SIMULATION AND SCENARIO ANALYSIS OF WATER RESOURCES MANAGEMENT IN PERKERRA CATCHMENT USING WEAP MODEL

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ABSTRACT

Integrated Water Resources Management (IWRM) approach at the catchment level especially for a water stressed system creates room for conflicts among the upstream and downstream users. Decision Support Systems (DSS) can provide effective tools for water allocation, supply and demand analysis. This research used Water Evaluation and Planning System (WEAP21) as a DSS to evaluate the current water management scenario and the effect of proposed water development projects in Perkerra catchment. The main objective was to apply WEAP to the catchment and assess the impact of various proposed water infrastructural developments, policy and regulation under various scenarios in view of the Water Act 2002. Hydrometeorological and water use data were obtained from the Ministry of Water and Irrigation, Water Resources Management Authority (WRMA), Kenya Meteorological Department (KMD) and Perkerra Irrigation Scheme. The collected information was geo-referenced in GIS software (ArcView) to create spatial database. The FAO Rainfall-runoff method was used to simulate runoff. In the simulations using WEAP21, the catchment was divided into three main sub-catchments where the supply (catchment runoff) and demand nodes were spatially located. Two main scenarios were built from the reference scenario; Chemususu dam and water resources development scenarios. Three sub-scenarios were built to analyse current abstraction levels; increased water demands and improved irrigation efficiency at Perkerra irrigation scheme. The results of the reference scenario were validated using observed flows at Marigat Bridge station (2EE7B). Results indicated very sharp peaks of the flow time series downstream and a high vulnerability at the demand nodes, with demand coverage varying between 10% and 100%. The construction of two Dams (Chemususu and Radat) stabilizes the flow and improves the demand coverage to between 60 % and 100 %. However with the implementation of environmental flows downstream of station 2EE7B, and water supply projects, the average demand coverage downstream drops to between 45% and 100 %. Moreover, the improved storage (by two dams) allows supply of 13,000m^3/d of water to neighbouring towns and 90% increase of water available for irrigation at Perkerra Irrigation Scheme. This analysis however, assumes proper regulation of abstraction and reservoir operations.