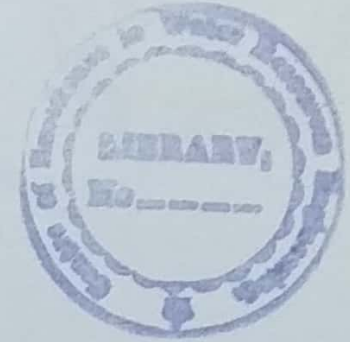


M.Sc. Thesis

MANAGEMENT OF TOBAS AND RAIN WATER HARVESTING
TECHNIQUES IN CHOLISTAN DESERT



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2018

ABSTRACT

Cholistan is a magnificent desert in the Punjab province covering about 26,000 km² area, where main source of water is rainfall that generate runoff and part of it accumulates in natural depressions, locally called tobas. There are about twelve hundred Tobas in Cholistan desert. The ground water in Cholistan is mostly saline, and area falls under arid type climate. The mean annual rainfall is about 238 mm. Most of the rainfall is received in the months of July, August and September.

In this study, trends of past rainfall and temperature, from year 1991 to 2015, were analysed by using MAKESENS 1.0 i.e. Mann-Kendal and Sen's slope estimation. This is an MS-excel template.

In Cholistan, average calculated water storage capacity of tobas about 3.8 million cubic meter to meet the requirement of drinking water for 0.12 million humans and 2 million livestock's was 13.66 Mm³. Annual average deficit in the desert was calculated as 9.9 Mm³. It is estimated that desert habitats needed 750 more tobas having capacity 15000 m³ to meet 9.9 Mm³ deficit demand. Potential runoff calculated in the desert was 688 million cubic meter by using HEC-HMS. Seepage losses may be minimized by spreading good quality polythene sheets on the bed of the toba. A physical model of toba was prepared in MT-Hall, CEWRE and calculated that seepage losses could be reduced completely by placing good quality polythene sheet on the bed of the toba.

Analysis of past data from years 2008-2017 showed that, year 2014 was the driest one. When rainfall was just 43 mm. There were severe drought condition because water was only available for three months (March to May). On the other hand 2015 was the wet

year in the considered duration of 2008-2017, when recorded average rainfall was 520 mm and water was available throughout the year.

Siltation is also the serious concern in tobas, only 500 tobas are in working condition. Hydrology of toba was a complex phenomenon so a physical model of toba with a sediment control structure was constructed in MT-HALL (Centre of Excellence in Water Resources Engineering) to examine hydrology and sedimentation effects by using rainfall simulator to achieve rainfall intensity of 340 mm/hr. Runoff generated by rainfall carried sediment about 870 ppm in main toba and 19600 ppm sediment was trapped in control structure. Sediment calculations were carried out by using universal soil lose equation (USLE). Trap efficiency of this physically modelled system calculated was 52%. Results showed that sediment control structure increases the life of toba about 50 years.