DEPARTMENT OF
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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record 1974/132

STURT ISLAND SAND AND GRAVEL DEPOSITS, SEISMIC REFRACTION SURVEY, MURRUMBIDGEE RIVER, A.C.T., 1974

by

B.H. Dolan & F.N. Michail

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ILLUSTRATIONS

SUMMARY

A seismic refraction survey was carried out by the Bureau of Mineral Resources, Geology & Geophysics (BMR) for the Department of Housing and Construction at Sturt Island, A.C.T., to determine the thickness of sand and gravel on parts of the island. Thicknesses of up to 13 m were recorded.

1. INTRODUCTION

The Australian Department of Services and Property is surveying the sand resources of holdings 98 and 193 at Sturt Island, on the Murrumbidgee River, A.C.T. Acting on a request from the Department of Housing and Construction, the Bureau of Mineral Resources, Geology & Geophysics carried out a seismic refraction survey to assist in the estimation of the quantity of silt, sand, cobbles, and boulders in the area, by determining the thickness of the deposit in selected zones. The terms 'bedrock' in this report refers to the deepest refractor detected.

The field work was carried out between 22 and 26 March 1974 by a party from the Engineering Geophysics group, consisting of F.N. Michail (geophysicist), M. Dickson and S. Green (Trainee Technical Officers), and A. Gleeson (field hand). The results were interpreted by B.H. Dolan and F.N. Michail. A total of 488 m of traverse was completed.

2. GEOLOGY

The geology of the area is described by Strusz, 1971. Bedrock in the area consists of dacites of the Uriarra Volcanics (Walker Member) of Upper Silurian age. They dip to the southwest at about 30° near the sand and gravel deposits. Sturt Island is on the Murrumbidgee River and consists of sand, loose gravel, and boulders deposited by the river mostly during periodic flooding. These are being quarried at the present time.

3. METHODS AND EQUIPMENT

The seismic refraction method was used to determine the depth to bedrock and the thicknesses of the overlying layers. The depths to layers with different seismic velocities were interpreted using the intercept-time method (Heiland, 1946).

Seismic recording was done on eight seismic spreads. Spreads B, C, E, G, and H were at right angles to the main axis of the deposit, and spreads A, D, and F along the axis. Spreads B, C, G, and E were on surveyed and levelled lines. The locations of the spreads were selected so as to represent the different conditions throughout the deposit. Plate 2 shows the location of the surveyed lines and the seismic spreads. 24-channel SIE PSU-19 refraction equipment and GSC-20D geophones were used with a geophone spacing of 4 and 2 m.

4. RESULTS

Plates 3 and 4 show the surface profiles and seismic crosssections. The results showed three groups of velocities. The seismic velocities and their interpretation are tabulated below.

Seismic velocity (m/s)	Interpretation
300 - 800	Unsaturated silt, sand, gravel, and boulders.
1350 - 2400	Saturated silt, sand, gravel, and boulders.
3400 - 4500	Bedrock.

The thickness of the unsaturated layer is generally about 2 m. It is thickest on spread C where it is 8 m, and on spread G where it is about 7 m. The measured thicknesses along some lines, e.g. spread C, are small because material has been removed. The underlying saturated deposits vary in thickness from zero on spreads B and C to 9 m on spread G. The total thickness of recoverable material in the area varies from about 0.5 m on spreads B, D, and H to 13 m on spread G.

Velocities in the range from 1350 to 2400 m/s could be due to weathered bedrock, but the measured layer in this velocity range is so thick that it is unlikely to be weathered bedrock, which would have been removed by the scouring action of the river. The laboratory measurements tabulated below indicate that the saturated unconsolidated sand and gravel could have seismic velocities in the range 1700-2650 m/s.

The laboratory results are shown below.

Sample No.	Description	Longitudinal velocity (m/s)
1	Unconsolidated sand, silt and gravel.	-*
2	Sand, and medium gravel.	1980
3	Coarse sand, and gravel.	2190
4	Sand, and medium gravel.	2650
5	Sand loam.	1900
6	Fine washed sand.	1700
7	Sand.	2030

* Velocity determination was not possible because of high attenuation.

Generally the higher velocities will indicate a coarse, poorly sorted material; the lower velocities will indicate finer-grained and well sorted material. Increased proportions of clay particles in a formation will also reduce the velocity, particularly if the clay is not completely saturated.

5. CONCLUSIONS AND RECOMMENDATIONS

The greatest thickness of sand and gravel material is along spread G, where it reaches almost 13 m. Below the water-table there are thicknesses of from 4 to 6 m on spreads A, D, E, and G.

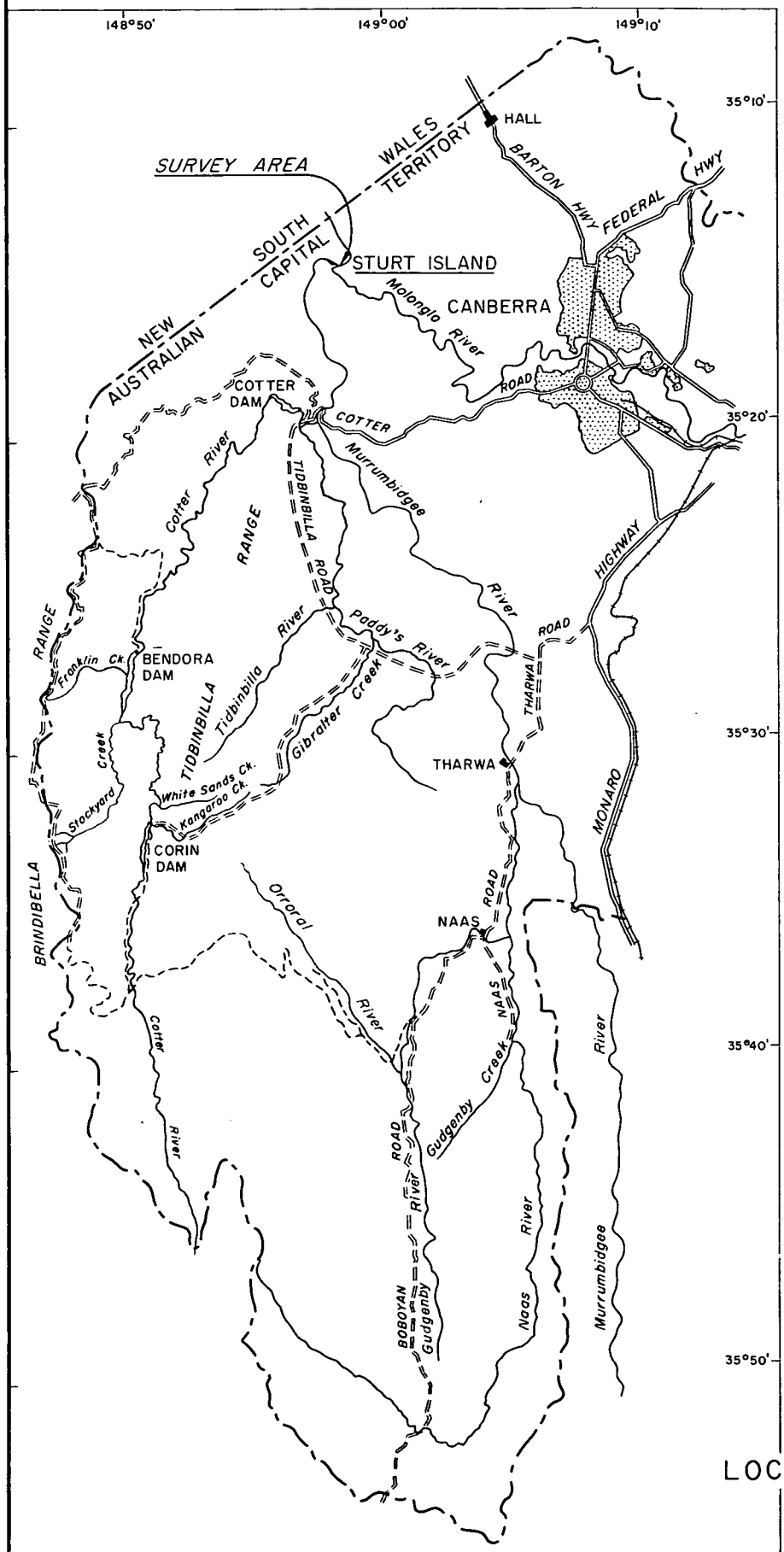
It is recommended that sampling by probing or back-hoe be undertaken at, for example, the centres of spreads A, E, and G, to provide a check on the seismic interpretation.

6. REFERENCES

HEILAND, C.A., 1946 - GEOPHYSICAL PROSPECTING. New York, Prentice Hall.

STRUSZ, D.L., 1971 - Canberra, A.C.T. and N.S.W. - 1:250 000 Geological Series. Bur. Miner. Resour. Aust. Explan. Notes SI/55-16.

PLATE I



REFERENCE

- Built up area
- Railway
- Highway, Principal Road
- Secondary Road
- Vehicle Track
- Territorial Boundary

LOCALITY MAP

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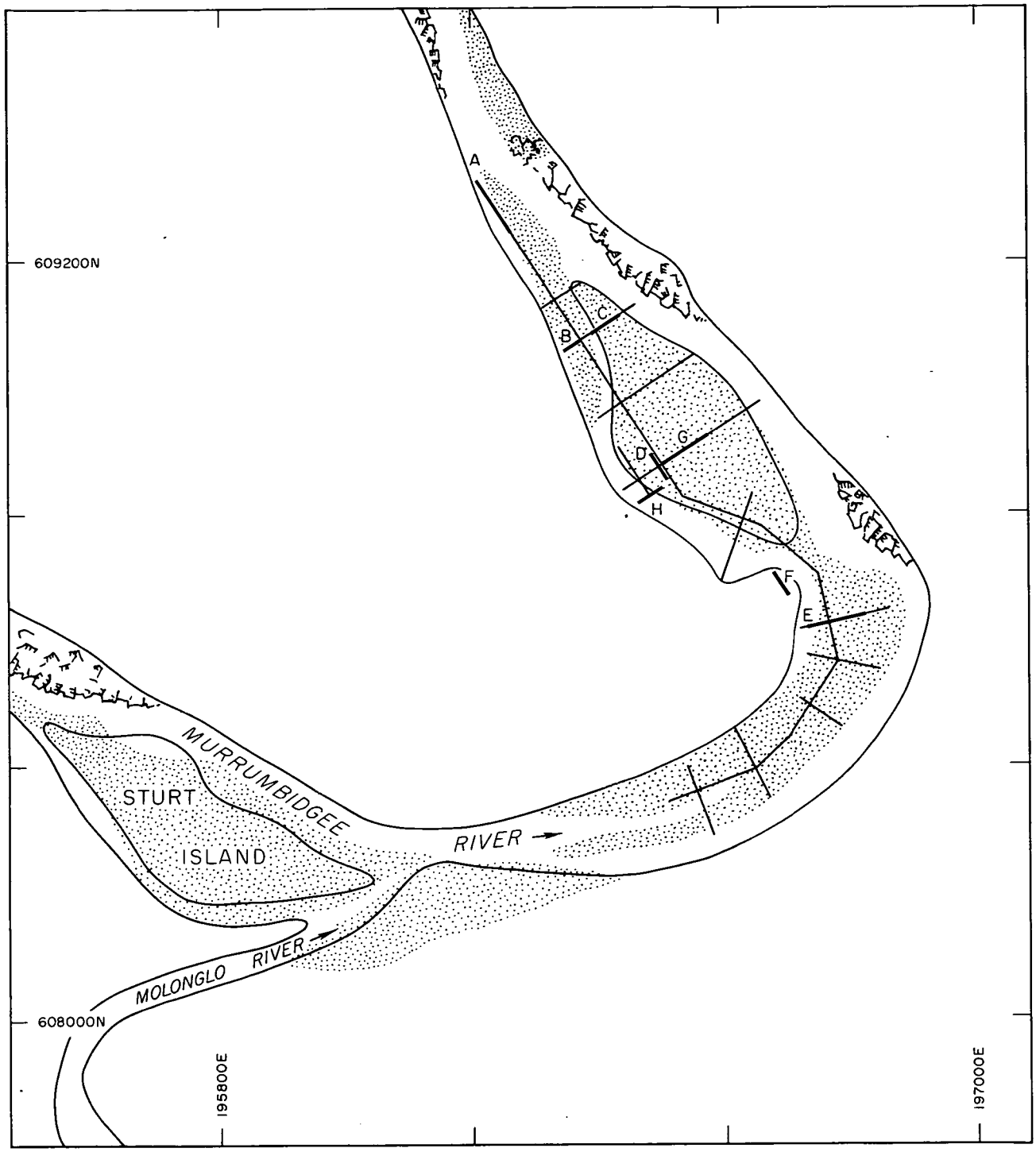
155/B5-225A

Based on 155/B0-43A

PLATE 2



100 0 200 400 METRES

Co-ordinates in metres

LEGEND

G — BMR seismic spread

Survey lines

Sand and gravel

LOCATION OF TRAVERSES

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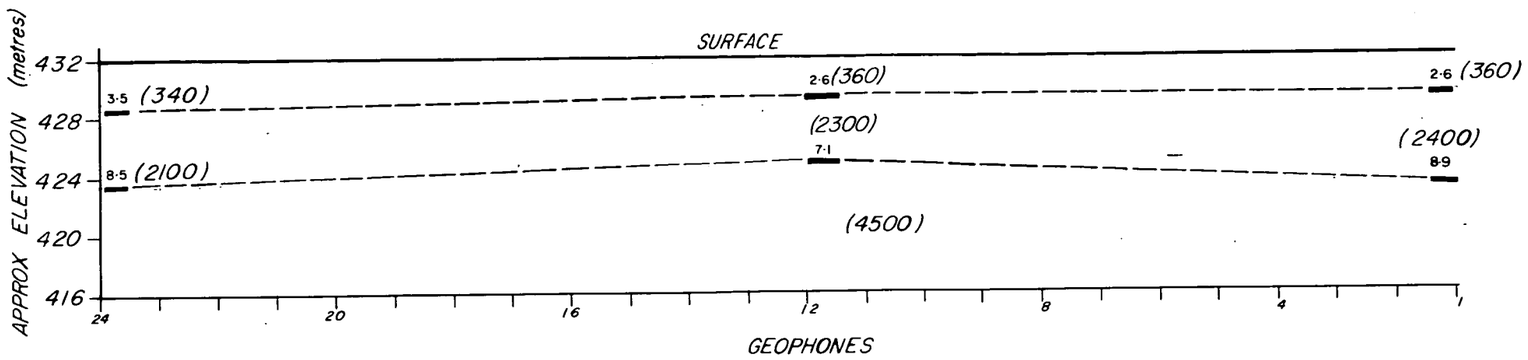
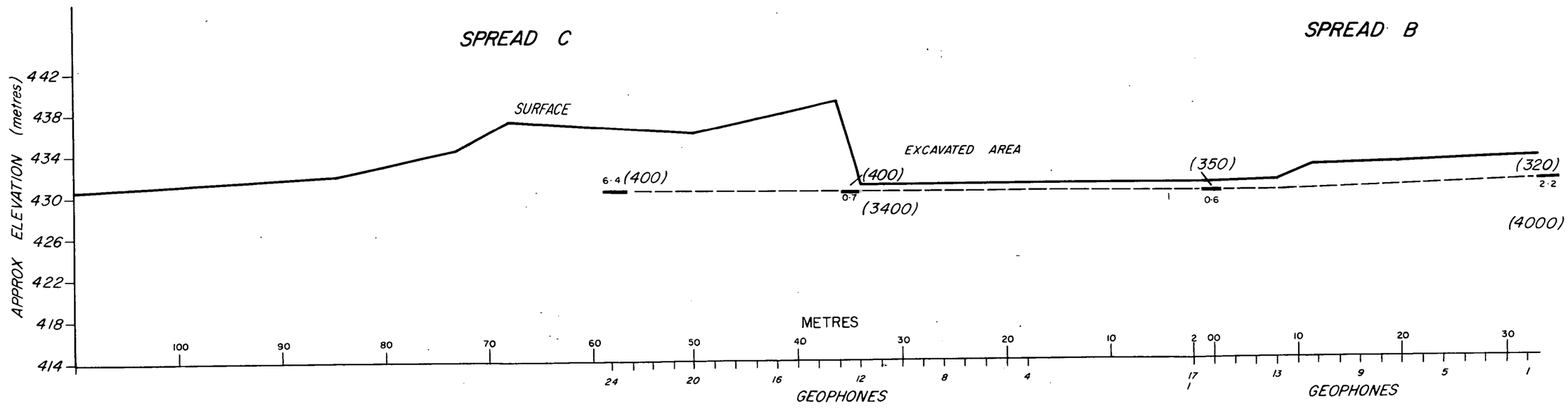
155/85-229A

SPREAD A



SPREAD C

SPREAD B



LEGEND

8·5 *Depth to refractor (metres)*

(2100) *Seismic velocity in formation (metres/second)*

METRES

10 0 10 20 30

SEISMIC CROSS SECTIONS

SPREADS A, B, AND C

I55/B5-223

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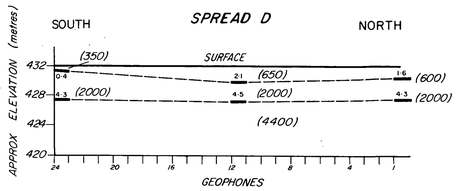

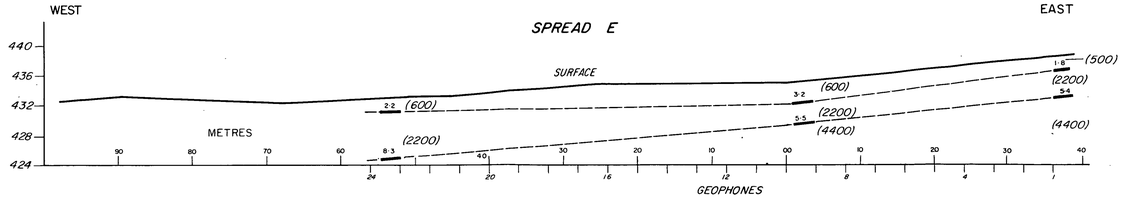

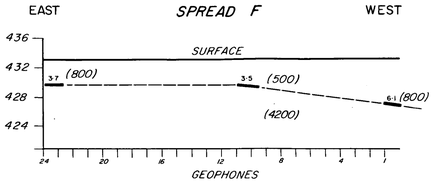

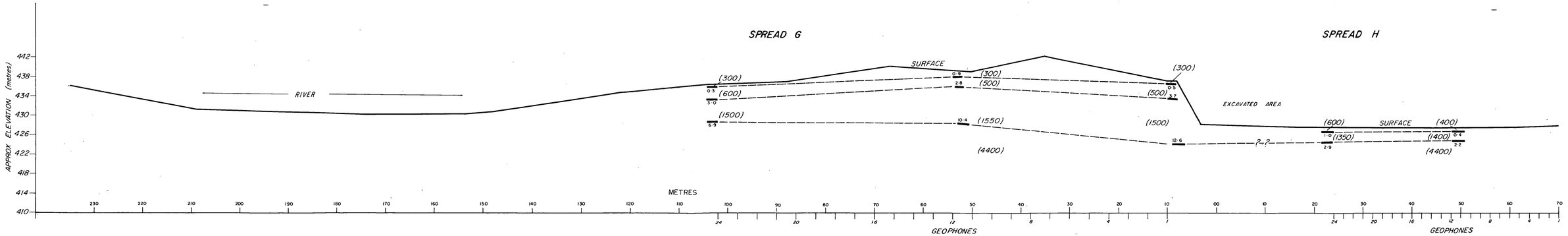

LEGEND

4·5 Depth to refractor (metres)

(2000) Seismic velocity in formation (metres/second)

METRES 10 0 10 20 30

SEISMIC CROSS SECTIONS

SPREADS D, E, F, G, AND H