DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
ENGINEERING DIVISION

BEACHPORT TOWN WATER SUPPLY FLOW TESTING OF BORE NO. 3

COMPLETION REPORT AND RECOMMENDATIONS

by

O.J.W. BOWERING
GEOLOGIST CLASS II

Rept.Bk.No.75/108
G.S. No. 5641
Hyd. No. 2694
DM. No. 1500A/70

4th September, 1974

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BEACHPORT TOWN WATER SUPPLY BORE NO. 3
FLOW TEST RESULTS AND RECOMMENDATIONS

ABSTRACT

The Beachport Town Water Supply No. 3 was flow-tested using a series of orifice plates. The testing programme consisted of a main test and five stages in a flow recession test. The orifice plates were used not to measure flow rate, but to ensure a constant flow rate during each stage.

The transmissivity of the Tartwaup Formation aquifer was determined to be 307 m^3/day/m and the safe discharge rate is 16 litres/second or 12 700 gallons/hour.

INTRODUCTION

The Beachport Town Water Supply Bore No. 2, drilled in 1969 was the first bore at Beachport to exploit the uppermost Knight Formation aquifer for town water supply purposes. This bore has an unsatisfactory yield because of problems associated with developing the screen and it was considered that the most suitable method of improving the town's water supply was to drill an additional bore.

The Beachport Town Water Supply Bore No. 3 was drilled to a depth of 130 metres by means of a cable tool drilling plant and was completed to a depth of 357 metres with a Mayhew 1000 rotary drilling plant on 10.12.73. The location of the bore is shown in Figure 1.

This report presents an analysis of the multistage testing programme carried out during August, 1974 and contains recommendations as to maximum flow rate of the bore.

CONSTRUCTION DETAILS

A 10 inch (250 mm) bore was drilled by a cable tool drilling plant to a depth of 130 metres. The bore was cased with 250 mm casing to a depth of 130 m through the lost circulation zone of cavernous limestone.

The bore was then deepened to 357 metres using Mayhew 1000 rotary drilling plant D.M. 187. An 8½ inch drilling bit was used. Six inch casing was run to a depth of 338.25 metres and pressure cemented to surface. A 5 inch wire sand screen, attached to 5 inch casing was set between 339.41 and 348.71 metres, the casing being attached to the 6 inch casing my means of a surescreen seal piece. A section of 5 inch and 4 inch blank casing was set from the bottom of the screen to 357 metres.

The details of the bore construction are shown in Figure 2.

Some problems were encountered in setting the screen in this bore because of bad hole conditions. When completed, the bore was jetted for approximately 12 hours until sand free.

SCREEN SELECTION

A sieve analysis was not performed on the bore because of the urgent necessity that it be completed at the earliest possible date. It was considered from previous experience of screening bores to the upper Knight Formation aquifer in the lower South East, that a uniform wire screen with 0.035 inch openings would be satisfactory. This, in fact, proved to be the case as the bore flows at a satisfactory rate of 16 litres per second and is sand free.

BOREHOLE GEOLOGY AND HYDROGEOLOGY

The sedimentary section penetrated in this bore is virtually identical to that encountered in Beachport T.W.S. Bore No. 2. For the sake of completeness, a description of the section is included in this report and is described in order of deposition.

Tartwaup Formation: 330 m to bottom Middle Eocene

This formation consists of sands, clay and sandy clays which are generally dark brown in colour but becoming pale grey toward the bottom of the bore. The sands are mainly medium to coarse grained, subrounded, poorly to moderately sorted and slightly to very clayey. The aquifer in which the bore is completed has a surprisingly high transmissivity although the samples suggest a lower value.

This aquifer is artesian over much of the coastal plain area of the lower South East and is an important source of non polluted groundwater. At Beachport T.W.S. Bore No. 3 the shut-in pressure is 23.5 p.s.i. which is equal to a potentiometric head of 16.50 metres.

Kongorong Sand: 276-330 m Middle Eocene

This unit consists predominantly of dark brown interbedded sands and clays. The sands are medium to coarse grained, subangular to subrounded, generally poorly sorted and clayey. The clays on the other hand are very sandy and throughout this unit there is only a relatively minor variation on the proportion of sand and clay between what is described as a sandstone or a clay.

The Kongorong Sand is a confined aquifer of limited areal extent within the lower South East and is exploited for town water supply purposes in some areas.

Lacepede Formation: 266-276 m Upper Eocene

This formation consists of clay, varying from pale grey to khaki green in colour with abundant glauconite. It is slightly sandy and slightly calcareous in part. This unit is the confining bed above the Kongorong Sand.

Gambier Limestone: 2-267 m Upper Eocene - Lower Miocene

This formation is a marine transgressive unit and in this locality, the bore is considered to be Upper Eocene in age. The lower part of the Gambier Limestone consists mainly of marls and calcsiltites with numerous bands and nodules of flint. The section grades upward into porous calcarenite and limestone consisting almost entirely of bryozoal and shelly remains with abundant foraminifera and sandy quartz. Nodules and bands of flint are common throughout this part of the Gambier Limestone also.

The Gambier Limestone is for the most part an unconfined aquifer throughout the South East and is the most important source of groundwater.

A geological log compiled from cable tool sludge samples and rotary cuttings is shown in Appendix A. This log shows the sandstone aquifer to occur between 342 and 354 metres. The geophysical logs show the top of the aquifer at approximately 339 metres and that it consists of thinly interbedded sandy clays and clayey sands.

FLOW TESTING

1. Procedure

The testing programme adopted for the bore was a Flow Recession test followed by a main test. The main test was to have been a constant discharge test of 72 hours duration. However, because of the relative situations of bores No. 2 and No. 3, problems were encountered with flooding of the pump house over the No. 2 bore.

At the time of the testing programme, concreting was being carried out in the compound surrounding the pump house which is located in the bottom of a hollow area. No. 3 bore was located on an upper slope of the hollow and all water from it flowed immediately to the bottom of the hollow and flooded the pump house. Because of this, it was decided to conduct a main test of only 100 minutes duration.

A summary of the testing programme is given in Table 1 below.

TABLE 1

STEP	FLOW RATE	DURATION	RECOVERY
1	1 357 m^3/day	32 mins	30 mins
2	1 074	32	30
3	750	32	30
4	575	30	30
5	294	30	-
main	1 125	100	30

For the testing programme, a series of orifice plates with corner tappings was used to ensure a constant discharge during each stage of the test. The flow pipe used for the orifice plates had an internal diameter of 6 inches. The orifice plate and pressure tubes arrangement is shown in Figure 9.

During preliminary experimental testing with the orifice plates, some difficulty was experienced in obtaining a satisfactory stable rise of water in the low pressure tube. This was most likely due to the fact that the flow pipe downstream from the orifice plate was not full with water.

It is essential that this pipe be filled for the orifice plate system to function satisfactorily. The flow rate from the bore was apparently insufficient to completely fill a 6 inch pipe. This problem could probably have been overcome by using some restriction further down in the downstream pipe.

For this reason, it was decided to use a conventional flowmeter in conjunction with the orifice plates which were used to ensure a constant discharge throughout each stage rather than as a means of measuring discharge. Preliminary testing with the orifice plates and flow meter at varying flow rates determined an approximate relationship between flow rate and height of water in the measuring tube. This enabled the appropriate orifice plate to be selected for each test and the desired flow rate for each step of the testing programme to be attained rapidly at its commencement.

2. Analysis

The time-drawdown curves of each test are shown in figures 3 and 4 and the variations in flow rate with time are shown in figures 5 and 6. It can be seen that despite efforts to maintain a constant discharge throughout each stage, this was not achieved because of surging in the bore which no amount of careful manipulation of the gate valve could eliminate. The average flow rates have been chosen for the purpose of the analysing of the data.

1. Step Drawdown Tests

The step drawdown tests are used to determine a relationship between time and drawdown for various pumping rates. This is to enable predictions to be made of drawdowns to be expected for various pumping or flow rates.

This relationship is expressed by the equation:

$$s = aQ + bQ \log_{10}t + cQ^2$$

or

$$s/Q = a + b \log_{10}t + cQ$$

therefore a plot of s/Q vs. Q should give a straight line of slope 'c' and an intercept of $a + b \log_{10}t$. For the purposes of this plot, the drawdown at the 10 minute mark of all tests was used in the plot of s/Q vs. Q. Because $\log_{10}t = 1$ when t = 10 minutes, the intercept on the graph becomes simply 'a + b'.

Table 2 below, gives the appropriate values of drawdown, flow rate, specific capacity (Q/s) and s/Q for all the tests.

TABLE 2

STEP	AVERAGE FLOW RATE lit/sec	m^3/min	DRAWDOWN (10 min)	Q/s lit./sec/m	s/Q (10 min) min.m^{2}
1	15.74	0.9424	13.55	1.138	14.38
2	12.46	0.7459	10.18	1.191	13.65
3	8.70	0.5209	6.46	1.130	12.40
4	6.67	0.3993	4.70	1.358	11.77
5	3.41	0.2042	1.97	1.386	9.65
main	13.05	0.7813	10.68	1.126	13.67

The plot of $^s/Q$ vs. Q is shown in Figure 7. It can be seen that the data for all tests fit quite well on a straight line with the exception of step No. 5. The reason that step 5 does not fit the line is obscure but may be due to the low flow rate (3.41 litres/second) which possibly did not allow full pipe flow and placed physical limitations on the measuring equipment.

The straight line plot gives a slope of 4.77 min^2 $metre^{-5}$ with an intercept of 9.9. These are the values of 'c' and 'a + b' respectively in the equation:

$$^s/Q = a + b \log_{10}t + cQ$$

$$a + b = 9.9$$

$$c = 4.77$$

The value of 'b' in the above equation is determined from the semilogarithmic time/drawdown plot of the main test shown in Figure 3. From this test:

$$s = 0.67$$

$$= bQ$$

where $Q = 0.7813\ m^3/min$

$$\therefore b = \frac{0.67}{0.78}$$

$$= 0.86$$

now $a + b = 9.90$

$$\therefore \quad a = 9.04$$

Therefore the drawdown equation can be written:

$$s_t = 9.0\ Q + 0.86 \log_{10}t + 4.77\ Q^2$$

where t is in minutes and Q is in $metres^3/minute$.

This equation can be checked against the data from the main test. Consider when t = 10 minutes

$$s_{10} = 9 \times 0.78 \times 0.86 \times 4.77 \times 0.78^2$$
$$= 10.79 \text{ metres}$$

The observed drawdown at 10 minutes was 10.68 metres

when $t = 100$ minutes

$$s_{100} = 9.0 \times 0.78 \times 2 \times 0.86 \times 4.77 \times 0.78^2$$
$$= 11.67 \text{ metres}$$

The observed drawdown at 100 minutes was 11.59 metres. It is quite probable that had the test been able to proceed for its scheduled 72 hours, even closer agreement would have been achieved.

Table 3 below gives the expected drawdowns of the potentiometric head at the bore for various flow rates after periods of 100 minutes and 1 000 minutes. The drawdowns are also expressed as decreases in flowing pressure at the bore head in kilopascals.

TABLE 3

FLOW OR PUMPING RATE(litre/sec)	DRAWDOWN 100 mins	PRESSURE HEAD DECLINE (kpa)	DRAWDOWN 1000 mins	PRESSURE HEAD DECLINE (kpa)
5	4.85 m	47.6	5.71 m	56.1
10	8.84	86.8	9.70	95.2
15	13.68	134.3	14.54	142.8
20	19.39	190.4	20.25	198.8

b. Main Test

The drawdown and recovery curves are shown on Figure 3. The drawdown curve shows a stepwise pattern with an inexplicable increase in pressure at about the 20 minute stage of the test. Some surging was experienced throughout the test and the flow rate plot of Figure 6 attests to the difficulty in maintaining a constant flow rate. The only useful calculation that can be made from this part of the test is a specific capacity of 1.126.

The recovery curve is much more satisfactory and a straight line solution for a value of transmissivity can be obtained by the Jacob method where

$$T = \frac{0.183 \times Q}{x}$$

where T = transmissivity

Q = flow rate

s = recovery per log cycle of time

Using this equation

$$T = \frac{0.183 \times 1125}{0.67}$$

$$= 307.3 \text{ m}^3\text{/day/m}$$

This can be regarded as a reasonably accurate value as the aquifer was fully penetrated and the bore has been well developed. This value compares with a value of 270 m^3/day/m obtained from an earlier test on bore No. 2.

SAFE DISCHARGE RATE

The safe discharge rate of the bore can be determined by means of the following equation.

$$Q_s = 7.48 \text{ A.V.S.}$$

from Walton (1970).

The safe discharge rate is that rate at which the bore can be pumped or allowed to flow over the long term without causing the migration of fine grained material from the aquifer to the screen. Adherence to the safe yield will ensure that the town water supply will always remain sand free and no blocking of the screen will occur.

Where Q_s = safe discharge rate of the bore

S = length of screen in feet

A = effective open area per foot of screen in square feet

V = optimum entrance velocity, in feet per minute.

For this bore

S = 30.50 feet

A = 53 square inches/ft of screen

= 0.37 square feet

Transmissivity = 307.3 m^3/day/m

= 2.06×10^4 gall/day/ft

Aquifer thickness = 34.11 ft

∴ Coefficient of permeability = 6.04×10^2 gall/day/sq foot.

From Table 5.1 in Walton 1970, the optimum water entrance velocity is 3 feet per minute for this permeability.

The safe discharge rate therefore, becomes:

$Q_s = 7.48 \times 0.37 \times 3 \times 30.50$

= 253 U.S. gallons per minute

= 211 Imperial gallons per minute

= 12 700 gallons/hour

= 16 litres/second

It is considered that this value represents the maximum safe pumping limit to prevent fine grained aquifer material migrating toward and entering the bore.

It is considered inadvisable to pump bores 2 and 3 simultaneously for extended periods of time as a large degree of interference between the two would occur due to their proximity to each other.

CONCLUSIONS

1. The results of the flow testing indicate that the bore is satisfactorily developed and the safe discharge rate is 16 litres per second.
2. The bore recovered quite rapidly at the end of each flow test, enabling reliable predictions of pressure decline for various flow rates.
3. The transmissivity of the developed part of the aquifer is 307 m^3/day/metre. This compares with a value of 270 m^3/day/metre obtained from bore No. 2.
4. Despite the trouble taken to ensure constant flow rates, this was difficult to obtain. Experience has shown that some modifications are required to ensure a full pipe of water downstream from the orifice plate, if this system of flow testing is to be used successfully.

RECOMMENDATIONS

1. The discharge rate of the bore should be kept lower than 16 litres per second to ensure that the water supply remains sand free.
2. Bores 2 and 3 should not be pumped simultaneously for extended periods of time to minimise the degree of interference between them.

OJWB:FdeA
4/9/75

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APPENDIX A

WATER ANALYSES

BEACHPORT T.W.S. BORE NO. 3

Approximate Total Salts Analyses

Analysis No.	Mg/l	Remarks
W5028/73	1070	Depth of bore 8 metres water cut at 6.5 m.
W5029/73	54400	Depth of bore 50 m water cut at 6.5 m.
W5507/73	615	Depth of bore 109.8 m water cut at 103.33 m.
W5508/73	700	First water cut at 103.33 m.
W5509/73	643	Final sample - tested by AMDEL.

The first four sanalyses were done by an approximate method which gives the total salts within small limits of error.

WATER ANALYSIS REPORT

SAMPLE NO. W5509-73 JOB NO. 2503-74

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE MG/L	MILLIEQUIVS. PER LITRE MG/L
CATIONS			
CALCIUM	(CA)	78.	3.9
MAGNESIUM	(MG)	18.	1.5
SODIUM	(NA)	148.	6.4
POTASSIUM	(K)	10.	.3
ANIONS			
BICARBONATE	(HCO3)	401.	6.6
SULPHATE	(SO4)	21.	.4
CHLORIDE	(CL)	171.	4.8
NITRATE	(NO3)	<1	.2

TOTALS AND BALANCE

CATIONS (ME/L) 12.1 DIFF = .2

ANIONS (ME/L) 11.8 SUM =23.9

$\frac{DIFF*100.}{SUM}$ = 1.0%

DERIVED AND OTHER DATA

CONDUCTIVITY (E.C.)

MICRO-S/CM AT 25 DEG. C 1571.

	MILLIGRAMS PER LITRE MG/L
TOTAL DISSOLVED SOLIDS	
A. BASED ON E.C.	
B. CALCULATED (HCO3=CO3)	643.
C. RESIDUE ON EVAP. AT 180 DEG. C	
TOTAL HARDNESS AS CACO3	269.
CARBONATE HARDNESS AS CACO3	269.
NON-CARBONATE HARDNESS AS CACO3	<5
TOTAL ALKALINITY AS CACO3	329.
FREE CARBON DIOXIDE (CO2)	
SUSPENDED SOLIDS	
SILICA (SIO2)	
BORON (B)	
	UNITS
REACTION -pH	7.6
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	
SODIUM TO TOTAL CATION RATIO (ME/L)	53.4%

NAME - E W S

ADDRESS - BEACHPORT

HUNDRED - RIVOLI BAY

SECTION - TOWN LOT

HOLE NO. - 3

SUPPLY -

SAMPLE COLLECTED BY -R. STREMPEL

WATER CUT - 339 m

WATER LEVEL - SURFACE

DEPTH HOLE - 357 m

DATE COLLECTED - 11.12.73

DATE RECEIVED -

APPENDIX B

TIME - DRAWDOWN READINGS

BEACHPORT T.W.S. BORE NO. 3

Main Flow Test: Duration: 100 minutes
Initial Pressure: 23.5 p.s.i.
Average Flow Rate: 1125 m^3/day
3 inch orifice plate

Time (minutes)	Pressure (p.s.i.)	Pressure Decrease	Drawdown Potentiometric Head (metres)
1	-	-	-
2	-	-	-
3	8.9	14.6	10.25
4	8.9	14.6	10.25
5	8.5	15.0	10.53
6	8.5	15.0	10.53
7	8.5	15.0	10.53
8	8.5	15.0	10.53
9	8.3	15.2	10.68
10	8.3	15.2	10.68
12	8.2	15.3	10.75
14	8.2	15.3	10.75
16	8.5	15.0	10.53
18	-	-	-
20	8.9	14.6	10.25
22	8.9	14.6	10.25
24	8.5	15.0	10.53
26	8.5	15.0	10.53
28	8.5	15.0	10.53
30	8.5	15.0	10.53
35	8.1	15.4	10.82
40	7.9	15.6	10.96
45	7.9	15.6	10.96
50	7.9	15.6	10.96
55	7.7	15.8	11.10
60	7.6	15.9	11.17
65	7.7	15.8	11.10
70	7.7	15.8	11.10
75	7.5	16.0	11.24
80	7.5	16.0	11.24
85	7.2	16.3	11.45
90	7.1	16.4	11.52
95	7.1	16.4	11.52
100	7.0	16.5	11.59

At the completion of the main flow test the control valve was fully opened and the bore allowed to flow until a stabilised open flow pressure was attained.

Main Recovery Test: Duration: 30 minutes
Stabilised Open Flow Pressure 3.7 p.s.i.

Time	Pressure	Pressure Increase	Potentiometric Head Recovery
0	3.7	17.3	12.15
1	21.0	17.3	12.15
2	21.6	17.9	12.57
3	21.9	18.2	12.78
4	22.2	18.5	12.99
5	22.3	18.6	13.06
6	22.5	18.8	13.20
7	22.6	18.9	13.27
8	22.6	18.9	13.27
9	22.7	19.0	13.34
10	22.75	19.05	13.38
12	22.8	19.1	13.41
14	22.9	19.2	13.48
16	23.0	19.3	13.55
18	23.0	19.3	13.55
20	23.0	19.3	13.55
22	23.1	19.4	13.62
24	23.1	19.4	13.62
26	23.15	19.45	13.65
28	23.2	19.5	13.69
30	23.2	19.5	13.69

Stage 1 Duration: 32 minutes
Initial Pressure: 23.4 p.s.i.
Average Flow Rate: 1357 m^3/day
3 inch orifice plate

Time	Pressure	Pressure Decrease	Drawdown Potentiometric Head
1	5.2	-	-
2	5.2	18.2	12.78
3	5.1	18.3	12.85
4	5.0	18.4	12.92
5	4.9	18.5	12.99
6	4.8	18.6	13.06
7	4.8	18.6	13.06
8	4.5	18.9	13.27
9	4.4	19.0	13.34
10	4.2	19.1	13.55
12	4.1	19.3	13.62
14	4.1	19.3	13.62
16	4.0	19.4	13.69
18	4.0	19.4	13.69
20	4.0	19.4	13.69
22	4.0	19.4	13.69
24	3.9	19.5	13.76
26	3.8	19.6	13.83
28	3.8	19.6	13.83
30	3.8	19.6	13.83
32	3.8	19.6	13.83

Stage 2

Duration: 32 minutes
Initial Pressure: 23.2 p.s.i.
Average Flow Rate: 1074 m^3/day
3 inch orifice plate.

Time	Pressure	Pressure Decrease	Drawdown Potentiometric Head
1	-		
2	9.5	13.7	9.62
3	9.2	14.0	9.83
4	9.0	14.2	9.97
5	9.0	14.2	9.97
6	8.9	14.3	10.14
7	8.8	14.4	10.11
8	8.8	14.4	10.11
9	8.7	14.5	10.18
10	8.7	14.5	10.18
12	8.7	14.5	10.18
14	8.6	14.6	10.25
16	8.6	14.6	10.25
18	8.5	14.7	10.32
20	8.5	14.7	10.32
22	8.5	14.7	10.32
24	8.5	14.7	10.32
26	8.4	14.8	10.39
28	8.4	14.8	10.39
30	8.4	14.8	10.39
32	8.3	14.9	10.46

Stage 3

Duration: 32 minutes
Initial Pressure: 23.2 p.s.i.
Average Flow Rate: 750 m^3/day
2.5 inch orifice plate.

Time	Pressure	Pressure Decrease	Drawdown Potentiometric Head
1	-		
2	14.0	9.2	6.46
3	14.0	9.2	6.46
4	13.75	9.45	6.64
5	13.75	9.45	6.64
6	13.75	9.45	6.64
7	13.75	9.45	6.64
8	13.75	9.45	6.64
9	14.0	9.2	6.46
10	14.0	9.2	6.46
12	14.0	9.2	6.46
14	14.0	9.2	6.46
16	13.9	9.3	6.53
18	13.8	9.4	6.60
20	13.8	9.4	6.60
22	13.8	9.4	6.60
24	13.8	9.4	6.60
26	13.75	9.45	6.64
28	13.75	9.45	6.64
30	13.75	9.45	6.64
32	13.75	9.45	6.64

Stage 4

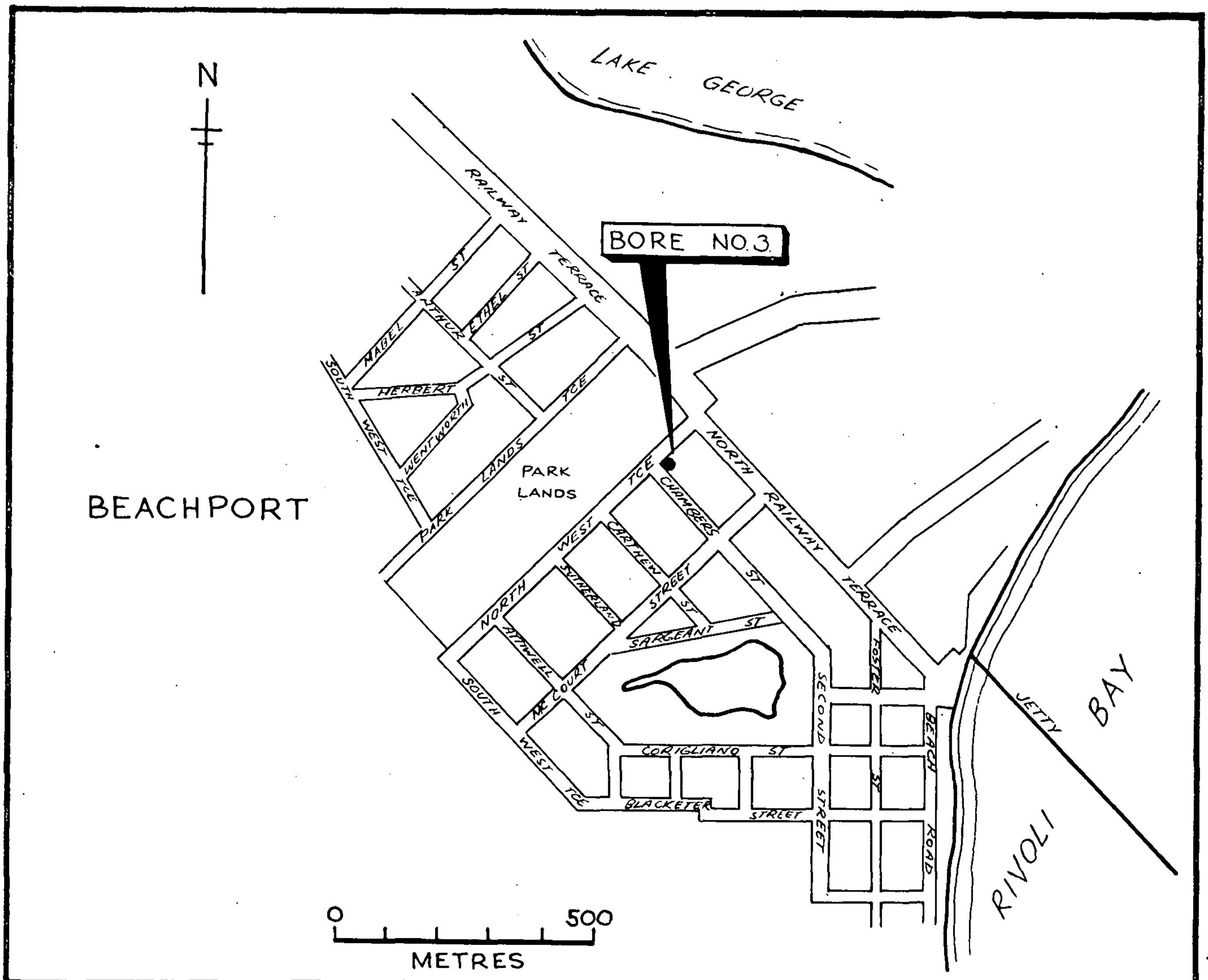
Duration: 30 minutes
Initial Pressure: 23.5 p.s.i.
Average Flow Rate: 575 m^3/day
2 inch orifice plate.

Time	Pressure	Pressure Decrease	Drawdown Potentiometric Head
1	19.75	3.75	2.63
2	17.25	6.25	4.39
3	17.20	6.3	4.42
4	17.1	6.4	4.49
5	17.0	6.5	4.56
6	16.9	6.6	4.63
7	16.8	6.7	4.70
8	16.8	6.7	4.70
9	16.8	6.7	4.70
10	16.8	6.7	4.70
12	16.8	6.7	4.70
14	16.75	6.75	4.74
16	16.6	6.9	4.84
18	16.6	6.9	4.84
20	16.5	7.0	4.91
22	16.5	7.0	4.91
24	16.5	7.0	4.91
26	1655	7.0	4.91
28	16.5	7.0	4.91
30	16.5	7.0	4.91

Stage 5

Duration: 30 minutes
Initial Pressure: 23.0 p.s.i.
Average Flow Rate: 294 m^3/day
2 inch orifice plate.

Time	Pressure	Pressure Decrease	Drawdown Potentiometric Head
1	19.5	3.5	2.46
2	19.25	3.75	2.63
3	19.5	3.5	2.46
4	20.1	2.9	2.04
5	20.4	2.6	1.83
6	20.4	2.6	1.83
7	20.45	2.55	1.80
8	20.5	2.5	1.76
9	20.2	2.8	1.97
10	20.2	2.8	1.97
12	20.2	2.8	1.97
14	20.25	2.75	1.93
16	20.25	2.75	1.93
18	20.25	2.75	1.93
20	20.25	2.75	1.93
22	20.3	2.7	1.90
24	20.25	2.75	1.93
26	20.5	2.5	1.76
28	20.3	2.7	1.90
30	20.3	2.7	1.90



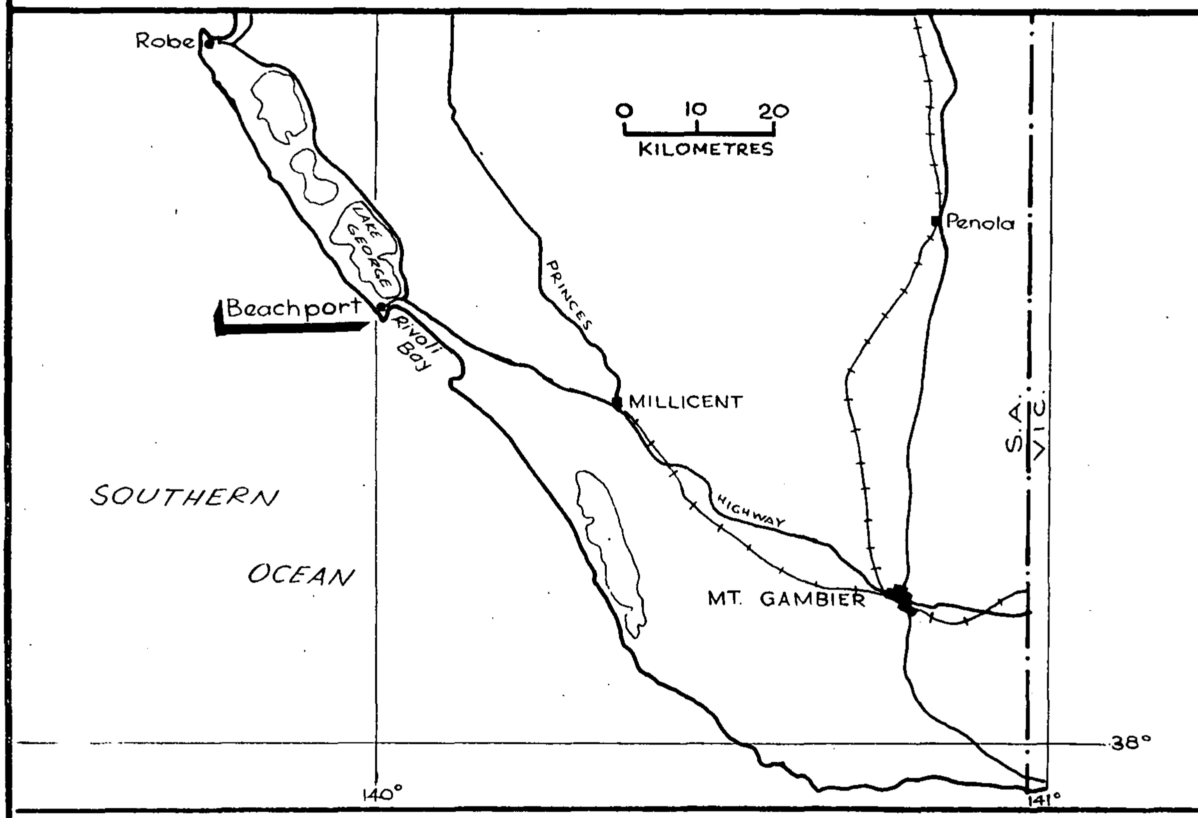


FIG. 1

DEPARTMENT OF MINES — SOUTH AUSTRALIA

HYDROGEOLOGY SECTION	**Drn.** A.F.	BEACHPORT TOWN WATER SUPPLY BORE NO.3 HD. RIVOLI BAY STATE NO. 610999107	**SCALE:** 1:13300 APPROX
	Tcd. A.F.		S11919
	Ckd.	LOCALITY PLAN	
	Exd.		**DATE:** 2-9-75

500–2.69 665 6923-III

6923-III

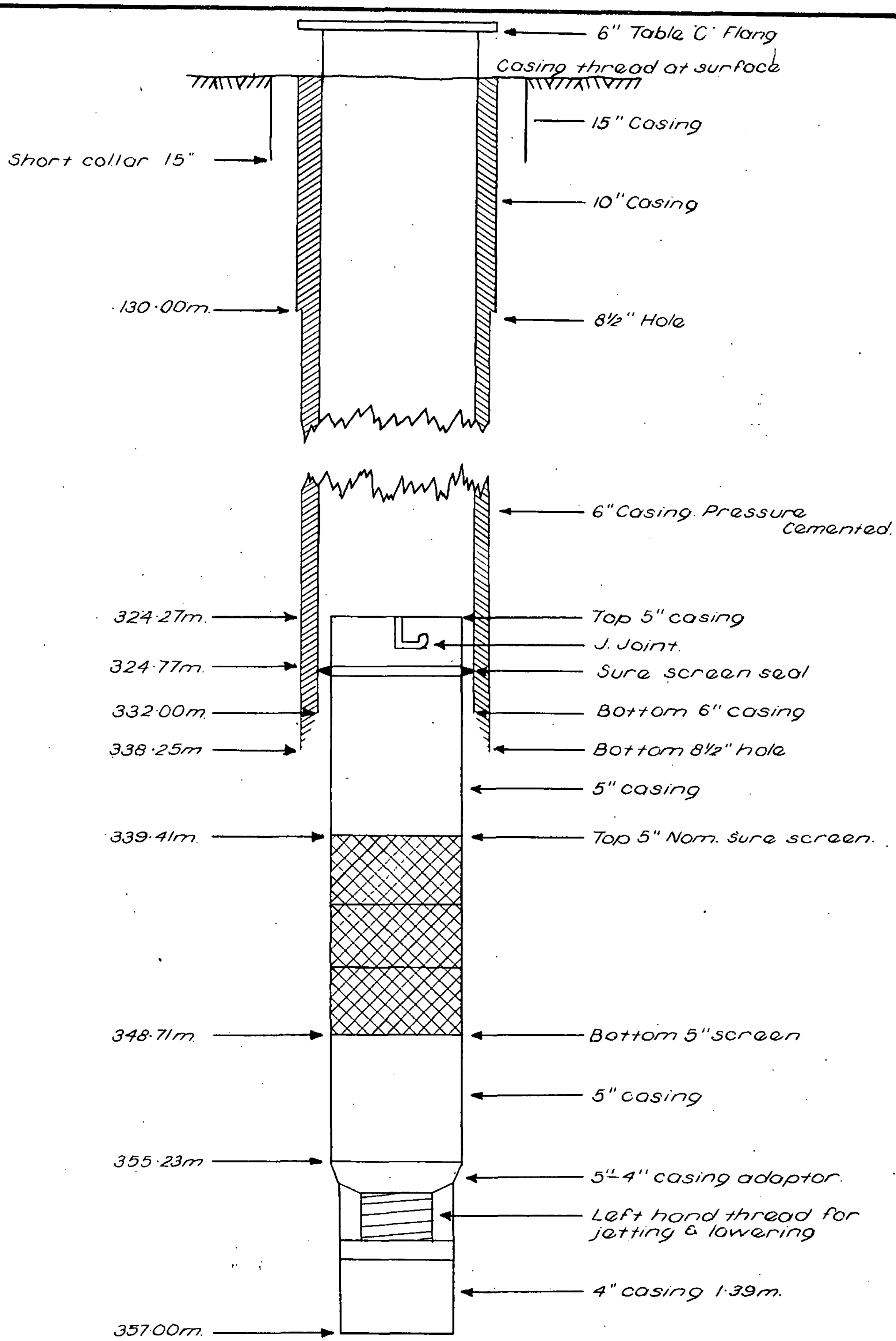
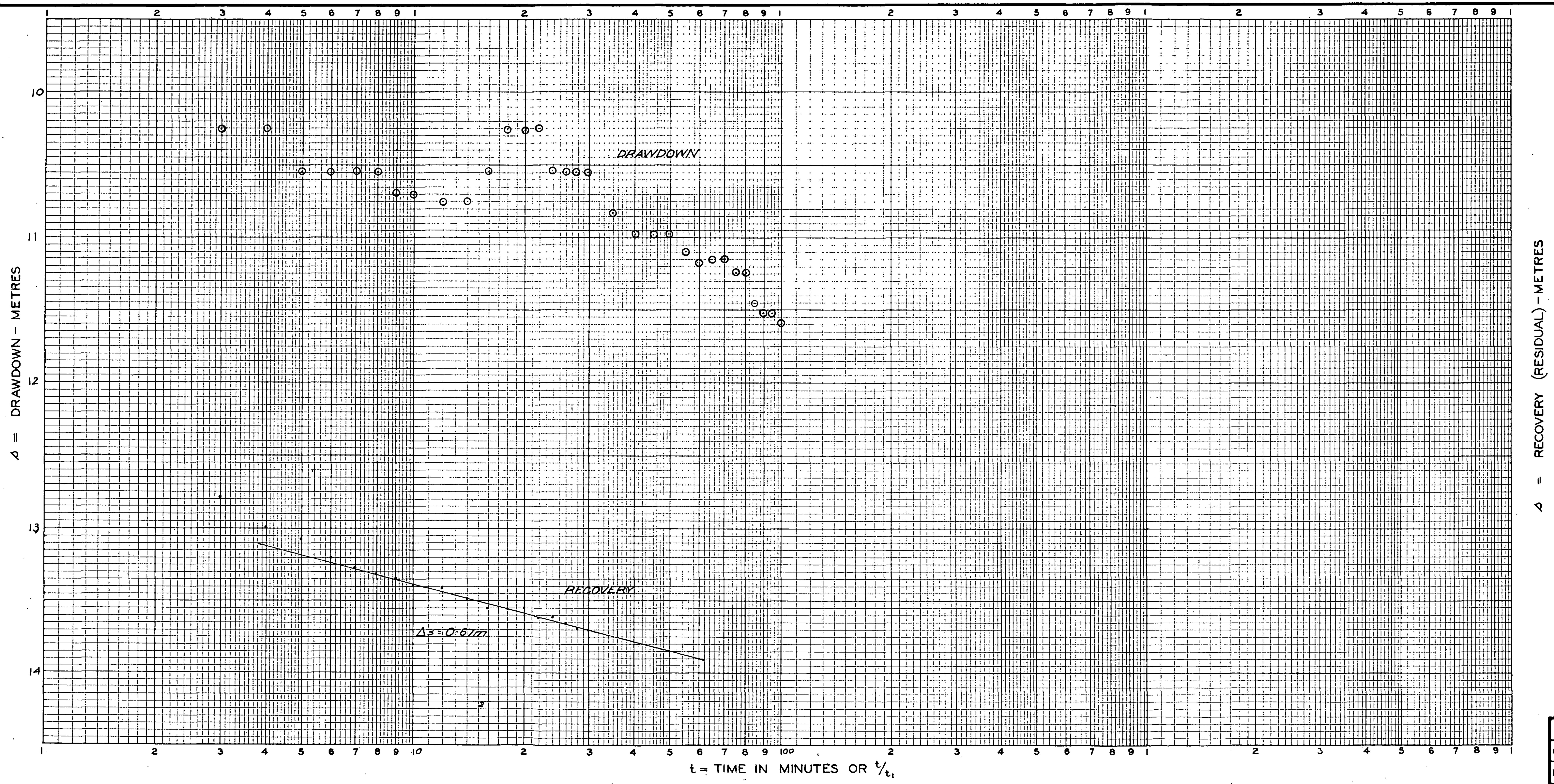


FIG. 2.

	DEPARTMENT OF MINES — SOUTH AUSTRALIA	Scale : Diagram
Compiled : O.J.W.B.	BEACHPORT TOWN SUPPLY CASING DETAILS BORE NO. 3	Date : 23-6-75.
Drn. G.J.T. Ckd		Drg. No. S11518

750—8.74 F332 O 6923-III



BOREHOLE STATE No. ____	TYPE OF PUMP ____
DEPTH TO WATER LEVEL AT TEST START (ℓ_2) ____ (L) **	DISCHARGE STARTED AT ____ ON ____
PUMP INTAKE DEPTH (ℓ_1) ____ (L)	" STOPPED AT ____ ON ____
*AVAILABLE DRAWDOWN ____ (L)	AQUIFER FROM ____ TO ____ (L)
	HOLE DEPTH ____ (L)

EQUATIONS

$T = \frac{0{\cdot}183 \times Q}{\Delta_s}$ $S = \frac{2{\cdot}25 \times T t_0}{r^2}$

In which
T = Transmissivity ($L^3/t/L$)
Q = Pumping Rate (L^3/t)
Δ_s = Drawdown per log cycle. (L)
S = Storage Coefficient
t_0 = Zero drawdown time - (t)
r = Distance to Observation Bore - (L)
1 day = $8{\cdot}64 \times 10^4$ secs.

DATA

Q	Δ_s	t_0
1125 m³/day	0·67m	

CALCULATIONS

$T = \frac{0{\cdot}183 \times 1125}{0{\cdot}67} = 307{\cdot}3\ m^3/day/m.$

FIG. 3.

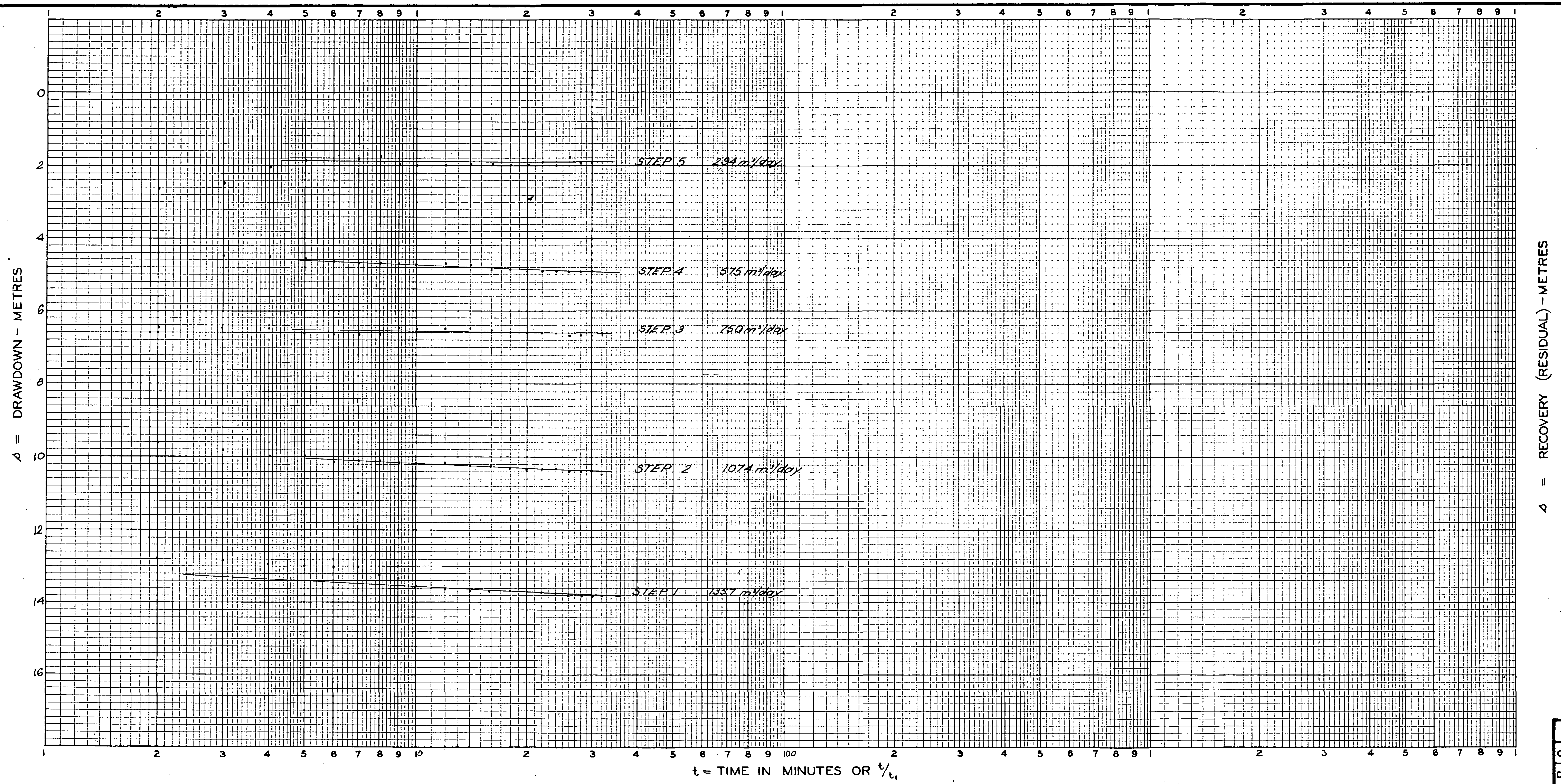
** L = unit of length.
t = time unit.

* Available drawdown = $\ell_1 - (\ell_2 + \text{\_\_\_\_\_})$

HYDROGEOLOGY SECTION	DEPARTMENT OF MINES—SOUTH AUSTRALIA	D.M. /
COMPILED: O.J.W.B.	BEACHPORT TOWN WATER SUPPLY BORE No. 3. MAIN AQUIFER TEST.	DATE: 24·6·75
DRN. G.J.T. CHD.		DRG. No. 75 - 626

P.F. No. 69—953 MH

6923 III



BOREHOLE STATE N°____________	TYPE OF PUMP________________
DEPTH TO WATER LEVEL AT TEST START (ℓ_2)__________(L) **	DISCHARGE STARTED AT____ON_____
	" STOPPED AT____ON____
PUMP INTAKE DEPTH (ℓ_1)________(L)	AQUIFER FROM______TO______(L)
* AVAILABLE DRAWDOWN__________(L)	HOLE DEPTH______(L)

EQUATIONS

$$T = \frac{0{\cdot}183 \times Q}{\Delta_o} \qquad S = \frac{2{\cdot}25 \times T t_o}{r^2}$$

In which
T= Transmissivity ($L^3/t/L$)
Q= Pumping Rate. (L^3/t)
Δ_o= Drawdown per log cycle. (L)

S= Storage Coefficient
t_o= Zero drawdown time- (t)
r = Distance to Observation Bore- (L)
1 day = $8{\cdot}64 \times 10^4$ secs.

DATA

Q Δ_o t_o

CALCULATIONS

FIG. 4.

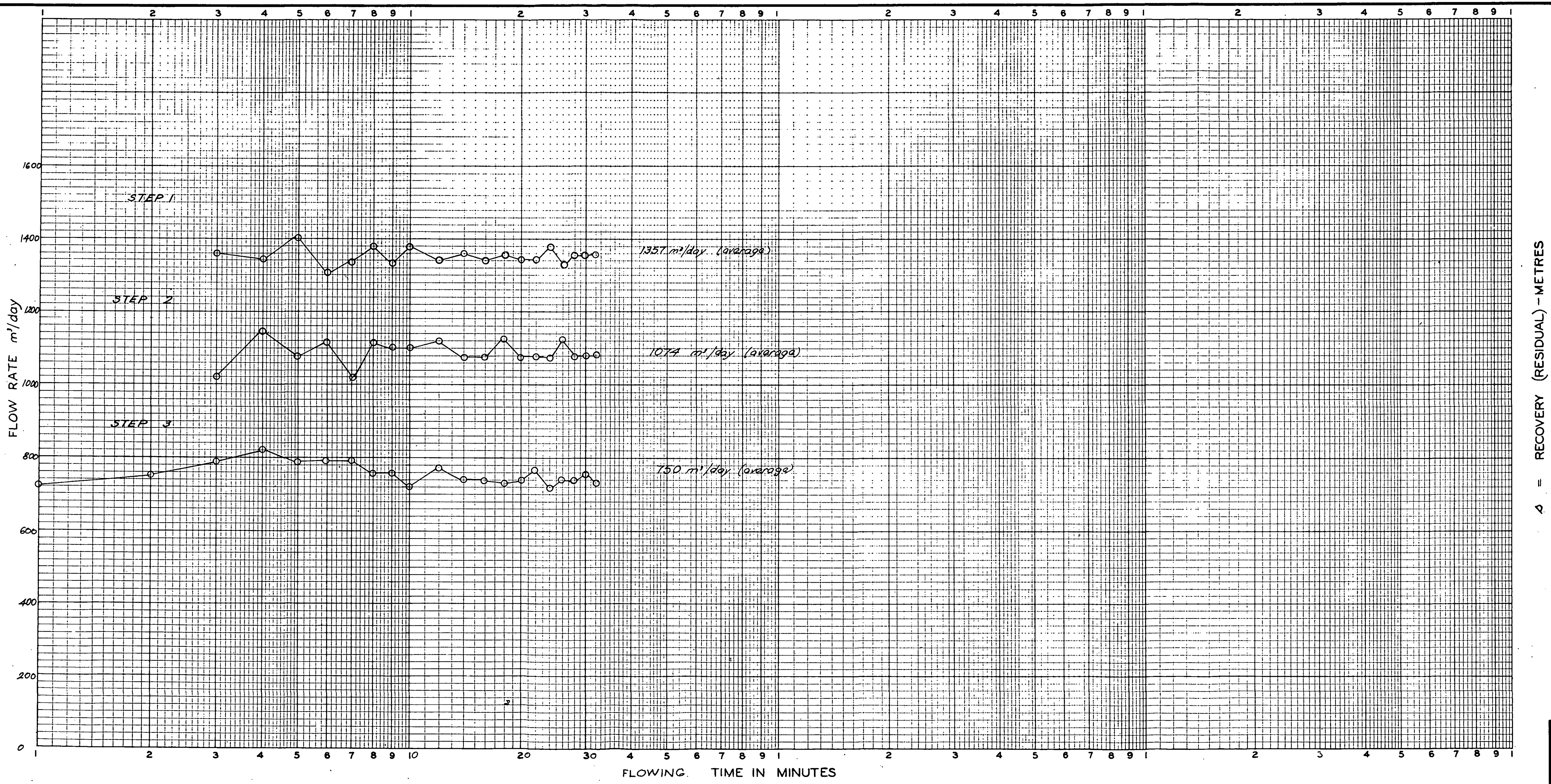
** L = unit of length.
t = time unit.

* Available drawdown = $\ell_1 - (\ell_2 + \text{-----})$

HYDROGEOLOGY SECTION	DEPARTMENT OF MINES—SOUTH AUSTRALIA	D.M. /
COMPILED: O. J. W. B.	BEACHPORT TOWN WATER SUPPLY BORE No. 3. STEP DRAWDOWN CURVES	DATE: 24-6-75.
DRN. G.J.T. CHD.		DRG. No. 75-627

P.F. No. 69—953 MH

6923 III



BOREHOLE STATE N°____________
DEPTH TO WATER LEVEL
AT TEST START (ℓ_2)_________(L) **
PUMP INTAKE DEPTH (ℓ_1)_______(L)
*AVAILABLE DRAWDOWN________(L)

TYPE OF PUMP_______________
DISCHARGE STARTED AT___ON____
" STOPPED AT___ON____
AQUIFER FROM_____TO_____(L)
HOLE DEPTH______(L)

EQUATIONS

$$T = \frac{0{\cdot}183 \times Q}{\Delta_o} \qquad S = \frac{2{\cdot}25 \times T t_o}{r^2}$$

In which
T = Transmissivity ($L^3/t/L$)
Q = Pumping Rate. (L^3/t)
Δ_o = Drawdown per log cycle. (L)

S = Storage Coefficient
t_o = Zero drawdown time- (t)
r = Distance to Observation Bore- (L)
1 day = $8{\cdot}64 \times 10^4$ secs.

DATA

Q Δ_o t_o

CALCULATIONS

FIG. 5.

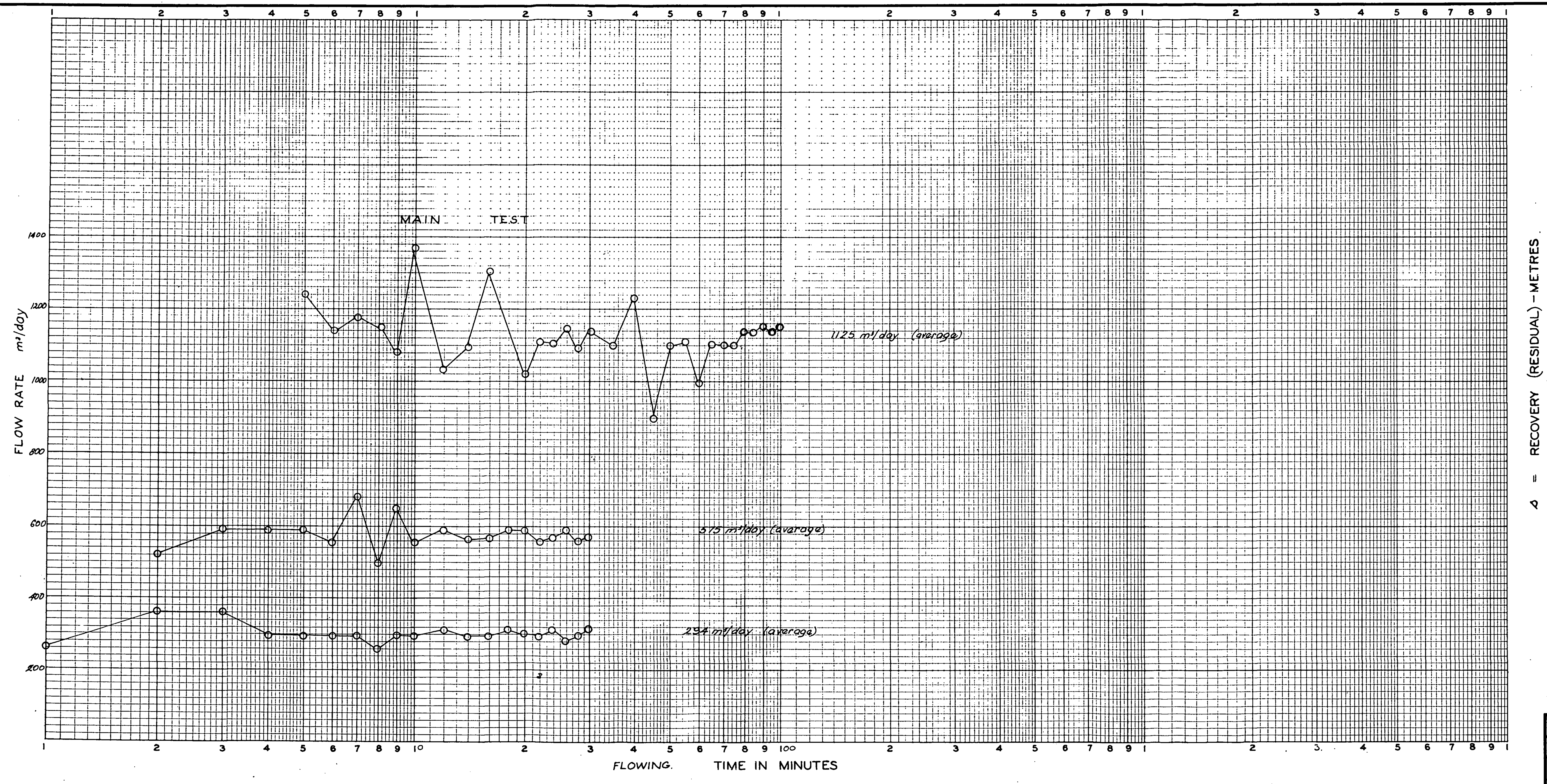
** L = unit of length.
t = time unit.

* Available drawdown = $\ell_1 - (\ell_2 +$ _____)

HYDROGEOLOGY SECTION	DEPARTMENT OF MINES—SOUTH AUSTRALIA	D.M. /
COMPILED: O. J. W. B.	BEACHPORT TOWN WATER SUPPLY BORE No. 3 FLOW RATE vs. TIME.	DATE: 24-6-75.
DRN. G. J. T. CHD.		DRG. No. 75—628

P.F. No. 69—953 MH

6923-111



BOREHOLE STATE Nº ____________ TYPE OF PUMP ____________
DEPTH TO WATER LEVEL DISCHARGE STARTED AT ____ ON ____
AT TEST START (ℓ_2) ________ (L) ** " STOPPED AT ____ ON ____
PUMP INTAKE DEPTH (ℓ_1) ________ (L) AQUIFER FROM ______ TO ______ (L)
* AVAILABLE DRAWDOWN ________ (L) HOLE DEPTH ______ (L)

EQUATIONS

$$T = \frac{0.183 \times Q}{\Delta_o} \qquad S = \frac{2.25 \times T t_o}{r^2}$$

In which

T = Transmissivity ($L^3/t/L$)
Q = Pumping Rate (L^3/t)
Δ_o = Drawdown per log cycle (L)
S = Storage Coefficient
t_o = Zero drawdown time – (t)
r = Distance to Observation Bore – (L)
1 day = 8.64×10^4 secs.

DATA

Q Δ_o t_o

CALCULATIONS

FIG. 6.

* Available drawdown = $\ell_1 - (\ell_2 + \_\_\_\_\_)$

** L = unit of length.
t = time unit.

HYDROGEOLOGY SECTION	DEPARTMENT OF MINES—SOUTH AUSTRALIA	D.M. /
COMPILED: O.J.W.B.	BEACHPORT TOWN WATER SUPPLY BORE No. 3 FLOW RATE vs. TIME	DATE: 24.6.75.
DRN. G.J.T. CHD.		DRG. No. 75—629

P.F. No. 69—953 MH

6923 III

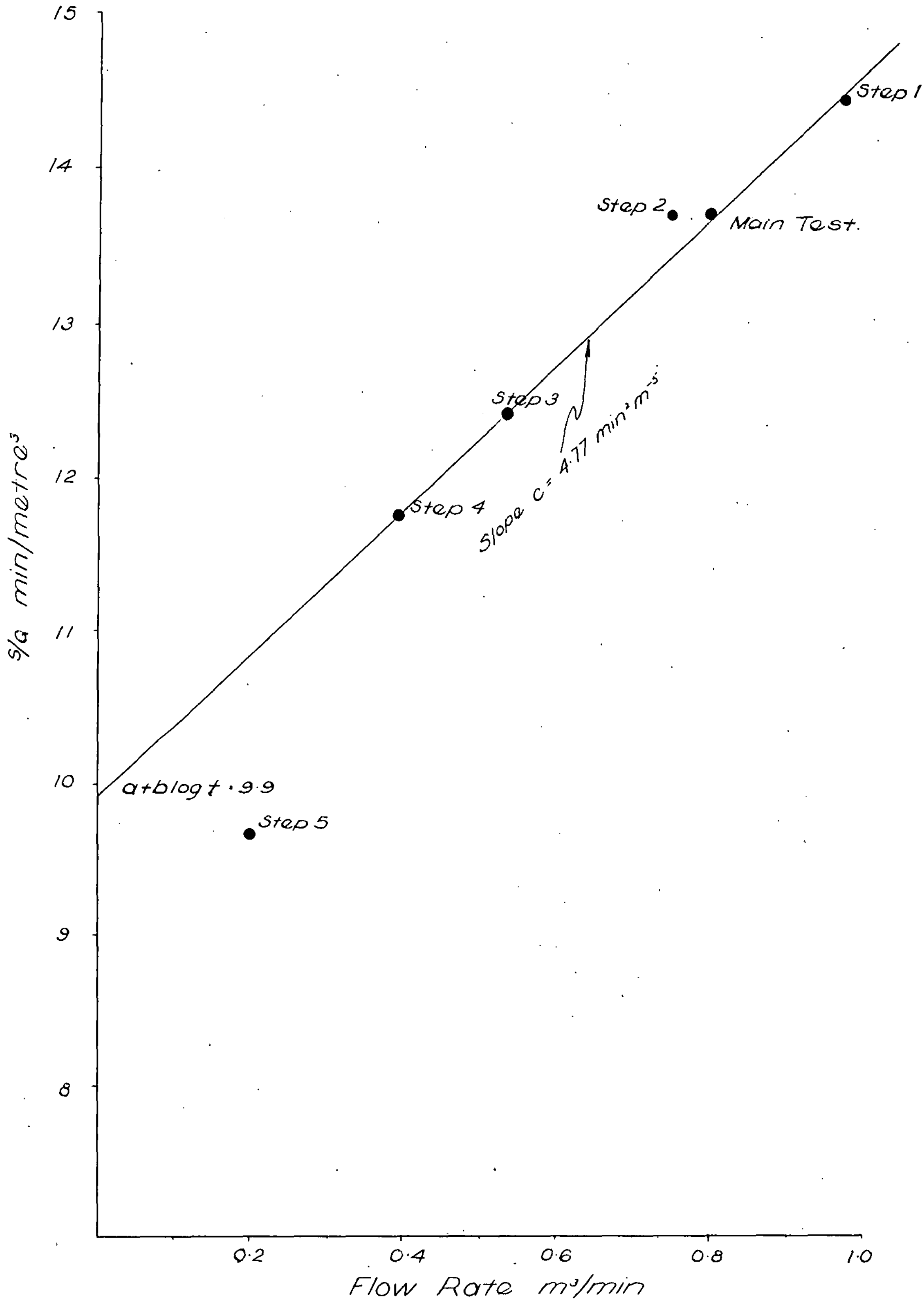


FIG. 7.

DEPARTMENT OF MINES — SOUTH AUSTRALIA	
Compiled : O.J. W. B	BEACHPORT TOWN SUPPLY
Drn. G.J.T. / Ckd	BORE NO. 3
	DRAWDOWN / FLOW RATE vs FLOW RATE
Scale : Graphical	Date : 25-6-75
Drg. No.	S11523

750—8.74 F332 O 6923 III

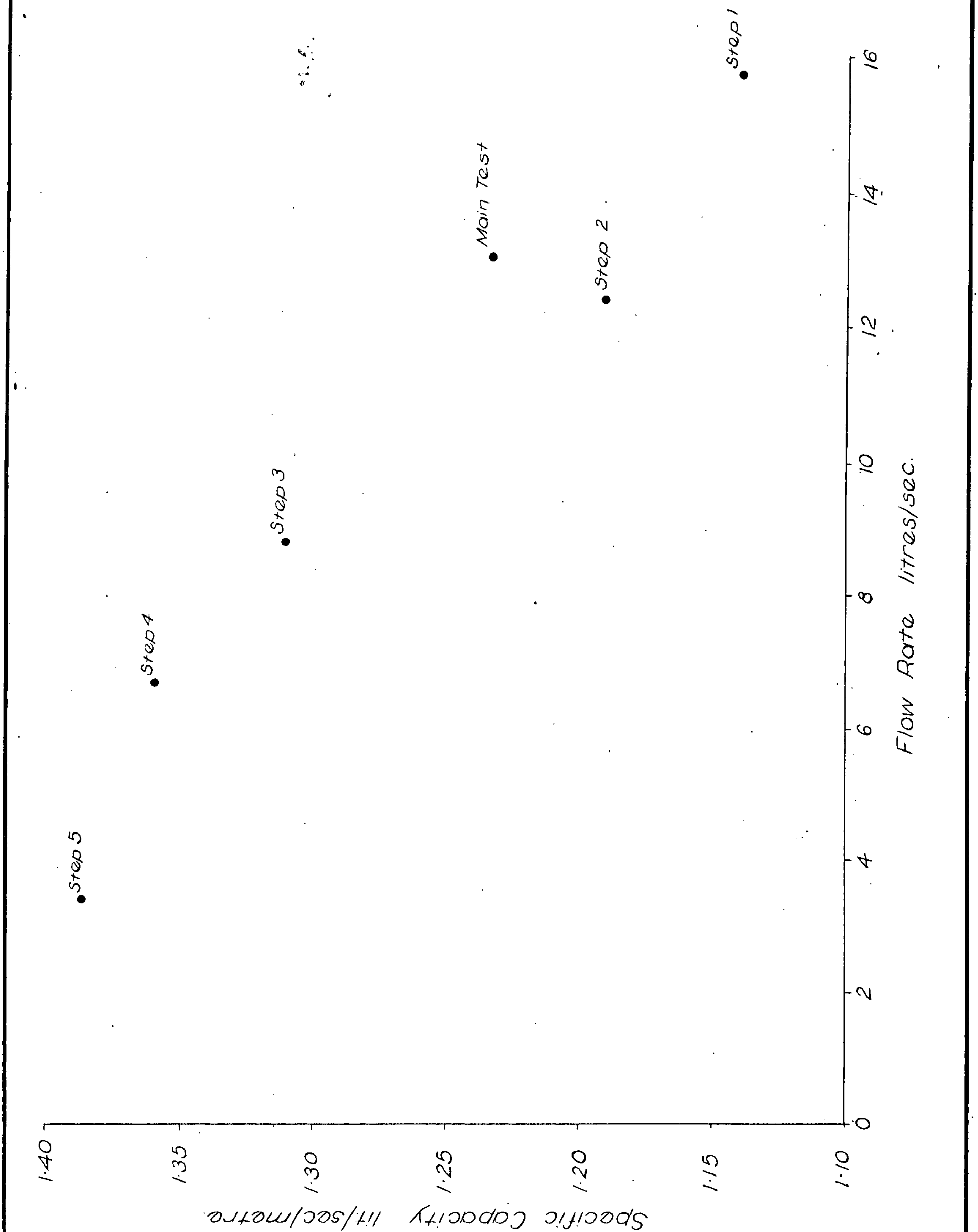
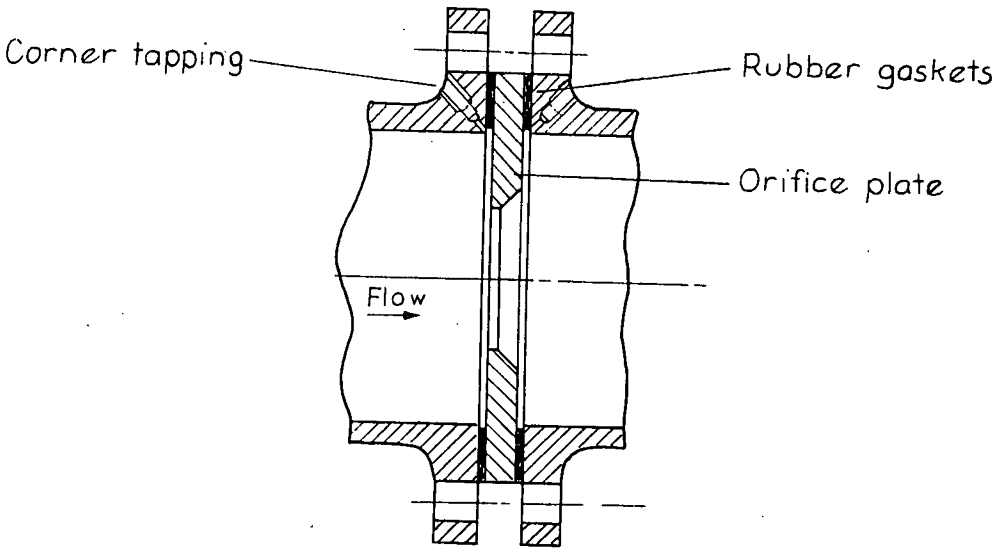


FIG. 8.

	DEPARTMENT OF MINES — SOUTH AUSTRALIA	Scale : *Graphical*
Compiled : *O.J.W.B.*	BEACHPORT TOWN SUPPLY BORE NO. 3 SPECIFIC CAPACITY vs TIME	Date : *24-6-75*
Drn. *G.J.T.* Ckd		Drg. No. S11524

750—8.74 F332 O *6923* *III*

Orifice plate with corner tappings.



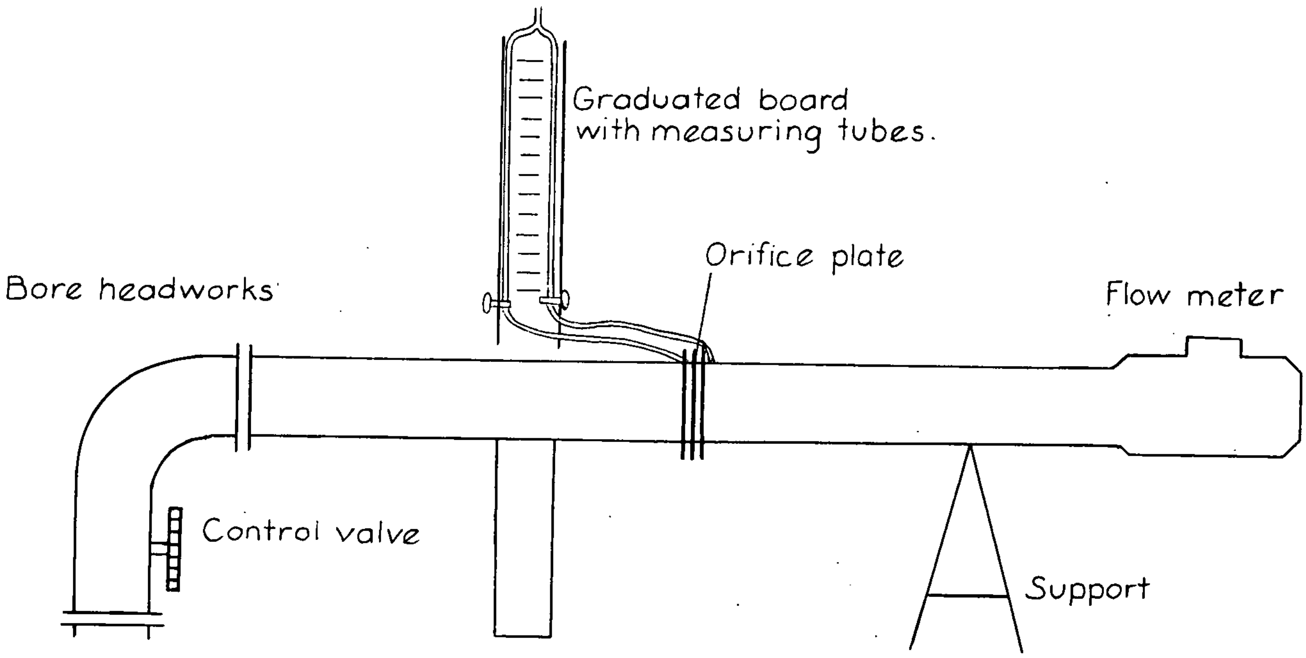


FIG. 9

	DEPARTMENT OF MINES — SOUTH AUSTRALIA	Scale :
Compiled :	BEACHPORT TOWN WATER SUPPLY BORE NO. 3 SCHEMATIC DIAGRAM SHOWING TESTING EQUIPMENT	Date : 2-9-75
Drn. P.D. | Ckd		Drg. No. S11920

750—8.74 F332 O

6923-III

6923 - III .

PROJECT NO: 3

COMPOSITE WELL LOG – HYDROGEOLOGY

DEPARTMENT OF MINES – SOUTH AUSTRALIA

CONSTRUCTION DETAILS

DRILLING TECHNIQUE: CABLE TOOL AND ROTARY
CIRCULATION: MUD
START: 1.10.73
FINISH: 10.12.73
TOTAL DEPTH: 365 metres

	Inches	mm	From(m)	To(m)
HOLE DIAMETER	12	305	0	130
	8½	216	130	338 25
	6	152	338 25	365
CASING DIAMETER (Cemented)	10	254	0	130
	6	152	0	332
CASING DIAMETER (Uncemented)	5	127	324 27	355 23
	4	116	355 61	357 0
SCREEN DETAILS Make / Model Dimensions surescreen	5	127	339 41	348·71

HIRER: E.&.W.S. DEPARTMENT
PROJECT: BEACHPORT T.W.S.
WELL STATUS: COMPLETED AS A WATER SUPPLY BORE

LOCATION
DESCRIPTIVE: Adjacent Town Reserve
HUNDRED: RIVOLI BAY
SECTION: Town Lot
LATITUDE
LONGITUDE
1 100,000 SHEET
OTHER

ELEVATION
DATUM (m)
REF PT (m)
SURFACE (m)

ACCESSION
STATE NO: 610999107
PROJECT NO: 3
DOCKET NO: 150 A/20
BORE SERIAL NO.: W 807/74
FOLDER NO
PERMIT NO.
EXPLORATION LIC.

LOCATION PLOTTED
SHEET
SCALE
SVY NO
RUN NO
PHOTO NO.
PHOTO SCALE
PLAN NO

TYPE OF LOG	16 IN NORMAL	64 IN NORMAL	6 FT LATERAL	S P	POINT RESISTIVITY	NEUTRON	GAMMA RAY	TEMPERATURE	
DATE OF RUN	22 11 73	22 11 73	22 11 73	22 11 73	22 11·73	22 11 73	22 11·73		
FIRST READING (m)	129	129	117	129	129	11	0		
LAST READING (m)	341	341	348	341	341	347	348		
INTERVAL MEASURED (m)	212	212	231	212	212	336	348		
CASING: LOGGER (m)	129	129	129	129	128	129	129		
CASING: DRILLER (m)	130	130	130	130	130	130	130		
DEPTH REACHED (m)	341	341	340	341	341	348	348		
BOTTOM: DRILLER (m)	365	365	365	365	365	365	365		
MUD TYPE	Bentonite	Bentonite	Bentonite	Bentonite	Bentonite	Bentonite	Bentonite		
MUD RESISTIVITY	2 256m	2 256m	2·256m	2 256m	2 256m	2 256m	2 256m		
RECORDED BY	B P Taylor	B P Taylor	B P Taylor	B P Taylor	B P Taylor	B P Taylor	B P Taylor		

WELL SYMBOLS

CONSTRUCTION LOG
- Casing seal
- Casing shoe
- Wire wound screen
- Slotted casing
- Cemented Interval
- Gravel packed Interval

HYDROGEOLOGICAL LOG
- Core Interval
- Aq Aquifer
- Cb Confining bed
- T Transmissivity $m^3 day^{-1} m^{-1}$
- S Storage Coefficient/Specific Yield
- θ Porosity
- K Hydraulic conductivity $m day^{-1}$

DEPTH TO WATER (m)	DEPTH TO S.W.L. (m)	YIELD litres/sec	YIELD Method of Test	TOTAL DISSOLVED SOLIDS mg/litre	TOTAL DISSOLVED SOLIDS Analysis W No
6 50	6 50			1070	5028/73
50·00	6 50			15000 +	5029/73
103 33	flow			700	5568/73
339 00	+ 16 5	16	flow	643	5509/73

REMARKS

DRILLER: R. Strempel
LITHOLOGY BY: J. Bowering
COMPILED BY: J. Bowering
DRAFTED BY: T.E.
DRAWING NUMBER: 75-835

CONSTRUCTION LOG	WATER CUT (m)	WATER LEVEL (m)	CORE	HYDRO. DATA	AGE	UNIT	LITHOLOGY DESCRIPTION
	6.5m	6·5		Salinity 1070 p.p.m.			0–1m SOIL: red brown–dark brown, sandy 1–2m CALCARENITE: pale brown, clayey, firm and consolidated 2–15m CALCARENITE: medium to coarse grained, pale yellow/orange, broken bryzoal fragments, some moderately sorted subangular to subrounded quartz
							15–21m CALCARENITE: pale grey to brown Coarse to medium grained, poorly to moderately sorted, subangular to subrounded abundant grey yellow to orange, bryzoal and shell fragments
							21–32m CALCISILTITE: pale grey, soft, slightly sandy with abundant dark grey flint decreasing towards 32m
							32–56m CALCILUTITE pale to medium grey, slightly sandy with occasional grey and white bryzoal fragments Traces of flint Some quartz grains up to 2mm in diameter and comprise 10–50% in some samples.
	50m.			Salinity 15000+ p.p.m.			Flint band at 56 m 56–68m. CALCILUTITE: as above with flint bands at 61 and 66m some white bryzoal stick fragments, occasional foraminifera, sponge spicules and sandy material consisting of milky and clear, subangular to rounded medium to coarse grained quartz
							68–98m. CALCILUTITE: becoming pale grey; more abundant bryzoal fragments and common coarse grained, subangular quartz and occasional shell fragments. Flint bands occur at 71, 77, 79, 85, 87, 93, 95, 97 metres. Becoming generally darker coloured at 98m.
		flow		Salinity 700 p.p.m.			98–114m. CALCILUTITE: as above but generally darker coloured throughout. Flint occurs at 101, 103, 105, 107 and 113m
							114–130m. CALCILUTITE: as above but becoming paler grey in colour. Flint occurs throughout.
10" casing set to 130 metres							130–135m. CALCARENITE: off white, yellow and orange, medium to coarse grained abundant bryzoal "sticks", foraminifera and calcitic chips; smokey grey quartz with some carbonaceous (?) matter. 135–156m MARL pale grey, soft and puggy, occasionally sandy with some bryzoal and dark grey flinty material throughout
					L. MIOCENE – U. EOCENE	GAMBIER LIMESTONE	156–162m MARL as above, becoming more brownish grey in colour; abundant bryzoa throughout.
							162–172m MARL: as above, almost 50% of samples consist of flint
							172–177m MARL as above but with less flint
							177–189m CALCARENITE: off white to pale grey, bryzoal with some flint. Becoming more marly towards 189m
							189–201m MARL: pale grey, sandy with some bryzoal matter throughout and occasional chips of flint.
							201–219m MARL as above with abundant brown flint and some bryzoal matter.
							219–226m CALCISILTITE: medium to dark grey, with abundant flint and some calcarenite.
							225–231m. CALCISILTITE: as above, becoming generally pale grey, with occasional bryzoa and flint.
							231–240m CALCISILTITE becoming off-white to cream in colour
							240–252m. CALCISILTITE: as above, flint becoming more abundant throughout and marly in part.
							252–264m. CALCARENITE off white to pale grey, bryzoal fragments, calcitic chips and some calcisiltite; occasional flint chips
							264–267m CALCARENITE: as above but becoming more marly.
					266 M–U EOCENE 276	LACEPEDE FMN	267–270m. CLAY off white to pale grey, soft and puggy, becoming greenish grey with glauconite; slightly calcareous. 270–276m CLAY as above but khaki green in colour with abundant glauconite becoming silty in part; occasional medium-sized grains (sandy)
					MIDDLE EOCENE	KONGORONG SAND	276–294m SANDSTONE very dark brown to black with up to 50% soft and puggy clay material. Sand is medium to coarse subangular to subrounded, poorly sorted quartz with rare traces of quartz.
							294–300m. SANDY CLAY: as above but becoming more clayey.
							300–315m. SANDSTONE as above, very dark brown, very clayey and silty. Sand is generally coarse, subangular to subrounded and poorly sorted.
							315–330m. SANDY CLAY: as above
Top of 5" casing 324·27m Sure screen seal at 324·27m.							
6" casing pressure cemented to 332m.					M EOCENE	BURRUNGULE MBR	330–342 CLAY pale grey to pale grey/green, with subordinate amount of sandy quartz.
Bottom of 8½ hole 338·25m.	339						
Top of 5" Nom. Sure screen 339·41m		flow			MIDDLE EOCENE	TARTWAUP FORMATION	342–354 SANDSTONE: pale brown, coarse to very coarse grained, generally sub rounded, moderately to poorly sorted; slightly dirty with some clayey coating on grains Quartz varies from clear to white to smokey grey, with some chert pebbles, becoming conglomeritic in parts
Bottom 5" screen 348·71m.							
5" to 4" casing adaptor 355·23m. Bottom 357·0m. (4" casing)							354–362m. CLAY: dark brown and sandy essentially a clayey facies of above with generally medium grained sand
							362–365m. CLAY: sandy as above but pale grey in colour
							END OF HOLE 365m.