

**NHT Funded Project
NLP 13188**

The effects of waste disposal on groundwater quality in Tasmania



Geotechnical investigations at the Dorset Council clay quarry, Jensens Road, North Scottsdale

**Tasmanian Geological
Survey Record 2002/13**

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Geotechnical investigations at the Dorset Council clay quarry, Jensens Road, North Scottsdale

A. R. Ezzy

Introduction

Mineral Resources Tasmania (MRT) initiated a project to investigate the effects of waste disposal on groundwater quality in Tasmania. The project was jointly funded by MRT and the Natural Heritage Trust (NHT) and included a number of sites for detailed study. The Jensens Road clay quarry at North Scottsdale (548 900 mE, 5 444 400 mN) was one of these sites.

In 1998 the Department of Primary Industries, Water and Environment (DPIWE) identified the Jensens Road clay quarry at North Scottsdale as a site worthy of geotechnical investigations, to address environmental issues related to waste management practices in the area.

Geology

The Tasmania Department of Mines 1:60 000 scale geological map of the area (Moore, 1990a) indicates that the geology of the clay quarry area comprises Kamona-type Devonian-Carboniferous granitic intrusions. These intrusions consist of fine to medium-grained, equigranular pink adamellite with common veining.

Geological mapping during the current study indicated that the site is dominated by high plasticity clay deposits which appear to overly the granitic intrusions. One sample, from the western end of the quarry, was selected (based on an average clay content of observed materials in the quarry) for XRD and Atterberg analyses (Appendix 2).

Hydrogeology

The Tasmania Department of Mines 1:60 000 scale hydrogeology map of the area (Moore, 1990b) defines the aquifer as a consolidated, sparsely fractured system. The hydrogeological properties of the

groundwater resource identified by Moore (1990b) are given below.

	Range	Average
Bore yield (l/min)	60-454	214.3
Water salinity (mg/l)	140-2250	1035

Two 120 mm diameter environmental monitoring bores fitted with 50 mm casing were auger drilled on 20 September 2000 for this project. The bores were logged in accordance with AS 1726-1993; engineering logs are presented in Appendix 1.

Groundwater was encountered at a depth of 10.5 m below ground level in hole DCQ2000/2. No water was intercepted in the drilling of hole DCQ2000/1 to a total depth of 14.7 metres. Flow during drilling indicated that the groundwater in hole DCQ2000/2 was unconfined, potentially perched on bedrock.

Additional laboratory testing

Bulk samples from the two boreholes and one surface sample were submitted to BFP Pty Ltd for particle size distribution, Atterberg limits and falling head permeability test (Appendix 3).

Summary and conclusion

Initial investigations at this site indicate that a clay resource may exist that could be used to address environmental issues related to waste management practices in the area.

References

- MOORE, W. R. 1990a. *North East Tasmania Groundwater Resource Project. Map 1. Geology of the Scottsdale Sedimentary Basin*. Tasmania Department of Mines.
- MOORE, W. R. 1990b. *North East Tasmania Groundwater Resource Project. Map 2. Hydrogeology of the Scottsdale Sedimentary Basin*. Tasmanian Department of Mines.

[30 May 2002]

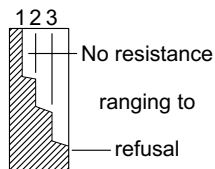
Appendix 1

Engineering logs of boreholes

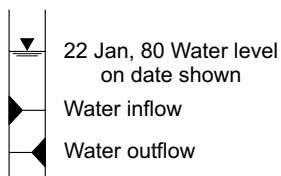
EXPLANATION SHEET FOR ENGINEERING LOGS

Borehole and excavation log

Penetration



Water



Notes — samples and tests

U50	Undisturbed sample 50 mm diameter
D	Disturbed sample
N	Standard penetrometer blow count for 300 mm
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 feels 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
e.g. M>PL — Moist, moisture content greater than the plastic limit	

Consistency

		: hand penetrometer
VS	Very soft	<25 (kPa)
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

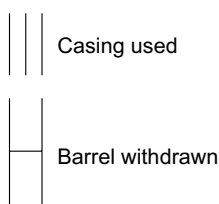
		%
VL	Very loose	0 – 15
L	Loose	15 – 35
MD	Medium dense	35 – 65
D	Dense	65 – 85
VD	Very dense	85 – 100

Fracture description

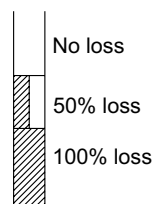
RP	Rough planar
RL	Rough irregular
SP	Smooth planar
SL	Smooth irregular

Cored borehole log

Case - lift



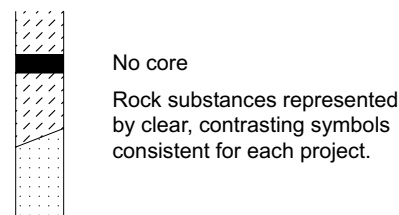
Fluid loss



Lugeons

Lugeon units (uL) are a measure of rock mass permeability. For a 46 to 74 mm 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

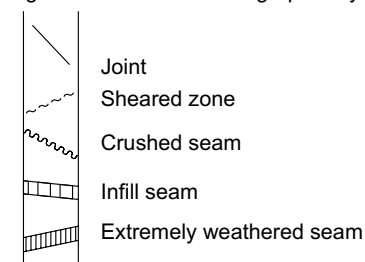
Strength

		point load strength index $1 \text{ s}_{(50)}$ (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

Notes: X on log is test result.

Significant defects

Significant defects shown graphically



ENGINEERING LOG - BOREHOLE

Project		Dorset Council clay quarry				Location		Jensens Road, North Scottsdale			
Co-ordinates		55 549066 mE 5444355 mN		Drill type		Auger		Hole commenced		20 September 2000	
				Drill method		Rotary		Hole completed		20 September 2000	
R.L.				Drill fluid		Nil		Drilled by		Mr Shane Heawood	
Inclination		vertical						Logged by		Mr Andrew Ezzy	
Bearing								Checked by		Mr Adrian Waite	
penetration		support		water		notes		metres		structure, geology	
1 2 3				R.L.		depth		graphic log		classification symbol	
								material		soil type: plasticity or particle characteristics, colour, secondary and minor components.	
										moisture condition	
										consistency density index	

ENGINEERING LOG - BOREHOLE

Borehole no.
DCQ 2000/1
Sheet 2 of 3

Project		Dorset Council clay quarry				Location		Jensens Road, North Scottsdale			
Co-ordinates		55 549066 mE 5444355 mN		Drill type		Auger		Hole commenced		20 September 2000	
				Drill method		Rotary		Hole completed		20 September 2000	
R.L.				Drill fluid		Nil		Drilled by		Mr Shane Heawood	
Inclination		vertical						Logged by		Mr Andrew Ezzy	
Bearing								Checked by		Mr Adrian Waite	
penetration		support		water		notes		metres		graphical log	
1 2 3						samples, tests		R.L.		depth	
										classification symbol	
										material	
										soil type: plasticity or particle characteristics, colour, secondary and minor components.	
										moisture condition	
										consistency density index	
										structure, geology	

ENGINEERING LOG - BOREHOLE

Project		Dorset Council clay quarry		Location		Jensens Road, North Scottsdale	
Co-ordinates		55 549066 mE 5444355 mN		Drill type		Auger	
				Drill method		Rotary	
R.L.				Drill fluid		Nil	
Inclination		vertical		Hole commenced		20 September 2000	
Bearing				Hole completed		20 September 2000	
				Drilled by		Mr Shane Heawood	
				Logged by		Mr Andrew Ezzy	
				Checked by		Mr Adrian Waite	

penetration	support	water	notes	metres	graphic log	classification	material	moisture	consistency	structure, geology
1 2 3			samples, tests	R.L. depth		symbol	soil type: plasticity or particle characteristics, colour, secondary and minor components.	condition	density index	
			D Sample ID 19				(As sheet 2)			
	No screen		D Sample ID 19	10.5						
			D Sample ID 19	11.0						
			D Sample ID 19	11.5						
			D Sample ID 20	12.0						
			D Sample ID 20	12.5						
			D Sample ID 20	13.0						
			D Sample ID 20	13.5						
			D Sample ID 20	14.0						
			D Sample ID 20	14.5						
Sample ID numbers refer to samples stored in MRT core shed							End of hole due to lack of drilling capacity at 14.7 m Note: No inflow.			

ENGINEERING LOG - BOREHOLE

Borehole no.
DCQ 2000/2
Sheet 1 of 3

Project			Dorset Council clay quarry			Location		Jensens Road, North Scottsdale				
Co-ordinates			55 548940 mE 5444469 mN		Drill type		Auger		Hole commenced		20 September 2000	
					Drill method		Rotary		Hole completed		20 September 2000	
R.L.					Drill fluid		Nil		Drilled by		Mr Shane Heawood	
Inclination			vertical						Logged by		Mr Andrew Ezzy	
Bearing									Checked by		Mr Adrian Waite	
penetration	support	water	notes	metres	graphic log	classification	material	moisture	consistency	structure, geology		
1	2	3	samples, tests	R.L.	depth	symbol	soil type: plasticity or particle characteristics, colour, secondary and minor components.	condition	density index			
		Cement	D Sample ID 1			SC	SAND - light grey and brown, gravelly, clayey	M	L S	Tertiary sediments		
		Bentonite	D Sample ID 2	0.5		SP	SAND - red-brown, gravelly, clayey	M	L	Tertiary sediments		
			D Sample ID 3	1.0		CL	CLAY - medium plasticity, light red and brown, gravelly, sandy	M	F	Tertiary sediments		
			D Sample ID 4	1.5		SP	SAND - black, gravelly, clayey	D	VL VS	Tertiary sediments		
			D Sample ID 5	2.0		SW	SAND - 90% dark brown and 10% red-yellow, gravelly, clayey	D	L S	Tertiary sediments		
			D Sample ID 6	2.5		CL	CLAY - medium plasticity, light yellow, gravelly	M	F	Tertiary sediments		
		No screen	D Sample ID 7	3.0		CH	CLAY - high plasticity, yellow, 5% quartz gravel	M	F	Tertiary sediments		
		7 mm Gravel	D Sample ID 8	3.5		CH	CLAY - high plasticity, yellow and grey, 1% smokey quartz up to 3 mm	M	F	Tertiary sediments		
			D Sample ID 9	4.0								
			D Sample ID 10	4.5								

ENGINEERING LOG - BOREHOLE

Project				Dorset Council clay quarry				Location		Jensens Road, North Scottsdale				
Co-ordinates				55 548940 mE 5444469 mN		Drill type		Auger		Hole commenced		20 September 2000		
						Drill method		Rotary		Hole completed		20 September 2000		
R.L.						Drill fluid		Nil		Drilled by		Mr Shane Heawood		
Inclination				vertical						Logged by		Mr Andrew Ezzy		
Bearing										Checked by		Mr Adrian Waite		
penetration		support	water	notes	metres		graphic log	classification	material			moisture	consistency	structure, geology
1 2 3				samples, tests	R.L. depth			symbol	soil type: plasticity or particle characteristics, colour, secondary and minor components.			condition	density index	
				D Sample ID 20					(As sheet 2)					
			3 metre N.R.F.S. Screen - 4 x 150mm spaced 5mm holes	D Sample ID 21	10.5			CH	CLAY - high plasticity, green and light grey, sandy, 5% gravel			W	VL VS	Tertiary sediments
			7 mm Gravel	D Sample ID 21	11.0									
				D Sample ID 21	11.5									
				D Sample ID 21	12.0									
				D Sample ID 21	12.5									
			No screen	D Sample ID 21	13.0									
				D Sample ID 22				SC	SAND - green and grey, clayey, 5% gravel			M	F	Tertiary sediments
					13.5			CL	CLAY - dark red-brown				VD	Hard pan
									End of hole due to auger refusal at 13.5 m					
				Sample ID numbers refer to samples stored in MRT core shed										

Appendix 2

Atterberg test results, Jensens Road quarry

Client: A. Ezzy
 Sample Source: Various
 Analyses: Approximate mineralogy and mechanical properties
 Methods: X-ray diffraction and Atterberg Limits tests
 Analyst: R. N. Woolley
 Date: 6 September 2001

XRD Results (approx wt %)

<i>Sample</i>	<i>Quartz</i>	<i>Kaolinite</i>	<i>Smectite</i>	<i>Mica</i>	<i>Gibbsite</i>
Jensens Road Quarry	25	75			

Peak overlap may interfere with identifications

Minerals present in trace amounts, or amorphous material, may not be detected

Atterberg Results

<i>Sample</i>	<i>MC</i>	<i>LL</i>	<i>PL</i>	<i>LS</i>
Jensens Road Quarry *	40	68	43	9

MC = Moisture Content

PL = Plastic Limit

LL = Liquid Limit

LS = Linear Shrinkage

* LL, PL and LS determined on <0.5 mm fraction of sample

Appendix 3
BFP Pty Ltd laboratory results

**BFP****TEST RESULTS****materials testing laboratories**

369A Bass Highway Prospect Vale Tas 7250

Ph (03) 6340 2155 Fax (03) 6340 2177

job No **26440**certificate No **440/AA**client **MINERAL RESOURCES TASMANIA**date tested **14/09/01**project **Capping Clay**location **Scottsdale**sample identification **DCQ 2001/1 1.0 - 14.5m**sample No **L01/408a**sampled by **client**date received **10/9/01****particle size distribution****AS1289 3.6.1**

AS sieve (mm)	Percent Passing
75.0	
37.5	
26.5	
19.0	
13.2	
9.5	
6.7	
4.75	100
2.36	92
1.18	77
0.600	66
0.425	63
0.300	61
0.150	56
0.075	52

atterberg limits**AS1289 3.1.2,3.2.1,3.3.1,3.4.1**

liquid limit	%	62
plastic limit	%	36
plasticity index (PI)	%	26
linear shrinkage	%	9
method of drying:		air
method of sieving:		dry
curing time:		>24hrs
grooving tool:		ASTM

remarks:

natural moisture content**AS1289.2.1.1**

moisture content	%	29.9
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material description/**product name****White silty clayey sand, some fine gravel.
Capping Clay**

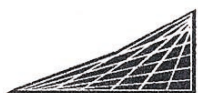
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LABORATORY ACCREDITATION No 2034

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Approved Signatory
M.A. Maundrell

date of issue

**BFP****TEST RESULTS****materials testing laboratories**

369A Bass Highway Prospect Vale Tas 7250

Ph (03) 6340 2155 Fax (03) 6340 2177

job No **26440**certificate No **440/AB**client **MINERAL RESOURCES TASMANIA**date tested **14/09/01**project **Capping Clay**location **Scottsdale**sample identification **DCQ 2001/2 3.0 - 10.5m**sample No **L01/408b**sampled by **client**date received **10/9/01****particle size distribution**

AS1289 3.6.1

AS sieve (mm)	Percent Passing
75.0	
37.5	
26.5	
19.0	
13.2	
9.5	
6.7	
4.75	100
2.36	92
1.18	78
0.600	67
0.425	63
0.300	60
0.150	53
0.075	48

atterberg limits

AS1289 3.1.2,3.2.1,3.3.1,3.4.1

liquid limit	%	53
plastic limit	%	34
plasticity index (PI)	%	19
linear shrinkage	%	7
method of drying:		air
method of sieving:		dry
curing time:		>24hrs
grooving tool:		ASTM

remarks:

natural moisture content

AS1289.2.1.1

moisture content	%	29.6
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material description/**product name**

Light brown silty clayey sand, some fine gravel.
Capping Clay



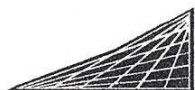
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date of issue

**BFP****TEST RESULTS****materials testing laboratories**

369A Bass Highway Prospect Vale Tas 7250

Ph (03) 6340 2155 Fax (03) 6340 2177

job No **26440**certificate No **440/AC**

client	MINERAL RESOURCES TASMANIA	date tested	14/09/01
project	Capping Clay		
location	Scottsdale		

sample identification	DCQ 2001/3	sample No	L01/408c
sampled by	client	date received	10/9/01

particle size distribution

AS1289 3.6.1

AS sieve (mm)	Percent Passing
75.0	
37.5	
26.5	
19.0	
13.2	
9.5	
6.7	
4.75	100
2.36	93
1.18	84
0.600	76
0.425	74
0.300	72
0.150	69
0.075	66

atterberg limits

AS1289 3.1.2,3.2.1,3.3.1,3.4.1

liquid limit	%	64
plastic limit	%	44
plasticity index (PI)	%	20
linear shrinkage	%	8
method of drying:		air
method of sieving:		dry
curing time:		>24hrs
grooving tool:		ASTM

remarks:

natural moisture content

AS1289.2.1.1

moisture content	%	35.2
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material description/

product name

White silty sandy clay, some fine gravel.
Capping Clay



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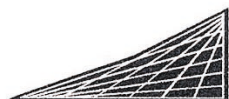
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M.A. Maundril 28/9/01

Approved Signatory
M.A. Maundril

date of issue

**BFP****FALLING HEAD PERMEABILITY**

materials testing laboratories

369A Bass Highway Prospect Vale Tas 7250

ACN 073 692 270

job No

26440

client **MINERAL RESOURCES TASMANIA** date tested 24/9 - 28/9/01project **Capping Clay**location **SCOTTSDALE**sampled by: **Client** date received 10/9/01

Sample Identification	Sample Description	coefficient of permeability cm/sec	Maximum Dry Density t/m ³	Optimum Moisture Content %
DCQ 2001/1 1.0 - 14.5m	White silty clayey sand	6.8×10^{-8}	1.66	20.7
DCQ 2001/2 3.0 - 10.5m	Light brown silty clayey sand	2.5×10^{-7}	1.64	21.3
DCQ 2001/3	White sandy silty clay	1.3×10^{-7}	1.50	25.4

Note:

- 1 Launceston tap water used. Mean temperature 14^o C.
- 2 Specimens remoulded to 95% Standard Compaction at Optimum Moisture Content.
- 3 Specimens saturated 5 days prior to test under a head equivalent to 1.5m.