Water management tools as a means of averting a possible water scarcity in South Africa by the year 2025

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Abstract

South Africa, currently categorised as water stressed country is forecasted to experience physical water scarcity by the year 2025 with an annual freshwater availability of less that 1 000 m^3 per capita. With the trends in population growth and its attributes and continuous pollution of the available water sources, there is bound to be increased pressure on the available water probably resulting in increased conflict over its allocation and a further stress on this resource leading to scarcity. Most countries in the world including South Africa have developed most of their water resources with very little scope for further expansion. This study attempted to establish possible solutions to this scenario. Possible solutions would be as follows. First is the demand management of the water through developing and or improving existing systems that improve water use efficiency in the various demand sectors thereby increasing access to more users and uses for a given volume of water. Second is identifying and developing alternative supply systems suitable for the various demand sectors in order to augment the conventional supply volumes. Third is the application of feasible, special management techniques to improve water quality to appropriate standards for particular uses in areas where natural poor quality water occurs. Fourth is the reallocation of some water from low benefit uses to higher benefit uses. Fifth is the possibility of water transfer from surplus areas to deficit area. A water management tool/model suitable for the various sectors of demand and suitable areas of application in each sector is envisaged as the output of this study. If found to be practicable, and eventually utilised, this model will have the potential to increase the water availability for the various sectors and avert possible conflicts in water allocation. The impact of this economically, socially and environmentally in South Africa and possible application in other water stressed countries with similar conditions will be significant.

Introduction

Sustainable water development and management is a critical component of development for all societies. Often, however, the geographic distribution of water resources does not correspond to the location of the demand centers. South Africa for example is a semi arid country (65% of the country) in which the average rainfall of 450mm/year is well below the world average of about 860mm/year. As a result, South Africa's water resources are in global terms, scarce and limited in extent (RSA, 2002). The country is currently categorised as water stressed with an annual fresh water availability of less than 1 700 m^3 per capita (the index for water stress). The current estimate by FAO is 1.154 m^3 per capita/year [2]. The International Water Management Institute (IWMI) (IWMI, 1996) estimates that in 2025 the country will be among the countries in the world that will experience a physical water scarcity scenario with an annual freshwater availability of less than 1000m^3 per capita (the index for water scarcity). The natural availability of water across the country is also uneven and this is compounded by a strong seasonality of rainfall. Currently eleven of the nineteen Water Management Areas (Catchment based) in the country are facing a water deficit where the requirements of water exceed its availability whilst a surplus still exists for the country as a whole. An analysis by the Department of Water Affairs and Forestry (DWAF) show that looking forward to 2025 several additional Water Management Areas (WMA) will be in a situation of water deficit even if further potential infrastructure development is factored in. the development of infrastructure is in itself an expensive option and therefore an efficient use of currently available water resources must be improved (RSA, 2002).

Often, it is not practical or economically viable for water to be transferred from areas of surplus to areas of deficit. The recently proposed First Edition National Water Resources Strategy (NWRS) (RSA, 2002) points out that such imbalance within the WMA will be addressed by the relevant catchment management strategies when they are developed. NWRS simply sets out the ways in which the RSA government aims to achieve integrated water resource management by way of describing the policies, strategies, plans and procedures by which this will be done.

Since such tool/model to address these imbalances at the catchment level is not in place yet, the aim of this study will be to make a contribution in realising the objectives of this strategy by applying known scientific knowledge and modeling techniques to develop a water management model/tool to address the imbalances in the deficit and near deficit WMA in South Africa. In this case, a representative deficit WMA(s) will be selected for study based on the level of development, agro climatic conditions, relative water scarcity, level of agricultural intensification and the degree of competition for water. This will be inline with the proposed NWRS objectives in fulfilling the National Water Act (RSA,1998) that seeks to equitably, efficiently and sustainably develop water resources in South Africa.

The model will look at the Potential Yield of the WMA, against the various water use sectors i.e. for domestic (including 'productive use' use), industrial, mining, agricultural and the environment need under normal (present) conditions. Optimisation techniques will then be applied to each use sector and the effect on the Yield analysed for the various optimisation levels (feasible both technologically and economically). An 'Augmented Yield' through intro-

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