شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

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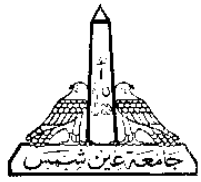

AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
Irrigation and Hydraulics

Sustainable Water Resources Management in Western Nile Delta

A Thesis submitted in partial fulfilment of the requirements
of the degree of
Doctor of Philosophy in Civil Engineering
(Irrigation and Hydraulics)

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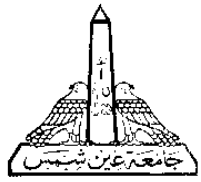

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Disclaimer

This thesis is submitted as a partial fulfilment of Doctor of Philosophy in Civil Engineering, Faculty of Engineering, Ain shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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Abstract

Egypt is one of the countries with high scarcity of water resources. Where the total water reequipments in Egypt are about 110 BCM; Egypt exports about 30 BCM of virtual water yearly that make the water requirements excluding exported virtual water about 80 BCM/year. In contrary the total fresh water resources are about 59.25 BCM/year; that makes a water shortage of about 20.75 BCM/ year is expected to continuously increase. So, Egypt is moving forward to optimize the use of each drop of water as about 21 BCM/year of drainage water is being reused to compensate this water shortage which may deteriorates the soil and water quality. The reuse of drainage water, mixing it with freshwater, is one of the essential nonconventional water management alternatives (WMA) in Egypt to increase water use efficiency and to fill the water balance gap.

This research seeks to optimize the use of each drop of water through having a sustainable water management plan on the regional scale considering the different water users M&I, crop requirements, climate change, water and soil salinities). Then, simulating the negative impacts of water shortage in Western Nile Delta using the SIWARE Model. In addition, statistical analysis techniques were used to analyze six scenarios to find the optimum alternatives. A tailor-made DSS module was developed using Visual Basic for Application (VBA) to provide decision-makers with flexible Geographical User Interface (GUI) to visually analyze differences between different WMAs in accord with output results of the SIWARE Model.

Six water management scenarios were carried out to detect the probable negative impacts of water shortage in WD due to current climate change conditions and the new challenges in the upper Nile basin projects (e.g., GERD dam). The first scenario is the reference year scenario that was well-calibrated and validated using data of three years (2014, 2015, 2016). The fourth scenario is to simulate a reduction of water supply by 10% of the reference year. The second and the fifth scenarios are to apply the first WMA which is changing the cropping pattern to the proposed crop in Sustainable Agricultural Development Strategy Towards 2030 (SADS) on the reference year conditions and the case of water reduction by 10 %. The third and the sixth scenarios are to apply the second WMA which raises the official water reuse by 10% on the reference year conditions and the case of water reduction by 10 %. In addition, the crop yield of each WMA was estimated along with the impacts of each WMA on the Egyptian national income.

Results indicated that the SADS crop gave a better crop performance, drainage rate and overall efficiency of the water system in the Western Delta than the other alternatives (increasing official reuse). While Increasing the official reuse gave the better salt efficiency and the less unofficial reuse salinity and quantity and with fewer impacts on the national income than the SADS crop alternative.

Accordingly, it is recommended to widely the use of the SIWARE model and the developed tailor-made VBA-GIS module to simulate the water management in Egypt.

Keywords: SIWARE, soil and water salinity, Drainage Water Management, Water Scarcity, Reuse of Drainage Water, crop yield reduction, reduction in National income.

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