

G.I.-30 SEPT. 1976

GEOCRES No. 31GS-10DIST. 9 REGION W.P. No. CONT. No. REVIEW FOR M.N.RW.O. No. 71-11076STR. SITE No. N/AHWY. No. N/ALOCATION SUBDIVISION T-21118 NEPEANTWP. (MCROSTIE REPORT)NO OF PAGES -=====OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

71-11-076

GEOC. N° 3165-10

REPORT ON

SUBSURFACE INVESTIGATION & SLOPE STABILITY STUDIES

AT

COUNTRY PLACE PROJECT

MERIVALE ROAD NEAR PINEGLEN

REGIONAL MUNICIPALITY OF OTTAWA-CARLETON

TO

G. J. SIMPSON CONSTRUCTION LTD.

Report No. SF-1462

July 12, 1971



**McROSTIE SETO GENEST**

& ASSOCIATES LTD. - CONSULTING ENGINEERS  
& ASSOCIÉS LTÉE - INGÉNIEURS CONSEILS  
OTTAWA, CANADA

**McROSTIE SETO GENEST**

& ASSOCIATES LTD. - CONSULTING ENGINEERS - 393 BELL ST., OTTAWA, ONTARIO  
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**1. TERMS OF REFERENCE**

We were requested by Mr. G. J. Simpson to carry out a subsurface investigation of the Country Place Project and with special emphasis on the possible problems of slope stability in the Leda clay and marine sediment soils which occur at the project. Only the area affecting the current draft plan of subdivision was to be included at this time, slopes adjacent to the Rideau River are to be studied when development of the river frontage is being processed.

**2. CONCLUSIONS AND RECOMMENDATIONS****2.1 Stability of Slopes**

The existing creek bank slopes along the southerly boundary of the project do not have adequate margins of safety to be incorporated into a subdivision development. The creek flood plain has been gradually widened by meanderings of the watercourse, the valley banks have been eroded to about the steepest slopes that would remain just stable over periods of time. Our soil testing studies and analysis programmes utilize the steepest natural slopes as evidence of the likely values for effective stress soil parameters and long term groundwater maximum conditions.

To produce a sufficient margin or reserve of stability in the slopes, consistent with having these slopes become part of the permanent environment close to housing, a programme of slope flattening will be required. In essence, the slopes should have a new average inclination of 3 horizontal to one vertical. These measures will be required over a length of about 2,500 feet along the west part of the south boundary of the project as shown on the accompanying plan.

Since much of the slope contains mature trees, every effort can be made to preserve this growth. Two adjustments would therefore be desirable to a routine 3 on 1 cut starting at the toe of the existing slope. These adjustments are shown on the accompanying sketches and consist firstly of placing toe berms of material cut from the top of the existing slopes, some creek re-routing will be needed in order to provide space for the toe berms and some erosion protection will need to be provided to prevent the long term erosion of the toe of the new slopes.

The second adjustment consists of creating a non uniform slope having the same average inclination as the analysed slopes. Short slopes, 10 ft. high can be cut on 2 to 1 inclination, coupled with 2 flat zones. This technique can result in the middle half of the existing slopes remaining untouched and the trees' growth preserved. Local humps in the general slope can also be left to preserve a few special tree clumps, if they are individually considered by geotechnical study.

## 2.2 Gully Branches

There are two branches to the main creek valley. One of these, running Northerly at about the centre of the south boundary of the project, has banks with little reserve of stability. We understand that it will also be the route of a sewer outlet. The proposal to add about 10 feet of fill across the bottom of the entire gully bottom as cover over the new sewer is a technically suitable and sufficient improvement to the slope stability problem. In essence, the effective slope heights will be reduced by 10 feet.

Control of erosion of the new fill from flow on top of the fill will need to be supplied by new vegetation cover or by simple log crib check dams.

The side gully running Westerly in turn from the gully mentioned above will likely be filled and will result in the need for special house foundations in the 3 or 4 lots affected.

## 2.3 Organic Layer

Apart from the problem of slopes, a fairly large but not very important layer of organic material exists in the north west quadrant of the project. Although it extends for a length of about 1,000 ft. and a width of 200 ft., it is fortunately only about 1 foot thick and can therefore be removed before road or house foundation construction on it.



#### 2.4 General Soil Conditions

The remainder of the project appears to have normal soils for the area. No special soils problems are to be expected in these areas provided that usual good building practices are followed.

#### 2.5 Supervision of Slope Flattening Programs

We have provided only guiding principles to be followed in the preventive measures outlined in section 2.1 of this report. It would therefore be advisable that we also provide a measure of field supervision so that detailed decisions were made in accordance with these principles. We would then also be able to provide a certificate of satisfactory completion of the slope stability preventive works for the guidance of Township or other authorities who would be controlling the release of performance bonds.

### 3. DETAILS OF INVESTIGATION AND ANALYSIS

#### 3.1 General Soil Conditions

The subsoil at the site can be generalized as consisting of 2 to 5 feet of loose to medium dense sand underlain by stiff clay up to 23 feet thick. Boreholes Nos. 1 & 2 indicate that the clay layer is underlain by silt generally dense, 4 to 15 feet thick which overlies dense sands and till soils. Bedrock encountered near elevation 265 in borehole No. 2 is essentially dolomite of the Oxford formation. About 1 foot of organic material was encountered in a test pit near borehole No. 4 and also in borehole No. 5. The groundwater level observed in the pilot boreholes was at an average elevation 268 during the investigation.

#### 3.2 Field Work

Eight boreholes were made at the site with our test drilling rig in the locations shown on Plate No. 1. Pilot boreholes Nos. 1 & 2 were made to provide a geotechnical profile of the bank of the adjacent Black Rapids creek. Tube samples were retrieved from the cohesive soil deposit generally at 5-ft. intervals and borehole vane tests were carried out in between tube samples. However, in pilot boreholes Nos. 1 & 2 continuous tube sampling was carried out in order to detect possible thin sandy layers in the generally cohesive soil

deposit. Borehole vane tests were made at 5-ft. intervals adjacent to borehole No. 1 in which continuous tube sampling was carried out. Split barrel samples were retrieved in the principally granular soil deposit below the clay layer usually at 2½-ft. intervals but continuously in borehole No. 1 in search of a clay layer. Standard penetration resistance tests were carried out simultaneously with the split barrel sampling. All samples were brought to the laboratory to be examined and tested. A hand dug test pit was made near borehole No. 4 to determine the thickness of organic material in this area. Bedrock was encountered in pilot borehole No. 2 and was diamond drilled and cores were recovered. Groundwater levels were observed and recorded during the investigation. Profiles of the banks of the Black Rapids creek were established for use in the slope stability analysis.

### 3.3 Laboratory Testing

Moisture content determinations were made on soil samples from boreholes Nos. 1, 2 & 3. Visual classifications were made on all soil samples. Small scale penetrometer tests were carried out at six-inch intervals on cohesive soil tube samples from boreholes Nos. 1, 2 & 3 to estimate the variation in shear strength within the tube samples. Atterberg limits were determined on pertinent samples in pilot borehole No. 1. The rock cores were examined by an Engineer and logged in the laboratory.

### 3.4 Slope Stability Analysis

An outline of the procedure used in the slope stability analysis can be recorded. The actual slope profiles were



surveyed at two representative sections and the actual geotechnical profile was obtained by test borings at the top of the slope. A careful search for the possibility of pervious sand layers was made by continuous sampling and drying of continuous strips of soil taken from the sides of continuous specimens. Laboratory tests were made to obtain suitable indicator properties to allow the best possible correlation with the extensive testing done in other studies in the same marine clay deposit. From these an appropriate range of soil parameters was chosen and a high groundwater level was assumed. The stability charts of Bishop and Morgenstern, supplemented by the Janbu stability charts were used to obtain estimates of stability. The analysis verified the parameters chosen with results indicating very little excess stability in the present slopes which have been eroded to their limiting stability conditions.

The preventive measure necessary to produce a 50% increase in stability using the same soil parameters, groundwater condition assumption and analysis is essentially flattening the present slope to an average 3:1 slope. The following table indicates an estimate of factors of safety obtained in the slope stability analysis.

| SLOPE<br>(PROFILE NO. 1) | HEIGHT<br>(FT.) | GROUNDWATER<br>LEVEL | FACTOR OF SAFETY FOR                 |                                      | METHOD                  |
|--------------------------|-----------------|----------------------|--------------------------------------|--------------------------------------|-------------------------|
|                          |                 |                      | $\phi' = 33^\circ$<br>$c' = 200$ psf | $\phi' = 33^\circ$<br>$c' = 300$ psf |                         |
| EXISTING<br>SLOPE 1.6:1  | 32              | AT SURFACE           | 0.97                                 | 1.17                                 | JANBU                   |
| FLATTENED<br>SLOPE 3:1   | 32              | AT SURFACE           | 1.40                                 | 1.65                                 | JANBU                   |
|                          |                 |                      | 1.41                                 | 1.70                                 | BISHOP &<br>MORGENSTERN |

# OVERSIZE DRAWING

PLAQUE  
PLATE No.  
5





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PROFIL SOUTERRAIN ET RÉSUMÉ DES ESSAIS

SOIL PROFILE & TEST SUMMARIES

MERIVALE ROAD & PINE GLEN

NIVEAU DU SOL (PROFONDEUR ZÉRO)

307.1'

DATE JULY 7, 1971

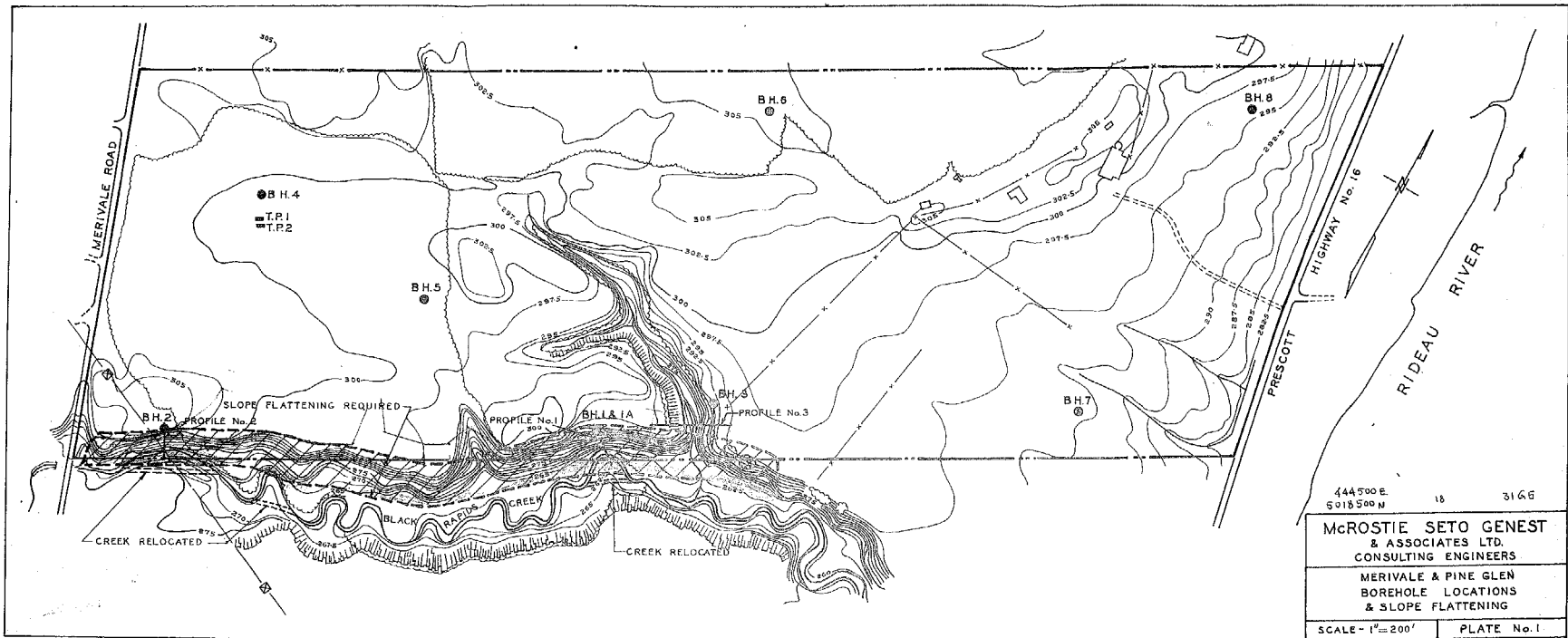
ELEVATION OF GROUND SURFACE (ZERO DEPTH)

NOTES SEE PLATE No. 2

FORAGE HOLE No. 6

| Résistance à la Compression K/Pd.2<br>Compressive Strength K.S.F. | Petit Pénétromètre K/Pd.2<br>Small Scale Penetrometer K.S.F. | Essai - Standard Penetration<br>Coups/pd-Blows/ft | No. Sample | DESCRIPTION DU SOL OF SOIL                  | Profondeur - Pied Depth in Feet | Niveau Elevation | SONDAGE OU ESSAI AU MOULINET<br>MARTEAU --- HAMMER<br>CHUTE LIBRE --- DROP<br>COUPS/PIED OU RÉSISTANCE AU CISAILLEMENT K/PD.2<br>BLOWS/FOOT OR SHEAR STRENGTH K.S.F. | PROBING OR VANE TEST<br>SANS TUBAGE - NO CASING<br>BARRE --- DIA. ROD |
|---|--|---|------------|---|---------------------------------|------------------|--|---|
|   |  |   |            | Niveau du Sol - Ground Surface              |                                 |                  |  |   |
|   |  |   |            | TOPSOIL & SAND                              | 0'                              | 307.1'           | 0 1.5 3.0 4.5 6.0 7.5  |   |
|   |  |   |            |   | 1.0'                            | 306.1'           |  |   |
|   |  |   | 4 6-1      | LOOSE TO MEDIUM DENSE FINE & VERY FINE SAND |                                 |                  |  |   |
|   |  |   | 11 6-2     |   |                                 |                  |  |   |
|   |  |   | 13 6-3     |   |                                 |                  |  |   |
|   |  |   |            | MEDIUM DENSE FINE & VERY FINE SAND          | 6.5'                            | 300.6'           | OVERNIGHT WATER LEVEL EL. 300.2'   |   |
|   |  |   | 12 6-4     | WITH A LITTLE SILT                          |                                 |                  |  |   |
|   |  |   |            | STIFF SANDY BROWNISH GRAY CLAY              | 100'                            | 297.1'           |  |   |
| 3.2, 3.4, 3.0   |  |   | 7 6-5      |   | 11.5'                           | 295.6'           |  |   |
|   |  |   |            | MEDIUM SOFT SANDY GRAY CLAY                 |                                 |                  | VANE SHEAR STRENGTH<br>REMOULDED<br>UNDISTURBED  |   |
| 10.1, 4.1, 6  |  |   | 6-6        |   |                                 |                  |  |   |
|   |  |   |            |   | 21.5'                           | 295.6'           |  |   |
|   |  |   |            | BOTTOM OF HOLE                              |                                 |                  |  |   |
| R - REMANIÉ - REMOULDED<br>CAROTTE RÉCUPÉRÉE<br>CORE RECOVERY     |  |   |            |   |                                 |                  | % TENEUR EN EAU<br>% WATER CONTENT<br>NATURELLE<br>NATURAL<br>LIMITE DE LIQUIDITÉ<br>LIQUID LIMIT<br>LIMITE DE PLASTICITÉ<br>PLASTIC LIMIT                           |   |
|   |  |   |            |   |                                 |                  | PLAQUE No. 7   |   |

# OVERSIZE DRAWING



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## PROFIL SOUTERRAIN ET RÉSUMÉ DES ESSAIS

MERIVALE RD. & PINE GLEN

ELEVATION OF GROUND SURFACE (ZERO DEPTH) 294.8  
NIVEAU DU SOL (PROFONDEUR ZÉRO)  
NOTES SEE PLATE No. 2

DATE JUNE 30, 1971

|                |     |
|----------------|-----|
| HOLE<br>FORAGE | No. |
| 3              |     |

| Compressive Strength K.S.F.<br>Réflectance à la Compression<br>K/P.D. 2 | Small Scale Pressure Tests<br>Penetration<br>Pencil Penetration<br>K/P.D. 2 | Basic Standard Penetration Test<br>Blow Count per Foot | Sample No. | DESCRIPTION OF SOIL<br>DU SOL   | Depth in Feet<br>Profondeur Pied | Elevation<br>Niveau | PRODING OR VANE TEST  |                          | SONDAGE OU ESSAI AU MOULINET |     |           |     |
|---|---|--|------------|---|----------------------------------|---------------------|---|--------------------------|------------------------------|-----|-----------|-----|
|   |   |  |            |   |                                  |                     | MARTEAU---HAMMER<br>CHUTE LIBRE---DROP  | NO CASING<br>SANS TUBAGE |                              |     |           |     |
|   |   |  |            |   |                                  |                     | BLOWS/FOOT OR SHEAR STRENGTH K.S.F.<br>COUPS/PIED OU RESISTANCE AU K/P.D. CISAILEMENT |                          |                              |     |           |     |
|   |   |  |            | Ground Surface - Niveau du Sol  |                                  |                     | 0   | 1.5                      | 3.0                          | 4.5 | 6.0       | 7.5 |
|   |   |  |            | TOP SOIL SAND GRAVEL  | 0                                | 294.8               |   |                          |                              |     |           |     |
|   |   |  | 8          | 3.1 LOOSE SILTY FINE & VERY FINE SAND WITH A LITTLE CLAY  | 1-0                              | 293.8               |   |                          |                              |     |           |     |
| 7.0, 5.4, 6.8   |   |  | 11         | 3.2 MEDIUM DENSE CLAYEY FINE SAND WITH SOME SILTY BROWNISH GRAY CLAY                                      | 2-5                              | 292.3               |   |                          |                              |     |           |     |
|   |   |  |            | STIFF TO VERY STIFF   | 4-0                              | 280.8               |   |                          | VANE SHEAR STRENGTH          |     |           |     |
| R.O.P. 6  |   |  | 3.3        | SANDY BROWNISH GRAY CLAY WITH SOME 1/4" TO 3/8" FINE & VERY FINE SAND LAYERS & POCKETS WITH A LITTLE CLAY | 10-0                             | 284.8               |   |                          | REMOLDED                     |     |           |     |
| R.O.P. 4  |   |  | 3.4        | STIFF SANDY BROWNISH GRAY CLAY WITH A FEW 1/4" TO 3/8" VERY FINE SAND LAYERS & POCKETS                    | 15-5                             | 279.3               |   |                          | UNDISTURBED                  |     |           |     |
| R.O.P. 4  |   |  | 3.5        | SOFT SILTY GRAY CLAY WITH A LITTLE VERY FINE SAND   | 20-0                             | 274.8               |   |                          |                              |     |           |     |
| R.O.P. 4  |   |  | 3.6        | STIFF GRAY CLAY WITH A LITTLE SILT  | 26-0                             | 268.8               |   |                          |                              |     |           |     |
| R.O.P. 4  |   |  | 3.7        | SILT WITH SOME 1/8" TO 1/4" GRAY CLAY LAYERS & WITH FINE SAND LAYER                                       | 27-5                             | 267.8               |   |                          |                              |     |           |     |
|   |   |  | 16         | 3.8 MEDIUM DENSE SILT WITH A FEW 1/4" TO 3/8" CLAYEY SILT LAYERS  | 30-0                             | 264.8               |   |                          |                              |     |           |     |
|   |   |  | 15         | 3.9 MEDIUM DENSE SANDY SILT   | 31-5                             | 263.3               |   |                          |                              |     |           |     |
|   |   |  |            | BOTTOM OF HOLE  |                                  |                     |   |                          |                              |     |           |     |
|   |   |  |            |   |                                  |                     | WATER CONTENT % TENEUR EN EAU   |                          | NATURAL NATURELLE            |     | Plate No. |     |
|   |   |  |            |   |                                  |                     | LIQUID LIMIT LIMITE DE LIQUIDITÉ  |                          |                              |     | 4         |     |
|   |   |  |            |   |                                  |                     | PLASTIC LIMIT LIMITE DE PLASTICITÉ  |                          |                              |     |           |     |



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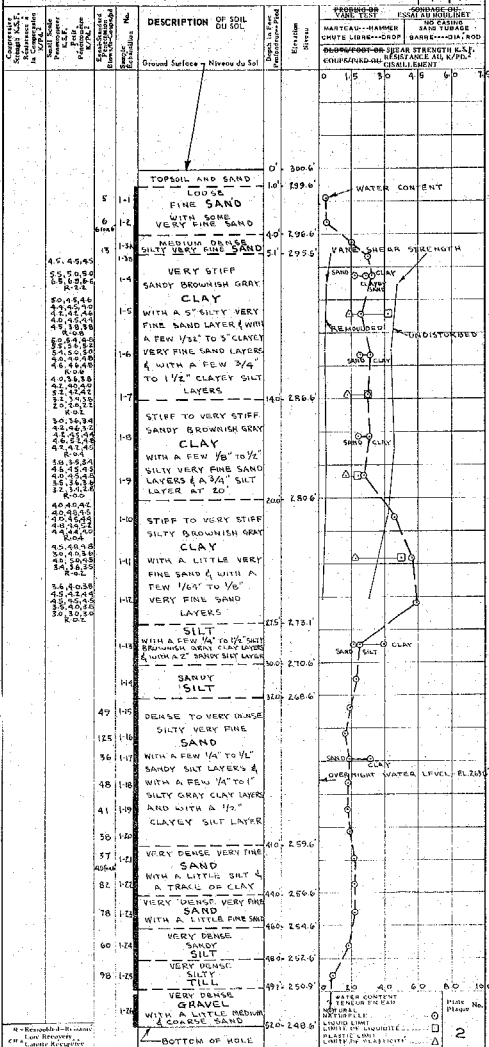
## SOIL PROFILE & TEST SUMMARIES

PROFIL SOUTERRAIN ET RÉSUMÉ DES ESSAIS

MERIVALE ROAD & PINE GLEN

ELEVATION OF GROUND SURFACE (ZERO DEPTH) 300.6'  
NIVEAU DU SOL (PROFONDEUR ZÉRO)  
NOTES: B.M. No. 3685 GEODETIC - EL 292.82

DATE JUNE 28, 1971 HOLE FORAGE No. 141A



R - Revisé à la suite  
de Révisions  
L - Ligne Révisée  
C - Carte Révisée

Plate No.  
Plaque No.  
2

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## SOIL PROFILE & TEST SUMMARIES

PROFIL SOUTERRAIN ET RÉSUMÉ DES ESSAIS

MERIVALE ROAD & PINE GLEN

ELEVATION OF GROUND SURFACE (ZERO DEPTH) 302.7

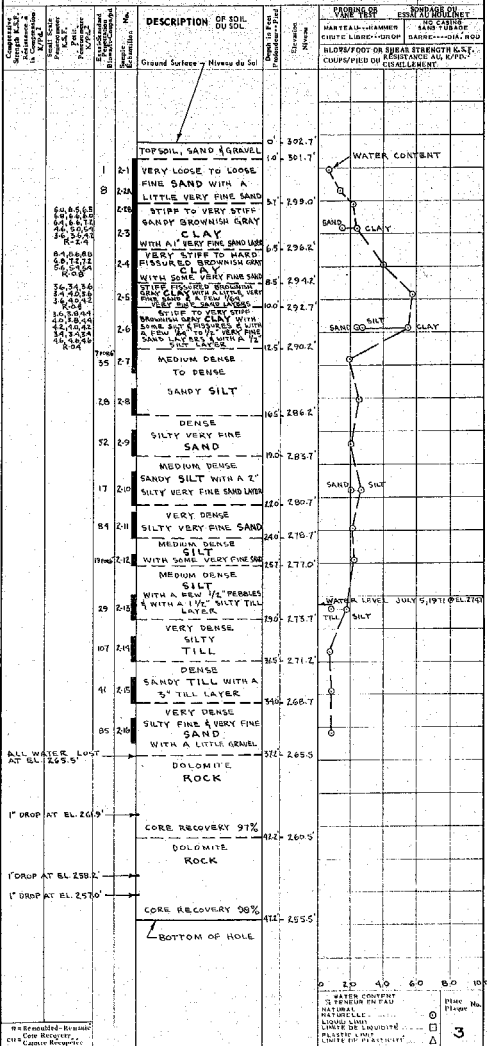
NIVEAU DU SOL (PROFONDEUR ZÉRO)

DATE JULY 1, 1971

HOLE FORAGE No.

2

NOTES

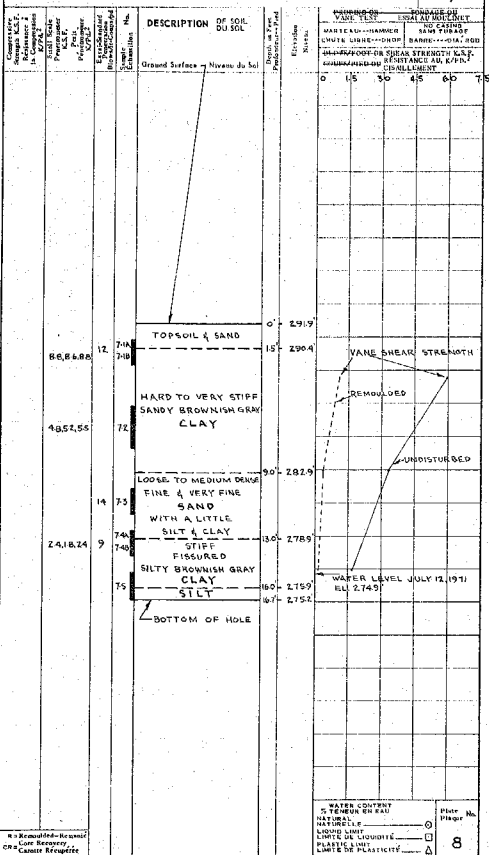


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OTTAWA CANADA

SOIL PROFILE & TEST SUMMARIES  
PROFIL SOUTERRAIN ET RÉSUMÉ DES ESSAIS  
MERIVALE ROAD & PINE GLEN

ELEVATION OF GROUND SURFACE (ZERO DEPTH) 291.9' DATE JULY 8, 1971 HOLE No. 7  
NIVEAU DU SOL (PROFONDEUR ZÉRO)  
NOTES SEE PLATE No. 2



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OTTAWA CANADA

## SOIL PROFILE & TEST SUMMARIES

## PROFIL SOUTERRAIN ET RÉSUMÉ DES ESSAIS

MERIVALE RD. & PINE GLEN

ELEVATION OF GROUND SURFACE (ZERO DEPTH) 294.1

DATE JULY 5, 1971

HOLE No.

NIVEAU DU SOL (PROFONDEUR ZÉRO)

NOTES, SEE PLATE No. 2

自

| Compressive Strength K.S.F.<br>Resistance à la Compression | Swail Scale<br>Perimeter<br>W.S.F.<br>P.C.<br>K/P.D. | Square Standard<br>Imperial<br>K/P.D. | Sample<br>Description No. | DESCRIPTION OF SOIL<br>DU SOL  | Depth in Feet<br>Profondeur - Pied | Elevation<br>Niveau | PROBING OR<br>VANE TEST                |  | SONDAGE OU<br>ESSAI AU MOULINET |   |
|--|--|---------------------------------------|---------------------------|--|------------------------------------|---------------------|--|--|---------------------------------|---|
|  |  |                                       |                           |  |                                    |                     | MARTEAU - HAMMER<br>CHUTE LIBRE - DROP | NO CASING<br>SAND TUBAGE<br>BARRE - DIA. ROD | BLOWS/FOOT OR<br>COUPS/PIED ON  | SHEAR STRENGTH K.S.F.<br>RESISTANCE AU K/P.D.<br>CISAILLEMENT |
|  |  |                                       |                           | Ground Surface - Niveau du Sol   | 0                                  |                     |  |  |                                 |   |
|  |  |                                       |                           | TOPSOIL & SAND   | 0                                  | 234.1               |  |  |                                 |   |
|  |  |                                       |                           | LOOSE FINE VERY FINE SAND WITH SOME 1/4" TO 1" SANDY BROWNISH GRAY CLAY LAYERS             | 1.0                                | 233.0               |  |  |                                 |   |
|  |  |                                       |                           | VERY STIFF SANDY BROWNISH GRAY CLAY LAYERS WITH SOME 1" TO 3" CLAYEY VERY FINE SAND LAYERS | 2.5                                | 231.6               |  |  |                                 |   |
| 4-8.4-4.4-6  |  | 13                                    | 8.2                       | STIFF SANDY BROWNISH GRAY CLAY WITH SOME SILT & A FEW 1" FINE SAND LAYERS                  | 5.0                                | 229.1               |  |  |                                 |   |
| 2.5-2.4-0.0  |  |                                       | 8.3                       | STIFF SILTY BROWNISH GRAY CLAY WITH A V. FINE SAND LAYER                                   | 10.0                               | 224.1               |  |  |                                 |   |
| 3-2.3-5.3-0  |  | 5                                     | 8.4                       | STIFF GRAY CLAY  | 11.5                               | 202.6               |  |  |                                 |   |
| 2-5.2-0.2-0  |  |                                       | 8.5                       |  |                                    |                     |  |  |                                 |   |
|  |  |                                       |                           | BOTTOM OF HOLE   | 13.0                               | 275.1               |  |  |                                 |   |

OVER-NIGHT WATER LEVEL 286.4

VANE SHEAR STRENGTH

REMOULDED

UNDISTURBED

R Remoulded - Remanié

CR Core Recovered

CAUTION Recovered

WATER CONTENT  
% TENEUR EN EAU

NATURAL \_\_\_\_\_

NATURELLE \_\_\_\_\_

LIQUID LIMIT \_\_\_\_\_

LIMITE DE LIQUIDITE \_\_\_\_\_

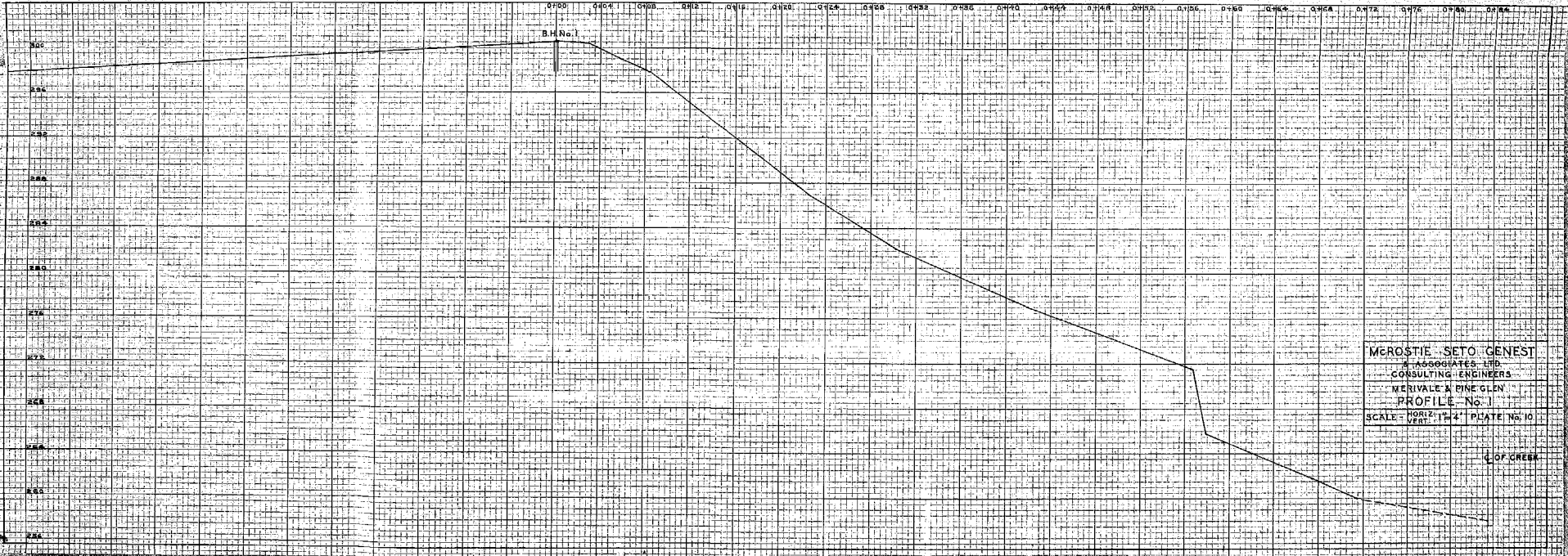
PLASTIC LIMIT \_\_\_\_\_

LIMITE DE PLASTICITE \_\_\_\_\_

Plate No.

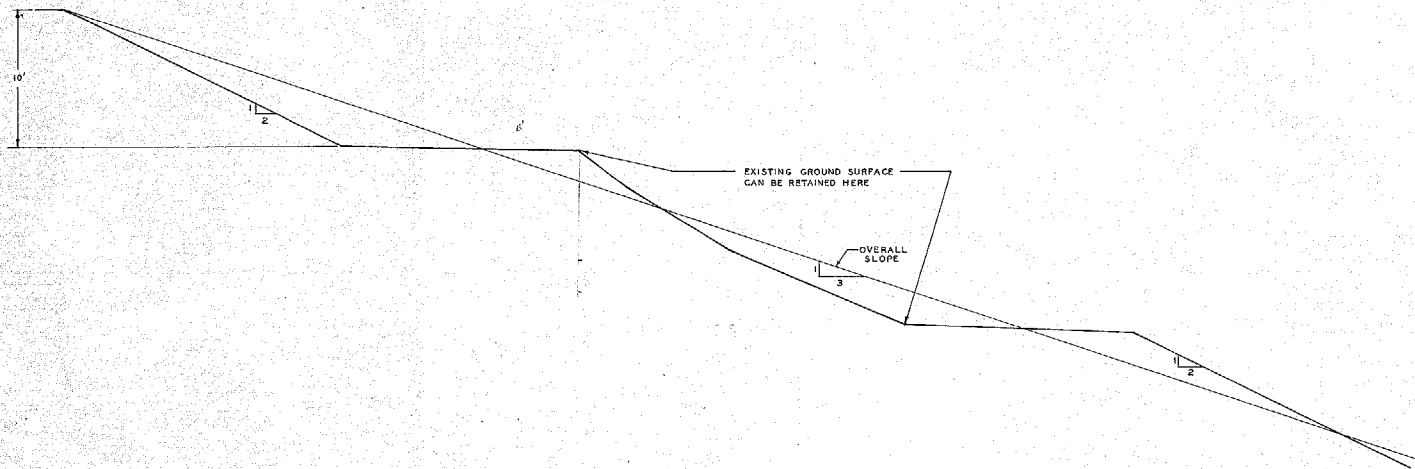
9





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MERIVALE & PINE GLEN  
PROFILE No. 1  
SCALE - HORIZ. 1" = 4' PLATE No. 10  
VERT. 1" = 4'

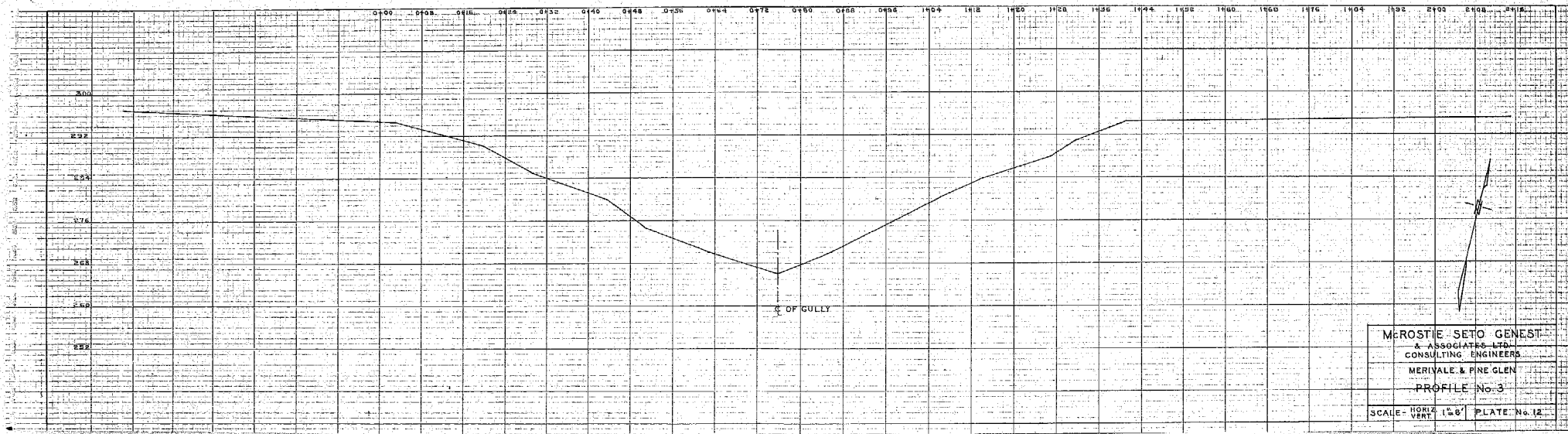
C. OF CROWN



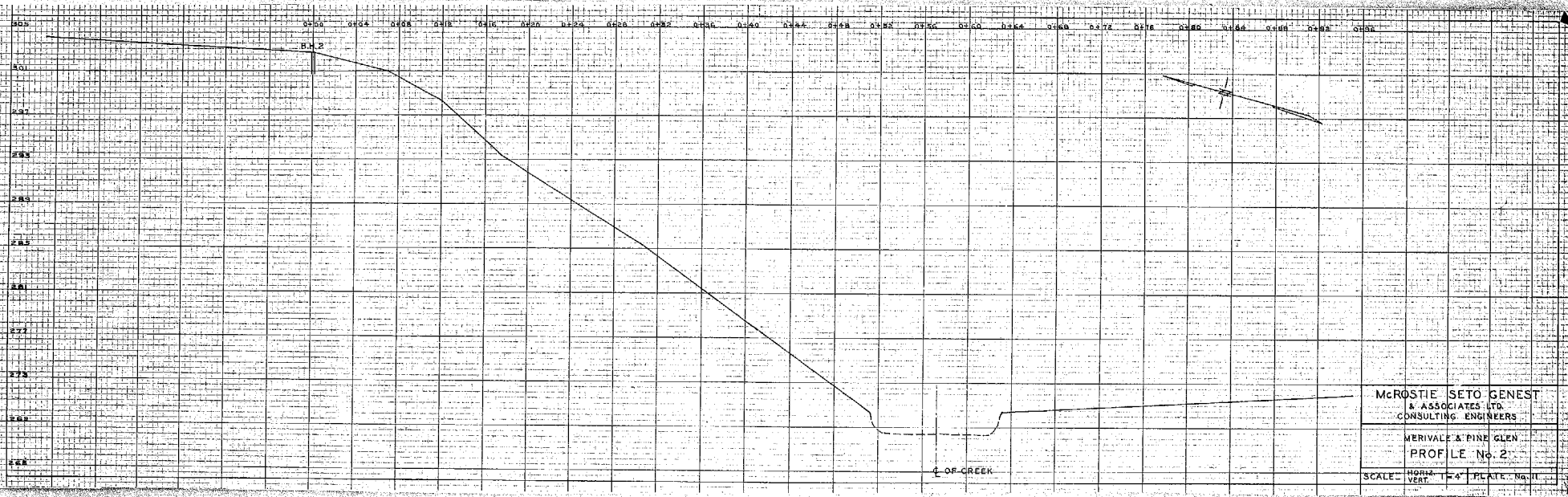
McROSTIE SETO GENEST  
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TYPICAL SLOPE FLATTENING  
PROFILE No. 1

SCALE - HORIZ. 1" = 4' | PLATE No. 13  
VERT. 1" = 4'



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MERIVALE & PINE GLEN  
PROFILE No. 3  
SCALE - HORIZ. 1"=8' VERT. 1"=8' PLATE No. 12'



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 MERIVALE & PINE GLEN  
 PROFILE No. 2  
  
 SCALE: HORIZ. 1"=4' VERT. 1"=4' PLATE No. II