



FEMA

National Dam Safety Program and Hydrology Needs

Advisory Committee on Water Information (ACWI)
Subcommittee on Hydrology (SOH)

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RiskMAP

Increasing Resilience Together



Agenda

- **FEMA and the National Dam Safety Program**
- **New FEMA Tools to Enhance Dam Safety**
- **Existing Hydrologic Practices**
- **Developing Hydrologic Practices**
- **Hydrologic Needs**
- **Discussion**

FEMA and the National Dam Safety Program

FEMA provides leadership to the National Dam Safety Program to support the efforts of the state and federal agency partners through collaboration to continuously improve dam safety

- **National Dam Safety Program Vision**

“The benefits and risks of dams are understood and risks are managed to improve public safety, economic strength, national security, and to sustain the environment.”

- **National Dam Safety Program Mission**

“Reduce risks to life, property and the environment from dam failure by guiding public policy and leveraging industry best practices across the dam safety community.”

FEMA and the Dam Safety Program

Key FEMA strategies to realize the vision and mission and to reduce the risk to the American public from dam failures

- Promote community and regional resilience
- Increase awareness of dams by the downstream public
- Increase the number and updates of EAPs
- Assess the risk associated with dams
- Increase inspections of dams
- Increase the number of stakeholders trained about dam safety
- Expand the research program
- Translate research products into training
- Achieve the participation of all states in the program

FEMA and the National Dam Safety Program

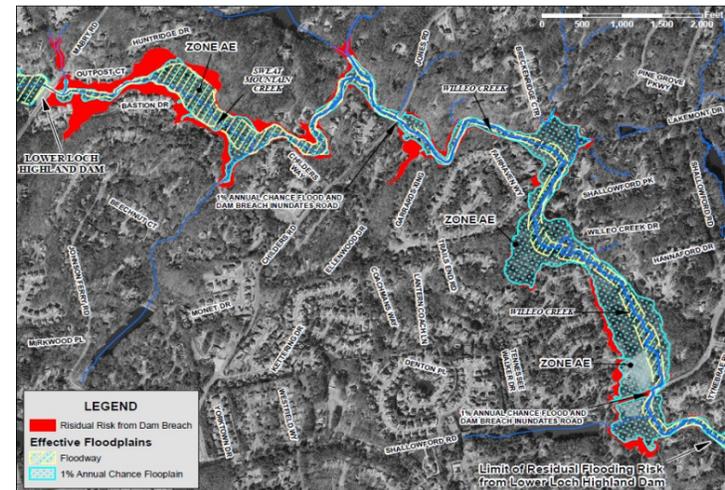
Collaboration among federal agencies, states, and dam owners is the key to increasing dam safety

- FEMA is transferring the coordination of state grants under the National Dam Safety Program to the FEMA Regional Offices to increase the working relationship between Risk MAP and dam safety
- FEMA is partnering with federal agencies to develop new tools for increasing dam safety and the evaluation of the consequences of potential dam failures
- FEMA is developing new products in collaboration with the Risk MAP program to support local government's communication of the potential flood risk related to dam failures and to develop mitigation actions to reduce the risk

New FEMA tools to enhance dam safety

An increasing role for Risk MAP

- Identify the flood hazard associated with potential dam failure incidents
 - Provide flood risk data to local governments for their use in performing dam breach consequence studies and for hazard mitigation
 - Provide tools for local governments to create risk communication products to inform the public the risk living downstream of dams
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- ✓ FEMA non-regulatory products for dams provide dam breach flood zone depth-velocity HAZUS compatible datasets for risk communication and for use in consequence studies and hazard mitigation planning
 - ✓ 2012 NFIP reauthorization authorizes FEMA in coordination with a Technical Advisory Committee the provision to *identify, review, update, maintain, and publish NFIP rate maps with respect to...areas that could be inundated as a result of the failure of a levee, dam, or other flood control structure...*
 - ✓ By identifying the flood hazards related to living downstream of dams, new development may be avoided that results in “hazard creep”



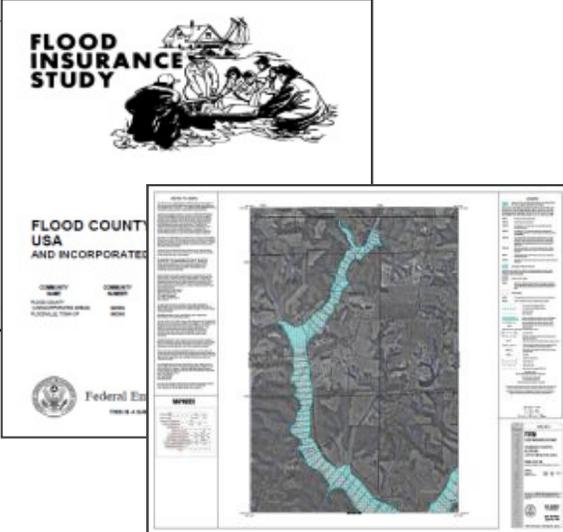
Risk communication map showing the Special Flood Hazard Area superimposed on a dam breach flood inundation zone

Non regulatory products overview

Traditional Regulatory Products

DFIRM Database

- Flood_Hazard_Data
- Political_Boundaries
- Public_Land_Survey_System
- TopoData
- Community_Panel
- L_Comm_Info
- L_MT1_LOMC
- L_Pan_Revis
- L_Pol_FHBM
- L_Riv_Model
- L_Stn_Start
- L_Wtr_Nm
- S_Bfe
- S_DOQ_Index
- S_Firm_Pan
- S_Gen_Struct
- S_Label_Id
- S_Label_Pt
- S_LOMR
- S_Perm_Bmk
- S_Quad
- S_Riv_Mrk
- S_Trnsport_Ar



FLOOD INSURANCE STUDY

FLOOD COUNTY USA AND INCORPORATED

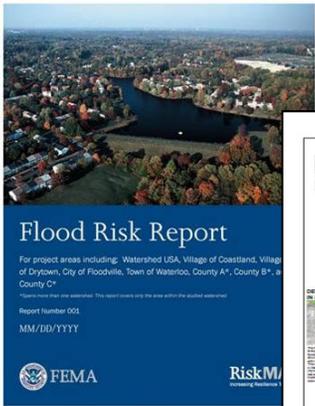
Federal Emergency Management Agency

Traditional products are regulatory and subject to statutory due-process requirements

Non-Regulatory Products

Flood Risk Database

- Community_Panel_Info
- L_Comm_Info
- L_MT1_LOMC
- L_Pan_Revis
- L_Pol_FHBM
- L_Riv_Model
- L_Stn_Start
- L_Wtr_Nm
- S_Bfe
- S_DOQ_Index
- S_Firm_Pan
- S_Gen_Struct
- S_Label_Id
- S_Label_Pt
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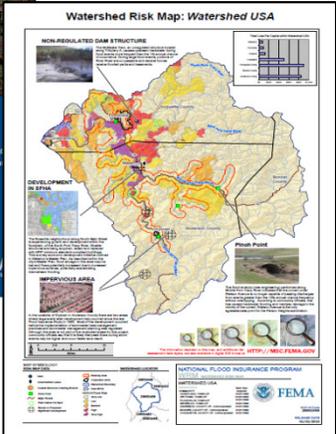


Flood Risk Report

For project areas including: Watershed USA, Village of Coastland, Village of Drytown, City of Floodville, Town of Waterloo, County A*, County B*, and County C*

Report Number 001
MM/DD/YYYY

FEMA RiskMAP



Watershed Risk Map: Watershed USA

NON-REGULATED DAM STRUCTURE

DEVELOPMENT IN SPILL

WATERWAY CROSSING

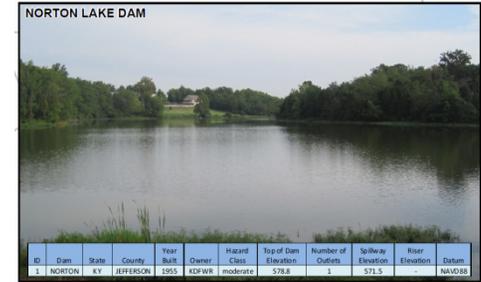
NATIONAL FLOOD INSURANCE PROGRAM

FEMA

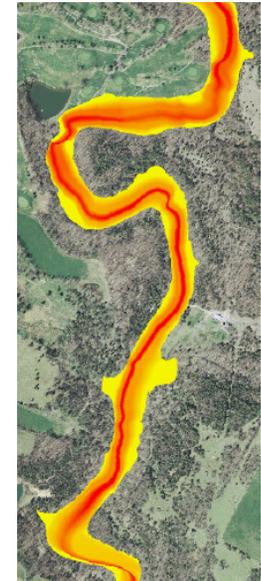
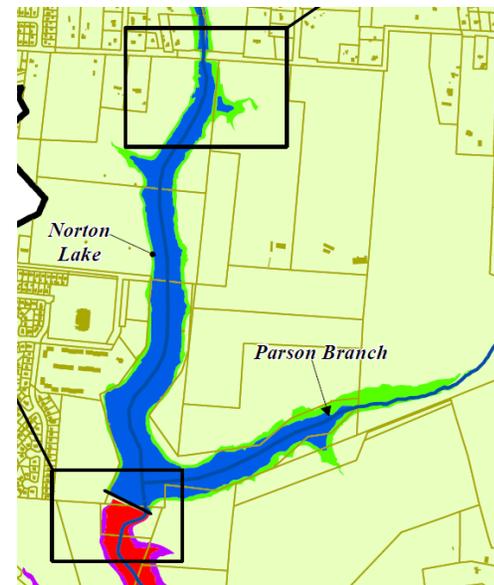
Risk MAP products are non-regulatory and are not subject to statutory due-process requirements

Non-Regulatory Datasets – Dams

- Leverages existing analysis from dam safety officials
- Flexible depending on varying state regulations & methods
- **Datasets proposed:**
 - ✓ Basic dam characteristics
 - ✓ Upstream inundation areas delineated
 - ✓ Downstream inundation areas delineated
 - ✓ Assorted depth and analysis grids (depth, velocity, arrival time)
 - ✓ Easements & critical facilities
 - ✓ Flood risk assessments
 - ✓ Additional Areas of Mitigation Interest categories
- **Data would be used to communicate risks & promote mitigation**



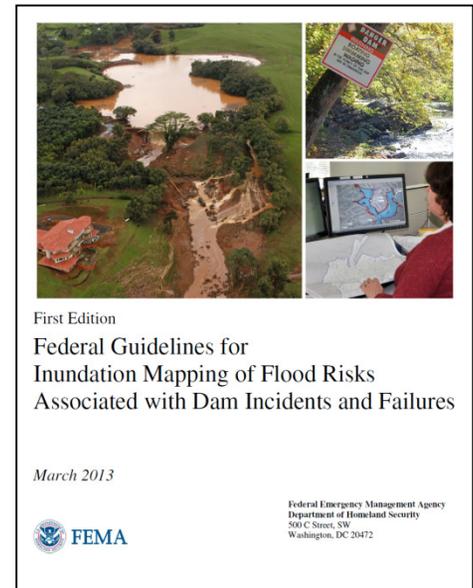
Emergency Spill-Crest Failure: Population at Risk = 450
 Sunny Day Failure: Population at Risk = 266
 100 Year Flood Event: Population at Risk = 167



New FEMA Tools to enhance dam safety

Federal Guidelines for Inundation Mapping of Flood Risks Associated with Dam Incidents and Failures Guidance for State Regulators

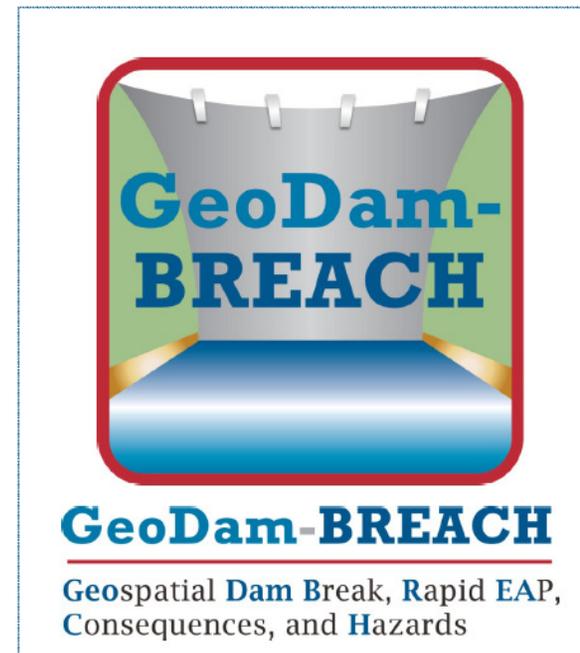
- Provides guidance to States to model dam breach zones and Emergency Action Plans (EAP's) consistently throughout the US
- Presents a tiered dam breach study process that introduces simplified dam breach modeling methodology as a tool to increase the number of dam breach studies and EAP's
- Provides standards for GIS-based dam breach model file naming and EAP map production so Risk MAP can leverage dam breach models and maps for the non-regulatory products



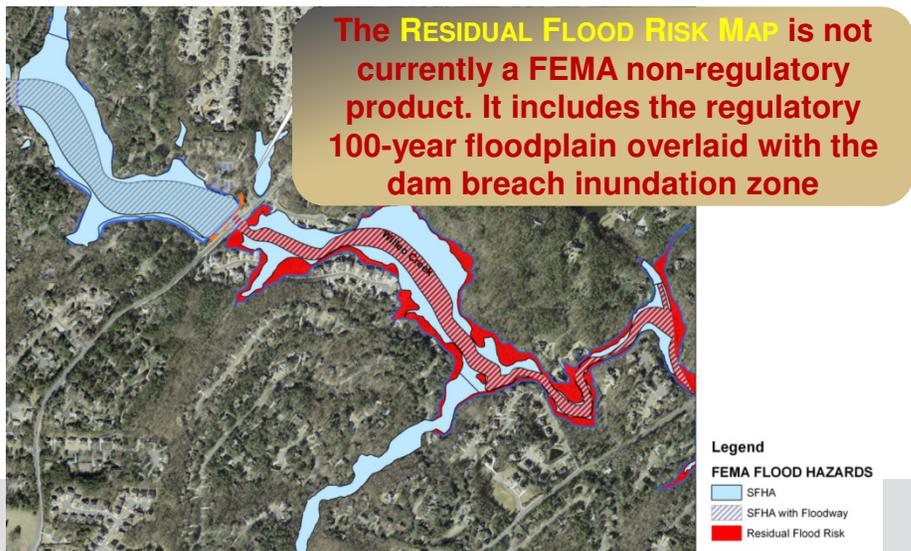
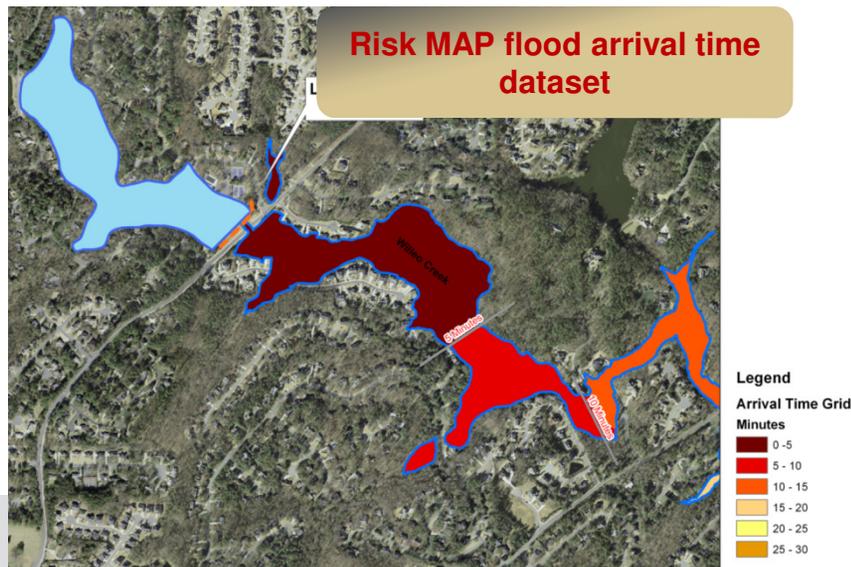
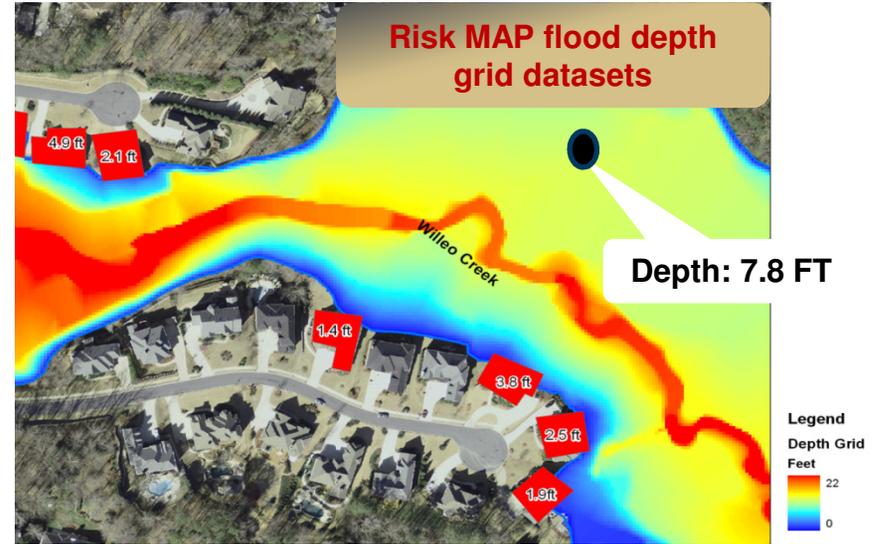
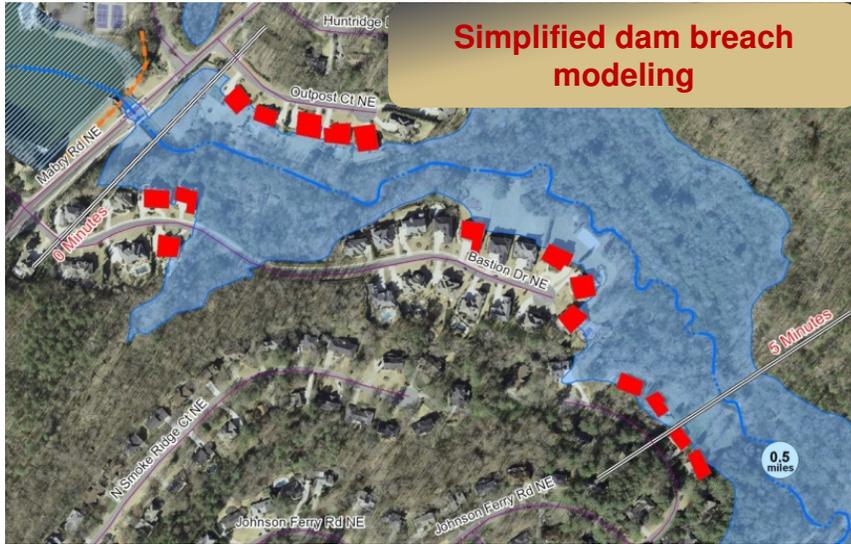
New FEMA Tools to enhance dam safety & RiskMAP

GEOSPATIAL DAM BREACH RAPID EAP, CONSEQUENCES AND HAZARDS (GEODAM-BREACH) TOOLSET.

- Developed in conjunction with the “Dam Breach Guidelines” to also support Risk MAP
- Provides a GIS-based simplified dam breach modeling and mapping capability based on the NWS SMPDBK program in use at River Forecast Centers
- Provides a capability to convert dam breach model results to standard Risk MAP non-regulatory datasets
- Provides a loss of life tool
- Provides semi-automated EAP report and map generation linked to the dam breach model



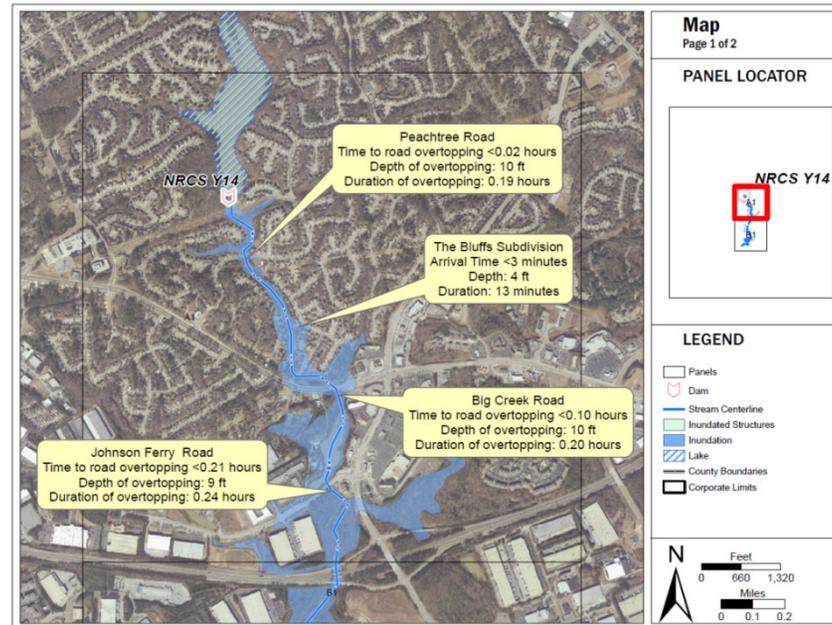
GeoDam-BREACH Toolset Functionality



GeoDam-BREACH Toolset Functionality

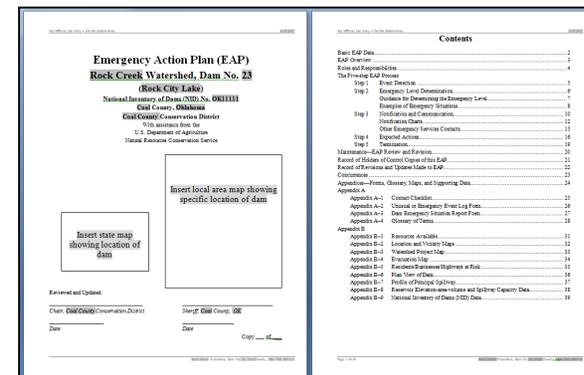
EAP Map Production Tools

- Tools for map paneling to standard sizes
- Standard map collar
- Automatically retrieves data from the dam breach model
- Annotation tools



EAP semi-automated report

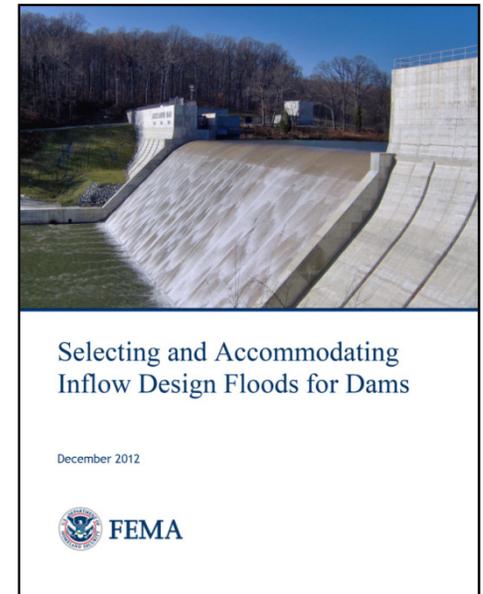
- Provides simple data entry that populates an editable Microsoft Word document



New FEMA Tools to enhance dam safety

Selecting and Accommodating Inflow Design Floods for Dams

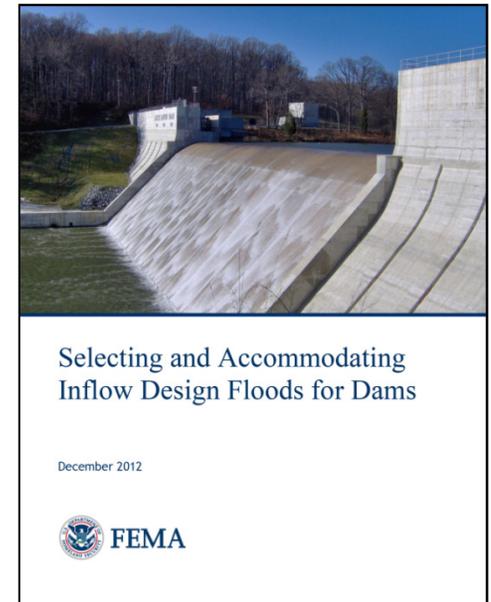
- **Flexible guidance intended for both federal and state agencies to update guidelines at their discretion according to their varied goals and resources**
 - ✓ No Difference between new and existing dams
 - ✓ The application of less stringent criteria for existing “grandfathered” dams is discouraged.
 - ✓ Eliminate Use of “emergency spillway terminology”
 - ✓ References to through flow through “emergency spillways often leads to misconception by the public that an emergency condition exists at a dam when the dam is functioning as designed



New FEMA Tools to enhance dam safety

Selecting and Accommodating Inflow Design Floods for Dams

- **Flexible guidance intended for both federal and state agencies to update guidelines at their discretion according to their varied goals and resources**
 - ✓ Eliminate Size in dam classification
 - ✓ Recommend that dam be classified according to hazard potential or adverse consequences should the dam fail.
 - ✓ Any classification system based on size (height or storage volume) should be discontinued.
 - ✓ Eliminate use of percentage of PMF
 - ✓ Recommend that the practice of using composite criteria and arbitrary percentages of hydrologic events be discontinued.



Existing Hydrologic Practices

Prescriptive event-based hydrology

- In practice for the vast majority of 88,000+ regulated dams
- Hydrology based on a prescriptive frequency event (typically a 50-, 100- yr. etc.) and/or percentage (fraction) of the PMF
- States regulate hazard potential classifications based on the downstream consequences of a dam failure which in turn establishes the inflow design flood (IDF) event for design. Many states allow a risk-based reduction in the IDF
- The current state of the practice requires the development of a hydrograph for the extreme events for dam breach modeling and watershed routing

Hydrologic Issues

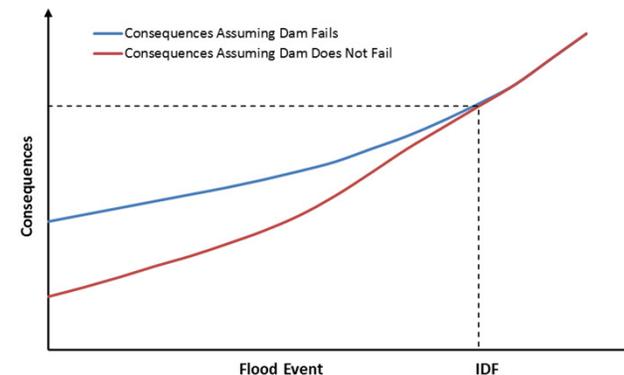
- Unavailability of rainfall-runoff data for extreme events for model validation
- Perceived issues with the age of the NWS HMR PMP publications
- Uneven selection of temporal and spatial rainfall distributions for extreme events
- Lack of consensus and guidance for incorporating future condition hydrology such as potential watershed development and climate change

Existing Hydrologic Practices

Risk-based design

- Established to identify optimal design and stretch limited funding
- Requires the hydrologic evaluation of a range of extreme events and the associated consequences of potential dam failure
- Many States allow the use of incremental damage assessments

“The inflow design flood selected using incremental consequence analysis is the flood above which there is a negligible increase in downstream water surface elevation, velocity, and/or consequences due to failure of the dam when compared to the same flood without dam failure”.



Issues

- Same hydrologic issues as noted on the previous slide
- Increasing importance of a detailed hydraulic model (unsteady and /or 2D model of downstream areas

Developing Hydrologic Practices

Probabilistic Flood Hazard Assessments (PFHA)

- Developing risk assessment methodology pioneered by USACE, USBR, NRC, and FERC to evaluate their dam inventory
- Requires the probabilistic hydrologic evaluation of extreme events up to PMF and beyond
- Requires highly specialized technical expertise and effort
- Hydrologic evaluations for extreme events involves multiple methods including statistical evaluation of extreme flood records, watershed modeling and paleo hydrology

Hydrologic Issues

- Highly technical and costly limiting its use to select high value dams
- Technical expertise does not exist throughout the dam safety community
- Procedures are in development stage for repeatability

Hydrologic Needs

- An internet accessible metadata identifying the availability of extreme rainfall and runoff data with links to sites for downloading propriety (for fee) and public data
- Updated guidance on frequency-based hydrologic evaluations of extreme events
- Updated PMP data and user guidance. Perhaps as the expansion of state specific updates to the NWS HMR publications to reflect current historical extremes and advancements in meteorology since the HMR publications were completed. Guidance for base flow and rainfall temporal and spatial distributions.
- Federal guidance on the incorporation of future conditions hydrology involving projected watershed development
- Continued research and guidance on the appropriate inclusion of climate change on hydrologic evaluations
- Agreement among the ICODS agencies on how the prescriptive event-based approach currently in practice throughout the US coexists with the developing probabilistic risk-based methodology
- Development of guidance and training to the dam safety community on the hydrologic principles of probabilistic considerations in dam design and dam safety

Discussion

National Dam Safety Awareness Day

Dam Safety is a Shared Responsibility



FEMA