COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD No. 1962/58

GOOGONG DAM SITE SEISMIC REFRACTION SURVEY, NSW 1961

by

W.A. Wiebenga and M. Kirton

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SUMMARY

This Record describes a geophysical survey of the Googong dam site in N.S.W., requested by the Geological Branch of the Bureau of Mineral Resources to assist in the investigations being made by the Department of Works, Canberra. The seismic work showed the depths to unweathered bedrock and indicated a shear zone, which is probably associated with the Googong Fault.

1. INTRODUCTION

The Commonwealth Department of Works is planning a dam at Googong, New South Wales, about four miles south of Queanbeyan on Queanbeyan River, to provide for Canberra's future water needs.

A geophysical survey of the dam site was requested by the Geological Branch of the Bureau of Mineral Resources, Geology and Geophysics, to help in the investigation of the site being carried out by the Department of Works, Canberra.

The co-ordinates of the centre of the dam site are approximately 628N and 228E, on the Canberra 4-mile sheet of the Australia Series.

The survey was done between 7th and 15th September 1961 by M. Kirton (geophysicist and party leader) and J.P. Pigott and C.J. Braybrook (geophysical assistants). The Department of the Interior provided a surveyor for the topographical surveying of the traverses. The seismic computations were done by J.T.G. Andrew.

2. GEOLOGY

The geology of the dam site is briefly described in an unpublished paper by G.M. Burton of the Bureau of Mineral Resources, entitled 'Googong Dam Site, Summary of Conclusions resulting from Geological Mapping May to July 1961 and Drilling to September 1961; with bore logs of drill hole Nos. 1 to 4.'

The site is on thick bedded Silurian dacite tuff and flows which dip west at 40° to 60°. It is believed that thin layers of tuff may be interbedded with the lava flows. On the eastern side of the site, according to the geological map about 300 ft east of Traverse D (Plate 1), the dacite is separated by the Googong Fault from slightly older tuff, sediments, slate etc. The strike of the Googong Fault is about 010° magnetic. The geological map shows another possible fault with a strike of about 090° magnetic 200 ft north of drill hole No. 4. On the western side the dacite is intruded by younger granite.

The strongest and oldest system of jointing strikes about 010° magnetic, and arose prior to the intrusion of granite. This jointing coincides with the regional cleavage system. Two other directions of jointing and shearing strike about 080° and 340°, and have affected the younger granite. According to the geological information from drill hole No. 1 the depth to 'sound' rock is one to two feet in the river bottom and about five feet in the jointed dacite. At drill hole No. 2 the depth to 'sound' rock is about eight feet. Drill hole No. 3 passes through weathered dacite, unweathered dacite, a contact zone between dacite and granite, and granite. The depth to unweathered rock in this locality is about 20 ft.

Drill hole No. 4 is located in dacite, and the depth to unweathered rock is about eight feet below the surface.

3. METHODS

The seismic refraction method used is referred to as 'method of differences', described in several earlier Bureau Records (e.g. Dyson and Wiebenga, 1957). The instrument used was a 12-channel S.I.E. refraction seismograph with geophones of natural period 20 c/s. Seismic 'spreads' with geophone intervals of 25 and 50 ft were used.

4. RESULTS

Plate 1 shows the traverse plan with some geological information and the location of the four drill holes.

Plates 2 and 3 show the depths to bedrock in seismic cross-sections.

The following table is a tentative interpretation of the measured longitudinal seismic velocities in geological terms.

Longitudinal seismic velocity (ft/sec)	Geological formation	Classification
1000	Soil or rubble	Overburden
3000 to 5000	Scree material, or very weathered jointed rock, joints open.	"
5000 to 8000	Weathered, jointed rock, joints more or less open or cemented with weathered minerals.	"
9000 to 14,000	Jointed to slightly jointed or fractured bedrock in shear or fault zone.	Bedrock
15,000 to 20,000	Slightly jointed to unjointed bedrock	"

Past experience has shown that rocks with velocities up to 8000 ft/sec are probably not strong enough to serve as a good foundation for concrete arch dams even if the appearance of the rock in a core is good. At Googong, seismic velocities from 5000 to 8000 ft/sec are associated with more or less weathered, jointed dacite, and are classified as 'overburden' in the above table.

Rocks with velocities ranging between 9000 and 14,000 ft/sec are classified as bedrock because they are the deepest seismic refractors recorded in some parts of the area. East from B3, C3, and F7 the lower velocity of the bedrock is possibly due to shearing associated with the Googong Fault. Another zone of lower bedrock velocity between J1 and J7 coincides approximately with a fault marked with question marks on the geological plan, with a strike of about 090°. The direction of strike of this zone cannot be inferred from the seismic work, as it is crossed by only a single traverse.

5. CONCLUSIONS

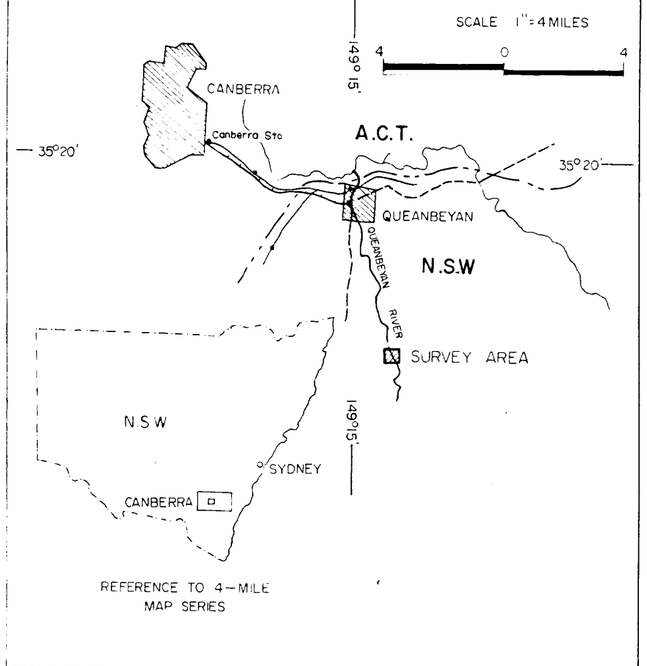
Any dam on the site should preferably be located west of the zone of lower-velocity bedrock whose western edge is marked by a line through B3, C3, and F7. Although the drill holes do not exactly coincide with the seismic stations, the depths to unweathered bedrock from the drill hole logs are roughly the same as the depths found by seismic work; that is for drill hole Nos. 2, 3, and 4 the depths from logs are about 20, 20, and 8 ft respectively, and from seismic work about 24, 18, and 10 ft.

6. REFERENCES

DYSON, D.F. and WIEBENGA, W.A. 1957 Final report on geophysical investigations of underground water, Alice Springs, N.T. 1956. Bur. Min. Resour. Aust. Rec. 1957/89, p.4.

PLATE I

LOCALITY MAP



REFERENCE TO 4-MILE MAP SERIES

TRAVERSE J

TRAVERSE H

TRAVERSE F

TRAVERSE G

TRAVERSE E

TRAVERSE K

TRAVERSE C

TRAVERSE B

TRAVERSE A

TRAVERSE D

DH1

DH2

DH3

DH4

? FAULT ?

SHEAR ZONE

SHEAR ZONE

GOOGONG FAULT

GOOGONG FAULT

Queanbeyan River

Weir

Magnetic North

True North

DACITE

SEDIMENTS

GRANITE

DACITE

APPROXIMATE DACITE - GRANITE CONTACT

DACITE

SLATE

LEGEND

(17,000) SEISMIC VELOCITY IN LOWEST REFRACTOR, FT/SEC

D10 SEISMIC STATION

DH3 INCLINED DRILL HOLE 3

SCALE IN FEET

40 0 40 80 120

SHEAR ZONE BOUNDARY

FAULT, FROM GEOLOGICAL REPORT

LOCATION OF SEISMIC TRAVERSES

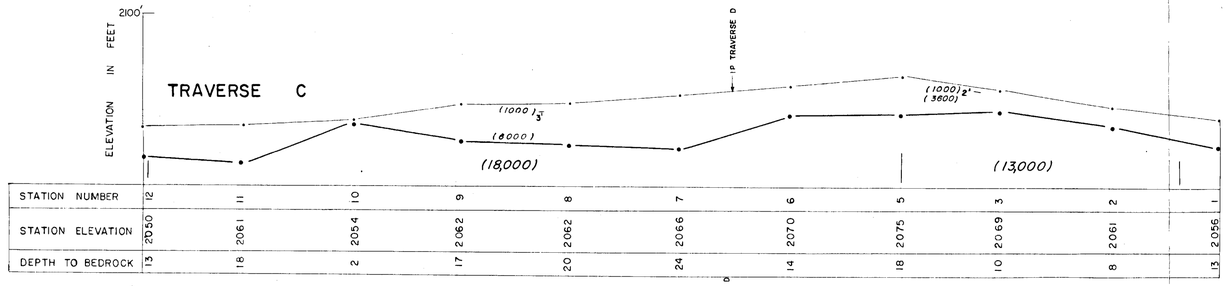
GOOGONG DAM SITE N.S.W

SEISMIC REFRACTION SURVEY 1961

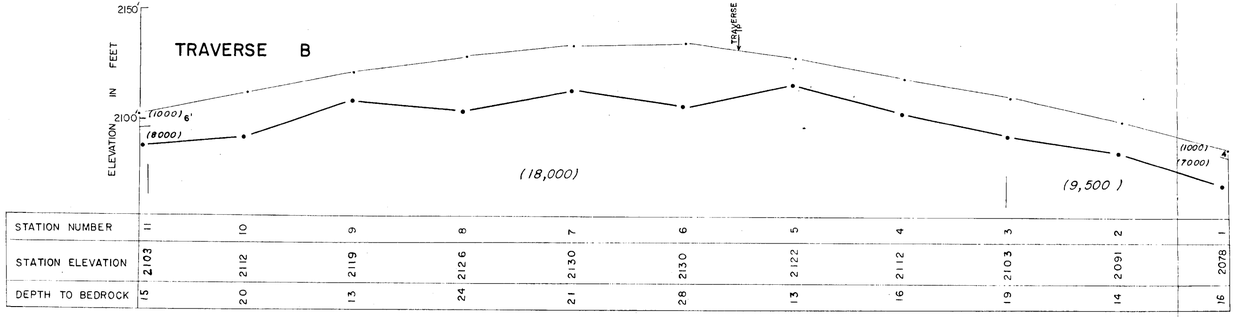
GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS

G413-1

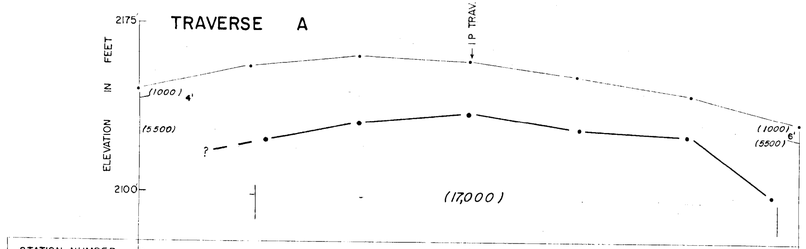
TO ACCOMPANY RECORD No 962/58



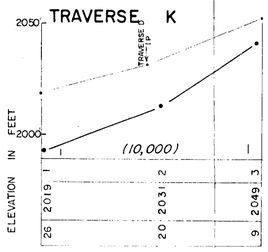
STATION NUMBER	12	11	10	9	8	7	6	5	3	2	1
STATION ELEVATION	2050	2061	2054	2062	2062	2066	2070	2075	2069	2061	2056
DEPTH TO BEDROCK	13	18	2	17	20	24	14	18	10	8	13



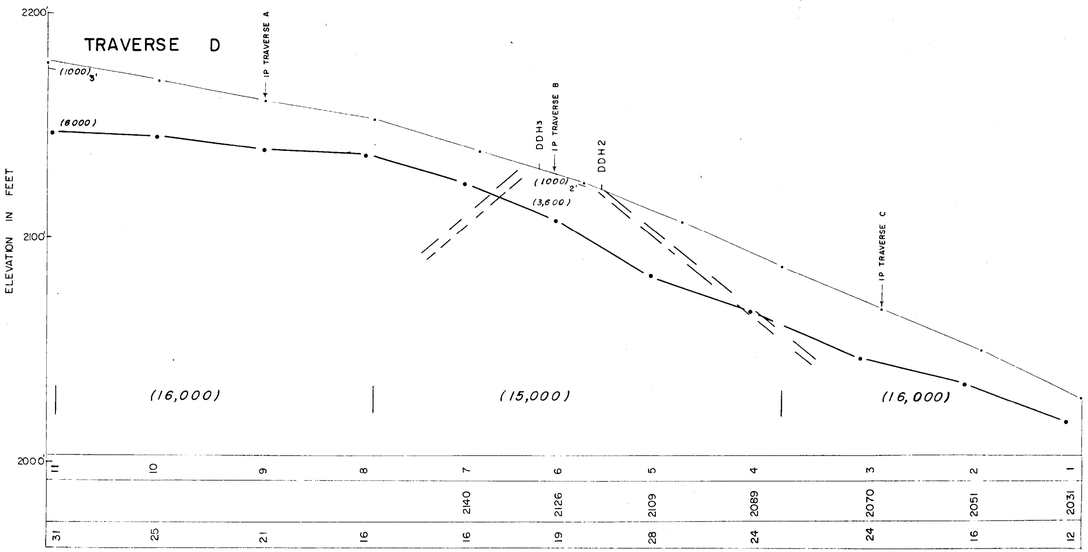
STATION NUMBER	11	10	9	8	7	6	5	4	3	2	1
STATION ELEVATION	2103	2112	2119	2126	2130	2130	2122	2112	2103	2091	2078
DEPTH TO BEDROCK	15	20	13	24	21	28	13	16	19	14	16



STATION NUMBER	7	6	5	4	3	2	1
STATION ELEVATION	2146	2157	2163	2162	2156	2148	2136
DEPTH TO BEDROCK		35	30	24	24	18	36



	1	2	3
ELEVATION	2019	2031	2049
	26	20	9



	11	10	9	8	7	6	5	4	3	2	1
					2140	2126	2109	2089	2070	2051	2031
	31	25	21	16	16	19	28	24	24	16	12

(17,000) SEISMIC VELOCITY IN FT/SEC

DDH 4 DIAMOND-DRILL HOLE

IP INTERSECTION POINT

SCALE IN FEET

40 0 40 80 120

SEISMIC TRAVERSES A, B, C, D, and K
CROSS - SECTIONS

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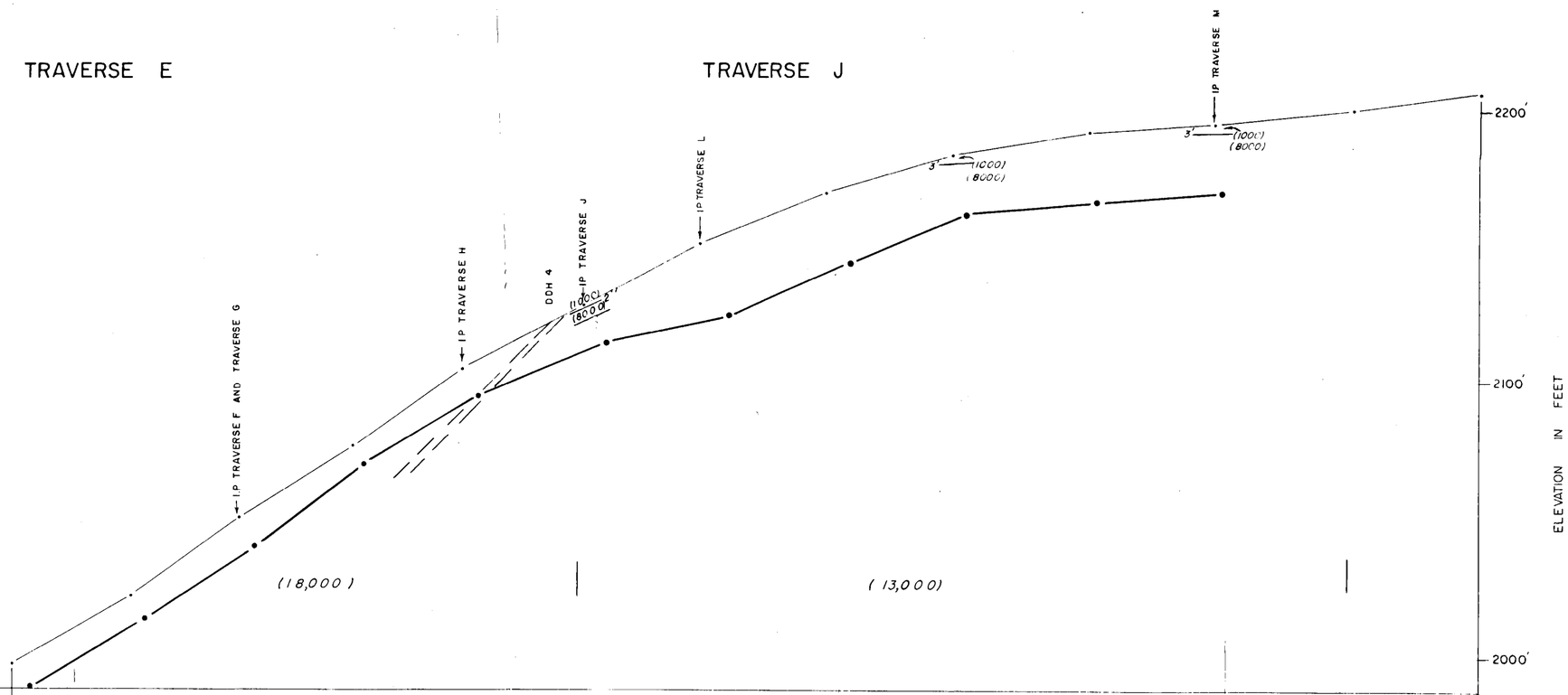
PLATE 3

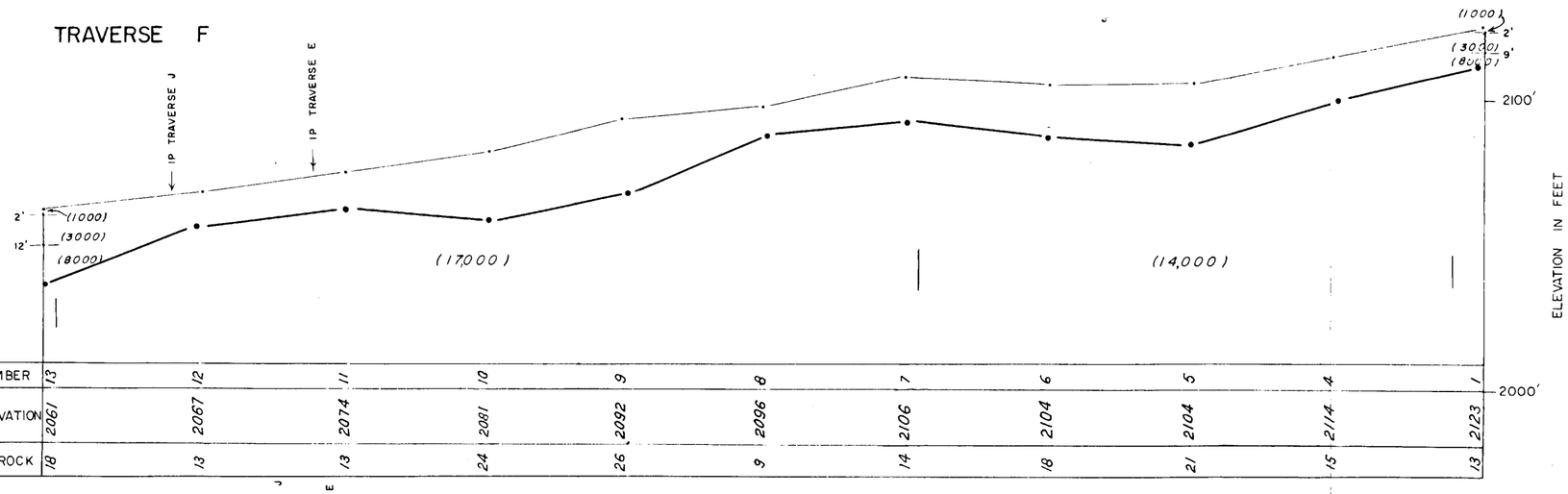
TRAVERSE E

TRAVERSE J



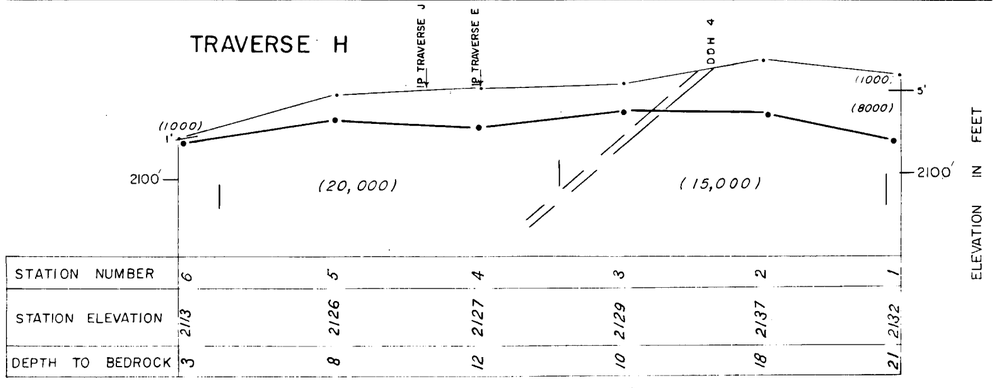
STATION NUMBER	1	2	3	4	5	E6	J1	2	3	6	7	8
STATION ELEVATION	2019	2043	2072	2098	2127		2150	2168	2182	2191	2194	2200
DEPTH TO BEDROCK	10	10	11	6	12		16	28	27	22	26	25

TRAVERSE F



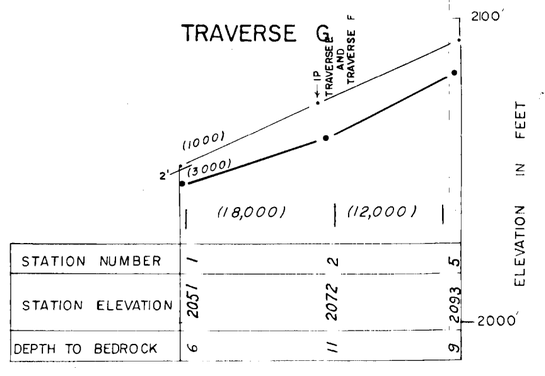
STATION NUMBER	13	12	11	10	9	8	7	6	5	4	1
STATION ELEVATION	2061	2067	2074	2081	2092	2096	2106	2104	2104	2114	2123
DEPTH TO BEDROCK	18	13	13	24	26	9	14	18	21	15	13

TRAVERSE H



STATION NUMBER	6	5	4	3	2	1
STATION ELEVATION	2113	2126	2127	2129	2137	2132
DEPTH TO BEDROCK	3	8	12	10	18	21

TRAVERSE G



STATION NUMBER	1	2	5
STATION ELEVATION	2051	2072	2093
DEPTH TO BEDROCK	6	11	9

SEISMIC TRAVERSES E, F, G, H, and J CROSS - SECTIONS

(17,000) SEISMIC VELOCITY IN FT/SEC

DDH 4 DIAMOND - DRILL HOLE

IP INTERSECTION POINT

SCALE IN FEET

40 0 40 80 120

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GOOGONG DAM SITE N.S.W.

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