DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

PROPOSED WEIR SITES - MT. BOLD, ECHUNGA CREEK AND BRADY'S GULLY

Sec. 1320 Hundred Noarlunga, Section 323 Hundred Kuitpo

Client: Engineering and Water Supply Department

by

B.J. MORRIS
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Rept.Bk.No. 71/163

5th October, 1971.

DEPARTMENT OF MINES
SOUTH AUSTRALIA

PROPOSED WEIR SITES - MT. BOLD, ECHUNGA CREEK AND BRADY'S GULLY

Sec. 1329 Hundred Noarlunga, Section 323 Hundred Kuitpo

Report on Geological Investigations
Feasibility Stage

Client: Engineering and Water Supply Department

by

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Rept.Bk.No. 71/163
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D.M. No. 543/71

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Rept. Bk. No. 71/163
G.S. No. 4737
D.M. No. 543/71

PROPOSED WEIR SITES - MT. BOLD, ECHUNGA CREEK AND BRADY'S GULLY

Section 1529, Hd. Noarlunga, Section 323 Hundred Kuitpo

REPORT ON GEOLOGICAL INVESTIGATIONS

Feasibility Stage

SUMMARY AND CONCLUSIONS

Two possible sites for proposed gauging weirs on major water supply creeks of Mt. Bold Reservoir were investigated by (a) surface geological examinations and (b) seismic refraction surveys.

A further site proposed in Brady's Gully in the upper reaches of the Mt. Bold Reservoir was under several feet of water at the time of investigations, and will be examined at a later date.

The sites show some outcrops of strong sandstone at the ground, surface but elsewhere they are covered by up to 20ft. of alluvium, and this, combined with the results of the seismic refraction traverses, indicates that the upper surface of the bedrock is irregular, probably due to erosion in old river channels.

The sites appear to be suitable for the construction of gauging weirs which can be founded on strong sandstone either at, or near the ground surface. At both sites at least one abutment will be in alluvium and some leakage is likely to occur.

INTRODUCTION

A request for a geological investigation of three sites (Fig. 1) for proposed gauging weirs at

(1) Entrance to Mt. Bold Reservoir on the Onkaparinga River.

(2) Echunga Creek.

(3) Brady's Gully

was received in a letter dated 20th April, 1971, from the Director

and Engineer-in-chief, Engineering and Water Supply Department.

The sites are possible locations for gauging weirs which the E. & W. S. Department proposes to construct as part of its water supply outrophication assessment programme.

Two of the proposed sites were investigated by (a) surface geological examinations and (b) seismic refraction surveys.

The Brady's Gully site was flooded by the Mt. Bold Reservoir waters at the time of the inspection, thus this site will not be included in this present discussion.

MOUNT BOLD SITE

Site Geology

This site is situated close to the headwaters of Mt. Bold Reservoir (Fig. 1) on the Onkaparinga River. The southern bank of the river at the site is steep (30°) and rocky. In contrast the northern bank is a gently sloping (2°) alluvial flood plane. The area is grass covered with numerous gum trees adjacent to the river.

Along the southern bank of the Onkaparinga River slightly weathered strong to very strong (Table 1) sandstone of Torrensian Age outcrops and is covered, in patches, by a thin layer of silty topsoil. The sandstone also outcrops as a bar of rock across the river bed (Fig. 2.)

The northern bank at the site is made up of about 20ft. (6m) of silt soil with numerous gravel and sand layers containing rounded rock fragments up to about 0.8 ft. (20cms) in size.

Because of the swiftly flowing river at the time of the inspection the outcrops on the southern bank could not be inspected in detail. However, the bedding appears to strike in the direction 040° and dip about 20° to the east. There is a cleavage developed that strikes in the direction 050° and dips about 10° to the east. A fault passes several hundred feet to the west (Sprigg 1954) of the proposed site but no evidence of major shearing or fracture zones was found.

Seismic Refraction Survey

A seismic refraction survey was carried out at the site by the Exploration Geophysics Section under the direction of Mr. R.A. Gerdes, and a report issued (Appendix). A hammer seismic traverse was also carried out.

The results of the survey are shown on Figure 2.

Results of Investigations

The seismic refraction profile (Fig. 2) shown bed rock occuring at the surface on the southern bank and in the creek bed. The bed rock is then covered by up to 20ft. (6m) of alluvium for a distance of about 130ft. (46m) away from the creek on the northern bank. At this point there is a marked break in the surface slope (Fig. 2) from almost flat to 20° as bed rock comes to within 3ft. (1m) of the surface. It is thought that this discontinuity is an ancient river bank that has since been covered by alluvium.

The rock outcrop on the southern bank should form a suitable abutment for the proposed gauging weir. The bed rock, underlying the rest of the site, appears to have a fairly regular surface which is up to 20ft. (6m) below the ground surface, and should form a sound foundation.

Some leakage could be expected around the northern edge of the proposed weir through gravel and boulder horizons in the alluvium unless the weir is extended to utilize the ancient river bank 130ft. (46m) north of the present bank.

ECHUNGA CREEK SITE

Site Geology

The site is on Echunga Creek (Fig. 1), which is entrenched about 5ft. (1.5m) in a broad gently sloping (8°) valley floor, between steeper hill slopes. The eastern bank is covered with trees and grass, and the western by trees and low scrub. Alluvium occurs at the surface over most of the valley floor, however rock outcrops in the floor and western bank of the creek.

The area is covered by silty soil of variable depth with numerous rock fragments at the surface. There are also some sand and gravel layers which contain rounded rock fragments up to about 0.8ft. (20cms) in size. The rock outcrops in the creek consist of a strong to very strong sandstone (Torrensian Age) which also appears to be close to the surface on the western bank.

Rock outcrop at this site is poor but bedding appears to strike in a direction of 040° and dip 30° to the east. A fault passes several hundred feet to the south (Sprigg 1954) of the proposed site but no evidence was found of major shearing or fracture zones during the brief inspection.

Seismic Refraction Survey

A seismic refraction survey was carried out at the site by the Exploration Geophysics Section under the direction of Mr. R.A. Gerdes, and a report issued (Appendix).

The results of the survey are shown on Figure 3.

Results of Investigations

The seismic refraction profile shows bed rock outcropping in the creek bed but either side of the creek the upper surface of the bedrock appears to be very irregular (Fig. 3) which may be due to erosion in old creek channels. The thickness of alluvium varies from about 0.4ft. (10cms) thick to about 20ft. (6m) thick.

On the western bank strong to very strong bed rock lies within about 10ft. (3m) of the surface for a distance of 46ft. (14m) west of the creek and should form a suitable foundation. The abutment on this side of the weir would necessarily be in alluvium as there is no rock outcrop, consequently some seepage will probably occur around this side of the proposed weir wall.

On the eastern bank bedrock lies about 20ft. (6m) below the surface for about 72ft. (22m) east of the creek and here the bed rock rises abruptly (Fig. 3) to within about 8 ft. (2.5m) of the surface. The rise in bedrock could form a suitable abutment for

the weir. Unless the weir is founded on bed rock below the 20ft. (6m) of alluvium or a clay core is constructed then considerable seepage will probably occur beneath the weir wall through gravel and boulder horizons.

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8.10.71
BJM:JTS

References

Sprigg, R.C. and Wilson, B. 1954. Echunga map sheet, Geol. Atlas of S.Aust., 1:63,360 series.

Geol. Survey. S. Aust.

TABLE 1

CLASSIFICATION OF ROCK CONDITIONS AND STRENGTH OF ROCK SUBSTANCE

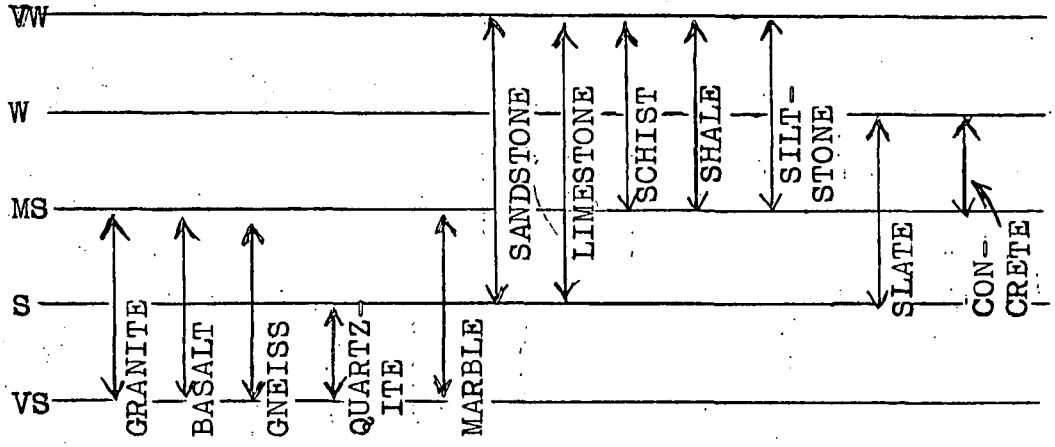
1. ROCK CONDITION TERMS

TERM	ABBRN	DEFINITION
Fresh	(F)	Substance shows no effects of chemical decomposition.
Chemically Decomposed	(D)	Substance is affected by chemical decomposition, but the exact process is not obvious.
Chemically Weathered	(W)	Substance shows effects of chemical decomposition processes which have occurred due to surface and near-surface agencies such as air and groundwater.
Chemically Altered	(A)	Substance shows effects of chemical decomposition processes which have occurred due to plutonic or volcanic fluids.
Extremely Decomposed	(XD)	Substance has been reduced to material which shows fabric of original rock, but which can be remoulded, i.e. soil substance. (Classified by Unified System).
Extremely Weathered	(XW)	
Extremely Altered	(XA)	

2. CLASSIFICATION OF ROCK SUBSTANCES BY UNCONFINED COMPRESSIVE STRENGTH

TERM	ABBRN	UNCONFINED COMPRESSIVE STRENGTH (Kg/sq.cm)	(lb/sq.in)
Very weak	VW	<70	≤ 1000
Weak	W	70 - 200	1000 - 3000
Medium strong	MS	200 - 700	3000 - 10,000
Strong	S	700 - 1800	10,000 - 25,000
Very strong	VS	>1800	$\geq 25,000$

RANGE OF STRENGTHS OF SOME COMMON ROCK SUBSTANCES IN THE FRESH STATE*



*Samples of fresh rock tested to Australian Standard. For rocks showing planar anisotropy the long axis of the sample is normal to fabric planes.

3. EXAMPLES OF USE OF CLASSIFICATION

Geological Name	Rock Condition Term	Strength Term
Granite	Fresh	Strong
Granite	Weathered	Medium Strong
Schist	Fresh	Weak
Schist	Altered	Very Weak

APPENDIX

Geophysics Report

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Rept.Bk.No. 71/159
G.S. No. 4733
DM. No. 543/71

REPORT ON SEISMIC REFRACTION SURVEYS OF PROPOSED WEIR SITES ON THE ONKAPARINGA RIVER AND ECHUNGA CREEK FLOWING INTO MT. BOLD RESERVOIR

Client: Engineering and Water Supply Department

by

R.A. GERDES
ASSISTANT SENIOR GEOPHYSICIST
EXPLORATION SERVICES DIVISION

CONTENTS

PLANS

Plan No.	Title	Scale
S9434	Locality plan. Showing Echunga Creek and Mount Bold Gauging Weir Sites.	As shown
71-723	Proposed Gauging Weir Echunga Creek Section 328 Hd. Kuitpo. Surface contours and Interpretation of Seismic Refraction Spreads	As shown
71-724	Proposed Gauging Weir near Mount Bold Reservoir - Section 1329 Hd. Noarlunga. Surface contour and Interpretation of Seismic Refraction Spreads.	As shown

30th September, 1971

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Rept.Bk.No. 71/159
G.S. No. 4733
D.M. No. 543/71

REPORT ON SEISMIC REFRACTION SURVEYS OF PROPOSED WEIR SITES ON THE ONKAPARINGA RIVER AND ECHUNGA CREEK FLOWING INTO MT. BOLD RESERVOIR.

Client: Engineering and Water Supply Department

ABSTRACT

A hammer and conventional surveys were conducted over two proposed weir gauging sites on the Onkaparinga River and on the Echunga Creek, near Mt. Bold Reservoir.

The interpreted bedrock profile on the north bank of Onkaparinga river indicates that the bedrock slopes gently down towards the creek from a vertical discontinuity. The latter probably represents the edge of the stream cutting. The bedrock profile over the Echunga creek indicates a deep alluvium filled river cutting east of the present stream. The hammer seismic results were unrealiable at Onkaparinga Creek.

INTRODUCTION

As part of the geological investigation of the proposed weir sites across streams flowing into Mt. Bold reservoir, a hammer and a conventional seismic refraction survey was requested by the Engineering Geology Section of the South Australian Geological Survey for the South Australian, Engineering and Water Supply Department. The purpose of the surveys was to locate bedrock for the foundations of weirs for water flow measurements. The locations of these sites are shown in drawing S 9434.

The hammer seismic survey was conducted at the Onkaparinga Weir Site earlier this year, and a conventioned seismic refraction survey was carried out on the 15th July, 1971, on the Onkaparinga and Echunga Creek weir sites.

Three hammer seismic continuous spreads were conducted at Onkaparinga Creek over a distance of 150 feet. One conventional spread was located at Onkaparinga Creek and two at the Echunga Creek site.

SURVEY PROCEDURES

Each of the three hammer seismic refraction spreads were 50 feet long with a geophone spacing of 5 feet. The mean of the minimum values of 10 to 40 readings of the first arrivals were recorded at each geophone position. It was found that the effective penetration of energy produced reliable results for a maximum distance of 50 feet, and that the apparatus was limited to a depth of penetration of less than 20 feet.

A Texas Instrument 7000B, 24 channel recording seismograph, mounted in a landrover, was used to record the first arrivals at the geophones for the conventional spread arrangement. The geophone spacing was 5 feet (1.524 metres).

Shots were fired at the centre, extremities, and at positions equidistant from the ends of each spread. The data from the latter shot points were used for the interpretation of the bedrock profile, as specified by Hawkins (1961).

RESULTS AND INTERPRETATION

The time-distance curves for each profile were plotted. The intercept times and the velocities of the soil profile and bedrock were obtained directly from the time-distance curves of both the hammer and conventional seismic spreads, using at least squares linear regression to obtain the best velocity fit.

The Reciprocal Method of Hawking (1961) was used to determine the corrected velocity of the bedrock and any lateral variations within the bedrock. The profile of the bedrock interface was determined from the time-depth for each geophone after correcting for the upper velocity layer, which had velocities between 500 to 1000 feet per second. i.e. (152 to 305 metres per second), using half intercept times. The depth to the bedrock interface at each geophone position was obtained using Hawkin's nomograph of depth conversion applied to the appropriate velocities.

This reciprocal method could not be applied to the hammer seismic results, because the energy was insufficient to give reliable data from points greater than 50 feet beyond each end of the 50 foot spread.

The localities of the two weir sites are shown in drawing No. S9434. The individual locality details of each site are shown together with the interpreted seismic profile on separate figures.

Interpretation of Weir Site on Echunga Creek

The interpreted seismic refraction profile of the wier site on Echunga Creek, from the results of two spreads, is shown in drawing No. 71-723. The profile shows an undulating thin surface material which wedges out towards the creek. The bedrock interface is irregular and shows a marked increase in depth just east of the creek. This increase in thickness of the 1,722 feet per second layer (525 metres per second) indicates the presence of an alluvium filled stream cutting, which has a depth of approximately 13 feet (4 metres). The bedrock velocity on the eastern spread is 5600 feet per second (1708 metres per second) and probably correlates with siltstone.

The surface layer immediately west of the creek is thin, and has a velocity of 2,780 feet per second (847 metres per second) and probably represents weathered quartzite. The latter rests directly on bedrock, which has a velocity of 6,370 feet per second (1943 metres per second) and correlates with quartzite. The bedrock shows a lateral variation in velicity, 4,870 feet per second (1,485 metres per second) to the west. This is indicative of lithology change.

Interpretation of Weir Site on Onkaparinga River

The bedrock profile on section BC, shown in drawing No. 71-724, was determined using Hawkins method. This shows a thin layer of material having velocity of 1,290 feet per second (393 metres per second), and probably represents alluvium. This rested directly on bedrock, which has a velocity of 9700 feet per second (2959 metres per second), and correlates to quartzite.

The hammer seismic results are shown in section AB on the same drawing. Fresh rock was identified to have a velocity of 11000 feet per second (3355 metres per second) but its depth was unreliable. A 4600 feet per second layer (1372 metres per second) probably represents either the water table or weathered rock.

A vertical discontinuity located near peg 15, was resolved from the hammer results, and probably represents the edge of the stream cutting and/or a lithological contact.

CONCLUSIONS AND RECOMMENDATIONS

The bedrock profile across the Echunga Creek indicates a deepening of the alluvial cover east of the creek indicating an infilled river channel.

The bedrock beneath the conventional refraction spread on Onkaparinga Creek near Mt. Bold reservoir slopes gently towards the creek. A vertical discontinuity delineated by the hammer seismograph results at peg 15 probably represents the edge of the stream cutting. The hammer refraction results do not appear to have clearly defined the bedrock. The 4500 feet per second layer may be weathered bedrock or the watertable.

The results using the hammer seismograph are unsatisfactory for this type of job, as the effective penetration is less than 20 feet, and the spread length is restricted to 50 feet. Finally it is impossible to map the bedrock profile, using Hawkins method with the hammer seismograph in this type of location.

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RAG:JTS
30.9.71

REFERENCES

Hawkins, L.V., 1961. The reciprocal method of routine shallow seismic investigations. Geophysics V.No. 26 pp.806-819.

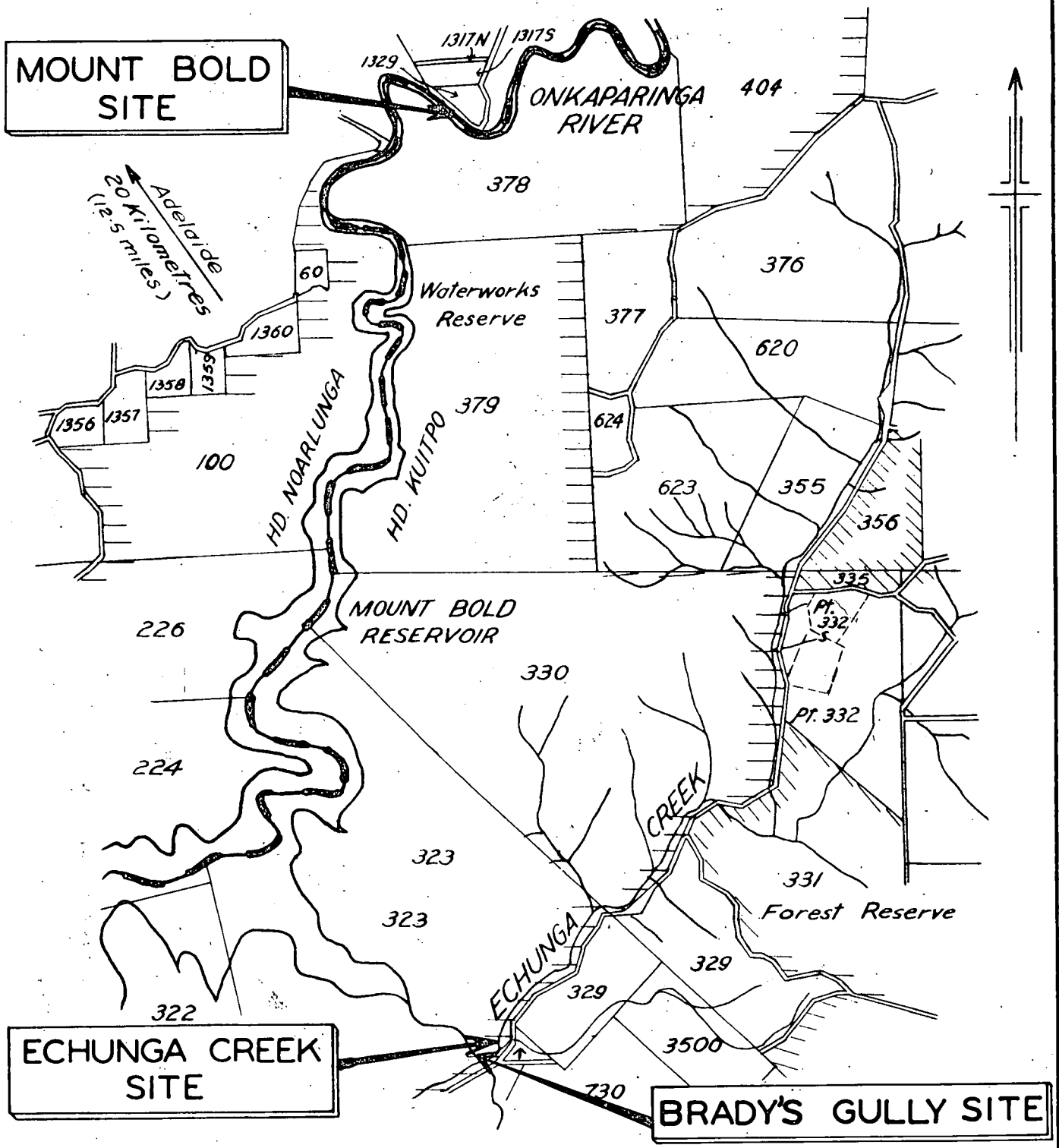
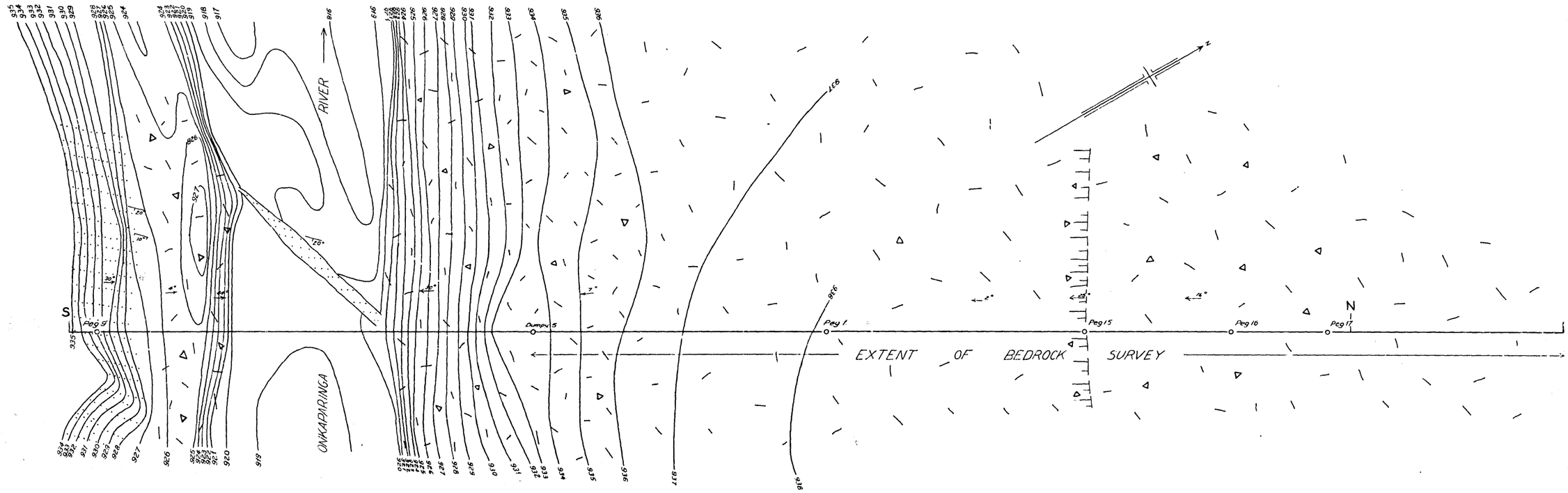


FIG. 1.

ENGINEERING GEOLOGY SECTION	DEPARTMENT OF MINES – SOUTH AUSTRALIA	Scale: As shown
Compiled: B.J.MORRIS.	LOCALITY PLAN	Date 7 Oct. 1971
Drn. J.M.B. | Ckd. B.J.M.	SHOWING MOUNT BOLD, ECHUNGA CREEK AND BRADY'S GULLY GAUGING WEIR SITES	Drg. No. S 9529 Ha 9/10

1M—2.70 A1810



LEGEND

- Silt soil with sandstone fragments
- Sandstone outcrops (strong)
- 20° Strike and dip of bedding
- 3° Strike and dip of cleavage
- 10° Direction and angle of surface slope
- Approximate position of escarpment
- 930 Surface contour with value in feet
- Seismic shot point
- Ground surface showing geophone positions (interval 5 feet)
- Extrapolated ground surface showing geophone positions
- 565 f.p.s. Velocity in feet per second
- (172 m.p.s.) Velocity in metres per second
- Hammer seismograph reading

SCALE IN METRES
5 0 5 10
10 0 10 20 30
SCALE IN FEET

Horizontal and vertical scales 1:120

Datum - 10568 feet (3221 metres) below mean sea level, Pt Adelaide

For locality sketch see plan no. 59528

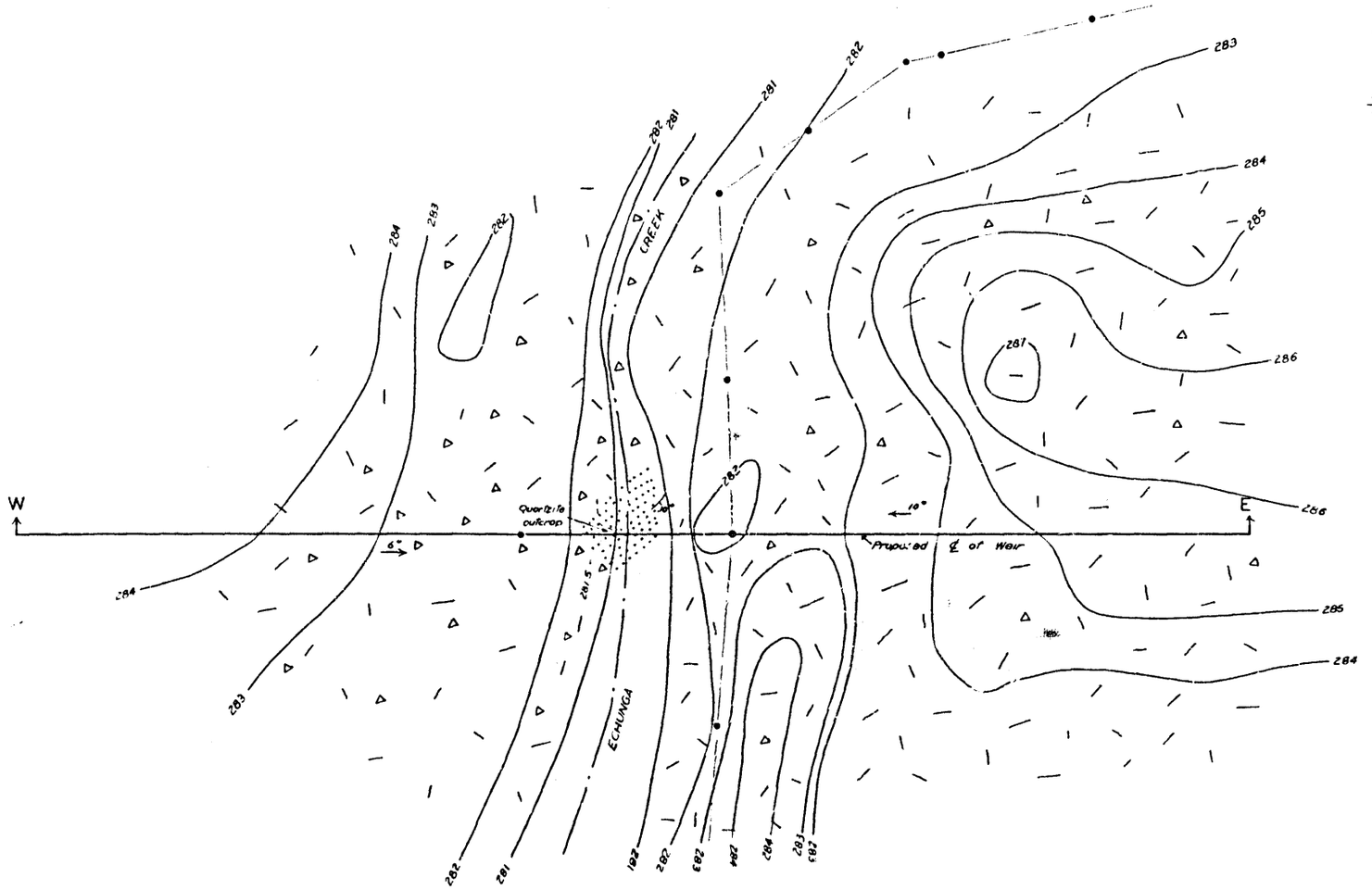
FIG. 2

DEPARTMENT OF MINES — SOUTH AUSTRALIA

PROPOSED GAUGING WEIR NEAR MOUNT BOLD RESERVOIR – SECTION 1329 HD. NOARLUNGA

GEOLOGICAL PLAN AND SECTION

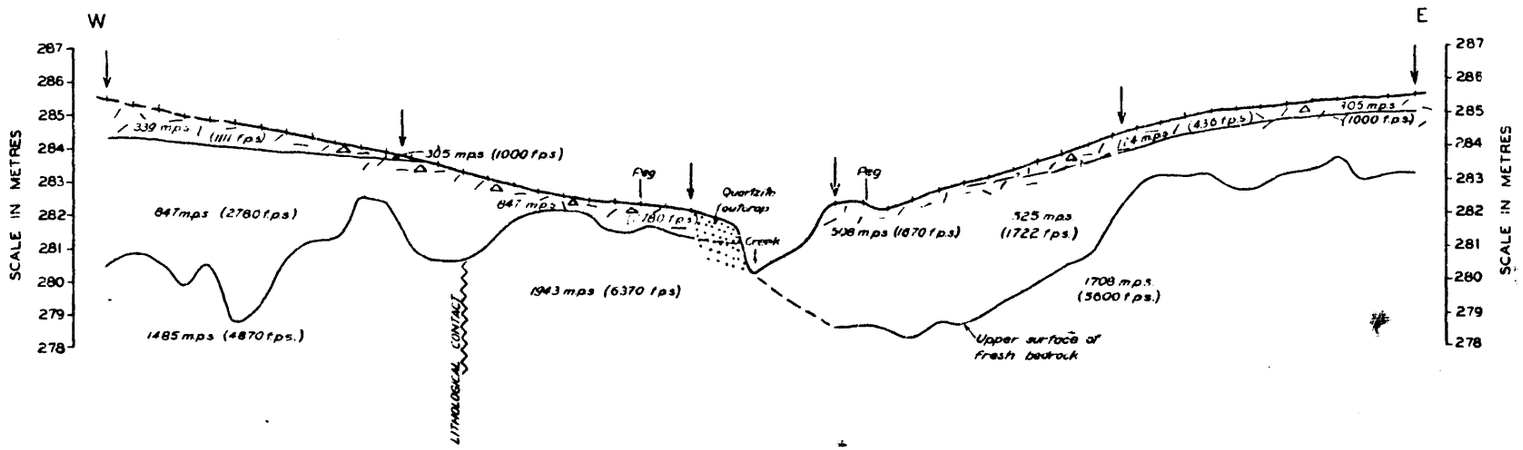
ENGINEERING GEOLOGY SECTION	GEOLOGIST	Drn. B.J.M	SCALE: As shown
		Tot. J.M.B	71-757
		Chd. B.J.M	Hd 9/10
Director of Mines	SEN. GEOLOGIST	Encl.	DATE: 7 October 1971

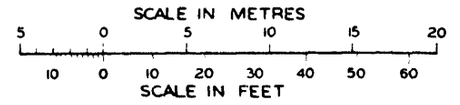


LEGEND

- 283 — Surface contour with value in metres
- Shot point
- Ground surface showing geophone positions (interval 5 feet)
- Extrapolated ground surface showing geophone positions
- Survey line, with peg
- 525 m.p.s — Velocity in metres per second
- (1722 f.p.s) — Velocity in feet per second
- Silt soil with quartzite fragments
- Quartzite outcrops (strong to very strong)
- 18° — Strike and dip of bedding
- 5° — Direction and angle of surface slope

Datum: 32·211 metres (105·68 feet) below mean sea level, Pt Adelaide





Horizontal scale 1:200 Vertical scale 1:100

For locality sketch see plan no. 59525

FIG. 3.

DEPARTMENT OF MINES — SOUTH AUSTRALIA

PROPOSED GAUGING WEIR – ECHUNGA CREEK
SECTION 323 HD. KUITPO
GEOLOGICAL PLAN AND SECTION

ENGINEERING GEOLOGY SECTION	GEOLOGIST	Drn. B.J.M.	SCALE: AS shown
		Tod. J.M.R.	71-758
		Chd. B.J.M.	4a 9/10
Director of Mines	SEN GEOLOGIST	Encl.	DATE: 7 October 1971