THESIS

ANALYZING BEHAVIOR OF PUNJAB AQUIFER

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Submitted By

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ABSTRACT

Groundwater is important fresh water resource and its strategic importance is due to agriculture, domestic and industrials uses. The renewable resource of groundwater can be utilized whenever and wherever required. There is necessity to evaluate the occurrence, availability and attributes of groundwater in all studies of groundwater. The geologic stratum is not defined as a whole but may be classified as confined, unconfined and leaky confined or unconfined aquifer. Punjab aquifers have the upper layer of fine materials as clay and lower layer of coarse materials as sand. During pumping the upper layer of aquifer behave as unconfined and lower layer as confined forming as a complex hydro geologic system. This study is planned to scrutinize the nature of Punjab aquifer.

WASID (WAPDA) carried out large number of aquifer tests in different doabs of Pakistan during 1960's and estimated the aquifer parameters by curve matching technique. Aquifer parameters estimation was revisited in this study for two wells BR-04 and CTW-35. The nature of aquifer was ascertained by testing applicability of various aquifer analysis methods such as Huntush, Jacob, Thies and Boulton, Aquifer Win32 and Modflow inverse modeling. Aquifer parameters were also determined and compared with WASID results.

In curve matching technique for Huntush, Thies and Boulton the value of transmissivity was estimated for BR-04 as 0.09, 0.13, 0.07 ft^2/sec and CTW-35 as 0.16, 0.32, 0.53 ft^2/sec and storage co-efficient for BR-04 as 4×10^{-2}, 2.60×10^{-3}, 7×10^{-1} and for CTW-35 as 1.28×10^{-3}, 2.02×10^{-3}, 9×10^{-2} respectively. The value of transmissivity and storage co-efficient for Jacob method was estimated for BR-04 as 0.25 ft^2/sec and 8.2×10^{-3}, and CTW-35 as 0.91 ft^2/sec and 0.04 respectively. The

observed data did not lend itself for perfect analysis by Huntush, Thies, Jacob and Boulton. Thus aquifer cannot be considered as confined, unconfined and leaky aquifer.

In Aquifer Win32 the value of transmissivity was estimated for simulation of Huntush, Thies (confined), Jacob and Thies (unconfined) method for BR-04 as 0.18, 0.42, 0.44, 0.44 ft^2/sec and CTW-35 as 1.22, 0.98, 1.49 and 0.99 ft^2/sec, and storage coefficient for BR-04 0.078, 0.024, 0.02, 0.025 and CTW-35 as 0.03, 0.028, 0.0064, 0.032 respectively. This model is sophisticated but simulate single well only. Transmissivity estimated for BR-04 and CTW-35 as 0.022 and 0.02 ft^2/sec respectively and storage co-efficient as 0.0039 and 0.021 respectively for inverse modeling of Modflow. Differences in results of Modflow and WASID were due to reason that the Modflow upper layer as unconfined but actually source was irrigation.

The governing equation and boundary conditions of Punjab aquifer included the vertical flow a $\partial^2 s/\partial z^2$ and yield. The continuity equation $h_1 = h_2$ is applied at boundary of confined and leaky layer. Higher mathematics required to take this solution and solution fall in the era of experienced mathematics.

This study concluded that Punjab aquifer cannot be adequately analyzed by Huntush, Thies, Jacob and Boulton methods. The observed data of Punjab aquifer did not lend itself that aquifer is clearly confined, unconfined and leaky confined or unconfined. Geologic stratum of Punjab aquifer comprised of finer materials at upper part and coarser material at lower part. Both parts behave differently as unconfined and confined respectively. WASID results could not be obtained/ reproduced in this study. There is need to develop analytical model considering the layering, boundary conditions prevalent in Punjab aquifer. WASID results may be used with caution.