



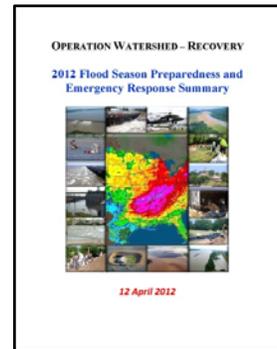
# 2011 MR&T POST FLOOD EVALUATION

Prepared by S.D. Whitney, 7 January 2013

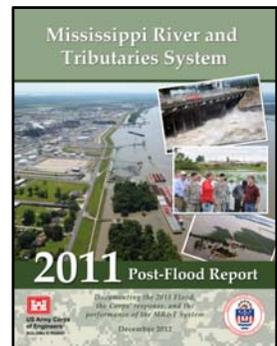
The MR&T Post Flood Evaluation was largely executed from August 2011 through December 2012 as a concentrated effort to investigate and document the performance of the MR&T system and how the entire Mississippi River Watershed was managed as a system during the historic Mississippi River Basin Flood Event that extended from March through July 2011. The purpose of this evaluation was to (1) assess MR&T system performance, (2) identify and prioritize recapitalization requirements for system components necessary to repair the MR&T system for future events, and (3) assess effectiveness or areas of improvement for water control communication and coordination across the watershed. The resulting documents will be a valuable resource for system management, operation and improvements. They will also serve as a reference guides for future flood risk management.

With over 1.5 years of intensive data collection, evaluation, writing and review, three key documents were produced as part of the MR&T Post Flood Evaluation. These documents are intended to serve as educational tools and reference points for our citizens, decision makers and future flood fighters. Facts, figures and lessons learned from the 2011 flood serve to hasten and guide our endeavors to rebuild and improve the MR&T project, ensuring continued safety and security of our citizen's lives and livelihoods.

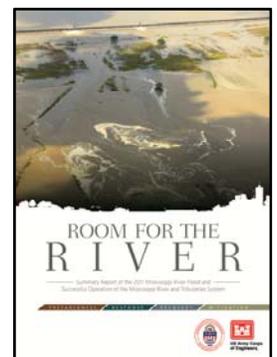
- (1) **APRIL 2012:** a 50-page handbook entitled “*2012 Flood Season Preparedness and Emergency Response Summary*”. This document was developed to capture in general terms, the efforts the Mississippi Valley Division (MVD) U.S. Army Corps of Engineers (USACE) took to manage and mitigate risks associated with the great flood of 2011 and in preparation for the next flood event. This handbook was designed as a useful tutorial for a number of innovative mapping products and web-based tools available to educate, inform and elicit action with respect to inherent flood risks following one on the largest flood events on record. Intended Audience: Flood Risk Management Professionals, Decision Makers and Flood Fighters



- (2) **DECEMBER 2012:** a 350 page technical document entitled “*MR&T 2011 Post Flood Report: Documenting the 2011 Flood, the Corps’ Response, and the performance of the MR&T System*”. A series of ten Appendices provided several thousand pages of supporting data and documentation are provided on accompanying CD. This comprehensive internal technical assessment evaluates the performance of individual MR&T System components and how well the individual components were utilized and operated as a system to manage the complex set of risks presented by the 2011 Flood. The report concludes with recommendations for improvements and future studies to aid MR&T recovery efforts and future system operation, management, and flood fight activities. Intended Audience: Flood Risk Management Professionals, Decision Makers and Flood Fighters.



- (3) **DECEMBER 2012:** a 32 page summary document entitled “*Room for the River*” provides a colorful series of images and condensed narratives on intriguing facts, figures and lessons learned from the 2011 flood experience and evaluation. The document focuses in on key themes and hot topics surrounding the 2011 Flood and Recovery. Intended Audience: Community/State/Federal Leaders, Congressionals, Media and General Public





## KEY MR&T TALKING POINTS

- The Mississippi River and Tributaries (MR&T) project is one of the world's most comprehensive and successful flood control and navigation systems.
- More than a dozen significant floods have tested the MR&T over the past eighty years, but none as extensively as the 2011 record flood.
- The system contains pre-flood deficiencies of which some were not tested by the flood and remain a risk. An example of such underlying/residual risks relates to the 11 percent of the MR&T System on-going construction efforts that may continue for decades.
- In 2011, the MR&T system performed as designed by accommodating the river while using only 85 percent of its design capacity. Yet at the same time, not a single life was lost.
- More than \$230 billion in flood damages were prevented by the MR&T during the 2011 record flood.
- Since its inception, the MR&T system is credited with preventing \$612 billion, or in excess of half a trillion dollars, in cumulative flood damages. At an investment level of \$14 billion, those savings result in a \$44 return on every \$1 invested.
- We owe a debt of gratitude for the wisdom, tenacity and efforts of our forbearers who devised, funded, constructed and maintained this innovative system that has proven so beneficial to so many for so long.
- We extend our sincere appreciation to the thousands of local land owners, levee boards, cities, states and other partners who desperately fought the flood fight alongside us and who continue to stand with us during the path to recovery.
- After more than 1.5 years of evaluation and documentation, the expansive MR&T 2011 Post Flood Report and the condensed "*Room for the River*" booklet will serve as educational tools and reference points for our citizens, decision makers and future flood fighters.
- Facts, figures and lessons learned from the 2011 flood serve to hasten and guide our endeavors to rebuild and improve the MR&T project, ensuring continued safety and security of our citizen's lives and livelihoods.
- The U.S. Army Corps of Engineers and Mississippi River Commission, working hand-in-hand with our strong partners, continue to keep an ear to the past, maintain a hand on the present and project a steady voice for our nation's bright and productive future.



# Operation Watershed - Recovery

## Responding to the Historic Mississippi River Flood of 2011

### MR&T 2011 POST FLOOD EVALUATION



## KEY FINDINGS AND CONCLUSIONS

Based on a holistic view of the 2011 Flood and the performance of the MR&T System, the following conclusions may be drawn regarding the system:

- The 2011 Flood was one of the largest on record, particularly in the lower reaches of the Mississippi River.
- Although it was one of the largest floods, much of the extreme rainfall was concentrated, resulting in range of interior flooding issues including drought-like conditions on the lower end of the system.
- Flood fighting was a key measure during the flood. The Corps assigned approximately 1,000 staff to the flood and spent nearly \$60M from March to August when Emergency Operations were underway.
- The flood fighting techniques employed at a tactical level were generally successful in maintaining the integrity of the primary FRM System. An exception is the construction of ring dikes around sand boils and seeps. Some locations reported the throat of the sand boil moving outside the ringed area and requiring re-ringing. This is typically caused by “bleed” channels located too high in the ring dike or missing entirely. The Flood Fight Manuals require updating to provide clearer instructions on ringing sand boils and overall flood fighting terminology and techniques.
- Tie-in issues (floodwall to high ground) have been studied and tested extensively in the aftermath of Hurricane Katrina, and recommendations for tie-in designs are available in the Corps Armoring Manual dated November 2011. As these recommendations are implemented, these types of problems should become less frequent.
- The operation of the MR&T System, as a whole, was adequate to minimize flood impacts. This includes the operation of gates, reservoirs, spillways, and diversions located throughout the System.
- There were 24 reservoirs utilized during the flood with only 5 of them being an MR&T component. The use of the 24 reservoirs ranged from simply monitoring conditions and reporting to normal control to deviation from normal control. Six of the reservoirs reached at least 100% of their flood control storage. Dam safety ratings of reservoirs influence their operation and could impact flood levels in the future.
- No significant breaches occurred in the primary FRM System. Minor breaches occurred in a private spur levee and as part of the operation of the New Madrid Bend Levee.
- Both MVK MR&T System segments were rated unacceptable (pre-flood) requiring extra diligence during 2011 flood fight operations. An “unacceptable” rating occurs when the condition of one or more components may prevent the system segment from performing as designed.
- One of seven MVM MR&T System segments was unacceptable (pre-flood). This increased to four systems post-flood.
- None of six MVN MR&T System segments were rendered unacceptable (pre or post flood).
- The system contains pre-flood deficiencies of which some were not tested by the flood and remain a risk. An example of such underlying/residual risks relates to the 11 percent of the MR&T System on-going construction efforts that may continue for decades.

These conclusions were used to develop a comprehensive and prioritized set of preliminary component-specific recommendations to address the weaknesses and vulnerabilities that were revealed by the 2011 Flood. The report divides these component specific recommendations into three overarching categories (strategic, operational, and technical) to help establish the most appropriate approach to advancing them.



## OVERARCHING RECOMMENDATIONS

The PFR effort identified several key overarching recommendations for the MR&T System. These overarching recommendations capture the main themes of the many detailed recommendations developed through this effort:

- **Use the information from the PFR effort to inform repair of the MR&T System.** Use 2011 MR&T System performance, damage, and risk assessment information developed through the PFR and other efforts to help establish appropriate repair processes. This includes efforts focused on improving levee resiliency, confirming level of protection, sharing best practices, and developing system repair plans using risk-informed decision making.
- **Use the information from the PFR effort to inform completion of the MR&T System.** Information from the PFR effort should be used to aid in the development of a plan to complete the remaining 11 percent of the MR&T System not yet constructed. Information that would provide insights into this include MR&T performance, changing river hydraulics, improved levee engineering, economics and associated risks, environmental and other stakeholder considerations.
- **Update Operation Plans/Manuals, Communications Plans, and SOPs using information from this PFR, external inputs, AARs, etc.** Use information developed through the PFR effort, AARs, external inputs, and further studies to inform the update and enhancement of MR&T operation and flood fight plans/manuals, SOPs and regionally standardized communication plans. These efforts would focus on improving both internal and external MR&T related operations during major flood events and would involve refinement of existing processes and utilization of new technologies. Example efforts may include enhancing flood fight operations with newly developed tools and examining the potential need to update operations plans for key MR&T FRM structures.
- **Regionally standardize communication approaches and products with MR&T System floodway and backwater area stakeholders.** Use feedback from stakeholders, lessons learned, best practices, and new technologies to develop regionally consistent communication approaches, tools and products to improve understanding, reduce impacts and improve collaboration during future floods. The Interagency Recovery Task Force offers great potential to make this a coordinated multi-agency effort.
- **Evaluate the need to conduct an updated flow line study for the MR&T System.** Use 2011 hydraulic flood data and associated MR&T component performance to evaluate the need for an updated flow line study for the System. Physical and hydraulic changes in the river system and complex flow patterns at Morganza, Bonnet Carre, and the Old River Control Complex should be examined to determine if a change in flow line data or water control plans is warranted.
- **Coordinate a regional “triage” effort to prioritize, refine and implement the recommendations identified in the MR&T System Post Flood Report.** The next steps in advancing the preliminary MR&T recommendations in this report will utilize the existing regional program management structure and process to further screen, combine, prioritize, refine, and develop detailed scopes for recommendation implementation. This process is vitally important due to the need to establish coordinated MR&T improvement, regional priorities, and because there is limited funding available to accomplish these tasks.

Many of the recommendations developed through this effort are considered preliminary and have not yet been fully scoped or vetted. The next steps in their advancement will include further screening, regional prioritization, refinement, detailed scoping, and analysis. Some of the recommendations provided are already moving forward (e.g., BPNM operation assessment, examination of river flow changes, etc.) and will continue to be advanced. The process of implementing the PFR recommendations will result in improved performance of the MR&T System and further reduce flood risks within the Lower Mississippi River Valley.