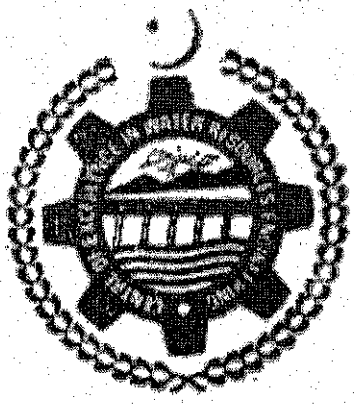
THESIS

ESTIMATION OF AQUIFER PARAMETERS USING COMPUTER BASED PARAMETER SEARCH TECHNIQUE



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(2006-PG-WRM-27)

For the Degree of

MASTER OF SCIENCE

IN

WATER RESOURCES MANAGEMENT

CENTRE OF EXCELLENCE IN WATER RESOURCES ENGINEERING,

University of Engineering and Technology, Lahore-Pakistan

2009

ABSTRACT

Ground water is a treasured earth's resource and it has several inherent advantages over the surface water resource. In view of the galloping population and unabated pollution worldwide, there is a dire need to manage the vital but shrinking groundwater resources efficiently to ensure its sustainable utilization. In all groundwater studies, it is necessary to evaluate the occurrence, availability and quality of groundwater. The worth of an aquifer as a fully developed source of water depends largely on two inherent characteristics i.e. its ability to store and transmit water, these characteristics are represented as storage coefficient (S) and transmissibility (T). Thus aquifer parameter estimation is very essential for judicious exploitation of groundwater resources.

WASID (WAPDA) conducted large number of pumping tests in various canal commands of Pakistan during 1960's and estimated the aquifer parameters using this pumping test data. This study was undertaken to revisit the aquifer parameters estimation using different computer based parameter search techniques and compare the results with WASID results.

Pumping test data of Bari doab was collected from WASID (WAPDA) report. Two wells BR-04 and BR-06 were selected for the detailed study. Time drawdown data was measured at each well at four observation wells (two deep and two shallow wells) around it. WASID estimated transmissivity for BR-04 and BR-06 as 1.86×10^{-2} m^2/s and 2.14×10^{-2} m^2/s.respectively and storage coefficient as 3.90×10^{-1} and 1.60×10^{-4}.respectively. Three different computer based techniques were used to estimate aquifer parameters. These techniques include (1) Theis curve matching, (2)

Aquifer win32 computer program and (3) inverse modeling using Modflow computer program.

In Theis curve matching the value of transmissivity estimated for BR-04 and BR-06 as 1.58×10^{-2} m^2/s and 8.37×10^{-3} m^2/s respectively and storage coefficient as 1.4×10^{-3} and 1.37×10^{-3} respectively. The values of transmissivity calculated by WASID and Theis curve matching obtained in the study were closed but the values of storage coefficient were very much different in BR-04. The reason of this difference in values is because of different curves were selected during curve matching by WASID and in this study. The value of storage coefficient estimated by WASID is too high (0.39). And Theis curve matching method can only be used when aquifer is homogeneous and isotropic so this technique for estimate aquifer parameters was discouraged.

Aquifer win32 was also used for aquifer parameter estimation. In Aquifer win32 the value of transmissivity estimated for BR-04 and BR-06 as 4.14×10^{-2} m^2/s and 3.14×10^{-2} m^2/s respectively and storage coefficient as 1.85×10^{-2} and 2.76×10^{-2} respectively.. Aquifer win32 calculated the aquifer parameters for each observation well separately and each observation well give different results so it was difficult to decide which well give perfect estimation of parameters. And Aquifer Win32 can also only be used when aquifer is homogeneous and isotropic so this technique to estimate aquifer parameters was also discouraged.

Inverse Modflow model was also formulated to estimate transmissivity and storage coefficient. In Modflow model the transmissivity estimated for BR-04 and BR-06 as 8.67×10^{-3} m^2/s and 4.46×10^{-3} m^2/s respectively and storage coefficient as 5.00×10^{-2} and 1.60×10^{-4} respectively. Difference in model and WASID results was

due to reason that WASID used Theis curve matching that can only be used for homogeneous and isotropic conditions.

Theis curve matching and Aquifer win32 are for homogeneous and isotropic conditions and was found not suited for the study of heterogeneous and anisotropic aquifer conditions. Aquifer win32 estimated parameters for a single observation well and no procedure is available to estimate cumulative characteristics of the aquifer based on multiple observations

It is recommended that Theis curve matching and Aquifer win32 can only be used for homogeneous and isotropic conditions. And models need to be developed for aquifer parameter estimation under heterogeneous and anisotropic conditions as in case of Bari Doab. For any aquifer parameter estimation program, as of WASID, the curve matchings should be included in the report to enhance confidence on the final reported results.