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DIST. 6 REGION CENTRAL

W.P. No. 218-65-01

CONT. No. 74-64

W. O. No. 72-11100

STR. SITE No. _____

HWY. No. 409

LOCATION TRUNK STORM SEWER

ALONG HWY 409 FROM MARTIN GROVE

TO MIMICO CREEK

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 0

REMARKS Documents to be unfolded before

microfilmed

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

30M11-116

GEOGRAPHIC No.

ATTENTION: Mr. W. C. Friedman, (2)
Senior Expressway Design Engineer,
Systems Design,
Central Region.

FROM: Foundations Office,
Design Services Branch,
West Bldg., Downsview.

DATE: November 15, 1972.

OUR FILE REF.

IN REPLY TO

NOV 24 1972

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For The

Proposed Trunk Storm Sewer Along Hwy. #409
From Martin Grove Road Westerly to Mimico Creek
Borough of Etobicoke, Metropolitan Toronto
District #6 (Toronto)

W.O. 72-11100 -- W.P. 218-65-01

Attached we are forwarding to you our detailed foundation investigation report on the subsoil conditions existing at the above-mentioned site.

We believe that the factual data and recommendations contained therein will prove adequate for your design requirements. Should additional information be required, please do not hesitate to contact our Office.

A. G. Stermac

A. G. Stermac,
PRINCIPAL FOUNDATIONS ENGINEER.

AGS/ao
Attach.

cc: E. J. Orr
B. R. Davis
A. Rutka
R. S. Pillar
H. Greenland
B. J. Giroux
C. Mirza
G. A. Wrong
B. A. Singh
G.C.E. Burkhardt
Foundations Files
Documents

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FOUNDATION INVESTIGATION REPORT
For The
Proposed Trunk Storm Sewer Along Hwy. #409
From Martin Grove Road Westerly to Mimico Creek
Borough of Etobicoke, Metropolitan Toronto
District #6 (Toronto)
..... W.O. 72-11100 -- W.P. 218-65-01

1. INTRODUCTION:

The Foundations Office was requested to carry out a subsurface investigation at the site of the above-mentioned proposed trunk sewer. The request was contained in a memorandum from Mr. W. C. Friedmann, Senior Expressway Design Engineer, Systems Design, Central Region, dated August 16, 1972. Subsequently, an investigation was carried out by this Office to determine the subsoil, bedrock and groundwater conditions existing at the site.

This report contains the results of our field and laboratory investigation, together with our recommendations pertaining to the excavation for and the installation of the storm sewer.

2. SITE AND GEOLOGY:

The site is located some 400 to 1,000 feet south of Belfield Road between Martin Grove Road on the east and Mimico Creek on the west, in the Borough of Etobicoke, Metropolitan Toronto. The terrain is gently undulating in relief with the ground surface varying between elevations 525 and 553. In the vicinity of the site, the land is vacant and grass covered. Twin north-south trending C.N.R. spur lines traverse the area between existing Hwy. #27 and Iron Street.

The site is located in the physiographical region known as the "Peel Plain." The characteristic deposit in this region is a ground moraine laid down during the Wisconsin Glacial Age.

In the vicinity of the area under investigation, this moraine is primarily composed of a glacial till whose thickness typically ranges from 50 to 80 feet. In this region, the Humber River and Etobicoke Creek have cut deep valleys into the overburden. There is, therefore, no large undrained depression, swamp or bog, although, in many of the interstream areas drainage is still imperfect.

The overburden is underlain by grey shale bedrock of the Meaford-Dundas formation, Ordovician Period.

3. FIELD AND LABORATORY WORK:

The field work along the proposed route of the trunk sewer consisted of putting down 30 sampled borings, each accompanied by a dynamic cone penetration test. In addition, six boreholes put down during previous investigations in this area are included because of their close proximity to the proposed alignment of the trunk sewer. The borings were advanced by means of two continuous flight auger machines adapted for soil sampling purposes (C.M.E. machines).

Samples of the overburden were obtained by means of a standard 2 inch O.D. split spoon sampler driven into the soil with an energy of 350 ft.lb. per blow according to the specifications for the Standard Penetration Test. The same method was used to advance the dynamic cone penetration tests. BX size rock core samples were obtained at three boring locations to prove bedrock.

All samples were subjected to a careful visual examination in the field and subsequently in the laboratory. Following these examinations, the following laboratory testing was carried out on selected representative samples to determine the engineering properties of the overburden.

Natural Moisture Contents

Atterberg Limits

Grain-Size Distribution

The field and laboratory test results are summarized on the Record of Borehole sheets contained in the Appendix to this report.

The location and elevation of the boreholes are shown on

Drawing No. 72-11100A, together with stratigraphical profiles along the route of the proposed trunk sewer. The surveying at the site was carried out by personnel from the Central Region Engineering Surveys Section. The elevations appearing in this report are referenced to a geodetic datum.

4. SUBSOIL AND BEDROCK CONDITIONS:

4.1) General:

The predominant stratum across the site is a competent glacial till. The upper portion of the glacial till is cohesive in nature, whereas the lower portion is generally granular. At certain locations the glacial till is overlain by as much as 20 feet of fill material. The overburden is underlain by grey shale bedrock.

The boundaries of various deposits, as determined in the boreholes, as shown on the accompanying Record of Borehole sheets. The stratigraphical section, shown on Drawing No. 72-11100A, has been inferred from this data.

A brief description of the subsoil and bedrock types encountered are presented in the subsections to follow.

4.2) Fill Material:

Fill material was found in Boreholes #101, 121, 123 and 129. It consists of a mixture of clayey silt, sand, gravel and trace of organics. The thickness of this stratum is from 6 to 20 feet. Standard Penetration testing carried out within this stratum gave 'N' values ranging from 5 to 11 blows per foot. Based on these values, it is estimated that the fill has been subjected to a moderate degree of compaction.

4.3) Glacial Till:

The glacial till stratum is present immediately beneath a thin top soil cover, except in those locations where fill is present. The glacial till stratum was fully penetrated at B.H.'s # 107, 113 and 134 only. At these locations it was found to be 59 to 79 feet thick. The glacial till stratum is generally cohesive; it is composed of a heterogeneous mixture of clayey silt, some sand

and a trace of gravel. In certain locations, the cohesive zone of the glacial till is followed by a lower area in which the till is granular consisting of a heterogeneous mixture of silty sand, gravel and clay. In addition, isolated layers of silty sand to sandy silt were present throughout the glacial till stratum. The thickness of these layers ranges from 2 to 9 feet. Grain-size distribution curves for samples obtained within the two distinct zones are plotted in envelope form on the figures listed below.

Figure 1 - Upper Cohesive Glacial Till

Figure 2 - Lower Granular Glacial Till

These figures are contained in Appendix 1 of this report.

Atterberg limit testing results are plotted on the Record of Borehole sheets and are summarized on the Plasticity Chart, Fig. No. 3. The results are also tabulated below.

			<u>Cohesive Glacial Till</u>	
			<u>Range</u>	<u>Average</u>
Liquid Limit	(W _L)	%	15 - 34	(22)
Plastic Limit	(W _p)	%	11 - 22	(14)
Natural Moisture Content	(W)	%	5.5 - 18.5	(12)

Referring to the Table, it can be seen that the cohesive portion of the glacial till is inorganic with a plasticity in the low range.

Standard Penetration testing was performed within this stratum; the values are plotted on the Record of Borehole sheets. In the upper cohesive portion of the glacial till the 'N' values range from 10 blows/ft. to more than 100 blows/ft. Based on these results it is estimated that the consistency of the cohesive glacial till varies from stiff to hard. The 'N' values in the granular portion vary between 16 blows/ft. and 70 blows for 1 inch, indicating that the relative density ranges from compact to very dense.

4.4) Bedrock:

Bedrock was proven at three of the boring locations (B.H.'s #107, 113 and 134) by obtaining 3 to 13 feet of BXL size rock core samples. The surface of the bedrock at these locations, was found

to be between elevations 472 and 478.

The bedrock is composed of a dark grey shale. The upper 2 to 7 feet of the bedrock is often in a weathered and fractured condition. Below this zone the bedrock is reasonably sound as evidenced by the high percentage of rock core recovered.

5. GROUNDWATER CONDITIONS:

Groundwater level observations were carried out, during and after the period of the investigation, by recording the water levels in the open borings. The observations are recorded on the Record of Borehole sheets and on Drawing No. 72-11100A.

The results of the observations indicate that the groundwater level within the overburden varies between elevations 491 and 546. These elevations correspond to depths of from 2 to 14 feet below the existing ground surface.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

It is proposed to construct an east-west expressway in the vicinity of Belfield Road which will connect Hwy. #401 in the Islington/Kipling area with the Toronto International Airport. The new Belfield Expressway (Hwy. #409) will be 3.3 miles long and will require a number of interchanges and structures, as well as a storm trunk sewer.

This discussion deals with the proposed 6,500 feet long trunk sewer which runs from Martin Grove Road to Mimico Creek; it will be located some 400 to 1,000 feet south of the existing Belfield Rd. The size of the sewer is to vary from 60 inches to 84 inches in diameter.

The invert elevation of the sewer will range from elevation 523, at Martin Grove Road to elevation 493 at its outfall at Mimico Creek. At this grade it will be located from 12 to 43 feet below the existing ground surface. Further, between Station 10+00

and 49+00 (Trunk Sewer chainage), the proposed grade of Hwy. #409 will range from elevation 530 to 518.5; i.e., corresponding to depths of from 6 to 24 feet below the existing ground surface. In this area the invert level of the sewer will be located from 12 to 26 feet below the profile grade of Hwy. #409. The sewer excavation will extend well below the piezometric groundwater level recorded in the overburden during the period of the investigation. The proposed profile grade of the sewer and the highway are plotted on Drawing No. W.O. 72-11100A.

The predominant stratum across the site is an extensive deposit of glacial till, which is up to 79 feet thick. The major portion of the till is cohesive in nature. Between Stations 4+00 and 30+00, however, the lower portion of the till has a granular matrix. The overburden is underlain by weathered to sound shale bedrock.

The invert of the sewer will be located in the glacial till stratum. The various alternative methods of constructing the sewer together with considerations regarding i) the stability of temporary cuts and ii) dewatering, will be discussed separately in the following subsections.

6.2) Hwy. #409 Cut Section (Station 10+00 to Station 49+00, Trunk Sewer Chainage):

As discussed previously, the proposed grade of Hwy. #409 will be some 6 to 24 feet below the existing ground surface. Temporary cuts of these heights will be stable against deep-seated rotational type of failure, provided that the cuts are constructed with 1:1 slopes. No major dewatering problems are anticipated, in view of the relatively impervious nature of the subsoil.

6.3) Sewers Constructed by Open-Cut Methods:

The excavations for the storm sewers will generally be carried out within the cohesive glacial till stratum. Between Station 10+00 and Station 49+00, Hwy. #409 will be in a cut section. It is our opinion that it is desirable to carry out the roadway excavations prior to constructing the trunk sewer. If such is the

case, the maximum depth of excavation in this area will be reduced from 43 to 26 feet. Temporary cuts up to 31 feet high will be stable against a deep-seated rotational type of failure, provided that the cuts are constructed with 1:1 slopes. If due to space restrictions, slopes steeper than those specified above or vertical cuts are desired, the excavations should be properly sheeted and braced. In all cases, the provisions adopted in the designated working areas should comply with the Trench Excavator's Act.

The prevailing groundwater level, as recorded during the course of the field investigation, is well above the invert elevations of the trunk sewer. Although the sewer is completely within the cohesive glacial till stratum, the possibility of ground heave exists when the bottom of the trench is reasonably close to the water bearing granular glacial till stratum; this is particularly true between Station 23+00 and Station 30+00. Calculations have been carried out to determine the safe hydrostatic groundwater head in the granular glacial till stratum for various distances between the sewer invert and the surface of the granular till. These results are plotted on Figure #4. To ensure safety, therefore, it will be essential, during construction, to maintain the hydrostatic groundwater head existing in the granular stratum at the required safe level by means of a suitable dewatering scheme until the backfilling of the trench is completed. However, it is believed that if excavations are carried out in a relatively short period of time and are backfilled immediately after the completion of sewer construction, major dewatering problems can be eliminated.

Where the invert of the sewer is within the water-bearing silty sand or sandy silt layer which exists randomly within the cohesive glacial till stratum, a danger of 'boiling' of the trench base exists. In order to prevent this, and to achieve dry safe working conditions, the hydrostatic pressure within the granular strata must be lowered to a level at least 2 feet below the trench base, and be maintained at this level until backfilling is completed. Alternatively, the isolated granular pocket which may boil should be completely removed and be backfilled with either well-graded granular material or mass concrete.

As discussed elsewhere, the majority of the sewer excavations will be carried out within the relatively impervious glacial till stratum. The groundwater seepage into the excavations will be negligible in quantity. However, where the excavations intercept the water bearing granular strata, excess seepage into the excavations can be anticipated. In all cases, it is believed that any groundwater seepage into the excavations or surface runoff can be handled by employing standard techniques, such as pumping from sumps.

The future performance of the sewer pipe depends to a great extent on the type and quality of the bedding used. It is, therefore, recommended that the pipe bedding adhere to standards currently being used by the Ministry, specifically for Class 'B' bedding on a Yielding Foundations (Standard No. DD-823), and be placed in a dry trench. In addition, particular attention should be paid to the compaction and shaping of the bedding material. Backfill for the sewer excavations should comply with Standard No. DD-813-B currently used by the Ministry. The cover material should meet the specifications for Granular 'B'.

6.4) Sewers Constructed by Tunnelling Through the Overburden:

An alternate scheme for sewer installation is to utilize tunnelling methods. Because of the high groundwater level, it will be necessary to lower the water level below the tunnel base, or to construct the tunnel using air pressure greater than the prevailing hydrostatic pressure to achieve safe, dry working conditions. Contractors, who consider using air pressure, should be advised that they will be responsible for determining the air pressure to be used and also be responsible for preventing leakage through the boreholes that have been drilled at the site insofar as it affects their operations.

6.5) Other Considerations:

Comments and recommendations relating to dewatering and stability of excavations mentioned in the foregoing paragraphs, are based on the assumption that the groundwater conditions, as determined during the course of the field investigation, will

apply during construction. However, it will be the responsibility of the contractor to determine exactly the conditions which prevail during construction, and to take such steps as are necessary to ensure safe and dry working conditions. It is believed that, if the sewer is constructed continuously from the outfall end, drainage in the critical zones will occur thus alleviating the situation considerably. In addition, permanent drainage of the sewer trenches into each manhole is recommended by providing a short length (20 feet) of 6" diameter perforated pipe surrounded with a suitable filter and discharging into the manhole.

7. MISCELLANEOUS:

The field investigation was carried out during the period of Aug. 23 to Sept. 11, 1972, under the supervision of Messrs. V. Korlu and C.S. Poon, Project Foundations Engineers.

The drilling equipment used was owned and operated by Master Soil Investigation Ltd., Toronto.

This report was prepared by Mr. C. S. Poon, Project Foundations Engineer. This project was carried out under the general supervision of Mr. M. Devata, Supervising Foundations Engineer, who also reviewed this report.

C.S. Poon
C. S. Poon, P. Eng.



M. Devata
M. Devata, P. Eng.

CSP/ao..
Nov. 13, 1972.

APPENDIX I

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 101

JOB 72-11100

LOCATION Co-ords. 879,231 N; 980,027 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE Sept. 11, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT w_L			BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	BLOWS / FOOT	20	40	60	80	100	PLASTIC LIMIT w_p		
535.0	Ground Level													
0.0	Fill Material		1	SS	9									
528.5	Clayey silt, with some sand & gravel, trace of organics. Firm to stiff		2	SS	14									
6.5			3	SS	77									
	Brown Grey		4	SS	60/90									
	Het. mix. of clayey silt, some sand & trace of gravel		5	SS	76									
	(Glacial Till)		6	SS	61									
			7	SS	45									
	Very stiff to Hard		8	SS	39									
505.0														
503.5	Silty sand, Very Dense		9	SS	67									7 42 40 11
31.5	End of Borehole													

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 102

JOB 72-11100

LOCATION Co-ords. 879,094 N; 980,064 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE Sept. 8, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

 CHECKED BY 2

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_P WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	w_p	w	w_L		
535.0	Ground Level															
0.0			1	SS	41	530										531.2
			2	SS	39											
			3	SS	65											
	Brown Grey		4	SS	38	520										
	Het. mix. of clayey silt, some sand and trace of gravel.		5	SS	44											
	(Glacial Till)		6	SS	60/61											
			7	SS	40	510										
	Hard		8	SS	71											
503.5			9	SS	72											
31.5	End of Borehole					500										

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 103

JOB 72-11100

LOCATION Co-rds. 878,900 N; 980,129 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE Sept. 7, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

 CHECKED BY SK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P — W — W_L	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT					
534.7	Ground Level									
0.0			1	SS	59	530				▼ 531.1
			2	SS	48					
			3	SS	44					
	Brown		4	SS	30					
	Grey		5	SS	43	520				
	Het. mix. of clayey silt, some sand and trace of gravel.		6	SS	37					
	(Glacial Till)		7	SS	37					
	Very Stiff to Hard		8	SS	30	510				
503.2			9	SS	77					
31.5	End of Borehole					500				

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 104

JOB 72-11100

LOCATION Co-ords. 878,710 N; 980,191 E.

ORIGINATED BY VK


W.P. 218-65-01

BORING DATE Sept. 7, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY 

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	w_r	w	w_L		
534.4	Ground Level															
0.0			1	SS	29	530										
			2	SS	37											
			3	SS	79											
	Brown		4	SS	57											
	Grey		5	SS	56	520										
	Het. mix. of clayey silty		6	SS	63											
	some sand and trace		7	SS	39											
	of gravel.		8	SS	29	510										
	(Glacial Till)															
506.4	Very Stiff to Hard															
25.0	Het. mix. of silty sand,															
	gravel & clay.															
502.9	Grey Dense		9	SS	41											15 41 37 7
31.5	End of Borehole					500										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 105

JOB 72-11100

LOCATION Co-ords. 878,573 N; 980,232 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE Sept. 6, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY 10

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	w_p	w	w_L		
533.8	Ground Level															
0.0			1	SS	25	530										
			2	SS	29											
			3	SS	77											
	Brown Grey Het. mix. of clayey silty some sand and trace of gravel. (glacial Till)		4	SS	37	520										
			5	SS	40											
			6	SS	34											
			7	SS	30	510										
	Very Stiff to Hard		8	SS	32											
505.8																
20.0	Het. mix. of silty sand, gravel & clay.															
502.3	Gray Very Dense		9	SS	64											21.54 (25)
31.5	End of Borehole					500										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 106

JOB 72-11100

LOCATION Co-ords. 878,418 N; 980,101 E.

ORIGINATED BY CSP

W.P. 218-65-01

BORING DATE August 23, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY LD

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	w_p	w	w_L		
536.3	Ground Level															
0.0			1	SS	34	530										
			2	SS	42											
			3	SS	63											
	Brown Grey		4	SS	27											
	Het. mix. of clayey silt, some sand and trace of gravel. (Glacial Till)		5	SS	40	520										
			6	SS	35											
			7	SS	34											
			8	SS	26	510										
	Very Stiff to Hard		9	SS	19											
503.3																
33.0	Het. mix. of silty sand, gravel & clay.		10	SS	65	500										
			11	SS	120	490										
489.8	Very Dense		12	SS	130	490										
46.5																
	with shale fragments below El. 490.					480										
474.0																
62.3	End of Borehole					470										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 107

JOB 72-11100

LOCATION Co-ords. 878,305 N; 980,012 E.

ORIGINATED BY GSP

W.P. 218-65-01

BORING DATE Aug. 23, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY 20

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w			BULK DENSITY γ P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	w_p	w	w_L		
536.9	Ground Level															
0.0			1	SS	18											
			2	SS	38	530										
			3	SS	47											
	Brown Grey		4	SS	68											
	Het. mixture of clayey silt, some sand and trace of gravel.		5	SS	38	520										
	(Glacial Till)		6	SS	38											
			7	SS	79											
			8	SS	38	510										
			9	SS	32											
501.9			10	SS	69	500										
35.0	Het. mix. of silty sand, gravel & clay.		11	SS	100	5"										
	Grey															
488.9	Very Dense					490										
48.0	with shale fragments below El. 487.		12	SS	125	480										
478.0																
58.9	Bedrock - Shale with limestone layers.		13	RC BXL	60%											
474.9	Dark Grey															
62.0	End of Borehole					470										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 109

JOB 72-11100

LOCATION Co-ords. 878,196 N; 979,554 E.

ORIGINATED BY CSP

W.P. 218-65-01

BORING DATE August 24, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

 CHECKED BY 10

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT			BULK DENSITY	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	BLOWS / FOOT			PLASTIC LIMIT						
						20	40	60	80	100	WATER CONTENT %				
						SHEAR STRENGTH P.S.F.			WATER CONTENT %						
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE			WATER CONTENT %						
542.6	Ground Level											Y	P.C.F. GR. SA. SI. CL.		
0.0															
			1	SS	24										
			2	SS	75										
			3	SS	75										
			4	SS	38										
			5	SS	24										
			6	SS	70										
			7	SS	32										
			8	SS	42										
			9	SS	42										
510.6			10	SS	25										
32.0			11	SS	59										
			12	SS	80 2/3"										
			13	SS	78										
			14	SS	100 1/3"										
477.6															
65.0	End of Borehole														

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 110

JOB 72-11100

LOCATION Co-ords. 878,147 N; 979,358 E.

ORIGINATED BY CSP

W.P. 218-65-01

BORING DATE August 24, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT W_L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT	20	40	60	80	100	PLASTIC LIMIT W_P	WATER CONTENT W		
545.8	Ground Level															
0.0			1	SS	36											
			2	SS	37	540										
			3	SS	61											
	Brown		4	SS	15											
	Grey		5	SS	11	530										
	Het. mix. of clayey silt, some sand and trace of gravel		6	SS	18											
	(Glacial Till)		7	SS	17											
520.8			8	SS	34	520										
518.8	Sandy silt		9	SS	16											
27.0			10	SS	32											
			11	SS	25	510										
	Very Stiff to Hard		12	SS	35											
504.8			13	SS	66	500										
41.0	Het. mix. of silty sand, gravel and clay (with shale fragments below el. 490.)		14	SS	118	490										
	Grey															
	Very Dense															
480.3			15	SS	100	480										
65.5	End of Borehole															

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 111

JOB 72-11100

LOCATION Co-ords. 878,099 N; 979,165 E.

ORIGINATED BY OSP

W.P. 18-65-01

BORING DATE August 25, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY LD

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	w_p	w	w_L		
547.4	Ground Level															
0.0			1	SS	36											
			2	SS	81	540										
			3	SS	73											
	Brown Grey		4	SS	71 1/4"											
	Het. mix. of clayey silt some sand and trace of gravel.		5	SS	31	530										
			6	SS	51											
	(Glacial Till)		7	SS	74											
			8	SS	71	520										
	Very Stiff to Hard		9	SS	60											
			10	SS	33											
			11	SS	30											
			12	SS	19	510										
506.4			13	SS	61											
41.0	Het. mix. of silty sand, gravel & clay.		14	SS	50 1/4"	500										
			15	SS	60 3/4"											
	Grey					490										
	Very Dense					480										
477.4																
70.0	End of Borehole					470										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 112

JOB 72-11100

LOCATION co-ords. 878,089 N; 978,970 E.

ORIGINATED BY CSP

W.P. 218-65-01

BORING DATE Aug. 25, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

 CHECKED BY SK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W			BULK DENSITY Y	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	W _P	W	W _L		
550.3	Ground Level					550										
0.0			1	SS	12											
			2	SS	14											
	Brown		3	SS	67	540										
	Grey		4	SS	32											
	Het. mix. of clayey silty		5	SS	33											
	some sand and trace		6	SS	23	530										
	of gravel.		7	SS	29											
	(Glacial Till)		8	SS	31											
			9	SS	21											
	Stiff to Hard		10	SS	23	520										
			11	SS	36											
			12	SS	31											
			13	SS	40	510										
503.3			14	SS	143											
47.0	Het. mix. of silty sand, gravel & clay.		15	SS	160	500										
	Grey															
	Very Dense		16	SS	95	490										
479.8			17	SS	100	480										
70.5	End of Borehole															
						470										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 113

JOB 72-11100

LOCATION Co-ords. 878,079N; 978,772 E.

ORIGINATED BY CSP

W.P. 218-65-01

BORING DATE Aug. 28, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY 10

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	W_P	W	W_L		
552.0	Ground Level															
0.0			1	SS	24	550										
			2	SS	38											
	Brown Grey		3	SS	39											
	Het. mix. of clayey silt, some sand and trace of gravel.		4	SS	36	540										
	(Glacial Till)		5	SS	27											
			6	SS	32											
	Very Stiff to Hard		7	SS	36	530										
			8	SS	20											
			9	SS	32											
521.0			10	SS	31	520										
519.0	Silty sand		11	SS	26											
33.0			12	SS	16											
			13	SS	27											
507.0			14	SS	31	510										
45.0			15	SS	25											
	Het. mix. of sandy silt clay and gravel.		16	SS	100	500										
			17	SS	75											
	Grey					490										
	Compact to Very Dense		18	SS	147											
						480										
473.2																
78.8	Bedrock - Shale with limestone layers.		19	RC BXL	95%	470										
468.2	Dark Grey		20	RC BXL	100%											
83.8	End of Borehole					460										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 114

JOB 72-11100

LOCATION Co-ords. 878,012 N; 978,438 E.

ORIGINATED BY CSP

W.P. 218-65-01

BORING DATE Aug. 28, 1972

COMPILED BY VK

DATUM Geodetic

- BOREHOLE TYPE Auger and Cone Test

CHECKED BY Lo

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — w_L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT	20	40	60	80	100		
552.2	Ground Level													
0.0						550								
			1	SS	29									
			2	SS	27									
			3	SS	41									
			4	SS	23	540								
			5	SS	20									
			6	SS	16									
			7	SS	17	530								
			8	SS	13									
			9	SS	13									
			10	SS	16	520								
			11	SS	26									
			12	SS	31									
			13	SS	22	510								
			14	SS	22									
505.2			15	SS	20									
47.0						500								
			16	SS	80									
			17	SS	97									
						490								
			18	SS	100/5"									
						480								
477.2														
75.0	End of Borehole					470								

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 115

JOB 72-11100

LOCATION Co-ords. 878,027 N; 978,238 E.

ORIGINATED BY CSP

W.P. 218-65-01

BORING DATE Aug. 29, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P — W — W_L	WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUM. OF	TYPE	BLOWS/FOOT						
552.7	Ground Level										
0.0			1	SS	40	550					
			2	SS	43						
	Brown		3	SS	65						
	Grey		4	SS	47	540					
	Het. mix. of clayey silt, some sand and trace of gravel.		5	SS	18						
	(Glacial Till)		6	SS	15	530					
	Stiff to Hard		7	SS	13						
			8	SS	19	520					
			9	SS	13						
			10	SS	24						
			11	SS	26	510					
			12	SS	29						
505.7			13	SS	14						
47.0											
	Het. mix. of silty sand gravel and clay.		14	SS	27	500					
	Grey		15	SS	98	490					
	Compact to Very Dense					480					
475.7											
77.0	End of Borehole					470					

545.6

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 116

JOB 72-11100

LOCATION Co-ords. 878,015 N; 977,779 E.

ORIGINATED BY CSP

W.P. 218-65-01

BORING DATE Aug. 29, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

 CHECKED BY Lo

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT w_L			BULK DENSITY	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT				PLASTIC LIMIT w_p					
							20	40	60	80	100	WATER CONTENT w				
												w_p	w			w_L
SHEAR STRENGTH P.S.F.						WATER CONTENT %			γ	P.C.F.	GR SA SI CL					
○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE																
545.5	Ground Level										10	20	30			
0.0			1	SS	29	540									540.1	
			2	SS	34											
	Brown		3	SS	60											
	Grey		4	SS	17	530									3 26 47 24	
	Het. mix. of clayey silt, some sand and trace of gravel. (Glacial Till)		5	SS	24											
			6	SS	13	520										
	Stiff to Hard		7	SS	10											
			8	SS	13	510										
			9	SS	14											
			10	SS	23											
500.5			11	SS	13	500										
45.0	Het. mix. of silty sand gravel and clay. Grey		12	SS	16											
			13	SS	50											
490.0	Compact to Very Dense		14	SS	100/6"	490										
55.5	End of Borehole															

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 117

JOB 72-11100

LOCATION Co-ords. 577,983 N; 977,580 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE August 30, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT — w_L PLASTIC LIMIT — w_P WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	w_P	w	w_L	
542.9	Ground Level														
0.0			1	SS	28	540									
			2	SS	28										
			3	SS	37										
	Brown Grey		4	SS	40	530									
	Het. mix. of clayey silt, some sand and trace of gravel		5	SS	26										
	(Glacial Till)		6	SS	22										
			7	SS	27	520									
			8	SS	15										
			9	SS	19										
	Stiff to Hard		10	SS	24	510									
499.9			11	SS	12	500									
43.0	Silty sand.		12	SS	87										
493.9	Very Dense														
49.0			13	SS	106	490									
487.4			14	SS	100	480									
55.5	End of Borehole														

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 118

JOB 72-11100

LOCATION Co-ords. 877,942 N; 977,239 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE August 30, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_P WATER CONTENT ——— w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	w_p	w	w_L		
542.0	Ground Level															
0.0			1	SS	20	540										
			2	SS	34											
	Brown Grey		3	SS	27	530										
			4	SS	18											
	Het. mix. of clayey silt, some sand and trace of gravel.		5	SS	29											
	(Glacial Till)		6	SS	11											
			7	SS	17	520										
	Stiff to Hard		8	SS	25											
			9	SS	22											
			10	SS	19	510										
			11	SS	22											
502.0																
40.0	Silty Sand		12	SS	12	500										
492.0																
43.0			13	SS	113											
			14	SS	100	490										
488.0																
54.0	End of Borehole															
						480										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 119

JOB 72-11100

LOCATION Co-ords. 877,766 N; 976,738 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE Aug. 31, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	W_P	W	W_L		
536.5	Ground Level															
0.0			1	SS	25											
			2	SS	28	530										
			3	SS	25											
			4	SS	17											
		Brown	5	SS	26	520										
		Grey	6	SS	30											
	Het. mix. of clayey silt, some sand and trace of gravel. (Glacial Till)		7	SS	19											
			8	SS	18	510										
			9	SS	11											
			10	SS	65/6"	500										
	Stiff to Hard		11	SS	70/6"											
			12	SS	73/4"	490										
			13	SS	75/6"											
480.0			14	SS	69	480										
56.5	End of Borehole															

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 120

JOB 72-11100

LOCATION Co-ords. S77,652 N; 976,398 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE August 31, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY 42

SOIL PROFILE			SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p — w — w_L WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLCT	NUMBER	TYPE					
532.5	Ground Level								
0.0	Het. mix. of clayey silt, some sand and trace of gravel. (Glacial Till)		1	SS	25				
			2	SS	29				
			3	SS	22				
			4	SS	18				
			5	SS	13				
			6	SS	18				
			7	SS	30				
508.5			8	SS	38				
21.0	Layered clayey silt and silty sand		9	SS	23				
499.5			10	SS	24				
33.0			11	SS	43				
			12	SS	74				
482.5			13	SS	20				
50.0	Silty sand		14	SS	100/5"				
480.5									
52.0									
476.0									
56.5	End of Borehole								

522.2

9 45 40 6

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 121

JOB 72-11100

LOCATION Co-ords. 877,578 N; 976,184 E

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE Sept. 1, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY 16

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P — W — W_L	BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT					
525.0	Ground Level									
0.0	Fill Material									
519.0	Clayey silt, some sand & trace of organics.		1	SS	8					
6.0			2	SS	33					
			3	SS	50					
	Brown Grey		4	SS	46					
	Het. mix. of clayey silt, some sand and trace of gravel.		5	SS	36					
			6	SS	36					
	(Glacial Till)		7	SS	50					
497.0			8	SS	56					
28.0			9	SS	17					
	Silty sand									
489.5			10	SS	93					
35.5										
483.5	Stiff to Hard									
41.5	End of Borehole									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 122

JOB 72-11100

LOCATION Co-ords. 877,658 N; 976,030 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE Sept. 5, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY

SOIL PROFILE		SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P W W_L	BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE					
508.0	Ground Level							
0.0								
		1	SS	69				
		2	SS	39				
		3	SS	9				
		4	SS	31				
	Brown	5	SS	23				
	Grey	6	SS	76				
	Het. mix. of clayey silt, some sand and trace of gravel.	7	SS	107				
	(Glacial Till)	8	SS	84				
476.5	Stiff to Hard	9	SS	103				
31.5	End of Borehole							

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 123

JOB 72-11100

LOCATION Co-ords. 877,015 N; 975,837 E.

ORIGINATED BY VE

W.P. 218-65-01

BORING DATE Sept. 1, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY *VE*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	w_p	w	w_L	
524.0	Ground Level														
0.0	Fill Material		1	SS	9	520									
	Clayey silt with trace of gravel & organics.		2	SS	5										
			3	SS	11										
			4	SS	10	510									
			5	SS	6										
	Soft to Stiff		6	SS	11										
504.0			7	SS	100	500									
20.0	Het. mix. of clayey silt, some sand and trace of gravel.		8	SS	36										
	(Glacial Till)		9	SS	95	490									
	(with silty sand layers throughout)		10	SS	120										
484.0	Grey Hard														
40.0	Het. mix. of sandy silt, gravel and clay.		11	SS	105	480									8 39 46 7
477.5	Grey Very Dense		12	SS	112										
46.5	End of Borehole					470									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 124

JOB 72-11100

LOCATION Co-ords. 877,552 N; 975,624 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE Sept. 1, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W			BULK DENSITY Y	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	W _P	W	W _L		
524.0	Ground Level															
0.0			1	SS	21	520										
			2	SS	39											
			3	SS	93											
			4	SS	59	510										
	Brown Grey		5	SS	34											
	Het. mix. of clayey silt, some sand and trace of gravel.		6	SS	20											
	(Glacial Till)		7	SS	71	500										
			8	SS	99											
			9	SS	30	490										
	Very Stiff to Hard		10	SS	100											
			11	SS	110	480										
477.5			12	SS	60/1"											
46.5	End of Borehole					470										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 125

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-ords. 877,501 N; 975,280 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE Sept. 5, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — w_L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	BLOWS / FOOT	20	40	60	80	100	WATER CONTENT — w		
525.5	Ground Level														
0.0			1	SS	23	520									
			2	SS	29										
	Brown		3	SS	19										
	Grey		4	SS	22										
	Het. mix. of clayey		5	SS	26	510									
	silt, some sand and		6	SS	24										
	trace of gravel.		7	SS	20										
	(Glacial Till)		8	SS	46	500									
	Very Stiff to Hard		9	SS	60/5"										
			10	SS	60/4"	490									
486.5															
39.0			11	SS	11										
481.5	Silty sand														
44.0			12	SS	58	480									
474.0			13	SS	101										
51.5	End of Borehole					470									

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 126

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-ords. 877,510 N; 975,078 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE Sept. 5, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY VB

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT ——— w_L			BULK DENSITY	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT			PLASTIC LIMIT ——— w_p						
							20	40	60	80	100	WATER CONTENT — w				
							SHEAR STRENGTH P.S.F.			w_p — w — w_L						
						○ UNCONFINED + FIELD VANE			WATER CONTENT %							
						● QUICK TRIAXIAL × LAB VANE										
517.7	Ground Level												P.C.F.	GR SA SI CL		
0.0																
			1	SS	43											
			2	SS	53	510								509.3		
			3	SS	52											
	Brown		4	SS	38											
	Grey		5	SS	46	500										
	Het. mix. of clayey		6	SS	68											
	silt, some sand and		7	SS	60/2"											
	trace of gravel.		8	SS	60/4"	490										
	(Glacial Till)		9	SS	87											
483.7	Hard		10	SS	21	480								23 54 18 5		
34.0	Silty sand		11	SS	95											
475.7			12	SS	97											
42.0																
471.2																
46.5	End of Borehole					470										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 127

JOB 72-11100 LOCATION Co-ords. 877,522 N; 974,836 E. ORIGINATED BY VK
 W.P. 218-65-01 BORING DATE Sept. 5, 1972 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Auger and Cone Test CHECKED BY 62

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — w_L			BULK DENSITY	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT			PLASTIC LIMIT — w_p						
							20	40	60	80	100	WATER CONTENT — w				
							SHEAR STRENGTH P.S.F.			w_p — w — w_L						
						○ UNCONFINED + FIELD VANE			WATER CONTENT %			γ				
						⊗ QUICK TRIAXIAL × LAB VANE			10 20 30			P.C.F.	GR.SA.SI.CL			
498.0	Ground Level															
0.0																
			1	SS	7	490										
	Brown		2	SS	34											
	Grey		3	SS	60/4"											
	Het.mix.of clayey silt, some sand and trace of gravel.		4	SS	38											
	(Glacial Till)		5	SS	46	480										
480.5	Firm to Hard		6	SS	40											
17.5	Het.mix.of silty sand gravel and clay.		7	SS	72											
	Grey		8	SS	60/6"											
471.5	Dense to Very Dense															
26.5	End of Borehole					470										

OFFICE REPORT IN SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 128

JOB 72-11100

LOCATION Co-ords. 877,479 N; 974,784 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE Sept. 6, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY SK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— w_L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT					PLASTIC LIMIT ——— w_p				
							20	40	60	80	100	WATER CONTENT ——— w				
							SHEAR STRENGTH P.S.F.					w_p ——— w ——— w_L				
						○ UNCONFINED + FIELD VANE					WATER CONTENT %			P.C.F.	GR. SA. SI. CL.	
						● QUICK TRIAXIAL × LAB VANE					10 20 30					
497.7	Ground Level															
0.0																
	Brown		1	SS	7	490									491.1	
	Grey		2	SS	106											
	Het. mix. of clayey		3	SS	34											
	silt, some sand and		4	SS	32											
	trace of gravel,															
	(Glacial Till)															
482.7	Firm to Hard															
15.0	Het. mix. of silty sand,		5	SS	28	480										
	gravel and clay.		6	SS	74											
	Grey															
475.7	Compact to Very Dense		7	SS	607"											
22.0	End of Borehole					470										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 129

JOB 72-11100

LOCATION Co-ords. 877,621 N; 974,955 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE Sept. 6, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY *SK*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w w_p — w — w_L			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE					WATER CONTENT % 10 20 30				
496.5	Ground Level															
0.0	Fill Material															
	Silty sand and trace of clay and organics.		1	SS	2											
489.5	Very Loose to Loose		2	SS	15	490										
7.0	Het. mix. of clayey silty		3	SS	35											
	some sand and trace of gravel.		4	SS	51											
	(Glacial Till)		5	SS	34	480										
	Grey		6	SS	56											
474.0	Hard		7	SS	92										6 36 43 15	
22.5	End of Borehole					470										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 130

JOB 72-11100

LOCATION Co-ords. 877,700 N; 975,052 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE Sept. 6, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY Jo

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P — W — W_L	BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT					
510.2	Ground Level									
0.0	Het. mix. of clayey silt, some sand and trace of gravel. (Glacial Till)		1	SS	16					
			2	SS	25					
			3	SS	42					
			4	SS	89					
			5	SS	60/6"					
			6	SS	70					
			7	SS	98					
			8	SS	104					
481.2	Very Stiff to Hard									
29.0	End of Borehole									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 131 (B.H. 6, 71-11039)

JOB 72-11100

LOCATION Co-ords. 877,506 N; 975,474 E.

ORIGINATED BY VK

W.P. 218-65-01


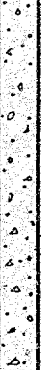
BORING DATE May 6, 1971

COMPILED BY WA

DATUM Geodetic

BOREHOLE TYPE Diamond Drill, washboring, BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			BULK DENSITY γ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.			W_P W W_L					
							O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE			WATER CONTENT % 10 20 30					
525.0	Ground Level														
0.0	Het. mix. of clayey silt with sand and trace of gravel. (Glacial Till) Very Stiff to Hard		1	SS	47	520									
			2	SS	33										
			3	SS	26										
			4	SS	57										
	Brown Grey		5	SS	39	510									
			6	SS	22										
			7	SS	24										
			8	SS	41		500								
493.0		9	SS	150/6"											
32.0	Het. mix. of silt, sand and gravel, trace of clay.		10	SS	175/11"	490									
			11	SS	62										
							480								
			12	SS	182/11"										
465.0						470									
60.0	End of Borehole					460									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 132 (B.H. 4, 71-11038)

JOB 72-11100

LOCATION Co-ords. 877,735 N; 976,534 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE May 13, 1971

COMPILED BY HS.

DATUM Geodetic

BOREHOLE TYPE Power Auger (Penndrill); Cone Test

CHECKED BY /10

SOIL PROFILE			SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE		20	40	60	80	100	w_p	w	w_L		
533.0	Ground Level														
0.0	Het. mixture of clayey silt with some sand and traces of gravel.		1	SS	41										
			2	SS	37										
			3	SS	60										
			4	SS	30										
			5	SS	40										
	Very Stiff to Hard		6	SS	29										
			7	SS	35										
	(Glacial Till)		8	SS	63										
			9	SS	91										
			10	SS	51										
			11	SS	114										
			12	SS	100.5"										
			13	SS	146										
			14	SS	175.5"										
464.3	Fragments of shale		15	SS	150.15"										
68.7	End of Borehole														

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 133 (B.H.11, 71-11038)

JOB 72-11100

LOCATION Co-ords. 877,663 N; 977,005 E.

ORIGINATED BY VH

W.P. 218-65-01

BORING DATE May 21, 1971

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE Power Auger (Pendril); Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p — w — w_L WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT					
535.5	Ground Level									
	Het. mixture of clayey silt with some sand and traces of gravel.		1	SS	11					
			2	SS	41	530				
			3	SS	45					
			4	SS	25					
	Stiff to Hard (Glacial Till)		5	SS	20	520				
			6	SS	21					
			7	SS	26					
			8	SS	29	510				
			9	SS	19					
			10	SS	156	500				
			11	SS	100	3"				
			12	SS	300	5"	490			
			13	SS	80					
481.0										
54.5	Sandy silt with traces of clay and gravel.		14	SS	74	480				
474.0	Very Dense		15	SS	100	3"				
61.5	End of borehole					470				

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 134 (B.H. 7, 71-11036)

JOB 72-11100

LOCATION Co-ords. 878,031 N; 977,940 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE May 31 and June 1, 1971

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE Power Auger-Washboring-BX Casing-BX Rock Core

CHECKED BY *LS*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT		PLASTIC LIMIT			
							20	40	60	80		
							SHEAR STRENGTH P.S.F.		WATER CONTENT %			
							○ UNCONFINED + FIELD VANE		W _p — W — W _L			
							● QUICK TRIAXIAL × LAB VANE		W _p — W — W _L			
									WATER CONTENT %			
									10 20 30			
									P.C.F.		GR SA SI CL	
547.8	Ground Level											
	Het. mixture of clayey silt with some sand and traces of gravel.		1	SS	14							
			2	SS	40							
			3	SS	51							
			4	SS	50							
			5	SS	31							
	Stiff to Hard.		6	SS	37							
			7	SS	16							
	(Glacial Till)		8	SS	18							
			9	SS	19							
			10	SS	25							
			11	SS	43							
			12	SS	15							
			13	SS	91							
			14	SS	85							
			15	SS	112							
	silty sand with some gravel		16	SS	91							
			17	SS	178							
472.3			18	SS	130 2/3"							
75.5	Bedrock - Shale		19	BXL RC	50%							
	Weathered		20	BXL RC	51%							
			21	BXL RC	75%							
159.3	Sound											
88.5	End of Borehole											

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 135 (B.H.13, 71-11036)

JOB 72-11100

LOCATION Co-ords. 878,030 N; 978,119 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE Jun 3 and 4, 1971

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger; Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	w_p	w	w_L		
552.2	Ground Level															
0.0	Het. mixture of clayey silt with some sand and traces of gravel. (Glacial Till) Very Stiff to Hard Occasional seams of silt up to 4" thick throughout.		1	SS	12	550						10				
			2	SS	45											
			3	SS	59	540										
			4	SS	58											
			5	SS	36											
			6	SS	27											
			7	SS	31	530										
			8	SS	28							0				
			9	SS	12	520										
			10	SS	36											
			11	SS	30	510										
			12	SS	21											
502.0																
50.2	Het. mixture of silty sand to sandy silt with traces of gravel. Compact to Very Dense		13	SS	25	500										
			14	SS	109											
			15	SS	109	490						0				
			16	SS	125	6"										
			17	SS	160	6"	480									
479.7																
472.5	Clayey silt with pockets of silty ss. & fragments of shale		18	SS	155	6"										
476.7																
475.5	End of Borehole															
						470										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 136 (B.H.2, 71-11037)

JOB 72-11100

LOCATION Co-ords. 877,992 N; 978,701 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE April 27, 1971

COMPILED BY SO

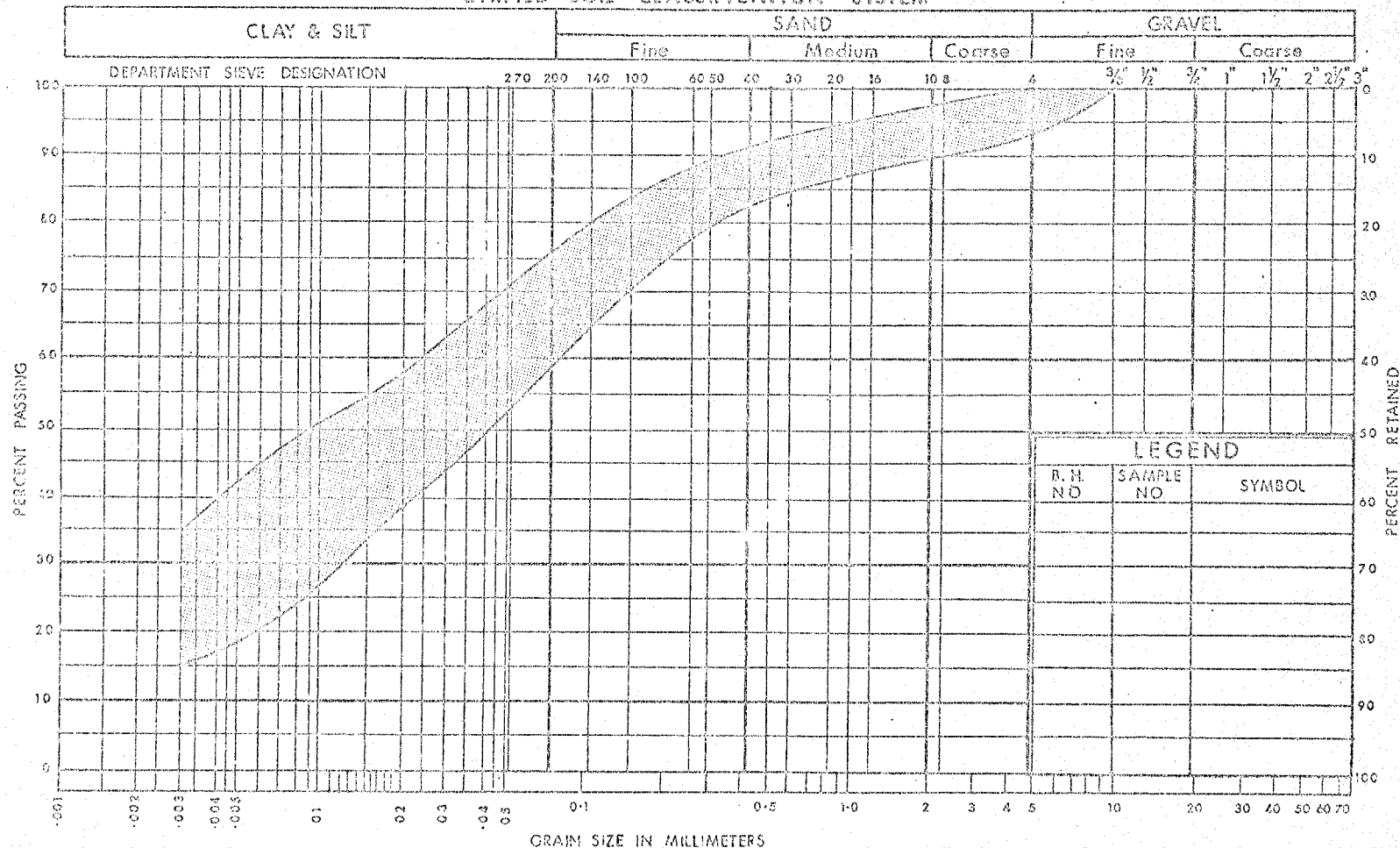
DATUM Geodetic

BOREHOLE TYPE Pendrill

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	W_P	W	W_L		
552.5	Ground Level															
0.0	Het. mix. of clayey silt, sand and trace of gravel.		1	SS	36	550										551.5
			2	SS	46											
	Very Stiff - Hard		3	SS	63											
	Brown		4	SS	40	540										4 28 52 16
	Grey		5	SS	32											
			6	SS	30											
	(Glacial Till)		7	SS	34	530										3 23 56 18
			8	SS	44											
			9	SS	22	520										
			10	SS	68											
			11	SS	25	510										
505.5			12	SS	33											
47.0	Het. mix. of silt, sand and trace of gravel and clay.		13	SS	100/5"	500										7 42 42 9
	Very Dense		14	SS	100/5"	490										
481.5			15	SS	100/2"											9 56 24 11
71.0	End of Borehole					480										

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT
OF
TRANSPORTATION AND COMMUNICATIONS



DESIGN SERVICES
BRANCH

GRAIN SIZE DISTRIBUTION

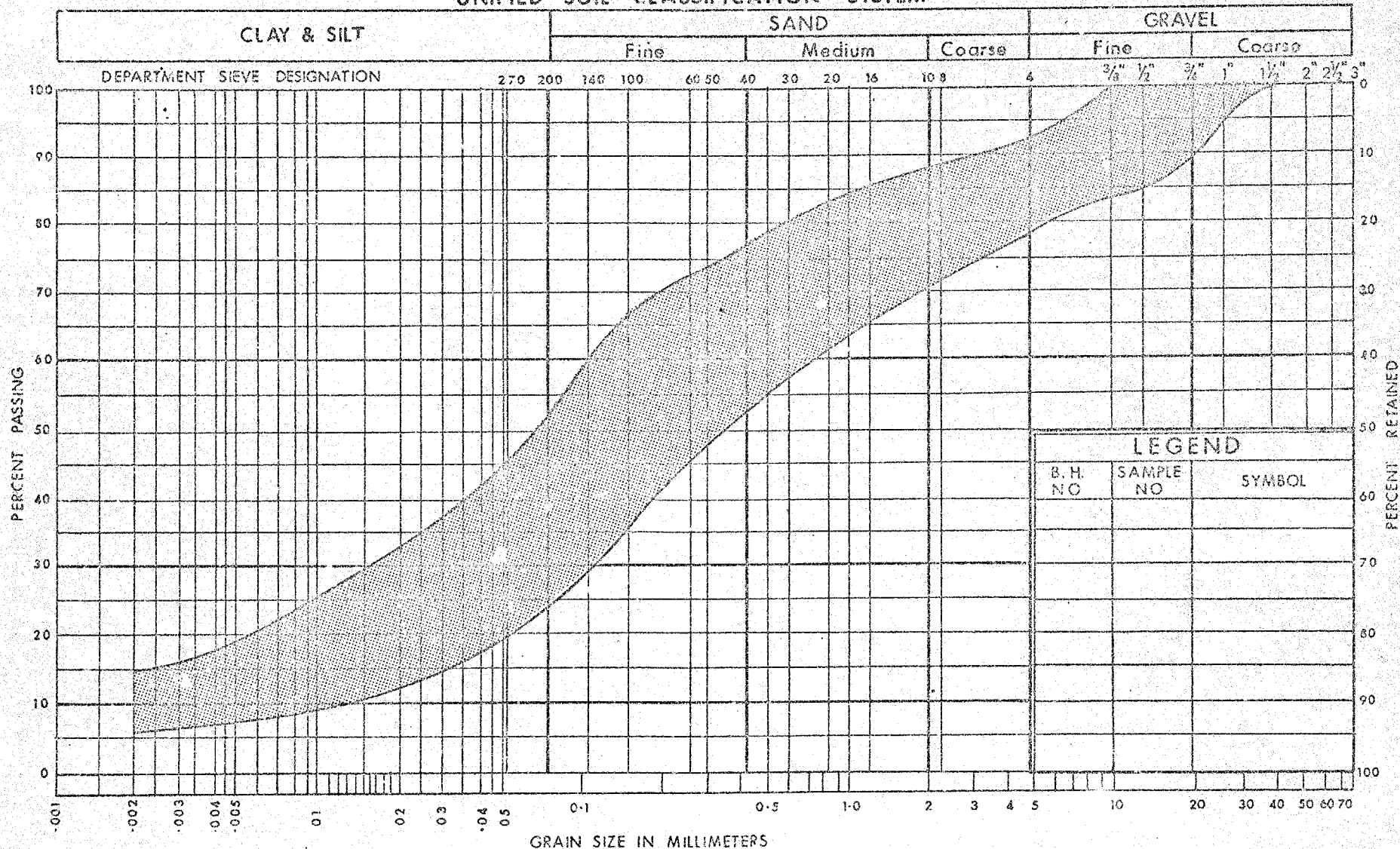
GLACIAL TILL
HET. MIXTURE OF CLAYEY SILT, SAND & GRAVEL

W.P. No. 218 - 65 - 01

JOB No. 72 - 11100

FIG. 1

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT
OF
TRANSPORTATION AND COMMUNICATIONS



DESIGN SERVICES
BRANCH.

GRAIN SIZE DISTRIBUTION

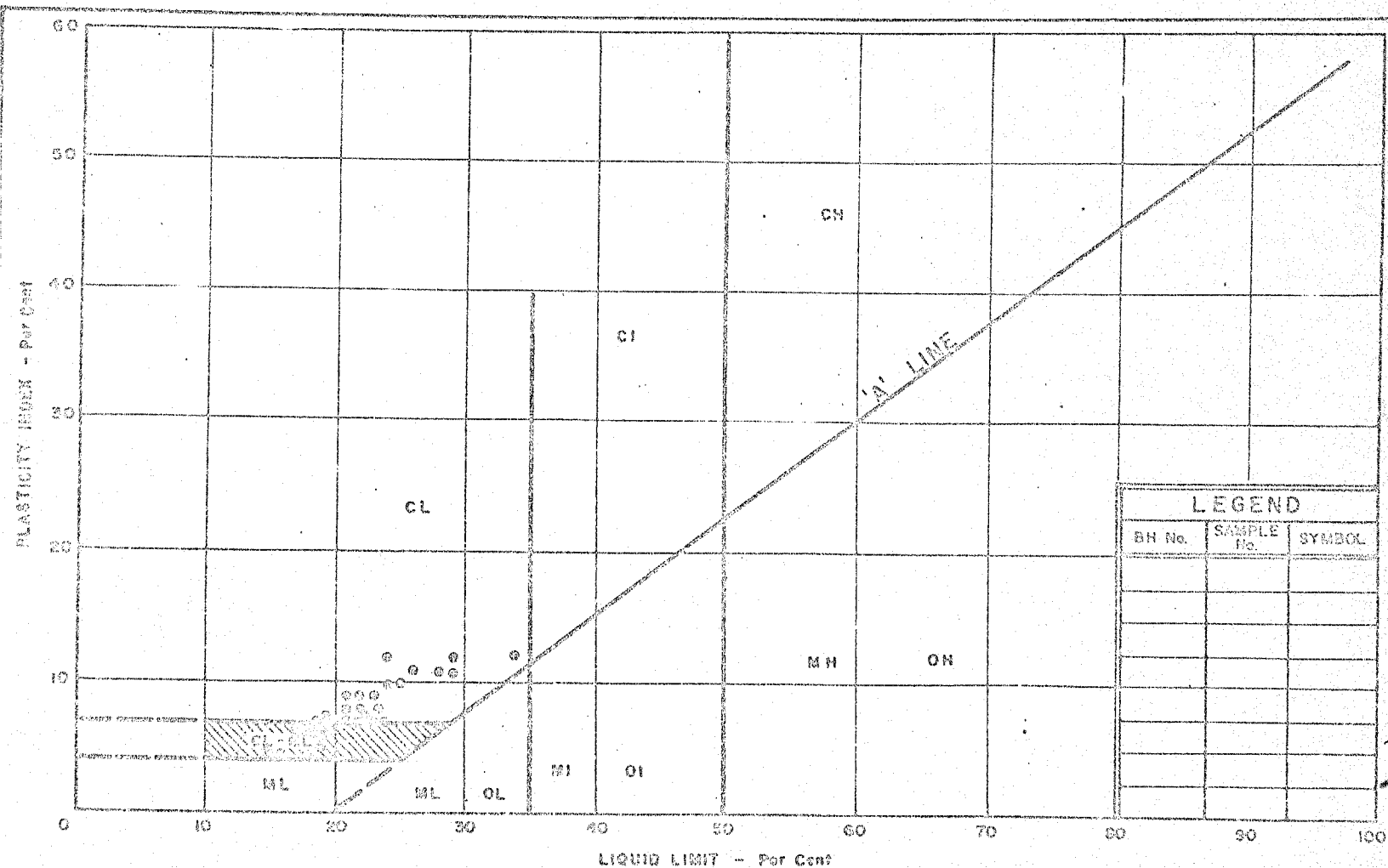
GLACIAL TILL

HET. MIXTURE OF SILTY SAND, GRAVEL & CLAY

W.F. No. 218 - 65 - 01

JOB No. 72 - 11100

FIG. 2



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

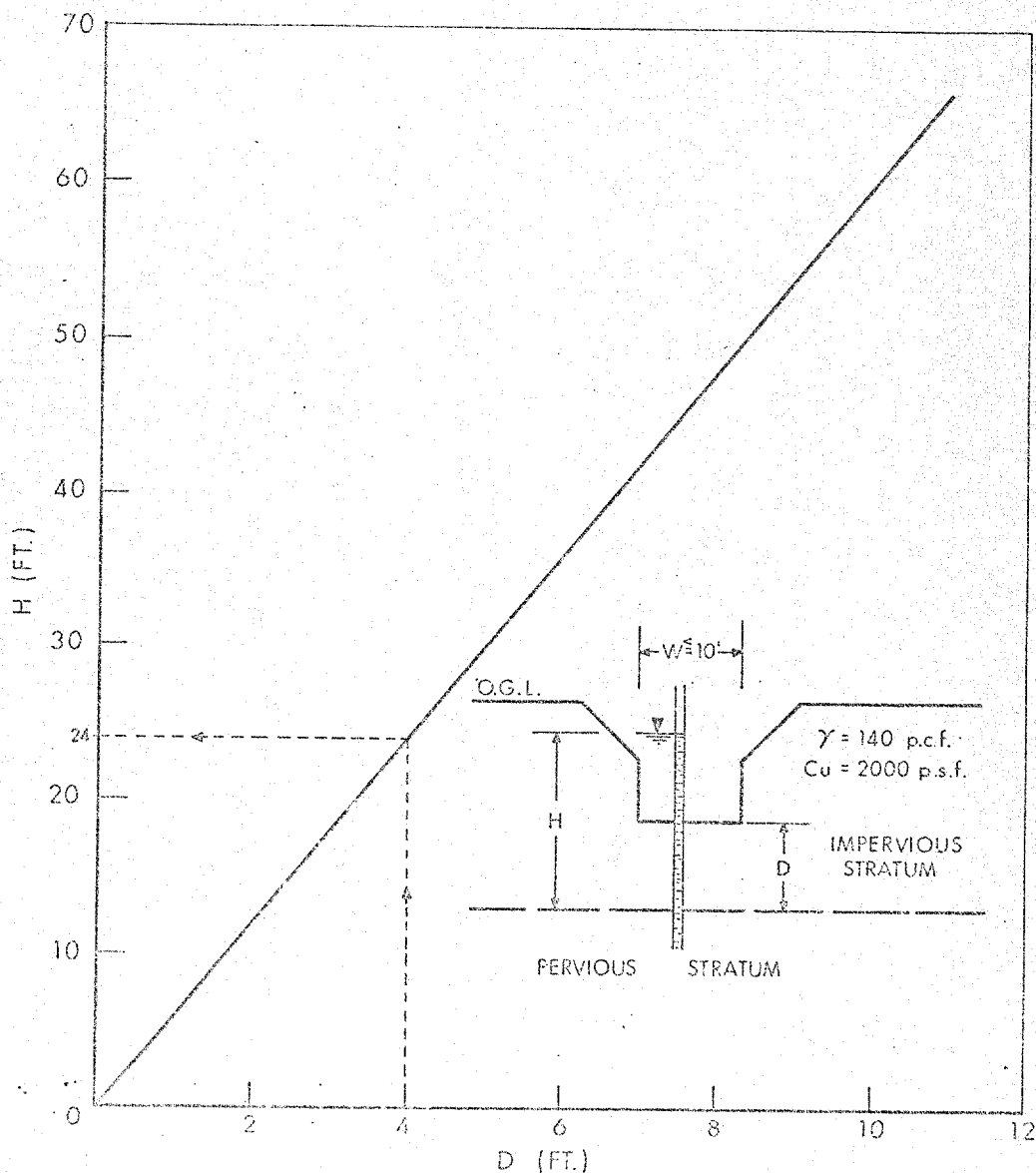
PLASTICITY CHART GLACIAL TILL HET. MIXTURE OF CLAYEY SILT, SAND & GRAVEL

WR No. 218 - 65 - 01

JOE No. 72 - 11100

FIG. 3

GRAPH RELATING SAFE HYDROSTATIC WATER HEAD
(H) TO DISTANCE (D) BETWEEN TRENCH BOTTOM
& PERVIOUS STRATUM SURFACE



ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

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

<u>CONSISTENCY</u>	<u>'N' BLOWS/FT.</u>	<u>c LB./SQ.FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

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

SOIL TESTS

Qu	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
S_r	DEGREE OF SATURATION
w_L	LIQUID LIMIT
w_p	PLASTIC LIMIT
I_p	PLASTICITY INDEX
s	SHRINKAGE LIMIT
I_L	LIQUIDITY INDEX $= \frac{w - w_p}{I_p}$
I_c	CONSISTENCY INDEX $= \frac{w_L - w}{I_p}$
e_{max}	VOID RATIO IN LOOSEST STATE
e_{min}	VOID RATIO IN DENSEST STATE
I_D	DENSITY INDEX $= \frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY D_r IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
m_v	COEFFICIENT OF VOLUME CHANGE $= \frac{-\Delta e}{(1+e)\Delta\sigma'}$
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX $= \frac{\Delta e}{\Delta \log_{10} \sigma'}$
T_v	TIME FACTOR $= \frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	$= 3.1416$
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ or $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ or $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

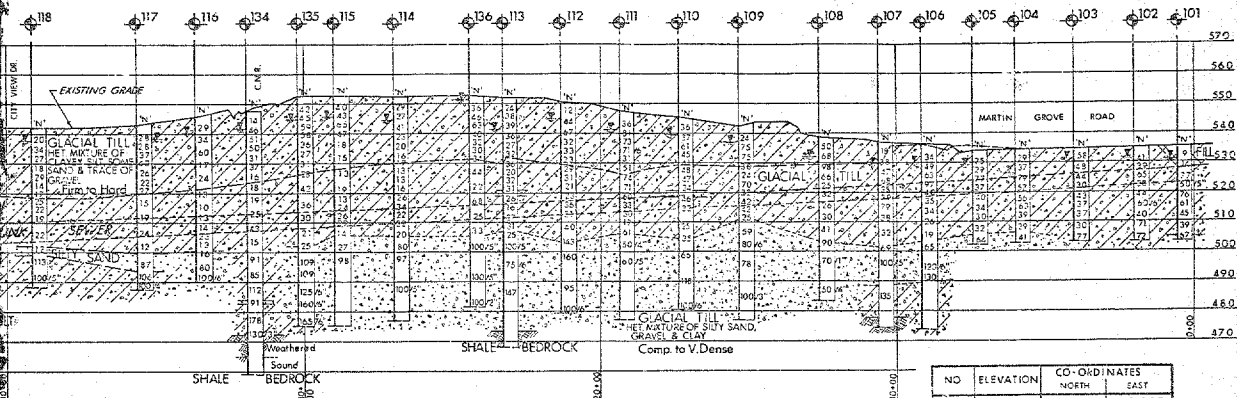
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

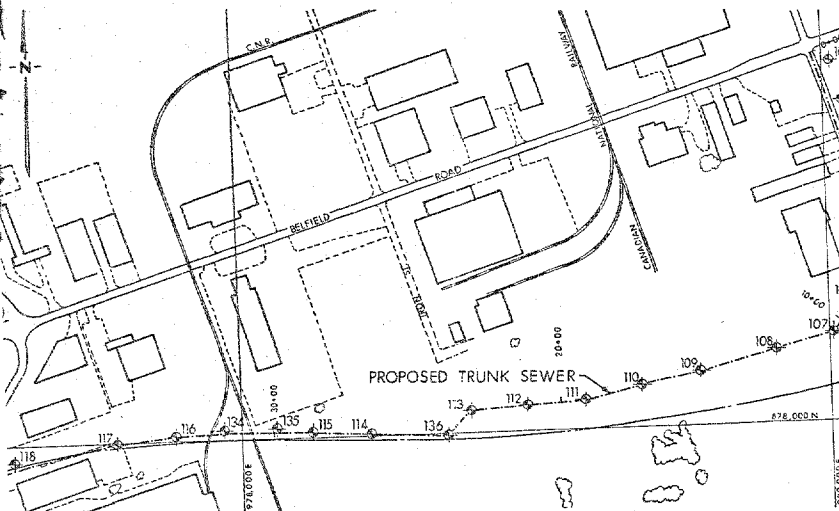
H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



ALONG PROPOSED TRUNK SEWER

VERT. 20 10 0 SCALE 20 40 FT.

HORIZ. 200 100 0 200 400



NO	ELEVATION	CO-ORDINATES	
		NORTH	EAST
101	513.5	879.231	980.027
102	513.5	879.092	980.064
103	513.4	878.900	980.129
104	513.3	878.710	980.191
105	513.3	878.573	980.232
106	513.3	878.418	980.101
107	513.3	878.253	980.012
108	513.3	878.092	979.817
109	513.3	877.926	979.554
110	513.3	877.766	979.388
111	513.3	877.602	979.165
112	513.3	877.438	978.970
113	513.3	877.274	978.772
114	513.3	877.110	978.438
115	513.3	876.946	978.258
116	513.3	876.782	977.779
117	513.3	876.618	977.550
118	513.3	876.454	977.319
119	513.3	876.290	977.088
120	513.3	876.126	976.857
121	513.3	875.962	976.626
122	513.3	875.798	976.395
123	513.3	875.634	976.164
124	513.3	875.470	975.933
125	513.3	875.306	975.702
126	513.3	875.142	975.471
127	513.3	874.978	975.240
128	513.3	874.814	975.009
129	513.3	874.650	974.778
130	513.3	874.486	974.547
131	513.3	874.322	974.316
132	513.3	874.158	974.085
133	513.3	873.994	973.854
134	513.3	873.830	973.623
135	513.3	873.666	973.392
136	513.3	873.502	973.161

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISION	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO
DESIGN SERVICES BRANCH—FOUNDATIONS OFFICE

PROPOSED TRUNK SEWER (MARTIN GROVE ROAD TO MIMICO CREEK)

HIGHWAY NO. PROPOSED 409 DIST. NO. 6
CO. YORK METRO TORONTO
TWP. ETOBICOKE LOT. CON.

BORE HOLE LOCATIONS & SOIL STRATA

SUBV. C.F.	CHECKED	W.F. NO.	218-62-01	DRAWING NO.
DRAWN S.D.	CHECKED	W.G. NO.	72-11102	72-11100A
DATE 10 NOV 1972	SITE NO.	BRIDGE DRAWING NO.		
APPROVED				

REF. NO. B-80-77

12 PROPOSED PAGE

72-11-100
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: D.M. Hopper
Manager
Contract Control Office

FROM: Systems Design Branch
East Building

ATTENTION:

DATE: June 6, 1973

OUR FILE REF.

IN REPLY TO

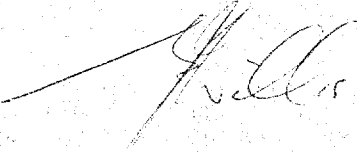
SUBJECT: Contract 73-20, W.P. 218-65-06, District 6, Hwy. 409
Location: Belfield Expressway

Please be advised that due to a misunderstanding between Regional Systems Design and Foundations Office, Bore Hole Locations and Soils Strata Drawing was not inserted in the Contract Drawings forwarded to your office for distribution purposes.

As this drawing is now part of the Contract it should be listed on index sheet 'F' as No. 99 presently marked "Not part of this Contract" and should be issued as an addendum to the bidders.

Sufficient number of copies were forwarded to your office under separate cover at an earlier date.

EJW/cs


E.J. Willis
Project Review Supervisor

for

c.c. H. Greenland
R.S. Pillar
B.J. Giroux
M. Devata ✓

Project Review Engineer

*Discussed with Ted Willis and he agreed the fault was
by Systems Design not Foundation office and in future
they will not repeat such a mistake.*

*On-2
June 11/73*

Materials & Testing Office,
Central Region,
3501 Dufferin Street,
Downsview, Ontario,
M3K 1N6.

(Telephone: 248-3252)

June 13, 1973.

Mr. R. J. A. Barr, P. Eng.,
Project Manager,
DeLeuw, Cather & Company of Canada Ltd.,
Consulting Engineers,
133 Wynford Drive,
Don Mills, Ontario,
M3C 1K1.

Attention: Mr. A. C. Teoh, P. Eng.
Project Engineer

72-11-100

Dear Al:

Re: W.P. 212-65-01
Highway 409, Belfield Expressway
Minutes of Meeting No. 108
Toronto District

Item 7 of the minutes mentions soil profiles in the contract. I believe the "soil profile" refers to data on soil stratigraphy and physical properties as determined by the Foundation Office, Design Services Branch, this Ministry.

In deference to established connotative implication and semantic idiosyncrasy exclusive to this Ministry, may I suggest

continued:-

DeLeuw, Cather.

June 13, 1973.

Re: W.P. 218-65-01

that the term soil profile be henceforth reserved for an engineering grade line profile on which subsoil information has been added at the instigation of or by the Regional Materials & Testing Office.

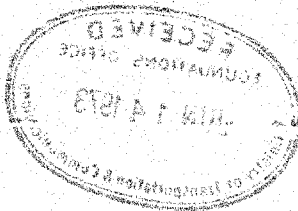
Yours truly,

Original Signed by
C. MIRZA

C. Mirza, P. Eng.,
Regional Materials Engineer.

CM/js.

cc: M. S. Devata ✓
R. P. Northwood



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. R.G. Gascoyne
Regional Director
Central Region

FROM: W.G. Porter
Regional Systems Design

ATTENTION:

DATE: June 18, 1974.

OUR FILE REF.

IN REPLY TO

SUBJECT:

RE: Highway 409
Hwy. 401 to Carlingview Drive
W.P. 218-65-C1
District 6, Toronto.

Dear Sir:

Enclosed is a copy of the Design Synopsis Report for the above project. Copies of this report are being distributed to other applicable offices.

WGP:JGC:hcs
Encl.



W.G. Porter
for:
J.G. Celmins,
Sr. Project Design Engineer.

c.c.—See Attached Page.

