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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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SECRETARIAT BUILDING FOUNDATIONS SEISMIC INVESTIGATION, CANBERRA 1964

by

E.J. Polak and M. Wainwright

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PROGRESS RECORD

SECRETARIAT BUILDING, CANBERRA A.C.T.

SEISMIC INVESTIGATION FOR FOUNDATIONS.

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ILLUSTRATIONS

1. INTRODUCTION.

The National Capital Development Commission is erecting a building to house the Secretariat. The building is located on the corner of Commonwealth Avenue and King Edward Terrace, Canberra, A.C.T. (Plate 1).

As the near surface strata, consisting of soil, clay and weathered rock, will be unable to support the buildings, they must be supported on piles resting on solid bedrock. During the construction of sections A and B of the building excessive variations in the level of the solid rock were found. To facilitate the construction of the foundation of sections C, D and E the Geological Branch of the Bureau of Mineral Resources in the capacity of geological adviser to the Commission requested the Geophysical Branch to assist with the investigation. The main problems were to measure the depth and to determine the lateral extent of the solid rock.

The field work was carried out from 27th to 30th October, 1964, by a geophysical party consisting of E.J. Polak (party leader) and M. Wainwright (geophysicist).

2. GEOLOGY.

A detailed description of the geology of the Secretariat site, based on diamond drillhole information, is given by Best (1963 a and b).

The area of the site is covered with soil overlying yellow-brown weathered bedded shales, underlain by impure limestone and calcareous shale.

The limestone is massive, containing many calcite veins and stringers. Weathering of the limestone produces a brown, mottled rock. Several cavities within the limestone were located in drillholes. The cavities result from the solution of calcite by circulating water.

The overlying shale is yellow brown in colour, soft, weak, and weathered into clay. Several pockets of slightly weathered shale were located in areas where the top of the limestone is less than 1800 ft above sea level.

3. METHODS AND EQUIPMENT.

The seismic refraction method was used in the investigation. Detailed description of the method has been given by Hawkins and Stocklin (1956). The "method of differences" and "step out times" were used for calculating the thickness of overburden. (Heiland, 1946, p. 548).

The equipment used in the survey was an SIE 12 Channel refraction seismograph, with TIC geophones having a natural frequency of about 20 c/s.

4. RESULTS.

The results of the survey are shown on Plates 1 to 4. The depths to the highest velocity refractor were calculated using apparent velocities obtained at each end and in the centre of a traverse.

The overburden in the area consists of two layers :

The upper one with the velocity of 1200 to 1600 ft/sec, is interpreted as decomposed rock in the aerated zone.

The lower layer with the velocity of 2500 to 3200 ft/sec is interpreted as decomposed rock partly saturated with water.

The bedrock consists of rock with seismic velocities of 8,000 to 12,400 ft/sec. The velocities indicate that the bedrock is jointed and probably weathered along these joints.

The contours on Plate 1 indicate the calculated elevation of the top of the bedrock assuming the surface level to be 1850 ft above the sea level. The figures in brackets indicate the seismic velocities in the bedrock in ft/sec. Traverse D1 was shot, but the results are doubtful and therefore not included.

The velocities in the bedrock are higher along Traverses C1 and C2 (direction SW to NE) than on Traverses E and D (direction NW to SE). This may indicate that major joints are more nearly parallel to Traverses C1 and C2.

The sections on Plates 2 to 4 show the vertical distribution of velocities and the shape of the top of the bedrock.

There were several factors which affected the seismic investigation and the results obtained.

The construction of Sections A and B of the building was in progress during the seismic work, and the industrial noise limited the amplification used in recording, making the records difficult to read to a high degree of accuracy; also the size of the explosive charge was strictly limited by the proximity of pipes, high tension electrical conductors, and buildings.

Some of the traverses crossed the filled-in trenches for pipes or conductors, or crossed heaps of loose material. In both cases the loose

material has a low seismic velocity but no correction could be made for it in computation.

It is difficult to estimate the percentage error of the depth determinations. It may be as high as 25 to 30 per cent, but the actual shape of the bedrock should be correct.

5. CONCLUSIONS.

The depth to the suitable foundation rock at the proposed building sites is up to 50 ft. Sections along the traverses indicate an irregular interface between bedrock and overburden. The velocity in the bedrock of between 10,000 to 12,400 ft/sec is not especially low for impure limestone and shale. The low velocity in the bedrock on Traverse E3 may be explained by a change in the rock type.

It may be necessary to adjust the estimated depth on the sections to the results of subsequent drilling.

6. REFERENCES.

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HAWKINS, L.W. and STOCKLIN, A. 1956 Seismic survey of the Eastern abutment of Dam Site E, Upper Cotter River A.C.T. Bur. Min. Res. Aust. Rec. 1956/124.

HEILAND, C.A. 1946 GEOPHYSICAL EXPLORATION, PRENTICE HALL INC. New York.

KING EDWARD TERRACE

SECRETARIAT BUILDING, CANBERRA, A C T

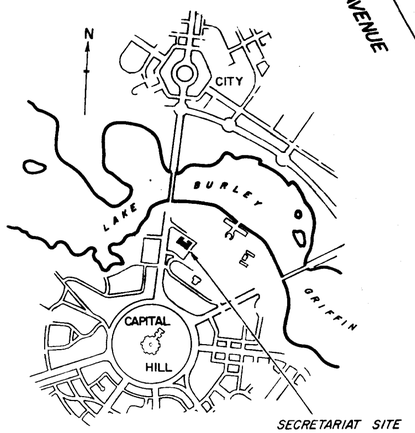
SEISMIC INVESTIGATION FOR FOUNDATIONS

LEGEND

- 5 — Drill hole
- Geophysical traverse
- Building–under construction
- Building–proposed
- 1800 — Contour of top of fresh rock based on drill hole information
- 1800 — Contour of top of fresh rock based on seismic refraction results
- (10,000) Bedrock velocity (ft/s)

TRUE NORTH
MAGNETIC NORTH

COMMONWEALTH AVENUE



TRAV. E3 (8000)
TRAV. E2 (11,000)
TRAV. E1 (10,000)
TRAV. D2 (10,000)
TRAV. D1
TRAV. C1 (12,400)
TRAV. C2 (12,200)
SECTION "A"
SECTION "B"

FEET
40 20 0 40 80 120 160 200
Contour interval 10 feet

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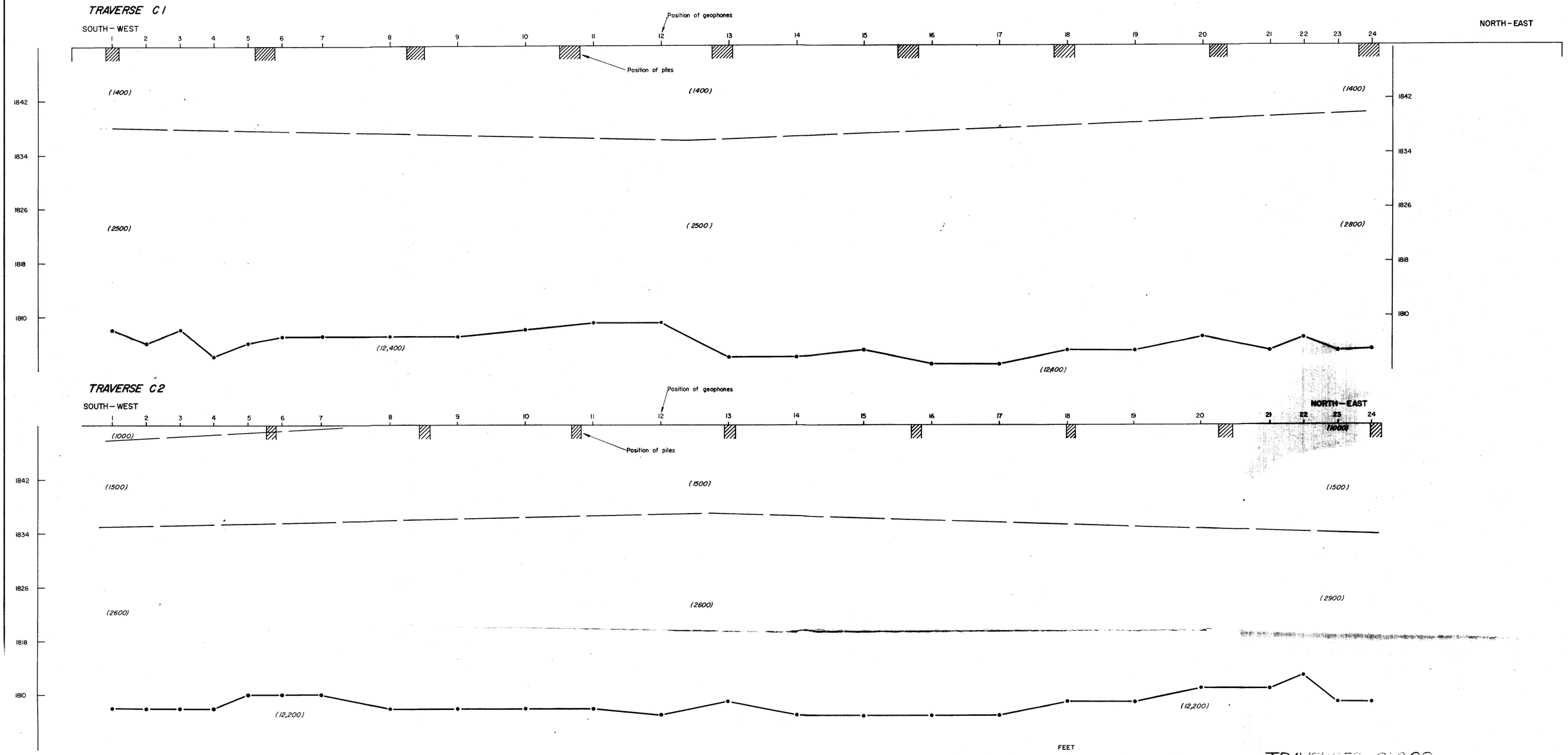

TRAVERSES C1 & C2
SEISMIC CROSS-SECTIONS

SITE CANBERRA 1964

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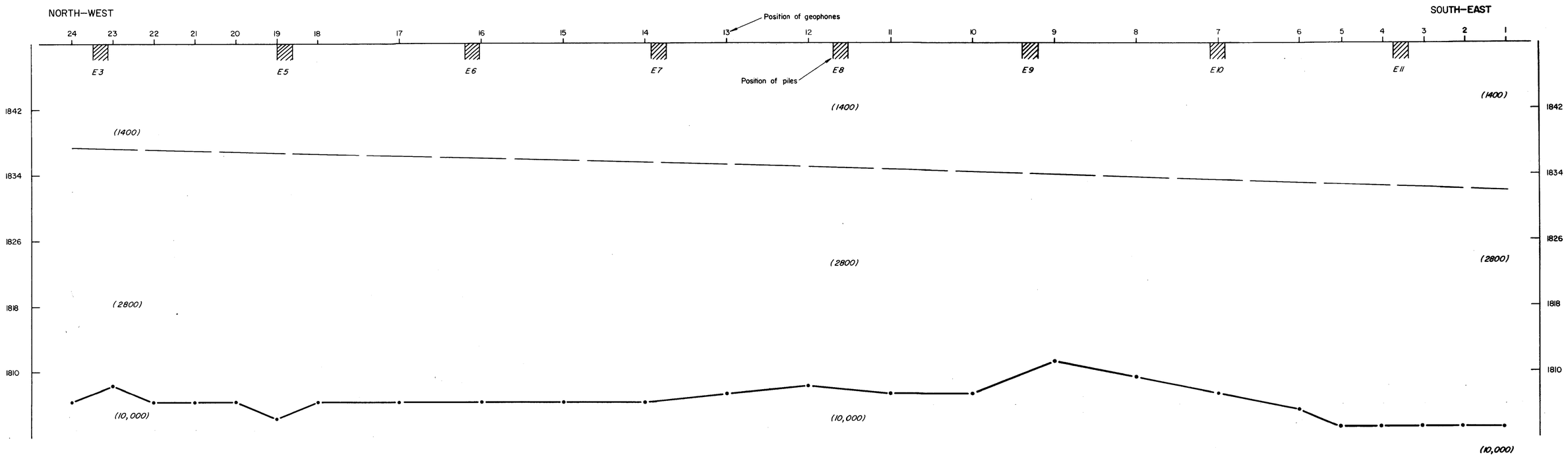
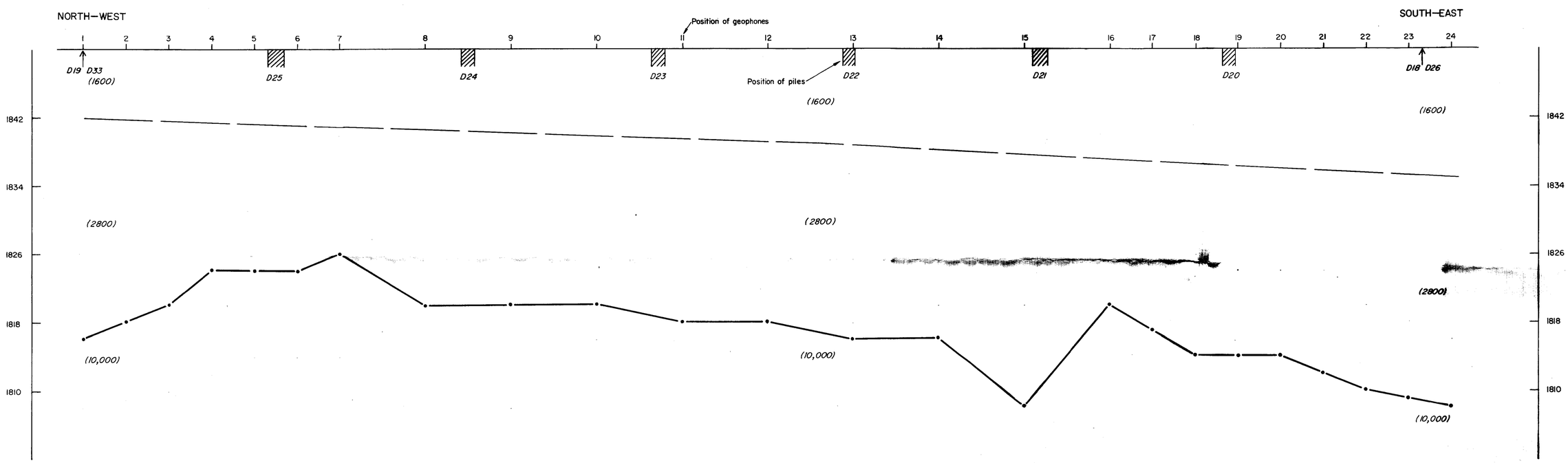
TRAVERSE E1



TRAVERSE D2



FEET

8 4 0 8 16 24

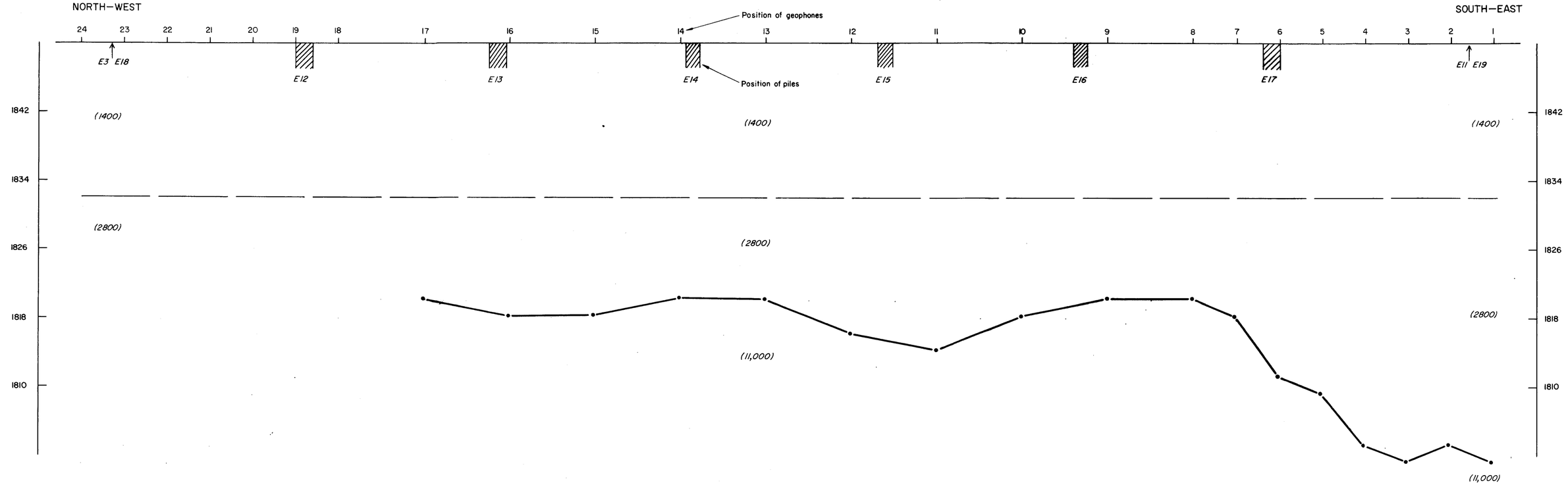
(Horizontal and Vertical)

TRAVERSES E1 - D2

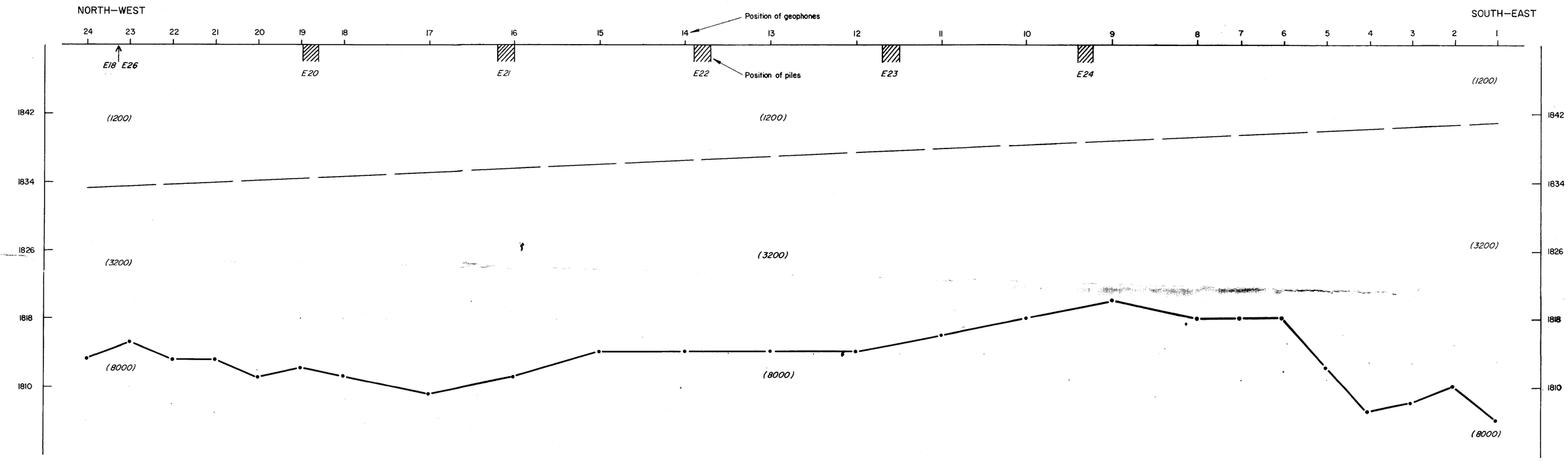
SEISMIC CROSS-SECTIONS

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics

TRAVERSE E2



TRAVERSE E3



FEET
8 4 0 8 16 24
(Horizontal and Vertical)

TRAVERSES E2 & E3
SEISMIC CROSS-SECTIONS

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