THESIS

HYDROLOGIC ASSESSMENT OF SMALL DAMS IN POTOHAR AREA: A CASE STUDY FOR JAMMERGAL DAM

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ABSTRACT

HYDROLOGIC ASSESSMENT OF SMALL DAMS IN POTOHAR AREA: A CASE STUDY FOR JAMMERGAL DAM

The Potohar Plateau covers an area 2.2 million hectares. The topography of the area is undulating generally sloping from North East to South West. The annual rainfall ranges from 450 mm to 1750 mm (highest in North Eastern side and lowest in the South West) with 70% rainfall occurs during monsoon months (June to September). Storm water channels originate from the Potohar plateau as hill torrents and ultimately merge with river Indus and Jhelum. Most of water runoff the Plateau unused.

To boost up the Barani areas by harnessing natural water resources, Small Dams Organization constructed a number of small dams in the area. The stored water is supplied in the area for agricultural purposes. However no detailed hydrological assessment of catchment yield was available before the design of these small dams. This indicates a need for hydrological assessment of rainfall runoff relationships in Potohar area for better design of future small dam projects. This study was conducted to analyse hydrologic assessment of Jammergal dam in terms of underlying rainfall-runoff relationships and probable inflows.

Data was collected for rainfall and resulting runoff for Jammergal dam and three other neighbouring small dams (Tainpura-I, Tainpura-II and Garat) in Potohar region.

The data showed wide variation and scatter and no simple relationship seem to be applicable. The traditional formula for estimating runoff did not match with the measured runoff of Jammergal dam. However, the discharge estimated on the basis of rainfall measured at the dam site gave better results. The SCS curve number method with a CN = 50 provided a fair estimate of ruoff.

A number of formulae were evaluated for measured rainfall and runoff data using a non-linear curve fitting procedure. The derived relationships were applied to the data of neighbouring small dams. Models were also evaluated by using the regional data (combined data of four small dams) and the derived relationships were tested on each dam. No formula was found to perfectly describe the measured runoff at any dam. The SDO formula [$Q = 0.046(P-9.999)^{1.354}$], exponential formula [$Q = 0.0446\ P^{1.349}$] and Lacy's formula [$Q = P/(1 + 578.305/P)$] were found to better describe the rainfall-runoff relationship (P = monthly rainfall, Q = monthly runoff). Since these models did not specifically take into account the basin parameters i.e. vegetation, soil type, size, shape and slopes etc, the resulting runoff may be under or over estimated by 10 to 50%. The relationships derived from the data of Jammergal dam when tested to data of neighbouring small dams (i.e. Tainpura-I, Tainpura-II and Garat dam) did not provide a perfect fit. Same was also true when relationship derived from regional data was applied to individual dams. However the relationships provide fair results and can be applied with confidence particularly in the absence of other better models.

A Gumbel frequency analysis was applied to determine the water yield of the Jammergal dam at different probability levels. The reservoir has almost 95% probability of getting completely filled in any year to its present live capacity of 930 Aft. It has seen that as much as 500 Aft of additional water can be harrnessed at Jammergal dam at 65% probability of getting completely filled. At 25% and 50% probability levels, the additional water amounts to 2128 Aft and 1636 Aft respectively. This indicate a substantial potential for increasing agriculture in the area.

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