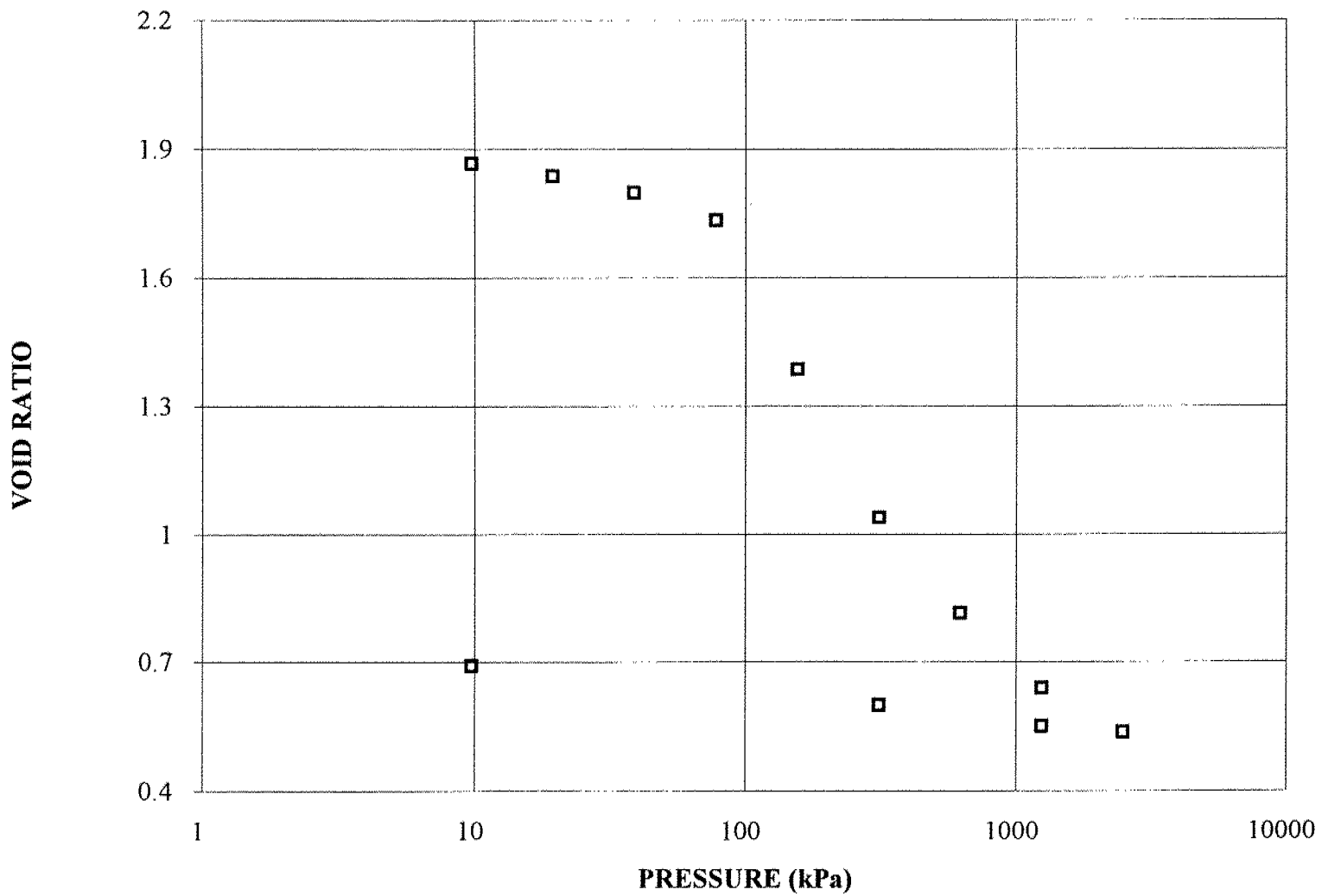
Notes:

k calculated using Cv based on t90 values.

|                          |       |                                    |       |
|--------------------------|-------|------------------------------------|-------|
| Water Content %, initial | 70.60 | Liquid Limit, %                    | 55.3  |
| Water Content %, final   | 33.45 | Plastic Limit, %                   | 21.3  |
|                          |       | Plastic Index, %                   | 34.0  |
| Original Volume, cc      | 60.17 | Liquidity Index                    | 1.450 |
| Volume of Solids, cc     | 20.80 |                                    |       |
| Volume of Voids, cc      | 39.37 | Unit Weight, kN/m <sup>3</sup>     | 15.26 |
| Degree of Saturation, %  | 98.5  | Dry Unit Weight, kN/m <sup>3</sup> | 8.95  |

CONSOLIDATION TEST  
VOID RATIO VS. LOG PRESSURE

FIGURE B-4





# memorandum

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To: Greg Godin, P. Eng.  
Senior Project Engineer  
Planning and Design Section  
Northern Region

From: Pavements and Foundations Section  
Room 232, Central Building  
Downsview, Ontario

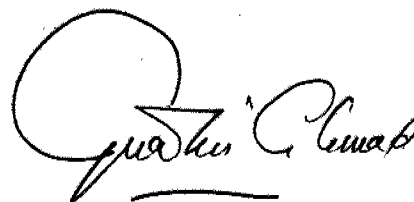
Re: Embankments Crossing Deep Swamps  
Lightweight fill/Temporary Embankment  
For Swamp between Station 18+600 and Station 18+690  
Hwy 69 Four Laning. Parry Sound Bypass  
GWP 209-97-00, District 52, Huntsville

1999 06 03

This is further to our discussion in the Technical Review meeting and our discussion today, June 3, 1999. As you know, it is recommended to fully excavate the peat and soft silty clay material for the embankment construction over swamps for this project. However, between stations 18+600 and Station 18+690 full depth excavation will impact on the adjacent existing highway embankment. Therefore, a temporary embankment constructed of lightweight fill material is proposed for the Northbound lane. This temporary embankment will be excavated after the SBL is constructed, and the Northbound embankment will be reconstructed with rockfill.

As we mentioned in our review comments of the Foundation Design report dated May 28, 1999 cross sections in this area are required to review the construction sequence and alternatives, particularly between stations 18+600 and 18+690. Such cross sections are normally provided in the foundation reports. Golder Associates has agreed to provide the cross sections. Once the cross sections are received, we will study the alternatives for the swamp excavations near the existing embankment and discuss with Golder. Golder's recommendation of constructing temporary embankment with ~~rockfill~~ and ~~lightweight~~ fill material is reasonable and appears to be the only option. However, we would still like to review other alternatives for a possible cost saving by not using lightweight fill material. We will also review if proposed excavation of rockfill in the temporary embankment is feasible.

Please forward this memo to Golder Associates. Should you have any questions, please advise.

A handwritten signature in black ink, appearing to read 'K. Ahmad', with a large, stylized initial 'K'.

K. Ahmad, P. Eng  
Foundation Engineer

For

T.C. Kim, P. Eng.  
Senior Foundation Engineer

cc: P. Stuart  
D. Smith  
W. Roy  
D. Yeo  
T. Kazmierowski

file: c:\data\wpwin60\2099700.gre5.wpd



# memorandum

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To: Greg Godin, P. Eng.  
Senior Project Engineer  
Planning and Design Section  
Northern Region

1999 05 28

From: Pavements and Foundations Section  
Room 232, Central Building  
Downsview, Ontario

Re: Foundation Investigation Reports  
Badger Road Underpass, Hwy 69 Northbound, Site 44-386 (Final Report)  
McGown Road Overpass, Hwy 69 Northbound, Site 44-388N (Final Report)  
McGown Road Overpass, Hwy 69 Southbound, Site 44-388S (Final Report)  
Bowes Street/McDougall Road Underpass, Site 44-389  
Embankments Crossing Deep Swamps  
Hwy 69 Four Laning. Parry Sound Bypass  
GWP 209-97-00, District 52, Huntsville

We have conceptually reviewed the above mentioned foundation reports, produced by Golder Associates Ltd. Consulting Engineers, for Cole, Sherman & Associates, to determine the consultant's performance in providing the deliverables as would be required by MTO for similar consultant assignments. The accuracy of the subsurface information and the adequacy and technical aspects of the recommendations remain the responsibility and liability of the consultant. The Ministry assumes no responsibility or liability for these aspects of the report. These aspects will be reviewed in order to assess the consultant's performance in this assignment upon implementation of the recommendations in the design and upon review of the performance of the foundations for the completed project. However, following are our comments:

## **General Comments for all projects**

The Pavements and Foundations Section has assigned Geocres Numbers for these projects. The Consultant should provide the Geocres numbers on the Final Reports. The Geocres number shall be shown on the lower left corner of the Title Page of the Foundation reports. The numbers are provided below.

#### **Badger Road Underpass, Northbound, Site 44-386**

The comments made in the preliminary report review dated 1998 07 16 have been incorporated in the final report.

We have received the Borehole Location Plans with the final reports. The bedrock symbols on the drawing are not consistent. The RQD values are shown under N values without any notes that those numbers are RQD values.

The Geocres Number for this project is 31E-137.

#### **McGown Road Overpass, Northbound and Southbound Structures, Site 44-388N/S**

The comments made in the preliminary report review dated 1998 07 16 have been incorporated in the final report.

The bedrock symbols on the drawing are not consistent. The RQD values are shown under N values without any notes that those numbers are RQD values.

The bedrock symbols on the drawing and on the logs are not consistent.

The Geocres Number for this project is 31E-138.

#### **Bowes Street/McDougall Road Underpass, Site 44-389**

The bedrock symbols on the drawing are not consistent. The RQD values are shown under N values without any notes that those numbers are RQD values.

In view of the numerous construction problems in Northern Ontario related to undulating bedrock surfaces, it is required that bedrock is proven in all corners of the footing. The Consultant has only put down one cored borehole at each footing locations. The other holes were either the probe holes or the bedrock was not cored in other holes. We would like the Consultant to comment that the refusal in the probe holes was actually on the bedrock, and, the bedrock elevation provided in the report and shown on the drawing are the actual bedrock elevations.

Section 5.2.2, Horizontal Resistance: The specification of the uniformly graded sand for the integral abutment should be provided.

Section: 5.2.3, Frost Protection: MTO has established the frost depth for the Huntsville District as 1.8m. The recommended frost depth for the pile caps should be changed to 1.8 m.

The Geocres Number for this project is 31E-140.



### Embankments Crossing Deep Swamps

Ground elevations (contours) are provided on the plans. However, elevations are not provided on the borehole logs.

Key Plans should be provided on the Borehole location plans.

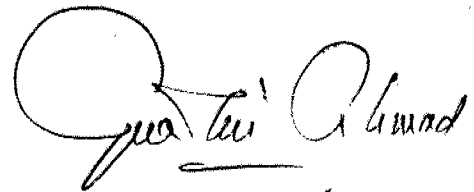
Cross Sections at the swamp locations should be provided. Without proper cross sections, planning for excavation is difficult. Also, without a cross section (that would show any adjacent structures, or embankments), comments on the feasibility of any proposed excavation cannot be made.

It is preferred that locations of the boreholes in terms of northing and easting should be provided. The northing and easting coordinates for this project are available on the plans.

We understand that full excavation of peat and soft material is recommended for all swamp locations. To remove peat and soft material excavation up to 11.5m will be required. Excavation to such depths have been successfully carried out on MTO projects. The swamp excavation shall be carried out as per revised OPSD 203.01, 02 and 03 (March 01, 1998)

The Geocres Numbers for this project are 31 E-139 and 41H-22.

Should you have any questions, please advise.



K. Ahmad, P. Eng  
Foundation Engineer

For

T.C. Kim, P. Eng.  
Senior Foundation Engineer

cc: P. Stuart  
D. Smith  
M. Pearsall  
W. Roy  
D. Yeo  
T. Kazmierowski