

THESIS

RESERVOIR SEDIMENT MANAGEMENT AT PATRIND
HPP ON RIVER KUNHAR



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ABSTRACT

Hydral power is achieved by converting the potential and kinetic energy of water to electrical energy by electro-mechanical means. Out of all types of renewable energy, hydral energy is the most attractive source of energy because of following reasons.

The Patrind hydropower is a run of river scheme proposed at Kunhar River , a tributary of Jhelum River . A 92 ft. high concrete structure is to be constructed at Patrind for raising the water level for intake structure creating storage of 1350 AF. The intake is proposed across the Kunhar River near the Patrind village and an open power house is proposed on the right bank of Jhelum River opposite to Lower Chatter of Muzafferabad. It will produce 133 MW power.

Run of river hydro dams are of fairly low height, and located on streams with steep bed slopes. These projects use the water mainly for power production and as such have a very small or no storage capacity. These projects are often subjected to a sudden increase in sediment concentration as a result of flash flood, stream bank slides or seismo- sedimentation. The volume of sediment carried by Kunhar River is generally less than that of other tributaries of Jhelum River. The upper reaches of the sub-basin are well forested and produce less sediment i.e. 150 tons/ sq.km. However there is an evidence of geological and accelerated erosion in the lower parts produce sediments up to 2060 tons/sq.km.

Sediment deposited in head pound will reduce the pounding capacity. Sediment damages the blades of turbine and ancillary equipments, plant cooling system, tunnel

lining, energy dissipation arrangement etc. So it is necessary to manage sediment accumulation and flushing to ensure sediment free water for power production.

The objective of this research were to study the historic sediment load pattern , the sediment deposition under post weir conditions in the pond area for no sediment control system and the performance of low level outlets in the weir body on sediment flushing.

Data of Kunhar River such as historic discharge, sediment discharge, river cross-sections and topography were collected from WAPDA offices. It was observed from data that annual flow varied from 1.4 to 4.08 MAF and sediment load varied from 0.54 to 19.80 MST, daily discharge varied from 275 to 81300 cusecs , sediment concentration varied from 3 to 116000 ppm . From results it was observed the reservoir capacity at elevation 2513 ft. will be 1350 AF. Rating curve between discharge and sediment rate was developed. Record of 9 readings for suspended sediment samples were available whereas bed sediment load was taken as 15% of suspended load ,hence composite sediment load curve was developed. Bed surface gradation curve was developed similar to curve prepared for Duber Khawar. Stage-Discharge curve for weir site was developed for various flow and water level options. HEC-6 model was used to simulate sediment transport and deposition pattern.

HEC-6 model was first tested for natural river condition, and gave balanced general behavior i.e. non-scouring and non- deposition. Model was then used for post weir conditions, which provide the result that 50% reservoir volume will be filled up within 12 years. Model was later used for flushing after impounding of 7 years and then periodic flushing every year during monsoon. Flushing shows the average exclusion of

356406 tons (284150 cubic yards) or 176 AF of sediment from reservoir for each flushing event

No flushing will be required during first 4 to 6 years of reservoir operation. It is recommended for flushing the low level outlet size should be 20'x80' rectangular with bottom level at 2425 ft. to ensure smaller flow depth and larger flow velocities needed for sediment scouring and transport. Flushing is recommended for discharge of 15000 cusecs for 15 days during monsoon (July), maximum flow also scour the deposits of upper reach of reservoir.

Shutting down of power plant during flushing period cause the loss of 446 AF water and 37 Gwh power however it will create the volume of 156 AF for water and sediment accumulation in reservoir. Moreover flushing is practicable due to river gradient and geometry.