1983/23. Geological investigation of the Remount Refuse Disposal Project

A.T. Moon

Abstract

The proposed Remount Refuse Disposal Project involves the placement of garbage in a valley north-east of Mowbray. The project area is underlain by dolerite of Jurassic age and sediments of Tertiary age. Subsurface conditions have been investigated by eighteen test pits excavated by backhoe.

The presence of an effectively impermeable B horizon of high plasticity clay divides 'perched groundwater' from 'confined groundwater'. If this B horizon clay is left intact, leachate will be largely confined to the perched near-surface system which discharges into the existing creeks.

An average of 0.3 m of soil suitable for fill occurs above the B horizon. Most drains are located in readily excavated material, but dolerite outcrops and boulders may be encountered in parts of the site.

INTRODUCTION

The Remount Refuse Disposal Project involves the placement of garbage in a valley [EQ128171] north-east of Mowbray. Garbage is to be covered daily with earth and creeks flowing onto the site are to be diverted around the tip. When the tip is completed, stormwater falling on the tip will also be diverted. Leachate from the operation is to be collected and piped to Launceston's sewerage system.

In May 1983, the Launceston City Engineer requested the Department of Mines to undertake geological investigations for the project. The field investigation was carried out between 14 and 17 June 1983. Work consisted of the mapping of the site area on a scale of 1:5000 and the excavation and logging of eighteen test pits. The writer was assisted in the field by R.N. Woolley.

This report presents the results of the investigation and discusses the feasibility of the project from the geological point of view.

RESULTS OF INVESTIGATION

Geological setting

Part of the tip site and most of the higher area surrounding the tip site (fig. 1) is underlain by dolerite, which intruded older rocks during the Jurassic period. During the Tertiary period the area was flooded and infilled with lake deposits (siltstone and clay in the project area).

It has been assumed that the siltstone encountered in the bottom of some of the test pits is of Tertiary age although there is a possibility that it is much older and pre-dates the dolerite. Marine deposits of Permian age occur in similar geologicl situations in the Tamar Valley.

Since the deposition of the lake sediments, faulting, erosion, and weathering have been the dominant geological processes. The dolerite exposed at the surface is weathered and residual soils have developed over the whole area. The ironstone nodules occurring at the north and south

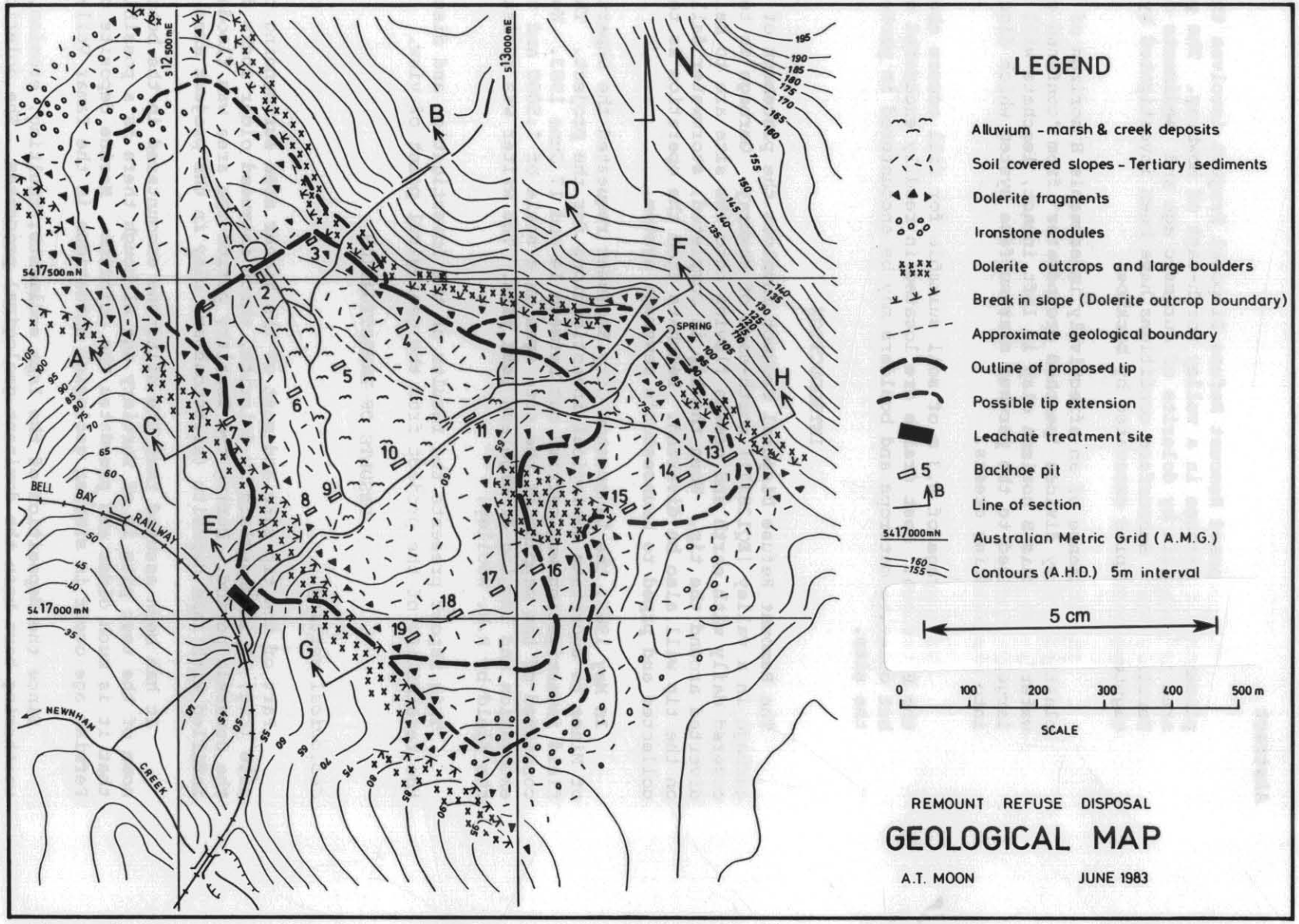

LEGEND
Alluvium - marsh & creek deposits
Soil covered slopes - Tertiary sediments
Dolerite fragments
Ironstone nodules
Dolerite outcrops and large boulders
Break in slope (Dolerite outcrop boundary)
Approximate geological boundary
Outline of proposed tip
Possible tip extension
Leachate treatment site
Backhoe pit
Line of section
Australian Metric Grid (A.M.G.)
Contours (A.H.D.) 5m interval
5 cm
0 100 200 300 400 500 m
SCALE
REMOUNT REFUSE DISPOSAL
GEOLOGICAL MAP
A.T. MOON
JUNE 1983
N
BELL BAY RAILWAY
NEWNHAM CREEK
SPRING
5417000mN
5417500mN
E512500mE
E513000mE

Figure 1.

end of the site were probably formed close to a land surface during the Tertiary period. Slope deposits, consisting of dolerite fragments in soil, have formed at the base of slopes. Recent alluvium (marsh and creek deposits) consisting of organic silty clay has accumulated in flat valley bottoms. These deposits are thin and have been partly removed by excavation.

The Tamar Valley is divided into blocks by north and north-westerly trending faults. Most of the faults initially developed during the Jurassic, but many were also active during the Tertiary. Most of the fault blocks are gently tilted towards the west. Some of the subsurface boundaries between the dolerite and the Tertiary sediments in the project area are probably faults.

Surface conditions

The proposed tip occupies a north-west trending valley which is drained by a tributary of Newnham Creek. The valley is bounded to the north-east by steep slopes (up to 20°) underlain by dolerite. Creeks drain this slope and converge in the valley. Drainage from the valley is through a small narrow gorge cut through dolerite (fig. 1).

The steeper slopes surrounding the valley are covered by bush. Dolerite fragments occur at the surface close to and downhill from outcrops. The dolerite outcrop boundary is often marked by a break in slope. Below this break, the slope is flatter, rock fragments are less common, and there are no outcrops.

Most of the valley is underlain by Tertiary sediments with well drained gentle slopes (less than 5°). Rock fragments are less common and some of the land has been cleared. The valley floor, into which the creeks drain, is flat and subject to flooding. The area has been disturbed in places by excavations and there was ponded water in some areas at the time of the field investigation.

The site has been used as a testing range by the Australian Army. Circular depressions (often water-filled) up to three metres diameter occur on the south-facing slope close to Test Pit 4. Some of these may be craters caused by explosives and/or impact of projectiles. Objects reported to be parts of anti-tank rockets were found north and east of Test Pit 11.

Subsurface conditions

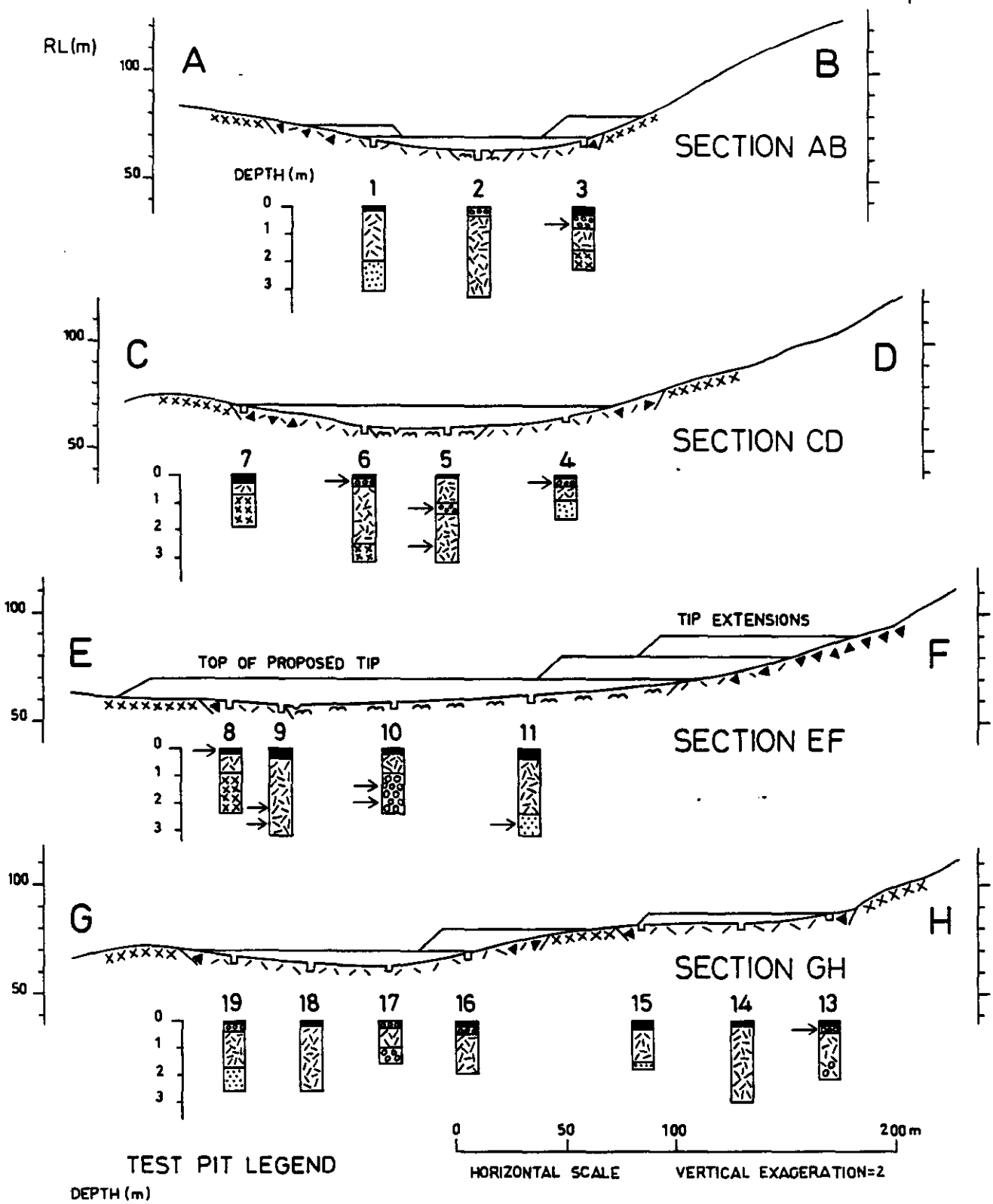
Subsurface conditions at the site were investigated by digging test pits with a backhoe. Summary logs of the test pits are given in Figure 2 and detailed logs of each test pit are given in Appendix 1. Eighteen test pits were dug, numbered 1 to 11, and 13 to 19. Test Pit 12 was planned and surveyed but not excavated because it was close to some unidentified metal cylinders, later reported to be anti-tank rockets.

The soil horizons referred to in the final column of the test pit logs represent a commonly used descriptive terminology. It should be noted that this classification system involves some interpretation and other workers might produce slightly different results.

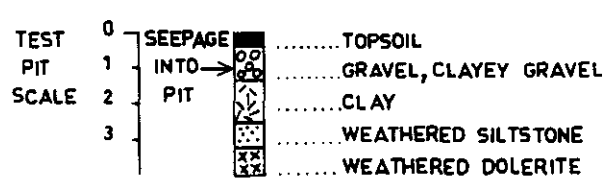
DISCUSSION

Groundwater and leachate control

The most important observation from the test pit logs is the presence



TEST PIT LEGEND



FOR LOCATION OF SECTIONS AND SECTION LEGEND, SEE FIGURE 1

FOR DETAILED TEST PIT LOGS, SEE APPENDIX 1

TEST PIT 12 ON SECTION EF WAS NOT DUG

REMOUNT REFUSE DISPOSAL

GEOLOGICAL SECTIONS

A.T. MOON JUNE 1983 FIG. 2

5 cm

of a B horizon consisting of high plasticity clay in all of the pits. The B horizon has an extremely low permeability and would be expected to provide an effective barrier to the downward migration of leachate or the upward flow of groundwater from more permeable underlying material.

Groundwater was observed above the B horizon in five test pits. Test pits 3, 4, and 13 all occur near the base of a steep slope north-east of the tip site. The presence of these seepages close to the surface indicates that rain falling on the slope only infiltrates as far as the B horizon and then flows downslope on top of that horizon. A very small amount of the rain which falls on rock outcrops may infiltrate into open joints, but observation of the cuttings in dolerite along the Bell Bay Railway indicates that joints will be tightly closed below two metres. The seepage above the B horizon in Test Pits 6 and 8 is probably due to the flow of water from the slope south-west of the tip. The water above the B horizon is described as 'perched groundwater'.

Groundwater occurred below the B horizon in four test pits (5, 9, 10, 11) in the flat valley floor. This water is described as 'confined groundwater', as upward migration is restricted by the effectively impermeable B horizon. This groundwater was observed to flow out of clayey gravel or out of fissures within high plasticity clay.

The perched groundwater flows downslope generally less than 0.5 m from the natural surface. The water eventually enters the creeks through the creek sides and floor and flows out of the valley as surface water in the main creek. Perched groundwater flow-lines are parallel to the ground surface and flow rates would fluctuate widely. Rapid flow occurs ater heavy rain and there would be little or no flow during periods of drought.

The confined groundwater would also enter the creek system by upward flow from below. Flow rates are likely to be low, but less affected by climate. Apart from in the creeks, there is likely to be little mixing of perched and confined groundwater. Once in the creek water can be controlled by the leachate treatment system.

As far as control of leachate water is concerned, it is essential to leave the B horizon, high plasticity clay, intact. This will ensure that the leachate will behave as the perched groundwater does now and collect in the creek system below the tip. If this is done there should be very little mixing of the leachate and the confined groundwater. Should any confined groundwater become contaminated it will eventually leave the valley through the creek system. Provided that the leachate treatment plant is in operation there is a negligible risk of contamination of groundwater away from the tip site.

It is assumed that monitoring of the quality of surface and groundwater has started and will be continued on a long term basis.

Fill

Regulations require that the refuse be covered daily with suitable fill and it is economically desirable that as much fill as possible be obtained from the tip site.

The test pit logs indicate that an average thickness of 0.3 m of silty clay topsoil, and clayey gravel or silty gravel soils overlie the B horizon. The thickness varied from 0.1 m to 0.8 m. These soils should be suitable for fill. If an average thickness of 0.3 m of soil is stripped

from an area of 50 ha, it will provide 150 000 m^3 of fill. As stated earlier it is essential that the B horizon not be removed during the stripping process, as it provides an impermeable base for leachate control. It is desirable that the stripping is done in stages so that the top of the B horizon is not exposed for long periods and allowed to dry out. Drying of the high plasticity clay would cause shrinkage cracks and increase the permeability of the horizon.

Excavation conditions

The project will involve the excavation of a number of surface and subsurface drains as part of the water and leachate control systems. Most of the tip area is underlain by materials which can be excavated by a backhoe or larger plant, although the Massey Ferguson 50B backhoe with a 600 mm bucket met refusal in several test pits at depths of 1.6 m and greater (Appendix 1).

Excavation in areas of dolerite outcrop and large boulders may encounter difficulties in places and some blasting may be required. The leachate treatment site was not investigated.

CONCLUSIONS

The Remount Refuse Disposal Project is considered feasible from the geological point of view. It is considered possible to control the leachate from the site without contaminating the groundwater. If the effectively impermeable B horizon clay is left intact the leachate will collect in the present creek system which flows to the leachate treatment site.

Soil above the B horizon may be stripped and used as fill. Up to 150 000 m^3 of fill may be available from the tip site. Most drains may be excavated by backhoe, but dolerite outcrops and boulders may require blasting.

[27 June 1983]

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APPENDIX 1

Explanation sheet and test pit logs

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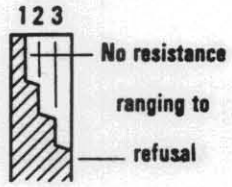
EXPLANATION SHEET FOR ENGINEERING LOGS

Borehole and excavation log

5 cm

Penetration



Water

22 Jan, 80 Water level on date shown.

Water inflow.

Water outflow.

Notes - samples and tests

U50	Undisturbed 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.

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

		hand penetrometer (kPa)
VS	Very soft.	< 25
S	Soft.	25 – 50
F	Firm.	50 – 100
St	Stiff.	100 – 200
VSt	Very stiff.	200 – 400
H	Hard.	> 400
Fb	Friable.	

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

Casing used.

Barrel withdrawn.

Fluid loss

No loss

50% loss

100% 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

No core.

Rock substances represented by clear, contrasting symbols consistent for each project.

Weathering

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

Strength

		point load strength index $I_{s(50)}$ (MPa)
EL	Extremely low.	< 0·03
VL	Very low.	0·03 – 0·1
L	Low.	0·1 – 0·3
M	Medium.	0·3 – 1
H	High	1 – 3
VH	Very high.	3 – 10
EH	Extremely high.	>10

Note: X on log is test result.

Significant defects

Significant defects shown graphically.

Joint.

Sheared zone.

Crushed seam.

Infill seam.

Extremely weathered seam.

5 cm

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ENGINEERING LOG – EXCAVATION

excavation no. 1
sheet 1 of 1

project REMOUNT REFUSE DISPOSAL location LAUNCESTON

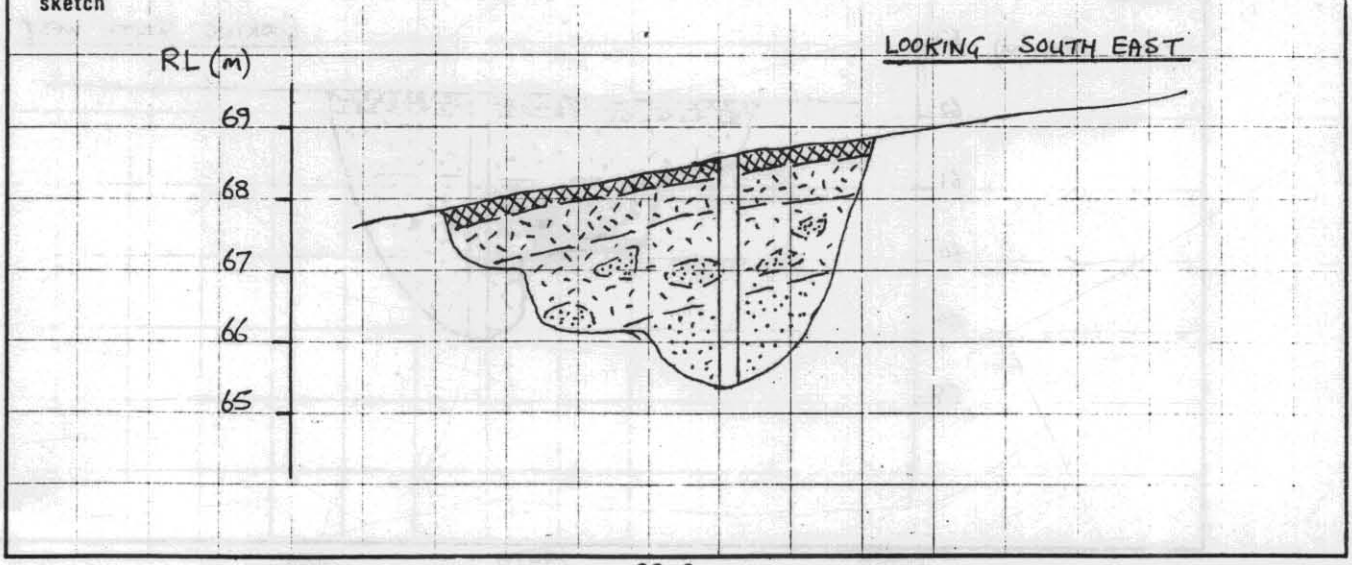
co-ordinates 512 540·4mE
5 417 456·9mN
R.L. 68·6m
excavation dimensions 6m x 0·6m x 3·1m deep

exposure type Pit
equipment Backhoe, Massey Ferguson 50B, 600mm bucket
operator B. Etchell

pit commenced 15 JUNE 1983, 9.00am
pit completed 15 JUNE 1983 9.30am
logged by Alan Moon
checked by R. Donaldson

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres 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 (25 50 100 200 400)	structure, geology
	NONE	NONE		68			OL	Organic Silty CLAY; dark grey, low plasticity some fine gravel	M	F	x	TOPSOIL
							CH	CLAY; high plasticity, yellow brown		St	x x x x	'B' HORIZON
				67	1		CH-MH	Mixture of CLAY, grey and yellow brown, high plasticity, and Silty CLAY, cemented (EW SILTSTONE), grey and yellow brown		VSt-H	x x x x x	'C' HORIZON
				66	2		(MH)	SILTSTONE, yellow brown, grey, and red brown EL to VL strength.				WEATHERED TERTIARY SEDIMENTS
					3			PIT STOPPED AT 3·1m – SLOW DIGGING				

sketch



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5 cm

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – EXCAVATION

excavation no. 2
sheet 1 of 1

project REMOUNT REFUSE DISPOSAL location LAUNCESTON

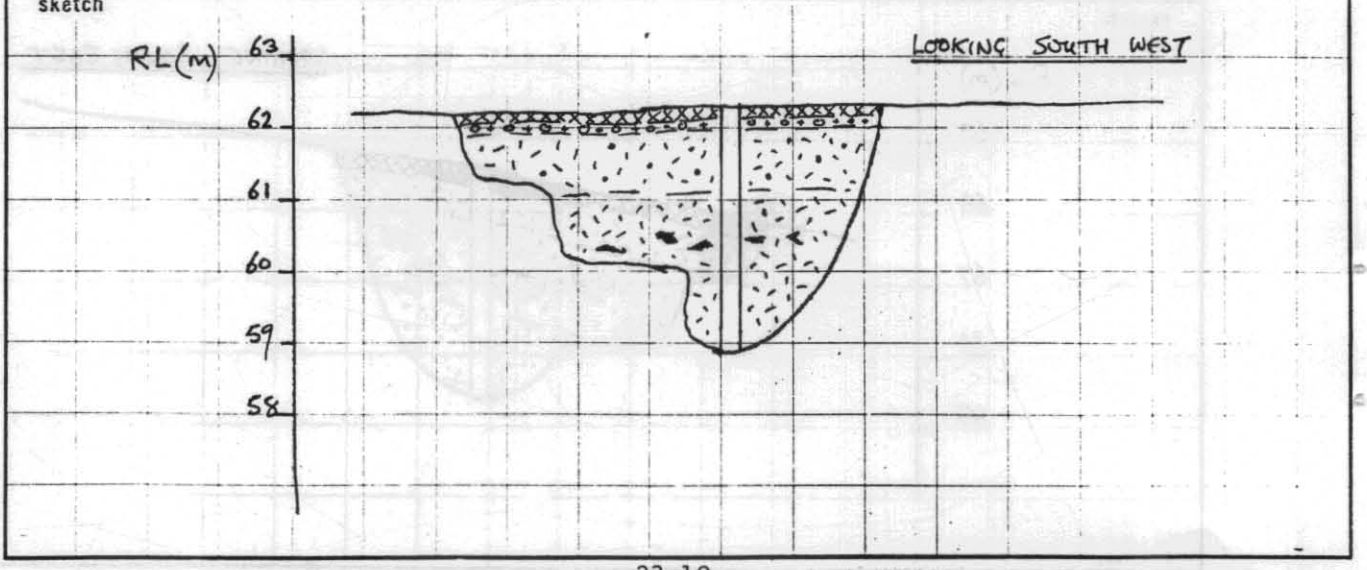
co-ordinates 512 621·9 mE
5 417 507·1 mN
R.L. 62·2 m
excavation dimensions 6m x 0·6m x 3·3 deep

exposure type Pit
equipment Backhoe, Massey Ferguson 50B, 600mm bucket
operator B. Etchell

pit commenced 15 JUNE 1983, 9·30 a.m.
pit completed 15 JUNE 1983 10·00 a.m.
logged by Alan Moon
checked by R. Donaldson

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres 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 (25 50 100 200 400)	structure, geology
	NONE	NONE		62	0		OL GM	Organic Gravelly Silty CLAY; dark grey, low plasticity, many fine roots	M	F St		TOPSOIL 'B' HORIZON
					1		CH	Clayey Silty GRAVEL; light grey, gravel fine to medium		St to VSt		'B' HORIZON
				61			CH	Gravelly CLAY; mottled yellow brown, red brown and grey, gravel fine to coarse (ironstone)		VSt		'C' HORIZON
				60	2			CLAY; high plasticity, grey, some yellow brown patches. Irregular pockets of ironstone at 1·5 to 1·7m				
					3			PIT STOPPED AT 3·3m – BACKHOE LIMIT				

sketch



11/26

5 cm

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ENGINEERING LOG – EXCAVATION

excavation no. 3
sheet 1 of 1

project REMOUNT REFUSE DISPOSAL location LAUNCESTON

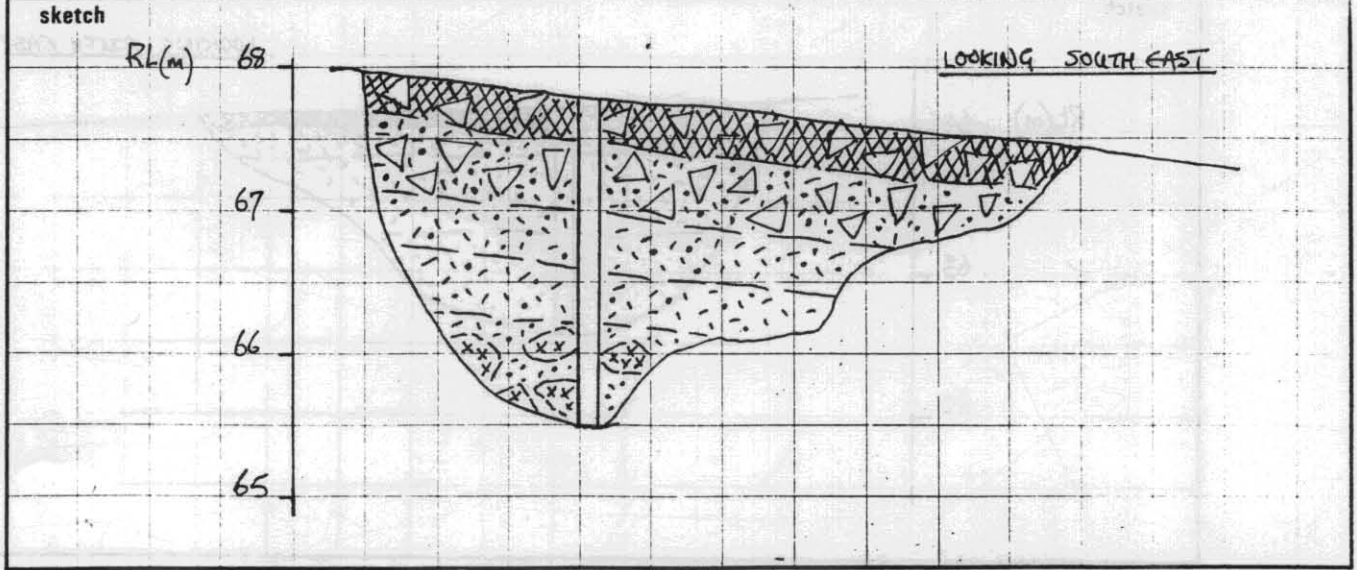
co-ordinates 512 699·6 m E
5 417 557·7 m N
R.L. 67·8 m
excavation dimensions 5m x 0·6m x 2·3 deep

exposure type Pit
equipment Backhoe, Massey Ferguson 50B, 600 mm bucket
operator B. Etchell

pit commenced 15 JUNE 1983, 10·00 am
pit completed 15 JUNE 1983 10·30 am
logged by Alan Moon
checked by R. Donaldson

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres 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 25 50 100 200 400	structure, geology
	NONE						OL	Organic Silty CLAY; dark grey, low plasticity, many roots with ROCK FRAGMENTS (60%) - angular dolerite, Fr to SW, EH strength	M	F	x x	TOPSOIL
			very small seepages	67			GC	Clayey GRAVEL; brown, with ROCK FRAGMENTS (as above)	W			SLOPE DEPOSITS (COLLUVIUM)
			<1 litre per hour		1		CH	Gravelly CLAY; orange brown and olive brown, high plasticity, gravel fine to medium (ironstone)	M	St	x x x	'B' HORIZON
							CH to GC	Gravelly CLAY – Clayey GRAVEL; mottled orange brown, olive brown and grey, high plasticity		H	x x	'C' HORIZON
				66	2		GC	Mixture of clayey GRAVEL and ROCK FRAGMENTS, – Dolerite, HW, L to EL strength, orange brown to olive brown.				EXTREMELY WEATHERED DOLERITE
								REFUSAL AT 2·3m				

sketch



12/26

5 cm

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – EXCAVATION

excavation no. 4
sheet 1 of 1

project REMOUNT REFUSE DISPOSAL location LAUNCESTON

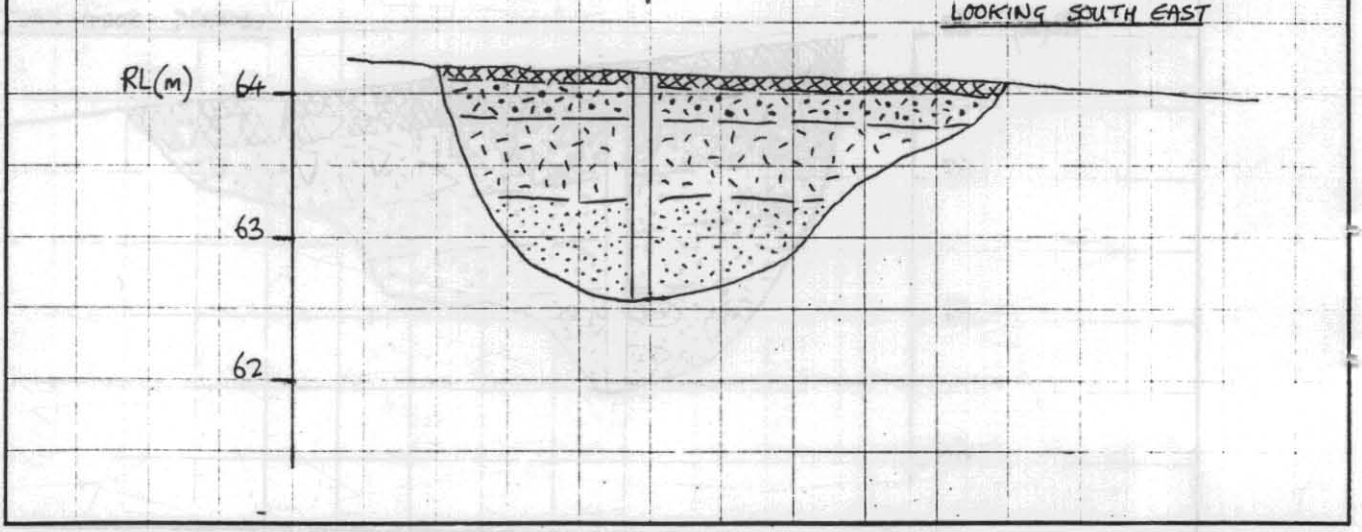
co-ordinates 512 540·4m E
5 417 456·9m N
R.L. 64·2m
excavation dimensions 4m x 0·6m x 1·6m deep

exposure type Pit
equipment Backhoe, Massey Ferguson 50B, 600mm bucket
operator B. Etchell

pit commenced 15 JUNE 1983, 10·30 a.m.
pit completed 15 JUNE 1983 11·00 a.m.
logged by Alan Moon
checked by R. Donaldson

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres 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 (25 50 100 200 400)	structure, geology
	NONE		Small seepages ≈ 12 litre per hour	64			OL	Organic Silty CLAY; dark grey, low plasticity	M	F	x	TOPSOIL
							GC	Clayey GRAVEL; grey, gravel fine to medium high plasticity clay	W	D		'E' HORIZON
							CH	CLAY; mottled grey and yellow brown, high plasticity fine roots	M	St to VSt		'B' HORIZON Fissures, irregular and discontinuous
				63	1			SILTSTONE; grey, pale yellow brown close to joints, VL to L strength				TERTIARY SEDIMENTS
								REFUSAL AT 1·6m				

sketch



13/26

5 cm

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – EXCAVATION

excavation no. 5
sheet 1 of 1

project REMOUNT REFUSE DISPOSAL location LAUNCESTON

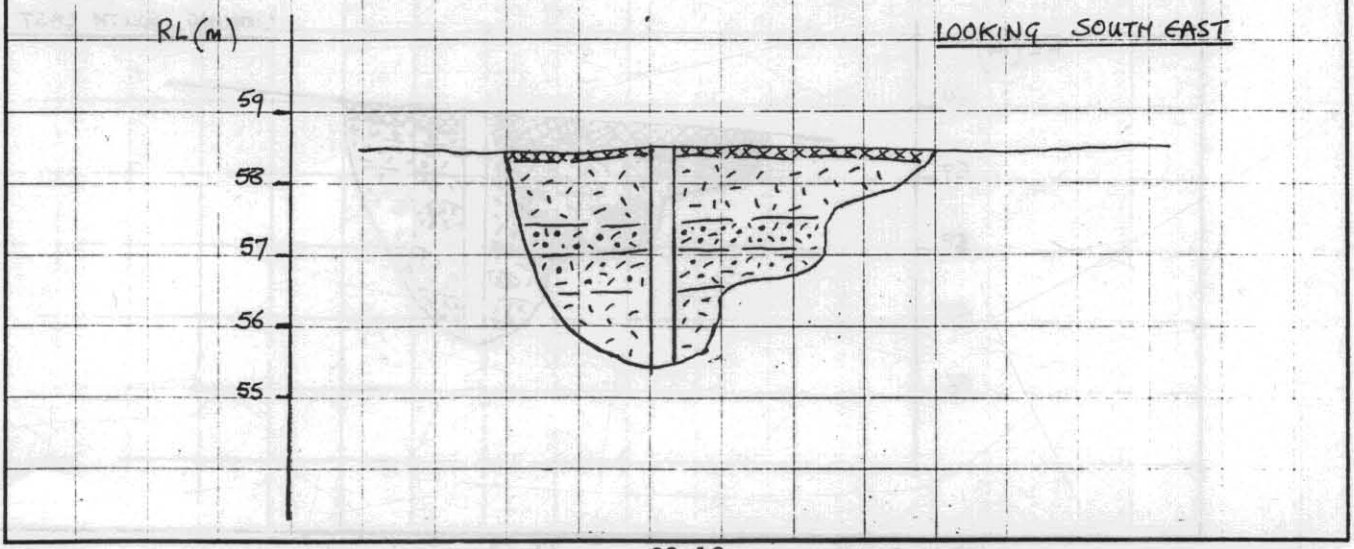
co-ordinates 512735·1mE
5417372·5m N
R.L. 58·5
excavation dimensions 6m x 0·6m x 3·1m deep

exposure type Pit
equipment Backhoe, Massey Ferguson 50B, 600mm bucket
operator B. Etchell

pit commenced 15 JUNE 1983, 11·00am
pit completed 15 JUNE 1983 11·30am
logged by Alan Moon
checked by R. Donaldson

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres 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 (25 50 100 200 400)	structure, geology
						XXXX	OH	Organic Silty CLAY, dark grey, high plasticity	M	F	x	TOPSOIL
	NONE						CH	CLAY; yellow brown, high plasticity		St	x x x x	'B' HORIZON
			small seepages		1		GC	Clayey GRAVEL; mottled yellow brown, gravel, fine to medium, high plasticity clay	M (W)	D		
			≈ 55 litre per hour				CH	CLAY, some Gravel; mottled yellow brown and grey, pockets of ironstone	M	VSt	x x x	
			small seepages		2		CH	CLAY; grey with patches of yellow brown, high plasticity	M (W)	VSt to H	x x x x	'C' HORIZON irregular and discontinuous fissures
					3			PIT STOPPED AT 3·2m - BACKHOE LIMIT				

sketch



14/26

5 cm

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – EXCAVATION

excavation no. 6
sheet 1 of 1

project REMOUNT REFUSE DISPOSAL location LAUNCESTON

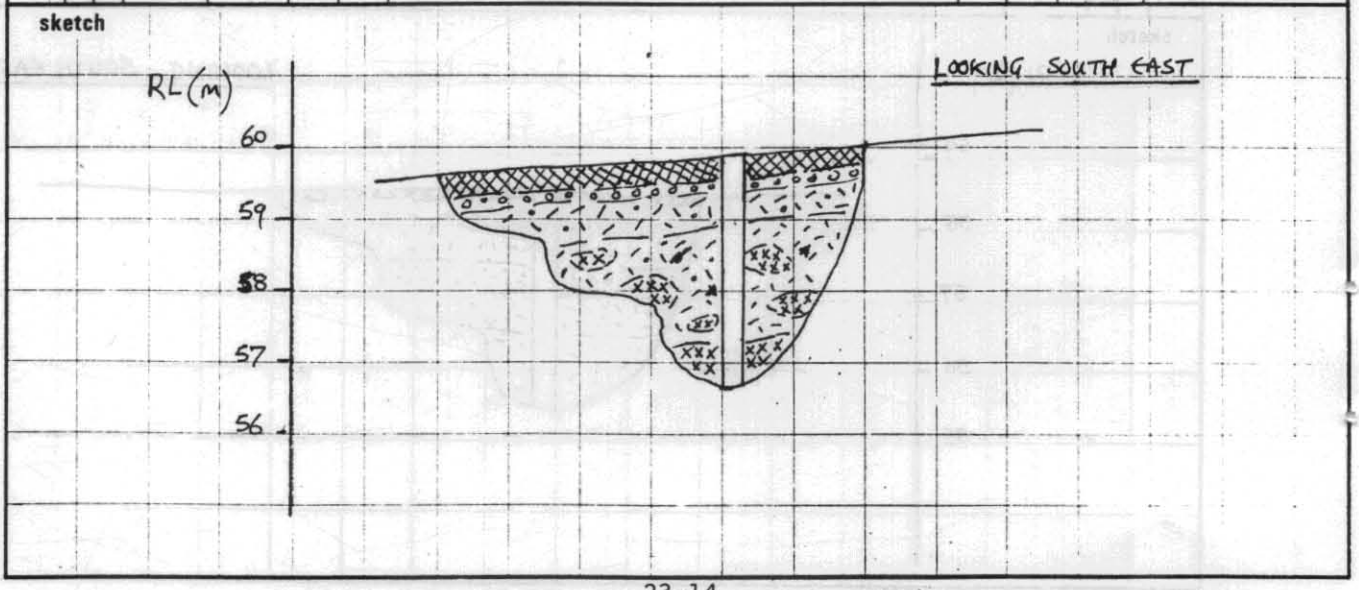
co-ordinates 512 670·0 mE
5417 332·2 mN
R.L. 59·8 m
excavation dimensions 6m x 0·6m x 3·1m deep

exposure type Pit
equipment Backhoe, Massey Ferguson 50B, 600mm bucket
operator B. Etchell

pit commenced 15 JUNE 1983, 11·30am
pit completed 15 JUNE 1983 12 noon
logged by Alan Moon
checked by R. Donaldson

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres 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 (25 50 100 200 400)	structure, geology
	NONE		small seepages				OL	Organic Silty CLAY; dark grey, low plasticity, many roots with ROCK FRAGMENTS up to 300mm	M	F	x	TOPSOIL
							GC		W	D		'E' HORIZON
							CH	Clayey GRAVEL, grey, gravel fine to medium	M	St to VSt	x x x	'B' HORIZON Many Fissures
					1		CH	CLAY; olive brown and grey, high plasticity Some gravel (ironstone)		VSt	x	
			≈ 22 litre per hour				(GC)	CLAY; mottled grey, yellow brown and red brown, high plasticity, some fine gravel with irregular pockets of clayey GRAVEL (EW Dolerite) and ironstone nodules		To H	x x x x x	'C' HORIZON
					2		GC	Clayey GRAVEL, yellow brown and red brown with ROCK FRAGMENTS (HW Dolerite)			x x	EXTREMELY WEATHERED DOLERITE
					3			PIT STOPPED AT 3·1m – BACKHOE LIMIT				

sketch



5 cm

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – EXCAVATION

excavation no. 7
sheet 1 of 1

project REMOUNT REFUSE DISPOSAL location LAUNCESTON

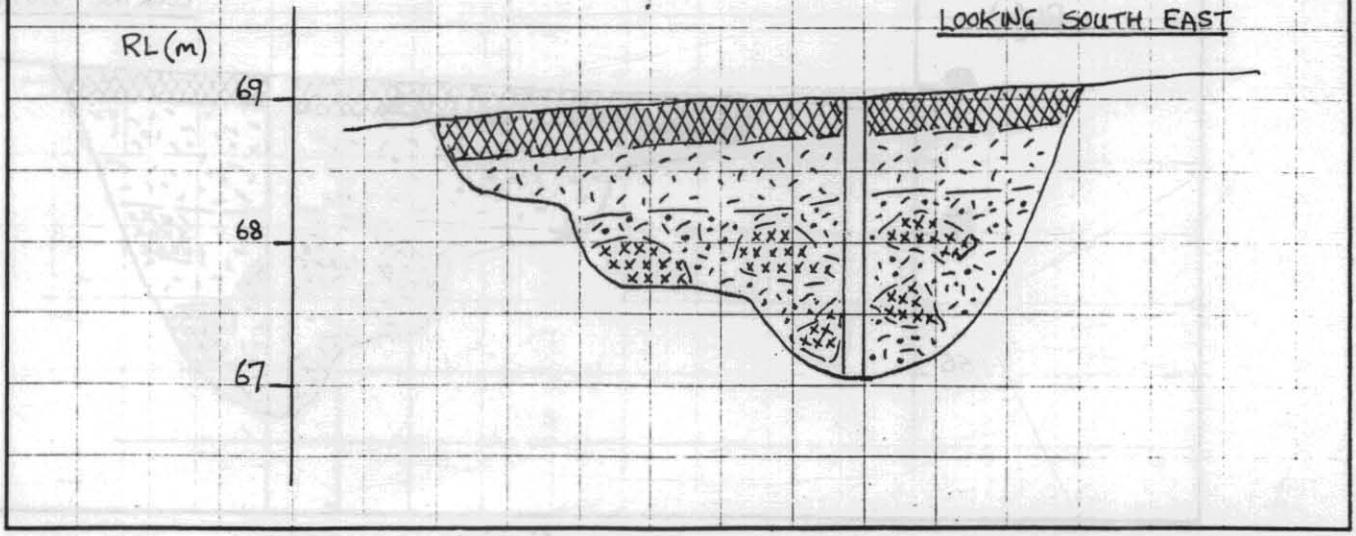
co-ordinates 512 572·4 m E
5417 290·1 m N
R.L. 69·0 m
excavation dimensions 4·5m x 0·6m x 1·9m deep

exposure type Pit
equipment Backhoe, Massey Ferguson 50B, 600mm bucket
operator B. Etchell

pit commenced 15 JUNE 1983, 1·00p
pit completed 15 JUNE 1983 1·30p
logged by Alan Moon
checked by R Donaldson.

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres 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 25 50 100 200 400	structure, geology
	NONE	NONE					OL	Organic Silty CLAY, dark grey, many roots, with rock fragments up to 0·3m across	M Wat base	F	x x	TOPSOIL
							CH	CLAY, yellow brown, high plasticity	M	St	x x x x	'B' HORIZON
				68	1		CH - GC	Gravelly CLAY and Clayey GRAVEL; mottled orange brown, olive brown with ROCK FRAGMENTS OF DOLERITE, HW L to EL strength.	D	H		HIGHLY TO EXTREMELY WEATHERED DOLERITE
								REFUSAL AT 1·9m				

sketch



16/26

5 cm

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – EXCAVATION

excavation no. 8
sheet 1 of 1

project REMOUNT REFUSE DISPOSAL location LAUNCESTON

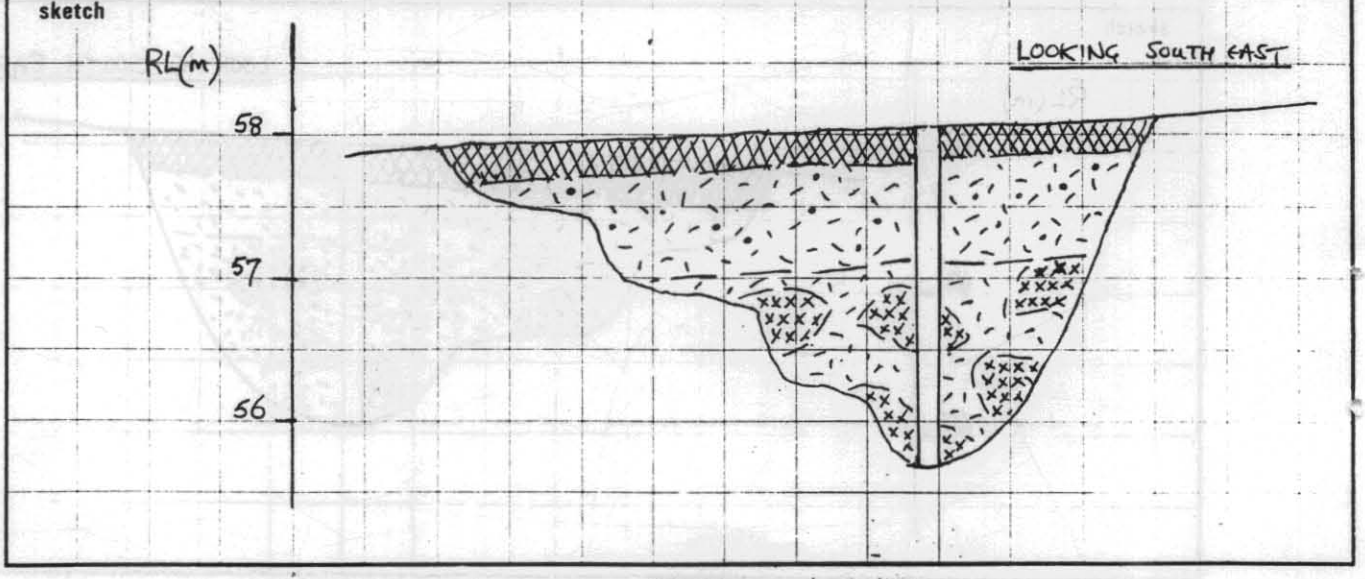
co-ordinates 512 695·9m E
5417 158·2m N
R.L. 58·1m
excavation dimensions 5m x 0·6m x 2·4m deep

exposure type Pit
equipment Backhoe, Massey Ferguson 50B, 600mm bucket
operator B. Etchell

pit commenced 15 JUNE 1983; 1·30p
pit completed 15 JUNE 1983 2·00p
logged by Alan Moon
checked by R. Donaldson.

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres 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 25 50 100 200 400	structure, geology
	NONE		very small seepages <1 litre per hour	58			OL	Organic Silty CLAY, dark grey, many roots, with rock fragments up to 0·3m across	M	F	× ×	TOPSOIL
							CH	CLAY; yellow brown and orange brown, with some gravel, high plasticity		St	× × × ×	'B' HORIZON
				57	1		CH	CLAY; olive grey, yellow brown and orange brown, with ROCK FRAGMENTS - DOLERITE, SW to HW, L to EH strength		VSt to H	× × × × ×	EXTREMELY WEATHERED DOLERITE
				56	2			REFUSAL AT 2·4m				

sketch



5 cm

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – EXCAVATION

excavation no. 9
sheet 1 of 1

project REMOUNT REFUSE DISPOSAL location LAUNCESTON

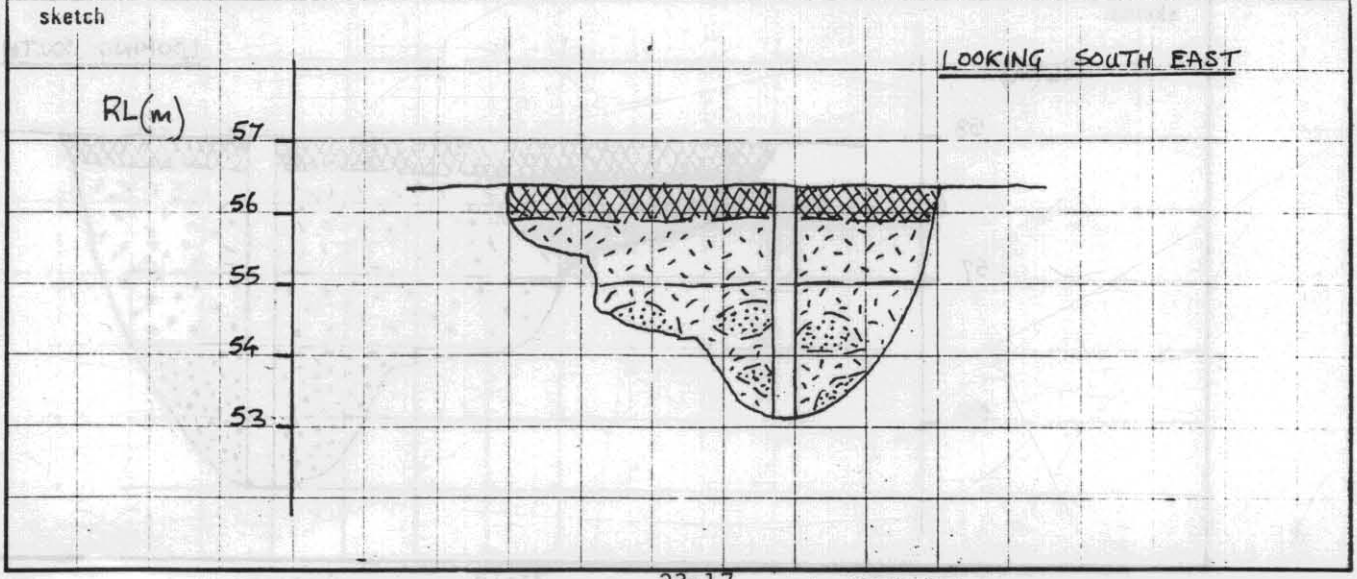
co-ordinates 512 732·3mE
5 417 176·4mN
R.L. 56·3m
excavation dimensions 6m × 0·6m × 3·2m deep

exposure type Pit
equipment Backhoe, Massey Ferguson 50B, 600mm bucket
operator B. Etchell

pit commenced 15 JUNE 1983, 2·00pm
pit completed 15 JUNE 1983 2·30pm
logged by Alan Moon
checked by R. Donaldson

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres 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 25 50 100 200 400	structure, geology
	NONE			56			OH	Organic Silty CLAY; dark grey, high plasticity, many roots	W	F	x x	TOPSOIL
					1		CH	CLAY; grey and olive grey, and yellow brown, high plasticity	M	St	x x	'B' HORIZON fissured
			small seepage along fissures ≈ 80 litre per hour	55	2		CH	CLAY; mottled grey and orange brown, high plasticity with ROCK FRAGMENTS - SILTSTONE, EL strength orange brown,		St to VSt	x x x x x x	'C' HORIZON and WEATHERED TERTIARY SEDIMENTS
				54	3			PIT STOPPED AT 3·2m – BACKHOE LIMIT				

sketch



18/26

5 cm

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – EXCAVATION

excavation no. 10
sheet 1 of 1

project REMOUNT REFUSE DISPOSAL location LAUNCESTON

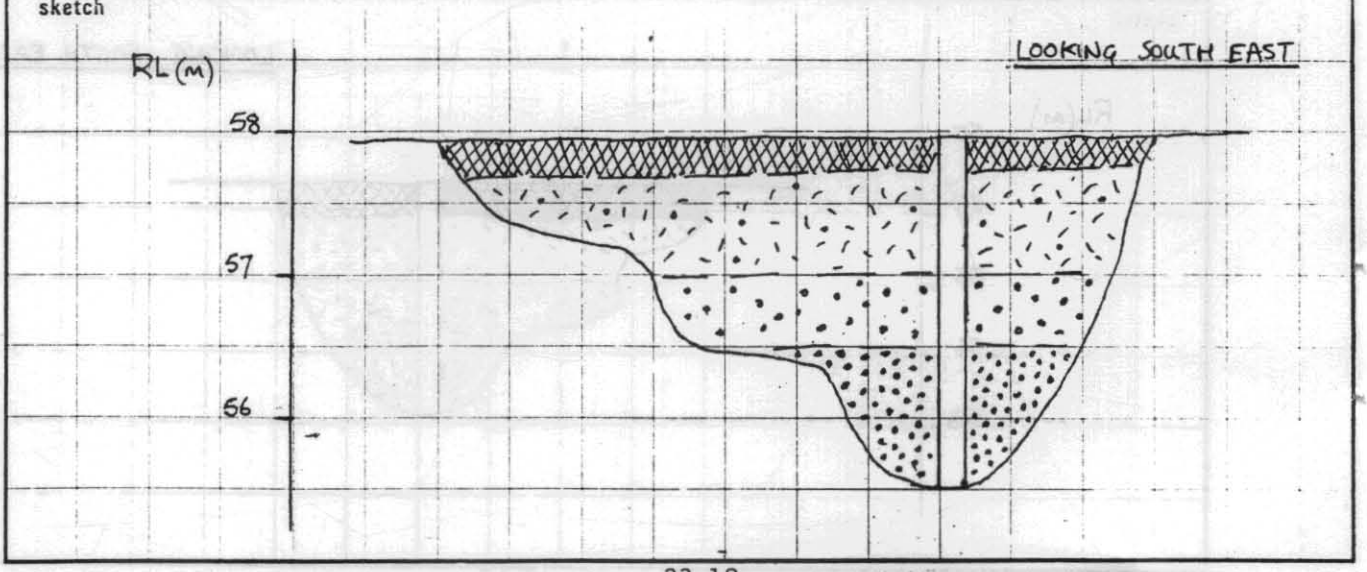
co-ordinates 512 824·7mE
5 417 226·2m N
R.L. 57·9m
excavation dimensions 5m × 0·6m × 2·4m deep

exposure type Pit
equipment Backhoe, Massey Ferguson 50B, 600mm bucket
operator B. Etchell

pit commenced 15 JUNE 1983. 2·30pm
pit completed 15 JUNE 1983 3·00pm
logged by Alan Moon
checked by R. Donaldson.

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres 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 (25 50 100 200 400)	structure, geology
							OH	Organic Silty CLAY; dark grey, many fine roots, high plasticity	M	F	x x	TOPSOIL
	NONE						CH	CLAY; olive grey, high plasticity, some fine gravel		St	x x x x	'B' HORIZON Fissured
				57	1		GC	Clayey GRAVEL, pink, grey green, and orange brown, clay is high plasticity, gravel is pink siltstone	W	VD		
			small seepages ≈80 litre per hour	56	2		(GC)	Cemented GRAVEL, orange brown, grey green and pink	M	H		'C' HORIZON
								REFUSAL AT 2·4m				

sketch



19/26

5 cm

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – EXCAVATION

excavation no. 11

sheet 1 of 1

project REMOUNT REFUSE DISPOSAL location LAUNCESTON

co-ordinates 512 933·6 mE
5417 293·7 mN

R.L. 61·8

excavation dimensions 6m x 0·6m x 3·2m deep

exposure type Pit

equipment Backhoe, Massey Ferguson 50B, 600mm bucket

operator B. Etchell

pit commenced 15 JUNE 1983, 3·00pm

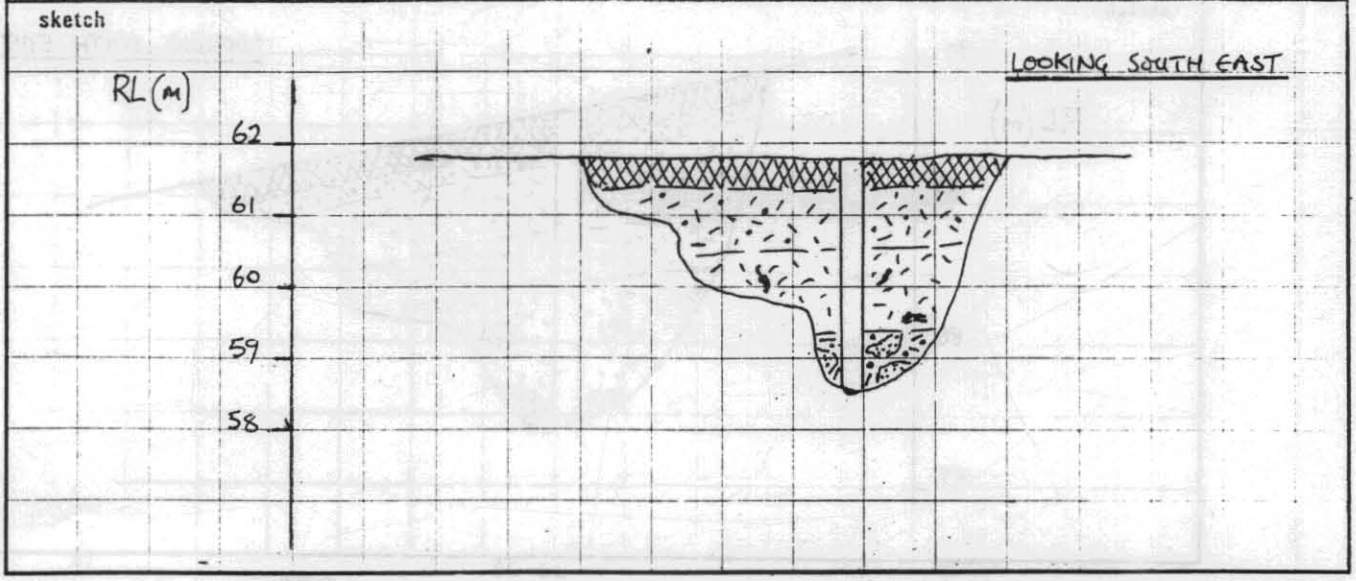
pit completed 15 JUNE 1983 3·30pm

logged by Alan Moon

checked by R Donaldson.

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres 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 25 50 100 200 400	structure, geology
	NONE			61	0		OH	Organic Silty CLAY; dark grey, many roots high plasticity, with some gravel	M	F	x x	TOPSOIL
					1		CH	CLAY; olive brown, high plasticity with some fine gravel		St	x x x	'B' HORIZON irregular discontinuous Fissures
			≈65 litre per hour	60	2		CH	CLAY; grey and yellow brown, high plasticity, ironstone nodules		St to VSt	x x x x x	'C' HORIZON
			small seepages	59	3		CH	CLAY and Gravelly CLAY, pale grey, high plasticity with ROCK FRAGMENTS – SILTSTONE, EL strength	M (W)	VSt to H	x x x	WEATHERED TERTIARY SEDIMENTS
								PIT STOPPED AT 3·2m – BACKHOE LIMIT				

sketch



20/26

TASMANIA DEPARTMENT OF MINES

5 cm

ENGINEERING LOG – EXCAVATION

excavation no. 13
sheet 1 of 1

project REMOUNT REFUSE DISPOSAL location LAUNCESTON

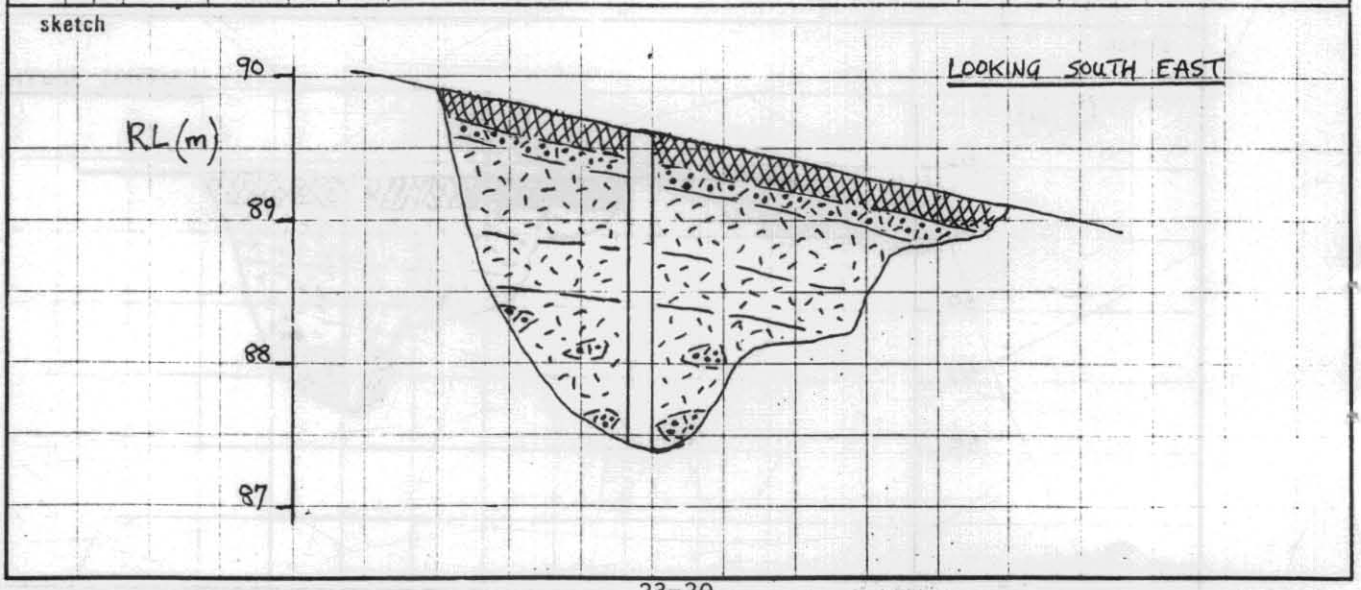
co-ordinates 513 316·0mE
5417 236·4m N
R.L. 89·6m
excavation dimensions 4m x 0·6m x 2·2m deep

exposure type Pit
equipment Backhoe, Massey Ferguson 50B, 600mm bucket
operator B. Etchell

pit commenced 16 JUNE 1983, 3·00pm
pit completed 16 JUNE 1983 3·30pm
logged by Alan Moon
checked by R. Donaldson.

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres 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 (25 50 100 200 400)	structure, geology
	NONE		small seepage <1 litre per hour				OL	Organic Silty CLAY; dark grey, some gravel, low plasticity, many roots	M	F	x x	TOPSOIL
							GC	Clayey GRAVEL; grey, gravel fine to medium	W	D		'E' HORIZON
				89			CH	CLAY; yellow brown and grey brown, high plasticity	M	St	x x x x	'B' HORIZON
					1		CH	CLAY; orange brown, high plasticity		VSt to H	x x x x	'C' HORIZON Fissured
				88			CH (GC)	CLAY; mottled grey, pink grey, with dark grey fissure coatings, high plasticity. Pink grey clay has thin coal partings. Pockets of Clayey GRAVEL, cemented, mainly below 2m		H	x x x x	and WEATHERED TERTIARY SEDIMENTS
					2			REFUSAL AT 2·2m				

sketch



5 cm

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – EXCAVATION

excavation no. 14
sheet 1 of 1

project REMOUNT REFUSE DISPOSAL location LAUNCESTON

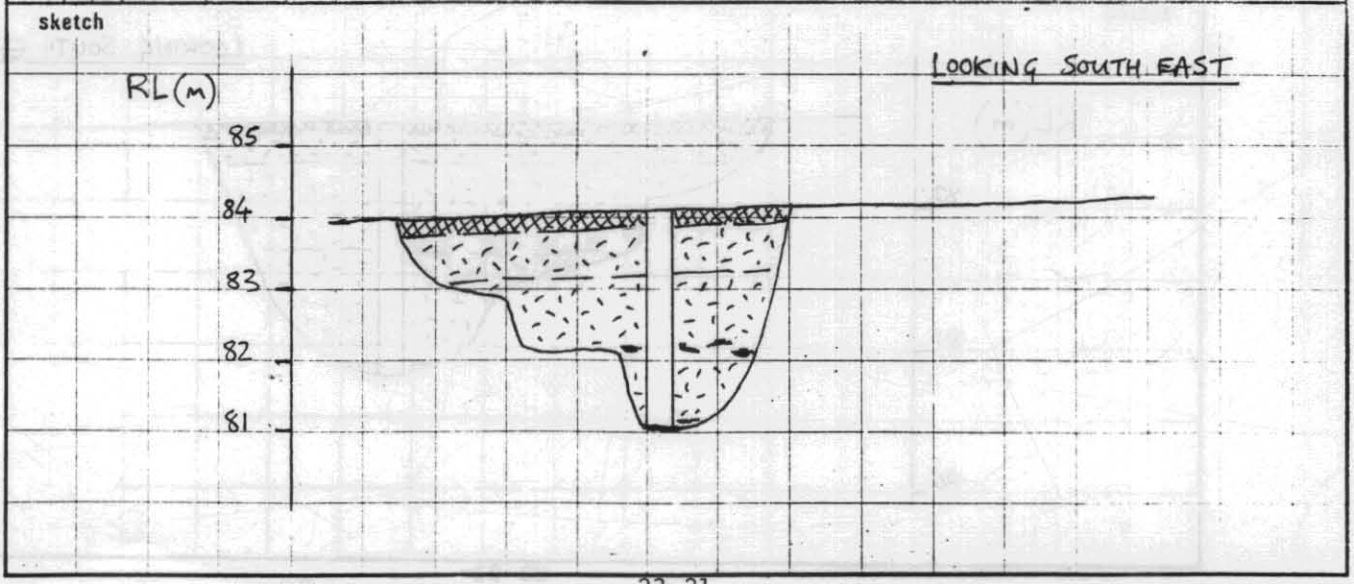
co-ordinates 513 245·1 mE
5 417 207·5 mN
R.L. 84·1 m
excavation dimensions 5·5m x 0·6m x 3m deep

exposure type Pit
equipment Backhoe, Massey Ferguson 50B, 600mm bucket
operator B. Etchell

pit commenced 16 JUNE 1983, 2·30pm
pit completed 16 JUNE 1983 3·00pm
logged by Alan Moon
checked by R. Donaldson

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres 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 (25 50 100 200 400)	structure, geology
	NONE	NONE		84	0		OL	Organic Silty CLAY; some gravel, dark grey, low plasticity many roots	M	F	x	TOPSOIL
							CH	CLAY, mottled olive brown, orange brown and grey, high plasticity		St	x x	'B' HORIZON
				83	1		CH	CLAY, mottled yellow brown and grey, high plasticity. Ironstone nodules at about 2m		H	x x x	'C' HORIZON WEATHERED TERTIARY SEDIMENTS
				82	2							
					3		CH	CLAY; pink grey, high plasticity, with coal partings up to 1mm thick			x	
								PIT STOPPED AT 3m – VERY SLOW DIGGING				

sketch



22/26

5 cm

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – EXCAVATION

excavation no. 15

sheet 1 of 1

project REMOUNT REFUSE DISPOSAL location LAUNCESTON

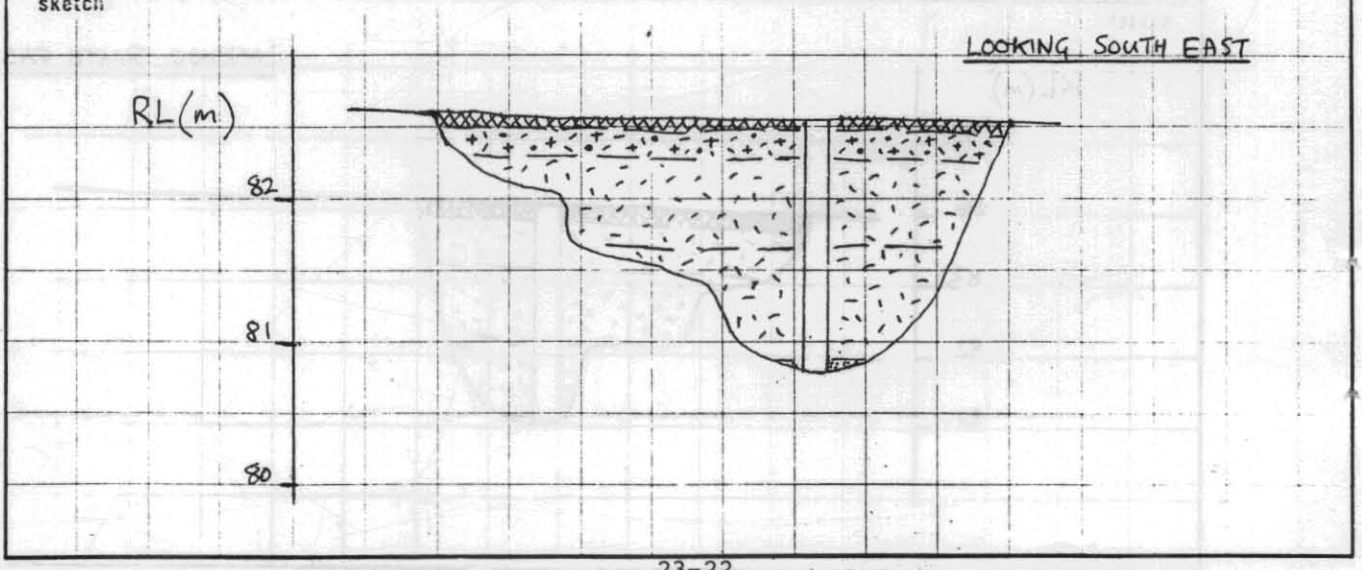
co-ordinates 513 164·7mE
5 417 161·5mN
R.L. 82·6
excavation dimensions 4m x 0·6m x 1·8m deep

exposure type Pit
equipment Backhoe, Massey Ferguson 50B, 600mm bucket
operator B. Etchell

pit commenced 16 JUNE 1983, 2·00pm
pit completed 16 JUNE 1983 2·30pm
logged by Alan Moon
checked by R. Donaldson.

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres 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 (25 50 100 200 400)	structure, geology
	NONE	NONE					OL	Organic Silty CLAY; dark grey, some fine gravel many roots, low plasticity	M	St	X	TOPSOIL
							ML	Gravelly Silty CLAY; brown, low plasticity gravel fine to medium, many roots.	D	H		'E' HORIZON
				82			CH	CLAY; mottled orange brown, yellow brown and grey, high plasticity	M	VSt to H		'B' HORIZON
					1		CH	CLAY; pale grey with yellow brown patches high plasticity		H		'C' HORIZON
				81				SILTSTONE, yellow brown and grey, HW L to VL strength, partly cemented with ironstone				WEATHERED TERTIARY SEDIMENT
								REFUSAL AT 1·8m				

sketch



5 cm

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – EXCAVATION

excavation no. 16
sheet 1 of 1

project REMOUNT REFUSE DISPOSAL location LAUNCESTON

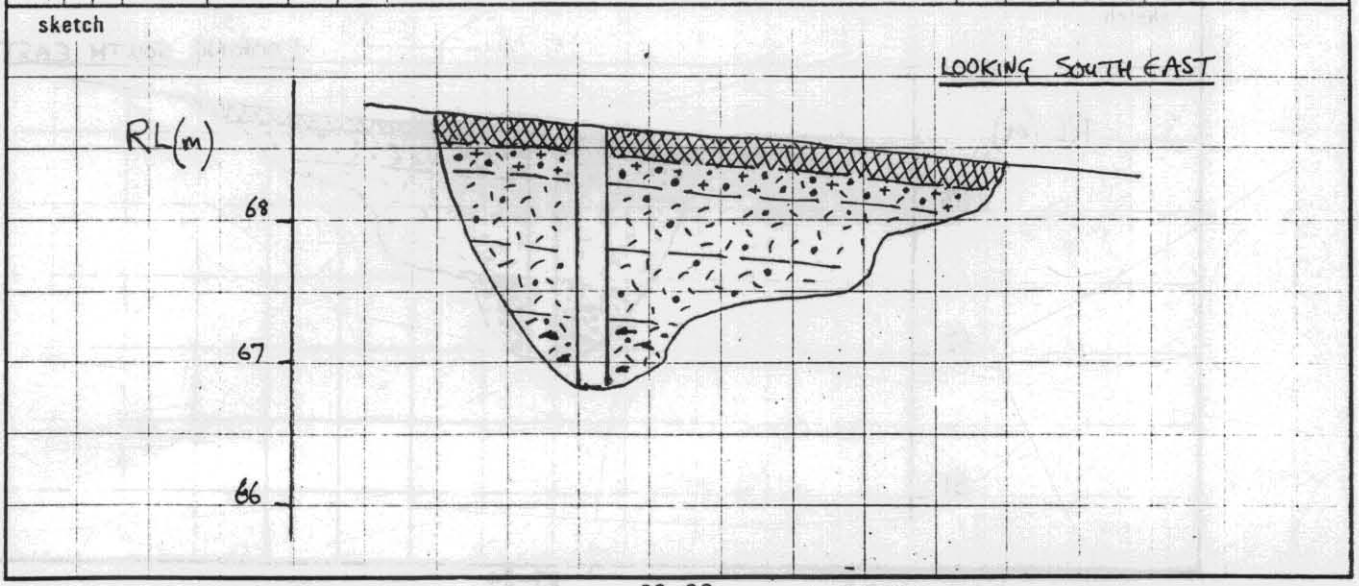
co-ordinates 513 031·2mE
5 417 073·0mN
R.L. 68·7m
excavation dimensions 4m x 0·6m x 1·9m deep

exposure type Pit
equipment Backhoe, Massey Ferguson 50B, 600mm bucket
operator B. Etchell

pit commenced 16 JUNE 1983, 1·30pm
pit completed 16 JUNE 1983 2·00pm
logged by Alan Moon
checked by R Donaldson.

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres 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 25 50 100 200 400	structure, geology
	NONE	NONE					OL	Organic Silty CLAY; some gravel, dark grey low plasticity, many roots	M	F to St	x x	TOPSOIL
							GM	Silty GRAVEL, some CLAY; grey brown, fine to medium gravel		D		'E' HORIZON
				68			CH	CLAY; high plasticity, mottled grey, yellow brown and red brown, some fine gravel		VSt	x x x	'B' HORIZON
					1		CH	as above except mottled grey brown and orange brown		H	x x	'C' HORIZON and
				67			CH	as above except mottled grey and orange brown, some ironstone nodules		H	x x	WEATHERED TERTIARY SEDIMENT
								PIT STOPPED AT 1·9m - VERY SLOW DIGGING				

sketch



24/26

5 cm

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – EXCAVATION

excavation no. 17
sheet 1 of 1

project REMOUNT REFUSE DISPOSAL location LAUNCESTON

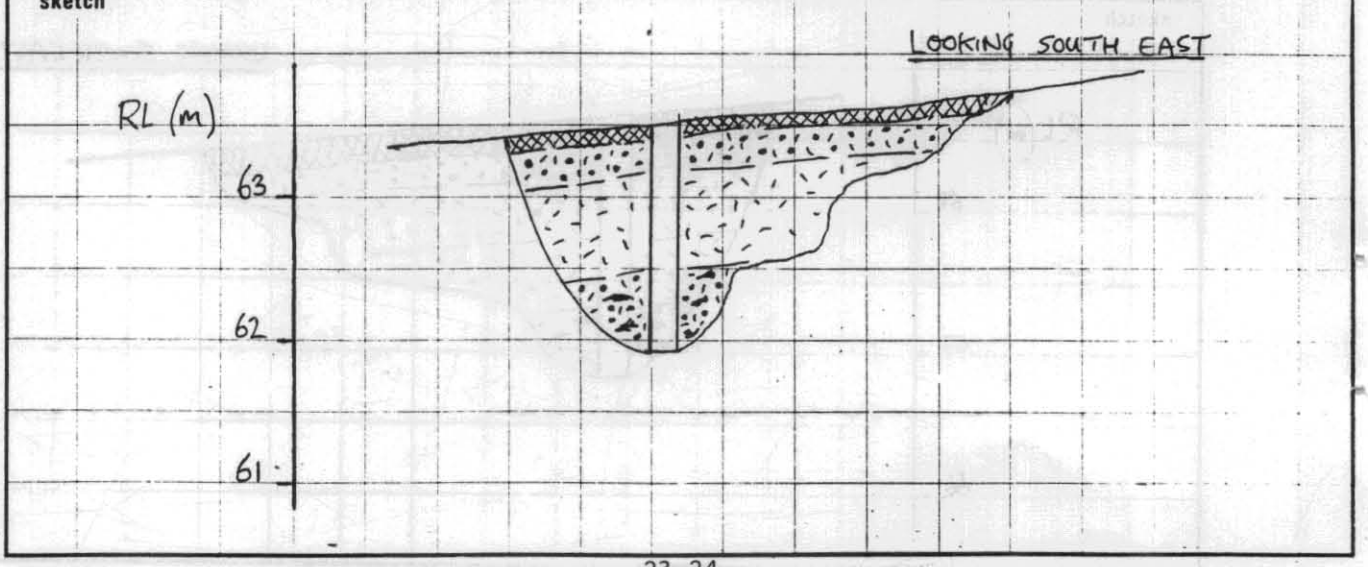
co-ordinates 512 968·6mE
5417 038·8mN
R.L. 63·5m
excavation dimensions 3·5m × 0·6m × 1·6m deep

exposure type Pit
equipment Backhoe, Massey Ferguson 50B, 600mm bucket
operator B. Etchell

pit commenced 16 JUNE 1983. 1.00pm
pit completed 16 JUNE 1983 1.30pm
logged by Alan Moon
checked by R. Donaldson

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres 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 (25 50 100 200 400)	structure, geology
	NONE	NONE		63	0		OL	Organic Silty CLAY; some gravel, dark grey, low plasticity, many roots	M	F	x	TOPSOIL
							GC			D		'E' HORIZON
							CH	Clayey GRAVEL; grey, gravel fine to medium, clay is high plasticity		VSt to H	x x x x x	'B' HORIZON Fissured
								CLAY; mottled red brown, orange brown, and yellow brown, high plasticity				
				62	1		GC (CH)	Cemented Clayey GRAVEL; mottled red brown, yellow brown and grey, cemented with ironstone and some ironstone nodules. Pockets of high plasticity clay		VD		'C' HORIZON
								PIT STOPPED AT 1·6m - VERY SLOW DIGGING				

sketch



5 cm

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – EXCAVATION

excavation no. 18
sheet 1 of 1

project REMOUNT REFUSE DISPOSAL location LAUNCESTON

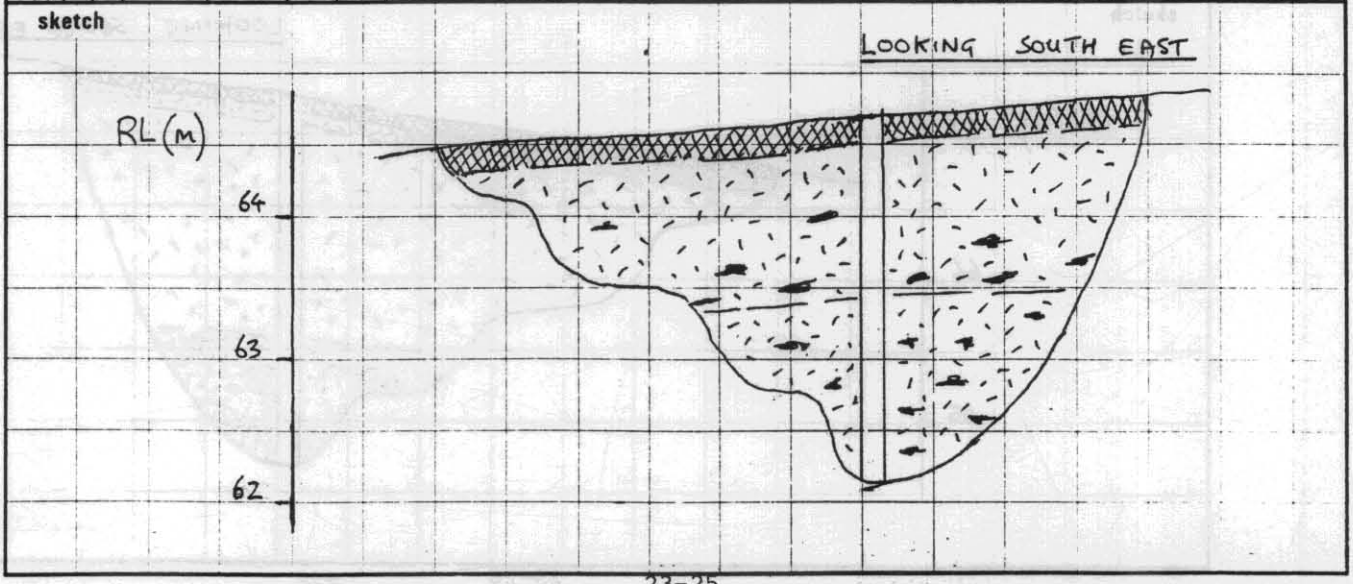
co-ordinates 512 905·6mE
5 417 003·5m N
R.L. 64·7m
excavation dimensions 5m x 0·6m x 2·6m deep

exposure type Pit
equipment Backhoe, Massey Ferguson 50B, 600mm bucket
operator B. Etchell

pit commenced 16 JUNE 1983, 12·30pm
pit completed 16 JUNE 1983 1·00pm
logged by Alan Moon
checked by R. Donaldson.

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 penetrometer kPa (25 50 100 200 400)	structure, geology
	NONE	NONE		64 / 0		OL	Organic Silty CLAY; some gravel, dark grey low plasticity, many roots	M	F	x x	TOPSOIL
						CH	CLAY; yellow brown and orange brown, some ironstone nodules towards base		St to VSt	x x x x x x x x x	'B' HORIZON fissured
				63 / 1		CH	CLAY; mottled grey, orange brown, and red brown, high plasticity, some ironstone nodules.		H	x x x x x	'C' HORIZON WEATHERED TERTIARY SEDIMENTS
				2			PIT STOPPED AT 2·6m – VERY SLOW DIGGING				

sketch



5 cm

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – EXCAVATION

excavation no. 19
sheet 1 of 1

project REMOUNT REFUSE DISPOSAL location LAUNCESTON

co-ordinates 512 844·8mE
5 416 972·5mN
R.L. 67·3m
excavation dimensions 5m x 0·6m x 2·6m deep

exposure type Pit
equipment Backhoe, Massey Ferguson 50B, 600mm bucket
operator B. Etchell

pit commenced 16 JUNE 1983, 12 noon
pit completed 16 JUNE 1983 12·30pm
logged by Alan Moon
checked by R Donaldson

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres 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 (25 50 100 200 400)	structure, geology
	NONE	NONE		67	0		OL	Organic Silty CLAY; some gravel, dark grey, many roots, low plasticity	M	F	x	TOPSOIL
							GC			D		'E' HORIZON
							CH	Clayey GRAVEL, grey, gravel fine to medium		VSt to H	x	'B' HORIZON
								CLAY; yellow brown, high plasticity, some fine gravel			x x x x x x	Irregular discontinuous fissures
				66	1							
							ML – MH (CH)	SILTSTONE, EW remoulds to Silty CLAY, yellow brown and grey, medium to high plasticity with pockets of high plasticity clay	D	H		EXTREMELY WEATHERED TERTIARY SILTSTONE
				65	2			SILTSTONE, HW to EW, L to EL strength, grey and yellow brown				SILTSTONE
								REFUSAL AT 2·6m				

sketch