

UR1973-35

Geophysical surveys, Ross water supply.

W.L. Matthews

Refraction seismic and resistivity surveys have been undertaken in an area previously recommended for investigation (Matthews, 1973). Their aim was to determine the thickness of Quaternary material overlying bedrock (probably Triassic sandstone). The best prospects for groundwater in quantities large enough to be used in a town supply appear to be gravel or sand beds which might occur in the Quaternary deposits.

RESULTS OF SEISMIC SURVEY

Fourteen seismic spreads were fired at the locations indicated in Figure 1. The geophone spacing was 3 m.

There are three main groups of seismic velocities indicated from the spreads (fig. 2). The lowest velocity group, 300-500 m/s, occurs in a surface layer usually up to about 2 m thick but occasionally up to 3 m thick. The second group of velocities range from 700-1,280 m/s. A layer with these velocities occurs below Spreads 7-14 and although not shown in the figure such a layer is present below at least a part of all the spreads except Spread 6. It is possible that a layer with this range of velocities occurs under the whole length of Spreads 1-6 but is too thin to be indicated clearly on the plots at the geophone interval used for the survey. Material with these seismic velocities underlies the surface material and appears to range in thickness from 0.6-3.7 m. The third group of seismic velocities indicated was 1,980-2,900 m/s. Material with this velocity probably occurs at an average depth of 3 m from the surface below much of the area examined with a probable range of 2-6 m.

Interpretation

The surface layer (seismic velocity: 300-500 m/s) is probably soil and relatively dry clay, gravel and sand. The material with a seismic velocity of 700-1,280 m/s is probably of a similar nature to the surface material but is moist (lower seismic velocity) or saturated with water (higher seismic velocity). Material with the seismic velocity of 1,980-2,900 m/s would almost certainly represent bedrock (probably sandstone). There are small sections along parts of some of the spreads where much higher velocities are indicated (c. 5,000 m/s) which may represent small dykes of dolerite intruding the sandstone.

RESULTS OF RESISTIVITY SURVEY

Eleven resistivity probes using a Schlumberger electrode configuration were undertaken in the same areas as the seismic spreads (fig. 1). The interpreted resistivity values of the various layers are indicated in Table 1. Probes indicated four layers with differing resistivities (except for Probes 9 and 10). The surface layer, usually about 0.3 m thick, has a relatively high resistivity with respect to the underlying layer except for Probes 3 and 8. The second layer extends from 1.5-3 m below the surface with the exception of Probes 2 and 4 where it extends to 15 and 6 m respectively. The third layer, in most cases extending to about 9.1 m, has a slightly higher resistivity than the second layer (except for Probes 2, 6 and 8). The fourth layer usually has a higher resistivity than the third (except for Probes 2, 8 and 11).

These results may be interpreted as follows:

- Layer 1 : Dry soil
- Layer 2 : Mainly clay
- Layer 3 : Water-saturated sand or gravel, the water being reasonably fresh.
- Layer 4 : Bedrock, probably sandstone in most cases.

The depths for various layers suggested from a resistivity probe are not usually very accurate but the general shape of most of the probes suggests the possibility of water-bearing strata at shallow depths.

Table 1. INTERPRETATION OF RESISTIVITY SURVEY

Probe No.	ρ_1 (Ω -m)	Layer depth (m)	ρ_2 (Ω -m)	Layer depth (m)	ρ_3 (Ω -m)	Layer depth (m)	ρ_4 (Ω -m)	Layer depth (m)
1	20	0-0.3	6	0.3-1.5	50	1.5-6.1	100	>6.1
2	200	0-0.3	30	0.3-15.2	1000	15.2-18.3	200	>18.3
3	24	0-0.3	18	0.3-1.5	25	1.5-6.1	100	>6.1
4	200	0-0.45	40	0.45-6.1	45	6.1-9.1	80	>9.1
5	90	0-0.3	10	0.3-3.1	20	3.1-9.1	300	>9.1
6	200	0-0.3	55	0.3-1.5	30	1.5-15.2	100	>15.2
7	600	0-0.3	100	0.3-1.8	110	1.8-9.1	500	>9.1
8	9	0-0.3	8	0.3-1.5	100	1.5-9.1	30	>9.1
9	4	0-0.45	200	>0.45				
10	270	0-0.3	10	0.3-1.8	15	>1.8		>1.8
11	110	0-0.3	8	0.3-3.0	25	3.0-6.1	20	>6.1

METHODS OF INVESTIGATION AND EXTRACTION OF WATER

The area where geophysical surveys were carried out is flat and these surveys suggest bedrock at shallow depth, perhaps up to a maximum of about 6 m from the surface. The material above bedrock is the only likely source of large quantities of water and the cheapest means of investigation would be with a back hoe capable of digging to depths of 4.5-6 m. Holes could be dug quickly in a number of areas to expose any gravel or sand beds that might occur. It might also be possible to undertake pump tests to determine approximate rates of flow where water-bearing material is struck.

There are several means by which a scheme to supply town water could be set up if a favourable area is found with investigations with a back hoe.

- (1) Areas where water is known to occur could be noted and when water was required in a dry year, a hole or several holes could be dug, again with a back hoe and water could be pumped directly from the holes. At the end of the dry periods the holes should be filled in again as silt in flood waters during the winter could silt up the gravel beds. If several holes are required then they should be spaced sufficiently far apart to avoid a reduction in water flow into adjoining holes. The investigation programme should determine whether several holes would be necessary.
- (2) A wide diameter well (about 1.2-2 m) could be dug in the most favourable area found from the back hoe excavations. Such a well would need to be lined to prevent collapse and sealed against the entry of flood waters as silting of the aquifer could occur during floods.

- (3) A perforated pipe and associated collection chamber could be installed in a trench in the most favourable area. This system would also require some protection from floods.

The first method would be the least expensive and could be easily and quickly set up in a dry year. The second and third methods would be permanent arrangements and more expensive to install.

Failing success in locating a convenient area where water occurs in the Quaternary deposits, the more expensive means of investigation, drilling, could be undertaken. It is expected that Triassic sandstone underlies most of the area and yields of 23-30 litres per minute are likely to be obtained from a successful bore in this rock type. As the area is flat and the storage area large, this kind of output could probably be maintained over long periods. Such a quantity amounts to 32,700-43,600 litres per day which could be a useful amount in a period of serious water shortage. There is a possibility that poor quality water might be obtained.

CONCLUSIONS

Seismic spreads indicate that Quaternary deposits overlying bedrock are relatively thin (up to about 6 m thick).

Resistivity probes suggest that water-bearing zones might occur within the Quaternary deposits.

The cheapest means of investigating the underground water potential of these deposits would be with holes dug by a back hoe.

Methods of extraction of water have been discussed in the previous section.

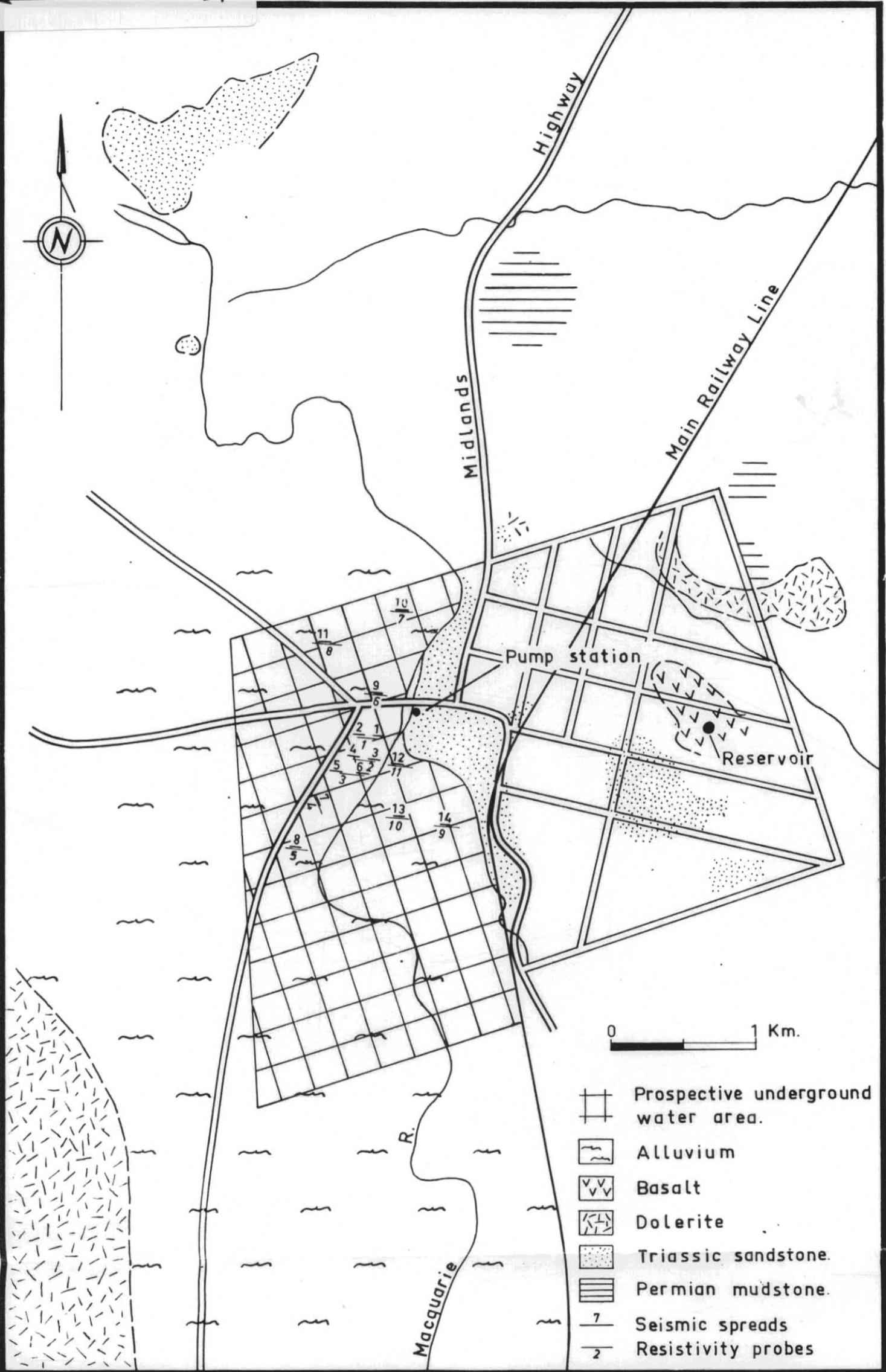
If favourable locations for water in the Quaternary deposits are not found, a bore through these deposits into Triassic sandstone which probably underlies the area, could supply some water, but the quality might be unsuitable for domestic purposes.

REFERENCE

MATTHEWS, W.L. 1973. Underground water at Ross. *Unpubl.Rep.Dep.Mines Tasm.* 1973/1.

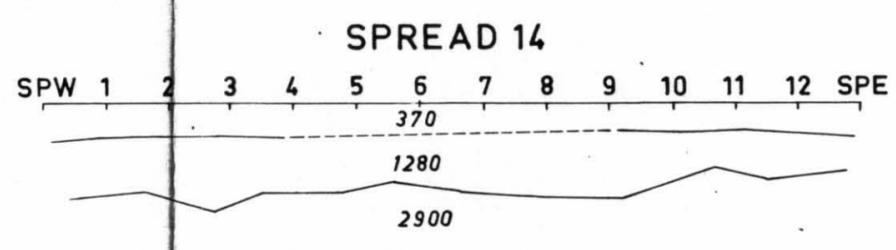
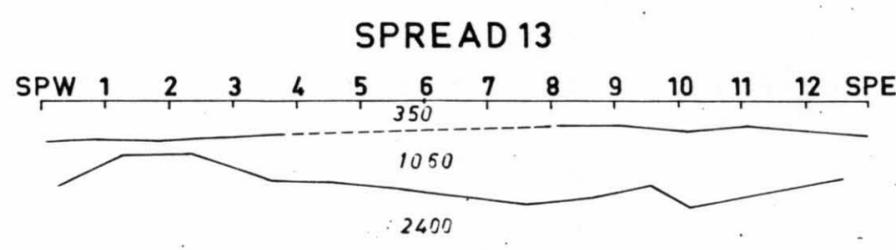
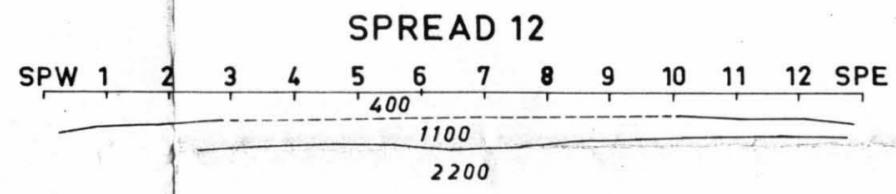
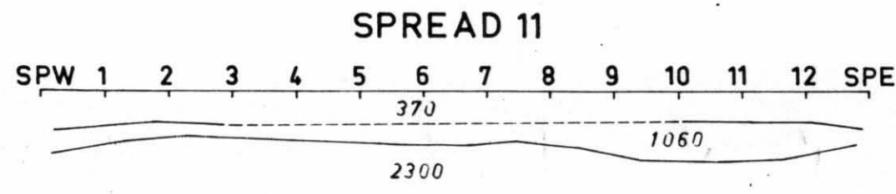
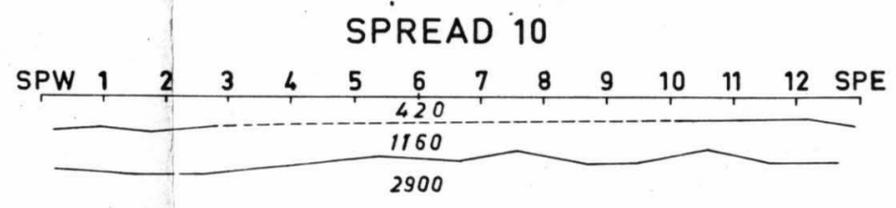
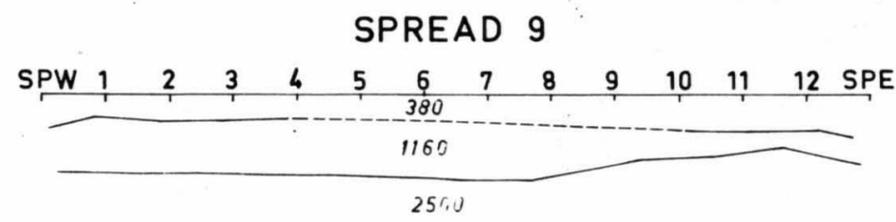
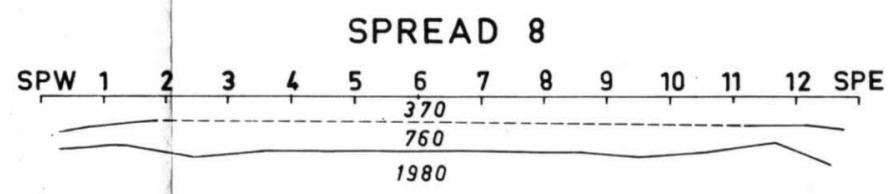
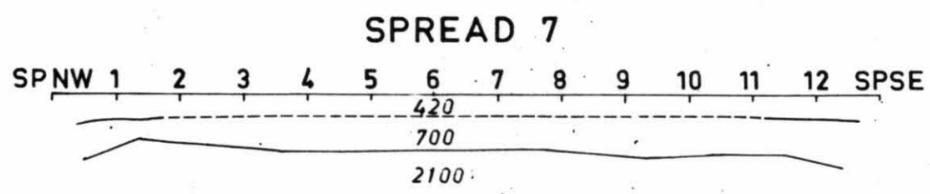
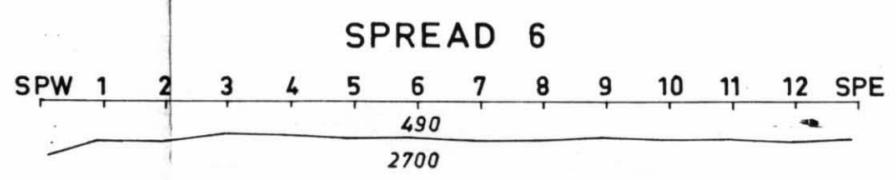
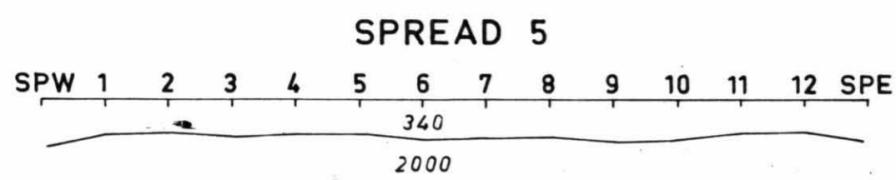
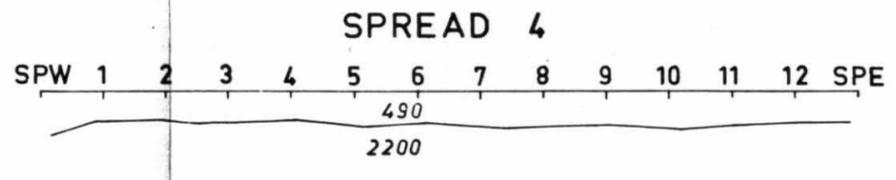
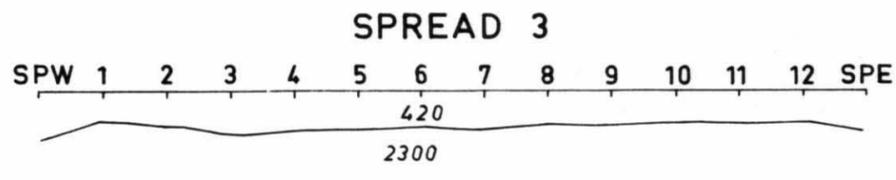
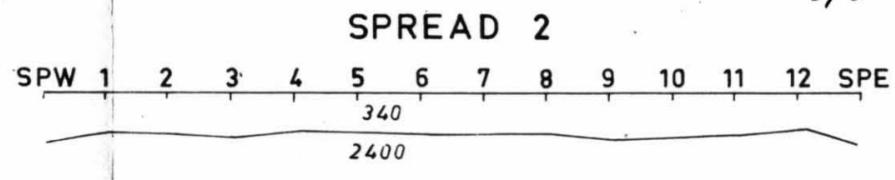
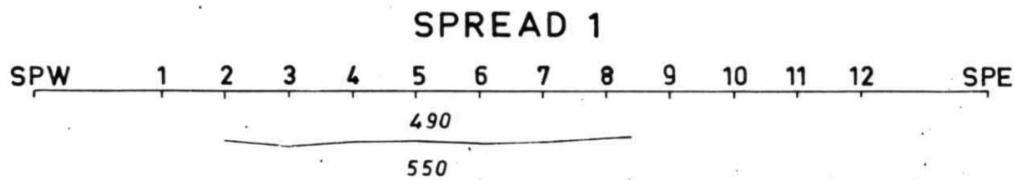
[17 April 1973]

5 cm



DEPARTMENT OF MINES — TASMANIA
**GEOLOGICAL SKETCH PLAN
 OF ROSS AREA** FIG. 1.

GEOLOGIST W.L.MATTHEWS	Draftsman P.J.Donnelly	Date January 1973	3708
---------------------------	---------------------------	----------------------	-------------



SEISMIC VELOCITIES IN M/S

DEPARTMENT OF MINES — TASMANIA
SEISMIC INTERPRETATIONS
— ROSS AREA

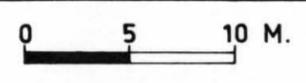
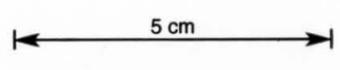


FIG. 2.

GEOLOGIST W.L.MATTHEWS	Draftsman P.J.Donnelly	Date March 1973		3724
----------------------------------	----------------------------------	---------------------------	--	-------------