Rept. Bk. No. 61/105
G.S. No. 3284
D.M. 2197/63
HYD. No. 1717

DEPARTMENT OF MINES
SOUTH AUSTRALIA

PUMP TEST RESULTS AND ANALYSES OF GAMBIER LIMESTONE AQUIFER

Section 22, Hundred Hindmarsh
Military Sheet Millicent

- Apcel Ltd. -

INTRODUCTION

A supply of some 7.1 cusecs or 160,000 gallons per hour of groundwater is required for the increase in production of paper. In order to obtain this water supply, four 10 inch diameter boreholes Nos. 7 to 10 were drilled. They are located at 1060 feet distance from each other along the southern boundary of the property. To facilitate the calculations of the aquifer characteristics two observation boreholes were drilled at 50 and 150 feet distance from the 10 inch boreholes.

A multiple stage test was carried out on bore No. 7 followed by a recovery test. The remainder of the boreholes were tested at a single rate of 24 hours duration also followed by a recovery test. Pump testing started on 17th June 1965 and the testing programme was completed on 9th July, 1965.

GEOLOGY

Apcel's property is underlain by sediments of Tertiary age which overlie Cretaceous and Basement rocks. The Tertiary sediments consist of Gambier limestones which occur from 10 feet to 438 feet below the surface as evidenced by the samples of the bores Nos. 7 to 9. Only 335 feet of Gambier limestone was penetrated in No. 10 borehole. This abrupt thinning of the

Gambier limestone may be due to the Tartwaup fault zone which has been recognised further to the southeast.

About one half mile to the north a 523 feet deep bore hole penetrated below the Gambier limestone 60 feet of lignitic clays which belong to the Knight group sediments. They overlie the sands of this group. It is recorded that this lignitic clay is extensive but its thickness is variable. It is assumed however that over this short distance these sediments are isotropic. The bores No's. 7 to 10 penetrated only the Gambier limestone and were discontinued just above the lignitic clays.

HYDROGEOLOGY

The Gambier limestone sequence, forming the aquifer, is not homogeneous. It consists of clastic limestones with flint concretions and is interbedded with marls and fine sandy beds. This is an important feature as all equations used to calculate field permeabilities are based upon infinite homogeneous and isotropic aquifers. In addition these formulae are developed for artesian aquifers. Although the groundwater was reported to rise slightly after it was encountered the pump testing proved that the Gambier limestone is an unconfined or free water table aquifer. These tests proved also that it is a leaky aquifer which will be further explained later. The raw field drawdown data of a free water table aquifer can not be used in the artesian aquifer formulae for the calculation of the field coefficient of transmissibility usually indicated by 'T' and the coefficient of storage, 'S'. Adjustments have to be made and a conversion table from field drawdown data 'S', to adjusted drawdowns 's', Figure 65-1135, is attached.

It was noted above that the Gambier limestones are not homogeneous beds. There is a good agreement between the calculated values of T and S from the pump-test on the four boreholes. It suggests that in its entirety, the aquifer could be considered to be homogeneous.

Drawdown levels measured in the observation boreholes are used to calculate the coefficients of transmissibility and storage. These two coefficients in turn are used to calculate the cone of drawdown which can be expected if prolonged pumping is anticipated.

Observation boreholes should penetrate the full aquifer as otherwise the drawdown levels measured would show effects similar to leaky aquifers, boundary conditions or even confining beds. The results obtained indicate leaky aquifer conditions and the drawdown levels of bore hole 10b suggest boundary conditions.

In order to eliminate possible errors the drawdown levels and recovery data measured in the pumped boreholes, which penetrate the aquifer in full, have been plotted and these show also that the aquifer is a leaky type but that boundary conditions are not reflected in them.

A leaky aquifer is defined as an aquifer which is overlain or underlain by a confining bed through which there is some seepage of groundwater into the pumped aquifer. In this case it should be the underlying Knight Sands which is the only other aquifer from which ground water could move into the Gambier limestone.

A leaky type aquifer could be considered to be advantageous. The groundwater level in a nonleaky aquifer will decrease slowly but steadily under heavy pumping conditions. Groundwater levels will fall to a certain level in a leaky type aquifer after which the seepage through the confining bed will supply sufficient water so that no further decrease in groundwater level will occur. Alternatively the seepage may reduce

the steady fall in groundwater level to a minimum.

The leakage or seepage is generally expressed in the vertical hydraulic conductivity, 'P, of the confining bed. Values of 'P are usually small but since seepage occurs through an extensive area the total quantity of water which finds its way into the Gambier limestone aquifer, is quite large.

DESCRIPTION OF PUMP TEST RESULTS

A multiple stage test was made on bore No. 7 in an attempt to calculate the aquifer and well loss which would occur in the borehole pumped and also to calculate the maximum quantity which could be withdrawn from one single borehole under prolonged pumping conditions. This test was not a complete success as aquifer and well loss could not be calculated and therefore it was also difficult to assess the maximum pumping rate.

The drawdown data are scattered over the graphs for which no good explanation has been found except that normally the drawdown data are less reliable than the recovery data. Plotting of the recovery data yielded a curve instead of a straight line. A straight line would have resulted if the Gambier Limestone was a nonleaky aquifer.

Calculations of values for T, S and P' were made on the drawdown results of the observation boreholes. These values are tabulated below.

Borehole No.	T. in $ft.^2/Sec.$	S nondimensional	P in ft./sec.
7a	1.24×10^{-1}	7.3×10^{-4}	2.7×10^{-6}
8a	4.42×10^{-2}	1.13×10^{-4}	1.8×10^{-7}
8b	6.96×10^{-2}	1.9×10^{-5}	7.4×10^{-9}
9a	1.03×10	5.95×10^{-2}	
9b	1.2×10^{-1}	1.43×10^{-3}	1.6×10^{-5}
10a	1.95×10^{-1}	3.12×10^{-8}	4.2×10^{-5}

The coefficients of transmissibility, T, resulting from the plots of the bores 9a is considered very high. In addition it did not show any effects of a leaky aquifer. This observation bore hole may have penetrated a very cavernous portion of the Gambier limestone hence the different values obtained for T.

Calculating the cone of drawdown which could be expected if the boreholes are pumped at a rate of 1.8 cusecs or 40,000 gallons per hour is difficult owing to the aquifer type.

An attempt has been made to construct the anticipated cone of drawdown which would occur due to heavy pumping condition between the bore holes 8 and 9. To construct this cone time drawdown graphs for bores 8 and 9 were made. The drawdown in a nonleaky aquifer can be obtained from this type of graph at any time and any distance. The time at which no further drawdown would occur in both boreholes was established from the log log curves of the observation bore holes. It is at about 1,000 minutes or 0.69 days. With the use of the time drawdown graph the anticipated cone of drawdown has been constructed shewing the situation when bore No. 8 is pumped at a rate of 1.8. Similarly the cone of drawdown for bore No. 9 has been constructed. These are shown as broken lines on graph 65-1132. The anticipated cone of mutual interference is given as a solid line. It shews that the drawdown in bore No. 8 will be about 1 foot more if both bores are pumped at the same time while the drawdown in borehole No. 9 will be about 6 feet more. This composite cone of drawdown indicates that probably the bores No. 7, 8, 9 and 10 are capable of yielding as much as 1.8 cusecs or 40,000 gallons per hour. It depends however on the capacity of the underlying Knight sands aquifer.

The Knight Sands contain large quantities of good quality water which are not extensively developed in this area. Therefore there are good prospects that water from the Knight Sands will continue to supply the overlying aquifer with large

quantities of water equal to the withdrawal.

The water levels reached during the pump test in bores No. 7, 8, 9 and 10 were 90 ft., 128 ft., 92 ft. and 146 ft. respectively. With a pump setting at 190 ft. and assuming that through mutual interference as much as 10 ft. extra drawdown will occur the lowest water level while pumping would be in the order of 160 ft.

A safe pump setting is considered to be 190 ft. as was done during the pumping testing as even under heavy pumping conditions about 30 ft. of water would stand above the pump.

It is considered that the borehole should not be pumped at a rate higher than 1.8 cusecs or 40,000 gallons per hour.

CONCLUSIONS

The Gambier Limestone is a leaky aquifer and therefore the drawdown will reach a certain level below the surface and remain at that level under heavy pumping conditions provided that the underlying Knight Sand aquifer continues to supply large quantities of water by means of seepage.

A maximum yield of 40,000 gallons per hour from each bore hole is warranted. The intake area of the pumps should be set at 190 feet to ensure that they are sufficiently submerged.

C. Bleys
Senior Geologist
HYDROGEOLOGY SECTION

CB:AGK
15/10/65

DEPARTMENT OF MINES, ADELAIDE

BORE LOG - PERCUSSION DRILLING

Purpose of Bore: OBSERVATION **Bore Serial No.:** 818/65
Hirer: APCEL LTD. **Address:** MILLICENT
Bore Location: **Hundred:** HINDMARSH **Section:** 22
Bore No.: O.B. 1 **Driller:** W.H. JAMES **Docket:** D.M. 2197/63
Drilling Commenced: 29.3.1965 **Depth:** 150'
Drilling Completed: 6.4.1965 **Casing:** 5" of 150'
Logged by: E.R. HILLWOOD **Date:** 23.7.1965

LOG

Depth (feet) From	To	Description
0' -	2'	Marl. Grey. Hard kunkar.
2 -	40	Bryozoal limestone and marl. Abundant cherts. Shelly fragments. Pale grey.
40 -	50	Limestone. Very abundant cherts. (70% of sample). Shelly and bryozoal fragments.
50 -	150	Limestone. Bryozoal and shelly. Abundant cherts throughout.

WATER CUT

Depth in Feet	Water Level	Supply G.P.H.	Supply How Tested	Total Salts p.p.m.	Analysis No.
20 40	18				

REMARKS: Completed Observation.

DEPARTMENT OF MINES, ADELAIDE

BORE LOG - PERCUSSION DRILLING

Purpose of Bore: OBSERVATION BORE Bore Serial No: 865/65

Hirer: A.P.C.E.L. Address: MILLICENT

Bore Location: Hundred: HINDMARSH Section: 22

Bore No: Obs. No 7A Driller: W.JAMES Docket: D.M. 2197/63

Drilling Commenced: 26.5.1965 Depth: 100'

Drilling Completed: 28.5.1965 Casing: 56'8" of 5"

Logged by: G. T. ROBERTS Date: 26.8.1965

LOG

Depth (feet) From	To	Description
0	1	Soil, clayey with peaty material, black.
1	10	Clay and sandy clay, calcareous dark grey and brownish.
10	60	Limestone, slightly sandy somewhat marly. Chert fragments throughout, but frequent from 50' - 60'. Grey.
60	100	Limestone, very fossiferous, slightly marly, chert fragments throughout. Grey.

WATER CUT

Depth in Feet	Water Level	Supply		Total Salts p.p.m.	Analysis No.
		G.P.H.	How Tested		
15'	13'6"	-	-	530	W1415/65
85'	13'6"	-	-	607	W1416/65

REMARKS: Completed Observation.

DEPARTMENT OF MINES, ADELAIDE

BORE LOG - PERCUSSION DRILLING

Purpose of Bore: WATER — **Bore Serial No.:** 999/65

Hirer: APCEL LIMITED — **Address:** MILLICENT

Bore Location: Hundred: HINDMARSH — **Section:** 22

Bore No.: 7 **Driller:** W.H. JAMES — **Docket:** D.M. 2197/63

Drilling Commenced: 5.5.1965 — **Depth:** 450'

Drilling Completed: 14.5.1965 — **Casing:** 85'2" of 10"

Logged by: E.R. HILLWOOD — **Date:** 10.8.1965

LOG

Depth (feet) From	To	Description
0 -	1	Sand loam. Fg. dark grey.
1 -	5	Clayey fg. sand. Calcareous. Yellowish grey.
5 -	9	Sand. Clayey and calcareous. Calcareous fragments. Yellow-grey.
9 -	12	Marl with calcareous fragments. Pale yellow.
12 -	20	Lime sand and marl. Clastic. Shelly fragments. Off-white.
20 -	120	Limestone and lime sand. Bryozoal fragments. Abundant black flints throughout. Pale grey.
120 -	175	Marl and calcareous clay. Few flints. Pale grey.
175 -	205	Marl and limy clay with abundant cherts. Pale grey.
205 -	215	Marl. Off-white.
215 -	225	Limy clay. Pale grey.
225 -	250	Limestone. Clayey with black cherty fragments. Pale grey. Generally coarse-grained with bryozoal fragments.
250 -	255	Clayey lime. Off-white.
255 -	260	Coarse, loose limestone. Yellowish white.
260 -	280	Marl and limy clay. Milky white.
280 -	375	Fossiliferous limestone with some black flint fragments. Shelly and bryozoal fragments very abundant. Yellowish white.
375 -	385	Same as above but larger fragments becoming marly.

APCEL BORE NO. 7 (Contd.) D.M.: 2197/63

Depth (feet) From	To	Description
385 -	390	Fossiliferous limestone and clay with some black flint fragments. Greyish white.
390 -	395	Clay with few calcareous grains. Grey.
395 -	400	Abundant grey flint mixed with calcareous clay. Light grey.
400 -	410	Coarse fossiliferous limestone with some cherty grains. Pale grey.
410 -	415	Limy clay and marl. Milky white.
415 -	433	Coarse to medium loosely consolidated limestone with bryozoal and shelly fragments mainly and some flint Yellowish grey.
433 -	438	Limy clay. Light grey.
438 -	443	Calcareous clay. Greenish grey.
443 -	450	Limy clay. Brownish grey.

WATER CUT

Depth in Feet	Water Level	Supply		Total Salts p.p.m.	Analysi No.
		G.P.H.	How Tested		
15 85 260	15	10,000	-	405	1411-14 Incl. 1579-15

REMARKS: Completed Water Productive.

DEPARTMENT OF MINES, ADELAIDE

BORE LOG - PERCUSSION DRILLING

Purpose of Bore: PUMP TEST OBSERVATION BORE **Bore Serial No.** 866/65

Hirer: APCEL LIMITED **Address:** MILLICENT

Bore Location: **Hundred:** MINDMARSH **Section:** 22

Bore No.: O.B.S. No. 7B **Driller:** W.H.JAMES **Docket:** D.M. 2197/63

Drilling Commenced: 29.5.1965. **Depth:** 100'

Drilling Completed: 31.5.1965. **Casing:** 57'8" of 5"

Logged By: G.T. ROBERTS **Date:** 26.8.1965.

LOG

Depth (feet) From	To	Description
0	1	Soil, clayey with peat. Black.
1	5	Sand, calcareous, fine, dark grey and grey.
5	75	Limestone, slightly sandy, somewhat marly. Chert fragments throughout but frequent from 70 - 75'. Grey.
75	100	Limestone, very fossiliferous, slightly marly, chert fragments scattered throughout. Grey.

WATER CUT

Depth in Feet	Water Level	Supply		Total Salts p.p.m.	Analysis No.
		G.P.H.	How Tested		
15	13	-	-	555	W1417/65
80	13	-	-	668	W1418/65

REMARKS: Completed Observation.

DEPARTMENT OF MINES, ADELAIDE

BORE LOG - PERCUSSION DRILLING

Purpose of Bore: OBSERVATION BORE **Bore Serial No.:** 868/65

Hirer: A.P.C.E.L. **Address:** MILLICENT

Bore Location: Hundred: HINDMARSH **Section:** 22

Bore No. OBS. NO.8A **Driller:** W. JAMES **Docket:** D.M. 2197/63

Drilling Commenced: 1.6.1965 **Depth:** 100'

Drilling Completed: 2.6.1965 **Casing:** 57'10" of 5"

Logged By: G.T. ROBERTS **Date:** 26.8.1965

LOG

Depth (feet) From	To	Description
0	1	Clay, black
1	10	Marl with some limestone. Grey.
10	75	Limestone slightly sandy and marly. Chert fragments throughout, but plentiful from 40 - 75'. Grey.
75	100	Limestone, very fossiliferous, slightly marly. Few chert fragments throughout. Grey.

WATER CUT

Depth in Feet	Water Level	Supply		Total Salts P.P.M.	Analysis No.
		G.P.H.	How Tested		
15 80	14 14	-	-	500	1421/65

REMARKS:

DEPARTMENT OF MINES, ADELAIDE

BORE LOG - PERCUSSION DRILLING

Purpose of Bore: WATER	**Bore Serial No:** 97/65
Hirer: APCEL	**Address:** MILLICENT
Bore Location: **Hundred:** HINDMARSH	**Section:** 22
Bore No: 8 **Driller:** JAMES	**Docket:** D.M. 2197/63
Drilling Commenced: 30.4.1965	**Depth:** 445 ft.
Drilling Completed: 5.5.1965	**Casing:** 81'5" of 10"
Logged by: S. K. YONG	**Date:** 10.8.1965

LOG

Depth (feet) From	To	Description
0	1	Black carbonaceous clayey soil, calcareous.
1	22	Calcareous sand with some clay, generally medium grained. Grey.
22	40	Limy sand with brown flint and calcareous fragments. Pale grey.
40	60	Limy sand similar to above but more flint fragments. Pale grey.
60	85	Conglomeratic mixture of lumpy brown flint and calcareous fragments with bryozoal remains and sand. Yellowish grey.
85	95	Medium to fine sand, limy with few flint, marly. Yellowish grey.
95	110	Coarse conglomeratic mixture of chert and calcareous fragments. Yellowish grey. Sandy matrix. Coarse marl.
110	135	Coarse sandy mixture of lumpy grey Chert and limy fragm with bryozoal remains.
135	170	Marl and calcareous clay with some coarse flint and bryozoal remains. Creamy grey.
170	180	Clayey marl with abundant lumps of flint. Pale grey.
180	205	Marl and limy clay, partly sandy with some small pieces of flint. Pale Grey.
205	210	Calcareous fine sand with much lumpy flint. Creamy grey.
210	215	Fine clay, calcareous. Cream.
215	250	Limy fine sand and clay with some grains of flint. Cream.
250	265	Limy [illegible], creamy grey with much coarser flint fragments.

APGBL BORE NO 8 (Contd.) D.H.: 2197/63

Depth (feet) From	To	Description
265	270	Limy clay. Cream.
270	290	Clayey limestone and marl. Yellowish cream.
290	335	Unconsolidated limestone with shelly and bryozoal remains and brown flint. Cream. Coarse grained.
335	360	Clayey lime and marl. Yellowish cream.
360	370	Clayey limestone, generally coarse with some flint. Creamy grey.
370	380	Clayey lime. Cream.
380	395	Sandy limestone with bryozoal remains. Cream.
395	415	Limy clay and marl. Pale grey.
415	430	Calcareous clay with coarse limy fragments. Light grey.
430	445	Calcareous clay. Pale grey.

WATER CUT

Depth in Feet	Water Level	Supply		Total Salts p.p.m.	Analysis No.
		G.P.H.	How Tested		
18 55 250	18	10,000	Bailer 1 hour	484	V1572/65

REMARKS:

DEPARTMENT OF MINES, ADELAIDE

BORE LOG - PERCUSSION DRILLING

Purpose of Bore: OBSERVATION BORE Bore Serial No.: 867/65

Hirer: A.P.C.E.L. Address: MILLICENT

Bore Location: Hundred: HINDMARSH Section: 22

Bore No.: OBS. NO. 8B Driller: W. JAMES Docket: D.M. 2197/63

Drilling Commenced: 31.5.1965 Depth: 100'

Drilling Completed: 1.6.1965 Casing: 58'2" of 5"

Logged by: G.T. ROBERTS Date: 26.8.1965

LOG

Depth (feet) From	To	Description
0' -	1'	Clay, black.
1 -	5	Limestone and marl - grey.
5 -	40	Limestone, slightly sandy, chert fragments throughout, but frequent from 30' - 40', grey.
40 -	75	As above but with increased chert throughout.
75 -	100	Limestone, very fossiliferous, slightly marly. Few chert fragments throughout.

WATER CUT

Depth in Feet	Water Level	Supply G.P.H.	Supply How Tested	Total Salts p.p.m.	Analysis No.
15'	13'	-	-	530	W1419/65
80'	13'	-	-	563	W1420/65

REMARKS: Completed Observation.

DEPARTMENT OF MINES, ADELAIDE

BORE LOG - PERCUSSION DRILLING

Purpose of Bore: OBSERVATION | **Bore Serial No.:** 883/65

Hirer: APCEL LIMITED | **Address:** MILLICENT

Bore Location: Hundred: HINDMARSH | **Section:** 22

Bore No.: O.B.9A **Driller:** W.H.JAMES | **Docket:** D.M. 2197/63

Drilling Commenced: 7.6.1965. | **Depth:**

Drilling Completed: 8.6.1965. | **Casing:**

Logged By: E.R. HILLWOOD | **Date:** 28.7.1965.

LOG

Depth (feet) From	To	Description
0	1	Clay soil. Black.
1	20	Marl. Pale grey.
20	25	Limestone. Lime cemented. Cream.
25	70	Limestone sndmarl. Abundant black cherts threughout. Breyozeal.
70	80	Limestone. Abundant bryozoa and cherts.
80	100	Limestone. Abundant bryozoa. Fg. fragments.

WATER CUT

Depth in Feet	Water Level	Supply		Total Salts p.p.m.	Analysis No.
		G.P.H.	How Tested		
20					
85	17				

REMARKS:

DEPARTMENT OF MINES, ADELAIDE

BORE LOG - PERCUSSION DRILLING

Purpose of Bore: WATER — **Bore Serial No.:** 92/65

Hirer: APCEL — **Address:** MILLICENT

Bore Location: **Hundred:** HINDMARSH — **Section:** 22

Bore No.: 9 — **Driller:** W.H. JAMES — **Docket:** D.M. 2197/63

Drilling Commenced: 15.4.1965 — **Depth:** 450'

Drilling Completed: 28.4.1965 — **Casing:** 79'6" of 10"

Logged by: E.R. HILLWOOD — **Date:** 10.8.1965

LOG

Depth (feet) From	To	Description
0'	1'6"	Clay. Slightly calcareous. Black.
1'6"	5'	Clay, calcareous. Yellow and black.
5	10	Clay, calcareous. Pale grey.
10	90	Marl, limestone. Abundant black flint throughout.
90	100	Limestone, Cg. Abundant flints. Cream.
100	110	Limestone. Cg, Cream.
110	130	Limestone. Cg. Abundant flints.
130	185	Marl. fg. Abundant flints. Pale grey.
185	230	Limestone and marl. Abundant flints. Pale grey.
230	260	Marl. fg.
260	278	Limestone. Some hard cemented fragments. Off-white Bryozoal.
278	295	Limestone. Bryozoal. Cg. Cream.
295	415	Limestone. Fg. Bryozoal fragments. Off-white.
415	450	Limestone and marl. Fg. Nodules of Lime. Bryozoal fragments.

WATER CUT

Depth in feet	Water level	Supply G.P.H.	Supply How Tested	Total Salts p.p.m.	Analysis No.
20 40 85 260 300	15'6"	10,000	Bailer, 1 hour	486	W1578/65

REMARKS: Completed Water Productive.

DEPARTMENT OF MINES, ADELAIDE

BORE LOG - PERCUSSION DRILLING

Purpose of Bore: OBSERVATION
Bore Serial No.: 884/65

Hirer: APCEL LIMITED
Address: MILLICENT

Bore Location: Hundred: HINDMARSH
Section: 22

Bore No.: O.B. 9B **Driller:** W.H. JAMES
Docket: D.M. 2197/63

Drilling Commenced: 8.6.1965.
Depth: 100'

Drilling Completed: 9.6.1965.
Casing:

Logged by: E.R.HILLWOOD
Date: 28.7.1965.

LOG.

Depth (feet) From	To	Description
0	1'6"	Soil, clayey, sandy and calcareous. Black.
1'6"	5	Limy clay. Grey.
5	20	Marl. Pale grey.
20	30	Limestone and marl. Pale grey.
30	95	Limestone. Bryozoal fragments. Abundant black cherts throughout.
95	100	Limestone and lime sand. Fg. clastic.

WATER CUT

Depth in Feet	Water Level	Supply G.P.H.	Supply How Tested	Total Salts p.p.m.	Analysis No.
25	16				
90					

REMARKS: Completed Observation.

DEPARTMENT OF MINES, ADELAIDE

BORE LOG - PERCUSSION DRILLING

Purpose of Bore: OBSERVATION	**Bore Serial No:** 886/65
Hirer: APCEL LIMITED	**Address:** MILLICENT
Bore Location: **Hundred:** HINDMARSH	**Section:** 22
Bore No: O.B.10A **Driller:** W. H. JAMES	**Docket:** D.M. 2197/63
Drilling Commenced: 10.6.1965	**Depth:** 100'
Drilling Completed: 11.6.1965	**Casing:** 5"
Logged by: D. R. HILLWOOD	**Date:** 28.7.1965.

LOG

Depth (feet) From	To	Description
0'	2'	Soil. Clayey, sandy and calcareous. Black.
2	20	Marl. Some cherts. Pale grey.
20	45	Limestone and marl. Bryozoal fragments. Abundant cherts throughout.
45	75	Limestone. Abundant bryozoa and black cherts.
75	100	Limestone and lime sand. Fg. clastic.

WATER CUT

Depth in Feet	Water Level	Supply		Total Salts P.P.m.	Analysi No.
		G.P.H.	How Tested		
22 90	16				

REMARKS: Completed observation

DEPARTMENT OF MINES, ADELAIDE

BORE LOG - PERCUSSION DRILLING

Purpose of Bore: WATER
Bore Serial No.: 91/65

Hirer: A.P.C.E.L.
Address: MILLICENT

Bore Location: **Hundred:** HINDMARSH
Section: 22

Bore No.: 10 **Driller:** W.H. JAMES
Docket: D.M.: 2197/63

Drilling Commenced: 6.4.1965
Depth: 365'

Drilling Completed: 14.4.1965
Casing: 79'3"

Logged by: E.R. HILLWOOD
Date: 23.7.1965

LOG

Depth (feet) From	To	Description
0' -	4'	Clay. Black.
4 -	10	Calcareous clay. Grey.
10 -	15	Marl. Grey.
15 -	40	Limestone. Grey. Bryozoal fragments. Abundant black cherts.
40 -	45	As above. Abundant shelly and bryozoal fragments.
45 -	85	Limestone. Bryozoal. Abundant black cherts.
85 -	110	Limestone. Abundant shelly fragments.
110 -	115	Limestone. Bryozoal. Abundant cherts. Grey.
115 -	170	As above.
170 -	200	Limestone. Bryozoal. Some cherts. Marly.
200 -	210	Limestone. Very abundant cherts.
210 -	265	Limestone. Grey. Marly. Cherts.
265 -	346	Limestone. Cream. Hard cemented bands. Sparse cherts.
346 -	365	Marl and limey clay. Grey. Soft and very wet.

WATER CUT

Depth in feet	Water Level	Supply G.P.H.	Supply How Tested	Total Salts p.p.m.	Analysis No.
20 45 90 195 250	15'	-	-	535	W1592/65

REMARKS: Completed Water Productive.

DEPARTMENT OF MINES, ADELAIDE

BORE LOG - PERCUSSION DRILLING

Purpose of Bore: OBSERVATION : **Bore Serial No.:** 885/65

Hirer: APCEL LIMITED **Address:** MILLICENT

Bore Location: Hundred: HINDMARSH **Section:** 22

Bore No.: O.B.10B **Driller:** W.H. JAMES **Docket:** D.M. 2197/63

Drilling Commenced: 9.6.1965. **Depth:** 100'

Drilling Completed: 10.6.1965. **Casing:**

Logged By: E.R. HILLWOOD **Date:** 28.7.1965.

LOG

Depth (feet) From	To	Description
0	1'6"	Soil. Clayey, sandy and calcareous. Black.
1'6"	20	Marl. Occasional cherts. Pale grey.
20	90	Limestone. Abundant bryozoa and black cherts throughout. Cream.
90	100	Limestone, and lime sand. Fg. clastic. Bryozoal fragments.

WATER CUT

Depth in Feet	Water Level	Supply		Total Salts p.p.m.	Analysis No.
		G.P.H.	How Tested		
20					
90	16				

REMARKS: