Abstract

The present study mainly deals with the prediction of drawdowns in two coupled aquifers near a stream. In the two layer aquifer the stream was fully penetrating the upper water table aquifer. Pumping was done from the lower confined aquifer. The storage in semipervious confining bed was neglected. The water pumped from the lower confined aquifer was derived from the artesian storage in that aquifer and the leakage through the overlying semipervious confining bed. This leakage in turn was derived from the storage in water table aquifer and *e.* reduction in evapotranspiration due to decline in water table.

Laplace transform method was applied to the governing equations to eliminate time dependence. Then the solution in Laplace domain was obtained using finite difference method. Finally, the solution in Laplace domain was inverted to time domain using Stehfest's numerical algorithm. The solution obtained from the proposed groundwater flow model was verified with that obtained from MODFLOW. In the present study two cases were considered, one when the depth of flow in stream was constant and the other when it was varying with respect to time. The varying depth of flow was classified in to different categories such as step change in stream head, gradual change in stream head, and flood wave in stream.

Also, an attempt was made to develop a coupled groundwater surface water (GWSW) model for the present problem. The coupled GWSW model involves simultaneous solution of groundwater and surface water equations. The governing equations for unsteady one dimensional flow in open channel are the St. Venant's equations. The leakage through the stream boundary couples the groundwater movement and the stream flow. The coupled GWSW model based on Laplace transform method is advantageous as compared to coupled model based on discretisation of time as the problem of co-ordination of time steps for groundwater flow and stream flow is not there. The coupled GWSW model was developed in two stages. In the first stage only the continuity equation for stream flow was solved along with the groundwater flow equations. In the second stage both the continuity and the momentum equations were solved along with the groundwater flow equations.