COMMONWEALTH OF AUSTRALIA
DEPARTMENT OF NATIONAL DEVELOPMENT
BUREAU OF MINERAL RESOURCES,
GEOLOGY AND GEOPHYSICS

RECORDS 1960, No. 125

CORFIELD No. 1 BORE LOGGING, QUEENSLAND, 1960

by

F. JEWELL

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F. Jowett.

CONTENTS

ILLUSTRATIONS

ABSTRACT

The electric (single-point resistance, resistivity, and self-potential), gamma-ray, temperature, and caliper logs of Corfield Bore No. 1, to a depth of 2450 ft, are discussed with reference to formation boundaries and possible aquifers.

The positive self-potential recorded between 2375 and 2415 ft indicates a permeable sandstone whose interstitial water is less saline than the drilling fluid.

Shaly sandstone between 1680 and 1717 ft is highly radioactive and is a useful marker.

1. INTRODUCTION

The Corfield No. 1 Bore was drilled by W.L. Sides and Son, Pty.Ltd. for the Winton Shire Council. Drilling commenced in January 1960. The bore site is 200 yards north-west of the Corfield Railway Station, at grid reference 669287 on the Manuka 4-mile military map.

The bore was sunk to obtain a water supply of at least 1500 gallons per hour at as shallow a depth as possible. The hole was drilled to basement at the request of the Magellan Petroleum Corporation, and eventually reached 4300 ft.

Logging was done by the Bureau in response to an application by W.L. Sides and Son. The logging operations, which took place between 3rd March and 30th March 1960, were done by the author assisted by N.D. Jackson.

2. EQUIPMENT AND OPERATIONS

The equipment used was a Failing Logmaster, which provides electric, radiometric, temperature, and caliper logs. The various logs were made by using different probes, each probe being suspended on a shielded three-core cable which was raised and lowered in the bore hole by a power-driven winch. The curves were recorded on the paper chart of a recorder connected electrically through slip-rings to the cable.

The first logs (Run 1) were made on 3rd March to a depth of 1945 ft and the operations lasted 12 hours. The caliper became clogged with debris from the hole and failed to operate on this occasion. After the hole was drilled to 2511 ft, attempts were made on 12th, 15th, and 16th March to log the remainder, but blockages in the hole prevented the logging probes from reaching below 1780 ft; however, a caliper log was obtained from 1185 ft upwards. These attempts took 13 hours. Drilling was held up by a lost drill collar which was not recovered until 26th March, after which drilling was suspended so that the mud pit could be cleaned out. The hole itself remained full of mud. On lowering the drill pipe on 28th March the drill collar was again lost. It was recovered on 30th March and the hole was then logged (Run 2). Prior to this logging, therefore, the mud had not been circulated for several days. Evidently the weight of the mud column had prevented water from entering the hole, as there is no evidence of an abrupt change in mud salinity on the self-potential logs. The depth reached by the electric log on this occasion was 2450 ft. However, when the caliper was being lowered it opened spontaneously at 1350 ft; thus a caliper log was obtained only from 1350 ft upwards. Logging operations lasted 10 hours.

All logs were taken on a depth scale of one inch to 50 ft; in addition, the electric logs were taken on a scale of one inch to 20 ft. As the more detailed electric logs disclosed nothing which was not visible on other logs, they are not reproduced in this report.

The logging cable was found to stretch at the rate of 1 ft per 1000 ft; the depth counter was adjusted to compensate for this during logging.

Baling tests during the drilling showed that water would flow from a depth just below the casing (300 ft). After drilling to 1945 ft the flow increased and, after drilling reached 2511 ft, the flow increased further; 1600 gallons per hour could then be baled with a draw-down of 100 ft.

3. GEOLOGY

In this area, the northern part of the Channel Country in South-west Queensland, a thin cover of Tertiary sandstone overlies blue clay of the Winton Formation. The geological sequence is (Whitehouse, 1954):-

Tertiary	Eyrian Formation	
Cretaceous	Rolling Downs Group	Winton Formation (shale) Tambo Formation (shale) Roma Formation (shale)
	Blythesdale Group	Transition Beds Mooga Sandstone Fossil Wood Beds Gubberamunda Sandstone
Triassic	Bundamba Group	Boxvale Sandstone Evergreen Shale Precipice Sandstone

The Tambo and Roma Formations are marine and the Winton Formation is lacustrine.

The Blythesdale Group constitutes the uppermost series of aquifers of the Artesian Basin. Bore holes within twenty miles of Corfield have struck sub-artesian water in sandy beds within shale of the Rolling Downs Group between 2200 to 2900 ft. Artesian water has been encountered at about 4000 ft both at Corfield and at Winton, 52 miles south-west of Corfield.

The driller's log of the bore hole is shown in simplified form below:-

Depth	Rock Type
4 - 55 ft	Soft sandstone with yellow clay bands
55 - 536 ft	Blue shaly clay with a few thin hard sandstone bands
536 - 1706 ft	Grey mudstone with a few thin hard sandstone bands
1706 - 1716 ft	Grey sandstone
1716 - 1724 ft	Brown mudstone
1724 - 2378 ft	Grey mudstone
2378 - 2450 ft	Sandstone (mud circulation lost)

As no geological examination was made of the rock cuttings, the boundaries of the various formations cannot be marked. The rocks logged as mudstone and shaly clay are those referred to as shale in the geological sequence, and the yellow clay is derived from shale by weathering.

4. INTERPRETATION OF LOGS

(1) Electric Logs

Plates 1 and 2 show the resistivity and self-potential logs recorded on Runs 1 and 2. For the short-normal resistivity curve, the electrode spacing was 16 in., and for the long-normal resistivity curve, 63 in. The self-potential curve represents the natural potentials set up between the shale or clay, the drilling mud, and the permeable formations.

Plates 3 and 4 show, relative to an arbitrary base line, the resistance between a single electrode in the bore hole and an electrode in the mud pit at the surface. The variations are due to changes in resistivity of the formations in the immediate vicinity of the bore hole electrode.

The zones of higher resistivity between 300 and 500 ft, and between 1680 and 1717 ft (Plate 1) correspond to beds of shaly sandstone. The slight negative self-potentials registered opposite the beds between 300 and 500 ft suggest that the beds are permeable. The beds between 1680 and 1717 ft show no such self-potential feature, but the reason may be that the formation water was less saline than the drilling fluid. The salinity of the drilling fluid during Run 1 was equivalent to approximately 500 parts per million of sodium chloride according to the measured resistivity; the resistivity of the mud filtrate, assumed to be three-quarters that of the mud, was 6.2 ohm-metres at 91°F.

Larger resistivity and positive self-potential anomalies occur between 2375 and 2415 ft (Plate 2). This pattern is typical of a permeable sandstone containing water much less saline than the drilling fluid. As the mud was not circulated before Run 2, its resistivity could not be measured but it was probably less than that recorded before Run 1, because the mud had become thicker.

Assuming the formation water salinity to be 500 parts per million equivalent sodium chloride, the formation water resistivity at the temperature corresponding to this depth (about 135°F) would be 5.7 ohm-metres. The formation resistivity (39 ohm-metres on the long-normal curve) would then be consistent with a formation porosity of about 35 per cent, which is a reasonable value.

Several bands of sandstone about one foot thick are indicated by peaks on the single-point resistance log (Plates 3 and 4). Examples are at 659, 704, and 760 ft, and many others occur lower in the sequence. The bands are too thin to be registered adequately on the short-normal and long-normal curves because the electrode separations are greater than the bed thicknesses.

The self-potential log indicates a change from shale or clay with permeable sandstone to impermeable shale or mudstone at about 540 ft. This depth may represent the contact between the Winton and Tambo Formations, as the Winton Formation is known to include permeable sandstone to a much greater extent than the Tambo Formation.

Lower down, between 1500 and 1600 ft, a sharp change in self-potential occurs at slightly different depths on Plates 1 and 3 and is probably caused by a change in mud salinity due to gravitational segregation of the mud. It has no significance, therefore, in relation to changes in formation.

No depth can be given, from a study of the logs, for the top of the Blythesdale Group, although it is possible that the sandstone between 2375 and 2415 ft belongs to this group. However, sandstone beds are known to occur also in the basal part of the Roma Formation (Whitehouse, 1954, p.10).

Between 2415 and 2450 ft the electric logs indicate mainly shale or mudstone with bands of sandstone.

(2) Gamma-Ray logs

A comparison between the gamma-ray logs (Plates 5 and 6), the driller's log, and the electric logs shows that the sandstone beds are in general slightly less radioactive than the shale and mudstone. The two shaly sandstone beds between 1680 and 1717 ft are, however, more radioactive than the shale and are excellent markers for correlation with any future bores drilled in the area.

The radioactivity falls off above 300 ft owing to the shielding of the casing.

(3) Caliper Logs

The log taken on 15th March (Plate 9) shows that the shale has caved considerably, especially between 850 and 1100 ft. There is a pronounced cavity between 530 and 533 ft which corresponds roughly to the contact between the blue shaly clay and the grey mudstone logged by the driller. In the sandy beds above this depth the hole has retained its original diameter, which suggests that a mud-cake had formed there.

The narrow diameter at 510 ft is probably due to a partial blockage caused by debris falling across the hole.

The log taken on 31st March (Plate 10) shows the same variation in hole size as the previous log except that the blockages and the zones of "non-caving" had been reamed away. Pronounced caving is indicated between 1157 and 1267 ft, the shale or mudstone doubtless being more friable there.

(4) Temperature Logs

The log on Plate 7 was taken about 9 hours after mud circulation had ceased, and shows the temperature distribution along the mud column before the mud had reached the static temperature gradient of the formations. Some of the temperature differences can be correlated with changes in hole size; for instance between 1010 and 1023 ft, and between 1070 and 1100 ft the larger diameters of the hole contain a greater volume of mud which is cooler than the formations.

The log on Plate 8 shows the temperature distribution after the mud had reached temperature equilibrium with the formations. The changes in temperature gradient at 350 ft and 1350 ft cannot be correlated with changes in formation. The temperature distribution in depth is influenced by the geological structure of the region as a whole, and only in horizontal strata would the changes in temperature gradient be correlated in a simple manner with changes in formation.

5. CONCLUSIONS

The bore hole, to the logged depth of 2450 ft, penetrated clay, shale, mudstone, and sandstone of the Rolling Downs and, possibly, the Blythesdale Groups. The sandstone between 2375 and 2415 ft is a permeable aquifer containing water whose salinity is less than that of the mud column at the time of logging. The salinity of the mud was not measured, but the assumption of a reasonable value of 35 per cent for the formation porosity is consistent with a formation water salinity of 500 parts per million equivalent sodium chloride.

Formation boundaries disclosed by the logging differ slightly from those logged by the driller. The amended succession is -

300 - 540 ft	Clay or shale with permeable sandstone beds
540 - 1680 ft	Shale or mudstone with thin sandstone beds
1680 - 1717 ft	Sandstone
1717 - 2375 ft	Shale or mudstone with a few thin sandstone beds
2375 - 2415 ft	Permeable sandstone
2415 - 2450 ft	Shaly sandstone.

The sandstone between 1680 and 1717 ft has anomalously high radioactivity and is a good marker for correlating with formations in other bores in the area.

6. REFERENCES

WHITEHOUSE, F.W., 1954 - The geology of the Queensland portion of the Great Australian Artesian Basin. Artesian water supplies in Queensland, Appendix G. Qld. Govt. Committee, Great Artesian Basin, First Interim Rep. 1945.

COMPANY: WINTON SHIRE COUNCIL

AREA: SOUTH-WEST QUEENSLAND

WELL: GOFFIELD NO.1.

COUNTY: STATE: QUEENSLAND

CO-ORDINATES: N. E.

ELEVATION: 843' A.S.L. D.F. R.T. G.L.

PLATE 1

	Run No. 1	Run No.	Run No.	Run No. 2
Date	3 March 1960	Type of Fluid in Hole	Fresh	
First Reading	1945	Density		
Last Reading	301	Viscosity		
Footage Logged	1644	Fluid Loss	8.3 91	
Bottom (Driller)	1947	pH		
Casing (Front Log)	301			
Casing (Driller)	300	Circ. Temp.		
Casing Size (I.D.)	7 1/2"	Rm. Temp.		
Bit Size	7 3/8"			
Bit Size				

Logged by: F. Jewell & N. Jackson

Witnessed by:

REMARKS: Depths relative to Kelly Bushing, 1 ft. above ground level

— SELF-POTENTIAL + RESISTIVITY

10 mV/inch

SHORT NORMAL Ohm-metres 0 5

LONG NORMAL Ohm-metres 0 5 10

300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000

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COMPANY WINTON SHIRE COUNCIL

AREA SOUTH-WEST QUEENSLAND

WELL COORFIELD NO. 1

COUNTY STATE QUEENSLAND

LOCATION
N
S
ELEVATION 843' A.S.L.
D.F.
K.B.
G.L.

PLATE 2

	Run No. 1	Run No. 2
Date	30 March 1960	
First Reading	2450	
Last Reading	1900	
Footage Logged	550	
Bottom (Driller)	2511	
Casing (From Log)	-	
Casing (Driller)	-	
Casing Size (I.D.)	7 1/2"	
Bit Size	7 3/8"	
Bit Size		

MUD	Run No. 1	Run No. 2
Nature	Fresh	
Density		
Viscosity	@ °F	@ °F
Resistivity	@ °F	@ °F
Res. @ BHT	@ °F	@ °F
pH		
Circ. Temp.		
B.H. Temp.		
Logged by	E. Jewell &	
Witnessed by	E. Jackson	

REMARKS Depths relative to Kelly Bushing, 1 ft. above ground level
Well had been standing for 4 days without mud circulation

-SELF-POTENTIAL+ RESISTIVITY

10 mV/inch

SHORT NORMAL
Ohm-metres
0 10 20

LONG NORMAL
Ohm-metres
0 10 20 30

1900
2000
2100
2200
2300
2400

To accompany Records 1960 N°26 949

CHART NO. 240819 GEO. E. FAILING CO., ENID, OKLAHOMA

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PLATE 3

COMPANY	WINTON SHIRE COUNCIL	COORDINATES	
AREA	SOUTH-WEST QUEENSLAND	ELEVATION	843' A.S.L.
WELL	CORFIELD NO.1	D.F.	
COUNTY		K.B.	
STATE	QUEENSLAND	G.L.	

	Run No. 1	MUD	Run No. 1	Run No. 2
Date	3 March 1960	Nature	Fresh	
First Reading	1945	Density		
Last Reading	301	Viscosity		
Footage Logged	1644	Resistivity	8.3 @ 91 F	
Bottom (Driller)	1947	Resist. BHT		
Casing (From Log)	301	pH		
Casing (Driller)	300	Circ. Temp.		
Casing Size (I.D.)	7 1/2"	B.H. Temp.		
	7 3/8"			
Bit Size				
		Logged by	F. Jewell &	
		Witnessed by	N. Jackson	

REMARKS Depths relative to Kelly Bushing, 1 ft. above ground level

- SELF-POTENTIAL + SINGLE-POINT RESISTANCE

To accompany Records 1960, No 125

950

COMPANY WINTON SHIRE COUNCIL

AREA SOUTH-WEST QUEENSLAND

WELL CORFIELD NO. 1

COUNTY _____ STATE QUEENSLAND

COORDINATES
N
S
ELEVATION 843' A.S.L.
D.F.
K.B.
G.L.

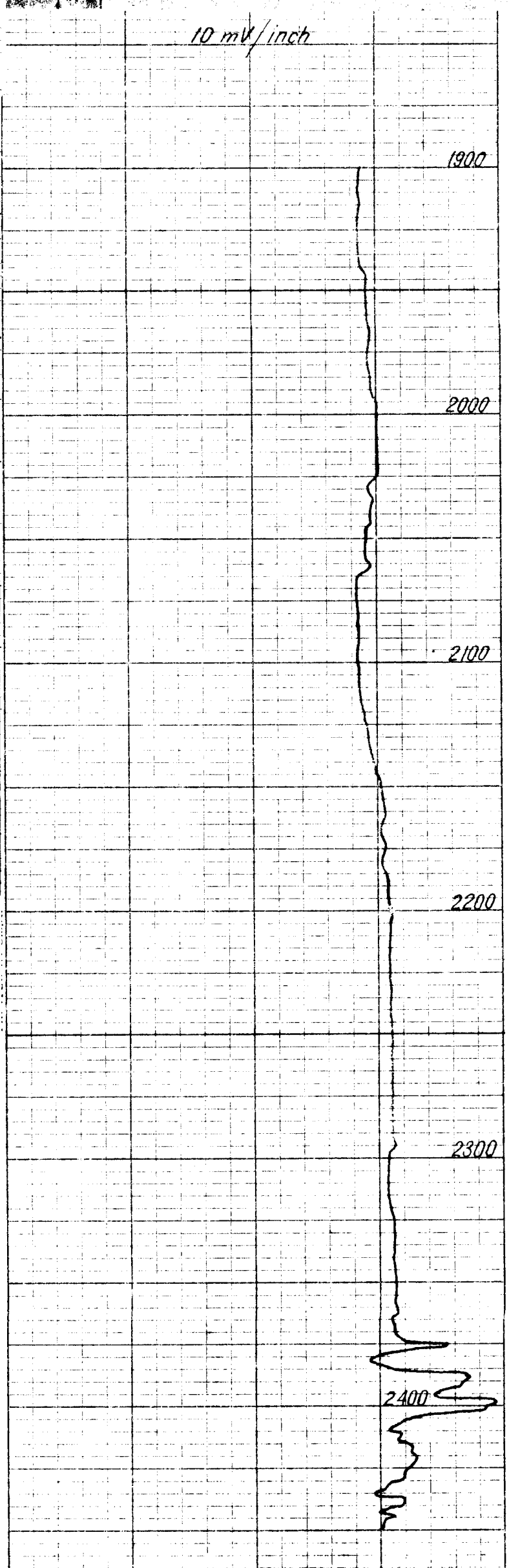
PLATE 4

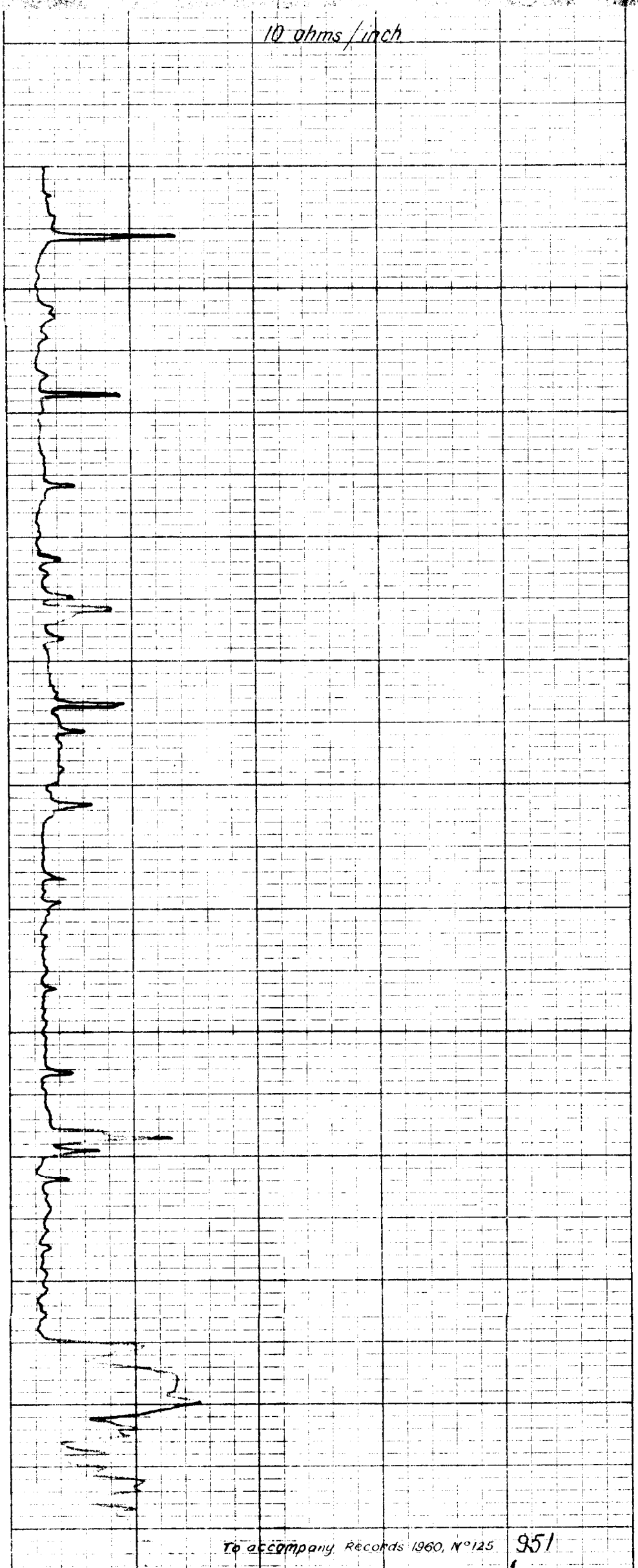
	Run No. 1	Run No. 2
Date	30 March 1960	
First Reading	2450	
Last Reading	1900	
Footage Logged	550	
Bottom (Driller)	2511	
Casing (From Log)	-	
Casing (Driller)	-	
Casing Size (I.D.)	7 1/2"	
Bit Size:	7 3/8"	
Bit Size:		

MUD	Run No. 1	Run No. 2
Nature		
Density		
Viscosity	@ F	@ F
Resistivity	@ F	@ F
Res. @ BHT	@ F	@ F
pH		
Circ. Temp.		
B.H. Temp.		
Logged by	F. Jewell &	
Witnessed by	N. Jackson	

REMARKS Depths relative to Kelly Bushing, 1 ft. above ground level
Well had been standing for 4 days without mud circulation

− SELF-POTENTIAL +	SINGLE-POINT RESISTANCE
10 mV/inch	10 ohms/inch





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To accompany Records 1960, N°125 951

COMPANY	WINTON SHIRE COUNCIL		COORDINATES N	PLATE 5
AREA	SOUTH-WEST QUEENSLAND		ELEVATION 843' A.S.L.	
WELL	CORFIELD NO.1		D.F.	
			K.B.	
COUNTY		STATE QUEENSLAND	G.L.	

	Run No. 1	Run No. 2	MUD	Run No. 1	Run No. 2
Date	3 March 1960		Nature		
First Reading	1950		Density		
Last Reading	45		Viscosity		
Footage Logged	1905		Resistivity		
Bottom (Driller)	1947		Res. @ BHT		
Casing (From Log)	-		pH		
Casing (Driller)	-		Circ. Temp.		
Casing Size (I.D.)	7 1/2"		B.H. Temp.		
Bit Size	7 3/8"				
Bit Size					
			Logged by	F. Jewell &	
			Witnessed by	N. Jackson	

REMARKS Depths relative to Kelly Bushing, 1 ft. above ground level

GAMMA-RAY LOG

To accompany Records 1960, No 125

952

COMPANY WINTON SHIRE COUNCIL

AREA SOUTH-WEST QUEENSLAND

WELL CORFIELD NO. 1

COUNTY STATE QUEENSLAND

COORDINATES N S

ELEVATION 843' A.S.L.
D.F.
K.B.
G.L.

PLATE 6

	Run No. 1	Run No. 2	Run No. 1	Run No. 2
Date	30 March 1960		Material	
First Reading	2400		Density	
Last Reading	1650		Viscosity	@ F
Footage Logged	750		Resistivity	@ F
Bottom (Driller)	2511		Resistivity @ BHT	@ F
Casing (From Log)	-		pH	
Casing (Driller)	-		Circ. Time	
Casing Size (I.D.)	7 1/2"		Max. Temp.	
Bit Size	7 3/8"			
Bit Size				
			Logged by	F. Jewell &
			Witnessed by	N. Jackson

REMARKS Depths relative to Kelly Bushing, 1 ft. above ground level

GAMMA-RAY LOG

Milli-roentgens / Hour

0 0·02 0·04 0·06 0·08

Time Constant 2 seconds

Logging Speed 40 ft./min

1900

2000

2100

2200

2300

2400

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AREA: SOUTH-WEST QUEENSLAND
WELL: CORFIELD NO. 1
COUNTY: STATE: QUEENSLAND

COORDINATES: PLATE 7
ELEVATION: 843' A.S.L.

	Run No. 1	Run No. 2
Date	3 March 1960	
First Reading	1955	
Last Reading	100	
Footage Logged	1845	
Bottom (Driller)	1947	
Casing (From Log)	-	
Casing (Driller)	-	
Casing Size (I.D.)	7 1/8"	
1st Size	7 3/8"	
2nd Size		

MUD	Run No. 1	Run No. 2
Nature		
Density		
Viscosity		
Resistivity	@ °F	@ °F
Fluid Loss	cc @ °F	cc @ °F
pH		
Corr. Temp.		
Bht. Temp.		

Logged by: F. Jewell & N. Jackson
Witnessed by:

REMARKS: Depths relative to Kelly Bushing, 1 ft. above ground level

TEMPERATURE LOG

PLATE 8

COMPANY: WINTON SHIRE COUNCIL
AREA: SOUTH-WEST QUEENSLAND
WELL: CORFIELD NO. 1
COUNTY: STATE: QUEENSLAND

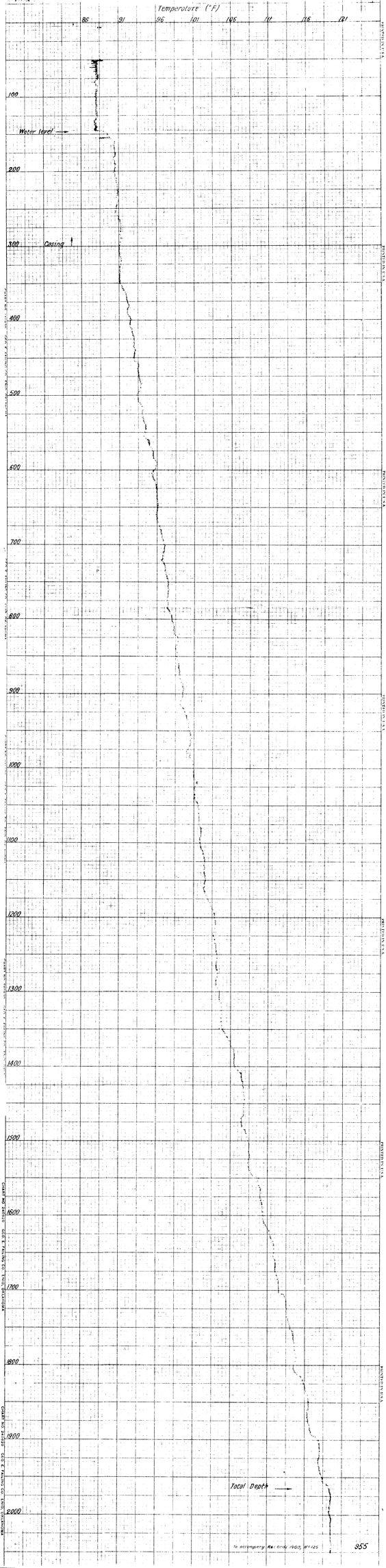
843' A.S.L.

Date	30 March 1960
Last Reading	1965
Last Reading	50
Footage Logged	1915
Surface (Driller)	2511
Casing (From Log)	-
Casing (Driller)	-
Casing Size (I.D.)	7 1/2"
Bit Size	7 3/8"
Bit Size	

Witnessed by: F. Jewell & N. Jackson

REMARKS: Depths relative to Kelly Bushing, 1 ft. above ground level

TEMPERATURE LOG



COMPANY WINTON SHIRE COUNCIL

AREA SOUTH-WEST QUEENSLAND

WELL CORFIELD NO. 1

COUNTY STATE QUEENSLAND

COORDINATES N

ELEVATION: 843' A.S.L.
D F
K B
G L

PLATE 9

	Run No. 1	Run No. 2	Run No. 3
Date	15 March 1960		
First Reading	1185		
Last Reading	50		
Footage Logged	1135		
Bottom (Driller)	2511		
Casing (From Log)	300		
Casing (Driller)	300		
Casing Size (I.D.)	7 1/2"		
Bit Size:	7 3/8"		
Bit Size.			
Logged by	F. Jewell & N. Jackson		

REMARKS Depths relative to Kelly Bushing, 1 ft. above ground level

CALIPER LOG

Diameter (inches)

2 4 6 8

Casing

Total Depth

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PLATE 10

COMPANY WINTON SHIRE COUNCIL

AREA SOUTH-WEST QUEENSLAND

WELL CORFIELD NO. 1

COUNTY _____ STATE QUEENSLAND

COORDINATES

ELEVATION 843' A.S.L.

	Run No. 1	Run No. 2		Run No. 1	Run No. 2
Date	31 March 1960				
First Reading	1350				
Last Reading	250				
Footage Logged	1100				
Bottom (Driller)	2511				
Casing (From Log)	300				
Casing (Driller)	300				
Casing Size	7 1/2"				
Bit Size	7 3/8"				
Bit Size					
			Logged by	F. C. Jewell &	
			Witnessed by	N. Jackson	

REMARKS Depths relative to Kelly Bushing, 1 ft. above ground level

CALIPER LOG

Diameter (inches)

2 4 6 8

Casing

300 400 500 600 700 800 900 1000 1100 1200 1300 1400

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957

COMPANY	WINTON SHIRE COUNCIL	COORDINATES	669287
AREA	SOUTH-WEST QUEENSLAND	ELEVATION	843' A S L
WELL	CORFIELD No 1	D F	
COUNTY	STATE QUEENSLAND	K B	
		G L	

PLATE II

	Run No. 1	Run No. 2	Mud	Run No. 1	Run No. 2
Date	3 MARCH 1960	30 MARCH 1960	Nature	Fresh	
First Reading	1925	2450	Density		
Last Reading	301	1925	Viscosity	@ F	@ F
Footage Logged	1624	525	Resistivity	8·3 @ 91 F	— @ — F
Bottom (Driller)			Res. @ B.H.T.	@ F	@ F
Casing (From Log)	301		pH		
Casing (Driller)	300		Circ. Temp.		
Casing Size (I.D.)	$7\frac{1}{2}$"		B.H. Temp.		
Bit Size:	$7\frac{3}{8}$"	$7\frac{3}{8}$"			
Bit Size:					
			Logged by	F JEWELL and	
			Witnessed by	N JACKSON	

REMARKS DEPTHS RELATIVE TO KELLY BUSHING, 1 FT. ABOVE GROUND LEVEL.

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics. 966

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