بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

MONA MAGHRABY

AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
Irrigation & Hydraulics Department

Development of an Efficient Tool to Evaluate New Irrigation Projects for Optimal Use of Egypt's Scarce Resources

A Thesis submitted in partial fulfillment of the requirements of the degree of
Doctor of Philosophy Degree

by

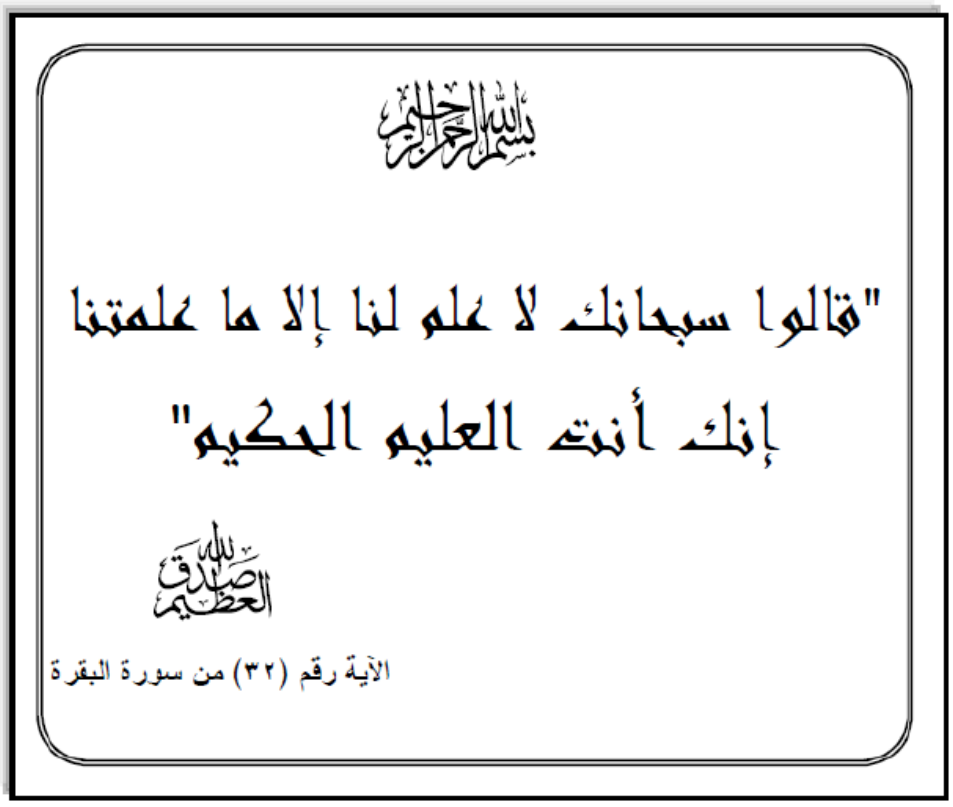
Heba Mahmoud Ahmed Salman
Master of Science in Civil Engineering
(Irrigation and Hydraulics)
Faculty of Engineering, Ain Shams University, 2008

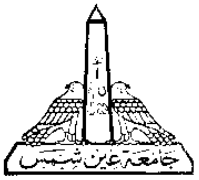
Supervised by

Prof. Dr. Aly Nabih El-Bahrawy
Professor of Hydraulics
Faculty of Engineering
Ain Shams University

Dr. Moamen Mohamed El-Sharkawy
Undersecretary of
Monitoring and Communication Central Directorate
Ministry of Water Resources and Irrigation

Cairo, Egypt – (2020)


بسم الله الرحمن الرحيم
"قالوا سبحانك لا علم لنا إلا ما علمتنا
إنك أنت العليم الحكيم"
صدق الله العظيم
الآية رقم (٣٢) من سورة البقرة



Ain Shams University- Faculty of Engineering

Irrigation & Hydraulics Department

Development of an Efficient Tool to Evaluate New Irrigation Projects for Optimal Use of Egypt's Scarce Resources

by

Heba Mahmoud Ahmed Salman

Master of Science in Civil Engineering (Irrigation and Hydraulics), 2008

A Thesis Submitted in Partial Fulfillment of the Requirements of

Doctor of Philosophy Degree

Examiners' Committee

Prof. Dr. Fatma Mohamed Hassan Shaltout Professor of Water Resources Management Faculty of Engineering, Egyptian Russian University	…….
Prof. Dr. Nahla M. Abdelhamid AboulAtta Professor of Irrigation Design, Irrigation & Hydraulics Department Faculty of Engineering, Ain Shams University	…….
Prof. Dr. Aly Nabih El-Bahrawy Professor of Hydraulics, Irrigation & Hydraulics Department Faculty of Engineering, Ain Shams University	…….
Dr. Moamen Mohamed El-Sharkawy Undersecretary of Monitoring and Communication Central Directorate Ministry of Water Resources and Irrigation	…….

Date:15 September 2020, Cairo - Egypt

Ain Shams University- Faculty of Engineering
Irrigation & Hydraulics Department

Doctor of Philosophy Degree

Researcher Name: Heba Mahmoud Ahmed Salman

Thesis Title: Development of an Efficient Tool to Evaluate New Irrigation Projects for Optimal Use of Egypt's Scarce Resources

Degree: Doctor of Philosophy in Engineering

Supervision Committee

Prof. Dr. Aly Nabih El-Bahrawy
Professor of Hydraulics
Faculty of Engineering - Ain Shams University

Dr. Moamen Mohamed El-Sharkawy
Undersecretary of
Monitoring and Communication Central Directorate
Ministry of Water Resources and Irrigation

تاريخ المناقشة : ...../...../.....

الدراسات العليا:

ختم الإجازة: اجيزت الرسالة بتاريخ :...../...../.....

موافقة مجلس الكلية : ...../...../.....

موافقة مجلس الجامعة : ...../...../.....

Title Sheet

Name	: Heba Mahmoud Ahmed Salman
Degree	: Doctor of Philosophy Degree
Department	: Irrigation and Hydraulics
Faculty	: Engineering
University	: Ain Shams University
Date of issued degree	: 2020

Researcher Data

Name	: Heba Mahmoud Ahmed Salman
Date of birth	: 23/7/1979
Place of birth	: Cairo- Egypt
Last academic degree	: Master of Science in Civil Engineering
Field of specialization	: Irrigation and Hydraulics
University issued the degree	: Ain Shams University
Date of issued degree	: 2008
Current job	: Civil Engineer- Ministry of Water Resources and Irrigation.

Statement

This thesis is submitted as a partial fulfilment of Doctor of Philosophy in Civil Engineering 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.

Heba Mahmoud Ahmed Salman

Signature

……...…….

Date:22 September 2020

ACKNOWLEDGMENT

First and foremost, glory and thanks to the God, the Almighty, for his blessings throughout my research work to complete the research successfully.

I would like to express my deep and sincere gratitude to my supervisor Prof. Dr. Aly Nabih El-Bahrawy, Professor of Hydraulics, Irrigation and Hydraulics Department, Faculty of Engineering, Ain Shams University for his worthless advices, effective notes, and constant encouragement helped me to complete this research work successfully.

I would like to express my special and sincere appreciation to my supervisor Dr. Moamen El-Sharkawy, Undersecretary of Monitoring and Communication Central Directorate, Ministry of Water Resources and Irrigation for his valuable ideas, suggestions, support, and continued help during my research.

Also, I wish to express my gratitude to all staff of Irrigation and Hydraulics Department, Faculty of Engineering, Ain Shams University.

Finally, I am extremely grateful to my parents for their prayers and encouragement, my husband, my children and my family especially my brothers Dr. Mohamed Salman, Lecturer, Faculty of Medicine, Ain Shams University and Dr. Ahmed Salman, The Jenner Institute, University of Oxford for continuous support. Thank you from the bottom of my heart.

September 2020

THESIS SUMMARY

Researcher Name: Heba Mahmoud Ahmed Salman

Thesis Title: Development of an Efficient Tool to Evaluate New Irrigation Projects for Optimal Use of Egypt's Scarce Resources

Degree: Doctor of Philosophy in Engineering

Egypt has tried to increase its agricultural area through reclamation of desert land to face the food gap and also increase food security in Egypt. In the new lands, water resources constitute the major determinant of reclamation and development. Therefore, the future of land reclamation in Egypt is depending largely on its groundwater potential. The efficient use and management of new land and groundwater resources will help to maximize land returns from each cubic meter of water and this would enhance the national effort to achieve food security in Egypt.

The scope of the problem is how to manage the available groundwater resources in reclamation lands especially the most of reclaimed lands are far from the center of decision makers. So, there is a need to use a remote management system to manage and control the groundwater resources and new agricultural lands in order to explore means of increasing water resources using efficiency in reclamation lands management based on dynamic maps and current data.

The primary objective of this research is to have an insight into groundwater resources management system to assess, evaluate and managing new groundwater irrigated lands in Egypt by providing a new tool for groundwater resources management in new lands to help decision makers to understand the

current status by giving a complete picture for available groundwater resources in land reclamation to optimal use of groundwater without depletion. Also, support and enhance capabilities for monitoring and controlling agricultural productivity in order to increase the value of crop production per unit of land and water.

Geographic Information Systems and Remote Sensing technologies (GIS & RS) are used in order to develop groundwater management tool includes web applications based on ArcGIS Online which includes built-in tools to create applications with full of GIS functionality. The web-based GIS application in the management tool enables data synchronization and integration with any existing systems to manage groundwater resources to facilitate the flow of information about existing wells and new lands, in addition to the empowerment of analysis capabilities for decision makers to study the current situation by providing change detection and Normalized Difference Vegetation Index NDVI images analysis to show the crop status and monitoring the agriculture areas. The management tool also includes a dashboard application which supports collaboration by providing a common operating view of key performance indicators (KPIs) to analyze, track and display information to monitor the groundwater resources in new lands which helps decision makers understand what is working well and what needs attention. The developed web-based GIS tool is applied to the locations of One and a Half Million feddan project as a study area. The data required for the project locations were collected from various resources and stored in both map and tables form and some data are hypothetic data.

The developed tool is ready for operation and achieves all the research objectives and provides decision makers with the available groundwater information in real-time. For future researches, the system can be integrated with

other models and data for soil, water quality, climate and crop which will be added value. Also, there is a very important needs for establishment of the management tool using ArcGIS Enterprise instead of using ArcGIS Online by running the ArcGIS platform within the related organization's IT infrastructure because the data of groundwater and land reclamation is a sensitive data that cannot be uploaded and stored in the cloud.

Key words: Egypt, GIS, RS, Groundwater, Land Reclamation, Management

TABLE OF CONTENTS