UR1984_85

1/3

1984/85. Geophysical investigations of the Thousand Acre Lane (Hamilton) groundwater site

J.W. Hudspeth

Abstract

Seismic and resistivity investigations produced no encouragement for groundwater drilling. As the geological assessment for groundwater potential is also low, the prospect will not be drilled. A VLF-EM anomaly was detected but requires further investigation to determine whether or not it is geological.

INTRODUCTION

The area of interest for groundwater is located south-east of the junction of Thousand Acre Lane with the Lyell Highway, four kilometres east of Hamilton. The most promising site (geologically and logistically) is a shallow dry gully ending in a small dam very close to the road junction. The rock is Jurassic dolerite covered by a shallow layer of alluvium. The dolerite crops out with shallow relief (a few centimetres) near the top of the south-east bank of the gully. Dolerite is exposed in the Lyell Highway road cutting at the road junction and appears to be moderately fractured. A seismic survey was proposed along the bed of the gully (running roughly NE-SW) to see if any low dolerite velocities were present.

SEISMIC SURVEY

Two Nimbus ES-1210 seismographs were used simultaneously on a single spread of 24 channels with geophone (one per channel) spacing of 7.5 metres. A shot was fired 7.5 m from each end of the spread and a third shot was fired at the position of the third geophone south-west of the spread centre (18.75 m SW of centre), the geophone from this position being placed at the south-west shot position. The spread was positioned running roughly NE-SW along the base of the gully. From the results it was estimated that the alluvium is one to three metres thick with a seismic velocity in the order of 750 m/sec. The alluvium is underlain by 27±5 m of material having a velocity of 2000±500 m/sec and presumed to be weathered dolerite. The lowest layer has a velocity of 5000-6000 m/sec and is thought to be sound dolerite. The seismic velocities of the weathered dolerite are too high and its thickness too low to encourage exploratory groundwater drilling in the absence of geological encouragement.

RESISTIVITY SURVEY

It is possible that if the gully topography is controlled by a fault along its axis then there may exist, to some prospective depth, a zone (in the fault plane) of low seismic velocity (and good fracture porosity and permeability) which would be invisible to the seismic survey because of its narrow width and the surrounding faster dolerite. It was decided to set up a simple fixed resistivity array and rotate the array around its central point to see if any significant lateral anisotropy could be detected. A Wenner array with a=30m was set up with the centre in the base of the gully. The array was rotated at 30° intervals. Six readings are sufficient to cover a full circle as each reading is also valid for the direction 180° around from its nominal direction.

The results were plotted as a polar diagram but no anisotropy was interpreted. One reading was slightly higher than the average (20% higher,

fig. 1a) but this reading is also more unreliable, being read with a very low input current. If this reading is replaced by the average of the two adjacent readings then we obtain Figure 1b. Although this plot is not perfectly circular, any anisotropy represented by it is not sufficiently clear to interpret as being geologically meaningful.

VLF RESULTS

Some VLF-EM results have been reported for this prospect (Hudspeth, 1984). The VLF investigation found an anomaly on the south-east bank of the gully but follow up has not been possible.

CONCLUSIONS AND RECOMMENDATIONS

The Thousand Acre Lane groundwater exploration site is considered by the investigating geologist (R.C. Donaldson) to have a poor chance of producing useful quantities of water. The seismic and resistivity results tend to corroborate this view. The VLF anomaly is interesting but is not on a known topographic trend and is not fully investigated - it may be due to a cultural source or it might represent a potential water-producing fracture zone. The site is not considered sufficiently promising to warrant any further effort as part of a routine groundwater investigation. However, if possible, the source of the VLF anomaly should be determined for future reference.

REFERENCE

HUDSPETH, J.W. 1984. VLF-EM trial investigation. *Unpubl.Rep.Dep.Mines Tasm.* 1984/79.

[12 December 1984]

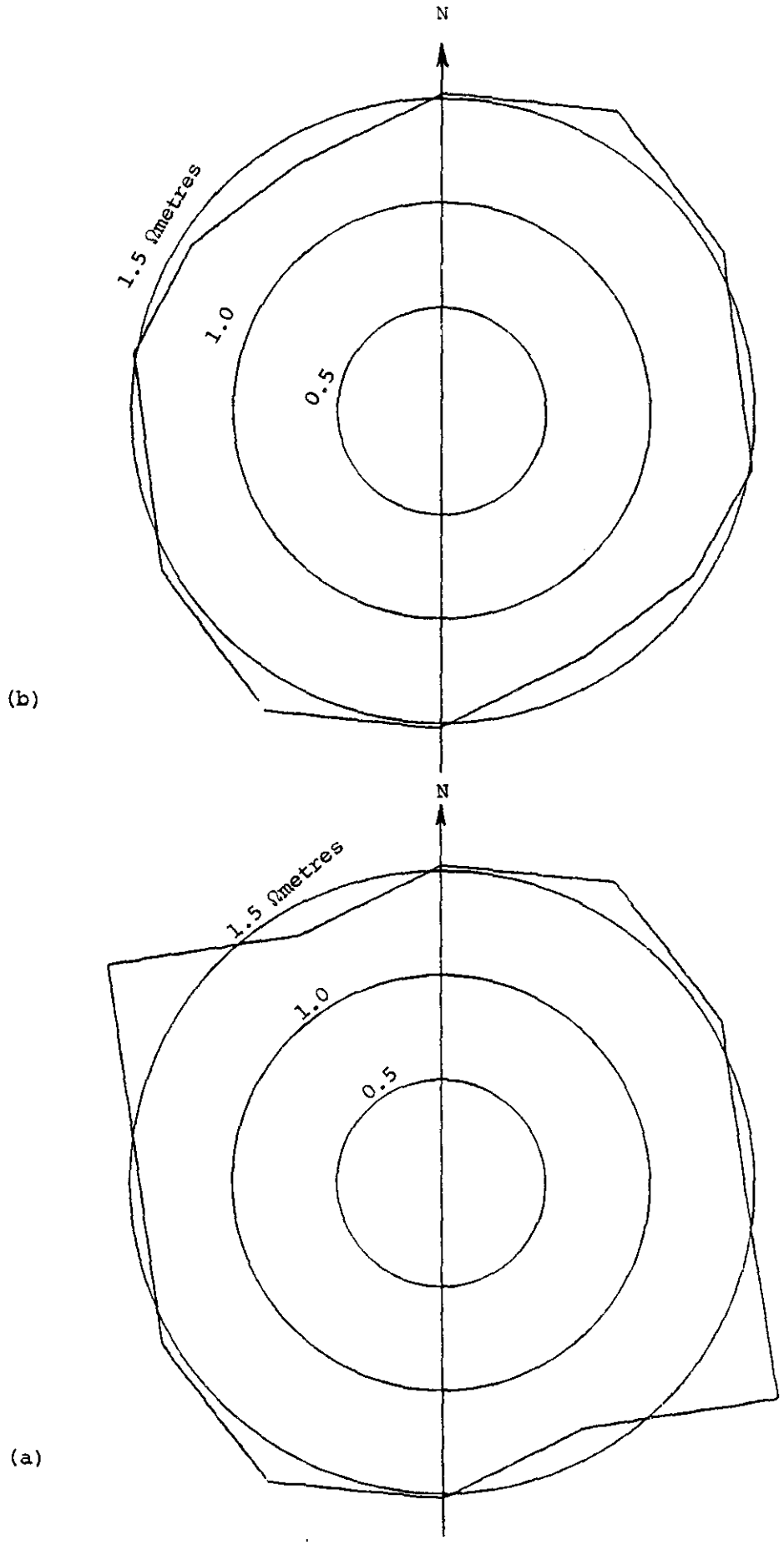

Figure 1. *Polar diagram of apparent resistivity*