

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 40P7-42

DIST. 3 REGION SOUTHWESTERN

W.P. No. \_\_\_\_\_

CONT. No. \_\_\_\_\_

W. O. No. \_\_\_\_\_

STR. SITE No. 33-313

HWY. No. \_\_\_\_\_

LOCATION W. OF HIGHLAND RD & FISHER  
DR., KITCHENER

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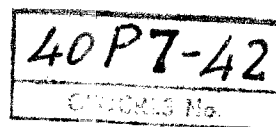
OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. \_\_\_\_\_

REMARKS: \_\_\_\_\_

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## 1.0 INTRODUCTION

This report describes the subsurface conditions encountered at the site of a proposed subdivision west of Highland Road and Fischer Drive, Kitchener, Ontario. Authorization to proceed with the work was received verbally on March 29, 1973 from Mr. Greg Voisin of Buildevco Limited.

The field work consisted of 26 boreholes drilled at the locations shown on Dwg. No. 1. Details of the methods used are given in Appendix 'A'.

The purpose of the investigation was to reveal the subsurface conditions at the site of a proposed shopping centre and for the adjacent subdivision and comment on excavating and dewatering problems associated with the construction of the sewer.

## 2.0 DESCRIPTION OF SITE AND PHYSIOGRAPHY

The site which occupies approximately 115 acres extends westerly from Fischer Drive and southerly from Highland Road. The area is at the western end of the City of Kitchener in an area of undulating topography.

A large wide spillway passes through kame hills with differences in elevation across the site of up to 60 feet. The slopes are

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generally less than 4% but in several areas slopes of up to 18% were noted. The site is generally agricultural but one area of bush was observed at the southwest corner of the site. Drainage is toward the centre of the site where ponded water was observed. A small creek dissects the spillway and provides some drainage toward the south.

The area makes up part of the physiographic region known as the Waterloo Hills, a kame moraine deposit of sands and sandy tills.

### 3.0 SUBSOIL CONDITIONS

Although the ground surface elevation varies from El. 1120 to 1180 feet, subsoil conditions are quite uniform across the site.

Topsoil was encountered in all areas ranging in thickness from 6 inches to 1½ feet. The deeper areas of topsoil were measured in the areas which had been tilled for agricultural crops. 18 inches of peat was encountered in borehole 25 which was located in a low lying area near the creek.

Underlying the topsoil, brown to grey silt till was encountered over most of the site. The amount of clay varied from 15% to 30% and embedded gravel and sand were observed in the samples. The consistency varies from firm to hard but was generally very stiff. Layers and

seams of sandy silt were noted in several boreholes but no distinct stratification was observed. The upper zones of this stratum were notably "softer" possibly due to ponded water on the surface. Laboratory test results are shown on the individual borehole logs and on Enclosures 27 to 30!

Fine sand was observed at varying levels in boreholes 1, 13, 19 and 21. In borehole 13, the sand was found to underly the clayey silt till below a depth of 18 feet. In the remaining boreholes the fine sand was encountered extending from under the topsoil. In borehole 1, it extended to 14 feet with a  $4\frac{1}{2}$  foot thick layer of silt till below  $5\frac{1}{2}$  feet. In borehole 19 the sand extended to 21 feet and in borehole 21 to 15 feet.

Boreholes 1 and 21 are located at the south-east corner of the site. Details of the subsoil conditions encountered in each borehole are given on the individual borehole logs of Enclosures 1 to 26, inclusive.

#### 4.0 GROUNDWATER CONDITIONS

The free surface of the groundwater table was measured in all boreholes except BH's 3, 4, 5, 17 and 19. In boreholes 3, 4, 5 and 19 the cave-in depths were measured and borehole 17 was dry upon completion. As the boreholes were done during an exceptionally wet period, the measured water table was very high (1 to 3 feet below the ground

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surface). It is anticipated that these levels represent locally perched water tables and their levels are expected to vary considerably depending on rainfall. In the low lying area near the creek, water appears to be ponded over most of the year.

## 5.0 DISCUSSION

The area being discussed in this report is to be developed as a residential subdivision with a shopping plaza at the easterly end of the site. This report will discuss foundation construction for the shopping plaza, sewer and road construction. Also, a channel is to be built near the present creek bed and this report will discuss the suitability of the excavated material as fill.

### 5.1 Shopping Plaza

Part of the site will be developed as a shopping plaza. Boreholes 20 to 24, inclusive were done in the area of the plaza. At this time the finished floor elevation will be either 1124 or 1135 resulting in a one or two storey building. If the latter elevation is chosen the majority of the building will be placed on fill resulting in fill depths of up to 12 feet.

Normal spread footings may be used in the design and may be cast at a depth of 2 feet below the ground surface. A safe net bearing pressure of 4000 pounds per square foot may be used. This value incorporates a factor of safety of 3 against a general shear failure of the soil. All exterior footings should have at least four feet of earth cover to ensure protection against frost action. The minimum width of any footing should be 18 inches.

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The total settlement will be less than 1 inch and will occur uniformly at a slow rate after the application of the full load. If shallow footings are used no special dewatering or excavating problems are envisioned.

Alternately, the footings may be supported on compacted fill. It is our understanding that materials excavated from the site will be used as fill. This will be discussed in Section 5.3.

The floor slabs may be constructed on grade provided that the topsoil is removed and the slab is underlain by a minimum of 12 inches of well-compacted clean granular fill.

## 5.2 Sewers

### 5.2.1. Excavating & Dewatering

The depth of the sewers is not known at this time, but it is expected that they will require excavations up to 10 feet in depth.

Excavations in the clayey silt till could be carried out without sheeting using 1 to 1 side slopes or as a vertical cut supported by skeleton sheeting. The perched water table is generally high as measured at the time of the soil investigation. Some seepage can be expected from the upper strata but we anticipate that it can be handled by gravity sumps and pumping into the completed portion of the sewer. The sumps should be protected by a sand and gravel filter.

Where the subsoil consists of silt or fine sand, the seepage can be expected to be greater resulting in some instability. Dewatering will, therefore, be required. In the sand stratum well points can be used or if the distance to be pumped down is less than 2 feet, gravity sumps will suffice. In the silt strata, tight sheeting will be required if it is necessary to lower the water table more than 2 feet.

The sheeting and bracing should be designed to resist a uniformly distributed lateral earth pressure given by the expression:

$$P = 0.2 \times \gamma \times H \text{ (p.s.f.)}$$

where  $\gamma$  = unit weight of soil (130 p.c.f.)

H = depth of excavation

#### 5.2.2. Bedding

The dense subsoil will provide good support to the pipes and normal Class 'B' type of bedding will be sufficient. Boulders encountered at the bottom of the trench should be removed and replaced with compacted granular material. A minimum of 6 inches of compacted granular material should be provided below the invert.



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5.2.3. Backfilling

The trenches should be backfilled with selected clean granular material carefully placed and compacted to at least 1 foot above the crown of the sewer. The fill should be placed in layers not exceeding 6 inches in thickness and each layer should be compacted to not less than 90% of the Standard Proctor Maximum Dry Density. The remaining backfill material in the trench should be compacted to not less than 90% of its Standard Proctor Maximum Dry Density. This should be increased to 95% within the upper four feet of the trench.

Excavated material may be used as backfill provided it is free of frost, organic material and boulders larger than 4 inches. The sand is suitable and is estimated to have a moisture content below its optimum. However, this material is uniformly graded and will require greater than normal compactive effort to achieve the desired degree of compaction. The clayey silt and silt encountered in some boreholes has a natural moisture content well above the optimum for compaction and will, therefore, be very difficult to compact. It is therefore recommended that the clayey silt and silt not be used as backfill.

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### 5.3 Sources of Fill

This report will discuss two areas with respect to the suitability of excavated material for use as fill.

#### 5.3.1. Proposed Channel

The Corporation of the City of Kitchener proposes to build an open channel parallel to the existing water course near boreholes 5, 25 and 26. With the exception of the upper zone in borehole 25, which contains organic material, the subsoil over the remainder of the area consists of silt till containing 15 to 30% clay. The moisture content of the soil significantly above optimum and is not suitable for use as controlled fill, unless it is dried to near optimum moisture content. Below 8 feet in borehole 5, brown silt was encountered which was above also optimum moisture content and, therefore, is not suitable.

The upper two feet is significantly above optimum moisture content and is, therefore, also unsuitable as fill in its present state.

#### 5.3.2 Proposed Plaza

The grade may be lowered on the south half of the plaza site and used to raise the north half. The excavated material will generally consist of brown silt till containing from 15 to 30% clay. The moisture content is near optimum and we anticipate that this material will be suitable as fill provided that the moisture content is not allowed to increase. However, the sandy silt from borehole 21 has a

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moisture content significantly above optimum and will be difficult if not impossible to compact.

The upper two feet of the site is very wet and is not suitable as fill in its present state.

#### 5.4 Fill Placement

In all areas where structures, roads or parking areas are proposed, the placement of fill should be controlled. All organic, loose and wet material should be removed from the subgrade. The fill should be placed at or near its optimum moisture content in 6 to 8 inch layers and should be compacted. The fill should be protected from vehicular traffic during and following a period of rainfall.

All areas should be compacted to 95% Standard Proctor Maximum Dry Density except where foundations are to be placed. In this case, the compaction should be increased to 98% Standard Proctor.

DOMINION SOIL INVESTIGATION LIMITED

*J.B. England*  
J. Byron England, P. Eng.  
Kitchener Branch Manager.

JBE:s



Our Reference No. 73-3-K8.

# LOG OF BOREHOLE 5

Enclosure No. 5

CLIENT: Buildevco Limited  
PROJECT: Proposed Subdivision  
LOCATION: Fischer Drive, Kitchener  
DATUM ELEVATION: G.S.C.

## DRILLING DATA

Method: Augering

Diameter: 4 1/2"

Date: April 3, 1973.

SUBSURFACE		PROFILE		SAMPLES			PENETRATION RESISTANCE Blows/Foot					WATER CONTENT %			REMARKS							
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	20	40	60	80	100	PLASTIC LIMIT	NATURAL		LIQUID LIMIT						
								UNDRAINED SHEAR STRENGTH p.s.f.														
								+ FIELD VANE TEST Q COMPRESSION TEST					W <sub>p</sub> — W — W <sub>L</sub>									
													10 20 30 40 50									
122.6	0	GROUND SURFACE																				
121.9	0.7	TOP SOIL																				
	3	Stiff to hard brown SILT some clay (TILL)						1	SS	10	0			0								
								2	SS	47		0		0								
114.4	8.2	Very dense brown SILT, sometime sand																				
	10							3	SS	56		0										
110.1	12.5	Hard grey clayey SILT embedded gravel (TILL)																				
	15							4	SS	72		0										
	20																					
101.1	21.5	END OF BOREHOLE						5	SS	79		0										

VERTICAL SCALE: 1 inch to 5 feet

VERTICAL SCALE: 1 inch to 5 feet

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: T D

CHECKED: J B E

Our Reference No. 73-3-K8

CLIENT: Buildvco Limited

PROJECT: Proposed Subdivision

LOCATION: Fischer Drive, Kitchener

DATUM ELEVATION: G.S.C.

# LOG OF BOREHOLE 7

Enclosure No. 7

## DRILLING DATA

Method: Augering

Diameter: 4 1/2"

Date: April 5, 1973.

SUBSURFACE		PROFILE		SAMPLES			PENETRATION RESISTANCE					WATER CONTENT			REMARKS	
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	Blows/Foot					PLASTIC LIMIT	NATURAL		% LIQUID LIMIT
								20	40	60	80	100				
								UNDRAINED SHEAR STRENGTH								
+ FIELD VANE TEST					Q COMPRESSION TEST											
													W <sub>p</sub> W      W <sub>L</sub>			

1134.4	0	GROUND SURFACE														
1133.1	1.3	TOP SOIL														
		root fibres														
	3	Hard brown SILT, some Clay														
	10	Embedded gravel (TILL)														
1120.4	14.0	END OF BOREHOLE														

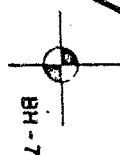
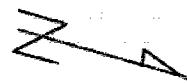
VERTICAL SCALE: 1 inch to 5 feet

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: T D

CHECKED: J B E

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BH-7

WESTHEIGHTS Drive

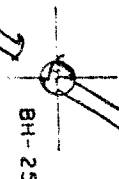


BH-8

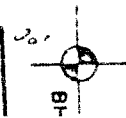


BH-5

QUEENS ROAD



BH-25



BH-1

ELM RIDGE