**PetoMacCallum Ltd.**
CONSULTING ENGINEERS

# SUPPLEMENTARY GEOTECHNICAL INVESTIGATION MOLSON PARK DRIVE SANITARY SEWER BARRIE, ONTARIO FOR THE CORPORATION OF THE CITY OF BARRIE and BARRIE VIEW FARMS LIMITED c/o SKELTON, BRUMWELL & ASSOCIATES LIMITED

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Job No. 85 F 406A / 85 F 406B

December, 1986

**Peto MacCallum Ltd.**
CONSULTING ENGINEERS

Job No. 85 F 406A / 85 F 406B December 17, 1986

The Corporation of The City of Barrie
and Barrie View Farms Limited
c/o Skelton, Brumwell & Associates Limited
49 Mary Street
P.O. Box 940
Barrie, Ontario
L4M 4Y6

Attention: Mr. D. Skelton, P.Eng.

Gentlemen:

Re: Supplementary Geotechnical Investigation
Molson Park Drive, Sanitary Sewer
Barrie, Ontario

We are pleased to report the findings of our supplementary geotechnical investigation carried out for the above noted project. The work was carried out for two Clients, The Corporation of The City of Barrie (Job No. 85 F 406A) and Barrie View Farms Limited (Job No. 85 F 406B). Authorization to proceed with the work on behalf of both Clients was received from Skelton, Brumwell & Associates Limited in a letter dated September 3, 1986.

The original geotechnical investigation for the project was carried out by Peto MacCallum Ltd. in January of 1986. The findings and recommendations of that investigation were presented in Peto MacCallum Ltd. report 85 F 406 dated March 21, 1986. This supplementary report should be read in conjunction with the original March 21, 1986 report.

The project involves a proposed sanitary sewer to service the City of Barrie lands near Molson Park Drive (formerly Mapleview Drive) and Highway 400. The project section, for purposes of

this assignment, follows Molson Park Drive from the westerly limits of the proposed Barrie View commercial/industrial subdivision some 560 m west of Highway 400, to Bayview Drive some 490 m east of Highway 400, giving a total length of about 1050 m. A 600 mm sewer pipe diameter is proposed with the sewer invert not more than 15.5 m below existing grade at the west end decreasing to about 4 m at the east end as shown on Skelton, Brumwell & Associates Limited Drawing 825288-2 dated April, 1986, and on the enclosed Drawing 2 "Soil Sections".

West of manhole X shown on the appended Borehole Location Plan Drawing 1, the exact profile has not been finalized and the profile shown on Drawing 2 represents the lowest profile considered. It is understood that the actual profile will likely be at least 2 m higher with a drop at manhole X.

Three alternative sewer routes were addressed in the original investigation as shown on the appended Borehole Location Plan. One alternative followed Molson Park Drive for the entire project route to Bayview Drive. A second alternative diverged south from Molson Park Drive at manhole X about 300 m west of Highway 400, and followed an existing stream channel east to the future Bayview Drive extension, then north to Molson Park Drive. A third alternative diverged north from manhole X for an approximate distance of 300 m, then ran east to Bayview Drive. Only the Highway 400 crossing locations of the north and south alternative routes were investigated in detail.

Since the original investigation the Molson Park Drive alignment has been selected as the preferred overall alternative. The actual Highway 400 crossing location was not finalized, and three alternative crossing locations being considered include the Molson Park Drive centreline directly beneath the Highway 400 overpass structure, and either north or

south of the structure some thirty meters from the Molson Park Drive centreline. Design revisions have also been made involving lowering of the sewer invert by some 3 to 4 m with the greatest change of depth at the west end.

The majority of the original boreholes put down along Molson Park Drive contacted a very dense, non-waterbearing sand stratum near termination depth, suggesting that much of the sewer at the revised invert level could be built in tunnel with relatively few problems. The purpose of the present, supplementary investigation was to fully establish the continuity of the non-waterbearing sand to a sufficient depth below invert level and to determine the soil and ground water conditions at the north and south alternative Highway 400 crossing locations adjacent to the overpass structure. Based on the findings, geotechnical design and construction recommendations are presented addressing the practical limits of tunnel construction, tunnelling techniques, ground water control considerations, shaft construction, the effects of tunnel construction and dewatering related settlement on the structure and the road surface, and the preferred Highway 400 crossing location.

## INVESTIGATION PROCEDURE

The supplementary investigation field work was carried out during the period from September 2 to September 8, 1986. Boreholes 1 through 9 of the original investigation were re-augered (unsampled) to the original borehole termination depth and then extended as conventional sampled boreholes to depths of between 9.25 and 16.40 m or 1 to 2 m below the revised sewer invert level. Boreholes 17 through 20 were newly drilled sampled boreholes put down to depths of between 12.35 and 13.70 m at the north and south alternative Highway 400 crossing

locations. Borehole 21 was a new, fully sampled borehole put down to 9.50 m depth beneath the Highway 400 overpass structure to verify the continuity of the soil stratigraphy between boreholes 5 and 6 at either end of the structure, as required to confirm the feasibility of tunnelling beneath the structure.

The borehole locations are shown on the appended Borehole Location Plan - Drawing 1. The re-augered boreholes are now numbered 1A through 9A.

A special, short boom drillrig was mobilized to drill borehole 21 beneath Highway 400 overpass. The remaining boreholes were advanced using a CME 55 track mounted drillrig fitted with 150 mm diameter hollow stem augers. Wash boring techniques were used to advance borehole 1A and 2A below 10 m depth. The drillrigs were supplied and operated by a specialist drilling contractors.

Representative samples were taken in conjunction with standard penetration testing at regular intervals of depth not exceeding 1.5 m.

Ground water observations were carried out in the boreholes during and following the completion of drilling. Specially installed standpipes were placed in eight of the boreholes to establish the stabilized ground water conditions. The standpipe water level readings are presented in Table I appended.

The field work was carried out under the full-time supervision of a Peto MacCallum Ltd. engineering staff member who directed the drilling, sampling and standpipe installation operations,

documented the soil stratigraphy, monitored ground water conditions and processed the recovered sample for laboratory testing and/or storage.

Survey control for the investigation was also carried out by Peto MacCallum Ltd. Ground surface elevations at the borehole locations are referred to the following geodetic benchmark (B.M.) obtained from the Ministry of Transportation and Communications:

B.M.: Tablet set horizontal in east face of north concrete abutment, 4.79 m south of northeast corner, 0.18 below coping of overpass structure at Highway 400 and Molson Park Drive. Number DH095-68.

Elevation: 301.731 (Metric, geodetic datum)

All recovered samples were returned to the laboratory for detailed visual examination and moisture content determinations. The laboratory testing also included six (6) particle size distribution analyses for the non-waterbearing sand stratum within which the sewer will be constructed. The results are presented on the appended Figure 1.

## SUMMARIZED FINDINGS

Detailed findings of the investigation including soil descriptions, inferred soil stratigraphy, sampling records, standard penetration test 'N' values, ground water observations, standpipe installation details and laboratory moisture content determinations, are presented on the appended Log of Borehole sheets.

The inferred soil stratigraphy and borehole data are also summarized on the enclosed soil sections drawing - Drawing 2.

It should be noted that the proposed sewer invert west of manhole X near borehole 3A is shown on Drawing 2 at the lowest depth being considered at the time the supplementary investigation was undertaken. As discussed, this portion of sewer will likely be at least 2 m higher.

The soil stratigraphy throughout the investigated area is comprised of five (5) distinct soil units, namely surficial topsoils and roadway embankment fills, "upper" fine sand, silty sand/sandy silt, silt and "lower" sand. For purposes of this report these units are numbered 1 to 5 respectively in order of contact during drilling.

The "upper" fine sand and silty sand/sandy silt extended to depths of between 13.25 m (borehole 1A) and 2.30 m (borehole 5A). The underlying silt layer ranges in thickness from 0.75 m (borehole 10) to 4.70 m (borehole 2A) and is typically between 1 and 2 m thick. All the native soil strata are typically in a dense to very dense condition.

A more detailed description of the soil stratigraphy is presented in our original report.

Ground water was contacted within the unit 2 "upper" fine sand and the unit 3 silty sand/sandy silt. The ground water occurs in a perched condition controlled by the underlying, less pervious unit 4 silt layer. The perched ground water was generally contacted from 1 to 2 m below ground surface along Molson Park Drive west of and including borehole 10, with a maximum depth of 3.59 m at borehole 3. Boreholes 17 through 20 were drilled on higher ground outside the cut section of roadway at the Highway 400 crossing and accordingly, the ground water was contacted at somewhat greater depths of between 2.95 and 4.74 m. The ground water contact depths indicate a

downward hydraulic gradient from west to east from about elevation 305.0 at borehole 1A to elevation 290.5 at borehole 10, as shown on the soil section drawing.

The soil stratigraphy disclosed by the supplementary investigation confirmed the presence of unit 5 "lower" sand through the full additional depth explored at all borehole locations except borehole 2A. At borehole 2A, the "lower" unit 5 sand extended from 13.55 to 15.25 m depth and was underlain by a 100 mm layer of grey, silty clay followed by a further 50 mm of grey, fine sand at the borehole termination depth.

At the alternative Highway 400 crossing locations (borehole 17 through 21) the soil stratigraphy was generally consistent with the previous borehole findings except for variations in the contact depth/elevations of the various soil strata.

The ground water conditions were also similar to the original investigation findings, except that the "lower" unit 5 sand deposit contained ground water at the location of borehole 2A. It is considered that the lower aquifer at borehole 2A is a local anomaly, related to the clay layer contacted at 15.25 m near the borehole termination depth.

## DISCUSSION AND RECOMMENDATIONS

### Construction Alternatives

Based on the findings of the supplementary investigation, and given the increased depth of the revised sewer invert, it is recommended that the majority of the sewer installation should be carried out by tunnelling.

Tunnelling techniques will be most practical where the tunnel

can be advanced through non-waterbearing unit 4 silt and/or unit 5 sand. Referring to the appended Soil Sections drawing, it should be possible to advance the tunnel through the unit 4 and unit 5 strata within the section defined by borehole 7 at the east and borehole 3 (manhole X) at the west end. Approximately 360 m of tunnelling would be involved within these limits which constitutes about 34% of the total 1050 m project section.

At borehole 8 the impervious silt layer was contacted at considerably greater depth - only 0.5 m above the sewer invert elevation. Tunnelling would be much more difficult because waterbearing unit 2 and 3 sand/sandy silt would be encountered necessitating some form of ground water control. The sewer invert would have to be lowered within the section east of borehole 7, so that tunnelling procedures could be feasible through to borehole 10. The sewer would have to be lowered to sufficient depth so that the tunnel obvert remains within the non-waterbearing unit 4 and 5 soil strata. The actual required depth will therefore depend on the selected tunnel diameter. It is understood that the tunnel will be at least 1.07 m in diameter in which case the sewer invert would have to be lowered by about 2 m.

East of the location of borehole 10, the sewer invert will generally be not more than 6 m below existing grade and open cut construction techniques will be more practical. Detailed recommendations regarding open cut construction have been presented in our original report.

Regarding the waterbearing "lower" sand unit at borehole 2A, eductor well points or deep wells will be required to effect dewatering for tunnelling purposes at the initially proposed 14 to 16 m maximum invert depth. Ground water control could

also be achieved by using special tunnelling techniques involving the use of compressed air within the tunnel chamber. As discussed, it is understood that the sewer will likely be raised by at least 2 m in the section west of manhole X near borehole 3. In this case, much of the sewer obvert could be within waterbearing unit 2 and 3 sands and sandy silts requiring similar ground water control measures for tunnel construction.

Based on discussions with specialist tunnelling contractors two alternative tunnelling techniques are being considered. It is understood that a small tunnel boring machine could be made available which would produce a 1.07 m outside tunnel diameter. A steel liner would be jacked into place following the tunnel boring machine. Alternatively, an oversized 2 m diameter could be constructed using conventional hand mining techniques or a tunnel boring machine. In this regard it is recommended that a hooded tunnelling shield is utilized since the unit 5 sand is will tend to exhibit a "running ground" condition if left unsupported for an extended time. Typical particle size distributions of the unit 5 sand material are presented on the Figure 1. It should be noted that gravelly materials were encountered at certain locations as noted on the borehole logs, which are not represented on the particle size distributions curves.

Conventional "Jack-and-Bore" tunnelling was also examined, but is not considered practical because the long distance between shaft locations (at least 75 m at the Highway 400 crossing location) would make it difficult to maintain alignment and profile control within the tolerance requirements for a sewer conduit.

Shaft and Manhole Construction

It will be necessary to control the perched ground water for construction of the tunnel shafts and manholes. With the aforementioned practical tunnelling limits, it is understood that the shaft at the east end of the tunnel will be situated opposite borehole 7, on the south side of the south ditch of Molson Park Drive. The west end shaft will be located at manhole X. Either vacuum well point dewatering or a sheet pile cutoff system may be considered for ground water control purposes as detailed in the original report in the context of open cut and braced excavation sewer construction alternatives. It should be noted that placement of the sheet piling using conventional pile driving techniques will be quite difficult given the very dense soil conditions. Either preaugering, jetting or vibratory hammer techniques should be considered.

It should be possible to avoid elaborate well point dewatering or sheet pile cut-off ground water control measures for construction of the manholes. The manholes could be constructed using a caisson augering machine in conjunction with steel liners set into the impervious silt layer to function as a ground water cut-off.

The shaft and manhole liners should be constructed with a permanent ground water cut-off at the location of the impervious silt layer in order to avoid long term seepage from the perched ground water aquifer into the pervious, non-waterbearing unit 5 sand below.

Highway 400 Crossing Locations

From a strictly geotechnical viewpoint, the north alternative crossing location (approximately 30 m north of the Molson Park

Drive centreline) would be least attractive since the obvert of a 1.07 m diameter tunnel could approach to within 0.5 m from the waterbearing unit 3 sand/sandy silt at borehole 18. A slightly greater cover of 0.6 m occurs at borehole 19 on the south side alternative. A 2 m diameter tunnel would not be practical at either the north or south location since it would encounter the waterbearing unit 3 material unless the tunnel invert is lowered. It would then be necessary to hang the sewer pipe from the top of the tunnel in order to maintain the designed sewer invert profile.

Although as little as 250 mm of cover is considered sufficient, the soil stratigraphy can vary between borehole locations and there would be a considerable risk of punching through to the unit 3 waterbearing material at both the north and south alternative crossing locations.

Along Molson Park Drive, at least 2.5 m of cover is available for a 1.07 m diameter tunnel at borehole 6. The Molson Park Drive centreline crossing alternative is, therefore, geotechnically most suitable. It is understood that construction accidents could occur resulting in loss of ground near the overpass structure foundations. The consequences of such accidental failures would be more manageable if the tunnel were located beneath the Highway 400 embankment at either the north or south alternative crossing locations.

Nevertheless, numerous tunnelling projects have been successfully completed beneath various types of structures with no adverse consequences. The cost/risk trade-off should be carefully reviewed in selecting the crossing route.

Overpass Structure Settlement Considerations

Two potential sources of settlement have been identified associated with the tunnelling operation. If the well point dewatering alternative is selected for shaft construction, settlement at the ground surface may occur as a result of the ground water drawdown and associated increase in effective stress within the dewatered units 2 and 3 soil strata. Settlement would also occur as a result of changes in the state stress of the soil induced by the actual tunnelling operation.

About 3 m of ground water drawdown would be required in the vicinity of the Highway 400 crossing at all three alternative crossing locations. The magnitude of drawdown related settlement would be less than 5 mm at the location of the well points. The radius of influence of the dewatering system is estimated at 60 m. Therefore, shafts located in the vicinity of boreholes 7 and 3 as previously discussed, would not be expected to cause drawdown related settlement at the overpass structure. A drawdown related settlement of 5 mm could occur only if the perched aquifer is permanently drained through the entire project area. It should be possible to avoid this situation by ensuring that the shaft and manhole liners are sealed into the impervious silt layer to prevent ground water seepage from the perched aquifer into the pervious, non-waterbearing unit 5 sand below.

Regarding settlement due to the actual tunnelling operation, a projected centreline settlement of less than 1 mm has been computed assuming a maximum tunnel diameter of 1.07 m at about 7 m depth. With a 2 m diameter tunnel and 6 m overburden cover above the obvert, 2 mm of settlement has been computed. Referring to the enclosed Drawing 3 showing a cross-section at the Highway 400 overpass, it is apparent that the settlement

should not effect the structure footings. Settlement will take place due to overburden pressure only, since the tunnel will be outside the zones of influence of the footing loads.

We trust you will find this report complete within our terms of reference and sufficient for your present requirements. Please contact our office if there are any questions or if we can be of any further service.

Yours very truly,

Peto MacCallum Ltd.

Marian S. Molodecki, P.Eng.
Consulting Geotechnical Engineer

Sol Pilch, P.Eng.
Chief Geotechnical Engineer

MSM:lvj/hm

**PetoMacCallum Ltd.**
CONSULTING ENGINEERS

Job No. 86 F 406A
86 F 406B

December, 1986

TABLE I
**STANDPIPE WATER LEVEL READINGS**

SUPPLEMENTARY GEOTECHNICAL INVESTIGATION
MOLSON PARK DRIVE SANITARY SEWER
BARRIE, ONTARIO

| DATE (1986) | Borehole 1A Depth (m) | Borehole 1A Elev. | Borehole 2A Depth (m) | Borehole 2A Elev. | Borehole 5A Depth (m) | Borehole 5A Elev. | Borehole 9A Depth (m) | Borehole 9A Elev. |
|---|---|---|---|---|---|---|---|---|
| Sept. 15 | 2.37 | 304.33 | 10.82 | 293.79 | 1.01 | 295.69 | 1.10 | 293.40 |
| Sept. 23 | - | | - | | 1.17 | 295.53 | - | |
| Sept. 26 | 1.48 | 305.22 | 10.15 | 294.46 | - | | 0.85 | 293.65 |
| Oct. 21 | - | | 12.01 | 292.60 | - | | - | |

| DATE (1986) | Borehole 17 Depth (m) | Borehole 17 Elev. | Borehole 18 Depth (m) | Borehole 18 Elev. | Borehole 19 Depth (m) | Borehole 19 Elev. | Borehole 20 Depth (m) | Borehole 20 Elev. |
|---|---|---|---|---|---|---|---|---|
| Sept. 15 | 3.87 | 296.96 | 4.51 | 295.87 | 3.81 | 295.72 | 3.99 | 296.14 |
| Sept. 23 | 2.95 | 297.88 | 4.74 | 295.64 | 3.90 | 295.63 | 4.04 | 296.09 |

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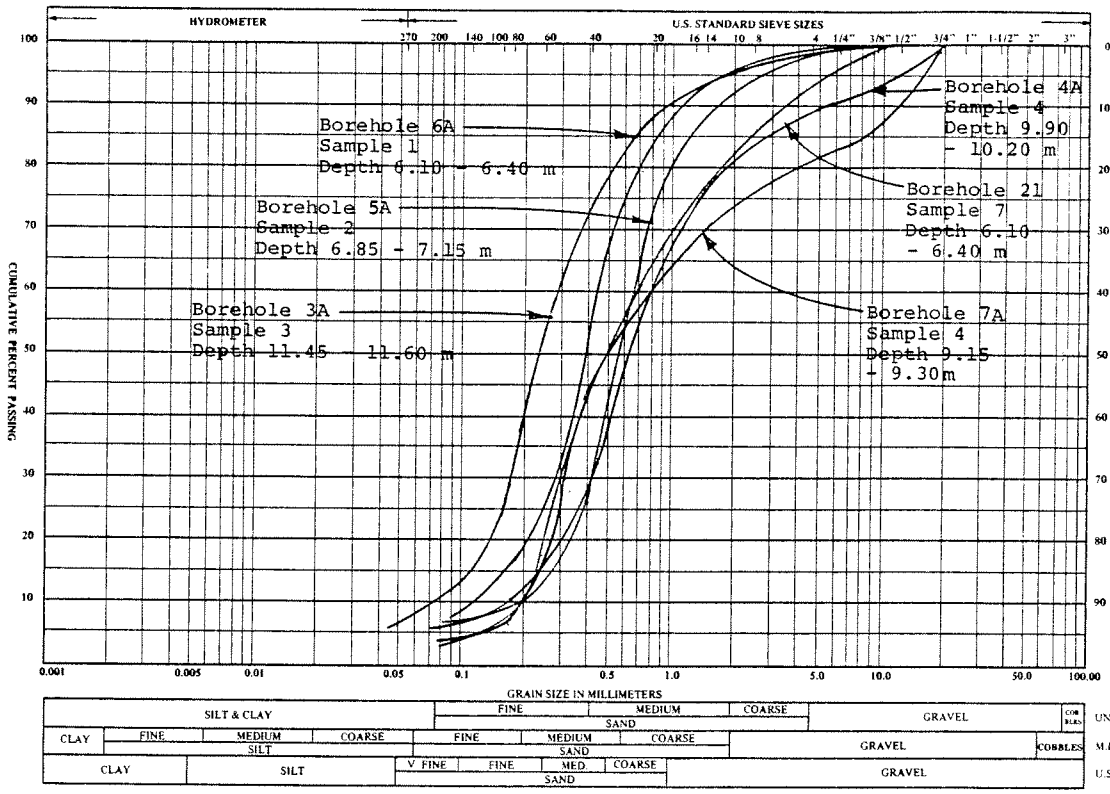
JOB NUMBER 85 F 406A

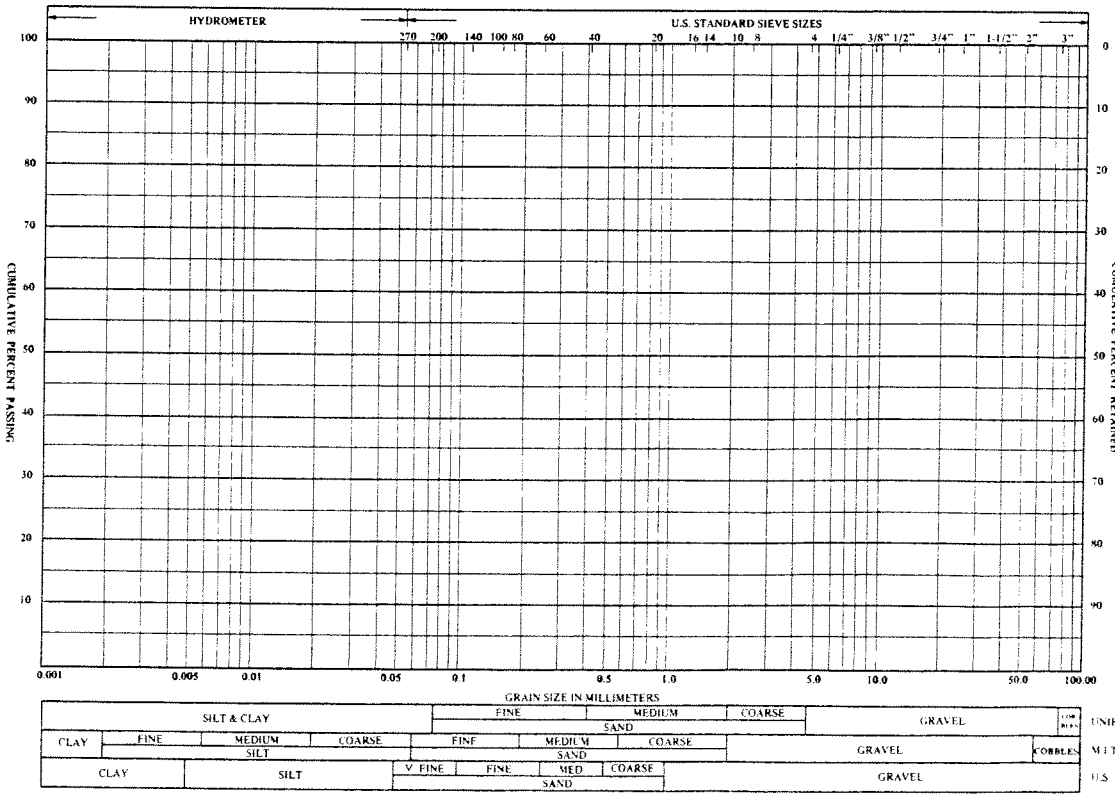
FIGURE 1

# PARTICLE SIZE DISTRIBUTION CHART




REMARKS Typical Particle Size Distributions

Sand - Unit 5




REMARKS

# LIST OF ABBREVIATIONS

## PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N', - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 0.3m INTO THE SUBSOIL. DRIVEN BY MEANS OF A 63.5kg HAMMER FALLING FREELY A DISTANCE OF 0.76m.

DYNAMIC PENETRATION RESISTANCE : - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 51mm, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS. 0.3m INTO THE SUBSOIL. THE DRIVING ENERGY BEING 475 J PER BLOW.

## DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

| CONSISTENCY | 'N' BLOWS/0.3 m | c kPa | DENSENESS | 'N' BLOWS/0.3 m |
|---|---|---|---|---|
| VERY SOFT | 0 - 2 | 0 - 12 | VERY LOOSE | 0 - 4 |
| SOFT | 2 - 4 | 12 - 25 | LOOSE | 4 - 10 |
| FIRM | 4 - 8 | 25 - 50 | COMPACT | 10 - 30 |
| STIFF | 8 - 15 | 50 - 100 | DENSE | 30 - 50 |
| VERY STIFF | 15 - 30 | 100 - 200 | VERY DENSE | > 50 |
| HARD | > 30 | > 200 | | |

W.T.P.L. WETTER THAN PLASTIC LIMIT D.T.P.L. DRIER THAN PLASTIC LIMIT

A.P.L. ABOUT PLASTIC LIMIT

## TYPE OF SAMPLE

| | | | |
|---|---|---|---|
| S.S | SPLIT SPOON | T W | THINWALL OPEN |
| W S | WASHED SAMPLE | T P | THINWALL PISTON |
| S.B | SCRAPER BUCKET SAMPLE | O S | OESTERBERG SAMPLE |
| A S | AUGER SAMPLE | F S | FOIL SAMPLE |
| C S | CHUNK SAMPLE | R C | ROCK CORE |
| S.T | SLOTTED TUBE SAMPLE | | |
| | P H SAMPLE ADVANCED HYDRAULICALLY | | |
| | P M SAMPLE ADVANCED MANUALLY | | |

## SOIL TESTS

| | | | |
|---|---|---|---|
| Qu | UNCONFINED COMPRESSION | L V | LABORATORY VANE |
| Q | UNDRAINED TRIAXIAL | F V | FIELD VANE |
| Qcu | CONSOLIDATED UNDRAINED TRIAXIAL | C | CONSOLIDATION |
| Qd | DRAINED TRIAXIAL | | |

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CONSULTING ENGINEERS

# LOG OF BOREHOLE No. 1/1A

JOB NAME MAPLEVIEW DRIVE SANITARY SEWER — JOB No. 85 F 406B
LOCATION Barrie, Ontario — BORING DATE ~~Sept. 4 & 5/86~~ Jan. 2/86 — ENGINEER M.S.M.
BORING METHOD Continuous Flight Hollow Stem Augers Wash Boring - NX Casing — TECHNICIAN R.S./S.B.

| DEPTH in METRES | DESCRIPTION — Borehole No. 1 — GROUND ELEVATION: 306.70 | LEGEND | ELEVATION | SAMPLES NUMBER | SAMPLES TYPE | BLOWS/0.3m N-VALUES |
|---|---|---|---|---|---|---|
| 0.08 | PAVEMENT: 75mm asphaltic concrete | | | | | |
| | FILL: Compact reddish brown fine sand, some silt, moist | 1 | 306 | 1 | SS | 22 |
| 1.5 1.50 | Becoming loose, wet | | 305 | 2 | SS | 7 |
| 2.15 | FINE SAND: Compact, light brown fine to medium sand, trace to some silt, saturated | | 304 | 3 | SS | 19 |
| 3.0 3.05 | Becoming very dense | 2 | | 4 | SS | 60 |
| | | | 303 | 5 | SS | 71 |
| 4.5 | | | 302 | 6 | SS | 93 |
| 6.0 | | | 301 | 7 | SS | 100 |
| 7.5 | | | 300 | 8 | SS | 87 |
| 9.0 | | | 299 | 9 | SS | 41 |
| 10.05 | | | 298 | | | |
| 10.5 | SILTY SAND/SANDY SILT: Very dense, grey silty fine sand to sandy silt, uniform, dilatant, saturated | 3 | 297 | 1 | SS | 80/150 mm |
| 11.05 | BOREHOLE 1 TERMINATED | | 296 | 10 | SS | 83 |
| 12.0 | | | 295 | | | |
| 13.25 | | | 294 | 2 | SS | 96 |
| 13.5 | SILT: Very dense, grey silt occ. sandy lenses, wet | | 293 | 3 | SS | 86/150 mm |
| 14.35 | Occ. silty clay lenses | 4 | 292 | 4 | SS | 94 |
| 15.0 | | | 291 | 5 | SS | 95 |
| 16.15 | | | | 6 | SS | 100/75 mm |
| 16.40 | SAND: V. dense, light brown, fine sand, trace silt | 5 | 290 | | | |
| 16.5 | BOREHOLE TERMINATED AT 16.40 m | | | | | |
| 18.0 | | | | | | |

SHEAR STRENGTH $C_u$ ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST •
BLOWS/0.3m: 20 40 60 80

LIQUID LIMIT ____ $W_L$
PLASTIC LIMIT ____ $W_P$
WATER CONTENT ____ W
$W_P$ W $W_L$
WATER CONTENT %: 10 20 30

Standpipe Installation Detail
GROUNDWATER OBSERVATIONS AND REMARKS

bentonite seal
Sept. 26/86
13 mm dia. CPVC standpipe
6.2 m slotted filter
auger cuttings
Proposed Sewer Invert EL 290.9
bentonite seal

Refer to Table I for standpipe waterlevel readings

NOTES:
* Moisture content of Unit 2, 3 and 5 strata not representative due to introduction of wash water into cased borehole.

CHECKED BY

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

# LOG OF BOREHOLE No. 2/2A

JOB NAME MAPLEVIEW DRIVE SANITARY SEWER — JOB No. 85 F 406B
LOCATION Barrie, Ontario — BORING DATE ~~Sept. 8/86~~ Jan. 2/86 — ENGINEER M.S.M.
BORING METHOD Continuous Flight Hollow Stem Augers Wash Boring - ~~NX~~ Casing — TECHNICIAN R.S./S.B.

| DEPTH in METRES | DESCRIPTION | LEGEND | ELEVATION | NUMBER | TYPE | BLOWS/0.3m N-VALUES |
|---|---|---|---|---|---|---|
| | Borehole NO. 2 | | | | | |
| | GROUND ELEVATION: 304.61 | | | | | |
| | FILL: Compact, brown fine to medium sand, trace gravel some silt, moist (frozen) | 1 | 304 | 1 | SS | 42 |
| 1.50 | | | | 2 | SS | 29 |
| 1.60 | TOPSOIL: Loose, dark brown silt, fine sand, low organic, moist | | 303 | 3 | SS | 8 |
| 2.15 | FINE SAND: Loose, reddish brown fine sand, trace to some silt, moist | 2 | 302 | 4 | SS | 9 |
| 3.05 | Becoming light brown fine to medium sand Becoming very dense, saturated | | 301 | 5 | SS | 51 |
| | | | | 6 | SS | 64 |
| 4.55 | SILTY SAND/SANDY SILT: Very dense, light brown sandy silt, uniform, dilatant, saturated | | 300 | 7 | SS | 69 |
| | | | 299 | | | |
| | | | | 8 | SS | 50 |
| 7.00 | Becoming grey silt, some sand | 3 | 298 | | | |
| | | | 297 | 9 | SS | 43 |
| | | | 296 | | | |
| 8.85 | SILT: Very dense, grey silt, numerous dark grey silty clay lenses and layers, trace fine sand, moist | 4 | 295 | 10 | SS | 64 |
| 10.50 | BOREHOLE 2 TERMINATED | | 294 | 1 | SS | 85 |
| | | | | 2 | SS | 97 |
| | | | 293 | 3 | SS | 87 |
| | | | 292 | 4 | SS | 81 |
| | | | | 5 | SS | 87 |
| 13.55 | | | 291 | | | |
| | SAND: Very dense, lgt. br. fine to medium sand, trace silt, saturated | 5 | | 6 | SS | 84/150 mm |
| | | | 290 | | | |
| 15.25 | | | | | | |
| 15.40 | 100 mm grey silty clay layer (till-like sandy) 50 mm grey fine sand, saturated | | 289 | 7 | SS | 100/175 mm |
| | BOREHOLE TERMINATED AT 15.40 m | | | | | |

SHEAR STRENGTH $C_u$ ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST •
BLOWS/0.3m 20 40 60 80

LIQUID LIMIT $W_L$
PLASTIC LIMIT $W_P$
WATER CONTENT W
$W_P$ W $W_L$
WATER CONTENT % 10 20 30

Standpipe Installation Detail
GROUNDWATER OBSERVATIONS AND REMARKS

13 mm dia. CPVC standpipe
auger cuttings
bentonite seal
Oct. 21/86
sand auger cuttings
Proposed Sewer Invert EL 290.4
open end

Refer to Table I for standpipe water level readings

NOTES
* Moisture content of Unit 5 stratum not representative due to introduction of wash water into cased borehole

CHECKED BY:

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

# LOG OF BOREHOLE No. 3/3A

JOB NAME: MAPLEVIEW DRIVE SANITARY SEWER — JOB No. 85 F 406A
LOCATION: Barrie, Ontario — BORING DATE: Sept. 9/86 Jan. 2/86 — ENGINEER: M.S.M.
BORING METHOD: Continuous Flight Solid Stem Augers — TECHNICIAN: S.B.

| DEPTH in Metres | DESCRIPTION<br>Borehole No. 3/3A<br>GROUND ELEVATION: 301.30 * | LEGEND | ELEVATION | NUMBER | TYPE | BLOWS/FOOT N - VALUES |
|---|---|---|---|---|---|---|
| | FILL: Dense, brown gravelly sand, trace silt, moist (frozen) | 1 | 301 | | | |
| 1.15 | | | | 1 | SS | 48 |
| 1.5 | FINE SAND: Dense, brown fine sand, some silt, wet | 2 | 300 | 2 | SS | 39 |
| 2.05 | | | | | | |
| | SILTY SAND/SANDY SILT: Dense, light brown silty fine sand, wet | | 299 | 3 | SS | 40 |
| 3.0 | | | | | | |
| 3.60 | | | 298 | 4 | SS | 34 |
| | Becoming very dense, saturated | | | 5 | SS | 52 |
| 4.5 | | 3 | 297 | | | |
| | | | | 6 | SS | 62 |
| | | | 296 | 7 | SS | 63 |
| 6.0 | | | | | | |
| 6.65 | | | 295 | | | |
| | Becoming grey, sandy silt, uniform, dilatant | | | 8 | SS | 51 |
| 7.5 | | | 294 | | | |
| | | | 293 | 9 | SS | 53 |
| 9.0 9.09 | | | | | | |
| | SILT: Dense, grey silt, trace fine sand, trace plasticity, moist to damp | 4 | 292 | 1 | SS | 100/ 275 mm |
| 10.15 | BOREHOLE 3 TERMINATED | | 291 | 10 | SS | 49 |
| 10.5 10.20 | SAND: Very dense, brown fine to medium sand, trace gravel, trace silt, damp | | | 2 | SS | 100/ 150 mm |
| | | | 290 | 3 | SS | 100/ 125 mm |
| | | 5 | | | | |
| 12.0 12.20 | | | 289 | 4 | SS | 100/ 100 mm |
| | 300 mm gravelly layer | | | 5 | SS | 100/ 150 mm |
| 13.20 | | | 288 | | | |
| 13.5 | BOREHOLE TERMINATED AT 13.20 m | | | | | |
| 15.0 | | | | | | |

SHEAR STRENGTH $C_u$ ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST - •
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT $W_L$
PLASTIC LIMIT $W_P$
WATER CONTENT W
$W_P$ W $W_L$
WATER CONTENT % 10 20 30

Proposed Sewer Invert EL 289.8

GROUNDWATER OBSERVATIONS AND REMARKS
(borehole 3)

Upon completion of drilling, water level at 7.90 m, borehole open to 9.60 m
7 hrs after completion water level at 3.60 m, borehole open to 4.00 m

NOTES * Road elevation raised since original borehole drilled, (boreholes 3 to 7)

CHECKED BY: M.S.M.

PME 504

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

# LOG OF BOREHOLE No. 4/4A

JOB NAME MAPLEVIEW DRIVE SANITARY SEWER — JOB No. 85 F 406A
LOCATION Barrie, Ontario — BORING DATE ~~Sept. 9/86~~ Dec. 31/85 — ENGINEER M.S.M.
BORING METHOD Continuous Flight Solid Stem Augers — TECHNICIAN S.B., R.S.

Borehole No. 4
GROUND ELEVATION: 298.10

| DEPTH in Metres | DESCRIPTION | LEGEND | ELEVATION | NUMBER | TYPE | BLOWS/FOOT N VALUES |
|---|---|---|---|---|---|---|
| | FILL: Very dense, brown, gravelly sand, trace silt, uniform, moist (frozen) | 1 | | 1 | SS | 78 |
| 1.20 | | | 297 | | | |
| 1.5 | FINE SAND: Very dense to dense, light brown fine sand, trace to some silt, moist to saturated | 2 | | 2 | SS | 77 |
| | | | 296 | 3 | SS | 39 |
| 2.75 | | | | | | |
| 3.0 | SILTY SAND/SANDY SILT: Dense, grey, sandy silt, occasional clayey lenses, uniform, dilatant, saturated | 3 | 295 | 4 | SS | 43 |
| | | | 294 | 5 | SS | 44 |
| 4.5 | | | | 6 | SS | 45 |
| 5.15 | | | 293 | | | |
| | SILT: Dense, grey silt, trace sand, occ. silty, fine sand & silty clay lenses, moist | 4 | | 7 | SS | 32 |
| 5.80 | | | | | | |
| 6.0 | Becoming clayey | | 292 | 8 | SS | 45 |
| | | | | 9 | SS | 50/80 mm |
| 6.90 | BOREHOLE 4 TERMINATED | | | 1 | SS | 100/250 mm |
| 6.95 | SAND: Very dense, brown, medium to coarse sand, trace silt, damp | 5 | 291 | | | |
| 7.5 | | | | 2 | SS | 100/200 mm |
| 8.25 | | | 290 | | | |
| | Becoming gravelly | | | 3 | SS | 100/100 mm |
| 9.0 | | | 289 | | | |
| | | | | 4 | SS | 100/225 mm |
| 10.10 | | | 288 | | | |
| 10.5 | BOREHOLE TERMINATED AT 10.10 m | | | | | |

SHEAR STRENGTH $C_u$ ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT $W_L$
PLASTIC LIMIT $W_P$
WATER CONTENT W
$W_P$ W $W_L$
WATER CONTENT % 10 20 30

Proposed Sewer Invert EL 289.5

GROUNDWATER OBSERVATIONS AND REMARKS

Upon completion of drilling, water level and cave at 1.65 m

NOTES:

CHECKED BY

# PETO MacCALLUM LTD.
CONSULTING ENGINEERS

## LOG OF BOREHOLE No. 5/5A

JOB NAME: MAPLEVIEW DRIVE SANITARY SEWER — JOB No. 85 F 406A
LOCATION: Barrie, Ontario — BORING DATE: Sept. 10/86 Jan. 2/86 — ENGINEER: M.S.M.
BORING METHOD: Continuous Flight Solid Stem Augers — TECHNICIAN: R.S., S.B.

| DEPTH in Metres | DESCRIPTION | LEGEND | ELEVATION | NUMBER | TYPE | BLOWS/FOOT N VALUES |
|---|---|---|---|---|---|---|
| | Borehole No. 5 | | | | | |
| | GROUND ELEVATION: 296.70 | | | | | |
| | PAVEMENT: Very dense, brown sand and gravel, trace silt, moist | 1 | | | | |
| 0.60 | | | 296 | | | |
| | FINE SAND: Dense, fine sand, some silt, wet | 2 | | | | |
| 1.5 | | | | 1 | SS | 43 |
| 1.85 | | | 295 | | | |
| 2.30 | SILTY SAND/SANDY SILT: Dense, grey sandy silt, uniform, dilatant, saturated | 3 | | 2 | SS | 38 |
| | SILT: Very dense to dense, grey silt, trace sand, occasional fine sand lenses, moist to damp | | 294 | | | |
| 3.0 | | | | 3 | SS | 68 |
| | | 4 | | 4 | SS | 48 |
| | | | 293 | | | |
| 4.5 | | | | 5 | SS | 47 |
| 4.55 | | | 292 | | | |
| 4.95 | Becoming brown | | | | | |
| | SAND: Very dense, brown fine to medium sand, trace gravel, damp | | | 6 | SS | 53/150 mm |
| 5.75 | | | 291 | 7 | SS | 50/75 mm |
| 6.0 | BOREHOLE 5 TERMINATED | | | | | |
| | | | | 1 | SS | 100/275 mm |
| 6.70 | | 5 | 290 | | | |
| | Some gravel, trace silt | | | 2 | SS | 100 |
| 7.5 | | | 289 | 3 | SS | 100/75 mm |
| | | | | | | |
| | | | 288 | 4 | SS | 100/75 mm |
| 9.0 | | | | | | |
| 9.45 | | | | 5 | SS | 100/250 mm |
| | BOREHOLE TERMINATED AT 9.45 m | | 287 | | | |
| 10.5 | | | | | | |

SHEAR STRENGTH $C_u$ ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT $W_L$
PLASTIC LIMIT $W_P$
WATER CONTENT W
$W_P$ W $W_L$
WATER CONTENT % 10 20 30

Sept. 23/86

Standpipe Installation Detail
GROUNDWATER OBSERVATIONS AND REMARKS

bentonite seal
13 mm dia. C.P.V. slotted standpipe
auger cuttings
bentonite seal
auger cuttings

Proposed Sewer Invert EL 289.2

Refer to Table I for standpipe water level readings.

NOTES

CHECKED BY 6/19/87

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

# LOG OF BOREHOLE No. 6/6A

JOB NAME MAPLEVIEW DRIVE SANITARY SEWER — JOB No. 85 F 406A
LOCATION Barrie, Ontario — BORING DATE Jan. 2/86 Sept. 11/86 — ENGINEER M.S.M.
BORING METHOD Continuous Flight Solid Stem Augers — TECHNICIAN R.S., S.B.

| DEPTH in Metres | DESCRIPTION | LEGEND | ELEVATION | SAMPLES NUMBER | SAMPLES TYPE | BLOWS/FOOT N VALUES |
|---|---|---|---|---|---|---|
| | Borehole No. 6 | | | | | |
| | GROUND ELEVATION: 296.50 | | | | | |
| | PAVEMENT: Brown, fine to medium sand, some gravel, moist (frozen) | 1 | 296 | 1 | SS | |
| 0.50 | | | | | | |
| 0.95 | FINE SAND: Very dense to dense, light brown fine sand, some silt, moist | 2 | 295 | 2 | SS | 58 |
| 1.5 | | | | | | |
| 1.85 | Becoming saturated | | | 3 | SS | 40 |
| | SILTY SAND/SANDY SILT: Dense, brown, sandy silt, uniform, dilatant, saturated | 3 | 294 | | | |
| 3.0 | | | | 4 | SS | 40 |
| | | | 293 | 5 | SS | 31 |
| 4.00 | | | | | | |
| | SILT: Dense, brown silt, trace to some sand, moist | 4 | 292 | 6 | SS | 36 |
| 4.5 | | | | 7 | SS | 48 |
| | | | 291 | | | |
| 5.85 | BOREHOLE 6 TERMINATED | | | 8 | SS | 72/225 mm |
| 6.0 5.93 | SAND: Very dense, brown, medium sand, trace silt, damp | 5 | 290 | 1 | SS | 100/225 mm |
| 7.5 | | | 289 | | | |
| | | | | 2 | SS | 100/175 mm |
| 8.25 | Becoming coarse, some gravel | | 288 | | | |
| 9.0 | | | | | | |
| 9.25 | | | | 3 | SS | 100/125 mm |
| | BOREHOLE TERMINATED AT 9.25 m | | 287 | | | |
| 10.5 | | | | | | |

SHEAR STRENGTH $C_u$ ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST •
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT $W_L$
PLASTIC LIMIT $W_P$
WATER CONTENT W
$W_P$ W $W_L$
WATER CONTENT % 10 20 30

Proposed Sewer Invert
EL 288.9

GROUNDWATER OBSERVATIONS AND REMARKS

Upon completion of drilling borehole 6A Water level at 5.80 Borehole open to 6.10 m. (not stabilized).

NOTES

CHECKED BY

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

# LOG OF BOREHOLE No. 7/7A

JOB NAME MAPLEVIEW DRIVE SANITARY SEWER — JOB No. 85 F 406A
LOCATION Barrie, Ontario — BORING DATE ~~Sept. 9/86~~ Jan. 2/86 — ENGINEER M.S.M.
BORING METHOD Continuous Flight Solid Stem Augers — TECHNICIAN R.S./S.B.

| DEPTH in Metres | DESCRIPTION | LEGEND | ELEVATION | NUMBER | TYPE | BLOWS/FOOT N VALUES |
|---|---|---|---|---|---|---|
| | Borehole No. 7 | | | | | |
| | GROUND ELEVATION: 296.10 | | | | | |
| | FILL: Brown, medium sand, some gravel, trace silt, moist (frozen) | 1 | | 1 | SS | 42 |
| 1.05 | | | 295 | | | |
| 1.5 | SILTY SAND/SANDY SILT: Dense, brown silty fine sand to sandy silt, uniform, moist | 3 | | 2 | SS | 42 |
| 1.95 | Becoming grey, wet | | 294 | 3 | SS | 47 |
| 2.60 | | | | | | |
| 3.0 | Dilatant, saturated, occasional silty clay lenses | | 293 | 4 | SS | 48 |
| | | | | 5 | SS | 43 |
| 4.10 | | | 292 | | | |
| 4.5 | SILT: Dense, grey silt, trace sand, occasional silty clay lenses, moist | 4 | | 6 | SS | 36 |
| | | | 291 | 7 | SS | 34 |
| 5.55 | | | | | | |
| 5.86 | BOREHOLE 7 TERMINATED | | | | | |
| 6.0 | SAND: Very dense, brown, fine sand, some silt, damp | | 290 | 8 | SS | 50/8 mm |
| | | | | 1 | SS | 85/275 mm |
| | | | 289 | | | |
| 7.5 | | 5 | | 2 | SS | 100 |
| | | | 288 | | | |
| 8.25 | Becoming gravelly fine to medium sand | | | 3 | SS | 100/150 mm |
| 9.0 | | | 287 | 4 | SS | 100/200 mm |
| | | | | 5 | SS | 100/175 mm |
| 10.05 | | | 286 | | | |
| | BOREHOLE TERMINATED AT 10.05 m | | | | | |
| 10.5 | | | | | | |

SHEAR STRENGTH $C_u$ ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST •
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT $W_L$
PLASTIC LIMIT $W_P$
WATER CONTENT W
$W_P$ W $W_L$
WATER CONTENT % 10 20 30

Proposed Sewer Invert EL 288.1

GROUNDWATER OBSERVATIONS AND REMARKS

Upon completion of drilling borehole 7A, borehole open, no free water (not stabilized)

NOTES

CHECKED BY

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

# LOG OF BOREHOLE No. 8/8A

JOB NAME MAPLEVIEW DRIVE SANITARY SEWER — JOB No. 85 F 406A
LOCATION Barrie, Ontario — BORING DATE ~~Sept. 10/86~~ Jan. 2/86 — ENGINEER M.S.M.
BORING METHOD Continuous Flight Solid Stem Augers — TECHNICIAN R.S., S.B.

| DEPTH | DESCRIPTION<br>Borehole No. 8<br>GROUND ELEVATION: 295.60 | LEGEND | ELEVATION | SAMPLES NUMBER | SAMPLES TYPE | BLOWS/FOOT N VALUES |
|---|---|---|---|---|---|---|
| 0.50 | FILL: Dense, light brown fine sand, some silt, trace gravel, moist | 1 | 295 | 1 | SS | 45 |
| | FINE SAND: Dense to very dense, light brown fine sand, trace to some silt, moist | | | 2 | SS | 31 |
| 1.55 | Becoming wet to saturated | | 294 | 3 | SS | 60 |
| | | 2 | 293 | 4 | SS | 58 |
| 3.0 | | | | 5 | SS | 94 |
| | | | 292 | | | |
| | | | | 6 | SS | 100 |
| 4.60 | | | 291 | | | |
| | SILTY SAND/SANDY SILT: Very dense, light brown silty fine sand, uniform, saturated | | | 7 | SS | 50/100 mm |
| 5.50 | | | | 8 | SS | 50/100 mm |
| | BOREHOLE 8 TERMINATED | 3 | 290 | | | |
| 6.0 6.25 | | | | 1 | SS | 100/150 mm |
| | Becoming grey, occ. silt lenses | | | 2 | SS | 87 |
| | | | 289 | | | |
| 7.45 | | | | 3 | SS | 54 |
| 7.5 | SILT: Very dense, grey silt, trace sand, moist | | 288 | 4 | SS | 76 |
| 8.25 | | 4 | | | | |
| | Numerous silty clay lenses | | 287 | 5 | SS | 100/250 mm |
| 8.60 9.0 | SAND: Very dense, brown, medium sand, some gravel, trace silt, damp | 5 | | 6 | SS | 100/200 mm |
| | | | 286 | | | |
| 10.05 | | | | 7 | SS | 88/150 mm |
| | BOREHOLE TERMINATED AT 10.05 m | | | | | |
| 10.5 | | | | | | |

SHEAR STRENGTH $C_u$ ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST •
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT $W_L$
PLASTIC LIMIT $W_P$
WATER CONTENT W
$W_P$ W $W_L$
WATER CONTENT % 10 20 30

Proposed Sewer Invert EL 287.6

GROUNDWATER OBSERVATIONS AND REMARKS

Upon completion of drilling borehole 8A water level and cave at 1.20 m

NOTES

CHECKED BY

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

# LOG OF BOREHOLE No. 9/9A

JOB NAME: MAPLEVIEW DRIVE SANITARY SEWER — JOB No. 85 F 406A
LOCATION: Barrie, Ontario — BORING DATE: Sept. 11/86 Dec. 31/85 — ENGINEER: M.S.M.
BORING METHOD: Continuous Flight Solid Stem Augers — TECHNICIAN: R.S., S.B.

| DEPTH in Metres | DESCRIPTION<br>Borehole No. 9<br>GROUND ELEVATION: 294.50 | LEGEND | ELEVATION | NUMBER | TYPE | BLOWS/FOOT N VALUES |
|---|---|---|---|---|---|---|
| 0.25 | FILL: Dark brown gravelly sand, some slit, moist (frozen) | 1 | 294 | 1 | SS | 64/150 mm |
| | | | | 2 | SS | 22 |
| 1.30 | SILTY SAND/SANDY SILT: Compact, mottled brown, silty fine sand to sandy silt, moist | 3 | 293 | | | |
| 1.95 | Becoming grey, saturated, clayey silt lenses | | | 3 | SS | 18 |
| 2.45 | Becoming uniform, dilatant, saturated | | 292 | 4 | SS | 32 |
| 3.0 | SILT: Dense to very dense, grey silt, trace sand, moist to damp | | | 5 | SS | 45 |
| 3.45 | Becoming hard, clayey silt, D.T.P.L. | 4 | 291 | 6 | SS | 60/130 mm |
| 4.40 | SAND: Very dense, brown, fine sand, trace silt, trace gravel, damp | | 290 | 7 | SS | 50/100 mm |
| 5.25 | BOREHOLE 9 TERMINATED | | 289 | 8 | SS | 50/130 mm |
| 6.0 | | | | 1 | SS | 100/200 mm |
| | | 5 | 288 | 2 | SS | 100/200 mm |
| | | | | 3 | SS | 100/225 mm |
| 7.5 | | | 287 | 4 | SS | 100/200 mm |
| | | | 286 | 5 | SS | 100 |
| 9.0 | | | | 6 | SS | 100/225 mm |
| 9.40 | BOREHOLE TERMINATED AT 9.40 m | | 285 | | | |
| 10.5 | | | | | | |

SHEAR STRENGTH $C_u$ ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST •
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT $W_L$
PLASTIC LIMIT $W_P$
WATER CONTENT W
$W_P$ W $W_L$
WATER CONTENT % 10 20 30

Sept. 26/86

Proposed Sewer Invert EL 287.4

STANDPIPE INSTALLATION DETAI
GROUNDWATER OBSERVATIONS AND REMARKS

bentonite seal
13mm diameter CP
slotted standpipe
auger cuttings
bentonite seal

Upon completion of drilling borehole 9A, borehole open, no free water (not stabilized)

Refer to Table I for standpipe water level readings

NOTES

CHECKED BY

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

# LOG OF BOREHOLE No. 9, 10

JOB NAME MAPLEVIEW DRIVE SANITARY SEWER — JOB No. 85 F 406
LOCATION Barrie, Ontario — BORING DATE Dec. 31/85 — ENGINEER M.S.M.
BORING METHOD Continuous Flight Solid Stem Augers — TECHNICIAN R.S.

## Borehole No. 9

GROUND ELEVATION: 294.70

| DEPTH in METRES | DESCRIPTION | LEGEND | ELEVATION | SAMPLE NUMBER | SAMPLE TYPE | BLOWS/0.3m N-VALUES |
|---|---|---|---|---|---|---|
| 0.45 | FILL: Dark brown gravelly sand, some silt, moist (frozen) | 1 | 294 | 1 | SS | 64/150mm |
| | SILTY SAND/SANDY SILT: Compact, mottled brown, silty fine sand to sandy silt, moist | 3 | | 2 | SS | 22 |
| 1.5 1.50 | Becoming grey, saturated, clayey silt lenses | | 293 | 3 | SS | 18 |
| 2.15 | Becoming uniform, dilatant, saturated | | | | | |
| 2.65 | SILT: Dense to very dense, grey silt, trace sand, moist to damp | 4 | 292 | 4 | SS | 32 |
| 3.0 | | | | 5 | SS | 45 |
| 3.65 | Becoming hard, clayey silt, D.T.P.L. | | 291 | 6 | SS | 60/130mm |
| 4.5 4.60 | SAND: Very dense, brown fine sand, damp | 5 | 290 | 7 | SS | 50/100mm |
| 5.45 | | | | 8 | SS | 50/130mm |
| | BOREHOLE TERMINATED AT 5.45m | | 289 | | | |
| 6.0 | | | | | | |
| 7.5 | | | | | | |

Upon completion of drilling, borehole open to 4.90m, no free water

7 hrs. after completion, wate level at 1.50m

## Borehole No. 10

Ground Elevation: 291.75

| DEPTH in METRES | DESCRIPTION | LEGEND | ELEVATION | SAMPLE NUMBER | SAMPLE TYPE | BLOWS/0.3m N-VALUES |
|---|---|---|---|---|---|---|
| 0 | | | | | | |
| 0.30 | PAVEMENT: Brown sand and gravel, trace silt, moist | 1 | | | | |
| 0.45 | TOPSOIL: Black silty sand, low organic, moist | | 291 | | | |
| | FINE SAND: Loose, dark brown silty fine to medium sand, some gravel, saturated | 2 | | 1 | SS | 7 |
| 1.5 1.50 | SILTY SAND/SANDY SILT: Compact, light brown sandy silt, uniform, dilatant, wet | 3 | 290 | 2 | SS | 23 |
| 2.15 | SILT: Dense, dark brown silt, trace sand, silty clay lenses, moist | 4 | 289 | 3 | SS | 68 |
| 2.90 | | | | 4 | SS | 66/225mm |
| 3.0 | SAND: Very dense, brown, fine to medium sand, some gravel, trace silt, damp to moist | 5 | 288 | 5 | SS | 62/150mm |
| 4.5 | | | 287 | 6 | SS | 71/225mm |
| 5.55 | | | | 7 | SS | 69/225mm |
| | BOREHOLE TERMINATED AT 5.55m | | 286 | | | |
| 6.0 | | | | | | |

Upon completion of drilling, borehole open, no free water

SHEAR STRENGTH $C_u$ ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST •
BLOWS/0.3m: 20 40 60 80

LIQUID LIMIT $W_L$
PLASTIC LIMIT $W_P$
WATER CONTENT $W$
$W_P$ W $W_L$
WATER CONTENT %: 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS

NOTES

CHECKED BY

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CONSULTING ENGINEERS

# LOG OF BOREHOLE No. 11, 12

JOB NAME: MAPLEVIEW DRIVE SANITARY SEWER — JOB No. 85 F 406
LOCATION: Barrie, Ontario — BORING DATE: Dec. 13/86 — ENGINEER: M.S.M.
BORING METHOD: Continuous Flight Solid Stem Augers — TECHNICIAN: S.B.

| DEPTH in METRES | DESCRIPTION | LEGEND | ELEVATION | SAMPLES NUMBER | SAMPLES TYPE | BLOWS/0.3m N-VALUES |
|---|---|---|---|---|---|---|
| | **Borehole No. 11** GROUND ELEVATION: 289.71 | | | | | |
| 0.30 | FILL: Light brown fine sand some silt, trace gravel, moist | 1 | | | | |
| 0.43 | TOPSOIL: Black, silty sand, low organic, moist | | 289 | 1 | SS | 9 |
| 1.20 | SAND: Very dense, light brown silty fine sand, moist to wet | 5 | | 2 | SS | 13 |
| 1.5 | Trace to some silt, moist | | 288 | 3 | SS | 100/250mm |
| 2.15 | Becoming gravelly fine to medium sand, moist | | 287 | 4 | SS | 100/200mm |
| 3.0 | | | | 5 | SS | 65/150mm |
| | | | 286 | 6 | SS | 100/250mm |
| 4.55 | Trace gravel | | 285 | 7 | SS | 100/250mm |
| 5.65 | BOREHOLE TERMINATED AT 5.65m | | 284 | 8 | SS | 97 |
| | **Borehole No. 12** Ground Elevation: 296.39 | 1 | | | | |
| 0.15 | TOPSOIL: Loose, dark brown silty fine to medium sand low organic, moist | | 296 | 1 | SS | 6 |
| 1.00 | FINE SAND: Loose, reddish brown silty fine sand, moist | 2 | | 2 | SS | 17 |
| 1.5 | Becoming compact, brown, trace to some silt | | 295 | 3 | SS | 27 |
| 2.15 | Becoming very dense to dense | | 294 | 4 | SS | 51 |
| 3.05 | Becoming wet to saturated | | | 5 | SS | 35 |
| 3.50 | SILTY SAND/SANDY SILT: Dense to very dense, light brown, silty fine sand, uniform, saturated | 3 | 293 | 6 | SS | 45 |
| 4.5 | | | 292 | 7 | SS | 57 |
| 4.90 | Becoming sandy silt, compact | | 291 | | | |
| 6.0 | | | 290 | 8 | SS | 23 |
| 7.30 | Becoming very dense, grey | | 289 | | | |
| 7.5 | | | | 9 | SS | 52 |
| 8.10 | BOREHOLE TERMINATED AT 8.10m | | 288 | | | |
| 9.0 | | | | | | |

SHEAR STRENGTH $C_u$ ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST •
BLOWS/0.3m: 20 40 60 80

LIQUID LIMIT $W_L$
PLASTIC LIMIT $W_P$
WATER CONTENT W
$W_P$ W $W_L$
WATER CONTENT %: 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS

Upon completion of drilling, borehole open to 5.05m, no free water

Standpipe Installation Details:
1m stick-up
Bentonite seal
13mm diameter CPVC Standpipe
Auger cuttings
0.6m slotted filter

Refer to Table I for waterlevel readings
Water level in standpipe 4.37 m Jan. 21, 1986

NOTES:

CHECKED BY

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

# LOG OF BOREHOLE No. 17

JOB NAME MOLSON PARK DRIVE SANITARY SEWER — JOB No. 85 F 406A
LOCATION Barrie, Ontario — BORING DATE Sept. 3/86 — ENGINEER M.S.M.
BORING METHOD Continuous Flight Hollow Stem Augers — TECHNICIAN M.S.M.

| DEPTH in Metres | DESCRIPTION<br>Borehole No. 17<br>GROUND ELEVATION: 300.83 | LEGEND | ELEVATION | SAMPLES NUMBER | SAMPLES TYPE | BLOWS/FOOT N VALUES |
|---|---|---|---|---|---|---|
| 0.20 | TOPSOIL: Dk. br. silty, fine to medium sand, low organic, damp | 1 | | | | |
| | FINE SAND: Compact, lgt. br., fine sand, some silt, trace gravel, moist | 2 | 300 | | | |
| 1.5 | | | 299 | 1 | SS | 27 |
| 2.45 | | | | | | |
| | SILTY SAND/SANDY SILT: Compact, lgt. br. silty fine sand, occ. silt and clayey silt lenses, saturated | 3 | 298 | | | |
| 3.0 | | | | 2 | SS | 26 |
| 3.65 | | | | | | |
| | SILT: Very stiff to hard, mottled grey clayey silt, occ. sandy silt and sand lenses, numerous clay lenses, D.T.P.L. | | 297 | | | |
| 4.5 | | 4 | 296 | 3 | SS | 27 |
| | | | 295 | 4 | SS | 65/225 mm |
| 6.0 | | | | | | |
| 6.15 | | | | 5 | SS | 100/100 mm * |
| | SAND: Very dense, lgt. br. med. gravelly sand, trace silt, damp | | 294 | | | |
| 7.00 | | | | 6 | SS | 100/200 mm |
| | Some gravel | | | | | |
| 7.5 | | | 293 | 7 | SS | 100/225 mm |
| | | | 292 | | | |
| 9.0 | | 5 | | 8 | SS | 100/225 mm |
| | | | 291 | | | |
| 10.5 | | | 290 | 9 | SS | 100/250 mm |
| | | | | | | Proposed Sewer Invert EL 289.3 |
| 12.0 | | | 289 | | | |
| | | | | 10 | SS | 77 |
| 13.20 | | | 288 | | | |
| 13.5 | BOREHOLE TERMINATED AT 13.20 m | | | 11 | SS | 100/230 mm |

SHEAR STRENGTH $C_u$ ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST •
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT ____ $W_L$
PLASTIC LIMIT ____ $W_P$
WATER CONTENT ____ W
$W_P$ W $W_L$
WATER CONTENT % 10 20 30

Standpipe Installation Details
GROUNDWATER OBSERVATIONS AND REMARKS

bentonite seal
13 mm dia. C.P.V.C. standpipe
Sept. 23/
3.05 m slotted filter
bentonite seal
auger cuttings
Upon completion of drilling borehole open to 9.10 m, no free water
Refer to Table I for standpipe water level readings

NOTES
* Sampler striking stone

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CONSULTING ENGINEERS

# LOG OF BOREHOLE No. 18

JOB NAME: MOLSON PARK DRIVE SANITARY SEWER — JOB No.: 85 F 406A
LOCATION: Barrie, Ontario — BORING DATE: Sept. 2/86 — ENGINEER: M.S.M.
BORING METHOD: Continuous Flight Hollow Stem Augers — TECHNICIAN: S.B.

| DEPTH in Metres | DESCRIPTION (Borehole No. 18; GROUND ELEVATION: 300.38) | LEGEND | ELEVATION | SAMPLES NUMBER | SAMPLES TYPE | BLOWS/FOOT N VALUES | Standpipe Installation Details / GROUNDWATER OBSERVATIONS AND REMARKS |
|---|---|---|---|---|---|---|---|
| 0.02 | TOPSOIL: Dk. brown sandy silt, low organic, moist | 1 | 300 | 1 | SS | 10 | |
| | FINE SAND: Compact, lgt. brown fine sand, trace to some silt, moist | | 299 | 2 | SS | 24 | |
| 1.5 | | | 298 | | | | |
| 3.0 3.05 | Becoming very dense | 2 | 297 | 3 | SS | 56 | |
| 4.25 | Becoming wet to saturated | | 296 | 4 | SS | 87 | |
| 4.5 | | | 295 | 5 | SS | 78 | |
| 6.0 | | | 294 | 6 | SS | 72 | |
| | | | | 7 | SS | 100/275 mm | |
| 7.5 | | | 293 | 8 | SS | 93 | |
| | | | 292 | 9 | SS | 94/275 mm | |
| 9.0 | | | 291 | 10 | SS | 32 | |
| 9.60 | SILTY SAND/SANDY SILT: Dense, grey silty fine sand, saturated | 3 | | 11 | SS | 71 | |
| 10.10 | SILT: Very dense, grey silt, trace sand, wet | | 290 | | | | |
| 10.5 10.65 | Becoming damp | 4 | | 12 | SS | 86 | |
| 11.50 | SAND: Very dense, lgt. br., fine to medium sand, moist | | 289 | 13 | SS | 73/150 mm | Proposed Sewer Invert El. 288.7 |
| 12.0 | | 5 | 288 | 14 | SS | 90/150 mm | |
| 13.5 13.70 | BOREHOLE TERMINATED AT 13.70 m | | 287 | 15 | SS | 100/125 mm | |
| 15.0 | | | | | | | |

SHEAR STRENGTH $C_u$ ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/FOOT: 20 40 60 80
LIQUID LIMIT $W_L$ — PLASTIC LIMIT $W_P$ — WATER CONTENT $W$
$W_P$ W $W_L$
WATER CONTENT %: 10 20 30

Standpipe Installation Details
GROUNDWATER OBSERVATIONS AND REMARKS

- auger cuttings
- 13 mm dia CPVC standpipe
- Sept.23/
- 3.05 m slotted filter
- bentonite
- auger cuttings

Upon completion of drilling, water level inside hollow stem augers at 7.4 m

Refer to Table I for standpipe waterlevel readings

NOTES:

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# LOG OF BOREHOLE No. 19

JOB NAME MOLSON PARK DRIVE SANITARY SEWER — JOB No. 86 F 406A
LOCATION Barrie, Ontario — BORING DATE Sept. 4/86 — ENGINEER M.S.M.
BORING METHOD Continuous Flight Hollow Stem Augers — TECHNICIAN M.S.M.

| DEPTH in metres | DESCRIPTION | LEGEND | ELEVATION | SAMPLES NUMBER | SAMPLES TYPE | BLOWS/FOOT N VALUES |
|---|---|---|---|---|---|---|
| | GROUND ELEVATION: 299.53 | | | | | |
| 0.15 | TOPSOIL: dk.br. silty fine sand, low organic, moist | 1 | 299 | | | |
| | SAND: very dense light brown fine sand, trace silt, moist | | 298 | 1 | SS | 95 |
| 1.5 | | 2 | 297 | | | |
| 3.0 | | | 296 | 2 | SS | 61 |
| 3.65 | becoming saturated, waterbearing | | | | | |
| 4.5 | | | 295 | 3 | SS | 85 |
| | | | 294 | 4 | SS | 90 |
| 6.0 6.10 | SILTY SAND/SANDY SILT: dense to very dense, light brown silty fine sand, saturated | 3 | 293 | 5 | SS | 46 |
| 7.5 | | | 292 | 6 | SS | 83 |
| | | | | 7 | SS | 46 |
| 8.25 | becoming grey | | 291 | | | |
| 9.0 9.05 | | | | 8 | SS | 44 |
| | SILT: dense, grey silt, numerous silty clay lenses, occasional fine sand lenses, moist | 4 | 290 | 9 | SS | 37 |
| 10.5 10.45 | | | 289 | 10 | SS | 42 |
| | SAND: very dense, brown fine to medium sand, trace silt, trace gravel, damp | 5 | 288 | 11 | SS | 76/150 mm |
| 12.0 | | | 287 | 12 | SS | 68/150 mm |
| 13.5 13.40 | | | | 13 | SS | 50/150 mm |
| | BOREHOLE TERMINATED AT 13.40 m | | 286 | | | |
| 15.0 | | | | | | |

SHEAR STRENGTH $C_u$ ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST-●
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT $W_L$
PLASTIC LIMIT $W_P$
WATER CONTENT W
$W_P$ W $W_L$
WATER CONTENT % 10 20 30

Standpipe Installation Details
GROUNDWATER OBSERVATIONS AND REMARKS

bentonite seal
13 mm diameter CPVC standpipe
Sept.23/86 auger cuttings
3.05 m slotted filter
bentonite seal
Proposed Sewer Invert El. 288.7
auger cuttings

Refer to Table I for standpipe water level readings

NOTES

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PMI 504

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PETO MacCALLUM LTD.
CONSULTING ENGINEERS

# LOG OF BOREHOLE No. 20

JOB NAME MOLSON PARK DRIVE SANITARY SEWER — JOB No. 86 F 406A
LOCATION Barrie, Ontario — BORING DATE Sept. 3/86 — ENGINEER M.S.M.
BORING METHOD Continuous Flight Hollow Stem Augers — TECHNICIAN M.S.M.

GROUND ELEVATION: 300.13

| DEPTH in metres | DESCRIPTION | LEGEND | ELEVATION | NUMBER | TYPE | BLOWS/FOOT N VALUES |
|---|---|---|---|---|---|---|
| 0.21 | TOPSOIL: dark brown silty fine to medium sand, low organic, damp | 1 | 300 | | | |
| 0.90 | SAND: loose to compact, reddish brown silty fine sand, moist | | 299 | | | |
| 1.5 | becoming dense, brown some silt | 2 | 298 | 1 | SS | 38 |
| 3.0 3.05 | becoming very dense, light brown trace silt, wet to saturated | | 297 | 2 | SS | 68 |
| 4.5 | | | 296 | 3 | SS | 100/250 mm |
| 5.20 | SILTY SAND/SANDY SILT: very dense, grey silt fine sand to sandy silt, dilatant, saturated | 3 | 295 | 4 | SS | 82 |
| 6.0 | | | 294 | 5 | SS | 95 |
| 6.95 | SILT: very dense, grey silt, some sand, occasional clayey lenses, moist | 4 | 293 | 6 | SS | 83 |
| 7.5 | | | | 7 | SS | 85 |
| | | | 292 | 8 | SS | 42 |
| 9.0 9.30 | becoming brown | | 291 | 9 | SS | 79 |
| 9.60 | SAND: very dense, brown medium sand, trace silt, trace gravel, damp | 5 | 290 | 10 | SS | 90/225 mm |
| 10.5 | | | | 11 | SS | 100/200 mm |
| | | | 289 | | | |
| 12.0 12.35 | BOREHOLE TERMINATED AT 12.35 m | | 288 | 12 | SS | 90/150 mm |
| 15.5 | | | | | | |

SHEAR STRENGTH $C_u$ ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT $W_L$
PLASTIC LIMIT $W_P$
WATER CONTENT W
$W_P$ W $W_L$
WATER CONTENT % 10 20 30

Proposed Sewer Invert El. 289.3

Standpipe Installat Details

GROUNDWATER OBSERVATIONS AND REMARKS

bentonite seal
augers cuttings
13 mm diameter CPVC standpipe
Sept.23/8
3.05 m slotted filter
bentonite seal

No ground water inside hollow stem augers during drilling

Upon completion of drilling, waterlevel inside hollow stem augers at 10.65 m.

Upon removal of augers, waterlevel at 5.50 m, borehole open to 5.80 m.

Refer to Table I for standpipe waterlevel readings.

NOTES.

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CONSULTING ENGINEERS

# LOG OF BOREHOLE No. 21

JOB NAME MOLSON PARK DRIVE SANITARY SEWER — JOB No. 86 F 406A
LOCATION Barrie, Ontario — BORING DATE Sept. 8/86 — ENGINEER M.S.M.
BORING METHOD Continuous Flight Hollow Stem Augers — TECHNICIAN D.Kelly

| DEPTH in metres | DESCRIPTION | LEGEND | ELEVATION | SAMPLES NUMBER | SAMPLES TYPE | BLOWS/FOOT N VALUES |
|---|---|---|---|---|---|---|
| | GROUND ELEVATION: 296.60 | | | | | |
| 0.30 | PAVEMENT: 100 mm asphalt, 50 mm granular 'A', 100 mm asphalt, 50 mm polystyrene | 1 | | | | |
| | FINE SAND: compact light brown fine sand, some silt, moist | 2 | 296 | | | |
| 1.20 | | | | | | |
| 1.5 | SILTY SAND/SANDY SILT: compact to dense, grey sandy silt, uniform, dilatant, saturated | | 295 | 1 | SS | 29 |
| | | 3 | 294 | 2 | SS | 34 |
| 3.0 3.05 | occasional sand and clay lenses | | | 3 | SS | 23 |
| 3.65 | | | 293 | | | |
| | SILT: compact, grey silt, occasional sand and clay lenses, moist | 4 | | 4 | SS | 22 |
| 4.5 | | | 292 | | | |
| 4.80 | becoming brown | | | 5 | SS | 28 |
| 5.20 | | | | | | |
| | SAND: very dense, light brown fine to medium sand, trace silt, damp | | 291 | 6 | SS | 100 |
| 6.0 6.10 | some gravel, occasional cobbles | 5 | | 7 | SS | 71 |
| | | | 290 | | | |
| 7.5 | | | 289 | 8 | SS | * |
| | | | 288 | 9 | SS | 93 |
| 9.0 | | | | | | |
| 9.30 | becoming moist, some silt | | | 10 | SS | 93/225 mm |
| 9.50 | BOREHOLE TERMINATED AT 9.50 m | | 287 | | | |
| 10.5 | | | | | | |

SHEAR STRENGTH $C_u$ ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST - ●
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT $W_L$
PLASTIC LIMIT $W_P$
WATER CONTENT W
$W_P$ W $W_L$
WATER CONTENT % 10 20 30

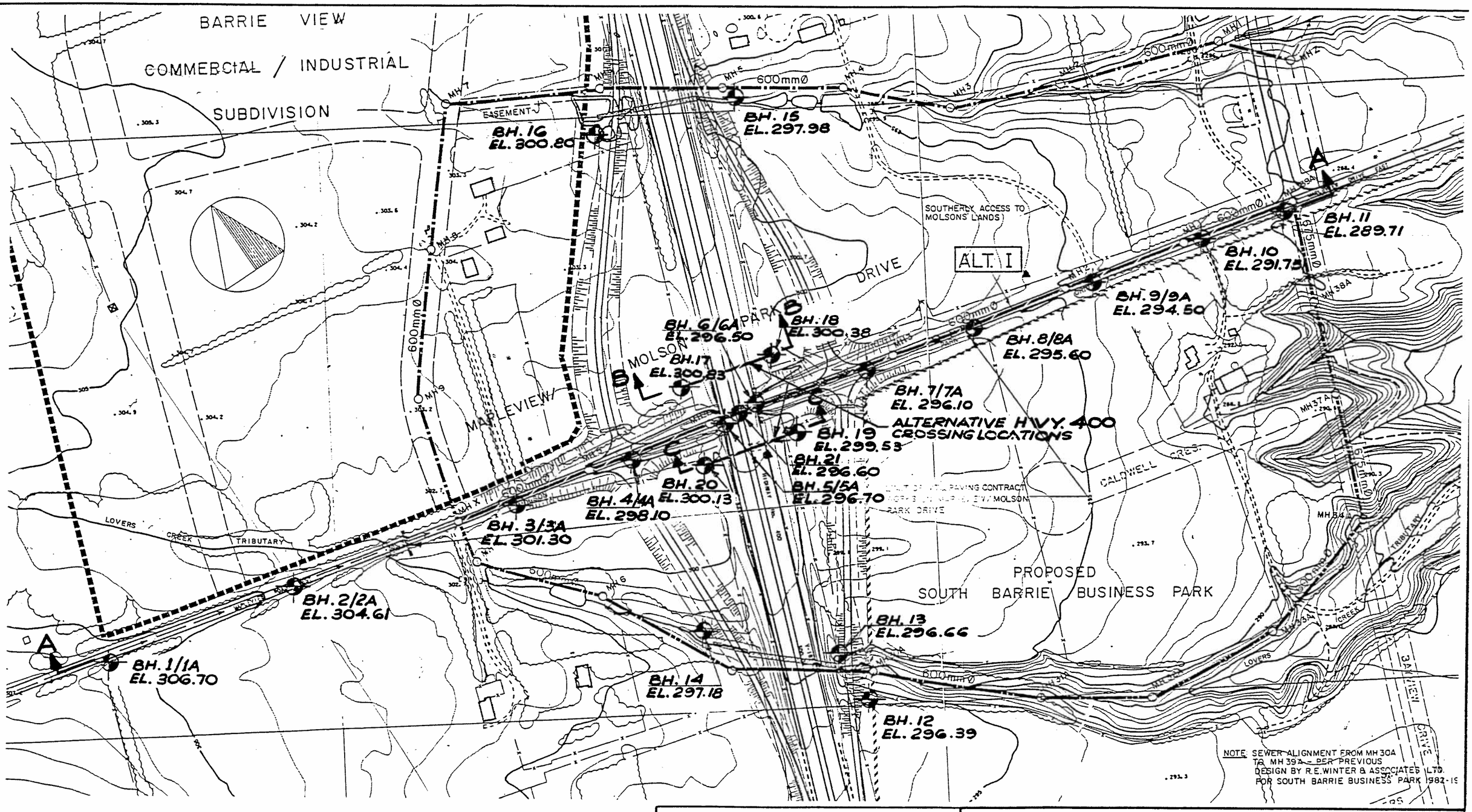
Proposed Sewer Invert El. 289.0

GROUNDWATER OBSERVATIONS AND REMARKS

Upon completion of drilling and withdrawal of hollow stem augers, borehole caved to 7.90 m with no free water (not stabilized)

NOTES * Sampler striking stone - no recovery

CHECKED BY




NOTE: SEWER ALIGNMENT FROM MH 30A TO MH 39A - PER PREVIOUS DESIGN BY R.E. WINTER & ASSOCIATES LTD. FOR SOUTH BARRIE BUSINESS PARK 1982-19

REFERENCE:
SKELTON, BRUMWELL & ASSOCIATES LTD.
DRAWING NO. 82528 B-1, PROJECT NO. 82-528B
APRIL 1980

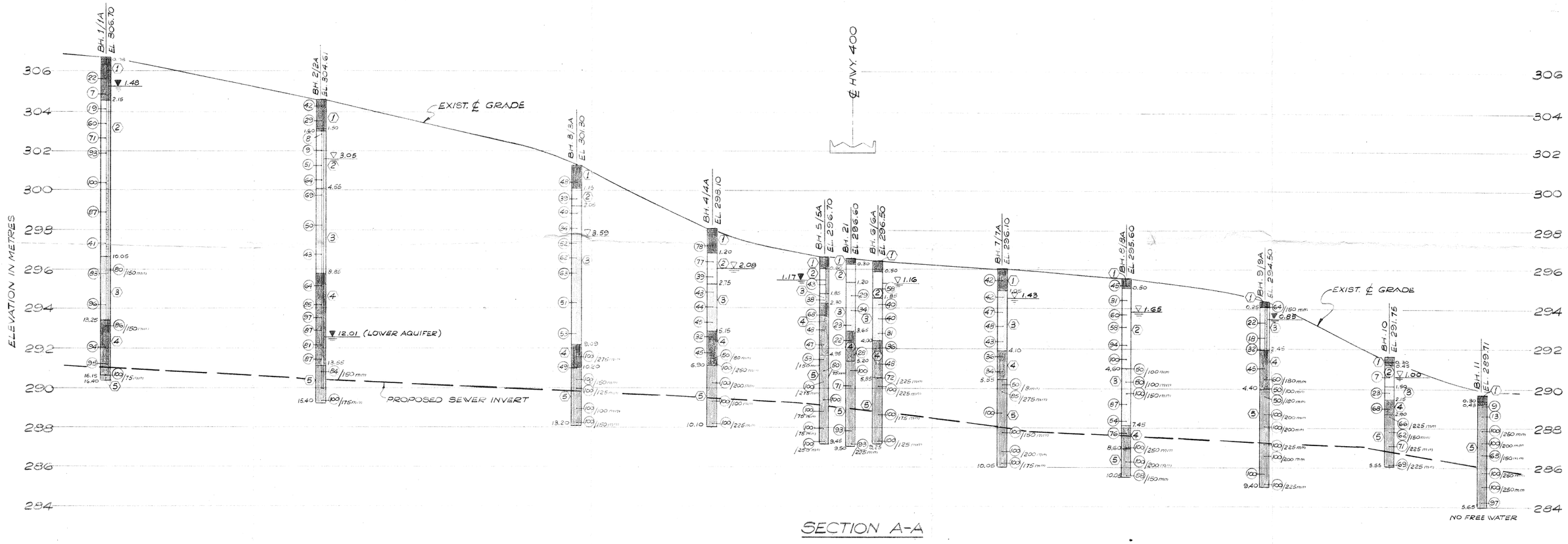
NOTE: The inferred stratigraphy referred to in the report is based on data from these boreholes, supplemented by geological evidence, and the actual stratigraphy may vary from that shown, at other points between the borings.

# BOREHOLE LOCATION PLAN

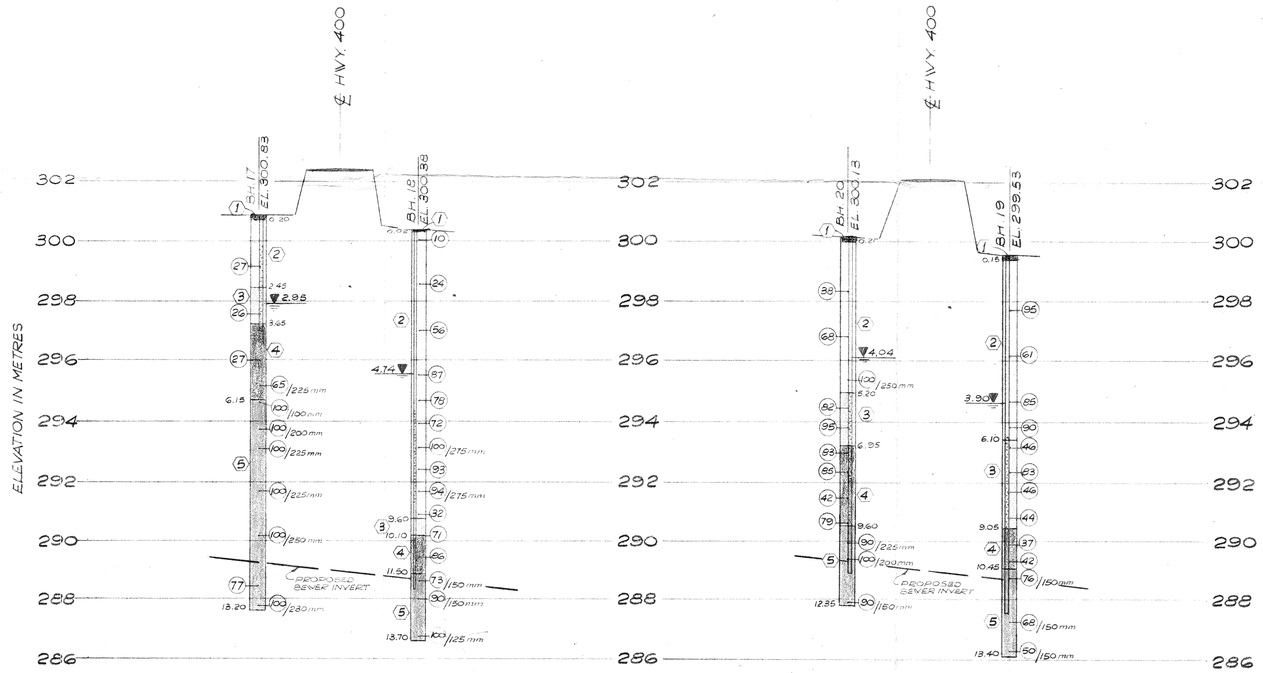
MOLSON PARK DRIVE SANITARY SEWER
BARRIE, ONTARIO

**Peto MacCallum Ltd.**
CONSULTING ENGINEERS

| | DATE | SCALE | JOB NO. | DRAWING NO. |
|---|---|---|---|---|
| DRAWN K.K. | DEC. 1986 | 1:3000 | 85F406A<br>85F406B | 1 |
| CHECKED MSM | | | | |
| APPROVED MSM | | | | |




SECTION A-A




SECTION B-B

SECTION C-C

## LEGEND

1. SURFICIAL SOILS
2. "UPPER" FINE SAND
3. SILTY SAND/SANDY SILT
4. SILT
5. "LOWER" SAND

(26) BLOWS/0.30m

▼ WATER LEVEL IN STANDPIPE

▽ INFERRED WATER LEVEL AT TIME OF INVESTIGATION

NOTES:
1) SEE BOREHOLE LOGS FOR COMPLETE SOIL DETAILS.
2) ALL DIMENSIONS ARE IN METRES UNLESS SHOWN OTHERWISE

NOTE: The inferred stratigraphy referred to in the report is based on data from these boreholes, supplemented by geological evidence, and the actual stratigraphy may vary from that shown, at other points between the borings.

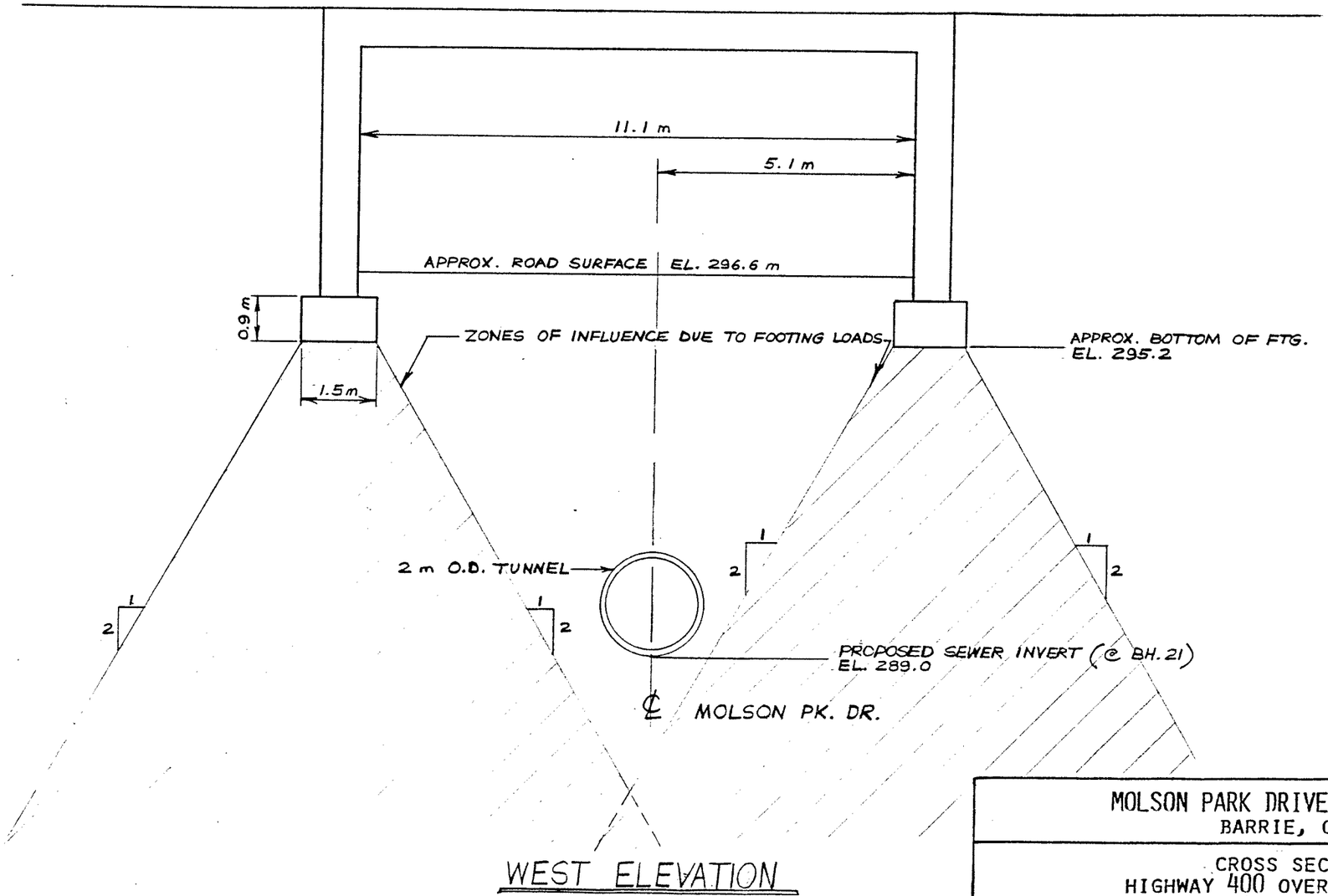
THE CORPORATION OF THE CITY OF BARRIE
AND BARRIE VIEW FARMS LIMITED
℅ SKELTON BRUMWELL & ASSOCIATES LIMITED

MOLSON PARK DRIVE SANITARY SEWER
BARRIE, ONTARIO

# SOIL SECTIONS

Peto MacCallum Ltd.
CONSULTING ENGINEERS

| DRAWN | DATE | SCALE | JOB NO. | DRAWING NO. |
|---|---|---|---|---|
| CHECKED HSH | NOV. 1986 | HOR. 1:1500 | 85F40GA | 2 |
| APPROVED HSH | | VERT. 1:100 | 85F40G8 | |




WEST ELEVATION

NOTE: OVERPASS STRUCTURE DETAILS OBTAINED FROM DEPARTMENT OF HIGHWAYS DRAWING D-2978 "INNISFIL TOWNSHIP OVERPASS" DATED SEPTEMBER 21, 1949

MOLSON PARK DRIVE SANITARY SEWER
BARRIE, ONTARIO

CROSS SECTION AT
HIGHWAY 400 OVERPASS STRUCTURE

**PetoMacCallum Ltd.**
CONSULTING ENGINEERS

| DRAWN T.M. | DATE | SCALE | JOB NO. | DRAWING NO. |
|---|---|---|---|---|
| CHECKED | DEC 1986 | 1:100 | 85F406A | 3 |
| APPROVED | | | | |