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Memorandum

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WATER MISSION AREA POLICY MEMORANDUM NO. 2011.01

Subject: PROGRAMS AND PLANS--Policy and Guidelines for Response, Documentation, and Reporting of Flood Events

The purpose of this memorandum is to provide policy and guidance to U.S. Geological Survey (USGS) Water Science Centers (Centers) regarding their responsibilities before, during, and after riverine and coastal flooding.

Priority Flood Activities

The USGS, as the nation's premier earth science agency, is expected by cooperators, emergency management agencies, news media, and the public to provide hydrologic information prior to, during, and after flooding, with a particular expectation that USGS will disseminate near real-time flood data and flood summaries on the World Wide Web. The role of the USGS related to floods response activities has greatly expanded over the years as commitments at all levels of government have increased.

Accordingly, Centers must prepare for and respond decisively and consistently to all flood events. One crucial step toward ensuring that USGS's basic flood responsibilities are met is to clearly describe the flood-related products and services that Centers are expected to provide. During flood events, Centers must give priority to:

1. ensuring that streamgages critical to the needs of cooperators and emergency management agencies are functioning,
2. verifying and extending stage-discharge ratings at active streamgages through discharge measurements based upon priority given in the Center's Flood Plan, and
3. keeping near real-time stage and discharge information accurate and up-to-date in NWISWeb.

For the purpose of describing a Center's flood responsibilities; it is useful to categorize flood events as follows:

Category I Flood: Flooding in one or more river basins (8-digit hydrologic cataloging units) that result in peak streamflows with probabilities greater than 2-percent annual exceedance probability (AEP) (formerly known as the 50-year flood).

Category II Flood: Flooding in one or more river basins that results in peak streamflows generally in the 2 percent to 1 percent AEP range lasting less than 2 weeks in duration for all locations or weather-related storm-surge or tsunami-induced flooding that results in widespread inundation of coastal property.

Category III Flood: 1) Flooding in one or more river basins that results in peak flows that have an AEP of less than 1 percent; 2) Flooding in one or more river basins that results in peak streamflows generally in the 2 percent to 1 percent AEP range that last more than 2 weeks in duration for a large part of the watershed(s) (8-digit hydrologic cataloging units); 3) a localized flood that results in numerous deaths and extensive property damage; or 4) weather-related storm-surge or tsunami-induced flooding that inundates a large area of coastline resulting in large amounts of property damage and/or loss of life. Usually a Category III flood event will result in a Federal disaster declaration.

Accurate categorizations of flood events are difficult at the onset of flooding and normally only become possible as the event unfolds. A listing of the continuum of Center flood responsibilities has been prepared and is shown in tables 1, 2, and 3. It should be noted that some of the "During" and "After" flood responsibilities involve data collection and/or analysis that are considered extraordinary activities, resulting in extraordinary costs and therefore beyond what a Center might be able to fund with their existing resources. Extraordinary flood activities are denoted with a “1” in tables 2 and 3. In addition, during Category II and III flooding, there may be extraordinary costs incurred by a Center in the conduct of keeping streamgages operational and rating curves updated. These costs are eligible for consideration of reimbursement, but not guaranteed. Attachment 1 provides clarification about extraordinary costs. Funding of extraordinary costs is discussed under “Funding Sources and Tracking Expenses” below.

Funding Sources and Tracking Expenses

Historically, Centers have assumed responsibility for determining, documenting, and reporting the occurrence, magnitude, and frequency of extreme hydrologic events in the United States. This expectation coupled with the decreasing certainty of supplemental funding sometimes places Centers in financial risk during major floods (Category II and III floods). To minimize the financial risk, Centers will work with their Regional Executive (REx), in concert with the National Flood Coordinator (NFC) and Mission Area leaders, to attempt to secure funds for the extraordinary flood costs at the lowest administrative level possible. If extraordinary costs (incurred and projected) are expected to approach 5 percent of a Center’s net (after overhead removed) streamgage program funding and efforts to cover extraordinary costs at lower administrative levels have not been fully successful, the NFC and REx will bring the funding need before both the Water and Natural Hazards Associate Director (AD) in an attempt to manage financial resources. If necessary, the NFC, Rex and ADs may bring the issue to the Hazard Response Executive Committee (HREC) for guidance and potential funding alternatives. HREC is chaired by the USGS Deputy Director with the mission to provide executive direction,

oversight, and support to USGS managers in responding to major hazard events. The charter for HREC can be found at: http://www.usgs.gov/emergency/docs/hrec_charter.pdf . To ensure a consistent consideration and treatment of extraordinary flood costs, the definition of the extraordinary flood costs and routine flood costs are defined in Attachment 1.

Centers should conduct extraordinary flood activities with knowledge and approval of the REx**.** For those extraordinary flood activities which involve discontinued stations and miscellaneous sites, only the minimum number of discontinued stations or miscellaneous sites needed to adequately define the extent, magnitude, and frequency of an event will be considered for funding assistance at administrative levels beyond the local Center. The minimum number of locations will be determined by consensus of the Center Surface Water Specialist, Water Science Field Team Surface Water Specialist, NFC, and other appropriate Office of Surface Water (OSW) staff.

The USGS has national guidelines and procedures for tracking expenses associated with hazard responses. Centers should work with their Regional Management Officer to utilize current procedures described in USGS Instructional Memoranda (IM) to track extraordinary flood costs.

Summary

When major flood events occur, Centers are called upon to perform tasks beyond the routine role of keeping streamgages functional and making streamflow measurements. Similarly, a Center's traditional post-flood duties have expanded as a result of Federal, State, and local governments' heightened commitment to rapid delivery of assistance to flood victims. The magnitude and extent of flooding and associated toll on life and property, customarily dictate the appropriate level of effort necessary for a Center to fulfill their mission responsibilities. These responsibilities include providing accurate, timely stream-stage and streamflow information before and during flooding and, afterward, documenting the setting, causes, and hydrologic significance of the flooding. A Center, in appropriate consultation and collaboration with the REx, NFC, and HREC, will continue to be the primary source for fulfilling the role of flood data gatherer, interpreter, and disseminator to meet both societal and scientific needs.

References

Rantz, S.E., 1982, Measurement and computation of streamflow, U.S. Geological Survey Water-Supply Paper 2175, 631 p.

2 Attachments

Distribution: A, B, DC, CD, REXs, AD

This memorandum supersedes WRD Memorandum No. 2000.12, dated July 20, 2000

Table 1. —Before Flooding tasks to be performed by the Centers as part of their hydrologic data and information program
Prepare and maintain a flood plan, making it easily accessible to USGS personnel via the intranet.
Establish a Center Flood Coordinator (CFC) and someone to interact with the media. Ensure the CFC is fully knowledgeable in how to use the appropriate mechanisms to fully engage the National Weather Service River Forecast Center (RFC) (such as NWSChat)
Update the peak flow file annually.
Identify streamgages where stage and discharge information are critically important to cooperators and emergency management agencies during floods.
Work with the RFC to identify critical model points that coincide with USGS streamgages to familiarize Center personnel about those streamgages which may need emergency rating extensions during a major flood in support of the RFC. See attachment 2 for detailed guidance on rating extensions.
Develop a program to properly extend stage-discharge ratings at all RFC forecast locations to the 0.5 percent AEP flood level. Centers may use NSIP funds to extend ratings. Guidance for rating extentions is provided in Rantz (1982, p334)
Maintain all streamgages (including stage-only stations) equipped with telemetry (satellite, telephone, VHF radio, etc.) on NWISWeb.
Periodically test existing redundant systems for receiving and processing real-time flood data, including hot-backup LRGS data retrieval and NWIS-RT data processing. Review backup sensors, data loggers, and transmission sources at streamgages and alert Center IT staff to non-standard NWIS update needs during floods.
Conduct or participate in interagency coordination meetings for the purpose of explaining the Water and Natural Hazards Mission Areas responsibilities and develop sound working relationships with emergency management officials and key water resource program managers and technical staff.
Develop means to quickly disseminate flood information to governmental agencies that are likely to access USGS data during flood events. ***Examples include: il.water.usgs.gov/flood , in.water.usgs.gov/flood ,and NWSChat (utilized heavily in the Mississippi River basin)***
Work with Office of Communications to develop and implement proactive interagency, news media, and public emergency communications products designed to provide timely flood information and explain our role in monitoring and analyzing flood data.
Pre-arrange for assistance (mutual aid) from other Centers for those times when flood response efforts exceed local resources, including: field, office, and communications/reporting assistance.
Make connection with the FEMA regional office and Corps of Engineers Districts to discuss ways USGS can assist them during and after major floods. FEMA may have particular interest particularly with flood inundation mapping and flood frequency characterization. USGS has an active flood-inundation mapping group (see http://water.usgs.gov/osw/flood_inundation/)

Table 2.—During Flooding tasks and potential tasks for Centers to perform by Category of flooding			
	Flood Category		
Task	**I**	**II**	**III**
Assess the category of flooding and then notify Project Alert either by email (GS-W_Project_Alert@usgs.gov) or using the Web: http://water.usgs.gov/project_alert/alert_form.html	X	X	X
Alert the USGS National Flood Coordinator (NFC) about the flooding. Flood or storm team coordination conference calls may be held. For coastal flooding, the storm team lead will be notified and involved in all coordination conference calls.	X	X	X
Activate interagency, news media, and emergency communication procedures. Use NWSChat where appropriate, particularly to push rating changes to the appropriate National Weather Service River Forecast Center (RFC).		X	X
Monitor stage data transmissions frequently to provide initial quality assurance of provisional data and identification of problems at critical streamgages. In the event a streamgage is destroyed, depending on availability, an OSW-owned Rapid Deployment Gage (RDG) may be requested by visiting the following HIF Web site: http://1stop.usgs.gov/uo/	X	X	X
Assign field teams to visit malfunctioning streamgages, assess and correct problems. If necessary, establish an alternative method of determining and reporting stage data from critical streamgage sites.	X	X	X
Obtain direct measurements of extreme flows at active streamgages to verify existing ratings or provide information for the modification of emergency rating extensions. Communicate rating changes to appropriate cooperators including RFC and Corps of Engineers offices	X	X	X
Document the measurement section used and what type of measuring instrument(s) worked at that magnitude of streamflow for future reference.	X	X	X
Extend stage-discharge ratings to new peak stages based on new discharge measurements and provide the information to requesting agencies as soon as possible. Do emergency rating extensions as necessitated by flood emergency (see attachment 2).	X	X	X
To determine or verify the areal extent of flooding, determine peak flow at selected discontinued streamgages and miscellaneous sites by direct flow measurement or flag sufficient high-water marks to obtain indirect measurement of streamflow after floods recede. [1]		X	X
Compile table of peak flood information, including location, historic peak of record, peak stage, peak streamflow, date and time, and estimate of AEP. This table can be easily modified for ready communication with cooperators, NFC, and other agencies. Consider adding a link on the Center real time NWIS page.	X	X	X
Discuss with the Regional Executive (REx) and NFC the potential funding sources outside the Center. REx and NFC will		X	X

[1] Unless funded by the Center or Cooperator, requires approval to be considered for cost reimbursement

determine if involvement of Hazard Response Executive Committee (HREC) is warranted			
Table 1 continued on next page			
Table 2. (contd)—During Flooding tasks and potential tasks for Centers to perform by Category of flooding			
	Flood Category		
Task	**I**	**II**	**III**
Flag peak high-water marks for selected stream reaches for use in determining flood profiles as part of a flood study. In addition, consider flagging high-water marks in locations where historic peak stage data are available such at historic buildings along rivers. [1]		X	X
Work with the USGS Geospatial Liaison(s) assigned to your State or Region to assess the need, availability, and cost of obtaining and sharing the appropriate aerial and satellite imagery. [1] If warranted, invoke the International Charter Space and Major Disasters in order to obtain free satellite imagery of the event.		X	X
Collect sediment and/or water quality samples at selected stations, as called for in Center flood plan. [1]	X	X	X

Table 3—After Flooding tasks and potential tasks for Centers to perform based on category of flooding			
	Flood Category		
Task	**I**	**II**	**III**
Repair and replace damaged streamgage structures and equipment.	X	X	X
Conduct indirect measurements of streamflow where appropriate to the USGS mission. [2]	X	X	X
Finish compilation table of flood peaks at active streamgages, discontinued streamgages, and miscellaneous sites. Table should include location, historic peak of record, peak stage, peak streamflow, date and time, period of record, rank, and estimate of AEP (for those locations where streamflow is known within a reasonable accuracy (+/- 20 percent).		X	X
Obtain NWS estimates of precipitation that caused or contributed to the flooding, along with rainfall AEP estimates when they become available.		X	X
Conduct surveys of high water profiles and document flooding extent along selected stream reaches. [1]		X	X
Prepare proposals and conduct special analysis, studies, and reports as deemed appropriate.[1]		X	X
Participate, as appropriate, in disaster-recovery and disaster assessment meetings and reconnaissance trips upon request from emergency-management or similar agencies (for example, FEMA State EMA's, COE, BOR, NWS).		X	X

[2] Unless funded by the Center or Cooperator, requires approval to be considered for cost reimbursement

Attachment 1: Definition of Routine and Extraordinary Flood Costs

To ensure consistent cost accounting during flood activities, it is important to establish guidelines and definitions of routine versus **extraordinary flood costs**.

Routine Flood Costs

- Regular (non overtime) salary expenses expended in the operation and maintenance of streamgages by Center staff who are routinely involved in the operation and maintenance of streamgages, regardless of the Category of flooding (I, II, III). This includes conducting field and office work for indirect measurements.
- Vehicle expenses incurred in the operation and maintenance of existing streamgages during Category I flooding.
- Travel expenses by Center staff that are routinely involved in the operation and maintenance of streamgages during Category I flooding.
- Salaries for the Center Management Team for all Categories of flooding.

Extraordinary Flood Costs

- The regular salary expenses expended in the operation and maintenance of existing streamgages during Category II and III flooding by Center staff who are **NOT** routinely involved in the operation and maintenance of streamgages.
- The regular salary expenses expended in the operation and maintenance of existing streamgages during Category II and III flooding by non-Center staff brought through mutual aid arrangements.
- Overtime salary expenses expended in the operation and maintenance of existing streamgages during Category II and III floods by all Center and non-Center USGS staff.
- Regular and overtime salary expenses expended in the installation of rapid deployment streamgages, streamflow measurements, flagging of high water marks, indirect measurements, or other data activities during Category II and III floods at ungaged locations.
- Regular and overtime salary expenses expended in support of other agencies through liaison activities (for example, providing staff liaison at the National Weather Service River Forecast Centers).
- Vehicle expenses incurred in the operation and maintenance of existing streamgages by all staff during Category II and III flooding.
- Travel costs by all Center and non-Center USGS staff involved in the operation and maintenance of streamgages during Category II and III flooding.
- Replacement cost for equipment damaged during Category II and III flooding.
- All expenses (salary, travel, vehicle, publishing, aerial imagery, etc) incurred in the conduct of post-flood studies and reporting for Category II and III floods.

Attachment 2: Guidance for extension of stage-discharge ratings through extrapolation at USGS streamgages

Occasionally, a Center will get a stage-discharge rating extension (rating extension) request from the National Weather Service (NWS) or other cooperator. The Center staff will decide what level of effort should/will be made to extend a rating. Centers should base their professional judgment, techniques, and decisions for rating extension on existing U. S. Geological Survey technical guidelines given in Rantz (1982, p 334). Rantz states "…only as a last resort should the rating curve be extrapolated beyond a discharge value equal to twice the greatest measured discharge." Rantz further explains that any extrapolations higher than twice the highest measured streamflow should only be done with more detailed hydraulic analysis. Center staff generally should not extend ratings much beyond the observed range in stage unless detailed hydraulic analysis is conducted to guide the rating extension. Following is guidance for conducting rating extensions at all streamgages during both non-flood and flood scenarios.

Scenario 1: No imminent or ongoing flooding– The National Streamflow Information Program (NSIP) full implementation plan calls for ratings to be extended at all the NWS forecast streamgage sites to the 0.5-percent annual exceedence probability flood level, but until NSIP is completely funded (or a cooperator provides funding) we should not broadly be extending ratings at streamgages. Centers should review the list of streamgages where rating extensions have been requested and in those situations where the requested stage range of the rating extension is contained within the hydraulic control defined by existing measurements and the stage range does not result in an extrapolated discharge that is greater than twice the highest streamflow measurement requirement, a straight-line rating extension with proper scale offset is acceptable should the Center desire to conduct the rating extension. The Graphical Rating and Shift Application Tool (GRSAT) should be used for the rating extension. The Center will decide whether or not to make the newly extended rating the active rating in the National Water Information System. A Center can choose not to make it the active rating by not giving the rating a starting date. The Center also has the option to conduct a detailed hydraulic analysis. If a Center agrees to make an extension, the Center must communicate the rating uncertainty in terms of control features, existing measurement information, and other factors to those who are provided the rating extension.

Scenario 2: Imminent or ongoing flood – In this situation, the Center receives a request from the NWS or a cooperator to extend a rating and public health and safety could be at risk if a rating extension is not conducted. The decision as to perform the rating extension rests with the Center Director. The Center should understand there is no guarantee of additional funding to cover the cost to extend a rating and have to factor that into decisions about how much unfunded work they are willing to do. In those cases where the Center cannot complete the request for a rating extension, The Water Resources Discipline (WRD) National

Flood Coordinator (NFC) should be notified and a decision will be made as to whether the rating extension will be done by Office of Surface Water (OSW) staff. If channel geometry is available, it is recommended that hydraulic analysis using step-backwater methods be conducted to guide the rating extension. Often times, no geometric data are available and the hydrologist or hydrographer needs to make their best effort using professional judgment. GRSAT should be used for the rating extension, but the newly extended rating should NOT be made the active rating in NWIS. This can be accomplished by not giving the rating a starting date. If a Center agrees to extend a rating, the Center must communicate its potential uncertainty in terms of control features, existing measurement information, and other factors to those who are requesting the rating extension.

Summary: OSW does not require WSCs to extend ratings when not funded to do so. However, there is a need for USGS to provide an overall good response in support of other Federal agencies (such as NWS, U.S. Army Corps of Engineers) and other cooperators during flooding. The Center needs to balance between not being funded to perform rating extensions as part of NSIP and being responsive during flood emergencies. As such, if the Center has been requested to extend a rating without funding and is unable to develop the extension due to funding limitations, the Center should contact OSW to explore the possibility of using OSW resources and staff to extend the rating.

References:

Rantz, S.E., 1982, Measurement and computation of streamflow: Volume 2. Computation of discharge, U.S. Geological Survey Water-Supply Paper 2175, 631 p.