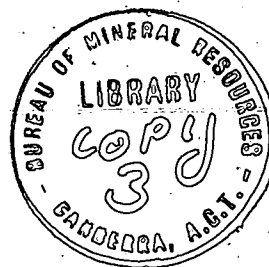


DEPARTMENT OF  
MINERALS AND ENERGY



BUREAU OF MINERAL RESOURCES,  
GEOLOGY AND GEOPHYSICS

RECORD 1974/190



TUGGERANONG SEWER PIPELINE,  
SEISMIC REFRACTION SURVEY,  
A.C.T., 1974

by

F.N. MICHAIL

BMR  
Record  
1974/190  
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## SUMMARY

A seismic refraction survey was carried out by the Bureau of Mineral Resources, Geology and Geophysics (BMR) on the proposed route of the Tuggeranong sewer pipeline, south Canberra. The aim of the survey was to determine rock conditions down to the pipeline level along sections of the route.

Bedrock consists of welded dacite tuff of Upper Silurian age and is characterized by a high seismic velocity 4200-4800 m/s. The overburden consists of sandy silty clay overlying highly weathered dacite tuff. Depth to bedrock is 7 to 19 m. The proposed pipeline route passes through rippable weathered rock on three of the test traverses, but some blasting will be required on the fourth.

## 1. INTRODUCTION

At the request of the Department of Housing and Construction, the Engineering Geophysics Group of BMR carried out a seismic refraction survey along the proposed pipeline route of the Tuggeranong Creek trunk sewer, stage 1, at Tuggeranong town centre, south Canberra, A.C.T.

Field work was carried out in May 1974 by a party consisting of F.N. Michail (Party Leader), A. Gleeson (Shooter), S. Green, and H. Davies (Trainee Technical Officers). Four seismic traverses totalling 184 m were completed using 2-m geophone spacings. Longitudinal velocity measurements were made in the Rock Testing Measurements Laboratory on three samples from the site.

The interpretation of the field results was done by F.N. Michail and supervised by B.H. Dolan. The object of the seismic investigation was to determine excavation conditions at the pipeline level along representative sections of the route. This information was required to accompany tender documents. The highest recorded seismic velocity (4200-4800 m/s) was considered to be that of the bedrock.

## 2. GEOLOGY

The geology of the Village Creek area is described by Rossiter, 1971. A BMR report on the geology of the proposed pipeline route including geological logs of holes drilled is being prepared (Purcell, in prep).

The bedrock along the pipeline route is Upper Silurian welded dacite tuff. The overburden consists of weathered dacite tuff underlying silty sandy clay and a very thin layer of topsoil.

## 3. EQUIPMENT AND METHOD

The equipment used consisted of a 24-channel SIE PSU-19 refraction seismograph with GSC-20D geophones. A geophone spacing of 2 m was employed on all traverses. Shots were fired at the centre of the spread, at 1 m, and 20 m from each end.

Results were interpreted by use of the 'intercept time' method (Heiland, 1946) and the 'reciprocal method' (Hawkins, 1961).

Four traverses each of 46 m were completed along the line of the proposed sewer pipeline locations. The centre of each spread was located at a chainage peg (Pl. 1).

Laboratory measurements of longitudinal velocity were carried out on samples collected from a back-hoe excavation at the site.

#### 4. RESULTS

Plate 1 shows the locations of the pipeline and the seismic traverses. Plates 2 and 3 show the sections obtained from seismic interpretations. 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.

Four seismic velocities of the subsurface layers were observed:

<u>Seismic velocity (m/s)</u>	<u>Description</u>
350 - 750	Topsoil, sandy silty clay
1050 - 1550	Highly weathered dacite
2000 - 2700	Moderately to slightly weathered dacite
4200 - 4800	Fresh bedrock (dacite)

Laboratory measurements of longitudinal velocity gave the following results:

<u>Sample No.</u>	<u>Longitudinal Velocity (m/s)</u>	<u>Description</u>
1	1470	Sandy silty clay
2	2100	Weathered dacite
3.	4250, 5550	Dacite velocity measured in two perpendicular direction

Samples 1 & 2 were water-saturated and tightly compacted. Dry and partly saturated samples showed too much attenuation for laboratory velocity determinations. Velocity measurements of sample 3 showed anisotropy of velocity in the bedrock. The laboratory measurements of velocities are in range of velocities measured in the field indicating that the lowering of velocities is due to the weathering and not to the excessive jointing.

The thickness of topsoil and highly weathered rock ranges from 1.5 to 12 m along the lines surveyed. Depth to bedrock ranges from 7 to 19 m.

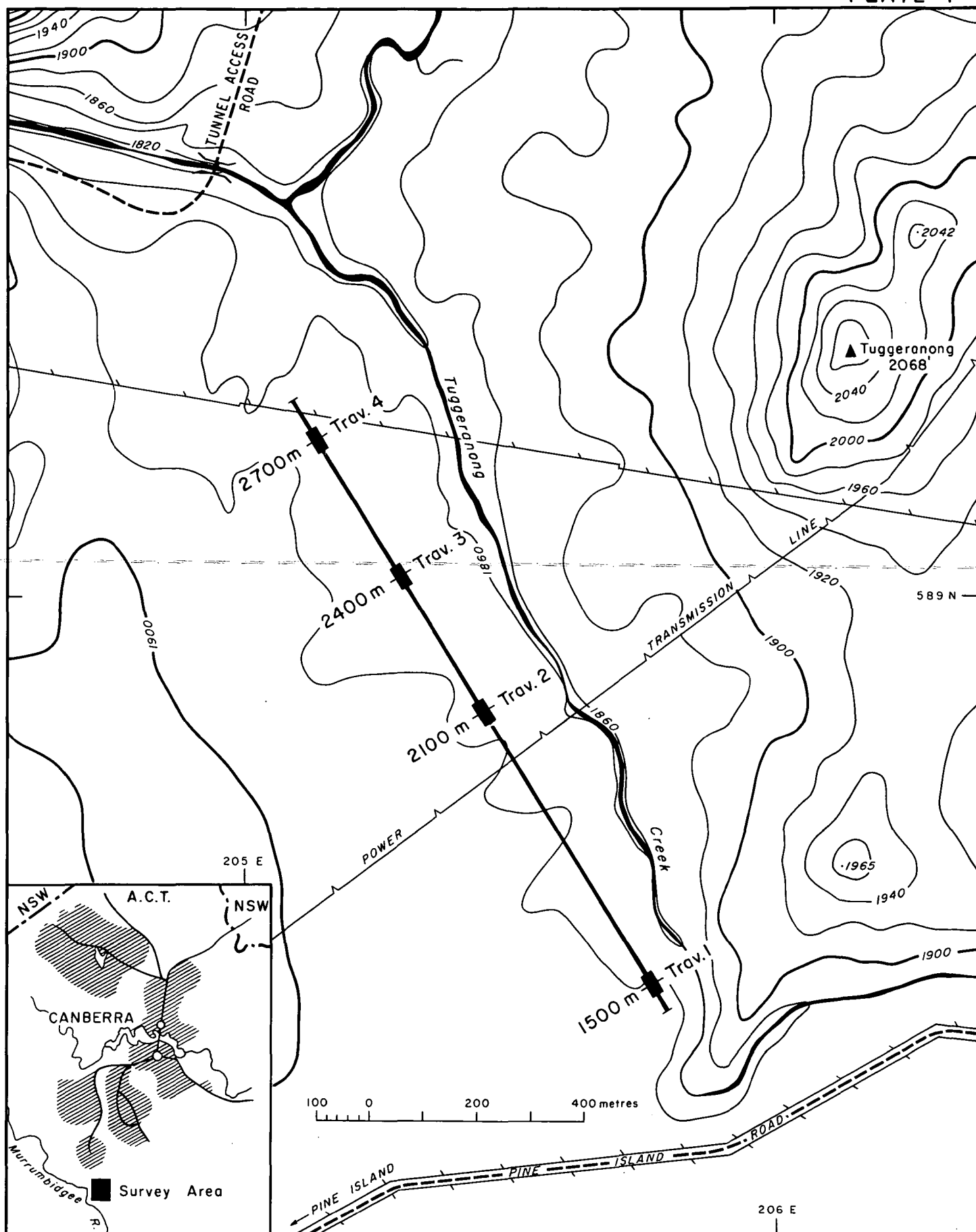
On traverses 2, 3, and 4 the expected excavations are to a depth of about 6.5 m into material with a seismic velocity of 1300 m/s or less. On traverse 1, approximately 5 m of material with a velocity of 1500 m/s to 2500 m/s has to be removed, and blasting will be necessary (Caterpillar, 1966).

## 5. CONCLUSIONS


The pipeline lies within rippable material on traverses 2, 3, and 4 but difficulties in excavations will be encountered on traverses 1, and blasting will be required on the south part of chainage 1500 where thickness of rippable material is 1.5 m.

## 6. REFERENCES

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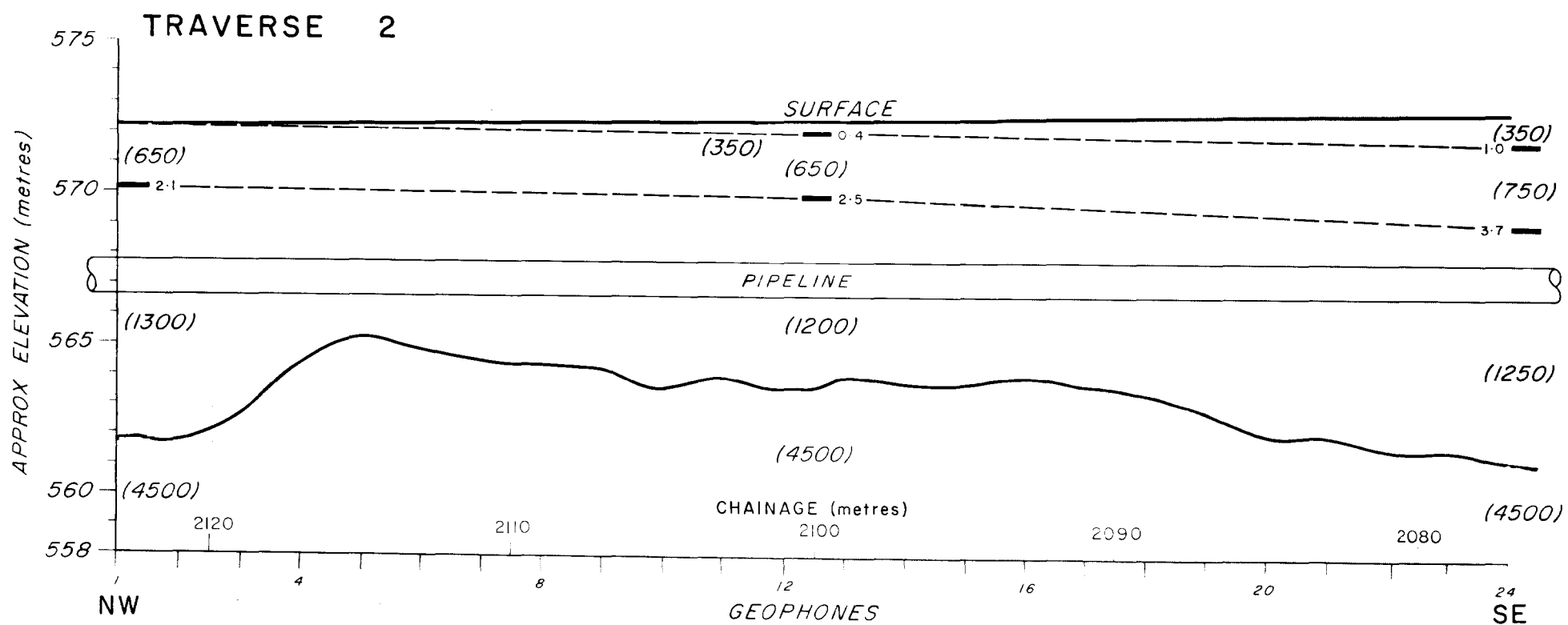
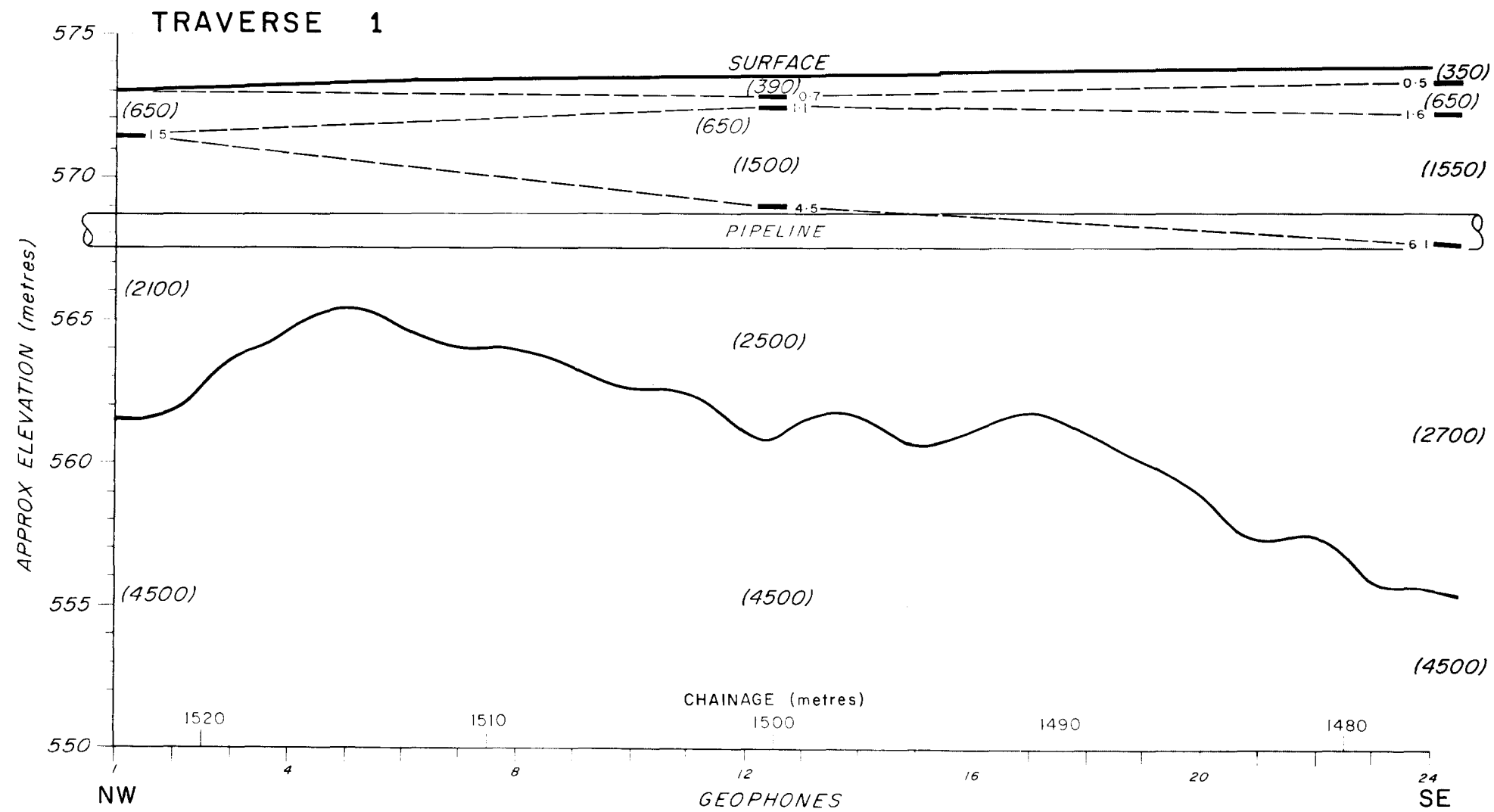


LEGEND

-  Location of seismic traverse either side of test hole centre line
- 1920- Elevation contour (Interval 20 feet)
- Fenced property boundary

TUGGERANONG SEWER PIPELINE  
LOCALITY MAP AND  
LOCATION OF TRAVERSES



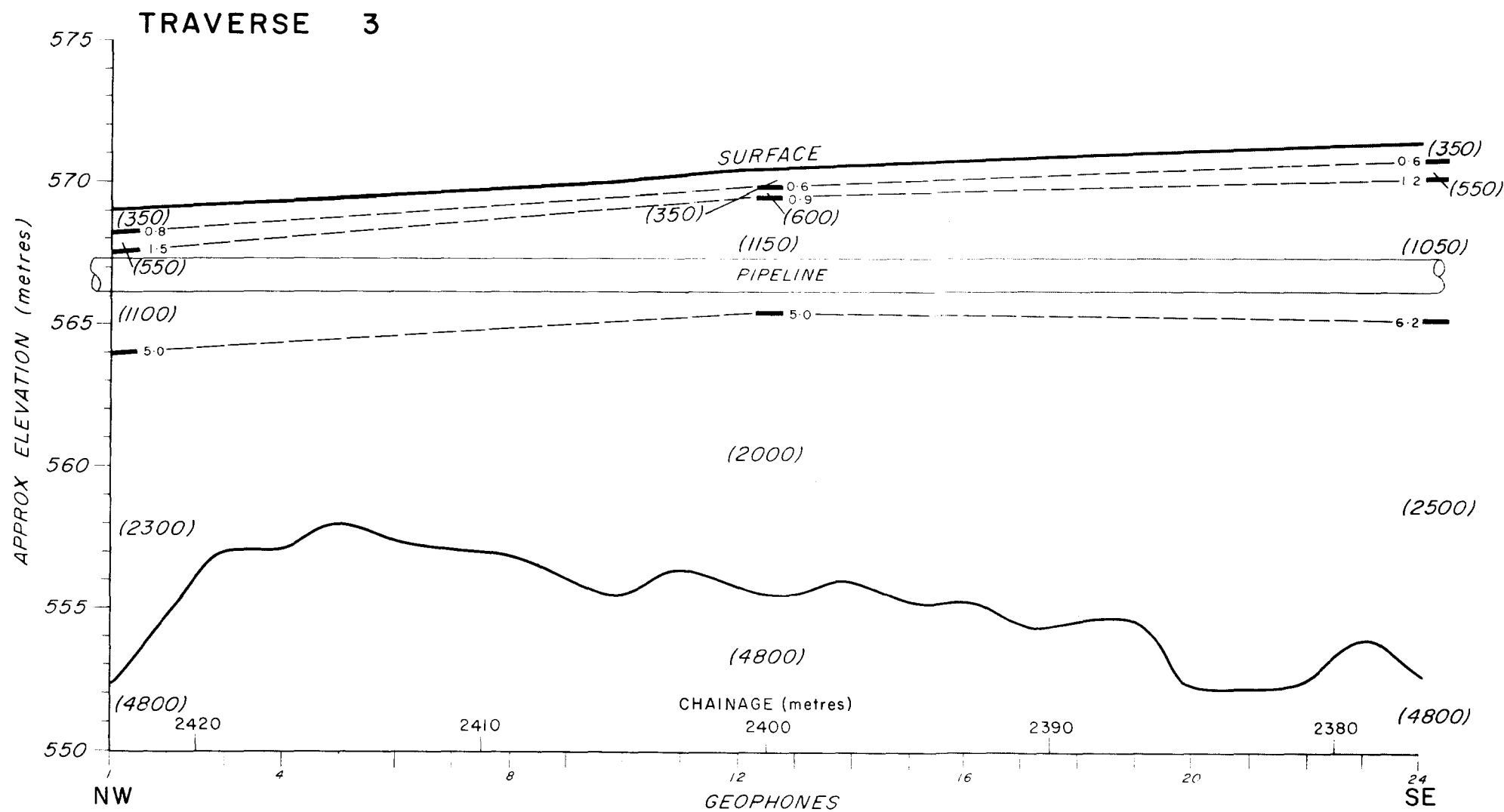
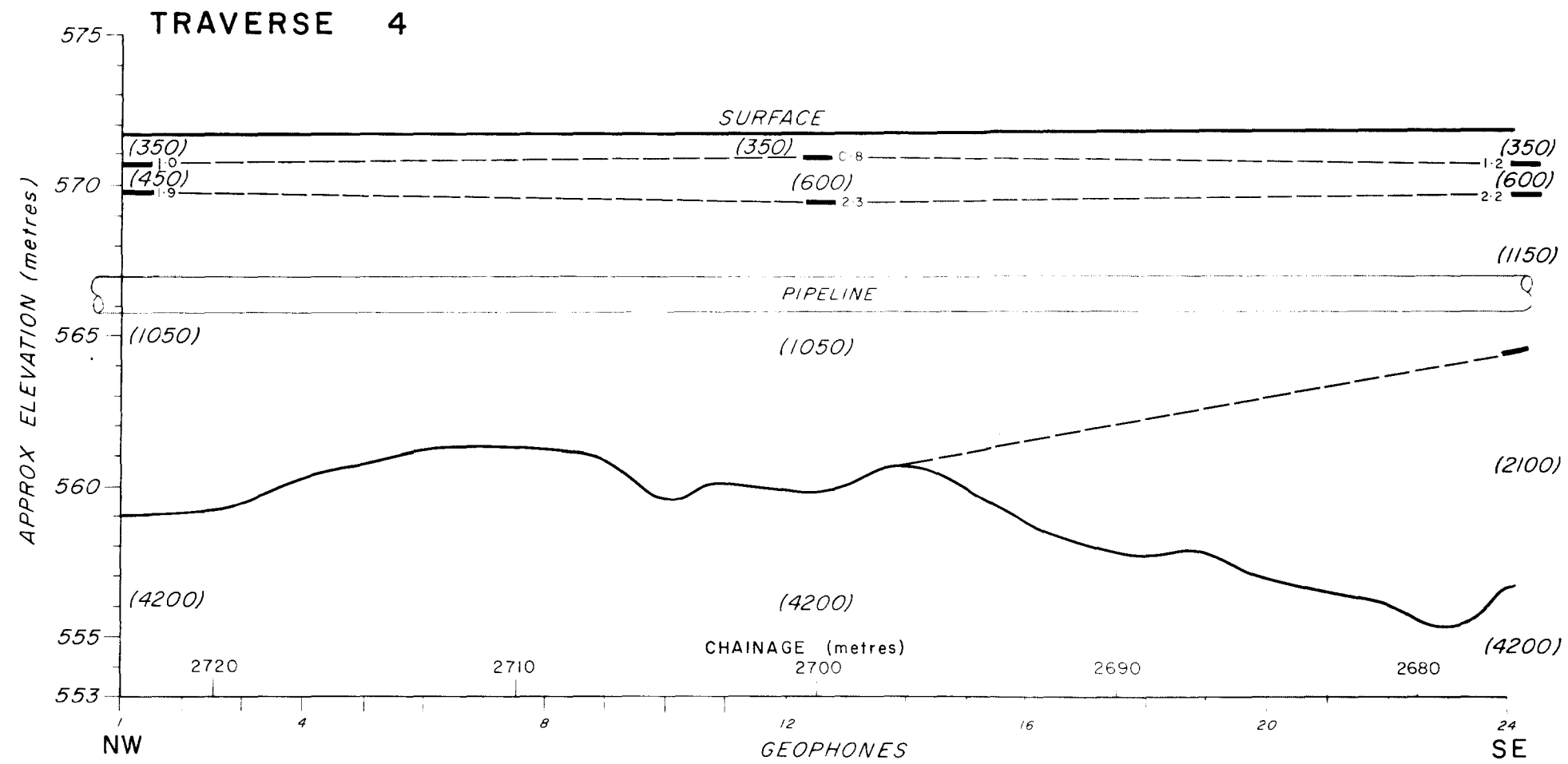


LEGEND

2.5 Depth to refractor (metres)

(1200) Seismic velocity in formation (metres/second)

## SEISMIC CROSS-SECTIONS TRAVERSES 1 and 2



LEGEND

4.5 Depth to refractor (metres)

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

## SEISMIC CROSS-SECTIONS

### TRAVERSES 3 and 4