Tasmanian Geological Survey
Record 2001/11

Drilling at Casuarina Crescent, Berriedale

A. Waite

Introduction

Casuarina Crescent is located on a small flat-topped peninsula on the western shore of the River Derwent, in the Municipality of Glenorchy in southern Tasmania. The area is between approximate Australian Metric Grid co-ordinates 520 700 mE, 5 260 800 mN and 521 000 mE, 5 260 800 mN. The potential for land instability in part of the peninsula has been recognised for a number of years (Stevenson, 1976).

Baynes Geologic was commissioned in 2000 by the Glenorchy City Council (GCC) to undertake a further investigation and review of land instability at Casuarina Crescent. A recommendation of this investigation was that a number of boreholes should be drilled and piezometers installed within them to allow long-term monitoring of groundwater levels near the southern boundary of the area subject to land instability.

Mineral Resources Tasmania (MRT) carried out a drilling programme in 2001 to emplace piezometers in suitable locations close to the boundary (hydraulically up-gradient) of the area identified in the report of the investigation carried out for GCC. Two holes were drilled with a Casagrande-type standpipe piezometer being installed in each hole.

This report contains a factual account of the work carried out.

Previous Investigations

The land instability problems at Casuarina Crescent were investigated by Stevenson (1976), who identified active landslide conditions in an area of land on the northern side of the peninsula, extending between the foreshore and the access road to properties in Casuarina Crescent. Stevenson also recognised the importance of elevated groundwater levels in influencing landslide activity.

Subsurface investigation work (Donaldson, 1976) in the low lying ground close to the foreshore proved the existence of a sequence of sandy clays overlying sandstone. Groundwater in this area was encountered at various levels and piezometric pressures, which may be a result of subsurface movement.

The report of an investigation by Baynes Geologic (Baynes, 2000) indicated the presence of a zone in which the ground was under tensional stress, extending upslope from the landslide headscarp. The report also recommended the drilling of boreholes and installation of piezometers at certain locations, to allow the long-term monitoring of groundwater levels in the area as an aid to management of the local land instability problem.

Current investigation

Two borehole locations were selected jointly by MRT, Dr Fred Baynes and Glenorchy City Council. Siting was also determined by the need for access for plant and the drilling techniques to be employed. The locations are shown on Figure 1.

Drilling work was carried out in June 2001. The objectives of this work were to recover core samples of the strata encountered and to emplace piezometers. Two boreholes (2001/1 and 2001/2) were drilled at the locations shown on Figure 1. Both holes were commenced with a lined hollow stem auger, to obtain samples of the near-surface material with minimal disturbance. Use of this method was discontinued upon encountering hard material. Drilling of the remainder of each hole was continued by rotary coring, using HQ size wireline drilling equipment to recover 76 mm nominal diameter core, except in the case of borehole 2001/1 where rotary percussion drilling was used between depths of 1.0 m and 6.0 m below ground level.

On completion of drilling, both boreholes were surveyed by total station and levelled.

Each borehole encountered a soil horizon of approximately one metre thickness. In borehole 2001/2, this was underlain by 2.41 m of extremely low strength sandstone containing gravel. In borehole

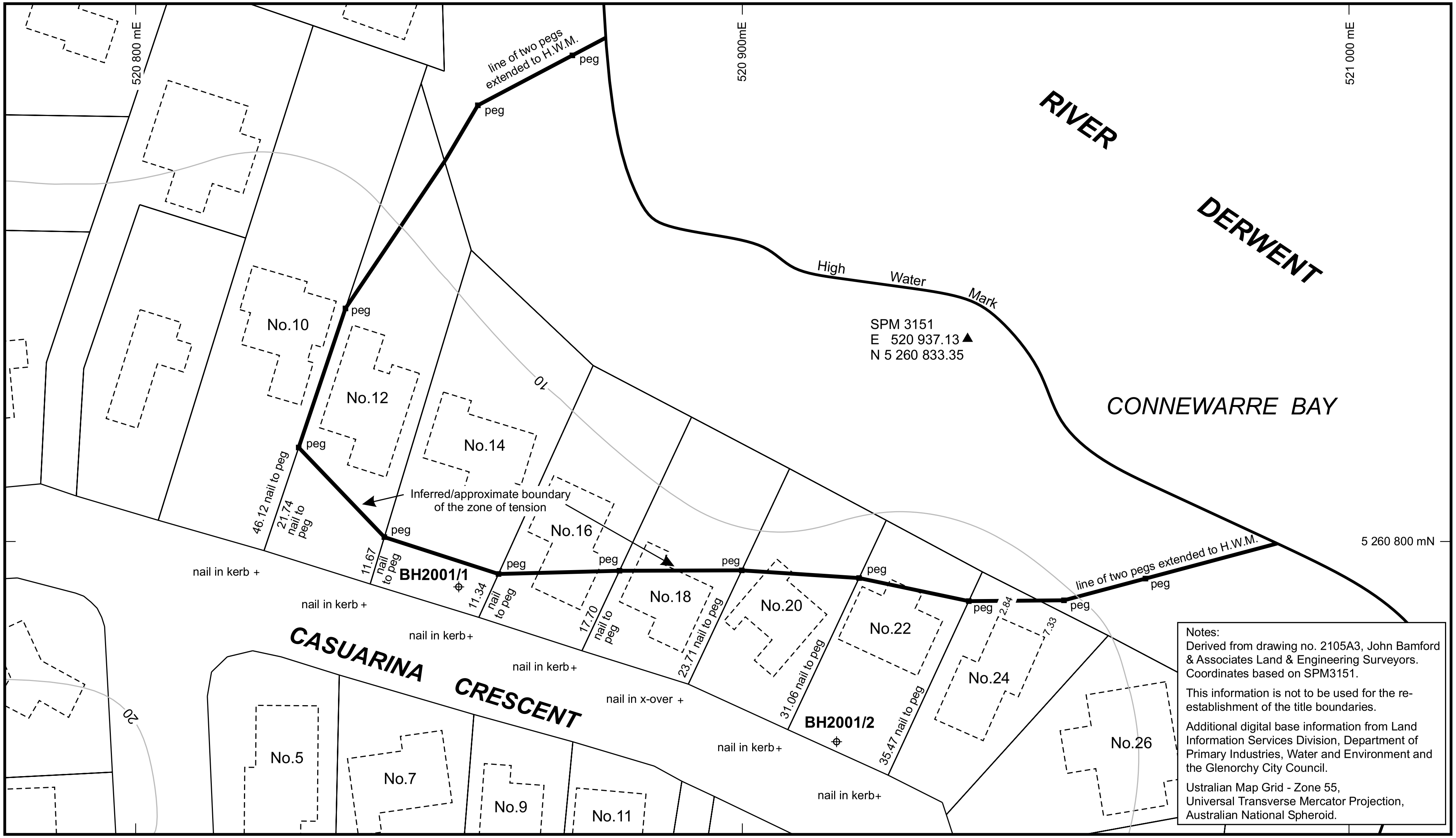


Figure 1

Tension location survey, Casuarina Crescent, berriedale

2001/1, the arisings recovered over the same depth range using a different drilling technique may also represent the same material, although this cannot be confirmed.

These near-surface materials were underlain by a sequence of gravel, cobbles and boulders, generally of dolerite and sandstone. This sequence also contained traces of an orange-brown clay in the recovered material, possibly representing the matrix of the coarser material, when present *in situ*. The deposits immediately underlying the soil horizon may represent either channel or flow deposits of possible Tertiary age, with a maximum thickness of 9.6 m present in borehole 2001/2. A mudstone/siltstone sequence was present below these deposits, and both holes were terminated in sandstone of probable Triassic age.

Jointing and fissures in the materials underlying the debris flow deposits tended to dip at high angles (generally 50–85°) and indicated few obvious signs of shear. Polishing or striation occurred in borehole 2001/2 while in borehole 2001/1, joints tended to have a clay infill, with dip angles being towards the higher end of this range, and were in many cases both polished and striated. Striations were orientated approximately normal to the joint dip directions. Borehole 2001/1 is significantly closer to the zone of tension identified by Baynes than hole 2001/2.

The borehole logs are shown in Appendix 1.

Groundwater

The drilling techniques used in drilling the boreholes did not allow detection of any water strikes encountered during drilling. A standpipe piezometer to monitor groundwater levels was installed in each borehole. Details of construction of these instruments are shown in Appendix 1.

Water levels in each instrument will be recorded on a regular basis.

Conclusions

Further information on the subsurface inland geology at Casuarina Crescent has been obtained, and instrumentation to allow long-term monitoring of groundwater levels in the vicinity of the landslide installed, as recommended by Baynes.

Recommendations

Regular monitoring of groundwater at Casuarina Crescent should be continued, and the results considered in determining a management strategy for the landslide. Should No. 16 Casuarina Crescent be demolished, it may be appropriate to consider the suitability of drilling a borehole to monitor groundwater within the zone of tension referred to by Baynes, as part of the management strategy.

References

BAYNES, F. B. 2000. *Investigation of the landslide at Casuarina Crescent*. Baynes Geologic.

DONALDSON, R. C. 1976. Drilling at Casuarina Crescent, Glenorchy. *Unpublished Report Department of Mines Tasmania* 1976/42.

STEVENSON, P. C. 1976. Ground movements at Casuarina Crescent, Glenorchy. *Unpublished Report Department of Mines Tasmania* 1976/16.

[5 November 2001]

APPENDIX 1

Borehole Logs

MINERAL RESOURCES TASMANIA

ENGINEERING LOG - CORED BOREHOLE

borehole no. 2001/1

sheet 1 of 3

project CASUARINA CRESCENT

co-ordinates	520853.25mE 5260792.52mN	drill method	Hollow stem auger to 1.0m, Rotary percussion drilling 1.00 - 6.00m Triple tube coring in HQ size using wireline system 6.00 - 20.00m	hole commenced	12/6/01
R.L.	+16.28m AHD			hole completed	15/6/01
inclination	Vertical			drilled by	KMR
		drill fluid	Water	logged by	AW
				checked by	SMF

drilling information					rock substance				rock mass defects	
fluid loss	water	notes	metres R.L.	depth	graphic log	substance description rock type: grain characteristics, colour, structure, minor components.	weathering	strength EL VL L M H VH EH	defect spacing (mm) 30 100 300 1000 3000	defect description thickness, type, inclination, planarity, roughness, coating. significant / general
		Hollow stem augering		0 – 0.5		CLAY topsoil, dark brown.				
			15.78	0.5 – 1		Recovered as SAND, fine to medium, light brown, silty, with much angular fine to medium gravel of slightly weathered dolerite.				
		Rotary percussion drilling		1 – 5						
			11.28	5 – 6		Recovered as SAND, fine to medium, light brown, slightly clayey, silty. Some fragments of greenish grey mudstone.				
		Coring	10.28	6 – 9.2		COBBLES and BOULDERS of slightly weathered dolerite and sandstone, in a matrix of brownish grey, becoming greenish grey below 8.30m, clay.				
			7.08	9.2 – 10		MUDSTONE (50%), grey and light brown becoming grey and orange brown mottled, SILTSTONE (50%), orange brown and light light grey motled, very clayey.	EW /HW			Polished surfaces, randomly orientated

ENGINEERING LOG - CORED BOREHOLE

borehole no. 2001/1
sheet 2 of 3

project CASUARINA CRESCENT

co-ordinates	drill method	hole commenced
R.L.	AS SHEET 1	hole completed
inclination		drilled by
		logged by
	drill fluid	checked by

drilling information: fluid loss	water	notes	R.L. (metres)	depth (metres)	graphic log	rock substance: substance description (rock type: grain characteristics, colour, structure, minor components.)	weathering	strength (EL VL L M H VH EH)	rock mass defects: defect spacing (mm) (30 100 300 1000 3000)	defect description (thickness, type, inclination, planarity, roughness, coating.) significant / general
		coring		10		MUDSTONE (50%), grey and light brown becoming grey and orange brown mottled, SILTSTONE (50%), orange brown and light light grey motled, very clayey.	EW /HW			
				11						joints, polished, 35°
				12		(TERTIARY)				abundant polished surfaces, 70 - 90° and locally randomly orientated.
				13						joints, rough, subvertical
			2.83			DOLERITE BOULDER, grey.	SW			
			2.53	14		CONGLOMERATE, comprised of greenish grey siltstone matrix containing rounded fine to coarse gravel of siltstone and mudstone. (TERTIARY)	HW			
			1.83			SANDSTONE, fine to medium, brownish grey locally brown, silty.	HW			Joint, smooth, subvertical, planar, striated. Striation subhorizontal.
				15						Two smooth subvertical joint sets, approx. 50° seperation, planar, infilled 2 - 10mm with grey and brown clay, frequently polished.
				16		(PERMIAN)				Joint, polished, 85° planar, striated. Striations subhorizontal.
				17						Joints, rough, 70°, planar, limonite coated, open < 1mm
										Joint, 30°, manganese oxide coated.
				18						Joints polished, occasionally smooth, 55-60°, coated by grey clay, striated, open < 1mm, striations dip 30°
										Joint, smooth, 85°, planar, tight
				19						Joint, smooth, 40°, limonite and manganese oxide coated.
			-3.72	20		End of borehole.				

MINERAL RESOURCES TASMANIA

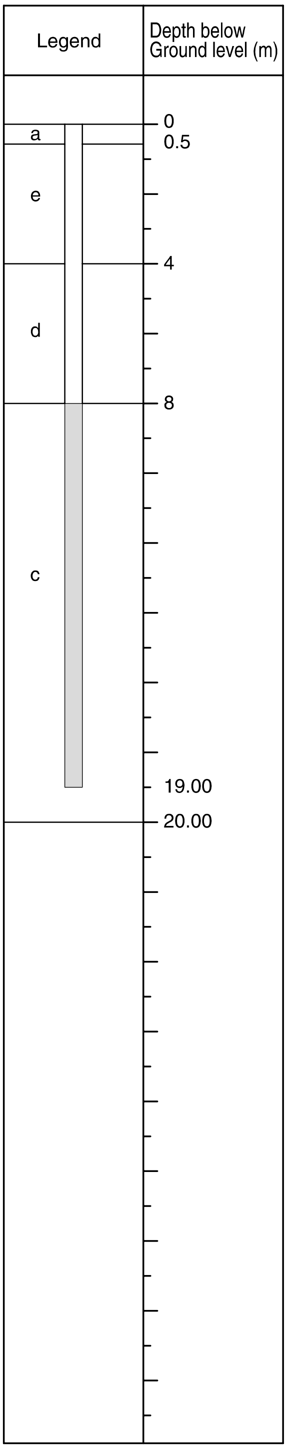
INSTALLATION SUMMARY - CORED BOREHOLE

borehole no. 2001/1
sheet 3 of 3

project CASUARINA CRESCENT

Type of installation: Standpipe
Date of installation: 15/6/01
Internal diameter of tubing: 50mm
Length of filter: 1200mm
Diameter of filter: 100mm

Depth (m)		SUMMARY OF INSTALLATION
From	To	
		Surface protection: Flush fit cover
0.00	0.50	Concrete
0.50	4.00	Grout
4.00	8.00	Bentonite seal
8.00	19.00	Slotted section
8.00	20.00	Gravel filter



key

a	Concrete	d	Bentonite seal
b	Sand filter	e	Bentonite/cement grout
c	Gravel filter	f	Backfill

Remarks
1. Ground level and coordinates as sheet 1

DETAILS OF INSTRUMENT

MINERAL RESOURCES TASMANIA

ENGINEERING LOG - CORED BOREHOLE

borehole no. 2001/2

sheet 1 of 3

project CASUARINA CRESCENT

co-ordinates	520915.54mE 5260767.01mN	drill method	Hollow stem auger to 1.0m, Open hole drilling 1.00 - 1.80m Triple tube coring in HQ size using wireline system 6.00 - 20.00m	hole commenced	15/6/01
				hole completed	19/6/01
				drilled by	KMR
R.L.	+13.19m AHD			logged by	AW
inclination	Vertical	drill fluid	Water	checked by	SMF

drilling information					rock substance				rock mass defects	
fluid loss	water	notes	metres R.L.	metres depth	graphic log	substance description rock type: grain characteristics, colour, structure, minor components.	weathering	strength EL VL L M H VH EH	defect spacing (mm) 30 100 300 1000 3000	defect description thickness, type, inclination, planarity, roughness, coating. significant general
		Hollow stem augering	12.89			Dark brown sandy silty TOPSOIL				
			12.35			CLAY, stiff, brown, high plasticity, occasional rootlets				
			12.19	1		SANDSTONE (as 1.80 - 3.25)	HW			
		Open hole drilling	11.39			NO CORING AND NO SAMPLE RECOVERY				
		Coring	9.94	2, 3		SANDSTONE, fine to medium grained, greenish brown, slightly clayey, with occasional fine to coarse gravel of quartz and extremely weathered dolerite (TERTIARY)	HW			
			9.59			CLAY, stiff, with some fine to coarse gravel of dolerite and quartz	HW			
			9.34			GRAVEL of dolerite and quartz	HW			
				4, 5, 6, 7, 8, 9, 10		Recovered as COBBLES and BOULDERS of dolerite, sandstone, tuff and quartz (TERTIARY)	HW			

MINERAL RESOURCES TASMANIA

ENGINEERING LOG - CORED BOREHOLE

borehole no. 2001/2

sheet 2 of 3

project CASUARINA CRESCENT

co-ordinates	drill method	hole commenced
R.L.		hole completed
inclination	AS SHEET 1	drilled by
		logged by
		checked by
	drill fluid	

drilling information (fluid loss, water, notes, metres: R.L., depth) — **rock substance** (graphic log; substance description: rock type: grain characteristics, colour, structure, minor components; weathering; strength: EL VL L M H VH EH) — **rock mass defects** (defect spacing (mm): 30 100 300 1000 3000; defect description: thickness, type, inclination, planarity, roughness, coating — significant / general)

notes	R.L.	depth	substance description	weathering	defect description
Coring		10	COBBLES and BOULDERS (as sheet 1) 10.67 - 10.75m: Recovered as CLAY, orange brown, sandy, with fine to medium quartz and dolerite gravel	HW	
	2.30	11	MUDSTONE, light grey (TRIASSIC)	HW	
	1.38	12	SANDSTONE, fine to medium, brownish grey (TRIASSIC)	HW	Joints, rough, planar, open < 1mm, surfaces light grey, limonite coated
	0.99	13	MUDSTONE, brown (TRIASSIC)	HW	Joints smooth, dip 70 - 80°, planar, surfaces light grey, tight or open < 1mm
	-0.21	14 15	SILTSTONE, brown, locally light grey, very clayey (TRIASSIC)	HW SW	Joints smooth, dip 70 - 80°, planar, limonite coated, occassionally surface light grey, tight Joint, rough, dip 75°, planar, surfaces light grey Joints rough, dip 70°, planar, tight Highly fractured
	-2.56	16	MUDSTONE, dark grey (TRIASSIC)	SW	Joint, rough, dip 75°, planar, tight, limonite coated
	-3.06		SANDSTONE, fine to medium, brown (TRIASSIC)	SW	
	-3.31	17	SANDSTONE, fine to medium, grey 16.87 - 18.00m: Partings of black siltstone spaced 2 - 5 mm (TRIASSIC)	SW	Joint, smooth, dip 75°, planar, tight, calcite infilled < 1mm
	-4.81	18	SANDSTONE, fine to medium, brown (TRIASSIC)	SW	
	-5.84	19	SANDSTONE, fine to medium, grey, with partings of black siltstone spaced 2 - 5mm (TRIASSIC)		
	-6.81	20	End of borehole		

MINERAL RESOURCES TASMANIA

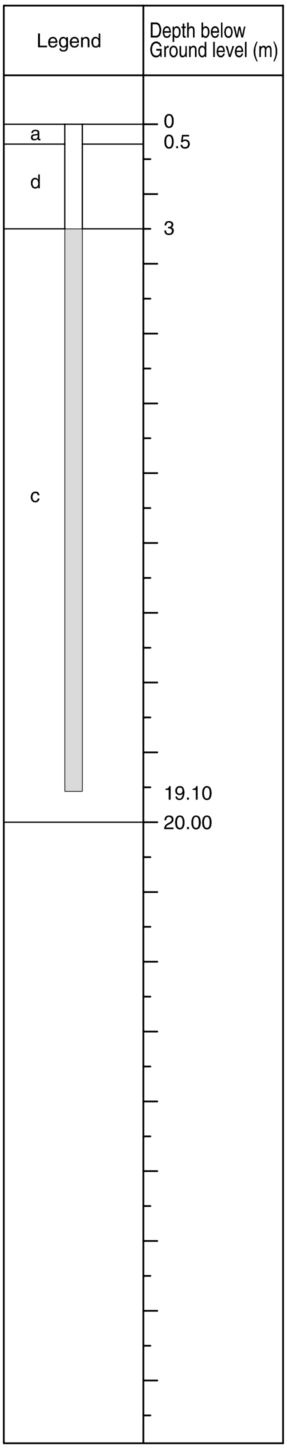
INSTALLATION SUMMARY - CORED BOREHOLE

borehole no. 2001/2
sheet 3 of 3

project CASUARINA CRESCENT

Type of installation:	Standpipe
Date of installation:	19/6/01
Internal diameter of tubing:	50mm
Length of filter:	1700mm
Diameter of filter:	100mm

Depth (m)		SUMMARY OF INSTALLATION
From	To	
		Surface protection: Flush fit cover
0.00	0.50	Concrete
0.50	3.00	Bentonite seal
3.00	19.10	Slotted section
3.00	20.00	Gravel filter



key

a	Concrete	d	Bentonite seal
b	Sand filter	e	Bentonite/cement grout
c	Gravel filter	f	Backfill

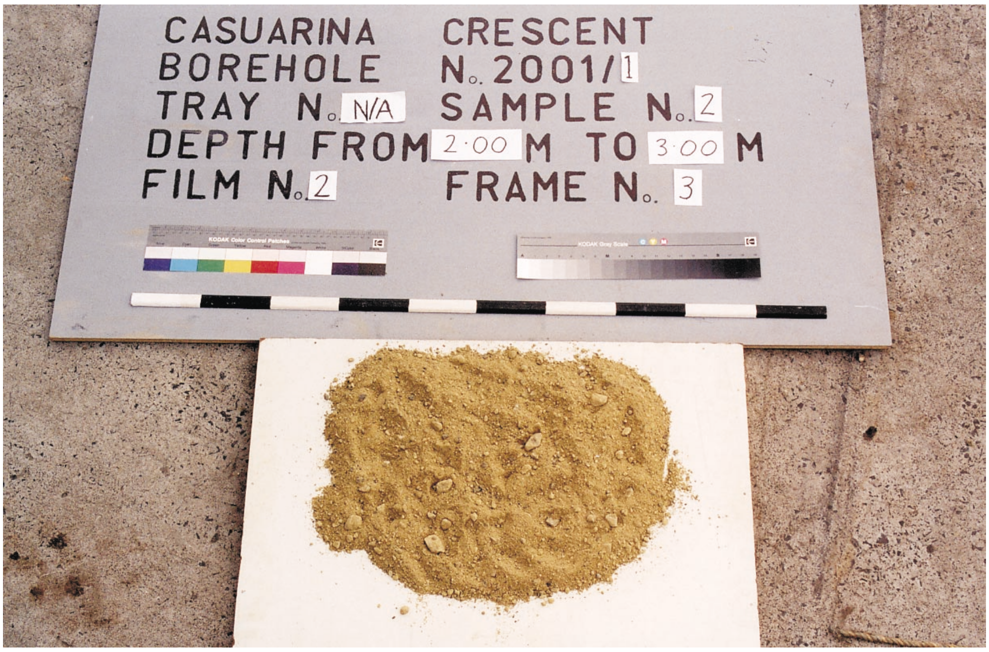
Remarks
1. Ground level and coordinates as sheet 1

DETAILS OF INSTRUMENT

Appendix 2

Core photographs

Sample 1, 1.00 – 2.00 m



Sample 2, 2.00 – 3.00 m

Sample 3, 3.00 – 4.00 m

Sample 4, 4.00 – 5.00 m

Sample 5, 5.00 – 6.00 m

Hole 2001/01
00.0 – 9.70 m

Hole 2001/01
9.70 – 13.45 m

Hole 2001/01
13.45 – 17.95 m

Hole 2001/01
17.95 – 20.00 m

Hole 2001/02
0.00 – 7.75 m

Hole 2001/02
7.75 – 13.75 m

Hole 2001/02
13.75 – 18.25 m

Hole 2001/02
18.25 – 20.00 m