RISK MITIGATION AND OPTIMIZATION USE OF RUNOFF WATER IN SOME WADIS IN THE EASTERN DESERT OF EGYPT

Submitted By

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B.Sc. Engineering (Mechanical Engineering), Faculty of Engineering,
American University in Cairo, 1990

Master in Engineering, Faculty of Engineering, American University in Cairo, 2004

A thesis submitted in Partial Fulfilment
Of
The Requirement for the Doctor of Philosophy Degree
In
Environmental Sciences

Department of Environmental Engineering Sciences
Institute of Environmental Studies and Research
Ain Shams University

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APPROVAL SHEET

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Dedication

To the most precious people in my life

My Father, Hamdy, and My Mother, Salwa,

My Brothers Ahmed, Basem, and Tarek

My beloved Nieces

Aya, Mariam, Ingy, and Malak

To You All

You are my whole world

You are my sweethearts

You are the joy of my life

I Love You All

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ABSTRACT

Egypt is currently suffering from water shortages and this shortage is expected to increase significantly as a result of increased population growth, agricultural activities, industrial activities, demands' needs of development and new projects.

The main source of water in Egypt is the Nile River. Since Egypt's share of water from the Nile is might be affected by the construction of Renaissance Dam of Ethiopia and other dams in Ethiopia and other Nile Basin countries. Other water resources: groundwater, rainfall, etc. not exploited optimally, while every drop of water should be exploited and maximized.

Although the Government has begun water recycling and desalination projects to overcome water shortages, the amount of water is still insufficient. As a result, Egypt should consider exploiting any possible water resources that can contribute to provide any amount of water, no matter this amount is small or large. Therefore, it has been thought to exploit the untapped and wasted water and make the best use of it. Surface water runoffs (floods) are important water source. The most important areas affected by the floods are Sinai and the Eastern Desert, which have sufficient source of water untapped.

Eastern Desert of Egypt is filled of wadis which are subjected to sudden rains that turn into huge floods that flow to the ground and dry either by leaking through the soil or through evaporation without being exploited and thus a large amount of water is lost. In addition, they pose a threat to villages and cities. Over the years, these floods have caused disasters that have claimed human lives and damaged vegetation, livestock and infrastructure.

Since Egypt needs every drop of water, the storage of flood water may cover part of these needs. It will also reduce the risks to and contribute to the

development of villages and cities, as well as the artificial recharge of groundwater reservoirs, and provide water in times of drought.

In this thesis, the floods in four Wadis of Eastern Desert of Egypt were examined. The four Wadis are: Wadi Abu Ghusun, Wadi Al-Nakheil, Wadi Al-Assuity, and Wadi Qena. The examinations of the four Wadis study how to take advantage of water storage, and the methods of protection and mitigation of the risks and disasters that can cause them by proposing solutions and models for water conservation and its uses in development sustainable environments. This thesis also examined the environmental impact assessment of these solutions in water storage areas in the basins under study.

Through this thesis the following studies were conducted:

1. Climatologic Analysis to determine the amounts of rainfalls and run-off.

2. Quantitative geomorphology to determine characteristics of each of the four wadis in the study area and its risks of flooding through defining the hydrological parameters with respect to the order bifurcation ratio, frequency of drainage density for major basins using topographic maps, remote sensing maps, geographic and hydro-geologic maps, and mining locations.

3. Means of runoff mitigation means to protect the villages and cities from its risks.

4. Optimum use of runoff water through construction of water harvesting means such as check dams, flood spreading bunds, collection ponds, cisterns, and dams.

5. Environmental impact assessment to define the impacts of water harvesting means on the surrounding environment.

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