Characterization of Aquifer Systems and Identification of Potential Groundwater Recharge Zones Using Geospatial Data and Arc GIS in Kagandi Water Supply System Well Field

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Abstract : A research study was undertaken to characterize the aquifers and identify the potential groundwater recharge zones in the Kagandi district. Quantitative characterization of hydraulic conductivities of aquifers is of fundamental importance to the study of groundwater flow and contaminant transport in aquifers. A conditional approach is used to represent the spatial variability of hydraulic conductivity. Briefly, it involves using qualitative and quantitative geologic borehole-log data to generate a three-dimensional (3D) hydraulic conductivity distribution, which is then adjusted through calibration of a 3D groundwater flow model using pumping-test data and historic hydraulic data. The approach consists of several steps. The study area was divided into five sub-watersheds on the basis of artificial drainage divides. A digital terrain model (DTM) was developed using Arc GIS to determine the general drainage pattern of Kagandi watershed. Hydrologic characterization involved the determination of the various hydraulic properties of the aquifers. Potential groundwater recharge zones were identified by integrating various thematic maps pertaining to the digital elevation model, land use, and drainage pattern in Arc GIS and Sufer golden software. The study demonstrates the potential of GIS in delineating groundwater recharge zones and that the developed methodology will be applicable to other watersheds in Uganda.