GROUND WATER MONITORING USING CTD DIVER

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BACKGROUND

Ground water provides the most convenient drinking water source as it's widely spread across locations and offers less treatment cost. Sustainability of the ground water is key to enabling it meet the intended purpose. The diver/data logger which measures the ground water level and other parameters enables achievement of the sustainability of ground water sources.

Water For People, through its effort to ensure sustainability in the water sector, installed CTD divers which measures the ground water level and salinity in 7 wells in Biguli Sub-county, Kamwenge District. The CTD diver made of ceramic material presents a better choice to other diver types as it measures two parameters and is less vulnerable to atmospheric attacks.

PROBLEM STATEMENT

Uganda has for a long period experienced cases of functional wells being saline and drying up presenting a major threat to the sustainability of the ground water sources. This is because of inadequate systems to inform measures that can help improve the performance of the ground water.

OBJECTIVE OF THE GROUND WATER MONITORING USING CTD DIVER

Water For People installed CTD divers to provide a remote system of ground water monitoring that informs performance factoring ground water level and electrical conductivity. The data collected informs decision making on the appropriate measures to enable sustainability of the ground water sources.

METHODOLOGY

Programming and installation of the CTD diver

- The set up consists of diver office software installed on a Laptop computer, a reading unit and the diver.
- The diver is inserted into the reading unit which is connected to a Laptop computer with diver office installed in.
- The diver office is launched and the diver programmed. The major parameters are: the date of initial reading, the sample interval, monitoring point, the file location and naming.
- The borehole drilling data is then reviewed and the existing water level measured using a piezometer, a cable with length depending on the piezometer measurement and drilling data is connected to the eye of the diver and connected to a loop of the modified borehole pedestal. The diver is then lowered into the well and locked for its safety at the site.

- A seperate Baro diver is used for balancing atmospheric pressure and hydrostatic pressure is programmed in a similar manner and installed in an open environment in one location for all the divers.

Figure 1: materials used for downloading data

Figure 2: CTD diver

Downloading and analysis of the CTD diver data

- The sensitivity of the diver requires that data be downloaded on site and the date corresponds with the date for downloading of the Baro data.
- After a pre-determined period for analysis, the diver is removed from the well, inserted in the reading unit connected to a Laptop with diver software and the uncompensated data downloaded. The diver is then installed back into the well upon completion of data downloading. This is done for all the wells before data compensation.
- The baro diver data is then downloaded on the same date with the diver data and data compensated on basis of pressure balancing to give the depth to the water table.
- Processing and analysis of the data is carried out using Microsoft Excel. It involves comparison of previous subsequent datasets and the drilling data.

PRELIMINARY RESULTS

The output from analysis of the diver/data logger data presents:

- The depth to the water table from the ground level which provides information of an increase/decrease in the water table.
- The electrical conductivity which informs if the water conforms to the set national drinking standards.
- The well recovery of the motorized wells which presents a measure of how long it takes for the water level to regain.
- Depending on the well recovery, the analysis informs about the safe pumping yield, the rate at which water is to be pumped from the well.

Figure 3: downloading of data at Byantumo well, Biguli Sub-county

Figure 4: installation of the diver into the well after downloading

These results inform the appropriate measures to improve on the ground water performance.

The data obtained from the 7 wells under monitoring in Biguli Sub-county indicates conformity of the electrical conductivity with the set drinking water standards, the recovery rate of the motorized wells is still commendable and the wells are being safely pumped. The data however indicated a fluctuating drop in water level in all the wells which were attributed possibly to the long period of sunshine in the area during the 3 months of monitoring.

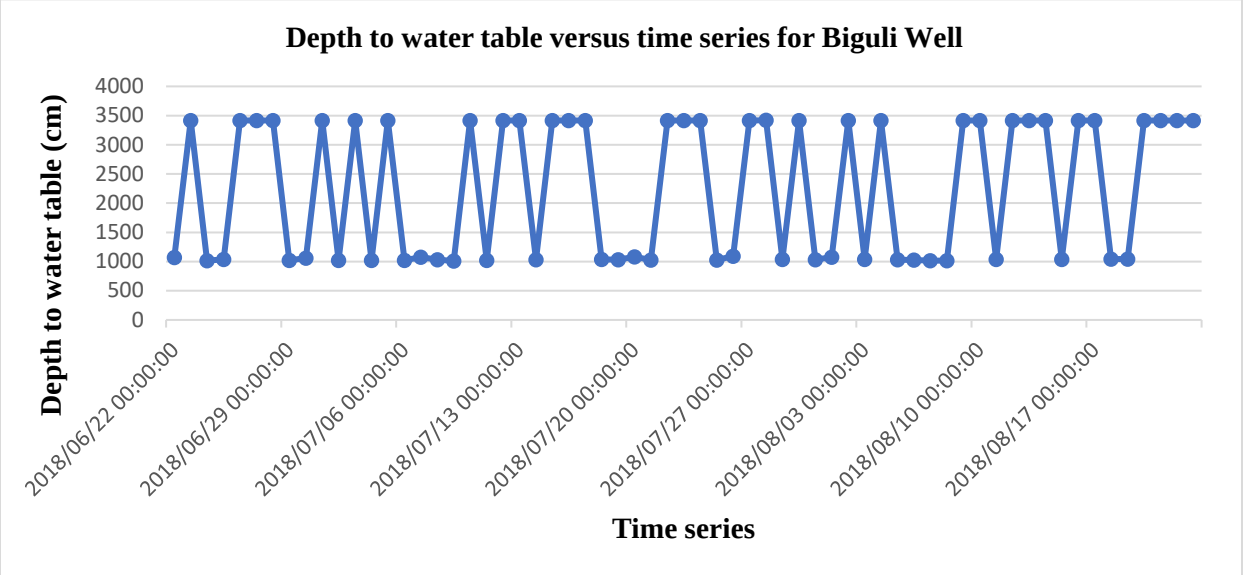

Figure 5: Data obtained from Biguli motorized well, Biguli Sub-county, Kamwenge District

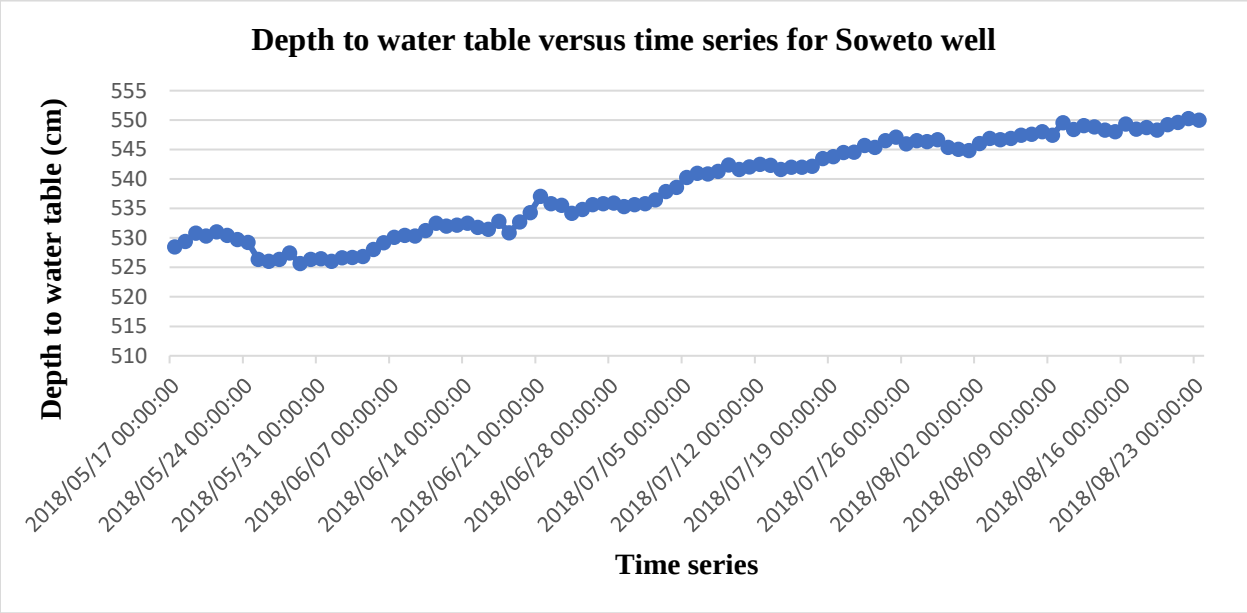

Figure 6: Data obtained from Soweto monitoring well, Biguli Sub-county, Kamwenge District

CHALLENGES

- CTD divers have been installed in 7 out of 19 wells in Biguli Sub-county. This represents a less data compared to the wells without the diver. For better data analysis and conclusions, divers need to be installed in more wells.
- There is inadequate meteorological data (missing data), limiting the ability to draw conclusions on the effect of precipitation on ground water level variation which requires data of at least 10 years.
- Weather conditions (rain) affects data collection process because of the sensitivity of the diver data as it allows complete downloading of both the CTD and Baro diver data in one day. This therefore calls for segmentation of the dates for CTD data collection which consequently leads to non-uniformity in the data collection.

CONCLUSION AND RECOMMENDATIONS

The conclusion on the analyzed diver data depends on the output from the results on parameters of depth of water table variation, electrical conductivity, recovery and safe pumping yield of the motorized wells.

Measures to improve ground water performance and achieve sustainability includes restoration of the wetlands (to hold the water) and improving on the land use (growing of crops with low crop water requirement), especially for the wells that depends on precipitation for recharge.

If the drop in the ground water level is highly due to shallow wells that depend on precipitation, drilling of deep wells can be recommended since the deep wells are less affected by precipitation and contamination.