DEPARTMENT OF MINES AND ENERGY
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LEIGH CREEK LOBE 'B' UPPER SERIES GROUNDWATER INVESTIGATION

GEOLOGICAL SURVEY

by

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INTRODUCTION

A series of relatively dry years at Leigh Creek has resulted in serious depletion of industrial water supplies used for road watering.

In response to a request from the Electricity Trust of South Australia (E.T.S.A.) an investigation was initiated into the possibility of obtaining industrial water from the hangingwall sediments in the Upper Series at Lobe B as soon as possible.

The increasing water problems encountered during mining of the Upper Series required that the possibility of dewatering the hangingwall sediments be investigated as a medium to long term exercise.

Drilling and well completion methods suitable for high yielding production wells in the Upper Series hangingwall sediments have been investigated and three successful production wells and a series of observation wells have been installed.

The anticipated consumption rate for industrial water at the present level of development of the mine is 660 ML per year or roughly 2 ML per day. This water has in the past been supplied from surface storage of rainwater and mine water in disused open pits on the coalfield and some minor contribution from Reverse Osmosis (R.O.) plant reject water will be available when the R.O. plant is operating.

Provided that the rate of deepening of these cuts is compatible, it is highly probable that the twin objectives of provision of an industrial water supply and mine dewatering will be attainable at relatively low cost, possibly without the drilling of any additional production wells for a period of at least five years.

WELL NUMBERING SYSTEM

In order to be compatible with the existing ETSA computer format a four digit numbering system was selected in which the first digit is 9 indicating that the hole is part of the water drilling programme. The second and third digits are the production well number and the fourth digit is the number of the observation well or piezometer associated with the production well indcated by the second and third digits. Suffixes W and P indicate production well and piezometer respectively. Thus:-

9040W is the fourth production well drilled.

and 9042P is the second piezometer associated with 9040W.

This numbering system replaces the HOB series and existing HOB wells have been allocated new numbers.

SELECTION OF SITES

An initial examination of electrical logs of existing coal exploration and geotechnical holes in early 1982 by G. Kwitko (SADME) indicated extensive zones of aquifer material in the hangingwall sequence. This exercise concentrated on the eastern end of the syncline which was closest to the M3? cut and therefore required a minimum of pipeline for disposal of water. Cored hole 3645 near the U/24 cut was selected as a suitable site and 9010W and 9020W were subsequently drilled at that location together with a series of piezometers completed partly by the E.T.S.A. shothole rig and partly by contractor during the 1983 drilling programme.

The results of pumping from 9020W were sufficiently encouraging to warrant further work in the upper series and logs of existing holes were examined in order to select sites covering a wider extent. Cored Holes nos. 3161 at U/25 and 3239 at U/27 were selected and after inspection of the cores it was decided to drill production wells at both sites.

Fig. 1 shows the location of the three sites investigated to date.

INITIAL PRODUCTION WELL DESIGN CONCEPT

9010W was designed as a scout hole and was equipped with 6 m of 100 mm diameter, 0.375 mm aperture screen and natural sand pack. After initial development problems the results of

airlifting this hole were sufficiently encouraging to justify the drilling of 9020W as a gravel packed large diameter well.

9020W. When 9020W was being designed it was still felt that the aquifer material was sand in a moderately consolidated state. A large diameter gravel packed well was designed employing a specially prepared gravel pack material and 6 m of 200 mm diameter 1.0 mm aperture screen with the selected gravel pack extending to approximately 15 metres above the screen and a coarse crushed rock gravel pack extending from that point to surface. This design theoretically allows all aquifer zones penetrated by the hole to contribute to discharge.

9030W to 9050W. The original concept was to construct relatively large diameter gravel packed screened wells with 2 screens in what were believed to be moderately consolidated sands. Verbal reports concerning the aquifer intervals strongly suggested that the material emerged from the core barrel in a plastic condition and subsequently hardened into a slightly friable sandstone on drying in the core box.

The lower screen in each well was designed as a telescopic assembly to permit withdrawal of the screen if corrosion or clogging problems were encountered during the operation of the well.

Cores from the lowest two sand intervals in 3239 and the second lowest sand interval in 3161 were carefully logged and sampled for grain size distribution analysis. Preparation of samples involved crushing and wet sieving. The resultant optimum screen aperture size of 0.4 mm was used in the construction of 9030W with disastrous results. It is now clear that the sample preparation process resulted in the breakdown of lithic fragments to produce a sand which was considerably finer than the material in the undisturbed state.

Pieces of core were also submitted to Australian Mineral Development Laboratories (A.M.D.E.L.) for petrographic description and laboratory permeability testing. The results of the AMDEL work (see Appendix 4) only became available after the drilling programme was partially completed and confirmed that the aquifers were sandstones of reasonable permeability and porosity and that 0.4 mm was too small an aperture size for the insitu materials.

AQUIFER IDENTIFICATION

Fig. 2 shows an interpretation of the continuity of permeable zones based on the inspection of 12 logged holes and the three production wells. This interpretation is provisional and may be changed as a result of further more detailed inspection of cores and electric logs.

At least 6 major sandy zones have been recognised and numbered consecutively starting from the lowest. They are referred to throughout this report as SAND 1 etc. but the lowest 2 or 3 members are sandstones at the depth of the production wells. The lithic nature of these sandstones renders them susceptible to chemical weathering as outcrop or subcrop is approached and in shallow intersection and pit walls they may appear as clayey sands.

It should be noted that 9020W is completed in SAND 2 and that SAND 2 appears to be washed out and replaced by a carbonaceous sequence between 9040W and 9050W.

1982-1983 DRILLING & TESTING PROGRAMME

U/24 Site 9010W

9010W was drilled by Thomson Drilling to a depth of 94 m close to cored hole 3645 and geophysically logged by Century Geophysical Corporation in May 1982.

Problems encountered in drilling and development are reported in SADME report No. 82/47 (D. Edwards) and are summarised below for completeness.

Difficulty in placing the screen at the first attempt necessitated reaming and the screen was finally located on top of a blockage (broken drill bit) at 56.5 m to 62.5 m in SAND 2.

Initial development yielded only 1.1 m^3/day and subsequent airlift development yielded 180 m^3/day. A further attempt at airlift development produced 320 m^3/day with 8 m of drawdown.

Clearly the poor construction of this hole was responsible for the difficult development however 3.7 l/sec (320 m^3/day) may be considered to be a useful yield from a 100 mm diameter screen in a poorly completed well for only 8 m of drawdown. Summary composite logs and completion details are shown in Appendix 1 and the results of the airlift pump test are shown in Fig. 3.

The specific capacity of 9010W is calculated at $\frac{320}{8}$ = 40 m^3/d per metre of drawdown. With a pump set at 35 m and available drawdown of about 20 m the well could be expected to produce up to 40 x 20 = 800 m^3/day or 9 l/sec.

The transmissivity indcated by the 8 hr. test is of the order of 60 to 70 m^2/day and the elastic storage coefficient is 7.8×10^{-5} or approximately 1×10^{-4}.

U/24 Site 9020W

Well 9010W was completed with relatively small diameter (150 mm) PVC casing to 38 m and therefore could not be equipped with a high capacity pump. It was decided to move 100 m in a downdip direction and drill a new well (9020W) with 200 mm casing in a fully gravel packed hole. In September 1982 Thompson Drilling contracted to drill the well which reached a total depth of 108 m. The hole was reamed to 311 mm diameter to 106 m and the section opposite the screen was reamed to 381 mm (90 m to 98 m). 200 mm diameter PVC casing with 6 m of 1 mm aperture screen located at 91.5 to 97.5 m (SAND 2) was installed and a selected gravel pack (1.1 mm to 1.8 mm) was placed from approximately 75 m to the bottom. The remainder ofthe annulus was filled with crushed rock aggregate (approximately 19 mm) containing about 5% of fines. Airlift development yielded 11 l/sec and a subsequent pump test (21/11/82) produced 9 l/sec with a drawdown in the well of the order of 50 m after 2 hrs.

Composite logs are presented in Appendix 1 and the results of the initial pump test in Fig. 4.

9020W was felt to be very inefficient and an attempt was made to redevelop the well using airlift which resulted in the removal of some dark fine grained material before the compressor failed.

A pump test carried out 21/1/83 produced a similar yield of 9 l/sec but for 2 m less drawdown (see Figs. 5 & 6).

The well was subsequently equipped and pumped for industrial water supply at 8 to 9 l/sec commencing 12/5/83. Drawdown was recorded for part of the period of pumping. The results are shown in Figs. 7, 8 and 9 and are discussed later.

In order to obtain a better feel for distance-drawdown relationships and drainage effects at the basin margins three shallow observation wells were drilled to a depth of 18 m using the ETSA shothole rig.

9021P is located 55 m in the updip direction from 9020W and was intended to intersect a permeable zone (SAND 5) appearing at a depth of 33 to 39 m in the production well. It was subsequently felt that 9021P may have been slightly too shallow and during the mid-1983 drilling programme a replacement 9026P was drilled to 30 m and completed with slotted 50 mm PVC casing in the target zone.

9022P and 9033P were drilled by ETSA at 170 m and 180 m respectively updip from the production well and were completed with 50 mm slotted PVC in the permeable zone which was screened in 9020W (SAND 2).

Because of the suspected low efficiency of 9020W it was decided to drill an observation well at 5 m radius from this production well. A dual completion technique enabled slotted PVC to be set opposite the screened zone in the production well (9024P) and in a permeable zone at a depth of 65 m (9025P SAND 5).

Summary logs, composite logs and completion details are given in Appendix 1 for all observation wells. A generalised cross section at U/24 site is given in Fig. 10.

Results of Pumping Tests at 9020W

The well was equipped with an electrosubmersible pump and pumped for approximately 4 200 mins at a rate of 9 l/sec commencing 21/11/82 and finishing 24/11/82.

Drawdown was observed in the pumping well, and 9010W. At the end of 4 200 mins the water level in 9020W was drawn down 54.48 m and in 9010W the drawdown was 4.94 m.

A semilog plot of drawdown vs time (Fig. 5) shows an unusual shape for the pumped well drawdown between 5 and 20 mins in which a recovery of over 2 m occurred despite continuous pumping. This feature is thought to be related to movement of water through the gravel packed annulus which requires some time to establish hence for the first 5 minutes of the test, the screened aquifer was supplying almost all of the discharge.

The log/log plot (Fig. 6) of observation well drawdown vs time clearly departs from the Theis Type Curve at about 30 mins in the fashion of a typical delayed yield response.

Transmissivity calculated from the early time match point data is 35 m^2/d and Elastic Storage Coefficient 5.7×10^{-5}.

The 120 mins test carried out on 21/1/83 after redevelopment showed a similar shape for the production well on the semilog plot (Fig. 7) but drawdowns were in general about 2 m less than drawdown prior to redevelopment.

Observation wells 9021P, 9022P and 9023P were drilled before the long term commissioning of 9020W as a water supply well and the drawdown observed for the 20 440 mins of continuous pumping between 12/5/83 and 24/5/83 are of considerable interest.

Fig. 7, a semilog drawdown vs time plot for the pumping well (9020W) shows three well defined straight line segments.

0- 100 mins - aquifer response T = 57 m^2/d
100- 3000 mins - delayed yield response
3000-20440 mins - basin dewatering.

The delayed yield segment reflects the onset of gravity drainage of the subcrop of the aquifer and the basin dewatering effect is felt when the contribution from delayed yield has diminished thus allowing the area of influence to increase and gradually drain the shallow margin of the basin.

The same three segments are evident in Fig. 9 a semilog drawdown vs time plot for 9010W and the aquifer response segment indicates an early time T of 55 m^2/d.

Fig. 8 is a log/log plot of drawdown vs time in 9010W and 9023P. Similar phases of drawdown can be interpreted from these plots with aquifer parameters from early time matches with the Theis Type Curve of:

9010W T = 41 m^2/d S = 6×10^{-5}
9023P T = 52 m^2/d S = 2.3×10^{-4}

The different stages of drawdown are excellently shown in the 9023P plot which indicates that the effects of basin dewatering were felt as early as 1 000 mins due to the location of the observation well close to the subcrop of SAND 2.

During the period of the test some 11 ML of water were withdrawn from 9020W. At the beginning of the pumping period the

Standing Water Level (SWL) in 9010W was 6.89 m below Top of Casing (T.O.C.) and two months later, on 25/7/83 the SWL had only recovered to 11.69 m below T.O.C. some intermittent pumping in the intervening period plus continued mine drainage in the working cut at U/27 make it impossible to relate the 4.8 m drop in SWL to a volume of water removed, however it does indicate that dewatering is occurring when a production well is pumped.

The early time response of 9020W to pumping is clearly shown for various test runs in Fig. 11.

It is interesting to note that the behaviour in the first 10 mins has changed between 21/1/83 and 12/5/83 with a much less pronounced recovery occurring at an earlier time on 12/5/83. Discharge rates were similar for each run.

The construction of an observation well at a radius of 5 m from 9020W has provided the opportunity to examine the efficiency of the pumped well however it has not been possible to observe the behaviour of 9024P and 9025P during a long period of pumping from 9020W.

Immediately after completion of the 5 m radius observation wells (26/7/83), the production well was airlifted at 8.5 l/sec for 3 hours (180 mins). Drawdowns observed in 9024P, opposite the screen in SAND 2 and in 9010W at 180 mins are shown in the distance versus drawdown semilog plot Fig. 12. The extrapolated drawdown at the radius of the wall of 9020W was 33 m compared with 48.5 m of drawdown observed during pumping of the well at a similar rate. The production well appeared to be only moderately efficient therefore it was decided to treat the production well with Calgon in an attempt to improve the efficiency. Previous airlift development had marginally improved the specific capacity from 15 $m^3/d/m$ to 15.5 $m^3/d/m$ and it was hoped that Calgon treatment would result in a more significant improvement.

During the airlift test of 26/7/83 prior to the placement of Calgon solution in 9020W the reaction of the 5 m radius observation wells was recorded whilst airlifting at 8.5 l/sec. FIg. 13 shows their response together with the results of a short post Calgon treatment airlift at the rate of 7.8 l/sec (9/8/83). The two sets of readings cannot be directly compared

since discharge was changing as the airlifted well was developing during the post Calgon phase.

The pre-Calgon behaviour of 9024P and 9025P will be compared with post-Calgon behaviour more effectively when 9020W is re-equipped with a pump.

U/25 Site: 9030W

The first production well in the 1983 driling programme - 9030W - was drilled to 162 m adjacent to existing cored hole 3161. The assumption was made that SANDS 1 & 2 were unconsolidated and a natural sand pack would be developed. Based on sieve analysis of core from 3161 and 3239 a screen aperture of 0.4 mm was selected.

An in line screen was set opposite SAND 2 at 135 to 140 m and a telscope screen assembly was set opposite SAND 1 at 153 to 158 m. Completion details are shown in Appendix 2.

A telescope screen in the lowest sand was selected on the assumption that the poor quality of the water in the Upper Series may create corrosion problems and if such was suspected in the future, the telescopic screen could be withdrawn and inspected.

Development commenced on 28/5/83 with the driller following instructions which were to develop the lower telescoped screen first in order to avoid the possibility of the telescope section floating up the hole. No sand was produced during early development. After 2 hours of jetting the main casing string dropped 200 mm and the yield increased from less than 0.1 l/sec of clear water to 4.4 l/sec of dirty water with clay and gravel particles. Subsequently the main casing string locked into the drill rods and rotated one complete turn. The driller suspected collapse of the upper screen and immediately pulled back the rods to 92 m. The yield had increased to 7 l/sec by this time.

The rods were withdrawn from the hole and a dummy pump was run on 30/5/83. The dummy would not pass below 136 m confirming collapse of the in line screen.

This probably occurred due to blinding of the screen by clay and carbonaceous particles with full hydraulic pressure against the outside of the screen and a much reduced pressure due to airlifting inside the screen.

An attempt was made to recover the casing but a joint failed at 80 m below surface thus only the upper 80 m of casing was recovered. The hole was abandoned and redrilled as 9040W.

U/25 Site 9040W

Following the failure of 9030W it was decided to redrill the production well under the new number 9040W. Drilling started on 6/6/83 and was completed on 14/6/83. A variation from the original design was the addition of a sand pack to prevent collapse of the walls of the hole during development. The sand was selcted from the U/27 excavation as the coarsest sand available and was in fact weathered aquifer material. The sand pack was emplaced in the hole using reverse circulation.

The driller was intructed to gradually develop both screens in order to avoid the problems encountered in 9030W however during development of the telescope screen set at 158 to 163 m, the jetting tool penetrated the end cap of the sump at 165 m. This cap was originally placed at 167 m therefore the telescope assembly had floated up the hole during the sand packing process to rest with the reducer and 'K' packer against the bottom of the in line screen.

This fact was subsequently confirmed by caliper logging.

A great deal of sand pack was lifted from the hole after the end cap had been penetrated. The annulus was topped up with sand, development was stopped and a cement plug set from 162 to 165 m to replace the end cap.

Subsequent development produced a yield of only 0.7 l/sec. The situation was reviewed and it was clear that the small screen aperture and sand pack were not effective.

It was decided to work over the hole, first driling out the cement plug and airlifting any sand pack material which was surrounding the telescope screen assembly. It was clear by this time that SANDS 1 & 2 were in fact sandstones and probably capable of standing open-hole. It was therefore decided to withdraw the telescope assembly if possible and attempt to develop open hole in SAND 1.

This work was undertaken on 20/7/83. On drilling out the cement plug and airlifting from beneath the casing a yield of approximately 40 l/sec was developed with some sand and clay which cleared fairly rapidly.

During this process the entire telescope section floated to the surface and was recovered. Development then continued with open hole from 157 m downwards.

Very little sand pack was recovered. The sandstone was demonstrated to be stable even under considerable stress and the in line screen was either stabilised by sand pack or free of sand pack since there was no seal at the bottom of the main casing string. The sand pack was stable at some level in the hole because although 7 m^3 of sand was added to the annulus during construction, only minor amounts were produced in this development process.

During airlifting, drawdown was observed in two observation wells and when the jetting tool was removed from the hole a caliper log was run over the open hole interval which confirmed the stability of the sandstone.

The final completion of 9040W is shown in Appendix 2.

Observation wells were drilled at 50 m radius to monitor SAND 1 (9041P) and SAND 2 (9042P). It was decided that useful distance drawdown data would be obtained from a dual completion observation well at 120 m radius, close to the projected highwall of the U25 cut.

A hole was drilled to 94 m and geophysically logged. Cuttings and geophysical logs indicated that SAND 1 was poorly developed so two observation wells were installed, 9043P slotted at 70 to 72 m and exposed via the hole annulus to SAND 1 and SAND 2, and 9044P slotted at 70 to 72 m opposite SAND 3.

Composite logs for all wells at U/25 site are presented in Appendix 2 and a cross section in Fig. 14.

Unfortunately there has been no pumping from 9040W since the completion of the observation wells at 120 m radius.

During airlifting of 9040W at approximately 40 l/sec, water levels were observed in 9041P and 9042P. The semilog plots of drawdown versus time are presented in Fig. 15.

Assuming that each aquifer contributes half of the discharge, the indicated transmissivities for early times are:-

9041P SAND 1 T = 63 m^2/d

9042P SAND 2 T = 53 m^2/d

An "impermeable" boundary was intersected at 10 and 8 mins in 9041P and 9042P respectively.

This behaviour is believed to be due to the interconnection between aquifers afforded by cored hole 3161 and the abandoned 9030W. At early time the induced leakage results in an apparent T value which is too high. At later times the leakage becomes less important and the T value approaches the true value for the aquifer.

Late Time 9041P SAND 1 T = 29 m^2/d

9042P SAND 2 T = 30 m^2/d

A comprehensive pump test will be carried out on 9040W as soon as a pipeline is installed to remove the water produced.

U/27 SITE 9050W

In order to test the theory that open hole completion would prove satisfactory for Upper Series production wells, 9050W was designed and constructed as follows.

Stage 1. A gravel packed well was constructed with 2 mm aperture heavy duty screen from 121 to 126 m opposite SAND 3. A fibreglass flange was installed at the bottom of the casing at 128 m. The well was developed and the yield noted.

Stage 2. The sandstone from 130 to 140 m (SAND 2) was drilled with a down the hole hammer and the yield noted after a short period of development.

Stage 3. The hole was advanced by down the hole hammer to penetrate the lowest sandstone (SAND 1, 144 to 151 m) and underlying siltstones to 160 m. Further development of aquifer intervals was then carried out.

Four observation wells, all at 50 m radius were completed prior to the commencement of the production well drilling. A fully cored hole 3239 is located 5 m from the production well.

Observations of water level fluctuation in all four observation wells were recorded during the three development stages and during drilling stages 2 and 3.

Stage 1 of the drilling of 9050W was carried out using the rotary mud technique and it was necessary to ream a slim (200 mm) pilot hole to 368 mm in order to install 200 mm ID fibreglass casing, stainless steel screen and 2 to 5 mm gravel pack. A fibreglass flange with open 200 mm ID centre and outside diameter of 355 mm was used as a firm base on which the casing could sit on the bottom of the hole. The flange would also prevent loss of gravel pack during stages 2 and 3.

Problems were encountered during installation of the casing due to the small clearance between the bottom flange and the walls of the hole, particularly opposite permeable sandstone intervals where mud cake had developed on the walls of the hole.

It required considerable effort to push the casing past such intervals and the last few metres required removal of the mudcake by prolonged washing beneath the casing before final depth could be achieved.

The reaming and casing operation occupied 5 full rig days.

The hammer drilling of stage 2 took only 40 mins and stage 3 took only 1 hr. 20 mins.

Two observation wells 50 m west of 9050W were drilled using rotary mud drilling.

9051P was completed in SAND 1 at 149 to 151 m and 9052P was completed in SAND 2 at 135 to 137 m.

A second pair of observation wells was drilled, also at 50 m radius but north of the production well, using air and a tricone bit. No problems were encountered with the drilling of 9053P and 9054P but both required to be filled with mud to retain wall stability during the casing operation.

9053P was completed in SAND 3 at 97 to 99 m and 9054P in SAND 4 at 86 to 88 m.

Thus at U/27 site there are observation wells in each of the four lowest sand members but there is no opportunity to observe distance drawdown relationships.

Standing water levels in these observation wells, after development showed a trend with the lowest sand member having the deepest SWL and successive members showing shallower SWL's.

		SWL (below Top of Casing)
9054P	SAND 4	19.28 m
9053P	SAND 3	21.77 m
9053P	SAND 2	23.00 m
9051P	SAND 1	23.35 m

This vertical potentiometric gradient is thought to be due to the drainage of the lowest sand member into the U/27 cut which has not yet exposed the higher sand members below water level and is believed to be a phenomenon which exists throughout the Upper Series hangingwall rocks.

Completion details and composite logs for all U27 drilling is contained in Appendix 3 and a cross section is presented in Fig. 16.

Results of Pumping Tests on 9050W

During the air drilling of 9053P airlift yield was carefully monitored as the drilling proceeded.

Depth(m)	Cumulative Q (l/sec)	
50	1.6	)
64	2.2	) SAND 5
76	3.3	)
80	4.1	) SAND 4 & 5
90	5.7	)
100	8.6	)
102	11.2	) SAND 3,4,5

It is clear that each sand unit is saturated and capable of yielding water. Available submergence for the efficient operation of air lift increased with drilling depth and the most significant discharge recorded was at full depth when the maximum submergence was available.

The 11.2 l/sec recorded was in good agreement with the discharge of 13 l/sec obtained from Stage 1 of 9050W in which similar sand members were exposed to the gravel pack and screen. All available observation wells were monitored during the airlift development of Stage 1 of 9050W. Results are shown in Figs. 17, 18. Although only SANDS 3 and 4 were penetrated by the production well, a response of 1 m was noted in the SAND 2

observation well at 50 m radius. This was due to interconnection of aquifers via the old cored hole 3239. The SAND 1 observation well did not respond at this stage.

Assuming that of the 13 l/sec discharge developed after 100 mins, 7 l/sec was contributed by the screened interval (SAND 3) for a Δs of 6 m but 1.6 l/sec was derived from SAND 2 via cored hole 3239, and 6 l/sec came from SAND 4 for a Δs of 5.6 m, the transmissivities of the two sand members are:-

SAND 3 $T = 14\ m^2/d$

SAND 4 $T = 17\ m^2/d$

Interesting observation well responses were noted during the drilling of Stages 2 and 3 (see Figs. 19 & 20).

During Stage 2, when the drill was penetrating SAND 2, some response was recorded in 9051P, the SAND 1 observation well. After 140 mins of airlifting, 7 m of drawdown had developed at 50 m radius. This drawdown can only be attributed to the presence of the cored hole at 5 m radius which must be assumed to be still open over the aquifer intervals.

During Stage 3, when SAND 1 was being drilled a drawdown of 17 m developed in 9051P.

The presence of an open hole so close to the production well simulates the behaviour of a leaky aquifer and makes precise analysis of pump test data impossible. Since there is a large number of exploration holes in the Upper Series, most of which can be assumed to be open at depth to some degree, the Upper Series can be expected to behave as a leaky aquifer system which will assist in the ultimate drainage of higher sand members in the sequence.

Back Analysis of Test Data on 9050W

Stage 1

After 100 m airlifting at Q = 13 l/sec = 1125 m^3/d.

SAND	Δs	Estimated Q	$\frac{Q}{\Delta s}$	$T = .183 \frac{Q}{\Delta s}$
4	5.6 m	432 m^3/d	77	14 m^2/d
3	6.0 m	550 m^3/d	92	17 m^2/d
2	0.8 m	141 m^3/d	176	32 m^2/d
1	-	-	-	-

Since SAND 2 was not exposed in the production well during Stage 1 there is clearly some interconnection between aquifers via cored hole 3239 (see Fig. 21A).

Ignoring leakage, Q SAND 3 = 661 m^3/d and T = 20 m^2/d.

Stage 2

After 100 mins airlifting Q = 27 l/sec = 2333 m^3/d.

SAND	Δs	Estimated Q	$\frac{Q}{\Delta s}$	T = $\frac{.183Q}{\Delta s}$
4	3.0 m	231 m^3/d	77	14 m^2/d
3	3.47m	319 m^3/d	92	17 m^2/d
2	4.3 m	1205 m^3/d	280	51 m^2/d
1	7.6 m	578 m^3/d	76	14 m^2/d

The T value for SAND 2 is spuriously high due to the excellent interconnection which must exist between 9050W and 3239 at the level of SAND 2 (see Fig. 21B).

Image well theory indicates that 3239 is behaving as a recharge well with respect to SAND 2 and will result in the Δs value observed in 9052P being reduced by half.

To calculate T for SAND 2 Q becomes 1205+578 = 1783 m^3/d and Δis doubled from 4.3 to 8.6 giving :-

$$T = \frac{.183 \times 1783}{8.6} = 38 \ m^2/d$$

Realistic values from Stage 2 are:-

	T
SAND 4	14 m^2/d
SAND 3	17 m^2/d
SAND 2	38 m^2/d
SAND 1	14 m^2/d

Drawdowns observed during a pump test (29/8/83) on Completed Well 9050W, with a Q = 2013 m^3/d are shown in Fig. 22.

Because all 4 sand zones are available for direct discharge into 9050W the effects of 3239 will be minimised and the system treated as if no leakage was occurring (see Fig. 21C).

SAND	Δs	Estimated Q	$\frac{Q}{\Delta s}$	T = $\frac{.183Q}{\Delta s}$
4	2.3 m	177 m^3/d	77	14 m^2/d
3	3.2 m	294 m^3/d	92	14 m^2/d
2	4.4 m	836 m^3/d	190	35 m^2/d
1	9.3 m	706 m^3/d	76	14 m^2/d
				ΣT 80 m^2/d

Analysis of the drawdown in the discharging well 9050W gives an apparent T of 87 m^2/d which is good agreement with values obtained by treating aquifers separately.

Hydraulic Conductivity may be calculated from the Transmissivity values obtained during pump testing.

SAND	T	Thickness bm	K = I b	Amdel lab values of K
4	14	5	2.8m/d	-
3	17	9	1.9m/d	-
2	35	10	3.5m/d	3.65 m/d
1	14	7	2.0m/d	2.72 to 3.28 m/d

The assumptions on which the above Transmissivity values were based rely on the equation $T = \frac{.183Q}{\Delta s}$ and the fact that for a given aquifer, Transmissivity is a constant therefore the ratio $\frac{Q}{\Delta s}$ should be a constant enabling Q to be determined from Δs . A subjective estimate of flow rates was made for Stage 1 and for flows from Sands 1 and 2 in the Pumping Test. Minor adjustments were then made to all flow values to obtain a stable set of transmissivities. Caliper logs from the open hole interval of 9050W before (8-8-83) and after (21-10-83) pumping are shown in Appendix.

Dewatering of the Upper Series Hangingwall Sequence

The Upper Series hangingwall consists of a multilayered sequence of alternating siltstone or mudstone aquitards separating sand or sandstone aquifers of moderate permeability.

This represents a complex leaky aquifer system whose behaviour in the undisturbed state would be largely governed by the vertical hydraulic conductivity (Kv) of the aquitards and the hydraulic properties of the aquifers themselves.

The situation is made more complex by the existence of a large number of coal exploration holes and several cored geotechnical holes which the present programme has shown to have a high probability of being open at least over the lower sand members particularly at depths unaffected by weathering where the material is in the form of sandstone.

An indication of the number of holes involved may be obtained from the location plan (Fig. 1). Counting only those holes which lie in areas outside the indicated 1986/87 highwall the number of holes by area is:-

Area	20	40
	21	16
	22	25
	23	62
	24	>100
	25	16
	26	16
	27	10

There are thus between 200 and 300 holes which may be open allowing interconnection of aquifers.

Whilst interconnection facilitates drainage of the entire basin it makes precise determination of aquifer properties on a basin-wide basis almost impossible.

The behaviour of the basin as a whole in response to dewatering pumpage will be dependent on a number of factors.

1. Degree of aquifer interconnection in a vertical sense.
2. Extent of continuity of aquifers horizontally.
3. Presence or absence of faults which may produce partial compartmentalisation of the system.
4. Changes in physical nature of aquifers in response to weathering at shallow depths. Delayed yields and perhaps inability to drain under gravity may accompany the process of weathering of a lithic sandstone to a sandy clay or clayey sand.
5. The hydraulic properties of the aquitards.
6. The absence or presence of recharge via surface alluvial sediments.
7. Interaction with existing and future pit drainage.

The situation in August 1983, when relatively little pumping of groundwater from dewatering wells had occurred indicates that mine drainage has created a potentiometric gradient from east to west.

Water levels from the three sites discussed in this report (Fig. 23) show a gradient of $\frac{3\ m}{1000m}$ or 3×10^{-3}m/m between 9040(U/25), and 9050(U/27) sites. The gradient between 9020(U/24) and 9040(U/25) is $\frac{6.5}{1000}$ or 6.5×10^{-3}m/m. These gradients are the result of early and continuing drainage at the U/27 cut which is currently the deepest upper series

excavation. Water levels at 9050 site are around 170 m AHD and at 9020 site are 186.5 m AHD.

It is anticipated that these gradients will be substantially modified by pumping from the dewatering wells which will ultimately produce interacting cones of influence which, in the absence of recharge, will gradually dewater the basin.

On the assumptions that:

1) industrial water is required at the rate of 3 ML/day,
2) 30 or 50 m total thickness of sand has to be drained with a Specific Yield of 0.2,
3) there is no recharge to the basin and pumping is continuous,

a simple model of the progress of dewatering can be constructed.

Fig. 24 shows such a model which suggests that for a total sand thickness of 50 m, the water level throughout the basin can be lowered by 150 m in about 14 years of continuous pumping at a rate of 3 ML/day which will satisfy industrial water requirements.

This model will underestimate the rate of lowering of water level if:-

a) Sand thickness is greater than 50 m
b) Specific Yield is greater than 0.2
c) The aquitards can yield significant volumes of water with depressurisation.

A higher discharge rate will increase the rate of lowering all other things being equal (current well capacity is at least 50 l/sec or 4.32 ML/day). If dewatering proceeds at a rate greater than the demand for industrial water a significant surface storage will be required.

As the basin water level declines so will the maximum capacity of the dewatering wells and it will be necessary to drill progressively deeper wells with the passage of time.

Overall dewatering planning will depend upon the rate of lowering of water level necessary to achieve dry pit conditons and it may therefore be necessary to drill some additional shallower wells to rapidly dewater areas required for mining in the immediate future.

In order to monitor the basin-wide progress of dewatering it would be desirable to establish observation wells at points remote from discharge sites.

Water Quality

Water analyses from all production wells are included in Appendix 5.

With the exception of 9010W which showed a wide variation in T.D.S. between 21 000 and 8 000 mg/l, all are typical sodium chloride type waters with some calcium and sulphate. (The latter due to oxidation of pyrite).

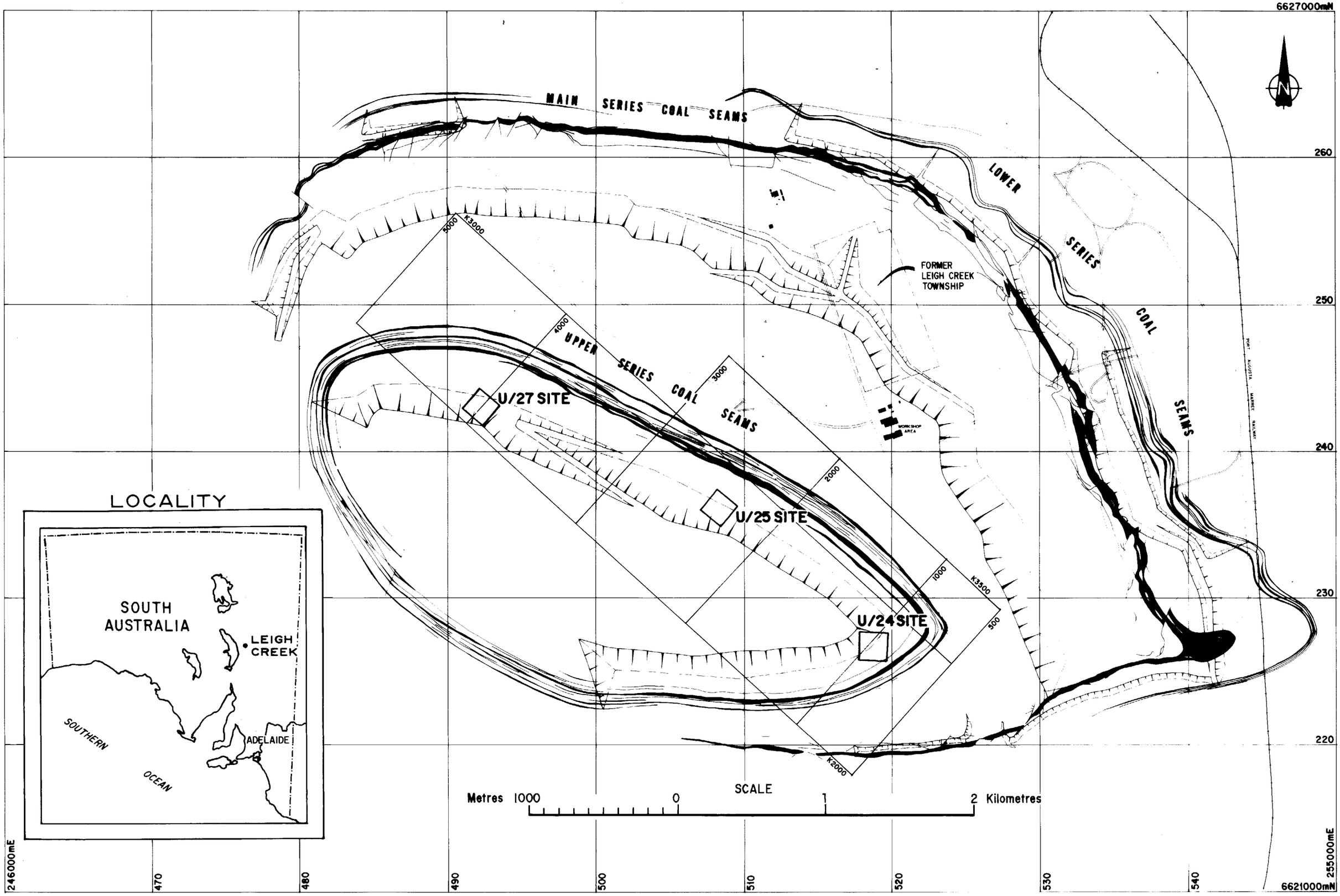
T.D.S. ranges from 12 070 mg/l to 16 400 mg/l suggesting a long residence time and poor flushing.

At the well head the water smells strongly of H_2S but strong smell is usually associated with relatively low levels of this gas which can easily be removed by aeration.

DA;DRE:ZV

D. ARMSTRONG

D.R. EDWARDS



REFERENCE

- Road
- Building other than township
- Sub—outcrop of coal seams
- Faults disclosed by drilling
- Mining limits
- Datum is Australian Map Grid, Zone 54

FIG.... 1

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

SITE LOCATION PLAN

COMPILED D.E.	C.D.O. 27/11/85 DATE
DRAWN G.B.	SCALE 1:25 000
DATE 27 JUN 84	PLAN NUMBER 84—274
CHECKED	

1629/1

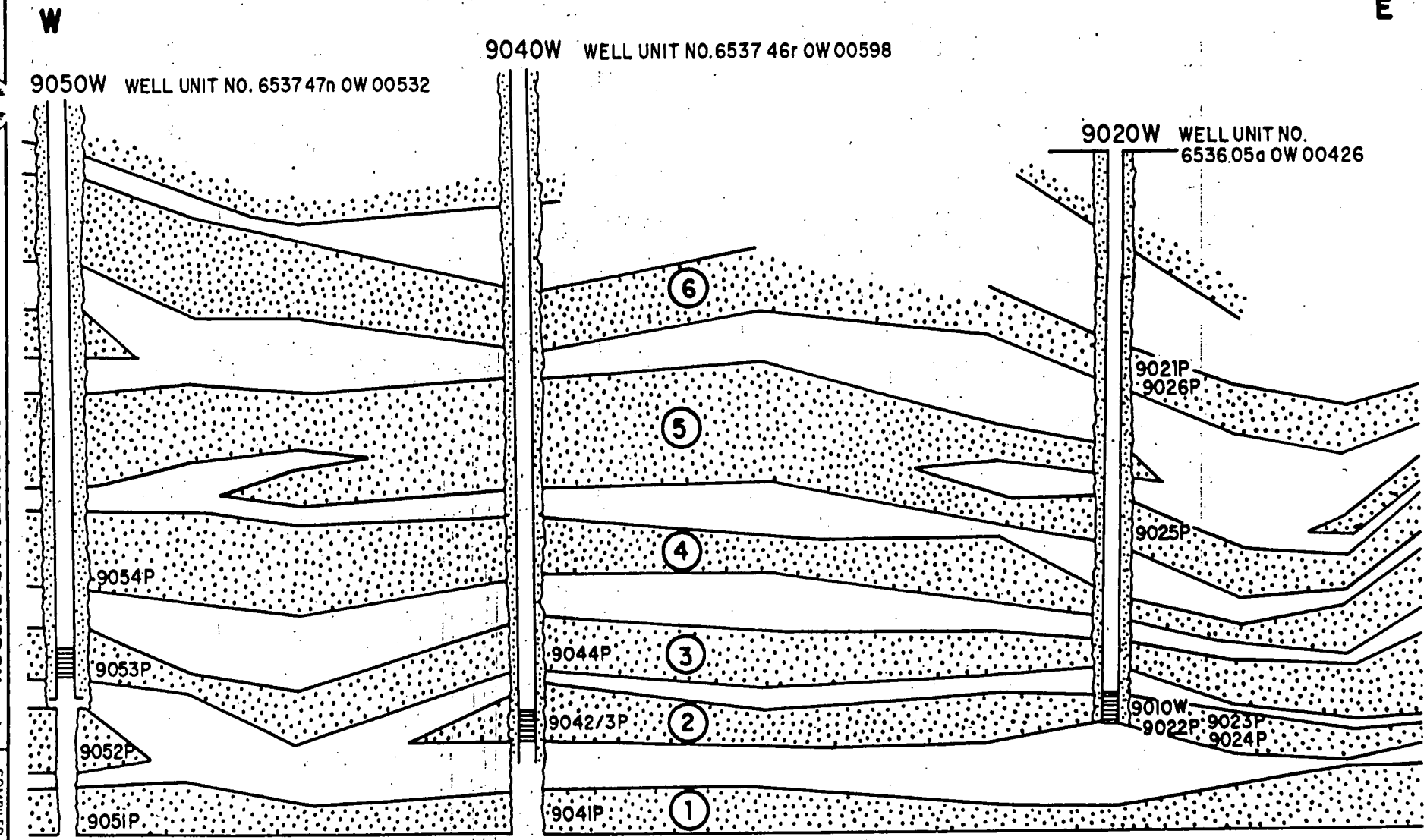


FIG....2

REFERENCE

W Production well (9050 – fifth production well drilled in upper series)

9044P Piezometer monitoring effect of 9040W on 'SAND' member 3

(6) 6th. 'SAND' member above highest exploitable coal seam

See text for 'AQUIFER IDENTIFICATION'

'Gravel packing

For all SADME Well Unit Nos. see appendix 6

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

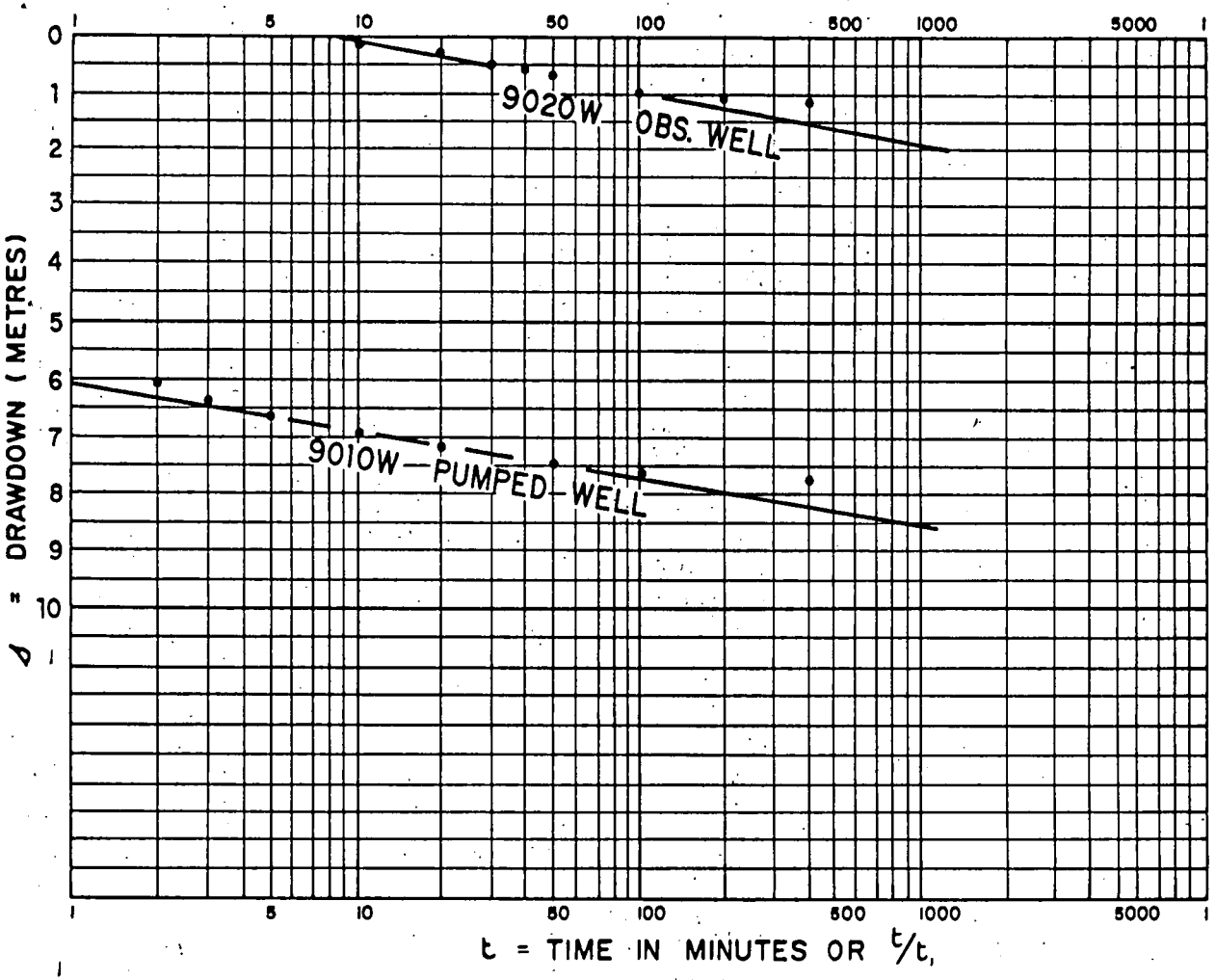
LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

PROVISIONAL CORRELATION OF SAND MEMBERS

COMPILED	DRAWN	DATE	CHECKED
D.A.	G.B.	25 JUN 84	C.D.O.

SCALE

PLAN NUMBER S17431



PROJECT No. 9010W

PRODUCTION/OBSERVATION WELL

INTERVAL TESTED

From 48 m. to 63 m.

HOLE DEPTH 94 m.

AQUIFER THICKNESS ? m.

DEPTH OF PUMP INTAKE AIRLIFT m.

DEPTH OF WATER LEVEL

AT TEST START 6·17 m.

AVAILABLE DRAWDOWN — m.

JACOB EQUATIONS*

$$T = \frac{0.183 \times Q}{\Delta s} \quad \text{in which}$$

T = Transmissivity (m^3/day/m.)

Q = Pumping rate (m^3/day)

Δs = Drawdown per log cycle (m.)

$$S = \frac{2.25 \times T t_o}{1440\, r^2} \quad \text{in which}$$

S = Storage coefficient

t_o = Zero drawdown time (minutes)

r = Distance to Observation Well (m.)

DATA

	Q	Δs	t_o	r
9010W	3·7L/s 320m^3/d	0·8m		
9020W	320m^3/d	0·88m	7mins	96m

CALCULATIONS

9010W

$$T = \frac{0.183 \times 320}{0.8} = 73\ m^3/d/m$$

9020W (OBS. WELL) r=96m

$$T = \frac{0.183 \times 320}{0.88} = 66\ m^3/d/m$$

$$S = \frac{2.25 \times 66 \times 7}{96 \times 96 \times 1440} = 7.8 \times 10^{-5}$$

Figure 3

For all SADME Well Unit No's. see appendix 6

* Check applicability of this method

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

9010W WELL UNIT NO. 6536050W00254
AIRLIFT TEST 1 OCT 82

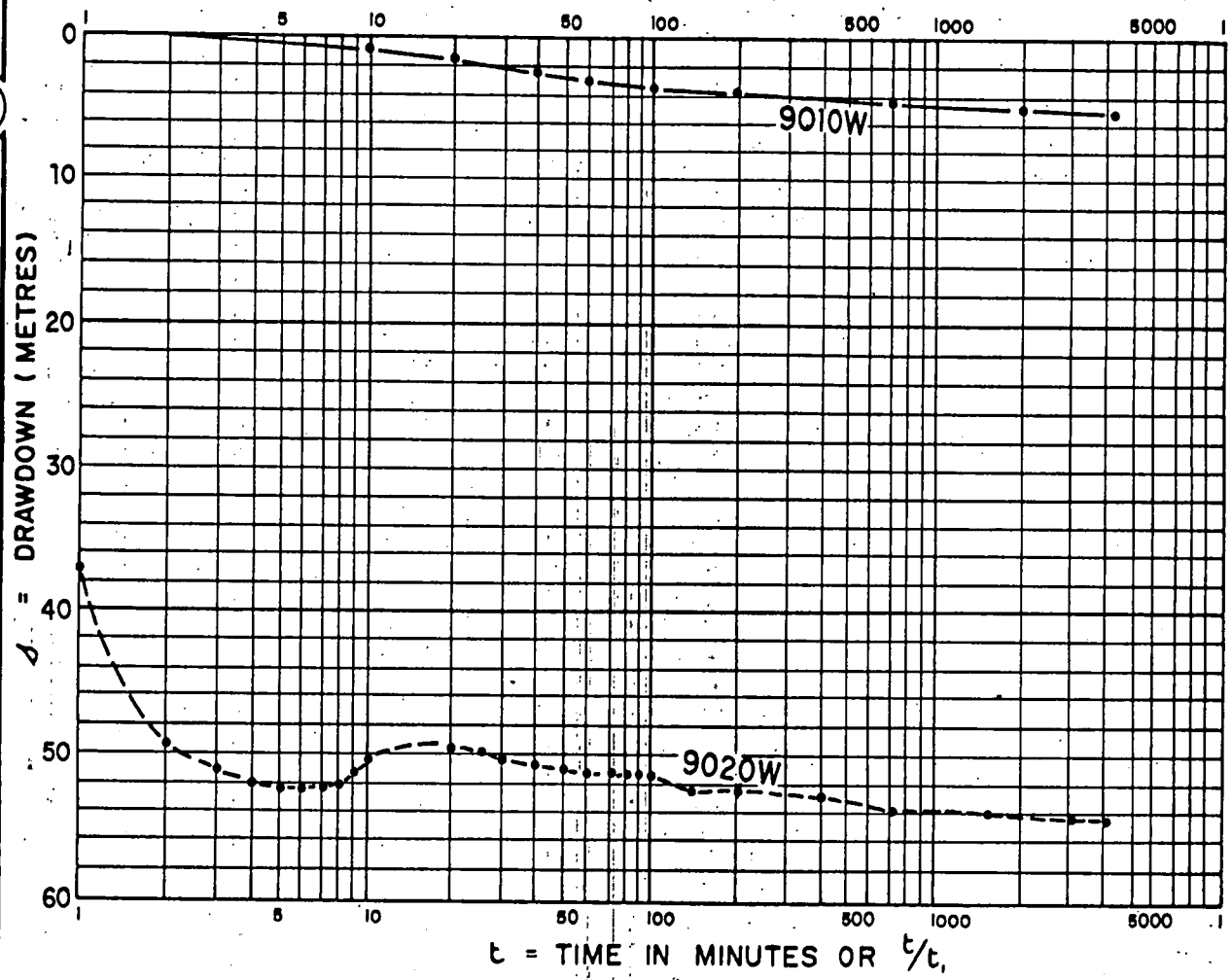
COMPILED	DRAWN	DATE	CHECKED
D.A B D.E.	G.B.	27 JUN 84	C.D.O.

SCALE

PLAN NUMBER S17432

3291

MF 89



PROJECT No. 9020W

PRODUCTION/OBSERVATION WELL

INTERVAL TESTED

From_____m. to_____m.

HOLE DEPTH_____m.

AQUIFER THICKNESS_____m.

DEPTH OF PUMP INTAKE_____m.

DEPTH OF WATER LEVEL

AT TEST START_____m.

AVAILABLE DRAWDOWN_____m.

JACOB EQUATIONS*

$$T = \frac{0{\cdot}183 \times Q}{\Delta\delta} \quad \text{in which}$$

T = Transmissivity (m^3/day/m.)

Q = Pumping rate (m^3/day)

$\Delta\delta$ = Drawdown per log cycle (m.)

$$S = \frac{2{\cdot}25 \times T t_o}{1440\, r^2} \quad \text{in which}$$

S = Storage coefficient

t_o = Zero drawdown time (minutes)

r = Distance to Observation Well (m.)

DATA

Q $\Delta\delta$ t_o r

CALCULATIONS

Figure 4

For all SADME Well Unit No s see appendix 6

* Check applicability of this method

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

9020W WELL UNIT NO. 6536050W00426

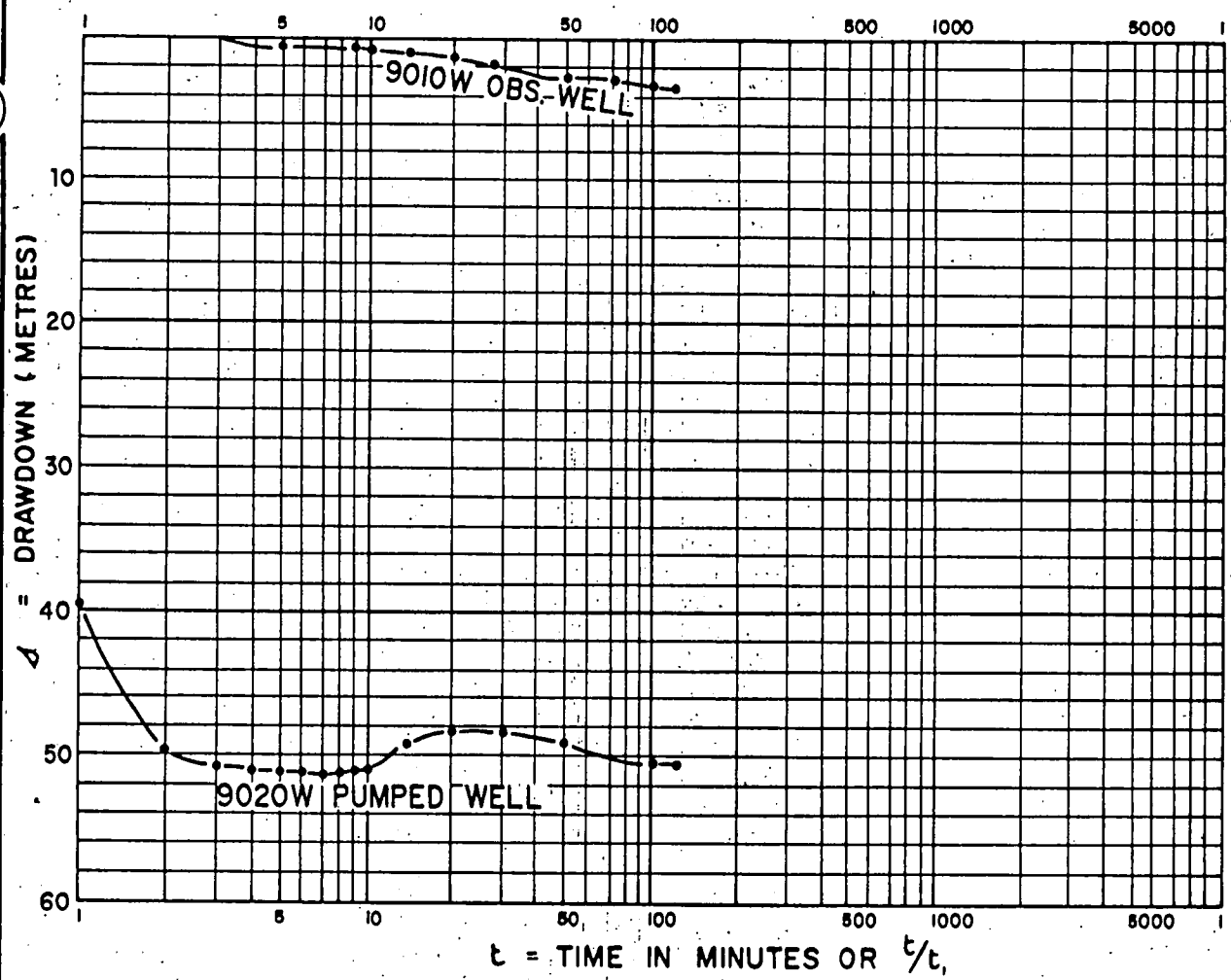
PUMP TEST 21 NOV 82

SEMI-LOG PLOT

COMPILED	DRAWN	DATE	CHECKED	DATE	PLAN NUMBER
D.E.B.D.A.	G.B.	27 JUN 84	C.D.O.		S17434

SCALE

3291



PROJECT No. 9020W

PRODUCTION/OBSERVATION WELL

INTERVAL TESTED

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

HOLE DEPTH.....m.

AQUIFER THICKNESS.....m.

DEPTH OF PUMP INTAKE.....m.

DEPTH OF WATER LEVEL

AT TEST START.....m.

AVAILABLE DRAWDOWN.....m.

JACOB EQUATIONS*

$$T = \frac{0{\cdot}183 \times Q}{\Delta s} \quad \text{in which}$$

T = Transmissivity (m^3/day/m.)

Q = Pumping rate (m^3/day)

Δs = Drawdown per log cycle (m.)

$$S = \frac{2{\cdot}25 \times T t_o}{1440\, r^2} \quad \text{in which}$$

S = Storage coefficient

t_o = Zero drawdown time (minutes)

r = Distance to Observation Well (m.)

DATA

Q Δs t_o r

CALCULATIONS

Figure 5

For all SADME Well Unit Nos see appendix 6

* Check applicability of this method

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

9020W WELL UNIT NO. 6536050W00426

PUMP TEST 21 JAN 83

SEMI-LOG PLOT

COMPILED	DRAWN	DATE	CHECKED	DATE
D.E.B D.A.	G.B.	27 JUN 84	C.D.O	

SCALE

PLAN NUMBER S17433

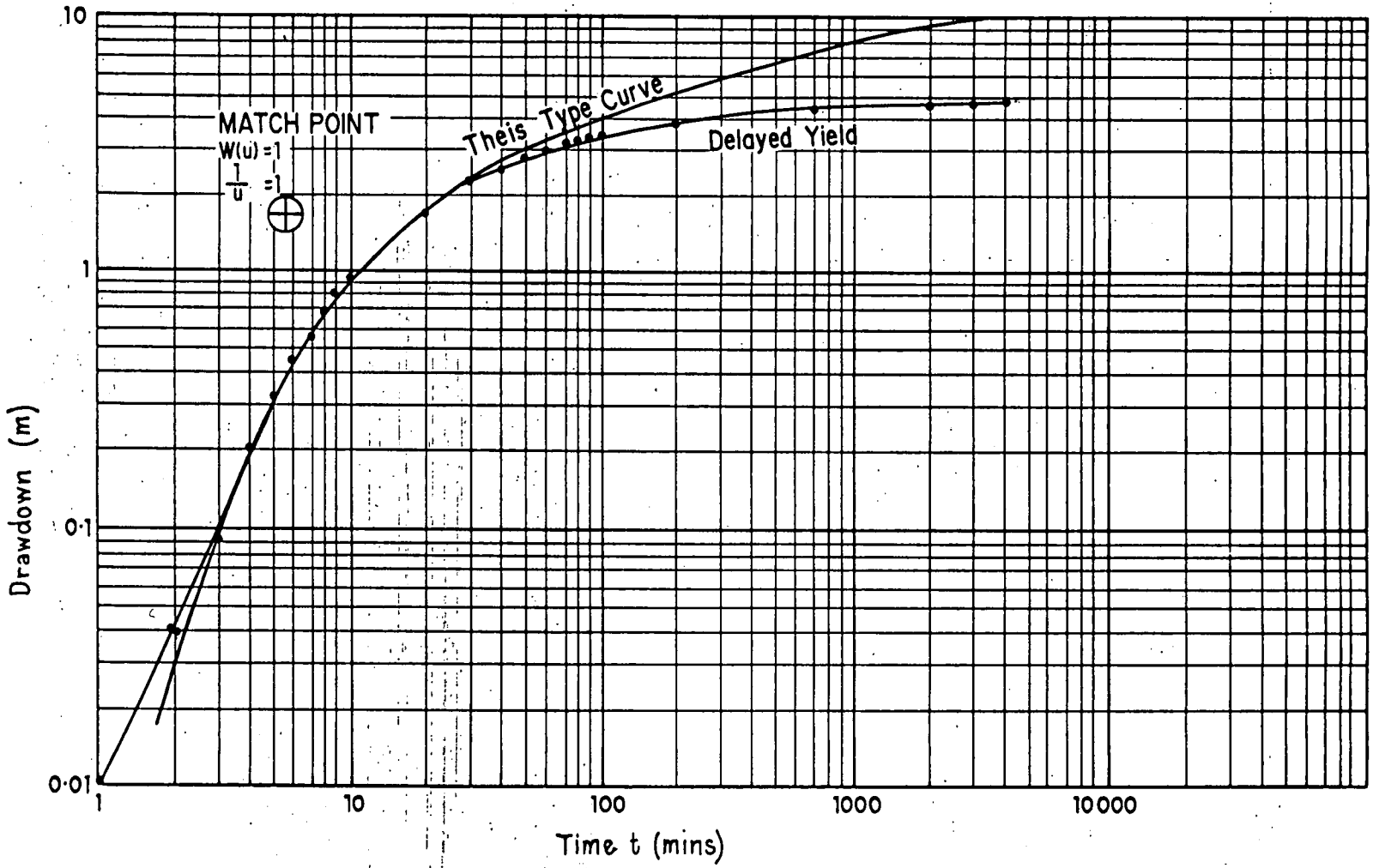
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

9020W WELL UNIT NO. 653605a0W00426

PUMP TEST 21 JAN 83

LOG–LOG PLOT



WELL No. _____

TYPE OF PUMP _____

DISCHARGE STARTED AT _____ ON _____

DISCHARGE STOPPED AT _____ ON _____

INTERVAL TESTED _____ m. to _____ m.

HOLE DEPTH _____ m.

CALCULATIONS

$Q = 778\ m^3/day$

EARLY TIME MATCH POINT $Wu = 1$ $s = 1{\cdot}75m$

$\frac{1}{u} = 1$ $t = 5{\cdot}5$ mins

$$T = \frac{Q\,W(u)}{4\pi s} = \frac{778 \times 1}{4\pi \times 1{\cdot}75} = 35\ m^3/day/m$$

$$S = \frac{4Tt}{r^2} = \frac{4 \times 35 \times 5{\cdot}5}{97 \times 97 \times 1440} = 5{\cdot}7 \times 10^{-5}$$

COMPILED	DRAWN	DATE	CHECKED
D.E. B.D.A.	G.B.	28 JUN 84	C.D.O

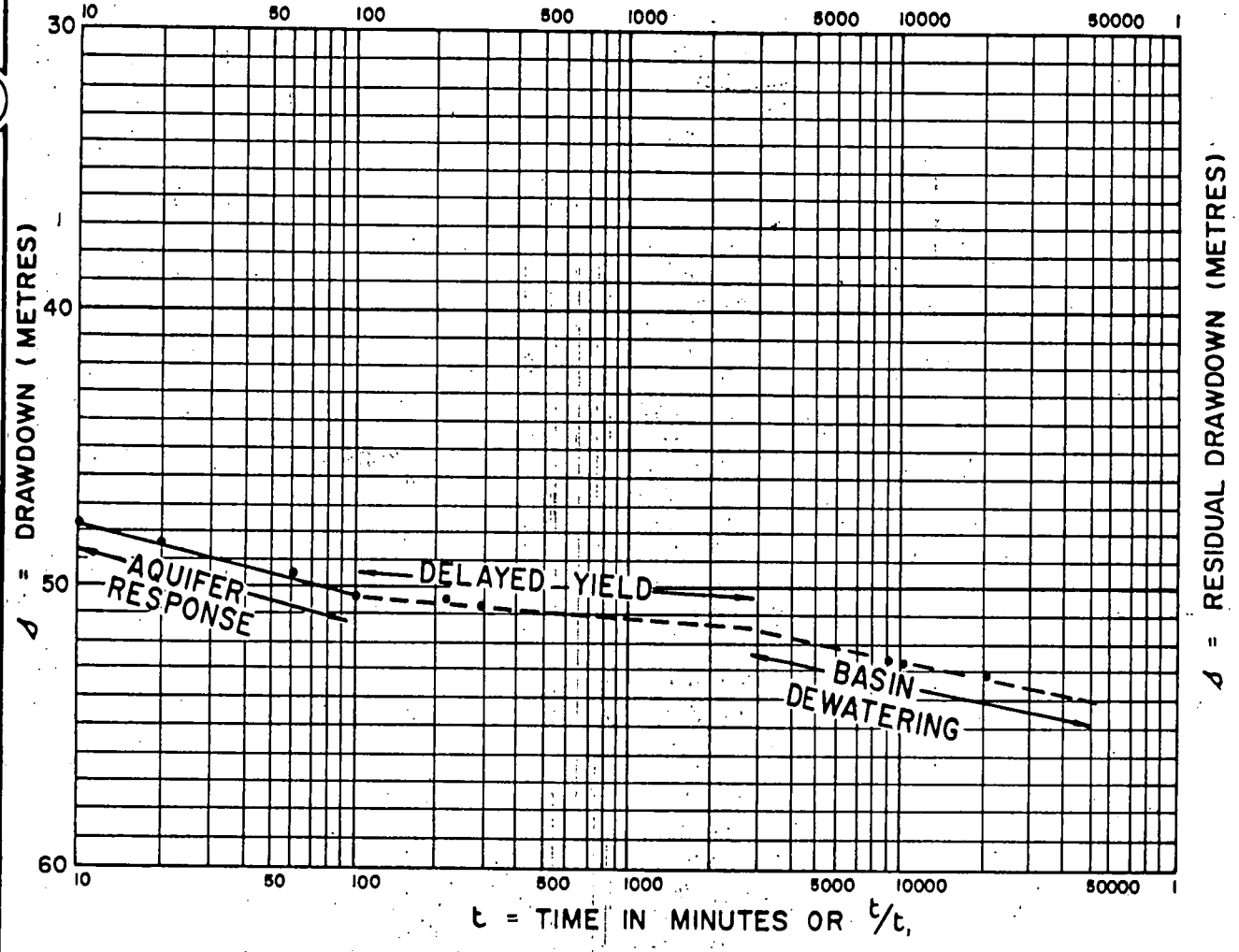
SCALE

PLAN NUMBER S17435

FIG....6

3291

MF 89



PROJECT No. 9020W

PRODUCTION/OBSERVATION WELL

INTERVAL TESTED

From _____ m. to _____ m.

HOLE DEPTH _____ m.

AQUIFER THICKNESS _____ m.

DEPTH OF PUMP INTAKE _____ m.

DEPTH OF WATER LEVEL AT TEST START _____ m.

AVAILABLE DRAWDOWN _____ m.

JACOB EQUATIONS*

$$T = \frac{0.183 \times Q}{\Delta s} \quad \text{in which}$$

T = Transmissivity (m^3/day/m.)

Q = Pumping rate (m^3/day)

Δs = Drawdown per log cycle (m.)

$$S = \frac{2.25 \times T t_o}{1440\, r^2} \quad \text{in which}$$

S = Storage coefficient

t_o = Zero drawdown time (minutes)

r = Distance to Observation Well (m.)

DATA

Q	Δs	t_o	r
778 m^3/d	2·51		

CALCULATIONS

$$T = \frac{0.183 \times 778}{2.51}$$

$$= 57\ m^3/day/m$$

* Check applicability of this method

Figure 7

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

9020W WELL UNIT NO. 653605a0W00426

PUMP TEST 12 MAY 83

SEMI-LOG PLOT

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

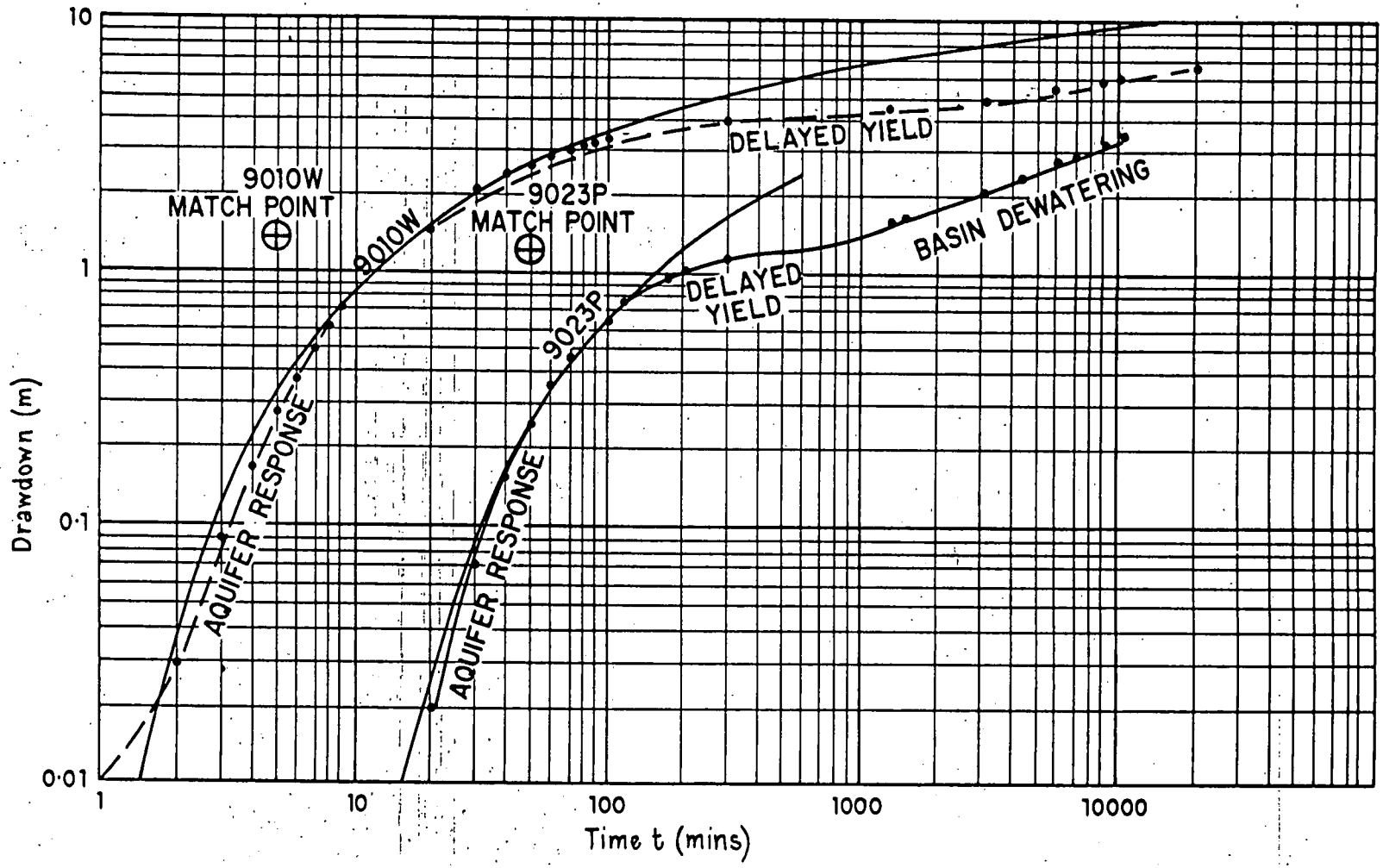
COMPILED	DRAWN	CHECKED	DATE
D.E.B D.A.	6.B.	C D O	28 JUN 84

SCALE

PLAN NUMBER S17436

3291

MF 87



WELL No. _____

TYPE OF PUMP _____

DISCHARGE STARTED AT _____ ON _____

DISCHARGE STOPPED AT _____ ON _____

INTERVAL TESTED _____ m. to _____ m.

HOLE DEPTH _____ m.

CALCULATIONS

9010W r = 97m
Early t Match Point
W(u) = 1 s = 1·5m
$\frac{1}{u} = 1$ t = 5mins

$T = \frac{778}{4\pi \times 1{\cdot}5} = 41\ m^3/day/m$

$S = \frac{4 \times 41 \times 5}{97 \times 97 \times 1440} = 6 \times 10^{-5}$

9023P r = 180m
Early t Match Point
W(u) = 1 s = 1·2m
$\frac{1}{u} = 1$ t = 52mins

$T = \frac{778}{4\pi \times 1{\cdot}2} = 52\ m^3/day/m$

$S = \frac{4 \times 52 \times 52}{180 \times 180 \times 1440} = 2{\cdot}3 \times 10^{-4}$

For all SADME Well Unit Nos see appendix 6

FIG....8

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

9020W WELL UNIT NO 6536050W00426 PUMP TEST
12 MAY 83
LOG–LOG PLOT

COMPILED	DRAWN	DATE	CHECKED
D.E.B.D.A.	G.B.	28 JUN 84	C.D.O.

SCALE

PLAN NUMBER S17437

9291

MF 89

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

9010W WELL UNIT NO 653605a0W00254 DRAWDOWN
12 MAY 83

COMPILED	DRAWN	DATE	CHECKED
D.E.B.D.A.	G.B.	28.JUN 84	C.D.O.

SCALE

PLAN NUMBER S17438

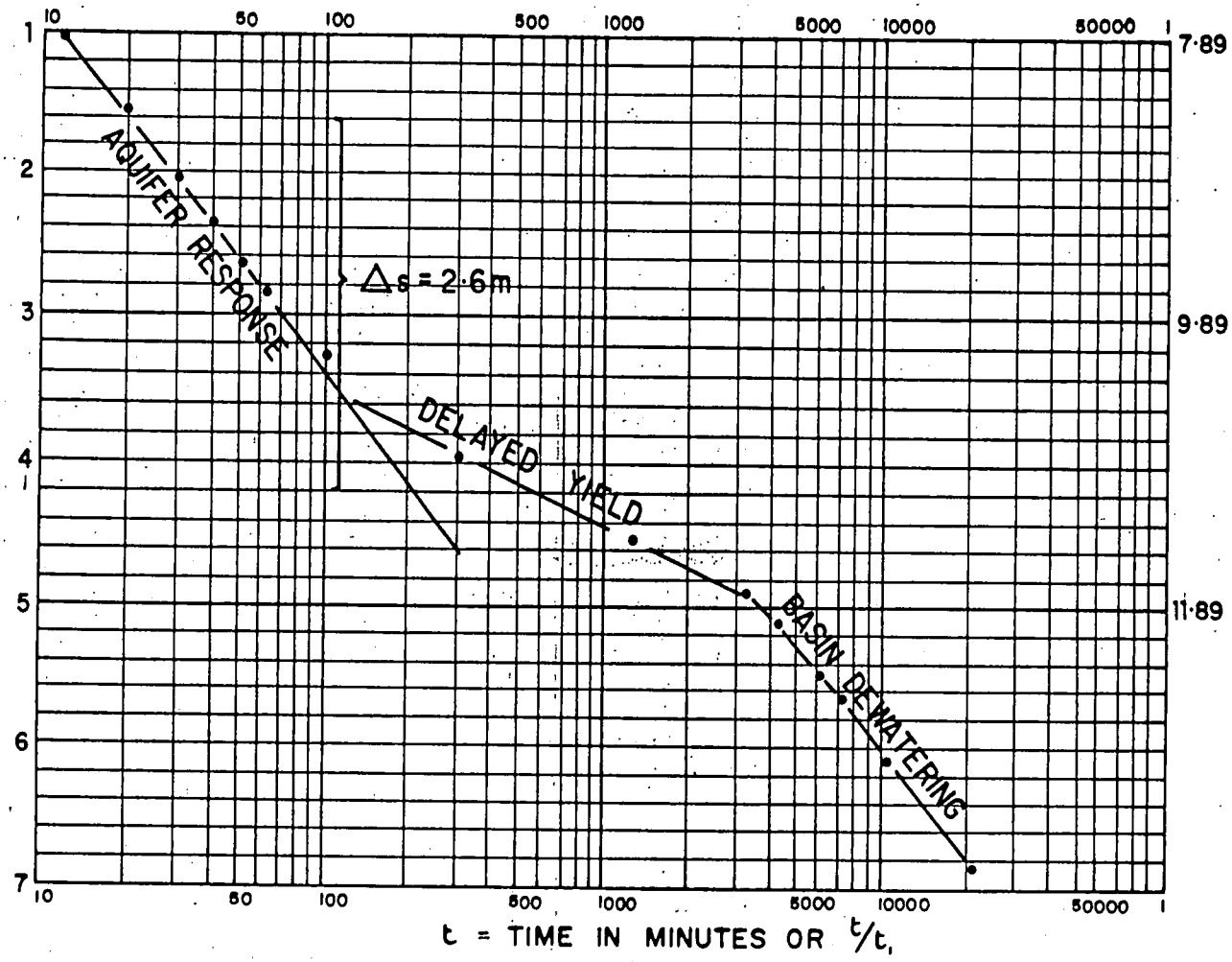


Figure 9

PROJECT No. 9010W

PRODUCTION/OBSERVATION WELL

INTERVAL TESTED

From _____ m. to _____ m.

HOLE DEPTH _____ m.

AQUIFER THICKNESS _____ m.

DEPTH OF PUMP INTAKE _____ m.

DEPTH OF WATER LEVEL

AT TEST START 6·89 m.

AVAILABLE DRAWDOWN _____ m.

JACOB EQUATIONS*

$$T = \frac{0{\cdot}183 \times Q}{\Delta\delta} \quad \text{in which}$$

T = Transmissivity (m^3/day/m.)

Q = Pumping rate (m^3/day)

$\Delta\delta$ = Drawdown per log cycle (m.)

$$S = \frac{2{\cdot}25 \times Tto}{1440\, r^2} \quad \text{in which}$$

S = Storage coefficient

to = Zero drawdown time (minutes)

r = Distance to Observation Well (m.)

DATA

Q	Δδ	to	r
778 m^3/d	2·6		

CALCULATIONS

$$T \text{ Early t} = \frac{0{\cdot}183 \times 778}{2{\cdot}6}$$

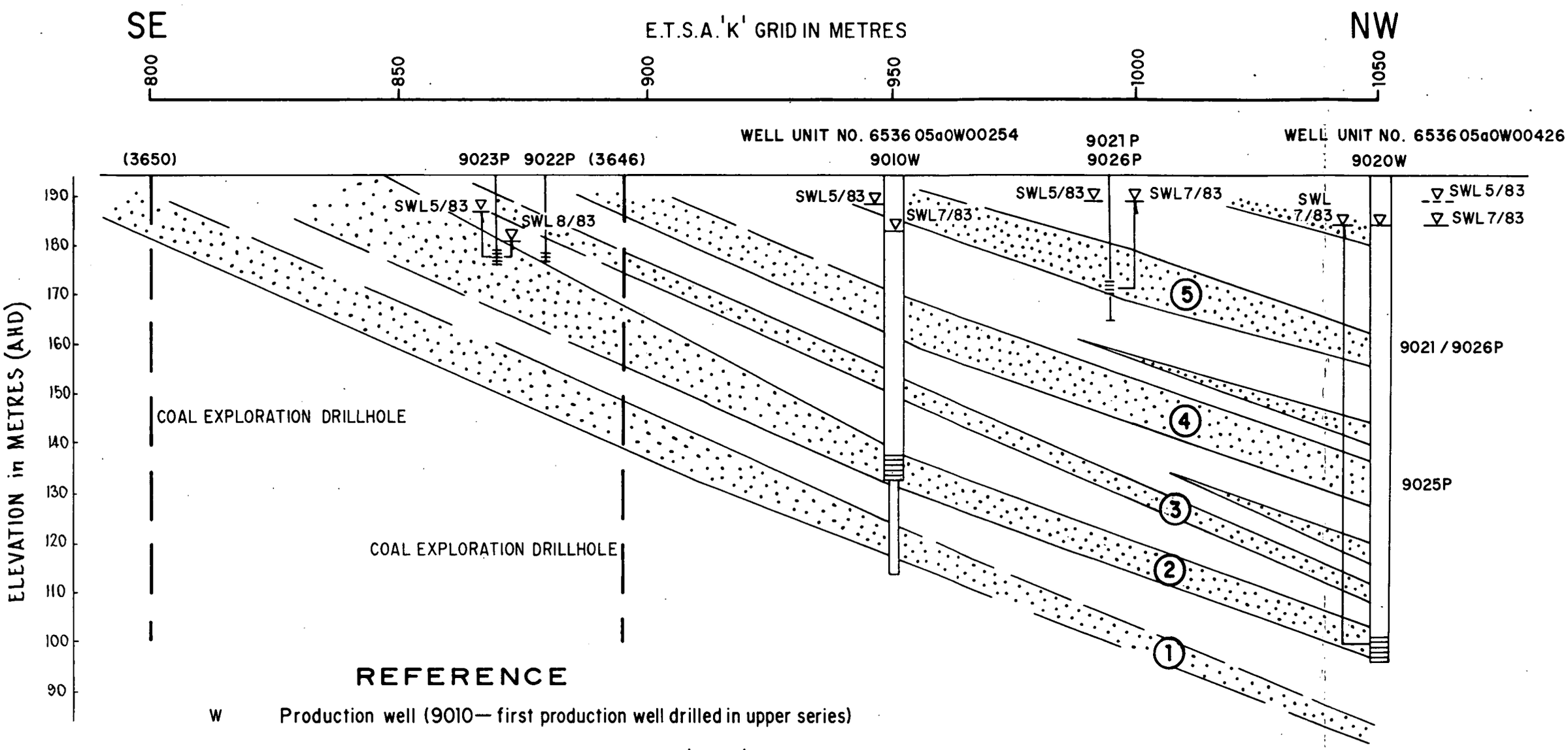
$$= 55\ m^3/d/m$$

27/7/83 SWL 11·69

12/5/83 SWL 6·89

Basin dewatered depth 4·80 m

* Check applicability of this method



REFERENCE

W	Production well (9010— first production well drilled in upper series)
9026P	Piezometer monitoring effect of 9020W on 'SAND' member 5
SWL7/83 ▽	Static Water Level at July 1983
②	2nd. 'SAND' member above highest exploitable coal seam

For all SADME Well Unit Nos see appendix 6

FIG....10

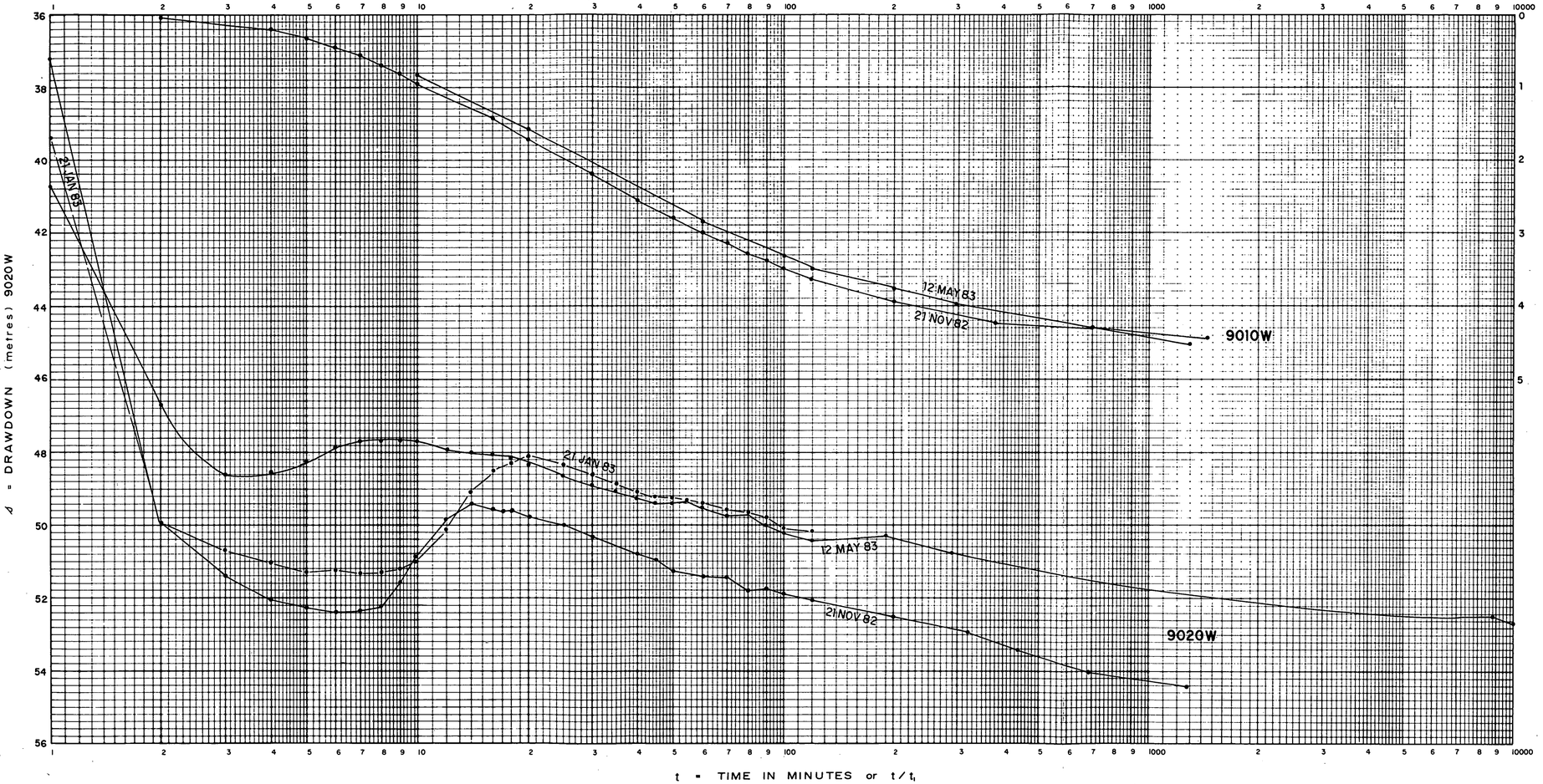
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

GENERALISED SECTION U/24 SITE

COMPILED D.E. & D.A.	C.D.O. 20/11/85 DATE
DRAWN G.B.	SCALE
DATE 29 JUN 84	PLAN NUMBER 84-275
CHECKED	

3291



WELL UNIT No. .....

REFERENCE POINT ..... m above ground

AQUIFER from ..... to ..... m

INTERVAL TESTED from ..... to ..... m

TYPE OF PUMP .....

LENGTH OF TEST .....

DEPTH PUMP INTAKE ..... m

DEPTH WATER LEVEL AT START OF TEST ..... m

AVAILABLE DRAWDOWN ..... m

EQUATIONS

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

In which

T = Transmissivity (m^3/day/m)
Q = Pumping rate (m^3/day)
$\Delta\Delta$ = Drawdown per log cycle (m)
S = Storage Coefficient
t_o = Zero drawdown time (mins.)
r = Distance to observation well (m)

1 day = $8{\cdot}64 \times 10^4$ secs

DATA

Q $\Delta\Delta$ t_o r

CALCULATIONS

For all SADME Well Unit Nos see appendix 6

Figure 11

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

9020W WELL UNIT NO. 653605a0W00426 EARLY TIME RESPONSE

COMPILED D.E. & D.A.	C.D.O. DATE
DRAWN G.B.	SCALE ——
DATE 11 JUL 84	PLAN NUMBER 84-276
CHECKED	

3291

MF 89

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

9020W WELL UNIT NO. 6536050W00426

DISTANCE VERSUS DRAWDOWN TEST 24 JUL 83

COMPILED	DRAWN	DATE	CHECKED	DATE
D.E.&D.A.	G.B.	29 JUN 84	C.D.O.	

SCALE

PLAN NUMBER S17439

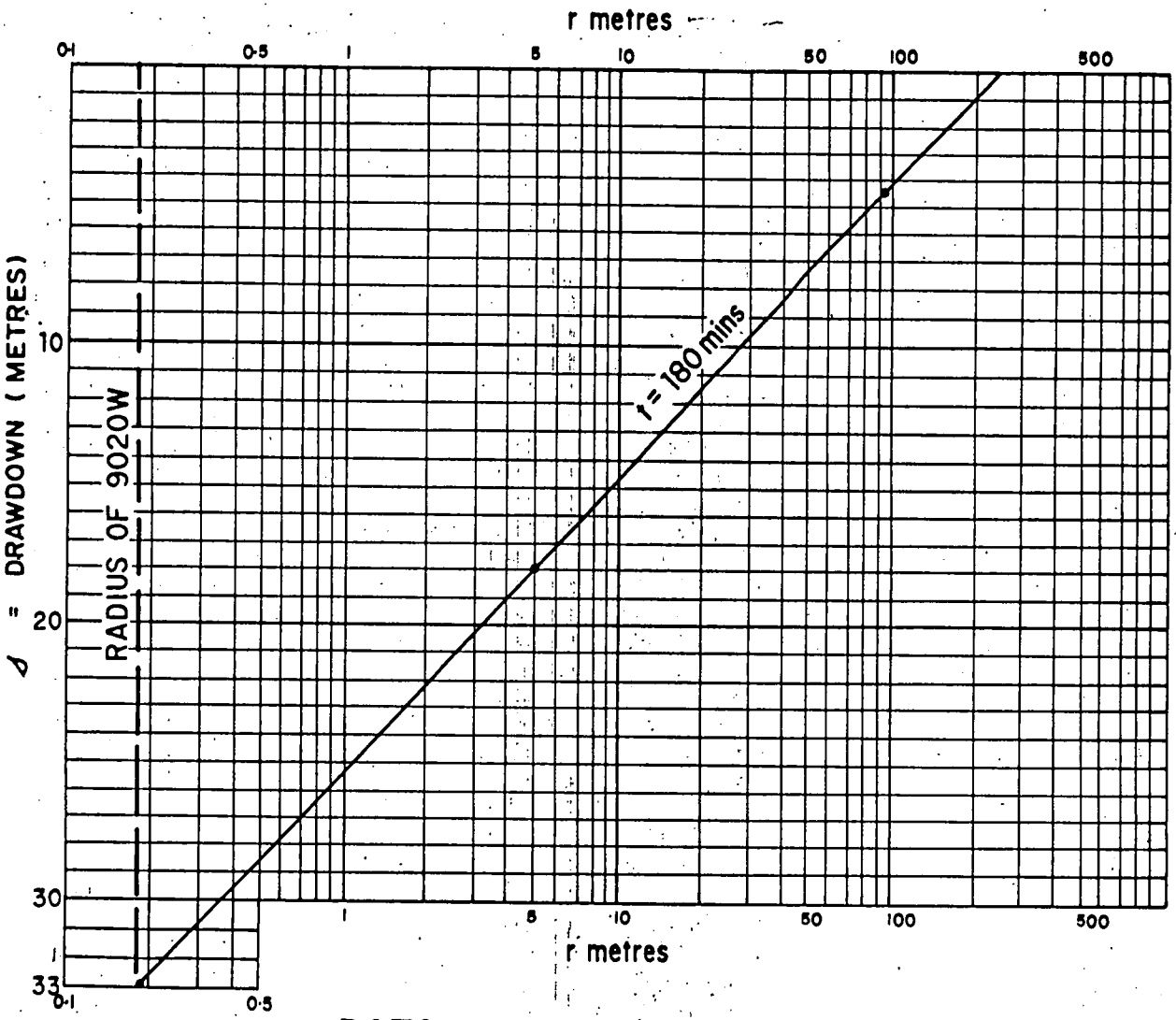


Figure 12

DATA

Q Δs to r

CALCULATIONS

PROJECT No. 9020W

PRODUCTION/OBSERVATION WELL

INTERVAL TESTED

From ____ m. to ____ m.

HOLE DEPTH ____ m.

AQUIFER THICKNESS ____ m.

DEPTH OF PUMP INTAKE ____ m.

DEPTH OF WATER LEVEL AT TEST START ____ m.

AVAILABLE DRAWDOWN ____ m.

JACOB EQUATIONS*

$$T = \frac{0.366 \times Q}{\Delta s}$$ in which

T = Transmissivity (m^3/day/m.)

Q = Pumping rate (m^3/day)

Δs = Drawdown per log cycle (m.)

$$S = \frac{2.25 \times Tto}{1440\, r^2}$$ in which

S = Storage coefficient

to = Zero drawdown time (minutes)

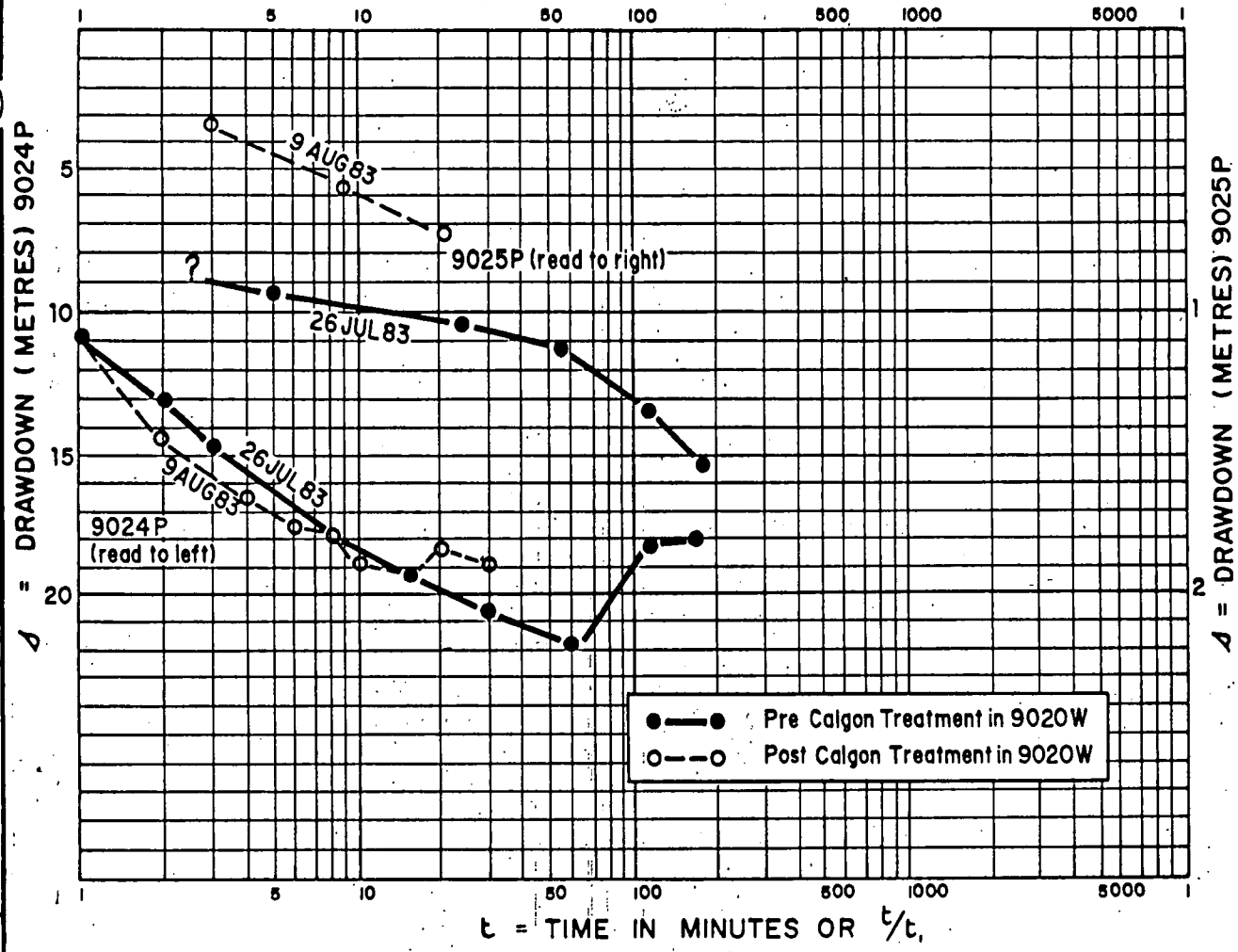
r = Distance to Observation Well (m.)

For all SADME Well Unit No's see appendix 6

* Check applicability of this method

3291

MF 89



PROJECT No. 9024P & 9025P

PRODUCTION/OBSERVATION WELL

INTERVAL TESTED

From _____ m. to _____ m.

HOLE DEPTH _____ m.

AQUIFER THICKNESS _____ m.

DEPTH OF PUMP INTAKE _____ m.

DEPTH OF WATER LEVEL

AT TEST START _____ m.

AVAILABLE DRAWDOWN _____ m.

JACOB EQUATIONS*

$$T = \frac{0.183 \times Q}{\Delta s} \quad \text{in which}$$

T = Transmissivity (m^3/day/m.)

Q = Pumping rate (m^3/day)

Δs = Drawdown per log cycle (m.)

$$S = \frac{2.25 \times T t_o}{1440\, r^2} \quad \text{in which}$$

S = Storage coefficient

t_o = Zero drawdown time (minutes)

r = Distance to Observation Well (m.)

DATA

Q Δs t_o r

CALCULATIONS

Figure 13

For all SADME Well Unit No's see appendix 6

* Check applicability of this method

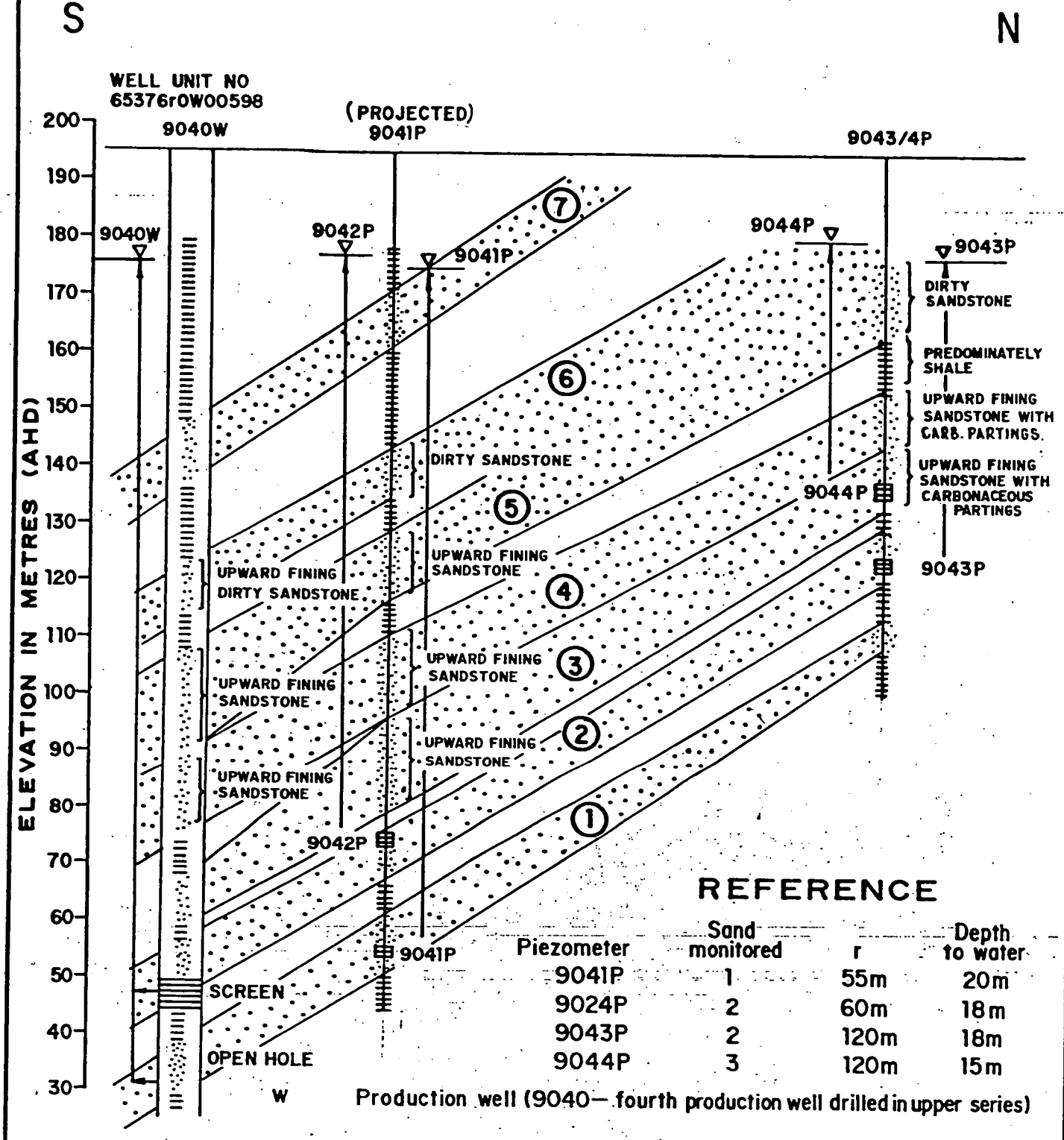
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

9024P & 9025P WELL UNIT NO. 653605a OW00319 & 320

RESPONSE 26 JUL 83 & 9 AUG 83

COMPILED	DRAWN	DATE	CHECKED	SCALE	PLAN NUMBER
D.E.B D.A.	G.B.	29 JUN 84	C.D.O 24/10/85 DATE		S17440



REFERENCE

Piezometer	Sand monitored	r	Depth to water
9041P	1	55m	20m
9024P	2	60m	18m
9043P	2	120m	18m
9044P	3	120m	15m

W — Production well (9040— fourth production well drilled in upper series)

9044P — Piezometer monitoring effect of 9040W on 'SAND' member 3

(2) — 2nd 'SAND' member

For all SADME Well Unit No's see appendix 6

SCALE

METRES 20 0 20 40 METRES

FIG....14

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

GENERALISED SECTION U/25 SITE

COMPILED D.E.& D.A.	CDO 7/11/85 DATE
DRAWN G.B.	SCALE 1:1000
DATE 2 JUL 84	PLAN NUMBER S17441
CHECKED	

3791

MF 89

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

OBSERVATION WELLS 9041P, 9042P

AIRLIFTING 9040W WELL UNIT NO.653746r0W00598

COMPILED D.E.B.D.A.	DRAWN G.B.	DATE 3 JUL 84 CHECKED
C.D.O. DATE	SCALE	PLAN NUMBER S17442

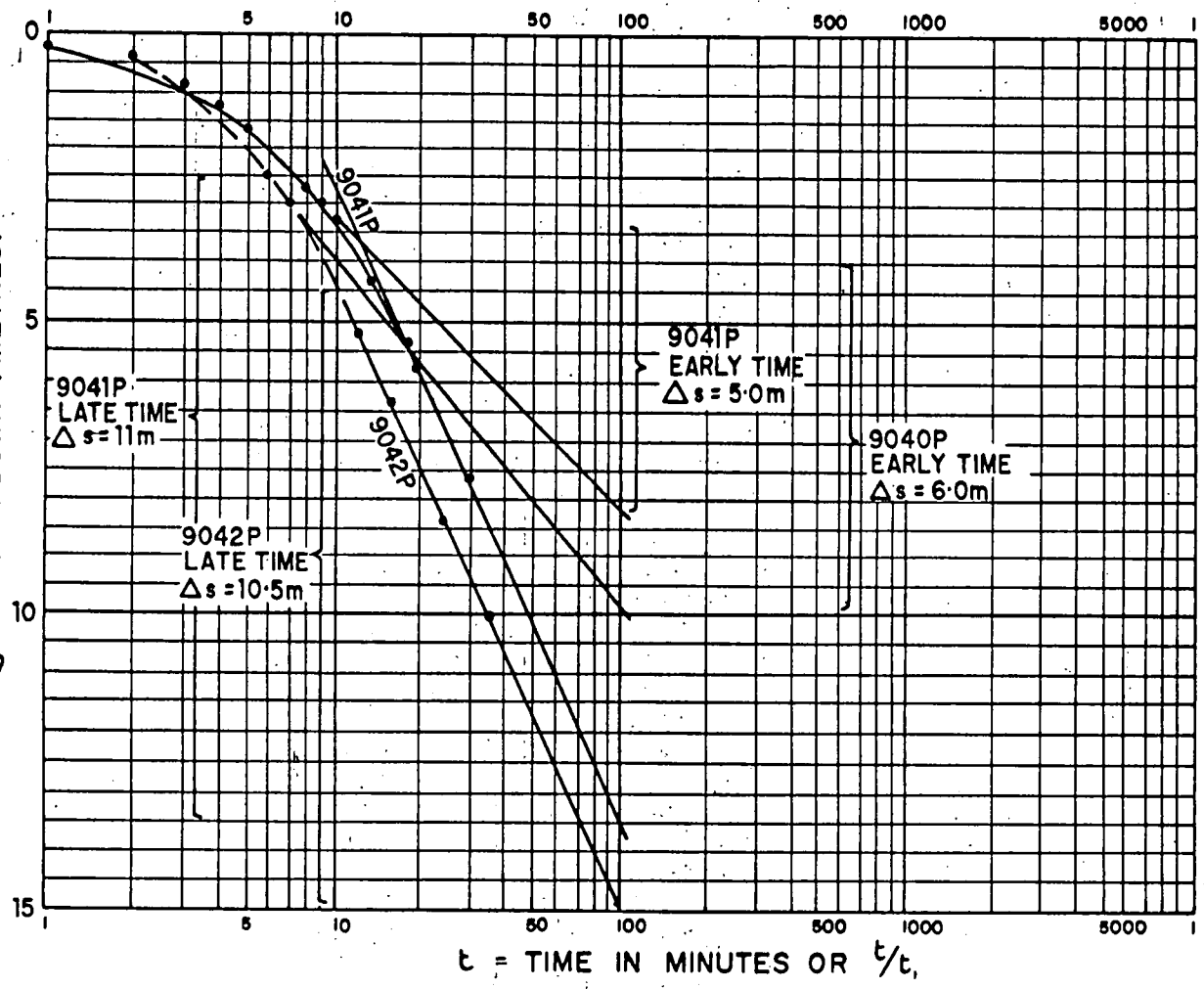


Figure 15

PROJECT No. 9040W

PRODUCTION/OBSERVATION WELL

INTERVAL TESTED

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

HOLE DEPTH.....m.

AQUIFER THICKNESS.....m.

DEPTH OF PUMP INTAKE.....m.

DEPTH OF WATER LEVEL AT TEST START.....m.

AVAILABLE DRAWDOWN.....m.

JACOB EQUATIONS*

$$T = \frac{0.183 \times Q}{\Delta s}$$ in which

T = Transmissivity (m^3/day/m.)

Q = Pumping rate (m^3/day)

Δs = Drawdown per log cycle (m.)

$$S = \frac{2.25 \times T t_o}{1440\, r^2}$$ in which

S = Storage coefficient

t_o = Zero drawdown time (minutes)

r = Distance to Observation Well (m.)

DATA

	Q	Δs	to	r
9043P	1728 m^3/d	5m		
9044P	1728 m^3/d	6m		
9040W	3456 m^3/d			

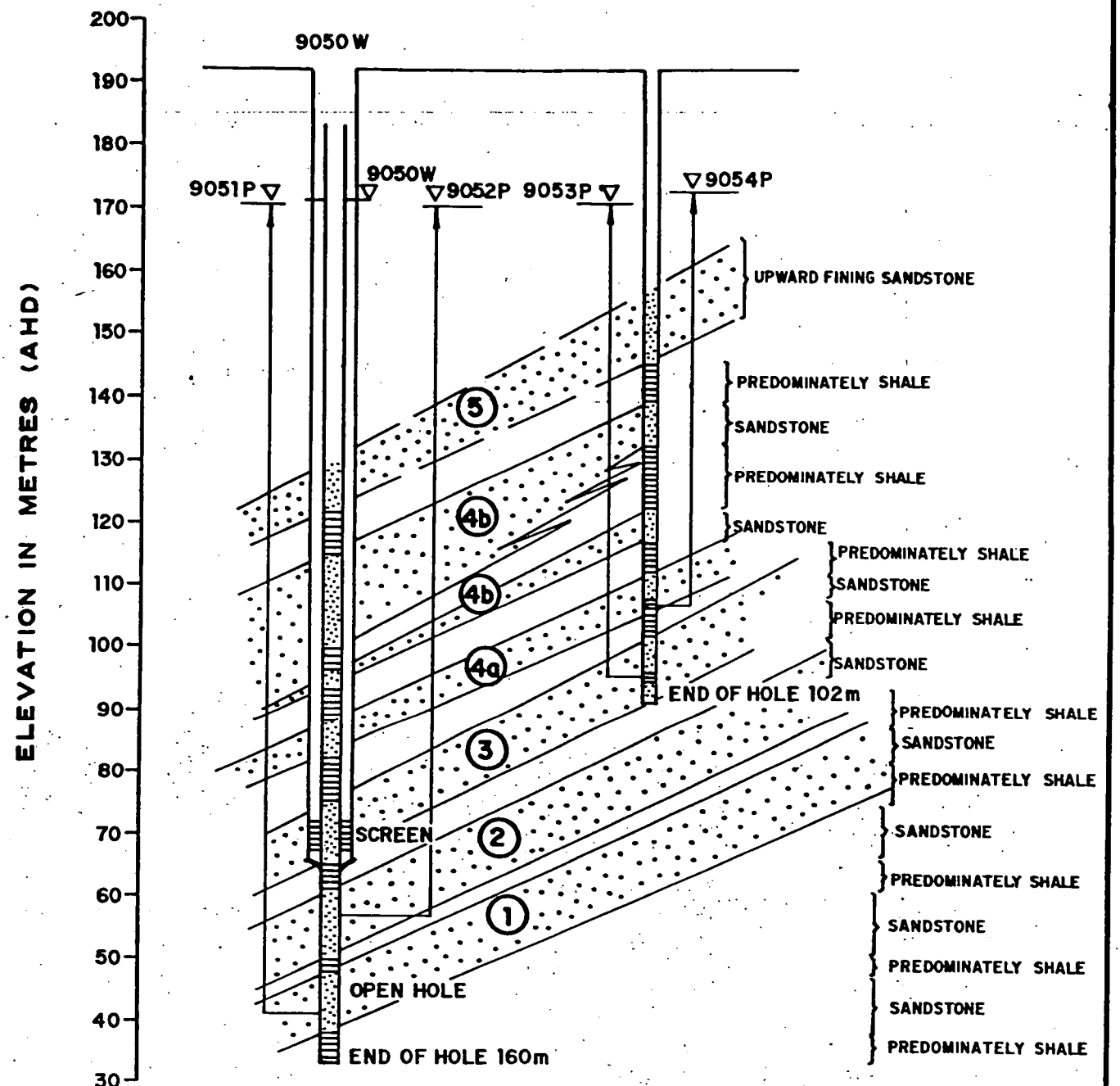
CALCULATIONS

SAND1 9041P	$T = \frac{0.183 \times 1728}{5}$	=	63 m^3/day/m * BOUNDARY AT 10 MINS.
SAND1 LATE TIME	$T = \frac{0.183 \times 1728}{11}$	=	29 m^3/day/m
SAND2 9042P	$T = \frac{0.183 \times 1728}{6}$	=	53 m^3/day/m * BOUNDARY AT 8 MINS
SAND2 LATE TIME	$T = \frac{0.183 \times 1728}{10.5}$	=	30 m^3/day/m

For all SADME Well Unit Nos see appendix 6

* Assumes Q 9040W = 40L/sec and each sand provides half of discharge.

* Check applicability of this method



REFERENCE

W	Production well (9050—fifth production well drilled in upper series.)
9051P	Piezometer monitoring effect of 9050W on 'SAND' member 1
②	2nd 'SAND' member

For all SADME Well Unit No's see appendix 6

FIG....16

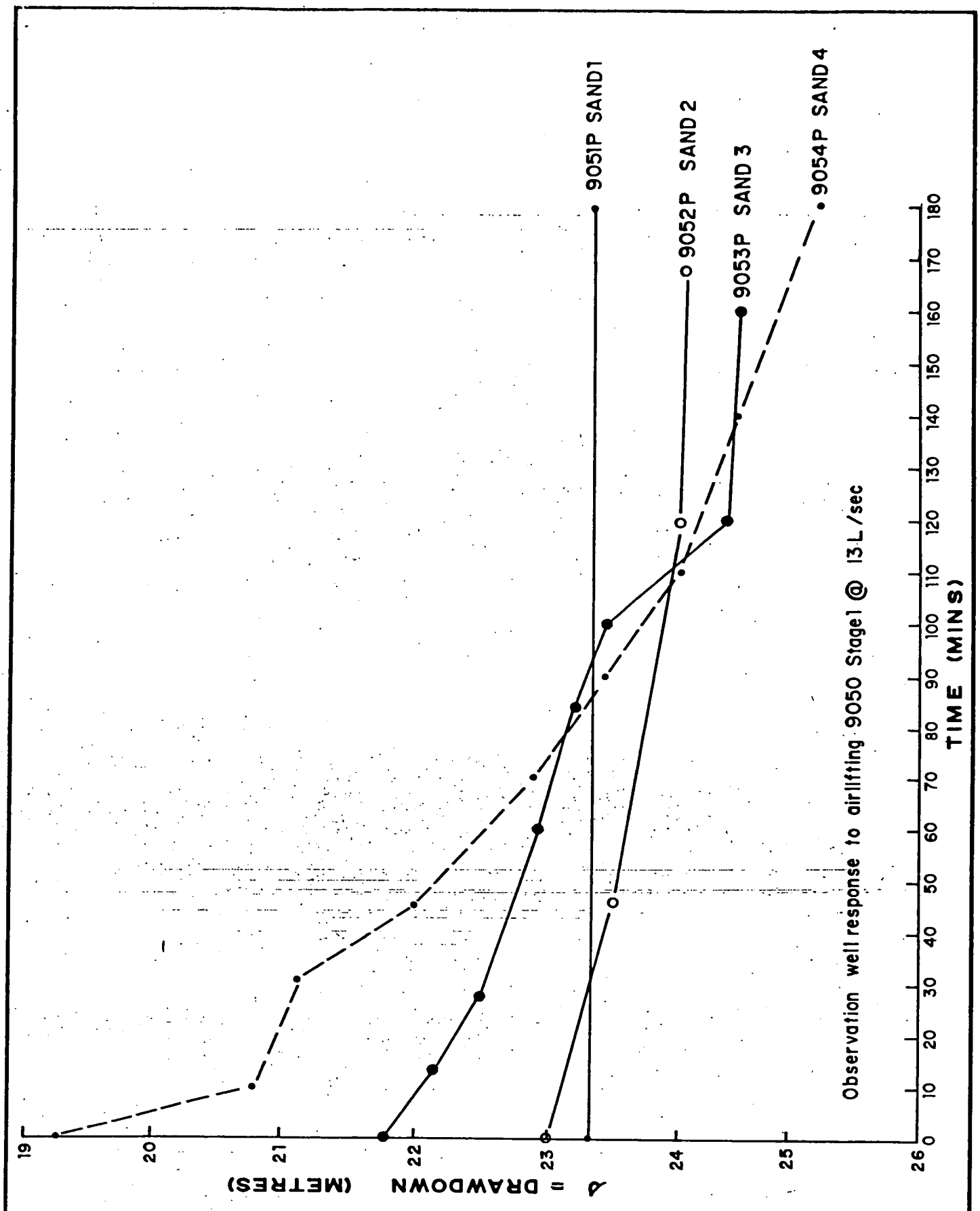
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

GENERALISED SECTION U/27 SITE

COMPILED D.E.B D.A.	W for C D O — 7/6/84 DATE
DRAWN G.B.	SCALE
DATE 5 JUL 84	PLAN NUMBER S17443
CHECKED	

529



For all SADME Well Unit No's see appendix 6

FIG....17

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

9050W WELL UNIT NO. 653747n0W00532
STAGE 1 AIRLIFT
LINEAR SCALE PLOT

COMPILED D.E. & D.A.	CDO DATE
DRAWN G.B.	SCALE
DATE 4 JUL 84	PLAN NUMBER S17444
CHECKED	

3291

3291

MF 89

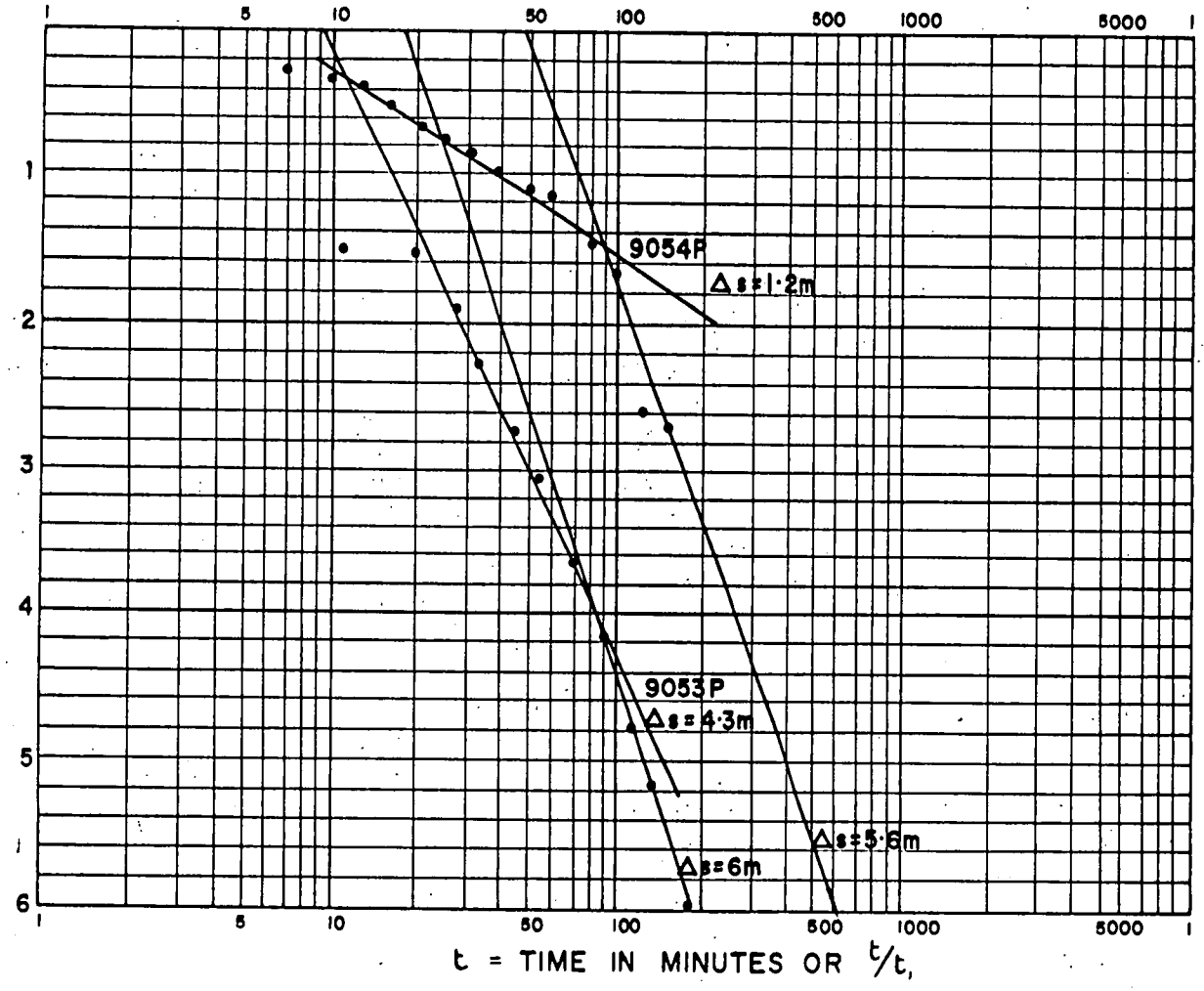


Figure 18

s = RESIDUAL DRAWDOWN (METRES)

PROJECT No. 9050W

PRODUCTION/OBSERVATION WELL

INTERVAL TESTED

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

HOLE DEPTH.....m.

AQUIFER THICKNESS.....m.

DEPTH OF PUMP INTAKE.....m.

DEPTH OF WATER LEVEL AT TEST START.....m.

AVAILABLE DRAWDOWN.....m.

JACOB EQUATIONS*

$$T = \frac{0.183 \times Q}{\Delta s}$$ in which

T = Transmissivity (m^3/day/m.)

Q = Pumping rate (m^3/day)

Δs = Drawdown per log cycle (m.)

$$S = \frac{2.25 \times Tto}{1440\ r^2}$$ in which

S = Storage coefficient

to = Zero drawdown time (minutes)

r = Distance to Observation Well (m.)

DATA

Q	Δs	to	r
13L/sec	after 100 mins.		

CALCULATIONS

FOR t > 100 mins.

ASSUME: 6·4L/sec for SAND 3 (Δs = 6m)

5L/sec for SAND 4 (Δs = 5·6m)

1·6L/sec derived from SAND 2 via leakage through 3239

T SAND 3 = $\frac{0.183 \times 550}{6}$ = 17 m^3/d/m

T SAND 4 = $\frac{0.183 \times 432}{5.6}$ = 14 m^3/d/m

For all SADME Well Unit No's see appendix 6

* Check applicability of this method

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

9050W WELL UNIT NO. 6537nOW00532

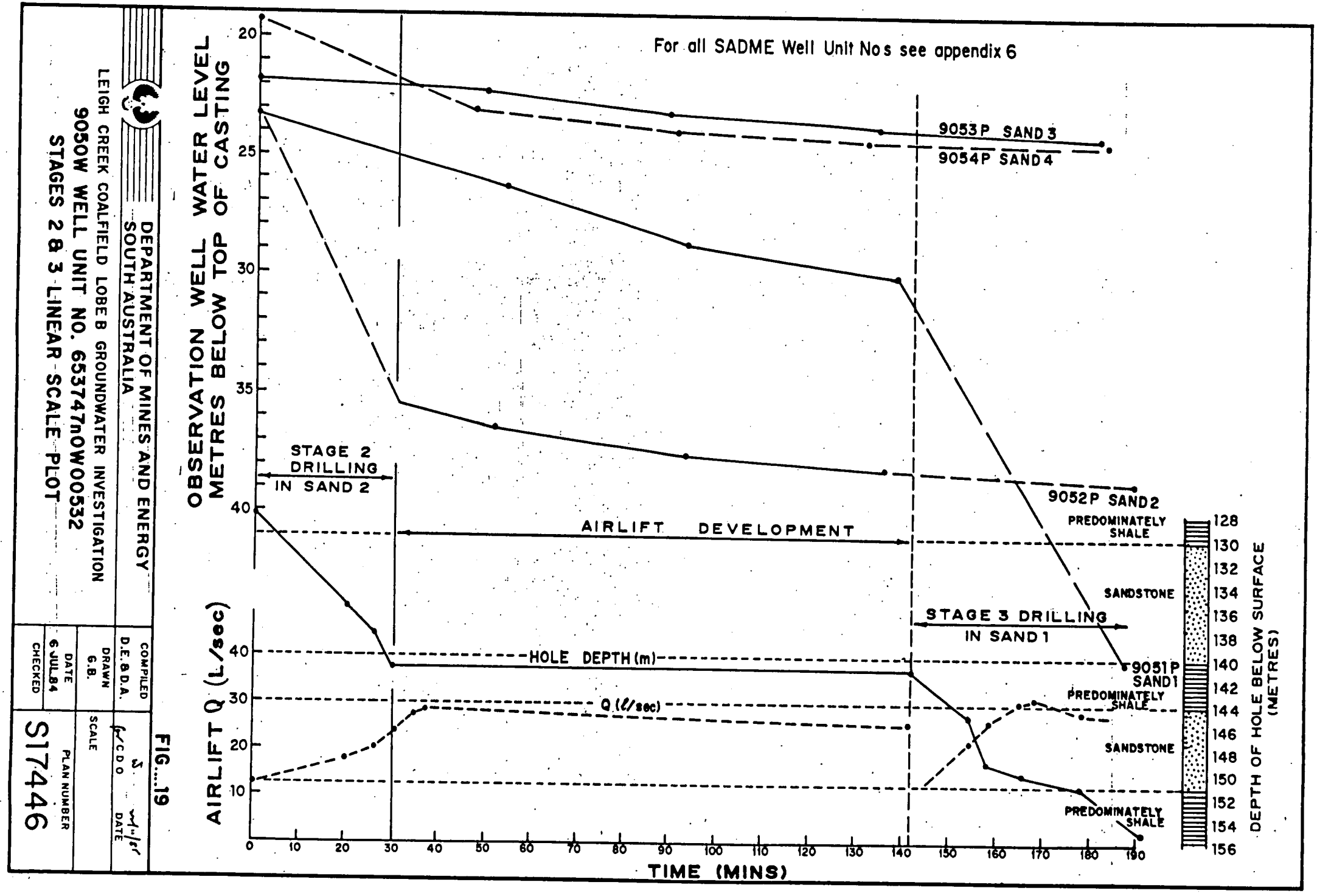
STAGE 1 AIRLIFT

SEMI—LOG PLOT

COMPILED	DRAWN	CHECKED	DATE
D.E. & D.A.	G.B.		4 JUL 84

SCALE

PLAN NUMBER S17445



DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

9050W WELL UNIT NO. 653747n0W00532

STAGES 2 & 3 LINEAR SCALE PLOT

COMPILED D.E.B.D.A.		
DRAWN G.B.	DATE 6 JUL 84	CHECKED
SCALE	PLAN NUMBER S17446	

C.D.D. DATE

FIG...19

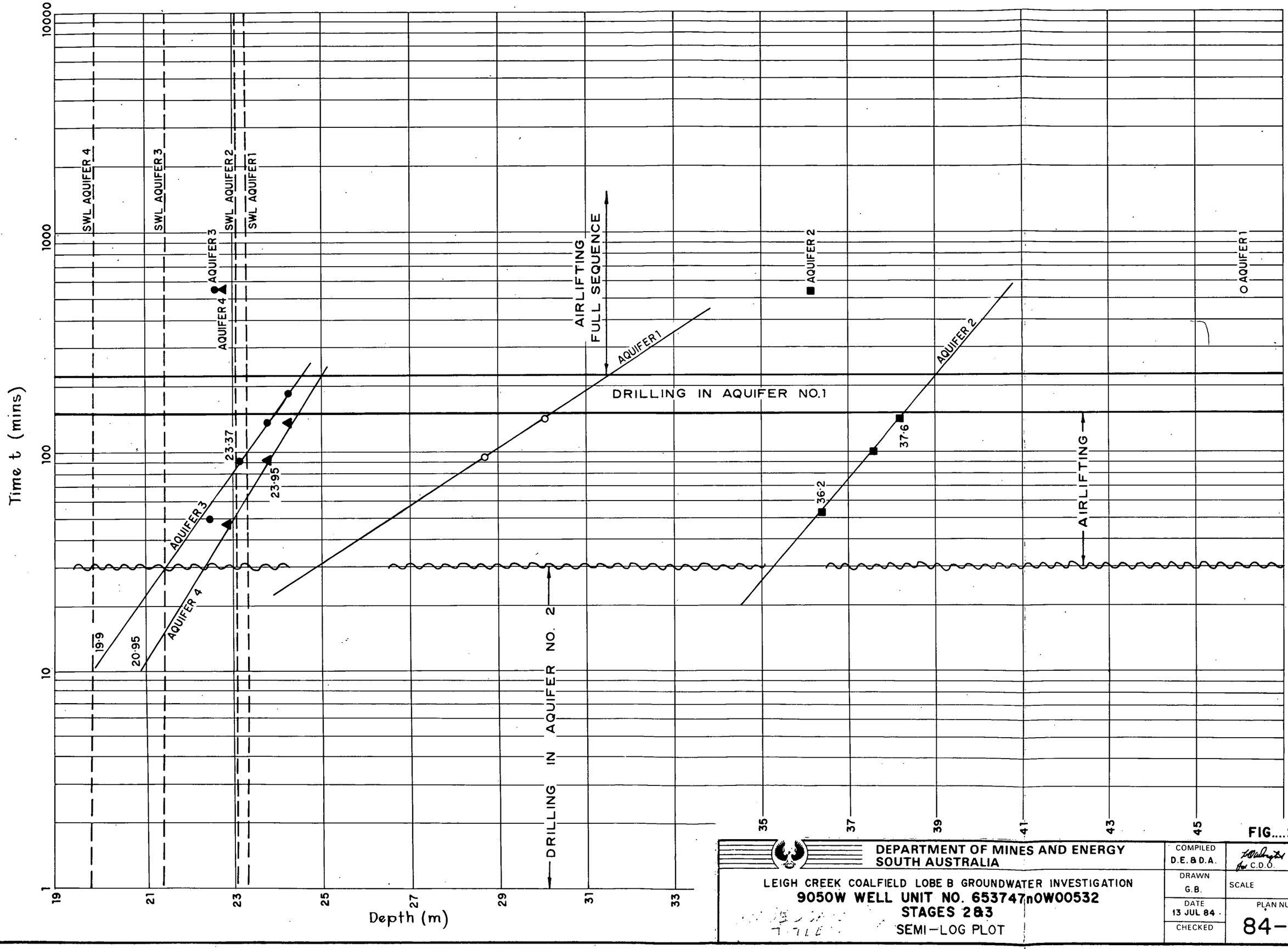


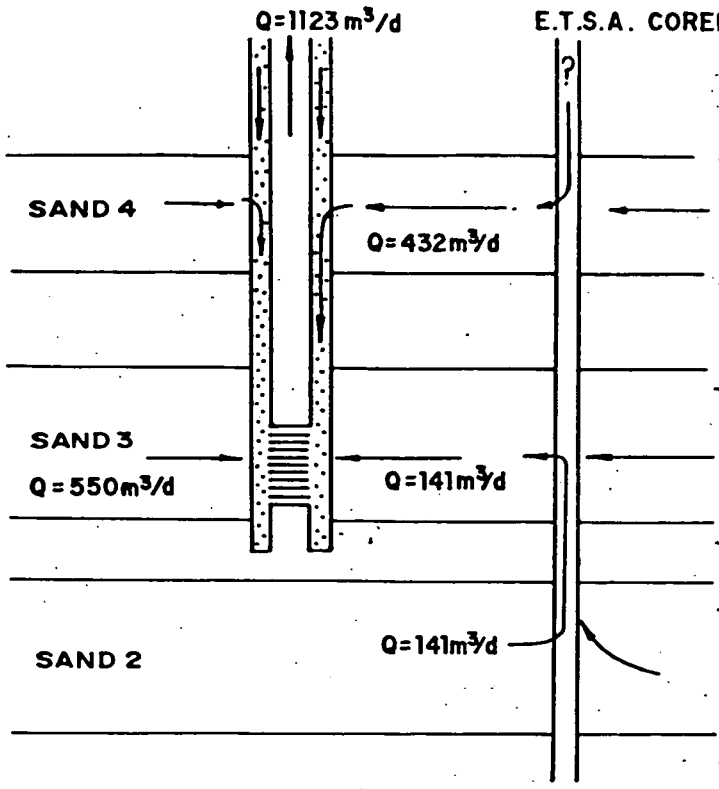
FIG....20

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

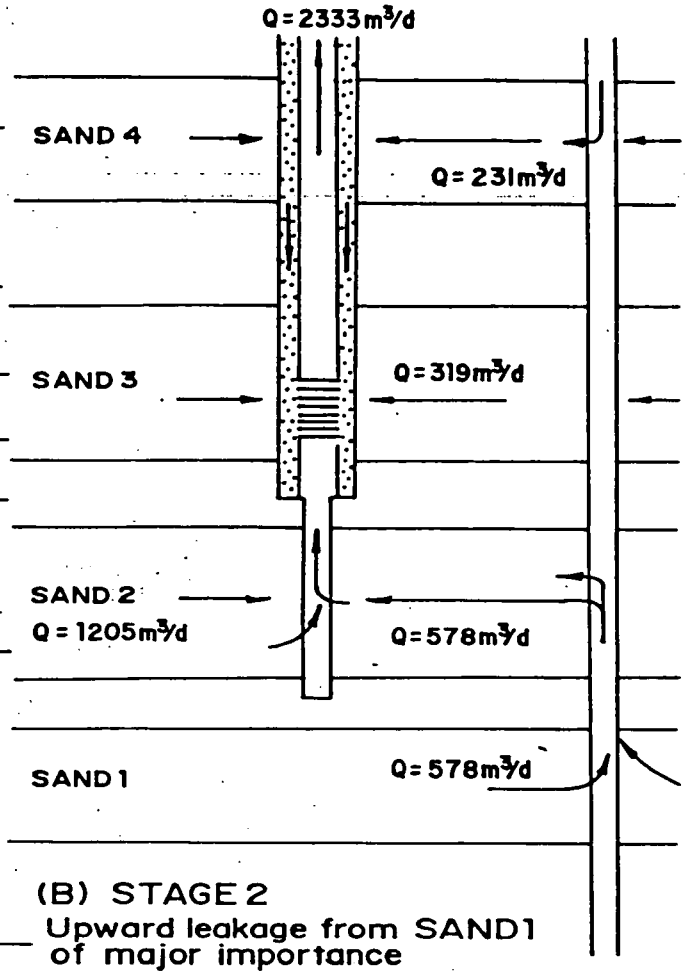
LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION
9050W WELL UNIT NO. 653747n0W00532
STAGES 2&3
SEMI-LOG PLOT

COMPILED D.E. & D.A.	C.D.O. 7/11/85 DATE
DRAWN G.B.	SCALE
DATE 13 JUL 84	PLAN NUMBER 84-277
CHECKED	

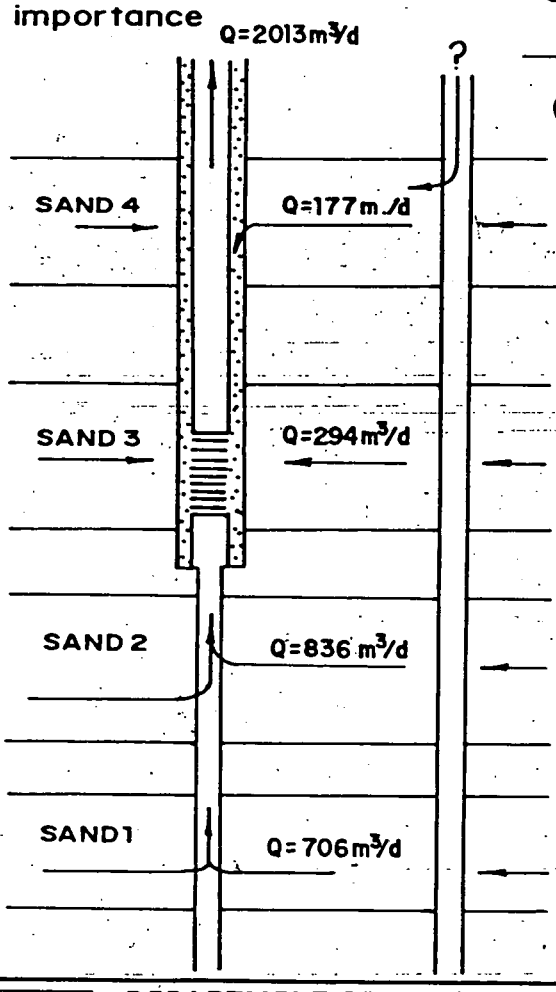
3291



(A) STAGE 1
Upward leakage from SAND 2 of minor importance



(B) STAGE 2
Upward leakage from SAND1 of major importance



(C) STAGE 3 AND PRODUCTION MODE
Radial flow dominant

FIG.... 21

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED D.E.& D.A.	W CDO DATE
LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION	DRAWN G.B.	SCALE
9050W WELL UNIT NO. 653747nOW00532	DATE 11 JUL 84	PLAN NUMBER
BEHAVIOUR DURING CONSTRUCTION	CHECKED	S17447

3291

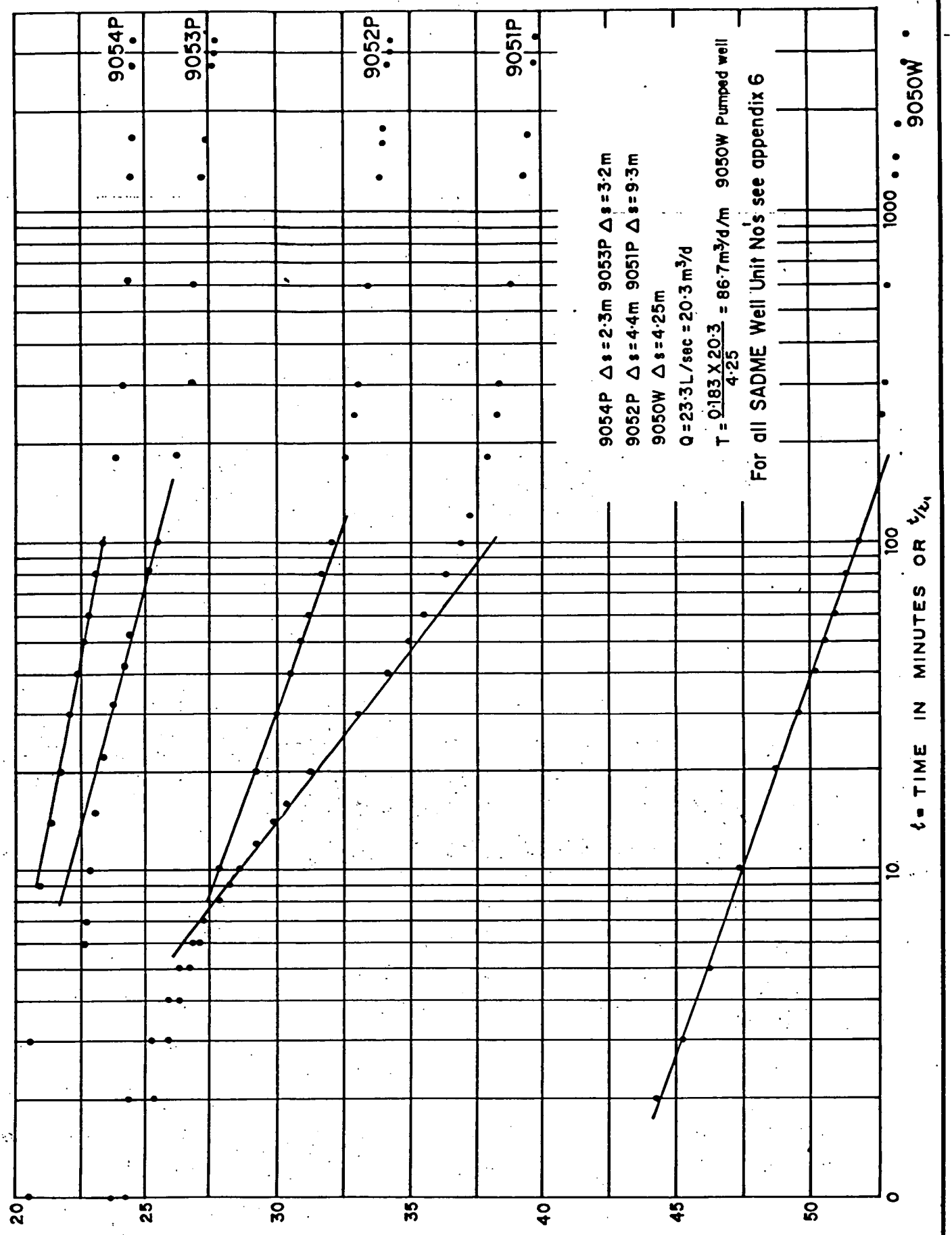


FIG....22

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

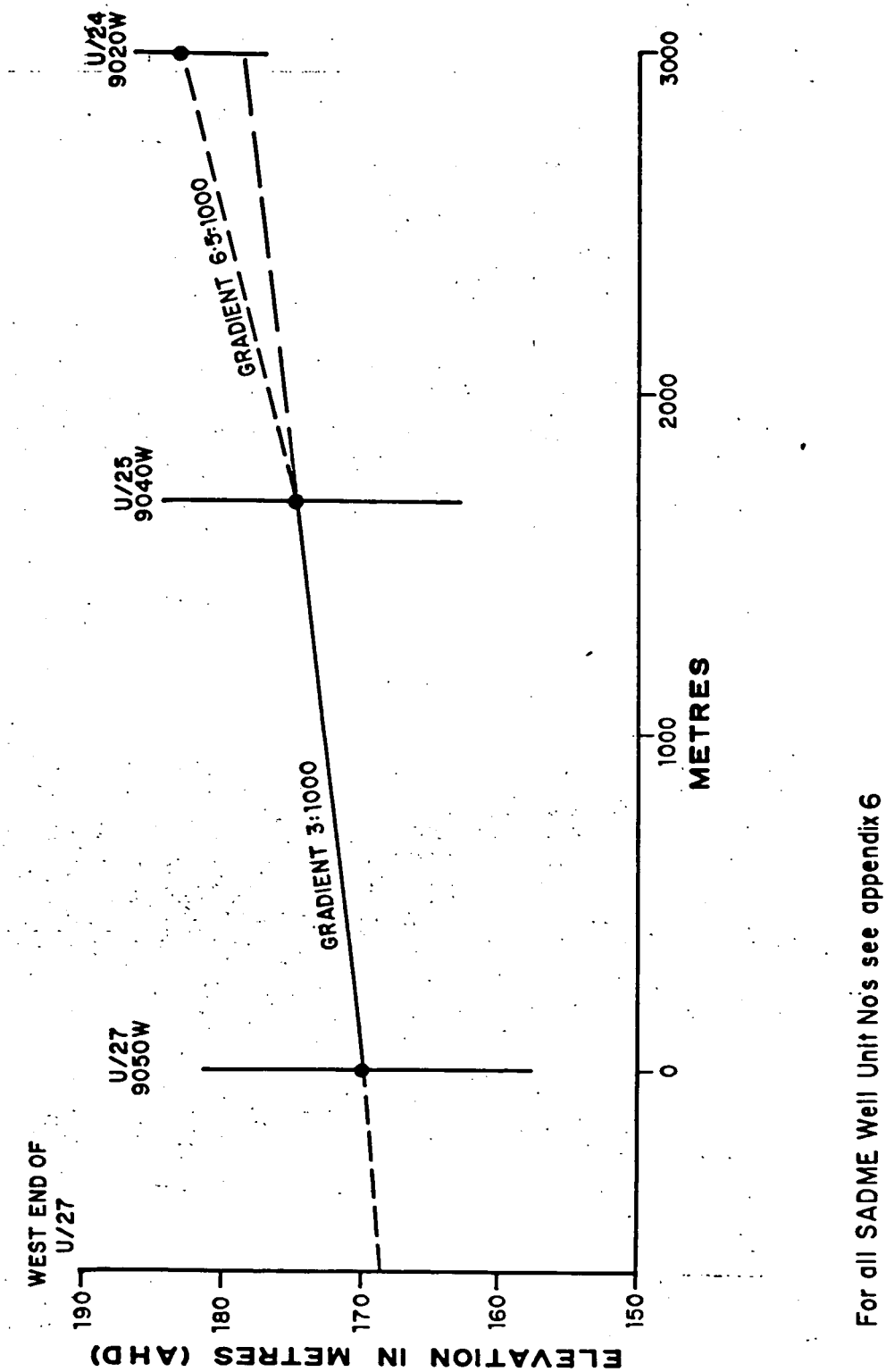
LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

9050W WELL UNIT NO. 653747n0W00532

PUMP TEST 29AUG83

COMPILED D.E. & D.A.	CDO DATE
DRAWN G.B.	SCALE
DATE 13 JUL 84	PLAN NUMBER S17448
CHECKED	

3291

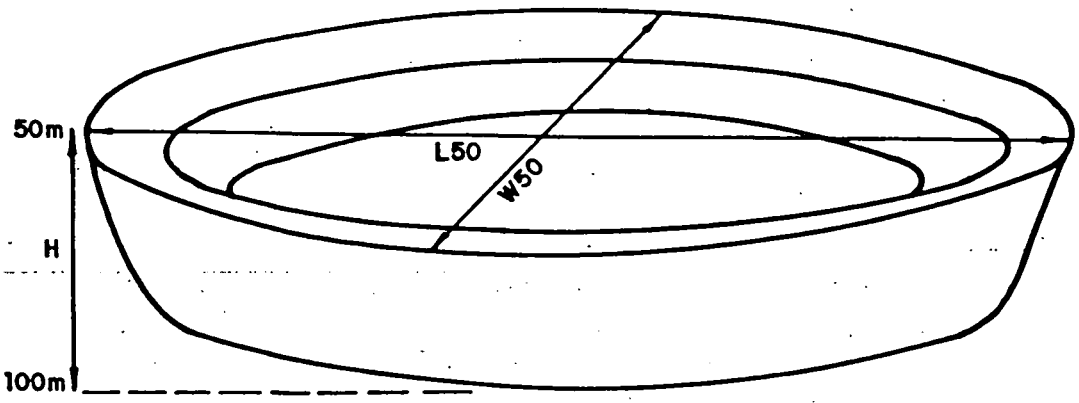


For all SADME Well Unit No's see appendix 6

FIG....23

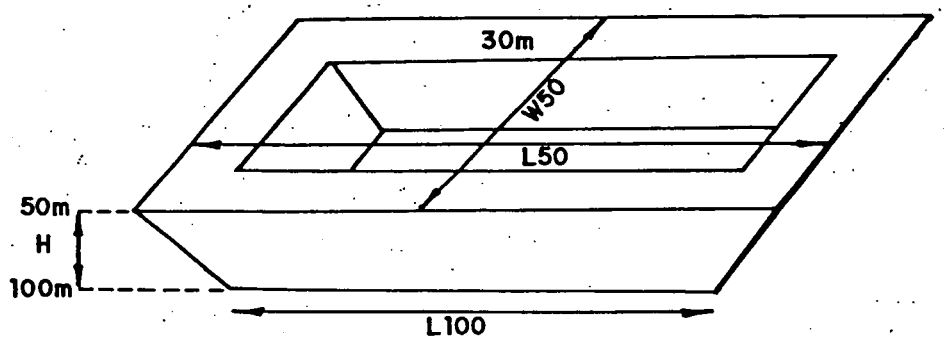
DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA		COMPILED D.E & D.A.	J. C D O — 4-1-84 DATE
LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION		DRAWN G.B.	SCALE
POTENTIOMETRIC GRADIENT		DATE 4 JUL 84	PLAN NUMBER S17449
		CHECKED	

3291



Volume of water contained = Volume sand X 0·2 = $2H\left(\frac{L50+L100}{2} + \frac{W50+W100}{2}\right)$ X0·2 X Sand thickness

SIMPLE GEOMETRIC APPROXIMATION OF BASIN



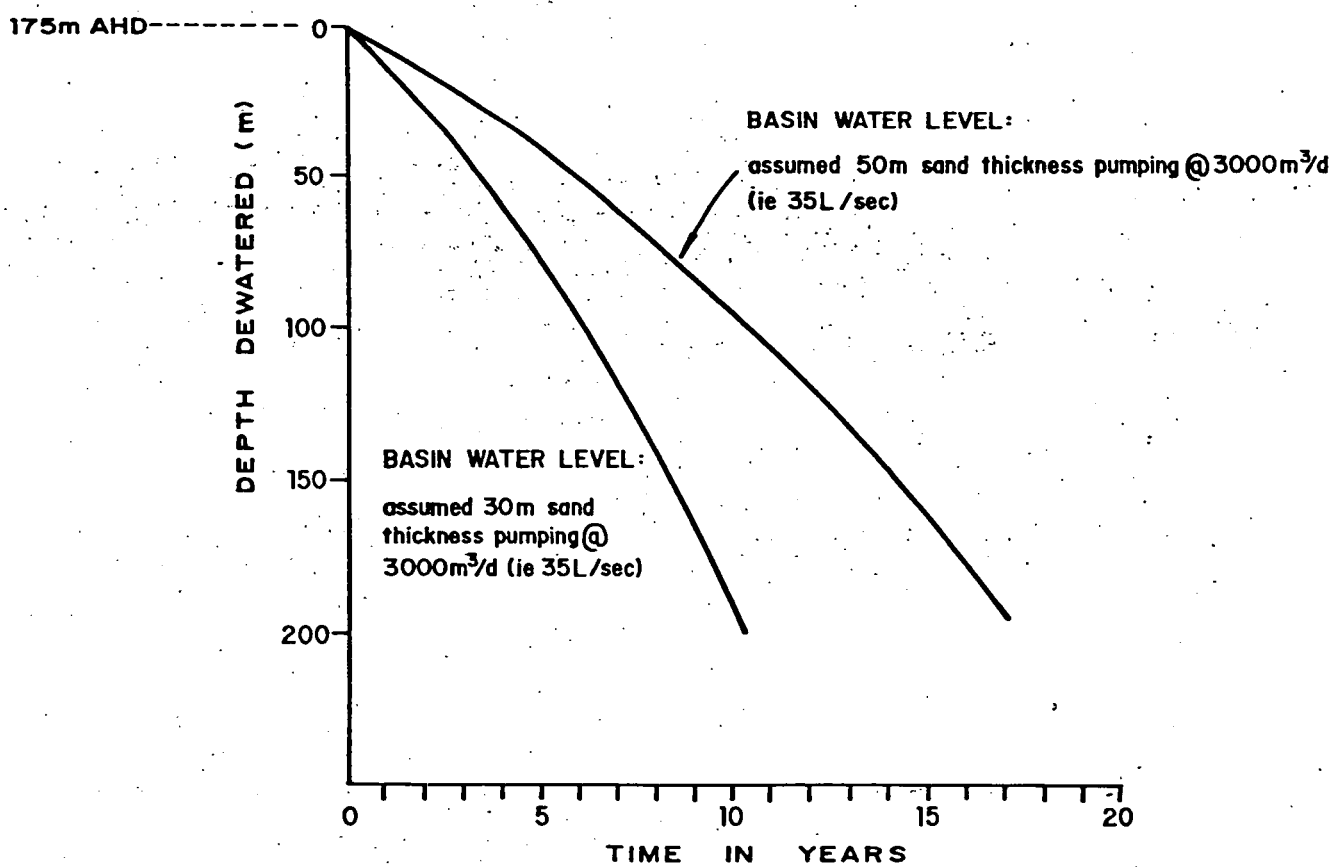


FIG....24

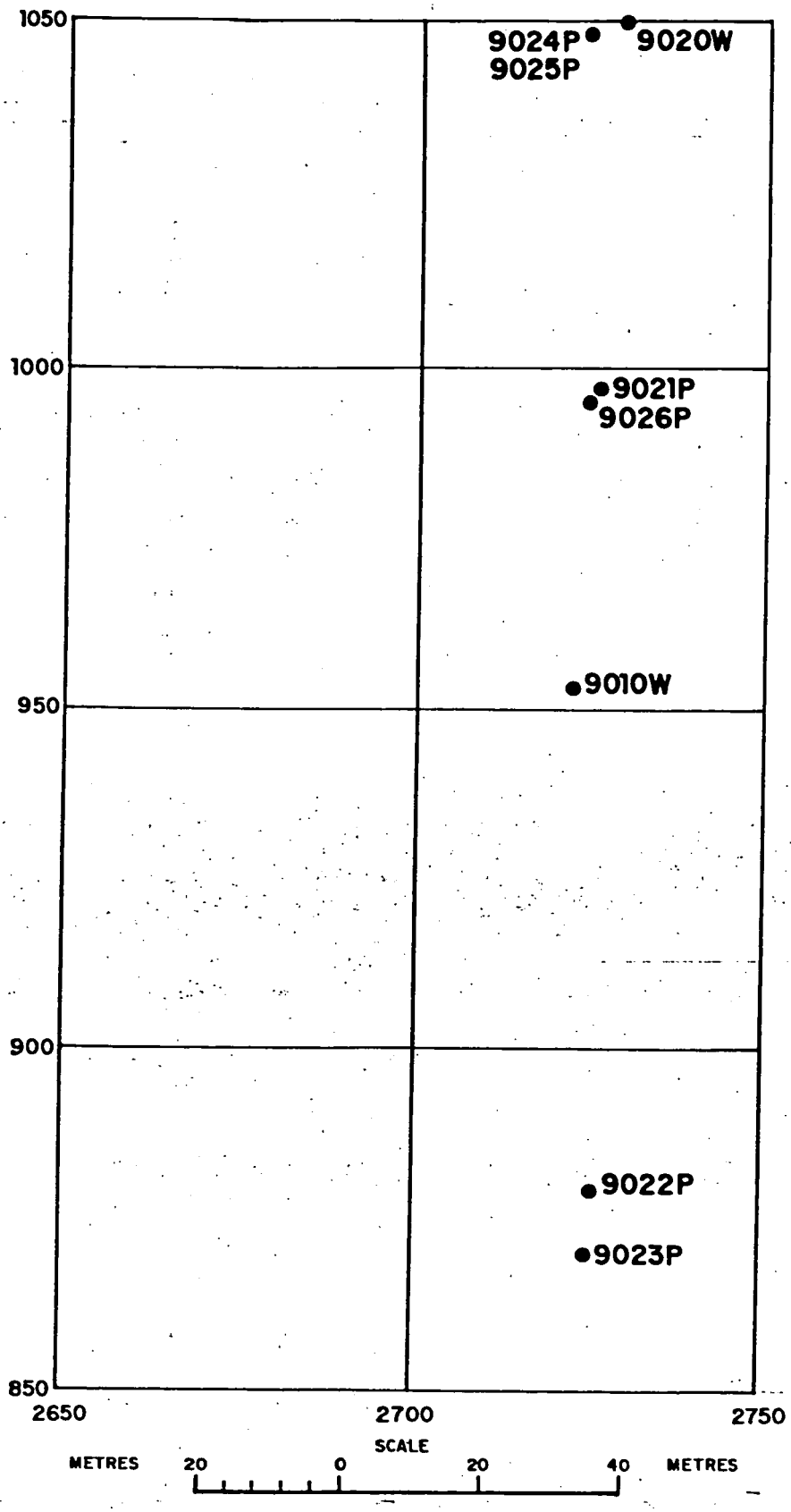
DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED D.E.&D.A.	for C D O DATE
LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION	DRAWN G.B.	SCALE
SIMPLE BASIN MODEL	DATE 12 JUL 84 / CHECKED	PLAN NUMBER S17450

3291

APPENDIX 1

		Plan No.
U/24 Site Well Locations		S17451
Composite log	9010W	82-335
	9020W	83-504
	9024/5P	83-503
	9026P	83-513
Summary Cuttings Logs	9010W	
	9020W	
	9021P	
	9022P	
	9023P	
	9024/5P	
	9026P	

For all SADME Well Unit Nos see appendix 6



APPENDIX 1

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

COMPILED D.E. & D.A.	CDO DATE
DRAWN G.B.	SCALE 1:1000
DATE 19 JUL 84	PLAN NUMBER S17451
CHECKED	

LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION

U/24 SITE WELL LOCATIONS
E.T.S.A. 'K' GRID

9291

2883

DEPARTMENT OF MINES & ENERGY – SOUTH AUSTRALIA
ENGINEERING DIVISION

COMPOSITE WELL LOG – GROUNDWATER

HOLE No. H.O.B. 1
UNIT/STATE No. 6536 05a ØW 00254
PERMIT No. 10530
FOLDER No.
DRG. No. 82 – 335

CONSTRUCTION DETAILS

DRILLING TECHNIQUE: ROTARY
CIRCULATION: MUD
START: 20/5/82
FINISH: 22/5/82
TOTAL DEPTH: 94m

	Inches	m.m	From(m)	To(m)
HOLE DIAMETER		220	0	63
		120	63	94
CASING DIAMETER (Cemented)				
CASING DIAMETER (Uncemented)		150	0	37·85
		class 12 PVC		
		100	38	56·5
		class 9 PVC		
		100	62·50	63 (Sump)
		class 9 PVC		
SCREEN DETAILS Make / Model Dimensions		100 "Johnson"	56·50	62·50
		Stainless Steel Aperture = 0·375 mm		
		(LINATEX SEAL SET AT 43·50m)		

PROJECT LEIGH CREEK INDUSTRIAL WATER SUPPLY – LOBE B.
UPPER SERIES DRILLING
LOCATION S.E. CORNER OF LOBE B.
SECTION ..... HUNDRED .....
CO-ORDINATES EAST K 2722·8 m.
NORTH 953·5 m.
LOGGED BY D. R. EDWARDS
REFERENCE ELEV. Top of P.V.C. 194·72
DATE 20/5/82.
SURFACE ELEV. .....
TRACED BY A.D.
DATUM metres A.H.D.
DATE 6th July 1982.

TYPE OF LOG	16 IN. NORMAL	64 IN. NORMAL	6FT. LATERAL	S.P.	POINT RESISTIVITY	NEUTRON	GAMMA RAY	TEMPERATURE	DENSITY
DATE OF RUN				20/5/82	20/5/82	20/5/82	20/5/82	20/5/82	20/5/82
FIRST READING (m)				94	94	94	92·4	94	57
LAST READING (m)				5	5	2	0·8	1·6	1
INTERVAL MEASURED(m)				89	89	92·5	91·6	92·4	56
CASING : LOGGER (m)									
CASING : DRILLER (m)									
DEPTH REACHED (m)				94	94	94	92·4	94	94
BOTTOM : DRILLER (m)				94	94	94	94	94	94
MUD TYPE				Geofluid + Biogel →		Geofluid + Biogel →		Geofluid + Biogel →	
MUD RESISTIVITY									
RECORDED BY				G. CREWS	G. CREWS	G. CREWS	(CENTURY GEOPHYSICAL Co.)		

WELL SYMBOLS

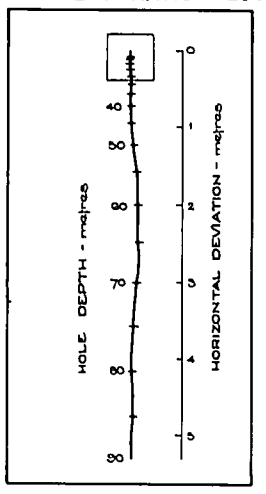
CONSTRUCTION LOG
- Casing seal
- Casing shoe
- Wire wound screen
- Slotted casing
- Cemented Interval
- Gravel packed Interval

HYDROGEOLOGICAL LOG
- Core Interval
- Aq Aquifer
- Cb Confining bed
- T Transmissivity m^3/day 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 m^3/day	YIELD Method of Test	TOTAL DISSOLVED SOLIDS mg./litre	TOTAL DISSOLVED SOLIDS Analysis W No.
46·2m	6m	180	Air Lifting	10,000	W/4032/82

REMARKS: LINATEX SEAL AT 43·5m MAY BE INEFFECTIVE AS HOLE HAD TO BE DRILLED OVERSIZE TO ALLOW CASING ACCESS DOWN TO 63m WHERE THERE IS A SOUTHERLY DEVIATION OF 2·3 METRES FROM VERTICAL.
D40 – MESH SIZE PASSING 40% OF SAMPLE. D60 – MESH SIZE PASSING 60% OF SAMPLE.

VERTICAL DEVIATION LOG



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DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA
ENGINEERING DIVISION

COMPOSITE WELL LOG - GROUNDWATER

WELL UNIT No.	653605aØW00426
PERMIT No.	92196
PLAN No.	83-504
E.T.S.A. WELL No.	9020 W

PROJECT: LOBE B UPPER SERIES DEWATERING

LOCATION: K2729:5/1050:4 (PRODUCTION WELL)

SECTION: HUNDRED:

REFERENCE ELEV. 194.54 m A.H.D. (T.O.C.) LOGGED BY: D.R. Edwards

LOG SYMBOLS
- CASING SEAL
- WIREWOUND SCREEN
- SLOTTED CASING
- GRAVEL PACKED INTERVAL
- K HYDRAULIC CONDUCTIVITY (m/day, Estimated)

CONSTRUCTION DETAILS

DRILLING TECHNIQUE: ROTARY MUD RESISTIVITY:

CIRCULATION: water

START: 22/9/82 FINISH: 28/9/82 TOTAL DEPTH: 108m

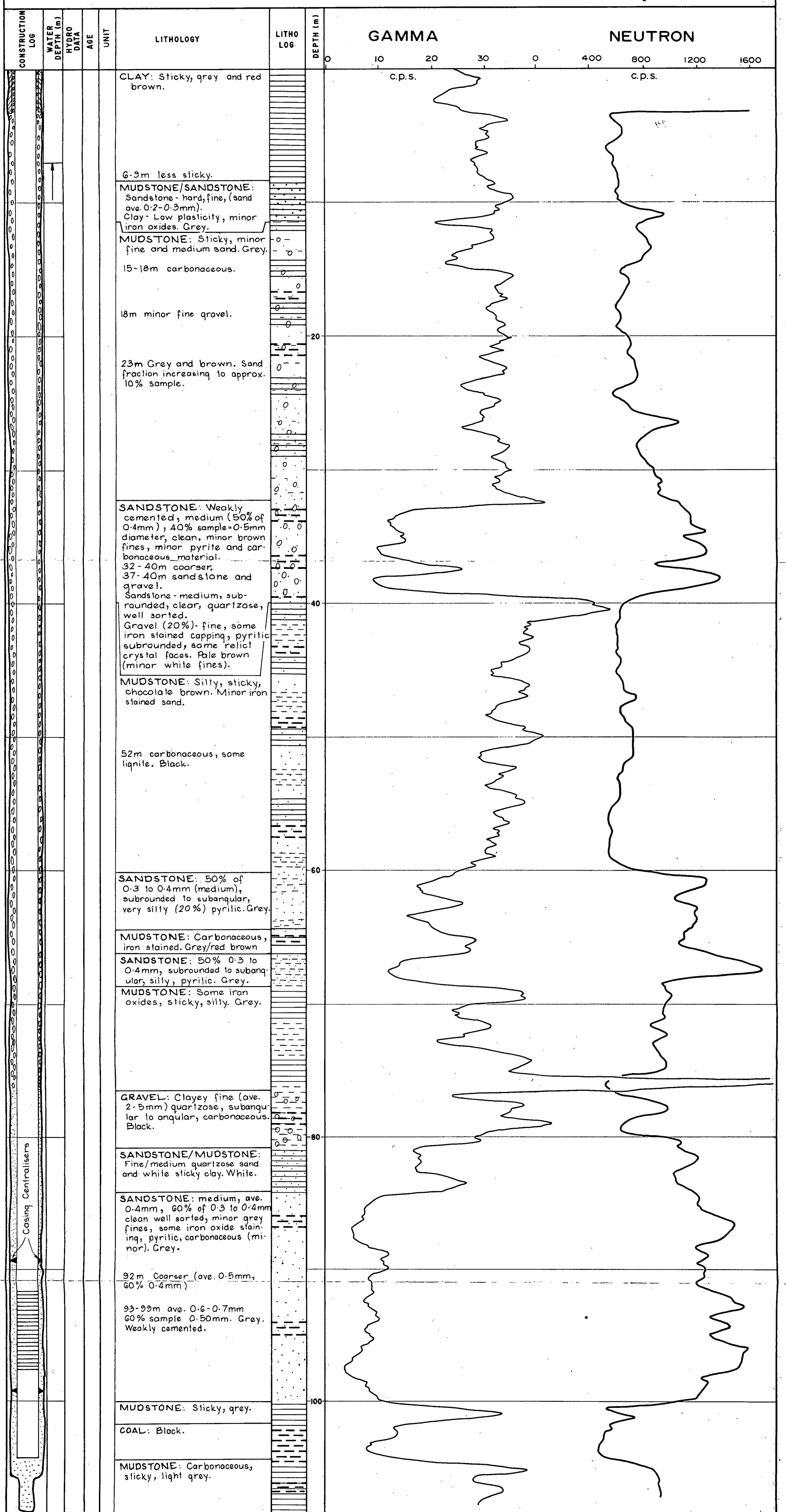
	mm.	FROM (m)	TO (m)
HOLE DIAMETER	350	0	3.2
	311	3.2	80
	381	1.90	98
	311	98	105.8
	128	105.8	108
CASING DIAMETER	330	0	3.2
	195	+0.27	31.5
	195	37.5	104.28
	Class 12 PVC		(sump)
SCREEN DETAILS	316 stainless steel (1mm aperture)	91.5	97.5

TYPE OF LOG	16in. NORMAL	64in. NORMAL	6ft. LATERAL	SELF POTENT.	POINT RESIST.	NEUTRON	GAMMA	DENSITY
DATE OF RUN						22/9/82	22/9/82	
FIRST READING						108	108	
LAST READING						0	0	
RECORDED BY						A. Young	A. Young	

DEPTH TO WATER	TOTAL DISSOLVED SOLIDS mg/L	Analysis No.	DATE
7m	10,000 (approx.)		

REMARKS: SITE 1

0-75m. Gravel packed w/- local material.
75-105.8m. Gravel packed w/- sand (1·2-1·7mm diam.).
Cement plug 0·2m.



3291

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA
ENGINEERING DIVISION

COMPOSITE WELL LOG - GROUNDWATER

WELL G53605a0W00319, UNIT No. 320
PERMIT No. 92899
PLAN No. 83-503
E.T.S.A. WELL Nº 9024P 9025P

PROJECT: LEIGH CREEK LOBE B UPPER SERIES DEWATERING
LOCATION: K 2724-61/1048-79 (5m Radius from 9020W)
SECTION: HUNDRED:
REFERENCE ELEV. 194.48 – 9024P, 194.60 – 9025P m A.H.D. LOGGED BY: D.R.EDWARDS

LOG SYMBOLS
- CASING SEAL
- WIREWOUND SCREEN
- SLOTTED CASING
- GRAVEL PACKED INTERVAL
- K HYDRAULIC CONDUCTIVITY (m/day, Estimated)

CONSTRUCTION DETAILS

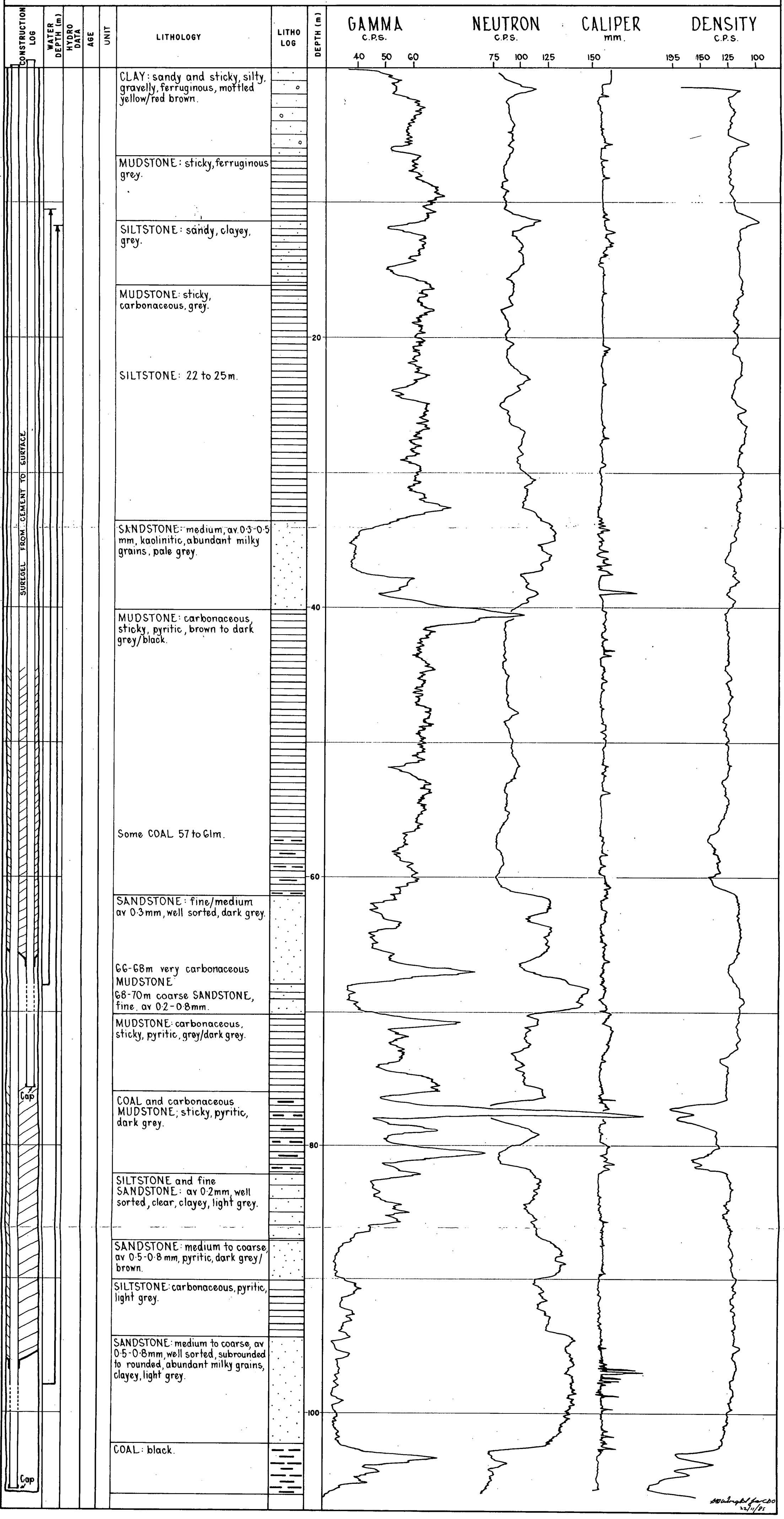
DRILLING TECHNIQUE: ROTARY MUD RESISTIVITY:
CIRCULATION: MUD
START: 23·7·83 FINISH: 23·7·83 TOTAL DEPTH: 106m

	mm.	FROM (m)	TO (m)
HOLE DIAMETER	150	0	106
CASING DIAMETER	50 Class 12 P.V.C.	+0·2	106 (9024P)
	50 Class 12 P.V.C.	+0·35	76 (9025P)
	Linatex Seal / Linatex Seal	at 96m - Cement / at 66m - Cement	96–76m (9024P) (9025P) / 66·45m, Suregel 45·0m
SCREEN DETAILS	3mm Slots	98	100 (9024P)
	3mm Slots	68	70 (9025P)

TYPE OF LOG	16in. NORMAL	64in. NORMAL	6ft. LATERAL	SELF POTENT.	CALIPER	NEUTRON	GAMMA	DENSITY
DATE OF RUN						23·7·83		
FIRST READING					105·8	106	106	106
LAST READING					0	0	0·5	0
RECORDED BY						D.R.EDWARDS		

DEPTH TO WATER	TOTAL DISSOLVED SOLIDS mg/L	Analysis No.	DATE
11·70 (T.O.C.) 9024P			26·7·83
10·70 (T.O.C.) 9025P			

REMARKS: SITE 1
For Grain Size Analysis
Interval m to m
See plan No.



3291

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA
ENGINEERING DIVISION

COMPOSITE WELL LOG - GROUNDWATER

WELL UNIT No. 653605aØW00300
PERMIT No. 92898
PLAN No. 83-513
ETSA WELL No. 9026P

PROJECT: LEIGH CREEK LOBE B UPPER SERIES DEWATERING
LOCATION: K 2724 70/995 43 (55 m radius 9020W)
SECTION: ..... HUNDRED: .....
REFERENCE ELEV. 194.60 m A.H.D. LOGGED BY: D.R. Edwards

LOG SYMBOLS
- CASING SEAL
- WIREWOUND SCREEN
- SLOTTED CASING
- GRAVEL PACKED INTERVAL
- K HYDRAULIC CONDUCTIVITY (m/day, Estimated)

CONSTRUCTION DETAILS

DRILLING TECHNIQUE: ROTARY MUD RESISTIVITY: .....
CIRCULATION: AIR
START: 24.7.83 FINISH: 24.7.83 TOTAL DEPTH: 30 m

	mm.	FROM (m)	TO (m)
HOLE DIAMETER	150	0	30
CASING DIAMETER	50	+0.32	30
	Class 12 PVC.		
SCREEN DETAILS	Slotted PVC 3mm slots	22	24
	Linatex Seal at 12 m Cement 12 m - Surface		

TYPE OF LOG	16 in. NORMAL	64 in. NORMAL	6 ft. LATERAL	SELF POTENT.	CALIPER	NEUTRON	GAMMA	DENSITY
DATE OF RUN					24/7/83		24/7/83	
FIRST READING					28		29	
LAST READING					1		0	
RECORDED BY					D.R.E.		D.R.E.	

DEPTH TO WATER	TOTAL DISSOLVED SOLIDS mg/L	Analysis No.	DATE
6.42 T.O.C. 8/8/83			

REMARKS: SITE 1

CONSTRUCTION LOG | WATER DEPTH (m) | HYDRO DATA | AGE | UNIT | LITHOLOGY | LITHO LOG | DEPTH (m)

CLAY: Ferruginous, mottled grey and red-brown.

MUDSTONE: Sticky grey

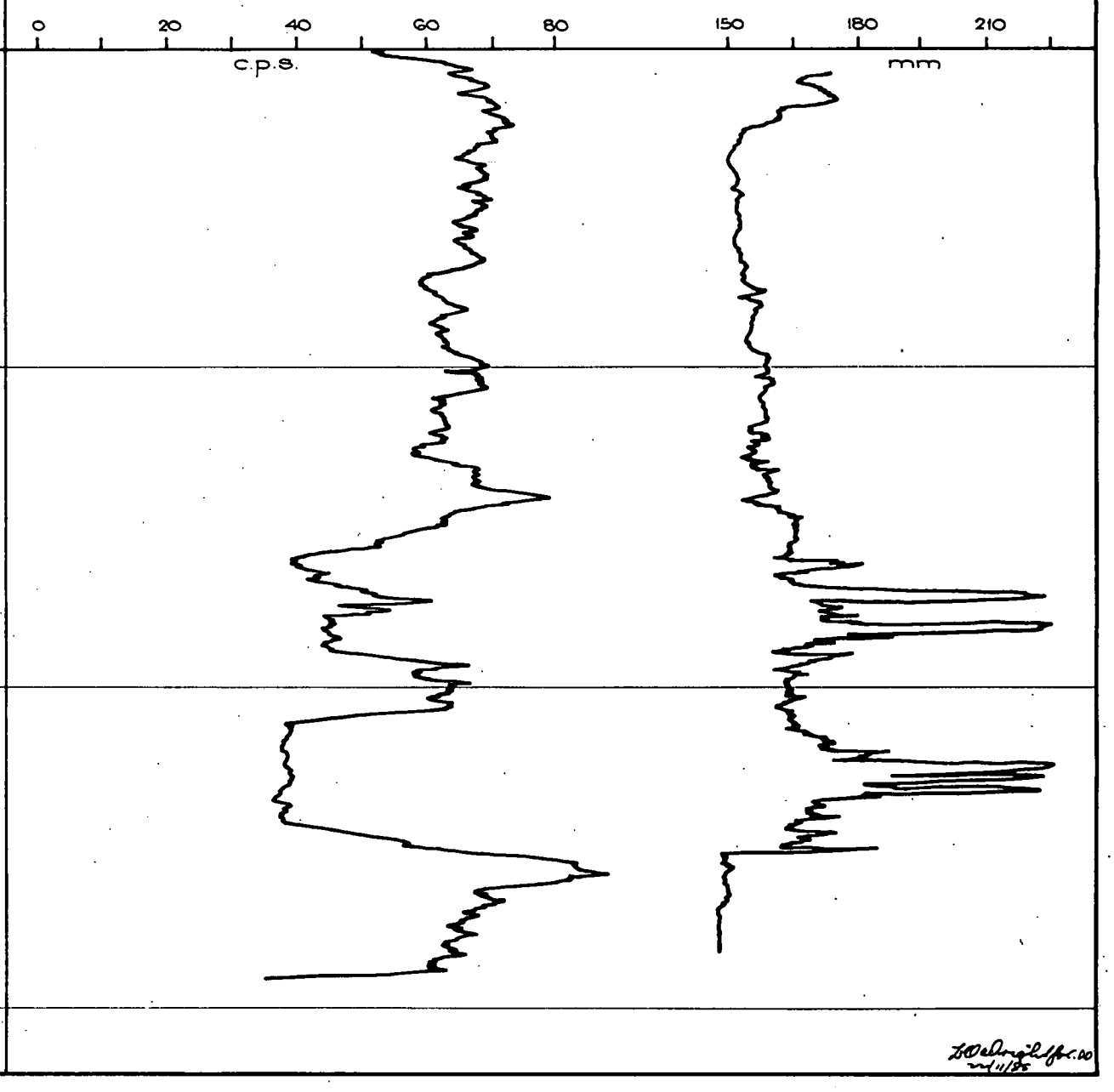
SILTSTONE/SANDSTONE Fine sandstone, ave 0.1/0.2 mm, grey.

SANDSTONE: Medium ave. 0.5 mm, well sorted, clear, kaolinitic.

Some mudstone 19-21 m.

21-25 m coarse (ave. 0.6 to 0.8 mm). Grey brown.

MUDSTONE: Carbonaceous, sandy, silty. Grey brown.



PROJECT: UPPER COAL SERIES DEWATERING LEIGH CREEK

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: 9010W

UNIT / STATE NO: 6536-05aOW-254

LOCATION OR COORDS: K2722.6/953.6 (100 m radius/ from 9020W)

SEC. HD. EL Surface EL Ref. Point 194.73 (TOC) m Datum AHD

DM PERMIT 10,530

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:
		6.4 (TOC) 25/5/82 11.69 (TOC) 25/7/83	56.5	62.5 aperture: 0.375 mm (ss. screen)	180		Air lifting	10,000 mg/l	W — 4032/82

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	4		CLAY sand & gravel	Ferruginous grey & yellow brown			100 (class 12)	+0.4	56.5
4	12		Sandstone	Weakly cemented clayey, medium light brown			Sump	62.5	63
12	22		Mudstone*	Carbonaceous, high plasticity brown					
22	26		Coal	Black					
26	30		SILTSTONE	Sandy, clayey pyritic black					
30	32		GRAVEL	Fine, grey.					
32	42		SILTSTONE/ *SANDSTONE	Pyritic, carbonaceous grey/black (weakly cemented)					
42	46		Mudstone/Siltstone	Carbonaceous, sandy dark grey.					
46	63		SANDSTONE	Medium, pyritic, grey.					
63	74		Mudstone/Coal	Dark grey					
74	76		Siltstone/Sandstone	Medium, (weakly cemented) grey.					
76	94		Mudstone	Dark grey.					

REMARKS: SITE 1 (U24)
(Previous No. HOB 1)

(Now an observation well only)

* NOTE: 110 kl / day = 1000gals / hr.
(* Previously denoted as clay or sand)

DRILL TYPE: ROTARY

CIRCULATION: MUD

SHEET 1 OF 1

COMPLETED: 22/5/82

LOGGED BY: D. EDWARDS

DATE: 20/5/82

PROJECT: UPPER COAL SERIES DEWATERING LEIGH CREEK

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: 9020W

LOCATION OR COORDS: K 2729.5/1050.4 (Production Well)

UNIT / STATE NO: 6536-05aOW-426

SEC. HD. EL Surface m EL Ref. Point (TOC) 194.54 m Datum AHD

DM PERMIT 92196

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:
		6.76m(TOC) 21/1/83 11.04m (TOC) 8/8/83	91.5	97.5 aperture 1 mm (ss. screen)	765 (approx.)	5 hours	Air lifting	10,700	W — 4893/82

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	7		CLAY	Sticky grey and red brown			200 (class 12 pvc).	+0.27	91.5
7	32		MUDSTONE	Sandy, carbonaceous, grey/brown				97.5 — 104 (capped sump)	
32	40		SANDSTONE	Weakly cemented, pyritic carbonaceous gravelly 37-40 m. Grey/pale brown (medium).					
40	60		MUDSTONE	Sticky, carbonaceous Grey Black.					
60	69		SANDSTONE & MUDSTONE	Medium sandstone av. 0.4 mm, carbonaceous sticky, pyritic, grey weakly cemented.					
69	76		/MUDSTONE	sticky, grey.					
76	81		GRAVEL/MUDSTONE	fine, carbonaceous, black.					
81	84		SANDST/MUDSTONE	fine, Kaolinitic, white.					
84	100		SANDSTONE	Medium, weakly cemented pyritic, carbonaceous grey.					
100	102		MUDSTONE	Sticky grey.					
102	105		COAL	Black					
105	108		MUDSTONE	Carbonaceous, sticky, light grey.					

REMARKS: SITE 1 (U24)
(Previous No. HOB 2)

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

DRILL TYPE: ROTARY

CIRCULATION: MUD

SHEET 1 OF 1

COMPLETED: 28/9/82

LOGGED BY: D. EDWARDS

DATE: 22/9/82

PROJECT: UPPER COAL SERIES DEWATERING LOBE B

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: 9021 P

UNIT / STATE NO: 6536-5aOW-331

DM

LOCATION OR COORDS: K 2726.1/997.0 (55m radius from 9020W)

SEC. HD. EL Surface m EL Ref. Point 195.33 m m Datum AHD

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 m		16	18	(NOW ABANDONED).				W —

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	6		CLAY	Ferruginous, sticky red brown.					
6	8		MUDSTONE	Sticky grey					
8	12		SILTSTONE/SANDSTONE	Grey (fine sandstone)					
12	16		MUDSTONE	Sticky, silty dark grey					
16	18		SANDSTONE	Medium (av. 0.5 mm) well sorted Kaolinitic pale grey.					

REMARKS: SITE 1 (U 24)

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

Previous No. "P1" (Adjacent to replacement piezo 9026 P). (ETSA piezo)
(*Lithological correlated from adjacent 9026 P).

DRILL TYPE: Hammer

CIRCULATION: Air (ETSA Drilled)

SHEET 1 OF 1

COMPLETED:

LOGGED BY: NOT LOGGED*

DATE:

PROJECT: UPPER COAL SERIES DEWATERING LEIGH CREEK

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: 9022P

UNIT / STATE NO: 6536-5aOW-332

DM

LOCATION OR COORDS: K 2726.0/879.5 (170 m radius from 9020 W).

EL Surface m

EL Ref. Point 195.69 (TOC) m Datum AHD

SEC. HD.

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:
		12.30 m (TOC) 15/8/83							W —

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)
				* Hole bottomed in same sandstone sequence as 9010/9020 W completions.					

REMARKS: SITE 1 (U 24)
Previous No. "P2 ETSA piezo

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

DRILL TYPE: HAMMER

CIRCULATION: AIR (ETSA DRILLED)

SHEET 1 OF 1

COMPLETED:

LOGGED BY: *NOT LOGGED

DATE:

PROJECT: UPPER COAL SERIES DEWATERING LOBE B LEIGH CREEK

LOCATION OR COORDS: K2725.5/870.0 (180 m radius from 9020W)

SEC. HD. EL Surface EL Ref. Point 196.03 (TOC) m Datum AHD

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: 9023P

UNIT / STATE NO 6536-5aOW-333

DM

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:
		12.70 m (TOC) 15/8/83							W —

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)
				* Hole bottomed in same sandstone sequence as 9010/9020 W completions.					

REMARKS: SITE 1 (U 24)
(Previous No. P3)

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

DRILL TYPE: Hammer

CIRCULATION: AIR (ETSA ~~DRILLED~~)

SHEET 1 OF 1

COMPLETED:

LOGGED BY* NOT LOGGED

DATE:

PROJECT: UPPER COAL SERIES DEWATERING LOBE B LEIGH CREEK

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: 9024 P
9025 P

LOCATION OR COORDS: K 2724.6/1048.79 (5 m radius from 9020W)
EL Ref Point 194.48 (9024P)

UNIT / STATE NO
6536-5a(W)-319
6536-5a(W)-320

SEC. HD. EL Ref. Point 194.60 (9025P) m Datum AHD

EM PERMIT 92899

AQUIFER SUMMARY:	DEPTH TO WATER CUT (m)	DEPTH TO STANDING WATER (m)	INTERVAL TESTED From:	To:	SUPPLY kilolitres/day*	Test Length (hrs)	Method	TOTAL DISSOLVED SOLIDS milligrammes/litre	Analysis No:
		11.70 (TOC) 9024P (26/7/83) 10.70 (TOC) 9025 P	98 9024P	100 9024P	3mm/ slots pvc		AIR LIFTED		W —
			68 9025P	70					

DEPTH (m) From	To	GRAPHIC LOG	ROCK / SEDIMENT NAME	GEOLOGICAL DESCRIPTION	FORMATION / AGE
0	8		CLAY	Gravelly, sandy, ferruginous sticky mottled yellow & red brown	
8	33		MUDSTONE & SILTSTONE	Sticky, carbonaceous, grey	
33	40		SANDSTONE	Medium av. 0.3/0.5 mm, Kaolinitic light grey	
40	61		MUDSTONE	Carbonaceous, pyritic, sticky dark grey/black	
61	70		SANDSTONE	Fine/coarse (av. 0.3 to 0.8/2 mm) well sorted, dark grey.	
70	76		MUDSTONE	Sticky, carbonaceous grey.	
76	82		COAL/MUDSTONE	Black & dark grey.	
82	87		SILTSTONE/ SANDSTONE	Carbonaceous, pyritic, light grey.	
87	90		SANDSTONE	Medium to coarse av. 0.5/0.8 pyritic dark grey/ grown.	
90	94		SILTSTONE	Carbonaceous, pyritic, light grey.	
94	102		SANDSTONE	Medium to coarse av. 0.5/0.8 mm well sorted clayey light grey.	
102	106		COAL	Black.	

DEPTH COPE SAMPLE	CASING Dia(mm)	From(m)	To(m)
9024 P completion	50 class 12 pvc	+0.2 (slots 98 – 100)	106
		seal at 96 m	
		cement 96 – 78 m	
	sumps	100 – 106	
9025 P completion	50 class 12 pvc	+0.35 (slots 68 – 70)	76
		seal at 66 m	
		cement 66 – 45	
		suregel 45 – 0	
	sump	70 – 76m	

REMARKS: SITE 1 (U-24)
(DUAL COMPLETION)

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

DRILL TYPE: ROTARY

CIRCULATION: MUD

SHEET 1 OF 1

COMPLETED: 23/7/83

LOGGED BY: D.R. EDWARDS

DATE: 23/7/83

PROJECT: Upper Coal Series Dewatering Lobe B Leigh Creek

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: 9026 P

LOCATION OR COORDS: K 2724.70/995.43 m (55m radius from 9020 W)

UNIT / ~~STATE~~ NO: 6536-5aφW-300

SEC. HD. EL Surface 194.32 m EL Ref. Point 194.60 (TOC) m Datum AHD

DM PERMIT 92898

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:
		6.42 (TOC) 8-8-83	22	24 (3mm slots).					W —

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	6		CLAY	ferruginous mattled grey & red brown		Sv	+.50	+0.32	-30
6	15		MUDSTONE & SILTS				class 12 PVC (slots 22 - 24).		
15	25		STONE						
15	25		SANDSTONE	medium to coarse av 0.5/0.8 mm, well sorted, clear, grey brown.					
25	30		MUDSTONE	carbonaceous, sandy, silty, grey Brown.					
							LINATEX SEAL AT 22 m (cement 12-0).		

REMARKS: SITE 1 (U24)

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

DRILL TYPE: rotary

CIRCULATION: AIR

SHEET 1 OF 1

COMPLETED: 24/7/83

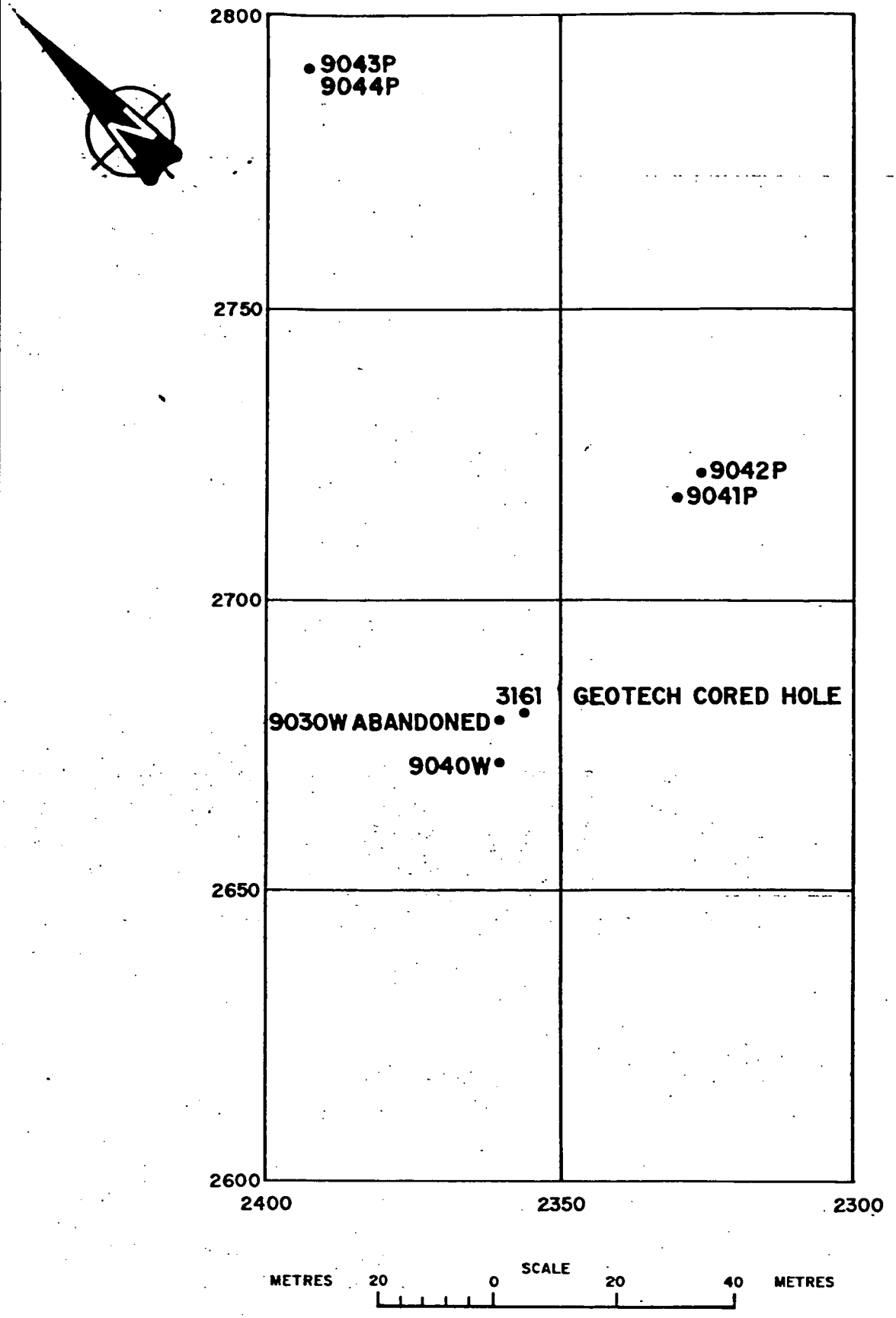
LOGGED BY: D. EDWARDS

DATE: 24/7/83

APPENDIX 2

		Plan No.
U/25 Site: Well Location		S17452
Composite log	9030W	83-506
	9040W	83-505
	9041P	83-507
	9042P	83-508
	9043/4P	83-509
Summary Cuttings Logs	9040W	
	9041P	
	9042P	
	9043/4P	

For all SADME Well Unit No s see appendix 6



APPENDIX 2

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED D.E.B D.A.	DATE
LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION	DRAWN G.B.	SCALE 1:1000
U/25 SITE WELL LOCATIONS E.T.S.A. 'K' GRID	DATE 19 JUL 84	PLAN NUMBER S17452
	CHECKED	

3291

3231

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA
ENGINEERING DIVISION

COMPOSITE WELL LOG - GROUNDWATER

WELL UNIT No. G5374Gr0W00573
PERMIT No. 92790
PLAN No. 83-506
E.T.S.A. WELL No. 9030W

PROJECT: LEIGH CREEK LOBE B- UPPER SERIES DEWATERING
LOCATION: 5 metres SW of Cored Hole 3161
SECTION: HUNDRED:
REFERENCE ELEV. m A.H.D. LOGGED BY: D.R.EDWARDS

LOG SYMBOLS
CASING SEAL
WIREWOUND SCREEN
SLOTTED CASING
GRAVEL PACKED INTERVAL
K HYDRAULIC CONDUCTIVITY (m/day, Estimated)

CONSTRUCTION DETAILS

DRILLING TECHNIQUE: ROTARY MUD RESISTIVITY:
CIRCULATION: MUD
START: 23-5-83 FINISH: 31-5-83 TOTAL DEPTH: 162 m

	mm.	FROM (m)	TO (m)
HOLE DIAMETER	300	0	149
	140	149	162
CASING DIAMETER	203 chemline	80-1	149
	125 telescopic	147	153
	(chemline)	158	161 (capped)
SCREEN DETAILS	200 Rubber K packer set at 147m	0.4mm aperture-135 to 140m	
	115	0.4mm aperture-153 to 158m (telescopic)	

TYPE OF LOG	16in. NORMAL	64in. NORMAL	6ft. LATERAL	SELF POTENT.	POINT RESIST.	NEUTRON	GAMMA	DENSITY
DATE OF RUN							24-5-83	
FIRST READING							161	
LAST READING							0	
RECORDED BY							D.R.Edwards	

DEPTH TO WATER	TOTAL DISSOLVED SOLIDS mg/L	Analysis No.	DATE
8m			
31-5-83	Hole collapsed and abandoned.		

REMARKS:
SITE 2.

Hole Collapsed (A) To 36.5m - 31.5.83
(B) To Surface - 14.6.83

Casing parted at top of female thread

Fibreglass casing

UNIT	AGE	LITHOLOGY	LITHO LOG	DEPTH (m)
QUATERNARY ALLUVIUM		SAND AND GRAVEL: up to 50mm, clayey, subrounded, av 0.1 to 2mm, poorly sorted, red-brown.		
		GRAVEL: clayey, medium, av 20mm, rounded chunks of basement, poorly sorted, from 6m - coarse, red-brown.		
UPPER SERIES OVERBURDEN	Cb	MUDSTONE: sticky, minor sandstone lenses, grey.		
	Cb	MUDSTONE/SANDSTONE: some ferruginous stained zones, grey to light grey, sand av 0.3 to 0.4mm.		
	Cb	MUDSTONE: sticky, some ferruginous staining, grey to light grey.		
	Aq	SANDSTONE: kaolinitic, abundant milky grains, medium to coarse, white.		
	Cb	CLAY: white - kaolinite.		
	Aq	SANDSTONE: av 0.3 to 0.6mm, kaolinitic, from 50m coarse, av 0.5 to 0.7mm, white.		
	Cb	MUDSTONE: sticky, grey. 54-67m, carbonaceous, grey and black. 67-88m, carbonaceous, light grey.		
TRIASSIC	Aq	SANDSTONE: medium, av 0.3 to 0.4mm, well sorted, clear, carbonaceous, dark grey, abundant mudstone. 98-100m, av 0.2 to 0.3mm. 100-101m, av 0.5mm.		
	Cb	MUDSTONE: minor fine-medium sandstone, sticky, dark grey.		
	Aq	SANDSTONE: coarse, av 1.0mm, well sorted, subrounded to rounded, clear, minor fines, dark grey.		
	Cb	MUDSTONE: carbonaceous, sticky, dark grey.		
	Aq	SANDSTONE: medium, av 0.3 to 0.6mm, clear, poorly sorted, grey.		
	Cb	MUDSTONE: sticky, grey.		
	Aq	SANDSTONE: medium, av 0.3 to 0.5mm, subrounded, clear, milky grains, some larger grains rounded, minor fines, carbonaceous, grey. 136-142m, coarse, av 0.7mm, silty, grey.		
	Cb	MUDSTONE: carbonaceous, sticky, grey and brown.		
	Aq	SANDSTONE: pyritic, medium, range 0.1 to 0.8mm, av 0.4mm, grey. 152m, minor mudstone.		
	Cb	MUDSTONE: sticky, minor sandstone, grey.		

GAMMA C.P.S. 0 100 200 300

DEPTH (m): 20, 40, 60, 80, 100, 120, 140, 160

Fibreglass casing

3231

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA
ENGINEERING DIVISION

COMPOSITE WELL LOG - GROUNDWATER

WELL UNIT No. 6537/6r0W00598
PERMIT No. 92893
PLAN No. 83-505
E.T.S.A. WELL No. 9040W

PROJECT: LEIGH CREEK LOBE B UPPER SERIES DEWATERING.....
LOCATION: K2672-38/2360-24 - Production Well.....
SECTION:..... HUNDRED:.....
REFERENCE ELEV 195.42 (T.O.C.)m A.H.D. LOGGED BY: D.R.EDWARDS.....

LOG SYMBOLS
CASING SEAL
WIREWOUND SCREEN
SLOTTED CASING
GRAVEL PACKED INTERVAL
K HYDRAULIC CONDUCTIVITY (m/day, Estimated)

CONSTRUCTION DETAILS

DRILLING TECHNIQUE: ROTARY MUD RESISTIVITY:.....
CIRCULATION: MUD (HYDROPOL)
START: 6-6-83 FINISH: 14-6-83 TOTAL DEPTH: 170m.

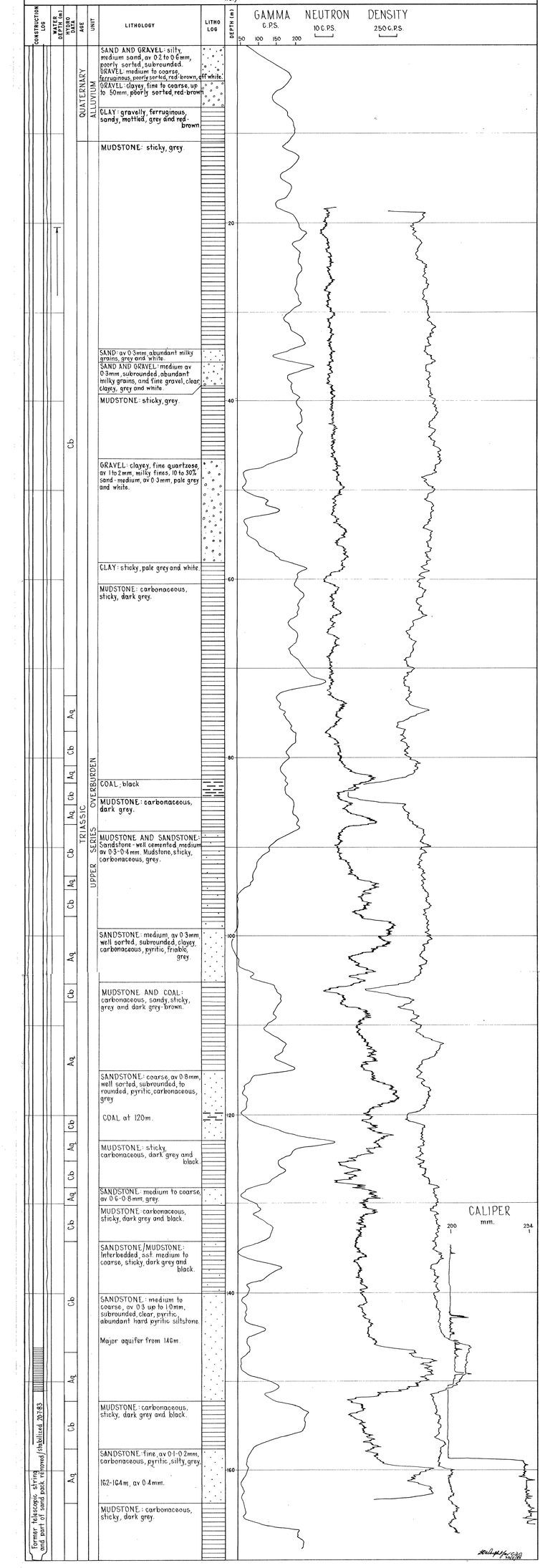
	mm.	FROM (m)	TO (m)
HOLE DIAMETER	300	0	169
	150	169	170
CASING DIAMETER	203 I.D.	+0.30	146
	203 I.D.	151	157
SCREEN DETAILS	200 I.D. (0.4mm apr.)	146	151

(Telescopic string removed 20-7-83 - Previously installed from 151 to 165m, Screen 157-162m, 125mm I.D.)

TYPE OF LOG	16in. NORMAL	64in. NORMAL	6ft. LATERAL	SELF POTENT.	CALIPER	NEUTRON	GAMMA	DENSITY
DATE OF RUN					21-7-83	7-7-83	6-6-83	21-7-83
FIRST READING					166	163	169	167
LAST READING					136	1-3	0	18-6
RECORDED BY						D.R. EDWARDS		

DEPTH TO WATER	TOTAL DISSOLVED SOLIDS mg/L	Analysis No.	DATE
20.05 T.O.C.	15000	3852/83	15-6-83

REMARKS: SITE 2 (U25)
Supply increased from 0.7 L/sec (14-6-83) to approx. 4.0 L/sec (20-7-83) once open hole conditions were established.



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DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA
ENGINEERING DIVISION

COMPOSITE WELL LOG - GROUNDWATER

WELL UNIT No. 6537461W00578
PERMIT No. 92791
PLAN No. 83-507
E.T.S.A. WELL No. 5041P

PROJECT: LEIGH CREEK LOBE B UPPER SERIES DEWATERING
LOCATION: K 2718 60/2330 52 (55m Radius from 9040W.)
SECTION: ..... HUNDRED: .....
REFERENCE ELEV. 95·65 (T.O.C.)m A.H.D. LOGGED BY: D.R. EDWARDS

LOG SYMBOLS
CASING SEAL
WIREWOUND SCREEN
SLOTTED CASING
GRAVEL PACKED INTERVAL
K HYDRAULIC CONDUCTIVITY (m/day, Estimated)

CONSTRUCTION DETAILS

DRILLING TECHNIQUE: ROTARY MUD RESISTIVITY:
CIRCULATION: MUD (HYDROPOL)
START: 31·5·83 FINISH: 1·6·83 TOTAL DEPTH: 150m.

	mm.	FROM (m)	TO (m)
HOLE DIAMETER	150	0	150
CASING DIAMETER	50 class 18 P.V.C.	+0·25m	149
	Linatex seal at 137m. Cement from 137m to		117m.
SCREEN DETAILS	3 mm slots (Gauze covered)	139	141

TYPE OF LOG	16in. NORMAL	64in. NORMAL	6ft. LATERAL	SELF POTENT.	POINT RESIST.	NEUTRON	GAMMA	DENSITY
DATE OF RUN						7·7·83	1·6·83	
FIRST READING						134·5	149	
LAST READING						1·3	0	
RECORDED BY						D.R. Edwards		

DEPTH TO WATER	TOTAL DISSOLVED SOLIDS mg/L	Analysis No.	DATE
20·71 (T.O.C.)	15000		
21·7·83			

REMARKS: ..... SITE 2 (U25) .....

CONSTRUCTION LOG	WATER LEVEL (m) HYDRO DATA	AGE	UNIT	LITHOLOGY	LITHO LOG	DEPTH (m)
		QUATERNARY	ALLUVIUM	SAND & GRAVEL: silty sand, medium to coarse, av 0·6mm, subrounded, ferruginous. Gravel, medium to boulder. Red brown. GRAVEL: clayey, medium, av 20mm, poorly sorted, red-brown and brown.		
		TRIASSIC	UPPER SERIES OVERBURDEN	MUDSTONE: sandy, medium, av 0·4mm, sticky, grey.		
	Aq			SANDSTONE: medium, av 0·3mm, range 0·1 to 0·8mm, ferruginous, abundant milky grains. 18-20m, some milky, rounded, fine gravel, yellow and white.		
	Cb			MUDSTONE: sticky, pale grey, brown and white.		20
	Aq			SANDSTONE: medium to coarse, av 0·3 to 0·8mm, range 0·1 to 5mm, poorly sorted, 30-50% fines, subrounded to rounded, abundant milky grains, white.		
	Cb					
	Aq			MUDSTONE: carbonaceous, sticky, light to dark grey.		
	Cb					40
	Aq			MUDSTONE & SANDSTONE: sst. fine, av 0·1 to 0·2mm, clear, subrounded, carbonaceous, silty.		
	Cb			MUDSTONE: silty, sticky, grey.		60
	Aq			SANDSTONE: carbonaceous, fine to medium, range 0·1 to 1·0mm, av 0·2-0·3mm, subrounded, clear, pyritic, abundant milky grains, grey, well consolidated.		
Surcgel to surface	Cb			MUDSTONE: carbonaceous, sticky, dark grey and black.		80
	Aq			SANDSTONE: very pyritic, poorly sorted, medium to coarse, av 0·3 to 0·6mm, carbonaceous. 93-95m, coarse, well sorted, subrounded, abundant milky grains, grey.		
	Cb			MUDSTONE: carbonaceous, sticky, grey		100
	Aq			SANDSTONE: pyritic, medium, av 0·3mm, well sorted, clear, subrounded, carbonaceous, grey.		
	Cb			MUDSTONE: carbonaceous, sticky, grey to dark grey.		
	Aq			SANDSTONE: medium, av 0·2-0·3mm, well sorted, pyritic, carbonaceous. From 121m, medium to coarse, abundant milky grains, grey.		120
	Cb			MUDSTONE: sticky, carbonaceous, grey and black.		
	Aq			SANDSTONE: medium, av 0·3mm, well sorted, clear, subrounded, grey. 139-144m, coarse, well sorted, av 0·7mm, rounded, clear, grey.		140
Cap	Cb			MUDSTONE: carbonaceous, sticky, grey to dark grey.		

GAMMA C.P.S. 50 100 150 200 250 300
NEUTRON C.P.S. 125 150 175 200 225
5c.p.s.

3291

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA
ENGINEERING DIVISION

COMPOSITE WELL LOG - GROUNDWATER

WELL UNIT No. GS3746rOW00579
PERMIT No. 32892
PLAN No. 83-508
E.T.S.A. WELL No. 9042P

PROJECT: LEIGH CREEK LOBE B - UPPER SERIES DEWATERING
LOCATION: K 2722-44/2326-72 (60m Radius from 9040W)
SECTION: HUNDRED:
REFERENCE ELEV. 195·77(toc)m A.H.D. LOGGED BY: D.R.EDWARDS

LOG SYMBOLS
CASING SEAL
WIREWOUND SCREEN
SLOTTED CASING
GRAVEL PACKED INTERVAL
K HYDRAULIC CONDUCTIVITY (m/day, Estimated)

CONSTRUCTION DETAILS

DRILLING TECHNIQUE: ROTARY MUD RESISTIVITY:
CIRCULATION: MUD (HYDROPOL)
START: 2·6·83 FINISH: 3·6·83 TOTAL DEPTH: 128m

	mm.	FROM (m)	TO (m)
HOLE DIAMETER	150	0	128
CASING DIAMETER	50 Class 18 PVC	+0·34	128
SCREEN DETAILS	Slotted PVC (3mm slots)	117	119

Linatex seal at 115m, Cement from 115m to 95m.

TYPE OF LOG	16in. NORMAL	64in. NORMAL	6ft. LATERAL	SELF POTENT.	POINT RESIST.	NEUTRON	GAMMA	DENSITY
DATE OF RUN						8·7·83	2·6·83	
FIRST READING				N.B. Neutron logged inside casing		123	128	
LAST READING						1·1	0	
RECORDED BY						D.R. Edwards		

DEPTH TO WATER	TOTAL DISSOLVED SOLIDS mg/L	Analysis No.	DATE
18·60m	15000		
(T.O.C. 21·7·83)			

REMARKS: SITE 2 (U25)

CONSTRUCTION LOG: SUREGEL from above cement to surface; Cap
WATER DEPTH (m)
HYDRO DATA
AGE: QUATERNARY; TRIASSIC
UNIT: ALLUVIUM; UPPER SERIES OVERBURDEN
Aq; Cb

LITHOLOGY

SAND and GRAVEL: silty sand, med. to coarse, av 0·6-0·7mm, sub-rounded, very ferruginous. GRAVEL, medium to boulder, red-br

GRAVEL: clayey, medium (av 20mm) rounded chunks of ferruginous siltstone, sandstone and shale, poorly sorted, red-brown and brown.

MUDSTONE: sandy, medium. av 0·4mm, sticky grey.

SANDSTONE: clayey, medium av 0·3mm, range 0·1-0·8mm, ferruginous, abundant milky grains. Yellow and white.

MUDSTONE: sticky, pale grey, brown and white.

SANDSTONE: medium to coarse, av 0·3 to 0·8mm, range 0·1 to 5mm, poorly sorted (some fine grained) 30-50% fines, subrounded to rounded, abundant milky grains, white.

MUDSTONE: carbonaceous, sticky, light and dark grey.

MUDSTONE and SANDSTONE: sst. fine av 0·1-0·2mm, clear, subrounded, carbonaceous. Mudstone, white and light grey.

MUDSTONE: silty, sticky, grey.

SANDSTONE: fine to medium, range 0·1-1·0mm, av 0·2-0·3mm, subrounded, clear, pyritic, abundant milky grains, grey.

MUDSTONE: carbonaceous, sticky, dark grey and black.

SANDSTONE: medium to coarse, av 0·3-0·6mm, carbonaceous, (91-93m, coarse, well sorted, av. 0·8-1·0mm). Subrounded, abundant milky grains, grey.

94-97m clayey.

MUDSTONE: carbonaceous, sticky, grey.

SANDSTONE: pyritic, medium, av 0·3mm, well sorted, clear.

MUDSTONE: carbonaceous, sticky, grey.

SANDSTONE: pyritic, medium av 0·3mm, well sorted, subrounded, clear, carbonaceous, grey.

MUDSTONE: carbonaceous, sticky, grey to dark grey.

SANDSTONE: medium, av 0·2-0·3mm, well sorted, pyritic, carbonaceous, 120-123m, coarse, av 0·8-2·0mm, abundant milky grains, grey.

MUDSTONE: sticky, carbonaceous, grey to dark grey.

LITHO LOG
DEPTH (m): 20, 40, 60, 80, 100

GAMMA C.P.S. 50 100 150 200 250
NEUTRON C.P.S. 150 200 250 300 350 400 450
100 c.p.s.

3291

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA
ENGINEERING DIVISION

COMPOSITE WELL LOG - GROUNDWATER

WELL G5374GrOW00570, UNIT No. 571
PERMIT No. 92795
PLAN No. 83-509
E.T.S.A. WELL Nº 9043P/ 9044P

PROJECT: LEIGH CREEK LOBE B UPPER SERIES DEWATERING
LOCATION: K.2791·69/2393·38 (120m Radius from 9040W)
SECTION: ..... HUNDRED: .....
REFERENCE ELEV. 195·57m A.H.D. - 9043P, 195·65m A.H.D. - 9044P
LOGGED BY: D.R. EDWARDS

LOG SYMBOLS
- CASING SEAL
- WIREWOUND SCREEN
- SLOTTED CASING
- GRAVEL PACKED INTERVAL
- K HYDRAULIC CONDUCTIVITY (m/day, Estimated)

CONSTRUCTION DETAILS

DRILLING TECHNIQUE: ROTARY MUD RESISTIVITY: .....
CIRCULATION: MUD (HYDROPOL)
START: 21·7·83 FINISH: 22·7·83 TOTAL DEPTH: 94m

	mm.	FROM (m)	TO (m)
HOLE DIAMETER	150	0	94
CASING DIAMETER	50 Class 18 P.V.C.	+0·25	94
	50 Class 18 P.V.C.	+0·33	65
SCREEN DETAILS	50mm Slotted P.V.C. (Deep)	70	72
	50mm Slotted P.V.C. (Shallow)	58	60

TYPE OF LOG	16in. NORMAL	64in. NORMAL	6ft. LATERAL	SELF POTENT.	CALIPER	NEUTRON	GAMMA	DENSITY
DATE OF RUN						22·7·83		
FIRST READING					93	93·5	93·5	93·5
LAST READING					2	0	0	0·4
RECORDED BY						D.R. EDWARDS		

DEPTH TO WATER	TOTAL DISSOLVED SOLIDS mg/L	Analysis No.	DATE
18·40 (T.O.C.) 9043P	14,000		
15·40 (T.O.C.) 9044P	26·7·83		

REMARKS: SITE 2 (U25)
For Grain Size Analysis
Interval m to m
See plan No. .....

CONSTRUCTION LOG: from 52m to surface; Suregel from ... to ...; Cap; Cap

WATER DEPTH (m)	HYDRO DATA	AGE	UNIT	LITHOLOGY	LITHO LOG	DEPTH (m)
				SAND/GRAVEL: medium-coarse, av. 0·5 to 1·0mm, subrounded, ferruginous. GRAVEL up to boulder size, rounded, red-brown.		
				SILT: white, minor gravel, ferruginous		
				SAND: medium, 0·3mm, subrounded clear, well sorted, silty, ferruginous, white.		
				CLAY/MUDSTONE: sticky, silty, ferruginous, white.		
				SILTSTONE: pale grey.		
				MUDSTONE: carbonaceous, sticky, dark grey. Sandy from 20-28m (av. 0·2 to 0·5mm), minor white fines.		20
				COAL and carbonaceous MUDSTONE: pyritic, black.		
				MUDSTONE: carbonaceous, pyritic, sticky, dark grey and black.		40
				SILTSTONE: pyritic, sandy, grey.		
				MUDSTONE: sticky, carbonaceous, pyritic, dark grey.		
				SILTSTONE: clayey, carbonaceous, pyritic, dark grey.		
				SANDSTONE: medium (0·1 to 1·0mm, av. 0·6 mm) pyritic, minor white fines, dark grey.		
				COAL: black.		
				MUDSTONE: very carbonaceous, sticky, minor white fines, dark grey and black.		
				SILTSTONE/SANDSTONE: sst. av. 0·3mm, fine, medium, carbonaceous, pyritic, dark grey. 60-61m SANDSTONE: av 0·5mm, subrounded, clear, pyritic, grey.		60
				MUDSTONE: very sticky, carbonaceous, dark grey.		
				SILTSTONE: light grey and white.		
				SANDSTONE: medium to coarse, (0·1 to 2·0mm, av 0·5mm) 5% of grains > 1mm, pyritic, well sorted, rounded to subrounded, abundant milky grains and white fines, (Kaolinite), grey.		
				COAL: black.		
				SILTSTONE: carbonaceous, dark grey.		
				COAL: black.		
				MUDSTONE: sticky, carbonaceous, pyritic, dark grey.		80
				SILTSTONE: clayey, carbonaceous, minor fine sand (av 0·2mm) dark grey.		
				COAL and MUDSTONE: sticky, dark grey and black.		
				MUDSTONE: very carbonaceous, sticky, dark grey.		

GAMMA C.P.S. 40 50 60 70
NEUTRON C.P.S. 75 100 125
DENSITY C.P.S. 2750 2500 2250 2000
CALIPER mm 150 196

L Walsh for C.P.O 22/11/85

PROJECT: Upper Coal Series Dewatering Leigh Creek

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: 9040 W *

UNIT / ~~STATE~~ NO 6537-46+ϕW-598

DM PERMITS 92893 92974

LOCATION OR COORDS: K 2672.38/2360.24 (Production Well)

SEC. HD. EL Surface m EL Ref. Point (TOC) 195.42 m Datum AHD

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:
		20.05 (TOC) 15/6/83	145 (200 mmID 0.4 mm Aperture)	150	40 L/sec	8 hours	Air lifting	14,068	W —

DEPTH (m) From	DEPTH (m) To	GRAPHIC LOG	ROCK / SEDIMENT NAME	GEOLOGICAL DESCRIPTION	FORMATION / AGE	DEPTH CORE SAMPLE
0	7		SAND/GRAVEL clayey	very ferruginous, medium sand some boulder gravel up to 50 mm, poorly sorted. Red Brown		
7	11		CLAY	gravelly ferruginous sandy mottled grey/red brown.		
11	34		MUDSTONE	sticky grey.		
34	38		SANDSTONE/gravel	medium sandstone and finegravel clear, clayey and white.		
38	47		Mudstone	sticky grey.		
47	58		Gravel/Sandst	fine gravel medium sandstone, milky fines (kaolinitic). Palegrey and white		
58	82		Mudstone	sticky pale grey and white		
82	84		Coal	Black		
84	99		Mudstone	sandy, sticky, carbonaceous. Grey.		
99	105		Sandstone	medium, will sorted, subrounded, carbonaceous, pyritic, grey.		

CASING Dia (mm)	CASING From (m)	CASING To (m)
203 ID chemline.	+0.3	157
OPEN HOLE 157	to	169m

REMARKS: SITE 2 (U25) ✓ * NOTE: 110 kl / day = 1000gals / hr.

(Permit 92974 refers to construction alteration). 125 mm telescopic string and portion of annulus sand pack removed/stabilized on 20/7/83. *Replacement well for 9030 (collapsed/abandoned) - see composite log for lithology of 9030.

DRILL TYPE: ROTARY

CIRCULATION: MUD

SHEET 1 OF 2

COMPLETED: 14/6/83

LOGGED BY: D.R. EDWARDS

DATE: 6/6/83

PROJECT: Upper Coal Series Dewatering Leigh Creek

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: 9041 P

LOCATION OR COORDS: K 2718.60/2330.52 (55 m radius from 9040W)

UNIT / ~~STATE~~ NO 6537-46+ϕW-578

SEC. HD. EL Surface EL Ref. Point 195.65 m Datum AHD

DM PERMIT 92791

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:
		20.71 m TOC	139	141 3 mm slots gauge wrapped			Air lifted	14,500 mg/l (approx)	W —

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	10		Sand and gravel clayey	medium to coarse sand av 0.6 mm, subrounded, gravel, medium to boulder Red Brown			50 mm class 18 PVC cap at end.	+0.25	149
10	13		Mudstone	sandy, sticky, grey					
13	34		SANDSTONE	clayey, medium av 0.3 mm, milky grains, kaolinitic, white. MUDST 23-25m.					
34	51		MUDSTONE	carbonaceous sticky light grey/dark grey					
51	67		Mudstone and Sandstone	sandstone-fine, carbonaceous, white and light grey.					
67	80		SANDSTONE	fine to medium subrounded, clear, pyrites, kaolinitic, grey.					
80	92		MUDSTONE	carbonaceous, sticky, dark grey and black					
92	101		SANDSTONE	medium to coarse carbonaceous, milky grains, subrounded, grey.					

REMARKS: SITE 2 (U25)

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

DRILL TYPE: ROTARY

CIRCULATION: Mud

SHEET 1 OF 2

COMPLETED: 1-6-83

LOGGED BY: D.R. Edwards

DATE: 31-5-83 1-6-83

PROJECT: Upper Coal Series Dewatering High Creek

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: 9042 P

LOCATION OR COORDS: K 2722.44/2326.72 (60 m radius from 9040 W)

UNIT / ~~STATE~~ NO 6537-46+ϕW-579

SEC. HD. EL Surface m EL Ref. Point 195.77 m Datum AHD

DM PERMIT 92892

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:
		18.60 m TOC 21/7/83	117	119 (3 mm slots) guage wrapped.			Air lifted	14,500 mg/l (approx)	W —

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	9		Sand & Gravel clayey	medium to coarse sand, average 0.6/0.7 mm, medium to boulder gravel Red Brown			50 class 18 PVC cap at end	+0.34 m	=128
9	11		Mudstone	sandy, grey					
11	16		Sandstone	medium av 0.3 mm ferruginous, kaolinitic, yellow/white					
16	24		Mudstone	sticky pale grey, brown and white.					
24	32		SANDSTONE clayey	medium to coarse av 0.3 to 0.8 mm, poorly sorted, 30% kaolinitic fines, white					
32	64		MUDSTONE	(same sandstone lenses 49-54 m) sticky, carbonaceous, light and dark grey.					
64	78		SANDSTONE	fine to medium av 0.2/0.3 mm subrounded, clear, pyritic, grey.					
78	90		MUDSTONE	carbonaceous, sticky, dark grey and black.					

REMARKS: SITE 2 (U25)

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

DRILL TYPE: ROTARY

CIRCULATION: MUD

SHEET 1 OF 2

COMPLETED: 3/6/83

LOGGED BY: D.R. EDWARDS

DATE: 2/6/83

PROJECT: Upper Coal Series Dewatering Leigh Creek

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: 9043 P
9044 P

UNIT / STATE NO
6537-46+ϕw-570
6537-46+ϕw-571.

DM PERMIT 92795

LOCATION OR COORDS: K 2791.69/2393.38 (120 m radius from 9040)

SEC. HD.

EL Surface m
EL Ref. Point 195.65 (9044 P) m Datum AHD W
~~(TOC) 195.57 (9043 P)~~

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:
	66 m	18.40 TOC (9043 P)	70	72	3mm slots guage wrapped		Air lifted	14,500 mg/l (approx)	W —
	56 m	15.40 TOC (9044 P) 26/7/83	58	60					

DEPTH (m) From	DEPTH (m) To	GRAPHIC LOG	ROCK / SEDIMENT NAME	GEOLOGICAL DESCRIPTION	FORMATION / AGE
0	8		SAND/GRAVEL	medium sand and boulder sized gravel ferruginous Red Brown	
8	28		MUDSTONE	silty, sandy carbonaceous, sticky minor white fines grey	
28	33		COAL	Black	
33	45		MUDSTONE AND SILTSTONE	carbonaceous, pyritic Dark grey and black.	
45	48		SANDSTONE	medium av 0.5 mm, carbonaceous, pyritic, Dark grey.	
48	49		COAL	Black	
49	56		Mudstone	carbonaceous sticky Dark grey/Black	
56	61		SANDSTONE	medium to coarse, kaolinitic, grey	
61	66		Mudstone and SILTSTONE	carbonaceous, sticky dark grey	
66	74		SANDSTONE	medium to coarse pyritic, grey.	

DEPTH COPE SAMPLE	CASING Dia(mm)	CASING From(m)	CASING To(m)
9043 P COMPLETION	(50 +0.25-94 class [illegible]		
	18 (slots PVC	70	72)
	LINATEX SEAL at 66 m cement from 66-62 m		
9044 P COMPLETION	(50 +0.33-65 class m		
	18 slots PVC	58	60)
	LINATEX SEAL AT 56 m cement from 56 to 52 m suregel 52 m to surface		

REMARKS: SITE 2 (U25)

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

DRILL TYPE: ROTARY

CIRCULATION: MUD

SHEET 1 OF 2

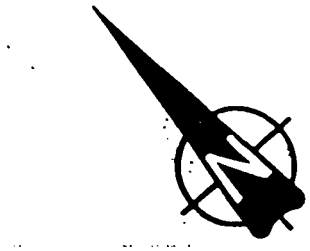
COMPLETED: 21/7/83

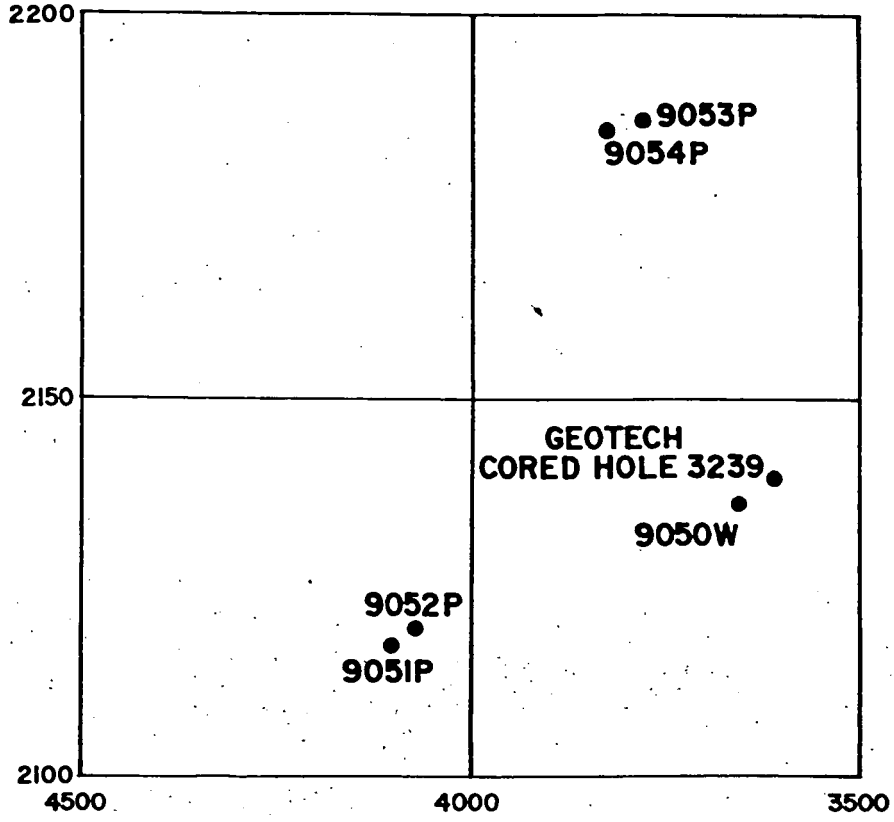
LOGGED BY: D.R. EDWARDS

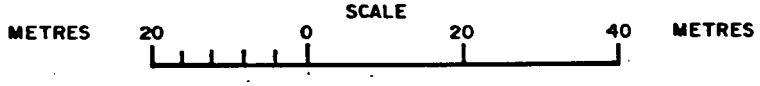
DATE: 21/7/83

APPENDIX 3

		Plan No.
U/27 Site Well Location		S17453
Composite log	9050W	83-510
	9051P	83-511
	9052P	83-515
	9053P	83-512
	9054P	83-514
Summary Cuttings Logs	9050W	
	9051P	
	9052P	
	9053P	
	9054P	
905W Caliper Logging		S17454







For all SADME Well Unit No's see appendix 6

APPENDIX 3

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED D.E.B D.A.	CDO DATE
LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION	DRAWN G.B.	SCALE 1:1000
U/27 SITE WELL LOCATIONS E.T.S.A. 'K' GRID	DATE 19 JUL 84	PLAN NUMBER S17453
	CHECKED	

3291

5201

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA
ENGINEERING DIVISION

COMPOSITE WELL LOG - GROUNDWATER

WELL 6537-1nOW00532
UNIT No.
PERMIT No. 02894
PLAN No. 83-510
E.T.S.A. WELL No. 9050W

PROJECT: LEIGH CREEK LOBE B UPPER SERIES DEWATERING
LOCATION: K2136-45/3966-65
SECTION: HUNDRED:
REFERENCE ELEV. 192-37(T.O.C.)m A.H.D. LOGGED BY: D.R.EDWARDS

LOG SYMBOLS
- CASING SEAL
- WIREWOUND SCREEN
- SLOTTED CASING
- GRAVEL PACKED INTERVAL
- K HYDRAULIC CONDUCTIVITY (m/day, Estimated)

CONSTRUCTION DETAILS

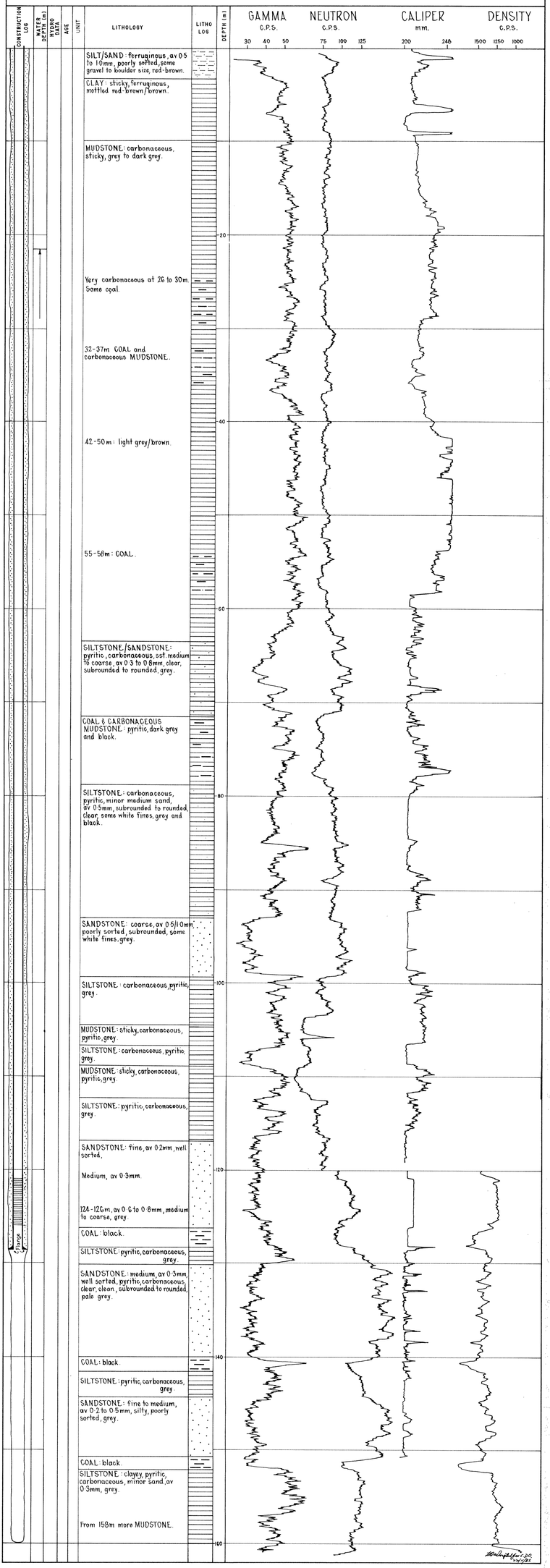
DRILLING TECHNIQUE: ROTARY
CIRCULATION: MUD (To 129m)-AIR (129m to 160m)
START: 29-7-83 FINISH: 5-8-83 TOTAL DEPTH: 160m.

	mm.	FROM (m)	TO (m)
HOLE DIAMETER	381	0	128
	199-8	128	160
CASING DIAMETER	203 I.D. CHEMLINE	+0-78	12-1
	203 I.D. CHEMLINE	126	128 (open)
SCREEN DETAILS	203 I.D. Stainless steel (2mm aperture)	12-1	126

TYPE OF LOG	16in. NORMAL	64in. NORMAL	6ft. LATERAL	CALIPER	CALIPER	NEUTRON	GAMMA	DENSITY
DATE OF RUN				After jetting	Before jetting	2-8-83	8-8-83	8-8-83
FIRST READING					150-6	16-1	160-5	160-5
LAST READING					0-4	1	0	120
RECORDED BY				A. Young	D. R. Edwards			

DEPTH TO WATER	TOTAL DISSOLVED SOLIDS mg/L	Analysis No.	DATE
21-55 T.O.C.	14,270		5-8-83
15-8-83			

REMARKS:
SITE 3.
Wells logged twice: 1. 0-129m.
2. 160 - 120m.



3229

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA
ENGINEERING DIVISION

COMPOSITE WELL LOG - GROUNDWATER

WELL UNIT No. 653747m0W00537
PERMIT No. 92895
PLAN No. 83-511
E.T.S.A. WELL No. 9051P

PROJECT: LEIGH CREEK LOBE B UPPER SERIES DEWATERING
LOCATION: K2117-36/4010-79 (50m Radius from 3050W)
SECTION: HUNDRED:
REFERENCE ELEV. 132.80 TOC m A.H.D. LOGGED BY: D.R.EDWARDS

LOG SYMBOLS
- CASING SEAL
- WIREWOUND SCREEN
- SLOTTED CASING
- GRAVEL PACKED INTERVAL
- K HYDRAULIC CONDUCTIVITY (m/day, Estimated)

CONSTRUCTION DETAILS

DRILLING TECHNIQUE: ROTARY MUD RESISTIVITY:
CIRCULATION: MUD
START: 18-7-83 FINISH: 19-7-83 TOTAL DEPTH: 164m

	mm.	FROM (m)	TO (m)
HOLE DIAMETER	150	0	164
CASING DIAMETER	50 Class 18 PVC	+0.40	163
	Limatex seal at 145m		Cement 145-125m
SCREEN DETAILS	Slotted PVC	145	151
	Baute wrapped		

TYPE OF LOG	16in. NORMAL	64in. NORMAL	6ft. LATERAL	SELF POTENT.	CALIPER	NEUTRON	GAMMA	DENSITY
DATE OF RUN						19-7-83		
FIRST READING					162.5	164.5	164.5	164
LAST READING					0.6	0	1	1
RECORDED BY						D.R. Edwards		

DEPTH TO WATER	TOTAL DISSOLVED SOLIDS mg/L	Analysis No.	DATE
23.34 TOC	14000 (approx)		
8-8-83			

REMARKS: SITE 3.

GAMMA C.P.S. 40 50 60 | NEUTRON C.P.S. 75 100 125 | CALIPER mm. 150 154 | DENSITY C.P.S. 1500 1250 1000

CONSTRUCTION LOG | WATER LEVEL (m) | HYDRO USE | UNIT | LITHOLOGY | LITHO LOG | DEPTH (m)

GRAVEL & SAND: boulder gravel and medium sand, ferruginous, red-brown.

CLAY: gravelly, sticky, ferruginous, sandy, coarse, mottled yellow/red brown.

MUDSTONE: sandy, medium (av 0.3mm), some muscovite, carbonaceous, grey.

From 53-59m, some coal and very carbonaceous mudstone.

SILTSTONE: carbonaceous, pyritic grey/brown, minor sandstone, fine-medium, av 0.2-0.3mm.

SANDSTONE & MUDSTONE: sst., medium to coarse, av 0.8-1.0mm, rounded, carbonaceous, grey/brown.

COAL: black.

MUDSTONE: carbonaceous, sticky, pyritic, grey/brown.

SILTSTONE: carbonaceous, pyritic, grey/brown.

SANDSTONE: fine to medium, av 0.2 to 0.3mm, well sorted, pyritic, grey.

MUDSTONE: carbonaceous, and SILTSTONE, grey.

SILTSTONE: some white fines, carbonaceous, pyritic, grey.

94-96m, some SANDSTONE, av 0.2-0.3mm.

MUDSTONE: carbonaceous, sticky, grey.

SANDSTONE: medium to coarse, some milky grains, kaolinitic, av 0.3 to 1.0mm, grey.

MUDSTONE: sticky, carbonaceous, pyritic, grey.

SILTSTONE: carbonaceous, pyritic.

MUDSTONE: sticky, carbonaceous, grey.

SANDSTONE: medium to coarse, av 0.3-1.0mm, pyritic, mainly clear, some milky grains, grey/white.

Minor MUDSTONE at 120m.

SILTSTONE/SANDSTONE: av 0.3mm, pyritic, carbonaceous, grey.

SANDSTONE: fine to coarse, av 0.2 to 0.6/1.0mm, carbonaceous, pale grey. Minor MUDSTONE. 123m.

124-139m, coarse SANDSTONE, av 0.8 to 1.0mm, well sorted, pyritic, subrounded to rounded.

COAL & carbonaceous MUDSTONE: sticky, grey and black.

SANDSTONE: medium to coarse av 0.8mm, subrounded, to rounded, pyritic.

MUDSTONE/SILTSTONE & SANDSTONE: fine, av 0.3mm, clear, subrounded, pyritic, carbonaceous, grey.

Surrogel from above cement to surface

Cap

3291

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA
ENGINEERING DIVISION

COMPOSITE WELL LOG - GROUNDWATER

WELL UNIT No. 653747mØW00599
PERMIT No. 92975
PLAN No. 83-512
E.T.S.A. WELL No. 9053 P

PROJECT: LOBE B UPPER SERIES COAL DEWATERING
LOCATION: K 218635/3977791 (55m radius from 9050W).
SECTION: ..... HUNDRED: .....
REFERENCE ELEV. 191.76 m A.H.D. (T.O.C.) LOGGED BY: D. R. Edwards

LOG SYMBOLS
- CASING SEAL
- WIREWOUND SCREEN
- SLOTTED CASING
- GRAVEL PACKED INTERVAL
- K HYDRAULIC CONDUCTIVITY (m/day, Estimated)

CONSTRUCTION DETAILS

DRILLING TECHNIQUE: ROTARY MUD RESISTIVITY: .....
CIRCULATION: AIR
START: 28.7.83 FINISH: 29.7.83 TOTAL DEPTH: 102m

	mm.	FROM (m)	TO (m)
HOLE DIAMETER	150	0	102
CASING DIAMETER	50	+0.15	102
	Class 12 P.V.C.		
SCREEN DETAILS	Slotted P.V.C. 3mm slots	97	99

Linatex seal at 90m
Cement from 90-70m
Suregel from 70-Surface

TYPE OF LOG	16 in. NORMAL	64 in. NORMAL	6 ft. LATERAL	SELF POTENT.	POINT RESIST.	NEUTRON	GAMMA	DENSITY
DATE OF RUN							28/7/83	
FIRST READING							101.6	
LAST READING							0	
RECORDED BY							D.R.E.	

DEPTH TO WATER	TOTAL DISSOLVED SOLIDS mg/L	Analysis No.	DATE
21.44 T.O.C. 8/8/83	14,000 Approx.		

REMARKS: SITE 3
For Grain Size Analysis
Interval m to m
See plan No. .....

CONSTRUCTION LOG	WATER DEPTH (m)	HYDRO DATA	AGE	UNIT	LITHOLOGY	LITHO LOG	DEPTH (m)
Suregel from cement to surface					CLAY: Sticky minor gravel, ferruginous. Red/yellow brown.		
					GRAVEL: Clayey, boulder, sandy, medium, ferruginous. Red/yellow brown.		
					CLAY: Sticky minor gravel/sand, ferruginous. Red/yellow brown.		
					SAND: Medium ave. 0.3-0.5mm, subrounded, ferruginous, grey.		
					MUDSTONE: Sticky, carbonaceous, silty, pyritic. Grey brown.		
					30-32m some coal.		20
					SILTSTONE: Sandy ave. 0.3mm, subrounded to rounded, clean, carbonaceous. Grey.		
					SANDSTONE: Medium to coarse ave. 0.5mm subrounded to rounded, silty calcareous. Grey.		40
					COAL and CARBONACEOUS MUDSTONE: Grey and black.		
					SANDSTONE: Well sorted medium to coarse, ave. 0.5-0.8mm subrounded to rounded, silty. Grey, carbonaceous (pyritic).		
					MUDSTONE: sticky, carbonaceous, pyritic, grey. 63-65m minor siltstone. 66m some coal.		60
					SANDSTONE: Medium ave. 0.3mm to coarse ave 1mm, well sorted, clean, ferruginous, Subrounded to rounded. Grey. 73m some coal. 74-76m some fine gravel.		
					SILTSTONE: Pyritic, carbonaceous. Grey. 78-80m some coal.		80
					SANDSTONE: Fine ave. 0.2mm to fine gravel ave. 1mm. Well sorted subrounded to rounded, clean. Grey.		
					MUDSTONE/SILTSTONE: sticky, carbonaceous, pyritic. Grey.		
					COAL: Black.		
					SANDSTONE: Medium to coarse, ave. 0.5 to 0.8mm, subrounded to rounded, clean, well sorted. Grey.		100
					COAL: Black.		

GAMMA
0 20 40 60 80 100 120 140 160 c.p.s.

L.A. Wingfield for C.D.O. 20/10/85

3291

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA
ENGINEERING DIVISION

COMPOSITE WELL LOG - GROUNDWATER

WELL UNIT No.	653747m0W00581
PERMIT No.	92897
PLAN No.	83-514

E.T.S.A. WELL Nº 9054 P

PROJECT: LEIGH CREEK LOBE B UPPER SERIES DEWATERING
LOCATION: K.2185·27/3982·61 (55m radius from 9050W)
SECTION: .... HUNDRED: ....
REFERENCE ELEV. 191·76 (T.O.C.) m A.H.D. LOGGED BY: D.R.Edwards

LOG SYMBOLS
- CASING SEAL
- WIREWOUND SCREEN
- SLOTTED CASING
- GRAVEL PACKED INTERVAL
- K HYDRAULIC CONDUCTIVITY (m/day, Estimated)

CONSTRUCTION DETAILS

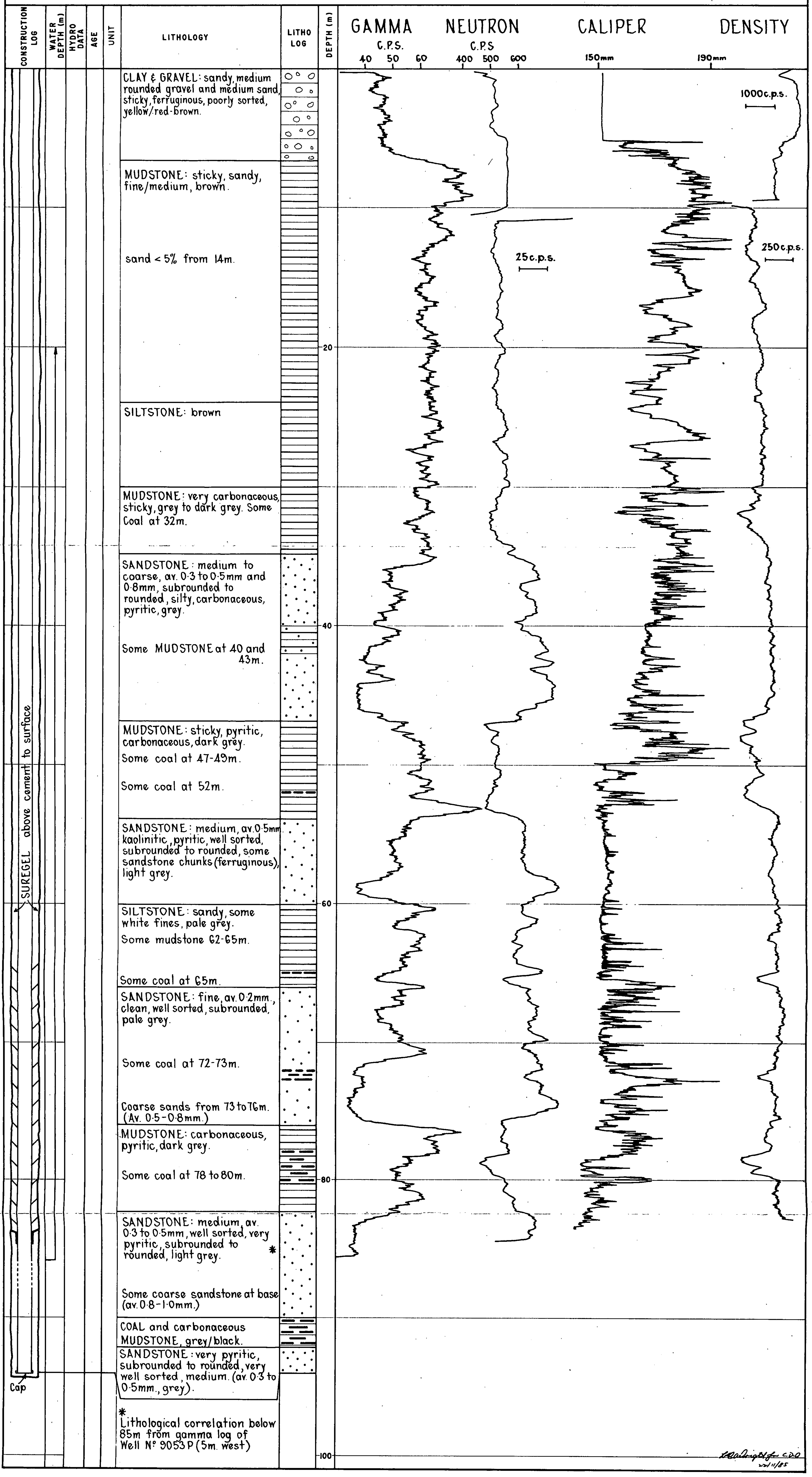
DRILLING TECHNIQUE: ROTARY MUD RESISTIVITY: ....
CIRCULATION: AIR
START: 27·7·83 FINISH: 28·7·83 TOTAL DEPTH: 94m

	mm.	FROM (m)	TO (m)
HOLE DIAMETER	150	0	94
CASING DIAMETER	50 (Class 18 P.V.C.)	+0·22	94
SCREEN DETAILS	3mm Slots	86	88
	Linatex seal at 84m - Cement from 84 to 64m		

TYPE OF LOG	16in. NORMAL	64in. NORMAL	6ft. LATERAL	SELF POTENT.	CALIPER	NEUTRON	GAMMA	DENSITY
DATE OF RUN						27·7·83		
FIRST READING					83·5	84·5	85·8	82·8
LAST READING					0·7	0	1	0
RECORDED BY						D.R.Edwards		

DEPTH TO WATER	TOTAL DISSOLVED SOLIDS mg/L	Analysis No.	DATE
19·93	14000		
T.O.C. 8·8·83	(approx.)		

REMARKS: SITE 3
For Grain Size Analysis
Interval m to m
See plan No. ....



PROJECT: Upper Coal Series Dewatering Lobe B
Leigh Creek

LOCATION OR COORDS: K. 2136.45/3966.65 (Production Well)

SEC. HD. EL Surface m EL Ref. Point 192.37 m Datum AHD

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: 9050 W

UNIT / ~~STATE~~ NO 6537-47nDW-532

DM PERMIT 92894

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:
		21,55 m TOC 15/8/83	121 SCREENED 128 open hole	126 160		16 hours	Air lifting.	14,270	W —

DEPTH (m) From	DEPTH (m) To	GRAPHIC LOG	ROCK / SEDIMENT NAME	GEOLOGICAL DESCRIPTION	FORMATION / AGE	DEPTH CORE SAMPLE
0	3		SLIT/SAND & GRAVEL	sand average 0.5 mm, gravel up to boulder sized, ferruginous, poorly sorted, red brown.		
3	10		CLAY	silty, mottled Red Brown.		
10	26		MUDSTONE	sticky carbonaceous grey		
26	30		COAL & carbonaceous MUDSTONE	grey		
30	63		Coal & carbonaceous MUDSTONE	grey		
63	71		SILTSTONE & SAND-STONE	pyritic, av 0.3/0.5 mm clear, grey.		
71	78		Coal & Mudstone	grey		
78	93		SILTSTONE	grey		
93	99		SANDSTONE	coarse av 0.5/1.00 mm poorly sorted grey		
99	116		MUDSTONE & SILT-STONE	grey		

CASING

Dia(mm)	From(m)	To(m)
200 ID Clemline	+0.78	128
Flanged shoe, at	128 m	
OPEN HOLE (199.8 mm DIAM)	128	160 m

REMARKS: SITE 3(U27)

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

*Annulus between casing and hole walls is gravel packed from flange at 128 m to surface, permitting aquifers above screen to contribute.

DRILL TYPE: ROTARY

CIRCULATION: MUD/AIR

SHEET 1 OF 2

COMPLETED: 5/8/83

LOGGED BY: D. EDWARDS

DATE: 29/7/83 30/7/83

PROJECT: Upper Coal Series Dewatering Lobe B Creek

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: 9051 P

UNIT / ~~STATE~~ NO 6537-47 mDW-537

LOCATION OR COORDS: K 2117.36/4010.79 (50 m radius from 9050 w)

EL Surface 192.41 m m

SEC. HD. EL Ref. Point 192.80 m m Datum AHD

DM PERMIT 92895

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:
		23.34 TOC 8/8/83	149 3 mm slots (guage wrapped)	151			AIR LIFTED UNTIL CLEAN	14,000 (approx)	W —

DEPTH (m) From	DEPTH (m) To	GRAPHIC LOG	ROCK / SEDIMENT NAME	GEOLOGICAL DESCRIPTION	FORMATION / AGE
0	2		GRAVEL & SAND	boulder gravel and medium sand av. 0.2/0.5 mm ferruginous, poorley sorted Red Brown	
2	9		CLAY	gravelly, sticky, ferruginous, sandy, mottled yellow and red brown.	
9	53		MUDSTONE	sandy (medium), carbonaceous, sticky, grey.	
53	59		COAL & MUDSTONE	sticky grey.	
59	64		SILTSTONE	pyritic, carbonaceous grey	
64	69		SANDSTONE/MUDSTONE	medium/coarse sandstone, carbonaceous pyritic mud-stone, grey	
69	71		Coal	black	
71	83		Mudstone/Siltstone	carbonaceous, pyritic grey brown.	
83	87		SANDSTONE	fine/medium av 0.2/0.3 mm grey.	
87	97		MUDSTONE & SILT-STONE	carbonaceous, pyritic, grey.	

DEPTH COPE SAMPLE

CASING

Dia (mm)	From (m)	To (m)
50 +0.04-163 class 18 PVC		

LINATEX SEAL AT 145 m

CEMENT FROM 145-125

SUREGEL from 125-0

REMARKS: SITE 3 (U27)

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

DRILL TYPE: ROTARY

CIRCULATION: MUD

SHEET 1 OF 2

COMPLETED: 19/7/83

LOGGED BY: D.R. EDWARDS

DATE: 18/7/83

PROJECT: Upper Coal Series Dewatering Lobe B Leigh Creek

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: 9052 P

UNIT / STATE NO: 6537-47mφW-538

DM PERMIT 92896

LOCATION OR COORDS: K 2119.46/4005.72 (45 m radius from 9050 w)

SEC. HD.

EL Surface 192.50 m

EL Ref. Point 192.741 m Datum AHD

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:
		23.025 m TOC	PVC 135	137 3 mm slotted (guage wrapped)			Air Lifted until clean	14,000 (approx)	W —

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	4		Gravel & Sand	boulder gravel and medium sand, poorly sorted, ferruginous red brown			50 class 18 PVC	+0.24	-144
4	6		CLAY	gravelly, (rounded), sticky, ferruginous mottled yellow/Red brown					
6	10		SAND	medium (av 0.5 mm) ferruginous, clayey, silty, Red Brown			slots	135	137
10	19		MUDSTONE & SILTSTONE	sticky, ferruginous, sandy grey					
19	55		MUDSTONE	sticky, carbonaceous, pyritic, grey/dark grey			slump	137	144
55	58		Coal & Carbonacous MUDSTONE	sticky, dark grey & black.					
58	65		Mudstone/Siltstone	sticky, carbonaceous, pyritic dark grey.			CINATEX SEAL AT 133 m		
65	70		SANDSTONE	medium to coarse, silty av 0.3/0.8 mm, carbonaceous pyritic grey.					
70	84		Coal MUDSTONE AND SILTSTONE	sticky, carbonaceous, pyritic grey brown.			CEMENT FROM 133 - 113 m		
					Suregel 113-0				

REMARKS: SITE 3 (U27)

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

DRILL TYPE: ROTARY

CIRCULATION: MUD

SHEET 1 OF 2

COMPLETED: 26/7/83

LOGGED BY D.R. EDWARDS

DATE: 25/7/83

PROJECT: Upper Coal Series Dewatering Lobe B Leigh Creek

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

LOCATION OR COORDS: K 2186.35/3977.91 (55m radius from 9050 W)

SEC. HD. EL Surface 191.61 m EL Ref. Point 191.76 (TOC) m Datum AHD

HOLE NO: 9053 P

UNIT / ~~STATE~~ NO 6537-47mDW-599

DM PERMIT 92975

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)	Method	TOTAL DISSOLVED SOLIDS milligrammes/litre	Analysis No:
		21.44 TOC 8/8/83	Slotted PVC (3mm slots) 97	99	At.... 40 m 1.6 l/sec 64 m 2.2 l/sec 86 m 5.7 l/sec 102 m 11.2 l/sec		Air Lifted While Drilling	14,000 (approx)	W —

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	2		CLAY	sticky minor gravel, ferruginous red/yellow brown.			50 class 12 PVC	+0.15	102
2	6		GRAVEL	clayey, (boulder) sandy ferruginous Red and yellow Brown.					
6	9		CLAY	sticky, minor gravel and sand ferruginous			SLOTS 97-99		
9	12		SAND	medium (av 0.3/0.5 mm), subrounded Red/yellow Brown ferruginous grey.			Slumps 99-102		
12	41		MUDSTONE & SILTSTONE	sticky carbonaceous, pyritic grey prown to grey. At 30 -32 m same COAL			BENTEX SEAL AT 90 m CEMENT FROM 90-70 m		
41	46		SANDSTONE	medium to coarse					
46	53		Coal & Carbonaceous MUDSTONE	sticky, pyritic, grey and black			SUREGEL 70-0		
53	60		SANDSTONE	medium to coarse av 0.5/0.8 mm, well sorted, subrounded, silty, carbonaceous pyritic grey.					

REMARKS: SITE 3 (U27)

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

DRILL TYPE: ROTARY

CIRCULATION: AIR

SHEET 1 OF 2

COMPLETED: 29/7/83

LOGGED BY: D.R. EDWARDS

DATE: 28/7/83

PROJECT: Upper Coal Series Dewatering Lobe B Leigh Creek

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

LOCATION OR COORDS: K. 2185.27/3982.61 (55 m radius from 9050 W)

SEC. HD.

EL Surface 191.61 m

EL Ref. Point 191.76 (TOC) m Datum AHD

HOLE NO: 9054 P

UNIT / ~~STATE~~ NO: 6537-47mϕW-581

DMPERMIT 92897

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:
		19.93 m (TOC) 8/8/83	86 (3mm slots)	88	11.2 (total cumulative Discharge)	3	Air Lifting While drilling	(14,000) approx.	W —

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	7		CLAY/GRAVEL	sandy, medium grave and sticky ferruginous clay yellow/Red Brown			50 Class 18 PVC	+0.22	94
7	35		Mudstone & SILTSTONE	carbonaceous, pyritic Brown to Dark grey			Slots 86-88		
35	47		SANDSTONE	medium to coarse, pyritic grey			LINATEX SEAL AT 84 m		
47	54		MUDSTONE & COAL	sticky grey					
54	60		SANDSTONE	medium, some sandstone chunks recovered, pyritic, well sorted light grey.			Cement from 84 m to 64 m		
60	66		SILTSTONE	carbonaceous, sandy pale grey (some coal 65 m)					
66	76		SANDSTONE	fine to coarse clear, well sorted pale grey (some coal 72 - 73 m).			Suregel from 64 - surface		
76	82		MUDSTONE	carbonaceous, pyritic sticky, grey.					
82	90		SANDSTONE	medium to coarse well sorted, pyritic light grey.					
90	92		COAL & MUDSTONE	sticky grey/black					
92	94*		SANDSTONE	medium, well sorted grey.					

REMARKS: SITE 3 (U27)

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

*Hole inadvertently drilled 2 m in to next aquifer, however a 1.51 m head difference is maintained between this hole and adjacent 9053 P completed in 92-101 m aquifer (indicating no contact)

DRILL TYPE: ROTARY

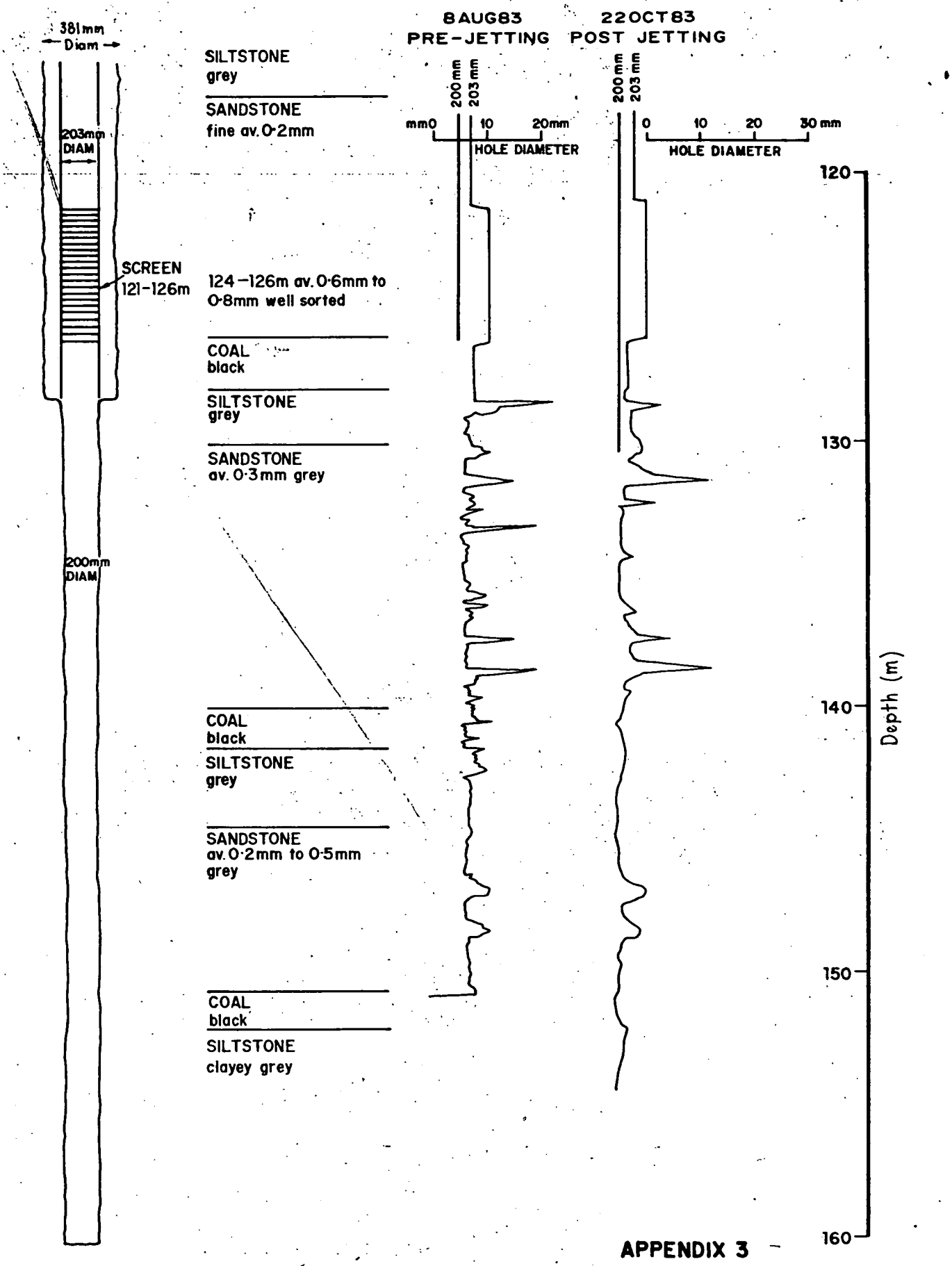
CIRCULATION: AIR

SHEET 1 OF 1

COMPLETED: 28/7/83

LOGGED BY: D.R. EDWARDS

DATE: 27/7/83



APPENDIX 3

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED D.E.B D.A.	AJ CDO 7/11/85 DATE
LEIGH CREEK COALFIELD LOBE B GROUNDWATER INVESTIGATION	DRAWN G.B.	SCALE
9050W WELL UNIT NO. 653747n0W00532 CALIPER LOGGING	DATE 20 JUL84	PLAN NUMBER S17454
	CHECKED	

3291

APPENDIX 4

A.M.D.E.L. Report

The Australian
Mineral Development
Laboratories

Flemington Street, Frewville,
South Australia 5063
Phone Adelaide 79 1662
Telex AA 82520

Please address all
correspondence to
P.O. Box 114 Eastwood
SA 5063
In reply quote:

Your Ref:

amdel

4 July 1983

GS 1/4/0

12.02

Director-General,
Department of Mines & Energy,
PO Box 151,
EASTWOOD, SA 5063.

Attention: D. Edward.

REPORT GS 6401/83

YOUR REFERENCE:	Application dated 15 June 1983
MATERIAL:	Four sandstone cores
LOCALITY:	Leigh Creek, South Australia
IDENTIFICATION:	A2330/83 Bore No. 3161 138.4-138.48 m A2331/83 Bore No. 3239 142.13-142.18 m A2332/83 Bore No. 3239 151.02-151.07 m A2333/83 Bore No. 3239 153.9 -153.95 m
DATE RECEIVED:	20 June 1983
WORK REQUIRED:	Brief petrographic description, identification of cementing material, porosity and permeability analysis

Investigation and Report by: Michael Till

Chief - Geological Services Section: Dr Keith J. Henley
Manager, Mineral and Materials Sciences Division: Dr William G. Spencer

Keith Henley

for Brian S. Hickman
Managing Director

jd/6

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ANALYSIS OF FOUR LEIGH CREEK CORE SAMPLES

1. INTRODUCTION

Four sandstone core samples were received from Mr N. Gerges of the South Australian Department of Mines & Energy with a request for brief petrographic description, identification of the cementing material and determination of the porosity and permeability of the samples.

2. PROCEDURE

2.1 Petrography

A transverse and a longtitudinal thin section was prepared for each sample (TSC40085-40092) using kerosene rather than water as the coolant.

2.2 X-ray Diffraction

The samples were air-dried at room temperature. A portion of each was powdered finely and used to prepare an X-ray diffractometer trace which was interpreted by standard procedures.

Further, weighed subsamples of samples A2330/83 and A2333/83 were taken and dispersed in water with the aid of deflocculants and an electric blender, and allowed to sediment to produce -2 μm e.s.d. fractions by the pipette method. The resulting dispersions were examined by plummet balance to determine their solids contents, and were then used to produce oriented clay preparations on ceramic plates. Two plates were prepared per sample, both being saturated with Mg++ ions, and one in addition being treated with glycerol. When air-dry, these were examined in the X-ray diffractometer. Various additional diagnostic examinations were carried out as required, including examination of the glycerol-free plate hot (∿130°C) and after heating for one hour at 550°C.

2.3 Core Analysis

Plugs of the samples were drilled under liquid nitrogen, fitted with lead sleeving and tested for porosity and gas permeability at ambient pressure.

3. RESULTS

3.1 X-ray Diffraction

Referring to the semi-quantitative abbreviations listed below the results are as follows:

Sample: A2330/83

Bulk Mineralogy:	Quartz	D
	Kaolinite	A
	Mica/illite	Tr
-2 μm Mineralogy:	Kaolinite	D
	Mica/illite	SD
	Quartz	Tr
	Montmorillonite	Tr

4.5% of the sample was found to separated into the -2 μm size fraction*

Sample: A2331/83

Bulk Mineralogy:	Quartz	D
	Kaolinite	A
	Halite	Tr

Sample: A2332/83

Bulk Mineralogy:	Quartz	D
	Kaolinite	A
	Mica/illite	Tr
	Halite	Tr

Sample: A2333/83

Bulk Mineralogy:	Quartz	D
	Kaolinite	A
	Mica/illite	Tr
	Pyrite	Tr
-2 μm Mineralogy:	Kaolinite	D
	Mica/illite	Tr-A
	Quartz	Tr
	Montmorillonite	Tr

1.5% of the sample was found to separate into the -2 μm size fraction*

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* As determined by the plummet balance. The figure obtained applies only to the pre-treatment and dispersion conditions used.

Semi-quantitative Abbreviations:

D = Dominant. Used for the component apparently most abundant, regardless of its probable percentage level.

CD = Co-dominant. Used for two (or more) predominating components, both or all of which are judged to be present in roughly equal amounts.

SD = Sub-dominant. The next most abundant component(s) providing its percentage level is judged above about 20.

A = Accessory. Components judged to be present between the levels of roughly 5 and 20%.

Tr = Trace. Components judged to be below about 5%.

3.2 Core Analysis

Sample	Bore No.	Depth	Permeability milli Darcys	K m/day	Porosity %
A2330/83	3161	138.4 - 138.48 m	5060	4.22	36.7
A2331/83	3239	142.13 - 142.18 m	4380	3.65	36.8
A2332/83	3239	151.02 - 151.07 m	3930	3.28	35.0
A2333/83	3239	153.9 - 153.95 m	3260	2.72	36.8

3.3 Petrography

Sample: A2330/83: TSC40085, 40086 #3161 138.4 - 138.48 m

Rock Name:
A kaolinitic well-sorted, medium-grained sandstone

Hand Specimen:
A medium-grey friable sandstone.

Thin Section:
The sample comprises a framework of fine to medium sand-sized, subrounded to well-rounded quartz grains with a matrix of argillaceous material.

The quartz framework grains range in size from 0.25 to 0.4 mm and consist predominantly of single crystals with a very few grains showing typical quartzite textures. Partially altered grains of K-feldspar occur in minor amounts and buff/olive tourmaline and detrital muscovite flakes occur in trace amounts.

The argillaceous matrix is stained brown and consists mainly of kaolinite with minor sericite. In only a very few pore spaces does it occupy the entire pore space, usually occupying less than 10% of the pore space or occurring as a thin coating on the quartz grains. The remaining potential pore space is void. Cementing of grains by authigenic quartz cement was not observed.

#3239

Sample: A2331; TSC40087-40088 142.13 - 142.18m

Rock Name:
A kaolinitic well-sorted, medium-grained sandstone

Hand Specimen:
A medium-grey friable sandstone.

Thin Section:
This sample consists of a framework of medium sand-sized, subrounded to well-rounded quartz grains with a matrix of finer-grained quartz and argillaceous material.

The quartz framework grains range in size from 0.25 to 0.4 mm and consist predominantly of single crystals. A minor number of grains consist of two or more grains cemented by quartz and a few quartz grains show marginal overgrowth. However, the cementation in each case is considered to have occurred before deposition. A very few grains with typical quartzite textures are also present. The few original feldspar grains now are altered to brown-stained grains of kaolinite, or kaolinite and sericite and opaques. These grains have been deformed by compaction of the surrounding quartz.

The argillaceous matrix is stained brown and consists of kaolinite occurring as a thin coating on the quartz grains. Small equant quartz grains 0.06 to 0.1 mm in size occupy part of the pore space in some areas. The remaining pore space is void. Cementing of grains by authigenic quartz was not observed.

3239

151.02 to 151.07m

Sample: A2332; TSC40089, 40090

Rock Name:
A kaolinite, well-sorted, medium-grained sandstone

Hand Specimen:
A medium-grey friable sandstone.

Thin Section:
This sample is very similar to sample A2330 as it comprises predominantly medium-grained detrital quartz grains in a matrix of argillaceous material.

The quartz grains vary in size from 0.2 to 0.55 mm and consist predominantly of single crystals, with a few grains consisting of cemented composite grains. A few deformed grains of brown-stained kaolinite or kaolinite, sericite and opaques are also present.

The argillaceous matrix consists of brown-stained kaolinite forming a thin coating on the quartz grains. The remaining potential pore space is void. Cementing of grains by authigenic quartz was not observed.

#3239
153.9 - 153.95 m

Sample: A2333; TSC40091, 40092

Rock Name:
A pyritic, kaolinitic well-sorted, medium-grained sandstone

Hand Specimen:
A medium-grey friable sandstone containing a few pyrite grains. The sandstone is not friable in the few areas containing pyrite cement.

Thin Section:
This sample consists of a framework of medium to coarse sand-sized, subrounded to well-rounded quartz grains with a matrix of argillaceous material and pyrite grains and a cement of pyrite.

The quartz framework grains range in size from 0.25 to 0.8 mm and consist predominantly of single crystals and with a very few quartzite grains. A very few grains show marginal overgrowth. A few deformed grains of brown-stained kaolinite are also present.

The matrix consists mainly of brown-stained kaolinite which occurs as a thin coating on the quartz grains and fills some of the smaller interstitial spaces. Small pyrite grains varying in size from 0.05 to 0.1 mm occur in the matrix. In addition, pyrite masses occur as overgrowths on quartz grains and pyrite fills interstitial spaces apparently at random, with adjacent pore spaces being free of pyrite. As observed using a stereo microscope, the pyrite does effectively cement the quartz grains in a few areas. The argillaceous matrix and mounting resin is stained yellow adjacent to these pyrite masses, and pale yellow crystals, probably derived from the alteration of pyrite, were observed in a few areas in hand specimen, but are not present in the area sectioned. Cementing of grains by authigenic quartz was not observed.

APPENDIX 5

Water Analyses

9010W	22/5/82	A.C.S. Laboratories
9010W	1/10/82	ETSA Laboratories
9040W	21/7/83	A.M.D.E.L.
9050W	8/8/83	A.M.D.E.L.
9020W	7/11/83	ETSA Laboratories
9050W	7/11/83	ETSA Laboratories

WATER ANALYSIS REPORT

SAMPLE No.

JOB No. A 4469 (A.C.S. LABORATORIES)

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	675	33.6
MAGNESIUM	(Mg)	480	39.5
SODIUM	(Na)	6600	287
POTASSIUM	(K)	37	1
IRON	(Fe)	-	-
ANIONS			
HYDROXIDE	(OH)	-	-
CARBONATE	(CO_3)	<1	-
BICARBONATE	(HCO_3)	70	1
SULPHATE	(SO_4)	3460	72
CHLORIDE	(Cl)	10220	288
FLUORIDE	(F)	-	-
NITRATE	(NO_3)	-	-
PHOSPHATE	(PO_4)	-	-

TOTALS AND BALANCE

CATIONS 361.1(me/ℓ) DIFF = 0.1

ANIONS 361 (me/ℓ) SUM = 722.1

DIFF 100 / SUM =

DERIVED AND OTHER DATA

	MILLIGRAMS PER LITRE mg/ℓ
CONDUCTIVITY (E.C.) MICRO-S/cm AT 25 DEG.C	
TOTAL DISSOLVED SOLIDS	
A. BASED ON E.C.	
B. CALCULATED (HCO_3=CO_3)	
C. RESIDUE ON EVAP. AT 180 DEG.C	21,560
TOTAL HARDNESS AS $CaCO_3$	
CARBONATE HARDNESS AS $CaCO_3$	
NON-CARBONATE HARDNESS AS $CaCO_3$	
TOTAL ALKALINITY AS $CaCO_3$	
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	

	UNITS
REACTION - pH	7.48
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	
SODIUM TO TOTAL CATION RATIO(me/ℓ)	

NAME - ETSA
ADDRESS LEIGH CREEK
DATE COLLECTED 22/5/82
SAMPLE COLLECTED BY: D.R. EDWARDS

FIELD TEMP. 12 °C
FIELD pH @ °C
FIELD COND. 14,000µ-S/cm

OBS. No. 9010 W
HOLE No.
D.M. No.

REMARKS Sample is from first development and probably includes same displacement water - (ATS >10,000 mg/l)

WATER ANALYSIS REPORT

SAMPLE No.

JOB No. (ETSA, LAB ANALYSIS)

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	280	14
MAGNESIUM	(Mg)	20	1.64
SODIUM	(Na)	2760	120
POTASSIUM	(K)	-	-
IRON	(Fe)	-	-
ANIONS			
HYDROXIDE	(OH)	-	-
CARBONATE	(CO_3)	-	-
BICARBONATE	(HCO_3)	490	8.03
SULPHATE	(SO_4)	400	8.33
CHLORIDE	(Cl)	4220	118.9
FLUORIDE	(F)	-	-
NITRATE	(NO_3)	-	-
PHOSPHATE	(PO_4)	-	-

TOTALS AND BALANCE

CATIONS 135.6 (me/ℓ)
ANIONS 135.2 (me/ℓ)

DIFF = 0.4
SUM = 231

$\frac{\text{DIFF } 100}{\text{SUM}}$ = 0.2

DERIVED AND OTHER DATA

CONDUCTIVITY (E.C.)
MICRO-S/cm AT 25 DEG.C 13,900

	MILLIGRAMS PER LITRE mg/ℓ
TOTAL DISSOLVED SOLIDS	8,170
A. BASED ON E.C.	
B. CALCULATED (HCO_3=CO_3)	
C. RESIDUE ON EVAP. AT 180 DEG.C	
TOTAL HARDNESS AS $CaCO_3$	
CARBONATE HARDNESS AS $CaCO_3$	
NON-CARBONATE HARDNESS AS $CaCO_3$	
TOTAL ALKALINITY AS $CaCO_3$	
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	

	UNITS
REACTION - pH	
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	

SODIUM TO TOTAL CATION RATIO(me/ℓ)

NAME - ETSA
ADDRESS LEIGH CREEK
DATE COLLECTED 1/10/82
SAMPLE COLLECTED BY: RER

FIELD TEMP. °C
FIELD pH @ °C
FIELD COND. µ-S/cm

OBS. No. 9010W
HOLE No. 6536OW254
D.M. No.

WATER ANALYSIS REPORT

SAMPLE No. W/4263/83

JOB No. 445/84 (AMDEL ANALYSIS)

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	515	25.7
MAGNESIUM	(Mg)	365	30
SODIUM	(Na)	4220	183.6
POTASSIUM	(K)	22	0.6
IRON	(Fe)	-	-
ANIONS			
HYDROXIDE	(OH)	0	0
CARBONATE	(CO_3)	0	0
BICARBONATE	(HCO_3)	311	5.1
SULPHATE	(SO_4)	2620	54.5
CHLORIDE	(Cl)	6269	176.8
FLUORIDE	(F)		
NITRATE	(NO_3)	<1	0
PHOSPHATE	(PO_4)	-	-

TOTALS AND BALANCE

CATIONS 239.8 (me/ℓ)
ANIONS 236.5 (me/ℓ)

DIFF = 3.4
SUM = 476.3

DIFF 100 / SUM = 0.7%

DERIVED AND OTHER DATA

	MILLIGRAMS PER LITRE mg/ℓ
CONDUCTIVITY (E.C.) MICRO-S/cm AT 25 DEG.C	
TOTAL DISSOLVED SOLIDS	
A. BASED ON E.C.	
B. CALCULATED (HCO_3=CO_3)	14165
C. RESIDUE ON EVAP. AT 180 DEG.C	
TOTAL HARDNESS AS $CaCO_3$	2788
CARBONATE HARDNESS AS $CaCO_3$	255
NON-CARBONATE HARDNESS AS $CaCO_3$	2533
TOTAL ALKALINITY AS $CaCO_3$	255
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	

	UNITS
REACTION - pH	7.7
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	
SODIUM TO TOTAL CATION RATIO(me/ℓ)	76.5%

NAME - ETSA
ADDRESS LEIGH CREEK
DATE COLLECTED 21/7/83
SAMPLE COLLECTED BY: D.R. EDWARDS

FIELD TEMP. °C
FIELD pH @ °C
FIELD COND. µ-S/cm

OBS. No. 9040W
HOLE No. Sampled Intervals
D.M. No. 145 to 150 and 157 to 169 m

WATER ANALYSIS REPORT

SAMPLE No. W/4265/83 JOB No. 445/84 (AMDEL ANALYSIS)

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	510	25.4
MAGNESIUM	(Mg)	365	30.0
SODIUM	(Na)	4270	185.7
POTASSIUM	(K)	26	0.7
IRON	(Fe)	-	-
ANIONS			
HYDROXIDE	(OH)	0	0
CARBONATE	(CO_3)	0	0
BICARBONATE	(HCO_3)	311	5.1
SULPHATE	(SO_4)	2680	55.8
CHLORIDE	(Cl)	6309	177.9
FLUORIDE	(F)		
NITRATE	(NO_3)	<1	0
PHOSPHATE	(PO_4)	-	-

TOTALS AND BALANCE

CATIONS 241.9 (me/ℓ)
ANIONS 238.8 (me/ℓ)

DIFF = 3.0
SUM = 480.7

$\frac{\text{DIFF } 100}{\text{SUM}}$ = 0.6%

DERIVED AND OTHER DATA

	MILLIGRAMS PER LITRE mg/ℓ
CONDUCTIVITY (E.C.) MICRO-S/cm AT 25 DEG.C	
TOTAL DISSOLVED SOLIDS	
A. BASED ON E.C.	
B. CALCULATED (HCO_3=CO_3)	14314
C. RESIDUE ON EVAP. AT 180 DEG.C	
TOTAL HARDNESS AS $CaCO_3$	2775
CARBONATE HARDNESS AS $CaCO_3$	255
NON-CARBONATE HARDNESS AS $CaCO_3$	2520
TOTAL ALKALINITY AS $CaCO_3$	255
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	

	UNITS
REACTION - pH	7.9
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	
SODIUM TO TOTAL CATION RATIO(me/ℓ)	76.8%

NAME - ETSA
ADDRESS LEIGH CREEK
DATE COLLECTED 8/8/83
SAMPLE COLLECTED BY: D.R. EDWARDS

FIELD TEMP. °C
FIELD pH @ °C
FIELD COND. µ-S/cm

OBS. No. 9050W
HOLE No. Sampled Interval
D.M. No. 121-151 m

WATER ANALYSIS REPORT

SAMPLE No.

JOB No. (ETSA LAB ANALYSIS)

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	336	16.8
MAGNESIUM	(Mg)	209	17.2
SODIUM	(Na)	3772	164.0
POTASSIUM	(K)	-	-
IRON	(Fe)	-	-
ANIONS			
HYDROXIDE	(OH)	-	-
CARBONATE	(CO_3)	-	-
BICARBONATE	(HCO_3)	482	7.9
SULPHATE	(SO_4)	1881	39.2
CHLORIDE	(Cl)	5388	152.0
FLUORIDE	(F)	-	-
NITRATE	(NO_3)	-	-
PHOSPHATE	(PO_4)	-	-

TOTALS AND BALANCE

CATIONS	(me/ℓ)	DIFF =
ANIONS	(me/ℓ)	SUM =

$\frac{\text{DIFF}}{\text{SUM}} \times 100$ =

DERIVED AND OTHER DATA

CONDUCTIVITY (E.C.)
MICRO-S/cm AT 25 DEG.C 16,400

	MILLIGRAMS PER LITRE mg/ℓ
TOTAL DISSOLVED SOLIDS	
A. BASED ON E.C.	12,076
B. CALCULATED (HCO_3=CO_3)	
C. RESIDUE ON EVAP. AT 180 DEG.C	
TOTAL HARDNESS AS $CaCO_3$	
CARBONATE HARDNESS AS $CaCO_3$	
NON-CARBONATE HARDNESS AS $CaCO_3$	
TOTAL ALKALINITY AS $CaCO_3$	
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	

	UNITS
REACTION - pH	6.96
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	

SODIUM TO TOTAL CATION RATIO(me/ℓ)

NAME -
ADDRESS
DATE COLLECTED 7/11/83
SAMPLE COLLECTED BY: ETSA

FIELD TEMP. °C
FIELD pH @ °C
FIELD COND. µ-S/cm

OBS. No. 9020W
HOLE No.
D.M. No.

WATER ANALYSIS REPORT

SAMPLE No.

JOB No.(ETSA LAB ANALYSIS)

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	492	24.6
MAGNESIUM	(Mg)	367	30.2
SODIUM	(Na)	4830	210.0
POTASSIUM	(K)	-	-
IRON	(Fe)	-	-
ANIONS			
HYDROXIDE	(OH)	-	-
CARBONATE	(CO_3)	-	-
BICARBONATE	(HCO_3)	305	5.0
SULPHATE	(SO_4)	3720	77.5
CHLORIDE	(Cl)	6665	188.0
FLUORIDE	(F)	-	-
NITRATE	(NO_3)	-	-
PHOSPHATE	(PO_4)	-	-

TOTALS AND BALANCE

CATIONS	(me/ℓ)	DIFF =
ANIONS	(me/ℓ)	SUM =

DIFF 100 / SUM =

DERIVED AND OTHER DATA

	MILLIGRAMS PER LITRE mg/ℓ
CONDUCTIVITY (E.C.) MICRO-S/cm AT 25 DEG.C	20,000
TOTAL DISSOLVED SOLIDS	
A. BASED ON E.C.	16,400
B. CALCULATED (HCO_3=CO_3)	
C. RESIDUE ON EVAP. AT 180 DEG.C	
TOTAL HARDNESS AS $CaCO_3$	
CARBONATE HARDNESS AS $CaCO_3$	
NON-CARBONATE HARDNESS AS $CaCO_3$	
TOTAL ALKALINITY AS $CaCO_3$	
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	

	UNITS
REACTION - pH	6.93
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	

SODIUM TO TOTAL CATION RATIO(me/ℓ)

NAME -
ADDRESS
DATE COLLECTED 7/11/83
SAMPLE COLLECTED BY: ETSA

FIELD TEMP. °C
FIELD pH @ °C
FIELD COND. µ-S/cm

OBS. No. 9050W
HOLE No.
D.M. No.

APPENDIX 6

Index of DME Well Unit Numbers

INDEX OF DME WELL UNIT NUMBERS

Site U/24

	UNIT NUMBER
9010W	6536-5aOW-254
9020W	6536-5aOW-426
9021P	6536-5aOW-331
9022P	6536-5aOW-332
9023P	6536-5aOW-333
9024P	6536-5aOW-319
9025P	6536-5aOW-320
9026P	6536-5aOW-300

Site U/25

9030W	6537-46rOW-573
9040W	6537-46rOW-598
9041P	6537-46rOW-578
9042P	6537-46rOW-579
9043P	6537-46rOW-570
9044P	6537-46rOW-571

Site U/27

9050W	6537-47nOW-532
9051P	6537-47mOW-537
9052P	6537-47mOW-538
9053P	6537-47mOW-599
9054P	6537-47mOW-581