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GROUNDWATER PHYSICAL AND HYDROCHEMICAL CHARACTERISTICS OF THE WEATHERED CRYSTALLINE ROCK AQUIFERS IN KAMULI DISTRICT, EASTERN UGANDA

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A DISSERTATION SUBMITTED TO DIRECTORATE OF RESEARCH AND GRADUATE TRAINING IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF MASTER OF SCIENCE IN GEOLOGY

MAKERERE UNIVERSITY

OCTOBER 2015

Abstract

Deeply weathered crystalline rocks constitute important groundwater aquifers that provide accessible and reliable sources of safe domestic water supply in Kamuli District in eastern Uganda. Inadequate characterization of groundwater makes it difficult to plan and sustainably manage of groundwater resources, which results into unsuccessful boreholes and community abandoning boreholes with high hardness and salinity. To improve the understanding of physical and hydrochemical characteristics of weathered crystalline rock aquifers in Kamuli District, the study determined principal aquifers, evaluated distribution of hydraulic and hydrochemical parameters, and developed hydrogeological conceptual model. Archived and field-based geophysical, borehole lithological logs, hydraulic test and hydrochemical data were analysed. Evidence from geophysical and borehole lithological log analysis indicate that the saprolite and saprock as the most productive aquifers encountered at mean range 25 - 45mbgl. Hydraulic test analysis revealed mean bulk aquifer transmissivity of 0.0 – 11.20m^2/d, with majority of values are <2.0m^2/d. Specific capacity test methods can be applied in estimating transmissivity in weathered crystalline rock aquifers of the study area. Hydrochemical data analysis revealed bicarbonate and mixed bicarbonate - sulphate facies characterized groundwater in Kamuli District, with the latter mainly in the high relief areas. Slow regional groundwater flow direction is northwestern towards Lake Kyoga and recharge increases in the same direction. The underlying geology was inferred from spatial distribution of potassium concentration, which displays pattern of increased concentrations in high relief areas. The hydrogeological conceptual model was developed to display aquifer lithological, hydraulic and hydrochemical properties, with emphasis on the observed contrast between low and high relief areas. However, follow up study, involving hydrochemical, lithological, petrography, and geophysical analysis is recommended to confirm the inferred underlying geology. For regional application, an additional study should ensure adequate observation time and the geographic scope includes Luuka District and Buyende District.