

A Case Study on the Estimation of Design Discharge for Flood Management in Lower Damodar Region, India

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Abstract : Catchment area of Damodar River, India experiences seasonal rains due to the south-west monsoon every year and depending upon the intensity of the storms, floods occur. During the monsoon season, the rainfall in the area is mainly due to active monsoon conditions. The upstream reach of Damodar river system has five dams store the water for utilization for various purposes viz, irrigation, hydro-power generation, municipal supplies and last but not the least flood moderation. But, in the downstream reach of Damodar River, known as Lower Damodar region, is severely and frequently suffering from flood due to heavy monsoon rainfall and also release from upstream reservoirs. Therefore, an effective flood management study is required to know in depth the nature and extent of flood, water logging, and erosion related problems, affected area, and damages in the Lower Damodar region, by conducting mathematical model study. The design flood or discharge is needed to decide to assign the respective model for getting several scenarios from the simulation runs. The ultimate aim is to achieve a sustainable flood management scheme from the several alternatives. there are various methods for estimating flood discharges to be carried through the rivers and their tributaries for quick drainage from inundated areas due to drainage congestion and excess rainfall. In the present study, the flood frequency analysis is performed to decide the design flood discharge of the study area. This, on the other hand, has limitations in respect of availability of long peak flood data record for determining long type of probability density function correctly. If sufficient past records are available, the maximum flood on a river with a given frequency can safely be determined. The floods of different frequency for the Damodar has been calculated by five candidate distributions i.e., generalized extreme value, extreme value-I, Pearson type III, Log Pearson and normal. Annual peak discharge series are available at Durgapur barrage for the period of 1979 to 2013 (35 years). The available series are subjected to frequency analysis. The primary objective of the flood frequency analysis is to relate the magnitude of extreme events to their frequencies of occurrence through the use of probability distributions. The design flood for return periods of 10, 15 and 25 years return period at Durgapur barrage are estimated by flood frequency method. It is necessary to develop flood hydrographs for the above floods to facilitate the mathematical model studies to find the depth and extent of inundation etc. Null hypothesis that the distributions fit the data at 95% confidence is checked with goodness of fit test, i.e., Chi Square Test. It is revealed from the goodness of fit test that the all five distributions do show a good fit on the sample population and is therefore accepted. However, it is seen that there is considerable variation in the estimation of frequency flood. It is therefore considered prudent to average out the results of these five distributions for required frequencies. The inundated area from past data is well matched using this flood.

Keywords : design discharge, flood frequency, goodness of fit, sustainable flood management

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