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Rept. Bk. No. 62/98
G.S. No. 3444
D.M. 480/66

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

ENGINEERING DIVISION

CHOWILLA PROJECT - SALINE WATER DISPOSAL TILMY FLAT COUNTY HAMLEY

GEOLOGICAL INVESTIGATION

PROGRESS REPORT NO. 1, MAY 1966

by

G. T. Roberts
Assistant Senior Geologist
ENGINEERING GEOLOGY SECTION

62/98

2nd May, 1966

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RB 62/98

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SOUTH AUSTRALIA

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DEPARTMENT OF MINES
SOUTH AUSTRALIA

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CHOWILLA PROJECT - SALINE WATER DISPOSAL TILMY FLAT COUNTY HAMLEY.

GEOLOGICAL INVESTIGATION

PROGRESS REPORT NO. 1, MAY 1966.

ABSTRACT

Low lying tracts of ground lying northwest of the Chowilla dam site are proposed for use as storage - evaporation basins for highly saline water produced in small quantities from excavations during construction of the dam and possibly in larger quantities for an unspecified period after construction is completed.

The area has been investigated by drilling and trenching to establish the geological sequence and to test the nature and thickness of clays lying close to the surface of the basins. The present static level of the groundwater under the general area has also been determined.

Various laboratory tests of the clays have been initiated and proposals made for further work including field tests and detailed geological mapping in key areas.

INTRODUCTION

Tilmy Flat is the name given to the general area lying to the northwest of the Chowilla dam site. This report covers the initial stages of an investigation into the feasibility of utilising approximately 20 square miles of low lying land for storage of highly saline water pumped from the dam site after construction and a smaller quantity during construction.

The areas likely to be flooded were roughly delineated by the E. & W.S. Department on the basis of the 275ft. contour as illustrated in Fig. 1. On the basis shown, large areas will be

covered by shallow water but several extensive depressions also exist, notably one near the western edge where the maximum water depth will exceed 50ft.

The feasibility of the salt-water storage project depends on a guarantee that no saline water will return to Chowilla Reservoir or, equally important, to the river downstream of the dam.

Two questions are, therefore, of prime importance:-

1. The ~~efficacy~~ efficiency of the various strata in preventing leakage from the saline ponds at Tilmy Flat either laterally or vertically.
2. The permeabilities of potential aquifers which may carry saline water back to the river valley.
3. The investigation, to date, has included:-
   .... a study of the general stratigraphy under the Tilmy Flat area, by means of 5 cored percussion holes totalling 471 feet.
   .... determination of the static levels of the main groundwater table by means of 17 rotary bores totalling 1,904 feet.
   .... trenching at 3 key locations to study the strata in detail down to about 15 feet.
   .... collection of samples from trenches and bores for laboratory tests.

This report discusses the geology of the area and appendices are attached which

.... record the participation of the C.S.I.R.O.

.... note further work to be done and outline possible field tests.

.... provide notes on cable tool drilling.

.... provide notes on rotary drilling.

REGIONAL GEOLOGY

These notes have been prepared from studies of the regional geology made by Dr. Ludbrook (Ref. 1) covering the stratigraphy to the close of the Tertiary and by J.B. Firman (Ref. 2) through the Quaternary Era to Recent times.

Sediments at depth in this part of the Murray Basin consist mainly of marine marls and siltstones (Pata Limestone and Bookpurnong Beds) overlain by estuarine and lacustrine sands and silts (Loxton Sands and Parilla Sands). By the close of the Tertiary Era the sea had receded from the Murray Basin and a prolonged period of weathering resulted in a hard silified cap on the Tertiary rocks.

During the ensuing Quaternary Era sedimentation took place under fluvio-lacustrine conditions. During part of this period a lake covered thousands of square miles in South Australia, Victoria and New South Wales and the Blanchetown Clay was deposited in this environment. The sedimentation closed with a drop in sea level which resulted in the erosion of the original, deeper valley of the Murray.

Recent times were marked by the deposition of wind blown sands, infill of the river valley with sands and silts to the present level and the development of the present meander system of the river.

Little structural deformation of the Murray Basin has taken place and the sediments are generally flat lying.

GEOLOGY OF TILMY FLAT

Physiography

The area known as Tilmy Flat forms part of the widespread Murray Basin plain and, as such, lacks any major relief.

The general plain level lies at about 275 feet, (E. & W.S. Chowilla Datum) with broad shallow lows commonly falling below 250 feet and, in one instance on Tilmy Flat, below 225feet. Minor relief above the plain consists of east-west trending dunes some of which rise to a level above 300feet.

Light to medium bush cover is widespread, except at lower elevations where large open areas are common.

For convenience, Tilmy Flat has been subdivided into five areas as illustrated in Fig. 1. Areas I, II and III comprise the low lying areas scheduled for flooding and Areas IV and V cover the important barrier zones between the saline ponds and the Chowilla reservoir.

General Stratigraphy

Tilmy Flat is almost completely devoid of natural exposures and although much of the early exploration for calcrete involved surface mapping techniques the current investigation to date has relied almost entirely on bores and trenches to establish the geology of the area.

Details of the succession are given in Table 1, and Fig. 2 illustrates in diagrammatic form a section across the area in a N.W. - S.E. direction.

Fig. 2 effectively illustrates the lateral variation of strata particularly in the Blanchetown Clay and Parilla Sand Formations. The formation boundaries are tentative but the overall succession is relatively well established.

Drainage

The Tilmy Flat area, in common with large areas of the Murray Basin has no developed drainage system. Runoff is confined

TABLE I

TILMY FLAT, GEOLOGICAL SUCCESSION

	AGE	FORMATION	RANGE OF THICKNESS	UNIFIED CLASSIFICATION	DESCRIPTION	MODE OF FORMATION	OCCURRENCE
QUATERNARY	Recent	Dune Sands	0 to 30ft.	S.W.	Fine to medium, red brown sands and calcareous sands	Wind blown	All areas but thin and rare at lower elevations
	"	Surface Soils	0 to 3ft.	S.M.	Mainly sands and silts. Often clayey and limy at lower levels. Fawn and brown.	Some wind blown but some elements washed in from higher levels.	Mainly covering depressions and areas without dunes.
	Pleistocene	Calcrete in BAKARA soil		G.P. and M.L.	'Ball' and sheet calcrete often associated with soft limy silt.	Hardened crust on loessal silt.	Substantial areas proved in Sub-Area IV Isolated pockets elsewhere.
	" "	BLANCHETOWN CLAY	0 to 35ft.	C.L. and C.H.	Mainly clays and sandy clays but containing interbedded clayey sands. Extremely disturbed and altered in places near surface.	Lacustrine	Intersected by all bores but may be locally very thin or absent in Sub Area I and II.
	"	PARILLA SAND	40 to 50ft.	S.P.	Mainly fine to medium clayey sands but often containing substantial clay horizons, Sands white and fawn, clays grey-green.	Lacustrine, and estuarine at depth.	Occurs generally at depth.
TERTIARY	LOWER PLIOCENE	LOXTON SANDS	100ft. plus	S.P.	Sands, coarse grained at top passing down into fine grained.	Estuarine	Occurs generally at depth.

to numerous small internal drainage basins.

Runoff has been observed in sheet form on the gentle slopes of the various sub-basins. Water collects temporarily in shallow ponds and may occasionally flow over short distances along interdune flats. The ponds normally persist for a few days only after rain, owing to the high evaporation rates and, in some areas at least, permeable conditions in the subsurface materials.

Natural drainage conditions have been modified near Tilmy, Mannum and Winack dams to induce rapid surface runoff. This has produced minor areas of shallow gullying but erosion has not been severe.

Early attention was drawn to the existence of large scale cracking of the surface soils in some areas, often accompanied by active areas of surface collapse covering many square yards. Old collapse areas are now represented by irregular depressions with a saucer shaped cross section often up to 3 or 4 feet deep.

These features occur in a variety of topographic locations but are most widespread on the lower areas and interdune flats. They are known locally as 'crab holes' and appear to have affinities with crabholes and gilgae structures noted elsewhere (Ref. 3) in swelling-type clays. 'Piping' in highly sodic clays used widely for the construction of earth dams (Ref. 4) may also be associated with this phenomenon.

Concern was expressed at an early stage that the 'crab holes' may be active drainage pipes or channels allowing water to percolate rapidly through the underlying clays and so, eventually, to the groundwater. Local reports suggested that surface runoff drained rapidly and continuously underground, but recent observations by Mines Department personnel have shown that rapid drainage continues for a short period only. When the immediate subsurface layers become saturated flooding of the ground surface takes place.

The recent observations took place following a prolonged dry period and it seems probable that insufficient water accumulated to thoroughly wet the soil profile to depth. Thus, although the ponds dried out within a few days, high evapotranspiration losses may have been a major factor in addition to percolation to deeper levels via pipes in the clays.

Alteration and structure of the Blanchetown Clay

The potential danger of piping was further reinforced by the inspection of cores of early percussion holes (G.77, 78, 79, 80). All the holes showed extensive veining of the upper clay horizons by sand suggesting that surface sands have been carried down into pre-existing cracks in the clay thus providing the environment for piping to proceed on a wide scale under a continuous head of water.

A trenching programme was undertaken to examine the clay horizons near the surface at three key locations (Trench 1 in Sub Area I, Trenches 2 and 3 in Sub Area II). The results of the trenches are presented in Figs. 3, 4 and 5 respectively.

In addition to a general confirmation of the drilling results the trenches reveal more clearly the shattered nature of the clays. The clays appear to have been subjected to a prolonged and complex period of structural alteration brought about by high differential pressures during drying and wetting to a considerable depth in the clay profile. This process also produced the flat lying faults which are illustrated in all three trench sections. The formation of the major sand dykes and pockets was controlled by the cracking of the clays during a dry period, but pressures generated by swelling of the clays during wet periods may account for the intimate and random nature of the finer sand veins.

Groundwater

Results of drilling to establish the static levels of the groundwater table are given on Fig. 1. The gradient of the water table is approximately 1ft. per mile in a S.W. direction.

Fig. 2 illustrates the relationship of the groundwater with the proposed levels upstream and downstream of the Chowilla dam.

Reliable salinities of the groundwater are not available but preliminary analyses confirmed the suspected high values. Dilution of the groundwater around each bore resulted from the use of water in both percussion and rotary holes and no further tests are proposed at present.

Summary of conditions in each sub area

Table 2 summarises by Sub Areas the main factors affecting the success of the salt water disposal project.

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ENGINEERING GEOLOGY SECTION

GTR:CLH
2nd May, 1966.

TABLE II

AREA	TYPE	EXPLORATION		GEOLOGICAL CONDITIONS	SPECIAL PROBLEMS
		DRILL HOLES	TRENCHES		
I	Storage basin	G78 G80	No. 1	'Crab holes', inactive and active present around G80 and Trench 1. Also developed elsewhere in local areas below 250ft. contour. Blanchetown Clay shattered and altered to base at 12ft.	Crucial area for side seepage problems through ridge of Sub Area V. Shortest leakage path at 250 contour (i.e. 25ft. head) about $\frac{3}{4}$ mile.
II	Storage basin	G87	No. 2 No. 3	Extensive 'crab holes' in all stages of development below 225 contour. Very thin, highly altered clay in Trench 2. No thick clay horizons to 100ft. in G87.	Maximum head at full flood level about 55feet. Possibility of conditions worse than shown in Trench 2 i.e. no clay near surface. Leaking water may penetrate quickly to groundwater table.
III	Storage basin	G79 G88 G89 G93 G94 G100	Nil	'Crab hole' development is widespread but intermittent. The drill holes record substantial thicknesses of clay, often at two levels.	No special problems. Leakage to groundwater is unlikely.
IV	Barrier area	G82 G83	Nil	This area includes much of the calcrete resource. Drill hole results show satisfactory clay profiles near the surface.	More drilling is desirable to prove the continuity of the clay barrier particularly in the saddle between G88 and G83.
V	Barrier area	G77 G84 G85 G86	Nil	Satisfactory clay profiles have been proved to exist in all four holes to a reduced level of at least 250 feet. Permeable sands lie below the clays.	Considerable doubt remains on the efficacy of this barrier to side seepage from Sub Area I. More mapping and core drilling is required.

REFERENCES

1. LUDBROOK, N.H., 1961. Geol. Surv. S.Aust. Bull. 36

2. FIRMAN, J.B., 1966, Pers. comm.

3. ALLCHURCH, P.D., 1965. Quart. Geol. Notes Geol. Surv. S.Aust, No. 14.

4. AITCHISON, G.D. and WOOD, C.C., 1965. Proc. 6th internat. Conf. Soil Mech.

APPENDIX 1

Participation of the C.S.I.R.O.

The two divisions of the C.S.I.R.O. concerned with soils were invited to advise on certain aspects of the project at Tilmy Flat as a result of the conditions found by trenching in the Blanchetown Clay in Sub Areas I and II. At this stage it became clear that a geological appraisal, however intensive, may be unable to prove the feasibility of using Tilmy Flat for surface disposal of salt water.

1. Division of Soils, Adelaide.

   Discussions were also held with Dr. Emmerson and as a result duplicate samples from the three trenches were submitted to him for laboratory tests. These tests are now complete and Dr. Emmerson has proposed a series of field tests. Details of these are given in Appendix 2.

2. Division of Soil Mechanics, Melbourne.

   Discussions were held with Drs. Aitchison and Woods on Tuesday 22nd March, 1966 and the Tilmy Flat area was inspected by aerial reconnaissance and on the ground on Wednesday 23rd March.

As a result of this the C.S.I.R.O. requested a series of tests on soil samples from the three trenches and this work was undertaken by AMDEL. The tests involve considerable laboratory work and full results are not yet available.

The C.S.I.R.O. also made suggestions for field tests and these are recorded in Appendix 2.

APPENDIX 2

Notes on further exploration and possible field tests.

A. Exploration

1. Geological mapping of the river cliffs along the edge of Sub Area V.
2. Detailed surface mapping of Sub Area I (and possibly, later, Sub Area II) with particular reference to features affecting drainage.
3. Stratigraphical drilling to elucidate the detailed geology of the barrier zone in Sub Area V.

B. Field Tests

1. Permeability tests as devised by the Division of Soils C.S.I.R.O. using large rings set
   (a) on the ground surface.
   (b) on the Blanchetown Clay.
2. The Division of Soil Mechanics C.S.I.R.O. suggested large scale field permeability tests using artificial lagoons. This idea has been amended by the E. & W.S. Dept. to utilise Sub Area I as an experimental area during the early construction phase of the dam.

APPENDIX 3

Notes on Cable Tool Drilling

Five holes (G77, 78, 79, 80 and 87) were drilled by this method. The first hole drilled (G78) was abandoned at 44 feet due to the loss of a sampling tube shoe but the remaining holes were carried down to the groundwater table.

Continuous tube sampling was attempted at each hole. Successful continuous samples, including sealed tubes at intervals, were obtained in the Blanchetown Clays but results in the loose strata of the Parilla sands were poor and, with the exception of Bore G80, only slush pump samples were obtained.

The samples were logged on site by the geologist using the Unified Soils Classification(1). Sealed tube samples were delivered to the Soils Laboratory of the E. & W. S. Department and the remaining cores and slush samples stored at the Chowilla construction camp.

Each of the holes to the groundwater is cased throughout. The hole position is indicated by a length of white casing above ground level. The casing is capped and marked with the hole number.

A summary of the holes is given in Table 3.

(1) United States Department of the Interior Earth Manual. Published 1961 Denver Colorado.

TABLE 3

SUMMARY OF CABLE TOOL HOLES

Number	Start	Finish	Total Depth Feet	Reduced Level		Depth to Water from		Reduced Static Water Level	Date	Remarks
				Surface	Casing	Surface	Casing			
G77	18 Jan.1966	2 Feb. 1966	145	287.76	292.99	124.67	129.90	163.1	30 Mar.	
G78	22 Dec.1965	23 Dec. 1965	44	-	-	-	-	-		Abandoned
G79	3 Feb. 1966	10 Feb. 1966	97	250.96	-	85.1	-	165.9	30 Mar.	
G80	10 Jan.1966	17 Jan. 1966	85	244.77	247.69	-	-	?		Hole silted
G87	11 Feb.1966	16 Feb. 1966	100	224.62	227.80	63.67	63.85	161.0	30 Mar.	

All reduced levels referred to E. & W. S. Chowilla datum.

APPENDIX 4

Notes on Rotary Drilling

Seventeen holes were drilled with a Mayhew rotary machine capable of using compressed air, water or mud to clear the hole of drill cuttings. A $4\frac{3}{4}$ inch diameter three-way blade bit (Hawthorne Insert) was used throughout for drilling the relatively soft strata in the Tilmy Flat area.

The procedure adopted was to drill using compressed air as long as the strata would stand without casing (i.e. normally well into the Parilla Sands). During this time drilling was continuous and samples of strata chippings blown back up the hole were collected over each foot drilled and laid out in sequence on the ground for inspection and logging by the geologist.

When the hole showed signs of collapsing a switch was made to mud drilling. This continued to a depth of 5-10 feet below the expected water level. Narrow tubing ($1\frac{1}{2}$ in I.D.), including 10 feet of slotted tube at the base, was then inserted, and the hole washed out with water to clear any remaining mud at, or below, the water table.

Strata identification proved difficult during mud drilling and with the exception of the first four rotary holes drilled (G88, 89, 90 and 91) no logs are given for this phase of drilling.

Each hole to the groundwater is marked by a length of the tubing painted white above ground level. The tubing is capped and marked with the hole number.

The position of the remaining shallow rotary holes is marked by white painted pickets showing the hole number.

Three holes may be noted as unsuccessful (G81, 85 and 90). This method of drilling, when mud is employed to secure the walls of the hole, is unsuited to accurate location of groundwater levels. The ultimate failure of the three holes may be attributed to non-availability of survey data at the time of drilling. A summary of the holes is given in Table 4.

TABLE 4

SUMMARY OF ROTARY DRILL HOLES

Number	Start	Finish	Total Depth Feet	Reduced Level		Depth to Water From		Reduced Static Water Level	Date	Remarks
				Surface	Casing	Surface	Casing			
G81	9 Mar.1966	11 Mar.1966	160	327.15	331.15	-	-	-	-	Not deep enough
G82	10 Mar.1966	11 Mar.1966	145	272.13	274.29	104.45	106.61	167.7	30 Mar.	
G83	12 Mar.1966	12 Mar.1966	155	267.92	269.29	102.18	103.55	165.7	30 Mar.	
G84	14 Mar.1966	14 Mar.1966	50	262.4	-	-	-	-	-	Strata exploration only.
G85	16 Mar.1966	16 Mar.1966	145	278.26	-	-	-	-	-	Hole collapsed at 110 feet.
G86	17 Mar.1966	17 Mar.1966	77	304.97	-	-	-	-	-	Strata exploration only.
G88	10 Feb.1966	17 Feb.1966	110	251.02	252.41	85.81	87.20	165.2	30 Mar.	
G89	18 Feb.1966	21 Feb.1966	110	261.31	263.21	97.9	99.8	163.4		
G90	22 Feb.1966	22 Feb.1966	110	280.82	-	-	-	-	-	Not deep enough
G91	23 Feb.1966	24 Feb.1966	154	283.23	284.73	121.66	123.16	161.6	30 Mar.	
G92	25 Feb.1966	1 Mar.1966	150	293.77	295.52	133.17	134.92	160.6	30 Mar.	
G93	1 Mar.1966	2 Mar.1966	120	255.29	256.81	90.60	92.12	164.7	30 Mar.	
G94	3 Mar.1966	3 Mar.1966	100	239.86	241.70	71.26	73.10	168.6	30 Mar.	
G95	4 Mar.1966	4 Mar. 1966	110	240.26	241.67	68.41	69.82	171.8	30 Mar.	
G96	5 Mar.1966	5 Mar.1966	110	253.50	254.84	84.66	86.00	168.8	30 Mar.	
G97	7 Mar.1966	7 Mar.1966	50	169.83	170.83	8.40	9.40	161.4	30 Mar.	
G100	17 Mar.1966	17 Mar.1966	52	254.00	-	-	-	-		Strata exploration only

All levels referred to P.F. & W.S. Chowilla Datum

477/66

CHOWILLA DAM — LOG OF CABLE TOOL HOLE

SALINE WATER DISPOSAL

TILMY FLAT

Co Hamley

HOLE NO G.77

SHEET 1 OF 2

R.L (Casing) 292.99 FT

R.L (Surface) 287.76 FEET

FEET	GRAPHIC	SYMBOL	DESCRIPTION	WATER	CONSIST. REL. DENS.	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	FIELD TEST DATA: PENETROMETER (Tons per sq. ft.) 3
0		SP	SAND poorly graded, fine to coarse grained, red-brown moderate dry strength.		Damp Loose		
10		SC / CL	SAND, excess clay fines, passing down into CLAY SOIL, low plasticity, sand in dykes and pipes — 50% at 7·5ft 10% at 10ft green grey.		Hard		> 4·5
20		SC	SAND poorly graded, grains up to 1·5mm. 20% clayey fines, grey to light brown. Moderate dry strength.				
30		CH	CLAY SOIL, high plasticity light green grey.		MC < PL		> 4·5
40		SC	SAND poorly graded, grains up to 1mm. excess clay fines.				
		CL	CLAY SOIL, low plasticity, sandy, mottled grey in mainly red base, limey patches. Becoming more sandy with depth.				> 4·5
50		SC / CL					131
60		SM	SAND fine to medium grained, excess silty fines (15%), poorly graded, Light red-brown to light yellow brown. Grains up to 0·8 mm. No dry strength Lumps of cemented sand up to 0·05 ft. form < 5% of volume.				Hole caving
70		SM ?	Slush pump samples are light brown. Material appears similar to above				Slush pump samples only
80							
90							
100		SP ?	SAND poorly graded, medium grained, some fines (nature and amount unknown) light brown to yellow brown.				

PLEISTOCENE — BLANCHETOWN CLAYS (LACUSTRINE)

Wind blown, dune sand. Lime disseminated and in patches.

Calcareous nodules

Vertical joints with rootlets common down to 10 ft.

Several joints, near-horizontal, slickensided.

Shattered structure

PLIOCENE — PARILLA SANDS (LACUSTRINE)

Quartz grains, mainly subrounded

Some siliceous cement

Quartz grains, mainly clear, subrounded.

TYPE OF SAMPLE	CONSISTENCY	REL. DENSITY	MOISTURE CONTENT	ENGINEERING GEOLOGY SECTION
A shoe (SA)	VS. — Very Soft	VL — Very Loose	H — Humid	LL — Liquid Limit
D " (SD)	S — Soft	L — Loose	D — Damp	PL — Plastic Limit
E " (SE)	F — Firm	C — Compact	M — Moist	≏ Near
G " (SG)	St. — Stiff	D — Dense	W — Wet	< Less than
Sealed Tube - A Shoe - SAL	V.St. — Very Stiff	VD — Very Dense	S — Saturated	> Greater than
Standard Penetration Test - SPT	H — Hard			<< Much less than

Water level, 7 May 65 (date) — Casing — WC Water cut

DRILL No. 9 — LOGGED J.P.T.

TYPE Ruston — DATE 3 Feb 66

DRILLER Farrow — DRAWN J.P.T.

START 18 Jan 66 — TRACED B.S.G.

FINISH 2 Feb 66 — CHECKED L.V.W.

DRG. No. S 5043 G+J

SERIAL No. 477/66

DEPARTMENT OF MINES — SOUTH AUSTRALIA

LOG OF CABLE TOOL HOLE

HOLE NO. G.77

SHEET 2 OF 2

PROJECT CHOWILLA DAM

FEATURE SALINE WATER DISPOSAL

LOCATION TILMY FLAT

SECTION

HUNDRED Co Hamley

CO-ORDINATES

R.L. (Casing) 292·99 Feet

R.L. (Surface) 287·76 FEET

SOIL TYPE GEOLOGICAL DESCRIPTION	R.L. (FEET) DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME (Unified Soil Classification. U.S.B.R. Earth Manual 1st. Edition 1963.)	WATER LEVEL CASING MOISTURE CONTENT	CONSISTCY REL. DENSITY	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	FIELD TEST DATA: SOIL TEST PENETROMETER qu (Tons per sq. ft) 1 2 3 4
LOXTON SANDS (ESTUARINE)	180							
	170							
	160							
	150							
	140							

SAND, poorly graded, medium grained, becoming slightly coarser with depth. Maximum grain size 1·5 mm.

SP

March '66 → 3 Feb '66

Some milky yellow & grey-blue grains.

Slush pump samples only

END OF HOLE 145 ft.

TYPE OF SAMPLE

A shoe (SA)
D " (SD)
E " (SE)
G " (SG)
Sealed Tube - A Shoe - SAL
Standard Penetration Test - SPT

Water level, → (date) 7 May 65 Casing
WC → Water cut

CONSISTENCY

VS. — Very Soft
S — Soft
F — Firm
St. — Stiff
V.St. — Very Stiff
H — Hard

REL. DENSITY

VL — Very Loose
L — Loose
C — Compact
D — Dense
VD — Very Dense

MOISTURE CONTENT

H — Humid
D — Damp
M — Moist
W — Wet
S — Saturated

LL — Liquid Limit
PL — Plastic Limit
≏ Near
< Less than
> Greater than
≪ Much less than

ENGINEERING GEOLOGY SECTION

DRILL No. 9 LOGGED J.P.T.
TYPE Ruston DATE 3 Feb '66
DRILLER Farrow DRAWN J.P.T.
START 18 Jan '66 TRACED B.S.G.
FINISH 2 Feb '66 CHECKED L.V.W.

DRG. No. S. 5043(a)

DEPARTMENT OF MINES — SOUTH AUSTRALIA

SERIAL No. 481/66

PROJECT CHOWILLA DAM

LOG OF CABLE TOOL HOLE

COUNTY HAMLEY.

FEATURE SALINE WATER DISPOSAL

LOCATION TILMY FLAT

CO-ORDINATES

HOLE NO. G79

SHEET 1 OF 1

R.L (Casing) ..... FEET

R.L. (Surface) 250.96 FEET

SOIL TYPE / GEOLOGICAL DESCRIPTION	R.L. (FEET) / DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION — GROUP NAME (Unified Soil Classification. U.S.B.R. Earth Manual 1st. Edition 1963.)	WATER LEVEL / CASING / MOISTURE CONTENT	CONSIST'CY REL. DENSITY	FIELD TEST DATA: BLOWS PER FOOT (20 40 60 80)	FIELD TEST DATA: SOIL TEST PENETROMETER qu (Tons per sq. ft) (1 2 3 4)
Pockets of chalky lime. Irregular slickensided structural faces; sand dykes as shown	250		SM SC	SAND poorly graded. fine to coarse grained, excess silt and clay (40%) red-brown, white patches				
	10		CL (SP)	CLAY SOIL, low plasticity, 5% to 15% fine to medium sand grains throughout, more sandy (40% to 60%) between 6 and 7 ft. light green, grey, yellow-brown mottled: Dykes of fine to medium sand up to 0.02 ft. wide, mainly near vertical.	H	M<<PL Hard		
PLEISTOCENE CLAY BLANCHETOWN (LACUSTRINE)	240		SC CL	SAND, fine to medium grained 40% to 50% clay, green grey, patches of red-brown sand as above. High dry strength.	D	C		
Shattered structure, polished faces on structural units. Core shows mainly horizontal cleavage below 21 ft. Near-vertical limonite stained joint. Very fine 'pipes' in places, limonite stained. Black manganese dioxide staining at 32.5 ft.	20					M<<PL Hard		
	230		CH	CLAY SOIL moderate to high plasticity, little or no sand, light green grey.				Not tested
Many joints, open to 1 m.m. limonite stained.	30							
	220							
	40			Limy CLAY, high plasticity.				
	210		SC to CL	SAND, fine to medium grained, 30-40% clay pale green grey, moderate to high dry strength. At 45-48 ft is CLAY, limy, high plasticity, rich in limonite at 47-49 ft. At 48-49 ft. CLAY SOIL, green grey, high plasticity with horizontal irregular band 3 m.m. thick of quartz sand SAND contains limonite fines, mottled appearance possible worm-tubes. Sludge samples from 52 to 97 ft. SAND medium grained up to 0.6 m.m.			DRILLED — SLUSH PUMP SAMPLES ONLY	
Mostly clear quartz grains, 0.2 to 0.6 m.m. limonite stained, some organic mottling.	50							
	200							
PLIOCENE PARILLA SANDS (LACUSTRINE)	60							
	190							
	70		SC SP					
	180							
	80							
	170				March '66			
	90							
	160			END OF HOLE 97 FEET.				

TYPE OF SAMPLE

- A shoe (SA)
- D " (SD)
- E " (SE)
- G " (SG)
- Sealed Tube - A Shoe - SAL
- Standard Penetration Test - SPT

Water level, (date) 7 May 65 — Casing

WC Water cut

CONSISTENCY

VS. — Very Soft
S — Soft
F — Firm
St. — Stiff
V.St. — Very Stiff
H — Hard

REL. DENSITY

VL — Very Loose
L — Loose
C — Compact
D — Dense
VD — Very Dense

MOISTURE CONTENT

H — Humid
D — Damp
M — Moist
W — Wet
S — Saturated

LL — Liquid Limit
PL — Plastic Limit
≃ Near
< Less than
> Greater than
<< Much less than

ENGINEERING GEOLOGY SECTION

DRILL No. 9 — LOGGED J.P.T.
TYPE RUSTON — DATE 3 FEB. '66
DRILLER FARROW — DRAWN J.P.T.
START 3 FEB. '66 — TRACED R.A.J.
FINISH 10 FEB. '66 — CHECKED DMS

DRG. No. S5044 G+J

DEPARTMENT OF MINES – SOUTH AUSTRALIA

HOLE NO. G80

SERIAL No. 472/66 LOG OF CABLE TOOL HOLE

SHEET 1 OF 1

PROJECT CHOWILLA PROJECT Hirer E. & W.S. DEPT

LOCATION TILMY FLAT County. HAMLEY

FEATURE DISPOSAL of SALINE WATER Depth 85 ft R.L. (Surface) ~~244.77~~ (Casing) 247.69 FEET.

SOIL TYPE GEOLOGICAL DESCRIPTION	CASING R.L. (FEET)	DEPTH (FEET)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME	CONSISTENCY REL. DENSITY	MOISTURE CONTENT	WATER LEVELS	PENETRATION DATA BLOWS/FOOT q_u tons/sq.ft (20 40 60 80 100 / 1 2 3 4)
PLEISTOCENE BLANCHETOWN CLAY: Few calcareous nodules, plant rootlets. Prismatic structure with polished faces on structural units.	240	10		SC / CL	SAND, poorly graded, excess clay fines increasing with depth, some silt, red-brown. Moderate to high dry strength. Few gravel fragments. CLAY SOIL, low plasticity, red-brown, mottled grey green, sand in dykes to 0.2 ft. wide — form 5 to 10% of volume.	Loose / Hard	Damp / MC < PL		>4.5
PLIOCENE (LACUSTRINE) PARILLA SANDS: Quartz grains, sub-rounded to subangular. Clay as coating on grains.	230	20		SP	SAND, poorly graded, fine to medium grained, yellow-grey, moderate dry strength, some clay (appr. 10%). Grains mainly less than 1 m.m. Band of CL-SC, grey-brown, from 28 to 29 ft., limonite stained cracks.	Compact / Dense	Humid		
Chert nodules. Mainly highly weathered. Shattered structure.	220	30		GP	Sample consists of GRAVEL fragments up to 0.1 ft. Clayey sand matrix. Medium dry strength.				
	210			SC-SP	SHALEY CLAY, brittle, low strength, unmouldable, floggy habit – easily broken into small prisms, sand and silt dykes green-grey.	Hard			
Quartz grains, mainly subrounded	200	40		SP	SAND, poorly graded, fine to medium grained, 15% clay, brown to grey. Medium dry strength decreasing with depth.				130 / 101
Few angular opal or chert fragments up to 5 m.m across.	190	50		SP	SAND, poorly graded, fine to medium grained, few fines, pale brown. No dry strength. Grains less than 1 m.m. Few rounded pellets of clay and clayey sand up to 20 m.m. Reddish brown and coarser grained below 55 feet. Few bands of clayey sand up to 2 cms thick.	Dense	Damp to humid	27 Jan '66 — 23 Feb '66 — LEVEL BELOW 85 FT MARCH '66	102
	180	60		SP to SC					
	170	70		SP	Dark red-brown				
	150	80							

85 ft. END of HOLE

TYPE OF SAMPLE	HYDROLOGY	CONSISTENCY	REL. DENSITY	MOISTURE
Open Tube	Water cut 83 ft.	VS-Very Soft	VL-Very Loose	H-Humid
Sealed Tube	Static level 83 ft.	S-Soft	L-Loose	D-Damp
Auger barrel	Supply	F-Firm	C-Compact	M-Moist
Slush pump	Analysis (p.p.m)	St-Stiff	D-Dense	W-Wet
Casing	← Water level. (Date)	VSt-Very Stiff	VD-Very Dense	S-Saturated
		H-Hard		

Plant No. 9 Logged J.P.T.

Type Ruston 22W Date 4 Jan. 66

Driller Christiansen Drawn J.P.T.

Started 10 Jan. '66 Traced G.F.J.M.

Finished 17 Jan '66 Checked DWS

PLAN No. S 5045 ± 1

Vertical Scale 1 in = 10 ft

SERIAL No. 482/66

DEPARTMENT OF MINES — SOUTH AUSTRALIA

LOG OF CABLE TOOL HOLE

HOLE NO. G87

SHEET 1 OF 1

PROJECT CHOWILLA DAM

FEATURE SALINE WATER DISPOSAL

LOCATION TILMY FLAT AREA

SECTION

HUNDRED COUNTY HAMLEY

CO-ORDINATES

R.L. Casing 228·80 FEET

R.L. (Surface) 224.62 FEET

SOIL TYPE / GEOLOGICAL DESCRIPTION	R.L. (FEET) / DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION / GROUP NAME (Unified Soil Classification, U.S.B.R. Earth Manual 1st Edition 1963.)	WATER LEVEL — CASING — MOISTURE CONTENT	CONSIST'CY REL. DENSITY	FIELD TEST DATA: BLOWS PER FOOT (20 40 60 80)	FIELD TEST DATA: SOIL TEST PENETROMETER qu (Tons per sq. ft) (1 2 3 4)
Surface sands	220		ML ↓ CL	CLAY, low plasticity, sandy silty and limey. Red-brown clay. Gravel up to 0·02 ft. 20% gravel, 10% sand 70% silt sizes. Medium dry strength.				
PLEISTOCENE ? BLANCHETOWN CLAY: SAND quartz grains with lime and clay. Sand clay and lime occur in pockets. 8 ft. to 9 ft moderately cemented lime. Possibly reworked.	10		SC	SAND, poorly graded, clayey Green sand, off-white lime and reddish-brown clay fines Medium grained sand up to 1m.m across.				
LIMESTONE, strongly? cemented, contains black organic matter.	210							
	20			Slush-pump samples are mainly sand with few rock fragments			DRILLED, SLUSH-PUMP SAMPLES 10 – 18 ft.	
	200		SP	SAND, poorly graded clayey fines. Grey to off white colour with 18 to 20 ft. Reddish brown. Approx. 5% clayey fines				
Sand is mainly quartz grains; coated with clay fines 18 ft to 20 ft	30							
PLIOCENE PARILLA SANDS (LACUSTRINE)	190							
	40							
	180							
	50							
	170			Medium grained with grains up to 1m.m. down to 55 ft., where sand grades into coarse grained; up to 2 m.ms. Sub-rounded.				
	60		SP					
	160							
? MIOCENE LOXTON SANDS (ESTUARINE)	70							
	150							
	80							
	140							
	90							
	130							
	100			END OF HOLE 100 FEET				

HUMID

MARCH '66

SLUSH-PUMP SAMPLES ONLY 26 – 100 ft.

TYPE OF SAMPLE	CONSISTENCY	REL. DENSITY	MOISTURE CONTENT	ENGINEERING GEOLOGY SECTION
A shoe (SA) D " (SD) E " (SE) G " (SG) Sealed Tube - A Shoe - SAL Standard Penetration Test - SPT	VS — Very Soft S — Soft F — Firm St — Stiff V.St — Very Stiff H — Hard	VL — Very Loose L — Loose C — Compact D — Dense VD — Very Dense	H — Humid D — Damp M — Moist W — Wet S — Saturated LL — Liquid Limit PL — Plastic Limit ≒ Near < Less than > Greater than ≪ Much less than	DRILL No. 9 TYPE RUSTON DRILLER FARROW START 11 FEB '66 FINISH 11 FEB '66 LOGGED M.C.B. DATE 25 FEB '66 DRAWN M.C.B. TRACED R.A.L. CHECKED J.W. DRG. No. S5106 G+J

Water level, 7 May 65 (date) — Casing — WC Water cut

DEPARTMENT OF MINES — SOUTH AUSTRALIA

SERIAL No. 961/66

LOG OF ROTARY HOLE

HOLE NO. G81

SHEET 1 OF 1

PROJECT CHOWILLA DAM

FEATURE SALINE WATER DISPOSAL

SECTION

LOCATION TILMY FLAT AREA

HUNDRED COUNTY HAMLEY

CO-ORDINATES

R.L. Casing 331.15 FEET

R.L. (Surface) 327.15 FEET

SOIL TYPE GEOLOGICAL DESCRIPTION	R.L. (FEET) DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME (Unified Soil Classification. U.S.B.R. Earth Manual 1st. Edition 1963.)	WATER LEVEL CASING MOISTURE CONTENT	CONSIST CY REL. DENSITY	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	FIELD TEST DATA: SOIL TEST PENETROMETER qu (Tons per sq. ft) 1 2 3 4
DUNE SAND, windblown, Several calcareous horizons as shown.	320			SAND, poorly graded fine to coarse grained, grains up to 2m.m., excess silt, up to 20% red-brown to pale brown.			NOT APPLICABLE	
	10		SM					
	310							
	20							
	300							
	30		SC	SAND, poorly graded, grains up to 2m.m., excess clayey fines, up to 20%, red-brown.				
			SM	SAND, poorly graded, grains up to 2mm. excess fines, mainly silty, clayey in parts, light brown.			AIR DRILLING	
	290							
	40							
Quartz grains mainly subrounded.			SC	SAND, poorly graded, grains up to 4m.m., excess clay, light red-brown.				
	280							
			SP-GP	SAND, poorly graded, grains up to 3.5 m.m, few fines above 45#, off-white. few fragments of clayey sand, may be from above.				
	50							
				END OF SAMPLES 50 FT. HOLE DEEPENED TO 160 FT. BY MUD DRILLING			MUD DRILLING TO TOTAL DEPTH OF 160 FEET.	
RECENT DUNE SANDS					Humid			
					CASED to 160 ft.			
					NO WATER CUT			

TYPE OF SAMPLE

A shoe (SA)
D " (SD)
E " (SE)
G " (SG)
Sealed Tube - A Shoe - SAL
Standard Penetration Test - SPT

Water level, (date) 7 May 65
WC Water cut
Casing

CONSISTENCY

VS. — Very Soft
S — Soft
F — Firm
St. — Stiff
V.St. — Very Stiff
H — Hard

REL. DENSITY

VL — Very Loose
L — Loose
C — Compact
D — Dense
VD — Very Dense

MOISTURE CONTENT

H — Humid
D — Damp
M — Moist
W — Wet
S — Saturated

LL — Liquid Limit
PL — Plastic Limit
≏ Near
< Less than
> Greater than
≪ Much less than

ENGINEERING GEOLOGY SECTION

DRILL No. 155
TYPE MAYHEW
DRILLER Digit Hor.
START 9 Mar '66
FINISH 11 Mar '66

LOGGED R.T.B/M.K
DATE 9 Mar '66
DRAWN B.M.H
TRACED T.P.S.
CHECKED D.K.

DRG. No. S 5100 G+J

DEPARTMENT OF MINES — SOUTH AUSTRALIA

SERIAL No. 961/66

LOG OF ROTARY HOLE

HOLE NO. G82

SHEET 1 OF 1

PROJECT CHOWILLA DAM

FEATURE SALINE WATER DISPOSAL

LOCATION TILMY FLAT AREA

SECTION

HUNDRED COUNTY HAMLEY

CO-ORDINATES

R.L. Casing 274·29 FEET

R.L. (Surface) 272·13 FEET

SOIL TYPE GEOLOGICAL DESCRIPTION	R.L. (FEET) DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME (Unified Soil Classification. U.S.B.R. Earth Manual 1st. Edition 1963.)	WATER LEVEL CASING MOISTURE CONTENT	CONSISTENCY REL. DENSITY	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	FIELD TEST DATA: SOIL TEST PENETROMETER qu (Tons per sq. ft) 1 2 3 4
RECENT TOPSOIL Lime in silt sizes and quartz in sand sizes. Quartz grains mainly subrounded.	270		SM	SAND, poorly graded, excess silt, Brown to red brown.			NOT APPLICABLE	
			ML	SILTSOIL, low plasticity excess sand, grains up to 1m.m. pale brown.				
	10		SC to SM	SAND, poorly graded, excess silt and clay fines, grains up to 1mm, brown.				
	260		SM	SAND, poorly graded, excess silt, grains up to 1m. m. Brown to pale brown.			AIR DRILLING	
	20		SP	SAND, poorly graded, some silt and clay fines, grains up to 1m.m. Brown.				
PLEISTOCENE BLANCHETOWN CLAY (LACUSTRINE)	250		CL	CLAYSOIL, low plasticity with sand grains up to 1m.m. Grey-green with red mottling.				
	30							
	240							
	40		CH	CLAYSOIL, high plasticity green-grey.				
	230		CL	CLAYSOIL, low plasticity sand grains up to 1m.m. green grey.				
				END OF SAMPLES 47 F.T. HOLE DEEPENED TO 145 FT. BY MUD DRILLING				
	220						MUD DRILLING TO TOTAL DEPTH OF 145 Feet	
	210							
	200							
	190							
	180							

WATER LEVEL RL 167.7 (March 66)

HOLE CASED TO 145 ft.

TYPE OF SAMPLE	CONSISTENCY	REL. DENSITY	MOISTURE CONTENT	ENGINEERING GEOLOGY SECTION
A shoe (SA) D " (SD) E " (SE) G " (SG) Sealed Tube - A Shoe - SAL Standard Penetration Test - SPT	VS. — Very Soft S — Soft F — Firm St. — Stiff V.St. — Very Stiff H — Hard	VL — Very Loose L — Loose C — Compact D — Dense VD — Very Dense	H — Humid D — Damp M — Moist W — Wet S — Saturated LL — Liquid Limit PL — Plastic Limit ≏ Near < Less than > Greater than ≪ Much less than	DRILL No. 135 TYPE MAYHEW DRILLER Pigtter START 10.Mar.66 FINISH 11.Mar.66 LOGGED B.M.H. DATE 18th Mar 66 DRAWN T.L.P. TRACED T.L.P. CHECKED D.M.S.

Water level, 7 May 65 (date) → Casing

WC Water cut

DRG. No. S5101 G+J

SERIAL No. 961/66

DEPARTMENT OF MINES — SOUTH AUSTRALIA

LOG OF ROTARY HOLE

HOLE NO. G83

SHEET 1 OF 1

PROJECT CHOWILLA DAM

FEATURE SALINE WATER DISPOSAL

LOCATION TILMY FLAT AREA

SECTION

HUNDRED COUNTY HAMLEY

CO-ORDINATES

R.L. Casing 269·29 FEET

R.L. (Surface) 267·92 FEET

SOIL TYPE GEOLOGICAL DESCRIPTION	R.L. (FEET) DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME (Unified Soil Classification. U.S.B.R. Earth Manual 1st. Edition 1963.)	WATER LEVEL — CASING — MOISTURE CONTENT	CONSISTENCY REL. DENSITY	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	FIELD TEST DATA: SOIL TEST PENETROMETER qu (Tons per sq. ft) 1 2 3 4
RECENT — Topsoil	260		SM	Sand excess silt, medium grained, grains up to 2 m.m. Pale red brown.			NOT APPLICABLE	
			SC to CL	Sand excess clay grading to clay soil, low plasticity. Sand grains mainly < 0·5 m.m. grey green to red brown			AIR DRILLED TO 52 FEET	
PLEISTOCENE BLANCHETOWN CLAY (LACUSTRINE)	10		CL	Clay soil, low plasticity < 20% sand grains. Grey green with red mottling				
	250		SP	Sand, poorly graded, coarse grained, grains up to 2 m.m. Off-white				
	20			CLAY SOIL, low plasticity < 20% sand, grains < 0·5 m.m. Grey green				
	240		CL					
	30							
	230							
PLIOCENE? PARILLA SAND (LACUSTRINE)	40		SP	SAND, poorly graded, medium to coarse grained, grains up to 2 m.m. Yellow to off-white.				
	220							
	50							
				END OF SAMPLES, 52 FT. HOLE DEEPENED TO 155 FT. BY MUD DRILLING.				
	210							
	200							
	190							
	180							
	170							

WATER LEVEL R.L. 165·7 (March '66)

HOLE CASED TO 155 FT.

155

TYPE OF SAMPLE

A shoe (SA)

D " (SD)

E " (SE)

G " (SG)

Sealed Tube - A Shoe - SAL

Standard Penetration Test - SPT

Water level, (date) 7 May 65

WC Water cut

Casing

CONSISTENCY

VS. — Very Soft

S — Soft

F — Firm

St. — Stiff

V.St. — Very Stiff

H — Hard

REL. DENSITY

VL — Very Loose

L — Loose

C — Compact

D — Dense

VD — Very Dense

MOISTURE CONTENT

H — Humid

D — Damp

M — Moist

W — Wet

S — Saturated

LL — Liquid Limit

PL — Plastic Limit

≏ Near

< Less than

> Greater than

<< Much less than

ENGINEERING GEOLOGY SECTION

DRILL No. 155

TYPE Mayhew

DRILLER Pignitter

START 12 Mar. 66

FINISH 12 Mar. 66

LOGGED B.M.H.

DATE 17 Mar. 66

DRAWN B.M.H.

TRACED R.A.J.

CHECKED DLK

DRG. No. S5102 G+J

DEPARTMENT OF MINES — SOUTH AUSTRALIA

SERIAL No. 961/66

LOG OF ROTARY HOLE

HOLE NO. G84

SHEET 1 OF 1

PROJECT CHOWILLA DAM

FEATURE SALINE WATER DISPOSAL

LOCATION TILMY FLAT AREA

SECTION

HUNDRED COUNTY HAMLEY

CO-ORDINATES

R.L. Casing (Not Cased) FEET

R.L. (Surface) 262·4 FEET

SOIL TYPE / GEOLOGICAL DESCRIPTION	R.L. (FEET) DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION — GROUP NAME (Unified Soil Classification. U.S.B.R. Earth Manual 1st. Edition 1963.)	WATER LEVEL — CASING — MOISTURE CONTENT	CONSISTCY REL. DENSITY	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	FIELD TEST DATA: SOIL TEST PENETROMETER qu (Tons per sq. ft) 1 2 3 4
TOPSOIL Gravel fragments are Calcrete. PLEISTOCENE BLANCHETOWN CLAYS (LACUSTRINE) Sand grains are quartz, sub-rounded.	260		SM GP	Sand excess silt fine grained. Few gravel fragments up to 40 m.m. Brown.	NO WATER CUT		NOT APPLICABLE	
	10		SC to CL	GRAVEL. poorly graded grain size 10 to 15 m.m. mainly. Excess silty fines. Brown.				
	250			SAND, excess clay, to CLAY SOIL, low plasticity Sand < 0.5 m.m. grey green with red mottling. Becoming less sandy with depth.			AIR DRILLING	
	20		CL	Clay soil, low plasticity 30% to 40% sand < 0.5 m.m. in size. Grey green with red mottling.				
PLIOCENE PARILLA SANDS (LACUSTRINE)	240		CL to SC	CLAY SOIL, low plasticity grading to SAND, excess clay, grain size < 1 m.m. Becoming sandier with depth. Yellow green to off-white.				
	30		SC					
	230		SP	SAND, excess clay medium grained. Grains 1 to 2 m.m. Off-white.				
	40			SAND, poorly graded. medium grained, grains 1 to 2 m.m.; Off-white to pale yellow.				
END OF HOLE	50A							

TYPE OF SAMPLE

A shoe (SA)
D " (SD)
E " (SE)
G " (SG)
Sealed Tube - A Shoe - SAL
Standard Penetration Test - SPT

Water level, (date) 7 May 65
WC Water cut
Casing

CONSISTENCY
VS. — Very Soft
S — Soft
F — Firm
St. — Stiff
V.St. — Very Stiff
H — Hard

REL. DENSITY
VL — Very Loose
L — Loose
C — Compact
D — Dense
VD — Very Dense

MOISTURE CONTENT
H — Humid
D — Damp
M — Moist
W — Wet
S — Saturated
LL — Liquid Limit
PL — Plastic Limit
≏ Near
< Less than
> Greater than
≪ Much less than

ENGINEERING GEOLOGY SECTION

DRILL No 155 — LOGGED B.M.H.
TYPE MAYHEW — DATE 7 Mar. '66
DRILLER Pighills — DRAWN B.M.H.
START 4 Mar '66 — TRACED R.A.J.
FINISH 4 Mar '66 — CHECKED D.M.S.

DRG. No. S 5103 G+J

DEPARTMENT OF MINES — SOUTH AUSTRALIA

SERIAL No. 961/66

LOG OF ROTARY HOLE

HOLE NO. G85

SHEET 1 OF 1

PROJECT CHOWILLA DAM

FEATURE SALINE WATER DISPOSAL

LOCATION TILMY FLAT AREA

SECTION

HUNDRED COUNTY HAMLEY

CO-ORDINATES

R.L. Casing — — FEET

R.L. (Surface) 276·26 FEET

SOIL TYPE GEOLOGICAL DESCRIPTION	R.L. (FEET) DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME (Unified Soil Classification. U.S.B.R. Earth Manual 1st. Edition 1963.)	WATER LEVEL	CASING	MOISTURE CONTENT	CONSISTENCY REL. DENSITY	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	FIELD TEST DATA: SOIL TEST PENETROMETER qu (Tons per sq. ft) 1 2 3 4
Lime present as silt and calcrete gravel fragments. Sand grains quartz, subrounded. PLEISTOCENE BLANCHETOWN CLAYS (LACUSTRINE)	270		GM	GRAVEL, excess silt, fragments up to 30 m.m. mainly 20 m.m, off-white					NOT APPLICABLE AIR DRILLED TO 61 FEET	
	10		SP	SAND, poorly graded coarse grained, size 1 to 2mm. 20% Gravel, fragments up to 10 m.m Pale brown						
	260		SC	SAND, excess clay coarse grained as before. Green grey to red brown						
	20		CL	CLAY SOIL, low plasticity 40% sand grains up to 0·5 m.m. size. Grey green with red mottling						
	250		SC	SAND, excess clay, med. grained, grains < 1 m.m. in size					AIR DRILLING	
	30		CL	CLAY SOIL, low plasticity 20% sand grains up to 0·5 m.m. in size. Grey green to dark red brown.						
PLIOCENE PARILLA SANDS (LACUSTRINE)	240		SC to SM	SAND excess clay grading to SAND, excess silty fines. Medium grained. Mainly 1 m.m. in size. Red brown.						
	40									
	230		SP	SAND, poorly graded, Coarse grained, sizes 1 to 2 m.m. Pale yellow to off white.						
	50									
	220			END OF SAMPLES, 61 FT. HOLE DEEPENED TO 145 FT. BY MUD DRILLING						
	60					HOLE CASED TO 145 FT.				

TYPE OF SAMPLE

A shoe (SA)
D " (SD)
E " (SE)
G " (SG)
Sealed Tube - A Shoe - SAL
Standard Penetration Test - SPT

Water level, (date) 7 May 65
WC Water cut
Casing

CONSISTENCY

VS. — Very Soft
S — Soft
F — Firm
St. — Stiff
V St. — Very Stiff
H — Hard

REL. DENSITY

VL — Very Loose
L — Loose
C — Compact
D — Dense
VD — Very Dense

MOISTURE CONTENT

H — Humid
D — Damp
M — Moist
W — Wet
S — Saturated

LL — Liquid Limit
PL — Plastic Limit
≏ Near
< Less than
> Greater than
≪ Much less than

ENGINEERING GEOLOGY SECTION

DRILL No. 155 LOGGED B.M.H.
TYPE Mayhew DATE 17 Mar. 66
DRILLER Pignitter DRAWN B.M.H
START 16 Mar. 66 TRACED R.A.J.
FINISH 16 Mar. 66 CHECKED L.C.

DRG. No. S 5104 G+J

DEPARTMENT OF MINES — SOUTH AUSTRALIA

SERIAL No. 961/66

LOG OF ROTARY HOLE

HOLE NO. G88

SHEET 1 OF 1

PROJECT CHOWILLA DAM.

FEATURE SALINE WATER DISPOSAL

LOCATION TILMY FLAT.

SECTION

HUNDRED COUNTY HAMLEY.

CO-ORDINATES

R.L. Casing 252.41 FEET
R.L. (Surface) 251.02 FEET

SOIL TYPE / GEOLOGICAL DESCRIPTION	R.L. (FEET) / DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION — GROUP NAME (Unified Soil Classification. U.S.B.R. Earth Manual 1st. Edition 1963.)	WATER LEVEL / CASING / MOISTURE CONTENT	CONSIST'CY REL. DENSITY	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	FIELD TEST DATA: SOIL TEST PENETROMETER qu (Tons per sq. ft) 1 2 3 4
PLEISTOCENE BLANCHETOWN CLAY (LACUSTRINE) limonite stained.	250		SM	SAND, fine grained, silty. Pale red-brown.				
	10		CL and SC	CLAYSOIL, low plasticity, sandy. Pale brown with grey green mottling. Up to 30% SAND, fine-grained, clayey. Pale brown, mottled grey green.	MC < PL	V. St.		
	240							
	20							
	230							
	30		CL CH	CLAY, low to moderate plasticity, grey green. Locally sandy.				
	220							
	40							
	210							
Calcareous, and limonite-stained	50		CL	CLAYSOIL, low plasticity Grey green to light yellow brown.	MC < PL	V. St.		
Mottled clay, clear quartz sand 0·5-1·5 mm. sub-rounded.	200		SC	SAND, medium grained excess CLAY, grey-green.				
Mostly clear quartz sand, 0·2-0·4 mm. sub-rounded.	60		SP	SAND, fine to medium grained. Poorly graded. Light yellow brown.				
PLIOCENE PARILLA SANDS (LACUSTRINE)	190							
	70							
	180							
	80							
	170							
	90							
	160							
	100							
	150							
	110			END OF HOLE 110 FT.				

Mar. '66 ↓ 18 Feb '66

CASED TO 118 FT.

NOT APPLICABLE.

AIR DRILLED

MUD DRILLED TO TOTAL DEPTH OF 110 FEET.

TYPE OF SAMPLE

- A shoe (SA)
- D " (SD)
- E " (SE)
- G " (SG)
- Sealed Tube - A Shoe - SAL
- Standard Penetration Test - SPT

Water level, 7 May 65 (date)

WC Water cut

Casing

MOISTURE CONTENT

- H — Humid
- D — Damp
- M — Moist
- W — Wet
- S — Saturated
- LL — Liquid Limit
- PL — Plastic Limit
- ≈ Near
- < Less than
- > Greater than
- << Much less than

ENGINEERING GEOLOGY SECTION

DRILL No 153 LOGGED S.P.
TYPE MAYHEW DATE 17 Feb '66
DRILLER Matthews DRAWN S.P.
START 10 Feb '66 TRACED R.A.J.
FINISH 17 Feb '66 CHECKED G.T.R.

DRG. No. S 5107 G+J

DEPARTMENT OF MINES — SOUTH AUSTRALIA

SERIAL No. 961/66.
PROJECT CHOWILLA DAM. **LOG OF ROTARY HOLE**
FEATURE SALINE WATER DISPOSAL SECTION:
LOCATION TILMY FLAT AREA HUNDRED COUNTY HAMLEY
CO-ORDINATES

HOLE NO. G89
SHEET 1 OF 1

R.L. Casing 263·21 FEET
R.L. (Surface) 261·31 FEET

SOIL TYPE / GEOLOGICAL DESCRIPTION	R.L. (FEET) / DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION / GROUP NAME (Unified Soil Classification. U.S.B.R. Earth Manual 1st. Edition 1963.)	WATER LEVEL / CASING / MOISTURE CONTENT	CONSIST'CY REL. DENSITY	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	FIELD TEST DATA: SOIL TEST PENETROMETER qu (Tons per sq. ft) 1 2 3 4
Windblown sand.	260		SM	SAND, fine grained, silty. Pale red brown.			NOT APPLICABLE.	
	10		CL to SC	CLAYSOIL, low plasticity sandy. Pale brown. Up to 30-40% SAND, fine grained excess clay Brown.				
PLEISTOCENE BLANCHETOWN CLAY (LACUSTRINE) Irregular patches of soft lime up to 5m.m. diam.	250		CL	CLAYSOIL, low plasticity 30-50%, silty sand, grey green', white mottling.		V.St.		
	20							
	240				MC < LL	V.St.		
Clear quartz sand 0·2 to 0·4 m.m. sub-rounded.	30		SC	SAND, fine grained excess clay, silt grey-green.			AIR DRILLED	
	230		CL to SC	CLAYSOIL, low plasticity 30-40% silty sand. Grey-green. Increase sand with depth, at 53-54 ft limy clay, 55 ft, limonite stained.				
PLIOCENE PARILLA SANDS (LACUSTRINE)	40							
	220							
	50					V.St.		
	210				MC < LL			
Clear quartz grains, 0·5-1·5 m.m. sub-rounded.	60		SC ?	SAND, medium to coarse grained. Pale yellow brown 63-64 ft, limy.			MUD DRILLED TO TOTAL DEPTH OF 110 FEET	
	200							
Mostly clear quartz grains 0·5 to 1·5 m.m. sub-rounded, yellow brown, limonite fines.	70		SP ?	SAND, coarse to medium grained Pale yellow brown.				
	190							
? LOXTON SANDS (ESTUARINE)	80							
	180							
	90							
	170							
Sand is mainly well-rounded clear quartz grains	100			SAND, coarse grained, poorly graded, grains up to 1.5 mm.				
	160							
	110			END OF HOLE 110 FT.				

NO WATER IN HOLE March '66
HOLE CASED TO 110 FT.

TYPE OF SAMPLE
A shoe (SA)
D " (SD)
E " (SE)
G " (SG)
Sealed Tube - A Shoe - SAL
Standard Penetration Test - SPT

Water level, (date) May 65
Casing
WC Water cut

MOISTURE CONTENT
H — Humid
D — Damp
M — Moist
W — Wet
S — Saturated
LL — Liquid Limit
PL — Plastic Limit
≏ Near
< Less than
> Greater than
≪ Much less than

ENGINEERING GEOLOGY SECTION

DRILL No. 155 LOGGED. S.P.
TYPE Mayhew DATE. 21 Feb '66
DRILLER Matthews DRAWN. S.P.
START 18 Feb '66 TRACED. R.A.J.
FINISH 21 Feb '66 CHECKED D.M.S.

DRG. No. S 5108 G+J

DEPARTMENT OF MINES — SOUTH AUSTRALIA

SERIAL No. 961/66.
PROJECT CHOWILLA DAM.
FEATURE SALINE WATER DISPOSAL.
LOCATION TILMY FLAT.

LOG OF ROTARY HOLE

SECTION
HUNDRED COUNTY HAMLEY.
CO-ORDINATES

HOLE NO. G92
SHEET 1 OF 2

R.L. Casing 295·52 FEET
R.L. (Surface) 293·77 FEET

SOIL TYPE GEOLOGICAL DESCRIPTION	R.L. (FEET) DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME (Unified Soil Classification. U.S.B.R. Earth Manual 1st. Edition 1963)	WATER LEVEL — CASING MOISTURE CONTENT	CONSISTENCY REL. DENSITY	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	FIELD TEST DATA: SOIL TEST PENETROMETER qu (Tons per sq. ft) 1 2 3 4
			SM	SAND.				
RECENT DUNE SANDS — Quartz grains with lime. Grains rounded to sub-rounded. Sand grains cooted with silt. Gravel is lime cemented sand - strongly cemented.	290		SM	SAND, Limey and silty brownish offwhite colour. Gravel particles up to 0·05ft across 10% gravel, 60% sand, 30% silty fines.			NOT APPLICABLE	
Quartz grains, sub-rounded to sub-angular.	10 280		SM	SAND, silty, slightly clayey low plasticity. Light brown to Reddish brown Grains up to 1mm. across				
CALCRETE, Lime and quartz grains. Strong to moderate cementation.	20		GP ML	GRAVEL, with sandy lime silt matrix. 20% gravel 20% sand, 60% lime silt fines. A, B and C qualify calcrete fragments.				
PLEISTOCENE BLANCHETOWN CLAY (LACUSTRINE) — Quartz grains rounded to sub-rounded. Sand occurs in pockets within clay - often stained. Few black organic impurities.	270		CL	CLAY, low plasticity grading to higher plasticity with depth. Sandy. Green with red mottles, green increasing with depth, Sand grains up to ½ m.m. Sand percentage decreasing with depth. Cloy limey near top.				
	30 260							
	40		CH					
	250			SAND, poorly graded. Silty and slightly clayey Off-white colour. Sand grains up to 2m.m., 44ft to 46ft approx, 10% fines. 46ft to 61ft approx 20% fines. Clayey band as shown.			DRILLED WITH AIR TO 61 FEET	
PLIOCENE PARILLA SANDS (LACUSTRINE) — Quartz grains with clayey and silty fines. Sand grains rounded to sub-rounded. Mostly clean sand.	50 240		SP					
			SC					
	60							
	230							
	70		SP					
	220						DRILLED WITH MUD 61 - 150A	
Sand may occur as pockets within the clay.	80		CL	CLAY, low plasticity sandy. Green clay.				
	210						SLUDGE SAMPLE TAKEN.	
	90		SP ?					
	200							
	100							

TYPE OF SAMPLE
A shoe (SA)
D " (SD)
E " (SE)
G " (SG)
Sealed Tube - A Shoe - SAL
Standard Penetration Test - SPT

7 May 65 — Water level (date) — WC Water cut — Casing

CONSISTENCY
VS. — Very Soft
S — Soft
F — Firm
St. — Stiff
V.St. — Very Stiff
H — Hard

REL. DENSITY
VL — Very Loose
L — Loose
C — Compact
D — Dense
VD — Very Dense

MOISTURE CONTENT
H — Humid
D — Damp
M — Moist
W — Wet
S — Saturated
LL — Liquid Limit
PL — Plastic Limit
≏ Near
< Less than
> Greater than
≪ Much less than

ENGINEERING GEOLOGY SECTION

DRILL No 155 . LOGGED M.C.B.
TYPE MAYHEW . DATE 25 Feb '66
DRILLER STRIMPED DRAWN M.C.B.
START 25 Feb '66 TRACED A.M.D.
FINISH 1 Mar '66 CHECKED D.K.S.

DRG. No. S5111 G + J.

SERIAL No. 961/66

DEPARTMENT OF MINES — SOUTH AUSTRALIA

PROJECT CHOWILLA DAM LOG OF ROTARY HOLE

FEATURE SALINE WATER DISPOSAL COUNTY HAMLEY

LOCATION TILMY FLAT CO-ORDINATES

HOLE NO. G 91

SHEET 2 OF 2

R.L (Casing) 284·73 FEET

R.L. (Surface) 283·23 FEET

SOIL TYPE / GEOLOGICAL DESCRIPTION	R.L. (FEET) / DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION — GROUP NAME (Unified Soil Classification. U.S.B.R. Earth Manual 1st. Edition 1963.)	WATER LEVEL — CASING — MOISTURE CONTENT — CONSISTENCY / REL. DENSITY	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	FIELD TEST DATA: SOIL TEST PENETROMETER qu (Tons per sq. ft) 1 2 3 4
MIOCENE LOXTON SANDS (ESTUARINE)	180 / 110 / 170 / 120 / 160 / 130 / 150 / 140 / 140 / 150 / 130		SP ?	SAND	March '66	NOT APPLICABLE / MUD DRILLING.	
				END OF HOLE 154 FT.			

TYPE OF SAMPLE

A shoe (SA)
D " (SD)
E " (SE)
G " (SG)
Sealed Tube - A Shoe - SAL
Standard Penetration Test - SPT

Water level, (date) 7 May 65
WC Water cut
Casing

CONSISTENCY

VS. — Very Soft
S — Soft
F — Firm
St. — Stiff
V.St. — Very Stiff
H — Hard

REL. DENSITY

VL — Very Loose
L — Loose
C — Compact
D — Dense
VD — Very Dense

MOISTURE CONTENT

H — Humid
D — Damp
M — Moist
W — Wet
S — Saturated

LL — Liquid Limit
PL — Plastic Limit
≏ Near
< Less than
> Greater than
≪ Much less than

ENGINEERING GEOLOGY SECTION

DRILL No. 155 LOGGED M.C.B.
TYPE MAYHEW DATE 23 Feb '66
DRILLER STREMPEL DRAWN M.C.B.
START 23 Feb 66 TRACED D.H.S.
FINISH 24 Feb '66 CHECKED D.H.S.

DRG. No. S 5110

SERIAL No. 961/66 — DEPARTMENT OF MINES — SOUTH AUSTRALIA

HOLE NO. G92 — SHEET 2 OF 2

PROJECT CHOWILLA DAM — LOG OF ROTARY HOLE

FEATURE SALINE WATER DISPOSAL — COUNTY HAMLEY

LOCATION TILMY FLAT — CO-ORDINATES

R.L. (Casing) 295·52 FEET

R.L. (Surface) 293·77 FEET

SOIL TYPE GEOLOGICAL DESCRIPTION	R.L. (FEET) DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME (Unified Soil Classification. U.S.B.R. Earth Manual 1st. Edition 1963.)	WATER LEVEL CASING MOISTURE CONTENT	CONSIST'CY REL. DENSITY	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	FIELD TEST DATA: SOIL TEST PENETROMETER qu (Tons per sq. ft) 1 2 3 4
? MIOCENE LOXTON SANDS (ESTUARINE)	190 110 180 120 170 130 160 140 150 150			SAND	March '66		NOT APPLICABLE	
				DRILLER'S NOTE "Hole caving and mud partly lost"			MUD DRILLING	
END OF HOLE				150 FT				

TYPE OF SAMPLE

- A shoe (SA)
- D " (SD)
- E " (SE)
- G " (SG)
- Sealed Tube - A Shoe - SAL
- Standard Penetration Test - SPT

Water level, (date) 7 May 65 — Casing

WC Water cut

CONSISTENCY

- VS. — Very Soft
- S — Soft
- F — Firm
- St. — Stiff
- V.St. — Very Stiff
- H — Hard

REL. DENSITY

- VL — Very Loose
- L — Loose
- C — Compact
- D — Dense
- VD — Very Dense

MOISTURE CONTENT

- H — Humid
- D — Damp
- M — Moist
- W — Wet
- S — Saturated
- LL — Liquid Limit
- PL — Plastic Limit
- ≏ Near
- < Less than
- > Greater than
- << Much less than

ENGINEERING GEOLOGY SECTION

DRILL No. 55 — LOGGED M.C.B.

TYPE MAYHEW — DATE 25 Feb '66

DRILLER S. BLEMAKE — DRAWN M.C.B.

START 25 Feb '66 — TRACED DPS

FINISH 1 Mar '66 — CHECKED G.T.R.

DRG. No. S5111 a G+J

DEPARTMENT OF MINES — SOUTH AUSTRALIA

SERIAL No. 961/66

LOG OF ROTARY HOLE

HOLE NO. G93

SHEET 1 OF 1

PROJECT CHOWILLA DAM.

FEATURE SALINE WATER DISPOSAL. SECTION.

LOCATION TILMY FLAT. HUNDRED COUNTY HAMLEY.

CO-ORDINATES.

R.L. Casing 256·81 FEET.

R.L. (Surface) 255·29 FEET

SOIL TYPE GEOLOGICAL DESCRIPTION	R.L. (FEET) DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME (Unified Soil Classification. U.S.B.R. Earth Manual 1st. Edition 1963.)	WATER LEVEL CASING MOISTURE CONTENT	CONSISTENCY REL. DENSITY	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	FIELD TEST DATA: SOIL TEST PENETROMETER qu (Tons per sq. ft) 1 2 3 4
PLEISTOCENE BLANCHETOWN CLAY (LACUSTRINE)	250		SM	SAND and silt.			NOT APPLICABLE	
CLAY, with quartz and limonite grains, rounded to sub-rounded.			CL	CLAY, low plasticity sandy Reddish brown colour green in parts. Grains up to 1m.m across, 20% sand.				
			SP					
	10		CL	SAND, poorly graded, clayey, Brownish yellow colour. Fine grained, few grains up to 2m.m across. 20% clayey fines.		V.St		
	240			CLAY, low plasticity 6ft to 9ft high plasticity 9ft to 36ft. Green colour with orange staining 6ft to 12ft and 24ft to 27ft. Sand grains up to 1m.m. across, 10% sand.	MC < PL	Stiff		
	20		CH					
	230							
	30							
	220							
Quartz grains sub-rounded, some limonite coated, some clay coated.			SP	SAND, poorly graded, clayey. Greenish yellow and orange yellow colour. Medium grained with grains up to 1.5m.m. Approx 10% clayey fines.				
	40							
PLIOCENE PARILLA SAND (LACUSTRINE)	210		CH	CLAY, high plasticity. Grey to green colour, with some orange staining 47ft to 49ft.			DRILLED WITH AIR TO 63 FEET.	
	50							
? Limonite staining. Sand, quartz grains, mixed with clay. Grains rounded.	200		CL	CLAY, low plasticity, sandy Orange, with some green-grey patches. Grains up to 1m.m. across.	MC < PL	Very Stiff		
			MH					
	60		SW to SP	SILT, medium to high plasticity, slightly sandy. Off-white				
				SAND, medium to coarse				
				END OF SAMPLES, 63 FT. HOLE DEEPENED TO 120FT. BY MUD DRILLING.			DRILLED WITH MUD FROM 63 - 120 FEET.	
	190							
	180							
	170							
	160				March 66 HOLE CASED TO 120 FT.			

TYPE OF SAMPLE

A shoe (SA)
D " (SD)
E " (SE)
G " (SG)
Sealed Tube - A Shoe - SAL
Standard Penetration Test - SPT

Water level, (date) → 7 May 65
WC ▶ Water cut
Casing

CONSISTENCY	REL. DENSITY	MOISTURE CONTENT	
VS. — Very Soft	VL — Very Loose	H — Humid	LL — Liquid Limit
S — Soft	L — Loose	D — Damp	PL — Plastic Limit
F — Firm	C — Compact	M — Moist	≏ Near
St. — Stiff	D — Dense	W — Wet	< Less than
V.St. — Very Stiff	VD — Very Dense	S — Saturated	> Greater than
H — Hard			<< Much less than

ENGINEERING GEOLOGY SECTION

DRILL No. 155 LOGGED M.C.B.
TYPE MAYHEW DATE 2 Mar '66
DRILLER GUTTE DRAWN M.C.B.
START 1 Mar '66 TRACED T.L.P.
FINISH 2 Mar '66 CHECKED D.B.

DRG. No. S5112 G + J

DEPARTMENT OF MINES — SOUTH AUSTRALIA

SERIAL No. 961/66

LOG OF ROTARY HOLE

HOLE NO. G94

SHEET 1 OF 1

PROJECT CHOWILLA DAM

FEATURE SALINE WATER DISPOSAL

LOCATION TILMY FLAT AREA

SECTION

HUNDRED COUNTY HAMLEY

CO-ORDINATES

R.L. Casing 241·70 FEET

R.L. (Surface) 239·86 FEET

SOIL TYPE / GEOLOGICAL DESCRIPTION	R.L. (FEET) / DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION — GROUP NAME (Unified Soil Classification. U.S.B.R. Earth Manual 1st. Edition 1963.)	WATER LEVEL — CASING — MOISTURE CONTENT	CONSISTENCY REL. DENSITY	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	FIELD TEST DATA: SOIL TEST PENETROMETER qu (Tons per sq. ft) 1 2 3 4
Surface soil, mainly wind blown sands.			SM	SAND excess silty fines limey, light brown.			NOT APPLICABLE	
PLEISTOCENE BLANCHETOWN CLAY (LACUSTRINE)			CL/SC	CLAY/SAND mixture, limey			AIR DRILLED TO 42 FEET	
	10 230		CL	CLAY, low plasticity, sandy light brown green. 10-20% sand, sand grains rounded up to 1 m.m. Low dry strength.				
			CH	CLAY, high plasticity mod. dry strength. Green and brown mixed to 16' green 16 – 22'				
	20 220		SW	SAND, mainly fine grain golden at 24', white below grains rare to 0·5 m.m. slight clay coating on grains, grains sub rounded				
	30		CH	CLAY as for 10–22'				
	210		CL	CLAY low plasticity, sandy dark grey				
			SP	SAND, off-white. Fine – med. grain, sub rounded grains, slightly clayey				
	40 200						DRILLED WITH MUD 42 TO 100 FEET	
PLIOCENE PARILLA SANDS (LACUSTRINE)	50 190							
	60 180			Sludges. Mainly sands, fine – med. grain.	March '66			
	70 170							
	80 160							
	90 150							
LOXTON SANDS? Ferruginous cement, strongly cemented	100		SP	SAND, poorly graded, red brown, grains to 1 m.m.				

END OF HOLE, 100 FT.

TYPE OF SAMPLE

A shoe (SA)
D " (SD)
E " (SE)
G " (SG)
Sealed Tube - A Shoe - SAL
Standard Penetration Test - SPT

Water level, (date) 7 May 65
Casing
WC Water cut

CONSISTENCY

VS. — Very Soft
S — Soft
F — Firm
St. — Stiff
V St. — Very Stiff
H — Hard

REL. DENSITY

VL — Very Loose
L — Loose
C — Compact
D — Dense
VD — Very Dense

MOISTURE CONTENT

H — Humid
D — Damp
M — Moist
W — Wet
S — Saturated

LL — Liquid Limit
PL — Plastic Limit
< Near
< Less than
> Greater than
<< Much less than

ENGINEERING GEOLOGY SECTION

DRILL. No. 155 — LOGGED. G.T.R.
TYPE MAYHEW — DATE 3 MAR. '66
DRILLER PIGNITTER — DRAWN. G.T.R.
START 3 MAR. 66 — TRACED. R.A.J.
FINISH 3 MAR. 66 — CHECKED DMT

DRG. No. S5113 G + J

DEPARTMENT OF MINES — SOUTH AUSTRALIA

SERIAL No. 961/66

LOG OF ROTARY HOLE

HOLE NO. G95

SHEET 1 OF 1

PROJECT CHOWILLA DAM

FEATURE SALINE WATER DISPOSAL

LOCATION TILMY FLAT

SECTION

HUNDRED COUNTY HAMLEY

CO-ORDINATES

R.L. Casing 241.67 FEET

R.L. (Surface) 240.26 FEET

SOIL TYPE GEOLOGICAL DESCRIPTION	R.L. (FEET) DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME (Unified Soil Classification. U.S.B.R. Earth Manual 1st. Edition 1963.)	WATER LEVEL — CASING — MOISTURE CONTENT	CONSISTENCY REL. DENSITY	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	FIELD TEST DATA: SOIL TEST PENETROMETER qu (Tons per sq. ft) 1 2 3 4
Top Soil.	240		SM	SAND, poorly graded excess silt and chalky lime, light brown & white.			NOT APPLICABLE	
PLEISTOCENE BLANCHETOWN CLAY (LACUSTRINE) Black markings in places.	10		CL to CH.	CLAY SOIL, mainly low plasticity, high in part. sand grains unevenly distributed, grey-green, mottled red.			AIR DRILLED	
	230							
	20							
	220		CH.	CLAY SOIL, high plasticity, grey-green yellow-brown mottled.				
				White clay mixed with above.				
Quartz grains, mainly sub-rounded. PLIOCENE PARILLA SAND (LACUSTRINE)	30		SW	SAND, fairly well graded grains up to 2m.m, few fines. Clay contamination to 31 ft.				
	210			32 FT. END OF SAMPLES. HOLE DEEPENED TO 110 FT BY MUD DRILLING				
	200						MUD DRILLED TO TOTAL DEPTH OF 110 FEET.	
	190							
	180				March '66			
	170				HOLE CASED TO 110 FT.			

TYPE OF SAMPLE

A shoe (SA)
D " (SD)
E " (SE)
G " (SG)
Sealed Tube - A Shoe - SAL
Standard Penetration Test - SPT

Water level, (date) → 7 May 65
WC Water cut
Casing

CONSISTENCY

VS. — Very Soft
S — Soft
F — Firm
St. — Stiff
V.St. — Very Stiff
H — Hard

REL. DENSITY

VL — Very Loose
L — Loose
C — Compact
D — Dense
VD — Very Dense

MOISTURE CONTENT

H — Humid
D — Damp
M — Moist
W — Wet
S — Saturated

LL — Liquid Limit
PL — Plastic Limit
≏ Near
< Less than
> Greater than
≪ Much less than

ENGINEERING GEOLOGY SECTION

DRILL No. 155 — LOGGED J.P. & B.M.H.
TYPE MAYHEW — DATE 9 Mar '66
DRILLER Painter — DRAWN J.P.T.
START 4 Mar '66 — TRACED R.A.J.
FINISH 4 Mar '66 — CHECKED D.M.J.

DRG. No. S5114 G + J

DEPARTMENT OF MINES — SOUTH AUSTRALIA

SERIAL No. 961/66

LOG OF ROTARY HOLE

HOLE NO. G97

SHEET 1 OF 1

PROJECT CHOWILLA DAM

FEATURE SALINE WATER DISPOSAL

LOCATION TILMY FLAT

SECTION

HUNDRED COUNTY HAMLEY

CO-ORDINATES

R.L. Casing 170.83 FEET

R.L. (Surface) 169.83 FEET

SOIL TYPE GEOLOGICAL DESCRIPTION	R.L. (FEET) DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME (Unified Soil Classification. U.S.B.R. Earth Manual 1st. Edition 1963.)	WATER LEVEL — CASING — MOISTURE CONTENT	CONSIST'CY REL. DENSITY	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	FIELD TEST DATA: SOIL TEST PENETROMETER qu (Tons per sq. ft) 1 2 3 4
NEWER VALLEY DEPOSITS. TOPSOIL — — — — Gravel fragments are Gypsum crystals.			SM	SAND, poorly graded, excess silt, grains up to 1 m.m, dark brown.			NOT APPLICABLE	
			GM	GRAVEL, poorly graded excess silt, fragments up to 15 m.m., pale brown.				
Quartz grains sub-angular to sub-rounded.	10		CL	CLAYSOIL, low plasticity contains gravel and sand, fragments up to 10 m.m. Becoming sandier with depth. Grey to green with red mottling.	↓ MARCH '66		AIR DRILLED	
OLDER VALLEY DEPOSITS	20		SP	SAND, poorly graded, grain size 1 to 2 m.m. becoming coarser with depth, yellow to red brown.			MUD DRILLED TO TOTAL DEPTH OF 50 ft.	
	30			NO SAMPLES.				
	40							
	50			END OF HOLE, 50 FT.				

TYPE OF SAMPLE

A shoe (SA)
D " (SD)
E " (SE)
G " (SG)
Sealed Tube - A Shoe - SAL
Standard Penetration Test - SPT

Water level, (date) → 7 May 65
WC Water cut
Casing

CONSISTENCY

VS. — Very Soft
S — Soft
F — Firm
St. — Stiff
V.St. — Very Stiff
H — Hard

REL. DENSITY

VL — Very Loose
L — Loose
C — Compact
D — Dense
VD — Very Dense

MOISTURE CONTENT

H — Humid
D — Damp
M — Moist
W — Wet
S — Saturated

LL — Liquid Limit
PL — Plastic Limit
≏ Near
< Less than
> Greater than
≪ Much less than

ENGINEERING GEOLOGY SECTION

DRILL No. 155. LOGGED. B.M.H.
TYPE MAYHEW. DATE 11 Mar. '66
DRILLER Painter DRAWN. B.M.H
START 7 Mar '66 TRACED. T.L.P.
FINISH 7 Mar '66 CHECKED D.M.S.

DRG. No. S5116 G+J

DEPARTMENT OF MINES — SOUTH AUSTRALIA

SERIAL No. 961/66

LOG OF ROTARY HOLE

HOLE NO. G100

SHEET 1 OF 1

PROJECT CHOWILLA DAM.

FEATURE SALINE WATER DISPOSAL

SECTION

HUNDRED COUNTY HAMLEY

LOCATION TILMY FLAT.

CO-ORDINATES

R.L. Casing (Not Cased) FEET.

R.L. (Surface) 254:00 FEET

SOIL TYPE / GEOLOGICAL DESCRIPTION	R.L. (FEET) / DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION — GROUP NAME (United Soil Classification. U.S.B.R. Earth Manual 1st. Edition 1963.)	WATER LEVEL	CASING	MOISTURE CONTENT	CONSISTENCY REL. DENSITY	FIELD TEST DATA: BLOWS PER FOOT (20 40 60 80)	FIELD TEST DATA: SOIL TEST PENETROMETER qu (Tons per sq. ft) (1 2 3 4)
Topsoil.	250		SM	SAND, excess silt, fine grained, grains mainly <1m.m., Dark brown.	NO WATER CUT		Damp.		NOT APPLICABLE.	
PLEISTOCENE BLANCHETOWN CLAY (LACUSTRINE)	10		SC to CL	SAND, excess clay, fine grained, grading to CLAYSOIL, low plasticity, up to 50% sand. Pale brown to brown.						
Sand is mainly quartz, sub-rounded.	240		SC	SAND, excess clay, to SAND, excess silt, medium grained, grains up to 2m.m. Yellow to off-white.						
	20		SM CL	SAND, well graded, medium to coarse grained, grains up to 2m.m. Off-white.			MC << PL		AIR DRILLED TO TOTAL DEPTH OF 52 FEET.	
	230			CLAYSOIL, low plasticity 25% sand, grading to 10% near base, grains mainly < 0.5m.m. Grey green.						
Sample almost pure [illegible]	30		SC to CL	SAND, excess clay, medium grained, grains up to 0.5m.m. Yellow brown to green brown. Grading to CLAYSOIL, low plasticity, grey green. 30% sand.						
Gypsum crystals	220									
Some silt or [illegible]	40		SM	SAND, excess silt, fine grained, grain size <1m.m. White. Becoming very clayey and silty where indicated.			Humid.			
			SC CL							
Sample blended	210		SP	SAND, excess clay grading to CLAY, low plasticity. Yellow to grey green.						
	50			SAND, poorly graded, fine grained, grains mainly <1 m.m Yellow.						
				52 FT. END OF HOLE						
check grain size										

TYPE OF SAMPLE

A shoe (SA)
D " (SD)
E " (SE)
G " (SG)
Sealed Tube

Water level, (date) → May. 65 Casing

CONSISTENCY

VS — Very Soft
S — Soft
F — Firm
St — Stiff
V-St — Very Stiff

REL. DENSITY

VL — Very Loose
L Loose
C Compact
D Dense
VD Very Dense

MOISTURE CONTENT

H — Humid
D — Damp
M — Moist
W — Wet
S — Saturated

LL — Liquid Limit
PL — Plastic Limit
≏ Near
< Less than
> Greater than

ENGINEERING GEOLOGY SECTION

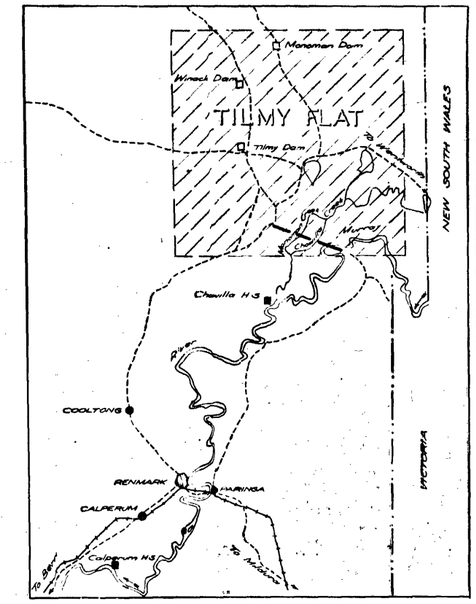
DRILL No. 155 LOGGED. B.M.H.

TYPE MAYHEW DATE 17/Mar./66

DRILLER [illegible] DRAWN. T.P.S.

START 17/Mar/66 TRACED. T.P.S.

FINISH 17/Mar/66 CHECKED. DK



LOCALITY PLAN

SCALE

MILES 4 2 0 4 8 MILES

LEGEND

- G93 255.3 164.7 — Rotary bore, Ground level, Reduced level – groundwater
- G87 224.6 161.0 — Percussion bore, Ground level, Reduced level – groundwater
- T.1 — Trench
- Area proposed to be flooded
- Sub-area boundary
- ③ — Geological section
- A — B — Geological section

For geological sections see following drawings :—

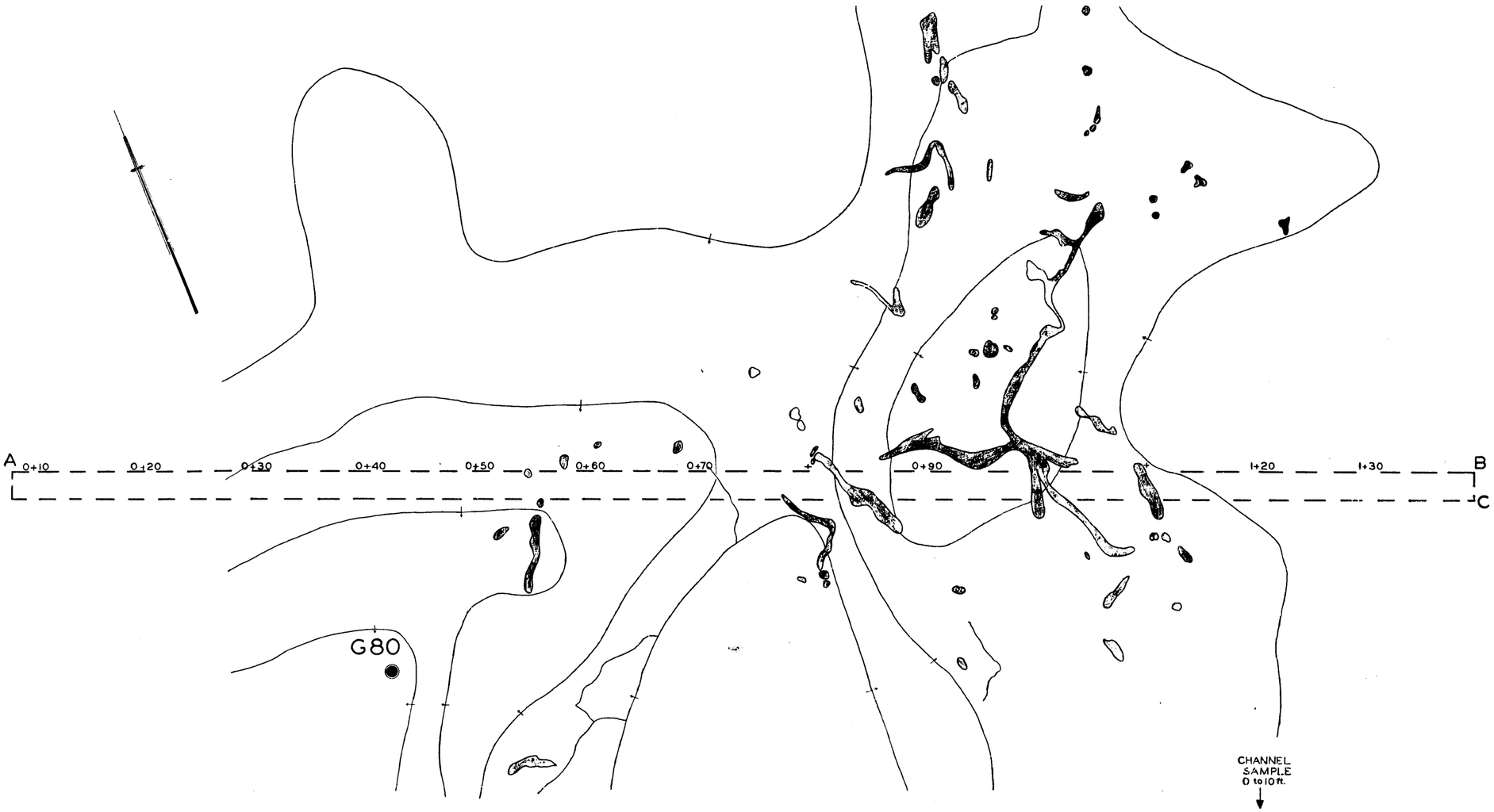
Section AB	66-248
CD	66-712
1-6	61-647
7	S5475
B41	S3995
B42	S3996
EF	L67-39

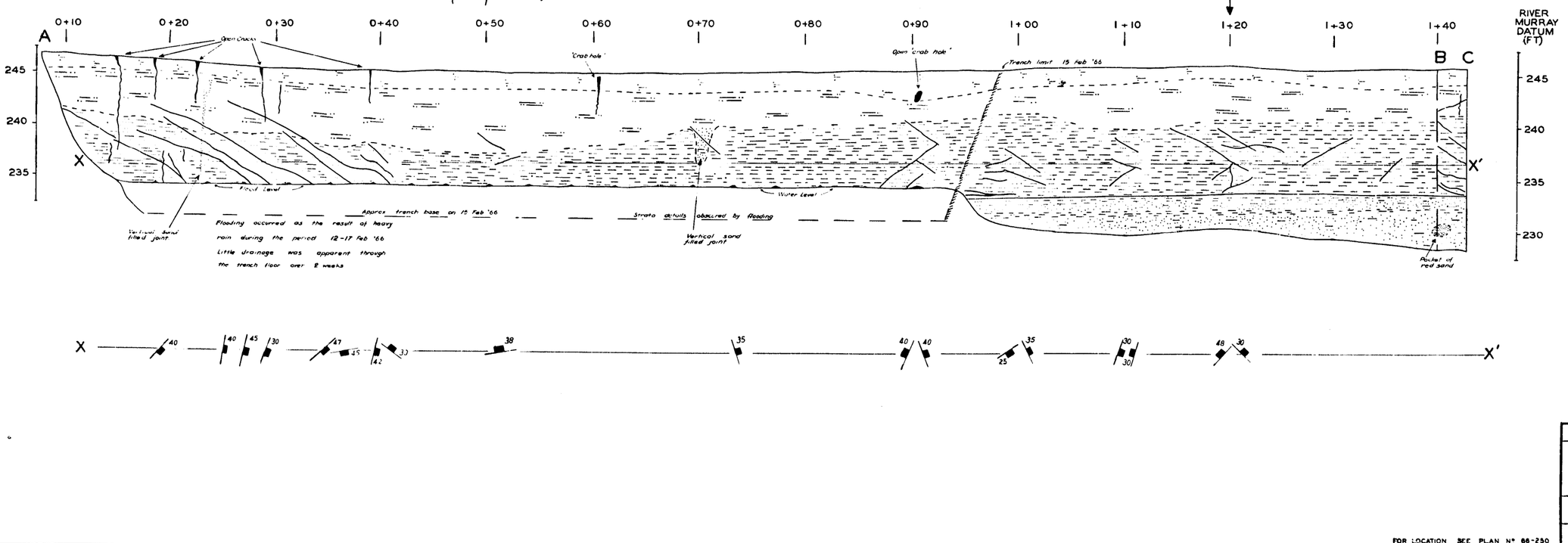
SCALE

FEET 5000 0 8000 10000 FEET

FIG. 1

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
CHOWILLA PROJECT SALINE WATER DISPOSAL — TILMY FLAT DRILLHOLE AND GEOLOGICAL SECTION LOCATION			
ENGINEERING GEOLOGY SECTION	GEOLOGIST	DRN GTA	SCALE: As shown
		TCD TAS	66-250
DIRECTOR OF MINES	SUP GEOLOGIST	CHD LVH	
		EXD	DATE 6-4-66





LEGEND

		SP	SAND, poorly graded, fine to medium grained, calcareous silty lines, calcareous, red brown.
PLEISTOCENE	BLANCHETOWN CLAY	SC to CL	SAND, poorly graded, fine to medium grained, excess clayed lines, increasing with depth, calcareous patches brown, mottled grey-green.
		CL to CH	CLAY SOIL, low plasticity, sand in patches, grey green, mottled red-brown.
PLIOCENE	PARILLA SANDS	SP (CL)	SAND, poorly graded, fine to medium grained, clayey lines, clayey bands as shown, light yellow-brown.

Form lines. Arrow shows direction of fall (form lines at 0.5 ft intervals, approx.)

'crab holes'

G80 Cable Tool drill hole

Strike and dip of slickensided joint

Trace of joint.

Geological boundary, gradational

Geological boundary, defined.

SCALE IN FEET (NATURAL)

5 0 5 10 15

FIG.3

FOR LOCATION SEE PLAN N° 66-250

DEPARTMENT OF MINES — SOUTH AUSTRALIA

CHOWILLA PROJECT
SALINE WATER DISPOSAL — TILMY FLAT
TRENCH 1
PLAN AND GEOLOGICAL SECTION

ENGINEERING GEOLOGY SECTION	GEOLOGIST	Drn.	SCALE AS SHOWN
Director of Mines	SENIOR GEOLOGIST	Trd. RAJ	66-253 G+J
		Ckd. I.V.W.	
		Exd.	DATE: 5 APRIL '66

II III IV I V

A B

ELEVATION IN FEET

300'
250'
200'
150'
100'

TRENCH NO.3
TRENCH NO.2
G87
G122
G91
G78
G80
TRENCH NO.1
G77

Maximum Water Level

DUNE SANDS

BLANCHETOWN CLAY FORMATION

PARILLA SANDS FORMATION

Lst

32FT.
100FT.
154FT.
44FT.
85FT.
145FT.

Renmark - Wentworth Road

Max. head above Full Reservior Level - 70 ft.

SANDSTONE capping

Max head above Tailwater Level - 125.5 ft.

Proposed Upstream Water Level 205'

Proposed Minimum Tailwater Level 159.50'

Static Water Level as at 31 Mar '66

SCALE
HORIZONTAL
FEET 1000 0 1000 2000 3000 4000 5000 6000 FEET

VERTICAL
1 INCH = 10 FEET

FIG. 3

For Location of Bores and Section Line see plan 66-250
Levels reduced to same datum as Chowilla Dam Survey

DEPARTMENT OF MINES — SOUTH AUSTRALIA

CHOWILLA PROJECT

SALINE WATER DISPOSAL - TILMY FLAT

DIAGRAMMATIC GEOLOGICAL SECTION A-B

ENGINEERING GEOLOGY SECTION

GEOLOGIST

Director of Mines

SUPERVISING GEOLOGIST

Drn. GTP | SCALE: As shown
Tcd. A.H. | 66-248 GJ
Chd. L.V.N.
Exd. DMS | DATE: 31-3-66

LEGEND

	SM	SAND, poorly graded, excess silt, calcareous, light brown, few cemented lime nodules
	SM	SAND, poorly graded, excess silt, numerous calcareous patches, few lime nodules, white to pale-brown. Clayey towards base
	SC-SM	SAND, poorly graded, clayey and silty fines, some calcareous patches, red-brown and white
BLANCHETOWN CLAY	CL-SC	CLAY SOIL, low plasticity, some sand, calcareous patches near top, brown, grey-green mottled. Sand in dykes and patches, red-brown
	CH-CL	CLAY SOIL, low plasticity, sandy in part, grey green. Patches and dykes of SAND, poorly graded, red-brown
	SP and CL	Bands of: SAND, poorly graded, fine grained, clayey, yellow grey and CLAY SOIL, low plasticity grey-green
		LIMESTONE, sandy and silty. White. Dendritic MnO_2 staining
		Vertical sand filled joint
	30	Strike and dip of slickensided joint
	30	Strike and dip of sand filled joint

Ground surface

Geological boundary, gradational

Traces of joints

Traces of irregular crack

Base of trench

Geological boundary, clearly defined

S.W. N.E.

CHANNEL SAMPLE 0 to 11 ft.

RIVER MURRAY DATUM (Ft)

1+30 1+20 1+10 1+00 0+90 0+80 0+70 0+60 0+50 0+40 0+30 0+20 0+10 0+00

230 225 220 215

Few lime patches

Few lime patches

Numerous calcrete nodules

Joint coated with clay where it passes through sand

Joint, sand filled 0·01 to 0·03 ft. wide

Joint, horizontal, planar, smooth 0·03 ft. above sand.

Joint, sand filled, 0·03 ft wide

Sand dyke 0·5 to 1 ft wide (Not present on south wall)

Pipes of lime up to 0·04 ft wide

Lime concentrated along joint

SAND extends more than 0·6 ft. into face

Patches of CH elongated horizontally form 20% of material.

X X'

Y Y'

X 30 85 70 30 35 30 40 25 20 25 to 35 40 30 to 40 X'

Y 25 35 40 30 40 35 30 Y'

SCALE IN FEET (NATURAL)

5 0 5 10 15

FIG. 4

FOR LOCATION SEE PLAN Nº 66-250

DEPARTMENT OF MINES — SOUTH AUSTRALIA

CHOWILLA PROJECT

SALINE WATER DISPOSAL — TILMY FLAT

TRENCH 2

PLAN AND GEOLOGICAL SECTION

ENGINEERING GEOLOGY SECTION	L. Landrigan Geologist	Drn.	SCALE: 1 inch = 5 feet
		Tcd.	66-254 G+J
Director of Mines	I. Johnson Junior Geologist	Ckd.	
		Exd.	DATE: 5 April '66

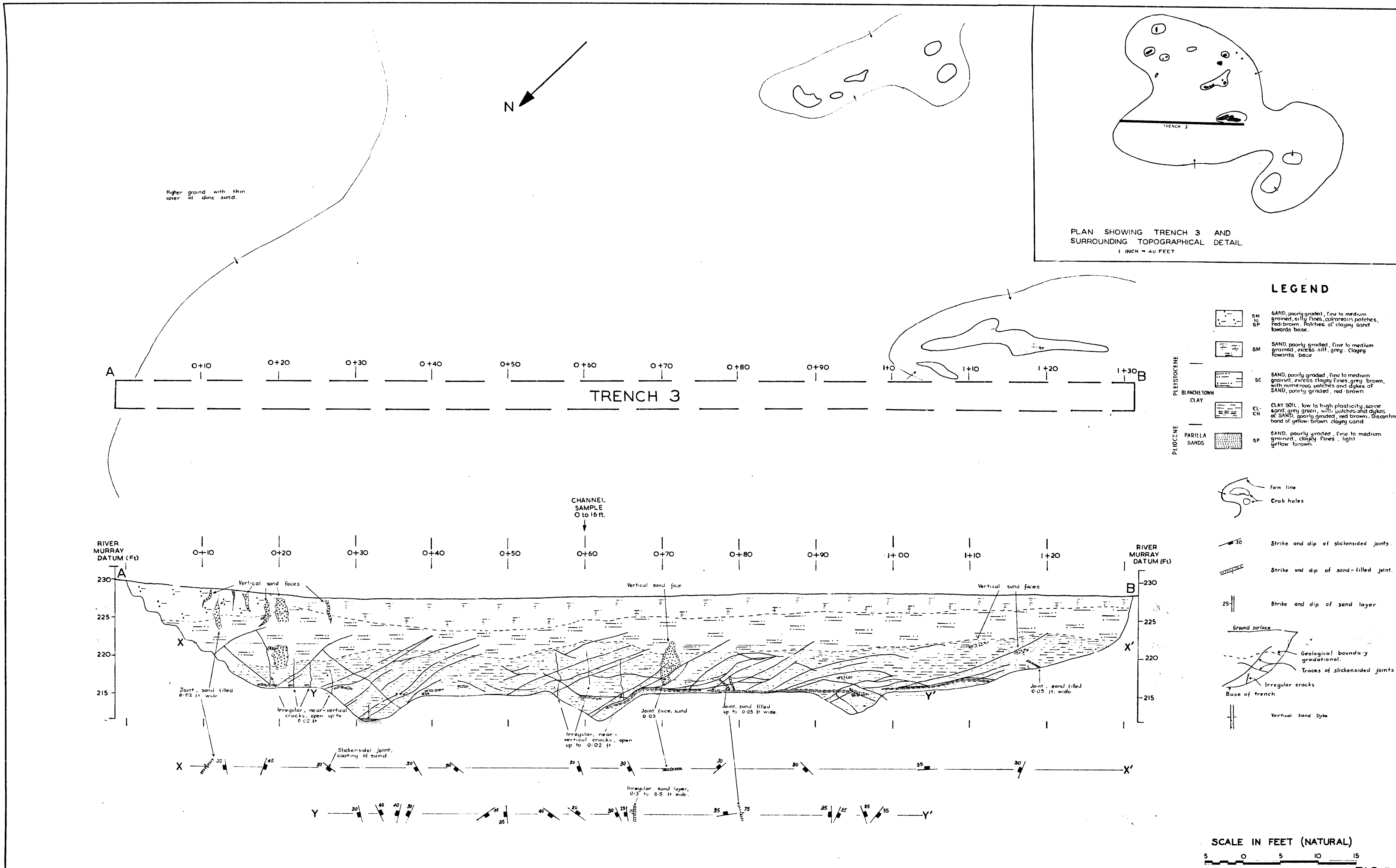


FIG.5

FOR LOCATION SEE PLAN Nº 66-250

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
CHOWILLA PROJECT SALINE WATER DISPOSAL — TILMY FLAT TRENCH 3 PLAN AND GEOLOGICAL SECTION			
ENGINEERING GEOLOGY SECTION	[signature] Geologist	Drn.	SCALE: 1 inch · 5 feet
		Tcd.	66–255 G+J
[signature] Director of Mines	[signature] Senior Geologist	Ckd.	
		Exd.	DATE: 5 April '66