Water Well Investigations in the Nampula Province, Mozambique

A minor field study investigation on hand pumped water wells in the Nampula Province, Mozambique. A step towards drilling less wells with insufficient yields.

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Access to safe water and sanitation is a human right, and clean water is considered one of the key factors in combating poverty. However this is not reality in large parts of the world.

Mozambique is one of the poorest countries in the world. Here 48% of the population lack access to safe drinking water, and 80% lack access to safe sanitation, which is causing spread of various diseases (Water Aid UK, 2015). Different organisations worldwide work to improve the situation. In Mozambique, the US foreign aid agency Millennium Challenge Corporation started the Rural Water Point Installation Program, where 600 water points were constructed to increase access to improved water sources. The water points consisted of drilled wells provided with hand pumps allowing for groundwater extraction. Groundwater is less exposed to outer contamination than for example rivers or hand-dug wells, and thereby a safer water source. Unfortunately, 25% of the drilled wells in the Nampula province gave insufficient yields for communal use.

To avoid future drilling of wells with insufficient yield, several investigations have been carried out in the Nampula area. These have focused on measuring properties of the subsurface in order to determine whether or not the boreholes that give insufficient yield have been placed in geological units or layers where it is unlikely to find water.

"*An aquifer is a geological unit that can store and transmit water at rates fast enough to supply reasonable amounts to wells".* (Fetter, 2014)

If a ground investigation method could point out where an aquifer is found, time and money could be saved by avoiding drilling of wells with insufficient yield.

A hint of the amount of water in a geological unit can be given by the resistivity. Water is an electrical conductor and a layer that stores a lot of water will have a very low resistivity. However, to be an aquifer, the unit also needs to be able to transmit water. When looking at a clay layer, the water storage can be very high while the transmissivity can be very low due to porosity and permeability properties, i.e. in that case not an aquifer. There are several ways of measuring the resistivity of a formation both above and below ground. An example of an above ground method is Electrical Resistivity Tomography (ERT), which gives a visual representation of a resistivity profile crossing over a borehole. Below ground, induction logging (a geophysical borehole logging technique using induced electromagnetic currents) is an example of methods, where a probe is lowered into a borehole, detecting different properties such as resistivity.

In this study induction logging was used to validate the reliability of using ERT measurements for siting of new wells in the hydrogeological environment of Nampula. It was also used to analyse the characteristics of the subsurface just around the borehole.

Generally the ERT and logging resistivity matched quite well, indicating that ERT is a good method to use for siting of new wells in the Nampula area. The logging showed that in the present environment one can expect to find classical weathering profiles of crystalline rock basements.

By looking at the results of the study it is suggested to carry out substantial hydrogeological investigations, including ERT, and analysis of geological data when siting for new boreholes, followed by borehole logging to determine borehole design properties. This procedure would give drilling of less wells with insufficient yield and increase the access to safe water sources.

References

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