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Study on the effect of groundwater recharge through water harvesting structures in semi-arid red soil region of south India

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ABSTRACT

A study was conducted to investigate the effect of Water Harvesting Structures (WHS) on groundwater (GW) recharge during 2004-08 in red soil watershed of semi arid region, namely K.D. Pally watershed (920 ha) in Kambadur Mandal of Anantapur district, Andhra Pradesh. Four WHS namely, P. Reddy Check Dam (PRCD), G. Reddy Percolation Tank (GRPT), Small Check Dam (Small CD) and Village Percolation Tank (VPT) of storage capacity 1.67, 4.36, 0.33 and 3.93 ha-m, respectively having a total capacity of 9.4 ha-m. One time filling were selected to assess their effect on GW recharge. In the present study, structure wise simple linear and multiple regression equations with API as an additional factor were developed to predict the runoff expected in a particular rainfall storm, for all four structures. The hydrological analysis showed that curve number (CN) was found to be less and storage (S_t) was higher in case of computed values from observed data using methodology prescribed in the present study compared to Hydrologic Soil Cover Complex method. Potential recharge has been estimated and empirical relationships were developed between cumulative potential recharge and cumulative rainfall. Changes in ground water utilization pattern was also studied and found that the irrigated area expanded up to 113.5 ha in post-project as against 37.2 ha pre-project. The present study showed that the WHS had very good impact on ground water recharge in the study area. Therefore, it is recommended that the study can be applied for similar other region for approximate quantification of surface storage and ground water recharge.

Key words :

Antecedent Precipitation Index,
Curve Number,
Ground water recharge,
Percolation tanks,
Watershed storage

1. INTRODUCTION

It has been estimated that irrigation through ground water resources would account for 40 m ha for the country as a whole apart from 58 m ha from major and medium irrigation projects. Surface water resources are inadequate and costly to develop for intensive agriculture and generally result in water logging and salinity problem. Hence it is of paramount importance to devise suitable techniques to augment ground water reserves, which have many advantages over the surface resources (Singh *et al.*, 2005).

Climate and soils are the two dominant factors in deciding whether or not water harvesting system will be possible and sensible. The hyper arid zone ($P/ETP < 0.3$) is too dry for viable runoff farming, while sub humid zone ($P/ETP 0.5-0.75$) will be too wet. The runoff farming zone is primarily situated in the arid zone ($P/ETP 0.03-0.2$) and to some extent in the semi-arid zone ($P/EPT 0.2-0.5$). The

watershed under study is falling under semi-arid red soil zone of Andhra Pradesh, hence this area is having highly potential for rain water management including water harvesting through soil and water conservation measures (Adhikari *et al.*, 2008; Singh and Khan, 1999).

Currently in India, the average potential surface flow is estimated as 1869 km³, out of which, total live storage of 174 km³ has already been created, and projects to create another live storage of 721 km³ are under construction (Agrawal and Goel, 2002; Singh *et al.*, 2014). It includes live storage of 25 km³ in minor irrigation and traditional tanks in India. Sustainable protection or management of surface and sub surface water resources is one of the most pressing needs of the nation. This issue is closely related to surface and sub surface flow in the minor gullies at micro level to major river systems at macro level (Samra *et al.*, 2003; Singh *et al.*, 1997; Kumar *et al.*, 2011). In view of above, the present