

1980/30. Groundwater investigations at Milford for the Tasmania Golf Club

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Abstract

Shallow drilling on Milford Farm has shown that the Quaternary marine, estuarine and aeolian sediments contain at least two water-bearing horizons separated by impermeable clay: a lower confined marine sand unit and an upper unconfined and partly confined aeolian/marine? unit. The resultant piezometric water level is generally continuous, ranging from 0-5 m above sea level. Both saturated units are too fine grained and of too low permeability to be useful aquifers, except in isolated pockets. Neither is capable of usefully supplying water to the golf club. In addition, the water salinity (up to 4000 mg/l) is too high for irrigation of greens and fairways.

INTRODUCTION

The Tasmania Golf Club on Pittwater Bluff [EN413592] uses up to about 4.5 Ml water each week for irrigating greens and fairways. All of this water comes from the Metropolitan Water Board's main on the Tasman Highway along the Club's south-eastern boundary. The Club asked the Department of Mines whether it was economically and geologically feasible to supplement or even replace this water with suitable groundwater from the district. In initial talks with club officials, the Department indicated that the Seven Mile Beach area east of Hobart Airport probably contained a large supply of suitable groundwater, but that more detailed studies would need to be made. It became obvious that the most expensive part of a groundwater scheme in that area would be the construction of a 2.5-3 km water main to the golf course. Club officials therefore asked that an initial survey be made on Milford Farm, immediately south-east of the Club to see whether a cheaper but smaller source of groundwater might be available, so reducing the Club's high water rates.

PREVIOUS INVESTIGATIONS

The first published account of the groundwater of the Seven Mile Beach area is that of Matthews (1964), who discussed groundwater conditions at the Royal Hobart Golf Course. (An early unpublished report, dated 1958, commissioned by the Royal Hobart Golf Club and done by consulting engineers, recommended the construction of soaks and use of groundwater for irrigation). Leaman (1971) discussed the regional hydrology of the Coal River Basin, including the Seven Mile Beach area, but his comments are too general to be applicable to the present survey. Later (Leaman, 1973) he conducted shallow augering and seismic surveys on Milford Farm to determine the area's suitability as a cemetery site. Leaman concluded that at least 25 m of sand and clay were present, overlying Triassic quartz sandstone at shallow (<6 m) depth near the Tasman Highway. From measured water levels in augered holes, he showed that (in 1973 at least), water tables and piezometric levels were deepest (>3 m) along the highway, and were closest to the surface (<1.5 m) towards the south-east.

In a preliminary but more detailed study of the hydrology of Seven Mile Beach, Cromer and Sloane (1976) drilled about 150 shallow auger holes throughout the area. About a dozen of these were in or near Milford Farm. This work generally confirmed Leaman's earlier conclusions about the slope of the water table, and also showed that water table salinities increased

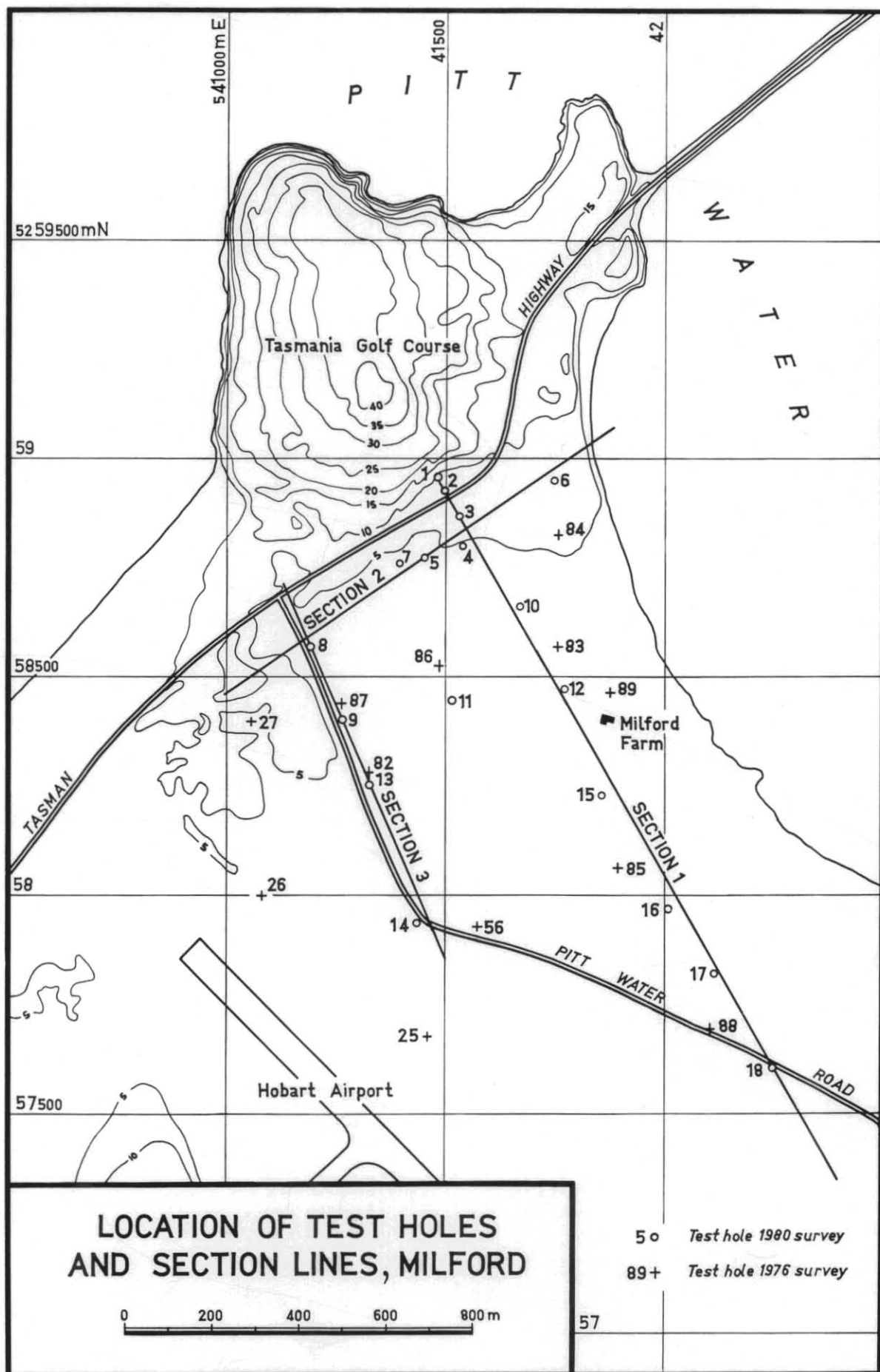


Figure 1.

from about 300 mg/l along the Pitt Water coast to more than 4000 mg/l in the clayey high water table levels in the centre of Milford Farm. The best quality water (100-200 mg/l) occurs south and east of Hobart Airport.

AIMS OF THE PRESENT INVESTIGATIONS

It was known from these earlier studies that groundwater existed at Milford, but that over most of the area its quality was not suitable for irrigating greens and fairways. (It is hard to give salinity limits for irrigation, and various factors including the nature and proportions of dissolved constituents in groundwater, soil type, frequency of irrigation, type of grass and frequency and amount of rainfall, must be considered. As an example, the Royal Hobart Golf Club sets as an upper salinity limit a value of about 2500 mg/l for groundwater irrigation of fairways and greens. Groundwater higher in salinity is either not used or diluted with surface water).

Even before the current investigations, it did not seem feasible that the Milford area was capable of supplying enough water of suitable quality. Nevertheless, the detailed geology of the unconsolidated sediments - the most promising aquifer - was unknown, and it was thought important to establish the stratigraphy of the area and the presence and nature of water-bearing horizons. It was intended to further test promising areas by pump testing and water analyses.

During the period 29 July - 20 August 1980 eighteen shallow bore holes were drilled at various sites on Milford Farm and the Tasmania Golf Club. The sites were chosen to enable geological sections to be drawn along two NNW-SSE lines and one WSW-EWE line.

The locations of all bores (including relevant holes from the 1976 survey) and section lines are shown in Figure 1. Holes 1-18 were drilled during the present survey; holes 25-27, 56 and 83-89 were drilled during 1973/74. Detailed logs of holes 1-18 (and less detailed logs of the earlier holes) are presented in Appendix I (the logs should be studied in conjunction with the explanatory sheet and notes accompanying the appendix). From these detailed logs geological cross-sections (fig. 2) were drawn showing tentative stratigraphic correlations (dashed lines) and water tables and piezometric levels (heavy dashed lines). The small horizontal arrows in Figure 2 indicate the depths at which water was struck. Holes 1-18 were surveyed and levelled. Heights are accurate to the nearest centimetre and are tied into the Australian Height Datum (AHD). Approximate high water mark (HWM) at Pitt Water is 0.62 m AHD.

RESULTS OF DRILLING

The main conclusions of the drilling survey, presented in Figure 2, can be briefly summarised as follows.

- (a) One hole (7) struck hard material (possibly Triassic sandstone basement), at a depth of -0.9 m AHD.
- (b) The unconsolidated sediments, all probably Quaternary in age, consist of a complex interbedded series of windblown (aeolian) sand, sand derived from weathered sandstone, marine shelly sand, and estuarine silty and clayey sand, sandy clay and clay. Tentative correlations suggest a subdivision into five units (youngest first):

- (1) Aeolian sand (1a) and sand and slightly clayey sand possibly derived both from wind-blown processes and from weathering of sandstone (1b).
 - (2) Estuarine clay, cropping out on the surface at the south-eastern end of Milford Farm (section 1 of fig. 2) and buried beneath unit 1 near Pitt Water (section 2) and along Pitt Water Road (section 3).
 - (3) Marine (in places possibly estuarine) sand underlying either units 1 or 2.
 - (4) Estuarine clay, sandy clay and minor sand or clayey sand of variable thickness (0.2-3 m) underlying the marine unit.
 - (5) Marine sand, possibly aeolian in places, and with minor silty or clayey sand, underlying unit 4.
- (c) Hydrologically the most important unit is unit 4, an impermeable barrier which separates two water-bearing horizons (units 3 and 5). The clay layer confines unit 5 so that artesian (or pressure water) occurs in the sand. The piezometric level of this lower aquifer is approximately 0-1 m AHD. At the south-eastern end of the section line where the confining layer (unit 4) is absent, true water table conditions exist in the marine sand, and the water table is continuous with the tidal canal.

The upper aquifer (unit 3) is partly confined near holes 15, 16 and 17 where it is overlain by impermeable clay (unit 2). Towards the Tasman Highway, however, true water table conditions exist at heights varying from 0-5 m AHD. The heavy dashed lines in Figure 2 represent the resultant water level from both aquifers at the time of the survey.

- (d) Hole 6 was dry, and it seems likely that a continuous water table does not exist throughout the area, especially along the Tasman Highway towards Pitt Water.
- (e) In most of the holes, the grain size of the water-bearing horizons was very fine to fine sand, often with varying amounts of clay or silt. It was not possible to obtain water samples from the open holes because of the sloppy nature of the sediments. This indicates that in most areas both the upper and lower "aquifers" have very low permeabilities and that, in general, neither would be capable of supplying useful quantities of clear water to shallow bores drilled into them. Small pockets of clean, coarser grained sand do exist, and these would probably be able to sustain low-yielding bores. The permeability of the sediments tends to increase markedly to the south-east of Milford near the tidal canal, where the combined marine/estuarine succession gives way to a marine sequence.

CONCLUSIONS

Because of the low permeability of the upper (unconfined) and lower (confined) water-bearing horizons at Milford, and the generally poor quality

of the water they contain, the area investigated is not capable of supplying even moderate amounts of water to the Tasmania Golf Club. Further investigations are therefore not warranted.

South-east of the marsh and tidal canal (where brackish groundwater has probably contaminated the underlying sand), better quality groundwater exists in the marine sand comprising the Seven Mile Beach spit. Earlier surveys suggest this area could be capable of supplying large amounts of water. However, before such a source is tapped, more detailed work will need to be done. If the Tasmania Golf Club wishes to proceed with such studies it will need to fully discuss the proposals with the new owner of the land, the Lands Department.

REFERENCES

CROMER, W.C; SLOANE, D.J. 1976. The hydrology of Seven Mile Beach.
Unpubl.Rep.Dept.Mines Tasm. 1976/10.

LEAMAN, D.E. 1971. The geology and ground water resources of the Coal River Basin. *Undergrn.Wat.Supply Pap.Tasm.* 7.

LEAMAN, D.E. 1973. Proposed lawn cemetery, Milford, Pitt Water. *Tech. Rep.Dep.Mines Tasm.* 16: 206-207.

MATTHEWS, W.L. 1964. Underground water at Seven Mile Beach Golf Course. *Tech.Rep.Dep.Mines Tasm.* 8: 144-145.

[29 August 1980]

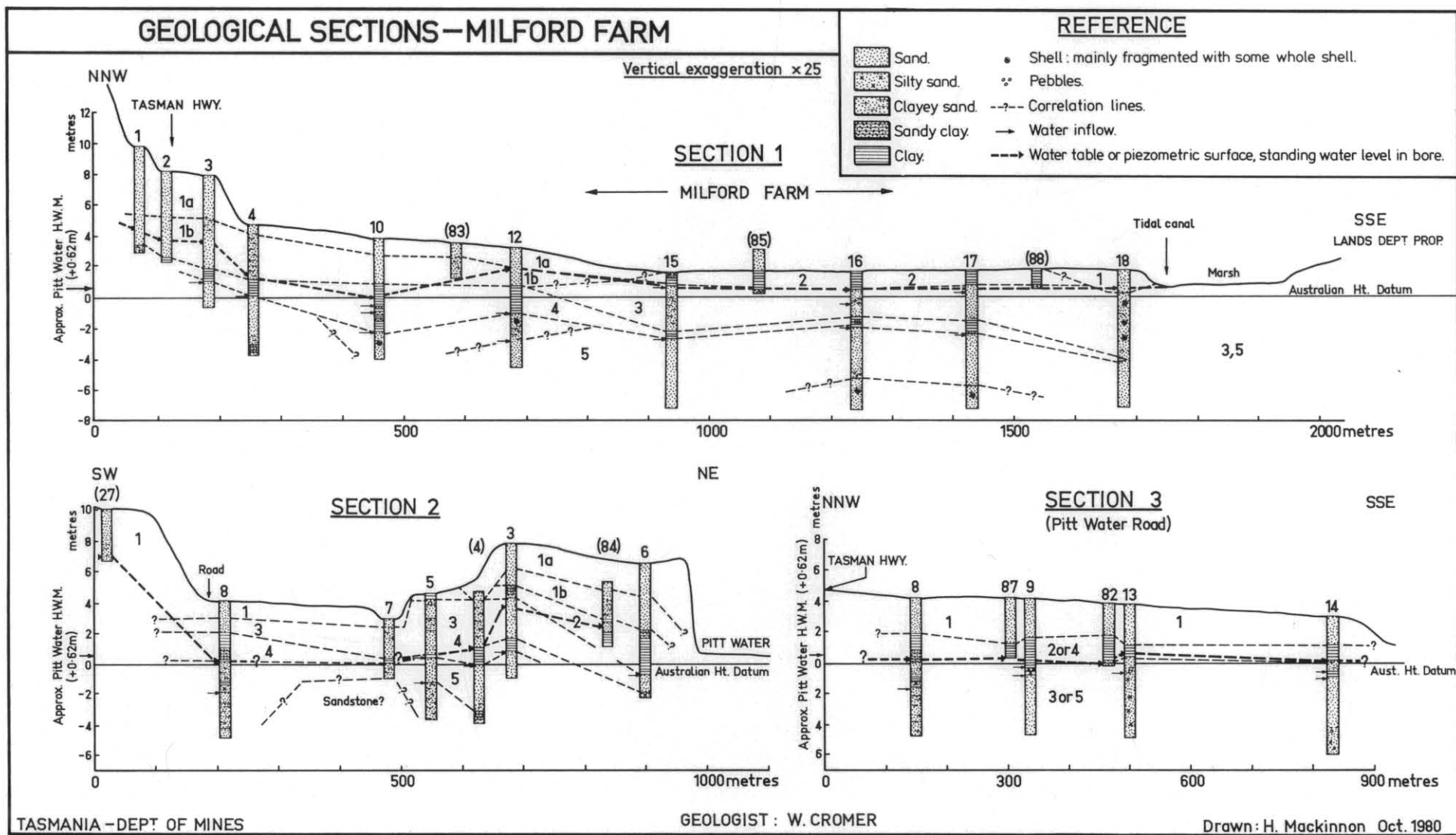
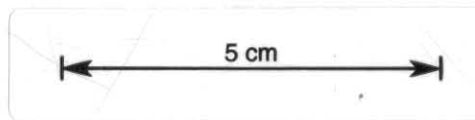


Figure 2.



APPENDIX 1

Geological logs of bores 1-18 and holes 25-27, 56 and 83-89.

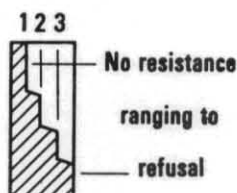
These logs should be read in conjunction with the accompanying explanation sheet. (Note the additions of colour, grain size and sorting to the sheet). All symbols used in the graphic log column are standard, and the relative density or frequency of a symbol is an indication of the nature of the material encountered.

TASMANIA DEPARTMENT OF MINES

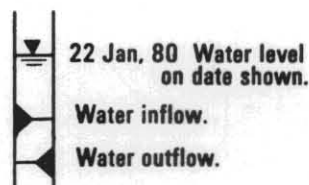
EXPLANATION SHEET FOR ENGINEERING LOGS

Borehole and excavation log

Penetration



Water



Notes - samples and tests

U50 Undistributed sample
50mm diameter.
D Disturbed sample.
N Standard penetrometer
blow count for 300mm.
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.
*COLOUR: All colour codes are based on Revised Standard Soil Colour chart 1971.

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

VS Very soft.
S Soft.
F Firm.
St Stiff.
VSt Very stiff.
H Hard.
Fb Friable.

hand penetrometer
(kPa)

< 25
25 - 50
50 - 100
100 - 200
200 - 400
> 400

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

*GRAIN SIZE (sand range)

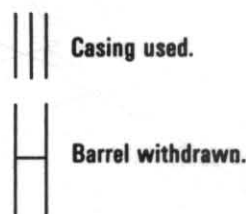
VF Very fine
F Fine
M Medium
C Coarse

*SORTING

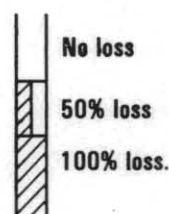
WS, MS, PS: well-, moderately and poorly-sorted.

Cored borehole log

Case - lift



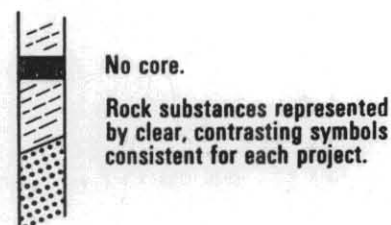
Fluid loss



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



Weathering

Fr Fresh.
SW Slightly weathered.
HW Highly weathered.
EW Extremely weathered.

Strength

EL Extremely low.
VL Very low.
L Low.
M Medium.
H High.
VH Very high.
EH Extremely high.

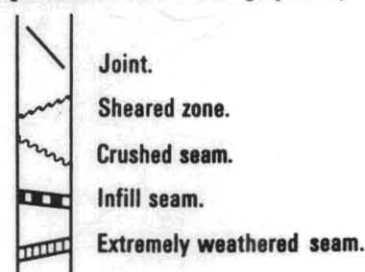
point load strength
index I_5 (50) (MPa)

< 0.03
0.03 - 0.1
0.1 - 0.3
0.3 - 1
1 - 3
3 - 10
> 10

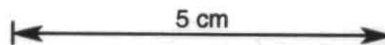
Note: X on log is test result.

Significant defects

Significant defects shown graphically.



ENGINEERING LOG – BOREHOLE



borehole no. /

sheet / of /

project		TASMANIA GOLF CLUB		location		In sandpit adjacent to Groundsman's shed, collar 2m below natural surface	
co-ordinates		541480m E 5258450m N		drill type		TRIEPUS	
R.L.		9.81m		drill method		AUGER PULL	
inclination		VERTICAL		drill fluid		NONE	
bearing		-		hole commenced		29.7.80	
				hole completed		29.7.80	
				drilled by		BC	
				logged by		WCC	
				checked by		ATM	

penetration 1 2 3	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 penetr- ometer kPa 25 50 100 200 400	structure, geology
	NONE			1		SP	SAND, yellowish brown (10YR 5/8), VF to F, WS, trace clay; grading to bright yellowish brown (10YR 6/6) VF, WS, and darkening near 1.5m to yellowish brown (10YR 5/6)	D	VL		AEOLIAN, GRADING TO SAND PROBABLY DERIVED FROM WEATHERED TRIASSIC SANDSTONE
				2							
				3							
				4							
				5		SP	SAND, bright yellowish brown (10YR 6/6), M, WS, with trace of M rock fragments & heavy minerals	M	L		
				6		SP	SAND, brown (10YR 4/6), M, WS, with trace clay, M dark rock fragments and flecks of cream, M rounded quartzite grains	W			
						SC	clayey SAND, mottled yellowish brown (10YR 5/6) and yellowish brown (2.5Y 5/7)		S		
				7			HOLE STOPPED AT REQUIRED DEPTH, 6.9m.				

ENGINEERING LOG – BOREHOLE

5 cm

borehole no. 2

sheet / of /

project		TASMANIA GOLF CLUB		location		Adjacent to Tasman Highway, on TGC land, in front of groundsman's shed; bearing 135°M from hole 1.	
co-ordinates		541490 ME 5258925 MN		drill type		TRIEFUS	
R.L.		8.13m		drill method		AUGER PULL	
inclination		VERTICAL		drill fluid		NONE	
bearing		-		hole commenced		29.7.80	
				hole completed		29.7.80	
				drilled by		BC	
				logged by		WCL	
				checked by		ATM	

penetration 1 2 3	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 penetr- ometer kPa 25 50 100 200 400	structure, geology
	NONE					SP	SAND, bright yellowish brown (10YR 7/6), F, WS, with trace C quartz grains and F dark rock fragments	D	VL		AEOLIAN, GRADING TO SAND AND CLAY PROBABLY DERIVED FROM WEATHERED TRIASSIC SANDSTONE
				1							
				2		SP	SAND, as above, but slightly coarser, trace fines; grades at 3.3m to paler slightly mottled sand, with dark olive grey (2.5GY 4/1) and dull yellow (2.5Y 6/4) mottles and irregular patches. Trace wood fragments	M	L		
				3							
				4		SP	SAND, dull yellow (2.5Y 6/4), VF-F, WS, trace fines? and brown wood fragments; with occasional irregular streaks of dark olive grey (2.5GY 4/1) and bright yellowish brown (10YR 7/6) sand.	W			
				5		SP	SAND, greyish yellow (2.5Y 6/2), VF-F, WS, with occasional streaks and patches of yellowish brown (2.5Y 5/4) sand; mainly yellowish brown 4.7-4.9m, changing to greyish yellow at 5.5m				
				6			Sandy CLAY, mottled yellowish brown (10YR 5/6) and olive grey (5GY 5/1)	F			
HOLE STOPPED AT REQUIRED DEPTH OF 6.0m.											

ENGINEERING LOG - BOREHOLE

project		TASMANIA GOLF CLUB		location		Milford Farm, 70-80m from h/2, bearing 120°M.	
co-ordinates		54 1535 m E 525 8860 m N		drill type		TRIEFUS	
R.L.		7.88m		drill method		AUGER PULL	
inclination		VERTICAL		drill fluid		NONE	
bearing		-		hole commenced		29.7.80	
				hole completed		29.7.80	
				drilled by		B.C	
				logged by		WCC	
				checked by		ATM	

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 penetr- ometer kPa 25 50 100 200 400	structure, geology
1 2 3	NONE					SP	SAND, dull yellow orange (10YR 6/4), grading rapidly to bright yellowish brown (10YR 7/6), F, WS, with streaks and patches (some weakly cemented) of yellowish brown (10YR 5/6) sand below 1.5m	M D	L VL		AEOHIAN, PROBABLY WITH SOME SAND AND FINES DERIVED FROM WEATHERED TRIASSIC SANDSTONE. POSITION OF BASE UNCERTAIN
				1							
				2							
				3		SP	SAND, bright yellowish brown (10YR 6/8), F, WS, trace fines and F wood fragments. Fines increase slightly near 3.3m. Sand friable in places		VL to Fb		
				4		SP	SAND, mottled and streaked dull yellow (2.5Y 6/4) and bright yellowish brown (10YR 6/8), F, WS, with trace clay, especially near 4.2m		L		ESTUARINE DEPOSITS?
				5				W			
				6		SP	SAND, greyish yellow (2.5Y 6/2), F, WS, trace fines, increasing with depth below 6m; slightly mottled near 5.2m with bright yellowish brown (10YR 6/8)				
				7		CL	CLAY, dark olive (5Y 4/3), mottled and streaked with yellowish brown (2.5Y 5/3), dark greenish grey (7.5G 4/1) with small patches and nodules of yellowish brown. Mod. plastic	M CL	ST PL		
				8		SP	SAND, greyish yellow brown (10YR 4/2), M, WS	W	L		
				9			HOLE STOPPED AT REQUIRED DEPTH OF 8.7m				

30-12

ENGINEERING LOG – BOREHOLE

5 cm

13/38

borehole no. 5

sheet / of /

project		TASMANIA GOLF CLUB		location		Mitford Farm, bearing 180°M from hole 1, 212°M from hole 3.			
co-ordinates		541435m E 525 8760 m N		drill type		TRIEFUS			
				drill method		AUGER PULL			
R.L.		4.46m		drill fluid		NONE			
inclination		VERTICAL				hole commenced		30.7.80	
bearing		-				hole completed		30.7.80	
						drilled by		BC	
						logged by		WCC	
						checked by		ATM	

penetration	support	water	notes	metres	graphic log	classification	material	moisture	consistency	hand	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	penetr-ometer kPa 25 50 100 200 400	
	NONE					CL	CLAY, brownish black (10YR 3/2), mottled with brown (10YR 4/4); trace silt; moderately plastic	D	F		ESTUARINE SEDIMENTS, POSSIBLY WITH MARINE SEDIMENTS
						SC	CLAYEY SAND, brown (10YR 4/6), M, WS, with trace F, white flecks of calcareous material		L		
						SP	SAND, dull yellow orange (10YR 6/3), F, WS, trace charcoal				
						SP	SAND, brown (10YR 4/6), F-M, WS, trace fines				
						SC	CLAYEY SAND, mainly yellowish brown (10YR 5/6) mottled with light yellow (2.5Y 7/4). Clayier near 2.4m				
						SP	SAND, dull yellow (2.5Y 6/4), F, WS, trace C quartzite grains				
						SP	SAND, dull yellowish brown (10YR 5/3), F, WS, grading to dark greyish yellow (2.5Y 5/2) M, WS. Streaked with irregular patches of dull yellowish brown (10YR 5/4). Trace clay near 4.1m				
						SC	CLAYEY SAND - sandy CLAY, light grey (2.5Y 8/2) and white, with trace M-C quartz grains in clayey matrix. Distinctive unit.	W	VS		
						SP	SAND, greyish yellow brown (10YR 5/2), M, WS, trace fines, with occasional irregular nodules of calcareous - cemented sand up to 25mm, and smaller M flecks of similar material. Trace C quartzite fragments, and small patches of sandy clay (lenses) are present.	M	L to St		
						SC	CLAYEY SAND - sandy CLAY, mottled yellow brown (2.5Y 5/3) and yellow brown (10YR 5/6), with dark olive grey clayey (5GY 4/1) core unreliable; probably thin interbedded layers. Probably loose sand at base. Very similar to 3.7-4.8m in hole 4.	W	L		
						SC	CLAYEY SAND, dull yellow (2.5Y 6/3), F-M, WS, grading through yellowish brown (10YR 5/8) to dull yellow (2.5Y 6/4), with patches of light grey (7.5Y 5/2). Sticky in places.				
							HOLE STOPPED AT REQUIRED DEPTH OF 8.4m				

ENGINEERING LOG - BOREHOLE

project		TASMANIA GOLF CLUB		location		Milford Farm, 130m from HWM, bearing 256°M to hole 1.	
co-ordinates		541742 mE 5258955 mN		drill type		TRIEFUS	
R.L.		6.66m		drill method		AUGER POLL	
inclination		VERTICAL		drill fluid		NONE	
bearing		-		hole commenced		30.7.80	
				hole completed		30.7.80	
				drilled by		BC	
				logged by		WCC	
				checked by		ATM	

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 penetr- ometer kPa	structure, geology
1	2	3								25 50 100 200 400	
						SP	SAND, dull yellow orange (10YR 7/3), VF-F, WS	D	VL		AEOLIAN ? - ? ESTUARINE SEDIMENTS
				1		SP	SAND, yellowish brown (10YR 5/6), F, WS, trace fines, grading rapidly to yellowish brown (2.5Y 5/4) mottled (with brown) in places, flecked with M CaCO ₃ - cemented patches. Trace fines and rock fragments. Pales to dull yellow (2.5Y 6/4) below 1.5m.		L		
				2		SP	SAND, mottled yellowish brown (10YR 5/6) and bright brown (7.5YR 5/8), F, WS. Trace clay				
				3		SP	SAND, dull yellow (2.5Y 6/4) and light yellow (2.5Y 7/3), F, WS				
				4		SP	SAND, mottled bright yellowish brown (10YR 6/6), dull yellow (2.5Y 6/4) and greenish grey (7.5GY 6/1), trace clay, friable in places, F, WS		L to Fb		
				5		SC	Sandy CLAY, dark olive (5Y 4/4)	M	F		
				6		CL	CLAY, dark olive (5Y 4/3), mottled in places with yellowish brown and grey-green greying. Some small grey-green sandy clay patches. Below about 5.6m, colour change to mottled dark greyish yellow (2.5Y 4/2), brownish black (2.5Y 3/2) and yellowish brown. Trace charcoal streaks. Moderately plastic. Yellowish brown (2.5Y 4/3), with sandy clay patches, 6.6 - 7.2m.		St		
				7		CH					
				8		SP	SAND, yellowish brown (2.5Y 5/3), F, WS, trace clay and silt	W	L		
						SC	SAND, olive brown (2.5Y 4/3), M, trace clay	M	MO		
						SM	Silty SAND, greyish brown (7.5YR 4/2)	W	L		
				9			HOLE STOPPED AT REQUIRED DEPTH, 8.7m.				

ENGINEERING LOG - BOREHOLE

project		TASMANIA GOLF CLUB		location		On track, 120m From Highway, bearing 50°M to hole 5; Rillford Farm	
co-ordinates		541370 m E 5258735 m N		drill type		TRIEFUS	
R.L.		3.04m		drill method		AUGER PULL	
inclination		VERTICAL		drill fluid		NONE	
bearing		-		hole commenced		31.7.80	
				hole completed		31.7.80	
				drilled by		BC	
				logged by		WCC	
				checked by		ATM	

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 index density index	hand penetr- ometer kPa	structure, geology
1 2 3											
	NONE					SP	SAND, dull yellow orange (10YR 6/3), VF, WS, some roots	D	VL		AEOLIAN
				1		SP	SAND, brown (10YR 4/6), mottled with olive yellow (5Y 6/3) patches, F-M, with trace clay, grading to dark greyish yellow (2.5Y 5/2) sand mottled with yellowish brown (10YR 5/8)	M	L to Fb		ESTUARINE SEDIMENTS
				2		SP, SW, SM	SAND, dark greyish yellow (2.5Y 5/2), M, M-PS, trace silt, and clay patches (up to 15mm), some well-rounded quartzite fine gravel (up to 10mm), some angular C sand. Near 2.6m, colour change to dull yellowish brown (10YR 5/4), M, WS, with trace fines		S		
				3		SC to CL	clayey SAND, yellowish brown (2.5Y 5/3), grading rapidly to dark greenish grey (5GY 4/1) plastic clay lensing with greenish grey (7.5GY 5/1) M, WS clayey sand	M to PL	F to MD		
				4		SW to SP	clayey SAND, dark greenish grey (5GY 4/1), grading rapidly to olive grey (2.5GY 5/1) sand, M, WS, some fines, and patches and diffuse zones of darker (5GY 4/1) sand. Trace of F quartz gravel in places	M to D			TRIASSIC SANDSTONE?
							REFUSAL AT 3.9m, PROBABLY ON TRIASSIC SANDSTONE BASEMENT				

ENGINEERING LOG – BOREHOLE

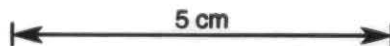
5 cm

16/38

borehole no. 8

sheet 1 of 1

project		location		co-ordinates		drill type		hole commenced					
TASMANIA GOLF CLUB		120m SE of Tasman Highway, on fence line beside dirt road. Allford Farm		541188 m E 5258580 m N		TRIEFUS		31.7.80					
inclination		bearing		drill method		drill fluid		hole completed					
VERTICAL		-		ALGER PALL		NONE		31.7.80					
penetration		support		notes		metres		material					
1 2 3		water		samples, tests		R.L.		soil type: plasticity or particle characteristics, colour, secondary and minor components.					
						depth							
						graphic log							
						classification symbol							
								moisture condition					
								consistency					
								density index					
								hand penetrometer kPa					
								25 50 100 200 400					
								structure, geology					
						SP		SAND, dull yellow orange (104R7/3), VF, WS		D	VL	Aeolian	
						1		SP SAND, dull yellow (2.5Y6/4), VF, WS, some weakly cemented lumps, trace silt?, grading to yellowish brown (10YR5/8) friable sand, trace clay			FB to L	? - ? - ? ESTUARINE/MARINE SEDIMENTS	
						2							
						3		CL CLAY, yellowish brown (2.5Y5/3), moderately plastic		M	St		
						4		SM SAND, greyish yellow brown (10YR5/2), M, WS, some silt, trace c sand			FB		
						5		SC clayey SAND - sandy CLAY, yellowish brown (2.5Y5/3), trace rock fragments (to 10mm); in places flecked white with CaCO ₃ -cemented fines; some c sand.			F		
						6		SP to SC SAND, brown (10YR 4/4), M-F, WS, trace silt?, grading to yellowish brown (2.5Y5/3) clayey sand, mottled in places with grey (10Y4/1), becoming clayier near 5.5m		W	L to F		
						7		SM Silty SAND, yellowish brown (2.5Y5/4); VF, WS			VS		
						8		SP SAND, greyish yellow brown (10YR6/2), F-M, WS, trace well-rounded c sand, trace clay and F rock fragments			L		
						9		SC Sandy CLAY - clayey SAND, bright yellowish brown (2.5Y6/6), mottled in places with (7.5GY6/1) greenish grey. M.		M	F		
						10		SP SAND, bright yellowish brown (10YR6/8), some clay, F-M, WS		W	S		
						11		HOLE STOPPED AT REQUIRED DEPTH OF 8.9m					



ENGINEERING LOG - BOREHOLE

project	TASMANIA GOLF CLUB		location	200m SE of hole 8, beside fence near dist road. Mt Hind Farm	
co-ordinates	541260 m E 5258405 m N		drill type	TRIEFUS	
R.L.	4.10m		drill method	Auger Pull	
inclination	VERTICAL		drill fluid	NONE	
bearing	-		hole commenced	31.7.80	
			hole completed	31.7.80	
			drilled by	BC	
			logged by	WCL	
			checked by	ATM	

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 penetr- ometer kPa	structure, geology
1 2 3											
	NONE			1		SP	SAND, dull yellow orange (104R6/3), F-VF, WS, grading at 0.6m to (104R7/4) sand, in places very weakly cemented	D	VL		Aeolian
				2		SP	SAND, mottled yellowish brown (104R5/8) and dull yellow (2.546/4), F, WS, trace fines		VL to F6		? - ? ESTUARINE/MARINE SEDIMENTS
				3		CH	CLAY, greyish olive (545/2), mottled and streaked with olive brown (2.544/6) and olive yellow (546/3). Some thin lenses and patches of greyish olive (545/2) M, WS clayey sand	M	St		
				4		SP	SAND, greyish yellow brown (104R4/2), M, WS		L		
				4		SC	SANDY CLAY, greyish olive (545/3), mottled with greyish olive (5645/1), grading to olive grey (1044/2); mottled 4.2-4.5m with yellowish brown (2.545/4) and (104R5/6)		S and F6 to F		
				5		CL	Silty CLAY, olive grey (1046/2), with conspicuous "pellets" of darker (1046/2) clay up to 10mm. Moderately plastic; some irregular yellowish brown (2.544/6) patches; trace small white caliche flecks	W	S to F		
			Poor recovery; running sand	6		SP	SAND, dull yellow (2.546/4), VF, WS. Trace fines; small mottled clay lenses		VL		
				7		SP	SAND, yellowish brown (2.545/6) VF, WS, trace white angular F sand fragments and clay fines, grading to dull yellow (2.546/4) slightly clayey sand, F, WS, sticky. Trace silt. Darkens to yellowish brown (2.545/6) near 6.9m and to yellowish brown (104R5/6) below 6.9m.		VS		
			Poor recovery	8		SP	SAND, yellowish brown (2.545/4), VF, WS, trace fines				
				9			HOLE STOPPED AT REQUIRED DEPTH OF 8.9m.				

ENGINEERING LOG - BOREHOLE

5 cm

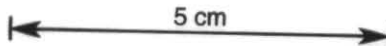
borehole no. 10

sheet 1 of 1

18/38

project TASMANIA GOLF CLUB				location In paddock on Milkford Farm, bearing 315°M to hole 1; 50m inside fence.							
co-ordinates 54 16 70 M E 525 86 55 M N				drill type TRIEFUS							
R.L. 4.10 m				drill method AUGER PULL							
inclination VERTICAL				drill fluid NONE							
bearing -				hole commenced 5/8/80							
				hole completed 5.8.80							
				drilled by JL							
				logged by WCC							
				checked by ATM							
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 penetr- ometer kPa	structure, geology
1 2 3											
						SP	SAND, dull yellow orange (10YR6/4), VF-F, WS trace dark rock fragments, heavy minerals; some dark brown (10YR3/3) organic sand streaks near 0.6m	D	L		AERIAN
				1		SP	SAND, yellowish brown (10YR5/8), F, WS, trace fines, grading near 1.2m to yellowish brown sand mottled with dull yellow (10YR6/4) patches	M	L to FB		?-?-? ESTUARINE SEDIMENTS
				2		SP	SAND, yellowish brown (10YR5/6), F, WS, some fines, with some mottling and patches of olive grey (5G45/1), slightly clayey below 2.2m; olive brown (2.5Y4/6) below 2.3m, and yellowish brown (2.5Y5/3) 2.6-3m.	W	L to MD		
				3					L		
				4		SC to CL	CLAYEY SAND, olive grey (2.5G45/1), mottled and with patches of yellowish brown (10YR5/8), grading to sandy CLAY at 3.3m and to CLAY (3.6m): mottled olive brown (2.5Y4/3), dark greenish grey (10G44/1), with greying patches and small red (10R4/8) streaks. Some small lenses and patches of sandy clay near 4.5m.	M	St		
				5		SP	SAND, yellowish brown (2.5Y5/4), VF-F, WS, trace VF dark rock fragments and silt	W	L		
				6		CL	CLAY, olive grey (2.5Y5/1), with small dark patches of calcareous material, or MnO ₂ ? Mottled, plastic	M	F		
				7		CL	Probably loam, running F, WS sand or silty sand.	W	VL		
				8		SC	CLAY, greyish olive (5Y5/2), with small irregular patches of olive grey (10Y4/2) and pale yellow (5Y8/3). Some F quartz grains (7-10%). Mottled, plastic	M	St		
				9		CL	CLAY, greyish olive (5Y5/2). Trace fines, flecked white	W	VS to L		?-?-? MARINE SAND?
				10		SC	SANDY CLAY, greenish grey (7.5G45/1), with trace nodular CaCO ₃ -cemented patches and fragments up to 20mm. Sandy clay in places, grades rapidly to greenish grey (7.5G45/1) M sand with trace shell fragments up to 10mm, trace fines, grading to yellowish brown (2.5Y5/4) M sand with shell.	F	L to F		
				11		SC	CLAYEY SAND, mainly dull yellow (2.5Y6/3) with irregular patches of yellowish brown (10YR5/8), M, WS. Trace fine shell fragments and fine gravel				
				12			HOLE STOPPED AT REQUIRED DEPTH OF 7.95m.				

ENGINEERING LOG - BOREHOLE



borehole no. //

sheet / of /

project **TASMANIA GOLF CLUB**

location **Milford Farm, 14 paddock, bearing 20°H to hole 10, approx. 200-250m S of hole 10.**

co-ordinates **541515 m E
5258445 m N**

drill type **TRIEFUS**
drill method **AUGER PULL**

hole commenced **5.8.80**
hole completed **5.8.80**

R.L. **1.94m**
inclination **VERTICAL**
bearing **-**

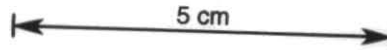
drill fluid **NONE**

drilled by **JL**
logged by **WCC**
checked by **ATM**

penetration	support	water	notes	metres	graphic log	classification	material	moisture	consistency	hand	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	penetr-ometer kPa	
						SP	SAND, dull yellow orange (104R6/3), F, WS, some brownish black (104R3/2) patches and trace fine roots and root fibres	D	VL		AELIAN
						SC	CLAYEY SAND, mottled yellowish brown (104R5/6), olive brown (2.5Y4/6), yellowish brown (104R5/8) and light yellow (2.5Y7/4), F-M.	M	F		ESTUARINE SEDIMENTS
						CL	CLAY, greyish olive (5Y5/2), moderately plastic, mottled in places with greenish grey (7.5G4/5/1) greyish; some black organic streaks and yellowish brown (2.5Y5/4) patches. Trace sand	W	VL		
						SP	SAND, dull yellow brown (104R4/3), F-M, WS		S to F		
						SC	CLAYEY SAND - sandy CLAY, mainly olive grey (104R5/2) with greenish grey (7.5G4/5/1). Some mottling with grey (104R5/1), light grey (7.5Y7/1). Grading to yellowish brown (2.5Y5/3) F, WS clayey sand with trace shell fragments up to 20mm. Primarily fine thin mud lenses; greyish olive (5Y6/2) 2.9-3.1m	M	F, ST		MARINE? SEDIMENTS
						SP	SAND, dull yellow (2.5Y6/3), F, WS, with trace dark rock fragments and shell; some irregular CaCO ₃ -cemented sand patches and fragments of calcite up to 15mm. Clayier, yellowish brown (104R5/8) near 3.8m. Running sand at base.	W	VL		
						SC	Sandy CLAY, mottled dull yellow (2.5Y6/4) and cream, in places with pale grey-yellow calcareous fine matrix; trace white calcareous patches and nodular calcarenite (up to 20mm)	M	F		ESTUARINE SEDIMENTS
						SP	SAND, dull yellow (2.5Y6/4), F, WS, trace calcite fragments and fine dark minerals, grading to yellowish brown (2.5Y5/4) and olive brown (2.5Y4/6) near 5.1m. Grades to VF silty SAND (2.5Y4/6) below running sand lens at 5.7m; trace VF dark minerals and rock fragments.	W	L		
							HOLE STOPPED AT REQUIRED DEPTH OF 7.8m				

checked by ATM

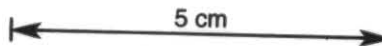
30-20



ENGINEERING LOG - BOREHOLE

project TASMANIA GOLF CLUB				location Hilford Farm, 200m SE of hole 9; on fence line near gate; bearing to hole 12 = 54°M.							
co-ordinates 541325 m E 5258250 m N				drill type TRIEFUS		hole commenced 6.8.80					
R.L. 3.86 m				drill method AUGER PULL		hole completed 6.8.80					
inclination VERTICAL				drill fluid NONE		drilled by GH					
bearing -						logged by WCC					
						checked by ATM					
penetration	support	water	notes	metres	graphic log	classification	material	moisture	consistency	hand	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	penetr-ometer kPa	
										25 50 100 200 400	
	NONE					SP	SAND , dull yellow orange (104R6/4), M, WS, trace root fibres, grading to yellowish brown (104R5/8), in places weakly cemented, crumbly, especially below 1m	D	VL		AEOLIAN
				1					VL to F6		ESTUARINE SEDIMENTS
				2		SP	SAND , mainly yellowish brown (104R5/6), with patches and streaks of olive yellow (546/3), M, WS, trace fines, slightly clayey in places				
				3		CL to CH	CLAY , mainly greyish olive (545/2), mottled and streaked with yellowish brown (104R5/6), and traces of red (7.5R4/8) and dark reddish grey (2.5YR 3/1), stiff, moderately plastic; some clay sand in places; grading to stiff, yellowish brown (104R5/6) clay mottled with greyling and small bright brown (7.5YR 5/8) patches. Trace rock fragments (up to 10 mm).	M	VST		
			Conductivity (25°C) 1100 µS/cm	4		SP	SAND , olive brown (2.5Y 4/3), M, WS, trace fines, grading at 4.2m to yellowish brown (2.5Y 5/4) sand with some clay	W	L		
			Poor recovery; possibly some VL sand.	5			Silty SAND? , poor recovery, VF; with some bluish grey M, WS sand and sandy clay near 4.4m				
				6			Silty SAND , olive yellow (546/3), VF-F, WS, some clay fines, trace VF dark minerals and well rounded quartzite fragments up to 5mm. Grades to yellow brown (2.5Y 5/4) silty sand, F-VF, WS. Rapid dilatancy.				
				7							
				8							
				9			HOLE STOPPED AT REQUIRED DEPTH OF 8.7m.				

ENGINEERING LOG - BOREHOLE



borehole no. 14

sheet 1 of 1

project TASMANIA GOLF COURSE				location Adjacent to Millford Farm, on bend in dirt road							
co-ordinates 541465 ME 5257915 MN				drill type TRIEFUS drill method RUGER PULL				hole commenced 20-8-80 hole completed 20-8-80			
R.L. 2.99m inclination VERTICAL bearing -				drill fluid NONE				drilled by GH logged by WCC checked by ATM			
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 penetr- ometer kPa	structure, geology
1 2 3											
						GW	Rock Fill, angular, up to 100mm, in grey brown silt	D			FILL
						SP	SAND, dull yellow orange (10YR 7/4), VF, WS, below 0.6m streaked and banded with yellowish brown (10YR 5/8); some weakly cemented crumbly patches	D	VL to L and Fb		AEOLIAN
				2	1						---?---
						CH	CLAY, mainly olive brown (2.5Y 4/3), streaked and mottled with yellowish brown (10YR 5/8) and trace blue-grey gleying; trace sand. Moderate-high plasticity	M > PL	F	x	ESTUARINE/ MARINE SEDIMENTS
				1	2						
				0	3	SP	SAND, yellowish brown (2.5Y 5/3), F-M, WS, streaked with trace grey-blue and yellowish brown (10YR 5/8). Trace fines	M	L		
						SC to CL	Sandy CLAY, olive grey (10Y 4/2), mottled and streaked with olive brown (2.5Y 4/4), yellowish-brown (10YR 5/8) and trace grey-blue gleying		ST		
				-1	4			W	L		
			POOR RECOVERY			SP	SAND, mainly yellowish brown (10YR 5/8), but with streaks of greyish yellow (2.5Y 6/2), grading to, WS, F, trace fines between 3.7-4m; trace VF dark minerals		VL		
				-2	5		SAND, yellowish brown (2.5Y 5/6), VF, WS, trace fines, grading to greyish yellow (2.5Y 6/2) F, WS. Trace VF dark minerals. Greyish olive (7.5Y 6/2) below 6m, with streaks and irregular patches of pale bluish grey. Trace fines 6.5-7m.		L to MD		
				-3	6						
				-4	7	SW	SAND, yellowish brown (2.5Y 5/4), M, MS-PS with some angular - well rounded quartz and rock fragments up to 3mm; in places grades to fine gravelly sand with trace fines				
				-5	8						
				-6	9		HOLE STOPPED AT REQUIRED DEPTH - 8.95m (-5.96m)				

ENGINEERING LOG - BOREHOLE

project				TASMANIA GOLF CLUB				location				Milford Farm			
co-ordinates				541865ME 5258225MN				drill type				TRIEFUS			
								drill method				AUGER PULL			
R.L.				1.63m				drill fluid				NONE			
inclination				VERTICAL				hole commenced				19.8.80			
bearing				-				hole completed				19.8.80			
								drilled by				JL			
								logged by				WCC			
								checked by				ATM			
penetration	support	water	notes	metres	graphic log	classification	material	moisture	consistency	hand					
1 2 3			samples, tests	R.L. depth		symbol	soil type: plasticity or particle characteristics, colour, secondary and minor components.	condition	density index	penetr-ometer kPa		structure, geology			
										25 50 100 200 400					
				1		SM	Silty SAND, dull yellowish brown (104R4/3), VF, WS, trace root fibres	M	MD			ESTUARINE/ MARINE SEDIMENTS			
				1		CL	CLAY, mainly dark olive brown (2.5Y3/3), finely mottled with darker and lighter brown; trace fine sand; low-moderate plasticity. Some weakly consolidated calcareous sand patches	M L PL	VS to H						
				0		SP	SAND, yellowish brown (2.5Y5/4), M, MS, some irregular grey (1045/1) patches, trace fines; clayier near 1.5m.		VL						
				2		SC	Sandy CLAY - clayey SAND, grey (1045/1) and olive grey (1044/2), F-M, WS; some greyish white calcareous sand patches								
				-1		SP	SAND, greyish yellow brown (104R4/2), F, WS, trace fines and M-C well-rounded quartzite, grading at 3m to yellowish brown (2.5Y5/3); and at 3.2m to olive grey (1045/2) M, WS clayey sand, mottled in places with grey. Near 3.4m MS-PS with trace well-rounded quartzite and rock fragments. Between 3.6 and 3.8m, distinctive white - light grey clean sand, F, WS flecked with trace VF dark minerals.		L						
				-2		SC	CLAYEY SAND - sandy CLAY, mainly olive (5Y5/4) with some grey - blue grey, and patches of pale grey - white calcareous sand. Trace charcoal streaks and patches, and fine gravel rock fragments (up to 10mm)		MD						
				-3					L to MD						
				-4											
				-5											
				-6											
				-7											
				-8											
				-9											
							HOLE STOPPED AT REQUIRED DEPTH 8.95m (-7.32m)								

ENGINEERING LOG - BOREHOLE

project **TASMANIA GOLF CLUB**location **Milford Farm**co-ordinates **542010 m E**
5257960 m Ndrill type **TRIEFUS**
drill method **AUGER PULL**hole commenced **19.8.80**hole completed **19.8.80**R.L. **1.64m**inclination **VERTICAL**bearing **-**drill fluid **NONE**drilled by **J.L**logged by **WCC**checked by **ATM**

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 penetr- ometer kPa	structure, geology
1 2 3											
	NONE					CL	CLAY, mainly brownish black (10YR2/2) mottled with brown (10YR4/4), low-moderate plasticity, trace sand	M PL	ST- VS	X	ESTUARINE / MARINE SEDIMENTS
				1		CL and CH	CLAY, mottled and streaked dark olive (5Y4/3) and yellowish brown (10YR5/6); low-moderate plasticity, trace sand. Some small patches of yellowish brown (10YR5/8) clayey sand and sandy clay 1.0-1.2m	M > PL	ST F	X	
				2		SP	SAND, yellowish brown (2.5Y5/3), M, WS, with patches of yellowish brown (10YR5/6)	W M	VL F	X	
				3		SC	CLAYEY SAND, olive grey (10Y4/2), WS, M, grading at 2.2m to distinctive sticky clayey sand - sandy clay, greenish grey (7.5GY6/1), PS; shelly, well fragmented and whole Sivalves up to 25mm. Some large irregular dark greenish olive patches, and irregular nodules (up to 40mm) of CaCO ₃ -cemented clayey sand; and conspicuous friable pale grey clayey sand with CaCO ₃ cement and matrix. Grades rapidly at 2.4m to sloppy light olive grey (5GY7/1) sand, VF, with trace fines and shell fragments up to 5mm	W M	VS F	X	
				4		SC	SANDY CLAY-clayey SAND, mainly clayey sand, yellowish brown (2.5Y5/4) 2.85-3m, grading to dark olive (7.5Y4/3). Below 3m, mottled and patchy clayey sand with cream CaCO ₃ -cemented patches in dark greenish olive, light grey and olive grey (10Y6/2). Sandier, olive grey, below 3.4m	W M	VL F	X	
			POR RECOVERY								
			VERY POOR RECOVERY								
				5		SP	SAND, olive yellow (5Y6/3), F to M, WS, trace M-C well-rounded white quartzite and fines, sloppy, with low recovery 4.25-5.1. Trace clay at 5.9m, clay dull yellow (2.5Y6/4), VF, with trace dark minerals. Clayier below 6m		MD		
				6		GW to GL	Gravelly SAND, dull yellow (2.5Y6/4), M-PS, trace fines, with sub-angular rock fragments up to 5mm, some well-rimmed quartzite up to 5mm; grading at 7m to gravelly clayey sand		L		
				7		SP	Shelly SAND, dark olive (5Y4/4), F, WS, with cream-pale yellow shell fragments up to 8mm, grading to dark olive (7.5Y4/3) VF sand flecked with VF shell fragments and trace VF dark minerals				
				8							
				9			HOLE STOPPED AT REQUIRED DEPTH - 8.95m				

ENGINEERING LOG - BOREHOLE

project TASMANIA GOLF CLOB				location Milford Farm							
co-ordinates 542115 m E 5257825 m N				drill type TRIEFOS drill method AUGER PULL		hole commenced 20.8.80 hole completed 20.8.80					
R.L. 1.64m inclination VERTICAL bearing -				drill fluid NONE		drilled by GH logged by WCC checked by ATM					
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 penetr- ometer kPa	structure, geology
1 2 3											
	NONE	20.8.80		1		CL and CH	CLAY , mainly olive black (5Y3/2) mottled and streaked with olive brown (2.5Y4/3) and trace organic streaks. Moderately plastic	M < PL	VST		ESTUARINE/ MARINE SEDIMENTS.
				0		SP	SAND , olive brown (2.5Y4/6), F, WS; trace VF dark minerals and rock fragments; between 1.1-1.2m trace clay. Generally WS sand below 1.2m, including dull yellow (2.5Y6/3) 1.5-2.3m; yellowish brown (10YR5/8) at 2.4m; and between 2.4 and 2.3m very sloppy greyish yellow brown (10YR5/2) and dull yellowish brown (10YR5/3) F-MG sand with trace fines.	W	L to VL		
				-1							
				2							
				-2			SANDY CLAY and CLAY , dark greenish grey (10G4/1), sticky, with trace of streaky reddish brown, patches of calcareous clayey sand, interbedded with a thin bed and some lenses of clean light grey (7.5Y7/1) M, MS sand with trace well-rounded C grade grains. Below 4.1m, the sandy clay contains trace of conspicuous irregular patches of cream-white nodular calcareous sand.	M	F		
				-3				W	L		
				4							
				-4			SAND , olive yellow (5Y6/3), F to M, WS to MS, in places with thin lenses of bright yellowish brown (2.5Y6/6) and bluish grey. In places, trace C sand, and rock fragments and VF dark minerals. Minor lensing with blue-grey clayey sand near 5m. Between 5 and 6m, olive yellow (5Y6/3) and grey (5Y6/1), F, WS, trace VF dark minerals. Between 6-7m, darkens to greenish grey (7.5G4/1) VF WS sand				
				-5							
				6							
				-6							
				7							
				-7			SAND , dark greenish grey - greenish black, VF, WS, flecked with F shell fragments, some up to 4mm; occasional lens of dull yellow (2.5Y6/4). Trace C sand.				
				8							
				-8							
				9			HAKE STOPPED AT REQUIRED DEPTH - 8.95m (-7.31m)				

sheet / of /

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ENGINEERING LOG – BOREHOLE

project		SEVEN MIKE BEACH HYDROLOGY										location		HOBART AIRPORT																					
co-ordinates		541040m E 5258410m N										drill type		-										hole commenced		7.12.73									
R.L.		Approx. 5m ASL										drill method		HAND AUGER										hole completed		7.12.73									
inclination		VERTICAL										drill fluid		-										drilled by		WCC									
bearing		-																						logged by		WCC									
																								checked by											

penetration		support	water	notes samples, tests	metres		graphic log	classification symbol	material		moisture condition	consistency density index	hand penetr- ometer kPa		structure, geology
1	2				3	R.L.			depth	soil type: plasticity or particle characteristics, colour, secondary and minor components.			25	50	
								SP	SAND, grey.						
					4	1		SP	SAND, yellow brown, medium grained, with to some patches and lumps of clayey sand; clay content increases with depth						
					3	2									
					2	3									
					1	4			HOLE STOPPED AT 3.2m (approx. RL 1.7m)						

[illegible]

ENGINEERING LOG – BOREHOLE

project SEVEN MILE BEACH HYDROLOGY		location Milford Farm	
co-ordinates S41740 ME 5258575 MN		drill type -	hole commenced 23.1.74
R.L. Approx 4.5m ASL		drill method HAND AUGER	hole completed 23.1.74
inclination VERTICAL		drill fluid -	drilled by WCL
bearing -			logged by WCL
			checked by

penetration 1 2 3	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 penetr- ometer kPa 25 50 100 200 400	structure, geology
				4		SP	SAND, grey, organic (0-0.3m), grading to fine grained, pale yellow brown				
				3		SP and SC	SAND, brown, with some clay				
				2							
				2			HOLE STOPPED AT 2.4m (Approx RL 2.1m)				
				3							

ENGINEERING LOG – BOREHOLE

project SEVEN MILE BEACH HYDROLOGY				location Milford Farm			
co-ordinates S41328m E S258225m N		drill type -		hole commenced 22.1.74			
R.L. Approx. 4.5m ASL		drill method HAND AUGER		hole completed 22.1.74			
inclination VERTICAL		drill fluid -		drilled by WLL			
bearing -				logged by WLL			
				checked by			

penetration 1 2 3	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 penetr- ometer kPa 25 50 100 200 400	structure, geology
			4		SP	SAND, organic, greyish brown (0-0.3m); grading to fine-medium grained yellow-brown sand				
			1							
			3							
			2		SC	Sandy CLAY, yellowish brown				
			2							
			3		CL	CLAY, grey, brown and blue				
			1							
			4			Sandy CLAY, greyish brown				
			0			HOLE STOPPED AT 4.3m (Approx. 0.2m RL)				
			5							

ENGINEERING LOG – BOREHOLE

project SEVEN MILE BEACH HYDROLOGY				location Milford Farm			
co-ordinates S41760 ME S258830 m N				drill type -		hole commenced 23.1.74	
R.L. Approx. 5.5m ASL				drill method HAND AUGER		hole completed 23.1.74	
inclination VERTICAL				drill fluid -		drilled by WCL	
bearing -						logged by WCL	
						checked by	

penetration 1 2 3	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 penetr- ometer kPa 25 50 100 200 400	structure, geology
				5		SP	SAND, grey, organic, fine grained, grading at 0.3m to pale yellow-brown fine-grained sand				
				1							
				4		SC	clayey SAND, brown, with brownish blue muddy clay near base				
				2							
				3							
				3		SP	SAND, brownish grey				
				2			CLAY, blue; some sand, grading to bluish brown clay				
				4							
				1			HOLE STOPPED AT 4.2m (APPROX. RL 1.3m)				
				5							

ENGINEERING LOG – BOREHOLE

project		SEVEN MILE BEACH HYDROLOGY		location		Milford Farm	
co-ordinates		54/885 m E 5258055 m N		drill type		—	
R.L.		Approx. 3.8 m A.S.L.		drill method		HAND AUGER	
inclination		VERTICAL		drill fluid		—	
bearing		—		hole commenced		23.1.74	
				hole completed		27.1.74	
				drilled by		WCL	
				logged by		WCL	
				checked by			

penetration 1 2 3	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 penetr- ometer kPa 25 50 100 200 400	structure, geology
				3		SP	SAND, grey, grading at 0.2m to pale yellow brown fine sand to 1.0m, then pale brown sand with patches of sandy clay	D			
				1				M			
				2		CL to CH	CLAY, bluish brown	D			
				2							
				1		SC	Sandy CLAY, brown, with some grey sand	W			
				3			HOLE STOPPED AT 2.8m (APPROX R.L. 1.0m)				

ENGINEERING LOG – BOREHOLE

project SEVEN MILE BEACH HYDROLOGY				location Milford Farm			
co-ordinates S41472 m E S258525 m N				drill type - drill method HAND AUGER		hole commenced 23.1.74 hole completed 23.1.74	
R.L. Approx. 4.0m ASL inclination VERTICAL bearing -				drill fluid -		drilled by WLL logged by WLL checked by	

penetration 1 2 3	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 penetr- ometer kPa 25 50 100 200 400	structure, geology
			Field water salinity = 4000 mg/l.	3	1	SP	SAND, grey, grading at 0.7m to grey-brown slightly clayey sand				
				2	2	SC	Sandy CLAY, grey-brown				
				1	3		CLAY, blue-grey, with some sand, grading at 2.7m to blue-green clayey sand with olive green between 2.8-3m. Sand content increases below 3m				
				0	4		HOPE STOPPED AT 3.2m (Approx. RL 0.8m)				

ENGINEERING LOG – BOREHOLE

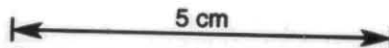
project SEVEN MILE BEACH HYDROLOGY				location Milford Farm			
co-ordinates S 41248 m E S 258430 m N				drill type - drill method HAND AUGER		hole commenced 23-1-74 hole completed 23-1-74	
R.L. APPROX. 5m A.S.L. inclination VERTICAL bearing -				drill fluid -		drilled by WCC logged by WCC checked by	

penetration 1 2 3	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 penetr- ometer kPa 25 50 100 200 400	structure, geology
				4	1	SP	SAND, grey, fine grained, grading at 0.3m to buff and brown-orange slightly clayey medium grained sand; some friable aggregated sand patches at 2.4m				
				3	2						
				2	3	SC	clayey SAND - sandy CLAY, grey.				
				1	4		HOLE STOPPED AT 3.8m (APPROX. R.L. 1.2m)				

23.1.74
Field water conductivity = 5000 µg/L.

drilled by WCL
logged by WCL
checked by

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ENGINEERING LOG – BOREHOLE

project SEVEN MILE BEACH HYDROLOGY				location Milford Farm			
co-ordinates 54/890 M E 52 58 460 M N		drill type - drill method HAND AUGER		hole commenced 23-1-74 hole completed 23-1-74			
R.L. Approx. 4 m A.S.L. inclination VERTICAL bearing -		drill fluid -		drilled by WCC logged by WCC checked by			

penetration 1 2 3	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 penetr- ometer kPa 25 50 100 200 400	structure, geology
			Salinity at 2m = 1300 mg/L Salinity at 2.4m = 4000 mg/L	3	1	SP, SAND, brown, grading at 0.1m to brown sandy and CLAY, and CLAY, with interbedded thin lenses of grey clayey SAND near 2.0m.						
				2	2	SC clayey SAND-sandy CLAY, green, pale blue, grey, with trace fine gravel and shell fragments						
				1	3	HOLE STOPPED AT 2.4m (APPROX. R.L. = 1.6m)						