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**REGIONAL MUNICIPALITY OF OTTAWA-CARLETON**  
**TRANSPORTATION DEPARTMENT**

**INVESTIGATION OF PROPOSED  
SNOW DUMP FACILITY**

**AUGUST 1983**

**GORE & STORRIE LIMITED**  
Consulting Engineers

**WATER AND EARTH SCIENCE  
Associates Ltd.**

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## CHAPTER 1

### INTRODUCTION

#### 1.1 BACKGROUND

The Regional Municipality of Ottawa-Carleton (RMOC) intends to develop a land facility for the disposal of snow, adjacent to the western end of the built-up area of the Region. The proposed capacity of the snow dump site would be at least 535,000 m<sup>3</sup> (700,000 cu.yd.).

#### 1.2 OBJECTIVE

The objective of this pre-design project, is to investigate the feasibility of developing the required snow disposal facility within the limits of the site proposed by RMOC and to determine if it is environmentally and economically viable.

#### 1.3 TERMS OF REFERENCE

The terms of reference for this project were developed by the RMOC Transportation Department and can be summarized as follows:

1. Calculate drainage boundaries within the study area.
2. Investigate the abandoned quarry and determine the area, depth and general drainage pattern.
3. Determine location of all existing wells within a 1 km (.62 mi.) radius of the property and evaluate the impact, if any, on these wells of the proposed snow dump facility.

4. Recommend appropriate measures to mitigate the impact of the snow dump on the adjacent wells, if such mitigating measures are required.
5. Investigate surface water drainage of the study area and evaluate the impact of snowmelt runoff on the water courses within the drainage area. Investigate and recommend appropriate mitigating measures, if required.
6. Evaluate the potential of the eastern half of the study area for use as a maintenance yard.
7. Attend meetings with representatives of the Regional Municipality, the Ministry of the Environment and other agencies, as required.
8. Prepare and submit a preliminary report summarizing the conclusions of the pre-design investigation and including design parameters for the recommended alternative scheme.



## CHAPTER 2

### STUDY AREA

#### 2.1 GENERAL

The site proposed by RMO for the snow disposal facility is located on Moodie Drive, approximately 1 600 m (1 mi.) north of Fallowfield Road, as shown on Figure No. 1, opposite. Access to the site is from Moodie Drive along an 8 m (26 ft.) wide gravel road, approximately 600 m (2,000 ft.) long, along the north edge of the property. The alignment of the proposed Cedarview Corridor is adjacent to the east side of the site.

The total area of the site which is presently owned by Miron Inc., occupies approximately 29.0 ha (72.2 ac.) and is shown on Figure No. 2 attached to this report. There is an abandoned rock quarry on the east half of this property. The west half of the site forms a part of the Stoney Swamp Conservation Area. Drainage in this area is tributary to the Ottawa River through Graham Creek and Still Water Creek. The east half of the site drains to the Jock River, which in turn, is tributary to the Rideau River. The existing quarry, which has a surface area of approximately 1.66 ha (4.1 ac.) is located in the eastern half of the site and therefore drains towards the east. The drainage boundary is shown on Figure No. 2, at the end of this report.

The east portion of the site is zoned a marginal resource area. The west half of the site and the area to the north of the site are zoned a natural environment area.

An active rock quarry is located west of Moodie Drive directly opposite the Study Area.



## 2.2 GEOLOGY AND HYDROGEOLOGY

Background information combined with field checking confirmed [1] that the bedrock outcrop on site is part of the Ottawa Formation (Leray beds). This unit is a relatively pure, thin to medium bedded limestone. Shaley partings and a more argillaceous composition are typical with depth.

\* The study area was bounded to the north by the northwest-southeast trending Hazeldean fault. North of this major discontinuity, underlying the Cedarview subdivision and Fallowfield Estates, is the interbedded limestone and sandstone of the March and Nepean Formations.

No evidence of significant faulting or vertical displacement of rock units could be seen on the quarry walls during dewatering.

Surficial materials on the study site are composed of a very thin and discontinuous veneer of till and recently deposited organic muds and peat. Thickness of these unconsolidated materials are given on Figure No. 3 opposite.

\* The Ottawa Formation underlying the proposed snow dump site is regarded as a poor aquifer due to its low transmissivity. Natural chemistry of the Ottawa Formation groundwater is often high in iron hardness and hydrogen sulphide concentrations.

\* The March and Nepean Formations which outcrop north of the site on the other side of the fault do, however, provide high quality groundwater of sufficient quantity to supply domestic and commercial users.

\* Hydraulic connections between the two aquifers are limited by the low transmissivity of the Ottawa Formation. Therefore, no significant well interference will occur as a result of fluctuations in the water level within the quarry.

Thirty-eight well records from MOE files were examined. These records represent wells located within a 2 km (1.25 mi.) radius of the study site (see Figure No. 4 opposite). Well records have been included as Appendix A. Four of these wells located on the study site, were abandoned at the time of the closing of the cement plant. A number of other wells are located along Moodie Drive but only two of these wells lie within a 1 km (.62 mi.) radius of the study site. In fact, these wells lie closer to the presently operating McFarland Quarry than to the proposed site. Interference effects from the McFarland Quarry would, therefore, be expected to be more significant from this operating quarry, than from the quarry within the study area. These wells also appear to obtain water from depths below that of the bottom of the quarry on the site (see Figure No. 5 following).

The Cedarview Subdivision and Fallowfield Estates to the north and east are serviced with a piped water distribution system and therefore, those homes which are connected to this distribution system would not be affected by quarry dewatering.

A review of well records and mapping of the potentiometric surface indicates a slight groundwater gradient towards the northeast.

### 2.3 HYDROGEOCHEMISTRY

A wide range of contaminants including salt, sediment, refuse, de-icing agents, trace metals and spilled fuel will be included with the snow deposited at this site. These contaminants vary in their concentration mobility, and levels of toxicity. In this hydrogeologic system, where annual dewatering of the quarry will precede any dumping of snow, a number of factors will reduce the migration and therefore, the impact of contaminants introduced at the quarry.

Natural groundwater gradients are northeasterly and are indicative of a discharge zone throughout the study area. These contaminants will not move any deeper into the groundwater flow regime. Very slow groundwater velocities are expected.

During periods when the water levels in the quarry are lowered the groundwater flow gradients toward the pit will be increased resulting in higher rates of groundwater flow into the quarry.

The high pH, high alkalinity environment of the Ottawa Formation groundwaters will restrict movement of many of the heavy metal contaminants [2] found in snow dumps. These will be deposited as sediment within the quarry.



## CHAPTER 3 IMPACT ON GROUNDWATER REGIME

### 3.1 GENERAL

This section of the report deals with the impact of the proposed quarry on the groundwater regime adjacent to the study site.

### 3.2 AQUIFER RECOVERY TEST

Field studies included dewatering the quarry and measurement of quarry water-levels during recovery (i.e. as groundwater inflow occurred).

Pumping involved the mobilization of two - 200 mm (8 in.) electric submersible pumps each of which produced an approximate discharge of 2,600 IGPM  $1.7 \text{ E}4 \text{ m}^3/\text{day}$  (2,600 IGPM). This work, which was conducted by Olympic Drilling Ltd. of Ottawa, was started at 1100 hr 18 May 1983, and was stopped at 2300 hr 25 May 1983. Pumping at a continuous discharge was not practical. Noise complaints were received during the operation of the diesel generators at night and flooding problems occurred at the downstream golf course when both pumps were operating. The quarry was almost completely drained by 25 May 1983. Pumps were run for a cumulative 231 pump-hours (units of one hour per pump) and produced an estimated total discharge of  $1.77 \text{ E}5 \text{ m}^3$  ( $3.89 \text{ E}7 \text{ IG}$ ).

Measurement of drawdown in the quarry was undertaken on a periodic basis during the pumping. At the conclusion of pumping, recovery water levels in the quarry were measured. Rainfall records for the Ottawa area were also obtained for the period through which recovery was monitored (up to 7 June 1983).

The recovery data was analysed using a steady-state approximation which was calibrated with data available from short duration aquifer tests from the MOE well records. The aim of this approach was to arrive at an approximation of the transmissivity of the materials into which the quarry was developed.

4 The large amount of swampy terrain, the low physiographic location and the continuous flow of water from the quarry prior to pumping 98 m<sup>3</sup>/day (15 IGPM) indicates that the study area is situated in an area of groundwater discharge. This natural flow into the quarry will be accelerated during lowering of the water level in the quarry to an estimated maximum inflow of 878.0 m<sup>3</sup>/day (134 IGPM). This maximum value of inflow was estimated from aquifer recovery testing data. A steady recovery of water levels in the quarry of 7 cm/day was observed and is shown on Figure No. 6 opposite. A reduction of at least 20% of this figure, to 5 cm, is anticipated for winter recovery and freezing conditions on the site.

### 3.3

#### CONTAMINANT HYDROGEOLOGY

In this hydrogeologic system, where dewatering of the quarry will precede any dumping of snow, a number of factors will reduce contaminant migration.

The low transmissivity of the Ottawa Formation and the distances between the quarry and the closest wells indicate that an effective contaminant buffer zone is present. In this type of system, contaminant transport is dominated by flow. The contaminants will move down groundwater gradient at velocities somewhat less than those of the groundwater velocity. The velocity of flow of groundwater will be higher than that of the movement of contaminants.

The alkaline chemical environment of the Ottawa Formation groundwaters will restrict movement of the heavy metal contaminants found in snow dumps. An examination of eH-pH stability field diagrams for aqueous species of lead, for example, indicates that solid phases dominate at a pH greater than 7, under most redox states

[2]. Therefore, lead will precipitate out as lead carbonate (cerussite) in the quarry.

Water quality standards for lead in drinking water have been established at 0.05 mg/l for humans and 0.1 mg/l for livestock. Irrigation waters may be as high as 10.0 mg/l for alkaline soils. An objective limit of 0.01 mg/l for aquatic life has been established [3].

Of the contaminants which will not be attenuated within the quarry, the most important from an environmental viewpoint is chloride, which will be dissolved in the snowmelt. Chloride has a relatively low level of toxicity and is commonly found in the natural environment. Drinking water standards for chloride are 250 mg/l [4]. Chloride does not accumulate and build in concentration to toxic levels in a moving water environment such as a surface stream or pond as long as water circulation is maintained.

Cations such as sodium are less mobile than anions such as chloride. Sodium has a recommended maximum concentration of 270 mg/l in drinking water and people on sodium restricted diets are generally advised not to drink water with sodium concentrations in excess of 20 mg/l [3].

A minor ground water discharge of approximately 98 m<sup>3</sup>/day (15 IGPM) were observed prior to the dewatering of the quarry indicating that the quarry is a groundwater sink for at least part of the year. On lowering of the water surface in the quarry, some increases in groundwater discharge into the quarry were observed. This would indicate an increased gradient toward the quarry. There is a possibility that the water level in the quarry could equilibrate with the surrounding gradient field (northeast). In this event, there would be some contaminant transport in the direction of the general gradient field (also northeast). When pumping of the quarry was resumed, the quarry would again become a groundwater sink and contaminant transport would reverse and be oriented toward the quarry. The reversed gradients would be steeper than the natural field near the quarry and therefore, flow velocities would be higher.



This would result in a flushing of the unattenuated contaminants in the rock back into the excavation.

### 3.4 CONCLUSIONS

The following conclusions summarize the findings of the investigations relating to the impact of the proposed snow dump on the adjacent groundwaters.

- 1) No significant groundwater interference on adjacent domestic and commercial well-water supplies will occur as a result of quarry dewatering.
- 2) There exists a natural seepage from the quarry walls of approximately  $98 \text{ m}^3/\text{day}$  (15 IGPM) which discharges to surface water in the spring. This is a low volume in relationship to the size and depth of this rock quarry.
- 3) Seepage into the quarry from the groundwater will increase to a maximum of  $878 \text{ m}^3/\text{day}$  (134 IGPM) when the quarry is rapidly pumped dry. This corresponds to a water level rise of 7 cm per day. A 20% lower seepage value is considered reasonable for drier late fall and winter conditions.
- 4) Significant attenuation of lead and other trace metals in the carbonate dominated alkaline geochemical environment of the bedrock may be expected. Trace-metal contaminants such as lead will precipitate out as carbonates when mixed with naturally occurring groundwaters. These precipitates will settle to the bottom of the quarry or be deposited on the surrounding site.

## 3.5

RECOMMENDATIONS

- 1) A continuous pumping rate of  $3600 \text{ m}^3/\text{day}$  (550 IGPM) would be adequate for complete quarry dewatering over a period of 60 days.
- 2) Water levels in the quarry could be maintained below equilibrium (below full) throughout the year. This will further reduce the likelihood of contaminant migration into the groundwater regime. Pump operation at a discharge of  $3600 \text{ m}^3/\text{day}$  (550 IGPM) for twenty-four hours per week during summer conditions should cause the required drawdown.
- 3) Groundwater quality information should be gathered from at least three sites to the northeast prior to and throughout the period of operation of the site. Sampling at intervals of six months for the first two years of operation will be sufficient.
- 4) Sediment, precipitates and debris deposited in the pit and on surrounding lands should be treated as contaminated waste and be landfilled appropriately.
- 5) Public access to the quarry for recreational aquatic activities should be discontinued after operation commences.

## CHAPTER 4 IMPACT ON SURFACE WATERS

### 4.1 GENERAL

This section of the report deals with the impact of the proposed snow dump on the adjacent surface water regime.

The orientation of the study area and the downstream drainage channels are shown on Figure No. 1, opposite page 3 of this report.

### 4.2 CONTAMINANTS IN SNOWMELT

The previous section of the report indicated that sediment and trace metals would be contained, to a large degree, within the quarry and in the soil on the surface, adjacent to the quarry. For the purposes of considering the impact of snowmelt on the adjacent surface waters, the most important pollutants are those which will be dissolved in the snowmelt and which will not be removed by flocculation and sedimentation processes which will naturally occur within the alkaline environment of the quarry.

Chlorides would be expected to be present in large amounts in the snow which would be disposed of at the site and would not be removed during the retention of the snowmelt within the quarry. Therefore, chloride is considered to be the most significant dissolved pollutant in the snowmelt which would be discharged from the snowdump.



#### 4.3 SIGNIFICANCE OF CHLORIDES

Chlorides are abundant in the natural environment and at moderate levels of exposure, are not considered to be toxic.

The following table indicates the approximate public health effect of chlorides in various concentrations, which are listed below in milligrams per litre (parts per million):

0 - 10	approximate range of drinking water in Ottawa
90	approximate average of groundwater supplies in Ontario
250	drinking water standard
300 - 400	approximate threshold of salty taste
3 000	maximum concentration total soluble salts for for watering of livestock [5]
20 000	approximate concentration of seawater

For general agricultural uses, the Ministry of Environment [5] suggests that water meeting the drinking water objectives, be used wherever possible. With reference to crop irrigation, the MOE [5] states the following:

"Total salt content is the single most important criterion for evaluating irrigation water quality. However, all crop tolerance data are based on the salinity of the soil solution in the root zone and these data are applicable to specific crops. Although criteria are not included here, water with salt content of less than 700 to 800 mg/l are not expected to create serious problems". [5]

It is noted that a single value for the maximum allowable concentration of chlorides in irrigation water cannot be determined because of the varying tolerances of different species of grasses, crops and trees to chlorides [6]. The susceptibility to damage from chlorides is also a function of environmental conditions and management practices [7].

CHLORIDE LOADINGS IN SNOWMELT

The reported loadings of chlorides in snowmelt and snowmelt runoff appear to be site specific and extremely variable. This variation of the reported concentrations [8,9,10,11,12,13] is typical of the melting of a snowpack, containing a significant amount of chlorides. At the beginning of a snowmelt, the action of chlorides on the melting point of snow predominates and the runoff generally consists of rather low rates of flow of extremely high chloride concentrations. This would be typical of observed levels of chlorides in roadside ditches or snowdumps at the early stages of melting. The reported levels of chloride concentrations do vary considerably and values in the range of 10 000 to 15 000 mg/l are not uncommon.

As melting of the snowpack proceeds during higher temperatures, the pure melting of snow predominates, producing higher rates of flow having much lower concentration of chlorides.

This characteristic pattern of flows and chloride loadings from melting snow is indicated by Figure No. 7 shown opposite. The data is taken from analysis of snowmelt runoff from the snow disposal site at Baseline Road and Woodroffe Avenue. [8] It is noted that the proposed site will likely receive snow which previously was taken to the Baseline-Woodroffe site and therefore, this data is particularly appropriate for this study. It is also noted that since the time of the previous research by J. L. Richards, [8] rates of application of salt to roadways in Ottawa-Carleton have decreased and the practice of using mixtures of salt and abrasives is increasing when permitted by weather conditions. This would indicate that the 1973 data from the Woodroffe site, should be considered to be conservatively high.

As indicated, the average concentration of chlorides in the snowmelt is of the order of 200 mg/l. This figure would be considered to be a conservatively high estimate of the chloride concentration of snowmelt which could be contained until the melting process was complete and the chlorides were diluted as much as possible by the melting snow.

#### 4.5 IMPACT ON RECEIVING STREAMS

Tables No. 1 and 2, opposite and following, indicate the monthly average flows of the Jock River and the Rideau River respectively. These receiving streams have a limited capacity to assimilate pollutant loadings, particularly during the summer months, when flows are low and recreational use is very extensive. Despite these limitations, it appears that the dilution capabilities of these receiving streams relative to the flow rates from the proposed quarry are relatively high. This is indicated by the following calculations:

##### Case 1

Assume that  $1.82 \text{ E5 m}^3$  ( $4.0 \text{ E7 IG}$ ) are pumped at a rate of  $.076 \text{ m}^3/\text{sec}$ . ( $1,000 \text{ gal/min}$ ) for a period of 30 days during the month of November. Comparing this pumping rate to the mean flows in the Jock River and the Rideau River for the month of November, the dilution ratio of the mean flow in the Jock River to the rate of pumping

$$= \frac{3.93}{0.075} = 52.4$$

For the Rideau River, the corresponding dilution ratio

$$= \frac{28.09}{0.075} = 375$$

Assuming a chloride loading of  $200 \text{ mg/l}$  in the water being pumped from the quarry, this indicates that there would be a negligible increase in the chloride loading in the receiving streams for the month of November.

##### Case 2

Pumping rate reduced to  $.019 \text{ m}^3/\text{sec}$ . ( $250 \text{ IGPM}$ ) ie. 25% of pumping rate in Case 1, for a period of 120 days, from August to November.

The minimum flows occur in August and the appropriate dilution factors for the receiving streams are as follows:

$$\text{For the Jock River, } \frac{0.25}{0.019} = 13$$

$$\text{For the Rideau River, } \frac{7.78}{.019} = 409.$$

These dilution factors indicate that at continuous low pumping rates, there would be a significant increase in chlorides in the Jock River during summer months, compared to the existing chloride concentration in the receiving stream. This indicates that continuous pumping over a longer period of time, at lower pumping rates, would have a more significant impact on the Jock River during periods of low flow during the summer, than if the dewatering of the quarry was carried out at higher rates, later in the fall, when flows are normally higher.

#### 4.6 IMPACT ON WATERSHED NORTH OF FALLOWFIELD ROAD

Flow from the quarry normally discharges at the surface and flows to an existing impoundment located on the west side of the Cedarhill Golf Course. This impoundment, which is controlled by a beaver dam, contains approximately  $.45 \text{ E5 m}^3$  (4 E6 IG) or approximately 1/10 of the volume of the quarry in the study area. The pond is utilized by the golf course for watering of the greens and fairways during periods of dry weather. An examination of topographic mapping of the area indicates a number of smaller ditches tributary to the pond. However, during the hot dry weather of the summer of 1983, flow in these ditches has been negligible and in fact, the drainage channel downstream of the beaver pond was dry for much of the summer. It appears therefore, that the natural discharge from the quarry is an important source of water for the beaver pond and that the interruption of this flow as occurred following the lowering of the quarry level by the aquifer recovery test, would significantly affect



the operation of the golf course irrigation system during periods of dry weather.

Although surface runoff from other ditches and precipitation will dilute, to some extent, the flow from the quarry, it is considered that for design purposes, no dilution of the discharge from the quarry can be safely assumed when considering the possible impact of continuous pumping over the summer months on the watering of the golf course. It should be emphasized however, that June and July of 1983 were unusually hot, dry months and that normally a significant amount of dilution could be expected.

As previously mentioned, data from the 1973 J. L. Richards Report, [8] indicates that the chloride loadings in the water discharged from the quarry would be increased to a level slightly less than the current standard for drinking water in Ontario. It is considered that the chloride levels in the pond would not be increased to the point of environmental concern. However, this conclusion is based on relatively limited data and, therefore, it is recommended that chloride levels in the quarry and the downstream pond be closely monitored following the commissioning of the snowdump.

#### 4.7 CONCLUSIONS

From the analysis of the impact of the proposed snowdump on the adjacent surface waters, the following conclusions have been reached.

1. Pumping from the quarry during summer conditions should be restricted to 3-4 hours per day, at a rate of approximately  $.038 \text{ m}^3/\text{sec}$  (500 IGPM)
2. The discharge from the quarry is an important source of water for the downstream pond.
3. The operation of the snow dump will increase chloride loadings in the discharge from the quarry. However, calculations indicate that the amount of chlorides in the

snowmelt will be comparable to the drinking water standards for chloride, providing that the discharge is contained until snowmelt is complete.

4. The snowdump site should be designed so that all snowmelt is directed through the quarry prior to discharge to the downstream drainage channel.
5. The water quality of the snowmelt and the pond downstream should be closely monitored during the operation of the snow dump facility.
6. The pumping equipment should be installed so that water is initially withdrawn from a point approximately 3 m above the bottom of the quarry. This will minimize the possibility of entrainment of contaminated bottom sediment.

## CHAPTER 5

### SITE REQUIREMENTS

#### 5.1 GENERAL

This section of the report outlines the activities required to implement the proposed snowdump facility. The recommended site plan is shown on Figure No. 2 attached to the end of this report.

#### 5.2 ACCESS

Access to the site will be from Moodie Drive, along the existing granular roadway on the north side of the site. This roadway is in relatively good condition. However, a minor amount of granular material and grading is necessary to upgrade the roadway for heavy traffic.

It is not expected that future access to the proposed Highway 416 will be permitted.

#### 5.3 SITE SECURITY

It is recommended that a chain link fence be installed around the entire perimeter of the proposed snow dump site, which comprises the eastern half of the study area. The extent of fencing required is shown on the site plan, Figure No. 2 at the end of this report. Access to the snowdump area will be through a gate in the new fence, at the northwest corner of the site, as shown on the site plan.

#### 5.4 CLEARING AND GRUBBING

That portion of the study area which is suitable for surface storage of snow, is presently covered, for the most part, with bush and grasses, which should be cleared prior to the disposal of snow in that area.

Within the quarry, there is a considerable amount of previously blasted rock on the floor of the quarry. It is not considered economically feasible to remove this material to increase the capacity of the quarry. It is recommended, however, that this material be bulldozed to the edges of the floor of the quarry, in order that it would not hamper snow disposal operations.

#### 5.5 SURFACE GRADING

It is recommended that drainage from all areas on surface where snow will be stored, be directed to the quarry. The existing slope of this area, as shown on the site plan, indicates that drainage will flow to the quarry. However, disruptions to this natural drainage pattern can be expected when large amounts of snow are placed on the surface. Because of the importance of not allowing drainage off the site to the adjacent conservation area, it is recommended that the perimeter berm shown on the site plan, be constructed before the start of snow disposal operations.

#### 5.6 METHOD OF OPERATION

It is recommended that the quarry be pumped out completely in the Fall of 1983, to permit the bulldozing of the loose rock at the bottom of the quarry and to maximize the volume available within the quarry for snow disposal. It is recommended that the rate of pumping for this work should not exceed the rate utilized during the aquifer recovery test, to minimize problems downstream relating to the flooding of the golf course. Therefore, the suggested maximum dewatering rate is  $.15 \text{ m}^3/\text{sec}$  (2,000 IGPM).

Calculations of the volume of the quarry indicate that the quarry has the capacity to accommodate the equivalent of approximately  $3.0 \text{ E5 m}^3$  ( $4.0 \text{ E5 yd}^3$ ) of uncompacted snow. It is recommended, therefore, that the first  $3.0 \text{ E5 m}^3$  ( $4.0 \text{ E5 yd}^3$ ) of snow which is disposed at the site each year, be placed in the quarry before the use of surface storage. The area designated on the site plan for surface storage will accommodate approximately  $2.7 \text{ E5 m}^3$  ( $3.5 \text{ E5 yd}^3$ ) of snow, if it is placed to an average height of approximately 5 m (16 ft.). This method of operation will permit the retention of the initial melt of the snowpack, which will allow the maximum dilution of contaminated water by melting snow. This type of operation may require a relatively minor amount of discharge to the downstream drainage channel, following those winters when the site is utilized to its maximum capacity. However, this will occur during Spring conditions, when the dilution by downstream waters will be relatively high.

From previous records of snow disposal within the Regional Municipality, it is concluded that the average amount of snow to be disposed of annually on the site is less than the amount which could be contained within the quarry. Therefore, during an average winter of snowfall, it will not be necessary to make extensive use of the surface storage which is available at the site. This type of operation will provide the optimum attenuation of contaminants within the quarry.

Assuming a concentration of suspended solids of 2 000 mg/l, it is estimated that approximately  $75 \text{ m}^3$  (100 cu.yd.) of sediment would be deposited at the bottom of the quarry each year. It is recommended that the accumulated sediment be removed and disposed of at a landfill site at an interval of approximately every 5 years. It is also noted that abandonment or closure of the site in the future will necessitate the stripping of the surface soil from the area of snow storage and replacement of topsoil. It is expected that the soil from the site will be contaminated with trace metals and other sediment from snow disposal operations.

It is recommended that the quarry be equipped with a pumping installation consisting of two electric submersible pumps, which will allow the quarry to be totally emptied within a period of 30 days. This will require a total pumping capacity of approximately  $0.76 \text{ m}^3/\text{sec}$  (1,000 gpm). The installation of two pumps will allow the flexibility required for routine operation and maintenance and will also provide the capability of pumping at a reduced rate during the summer months. It is noted that pumping during summer conditions should only be for periods of approximately 3 to 4 hours per day at  $.038 \text{ m}^3/\text{sec}$  (500 IGPM). This will maintain favourable groundwater gradients and reduce the impact of the discharge from the quarry on downstream receiving waters. A permanent power supply and soundproof control enclosure will permit the control and operation of the pumps without requiring permanent maintenance staff. The use of a permanent power supply to electric submersible pumps will eliminate the problem of noise during dewatering of the quarry.



CHAPTER 6  
ESTIMATED COSTS

6.1 SUMMARY OF CAPITAL COSTS

The following are the estimated costs required to prepare the site for disposal of snow.

Access Road Improvements	\$ 5,000
Clearing, Grubbing, Construction of Perimeter Berms	15,000
Chain Link Fence	75,000
Pumps, Including Panel, Controls, Enclosure	45,000
Power Supply	25,000
Installation of Monitoring Wells	<u>10,000</u>
Sub-Total	\$175,000
Engineering and Contingencies @20%	<u>35,000</u>
Total Estimated Cost	<u>\$210,000</u>

The above estimate does not include the cost of property acquisition.

The costs of constructing other permanent facilities necessary for the site, lighting, curb-stops, noise attenuation and aesthetic screening will be identified during final design and are not included in the above noted costs.

### BIBLIOGRAPHY

1. Wilson, A.E., "Geology of the Ottawa-St. Lawrence Lowlands, Ontario-Quebec", G.S.C. Memoir 241, Ottawa, Ont., 1946.
2. Garrels, R.M., and C. L. Christ, "Solutions, Minerals and Equilibria", Freeman, Cooper & Co., San Francisco, Calif., 1965, pp. 450.
3. McNeely, R.N., et. al., "Water Quality Sourcebook: A Guide to Water Quality Parameters", Inland Waters Directorate, Environment Canada, Ottawa, Ont., 1979.
4. Ontario Ministry of the Environment, "Water Quality Objectives", Toronto, Ont., 1978.
5. Ontario Ministry of the Environment, "Water Management Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment", Toronto, Ont., 1978.
6. Field, R., et. al., "Water Pollution and Associated Effects from Street Salting", Report prepared for EPA, EPA-R2-73-257, May 1973.
7. Gore & Storrie Limited, "Review of Canadian Municipal Urban Drainage Policies and Practices", Project No: 76-8-40, MOE, Toronto, Ont.
8. J. L. Richards & Associates et. al., "Snow Disposal Study for the National Capital Area", Ottawa, Ont., 1973.
9. Van Loon, J. C., "The Snow Removal Controversy", Water and Pollution Control, 110, 11, 1972, pp. 16-20.
10. Waller, D. H., and W. A. Coulter, "Winter Runoff From an Urban Catchment", A report prepared for Water Pollution Control Directorate, Environment Canada, Ottawa, Ont., May 1974.
11. Shaheen, D. G., "Contributions of Urban Roadway Useage to Water Pollution", Report prepared for EPA, EPA-600/2-75-004, March 1975.
12. Kronis, H., "Characterization and Treatment of Snowmelt Runoff from an Urban Catchment", Research Publication No. 73, MOE, Toronto, Ont., December 1978.
13. James F. MacLaren Ltd., et. al., "Storm Water Management Model Study", Vol. I., Project No. 73-5-10, MOE, Toronto, Ont., September, 1976.

DATE COMPILED: April, 1983

Well No.	Con No.	Lot No.	Csg Dia Ins	Kind of H <sub>2</sub> O	Water Found Feet	Stat Lvl Feet	Pump Lvl Feet	Test Rate GPM	Test Time Hr/Mn	H <sub>2</sub> O Use	Owner/Log Depths in feet to which Formations Extend
1	4	20	5	fr	40	12	27	10	/30	do	Featherstone, D gr ms br 14 lm 81
				fr	60						
				fr	73						
2	4	20	4	fr	31	18	24	3	1/00	do	Neil, R. cl st 24 lm 84
3	4	20	5	fr	80	15	70	5	/30	do	McCaskill cl tp 12 lm 80
4	4	20	5	fr	85	8	8	30	1/00	do	Neill, W. cl 8 lm 35
5	4	20	6	fr	64	8	20	15	/30	do	Poulin, Ronald cl br 14 lm 60 lm ms 80
6	4	21	6	fr	167	12	240	20	3/00	in	Dominion Bld. Mtl. prd 75 lm 280
7	4	21	5	fr	48	10	37	7	1/00	mu	Nepean Twp. hp br 17 lm 139
8	4	21	6	fr	-	27	175	6	3/00	mu	Nepean Garage cl ms 8 lm 367
9	4	21	4	fr	80	18	24	5	1/00	do	Houlihan F cl br 24 lm 80
10	4	21	4	fr	84	14	20	7	1/00	st do	Houlihan A cl 3 lm 84
11	4	22	6	fr	100	flw	6	30	1/00	do	Stanton, D cl 40 ms st 92 lm 100

PROJECT : 1063 Nepean Snow Dump  
 COMPILED BY : JBT, RMW  
 DATE COMPILED : April, 1983

Well No.	Con No.	Lot No.	Csg Dia Ins	Kind of H <sub>2</sub> O	Water Found Feet	Stat Lvl Feet	Pump Lvl Feet	Test Rate GPM	Test Time Hr/Mn	H <sub>2</sub> O Use	Owner/Log Depths in feet to which Formations Extend
12	4	22	5	fr	100	20	80	3	/30	do	McKay, J 1m 123
13	4	22	10	fr	28	flw	70	104	50/00	st	Dept. of Agriculture cl 23 dlmt 201
14	4	22	4	fr	40	8	8	3	1/00	st do	Moylan, L tp 2 1m 40
15	4	22	2	fr	90	26	30	6	2/00	do	Moylan, L tp ms 3 sn 90
16	4	24	6	fr	20	20	50	8	2/00	in	Inter Concrete Matl. fill 10 1m 70
17	4	24	8	fr	205	4	150	40	3/00	in	Inter Concrete Matl. 1m 140 sn 210
18	4	24	6	fr	140	4	140	17	1/00	in	Inter Concrete Matl. 1m 40 sn 145
19	4	24	6	fr	22	20	50	4	1/30	in	Inter Concrete Matl. Fill 10 1m 80
20	4	25	5	fr	60	10	30	10	1/00	do	McIvor D sn 62
21	4	25	4	fr	76	12	12	5	/30	do	Scherer B tp ms br 12 sn 76
22	4	25	5	fr	103	7	70	5	1/00	do	Lytle, H.B. cl st 4 sn 108
23	4	25	7	fr	82	2	30	10	1/00	do	Scherer Carpentry ms cl 1 snms 12 sn 85

PROJECT : 1063 Nepean Snow Dump

COMPILED BY : JBT, RMW

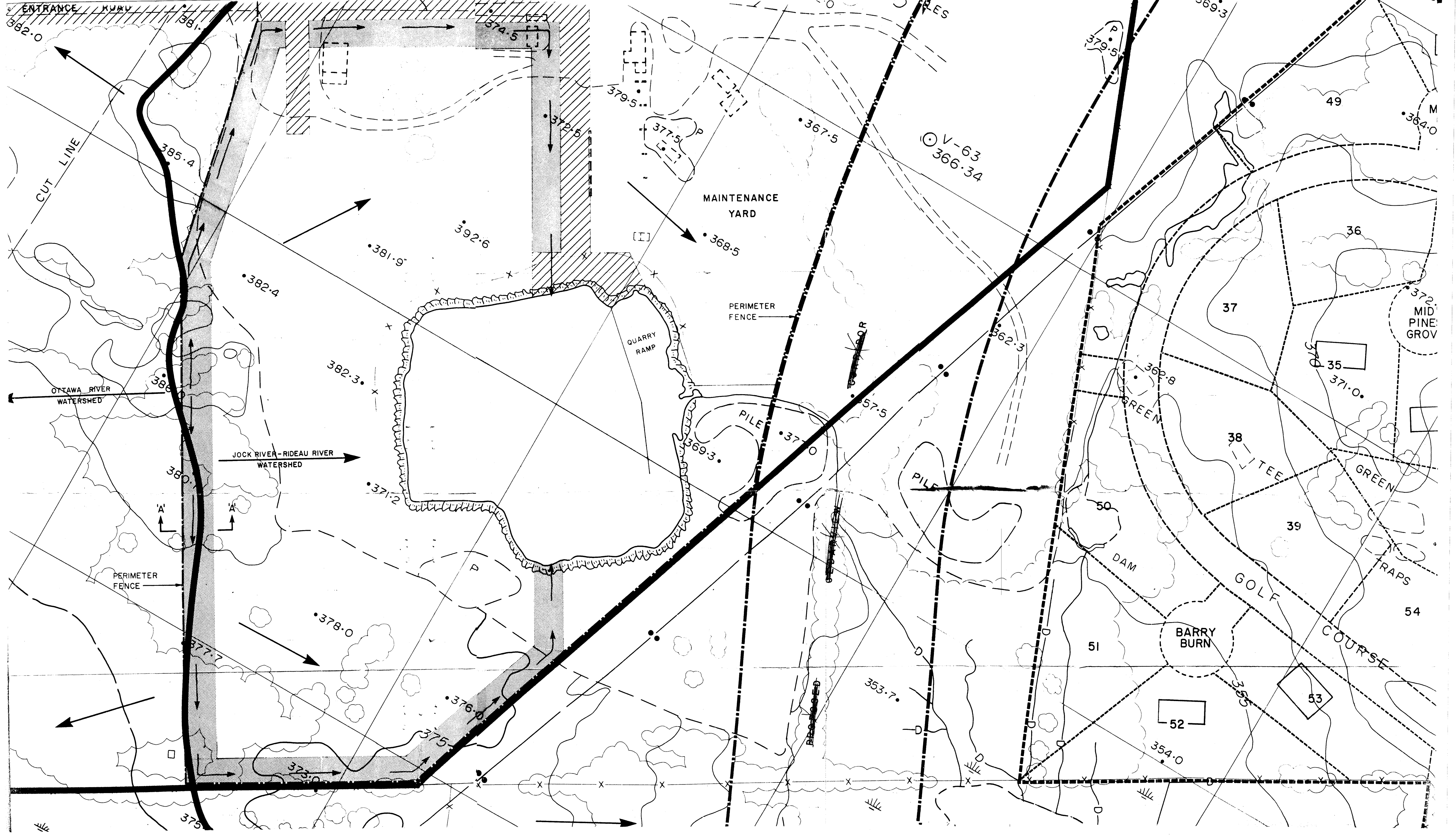
DATE COMPILED : April 1983

Well No.	Con No.	Lot No.	Csg Dia Ins	Kind of H <sub>2</sub> O	Water Found Feet	Stat Lvl Feet	Pump Lvl Feet	Test Rate GPM	Test Time Hr/Mn	H <sub>2</sub> O Use	Owner/Log Depths in feet to which Formations Extend
24	4	25	6	fr	62	8	50	10	1/00	do	McIvor, D. ms tp 2 sn 63
25	4	25	5	fr	70	10	30	5	1/00	do	Nanure tp 4 sn 70
26	4	25	4	fr	68	7	16	4	0/30	do	Vanryswyk, H. ms br 6, ss 68
27	4	25	5	fr	58	20	39	10	1/00	do	Vanryswyk, H. cl 6 ss 60
28	4	25	5	fr	50	4	20	5	1/00	do	Belonge, C tp 4, ss 50
29	4	25	4	fr	15	2	6	6	1/00	do	Lyttle, H ms 3 ss 20
30	4	25	4	fr	75	2	25	4	2/00	do	Cossell, A msbrhp 9 ss 72 unk 75
31	4	25	5	fr	55	1	30	5	1/00	do	Bonneventure, C cl 5 ss 65
32	4	25	5	fr	80	10	80	5	1/00	do	Heinza, cl 12, 55, 20
33	4	25	5	fr	65	-	20	6	1/00	do	Stinson, J. tp 4 ss 65
34	4	25	4	fr	52	15	17	5	1/00	do	Reithmeier, F. cl 14, ss 52
35	3	21	6	fr	48	1	31	6	3/00	st	Cooper Ellis Ltd. cl 10, br hp 10

PROJECT :	1063 Nepean Snow Dump
COMPILED BY :	JBT, RMW
DATE COMPILED :	April 1983

AL.





**Golder Associates Ltd.**

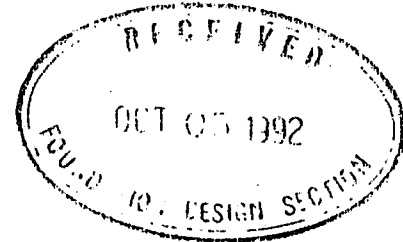
2180 Meadowvale Boulevard  
Mississauga, Ontario, Canada L5N 5S3  
Telephone (416) 567-4444  
Fax (416) 567-6561



October 2, 1992

911-1401

Ministry of Transportation Ontario  
1201 Wilson Avenue  
Central Building  
Room 315  
Foundation Design Section  
DOWNSVIEW, Ontario  
M3M 1J8



ATTENTION: Mr. M.S. Devata, P. Eng.

**RE: LIMITS OF DIAPHRAGM WALLS**  
**HIGHWAY 416 CUT ADJACENT TO LYNWOOD VILLAGE SUBDIVISION**  
**NEPEAN, ONTARIO**  
WP 146-7400-03B

Dear Sirs:

We have reviewed with you the detailed sections forwarded by Fenco on August 31, 1992. The results of the review are summarized on the tables for the West Wall and East Wall area.

The table for the West Wall area indicates that the limits for the diaphragm wall are from Highway 416 Station 27 + 875 to Station 28 + 190. A wall is required where the height of the slope is greater than 7 metres and relatively soft clay exists at the bottom of the slope. This is in keeping with our engineering study dated August, 1990.

The table for the East Wall indicates that the south limit of the wall should be at Cedarview Road Station 11 + 940. Our review of the Fenco detailed sections indicate that the diaphragm wall may have to be lengthened beyond 12 + 200 depending on the subsurface conditions in that area, which are undetermined at this time.

During your visit at our offices, we reviewed the soil boring logs from the proposed Baseline Road overpass. Subsequently, we have reviewed the boring plan from you and have plotted the information on the attached Figure 1, together with the information from our boreholes put down previously.

Boreholes BH 89-1 and BH 89-2 are north of Baseline Road and are not shown on Figure 1. Boreholes BH 9-1 to BH 9-6 are on either side of Baseline Road and show that the clay is of limited depth (2 to 4 metres) in this area.

Borehole BH 9-8 at about Station 28 + 270 along the line of the West Wall has limited clay thickness (2 metres) as well, which helps to confirm that no wall is needed in this area.

Borehole BH 9-7 at about Station 12 + 270 has a clay thickness of 4.6 metres indicating that the East Wall can be ended before this station.

The station where the East Wall can be ended requires further soils information. We would request that boreholes be put down at the following locations as shown on Figure 1:

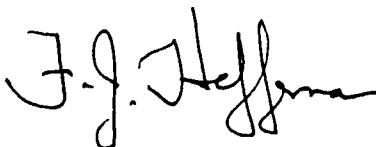
BOREHOLE	STATION	OFFSET
92-W31	28 + 145	30 m Right
92-W32	28 + 170	30 m Right
92-W33	28 + 190	30 m Right
92-W34	28 + 180	55 m Right

When this borehole information is made available to us, we will review it and meet with you to determine the limit and wall arrangement at the north end along Cedarview Road.

We trust that this letter provides sufficient information for your present purposes. Should you require further information, please contact us.

Yours truly,

**GOLDER ASSOCIATES LTD.**



F.J. Heffernan, P. Eng.  
Principal

FJH/clg

# REVIEW OF FENCO (AUG. 31/92) SECTIONS – WEST WALL AREA

911-1401

Chainage	Original GL (EI)	Cut Slope	Max. Cut H (m)		Soil Conditions (from nearest BH)	Comment
27+500	98.5	2.5/1	10.4		MTO-5 SAND	
+500	96.0	2.5/1	8.3		MTO-5	
+600	93.0	2.5/1	7.0		88-8 to 88-7 V. STIFF CLAY	Silt & Sand seams, Weathered Crust?
+650	<91.0	2.5/1	5.5		88-8 to 88-7	
+700	89.0	2.5/1	4.8		89-8 to 89-5 V. STIFF CLAY overlying FIRM CLAY	
+750	88.5	2.5/1	5.4		89-4 V. STIFF overlying STIFF CLAY	
+800	>88.0	2.5/1	6.0			
+850	<88.0	2.5/1	6.7			
(875)			H	Hc		
+900	>87.5		7.4	7.4	90-W11 Stiff overlying FIRM CLAY	WH* at El. 80+
+950	~87.0		8.0	8.0	90-W9	CLAY to El. 77.2
28+000	86.8		8.6	7.4	90-W9	CLAY to El. 77.2
+020	86.6		8.9	6.9	90-W5 Cut to El 78	CLAY to El. 79.7
+040	86.5	W	9.2	5.5	90-W4	CLAY to El. 81.0
+050	86.3		9.3	5.3	90-W4	CLAY to El. 81.0
+060	86.2		9.2	5.2	90-W4	CLAY to El. 81.0
+070	86.6	A	9.9	7.0	101 STIFF overlying FIRM	CLAY to El. 79.6
+080	~87.0		10.5	7.4	101	CLAY to El. 79.6
+090	87.2		10.7	8.6	106	CLAY to El. 78.6
+100	87.5	L	11.3	8.9	106	CLAY to El. 78.6
+110	~86.0		9.9	7.4	106	CLAY to El. 78.6
+120	86.2		10.4	8.5	90-W3	CLAY to El. 77.7
+130	87.5		11.8	9.8	90-W3	CLAY to El. 77.7
+140	~86.0	L	10.6	8.3	90-W3	CLAY <77.7 (77.4)
+150	85.8		10.5	7.3	90-W2	CLAY 78.5 (77.8)
+160	85.7		10.4	7.2	90-W2	CLAY to 78.5
+180	85.5		10.6	7.0	90-W1	CLAY to 78.8 (78.5)
(190)						
+200	84.5		10.2	6.0	90-W1 STIFF overlying FIRM	CLAY to 78.8 (78.5)
+225	83.8	2.5/1	~10.0	5.3	90-W1	CLAY to 78.8 (78.5)

# REVIEW OF FENCO (AUG. 31/92) SECTIONS – EAST WALL AREA

911-1401

Chainage	Original GL (El)	Cut Slope	Max. Cut H (m)		Soil Conditions (from nearest BH)	Comment
			H	Hc		
11+900	87.6	>5/1	6.4	6.4	89-3 V. STIFF overlying Stiff Clay	CLAY to El. 79.8
+920	85.5	~6/1	6.7	6.7	89-3	CLAY to El. 79.8
(940)						
+940	87.5	W	7.0	7.0	89-3 V. STIFF overlying Stiff Clay	
+960	87.4		7.4	7.4	89-22	CLAY to < El. 77.5
+980	87.4		7.9	7.9	90-W30 Deep CLAY	CLAY to El. 74.1
12+000	~87.0		8.1	8.1	90-W27	CLAY to El. 72.9
+020	<87.0		8.6	8.6	90-W26	CLAY to El. 72.9
+040	86.5		8.6	8.6	90-W29	CLAY to El. 72.9
+050	86.4		8.9	8.9	90-W24	CLAY to El. 73.3
+080	86.2		9.3	9.3	90-W24	CLAY to El. 73.3
+100	~86.0		9.5	9.5	90-W23	CLAY to El. 74.2
+120	~87.5		10.0	10.0	90-W22	CLAY to El. 74.4
+140	85.8	L	9.0	9.0	109	CLAY to El. 74.5
+160	85.6		9.3	9.3	90-W21	CLAY to El. 75.6
+170		L			Wall re-located to west?	REFER to FIGURE 1
+180	85.5		10.3	10.3	90-W20	CLAY to El. 73.8
+200	85.5		10.0	10.0	90-W19	CLAY at ~ El. 73.5
+220	~85.0	?	10.2		Soil conditions NOT DEFINED	
+240	~85.0		10.2		Wall ends in this area?	
+260	~82+	Cut 9 m to 416	>8.4	7.0		REFER to FIGURE 1

April 6, 1990

Our Ref.: 901-2107

COMMENTS ON ROADWAY EXCAVATION AND CONSTRUCTION

- o Two stage excavation will likely be required where the depth of the cut is about 8 to 9 metres or greater; where the depth reduces to 5 or 6 metres, the excavation could readily be carried out in one stage.

No equipment should be permitted to operate on or near (within 1.5 metres of) the final subgrade. Any excavation equipment must be fitted with a smooth excavation blade. Conventional excavator buckets with teeth will cause unnecessary and excessive disturbance to the subgrade.

All the excavation should be planned using large hydraulic shovel(s) with trucks to haul the soil away.

- o The granular material placement should follow excavation. As a rule, the lowest lift of granular material should be placed in a thickness of at least 0.75 metres to allow haulage vehicle access, although thinner lifts have been used in the past. The subgrade must be properly shaped and graded to promote drainage to the sub-drains. Even with good construction, considerable total and differential frost heaving will occur due to the wet conditions.

ON CLAY SUBGRADE

- o Where the subgrade is more than about 1 metre below the ground surface in frost susceptible soil such as sensitive silty clay, silty fine sand, clayey silt, etc. we suggest that the subgrade be protected against frost penetration with at least 50 mm of high strength polystyrene<sup>insulation</sup> installed beneath the subbase.

The insulation should be underlain by a levelling layer of ~~clean sand~~<sup>granular material</sup>, where required. Insulation sheets should all be overlapping or ship-lapped. With insulation, the total pavement thickness may possibly be reduced somewhat.

- o The requirement for 3H:1V slopes for this cut seems excessively flat given that, for the most part, the slopes are less than about 8 m in height. Other cut side slopes within sensitive clay in Ottawa have been excavated at 3H:1V and steeper (see attached list of references). The steepened section (2H:1V) above and below the terrace(s) has a high risk of sloughing (see reference 2) and could experience considerable creep (thus leading to eventual rounding of the terrace berm anyway). Pending the results of stability analyses, suggest that MTO review/consider 3H:1V slopes with no berms. Special measures such as berms, set back of abutments, reduced slopes, etc. may be required locally at the CN underpass.



April 19902901-2107

- o If a slurry wall is used, it would likely have to be insulated to prevent frost penetration to frost susceptible soils behind it in order to reduce lateral heaving forces.
- o Based on the water content and Atterberg limit data available (see attached Figure), most of the silty clay and clayey silt will not be suitable for engineered re-use following excavation. The weathered silty clay within about 1.0 metre of ground surface can be considered for use in embankment fill construction. Since these soil types are sensitive to changes in moisture content and wetting, earthwork using the native weathered silty clay could practically only be carried out during consistent dry weather. Reuse of this weathered material may not be practical economically, since it would involve two stage excavation. The wet weathered silty clay and the grey silty clay, although sensitive to disturbance, should remain intact ("solid") throughout haulage and disposal and could likely be piled to a low height at the disposal site (liquid-like spoil is not expected). It is not expected that the haulage and spreading equipment will be able to travel on any of the excavated, disturbed, wet clay material until the material has had a considerable drying period. Even then, only a bulldozer could operate on the piles; a thick granular road would have to be constructed on the clay to enable haulage vehicle access.

April 6, 1990

Our Ref.: 901-2107

/ Roadway

EXAMPLES OF PREVIOUS HIGHWAY CUTS IN OTTAWA

1. Heron Road at the CN Beachburg Overpass - Confederation Heights
  - slope height = 6m
  - slope angle 2.5H:1.V with no berm
  - soil composed of 3.5 m weathered crust, followed by firm grey silty clay (Cu = 40 to 50KPa)
2. Billings Bridge Transitway Station (Our ref.: 821-2039)
  - slope height = 7.5 m
  - slope angle = 2.5 H:1.0V to 2.0H:1.0V with no berm
  - soil composed of weathered crust to 6.4 m depth followed by low plasticity grey silty clay, Cu=70KPa
  - some surficial sloughing has occurred where slope is cut at about 1.9 H:1.0V
3. Hunt Club Road Underpass at the CP Prescott Railway, near Airport Parkway (73748)
  - slope height = 5m
  - slope angle = 3.0H to 1.0V with no berms
  - soil composed of 2m of weathered crust followed by firm to stiff grey silty clay having a shear strength of 24 to 43 KPa
4. Orleans Boulevard Cut south of St. Joseph Boulevard (Our ref. 821-2279)
  - roadway in cut section up to 5m
  - recommendations were given for 2H:1V slopes or flatter
  - soil composed of 2.3 m of sand, followed by firm grey clay (Cu = 25 to 30 KPa)
  - clay is highly plastic with high moisture content
  - recommended pavement subbase was 675mm; the lower 400 mm was to be placed in 1 lift on the shaped subgrade. Some differential frost heaving has occurred since construction with a total pavement thickness of 1 m.

Note: insulation would have been recommended today. Insulation has been used on Tenth Line Road cut and Innes Road cuts to reduce total and differential frost heave.

5. Duford Street Access Road - South of St. Joseph Boulevard (our ref.: 69783)
  - recommendations were given to reduce the side slopes adjacent to the roadway cut to prevent further slope failures,  
i.e. for H < 30'    2H : 1V  
                  H = 40'    2½H : 1V  
                  H = 50'    3H : 1V

April 19902901-2107

6. Prestone Drive Access Road - south of St. Joseph Boulevard (our ref. 752160, 871-2254)
- slopes of 3H : 1V (with no berm) were used for this cut through weathered crust and grey silty clay to about 9 and 12 metres depth.
  - Steeper side slopes and quarried rock retaining walls were used for lower height slopes (i.e. where H = 5.5 m, average 1.6H to 1.0V slopes were used)
  - Gray clay is highly plastic with water contents near the liquid limit; the shear strengths range from 50 to 60 kilopascals.

AFC:cr  
B001/032

G.A.-E-38

**Golder  
Associates**

SUBJECT *GRAPH OF MOISTURE CONTENT VS ELEV.*

Job No. *901-2107*

Made by *APC*

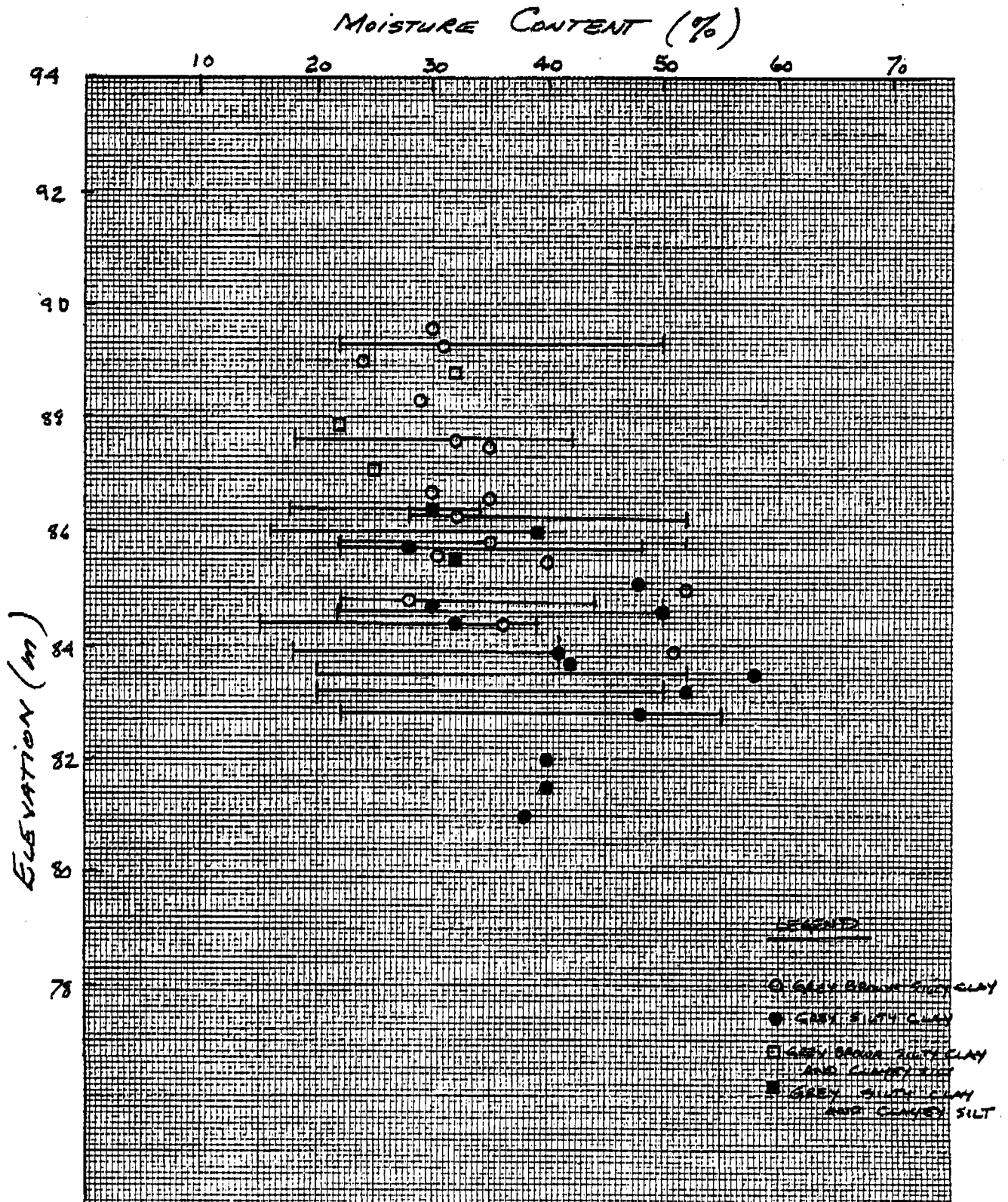
Date *APRIL 6/90*

Ref.

Checked

Sheet *1* of *1*

Reviewed





PUBLIC WORKS DEPARTMENT

our reference: R-84

your reference:

April 19, 1988



Mr. R. J. Oszcewski,  
22 Foothills Drive,  
Nepean, Ontario.  
K2H 6K3

Dear Mr. Oszcewski:

**Re: Proposed Highway 416**

Thank you for your correspondence of April 6th, 1988 reiterating your concerns for soil movements in the Lynwood Village area related to the potential dewatering effects of the Highway 416 construction.

You may be assured that the detailed design project has not yet started, and that at this time geotechnical investigations and drainage investigations are scheduled for the summer of 1988.

The Ministry of Transportation of Ontario have kept us fully informed of their progress on this work, and as investigative studies proceed we expect to be provided with copies of the subsurface information. You may be assured that when subsurface data is made available to us, we will review it in detail, share it with you, and express our professional opinions at that time.


We are taking the liberty of sending a copy of your correspondence expressing your concern to the Ministry of Transportation of Ontario, and we shall request of them that meaningful monitoring wells be installed outside the right-of-way to allow accurate observations of ground water levels within the community. Should the Ministry of Transportation of Ontario be unwilling to install the necessary monitoring wells, you may be assured that we will recommend to our Council that they be installed by the City Engineering Department and monitored in an appropriate manner. We do not however anticipate a problem in this regard.

...../2

In closing, you may be assured that the Department are aware of your concerns and will act in a responsible way to make certain that the interests of the City of Nepean are respected, and that the impact of the project on the citizens of the City of Nepean is minimized.

Thank you for your interest in this matter.

Yours truly,



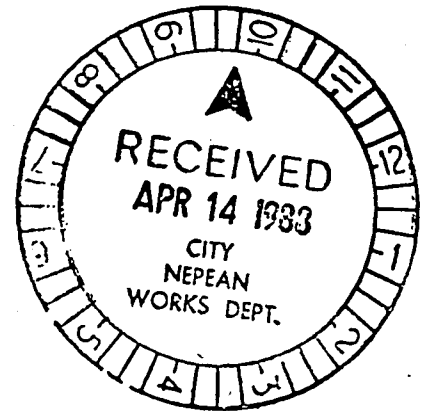
A. C. Bellinger, P.Eng.  
Commissioner of Works.

ACB/cc

c.c.-Mr. Ken Shepherd, Area Manager,  
Ministry of Transportation & Communications, Ontario  
Planning & Design Section, Postal Bag 4000,  
355 Counter Street,  
Kingston, Ontario. K7L 5A3



R. J. Oszcewski  
22 Foothills Dr  
Nepean, Ontario  
K2H 6K3  
April 6, 1988.



A. C. Bellinger  
Commissioner of Works  
Works Department  
101 Centrepont Dr.  
Nepean, Ontario  
K2G 5K7

Re: Highway 416

Dear Mr. Bellinger:

Our last correspondence on this project was in October 1986 (your reference R-84). At that time I expressed concern regarding the possibility that the planned cut section adjacent to Lynwood Village could result in a dewatering of the clay upon which the subdivision is built. I feared a smaller-scale version of the Crestview situation of some years ago where major ground settlement problems occurred.

In your reply you stated that it could not be assumed that hydrogeological conditions in the Lynwood Village area would be similar to those in the Crestview area which caused so much trouble, ie clay interspersed with permeable sand layers. During the hearings I asked the Ministry for a copy of the preliminary foundation investigation report. It did nothing to allay my fears. Sand layers were found in several of the boreholes in the Lynwood Village segment. The proposed design of the side slopes of the cut section includes sub drains and a granular blanket to prevent local slope instability due to water seepage from intersected "sand stratum which are water bearing".

I pursued this concern during the hearings and requested that MTC install groundwater monitors in the area. The Ministry agreed to do this but only, of course, on the highway right of way. Since the right of way is so narrow, the value of these monitors would be greatly increased if the Works Department were to install similar monitors in the Village in the area of the cut.

Presumably the detailed design stage of the project must be underway. I am not aware that any detailed geotechnical study has as yet been carried out. If it has, I would appreciate your professional opinion of the likelihood of ground settlement resulting from the highway based the full, detailed geotechnical investigation.

Sincerely,

  
R. J. Oszcewski

FOR A  
NOTE

T. Mc  
L. H.  
J.M. H.  
D.S. S.  
M. T.  
L. C.  
B. L.  
L.R. H.  
S.T.  
C. E.  
K. H.  
D. H.  
F. P.  
P. C.  
T. H.  
N. H.  
G. H.  
J.E. H.  
Clerk



# The Carleton Board Of Education Le Conseil d'Éducation de Carleton

133 Greenbank Rd. Nepean Ontario K2H 6L3 613-820-1820



6 April, 1988

Mr. W.H. Campbell,  
Property Agent,  
Eastern Region,  
Ministry of Transportation and Communications,  
355 Counter Street,  
Postal Bag 4000,  
KINGSTON, Ontario.  
K7L 5A3

Dear Mr. Campbell:

RE: Hydrogeological Investigation - NCC Lands Adjacent to Bell High School

This letter is further to our conversations on this matter and our subsequent permission for the Ministry of Transportation and Communications to enter the NCC property adjacent to Bell High School which has been leased for many years by the Carleton Board of Education for use as playing fields.

We simply wish to confirm that once a definite time period is established during which the investigation of the lands is to be carried out that some advance notice is given to us so that, if necessary, alternate arrangements can be made by Bell High School staff for use of the playing fields.

In addition, I am sure we need not reiterate that during your investigation of the property, all safety precautions must be taken to ensure the safety of students and staff.

Thank you for your consideration.

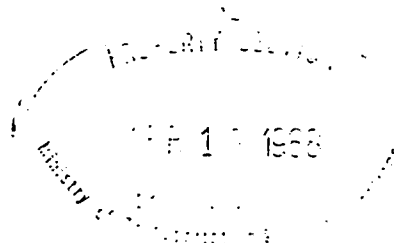
Yours sincerely,

Dr. M. A-Khair  
Manager,  
Planning and Design

:bjb

cc: R. A. Fraser  
M. Carlon, School Superintendent  
G. Fenton, Principal, Bell High School

*Bill*  
*Ensure that these people*  
*are advised in advance*  
*MK 84-64-12*



*Deposited 83/04/29*

# memorandum



(613) 545-4795

To: M. Devata  
Chief Foundations Engineer (East)  
Foundation Design Section  
Central Building, Downsview

Date: August 12, 1988

From: Planning and Design Section  
Eastern Region, Kingston

RE: Hydrogeological Studies for Highway 416

Murty, as requested, I am forwarding copies of the Bruce Pit borehole logs prepared by Conestoga Rovers. Also enclosed is a location plan of the Bruce Pit area.

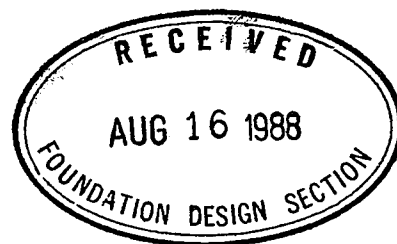
The draft Bruce Pit report is expected by late next week, and I will forward a copy to you for your review and comments.

If you require any other information, please let me know.

A handwritten signature in black ink, appearing to read "Brian Ruck".

Brian E. Ruck  
Senior Project Manager

BER/hs  
Encl.



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: BRUCE PIT

HOLE DESIGNATION: OW1-88

PROJECT NO.: 2396

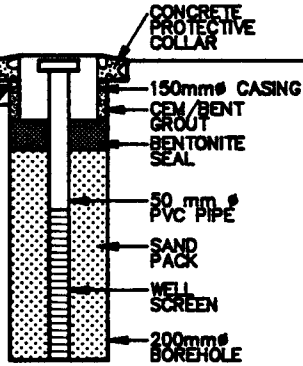
DATE COMPLETED: 27 APR 1988

CLIENT: MTO

DRILLING METHOD: 108 mm ID HSA

LOCATION: AS PER PLAN

CRA SUPERVISOR: S. CROSSMAN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE		
				NUMBER	STATE	VALUE
	REFERENCE POINT (Top Of Casing) GROUND SURFACE	87.311 87.31	 <p>CONCRETE PROTECTIVE COLLAR</p> <p>150mm CASING</p> <p>CEM/BENT GROUT</p> <p>BENTONITE SEAL</p> <p>50 mm PVC PIPE</p> <p>SAND PACK</p> <p>WELL SCREEN</p> <p>200mm BOREHOLE</p>			
1.0	PT PEAT: amorphous, fibrous in a slightly woody structure, compact, brown, very moist.	87.11				
2.0	SM SAND: little silt, compact, fine to medium grained, poorly graded, massive, brown, moist. - wet - grey	86.87		1SS	X	13
3.0				2SS	X	16
3.0	END OF HOLE • 3.05 m BGS.	84.26				
4.0			<p><b>SCREEN DETAILS:</b> Screened Interval: 84.26 to 85.79 AMSL Length -1.52m Diameter -50mm Slot # 10 Material- PVC</p>			
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						
13.0						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS



WATER FOUND



STATIC WATER LEVEL



2/05/88

# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: BRUCE PIT

PROJECT NO.: 2396

CLIENT: MTO

LOCATION: AS PER PLAN

HOLE DESIGNATION: OW2-88

DATE COMPLETED: 25 APR 1988

DRILLING METHOD: 108 mm ID HSA

CRA SUPERVISOR: S. CROSSMAN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE		
				NUMBER	STATE	VALUE
	REFERENCE POINT (Top Of Casing) GROUND SURFACE	96.903 96.90 96.83	CONCRETE PROTECTIVE COLLAR			
1.0	TOPSOIL: sandy, silty loam, compact, brown, slightly moist. SW SAND: trace silt, trace fine gravel, dense, well graded, medium to coarse grained, brown, slightly moist.		150mm# CASING CONCRETE			
2.0			200mm# BOREHOLE	1SS	X	34
3.0	- little gravel		CEMENT/BENTONITE GROUT	2SS	X	40
4.0			50 mm # PVC PIPE			
5.0			BENTONITE SEAL	3SS	X	38
6.0	- very dense, moist		NATURAL CAVE-IN	4SS	X	72
7.0						
8.0	- dense		BENTONITE SEAL	5SS	X	28
9.0	- very moist, slight plasticity, some silt	87.66		6SS	X	54
10.0			SAND PACK			
11.0	- very dense, occasional silt seam, angular gravel, wet		WELL SCREEN	7SS	X	37
12.0		84.62				
13.0	SM SAND: some silt, very dense, fine grained, poorly graded, massive, grey, wet. END OF HOLE @ 12.80 m BGS.	84.10	SCREEN DETAILS: Screened Interval: 84.80 to 86.33 AMSL Length -1.52m	8SS	X	53

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS



WATER FOUND



STATIC WATER LEVEL



4/05/88

# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: BRUCE PIT  
PROJECT NO.: 2396  
CLIENT: MTO  
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW3-88  
DATE COMPLETED: 26 APR 1988  
DRILLING METHOD: 108 mm ID HSA  
CRA SUPERVISOR: S. CROSSMAN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE		
				NUMBER	STATE	VALUE
	REFERENCE POINT (Top Of Casing) GROUND SURFACE	98.262 98.26	CONCRETE PROTECTIVE COLLAR			
1.0	TOPSOIL: sandy loam, brown, moist.	98.21	150mm Ø CASING			
2.0	SP SAND: trace silt, compact, poorly graded, medium grained, layered, light brown, slightly moist.		200mm Ø BOREHOLE	1SS	⊗	7
3.0			CEMENT/BENTONITE GROUT			
4.0	CL CLAY (TII): little silt, little fine gravel, trace sand, stiff, low plastic, green-grey, silt seams, moist, occasional wet lenses of coarse sand.	94.66	50 mm Ø PVC PIPE	2SS	⊗	11
5.0				3SS	⊗	5
6.0				4SS	⊗	11
7.0	SW SAND: some silt, some fine gravel, very dense, well graded, fine to coarse grained, layered, slightly moist.	91.61		5SS	⊗	85
8.0			BENTONITE SEAL			
9.0				6SS	⊗	>100
10.0			SAND PACK			
11.0	- little gravel, massive, wet, grey-brown	87.97	WELL SCREEN	7SS	⊗	57
12.0	- siltier, very moist			8SS	⊗	58
13.0	END OF HOLE ● 12.80 m BGS.	85.45	SCREEN DETAILS: Screened Interval: 86.59 to 88.11 AMSL Length -1.52m			

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ○

WATER FOUND ∇

STATIC WATER LEVEL ▼

4/05/88

# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: BRUCE PIT  
PROJECT NO.: 2396  
CLIENT: MTO  
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW4-88  
DATE COMPLETED: 27 APR 1988  
DRILLING METHOD: 108 mm ID HSA  
CRA SUPERVISOR: S. CROSSMAN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	* HNU (ppm)
	REFERENCE POINT (Top Of Casing) GROUND SURFACE	95.707 95.71	CONCRETE PROTECTIVE COLLAR				
1.0	REFUSE: decayed domestic garbage, plastic, wood, black, moist, compact.		150mm CASING				
2.0			200mm BOREHOLE				
3.0			CEMENT/BENTONITE GROUT				
4.0			50 mm PVC PIPE				
5.0							
6.0	SP SAND: trace silt, compact, medium grained, uniform, massive, light grey-brown, moist, garbage odour.  - occasional thin seam of coarse sand	89.46	BENTONITE SEAL	1SS	×	32	3
7.0							
8.0		87.87		2SS	×	32	2
9.0	SM SAND: little silt, dense, fine grained, poorly graded, grey-brown, massive, very moist, garbage odour.	86.56	SAND PACK	3SS	×	29	
10.0			WELL SCREEN				
11.0	ML SILT: some sand, compact, layered, thin laminations of fine sand, wet, grey, slight garbage odour.	84.67		4SS	×	27	
12.0							
13.0	SM SAND: little silt, fine grained, poorly graded, massive, compact, grey, wet, odourless. END OF HOLE @ 12.80 m BGS. * - HNU READING FROM SAMPLE HEAD SPACE	83.15 82.91		5SS	×	17	

SCREEN DETAILS:  
Screened Interval:  
84.73 to 87.78 AMSL  
Length - 3.05m

Diameter - 50mm  
Slot # 10  
Material - PVC

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS



WATER FOUND



STATIC WATER LEVEL

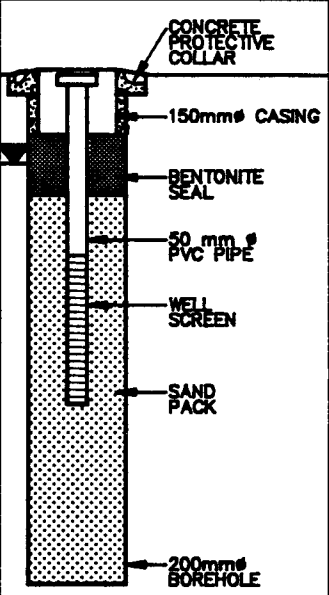


5/05/88

# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: BRUCE PIT  
PROJECT NO.: 2396  
CLIENT: MTO  
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW5-88  
DATE COMPLETED: 26 APR 1988  
DRILLING METHOD: 108 mm ID HSA  
CRA SUPERVISOR: S. CROSSMAN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE		
				NUMBER	STATE	VALUE
	REFERENCE POINT (Top Of Casing) GROUND SURFACE	88.534 88.53	 <p>CONCRETE PROTECTIVE COLLAR 150mm CASING BENTONITE SEAL 50 mm PVC PIPE WELL SCREEN SAND PACK 200mm BOREHOLE</p>			
1.0	SP SAND: little silt, compact, uniform, medium grained, massive, brown, moist.  - wet	87.63		1SS	⊗	17
2.0						
3.0	SM SAND: some silt, compact, fine grained, layered with occasional 3 cm seams of coarse sand, wet, grey, thin silt seams.	85.64		2SS	⊗	20
4.0						
5.0	- siltier, not as dense			3SS	⊗	15
	END OF HOLE ● 5.18 m BGS.	83.35	<p>SCREEN DETAILS: Screened Interval: 85.18 to 86.71 AMSL Length -1.52m Diameter -50mm Slot # 10 Material- PVC</p>			
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						
13.0						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ○

WATER FOUND ∇

STATIC WATER LEVEL ▽

2/05/88

# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: BRUCE PIT

PROJECT NO.: 2396

CLIENT: MTO

LOCATION: AS PER PLAN

HOLE DESIGNATION: GP1-88

DATE COMPLETED: 28 APR 1988

DRILLING METHOD: 108 mm ID HSA

CRA SUPERVISOR: S. CROSSMAN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE		
				NUMBER	STATE	VALUE
	REFERENCE POINT (Top Of Casing) GROUND SURFACE	95.835 95.83	CONCRETE PROTECTIVE COLLAR			
1.0	REFUSE (Fill): sand and silt, decomposed domestic garbage, construction rubble, black, decomposed wood, paper etc.		150mmØ CASING	1SS		15
2.0			CEMENT/ BENTONITE GROUT			
3.0			BENTONITE SEAL			
4.0			12.7mm Ø PVC PIPE			
5.0			GRAVEL PACK			
6.0	SP SAND: trace silt, compact, medium grained, layered, grey, moist, garbage odour	90.29	GAS PROBE	1SS		15
	END OF HOLE ● 6.10 m BGS.	89.74	BENTONITE SEAL			
7.0			GRAVEL PACK			
8.0			GAS PROBE			
9.0			200mmØ BOREHOLE			
10.0			SCREEN DETAILS: GAS PROBE A Screened Interval: 90.65 to 91.87 AMSL Length -1.22m Diameter -12.7mm Slot # 10mmØ HOLES Material- PVC			
11.0			SCREEN DETAILS: GAS PROBE B Screened Interval: 92.48 to 93.40 AMSL Length -0.91m Diameter -12.7mm Slot # 10mmØ HOLES Material- PVC			
12.0						
13.0						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

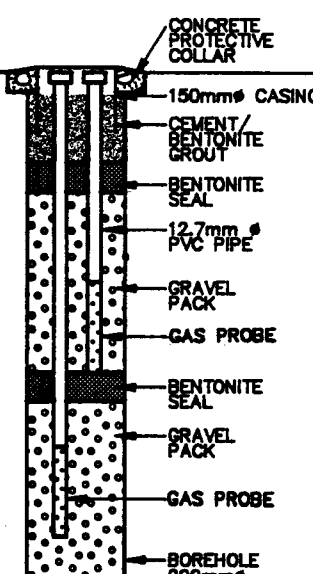
GRAIN SIZE ANALYSIS WATER FOUND STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: BRUCE PIT  
PROJECT NO.: 2396  
CLIENT: MTO  
LOCATION: AS PER PLAN

HOLE DESIGNATION: GP2-88  
DATE COMPLETED: 28 APR 1988  
DRILLING METHOD: 108 mm ID HSA  
CRA SUPERVISOR: S. CROSSMAN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE		
				NUMBER	STATE	VALUE
	REFERENCE POINT (Top Of Casing) GROUND SURFACE	96.749 96.75				
1.0	REFUSE (Fill): silty sand, black, weak methane odour.					
2.0						
3.0						
4.0	- decomposed domestic garbage					
5.0	SP SAND: trace silt, compact, massive, medium grained, grey, moist, garbage odour. END OF HOLE ● 5.18 m BGS.	91.87 91.57		1SS	X	21
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						
13.0						

SCREEN DETAILS:  
GAS PROBE A  
Screened Interval:  
92.02 to 92.94 AMSL  
Length -0.91m  
Diameter -12.7mm  
Slot # 10mm HOLES  
Material- PVC

SCREEN DETAILS:  
GAS PROBE B  
Screened Interval:  
93.70 to 94.62 AMSL  
Length -0.91m  
Diameter -12.7mm  
Slot # 10mm HOLES  
Material- PVC

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE  
GRAIN SIZE ANALYSIS ○ WATER FOUND ∇ STATIC WATER LEVEL ▼

# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: BRUCE PIT

HOLE DESIGNATION: GP3-88

PROJECT NO.: 2396

DATE COMPLETED: 28 APR 1988

CLIENT: MTO

DRILLING METHOD: 108 mm ID HSA

LOCATION: AS PER PLAN

CRA SUPERVISOR: S. CROSSMAN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE		
				NUMBER	STATE	VALUE
	REFERENCE POINT (Top Of Casing) GROUND SURFACE	94.014 94.01				
1.0	REFUSE (Fill): sand and domestic garbage, decomposed, black, moist, strong methane odour.					
2.0						
3.0						
4.0		89.90 89.75		1SS	⊗	7
5.0	SP SAND: trace silt, compact, uniform, medium grained, grey, garbage odour, moist. END OF HOLE ● 4.27 m BGS.			2SS	⊗	25
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						
13.0						

## SCREEN DETAILS:

GAS PROBE A  
Screened Interval:  
90.05 to 90.97 AMSL  
Length -0.91m  
Diameter -12.7mm  
Slot # 10mmØ HOLES  
Material- PVC

## SCREEN DETAILS:

GAS PROBE B  
Screened Interval:  
91.42 to 92.34 AMSL  
Length -0.91m  
Diameter -12.7mm  
Slot # 10mmØ HOLES  
Material- PVC

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ○

WATER FOUND ∇

STATIC WATER LEVEL ▼

# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: BRUCE PIT

HOLE DESIGNATION: GP4-88

PROJECT NO.: 2396

DATE COMPLETED: 28 APR 1988

CLIENT: MTO

DRILLING METHOD: 108 mm ID HSA

LOCATION: AS PER PLAN

CRA SUPERVISOR: S. CROSSMAN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE		
				NUMBER	STATE	VALUE
	REFERENCE POINT (Top Of Casing) GROUND SURFACE	98.391 98.39	CONCRETE PROTECTIVE COLLAR			
1.0	SP SAND: trace silt, compact, massive, medium grained, uniform, light brown, moist.		150mm $\phi$ CASING	1SS		
2.0			CEMENT/ BENTONITE GROUT			
3.0			BENTONITE SEAL			
4.0			12.7mm $\phi$ PVC PIPE			
5.0			GRAVEL PACK			
6.0	CL CLAY (TII): some silt, cobbles, stiff, low to medium plastic, blue-grey, moist to very moist.	92.60 91.99 91.90	GAS PROBE			
7.0			BENTONITE SEAL			
8.0	SP-GP SAND and GRAVEL: coarse sand and fine gravel, dense, poorly graded, layered, rounded, odourless, moist.		GAS PROBE			
9.0			GRAVEL PACK			
10.0	END OF HOLE @ 6.49 m BGS.		CEMENT/ BENTONITE GROUT			
11.0			200mm $\phi$ BOREHOLE			
12.0						
13.0						

SCREEN DETAILS:  
GAS PROBE A  
Screened Interval:  
92.90 to 93.82 AMSL  
Length -0.91m  
Diameter -12.7mm  
Slot # 10mm $\phi$  HOLES  
Material- PVC

SCREEN DETAILS:  
GAS PROBE B  
Screened Interval:  
95.34 to 96.26 AMSL  
Length -0.91m  
Diameter -12.7mm  
Slot # 10mm $\phi$  HOLES  
Material- PVC

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS  WATER FOUND  STATIC WATER LEVEL 

# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: BRUCE PIT

HOLE DESIGNATION: GP5-88

PROJECT NO.: 2396

DATE COMPLETED: 29 APR 1988

CLIENT: MTO

DRILLING METHOD: 108 mm ID HSA

LOCATION: AS PER PLAN

CRA SUPERVISOR: S. CROSSMAN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE		
				NUMBER	STATE	VALUE
	REFERENCE POINT (Top Of Casing) GROUND SURFACE	98.331 98.33	CONCRETE PROTECTIVE COLLAR			
1.0	SP SAND: trace silt, compact, massive, medium grained, uniform, light brown, odourless, moist.  - some gravel, little silt, dense, poorly graded, layered.		150mmø CASING			
2.0			CEMENT/BENTONITE GROUT			
3.0			BENTONITE SEAL			
4.0			12.7mmø PVC PIPE			
5.0	GW GRAVEL: some sand, trace silt, dense, well graded, fine to coarse grained, massive bedding, moist, odourless, rounded.	92.39 91.78 91.63	GRAVEL PACK	1SS 2SS	<input checked="" type="checkbox"/>	34 30
6.0			GAS PROBE			
7.0			BENTONITE SEAL			
8.0			GRAVEL PACK			
9.0	CL CLAY (Till): some silt, trace gravel, stiff, low to medium plastic, blue-grey, moist, silt nodules. END OF HOLE @ 6.71 m BGS.		GAS PROBE			
10.0			200mmø BOREHOLE			
11.0						
12.0						
13.0						

## SCREEN DETAILS:

### GAS PROBE A

Screened Interval:

93.15 to 94.16 AMSL

Length -0.91m

Diameter -12.7mm

Slot # 10mmø HOLES

Material- PVC

## SCREEN DETAILS:

### GAS PROBE B

Screened Interval:

95.59 to 96.50 AMSL

Length -0.91m

Diameter -12.7mm

Slot # 10mmø HOLES

Material- PVC

## NOTES:

MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: BRUCE PIT

HOLE DESIGNATION: GP6-88

PROJECT NO.: 2396

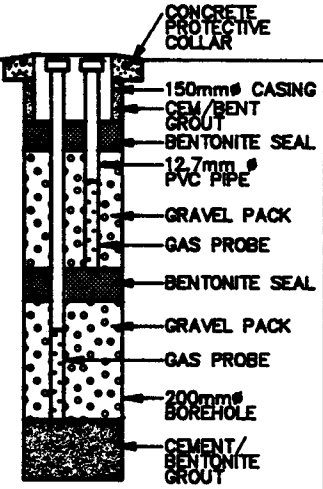
DATE COMPLETED: 29 APR 1988

CLIENT: MTO

DRILLING METHOD: 108 mm ID HSA

LOCATION: AS PER PLAN

CRA SUPERVISOR: S. CROSSMAN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE		
				NUMBER	STATE	VALUE
	REFERENCE POINT (Top Of Casing) GROUND SURFACE	95.179 95.18	 <p>CONCRETE PROTECTIVE COLLAR</p> <p>150mm Ø CASING</p> <p>CEM/BENT GROUT</p> <p>BENTONITE SEAL</p> <p>12.7mm Ø PVC PIPE</p> <p>GRAVEL PACK</p> <p>GAS PROBE</p> <p>BENTONITE SEAL</p> <p>GRAVEL PACK</p> <p>GAS PROBE</p> <p>200mm Ø BOREHOLE</p> <p>CEMENT/BENTONITE GROUT</p> <p><u>SCREEN DETAILS:</u> GAS PROBE A Screened Interval: 91.52 to 92.44 AMSL Length -0.91m Diameter -12.7mm Slot # 10mm Ø HOLES Material- PVC</p> <p><u>SCREEN DETAILS:</u> GAS PROBE B Screened Interval: 93.05 to 93.96 AMSL Length -0.91m Diameter -12.7mm Slot # 10mm Ø HOLES Material- PVC</p>			
1.0	REFUSE (Fill): some sand, little silt, high rubble content, domestic refuse, methane odour, black, moist.					
2.0						
3.0						
4.0	SP SAND: little silt, dense, fine grained, poorly graded, massive, grey stained from refuse, moist, methane odour.	91.22 90.91		1SS	⊗	15
5.0	END OF HOLE ● 4.27 m BGS.					
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						
13.0						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ○

WATER FOUND ∇

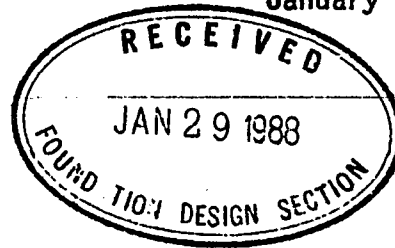
STATIC WATER LEVEL ▼

(613) 545-4748

FILE

January 27, 1988

From: Environmental Unit  
Planning & Design Section  
Eastern Region  
Kingston



Re: W.P. 146-74-00, Highway 416  
Meeting to Discuss Soils - Foundations and Hydrogeological  
Investigations

---

A regional review meeting was held to discuss the 1988 site investigation proposals for soils/foundations and hydrogeological requirements. Mr. M. Devata of the Foundation Design Section attended.

Ken Shepherd reviewed the need to undertake the Hydrogeological Studies as part of the Conditions of Approval of the Environmental Assessment Board Decision. The areas to be investigated are: 1. the rock cut in the vicinity of the Stony Swamp - Log Farm Conservation Area; 2. the fill section through Bruce Pit Recreation Area; 3. the Lynwood Community Area and; 4. the Silver Springs Farm - spring water well.

It had been the Region's intention to undertake these studies by way of a Consultant Assignment. Mr. Devata advised that his office has the capability and expertise to undertake these studies. It was agreed, therefore, that his office would be relied on to undertake these studies rather than a consultant. It was determined that the studies would be completed this summer and that reports would be available by January 1, 1989.

Planning & Design will supply Mr. Devata with: a letter detailing the specific requirements of the study, any relevant existing data, reports, plans, profiles, cross-sections, aerial photos, etc., identify any priority areas and timing requirements, etc.

As all of the area involved is National Capital Commission Greenbelt property, Mr. Devata was advised of the restrictions imposed by the National Capital Commission regarding access and site disturbance. The need for a detailed work plan to be submitted was discussed. Mr. Devata suggested that a site review be held early in the new year.

The Soils and Foundation investigation requirements were also reviewed. A minimum nine structure locations at the 416/417 interchange will require field work this summer to meet structural design requirements. Again, Mr. Devata advised that his office would have no problem completing these studies this year. Structural Office advised that the requests will be submitted by late spring/early summer or as soon as the alignments from Planning & Design are finalized.

Continued on Page 2

Memo to File cont'd  
January 27, 1988

There is a possibility that a structure location on one of the southern contracts will also require investigation.

Mr. Devata was advised of the consultant assignment to undertake investigations in the Bruce Pit abandoned landfill area. It was agreed that his office will be advised of the status of these investigations. The attendance of Mr. Devata at early meetings with the consultant will be considered.

The need for close liaison with the Surveys & Plans Office was also discussed.



D. McAvoy  
Environmental Planner

DMcA:skl  
cc: R.W. Franks  
E.C. Lane  
B.J. Maloney  
T.W. Murphy  
J.W. Reid  
✓ M.S. Devata

# memorandum



To: F. Walsh  
Highway Program Development Branch  
Downsview

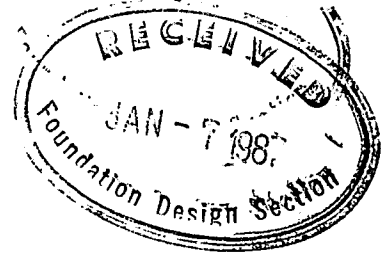
Date: January 6, 1987

✓ M. Devata  
Foundation Design Section

S. Ng  
Landscape Planning and Operations Section

C. Blaney  
Research and Development Branch

From: Environmental Unit  
Planning and Design  
Eastern Region  
Kingston



Re: Environmental Assessment Board Hearing for  
Highway 416: W.P. 146-74-00

Further to my memo of October 8, 1986, I would like to advise you that the E.A.B. hearing will resume on January 12, 1987, for two weeks. It is anticipated that most of the M.T.C. evidence will be entered at this time.

The hearing will then recess. There is a strong possibility that the hearing will resume on February 16, 1987, for 3 weeks. If required, the hearing would then be recessed again until March 30, 1987.

I will confirm these latter dates when they are finalized by the Board.

A handwritten signature in cursive script, appearing to read "D. McAvoy".

D. McAvoy  
Environmental Planner

DMcA:sk1  
cc: K. Gosselin