

THESIS

**A MODE OF EXPLOITATION OF
FRESH GROUNDWATER LENS
IN CHOLISTAN DESERT**

Submitted by:

GHULAM SARWAR

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Center of Excellence in Water Resources Engineering
University of Engineering and Technology
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ABSTRACT

A MODE OF EXPLOITATION OF FRESH GROUNDWATER LENS IN CHOLISTAN DESERT

A huge fresh groundwater body (FGW) was discovered in Cholistan desert as a main outcome of the project "Regional Groundwater Investigations in Desert areas of Pakistan" which was carried out jointly by Hydrogeology Directorate, WAPDA and Federal Institute for Geosciences and Natural Resources (BGR), Hannover, Germany from 1986 to 1991. The dimensions of the FGW body was more than 80 Km long, 15 to 20 Km wide with vertical thickness up to 120 m.

Cholistan is a large desertified sandy area, where surface water resources are negligible and groundwater is generally saline. The local population face an acute shortage of fresh water even for their drinking and daily life uses. Due to the vital importance of the FGW lens in saline environment, a systematic planning is required for its future development.

In this study, a numerical approach has been used to propose a mode of exploitation of this fresh groundwater body. For this purposes, a finite difference based model "MODFLOW", initially developed by United States Geological Survey has been used. The model was calibrated for both steady & transient state conditions in accordance with the local field conditions for single layer and unconfined conditions. The calibrated model was then used to predict the behavior of FGW lens in response to the various development scenarios for domestic/livestock and agricultural water supplies. The model was run for the next 50 years to check the behavior of the lens in terms of change in

water levels and the movement of fresh/saline interface in response to the exploitation for both domestic/livestock and agricultural water supplies.

Modeling results proved the capability of the aquifer that it can be developed for domestic/livestock water requirements, whereas it shows incapability for agricultural sustainable supplies. With the help of modeling results it is estimated that if the lens will be developed only for domestic/livestock water supplies, the fresh/saline interface will move towards the pumping area at an average rate of 8 meters per year and will cover a distance of 429 m during the next 50 years.

However, for agricultural development with 70% cropping intensity, the fresh/saline interface will move at the rate of 115 m/year towards the development zone and it will take only 8.7 years to travel one Km distance. For agricultural development with 35% cropping intensity, a time period of 18 years is required to cover the same distance. Depletion of the lens will occur at a very high rate as a result of agricultural development in comparison to domestic development.

It is, therefore suggested that FGW body should be developed only for domestic/livestock supplies and should not be allowed the exploitation for agricultural activities. To avoid upcoming effects it is also suggested that shallow penetrating wells should be installed with low discharges.

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