COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record 1971/91

SEISMIC REFRACTION SURVEY ON THE SITE FOR RELOCATION OF THE BELCONNEN TRUNK SEWER, A.C.T. 1971

by

B.H. Dolan

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ILLUSTRATIONS

SUMMARY

A seismic refraction survey was carried out along the site of the proposed relocation of the Belconnen trunk sewer to determine depth to bedrock and the nature of the weathered layer.

The seismic results indicate that the depth to bedrock is greater than the depth of excavation for the sewer except for parts of Traverses 1 and 3 and that the weathered layer is most consolidated on Traverse 3.

1. INTRODUCTION

The National Capital Development Commission proposes to relocate the trunk sewer at Belconnen, A.C.T., around the site of the future lake scheme.

At the request of the Department of Works, the Bureau of Mineral Resources, Geology & Geophysics carried out a seismic refraction survey at selected sites along the line of the proposed sewer in order to determine the thickness and character of the weathered layer.

The sites were surveyed in January 1971 by a party from the Engineering Geophysics Group consisting of P.J. Hill (party leader), B.H. Dolan (geophysicist), S. Hall (field assistant), and two field assistants provided by the Department of Works.

2. GEOLOGY

The geology of the area has been described by Yendall, Walraven & Doutch (1967). The geology is controlled by the Deakin fault, which runs approximately northwest through Traverse 4. East of the fault are Middle Ordovician and Silurian metasediments and volcanic rocks intruded by granodiorite; west of the fault are Upper Silurian volcanics and sediments.

In general the strata of the area have been thoroughly lithified and slightly metamorphosed. Where fresh, all bedrock in the area is strong, hard, and stable. It would require explosives to break.

Superficial deposits of clay, sand, and gravel, generally modified into soils, range from 0-5 feet in thickness on the hills and valley slopes.

3. METHODS AND EQUIPMENT

The depth to bedrock and nature of the overburden were investigated using a 24-channel SIE seismic refraction equipment with TIC 20-Hz geophones. A geophone spacing of 10 feet was employed on all traverses. Charges were fired in line with the spread and at distances of 5 and 200 feet beyond the spread. A shot was fired at the centre of each spread to give additional information on the overburden.

Results were interpreted by use of 'intercept time' (Heiland, 1946) and the 'reciprocal method' (Hawkins, 1961). The intercept-time method gives the depth to formations with different seismic velocities in the area underneath the 5-foot and centre shot-holes. The reciprocal method gives the depth to bedrock at each geophone position calculated from velocities obtained in the intercept time method.

Five traverses each of 230 feet were completed along the line of the proposed sewer relocation.

4. RESULTS

Plate 1 shows the location of the seismic traverses and Plate 2 the seismic cross-sections. Chainage pegs and man-hole positions are shown along the traverses. The elevation reference level of 1820 feet is indicated.

Depths to the deepest refractor encountered were calculated at each geophone position and are reproduced as a continuous bedrock profile. Depths to shallower refractors were calculated at shot-points and interpolated between them.

The subsurface layers encountered were classified according to their velocities (Table 1).

TABLE 1

Longitudinal seismic velocity (ft/sec).	Inferred rock type
1000-3000	Soil, unconsolidated alluvial material, completely weathered bedrock
5000-5100	Saturated, unconsolidated material
5000-8500	Very weathered to moderately weathered bedrock
12500-16000	Unweathered bedrock

The thickness of completely weathered or unconsolidated material ranges from a maximum of 19 feet to 3 feet along the lines surveyed. Depth to bedrock ranges from 12 to 60 feet.

5. CONCLUSIONS

On Traverses 2, 4, and 5, excavation would extend into formations with a seismic velocity of 5800 ft/sec or less. On Traverse 3 approximately 15 feet of material with a velocity of 7000 to 7300 ft/sec would have to be removed and possibly 5 feet of bedrock (12,500 ft/sec). On Traverse 1 the excavation would extend up to 8 feet into bedrock (16,000 ft/sec).

On Traverse 1 and 3 blasting may be necessary in excavating the pipe trench.

6. REFERENCES

HAWKINS, L.V., 1961 - The reciprocal method of routine shallow seismic refraction investigations, Geophysics, 26 (6), 806-819.

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

YENDALL, L., WALRAVEN, L.F., and DOUTCH, H.F., 1967 - Geological Investigations, Belconnen sheets H4C and H5A, Australian Capital Territory, 1967. Bur. Miner. Resour. Aust. Rec. 1967/146 (unpubl.).

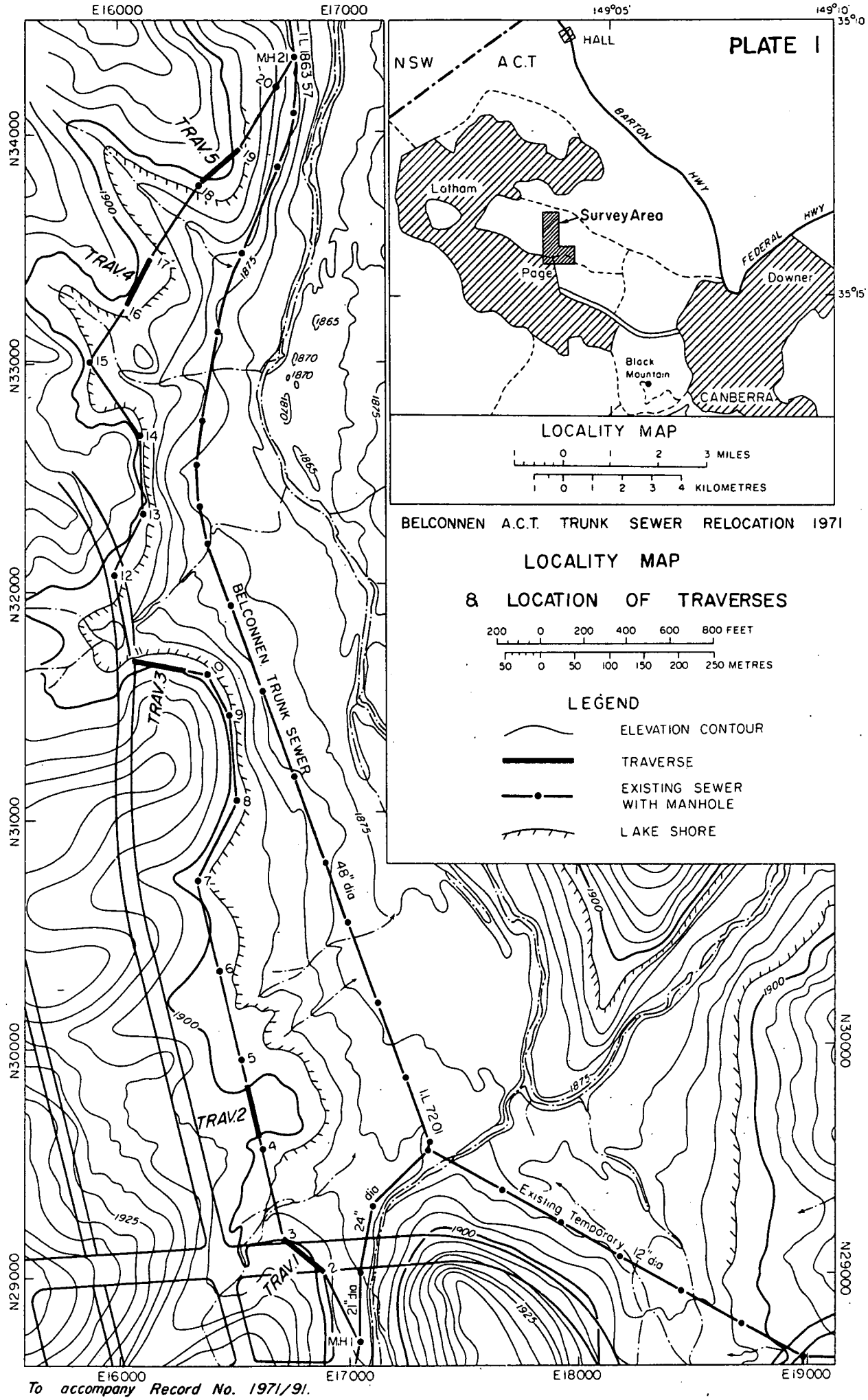

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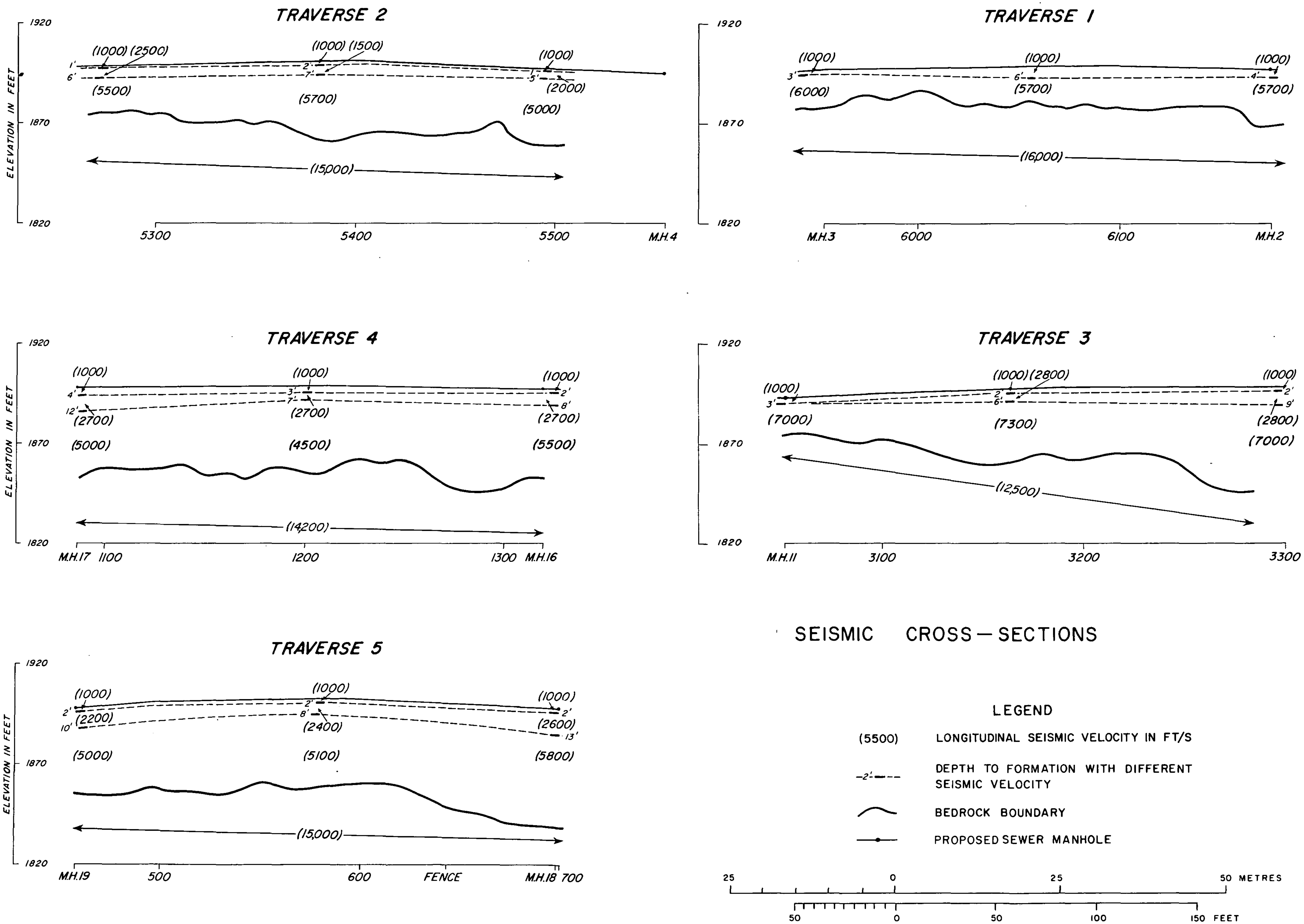
PLATE 2


TRAVERSE 2
1920
1870
1820
ELEVATION IN FEET
(1000) (2500)
(1000) (1500)
(1000)
(5500)
(5700)
(5000)
(2000)
(15,000)
5300
5400
5500
M.H.4
TRAVERSE 1
(1000)
(6000)
(5700)
(16,000)
M.H.3
6000
6100
M.H.2
TRAVERSE 4
(2700)
(5000)
(4500)
(5500)
(14200)
M.H.17 1100
1200
1300 M.H.16
TRAVERSE 3
(1000) (2800)
(7000)
(7300)
(2800)
(12,500)
M.H.11
3100
3200
3300
TRAVERSE 5
(2200)
(2400)
(2600)
(5100)
(5800)
(15,000)
M.H.19
500
600
FENCE
M.H.18 700
LEGEND
(5500) LONGITUDINAL SEISMIC VELOCITY IN FT/S
DEPTH TO FORMATION WITH DIFFERENT SEISMIC VELOCITY
BEDROCK BOUNDARY
PROPOSED SEWER MANHOLE
50 METRES
150 FEET

SEISMIC CROSS-SECTIONS