Experiment No. 7

"To study the water abstraction from a well in a confined aquifer"

Apparatus Name: Advanced Hydrological Apparatus

HYDROGEOLOGY LAB

CENTRE OF EXCELLENCE IN WATER RESOURCES ENGINEERING

UET, LAHORE

Procedure:

1) Abstraction from a Single Well in a Confined Aquifer with Radial Symmetry:

The well placed centrally in the catchment tank is used in this experiment. A shallow depression is scooped in the sand until the top of the gauze well tube is exposed. A flat sand surface is now prepared at this level, large enough to take the closed ring, arranged with its centre opening over the well tube. The closed ring is now placed in position with its transparent central standpipe (sight tube) in position, and a shallow trench is excavated in the sand outside its periphery (see Figure 2).

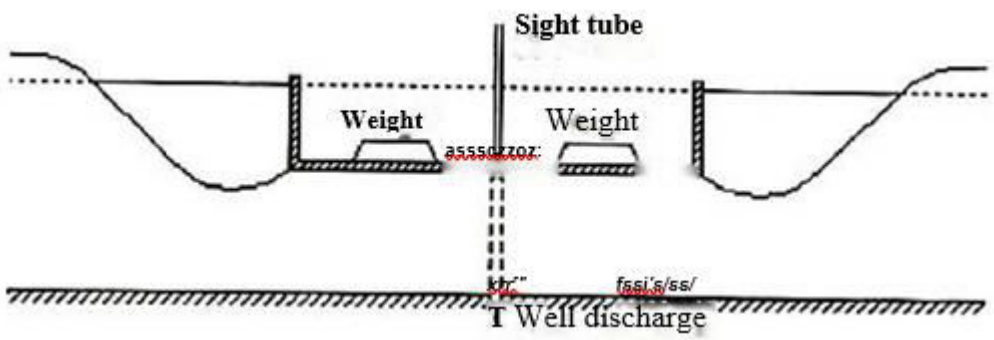

Figure 2

Using the two ground inlet supply valves, flood the sand until the water level surrounding the closed ring is just below its rim or, if this level is not possible, as near below as is possible. It will be necessary to weight the closed ring to stop it floating when the bed is flooded, approximately 10 kg weight. Items used for this must be suitable for use in water and must not damage the ring. The water level in the sight tube must also be observable with the weights in place.

The closed ring forms the upper impermeable stratum confining the aquifer (sand) and so producing the required radial flow distribution. It will be necessary to determine the depth of the aquifer (H) to use in equation (1) in "Water Abstraction from a Well in a Confined Aquifer". Now if values r_1 and r_2, s_1 and s_2 are obtained from either the manometer pressure tapping's or the water levels in the peripheral trench and the sight tube, the value of the coefficient of permeability (k) can be found.

Q_o must, of course, be measured from the flow leaving the well. To do this, the outflow pipe should be diverted into a measuring cylinder to collect the outflow over a timed period. It will be necessary to balance the inflow valves so that the well abstraction does not lead to a falling water table while readings of s and Qo are being taken. It is also important to check that a water surface is visible in the sight tube to ensure that the aquifer remains fully saturated in the region close to the wall.

Graphs showing the level of the piezometric surface in sections along the axis of the tank and at right angles to it can be plotted from the manometer readings. It is also possible to prepare a plan from these graphs showing piezometric surface contour lines.

2) Abstraction from a Single Well in a Confined Aquifer of Rectangular Plan:

The apparatus is set up in exactly the same way as described in "Abstraction from a Single Well in a Confined Aquifer with Radial Symmetry", except that the large rectangular closed ring is used to seal off the top of the aquifer. For any shape confined aquifer, a variation of Thiem's Formula, (1) in "Water Abstraction from a Well in a Confined Aquifer", relates the drawdown of the water surface in a well to that of the piezometric surface above the neighbouring aquifer.

$$s = \frac{Q}{2kHr} \log_n \frac{R}{r} \quad \text{(Dupuit formula)}$$

in which s is the drawdown of the piezometric surface at a radius r from the well and R, is the integration constant described below. This equation holds good only for the area close to the well (r small) and, using a k value determined in "Abstraction from a Single Well in a Confined Aquifer", the elevation of the piezometric surface can be calculated using equation.

For a confined aquifer Ro has the value **D** where D is the diameter of the constraining cap and, in a rectangular plan aquifer of width 2L, R, has the value 1.27 L (Fig. 3).

It is suggested that values of s are computed using the measured value of Qo and equation, (with the appropriate value of Ro) and a line is then drawn on a graph of s against r to represent these values. Further points can now be drawn on the same graph from the measure values obtained with the manometer tubes.

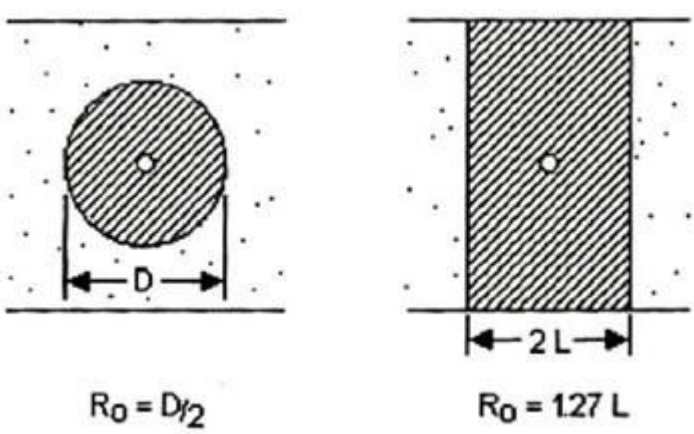

Figure 3

Observations and Calculations:

Volume Collected L	Time to Collect sec	Qo m^3/s	H m	Tapping Position m	Manometer Readings m	S (=H -manometer reading)

Assignment:

a) Compare the results obtained with typical permeability values of different types of aquifer.