There is scarcity of portable drinking water in Tshivhilwi Village located in the northern Limpopo Province of South Africa. A site was investigated for groundwater potential. Previously drilled boreholes (BH1 and BH2) had low groundwater yields, there were drilled into weathered meta-volcanic dykes. Geophysical surveys were carried out at the site for groundwater exploration. The surveys were conducted in order to locate a sustainable groundwater source for the site.

The geophysical methods that were applied included magnetic, electromagnetic (EM) and electrical resistivity tomography (ERT) techniques. These methods were used to map possible fracture or fault zones that could have groundwater potential. Equipment that was used for measuring magnetic, electromagnetic and resistivity data comprised Geometrics G856 magnetometers, Geonics EM34-3 conductivity meter and an Iris Syscal Pro switch 72 channel resistivity meter respectively. The station spacing for magnetic and electromagnetic surveys was 5 m, this was chosen in order to map subtle variations in the subsurface geology. ERT Resistivity surveys were carried out using a 5 m and 10 m dipole-dipole and Schlumberger arrays. ERT traverses were carried out along lines EF and EG. EM profiling was done along lines AB, CD and EH. The average line separation for the magnetic survey was 25 m.

Geological contact zones were inferred from magnetic survey data, low resistivity zones with corresponding high electromagnetic conductivity values were identified as possible targets. Borehole targets S1 and S2 were recommended. A groundwater yielding borehole was drilled a few meters south for target S2. The surveys showed that geophysical methods are effective tools for investigating the occurrence of shallow groundwater aquifers.

Cited Literature


McNeill, J.D., 1980. Electromagnetic terrain conductivity measurement at low conductivity numbers: Geonics

Figure 1. Magnetics results covering the site, showing borehole targets S1 and S2 and positions of measured ERT traverses (EF and EG) and EM profiles (AB, CD and EH). The rectangular block in red denotes an exclusion, construction zone on the site. BH1 and BH2 are test boreholes.

Figure 2. Electrical conductivity results for a 20 m dipole separation survey showing the position of borehole target S2.