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Groundwater in Egypt's Deserts

Springer

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Preface

No doubt that groundwater is an essential source of water resources in many regions in the world particularly in arid desert areas as in the case of Egypt. Egypt's deserts rely on groundwater where no other reliable source is available. The rapid growth of the population and the need for food at a reasonable price lead Egypt to extend its agricultural expansion to the deserts where 1.5 million feddans (1 Feddan = 4200 m^2) are entering the plan for cultivation. This book focuses on the groundwater in Egypt's deserts, its availability, quantity, quality, uses, and the future agricultural expansion. The book consists of 17 chapters in five parts.

Part "Introductory Section" is an introduction and contains two Chaps. "Introduction to "Groundwater in Egypt's Deserts"" and "An Overview of the Egyptian Deserts' Resources" as an introductory section to the book. Chapter "Introduction to "Groundwater in Egypt's Deserts"" introduces the book to the audience, where it presents a very brief description of the technical elements of the chapters. While in Chap. "An Overview of the Egyptian Deserts' Resources", an overview of the resources in Egypt's desert including the general features of the Egyptian deserts, the main geographical units, the main characteristics of the natural resources in Egyptian deserts.

Part "Groundwater Occurrence and Ecosystem Services" includes Chaps. "Groundwater Ocurrences in West Nile Delta, Egypt" and "Characterizing Ecosystem Services to Human Well-Being in Groundwater Dependent Desert Environments" that are devoted to groundwater occurrence and ecosystems associated with groundwater availability in the deserts. Chapter "Groundwater Ocurrences in West Nile Delta, Egypt" classifies and assesses the geological, geophysical, hydrological, and hydrochemical bases of the existed aquifers in the study area which are represented by the Oligocene and the Miocene aquifers. The chapter also aims to create baseline data to be used as a guide to monitor and detect the future changes in the groundwater level and quality clarifying the roles of lowering the groundwater levels, aquifer depletion, increase in water salinity and mixing between different aquifers. While Chap. "Characterizing Ecosystem Services to Human Well-Being in Groundwater Dependent Desert Environments" explores the merits of the ecosystem services framework as a means to characterize the services associated with groundwater availability and use in Egypt and to begin to capture their value

with a focus on the Western Desert to illustrate the scope to apply the ecosystem service characterization and assessment approach and also highlights areas where Egyptian groundwater managers could invest in improving information systems for this purpose.

Part "Groundwater Exploration, Quantity, Quality, and Their Management" deals with Groundwater Exploration, Quantity, Quality and their Management in 8 Chapters from "Geophysical Groundwater Exploration in Arid Regions Using Integrated Land-Based Magnetic and DC Resistivity Measurements: A Case Study at Gilf Kebir Area, South Western Desert, Egypt" to "Assessment of Groundwater Resources in Egypt's Deserts". Chapter "Geophysical Groundwater Exploration in Arid Regions Using Integrated Land-Based Magnetic and DC Resistivity Measurements: A Case Study at Gilf Kebir Area, South Western Desert, Egypt" is titled (Geophysical groundwater exploration in arid regions using integrated DC resistivity and Magnetic modeling: A case study at Gilf Kebir area, Southwestern Desert, Egypt). It focuses mainly on evaluating the groundwater accumulations of the areas through the determination of the aquifer geometry as well as the depth to the water level that is done by applying surface geophysics techniques with remote sensing information. Additionally, Chap. "Ground Water Potentiality in Siwa and Baris Oases, Western Desert, Egypt" is about (Ground Water potentiality in Siwa and Baris Oases, Western Desert, Egypt). It deals with the employment of geological and geoelectrical and hydrogeological techniques for evaluation of the potentiality of groundwater in Siwa and Baris Oases that are located in the Western Desert. Chapter "Groundwater and Characteristics of the Tertiary-Quaternary Aquifer System West of Mallawi, Upper Egypt" is titled (Groundwater and Characteristics of the Tertiary-Quaternary Aquifer System West of Mallawi, Upper Egypt) and evaluates the characteristics of the existed aquifers and assessment of the groundwater potentialities and quality at the west of Mallawi area aiming to realize the sustainable development of such area.

On the other hand, Chap. "Groundwater Characterization and Quality Assessment in Nubian Sandstone Aquifer, Kharga Oasis, Egypt" which is titled (Groundwater Characterization and Quality Assessment in Nubian Sandstone Aquifer, Kharga Oasis, Egypt) assesses the hydro-geochemical characteristics in the Nubian Sandstone Aquifer (NSSA) in Kharga Oasis by identifying major variables affecting the quality of groundwater and evaluating the suitability of groundwater for domestic and agricultural purposes. GIS is used to create thematic maps for the most important parameters associated with groundwater quality. Moreover, Chap. "Groundwater Potential in the Bahariya Oasis, Western Desert, Egypt" under the title (Groundwater Potential in the Bahariya Oasis, Western Desert, Egypt) evaluates the hydrogeological conditions of the groundwater in Bahariya Oasis to determine its potentialities for optimum exploitation of groundwater, using the available data and field measurements and investigating the water exploitation effect on water quality of the aquifer. Additionally, Chap. "Groundwater Quality and Potentiality of Moghra Aquifer, Northwestern Desert, Egypt" with the title (Groundwater Quality and Potentiality of Moghra Aquifer, Northwestern Desert, Egypt) deals with the water quality and potentiality of the groundwater of the Lower Miocene aquifer in the Moghra area to delineate the subsurface geologic setting and the affecting structural elements

(faulting and fractured zones). It shows the occurrence of groundwater resources in the Lower Miocene aquifer and investigates the hydrogeological characteristics of the lower Miocene aquifer by using geochemical and geophysical methods.

On the other hand, the topic (Transboundary groundwater management issues in the Nubian Sandstone Aquifer System (NSAS) is covered in Chap. "Transboundary Groundwater Management Issues in the Nubian Sandstone Aquifer System (NSAS)" which explores how Egypt can lead the way forward toward the sustainable utilization of the NSAS by sharing insights with the other riparian countries concerning available management technologies and innovations as it pushes the boundaries of science, engineering, and ecosystem management to respond to pressing shared water management challenges. Conserving the quality of groundwater and keeping it away from pollution by sewage system is discussed in Chap. "Groundwater Quality for Irrigation as an Aspect of Sustainable Development Approaches: A Case Study of Semi-Arid Area Around Ismailia Canal, Eastern Nile Delta, Egypt" which is titled (Groundwater quality for irrigation as an aspect of sustainable development approaches: a case study of semi-arid area around Ismailia Canal, Eastern Nile Delta, Egypt) with a focus on an area in the East of the Nile Delta where the land is semi-arid or arid. While Chap. "Assessment of Groundwater Resources in Egypt's Deserts" closes this section by making an assessment of the groundwater resources in Egypt's deserts and discusses its availability and sustainability.

In "Potential Use of Groundwater and Future Expansion", 3 chapters are presents to cover the theme (Potential Use of Groundwater and Future Expansion). This theme is devoted to the Potential Use of Groundwater and Future Expansion of agricultural projects and their needs for water. It is covered in three chapters. Chapter "Groundwater Exploitation in Mega Projects: Egypt's 1.5 Million Feddan Project" provides a brief description of the Mega agricultural project in Egypt. An overview of the general vision and strategy adopted by the MWRI highlights the MWRI's plans. On the other hand, Chap. "Optimum Economic Uses of Precious Costly Ground Water in Marginal and Desert Lands; Case Study in Egypt" explains the various possible ways to optimize the use of the scarce groundwater source which might be non-renewable. The last chapter in Part "Potential Use of Groundwater and Future Expansion" is dealing with the overall assessment of the water resources in Egypt including the share of the groundwater. The chapter presents the expected water resources demand in Egypt in the year 2025 and in the year 2050 to draw the attention of the concerning authorities to take care of this very critical file to the life of the Egyptians.

The last Part of the book is to conclude the book with a chapter titled (Update, Conclusions and Recommendations of the Groundwater in Egypt's Deserts". It closes the volume of the book with the main conclusions and recommendations for the benefits of the readers, policy planners, decision-makers, and stakeholders.

Last but not least, we want to thank all who contributed to this high-quality volume, which is a real source of knowledge and the latest research findings in the field of groundwater in Egypt's Deserts. We would love to thank all the authors for their invaluable contributions. Much appreciation and great thanks are also owed to the editors of the Earth and Environmental Sciences series at Springer for constructive

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Comments and feedback from the current and audiences are most welcomed to improve the quality of the books in the next editions. New chapters are welcomed for the next edition from any potential qualified author.

Zagazig, Egypt, December 2019 Abdelazim Negm
Cairo, Egypt, September 2019 Ahmed Elkhouly

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