

# 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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Mineral Resources Tasmania Tasmanian Geological Survey Record 2002/12



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

A. R. Ezzy

#### 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

22 Jan, 80 Water level on date shown Water inflow Water outflow

No	tes — s	amples and tests
el	U50	Undisturbed sample 50 mm diameter
	D	Disturbed sample
	Ν	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
- Μ Moist, no free water on hand when remoulding
- W Wet, free water on hand when remoulding
- Liquid limit LL
- PL Plastic limit
- ΡI Plasticity index
- e.g. M>PL Moist, moisture content greater than the plastic limit

#### Consistency

	: ha	and penetrometer
VS	Very soft	<25 (kPa)
S	Soft	25 – 50
F	Firm	50 - 100
St	Stiff	100 – 200
VSt	Very stiff	200 - 400
Н	Hard	>400
Fb	Friable	
Notes	: X on log is te	est 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

Casing used

Fluid loss

No loss

50% loss

100% loss

Barrel withdrawn

#### 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 x 10<sup>44</sup> mm / sec.

Stre	ngth <sub>po</sub>	point load strength						
	ind	dex 1 5 (50) (MPa)						
EL	Extremely lo	ow < 0.03						
VL	Very low	0.03 - 0.1						
L	Low	0.1 – 0.3						
М	Medium	0.3 – 1						
н	High	1 – 3						
VH	Very high	3 – 10						
EH	Extremely h	nigh >10						
Notes	: X on log is t	test result.						

#### Graphic log



#### No core

Significant defects

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

#### Weathering

Fr	Fresh
SW	Slightly weathered
HW	Highly weathered
EW	Extremely weathered

Significant defects shown graphically

# ENGINEERING LOG - BOREHOLE

 $\begin{array}{c} \text{Borehole no.} \\ \textbf{TSR 2002/1} \\ \text{Sheet } 1 \quad \text{of } 5 \end{array}$ 

٦

Project Chapel Street waste						vaste	depot Location Chapel Street, Glenorchy			Glenorchy		
Co- R.L Incl Bea	ord inat	ina tior g	tes 55 :	520285 n 5255568 al	nE mN	T	Drill type     Percussion     Hole cor       Drill method     Down hole hammer     Hole cor       Drill fluid     Air     Drilled b       Logged     Checked		commenced completed d by ed by ced by		23 January 2002 23 January 2002 KMR Drilling Pty Ltd Mr Andrew Ezzy Mr Adrian Waite	
<ul> <li>benetration</li> </ul>	support	water	notes samples, tests	R.L. depth	graphic log	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 pla siltstone and sandsto	sticity, brown, fragmen ne to 50 mm recovered	its of I	М	F	Permian rocks- reworked weathered
		Back fill	D Sample ID 2	1.0			Interbedded MUDST SANDSTONE - whit	FONE, SILTSTONE and	ıd	D		Permian rock
	No screen		D Sample ID 3	2.0-		- - - - - - - - -	MUDSTONE - grey			D		Permian rock
			D Sample ID 4	3.0-								-
				4.5-								

# **ENGINEERING LOG - BOREHOLE**

Borehole no. TSR 2002/1 Sheet 2 of 5

Project Tolosa Street Reser							voir	Tolosa Street, Glenorchy				
Co- R.L Incl Bea	ord	lina tion g	tes 55	520285 n 5255568 al	nE mN	1	Drill type Drill method Drill fluid	Percussion Down hole hammer Air	Hole comp Hole comp Drilled by Logged by Checked b	nenced pleted	23 January 2002 23 January 2002 KMR Drilling Pty Ltd Mr Andrew Ezzy Mr Adrian Waite	
<ol> <li>penetration</li> </ol>	support	water	notes samples, tests	metres Gebth de bth	graphic log	classification symbol	<b>n</b> soil type: plasticity colour, secondar	naterial or particle characteristics, y and minor components.	moisture	consistency density index	structure, geology	
	No Screen	Sand pack Bentonite Bentonite	D Sample ID 5	5.5 - 5.5 - 6.0 - 6.5 - 7.0 - 7.5 - 8.0 - 8.0 - 9.0 -			(As sheet 1) MUDSTONE - grey, siltstone, green	alternating layers of	D		Permian rock	
			D Sample ID 6	9.5		-	MUDSTONE - grey		M		Permian rocks with some minor fracturing	

# **ENGINEERING LOG - BOREHOLE**

Borehole no. TSR 2002/1 Sheet 3 of 5

Project Tolosa Street Reserve							voir	Tolosa Street, Glenorchy				
Co- R.L Incl Bea	ord ina arin	lina tior g	tes 55 ;	520285 n 5255568 al	nE mN		Drill type Drill method Drill fluid	Percussion Down hole hammer Air	Hole commenced Hole completed Drilled by Logged by Checked by		enced	23 January 2002 23 January 2002 KMR Drilling Pty Ltd Mr Andrew Ezzy Mr Adrian Waite
2 5 penetration	support	water	notes samples, tests	metres Gepth depth	graphic log	classification symbol	soil type: plastici colour, second	material ity or particle characteristics, ary and minor components.		moisture condition	consistency density index	structure, geology
	No Screen	Sand pack	D Sample ID 7	10.5 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 14.5			(As sheet 2) MUDSTONE - grey			D		Permian rocks

# **ENGINEERING LOG - BOREHOLE**

Borehole no. TSR 2002/1 Sheet 4 of 5

Project Tolosa Street Reser							voir	Tolosa Street, Glenorchy										
Co R.I Inc Be	-orc lina arin	lina tior g	ites 55 5	520285 n 5255568 al	nE mN		Drill type Drill method Drill fluid	Drill typePercussionHole commencedDrill methodDown hole hammerHole completedDrill fluidAirDrilled byLogged by Checked by		23 January 2002 23 January 2002 KMR Drilling Pty Ltd Mr Andrew Ezzy Mr Adrian Waite								
Denetration	e penetration support water water sambles' depth symbol symbol symbol				graphic log	classification symbol	<b>material</b> soil type: plasticity or particle characteristics, colour, secondary and minor components.			consistency density index	structure, geology							
						-	(As sheet3)											
			D Sample ID 8			-	MUDSTONE - grey	, pyrrhotite trace	D		Permian rocks with minor iron sulphide_ 							
						-												
	No Screen			10.5		-												
		ack				-												
		Sand pa												-				
				18.0		-												
	n slots	_	D Sample ID 9	18.5		-	MUDSTONE - grey	,	D		Permian rock							
	mm Screen, 1mn		S.W.L.	19.0- - - -		-												
	1001	Ē	D Sample ID	19.5 – - -		-	MUDSTONE - grey	7	W		Fractured Permian rocks							

## **ENGINEERING LOG - BOREHOLE**

Borehole no. TSR 2002/1 Sheet 5 of 5

F	Project Tolosa Street Reser							voir Location			Tolosa Street, Glenorchy			
( F I E	Co- R.L ncl Bea	ord inat	lina tion g	tes 55 :	520285 n 5255568 al	nE mN		Drill type Drill method Drill fluid	Percussion Down hole hammer Air	Hole commenced Hole completed Drilled by Logged by Checked by		enced eted	23 January 2002 23 January 2002 KMR Drilling Pty Ltd Mr Andrew Ezzy Mr Adrian Waite	
1	c penetration	support	water	notes samples, tests	metres depth depth	graphic log	classification symbol	soil type: plastic colour, second	material city or particle characteristics, dary and minor components.		moisture condition	consistency density index	structure, geology	
		100mm Screen, 1mm slots	Sand pack	D Sample ID 11	20.5- 21.0- 21.5- 22.0- 22.5- 23.0- 23.5- 24.0- 24.0-			(As sheet 4)						
	   S 	 Sam amj	ıple ple	ID num s stored i	bers refe n MRT c	r to ore sł	ned	End of note					- - -	

# ENGINEERING LOG - BOREHOLE

 $\begin{array}{c} \text{Borehole no.} \\ \text{TSR 2002/2} \\ \text{Sheet } 1 \quad \text{of } 7 \end{array}$ 

Pro	ojec	t	То	losa Str	eet R	leser	voir	Location	Tolos	a Str	eet, (	Glenorchy
Co R.L Inc Bea	-ord linat	lina tior g	ntes 55 g	520534 n 5255764 al	nE mN		Drill type Drill method Drill fluid	Drill type Percussion Hole ca Drill method Down hole hammer Hole ca Drill fluid Air Drilled Logger Checke		e commenced e completed ed by ged by cked by		24 January 2002 24 January 2002 KMR Drilling Pty Ltd Mr Andrew Ezzy Mr Adrian Waite
<ol> <li>penetration</li> </ol>	support	water	notes samples, tests	R.L. depth depth	graphic log	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 -		CL	CLAY - medium pla	asticity, brown, mottled	orange	М	St	Reworked weathered Permian rocks -
			D Sample ID 2	1.0			Interbedded MUDST SANDSTONE - red, brown recovered	FONE, SILTSTONE and grey, mottled clay,	1	D		Permian rock
	No screen	Back fill	D Sample ID 3	2.5-			Interbedded MUDS SANDSTONE - ligl	TONE, SILTSTONE an	d	D		Permian rock
			D Sample ID 4	4.0-			MUDSTONE - light	t brown, grey		D		Permian rock

# **ENGINEERING LOG - BOREHOLE**

 $\begin{array}{r} \text{Borehole no.} \\ \text{TSR 2002/2} \\ \text{Sheet } 2 \quad \text{of } 7 \end{array}$ 

Project Tolosa Street Reserv							voir Location			Tolosa Street, Glenorchy			
Co-ordinates 55 520534 mE 5255764 mN R.L. Inclination vertical Bearing							Drill type Drill method Drill fluid	Percussion Down hole hammer Air	Hole commenced Hole completed Drilled by Logged by Checked by		encec eted	<ul> <li>24 January 2002</li> <li>24 January 2002</li> <li>KMR Drilling Pty Ltd</li> <li>Mr Andrew Ezzy</li> <li>Mr Adrian Waite</li> </ul>	
benetration	support	water	<b>notes</b> samples, tests	metres Gepth	graphic log	classification symbol	r soil type: plasticit colour, seconda	material y or particle characteristics, ry and minor components.		moisture condition	consistency density index	structure, geology	
			D Sample ID	-		-	MUDSTONE - grey			D		Permian rock _	
			5	-		+						-	
				5.5 -		+							
				-		-						-	
				6.0 -								-	
				-		+						-	
				65-		-							
			D Sample ID	-			MUDSTONE - grey			М		Permian rocks with	
			0	-								-	
				7.0-									
	en			-								-	
	No Scre	Back fi		7.5									
				-								-	
				- 8.0 -								-	
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				-								-	
				8.5-								-	
				-								-	
				9.0-									
				-								-	
			 П	9.5 -			MUDSTONE			D		Permian rock	
			Sample ID	-			MUDSIONE - grey			U			
				-								-	

# **ENGINEERING LOG - BOREHOLE**

Borehole no. TSR 2002/2 Sheet 3 of 7

Project Tolosa Street Reserv							voir	Tolosa Street, Glenorchy				
Co-ordinates 55 520534 mE 5255764 mN R.L. Inclination vertical Bearing						I	Drill type Drill method Drill fluid	Percussion     Hole common       Drill type     Percussion     Hole common       Drill method     Down hole hammer     Hole component       Drill fluid     Air     Drilled by       Logged by     Checked b		imenced 24 January 200 ipleted 24 January 200 KMR Drilling y Mr Andrew Ez by Mr Adrian Wai		24 January 2002 24 January 2002 KMR Drilling Pty Ltd Mr Andrew Ezzy Mr Adrian Waite
vater symbol graphic log symbol r 1 7 3				graphic log	classification symbol	soil type: plastic colour, second	material bity or particle characteristics, lary and minor components.	moisture	condition consistency	density index	structure, geology	
		Bentonite					(As sheet 2)					- - - - - - - - - -
			D Sample ID 8	11.0			MUDSTONE - bro	wn, grey, gravel, silt	1	M		Fractured weathered Permian rocks
	creen	l pack	5	12.0-								
	No S	Sand	D Sample ID 9	13.0			MUDSTONE - grey	/	N	1		
			D Sample ID 10	13.5-			MUDSTONE - grey		I	)		Permian rock
			D Sample ID 11	- - 14.5 - - -								- - - - - -

# **ENGINEERING LOG - BOREHOLE**

Borehole no. TSR 2002/2 Sheet 4 of 7

Pı	oje	ct	То	losa Str	eet F	Reser	voir	Dir Location			Tolosa Street, Glenorchy			
Co-ordinates 55 520534 mE 5255764 mN R.L. Inclination vertical Bearing							Drill type Drill method Drill fluid	Percussion Down hole hammer Air	Hole commenced Hole completed Drilled by Logged by Checked by			24 January 2002 24 January 2002 KMR Drilling Pty Ltd Mr Andrew Ezzy Mr Adrian Waite		
<ul> <li>benetration</li> </ul>	t 000	water	notes samples, tests	metres depth depth	graphic log	classification symbol	soil type: plastici colour, seconda	material ty or particle characteristics, ary and minor components.		moisture condition	consistency density index	structure, geology		
				15.5-		· - - - -	(As sheet 3)							
			D Sample ID 12	16.0 -		-	MUDSTONE - grey,			М		Permian rocks minor fracture zones		
				16.5 -		-								
			Sample ID 13	17.0		-								
	Concer	u screen	D III Dack	17.5-		-								
	ĨN		Sample ID 14	18.0		-						- - - -		
			D Sample ID			-	MUDSTONE - grey			D		- - Permian rock		
			15	19.0-		-						- - - -		
				19.5 -		- - - - -						- - - -		
				-		-						-		

# ENGINEERING LOG - BOREHOLE

Borehole no. TSR 2002/2 Sheet 5 of 7

Pro	ojec	t	То	losa Str	eet F	Reser	voir	Tolosa Street, Glenorchy				
Co-ordinates 55 520534 mE 5255764 mN R.L. Inclination vertical Bearing							Drill type Drill method Drill fluid	Percussion Hole commenced Down hole hammer Air Drilled by Logged by Checked by		24 January 2002 24 January 2002 KMR Drilling Pty Ltd Mr Andrew Ezzy Mr Adrian Waite		
benetration	z 3 penetration support water water kabort water support support depth graphic log symbol symbol				graphic log	classification symbol	soil type: plastic colour, second	material soil type: plasticity or particle characteristics, colour, secondary and minor components.		moisture condition	consistency density index	structure, geology
	Screen No Screen	III Sand pack	D Sample ID 16	20.5- 21.0 - 21.5 - 22.0 - 22.5 - 23.0 - 23.5 - 24.0 -			(As sheet 4)					

# ENGINEERING LOG - BOREHOLE

 $\begin{array}{c} \text{Borehole no.} \\ \text{TSR 2002/2} \\ \text{Sheet } 6 \quad \text{of } 7 \end{array}$ 

Project Tolosa Street Reserv							voir	oir Location			Tolosa Street, Glenorchy				
Co-ordinates 55 520534 mE 5255764 mN R.L. Inclination vertical Bearing							Drill type Drill method Drill fluid	Percussion Down hole hammer Air	Hole commenced Hole completed Drilled by Logged by Checked by		d 24 January 2002 24 January 2002 KMR Drilling Pty Ltd Mr Andrew Ezzy Mr Adrian Waite				
5 penetration	vater 1 5 3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2				graphic log	classification symbol	soil type: plas colour, seco	material soil type: plasticity or particle characteristics, colour, secondary and minor components.		consistency density index	structure, geology				
	100mm Screen, 1mm slots	Sand pack	D Sample ID 17 Sample ID 18	25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0 29.5 29.5 29.5			MUDSTONE - gr	ey, light grey			Fractured Permian rock aquifer				

# **ENGINEERING LOG - BOREHOLE**

Borehole no. TSR 2002/2 Sheet 7 of 7

Project Tolosa Street Reservoir								voir	Location			Tolosa Street, Glenorchy			
	Co· R.L Incl Bea	ord	lina tion g	tes 55	520534 m 5255764 al	nE mN		Drill type Drill method Drill fluid	Percussion Down hole hammer Air	Hole com Hole com Drilled by Logged b Checked I	menced pleted /	24 January 2002 24 January 2002 KMR Drilling Pty Ltd Mr Andrew Ezzy Mr Adrian Waite			
R.L. symport water R.L. R.L. graphic log graphic log symbol						graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.		moisture	consistency density index	structure, geology			
		Screen	Sand pack		30.5-		-	(As sheet 6)				-			
					-										
					-	-									
												-  - -			
L					-	1						-			