DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

REPT.BK.NO.80/136
HAZELWOOD PARK RECREATION RESERVE, HYDROGEOLOGICAL INVESTIGATION BORE: COMPLETION REPORT

by

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D.M. No. 250/78
Eng. No. 1980/2

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ABSTRACT

A bore drilled in the Hazelwood Park Recreation Reserve reached a total depth of 194 metres, intersecting 85 metres of Recent and Quaternary clay and sandy clay, above 109 metres of Tertiary fine quartz sands. Adelaidean bedrock was not intersected.

It was completed as an irrigation well with a screen from 129.21to 132.2 m within the confined Tertiary fine sand aquifer. The pump testing revealed that the bore had a safe yield of 32kl/hr, with the pump set at 116 m and produces water of salinity 1200 mg/litre, suitable for the irrigation of grass of medium salt tolerance. The bore is to be utilised by the Corporation of the City of Burnside.

INTRODUCTION

The Department of Mines and Energy has drilled a hydrogeological investigation bore at Hazelwood Park Recreation Reserve (Figure I) and completed it as an irrigation bore which was sold to the Corporation of the City of Burnside. Work commenced in November 1979 and was completed in May 1980.

The investigation arose in response to an enquiry from the Corporation, on the prospects of obtaining adequate groundwater to supplement existing irrigation supplies for its several recreation reserves in the Council area. It was anticipated that there would be an increasing interest in using the virtually unexploited groundwater resources of the underlying confined Tertiary sands, which constitute the only large aquifer over an area extending along the south eastern margin of the Adelaide Plains Basin (Figure 1) . Because of its very fine, silty and unconsolidated nature, the relatively few

bores previously drilled into this aquifer have produced only small supplies, while encountering many difficulties in drilling and completing them with adequate sandscreens.

The main aims of the investigation were to gather information of the hydrogeology of the aquifer and to test the economic viability of exploiting its groundwater resource using modern drilling and well completion techniques. The bore was to penetrate the sequence to bedrock and then be completed as a production well in the best aquifer interval.

HYDROGEOLOGY

A composite hydrogeological and geophysical log is presented in Figure 2.

The bore penetrated 25 metres of Recent alluvium above the Pleistocene Hindmarsh Clay Formation which extended to 85 metres. Five thin water bearing horizons (less than 2 metres in thickness) were intersected in this formation and these produced small supplies estimated to vary from 0.1 L/sec up to 1 L/sec. Water quality within these aquifers was consistently good, with salinities increasing with depth from 460 mg/litre to 740 mg/litre. The static water level in the uppermost aquifer was 4 metres below ground level and the deeper aquifers had pressure heads varying from 12 to 14 metres below E.L.

Below 85 metres was a thick sequence of quartz sand containing one bed of carbonaceous clay from 132 to 138 metres. Drilling stopped at 195 metres, after penetrating 110 metres of the sand sequence without intersecting bedrock. The sands were well sorted, fine and medium grained, with intervals containing variable amounts of carbonaceous material and degrees of consolidation with pyrite cement.

This Tertiary sequence below 85 metres constitutes a large confined unconsolidated sand aquifer. The uniform fine and even grain size throughout the sequence is illustrated by the results of sieve analyses from the best aquifer intervals (Figures 3 to 6) Accurate grain size analyses were therefore of prime importance in choosing the best aquifer interval and designing the most suitable completion as a production well. The coarsest sands occurred between 114 to 132 metres (Figure 5) of which two intervals were suitable for completion with a sandscreen of 0.25 mm aperture size (Figure 7). The interval from 129 to 132 metres was chosen on the basis of geophysical logs (Figure 2).

Analysis of water samples taken during drilling showed that salinities increased gradually with depth from 605 mg/litre at 91 metres to 820 mg/litre at 190 metres. However these results cannot be assumed to be representative of the salinity distribution because groundwater pumped from the completed bore had a salinity of 1150 mg/litre throughout the pump test whereas the drilling sample from 129 metres had a salinity of 755 mg/litre. It is probable that the drilling samples were contaminated by downward leakage of shallow aquifer waters by a pathway leading between the casing and the formation.

The waters consistently stood at about 58 metres below ground level through most of the aquifer thickness.

DRILLING PROCEDURE AND COMPLETION DETAILS

The bore was drilled by the cable tool method with the casing driven closely behind as the formation was penetrated, to define aquifer intervals and to seal off shallow waters from the hole while collecting hydrogeological information from consecutivel deeper aquifers. This method also enabled the collection of representative sand samples from aquifer intervals for sieve analysis and undisturbed tube samples for palaeontological examination.

The hole was drilled through the Hindmarsh Clay Formation to 91 metres using 254 mm O.D. steel casing. Difficulty in driving the casing in the underlying fine sands (below 85 metres) markedly slowed penetration rates and drilling continued from 91 metres using 200 mm O.D. steel casing. At 129.5 metres the 200 mm casing could not be driven further and during an attempt at freeing it using hydraulic jacks, the line of casing parted at a joint 18 metres downhole. Enough thread was left undamaged to reconnect the severed casing and it was decided to cut the casing shoe downhole upon completion of drilling to lessen the lifting pressure required to free the casing. Penetration to the anticipated bedrock depth of 150 metres was achieved by drilling without casing while using REVERT mud to support the formation. Bedrock was not intersected and 150 mm O.D. steel casing was used while drilling to the final depth of 195 metres.

Upon completion of drilling the three lines of casing were fixed too tightly in the hole for the cable tool rig to lift them without assistance from hydraulic jacks. The 150 mm casing was freed and removed to allow the 200 mm casing shoe to be cut off from the casing downhole. The 200 mm and 250 mm casings were then freed, after which casing depths were 127 metres and 87 metres respectively. The hole depth was 126 metres because the formation had collapsed when the 150 mm casing was removed.

The interval for screen placement was 129 to 132 metres. The hole was to be completed with a 3 metre length of 125 mm O.D. WELLMASTER sandscreen (0.254 mm aperture size) attached to 6 metres of 150 mm O.D. steel casing, which was equipped with a rubber seal for connection to the inside of the 200 mm casing.

With the assistance of REVERT mud to support the formation, the hole was drilled to 130 metres but the interval from 130 to 132 metres would not stand open. The screen assembly was lowered

to the base of the hole and induced to settle to the completion depth of 132 metres by bailing through the base of the screen, after which it was sealed with a lead plug. During development by pumping the lead plug came free, allowing sand to move 10 metres up the casing annulus.

The screen was removed and a subsequent attempt to place it in position by bailing was unsuccessful as formation sands entered the screen annulus more quickly than it could be bailed out. Revert mud was placed in the bore to stabilize the sands but this was quickly lost to the aquifer. A line of 150 mm O.D. casing was run and the hole redrilled to the completion depth of 133 metres. The screen assemblage (with a 1 metre sump added) was then placed and after removal of the 150 mm casing, sealed to the inside of the 200 mm casing.

After pump testing the 250 mm casing was removed and the bore completed by backfilling with clay and cement between the 200 mm casing and the formation from 0 to 85 metres.
Details of the completed well are summarized in Table I.

TABLE I

SUMMARY OF WELL DETAILS

STATE NO.	6628-42-11160
Completion Depth	133.20 metres
Casing	0-127 metres (200mm O.D. steel casing) 123.25-129.25 metres (125 mm O.D. steel casing rubber sealed to inside of 200 mm casing).
Screen	129.20-132.20 metres (125 mm O.D. stainles steel Wellmaster sandscreen of 0.025 mm aperture size equipped with a 1 metre sump.
Cemented Intervals	24-30 metres, 45-55 metres, 63-72 metres
Aquifer	Tertiary sand
Salinity	1200 mg/litre TDS
Water Level	58.85 metres (9-5-80)
Recommended safe yield	32 kl/hour
Recommended pump depth	between 91.5 and 126 m below ground.

PUMP TESTING

Pump testing of the bore was carried out before the 254 mm steel casing was removed, to determine the transmissivity of the screened aquifer interval and the safe yield for irrigation pumping. A step drawdown test was used to obtain a relation between drawdown and discharge rates, and an extended final step was used to reveal the presence of hydrogeological boundaries within the aquifer which might affect the wells performance over long pumping periods.

For the test, a turbine pump was installed at a depth of 116 metres and the aquifer was developed for two days to increase the efficiency of the bore and ensure it would produce sand free water. However, during the final stage of the pump test, sand was entering the screen for the first 5 hours, after which the bore produced sand free water for the final 5 hours. The bore was pumped at a maximum rate of 55 kl/hr during development, which is near the maximum capacity allowed by the sandscreen.

The pump test comprised three 100 minute stages at average discharge rates of 16.25 kl/hour, 20.2 kl/hour and 36.3 kl/hour and a final 10 hour stage at 43.63 kl/hour. Drawdown and recovery data are presented in Figure 8.

A well equation relating drawdown at any time to different discharge rates could not be solved as development of the aquifer was still occurring during the pump test. However, the specific capacity (the discharge rate per metre of drawdown) calculated for each stage of the test was constant at 1.3 kl/hr/m, and a graph relating drawdown to discharge rate is presented in Figure 9.

A transmissivity calculated using Jacob's straight line solution for data from the last 5 hours pumping of the main test gave a value of 153 m^3/day/m. The permeability of the aquifer is therefore 3.3 $m^3/day/m^2$.

WATER QUALITY

Water samples were taken before each stage and on completion of the pump test and the final sample was submitted for full analysis (Appendix A).

Salinity values remained constant at 1150 mg/litre throughout the pump test. Water of this salinity is suitable for the irrigation of lawns of medium salt tolerance.

RECOMMENDED PUMPING CONDITIONS

The Burnside City Council required a minimum discharge rate of 22.7 kl/hour for the irrigation bore. Development of the aquifer was occurring during the initial stages of the main pump test (43.6 kl/hour) and it is therefore recommended that the irrigation bore be pumped at a rate of no greater than 32 kl/hour to ensure that the aquifer sands are not carried with groundwater entering the bore.

The available drawdown within the 200 mm casing is 57 metres, but pumping at the recommended safe yield would induce a drawdown of only 24.6 metres, which is at 83.5 metres below groundlevel (see Figure 6). If a tolerance of 3 metres for seasonal variation in static water level and a 3 metre head of water above the pump intake is allowed for, the pump could be set at 91.5 metres. It is therefore recommended that the pump be set wherever most appropriate between 91.5 and 126 metres below groundlevel.

Predictions for drawdowns at pumping times of greater than 10 hours cannot be safely made as hydrogeological boundaries which could dramatically alter rates of drawdown might be encountered within the aquifer. The water level would recover to within 1 metre of the static water level within 2 hours after a 10 hour pumping period (see Figure 8). A safe pumping cycle is therefore restricted to an operating time of 10 hours followed by two hours of non pumping.

STRATIGRAPHY

A stratigraphic log of the bore is presented in Figure 2.

The normal sedimentary succession within the Adelaide Plains Basin consist of terrestial clays and sand (Recent to Pliocene) above a marine sequence of predominantly sandstone limestone and marl (Pliocene to Upper Eocene) above restricted marine and non marine sands and clays (Middle to Upper Eocene). However near the basins southwestern maring ie in the vicinity of this bore, the sequence of marine sandstone and limestone is missing.

At Hazelwood Park Recreation Reserve, the sequence below the Hindmarsh Clay Formation (Pleistocene terrestial sediments), consists of a thick succession of pyritic and carbonaceous, well sorted, fine to medium quartz sands with minor lignitic clays. The sequence is indicative of a non marine lacustrine environment of deposition with minor marine influx. The full sequence to bedrock was not penetrated but it is at least 110 metres in thicknes

Tube samples were collected for palaeontological examination from two intervals below the Hindmarsh Clay Formation, at:-

a) 116 metres within a sequence of carbonaceous sand

b) 137 metres within a bed of carbonaceous clay

Palynological examination of the samples (Harris, 1980) revealed that the samples from 116 and 137 metres were deposited during the latest Eocene to early Oligocene (i.e. equivalent to the early part of the marine succession found nearer the centre of the Adelaide Plains Basin). The sand from 116 metres was tentatively classified as a time equivalent of the AldinganA Member of the Port Willunga Formation (Pirraminna Sand?) and the sample from 132 metres was tentatively classified as a time equivalent of the Chinaman Gully Formation: "At 101 m, the only horizon in the bore containing shelly fossils was encountered. Pyritic casts of Turritella were recovered.

This is consistent with a stratigraphic position also in the Aldinga Member of Port Willunga Formation comparable with the sample from 116 m determined palynologically by W.K. Harris" (Pers. Comm. J.M. Lindsay 29/9/80).

SEISMIC INVESTIGATION

A downhole seismic investigation was performed to interpret the depth to bedrock when the hole depth was at 171.5 metres. Small charges were detonated within the casing at intervals of 10 metres and analysis of the resulting seismic data defined a high velocity interface at 185 metres. Subsequent drilling proved that this high velocity interface was the top of a hard band of pyrite cemented sand from 185 to 189 metres. It was concluded that this method of investigation is not appropriate for this sedimentary environment as the magnitude of the charges that could safely be detonated within the casing is not sufficiently large to distinguish between bedrock and hard pyritic layers.

CONCLUSIONS

The investigation resulted in the completion within the confined Tertiary sand aquifer of an irrigation bore of capacity, 32 kl/hour, producing water of salinity, 1150 mg/litre. The great thickness of unconsolidated sands made drilling conditions slow and difficult using the cable tool method. However this method was necessary for the selection of an appropriate unprotected sandscreen, as the uniformly fine and well sorted nature of the sands made the collection of representative sand samples for accurate grain size analysis of prime importance.

The alternative method of rotary drilling with mud circulation has disadvantages in selection, screening and development of the best sand interval but would appreciably improve the ease and

time of drilling and thus the cost of the bore. In this instance, the best aquifer interval chosen from an inspection of the geophysical logs was the same as that chosen on the basis of grain size analyses and could have been completed with a suitably gravel packed sandscreen of aperture size chosen for a fine grained sand.

B Eberhard.

B. EBERHARD

GEOLOGIST

REFERENCES

Harris, W., 1980. Palynology of samples from two bores on the eastern margin of the Adelaide Plains Sub-basin: St. Vincent Basin; Western Mining Corporation Palynology Report 80-3.

Walton, C.W., 1970. Groundwater Resource Evaluation; McGraw Hill Series.

APPENDIX I
Water Analysis Results

WATER ANALYSIS REPORT — AMDEL COMPUTER SERVICES

SAMPLE ID: W27/80 — JOB NO. 6011-80

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE MG/L	MILLIEQUIVS. PER LITRE ME/L
CATIONS			
CALCIUM	(CA)	70	3.5
MAGNESIUM	(MG)	70	5.8
SODIUM	(NA)	295	12.8
POTASSIUM	(K)	11	.3
IRON	(FE)		
ANIONS			
HYDROXIDE	(OH)		
CARBONATE	(CO3)		
BICARBONATE	(HCO3)	558	9.1
SULPHATE	(SO4)	86	1.8
CHLORIDE	(CL)	405	11.4
BROMIDE	(BR)		
FLUORIDE	(F)		
NITRATE	(NO3)	<1	
PHOSPHATE	(PO4)		

TOTALS AND BALANCE

CATIONS (ME/L)	22.4	DIFF =	.0
ANIONS (ME/L)	22.3	SUM =	44.7

DIFF*100. / SUM = .0 %

DERIVED AND OTHER DATA

CONDUCTIVITY (E.C.)
MICRO-S/CM AT 25 DEG. C 2025.

	MILLIGRAMS PER LITRE MG/L
TOTAL DISSOLVED SOLIDS	
A. BASED ON E.C.	
B. CALCULATED (HCO3=CO3)	1211.
C. RESIDUE ON EVAP. AT 180 DEG. C	
TOTAL HARDNESS AS CACO3	463.
CARBONATE HARDNESS AS CACO3	458.
NON-CARBONATE HARDNESS AS CACO3	5.
TOTAL ALKALINITY AS CACO3	458.
FREE CARBON DIOXIDE (CO2)	
SUSPENDED SOLIDS	
SILICA (SIO2)	
BORON (B)	

	UNITS
REACTION - PH	7.2
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	
SODIUM TO TOTAL CATION RATIO (ME/L)	57.4 %

REMARKS

PROJECT NO 12/02/0061

NAME- B EBERHARD.
ADDRESS- DEPT.MINES.

HUNDRED- ADELAIDE.
SECTION- HAZELWOOD PARK.
HOLE NO-
SUPPLY-

WATER CUT- 116M
WATER LEVEL-
DEPTH HOLE-

DATE COLLECTED 9/5/80.
DATE RECEIVED

SAMPLE COLLECTED BY- C.J.PENHALL.

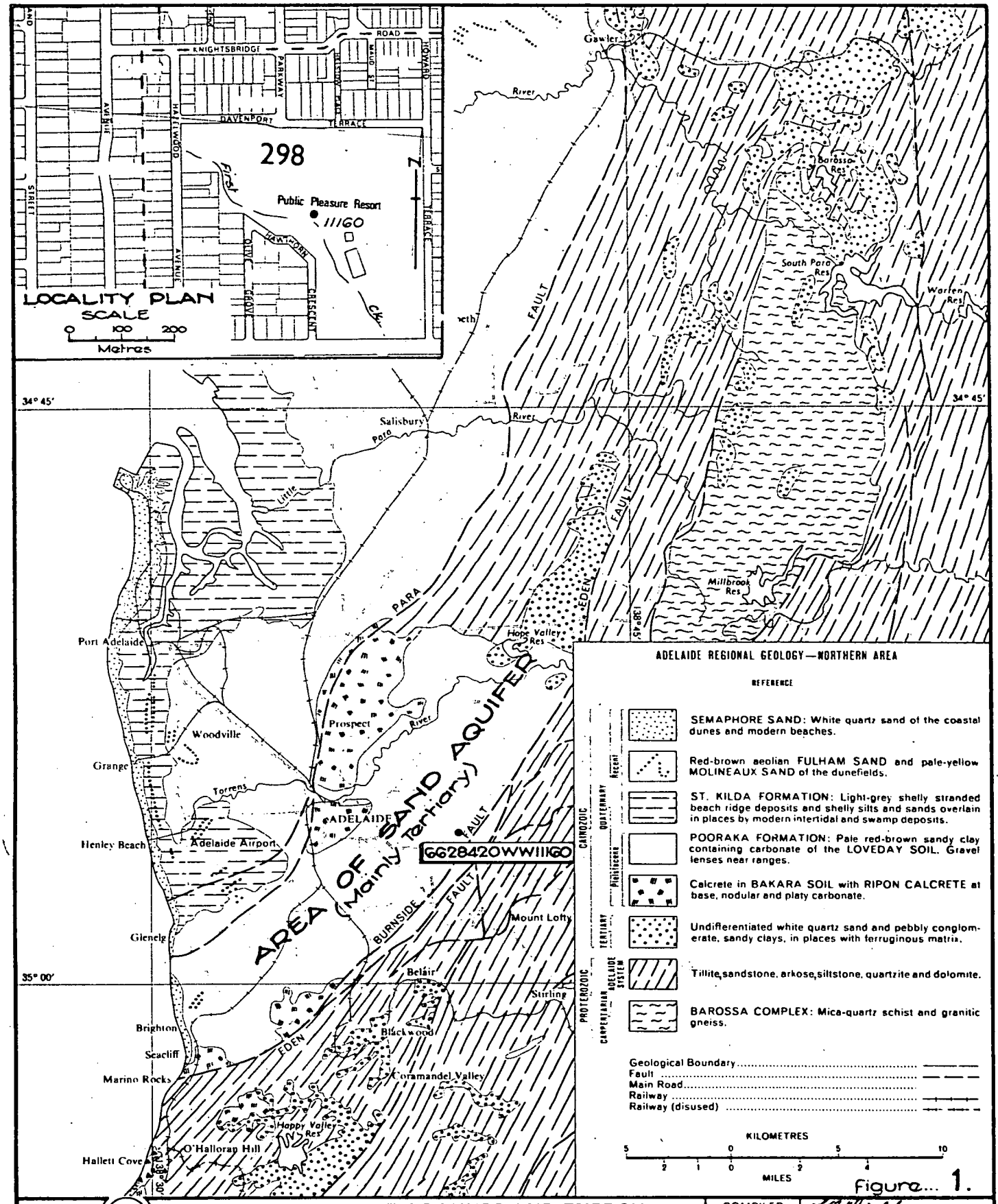


Figure... 1.

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

COMPILED B.A.E.	L.D. Wright 19/5/80 for C D O DATE
DRAWN C.J.W.	SCALE As shown
DATE Sept 80	PLAN NUMBER S15038.
CHECKED	

HAZELWOOD PARK RECREATION RESERVE
HYDROLOGICAL INVESTIGATION WELL
WELL No. 6628420WW11160
LOCATION AND REGIONAL GEOLOGY.

2/08

PF No 59992 GH

DEPARTMENT OF MINES & ENERGY – SOUTH AUSTRALIA
ENGINEERING DIVISION

COMPOSITE WELL LOG – GROUNDWATER

HOLE No.	
UNIT/STATE No.	6628428WW11189
SERIAL No.	114-80
FOLDER No.	
DRG. No.	80-680
SHEET	OF

CONSTRUCTION DETAILS

DRILLING TECHNIQUE: Cable Tool
CIRCULATION: Water (0–190m) Mud 190–195m.
START: 20-11-79
FINISH:
TOTAL DEPTH: 195m.

	Inches	m.m	From(m)	To(m)
HOLE DIAMETER		200	Surface	129
CASING DIAMETER (Cemented)		200	Surface	
CASING DIAMETER (Uncemented)		200		129
		125	125	129
SCREEN DETAILS Make / Model Dimensions		5m of 125mm o.D. stainless steel Watermaster Sandscreen (0.25mm aperture)	129	132

PROJECT Hazelwood Park Recreation Reserve Hydrological Investigation Well
LOCATION Hazelwood Park Recreation Reserve
SECTION 298 HUNDRED ADELAIDE
CO-ORDINATES
LOGGED BY B.A. Eberhard
REFERENCE ELEV. DATE 4th Feb '80
SURFACE ELEV. TRACED BY
DATUM DATE

TYPE OF LOG	16 IN. NORMAL	64 IN. NORMAL	6FT. LATERAL	S.P.	POINT RESISTIVITY	NEUTRON	GAMMA RAY	TEMPERATURE	DENSITY
DATE OF RUN						27-2-80	27-2-80		27-2-80
FIRST READING (m)						174	174.4		174.4
LAST READING (m)						58	0		58
INTERVAL MEASURED (m)						116			
CASING: LOGGER (m)									
CASING: DRILLER (m)						171.5	171.5		171.5
DEPTH REACHED (m)									
BOTTOM: DRILLER (m)									
MUD TYPE						Formation Water	Formation Water		Formation Water
MUD RESISTIVITY									
RECORDED BY									

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^2/day m^{-1}
- S Storage Coefficient/Specific Yield
- θ Porosity
- K Hydraulic conductivity m/day

DEPTH TO WATER(m)	DEPTH TO S.W.L.(m)	YIELD m³/day	YIELD Method of Test	TOTAL DISSOLVED SOLIDS mg/l litre	TOTAL DISSOLVED SOLIDS Analysis # No.
8	4	Soakage		420	
34	14			485	
44	12			425	
58	26	Soakage			
68	14			705	
72	14	85	Bailed	740	
125–152	58·85	768 (Recommended)	Pump Test.	1150	

REMARKS:

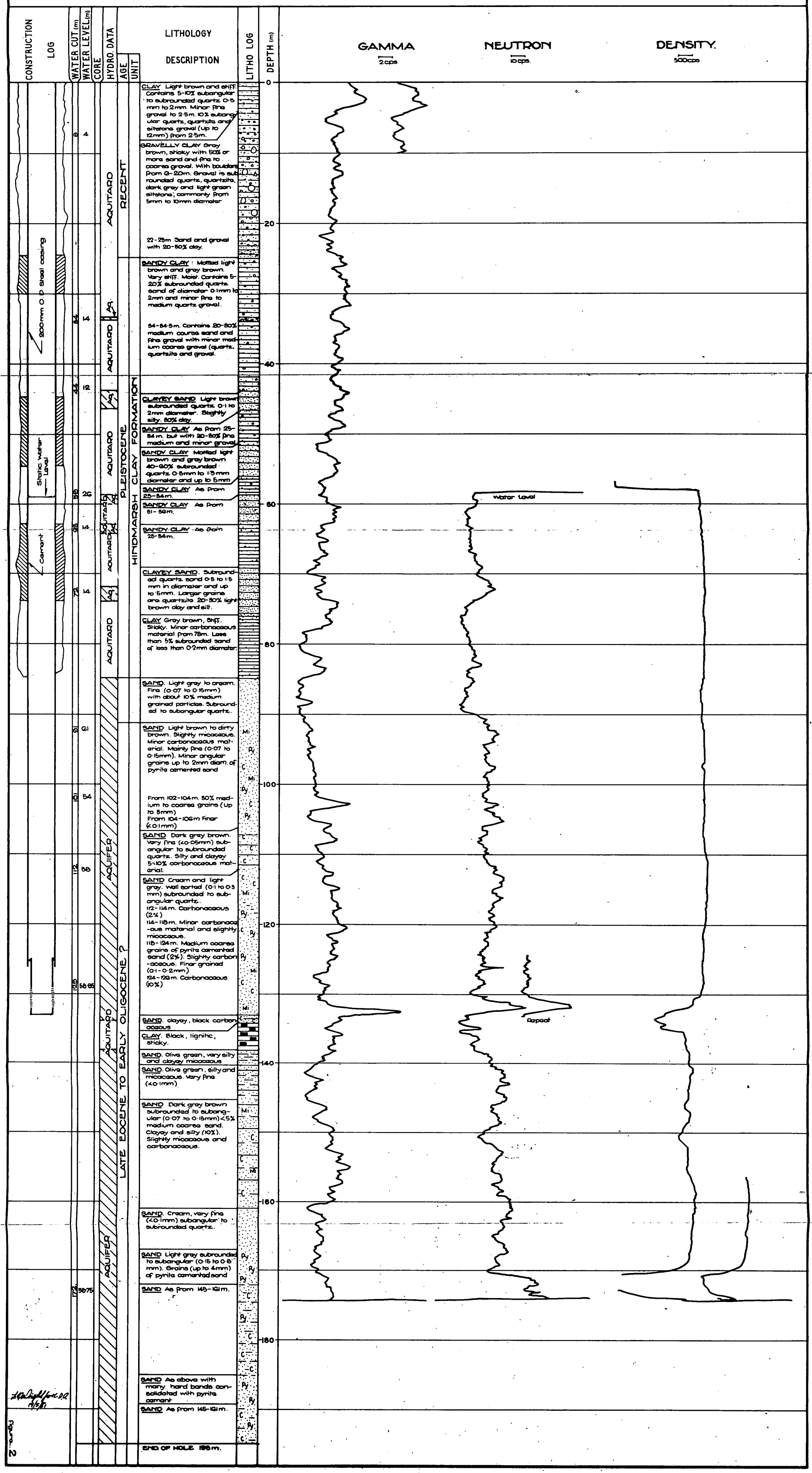
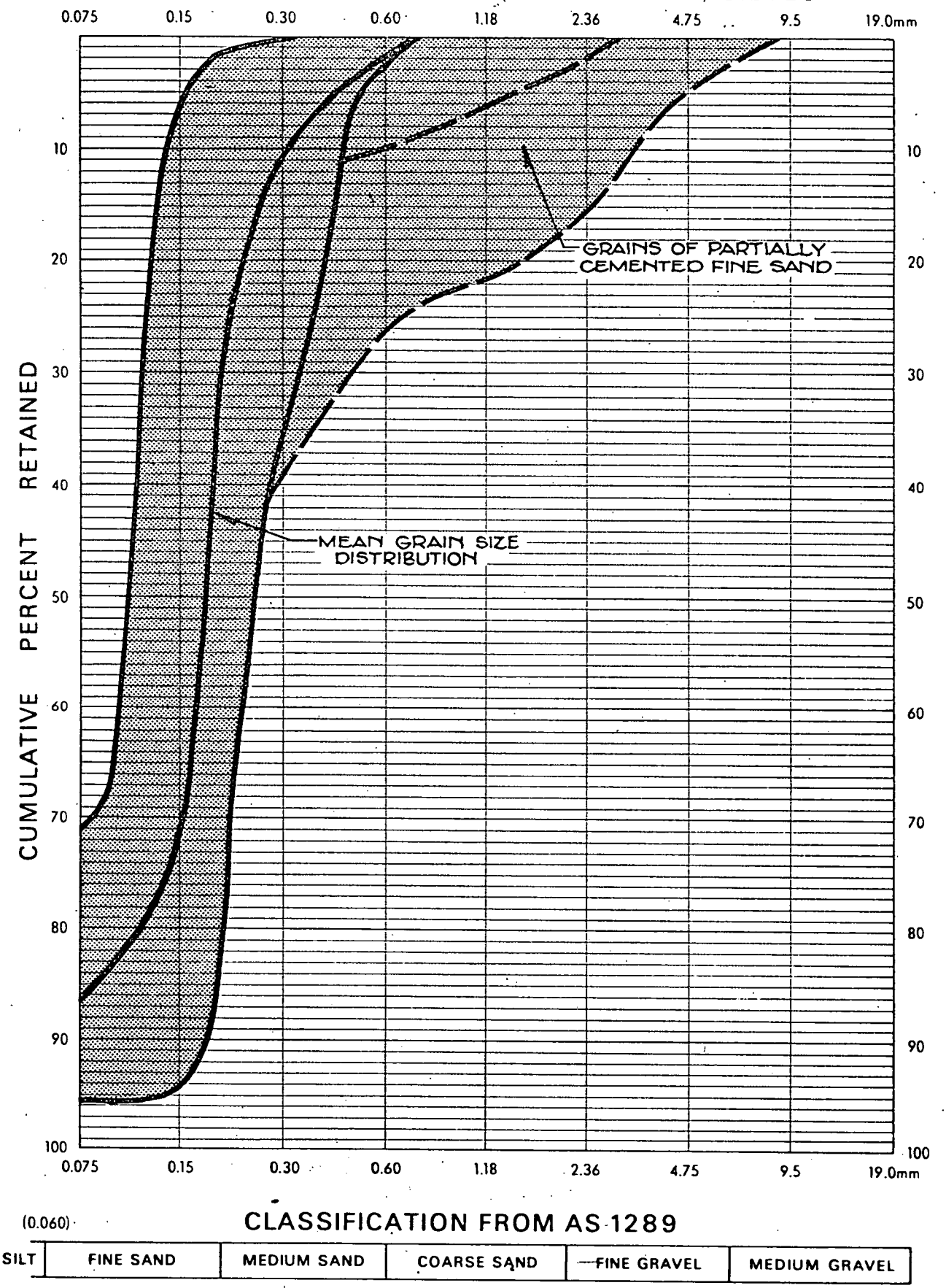


Figure 2



(0.060)

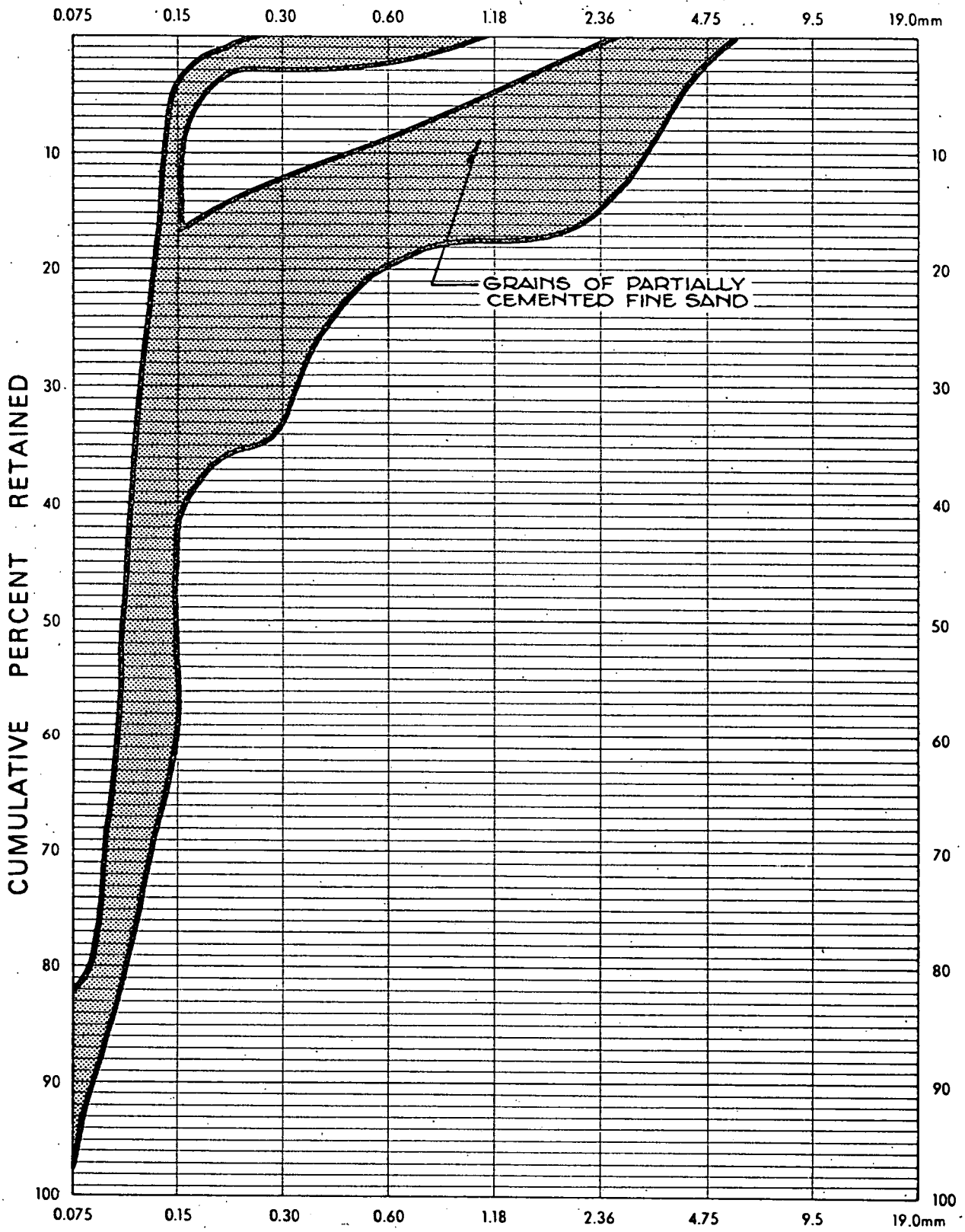
CLASSIFICATION FROM AS 1289

SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL

Figure... 3.

ENGINEERING DIVISION	DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA	Scale: As shown
Compiled: B.A.E.	HAZELWOOD PARK RECREATION RESERVE HYDROLOGICAL INVESTIGATION WELL WELL No. GG28420WW11160 ENVELOPE OF ALL GRAIN SIZE ANALYSES (47m)	Date: 9th Sept '80
Drn. C.J.W. Ckd.		Drg. No. S 15039
19/9/80		

2108



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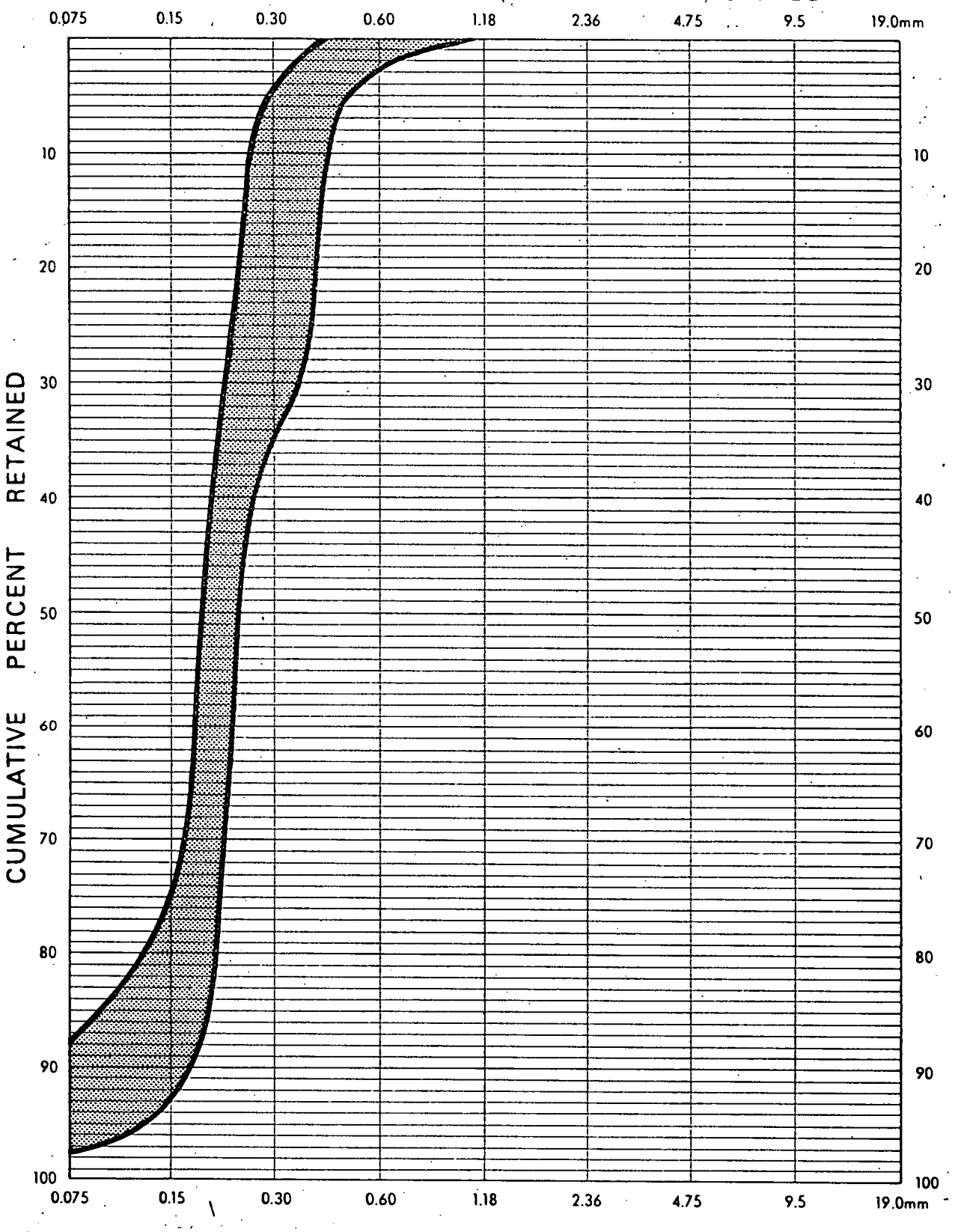
CLASSIFICATION FROM AS 1289

SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL

Figure... 4.

ENGINEERING DIVISION	DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA	Scale: As shown
Compiled: B.A.E.	HAZELWOOD PARK RECREATION RESERVE HYDROLOGICAL INVESTIGATION WELL WELL No. GG28420WW11160 ENVELOPE OF GRAIN SIZE ANALYSES (94-106m)	Date: 9th Sept. '80
Drn. C.J.W. Ckd.		Drg. No. S 15040
19/9/80		

MF 65



(0.060)

CLASSIFICATION FROM AS 1289

SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL

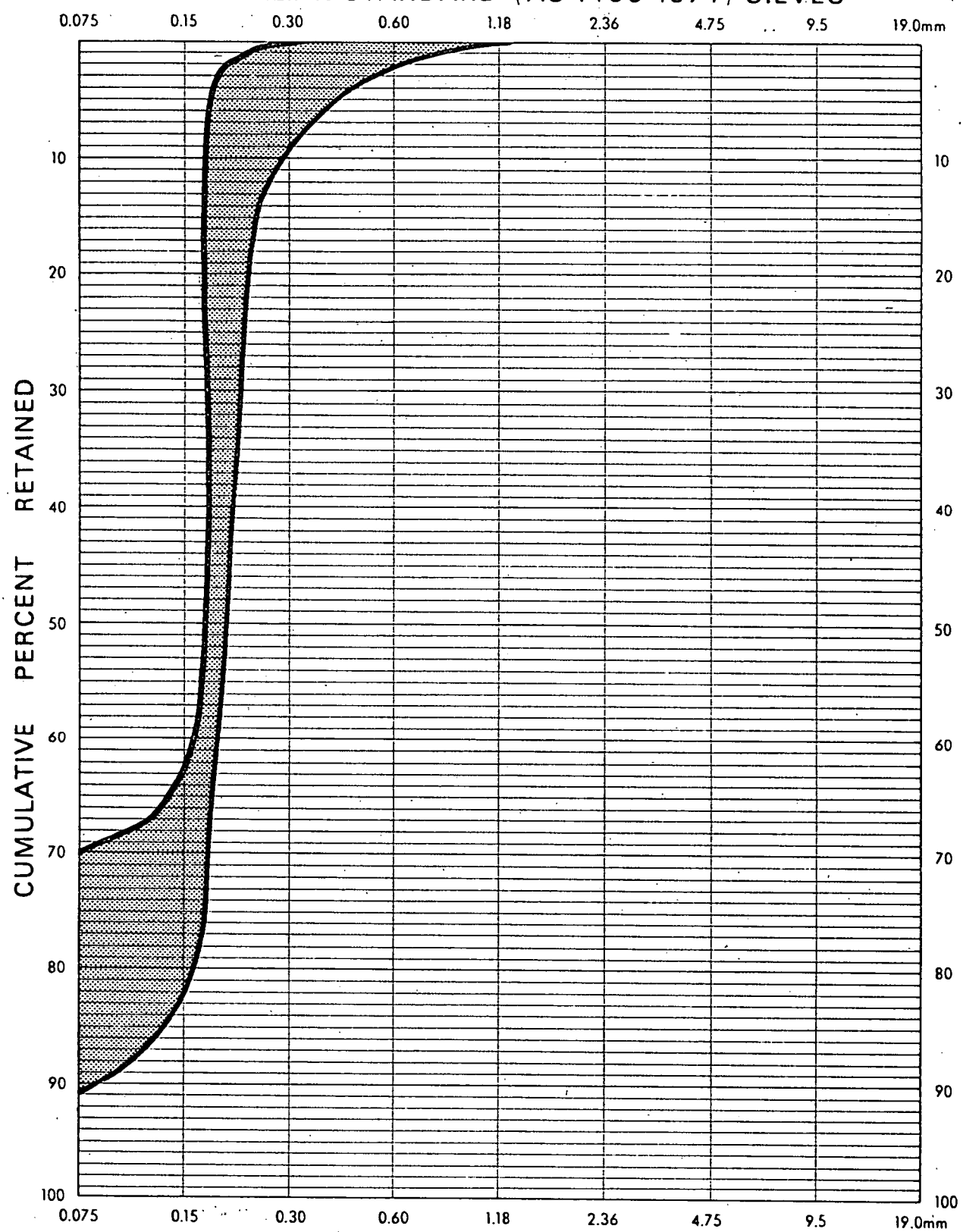
Figure... 5

ENGINEERING DIVISION	DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA	Scale: As shown
Compiled: B.A.E.	HAZELWOOD PARK RECREATION RESERVE HYDROLOGICAL INVESTIGATION WELL WELL No. GG28420WW11160 ENVELOPE OF GRAIN SIZE ANALYSES (114-132m.)	Date: 9th Sept '80.
Drn. C.J.W. Ckd.		Drg. No. S 15041.

2/08

19/5/81

MF 65



(0.060)

CLASSIFICATION FROM AS 1289

SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL

Figure... 6.

ENGINEERING DIVISION	**DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA**	Scale: As shown
Compiled: B.A.E.	HAZELWOOD PARK RECREATION RESERVE. HYDROLOGICAL INVESTIGATION WELL WELL No. GG28420WW111GO ENVELOPE OF GRAIN SIZE ANALYSES (168-195m.)	Date: 9th Sept. 80
Drn. C.J.W. Ckd. 19/5/81		Drg. No. S 15042

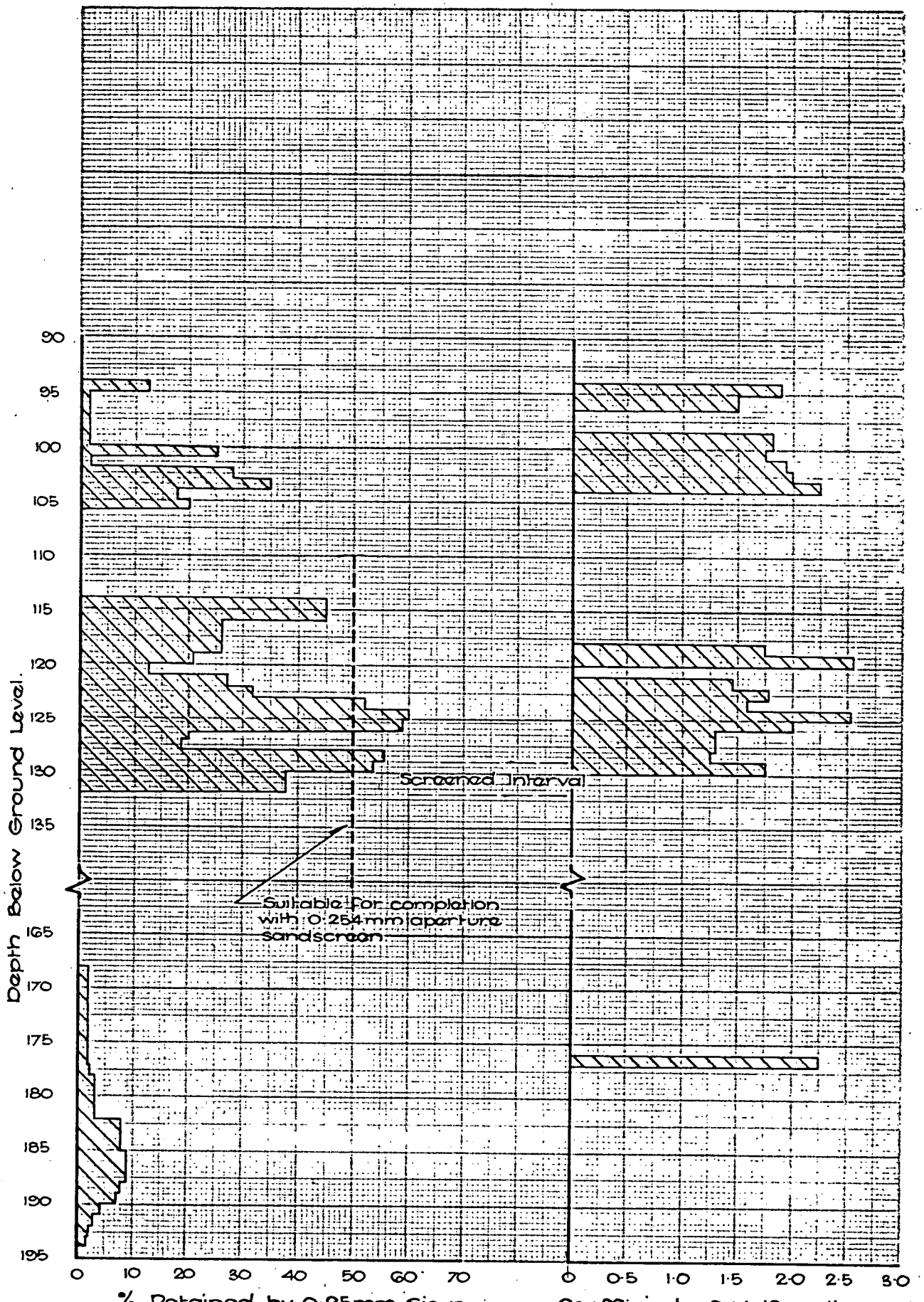
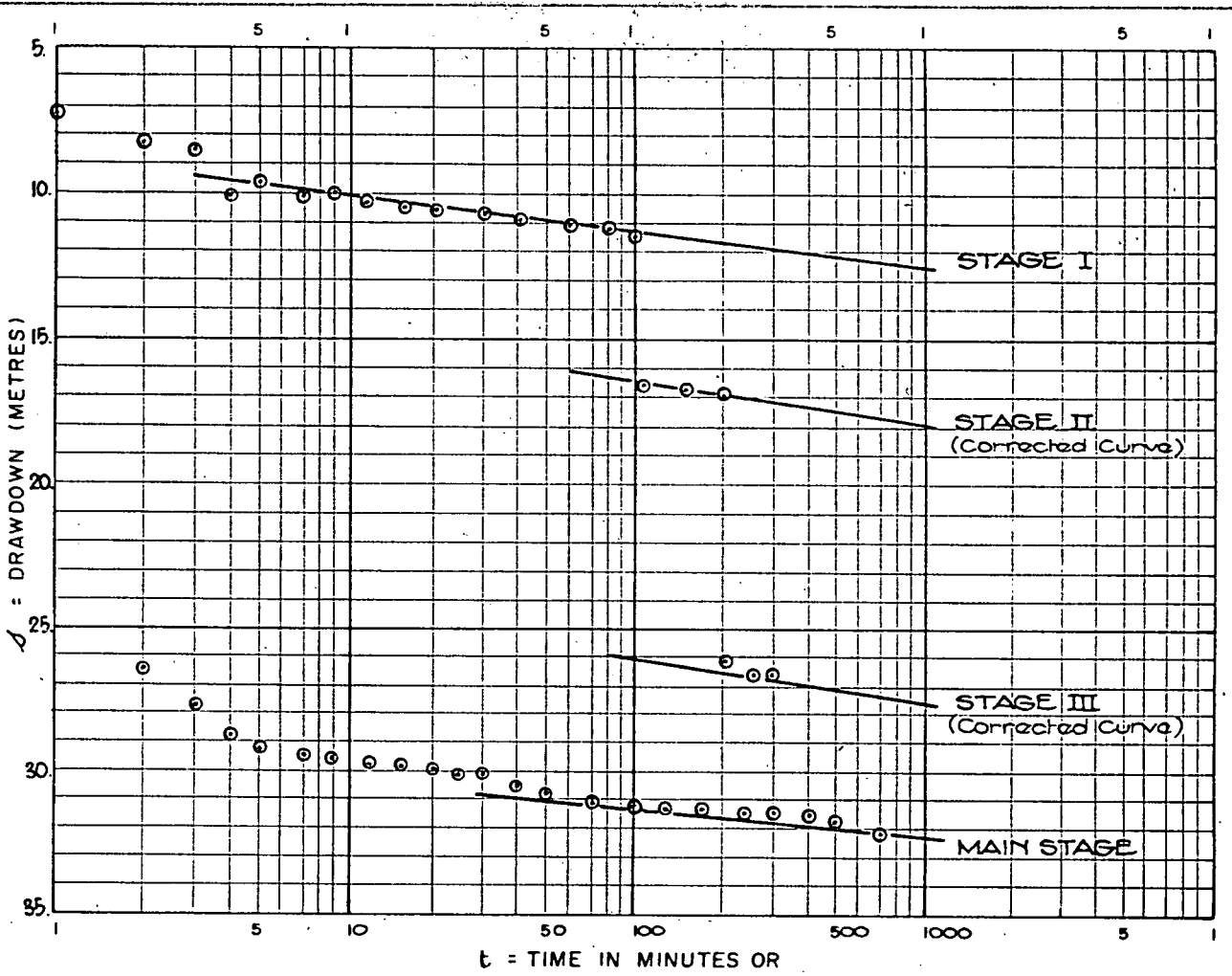
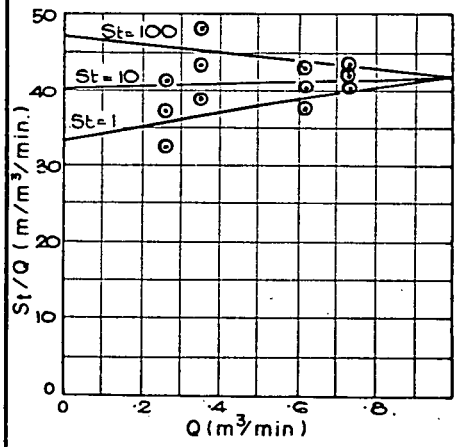


fig... 7.

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE
COMPILED B.A.E.	HAZELWOOD PARK RECREATION RESERVE HYDROLOGICAL INVESTIGATION WELL	DATE 9th. Sept. '80
DRN C.J.W. CKD	WELL No. GG28420WW11160	PLAN NUMBER S15043.
A Whitbread for C.D.O 19/5/81	PERCENTAGE OF SAND SAMPLE RETAINED BY SIEVE	





STEP	Q (m³/min)	$S_t = 1$	$\frac{S_t=1}{Q}$	$S_t = 10$	$\frac{S_t=10}{Q}$	$S_t = 100$	$\frac{S_t=100}{Q}$	$\Delta\delta$	$\frac{\Delta\delta}{Q}$	T*
1	0·27	8·8	32·7	10·1	37·2	11·3	41·7	1·22	4·52	
2	0·34	13·3	39·1	14·8	43·5	16·4	48·2	1·56	4·59	
3	0·61	23·1	37·9	24·6	40·3	26·0	42·7	1·50	2·46	
Main	0·73	29·9	40·9	30·7	42·1	31·3	42·8	0·91	1·25	153

* JACOB EQUATION : $T = \frac{0{\cdot}183.\,Q}{\Delta\delta}$

STATE / UNIT No. 6628420WW11160

INTERVAL TESTED

From 85 m. to 132 m.

HOLE DEPTH 132 m.

AQUIFER

From 85 m. to ..... m.

LENGTH OF TEST 10 Hours

DEPTH OF PUMP INTAKE 116 m.

DEPTH OF WATER LEVEL

AT START OF TEST 58·85 m.

AVAILABLE DRAWDOWN 57 m.

WELL EQUATION : $S = aQ + cQ^2 + b.Q.\log_{10}t$

OR $\frac{S_t}{Q} = a + cQ + b.\log_{10}t$

From $\frac{S_t}{Q}$ versus Q, a =

b =

c =

=

Therefore S_t = Q + Q^2 + $\log_{10}t$

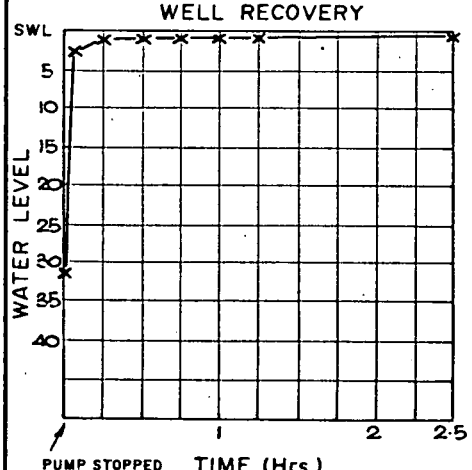


Figure... 8

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE
COMPILED B.A.E.	HAZELWOOD PARK RECREATION RESERVE HYDROLOGICAL INVESTIGATION WELL	DATE Sept '80.
DRN C.J.W. CKD	WELL No. 6628420WW11160 STEP DOWN TEST.	PLAN NUMBER S15044.

MF 88

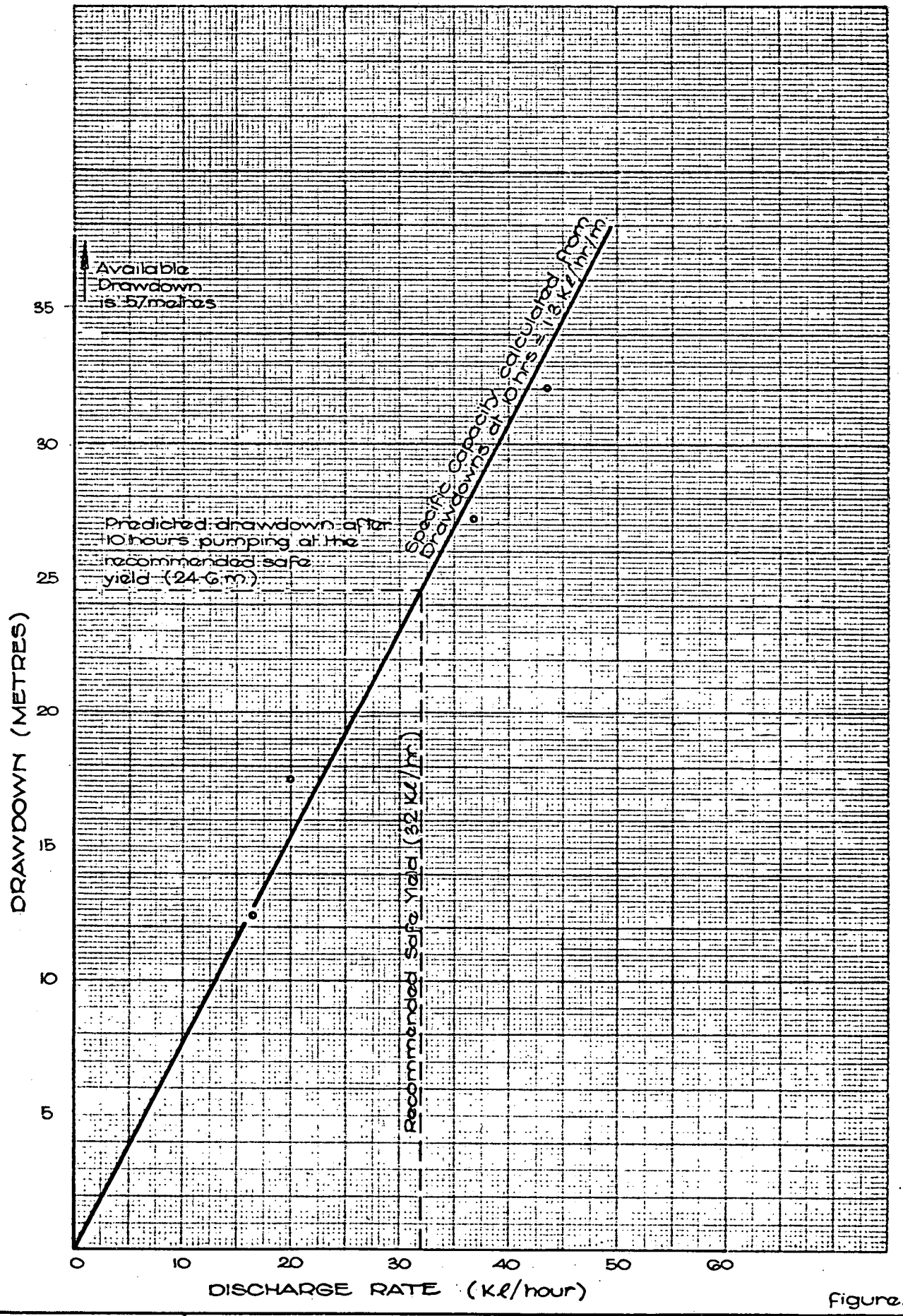


Figure... 9

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE
COMPILED B.A.E.	HAZELWOOD PARK RECREATION RESERVE HYDROLOGICAL INVESTIGATION WELL	DATE 9th Sept. '80
DRN C.J.W. CKD	WELL No. GG28420WW111GO	PLAN NUMBER
L.A. Wright for C.R.O. 19/5/81	PREDICTED DRAWDOWN FOR VARIOUS DISCHARGE RATES	S15045

2108.