

NHT Funded Project NLP 13188

The effects of waste disposal on groundwater quality in Tasmania



**Drilling near the
Tolosa Street
reservoir,
Glenorchy**

**Tasmanian Geological
Survey Record 2002/12**

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Drilling investigations to identify groundwater flow directions in the area north of the Tolosa Street Reservoir, Glenorchy

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Introduction

Drilling undertaken in 2001 at the toe of the Chapel Street landfill footprint (Ezzy, 2002) identified contaminated groundwater (including chloride, ammonia, manganese and total petroleum hydrocarbons) at a depth of five metres. The Steering Committee supervising this Natural Heritage Trust project requested that additional drilling be undertaken between the Tolosa Street Reservoir and the Chapel Street waste depot, with the aim of assisting in determining groundwater flow directions in the area between the two sites.

Hydrogeology

Two additional monitoring boreholes were percussion drilled on the north side of the Tolosa Street reservoir (fig. 1) between 23 and 24 January 2002 using the down-hole hammer technique. Borehole TSR2002/1 was drilled to 24.5 metres and borehole TSR2002/2 was drilled to 30.5 metres. Both bores had a diameter of 170 mm and 100 mm casing was installed. Both bores were logged in accordance with AS1726-1993; engineering logs are presented in Appendix 1. Both holes were developed on 25 January 2002 using the air lifting method.

Both bores were drilled in Permian grey mudstone. Water was struck at 19.5 m in hole TSR2002/1 and at 25 m and 27.5 m in hole TSR2002/2. Standing water

levels of 19.5 m (TSR2002/1) and 24.6 m (TSR2002/2) indicate that groundwater in both bores is unconfined.

Summary and conclusions

As detailed surveying of all the bores is still to be undertaken, the current data can only be generalised. Using current contour data, an initial review of groundwater gradients (fig. 1) implies that it is unlikely that contaminated groundwater (originating from the Chapel Street waste depot) is entering the reservoir. Local groundwater flow appears to move away from the toe of the waste depot to the east beneath Humphrey Rivulet.

Future work

Groundwater chemistry is awaited for the Tolosa Street boreholes. Pump tests are recommended for boreholes CS2001/1, TSR2002/1 and TSR2002/2. The application of hard-rock resistivity geophysical techniques may help to better refine groundwater flow within the local area. All future work in the area should consider potential vandalism of hardware and infrastructure.

Reference

EZZY, A. R. 2002. Groundwater quality investigations at the Chapel Street and Jackson Street waste depots, Glenorchy. *Record Tasmanian Geological Survey* 2002/11.

[30 May 2002]

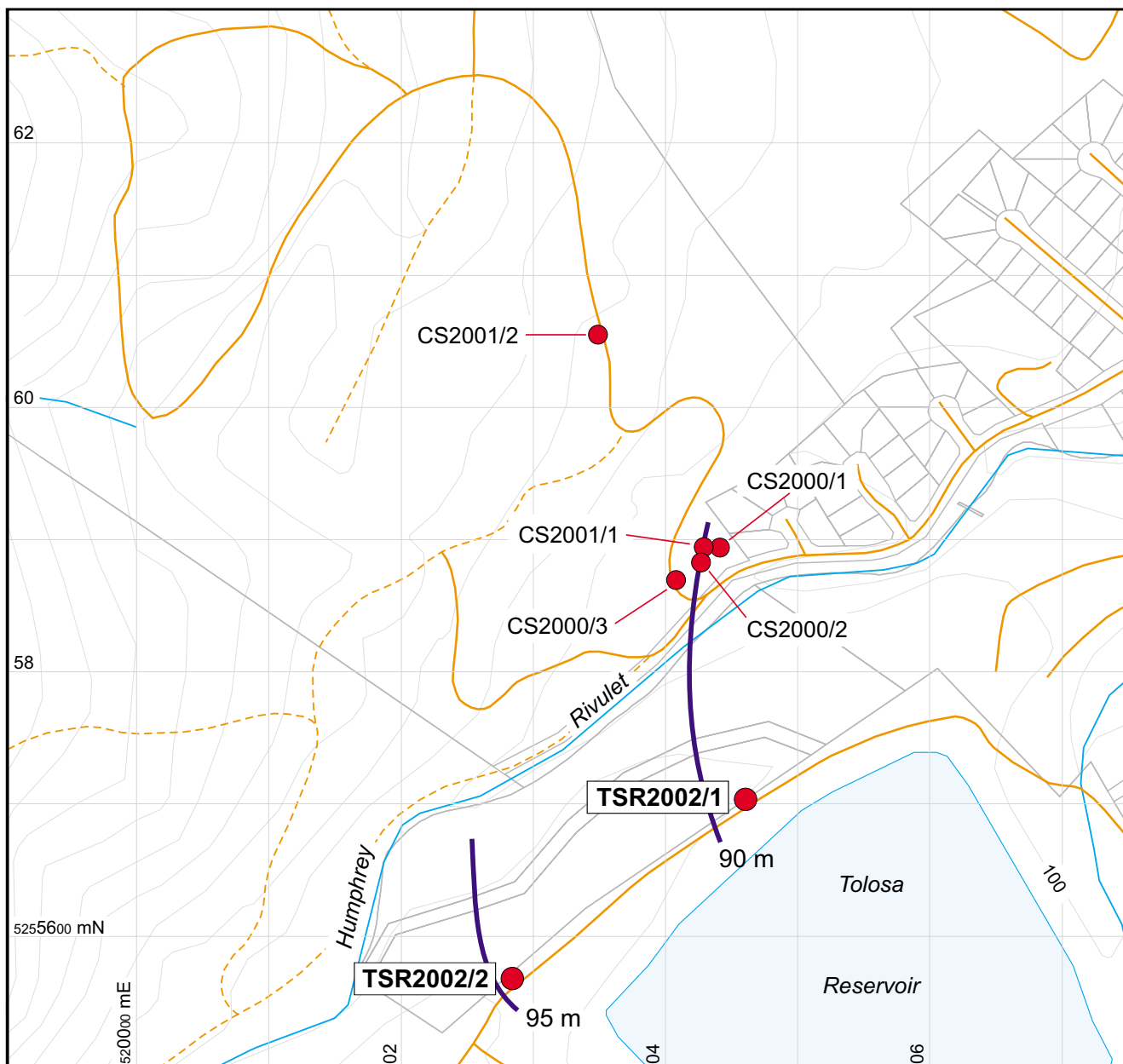


Figure 1

*Locations of monitoring bores installed at the Chapel Street waste depot and Tolosa Street Reservoir.
Interpretation of groundwater contours (RL heights) based on existing data sets.*

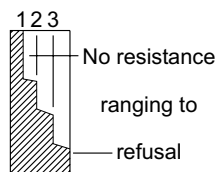
Appendix 1

Engineering logs of boreholes

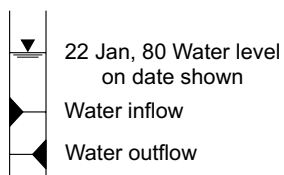
EXPLANATION SHEET FOR ENGINEERING LOGS

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

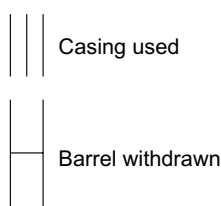
		%
VL	Very loose	0 – 15
L	Loose	15 – 35
MD	Medium dense	35 – 65
D	Dense	65 – 85
VD	Very dense	85 – 100

Fracture description

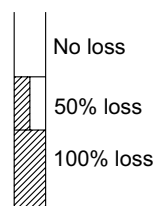
RP	Rough planar
RL	Rough irregular
SP	Smooth planar
SL	Smooth irregular

Cored borehole log

Case - lift



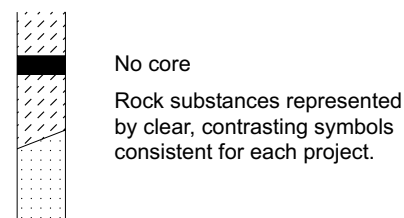
Fluid loss



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

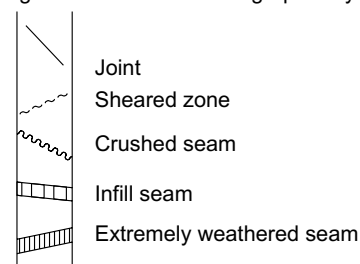
Strength

		point load strength index $1.5 \sqrt{50}$ (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

Borehole no.
TSR 2002/1
Sheet 1 of 5

Project		Chapel Street waste depot				Location		Chapel Street, Glenorchy			
Co-ordinates		55 520285 mE 5255568 mN		Drill type		Percussion		Hole commenced		23 January 2002	
				Drill method		Down hole hammer		Hole completed		23 January 2002	
R.L.				Drill fluid		Air		Drilled by		KMR Drilling Pty Ltd	
Inclination		vertical						Logged by		Mr Andrew Ezzy	
Bearing								Checked by		Mr Adrian Waite	
penetration		support		water		notes		metres		graphic 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	
				Cement		D Sample ID 1		0.5		CI	
										CLAY - medium plasticity, brown, fragments of siltstone and sandstone to 50 mm recovered	
										M	
										F	
										Permian rocks-reworked weathered	
				Back fill		D Sample ID 2		1.0		Interbedded MUDSTONE, SILTSTONE and SANDSTONE - white, grey, brown	
										D	
										Permian rock	

ENGINEERING LOG - BOREHOLE

Borehole no.
TSR 2002/1
Sheet 2 of 5

Project		Tolosa Street Reservoir		Location		Tolosa Street, Glenorchy	
Co-ordinates		55 520285 mE 5255568 mN		Drill type		Percussion	
				Drill method		Down hole hammer	
R.L.				Drill fluid		Air	
Inclination		vertical		Hole commenced		23 January 2002	
Bearing				Hole completed		23 January 2002	
				Drilled by		KMR Drilling Pty Ltd	
				Logged by		Mr Andrew Ezzy	
				Checked by		Mr Adrian Waite	

penetration			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	structure, geology
1	2	3				R.L.	depth						
										(As sheet 1)			Permian rock
				Bentonite			5.5						
							6.0						
							6.5						
					D Sample ID 5					MUDSTONE - grey, alternating layers of siltstone, green	D		Permian rock
				No Screen Sand pack			7.0						
							7.5						
							8.0						
							8.5						
							9.0						
							9.5						
					D Sample ID 6					MUDSTONE - grey	M		Permian rocks with some minor fracturing

ENGINEERING LOG - BOREHOLE

Borehole no.
TSR 2002/1
Sheet 3 of 5

Project		Tolosa Street Reservoir			Location		Tolosa Street, Glenorchy				
Co-ordinates		55 520285 mE 5255568 mN		Drill type		Percussion		Hole commenced		23 January 2002	
				Drill method		Down hole hammer		Hole completed		23 January 2002	
R.L.				Drill fluid		Air		Drilled by		KMR Drilling Pty Ltd	
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	
							(As sheet 2)			
				10.5						
				11.0						
				11.5						
				12.0						
				12.5			MUDSTONE - grey	D		Permian rocks
				13.0						
				13.5						
				14.0						
				14.5						

ENGINEERING LOG - BOREHOLE

Borehole no.
TSR 2002/1
Sheet 4 of 5

Project		Tolosa Street Reservoir		Location		Tolosa Street, Glenorchy	
Co-ordinates		55 520285 mE 5255568 mN		Drill type		Percussion	
				Drill method		Down hole hammer	
R.L.				Drill fluid		Air	
Inclination		vertical		Hole commenced		23 January 2002	
Bearing				Hole completed		23 January 2002	
				Drilled by		KMR Drilling Pty Ltd	
				Logged by		Mr Andrew Ezzy	
				Checked by		Mr Adrian Waite	

penetration			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	structure, geology		
1	2	3				R.L.	depth								
			No Screen		D Sample ID 8					(As sheet3)					
			Sand pack		D Sample ID 9					MUDSTONE - grey, pyrrhotite trace	D		Permian rocks with minor iron sulphide		
			100mm Screen, 1mm slots		S.W.L. 24/01/02					MUDSTONE - grey	D		Permian rock		
			11"		D Sample ID 10					MUDSTONE - grey	W		Fractured Permian rocks		

ENGINEERING LOG - BOREHOLE

Borehole no.
TSR 2002/1
 Sheet **5** of **5**

Project		Tolosa Street Reservoir		Location		Tolosa Street, Glenorchy	
Co-ordinates		55 520285 mE 5255568 mN		Drill type		Percussion	
				Drill method		Down hole hammer	
R.L.				Drill fluid		Air	
Inclination		vertical		Hole commenced		23 January 2002	
Bearing				Hole completed		23 January 2002	
				Drilled by		KMR Drilling Pty Ltd	
				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	
							(As sheet 4)			
					20.5					
					21.0					
					21.5					
			D Sample ID 11		22.0					
					22.5					
					23.0					
					23.5					
					24.0					
					24.5					
							End of hole			

Sample ID numbers refer to samples stored in MRT core shed

ENGINEERING LOG - BOREHOLE

Borehole no.
TSR 2002/2
Sheet 1 of 7

Project			Tolosa Street Reservoir			Location		Tolosa Street, Glenorchy					
Co-ordinates			55 520534 mE 5255764 mN		Drill type	Percussion		Hole commenced	24 January 2002				
					Drill method	Down hole hammer		Hole completed	24 January 2002				
R.L.					Drill fluid	Air		Drilled by	KMR Drilling Pty Ltd				
Inclination			vertical					Logged by	Mr Andrew Ezzy				
Bearing								Checked by	Mr Adrian Waite				
penetration			support	water	notes	metres							
1 2 3					samples, tests	R.L.	depth	graphic log	classification symbol	material	moisture condition	consistency density index	structure, geology
				Cement	D Sample ID 1				CL	CLAY - medium plasticity, brown, mottled orange	M	St	Reworked weathered Permian rocks
							0.5						
					D Sample ID 2		1.0			Interbedded MUDSTONE, SILTSTONE and SANDSTONE - red, grey, mottled clay, brown recovered	D		Permian rock
							1.5						
					D Sample ID 3		2.0			Interbedded MUDSTONE, SILTSTONE and SANDSTONE - light brown, grey	D		Permian rock
							2.5						
							3.0						
					D Sample ID 4		3.5			MUDSTONE - light brown, grey	D		Permian rock
							4.0						
							4.5						

ENGINEERING LOG - BOREHOLE

Borehole no.
TSR 2002/2
Sheet 2 of 7

Project		Tolosa Street Reservoir		Location		Tolosa Street, Glenorchy	
Co-ordinates		55 520534 mE 5255764 mN		Drill type		Percussion	
				Drill method		Down hole hammer	
R.L.				Drill fluid		Air	
Inclination		vertical		Hole commenced		24 January 2002	
Bearing				Hole completed		24 January 2002	
				Drilled by		KMR Drilling Pty Ltd	
				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 5				MUDSTONE - grey	D		Permian rock
				5.5						
				6.0						
				6.5						
			D Sample ID 6				MUDSTONE - grey	M		Permian rocks with some minor fracturing
				7.0						
				7.5						
				8.0						
				8.5						
				9.0						
				9.5						
			D Sample ID 7				MUDSTONE - grey	D		Permian rock

ENGINEERING LOG - BOREHOLE

Borehole no.
TSR 2002/2
Sheet 3 of 7

Project		Tolosa Street Reservoir		Location		Tolosa Street, Glenorchy	
Co-ordinates		55 520534 mE 5255764 mN		Drill type		Percussion	
				Drill method		Down hole hammer	
R.L.				Drill fluid		Air	
Inclination		vertical		Hole commenced		24 January 2002	
Bearing				Hole completed		24 January 2002	
				Drilled by		KMR Drilling Pty Ltd	
				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	
							(As sheet 2)			
			Bentonite	10.5						
			D Sample ID 8	11.0			MUDSTONE - brown, grey, gravel, silt	M		Fractured weathered Permian rocks
				11.5						
				12.0						
			No Screen Sand pack	12.5			MUDSTONE - grey	M		Permian rock
			D Sample ID 9	13.0						
				13.5			MUDSTONE - grey	D		Permian rock
			D Sample ID 10	14.0						
				14.5						
			D Sample ID 11							

ENGINEERING LOG - BOREHOLE

Borehole no.
TSR 2002/2
Sheet 4 of 7

Project		Tolosa Street Reservoir		Location		Tolosa Street, Glenorchy	
Co-ordinates		55 520534 mE 5255764 mN		Drill type		Percussion	
				Drill method		Down hole hammer	
R.L.				Drill fluid		Air	
Inclination		vertical		Hole commenced		24 January 2002	
Bearing				Hole completed		24 January 2002	
				Drilled by		KMR Drilling Pty Ltd	
				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	
							(As sheet 3)			
			D Sample ID 12	15.5			MUDSTONE - grey,	M		Permian rocks minor fracture zones
			D Sample ID 13	16.0						
			D Sample ID 14	16.5						
			D Sample ID 15	17.0						
				17.5						
				18.0						
				18.5			MUDSTONE - grey	D		Permian rock
				19.0						
				19.5						

ENGINEERING LOG - BOREHOLE

Borehole no.
TSR 2002/2
Sheet 6 of 7

Project		Tolosa Street Reservoir		Location		Tolosa Street, Glenorchy	
Co-ordinates		55 520534 mE 5255764 mN		Drill type		Percussion	
				Drill method		Down hole hammer	
R.L.				Drill fluid		Air	
Inclination		vertical		Hole commenced		24 January 2002	
Bearing				Hole completed		24 January 2002	
				Drilled by		KMR Drilling Pty Ltd	
				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 17	25.5			MUDSTONE - grey, light grey	W		Fractured Permian rock aquifer
				26.0						
				26.5						
				27.0						
				27.5						
			D Sample ID 18	28.0						
				28.5						
				29.0						
				29.5						

