COMPARISON OF MODERN DAY INUNDATION MODELING TECHNIQUES (2-D VERSUS 1-D, WITH 3-D ON THE HORIZON)

Author: Milan Jankovic, M.S., P.E.[1]
Co-Author: Shane Willard [2]

Abstract

Looking back through history, we cannot deny the important role that water has played for humans in the development of civilization. To meet this demand, many dams were built for things such as irrigation, potable water, flood control, hydro power, recreation, and more. Along with the benefits of controlled water, comes the increased danger of their potential structural failure, or multiple failures, and corresponding downstream human impacts.

In recent decades, and with the constant increase of technology, more and more attention has been given to the analysis of existing, as well as soon to be designed dams with respect to their failures.

The ever increasing advancement of computer technology has enabled us to rely more on numerical (less costly) models, and less on physical (more costly) models with the latter being used mainly to check the numerical model results and to calibrate software.

The process of selecting numerical models (1-D, 2-D, or 3-D) and computer software is very critical and depends on many factors that are defined in detail in this paper.

If a computerized model can be viewed as a "black box" that has been approved for use by an authoritative organization (for example FEMA), then the accuracy of input data into that "black box" is essential for getting accurate and precise outputs. In this paper, great care has been given to the consideration of the necessary input data, technology of the calculations and selection of appropriate input values.

Depending on complexity, computer model calculations could take anywhere from several minutes, up to a few months. The results obtained from a computer simulation of the dam failure flood inundation model are usually presented cartographically as flood polygons and, more recently, as flood depths, flood velocities, and hazard raster (grids), as well as video animations.

Results of several analyzed dams presented in this paper demonstrate that the 2-D models are preferred in may situations in order to gain a realistic picture of what could happen when a dam fails. The selection of the dam breach parameters, such as breach formation time and breach width are very critical to the quality of the output results. Animations, one product from a 2-D model, represent a high-level view of the modeling results with a temporal dimension that 1-D models lack. This tool can help us visualize what can be expected if this adverse event occurs.

---

[1] Hydrology, Hydraulic and Geotechnical Engineer, Bureau of Indian Affairs (Contractors), 13922 Denver West Parkway, Building 54, Suite 300, Lakewood, CO 80401,
Phone: 303-231-5237, Email: milan.jankovic@bia.gov

[2] Geospatial Program Manager