RB 61/82

DEPARTMENT OF MINES
SOUTH AUSTRALIA

CHOWILLA PROJECT

MATERIALS INVESTIGATION

DEVLIN POUND QUARRY SITE - GEOLOGICAL REPORT

by

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DEVLIN POUND QUARRY SITE - GEOLOGICAL REPORT

ABSTRACT

A quarry site at Devlin Pound has been explored by four diamond drill holes totalling 360 feet. in depth. Drilling shows that hard limestone occurs in thin bands in the upper 75 ft. of the sequence of shallow marine sediments. To recover this rock it would be necessary to remove more than five time its volume of unusable material.

INTRODUCTION

In a minute to the Chief Geologust dated 19th May 1964, (Ref. 1) the limestone deposits at Devlin Pound were listed as worthy of further investigation as a possible source of rip-rap for Chowilla Dam.

Devlin Pound is located on the right bank of the River Murray, near the Morgan-Barmera road, 65 miles by road from Chowilla Dam site. (Fig. 1)

Hard bands of rock are exposed in a cliff up to 100 ft. high which is interrupted in, many places by gullies.

The investigation consisted of:-

.....Mapping of a cliff section on a scale of 10 feet to one inch.

.....Four diamond drill holes totalling 360 ft. in depth.

.....Examination of the cliffs for several miles upstream and downstream of Devlin Pound.

GENERAL GEOLOGY

Devlin Pound is located in the Murray Basin on the right bank (north side) of the River Murray. Cliffs up to 130 ft. high on both sides of the river expose shallow water marine. Tertiary sediments of the Morgan Limestone unit (Ref. 2).

The succession between adopted R.L. 250 ft. and adopted R.L. 150 ft. is described below:-

AGE	UNIT NAME	INTERVAL	ROCK TYPE
LOWER MIOCENE	MORGAN LIMESTONE	0 - 75'	Interbedded, near-horizontal bands of bryozoal limestone, marl and sandy limestone from 0.5 to 4 ft. thick.
		75 - 100'	Bryozoal limestone with lenses of marl up to 1ft. thick.

TABLE 1

DESCRIPTION OF MATERIALS

MATERIAL	THICKNESS OF BEDS	COMPOSITION	QUALITY
Bryozoal limestone	1 to 4 ft.	Consists mainly of fossil bryozoal remains with up to 20% fine to medium quartz sand and some shelly fossils. Pale brown.	Very porous. Cores of 2 inch diameter can be easily broken by hand.
Sandy limestone-well cemented	0.5 to 2 ft.	Consists of up to 40% fine to medium sand in a matrix of dense crystalline limestone. Some shelly fossils in bands. Grey-brown.	Slightly porous. Cores of 2 inch diameter are not broken by a light hammer blow.
Sandy limestone - weakly cemented.	0.5 to 2 ft.	Consists of up to 60% fine to medium sand cemented by chalky lime in silt sizes. Some shelly fossils in bands. Pale grey.	Very porous. Cores of two inch diameter cannot be broken by hand but are easily broken by a light hammer blow.
Marl (Calcareous clay)	0.5 to 3 ft.	Consists of lime in silt and clay sizes with up to 20% of fine sand. No fossils. Light yellow-brown.	Soil properties.

DETAILED GEOLOGY OF THE SITE

The detailed section A-B was made to determine the thicknesses of the well-cemented sandy limestone beds which outcrop along the cliff. A reconnaissance of the cliffs for several miles in each direction was made to see if the material occurred elsewhere in thicker bands or with less overburden. It was found that the Section A-B area contained the thickest beds of hard limestone and this area was therefore explored by diamond drilling.

Four holes were drilled using a hydraulic feed machine with NMS coring equipment. The NMS core barrel is of the "M" type, with a stationary inner tube, and a bottom discharge bit. The inner tube was of the split type, ensuring minimum disturbance of the core during removal from the barrel.

Rock Types

Table 1 shows the thicknesses and compositions of the four types of material which were recovered in the drill holes. Core losses ranged from 20% to 30% even with the use of NMS coring equipment. It is considered that the materials not recovered must be very friable and weak.

Surface Weathering Effects

The well-cemented sandy limestone is relatively resistant to weathering and stands out in step-like bands in the side of the cliff (Fig.3).

The bryozoal limestone and the weakly cemented sandy limestone in the cliff commonly have a hard surface crust approximately $\frac{1}{4}$ inch thick, which has been formed by case-hardening. The surface of the bryozoal limestone is commonly pitted with cavities which extend up to one foot in from the face.

Groundwater

No water was encountered in the diamond drill holes, the

deepest of which ended at RL 137 feet. At this time the level of the river was at R.L. 145 ft.

QUALITY OF MATERIALS

Table 1 shows the physical properties of the different materials recovered as diamond drill core. Of these only the well cemented sandy limestone appears strong enough for use as rip-rap or aggregate. The average thickness of the hard limestone bands is about one foot. The drill holes showed a total thickness of 7 to 12 ft. of this material, in a total thickness of 60 to 75 ft. of material.

CONCLUSIONS

The investigation has shown that hard limestone occurs in thin bands which extend along the cliff for several miles and at least 500 ft. in from the cliff. To recover this rock it would be necessary to remove more than 5 times its volume of unusable material. The site should therefore be abandoned as a potential source of rock.

JPT:AWK
23.9.65

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REFERENCES

1. Minute to the Chief Geologist from the Senior Geologist, Engineering and Soils Geology Section, 19th May, 1964. D.M. 52/63.

2. Ludbrook, N.H. , 1961 - Stratigraphy of the Murray Basin in South Australia. Department of Mines, S.A. Bulletin 36.

APPENDIX A

LOGS OF DIAMOND DRILL HOLES

Hole No.	Dept. (ft.)	R.L.(Surface) (ft.)	Reference No.
1	60	234	S4071 G+J
2	100	249	S4211 G+J
4	100	237	S4162 G+J
5	100	248	S4163 G+J

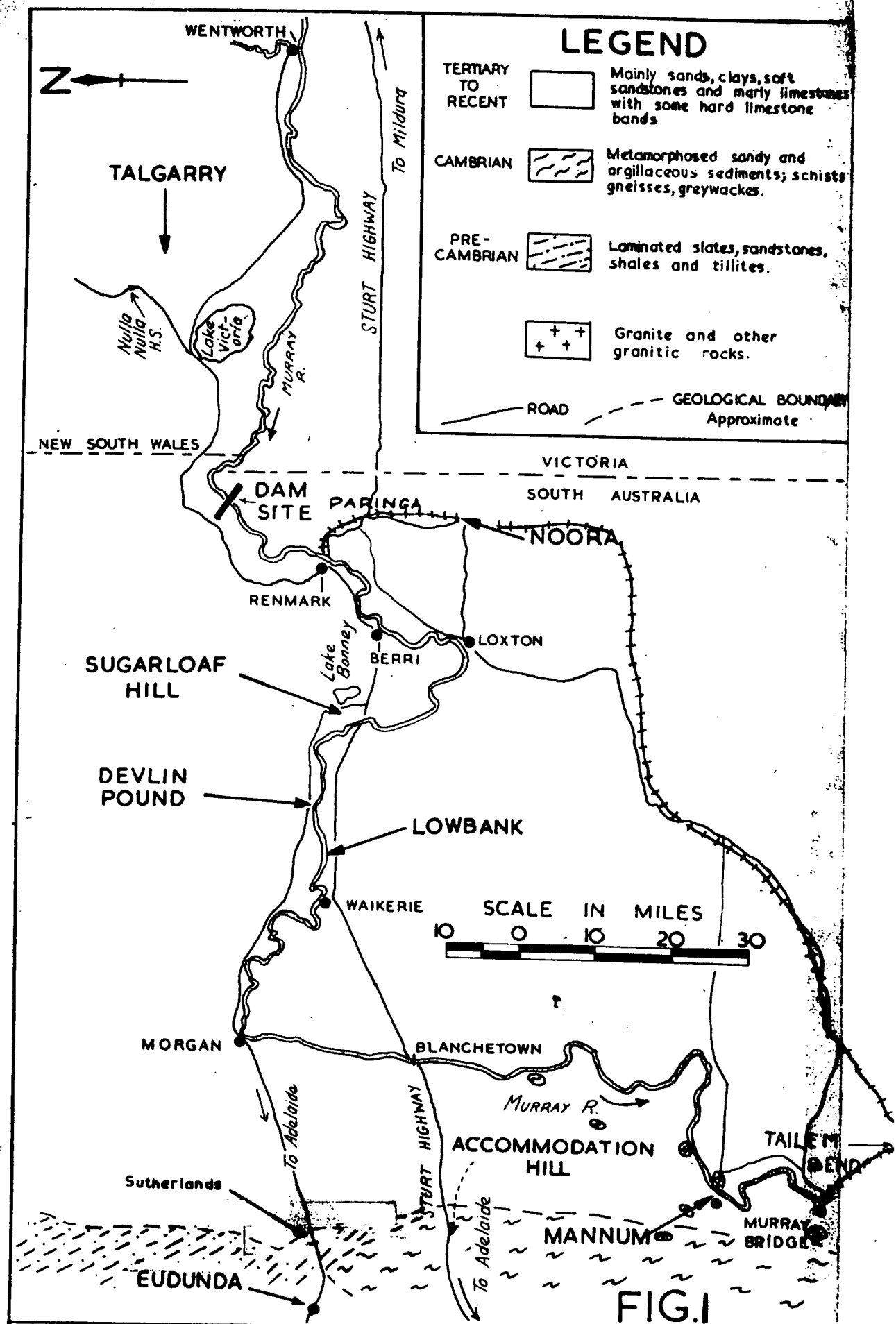
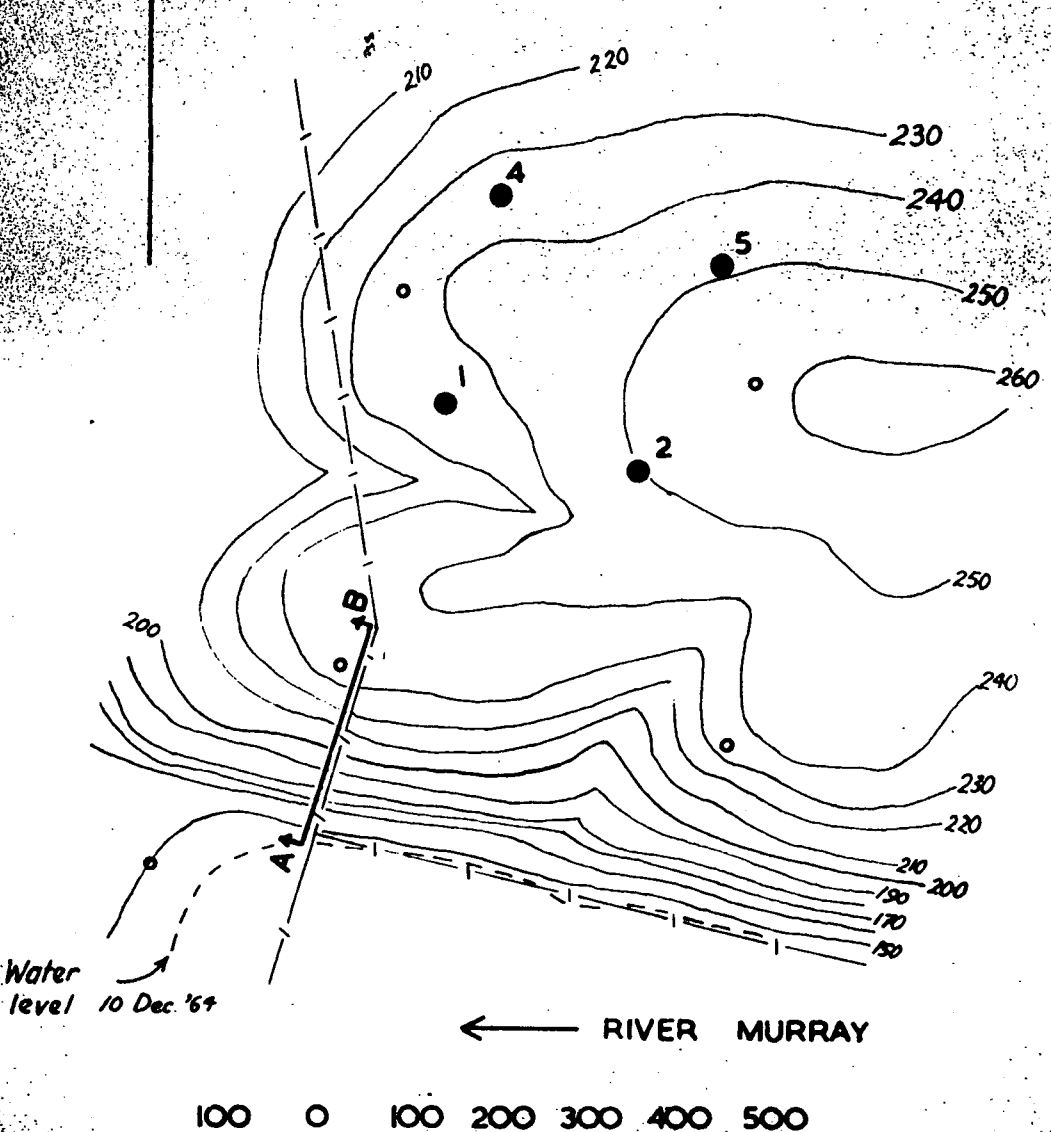


FIG.1

S.A. DEPARTMENT OF MINES

	Passed	Drn. J.P.I.	CHOWILLA PROJECT	D.M.	Scale 1: 1,000,000
		Tcd. J.P.T.		Req.	
		Ckd.	DISTRIBUTION OF POSSIBLE ROCK SOURCES		S 4076 G+J
		Exd.			Date 20 Jan '65



Survey R.E.A
S.F.B 319 Dec '64
Arbitrary Datum Adopted

LEGEND

- 2 — DIAMOND DRILL HOLE
- GEOLOGICAL SECTION
- 230 — CONTOUR. INTERVAL = 10 ft.
- FENCE
- SURVEY STATIONS

FIGURE 2

DEPARTMENT OF MINES — SOUTH AUSTRALIA

	Drn. REA	CHOWILLA PROJECT	SCALE: 1 inch = 200 ft.
	Tcd. J.P.T.	DEVLIN POUND QUARRY SITE	S 4161 G+J
	Ckd.	GEOLOGICAL PLAN	

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 1

GEOLOGICAL LOG OF DRILL HOLE

PROJECT CHOWILLA DAMSITE CO-ORDINATES — ADOPTED R.L. 234 FT

FEATURE RIP-RAP HUNDRED POOGINOOK DIRECTION —

LOCATION DEVLINS POUND SECTION — ANGLE FROM HORIZONTAL 90

ROCK TYPE (Degree of Weathering Shown in Core)	DESCRIPTION	R.L.	Depth and Size of Core	% Core	STRUCTURES	WATER LEVEL	WATER PRESSURE TEST GALLONS PER MINUTE LOSS
MORGAN LIMESTONE TERTIARY — Bryozoal and Sandy limestone with Marl bands	Slightly clayey		NX	67		NO WATER ENCOUNTERED	NOT WATER PRESSURE TESTED.
	slightly clayey	230	NMLC	85			
NO CORE			10	90			
		220		70			
NO CORE	Alternating bands of hard and soft slightly sandy, fossiliferous limestone. Bands averaging 2 ft thick, Cemented by $CaCO_3$, Pale brown colour, Varying from material that is breakable in hand to rock broken by light hammer blow. Soft bands tend to be more sandy and friable.	210	20	90	Bedding near horizontal. Joints mainly near horizontal, mainly 2 ft apart. Voids irregular, 5 to 20% of total volume. Porosity varying from slightly porous to very porous in soft slightly sandier layers.		
NO CORE				70			
NO CORE		200	30	65			
				100			
NO CORE			40	55			
NO CORE		190		55			
NO CORE			50	55			
NO CORE		180		70			
NO CORE	Not broken by light hammer blow		60	70			

END OF HOLE 60 FT

TEST PRESSURES SHOWN IN POUNDS PER SQ. INCH MEASURED AT GROUND SURFACE

Drill No. 5

Type E1000

Driller G. COOKE

Commenced 7 Dec 64

EXPLANATION

Harder bands usually only just broken by light hammer blow.

— Marl. Bryozoal limestone. Well cemented Sandy ...

Logged M.G. Mason

Date

Drawn M.G.M.

1 in. = 10 ft Vert. Scale

Sheet 1 of 1

S4071

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 2

GEOLOGICAL LOG OF DRILL HOLE

PROJECT CHOWILLA PROJECT CO-ORDINATES —

FEATURE RIP-RAP HUNDRED POOGINOOK

LOCATION DEVLIN POUND SECTION

ADOPTED R.L. 249 FT

DIRECTION —

ANGLE FROM HORIZONTAL 90°

ROCK TYPE (Degree of Weathering Shown in Core)	DESCRIPTION	R.L.	Depths and Size of Core	Loss	Left and Core Recovery	Core Lengths	STRUCTURES (Joints, Veins, Seams, Faults, Crushed Zones)	WATER LEVEL	WATER PRESSURE TEST GALLONS PER MINUTE LOSS 5 10
NO CORE			NXC						
	Bands of fossiliferous Sandy Limestone, Bryozoal Limestone and Calcareous Clay as shown.		10		20 100 100 100 70				NOT WATER PRESSURE TESTED.
NO CORE					85				
NO CORE			20		70				
NO CORE	Sandy Limestone Two types occur: (a) Well cemented with crystalline cement, sand grains up to 0·8 mm. form 30% of the volume, few fossils, not broken by light hammer blow.				90		Near horizontal bedding		
NO CORE			30		60				
NO CORE			NMS		75				
NO CORE			40		85		Voids up to 20% of volume in weakly cemented rock.		
NO CORE	(b) Weakly cemented with chalky lime sand grains up to 0·8 mm form up to 50% of volume, few fossils, readily broken by light hammer blow, very porous.				0				
NO CORE					95				
NO CORE			50		75				
NO CORE					45	0·2 to 0·3 ft. mainly			
NO CORE					85				
NO CORE	Bryozoal Limestone Consists mainly of fragmented fossil bryozoal remains up to 20% fine sand, core is mainly breakable by hand, very porous.		60		70				
NO CORE					100				
NO CORE			70		80	0·1 ft. to 1·0 ft.,			
NO CORE					85				
NO CORE	Calcareous Clay Low plasticity, high dry strength, some fine sand.		80		80				
					90				
			90		90				
					95				
			100						

END OF HOLE 100 ft.

TERTIARY — LOWER MIOCENE.

MORGAN LIMESTONE FORMATION. Interbedded Bryozoal Limestone, Sandy Limestone and Marl bands.

TEST PRESSURES SHOWN IN POUNDS PER SQ. INCH MEASURED AT GROUND SURFACE

WATER LEVEL (3 March '65) NO WATER IN HOLE.

Drill Nos. 5 & 7

Type E.1000.

Driller Cooke & Briggs

EXPLANATION

Weakly cemented } Sandy

Well cemented } limestone.

= = Clay

Logged M.G.M., J.P.T.

Date 27 Jan, 3 March '65

Drawn J.P.T.

1 in = 10 ft Vert. Scale

Sheet 1 of 1

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DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 4

GEOLOGICAL LOG OF DRILL HOLE

PROJECT	CHOWILLA DAM	CO-ORDINATES		ADOPTED R.L.	237 FT
FEATURE	RIP-RAP	HUNDRED	POOGINOOK	DIRECTION	— °
LOCATION	DEVLIN POUND	SECTION		ANGLE FROM HORIZONTAL	90°

Stratigraphy: MORGAN LIMESTONE FORMATION LOWER MIOCENE (TERTIARY) — Interbedded Bryozoal Limestone, Sandy Limestone and Marl bands

Core size / bit: NXC, NMS

Description:

Bands of fossiliferous Sandy Limestone, Bryozoal Limestone and Calcareous clay as shown.

Sandy Limestone. 2 types occur
(a) Well cemented with crystalline cement. Sand grains up to 0·8mm form 30% of the volume, few fossils, not broken by light hammer blow.
(b) Weakly cemented with chalky lime. Sand grains up to 0·8mm. form up to 60% of volume, few fossils, broken by light hammer blow, very porous.

Bryozoal Limestone. Weakly cemented, up to 20% fine sand, consists mainly of fossil bryozoal remains, core is breakable in hand, very porous.

Calcareous Clay. Low plasticity, high dry strength, some fine sand.

No core intervals marked at several depths (NO CORE).

Depth (ft) / R.L.: 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 / 230, 220, 210, 200, 190, 180, 170, 160, 150, 140

Core recovery (%): 30, 96, 75, 63, 88, 100, 50, 50, 70, 60, 75, 55, 70, 45, 95, 95, 95, 75, 95, 95, 90

Core lengths: Core lengths less than 1 ft. Lengths of well cemented Sandy Limestone from 0.5 to 1 ft., mainly 0.7 ft.

Structures: Core mainly breaks along horizontal bedding. Some horizontal joints.

Water level: NO WATER IN HOLE (3 Feb. '65)

Water pressure test (Gallons per minute loss 5, 10): NOT WATER PRESSURE TESTED

END OF HOLE. 100 ft.

TEST PRESSURES SHOWN IN POUNDS PER SQ. INCH MEASURED AT GROUND SURFACE

Drill No. 7
Type Mindrill E1000
Driller Briggs

EXPLANATION
Calcareous clay.
Bryozoal limestone
Fossils

Logged J.P.T.
Date 3 March '65
Drawn J.P.T.

1 in. = 10 ft. Vert. Scale
Sheet 1 of 1

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 5

GEOLOGICAL LOG OF DRILL HOLE

PROJECT CHOWILLA DAM — CO-ORDINATES — — — ADOPTED R.L. 248 FT

FEATURE RIP-RAP — HUNDRED POOGINOOK — DIRECTION —

LOCATION DEVLIN POUND — SECTION — ANGLE FROM HORIZONTAL 90°

DESCRIPTION	R.L.	Depth and Size of Core	Loss	Lift and Core rec'y	Core Lengths	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST GALLONS PER MINUTE LOSS
NO CORE		NXC						
Bands of fossiliferous Sandy Limestone, Bryozoal Limestone and Calcareous Clay as shown.	240	NMS		35		Core broken along near horizontal bedding.		NOT WATER PRESSURE TESTED.
NO CORE				100				
NO CORE	10			60	Less than 0.3 ft.			
NO CORE				95				
NO CORE	230							
Sandy Limestone Two types occur: (a) Well cemented with crystalline cement, sand grains up to 0·8 mm. form 30% of the volume, few fossils, not broken by light hammer blow.	20			80		Some horizontal joints.		
NO CORE				85	From 0.05 to 1 ft., mainly 0.4 ft.			
NO CORE	220			80				
NO CORE	30			75				
NO CORE	210							
NO CORE	40			15	Less than 0.2 ft.			
(b) Weakly cemented with chalky lime, sand grains up to 0·8 mm form up to 50% of volume, few fossils, readily broken by light hammer blow, very porous				75				
NO CORE	200			60				
NO CORE	50			55				
NO CORE					Hard limestone core 1 ft. lengths.			
NO CORE	190			75				
Bryozoal Limestone Consists mainly of fragmented fossil bryozoal remains, up to 20% fine sand, core is mainly breakable by hand, very porous.	60			55				
NO CORE				70	0.1 to 1.2 ft. mainly 0.2 ft.			
NO CORE	180			50				
NO CORE	70							
NO CORE				95				
Calcareous Clay Low plasticity, high dry strength, some fine sand.	170							
NO CORE	80			80				
NO CORE				70				
NO CORE	160							
NO CORE	90			65				
NO CORE					0.03 to 0.5 ft., mainly 0.2 ft.			
NO CORE	150			85				
	100	END OF HOLE 100 ft.						

LOWER MIOCENE (TERTIARY)

MORGAN LIMESTONE FORMATION

Interbedded Bryozoal Limestone, Sandy Limestone and Marl bands

NO WATER IN HOLE (5 Feb. '65)

TEST PRESSURES SHOWN IN POUNDS PER SQ. INCH MEASURED AT GROUND SURFACE

Drill No. 7

Driller Briggs

Type Mindrill E1000

EXPLANATION

Calcareous clay — c c Fossils

Bryozoal limestone

Well cemented) Sandy

Logged J.P.T.

Date 3 March '65

Drawn J.P.T.

1 in. = 10 ft. Vert. Scale

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