

# 2011 Floods

## Science Efforts of the U.S. Geological Survey

**2011** proved to be a record-setting year for flooding in the central United States, with floods that extended from headwater streams in the Rocky Mountains, to trans-boundary rivers in the upper Midwest and Northern Plains, to the deep and wide sand-bedded lower Mississippi River. The U.S. Geological Survey (USGS), as part of its mission, collected extensive information during and in the aftermath of the 2011 floods to support scientific analysis of the origins and consequences of extreme floods. The information collected for the 2011 floods, combined with decades of

past data, enables scientists and engineers from the USGS to provide syntheses and scientific analyses to inform emergency managers, planners, and policy makers about life-safety, economic, and environmental-health issues surrounding flood hazards for the 2011 floods and future floods like it. USGS data, information, and scientific analyses provide context and understanding of the effect of floods on complex societal issues such as ecosystem and human health, flood-plain management, climate-change adaptation, economic security, and the associated policies enacted for mitigation.

*USGS data, information, and scientific analysis provide context and understanding as to the effect of floods on complex societal issues....*

### Societal Question Pertaining to Flooding

Among the largest societal question is “How do we balance agricultural, economic, life-safety, and environmental needs in and along our rivers?” To address this issue, many scientific questions have to be answered including the following.

- ◆ How do 2011 weather and flood conditions compare to the past and what can we reasonably expect in the future for flood magnitudes?
- ◆ What is the “natural” hydrology of these watersheds and how have they been changed?
- ◆ How do rivers change during floods and what effects do they have on the natural and built environment: conversely, what effects do the natural and built environments have on rivers and floods?
- ◆ Do floods contribute to the transport and fate of contaminants that affect human and ecosystem health?

### USGS Science Efforts in Response to the 2011 Floods

Starting with more than 7,500 real-time streamgages nationwide, the USGS has a large base of streamflow data that enables accurate accounting of flooding in real-time along with assessments of the aftermath of flooding. From the long-term data, statistical analyses can be done on the flood peaks and volumes of water conveyed in a river system. These analyses are used to evaluate the magnitude and frequency of similar, large floods. In 2011, hundreds of USGS streamgage locations reported record or near-record peak streamflows and flood volumes.

Water quality, sediment transport, biologic and ecosystem characteristics, and physical river characteristic (such as channel morphology and stream hydraulics) data were collected by USGS at a number of locations throughout the central United States during 2011. These data enable assessment of the constituent transport, channel and floodplain response to the flooding, and ecosystem

### Selected Planned USGS Flood 2011 Circular Report Chapters

- ◆ General Weather Conditions and Precipitation
- ◆ Peak Streamflow and Flood Volumes
- ◆ Annual Exceedance Probabilities
- ◆ Effects of Regulation on the Missouri River Hydrograph
- ◆ Changes in Hydraulics and Stage-Streamflow Rating Curves
- ◆ Concentrations and Fluxes of Water-Quality Constituents in the Missouri River
- ◆ Ecosystem Aspects of the 2011 Flooding in the Lower Mississippi River Basin
- ◆ Sediment Transport and Budget for the Missouri River
- ◆ Geomorphic Effects on the Missouri River
- ◆ Monitoring Critical Infrastructure
- ◆ Hydraulics of the Mississippi/Ohio/ Birds Point-New Madrid Floodway
- ◆ Geomorphic Change Resulting from the Activation of the Birds Point-New Madrid Floodway

and environmental health changes in the aftermath of the 2011 floods.

As part of its flood science efforts, USGS plans to produce a report in the Circular series, with individual chapters documenting selected data and scientific analysis topics. These individual chapters will be available as they are published, beginning in 2012.