DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

ENGINEERING GEOLOGY SECTION

AROONA DAM - LEIGH CREEK

GEOLOGICAL INVESTIGATIONS - REPORT NO.5

Client: Engineering and Water Supply Department

by

B.J. MORRIS
GEOLOGIST
ENGINEERING GEOLOGY SECTION

19th July, 1971

Rept.Bk.No. 71/111

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CONTENTS — PAGE

Rept.Bk.No. 71/111
G.S. No. 4686
D.M. No. 242/71

19th July, 1971

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Rept.Bk.No. 71/111
G.S. No. 4686
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AROONA DAM - LEIGH CREEK

GEOLOGICAL INVESTIGATIONS: REPORT NO. 5

SUMMARY AND CONCLUSIONS

A diamond drilling programme was undertaken in the quartzite and interbedded sandstone forming the left abutment of Aroona Dam, to determine the amount, and cause of water leakage through the abutment.

Preliminary diamond drilling was carried out in 1962, with 4 holes being drilled and pressure tested. Two diamond drill holes have been put down, and pressure tested, during the present programme.

The following conclusions are made from the results:-

a) leakages are due to a general opening of inter-connecting joints.

b) no obvious relation of leakage to rock type has been observed, although some sandstone interbeds may be slightly more permeable than the quartzite.

c) no general tightening of joints occurs with depth over the length of the drill holes although some areas appear tighter than others.

d) there is a slight general tightening of joints in a direction downstream of the dam, possibly associated with a broadening and heightening of the ridge.

e) leakages could be decreased considerably with construction of a grout curtain in the left abutment downstream of the dam.

f) a grout curtain along the R.L. 875ft. contour, for 1200ft. downstream of the dam with grouting commencing at R.L. 865ft. in each hole, would greatly reduce leakage.

g) the grout curtain would have to be between 100ft. and 150ft. deep or to a depth where the leakage is less than 3 lugeons. This depth could be determined by prior water pressure testing in each hole.

h) grout takes would be large and leakages to the ground surface would be common, especially in the upper part of each hole.

i) holes should be spaced 20ft. apart with secondary and tertiary holes as necessary.

A site for an upstream storage dam in the head waters of the reservoir and possible quarry sites for rock material for this dam were also investigated.

INTRODUCTION

Investigation of leakage through the left abutment of Aroona Dam was requested by the Director and Engineer in Chief, Engineering and Water Supply Department, in a letter dated 5th February, 1971 to the Director of Mines.

Aroona Dam is situated in Aroona Gorge about 8 miles south-west of Leigh Creek and supplies this township and the open cut coal fields with water. The dam wall is 65ft. high and the total capacity of the reservoir in 1948 was 1650 million gallons, however due to inflows of silt into the reservoir the total capacity in 1970 was reduced to 1200 million gallons.

Considerable leakage (estimated at about 8 million gallons a month) from the reservoir occurs through the left abutment of the dam, and two diamond drill holes were drilled (Fig.1) to a depth of 51.2ft. (DH.1) and 70ft. (DH.2) and water pressure tested, to determine the frequency of open joints, the occurrence of permeable sandstone beds in the quartzite, the possible occurrence of shear zones, the water gradient through the ridge (Fig.2) and the average permeability of the ridge.

During a previous investigation of the leakage (Johnson 1962) four diamond drill holes were drilled, water pressure tested and logged. Ths positions of these holes (AL1 AL2 AL3 and A14) are shown on Figure 1.

Possible sites for an upstream storage dam within the reservoir were also inspected. This dam would be designed to form a settling pond in the upper reaches, to prevent silt entering the main portion of the reservoir. The reservoir is fed by Aroona, Windy and Emu Creeks which only flow a few times a year after heavy rains, and carry large quantities of silt into the reservoir. This storage dam would also be of some assistance in alleviating the high evaporation rate from the reservoir. Possible quarry sites to provide material for construction of the dam were inspected.

Prior to this report four other reports had been written on the Aroona Dam site and the leakage through the left abutment of the dam. (see Bibliography).

REGIONAL GEOLOGY

The area consists of two sequences of sedimentary rocks, one of Cambrian Age and the other of Proterozoic Age (Adelaide System) striking in a north-westerly direction and dipping about 55° to the north-east (Parkin and King 1952). The two sequences are separated by a large regional, almost vertical, fault (Norwest Fault) with the same strike as the sedimentary sequence and with a throw of about 40,000 ft., which has the effect of bringing the Lower Cambrian beds in contact with the basal beds of the Adelaide System (Cochrane 1955). Several sets of minor faults occur parallel to the major fault.

Aroona Creek, upon which the dam is situated in Aroona Gorge, runs approximately parallel to the regional strike of the rocks and within the Copley Quartzite Unit (Torrensian Series) which consists of interbedded quartzite and sandstone. Upstream of the dam (Fig.2) the creek cuts across the strike of the beds and back again forming a horseshoe bend. The Copley Quartzite is a very resistant unit and forms steep rugged ranges with Mr. Aroona being the most prominent peak.

SITE GEOLOGY

Topography and Geology

Aroona Dam is built on the western limb of the horseshoe bend of Aroona Gorge, leaving a central ridge about 2500ft. long, about650ft. wide and up to 160ft. high which acts as the left abutment of the dam and one of the main retaining walls of the reservoir. It is through this ridge that seepage occurs, downstream of the dam. The western side of the ridge, on which the exploratory drill holes are situated (Fig.1) slopes about

15° to 20° and is completely covered with angular quartzite scree up to 1ft. in size.

The ridge is composed entirely of rocks of the Copley Quartzite Unit. These consist of white, very strong quartzite resistant to erosion, and interbedded sandstone which is medium to fine grained, fissile, generally feldspathic and less resistant to erosion. Weathering of the sandstone commonly produces small gullies with steeper over-hanging quartzite layers. The rocks are thinly bedded with ripple marking and cross-bedding being a common feature, and indicative of shallow water deposition. The rocks of the Copley Quartzite have been sub-divided into 3 separate units (Cochrane 1955) as shown on Figure 1;a) quartzite, which consists predominantly of quartzite with minor sandstone interbeds, (b) sandstone, which consists of sandstone with minor quartzite interbeds, and c) quartzite and sandstone interbedded in about equal proportions.

Structure

The beds strike across the ridge at about 140°and dip upstream towards the dam at about 55°N. There are two main sets of joints, one striking at about 150° and dipping about 40°S.W. and the other striking at about 60°and dipping about 50° S.E. This three way system of planes of bedding and jointing, divides the rock into blocks up to 2ft. in size, which readily break away at the surface, producing large areas of scree. Many of the joints are open with white cyrstalline deposits of gypsum, calcite, and dark manganese deposits lining their walls, suggesting that water moves freely through them. Faulting is common in the area (Fig. 1) but does not appear to have any significant effect on water leakage.

Hydrogeology

Seepage occurs near the base of the dam wall and at various positions along the eastern bank of the creek downstream of the dam (Fig.1). Water pressure tests in holes DH.1 and DH.2 show that leakages range from a reasonably low 3 Lugeons to over 100 Lugeons with an average of 38 lugeons and 44 lugeons in holes DH.1 and DH.2 respectively. The water loss is directly proportional to the degree of fracturing (Appendix A) and steadily increases down hole DH.1 and also in DH.2 after an initially large water loss nearer the surface. The water loss is greatest where the open joints are coated with gypsum, calcite and manganese. The water gradient across the ridge as measured in the drill holes with the reservoir full is about 1 in 10 (Fig.2), and the calculated value of the hydraulic conductivity is about 10^{-4} cms. per. sec. which is well down in the range of permeabilities of naturally occurring materials, and is equivalent to that of fine sands or a mixture of sand, silt, and clay (Terzaghi and Peck 1966). A similar result was also obtained by W. Johnson (1962) during previous investigations. An increase in groundwater gradient occurs southwards from the left abutment of the dam and this is probably due to a decrease in permeability in this direction, as a result of tightening of joints as the ridge becomes wider and higher and thus less weathered at depth. The flow through the interconnecting joints and cracks in the ridge appears to be slow, but wide spread, and a grouting programme along the ridge should greatly reduce this leakage.

The water emerging as seepages along the creek bank, although now having occurred for many years, still remains at a salinity close to that of the naturally occurring ground water which is much higher than that of the reservoir water. This is considered to be due to the slow rate of flow of the water through the ridge. With a hydraulic conductivity of 10^{-4}cms. per sec. water would flow through the ridge when the reservoir was full at about 100ft. per year. On this basis water from the reservoir would take about 7 years to flow through the narrowest part of the ridge, assuming full head for that period. It is considered that the water issuing as seepages is naturally occurring ground water forced to the surface under pressure effects related to the head of water in the reservoir.

UPSTREAM STORAGE DAM

Since the capacity of the reservoir has been decreased by an estimated 450 million gallons in about 20 years by the inflow of silt an upstream storage dam was proposed. A possible site for the dam was chosen mainly on the basis of topography (Appendix B. Photo (a)), but rock exposures on both abutments indicate that adequate foundations for a rock fill dam could be reasonably expected to be obtained. The site is about 1½ miles upstream of the present dam (Fig.2). Two quarry sites (Appendix B. Photos, b & c) for the dam, close to the left abutment, have been proposed. These could be expected to produce blocky quartzite pieces up to 3ft., but mainly 0.5 ft. to 1ft. in size, suitable for use as rock fill. Any other site in the vicinity would produce a similar rock, as the ranges in this area are all composed of quartzite and sandstone. Access to the left abutment of the proposed dam and the quarry sites, from the existing access road to the Aroona Dam, is relatively good (Appendix B. Photo, c).

B.J. MORRIS
GEOLOGIST
ENGINEERING GEOLOGY SECTION

BJM:CF
19th July, 1971

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Parkin, L.W. and King, D. 1962. Copley Sheet, Geol. Atlas of South Aust. 1:63,360 series. Geol. Survey. S. Aust.

Terzaghi K. and Peck, R.B. 1966. Soil Mechanics in Engineering Practice. Wiley International Edition.

APPENDIX A

Logs of diamond drill holes and explanatory notes

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF DIAMOND DRILL HOLE

HOLE NO. *D.H. 1.*
SERIAL No

PROJECT. *AROONA DAM*
FEATURE. *Left Bank of Dam.*
LOCATION *Leigh Creek*

SECTION
CO-ORDINATES
ANGLE FROM HORIZ. *90°* DIRECTION

HUNDRED *Copley. Im. grid J.5*

R.L. Surface .FT.
R.L. Collar *827·5* .FT.
Datum

DESCRIPTION OF CORE	② GROUP SYMBOL	① STRENGTH TERM VS S MS W VW SO	CORE SIZE	DEPTH R.L. FT.	LOG	③ FRACTURE LOG 1 4 16 64	STRUCTURES JOINTS, VEINS, SEAMS, SHEARED ZONES, CRUSHED ZONES	LIFT CORE LOSS% 10 5 50	WATER LEVEL DATE	CASING	DRILL WATER LOSS % 0 100	④ WATER PRESSURE TESTS LUGEONS 0.5 5 10 50 100
No core				0								
Medium grained quartz pebbles up to 6 cm. in size.												
No core												
Coarse gravel, sand & yellow limy clay mixture.			NX									*NOT TESTED*
No core												
50% GRAVELS (6cm) 40% medium coarse SAND 10% Limy SILT SOIL.				10								
60% medium SAND 40% limy SILT SOIL									*7 May 71.*			
Coarse (½mm) quartzite with faint layering 40°.			NX				*Joints and cracks coated with manganese, iron & limy silt. Joints at 50°*					
				20								
Medium grained quartzite rounded quartz 75% feldspar 20%, other minerals 5% and siliceous cement.							*Numerous joints and fractures, smooth surfaced, spacing about 2 cms.*					*(1·05)*
bedding at 40°												
				30			*shear zone. Two main sets of joints (1) bedding plane joint 40° (2) cross cutting joint at 50° plus irregular fractures.*					*(2·1)*
No limy silt below this depth. →			NX				← *Joints more widely spaced. 5 cm apart.*					
Sandstone interbed.				40			← *Shear Zone.*					*(2·1)*
Sandstone interbed			NX									
				50			← *Joints heavily coated with manganese.*					*(2·1)*
							END OF HOLE 51·2 ft.					
				60								
				70								

COPLEY QUARTZITE (Torrensian) medium grained cream quartzite with occasional sandstone interbeds

ROCK SUBSTANCE
① STRENGTH TERM
VS-Very Strong
S-Strong
MS-Medium Strong
W-Weak
VW-Very Weak
SO-Soil properties

CONDITION TERM
Fresh
Decomposed
Weathered
Altered
Not Applicable

② Substances with soil properties remoulded and classified by Unified System

③ FRACTURE LOG
1 4 16 64 Natural fractures per foot of core
12 3 3/4 3/16 Equivalent length of core in inches

④ (3·5) Maximum effective pressure (bars) reached during test.
Min. = Minimum value.

ENGINEERING GEOLOGY SECTION

DRILL No. *15*
TYPE. *Mindrill*
DRILLER *J. Jensen.*
START. *1st May. 71.*
FINISH *3rd May 71.*

LOGGED *B. J. Morris*
DATE *19th May 71.*
TRACED *B. S. G.*
CHECKED *B. J. M.*

SHEET *1.* OF *1.*   DRG. No. S 9303 Co.

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF DIAMOND DRILL HOLE

HOLE NO. *D. H. 2.*

SERIAL No.

PROJECT. *ARDONA DAM*

FEATURE. *Left bank of Dam.*

LOCATION *Leigh Creek*

SECTION

CO-ORDINATES

ANGLE FROM HORIZ. *90°*

HUNDRED *Copley 1m. grid J5*

DIRECTION

R.L. Surface .FT.

R.L. Collar *874·8* .FT.

Datum

DESCRIPTION OF CORE	② GROUP SYMBOL	① STRENGTH TERM VS S MS W VW SO	CORE SIZE DEPTH R.L. FT.	LOG	③ FRACTURE LOG 1 4 16 64	STRUCTURES JOINTS, VEINS, SEAMS, SHEARED ZONES, CRUSHED ZONES	LIFT CORE LOSS% 10 5 50	WATER LEVEL DATE	CASING	DRILL WATER LOSS % 0 100	WATER PRESSURE TESTS LUGEONS ④ 0.5 1 5 10 50 100

COPLEY QUARTZITE (Torrensian)

medium grained cream quartzite with occasional sandstone interbeds.

No core

Angular quartzite gravel - 6 cms.

No core

Quartzite pebbles 6 cms angular

Coarse gravel quartzite, limy silt in joints and fractures.

Faint bedding plane at 35°

Sandstone →

Fine grained sandstone with some limy silt soil.

No lime after 33 ft. - medium grained quartzite - 75% quartz, 20% feldspar 5% amphibole "pepper & salt" texture.

Sandstone →

Bedding at 40°

Core size / depth: NX; 10; 20; 30; NX; 40; 50; NX; 60; 70

Bedding plane joints and cross cutting joints plus irregular fractures.

← Joint and fractures coated with manganese, iron calcite.

← Open joints 0.5 cms. with white crystalline coating of Gypsum. Joints at 35° & 40°

Small shear zone.

Numerous sets of joints coated with yellow silt & gypsum.

gypsum coating on joint.

← manganese coating on joints, also some calcite.

← Joints coated with calcite and manganese and yellow silt.

← manganese coating.

Water level: *9th May 71.*

Water pressure tests: *NOT TESTED*; *(0)*; *(2.8)*; *(4.2)*

Continued

① ROCK SUBSTANCE

STRENGTH TERM
- VS-Very Strong
- S-Strong
- MS-Medium Strong
- W-Weak
- VW-Very Weak
- SO-Soil properties

CONDITION TERM
- Fresh
- Decomposed
- Weathered
- Altered
- Not Applicable

③ FRACTURE LOG

1 4 16 64 Natural fractures per foot of core

12 3 3/4 3/16 Equivalent length of core in inches

④ (3.5) Maximum effective pressure (bars) reached during test.

Min. = Minimum value.

② Substances with soil properties remoulded and classified by Unified System

ENGINEERING GEOLOGY SECTION

DRILL No. *15*

TYPE *Mindrill*

DRILLER *J. Jensen.*

START. *5th May 71.*

FINISH *8th May 71.*

LOGGED *B. J. Morris*

DATE *19th May 71.*

TRACED *B. S. G.*

CHECKED *B. J. M.*

SHEET *1* OF *2*

DRG. No. S 9304 *a*

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF DIAMOND DRILL HOLE

HOLE NO. DH 2

SERIAL No

PROJECT. AROONA DAM

FEATURE. Left bank of dam

LOCATION Leigh Creek

SECTION

CO-ORDINATES

ANGLE FROM HORIZ. 90°

HUNDRED Copley 1m. grid, J5

DIRECTION

R.L. Surface FT.

R.L. Collar 874·8 FT.

Datum

DESCRIPTION OF CORE	② GROUP SYMBOL	① STRENGTH TERM VS S MS W VW SO	CORE SIZE DEPTH R.L. FT.	LOG	③ FRACTURE LOG 1 4 16 64	STRUCTURES JOINTS, VEINS, SEAMS, SHEARED ZONES, CRUSHED ZONES	LIFT CORE LOSS% 10 5 50	WATER LEVEL DATE	CASING	DRILL WATER LOSS% 0 100	WATER PRESSURE TESTS ④ LUGEONS 0.5 1 5 10 50 100
COPLEY QUARTZITE (Torrensian) medium grained cream quartzite with occasional sandstone interbeds			70 NX								(4·2)
			80								
development of slickensided mylonite →						← Shear zone.					(4·2)
			90			End of Hole 90 ft.					

① ROCK SUBSTANCE

STRENGTH TERM
- VS-Very Strong
- S-Strong
- MS-Medium Strong
- W-Weak
- VW-Very Weak
- SO-Soil properties

CONDITION TERM
- Fresh
- Decomposed
- Weathered
- Altered
- Not Applicable

② Substances with soil properties remoulded and classified by Unified System

③ FRACTURE LOG

1 4 16 64 Natural fractures per foot of core

12 3 3/4 3/16 Equivalent length of core in inches

④ (3·5) Maximum effective pressure (bars) reached during test.

Min. = Minimum value.

ENGINEERING GEOLOGY SECTION

DRILL No. 15	LOGGED B.J. Morris
TYPE Mindrill	DATE 19th May '71
DRILLER J. Jensen	TRACED B.S.G.
START. 5th May '71	CHECKED B.J.M.
FINISH 8th May '71	
SHEET 2 OF 2	DRG. No. S 9304 b

APPENDIX

LOGS OF DIAMOND DRILL HOLES AND EXPLANATORY NOTES

NOTES ON DRILLING PROCEDURES

Equipment

The core sizes are as follows:-

Symbol	Nominal Diameter of Cores (inches)
NXC (NX casing)	2.8
NMLC	2.0
BMLC	1.4

The NMLC and BMLC cores were obtained with "M" type stationery inner tube core barrels fitted with bottom discharge bits. The inner tubes were of the split type, ensuring minimum disturbance of the core during removal from the barrel.

Storing and marking of core

Cores are stored in wooden boxes, each compartment of which is designed to contain five feet of core. The internal length for each compartment is actually five feet one inch, to allow for 100 per cent core recovery. Roughness of the ends of the core, and small inaccuracies in measurement when breaking it to fit the box, make it difficult to fit five feet of core in a compartment of exactly that length. The boxes are marked with consecutive compartment numbers at one end, and the drilled depths from the surface in feet at the other.

The core was boxed in this manner at the drill site, the core being placed in its appropriate place in the box as soon as it was extracted from the core barrel. The bottom of each lift was marked with paint or indelible ink immediately it was placed in the box, and a corresponding mark made on the side of the core box. The measured depth of the hole in feet from the surface was painted on the side of the core box and on the core. Timber blocks cut to the correct length indicate core not recovered (red blocks), and core removed for testing (white blocks).

The core has been stored at the Department of Mines, Drilling and Mechanical Branch, Dalgleish Street, Thebarton, South Australia.

NOTES ON DIAMOND DRILL LOG SHEETS

The logs are plotted on a vertical scale of one inch = 10 feet (1:120) or one inch = five feet (1:60). In the column headed "Log", places where core was obtained are shown by stippling. Places where core was lost are shown by blank spaces.

The descriptions given on the log sheet refer only to materials recovered as core. Core is lost by the material being ground or washed away during the drilling process; it may usually be inferred that such material is relatively weak. The weakness may arise from weathering or else from sheared, crushed, or closely jointed rock. It cannot always be assumed that the material not recovered is weak, since even solid rock core may be ground away and lost during drilling operations.

To the left of the graphic log is a geological description of the materials sampled. This includes:-

... Geological age) Printed vertically
... Rock unit name)
... Type of material)
... Mineral composition
... Cementation
... Physical description of core

Classification of the rock substance in terms of its strength and its condition (eg. weathering, alteration) is shown graphically in the column "Strength Term". The terms used in the classification are defined in Table 1. Where the substance has soil properties this is shown graphically in the column, and immediately to the left of the column under "Group Symbol", the symbol representing the remoulded sample as classified under the Unified Soils Classification (USBR 1966) is given.

The "Fracture Log" to the right of the graphic log column shows the degree of fracturing of the core by means of a histogram-type plot. Degree of fracturing means the degree to which the rock has mechanically broken up along geological defects such as joints, cleavage planes, foliation planes, bedding planes or seams. Fresh fractures across the fabric of the rock, not along the existing planar geological defects, are not included. In sections in which no core was recovered, the fracture log column is left blank.

In the column marked "Structures" the angles shown on joints, bedding, or other geological structures are the angles which they make with the plane at 90° to the axis of the core, unless otherwise stated.

Percentage loss of drilling water as recorded by the driller is shown graphically in the column "Drill Water Loss %".

REFERENCE

1. UNITED STATES BUREAU OF RECLAMATION 1966, Earth Manual 2nd Edition.

NOTES ON WATER PRESSURE TESTING

Water pressure testing was carried out during drilling by sealing the hole with an expandable packer and pumping in water at measured pressures.

The following procedure was used.

a. Immediately after drilling of the test section, the hole was cleaned out by flushing with water pumped down through the drill rods, until the returning water was clear.

b. An expandable rubber packer in series with NX drill rods, was placed down the hole at the top of the test section and expanded to form a seal against the walls of the hole.

c. Water was pumped into the test section between the packer and the bottom of the hole, and the pressure measured by a pressure guage. The quantity of water pumped into the hole, for a given period, usually 5 minutes, was measured by a water meter.

The results have been used to calculate permeability figures for the rock mass, as described below.

Calculation of permeability figures

The results of the water pressure testing have been plotted as Lugeon units on the log.

One Lugeon unit is defined in Talobre (1957) as a water loss of 1 litre per minute per metre of drill hole of diameter 46 to 76 mm at a pressure of 10 bars (10.2 kg/cm^2) maintained for 10 minutes.

The testing procedure used has been described above. The conditions of test differed in some respects from those required by the above definition, but were sufficiently close to warrant the use of Lugeon units. It is generally not possible to reach test pressures as high as 10 bars, and Lugeon values are calculated by extrapolation from leakage values obtained at actual effective pressures used during the test. The maximum effective pressure obtained is shown on the log.

In some cases during testing water can be pumped into the test section at full pump capacity without registering any pressure in the gauge at the surface. The Lugeon value is then calculated assuming that the drill rods were filled with water, although it is most likely that the rods were only partly filled because no pressure was registered. In cases such as these the actual Lugeon value would be more than that calculated and is therefore shown on the log as a "minimum value".

REFERENCE

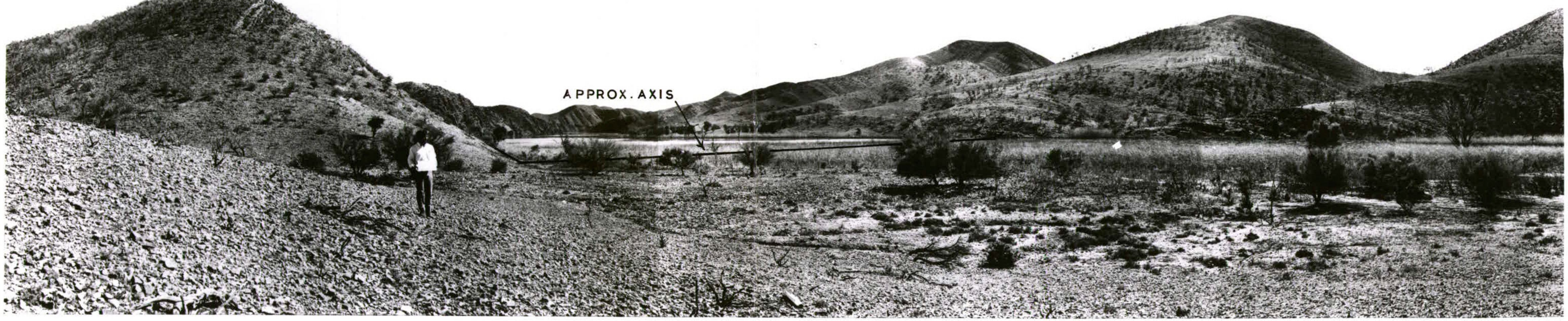
TALOBRE, J., (1957) La Mechanique des Roches (Dunod : Paris), pp. 151-5.

APPENDIX B

Photographs a) proposed site for Upstream Storage Dam

b) proposed site for rock fill quarry

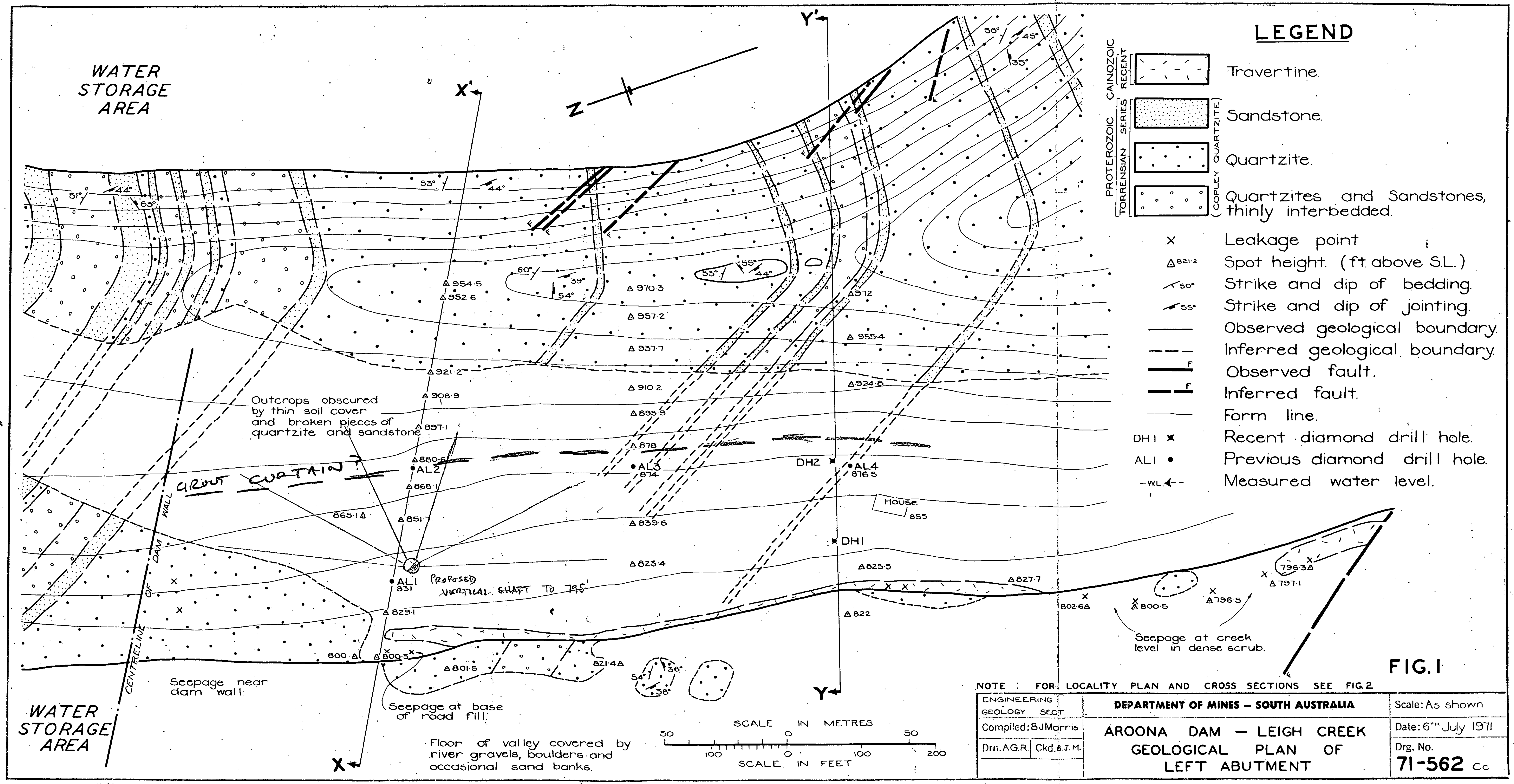
c) access path and proposed quarry sites.



PROPOSED SITE OF UPSTREAM STORAGE DAM
AROONA RESERVOIR

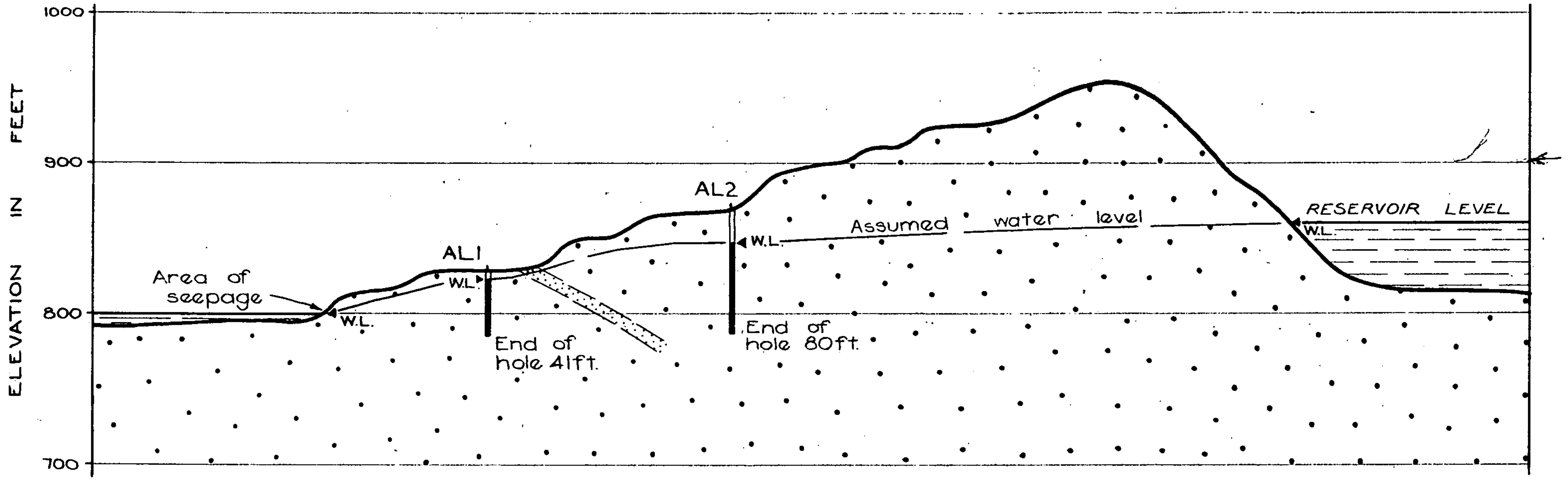
b) Proposed site for rock fill quarry

c) Access path and proposed quarry sites

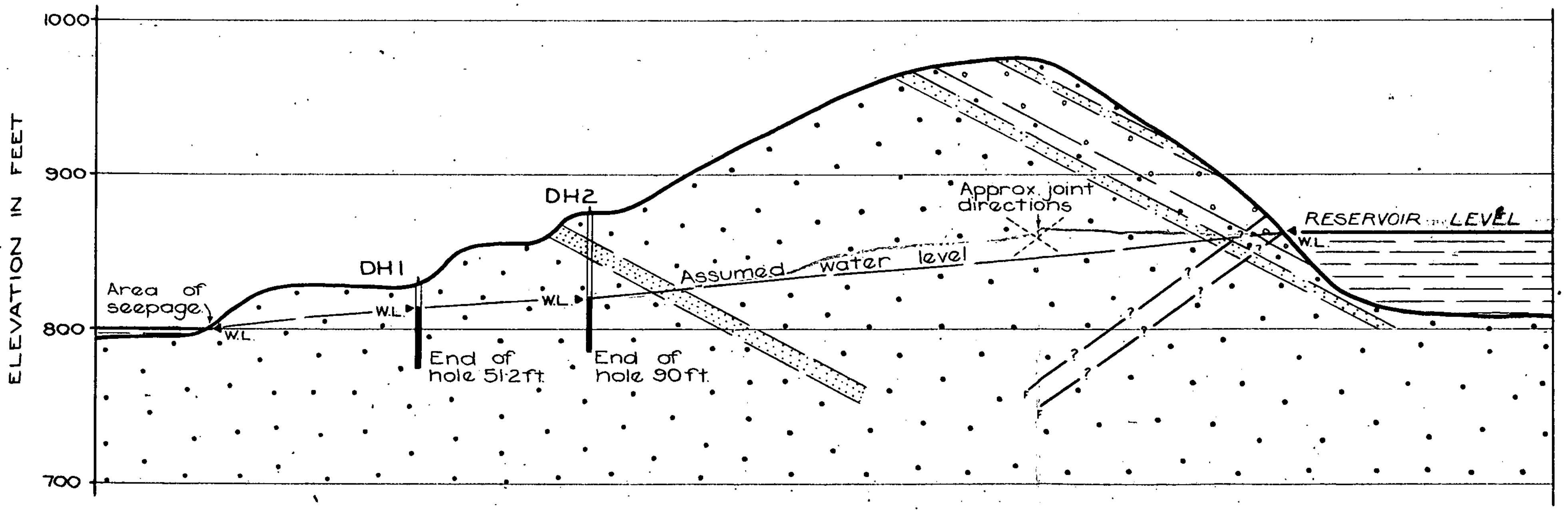

WATER STORAGE AREA
X'
Y'
N
LEGEND
CAINOZOIC RECENT
Travertine.
PROTEROZOIC TORRENSIAN SERIES (COPLEY QUARTZITE)
Sandstone.
Quartzite.
Quartzites and Sandstones, thinly interbedded.
Leakage point
Spot height. (ft. above S.L.)
Strike and dip of bedding.
Strike and dip of jointing.
Observed geological boundary.
Inferred geological boundary.
Observed fault.
Inferred fault.
Form line.
DH1 Recent diamond drill hole.
AL1 Previous diamond drill hole.
W.L. Measured water level.
Outcrops obscured by thin soil cover and broken pieces of quartzite and sandstone
GROUT CURTAIN?
CENTRELINE OF DAM WALL
AL1 831
AL2
AL3 874
AL4 876·5
DH1
DH2
House 855
PROPOSED VERTICAL SHAFT TO 795'
Seepage near dam wall.
Seepage at base of road fill.
Seepage at creek level in dense scrub.
Floor of valley covered by river gravels, boulders and occasional sand banks.
WATER STORAGE AREA
X
Y
SCALE IN METRES
SCALE IN FEET
FIG.1
NOTE: FOR LOCALITY PLAN AND CROSS SECTIONS SEE FIG.2
ENGINEERING GEOLOGY SECT.
Compiled: B.J.Morris
Drn. A.G.R.
Ckd. B.J.M.
DEPARTMENT OF MINES – SOUTH AUSTRALIA
AROONA DAM – LEIGH CREEK
GEOLOGICAL PLAN OF LEFT ABUTMENT
Scale: As shown
Date: 6TH July 1971
Drg. No. 71-562 Cc

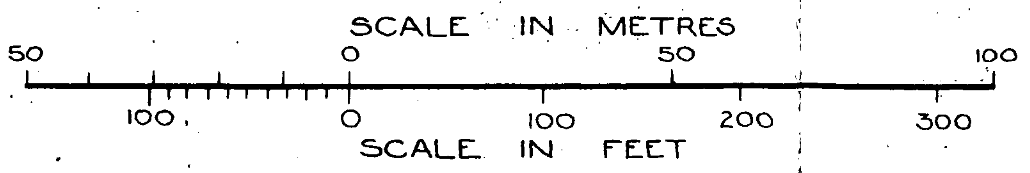
1M–2.70 A1811

SECTION X - X'

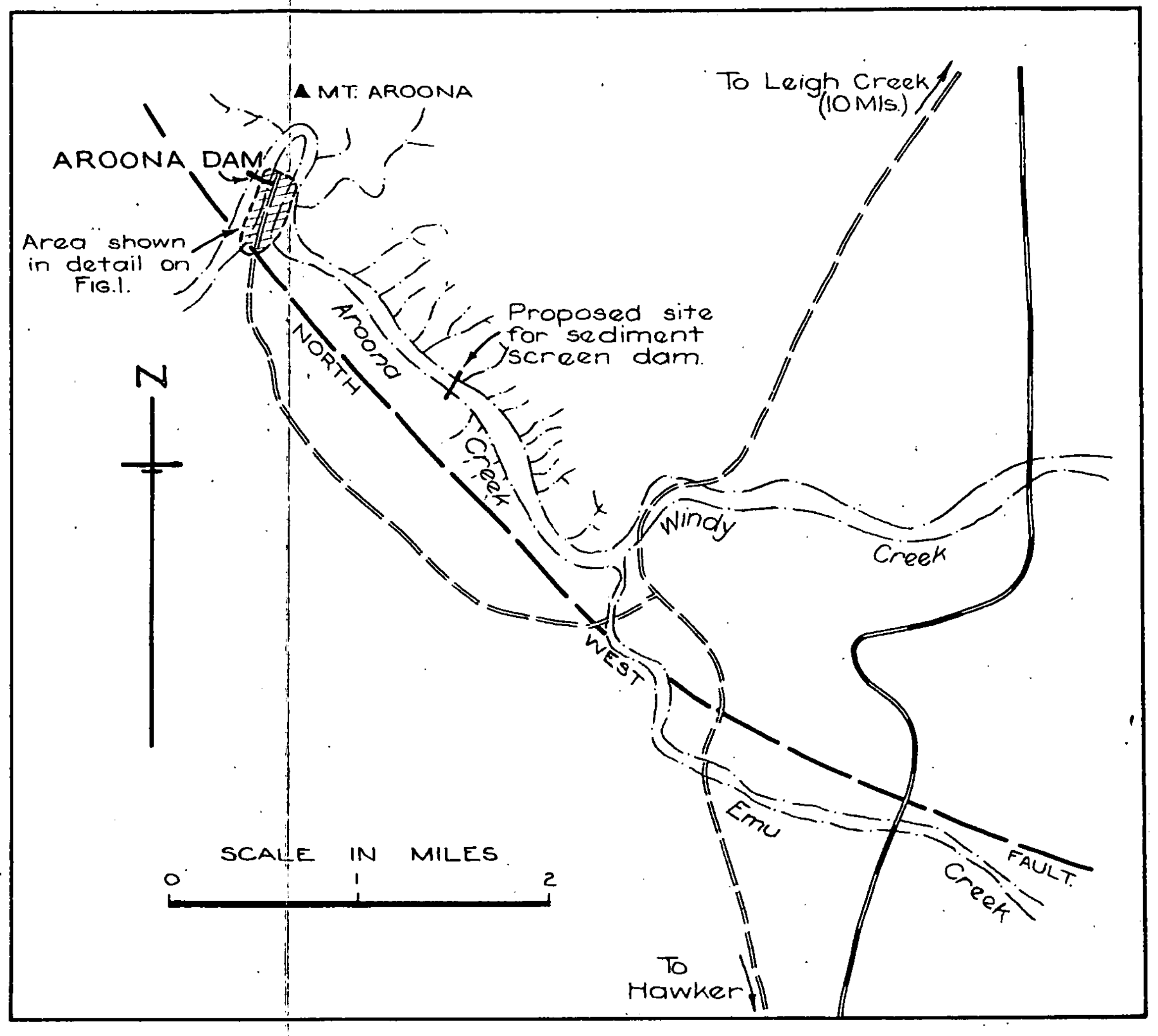


SECTION Y - Y'





LOCALITY PLAN



Note : For legend see Fig.1.

FIG. 2.

ENGINEERING GEOLOGY SECT.	**DEPARTMENT OF MINES – SOUTH AUSTRALIA**	Scale: As shown.
Compiled: B.J.Morris	AROONA DAM – LEIGH CREEK GEOLOGICAL SECTIONS AND LOCALITY PLAN	Date: 29TH June 1971
Drn. A.G.R. Ckd. B.J.M.		Drg. No. 71-561 Cc

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