سامية محمد مصطفى



شبكة المعلومات الحامعية

### بسم الله الرحمن الرحيم



-Caro-

سامية محمد مصطفي



شبكة العلومات الحامعية



شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم





سامية محمد مصطفى

شبكة المعلومات الجامعية

### جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

### قسو

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



يجب أن

تحفظ هذه الأقراص المدمجة يعيدا عن الغيار



سامية محمد مصطفي



شبكة المعلومات الجامعية



المسلمة عين شعور المسلمة عين شعور المسلمة عين شعور المسلمة عين شعور المسلمة ا

سامية محمد مصطفى

شبكة المعلومات الحامعية



بالرسالة صفحات لم ترد بالأصل



## THE GEOGRAPHIC INFORMATION SYSTEMASDECISION SUPPORT TOOL IN THE ENVIRONMENTAL MANAGEMENT OF GROUNDWATER

By
Safaa Moustafa Mohamed
B.Sc. Electrical Engineering, Cairo University, 1982
M.Sc. Environmental Engineering, Ain Shams University, 1996

A Thesis Submitted for Doctor of Philosophy in Environmental Engineering

Engineering Department
Institute of Environmental Studies and Research
Ain Shams University

Cairo 2002

B 1059.

#### APPROVAL SHEET

# WIE CONTRAPTION SUPPORTION SUPPORT TOOL OF THE SUPPORT TOOL OF SUPPORT SUPPORT TOOL OF SUPPORT SUPPORT OF SUPPORT SUPPORT OF SUPPORT S

e de la companya de l

The second of th

interessive "

. Tangan sa manggan sa

i, in this genis 12 same. The acting Children in The gravital hamodic also by direction in a

think - more ended that the same - an abund

#### APPROVAL SHEET

# THE GEOGRAPHIC INFORMATION SYSTEMASDECISION SUPPORT TOOL IN THE ENVIRONMENTAL MANAGEMENT OF GROUNDWATER

#### By Safaa Moustafa Mohamed

B.Sc. Electrical Engineering, Cairo University, 1982 M.Sc. Environmental Engineering, Ain Shams University, 1996

This Thesis for Ph. D. Degree in Environmental Engineering has been approved by:

- 1- Pro. Dr. Mohamed Adel Yehia
  Head of National Authority for Remote Sensing
  And Space Sciences.
- 2- Pro. Dr. Abdel Kawy Ahmed Mokhtar Khalifa Irrigation and hydraulic Department Faculty of Engineering - Ain Shams University
- 3- Pro. Dr. Mohamed El Niazy Hammad
  Irrigation and hydraulic Department
  Faculty of Engineering Ain Shams University
- 4- Assoc. Pro. Ibrahiem Fathey Mohamed Shaker
  Associate Professor Public works department Ain Shams
  University.

121.86. A. 19

. •

## THE GEOGRAPHIC INFORMATION SYSTEMASDECISION SUPPORT TOOL IN THE ENVIRONMENTAL MANAGEMENT OF GROUNDWATER

#### By

Safaa Moustafa Mohamed B.Sc. Electrical Engineering, Cairo University, 1982 M.Sc. Environmental Engineering, Ain Shams University, 1996

### A Thesis Submitted for Doctor of Philosophy in Environmental Engineering

#### Under The Supervision of:

1- Prof. Dr. Mohamed El-Niazy Hammad

Irrigation Department - Faculty of Engineering
Ain Shams University

2- Prof. Dr. Fatma Abdel Rahman

Head of Groundwater Sector Ministry of Water Resources and Irrigation

3- Prof. Dr. Mohamed Gharib El-Malky

Biology Department Institute of Environmental Studies and Research Ain Shams University

4- Assoc. Prof. Ibrahiem Fathey Mohamed Shaker

Associate Professor – Public works department – Ain Shams University.

• . • • .  $J_{i}$ 

#### **ACKNOWLEDGEMENTS**

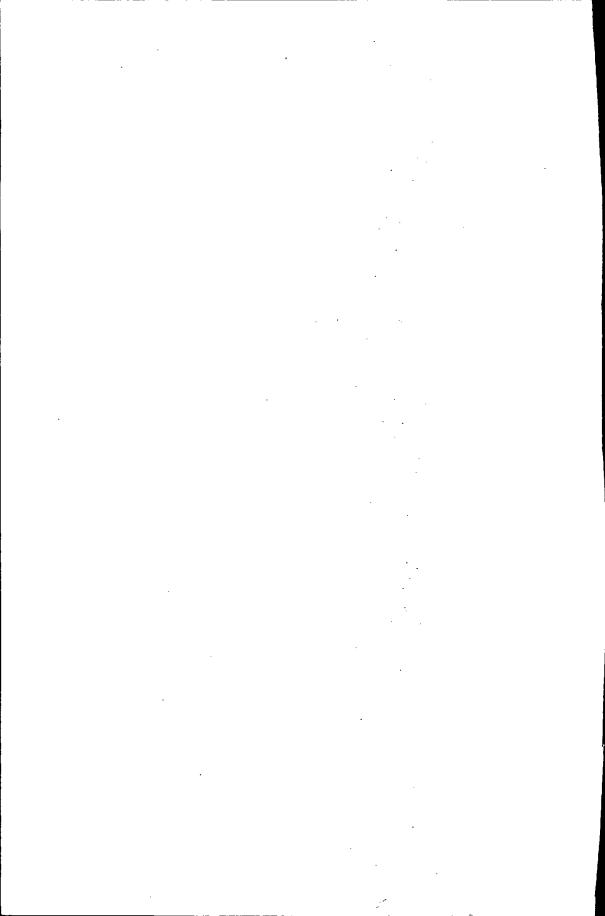
I would like to express my special gratitude to my supervisors, Prof. Dr. Mohamed El Niazy Hammad, Prof. Dr. Fatma Attia, Prof. Dr. Ibrahiem F. Shaker and Prof. Dr. Mohamed G. El Malky for their invaluable advise and continuous encouragement, and for the many hours of their valuable time that were spent on the critical review of the manuscript of this thesis.

I wish to express my deepest appreciation and sincere thanks to Eng. Omar El Badwy who helped me in learning programming language (avenue).

My special thanks to Dr. Ahmed Khedre Taha for his fruitful discussions. Without his patience, this work would have not been completed.

Last but not least, I wish to thank my colleague Eng. Maher El Shiwy for his continuous help and assistance.

1



#### **TABLE OF CONTENTS**

ACKNOWLEDGEMENTS
TABLE OF CONTENTS
LIST OF FIGURES
LIST OF TABLES
ABBREVIATIONS
ABSTRACT

		Page
CHAPTER 1	INTRODUCTION	1
1.1 Concept of C	GIS	. 2
1.2 Framework for Groundwater Protection		3
1.2.1 Groundwater pollution		3
	nerability	
	undwater protection scales and types	
1.2.4 General protection scheme		
	eific protection	
_	iitoring	
1.3 Decisions for Groundwater Protection		8
1.4 Motivation behind the Present Research		8
1.5 Objectives a	nd Approach of the Work	9
	ut	10
CHAPTER 2	LITERATURE REVIEW	12
2.1 Geographic Information System (GIS)		12
2.1.1 General characteristics of GIS		
2.1.2 Arc	eView GIS	13
2.1.3 Arc	View Spatial Analyst	13

	Page			
2.1.4 Spatial and attribute data	13			
2.1.5 Topology				
2.2 GIS Applications in Combination with Groundwater				
Models				
2.2.1 Import and export requirements				
2.2.2 Requirements for model design				
		2.3 Application of GIS in Three- and Four –		
		Dimensional Problems		
2.4 GIS as a Communication Tool	21			
2.5 GIS-A Planning and Management Tool				
2.5.1 Environmental planning and assessment	- 22			
2.5.2 Groundwater protection				
2.5.3 Using GIS in designing and optimizing a	27			
groundwater monitoring system				
2.6 GIS Sample Applications	27			
CHAPTER 3 DEVELOPMENT OF PACKAGE	. 31			
3.1 Running the Control System	34			
3.2 Groundwater Quality Module	36			
3.2.1 Groundwater quality map program	36			
3.2.2 Program of the change in groundwater	39			
quality map				
3.2.3 New groundwater quality table				
3.2.4 Delete old data				
3.3 Groundwater Suitability Module	45			
3.3.1 Program of groundwater suitability map for drinking	47			
3.3.2 Program of groundwater suitability map for agriculture	49			
3.3.3 Groundwater suitability for drinking chart	1 52			