

7398

THESIS

**FLOOD ZONING SIMULATION: A CASE STUDY OF RIVER
SWAT FROM UTROR VALLEY KALAM TO BAZKHELA**



RESEARCH ADVISOR

PROF. DR. ABDUL SATTAR SHAKIR

SUBMITTED BY

**QASIM SARFARAZ
(2015-MS-WRE-01)**

**CENTRE OF EXCELLENCE IN WATER RESOURCES ENGINEERING
University of Engineering and Technology, Lahore**

2017

ABSTRACT

Indus River is a major trans-boundary river in Asia. It has nine tributaries, five on the left bank (Sutlej, Jhelum, Beas, Ravi and Chenab) and four on the right bank (Kurram, Swat, Gomel and Kabul). A tragic and massive flood was faced by Pakistan in 2010. Heavy Rainfall on Karakorum and Hindukush ranges generated extraordinary flows towards River Indus, which resulted flash flood in River Kabul and River Swat. The resulted flash flood in River Swat severely affected the part of District Swat. A reach from *Utror valley Kalam* to *Bazkhela* was selected to explore the flood impacts. In this study assessment of design flood for various return periods, computation of water surface profiles and the generation of flood risk maps was carried out.

Instantaneous discharge data from 1963-2010 (47 years) of Chakdara Station, located on River Swat was taken. Six statistical distributions, Gen Extreme Value Distribution, Normal Distribution, Log Normal Distribution, Log Pearson Type III Distribution, Frequency Factor and Gumbel Distribution were applied for flood frequency analysis. It has been found that the Gen Extreme Value (Type I) Distribution is the best fit distribution for the study reach with 734.63, 1478.08, 1970.31, 2442.46, 2592.24, 3053.62, 3511.60, 4569.91, 5024.90, 6535.53 discharges in Cumecs against 2,5,10,20,25,50,100,500,1000, and 10000 years return period respectively.

The Water surface profile of the study reach using Gen Extreme Value (Type I) at different return periods 2, 5, 10, 20, 25, 50, 100, 500, 1000 and 10000 years respectively was computed for the description of the hydraulic behavior of the river. Hydraulic model (HEC-RAS) was used for mix flow condition. It has been found that

at few locations the slope was mild and at few locations it was steep. M1, M2, S1 & S2 type profiles were observed within the study reach. M1 profile was observed at locations where mild slope was entering into a pool and M2 profile was observed at locations where slope was becoming steeper. The locations where steep slope started entering into a pool, S1 profile was observed and locations where steep slope started becoming mild, S2 profile was observed.

For this study geographic information system (GIS), digital elevation model (ASTER GTM 30m DEM), along with HEC-RAS was used for Flood Hazard Mapping. The stream Centerline, Bank-lines and flood-plain lines were marked using Google Earth, The water surface profiles were generated using HEC-RAS and flood Inundation of study reach was evaluated using HEC-Geo RAS extension of geographic information system (GIS).

The model predicted flood inundation extents of about 13.05 Sq. km against 100 year return period (3511.60 Cumecs), the total predicted buildings & bridges in risk are 1320, out of which 221 are at High Risk with an inundated area of about 3.6 Sq. km, 183 at Moderate to Low Risk with an inundated area of about 2.1 Sq. km while 916 are at very low risk with an inundated area of about 5.9 Sq. km.

Results obtained from such studies can further be improved by using observed X-Sections or finer DEM (0.5m or 1m) instead of ASTER GTM 30m DEM, using DOQQ base-map and extending historic data upto 100 years.