COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

RECORDS

1959 No.107

GEOPHYSICAL INVESTIGATION OF THE JUDBURY DAMSITE, HUON RIVER, TASMANIA

by

D.F. DYSON and B.J. BAMBER

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C O N T E N T S.

P L A T E S.

ABSTRACT.

The results are given of a seismic refraction survey that was carried out in response to an application from the Hydro-Electric Commission of Tasmania for a geophysical investigation of a proposed dam site on the Huon River, near Judbury.

The purpose of the survey was to determine the thickness of the overburden and the seismic velocity in the overburden and bedrock. Seismic results indicate that the thickness of the overburden ranges from 13 to 96 feet with an average thickness of 40 to 50 feet. The overburden consists of soil, river sands, gravels, clays and weathered bedrock. The bedrock is composed of unweathered dolerite.

It is considered that the thickness of the overburden has been calculated with an error of not more than 30 per cent.

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1. INTRODUCTION.

The Hydro Electric Commission of Tasmania proposes to construct a regulating dam on the Huon River above its junction with Judd Creek, approximately 1 mile upstream from Judbury (Plate 1). The dam is designed to provide short term regulation of the water flow otherwise disturbed by a Hydro-Electric Power Station which is proposed upstream near Blackfish Creek.

The dam site area has been extensively drilled, but drilling logs are still being analysed and have not yet been made available by the Hydro Electric Commission.

In response to an application from the Commission, the Bureau of Mineral Resources, Geology and Geophysics, carried out a geophysical survey to determine the seismic velocity in the overburden and bedrock and the depth to bedrock in the site area. The seismic velocity can be correlated with the types of rocks present and their degree of fracturing and/or weathering.

Seismic refraction methods were used. Along each traverse, the seismic refractor with the highest recorded velocity is termed "bedrock". The material overlying the bedrock, such as soil, river sands, gravels, clays and completely and partly weathered bedrock is called "overburden".

The survey consisted of two parts. The work was done in the first week of March and in the last week of April, 1959. The geophysical party consisted of D.F. Dyson (Party Leader), P.E. Mann, B.J. Bamber (Geophysicists) and J. Croger (Geophysical Assistant). The Commission provided an additional 5 assistants and carried out a topographical survey along the traverses, the lay-out of which is shown on Plate 1.

2. GEOLOGY.

The geology of the general area has been described by Ford (1956).

The main rock in the area is dolerite, probably of Jurassic age (Ford, 1956). Isolated outcrops of dolerite occur on the right (southern) bank and in the river. Apart from these outcrops the dolerite is covered with sand and soil and possibly gravels and clay.

3. METHODS AND EQUIPMENT.

The seismic refraction method of exploration, as used in this investigation, depends for its success on the contrast in the velocity of the seismic waves through different rock formations. Hard, unweathered rocks have higher velocities than their weathered counterparts, which, in turn, usually have higher velocities than soil and unconsolidated deposits.

For this survey the technique known as the "Method of Differences" was used (Heiland, 1946, p.548). Twelve geophones per spread were used and the following types of spread were shot:-

(i) Weathering Spreads. These were used to obtain seismic wave velocities in, and the thickness of, near-surface layers. The geophone intervals were 10 foot and shot points were 10, 50 and 150 foot from each end of the spread.

(ii) Normal Spreads. The geophone intervals were 25 or 50 foot and shot points were 50 foot and 200 to 250 foot from each end of the spread.

The equipment used on the survey was a SIE 12-channel refraction seismograph (Type PRO 11-6) with Technical Instruments Co. geophones of natural frequency of about 20 cycles per second. The total length of seismic traverses surveyed was 2,400 ft.

4. RESULTS.

Seismic Results.

The depth to bedrock, as indicated by the seismic results, is shown on Plate 2 in the form of profiles, and on Plate 3 as a contour map. The following are the principal features to be noted:-

(i) On traverse D is a layer of considerable thickness having a seismic velocity of about 12500 ft/sec. overlying the refractor with the higher velocity of about 15000 ft/sec. which is probably unweathered dolerite. Its depth is shown only at the ends of the traverse since it was not recorded continuously along the traverse. A number of additional shots would have been necessary to do this. The 12500 ft/sec. layer which is probably partly weathered dolerite, might be considered as a good foundation rock. Similarly, the 11500 ft/sec. layer, which overlies the bedrock on traverse B may be partly weathered dolerite suitable for foundations.

(ii) In general the bedrock surface over the area tested is relatively flat (Plate 3) but rises slightly towards the eastern (downstream) end of traverse B.

It is considered that errors in the determination of overburden thickness do not exceed 30 per cent.

Table 1 shows a tentative interpretation of recorded seismic velocities in terms of rock type.

TABLE 1.

Rock Type	Seismic Velocity (ft/sec.)	Estimated value for Youngs Modulus (lbs.wt.(sq.in))
Soil	900	
River Terrace) Material) Sands, Clays and) Gravel)	1300 - 2000	
Weathered bedrock	5000 - 12500	$0.7 - 4.6 \times 10^6$
Unweathered bedrock (including jointed (?)) (dolerite)	11500 - 16000	3.9×10^6 - 9.7×10^6

The values of Young's Modulus are estimated using a density of 2.8 and a Poisson's Ratio of 0.28 (Birch, Schaiver and Spicer, 1950) and are included in Table 1. The error in Young's Modulus as given above is unlikely to exceed 30 per cent.

5. CONCLUSIONS.

The geophysical survey provided information on the depth to the unweathered bedrock at the Judbury Dam Site. The overburden consists of soil, river sands, gravels, clays and completely and partly weathered bedrock, and attains a maximum thickness of 96 ft. at peg 6 on traverse D.

The seismic survey indicated that the depth to bedrock is at least at the downstream end of traverse B from peg 8 to peg 11.

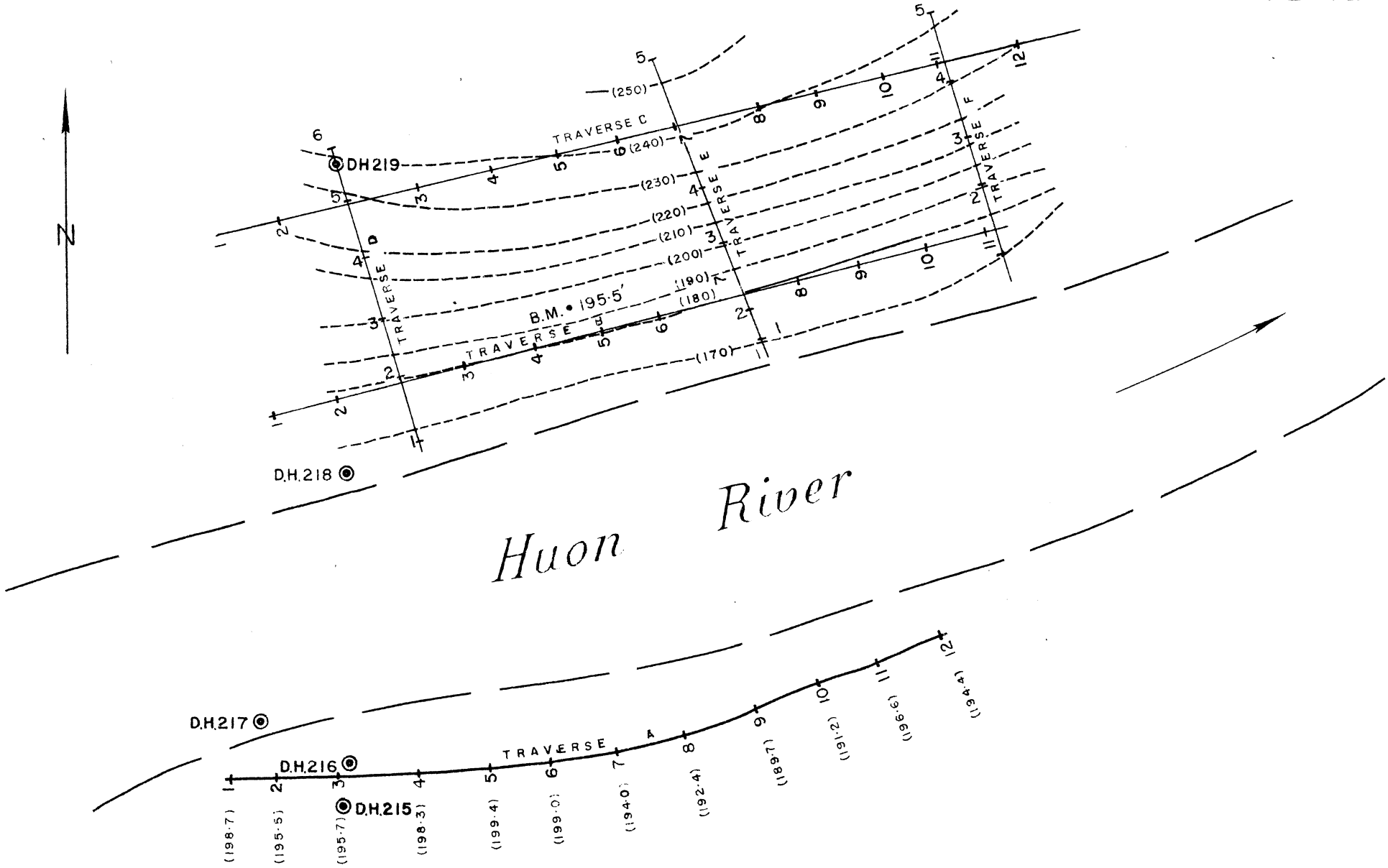
6. REFERENCES

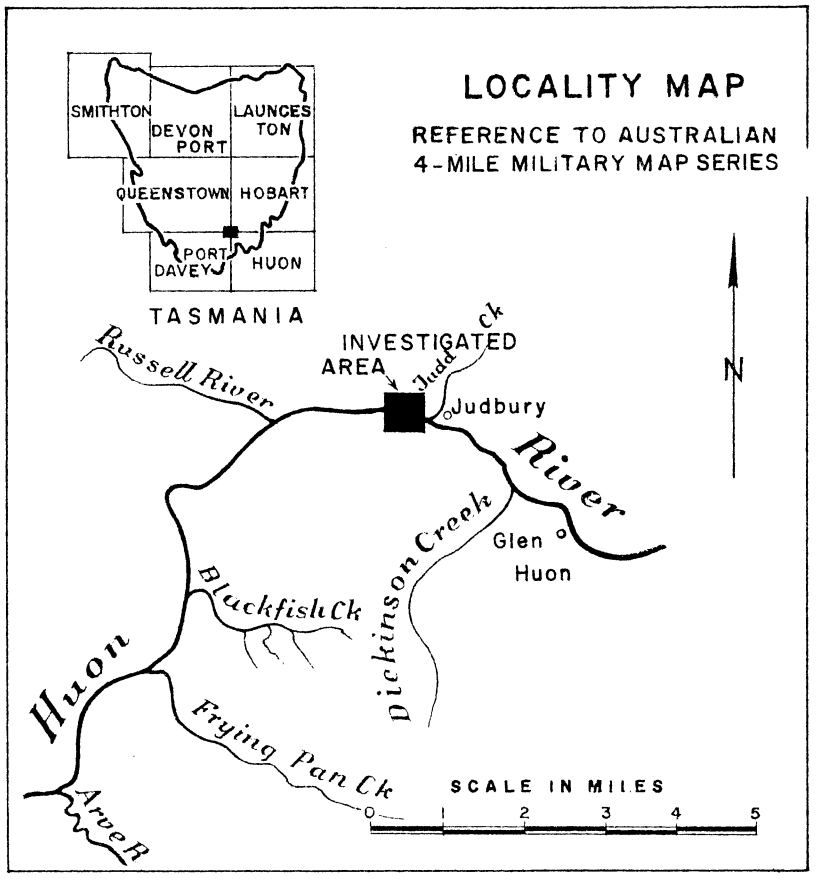
BIRCH, F., SCHAIVER, J.F. and SPICER, H.B. 1950 - Handbook of Physical Constants. U.S. Geol. Soc. Spec. Paper No.36.

FORD, R.J., 1956 - The Geology of the Upper Huon-Arve River Area. Papers Proc.Roy.Soc.Tas. 90, 147-150.

WIEBENGA, W.A. and POLAK, E.J., 1958 - Geophysical Investigations at the Huon River Dam Site, Tasmania. Bur.Min.Resour., Aust., Records 1958 No. 29.

PLATE 1





LEGEND

B.M. • 195·5' Bench mark 37 (elevation 195·5')

DH 219 ◉ Drill hole

---(240)--- Contour line indicating height of surface above M.S.L.

6 + Traverse with station No.

GEOPHYSICAL INVESTIGATIONS AT THE JUDBURY DAM SITE, HUON RIVER, TASMANIA

TOPOGRAPHICAL CONTOURS AND LAYOUT OF GEOPHYSICAL TRAVERSES

SCALE IN FEET

100 0 100 200 300

CONTOUR INTERVAL 10 FT.

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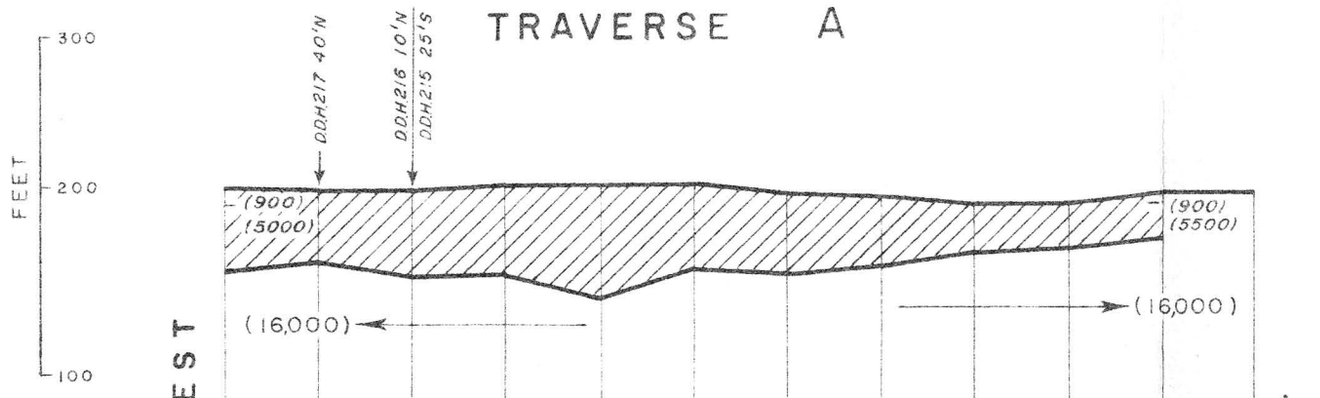
To accompany Records 1959, N° 107

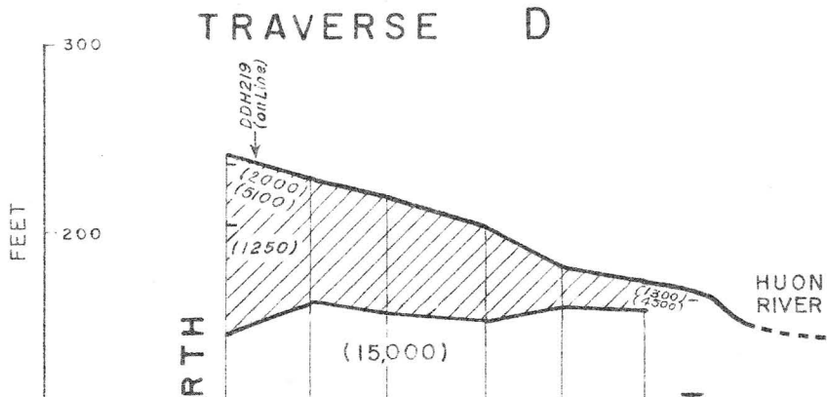
PLATE 2

TRAVERSE A



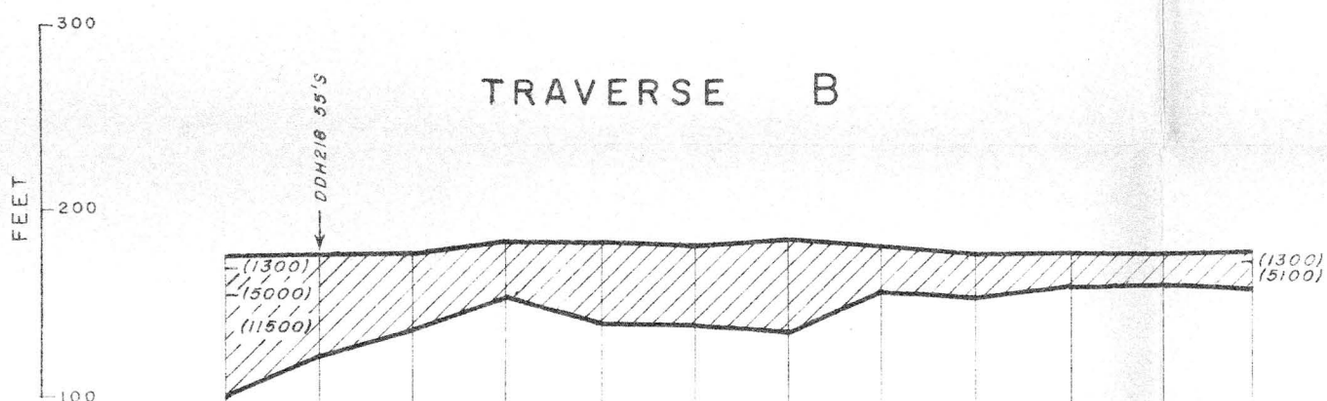
STATION No.	1	2	3	4	5	6	7	8	9	10	11	12
SURFACE LEVEL	198.7	195.5	195.7	198.34	199.45	199.06	199.40	192.4	189.7	191.2	196.6	194.4
DEPTH TO BEDROCK	46	41	49	49	61	46	43	35	26	23	23	

TRAVERSE D



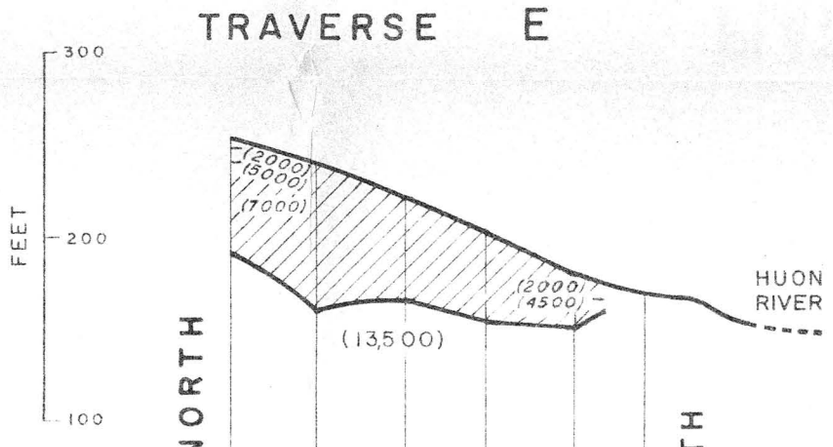
STATION No.	6	5	4	3	2	1
SURFACE LEVEL	242.1	227.9	213.6	199.8	176.8	168.3
DEPTH TO BEDROCK	96	67	53	48	22	16

TRAVERSE B



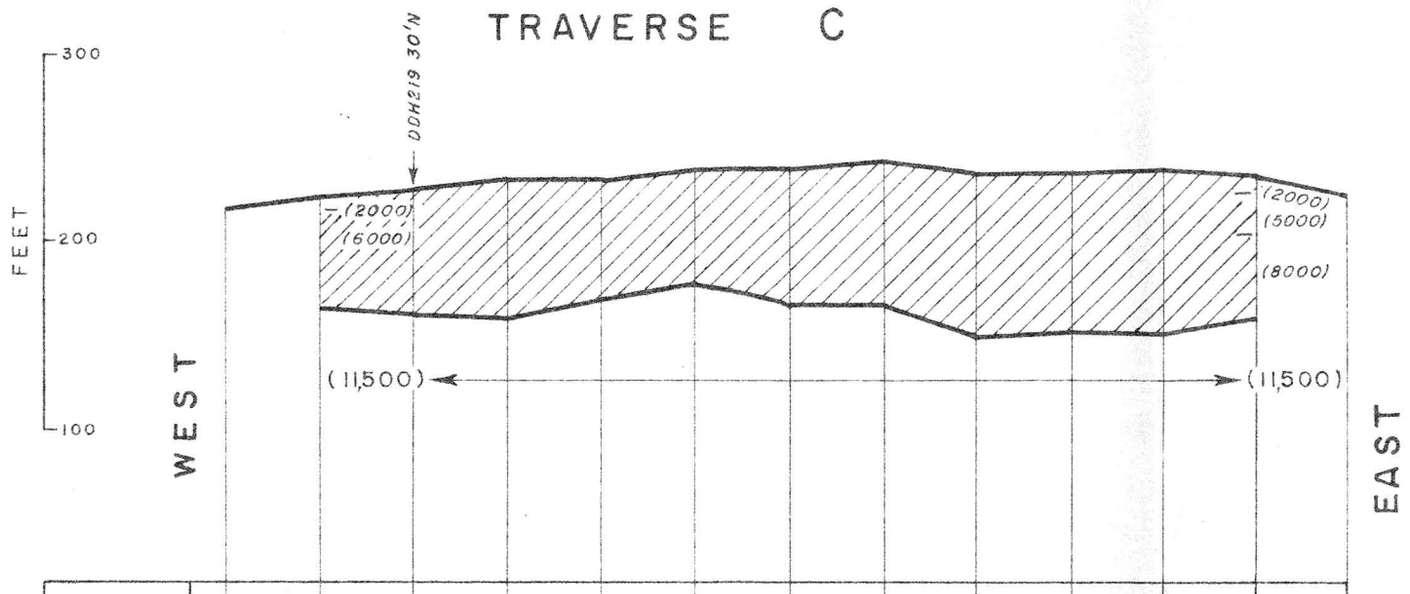
STATION No.	1	2	02	3	4	5	6	7	8	9	10	11
SURFACE LEVEL	173.7	175.1	176.8	180.8	181.9	179.3	181.4	178.8	171.4	175.6	176.9	175.7
DEPTH TO BEDROCK	73	52	39	30	41	40	43	24	21	20	17	22

TRAVERSE E



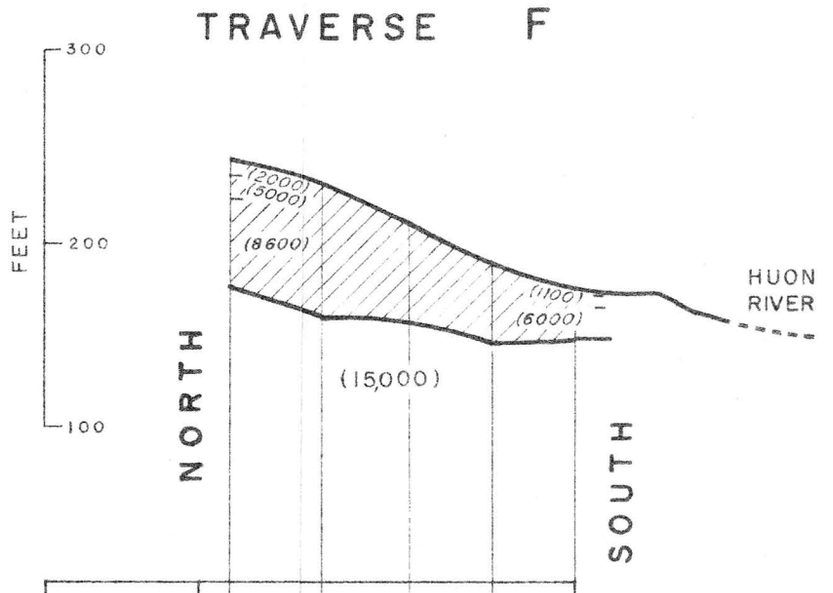
STATION No.	5	07	4	3	2	1
SURFACE LEVEL	254.9	241.8	223.2	200.5	174.7	
DEPTH TO BEDROCK	59	76	55	46	13	

TRAVERSE C



STATION No.	1	2	05	3	4	5	6	7	8	9	10	11	12
SURFACE LEVEL	216.8	223.4	227.5	232.3	232.6	237.0	241.2	241.8	238.3	237.8	237.4	234.9	229.1
DEPTH TO BEDROCK		61	67	75	64	57	77	75	85	84	86	76	

TRAVERSE F



STATION No.	5	4	3	2	1
SURFACE LEVEL	242.3	230.9	213.4	188.4	169.6
DEPTH TO BEDROCK	66	70	52	41	20

LEGEND

OVERBURDEN

BEDROCK

(11600) SEISMIC VELOCITY IN FT/SEC.

DIRECTION TO NEAREST DRILL HOLE

HORIZONTAL AND VERTICAL SCALES IN FEET

100 0 100 200 300

GEOPHYSICAL INVESTIGATIONS AT THE JUDBURY DAM SITE, HUON RIVER, TASMANIA.

SEISMIC PROFILES

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G 278-8

Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics

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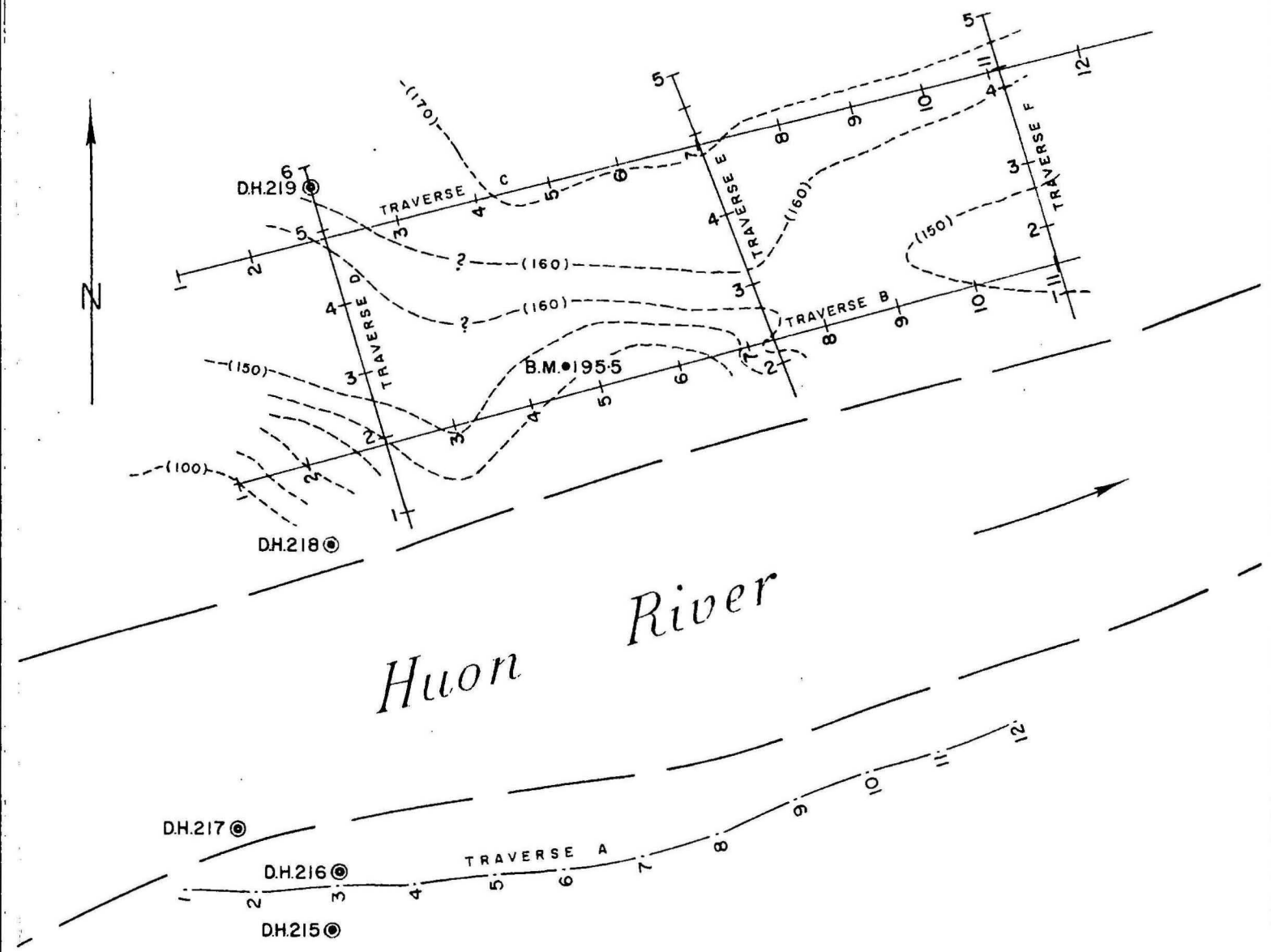
PLATE 3



LEGEND

B.M.•195·5	Railway bench mark 37
◉ D.H.219	Drill hole
---(180)---	Contour line indicating height of bedrock above M.S.L.
	Contour interval 10 ft.
⌀	Traverse with station No.

D. F. Dyson
Geophysicist

GEOPHYSICAL INVESTIGATIONS AT THE JUDBURY DAM SITE, HUON RIVER, TASMANIA

CONTOURS OF SURFACE OF BEDROCK

(FROM SEISMIC DATA)

SCALE IN FEET

100 0 100 200 300

Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics

G278-9

TO ACCOMPANY RECORDS 1959, N° 107