DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Rept.Bk.No.79/81

STREAKY BAY TOWN WATER SUPPLY
PROGRESS REPORT NO. 2

GEOLOGICAL SURVEY

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AUGUST, 1979

Eng.Geol.No. 78/60
D.M. No. 225/77

CONTENTS

	PAGE
ABSTRACT	1
LOCATION	1
INTRODUCTION	1
EXPLORATORY DRILLING	2
TRENCH No. 3	6
GEOPHYSICS	6
OBSERVATION WELL NETWORK	7
OBSERVATION WELL DRILLING PROGRAMME	7
DRILLING RESULTS	8
"MARYVALE - YANDRA BASIN"	9
FUTURE WORK	9
REFERENCES	10

TABLE	1	Salinity versus Depth - SB12, 13
	2	Salinity of Caisson Inlet Pipes
	3	Salinity of Caisson Inlet Pipes after Cementing
	4	Salinities of SB15, 16
	5	Summary of Wells Drilled
APPENDIX	1	Geological Logs
	2	Streaky Bay Town Water Supply Interim Report by D. Armstrong

FIGURES

Fig. No.	Title	Drawing No.
1	Locality Plan	S12648
2	Location of Exploratory Holes	79-342
3	Salinity Profile-Observation Well FOR 4 & Trench No. 3	S14036
4	Salinity Profile-Caisson & Observation Well 357005709	S14037
5	Caisson Configuration and Salinities	S14038
6	Regional Water Table Contours - Jan. 1979	79-343
7	Reserve Water Table Contours - Jan. 1979	
8	Groundwater Salinity - Jan. 1979	79-363
9	Maryvale-Yandra Basin - Water Table Contours Jan. 1979	79-429
10	Water Level Response to Precipitation (1949-76)	S13268
11	Estimated Potential Evapotranspiration and Average Monthly Precipitation	S13269
12	Water Level Response to Precipitation at Various Discharge Rates	S13270

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ABSTRACT

Five exploratory wells were drilled by the Department of Mines and Energy in the continuing investigation to improve the town supply. Two were drilled in the Water Reserve with one later being backfilled as it was a suspected source of salt water contamination of the caisson. The remaining three holes investigated a probable 'fresh water basin' 3 km east of the Reserve which proved unsuitable due to low supplies.

A further 21 observation wells were drilled by the Engineering and Water Supply using an Air Track percussion rig to provide additional water table contour control and groundwater sample points in and around the Reserve.

The caisson was pumped during the winter months after above average rains, but salinities quickly rose after several dry months. Pumping tests will be carried out to see whether upward leakage of saline water can be controlled by pumping from the lower aquifer.

Approximately 50 observation wells are being monitored in the Maryvale - Yandra area in case of further investigations being warranted in this area.

LOCATION

Streaky Bay is on the West Coast of South Australia 100 km south of Ceduna, on the Flinders Highway (see Fig. 1). The area has a district population of 2 500 most of whom live in the township. The town water supply comes from a shallow groundwater basin 10 km from the town on the Flinders Highway towards Port Lincoln.

INTRODUCTION

In 1977 the Department of Mines and Energy was asked to investigate the possibility of increasing the caisson yield

and to investigate further supplies of potable groundwater. This work was carried out by Armstrong & Barnett (1977) and a report issued. The report recommended a drilling programme of five exploratory holes - two in the Water Reserve with a further three holes in a 'fresh water basin' shown to exist by Painter (1967) 4 km east of the reserve. An interim report by D. Armstrong in February 1978 (Appendix 2) establishes an approximate model and water balance for the basin, and made further recommendations for investigations. This report summarizes the results of this drilling and of subsequent investigations to December 1978.

EXPLORATORY DRILLING

A. E. & W.S. Dept. Reserve

Two exploratory holes were drilled in the reserve, one being 14 m from the caisson and the other in the southwest corner of the Reserve (see Fig. 2). These holes were to be drilled to basement and to be sampled regularly (one metre intervals) to obtain a salinity profile. A Department of Mines and Energy cable tool drilling rig was used for the project.

Details of the two holes are: -

	SB12 (FOR 4)	SB13 (357005709)
DATE OF DRILLING	11-15/7/77	15/7-2/8/77
STATE NUMBER	357005708	357005709
DEPTH	23.5m Backfilled to 7 m	35m Backfilled to surface
CASING	5m x 75mm PVC	28 x 75mm PVC
SCREEN	2m x 89mm x 0.5mm Set 5-7m	2m x 89mm x 0.5mm Set 28-30m
WATER CUT	3.65 m	8.00 m
STATIC WATER LEVEL	2.05 m	7.10 m
QUANTITY	300 kl/day	Not tested
QUALITY	1058 mg/l	3035 mg/l

Water samples were taken every metre during the drilling of SB12 but only four samples were taken during drilling of SB13 with one of these being broken in transit. However, conductivity measurements were taken at one metre intervals by a portable conductivity meter in both holes.

Drilling ceased in SB12 when weathered basement was encountered, however SB13 was stopped due to the inflow of loose sand into the casing from below.

Salinities have been tabulated in Table I with geological logs and salinity profiles of SB12 & SB13 shown in Figures 3 & 4.

TABLE I

DEPTH vs SALINITY

SB12 (FOR 4)

DEPTH m.	SALINITY mg/l
4	1015
5.5	1010
6.5	1000
6.5	1030 After 20 mins. Pumping
7.5	1060
8.5	1060
9.5	1120
10.5	1130
11.5	1190
12.5	1140
13.5	1625
14.5	1295
15.5	1430
16.5	9000
17.5	1425
18.5	2465
19.5	1940
20.5	1805
21.5	25000
22.5	30000+
23.5	30000+
SCREEN	1231 END 20 mins Pumping
SCREEN	1337 END 60 mins Pumping

SB13 (357005709)

DEPTH m.	SALINITY mg/1
8	3050
16	Sample Broken
31	45000
35	11000

(1) Effect on the Caisson

During the summer of 1977/78 it was found that salinities in the caisson were rising far in excess of safe limits for a town water supply. Samples were taken from the 22 inlet pipes, starting at 9.30 am on the 15/11/77 and at various other times during the day and sampled again the next day after 24 hours continuous pumping. The results showed an increase in salinity in nearly all inlet pipes but the most pronounced increases were from the pipes entering from the direction of SB13 (see Table 2 and Figure 5).

TABLE 2

SALINITY OF CAISSON INLET PIPES (mg/1)

Pipe No.	15/11/77 10.00am	15/11/77 11.45am	15/11/77 1.15pm	15/11/77 4.00pm	16/11/77 9.10am
12	1520	1540	1630	1610	1825
13	2200	2570	2895	3150	3850
14	2000	2465	2880	2580	3100
15	2000	2265	2375	2335	2750
16	1760	1955	2075	2125	2265
17	1300	1850	1350	2265	2600
18	1400	1610	1765	1850	2090
19	1180	1155	1185	1380	1380
20	1120	1125	1125	1125	1185
21	1320	1380	1515	1445	1580
22	1550	1580	1645	1645	1780

On the 24/11/77 a cable tool drilling rig was sent to Streaky Bay to backfill SB13 with cement. The original concept was to drill 2 bores, one either side of SB13 and as close as possible to the original bore. The first bore was drilled to a depth of 20 m. The second bore broke through into the

TABLE 3

SALINITIES OF CAISSON INLET PIPES AFTER CEMENTING (mg/1)

Pipe No.	30/11/77 8.50am	30/11/77 9.00am	30/11/77 11.00am	30/11/77 1.20pm	30/11/77 1.45pm	30/11/77 4.40pm	1/12/77 3.00pm	2/12/78 1.00pm	3/12/78 9.00am	4/12/77 9.00am	5/12/77 9.00am
12	1415	1475	1565	1575		1575	1905	4470	2500	2885	3100
13	1900	2075	2235	2160	2420	2275	4470	4920	6400	7300	5500
14	1985	2235	1965	1900	2545	1765	4470	6420	7200	8600	6200
15	1985	2030	2335	2219	1900	2310	3260	6750	3770	8100	5500
16	1715	1765	1915	1905	1670	1965	2600	6010	3750	6070	6200
17	DRY	DRY	DRY	DRY		DRY	DRY	DRY	DRY	DRY	DRY
18	1515	1565	1645	1670		1575	2435	5600	5700	5350	5200
19	1245	1200	1280	1225		1170	1200	3770	3350	2840	2800
20	1095	1115	1235	1105		1080	1135	4110	3350	2705	2700
21	1315	1365	1380	1415		1300	1625	3950	3980	4500	3600
22	1380	1395	1415	1510		1565	1900	4525	4600	8400	4500

original bore at a depth of 2 m, and SB13 was then drilled out and all bores backfilled with 56 bags of cement.

Several days later the caisson was pumped for six days, starting on the 30/11/78. Salinities on all inlet pipes still continued to rise (see Table 3).

After above average winter rains in 1978 the salinity in the caisson was 700 mg/1 but during the drier months of October and November the salinity rose to 1500 mg/1 and pumping from the caisson was discontinued.

B. "Fresh Water Basin"

Three exploratory holes were drilled in a "fresh water basin" 4 km east of the reserve. All bores were drilled to basement with good quality water being present for the total thickness of the aquifer in two of the holes, the other being dry (SB14-357004304).

Details of these bores are: -

	SB 15 (FOR 10)	SB 16 (FOR 11)
DATE OF DRILLING	5-12/8/77	15-20/8/77
STATE NUMBER	357004305	357004306
DEPTH	37m Backfilled to 34m	30m Backfilled to 18m
CASING	32mx75mm	36mx75mm
SCREEN	2mx89mmx0.5mm Set 32-34m	2mx89mmx0.5mm Set 16-18m
WATER CUT	24 m	16 m
STATIC WATER LEVEL	19.5 m	15-10 m
QUANTITY	90 kl/day	90 kl/day
QUALITY	430 mg/1	900 mg/1

Details of salinities are shown in Table 4.

TABLE 4

DEPTH vs SALINITY

	DEPTH m.	SALINITY mg/1
SB14	DRY	
SB15(FOR 10)	24m	540
	34m	430
SB16(FOR 11)	13m	900
	30m	460

The results of these holes show an even smaller area of good quality groundwater than suggested by Painter (1967) Fig 2. Although water quality was good, supplies were very small, also the depth to the water rules this area out as an alternative basin. Geological logs are shown in Appendix I for all exploratory holes.

TRENCH No. 3

The below average rainfall in 1977 continued the trends of rising salinity and lower water tables in the Reserve. With the caisson inoperable, Wilkalinsie Well was brought into production to help ease the withdrawals from Trenches 1 and 2. However, it soon became obvious that a new trench would be required. The location in the southwest corner of the Reserve adjacent to FOR4 (Fig. 2) was recommended because of the shallow water table, a 13 m thickness of fresh groundwater (Fig. 3) and its position downgradient of the other trenches meant that it intercepted underflow which would have otherwise been lost from the Reserve.

Construction was completed in December 1977, and a 36 hour aquifer test was carried out at a discharge rate of 785 m^3/day. A drawdown of 0.5 m was recorded at the completion of the test. Analysis of the drawdown data by using a type curve matching method which takes account of storage in the trench resulted in a calculated Transmissivity of 1560 m^3/day/m which is slightly higher than that calculated for the caisson and Trench No. 1.

This new trench proved its value to the town water supply in supplying a total of 58 000 m^3 between December and April, 1978. During this time, the salinity gradually rose from 1150 mg/l at the commencement of pumping to 1400 mg/l in April.

GEOPHYSICS

As a result of recommendations made in Appendix 2, a resistivity survey was carried out in late 1977 (Roberts, 1978)

to determine basement topography and its effect on groundwater movement and quality. Twenty one vertical electric soundings and seven profiles were used to interpret the depth to basement. However, the true depth is uncertain due to weathering effects and data uncertainties. It appears that the basement configuration does not exert any influence over groundwater movement in the area.

OBSERVATION WELL NETWORK

After a water well survey of the hundreds of Forrest, Campbell and parts of Inkster, Scott, Murray, Rounsevell, Wrenfordsley and Witera were complete, an observation network was established around the Water Reserve. This observation network consisted of 26 private wells monitored on a monthly basis. The data supplied from these observation wells was not enough to show what influence the swamps to the south of the reserve have on the groundwater system. Additional wells were also needed to obtain a more detailed impression of groundwater movement through the reserve.

A proposal was submitted to have 25 new observation wells drilled - mainly within the reserve.

OBSERVATION WELL DRILLING PROGRAMME

The E & WS Dept has successfully used their Air Track rig to drill blasting holes into the water table during construction of the new trench. It was decided that this method would be a quick and inexpensive way to provide the additional observation wells as well as to actively involve the E & WS Dept. in the project. The Western Region of the E & WS Dept. obtained approval of $5000 to do this drilling. An air compressor was truck mounted while the Air Track was on a tilt trailer, from which it operated.

A total of 21 wells were drilled, 14 within the Reserve and seven as regional observation wells. All wells were completed with 50 mm diameter PVC pipe with 2 m section slotted at the bottom of the hole.

The surface around the well headworks was cemented and covered with E & WS Dept. topstones. A 1.5m yellow fence dropper was placed beside each well.

A summary of well details is in Table 5.

DRILLING RESULTS

The new wells gave a much more detailed water table contour control in and around the Reserve, (see Figs. 6, 7) as well as providing valuable salinity data.

The salinities obtained show that the groundwater becomes more saline to the south of the Reserve. Wells with the highest salinity were situated closest to the swamps.

One well drilled on the northern boundary of the Reserve (FOR 17) recorded a salinity of 7250 mg/l and an unusually low water level. This may be the result of the water table being intersected in the sandy clay confining layer and/or the underlying sands and gravels instead of the aeolianite, probably due to the effects of the rising topgraphy.

TABLE 5

SUMMARY OF WELLS DRILLED

WELL NO.	SALINITY mg/l	SWL m	DEPTH m
FOR 17	7250	9.04	12.65
FOR 18	740	2.65	5.25
FOR 19	910	3.76	7.02
FOR 20	800	2.54	5.47
FOR 21	1120	2.83	7.52
FOR 22	1200	2.84	5.25
FOR 23	920	3.41	6.38
FOR 24	1320	3.10	5.00
FOR 25	1165	2.95	5.00
FOR 26	720	1.90	5.60
FOR 27	1000	3.74	7.23
FOR 28	820	4.22	8.12
FOR 29	1000	3.59	6.10
FOR 30	840	4.18	6.68
FOR 31	7250	0.41	4.47
FOR 32	20000	5.65	8.65
RIP 9	1125	2.33	4.69
RIP 10	2200	4.11	5.79
RIP 11	14000	0.68	2.72
RIP 12	35000	2.63	5.38
RIP 13	36000	9.45	12.00

"MARYVALE - YANDRA BASIN"

The completion of the field survey of the surrounding hundreds revealed new information on the "fresh water basin" known to exist between Maryvale and Yandra Stations. This survey indicated that a large area of good quality groundwater existed. Approximately 50 observation wells were chosen in this area to monitor groundwater levels and salinities. These wells will be read on a monthly basis for at least two years and will provide basic data if it is considered that further investigations are necessary for additional supplies of water for Streaky Bay (see Fig. 9).

FUTURE WORK

A pluviograph and water level recorder have been installed in FOR 18 by E & WS in an attempt to record the response of the shallow aquifer to individual rainfall events.

Further work on the Streaky Bay waterworks reserve will be directed towards obtaining further information on the lower saline aquifer with a view to controlling possible upward leakage of undesirable saline water by pumping from the lower aquifer so that hydraulic gradients are always in a downward direction during pumping from the production trenches.

PDH:SRB:ZV

P.D. HERRAMAN

S.R. BARNETT

REFERENCES

Armstrong, D. and Barnett, S.R., 1977. Streaky Bay Town Water Supply, Groundwater Investigation. Progress Report No. 1. S. Aust. Dept. Mines report 77/46 (unpublished).

Painter, J.A.C., 1967. Groundwater Investigation - County Robinson. Progress Report No. 2, Hds. Forrest, Campbell and Rounsevelt. S. Aust. Dept. Mines report 65/64 (unpublished).

Roberts, D.C., 1978. Streaky Bay Town Water Supply, Resistivity Survey, 1978. S. Aust. Dept. Mines report 78/77 (unpublished).

APPENDIX 1

Geological logs

PROJECT: STREAKY BAY TWS

LOCATION OR COORDS:

SEC. 57 HD. FORREST

EL Surface m

EL Ref. Point m Datum

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: SB12

UNIT / STATE NO 357005708

DM 225/77

AQUIFER SUMMARY:	DEPTH TO WATER CUT (m)	DEPTH TO STANDING WATER (m)	INTERVAL TESTED From:	INTERVAL TESTED To:	SUPPLY kilolitres/day*	SUPPLY Test Length (hrs)	SUPPLY Method	TOTAL DISSOLVED SOLIDS milligrammes/litre	TOTAL DISSOLVED SOLIDS Analysis No:
	3.65	2.05	5.5	6.5	300	20 min	PUMP	1058	W— 4877/78
			14	15	300	"	"	1231	4895/78
								42500	4894/78 23 m

DEPTH (m) From	DEPTH (m) To	GRAPHIC LOG	ROCK / SEDIMENT NAME	GEOLOGICAL DESCRIPTION	FORMATION / AGE	DEPTH CORE SAMPLE	CASING Dia(mm)	CASING From(m)	CASING To(m)
0	8		AEOLIANITE	Calcrete at surface. Aeolianite off white to pale orange, consisting of fossil frags. & calc. chips up to 1mm with 10-20% fine to medium quartz. Hard nodular calcrete 3-4m. Quartz content increases to 40% at 7 m.	BRIDGEWATER FM. PLEISTOCENE		76	0	5
8	8.5		SANDY CLAY	Dark orange, mottled white & pale green, stiff & calcareous with 25-30% medium grained quartz.	PANTOULBIE FM. LATE TERTIARY	9.5			
8.5	22.5		INTERBEDDED CLAYEY SANDS AND GRAVELS	Quartz sand, orange brown, medium to coarse grained up to 1 mm, occasionally well cemented in white calc matrix. Gravels consist of rounded dark red to purple ferruginous nodules up to 1 cm diam. Up to 30-40% orange sandy clay present. Ferruginous nodules up to 40 m at base.					
22.5	23.5		WEATHERED BASEMENT	White plastic clay mottled yellow pink and orange, containing occ. mica flakes and quartz grains.		21.5			

REMARKS:

Driller - J. Loring

Serial No. 103/78

*NOTE: 110 kl / day = 1000gals / hr.

Completed observation well FOR 4

76 m sandscreen 5.0-7.0 m.

DRILL TYPE: CABLE TOOL

CIRCULATION: WATER

SHEET 1 OF 1

COMPLETED: 15.7.77

LOGGED BY: S.R.B.

DATE: 6.12.77

12

PROJECT: STREAKY BAY TWS

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: SB13

UNIT / STATE NO 357005709

DM 225/77

LOCATION OR COORDS:

SEC. 57 HD. FORREST

EL Surface m

EL Ref. Point m Datum

AQUIFER SUMMARY:	DEPTH TO WATER CUT (m)	DEPTH TO STANDING WATER (m)	INTERVAL TESTED From:	INTERVAL TESTED To:	SUPPLY kilolitres/day*	SUPPLY Test Length (hrs)	SUPPLY Method	TOTAL DISSOLVED SOLIDS milligrammes/litre	TOTAL DISSOLVED SOLIDS Analysis No:
	8.00	7.10						3035	W— 7025/77 8.0 m
								45000	7023/77 31.0 m

DEPTH (m) From	DEPTH (m) To	GRAPHIC LOG	ROCK / SEDIMENT NAME	GEOLOGICAL DESCRIPTION	FORMATION / AGE	DEPTH CORE SAMPLE	CASING Dia(mm)	CASING From(m)	CASING To(m)
0	1		CALCRETE	Offwhite hard & nodular	BRIDGEWATER FM. PLEISTOCENE				
1	4		CLAYEY SILT	orange-red and calcareous, contains 30% calc. frags.					
4	10		AEOLIANITE	40% calcrete nodules (4-5 m) and 30% calcareous silt with minor quartz and blebs of white clay. 8-10 m bright orange aeolianite consisting of mainly calc. frags. up to 0.5 mm diam. and 30% medium quartz up to 0.3 mm 15-20% clay.					
10	11		CLAYEY SAND	Quartz grains av. 0.2-0.3mm diam., translucent and well-sorted. 40% pale orange clay with minor rounded well cemented fragments. Rare calc. frags.	PANTOULBIE FM. LATE TERIARY				
11	20		SANDY CLAY	Pale orange stiff clay mottled red-orange with occ. ferruginous nodules to 5 mm diam. Sand content increases from 30% to 50% at 20 m.					
20	22		CLAYEY SAND	Quartz grains av. 0.3-0.5 mm, medium clear & sub-rounded 30-40% clay a.a.					
22	35		SAND	Well sorted clean sand, bright orange in colour, medium grained av. 0.3-0.5 mm with occ. rounded grains up to 4mm. Minor silt 24-35m finer grained (0.2-0.3 mm)		24			

REMARKS:

Driller - J. Loring

Serial No. 104/78

*NOTE: 110 kl / day = 1000gals / hr.

Abandoned & backfilled

DRILL TYPE: CABLE TOOL

CIRCULATION: WATER

SHEET 1 OF 1

COMPLETED: 2.8.77

LOGGED BY: S.R.B.

DATE: 10.12.77

13

PROJECT: STREAKY BAY TWS

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: SB14

LOCATION OR COORDS:

UNIT / STATE NO 357004304

SEC. 43 HD. FORREST

EL Surface m

EL Ref. Point m Datum

DM 225/77

AQUIFER SUMMARY:	DEPTH TO WATER CUT (m)	DEPTH TO STANDING WATER (m)	INTERVAL TESTED From:	INTERVAL TESTED To:	SUPPLY kilolitres/day*	SUPPLY Test Length (hrs)	SUPPLY Method	TOTAL DISSOLVED SOLIDS milligrammes/litre	TOTAL DISSOLVED SOLIDS Analysis No:
					DRY				W —

DEPTH (m) From	DEPTH (m) To	GRAPHIC LOG	ROCK / SEDIMENT NAME	GEOLOGICAL DESCRIPTION	FORMATION / AGE
0	16		AEOLIANITE	silty, pink to pale orange, consists of calcareous frags. up to 0.5 mm with minor quartz sand increasing with depth to 50% at 16 m. Occasional calcrete fragments 0–4 m.	BRIDGEWATER FM. PLEISTOCENE
16	18		SANDY CLAY	Dark orange, mottled red, white & orange. 30–40% quartz sand, medium grained. Minor calcareous frags.	PANTOULBIE FM. LATE TERTIARY
18	19		CLAYEY SAND	Quartz sand, fine to medium grained av. 0–2 mm diam., with blebs of white clay.	
19	20		WEATHERED BASEMENT	White to pale pink sticky clay (granite) 30% fine grained sand.	

DEPTH CORE SAMPLE	CASING Dia(mm)	CASING From(m)	CASING To(m)

REMARKS:

Driller - J. Loring

Serial No. 106/78

Abandoned & backfilled

*NOTE: 110 kl / day = 1000gals / hr.

DRILL TYPE: CABLE TOOL

CIRCULATION: WATER

SHEET 1 OF 1

COMPLETED: 5.8.77

LOGGED BY: SRB

DATE: 8.12.77

14

PROJECT: STREAKY BAY TWS

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: SB15

LOCATION OR COORDS:

UNIT / STATE NO 357004305

SEC. 43 HD. FORREST EL Surface m EL Ref. Point m Datum

DM 225/77

AQUIFER SUMMARY:	DEPTH TO WATER CUT (m)	DEPTH TO STANDING WATER (m)	INTERVAL TESTED From:	INTERVAL TESTED To:	SUPPLY kilolitres/day*	SUPPLY Test Length (hrs)	SUPPLY Method	TOTAL DISSOLVED SOLIDS milligrammes/litre	TOTAL DISSOLVED SOLIDS Analysis No:
	24.0	19.5	36	37	90	1	BAILER	430	W— 7027/77

DEPTH (m) From	DEPTH (m) To	GRAPHIC LOG	ROCK / SEDIMENT NAME	GEOLOGICAL DESCRIPTION	FORMATION / AGE	DEPTH CORE SAMPLE	CASING Dia(mm)	CASING From(m)	CASING To(m)
0	15		AEOLIANITE	Orange in colour, silty with minor calcrete fragments near surface. Quartz, fine to medium grained increasing from 10% at 5 m to 30% at 15 m. Minor clay.	BRIDGEWATER FORMATION PLEISTOCENE		76	0	32
15	22		SANDY CLAY	Orange-fawn colour, silty, with 30-40% quartz sand, fine to medium grained. Occasional well cemented calcareous nodules.	PANTOULBIE FM. LATE TERTIARY				
22	34		SAND	Quartz sand, well sorted with clear sub-rounded grains av. 0.2-0.3mm diam. Few blebs of whitish clay but mostly clean sand.					
34	35		SANDY CLAY	Dark reddish-orange mottled sandyclay with 25% qtz. a.a. and minor calc. frags.					
35	37		WEATHERED BASEMENT	Pale Pink & white mottled sandy clay.					

REMARKS: Driller - J. Loring

Serial No. 107/78

*NOTE: 110 kl / day = 1000gals / hr.

Completed observation well. FOR LO
76 mm sandscreen 32-34 m.

DRILL TYPE: CABLE TOOL

CIRCULATION: WATER

SHEET 1 OF 1

COMPLETED: 12.8.77

LOGGED BY: S.R.B.

DATE: 13.12.77

15

PROJECT: STREAKY BAY TWS

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: SB16

UNIT / STATE NO 357004306

LOCATION OR COORDS:

SEC. 43 HD. FORREST

EL Surface m

EL Ref. Point m Datum

DM 225/77

AQUIFER SUMMARY:	DEPTH TO WATER CUT (m)	DEPTH TO STANDING WATER (m)	INTERVAL TESTED From:	INTERVAL TESTED To:	SUPPLY kilolitres/day*	SUPPLY Test Length (hrs)	SUPPLY Method	TOTAL DISSOLVED SOLIDS milligrammes/litre	TOTAL DISSOLVED SOLIDS Analysis No:
	16.0	15.10	23	25	90	1	BAILER	900	W — 7028/77

DEPTH (m) From	DEPTH (m) To	GRAPHIC LOG	ROCK / SEDIMENT NAME	GEOLOGICAL DESCRIPTION	FORMATION / AGE	DEPTH CORE SAMPLE	CASING Dia(mm)	CASING From(m)	CASING To(m)
0	11		AEOLIANITE	off white to orange in colour, silty, 10-15% quartz grains, well sorted av. 0.2-0.33 mm increasing with depth, 50% at 10 m.	BRIDGEWATER FM. PLEISTOCENE		76	0	16
11	25		SANDY CLAY	dark red-brown, mottled white and yellow containing up to 30% quartz sand a.a. Occasional blebs of white stiff sandy clay.	PANTOULBIE FM. LATE TERTARY				
25	30		WEATHERED BASEMENT	(granite) white sticky clay containing occasional quartz grains up to 1 mm.					

REMARKS: Driller-J.Loring

Serial No. 108/78

*NOTE: 110 kl / day = 1000gals / hr.

Completed observation well FOR 11
76 m sand screen 16-18 m.

DRILL TYPE: CABLE TOOL

CIRCULATION: WATER

SHEET 1 OF 1

COMPLETED: 20.8.77

LOGGED BY: SRB

DATE: 20.12.77

16

APPENDIX 2

Streaky Bay Town Water Supply

Interim Report

APPENDIX 2

STREAKY BAY TOWN WATER SUPPLY - Interim Report

Summary

A simple graphical model of the Streaky Bay groundwater basin shows that, in a year of median rainfall, water levels would have a net drop of 0.22 m. Assuming a specific yield of 27% for the aquifer, also derived from the model, this represents about 240 Ml loss in storage over the year.

Total subflow losses from the basin may be as high as 680 Ml/year which is more than twice the current discharge rate.

Data from the Water Reserve show that considerable depletion of the groundwater resource takes place during low rainfall periods. It is considered that with completion of No. 3 trench the Water Reserve will be fully developed, and a maximum withdrawal rate of about 200 Ml/year is recommended.

A geophysical (resistivity) survey and drilling program is proposed in an attempt to locate areas of significant subflow to the south and west; consideration can then be given to extending the existing Water Reserve.

INTRODUCTION

Using annual precipitation and changes in water level in the No. 1 Trench a model has been established relating these two parameters.

Figure 10 shows the model in diagrammatic form. Information which can be derived from this include:-

Specific Yield = 0.27 (= inverse of slope of regression line)

Precipitation below which a net annual decrease in water level occurs = 380 mm.

EVAPOTRANSPIRATION

An analysis to determine evapotranspirative losses was made using Thornthwaite's method (assuming values for mean monthly

temperatures) incorporating the median value for monthly rainfalls (equivalent to an annual rainfall of 317 mm). The potential evapotranspiration and precipitation (Fig. 11) clearly shows a surplus of precipitation over the period May to August so that recharge is possible even at this low rainfall (317 mm).

The model indicates that for a rainfall of 317 mm, we can expect a net drop in water level of 0.22 m despite some recharge. Subflow losses are therefore occurring as well as consumptive discharge and the sum of the losses exceeds the recharge by 0.22 x 0.27 = 0.059 m. (i.e. ~ 60 mm Δ Ground Water Storage).

The 317 mm rainfall is calculated to be disposed of as follows:-

Evapotranspiration = 182 mm

Recharge = 135 mm

SUBFLOW AND TRANSMISSIVITY

The net loss of 60 mm of water arises as the result of excess of subflow + discharge over recharge. Approximate mean discharge over the 4 km^2 of basin for the period since pumping commenced is of the order of 1 x 10^5 m^3/year which is equivalent to 0.025 m of water over the basin area.

Subflow loss can now be estimated.

Subflow loss = Recharge + Δ Ground Water Storage - Discharge

= 135 + 59 - 25

= 169 ~ 170 mm/year

Knowing the subflow loss it is now possible to apply D'arcy's law to determine Transmissivity for the whole aquifer rather than for the upper few metres such as is determined by testing the trenches or caisson.

$$Q = T \; i \; W$$

$$T = \frac{Q}{i \; w}$$

$i = 0.00034$ m/m

$W = 2400$ m

$Q = 0.17 \times 4 \times 10^6$ m^3/year $= 6.8 \times 10^5 m^3$year

$$T = \frac{6.8 \times 10^5}{2400 \times 0.00034 \times 365} = 2283 \text{ } m^3/day/m$$

For the period of data available, the average annual subflow loss of $6.8 \times 10^5 m^3$ is more than twice the current (1976) extraction rate. This is being lost in a down-gradient direction presumably at a discharge boundary such as the swamps to the southwest of the water reserve (see Fig. 6).

The current extraction rate is equivalent to almost 75 mm of water over the whole water reserve area and the effect of this additional discharge is probably to reduce to some extent the subflow loss. Subtracting on extra 50 mm from the subflow loss of 170 mm leaves an estimated minimum subflow loss of 120 mm/annum.

GROUNDWATER BUDGET

The groundwater budget for the reserve area may be summarized in the following manner:

Recharge = Subflow loss + Discharge $\pm$ Change in Storage

= 120 mm + 75 mm $\pm$ (Change in Water level x 0.27)

Substituting values for 1976:

(1) Estimated Recharge = 120 + 75 + (61 x 0.27)

= 211.5 mm

(2) 1976 Recharge estimate

from Pptn - Av. yearly evapotranspiration = 422-182

= 240 mm

The discrepancy between the two estimates is due to the abnormally high Feb. 1976 rainfall of 110 mm occurring at a time of high potential evapotranspiration loss. This would result in higher than average evapotranspiration and therefore lower than predicted recharge. Substantial rainfall during the period October to

March in any year will make very little contribution to recharge and produces the scatter below the regression line in Fig. 10. Conversely the occurrence of very low summer rainfall and abnormally high winter rains will produce scatter of points above the regression line.

LOCAL RAINFALL

Available rainfall data for the water reserve, 1949-1976, indicates a 2 year return interval for an annual minimum of 360 mm. This compares well with the Bureau of Meteorology's 50 percentile value of 370 mm for Streaky Bay Township (based on 88 years data up to 1968). The figure is only marginally less than the rainfall required to maintain the trench level obtained from Fig. 1.

Return Period	Annual Rainfall	No. of Times exceeded from 1949-1976
2 yrs	360	13
5	440	7
10	490	3
20	550	1
100	650	0

In the 27 years of record since 1949 the 20 yrs Return Period Rainfall of 550 mm has been exceeded only once (in 1952) and there has been one continuous spell of 6 years (1957-1962) during which the 2 yr Return Period rainfall was not exceeded. The result of this six year dry spell was considerable depletion of the groundwater resource despite the relatively low extraction rate of between 1 x $10^5 m^3$/year and 1.38 x 10^5 m^3/year. Concentration of the majority of the rain in the winter months must have permitted some recharge.

GROUNDWATER LEVELS AND WITHDRAWAL RATES

Some idea of the influence of increased withdrawal rates can be obtained by plotting changes in water level against annual

precipitation for intervals of time during which the rate of withdrawal was maintained between specified limits. Fig. 12 shows the data replotted for the following periods.

1949 to 1956 Annual extraction less than 1 x 10^5 m^3/year (22×10^6 gal/yr)

1957 to 1969 " " between 1 and 2 x 10^5 m^3/year (44×10^6 gal/yr)

1970 to 1976 " " between 2 or 3 x 10^5 m^3/year (66×10^6 gal/yr)

It is assumed in this analysis that the specific yield of the basin remains constant at 0.27, therefore the best fit line must have a slope of $\frac{1}{0.27}$.

Fitting a line to the data plots produces the following intercepts on the precipitation axis with $\Delta GWL = 0$, indicating the precipitation required to maintain the groundwater level in the basin at various withdrawal rates:

Q = less than 1 x 10^5 m^3/year; intercept = 350 mm

Q = 1 to 2 x 10^5 m^3/year; intercept = 370 mm

Q = 2 to 3 x 10^5 m^3/year; intercept = 390 mm

This indicates that an additional 20 mm of ~~rain~~ ? recharge is required to support an increment of 1 x 10^5 kl/year discharge if water levels are not to drop.

The safe yield of the basin as currently developed will therefore vary according to the current years rainfall and the water level at the beginning of the water year (July 1st). Assuming that the 50 percentile rainfall value of 370 mm quoted for Streaky Bay Township can be applied to the Water Reserve, the maximum withdrawal should be of the order of 2 x 10^5 m^3/year which should be produced from the three existing trenches with minimum drawdown in order to preserve water quality.

CONCLUSIONS

With the current withdrawal rate exceeding 3 x 10^5 kl/year

an additional supply of more than 1 x 10^5 kl/year of suitable quality water is urgently needed to enable the presently established facilities to function satisfactorily in poor years.

The annual subflow loss, occurring presumably to the west, and estimated to be equivalent to 170 mm/year over the area of the water reserve (i.e. 0.017 x 4 x 10^6 m^3 = 6.8 x 10^5 m^3/year) represents one possible area of investigation. The pattern of groundwater flow is not well understood and may be controlled in part by the presence of basement highs.

All wells in the area surrounding the E. & W.S. Water Reserve are being levelled and an up to date water table contour map should be available in the near future. This will assist in the delineation of the flow pattern. At the same time a geophysical survey is in progress with the objective of delineating any basement trends which may influence the flow pattern.

Based on the combined results of these exercises, a drilling program should be carried out with two main objectives:

a) To obtain more detailed information on water levels.

b) To carefully sample groundwater to determine the distribution of relatively fresh water in relation to the flow pattern.

The use of a rotary-percussion rig (Airtrack or Halco) is suggested to attain objective a) at minimum cost, and also to precollar holes for objective b) which can only be attained using the relatively expensive cable-tool method. In addition to the above, a well survey of the Hundreds of Ripon, Forrest, Campbell, Wrenfordsley, Roun sevell and Scott is in progress to determine the distribution of water quality at the present time. Previous surveys of this type have indicated several localities at which water quality was better than 1000 mg/l. These lie close to the boundary between the Hundreds of Forrest and Campbell, up to 15 km to the southeast of the Water Reserve.

If the proposed work in the immediate vicinity of the Water Reserve fails to locate the required supply and the results of the well survey prove to be encouraging, a program of drilling and testing any prospective area should be initiated as soon as funds, manpower, and drilling plant become available.

21st February, 1978.

D. ARMSTRONG
SENIOR GEOLOGIST

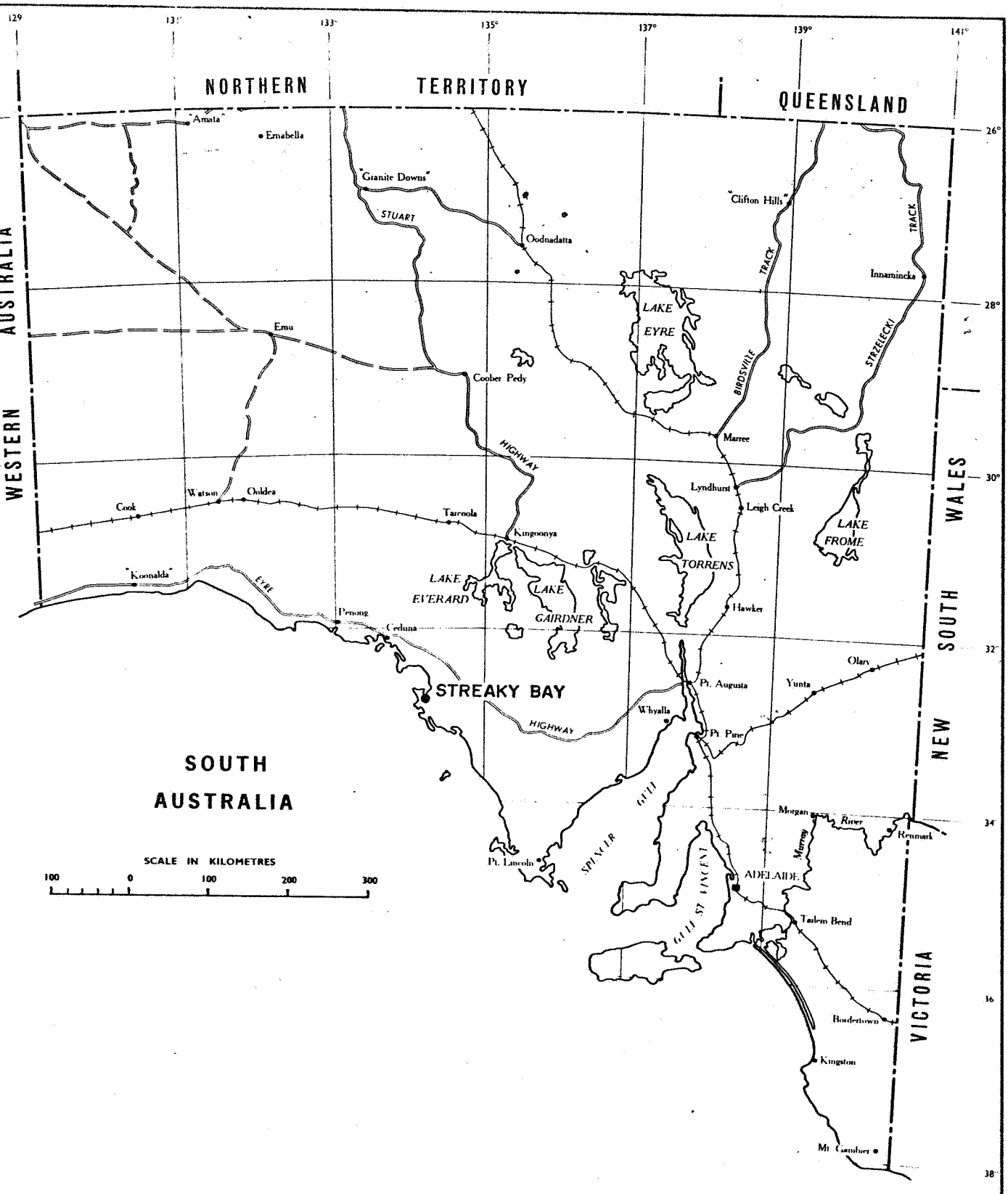


FIG. 1

DEPARTMENT OF MINES —— SOUTH AUSTRALIA

Compiled. D.A.	STREAKY BAY TOWN WATER SUPPLY	Date: Apr. 1977
Drn. R.H. Ckd.	LOCALITY PLAN	Drg. No. S12648

P.F. No. 55850 994 2

5732-III

7km. Streaky Bay

HD. RIPON

HD. FORREST

FLINDERS HIGHWAY

36

37

38

41

44

N

3·0
9·0
1385

8 SW.

8 NE.

7·0
10·4
400

Caisson

7·1
35
3085
357005709

WILKALINSIE WELL

57

WATER RESERVE

Trench No.1

8·5
12·0
1990

Trench No.2

Trench No.3

2·1
23·5
1058
FOR 4
Granite basement at 22·5m

8 SW

8·6
10·5
446

FOR 11
15·1
30
900
Granite basement at 25·0m

FOR 10
19·5
37
430
Granite basement at 35·0m

13·7
15·2
1091

13·7
23·2
324

43

357004304
Dry
20·0
Granite basement at 19·0m

11·0
52·0
9500
Granite basement at 26·8m.

11·0
12·0
417

56

25·0
34·5
1033

dry
20·0
Granite basement at 18·3m.

Bk.18 B

dry
18·5

Existing Well ● 8·5 Depth to water (m)
12·0 Depth of well (m)
1990 Salinity (mg/l)

Inferred area of fresh groundwater (Painter '67)

1000 0 1000
METRES

FIG.2

	DEPARTMENT OF MINES – SOUTH AUSTRALIA	As shown
D.A.	STREAKY BAY TOWN WATER SUPPLY	Apr. 1977
R.H.	LOCATION OF EXPLORATORY WELLS	79-342

5732-111

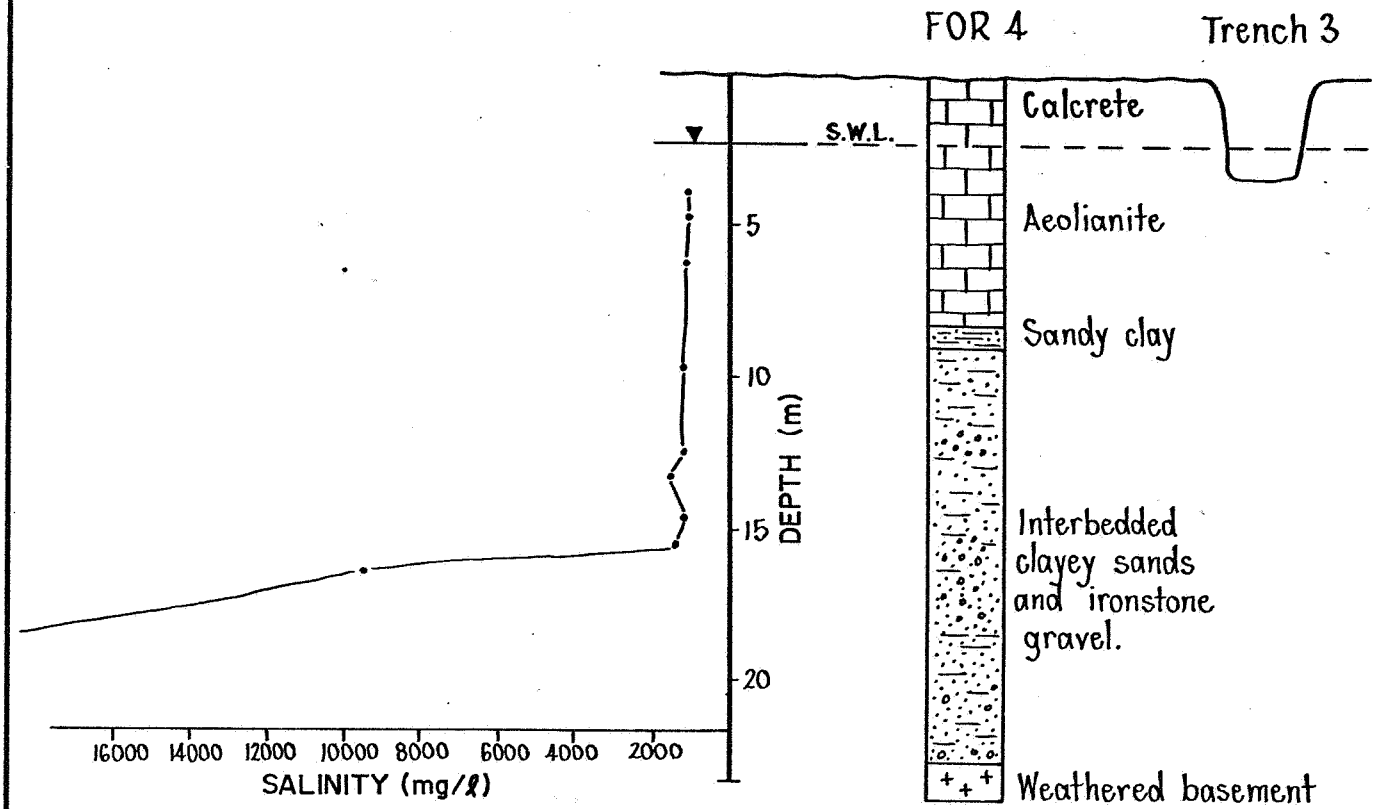


FIG. 3

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE:
COMPILED: S.R.B	STREAKY BAY TOWN WATER SUPPLY SALINITY PROFILE OBSERVATION WELL FOR 4 & TRENCH Nº 3	DATE: May 1979
DRN: R.H. CKD:		PLAN NUMBER S14036

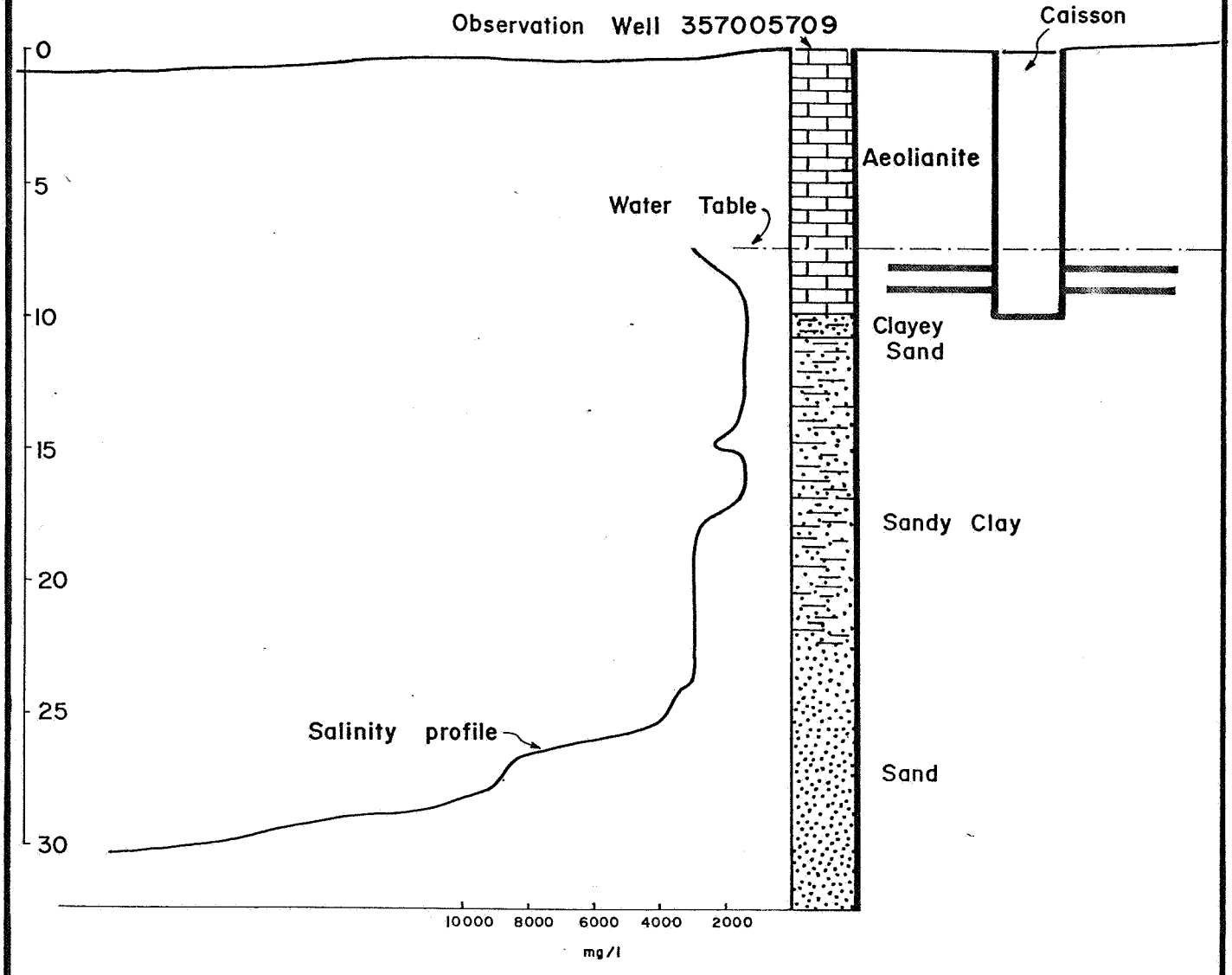
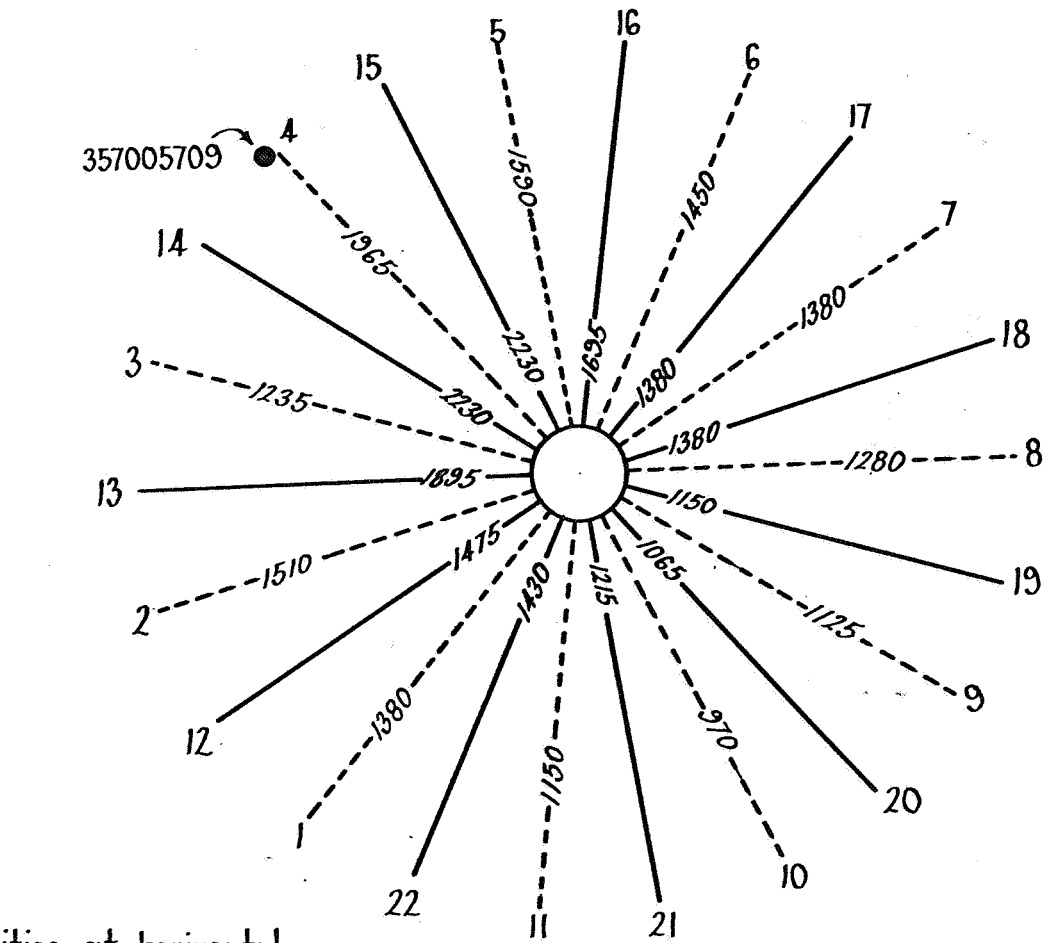


FIG. 4

	DEPARTMENT OF MINES – SOUTH AUSTRALIA	SCALE: Diagrammatic
COMPILED: D. A.	STREAKY BAY TOWN WATER SUPPLY	DATE: 11th NOV. 1977
DRN: T. E. | CKD:	SALINITY PROFILE	PLAN NUMBER:
	CAISSON & OBS. WELL 357005709	S14037



Salinities at horizontal holes measured 4 Nov. 1977

FIG. 5

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE: As shown
COMPILED: S.R.B.	STREAKY BAY TOWN WATER SUPPLY	DATE: May 1979
DRN. R.H. CKD:	CAISSON CONFIGURATION AND SALINITIES	PLAN NUMBER S14038

STREAKY BAY

N

SEE FIG.7

FLINDERS HWY

WATER RESERVE

Wilkalinsie Well

Carsson

Trench 1

Trench 2

Trench 3

1 0·15

2 −0·25

3 −0·09

4 0·31

5 0·40

6 0·42

7 0·38

8 1·90

9 1·68

10 0·43

11 0·14

12 0·21

13 −0·07

14 1·31

15 1·16

16 0·53

2 0·58

3 0·76

4 0·23

5 −0·16

6 0·71

7 1·16

9 0·48

10

11 Dry

12 8·73

13 Dry

31 −0·26

32 0·32

0

0·25

0·5

1·0

1·5

RIPON

FORREST

Hd.

Hd.

SCALE 1:50,000

0 1 2 3 Kms

LEGEND

4 BORE AND NUMBER

5·5 ELEV OF S.W.L. IN METRES

8 S.W.L. CONTOUR DATUM MEAN SEA LEVEL PT. ADELAIDE

NOTE: TO OBTAIN THE PROGRAM NUMBER OF A BORE, PREFIX THE NUMBER WITHIN EACH HUNDRED WITH THE ABBREVIATION BELOW

RIP ..... RIPON

FOR ..... FORREST

FIG.6

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	1:50,000
P.D.H.	STREAKY BAY TOWN WATER SUPPLY REGIONAL WATER TABLE CONTOURS JAN 1979	MAY 1978
		79-343

RIPON

FORREST

OF

OF

HUNDRED

HUNDRED

FOR 16
0·53

8 S.W.

FOR 14
1·31

8 N.E.

FOR 17
0·22

FOR 2
0·58
Caisson

FOR 22
0·64

WILKALINSIE
0·60

0·6

FOR 18
0·60

RIP 9
0·48

8 S.W.

FOR 26
0·66

FOR 19
0·60

57

FOR 3
0·76

FOR 25
0·43

FOR 23
0·47

FOR 24
0·40

Trench 1

0·4

FOR 20
0·66

FOR 21
0·56

0·5

FOR 27
0·29

FOR 28
0·49

Trench 2

0·3

FOR 29
0·41

FOR 30
0·51

1·0

0·4

0·23

FOR 4

Trench 3

0·3

RIP 7
0·38

0·9

0·7

0·4

RIP 10
0·43

0·5

8 S.W.

N

SCALE

0 200 400 600 800 1000

METRES

10 Water table contour (metres)

FIG. 7

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE As shown
COMPILED S.R.B.	STREAKY BAY TOWN WATER SUPPLY	DATE May 1979
DRN R.H. CKD	RESERVE WATER TABLE CONTOURS	PLAN NUMBER 79-344
	JANUARY 1979	

600 FOR 16

RIPON FORREST

8 S.W.

360

8 N.E.

1000

FOR 17
9500

800 FOR 2
1300 Caisson

1100 FOR 22

1000

WILKALINSIE
830

RIP 9
1150

800 FOR 18

2000

600 FOR 26

800

FOR 19 57
875

8 S.W.

FOR 3
3000

OF OF

FOR 25
1120

FOR 23
900
1000

FOR 24
1200

Trench 1

FOR 20
650

800

1000

FOR 21
1120

FOR 27
1110

FOR 28
800

Trench 2
1050

1080 FOR 29

FOR 30
920

FOR 4
1300

Trench 3

RIP 7
1400

1400

1200

RIP 9
2200

8 S.W.

N

SCALE

0 200 400 600 800 1000
METRES

GROUNDWATER SALINITY (mg/l)

600

FIG. 8

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE 1:10000
COMPILED S.R.B.	STREAKY BAY TOWN WATER SUPPLY GROUNDWATER SALINITY JANUARY 1979	DATE MAY 1979
DRN S.R. CKD		PLAN NUMBER 79-363

1349

STREAKY BAY
BLANCHE PORT
GIBSON PENINSULA
FLINDERS HIGHWAY
LANDING GROUND
Streaky Bay
HD. SCOTT
HD. MURRAY
HD. RIPON
HD. FORREST
HD. CAMPBELL
HD. WRENFORDSLEY
HD. ROUNSEVELL
HD. WITERA
The White Sands Of Yonerby
SCEALE BAY
CALPATANNA WATERHOLE CONSERVATION PARK
WATER RESERVE
FLINDERS HIGHWAY

RIP1 0.0
RIP2 -0.35 Alcannabe Well
RIP3 -0.26 Native Well
RIP4 0.25
RIP5 0.40
RIP6 0.42
RIP7 0.28
RIP9 0.47
RIP10 0.29
RIP11 0.0
RIP12 0.21
RIP13 -0.02
FOR 1 0.63
FOR 2
FOR 3 0.78
FOR 4 7.91
FOR 5 -0.31 Parnalana Well
FOR 6 -0.39
FOR 7 1.11
FOR 8 1.25
FOR 9 1.68
FOR 10 3.06
FOR 12 11.93
FOR 13 1.42
FOR 14 1.41
FOR 16 0.53
FOR 31 0.42
FOR 32 0.27
FOR 33 6.50
FOR 34 3.45
FOR 35 4.16
FOR 36 9.85
FOR 37 9.54
FOR 38 16.38
FOR 39 5.65
FOR 40 dry
FOR 42 -0.08 Purdnia Well
FOR 43 2.43 Cotlo Well
FOR 44 8.49 Kandaloodra Well
FOR 45 9.21 Strata 2 Well
FOR 46 13.71
FOR 47 18.20 Eucrosia Well
FOR 48 13.98 Strata 1 Well
FOR 49 15.60
FOR 50 17.56
FOR 51 17.68 Mundoora Well
FOR 52 23.74
FOR 53 23.0
FOR 54 15.12
CAP 1 31.30 Foskin Well
CAP 2 30.98 Wauraga Well
CAP 3 32.79 Lyncia Well
CAP 4 32.51
CAP 5 36.62
CAP 6 33.28
CAP 7 20.86
CAP 8 16.36
CAP 9 30.20 Alexandra Well
CAP 10 24.83 Wirrina Well
CAP 11 30.23 Deep Well
CAP 12 47.42
CAP 13 42.53
CAP 14 34.11
CAP 15 19.25
CAP 16 16.81
CAP 17 14.04 Checola Well
CAP 18 20.15
CAP 19 39.20
RON 1 19.46 Barbarber Well
Yandra Well

SCALE 1:50 000
METRES 1000 0 1 2 3 4 5 KILOMETRES
AREAS OF LESS THAN 1500 mg/litre

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA
STREAKY BAY TOWN WATER SUPPLY INVESTIGATION
MARYVALE – YANDRA BASIN
WATER TABLE CONTOURS – JAN 1979
79-629

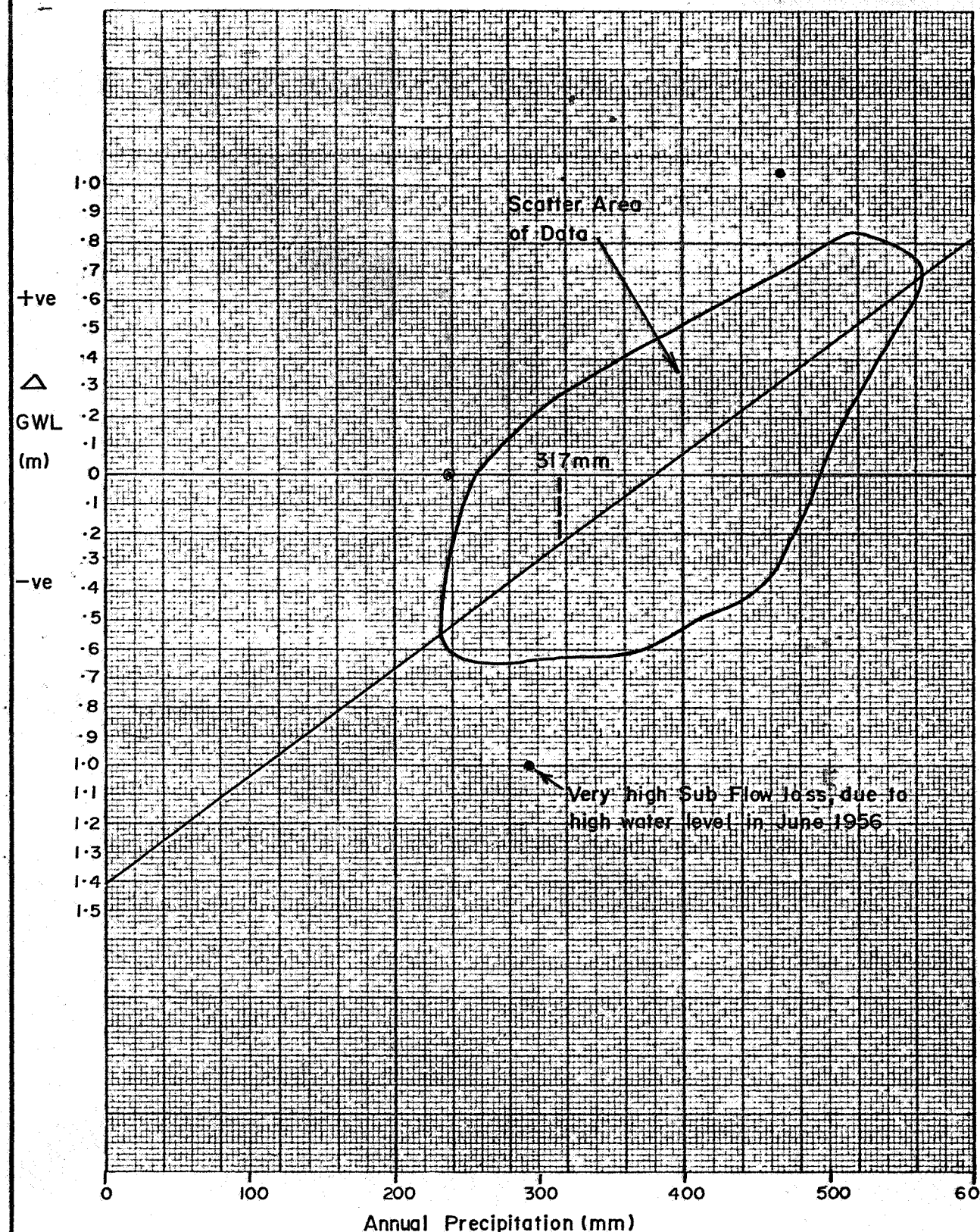


FIG. 10

	DEPARTMENT OF MINES — SOUTH AUSTRALIA	Scale:
Compiled:- D.A.	STREAKY BAY TOWN WATER SUPPLY	Date: 20/2/78
Drn. P.D. | Ckd.	WATER LEVEL RESPONSE TO PRECIPITATION (1949 – 1976)	Drg. No. S 13268

965

P.F. N° S 7852 M

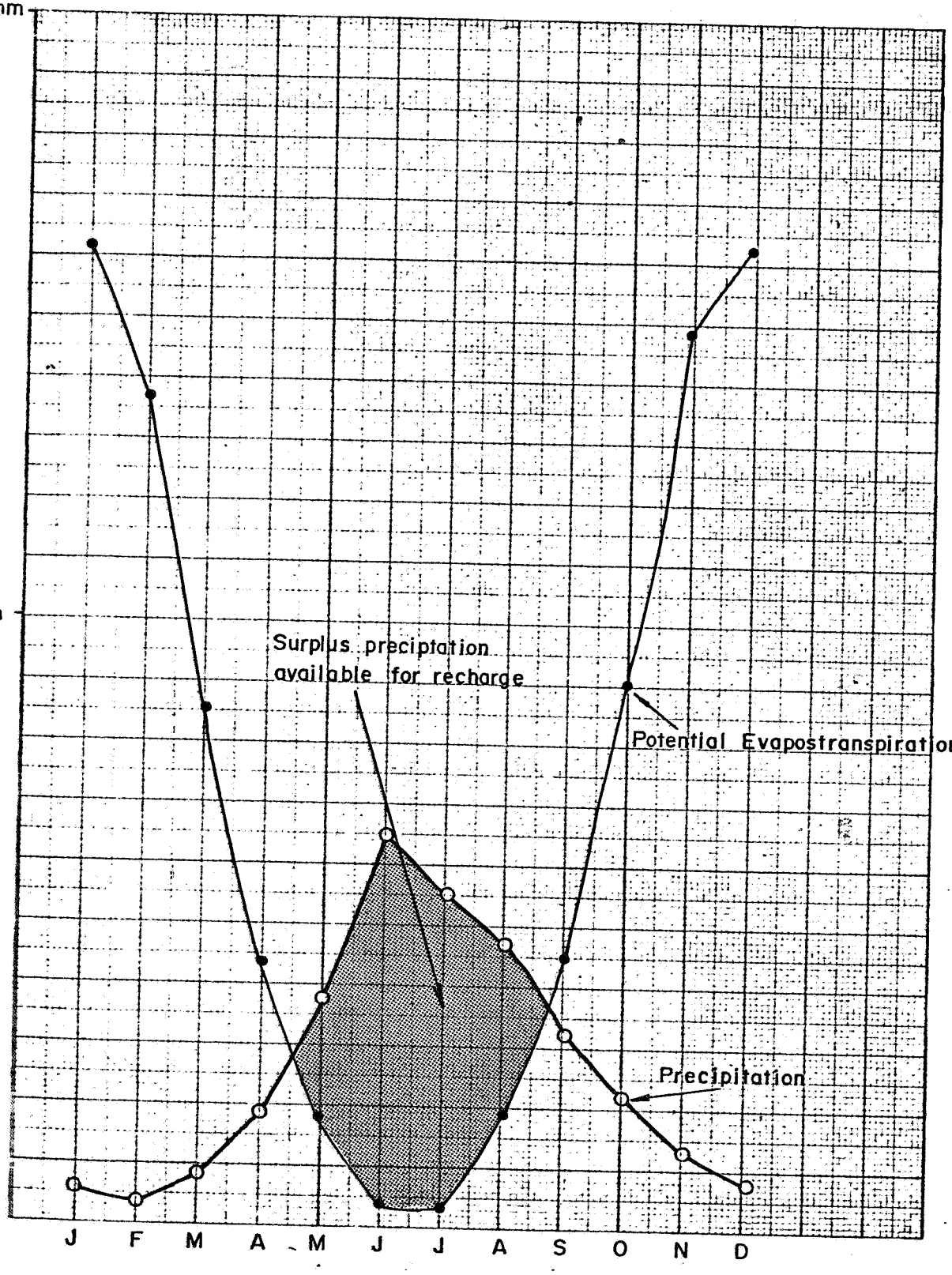


FIG. II

Compiled: D.A.	DEPARTMENT OF MINES – SOUTH AUSTRALIA	Scale:
Drn. P.D. | Ckd.	STREAKY BAY TOWN WATER SUPPLY	Date: 20/2/78
	ESTIMATED POTENTIAL EVAPOTRANSPIRATION AND AVERAGE MONTHLY PRECIPITATION	Drg. No. S 13269

P.F. N° S 7852 M

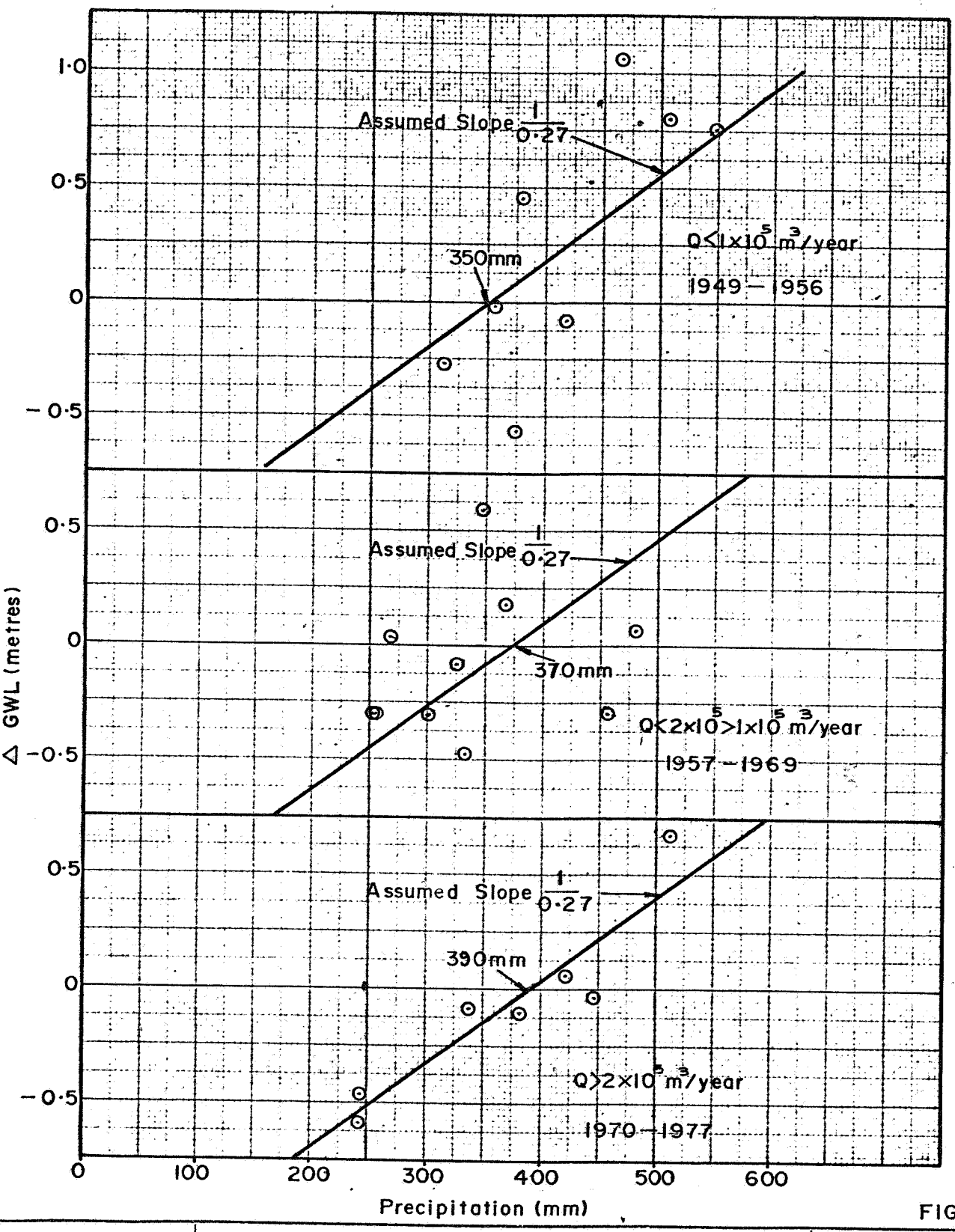


FIG. 12

Compiled: D.A.	DEPARTMENT OF MINES – SOUTH AUSTRALIA	Scale:
Drn. P.D | Ckd.	STREAKY BAY TOWN WATER SUPPLY WATER LEVEL RESPONSE TO PRECIPITATION AT VARIOUS DISCHARGE RATES	Date: 21/2/78
		Drg. No. S 13270

D.N°57852 M