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Design and testing of sand and gravel filter for artificial ground water recharge

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ABSTRACT

The study was conducted for recommendation of best filter model for artificial ground water recharge through wells. Keeping this view in mind the experiment was planned with different grades and thickness of filter materials *i.e.* sand and gravel, which were easily available at local market in standard size. These filter material were tested for the constant suspended load concentration of 10 ppm and 30 ppm taking in to consideration the soil loss of vertisol and filtered under low hydraulic head independently and in combination of two layers and three layers with varying layer thickness of 20 cm, 40 cm and 60 cm, respectively. The effect of filter materials on filtration was studied by recording the observations on inlet head, outlet head, velocity of flow, time of filtration and filtration efficiency. The data were analyzed statistically. The three layer filter, pea gravel grade I used with angular gravel grade I, having 60 cm thickness of each layer and combined with sand grade I with 20 cm of layer thickness, has given the best filtration efficiency 90.23 per cent amongst all other treatment combinations of multilayer filter.

Key words : Filter, Sand, Gravel, Efficiency, Ground water recharge.

Water is essential for survival of living body. With continuous increase in population, the demand on land and water resources has been increasing for enhancing agricultural production. Contribution of groundwater is so significant that more than 70 per cent of population uses groundwater for it's domestic needs and also more than half of irrigation needs are met from this source (Raheja and Taneja, 2004). Groundwater is a natural resource with both ecological and economic value and is of vital importance for sustaining life, health and integrity of ecosystems. The availability of groundwater is extremely uneven, both spatially and temporally and so will be the case in future. The uneven distribution of groundwater can be mainly attributed to highly heterogeneous lithology and due to uneven distribution of rainfall. An effective way to bridge the gap between groundwater withdrawal and natural recharge is augmentation of groundwater by artificial recharge.

Out of the various methods of artificial groundwater recharge, the recharge through existing open wells and tube wells may be better suited in Maharashtra. These existing wells can be used, as irrigation cum recharge wells, moreover there is no excess land, which can be utilized for surface spreading. In artificial groundwater recharge, the main hindrance is clogging of the system due to presence of sediments in the surface runoff water, which is being recharged. The surface runoff water contains impurities of physical, biological and chemical nature, hence the great care is required to inject the water as these impurities with water may pollute the precious groundwater reserves and also block the fractures. Hence it is necessary that artificial groundwater recharge should be done only from clear water.

In view of above, effort was made to develop suitable sand and gravel filter for testing it's effectiveness and feasibility by using locally available filter material to provide sufficient quantity of clear water for artificial recharge of the wells.

METHODOLOGY

The experiment was conducted in the demonstration garden of College of Agricultural Engineering, Parbhani during the year 2006-07. The objectives of the study was fulfilled with the help of following techniques and data.

The sand and gravel filter was designed from locally available materials such as: Sand grade I of size 0.5 to 2 mm, angular gravel grade I of size 6 mm, angular grave grade II of size 12 mm and angular gravel grade III of size 20 mm, Pea gravel grade I of size 6 to 10 mm, pea gravel grade II of size 10-15 mm and pea gravel grade III of size 15-20 mm were tested along with different thicknesses of filter materials such as 20 cm, 40 cm and 60 cm, respectively. These filter materials were tested in single layer, two layer and three layer combinations under constant suspended load concentrations of 10 ppm and 30 ppm.

Known quantity of soil was mixed in the water. The samples of various proportions of soil components was passed through sand and gravel filter and the proportions coming out of filter was measured with the help of turbidity meter.

The water with the known turbidity was passed