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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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**Seismic Refraction Survey at
Belconnen No. 5 Reservoir Site
A.C.T., 1970**



by

P. J. Hill

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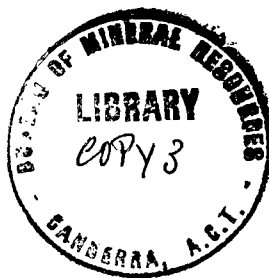
SEISMIC REFRACTION SURVEY AT BELCONNEN No. 5 RESERVOIR SITE, A.C.T. 1970

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P.J. HILL

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ILLUSTRATIONS

Plate 1. Locality Map and traverse plan

Plate 2. Seismic cross-sections with required excavation indicated

SUMMARY

The Bureau of Mineral Resources conducted a seismic refraction survey following a request from the Department of Works at the site chosen for the construction of the Belconnen No. 5 Reservoir. The Department required information on rock conditions likely to be encountered in the major excavation that was planned for the reservoir and advice on any further drilling deemed necessary on the basis of the seismic results.

The survey showed that the bedrock of porphyritic rhyodacite lies well below the floor level of the reservoir, and excavation will be mainly in weathered rock which with some blasting should be removed without difficulty by earth-moving machinery. No extensive drilling at the site appears necessary.

1. INTRODUCTION

At a site in Belconnen the Department of Works proposes the construction of No. 5 Reservoir. It is to be built partly below ground level, and excavation is planned over an area measuring approximately 240 by 480 feet to a maximum depth of about 24 feet.

The Bureau of Mineral Resources, Geology & Geophysics was asked to carry out a seismic investigation of the site, to predict excavation conditions, and to advise on any further drilling that may be required. The field work for the survey was done in November 1970 by a party from the Engineering Geophysics Group of the Bureau. The party consisted of P.J. Hill (geophysicist and party leader), B.H. Dolan (geophysicist), S. Hall (shooter), and two field assistants provided by the Department of Works.

2. GEOLOGY

A geological investigation of the area has been made by BMR geologists (Henderson, 1970; Holt, Christiansen & Henderson, 1970). In the area the rocks are of volcanic origin and Upper Silurian age, and are generally exposed at the surface in the form of scattered small outcrops.

The site is situated on a fairly even slope with a soil cover which extends at least two feet down. Outcrops of grey-green porphyritic rhyodacite in the vicinity of the site are shown in the Traverse Plan of Plate 1. The rock is slightly weathered and hard and occurs mainly as boulders embedded in the soil.

3. EQUIPMENT AND METHODS.

Seismic refraction was used to investigate the site, and a 24-channel SIE seismograph with 20-Hz TIC geophones was employed. A traverse of 690 feet along the length of the reservoir site and two 460-foot cross-traverses were considered sufficient to provide the required information. Spreads were laid with a 10-foot geophone spacing and generally shots were fired at the centre and at 5 feet and 235 feet beyond the ends of each spread.

Interpretation of the field results was done using intercept times and a method based on the 'method of differences' (Heiland, 1946).

4. RESULTS

The location of the traverses is shown in Plate 1, and Plate 2 shows the seismic cross-sections as well as cross-sections of the excavation necessary for the reservoir.

The seismic information obtained on the survey suggests an interpretation in which the subsurface is divided into four layers:

- (1) The top layer having a seismic velocity of about 1000 ft/s composed of soil and completely weathered rock.

- (2) Below this a layer of highly weathered rock with velocity in the range 2300 to 4000 ft/s.
- (3) Next a layer with velocity 4000 to 6300 ft/s consisting of moderately weathered rock.
- (4) Bedrock (defined here as the highest-velocity refractor recorded) varying from slightly weathered to fresh and having a velocity of 13600 to 15800 ft/s.

Along the traverses the bedrock occurs at least 15 feet below the planned excavation depth, so that excavation will be required only within the first three layers. The removal of the top layer of soil and completely weathered rock should be no problem to most kinds of earth-moving machinery (Bartlett, 1969). However, for the highly weathered second layer a bulldozer of the larger sizes fitted with hydraulic ripper may be necessary. Some excavation will be required into the moderately weathered rock having a velocity in the range 4000 to 6300 ft/s, but the amount of this rock that has to be removed is not excessive; in the north-west corner of the site the top of this layer coincides with the planned floor level of the reservoir and rises eastward and southward to about 8 feet above it. Blasting will probably be needed to fracture this rock before it can be excavated.

5. CONCLUSIONS & RECOMMENDATIONS

The seismic survey has shown that excavation will be mainly in material having a velocity less than 4000 ft/s but penetration will also have to be made into the underlying moderately weathered rock. While the low velocity material composed of soil, completely and highly weathered rock would be excavated without difficulty by earthmoving machinery, the harder moderately weathered rock is likely to require blasting. However, the fact that the reservoir will be based in this rock assures a good strong foundation.

The presence of small boulders and floaters of hard, only partly weathered rock particularly those less than 10 feet across would not be indicated by the seismic work, and since outcrops of these occur near the site their uncovering during excavation should not be unexpected.

No major excavation problems are revealed by the survey and a detailed drilling program appears unnecessary, however one drill hole, say at the intersection of Traverses X and Z would prove useful in verifying the seismic interpretation and testing the hardness and strength of the moderately weathered rock.

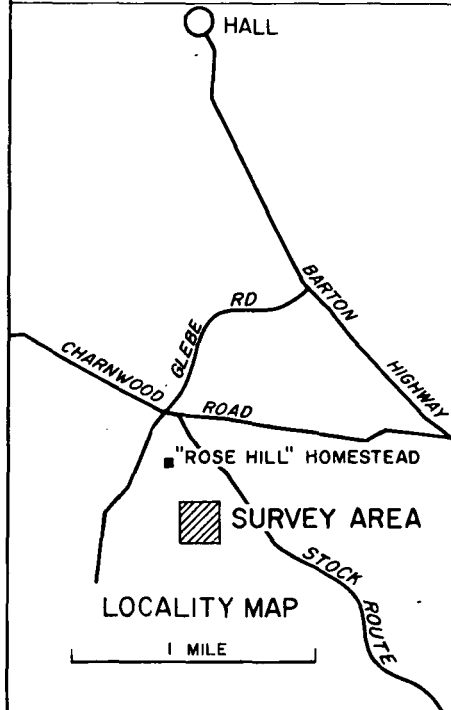
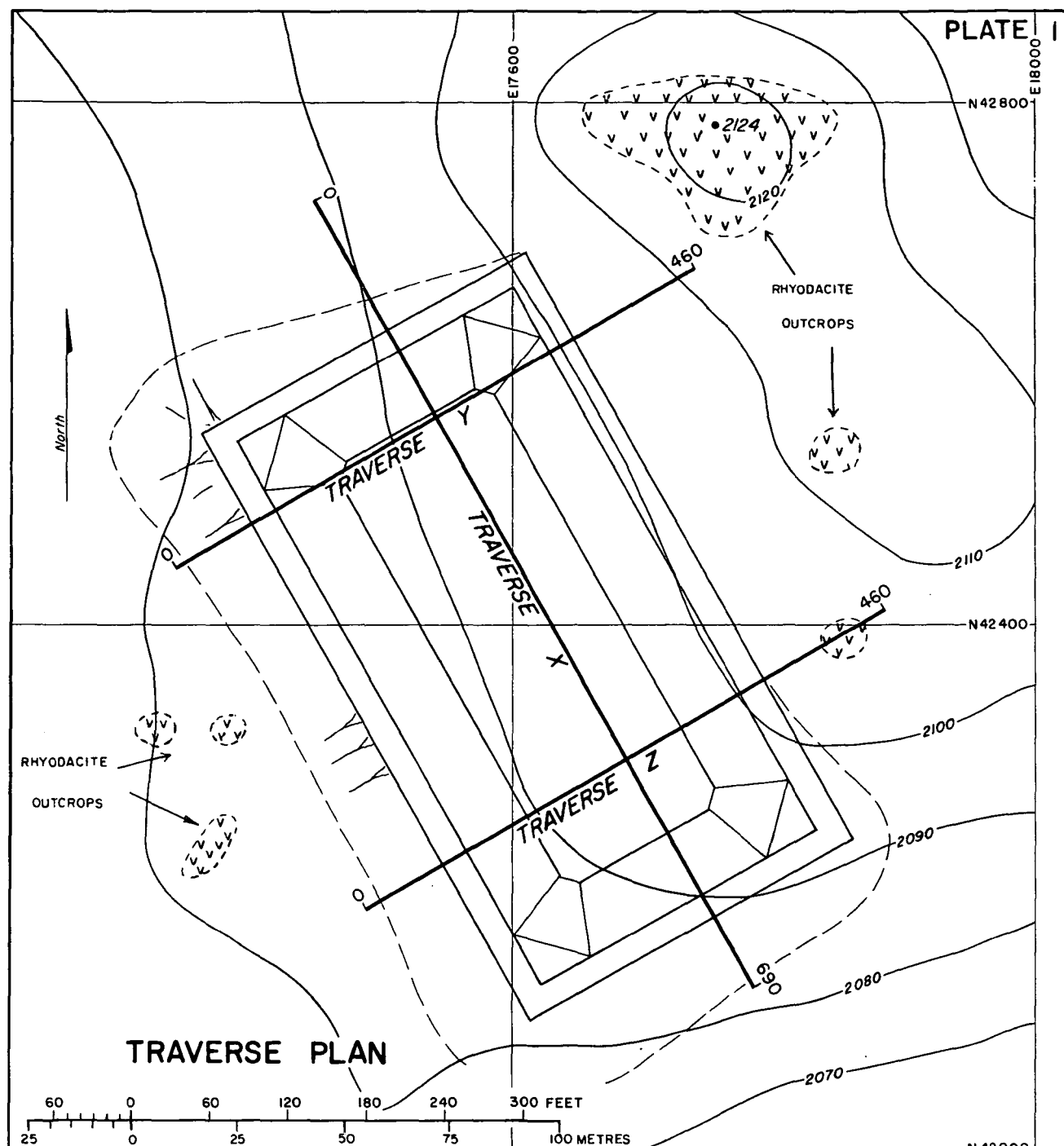
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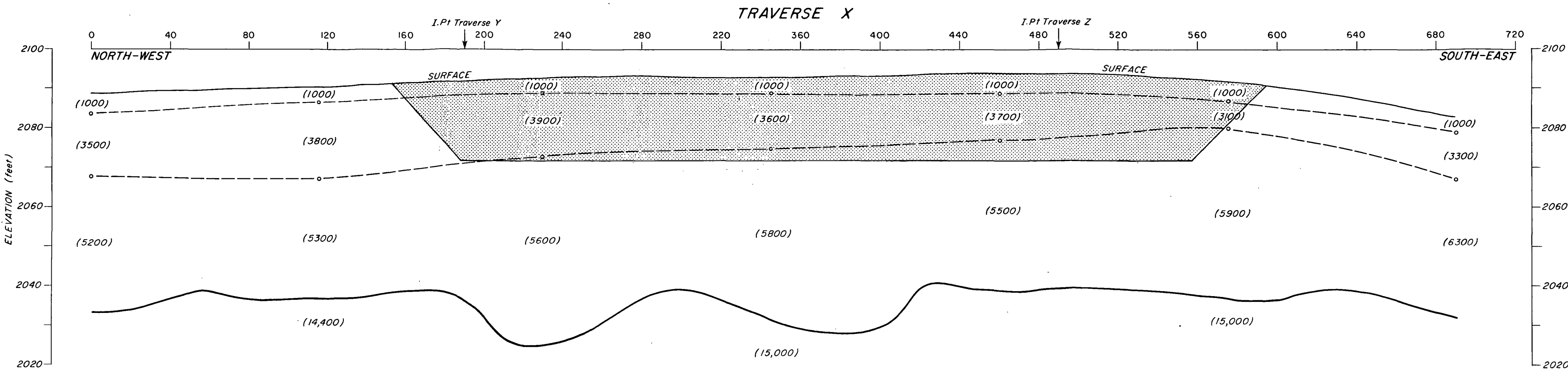
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BELCONNEN N^o. 5 RESERVOIR LOCALITY MAP AND TRAVERSE PLAN



SEISMIC CROSS-SECTIONS

ALSO SHOWN IS CROSS-SECTION OF EXCAVATION REQUIRED FOR RESERVOIR

- LEGEND**
- Outline of excavation
 - Interpolated boundary
 - Bedrock boundary
 - (5900) Seismic velocity in formation (ft/s)
 - I.Pt Intersection point of traverses

