AN INNOVATIVE APPROACH TO EVALUATE DOWNSTREAM FLOOD IMPACT FROM MODIFIED DAM OPERATIONS CONSIDERING EFFECTS OF STORM PATTERN AND TIMING

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West Point Dam is one of the critical elements in the Apalachicola-Chattahoochee-Flint (ACF) Rivers system. It officially operates for flood control to reduce flood damages along the reach of the Chattahoochee River between West Point Dam and Columbus. The U.S. Army Corps of Engineers evaluated two flood operation alternatives at West Point Dam, an Early Refill condition and a Fall Stepped-down condition. Because the flood operation guide curve determines available flood storages, which affects the peak and volume of reservoir releases during flood operations, any modification to the guide curve may have some direct impacts on flood conditions downstream. For the Chattahoochee River between West Point and Columbus, the flood damage site is at Columbus. A flood operation alternative is acceptable only if it does not significantly increase the flood frequency curves at Columbus. This paper presents an innovative approach used to evaluate the flood impacts of modified flood operations at West point Dam on the flood conditions at Columbus.

The flow in the Chattahoochee River at Columbus is regulated. The magnitude of flood discharge at Columbus is primarily influenced by the magnitude of storms, which have two distinct types. One is general cyclonic storms typically occurring in winter and spring months. The other is intense tropical storms typically occurring between the summer and fall seasons. As a result, large flood events do show seasonal distributions and variations in hydrograph shapes. At the same time, due to flow regulation, it is also affected by flood operations at West Point Dam and the upstream dams, which typically vary month to month. Therefore, the combined regulated flood frequency relationship at Columbus is a function of two variables, storm and month. For each month, a regulated flood frequency relationship was developed by applying a series of hypothetical flow hydrographs with different shapes and different exceedance probabilities to a reservoir model and by associating the resulting regulated peak flows at Columbus with the exceedance probabilities of the input hypothetical hydrographs. The monthly regulated flood frequency curves was then combined to produce a combined regulated flood frequency curve at Columbus using the total probability theorem. Combined regulated flood frequency curves at Columbus were developed for the baseline and proposed conditions, and were used to evaluate potential impacts from the modified dam operations.