

THESIS

APPLICATION OF GIS TECHNIQUE FOR GROUNDWATER ANALYSIS:

A CASE STUDY OF FESS AREA

6006

Submitted by:

CYRUS RAZA MIRZA

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ABSTRACT

Increasing public awareness, strict measures and promulgation of new laws in the area of water resources have made the use of advanced technologies indispensable. Use of Geographic Information Systems (GIS) has become an effective and inevitable tool for storing, managing and displaying spatial data often encountered in water resources management.

The Fordwah Eastern Sadiqia South (FESS) Project, located between two canals Hakra, and Malik branch, seepage losses from irrigation system coupled with the lack of drainage system have resulted in waterlogging in most of the project area. For subsurface drainage design, the estimation of the rate of natural groundwater recharge is a prerequisite and is of paramount importance for both technical and financial purposes.

The present study is aimed at determining reliable and appropriate interpolation technique and net recharge in the irrigated areas of Fordwah Eastern Sadiqia South (FESS), Bahawalnagar. Interpolation techniques inverse distance to power, kriging and triangulation were compared and evaluated by using three-dimensional surface plotting graphic program Surfer for Windows developed by Golden Software, Inc. 1996.

For the net recharge estimation, spatio-temporal database of water table behavior was developed by using GIS. The groundwater net recharge was estimated by using the "Water level fluctuation" method.

By applying statistical efficiency estimators, it was found that kriging defines the spatial variability over the problem domain in a better way as compared to the triangulation and inverse distance to power. It provides estimates in a well-defined sense and a measure of the reliability of the estimate. By using this technique in GIS, it has been observed that water-logged areas (having water table less than 150 cm) has increased from 40.7 to 73 percent during the study period. For prevailing conditions of depth to water table areas with rise and decline trend of water table during 1994-95, covered 58.75 and 5.02 percent of the total project area, respectively whereas in 1995-96, the areas showing rising and decline trends have decreased by 20.53 and 3.03 percent, respectively. However the areas exhibiting constant water table have increased by 23.58 percent during the study period. It has also been observed that the aquifer was recharged by 46.62 mm and 26.97 mm for the years 1994-95 and 1995-96 respectively. At the same time the maximum water from the upper reaches of study area that should be removed from the root zone was 60.27 mm per unit area during the study period of 1994-1996.