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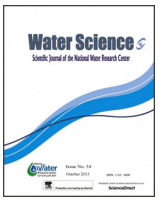

Evaluation of actions for better water supply and demand management in Fayoum, Egypt using RIBASIM

Mohie M. Omar

National Water Research Center, Ministry of Water Resources and Irrigation, Shoubra El-Kheima, Egypt

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Abstract

Fayoum Governorate faces many water-related challenges being; compensating the water shortage and controlling the volumes of drainage water effluents into Quarun Lake. There are many actions, based on water resources management approach, which can help overcome these water-related challenges. These actions are classified to developing additional water resources (supply management), and properly using the existing water resources (demand management). This study investigates using the RIBASIM (RIver BAsin SIMulation) model, the most suitable actions for the future. RIBASIM was used to simulate the current condition and evaluate various scenarios in 2017 based on different actions. Three scenarios were formulated being optimistic, moderate, and pessimistic which represent different implementation rates of the tested actions. RIBASIM results indicated a water shortage of 0.59, 1, and 1.85 Billion Cubic Meter (BCM)/year, for the simulated scenarios, respectively. Since Fayoum is a miniature of Egypt with respect to both, the natural and water resources systems, the results of this study can be used as guidelines for optimization of the water resources system in Egypt.

Keywords: RIBASIM; Water supply; Water demand; Water shortage

1. Introduction

Fayoum Governorate as shown in Figs. 1 and 2, is a large depression in the Egyptian western desert, located 90 km south-west of Cairo. Bahr Youssef Canal is the only water resource for Fayoum, and it is one of the main branches of Ibrahimia Canal. Ibrahimia Canal takes off the water from the Nile River at a distance of 539 km from Aswan High Dam. The length of Bahr Youssef Canal is 313 km and it provides water to four districts: West Menia, Bani-Swif, Fayoum and Giza. Fayoum is the largest district served by Bahr Youssef Canal with 454,700 Feddans (1 Feddan = 4200 m^2) (NWRP/MWRI, 2013). Fayoum Governorate has been selected in this study, because it has similar characteristics of Egypt with respect to both, the natural and water resources systems. Fayoum water shortage is compensated by drainage reuse, which negatively affects the soil and plants. The remaining drainage water flows into Quarun Lake and Rayan

E-mail address: Mohie.omar@hotmail.com
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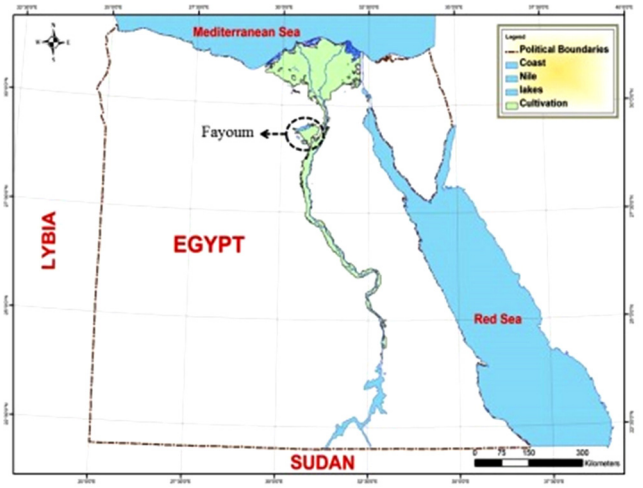

Fig. 1. Location of Fayoum in Egypt (National Water Research, Egypt).

Channel. The excess of drainage water beyond the capacity of Quarun Lake and Rayan Channel floods the surrounding villages, lands, and resorts. This limits horizontal expansion projects, since Fayoum is a closed depression.

This primary goal of this study is to evaluate the influences of different management actions on the quantitative water system performance of Fayoum Governorate in the future. This evaluation enables the interested stakeholders to identify and implement actions for minimizing water shortages and controlling volumes of drainage water effluents into Quarun Lake.

It was found that many researchers locally and worldwide investigated the water resources management actions using numerical models. The Agro-hydrological modeling system (ACRU) has been developed and applied in South Africa for simulation of land use/management influences on water resources demand and supply (Schulze and Smithers, 2004). Water evolution and planning (WEAP) model has been developed by Stockholm environment Institute to evaluate planning issues related to water resources for both municipal and agricultural systems including: sector demand analyses, water conservation, water rights and allocation priorities, stream flow simulation, reservoir operation, ecosystem requirements and project cost–benefit analyses. The model has been applied to assess scenarios of water resource development in the Pangani Catchment in Tanzania (Arranz and McCartney, 2007).

The Nile Decision support Tool (Nile DST) has been developed as part of the FAO Nile Basin Water Resources project to objectively assess the benefits and tradeoffs associated with various water development strategies. The Nile

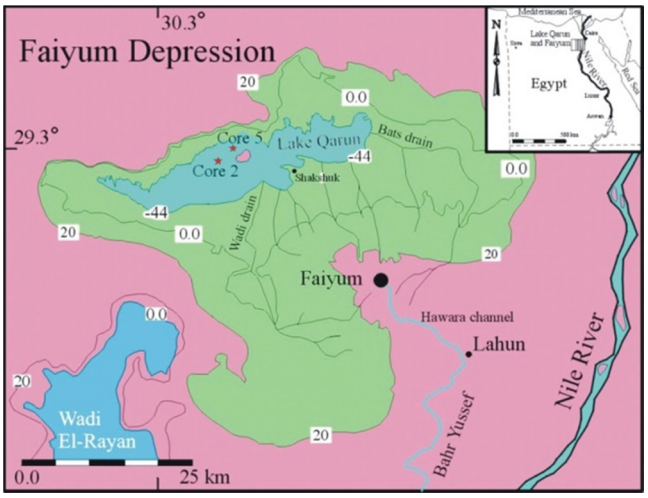

Fig. 2. Fayoum depression, Lake Quarun and the surrounding deserts in 2012.