

#62 - F-324 M

B RIDGE

VICTORIA RD.

ERAMOSA RIVER

GUELPH CITY

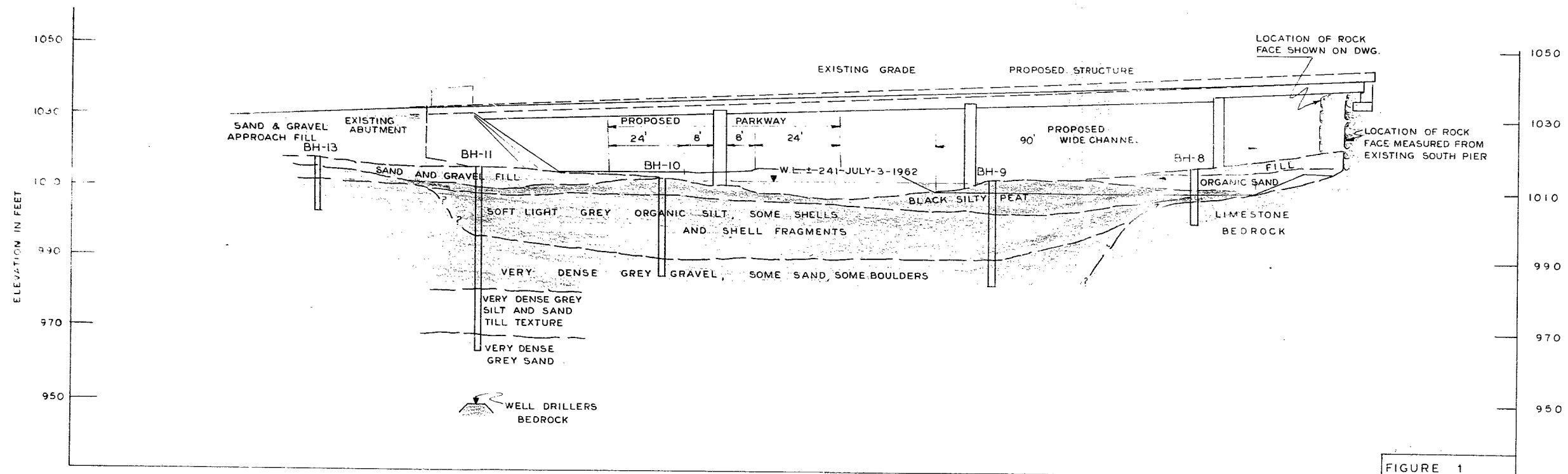
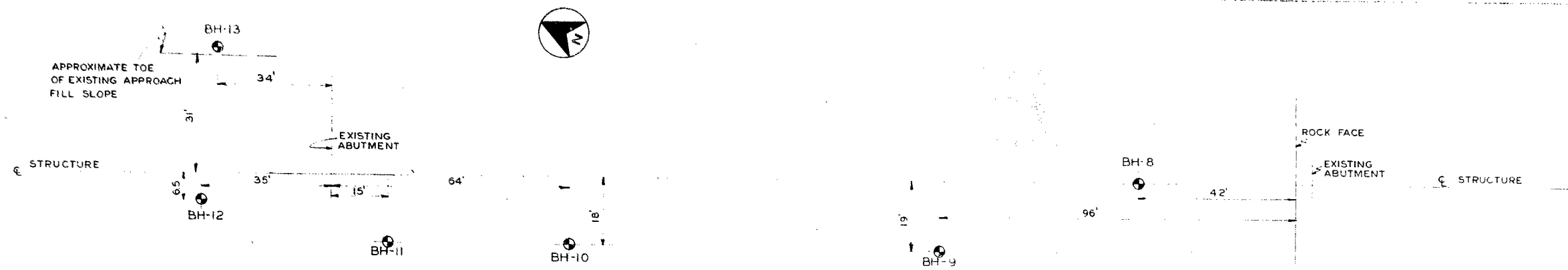


FIGURE 1

FOUNDATION INVESTIGATION REPORT  
 PROPOSED BRIDGE REPLACEMENT  
 VICTORIA ROAD AND ERAMOSA RIVER  
 CITY OF GUELPH

32 2 3247

R. K. KILBORN & ASSOCIATES

KILBORN & ASSOCIATES LTD.			
RECEIVED			
JUL 27 1962			
K.M.D.	E.S.C.	W.C.	G.M.D.
N.O.S.	H.S.	W.C.	FILE

Submitted by

ASSOCIATED GEOTECHNICAL SERVICES LIMITED  
 211 Davenport Road, Toronto 5, Ontario.

July 20, 1962

## TABLE OF CONTENTS

<u>SECTION</u>		<u>Page</u>
1	INTRODUCTION . . . . .	1
2	SUMMARY . . . . .	2
3	DISCUSSION OF PROCEDURES . . . . .	3
	3.1 Field Procedures . . . . .	3
	3.2 Laboratory Procedures . . . . .	3
4	DISCUSSION OF SITE . . . . .	4
5	DISCUSSION OF PROPOSED STRUCTURE . . . . .	6
	5.1 Spread Footings . . . . .	6
	5.2 Piles . . . . .	6
	5.3 Approach Fill and Proposed Parkway . . . . .	7

## APPENDIX

Plan and Soil Profile . . . . .	Fig. 1
Borehole Logs . . . . .	Figs. 2 to 7 incl.
Triaxial Test Results	
Classification Charts	

SECTION 1INTRODUCTION

The purpose of this Report is to present the results of a foundation investigation carried out in connection with the proposed bridge replacement on Victoria Road over the Eramosa River in the City of Guelph, Ontario.

The work was authorized on behalf of the City of Guelph by Mr. W. A. Scott, P.Eng., of R. K. Kilborn & Associates, on June 21, 1962.

We wish to acknowledge the kind assistance of Mr. A. G. Stermac, Principal Soils and Foundation Engineer, Department of Highways of Ontario, from whom we were able to reap the benefit of the Department's experience in the art of soil displacement.

SECTION 2SUMMARY

It is proposed to replace the existing structure with a 4 span bridge. The soils investigation for the new bridge consisted of 4 borings in the vicinity of the piers and north abutment and 2 borings in the vicinity of the north abutment.

Bedrock was encountered at shallow depth on the south bank of the river. The south pier and south abutment may be founded on rock. The remainder of the site consisted of about 20 feet of soft organic silt underlain by very dense soils. The other two piers and the north abutment, therefore, should be supported by piles driven into the very dense soils.

In view of the fact that the soft organic silt will not support the weight of the lengthened north approach fill or the proposed parkway fill without stability or settlement problems, it is recommended that the organic silt be removed and replaced with a sand and gravel fill. The organic silt may be removed by the method of partial excavation and partial displacement. It is recommended that this operation be carried out prior to pile driving.

## SECTION 3

### DISCUSSION OF PROCEDURES

#### 3.1 Field Procedure

The field drilling program was carried out in two phases. The primary phase consisted of four boreholes near the proposed piers and north abutment. The secondary phase consisting of two shallow borings was initiated in order to provide additional information near the north approach fill.

The borehole locations for the primary phase of the drilling program were established by the Consulting Engineers and determined in the field by the Soils Technician. The two secondary holes were established by the field Soils Engineer. The locations of all boreholes are shown on the plan (Fig. 1) in the Appendix. The elevation of each borehole was established by spirit level from a nearby geodetic bench mark.

One skid mounted Boyles screw feed drilling rig was used in the primary phase of the drilling program, whereas a jeep-mounted power auger was employed for the secondary phase. All soil boring and sampling operations were carried out by an experienced soil sampling crew under the full time supervision of either a qualified Soils Technician or Soils Engineer.

The soil boring for the primary phase of the drilling program was carried out using the normal wash boring techniques. The boreholes in the secondary phase were advanced by augering. Samples in cohesionless soil were obtained in split spoon samplers in conjunction with the standard penetration test. Several shelly tube samples were taken in the organic silt material. The depths at which samples were taken in each borehole have been plotted on the borehole logs included in the Appendix.

#### 3.2 Laboratory Procedures

Moisture content, unit weight, specific gravity and undrained triaxial laboratory tests were carried out on representative samples of soil from beneath the proposed structure. All soil tests were carried out in the soils laboratory of Associated Geotechnical Services Limited. In general, the methods used were those outlined in "Soil Testing for Engineers" by T. W. Lambe. The results of these tests are shown on the borehole logs in the Appendix.

## SECTION 4

4.

### DISCUSSION OF SITE

The soils at the site are shown in profile on Figure 1, in the Appendix. The boring details for each soil stratum are shown on the Borehole Logs and in the laboratory test results also included in the Appendix.

As can be seen on the soil profile, the foundation materials at the site can be classified into three general types;

1. bedrock
2. very dense soils
3. soft organic soils.

A bedrock scarp forms the south bank of the Eramosa River valley in the vicinity of the Victoria Road Bridge. Bedrock was also encountered at elevation 1011 in borehole 8, near the proposed south pier and at elevation 950 in the well driller's borehole near the proposed north abutment. The bedrock was found to consist of a dark brown to black, thinly bedded limestone with numerous horizontal bituminous partings. This rock may be classified as the Niagara-Guelph Formation of Silurian Age.

The very dense soils at the site were found to traverse the present river valley as shown in the soil profile (Fig. 1 in the Appendix). As shown on the profile, the very dense soils consist of 15 feet of gravel, some sand underlain by 12 feet of till-textured silt and sand underlain by more than 5 feet of grey sand. These soils are glacial in origin. The grey sand represents interglacial deposition; the till was probably deposited beneath the last ice mass and the gravel; some sand was probably deposited as glacial outwash material when the ice mass melted. From the shape of the upper surface of the very dense soils, it appears that this surface has been contoured by glacial meltwaters which scoured out the wide river bed-like profile. The old river bed was subsequently filled with soft organic soils which now forms the bed of the present Eramosa River.

The soft organic soils are shown on the soil profile and were encountered in boreholes 9, 10 and 11 in the vicinity of the proposed centre river pier, the north pier and the north abutment. The major portion of the soft soils consisted of a grey organic silt which was overlain by a black silty peat. The moisture content, unit weight, specific gravity, void ratio and shear strength were determined in the soils laboratory for representative samples of this material. The results of these determinations are listed below.



Grey Organic Silt

<u>Borehole No.</u>	<u>Sample No.</u>	<u>Percent Moisture Content</u>	<u>Unit Weight</u>	<u>Specific Gravity</u>	<u>Void Ratio</u>
9	2	126.1			
9	3	143.0			
9	4	158.0	81.7	-	3.99
10	2	112.7			
10	3	106.5	88.0	2.53	2.68
10	4	104.4			
10	5	128.8	81.5	-	3.43
11	3	102.7			
11	4	101.5			

Black Silty Peat

<u>Borehole No.</u>	<u>Sample No.</u>	<u>Percent Moisture Content</u>
9	1	394.2
10	2	153.1
11	2	451.0

Undrained triaxial tests were carried out on undisturbed organic silt samples at a lateral pressure of 0.8 times the estimated existing sample overburden pressure. The shear strength of the organic silt was found to be 282 lbs/sq.ft for sample 3, borehole 10, and 234 lbs/sq.ft for sample 5, borehole 10.

## SECTION 5

### DISCUSSION OF PROPOSED STRUCTURE

At the time of writing this Report, it had been proposed to replace the existing bridge with a 4 span structure having a deck grade closely approximating the existing facility. The new structure, however, was about 13 feet shorter and considerably wider. To the south of the structure, access to the bridge was by ground level approach. However, an approach fill embankment was required for the north access. Although there was an approach fill to the existing embankment, it would have to be made wider and longer to accommodate the new structure.

In addition, provision for a proposed parkway was to be included in the design. The parkway was to be symmetrical about the north pier as shown on Figure 1 in the Appendix.

Considering this proposal, we wish to comment as follows with respect to the foundation conditions.

#### 5.1 Spread Footings

Spread footings placed on limestone bedrock appear to be suitable methods of supporting the south abutment and the south pier. In both locations, the rock appears to be sound. However, a further examination should be made on excavation for the south abutment to confirm the rock conditions under the footing. On the basis of a visual examination of the rock core from borehole 8, bedrock in the vicinity of the south pier would be capable of safely supporting a vertical load of 8 tons per square foot. However, at the south pier, keying of the foundation into bedrock and/or the placing of dowels into bedrock will be required to withstand horizontal forces such as ice pressure.

#### 5.2 Piles

Due to the presence of a deep layer of soft grey organic silt, the centre pier, north pier and north abutment will require pile support. For these locations, we recommend that end bearing piles such as H piles or pipe piles placed into the very dense soils be employed for the foundations.

We recommend that the piles be placed after the removal of the organic silt and replacement with fill as described in Section 5.3 has been completed. Pile driving may be carried out on top of the fill, thus making easy access for the pile driving equipment.

Considering the use of steel H piles for this structure, it is expected that a BP12 pile will be capable of supporting loads of about 50 tons each if driven to refusal in the very dense soil strata. Refusal may be taken as a penetration resistance of 12 blows or more to the inch using a D-12 Delmag hammer. Refusal can be expected at approximately the following elevations.

Centre pier	-	elevation 987
North pier	-	elevation 985
North abutment	-	elevation 990

Closed-end or open-end pipe piles may also be used for the centre pier, north pier and north abutment. The allowable bearing capacity for 12 inch diameter pipe piles taken to the elevations listed above would be in the order of 75 tons per pile. However, in this case, the actual load carrying capacity of the piles may be governed by the structural strength of the pile itself rather than of the soil. Where the spacing of the piles is less than 4 times the diameter of the pile, the bearing capacity of the group must be determined on the base resistance of the piles and enclosed soil.

### 5.3 Approach Fill and Proposed Parkway

The proposed layout of the new structure included the widening and lengthening of the northern approach fill and provision for the construction of a parkway as shown on the drawing.

In our opinion, the widening of the approach fill should take place as follows (see also sketch, overleaf):

1. Remove all organic material from the area in which the embankment is to be widened.
2. Using the material in the existing approach fill embankment, backfill the excavation and widen the fill to the required dimensions.
3. Place new fill to bring the embankment up to grade.

Lengthening the approach fill embankment will involve placing fill over the soft organic silt found in boreholes 9, 10 and 11. Where roadways have to be constructed over such unstable ground as peat or organic silt, it is essential to

CLIENT R. K. KILBORN & ASSOCIATES

ASSOCIATED GEOTECHNICAL SERVICES  
Limited

JOB. NO. 6221

LOCATION \_\_\_\_\_

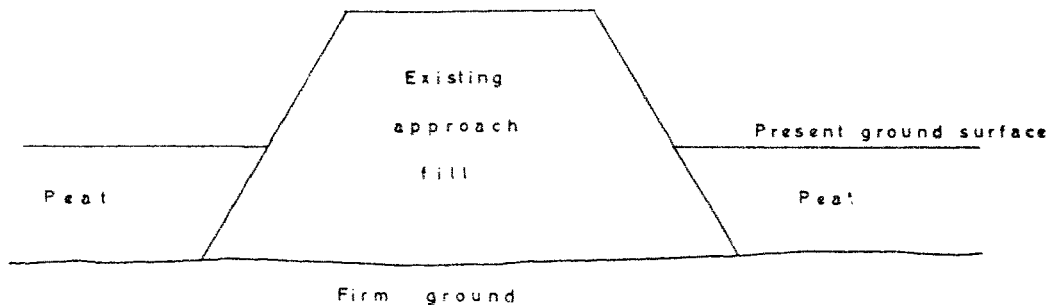
BOREHOLE NUMBER \_\_\_\_\_

DEPTH \_\_\_\_\_

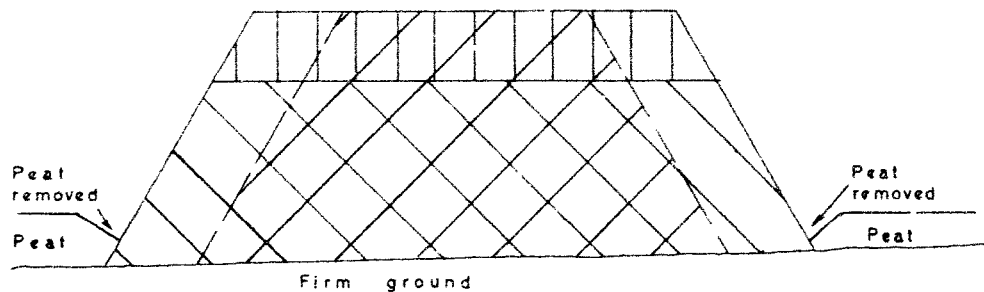
SAMPLE NUMBER \_\_\_\_\_




DATE \_\_\_\_\_

1. Existing conditions.



2. Suggested method of widening.



-  Existing fill
-  Existing fill spread out during widening process
-  New fill

SKETCH - 1

use construction methods which will ensure removal of the soft material or its complete consolidation before the structure is completed. Considering the soil conditions at the site, we recommend that the lengthening of the approach fill be carried out using the method of partial excavation and partial displacement to remove the soft organic silt and peat from beneath the embankment. This method is used where the depth of material to be displaced is over 10 feet and where the material is fibrous or woody near the surface and soft below. Removal of soft soils can usually be carried out by displacement alone when the shear strength of the material to be removed is less than 200 lbs/sq.ft. However, when the shear strength is between 200 and 300 lbs/sq.ft, such as at the Guelph site, the method of partial excavation and partial displacement produces more satisfactory results.

The partial excavation and displacement method should consist of excavating the upper soil to a depth of about 8 to 10 feet then displacing the lower part by the superimposed weight of soil in the embankment (see sketch 2). As the mud wave is formed in front of the embankment, it will be necessary to remove it in order to reduce the passive pressure in front of the fill. Whenever a heavy fill such as rock or bouldery gravel is used for the embankment, D.H.O. experience has demonstrated that it is necessary to provide a thin blanket of sand at the bottom of the fill so that the embankment will act as a unit in displacing the soft soil independently and thereby trapping some of the soil between the rock pieces. Displacement then becomes only partially successful and would lead to subsequent erratic settlement of the fill. When a sand and gravel embankment fill is used, the blanket is not required.

In order to facilitate the displacement operation, it is suggested that all man-made objects which might impede the movement of the organic silt during displacement be removed. These would include the unused wooden piles on the north bank of the river beneath the existing bridge as well as any piles, piers, etc., forming part of the existing structure.

With reference to the proposed parkway, it should be realized that any fill placing operations which may take place near the completed bridge subsequent to its construction would endanger the structure. If the fill placement for the parkway takes place after construction of the bridge, the lateral pressures and movement of the organic silt due to the superimposed load of the fill could cause lateral movement of the piles supporting the north and centre piers leading to possible collapse of the bridge. Therefore, it will be necessary to place the parkway fill before the piles for the new bridge are driven. This will also facilitate access of the pile driving equipment to the pier locations.

CLIENT R. K. KILBORN & ASSOCIATES

ASSOCIATED GEOTECHNICAL SERVICES  
Limited

JOB. NO. 6221

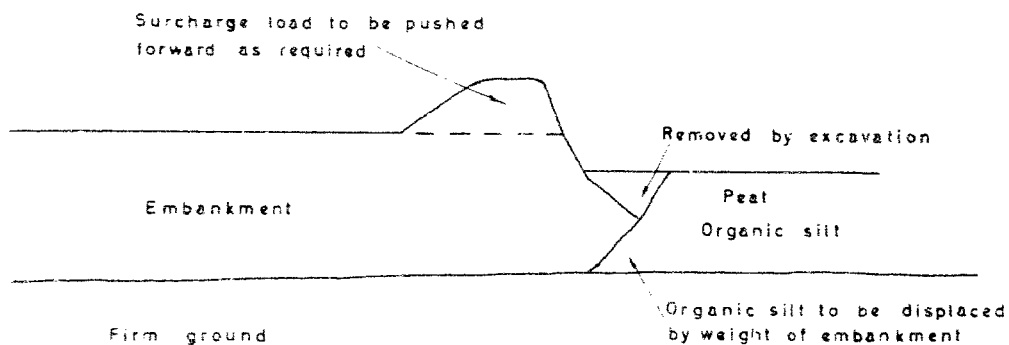
LOCATION

BOREHOLE NUMBER

DEPTH

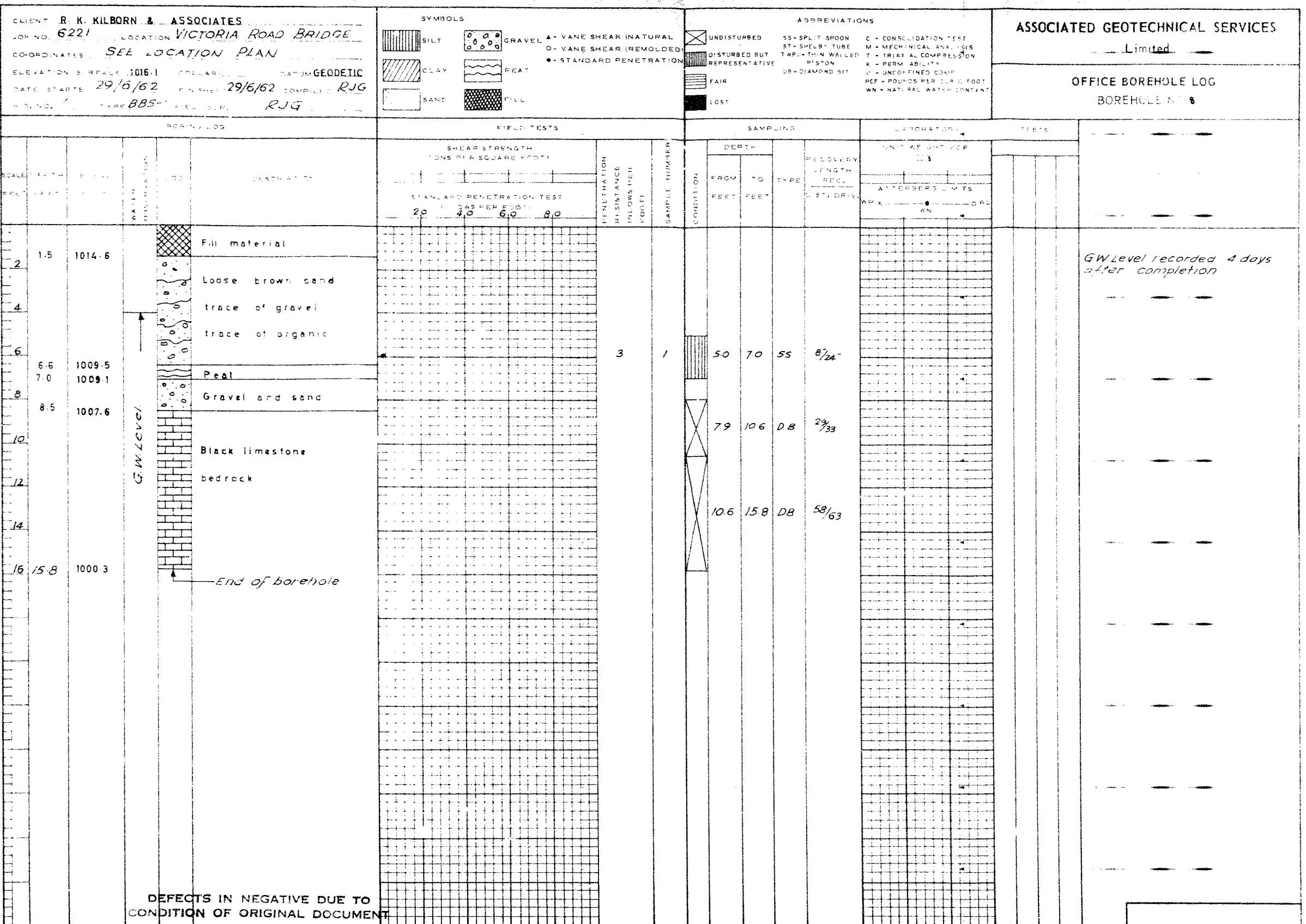
SAMPLE NUMBER

DATE



SKETCH - 2

APPENDIX I





CLIENT <u>R. K. KILBORN &amp; ASSOCIATES</u>				DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT				ASSOCIATED GEOTECHNICAL SERVICES Limited											
JOB NO. <u>6221</u> LOCATION <u>VICTORIA RD BRIDGE</u>				SYMBOLS				ABBREVIATIONS											
CO-ORDINATES <u>SEE LOCATION PLAN</u>				<div style="display: flex; justify-content: space-around;"> <div>  SILT   CLAY   SAND </div> <div>  GRAVEL   PEAT   FILL </div> <div>           A - VANE SHEAR (NATURAL)            O - VANE SHEAR (REMOLDED)            • - STANDARD PENETRATION </div> </div>				<div style="display: flex; justify-content: space-around;"> <div>  UNDISTURBED   DISTURBED BUT REPRESENTATIVE   FAIR   LOST </div> <div>           SS - SPLIT SPOON            ST - SHELBY TUBE            TWP - THIN WALLED PISTON            DB - DIAMOND BIT </div> <div>           CONSOLIDATION TEST            MECHANICAL ANALYSIS            TRIAXIAL COMPRESSION            PERMEABILITY            UNSATURATED COMP.            PORE PRESSURE COEFF.            NAT. RAL. WATER CONTENT </div> </div>											
ELEVATION (SURFACE) <u>1012.7</u> COLLAR: <u>    </u> DATUM <u>GEODETIC</u>				FIELD TESTS				SAMPLING				TESTS							
DATE (STARTED) <u>29/6/62</u> (FINISHED) <u>3/7/62</u> (COMPILED) <u>RJG</u>																			
R.C. NO. <u>1</u> TYPE <u>BBS-1</u> FIELD SUP. <u>RJG</u>				SHEAR STRENGTH TONS PER SQUARE FOOT STANDARD PENETRATION TONS PER FOOT				PENETRATION RESISTANCE TONS PER FOOT SAMPLE NUMBER				DEPTH FROM TO FEET FEET TYPE RECOVERY LENGTH REC. PER CENT				UNIT AND UNIT REC. 80 90 5.0 100 WATER CONTENT			
BORING LOG																			
DEPTH FEET	ELEV. FEET	WATER OBSERVATION	LOG	DESCRIPTION															
2	1011.4	G.W.L.		Black silty peat															
4																			
6																			
8																			
9.0	1003.7			Light grey organic silt (shells and shell fragments).															
10																			
12																			
14																			
16																			
18																			
20				Very dense grey gravel some sand trace of silt (occasional boulder)															
22	991.5																		
24																			
26																			
28																			
30																			
30	982.7			End of borehole															

G.W. Level recorded while hole at 20.0' and after 3 1/2 days

W<sub>n</sub> at 6.0 ft. 39%.

Samples 2, 3, 4, pushed down by hand.

W<sub>n</sub> at 21 ft. 158%.

Mere trickle of artesian flow noticed 1/2 hr after casing pulled.

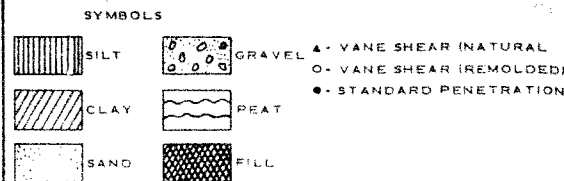
Flow stopped.

CLIENT <b>R K KILBORN &amp; ASSOCIATES</b>				SYMBOLS		DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT				ASSOCIATED GEOTECHNICAL SERVICES Limited													
JOB NO. <b>6221</b> LOCATION <b>VICTORIA ROAD BRIDGE</b>				GRAVEL		UNDISTURBED				OFFICE BOREHOLE LOG BOREHOLE NO. 10													
CO-ORDINATES <b>SEE LOCATION PLAN</b>				CLAY		DISTURBED BUT REPRESENTATIVE																	
ELEVATION (SURFACE) <b>1021.8</b> (COLLAR) _____ DATUM <b>GEODETIC</b>				PEAT		FAIR																	
DATE (STARTED) <b>28/6/62</b> (FINISHED) <b>28/6/62</b> (COMPILED) <b>RJG</b>				SAND		LOST																	
RIG NO. <b>1</b> TYPE <b>B85-1</b> FIELD SUP. <b>RJG</b>				FILL		SS - SPLIT SPOON ST - SHELBY TUBE TWP - THIN WALLED PISTON DB - DIAMOND BIT																	
BORING LOG				FIELD TESTS		SAMPLING						LABORATORY TESTS											
SCALE	DEPTH	ELEV.	WATER	LOG	DESCRIPTION	SHEAR STRENGTH (TENS PER SQUARE FOOT)				PENETRATION RESISTANCE (BLOWS PER FOOT)	SAMPLE NUMBER	CONDITION	DEPTH		RECOVERY LENGTH REC. DIST. DRIV.	UNIT WEIGHT PCF		TESTS					
FEET	FEET	FEET	OBSERVATION			0.1	0.2	0.3	0.4				FROM	TO		TYPE	80	90	W <sub>n</sub>	G <sub>s</sub>	T		
						STANDARD PENETRATION TEST (BLOWS PER FOOT)										ATTERBERG LIMITS							
						20 40 60 80										50 100							
2					Black silty peat					2	1		10	3.0	SS	5 1/2							
4	4.0	1007.8									2		50	70	SS	10							
6																							
8																							
10																							
12					Light grey organic silt (shells and shell fragments)						3		100	120	ST	24							
14																							
16											4		150	170	SS	24							
18											5		180	195	ST	12							
20																							
22	22.4	989.4																					
24					Very dense grey gravel some sand trace of silt (occasional boulder).					50	6		230	245	SS	11							
26											7		245	272	DB	22							
28	27.2	984.6			End of borehole																		

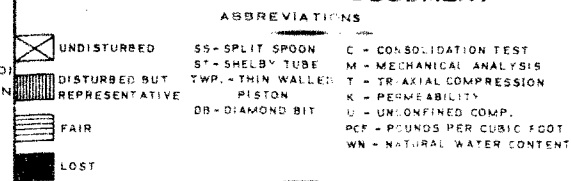
Samples 2, 3, 4 & 5 pushed down by hand  
G<sub>s</sub> at 12 ft is 2.53

Artesian flow at 24.1 300 gal/hr  
Head 1.6 above ground.  
Artesian flow at 27.2 300 gal/hr.  
Head 1.9 above ground.  
On completion artesian flow stopped.

CLIENT R. K. KILBORN & ASSOCIATES  
JOB NO. 6221 LOCATION VICTORIA ROAD BRIDGE  
CO-ORDINATES SEE LOCATION PLAN  
ELEVATION SURFACE 1015.1 COLLAR 1015.1 DATUM GEODETIC  
DATE (STARTED) 25/6/62 (FINISHED) 27/6/62 (COMPILED) RJG  
RIG. NO. 1 TYPE BBS-1 FIELD SUP. RJG



DEFECTS IN NEGATIVE DUE TO  
CONDITION OF ORIGINAL DOCUMENT



ASSOCIATED GEOTECHNICAL SERVICES  
Limited

OFFICE BOREHOLE LOG  
BOREHOLE NO. 11 Page 1 of 2

BORING LOG					FIELD TESTS				SAMPLING				LABORATORY				TESTS											
SCALE FEET	DEPTH FEET	ELEV. FEET	WATER OBSERVATION	LOG	DESCRIPTION	SHEAR STRENGTH (TONS PER SQUARE FOOT)				PENETRATION RESISTANCE (BLOWS PER FOOT)	SAMPLE NUMBER	DEPTH			RECOVERY LENGTH REC. DIST. ONLY	UNIT WEIGHT PCF 10%		ATTERBERG LIMITS		W <sub>n</sub>	V							
						STANDARD PENETRATION TEST (BLOWS PER FOOT)						FROM FEET	TO FEET	TYPE		W <sub>p</sub>	W <sub>L</sub>	LL	PL									
						20	40	60	80																			
2			GW Level		Sand, gravel, clinkers, glass (fill material)					1/6	1		10	25	SS	6 1/8												
4																												
6	6.6	1008.5				Peat					3	2		50	70	SS	24 1/2											
8	7.2	1007.9																										
10						Light grey organic silt (shells and shell fragments)					1 2/3	3		100	120	SS	15 1/2											
12																												
14																												
16																												
18													1 4/5	4		150	183	SS	22 1/4									
20	19.8	995.3											7 4/5	5		200	220	SS	22 1/2									
22							Very dense grey gravel some sand trace of silt (occasional boulder).																					
24																												
26														11 9/10	6		250	265	SS	3 1/8								
28															7		263	285	DB	5 1/27								
30												19 6/4	8		284	300	DB	5 1/19										
															300	303	SS	0										
32													9		296	326	DB	17 1/36										
																							Lost 50 - 75% water while drilling					

RIG. NO. 1 TYPE BBS-1 FIELD SUP. R. J. G.

- ▲ - VANE SHEAR (NATURAL)
- - VANE SHEAR (REMOLDED)
- - STANDARD PENETRATION

100

Limited

BOREHOLE NO. 11 Page 2 of 2

Y Z S T S

UNIT WEIGHT PCF  
BY

ATTEMBERG LIMITS


WD X WN OW

Lost water return when bit at  
32.3 - returned 100% at 32.8 -  
BX casing at 32.0.

DEFECTS IN NEGATIVE DUE TO  
CONDITION OF ORIGINAL DOCUMENT

RIG. NO. 2 TYPE AUGER FIELD SUP. D.S.O.

BOREHOLE NO. 12

DEPTH FEET ELEV. FEET	DESCRIPTION	LOG		SHEAR STRENGTH TONS PER SQ. FT.	SAMPLE NO.	CORRECTION	REMARKS
		STANDARD PENETRATION BLOCS PER FOOT					
		20	40	60			
2	Brown sand and gravel some cobbles and boulder (fill material)				1		
4							
6							
7.0 1024.3							
8							
10	END OF BOREHOLE						
12							

DEFECTS IN NEGATIVE DUE TO  
CONDITION OF ORIGINAL DOCUMENT

R K KILBORN & ASSOCIATES				SYMBOLS				ABBREVIATIONS				ASSOCIATED GEOTECHNICAL SERVICES Limited											
6221 LOCATION VICTORIA RD. BRIDGE				A - VANE SHEAR (NATURAL) O - VANE SHEAR (REMOLDED) • - STANDARD PENETRATION				UNDISTURBED DISTURBED BUT REPRESENTATIVE FAIR LOST				SS - SPLIT SPOON ST - SHELBY TUBE TWP - THIN WALLED PISTON DB - DIAMOND BIT				C - CONSOLIDATION TEST M - MECHANICAL ANALYSIS T - TRI-AXIAL COMPRESSION K - PERMEABILITY U - UNCONFINED COMP. PCF - POUNDS PER CUBIC FOOT WN - NATURAL WATER CONTENT							
SEE LOCATION PLAN				CLAY												OFFICE BOREHOLE LOG							
1017.1 (COLLAR) DATUM GEODETIC				PEAT												BOREHOLE NO. 13							
12 JULY (FINISHED) 12 JULY (COMPILED) S.O.				SAND																			
2 TYPE AUGER FIELD SUP. D.S.O.				FILL																			
BORING LOG						FIELD TESTS						SAMPLING						LABORATORY TESTS					
SCALE FEET	DEPTH FEET	ELEV. FEET	WATER OBSERVATION	LOG	DESCRIPTION	SHEAR STRENGTH (TONS PER SQUARE FOOT)				PENETRATION RESISTANCE (BLOWS PER FOOT)	SAMPLE NUMBER	DEPTH			RECOVERY LENGTH REC. DIST. DRIV.	UNIT WEIGHT PCF		TESTS					
						STANDARD PENETRATION TEST (BLOWS PER FOOT)						FROM	TO	TYPE		ATTERBERG LIMITS							
						20	40	60	80														
	1.0	1016.1			Black sand and silt					4	1	0.0	1.5	SS	16/18								
	2.0				Sand and gravel																		
	3.0	1014.1																					
	4.0				Peat					4	2	4.5	6.0	SS	5/18								
	6.0	1011.1			Dense to very dense					9	3	6.0	7.5	SS	9/18								
	8.0				Brown gravel some sand																		
	10.0				trace of silt																		
	12.0				(Occasional cobbles					24	4	9.4	10.9	SS	5/18								
	14.0				and boulders)																		
	16.0																						
	14.9	1002.2								60/5"	5	14.4	14.9	SS	5/5								
	18.0				END OF BOREHOLE																		
	20.0																						
DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT																							

CLIENT R. K. KILBORN & ASSOCIATES

ASSOCIATED GEOTECHNICAL SERVICES  
Limited

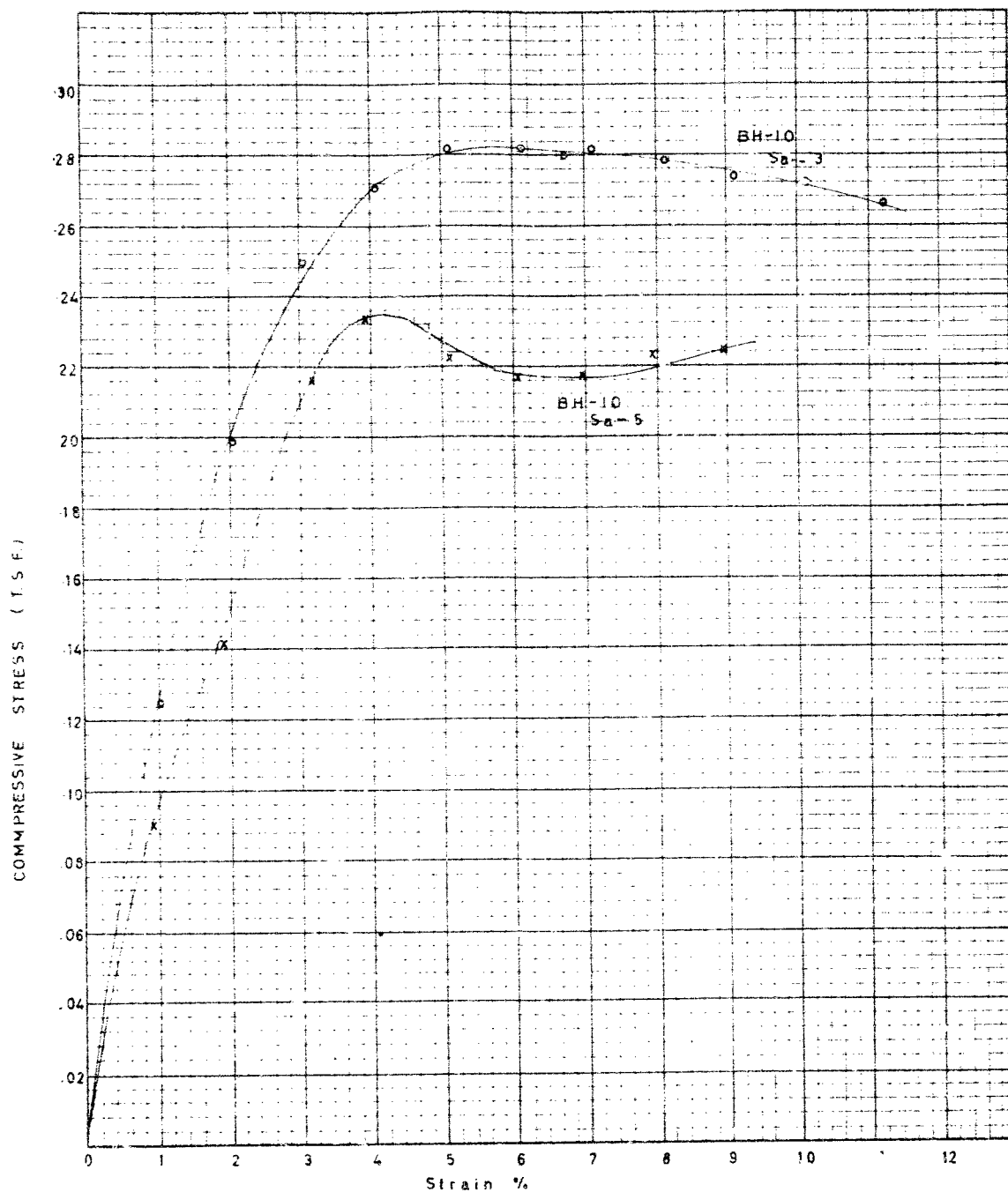
TEST NO. 62.21 LOCATION

BOREHOLE NUMBER AS MARKED DATE JULY 7, 62

SOIL MECHANICS LABORATORY

TRIAXIAL TESTS

SAMPLE NUMBER DEPTH



CLIENT \_\_\_\_\_

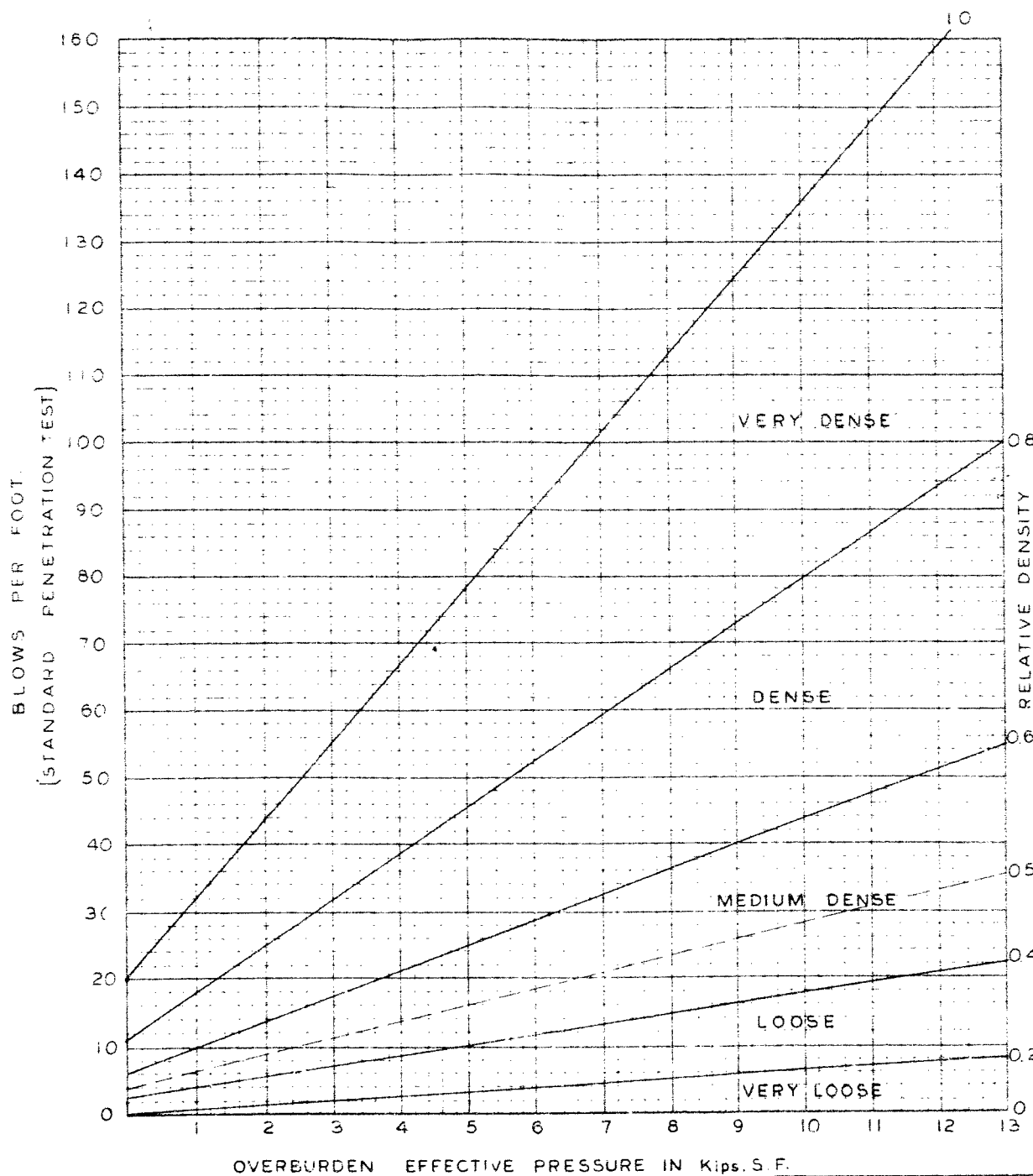
ASSOCIATED GEOTECHNICAL SERVICES  
Limited

JOB NO. \_\_\_\_\_ LOCATION \_\_\_\_\_

BORERHOLE NUMBER \_\_\_\_\_ DATE \_\_\_\_\_

SOIL MECHANICS LABORATORY  
DENSITY CHART

SAMPLE NUMBER \_\_\_\_\_ DEPTH \_\_\_\_\_





## SOIL CLASSIFICATION SYSTEM

The following system was used to describe the various soils encountered at the site as determined by visual field examination and test. It was also used to classify those soils upon which a laboratory grain size determination had been made.

### Soil Components

### Particle Size

Clay	$< .002$ mm
Silt	$> .002$ mm $< .06$ mm
Sand	$> .06$ mm $< 2.0$ mm
Gravel	$> 2.0$ mm $< 2$ in.
Cobbles	$> 2$ in. $< 6$ in.
Boulders	$> 6$ in.

### Descriptive Terms

### Range of Proportions

and	greater than 40%
with	25% to 40%
some	10% to 25%
trace	less than 10%

### Example

1. Silt (predominant type) with (25% - 40%) sand.
2. Sand and silt (predominant types), some (10% - 25%) gravel, trace ( $< 10\%$ ) clay.