

UR1984-08

1984/08. Stability assessment of the Kelcey Tier Reservoir Project

A.T. MOON

Abstract

It is proposed to construct a new 10 Ml reservoir close to the existing reservoir at Kelcey Tier. The project area is located within an old landslip complex in sediments of Permian age.

The proposed reservoir is located on a ridge which appears to have been stable for many years. If the site is developed carefully the risk of renewed landslip movements affecting the proposed reservoir can be minimised.

INTRODUCTION

The Kelcey Tier Reservoir Project involves the construction of a 10 Ml reservoir close to an existing reservoir at Kelcey Tier, two kilometres west of Spreyton [DQ437366]. The site is located on an east-facing slope overlooking the Mersey River. The slope is underlain by sedimentary rocks of Permian age. A geological investigation of the site was undertaken in 1956 (Burns, 1957). This investigation concluded that large landslips had occurred at the site in the past. The report suggested that the area was unsuitable for reservoir construction, as the slopes were "still potentially unstable and reservoir loads would only accentuate the instability".

RESULTS OF SITE INVESTIGATION

The present investigation consisted of a site inspection, a seismic refraction survey, and the excavation and logging of three test pits. The site inspection confirmed the presence of the large old landslips reported in 1956. Both the proposed reservoir site (Site 1 on Figure 1) and the alternative site (Site 2 on Figure 1) occur within the old landslip complex. The seismic refraction traverse indicates that undisturbed and unweathered bedrock does not occur within 10 m of the ground surface. The backhoe pit encountered weathered sandstone and mudstone (detailed logs of the test pits are given in Appendix 1). The weathered rock would have moved when the landslip was active but if there are no further landslip movements it will provide a sound foundation and can be readily excavated with a bulldozer and ripper. In 1956 a shaft was excavated by hand to a depth of 8.5 m at the proposed reservoir site. It is not known whether this depth was the base of the old landslip or whether movement occurred at greater depths.

DISCUSSION

If either of the sites is to be developed the proposed site (Site 1) is preferred from the stability point of view to the alternative site (Site 2). Both sites occur on ridges but there is less potential for landslips to develop around the southern site. Gentle slopes occur in all directions except towards the north-east, and this slope has been effectively monitored by the existence of the pipeline. The alternative northern site is more exposed and steeper slopes occur on several sides.

The pipeline running south-east from the existing reservoir and immediately north-east of the proposed reservoir was constructed many years ago (about 1900, definitely before 1903, B. Monks personal communication). There have been no reported problems of cracking or movement of either the

pipeline or the existing reservoir since construction. This implies that the proposed reservoir site has been stable (i.e. free of any landslip movement) for at least that period. If the reservoir site is developed in such a way as to increase the stability of the slope, then the risk of any landslip movement affecting the reservoir in the future could be minimised. If the weight of the full reservoir is less than the weight of the material excavated for the foundation, if the excavated material is completely removed from the site and not dumped anywhere on the slope, and if careful attention is paid to drainage, the development of the site should improve the stability of that area. It is also important to ensure that no development detrimental to stability occurs anywhere on the slope north or east of the proposed reservoir.

In order to ensure that the weight of the full reservoir is less than the weight of excavated material it may be necessary to consider a reservoir of smaller capacity than the 10 MJ proposed. Also a steel reservoir has the advantage that it may be reusable should any problems occur in the future.

SUMMARY AND CONCLUSIONS

The proposed reservoir site is within an old landslip complex. The site is on a ridge with gentle slopes on all sides except towards the north-east.

The slope north-east of the site has been stable for the life of the pipeline.

Risk of renewed landslip movements affecting the proposed reservoir will be minimised if:

- (1) the full reservoir weighs less than the material excavated from the site,
- (2) all excavated material is removed from the area,
- (3) drainage ensures that no additional water flows onto the north-east slope, and
- (4) development is restricted downslope of the reservoir.

The material to be excavated from the site will be rippable with a bulldozer.

REFERENCE

BURNS, K.L. 1957. Reservoir sites near Kelcie's Tier. *Tech.Rep.Dep. Mines Tasm.* 1:41-49.

[19 January 1984]

8-3

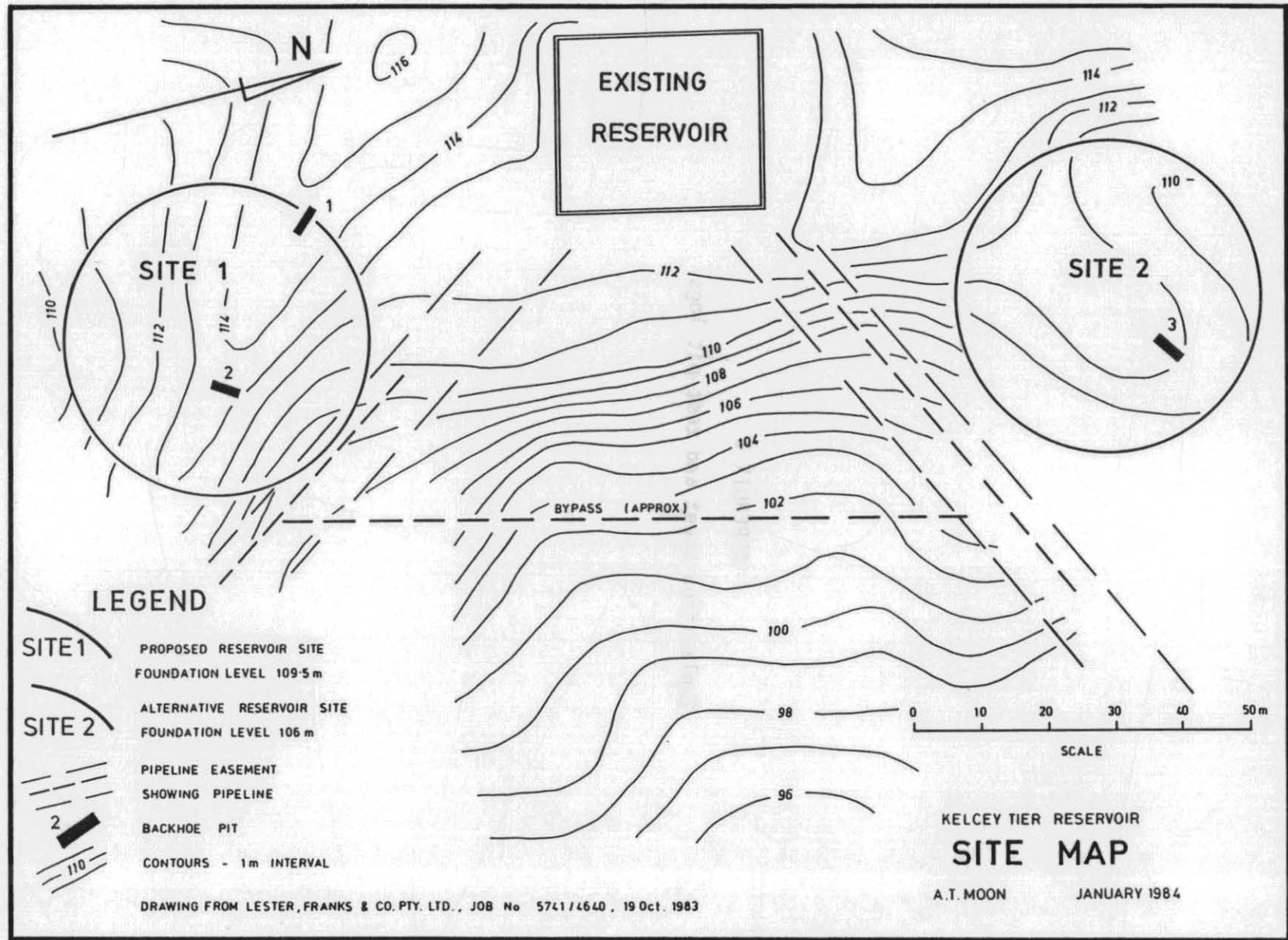
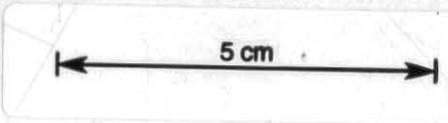
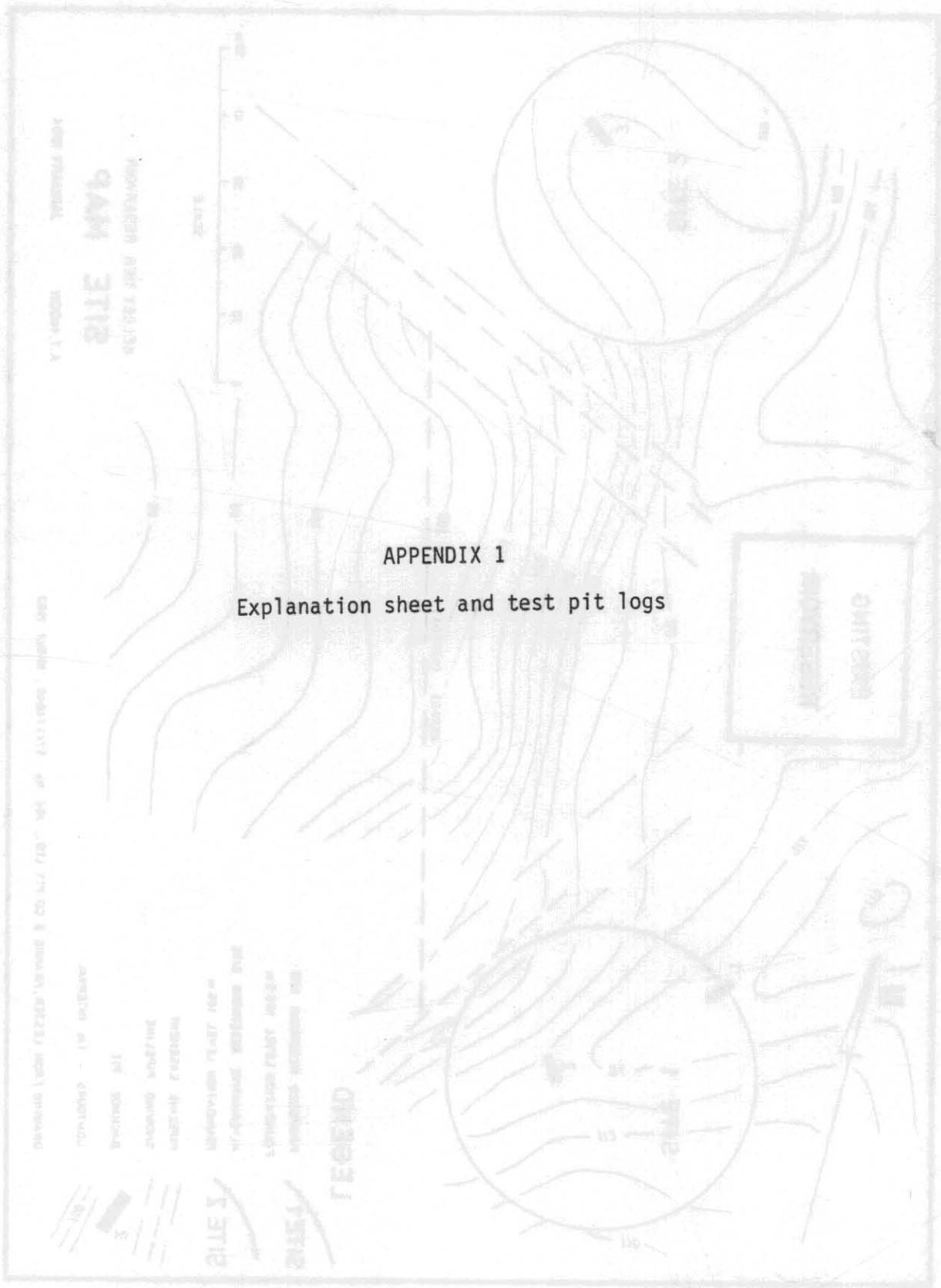


Figure 1.



5/8

3/8

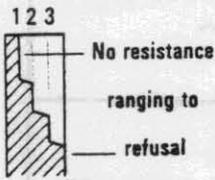


APPENDIX 1
 Explanation sheet and test pit logs

Figure 1

EXPLANATION SHEET FOR ENGINEERING LOGS

Borehole and excavation log

Penetration	Water	Notes - samples and tests	Material classification
		U50 Undisturbed sample 50mm diameter. D Disturbed sample. N Standard penetrometer blow count for 300mm. N* SPT + sample.	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.	

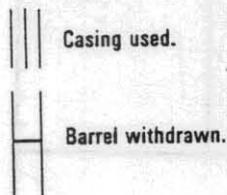
Notes: X on log is test result
 — is range of results.

Density index

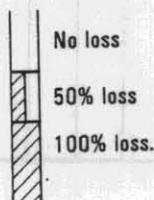
		%
VL	Very loose.	0 - 15
L	Loose.	15 - 35
MD	Medium dense.	35 - 65
D	Dense.	65 - 85
VD	Very Dense	85 - 100

Cored borehole log

Case - lift



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



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.

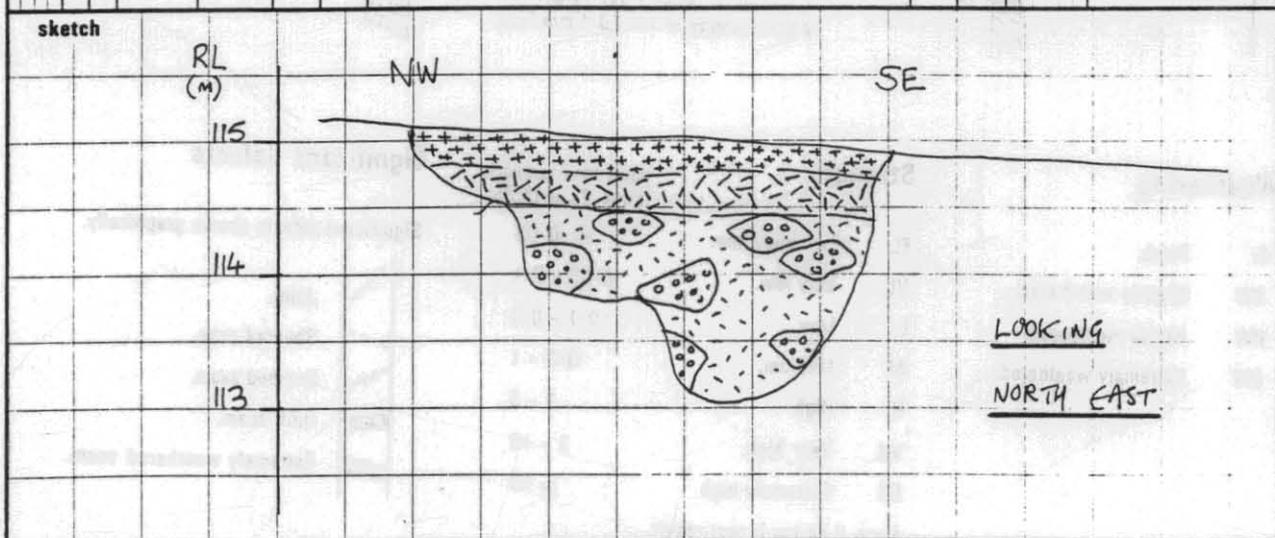
ENGINEERING LOG - EXCAVATION

excavation no. 1
sheet 1 of 1

project **KELCEY TIER RESERVOIR** location **SPREYTON**

co-ordinates exposure type **TEST PIT** pit commenced **11 Jan 1984, 8:30am**
 R.L. **115m (approx.)** equipment **CASE BACKHOE** pit completed **11 Jan 1984, 9:00am**
 excavation dimensions **3.5m x 0.5m x 2.0m deep** operator **D. Appleby** logged by **AT.Moon**
 checked by

penetration 1 2 3	support water	notes samples, tests	metres		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
			R.L.	depth						
	NONE				OL	Organic Silty CLAY; some gravel, grey many roots, very slow dilatancy	D	H		TOPSOIL
	NONE				CH MH	Silty CLAY; pale grey, high plasticity, some gravel (rock fragments), many roots				'B' HORIZON fissured
			114	1	CL ML	Mixture of SOIL (70%) and ROCK FRAGMENTS (30%). SOIL consists of Silty CLAY, mottled grey yellow brown and orange brown ROCK consists of SANDSTONE, yellow brown and pale grey, fine to medium grained, highly weathered, low strength				HIGHLY TO EXTREMELY WEATHERED SANDSTONE
			113	2		HOLE STOPPED AT 2M - VERY SLOW DIGGING				



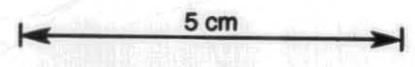
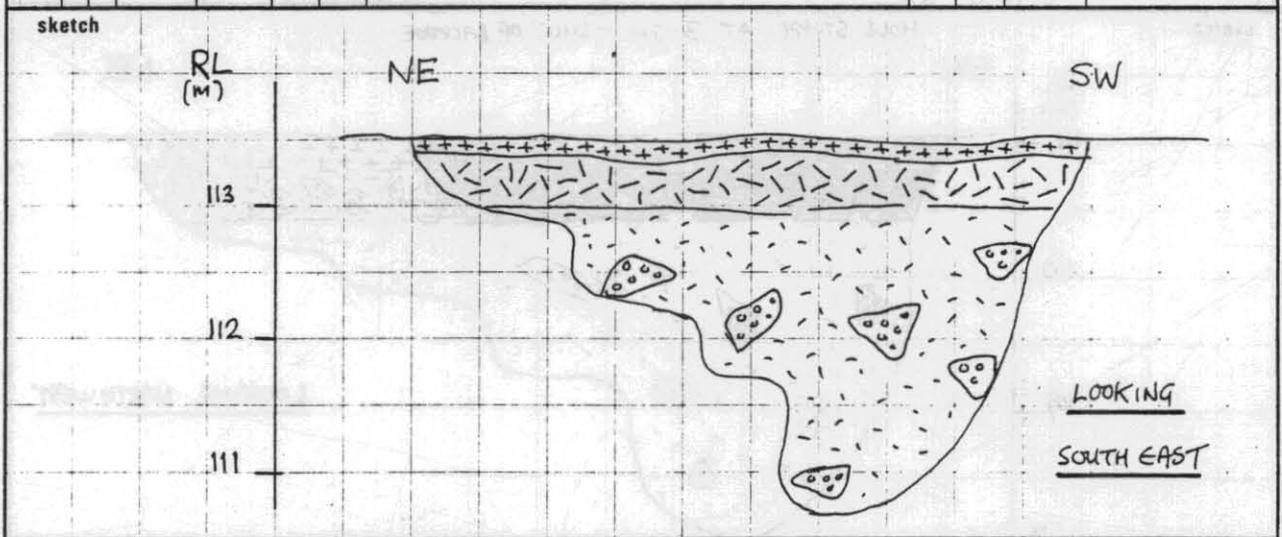
TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG - EXCAVATION

excavation no. 2
sheet 1 of 1

project KELCEY TIER RESERVOIR location SPREYTON
 co-ordinates 113.5 m (approx.) exposure type TEST PIT pit commenced 11 Jan 1984 9.00am
 R.L. 113.5 m (approx.) equipment CASE BACKHOE pit completed 11 Jan 1984 9.30am
 excavation dimensions 5m x 0.5m x 2.8m deep operator D. Appaby logged by A.T. Moon
 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											25 50 100 200 400	
	NONE	NONE		113	++	OL	Organic Silty CLAY, grey, some fine gravel, roots	D	H			TOPSOIL
				113	---	CH MH	Silty CLAY, grey-brown, high plasticity, some rock fragments, roots					'B' HORIZON fissured
				1	o	CL ML	Mixture of SOIL (90%) and ROCK FRAGMENTS (10%) SOIL consists of Silty CLAY and clayey SILT, low plasticity, mottled grey, yellow brown and orange brown					EXTREMELY WEATHERED
				2	o		ROCK consists of SANDSTONE, yellow brown and grey, fine to medium grained, highly weathered, very low to medium strength					SANDSTONE
				111	o							
HOLE STOPPED AT REQUIRED DEPTH - 2.8M												



ENGINEERING LOG - EXCAVATION

excavation no. 3
sheet 1 of 1

project	KELCEY TIER RESERVOIR	location	SPREYTON
co-ordinates	---		
R.L.	111 m (approx.)	exposure type	TEST PIT
excavation dimensions	6m x 0.5m x 3.0m	equipment	CASE BACKHOE 500mm bucket
		operator	D. Appleby
		pit commenced	11 Jan 1984, 19.00m
		pit completed	11 Jan 1984, 10.30m
		logged by	A.T. Moon
		checked by	

penetration 1 2 3	support water	notes samples, tests	metres		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
			R.L.	depth						
	NONE	NONE	111	1	OL	Organic Silty CLAY; grey, low plasticity, some fine gravel, roots	D	H		TOPSOIL
			110		CH	Mixture of SOIL (30%) and ROCK FRAGMENTS (70%) SOIL consists of CLAY, yellow brown, high plasticity, some gravel ROCK consists of SANDSTONE and MUDSTONE, grey and yellow brown, highly weathered, very low to medium strength				COLLUVIUM (SLOPE DEPOSITS)
			109	2	CL	Mixture of SOIL (90%) and ROCK FRAGMENTS (10%) SOIL consists of Silty CLAY, yellow brown and grey, low plasticity ROCK consists of SANDSTONE and MUDSTONE as above				EXTREMELY WEATHERED SANDSTONE AND MUDSTONE
			108	3						

