DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 30M13-135

DIST. CR REGION

W.P. No. 145-96-00

CONT. No.

W. O. No.

STR. SITE No.

HWY. No. 9

LOCATION RSS No. 2 : St. Andrews Rd.

No OF PAGES - —

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

# RECORD OF BOREHOLE No A2 1 OF 1 METRIC

W.P. 145-96-00 LOCATION N 4 866 522.4 E 264 171.0 ORIGINATED BY AMG

DIST CR HWY 9 BOREHOLE TYPE HS Auger COMPILED BY BB

DATUM Geodetic DATE 97 07 29 CHECKED BY BB

| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES 'N' VALUES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) 20 40 60 80 100 | PLASTIC LIMIT $w_P$ / NATURAL MOISTURE CONTENT $w$ / LIQUID LIMIT $w_L$ — WATER CONTENT (%) 10 20 30 | UNIT WEIGHT $\gamma$ kN/m³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 426.4 | Ground Surface | | | | | | | | | | |
| 0.0 | PEAT<br>Trace Sand<br>Trace Silt<br>Dark Brown to Black<br>Very Soft to Soft | | 1 | SS | 4 | | 426 | | | | |
| | | | 2 | SS | 4 | ▼ | | | | | |
| | | | 3 | SS | 3 | | | | w=143.5 | | 27% org |
| 423.5 | | | 4 | SS | 2 | | 424 | | | | |
| 2.9 | MARL<br>Trace Sand<br>Beige<br>Very Loose | | 5 | SS | 1 | | | | 40.5<br>w=76 | | 3 13 77 7 |
| 422.4 | | | | | | | 422 | | | | |
| 4.0 | SILTY SAND<br>Trace Gravel<br>Grey<br>Loose | | 6 | SS | 5 | | | | o | | 14 57 (29) |
| | | | 7 | SS | 5 | | 420 | | | | |
| 418.0 | | | 8 | SS | 6 | | | | | | |
| 8.4 | CLAYEY SILT<br>Trace Sand<br>Very Stiff | | 9 | SS | 23 | | 418 | | ⊢● | 20.9 | 0 6 (94) |
| 416.8 | | | | | | | | | | | |
| 9.6 | End of Borehole | | | | | | | | | | |

+3, ×5 : Numbers refer to Sensitivity

15 ◇ 20/10 5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No A3 1 OF 1 METRIC

W.P. 145-96-00 LOCATION N 4 866 512.0 E 264 129.5 ORIGINATED BY DT

DIST CR HWY 9 BOREHOLE TYPE SS Auger COMPILED BY BB

DATUM Geodetic DATE 98 01 16 CHECKED BY BB

| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES 'N' VALUES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100) | PLASTIC LIMIT $w_P$ / NATURAL MOISTURE CONTENT $w$ / LIQUID LIMIT $w_L$ — WATER CONTENT (%) (10 20 30) | UNIT WEIGHT $\gamma$ kN/m³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 425.5 | Ground Surface | | | | | | | | | | |
| 0.0 | SILTY SAND<br>Some Gravel<br>Brown<br>Very Loose<br>(Fill Material) | | 1 | SS | 5 | | 425 | | w=107.5 | | 9 57 (34) |
| 423.7 | | | 2 | SS | 3 | | | | | | |
| 1.8 | PEAT<br>Occasional wood fragments<br>Occasional silty sand zones<br>Black<br>Very Soft | | 3 | TW | PH | | 423 | | $w_L$ 63<br>$w_P$ 55 w=780 | 11.4 | |
| 421.4 | | | 4 | SS | 1 | | | | | | |
| 4.1 | MARL<br>Occasional organic fibres<br>and wood fragments<br>Trace Sand<br>Very Loose / Very Soft | | 5 | TW | PH | | 421 | • | w=69 | 12.0 | |
| | | | 6 | SS | 2 | | | | w=224 | | |
| | | | 7 | SS | 0 | | 419 | | w=121.5 | | |
| 418.0 | | | 8 | SS | 0 | | | | $w_L$ 66<br>$w_P$ 57 w=102.5 | | |
| 7.5 | Silty Clay zone<br>SILTY SAND<br>Trace/Some Gravel<br>Compact | | 9 | SS | 0 | | 417 | | $w_L$ 26<br>$w_P$ 18 o | | 0 7 (93) |
| 415.9 | | | 10 | SS | 14 | | | | o | | 15 26 (59) |
| 9.6 | End of Borehole<br>END of CONE TEST | | | | | | | 100/ 23cm | | | |

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

# RECORD OF BOREHOLE No A4 1 OF 1 METRIC

W.P. 145-96-00 LOCATION N 4 866 498.0 E 264 111.0 ORIGINATED BY DT

DIST CR HWY 9 BOREHOLE TYPE SS Auger COMPILED BY BB

DATUM Geodetic DATE 98 01 16 CHECKED BY BB

| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES 'N' VALUES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (o UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE) (20 40 60 80 100) | PLASTIC LIMIT $w_P$ / NATURAL MOISTURE CONTENT $w$ / LIQUID LIMIT $w_L$ / WATER CONTENT (%) (10 20 30) | UNIT WEIGHT $\gamma$ kN/m³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 429.0 | Ground Surface | | | | | | | | | | |
| 0.0 | SAND and GRAVEL<br>Trace Silt<br>Compact | | 1 | SS | 12 | | | | | | |
| 427.1 | (Fill Material) | | 2 | SS | 14 | | | | o | | 27 5t (22) |
| 1.9 | SILTY SAND<br>Trace to Some Gravel<br>Loose to Dense | | 3 | SS | 6 | ▼* | 426.4 | | | | |
| | | | 4 | SS | 23 | | | | | | |
| 424.6 | (Fill Material) | | 5 | SS | 33 | | | | o | | 39 (43) (18) |
| 4.4 | PEAT<br>Occasional wood fragments<br>Trace Sand<br>Trace Silt<br>Black<br>Soft to Stiff | | 6 | SS | 6 | | | | | | |
| | | | 7 | SS | 7 | | | | | | |
| | | | 8 | SS | 9 | | | | | w=167.5 | |
| 421.7 | | | 9 | SS | 3 | | | | | w=116 | |
| 7.3 | MARL | | | | | | | | | | |
| 420.9 | Very Loose/Soft | | 10 | SS | 2 | | | | (NP) | w=105.5 | 12.8 |
| 8.1 | End of Borehole | | | | | | | | | | |

* Cave-in

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

# RECORD OF BOREHOLE No A5 1 OF 1 METRIC

W.P. 145-96-00 LOCATION N 4 866 500.0 E 264 153.3 ORIGINATED BY DT

DIST CR HWY 9 BOREHOLE TYPE SS Auger COMPILED BY BB

DATUM Geodetic DATE 98 01 16 CHECKED BY BB

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa o UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100 | PLASTIC LIMIT $w_P$ / NATURAL MOISTURE CONTENT $w$ / LIQUID LIMIT $w_L$ WATER CONTENT (%) 10 20 30 | UNIT WEIGHT $\gamma$ kN/m³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | | | | |
| 428.0 | Ground Surface | | | | | | | | | | |
| 0.0 | SAND and GRAVEL<br>Trace Silt<br>Compact | | 1 | SS | 18 | | | | | | |
| 425.9 | (Fill Material) | | 2 | SS | 15 | ▼* | | | o | | 15 To (15) |
| 2.1 | SILTY SAND<br>Trace to Some Gravel<br>Very Loose | | 3 | SS | 2 | | | | | | |
| 423.6 | (Fill Material) | | 4 | SS | 3 | | | | | | |
| 4.4 | PEAT<br>Occasional wood fragments<br>Compact/Stiff | | 5 | SS | 11 | | | | w=40.5 | | 1o 65 25 |
| | | | 6 | SS | 11 | | | | w=40.5 | | |
| 419.9 | | | 7 | SS | 7 | | | | w=117 | | |
| 8.1 | End of Borehole | | | | | | | | | | |

+³, ×⁵ : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

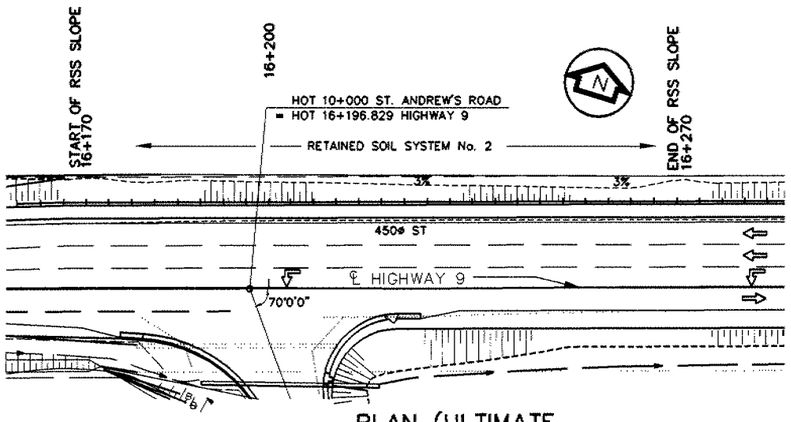
14.5
3.75
10.75

METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

DIST 6
CONT No
WP No 145-96-00

RETAINED SOIL SYSTEM NO. 2
STA. 16+170 TO STA. 16+270
GENERAL ARRANGEMENT

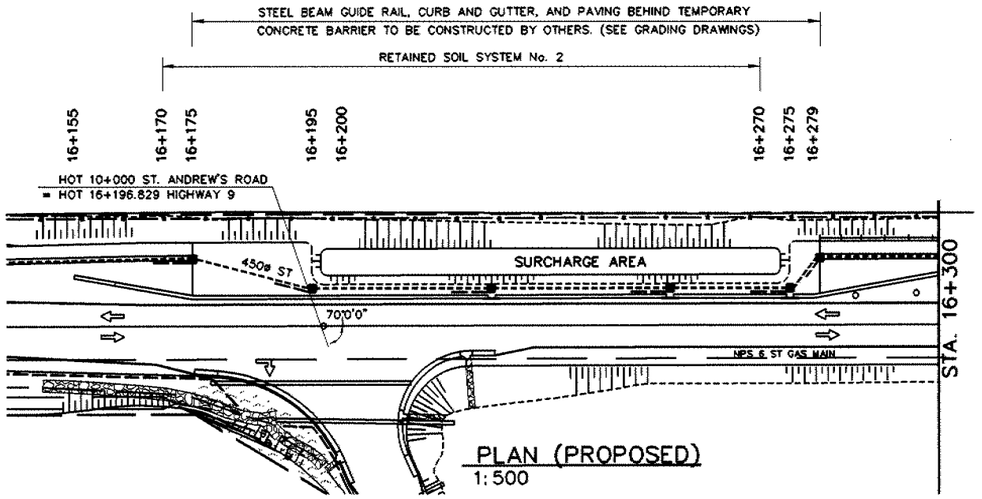
SHEET



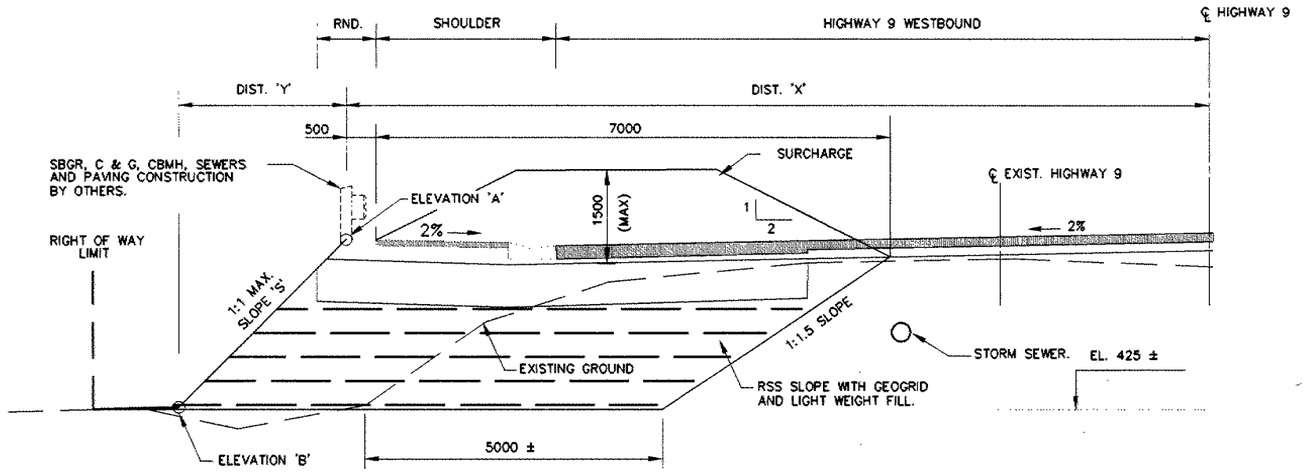

PLAN (ULTIMATE
1:500

| RETAINED SOIL SYSTEM No. 2 | | | | | |
|---|---|---|---|---|---|
| STATION | ELEVATION 'A' | ELEVATION 'B' | DIST. 'X' | DIST. 'Y' | SLOPE 'S' |
| 16+170 | 429.84 | 427.76 | 14.50 | 4.16 | 2:1 |
| 16+180 | 429.50 | 426.73 | 14.50 | 2.77 | 1:1 |
| 16+187.5 | 429.26 | 425.57 | 14.50 | 3.69 | 1:1 |
| 16+200 | 428.90 | 425.56 | 14.50 | 3.34 | 1:1 |
| 16+212.5 | 428.60 | 425.41 | 14.50 | 3.19 | 1:1 |
| 16+225 | 428.35 | 425.55 | 14.50 | 2.80 | 1:1 |
| 16+237.5 | 428.15 | 425.51 | 14.50 | 2.64 | 1:1 |
| 16+250 | 428.00 | 425.63 | 14.50 | 2.37 | 1:1 |
| 16+260 | 427.93 | 425.72 | 14.50 | 2.21 | 1:1 |
| 16+270 | 427.87 | 426.07 | 14.50 | 3.60 | 2:1 |

| RSS ATTRIBUTES |
|---|
| APPLICATION : BASE REINFORCEMENT |
| PERFORMANCE : LOW |
| APPEARANCE : LOW |




PLAN (PROPOSED)
1:500




TYPICAL SECTION OF RETAINED SOIL SYSTEM
SCALE = 1:50

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

| REVISIONS | DESCRIPTION | | | | |
|---|---|---|---|---|---|
| DESIGN NG/GY | CHK | CODE OHBDC-91 | LOAD CLASS 'A' | DATE OCT. 1997 | |
| DRAWN G.Y. | CHK N.G. | SITE | STRUCT | SCHEME | DWG 1 |

# memorandum

Ontario

To: T. Fazio
Highway Engineering
Central Region

February 5, 1998

From: Pavements and Foundations Section
Room 223, Central Building

Phone: 235-4333

Re: Highway 9 Reconstruction, RSS No. 2
WP 145-96-00, Central Region

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This memo follows our meeting of 98 02 04 at which the foundation design alternatives for RSS No. 2 were discussed. The alternatives presented were over and above those in the Foundation Investigation and Design Report and are attached in chart form together with their advantages, disadvantages and costs.

The preferred alternative selected from the conceptual designs outlined in the Foundation Investigation and Design Report for this project was the lightweight fill over a base reinforcement. The lightweight fill types proposed for the embankment were not environmentally acceptable. When the proprietary company (Tensar) was approached for the design of the base reinforcement and reinforced slope with the use of conventional fill, it was determined that excessive settlements would take place with an associated risk to the stability of the existing embankment.

The Tensar company proceeded with a design and forwarded a proposal to found the widened embankment on a matrix of piles. The design, in combination with base reinforcement and a reinforced slope would minimize the settlement concerns and eliminate slope stability problem.

Consideration was also given to a soil improvement alternative that requires the installation vertical wick drains in combination with a series of stage loadings. This alternative could support the use of conventional fill. A conceptual proposal was submitted by a geotechnical consultant specializing in construction over soft ground. This design would accelerate the settlements imposed by the embankment widening but carries the risk that settlement would continue for many years.

\...2

The design of the two alternatives described above is essentially complete. They are offered as alternatives to the lightweight fill option and it is felt that they are the most feasible from a foundations perspective at this site. However, it is our understanding that due to environmental/ hydrogeological concerns and scheduling constraints, these alternatives will not be pursued at this time and that construction of a truck climbing lane in the vicinity of RSS No. 2 will be deleted from the contract.

Please advise if further information is required.

Betty Bennett, P. Eng.
Foundation Engineer

c.c. R. Hanmer
P. Shaver
F. Leech
T. Kazmierowski

**WP 145-96-00 Highway 9 Reconstruction** **RSS No. 2 - Alternatives**

| ALTERNATIVE | DESCRIPTION | ADVANTAGES | DISADVANTAGES | ESTIMATED COST |
|---|---|---|---|---|
| **Realignment** | Shift alignment to the south | The construction and environmental challenges are avoided; no impact on existing embankment | Planning constraints | $ 20 K |
| **Conventional Embankment** | Standard fill with reinforced slope | N/A | Embankment would experience slope failure and settlement | N/A |
| **Excavation with Sheet Piles** | Temporary sheet piles driven adjacent to property while excavation of peat is carried out; peat replaced with granular fill | The most problematic soil is removed and stability of the existing and new embankment is ensured. Large % of settlement could be realised during construction. | Potential change to the hydrogeological regime with use of replacement material | Sheet piles $200K<br>Sub-exc/fill $ 50K<br>Disposal $20K<br>Total 270 K |
| **Lightweight Fill on Geogrid**<br>**i) Polystyrene**<br>**ii) Corrugated Steel Pipe** | Foundation improvement using Tensar geogrid base reinforcement with various fill options:<br>i) Sheets of extruded polystyrene placed between layers of geogrid to reduce weight of embankment<br>ii) Series of CSP's set transversely into the embankment | Base reinforcement and lightweight fill in combination would reduce the amount of settlement induced by conventional fill and would maintain the global stability of the embankment<br>i) Polystyrene is the most lightweight of all fill materials and would, together with base reinforcement, create a floating embankment<br>ii) Use of CSP would replace the weight of fill with voids introduced by the open pipe | Settlement still likely due to weight of road bed; concerns with future maintenance.<br>i) Polystyrene requires a polyethylene cover to prevent damage from fuel and ultraviolet rays<br>ii) Care required during installation to ensure simultaneous placement of backfill<br>Reported environmental concerns | i) Polystyrene $ 180K<br>Base Reinforcement $60K<br>Total $ 240 K<br>ii) CSP $ 100K<br>Base Reinforcement $60K<br>Total $ 160 K |
| **Pile-Geogrid Bridge** | Transfer of embankment loading to piles with geogrid spanning the piles | The weight of the embankment widening would be transferred to the piles thereby resulting in no weight transfer to the existing embankment | Expensive | Piles $ 240K<br>Base reinforcement $60 K<br>Total $ |
| **Soil Improvement using Wick Drains and Stage Loading** | Installation of wick drains and gradual loading of fill with observational engineering in conjunction with Tensar geogrid base reinforcement | Accelerated settlements are achieved with wick drains; stage loading allows for dissipation of pore pressures | Risk of instability; possible failure<br>Risk to existing embankment<br>Risk of continued settlement/maintenance<br>Possible displacement of material below water table | Engineering $ 30 K<br>Installation $ 30K<br>Base Reinforcement $ 60 K<br>Total $ 120 K |
| **Conventional Bridge** | Deep foundations spanned by deck | A technical solution | Expensive | $ 400 K |

*** All alternatives using base reinforcement would require the Sierra Reinforced Slope which is estimated to be an additional cost of $60 K.**

Ontario

# FAXGRAM

**DATE:** January 30, 1998



TO: Dr. B. Fellenius
Urkadda Technology Ltd.

Fax: (613) 748-7402

FROM: D. Dundas
MTO, Pavements & Foundations
Ph: (416)235-3482
Fax: (416) 235-5240

SUBJECT: Embankment over Organic Deposit

As discussed over the telephone, I am forwarding a description of the site and subsurface conditions together with a drawing of embankment widening on Highway 9, near the town of Orangeville.

We have considered a variety of solutions at this site but have been restricted by stringent environmental constraints.

We would consider presenting an alternative using wick drains if you could assist us in preparing a conceptual design with installation details.

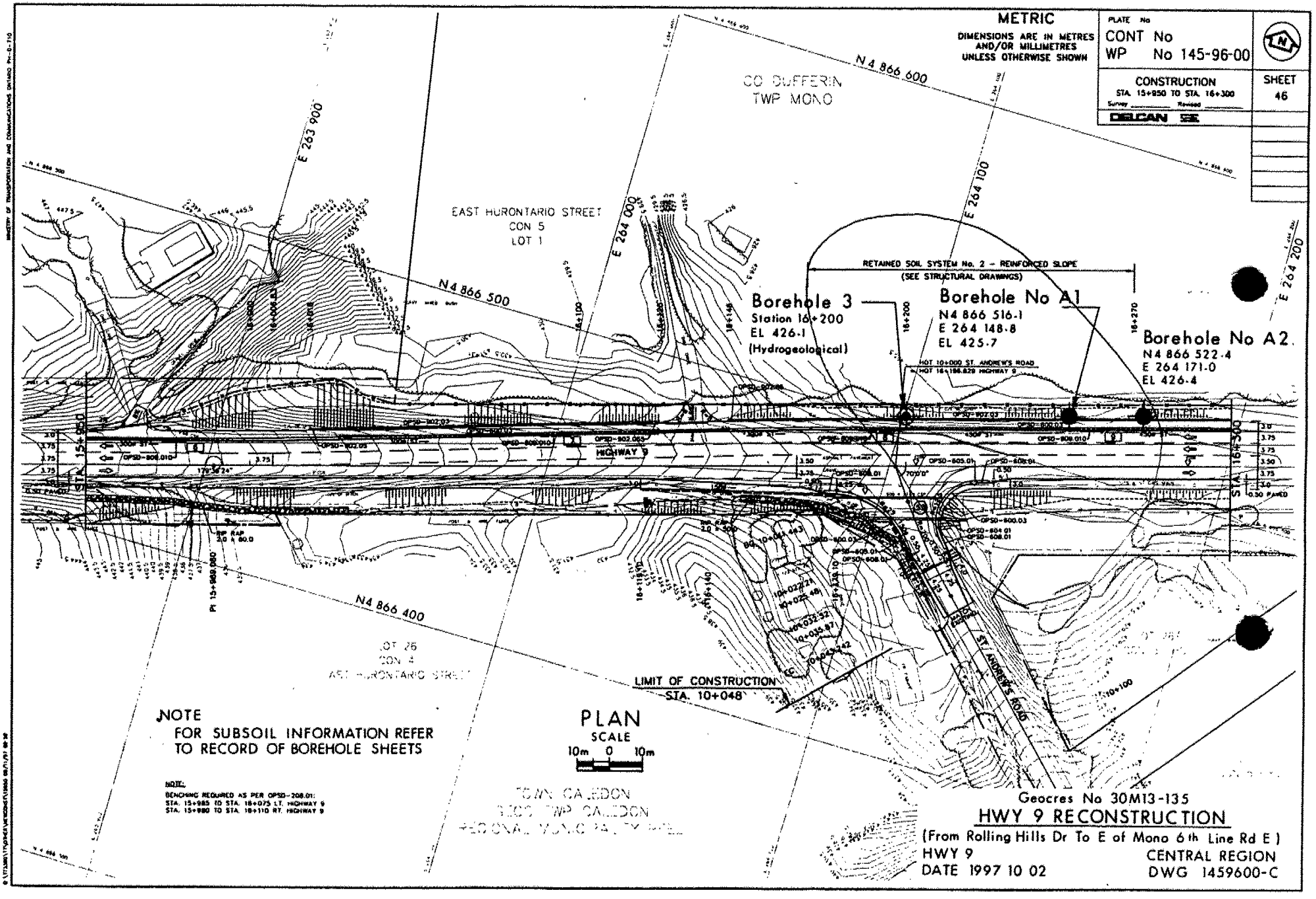
Reconstruction of Highway 9 through this area is expected to begin this summer. At this point in time, the embankment widening across this organic deposit is to be constructed during this construction period, so we have 6 months in which to build up the embankment.

As was explained, we are not in a position to confirm that the design will be accepted or incorporated at this point in time.

If you require any additional information, please call.

Regards,

Dave


METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
PLATE No
CONT No
WP No 145-96-00
CONSTRUCTION
STA. 15+850 TO STA. 16+300
SHEET 46
DELCAN SE
CO DUFFERIN
TWP MONO
EAST HURONTARIO STREET
CON 5
LOT 1
N4 866 600
N4 866 500
N4 866 400
E 263 900
E 264 000
E 264 100
E 264 200
RETAINED SOIL SYSTEM No. 2 – REINFORCED SLOPE
(SEE STRUCTURAL DRAWINGS)
Borehole 3
Station 16+200
EL 426.1
(Hydrogeological)
Borehole No A1
N4 866 516.1
E 264 148.8
EL 425.7
Borehole No A2
N4 866 522.4
E 264 171.0
EL 426.4
HIGHWAY 9
HOT 10+000 ST. ANDREW'S ROAD
HOT 16+186.829 HIGHWAY 9
STA 15+800
STA 16+300
LOT 25
CON 4
EAST HURONTARIO STREET
LIMIT OF CONSTRUCTION
STA. 10+048
ST. ANDREW'S ROAD
NOTE
FOR SUBSOIL INFORMATION REFER TO RECORD OF BOREHOLE SHEETS
NOTE:
BENCHING REQUIRED AS PER OPSD-208.01:
STA. 15+985 TO STA. 16+075 LT. HIGHWAY 9
STA. 15+980 TO STA. 16+110 RT. HIGHWAY 9
PLAN
SCALE
10m 0 10m
TOWN CALEDON
FORMER TWP CALEDON
REGIONAL MUNICIPALITY OF PEEL
Geocres No 30M13-135
HWY 9 RECONSTRUCTION
(From Rolling Hills Dr To E of Mono 6th Line Rd E)
HWY 9
CENTRAL REGION
DATE 1997 10 02
DWG 1459600-C

**W.P. 91-23-025, Hwy. 9**
**Buena Vista Dr. - 7th Line Mono**

16+100 5.2 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 330 mm | cr.gr. |
| 330 | - | 1.0 m | br.sa. (S.P.) dry + stny. |
| 1.0 | - | 1.2 m | br.sa. (S.W.) dry + stny. |
| 1.2 | - | 1.5 m | br.si.sa.tr.org. moist + stny. |

16+100 6.6 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 100 mm | dk.br.si.sa.tps. |
| 100 | - | 1.0 m | br.si.sa. moist |
| 1.0 | - | 1.5 m | br.sa.si. moist-wet (moist to 1.2 m) |

16+206 4.0 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 150 mm | asph. |
| 150 | - | 370 mm | cr.gr. |
| 370 | - | 1.5 m | br.sa. (S.P.) tr.si. dry + stny. |

16+206 5.7 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 240 mm | cr.gr. |
| 240 | - | 1.2 m | br.sa. (S.P.) tr.si. dry + stny. |
| 1.2 | - | 1.5 m | br.si.sa. moist + stny. |

16+206 7.3 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 370 mm | cr.gr. |
| 370 | - | 1.3 m | br.sa. (S.P.) tr.si. dry + stny. |
| 1.3 | - | 1.5 m | br.si.sa. moist + stny. |

16+230 3.6 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 50 mm | asph. |
| 50 | - | 380 mm | cr.gr. |
| 380 | - | 2.0 m | br.sa. (S.P.) moist + stny. |
| 2.0 | - | 2.3 m | br.si.sa.tr.org. moist + stny. |

16+230 6.3 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 330 mm | cr.gr. |
| 330 | - | 1.0 m | br.sa. (S.P.) moist + stny. |
| 1.0 | - | 1.6 m | br.si.sa. w/s cl. moist |
| 1.6 | - | 2.5 m | br.si.sa. wet (2.0 m+ sat.) |
| | | | Test 96-WB-23 (taken 1.7 - 2.0 m) |
| | | | (hole water filled to 1.2 m) |

16+255 3.6 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 30 mm | asph. |
| 30 | - | 330 mm | cr.gr. |
| 330 | - | 1.7 m | br.sa. (S.P.) moist + stny. |
| 1.7 | - | 2.0 m | gry.sa.si.tr.cl. + org. moist |

16+255 6.6 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 330 mm | cr.gr. |
| 330 | - | 1.5 m | br.sa. (S.P.) moist + stny. (1.0 m+ wet) |
| 1.5 | - | 2.0 m | br.si.sa.tr.cl. wet-sat. |
| | | | Test 96-WB-24 Jar (taken 1.7 - 1.9 m) |
| 2.0 | - | 2.5 m | gry.sa.si. w/s cl.tr.org. |
| | | | moist-wet + stny. cl. pockets 2.2 m+ |

16+275 3.5 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 30 mm | asph. |
| 30 | - | 260 mm | cr.gr. |
| 260 | - | 1.0 m | br.sa. (S.P.) moist + stny. |
| 1.0 | - | 1.8 m | br.si.sa.tr.cl. moist + stny. |

16+275 6.9 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 100 mm | cr.gr. |
| 100 | - | 360 mm | br.sa. (S.P.) moist + stny. |
| 360 | - | 620 mm | dk.br.org. w/s sa.si.co.fib. wet<br>Test 96-WB-25 Jar (taken 620-820 mm) |
| 620 | - | 870 mm | br.sa. (S.P.) w/s si. moist + stny. |
| 870 | - | 1.4 m | dk.br.org. w/s sa.si. seams<br>co.fib. wet + stny.<br>Test 96-WB-26 (taken 900 mm - 1.2 m) |
| 1.4 | - | 1.8 m | br.si.sa. moist + stny.(1.5 m+ moist-wet) |

16+300 3.5 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 50 mm | asph. |
| 50 | - | 300 mm | cr.gr. |
| 300 | - | 670 mm | br.sa. (S.P.) moist + stny. |
| 670 | - | 2.0 m | br.sa. (S.P.) w/s si. moist + stny. |

16+300 4.3 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 70 mm | asph. |
| 70 | - | 340 mm | cr.gr. |
| 340 | - | 1.2 m | br.sa. (S.P.) w/s si. moist + stny. |
| 1.2 | - | 1.5 m | br.si.sa. moist + stny. |

16+300 6.0 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 300 mm | cr.gr. |
| 300 | - | 500 mm | br.sa. (S.P.) tr.si. moist + stny. |
| 500 | - | 570 mm | dk.br.org. moist fi.fib. |
| 570 | - | 780 mm | br.sa. (S.P.) moist + stny. |
| 780 | - | 2.0 m | br.si.sa.tr.cl. moist + stny.<br>(sa.si. seams 1.7 m+) |

16+300 6.1 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 200 mm | cr.gr. |
| 200 | - | 800 mm | br.sa. (S.P.) tr.si. moist + stny. |
| 800 | - | 1.5 m | br.si.sa. moist + stny.<br>Test 96-WB-05 (taken 750 mm - 1.2 m) |

16+300 7.7 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 150 mm | cr.gr. wet |
| 150 | - | 700 mm | br.sa. (S.P.) tr.si. moist + stny. |
| 700 | - | 820 mm | dk.br.org. wet fi.fib.<br>Test 96-WB-06 (taken 700 - 820 mm) |
| 820 | - | 1.5 m | br.si.sa.tr.cl. moist-wet + stny. |
| 1.5 | - | 3.0 m | dk.br.org. wet fi.fib. |

16+325 3.4 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 160 mm | asph. |
| 160 | - | 380 mm | cr.gr. |
| 380 | - | 1.1 m | br.sa. (S.P.) moist + stny. |
| 1.1 | - | 1.4 m | dk.br.org. + si.sa. mix moist |
| 1.4 | - | 1.8 m | br.si.sa. moist-wet |

16+325 3.5 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 80 mm | asph. |
| 80 | - | 280 mm | cr.gr. |
| 280 | - | 1.2 m | br.sa. (S.P.) moist + stny. |
| 1.2 | - | 1.7 m | br.si.sa. moist-wet + stny. |

**W.P. 91-23-025, Hwy. 9**
**Buena Vista Dr. - 7th Line Mono**

9+975 3.1 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 250 mm | cr.gr. |
| 250 | - | 900 mm | gr. (G.P. |
| 900 | - | 1.2 m | br.cl.gr. moist |
| 1.2 | - | 1.5 m | br.cl.si. w/s sa.tr.org. moist |

9+975 3.1 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 300 mm | cr.gr. |
| 300 | - | 600 mm | br.sa. (S.P.) w/s si. moist + stny. |
| 600 | - | 700 mm | br.si.sa. w/s cl. moist-wet |
| 700 | - | 1.5 m | gr. (G.P.) |

16+192 Hwy. 9 = 10+000 4th Line Caledon

10+019 4.6 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 90 mm | asph. |
| 90 | - | 270 mm | cr.gr. |
| 270 | - | 850 mm | br.sa. (S.P.) moist + stny. |
| 850 | - | 1.1 m | br.sa.si. - si.fi.sa. moist |
| | | | Test 96-WB-29 Jar (taken 900mm-1.1m) |
| 1.1 | - | 1.5 m | br.si.fi.sa.tr.org. moist |

10+019 7.0 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 60 mm | cr.gr. |
| 60 | - | 800 mm | gr. (G.P.) tr.cl. moist |
| 800 | - | 1.1 m | br.sa. (S.P.) moist + stny. |
| 1.1 | - | 1.5 m | br.sa.si. w/s cl.tr.org. moist-wet |

10+040 18.1 Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 160 mm | dk.br.org.fi.fib. wet |
| 160 | - | 600 mm | gry.cl.si. w/s sa. + org. wet + soft |
| 600 | - | 2.2 m | dk.br.org.fi.fib. wet |
| 2.2 | - | 2.5 m | gry.cl.si. wet + firm |
| 2.5 | - | 5.4 m | dk.br.org. fi.fib. wet |

16+252 4.2 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 100 mm | asph. |
| 100 | - | 310 mm | cr.gr. |
| 310 | - | 1.75 m | br.gr.sa.tr.si. moist + stny. |

16+252 6.6 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 300 mm | cr.gr. |
| 300 | - | 850 mm | br.gr.sa. moist |
| 850 | - | 2.3 m | br.si.sa. w/s cl. moist-wet + stny. |
| | | | (1.7 - 2.0 m wet) (2.0 m+ moist) |

16+275 1.8 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 300 mm | asph. |
| 300 | - | 470 mm | cr.gr. |
| 470 | - | 820 mm | br.gr.sa. moist |
| 820 | - | 1.8 m | br.si.sa.tr.cl. moist + stny. |
| 1.8 | - | 2.5 m | gry.sa. (S.P.) tr.si. moist-wet |
| 2.5 | - | 3.5 m | br.si.sa. moist + stny. |
| 3.5 | - | 4.7 m | dk.br.org.co. fib. wet |
| | | | (4.5 m+ w/s moist) |
| 4.7 | - | 5.1 m | gry.si.sa. till moist |

16+275 3.6 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 80 mm | asph. |
| 80 | - | 340 mm | cr.gr. |
| 340 | - | 900 mm | br.gr.sa. moist |
| 900 | - | 1.6 m | gry.si.sa. w/s gr. moist |

16+275 6.1 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 350 mm | cr.gr. |
| 350 | - | 820 mm | br.gr.sa. moist |
| 820 | - | 1.75 m | dk.br.org.si.sa. moist |
| 1.75 | - | 3.5 m | gr.si.sa.tr.ci. moist + stny. |
| 3.5 | - | 6.0 m | dk.br.org.fi.fib. wet |

16+300 2.3 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 260 mm | asph. |
| 260 | - | 470 mm | cr.gr. |
| 470 | - | 780 mm | br.gr.sa. moist |
| 780 | - | 1.6 m | br.si.sa. moist + stny. |
| 1.6 | - | 2.4 m | br.sa. (S.P.) w/s si. moist + stny. |
| 2.4 | - | 3.2 m | br.si.sa. w/s cl. moist + stny. cobs |
| 3.2 | - | 3.7 m | br.sa. (S.P.) w/s si. moist-wet + stny. |
| 3.7 | - | 4.3 m | br.si.sa. w/s cl. wet + stny. |
| 4.3 | - | 4.8 m | gry.si.sa. till moist |

16+300 7.0 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 190 mm | cr.gr. |
| 190 | - | 580 mm | br.gr.sa. moist |
| 580 | - | 700 mm | dk.br.org.si.sa. moist |
| 700 | - | 1.5 m | gry.si.sa.tr.cl. moist + stny. |
| 1.5 | - | 4.2 m | dk.br.org.fi.fib. wet |
| 4.2 | - | 4.5 m | gry.si.sa. w/s cl. moist + stny. |

14+033 Hwy. 9 = 10+000 3rd Line Mono

9+925 4.2 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 200 mm | cr.gr. |
| 200 | - | 360 mm | br.si.sa. moist |
| 360 | - | 500 mm | br.gr.sa. moist |
| 500 | - | 1.1 m | br.si.sa. moist + stny. |
| 1.1 | - | 1.3 m | br.cl.si. w/s sa. moist-wet |
| 1.3 | - | 1.5 m | br.si.sa. moist + stny. |

9+987 8.7 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 50 mm | cr.asph. |
| 50 | - | 140 mm | cr.gr. |
| 140 | - | 400 mm | br.sa. (S.P.) moist + stny. cobs |
| 400 | - | 1.5 m | br.si.sa. moist |

9+987 11.7 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 80 mm | cr.asph. |
| 80 | - | 170 mm | cr.gr. |
| 170 | - | 400 mm | br.sa. (S.P.) moist + stny. |
| 400 | - | 1.5 m | br.si.sa. moist occ.stn. |

16+696 Hwy. 9 = 10+000 5th Line Mono

9+954 2.9 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 260 mm | cr.gr. |
| 260 | - | 1.0 m | br.sa. (S.P.) moist + stny. |
| 1.0 | - | 1.3 m | dk.br.org.fi.fib. wet |
| 1.3 | - | 1.5 m | gry.sa.si. w/s cl. moist-wet |
| 1.5 | - | 1.8 m | gry.si.cl. L.P. moist-wet |

9+980 14.2 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 200 mm | dk.br.sa.si.tps. |
| 200 | - | 700 mm | br.sa.si. |
| 700 | - | 1.8 m | blk.org.si.fib |
| 1.8 | - | N.F.P. | stns. material moist to 1.0 m wet from 1.0 m - 1.8 m |

End of Culvert - 700 mm water
800 mm si.sa. w/s gr. N.F.P. stns.

17+715 Hwy. 9 = 10+000 5th Line Rd. East Caledon

10+015 11.3 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 80 mm | dk.br.sa.si.tps. |
| 80 | - | 250 mm | br.si.sa. |
| 250 | - | 850 mm | br.sa. (S.P.) tr.si. |
| 200 | - | 2.1 m | blk.org.si.occ.stn. |
| 2.1 | - | N.F.P. | stns. |

10+015 11.3 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 90 mm | dk.br.si.sa.tps. |
| 90 | - | 850 mm | br.sa. (S.P.) tr.si. |

13+150 10 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 240 mm | br.sa.tps.tr.gr. |
| 240 | - | 1.0 m | br.sa. w/s si. moist |
| 1.0 | - | 1.3 m | br.si. w/s sa. moist-wet |

13+825 12 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 300 mm | dk.br.sa.si.tps. |
| 300 | - | 700 mm | br.sa. (S.P.) moist |
| 700 | - | 1.2 m | br.si. w/s sa. moist-wet |

13+850 12 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 250 mm | dk.br.si. w/s sa.tps. |
| 250 | - | 600 mm | br.si. w/s sa. stny. |
| 600 | - | N.F.P. | stns. |

16+100 12 m Rt. ℄ (10 m on Gas Line)

| | | | |
|---|---|---|---|
| 0 | - | 300 mm | dk.br.sa.si.tps. |
| 300 | - | 400 mm | br.sa. (S.P.) w/s si. |
| 400 | - | 1.1 m | br.si. w/s sa.tr.gr. moist-wet + firm from 900 mm - 1.1 m) |
| 1.1 | - | N.F.P. | stns. |

16+180 13 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 170 mm | dk.br.sa.si.tps.occ.stn. |
| 170 | - | 600 mm | br.sa. w/s si. |
| 600 | - | 900 mm | br.si. w/s sa.tr.gr.occ.cobbles |

16+205 14 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 200 mm | blk.fib.org. wet |
| 200 | - | 750 mm | br.sa. w/s si. wet |
| 750 | - | 4.0 m | blk.org.fi.fib. wet + soft |
| 4.0 | - | | org. exceed 4.0 (talk to L. Lowe) |

16+225 14 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 400 mm | water |
| 400 | - | 800 mm | blk.org. wet + soft |
| 800 | - | 1.2 m | br.sa.si. w/s gr. moist + firm |
| 1.2 | - | 2.0 m | blk.si.org. wet + soft |
| 2.0 | - | 2.4 m | blk.si.org. w/s stns. moist + firm (occ. pockets of fib.org.) |
| 2.4 | - | N.F.P. | (?) |

16+235 13 m Rt. ℄ (Organic Deposit)

16+825 13 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 170 mm | dk.br.sa.si.tps. |
| 170 | - | 600 mm | br.gr.si. w/s sa. moist + firm |
| 600 | - | 1.0 m | blk.br.si. w/s sa. moist + firm |
| 1.0 | - | 1.3 m | br.si. w/s gr.tr.org. |

16+250 13 m ℄

| | | | |
|---|---|---|---|
| 0 | - | 200 mm | dk.br.sa.si.tps. |
| 200 | - | 400 mm | blk.org.si. |
| 400 | - | 900 mm | br.si. w/s org.tr.sa. moist + firm |
| 900 | - | 2.1 m | blk.org.fi. + fib. wet + soft |
| 2.1 | - | 2.6 m | br.sa.si. w/s org. moist-wet + firm |
| 2.6 | - | 3.5 m | blk.org.fi.fib. wet + soft |

16+275 13 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 200 mm | dk.br.si.sa. w/s cl.tps. |
| 200 | - | 400 mm | blk.org.fi.fib. |
| 400 | - | 650 mm | br.si.sa. moist |
| 650 | - | 1.3 m | br.si. w/s org. + sa.tr.gr. |
| 1.3 | - | 4.5 m | blk.org.fib. wet + soft |
| 4.5 | - | 4.6 m | gry.si.sa. w/s gr. moist + firm |
| 4.6 | - | N.F.P. | stns. |

16+300 13 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 180 mm | dk.br.sa.si.tps. |
| 180 | - | 500 mm | br.si.sa. |
| 500 | - | 1.0 m | blk.org.si. moist + firm occ.stn. |
| 1.0 | - | 1.9 m | br.si.si.tr.gr. + org. moist + firm |
| 1.9 | - | 2.5 m | br.si. w/s org.tr.gr. moist |
| 2.5 | - | 3.0 m | br.si. w/s org. + sa. |

16+325 13 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 400 mm | dk.br.sa.si.tps. |
| 400 | - | 1.9 m | blk.org.fi.fib. moist occ.stn. |
| 1.9 | - | N.F.P. | stns. |

16+350 13 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 350 mm | dk.br.sa.si.tps. |
| 350 | - | 1.4 m | blk.org.si.tr.gr. moist + firm |
| 1.4 | - | N.F.P. | stns. |

16+375 13 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 300 mm | dk.br.sa.si.tps. w/s gr. |
| 300 | - | 600 mm | blk.org.si.fib. |
| 600 | - | 800 mm | gry.sa.si.tr.gr. |
| 800 | - | N.F.P. | stns. |

16+450 12 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 200 mm | dk.br.sa.si.tps. |
| 200 | - | 700 mm | br.si.tr.cl. |
| 700 | - | N.F.P. | stns. |

**W.P. 91-23-025, Hwy. 9**
**Buena Vista Dr. - 7th Line Mono**

| | | | |
|---|---|---|---|
| 14+900 | | 7.0 m Lt. ℄ | |
| 0 | - | 250 mm | br.sa. (S.P.) w/s si. moist + stny. |
| 250 | - | 570 mm | br.si.sa. w/s cl. moist + stny. |
| 570 | - | 750 mm | dk.br.org.sa.si. moist |
| 750 | - | 930 mm | br.sa.si. w/s cl. moist |
| 930 | - | 1.5 m | br.si.sa. w/s cl. moist-wet |
| 14+925 | | 3.4 m Lt. ℄ | |
| 0 | - | 150 mm | asph. |
| 150 | - | 340 mm | cr.gr. |
| 340 | - | 1.0 m | br.sa. (S.P.) tr.si. moist + stny. |
| 1.0 | - | 1.5 m | br.si.sa.tr.cl. moist + stny. |
| 14+925 | | 6.8 m Lt. ℄ | |
| 0 | - | 140 mm | cr.gr. |
| 140 | - | 280 mm | br.sa. (S.P.) tr.si. dry + stny. |
| 280 | - | 570 mm | br.si.sa. moist |
| 570 | - | 1.5 m | br.si.sa.tr.cl. moist + stny. occ.cob. |
| 16+206 | | 4.0 m Lt. ℄ | |
| 0 | - | 120 mm | asph. |
| 120 | - | 430 mm | cr.gr. |
| 430 | - | 1.4 m | br.sa. (S.P.) moist + stny. |
| 1.4 | - | 1.6 m | dk.br.org.fi.fib. wet |
| 1.6 | - | 2.0 m | br.si.sa. w/s cl.tr.org. moist + stny. |
| 2.0 | - | 2.7 m | br.si.sa. moist + stny. |
| 2.7 | - | 4.0 m | gry.si.sa. till tr.cl. wet + stny. |
| 4.0 | - | 5.0 m | dk.br.org.fi.fib. wet |
| 5.0 | - | 6.0 m | dk.br.org.sa.si. w/s cl.fi.fib. wet |

| | | | |
|---|---|---|---|
| 16+206 | | 6.0 m Lt. ℄ | |
| 0 | - | 540 mm | cr.gr. |
| 540 | - | 1.8 m | gr. (G.P.) occ.cob. |
| 1.8 | - | 3.8 m | br.si.sa.tr.cl. moist + stny. (2.5 m+ wet) |
| 3.8 | - | 5.3 m | dk.br.org.fi.fib. moist-wet |
| 5.3 | - | 6.0 m | br.si.sa.tr.cl. + org. wet + soft |
| 16+220 | | 4.2 m Rt. ℄ | |
| 0 | - | 90 mm | asph. |
| 900 | - | 500 mm | cr.gr. |
| 500 | - | 1.7 m | br.sa. (S.P.) tr.si. moist + stny. |
| 1.7 | - | 2.7 m | br.si.sa.tr.cl. + org. moist occ.fi.fib. (2.0 - 2.5 m moist-wet) |
| 2.7 | - | 4.0 m | gry.si.sa. till moist (3.2 m+ moist-wet) |
| 4.0 | - | 5.0 m | gry.si.sa. till w/s cl. moist + firm |
| 16+220 | | 7.2 m Rt. ℄ | |
| 0 | - | 470 mm | cr.gr. |
| 470 | - | 2.6 m | br.sa. (S.P.) tr.si. moist + stny. (1.3 - 1.7 m wet) 1.7 m+ sat.) |
| 2.6 | - | 3.3 m | gry.si.sa. till w/s cl. sat. |
| 3.3 | - | 4.4 m | gry.si.sa. till moist |
| 4.4 | - | 5.9 m | dk.br.org.fi.fib. moist-wet |
| 16+255 | | 3.7 m Rt. ℄ | |
| 0 | - | 120 mm | asph. |
| 120 | - | 400 mm | cr.gr. |
| 400 | - | 1.5 m | br.sa. (S.P.) tr.si. moist + stny. |
| 1.5 | - | 1.8 m | br.si.sa. w/s cl. + org. moist |
| 1.8 | - | 5.0 m | br.si.sa.tr.cl. wet (2.2 - 3.3 m moist) |

**W.P. 91-23-025, Hwy. 9**
**Buena Vista Dr. - 7th Line Mono**

16+255 4.4 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 100 mm | asph. |
| 100 | - | 400 mm | cr.gr. |
| 400 | - | 1.7 m | br.sa. (S.P.) moist occ.stn. |
| 1.7 | - | 2.2 m | gry.br.si.sa. w/s cl.tr.org. moist-wet + stny. |
| 2.2 | - | 5.0 m | br.si.sa. till tr.cl. moist (3.7 m moist-wet) |

16+255 6.1 m Lt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 360 mm | cr.gr. |
| 360 | - | 530 mm | br.sa. (S.P.) moist + stny. |
| 530 | - | 700 mm | br.si.sa. w/s cl. moist + stny. |
| 700 | - | 1.3 m | br.si.sa. moist-wet + stny. |
| 1.3 | - | 2.0 m | dk.br.org.si.sa. moist-wet + stny. |
| 2.0 | - | 5.0 m | gry.br.si.sa. till tr.cl. moist (2.5 - 3.0 m moist-wet) (3.0 m+ wet) |

16+255 6.7 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 340 mm | cr.gr. |
| 340 | - | 500 mm | asph. friable |
| 500 | - | 1.3 m | br.sa. (S.P.) tr.si. moist + stny. |
| 1.3 | - | 2.6 m | br.si.sa. w/s cl. + org. moist + stny. (moist-wet 1.7 m+) |
| 2.6 | - | 4.2 m | br.si.sa.tr.cl. moist + stny. |
| 4.2 | - | 5.8 m | dk.br.org.fi.fib. w/s peat wet (5.0 m+ woody) |

16+275 3.5 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 50 mm | asph. |
| 50 | - | 400 mm | cr.gr. |
| 400 | - | 720 mm | br.sa. (S.P.) tr.si. dry + stny. |
| 720 | - | 2.5 m | br.si.sa.tr.cl. moist + stny. |
| 2.5 | - | N.F.P. | blds. |

16+275 6.8 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 200 mm | cr.gr. |
| 200 | - | 430 mm | br.sa. (S.P.) tr.si. moist + stny. |
| 430 | - | 830 mm | dk.br.org.sa.si. moist |
| 830 | - | 2.7 m | br.si.sa.tr.cl. moist-wet + stny. (2.0 m+ moist) |
| 2.7 | - | 3.0 m | dk.br.org.fi.fib. wet |
| 3.0 | - | 5.0 m | br.si.sa. till tr.cl. moist (4.7 m+ wet) |

16+300 3.5 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 90 mm | asph. |
| 90 | - | 320 mm | cr.gr. |
| 320 | - | 780 mm | br.sa. (S.P.) tr.si. moist + stny. |
| 780 | - | 4.5 m | br.si.sa. till tr.cl. moist + stny. (4.0 m+ moist-wet) |
| 4.5 | - | N.F.P. | blds. |

16+300 6.5 m Rt. ℄

| | | | |
|---|---|---|---|
| 0 | - | 170 mm | cr.gr. |
| 170 | - | 430 mm | br.sa. (S.P.) tr.si. moist + stny. |
| 430 | - | 660 mm | br.sa.si. w/s cl. moist + stny. |
| 660 | - | 1.1 m | dk.br.org.sa.si. moist-wet |
| 1.1 | - | 3.0 m | br.si.sa. moist + stny. |
| 3.0 | - | 3.5 m | dk.br.org.fi.fib. wet |
| 3.5 | - | 4.1 m | dk.br.org. + br.si.sa. mix wet |
| 4.1 | - | 4.6 m | br.si.sa. till tr.cl. moist |
| 4.6 | - | 5.3 m | br.si.sa. w/s cl.tr.org. wet |

**From:** Betty Bennett
**To:** MTOCR.DOWNSVCR(Sieradzk)
**Date:** 1997/10/27 1:10pm
**Subject:** hwy 9 orangeville RSS lightweight fill -Reply

Susan

A polyethylene film is required to protect the polystyrene from ultraviolet rays and from contact with fuel, etc.. It is possible that the liner could be extended to surround the entire mass of lightweight fill, but I don't think there is a guarantee that water will not infiltrate by some means over a period of time. There should be a mechanism for free water to drain from such an enclosure. In addition, in order for the Styrofoam panels to remain in place, rebar stakes are driven through the panels into the underlying granular material.

As for the integrity of the liner under the surcharge , I'm not sure I understand the concern.

Betty

**Highway 9 Reconstruction**
**Rolling Hills Drive to E of Mono Mills**
**RSS 2 - Sta 16+170 to Sta 16+270**

Construction Sequence - Conceptual

Phase I

1. Excavation of existing embankment at a slope of 1.5H:1V. Excavation to proceed between minimum and maximum limits shown on section. Geogrid to extend 3 to 5 m into existing embankment.

2. Placement of base reinforcement geogrid(s) directly on original ground from base of excavation to the property line.

3. Placement of 1 m of well-graded crushed rock or rock fill; maximum 150 mm and free-draining.

4. Placement of alternate layers of geogrid and 0.3 m of lightweight fill - approx. 5 layers which brings the embankment to El. 427.5. This geogrid is placed as base reinforcement and as the reinforced slope. Slope facing to incorporate slope erosion protection to ensure the stability of the 1H:1V ± slope face.

5. Material used for the sub-base to be extended to a height of 1.0 to 1.5 m above the proposed profile grade to act as a surcharge. The slopes of the surcharge will likely be limited to 1.5H:1V. The limits of the surcharge to extend from the crest of the embankment for a distance of 5 m.

6. Maintain surcharge for one year to accelerate settlement of new embankment. Silt fence can be placed at base of embankment to control sediment. The surcharge may be vegetated if there is time to establish growth. Since surcharge is granular, additional treatment may be required to encourage vegetation. Alternatively, a cover such as plastic sheeting may be considered.

Phase II

1. Remove surcharge to profile elevation or build up embankment to profile elevation depending upon how much settlement has taken place.

2. Construct pavement structure.

October 22, 1997

# memorandum

Ontario

To: T. Fazio
Highway Engineering
Central Region

October 9, 1997

From: Pavements and Foundations Section
Room 223, Central Building

Phone: 235-4333

Re: Foundation Recommendations for RSS Embankment
Highway 9 Widening, Sta 16+170 to Sta 16+270, Left
WP 145-96-00

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Further to the alternatives presented at this site, there is a sense that the full replacement option with the sheet piling (Alternative 1) is an unlikely choice because of the hydrogeological implications. Another site visit and further deliberations have resulted in a modification of this alternative to perhaps make it more acceptable. From our perspective, this alternative provides the best technical solution as it reduces future maintenance problems.

It is proposed to limit the depth of full replacement to the base of the peat deposit only and to leave the marl in place. The use of sheet piles are still recommended, however, they would be installed on a temporary basis only. It may be that the sheet piles would derive some frictional resistance from the marl and driving into the silty sand may be avoided. As a minimum, the sheet piles would be driven to a depth below the excavation that is equal to the depth of excavation, i.e. in the order of 4.0 m below the base of excavation. Bracing of the sheet piles is still recommended.

As mentioned in the original recommendations, crushed stone or rockfill, 150 mm maximum size, is recommended to fill the excavation since it does not require compaction. And it may be necessary to excavate and place the fill almost concurrently to ensure that material from outside the trench does not slough in. It is expected that the fill will be placed to the base of embankment elevation.

When the pile sheeting is removed, it is likely to cause rearrangement of the fill and, on the north side, its movement into the adjacent peat. As well, some settlement of the marl beneath it will take place. Therefore, time is required to allow this rearrangement to occur and to add fill as required before the final embankment is constructed.

For this alternative, a reinforced slope is recommended. Once the embankment is constructed, the placement of the pavement should be delayed for as long as possible to allow for further readjustment of the fill and post construction settlement.

The final Foundations Investigation and Design Report is in printing. It contains the three alternatives for this site as originally recommended. This modified solution is provided for your consideration. If there are any questions, please advise.

Betty Bennett, P.Eng.
Foundation Engineer

c.c. N. Garland, Central Region, Structural
D. DiGennaro, Central Region, Geotechnical

# memorandum

Ontario

To: T. Fazio
Highway Engineering
Central Region

September 26, 1997

From: Pavements and Foundations Section
Room 223, Central Building

Phone: 235-4333

Re: Foundation Recommendations for RSS Embankment
Highway 9 Widening, Sta 16+170 to Sta 16+270, Left
WP 145-96-00

The attached contains the alternatives for swamp treatment and embankment construction for the widening proposed along Highway 9 between Sta 16+170 to 16+270, north side. The alternatives are conceptual in nature and further details will be forthcoming once a preferred option is selected. These alternatives are presented for your consideration, review and discussion.

If there are any questions regarding the attached, please advise.

B Bennett

Betty Bennett, P.Eng.
Foundation Engineer

c.c. N. Garland, Central Region, Structural
D. DiGennaro, Central Region, Geotechnical

**Sta 16+170 to Sta 16+270, north side, RSS No. 2**

It is proposed to construct a 100 m long RSS wall along this section as property restricts conventional widening. The height of the existing and proposed embankment is in the order of 3m. The subsurface material in the vicinity consists of as much as 9.1m of soft peat and marl.

During the subsurface investigation, the drill rig could not advance further west than Sta 16 + 250 because the wet ground would not support it. Even the weight of a person was too great at Sta 16+200, for sinking 0.3 m into the peat was experienced. These events are presented as examples of how soft the ground is at this site and the conditions that will be encountered during construction.

The extent of the organic material beneath the existing embankment is not known, however, no distress of the embankment was observed. It is likely that the roadway has been in use for decades and most or all of the settlement has been realized. It is imperative that the widening be designed and constructed properly to ensure that the existing embankment is not destabilized.

Global slope stability and settlement are the foundation concerns. An analysis of the addition of new fill at the site assuming a conventional widening, is shown in Figure 1. A safety factor of only 1.0 was calculated. Because of the presence of a considerable depth of organics (4.1m), 3.0 m of fill placed directly on the peat will result in settlement of at least 0.5 m and probably in the order of 1m. The compressibility of the peat and the presence of up to 5 m of marl will affect the performance of the embankment and if not constructed properly will result in continuous maintenance problems for many years. The widening will be tied into the existing embankment and any settlement of the new embankment will cause longitudinal cracking of the pavement and jeopardize the performance of the existing embankment.

The following alternatives for embankment construction are presented along with the anticipated risks, benefits and shortcomings. The highway widening at this location is constrained by property and environmental considerations. Its long term performance depends on selecting a solution that may not satisfy all criteria. It should be noted that the worst conditions exist between approximate Sta 16+200 and Sta 16+250. Beyond these limits, excavation of the peat could be carried out by conventional means and the RSS slope constructed without any special treatment.

*Alternative 1: Full Replacement*

The following alternative will result in an embankment that is stable and will experience the least post-construction settlement. All excavation and embankment construction will take place within the property limits and pre-loading is not required.

Excavation of the poor soils can occur with a trench excavation using sheet piles driven or vibrated below the peat and marl into the silty sand deposit. A longitudinal wall of sheet piles driven within 1 m of the property line and another wall driven halfway up the existing embankment would create the limits of the trench approximately 6 m wide, as sketched in Figure 2. The piles would be driven to sufficient depth to ensure the basal stability of the trench. Excavation of the subsurface material would be carried out between the sheet pile walls to the

bottom of the marl deposit. Bracing of the sheet piles at the top would be required to maintain the stability of the walls of the trench as the excavation progresses. Crushed stone or rockfill, 150 mm maximum size, is recommended to fill the excavation since it does not require compaction. It may be necessary to excavate and place the fill almost concurrently to ensure that material from outside the trench does not slough in. The sheet piles would remain in place. If removed, the backfill material would tend to displace the soft subsurface material in the adjacent property.

Crushed rock or rockfill is recommended to elevation 425 or the base elevation of the embankment, above which a retaining system may be constructed using conventional fill. An RSS slope or wall may be used. Alternatively, the rock fill may be used as the embankment widening material as it maintains a slope of 1.25:1V.

It is expected that the trench excavation proposed would be less disruptive to the surroundings than an oversize excavation as well as being safer from a construction perspective.

*Alternative 2: Partial Excavation and Surcharging*

This alternative proposes to displace only the peat using excavation as shown in Figure 3. It would require a temporary limited interest in order that the limits of the excavation are compatible with the geometry of the new embankment, i.e. removal of the organics where the embankment loading will be concentrated. The resulting excavation would extend onto adjacent property by 3 m. The presence of peat at the base of the embankment creates a global instability, hence its removal is required

The slopes of the excavation would be constructed as steeply as possible, but it is anticipated to require a slope of at least 1H:1V. The slopes of the existing embankment require a slighter flatter slope for stability reasons. Because of the saturated condition of the peat, the displacement and replacement operations would have to carried out concurrently in order to minimize any sloughing. The excavation and backfilling operation should be carried out in controlled strips perpendicular to the embankment.

The fill below El. 425, or base of embankment elevation, should consist of crushed stone or rock fill. Above this, granular material should be used to construct a surcharge that extends to a height of 2 m above the final profile elevation. Although a period of one year would be most beneficial for the surcharge to remain in place, a period of three to six months is acceptable. The fill above the base of embankment elevation should be placed at a rate of 1.0m maximum per week in order to avoid any slope failure.

Once pre-loading is complete, the surcharge should be removed to the geometry required to accommodate a RSS slope. A RSS wall is not recommended because of the point loading created by the wall facing. Consideration should be given to the use of a lightweight fill material in the embankment widening such as blast furnace slag or polystyrene.

Post-construction settlements are expected to continue for some time after completion (up to two years). It is anticipated that they would be limited to less than 150 mm. A more accurate value will be calculated upon selection of the preferred alternative.

*Alternative 3: Base Reinforcement*

The use of base reinforcement is a more recent technology, first tried on an MTO contract at a widening project on Highway 69 in 1992. Base reinforcement is a proprietary design from a RSS company. It requires minimal excavation as geosynthetic grid is used to create an essentially floating embankment (refer to Figure 4). However, substantial settlements still occur. The embankment at Highway 69 experience 0.8 m of settlement within a period of six months. In addition, final paving operations were deferred for one year following its construction.

A surcharge should be placed in order to realize greater magnitudes of settlement. The use of vertical wick drains could also be considered with the base reinforcement option to accelerate settlement. The use of a lightweight fill such as polystyrene is also recommended.

In this alternative, since time is the key to the performance of the embankment, delaying the opening of the truck climbing lane would be required.

For all alternatives, the paving operation should be delayed for as long as possible to allow for readjustment of the fill and post construction settlement.

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DIST. CR REGION

W.P. No. 145-96-00

CONT. No.

W. O. No. 91-23025

STR. SITE No.

HWY. No. 9

LOCATION Rolling Hills To Mono 6th Line Rd. E

No = PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

**DELCAN** ENGINEERS PLANNERS ARCHITECTS

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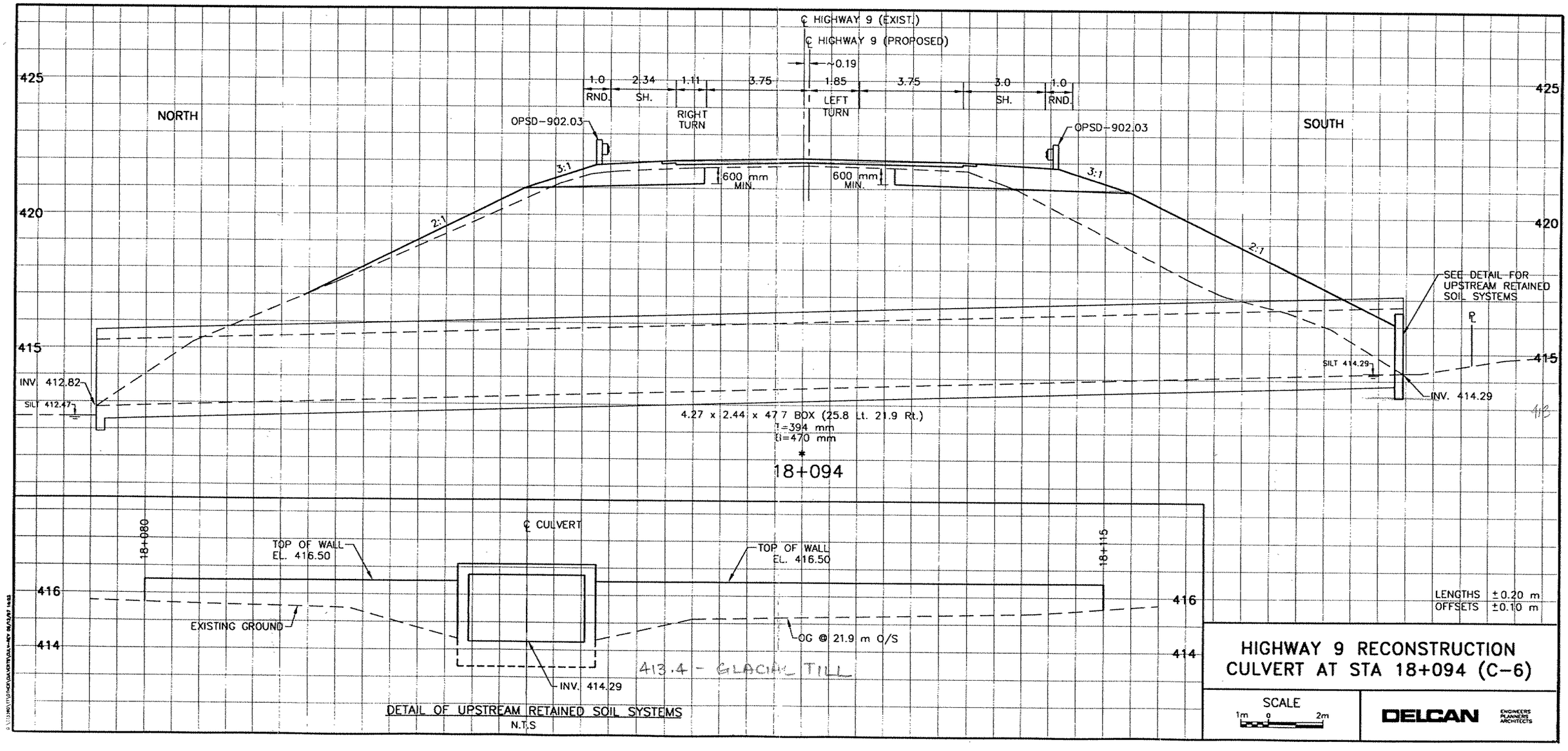
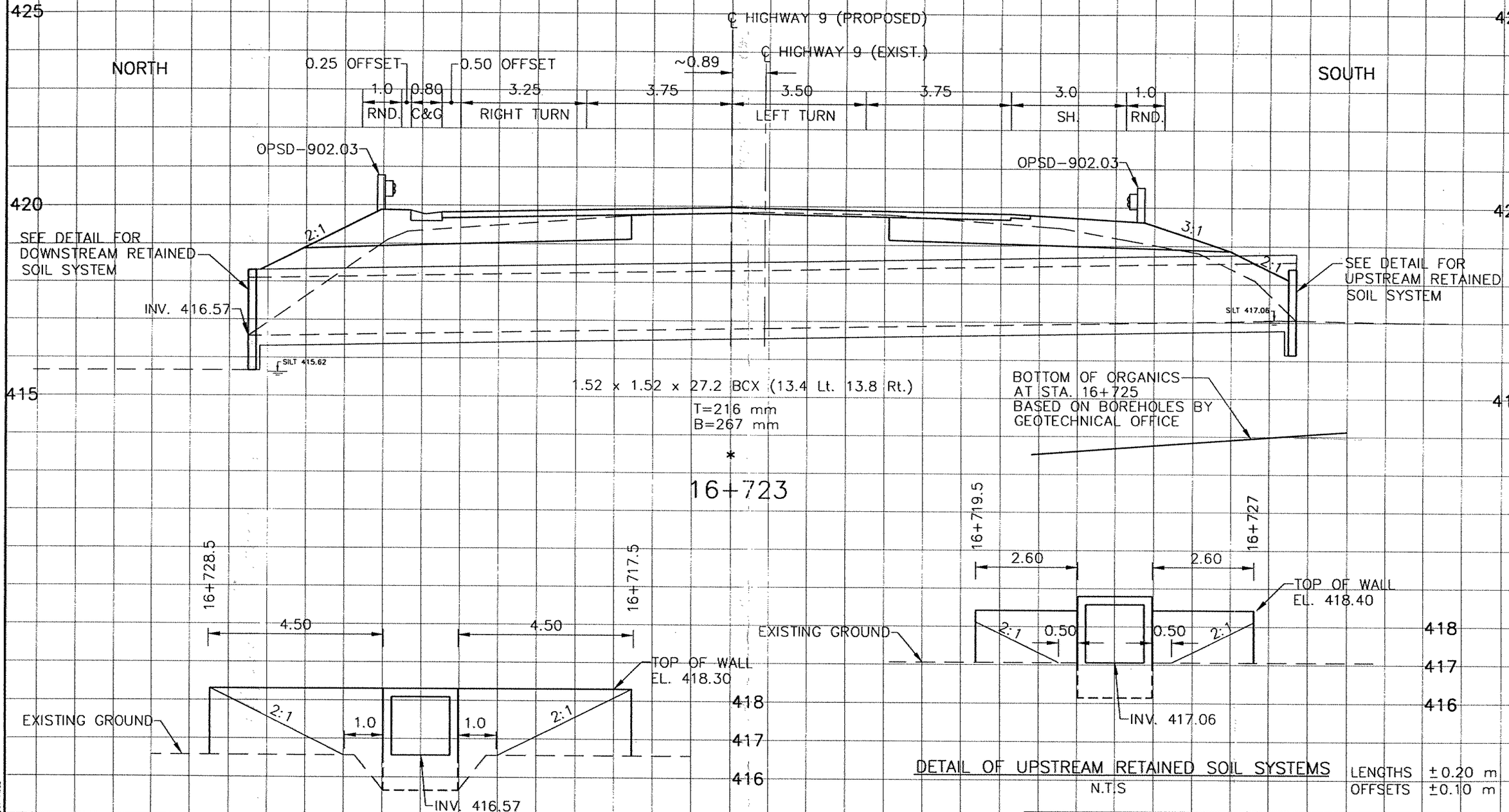



LENGTHS ±0.20 m
OFFSETS ±0.10 m

# HIGHWAY 9 RECONSTRUCTION
# CULVERT AT STA 18+094 (C-6)

SCALE
1m 0 2m

DELCAN ENGINEERS PLANNERS ARCHITECTS




# HIGHWAY 9 RECONSTRUCTION CULVERT AT STA 16+723 (C-5)

SCALE
1m 0 2m

DELCAN ENGINEERS PLANNERS ARCHITECTS

D:\1753390\TYPHER\CULVERTS\CULV-REV 06/12/97 14:03

NORTH

℄ HIGHWAY 9 (EXIST.)

℄ HIGHWAY 9 (PROPOSED)

SOUTH

1.0 RND. | 3.0 SH. | 3.75 | 3.75 | 3.50 LEFT TURN | 3.75 | 3.0 SH.

430

OPSD-902.03

OPSD-600.03

OPTIONAL RSS WALL OR TOE WALL

2%

2%

℄

2:1

1.2:1

425

REINFORCED SLOPE

BOTTOM OF ORGANICS AT STA. 16+350 BASED ON BOREHOLES BY GEOTECHNICAL OFFICE

*

16+375

420

LENGTHS ±0.20 m
OFFSETS ±0.10 m

# HIGHWAY 9 RECONSTRUCTION
# RETAINED SOIL SYSTEM No. 3
REINFORCED SLOPE STA. 16+350 TO STA. 16+390

SCALE
1m 0 2m

DELCAN ENGINEERS PLANNERS ARCHITECTS

Q:\YT2390\YTOTHER\CULVERTS\CULV-REV 06/12/97 14:03

# HYDROGEOLOGICAL REPORT

# and

# ADDENDUM

# for the

# HIGHWAY 9 RECONSTRUCTION

## HIGHWAY 10/24, ORANGEVILLE TO
## East of MONO 6th LINE EAST, MONO MILLS

**Prepared for**

**DELCAN CORPORATION**

**by**

**CHARLESWORTH & ASSOCIATES**

**Hydrogeological Report** **September 1997**

**Addendum to the Report** **October 1997**

Charlesworth & Associates

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# 1. INTRODUCTION

This report has been prepared in response to the foundation design modification to Alignment Alternative 2 (Section 16+170 to 16+390 and RSS No. 3) and Culvert C-5, and is an addendum to the Charlesworth report of September 1997 entitled *Hydrogeological Report for the Highway 9 Reconstruction, Highway 10/24, Orangeville to East of Mono 6th Line East, Mono Mills.*

This addendum addresses recent revisions made to the preliminary design of retaining wall footings and embankment foundations as a result of a field investigation by MTO. Details of the field investigation and reasons for foundation design changes are provided in the *Foundation Investigation Report, Highway 9 Reconstruction, Swamp Crossings and Culvert Wingwalls, Rolling Hills Drive to East of Mono Mills 6th Line Road East* (MTO, Oct. 14, 1997).

The proposed designs are summarized below with reference to their significance for potential impact on groundwater conditions. These descriptions are to facilitate discussion of groundwater impact only. Detailed design descriptions are provided in the MTO Foundations Report (Oct, 14, 1997) or the ESR prepared by Delcan (1997).

# 2. DESIGN REVISIONS

## 2.1 Background

In the length of highway adjacent to the fish hatchery, the width of the highway right of way is inadequate to permit conventional embankment construction of the widened road bed. To accommodate this, retained soil system (RSS) wall/slope designs are proposed.

In the preliminary design the depth of foundations for these RSS walls/slope was not expected to exceed 1.5m depth. ~~Fill would be 'floated' across the swamp area.~~ However, further analysis indicated that the preliminarily design needed to be modified in order to provide a stable foundation for the road embankment.

## 2.2 Alignment Alternative 2 - Station 16+170 to 16+390

### *2.2.1 RSS No. 2: Station 16+170 to 16+270 North Side of Highway*

In this area, thick peat deposits overlie very soft marl above a sand to silty sand. A combined depth of peat and marl up to 9.1 metres has been identified.

Three proposed alternatives (MTO Oct 14, 1997) are presented to deal with this occurrence of swamp conditions (thick peat deposits) and the proposed 100m long RSS wall/slope required for the embankment through this area.

- **Alternative 1: Full Replacement** - full excavation of the peat and marl with permanent sheet piling along the north side of the highway.

  Parallel sheet pile walls, about 6m apart, would be driven down through the peat and marl into the silty sand. The walls would be offset about 1 metre from the property boundary. The depth to which the walls would penetrate into the silty sand deposit is not specified. The peat and marl between the walls would be excavated and replaced with rock fill. The sheet pile walls would stay in place.

- **Alternative 1(A) - Excavation of Peat only with Temporary Sheet Pile Walls** (walls removed after construction).

- **Alternative 2: Partial Excavation and Surcharging**

  In this alternative, only the peat would be excavated and would be replaced with rock fill below 425m elevation (base of embankment elevation); granular material would be placed above this to a height of 2m above proposed final profile elevation. This granular surcharge would remain in place for a minimum of 3 to 6 months. After preloading was complete, the surcharge would be removed to accommodate an RSS slope. Lightweight fill is proposed for the embankment fill.

  Excavation would occur in an open trench. Excavation would extend on to the adjacent property by 3 meters.

- **Alternative 3: Base Reinforcement and Lightweight Fill**

  This alternative uses a proprietary design to create an essentially floating embankment. The MTO drawings (Oct 14, 1997) indicate less than 1 meter excavation is required.

  Vertical wick drains have been suggested in the Foundation Report to increase the rate of settlement, however recent comments from the MTO indicate that these will not be installed (Pers. Comm.). Lightweight fill is recommended.

### *2.2.2 RSS No. 2A - Station 16+350 to 16+390, north side of Highway 9*

Removal of the peat to approximately 3m depth (elevation 423.0 to 423.5) and replacement with crushed stone is recommended for the embankment and RSS foundation. The peat would be excavated in an open trench.

### 2.3 Culvert C-5 - RSS Wingwalls at Inlet and Outlet

It is proposed that the peat beneath the proposed wingwalls would be excavated and replaced with granular material to provide adequate foundation for the wingwalls. On the south side of the culvert this would be either: a) full excavation of the peat (about 5 metres) to the underlying silty sand and replacement with rockfill; or b) partial excavation to 3.0 m and replacement with granular fill. On the north side, the peat would be excavated to underlying silt (2.1 metres depth) and replaced with rock fill.

## 3. REVIEW OF PROPOSED DESIGNS

### 3.1 RSS No. 2: Station 16+170 to 16+270 north side of highway

Of the three alternative designs, Alternative 3 is preferred over Alternatives 1, 1A and 2 with regard to hydrogeological considerations. The minimal excavation required (as per MTO Foundations Report) would result in the least interference in the subsurface and would not affect groundwater flow.

Alternative 1 would require a deep excavation and disturbance of the subsurface, and could result in significant impact on groundwater flow in this area. With sheet piling left in place, this design could substantially affect groundwater flow through the silty sand underlying the marl and peat. Given the irregular surface of the silty clay underlying the sands the sheet piling may, at some locations, be driven through the sand and keyed into the clayey silt, potentially cutting off flow through a section of the sands. In addition, this alternative would remove the confining layer over the sands resulting in groundwater discharge through the granular material to surface. There is the potential to affect groundwater discharge contributing to flow at the fish hatchery.

Alternative 1A reduces the potential impact that could be created by the permanent sheet pile walls interrupting flow through the sands. However, temporary interruption of flow could occur during construction, if sheet piling was driven through the sands into the clayey silt. Excavation will still be required to approximately 4 metres, with removal of part of the confining layer over the silty sands.

Alternative 2 requires excavation and replacement of the peat; excavation depth would exceed 3.5 metres. This would still require considerable subsurface disturbance and replacement of a portion of the layer confining groundwater in the underlying sands with granular materials. In order to be able to carry out this excavation, and the excavation in Alternatives 1 and 1A, it would be necessary to dewater the underlying sands to lower the groundwater head beneath the excavation. Given that the head in these sands is at or above ground surface, this may involve considerable dewatering and temporary impact on water levels in the sands and potentially impact on

discharges contributing flow to the hatchery. The significance of the impact will depend on the degree of dewatering and the nature of the sand unit.

### 3.2 RSS No. 3/2A - Station 16+350 to 16+390, north side of Highway 9

This 40 metre long toe wall is located in an area of thick peat over a thin deposit of marl and then silty clay (Borehole 4; Hydrogeological Report). If, as expected, subsurface conditions are consistent through this area, then excavation and replacement of the peat with granular material should have minimal impact on groundwater conditions, since the finite area of granular material should not allow the fill to act as a drain. Impact should be largely restricted to dewatering, if required, during construction.

### 3.3 Culvert C-5 - RSS Wingwalls at Inlet and Outlet

The comments on the wingwalls at culvert 5 included in the Hydrogeological Report (September 1997) assumed a maximum of 1.5 metres excavation and replacement of peat.

On the south side, the current foundation proposal recommends removal of all the peat overlying the silty sand, and replacement with granular fill. Although no groundwater levels were measured at the three boreholes drilled for the foundation investigation, it is probable that water levels in the underlying sands are at or slightly above ground surface. Hence, groundwater would discharge through the granular fill. Given the expected limited area of this excavation, it is not expected to have a significant impact on the groundwater flow; there would probably be some increase in discharge to the stream.

On the north side, no water levels were taken in the 1.6 metres of silt and silty sand and gravel that underlie the peat. However, the removal of the peat and replacement with granular material is not expected to have any noticeable impact on groundwater flow.

## 4. SUMMARY

With respect to RSS No. 2, of the alternative foundation designs proposed, Alternative 3 is preferred over Alternatives 1, 1A, and 2 from a hydrogeological perspective. The minimal excavation described in the MTO foundation report would result in the least interference in the subsurface and would not affect groundwater flow. Inert lightweight fill should be used.

In the case of RSS No. 3/2A and Culvert C-5 neither proposal is expected to have an adverse impact on the groundwater regime.

# ADDENDUM

# to the

# HYDROGEOLOGICAL REPORT

# for the

# HIGHWAY 9 RECONSTRUCTION

## HIGHWAY 10/24, ORANGEVILLE TO East of MONO 6th LINE EAST, MONO MILLS

**Prepared for**

**DELCAN CORPORATION**

**by**

**CHARLESWORTH & ASSOCIATES**

**October 1997**

Charlesworth & Associates
CONSULTING HYDROGEOLOGISTS
DAVID L. CHARLESWORTH & ASSOCIATES INC.
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October 23, 1997
Our Ref. 97-174

Delcan Corporation
133 Wynford Drive
North York
Metropolitan Toronto, Ontario
M3C 1K1

Attention: Mr. Richard Hassall, P.Eng.

Dear Sir:

**Re: Highway 9 Reconstruction - Addendum to Hydrogeology Report**

Charlesworth & Associates have prepared the attached addendum to our September 1997 Hydrogeological Report for the reconstruction of Highway 9 between Highway 10/24, Orangeville and east of Mono 6th Line East, Mono Mills.

This addendum responds to recently proposed foundation designs for the road embankment and associated retained soil system (RSS) wall/slopes between Station 16+170 and 16+390 adjacent to the fish hatchery and culvert C-5 at Station 16+725. The modifications between Station 16+170 and 16+390 relate to Alternative 2 discussed in our original report. Details of the foundation design changes are provided in the *Foundation Investigation Report, Highway 9 Reconstruction, Swamp Crossings and Culvert Wingwalls Rolling Hills Drive to East of Mono Mills 6th Line Road East* (MTO, Oct 14, 1997).

Yours truly
Charlesworth & Associates

for Janet Haynes, M.E.Sc.
Senior Associate

JH/smc

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## 2.2 Alignment Alternative 2 - Station 16+170 to 16+390

### *2.2.1 RSS No. 2: Station 16+170 to 16+270 North Side of Highway*

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  Excavation would occur in an open trench. Excavation would extend on to the adjacent property by 3 meters.

- **Alternative 3: Base Reinforcement and Lightweight Fill**

  This alternative uses a proprietary design to create an essentially floating embankment. The MTO drawings (Oct 14, 1997) indicate less than 1 meter excavation is required.

  Vertical wick drains are suggested to increase the rate of settlement. The depth of these drains is not identified, nor how they would be installed. Lightweight fill such as blast furnace slag or polystyrene is recommended.

### *2.2.2 RSS No. 3 - Station 16+350 to 16+390, north side of Highway 9*

Removal of the peat to approximately 3m depth (elevation 423.0 to 423.5) and replacement with crushed stone is recommended for the embankment and RSS foundation. The peat would be excavated in an open trench.

### 2.3 Culvert C-5 - RSS Wingwalls at Inlet and Outlet

It is proposed that the peat beneath the proposed wingwalls would be excavated and replaced with granular material to provide adequate foundation for the wingwalls. On the south side of the culvert this would be either: a) full excavation of the peat (about 5 metres) to the underlying silty sand and replacement with rockfill; or b) partial excavation to 3.0 m and replacement with granular fill. On the north side, the peat would be excavated to underlying silt (2.1 metres depth) and replaced with rock fill.

## 3. REVIEW OF PROPOSED DESIGNS

### 3.1 RSS No. 2: Station 16+117 to 16+270 north side of highway

Of the three alternative designs, Alternative 3 is preferred over Alternatives 1, 1A and 2 with regard to hydrogeological considerations. The minimal excavation required (as per MTO Foundations Report) would result in the least interference in the subsurface and would not affect groundwater flow. However the use of blast furnace slag as lightweight fill is not acceptable with regard to groundwater quality, as heavy metals can leach from this type of fill.

Alternative 1 would require a deep excavation and disturbance of the subsurface, and could result in significant impact on groundwater flow in this area. With sheet piling left in place, this design could substantially affect groundwater flow through the silty sand underlying the marl and peat. Given the irregular surface of the silty clay underlying the sands the sheet piling may, at some locations, be driven through the sand and keyed into the clayey silt, potentially cutting off flow through a section of the sands. In addition, this alternative would remove the confining layer over the sands resulting in groundwater discharge through the granular material to surface. There is the potential to affect groundwater discharge contributing to flow at the fish hatchery.

Alternative 1A reduces the potential impact that could be created by the permanent sheet pile walls interrupting flow through the sands. However, temporary interruption of flow could occur during construction, if sheet piling was driven through the sands into the clayey silt. Excavation will still be required to approximately 4 metres, with removal of part of the confining layer over the silty sands.

Alternative 2 requires excavation and replacement of the peat; excavation depth would exceed 3.5 metres. This would still require considerable subsurface disturbance and replacement of a portion of the layer confining groundwater in the underlying sands with granular materials. In order to be able to carry out this excavation, and the excavation in Alternatives 1 and 1A, it would be necessary to dewater the underlying sands to lower the groundwater head beneath the excavation. Given that the head in these sands is at or above ground surface, this may involve considerable dewatering and temporary impact on water levels in the sands and potentially impact on

discharges contributing flow to the hatchery. The significance of the impact will depend on the degree of dewatering and the nature of the sand unit. Blast furnace slag should not be used as lightweight fill.

### 3.2 RSS No. 3 - Station 16+350 to 16+390, north side of Highway 9

This 40 metre long toe wall is located in an area of thick peat over a thin deposit of marl and then silty clay (Borehole 4; Hydrogeological Report). If, as expected, subsurface conditions are consistent through this area, then excavation and replacement of the peat with granular material should have minimal impact on groundwater conditions, since the finite area of granular material should not allow the fill to act as a drain. Impact should be largely restricted to dewatering, if required, during construction.

### 3.3 Culvert C-5 - RSS Wingwalls at Inlet and Outlet

The comments on the wingwalls at culvert 5 included in the Hydrogeological Report (September 1997) assumed a maximum of 1.5 metres excavation and replacement of peat.

On the south side, the current foundation proposal recommends removal of all the peat overlying the silty sand, and replacement with granular fill. Although no groundwater levels were measured at the three boreholes drilled for the foundation investigation, it is probable that water levels in the underlying sands are at or slightly above ground surface. Hence, groundwater would discharge through the granular fill. Given the expected limited area of this excavation, it is not expected to have a significant impact on the groundwater flow; there would probably be some increase in discharge to the stream.

On the north side, no water levels were taken in the 1.6 metres of silt and silty sand and gravel that underlie the peat. However, the removal of the peat and replacement with granular material is not expected to have any noticeable impact on groundwater flow.

## 4. SUMMARY

With respect to RSS No. 2, of the alternative foundation designs proposed, Alternative 3 (without the use of blast furnace slag) is preferred over Alternatives 1, 1A, and 2 from a hydrogeological perspective. The minimal excavation described in the MTO foundation report would result in the least interference in the subsurface and would not affect groundwater flow. Inert lightweight fill should be used in place of blast furnace slag.

In the case of RSS No. 3 and Culvert C-5 neither proposal is expected to have an adverse impact on the groundwater regime.

# HYDROGEOLOGICAL REPORT

**for the**

# HIGHWAY 9 RECONSTRUCTION

## HIGHWAY 10/24, ORANGEVILLE TO
## East of MONO 6th LINE EAST, MONO MILLS

**Prepared for**

**DELCAN CORPORATION**

**by**

**CHARLESWORTH & ASSOCIATES**

**September 1997**

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September 17, 1997
Our Ref. 97-174

Delcan Corporation
133 Wynford Drive
North York
Metropolitan Toronto, Ontario
M3C 1K1

Attention: Mr. Richard Hassall, P.Eng.

Dear Sir:

**Re: Highway 9 Reconstruction - Hydrogeology Study Report**

As per your request, Charlesworth & Associates have conducted a hydrogeological investigation to assess the potential impacts of the proposed reconstruction of the section of Highway 9 from Highway 10/24 (Orangeville) to west of Mono 7th. Line Road East.

The results of our investigations are presented in this report, along with recommendations with regard to future monitoring and possible mitigative measures, where applicable.

Should you have any questions or comments, please do not hesitate to contact us.

Yours truly
Charlesworth & Associates

for Janet Haynes, M.E.Sc.
Senior Associate

JH/bm

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## APPENDICES

APPENDIX A MOEE Water Well Records, Caledon Township, Peel Region and Mono Township, Dufferin County

APPENDIX B Borehole Logs, July 29, 30, 1997 and August 6th, 1997

## 1. INTRODUCTION

The Ontario Ministry of Transportation is planning to reconstruct eight kilometres of Highway 9 from Highway 10/24 (Orangeville) to east of Mono 6th Line East (WP 145-96-00). As part of the background studies, an Environmental Study Report (ESR) is required for the route and adjacent areas. On March 25, 1997, Charlesworth & Associates were retained by Delcan to complete the hydrogeological component of the ESR for the project area.

The objectives of the study were to:

- identify the groundwater regime (including high water table areas, recharge-discharge areas, groundwater flow directions, and municipal/communal wells) for the entire project area;
- assess the impact of the general reconstruction activity and new features on the groundwater regime and groundwater quality in the entire project area; and
- specifically assess the impact of reconstruction and the installation of a retaining wall on the groundwater regime of the Humber Springs Trout Hatchery and to identify mitigation measures that may be required during construction and post-construction.

The study was carried out in two phases. The first phase addressed groundwater issues using secondary sources of information for the entire study area. The second phase consisted of a site investigation focused on the Humber Springs Trout Hatchery located at the eastern end of the proposed reconstruction area.

This report has been prepared for use by Delcan Corporation and their client, the Ontario Ministry of Transportation, as part of the Environmental Study of the proposed reconstruction of Highway 9. The comments on possible impacts are based on the information in the preliminary design drawings and design information supplied to Charlesworth & Associates by Delcan.

## 2. OUTLINE OF PROPOSED HIGHWAY 9 RECONSTRUCTION

Broadly outlined, the proposed reconstruction of Highway 9 from Highway 10/24 east to Mono 6th Line East (Figure 1) consists of:

- widening pavement and shoulders to standard width;
- providing partial paved shoulders, with fully paved shoulders in the western end of

the project;

- addition of left-turn lanes and right-turn tapers/lanes to all intersections plus a shared, continuous left-turn lane for the commercial area between Station 10+810 and 13+056;

- a westbound truck climbing lane between station 13+673.53 and 16+455.55 (Mono 3rd Line Road East to St. Andrew's Road).

This proposed general widening of the paved highway will require modifications to the existing drainage ditches, CSP extensions of 4 concrete culverts and wingwalls provided at 2 others, some cut and fill, and construction of retaining walls.

The highway reconstruction will also result in some changes to stormwater runoff patterns, particularly an increase in the area of paved roadway and hence the volume of runoff.

From a hydrogeological perspective, the most significant activities will be associated with the maintenance of an existing embankment (retaining wall #1) and widening of the highway between Station 15+700 and 16+600 adjacent to the Humber Springs Trout Hatchery. This will require placement of fill and construction of toe walls and/or retaining walls where there is insufficient space for a slope to support the required highway grading. Hydrogeological issues are raised if the foundation for these structures or the highway reconstruction activities could affect shallow groundwater movement that could in turn affect the quantity or quality of the groundwater sources upon which the fish hatchery relies.

The widening of the highway through this area from two up to four lanes is associated with a left turn lane for St Andrew's Road and the above mentioned westbound truck climbing lane. Delcan has identified three alternative alignments for this area:

1. Left turn lane north of centre line; no shift in alignment
2. Left turn lane north of centre line; 3.5 m shift to south in alignment
3. Left turn lane north of centre line; maximum shift in alignment (to south)

Retaining wall #1 located at the foot of the steep embankment on the north side of the highway between Stations 15+717 and 15+843 is similar for all three alternatives, with only the height varying from 4 to 5.5 metres. Construction of this retaining wall is required to address slope stability concerns irrespective of the highway widening activity or alignment alternatives. The proposed design is a Reinforced Soil System (RSS) wall, with base of excavation approximately 1.2 metres below grade.

Between Stations 16+040 and 16+400, toe walls or retaining walls would be required at two

locations along the north side of the highway to accommodate widening under alternatives 1 or 2. The proposed design requires excavation to 1.2 metres for RSS walls in Alternative 1, or 0.45 metres excavation or to firm stratum for gravity toe walls for Alternative 2. Under Alternative 3, there is a requirement for a cut on the south side of the highway between Station 16+005 and 16+179. Deep soft subsoil on the north side of the highway will require preloading of fill in some sections for all alternatives.

## 3. DATA COLLECTION

### 3.1 Existing Data

The available existing geological and hydrogeological data were collected and reviewed. This included: MOEE well logs for the highway route and surrounding area up to 2 km from the road; soils and geological reports; detailed aerial photographs; and preliminary design reports from MTO. Data on the municipal and communal wells in the area were also obtained.

A field visit to the fish hatchery on April 29, 1997 included a tour of the property with the owner, Mr Tiffin; the water sources for the various ponds and the main hatchery were identified. In addition, an overview of the entire study area was obtained at that time.

The study area defined for data collection of this report is 0.5 km either side of the highway alignment (Figure 1). The MOEE water well locations within the study area are plotted on Figure 4; due to the density of wells at the west end of the study area only a few wells are plotted in this area. All water well records are provided in Appendix A.

### 3.2 Site Investigation

The site investigation focused on understanding the hydrogeological conditions in the areas where the three alignment alternatives would require construction of retaining structures with footings that could interfere with shallow groundwater movement. Borehole depths were usually between 3 to 5 metres since expected depth of excavation in sound soil materials for foundations of these retaining structures is expected to be less than 1.5 metres. The intent of the site investigation was to answer the question of whether a structure required by any alternative could cause long term or short term impact on the groundwater supply to the fish hatchery; it was not designed to identify in detail the origin of all the groundwater resources supplying the hatchery.

On July 29 and 30 and on August 6, 1997, a total of nine boreholes were drilled at eight locations along the highway adjacent to the Humber Springs Hatchery. A piezometer was installed in each borehole to measure water levels and permit in-situ hydraulic conductivity measurements. Depths ranged from 3 to 7 metres.

Boreholes 1 to 5 were drilled using a CME-75 hollow stem auger rig, with split spoon sampling. Because of access difficulties due to overhead hydro lines, boreholes 6 to 8 were drilled using a vibratory rig. Borehole 6 was located less than 10 metres upgradient of a major spring, at the foot of the steep slope on the north side of the highway. A water sample was taken from the spring to observe turbidity prior to drilling, upon completion of piezometer installation and two hours later. There was no visual difference in the three samples.

Figure 2 shows the borehole locations. Borehole logs showing stratigraphy and installation are provided in Appendix B. Table 1 provides installation details and water levels. Elevations were provided by Delcan.

## 4. REGIONAL SETTING

### 4.1 Topography and Drainage

Highway 9 between Highway 10/24 (Orangeville) to Mono 7th Line Road East traverses a hilly area, with rolling topography in the west half of the route and the hummocky topography characteristic of the Orangeville Moraine in the east. Total relief along the road is approximately 45 metres, somewhat greater in the adjacent landscape.

The road crosses a local height of land that forms the watershed divide between several river systems. Groundwater-fed streams draining to the northwest and the southwest and to the east are headwater tributaries for, respectively, the Credit and the Humber Rivers (Figure 1). The Humber River flows eastward in a deeply-incised valley just north of Highway 9 at the east end of the study area. The Credit River valley is west of the study area.

### 4.2 Geology and Soils

The upper overburden in the study area is composed of predominantly sandy to sandy silt and gravel ice-contact deposits and sandy silt glacial tills (Figure 3). Shallow (<2m) auger holes along the right of way confirm the general textures identified by the geological mapping (Ministry of Transportation 1996). Organic deposits have developed in poorly drained depressions and there is a deposit of glacio-lacustrine clay at the Humber Springs hatchery. While the ice-contact deposits are generally granular materials, they typically have complex stratigraphy, with sudden changes in texture and thickness of given units over any distance. Similarly, the glacial till is often heterogeneous, with irregular granular seams.

The Amabel limestone bedrock, which underlies most of the study area, outcrops just north of the highway at Mono 1st Line Road East, and northeast of the study area along the deeply-incised Humber River valley (Figure 3). The Amabel Formation is relatively thin in this area and is underlain by limestone, sandstones and shales of the Cataract Group. The limestone and shale

bedrock is found at relatively shallow depth at either end of the study area, however, generally the bedrock is buried by deep overburden deposits (Figure 5). A deep bedrock valley, now filled by glacial deposits of clay, till and sand and gravel, and occupied in part by the Humber River, interrupts the north trend of the escarpment crest. This valley is visible on Figure 4 and more clearly, on Figure 5 the cross-section along Mono 5th Line Road East, at the hatchery.

## 4.3 Regional Hydrogeology

### Groundwater Flow

The shallow groundwater system is characterized by moderate recharge through the silty and sandy soils in the higher topographic areas and discharge to the streams at lower elevation. The scattered ponds that occur in small depressions at higher elevations (such as the pond south of the highway at approximately 445 m elevation near station 15+800) are the result of perched water tables and/or the collection of surface runoff. For the upper reaches of most of the tributary streams, groundwater discharge and flow will be seasonal. Permanent flow will be associated with streams at lower elevation. There are insufficient shallow well records in the existing data to permit specific interpretations, however the water table is expected to be 3-10 metres or more below surface in higher areas; high water table conditions will occur in the major topographic lows. The overall pattern of shallow groundwater flow will be towards the streams and river valley. A shallow groundwater divide will roughly mirror the surface water divide between the Humber and Credit watersheds.

Deeper groundwater flow is generally northward with the Credit and Humber River valleys acting as regional groundwater discharge areas. The deeper overburden and the bedrock are recharged in the central part of the study area and to the south of Highway 9. Regional maps show flow in the bedrock as being from the south across the highway to the Humber valley in the east and to the north and west in the western portion of the study area towards the Credit River.

### Groundwater Quality

No groundwater quality data was collected for this study; however, groundwater discharge to streams will create cold water stream conditions in the discharge areas.

### Groundwater Resources

The majority of residents obtain their water supplies from wells penetrating more than 20 metres into the overburden and bedrock. The Amabel bedrock that underlies most of the study area is a major regional aquifer; although in this area the formation is relatively shallow and many wells obtain water from the shales, limestone, and sandstone of the underlying Cataract Formation. No major overburden aquifers are identified in the study area ( Dames & Moore 1996). The hydro-

geological cross-section (Figure 5) does indicate that there may be significant thicknesses of buried sand and gravel deposits with potential groundwater resources, although reported yields are typically less that .75 l/s (10 gpm).

Well records could not be obtained for all homes along the highway possibly because some of these homes may be using old shallow dug wells. No active municipal or communal wells were identified within the study area. The closest municipal wells are #2, 3, and 4 at Mono Mills, Peel Region; these wells located 50 metres south of Highway 9 are east of the study area (Figure 1).

## 5. HUMBER SPRINGS TROUT HATCHERY

### 5.1 Operation

Humber Springs Trout Hatchery is located at the east end of the study area on the north side of the highway near Mono 5th Line Road East. The hatchery has been developed in a low area between hills, where a pocket of glacio-lacustrine clays and silts overlies the more pervious soils of ice-contact and glacial tills. The thick clays have been used to construct the berms for the hatchery ponds. Small dams have been placed across the various streams. The western portion of the property is underlain by ice-contact materials.

Figure 7 is a sketch of the property showing the location of the major water sources and surface flow. The various ponds on site and the hatchery building are fed by a combination of springs and flowing wells; the system is gravity fed and there is sufficient flow to maintain operation year round.

The main hatchery operation is located in the south of the property adjacent to the highway, set back from the right-of-way limit a minimum of 25 to 40 m. The main spring supplying the hatchery is located on a south facing slope about 250 metres west of the hatchery building and about 70 metres north from the highway near the original hatchery building. The outfall from this spring has been dammed and flow diverted into a 6 inch pipe that carries flow to the hatchery. Pond 3 located beside the highway has been created by constructing a dam across a topographic low and collecting flow (approx. 5 gpm) from an old well tapping a spring on the north side of the pond. Several other small springs contribute flow to the system; these are located on the same south facing slope some 70 metres north of the highway. The water supply is also supplemented by artesian flow from a deep drilled well about 50 metres west of the hatchery; discharge from the well is piped to the hatchery with overflow contributing to surface flow. The surface flow and the hatchery flow is directed through the bermed ponds 1 and 2, and then flows east to the Humber River. (The berms raise the pond water level about 5 metres above the downstream ground surface.)

Two other large ponds have been created in the northeast of the property (ponds 4 and 5) by digging up the underlying clay and damming the flow from groundwater springs and tributary streams. The ponds are used for a fishing club that are part of the commercial operation but not

hydraulically connected to the hatchery. Pond 4 is fed by a tributary draining land to the north of the property. Pond 5 is fed by a stream originating in the wetland on the north side of the highway, at the base of the proposed retaining wall #1. An access road skirts the edge of the wetland, at the base of the slope; the main discharge into the wetland is a spring located just below the access road, at the toe of the slope, and at the east end of the proposed retaining wall. Flow from the spring is supplemented by seepage from the entire perimeter of the wetland and along the course of the stream to pond 5.

## 5.2 General Hydrogeological Setting of the Trout Hatchery

The hatchery has developed in an area of headwater springs for the Humber River, within a regional discharge area. The Figure 6 cross-section shows the general hydrogeological setting for the hatchery site. The location of the main springs supplying the site are shown on Figure 7.

As can be seen on Figure 6, the land surface rises steeply to the south. It also rises, although less steeply, to the west and north of the property. As a result, due to the topographic position of the property, there is shallow groundwater discharge at the base of these slopes. Seepage is observed into the wetlands throughout the property and at the base of the slopes along Highway 9. (See Section 5.3)

In addition to the shallow groundwater discharge associated with the local topography, the area is on the edge of the regional discharge area associated with the Humber River. Groundwater heads (piezometric levels) in the surrounding area are higher than the low areas of the hatchery property leading to groundwater discharge in this lower area. The effect of this is most obvious in the flowing wells that are reported on site and adjacent to the property. Here the piezometric heads in deep wells are above ground surface due to the presence of low-permeability materials in the overlying deposits acting as a confining layer.

The main spring for the hatchery, and a number of smaller springs nearby that contribute surface flow, are all located part-way up a south-facing slope some 50 to 70 metres north of the highway and, compared to the north-facing slope south of the highway, only of moderate height. Flow to these springs is probably via a combination of a pervious stratum, topographic position and the regional groundwater heads.

Based on the site investigations the source of the spring in the west wetland, which contributes flow to pond 5, appears to be a sand and gravel unit which was encountered at the base of the steep embankment.

No flow volume or water quality measurements were taken during the spring or summer field visits. However the main springs are perennial and the owner reports that the flow piped from the main spring and the one flowing well is sufficient to maintain water velocity and depth for healthy trout

habitat throughout the year; water temperatures are reported to be around 5-8° C, typical of groundwater.

## 5.3 Hydrogeological Conditions Along Highway 9 in the Vicinity of the Trout Hatchery

The shallow soil and hydrogeological conditions along the route of Highway 9 in the vicinity of the Humber Springs Trout Hatchery fall into three areas of interest:

**a) South side of Highway 9 in the area of retaining wall #1.**

Borehole 1 was drilled at this location and encountered four metres of silty sand to sandy silt till overlying a silt layer, with occasional sand seams. The soil will have a low vertical permeability, supporting the thesis that the pond south of the highway at this location is perched. Recharge through this material will be relatively low.

**b) Base of steep embankment north of highway; proposed retaining wall #1.**

Boreholes 6, 7, and 8 were drilled at the base of the embankment to determine the soil materials and the water level , particularly near the main spring. An earlier borehole without a piezometer installation had been drilled by the MTO Foundation Design Section.

At borehole 6, adjacent to the spring, over 6 metres of red-brown silty sand and gravel were encountered; this is the aquifer material for the spring. The same material was encountered at borehole 8, below 2.25 m depth beneath a layered sequence of clayey silts, silts, sands, sand and gravels and till-like soil materials. The red-brown sand and gravel was not encountered in borehole 7; the observed 2.3 metres of brown silty sand and gravel (possible fill) overlying sandy silt till shows the local variation in materials that can occur.

The water table is at or just below surface along the base of the slope; the water table will rise slightly back from the toe of the slope. The static water level declines west to east from 433.5 to 432.8 m elevation between borehole 8 and 6, in keeping with the pattern of discharge occurring at the spring. (See Table 1. The water level in borehole 7 is still recovering.) In August, at the time of drilling, minor discharge was observed at the base of the slope, ponding on the access road just east of borehole 8 at the clump of cedars. Elsewhere, the seepage appears to occur at slightly lower elevation, within the wetland immediately north of the access road.

**c) Stations 16+040 to 16+400, north highway right-of-way**

This area breaks into several sections, with the western portion underlain by competent soil and the remainder by organic materials, with some strong upward groundwater gradients for most of the distance. Details are:

**- western portion between Station 16+040 and the break in slope near Station 16+150**

This section is expected to be underlain by competent soils similar to the sand, silt and till recorded in borehole 2. The water table is probably at a depth of 1 to 2 metres, but groundwater movement through the shallow deposits is expected to be minor in relation to the fish hatchery supply.

**- between Stations 16+150 and 16+200**

Evidence of minor shallow groundwater discharge was observed with small patches of cattails scattered on this slope. Seepage is from sand seams, inter-layered with till (as recorded in borehole 3), where the water table intersects the surface due a moderately steep slope. The discharge is minor; shallow underlying soils are competent.

A deeper sand aquifer was encountered in borehole 3, at 3.5 metres depth. Vertical gradients from the sand unit are upward, with the piezometric head being at ground level, 0.8 m above the water table measured in the shallow piezometer 3A.

**- between Stations 16+200 and approximately 16+250**

A cattail wetland occupies this topographic low and is a groundwater discharge zone. Based on drilling by MTO and water level observations in the piezometers, a surface layer of several metres of peat is underlain by several metres of very soft calcareous silt; the fine sand aquifer identified in borehole 3 probably underlies the silt, with strong upward groundwater gradients. It is probable that the area south of highway 9, east of St Andrew's Road, is underlain by the same sequence.

Seepage from this wetland area contributes to the surface flow that reaches the fish hatchery pond.

**- between Stations 16+250 and 16+400**

Over 3 metres of peat and silty sand interlayered from surface were encountered in boreholes 4 and 5 in this area.

In borehole 5 the peat and sand unit was underlain by a half metre of calcareous silt, then a silt grading over a metre to a sand unit at approximately 4.3 metres depth. This is the same sand unit as encountered in borehole 3; piezometric heads are similar. At this location, the upward vertical gradient is stronger, with the piezometric head 0.4 metres above grade.

At borehole 4, the peat and sand unit is underlain by a layer of calcareous silt, and at 4.2 metres depth, a varved clayey silt and silt deposit. The water level was measured at 2.2 metres below grade in August.

# 6. POTENTIAL IMPACT OF PROPOSED HIGHWAY 9 RECONSTRUCTION

## 6.1 Potential Impact between Station 10+450 to 15+700 and 16+800 (Mono 5th Line Road East) to 18+450

It is concluded that the impact on groundwater flow, and hence on the quantity of the resource, resulting from the proposed reconstruction along these sections of highway will be negligible.

The addition of turn lanes, merge lanes and paved or partially paved shoulders will increase the volume of storm runoff and the area of impervious cover along the route. However, the increase in impervious area and corresponding decrease in the area for recharge is considered negligible when compared to the total area available for recharge to the deeper groundwater aquifers used for water supply and regional discharge. Even shallow groundwater discharge paths should see no discernable impact. Much of the newly paved area is already well compacted road shoulder, and probably has low recharge characteristics.

The increase in paved area will marginally increase the volume of runoff; however, the quality of this runoff is unlikely to affect water quality in the domestic wells serving homes and businesses along the highway due to the depth of the wells. Most of the storm water will be directed to grassed ditches and swales and a portion will enter surface water bodies. The storm water that infiltrates will likely have minimal impact due to dilution.

Two wells obtaining water from the water table in a shallow sand are plotted near Station 17+300 between Mono 5$^{th}$ Line Road East and 6$^{th}$ Line Road East (Figure 5); however, in this area the highway will remain at two lanes.

Cuts and fills are to be made within the existing highway right of way to accommodate the widening; the cuts are not expected to have any significant effect upon groundwater conditions. In areas where cuts encounter the water table in silty soils, seepage from the base of the cuts may need to be accommodated to maintain bank stability. This will need to be addressed on a site by site basis. Widening the road and shoulder will force ditches to be relocated several metres from the present location; the use of pervious fill beneath the widened highway should have no impact on groundwater discharge.

The relocated ditches may intercept groundwater seepage but, without significant deepening, there should be no discernable impact. High water table conditions, where these issues may arise, are most likely to be encountered in the topographic lows, particularly the area east of St. Andrew's Road.

## 6.2 Humber Spring Trout Hatchery

### 6.2.1 Retaining Wall # 1- Stations 15+717 to 15+843

The proposed retaining wall design should not interfere with the long term quantity or quality of groundwater discharge to the wetland, which eventually drains to Pond 5 for the fishing club. However, there is potential for short term impacts during construction, arising from encountering the saturated sand and gravel unit.

Based on the location of the wall and grade elevations shown on the preliminary drawings, and assuming a 1.2 metre depth of excavation below grade, the depth of excavation will vary from 435.8 m elevation at the west, to 432.8 near Station 15+800 and to 435.8 m elevation at the east. Comparing these estimated excavation elevations with the water table measured at the borehole locations, it appears that portions of the excavation will go below the water table and the piezometric head in the sand and gravel aquifer unit. Based on the August water levels, the depth of estimated excavation below the water level is expected to be less than a metre, and generally less than half a metre, though this may vary with seasonal fluctuations in the water table. This will not be of concern in areas where the excavation is in slowly to moderately permeable material where dewatering is not required, as appears to be the case at borehole 7.

Should the excavation encounter the saturated sand and gravel unit or be in finer sediments but require slight lowering of the water table to prevent any potential heave in the excavation, temporary dewatering will likely be required. This could be expected on either side of Station 15+800, depending on the actual stratigraphy encountered during construction.

Once the final geotechnical design is completed, the relative elevation of the expected base of excavation and the expected water table should be compared to confirm the expected depth of any excavation below the water table.

Discharging dewatering water to the wetland would mitigate any impact on the volume of groundwater discharge to the wetland. However, based on field observations, the dewatering water will be turbid and will require discharge to a settling tank or settling pond to reduce the sediment load to acceptable levels before discharging to the wetland. Using either settling system to reduce the turbidity of the discharge water will reduce much of the impact; any remaining fine sediment should settle as the discharge water flows through the wetland.

In general, dewatering should be kept to a minimum in terms of depth, duration and extent of influence. Preferably, excavation should take place during the period of lowest water levels as identified by groundwater monitoring.

Excavation of the slope above and behind the base of the wall to install the RSS wall should stay above the water table to reduce impacts which might arise during construction if dewatering was required.

Replacement of the fill above the vertical wall with soil is not expected to affect the groundwater discharge.

***Evaluation of Alternatives*:**

All alternatives will have the same impact on groundwater.

### 6.2.2 Station 16+040 to 16+400 North of Highway

Excavation for the proposed retaining structures up to 1.2 m depth between Stations 16+040 and 16+200 (west side of the wetland) should have no identifiable impact on the shallow groundwater contribution to the hatchery.

From Station 16+200 east to 16+400, a thick layer of organic material occurs from surface; a firm stratum was encountered at 4.2 m in borehole 4, while at borehole 5, the organic material was underlain at 3.5 metres depth by soft calcareous silt grading into sand.

From the vicinity of borehole 5 west to Station 16+200, MTO indicates it is not feasible to remove surface organic material due to lack of firm stratum beneath and strong upward groundwater gradients. The proposed design recommended by the ministry's foundation office is to undertake minor excavation to allow the construction of a retaining wall and then to place a granular or rock fill on a geotextile over the existing ground surface, in a process known as preloading. After sufficient consolidation of the underlying soft sediments, excess fill will be removed to reach the desired highway elevation. Where a retaining structure is required to support the highway embankment, a RSS wall or concrete toe wall design will be used in the fill.

The consolidation of the underlying compressible organic soils will reduce the hydraulic conductivity. However, the magnitude of the reduction in hydraulic conductivity is not expected to have any significant long term impact on groundwater discharge to the wetland in the adjacent hatchery property. Pervious fill above the textile will continue to allow lateral groundwater movement beneath the road to the extent it now occurs.

East of borehole 5 (Station 16+250), it may be feasible (pending final geotechnical recommendations) to excavate the organic material, depending upon the depth to a firm stratum. Replacement of the organic material with a pervious subgrade would not impede lateral groundwater movement; however, depending upon the depth below the water table, the elevation of the base of the fill and its continuity, it could potentially act as a drain to the shallow groundwater system.

While the water level at borehole 4 suggests that the water table is below the depth of any proposed footing on the replacement subgrade, it would be preferable to minimise excavation and replacement with pervious fill below the water table. If it is a suitable option, pre-loading should be used in preference to excavation in order to minimize potential impacts. Similarly, if the storm sewer proposed along the north side of the highway through this section is constructed below the water table, flow interrupters (i.e. less permeable materials) should be placed periodically along the pipe bedding, so that the granular blanket around the pipe cannot act as a drain.

During construction, localised impact on shallow groundwater flow could occur if dewatering is required to excavate and replace the organic materials. If dewatering is necessary, it should be kept as shallow and restricted as possible and discharge should be directed back to the wetland, adjacent on the hatchery lands. If the water is turbid it should be discharged to settling tanks or settling ponds prior to discharging to the wetland.

Silt curtains and other similar sediment control practices should be used to reduce potential impact on surface water from runoff of the fill. Any minor turbidity, however, will likely settle out as water moves through the wetland.

Surface runoff from the highway in this area will be intercepted by a curb and gutter system, and directed to the south ditch. Since this is predominantly a groundwater discharge area, this further reduces any concern of contaminated infiltration to the groundwater system.

***Evaluation of Alternative Alignments:***

There are three alternative alignments as outlined in Section 2:

Alternative 1. Left turn lane north of centre line; no shift in alignment
Alternative 2. Left turn lane north of centre line; 3.5 m shift to south in alignment
Alternative 3. Left turn lane north of centre line; maximum shift in alignment (to south)

Complete details are provided in the ESR prepared by Delcan (1997).

There is little difference in expected potential impact between the three alternatives and the difference relates more to the proximity of construction activity to the property boundary of the hatchery rather than any significant differences in potential impact on groundwater conditions. Details are given below.

On the north of the highway Alternative 2 is preferred over 1, since there are fewer retaining structures and the proposed footings and excavations extend to a shallower depth.

Alternative 3, east of St. Andrew's Road, will probably require that the road bed and embankment

be placed using the preloading design. This will have negligible impact on groundwater in this area. For the stretch east of St. Andrew's Road, Alternative 3 is preferred slightly over Alternatives 2 and 1, because most construction activity will be on the south of the highway. However, excavation on the north side of the highway will still be necessary to install the storm sewer.

West of St. Andrew's Road, Alternative 3 requires a cut into a steep slope. The cut can expect to encounter water table seepage, possibly similar to the seepage encountered in the lower slope between Station 16+150 and 16+200 on north side of the highway. (No boreholes were drilled in this area south of the highway.) Groundwater seepage could be allowed to discharge through the retaining structure if necessary and be directed east to the wetland on the south side of the highway. It is unlikely that there would be any impact on groundwater conditions at the hatchery.

### 6.2.3 Hatchery Water Supply - Conclusions

In our opinion, none of the proposed alternatives for widening of the highway, as discussed above, will affect the quality or quantity of groundwater discharge to the main spring and artesian well supplying the hatchery operations. Nor is the widening of the highway adjacent to pond 3 likely to affect the groundwater contribution to this man-made pond.

The highway reconstruction using Alternatives 1 or 2 may have some short term effect on the quantity of shallow groundwater flow from Station 16+200 to 16+400 contributing to the surface water flow at the hatchery. If the effect is detectable, and if it persists, it should be possible to mitigate the impact by using groundwater from the underlying sand aquifer unit. Installing a well (or wells) into the layer and permitting it to discharge to the surface would augment the reduced surface flow.

***Evaluation of Alternative Alignments:***

Based on the preliminary drawings and design information provided for this study, there is little difference in the expected potential impact on shallow groundwater conditions between the three alternatives. Alternative 2 is preferred over Alternative 1, while Alternatives 2 and 3 appear similar.

## 6.3 Other Areas

### 6.3.1 Cold Water Habitat - Culvert 5

Groundwater discharge adjacent to the existing culvert 5 east of Mono 5th Line Road East has been identified as contributing to cold water fish habitat. The MTO site investigation identified a similar stratigraphy of thick organic deposits (+/- 5 metres) overlying soft soils as observed north of the highway in the vicinity of Station 16+200 (per. comm.). It is probable that the groundwater discharge is originating in the underlying soft soil (silts and sands) with upward vertical gradients

resulting from the location in this regional discharge area.

The construction of wingwalls at this culvert is not expected to have any impact on the groundwater discharge.

### 6.3.2 Grassed Swale - West of Culvert 5

Surface runoff in the grassed swale (Station 16+005 to 16+119) leading from the storm sewer in front of the hatchery is not expected to have a significant impact on groundwater quality at the hatchery. The volume of infiltration should not be large. Contaminants, such as road salt or metals, will be mitigated partly by uptake in the cattails during the growing season and in the soil and organic matter beneath the ditch.

## 7. RECOMMENDATIONS

Excluding the proposed reconstruction activities adjacent to the fish hatchery, no additional monitoring or investigation relating to groundwater conditions is necessary at this time in order to support the proposed design. Standard due care needs to be exercised during construction to minimize the impact on groundwater and surface water; if unexpected conditions are encountered, these will need to be addressed on a site specific basis.

In the area of the Humber Springs Trout Hatchery, a program of pre-construction to post-construction monitoring is essential to confirm the conclusions of this report and to provide sound data for both MTO and the hatchery owner in evaluating the effect of highway reconstruction on the local groundwater regime. The following monitoring program is proposed:

1. Prior to construction, the elevation of the groundwater springs and their position relative to the monitoring locations should be surveyed.

2. Volume of flow from springs.

   Although the reconstruction is not expected to affect the flow, the volume of flow from both the spring below retaining wall #1 and the main hatchery spring should be monitored prior to, during and following construction.

   Monitoring data should be obtained continuously; spot measurements may be affected by natural fluctuations. Monitoring should start immediately to provide adequate data prior to construction. The monitoring should continue throughout and following construction for a minimum of 1 year. This is essentially a surface water monitoring program. Failure to collect an adequate data base prior to start of construction will make it extremely difficult to assess the validity of any subsequent claims with regard to reduction in flow due to highway

reconstruction.

3. Pre-construction to post-construction monitoring of the water quality for the main hatchery supply.

   - Pre-construction. To obtain background water quality data:

     A) the following locations should be sampled with field measurement of pH, temperature and electrical conductivity and laboratory measurement of chloride, turbidity, calcium and sodium:
     - discharge from the main spring for the hatchery
     - the artesian well contributing to the hatchery flow
     - the discharge into the hatchery building
     - discharge into pond 1

     Sampling should commence immediately to permit at least 1 year of data prior to construction; the suggested schedule is monthly through the winter period until the start of construction (at least summer 1998); the frequency of sampling should then be reviewed in light of the potential construction schedule.

     B) the discharge into the hatchery building should also be sampled for total suspended solids, nitrate, heavy metals, BOD, calcium and sodium and petroleum products. Sampling should occur once per season up to construction. If the analysis yield significant results, additional sampling for these parameters at other locations may be required.

   - During and post-construction. Monitoring should continue throughout and following construction; the frequency should be determined once a firm schedule for construction is available and, after construction, follow a regular sampling pattern. The results of the pre-construction monitoring should assist in designing an effective post-construction monitoring schedule and duration.

4. Pre-construction to post-construction monitoring of the water quality of the spring below the proposed retaining wall.

   - Pre-construction. To obtain background water quality data, the spring should be sampled with field measurement of pH, temperature and electrical conductivity and laboratory measurement of chloride, turbidity, calcium and sodium.

     Sampling should commence immediately to permit at least 1 year of data before

construction; the suggested schedule is monthly through the winter period until construction; frequency of sampling should then be reviewed in light of the potential construction schedule.

- During and post-construction: monitoring should continue throughout and following construction. The frequency should be determined once a firm schedule for construction is available and, after construction, follow a regular sampling pattern. The results of the pre-construction monitoring should assist in designing an effective monitoring schedule.

5. Water levels in borehole 6, 7 and 8 should be monitored on a monthly basis, starting immediately in order to confirm the water levels and to record annual fluctuation.

6. The owner of the hatchery should be consulted to identify any additional locations within their hatchery supply system that the owner considers to be significant for flow or quality. Before deciding to monitor MTO should review the location(s) to determine if it adds value to the program.

## 8. REFERENCES

Cowan, W.R. (1976)
Quaternary Geology of the Orangeville Area, Southern Ontario; Ontario Division of Mines Geological Report 141

Dames and Moore, Canada (1995)
Town of Caledon, Wellhead Protection Program Phase 2 Report; Volume 1, Text and Appendices; prepared for Regional Municipality of Peel

Hickinbotham, A. (1979)
Groundwater Probability, Region of Peel; Ontario Ministry of the Environment Water Resources Map 3128

Ministry of Transportation 1996
Pavement Design Report, Geotechnical Engineering, Central Region, WP 145-96-00

Ontario Ministry of the Environment and Energy (to present)
Water Well Records

White, O.L. (1975)
Quaternary Geology of the Bolton Area, Southern Ontario; Ontario Division of Mines Geological Report 117

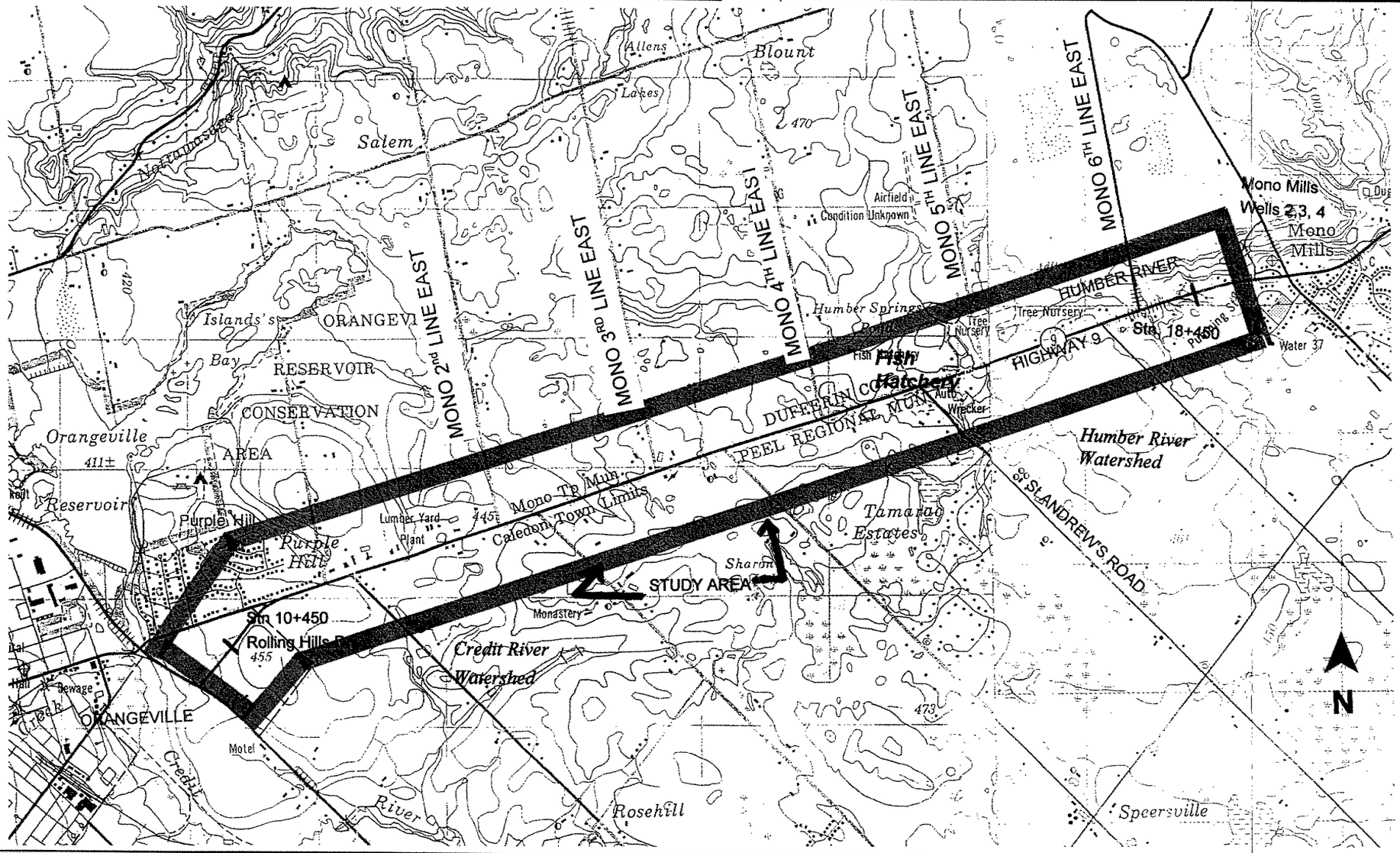
# TABLE

**TABLE 1 WATER LEVELS AND INSTALLATION DETAILS**
**HIGHWAY 9 RECONSTRUCTION, ORANGEVILLE TO MONO MILLS**

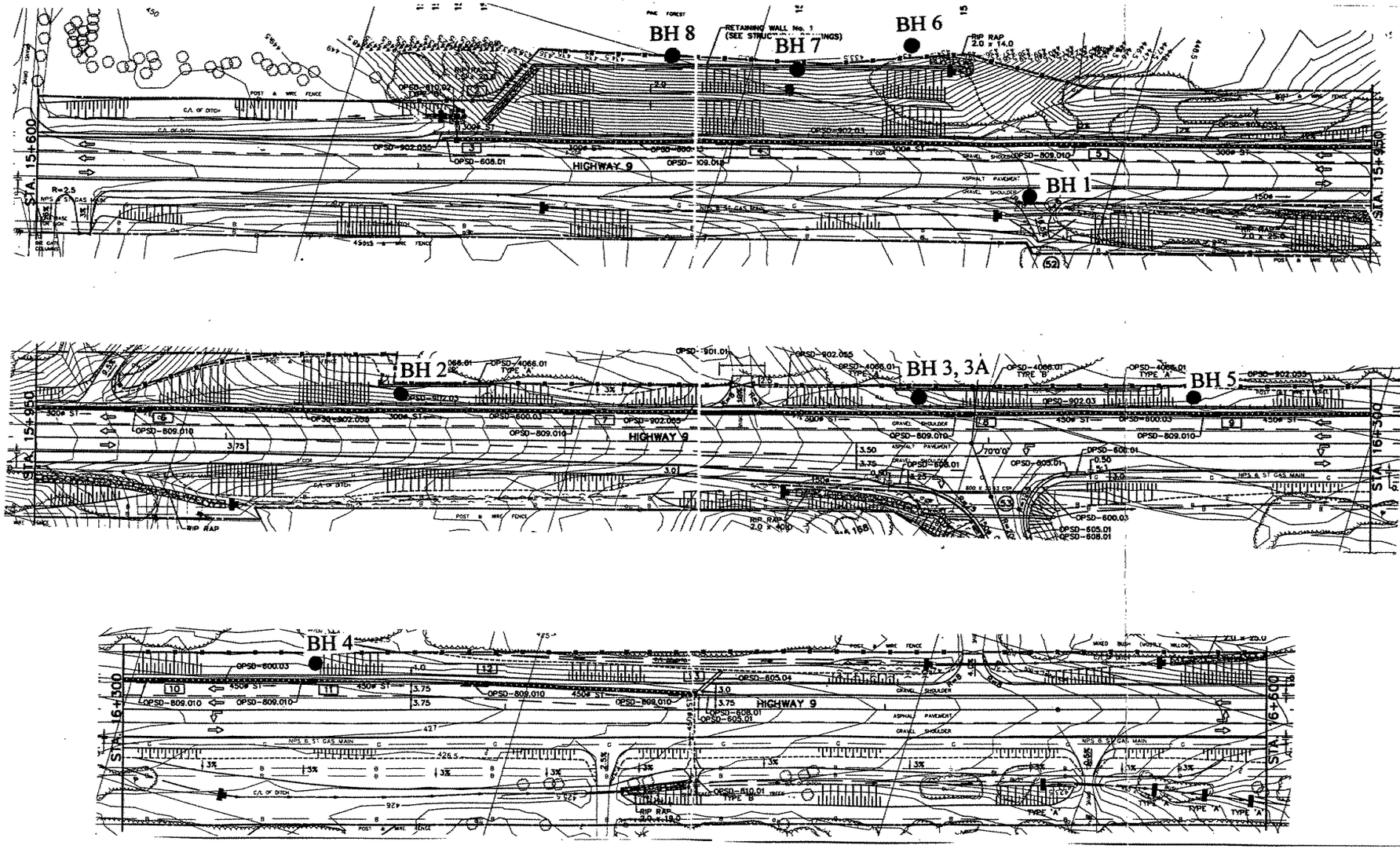
| Piezometer | Ground Elev. (m) | Top of Pipe Elev. (m) | Depth to Tip (From Top of Pipe) | Screened Length (m) | Static Level | |
|---|---|---|---|---|---|---|
| | | | | | July 30th | Aug. 7th |
| 1 | 443.4 | 443.4 | 5.5 | 3 | 438.9 | |
| 2 | 433.0 | 433.6 | 3.67 | 1.5 | 430.05 | 430.11 |
| 3 | 426.1 | 426.9 | 5.15 | 1.5 | 426.04 | 426.1 |
| 3A | 426.1 | 426.6 | 2.99 | 1.5 | 425.32 | 425.3 |
| 4 | 425.9 | 426.5 | 3.94 | 1.5 | 424.24 | 424.31 |
| 5 | 426.0 | 426.5 | 4.45 | 1.5 | 426.25 | 426.4 |
| 6 | 433.4 | 434.1 | 4.55 | 1.5 | | 432.8 |
| 7 | 434.4 | 434.7 | 3.11 | 1.5 | | 431.8 |
| 8 | 433.9 | 434.5 | 3.10 | 1.5 | | 433.5 |

NOTE: Ground elevations provided by Delcan

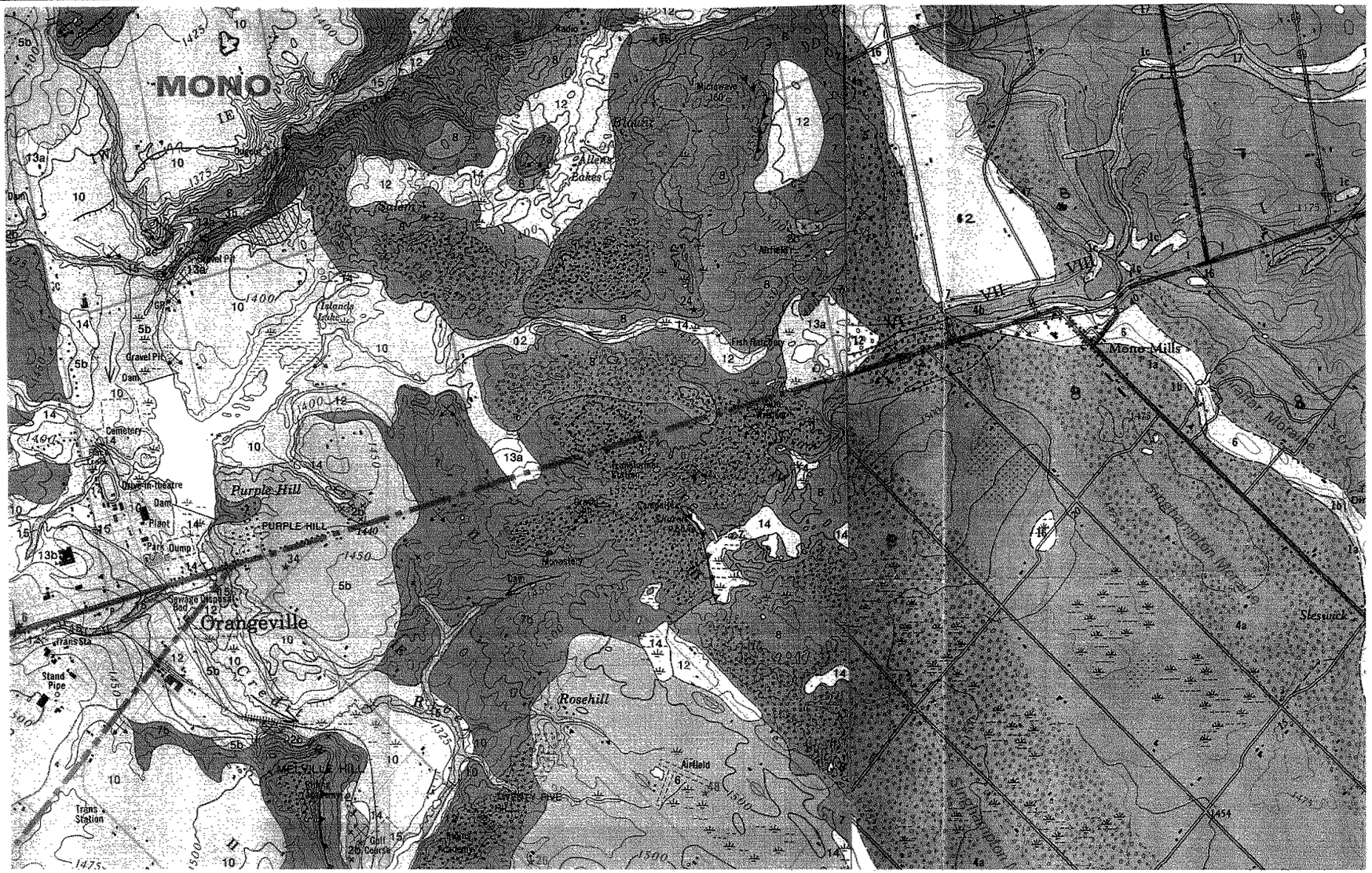
# FIGURES




| | | | |
|---|---|---|---|
| | HYDROGEOLOGICAL STUDY<br>ENVIRONMENTAL STUDY REPORT<br>Highway 9 Reconstruction, Orangeville to Mono Mills | STUDY AREA | FIGURE 1 |




| | | | |
|---|---|---|---|
| | HYDROGEOLOGICAL STUDY<br>ENVIRONMENTAL STUDY REPORT<br>Highway 9 Reconstruction, Orangeville to Mono Mills | BOREHOLE LOCATIONS | FIGURE 2 |




**RECENT**

15 *Alluvium, unsubdivided: silt, sand, gravel.*

14 *Bog deposits: peat, muck, marl.*

**PLEISTOCENE**

LATE WISCONSINAN

13 *Glaciolacustrine or local pond sediments:*
13a *Mainly silt and clay.*
13b *Mainly fine to very fine sand.*

12 *Glaciofluvial outwash sand, minor gravel.*

11 *KETTLEBY TILL: clayey silt till.*

10 *Glaciofluvial outwash gravel and gravelly sand, frequently overlain by several feet of sand or silt.*

9 *WENTWORTH TILL: stony, sandy silt till.*

8 *NEWMARKET TILL: sandy silt till.*

7 *Ice-contact stratified drift, unsubdivided: sand and gravel including some till or silt.*
7a *Mainly gravel.*
7b *Mainly sand.*

6 *PORT STANLEY TILL: sandy silt till.*

5 *TAVISTOCK TILL*
5a *Silt to clayey silt till; Georgian Bay lobe.*
5b *Sandy silt till; Lake Simcoe sublobe.*

4 *Middle till: silt till.*

3 *CATFISH CREEK TILL: stony, sandy silt till.*

UNCONFORMITY

**PALEOZOIC**

**SILURIAN**

2 2a *Guelph Formation: dolostone.*
2b *Amabel Formation (includes Fossil Hill Formation at base): dolostone.*
2c *Cataract Group: sandstone, dolostone, shale.*

**ORDOVICIAN**

1 *Queenston Formation: red shale.*

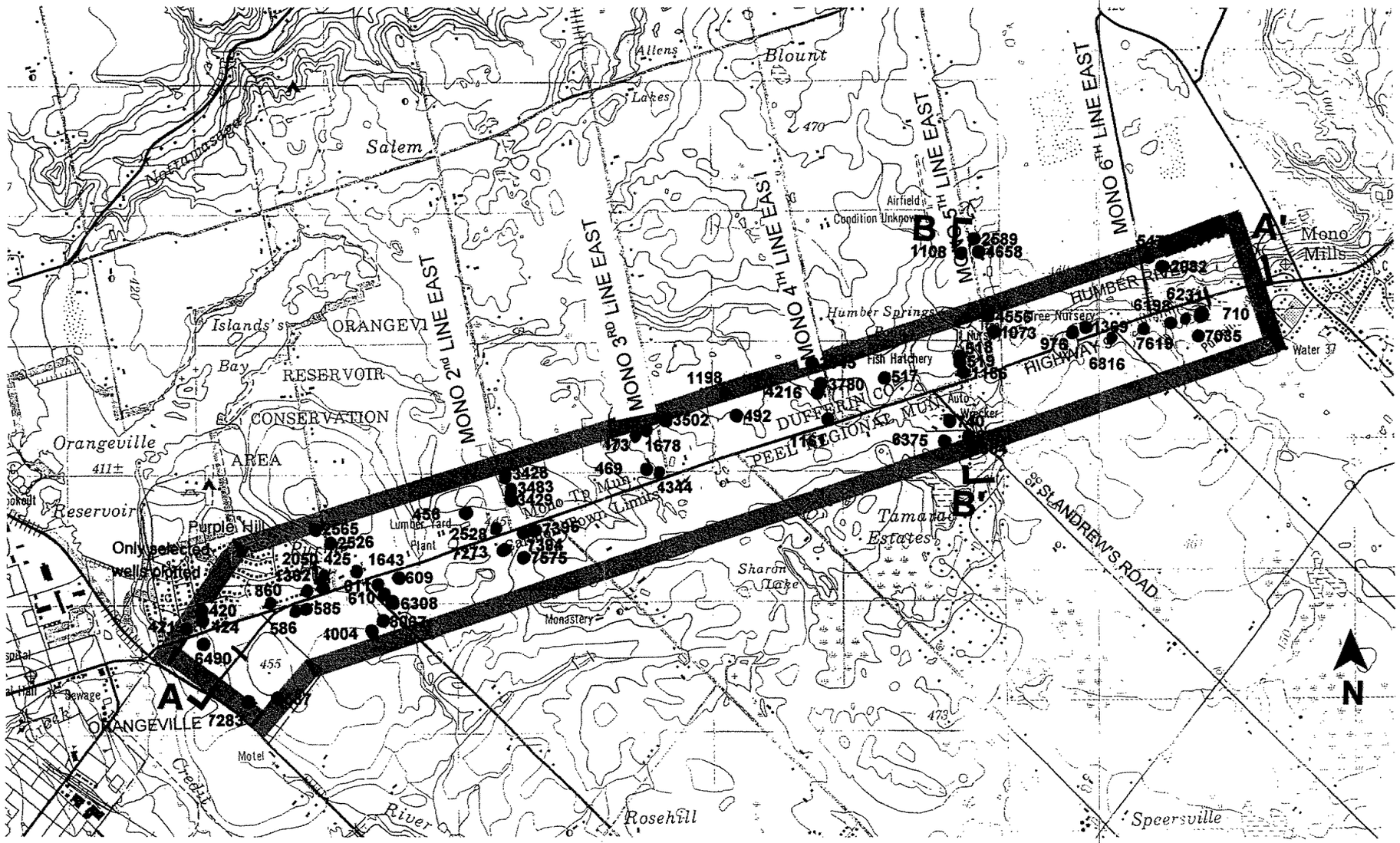
*Deposits on this sheet are mapped where they reach three feet or more in thickness. Thinner deposits are not shown.*

Source: Cowan 1976; White 1975

HYDROGEOLOGICAL STUDY
ENVIRONMENTAL STUDY REPORT
Highway 9 Reconstruction, Orangeville to Mono Mills

SUFICIAL GEOLOGY

FIGURE 3




| | | | |
|---|---|---|---|
| | HYDROGEOLOGICAL STUDY<br>ENVIRONMENTAL STUDY REPORT<br>Highway 9 Reconstruction, Orangeville to Mono Mills | CROSS-SECTION and<br>WATER WELL LOCATIONS ,<br>Ministry of the Environment Records | FIGURE 4 |

West

East

Highway 9 Reconstruction

Highway 10

Mono Mills

Humber Springs

Elevation in metres

480
470
460
450
440
430
420
410
400
390
380

421 420 1061 860 427 2152 2242 1362 586 585 2050 425 1643 611 610 6308 609 2528 7273 7395 469 4344 1161 517 6375 7110 518 519 1186 1073 976 1389 6816 7619 6198 6231 710 4897 5338 5337 5336 706

'Clay'

'Clay'

'Clay'

'Clay'

Limestone and Shale Bedrock

Predominantly sand and gravel

Predominantly 'Clay' – fine grained till and sediments

611 MOEE well record

Static water level

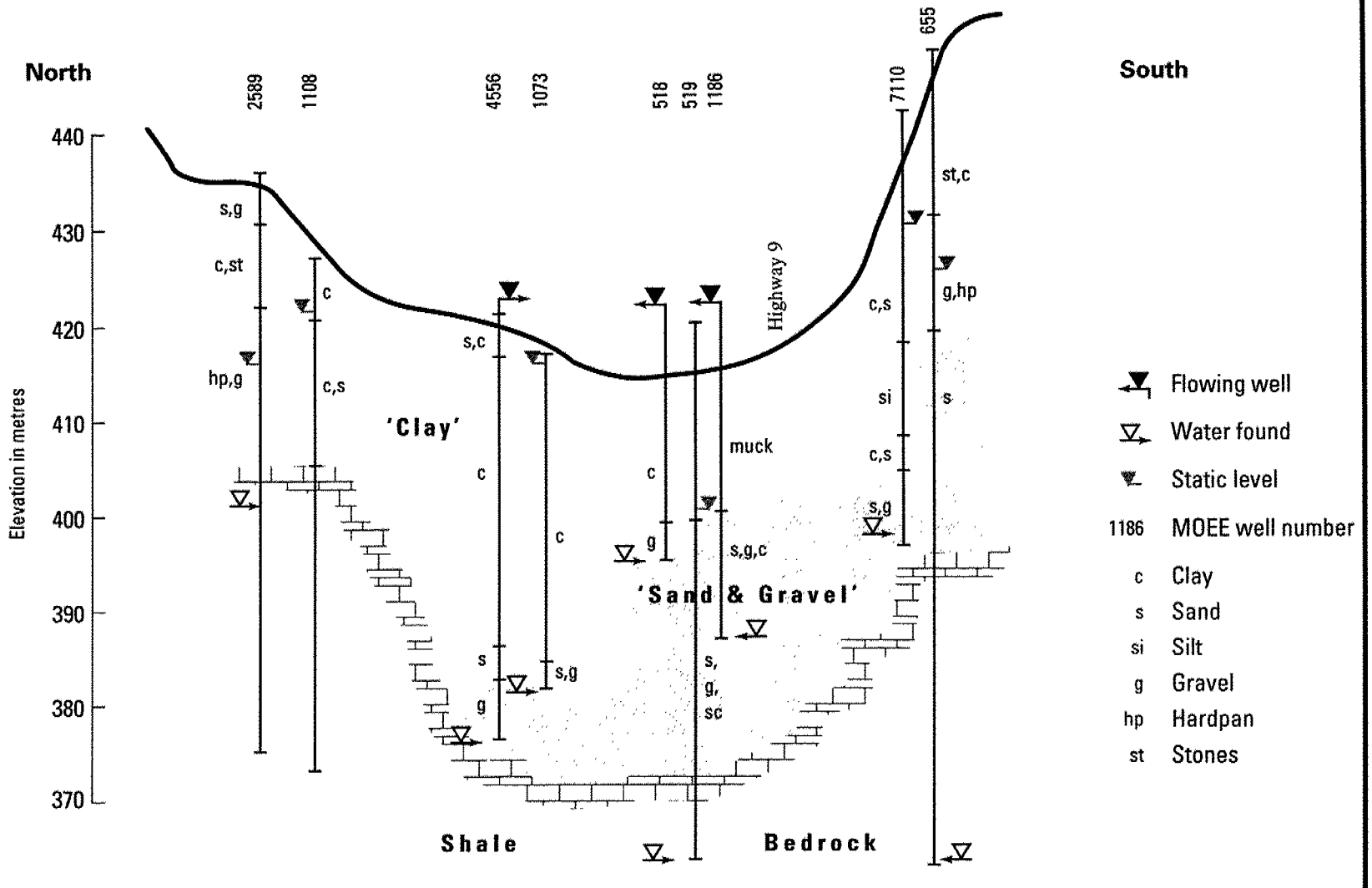
Water found

Charlesworth & Associates

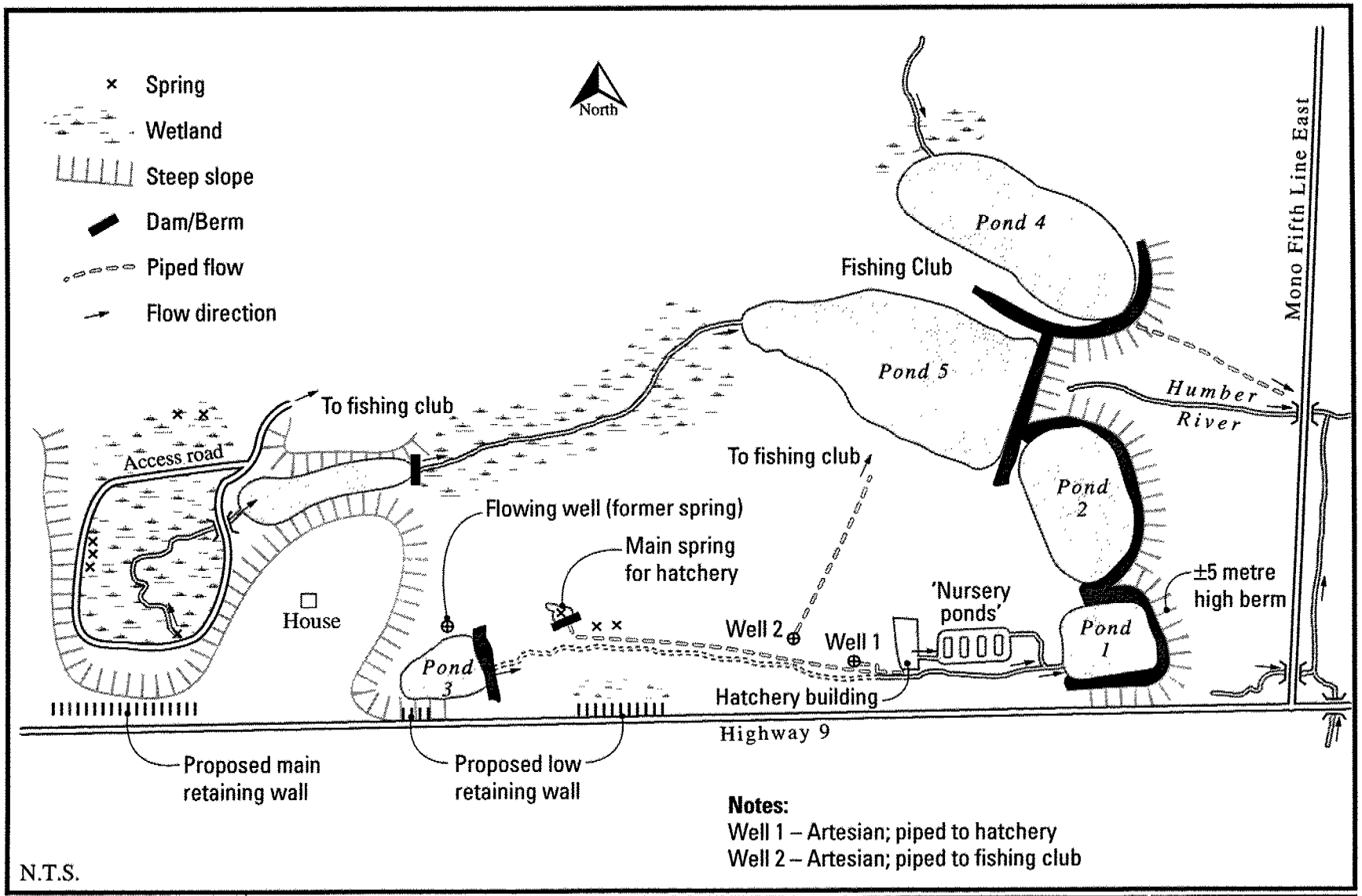
HYDROGEOLOGICAL STUDY
ENVIRONMENTAL STUDY REPORT
Highway 9 Reconstruction, Orangeville to Mono Mills

Hydrogeologic Cross-section along Highway 9
Looking North

FIGURE 5




| | | | |
|---|---|---|---|
| Charlesworth & Associates | HYDROGEOLOGICAL STUDY<br>ENVIRONMENTAL STUDY REPORT<br>Highway 9 Reconstruction, Orangeville to Mono Mills | Cross-section along Mono 5th Line East Looking East | FIGURE 6 |




| | | | |
|---|---|---|---|
| Charlesworth & Associates | HYDROGEOLOGICAL STUDY<br>ENVIRONMENTAL STUDY REPORT<br>Highway 9 Reconstruction, Orangeville to Mono Mills | Sketch of Humber Springs Trout Hatchery | FIGURE 7 |

# APPENDIX A

## MoEE WATER WELL RECORDS
### Caledon and Mono Tps., Highway 9

MONO TOWNSHIP, DUFFERIN COUNTY

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MONO TOWNSHIP** | | | | | | | | | | | | | | | | | |
| HS E | 1 | 1 | 430 573353 4863430 | 1335 | 11/58 | 4703 | 4 | FR | 0085 | 65 | 75 | 8 | 03:00 | DO | | | GIBSON H<br>CLAY STNS 0025 CLAY LMSN 0040 CLAY MSND 0047 LMSN 0100 |
| HS E | 1 | 1 | 2240 573550 4863900 | 1400 | 10/76 | 3406 | 5 | FR | 0121 | 80 | 88 | 10 | 05:00 | DO | | | CROFTS H<br>BRWN CLAY 0047 GREY LMSN 0121 |
| HS E | 1 | 1 | 436 573650 4863950 | 1425 | 05/66 | 1804 | 4 | FR | 0110 | 68 | 72 | 10 | 03:00 | DO | | | SHANTY N<br>LOAM 0001 CLAY 0064 GREY LMSN 0100 RED SHLE 0116 |
| HS E | 1 | 1 | 1482 573650 4863750 | 1375 | 05/73 | 3316 | 5 | FR | 0080 | 50 | 70 | 10 | 05:00 | DO | | | RULE<br>BRWN CLAY ROCK 0048 LMSN 0070 BLUE SHLE DLMT 0137 |
| HS E | 1 | 1 | 440 573677 4863859 | 1425 | 09/67 | 1315 | 5 | FR | 0118 | 78 | 90 | 4 | 03:00 | DO | | | ROBBIE D<br>YLLW CLAY 0017 BLDR CLAY 0035 YLLW CLAY STNS 0054 GRVL STNS 0064 LMSN 0095 BLUE SHLE 0118 |
| HS E | 1 | 1 | 1016 573680 4864000 | 1410 | 09/69 | 3422 | 4 | FR | 0118 | 30 | 55 | 7 | 03:00 | DO | | | KRECH K<br>BRWN MSND CLAY 0016 WHIT LMSN 0045 RED SHLE 0075 BLUE SHLE 0102 LMSN SHLE 0113 GREY LMSN 0118 |
| HS E | 1 | 1 | 969 573690 4863870 | 1430 | 03/69 | 3422 | 4 | FR | 0103 | 70 | 93 | 6 | 04:00 | DO | | | LOMAS L<br>BRWN CLAY 0010 CLAY MSND 0046 LMSN 0075 BLUE SHLE 0080 RED SHLE 0090 LMSN 0091 RED SHLE 0103 |
| HS E | 1 | 1 | 429 573732 4863603 | 1400 | 06/56 | 4728 | 4 | FR | 0086 | 41 | 67 | 4 | 10:00 | DO | | | BAILES R<br>PRDG 0038 HPAN STNS 0047 BLUE SHLE 0086 |
| HS E | 1 | 1 | 432 573734 4863734 | 1395 | 04/60 | 4703 | 4 | FR | 0045 | 27 | 45 | 8 | 02:30 | DO | | | LINGARD T<br>CLAY STNS 0024 LMSN 0045 BLUE SHLE 0080 |
| HS E | 1 | 1 | 431 573739 4863734 | 1395 | 04/60 | 4703 | 4 | FR | 0054 | 26 | 50 | 8 | 03:00 | DO | | | ENFIELD J<br>CLAY STNS 0018 LMSN 0045 BLUE SHLE 0080 |
| HS E | 1 | 1 | 1196 573740 4863840 | 1125 | 04/71 | 1315 | 5 | FR | 0136 | 55 | 70 | 8 | 03:20 | DO | | | ERINCO HOMES LTD<br>CLAY STNS GRVL 0058 LMSN 0090 RED SHLE 0136 |
| HS E | 1 | 1 | 1556 573741 4864024 | 1405 | 12/73 | 1315 | | FR | | 46 | 70 | 12 | 04:00 | DO | | | DENOGEL CONST<br>YLLW CLAY BLDR STNS 0040 SAND GRVL 0046 LMSN ROCK 0058 LMSN 0089 BLUE SHLE 0136 |
| HS E | 1 | 1 | 1484 573750 4864050 | 1410 | 04/73 | 3316 | 5 | FR | 0085 | 69 | 71 | 6 | 01:00 | DO | | | HILL T<br>CLAY ROCK 0015 CLAY SAND 0040 CLAY ROCK 0060 LMSN 0078 GREY LMSN 0090 BLUE SHLE 0092 |
| HS E | 1 | 1 | 439 573773 4863564 | 1400 | 07/67 | 3406 | 4 | FR | 0083 | 67 | 68 | 8 | 03:00 | DO | | | MANNING D<br>CLAY 0025 GRVL CLAY STNS 0047 LMSN 0083 |
| HS E | 1 | 1 | 1157 573790 4863810 | 1430 | 08/70 | 3406 | 5 | FR | 0085 | 70 | 73 | 6 | 02:00 | DO | | | PORTEOUS J E<br>BRWN CLAY 0025 BRWN CLAY GRVL 0060 BRWN LMSN 0085 |
| HS E | 1 | 1 | 1521 573798 4863844 | 1430 | 09/73 | 1570 | 6 | FR | 0088 | 83 | 83 | 10 | 02:00 | DO | | | SAN ANN DEVELOPMENTS<br>BRWN CLAY 0064 BLDR CLAY 0070 GREY LMSN 0072 BRWN |

CONTINUING ... MONO TOWNSHIP

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HS E | 1 | 1 1707 | 573799 4864067 | 1400 | 05/74 | 3316 | 5 | FR | 0070 | 54 | 58 | 10 | 15:00 | DO | | | CLAY SAND 0079 GREY LMSN 0092<br>HENDERSON JACK<br>SAND STNS CLAY 0038 GREY CLAY STNS 0047 BRWN LMSN 0076 LMSN SHLE 0085 |
| HS E | 1 | 1 419 | 573800 4863830 | 1430 | 03/64 | 4703 | 4 | FR | 0075 | 60 | 100 | 3 | 02:00 | DO | | | RHODES W F<br>CLAY STNS 0025 YLLW CLAY 0039 GREY LMSN 0055 RED SHLE 0065 BLUE SHLE 0120 |
| HS E | 1 | 1 437 | 573800 4863860 | 1430 | 07/66 | 3406 | 4 | FR | 0072 | 58 | 66 | 7 | 03:00 | DO | | | GIEBMANNS A<br>CLAY 0022 GRVL 0045 BRWN SHLE 0072 SHLE 0086 |
| HS E | 1 | 1 1187 | 573800 4863950 | 1415 | 10/70 | 1315 | 5 | FR | 0143 | 60 | 83 | 7 | 03:00 | DO | | | BELPARK CONST<br>LOAM 0006 CLAY BLDR GRVL 0048 GRVL 0054 LMSN 0086 RED SHLE 0143 |
| HS E | 1 | 1 1188 | 573800 4864050 | 1400 | 09/70 | 1315 | 5 | FR | 0144 | 58 | 80 | 7 | 03:00 | DO | | | BELPARK CONST<br>LOAM 0004 BRWN CLAY BLDR GRVL 0018 CLAY STNS GRVL 0045 GRVL 0054 BRWN LMSN 0068 BLUE LMSN 0087 RED SHLE 0144 |
| HS E | 1 | 1 1189 | 573800 4863960 | 1400 | 09/70 | 1315 | 5 | FR | 0146 | 55 | 80 | 7 | 02:30 | DO | | | BELPARK CONST<br>LOAM 0007 CLAY BLDR GRVL 0023 CLAY GRVL 0050 GRVL STNS 0062 LMSN 0084 RED SHLE 0146 |
| HS E | 1 | 1 1498 | 573800 4863900 | 1430 | 06/73 | 3316 | 5 | FR | 0080 | 50 | 100 | 4 | 10:00 | DO | | | LUCAS<br>BRWN CLAY ROCK 0025 GREY LMSN 0055 BLUE SHLE DLMT 0159 RED SHLE 0162 |
| HS E | 1 | 1 1128 | 573810 4863850 | 1435 | 04/70 | 1315 | 5 | FR | 0140 | 55 | 75 | 5 | 02:15 | DO | | | BELLPARK CONSTR<br>CLAY STNS 0038 BRWN LMSN GRVL 0056 LMSN 0102 RED SHLE 0140 |
| HS E | 1 | 1 1191 | 573810 4863940 | 1425 | 08/70 | 1315 | 5 | FR | 0142 | 45 | 78 | 6 | 02:00 | DO | | | BELPARK CONST CO<br>CLAY 0018 BLDR CLAY 0024 CLAY STNS GRVL 0043 LMSN 0085 RED SHLE 0142 |
| HS E | 1 | 1 854 | 573820 4864050 | 1420 | 07/68 | 3406 | 4 | FR | 0142 | 56 | 75 | 4 | 04:00 | DO | | | BELPARK CONST LTD<br>CLAY 0028 GRVL CLAY 0040 LMSN 0068 BLUE SHLE 0074 RED SHLE 0100 BLUE SHLE LMSN 0125 LMSN 0142 |
| HS E | 1 | 1 421 | 573824 4863524 | 1400 | 04/54 | 4703 | 4 | FR | 0060 | 32 | 32 | 12 | 03:00 | DO | | | WATT F<br>CLAY BLDR 0030 BRWN LMSN 0068 |
| HS E | 1 | 1 434 | 573828 4863856 | 1425 | 06/64 | 4703 | 4 | FR | 0085 | 79 | 81 | 6 | 02:00 | DO | | | REPKE H<br>GRVL 0020 CLAY STNS 0050 LMSN 0095 |
| HS E | 1 | 1 433 | 573841 4863665 | 1425 | 11/61 | 5416 | 4 | FR | 0110 | 60 | 80 | 6 | 03:00 | DO | | | BUTT D<br>CLAY BLDR 0020 GRVL 0030 GREY LMSN 0080 BLUE SHLE 0120 |

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
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| CONTINUING ... MONO TOWNSHIP | | | | | | | | | | | | | | | | | |
| HS E | 1 | 1 420 | 573842 4863635 | 1425 435 | 11/56 | 4728 | 4 | FR | 0070 | 60 | 60 | 3 | 08:00 | DO | | | JOHNSON H<br>CLAY LOAM 0003 CLAY GRVL BLDR 0042 LMSN 0072 |
| HS E | 1 | 1 424 | 573842 4863635 | 1425 435 | 10/51 | 4703 | 4 | FR<br>FR | 0080<br>0100 | 70 | 75 | 5 | 04:00 | DO | | | WOOLHEAD E<br>CLAY STNS 0060 BRWN LMSN 0104 |
| HS E | 1 | 1 968 | 573850 4863750 | 1425 | 03/69 | 3422 | 4 | FR | 0090 | 58 | 80 | 6 | 03:00 | DO | | | REED R<br>CLAY 0015 CLAY GRVL 0038 LMSN 0080 BLUE SHLE 0090 |
| HS E | 1 | 1 1193 | 573850 4863720 | 1425 | 02/71 | 1315 | 6 | FR | 0138 | 55 | 68 | 5 | 03:00 | DO | | | BELPARK CONST<br>OBDN 0006 CLAY BLDR 0028 GRVL 0045 LMSN 0098 RED SHLE 0138 |
| HS E | 1 | 1 1197 | 573850 4863750 | 1425 | 03/71 | 1315 | 5 | FR | 0138 | 58 | 72 | 8 | 04:00 | DO | | | BELPARK CONST<br>CLAY STNS 0025 BLDR CLAY GRVL 0053 LMSN 0094 BLUE SHLE 0138 |
| HS E | 1 | 1 1483 | 573850 4863760 | 1440 | 07/73 | 3316 | 5 | FR<br>FR | 0110<br>0160 | 77 | 85 | 12 | 08:00 | DO | | | SCARSBROOK T<br>BRWN CLAY ROCK 0038 GREY LMSN CLAY 0074 BLUE SHLE LMSN 0095 BLUE SHLE 0155 GREY DLMT 0177 |
| HS E | 1 | 1 855 | 573870 4864060 | 1410 | 07/68 | 3406 | 4 | FR | 0144 | 60 | 85 | 5 | 06:00 | DO | | | PIRPAMER FRANK<br>CLAY GRVL 0042 LMSN 0067 BLUE SHLE 0111 BLUE SHLE LMSN 0126 LMSN SHLE 0144 |
| HS E | 1 | 1 441 | 573887 4863933 | 1430 | 10/67 | 5416 | 5 | FR | 0132 | 70 | 70 | 10 | 01:00 | DO | | | ALLAN R<br>HPAN 0041 BRWN LMSN 0108 GREY SHLE 0140 |
| HS E | 1 | 1 438 | 573889 4863797 | 1425 | 06/67 | 5416 | 4 | FR<br>FR | 0108<br>0134 | 68 | 80 | 15 | 01:00 | DO | | | MCKIBBAN K<br>CLAY 0022 HPAN 0039 BRWN LMSN SHLE 0108 RED SHLE 0136 |
| HS E | 1 | 1 1185 | 573900 4863740 | 1425 | 11/70 | 1315 | 5 | FR | 0130 | 55 | 73 | 5 | 04:00 | DO | | | BELLPARK CONST<br>LOAM 0008 CLAY STNS GRVL 0040 STNS 0058 LMSN 0097 RED SHLE 0136 |
| H@ E | 1 | 1 2225 | 573900 4864050 | 1420 | 01/77 | 3406 | 6 | FR | 0106 | 60 | 74 | 12 | 03:30 | DO | | | MCNAMARA<br>BRWN CLAY 0046 GREY LMSN 0090 GREY LMSN 0106 |
| HS E | 1 | 1 858 | 573930 4863960 | 1425 | 10/68 | 1315 | 4 | FR | 0070 | 38 | 50 | 10 | 04:00 | DO | | | PIRPAMER F<br>MSND CLAY BLDR 0030 LMSN SHLE CLAY 0056 LMSN 0085 BLUE SHLE 0126 |
| HS E | 1 | 1 1089 | 573930 4864050 | 1415 | 03/70 | 1315 | 6 | FR | 0138 | 43 | 70 | 4 | 02:00 | DO | | | BELLPARK CONSTR<br>CLAY BLDR STNS 0026 BRWN LMSN 0063 LMSN 0086 RED SHLE 0138 |
| HS E | 1 | 1 859 | 573950 4864050 | 1420 | 10/68 | 1315 | 4 | FR | 0068 | 31 | 55 | 12 | 04:00 | DO | | | BELPARK CONSTRUCTION<br>CLAY BLDR 0025 MSND CLAY STNS 0042 LMSN 0068 BLUE SHLE 0120 |
| HS E | 1 | 1 893 | 573950 | 1422 | 12/68 | 1315 | 5 | FR | 0094 | 26 | 45 | 12 | 02:00 | DO | | | HODGE R J |

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
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| CONTINUING ... MONO TOWNSHIP | | | | | | | | | | | | | | | | | |
| | | | 4863010 | | | | | | | | | | | | | | CLAY BLDR 0025 CLAY STNS 0041 LMSN SHLE 0061 LMSN 0094 BLUE SHLE 0118 |
| HS E | 1 | 1 960 | 573950 4863990 | 1425 | 01/69 | 1315 | 4 | FR | 0089 | 26 | 50 | 5 | 03:00 | DO | | | VANDERBYL M<br>LOAM MSND 0006 CLAY BLDR STNS 0044 LMSN 0089 BLUE SHLE 0123 |
| HS E | 1 | 1 961 | 573950 4864030 | 1420 | 01/69 | 1315 | 4 | FR | 0090 | 31 | 50 | 5 | 03:00 | DO | | | TURNER G<br>LOAM MSND 0006 CLAY BLDR STNS 0045 LMSN 0090 BLUE SHLE 0122 |
| HS E | 1 | 1 428 | 573972 4863653 | 1440 | 07/55 | 4703 | 4 | FR<br>FR | 0085<br>0095 | 64 | 64 | 8 | 03:00 | DO | | | MCKENNA C<br>CLAY 0010 BLDR CLAY 0040 LMSN 0100 |
| HS E | 1 | 1 853 | 574000 4863625 | 1437 | 07/68 | 3406 | 4 | FR | 0084 | 58 | 70 | 4 | 04:00 | DO | | | CAMPBELL LYLE<br>CLAY 0020 CLAY GRVL 0048 LMSN 0081 BLUE SHLE 0085 RED SHLE 0089 |
| HS E | 1 | 1 1059 | 574000 4863850 | 1450 | 12/69 | 1315 | 6 | FR | 0136 | 51 | 60 | 3 | 02:00 | DO | | | BELPARK CONST CO<br>CLAY BLDR 0038 STNS 0054 LMSN 0098 RED SHLE 0136 |
| HS E | 1 | 1 1070 | 574010 4863720 | 1440 | 10/69 | 3406 | 4 | FR | 0084 | 60 | 65 | 5 | 04:00 | DO | | | HEIZIG E<br>YLLW CLAY 0015 YLLW CLAY GRVL 0036 BRWN LMSN 0084 |
| HS E | 1 | 1 856 | 574020 4863710 | 1440 | 08/68 | 3406 | 4 | FR | 0105 | 77 | 97 | 9 | 04:00 | DO | | | BELPARK CONSTRUCTION<br>YLLW CLAY 0015 YLLW CLAY GRVL 0055 BRWN LMSN 0097 BLUE SHLE 0107 |
| HS E | 1 | 1 1061 | 574020 4863600 | 1440 | 12/69 | 1315 | 6 | FR | 0157 | 51 | 51 | 3 | 01:40 | DO | | | BELPARK CON CO<br>CLAY BLDR 0040 STNS 0064 MUCK 0078 LMSN 0126 BLUE SHLE 0157 |
| HS E | 1 | 1 857 | 574025 4863650 | 1440 | 09/68 | 3406 | 4 | FR | 0091 | 65 | 75 | 7 | 04:00 | DO | | | BELPARK CONST LTD<br>BRWN CLAY 0010 BRWN CLAY GRVL 0036 LMSN 0091 |
| HS E | 1 | 1 860 | 574030 4863620 | 1440 | 12/68 | 3406 | 4 | FR | 0113 | 70 | 107 | 4 | 04:00 | DO | | | MCKIBBON KEITH<br>CLAY 0020 MSND 0053 LMSN 0110 BLUE SHLE 0115 |
| HS E | 1 | 1 418 | 574043 4863659 | 1445 | 05/49 | 4703 | 4 | FR<br>FR | 0105<br>0112 | 70 | 76 | 20 | 02:00 | DO | | | HUETHER J C<br>CLAY 0030 CLAY MSND STNS 0035 BRWN LMSN 0105 WHIT LMSN 0116 |
| HS E | 1 | 1 2150 | 574050 4863850 | 1450 | 07/76 | 3406 | 5 | FR | 0105 | 50 | 75 | 7 | 04:00 | DO | | | SCHELLENBERG DON<br>BRWN CLAY 0038 GREY LMSN 0105 |
| HS E | 1 | 1 2268 | 574050 4863900 | 1445 | 04/77 | 3406 | 6 | FR | 0095 | 60 | 79 | 10 | 02:00 | DO | | | FRIDMAN S<br>BRWN CLAY 0033 BRWN SAND GRVL 0075 GREY LMSN 0095 |
| HS E | 1 | 1 1060 | 574060 4863900 | 1450 | 12/69 | 1315 | 5 | FR | 0138 | 50 | 68 | 3 | 02:00 | DO | | | BELPARK CONST CO<br>BLDR CLAY 0034 LMSN 0097 BLUE SHLE 0138 |
| HS E | 1 | 1 426 | 574118 4863681 | 1450 | 08/54 | 4703 | 4 | FR<br>FR | 0080<br>0090 | 66 | 69 | 12 | 03:00 | DO | | | WOOLHEAD E<br>CLAY 0012 BLDR CLAY 0030 CLAY MSND BLDR 0034 BRWN |

CONTINUING ... MONO TOWNSHIP

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | LMSN 0097 |
| HS E | 1 | 1 427 | 574118 4863686 | 1450 | 03/54 | 4703 | 4 | FR | 0090 | 70 | 70 | 10 | 02:00 | DO | | | BOOKMAN C<br>CLAY STNS 0030 ROCK CLAY 0040 BRWN LMSN 0100 |
| HS E | 1 | 1 2349 | 574150 4863750 | 1450 | 03/78 | 2341 | 6 | | 0081 | 60 | | 10 | 24:00 | CO | | | JAMES DICK CONST<br>BRWN GRVL SAND 0015 BRWN CLAY GRVL 0045 LMSN 0065<br>BLUE SHLE 0070 BLUE SHLE LMSN 0081 RED SHLE 0090<br>BLUE SHLE 0100 |
| HS E | 1 | 1 2152 | 574200 4863700 | 1455 | 07/76 | 3406 | 5 | | 0090 | 68 | 70 | 8 | 01:30 | DO | | | HOLOMIS<br>BRWN CLAY 0041 GREY LMSN 0090 |
| HS E | 1 | 1 2301 | 574250 4864150 | 1430 | 09/77 | 2336 | 6 | FR | 0072 | 27 | 60 | 10 | 01:00 | NU DO | | | ADROMAN HOME LTD<br>LOAM 0001 BRWN CLAY SAND STNS 0016 BRWN ROCK 0071<br>GREY ROCK 0078 BLUE SHLE 0085 RED SHLE 0091 |
| HS E | 1 | 1 2300 | 574300 4864000 | 1430 | 08/77 | 2336 | 6 | FR | 0063 | 37 | 52 | 18 | 24:00 | CO | | | ADROMAN HOMES LTD<br>LOAM 0001 BRWN CLAY STNS 0005 BRWN ROCK 0058 BRWN<br>ROCK DKCL 0063 GREY ROCK DKCL 0070 BLUE SHLE 0076<br>RED SHLE 0090 |
| HS E | 1 | 1 2306 | 574300 4864150 | 1435 | 10/77 | 2336 | 6 | FR | 0085 | 46 | 53 | 18 | 01:00 | NU DO | | | ADROMAN HOMES LTD<br>BRWN LOAM 0001 BRWN CLAY STNS 0010 BRWN ROCK LTCL<br>0093 BLUE SHLE 0100 RED SHLE LYRD 0103 |
| HS E | 1 | 1 2302 | 574400 4864200 | 1435 | 09/77 | 2336 | 6 | FR | 0091 | 23 | 40 | 12 | 04:00 | NU DO | | | ADROMAN HOMES LTD<br>LOAM 0001 BRWN CLAY STNS 0015 BRWN ROCK 0038 GREY<br>ROCK 0075 GREY ROCK 0091 BLUE SHLE 0097 RED SHLE<br>0106 |
| HS E | 1 | 1 3901 | 574411 4864280 | 1440 | 05/89 | 1413 | 10 | FR | 0020 | 45 | | 20 | 05:45 | MU | | | LEONARD GODFREY<br>BRWN CLAY STNS PCKD 0007 BRWN LMSN FCRD 0064 BRWN<br>LMSN FCRD 0070 GREY LMSN 0080 |
| HS E | 1 | 1 2242 | 574500 4863750 | 1455 | 11/76 | 3406 | 5 | FR | 0099 | 55 | 58 | 12 | 02:00 | DO | | | CADMAN D<br>BRWN CLAY 0013 GREY LMSN 0099 |
| HS E | 1 | 1 3888 | 574561 4864004 | 1447 | 04/89 | 1413 | 10 | FR | 0065 | | | 20 | 02:30 | DO | | | DIX. INVESTMENT LTD.<br>BRWN CLAY STNS SAND 0006 BRWN LMSN HARD 0010 GREY<br>LMSN HARD 0030 GREY LMSN HARD 0065 GREY LMSN FCRD<br>0076 BRWN LMSN SOFT 0082 |
| HS E | 1 | 1 3872 | 574570 4864064 | 1444 | 03/89 | 1413 | 6 | FR | 0065 | 55 | | 15 | 04:30 | MU | | | DIX. INVESTMENT LTD.<br>BRWN CLAY STNS SAND 0006 BRWN LMSN HARD 0010 GREY<br>LMSN HARD 0030 GREY LMSN HARD 0065 GREY LMSN FCRD<br>0076 BRWN LMSN SOFT 0080 |
| HS E | 1 | 1 4113 | 574639 4864139 | 1437 | 09/89 | 3406 | 6 | | 0062<br>0082 | 34 | 100 | 7 | | DO | | | BROWNE MICHAEL<br>BRWN CLAY LMSN FCRD 0008 LMSN 0082 BLUE SHLE 0100 |

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
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| CONTINUING ... MONO TOWNSHIP | | | | | | | | | | | | | | | | | |
| HS E | 1 | 1 | 1362 | 574830 4863860 | 1450 447 | 08/72 | 3406 | 5 | FR | 0079 | 65 | 67 | 8 | 01:30 | DO | | MCKENNA G<br>BRWN CLAY 0029 BRWN GRVL CLAY 0034 WHIT LMSN CLAY 0079 |
| HS E | 1 | 1 | 435 | 574938 4863948 | 1450 442 | 07/65 | 1804 | 4 | FR | 0090 | 72 | 78 | 8 | 04:00 | DO | | BOYS R<br>LOAM 0004 YLLW MSND 0044 LMSN 0112 |
| HS E | 1 | 1 | 2050 | 574950 4863900 | 1450 442 | 12/75 | 3406 | 5 | FR | 0121 | 55 | 95 | 5 | 01:00 | DO | | BAIRD O<br>BRWN CLAY 0046 GREY LMSN 0095 GREY LMSN SHLE 0121 |
| HS E | 1 | 1 | 425 | 574978 4863984 | 1450 493 | 06/53 | 4703 | 4 | FR<br>FR | 0080<br>0090 | 70 | 72 | 8 | 02:00 | DO | | WOOLHEAD E<br>CLAY STNS 0020 ROCK CLAY 0038 LMSN 0095 |
| HS E | 1 | 1 | ~~422~~ | ~~999999~~ ~~9999999~~ | | 11/47 | 4703 | 4 | FR | 0070 | 45 | 70 | 3 | 02:00 | DO | | MURRAY R<br>CLAY 0025 CLAY STNS 0035 GREY LMSN 0055 RED SHLE 0075 |
| HS E | 1 | 2 | 1343 | 573650 4864080 | 1400 | 06/71 | 1315 | 5 | FR | 0126 | 53 | 75 | 5 | 02:00 | DO | | REPKO H<br>OBDN 0006 CLAY BLDR 0024 CLAY GRVL SAND 0051 LMSN 0097 RED SHLE 0126 |
| HS E | 1 | 2 | 1800 | 574133 4864781 | 1375 | 11/74 | 3406 | 6 | FR | 0114 | 20 | 57 | 12 | 15:00 | PS | | CREDIT VALLEY CONSV<br>BRWN CLAY GRVL LMSN 0050 BRWN SAND 0093 GREY LMSN 0114 |
| HS E | 1 | 2 | 3724 | 574451 4864311 | 1434 | 10/88 | 3903 | 6 | FR | 0051 | 41 | 63 | 8 | 24:00 | MU | | L. GODFREY<br>BRWN DLMT CLAY FCRD 0007 BRWN DLMT 0072 GREY SHLE 0094 |
| HS E | 1 | 2 | 3723 | 574466 4864357 | 1434 | 10/88 | 3903 | 6 | FR<br>FR | 0040<br>0049 | 40 | | 8 | 02:00 | NU | | L. GODFREY<br>BRWN CLAY ROCK FCRD 0007 BRWN DLMT 0060 GREY SHLE 0094 |
| HS E | 1 | 2 | 3722 | 574476 4864364 | 1434 | 10/88 | 3903 | 6 | FR | 0051 | 46 | 56 | 20 | 24:00 | MU | | L. GODFREY<br>BRWN DLMT CLAY FCRD 0007 BRWN DLMT 0072 GREY SHLE 0094 |
| HS E | 1 | 2 | 442 | 574721 4864789 | 1460 | 06/67 | 3406 | 4 | FR | 0086 | 73 | 74 | 4 | 04:30 | ST DO | | HAND J<br>GREY CLAY GRVL 0055 SNDS 0086 |
| HS E | 1 | 2 | 1282 | 574900 4864435 | 1475 | 10/71 | 3406 | 4 | FR | 0122 | 90 | 97 | 6 | 01:30 | DO | | HAND D<br>BRWN CLAY 0023 BRWN CLAY GRVL 0049 BRWN LMSN 0075 WHIT LMSN 0116 GREY LMSN 0122 |
| HS E | 1 | 3 | 2148 | 574300 4865300 | 1355 | 06/76 | 3406 | 6 | MN | 0114 | 25 | 35 | 9 | 07:00 | PS | | CREDIT VALLEY CONS<br>BRWN CLAY GRVL 0030 BRWN SAND 0112 BRWN SAND GRVL 0114 |
| HS E | 1 | 3 | 3682 | 574695 4865701 | 1375 | 09/88 | 3612 | 30 | | 0021 | 21 | 27 | 3 | 01:00 | DO | | GORDON WEECH<br>BRWN LOAM STNS 0002 GREY GRVL SAND 0021 GREY FGVL 0023 GREY GRVL STNS 0028 |

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
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| CONTINUING ... MONO TOWNSHIP | | | | | | | | | | | | | | | | | |
| HS E | 1 | 3 | 3720 574792 4865161 | 1401 | 09/88 | 3903 | 6 | FR | 0190 | 12 | 125 | 200 | 08:00 | CO | | | ECCLES<br>BRWN SAND CLAY LOOS 0005 BRWN SAND GRVL CLAY 0035 BRWN CLAY SAND GRVL 0051 GREY CLAY DNSE 0100 GREY CLAY FSND LYRD 0130 BRWN MSND GRVL LOOS 0194 RED SHLE DNSE 0196 |
| HS E | 1 | 3 | 2311 574800 4865550 | 1380 | 11/77 | 3662 | 30 | | 0020 | 22 | 28 | 2 | 02:00 | ST | | | LENNOX VERNET<br>BLCK LOAM 0001 BRWN GRVL STNS 0006 BRWN CSND STNS 0012 BRWN SAND CLAY 0015 BRWN SAND STNS 0024 BLUE CLAY STNS 0030 |
| HS E | 1 | 5 | 443 573997 4866607 | 1400 | 05/67 | 3316 | 4 | SA<br>SA | 0190<br>0280 | 140 | 200 | 2 | 05:00 | DO | | | DOUGLAS D<br>GRVL STNS 0072 MSND 0090 CLAY STNS 0144 RED SHLE 0300 |
| HS E | 2 | 1 | 2565 574000 4864400 | 1450 | 07/79 | 3406 | 6 | FR | 0117 | 87 | 97 | 10 | 12:00 | DO | | | MURDOCK L<br>BRWN CLAY SAND 0058 BRWN LMSN SOFT FCRD 0087 BRWN LMSN 0120 |
| HS E | 2 | 1 | 2526 575050 4864250 | 1425 | 04/79 | 3406 | 5 | FR | 0067 | 52 | 52 | 5 | 01:20 | DO | | | WHITE T<br>BRWN CLAY 0013 LMSN 0042 BRWN CLAY LMSN LYRD 0082 |
| HS E | 2 | 1 | 1643 575172 4864040 | 1430 | 04/74 | 4320 | | FR | 0030 | 25 | 40 | 9 | 05:00 | CO | | | STAGG FRED A<br>BRWN LOAM 0001 BRWN CLAY STNS 0008 BRWN DLMT 0075 |
| HS E | 2 | 1 | 456 576039 4864512 | 1455 | 11/62 | 5001 | 36 | FR | 0009 | 9 | | 4 | | ST DO | | | FRENCH B<br>LOAM MSND 0002 CSND 0016 QSND 0020 |
| HS E | 2 | 1 | 2528 576300 4864350 | 1450 | 06/79 | 3406 | 5 | FR | 0113 213 | 105 | 120 | 8 | 01:00 | CO | 0129 | 03 | ENERGY SYS HIGHLANDS<br>BRWN SAND 0031 BRWN CLAY 0146 BRWN SAND GRVL DRTY 0154 HPAN 0213 GREY SAND CLN LOOS 0225 |
| HS E | 2 | 2 | 457 574965 4864894 | 1460 | 05/56 | 4728 | 4 | FR | 0063 | 63 | 63 | 4 | 24:00 | ST DO | | | LENNOX B<br>BRWN CLAY 0003 GRVL CLAY 0031 CLAY BLDR 0058 LMSN 0088 |
| HS E | 2 | 3 | 3725 574833 4865421 | 1381 | 09/88 | 3662 | 30 | | 0020 | 20 | 25 | 5 | 02:00 | DO | | | ANDY LENNOX<br>BLCK LOAM 0001 BRWN CLAY 0003 BRWN CGVL STNS 0019 BRWN FGVL 0026 BRWN CGVL STNS 0028 |
| HS E | 2 | 3 | 3206 574907 4865161 | 1398 | 06/85 | 2332 | 5 | FR | 0070 | 42 | 46 | 6 | 02:00 | DO | | | OSBURN J.<br>BRWN SAND 0033 BRWN CLAY SAND 0045 GREY CLAY ROCK 0062 BRWN SHLE ROCK 0064 BLUE CLAY SHLE LYRD 0090 |
| HS E | 2 | 4 | 2366 574700 4865950 | 1345 | 07/77 | 3406 | 6 | FR | 0079 | 57 | 63 | 10 | 02:00 | DO | | | M-G-CONSTRUCTION<br>BRWN CLAY 0017 BRWN GRVL 0079 |
| HS E | 2 | 4 | 2445 574700 4866150 | 1350 | 07/78 | 4640 | 30 | FR | 0018 | 18 | 18 | 15 | 02:00 | DO | | | BUTLER D<br>BRWN SAND GRVL STNS 0008 BRWN SAND 0019 BRWN SAND GRVL STNS 0023 |

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
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| CONTINUING ... MONO TOWNSHIP | | | | | | | | | | | | | | | | | |
| HS E | 2 | 4 980 | 574720 4865850 | 1375 ? | 05/69 | 3612 | 36 | FR | 0019 | | | 2 | 01:00 | DO | | | WOODLAND BRUCE<br>LOAM 0002 CLAY MSND 0004 GRVL 0019 MSND GRVL 0025 |
| HS E | 2 | 4 3431 | 576012 4866163 | 1414 430 | 07/87 | 2576 | 6 | FR | 0066 | 58 | 62 | 4 | 03:00 | DO | | | MONAGHAM J.<br>BRWN GRVL 0002 GRVL STNS 0018 SAND GRVL 0038 YLLW GRVL LMSN SAND 0070 |
| HS E | 2 | 5 1485 | 574600 4866500 | 1385 | 06/73 | 3316 | 5 | FR<br>FR | 0207<br>0242 | 80 | 120 | 6 | 08:00 | DO | | | HEYWOOD C<br>GRVL STNS CLAY 0046 CLAY SAND SILT 0200 RED SHLE 0242 |
| HS E | 2 | 5 2396 | 574650 4866800 | 1375 | 04/78 | 2341 | 6 | FR | 0047 | 7 | 7 | 40 | 02:00 | ST DO | | | SAKORNYK G<br>BRWN CLAY 0008 GRVL STNS DRTY 0050 |
| HS E | 2 | 5 1820 | 575072 4866926 | 1400 | 08/74 | 3406 | 6 | FR | 0365 | 195 | 285 | 4 | 02:30 | DO | | | FOESSEL JACK<br>BRWN CLAY 0026 BRWN GRVL 0063 GREY CLAY 0160 GREY CLAY GRVL SILT 0318 BLUE SHLE SAND 0365 |
| HS E | 2 | 5 1190 | 575420 4866840 | 1450 | 08/70 | 1315 | 6 | FR | 0311 | 188 | 240 | 3 | 08:00 | DO | | | TORTINGTON G<br>LOAM MSND 0004 CLAY STNS BLDR 0050 CLAY GRVL 0060 BLUE CLAY STNS BLDR 0090 BLUE CLAY QSND 0200 QSND STNS 0293 GRVL STNS 0311 |
| HS E | 2 | 5 458 | 575713 4866906 | 1470 | 04/63 | 5001 | 36 | FR | 0075 | 75 | | 5 | | ST DO | | | CAUGHLIN W<br>LOAM MSND 0005 STNS GRVL 0040 GREY CLAY LOAM 0065 CSND 0075 FSND GRVL 0085 |
| HS E | 2 | 5 1370 | 575820 4867060 | 1425 | 10/72 | 3612 | 30 | | 0044 | 44 | 60 | 2 | 01:00 | DO | | | WOODLAND A T<br>BLCK LOAM 0002 BRWN CLAY STNS 0035 GREY SAND GRVL 0044 GREY CSND 0061 BLUE CLAY 0062 |
| HS E | 3 | 1 3428 | 576337 4864832 | 1411 435 | 07/87 | 3602 | 6 | FR | 0024<br>0260 | 30 | | 1 | | DO | | | RODAJANET ANDREWS<br>BRWN FILL 0008 BRWN SAND CLAY 0012 GREY CLAY 0120 GREY CLAY STNS 0174 RED SHLE 0260 |
| HS E | 3 | 1 3429 | 576407 4864625 | 1447 440 | 08/87 | 3602 | 6 | FR | 0157<br>0161 | 35 | 155 | 9 | 01:00 | DO | | | REDMAN JEOFF<br>BRWN SAND CLAY 0020 BRWN CLAY SILT 0157 WHIT SHLE GRVL 0161 |
| HS E | 3 | 1 3483 | 576410 4864630 | 1447 439 | 10/87 | 3602 | 6 | FR<br>FR | 0153<br>0212 | 52 | 270 | 8 | 00:50 | DO | | | REDMAN JEOFF<br>BRWN SAND CLAY 0020 BRWN CLAY SILT 0157 WHIT SHLE GRVL 0161 RED SHLE 0281 |
| HS E | 3 | 1 473 | 577360 4865201 | 1475 453 | 09/65 | 5416 | 5 | FR | 0185 | 43 | 70 | 8 | 03:00 | DO | | | BAUER E<br>HPAN BLDR 0108 GRVL BLDR 0145 BLUE SHLE 0200 |
| HS E | 3 | 1 469 | 577378 4864789 | 1500 458 | 07/65 | 5416 | 5 | FR | 0185 | 80 | 90 | 8 | 03:00 | DO | | | HOLMES W<br>GRVL BLDR 0070 GRVL MSND 0120 GRVL STNS HPAN 0160 RED SHLE 0192 |
| HS E | 3 | 1 4344 | 577611 | 1519 462 | 04/91 | 2576 | 6 | FR | 0193 | 95 | | 12 | 01:00 | DO | | | DIXON BOB |

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
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| CONTINUING ... MONO TOWNSHIP | | | | | | | | | | | | | | | | | |
| | | | 4864765 | | | | | FR | 0214 | | | | | | | | LOAM 0001 BRWN CLAY STNS 0025 BRWN SAND 0059 WHIT SAND 0085 GREY GRVL SAND 0127 BRWN LMSN SHLE CLAY 0163 BLUE SHLE 0181 GREY SHLE 0190 BLUE SHLE LMSN 0216 |
| HS E | 3 | 2 2562 | 576350 4864800 | 1450 | 06/79 433 | 3814 | 30 | FR | 0015 | 15 | 15 | 4 | 00:01 | DO | | | BROWN E BRWN SAND 0012 GRVL 0027 |
| HS E | 3 | 2 470 | 577313 4865824 | 1455 | 10/62 443 | 3316 | 4 | FR | 0153 | 45 | 80 | 6 | 01:30 | ST DO | | | PEARSON I CLAY STNS 0035 MSND 0050 CLAY STNS 0115 GREY LMSN 0154 |
| HS E | 3 | 2 1678 | 577450 4865250 | 1475 | 04/74 455 | 3406 | 5 | FR | 0200 | 36 | 160 | 4 | 02:00 | DO | | | BARGEMAN GEO BRWN CLAY 0010 GREY CLAY GRVL 0134 BLUE SHLE GRVL 0156 BLUE SHLE LMSN 0200 |
| HS E | 3 | 3 2370 | 576350 4865550 | 1415 | 08/77 433 | 3406 | 6 | FR | 0212 | 50 | 86 | 5 | 15:00 | DO | 0208 | 04 | ALLEN NORMAN BRWN CLAY 0013 BRWN GRVL 0042 GREY CLAY SAND 0206 BRWN GRVL SAND 0212 |
| HS E | 3 | 3 4501 | 576781 4866217 | 1394 | 08/92 428 | 3602 | 6 | FR | 0155 | 85 | 145 | 10 | 02:00 | DO | | | CAMPBELL DAVID BRWN LOAM 0001 BRWN CLAY SAND GRVL 0055 GREY CLAY GRVL 0095 GREY CLAY HARD 0155 WHIT LMSN FCRD 0157 |
| HS E | 3 | 3 1151 | 577210 4866250 | 1460 | 07/70 440 | 3406 | 6 | FR | 0095 | 76 | 80 | 8 | 03:00 | ST | | | HILLIER MELBA BRWN MSND CLAY 0010 BRWN CLAY 0022 BRWN GRVL CLAY 0092 BRWN LMSN 0097 |
| HS E | 3 | 3 997 | 577300 4866270 | 1465 | 07/69 446 | 3422 | 6 | FR | 0107 | 21 | 96 | 5 | 03:00 | DO | | | REAUME W J GRVL 0107 |
| HS E | 3 | 4 2027 | 576050 4866250 | 1425 | 09/75 | 3406 | 6 | FR | 0064 | 58 | 59 | 10 | 01:00 | ST | | | FRENCH HARRY BRWN CLAY 0008 BRWN GRVL 0064 |
| HS E | 3 | 4 1702 | 577150 4866550 | 1500 | 06/74 | 4320 | 4 | FR | 0266 | 132 | | 8 | 03:00 | DO | | | VEENMAN GARY BRWN CLAY STNY 0105 GREY CLAY STNS 0195 WHIT DLMT LMSN CLAY 0214 BLUE SHLE SOFT 0222 GREY SHLE 0271 |
| HS E | 3 | 4 3863 | 577194 4866842 | 1476 | 12/88 | 3132 | 6 | FR | 0215 | 90 | 160 | 7 | 02:30 | DO | | | W.G. LAUTERBACH GREY CLAY BLDR DNSE 0021 GREY CLAY SAND DNSE 0045 BRWN CLAY STNS DNSE 0086 BLUE CLAY STNS DNSE 0158 BRWN CLAY STNS DNSE 0193 BLUE CLAY STNS DNSE 0208 RED CLAY STNS DNSE 0230 |
| HS E | 3 | 5 471 | 576050 4866887 | 1420 | 06/62 | 5416 | 4 | SA | 0457 | 200 | 250 | 5 | 05:00 | ST DO | | | STILL G LOAM 0002 MSND 0030 HPAN 0050 GRVL 0060 MSND 0075 GREY CLAY 0140 MSND 0282 RED SHLE 0467 |
| HS E | 3 | 5 1251 | 576050 4866900 | 1475 | 11/71 | 3612 | 30 | | 0063 | 70 | 88 | 2 | 01:30 | ST | | | STILL L BRWN LOAM 0001 BRWN CLAY BLDR 0035 GREY GRVL MSND |

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONTINUING ... MONO TOWNSHIP | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | 0063 BRWN MSND 0083 RED CLAY MSND 0093 |
| HS E | 3 | 5 472 | 576445 4867010 | 1385 | 12/62 | 5001 | 36 | FR | 0057 | 57 | | 2 | | ST DO | | | HAYMAN J<br>LOAM 0002 GRVL STNS 0024 FSND 0040 GRVL 0045 CSND 0057 CSND STNS 0066 |
| HS E | 4 | 1 3502 | 577670 4865380 | 1493 | 09/87 | 3406 | 6 | | 0161 | 85 | 115 | 10 | 24:00 | DO | | | ELIVINS HARRY<br>BRWN SAND 0001 HPAN 0025 SAND CLAY 0076 GRVL CLAY 0105 RED GRVL CLAY 0110 GREY CLAY 0122 GREY CLAY SHLE 0141 WHIT LMSN 0161 |
| HS E | 4 | 1 1198 | 578140 4865350 | 1470 | 12/70 | 2643 | 7 | FR | 0102 | 26 | | 7 | 01:00 | DO | | | TAUCHEN F<br>LOAM 0001 BRWN FSND 0036 MSND GRVL 0072 HPAN 0084 BLUE CLAY 0089 CLAY GRVL 0098 BRWN LMSN 0105 |
| HS E | 4 | 1 492 | 578199 4865262 | 1475 | 07/60 | 4703 | 4 | FR | 0110 | 22 | 120 | 4 | 03:00 | DO | | | TAUCHEN F<br>GRVL CLAY 0060 CLAY MSND 0100 CLAY GRVL 0110 BLUE DLMT 0160 BLUE SHLE 0190 |
| HS E | 4 | 1 3545 | 578774 4865670 | 1453 | 11/87 | 3602 | 6 | FR | 0130 | 51 | 70 | 10 | 01:00 | DO | | | DODDS JOHN<br>BRWN SAND 0020 BRWN SAND CLAY 0040 WHIT SHLE GRVL 0080 GREY SHLE CLAY 0094 GREY SHLE 0139 |
| HS E | 4 | 1 4216 | 578843 4865362 | 1509 | 05/89 | 1663 | 10 | | DRY | | | | | | | | COLES POACH<br>BRWN LOAM 0001 RED CLAY SAND 0003 BRWN SAND GRVL 0015 BLUE CLAY SAND GRVL 0124 BRWN GRVL 0129 BLUE CLAY 0141 GREY GRVL CLAY BLDR 0178 BRWN SAND CLAY GRVL 0200 |
| HS E | 4 | 1 3780 | 578849 4865357 | 1509 | 07/88 | 1663 | 10 | FR | 0207 | | | | | CO | | | CROWELEY<br>BRWN LOAM SAND 0001 BRWN SAND GRVL 0022 RED CLAY GRVL 0033 GREY GRVL CLAY 0041 BLUE CLAY GRVL 0136 GREY GRVL CLAY BLDR 0157 RED CLAY GRVL 0183 GREY FSND CLAY SOFT 0207 GREY FSND 0270 GREY FSND SILT 0290 |
| HS E | 4 | 1 1161 | 578850 4865200 | 1490 | 06/70 | 3406 | 5 | FR | 0095 | 67 | 68 | 8 | 02:00 | ST | 0091 | 04 | DODDS CALVIN<br>BRWN CLAY GRVL 0020 BRWN MSND CLAY 0025 BRWN GRVL CLAY 0091 GREY GRVL MSND 0095 |
| HS E | 4 | 2 1321 | 577520 4865740 | 1460 | 06/72 | 3406 | 5 | FR | 0330 | 37 | 300 | 4 | 02:00 | DO | | | SEARLE R<br>BRWN GRVL CLAY 0125 GREY LMSN SHLE 0146 RED SHLE LMSN 0330 |
| HS E | 4 | 2 4520 | 577671 4865789 | 1476 | 09/92 | 3132 | 6 | FR | 0137 | 70 | | 10 | 03:00 | DO | | | STAN TURECK<br>BRWN CLAY STNS DNSE 0016 BLUE CLAY STNS DNSE 0034 GREY CLAY STNS SAND 0086 RED CLAY STNS DNSE 0093 BLUE CLAY FSND DNSE 0111 BLUE SHLE HARD 0160 |

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONTINUING ... MONO TOWNSHIP | | | | | | | | | | | | | | | | | |
| HS E | 4 | 2 | 1234 | 578700 1450 | 06/71 | 3406 | 5 | FR | 0056 | 39 | 40 | 10 | 02:00 | ST | | | REID H |
| | | | 4866075 434 | | | | | | | | | | | | | | BRWN MSND GRVL 0032 BRWN LMSN 0056 |
| HS E | 4 | 3 | 2535 | 577350 1510 | 06/79 | 3406 | 6 | FR | 0157 | 80 | 120 | 6 | 01:00 | DO | | | MCCLELLAN D |
| | | | 4866600 461 | | | | | | | | | | | | | | BRWN LOAM 0002 CLAY GRVL 0122 BRWN SAND GRVL DRTY 0157 GRVL 0161 RED CLAY 0162 |
| HS E | 4 | 4 | 1667 | 577350 1500 | 12/70 | 3406 | 6 | FR | 0184 | 135 | 144 | 7 | 03:00 | DO | | | SMITH G |
| | | | 4866550 | | | | | | | | | | | | | | BRWN CLAY SOFT 0008 BRWN GRVL CLAY HARD 0040 BRWN SAND CLAY SOFT 0075 BRWN GRVL CLAY HARD 0105 BRWN GRVL CLAY SAND 0181 BRWN SNDS LMSN SOFT 0184 |
| HS E | 4 | 4 | 2238 | 578450 1495 | 10/76 | 3406 | 5 | FR | 0078 | 35 | 50 | 14 | 01:00 | DO | | | COLEMAN JAMES H |
| | | | 4866900 | | | | | | | | | | | | | | BRWN CLAY 0013 BRWN SAND 0054 GREY LMSN 0078 |
| HS E | 4 | 4 | 1153 | 578510 1500 | 07/70 | 3406 | 5 | FR | 0064 | 40 | 42 | 15 | 02:00 | DO | | | REID WAYNE |
| | | | 4866790 | | | | | | | | | | | | | | BRWN GRVL CLAY 0030 BRWN MSND 0058 BRWN LMSN 0064 |
| HS E | 4 | 5 | 2069 | 577250 1400 | 09/75 | 3317 | 5 | FR | 0067 0070 | 54 | 55 | 11 | 04:00 | DO | | | ANDERSON H G |
| | | | 4867050 | | | | | | | | | | | | | | SAND 0015 CLAY STNS SAND 0067 GRVL 0070 |
| HS E | 4 | 5 | 1283 | 578090 1485 | 10/71 | 3406 | 6 | FR | 0079 | 55 | 62 | 9 | 02:00 | DO | | | COWL G |
| | | | 4867850 | | | | | | | | | | | | | | BRWN GRVL CLAY 0025 WHIT LMSN 0079 |
| HS E | 4 | 5 | 994 | 578340 1510 | 05/69 | 3406 | 4 | FR | 0081 | 66 | 75 | 8 | 05:00 | DO | | | WOODS FRANK |
| | | | 4867900 | | | | | | | | | | | | | | MSND CLAY 0010 MSND GRVL CLAY 0070 SNDS LMSN 0081 |
| HS E | 5 | 1 | 517 | 579383 1430 | 11/58 | 1307 | 36 | FR | 0037 | 37 | | 10 | | DO | | | MILTON J |
| | | | 4865460 431 | | | | | | | | | | | | | | BRWN LOAM 0020 GRVL BLDR 0037 GRVL 0042 |
| HS E | 5 | 1 | 519 | 580025 1380 | 11/67 | 1315 | 5 | FR | 0180 | 65 | 70 | 5 | 03:00 | ST DO | | | TIFFIN T |
| | | | 4865558 422 | | | | | | | | | | | | | | LOAM 0003 MSND GRVL BLDR 0160 LMSN 0178 BLUE SHLE 0180 |
| HS E | 5 | 1 | 518 | 580034 1375 | 09/60 | 4703 | 4 | FR | 0081 | FLW | 50 | 4 | 03:00 | DO | 0077 | 04 | TIFFIN T |
| | | | 4865603 422 | | | | | | | | | | | | | | CLAY 0070 CLAY MSND GRVL 0081 |
| HS E | 5 | 1 | 1186 | 580050 1380 | 10/70 | 1315 | 6 | FR | 0110 | FLW | | | | CO | | | TIFFIN T |
| | | | 4865500 422 | | | | | | | | | | | | | | LOAM 0004 BLUE MUCK 0066 MSND GRVL CLAY 0110 |
| HS E | 5 | 2 | 1108 | 579990 1410 | 03/70 | 3406 | 5 | FR | 0194 | 18 | 179 | 4 | 04:00 | ST | | | MEEK W H ESTATE |
| | | | 4866430 428 | | | | | | | | | | | | | | BRWN CLAY 0020 BRWN GRVL CLAY 0074 BRWN LMSN 0095 RED SHLE 0124 BLUE SHLE 0138 RED SHLE 0194 |
| HS E | 5 | 4 | 2504 | 579450 1510 | 12/78 | 2341 | 6 | FR | 0065 | 62 | 70 | 8 | 03:00 | ST | | | DIXON K |
| | | | 4867550 | | | | | FR | 0083 | | | | | | | | BRWN CLAY SOFT 0028 BRWN LMSN HARD 0085 |
| HS E | 5 | 4 | 1939 | 579700 1500 | 08/75 | 4856 | 2 | FR | 0060 | 15 | 60 | 6 | 02:00 | DO | | | DYCE GEORGE |
| | | | 4867600 | | | | | FR | 0084 | | | | | | | | BLCK LOAM 0001 BRWN SAND CLAY BLDR 0013 WHIT LMSN 0018 RED SHLE 0020 WHIT LMSN SHLE LYRD 0085 |
| HS E | 5 | 4 | 1889 | 579876 1520 | 04/75 | 4856 | 4 | FR | 0069 | 27 | 55 | 4 | 03:00 | DO | | | DYCE DAVID |
| | | | 4867336 | | | | | | | | | | | | | | BLCK LOAM 0001 BRWN SAND GRVL STNS 0008 WHIT LMSN |

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
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| CONTINUING ... MONO TOWNSHIP | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | 0022 GREY SHLE 0024 WHIT LMSN 0067 BLUE LMSN 0070 |
| HS E | 5 | 5 1780 | 579700 4867800 | 1495 | 08/74 | 4856 | 4 | FR | 0073 | 24 | 60 | 4 | 02:30 | DO | | | BRUCE MAURICE<br>BLCK LOAM 0001 BRWN SAND 0004 WHIT LMSN 0020 RED SHLE 0021 WHIT LMSN 0024 RED SHLE 0025 WHIT LMSN 0063 GREY LMSN 0069 GREN SHLE 0071 BRWN LMSN 0075 |
| HS E | 6 | 1 975 | 580180 4865940 | 1375 418 | 05/69 | 3637 | 30 | FR | 0010 | 7 | | | | DO | | | PRICE H<br>LOAM 0001 BRWN CLAY 0010 GREY CLAY 0030 |
| Same well? | | | | | | | | | | | | | | | | | |
| HS E | 6 | 1 1073 | 580180 4865940 | 1375 418 | 10/69 | 3406 | 4 | FR | 0116 | 1 | 12 | 4 | 02:00 | DO | | | PRICE S<br>PRDG 0025 RED SILT CLAY 0106 BRWN MSND 0115 GREY MSND GRVL 0116 |
| HS E | 6 | 1 976 | 580750 4865800 | 1425 430 | 05/69 | 3637 | 30 | FR | 0014 | 10 | | | | DO | | | PROVINCE S<br>LOAM 0001 BRWN MSND 0014 CSND GRVL 0020 BRWN MSND 0028 |
| HS E | 6 | 1 1369 | 580830 4865800 | 1435 430 | 10/72 | 3612 | 30 | | 0019 | 19 | 32 | 3 | 01:00 | DO | | | GEIBENER G<br>BRWN LOAM 0002 BRWN SAND CLAY 0019 GREY GRVL SAND 0035 |
| HS E | 6 | 2 2589 | 580050 4866600 | 1450 437 | 10/79 | 4869 | 5 | FR | 0117 | 65 | 140 | 2 | 01:10 | DO | | | TIVERON D<br>BLCK LOAM 0001 BRWN SAND GRVL 0018 GREY CLAY STNS 0045 GREY HPAN GRVL 0103 BLUE SHLE 0133 RED SHLE 0200 |
| HS E | 6 | 3 1243 | 580990 4867300 | 1445 438 | 09/71 | 3645 | 5 | MN | 0170 | 30 | 120 | 2 | 08:00 | CO | | | SPEERS E<br>MSND GRVL 0042 CLAY MSND 0050 BRWN CLAY 0068 HPAN 0075 MSND GRVL 0085 SILT 0100 HPAN 0110 RED SHLE 0185 |
| HS E | 6 | 4 1537 | 579863 4867699 | 1497 | 08/73 | 5206 | 6 | FR | 0053 | 22 | 55 | 15 | 02:00 | DO | | | DOMONKOS A<br>SAND GRVL BLDR 0008 LMSN 0068 |
| HS E | 6 | 4 1917 | 580000 4867400 | 1515 | 06/75 | 3406 | 5 | FR | 0160 | 50 | 112 | 8 | 03:15 | DO | | | PALFI A C<br>BRWN CLAY 0002 WHIT LMSN 0033 BRWN CLAY 0034 WHIT LMSN 0037 BRWN CLAY 0038 WHIT LMSN 0083 GREY LMSN SHLE 0160 |
| HS E | 6 | 4 913 | 580880 4867850 | 1448 | 10/68 | 3406 | 4 | MN | 0201 | 20 | 110 | 4 | 04:00 | DO | | | HALL G B<br>GRVL 0030 MSND GRVL CLAY 0064 RED SHLE 0201 |
| HS E | 6 | 4 1405 | 580921 4867904 | 1449 | 11/72 | 3406 | 6 | FR | 0130 | 115 | 127 | 3 | 24:00 | DO | | | MOREAU L<br>BRWN CLAY GRVL 0037 WHIT LMSN 0128 BLUE SHLE 0130 |
| HS E | 6 | 5 1977 | 579950 4868050 | 1485 | 08/75 | 4320 | 5 | FR | 0070 | 40 | | 3 | 02:00 | DO | | | SNOW JIM<br>BRWN CLAY 0008 WHIT DLMT SOFT 0024 GREY DLMT HARD 0064 BLUE SHLE 0070 BLUE SHLE 0091 |
| HS E | 6 | 5 532 | 580091 | 1485 | 12/65 | 2613 | 5 | FR | 0080 | 45 | 57 | 20 | 04:00 | DO | | | WILSON J |

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
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| CONTINUING ... MONO TOWNSHIP | | | | | | | | | | | | | | | | | |
| | | | 4868749 | | | | | | | | | | | | | | BRWN CLAY STNS 0055 RED SHLE 0080 BLUE SHLE 0102 |
| • HS E | 7 | 1 | 547 581383 4866327 | 1375 420 | 11/65 | 1315 | 7 | FR | 0205 | 100 | 150 | 6 | 08:00 | ST DO | | | KEE E<br>CLAY STNS 0040 RED CLAY STNS 0130 QSND 0190 GRVL 0200 RED SHLE 0217 |
| • HS E | 7 | 1 | 2082 581500 4866350 | 1385 425 | 07/75 | 5206 | 6 | SU | 0142 | 90 | 130 | 6 | 12:00 | DO | 0147 | 03 | CERESNE K<br>GRVL CLAY 0080 RED CLAY 0120 GRVL SAND 0142 CSND GRVL 0150 |
| • HS E | 7 | 2 | 1677 581950 4867300 | 1430 427 | 04/74 | 3406 | 6 | FR | 0165 | 70 | 80 | 5 | 08:00 | DO | | | POTKOLABOVIC A<br>BRWN GRVL 0060 GREY CLAY GRVL 0165 |
| • HS E | 7 | 2 | 1080 581960 4867060 | 1435 426 | 02/70 | 3108 | 7 | | 0221 | 72 | 232 | 3 | 08:00 | DO | | | RYE TOM<br>BRWN LOAM 0001 RED MSND CLAY 0020 BLUE GRVL MSND 0115 BLUE MSND SILT 0140 BLUE CLAY GRVL 0180 RED MSND CLAY GRVL 0202 RED SHLE 0240 |
| • HS E | 7 | 2 | 1559 582192 4866883 | 1420 429 | 10/73 | 2341 | 5 | FR | 0102 | 65 | 100 | 4 | 02:30 | DO | 0100 | 03 | DIADAMO A<br>RED SAND GRVL 0015 GREY GRVL 0061 RED FSND 0078 BLUE CLAY 0084 RED FSND 0102 BRWN SAND GRVL 0107 RED SAND 0110 |
| HS E | 7 | 3 | 1327 581650 4867730 | 1425 | 06/72 | 3612 | 36 | | 0020 | 20 | 29 | 5 | 01:00 | DO | | | BONIFACE J<br>BLCK LOAM 0002 GREY GRVL CLAY 0020 BRWN CSND 0030 |
| HS E | 7 | 4 | 1103 580990 4867980 | 1440 | 05/70 | 2801 | 2 | FR<br>FR | 0017<br>0050 | | | | | NU | 0066 | 11 | CONSOLIDATED SAND<br>LOAM 0002 BLDR GRVL MSND 0017 MSND GRVL CLAY 0034 RED CLAY 0035 GREY CLAY SILT 0052 GREY FSND CLAY 0073 GREY MSND GRVL CLAY 0075 GREY CLAY MSND 0078 RED CLAY 0103 |
| HS E | 7 | 4 | 1100 581040 4867990 | 1430 | 05/70 | 2801 | 2 | FR | 0070 | 20 | 29 | 20 | 05:00 | NU | 0088 | 11 | CONSOLIDATED SAND<br>RED GRVL CLAY 0003 RED MSND GRVL 0016 GREY MSND GRVL 0019 BRWN CLAY MSND 0057 GREY CLAY MSND 0072 RED CLAY MSND 0119 GREY SHLE 0131 |
| HS E | 7 | 4 | 1101 581050 4867980 | 1430 | 06/70 | 2801 | 8 | FR<br>FR | 0020<br>0070 | 20 | 70 | 143 | 09:00 | IN | 0082 | 20 | CONSOLIDATED SAND<br>RED GRVL BLDR CLAY 0005 RED GRVL MSND 0017 BLDR GRVL MSND 0022 MSND GRVL CLAY 0030 BRWN CLAY MSND 0035 BLDR MSND GRVL 0042 BRWN CLAY MSND 0052 GREY CLAY SILT 0069 MSND CLAY GRVL 0073 GREY FSND SILT 0087 GREY CLAY 0091 MSND 0098 RED CLAY MSND 0104 GREY CLAY 0107 RED CLAY 0109 MSND GRVL CLAY 0111 RED SHLE 0117 |
| HS E | 7 | 4 | 1431 581700 4868050 | 1425 | 04/73 | 3612 | 36 | | 0043 | 43 | 57 | 4 | 01:00 | DO | | | STAINTON B<br>BRWN LOAM 0002 GREY GRVL STNS 0018 BRWN FSND 0043 BRWN CSND STNS 0058 |

Area

Ministry of the Environment
Ontario

The Ontario Water Resources Act

# WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 1704556 MUNICIP 17005 LOT

| COUNTY OR DISTRICT | TOWNSHIP BOROUGH CITY TOWN VILLAGE | CON BLOCK TRACT SURVEY ETC | LOT |
|---|---|---|---|
| DUFFERIN | MONO | 5-6 | 2 |

| OWNER (SURNAME FIRST) | ADDRESS | DATE COMPLETED |
|---|---|---|
| BOUGHAN, WALLY | | DAY 05 MO 09 YR 92 |

21 ZONE EASTING NORTHING RC ELEVATION RC BASIN CODE

## LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

| GENERAL COLOUR | MOST COMMON MATERIAL | OTHER MATERIALS | GENERAL DESCRIPTION | DEPTH - FEET FROM | TO |
|---|---|---|---|---|---|
| BROWN | SANDY CLAY | | | Ø | 18 |
| GREY | CLAY | | | 18 | 115 |
| BR/GREY | SAND | | | 115 | 130 |
| | GRAVEL | | | 130 | 146 |

31

32

## 41 WATER RECORD

| WATER FOUND AT - FEET | KIND OF WATER |
|---|---|
| 146 | 1 FRESH 2 SALTY 3 SULPHUR 4 MINERALS 5 GAS — NOT TESTED |
| | 1 FRESH 2 SALTY 3 SULPHUR 4 MINERALS 5 GAS |
| | 1 FRESH 2 SALTY 3 SULPHUR 4 MINERALS 5 GAS |
| | 1 FRESH 2 SALTY 3 SULPHUR 4 MINERALS 5 GAS |

## 51 CASING & OPEN HOLE RECORD

| INSIDE DIAM (INCHES) | MATERIAL | WALL THICKNESS (INCHES) | DEPTH - FEET FROM | TO |
|---|---|---|---|---|
| 6¼ | 1 STEEL 2 GALVANIZED 3 CONCRETE 4 OPEN HOLE 5 PLASTIC | .188 | 12 | 146 |
| | 1 STEEL 2 GALVANIZED 3 CONCRETE 4 OPEN HOLE 5 PLASTIC | | | |
| | 1 STEEL 2 GALVANIZED 3 CONCRETE 4 OPEN HOLE 5 PLASTIC | | | |

## SCREEN

SLOT NO. OF OPENING (SLOT NO.) | DIAMETER | LENGTH | FEET
MATERIAL AND TYPE | DEPTH SET AT FEET FROM TO

## 61 PLUGGING & SEALING RECORD

| DEPTH SET AT - FEET FROM | TO | MATERIAL AND TYPE (CEMENT GROUT CLAY PACKER ETC.) |
|---|---|---|
| 0 | 20 | IDLE PLUG |
| | | |
| | | |

## 71 PUMPING TEST

PUMPING TEST METHOD 1 PUMP 2 BAILER: AIR
PUMPING RATE: 25 GPM
DURATION OF PUMPING: 2 HOURS 45 MINUTES

| STATIC LEVEL | WATER LEVEL END OF PUMPING |
|---|---|
| Flow FEET | FEET |

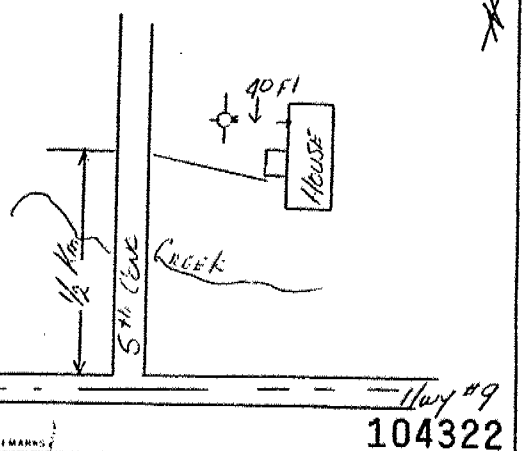
WATER LEVELS DURING: 1 PUMPING 2 RECOVERY

| 15 MINUTES | 30 MINUTES | 45 MINUTES | 60 MINUTES |
|---|---|---|---|
| Flow FEET | FEET | FEET | FEET |

IF FLOWING GIVE RATE: 2 GPM
PUMP INTAKE SET AT: 40 FEET
WATER AT END OF TEST: 1 CLEAR 2 CLOUDY
RECOMMENDED PUMP TYPE: SHALLOW DEEP
RECOMMENDED PUMP SETTING: 30 FEET
RECOMMENDED PUMPING RATE: 20 GPM

## LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE INDICATE NORTH BY ARROW




DRILLERS REMARKS: 104322

## FINAL STATUS OF WELL

1 WATER SUPPLY 2 OBSERVATION WELL 3 TEST HOLE 4 RECHARGE WELL 5 ABANDONED INSUFFICIENT SUPPLY 6 ABANDONED POOR QUALITY 7 UNFINISHED 8 DEWATERING

## WATER USE

1 DOMESTIC 2 STOCK 3 IRRIGATION 4 INDUSTRIAL 5 COMMERCIAL 6 MUNICIPAL 7 PUBLIC SUPPLY 8 COOLING OR AIR CONDITIONING 9 NOT USED OTHER

## METHOD OF CONSTRUCTION

1 CABLE TOOL 2 ROTARY (CONVENTIONAL) 3 ROTARY (REVERSE) 4 ROTARY (AIR) 5 AIR PERCUSSION 6 BORING 7 DIAMOND 8 JETTING 9 DRIVING DIGGING OTHER

## CONTRACTOR

NAME OF WELL CONTRACTOR: GERRITS WELL DRILLING INC
WELL CONTRACTOR'S LICENCE NUMBER: 3406
ADDRESS: RR1 GRAND VALLEY ONT
NAME OF WELL TECHNICIAN: L KROADFOOT
WELL TECHNICIAN'S LICENCE NUMBER: 10370
SIGNATURE OF TECHNICIAN/CONTRACTOR: PUMPS FOR
SUBMISSION DATE: DAY 08 MO 01 YR 93

## OFFICE USE ONLY

DATA SOURCE | CONTRACTOR 3406 | DATE RECEIVED JAN 25 1993
DATE OF INSPECTION | INSPECTOR
REMARKS

Ministry of Environment and Energy
Ontario

# The Ontario Water Resources Act
# WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

1704964

Municipality 17005 Con. H.S. E 03

| County or District | Township/Borough/City/Town/Village | Con block tract survey, etc. | Lot |
|---|---|---|---|
| DUFFERIN | MONO | III EHS | 01 |

| Owner's surname | First name | Address | Date completed |
|---|---|---|---|
| GIDASZEWSKI | A. | 365 Kennedy Rd. BRAMPTON Ap. 414 | 06 (day) 06 (month) 96 (year) |

21 Zone | Easting | Northing | HC | Elevation | HC | Basin Code | II | III | IV

## LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

| General colour | Most common material | Other materials | General description | Depth - feet From | Depth - feet To |
|---|---|---|---|---|---|
| Grey | CLAY | Stones & sand | DENSE | 0 | 28 |
| BROWN | CLAY | - " - | DENSE | 28 | 34 |
| GRAY | CLAY | COURS SAND | DENSE | 34 | 47 |
| BLUE | CLAY | STONES & SAND | Cemented | 47 | 53 |
| GRAY | CLAY | Coarse Sand & Stones | - " - | 53 | 125 |
| BLUE | CLAY | STONES | PACKED | 125 | 132 |
| BLUE | CLAY | SAND & Small Stones | SOFT | 132 | 160 |
| | FROM 145 TO 160 FT. HOLE IS | | | | |
| | PACKED | WHIT GRAVEL 1/4 3/4 | | | |

31
32

## 41 WATER RECORD

| Water found at - feet | Kind of water |
|---|---|
| 156 | 1 [X] Fresh 2 [ ] Salty; 3 [ ] Sulphur 4 [ ] Minerals 5 [ ] Gas |
| | 1 [ ] Fresh 2 [ ] Salty; 3 [ ] Sulphur 4 [ ] Minerals 5 [ ] Gas |
| | 1 [ ] Fresh 2 [ ] Salty; 3 [ ] Sulphur 4 [ ] Minerals 5 [ ] Gas |
| | 1 [ ] Fresh 2 [ ] Salty; 3 [ ] Sulphur 4 [ ] Minerals 5 [ ] Gas |
| | 1 [ ] Fresh 2 [ ] Salty; 3 [ ] Sulphur 4 [ ] Minerals 5 [ ] Gas |

## 51 CASING & OPEN HOLE RECORD

| Inside diam inches | Material | Wall thickness inches | Depth - feet From | Depth - feet To |
|---|---|---|---|---|
| 6 | 1 [X] Steel 2 [ ] Galvanized 3 [ ] Concrete 4 [ ] Open hole 5 [ ] Plastic | .188 | 0 | 150 |
| 6 | 1 [ ] Steel 2 [ ] Galvanized 3 [ ] Concrete 4 [X] Open hole 5 [ ] Plastic | | 150 | 160 |
| | 1 [ ] Steel 2 [ ] Galvanized 3 [ ] Concrete 4 [ ] Open hole 5 [ ] Plastic | | | |

## SCREEN

Sizes of opening (Slot No.) | Diameter inches | Length feet | Material and type | Depth at top of screen feet

## 61 PLUGGING & SEALING RECORD

[X] Annular space [ ] Abandonment

| Depth set at - feet From | Depth set at - feet To | Material and type (Cement grout, bentonite, etc.) |
|---|---|---|
| 0 | 16" | Bentonit & Blue |
| | | CLAY |

## PUMPING TEST

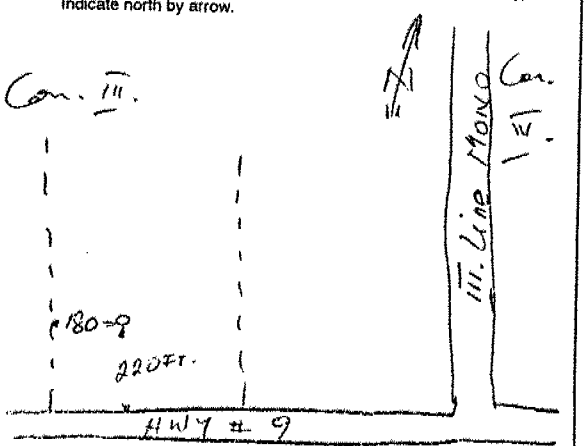
Pumping test method: 1 [ ] Pump 2 [ ] Bailer
Pumping rate: 15 GPM
Duration of pumping: ..... Hours ..... Mins

| Static level | Water level end of pumping | Water levels during: 1 [X] Pumping 2 [ ] Recovery | | | |
|---|---|---|---|---|---|
| | | 15 minutes | 30 minutes | 45 minutes | 60 minutes |
| 39 feet | 65 feet | 61 feet | 65 feet | 65 feet | 65 feet |

If flowing give rate: GPM
Pump intake set at: feet
Water at end of test: [X] Clear [ ] Cloudy
Recommended pump type: [ ] Shallow [X] Deep
Recommended pump setting: 75 feet
Recommended pump rate: 10 GPM

## LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.




159795

## FINAL STATUS OF WELL

1 [X] Water supply 2 [ ] Observation well 3 [ ] Test hole 4 [ ] Recharge well
5 [ ] Abandoned, insufficient supply 6 [ ] Abandoned, poor quality 7 [ ] Abandoned (Other) 8 [ ] Dewatering
9 [ ] Unfinished 10 [ ] Replacement well

## WATER USE

1 [X] Domestic 2 [ ] Stock 3 [ ] Irrigation 4 [ ] Industrial
5 [ ] Commercial 6 [ ] Municipal 7 [ ] Public supply 8 [ ] Cooling & air conditioning
9 [ ] Not used 10 [ ] Other .....

## METHOD OF CONSTRUCTION

1 [X] Cable tool 2 [ ] Rotary (conventional) 3 [ ] Rotary (reverse) 4 [ ] Rotary (air)
5 [ ] Air percussion 6 [ ] Boring 7 [ ] Diamond 8 [ ] Jetting
9 [ ] Driving 10 [ ] Digging 11 [ ] Other .....

Name of Well Contractor: M. KIVAC Drilling Co.
Well Contractor's Licence No.: 3132
Address: P.O. Box 148 Caledon - Ont. LONIC 0
Name of Well Technician: MARKO KIVAC
Well Technician's Licence No.: T-0278
Signature of Technician/Contractor:
Submission date: day 21 mo 06 yr 96

## MINISTRY USE ONLY

Data source | 3132 | Date received: AUG 2 1 1996
Date of inspection | Remarks

MINISTRY OF ENVIRONMENT & ENERGY

TOWN OF CALEDON, PEEL REGION

Elev from obm (m)



| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONTINUING ... CALEDON TOWN (CALEDON TOWNSHIP) | | | | | | | | | | | | | | | | | |
| HS E | 1 | 26 | 6834 576468 4861642 | 1388 | 05/88 | 2576 | 5 | FR | 0235 | 30 | 125 | 4 | 01:00 | DO | | | 0034 GREY CLAY LMSN LYRD 0042 CLAY GRVL 0054 LMSN CLAY LYRD 0069 BRWN CLAY GRVL 0073 BLUE SHLE SOFT 0087 GREY LMSN SHLE 0135 RED SHLE 0154 BLUE SHLE 0159 RED SHLE 0175 G.DICKSON RED SHLE SOFT 0230 BLUE SHLE HARD 0238 RED SHLE 0241 |
| HS E | 1 | 26 | 583 576920 4862034 | 1415 | 03/61 | .4703 | 4 | FR | 0100 | .24 | 55 | 8 | 04:00 | DO | | | RADFORD E A BRWN CLAY BLDR 0030 BRWN CLAY GRVL STNS 0070 BLDR LMSN 0080 BLUE SHLE 0126 |
| HS E | 1 | 26 | 582 576996 4861980 | 1410 | 08/59 | 4703 | 4 | FR | 0055 | 35 | 40 | 12 | 02:00 | DO | | | RADFORD ERNEST CLAY STNS 0040 CLAY LMSN 0045 LMSN 0073 |
| HS E | 1 | 27 | 5288 575800 4861550 | 1340 | 11/77 | 3814 | 30 | FR | 0019 | 19 | 19 | 4 | 01:00 | DO | | | COLLIS EDWARD BRWN LOAM 0007 SAND GRVL WBRG 0019 |
| HS E | 1 | 29 | 4004 575375 4863650 | 1450 | 10/72 | 4320 | 4 | FR | 0090 | 39 | 60 | 5 | 02:00 | DO | | | WHITE M BRWN CLAY SAND STNS 0024 BRWN DLMT 0034 DLMT 0067 GREY DLMT 0085 BLUE LMSN 0100 BLUE CLAY SHLE 0102 |
| HS E | 1 | 30 | 7283 574341 4863006 | 1450 | 07/89 | 3406 | 6 | | 0166 0172 0181 0200 | | | | | NU | | | GOLDFAM HOLDINGS INC BRWN SAND CLAY 0003 BRWN SILT CLAY 0045 RED SAND CLAY BLDR 0090 BRWN SILT SAND CLAY 0156 BRWN LMSN HARD 0159 BRWN LMSN SHLE CLAY 0165 BRWN LMSN HARD 0166 BRWN LMSN 0168 GREY LMSN SHLE LYRD 0182 GREY SILT 0198 GREY SNDS HARD 0200 GREY SHLE SOFT 0215 |
| HS E | 1 | 30 | 587 574528 4863080 | 1450 | 10/58 | 4703 | 5 | FR | 0085 | 65 | 75 | 8 | 02:00 | DO | | | MCCARRELL KENNETH CLAY 0045 LMSN 0100 |
| HS E | 1 | 30 | 7284 574626 4863061 | 1476 | 07/89 | 3406 | 6 | | 0080 0110 0118 0123 | | 125 | 10 | 01:05 | NU | | | GOLDFAM HOLDINGS INC BRWN CLAY 0003 BRWN CLAY STNS 0017 RED CLAY GRVL STNS 0026 RED SAND GRVL 0038 RED SAND CLAY STNS 0050 BRWN LMSN HARD 0090 GREY LMSN 0110 GREY LMSN LYRD 0112 GREY LMSN SHLE LYRD 0128 GREY SHLE 0145 |
| HS E | 1 | 30 | 586 574826 4863781 448 | 1450 | 09/55 | 4728 | 4 | FR | 0090 | 68 | 68 | 6 | 10:00 | DO | | | RAYBURN ELWOOD CLAY LOAM 0003 CLAY BLDR 0060 LMSN 0090 BRWN LMSN 0095 |
| HS E | 1 | 30 | 585 574851 4863782 447 | 1450 | 01/64 | 5416 | 5 | FR | 0110 | 80 | 90 | 6 | 03:00 | DO | | | LARSEN GLEN LOAM 0002 STNS HPAN 0010 GRVL MSND 0032 LMSN 0082 BRWN SHLE 0112 |
| HS E | 2 | 20 | 6380 580546 4860550 | 1509 | 06/88 | 3317 | 5 | FR | 0078 | 15 | 20 | 10 | 02:30 | DO | | | KEITH, NORRIS GRVL CLAY BLDR 0030 GREY CLAY STNS 0055 LMSN 0079 |

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONTINUING ... CALEDON TOWN (CALEDON TOWNSHIP) | | | | | | | | | | | | | | | | | |
| HS E | 2 | 22 | 5248 | 579300 4861700 | 1525 | 11/77 | 3740 | 4 | FR | 0090 | 24 | 36 | 12 | 01:00 | DO | | | PRINCE JOHN P CO LTD<br>BLCK LOAM 0001 BRWN CLAY STNS 0053 BRWN LMSN SHLE 0090 |
| HS E | 2 | 23 | 604 | 578356 4861092 | 1485 | 12/61 | 2313 | 5 | FR | 0072 | 5 | 5 | 8 | 04:00 | ST DO | | | FRAMPTON NORMAN<br>MPAN CLAY 0038 BRWN LMSN 0072 |
| HS E | 2 | 24 | 605 | 577733 4861607 | 1480 | 03/65 | 3512 | 7 | FR | 0075 | 12 | 52 | 25 | 10:00 | ST DO | | | PAZNAR PHIBYS<br>LOAM 0002 MPAN BLDR 0021 BLDR LMSN 0050 LMSN 0076 |
| HS E | 2 | 25 | 606 | 577302 4861963 | 1480 | 10/67 | 4813 | 7 | FR | 0070 | 30 | 53 | 15 | 02:00 | ST DO | | | MCCLURE J D<br>GRVL BLDR 0020 LMSN 0071 |
| HS E | 2 | 26 | 607 | 577672 4863393 | 1475 | 08/65 | 5001 | 36 | FR | 0023 | 12 | | | | DO | | | BRADLEY ELWOOD<br>LOAM 0002 LOAM MSND 0022 GRVL STNS 0024 |
| HS E | 2 | 26 | 3126 | 577730 4863280 | 1500 | 09/68 | 3406 | 4 | FR | 0081 | 28 | 44 | 5 | 05:00 | DO | | | BRADLEY L<br>YLLW CLAY GRVL 0040 BRWN FSND 0079 GREY LMSN 0081 |
| HS E | 2 | 27 | 5869 | 577100 4863800 | 1550 480 | 05/81 | 3317 | 5 | FR | 0170 | 35 | 150 | 7 | 02:00 | CO | | | ENNIS P<br>CLAY SAND 0025 SAND SILT 0056 CLAY STNS 0078 CLAY SAND LYRD 0130 BRWN CLAY 0136 GREY CLAY 0140 GREY SHLE CLAY SOFT 0160 GREY SHLE STNS 0175 DLMT SNDS 0210 |
| HS E | 2 | 27 | 608 | 577184 4863478 | 1465 445 | 11/61 | 4823 | 5 | FR | 0200 | 85 | 107 | 6 | 48:00 | DO | | | MT ALVERNO SEMINARY<br>PRDG 0012 RED MSND 0043 BLUE CLAY 0051 RED MSND 0103 BLUE CLAY 0104 SILT CLAY 0141 BLDR CLAY SILT 0172 BLUE LMSN 0210 |
| HS E | 2 | 27 | 6058 4 | 577300 4863800 | 1525 469 | 03/82 | 3406 | 6 | FR<br>FR | 0086<br>0105 | 76 | 105 | 3 | 01:30 | DO | 0082 | 03 | MOUNT A<br>RED SAND 0008 RED CLAY SAND 0086 BRWN SAND 0092 RED CLAY SAND 0105 BRWN SAND 0109 |
| HS E | 2 | 29 | 7394 | 576489 4864285 | 1490 452 | 09/90 | 2652 | | | 0166 | | | | | NU PS | | | ST.JOHN'S ANGEL.CHUR<br>BRWN SAND 0050 RED CLAY 0058 GREY CLAY 0093 BRWN SNDS STNS FGRD 0158 GREY CLAY 0166 BRWN GRVL 0172 GREY GRVL 0191 GREY CLAY 0209 RED SHLE 0300 |
| HS E | 2 | 29 | 7395 | 576489 4864283 | 1490 452 | 10/90 | 2652 | 8 | FR | 0168 | 59 | 98 | 4 | 26:00 | | 0164 | 05 | ST.JHON'S ANGLI CHUR<br>BRWN SAND 0052 RED CLAY 0061 GREY CLAY 0094 BRWN SAND 0160 GREY CLAY 0168 BRWN GRVL 0175 GREY GRVL 0180 |
| HS E | 2 | 30 | 611 | 575350 4863950 | 1440 440 | 04/55 | 4728 | 4 | FR<br>FR | 0040<br>0060 | 14 | 15 | 8 | 12:00 | CO | | | MCCOMACHIE ROBERT<br>BLDR CLAY 0010 LMSN 0070 |
| HS E | 2 | 30 | 610 | 575400 4863900 | 1440 446 | 09/54 | 4728 | 4 | FR | 0050 | 22 | 29 | 4 | 12:00 | DO | | | SHROPSHIRE CHARLES<br>LOAM MSND 0003 CLAY GRVL BLDR 0026 MPAN 0031 GRVL 0032 LMSN 0052 |

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONTINUING ... CALEDON TOWN (CALEDON TOWNSHIP) | | | | | | | | | | | | | | | | | |
| MS E | 2 | 30 6308 | 575449 4863852 | 1447 440 | 05/85 | 3406 | 5 | FR | 0032 | 14 | 30 | 8 | 01:00 | DO | | | BOB, POUW<br>BLCK LOAM 0002 BRWN CLAY SAND BLDR 0018 WHIT LMSN<br>ROCK LYRD 0036 |
| MS E | 2 | 30 609 | 575501 4863995 | 1440 440 | 12/52 | 4918 | 4 | FR | 0045 | 30 | 40 | 3 | 00:30 | DO | | | SHROPSHIRE CHARLES<br>PRDG 0014 WHIT HPAN 0018 GRVL 0019 BRWN HPAN MSND 0045 |
| MS E | 2 | (30) 7273 plots lot 29 | 576293 4864268 | 1467 447 | 01/89 | 3406 | 6 | | 0229 | 105 | 225 | 5 | 07:00 | DO | 0229 | 03 | WOODS, FRANK<br>BRWN CLAY SNDY 0035 GREY CLAY 0151 BRWN GRVL CLAY 0229 BRWN SAND 0232 |
| MS E | 4 | 20 5868 | 581530 4862000 | 1475 | 04/81 | 3317 | 5 | FR | 0073 | 25 | 35 | 10 | 02:00 | DO | | | DOUGLAS P<br>CLAY STNS GRVL 0070 STNS 0074 |
| MS E | 4 | 20 4704 | 581593 4862586 | 1490 | 07/74 | 3316 | 4 | FR | 0072 | FLW | 5 | 15 | 01:00 | DO | 0072 | 04 | REID CONST-CARBERRY<br>FILL 0004 CLAY STNS SAND 0072 GRVL SAND 0076 |
| MS E | 4 | 20 6588 | 581611 4862622 | 1503 | 05/86 | 3406 | 5 | | 0120 | 18 | 90 | 20 | 01:00 | DO | 0129 | 03 | LEABETER, R.I.<br>PRDR 0120 BRWN SAND CLN FGRD 0126 BRWN SAND MGRD 0129 BRWN SAND CGRD 0131 BRWN GRVL SAND MGRD 0135 BRWN GRVL MGRD 0138 RED SHLE 0141 |
| MS E | 4 | 20 7454 | 581626 4862651 | 1519 | 07/90 | 3317 | 5 | FR | 0147 | 40 | 100 | 10 | 15:00 | DO | | | ERNA, LANDEEN<br>CLAY STNS 0080 GREY CLAY SAND STNS 0144 LMSN GRVL STNS 0147 |
| MS E | 4 | 20 7603 | 581658 4862667 | 1519 | 01/92 | 2663 | 6 | FR | 0086 | 36 | 36 | 10 | 01:00 | DO | | | BAINES, R.<br>BRWN LOAM 0001 BRWN CLAY SAND GRVL 0077 GREY BLDR 0079 GRVL STNS 0086 |
| MS E | 4 | 21 3221 | 580800 4862290 | 1535 | 02/69 | 3316 | 4 | FR | 0076 | 20 | 30 | 8 | 01:00 | DO | | | DARLOW RON<br>MSND 0011 CLAY GRVL 0040 GREY LMSN 0080 |
| MS E | 4 | 21 3975 | 581250 4862375 | 1500 | 08/72 | 1660 | 6 | FR | 0074 | 7 | 7 | 15 | 01:00 | DO | | | VAN HALEM W<br>BRWN SAND 0010 QSND GRVL 0065 CSND 0067 GREY CLAY 0074 LMSN 0075 |
| MS E | 4 | 21 6539 | 581292 4862502 | 1499 | 11/86 | 2576 | 6 | FR<br>FR<br>FR | 0080<br>0098<br>0125 | 14 | 40 | 35 | 02:00 | DO | | | BRIAN, TESKE<br>BRWN SAND CLAY 0006 CLAY SAND GRVL 0021 CLAY GRVL STNS 0039 GREY CLAY GRVL 0060 GRVL SILT 0070 STNS BRVL SILT 0076 WHIT LMSN 0098 BLUE SHLE 0115 RED SHLE 0125 BLUE SHLE 0130 |
| MS E | 4 | 21 4105 | 581328 4862538 | 1490 | 05/73 | 3406 | 5 | FR | 0057 | 4 | 20 | 15 | 03:00 | DO | | | DOUGLAS P<br>BRWN CLAY SAND 0007 BRWN GRVL CLAY 0056 GREY SAND 0057 |
| MS E | 4 | 21 5807 | 581500 4862750 | 1500 | 06/81 | 3132 | 6 | FR | 0133 | 20 | 105 | 10 | 03:30 | DO | | | LEABETER R<br>BRWN CLAY STNS DNSE 0079 BLUE CLAY STNS DNSE 0117 BLUE HPAN HARD 0140 |

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONTINUING ... CALEDON TOWN (CALEDON TOWNSHIP) | | | | | | | | | | | | | | | | | |
| HS E | 4 | 24 5061 | 580100 4864450 | 1485 | 07/76 | 5206 | 6 | | 0160 | 12 | 80 | 10 | 04:00 | DO | | | MODCO INVESTMENTS BRWN SAND 0008 GRVL BLDR 0075 RED SHLE 0110 LMSN 0165 |
| HS E | 4 | 24 4926 | 580150 4864250 | 1475 | 05/75 | 5206 | 6 | FR | 0190 | 92 | 150 | 15 | 04:00 | DO | | | MODCO INVESTMENTS BRWN SAND 0008 GRVL BLDR 0120 LMSN FCRD 0156 LMSN 0165 SNDS 0190 |
| HS E | 4 | 24 4927 | 580150 4864550 | 1470 | 07/76 | 5206 | 6 | FR | 0190 | 92 | 150 | 10 | 04:00 | DO | | | MADEO INVESTMENTS BRWN SAND 0012 GRVL BLDR MUCK 0142 RED SHLE 0150 LMSN 0190 SNDS 0195 |
| HS E | 4 | 24 4857 | 580196 4864692 | 1475 | 08/75 | 5206 | 6 | FR | 0090 | 40 | 40 | 10 | 04:00 | DO | | | MODCO INVESTMENT LTD RED GRVL SAND CLAY 0090 WHIT LMSN SHLE 0100 |
| HS E | 4 | 24 4952 | 580200 4864600 | 1475 | 09/76 | 5206 | 6 | FR | 0190 | 72 | 180 | 5 | 04:00 | DO | | | ALVAR CONST-HALEY M BRWN SAND GRVL 0023 LMSN GRVL BLDR 0140 LMSN 0149 SNDS 0165 RED SHLE 0200 |
| HS E | 4 | 24 4856 | 580217 4864752 | 1475 | 08/75 | 5206 | 6 | FR | | 40 | 40 | 10 | 04:00 | DO | | | MODCO INVESTMENT LTD RED GRVL SAND CLAY 0090 WHIT LMSN SHLE 0100 |
| HS E | 4 | 24 653 | 580313 4864594 | 1475 | 11/65 | 3316 | 4 | FR FR | 0195 0270 | 60 | 150 | 5 | 01:00 | ST DO | | | GLASSFORD GEORGE MSND STNS CLAY 0115 GREY CLAY STNS 0140 BLUE SHLE 0162 LMSN 0200 RED SHLE 0280 |
| HS E | 4 | 24 6964 | 580360 4866040 | 1503 | 01/89 | 4005 | 6 | | 0110 | 32 | 40 | 36 | 02:00 | DO | | | YURCSI, B. GREY CLAY LOOS 0097 GREY LMSN SAND HARD 0110 BLUE CLAY HARD 0112 |
| HS E | 4 | 24 7202 | 580531 4864286 | 1499 | 09/89 | 3132 | 6 | FR | 0064 | 27 | 45 | 10 | 12:00 | DO | | | SOLIANI, LOU BRWN CLAY STNS DNSE 0043 BLUE CLAY STNS DNSE 0054 RED CLAY STNS DNSE 0065 |
| HS E | 4 | 25 6056 | 578900 4864250 | 1525 | 12/82 | 3406 | 5 | FR | 0243 | 135 | 202 | 4 | 48:00 | DO | | | LEBANS B PRDG 0215 GREY SHLE LMSN LYRD 0230 GREY LMSN SNDS LYRD 0247 |
| HS E | 4 | 25 5920 | 579000 4864300 | 1550 | 07/81 | 5206 | 8 | | 0155 0210 | 97 | 155 | 5 | 05:00 | DO | | | LEBANS B BRWN LOAM STNS 0001 BLDR GRVL CLAY 0020 GRVL BLDR PORS 0090 BRWN GRVL CLAY 0140 GREY FSND CLAY SRTY 0155 GRVL BLDR CLAY 0166 WHIT LMSN FCRD PORS 0181 GREN SHLE LYRD 0215 |
| HS E | 4 | 25 7191 | 579364 4863793 | 1519 | 11/89 | 4868 | 30 | FR | 0018 | 16 | 22 | 4 | 01:00 | | | | HUNG, B. BRWN LOAM HARD 0001 BRWN SAND HARD 0011 BRWN SAND HARD 0015 BRWN SAND SILT CLAY 0018 BRWN SAND FGRD LOOS 0030 |
| HS E | 4 | 25 7190 | 579393 4863829 | 1519 | 09/89 | 4868 | 30 | FR | 0015 | 11 | 12 | 4 | | DO | | | HUNG, ME.B. |

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONTINUING ... CALEDON TOWN (CALEDON TOWNSHIP) | | | | | | | | | | | | | | | | | |
| | | | 4863828 | | | | | | | | | | | | | | BRWN LOAM LOOS 0004 BRWN CLAY WDFR LOOS 0010 BRWN SAND HARD 0024 BRWN CLAY HARD 0025 |
| NS E | 4 | 25 | 7110 | 579828 4865159 | 1470 | 04/89 | 3132 | 6 | FR | 0145 | 40 | 105 | 15 | 02:30 | DO | | MCKIBON BRWN CLAY STNS DNSE 0017 RED CLAY LOOS 0082 RED SILT LOOS 0105 RED CLAY SAND SOFT 0127 BLUE SAND GRVL CGRD 0150 |
| NS E | 4 | 25 | 655 | 579921 4865061 | 1500 | 08/61 | 5416 | 4 | FR | 0290 | 80 | 140 | 3 | 06:00 | DO | | MCCREADY T STNS CLAY 0060 GRVL KPAN 0100 MSND 0180 RED SHLE 0296 |
| NS E | 4 | 25 | 654 | 579958 4864906 | 1500 | 07/61 | 5416 | 4 | FR | 0280 | 100 | 120 | 6 | 08:00 | DO | | MIKWAL BEN CLAY BLDR 0065 MSND 0190 GRVL 0200 RED SHLE 0292 |
| NS E | 5 | 20 | 665 | 582354 4862737 | 1480 | 05/66 | 4703 | 4 | FR | 0040 | 16 | 30 | 12 | 02:00 | DO | | MURDOCK ELGIN PRDB 0012 CLAY 0030 GREY LMSN 0050 |
| NS E | 5 | 20 | 7491 | 582751 4864245 | 1473 | 09/90 | 3406 | 6 | | 0100 | 3 | 100 | 30 | 04:00 | | | GEO-ENVIRON CLAY ROCK 0016 LMSN 0060 SHLE 0061 LMSN 0063 SHLE 0104 LMSN SHLE 0118 LMSN 0132 LMSN SHLE 0141 SHLE SOFT 0153 SHLE 0168 |
| NS E | 5 | 20 | 7493 | 582982 4864054 | 1476 | 09/90 | 3406 | 8 | | 0030 0100 0140 | 8 | 50 | 180 | 24:00 | MU | | GEO-ENVIRON CLAY ROCK SNDY 0015 GREY LMSN 0059 RED SHLE 0081 RED SHLE 0085 BLUE SHLE LYRD 0105 GREY LMSN SHLE 0119 BRWN LMSN 0133 BRWN LMSN 0142 GREY LMSN 0144 GREY SHLE SOFT 0155 RED SHLE 0157 BLUE SHLE 0159 RED SHLE 0170 |
| NS E | 5 | 21 | 7325 | 582061 4863462 | 1493 | 06/90 | 3132 | 6 | FR | 0027 | 17 | 21 | 12 | 06:00 | DO | | PETER PEIOS BRWN CLAY STNS PCKD 0018 BRWN LMSN HARD 0031 |
| NS E | 5 | 21 | 4914 | 582450 4864250 | 1465 | 05/76 | 3406 | 5 | FR | 0036 | 5 | 25 | 12 | 01:00 | DO | | PATTERSON RAY BRWN SAND CLAY 0011 GREY LMSN 0036 |
| NS E | 5 | 22 | 4744 | 581319 4863909 | 1495 | 06/75 | 4320 | 5 | FR | 0075 | 30 | 45 | | | DO | | ROSS JOHN BARRY BRWN CLAY 0018 BRWN CLAY GRVL 0038 WHIT DLMT 0104 |
| NS E | 5 | 22 | 4745 | 581403 4863797 | 1495 | 06/75 | 4320 | 5 | FR | 0075 | 30 | 70 | 25 | 02:00 | DO | | TERRELL JACK A BRWN CLAY BLDR 0035 BRWN LMSN 0046 GREY LMSN 0106 |
| NS E | 5 | 22 | 4786 | 581407 4863783 | 1495 | 10/75 | 3406 | 5 | MK | 0081 | 20 | 40 | 10 | 50:00 | DO | | KOOLEN K F BRWN CLAY 0007 BRWN GRVL 0043 BRWN GRVL SAND 0081 |
| NS E | 5 | 22 | 5122 | 581460 4864030 | 1495 | 05/77 | 3406 | 5 | MN | 0080 | 27 | 31 | 10 | 01:30 | DO | | MARFLEET D W BRWN CLAY 0032 BRWN CLAY GRVL 0042 GREY LMSN 0080 |
| NS E | 5 | 22 | 666 | 581814 4865028 | 1475 | 01/61 | 4703 | 4 | FR | 0100 | 39 | 100 | 3 | 02:30 | DO | 0067 | HOLMES ERIC BRWN CLAY 0020 CLAY MSND GRVL 0064 BLUE SHLE 0123 |
| NS E | 5 | 23 | 5717 | 580850 4864300 | 1500 | 11/80 | 3317 | 5 | FR | 0063 | 44 | 48 | 10 | 07:00 | DO | | HODGKINSON P |

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONTINUING ... CALEDON TOWN (CALEDON TOWNSHIP) | | | | | | | | | | | | | | | | | |
| MS E | 5 | 23 | 6019 | 4864300<br>580900<br>4864250 | 1500 | 06/82<br>? | 3317 | 5 | FR | 0060 | 36 | 40 | 10 | 07:00 | DO | | GRVL CLAY 0010 CLAY STNS GRVL 0060 LMSN 0072<br>MARVALIK J |
| MS E | 5 | 23 | 667 | 581804<br>4865903 | 1475 | 11/59<br>447 | 4703 | 4 | FR | 0027 | 18 | 20 | 15 | 01:00 | DO | | BRWN CLAY SAND 0005 GRVL STNS 0014 CLAY STNS GRVL 0055 LMSN 0062<br>HOLMES ERIC |
| MS E | 6 | 20 | 7109 | 582902<br>4864145 | 1473 | 03/89 | 3132 | 6 | FR | 0028 | 7 | 22 | 10 | 06:00 | DO | | CLAY 0015 CLAY STNS 0027 LMSN 0040<br>JASPER, ROBERT. |
| MS E | 6 | 20 | 6472 | 583182<br>4863910 | 1473 | 05/86 | 3317 | 5 | | | 17 | 40 | 100 | 01:15 | DO | | GREY CLAY STNS DNSE 0020 BRWN LMSN HARD 0035<br>MICHAEL, BALL. |
| MS E | 6 | 20 | 691 | 583274<br>4864711 | 1500 | 05/63 | 4703 | 4 | FR | 0050 | 35 | 40 | 8 | 02:00 | DO | | BRWN CLAY SAND STNS 0020 GREY ROCK 0070<br>HOOKE GEO |
| MS E | 6 | 20 | 690 | 583423<br>4864913 | 1500 | 01/67 | 3406 | 4 | FR | 0051 | 27 | 35 | 12 | 02:00 | ST DO | | CLAY MSND BLDR 0037 BRWN LMSN 0055 GREY LMSN 0065<br>MATHEWS TJ |
| MS E | 6 | 20 | 692 | 583880<br>4864820 | 1485 | 10/64 | 4703 | 4 | FR | 0035 | 18 | 25 | 8 | 02:00 | DO | | MSND CLAY 0010 GRVL 0030 LMSN 0051<br>HOOKE DAVE |
| MS E | 6 | 20 | 693 | 583895<br>4864840 | 1485 | 04/66 | 4703 | 4 | FR | 0045 | 6 | 25 | 10 | 02:00 | PS | | CLAY SILT 0020 CLAY MSND STNS 0030 BRWN LMSN 0053<br>BLUE SHLE 0060<br>HOOKE DAVE |
| MS E | 6 | 21 | 694 | 582669<br>4864532 | 1470 | 12/61 | 3514 | 5 | FR | 0050 | 24 | 34 | 4 | 03:00 | ST DO | | PRDG 0012 CLAY MSND STNS 0018 LMSN 0040 RED SHLE 0048 BLUE SHLE 0055<br>SPEERS RICHARD |
| MS E | 6 | 21 | 695 | 583178<br>4864891 | 1503 | 12/65 | 4703 | 4 | FR | 0065 | 54 | 60 | 8 | 02:00 | DO | | CLAY MSND 0016 GREY LMSN 0051<br>TRIPLE T FARMS |
| MS E | 6 | 21 | 696 | 583377<br>4865143 | 1490 | 01/66<br>450 | 4703 | 4 | FR | 0035 | 25 | 30 | 10 | 02:00 | CO DO | | CLAY MSND 0018 CLAY GRVL 0048 BRWN LMSN 0075<br>TRIPLE T FARMS LTD |
| MS E | 6 | (22) Plot 23 | 7034 | 581674<br>4865539 | 1460 | 09/88<br>446 | 1663 | 6 | FR | 0050 | 28 | 46 | 20 | 01:30 | DO | | CLAY MSND 0024 GREY LMSN 0055<br>CORMACK, DR. |
| MS E | 6 | (22) Plot 23 | 7035 | 581867<br>4865858 | 1444 | 09/88<br>445 | 1663 | 6 | FR | 0078 | 33 | 42 | 14 | 02:00 | DO ST | | BRWN CLAY SAND GRVL 0008 BRWN SAND GRVL 0023 BRWN CLAY GRVL SAND 0029 GREY LMSN BLDR CLAY 0036 GREY LMSN 0050<br>CORMACK ANIMAL CLINK |
| MS E | 6 | 22 | 704 | 582101<br>4864920 | 1490 | 04/67<br>? | 3406 | 4 | FR | 0040 | 22 | 23 | 8 | 04:00 | DO | | BRWN CLAY GRVL SAND 0014 BRWN SAND GRVL 0026 RED CLAY SAND GRVL 0036 GREY LMSN GRVL FCRD 0039 GREY LMSN 0057 BLUE SHLE LMSN LYRD 0063 RED SHLE 0069 BLUE SHLE 0080<br>KEE N<br>MSND 0037 LMSN 0040 RED SHLE 0041 LMSN 0042 RED SHLE 0043 |

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME HR:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONTINUING ... CALEDON TOWN (CALEDON TOWNSHIP) | | | | | | | | | | | | | | | | | |
| NS E | 6 | 22 | 697 582772<br>4865725 | 1475<br>447 | 11/53 | 4728<br>L | 4 | FR | | 30 | 30 | 2 | 00:40 | DO | | | TAYLOR WM<br>LOAM MSND 0003 STNS MSND 0018 LMSN 0022 GRVL 0023 LMSN 0037 |
| NS E | 6 | 22 | 703 582786<br>4865916 | 1465<br>440 | 12/65 | 3512 | 7 | FR | 0120 | 30 | 105 | 4 | 05:00 | DO | | | BUCKLE FRED<br>PRDG 0015 CLAY 0042 BLUE CLAY 0086 RED CLAY 0091 RED SHLE 0125 |
| NS E | 6 | 22 | 700 582837<br>4865816 | 1475<br>447 | 10/62 | 3513 | 5 | FR | 0045 | 22 | 48 | 2 | 02:00 | DO | | | HOOK DAVE<br>BRWN CLAY 0018 GREY SHLE 0048 |
| NS E | 6 | 22 | 702 582877<br>4865801 | 1480<br>447 | 05/66 | 4703 | 4 | FR | 0045 | 18 | 25 | 12 | 02:00 | DO | | | MCCANDLESS MELINDA<br>CLAY BLDR 0024 LMSN SHLE 0050 RED SHLE 0062 |
| NS E | 6 | 22 | 699 582978<br>4865581 | 1485<br>453 | 03/64 | 4703 | 4 | FR | 0040 | 28 | 32 | 10 | 02:00 | CO DO | | | TRIPLE T FARMS LTD<br>CLAY 0015 CLAY GRVL 0023 GREY LMSN 0035 WHIT LMSN 0048 RED SHLE 0065 |
| NS E | 6 | 22 | 701 583018<br>4865627 | 1485<br>455 | 03/63 | 4703 | 4 | FR | 0050 | 48 | 60 | 8 | 02:00 | DO | | | TRIPLE T FARMS LTD<br>CLAY GRVL 0028 LMSN 0034 LNSN 0065 RED SHLE 0080 |
| NS E | 6 | 22 | 698 583084<br>4865612 | 1480<br>455 | 04/59 | 3514 | 4 | FR | 0045 | 28 | 28 | 4 | 03:00 | DO | | | MCCANLESS GORDON<br>BRWN CLAY 0007 GRVL 0032 HPAN 0036 LMSN 0045 |
| NS E | 6 | 23 | 708 581612<br>4865388 | 1480<br>446 | 06/63 | 4703 | 4 | FR | 0070 | 40 | 50 | 10 | 02:00 | DO | | | DOCTER GN<br>CLAY STNS 0044 LMSN 0080 RED SHLE 0100 |
| NS E | 6 | 23 | 709 581756<br>4865494 | 1423<br>445 | 11/65 | 3316 | 5 | FR<br>FR | 0054<br>0090 | 40 | 50 | 3 | 02:00 | DO | | | MCKINNON NEIL<br>CLAY 0005 MSND STNS 0015 GREY CLAY STNS 0048 RED SHLE 0055 BLUE SHLE 0105 |
| NS E | 6 | 23 | 710 581824<br>4865970 | 1455<br>448 | 11/65 | 3316 | 4 | MN<br>MN | 0090<br>0185 | 54 | 110 | 3 | 01:00 | DO | | | WADE F<br>MSND 0035 GREY CLAY STNS 0056 LMSN 0105 RED SHLE 0200 |
| NS E | 6 | 23 | 4897 582050<br>4866100 | 1445<br>438 | 03/76 | 5206 | 12 | FR | 0036 | 22 | 40 | 75 | 48:00 | IN DO | 0036 | 06 | CALBION DEVELOPMENTS<br>SAND GRVL FILL 0020 SAND GRVL 0036 GRVL 0044 LMSN 0050 |
| NS E | 6 | 23 | 5285 582100<br>4866050 | 1450<br>430 | 05/75 | 5206 | 20 | FR | 0032 | 28 | 32 | 60 | 24:00 | MU | 0032 | 08 | MONO-CALEDON ESTATES<br>GREY SAND GRVL BLDR 0040 GREY SHLE 0044 |
| NS E | 6 | 23 | 5338 582100<br>4866100 | 1440<br>428 | 03/76 | 5206 | 12 | FR | 0038 | 18 | 23 | 60 | 99:59 | MU | 0038 | 06 | MONO-CALEDON ESTATES<br>BRWN SAND GRVL BLDR 0044 GREY SHLE 0065 |
| NS E | 6 | 23 | 4496 582133<br>4865965 | 1450<br>440 | 06/74 | 1556 | 16 | FR | 0009 | 7 | 14 | 300 | 24:00 | PS | 0011 | 08 | CALBION INVEST<br>BRWN SAND CLAY 0005 BRWN SAND GRVL 0010 BRWN GRVL SAND 0015 BRWN GRVL SAND CLAY 0017 BRWN GRVL 0019 GREY SHLE 0020 GREY GRVL SAND 0021 GREY SHLE 0023 |
| NS E | 6 | 23 | 5337 582150<br>4866100 | 1425<br>424 | 01/76 | 5206 | 7 | FR | 0032 | 17 | | | | DO | | | MONO-CALEDON ESTATES<br>BRWN SAND GRVL SILT 0038 GREY LMSN SNDS 0045 |

| MUNICIPALITY CONCESSION ETC | LOT | WELL NO | UTM EASTING NORTHING | ELEV FEET | DATE | DRILLER | CSG DIA INS | KIND OF WATER | WATER FOUND FEET | STAT LVL FEET | PUMP LVL FEET | TEST RATE GPM | TEST TIME Hr:MN | WATER USE | SCREEN DEPTH FEET | SCREEN LENGTH FEET | OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONTINUING ... CALEDON TOWN (CALEDON TOWNSHIP) | | | | | | | | | | | | | | | | | |
| HS E | 6 | 23 5336 | 582200 4866150 | 1450 425 | 09/76 | 5206 | 12 | FR | 0014 | 9 | 11 | 60 | | MU | 0015 | 06 | MONO-CALEDON ESTATES<br>BRWN CSND CGVL SILT 0021 WHIT LMSN SNDS 0028 |
| HS E | 6 | 23 706 | 582438 4866315 | 1365 428 | 11/54 | 3512 | 5 | FR | 0073 | 50 | 50 | 1 | | CO | | | BEATTY W<br>GRVL MSND 0075 GRVL 0087 RED SHLE 0170 |
| HS E | 6 | 23 707 | 582536 4865894 | 1460 434 | 10/61 | 4703 | 5 | FR | 0050 | 23 | 30 | 12 | 05:00 | PS | | | VICTORIA PKS SCHOOL<br>PRDG 0030 GRVL STNS CLAY 0040 LMSN 0065 |
| HS E | 6 | 23 705 | 582705 4866906 | 1460 429 | 10/54 | 3512 | 4 | FR | 0072 | 22 | 70 | 1 | | DO | | | LEWIS CW<br>GRVL MSND 0060 GRVL 0072 LMSN 0089 RED SHLE 0090 |
| HS E | 6 | 24 7619 | 581330 4865876 | 1421 428 | 07/91 | 3132 | 6 | FR | 0081 | 36 | 68 | 4 | 05:00 | DO | | | BAKER, ELSIE.<br>BRWN CLAY SNDS PCKD 0036 GREY CLAY STNS ONSE 0068 |
| HS E | 6 | 24 6198 | 581632 4865933 | 1371 425 | 08/84 | 3132 | 6 | FR | 0027 | | 35 | 2 | 01:30 | DO | | | BLUE CLAY SAND STNS 0085<br>ORME, STEVEN. |
| HS E | 6 | 24 6231 | 581640 4865932 | 1371 425 | 11/84 | 3406 | 6 | FR<br>FR | 0030<br>0082 | | 95 | 4 | 01:30 | DO | | | BRWN CLAY BLDR 0011 BLUE CLAY STNS ONSE 0018 BLUE SHLE HARD 0040<br>ORME, STEVE.<br>BLCK LOAM 0001 BRWN CLAY BLDR 0013 GREY CLAY STNS 0018 BLUE ROCK LMSN LYRD 0059 RED SHLE SOFT LYRD 0081 RED SHLE VERY SOFT 0097 |

elev 445

plot on Sec 12

Ministry of the Environment
Ontario

The Ontario Water Resources Act

# WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 — 4906816 — MUNICIP — CON.

| COUNTY OR DISTRICT | TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE | CON., BLOCK, TRACT, SURVEY, ETC. | LOT |
|---|---|---|---|
| Peel | Caledon (CALEDON). | Con 5 EHS | 24 |

| OWNER (SURNAME FIRST) | ADDRESS | DATE COMPLETED |
|---|---|---|
| Wilson Mark | RR #2 Caledon | DAY 8 MO. 3 YR. 8 |

21 — ZONE — EASTING — NORTHING — RC. — ELEVATION — RC — BASIN CODE

## LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

| GENERAL COLOUR | MOST COMMON MATERIAL | OTHER MATERIALS | GENERAL DESCRIPTION | DEPTH - FEET FROM | DEPTH - FEET TO |
|---|---|---|---|---|---|
| | Topsoil | | | 0 | 2 |
| | gravel | sand | | 2 | 35 |
| | gravel | | | 35 | 57 |
| White | Clay | gravel | | 57 | 88 |
| Gray | Clay | | | 88 | 110 |
| Gray | Limestone | Shale | Broken | 110 | 123 |
| Blue | Limestone | | | 123 | 143 |
| Brown | Limestone | | | 143 | 148 |
| Blue | Shale | | | 148 | 152 |
| Red | Shale | | | 152 | 160 |
| | | | | | |
| | | | | | |

31

32

## 41 WATER RECORD

| WATER FOUND AT - FEET | KIND OF WATER |
|---|---|
| 145 | 1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 5 ☐ GAS |
| 158 | 1 ☐ FRESH 2 ☒ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 5 ☐ GAS |
| | 1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 5 ☐ GAS |
| | 1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 5 ☐ GAS |
| | 1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 5 ☐ GAS |

## 51 CASING & OPEN HOLE RECORD

| INSIDE DIAM INCHES | MATERIAL | WALL THICKNESS INCHES | DEPTH - FEET FROM | DEPTH - FEET TO |
|---|---|---|---|---|
| 6 | 1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC | .188 | +2 | 114 |
| 5" | 1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC | .188 | 105 | 125 |
| 5" | 1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☒ OPEN HOLE 5 ☐ PLASTIC | | 125 | 160 |

## SCREEN

| SIZE(S) OF OPENING (SLOT NO.) | DIAMETER INCHES | LENGTH FEET |
|---|---|---|
| | | |

| MATERIAL AND TYPE | DEPTH TO TOP OF SCREEN FEET |
|---|---|
| | |

## 61 PLUGGING & SEALING RECORD

| DEPTH SET AT - FEET FROM | DEPTH SET AT - FEET TO | MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.) |
|---|---|---|
| 15 | 22 | Hole plug |
| | | |

## 71 PUMPING TEST

| PUMPING TEST METHOD | PUMPING RATE | DURATION OF PUMPING |
|---|---|---|
| 1 ☐ PUMP 2 ☒ BAILER | 2 GPM | 1 HOURS ___ MINS |

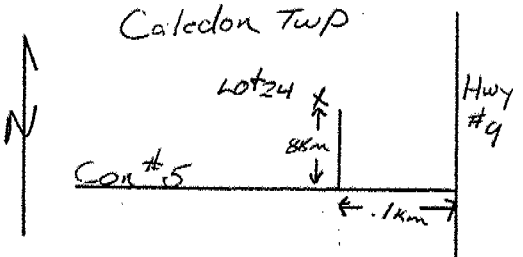
| STATIC LEVEL | WATER LEVEL END OF PUMPING | WATER LEVELS DURING (1 ☐ PUMPING 2 ☐ RECOVERY) | 15 MINUTES | 30 MINUTES | 45 MINUTES | 60 MINUTES |
|---|---|---|---|---|---|---|
| 49' FEET | 130 FEET | | FEET | FEET | FEET | FEET |

| IF FLOWING, GIVE RATE | PUMP INTAKE SET AT | WATER AT END OF TEST |
|---|---|---|
| GPM | 130 FEET | 1 ☐ CLEAR 2 ☒ CLOUDY |

| RECOMMENDED PUMP TYPE | RECOMMENDED PUMP SETTING | RECOMMENDED PUMPING RATE |
|---|---|---|
| ☐ SHALLOW ☒ DEEP | 130 FEET | 2-3 GPM |

## LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.




DRILLERS REMARKS: 14973

| FINAL STATUS OF WELL | WATER USE | METHOD OF CONSTRUCTION |
|---|---|---|
| 1 ☒ WATER SUPPLY | 1 ☒ DOMESTIC | 1 ☐ CABLE TOOL |
| 2 ☐ OBSERVATION WELL | 2 ☐ STOCK | 2 ☒ ROTARY (CONVENTIONAL) |
| 3 ☐ TEST HOLE | 3 ☐ IRRIGATION | 3 ☐ ROTARY (REVERSE) |
| 4 ☐ RECHARGE WELL | 4 ☐ INDUSTRIAL | 4 ☐ ROTARY (AIR) |
| 5 ☐ ABANDONED, INSUFFICIENT SUPPLY | 5 ☐ COMMERCIAL | 5 ☐ AIR PERCUSSION |
| 6 ☐ ABANDONED, POOR QUALITY | 6 ☐ MUNICIPAL | 6 ☐ BORING |
| 7 ☐ UNFINISHED | 7 ☐ PUBLIC SUPPLY | 7 ☐ DIAMOND |
| 9 ☐ DEWATERING | 8 ☐ COOLING OR AIR CONDITIONING | 8 ☐ JETTING |
| | 9 ☐ NOT USED | 9 ☐ DRIVING |
| | ☐ OTHER | ☐ DIGGING ☐ OTHER |

## CONTRACTOR

| NAME OF WELL CONTRACTOR | WELL CONTRACTOR'S LICENCE NUMBER |
|---|---|
| Highland Water Wells | 2576 |

| ADDRESS | |
|---|---|
| Box 141 Dunbarton Ont | |

| NAME OF WELL TECHNICIAN | WELL TECHNICIAN'S LICENCE NUMBER |
|---|---|
| E. Wilson | T-0113 |

SIGNATURE OF TECHNICIAN/CONTRACTOR — SUBMISSION DATE

## OFFICE USE ONLY

| DATA SOURCE | CONTRACTOR | DATE RECEIVED |
|---|---|---|
| | 2576 | APR 18 1988 |

DATE OF INSPECTION — INSPECTOR

REMARKS

dev 452 (south of area?)

Ministry of the Environment
Ontario

The Ontario Water Resources Act

# WATER WELL RECORD

4906375

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11

MUNICIP. CON.

COUNTY OR DISTRICT: Peel
TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: Town of Caledon (CALEDON)
CON., BLOCK, TRACT, SURVEY, ETC.: 4 EHS
LOT: 25
OWNER (SURNAME FIRST): Lawrence Kathy
ADDRESS: R.R.# 3, Caledon East Ont. LON 1EO
DATE COMPLETED: DAY Nov MO. 11 YR. 85

21 ZONE EASTING NORTHING SEC. ELEVATION SEC. BASIN CODE

## LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

| GENERAL COLOUR | MOST COMMON MATERIAL | OTHER MATERIALS | GENERAL DESCRIPTION | DEPTH - FEET FROM | DEPTH - FEET TO |
|---|---|---|---|---|---|
| Brown | fine sand | | | 0 | 30 |
| Brown | coarse sand | | | 30 | 68 |
| Grey | coarse sand | | | 68 | 82 |

## 41 WATER RECORD

| WATER FOUND - FEET | KIND OF WATER |
|---|---|
| 68 | 1 ☒ FRESH 3 ☐ SULPHUR / 2 ☐ SALTY 4 ☐ MINERAL |
| | 1 ☐ FRESH 3 ☐ SULPHUR / 2 ☐ SALTY 4 ☐ MINERAL |
| | 1 ☐ FRESH 3 ☐ SULPHUR / 2 ☐ SALTY 4 ☐ MINERAL |
| | 1 ☐ FRESH 3 ☐ SULPHUR / 2 ☐ SALTY 4 ☐ MINERAL |

## 51 CASING & OPEN HOLE RECORD

| INSIDE DIAM. INCHES | MATERIAL | WALL THICKNESS INCHES | DEPTH - FEET FROM | DEPTH - FEET TO |
|---|---|---|---|---|
| 6¼ | 1 ☐ STEEL / 2 ☑ GALVANIZED / 3 ☐ CONCRETE / 4 ☐ OPEN HOLE | 188 | 0 | 69 |
| 5 | 1 ☐ STEEL / 2 ☐ GALVANIZED / 3 ☐ CONCRETE / 4 ☐ OPEN HOLE | 188 | 78 | 82 |
| | 1 ☐ STEEL / 2 ☐ GALVANIZED / 3 ☐ CONCRETE / 4 ☐ OPEN HOLE | | | |

SCREEN: SIZE(S) OF OPENING (SLOT NO.) 30 | DIAMETER 6" INCHES | LENGTH 3' FEET | MATERIAL AND TYPE: Stainless steel | DEPTH TO TOP OF SCREEN 79 FEET

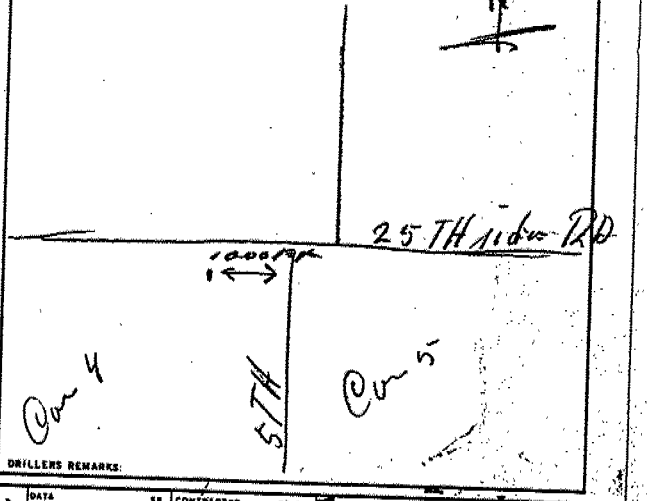
## 61 PLUGGING & SEALING RECORD

| DEPTH SET AT - FEET FROM | TO | MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.) |
|---|---|---|
| | | |
| | | |
| | | |

PUMPING TEST METHOD: 1 ☐ PUMP 2 ☐ BAILER — air
PUMPING RATE: 10 GPM
DURATION OF PUMPING: 10 HOURS 4 MINS
STATIC LEVEL: 6 FEET
WATER LEVEL END OF PUMPING: 75 FEET
WATER LEVELS DURING: 1 ☐ PUMPING 2 ☐ RECOVERY
15 MINUTES: 6 FEET | 30 MINUTES: 6 FEET | 45 MINUTES: 6 FEET | 60 MINUTES: 6 FEET
IF FLOWING, GIVE RATE: GPM
PUMP INTAKE SET AT: FEET
WATER AT END OF TEST: 1 ☒ CLEAR 2 ☐ CLOUDY
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☒ DEEP
RECOMMENDED PUMP SETTING: 25 FEET
RECOMMENDED PUMPING RATE: 10 GPM

## LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.




DRILLERS REMARKS:

**FINAL STATUS OF WELL**
1 ☒ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED

**WATER USE**
1 ☒ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☐ INDUSTRIAL 5 ☐ COMMERCIAL 6 ☐ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING 9 ☐ NOT USED ☐ OTHER

**METHOD OF DRILLING**
1 ☐ CABLE TOOL 2 ☒ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☐ ROTARY (AIR) 5 ☐ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING

NAME OF WELL CONTRACTOR: Vandenboom waterwells — LICENCE NUMBER: 5206
ADDRESS: R.R.# 3, Caledon East
NAME OF DRILLER OR BORER: Ron Sloan — LICENCE NUMBER:
SIGNATURE OF CONTRACTOR — SUBMISSION DATE: DAY MO. YR.

OFFICE USE ONLY
DATA SOURCE | CONTRACTOR | RECEIVED 140286
DATE OF INSPECTION | INSPECTOR
REMARKS

dev 452 — pt from x Section C

Ministry of the Environment
Ontario

The Ontario Water Resources Act

# WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 — 4907575 — MUNICIP. 49002 — CON. H.S. E

COUNTY OR DISTRICT: PEEL
TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: CALEDON
CON., BLOCK, TRACT, SURVEY, ETC: CONC. 2 EHS
LOT: 29
OWNER (SURNAME FIRST): St. John's Anglican Church
ADDRESS: RR 3 3907 Hwy 9 Orangeville Ont
DATE COMPLETED: DAY 18 MO 10 YR

21 — ZONE 17 — EASTING 576541 — NORTHING 4843096 — RC — ELEVATION 455 — RC — BASIN CODE

## LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

| GENERAL COLOUR | MOST COMMON MATERIAL | OTHER MATERIALS | GENERAL DESCRIPTION | DEPTH - FEET FROM | TO |
|---|---|---|---|---|---|
| BROWN | SAND | | | 0 | 32 |
| BROWN | CLAY | | STICKY | 32 | 47 |
| GREY | CLAY | RED CLAY LAYERS | | 47 | 88 |
| GREY | SAND | | FINE | 88 | 153 |
| GREY | CLAY | | | 153 | 166 |
| GREY | SAND | | | 166 | 171 |
| GREY | CLAY | RED CLAY LAYERS | | 171 | 192 |
| GREY | SAND | | FINE | 192 | 195 |
| GREY | GRAVEL | | | 195 | 196 |
| GREY | SAND | | FINE | 196 | 200 |
| BROWN | GRAVEL | | | 200 | 207 |

31
32

## 41 WATER RECORD

| WATER FOUND AT - FEET | KIND OF WATER |
|---|---|
| 200 | 1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS |
| | 1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS |
| | 1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS |
| | 1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS |
| | 1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS |

## 51 CASING & OPEN HOLE RECORD

| INSIDE DIAM INCHES | MATERIAL | WALL THICKNESS INCHES | DEPTH - FEET FROM | TO |
|---|---|---|---|---|
| 6 1/4 | 1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC | .188 | +1'2" | 203'6" |
| | 1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC | | | |
| | 1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC | | | |

SCREEN: SIZE(S) OF OPENING (SLOT NO.) 2x10 — DIAMETER 2x6 INCHES — LENGTH 3 FEET — MATERIAL AND TYPE DUAL WALL STAINLESS STEEL — DEPTH TO TOP OF SCREEN 201'11" FEET

## 61 PLUGGING & SEALING RECORD

| DEPTH SET AT - FEET FROM | TO | MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER, ETC.) |
|---|---|---|
| 4 | 10 | BENSEAL |
| | | |
| | | |

## PUMPING TEST

71 — PUMPING TEST METHOD: 1 ☐ PUMP 2 ☐ BAILER — PUMPING RATE GPM — DURATION OF PUMPING HOURS MINS

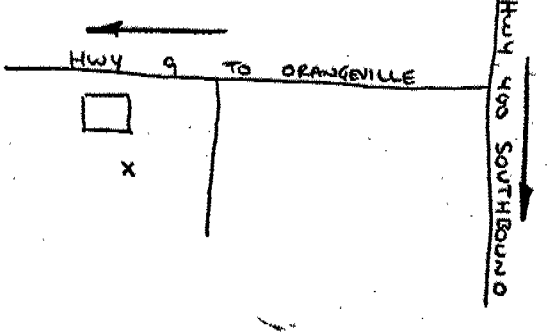
| STATIC LEVEL | WATER LEVEL END OF PUMPING | WATER LEVELS DURING: 1 ☐ PUMPING 2 ☐ RECOVERY | 15 MINUTES | 30 MINUTES | 45 MINUTES | 60 MINUTES |
|---|---|---|---|---|---|---|
| FEET | FEET | | FEET | FEET | FEET | FEET |

IF FLOWING, GIVE RATE GPM — PUMP INTAKE SET AT FEET — WATER AT END OF TEST: 1 ☐ CLEAR 2 ☐ CLOUDY

RECOMMENDED PUMP TYPE: 1 ☐ SHALLOW 2 ☒ DEEP — RECOMMENDED PUMP SETTING 145 FEET — RECOMMENDED PUMPING RATE 4.0 GPM

## LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.




DRILLERS REMARKS: 107477

**FINAL STATUS OF WELL** — 1 ☒ WATER SUPPLY; 2 ☐ OBSERVATION WELL; 3 ☐ TEST HOLE; 4 ☐ RECHARGE WELL; 5 ☐ ABANDONED, INSUFFICIENT SUPPLY; 6 ☐ ABANDONED, POOR QUALITY; 7 ☐ UNFINISHED; ☐ DEWATERING

**WATER USE** — 1 ☒ DOMESTIC; 2 ☐ STOCK; 3 ☐ IRRIGATION; 4 ☐ INDUSTRIAL; ☐ OTHER; 5 ☐ COMMERCIAL; 6 ☐ MUNICIPAL; 7 ☐ PUBLIC SUPPLY; 8 ☐ COOLING OR AIR CONDITIONING; 9 ☐ NOT USED

**METHOD OF CONSTRUCTION** — 1 ☐ CABLE TOOL; 2 ☐ ROTARY (CONVENTIONAL); 3 ☐ ROTARY (REVERSE); 4 ☒ ROTARY (AIR); 5 ☐ AIR PERCUSSION; 6 ☐ BORING; 7 ☐ DIAMOND; 8 ☐ JETTING; 9 ☐ DRIVING; ☐ DIGGING; ☐ OTHER

NAME OF WELL CONTRACTOR: Howell Drilling — WELL CONTRACTOR'S LICENCE NUMBER 2652
ADDRESS: Box 368 Colwater Ont
NAME OF WELL TECHNICIAN: Kim Howell — WELL TECHNICIAN'S LICENCE NUMBER T1057
SIGNATURE OF TECHNICIAN/CONTRACTOR: Kim Howell — SUBMISSION DATE DAY 22 MO 10 YR 91

OFFICE USE ONLY — DATA SOURCE — CONTRACTOR 2652 — DATE RECEIVED NOV 19 1991 — DATE OF INSPECTION — INSPECTOR — REMARKS

Ontario Ministry of Environment and Energy

approx elevation location

The Ontario Water Resources Act

# WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11 — 4908067 — Municipality 49002 — Con. HS W — Lot 101

| County or District | Township/Borough/City/Town/Village | Con | block | tract | survey, etc. | Lot |
|---|---|---|---|---|---|---|
| PEEL | CALEDON (Caledon) | I | EHS | | | 29 |

Owner's surname: WHITE — First name: MERV.

Address: RR6 ORANGEVILLE ONT.

Date completed: 20 10 95 (day month year)

21 — Zone — Easting — Northing — RC — Elevation — RC — Basin Code — II — III — IV

## LOG OF OVERBURDEN AND BEDROCK MATERIALS (see Instructions)

| General colour | Most common material | Other materials | General description | Depth – feet From | Depth – feet To |
|---|---|---|---|---|---|
| BR | CLAY | BOULDERS | | 0 | 12 |
| BR/GR | LIMESTONE | (CLAY LEDGES) | | 12 | 35 |
| GR/BR | LIMESTONE | | | 35 | 77 |
| GR | SHALE | (RED LEDGES) | | 77 | 98 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | LINER: 38'-98' | | | | |
| | PERFORATED PVC. | | | | |

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## 41 WATER RECORD

| Water found at – feet | Kind of water |
|---|---|
| 50 – 98 | 1 ☒ Fresh 2 ☐ Salty; 3 ☐ Sulphur 4 ☐ Minerals 5 ☐ Gas |
| | 1 ☐ Fresh 2 ☐ Salty; 3 ☐ Sulphur 4 ☐ Minerals 5 ☐ Gas |
| | 1 ☐ Fresh 2 ☐ Salty; 3 ☐ Sulphur 4 ☐ Minerals 5 ☐ Gas |
| | 1 ☐ Fresh 2 ☐ Salty; 3 ☐ Sulphur 4 ☐ Minerals 5 ☐ Gas |
| | 1 ☐ Fresh 2 ☐ Salty; 3 ☐ Sulphur 4 ☐ Minerals 5 ☐ Gas |

## 42 CASING & OPEN HOLE RECORD

| Inside diam inches | Material | Wall thickness inches | Depth – feet From | Depth – feet To |
|---|---|---|---|---|
| 6¼ | 1 ☒ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic | .188 | 0 | 41'8" |
| | 1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic | LINER | 38 | 98 |
| | 1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic | | | |

## SCREEN

| Sizes of opening (Slot No.) | Diameter inches | Length feet |
|---|---|---|
| | | |

Material and type: — Depth at top of screen feet:

## 61 PLUGGING & SEALING RECORD

☐ Annular space ☐ Abandonment

| Depth set at – feet From | Depth set at – feet To | Material and type (Cement grout, bentonite, etc.) |
|---|---|---|
| | | |
| | | |
| | | |

## 71 PUMPING TEST

Pumping test method: 1 ☐ Pump 2 ☐ Bailer — Pumping rate: 3 GPM — Duration of pumping: 1 Hours 30 Mins

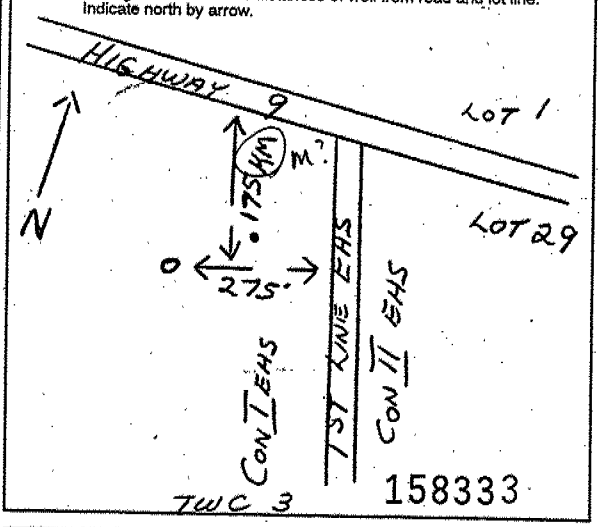
| Static level | Water level end of pumping | Water levels during: 1 ☒ Pumping 2 ☐ Recovery | | | |
|---|---|---|---|---|---|
| 27 feet | 75 feet | 15 minutes: 75 feet | 30 minutes: 75 feet | 45 minutes: 75 feet | 60 minutes: 75 feet |

If flowing give rate: GPM — Pump intake set at: feet — Water at end of test: ☒ Clear ☐ Cloudy

Recommended pump type: ☐ Shallow ☒ Deep — Recommended pump setting: 92 feet — Recommended pump rate: 3 GPM

## LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.




## FINAL STATUS OF WELL

1 ☒ Water supply; 2 ☐ Observation well; 3 ☐ Test hole; 4 ☐ Recharge well; 5 ☐ Abandoned, insufficient supply; 6 ☐ Abandoned, poor quality; 7 ☐ Abandoned (Other); 8 ☐ Dewatering; 9 ☐ Unfinished; 10 ☐ Replacement well

## WATER USE

1 ☒ Domestic; 2 ☐ Stock; 3 ☐ Irrigation; 4 ☐ Industrial; 5 ☐ Commercial; 6 ☐ Municipal; 7 ☐ Public supply; 8 ☐ Cooling & air conditioning; 9 ☐ Not used; 10 ☐ Other

## METHOD OF CONSTRUCTION

1 ☐ Cable tool; 2 ☒ Rotary (conventional); 3 ☐ Rotary (reverse); 4 ☐ Rotary (air); 5 ☐ Air percussion; 6 ☐ Boring; 7 ☐ Diamond; 8 ☐ Jetting; 9 ☐ Driving; 10 ☐ Digging; 11 ☐ Other

Name of Well Contractor: KING WELL DRILLING LTD — Well Contractor's Licence No.: 3317

Address: R.R.1 HILLSBURGH ONT.

Name of Well Technician: RAY LANG — Well Technician's Licence No.: T-0158

Signature of Technician/Contractor: Ray Lang — Submission date: day 11 mo 4 yr 96

MINISTRY USE ONLY: Data source — Contractor: 3317 — Date received: NOV 16 1995

Date of inspection — Inspector —

Remarks

MINISTRY OF ENVIRONMENT & ENERGY COPY

0506 (07/84) Front Form 9

Ministry of the Environment
Ontario

The Ontario Water Resources Act

# WATER WELL RECORD

11 4906490

| COUNTY OR DISTRICT | TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE | CON., BLOCK, TRACT, SURVEY, ETC. | LOT |
|---|---|---|---|
| PEEL | Caledon (Caledon) | 1E | 31 |

OWNER (SURNAME FIRST): MAPLE ENGINEERING LTD.

ADDRESS: 25 HALE RD.,BRAMPTON, ONT.,L6W 3J9

DATE COMPLETED: DAY 18 MO. 07 YR. 86

21 | UTM ZONE | EASTING | NORTHING | NC. | ELEVATION | RC. | BASIN CODE

## LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

| GENERAL COLOUR | MOST COMMON MATERIAL | OTHER MATERIALS | GENERAL DESCRIPTION | DEPTH - FEET FROM | DEPTH - FEET TO |
|---|---|---|---|---|---|
| Brown | sand & stones | | | 0 | 6 |
| Brown & Grey | Dolstone | | | 6 | 75 |

31

32

## 41 WATER RECORD

| WATER FOUND AT - FEET | KIND OF WATER |
|---|---|
| 50 to 75 | 1 FRESH 2 SALTY 3 SULPHUR 4 MINERAL |

## 51 CASING & OPEN HOLE RECORD

| INSIDE DIAM INCHES | MATERIAL | WALL THICKNESS INCHES | DEPTH - FEET FROM | DEPTH - FEET TO |
|---|---|---|---|---|
| 8½b | 3 STEEL 2 GALVANIZED 1 CONCRETE 4 OPEN HOLE | .250 | MPOON, LON | 49½ |

## SCREEN

| SIZE(S) OF OPENING (SLOT) | DIAMETER INCHES | LENGTH FEET |
|---|---|---|
| 100 | 8 | 25½ |

MATERIAL AND TYPE: S.S.Johnston

DEPTH TO TOP OF SCREEN: 49½ FEET

## 61 PLUGGING & SEALING RECORD

| DEPTH SET AT - FEET FROM | DEPTH SET AT - FEET TO | MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.) |
|---|---|---|
| | | |

## 71 PUMPING TEST

PUMPING TEST METHOD: 1 PUMP 2 AIR

PUMPING RATE: 30 GPM

DURATION OF PUMPING: 36 HOURS MINS

| STATIC LEVEL | WATER LEVEL END OF PUMPING | WATER LEVELS DURING: 1 PUMPING 2 RECOVERY | 15 MINUTES | 30 MINUTES | 45 MINUTES | 60 MINUTES |
|---|---|---|---|---|---|---|
| 40 FEET | 40 FEET | | FEET | FEET | FEET | FEET |

IF FLOWING, GIVE RATE: GPM

PUMP INTAKE SET AT: FEET

WATER AT END OF TEST: 1 CLEAR 2 CLOUDY

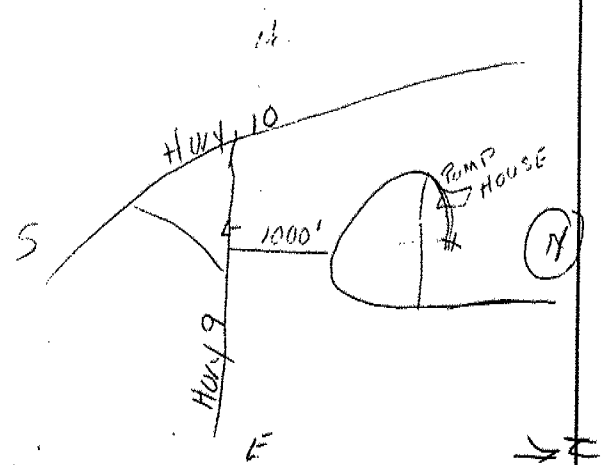
RECOMMENDED PUMP TYPE: SHALLOW X DEEP

RECOMMENDED PUMP SETTING: FEET

RECOMMENDED PUMPING RATE: GPM

## LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.




DRILLERS REMARKS:

## FINAL STATUS OF WELL

1 X WATER SUPPLY 2 OBSERVATION WELL 3 TEST HOLE 4 RECHARGE WELL 5 ABANDONED, INSUFFICIENT SUPPLY 6 ABANDONED, POOR QUALITY 7 UNFINISHED

## WATER USE

1 DOMESTIC 2 STOCK 3 IRRIGATION 4 INDUSTRIAL 5 COMMERCIAL 6 XX MUNICIPAL 7 PUBLIC SUPPLY 8 COOLING OR AIR CONDITIONING 9 NOT USED OTHER

## METHOD OF DRILLING

1 CABLE TOOL 2 ROTARY (CONVENTIONAL) 3 ROTARY (REVERSE) 4 ROTARY (AIR) 5 X AIR PERCUSSION 6 BORING 7 DIAMOND 8 JETTING 9 DRIVING

## CONTRACTOR

NAME OF WELL CONTRACTOR: G.HART & SONS WELL DRILLING LTD

LICENCE NUMBER: 2517

ADDRESS: R.R.#.1.FENELON FALLS,ONT.,K0M 1N0

NAME OF DRILLER OR BORER: PHIL BROWN

LICENCE NUMBER:

SIGNATURE OF CONTRACTOR: Kenneth Hart

SUBMISSION DATE: DAY 21 MO. 07 YR. 86

## OFFICE USE ONLY

DATA SOURCE | CONTRACTOR | DATE RECEIVED T860886

DATE OF INSPECTION | INSPECTOR

REMARKS

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506—6—77 FORM 7

# APPENDIX B

## BOREHOLE LOGS
**July 29, 30, 1997 and August 6, 1997**

Project HIGHWAY 9 No.

Date Drilled JULY 29/97 Driller LANTECH

Borehole Location South Side, Near Stn. 15+870

Drilling Supervised by JH

Drilling Method HSA

Piezometer Details

Type of Pipe 2" PVC

Type of Screen 10 SLOT

Borehole No. 1

Piezometer No. 1

Sheet 2 of 2

SS Split Spoon Sample
WA Wash Sample
AU Auger Sample
CN Continuous Sample
RX Rock Core

Piezometer Screen (water level elevation m, Y/M/D)

| Scale (ft.) (m) | Geological Log — Description | Elev. (m GSD) / Depth (m) | Piezometer Details | Sample No. | Sample Type | Blows /0.3m |
|---|---|---|---|---|---|---|
| | Ground Surface (m GSD) | 443.4 | | | | |
| 5 / 17 | as above | | | 8 | SS | 12 |
| 18 | | | | 8 | SS | 12 |
| 19 | End Borehole at 5.6m | | | | | |
| 6 / 20 | | | | | | |
| 21 | End Borehole at 5.6 m | | WATER END OF DRILLING | | | |
| 22 | | | | | | |
| 23 | | | | | | |
| 24 | | | | | | |
| 25 | | | | | | |
| 26 | | | | | | |
| 27 | | | | | | |
| 28 | | | | | | |
| 29 | | | | | | |
| 30 | | | | | | |
| 31 | | | | | | |
| 32 | | | | | | |

Borehole Record

JH
Prepared by

Date

Charlesworth & Associates
CONSULTING HYDROGEOLOGISTS

Project HIGHWAY 9 No.

Date Drilled JULY 29/97 Driller LANTECH

Borehole Location South Side, Near Stn. 15+870

Drilling Supervised by J.H

Drilling Method HSA

Piezometer Details

Type of Pipe 2" PVC

Type of Screen 10 Slot

Borehole No. 1

Piezometer No. 1

Sheet 1 of 2

SS Split Spoon Sample
WA Wash Sample
AU Auger Sample
CN Continuous Sample
RX Rock Core

Piezometer Screen (water level elevation m, Y/M/D)

| Scale (ft.) (m) | Geological Log — Description | Elev. (m GSD) / Depth (m) | Piezometer Details | Sample No. | Sample Type | Blows / 0.3m |
|---|---|---|---|---|---|---|
| 443.4 | Ground Surface (m GSD) | 443.4 | | | | |
| 1 | FILL, BROWN SAND and gravel, moist | | seal | 1 | SS | 18 |
| 2 | | | backfill | | | |
| 3 (1) | SILTY SAND TILL, brown; moist becoming SANDY SILT TILL, saturated below 1.5 m. | | | 2 | SS | 18 |
| 4 | | | | | | |
| 5 | | | | 3 | SS | 18 |
| 6 | | | holeplug | | | |
| 7 (2) | | | | 4 | SS | 19 |
| 8 | | | sand pack | | | |
| 9 | | | | | | |
| 10 (3) | | | | 5 | SS | 25 |
| 11 | -2 cm pocket of fine sand @ 3.5 m | | | | | |
| 12 | -large red mottles below 3.6m | | | 6 | SS | 16 |
| 13 (4) | SAND, trace silt, brown, sat. | | | | | |
| 14 | SILT, brown, saturated faint 'mottles below 17' | | | | | |
| 15 | | | ▽ 29/07/97 | 7 | SS | 14 |
| 16 | | | | | | |

Borehole Record

Prepared by J.H

Date Aug 8/97

Charlesworth & Associates
CONSULTING HYDROGEOLOGISTS

Project HIGHWAY 9 No.

Date Drilled AUG. 29/97 Driller LANTECH

Borehole Location North ditch, near Station 16+040

Drilling Supervised by J.H.

Drilling Method HSA

Piezometer Details

Type of Pipe 2" PVC TRILOCK

Type of Screen 10 SLOT

Borehole No. 2

Piezometer No. 2

Sheet / of 1

SS Split Spoon Sample
WA Wash Sample
AU Auger Sample
CN Continuous Sample
RX Rock Core

Piezometer Screen (water level elevation m, Y/M/D)

| Scale (ft.) (m) | Geological Log — Description | Elev. (m GSD) / Depth (m) | Piezometer Details | Sample No. | Sample Type | Blows /0.3m |
|---|---|---|---|---|---|---|
| | Ground Surface (m GSD) | 433.0 | | | | |
| 1 | TOPSOIL | | | 1 | SS | – |
| 2 | SAND, fine, brown, moist | | cuttings | | | |
| 3 — 1 | SILT-SAND TILL, brown, mottled moist | | | 2 | SS | 9 |
| 4 | SILT, dark brown; moist; pockets of organics becoming | | holeplug | | | |
| 5 | SILTY FINE SAND, brown, moist | | | 3 | SS | 6 |
| 6 — 2 | | | | | | |
| 7 | | | SAND PACK | 4 | SS | 3 |
| 8 | | | | | | |
| 9 | SAND, fine to coarse, brown, layered; black mottles and small pockets of organic material; saturated | | | 5 | SS | 2 |
| 10 — 3 | | | 29/07/97 | | | |
| 11 | | | | | | |
| 12 | End of Borehole | | | | | |
| 13 — 4 | | | | | | |
| 14 | | | | | | |
| 15 | | | | | | |
| 16 | | | | | | |

Borehole Record

Prepared by

Date

Charlesworth & Associates
CONSULTING HYDROGEOLOGISTS

Project HIGHWAY 9 No.

Date Drilled JULY 30/97 Driller LANTECH

Borehole Location North ditch; near station 16+200

Drilling Supervised by JH

Drilling Method HSA

Piezometer Details

Type of Pipe 2" PVC TRILOC

Type of Screen 10 SLOT

Borehole No. 3

Piezometer No. 3

Sheet / of 1

SS Split Spoon Sample
WA Wash Sample
AU Auger Sample
CN Continuous Sample
RX Rock Core

Piezometer Screen (water level elevation m, Y/M/D)

| Scale (ft.) | (m) | Geological Log — Description | Elev. (m GSD) / Depth (m) | Piezometer Details | Sample No. | Sample Type | Blows /0.3m |
|---|---|---|---|---|---|---|---|
| | | Ground Surface (m GSD) | 426.1 | | | | |
| 1 | | NO SAMPLE | | seal; 30/07/97 | | | |
| 2 | | | | | 1 | SS | 6 |
| 3 | 1 | SAND, fine brown, dry, becoming grey, saturated at 1m | | | | | |
| 4 | | SAND, red brown, saturated, grading to | | cuttings | 2 | SS | 6 |
| 5 | | SILTY SAND to SANDY SILT below 1.6 m | | | | | |
| 6 | | | | | | | |
| 7 | 2 | SILT TILL, red-brown, sat. | | | 3 | SS | 9 |
| 8 | | SILTY SAND, becoming SILT, some CLAYEY SILT SEAMS, red-brown; sat. | | noleplug | | | |
| 9 | | SILT TILL, brown, saturated | | | | | |
| 10 | 3 | occ. fine sand partings | | | 4 | SS | 11 |
| 11 | | | | | | | |
| 12 | | SAND, fine to medium, trace silt; brown, saturated. | | sand pack | 5 | SS | 4 |
| 13 | 4 | | | | | | |
| 14 | | | | | | | |
| 15 | | | | | 6 | SS | 6 |
| 16 | | END OF BOREHOLE | | | | | |

Borehole Record

Prepared by

Date

Charlesworth & Associates
CONSULTING HYDROGEOLOGISTS

Project HIGHWAY 9 No.

Date Drilled JULY 30/97 Driller LANTECH

Borehole Location 1.5m west of BH 3

Drilling Supervised by JH

Drilling Method HSA

Piezometer Details

Type of Pipe 2" PVC TRILOC

Type of Screen 10 SLOT

Borehole No. 3A

Piezometer No. 3A

Sheet 1 of 1

SS Split Spoon Sample
WA Wash Sample
AU Auger Sample
CN Continuous Sample
RX Rock Core

Piezometer Screen (water level elevation m, Y/M/D)

| Scale (ft.) (m) | Geological Log Description | Elev. (m GSD) / Depth (m) | Piezometer Details | Sample No. | Sample Type | Blows /0.3m |
|---|---|---|---|---|---|---|
| | Ground Surface (m GSD) | | | | | |
| 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 (1 2 3 4) | SEE BOREHOLE LOG 3 | | seal; cuttings; bole plug; 30/07/97; sand pack | | | |

Borehole Record

Prepared by

Date

Charlesworth & Associates
CONSULTING HYDROGEOLOGISTS

Project HIGHWAY 9 No.

Date Drilled JULY 30/97 Driller LANTECH

Borehole Location North ditch; nr. station 16+360

Drilling Supervised by JH.

Drilling Method HSA

Piezometer Details

Type of Pipe 2" TRILOC PVC

Type of Screen 10 SLOT

Borehole No. 4

Piezometer No. 4

Sheet 1 of 1

SS Split Spoon Sample
WA Wash Sample
AU Auger Sample
CN Continuous Sample
RX Rock Core

Piezometer Screen (water level elevation m, Y/M/D)

| Scale (ft.) | Scale (m) | Geological Log — Description | Elev. (m GSD) / Depth (m) | Piezometer Details | Sample No. | Sample Type | Blows / 0.3m |
|---|---|---|---|---|---|---|---|
| | | Ground Surface (m GSD) | 425.9 | | | | |
| 1 | | TOPSOIL | | seal | 1 | SS | 8 |
| 2 | | ORGANICS (PEAT) interlayered with SILTY SAND, grey, saturated | | CUTTINGS | 2 | SS | 3 |
| 3 | 1 | | | | | | |
| 4 | | | | hole plug | 3 | SS | 2 |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | 2 | | | 30/07/97 SAND PACK | 4 | SS | 2 |
| 8 | | | | | | | |
| 9 | | | | | | | |
| 10 | 3 | - layers of calcareous silt (marl), shell fragments fine organic material below 2m | | | 5 | SS | 0 |
| 11 | | | | | | | |
| 12 | | | | SAND BACKFILL | 6 | SS | 5 |
| 13 | 4 | CALCAREOUS SILT, grey and cream, sat. (marl) | | | | | |
| 14 | | | | | | | |
| 15 | | CLAYEY SILT TILL, red-brown saturated grading into CLAYEY SILT and SILT varved sat. | | | 7 | SS | 7 |
| 16 | | END OF BOREHOLE | | | | | |

Borehole Record

Prepared by

Date

Charlesworth & Associates
CONSULTING HYDROGEOLOGISTS

Project HIGHWAY 9 No.

Date Drilled JULY 30/97 Driller LANTECH

Borehole Location North ditch Station 16+280

Drilling Supervised by JH

Drilling Method HSA

Piezometer Details

Type of Pipe 2" PVC TRILOC

Type of Screen 10 SLOT

Borehole No. 5

Piezometer No. 5

Sheet 1 of 1

SS Split Spoon Sample
WA Wash Sample
AU Auger Sample
CN Continuous Sample
RX Rock Core

Piezometer Screen (water level elevation m, Y/M/D)

| Scale (ft.) | (m) | Geological Log Description | Elev. (m GSD) / Depth (m) | Piezometer Details 30/07/97 | Sample No. | Sample Type | Blows /0.3m |
|---|---|---|---|---|---|---|---|
| | | Ground Surface (m GSD) | 426.0 | | | | |
| 1 | | NO SAMPLE | | CUTTINGS | | | |
| 2 | | | | | | | |
| 3 | 1 | SILTY SAND, grey, interlayered; with ORGANICS (peat), occ. wood fragments; gravel saturated | | | 1 | SS | 5 |
| 4 | | | | | | | |
| 5 | | | | | 2 | SS | 2 |
| 6 | | | | hole Plug | | | |
| 7 | 2 | | | | 3 | SS | 1 |
| 8 | | | | | | | |
| 9 | | | | | | | |
| 10 | 3 | CALCAREOUS SILT (MARL), light grey and cream, fine shell and organic fragments; sat. | | SAND PACK | 4 | SS | 0 |
| 11 | | | | | | | |
| 12 | | SILT, dark grey; sat. | | | | | |
| 13 | 4 | SANDY SILT, grey, saturated | | | 5 | SS | 2 |
| 14 | | | | | | | |
| 15 | | SAND, fine, grey, saturated | | | | | |
| 16 | | END OF BOREHOLE | | | | | |

Borehole Record

Prepared by

Date

Charlesworth & Associates
CONSULTING HYDROGEOLOGISTS

Project HIGHWAY 9 No.

Date Drilled AUG. 6/97 Driller SONIC

Borehole Location Near Spring; (Station 15+840)

Drilling Supervised by JH

Drilling Method SONIC

Piezometer Details

Type of Pipe 1½" PVC TRILOC

Type of Screen 10 SLOT

Borehole No. 6

Piezometer No. 6

Sheet / of 2

SS Split Spoon Sample
WA Wash Sample
AU Auger Sample
CN Continuous Sample
RX Rock Core

Piezometer Screen (water level elevation m, Y/M/D)

| Scale (ft.) (m) | Geological Log — Description | Elev. (m GSD) / Depth (m) | Piezometer Details | Sample No. | Sample Type | Blows /0.3m |
|---|---|---|---|---|---|---|
| | Ground Surface (m GSD) | 433.4 | | | | |
| 1–3 / 1 | SANDY SILT and GRAVEL, red-brown, wet grading into SILTY SAND with some gravel to SILTY SAND AND GRAVEL, saturated below 0.9 m | | seal; 06/08/97 ▽; sand pack | | | |
| 5–7 / 2 | SAND AND GRAVEL, trace silt, brown, saturated | | cave | | | |
| 7 | SILT, grey | | | | | |
| 8–12 / 3 | SILTY SAND AND GRAVEL, red-brown, saturated | | | | | |
| 12 | — 5cm SILT AND VERY FINE SAND, brown, layered | | | | | |
| 13–14 / 4 | — medium to coarse sand seams, trace silt 3.8–4.1m and 4.6 to 4.8 m | | cave | | | |
| 15–16 | | | | | | |

Borehole Record

Prepared by

Date

Charlesworth & Associates
CONSULTING HYDROGEOLOGISTS

Project HIGHWAY 9 No.

Date Drilled AUG. 6/97 Driller SONIC

Borehole Location Near Spring; (Station 15+840)

Drilling Supervised by JH

Drilling Method SONIC

Piezometer Details

Type of Pipe 1 1/2" PVC TRILOCK

Type of Screen 10 SLOT

Borehole No. 6

Piezometer No. 6

Sheet 2 of 2

SS Split Spoon Sample
WA Wash Sample
AU Auger Sample
CN Continuous Sample
RX Rock Core

Piezometer Screen (water level elevation m, Y/M/D)

| Scale (ft.) (m) | Geological Log — Description | Elev. (m GSD) / Depth (m) | Piezometer Details | Sample No. | Sample Type | Blows /0.3m |
|---|---|---|---|---|---|---|
| | Ground Surface (m GSD) | | | | | |
| 17 / 5 | as above | | | | | |
| 18 | | | | | | |
| 19 | | | | | | |
| 20 / 6 | END OF BOREHOLE<br>REFUSAL ON STONE | | | | | |
| 21 | | | | | | |
| 22 | | | | | | |
| 23 / 7 | | | | | | |
| 24 | | | | | | |
| 25 | | | | | | |
| 26 / 8 | | | | | | |
| 27 | | | | | | |
| 28 | | | | | | |
| 29 | | | | | | |
| 30 / 9 | | | | | | |
| 31 | | | | | | |
| 32 | | | | | | |

Borehole Record

Prepared by

Date

Charlesworth & Associates
CONSULTING HYDROGEOLOGISTS

Project HIGHWAY 9 No.

Date Drilled AUG. 6/97 Driller SONIC

Borehole Location North of Highway, Nr. Stn. 15+800

Drilling Supervised by JH

Drilling Method SONIC

Piezometer Details

Type of Pipe 1 1/2 " PVC TRILOC

Type of Screen 10 SLOT

Borehole No. 7

Piezometer No. 7

Sheet 1 of 1

SS Split Spoon Sample
WA Wash Sample
AU Auger Sample
CN Continuous Sample
RX Rock Core

Piezometer Screen (water level elevation m, Y/M/D)

| Scale (ft.) | Scale (m) | Geological Log — Description | Elev. (m GSD) / Depth (m) | Piezometer Details | Sample No. | Sample Type | Blows / 0.3m |
|---|---|---|---|---|---|---|---|
| | | Ground Surface (m GSD) | 434.4 | | | | |
| 1 | | TOPSOIL | | CUTTINGS | | | |
| 2 | | SILTY SAND, SOME GRAVEL (FILL), brown, dry becoming moist, below 0.3 m | | Seal | | | |
| 3 | 1 | SILTY SAND AND GRAVEL, brown, mottled, moist becoming grey-brown, mottled and saturated below 1.05 m (FILL?) | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |
| 6 | 2 | SILTY SAND AND GRAVEL, trace CLAY (TILL), brown becoming grey brown and decrease in gravel with depth; mottled, saturated; Pockets of sand | | SAND PACK | | | |
| 7 | | | | | | | |
| 8 | | SANDY SILT TILL, grey, mottled; saturated | | | | | |
| 9 | | | | 06/08/97 | | | |
| 10 | 3 | | | | | | |
| 11 | | END OF BOREHOLE | | | | | |
| 12 | | | | | | | |
| 13 | 4 | | | | | | |
| 14 | | | | | | | |
| 15 | | | | | | | |
| 16 | | | | | | | |

Borehole Record

Prepared by

Date

Charlesworth & Associates
CONSULTING HYDROGEOLOGISTS

Project HIGHWAY 9 No.

Date Drilled AUG. 6/97 Driller SONIC

Borehole Location North of Highway, NR. STN. 15+750

Drilling Supervised by J.H.

Drilling Method SONIC

Piezometer Details

Type of Pipe 1 1/2" PVC TRILOC

Type of Screen 10 SLOT

Borehole No. 8

Piezometer No. 8

Sheet 1 of 1

SS Split Spoon Sample
WA Wash Sample
AU Auger Sample
CN Continuous Sample
RX Rock Core

Piezometer Screen (water level elevation m, Y/M/D)

| Scale (ft.) | Scale (m) | Geological Log — Description | Elev. (m GSD) / Depth (m) | Piezometer Details | Sample No. | Sample Type | Blows /0.3m |
|---|---|---|---|---|---|---|---|
| | | Ground Surface (m GSD) | 433.9 | | | | |
| 1 | | TOPSOIL | | | | | |
| 2 | | SILT, CLAYEY SILT, SILT, some sand, and VERY FINE SAND, interlayered, brown, moist, mottled, becoming grey, saturated below 1m | | seal; 06/08/97 | | | |
| 3 | 1 | | | | | | |
| 4 | | SANDY SILT TO SILTY SAND, grading to CLAYEY SILT AND SILT, layered, red-brown, sat. | | | | | |
| 5 | | FINE SAND, trace silt, grading to FINE SAND AND GRAVEL, brown, sat. | | SAND PACK | | | |
| 6 | | SILTY SAND AND GRAVEL, red-brown, sat. TILL-LIKE below 2.2 m | | | | | |
| 7 | 2 | | | | | | |
| 8 | | SAND AND GRAVEL, some silt, red-brown, saturated | | | | | |
| 9 | | | | | | | |
| 10 | 3 | | | CAVE | | | |
| 11 | | END OF BOREHOLE | | | | | |
| 12 | | | | | | | |
| 13 | 4 | | | | | | |
| 14 | | | | | | | |
| 15 | | | | | | | |
| 16 | | | | | | | |

Borehole Record

Prepared by

Date

Charlesworth & Associates
CONSULTING HYDROGEOLOGISTS

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Ministry
of
Transportation
Ontario

## FOUNDATION DESIGN SECTION

# foundation investigation and design report

**ENGINEERING MATERIALS OFFICE**
FOUNDATION DESIGN SECTION

| | | | |
|---|---|---|---|
| WP | 145-96-00 | REGION | Central |
| HWY | 9 | STR SITE | |

Embankment Stability, Hwy. 9 Reconstruction
Rolling Hills Drive to E of Mono 6th Line Road East

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GEOCRES 30M13-135 DATE NOV 18 1996

# FOUNDATION INVESTIGATION REPORT

**for**

**Embankment Stability, Highway 9 Reconstruction**

**Rolling Hills Drive to E of Mono 6th Line Road East**

**W.P. 145-96-00, Central Region**

---

## *Introduction*

This report summarizes the factual information obtained from a foundation investigation conducted for two high fill sections along the proposed widening of Highway 9, Rolling Hills Drive to east of Mono 6th Line Road East. The investigation was carried out at the request of Central Region, Geotechnical Section. The following areas were identified in the request:

Hwy 9: Sta 15+700 to 15+950
Hwy 9: Sta 17+950 to 18+200

## *Site Description*

The fill sections are located along Highway 9 in the Mono Township, just east of Orangeville. The terrain is generally hilly with a number of low lying marshy areas and ponds. Land use is primarily agricultural and recreational.

The Mono Mills area lies within the physiographic region of the Oak Ridges Moraine. A glacial end moraine, it has a typical "knob and basin" relief" typified by "rugged sand hills and till knobs" (after Putnam and Chapman, 1984, The Physiography of Southern Ontario, 3rd Edition).

## *Field Investigation*

The field investigation was carried out by the Foundations Unit on 96 08 26. Two boreholes were advanced, one at each section, using a track-mounted auger machine equipped with hollow stem augers.

Samples were recovered by means of a 50 mm O.D. split spoon sampler driven into the ground according to the specifications of the Standard Penetration Test (ASTM D 1586-8).

Groundwater elevations were obtained by measuring the water levels in the open boreholes prior to backfilling.

***Subsurface Conditions***

*Fill Section Sta 15+700 to 15+950 (Borehole 1)*
The subsurface data obtained from the borehole advanced at this location reveal a surficial fill deposit consisting of cohesive clayey silt extending for a depth of 2.9 m. The deposit contains occasional zones of silty sand, trace gravel and trace organics. N values ranging from 7 to 25 were measured within the deposit indicating a firm to very stiff consistency. The following soil properties were observed from laboratory testing:

| | |
|---|---|
| Water Content (w) | 15.5% |
| Plastic Limit ($w_p$) | 16.0% |
| Liquid Limit ($w_L$) | 24.0% |
| Unit Weight ($\gamma$) | 21.8 kN/m$^3$ |

The fill is underlain by a non-cohesive silty sand stratum that is 2.3 m thick. Organics are present throughout imparting the deposit with its dark grey colour. N values range from 8 to 14, indicating that the deposit is in a loose to compact state of denseness. Laboratory testing revealed a water content of 13.5%.

A thin bed of homogeneous clayey silt, 0.7m thick, was present beneath the silty sand stratum. It contains a trace of sand and is light grey in colour. The silty clay is stiff in consistency as evidenced by a single N value of 12. The following soil properties were observed from laboratory testing:

| | |
|---|---|
| Water Content (w) | 18.5% |
| Plastic Limit ($w_p$) | 16.0% |
| Liquid Limit ($w_L$) | 23.0% |
| Unit Weight ($\gamma$) | 21.7 kN/m$^3$ |

The borehole was terminated at El. 422.9, at a depth of 11.1 m, in a deposit consisting of a heterogeneous mixture of gravel, sand, silt and clay. The deposit is a non-cohesive glacial till. N values range from 36 to 73, indicating that the material is in a dense to very dense state. A water content of 8.0% was measured on a representative sample.

The groundwater level, measured in the open borehole following completion, was present at a depth of 2.9 m, or El. 431.1

*Fill Section Sta 17+950 to 18+200 (Borehole 2)*
The surficial deposit encountered at BH2 is a non-cohesive fill consisting of silty sand. The deposit is 1.4 m thick at the boring location and contains traces of gravel and organics. An N value of 5 indicates that the material is in a loose state of compaction.

The fill is underlain by a dark grey to black peat that is interspersed with silty sand zones. The organic deposit extends to El. 413.9 and is 1.2 m thick. Laboratory testing on the organic portion revealed a water content of 103.5% and an organic content of 28%. A water content of 42% was

observed on the silty sand portion of the deposit. The material is very soft/very loose as exhibited by N values of 2 and 1.

The peat diminishes into a silty sand deposit that contains trace organics throughout, as well as a trace of clay. The deposit is dark grey in colour and is 1.8 m thick. N values of 2 and 9 indicate that the deposit ranges from a very loose to loose state of compaction.

A heterogeneous mixture of clayey silt, sand and gravel was encountered beneath the silty sand stratum at a depth of 4.4 m. The material is cohesive and is glacial in origin. The deposit exhibits a consistency of very stiff to hard as shown from measured N values ranging from 23 to 47. A single lab test revealed a water content of 7.5%. The borehole was terminated in the glacial till deposit. Auger refusal was encountered at a depth of 8.2 m (El. 408.3) on a possible boulder.

The groundwater level was measured in the open borehole and was present at a depth of 2.4 m, or El. 414.0.

For the boundaries of the various subsoil types, field and laboratory test results and groundwater levels refer to the appended Record of Borehole Sheets. The locations of the borings in plan are shown on the appended drawings, Drawing Nos. 1459600-A and 1459600-B.

## DISCUSSION

The proposed fills are extensions of existing fill slopes required to accommodate the Highway 9 widening. The existing fill embankments are as much as 12 m high between Sta 15+700 and Sta 15+950, and 8 m high between Sta 17+950 and Sta 18+200.

Visual inspection of the fill areas revealed that the section between Sta 15+700 and Sta 15+950 has experienced considerable surficial movement. Stakes present on the slope are evidence that an attempt was made in the past to maintain the vegetation and minimize the surficial creep of the slope. A section of guard rail along the crest of the slope has moved out of alignment towards a large depression created as a result of ground movement.

In the event that the project construction is delayed beyond 1997, consideration should be given to rehabilitate the slope (Sta 15+700 to Sta 15+950) during the1998 construction season. Although no global failure is anticipated, the surficial erosion due to run off along the shoulder of this section may cause damage to the pavement structure and patching may be required. Seasonal monitoring of the slope may be prudent during the interim period.

The existing slope between Sta 17+950 and 18+200 are stable, both surficially and globally.

## RECOMMENDATIONS

Recommendations consisting of slope stability, slope geometry, and slope treatment are provided for the high fill sections proposed along the Highway 9 widening. They are based on the premise that no additional property will be acquired and that, for the most part, the location of the toe of slope will not change.

For both fill sections, slopes steeper than 2H:1V will be unstable. It is recommended that a retained soil system be applied at each of the slopes to accommodate the widening of Highway 9 and to minimize surficial instability. They should extend for a minimum height that will accommodate a 2H:1V slope and berm, if required. It is recommended that a retaining system at the fill section Sta 15+700 to 15+950 be constructed at the base of the slope as shown in Figure 1. At fill section Sta 17+950 to 18+200 a retaining system at the crown of the slope is preferred because the presence of 2.6 m of peat at the base of the slope would require considerable subexcavation.

The designer is referred to DSM Item 9.70.55 Retained Soil Systems (RSS) which lists the approved proprietary systems. For this project, a reinforced vertical/terraced wall meeting the minimum requirements for performance and appearance is the preferred geometry.

Where the fill embankment heights are greater than or equal to 8.0 m, a 2.0m berm is recommended. The berms may be run out as quickly as is feasible in the area beyond which they are required for stability. There should be a slight grade in the berm towards the slope to prevent the ponding of water.

Prior to placement of the fill, all surficial organic material should be removed. Any necessary proof-rolling or foundation preparation should be carried out prior to placement of retaining system elements. Any soft areas identified by proof-rolling should be sub-excavated and replaced with suitable backfill. Suitable backfill does not include silt. Temporary excavations should be inclined at 1.5H:1V or flatter.

Excavation for the installation of reinforcing elements at the fill section from Sta 17+950 to 18+200 may require temporary shoring for roadway protection, depending on the final height of the system. If so, the designer is referred to OPSS 538 Shoring and Bracing.

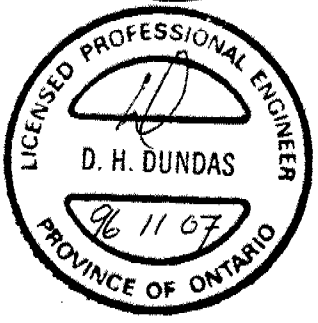
Fill placed on existing embankments should be keyed into the existing fill. Topsoil and slope vegetation should be established as soon as possible after filling and grading to control surficial erosion. The use of straw mats is also recommended. The RSS must maintain the integrity of the slope and vegetative growth must be ensured.

Drainage by means of interceptor ditches, catch basins, or curb and gutter at the top of the slope is recommended to control surface runoff. Directing runoff to armoured spillways on the slopes should also be considered to minimize surficial erosion. Ditches placed at the base of the lower slopes with provisions for positive drainage should be incorporated to prevent ponding of water.

**Miscellaneous**

The fieldwork for this investigation was carried out on August 26,1996 under the supervision of J. Werner, Engineer in Training . The report was prepared by B. Bennett, Foundation Engineer and was reviewed by D. Dundas, Senior Foundation Engineer.


Betty Bennett, P.Eng.
Foundation Engineer




David Dundas, P.Eng.
Sr. Foundation Engineer

# APPENDIX

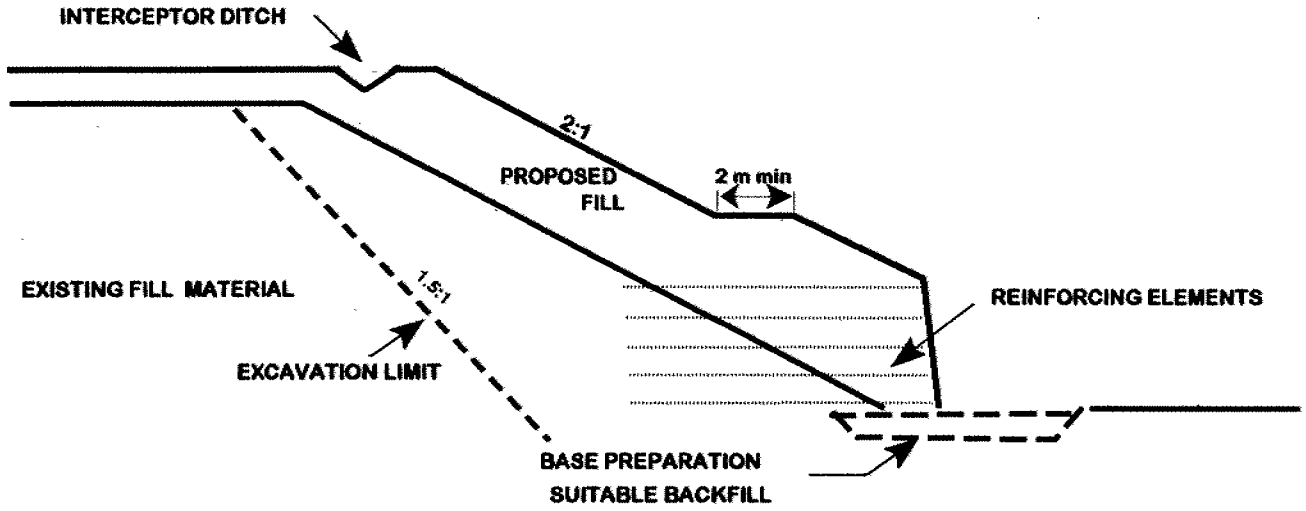



**Figure 1 - GEOMETRY AND TREATMENT FOR HIGH FILL SECTION - Sta 15 + 700 to 15 + 950**

WP 145-96-00

# RECORD OF BOREHOLE No 1 — 1 OF 1 — METRIC

W.P. 145-96-00 LOCATION Coords: N 4 866 407 5 E 263 713.1 ORIGINATED BY JW

DIST CR HWY 9 BOREHOLE TYPE HS Auger COMPILED BY JW/BB

DATUM Geodetic DATE 96/08/26 CHECKED BY BB/DD

| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | TYPE | 'N' VALUES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100 | PLASTIC LIMIT $w_P$ — NATURAL MOISTURE CONTENT $w$ — LIQUID LIMIT $w_L$ WATER CONTENT (%) 10 20 30 | UNIT WEIGHT $\gamma$ kN/m$^3$ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 434.0 | Ground Surface | | | | | | | | | | |
| 0.0 | CLAYEY SILT Trace Organics<br>With Sand<br>Trace Gravel<br>Occasional Silty Sand zones<br>Brown<br>Firm to Very Stiff<br>(Fill Material) | | 1 | SS | 7 | | 433 | | | 21.8 | 3 42 (55) |
| | | | 2 | SS | 25 | | 432 | | | | |
| 431.1 | | | 3 | SS | 11 | ▼* | 431 | | | | |
| 2.9 | SILTY SAND<br>Trace to Some Gravel<br>Trace Clay<br>Trace Organics<br>Dark Grey<br>Loose to Compact | | 4 | SS | 14 | | | | | | |
| | | | 5 | SS | 8 | | 430 | | | | 1 48 44 7 |
| 428.8 | | | 6 | SS | 12 | | 429 | | | | |
| 5.2 | CLAYEY SILT<br>Trace Sand<br>Grey<br>Stiff | | 7 | SS | 12 | | | | | 21.7 | 0 5 (95) |
| 428.1 | | | | | | | 428 | | | | |
| 5.9 | Heterogeneous Mixture of<br>GRAVEL, SAND, SILT and CLAY<br>Occasional wet Sand Seams<br>Red Brown<br>Dense to Very Dense | | 8 | SS | 32 | | | | | | 28 41 (31) |
| | | | 9 | SS | 73 | | 427 | | | | |
| | (Glacial Till) | | | | | | 426 | | | | |
| | | | 10 | SS | 41 | | 425 | | | | |
| | | | | | | | 424 | | | | |
| 422.9 | | | 11 | SS | 57 | | 423 | | | | |
| 11.1 | End of Borehole | | | | | | | | | | |

* 96/08/26

$+^3$, $\times^5$ : Numbers refer to Sensitivity

$\frac{20}{15}\diamond\frac{5}{10}$ (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 2 1 OF 1 METRIC

W.P. 145-96-00 LOCATION Coords: N 4 867 045.1 E 265 811.3 ORIGINATED BY JW

DIST CR HWY 9 BOREHOLE TYPE HS Auger COMPILED BY JW/BB

DATUM Geodetic DATE 96/08/26 CHECKED BY BB/DD

| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES 'N' VALUES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100) | PLASTIC LIMIT $w_P$ / NATURAL MOISTURE CONTENT $w$ / LIQUID LIMIT $w_L$ — WATER CONTENT (%) (10 20 30) | UNIT WEIGHT $\gamma$ kN/m³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 416.5 | Ground Surface | | | | | | | | | | |
| 0.0 | SILTY SAND<br>Trace Gravel<br>Trace Organics<br>Brown<br>Loose<br>(Fill Material) | | 1 | SS | 5 | | 416 | | | | |
| 415.1 | | | | | | | | | | | |
| 1.4 | PEAT<br>Interspersed with Silty Sand<br>Trace Clay<br>Black<br>Very Soft/Very Loose | | 2 | SS | 2 | | 415 | | w=103.5 | 28% org | 0 48 (52) |
| 413.9 | | | 3 | SS | 1 | ▼* | 414 | | w=42 | | 0 63 34 3 |
| 2.6 | SILTY SAND<br>Trace Gravel<br>Trace Organics<br>Trace Clay<br>Dark Grey<br>Very Loose to Loose | | 4 | SS | 2 | | 413 | | | | |
| 412.1 | | | 5 | SS | 9 | | 412 | | | | |
| 4.4 | Heterogeneous Mixture of<br>CLAYEY SILT, GRAVEL AND SAND<br>Grey<br>Very Stiff to Hard | | 6 | SS | 23 | | | ○ | | | 30 32 (38) |
| | | | 7 | SS | 29 | | 411 | | | | |
| | | | 8 | SS | 47 | | 410 | | | | |
| | (Glacial Till) | | 9 | SS | 60/6cm | | 409 | | | | |
| 408.3 | | | | | | | | | | | |
| 8.2 | End of Borehole<br><br>+ 96/08/26 | | | | | | | | | | |

+³, ×⁵ : Numbers refer to Sensitivity

20
15◇5 (%) STRAIN AT FAILURE
10

# EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS $\bar{N}$.

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH ($c_u$) AS FOLLOWS:

| $c_u$ (kPa) | 0 - 12 | 12 - 25 | 25 - 50 | 50 - 100 | 100 - 200 | >200 |
|---|---|---|---|---|---|---|
| | *VERY SOFT* | *SOFT* | *FIRM* | *STIFF* | *VERY STIFF* | *HARD* |

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

| N (BLOWS/0.3m) | 0 - 5 | 5 - 10 | 10 - 30 | 30 - 50 | >50 |
|---|---|---|---|---|---|
| | *VERY LOOSE* | *LOOSE* | *COMPACT* | *DENSE* | *VERY DENSE* |

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (R Q D), FOR MODIFIED RECOVERY, IS:

| RQD (%) | 0 - 25 | 25 - 50 | 50 - 75 | 75 - 90 | 90 - 100 |
|---|---|---|---|---|---|
| | *VERY POOR* | *POOR* | *FAIR* | *GOOD* | *EXCELLENT* |

JOINTING AND BEDDING:

| SPACING | 50mm | 50 - 300mm | 0.3m - 1m | 1m - 3m | >3m |
|---|---|---|---|---|---|
| JOINTING | *VERY CLOSE* | *CLOSE* | *MOD. CLOSE* | *WIDE* | *VERY WIDE* |
| BEDDING | *VERY THIN* | *THIN* | *MEDIUM* | *THICK* | *VERY THICK* |

# ABBREVIATIONS AND SYMBOLS

## FIELD SAMPLING

| | | | |
|---|---|---|---|
| S S | SPLIT SPOON | T P | THINWALL PISTON |
| W S | WASH SAMPLE | O S | OSTERBERG SAMPLE |
| S T | SLOTTED TUBE SAMPLE | R C | ROCK CORE |
| B S | BLOCK SAMPLE | P H | T W ADVANCED HYDRAULICALLY |
| C S | CHUNK SAMPLE | P M | T W ADVANCED MANUALLY |
| T W | THINWALL OPEN | F S | FOIL SAMPLE |

## STRESS AND STRAIN

| | | |
|---|---|---|
| $u_w$ | kPa | PORE WATER PRESSURE |
| $r_u$ | 1 | PORE PRESSURE RATIO |
| $\sigma$ | kPa | TOTAL NORMAL STRESS |
| $\sigma'$ | kPa | EFFECTIVE NORMAL STRESS |
| $\tau$ | kPa | SHEAR STRESS |
| $\sigma_1, \sigma_2, \sigma_3$ | kPa | PRINCIPAL STRESSES |
| $\epsilon$ | % | LINEAR STRAIN |
| $\epsilon_1, \epsilon_2, \epsilon_3$ | % | PRINCIPAL STRAINS |
| E | kPa | MODULUS OF LINEAR DEFORMATION |
| G | kPa | MODULUS OF SHEAR DEFORMATION |
| $\mu$ | 1 | COEFFICIENT OF FRICTION |

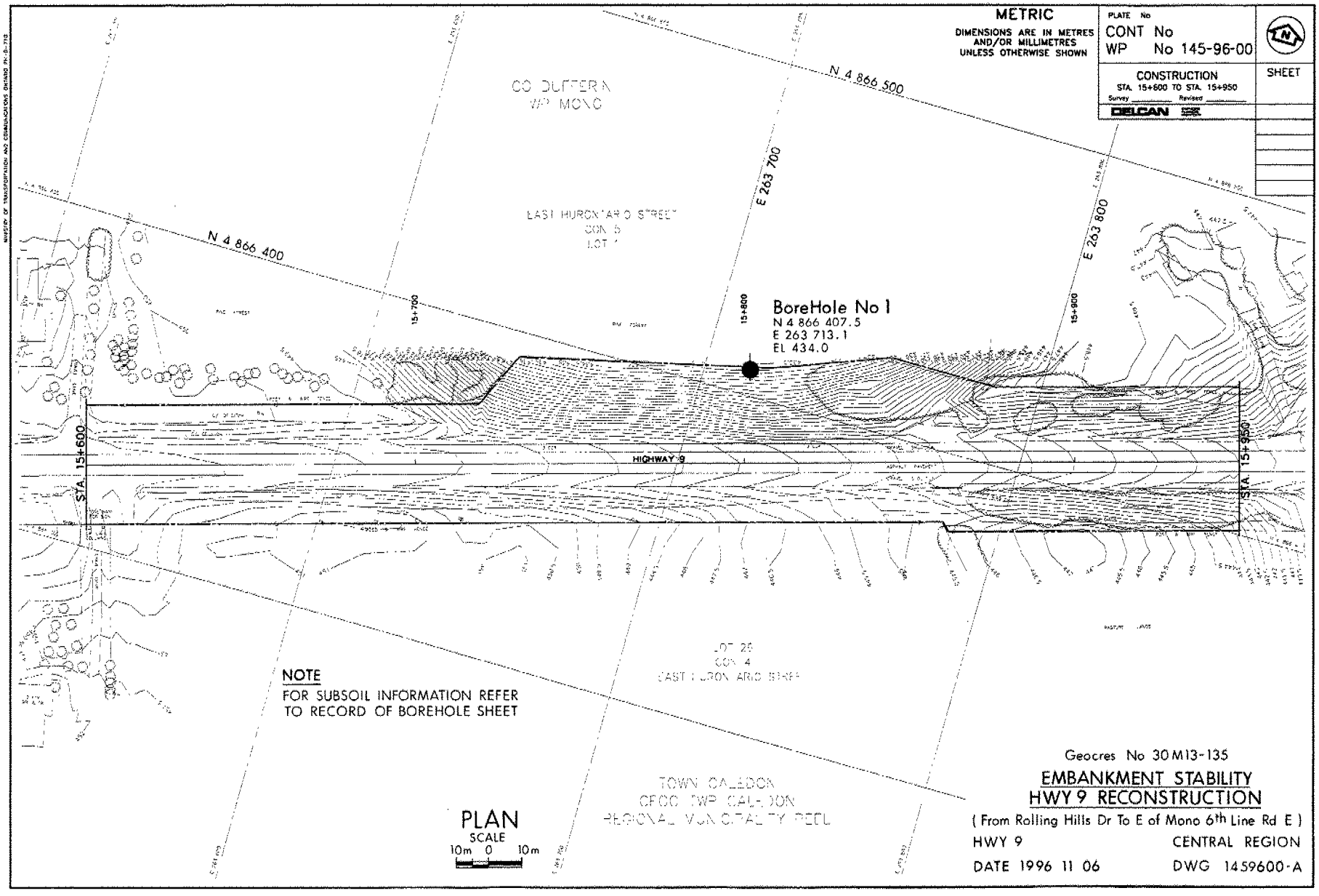
## MECHANICAL PROPERTIES OF SOIL

| | | |
|---|---|---|
| $m_v$ | $kPa^{-1}$ | COEFFICIENT OF VOLUME CHANGE |
| $C_c$ | 1 | COMPRESSION INDEX |
| $C_s$ | 1 | SWELLING INDEX |
| $C_\alpha$ | 1 | RATE OF SECONDARY CONSOLIDATION |
| $c_v$ | $m^2/s$ | COEFFICIENT OF CONSOLIDATION |
| H | m | DRAINAGE PATH |
| $T_v$ | 1 | TIME FACTOR |
| U | % | DEGREE OF CONSOLIDATION |
| $\sigma'_{vo}$ | kPa | EFFECTIVE OVERBURDEN PRESSURE |
| $\sigma'_p$ | kPa | PRECONSOLIDATION PRESSURE |
| $\tau_f$ | kPa | SHEAR STRENGTH |
| $c'$ | kPa | EFFECTIVE COHESION INTERCEPT |
| $\phi'$ | -° | EFFECTIVE ANGLE OF INTERNAL FRICTION |
| $c_u$ | kPa | APPARENT COHESION INTERCEPT |
| $\phi_u$ | -° | APPARENT ANGLE OF INTERNAL FRICTION |
| $\tau_R$ | kPa | RESIDUAL SHEAR STRENGTH |
| $\tau_r$ | kPa | REMOULDED SHEAR STRENGTH |
| $S_t$ | 1 | SENSITIVITY = $\frac{c_u}{\tau_r}$ |

## PHYSICAL PROPERTIES OF SOIL

| | | |
|---|---|---|
| $\rho_s$ | $kg/m^3$ | DENSITY OF SOLID PARTICLES |
| $\gamma_s$ | $kN/m^3$ | UNIT WEIGHT OF SOLID PARTICLES |
| $\rho_w$ | $kg/m^3$ | DENSITY OF WATER |
| $\gamma_w$ | $kN/m^3$ | UNIT WEIGHT OF WATER |
| $\rho$ | $kg/m^3$ | DENSITY OF SOIL |
| $\gamma$ | $kN/m^3$ | UNIT WEIGHT OF SOIL |
| $\rho_d$ | $kg/m^3$ | DENSITY OF DRY SOIL |
| $\gamma_d$ | $kN/m^3$ | UNIT WEIGHT OF DRY SOIL |
| $\rho_{sat}$ | $kg/m^3$ | DENSITY OF SATURATED SOIL |
| $\gamma_{sat}$ | $kN/m^3$ | UNIT WEIGHT OF SATURATED SOIL |
| $\rho'$ | $kg/m^3$ | DENSITY OF SUBMERGED SOIL |
| $\gamma'$ | $kN/m^3$ | UNIT WEIGHT OF SUBMERGED SOIL |

| | | |
|---|---|---|
| e | 1, % | VOID RATIO |
| n | 1, % | POROSITY |
| w | 1, % | WATER CONTENT |
| $S_r$ | % | DEGREE OF SATURATION |
| $w_L$ | % | LIQUID LIMIT |
| $w_P$ | % | PLASTIC LIMIT |
| $w_S$ | % | SHRINKAGE LIMIT |
| $I_P$ | % | PLASTICITY INDEX = $w_L - w_P$ |
| $I_L$ | 1 | LIQUIDITY INDEX = $\frac{w - w_P}{I_P}$ |
| $I_C$ | 1 | CONSISTENCY INDEX = $\frac{w_L - w}{I_P}$ |
| $e_{max}$ | 1, % | VOID RATIO IN LOOSEST STATE |
| $e_{min}$ | 1, % | VOID RATIO IN DENSEST STATE |
| $I_D$ | 1 | DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$ |
| D | mm | GRAIN DIAMETER |
| $D_n$ | mm | n PERCENT - DIAMETER |
| $C_U$ | 1 | UNIFORMITY COEFFICIENT |
| h | m | HYDRAULIC HEAD OR POTENTIAL |
| q | $m^3/s$ | RATE OF DISCHARGE |
| v | m/s | DISCHARGE VELOCITY |
| i | 1 | HYDRAULIC GRADIENT |
| k | m/s | HYDRAULIC CONDUCTIVITY |
| j | $kN/m^3$ | SEEPAGE FORCE |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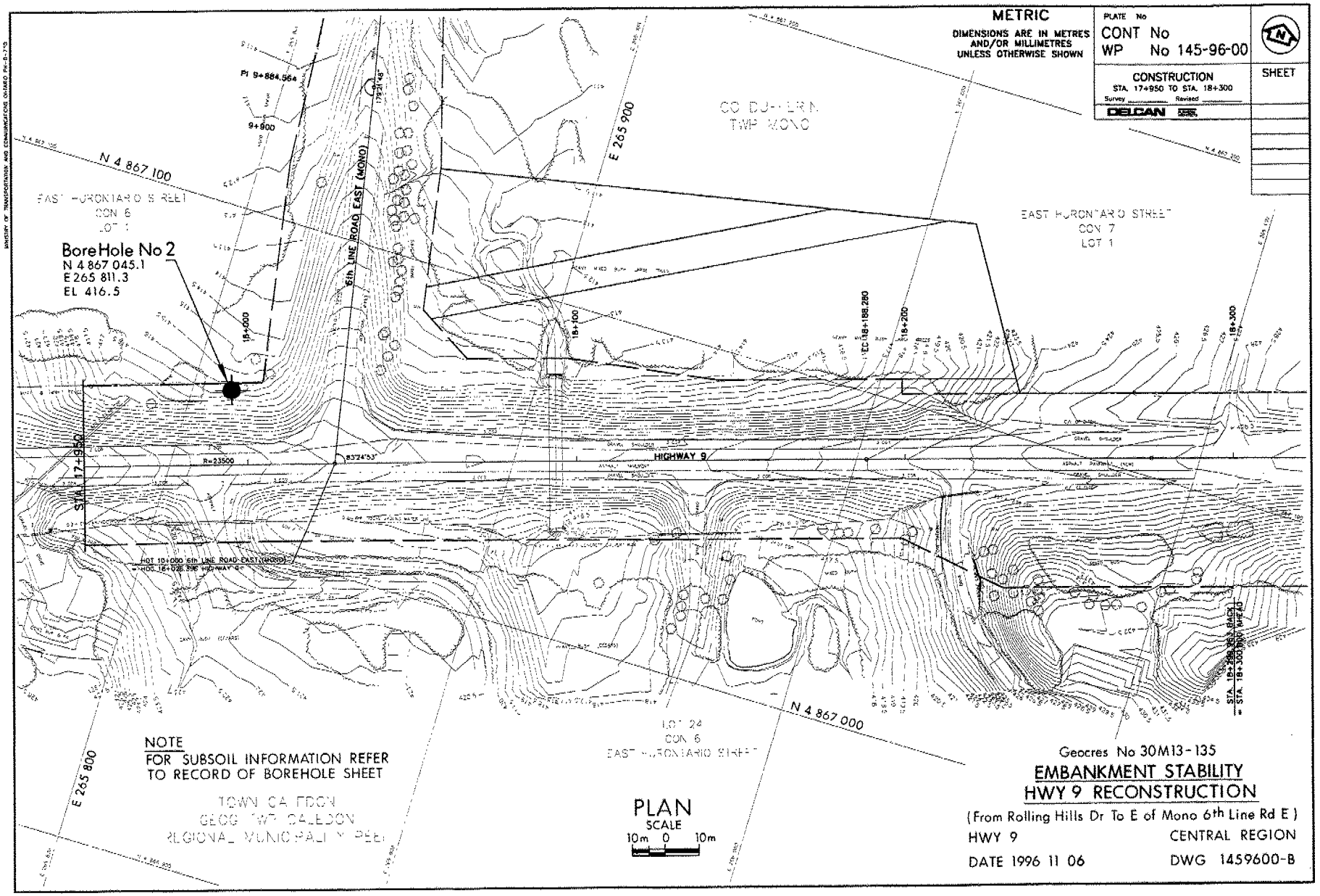
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
PLATE No
CONT No
WP No 145-96-00
CONSTRUCTION
STA. 15+600 TO STA. 15+950
Survey
Revised
DELCAN
SHEET
CO DUFFERIN
WP MONO
EAST HURONTARIO STREET
CON 5
LOT 1
N 4 866 500
N 4 866 400
E 263 700
E 263 800
15+700
15+800
15+900
BoreHole No 1
N 4 866 407.5
E 263 713.1
EL 434.0
STA. 15+600
STA. 15+950
HIGHWAY 9
LOT 25
CON 4
EAST HURONTARIO STREET
TOWN CALEDON
GEOG TWP CALEDON
REGIONAL MUNICIPALITY PEEL
NOTE
FOR SUBSOIL INFORMATION REFER TO RECORD OF BOREHOLE SHEET
PLAN
SCALE
10m 0 10m
Geocres No 30M13-135
EMBANKMENT STABILITY
HWY 9 RECONSTRUCTION
( From Rolling Hills Dr To E of Mono 6th Line Rd E )
HWY 9
CENTRAL REGION
DATE 1996 11 06
DWG 1459600-A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DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
PLATE No
CONT No
WP No 145-96-00
CONSTRUCTION
STA. 17+950 TO STA. 18+300
Survey
Revised
DELCAN
SHEET
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO FM-8-715
CO DUFFERIN
TWP MONO
N 4 867 100
E 265 900
EAST HURONTARIO STREET
CON 6
LOT 1
EAST HURONTARIO STREET
CON 7
LOT 1
Bore Hole No 2
N 4 867 045.1
E 265 811.3
EL 416.5
6th LINE ROAD EAST (MONO)
Pl 9+884.964
9+600
18+000
18+100
18+200
18+300
EC 18+188.280
STA 17+950
R=23500
83°24'53"
HIGHWAY 9
HOT 10+000 6th LINE ROAD EAST (MONO)
=HOT 18+025.596 HIGHWAY 9
STA 18+288.280 (BACK)
= STA 18+300 (AHEAD)
N 4 867 000
E 265 800
LOT 24
CON 6
EAST HURONTARIO STREET
TOWN OF CALEDON
GEOG TWP OF CALEDON
REGIONAL MUNICIPALITY PEEL
NOTE
FOR SUBSOIL INFORMATION REFER TO RECORD OF BOREHOLE SHEET
PLAN
SCALE
10m 0 10m
Geocres No 30M13-135
EMBANKMENT STABILITY
HWY 9 RECONSTRUCTION
(From Rolling Hills Dr To E of Mono 6th Line Rd E)
HWY 9
CENTRAL REGION
DATE 1996 11 06
DWG 1459600-B

**ENGINEERING MATERIALS OFFICE**
FOUNDATION DESIGN SECTION

| | | | |
|---|---|---|---|
| WP | 145-96-00 | REGION | Central |
| HWY | 9 | STR SITE | |

Hwy 9 Reconstruction
Swamp Crossings and Culvert Wingwalls
Rolling Hills Drive to E of Mono 6th Line Road East

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GEOCRES 30M13-135

DATE OCT 14 1997

# FOUNDATION INVESTIGATION REPORT

**for**

**Highway 9 Reconstruction - Swamp Crossings and Culvert Wingwalls**

**Rolling Hills Drive to E of Mono 6th Line Road East**

**W.P. 145-96-00, Central Region**

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## INTRODUCTION

This report summarizes the factual information obtained from a foundation investigation conducted for three fill areas/swamp crossings and two culverts along the proposed widening of Highway 9, Rolling Hills Drive to east of Mono 6th Line Road East. The investigation was carried out at the request of Central Region, Structural and Geotechnical Sections. The following areas were identified in the request:

| | |
|---|---|
| Swamp Crossing | Sta 16+170 to Sta 16+270, Left |
| Fill Area | Sta 16+350 to Sta 16+390, Left |
| Swamp Crossing | Sta 16+725 to Sta 16+760, Right |
| Culvert C-5 | Sta 16+723 |
| Culvert C-6 | Sta 18+094 |

## SITE DESCRIPTION

The fill sections are located along Highway 9 in Mono Township, just east of Orangeville. The terrain is generally hilly with a number of low lying marshy areas and ponds. Land use is primarily agricultural and recreational.

The Mono Mills area lies within the physiographic region of the Oak Ridges Moraine. A glacial end moraine, it has a typical "knob and basin" relief" typified by "rugged sand hills and till knobs" (after Putnam and Chapman, 1984, The Physiography of Southern Ontario, 3rd Edition) and depressed areas of organic and soft clay deposits.

## FIELD INVESTIGATION

The field investigation was carried out by the Foundations Unit between 97 07 29 and 97 08 18. Six boreholes were advanced across the project area, using a track-mounted auger machine equipped with solid and hollow stem augers.

Samples were recovered by means of a 50 mm O.D. split spoon sampler driven into the ground according to the specifications of the Standard Penetration Test (ASTM D 1586-8).

Groundwater elevations were obtained by measuring the water levels in the open boreholes prior to backfilling.

## SUBSURFACE CONDITIONS

The soils descriptions together with the field and laboratory test results are shown on the Record of Borehole Sheets appended to this report. Boreholes 3 and 4, advanced for a hydrogeological study by Charlesworth and Associates, are included for their factual information only. The locations of the borings in plan are shown on the appended drawings, Drawing Nos. 1459600-C, 1459600-D and 1459600-E and 1459600-F.

The subsurface conditions observed at each of the five sites are described below.

***Swamp Crossing*** ***Sta 16+205 to Sta 16+275, Left*** ***Boreholes A1, A2 and 3***

The subsurface data obtained from the boreholes advanced at this location reveal extensive organic deposits of peat and marl. At the time of the investigation, the drilling rig could advance only as far west as Sta 16+250 beyond which the rig could not be supported by the soft ground.

A borehole was advanced for the hydrogeological study at Sta 16+200. Organics were not present at this location. The subsurface material consisted of alternating deposits of sand and silt till to an elevation of 421.2 at which the borehole was terminated.

In boreholes A1 and A2, a surficial deposit of black peat, ranging from 2.9 to 4.1 m in thickness, was encountered. The peat extends to El. 421.6 at Sta 16+250 and to El. 423.5 at Sta 16+275. It contains occasional zones or bands of grey silty sand. N values ranging from 2 to 5 were measured within the deposit indicating a very soft to firm consistency. The following soil properties were determined from laboratory testing carried out on representative samples:

| | |
|---|---|
| Moisture Content (w) | 64 -143.5% |
| Organic Content | 9.5 - 27% |

The peat is underlain by a stratum of marl that was present to El. 416.6 in BH A1 and El. 422.4 in BH A2. The marl thickness ranges from 5.0 m at Sta 16+250 to 1.1 m in Sta 16+275. The deposit is composed largely of silt and is beige in colour. The marl contains a trace of gravel and the sand content of the deposit increases with depth. The state of the marl varies from semi-solid to liquid and it is non-plastic. A fibrous zone was encountered in BH A1 at El. 421.0 N values range from 0 to 1 indicating that the deposit has a very loose relative density. Laboratory testing revealed a water content ranging from 40.5% to 127%. Because of the high water content samples could not be extracted in this stratum below El. 419.

The marl stratum is underlain by a silty sand deposit that is 4.4 m thick in borehole A2. BH A1 was terminated in the silty sand at El. 414.6. The silty sand contains trace gravel. N values ranging from 5 to 11 were obtained from SPT testing indicating that the deposit is very loose to compact in denseness. Moisture contents obtained from laboratory testing varied from 19.5% to 20%.

Borehole A2 was terminated in a clayey silt stratum underlying the silty sand layer. It contains a trace of sand and is grey in colour. The silty clay is very stiff in consistency as evidenced by a single N value of 23. The following soil properties were observed from laboratory testing:

| | |
|---|---|
| Moisture Content (w) | 19.5% |
| Plastic Limit ($w_p$) | 15.0% |
| Liquid Limit ($w_L$) | 19.0% |
| Unit Weight ($\gamma$) | 20.9 kN/m$^3$ |

The following groundwater levels were measured in the open boreholes following completion:

| Borehole | Groundwater Elevation | Depth below O.G. |
|---|---|---|
| A1 | 425.7 | 0.0 m |
| A2 | 425.2 | 1.2 m |
| 3 | 425.8 | 0.3 m |

***Fill Area*** ***Sta 16+350 to Sta 16+390, Left*** ***Borehole 4***

The proposed fill area was investigated by the hydrogeological and the regional geotechnical studies. Borehole 4 of the hydrogeological investigation was advanced at approximate Sta 16+360 and the subsurface conditions observed in this area are similar to those identified in borehole A2. An organic deposit of very soft to soft peat extends to an approximate depth of 3.5 m or El. 422.2. The peat overlies a thin stratum of very loose marl 0.5 m thick. A clayey silt deposit was encountered beneath the marl at El. 421.6. Boring was terminated in this deposit. Groundwater in BH 4 was recorded within 2 m of ground surface or El. 423.9.

***Swamp Crossing*** ***Sta 16+725 to Sta 16+760, Right*** ***Boreholes B1 and B2***

Two boreholes were advanced to determine the extent of the peat deposit. At borehole B1, in the vicinity of the south end of culvert C-5, a surficial deposit of silty sand fill material, 1.4 m thick, overlies the peat. The fill material is non-cohesive and contains traces of gravel and organics. N values of 3 and 5 were observed indicating that the fill is in a very loose state of compaction.

The peat deposit along this site ranges in thickness from 3.5 to 3.7 m. It was encountered at El. 417.7 near Sta 16+725 (BH B1) and El. 419.2 at Sta 16+270 (BH B2) and extended to

El. 414.2 (BH B1) and El. 415.5 (BH B2). It contains traces of sand and gravel and is black in colour. The deposit has a consistency that varies from very soft to soft as evidenced by N values of 1 to 4. Laboratory testing revealed natural moisture contents of 193.5% and 208.7%. Organic contents of 17.2% and 57.2% were also measured.

A deposit of sand to silty sand underlies the peat at a depth of 4.9 m in BH 1. Both borings were terminated in this stratum. The non-cohesive deposit contains traces of gravel and organics, and occasional clayey silt zones. N values range from 5 to 19 indicating that the sand to silty sand is has a relative denseness of loose to compact. Natural moisture contents of the deposit vary from 15.5% to 24%.

The groundwater level was not established at this location, but is expected to be present within 1 m of the ground surface.

***Culvert C-5 at Sta 16+723*** ***Boreholes B1 and C5***

The subsurface conditions at culvert C-5 are reflected in borehole B1 on the south side and borehole C5 on the north side. Peat is present at both the north and south ends of the culvert. At the south end, a 1.4 m thick surficial deposit of silty sand fill material overlies 3.5 m of peat. The peat extends from El. 417.7 to El. 414.2. At the north end, peat is the surficial deposit and extends for a thickness of 2.1 m (El. 414.4).

The peat deposit is underlain by silty sand at the south end and by a number of varied strata at the north end of the culvert.

The groundwater levels were not established during the investigation. It is presumed that the water table is present at the elevation of the stream at the inlet and outlet of the culvert.

***Culvert C-6 at Sta 18+094*** ***Borehole C6***

A borehole was advanced at the south end of culvert C-6. In the vicinity of the culvert inlet, a surficial deposit of silt was encountered. The silt deposit contains traces of sand and organics. The stratum extends for a depth of 1.1 m (El. 413.4). An N value of 5 was recorded indicating that the silt is in a loose state of compaction. A glacial deposit consisting of a heterogeneous mixture of gravel, sand and silt underlies the silt deposit. The glacial till is non-cohesive and in a very dense state as exhibited by N values exceeding 120 blows per 30 cm. The borehole was terminated at a depth of 2.6 m where auger refusal was experienced.

The groundwater level was recorded at El. 414.4.

## DISCUSSION

The proposed reconstruction of Highway 9 includes widening of existing fill slopes. Because of property constraints at some locations, conventional embankment construction can not be carried out and retained soil system (RSS) walls/slopes are proposed. Foundation recommendations are provided for the following:

1. Embankment widening between Sta 16+205 and Sta 16+275 left, along with RSS requirements between Sta 16+170 to Sta 16+270, left of Highway 9 (RSS No. 2).
2. Embankment widening and RSS requirements between Sta 16+350 to Sta 16+390, north side (RSS No. 3)
3. Swamp treatment between Sta 16+725 to Sta 16+760, south side
4. Culvert C-5 RSS wing walls - both south and north sides
5. Culvert C-6 RSS wing walls - south side.

## RECOMMENDATIONS

**Swamp Treatment: Sta 16+205 to Sta 275, Left**
**RSS No. 2: Sta 16+170 to Sta 16+270, Left**

A request was made by the Central Region, Geotechnical Section to investigate and provide foundation recommendations for a swamp area identified between Sta 16+205 an 16+275, left. Subsequent to the request, the embankment design incorporated an RSS wall/slope between Sta 16+170 and 16+270 as a result of property constraints. The foundation recommendations are intended to deal with both the presence of the swamp and the proposed 100 m long RSS wall/slope.

The height of the existing and proposed embankment is in the order of 3m. The proposed elevation of Highway 9 is approximately 428.2 and the base of embankment elevation is 425.5±.

The subsurface material in the vicinity consists of as much as 9.1m of soft peat and marl. During the subsurface investigation, the drill rig could not advance further west than Sta 16+250 because the wet ground would not support it. Even the weight of a person was too great at Sta 16+200, for sinking 0.3 m into the peat was experienced. These are examples of how soft the ground is at this site and the conditions that will be encountered during construction.

Data obtained from borings advanced by the Geotechnical Section revealed that some organic material is still present beneath the existing embankment. It is likely that the roadway has been used for decades and most or all of the settlement has been realized.

Global slope stability and settlement are the foundation concerns. A slope stability analysis that incorporates the addition of new fill at the site assuming a conventional widening, is

shown in Figure 1. A safety factor of only 1.0 was calculated. Because there is a considerable depth of organics (4.1m), 3.0 m of fill placed directly on the peat will result in settlement of at least 0.5 m and probably in the order of 1m. The compressibility of the peat and the presence of up to 5 m of marl will affect the performance of the embankment and if not constructed properly will result in continual maintenance problems for many years. The widening will be tied into the existing embankment and any settlement of the new embankment will cause longitudinal cracking of the pavement and jeopardize the performance of the existing embankment. Hence, it is imperative that the widening be designed and constructed properly to ensure that the existing embankment is not destabilized.

The following alternatives for embankment construction are presented along with the anticipated risks, benefits and shortcomings. The highway widening at this location is constrained by property and environmental considerations. Its long term performance depends on selecting a solution that may not satisfy all criteria. It should be noted that the worst conditions exist between approximate Sta 16+200 and Sta 16+250. Beyond these limits, excavation of the peat could be carried out by conventional means and the RSS slope constructed without any special treatment.

*Alternative 1: Full Replacement*

The following alternative will result in an embankment that is stable and will experience the least post-construction settlement. All excavation and embankment construction will take place within the property limits and pre-loading is not required.

Excavation of the poor soils can occur within a trench excavation using sheet piles driven or vibrated below the peat and marl into the silty sand deposit. A longitudinal wall of sheet piles driven within 1 m of the property line and another wall driven halfway up the existing embankment would create the limits of the trench approximately 6 m wide, as sketched in Figure 2. The piles should be driven to sufficient depth to ensure the basal stability of the trench. Excavation of the subsurface material should be carried out between the sheet pile walls to the bottom of the marl deposit. Bracing of the sheet piles at the top would be required to maintain the stability of the walls of the trench as the excavation progresses. Crushed stone or rockfill, 150 mm maximum size, is recommended to fill the excavation since it does not require compaction. It may be necessary to excavate and place the fill almost concurrently to ensure that material from outside the trench does not slough in. The sheet piles should be kept in place. If removed, the backfill material would tend to displace the soft subsurface material in the adjacent property.

Crushed rock or rockfill is recommended to elevation 425 or the base elevation of the embankment, above which a retaining system may be constructed using conventional fill. An RSS slope or wall may be used. Alternatively, the rock fill may be used as the embankment widening material as it maintains a slope of 1.25:1V.

It is expected that the trench excavation proposed would be less disruptive to the surroundings than an oversize excavation as well as being safer from a construction perspective.

*Alternative 2: Partial Excavation and Surcharging*

This alternative proposes to displace only the peat using excavation as shown in Figure 3. It would require a temporary limited interest in order that the limits of the excavation are compatible with the geometry of the new embankment, i.e. removal of the organics where the embankment loading will be concentrated. The resulting excavation would extend onto adjacent property by 3 m. The presence of peat at the base of the embankment creates a global instability, hence its removal is required.

The slopes of the excavation should be constructed as steeply as possible, but it is anticipated to require a slope of at least 1H:1V. The slopes of the existing embankment require a slighter flatter slope for stability reasons. Because of the saturated condition of the peat, the displacement and replacement operations would have to be carried out concurrently in order to minimize any sloughing. The excavation and backfilling operation should be carried out in controlled strips perpendicular to the embankment.

The fill below El. 425, or base of embankment elevation, should consist of crushed stone or rock fill. Above this, granular material should be used to construct a surcharge that extends to a height of 2 m above the final profile elevation. Although a period of one year would be most beneficial for the surcharge to remain in place, a period of three to six months is acceptable. The fill above the base of embankment elevation should be placed at a rate of 1.0m maximum per week in order to avoid any slope failure.

Once pre-loading is complete, the surcharge should be removed to the geometry required to accommodate a RSS slope. A RSS wall is not recommended because of the point loading created by the wall facing. Consideration should be given to the use of a lightweight fill material in the embankment widening such as blast furnace slag or polystyrene.

Post-construction settlements are expected to continue for some time after completion (up to two years). It is anticipated that they would be limited to less than 150 mm. A more accurate value will be calculated upon selection of the preferred alternative.

*Alternative 3: Base Reinforcement and Lightweight Fill*

The use of base reinforcement is a more recent technology, first tried on an MTO contract at a widening project on Highway 69 in 1992. Base reinforcement is a proprietary design from a RSS company. It requires minimal excavation as geosynthetic grid is used to create an essentially floating embankment (refer to Figure 4). However, substantial settlements still occur. The embankment at Highway 69 experience 0.8 m of settlement within a period of six months. In addition, final paving operations were deferred for one year following its construction.

A surcharge should be placed in order to realize greater magnitudes of settlement. The use of vertical wick drains could also be considered with the base reinforcement option to accelerate settlement. The use of a lightweight fill such as polystyrene for the embankment

widening is also recommended.

In this alternative, since time is the key to the performance of the embankment, delaying the opening of the truck climbing lane would be required.

For all alternatives, the paving operation should be delayed for as long as possible to allow for readjustment of the fill and post construction settlement.

**RSS No. 3: Sta 16+350 to Sta 16+390, Left** (2A).

It is proposed to construct a RSS wall to accommodate the embankment widening on the north side of Highway 9 between Sta 16+350 to Sta 16+390. The embankment height is in the order of 2.5 m, with profile grade at approximate El. 427 and base of embankment elevation at 424.5.

Based on the information obtained in BH A2 and BH 4, an organic peat deposit extends to a depth of approximately 3.0 m to 3.5 m. It is recommended that the peat deposit be sub-excavated to approximate El. 423.0 to 423.5, or to a depth of 3.0 m.

The slopes of the excavation should be maintained as steeply as possible, but not steeper than 1H:1V to allow for removal of the maximum amount of organics. The excavation and backfilling should be carried out concurrently in order to minimize any sloughing. Alternatively, strip excavation perpendicular to the embankment could be used. The excavated strips, 5 m in width, would be removed with concurrent placement of suitable backfill, preferably crushed stone.

Once backfilling has reached the base of embankment elevation, the RSS wall or slope be incorporated in the embankment widening,

**Swamp treatment at Sta 16+725 to Sta 16+760, south side**

Boreholes B1 and B2 revealed an extensive deposit of peat between Sta 16+275 and Sta 16+760. At this location, the proposed profile elevation of Highway 9 is 419.8 and the base of embankment elevation is 419.1, giving an embankment height of less than one metre.

At this site, the performance of the embankment will be affected by the presence of the underlying peat deposit. The peat deposit ranges in thickness from 3.5 m at the west end to 3.7 m at the east end. It is recommended that either full sub-excavation and replacement be carried out or partial displacement and replacement of the organic material take place. Full replacement would require that the peat be removed to El. 415, and replaced with crushed stone or rockfill. This would require an excavation of up to 4.5 m.

Alternatively, partial displacement can be accomplished by subexcavating the peat to El. 416 at Sta 16+725 and progressing to El. 417 at Sta 16+760. In this way, the excavation of the peat is limited to a depth of 3.0 m. Backfilling with rock fill or crushed stone to the base of

the embankment elevation would result in the displacement and compression of the remaining peat. At this location the embankment could be constructed to the proposed profile elevation using conventional fill material. The paving operation should be delayed as long as three months in order to allow some time for the rearrangement of the rockfill and for any immediate post-construction settlement. Subsequently, additional fill could be placed as required prior to paving.

**Culvert C-5: RSS Wingwalls at Inlet and Outlet**

It is proposed to construct RSS wing walls at the inlet and outlet of the existing culvert in order that extensions to the culvert need not be required.

Borehole B2, advanced near the inlet of culvert C-5 contains a deposit of peat that extends to El. 414. The swamp treatment proposed along Sta 16+725 to Sta 16+760 should be extended to include the wingwalls of the culvert so that an appropriate founding material be provided for the RSS wingwalls. This will require the construction of a cofferdam adjacent to the culvert on each side so that disturbance to the existing stream is minimized and to allow the construction of the wingwalls.

In the borehole advanced at the north end of culvert C-5, a peat deposit was encountered from ground surface to an elevation of 414.4, or a depth of 2.1 m. The peat deposit should be removed for the plan limits required for the wingwalls and replaced with suitable granular material. Again, to assist in construction of the wingwalls, cofferdams may be required on either side of the culvert.

**Culvert C-6: RSS Wingwalls at Inlet**

RSS wing walls have been proposed at the south end of culvert C-6. Auger refusal was encountered at three separate locations in the vicinity of C6. A very dense deposit of glacial till is present at El. 413.4. RSS walls for the wing walls may be founded on the glacial till.

**General Recommendations for RSS Walls/Slopes**

The designer is referred to DSM Item 9.70.55 Retained Soil Systems (RSS) which lists the approved proprietary systems. For this project, a reinforced vertical/terraced wall meeting the minimum requirements for a low performance and appearance is the preferred geometry.

Prior to placement of the fill where sub-excavation or base treatment has not been carried out, all surficial organic material should be removed. Any necessary proof-rolling or foundation preparation should be carried out prior to placement of retaining system elements. Any soft areas identified by proof-rolling should be sub-excavated and replaced with suitable backfill. Suitable backfill does not include silt. At these locations, temporary excavations should be inclined at 1.5H:1V or flatter.

Fill placed on existing embankments should be keyed into the existing fill. Topsoil and slope vegetation should be established as soon as possible after filling and grading to control surficial erosion. Where RSS slopes are used, some means of slope erosion control such as geocells are recommended to maintain the integrity of the slope and encourage vegetative growth.

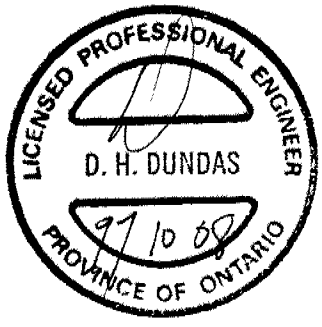
**General Recommendations for Construction**

Utilities, both overhead and underground are present at the excavation locations. Means of re-routing or supporting the lines during construction should be considered.

**Miscellaneous**

The fieldwork for this investigation was carried out between July 29 and August 18, 1997 under the supervision of A. Gibson, Engineering Student. The report was prepared by B. Bennett, Foundation Engineer and was reviewed by D. Dundas, Senior Foundation Engineer.


Betty Bennett, P.Eng.
Foundation Engineer




David Dundas, P.Eng.
Sr. Foundation Engineer

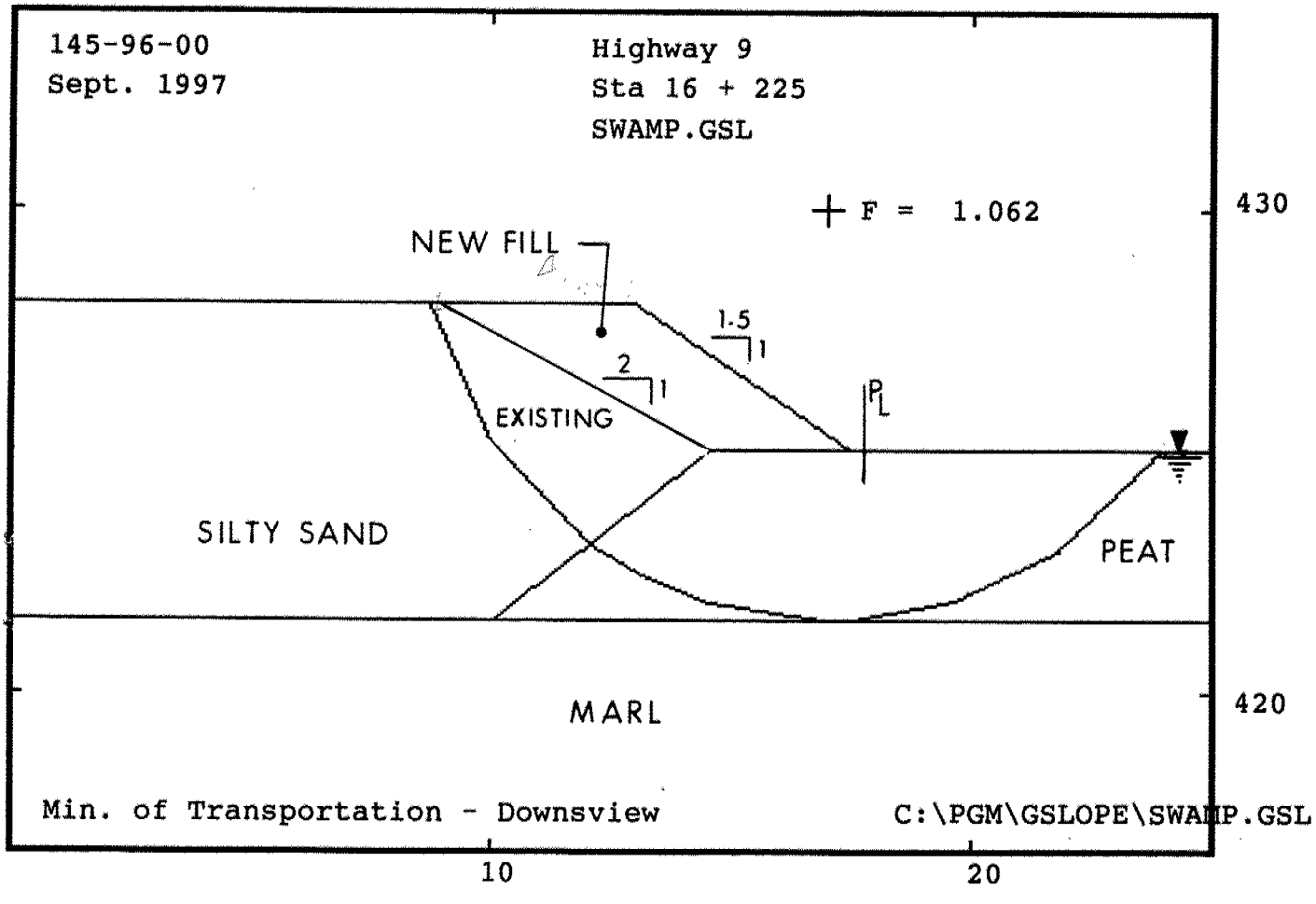
# APPENDIX

Results are for Bishop's Modified Method unless otherwise noted.

File C:\PGM\GSLOPE\SWAMP.GSL  Output dated 09-25-1997 at 11:38:09

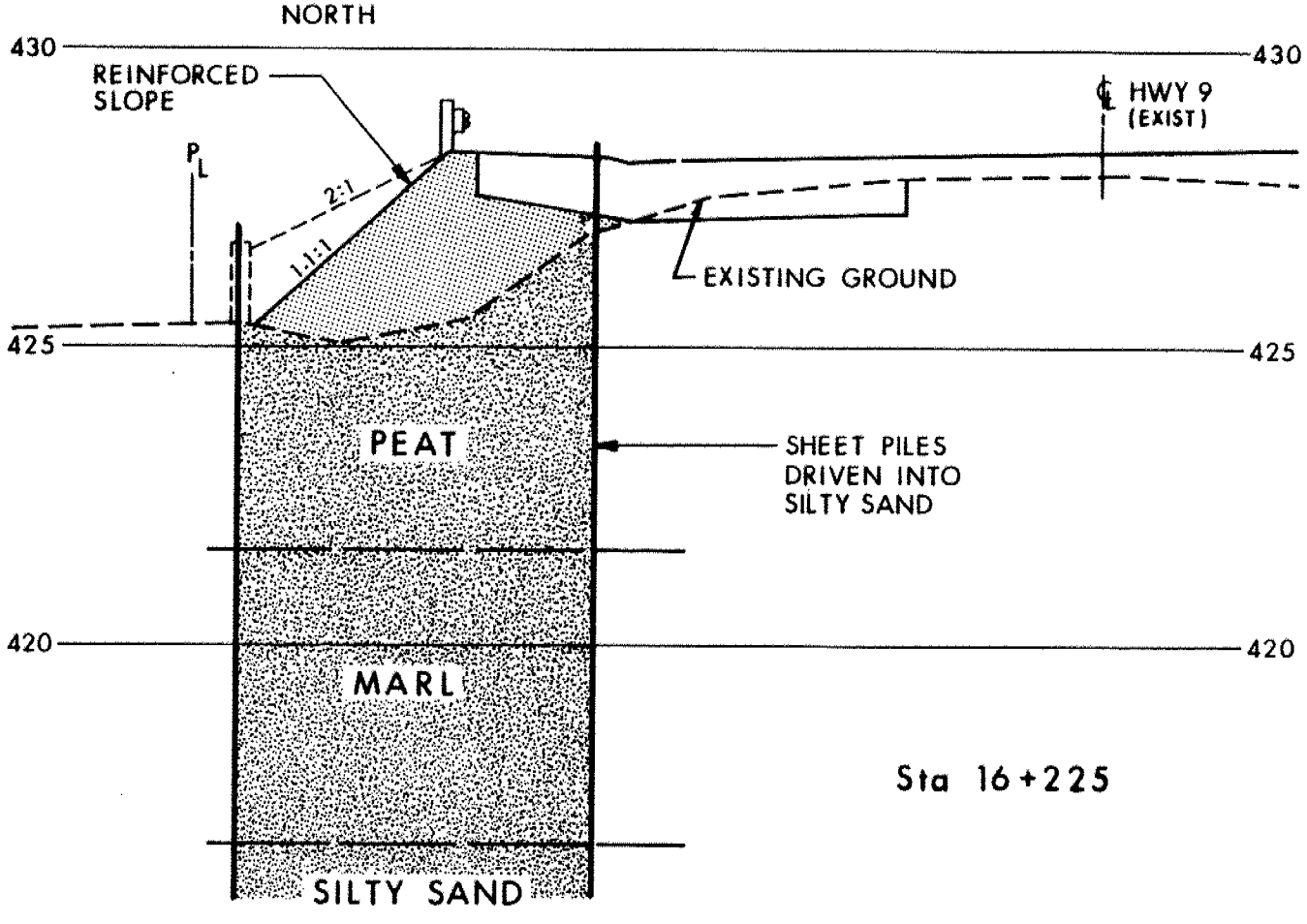
| Material | Unit Wt | Cohesion | Friction Angle | Piezo Surface | Ru Value |
|---|---|---|---|---|---|
| # 1 -Silty Sand Fill | 23 | 0 | 30 | 0 | 0 |
| # 2 -Peat | 12 | 10 | 0 | 1 | 0 |
| # 3 -Marl | 13 | 15 | 0 | 1 | 0 |
| # 4 -Silty Sand | 20 | 0 | 28 | 1 | 0 |

| X-centre | Y-centre | Radius | Factor of Safety | Iterations | Slices | M Alpha Warnings |
|---|---|---|---|---|---|---|
| 17.00 | 430.00 | 8.50 | 1.0623 | 5 | 10 | 0 |




There are no explicit external forces in the data set.

Fig - 1

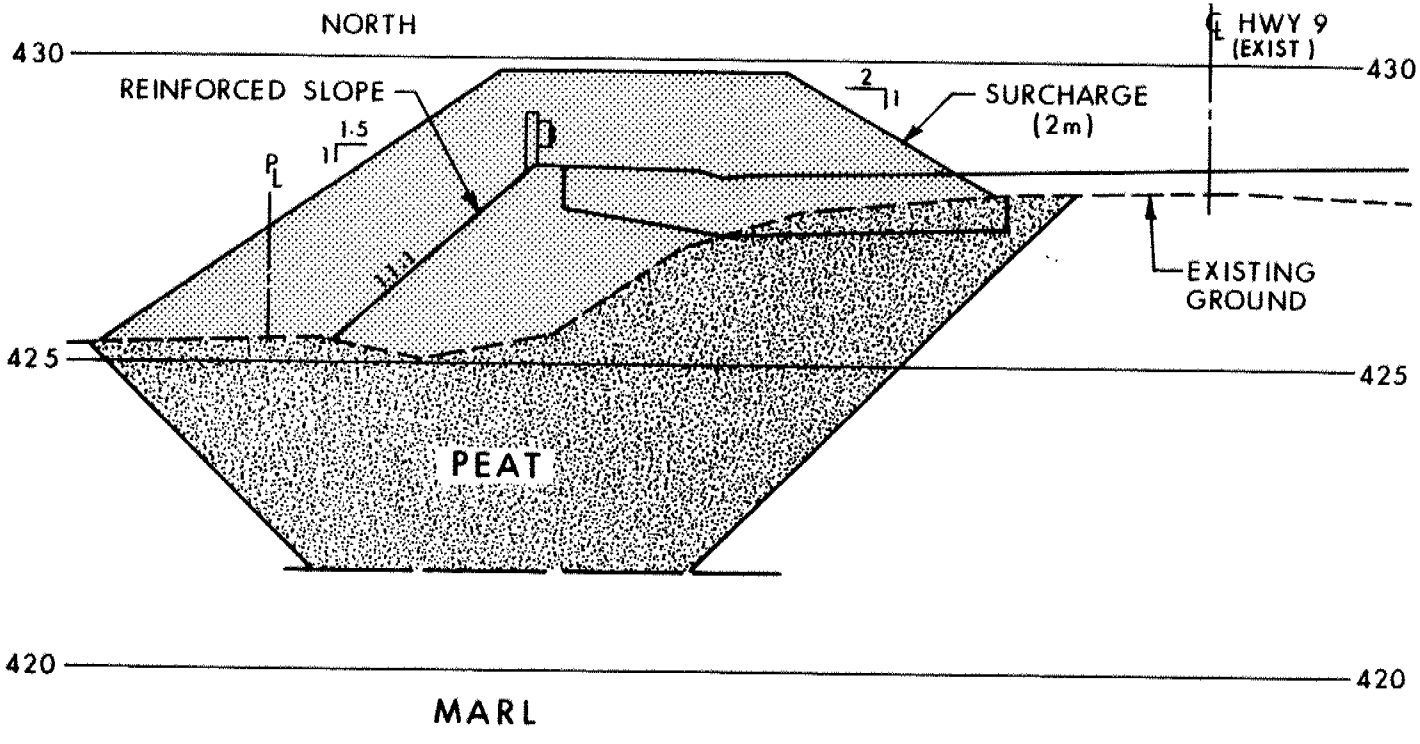



## ALTERNATIVE - 1 : FULL REPLACEMENT

SCALE

4m 0 4m

Fig - 2
WP 145-96-00




Sta 16+225

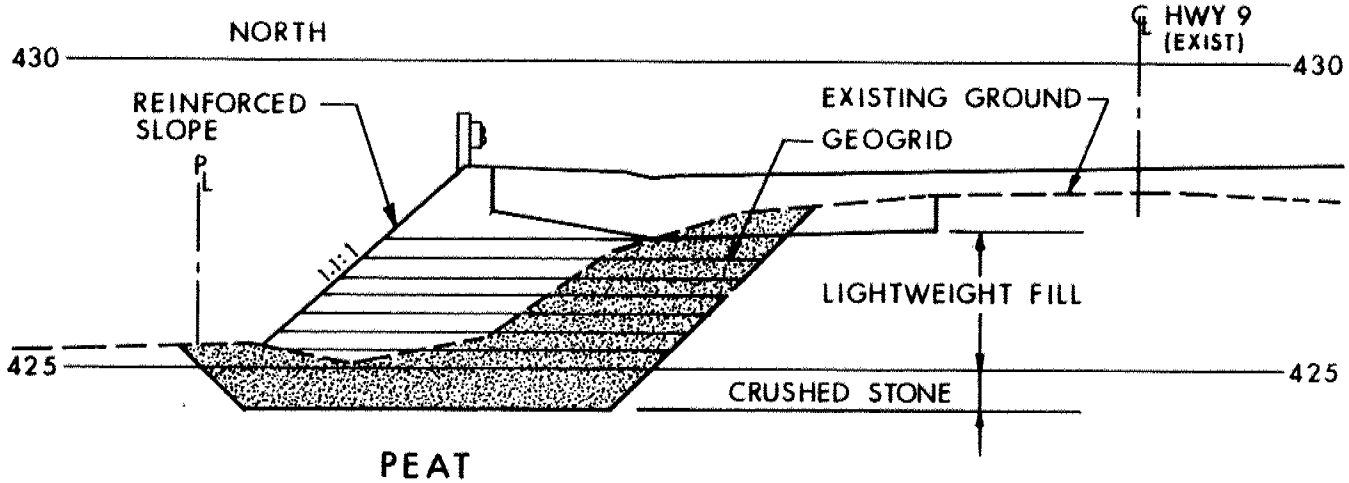
SILTY SAND

## ALTERNATIVE -2 : PARTIAL EXCAVATION & SURCHARGING

SCALE

4m 0 4m

Fig - 3
WP 145-96-00




Sta 16+225

SILTY SAND

## ALTERNATIVE - 3 : BASE REINFORCEMENT

SCALE

4m 0 4m

Fig - 4
WP 145-96-00

# RECORD OF BOREHOLE No A1 1 OF 1 METRIC

W.P. 145-96-00 LOCATION N 4 866 516.1 E 264 148.8 ORIGINATED BY AMG

DIST CR HWY 9 BOREHOLE TYPE SS Auger COMPILED BY BB

DATUM Geodetic DATE 97 07 29 CHECKED BY BB

| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | TYPE | 'N' VALUES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) | PLASTIC LIMIT $w_P$ / NATURAL MOISTURE CONTENT $w$ / LIQUID LIMIT $w_L$ / WATER CONTENT (%) | UNIT WEIGHT $\gamma$ kN/m³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 425.7 | Ground Surface | | | | | | | 20 40 60 80 100 | 10 20 30 | | |
| 0.0 | PEAT<br>Occasional zones/bands of grey silty sand Trace Gravel<br>Black<br>Very Soft to Firm | | 1 | SS | 2 | | 425 | | | | |
| | | | 2 | SS | 2 | | | | w=64 | | 9.5% org |
| | | | 3 | SS | 4 | | | | | | |
| | | | 4 | SS | 5 | | 423 | | | | |
| | | | 5 | SS | 5 | | | | | | |
| 421.6 | | | 6 | SS | 2 | | | | | | |
| 4.1 | Fibrous zones<br>MARL<br>Trace Sand<br>Very Loose | | 7 | SS | 1 | | 421 | | w=127 | | 0 1 (99) |
| | | | 8 | SS | 0 | | | | | | |
| | Increasing sand with depth | | 9 | SS | 0 | | | | w=117 | | 0 20 (80) |
| 416.6 | | | | | | | 419 | | | | |
| 9.1 | Silty Clay zone Trace Organics<br>SILTY SAND<br>Trace Gravel<br>Loose to Compact | | 10 | SS | 11 | | 417 | | | | |
| 414.6 | | | 11 | SS | 6 | | 415 | | | | 0 79 (21) |
| 11.1 | End of Borehole | | | | | | | | | | |

+3, ·5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No A2 1 OF 1 METRIC

W.P. 145-96-00 LOCATION N 4 866 522.4 E 264 171.0 ORIGINATED BY AMC

DIST CR HWY 9 BOREHOLE TYPE HS Auger COMPILED BY BB

DATUM Geodetic DATE 97 07 29 CHECKED BY BB

| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES 'N' VALUES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) | PLASTIC LIMIT $w_P$ / NATURAL MOISTURE CONTENT $w$ / LIQUID LIMIT $w_L$ — WATER CONTENT (%) | UNIT WEIGHT $\gamma$ kN/m³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 426.4 | Ground Surface | | | | | | | 20 40 60 80 100 | 10 20 30 | | |
| 0.0 | PEAT<br>Trace Sand<br>Trace Silt<br>Dark Brown to Black<br>Very Soft to Soft | | 1 | SS | 4 | | 426 | | | | |
| | | | 2 | SS | 4 | ▼ | | | | | |
| | | | 3 | SS | 3 | | | | w=143.5 | | 27% org |
| 423.5 | | | 4 | SS | 2 | | 424 | | | | |
| 2.9 | MARL<br>Trace Sand<br>Beige<br>Very Loose | | 5 | SS | 1 | | | | 40.5<br>w=76 | | 3 13 77 7 |
| 422.4 | | | | | | | 422 | | | | |
| 4.0 | SILTY SAND<br>Trace Gravel<br>Grey<br>Loose | | 6 | SS | 5 | | | | o | | 14 57 (29) |
| | | | 7 | SS | 5 | | 420 | | | | |
| | | | 8 | SS | 6 | | | | | | |
| 418.0 | | | | | | | 418 | | | | |
| 8.4 | CLAYEY SILT<br>Trace Sand<br>Very Stiff | | 9 | SS | 23 | | | | ⊢p | 20.9 | 0 6 (94) |
| 416.8 | | | | | | | | | | | |
| 9.6 | End of Borehole | | | | | | | | | | |

+3, ×5 : Numbers refer to Sensitivity

15 (20 / 10) 5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No B1 1 OF 1 METRIC

W.P. 145-96-00 LOCATION N 4 866 626.0 E 264 616.3 ORIGINATED BY AMG

DIST CR HWY 9 BOREHOLE TYPE SS Auger COMPILED BY BB

DATUM Geodetic DATE 97 06 30 CHECKED BY BB

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) | PLASTIC LIMIT $w_P$ / NATURAL MOISTURE CONTENT $w$ / LIQUID LIMIT $w_L$ — WATER CONTENT (%) | UNIT WEIGHT $\gamma$ kN/m³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | 20 40 60 80 100 | 10 20 30 | | GR SA SI CL |
| 410.1 Ground Surface | | | | | | | | | | | |
| 0.0 | SILTY SAND<br>Trace Gravel<br>Trace Organics<br>Very Loose | | 1 | SS | 5 | * | | | | | |
| 417.7 | (Fill Material) | | 2 | SS | 3 | | 418 | | o | | 6 63 (31) |
| 1.4 | PEAT<br>Trace Gravel<br>Trace Sand<br>Black<br>Very Soft | | 3 | SS | 3 | | | | | | |
| | | | 4 | SS | 1 | | | | | | |
| | | | 5 | SS | 2 | | 416 | | w=193.5 | | 17.2% org |
| | | | 6 | SS | 2 | | | | | | |
| 414.2 | | | 7 | SS | 4 | | | | | | |
| 4.9 | SAND to SILTY SAND<br>Trace Gravel<br>Occasional Clayey Silt zones<br>Loose to Compact | | 8 | SS | 12 | | 414 | | o | | 7 80 11 2 |
| | | | 9 | SS | 10 | | | | | | |
| | | | 10 | SS | 8 | | 412 | | | | |
| | | | 11 | SS | 19 | | 410 | | o | | 4 84 (12) |
| 408.0 | | | 12 | SS | 11 | | | | | | |
| 11.1 | End of Borehole | | | | | | 408 | | | | |

* Water level not established

+3, v5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No B2 1 OF 1 METRIC

W.P. 145-96-00 LOCATION N 4 866 635.0 E 264 647.0 ORIGINATED BY AMG

DIST CR HWY 9 BOREHOLE TYPE SS Auger COMPILED BY BB

DATUM Geodetic DATE 97 07 30 CHECKED BY BB

| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES 'N' VALUES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE (20 40 60 80 100) | PLASTIC LIMIT $w_P$ / NATURAL MOISTURE CONTENT $w$ / LIQUID LIMIT $w_L$ WATER CONTENT (%) (10 20 30) | UNIT WEIGHT $\gamma$ kN/m³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 419.2 | Ground Surface | | | | | | | | | | |
| 0.0 | PEAT<br>Trace Sand<br>Black<br>Very Soft to Soft | | 1 | SS | 3 | * | 418 | | | | 57.2% org |
| | | | 2 | SS | 3 | | | | | | |
| | | | 3 | SS | 4 | | | | | | |
| | | | 4 | SS | 2 | | | | w=208.7 | | |
| 415.5 | | | 5 | SS | 1 | | 416 | | | | |
| 3.7 | Trace Organics<br>SILTY SAND<br>Trace Gravel<br>Loose | | 6 | SS | 8 | | | | ‖ o | | 7 28 (65) |
| | | | 7 | SS | 5 | | 414 | | | | |
| | | | 8 | SS | 6 | | | | o | | 11 63 22 4 |
| 412.6 | | | 9 | SS | 7 | | | | | | |
| 6.6 | End of Borehole | | | | | | | | | | |

* Water level not established

+3, 5 Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No C5 1 OF 1 METRIC

W.P. 145-96-00 LOCATION N 4 866 658.0 E 264 603.0 ORIGINATED BY AMG
DIST CR HWY 9 BOREHOLE TYPE SS Auger COMPILED BY BB
DATUM Geodetic DATE 97 08 18 CHECKED BY BB

| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES 'N' VALUES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100 | PLASTIC LIMIT $w_P$ / NATURAL MOISTURE CONTENT $w$ / LIQUID LIMIT $w_L$ WATER CONTENT (%) 10 20 30 | UNIT WEIGHT $\gamma$ kN/m³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 416.5 | Ground Surface | | | | | | | | | | |
| 0.0 | PEAT<br>Occasional silty sand zones<br>Occasional wood fragments<br>Black<br>Very Loose to Loose | | 1 | SS | 3 | * | 416 | | ○ | | 0 48 (52) |
| 414.4 | | | 2 | SS | 9 | | | | | | |
| 2.1 | SILT<br>Compact | | 3 | SS | 14 | | 414 | | ○ | | 0 2 83 15 |
| 413.6 | | | | | | | | | | | |
| 2.9 | HETEROGENEOUS MIXTURE OF GRAVEL, SAND AND SILT<br>Trace Organics<br>Compact | | 4 | SS | 19 | | | | | | |
| 412.8 | | | | | | | | | | | |
| 3.7 | CLAYEY SILT<br>interbedded with SILT<br>Red Brown to Grey<br>Firm to Very Stiff | | 5 | SS | 5 | | 412 | | ○ | | 0 2 (98) |
| | | | 6 | SS | 17 | | | | | | |
| | | | 7 | SS | 12 | | | | | | |
| | | | 8 | SS | 11 | | 410 | | | | |
| | Trace Gravel<br>Trace Sand | | 9 | SS | 4 | | | | | | |
| 408.1 | | | | | | | | | | | |
| 8.4 | SILTY SAND<br>Trace Gravel<br>Very Loose to Compact | | 10 | SS | 4 | | 408 | | ○ | | 0 69 (31) |
| 405.4 | | | 11 | SS | 20 | | 406 | | | | |
| 11.1 | End of Borehole<br>* Water level not established | | | | | | | | | | |

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

# RECORD OF BOREHOLE No C6 1 OF 1 METRIC

W.P. 145-96-00 LOCATION N 4 867 031.0 E 265 921.7 ORIGINATED BY AMG

DIST CR HWY 9 BOREHOLE TYPE SS Auger COMPILED BY BB

DATUM Geodetic DATE 97 08 18 CHECKED BY BB

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 | PLASTIC LIMIT $w_P$ / NATURAL MOISTURE CONTENT $w$ / LIQUID LIMIT $w_L$ | UNIT WEIGHT $\gamma$ kN/m³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100 | WATER CONTENT (%) 10 20 30 | | GR SA SI CL |
| 414 Ground Surface | | | | | | | | | | | |
| 0.0 | SILT<br>Trace Sand<br>Trace Organics<br>Loose | | | | | ▽ | 414 | | | | |
| 413.4 | | | 1 | SS | 5 | | | | o | | 1 15 (84) |
| 1.1 | HETEROGENEOUS MIXTURE OF GRAVEL, SAND AND SILT<br>Very Dense | | 2 | SS | 56 | /5cm | | | | | |
| 411.9 | * | | 3 | SS | 50 | /11cm | 412 | | o | | 44 30 (26) |
| 2.6 | End of Borehole | | | | | | | | | | |

* Auger Refusal

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

Project HIGHWAY 9 No.

Date Drilled JULY 30/97 Driller LANTECH

Borehole Location North ditch; near Station 11+200

Drilling Supervised by JH

Drilling Method HSA

Piezometer Details

Type of Pipe 2" PVC TRILOC

Type of Screen 10 SLOT

Borehole No. 3

Piezometer No. 3

Sheet 1 of 1

SS Split Spoon Sample
WA Wash Sample
AU Auger Sample
CN Continuous Sample
RX Rock Core

Piezometer Screen (water level elevation m, Y/M/D)

| Scale (ft.) | Scale (m) | Geological Log Description | Elev. (m GSD) / Depth (m) | Piezometer Details | Sample No. | Sample Type | Blows / 0.3m |
|---|---|---|---|---|---|---|---|
| | | Ground Surface (m GSD) | 426.1 | | | | |
| 1 | | NO SAMPLE | | seal 30/07/97 | | | |
| 2 | | | | | 1 | SS | 6 |
| 3 | 1 | SAND, fine brown, dry, becoming grey, saturated at 1m | | | | | |
| 4 | | SAND, red brown, saturated, grading to | | cuttings | | | |
| 5 | | SILTY SAND to SANDY SILT below 1.6 m | | | 2 | SS | 6 |
| 6 | | | | | | | |
| 7 | 2 | SILT TILL, red-brown, sat. | | | 3 | SS | 9 |
| 8 | | SILTY SAND, becoming SILT, some CLAYEY SILT SEAMS, red-brown; sat. | | | | | |
| 9 | | SILT TILL, brown, saturated | | holeplug | | | |
| 10 | 3 | occ. fine sand partings | | | 4 | SS | 11 |
| 11 | | | | | | | |
| 12 | | SAND, fine to medium, trace silt, brown, saturated. | | sand pack | 5 | SS | 4 |
| 13 | 4 | | | | | | |
| 14 | | | | | | | |
| 15 | | | | | 6 | SS | 6 |
| 16 | | END OF BOREHOLE | | | | | |

Borehole Record

Prepared by

Date

Charlesworth & Associates
CONSULTING HYDROGEOLOGISTS

NOTE: Advanced for Hydrogeological Purposes

Project HIGHWAY 9 No.

Date Drilled JULY 30/97 Driller LANTECH

Borehole Location North ditch : nr. station 15+360 (16)

Drilling Supervised by J.H.

Drilling Method HSA

Piezometer Details

Type of Pipe 2" TRILOC PVC

Type of Screen 10 SLOT

Borehole No. 4

Piezometer No. 4

Sheet 1 of 1

SS Split Spoon Sample
WA Wash Sample
AU Auger Sample
CN Continuous Sample
RX Rock Core

Piezometer Screen (water level elevation m, Y/M/D)

| Scale (ft.) | (m) | Geological Log — Description | Elev. (m GSD) / Depth (m) | Piezometer Details | Sample No. | Sample Type | Blows / 0.3m |
|---|---|---|---|---|---|---|---|
| | | Ground Surface (m GSD) | 425.9 | | | | |
| 1 | | TOPSOIL | | seal | 1 | SS | 8 |
| 2 | | ORGANICS (PEAT) interlayered with SILTY SAND, grey, saturated | | CUTTINGS | 2 | SS | 3 |
| 3 | 1 | | | | | | |
| 4 | | | | holeplug | 3 | SS | 2 |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | 2 | | | 30/07/97 SAND PACK | 4 | SS | 2 |
| 8 | | | | | | | |
| 9 | | | | | | | |
| 10 | 3 | - layers of calcareous silt (marl), shell fragments fine organic material below 2m | | | 5 | SS | 0 |
| 11 | | | | | | | |
| 12 | | | | SAND BACKFILL | 6 | SS | 5 |
| 13 | 4 | CALCAREOUS SILT, grey and cream, sat. (marl) | | | | | |
| 14 | | | | | | | |
| 15 | | CLAYEY SILT TILL, red-brown saturated grading into CLAYEY SILT and SILT varved sat. | | | 7 | SS | 7 |
| 16 | | END OF BOREHOLE | | | | | |

Borehole Record

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Date

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# EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS $\bar{N}$.

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH ($c_u$) AS FOLLOWS:

| $c_u$ (kPa) | 0 - 12 | 12 - 25 | 25 - 50 | 50 - 100 | 100 - 200 | >200 |
|---|---|---|---|---|---|---|
| | *VERY SOFT* | *SOFT* | *FIRM* | *STIFF* | *VERY STIFF* | *HARD* |

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

| N (BLOWS/0.3m) | 0 - 5 | 5 - 10 | 10 - 30 | 30 - 50 | >50 |
|---|---|---|---|---|---|
| | *VERY LOOSE* | *LOOSE* | *COMPACT* | *DENSE* | *VERY DENSE* |

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (R Q D), FOR MODIFIED RECOVERY, IS:

| RQD (%) | 0 - 25 | 25 - 50 | 50 - 75 | 75 - 90 | 90 - 100 |
|---|---|---|---|---|---|
| | *VERY POOR* | *POOR* | *FAIR* | *GOOD* | *EXCELLENT* |

JOINTING AND BEDDING:

| SPACING | 50mm | 50 - 300mm | 0.3m - 1m | 1m - 3m | >3m |
|---|---|---|---|---|---|
| JOINTING | *VERY CLOSE* | *CLOSE* | *MOD. CLOSE* | *WIDE* | *VERY WIDE* |
| BEDDING | *VERY THIN* | *THIN* | *MEDIUM* | *THICK* | *VERY THICK* |

# ABBREVIATIONS AND SYMBOLS

## FIELD SAMPLING

| | | | |
|---|---|---|---|
| S S | SPLIT SPOON | T P | THINWALL PISTON |
| W S | WASH SAMPLE | O S | OSTERBERG SAMPLE |
| S T | SLOTTED TUBE SAMPLE | R C | ROCK CORE |
| B S | BLOCK SAMPLE | P H | T W ADVANCED HYDRAULICALLY |
| C S | CHUNK SAMPLE | P M | T W ADVANCED MANUALLY |
| T W | THINWALL OPEN | F S | FOIL SAMPLE |

## STRESS AND STRAIN

| | | |
|---|---|---|
| $u_w$ | kPa | PORE WATER PRESSURE |
| $r_u$ | 1 | PORE PRESSURE RATIO |
| $\sigma$ | kPa | TOTAL NORMAL STRESS |
| $\sigma'$ | kPa | EFFECTIVE NORMAL STRESS |
| $\tau$ | kPa | SHEAR STRESS |
| $\sigma_1, \sigma_2, \sigma_3$ | kPa | PRINCIPAL STRESSES |
| $\epsilon$ | % | LINEAR STRAIN |
| $\epsilon_1, \epsilon_2, \epsilon_3$ | % | PRINCIPAL STRAINS |
| $E$ | kPa | MODULUS OF LINEAR DEFORMATION |
| $G$ | kPa | MODULUS OF SHEAR DEFORMATION |
| $\mu$ | 1 | COEFFICIENT OF FRICTION |

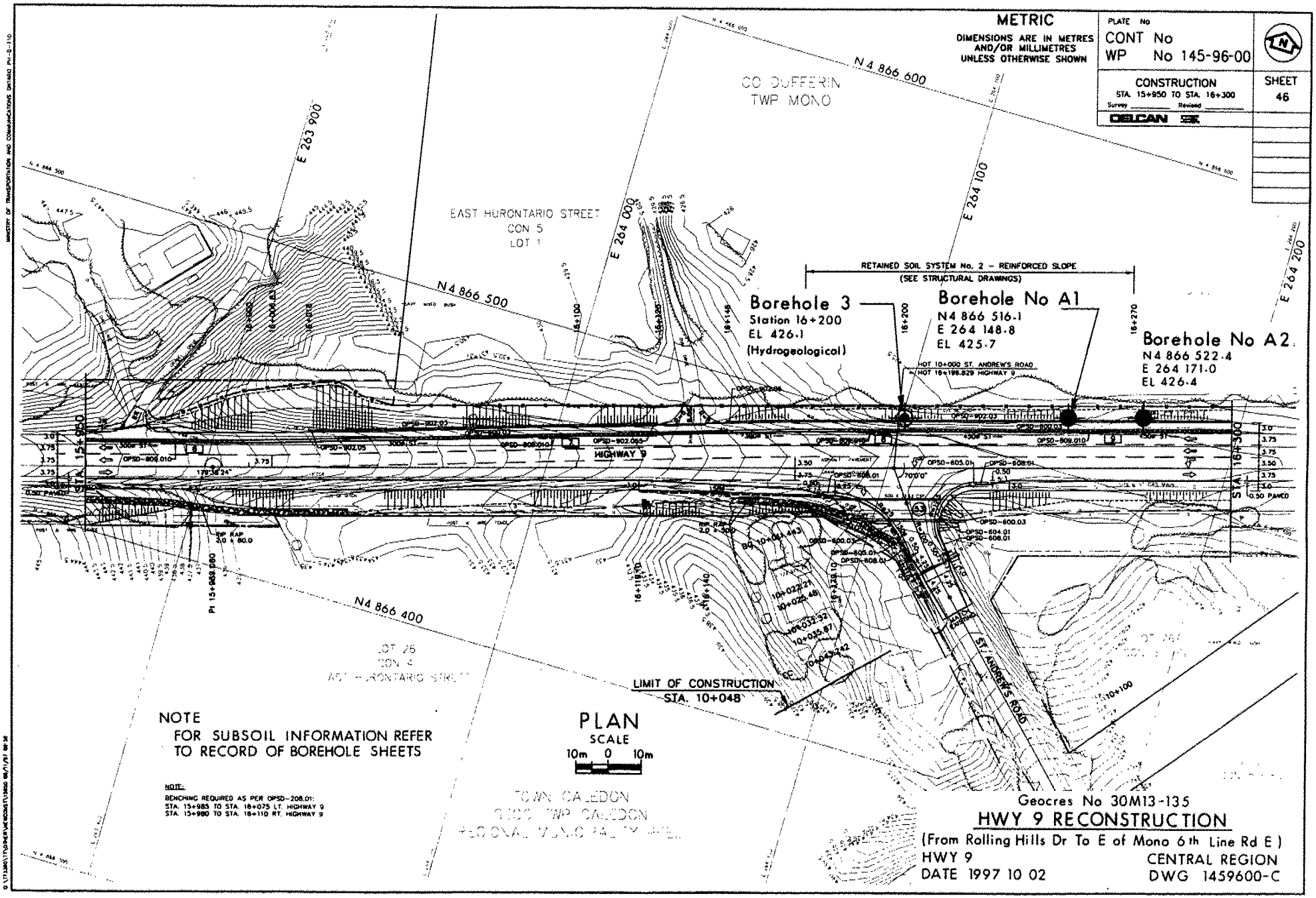
## MECHANICAL PROPERTIES OF SOIL

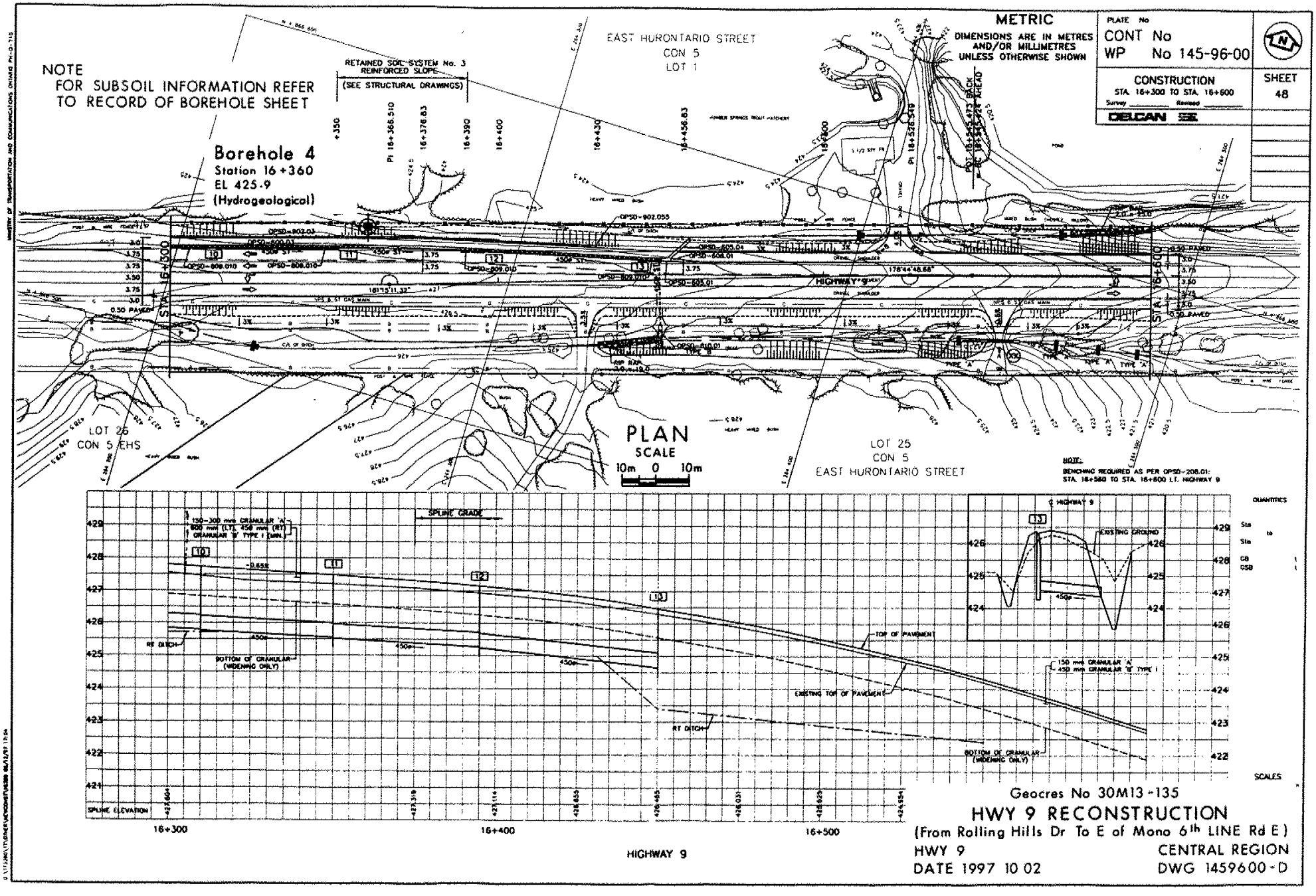
| | | |
|---|---|---|
| $m_v$ | $kPa^{-1}$ | COEFFICIENT OF VOLUME CHANGE |
| $C_c$ | 1 | COMPRESSION INDEX |
| $C_s$ | 1 | SWELLING INDEX |
| $C_\alpha$ | 1 | RATE OF SECONDARY CONSOLIDATION |
| $c_v$ | $m^2/s$ | COEFFICIENT OF CONSOLIDATION |
| $H$ | m | DRAINAGE PATH |
| $T_v$ | 1 | TIME FACTOR |
| $U$ | % | DEGREE OF CONSOLIDATION |
| $\sigma'_{vo}$ | kPa | EFFECTIVE OVERBURDEN PRESSURE |
| $\sigma'_p$ | kPa | PRECONSOLIDATION PRESSURE |
| $\tau_f$ | kPa | SHEAR STRENGTH |
| $c'$ | kPa | EFFECTIVE COHESION INTERCEPT |
| $\phi'$ | -° | EFFECTIVE ANGLE OF INTERNAL FRICTION |
| $c_u$ | kPa | APPARENT COHESION INTERCEPT |
| $\phi_u$ | -° | APPARENT ANGLE OF INTERNAL FRICTION |
| $\tau_R$ | kPa | RESIDUAL SHEAR STRENGTH |
| $\tau_r$ | kPa | REMOULDED SHEAR STRENGTH |
| $S_t$ | 1 | SENSITIVITY = $\frac{c_u}{\tau_r}$ |

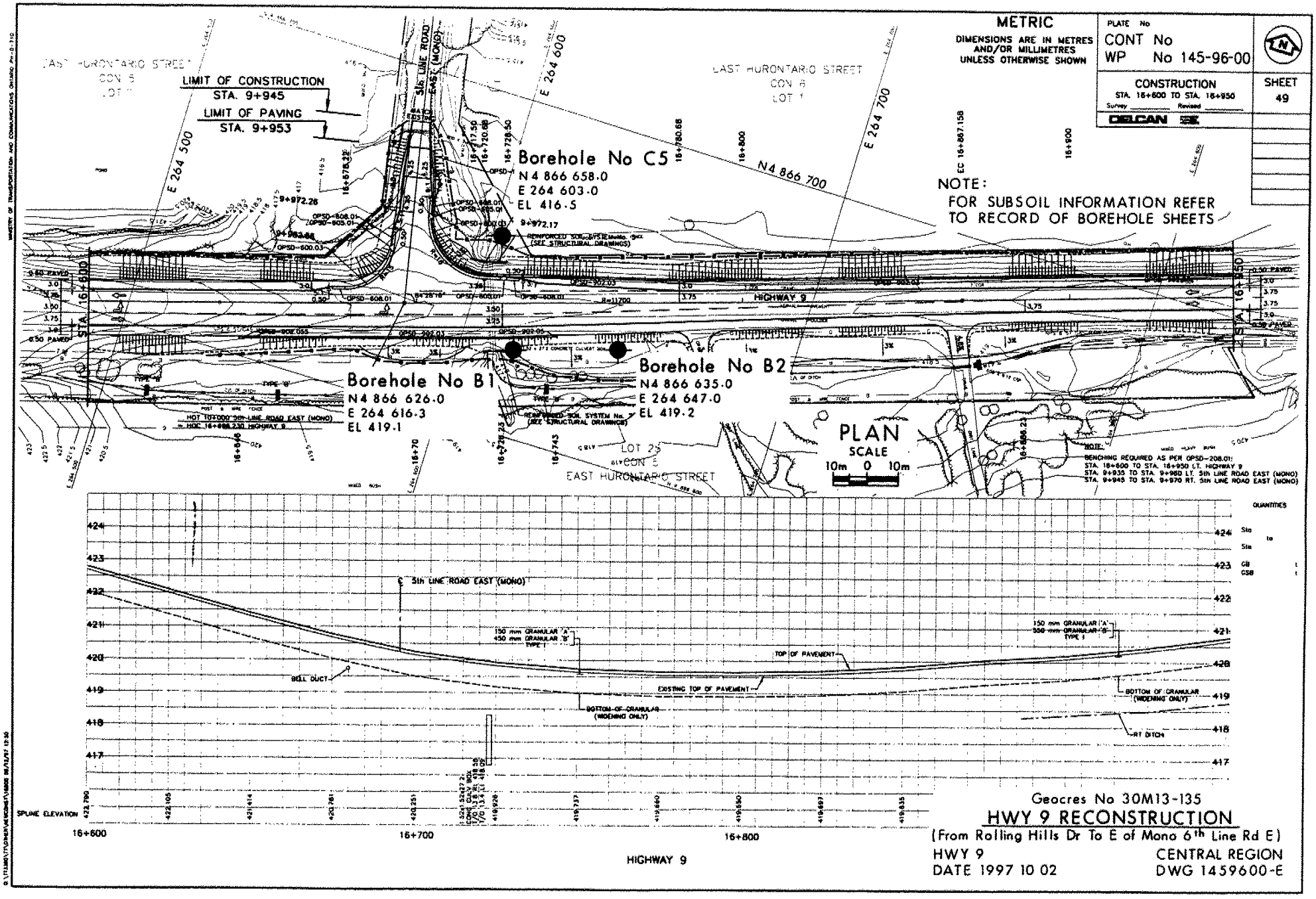
## PHYSICAL PROPERTIES OF SOIL

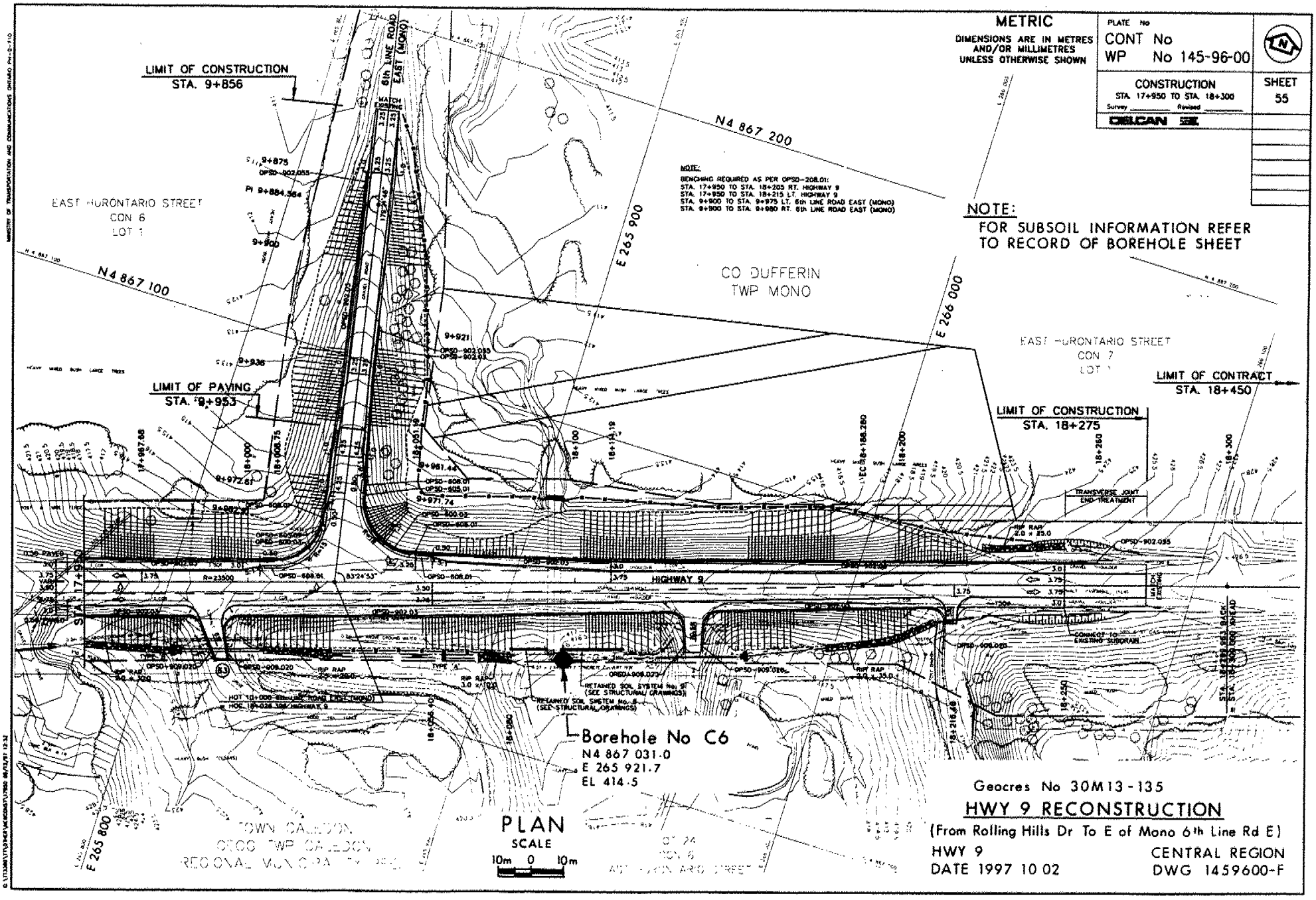
| | | |
|---|---|---|
| $\rho_s$ | $kg/m^3$ | DENSITY OF SOLID PARTICLES |
| $\gamma_s$ | $kN/m^3$ | UNIT WEIGHT OF SOLID PARTICLES |
| $\rho_w$ | $kg/m^3$ | DENSITY OF WATER |
| $\gamma_w$ | $kN/m^3$ | UNIT WEIGHT OF WATER |
| $\rho$ | $kg/m^3$ | DENSITY OF SOIL |
| $\gamma$ | $kN/m^3$ | UNIT WEIGHT OF SOIL |
| $\rho_d$ | $kg/m^3$ | DENSITY OF DRY SOIL |
| $\gamma_d$ | $kN/m^3$ | UNIT WEIGHT OF DRY SOIL |
| $\rho_{sat}$ | $kg/m^3$ | DENSITY OF SATURATED SOIL |
| $\gamma_{sat}$ | $kN/m^3$ | UNIT WEIGHT OF SATURATED SOIL |
| $\rho'$ | $kg/m^3$ | DENSITY OF SUBMERGED SOIL |
| $\gamma'$ | $kN/m^3$ | UNIT WEIGHT OF SUBMERGED SOIL |

| | | |
|---|---|---|
| $e$ | 1, % | VOID RATIO |
| $n$ | 1, % | POROSITY |
| $w$ | 1, % | WATER CONTENT |
| $S_r$ | % | DEGREE OF SATURATION |
| $w_L$ | % | LIQUID LIMIT |
| $w_P$ | % | PLASTIC LIMIT |
| $w_S$ | % | SHRINKAGE LIMIT |
| $I_P$ | % | PLASTICITY INDEX = $w_L - w_P$ |
| $I_L$ | 1 | LIQUIDITY INDEX = $\frac{w - w_P}{I_P}$ |
| $I_C$ | 1 | CONSISTENCY INDEX = $\frac{w_L - w}{I_P}$ |
| $e_{max}$ | 1, % | VOID RATIO IN LOOSEST STATE |
| $e_{min}$ | 1, % | VOID RATIO IN DENSEST STATE |
| $I_D$ | 1 | DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$ |
| $D$ | mm | GRAIN DIAMETER |
| $D_n$ | mm | n PERCENT - DIAMETER |
| $C_U$ | 1 | UNIFORMITY COEFFICIENT |
| $h$ | m | HYDRAULIC HEAD OR POTENTIAL |
| $q$ | $m^3/s$ | RATE OF DISCHARGE |
| $v$ | m/s | DISCHARGE VELOCITY |
| $i$ | 1 | HYDRAULIC GRADIENT |
| $k$ | m/s | HYDRAULIC CONDUCTIVITY |
| $j$ | $kN/m^3$ | SEEPAGE FORCE |


METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
PLATE No
CONT No
WP No 145-96-00
CONSTRUCTION
STA. 15+950 TO STA. 16+300
Survey
Revised
DELCAN
SHEET 46
CO DUFFERIN
TWP MONO
EAST HURONTARIO STREET
CON 5
LOT 1
N4 866 600
N4 866 500
N4 866 400
E 263 900
E 264 000
E 264 100
E 264 200
RETAINED SOIL SYSTEM No. 2 – REINFORCED SLOPE
(SEE STRUCTURAL DRAWINGS)
Borehole 3
Station 16+200
EL 426.1
(Hydrogeological)
Borehole No A1
N4 866 516.1
E 264 148.8
EL 425.7
Borehole No A2
N4 866 522.4
E 264 171.0
EL 426.4
HIGHWAY 9
HOT 10+000 ST. ANDREW'S ROAD
HOT 16+198.829 HIGHWAY 9
ST. ANDREW'S ROAD
LIMIT OF CONSTRUCTION
STA. 10+048
LOT 26
CON 4
EAST HURONTARIO STREET
TOWN CALEDON
FORMER TWP CALEDON
REGIONAL MUNICIPALITY PEEL
STA. 15+900
STA. 16+300
NOTE
FOR SUBSOIL INFORMATION REFER TO RECORD OF BOREHOLE SHEETS
NOTE:
BENCHING REQUIRED AS PER OPSD-208.01:
STA. 15+985 TO STA. 16+075 LT. HIGHWAY 9
STA. 15+980 TO STA. 16+110 RT. HIGHWAY 9
PLAN
SCALE
10m 0 10m
Geocres No 30M13-135
HWY 9 RECONSTRUCTION
(From Rolling Hills Dr To E of Mono 6th Line Rd E)
HWY 9
CENTRAL REGION
DATE 1997 10 02
DWG 1459600-C


METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
PLATE No
CONT No
WP No 145-96-00
CONSTRUCTION
STA. 16+300 TO STA. 16+600
SHEET 48
DELCAN
NOTE
FOR SUBSOIL INFORMATION REFER TO RECORD OF BOREHOLE SHEET
Borehole 4
Station 16+360
EL 425.9
(Hydrogeological)
RETAINED SOIL SYSTEM No. 3 REINFORCED SLOPE
(SEE STRUCTURAL DRAWINGS)
EAST HURONTARIO STREET
CON 5
LOT 1
LOT 25
CON 5
EAST HURONTARIO STREET
LOT 25
CON 5 EHS
HIGHWAY 9
PLAN
SCALE
10m 0 10m
SPLINE GRADE
TOP OF PAVEMENT
EXISTING TOP OF PAVEMENT
EXISTING GROUND
RT DITCH
BOTTOM OF GRANULAR (WIDENING ONLY)
150 mm GRANULAR 'A'
450 mm GRANULAR 'B' TYPE I
SPLINE ELEVATION
16+300
16+400
16+500
HIGHWAY 9
QUANTITIES
SCALES
Geocres No 30M13-135
HWY 9 RECONSTRUCTION
(From Rolling Hills Dr To E of Mono 6th LINE Rd E)
HWY 9
CENTRAL REGION
DATE 1997 10 02
DWG 1459600-D


METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
PLATE No
CONT No
WP No 145-96-00
CONSTRUCTION
STA. 16+600 TO STA. 16+950
Survey
Revised
DELCAN
SHEET 49
LIMIT OF CONSTRUCTION STA. 9+945
LIMIT OF PAVING STA. 9+953
5th LINE ROAD EAST (MONO)
EAST HURONTARIO STREET
CON 5
LOT
CON 6
LOT 1
E 264 500
E 264 600
E 264 700
N4 866 700
Borehole No C5
N4 866 658.0
E 264 603.0
EL 416.5
Borehole No B1
N4 866 626.0
E 264 616.3
EL 419.1
Borehole No B2
N4 866 635.0
E 264 647.0
EL 419.2
NOTE:
FOR SUBSOIL INFORMATION REFER TO RECORD OF BOREHOLE SHEETS
HIGHWAY 9
REINFORCED SOIL SYSTEM No. 7
(SEE STRUCTURAL DRAWINGS)
PLAN
SCALE
10m 0 10m
LOT 25
CON 5
EAST HURONTARIO STREET
NOTE:
BENCHING REQUIRED AS PER OPSD-208.01:
STA. 16+600 TO STA. 16+950 LT. HIGHWAY 9
STA. 9+935 TO STA. 9+980 LT. 5th LINE ROAD EAST (MONO)
STA. 9+943 TO STA. 9+970 RT. 5th LINE ROAD EAST (MONO)
5th LINE ROAD EAST (MONO)
150 mm GRANULAR 'A'
450 mm GRANULAR 'B' TYPE I
BELL DUCT
TOP OF PAVEMENT
EXISTING TOP OF PAVEMENT
BOTTOM OF GRANULAR (WIDENING ONLY)
150 mm GRANULAR 'A'
550 mm GRANULAR 'B' TYPE II
BOTTOM OF GRANULAR (WIDENING ONLY)
RT DITCH
SPLINE ELEVATION
16+600
16+700
16+800
HIGHWAY 9
QUANTITIES
Sta
to
Sta
GB
GSB
Geocres No 30M13-135
HWY 9 RECONSTRUCTION
(From Rolling Hills Dr To E of Mono 6th Line Rd E)
HWY 9
CENTRAL REGION
DATE 1997 10 02
DWG 1459600-E


METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
PLATE No
CONT No
WP No 145-96-00
CONSTRUCTION
STA. 17+950 TO STA. 18+300
SHEET 55
DELCAN
LIMIT OF CONSTRUCTION STA. 9+856
6th LINE ROAD EAST (MONO)
N4 867 200
E 265 900
E 266 000
NOTE:
BENCHING REQUIRED AS PER OPSD-208.01:
STA. 17+950 TO STA. 18+205 RT. HIGHWAY 9
STA. 17+950 TO STA. 18+215 LT. HIGHWAY 9
STA. 9+900 TO STA. 9+975 LT. 6th LINE ROAD EAST (MONO)
STA. 9+900 TO STA. 9+980 RT. 6th LINE ROAD EAST (MONO)
NOTE:
FOR SUBSOIL INFORMATION REFER TO RECORD OF BOREHOLE SHEET
EAST HURONTARIO STREET
CON 6
LOT 1
CO DUFFERIN
TWP MONO
EAST HURONTARIO STREET
CON 7
LOT 1
LIMIT OF PAVING STA. 9+953
LIMIT OF CONTRACT STA. 18+450
LIMIT OF CONSTRUCTION STA. 18+275
HIGHWAY 9
TRANSVERSE JOINT END TREATMENT
CONNECT TO EXISTING SUBDRAIN
RETAINED SOIL SYSTEM No. 9 (SEE STRUCTURAL DRAWINGS)
RETAINED SOIL SYSTEM No. 8 (SEE STRUCTURAL DRAWINGS)
Borehole No C6
N4 867 031.0
E 265 921.7
EL 414.5
PLAN
SCALE
10m 0 10m
Geocres No 30M13-135
HWY 9 RECONSTRUCTION
(From Rolling Hills Dr To E of Mono 6th Line Rd E)
HWY 9
DATE 1997 10 02
CENTRAL REGION
DWG 1459600-F