COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORDS 1956, No. 136

SEISMIC REFRACTION SURVEY OF
No. 1 POWER STATION SITE, KIEWA, VICTORIA

by

D. F. DYSON and M. J. O'CONNOR

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A B S T R A C T

Details and results are given of a seismic refraction survey made in response to an application by the State Electricity Commission of Victoria, to investigate the area proposed for the No. 1 power station site at Kiewa, Victoria.

The purposes of the survey were to determine the thickness of the weathered layer and to supply a contour plan of the depth to unweathered rock from which sites worthy of more detailed investigation could be suggested.

The thickness of soil over the area ranges from zero to 43 feet. The weathered layer of granodiorite, which varies considerably in character (as shown by the velocity range from 3,900 to 6,200 feet/sec.), has a maximum depth of 213 feet. The seismic velocity of the unweathered granodiorite bedrock ranges from 11,000 to 18,000 feet/sec., the lower velocity being correlated to shearing in the granodiorite.

Comparison between seismic results and drilling data along and near the traverses indicates that depths determined by the seismic method have a standard error of approximately 9 feet.

Locations are suggested for further drilling investigations for both a surface and an underground power station.

1. INTRODUCTION

The planned Kiewa No. 1 Power Station is part of the Victorian State Electricity Commission's Kiewa No. 1 Power Development Scheme, which consists of the Rocky Valley Dam, the Pretty Valley diversion tunnel, penstock line and a power station.

The seismic refraction survey of the power station site was made by the Bureau in response to an application by the State Electricity Commission, during October and November 1955. A preliminary report on the survey (Dyson, 1956) was submitted to the Commission in July, 1956. The co-ordinates of the approximate centre of the area, on the grid of the 4-mile military maps, are 1356500 North and 1560500 East.

The purposes of the survey were to determine the depths to unweathered bedrock in the surveyed area and to supply a contour plan of depths to unweathered rock to assist in the design of an underground power station.

The geophysical party consisted of D. F. Dyson (party leader) and M. J. O'Connor, geophysicists, and J. P. Piggott, field assistant. The Commission supplied additional assistants and carried out the necessary topographical survey of the traverses.

2. GEOLOGY

The country rock consists of granodiorite which weathers at and near the surface to a completely decomposed rock. Parts of the hill slopes are covered with sandy material (quartz from the granodiorite) washed down hill.

The shear and fault pattern in the area is relatively complicated. One system of almost parallel faults strikes N50E to N80E, and another system with basic dykes associated with it strikes about N60W.

A deeply weathered zone (disclosed by excavation and diamond drilling) which crosses the north-western part of the area is known as the "Pretty Valley Fault Zone". Some features of the fault pattern are shown on Plate 1.

From results obtained in other areas, it may be assumed that the granodiorite in, or close to, the fault and shear zones is usually weathered to greater depths than in places where faulting and shearing are absent. This was confirmed by surface mapping, excavations and diamond drilling.

3. METHODS

The seismic refraction method depends on the degree of contrast between the elastic properties of the different zones of rock. In foundation investigations the objects are the determination of the depths to elastic discontinuities and an indication of the rocks concerned. The physical laws involved resemble those of optical phenomena in that energy propagated through the ground will undergo reflection and refraction at discontinuities.

An explosive charge detonated at or near the ground surface produces a train of seismic waves. In the normal refraction method the charge is in line with a series of detectors (geophones), known as a spread, and the first arrival times of the seismic waves are recorded. A graph of first arrival times against distances from the shot point is called a time-distance curve.

A technique known as the Method of Differences (Heiland, 1946, p.548) was used. If A is a shotpoint at one end of the spread then the time taken for the energy to reach a point B within the spread is T_{BA} and the time to a point C beyond B is T_{CA}. Similarly, shooting from C the time for the energy to travel from C to B is T_{BC} and from C to A the time taken is T_{AC}. The times T_{CA} and T_{AC} are the reciprocal times, and should be equal.

The depth is computed from the vertical travel time T_D which is defined as $\frac{1}{2}(T_{BA} + T_{BC} - T_{CA})$. The depth, D, becomes

$$\frac{V_2}{\sqrt{V_2^2 - V_1^2}} \cdot T_D V_1,$$

where V_1 is the velocity of the first recorded wave through the layer above the discontinuity, and V_2 is the velocity through the layer below. For $V_2 > 3V_1$,

$$\frac{V_2}{\sqrt{V_2^2 - V_1^2}}$$

approaches the value 1, and the depth becomes $V_1 T_D$.

The velocities of the successive refracting layers are determined from the time-distance curves. Seismic velocities give a fair indication of the type of rock encountered but a certain amount of geological control is necessary before a more definite interpretation can be made. A sandstone for example, may have the same velocity as a fractured granodiorite.

Two types of geophone spread were used :-

(a) Normal spreads, in which the geophones were placed at 50-foot intervals, with shot distances of 50 and 300 feet.

(b) Weathering spreads, with geophone intervals of 10 feet and shot distances of 10, 50, 150 and 300 feet.

The vertical travel times and the velocities of the near-surface layers were computed from data obtained from these spreads.

A 12-channel portable "Century" Seismograph, Model 506, with Technical Instrument Company geophones (natural frequency 19 c.p.s.), was used.

Operational Difficulties.

The following difficulties were encountered during the survey :-

(i) Deep soil over most of the area (up to 43 feet thick) necessitated the use of large charges (a maximum of 20 lbs.) of gelignite and shot holes as deep as 12 feet.

(ii) Construction work in or near the area resulted in high noise level on the records, the thick soil layer acting as a channel for low frequency waves.

(iii) Power line interference, both directly and by transmission through the ground, particularly when wet.

(iv) The energy transmitted through the refractors was dissipated by faults and shear zones.

(v) The presence of buildings restricted the selection of shot points and the amount of the charge.

To improve the reliability of the records the spreads were often shot a second time during periods of comparative quietness and using different shot points.

4. RESULTS.

The results of the survey are shown by the cross-sections on Plates 2 to 4 and the contour map of the surface of the "high velocity rock" on Plate 1. Table 1 shows the correlation between velocity and rock type identified by surface observations and diamond drilling data.

TABLE 1

Rock Type	Seismic Velocity (feet per second)
Soil	1,000 ± 100
Weathered granodiorite	3,500 ± 1,000
Fractured and partly weathered granodiorite	7,000 ± 2,000
Fractured or sheared granodiorite (unweathered)	12,500 ± 1,500
Unweathered granodiorite	17,500 ± 500

The soil ranges in thickness from zero to approximately 40 feet. Soil velocities in the area range from 900 to 1,100 feet/sec., and a uniform value of 1,000 feet/sec. was used.

Average velocities in weathered rock underlying the soil range from 3,900 feet/sec. to 6,200 feet/sec. The lower velocities in this range are considered to represent completely weathered granodiorite and the higher velocities fractured and partly weathered granodiorite.

The term "high velocity rock" is used for rocks with velocities ranging from 11,000 feet/sec. to 18,000 feet/sec. Velocities of 11,000 to 15,000 feet/sec. were recorded on traverses A, B, C, and D where they intersect the Pretty Valley Fault Complex. The velocity of the refractor along traverse H, which is within, and parallel to, the boundaries of the Pretty Valley Fault Complex, ranges from 16,000 to 17,000 feet/sec. This indicates that the major fracture pattern is parallel to the strike (N60°E) of the Pretty Valley Fault Complex. High velocities of 17,000 to 18,000 feet/sec. indicate unweathered, unfractured granodiorite.

The large range of velocities in the "high velocity rock" (from 11,000 feet/sec. on traverse B to 18,000 feet/sec on traverse G) is due to the presence of shear zones, faults and dykes. The local influence of these features cannot be distinguished clearly on the time-distance curves, and it is therefore impossible to determine their position precisely.

In the preliminary report on the survey (Dyson, 1956), a contour map of the "high-velocity rock" was drawn from the sections on Plates 2 to 4, using geophysical data only. As these data can strictly be used only for points along the traverses, a certain amount of interpolation is necessary between traverses in order to complete the contour map. The uncertainty of such interpolation is increased in the present survey by the presence of structural complexities such as shears with intersecting faults. This is particularly so in the area bounded by traverses A, E, F and part of C. Drill hole data indicate that the "high-velocity rock" is at a greater depth in this area than that shown in the contour map contained in the preliminary report. That contour map has now been replaced, therefore, by the map shown on Plate 1 of this report which has been compiled from both geophysical and drilling data.

The map shows a trough striking east-north-east in the northern part of the area. It coincides with the Pretty Valley Fault Complex and suggests that weathering penetrates downwards along fault or shear structures. There are indications in the geophysical data of other smaller structures, but the information available is insufficient to delineate these structures. An example is the trough on traverse F between stations F10 and F11. This may correspond to the geologically identified Fault B1, but for precise positioning of this fault at the level of the "high velocity rock", diamond drilling investigations would be required.

5. ACCURACY

Errors in depth estimates to the "high velocity rock" are due mainly to errors in the calculated velocity in the weathered layer and to errors in the vertical travel times.

It appears from the data the the velocity in the weathered layer can be determined with a standard error of 715 feet/sec. (number of data used, 15). This means that 95 per cent of the velocity determinations are within twice the standard error, i.e. within $\pm$ 1430 feet/sec. With a vertical travel time of t msec., this represents an accuracy of within $\pm$ 1.4 x t feet.

Errors in vertical travel time depend mainly on the accuracy with which the records can be read and the ability to make reliable corrections for soil thicknesses ("soil correction"). If the errors in reading the records are within $\pm$ 1 msec., then the accuracy in the vertical travel time is about $\pm \frac{1}{2}\sqrt{3}$, i.e. within about $\pm$ 1 msec.

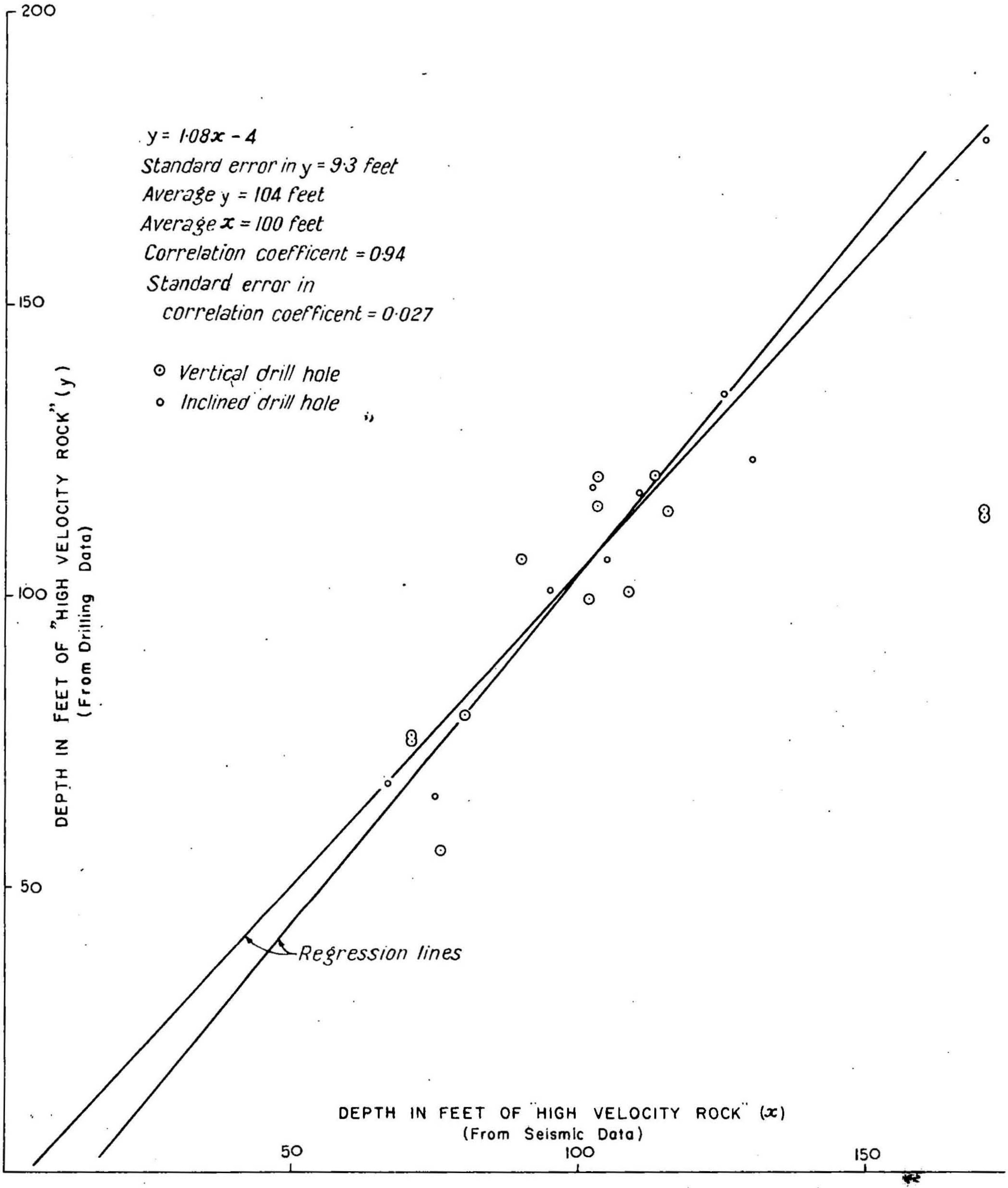
The maximum error in the estimates of soil thickness is about $\pm$ 5 feet. With a weathered layer velocity of 5,000 feet/sec., and a soil velocity of 1,000 feet/sec., the resultant errors in soil correction are within $\pm\frac{5}{1} - \frac{5}{5} = \pm$ 4msec.

Based on the above estimates, the errors in vertical travel time are within $\sqrt{1^2 + 4^2}$, i.e. within about $\pm$ 4 msec. With weathered layer velocities of about 5,000 feet/sec., this results in errors of within $\pm$ 20 feet.

The total error in depth estimates to the "high velocity rock" is then within $\pm$ (20 + 1.4t). For an average velocity in the weathered layer of 5,000 feet/sec., the maximum possible percentage errors are as shown in Table 2.

The depths of the "high velocity" refractor obtained by drilling and by the seismic method are compared in Table 3.

Drill holes omitted from Table 3 include :-



SEISMIC REFRACTION SURVEY
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STATISTICAL ANALYSIS OF DEPTH DETERMINATIONS

(i) Those outside the area surveyed.
(ii) Inclined holes drilled to investigate vertical structures crossing the area.

TABLE 2

Depth (ft.)	Maximum Error (ft.)	Maximum Percentage Error
25	27	108
50	34	68
100	48	48
150	62	41
200	76	38

TABLE 3

Drill Hole No.		Depth to high velocity rock (ft)		Difference	Difference as % of drilling data
		Drilling data	Seismic data		
1086	Vertical	62	76	+ 14	+ 23
1087	"	121	103	- 18	- 15
1088	"	100	102	+ 2	+ 2
x1089	"	107	90	- 17	- 16
x1090	"	76	71	- 5	- 7
1091	"	116	103	- 13	- 11
x1094	"	80	80	0	0
x1095	"	121	113	- 8	- 7
1097	"	101	108	+ 7	+ 7
1180	"	100	109	+ 9	+ 9
1184	"	75	71	- 4	- 5
1166	Inclined	66	75	+ 9	+ 14
1169	"	118	110	- 8	- 7
1170	"	124	130	+ 6	+ 5
1171	"	68	67	- 1	- 1
1174	"	102	95	- 7	- 7
1176	"	135	125	- 10	- 7
1178	"	179	170	- 9	- 5
1182	"	107	105	- 2	- 2
x1185	"	119	102	- 17	- 14

In the inclined holes the depth given is the vertical depth from the surface to the point at which the drill hole intersected the refractor.

In the drill holes marked with an asterisk the seismic refractor does not represent unweathered granodiorite, but fractured granodiorite.

In Figure 1 the depths calculated from the seismic data are plotted against the depths obtained from the drilling operations. The line which best fits the data is expressed by the equation :-

$$y = 1.08x - 4$$

Standard error in y is 9.3 feet

Average $\bar{x}$ = 100 feet

Average $\bar{y}$ = 104 feet

The correlation coefficient is 0.94 with a standard error of 0.027. As a close approximation the seismic data along the traverses indicate the depth of the "high velocity rock" fairly accurately, with a standard error of 9 feet in the range from 60 to 170 feet.

These results indicate that the accuracy is within the limits shown by Table 2.

6. CONCLUSIONS AND RECOMMENDATIONS

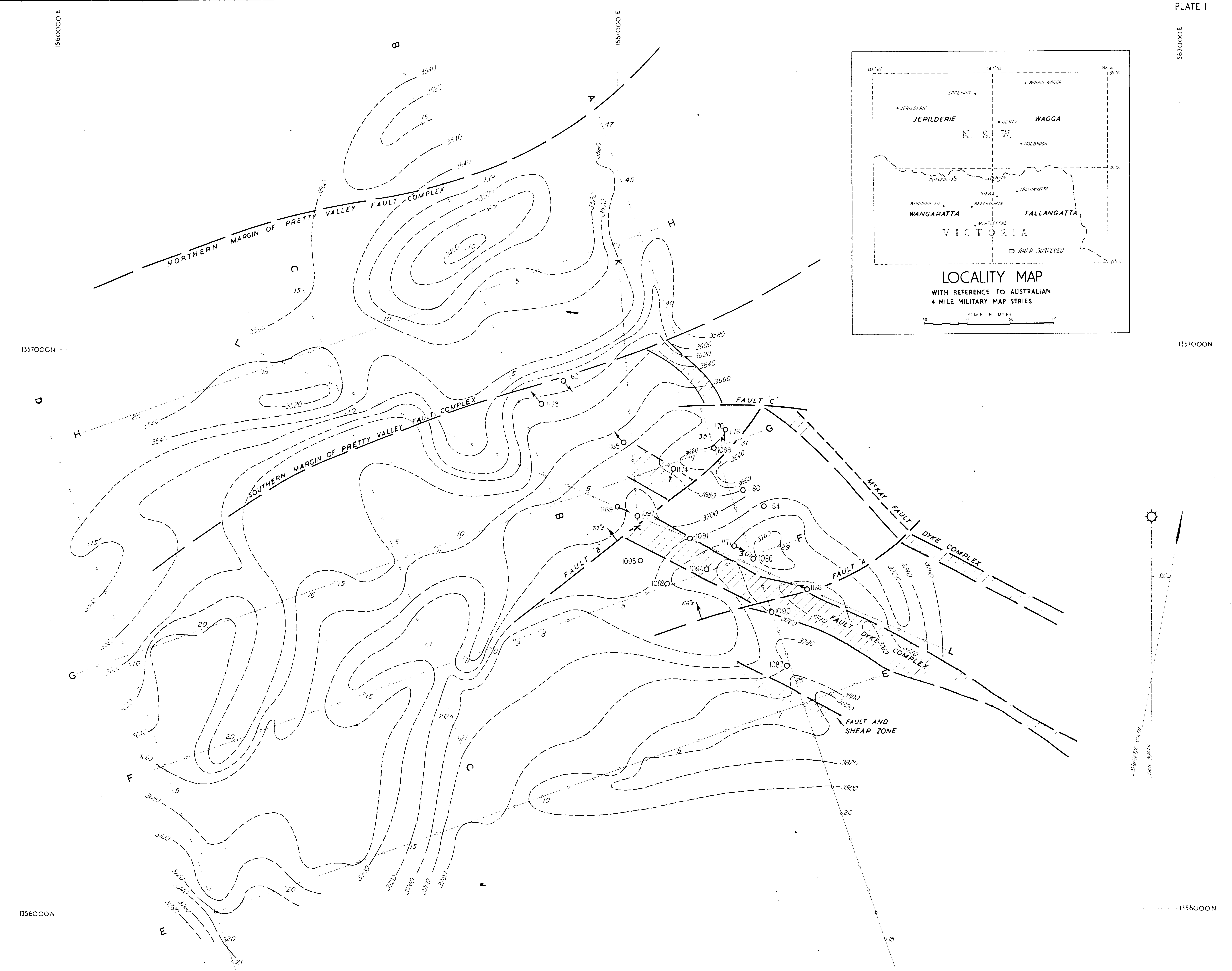
The survey has provided information for the selection of two possible areas worthy of detailed investigation, one for a surface power station and the other for an underground station.

It is considered that the area bounded to the south by traverse G and between stations G11 and G16 is the most suitable site for further investigations for a surface power station. The depth to suitable foundation rock should be of the order of 50 feet. Upon the removal of the weathered layer in this area precautions may be necessary to guard against slipping of the weathered material on the uphill side of the area. The most likely point at which slipping may take place is near stations C1 and C2.

Detailed investigations for an underground station should be made within the triangular area bounded by lines joining E1, F8 and C21+50 feet. This area should have sufficient cover of unweathered rock, with no major intersecting faults or shear zones. The tail race from this site would pass through Fault B and possibly other faults which would require investigation by diamond drilling.

7. REFERENCES

Beavis, F., 1956	-	Report on the Geological Investigation for the No. 1 Underground Power Station, S.E.C. (Internal Report).
Dyson, D.F., 1956	-	Preliminary Report on a Seismic Refraction Survey of No. 1 Power Station Site, Kiewa, Vic. Bur. Min. Res. Geol. & Geophys., Records 1956 No. 53.
Heiland, C.A., 1946	-	GEOPHYSICAL EXPLORATION, Prentice-Hall, New York.



SEISMIC REFRACTION SURVEY. No1 POWER STATION SITE. KIEWA. VICTORIA.

REVISED CONTOURS (R.L) OF "HIGH VELOCITY ROCK"

SCALE IN FEET

100 0 100 200 300

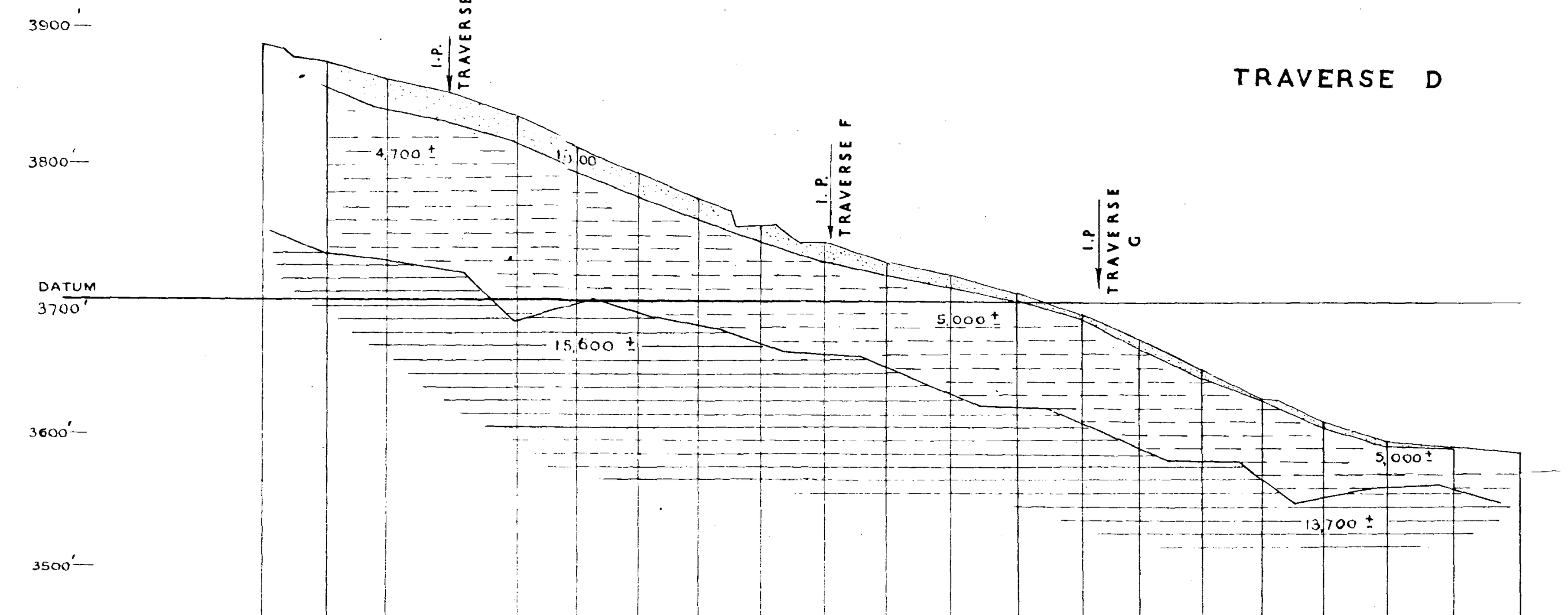
LEGEND

- Seismic traverses
- 3600 — "High Velocity Rock" contour (Feet above S.E.C datum -92' below M.S.L.)
- 1095 O Vertical drill hole
- 1176 Inclined " "
- Fault Diorite Dyke Complexes } Beavis (1956)
- 70°E Fault

GEOPHYSICIST

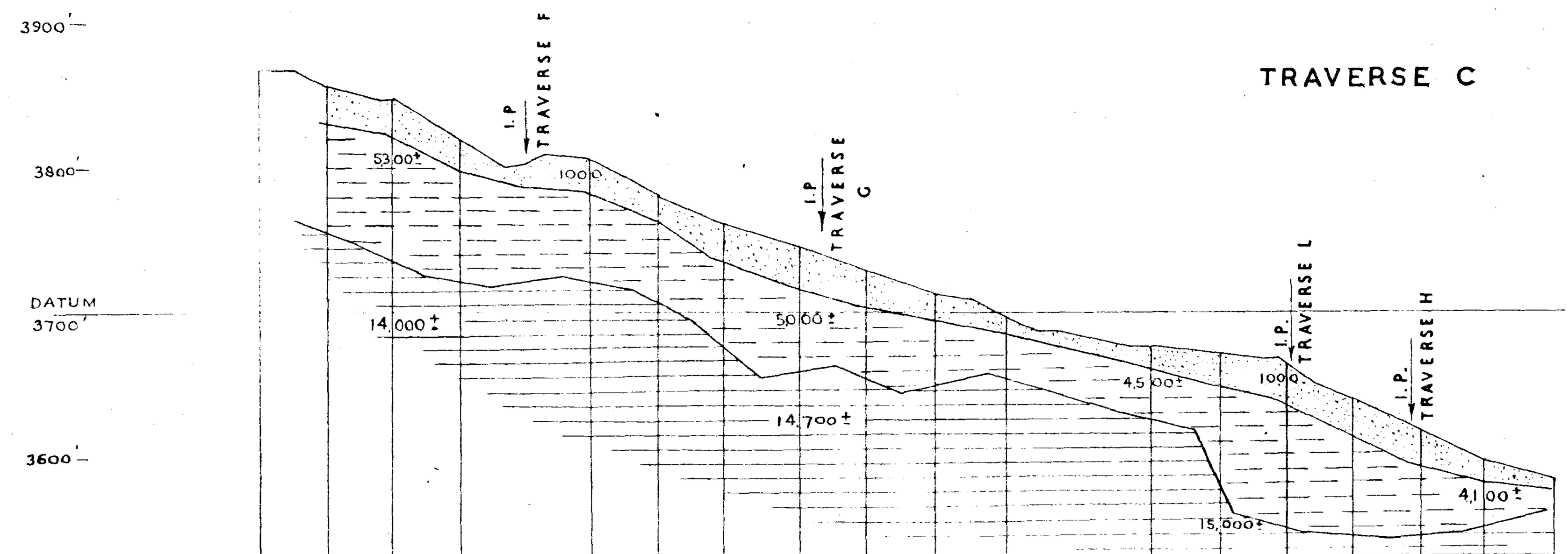
PLATE 2

TRAVERSE D



SOUTH	D21	D20	I.P. TRAV. E	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	NORTH
STATION No.	D21	D20	I.P. TRAV. E	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	
REDUCED LEVEL	3875'	3862'		3835'	3815'	3795'	3776'	3756'	3743'	3727'	3718'	3701'	3691'	3672'	3649'	3626'	3608'	3594'	3590'	3587'	
APPROXIMATE DEPTH OF SOIL COVER	17	21	20	18	17	15	14	9	13	10	8	6	4	6	6	1	4	3	0	2	
APPROXIMATE DEPTH TO HIGH VELOCITY ROCK	130	135	130	123	138	100	95	83	86	73	82	90	75	75	75	49	66	36	28	41	

TRAVERSE C



SOUTH																			NORTH
STATION No	C21	C20	C19	I.P. TRAV. F	C1	C2	C3	C4	C5	C6	C7	C9	C10	C11	C12	C13	C14	C15	
REDUCED LEVEL	3854'	3846'	3818'		3805'	3778'	3759'	3746'	3726'	3711'	3696'	3675'	3670'	3667'	3638'	3618'	3595'	3582'	
APPROXIMATE DEPTH OF SOIL COVER	24	24	22	18	23	16	25	26	27	16	12	15	23	26	25	24	14	7	
APPROXIMATE DEPTH TO HIGH VELOCITY ROCK	96	102	99	90	84	67	70	95	70	71	42	49	56	110	99	80	53	23	

LEGEND

Soil

Weathered rock

High velocity rock

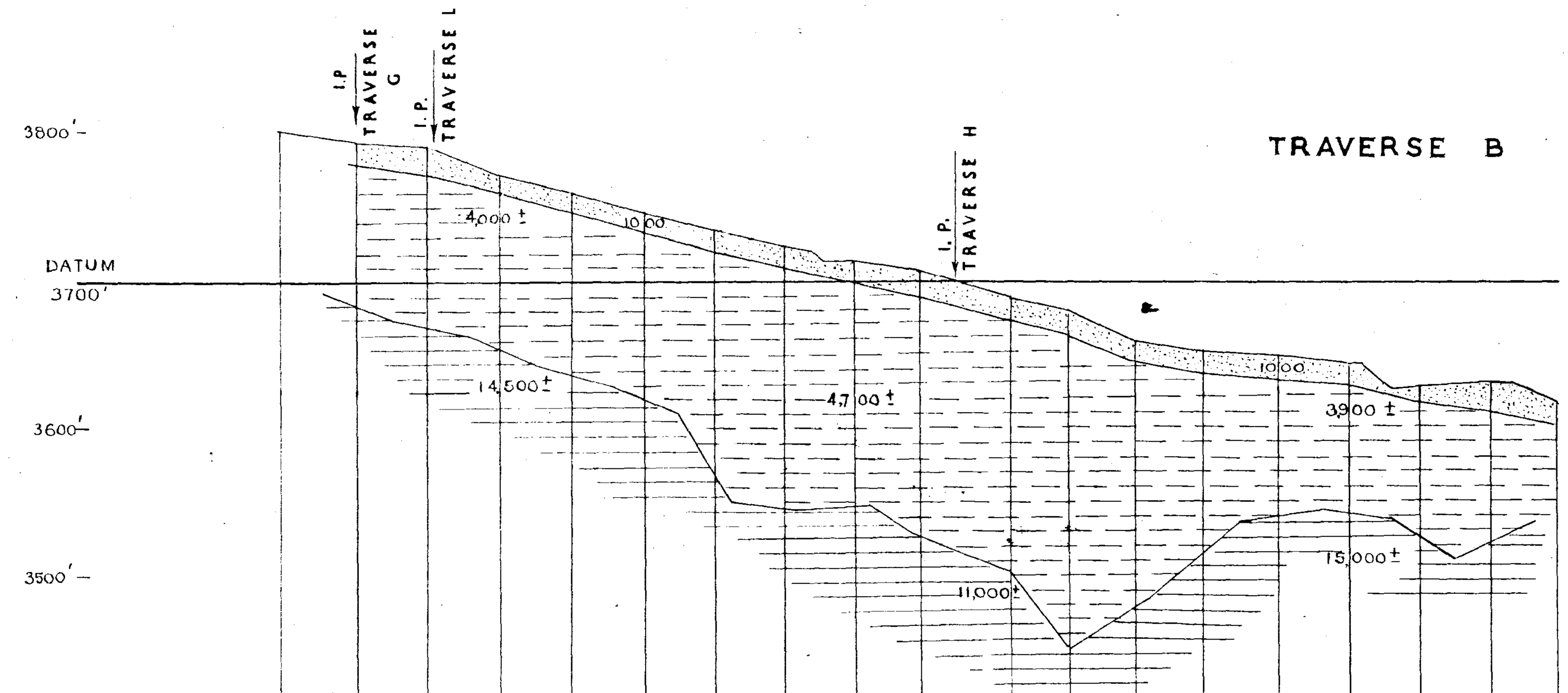
4000 ± Approx. seismic velocity in ft/sec

I.P. Intersection point

Horizontal and Vertical Scales in Feet

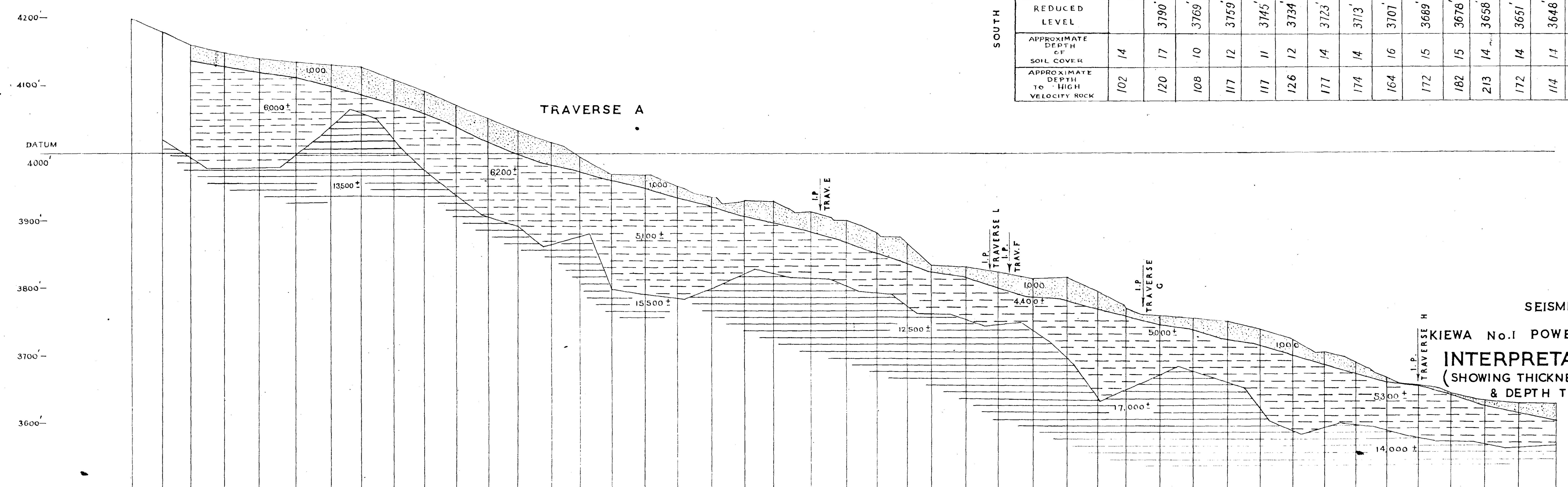
100 0 100 200 300

TRAVERSE B



SOUTH																			NORTH
STATION No.		B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	
REDUCED LEVEL		3790'	3769'	3759'	3745'	3734'	3723'	3713'	3707'	3689'	3678'	3658'	3651'	3648'	3642'	3627'	3629'	3614'	
APPROXIMATE DEPTH OF SOIL COVER	14	17	10	12	11	12	14	14	16	15	15	14	14	14	14	10	18	14	
APPROXIMATE DEPTH TO HIGH VELOCITY ROCK	102	120	108	117	117	126	177	174	164	172	182	213	172	114	102	90	122	82	

TRAVERSE A



SOUTH																						
STATION No.	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25
REDUCED LEVEL	4182·29'	4162·21'	4150·49'	4143·22'	4137·22'	4133·80'	4129·97'	4111·54'	4092·39'	4072·72'	4053·79'	4035·04'	4017·15'	3997·25'	3969·90'	3967·92'	3952·20'	3935·49'	3930·86'	3926·83'	3913·21'	3899·78'
APPROXIMATE DEPTH OF SOIL COVER	26	24	23	24	25	33	43	39	34	32	35	35	35	24	10	19	20	14	24	34	31	32
APPROXIMATE DEPTH TO HIGH VELOCITY ROCK		156	175	165	158	117	67	66	94	110	123	137	134	146	95	178	167	157	132	105	103	91

																							NORTH
STATION No.	A26	A27	A28	A29	A30	A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	A41	A42	A43	A44	A45	A46	A47	
REDUCED LEVEL	3880·85'	3866·13'	3831·62'	3830·23'	3824·11'	3819·31'	3815·76'	3794·71'	3768·08'	3759·13'	3755·00'	3749·13'	3738·10'	3722·97'	3703·94'	3688·10'	3664·13'	3652·80'	3641·97'	3630·58'	3626·92'	3625·43'	
APPROXIMATE DEPTH OF SOIL COVER	32	31	12	16	24	28	33	26	13	14	19	28	25	24	18	17	8	1	3	7	14	25	
APPROXIMATE DEPTH TO HIGH VELOCITY ROCK	91	81	75	74	85	62	95	115	145	109	78	89	94	129	129	95	76	78	76	64	70	67	

SEISMIC REFRACTION SURVEY
OF THE
KIEWA No.1 POWER STATION SITE, S.E.C., VICTORIA

INTERPRETATION OF SEISMIC DATA

(SHOWING THICKNESS OF SOIL & WEATHERED GRANODIORITE & DEPTH TO UNWEATHERED GRANODIORITE)

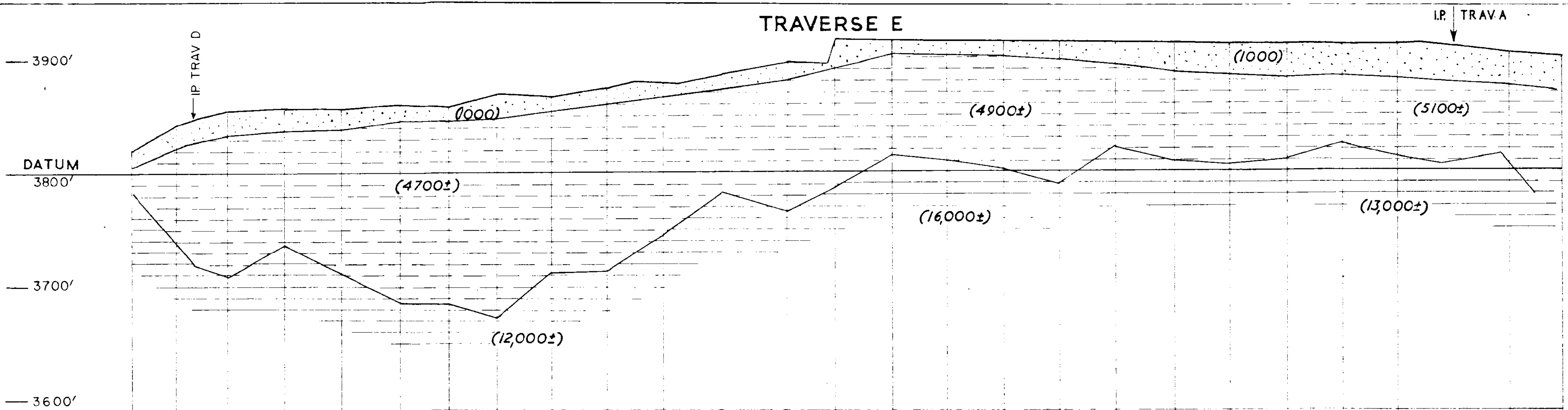
TRAVERSES A – D

D F Dyson

GEOPHYSICIST

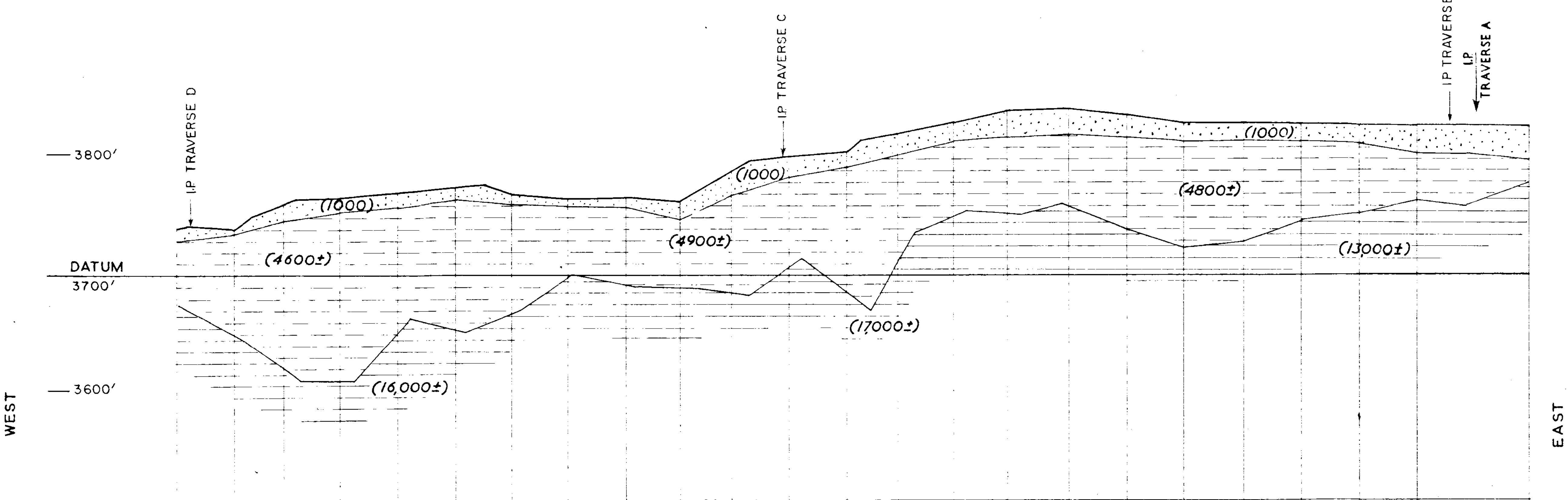
PLATE 3

TRAVERSE E



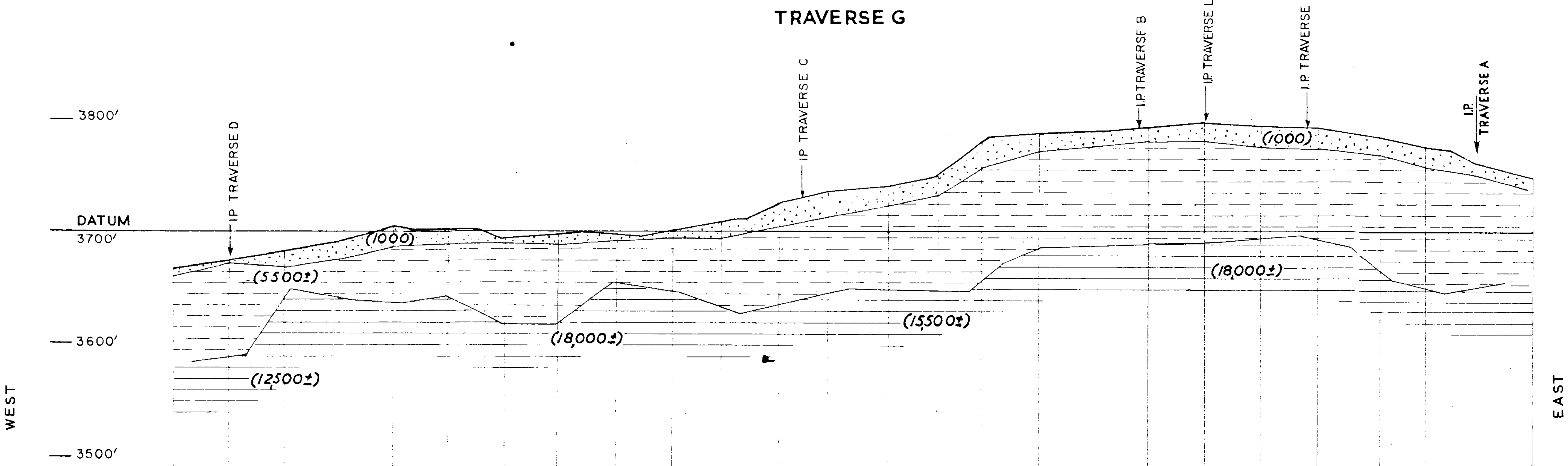
STATION NO	E24	E23	TRAV D	E22	E21	E20	E19	E18	E17	E16	E15	E14	E13	E12	E11	E10	E9	E8	E7	E6	E5	E4	E3	E2	E1	TRAV.A	E28	E29
REDUCED LEVEL	3822	3844	I.P.	3856	3856	3855	3860	3856	3869	3866	3873	3879	3885	3895	3916	3916	3915	3915	3915	3914	3913	3913	3913	3913	3913	I.P.	3904	3901
APPROXIMATE DEPTH OF SOIL COVER	15	19	20	23	19	17	15	12	20	12	13	12	11	14	22	12	10	13	16	20	26	27	28	27	29	31	30	30
APPROXIMATE DEPTH TO HIGH VELOCITY ROCK	36	105	130	145	120	143	173	168	194	155	158	133	102	128	130	101	104	112	122	90	101	105	100	85	96	104	77	121

TRAVERSE F



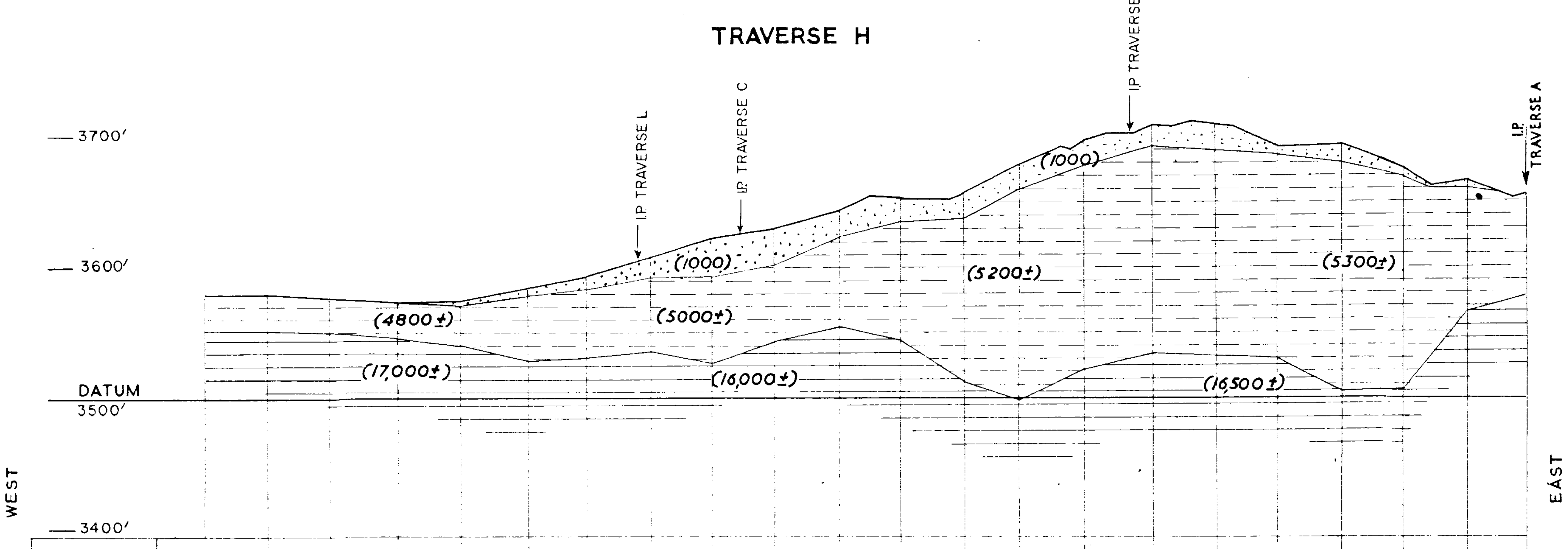
STATION NO	F23	F22	F21	F20	F19	F18	F17	F16	F15	F14	F13	F12	F11	F10	F9	F8	F7	F6	F5	F4	F3	F2	F1	I.P. TRAV.A	F29
REDUCED LEVEL	3740	3739	3761	3766	3771	3775	3769	3765	3767	3763	3790	3802	3805	3821	3830	3841	3843	3839	3830	3831	3830	3828	3829		3829
APPROXIMATE DEPTH OF SOIL COVER	13	4	14	12	13	11	10	9	11	14	21	18	15	19	15	24	24	21	16	12	13	14	22	24	29
APPROXIMATE DEPTH TO HIGH VELOCITY ROCK	72	96	154	159	110	127	101	67	79	76	100	89	138	87	76	92	82	99	107	105	91	77	69	73	52

TRAVERSE G



STATION NO	G24	G23	G22	G21	G20	G19	G18	G17	G16	G15	G14	G13	G12	G11	G10	G9	G8	G6	G5	G4	G3	G2	G1	I.P. TRAV.A	G31
REDUCED LEVEL	3670	3676	3693	3692	3703	3702	3695	3699	3699	3700	3707	3725	3736	3740	3750	3780	3787	3792	3796	3791	3791	3782	3774		3744
APPROXIMATE DEPTH OF SOIL COVER	9	3	15	17	16	14	5	9	6	6	14	22	23	18	20	22	17	13	17	18	17	16	17	8	11
APPROXIMATE DEPTH TO HIGH VELOCITY ROCK	88	88	34	55	70	59	77	80	44	54	85	89	89	95	108	111	103	103	107	101	96	100	120	117	96

TRAVERSE H



STATION NO	H21	H20	H19	H18	H17	H16	H15	H14	H13	H12	H11	H10	H9	H8	H7	H6	H5	H4	H3	H2	H1	I.P. TRAV. A
REDUCED LEVEL	3575	3576	3574	3571	3573	3582	3591	3606	3620	3628	3641	3651	3654	3677	3695	3706	3707	3689	3692	3674	3663	
APPROXIMATE DEPTH OF SOIL COVER	0	0	0	1	4	7	10	17	28	26	19	19	19	19	20	17	19	6	13	6	4	1
APPROXIMATE DEPTH TO HIGH VELOCITY ROCK	25	25	25	28	33	56	61	72	93	85	89	112	146	179	176	174	176	162	188	168	98	78

LEGEND

SOIL

WEATHERED ROCK

HIGH VELOCITY ROCK

(4600±) APPROXIMATE SEISMIC VELOCITY, FEET/SEC.

IP INTERSECTION POINT

HORIZONTAL AND VERTICAL SCALES IN FEET

100 0 100 200 300

SEISMIC REFRACTION SURVEY OF THE KIEWA NO.1 POWER STATION SITE, S.E.C., VICTORIA

INTERPRETATION OF SEISMIC DATA

(SHOWING THICKNESS OF SOIL & WEATHERED GRANODIORITE & DEPTH TO UNWEATHERED GRANODIORITE)

TRAVERSES E-F-G-H

D F Dyson

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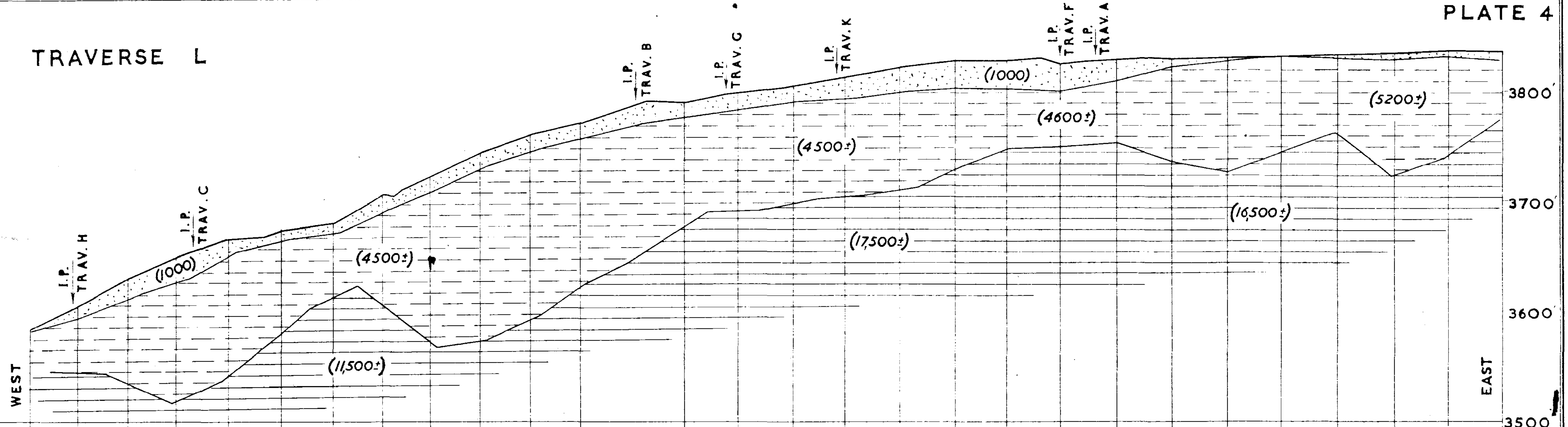
TRAVERSE L



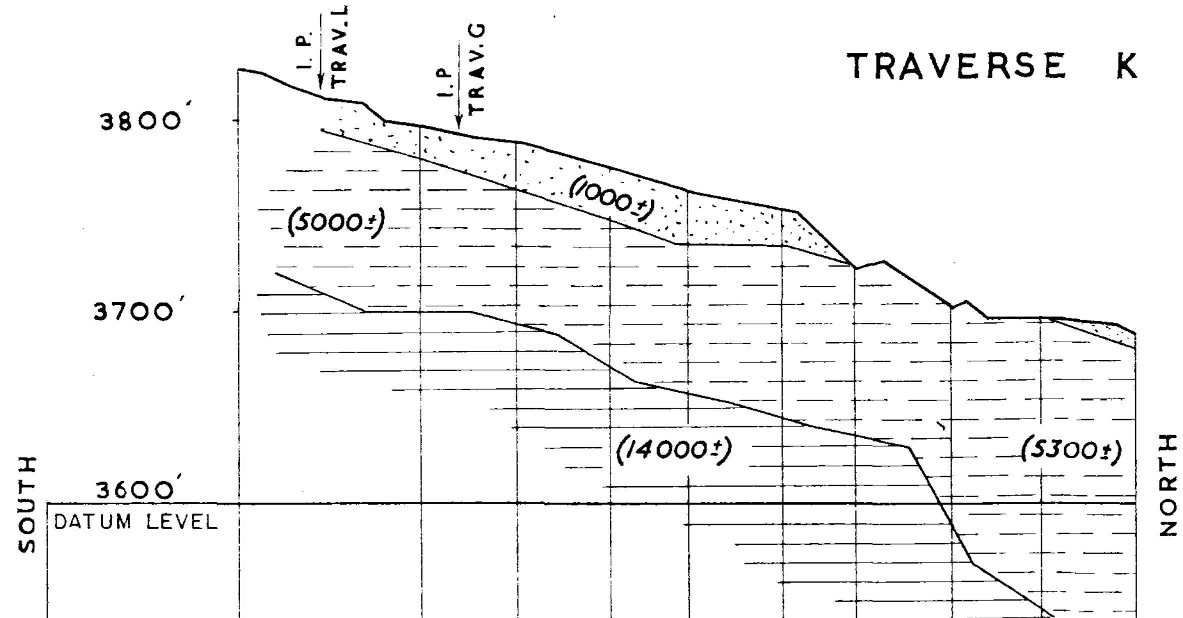
STATION No.	L31	L30	L29	L28	L27	L26	L25	L24	L23	L22	L21	L20		L18	L17	L16	L15	L14	L13	L12	L11	L10	L9	L8	L7	L6	L5	L4	
REDUCED LEVEL	3584'	3605'	3631'	3650'	3666'	3674'	3681'	3705'	3724'	3745'	3761'	3771'		3790'	3799'	3805'	3814'	3821'	3827'	3828'	3825'	3829'	3830'	3830'	3830'	3832'	3834'	3835'	3836'
APPROXIMATE DEPTH OF SOIL COVER	3	12	16	23	12	11	12	14	15	15	16	15	19	16	17	17	22	24	25	28	27	22	11	3	0	2	7	5	8
APPROXIMATE DEPTH TO HIGH VELOCITY ROCK	42	66	120	120	101	76	61	147	159	159	145	136	124	104	110	106	110	113	99	82	77	77	97	107	90	72	113	88	63

LEGEND

- SOIL
- WEATHERED ROCK
- HIGH VELOCITY ROCK
- (4600±) APPROX. SEISMIC VELOCITY IN FT/SEC.
- I. P. INTERSECTION POINT

HORIZONTAL AND VERTICAL SCALES IN FEET
100 0 100 200 300 400

TRAVERSE K



STATION No.		K1	K2	K3	K4	K5	K6	K7	K8	K9
REDUCED LEVEL		3797'	3790'	3775'	3762'	3752'	3723'	3705'	3697'	3689'
APPROXIMATE DEPTH OF SOIL COVER	23	17	28	27	30	(20)	1	0	0	7
APPROXIMATE DEPTH TO HIGH VELOCITY ROCK	96	103	93	93	104	104	87	81	133	154

SEISMIC REFRACTION SURVEY OF THE KIEWA No.1 POWER STATION SITE, S.E.C., VICTORIA

INTERPRETATION OF SEISMIC DATA

(SHOWING THICKNESS OF SOIL & WEATHERED GRANODIORITE & DEPTH TO UNWEATHERED GRANODIORITE)

TRAVERSES L–K

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