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# COMBINATION OF DIFFERENT METHODS OF LOWERING GROUNDWATER TABLE IN URBAN AREAS

By

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# Statement

This thesis is submitted to Ain Shams University for the degree of M.Sc. in Civil Engineering.

The work included in this thesis was carried out by the author at the Department of Irrigation and Hydraulics, Faculty of Engineering, Ain Shams University, Cairo, Egypt.

No part of this thesis has been submitted for a degree or a qualification at any other University or Institution

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# Abstract

Controlling and lowering the groundwater table in urban areas is an important point of research as groundwater can be one of the main obstacles that might hinder the implementation of construction projects and the protection of monuments.

This study is concerned about how to combine and integrate different dewatering methods to achieve better efficiency and lower cost.

The research scope is focusing on deep well dewatering method, limitation of its usage, relation between depth of well and drawdown, and when to introduce another dewatering method in combination with deep wells. This study is aimed towards giving solutions for the inefficient usage of only deep wells system in dewatering, especially in stratified layered soil with low permeability soil overlying the aquifer pervious layers.

To achieve the previous goals; "Visual MODFLOW" was used to develop a groundwater numerical simulation model for a construction site under different conditions of soil stratification especially with upper clayey strata followed by sandy layer with different depths.

The effect of depth, number, and arrangements of deep wells with constant total discharge on the groundwater table and drawdowns is investigated under different stratifications.

The studied scenarios are compared in order to identify the most efficient one, the limitations of usage of the deep well system and when to combine another method with the deep well system.

In the cases where the deep wells system didn't achieve the targeted drawdown, shallow wells were used in combination with the existing deep wells; to study the effect of combining the two proposed systems on the groundwater table and the expected drawdown, with the change of deep well depths, number and arrangements with constant total discharge.

The Results of this research are presented in the form of trend curves and percentage limitations; aiding to know when to introduce another dewatering system in combination with the deep well system and the relation between different arrangements of deep wells, screen length and the expected drawdowns.

**Keywords:** Groundwater, Dewatering, numerical modeling, Visual MODFLOW, Deep wells, shallow wells, urban areas

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