ABSTRACT

In recent years groundwater is playing a major role in regional planning for agricultural and municipal water supplies. A shallow tubewell operated by a centrifugal pump is commonly used for lifting groundwater. The pumps are usually placed at ground level and they work satisfactorily where water level in the well remains within their suction lift. Sometimes the pumps are placed in a pump chamber below the ground level in order to reduce the static suction lift. Generally the aquifer nearest to the ground level is tapped fully. But if the aquifer is of large thickness, farmers opt for partial penetration to reduce the cost of installation of a tubewell.

The discharge from a partially penetrating tubewell in confined aquifer depends upon the characteristics of the pump, the position of static water level in the well, the aquifer characteristics, the degree of penetration, spacing between wells and the number of wells operating at a time in the same aquifer. In summer months when the crop demand for water is maximum, the piezometric surface of the ground level goes down inducing higher static suction lift. In addition to the seasonal fluctuation in water level, the piezometric surface further goes down during the time of pumping due to drawdown. The total drawdown increases due to partial penetration, proximity of no flow boundaries of the aquifer to

the pumping well and mutual interference of wells in the neighbourhood. This results in a reduction of discharge of centrifugal pump at a given static suction lift. To provide irrigation water to a command area on a dependable basis, a method has been evolved for predicting the discharge by taking into account the combined effect of partial penetration, the number of shallow tubewells operating at a time, the fluctuation of piezometric surface during the cropping season and the pump characteristics by using finite element method (FEM). Equations are developed to find out the relationship between (i) the discharge and degree of penetration, and (ii) the discharge and static suction lift of a partially penetrating shallow tubewell. The static suction lift required for each pump, in order to get the same discharge from all wells working simultaneously, is determined. A method has been proposed to predict the discharge at a given time of the year by taking into account the pump characteristics, aquifer parameters and the expected piezometric surface at the time.

Key word: Shallow tubewells, Degree of penetration, Static suction lift, Piezometric surface, Well loss, NPSHR