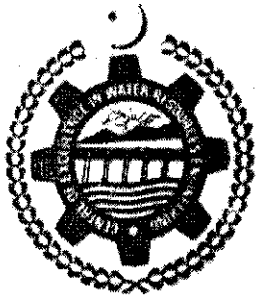
THESIS

RISK ON INDUS BASIN WATER TRANSFER IN VIOLATION OF INDUS BASIN TREATY



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ABSTRACT

Indus Water Treaty (IWT) was signed in 1960 between Pakistan and India to resolve the water conflict. According to this treaty India is not allowed to store the western river water and diverting the rivers water. India is seen to violate the treaty and harm Pakistan by transferring water of western rivers (Indus, Jhelum and Chenab rivers) to the eastern rivers (Ravi, Beas and Sutlej River's) under covert arrangements. This study was carried to study threat of unlawful transfer of western river's water through tunnels.

River bed profile of all river's were determined by Google Earth. Catchment area of the study area was determined by Arc GIS software. Locations for water diversion were selected considering following criteria: Large elevation difference available between source river and recipient river, River have narrow cross section to allow tunnel on steep river section face, and Location where river has enough water depth so that the tunnel intake (mouth) mostly remain under water even during low flow conditions.

Cross sections of all possible locations were also determined by Arc GIS software. Flow available at possible locations were estimated on catchment area basis. Water depth in possible locations were determined by HEC-RAS model. Tunnel route was marked considering shortest length and largest elevation difference between the source and recipient river and thus tunnel length was determined. Tunnel design was done considering total energy available between source and recipient river, head losses at intake and control gates, friction losses of tunnel surface, tunnel length and exit losses. Tunnel dia was selected such that tunnel intake remain mostly under water even during low flow conditions. Tunnel design provided tunnel

discharge capacity. Flow diversion volumes were determined considering average monthly flows and flow depth of source river.

River bed level of Indus River varies from 2200 m at Skardu to 6707 m at source over a length of 475 km. Chenab River bed level varies from 673 m at Dhamkund to 2904 m at source over a length of 375 km.

Twenty possible diversion locations and tunnel alignments were identified with eighteen on Indus River and two on Chenab River with tunnel length varying from 32 to 180 Km. Tunnel diameter varies from 2.5 to 4.5 m with discharge capacity of 6 to 165 cumecs. Tunnels having smaller lengths are more viable.

Annual water transfer is estimated from minimum of 141 million cubic meter (MCM) to as much as 2131 MCM from Indus River. Five sites Tso Moriri, Gaik, Nimmo Bazgo, Dah and Batalik on Indus and two sites Jangalwar and Kund Bara on Chenab River are identified as high risk sites. The Kund Bara tunnel from Chenab River seems to be first adopted due to be shorter length (32.3 Km) and large flow diversion (3532 MCM).

Technical capabilities, financial gains and most important socio-political-diplomatic hegemony of India reflect high risk of Indus basin water transfer by India in violation of Indus Water Treaty. There are more than twenty possible locations where unlawful river flow diversion could be made.

Extensive study should be carried out with broad focus and detailed engineering analysis to enhance results of this study. Pakistan should be most vigilant for any construction near locations identified in this study on Indus and on Chenab River for which high intensity satellite image may be used for deep watch.