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EXPERIENCE WITH FINITE DIFFERENCE AND FINITE ELEMENT MODELLING IN THE SEDIMENTARY FORMATION OF NORTH-WESTERN NIGERIA.

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ABSTRACT

Groundwater flow in the sedimentary formation of North-Western Nigeria was simulated with the aid of borehole data obtained from some 20 locations fairly distributed within the aquifer formation. The aquifer was modeled, in turn, using the Finite Difference Method (FDM) and the Finite Element Method (FEM), with appropriate initial and boundary conditions. The Finite Difference model employed is that developed by Pricket and Lonnquist (1971), where the sets of equations are solved by the Modified Iterative Alternating Direction Implicit Method, while the matrix solver technique adopted for the FEM was that of the Conjugate Gradient Method. Comparisons of output results were made between FDM and FEM in graphical formats for the steady state conditions as well as with the field data. The simulated results were found to compare favourably with field data, with the FEM giving a better response to excitation. The models were thereafter used to predict the effect of pumping on hydraulic heads from the base year 2000 to year 2030. The FDM and FEM results indicated the necessity of investigating borehole data at some locations where computed values differed appreciably from field values. These locations included boreholes 13, 14, 15, 18 and 19, representing Bulassa LIBC, Kurdula, Tangaza, Ruawuri and Safla, respectively. The outcome of the simulation exercise however suggests that the FEM is a more reliable modeling tool in view of its versatility, flexibility and accuracy.

Keywords: Groundwater Flow, Boundary Conditions, Graphical Formats, Steady State, Simulation.