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Decision support tools for sustainable groundwater management

title: **Characterization of hydraulic head distribution and recharge area delineation: Application of the water table fluction method on the Lusaka Plateau, Zambia**

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The carbonate and schist aquifers on the Lusaka Plateau are amongst the highly exploited aquifers in Zambia. Legitimate use of groundwater on the Lusaka Plateau include domestic, irrigated agriculture and industrial. Groundwater abstraction in these aquifers accounts for 50% of the piped water supplied to Lusaka city and 100% for most private users that depend on the unconfined upper aquifers. Protection of groundwater associated with surface water and dependent terrestrial ecosystems is not currently feasible due to limitations in the existing legislation. Groundwater data and information deficit is one such a challenge that has created considerable uncertainty concerning the effects of present pumping and has also limited the development of hydrological as well as hydrogeological models to explain the dynamics of water resources inflows to and outflows from the Lusaka Plateau. The absence of legislation to assure sustainable groundwater utilization and management, prompted the Ministry of Energy and Water Development (MEWD) through the Department of Water Affairs (DWA) to adopted the Water Table Fluctuation Method (WTF) to understand the required protection of the various uses of groundwater on the Lusaka Plateau in the context of Integrated Water Resources Management (IWRM). A groundwater monitoring network was designed and observation boreholes progressively constructed in the unconfied aquifers. These are now used as a groundwater management tool for taking the hydraulic head as a directly measurable property in the upper unconfined aquifers. Preliminary analysis of the changes in the hydraulic head over time facilitated the delineation of the main recharge area, various transmissive zones and identification of production boreholes for use as part of the monitoring network to continuously assess the groundwater quality status. Determination of groundwater flow, assessment of the yearly recharge and identification of areas affected by high abstraction is now possible. The fundamental premise is that the upper water table aquifers provides a source of fresh water for various uses and a valuable storage of groundwater. Initial efforts are directed at creating awareness amongst groundwater users on the yearly variability of recharge, the declining water table observed within the city boundary and the need to keep as well as provide groundwater abstraction records. Furthermore, involvement of private drillers in the collection of relevant groundwater data and information is another aspect aimed at improving the information deficit. Based on the WTF principles, intial steps in the delineation of zones for restricted and controlled groundwater abstraction has been achieved to accommodate policy development as well as future active groundwater management for long-term sustainability.

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