Case study

Dam-breach modelling for the Lane City Reservoir, USA

Jacobs performed dam-breach modelling using the 1D and 2D solvers within Flood Modeller to confirm hazard classification of the Lane City Reservoir dam and develop dam-failure inundation maps for an Emergency Action Plan.

Lane City Reservoir is a proposed off-channel reservoir owned and operated by the Lower Colorado River Authority. Existing and proposed conveyance facilities will move water in and out of the reservoir, including pump stations, canals and a river outlet.

Key facts

- Dam-breach modelling was carried out to assess the hazard classification of the dam
- Dam-failure inundation maps were developed for an Emergency Action Plan
- Flood Modeller's 2D TVD solver allowed changes in velocity and water levels to be calculated more accurately
- Flood Modeller's HEC-RAS import tool streamlined the project, allowing existing data to be automatically imported

The undeveloped project site is relatively flat, and the reservoir will be ringed on four sides of a rectangle by a 45-feet-high embankment dam that encloses nearly 1,100 acres of farmland to store 40,000 ac-ft of water. By optimising reservoir operations, Lower Colorado River Authority projects that the new reservoir will add 90,000 ac-ft of firm water supply.

During design, Jacobs performed dam-breach modelling using Flood Modeller to confirm hazard classification of the dam and develop dam-failure inundation maps for an Emergency Action Plan.

Due to the flat terrain, a variety of split flow paths and complex hydraulic interactions between multiple watersheds, channels and floodplains were modelled. Dam-failure floods were also modelled for breaches on each side of the rectangular ring-embankment using a 1D-2D linked model.

Flood Modeller was selected as it provided a range of tools which enabled the modelling team to help avoid model instabilities that can occur within complex hydrodynamic dam-failure models.

The Lane City Reservoir project provided an opportunity to leverage the software's integrated 1D and 2D solvers, particularly the 2D TVD solver which has been specifically developed to model "shock" waves produced by rapid flow from a dam breach. It allows the complex hydraulics of steep changes in velocity and water level to be calculated more accurately, and provides increased stability when compared to other 2D solvers. This feature is especially important for modelling a dam breach flood wave across a flat terrain surface, like that surrounding Lane City Reservoir.

Model development

Using Flood Modeller, 1D model components were used to represented discharge through the dam

Flood Modeller

Jacobs

breach and flows within the Colorado River and 2D model components were used to represent flow across overland areas east and west of the Colorado River, including its floodplains and the adjacent eastern watershed.

The complex interactions between flow areas were represented by linking the 1D and 2D model components, enabling the 1D breach model to be influenced by 2D tailwater effects and 2D overland flow on both sides of the Colorado River to be influenced by the 1D elevations within the Colorado River channel. Each model seamlessly passed flows to the connecting models, responding dynamically to adjacent water depths and flows.

Artist's rendering of Lane City Reservoir embankment

The 1D Flood Modeller model of the Colorado River channel was developed by importing cross sections and other data from two existing, sequential 1D HEC-RAS models of the Colorado River. The HEC-RAS importer tool within Flood Modeller enabled cross-section data from HEC-RAS to be directly imported into Flood Modeller, removing the manual conversion process.

The first model began well upstream of Lane City Reservoir and extended to downstream of Bay City. The second model began at Bay City and extended to the Gulf Coast. The first model used results from the second model as a downstream boundary condition, so the two models were readily linked together without affecting their hydraulic performance.

The 2D models were developed using digital elevation models with a combined spatial domain that covered over 300 square miles. The finest digital elevation models were available with a 3m grid size, but a coarser resolution was selected for modelling most areas.

Contact us

support@floodmodeller.com
+44 (0)845 094 7994
www.floodmodeller.com

Jacobs