COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF
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BUREAU OF MINERAL
RESOURCES, GEOLOGY
AND GEOPHYSICS

Record 1972/43

WODEN TRUNK SEWER EXTENSION SEISMIC REFRACTION INVESTIGATION, ACT, 1971

by

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SUMMARY

A seismic refraction survey along selected portions of the proposed Woden Trunk Sewer extension revealed low-velocity overburden in the region of a proposed tunnel between manholes (M.H.) 5 and 6. Elsewhere along trenched portions of the pipeline the velocity of the overburden suggests that the completely weathered layers and weathered bedrock may be marginally rippable with a tractor and backhoe but that some blasting may be required.

1. INTRODUCTION

The Department of Works plans toconstruct an extension of the Woden Trunk Sewer from the existing main outfall sewer, near Yarralumla Woolshed, along the southern bank of the Molonglo River to the Weston Creek treatment works. In response to a request from the Department of Works the Bureau of Mineral Resources (BMR) carried out a seismic refraction survey to investigate trenching and tunnelling conditions at selected positions along the sewer line. Three traverses were investigated (Plate 1). Traverse 1 was located over a spur where tunnelling is proposed to a maximum depth of 10 m. Traverses 2 and 3 were planned to investigate overburden rippability along trenched positions of the trunk sewer.

The field work was carried out in November 1971 by a party consisting of G.R.Pettifer (geophysicist), P.J. Hill (geophysicist), S. Hall (shooter), and two field hands.

2. GEOLOGY

Four main rock types are traversed along the length of the sewer line. The geology (Strusz & Henderson, 1971) is shown in Plate 1.

Traverse 1 is located over an area of the medium to coarse grained crystalline dacitic tuff of the Silurian Mount Painter Porphyry. Farther west, Traverse 2 is located in a region where outcrops suggest a thin veneer of cream rhyolite tuff of the Silurian Deakin Volcanics overlying the Mount Painter Porphyry. Still farther west, near the proposed Tuggeranong Freeway bridge over the Molonglo River, sandstone of the Yarralumla Formation crops out. Traverse 3 is located on acid lavas and tuffs of the Deakin Volcanics just east of a northeast-trending fault.

3. EQUIPMENT AND METHOD

BMR's standard 24-channel seismic refraction equipment (S.I.E. Dresser Co.) with 20-Hz geophones (Technical Instruments Co.) was used on the survey.

Seven refraction spreads where shot during the survey using a geophone interval of 3 m. Five shots were fired for each spread; one in the centre, one 1 m beyond each end of the spread, and one 70 m beyond each end of the spread.

The convential reciprocal method of interpretation (Heiland, 1946; Hawkins, 1961) was employed in interpreting the data. Depths to each intermediate layer were computed at each shot-point and as bedrock (here defined as the highest-velocity layer encountered) was found to be well below the proposed level of the pipeline. Bedrock depths were computed only at shot-points and interpolated between shot-points.

4. RESULTS

Plate 2 shows the seismic cross-sections for the three traverses. The Traverse 1 results indicate four main layers in the region of the tunnel line. A top layer generally 2-2.5 m thick, with a velocity in the 300-400 m/s range, represents surface soil and clay. Underlying this is a 1 200 - 1 600 m/s layer, which is interpreted as representing completely weathered bedrock. This layer may be too hard to be ripped by an excavator of lesser ripping capability than a D-7 bulldozer (Caterpillar, 1966). The proposed tunnel appears to lie in this completely weathered layer and the relatively low velocity of the layer suggests that soft tunnelling methods may have to be employed.

The 2 100 - 2 200 m/s layer, interpreted as representing weathered bedrock, occurs below the level of the proposed sewer line on the western end of the traverse near manhole (M.H.) 6. At the centre of the traverse the weathered bedrock layer rises to the level of the tunnel; east of the centre of the traverse, an anomalously high overburden velocity (1 600 m/s) obscured the presence of the 2 100 m/s layer. There is evidence of the 2 100 m/s layer occuring near M.H. 15; however, the layer is very thin. The results are plotted showing the maximum thickness of the weathered bedrock (2 100 m/s) layer and indicate that the weathered bedrock layer may be encountered in the centre of the traverse during tunnelling. Bedrock velocity appears to decrease to the east.

On Traverse 2, the sewer line appears to be at the top of the 1 100 - 1 400 m/s completely weathered layer. Trenching of the 300-400 m/s soil layer by a backhoe should be easily achieved. Below the level of the trench is a 2 100 - 2 300 m/s layer interpreted as being weathered bedrock. Fresh bedrock (4 200 - 4 400 m/s) ranges in depth from 13 to 20 m.

The cross-section of Traverse 3 shows that the overburden velocities are generally higher in the Deakin Volcanics in this area. The 2 000 - 2 400 m/s layer is interpreted as weathered bedrock, and along this section of the pipeline the trench appears to be located in the weathered bedrock layer. Trenching may thus be harder along this section.

Part of the pipeline, from approximately M.H. 16 to M.H. 18, crosses a region of sandstone of the Yarralumla Formation. The present survey has not investigated this region but a previous survey for the proposed Molonglo bridge site was carried out (Whiteley, 1971) about 100 m north of the pipeline (Plate 1) over the sandstone. The results of this survey revealed a soil layer of seismic velocity 350-750 m/s about 3 m thick overlying completely weathered bedrock (1 350 - 1 550 m/s) generally 6 to 7 m thick and then generally a further 10-15 m of weathered bedrock (1 800 - 2 500 m/s) overlying sandstone bedrock (3 400 - 3 600 m/s).

5. CONCLUSIONS

Tunnelling between M.H. 5 and M.H. 6 may encounter difficulties because of the large thickness of low velocity (1 200 - 1 600 m/s) material above the proposed level of the tunnel.

The soil layer was found to range in thickness from about 1.5 to 3.5 metres along the pipeline. From M.H. 1 to M.H. 18 evidence suggests that a marginally rippable completely weathered layer is present. The Traverse 3 results over the acid lavas and tuff indicate a relatively higher-velocity overburden in the section. These conditions may prevail from about M.H. 18 to M.H. 27. In general, from the velocities of the near-surface layers, it may be necessary to make use of blasting for the trench excavations.

6. REFERENCES

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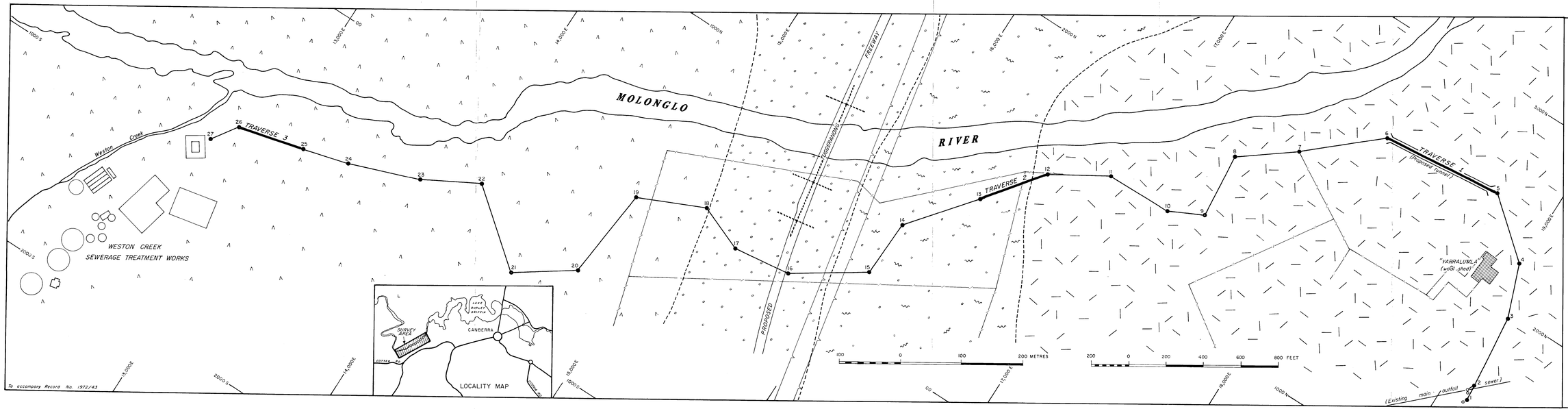

PLATE 1

SEISMIC TRAVERSE

PREVIOUS SEISMIC TRAVERSE (Whitely, 1971)

PROPOSED SEWER LINE AND MANHOLES

FENCE

TRANSMISSION LINE

GEOLOGY

MT PAINTER PORPHYRY
Dacite crystalline tuff

YARRALUMLA FORMATION
Sandstone

DEAKIN VOLCANICS
Rhyolite tuff

DEAKIN VOLCANICS
Acid lavas and tuffs

GEOLOGY AFTER GARDNER (Strusz and Henderson, 1971)

Co-ordinates are in feet with origin at Stromlo Trig Station.

WODEN TRUNK SEWER EXTENSION SEISMIC REFRACTION INVESTIGATION A.C.T. 1971

LOCALITY MAP, TRAVERSES PLAN AND GEOLOGY

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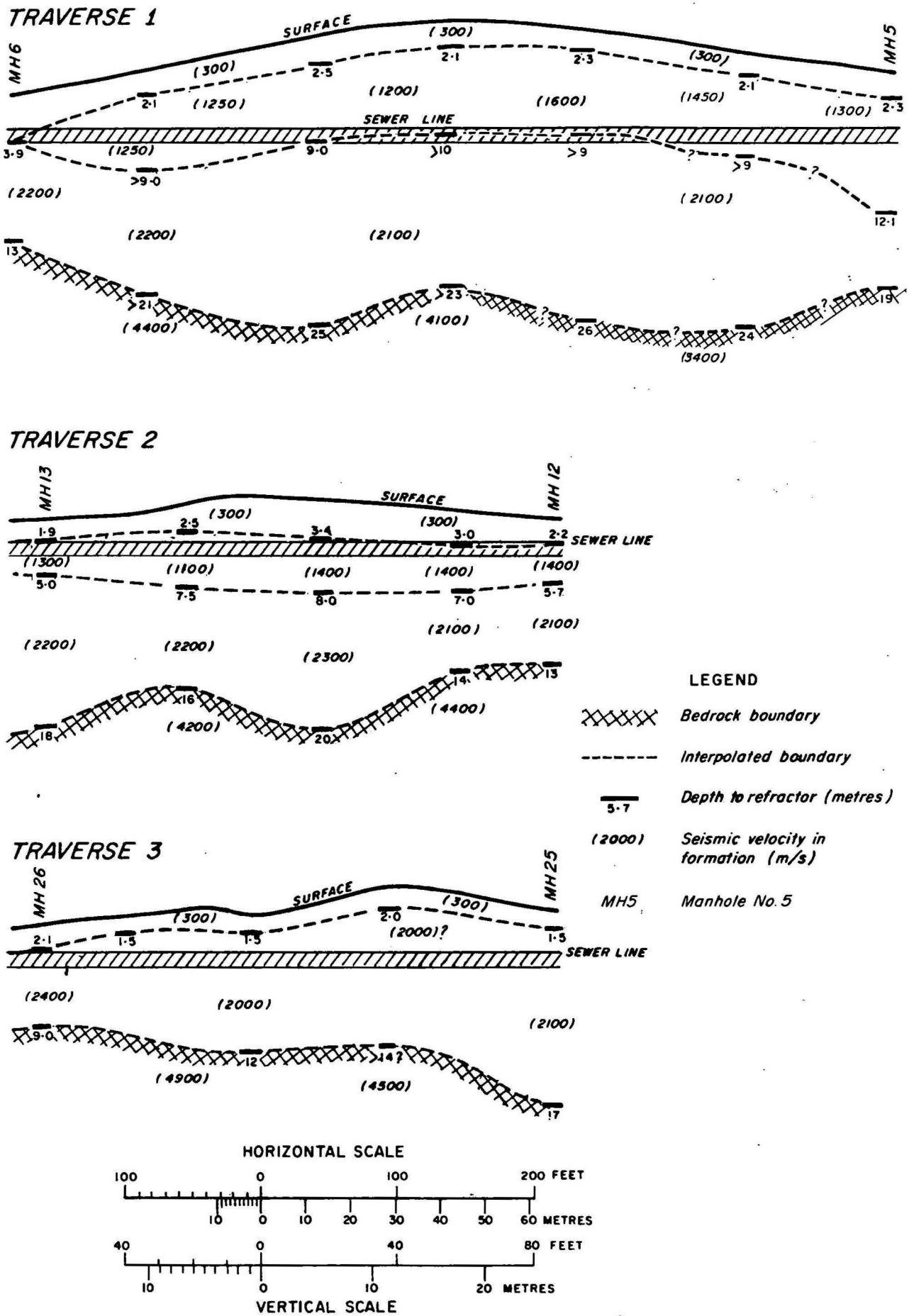

SEISMIC CROSS-SECTIONS

I55/B5-127A

To accompany Record No. 1972/43