Building Water Resilience in Uganda, One Well at a Time

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# Abstract

From 6 February to 17 February 2023, geophysical surveys were used to site water wells in 10 villages and one primary school in the Acholi-speaking districts of Northern Uganda (Acholiland). Over the same period, non‑functioning hand pumps were repaired in nine villages. The goal of this Geoscientists Without Borders-sponsored program was to provide improved access to safe groundwater for rural communities. The nine repaired wells benefit an estimated 6,920 people. The 11 new wells benefit an estimated 6,096 people and 1,200 primary school students. 27 Acholi trainees participated in all aspects of this program which included: 1. Electrical resistivity tomography and terrain conductivity surveys. 2. Groundwater sampling for microbiological, major ion, trace metal, and stable isotope water chemistry analyses. 3. Borehole camera surveys. 4. Hand pump functionality testing. 5. Borehole formation conductivity and magnetic susceptibility logging. The trainees carried out the hand pump repairs largely independently; the manual drilling, well construction, and hand pump installations were performed completely independently by the trainees.

Beyond the goals of providing safe water, the field science associated with this project has resulted in numerous conclusions with broad implications to Northern Uganda, and quite likely to broader regions of Sub-Saharan Africa. These include: 1. Weathered and fractured crystalline basement aquifers can be bracketed by well defined formation resistivities. 2. 2-D geophysical surveys are essential for optimizing well placements, and optimized well placements are necessary for a water well to sustainably provide sufficient yields through the dry season and perhaps even through a failed rainy season. 3. A novel method of *E. coli* field testing shows that, in general, groundwater is safe and surface water is unsafe. 4. Groundwater systems are predominantly recharged by heavy monsoonal rains with little contribution from lighter rains during the drier seasons. 5. Groundwater quality is generally excellent as a drinking water source. 6. Groundwater hand pump non-functionality is greatly underreported. 7. Manual drilling facilitates the drilling, well construction, and hand pump installation at a relatively low cost of less than $2,200 USD per well.