

1980/31. Further investigations at a proposed cemetery site, Kingston

W.C. Cromer

Abstract

Geological logging of thirteen back-hoe pits at a proposed cemetery site near Kingston has shown that about 80% of the site is suitable for single and double graves, but that the higher parts of the block are unsuitable.

INTRODUCTION

In 1975 the Department of Mines investigated two possible sites for a proposed cemetery in the Kingston area (Cromer, 1977). The most suitable site was off Summerleas Road [EN227416], now adjacent to the Kingborough Sports Centre.

Recently it was noticed that because the original site plan was incorrect, only part of the proposed cemetery site was tested in 1975. The Kingborough Municipal Council therefore asked the Department of Mines to determine the suitability of the remainder of the site, which adjoins the area initially studied.

A plan of the site is shown in Figure 1. The boundaries to the proposed cemetery are shown by the thick border. The heavy dashed vertical line separates the present study area (to the left) from the area studied in 1975 (to the right). This report summarises the results of the present survey, and includes those results of the 1975 survey within the boundaries of the proposed cemetery.

PRESENT SURVEY

Thirteen back-hoe pits were dug (on 3.9.80 and 4.9.80) and logged (4.9.80). Their locations are shown in Figure 1, together with test pits and seismic spreads done by Cromer (1977), and with test pits dug and logged by the Kingborough Municipal Council in 1977. Detailed logs of pits dug in the present survey are listed in Appendix 1, and partial logs of the 1977 holes are shown in Appendix 2.

DISCUSSION

The main geological aspects of favourable cemetery sites include the absence of a permanent water table to the required depth, and the presence of easily excavable material to a depth of at least 1.5 m (single graves) or about 2.75 m (double graves).

The cemetery site is covered with a veneer of grey sandy soil, generally overlying stiff clay which in turn overlies sandstone or silt-stone bedrock. The purpose of the back-hoe pits (and the earlier seismic survey) was to determine the depth to bedrock over the area.

In Figure 1 the area has been divided into three zones marked 'no graves', 'single graves' and 'double graves', based on the logs in the Appendices. The position of the lines separating the zones are inferred and approximate in places, depending on the available information.

No graves. Where the site is steep or elevated, soils are thin and solid bedrock occurs within one metre of the surface. Generally no graves will be possible here, although a small area south of pit B on a gentler slope

may permit single graves: an additional test pit should be dug in this area marked 'possibly no graves'.

Single graves. Single graves, in areas with at least 1.5 m of excavable material, are confined to a narrow strip of land about 25 m wide, corresponding roughly to the break of slope at the 'base' of the hill. An area bounded by pits A, B and G extends up the hill and is also suitable for single graves.

Double graves. The rest of the site is suitable for double graves, with excavable material present at least to 2.75 m.

In summary, about 67% of the cemetery site is suitable for double graves (in the lower parts of the property), 12% is suitable for single graves and the remainder is unsuitable for graves. Minor seepages were observed in some back-hoe pits, but adequate drainage will probably remedy this. A permanent water table is absent.

REFERENCE

CROMER, W.C. 1977. Examination of proposed cemetery sites, Kingston.
Tech.Rep.Dep.Mines Tasm. 20:165-173.

[12 September 1980]

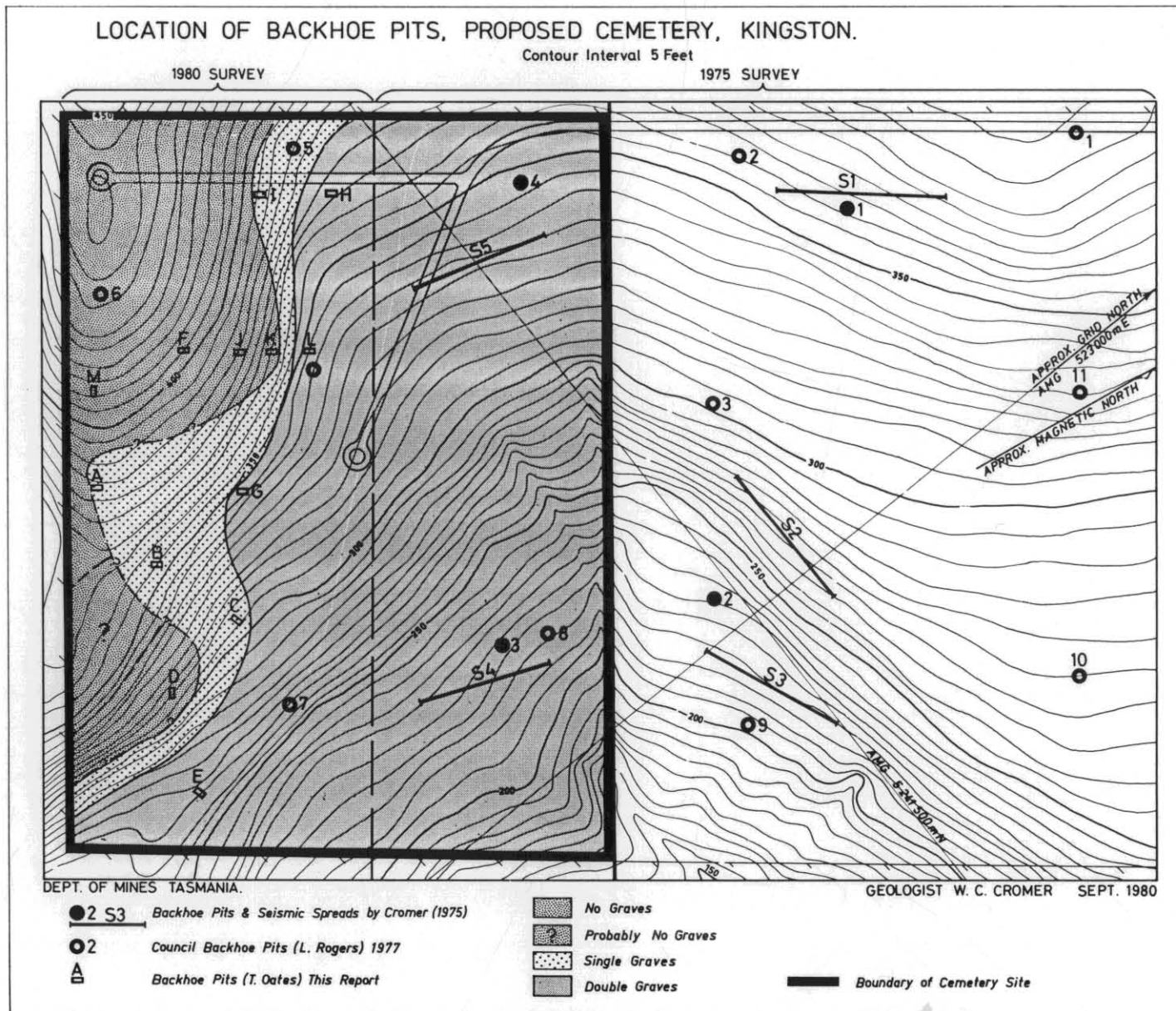


Figure 1.

APPENDIX 1

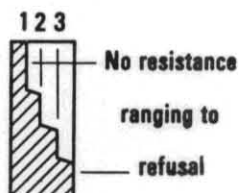
Logs of test pit holes, Kingston cemetery site

Locations are shown in Figure 1. These logs should be read in conjunction with the accompanying explanatory note sheet. Note the explanatory note for colour.

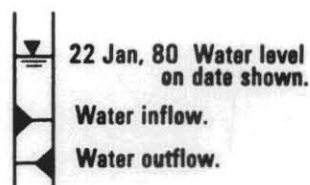
EXPLANATION SHEET FOR ENGINEERING LOGS

Borehole and excavation log

Penetration



Water



Notes - samples and tests

U50 Undistributed sample 50mm diameter.
 D Disturbed sample.
 N Standard penetrometer blow count for 300mm.
 N* SPT + sample.

Material classification

Based on Unified Soil Classification System.
 In Graphic Log materials are represented by clear contrasting symbols consistent for each project.
 * Colour. All colours with an associated code number are based on the Revised Standard Soil Color Chart, 1971.

Moisture content

D Dry, looks and feel dry.
 M Moist, no free water on hand when remoulding.
 W Wet, free water on hand when remoulding.
 LL Liquid limit.
 PL Plastic limit.
 PI Plasticity Index.
 eg. $M > PL$ - Moist, moisture content greater than the plastic limit.

Consistency

VS Very soft.
 S Soft.
 F Firm.
 St Stiff.
 VSt Very stiff.
 H Hard.
 Fb Friable.

hand penetrometer (kPa)

< 25
 25 - 50
 50 - 100
 100 - 200
 200 - 400
 > 400

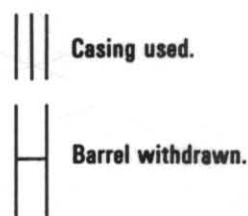
Notes: X on log is test result
 — is range of results.

Density index

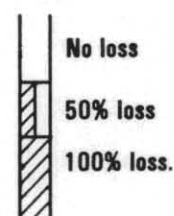
VL Very loose. 0 - 15
 L Loose. 15 - 35
 MD Medium dense. 35 - 65
 D Dense. 65 - 85
 VD Very Dense 85 - 100

Cored borehole log

Case - lift



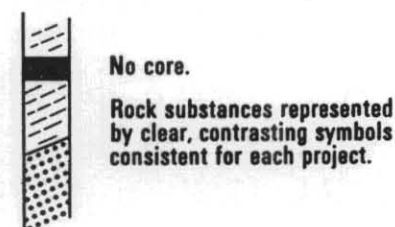
Fluid loss



Lugeons

Lugeon units (μL) are a measure of rock mass permeability. For a 46 to 74mm diameter borehole 1 Lugeon is defined as a rate of loss of 1 litre per metre per minute. 1 Lugeon is roughly equivalent to a permeability of 1×10^{-4} mm/sec.

Graphic log



Weathering

Fr Fresh.
 SW Slightly weathered.
 HW Highly weathered.
 EW Extremely weathered.

Strength

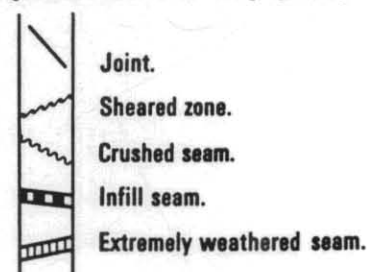
EL Extremely low.
 VL Very low.
 L Low.
 M Medium.
 H High
 VH Very high.
 EH Extremely high.

point load strength index $I_{s(50)}$ (MPa)

< 0.03
 0.03 - 0.1
 0.1 - 0.3
 0.3 - 1
 1 - 3
 3 - 10
 > 10

Significant defects

Significant defects shown graphically.



Note: X on log is test result.

ENGINEERING LOG - EXCAVATION

project KINGSTON CEMETERY SITE

location OFF Summerkas Rd. Kingston

co-ordinates See map

exposure type BACKHOE PIT

pit commenced 3.9.80

equipment FORD 420
boom bucket

pit completed 3.9.80

R.L. 117m

operator T. OATES (KINGBOROUGH
COUNCIL)

logged by WCL

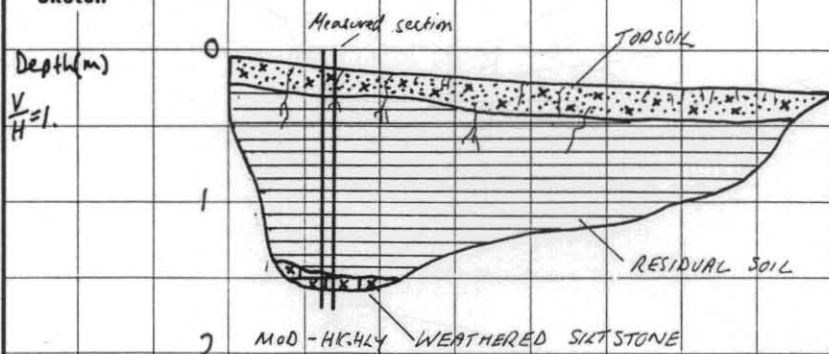
excavation dimensions

checked by

4m x 0.8m x 1.7m deep

penetration 1 2 3	support water	notes samples, tests	metres R.L. depth	graphic log classification symbol	material soil type: plasticity or particle characteristics, colour secondary and minor components	moisture condition consistency density index	hand penetr- ometer kPa 25 50 100 200 400	structure, geology
			0.5	SM	Silty SAND and sandy SILT, brownish black (10YR 2/3), many fine roots, trace charcoal fragments; mottled in places with dull yellowish brown (10YR 5/4); trace milky quartzite fine gravel; some harder grey patches	M MD		TOPSOIL
			1	CL	CLAY, dull yellowish brown (10YR 5/4), low-mid. plasticity, broken in places with beds up to 50mm; trace roots, root fibres; mottled in places with streaks, patches of yellowish brown (10YR 5/3) and grey. Some patches of grey clayey sand near 1.4m. Slightly silty near base	M L PL		
			1.5		SILTSTONE, grey-blue, highly weathered, fractured			PERMIAN?
			2.0		Backhoe refusal at 1.7m in moderately - highly weathered grey, blue-grey and yellowish brown siltstone.			

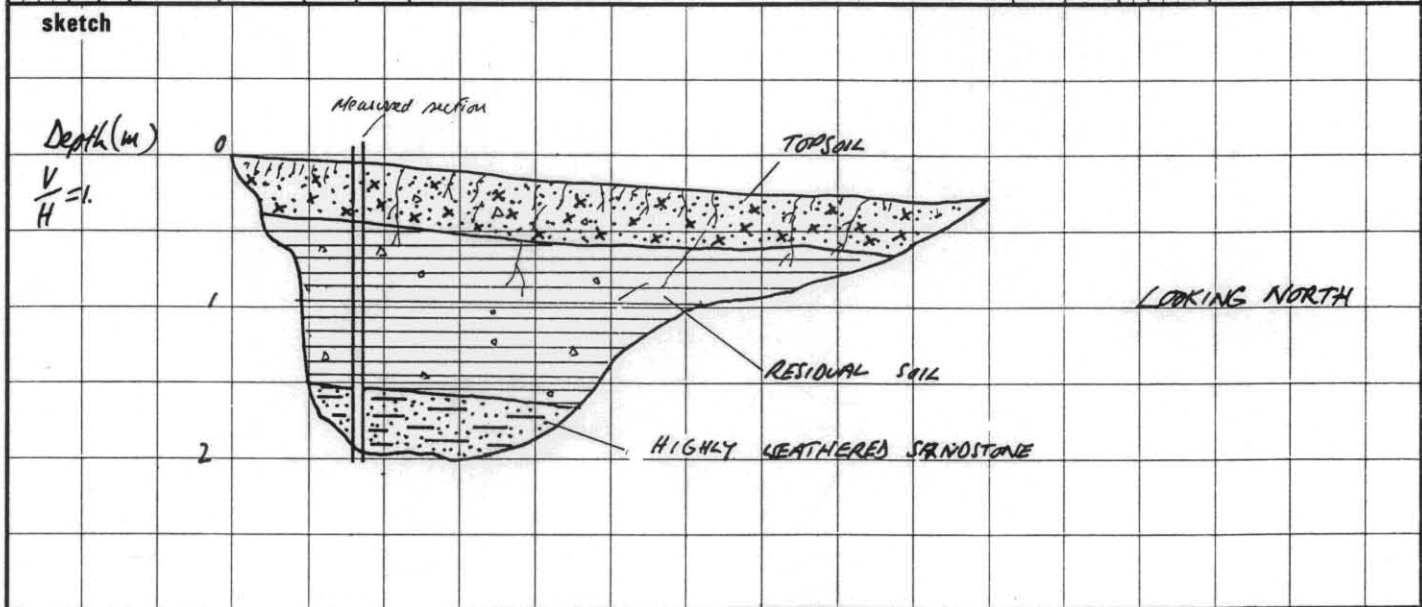
sketch



ENGINEERING LOG – EXCAVATION

project <i>KINGSTON CEMETERY SITE</i>		location <i>OFF Summerleas Rd, Kingston</i>	
co-ordinates <i>See map</i>		exposure type <i>BACKHOE PIT</i>	pit commenced <i>3.9.80</i>
R.L. <i>108m</i>		equipment <i>FORD 420</i> <i>600mm bucket</i>	pit completed <i>3.9.80</i>
excavation dimensions <i>5m x 0.7m x 2.1m deep.</i>		operator <i>T. OATES (KINGBOROUGH COUNCIL)</i>	logged by <i>WCL</i> checked by

penetration 1 2 3	support water	notes samples, tests	metres R.L. depth	graphic log classification symbol	material soil type: plasticity or particle characteristics, colour secondary and minor components	moisture condition	consistency density index	hand penetr- ometer kPa 25 50 100 200 400	structure, geology
	<i>NONE</i>			<i>SM</i>	<i>Silty SAND, black, with many fine roots, grading at 0.3m to sandy SILT, brownish grey (10YR 5/1) with trace rock fragments</i>	<i>M</i>	<i>St</i>		<i>Topsoil</i>
			<i>0.5</i>	<i>CL</i>	<i>CLAY, dull yellowish brown (10YR 5/4), in places mottled with greyish yellow brown (10YR 4/2). Trace fine gravel and rock fragments</i>	<i>M</i>	<i>Vst</i>		<i>Residual Soil</i>
		<i>Small seepage</i>	<i>1.5</i>	<i>SC</i>	<i>Clayey SAND, mottled dull yellowish brown (10YR 5/4) and greyish yellow brown (10YR 4/2);</i>	<i>W</i>	<i>S to H</i>		<i>Extremely weathered sandstone</i>
			<i>2</i>		<i>Refusal at 2.1m in highly weathered clayey sandstone</i>				<i>Highly weathered sandstone</i>



ENGINEERING LOG - EXCAVATION

project KINGSTON CEMETERY SITE

location OFF Summerleas Rd, Kingston

co-ordinates See map

exposure type BACKHOE PIT

pit commenced 3.9.80

equipment FORD 420

pit completed 3.9.80

R.L. 93m

boom bucket

logged by WCL

excavation dimensions

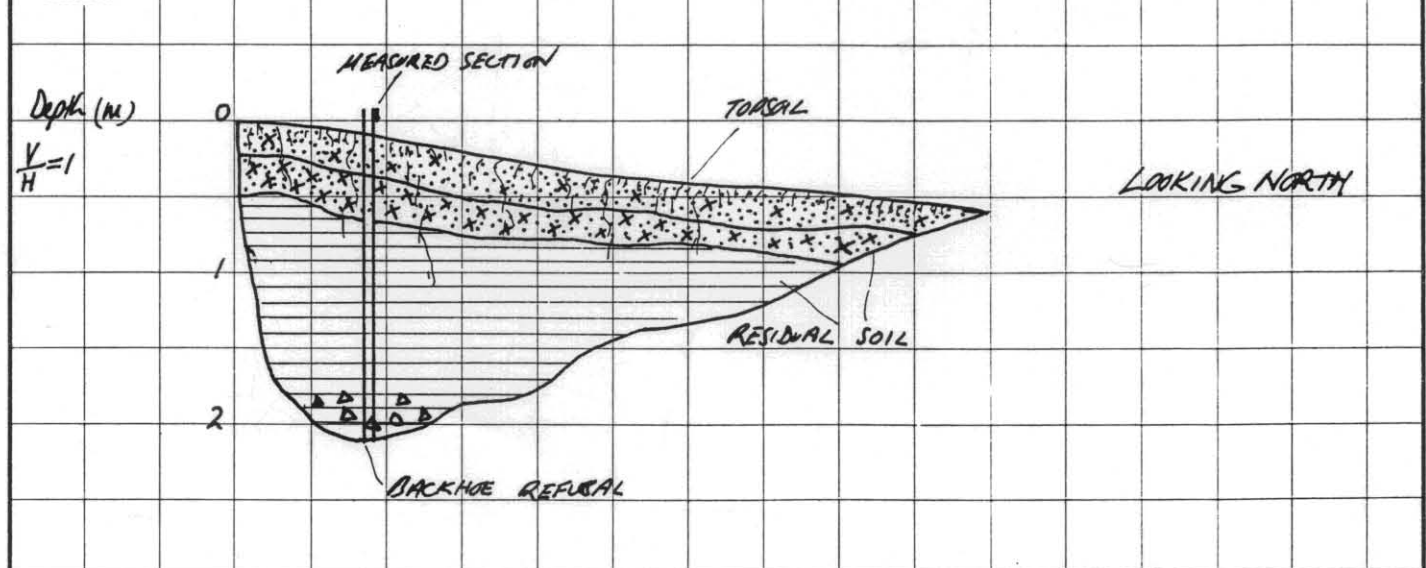
operator T. OATES (KINGBOROUGH COUNCIL)

checked by

5m x 0.7m x 2m deep.

penetration	support	water	notes samples, tests	metres R.L. depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour secondary and minor components	moisture condition	consistency density index	hand penetr- ometer kPa	structure, geology
1 2 3										25 50 100 200 400	
						SM	Silty SAND, black, with some roots and root Fibres	M	L to MO		TOPSOIL
				0.5		SM	Sandy SILT, greyish yellow brown (10YR 4/2), with trace rock fragments (siltstone) up to 50mm, and some fine gravel	H			* > 450
				1		CH, CL	CLAY, in places sandy CLAY, mottled yellowish brown (10YR 5/6) and greyish yellow brown (10YR 5/2), with some black charcoal streaks, patches. Trace sand below 1.7m; becomes harder near 1.8m and grades to light yellow (2.5Y 7/3) highly weathered mudstone and siltstone. Some rock fragments at base	M > PL			
				1.5							x
				2.0							x
							Backhoe refusal at 2.0m in light yellow (2.5Y 7/3) fractured highly weathered sandy siltstone				* > 450

sketch



ENGINEERING LOG – EXCAVATION

project *KINGSTON CEMETERY SITE*location *OFF Summerleas Rd, Kingston*co-ordinates *See map*exposure type *BACKHOLE PIT*pit commenced *3.9.80*R.L. *95m*equipment *FORD 420*pit completed *3.9.80*

excavation dimensions

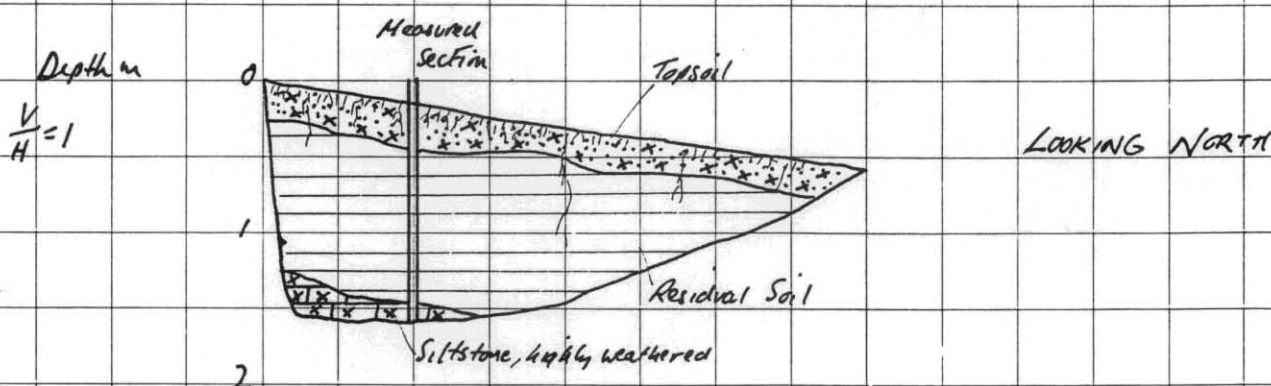
operator *T. OATES (KINGBOROUGH COUNCIL)*logged by *WCL*

checked by

4m x 1.4m deep x 0.7m

penetration 1 2 3	support water	notes samples, tests	metres R.L. depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour secondary and minor components	moisture condition	consistency density index	hand penetr- ometer kPa 25 50 100 200 400	structure, geology
	<i>NONE</i>				<i>SM</i>	<i>Silty SAND, black, grading to sandy SILT greyish yellow brown (10YR 4/2), trace roots, root fibres, charcoal and rock fragments</i>	<i>M</i>	<i>MO to H</i>		<i>TOPSOIL</i>
			<i>0.5</i>		<i>CH to CL</i>	<i>CLAY, dull yellow orange (10YR 6/3), moderate- high plasticity; trace roots, root fibres, silt stone fragments (up to 75 mm); charcoal patches and (up to 200 mm). Siltstone fragments become more common at base</i>	<i>M > PL</i>			<i>* > 450</i>
		<i>Minor Seepage</i>	<i>1</i>		<i>GC</i>	<i>SILTSTONE, pale cream / grey blue, fractured, highly weathered</i>	<i>W M</i>			<i>RESIDUAL SOIL</i>
			<i>1.5</i>			<i>REFUSAL IN HIGHLY WEATHERED SILTSTONE AT 1.5 m.</i>				<i>BEDROCK</i>

sketch



ENGINEERING LOG - EXCAVATION

project *KINGSTON CEMETERY SITE*location *OFF Summerkas Rd, Kingston*co-ordinates *See map*exposure type *BACKHOE PIT*pit commenced *3.9.80*R.L. *81 m*equipment *FORD 420*pit completed *3.9.80*

excavation dimensions

*600 mm bucket*logged by *WCC**5m x 0.8m x 2.8m deep*operator *T. OATES*

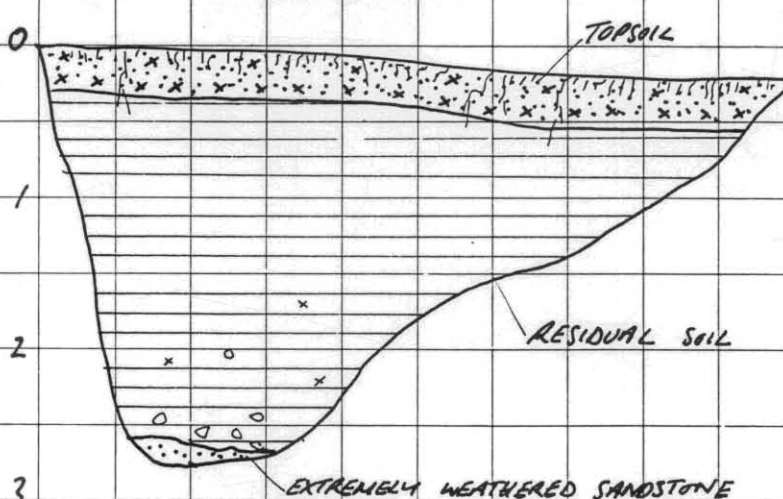
checked by

(KINGBOROUGH COUNCIL)

penetration	support	water	notes samples, tests	metres R.L. depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour secondary and minor components	moisture condition	consistency density index	hand penetr- ometer kPa	structure, geology
1 2 3											
						SM	<i>Silty SAND, black, many root fibres</i>	<i>W</i>	<i>L</i> <i>to</i> <i>MO</i>		
				0.5		CH to CL	<i>CLAY, in places sandy CLAY, mottled yellowish brown (10YR5/6) and greyish yellow brown (10YR5/2). Some silt in places. Trace friable sandstone fragments near base.</i>		<i>St</i> <i>to</i> <i>H</i>		
				1							
				1.5							
				2							
				2.5							
				3.0			<i>SANDSTONE, yellow brown, extremely weathered</i>	<i>M</i>			
							<i>Hole stopped at 2.75m in extremely weathered sandstone.</i>				

sketch

Depth(m)

 $\frac{V}{H} = 1$ 

ENGINEERING LOG - EXCAVATION

project KINGSTON CEMETERY SITES

location Off Summerleas Rd, Kingston

co-ordinates See map

exposure type BACKHOE PIT

pit commenced 3.9.80

R.L. 123m

equipment FORD 420
600mm bucket

pit completed 3.9.80

excavation dimensions

operator T. OATES

logged by WCL

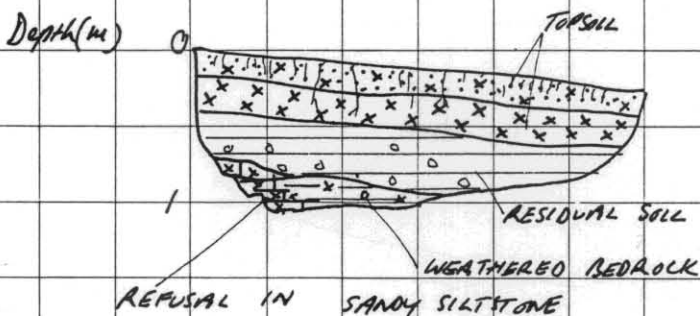
checked by

3m x 0.7m x 1m deep

(KINGBOROUGH COUNCIL)

penetration 1 2 3	support water	notes samples, tests	metres R.L. depth	graphic log classification symbol	material soil type: plasticity or particle characteristics, colour secondary and minor components	moisture condition	consistency density index	hand penetr- ometer kPa 25 50 100 200 400	structure, geology
				SM	Sandy SILT, brownish black (10YR 2/2), with many roots and fibres and trace rock fragments (up to 10mm)	M	S+		TOPSOIL
			0.5	ML	SILT, brownish grey (7.5YR 4/1), trace fibres, roots.	D	VS+		
				CH	CLAY, brown (10YR 4/4), moderate-high plasticity; trace sandstone rock fragments (up to 50mm)	M			RESIDUAL SOIL
			1		Gravelly, clayey SILT, greyish yellow (2.5Y 7/2), in places with very hard patches of fine sandy siltstone	PL	H		WEATHERED
					Backhoe refusal at 1m in Fractured, highly weathered pale yellow sandy siltstone	D			> 450 BEDROCK
									BEDROCK

sketch



ENGINEERING LOG - EXCAVATION

project KINGSTON CEMETERY SITE				location OFF Summerleas Rd, Kingston							
co-ordinates See map				exposure type BACKHOE PIT							
R.L. 106m				equipment FORD 420							
excavation dimensions 6m x 0.7m x 2.5m deep				operator T. OATES (KINGBOROUGH COUNCIL)							
pit commenced 3.9.80				pit completed 3.9.80							
logged by WCL				checked by							
penetration	support	water	notes samples, tests	metres R.L. depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour secondary and minor components	moisture condition	consistency density index	hand penetrometer kPa	structure, geology
1 2 3											
				0.5		SM	Sandy SILT, brownish black (10YR 2/2), trace roots and root fibres	M	MD to H		TOPSOIL
						ML	SILT, greyish yellow brown (10YR 5/2); trace roots	D	H		TOPSOIL
				1		CH	CLAY, mainly greyish yellow brown (10YR 5/2) but with streaks and patches of dull yellowish brown (10YR 4/3). Some small sandy clay patches near 1.5m. Moderately plastic.	M to PL	VS to VST		RESIDUAL SOIL
				1.5							
				2.0		SC	Sandy CLAY, mottled yellowish brown (2.5Y 5/6), light yellow (5Y 5/3) and brown (10YR 4/6). Some silt below 2.0m, grading to extremely weathered siltstone		H		
				2.5							
							Very hard digging tending to backhoe refusal at 2.5m				
sketch											

ENGINEERING LOG – EXCAVATION

project *KINGSTON CEMETERY SITE*

location OFF Summerleas Rd., Kingston

co-ordinates *See map*

exposure type *BACKHOE PIT*

pit commenced 4.9.80

R.L. 1/2 m

equipment *FORD 420*

pit completed 4.9.80

excavation dimensions

operator *T. OATES*

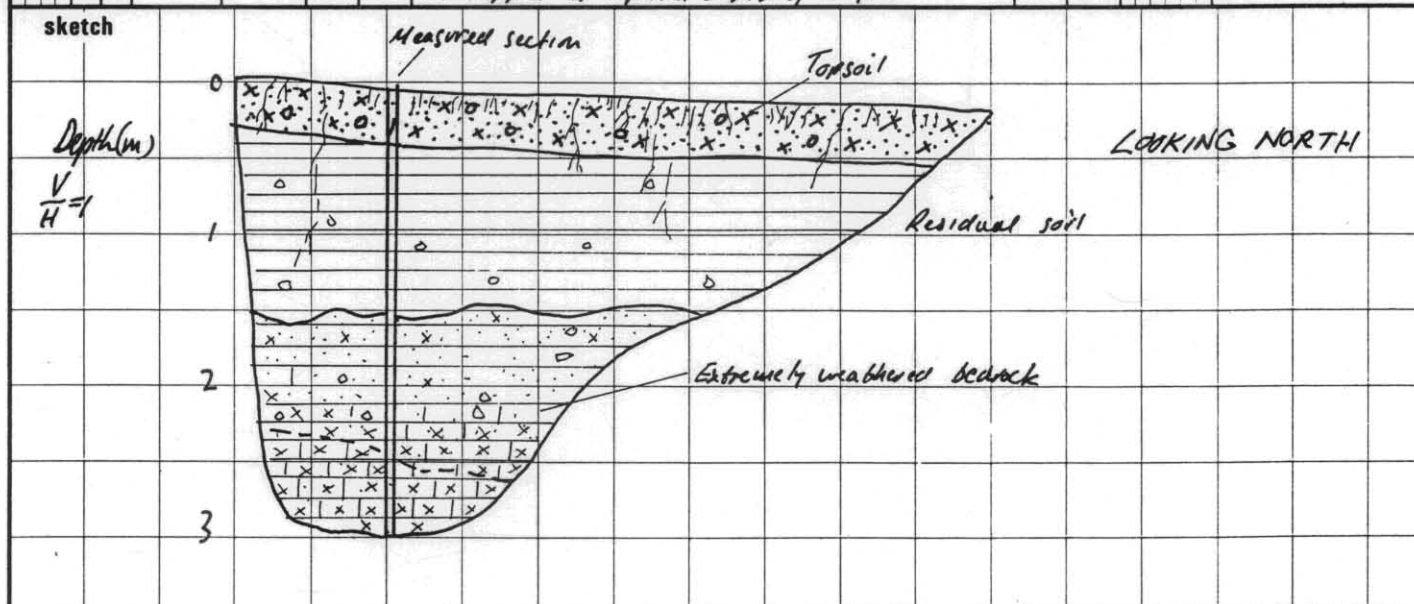
logged by *WCC*

5m x 0.7m x 2.9m deep

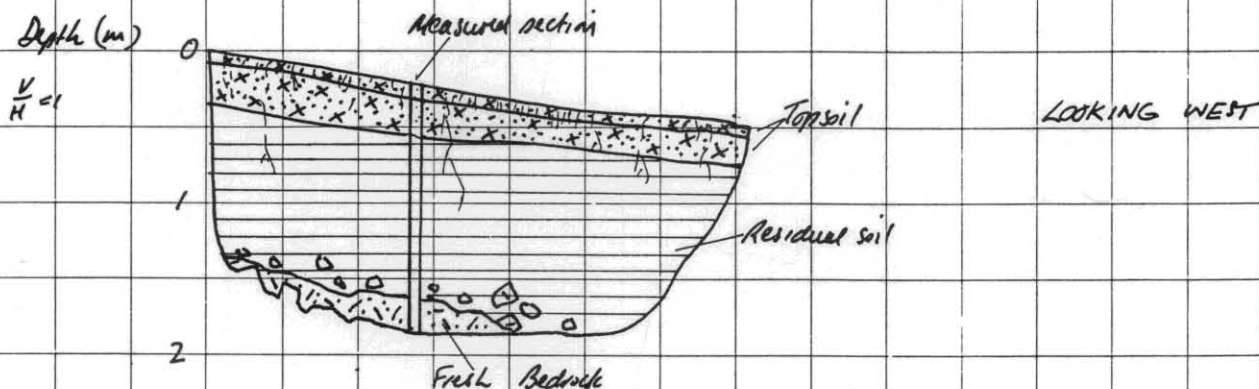
(KINGBOROUGH COUNCIL)

penetration	support	water	notes samples, tests	metres R.L. depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour secondary and minor components	moisture condition	consistency density index	hand penetr- ometer kPa 25 50 100 200 400	structure, geology
1	2	3									
			Minor Seepages			SM	Sandy SILT, brownish black (10YR 3/2); trace rock fragments	M	ST	*	TOPSOIL
				0.5		CH	CLAY, brown (10YR 4/4), mottled and streaked with yellowish brown (10YR 5/6), with trace charcoal, rock fragments (up to 5mm), roots and friable yellowish brown (10YR 5/6) muddy clay patches. Moderate-high plasticity	M > PL		x	RESIDUAL SOIL
				1						x	
				1.5						x	
				2			Clayey SILT - sandy CLAY, mainly yellowish brown (10YR 5/8), streaked and mottled with greyish blue. Textured. Extremely weathered sandy mudstone	M	H	x	X7450 EXTREMELY WEATHERED BEDROCK
				2.5							
							Pit stopped at required depth of 2.9m.				

Pit stopped at required depth of 2.9m.



17/20



operator T.OATES
(KINGBOROUGH COUNCIL)

sketch

Depth (m)

$\frac{V}{H} = 1$

Measured section

Topsoil

Residual Soil

WEATHERED BEDROCK

LOOKING WEST

16/20

location *Off Summerheas Rd; Kingston*

pit commenced 4.9.80

pit completed 4.9.80

logged by WCL

operator
T.OMES, KINGBOROUGH COUNCIL

checked by

sketch

Depth (m)

$\frac{V}{H} = 1$

Measured section

Top soil

Residual Soil

Moderately weathered bedrock

LOOKING WEST

ENGINEERING LOG - EXCAVATION

5 cm

excavation no. L

sheet 1 of 1

17/20

project KINGSTON CEMETERY SITE

location OFF Summerleas Rd; Kingston

co-ordinates See map

exposure type BACKHOE PIT

pit commenced 4.9.80

R.L. 105m

equipment FORD 420
600 mm bucket

pit completed 4.9.80

excavation dimensions

operator T. OATES,
KINGBOROUGH COUNCIL

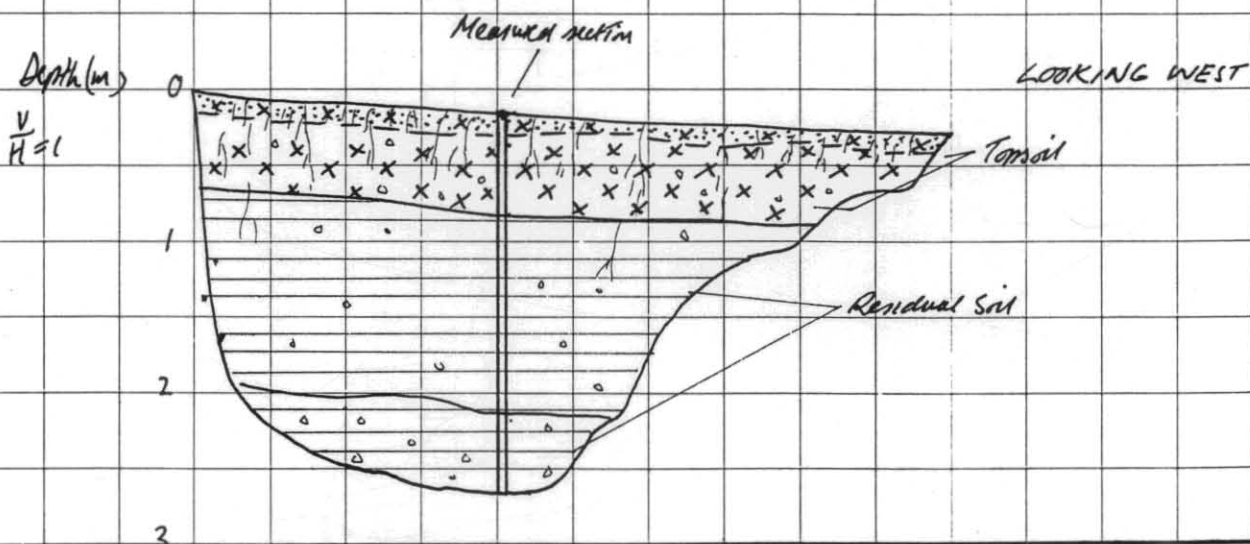
logged by WCC

checked by

5m x 0.8m x 2.7m deep

penetration	support	water	notes samples, tests	metres R.L. depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour secondary and minor components	moisture condition	consistency density index	hand penetr- ometer kPa	structure, geology
1 2 3										25 50 100 200 400	
				0.5		ML	SILT - sandy SILT, brownish black (10YR2/3), trace root fibres and fine sand; trace rock fragments (up to 15 mm), grading abt 0.2 m to greyish yellow brown (10YR4/2)	M D to M	MD + F8 to ST H		TOPSOIL
			Minor seepage	1		CH	CLAY, mottled greyish yellow brown (10YR5/2), dull yellowish brown (10YR5/4) and brown 10YR4/6. Trace charcoal, blue-grey gleying patches, silt, rock fragments (up to 20 mm); some small wet and very soft patches. Moderately- highly plastic	M, in places W	ST to VST		
				1.5							
				2							
				2.5		CL	CLAY, light grey (5Y7/2), with bands and irregular streaks of dull yellow (5Y6/4). Trace brown charcoal, wood fragments, rock fragments; trace silt and fine sand. has plasticity; in places friable; some minor mottling with yellowish brown (10YR5/6)	D to M < PL	VST to H; in places F8		
				3			Pit stopped at requested depth of 2.7 m				

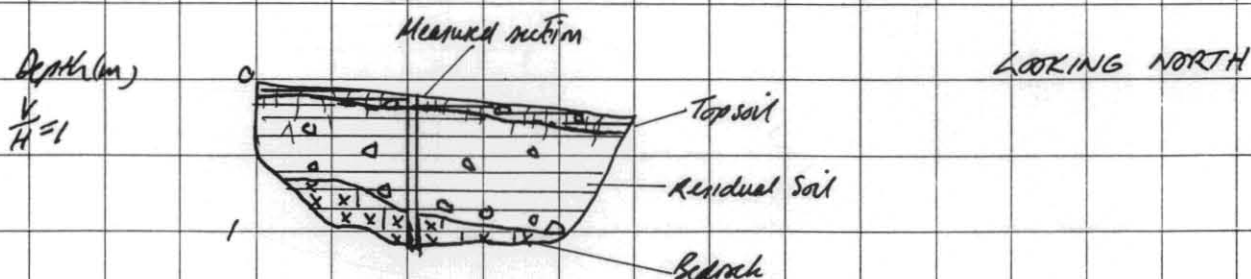
sketch



18
20

KINGBOROUGH COUNCIL

sketch



APPENDIX 2

Logs of backhoe holes dug by Kingborough Municipal Council (L. Rogers) in 1977, at the proposed Kingston cemetery site. (Approximate locations shown in Figure 1).

Test hole 1

Depth 1.8 m	0.3 m (1') of top soil with some small rocks	)	
(6')	0.3 m (1') of soft clay	)	
	1.2 m (4') of clay gravel with one boulder	)	Dry hole
	undiggable with back-hoe. End of hole	)	

Test hole 2

Depth 1.8 m	150 mm (6") of top soil	)	
(6')	0.6m (2') of clay - no stones	)	
	1.07 m (3'6") of clay gravel with three parts	)	Dry hole
	gravel	)	

Test hole 3

Depth 1.8 m	0.3 m (1') of top soil	)	
(6')	1.0 m (3') of clay	)	Dry - no
	0.6 m (2') of sandstone formation (soft)	)	stones

Test hole 4

Depth 1.8 m	0.3 m (1') of sandy loam	)	Dry - no
(6')	1.5 m (5') of heavy clay	)	stones

Test hole 5

Depth 1.8 m	150 mm (6") of top soil	)	
(6')	0.6 m (2') of clay	)	Dry - no
	1.07 m (3'6") of soft rock formation	)	stones

Test hole 6

Reef of rock

Test hole 7

Depth 1.8 m	150 mm (6") of top soil	)	Dry - no
(6')	1.7 m (5'6") of heavy clay	)	stones

Test hole 8

Depth 1.8 m	0.3 m (1') of top soil	)	Dry - no
(6')	1.5 m (5') of heavy clay	)	stones

Test hole 9

Depth 1.8 m	150 mm (6") of top soil	)	
(6')	1.0 m (3') of heavy clay	)	Dry - no
	760 mm (2'6") of dry crumbly clay gravel	)	stones

Appendix 2 (continued)

Test hole 10

Depth 1.8 m	0.3 (1') of top soil	)
(6')	0.6 m (2') of clay	) Dry - no
	75 mm (3") of clay gravel	) stones

Test hole 11

Depth 1.8 m	150 mm (6") of top soil
(6')	0.6 m (2') of clay and basalt boulder, undiggable