

ROLE OF THE MODELING, MAPPING, AND CONSEQUENCES PRODUCTION CENTER

Russ Wyckoff, P.E., CFM, MMC Modeling Lead, Tulsa District, USACE, Tulsa, Oklahoma,
russell.wyckoff@usace.army.mil

ABSTRACT: The goal of the Modeling, Mapping, and Consequence Production Center (MMC) is to provide modeling, mapping and consequence support for all USACE. The Modeling, Mapping, and Consequences (MMC) Production Center is charged with supporting the U.S. Army Corps of Engineers (USACE) Institute for Water Resources (IWR) Risk Management Center (RMC) in the production of hydrologic and hydraulic (H&H) models, economic consequences models, and flood inundation mapping. These models and maps support a risk-based assessment, prioritization, and management framework for the USACE Critical Infrastructure Protection and Resilience (CIPR) and Dam Safety programs. The MMC Production Center also provides critical feedback necessary for the RMC to refine and update USACE guidance and policy within the MMC functional areas. As a virtual team, staffed by USACE employees across the United States, the MMC Production Center also plays an important role in developing and maintaining USACE competency in the Hydrology, Hydraulic, and Coastal Engineering (HH&C) Community of Practice.

INTRODUCTION

The MMC Production Center's current efforts primarily support the CIPR and Dam Safety programs; however the MMC Production Center also supports USACE districts and external agencies. The CIPR and Dam Safety programs share several common requirements for MMC products, including the following: developing models that support the estimation of inundation areas and consequences for dam failure and non-failure scenarios over a broad range of loading conditions and project performance; tabulation of consequences that support national infrastructure protection priority setting within a risk-based portfolio management framework; and development of mapping products that clearly communicate the location of potential inundation areas and the critical facilities and communities at risk. Within the broad range of common requirements discussed above, both the CIPR and Dam Safety programs have specific needs that are met by the MMC Production Center. For example, the Dam Safety Program specifically requires inundation mapping of dam failure and non-failure scenarios. The inundation map product is formatted for publication within USACE emergency action plans (EAPs) and will be used by district dam safety program managers (DSPMs) to coordinate response activities with local emergency response agencies. In contrast, the CIPR Program also requires inundation mapping for EAPs; however, other CIPR Program requirements are more general in nature. These general requirements of the two programs (CIPR and Dam Safety) are met by the MMC geospatial databases and electronic inundation map visualization products produced during the EAP map production process.

PURPOSE

The U.S. Army Corps of Engineers' (USACE) vision is to provide a safe, secure, and more resilient USACE civil works infrastructure. To achieve that vision, the USACE is enhancing its

capacity to prevent, deter, or mitigate the potential for dam failure and improving its preparedness, responsiveness, and rapid recovery capabilities in the event of an attack, natural disaster, and other emergencies. In support of this vision, the USACE Dam Safety Program and Office of Homeland Security (OHS) have tasked the Hydraulics and Hydrology (H&H) Community of Practice to develop consistent dam break flood inundation models, inundation mapping, and consequence estimates for USACE water resource projects. This effort will support national critical infrastructure protection responsibilities under the Critical Infrastructure Protection and Resilience (CIPR) Program and portfolio risk management under the Dam Safety Program. To accomplish these tasks, production teams have been established with virtual staff from across the USACE. These teams consist of hydraulic engineers, Geographic Information System (GIS) specialists, and economists. Operating together, these production teams make up the USACE MMC Production Center

MODELING

H&H unsteady flow models developed using either the Hydrologic Engineering Center's River Analysis System (HEC-RAS) or FLO-2D programs support the estimation of inundation areas and consequences for dam failure and non-failure scenarios over a broad range of real-world loading conditions and project performance. The FLO-2D is being used as an interim tool while other two-dimensional (2-D) modeling tools are being investigated. The modeled inundations for a standard set of failure and non-failure scenarios are being evaluated for a full range of load conditions from a low pool approximated by a 90-percent exceedance duration all the way to the project top of dam elevation. Consequences for each scenario are being evaluated using the program HEC-FIA consequence model. This model incorporates FEMA HAZUS data developed from current census data to determine potential damages due to inundation. When coupled with the flood wave depths derived from the hydraulic modeling, the potential for loss of life is also being determined.

MAPPING

Inundation mapping is developed for each fail and non-failure scenario. Additional mapping products are developed from the hydraulic modeling and include: Google Earth Keyhole Markup Language (KMZ) format files; Geographic Information Systems (GIS) shape files and Environmental Systems Research Institute (ESRI) File Geodatabase formats; and electronic inundation map atlases in GeoPDF and PDF formats. A sample of the Inundation Map Atlas is shown in Figure 1. These KMZ format is an interim product used to quickly review basic model features such as stream centerline, cross sections, and storage areas. The final mapping products will be used to develop a standardized Emergency Action Plan (EAP) map product. These will be provided in hard copy showing failure scenarios for the maximum failure and the normal failure scenarios.

CONSEQUENCES

Infrastructure damage and population estimates will be computed using the hydraulic data and FEMA HAZUS data in the program HEC-FIA. Additional economic analysis will be included to evaluate any items not included in the HAZUS database in order to have a more complete product. Estimates will be tabulated for each scenario and documented as part of the MMC

process and used as evaluating tools during other Dam Safety phases. The data will be updated periodically as new data becomes available.

PRODUCT DISSEMINATION

All MMC Production Center products are available for download by authorized USACE staff via the secure Risk Assessment for Dam Safety II (RADS II) database. Electronic files for all completed projects are consistently organized, named, and documented. The available data includes all hydraulic input and output data, preliminary inundations, profiles, all data used to develop the consequence model, depth grids, structure damages, and all mapping products. The RADS II database format is provided so that all MMC data is available and encourages updates in modeling and analysis.

CONCLUSION

The MMC Production Center goal is to provide standardized models, maps, and consequence estimates for all USACE owned dams. A Standard Operating Procedures (SOP) document is available that list the pertinent processes needed to develop a full MMC production level product. The products are designed to meet the current needs of the CIPR and Dam Safety programs but are also intended to be used by USACE districts and support local needs.

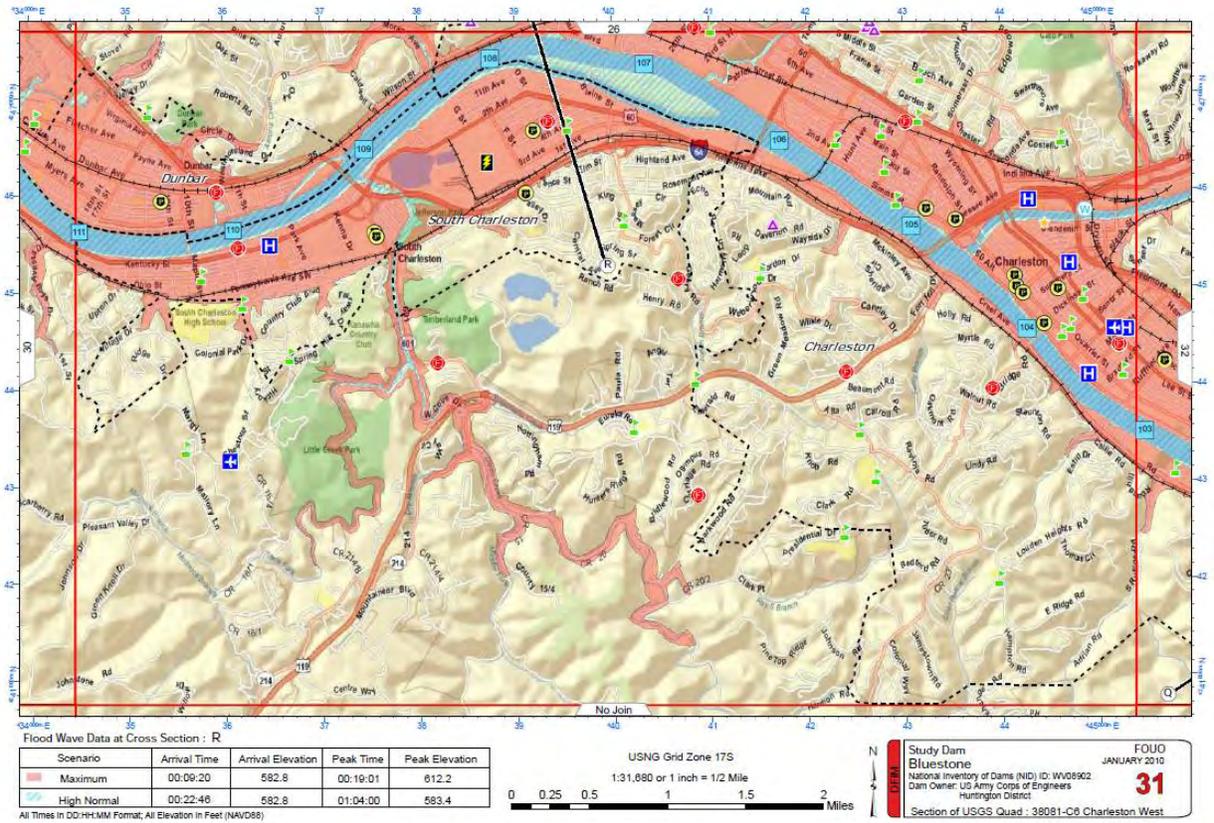


Figure 1. Inundation Map Atlas

REFERENCES

USACE, Modeling, Mapping and Consequences Production Center, “Modeling, Mapping, and Consequences Production Center Standard Operating Procedures (FINAL_DRAFT)” MMC Steering Committee, Headquarters, USACE, March 2010

USACE, “Critical Infrastructure Security Program Dam Break Emergency Action Plan, Inundation Mapping Guidance,” December 2008.

Federal Emergency Management Agency (FEMA) Publication 64, “Federal Guidelines for Dam Safety, Emergency Action Planning for Dam Owners,” Federal Emergency Management Agency (FEMA) U.S. Department of Homeland Security (DHS), Washington, D.C., 2004. Available from: <http://www.fema.gov/library/viewRecord.do?id=1672>.