

THESIS

**IMPACT OF HIGH/LOW FLOWS ON SEDIMENT YIELD AND
HYDROPOWER POTENTIAL
(A CASE STUDY WITH REFERENCE TO BUNJI HYDROPOWER PROJECT)**



By

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ABSTRACT

Bunji Hydropower Project is a run off river hydropower project with peaking reservoir on Indus River near Gilgit District. The study was aimed at the impact of high/low flows on sediment yield and hydropower potential of Bunji Hydropower project. The flows were divided into high/low flows on the basis of sediment yield. High flows months include June to September whereas low flows months are from October to May. Suspended sediment yield for high /low flows was determined at Kachura sediment gauging station by sediment rating curve method whereas bed load for high/low flows was determined with different bed load formulae. Suspended sediment load and bed load were transposed to Bunji dam site by area ratio method. By adding the both loads, total sediment yield for high /low flows was determined at Bunji dam site.

The bed material load was determined by three equations, Englund Hansen (1967) Equation, Ackers-White (1973) Equation and Yang's (1972) unit stream power Equation. None of the equations satisfied the total observed load. However, for low flows, Englund Hansen equation gave result close to observed load whereas for high flows, non of these equations gave results close to observed load.

According to the location of gauging stations i.e. Kachura and Partab Bridge on Indus River and Alam Bridge on Gilgit River, flows for Bunji dam site were determined. For high/low flows, power, peak/off peak energy was computed. Benefits for power, peak and off-peak energy were computed with the help of specially designed worksheet(M.S. Excel). The river cross-sections and longitudinal profile of Indus river in the project area

surveyed for pre-feasibility study have been used for estimating trapped sediments and amount of flushed material. The reservoir life was determined by M.A. Churchill (1948) method.

The unsluiced Bunji reservoir life by actual trap efficiency (40 percent) was 6 years whereas by 50 percent trap efficiency (percentage of sand is 50 percent in suspended sediment), it was 4 years. The sluiced reservoir life on the basis of 20 percent bed load trap efficiency was 83 years. Delta profile in reservoir was provided on monthly basis for the two years of data i.e. year 1973 and 1994 by estimating the slope for zero bed load transport rate by Meyer-Petter and Muller bed load equation. As the results were small, the topset slope was fixed as half of the bed slope. The movement of delta pivot point was 6 and 9 km for the years 1973 and 1994 respectively. In brief the present study was a contribution to future work for planning of Bunji hydropower project and hopefully it would be helpful for engineers and planners in planning of hydropower projects on River Indus.