Prepared in cooperation with the U.S. Army Corps of Engineers

Annual Exceedance Probabilities and Trends for Peak Streamflows and Annual Runoff Volumes for the Central United States During the 2011 Floods

Chapter D of
2011 Floods of the Central United States

Professional Paper 1798–D

U.S. Department of the Interior
U.S. Geological Survey

Front cover. Top photograph: View of flooding from Nebraska City, Nebraska, looking east across the Missouri River, August 2, 2011. Photograph by Robert Swanson, USGS.

Right photograph: Flooding along the Missouri River at Blair, Nebraska, June 28, 2011. Photograph by Kevin Richards, USGS.

Back cover. Looking upstream to spillway at Garrison Dam, June 11, 2011. Photograph by Nathan A. Stroh, USGS.

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U.S. Geological Survey

U.S. Department of the Interior
SALLY JEWELL, Secretary

U.S. Geological Survey
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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
acre	4,047	square meter (m^2)
acre	0.4047	hectare (ha)
acre	0.4047	square hectometer (hm^2)
acre	0.004047	square kilometer (km^2)
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
acre-foot (acre-ft)	1,233	cubic meter (m^3)
acre-foot (acre-ft)	0.001233	cubic hectometer (hm^3)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Water year is the 12-month period from October 1 to September 30 and is designated by the calendar year in which it ends. For example, water year 2011 is from October 1, 2010 to September 30, 2011.

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Abstract

During 2011, excess precipitation resulted in widespread flooding in the Central United States with 33 fatalities and approximately $4.2 billion in damages reported in the Red River of the North, Souris, and Mississippi River Basins. At different times from late February 2011 through September 2011, various rivers in these basins had major flooding, with some locations having multiple rounds of flooding. This report provides broadscale characterizations of annual exceedance probabilities and trends for peak streamflows and annual runoff volumes for selected streamgages in the Central United States in areas affected by 2011 flooding.

Annual exceedance probabilities (AEPs) were analyzed for 321 streamgages for annual peak streamflow and for 211 streamgages for annual runoff volume. Some of the most exceptional flooding was for the Souris River Basin, where of 11 streamgages considered for AEP analysis of peak streamflow, flood peaks in 2011 exceeded the next largest peak of record by at least double for 6 of the longest-term streamgages (75 to 108 years of peak-flow record). AEPs for these six streamgages were less than 1 percent. AEPs for 2011 runoff volumes were less than 1 percent for all seven Souris River streamgages considered for AEP analysis. Magnitudes of 2011 runoff volumes exceeded previous maxima by double or more for 5 of the 7 streamgages (record lengths 52 to 108 years).

For the Red River of the North Basin, AEPs for 2011 runoff volumes were exceptional, with two streamgages having AEPs less than 0.2 percent, five streamgages in the range of 0.2 to 1 percent, and four streamgages in the range of 1 to 2 percent. Magnitudes of 2011 runoff volumes also were exceptional, with all 11 of the aforementioned streamgages eclipsing previous long-term (62 to 110 years) annual maxima by about one-third or more.

AEPs for peak streamflows in the upper Mississippi River Basin were not exceptional, with no AEPs less than 1 percent. AEPs for annual runoff volumes indicated less frequent recurrence, with 11 streamgages having AEPs of less than 1 percent. The 2011 runoff volume for streamgage 05331000 (at Saint Paul, Minnesota) exceeded the previous record (112 years of record) by about 24 percent.

An especially newsworthy feature was prolonged flooding along the main stem of the Missouri River downstream from Garrison Dam (located upstream from Bismarck, North

Flood inundation along the Souris River in Minot, North Dakota, June 27, 2011. Photograph by Brent Hanson, USGS.

Dakota) and extending downstream throughout the length of the Missouri River. The 2011 runoff volume for streamgage 06342500 (at Bismarck) exceeded the previous (1975) maximum by about 50 percent, with an associated AEP in the range of 0.2 to 1 percent.

In the Ohio River Basin, peak-streamflow AEPs were less than 2 percent for only four streamgages. Runoff-volume AEPs were less than 2 percent for only three streamgages. Along the lower Mississippi River, the largest streamflow peak in 91 years was recorded for streamgage 07289000 (at Vicksburg, Mississippi), with an associated AEP of 0.8 percent.

Trends in peak streamflow were analyzed for 98 streamgages, with 67 streamgages having upward trends, 31 with downward trends, and zero with no trend. Trends in annual runoff volume were analyzed for 182 streamgages, with 145 streamgages having upward trends, 36 with downward trends, and 1 with no trend. The trend analyses used descriptive methods that did not include measures of statistical significance. A dichotomous spatial distribution in trends was apparent for both peak streamflow and annual runoff volume, with a small number of streamgages in the northwestern part of the study area having downward trends and most streamgages in the eastern part of the study area having upward trends.

Introduction

Major flooding at various times during 2011 caused 33 fatalities and approximately $4.2 billion in damages in areas spanning from the Canadian border to the Gulf of Mexico and the Rocky Mountains to the Allegheny Mountains (National Oceanic and Atmospheric Administration, 2011). Affected river basins included parts of the Red River of the North (frequently referred to simply as Red River throughout this report), the Souris River, upper Mississippi River, Missouri River, Ohio River, and middle and lower Mississippi River, in the Central United States (fig. 1) and the southern Prairie Provinces of Canada. The flooding began in earnest in February and March in the lower Missouri River, middle and lower Mississippi River, and Ohio River Basins. Snowmelt flooding began during late March and early April in the Red River and upper Mississippi River Basins, followed by successive flooding in the lower Mississippi River, and Missouri River Basins (second round) from mid-April through August (Holmes and others, 2013). The Souris River, which is a major tributary to the Red River, experienced a second round of flooding in June 2011. The 2011 floods in the Central United States were caused by one or more combinations of the following: saturated antecedent soil conditions, higher than average streamflow at the beginning of 2011, rapid melting of the larger than normal snowpack, excess precipitation on snowpack, or simply excess precipitation (Holmes and others, 2013). In some parts of the Central United States, precipitation amounts in excess of 20 inches in a 2-week period (700- to 1,000-percent above normal) were observed (National Oceanic and Atmospheric Administration, 2012a) following snowpack greater than 150 percent of normal in parts of the northern U.S. Rocky Mountains (National Oceanic and Atmospheric Administration, 2012b). During the 2011 flooding, the U. S. Geological Survey (USGS) made more than 2,300 measurements of streamflow at USGS streamgages and other strategic river locations to document peak streamflows, stages, and runoff volumes at locations throughout the Central United States (Holmes and others, 2013).

Purpose and Scope

In 2011, the USGS operated a network of more than 7,800 streamgages throughout the United States, providing data that are vital for human, economic, and environmental welfare. As the principal federal agency charged with documenting water resources of the United States and assessing natural hazards, it is important to document floods, particularly those of exceptional proportions. Streamflow data from USGS (U. S. Geological Survey, 2013) and other agencies, with some data existing back to the late 1800s, are important to place context to magnitudes of the 2011 floods. This report provides broadscale characterizations of annual exceedance probabilities and trends for peak streamflows and annual runoff volumes (frequently referred to simply as runoff volume throughout this report) for selected streamgages in the Central United States in areas affected by 2011 flooding. Streamgages considered are the same as those considered by Holmes and others (2013), who documented peak streamflows, stages, and runoff volumes for the 2011 floods.

Overview of 2011 Precipitation and Flooding

Vining and others (2013) documented the general weather conditions and precipitation contributing to the 2011 flooding in the Central United States. Severe flooding in the Mississippi River and Red River Basins during spring and summer 2011 resulted from weather conditions during December 2010 through July 2011 that were affected, in part, by a La Niña climate pattern. This pattern is characterized by cooler than average sea surface temperatures in the central and east-central equatorial Pacific Ocean and a strong high pressure area in the northern Pacific Ocean. This pattern tends to produce cooler and wetter than normal weather conditions over the western and north-central regions of the Mississippi River and Red River Basins, and often warmer and drier than normal weather conditions over the southern Mississippi River Basin.

Figure 1. Major river basins of the Central United States along with other locations affected by flooding streams from February to September, 2011 (modified from Holmes and others, 2013).

Precipitation patterns across the Red River and Mississippi River Basins from December 2010 through July 2011 followed the mean position of the jet stream (Vining and others, 2013). During December, January, and February, a southward push of the jet stream steered several low-pressure troughs across the country from the Rocky Mountains into the Ohio River Basin producing copious precipitation. From March through May, a large low-pressure trough dominated the continental States, and a high-pressure ridge was centered near the Gulf of Mexico. This weather combination produced storms with abundant precipitation along frontal boundaries that were steered across the Central United States. During June and July, moisture from the southwestern monsoon and the Gulf of Mexico worked into the Plains States. Low-pressure troughs moving across the country interacted with the moist unstable air; thunderstorm development along frontal boundaries resulted in areas of heavy rain across the Northern Plains States into the Missouri and upper Mississippi River Basins. Excess precipitation fell on already saturated ground and ran off into already full streams and rivers, producing severe flooding in the Mississippi River and Red River Basins during spring and summer 2011.

Holmes and others (2013) documented peak streamflows, stages, and runoff volumes for the 2011 flooding in the Central United States. Flooding began in late February 2011 in the Mississippi River Basin and continued in parts of the Mississippi River or Red/Souris River Basins until September 2011. Some locations received multiple flood pulses; the Souris River received two separate flood pulses, and the lower Mississippi River had three separate flood pulses. Peak streamflow records were broken at 105 streamgages considered by Holmes and others (2013) across the Souris/Red and Mississippi River Basins, with many previous peaks being longstanding records. For example, the 2011 peak streamflow on the Souris River above Minot, North Dakota broke a record set more than 100 years prior. The widespread major flooding in the upper Mississippi River, Missouri, and Ohio Basins in 2011 resulted in record peak streamflows in the lower Mississippi River; in some locations breaking records established in 1927. Records for annual runoff volume were established at 47 streamgages considered by Holmes and others (2013) in the Souris/Red and Mississippi River Basins, with no annual runoff records occurring in the Ohio or lower Mississippi River Basins.

Annual Exceedance Probabilities for Peak Streamflows and Annual Runoff Volumes

Holmes and others (2013) provided rankings of 2011 peak streamflows or 2011 annual runoff volumes for 497 streamgages (fig. 2) in the Central United States for comparison with previous large floods. Although rankings help to illustrate relative magnitudes of the floods, evaluation of future flood risk requires a probability analysis that involves determining parameters needed to estimate a probability distribution from a set of observed streamflow data. The probability distribution relates probability to the magnitude of a certain size flood peak (or annual runoff volume) being equaled or exceeded, from which annual exceedance probabilities (AEPs) can be estimated.

Flooding along the Missouri River at Sioux City, Iowa, at the I-29/Hamilton Street interchange, June 13, 2011. Photograph by Joe Gorman, USGS.

Methods for Probability Analyses

Selection of an appropriate probability distribution and the process for fitting parameters of the distribution may vary depending on the underlying characteristics of the data. For consistency in estimating flood frequencies, Federal agencies follow standard guidelines, known as Bulletin 17B (U.S. Interagency Advisory Committee on Water Data, 1982), which recommended the use of the log-Pearson type III (LPIII) distribution and the "method of moments" for estimating the distribution parameters (mean, standard deviation, and skewness of the data). For USGS streamgages, the peak streamflow and annual runoff data are available from the USGS National Water Information System database (U.S. Geological Survey, 2013).

This report section provides results of probability analyses for both peak streamflows and annual runoff volumes for streamgages considered by Holmes and others (2013). These probability analyses were done to incorporate streamflow data through 2011 using a standardized process, as described herein, for the purpose of broadscale characterization of the relative frequency of occurrence of the 2011 flooding in the Central United States. Results of the frequency analyses are not intended for site-specific applications, for which more rigorous analytical methods involving multiple approaches or reviews of previous probability analyses might be justified, as recommended in Bulletin 17B (U.S. Interagency Advisory Committee on Water Data, 1982). As such, site-specific applications could involve consideration of site-specific circumstances, which could include consideration of other published frequency analyses such as Parrett and Johnson (2003), Sando and others (2008), U.S. Army Corps of Engineers (2001, 2004, and 2010), and Westerman and others (2013).

In many previous flood reports (for example, Chin and others, 1975; Parrett and others, 1993; Holmes and Kupka, 1997), flood probabilities were expressed by listing T-year recurrence intervals for particular flood quantiles (for example, the "100-year flood"), which recently has been discouraged to avoid confusing the general public (Holmes and Dinicola, 2010). The use of an AEP percentage for a flood is instead recommended because of the clear communication that the peak streamflow is being characterized by its probability or chance of occurrence. Users can easily convert from the AEP to the T-year recurrence interval by simply taking the reciprocal of the AEP. For example, a 1-percent AEP flood corresponds to the streamflow magnitude that is equaled or exceeded by a probability (expressed as a decimal) of 0.01 in any given year. The reciprocal of 0.01 is 100, thus the T-year recurrence interval for a 1-percent AEP flood is the 100-year flood.

The reliability of an AEP flood quantile from Bulletin 17B methods may be expressed as a "variance of prediction" that is computed by using the asymptotic formula given by Cohn and others (2001), with the addition of the mean-squared error of generalized skew (Griffis and others, 2004). The variance of prediction varies as a function of record length, the fitted flood-probability distribution parameters (mean, standard deviation, and weighted skew), and the accuracy of the method used to determine the regional skew component of the weighted skew.

Another way to obtain an AEP flood-quantile estimate, besides using Bulletin 17B methods, is to use regional regression equations (RREs), when available (*http://water.usgs.gov/software/nss.html*). RREs are developed by using regression techniques that relate the flood-probability data for many streamgages in a particular region to basin characteristics of streams (Jennings and others, 1994). For any location along a stream (gaged or ungaged), a user can enter basin characteristics (drainage area, basin slope, and so on) as independent variables into RREs and compute various streamflow characteristics, such as the 1-percent AEP flood quantile. The variance of prediction from the regional regression is a function of the RRE and values of independent variables used to develop the streamflow estimate from the RRE. The variance generally increases with departure of actual values from mean values of the independent variables.

Holmes and others (2010) provided detailed discussions regarding expressing the accuracy of RREs in terms of equivalent years of record and suggested that weighting by variance provides a more natural characterization of the underlying uncertainty of the various streamflow estimates. The optimal estimate of the AEP flood quantile for a gaged site is determined by weighting the AEP flood-quantile estimate determined from the Bulletin 17B methods with the AEP flood quantile estimate determined from the RRE. The weights are inversely proportional to the variances of prediction (equation 1), yielding the weighted estimator:

$$LogQ_{P,OPT} = \frac{(Var[RRE] * LogQ_{P,LPIII} + Var[LPIII] * LogQ_{P,RRE})}{(Var[RRE] + Var[LPIII])} \tag{1}$$

where

$Q_{P,OPT}$ is the optimal estimate of AEP flood quantile for a particular probability of flooding (*p*) (U.S. Interagency Advisory Committee on Water Data, 1982, appendix 8),

$Var[RRE]$ is the variance of the RRE estimate of the AEP flood quantile for a particular probability of flooding (*p*),

$Q_{P,LPIII}$ is the Bulletin 17B method estimate of the AEP flood quantile for a particular probability of flooding (*p*),

$Var[LPIII]$ is the variance of the Bulletin 17B estimate of the AEP flood quantile for a particular probability of flooding (*p*), and

$Q_{P,RRE}$ is the RRE estimate of the AEP flood quantile for a particular probability of flooding (*p*).

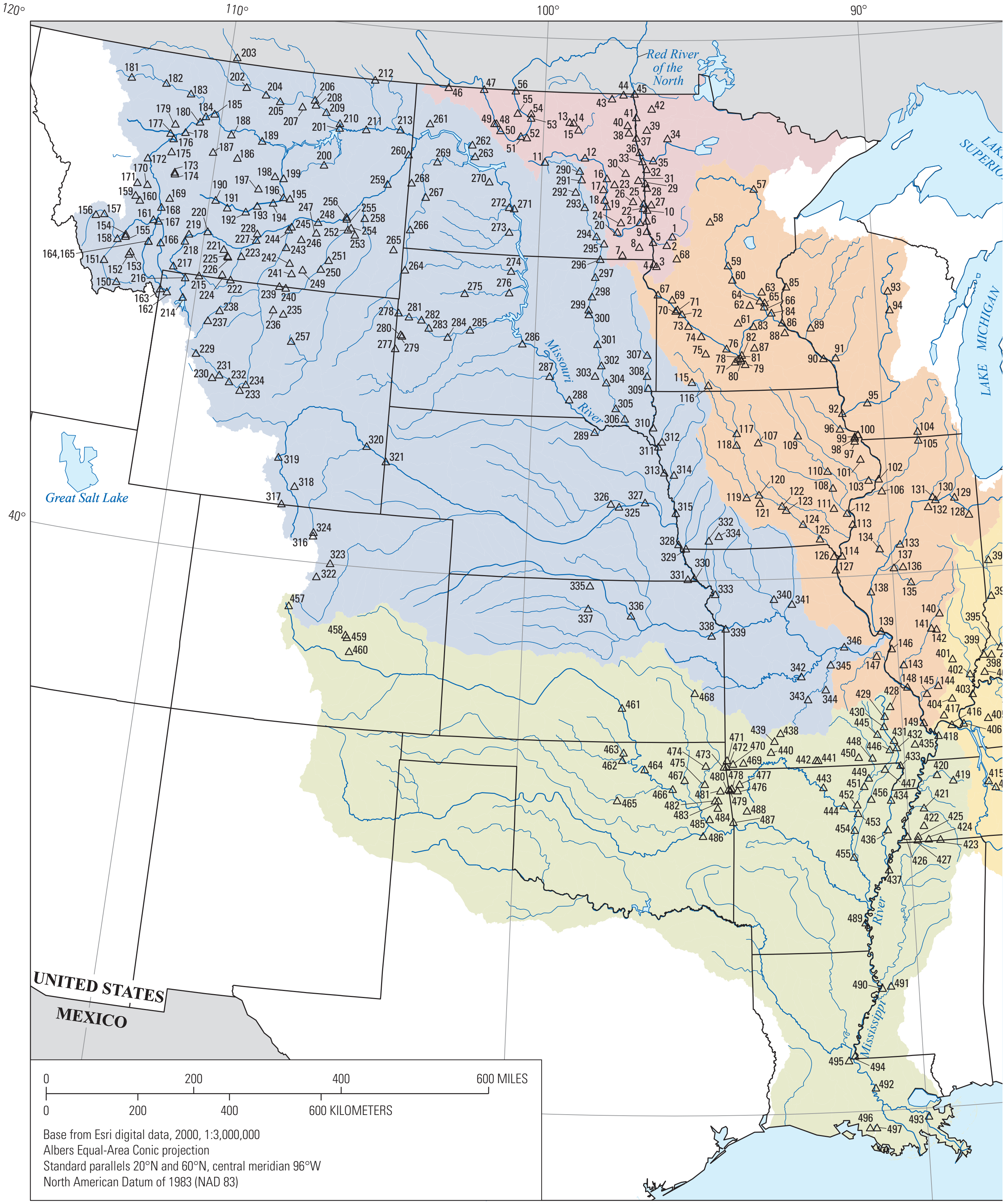


Figure 2. Locations of selected streamgages in the Central United States where flooding took place during February to September, 2011 (modified from Holmes and others, 2013).

Figure 2. Locations of selected streamgages in the Central United States where flooding took place during February to September, 2011 (modified from Holmes and others, 2013).—Continued

Data regarding AEPs for peaks during the 2011 floods are provided in table 1 (at the end of this report) for 369 streamgages in the Red, Souris, upper Mississippi, Missouri, Ohio, and lower Mississippi River Basins. Table 1 also includes data for previous streamflow maxima and rankings of the 2011 streamflow peaks that were previously reported by Holmes and others (2013). Streamgages were chosen either because the AEP for 2011 peak streamflow was anticipated to be less than 10-percent or to allow comparison with past major floods. Although desirable, weighting with data from RREs could not be used in computing optimal AEP flood-quantile estimates for many streamgages, most typically for regulated streamgages, where RREs are not applicable or not available. The table 1 listings for most streamgages include an AEP estimate for the 2011 flood peak and estimates of the AEP flood quantiles corresponding to the 2-percent, 1-percent, and 0.2-percent AEPs, along with their respective 95-percent confidence limits. The AEP estimate for each 2011 flood peak also includes lower and upper bounds for a "typical range" defined by 66.7-percent confidence levels. This typical range is calculated using order statistics and is nonparametric, that is, it does not assume the same underlying LPIII statistical model that is used in fitting the at-site streamflow data for computing the flood-quantile estimates. Thus, for a streamgage where an individual flood magnitude (such as 2011) is especially large relative to the rest of a dataset, the LPIII model-based AEP estimate can lie outside the typical range of AEP for a flood of a given rank within a specified period of record.

AEPs for the 2011 flood peaks are not listed for 48 streamgages, of which AEP flood quantiles are not available for 15 streamgages. AEP flood quantiles are listed for 33 streamgages that were obtained only from RREs or that were extracted from previous floods studies (Parrett and Johnson, 2003; Sando and others, 2008; U.S. Army Corps of Engineers; 2001, 2004, and 2010; and Westerman and others, 2013) that are not inclusive of the 2011 streamflow peaks. Thus, estimation of AEPs from these flood quantiles would not be consistent with AEP estimates throughout the rest of table 1.

For some streamgages in table 1, the number of streamflow peaks used for the AEP analysis was smaller than what was listed for the period of record. There are several possible reasons, of which the most common were use of a shortened analysis period to reflect current (and thus consistent) conditions relative to effects of regulation and exclusion of historic peaks from an analysis. For a few streamgages, the number of streamflow peaks used for the AEP analysis was larger than listed for the period of record, which most commonly was based on comparisons with records for nearby streamgages (U.S. Interagency Advisory Committee on Water Data, 1982). Other reasons for using more peaks for AEP analysis involve other record-extension procedures and adjustments associated with procedures involving use of historic peaks. Sando and others (2008) provided in-depth discussions of procedures used in a statewide peak-flow analysis for South Dakota streamgages. Those procedures are applicable for many of the South Dakota streamgages listed in table 1 and also could be applicable for other streamgages in table 1.

Flood-quantile estimates for annual runoff volumes corresponding to the 4-percent, 2-percent, 1-percent, and 0.2-percent AEPs, along with their respective 95-percent confidence limits, are listed in table 2 (at the end of this report) for 211 streamgages in the Red, Souris, upper Mississippi, Missouri, Ohio, and lower Mississippi River Basins. Table 2 also includes data for previous annual runoff maxima reported by Holmes and others (2013). Weighting with data from RREs could not be used in computing AEP flood quantiles for any of the streamgages because RREs for flood volume typically do not exist. Furthermore, regional skew coefficients do not exist for annual runoff, which precludes weighting of skew coefficients for individual streamgages. AEP ranges for the 2011 runoff volumes are provided (rather than specific AEP estimates) because specific AEP confidence limits for the 2011 runoff volumes cannot be determined.

For some of the 83 streamgages in table 2 that are common with streamgages in table 1, the number of years of annual runoff data is smaller than the length of the peak-flow record used for AEP analysis, most typically because of years when only peak streamflow was collected, interruptions in the continuous streamflow record, or regulation or diversions in the basin affecting what years were used for the peak-flow record analysis (as footnoted in table 1). The period of peak-flow record considered for AEP analysis in table 1 typically was restricted to a period of consistent regulation conditions because of especially large effects that regulation can have on peak-flow conditions. In contrast, effects of regulation on annual runoff typically are small (especially relative to the high flows of interest) and often tend to be offsetting in an annual time series. Furthermore, effects of regulation may be small relative to the effects of the choice of an applicable probability distribution, which may not necessarily be log-normal for some annual runoff datasets. Thus, benefits from increased record length were considered to outweigh minor detriments from inconsistent regulation conditions.

Results of Probability Analyses

Figure 3 shows AEP ranges for peak streamflows during the 2011 floods for streamgages from table 1, and figure 4 shows AEP ranges for 2011 runoff volumes for streamgages from table 2. Inspection of figure 3 indicates that low-probability peak streamflow (small AEPs or large recurrence intervals) occurred throughout large parts of the Mississippi River Basin in 2011. However, inspection of figure 4 indicates that the low-probability runoff volumes were concentrated in the northwestern part of the basin (Red, Souris, and Missouri River Basins); whereas, higher-probability runoff volumes were more prevalent throughout the southern and eastern parts of the basin.

Table 3 provides a summary of results of probability analyses for annual peak streamflows (table 1) and annual runoff volumes (table 2). Within the Red River of the North

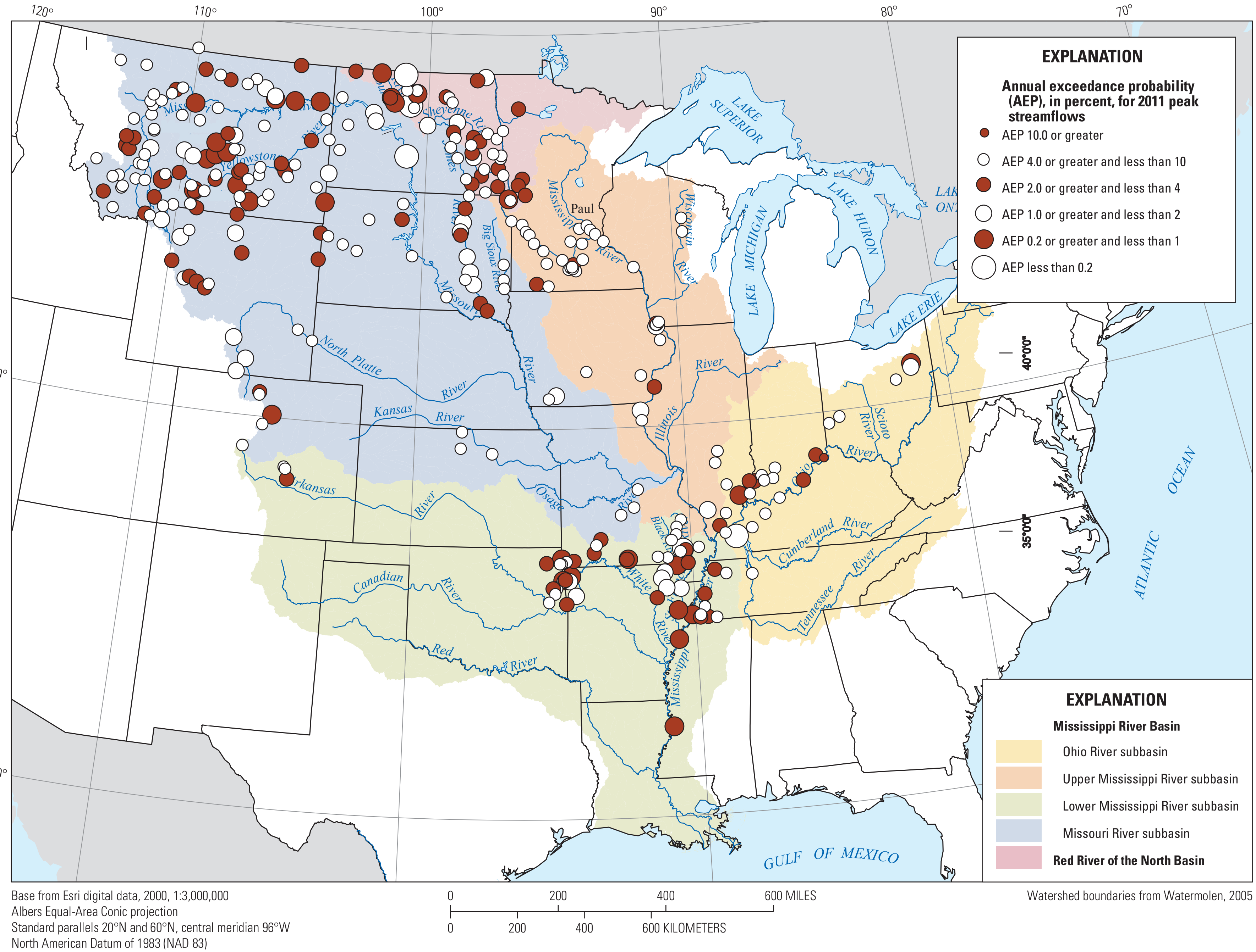
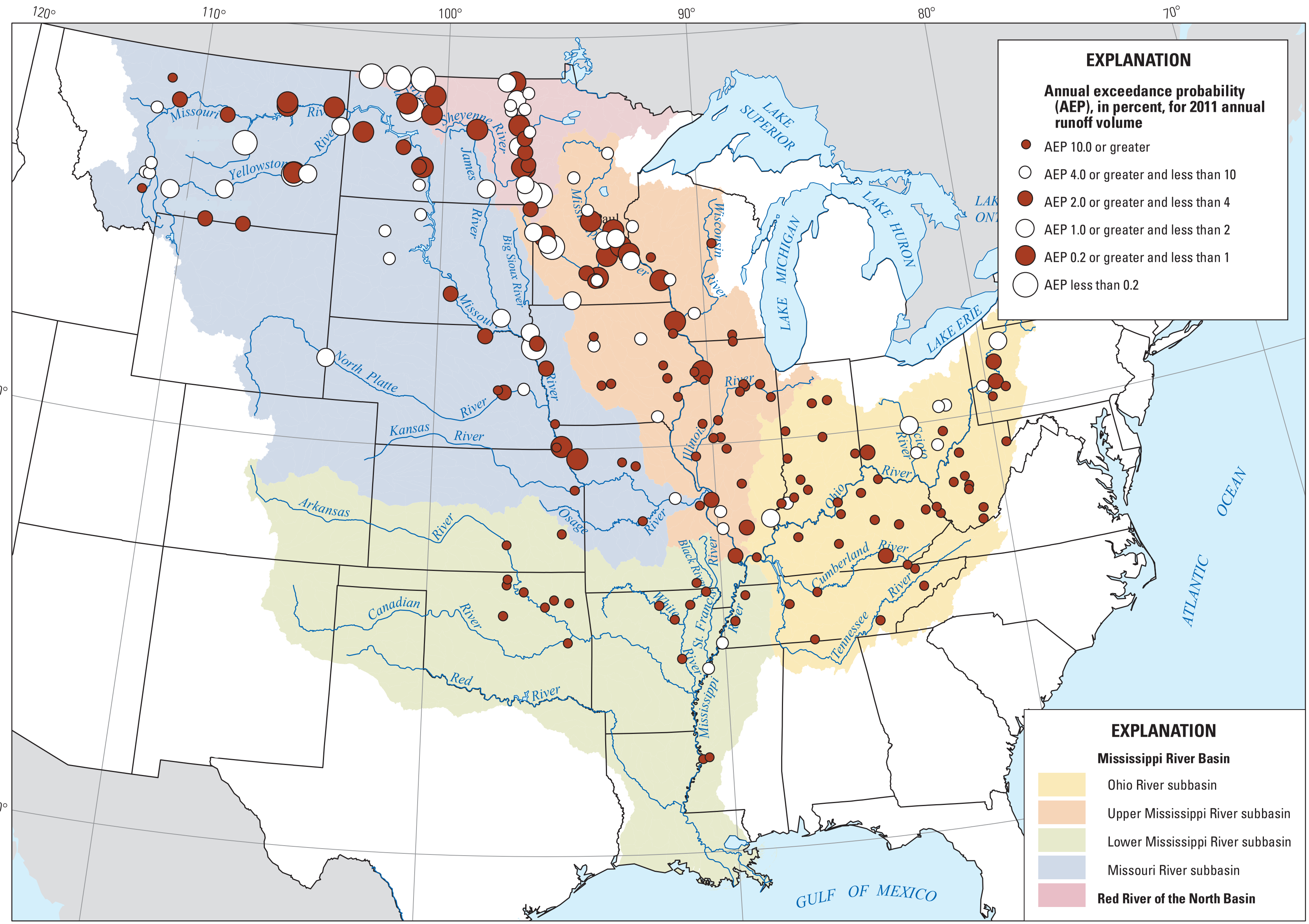


Figure 3. Annual exceedance probabilities for 2011 peak streamflows for selected streamgages in the Central United States affected by 2011 flooding.



Base from Esri digital data, 2000, 1:3,000,000
Albers Equal-Area Conic projection
Standard parallels 20°N and 60°N, central meridian 96°W
North American Datum of 1983 (NAD 83)

0 200 400 600 MILES
0 200 400 600 KILOMETERS

Watershed boundaries from Watermolen, 2005

Figure 4. Annual exceedance probabilities for 2011 annual runoff volumes for selected streamgages in the Central United States affected by 2011 flooding.

Basin, AEPs for 2011 peak streamflows were not exceptionally small, with only 1 of 29 streamgages with computed AEPs having a peak streamflow in the range of 0.2 to 1 percent and 4 in the range of 1 to 2 percent. AEPs for many of the 2011 runoff volumes were small; however, with 2 of 20 streamgages less than 0.2 percent, 5 streamgages in the range of 0.2 to 1 percent, and 4 streamgages in the range of 1 to 2 percent. Magnitudes of annual runoff volumes were exceptional, with all 11 streamgages with AEPs less than 2 percent eclipsing previous long-term (62 to 110 years) annual maxima by about one-third or more. Flooding was caused primarily by melting of a heavy snowpack, with most of the streamflow peaks occurring during April (Vining and others, 2013).

AEP estimates are not included in table 1 for 8 of the 37 Red River streamgages, all of which are along the main stem. One of these is streamgage 05054000 (at Fargo, N. Dak.), for which the largest flow in 111 years of peak-streamflow record (29,500 ft^3/s in 2009) surpassed the 2011 flow of 27,200 ft^3/s. Neither of these exceptional values was considered within the U.S. Army Corps of Engineers (2001) hydrology report for the Red River, which is the source of the quantile estimates in table 1. Those quantile estimates were developed through consideration of many relevant datasets, and in concurrence with other cooperating agencies (including USGS), to be used as a primary source of flood-probability information for the Red River. For this reason, AEPs for 2011 flood peaks are not listed for streamgage 05054000 and the seven other main-stem streamgages along the Red River.

The 2011 flooding in the Souris River Basin was exceptional from all standpoints. Six of 11 streamgages listed in table 1 for the Souris River Basin recorded flood peaks that were more than double the previous peak of record. These six streamgages were among the longest-term streamgages and had 75 to 108 years of peak-flow record. AEPs for these six streamgages were less than 1 percent (tables 1 and 3). AEPs for 2011 runoff volumes were less than 1 percent for all seven

Table 3. Summary of results of probability analyses for selected streamgages in the Central United States for annual peak streamflows (from table 1) and annual runoff volumes (from table 2).

Basin	2011 annual peak streamflows, number of streamgages within annual exceedance probability (AEP) range						Number of sites with AEP	AEP not calcu-lated	Total sites in table 1
	10.0 or greater	4.0 or greater and less than 10	2.0 or greater and less than 4	1.0 or greater and less than 2	0.2 or greater and less than 1	Less than 0.2			
Red River of the North	0	13	11	4	1	0	29	8	37
Souris River	0	3	2	0	4	2	11	0	11
Upper Mississippi River	0	33	5	3	0	0	41	12	53
Missouri River	0	84	37	23	14	2	160	16	176
Ohio River	1	15	5	1	2	1	25	1	26
Lower Mississippi River	0	21	16	8	9	1	55	11	66
Total selected streamgages	**1**	**169**	**76**	**39**	**30**	**6**	**321**	**48**	**369**

Basin	2011 annual runoff volumes, number of streamgages within annual exceedance probability (AEP) range						Number of sites with AEP	AEP not calcu-lated	Total sites in table 2
	10.0 or greater	4.0 or greater and less than 10	2.0 or greater and less than 4	1.0 or greater and less than 2	0.2 or greater and less than 1	Less than 0.2			
Red River of the North	0	5	4	4	5	2	20	0	20
Souris River	0	0	0	0	3	4	7	0	7
Upper Mississippi River	26	12	5	6	10	1	60	0	60
Missouri River	9	10	11	8	8	3	49	0	49
Ohio River	40	6	4	3	0	0	53	0	53
Lower Mississippi River	20	2	0	0	0	0	22	0	22
Total selected streamgages	**95**	**35**	**24**	**21**	**26**	**10**	**211**	**0**	**211**

streamgages in table 2. Magnitudes of annual runoff volumes also were exceptional, with all 7 streamgages exceeding previous maxima (record lengths 52 to 108 years), and 5 of the 7 streamgages exceeding by double or more. The heaviest flooding in this basin generally was in late June and was caused by heavy and widespread rainstorms that followed a heavy snowpack (Vining and others, 2013).

AEPs for peak streamflows in the upper Mississippi River Basin were not exceptional, with no AEPs less than 1 percent, 3 AEPs between 1 and 2 percent, and 38 AEPs of 2 percent or larger (table 3). AEPs for runoff volumes indicated somewhat less frequent recurrence, with 11 having AEPs of less than 1 percent, 11 having AEPs between 1 and 4 percent, and 38 having AEPs of 4 percent or larger. Most of the small AEPs for runoff volume were either along the main stem of the Mississippi River upstream from streamgage 05420500 (at Clinton, Iowa) or in tributaries upstream from streamgage 05331000 (at Saint Paul, Minnesota). The 2011 runoff volume for this streamgage exceeded the previous record (112 years of record) by about 24 percent. Moving downstream, the next three main-stem streamgages (05344500, 05378500, and 05389500) exceeded long-term records by about 4 to 13 percent (table 2).

The Missouri River upstream from Gavins Point Dam at Yankton, South Dakota, is regulated by a series of six large multiuse main-stem dams constructed between 1933 and 1963 to “be operated for the purposes of flood control, navigation, irrigation, power, water supply, water quality control, recreation, and fish and wildlife” (U.S. Army Corps of Engineers, 2006). The total system storage for the six main-stem reservoirs is 73.1 million acre-feet (U.S. Army Corps of Engineers, 2012). Many other dams provide additional regulation on various tributaries throughout the Missouri River Basin.

An especially newsworthy feature of the 2011 flooding in the Central United States was prolonged flooding along the main stem of the Missouri River downstream from Garrison Dam (upstream from Bismarck, N. Dak.) and extending downstream throughout the length of the Missouri River. The 2011 runoff volume for streamgage 06342500 (at Bismarck) exceeds the previous (1975) maximum by about 50 percent, with an associated AEP in the range of 0.2 to 1 percent (table 2). Similarly, new annual runoff records (by about 37 to 42 percent, relative to previous maxima from 1997) were set for the next three downstream main-stem streamgages (06486000, at Sioux City, Iowa; 06813500, at Rulo, Nebraska; and 06818000, at St. Joseph, Missouri). AEPs for the 2011 runoff volumes are less than 1 percent for all three streamgages. However, the 2011 runoff volume for streamgage 06934500 (at Hermann, Mo.) is only about 76 percent as large as the volume for the record flow of 1993 and has an associated AEP exceeding 4 percent. AEPs are not listed for peak streamflows for streamgage 06486000 (at Sioux City, Iowa) and downstream main-stem streamgages because as previously described for the Red River Basin, the flood quantiles in table 1 are from an earlier U.S. Army Corps of Engineers (2004) report.

Flooding along the Red River of the North in Grand Forks, North Dakota, April 13, 2011. Photograph by Brent Hansen, USGS.

Table 3 indicates 39 Missouri River streamgages with peak-streamflow AEPs of less than 2 percent, with all but 16 of these (table 1) occurring between streamgages 06115200 (near Landusky, Montana) and 06342500 (at Bismarck, N. Dak.) and all but 3 of 16 with AEPs of 1 percent or less in this reach. Similarly 12 of 19 streamgages with runoff-volume AEPs less than 2 percent are in the same reach, with 4 of the other 7 streamgages along the main stem of the Missouri River (table 2). The exceptional runoff and flooding in this reach was caused by a combination of melting of a heavy snowpack followed by exceptionally heavy and widespread rainstorms in May and June (Vining and others, 2013).

Missouri River flooding was less exceptional upstream from Landusky, Mont. (streamgage 06115200), where the 1975 runoff volume exceeded the 2011 volume by 3 percent. Four main-stem streamgages upstream from Landusky (all in Montana; 06054500, at Toston; 06090300, near Great Falls; 06090800, at Fort Benton; and 06109500, at Vergelle) have peak-streamflow AEPs exceeding 4 percent. The 2011 runoff volume for long-term streamgage 06090800 (at Fort Benton) exceeds the previous (1894) maximum by about 3 percent; however, the associated AEP is between 2 and 4 percent because of the distribution of the annual-volume dataset.

Within the Ohio River Basin, most of the streamflow peaks occurred during early March to early May, with associated AEPs and runoff-volume AEPs that are not exceptional (table 3). For the Ohio River just upstream from the Mississippi River confluence (streamgage 03611500 at Metropolis, Illinois), the 2011 streamflow peak ranks fourth in 83 years of record, with an AEP of 4.0 percent (table 1), and the 2011 runoff volume ranks 26 of 83, with an AEP of greater than 10 percent (table 2). Throughout the basin, peak-streamflow AEPs are less than 2 percent for only four streamgages, and runoff-volume AEPs are less than 2 percent for only three streamgages.

Especially large streamflow peaks occurred along the lower Mississippi River during May. The largest streamflow peak in 91 years was recorded on May 17 for streamgage 07289000 (at Vicksburg, Mississippi), with an associated AEP of 0.8 percent. Annual streamflow peaks were recorded about a week earlier at two upstream Mississippi River streamgages (07032000, at Memphis, Tennessee and 07047970, at Helena, Arkansas), which exceeded previous maxima by about 8 and 7 percent, respectively, in 83 and 132 years of record, and with associated AEPs of less than 1 percent. Annual streamflow peaks also were recorded about another week earlier at streamgages along the Ohio and upper Mississippi Rivers. The St. Francis and Black Rivers, which have long peak-flow records, also had low-probability floods (AEPs less than 10 percent for 8 of the 10 streamgages on these rivers between station numbers 07036100 and 07072500). Low-probability peaks also were recorded for several streamgages along the Illinois River; however, associated periods of record generally are short. Of 55 lower Mississippi River streamgages considered for AEP analysis for peak streamflow, 10 had AEPs less than 1 percent (table 3). AEPs for 2011 runoff volumes for all of the lower Mississippi River streamgages were larger than 4 percent, which resulted from extensive drought conditions in areas to the west. For water year 2011, the Arkansas River at Tulsa, Oklahoma (streamgage 07164500) recorded the smallest runoff volume in 86 years of record, and other streamgages along the Arkansas, Canadian, and Big Black Rivers recorded unusually small runoff volumes.

Trends in Peak Streamflows and Annual Runoff Volumes

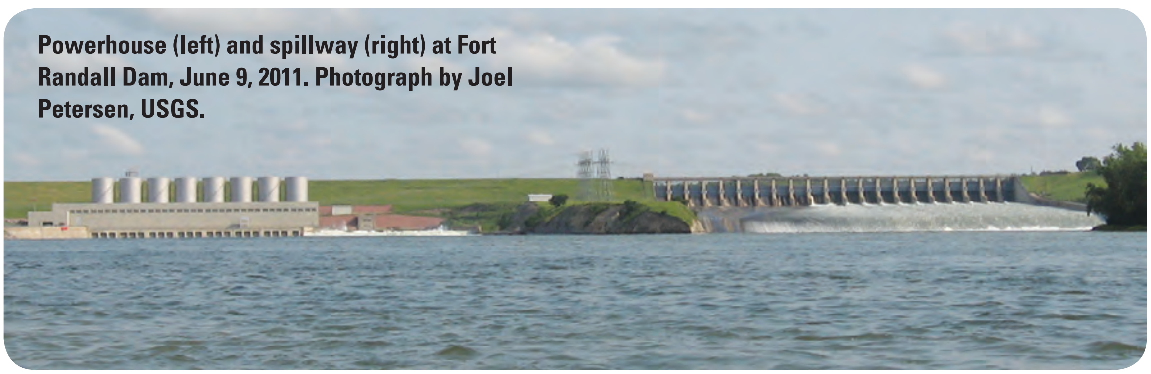
Knowledge regarding streamflow trends can be useful to water-resource and water-hazard planners and managers for many purposes. Various investigators have suggested trends in both peak streamflows and annual runoff volumes for areas that include the Central United States (Anderson and others, 2008; Hirsch, 2011; Holmes and others, 2010). This report section provides results of trend analyses for peak streamflows and annual runoff volumes for selected streamgages considered in tables 1 and 2. The trend analyses were done to provide a broadscale perspective regarding trends for these specific streamgages, which were selected by Holmes and others (2013) to characterize flooding conditions in the Central United States. As such, most of these streamgages recorded high-flow conditions in 2011. Trend analysis emphasizing streamgages that had 2011 flooding has the potential to produce a small bias towards upward trends (as opposed to downward trends). Thus, results of the trend analyses should be considered a broadscale characterization, as opposed to a rigorous study of trends that would include in its design the selection of streamgages that would eliminate any artificial bias.

Methods for Trend Analyses

Annual time-series data for peak streamflows (table 1) and annual runoff volumes (table 2) were analyzed to determine the presence and associated magnitudes of trends through time for selected streamgages. Methods of analysis followed those of Holmes and others (2010), who reported on trends in peak streamflows relative to 2008 flooding in the Midwestern United States. Only trend magnitudes were computed with no effort to include null hypothesis significance testing, as much discussion in recent literature has focused on problems with null hypothesis significance testing (Nichols, 2001) and the issue of long-term persistence (Cohn and Lins, 2005) that may be erroneously taken as statistically significant trends. The omission of significance testing is an indication that results are reported for descriptive and comparative purposes, and may suggest avenues for future detailed research.

Trend magnitudes were computed based on the Sen slope estimator (Sen, 1968) using the MAKESENS application from the Finnish Meteorological Institute (Salmi and others, 2002).

Spillway at Garrison Dam, June 19, 2011. Photograph by Stacey Gerhardt, USGS.



Powerhouse (left) and spillway (right) at Fort Randall Dam, June 9, 2011. Photograph by Joel Petersen, USGS.

Oahe Dam (powerhouse in background), June 7, 2011. Photograph by Joel Petersen, USGS.

Photographs showing large water releases from three of the Missouri River main-stem dams

The Sen slope, also known as the Kendall-Theil robust line, is a nonparametric estimator of trend magnitude slope for a univariate time series when the time interval is constant (equally spaced), as shown in equation 2.

$$f(t) = M_q t + B \tag{2}$$

where

- $f(t)$ is the increasing or decreasing function of time for the trend magnitudes of the peak streamflows or annual runoff volume used in the investigation,
- M_q is Sen slope (trend magnitude),
- t is time, and
- B is a constant.

The Sen slope is the median slope for all pairwise comparisons, with each pairwise difference divided by the number of years separating the records. To determine the Sen slope estimate in equation 2, slopes of all data pairs are calculated as shown in equation 3.

$$M_{j,k} = \frac{x_k - x_j}{\Delta t_{j,k}} \quad \text{for } j = 1, \ldots, n\text{-}1; j < k \leq n \tag{3}$$

where

- $M_{j,k}$ is slope between data points x_j and x_k,
- x_j is data measurement at time j,
- x_k is data measurement at time k, and
- $\Delta t_{j,k}$ is change in time between observations.

The Sen slope, M_q, is equal to the median value of all the $M_{j,k}$.

Results of Trend Analyses

Trends in peak streamflow were analyzed for 98 of the 321 streamgages listed table 1. Sites and periods of record considered were selected to be parallel with similar analyses by Holmes and others (2010) for 2008 flooding in the Midwestern United States, who used criteria outlined by Hodgkins and others (2007). Those criteria stipulated that streamgages must have at least 50 years of concurrent data with no more than 5 percent missing, and that streams must not be regulated by major dams or substantial regulating structures. The 50-year criterion was arbitrary and was modified to a 54-year criterion (1958 to 2011) for this analysis, to allow direct comparison with sites common to those reported by Holmes and others (2010). Of 369 streamgages listed in table 1, 98 met these criteria (denoted by italics in table 1) and 271 were eliminated from the analysis.

For comparison of streamgages with varying basin sizes, the Sen slope for each streamgage was divided by the median annual peak streamflow, which provides scaling relative to the median annual peak streamflow for each streamgage. Results of analyses from 1958 to 2011 (scaled by median annual peak flood streamflow) are summarized in table 4, which indicates 67 streamgages with upward trends, 31 with downward trends, and zero with no trend. Examination of figure 5 indicates a dichotomous spatial distribution in trends, with most streamgages in the northwestern part of the study area having either downward trends or small upward trends and most streamgages in the eastern part of the study area having upward trends. A cluster of streamgages in eastern North Dakota, eastern South Dakota, and southern Minnesota has consistently large upwards trends. Upward trends are somewhat smaller and less consistent (including a few downward trends) for streamgages southeast of this cluster.

Table 4. Results of trend analyses (1958 to 2011) for selected streamgages in the Central United States affected by 2011 flooding.

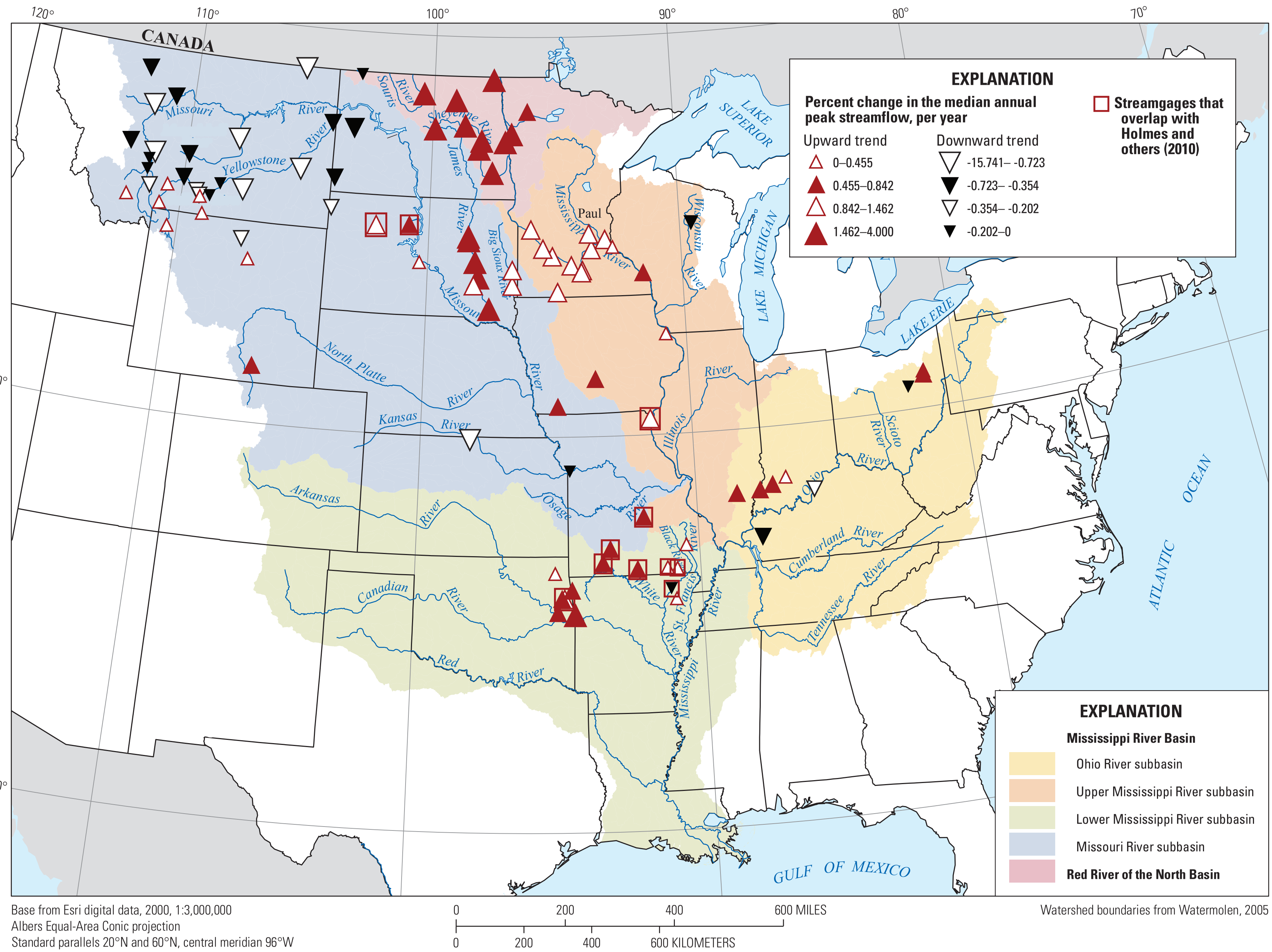
[N, number of streamgages in the slope range]

Percentile range	Percent change of median annual peak streamflow for unregulated streamgages				Percent change of median annual runoff volume			
	N	Slope range[1] for downward trends	N	Slope range[1] for upward trends	N	Slope range[2] for downward trends	N	Slope range[2] for upward trends
No trend[3]	0	0.057 to -0.009	0	0.057 to -0.009	1	0.012 to -0.021	0	0.012 to -0.021
0 to 0.25	8	-0.009 to -0.202	17	0.057 to 0.455	9	-0.021 to -0.212	36	0.012 to 0.463
0.25 to 0.50	7	-0.202 to -0.354	17	0.455 to 0.842	9	-0.212 to -0.345	36	0.463 to 0.779
0.50 to 0.75	8	-0.354 to -0.723	16	0.842 to 1.462	9	-0.345 to -0.456	36	0.779 to 1.617
0.75 to 1	8	-0.723 to -15.741	17	1.462 to 4	9	-0.456 to -1.445	37	1.617 to 5.116
Total N	31		67		37		145	

[1]Sen slope divided by the median annual peak streamflow (in percent change, per year).

[2]Sen slope divided by median annual runoff volume (in percent change, per year).

[3]The slope range for no trend brackets zero and is listed under both downward and upward trends.



Base from Esri digital data, 2000, 1:3,000,000
Albers Equal-Area Conic projection
Standard parallels 20°N and 60°N, central meridian 96°W
North American Datum of 1983 (NAD 83)

Watershed boundaries from Watermolen, 2005

Figure 5. Percentage changes in median annual peak streamflow values (1958 to 2011) for selected streamgages in the Central United States affected by 2011 flooding.

Figure 6 shows trends in peak streamflow for 1958 to 2007 for 11 streamgages that were previously reported by Holmes and others (2010). These streamgages are common to 11 streamgages in figure 5, as denoted by open square symbols. The 11 common streamgages are denoted with bold font in table 1. Only 6 of 11 streamgages from figure 6 (data through 2007) have upwards trends; whereas all but one of the common streamgages in figure 5 (data through 2011) have upward trends. The changes in trend for common streamgages show how easily trends can be leveraged by as little as 4 years of additional data that may include one or more especially large peak streamflow values.

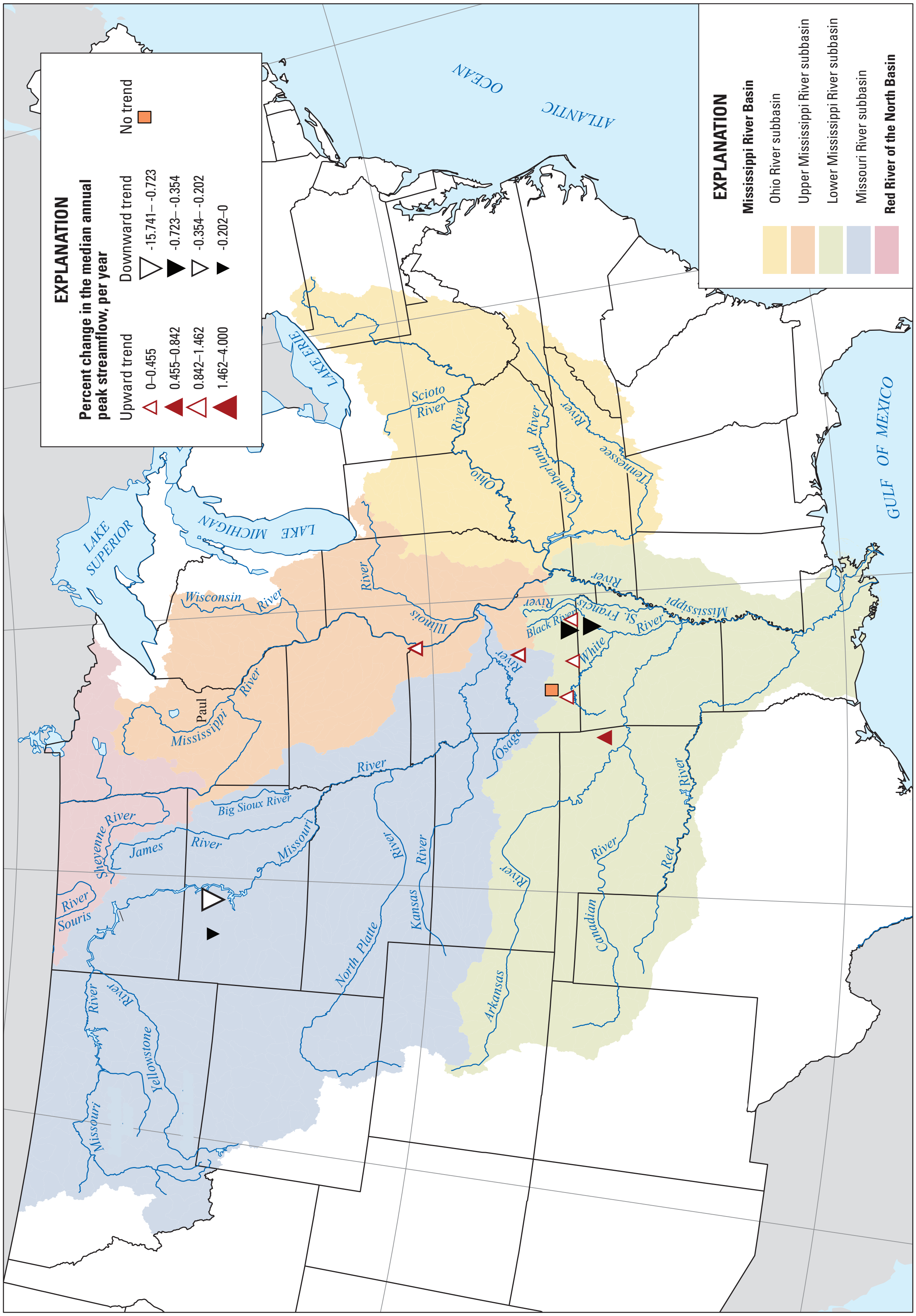
Trends in annual runoff volume were analyzed for 182 of the 211 streamgages listed in table 2, as indicated by italics. The period of record (1958 to 2011) was selected to be parallel with the analysis of trends for peak streamflows, and also similarly, the Sen slope for each streamgage was scaled by dividing by the median annual runoff volume. Trends were analyzed regardless of any possible changes in regulating conditions during 1958 to 2011, as major and quantifiable changes in regulating conditions are uncommon within the study area.

Results of analyses are summarized in table 4, which indicates 145 streamgages with upward trends, 36 with downward trends, and 1 with no trend. Examination of figure 7 indicates a dichotomous spatial distribution in trends that is similar to the trends for peak streamflows (fig. 5), with most streamgages in the northwestern part of the study area having downward trends and most streamgages in the eastern part of the study area having upward trends. Predominantly downward trends are indicated for a small handful of streamgages southeast of the main stem of the Ohio River (fig. 7), none of which are considered on the map showing trends in peak streamflow (fig. 5). In general, trends in runoff volume are predominantly upward throughout the study area with the exception of the southeastern part of the Ohio River Basin and the Missouri River Basin upstream from (and including) site number 271 (streamgage 06342500, Missouri River at Bismarck, North Dakota). All four Missouri River main-stem streamgages farther downstream (sites 311, 330, 333, and 346) have upward trends resulting from the effect of tributary areas dominated by upward trends.

Additional Perspectives Regarding Hydrologic Trends in the Central United States

As stated in a previous section (*Methods for Trend Analyses*), only trend magnitudes were computed with no effort to include null hypothesis significance testing. Notwithstanding evaluation of statistical significance of trends, the distinct spatial distributions in trends for both peak streamflows and

Gaging station 06130500, Musselshell River at Mosby, Montana, May 23, 2011. Photograph by Dennis Elliott, USGS.



Base from Esri digital data, 2000, 1:3,000,000
Albers Equal-Area Conic projection
Standard parallels 20°N and 60°N, central meridian 96°W
North American Datum of 1983 (NAD 83)

Watershed boundaries from Watermolen, 2005

Figure 6. Percentage changes in median annual peak streamflow values (1958 to 2007) for selected streamgages in the Central United States previously reported by Holmes and others (2010).

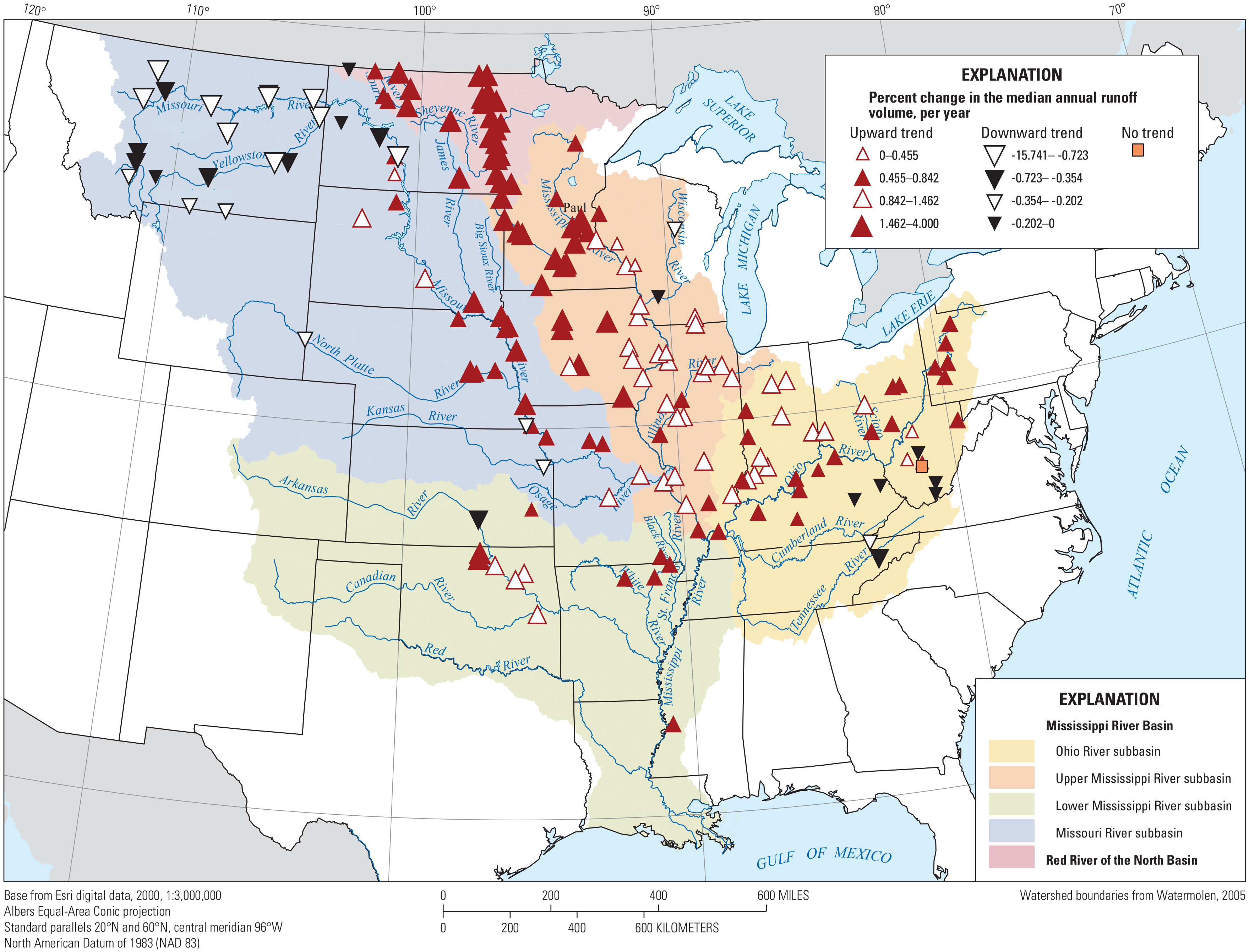


Figure 7. Percentage changes in median annual runoff volumes (1958 to 2011) for selected streamgages in the Central United States affected by 2011 flooding.

annual runoff volumes are indicative of regional-scale trends that cannot be ubiquitously affected by short-term (year-to-year) variability in streamflow. Trends in peak streamflow were analyzed only for unregulated streamgages having records dating back to at least 1958, which restricted analyses to only 98 of the streamgages in table 1. However, trends in annual runoff volume were analyzed for 182 streamgages in table 2. A more comprehensive analysis of trends could have included many additional streamgages. For example, figure 7 shows only two streamgages along the James River with upward trends, one in South Dakota and one just north of the North Dakota/South Dakota state line. In contrast, figure 5 shows five streamgages along the lower James River in South Dakota, of which four were not included in table 2. A more comprehensive analysis of trends also could have included additional years of record for many streamgages, as shown by examples (figs. 8 and 9) for the James River near Scotland, S. Dak. (streamgage 06478500) , which was analyzed for trends in both peak streamflow and annual runoff volume.

Two large closed-basin lake systems, Devils Lake in North Dakota and the Waubay Lakes Chain in South Dakota, provide additional perspectives regarding hydrologic trends in the northern part of the area for which generally upward trends in peak streamflows and annual runoff volumes are indicated (figs. 5 and 7). The Waubay Lakes Chain (not shown) is located in a closed basin in northeastern South Dakota between headwaters of the Big Sioux, James, Little Minnesota, Sheyenne, and Red Rivers. Available lake-level records (South Dakota Department of Environment and Natural Resources, 2013) date back to only 1959 (fig. 10); however, flooding of several small towns and numerous homesteads indicates unprecedented lake levels dating back to the late 1800s (Niehus and others, 1999a; Niehus and others, 1999b). Extensive documentation exists (Vecchia, 2008; North Dakota State Water Commission, 2013) regarding long-term lake-level trends for Devils Lake (not shown), which is located just north of the Sheyenne River in northeastern North Dakota.

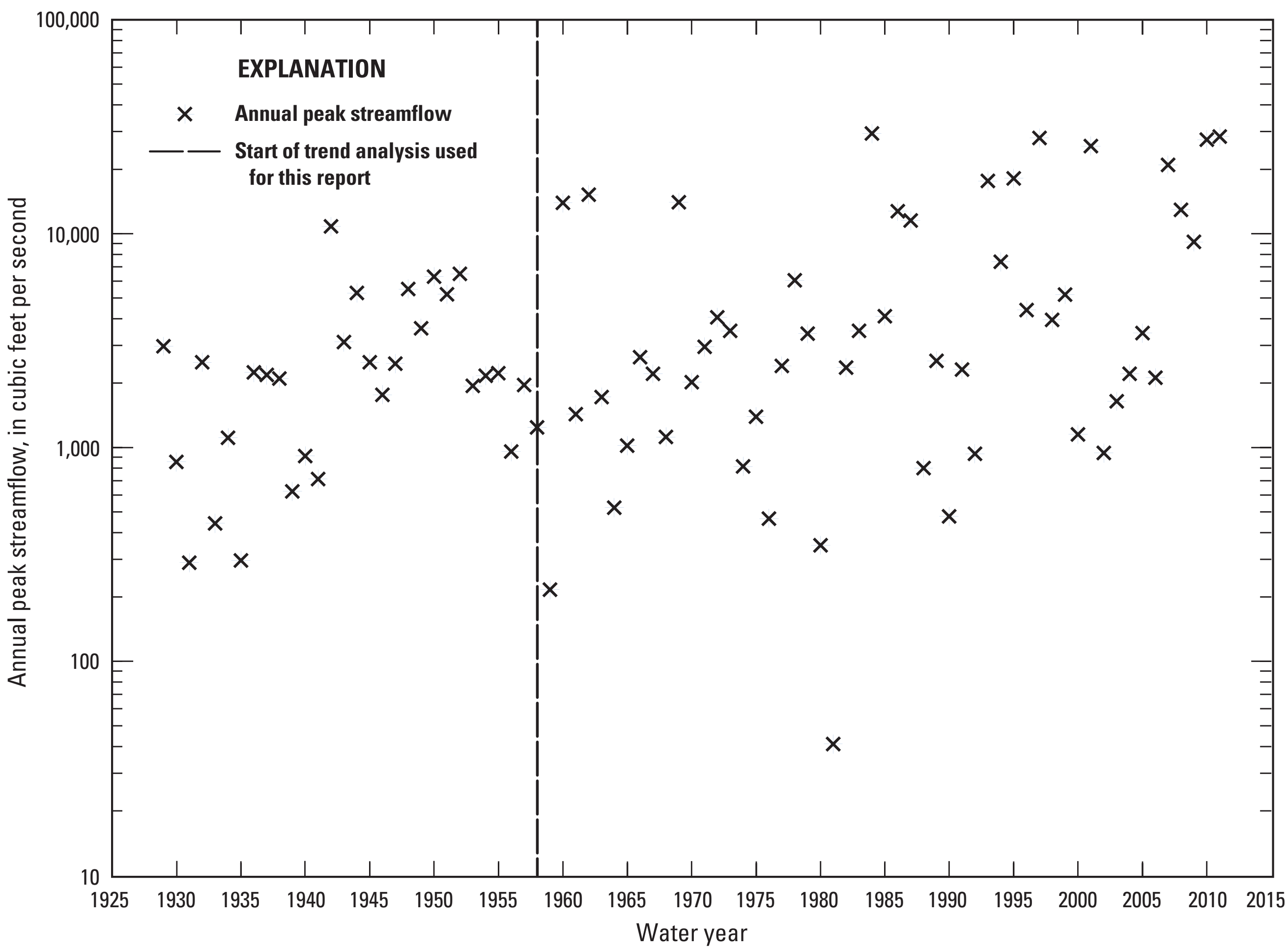


Figure 8. Time-series (1929 to 2011) record of annual peak streamflow for the James River near Scotland, South Dakota (streamgage 06478500).

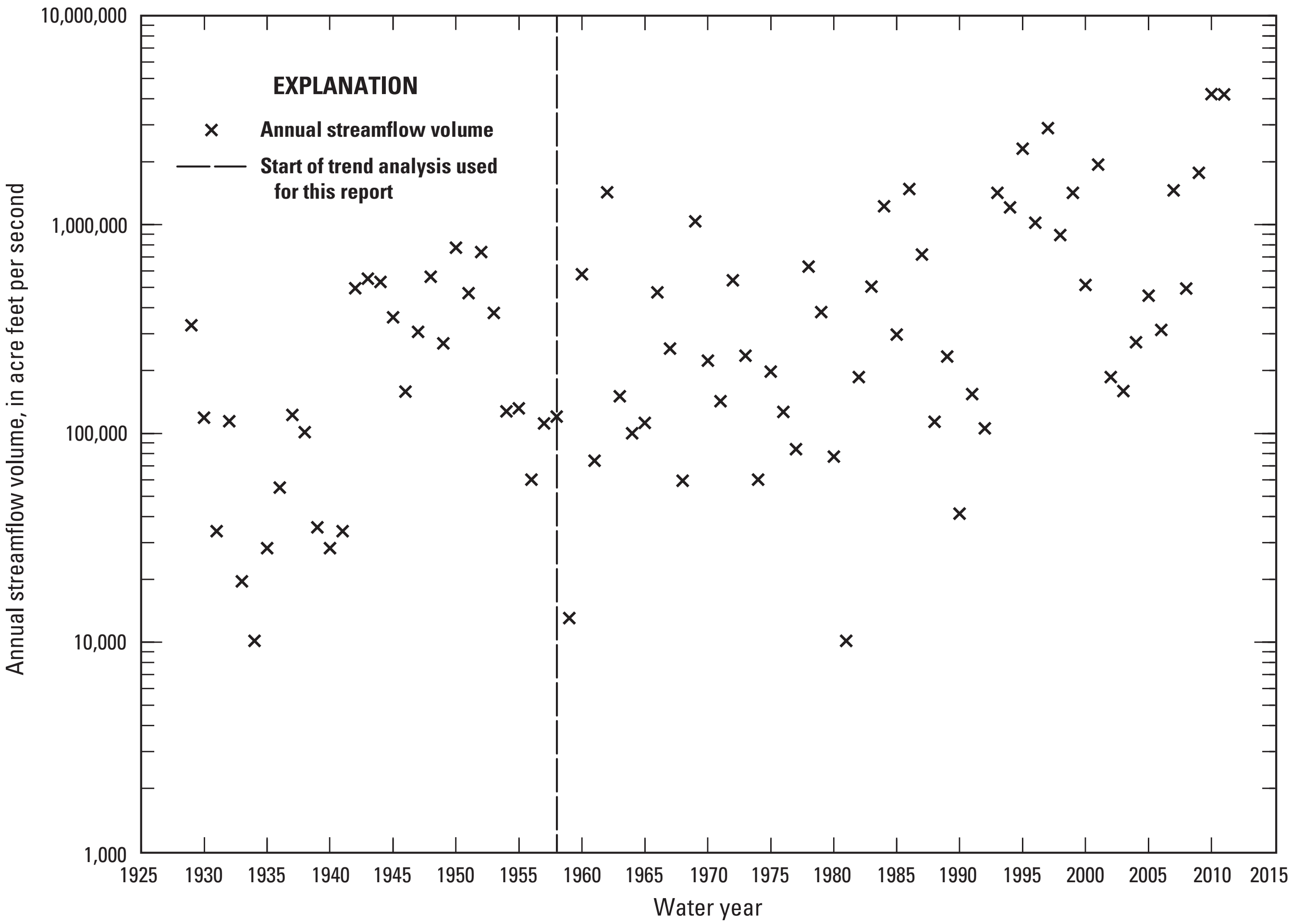


Figure 9. Time-series (1929 to 2011) record of annual runoff volume for the James River near Scotland, South Dakota (streamgage 06478500).

Figure 11 indicates about 70 years of generally downward trends followed by about 70 years of generally upward trends.

Collectively, the two closed-basin systems (figs. 10 and 11) indicate substantial changes throughout time in the lake-system water balances, essentially the differential between lake inflows and evaporation. Recent upward trends in both closed-basin systems have been driven by especially wet climatic conditions that began in the early 1990s and have persisted at least sporadically ever since. The wet climatic conditions have been part of regional-scale conditions that have driven the peak-streamflow and annual-volume trends in the Central United States.

Additional perspectives are provided by figures 12 and 13, which summarize information regarding annual time series for both peak streamflow and runoff volumes for streamgages that were considered in the trend analyses (figs. 5 and 7). Figures 12 and 13 show "normalized" sums of ranks (smallest to largest) for each of the six individual subbasins that were considered, as well as plots showing cumulative data for the combined subbasins (all streamgages for which the trend analyses were performed). The sums were normalized by dividing the sum of the ranks for each year by the number of streamgages in each river basin for which a value was available. The criterion for trend analysis required availability of at least 51 years out of a maximum of 54 years of record (1958 to 2011) for consideration. Using the Red River of the North as an example, the normalized sum of ranks for 2011 is about 53 for both the peaks and the runoff volumes, which indicates that 2011 was the largest, or nearly the largest value, for all of the streamgages considered, which is consistent with data presented in tables 1 and 2.

Figures 12 and 13 include LOcally WEighted Scatterplot Smoothing (LOWESS) curves (Helsel and Hirsch, 2002), which emphasize the shape of a relation between two variables without assuming linearity or normality. The LOWESS curves

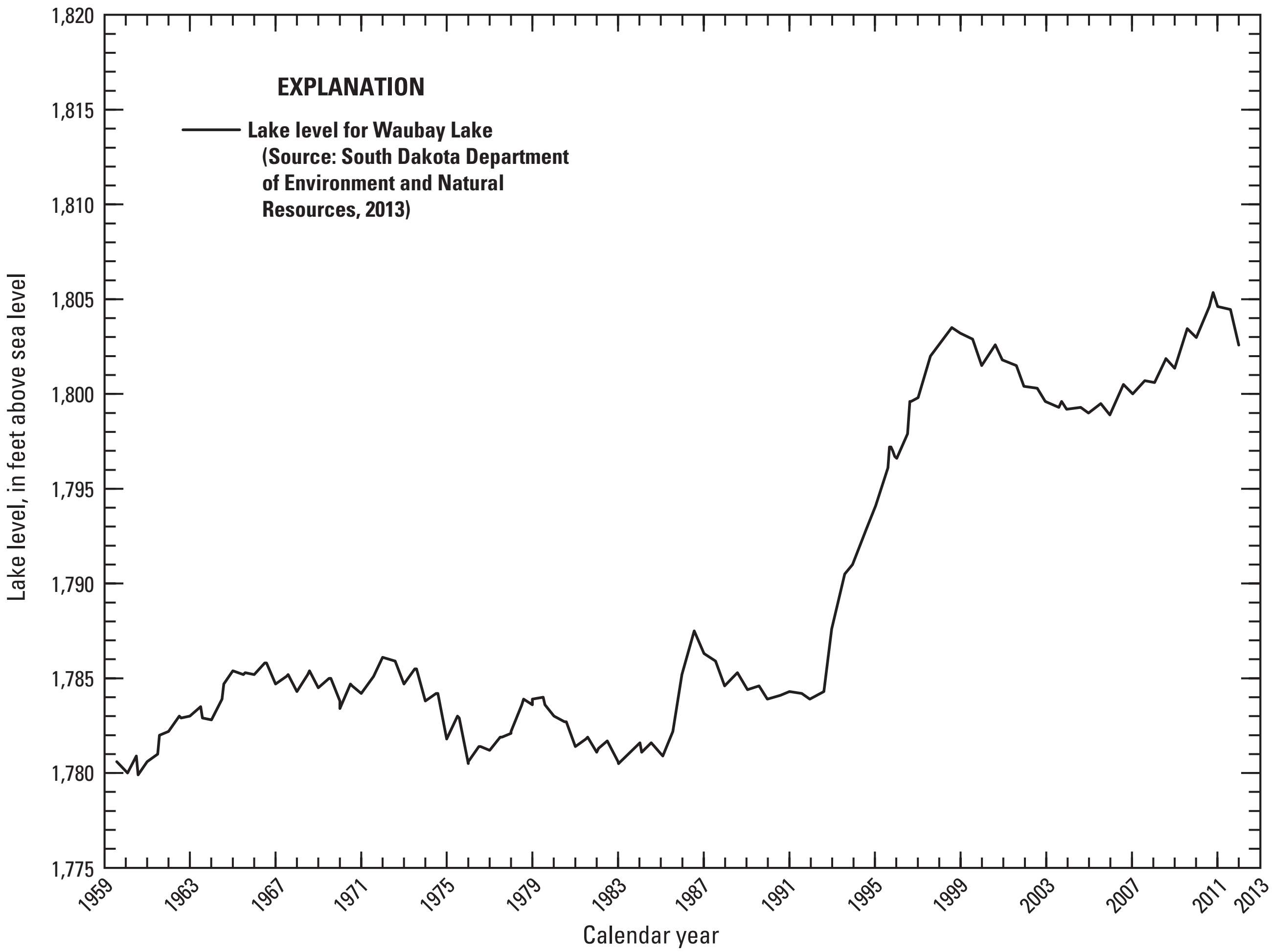


Figure 10. Lake-level record for Waubay Lake within the Waubay Lakes Chain in northeastern South Dakota.

also provide a robust description of the data pattern or trend (Helsel and Hirsch, 2002).

The LOWESS curves (figs. 12 and 13) are useful in pointing out periods of short-term trends and especially in combination with the normalized summed ranks, clearly depict primary regional-scale periods of relatively high or low streamflow conditions. Trends for all Red River of the North streamgages were consistently upwards and large for peak streamflows and annual runoff volumes (figs. 5 and 7), which is consistent with the LOWESS curves. In comparison, trends for the nearby Souris River Basin were smaller and less consistent, with one downward trend among streamgages analyzed for peak streamflows and for runoff volumes. Although only two streamgages were analyzed for trends in peak streamflows, the regional patterns depicted by figure 12 are similar to those for the runoff volumes (fig. 13), with relatively small normalized sums for peak streamflows and runoff volumes recorded before 1969. The period of 1969 to 1979 included relatively high-flow conditions, with many of the previous maxima for peak streamflows and runoff volumes occurring during this period (tables 1 and 2). This was followed by a decade or more of relatively low-flow conditions, which culminated in particularly low annual runoff volumes for the late 1980s and early 1990s. Generally similar but dampened short-term trends for this period also are apparent for the Red River.

The LOWESS curves for the upper Mississippi River Basin are consistent with the trend analyses for both peak streamflows and runoff volumes (figs. 5 and 7), which are generally upwards, but as with the Souris River Basin, less strongly than for the Red River. The normalized summed ranks clearly indicate 1993 as an outstanding year for peak streamflows and as the most outstanding year for runoff volume in the upper Mississippi River Basin. Relatively large

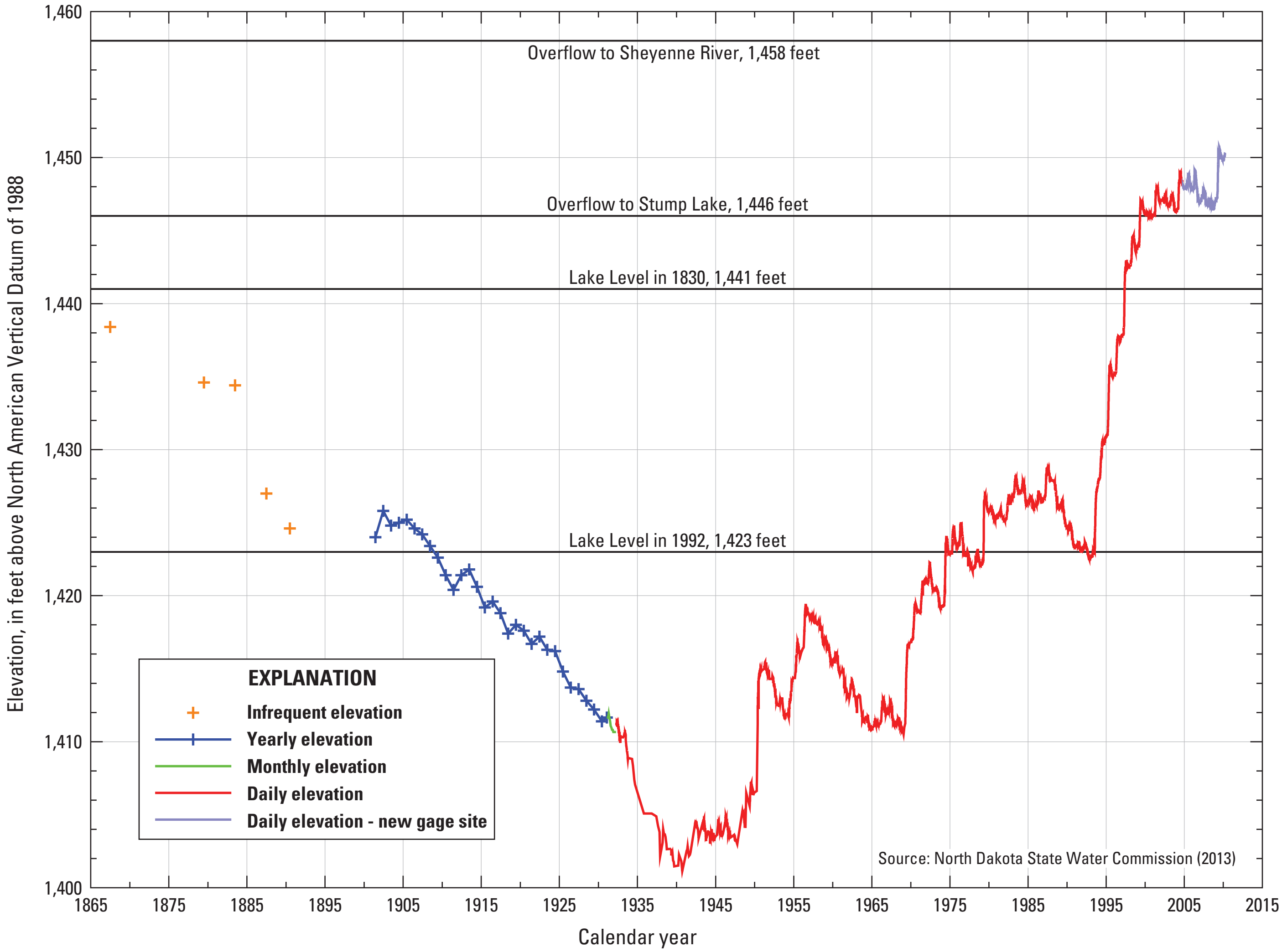


Figure 11. Lake-level record for Devils Lake in northeastern North Dakota.

peak streamflows and runoff volumes for 1993 also are apparent for the Red River and lower Mississippi River Basins, with 1993 essentially marking the start of the particularly wet climatic conditions that have driven the rising lake levels for the Waubay Lakes Chain and Devils Lake (figs. 10 and 11). Trends for both peak streamflows and runoff volumes for the Ohio and lower Mississippi River Basins generally were not as strongly upwards as for several of the other river basins, as reflected by the LOWESS curves.

For the Missouri River Basin, major extended drought periods are clearly apparent for about 1988 to 1992 and 2000 to 2007 (fig. 13). Relatively dry conditions for both periods are apparent to at least some extent for all of the other river basins and also are reflected in the cumulative plot for all streamgages. The cumulative plot also indicates a preponderance of large runoff volumes for the period of about 2007 or 2008 through 2011, and for the mid-1990s, as reflected in the plots for the individual river basins. A similar preponderance of large peak streamflows during these periods also is apparent for the cumulative plot for peak streamflows (fig.12), but is less pronounced for some of the individual river basins.

Trends in peak streamflows and annual flow volumes can be affected by climatic conditions and by land-use changes such as steadily increasing urbanization or large-scale changes in agricultural practices. The relative preponderance of high-flow conditions since about 1993 closely corresponds with the lake-level records for Devils Lake and the Waubay Lakes Chain, which provide somewhat of a physical measure of changing water-balance conditions for the contributing drainage areas and collectively provide an indicator of regional-scale conditions that for these closed basins probably are driven primarily by climatic conditions.

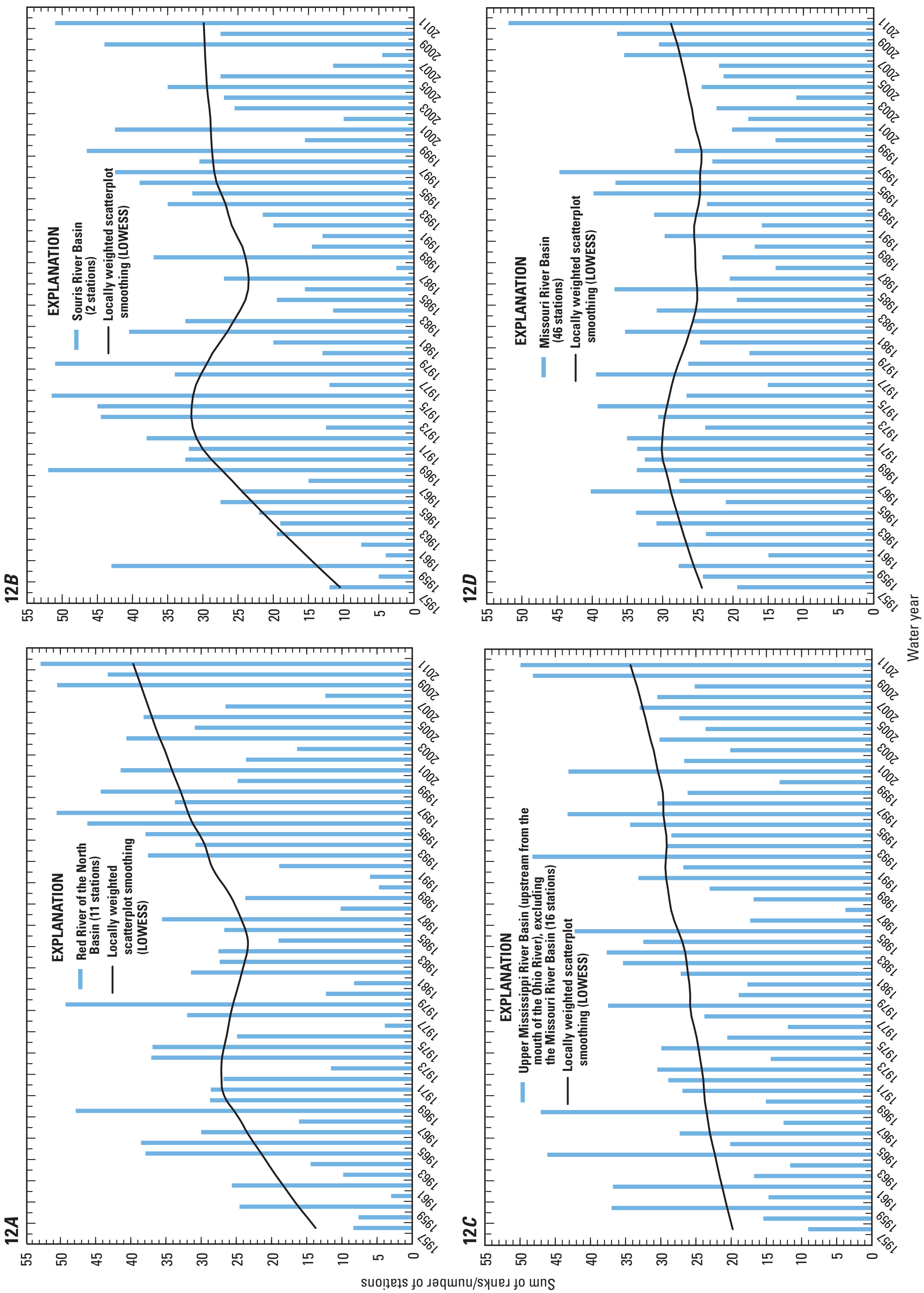


Figure 12. Sum of normalized ranks for peak streamflows, by water year (1958 to 2011).

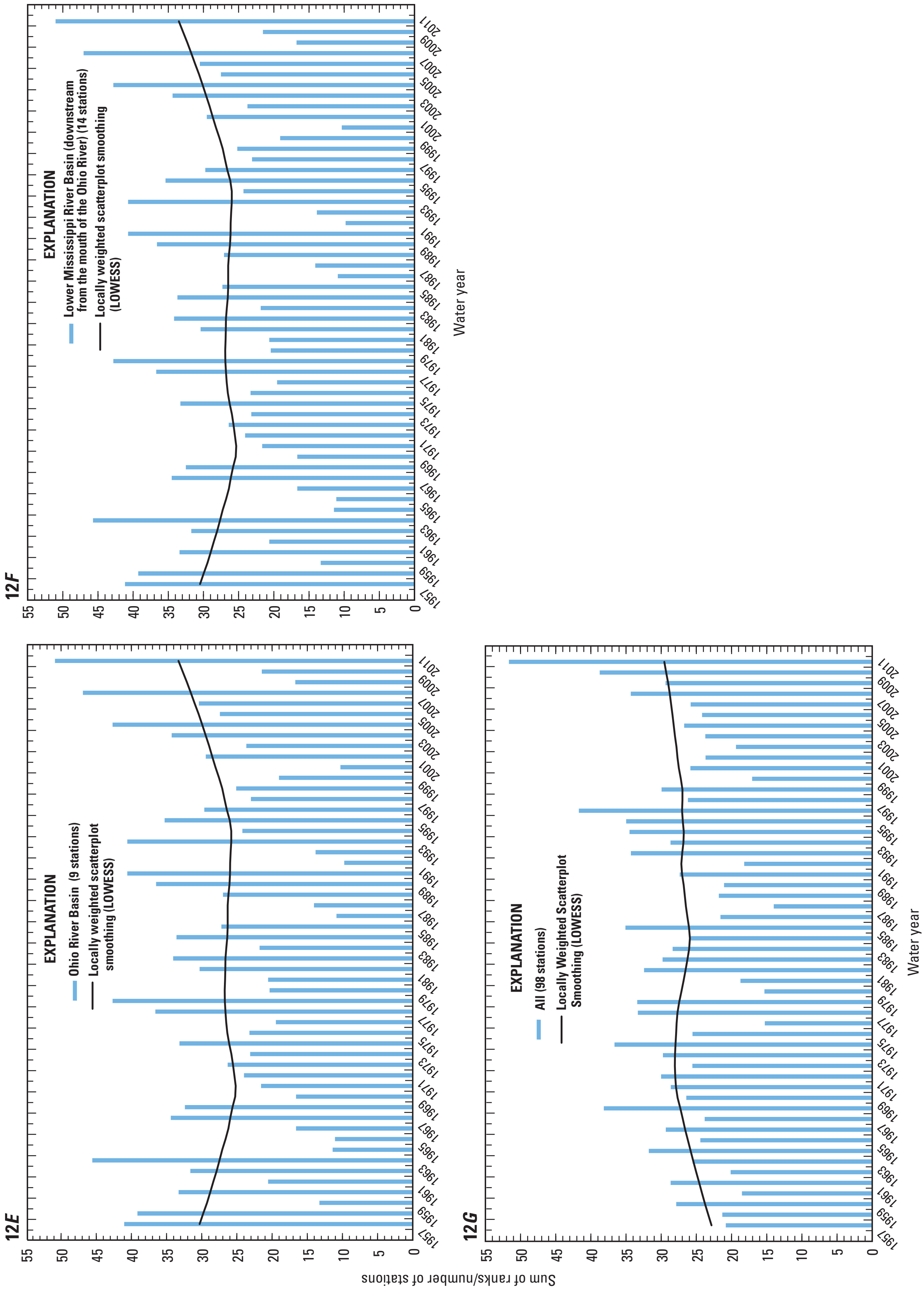


Figure 12. Sum of normalized ranks for peak streamflows, by water year (1958 to 2011).—Continued

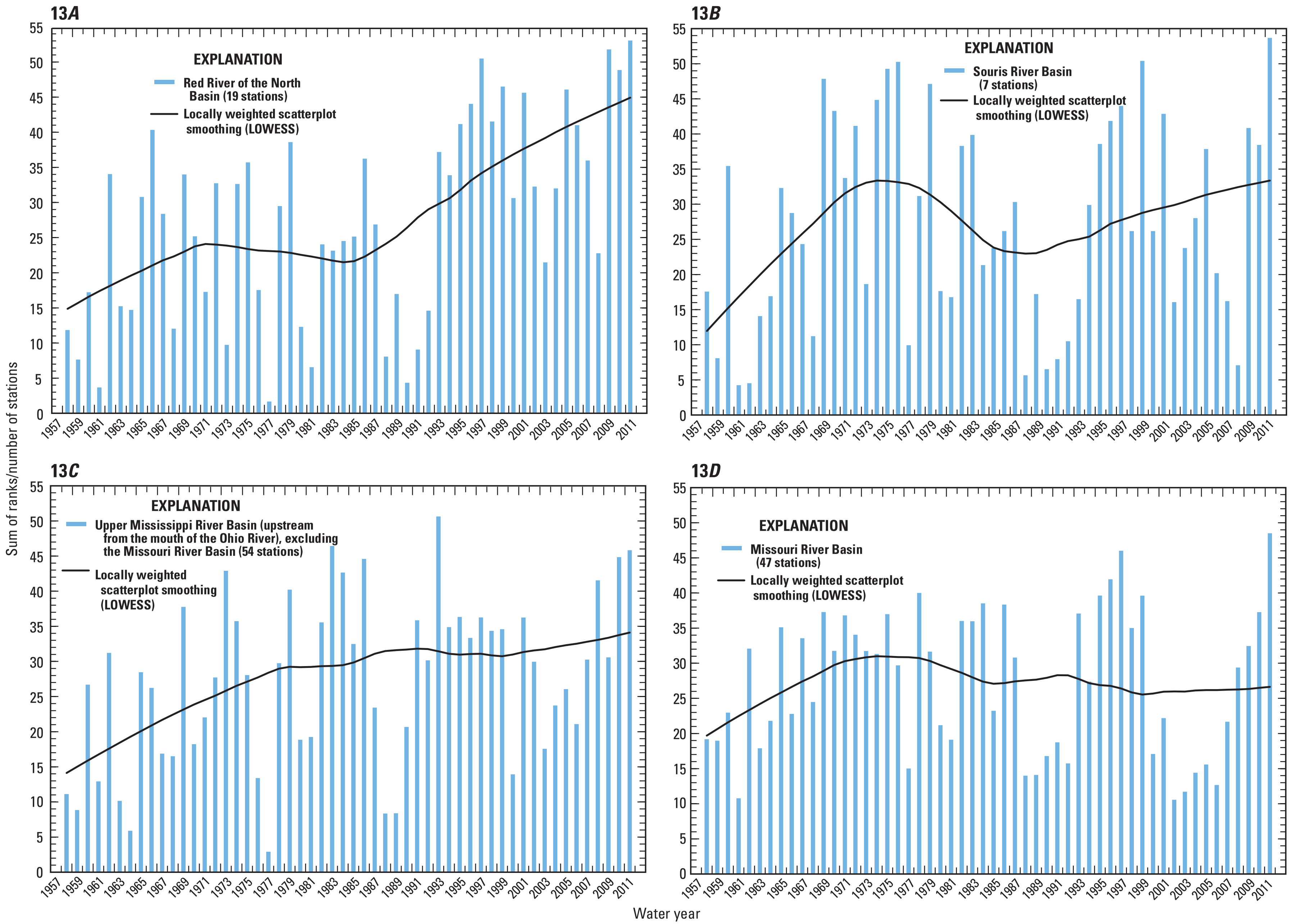


Figure 13. Sum of normalized ranks for annual runoff volume, by water year (1958 to 2011).

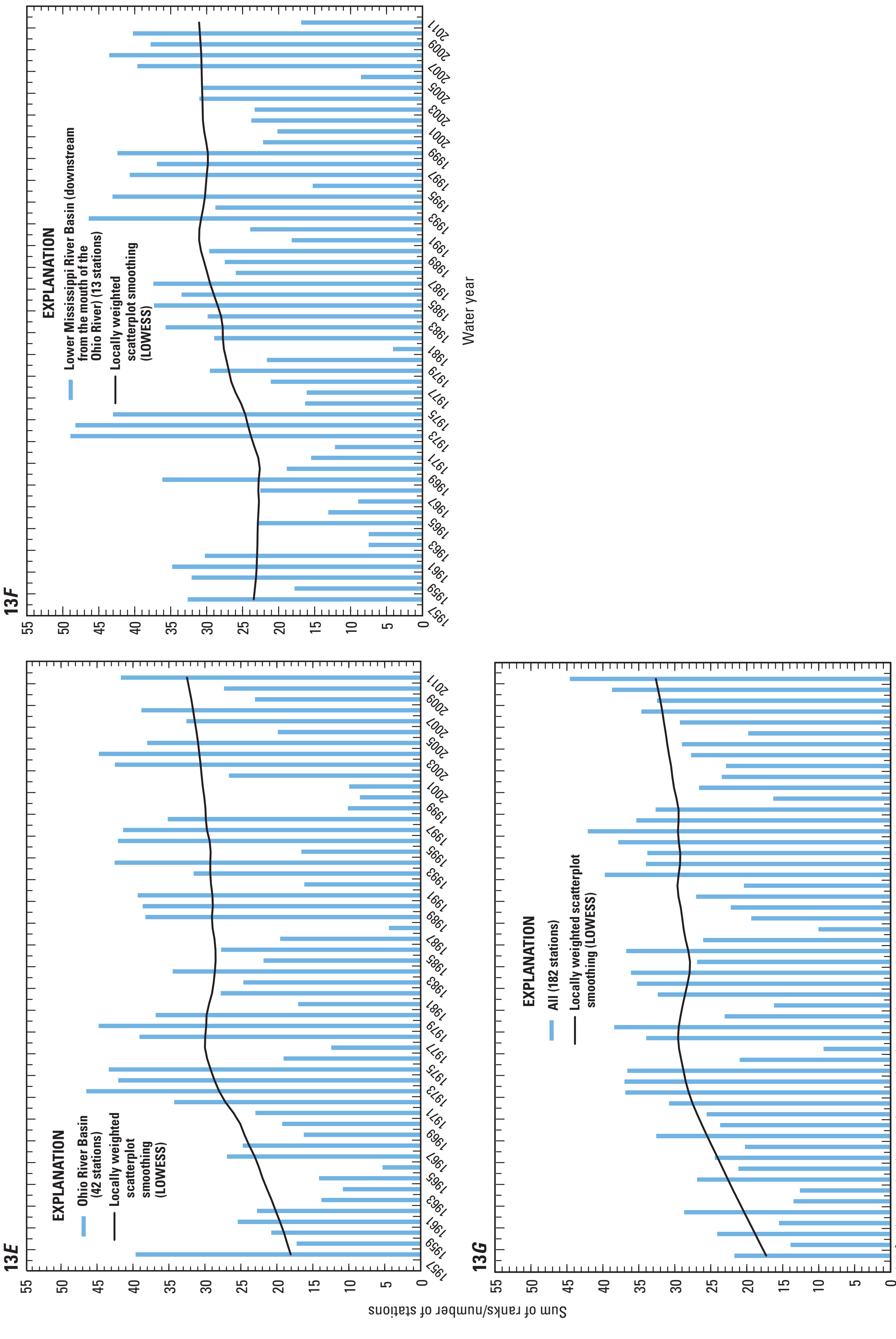


Figure 13. Sum of normalized ranks for annual runoff volume, by water year (1958 to 2011).—Continued

Summary

During 2011, flooding on numerous rivers in the Central United States, spanning from the Canadian border to the Gulf of Mexico and the Rocky Mountains to the Allegheny Mountains, resulted in 33 fatalities and approximately $4.2 billion in damages. The flooding began in late February 2011 in parts of the Mississippi River Basin and continued in parts of the Mississippi River Basin or Souris and Red River of the North Basins until September 2011. The 2011 floods in the Central United States were caused by one or more combinations of the following: saturated antecedent soil conditions, higher than average streamflow at the beginning of 2011, rapid melting of the larger than normal snowpack, excess precipitation on snowpack, or simply excess precipitation. In some parts of the Central United States, precipitation amounts in excess of 20 inches in a 2-week period (700- to 1,000-percent above normal) were observed. This report provides broadscale characterizations of annual exceedance probabilities and trends for peak streamflows and annual runoff volumes for selected streamgages in the Central United States in areas affected by 2011 flooding.

Annual exceedance probabilities (AEPs) were analyzed for 321 streamgages for annual peak streamflow and for 211 streamgages for annual runoff volume. Within the Red River of the North Basin, AEPs for 2011 peak streamflows were not necessarily exceptional. However, AEPs for 2011 runoff volumes were exceptional, with 2 of 20 streamgages considered having AEPs less than 0.2 percent, 5 streamgages in the range of 0.2 to 1 percent, and 4 streamgages in the range of 1 to 2 percent. Magnitudes of 2011 runoff volumes also were exceptional, with all 11 of these streamgages eclipsing previous long-term (62 to 110 years) annual maxima by about one-third or more.

Flooding in the Souris River Basin was exceptional from all standpoints. Of 11 streamgages considered for AEP analysis of peak streamflows, 2011 flood peaks exceeded the next largest peak of record by at least double for 6 of the longest-term streamgages (75 to 108 years of peak-flow record). AEPs for these six streamgages were less than 1 percent. AEPs for 2011 runoff volumes were less than 1 percent for all seven streamgages considered for analysis. Magnitudes of annual runoff volumes also were exceptional, with all seven streamgages exceeding previous maxima (record lengths 52 to 108 years), and five of the seven streamgages exceeding by double or more.

AEPs for peak streamflows in the upper Mississippi River Basin were not exceptional, with no AEPs less than 1 percent. AEPs for annual runoff volumes indicated somewhat less frequent recurrence, with 11 having AEPs of less than 1 percent (out of 60 streamgages considered). The 2011 runoff volume for streamgage 05331000 (at Saint Paul, Minn.) exceeded the previous record (112 years of record) by about 24 percent.

An especially newsworthy feature was the prolonged flooding during 2011 along the main stem of the Missouri River downstream from Garrison Dam and extending downstream throughout the length of the Missouri River. The 2011 runoff volume for streamgage 06342500 (at Bismarck, North Dakota) exceeded the previous (1975) maximum by about 50 percent, with an associated AEP in the range of 0.2 to 1 percent.

Within the Ohio River Basin, most annual streamflow peaks occurred during early March to early May, with associated AEPs and runoff-volume AEPs that were not exceptional. Throughout the basin, peak-streamflow AEPs were less than 2 percent for only 4 streamgages (out of 25 considered), and runoff-volume AEPs were less than 2 percent for only 3 streamgages (out of 53 considered).

Along the lower Mississippi River, the largest streamflow peak in 91 years was recorded for streamgage 07289000 (at Vicksburg, Miss.), with an associated AEP of 0.8 percent. Of 55 streamgages considered for AEP analysis for peak streamflows, 10 had AEPs less than 1 percent. AEPs for annual runoff volume were larger than 4 percent for all lower Mississippi River streamgages considered, which resulted from extensive drought conditions in areas to the west.

Trends in peak streamflow were analyzed for 98 streamgages, with 67 streamgages having upward trends, 31 with downward trends, and zero with no trend. Trends in annual runoff volume were analyzed for 182 streamgages, with 145 streamgages having upward trends, 36 with downward trends, and 1 with no trend. The trend analyses used descriptive methods that did not include measures of statistical significance. A dichotomous spatial distribution in trends was apparent for both peak streamflow and annual runoff volume, with a small number of streamgages in the northwestern part of the study area having downward trends and most streamgages in the eastern part of the study area having upward trends.

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Tables 1 and 2

Table 1. Peak streamflow data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.

[mi², square miles; ft³/s, cubic feet per second; AEP, annual exceedance probability; n/a, not applicable; --, data not available; <, less than; >, greater than] [Stations used in the trend analysis are italicized; Stations used in the trend analysis that overlap with trend analyses of Holmes and others (2010) are italicized and bold]

Map site number (fig. 2)	Site number	Station name	Contri-buting drainage area (mi²)	Flood data: Previous maximum streamflow			Flood data: Floods of 2011			
				Date (month/year)	Stage (ft)	Streamflow (ft³/s)	Rank[c] / annual peaks in record	Date of peak streamflow	Peak stage (ft)	Peak streamflow (ft³/s)
				Red River of the North Basin						
1	05030500	Otter Tail River near Elizabeth, Minnesota	1,230	05/2009	9.66	1,330[d]	1/34	6/1/2011	9.96[e]	1,360[d]
2	05046000	Otter Tail River below Orwell Dam near Fergus Falls, Minnesota	1,740	05/2001	5.46	2,040[d]	3/81	5/2/2011	5.24	2,010[d]
3	05049000	Mustinka River above Wheaton, Minnesota	810	04/2001	21.18[f]	11,000	3/63	4/6/2011	94.61	7,730
4	05050000	Bois De Sioux River near White Rock, South Dakota	1,160	04/1997	16.90	8,750[d]	2/70	4/15/2011	16.11[e]	6,770[d]
5	05051500	Red River of the North at Wahpeton, North Dakota	2,425	04/1997	19.25[g]	12,800[d]	7/71	4/7/2011	15.69	7,490[d]
6	05051522	Red River of the North at Hickson, North Dakota	4,300	03/2009	39.04	23,700[d]	3/36	4/7/2011	37.15	13,900[d]
7	05051600	Wild Rice River near Rutland, North Dakota	296	04/1997	10.11	2,700	5/52	4/5/2011	8.01[h,e]	1,280
8	05052000	Wild Rice River near Mantador, North Dakota	1,160	03/2010	11.37[g,i]	4,730[d]	2/35	4/11/2011	10.94	4,060[d]
9	05053000	Wild Rice River near Abercrombie, North Dakota	1,490	03/2009	27.78	14,100[d]	2/79	4/6/2011	25.99	11,800[d]
10	05054000	Red River of the North at Fargo, North Dakota	4,625	03/2009	40.84	29,500[d]	3/111	4/9/2011	38.81	27,200[d]
11	*05054500*	*Sheyenne River above Harvey, North Dakota*	*424*	*04/2009*	*10.46*	*2,100*	*2/56*	*4/13/2011*	*10.52*	*2,010*
12	*05056000*	*Sheyenne River near Warwick, North Dakota*	*760*	*04/2009*	*8.43*	*4,930*	*1/62*	*4/11/2011*	*9.29*	*8,200*
13	05056060	Mauvais Coulee Trib #3 near Cando, North Dakota	60.2	04/1969	9.35	2,300	2/42	4/14/2011	11.18	2,040
14	*05056100*	*Mauvais Coulee near Cando, North Dakota*	*377*	*04/1997*	*11.68*	*3,000*	*1/54*	*4/15/2011*	*12.42*	*3,770*
15	05056239	Starkweather Coulee near Webster, North Dakota	210	04/2009	8.58	978	3/32	4/16/2011	9.61[h,e]	885
16	*05057000*	*Sheyenne River near Cooperstown, North Dakota*	*1,270*	*04/1950*	*18.69*	*7,830*	*1/67*	*4/14/2011*	*19.51*	*8,460*
17	*05057200*	*Baldhill Creek near Dazey, North Dakota*	*351*	*04/1979*	*17.78*	*9,000[j]*	*4/56*	*4/10/2011*	*11.93*	*3,200*
18	05058000	Sheyenne River below Baldhill Dam, North Dakota	1,910	04/2009	38.35	6,200[d]	1/63	4/13/2011	38.57	7,060[d]
19	05058500	Sheyenne River at Valley City, North Dakota	2,110	04/2009	20.59[g]	7,940[d]	2/73	4/18/2011	20.66	7,270[d]
20	05058700	Sheyenne River at Lisbon, North Dakota	2,490	04/2009	22.86	9,250[d]	2/55	4/20/2011	21.70	8,280[d]
21	05059000	Sheyenne River near Kindred, North Dakota	3,020	04/1997	21.38[g]	5,970[d]	1/63	4/27/2011	21.35[e]	6,290[d]
22	05059500	Sheyenne River at West Fargo, North Dakota	3,090	04/1997	22.68[g]	4,810[d]	1/86	4/29/2011	22.80[h,e]	4,830[d]

Rank/ annual peaks used in analysis[ff]	AEP for observed 2011 flood (percent)[b]			Expected peak streamflows for selected AEP (ft^3/s)[a]								
				2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	Typical range for 66.7-percent confidence level		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High		Low	High
Red River of the North Basin												
1/34	3.5	.5	5.1	1,420[s]	1,240	1,800	1,490[s]	1,260	1,970	1,620[s]	1,290	2,380
3/81	2.1	1.7	5.5	2,020[s]	1,800	2,330	2,190[s]	1,930	2,560	2,550[s]	2,220	3,040
3/63	4.2	2.2	7.1	10,100	6,460	15,900	12,500	7,550	20,800	18,800	9,820	35,800
2/70	.9	1.0	4.5	5,090[s]	3,570	7,910	6,340[s]	4,360	10,200	9,540[s]	6,300	16,200
--/--	--	--	--	10,850[gg]	--	--	12,150	--	--	18,300[gg]	--	--
--/--	--	--	--	--	--	--	--	--	--	--	--	--
5/52	9.7	5.6	13	3,050[s]	1,770	6,180	4,020[s]	2,260	8,520	6,640[s]	3,530	15,300
2/20	3.7	3.7	15	5,990[s]	2,580	22,600	8,920[s]	3,590	38,200	19,700[s]	6,880	109,000
2/54	5.7	1.4	5.9	18,000[s]	11,200	33,200	22,800[s]	13,800	43,600	34,900[s]	20,200	71,500
--/--	--	--	--	22,300[gg]	--	--	29,300[gg]	--	--	50,000[gg]	--	--
2/56	1.2	1.3	5.7	1,580[s]	1,030	2,730	2,160[s]	1,370	3,920	4,020[s]	2,370	8,100
1/62	1.2	.3	2.8	6,980[s]	4,920	10,900	8,600[s]	5,930	13,800	12,700[s]	8,390	21,600
2/42	3.6	1.7	7.5	2,530[s]	1,460	5,250	3,180[s]	1,790	6,880	4,760[s]	2,550	11,100
1/54	9.4	.3	3.3	9,440[s]	4,550	23,900	12,400[s]	5,820	32,700	19,400[s]	8,700	54,800
3/32	9.3	4.4	14	1,330[s]	937	2,180	1,530[s]	1,050	2,570	1,940[s]	1,300	3,450
1/67	2.3	.3	2.6	8,770[s]	6,390	13,100	10,800[s]	7,690	16,500	15,800[s]	10,900	25,600
4/56	6.9	3.8	10	6,380[s]	3,890	12,100	8,990[s]	5,280	18,000	17,600[s]	9,570	39,300
1/62	2.2	.3	2.8	7,180[s]	5,210	10,800	8,320[s]	5,950	12,700	10,700[s]	7,470	17,000
2/58	1.5	1.3	5.5	6,690[s]	5,090	9,500	7,860[s]	5,880	11,400	10,600[s]	7,690	16,200
2/55	2.6	1.3	5.8	8,890[s]	6,560	13,200	10,800[s]	7,810	16,600	15,800[s]	10,900	25,700
1/62	3.7	.3	2.8	7,510[s]	5,710	10,700	9,010[s]	6,720	13,100	12,700[s]	9,160	19,600
1/61	6.0	.3	2.9	6,270[s]	4,850	8,670	7,210[s]	5,500	10,200	9,280[s]	6,900	13,600

Table 1. Peak streamflow data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[mi², square miles; ft³/s, cubic feet per second; AEP, annual exceedance probability; n/a, not applicable; --, data not available; <, less than; >, greater than] [Stations used in the trend analysis are italicized; Stations used in the trend analysis that overlap with trend analyses of Holmes and others (2010) are italicized and bold]

Map site number (fig. 2)	Site number	Station name	Contributing drainage area (mi²)	Flood data						
				Previous maximum streamflow			Floods of 2011			
				Date (month/year)	Stage (ft)	Streamflow (ft³/s)	Rank[c] / annual peaks in record	Date of peak streamflow	Peak stage (ft)	Peak streamflow (ft³/s)
Red River of the North Basin—Continued										
23	05059600	Maple River near Hope, North Dakota	17.4	03/2004	6.98[g]	1,000	1/47	8/1/2011	8.05	1,340
24	*05059700*	*Maple River near Enderlin, North Dakota*	*796*	*06/1975*	*15.41*	*7,610*	*3/56*	*4/11/2011*	*13.31*	*6,830*
25	05060400	Sheyenne River at Harwood, North Dakota	--[k]	04/1997	92.02	11,000[j,d]	1/16	4/10/2011	91.82	13,000[d]
26	*05060500*	*Rush River at Amenia, North Dakota*	*116*	*04/1979*	*10.37*[g]	*3,490*	*5/65*	*4/7/2011*	*11.00*	*1,970*
29	05064500	Red River of the North at Halstad, Minnesota	15,205	04/1997	40.74	71,500[d]	3/72	4/12/2011	40.51	60,700[d]
30	05065500	Goose River near Portland, North Dakota	407	05/1950	27.10[f]	8,530	6/46	4/8/2011	25.15	3,220
31	*05066500*	*Goose River at Hillsboro, North Dakota*	*1,093*	*04/1979*	*16.76*	*14,800*	*2/85*	*4/9/2011*	*15.50*	*10,000*
32	*05069000*	*Sand Hill River at Climax, Minnesota*	*420*	*04/1965*	*17.81*	*4,560*	*1/69*	*4/10/2011*	*34.56*[h,e]	*4,800*[j,l]
33	05070000	Red River of the North near Thompson, North Dakota	24,010	04/2009	64.56	61,300[d]	1/13	4/13/2011	65.18	72,000[d]
34	*05076000*	*Thief River near Thief River Falls, Minnesota*	*985*	*05/1950*	*17.38*	*5,610*	*3/100*	*4/6/2011*	*16.07*	*4,640*
36	05082500	Red River of the North at Grand Forks, North Dakota	21,445	04/1997	52.04[g]	137,000[d]	2/130	4/14/2011	49.86	87,500[d]
37	05083500	Red River of the North at Oslo, Minnesota	22,520	04/1997	38.00	120,000[d]	2/49	4/14/2011	38.09	81,400[d]
41	05092000	Red River of the North at Drayton, North Dakota	26,085	04/1997	45.55	124,000[d]	5/74	4/19/2011	43.17	83,000[d]
43	05099600	Pembina River at Walhalla, North Dakota	3,350	04/1997	16.53	23,100[m]	4/65	4/18/2011	16.55	16,300
44	*05100000*	*Pembina River at Neche, North Dakota*	*3,410*	*04/2009*	*21.61*	*16,900*	*2/104*	*4/19/2011*	*21.78*[h,e]	*15,300*
Souris River Basin										
46	*05113600*	*Long Creek near Noonan, North Dakota*	*630*	*03/1976*	*17.61*	*6,310*	*1/52*	*6/21/2011*	*19.55*	*10,800*
47	05114000	Souris River near Sherwood, North Dakota	3,040	04/1976	25.15	14,800[d]	1/82	6/23/2011	28.16	29,700[d]
48	05116000	Souris River near Foxholm, North Dakota	3,270	04/1976	17.17	8,600[d]	1/75	6/25/2011	22.44	26,400[d]
49	05116500	Des Lacs River at Foxholm, North Dakota	539	04/1979	21.23	4,260[d]	3/66	6/1/2011	20.57	3,620[d]
50	05117500	Souris River above Minot, North Dakota	3,900	04/1904	21.90[f,j]	12,000[m]	1/108	6/25/2011	24.37	26,900[d]
51	05120000	Souris River near Verendrye, North Dakota	4,400	04/2009	17.92	10,900[d]	1/75	6/26/2011	18.53	26,900[d]
52	05120500	Wintering River near Karlsruhe, North Dakota	285	04/1949	12.00[h]	3,000[d]	6/75	4/12/2011	8.87[h,e]	1,360[d]

Rank/annual peaks used in analysis[ff]	AEP for observed 2011 flood (percent)[b]			Expected peak streamflows for selected AEP (ft³/s)[a]								
				2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	Typical range for 66.7-percent confidence level		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High		Low	High
Red River of the North Basin—Continued												
1/47	3.4	.4	3.7	1,550[s]	1,010	2,700	1,850[s]	1,190	3,320	2,530[s]	1,570	4,780
3/56	*6.3*	*2.5*	*8.0*	*10,900*[s]	*6,920*	*19,500*	*13,900*[s]	*8,580*	*25,800*	*21,400*[s]	*12,600*	*42,600*
1/16	9.5	1.1	11	17,800[s]	12,400	31,700	19,600[s]	13,500	36,300	23,400[s]	15,600	46,200
5/65	*8.5*	*4.5*	*11*	*3,540*[s]	*2,460*	*5,620*	*4,420*[s]	*3,000*	*7,230*	*6,650*[s]	*4,330*	*11,600*
--/--	--	--	--	50,700[gg]	40,500	66,300	62,200[gg]	48,900	83,300	93,000[gg]	70,600	130,000
6/46	9.2	8.1	17	6,470[s]	4,240	11,300	8,330[s]	5,310	15,200	13,600[s]	8,160	27,200
2/81	*5.0*	*.9*	*3.9*	*14,100*[s]	*9,730*	*22,100*	*17,500*[s]	*11,900*	*28,300*	*25,800*[s]	*16,900*	*43,700*
1/69	*4.9*	*.3*	*2.6*	*6,170*	*4,480*	*8,500*	*7,330*	*5,080*	*10,600*	*10,100*	*6,270*	*16,200*
--/--	--	--	--	--	--	--	--	--	--	--	--	--
3/100	*3.7*	*1.4*	*4.5*	*5,070*	*3,910*	*6,570*	*5,490*	*4,050*	*7,460*	*6,260*	*4,180*	*9,360*
--/--	--	--	--	87,600[gg]	71,000	113,000	108,000[gg]	85,800	141,000	161,000[gg]	124,000	220,000
--/--	--	--	--	--	--	--	--	--	--	--	--	--
--/--	--	--	--	91,200[gg]	70,600	126,000	112,000[gg]	84,900	160,000	169,000[gg]	123,000	258,000
3/64	4.0	2.2	7.0	21,600[s]	15,000	34,200	27,800[s]	18,900	45,700	45,300[s]	29,200	80,200
2/104	*1.9*	*.7*	*3.1*	*15,100*[s]	*11,400*	*21,300*	*19,500*[s]	*14,300*	*28,200*	*31,700*[s]	*22,400*	*48,600*
Souris River Basin												
1/52	*2.3*	*.4*	*3.4*	*11,500*[s]	*6,390*	*24,600*	*15,600*[s]	*8,380*	*35,000*	*27,100*[s]	*13,700*	*66,700*
1/70	.5	.3	2.5	14,200[s]	9,540	23,400	19,500[s]	12,700	33,500	36,500[s]	22,300	68,800
1/75	.4	.2	2.4	9,220[s]	6,230	15,100	14,000[s]	9,040	24,200	33,300[s]	19,700	65,500
3/66	3.1	2.1	6.8	4,200[s]	2,840	6,870	5,250[s]	3,470	8,860	7,880[s]	5,000	14,100
1/76	.2	.2	2.3	9,490[s]	6,740	14,600	13,400[s]	9,220	21,600	27,600[s]	17,600	49,200
1/75	< 0.2	.2	2.4	10,500[s]	7,630	15,700	14,200[s]	10,000	22,200	26,500[s]	17,500	45,100
6/75	5.2	5.0	11	2,220[s]	1,460	3,760	3,090[s]	1,970	5,460	5,880[s]	3,510	11,300

Table 1. Peak streamflow data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[mi², square miles; ft³/s, cubic feet per second; AEP, annual exceedance probability; n/a, not applicable; --, data not available; <, less than; >, greater than] [Stations used in the trend analysis are italicized; Stations used in the trend analysis that overlap with trend analyses of Holmes and others (2010) are italicized and bold]

Map site number (fig. 2)	Site number	Station name	Contributing drainage area (mi²)	Flood data						
				Previous maximum streamflow			Floods of 2011			
				Date (month/year)	Stage (ft)	Streamflow (ft³/s)	Rank[c] / annual peaks in record	Date of peak streamflow	Peak stage (ft)	Peak streamflow (ft³/s)
		Souris River Basin—Continued								
53	05122000	Souris River near Bantry, North Dakota	4,700	04/1976	14.59	9,330[d]	1/75	6/28/2011	16.90	30,000[d]
54	*05123400*	*Willow Creek near Willow City, North Dakota*	*730*	*04/1969*	*16.76*	*5,900*	*4/75*	*4/12/2011*	*15.24*	*2,900*
55	05123510	Deep River near Upham, North Dakota	370	04/1969	18.18	6,760	2/49	4/11/2011	17.62	5,110
56	05124000	Souris River near Westhope, North Dakota	6,600	04/1976	19.16	12,600[d]	1/82	7/5/2011	22.95[e]	30,400[d]
		Upper Mississippi River Basin (upstream of the mouth of the Ohio River), excluding the Missouri River Basin								
61	05278930	Buffalo Creek near Glencoe, Minnesota	373	09/1991	11.78	4,300[n]	4/27	3/25/2011	19.59[h,e]	3,490
62	05280000	Crow River at Rockford, Minnesota	2,640	04/1965	19.27	22,400	9/90	4/10/2011	13.82	11,700
64	05287890	Elm Creek near Champlin, Minnesota	86.0	04/2001	10.02	875	3/33	3/24/2011	9.81	803
66	05288705	Shingle Creek at Queen Ave In Minneapolis, Minnesota	28.2	09/2005	13.26	291[o]	1/15	7/16/2011	13.93[h]	301[o]
67	05292000	Minnesota River at Ortonville, Minnesota	1,160	03/2010	12.84	5,680[d]	5/74	4/9/2011	10.28	3,840[d]
68	05293371	Pomme De Terre River below Elbow Lake, Minnesota	340	03/2009	6.81	744	1/26	7/15/2011	7.36	910
69	*05294000*	*Pomme De Terre River at Appleton, Minnesota*	*905*	*04/1997*	*18.13*	*8,890*[p]	*7/79*	*4/6/2011*	*11.00*	*3,170*
71	05301000	Minnesota River near Lac Qui Parle, Minnesota	4,050	04/1997	--	43,000[j,d,m]	5/66	4/6/2011	38.30	19,700[d]
72	05311000	Minnesota River at Montevideo, Minnesota	6,180	04/1997	23.90	47,500[d]	6/102	4/7/2011	19.76	23,700[d]
73	*05313500*	*Yellow Medicine River near Granite Falls, Minnesota*	*664*	*04/1969*	*14.90*	*17,200*	*8/80*	*3/25/2011*	*9.77*	*6,620*
74	*05316500*	*Redwood River near Redwood Falls, Minnesota*	*629*	*06/1957*	*15.92*	*19,700*	*6/86*	*3/25/2011*	*15.51*[h,e]	*7,370*[j,l]
75	05316950	Cottonwood River near Springfield, Minnesota	777	04/1969	31.55	18,300[m]	4/40	3/23/2011	30.06	9,480
76	*05317000*	*Cottonwood River near New Ulm, Minnesota*	*1,300*	*04/1969*	*19.15*	*28,700*	*6/85*	*3/24/2011*	*17.15*	*15,100*
77	05319500	Watonwan River near Garden City, Minnesota	851	04/1965	18.89	19,000[m]	6/44	3/24/2011	13.64	9,730
78	05320000	Blue Earth River near Rapidan, Minnesota	2,410	04/1965	21.36	43,100	7/99	3/22/2011	12.70	18,600[d]
79	05320270	Little Cobb River near Beauford, Minnesota	130	09/2010	15.31	5,120	2/15	3/20/2011	13.62	3,380
80	05320480	Maple River near Rapidan, Minnesota	338	09/2010	18.30	12,800	4/40	3/20/2011	13.09	4,660
81	*05320500*	*Le Sueur River near Rapidan, Minnesota*	*1,110*	*09/2010*	*21.35*	*30,500*	*4/69*	*3/21/2011*	*12.45*	*14,200*

Rank/ annual peaks used in analysis[ff]	AEP for observed 2011 flood (percent)[b]			Expected peak streamflows for selected AEP (ft^3/s)[a]								
		Typical range for 66.7-percent confidence level		2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
					95-percent confidence limit			95-percent confidence limit			95-percent confidence limit	
	Estimate	Low	High	Estimate	Low	High	Estimate	Low	High	Estimate	Low	High
Souris River Basin—Continued												
1/74	.2	.2	2.4	10,400[s]	7,410	16,100	14,900[s]	10,200	24,100	31,200[s]	19,800	56,200
4/55	*8.6*	*3.9*	*10*	*6,330*[s]	*3,780*	*12,300*	*8,460*[s]	*4,900*	*17,200*	*14,500*[s]	*7,910*	*32,200*
2/48	7.0	1.5	6.6	13,900[s]	5,170	50,000	21,500[s]	7,650	83,500	46,800[s]	15,300	208,000
1/75	< 0.2	.2	2.4	14,500[s]	9,270	25,000	18,700[s]	11,700	33,500	29,800[s]	17,900	56,700
Upper Mississippi River Basin (upstream of the mouth of the Ohio River), excluding the Missouri River Basin												
4/27	9.6	8.0	20	5,520	3,650	8,360	6,510	4,090	10,400	9,050	4,990	16,400
9/90	7.6	6.9	13	16,300	12,500	21,200	18,800	13,800	25,500	24,400	16,300	36,700
3/33	8.5	4.3	13	1,110	786	1,560	1,260	846	1,870	1,610	964	2,700
1/15	4.6	1.2	11	326	268	397	347	277	435	394	293	531
5/74	7.0	3.9	9.4	5,860[s]	4,210	10,100	7,160[s]	4,800	13,600	10,500[s]	5,830	25,600
1/26	3.4	.7	6.7	1,070	700	1,630	1,330	830	2,140	2,070	1,130	3,790
7/79	*6.8*	*5.7*	*12*	*4,990*	*3,510*	*7,090*	*6,290*	*4,230*	*9,360*	*9,950*	*5,960*	*16,600*
4/65	4.9	3.3	8.8	29,000[s]	19,200	71,500	38,600[s]	23,800	122,000	69,500[s]	36,100	400,000
6/102	4.0	3.6	8.0	32,800[s]	22,600	62,500	43,900[s]	28,500	97,100	79,400[s]	43,600	251,000
8/80	*7.6*	*6.7*	*13*	*10,500*	*7,370*	*15,000*	*12,800*	*8,550*	*19,300*	*18,700*	*11,000*	*31,800*
6/86	*6.8*	*4.3*	*9.4*	*11,900*	*8,100*	*17,400*	*14,900*	*9,690*	*23,000*	*23,000*	*13,100*	*40,300*
4/40	9.3	5.4	14	17,100	11,100	26,300	21,300	13,200	34,600	33,100	17,900	60,900
6/85	*6.1*	*4.4*	*9.6*	*22,200*	*16,000*	*30,800*	*27,500*	*19,000*	*39,900*	*41,700*	*25,700*	*67,600*
6/44	7.3	8.5	18	14,700	10,100	21,500	18,000	11,800	27,400	26,500	15,500	45,200
7/98	8.1	4.6	9.5	26,500[s]	20,800	36,200	30,400[s]	22,400	44,100	39,200[s]	24,500	66,200
2/15	5.1	4.9	20	4,720	2,350	9,510	5,960	2,720	13,100	9,380	3,510	25,100
4/40	9.8	5.4	14	7,160	5,160	9,920	8,360	5,780	12,100	11,500	7,120	18,500
4/69	*7.0*	*3.1*	*8.3*	*20,000*	*14,900*	*26,800*	*23,600*	*16,800*	*33,000*	*32,500*	*20,900*	*50,500*

Table 1. Peak streamflow data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[mi², square miles; ft³/s, cubic feet per second; AEP, annual exceedance probability; n/a, not applicable; --, data not available; <, less than; >, greater than] [Stations used in the trend analysis are italicized; Stations used in the trend analysis that overlap with trend analyses of Holmes and others (2010) are italicized and bold]

Map site number (fig. 2)	Site number	Station name	Contri-buting drainage area (mi²)	Flood data						
				Previous maximum streamflow			Floods of 2011			
				Date (month/year)	Stage (ft)	Streamflow (ft³/s)	Rank[c] / annual peaks in record	Date of peak stream-flow	Peak stage (ft)	Peak streamflow (ft³/s)
Upper Mississippi River Basin (upstream of the mouth of the Ohio River), excluding the Missouri River Basin—Continued										
82	*05325000*	*Minnesota River at Mankato, Minnesota*	*14,900*	*04/1965*	*29.09*	*94,100*	*8/109*	*3/26/2011*	*25.51*	*64,900*
83	*05330000*	*Minnesota River near Jordan, Minnesota*	*16,200*	*04/1965*	*33.89[f,g]*	*117,000*	*7/77*	*3/28/2011*	*31.81*	*72,300*
84	*05331000*	*Mississippi River at Saint Paul, Minnesota*	*36,800*	*04/1965*	*26.01*	*171,000[d]*	*7/119*	*3/29/2011*	*19.04[e]*	*103,000[d]*
86	*05344500*	*Mississippi River at Prescott, Wisconsin*	*44,800*	*04/1965*	*43.11*	*228,000*	*8/83*	*4/12/2011*	*36.76[e]*	*125,000*
87	05348550	Cannon River below Sabre Lake near Kilkenny, Minnesota	87.9	04/2001	13.83	563	3/26	7/16/2011	13.91	497
90	*05378500*	*Mississippi River at Winona, Minnesota*	*59,200*	*04/1965*	*20.77*	*268,000*	*7/83*	*4/15/2011*	*16.58*	*170,000*
92	05389500	Mississippi River at McGregor, Iowa	67,500	04/1965	25.38	276,000[d,l]	10/74	4/17/2011	21.38[e]	182,000[d]
93	*05394500*	*Prairie River Near Merrill, Wisconsin*	*184*	*08/1941*	*9.45*	*5,800*	*7/90*	*4/12/2011*	*7.62*	*2,550*
94	05398000	Wisconsin River at Rothschild, Wisconsin	4,020	09/1941	22.30	75,000[d,m]	6/68	4/11/2011	28.17	48,000[d]
97	*05414350*	*Little Maquoketa River near Graf, Iowa*	*39.6*	*06/2008*	*16.47*	*8,370*	*1/61*	*7/28/2011*	*17.48*	*9,420*
98	05414400	Middle Fork Little Maquoketa River near Rickardsville, Iowa	30.2	08/1972	27.70	23,000	8/58	7/28/2011	19.81	7,510
99	05414450	North Fork Little Maquoketa River near Rickardsville, Iowa	21.6	06/2008	12.58	8,040	3/61	7/28/2011	14.88	6,690
100	05414605	Bloody Run Tributary near Sherrill, Iowa	.6	06/2008	22.71	1,110	3/21	7/28/2011	18.63	624
101	05418400	North Fork Maquoketa River near Fulton, Iowa	505	07/2010	22.44	25,000	4/13	7/29/2011	19.53	17,100
102	05420500	Mississippi River at Clinton, Iowa	85,600	04/1965	24.65	307,000[d,l]	10/138	4/20/2011	21.93[e]	229,000[d]
107	05451080	South Fork Iowa River near Blairsburg, Iowa	12.0	06/2008	12.50	762	3/6	2/16/2011	11.14	564
111	05465150	North Fork Long Creek at Ainsworth, Iowa	30.2	06/1990	90.66	5,800[j]	7/48	6/15/2011	91.88	3,330
113	05469350	Haight Creek at Kingston, Iowa	2.7	05/2010	20.17	3,170	2/22	6/15/2011	19.60	2,940
114	05474500	Mississippi River at Keokuk, Iowa	119,000	07/1993	27.58	446,000[d,t]	11/134	4/25/2011	18.98	276,000[d,l,t]
115	05474900	Elk Creek On CSAH 1 near Brewster, Minnesota	61.0	05/2001	25.59	4,360	2/11	7/12/2011	25.29	3,680
116	*05476000*	*Des Moines River at Jackson, Minnesota*	*1,250*	*04/1969*	*19.45*	*15,700*	*7/86*	*3/26/2011*	*15.69*	*6,860*
121	*05486490*	*Middle River near Indianola, Iowa*	*489*	*06/1947*	*26.40[f]*	*34,000*	*4/72*	*6/10/2011*	*24.08*	*15,100*
122	05488110	Des Moines River near Pella, Iowa	12,330	07/1993	109.71	105,000[d]	5/19	7/20/2011	96.39	31,000[d]

Rank/ annual peaks used in analysis[ff]	AEP for observed 2011 flood (percent)[b]			Expected peak streamflows for selected AEP (ft^3/s)[a]								
		Typical range for 66.7-percent confidence level		2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
					95-percent confidence limit			95-percent confidence limit			95-percent confidence limit	
	Estimate	Low	High	Estimate	Low	High	Estimate	Low	High	Estimate	Low	High
Upper Mississippi River Basin (upstream of the mouth of the Ohio River), excluding the Missouri River Basin—Continued												
8/109	*3.3*	*4.9*	*9.6*	*72,400*[s]	*57,600*	*97,700*	*83,000*[s]	*62,600*	*118,000*	*106,000*[s]	*70,400*	*175,000*
7/77	*4.9*	*5.9*	*12*	*95,400*[s]	*76,000*	*127,000*	*117,000*[s]	*91,100*	*159,000*	*175,000*[s]	*131,000*	*252,000*
7/119	*5.0*	*3.8*	*7.8*	*123,000*[s]	*107,000*	*146,000*	*140,000*[s]	*120,000*	*167,000*	*177,000*[s]	*150,000*	*217,000*
8/83	*9.1*	*6.5*	*13*	*172,000*[s]	*149,000*	*206,000*	*194,000*[s]	*166,000*	*235,000*	*246,000*[s]	*206,000*	*307,000*
3/26	9.1	5.5	17	676	504	906	764	547	1,070	976	632	1,510
7/83	*8.7*	*5.5*	*11*	*224,000*[s]	*197,000*	*262,000*	*250,000*[s]	*218,000*	*296,000*	*310,000*[s]	*264,000*	*377,000*
--/--	--	--	--	226,000[q]	--	--	251,000[q]	--	--	309,000[q]	--	--
7/89	*7.2*	*5.1*	*10*	*3,210*	*2,730*	*3,770*	*3,610*	*2,990*	*4,370*	*5,310*[s]	*4,500*	*6,530*
5/67	8.5	4.4	10	59,300[s]	52,000	69,900	64,200[s]	55,900	76,500	74,200[s]	63,600	90,300
1/61	*1.9*	*.3*	*2.9*	*9,290*	*6,950*	*12,400*	*11,300*	*8,130*	*15,600*	*16,600*	*10,900*	*25,400*
8/58	7.3	9.3	18	11,700	8,860	15,600	14,400	10,500	19,800	21,800	14,400	33,100
3/61	2.0	2.3	7.3	6,710	4,810	9,370	8,210	5,670	11,900	12,300	7,720	19,700
3/21	9.9	6.8	20	1,540[s]	861	3,830	2,150[s]	1,140	5,940	4,300[s]	2,010	14,900
4/13	8.1	17	40	24,900	19,000	32,600	28,900	21,400	39,200	39,000	26,400	57,600
--/--	--	--	--	259,000[q]	--	--	283,000[q]	--	--	337,000[q]	--	--
--/--	--	--	--	644[r]	--	--	743[r]	--	--	982[r]	--	--
7/48	9.6	9.5	19	5,700	4,120	7,870	6,840	4,790	9,780	9,840	6,270	15,500
2/22	2.8	3.3	14	3,230	2,220	4,720	3,950	2,620	5,970	5,980	3,590	9,960
--/--	--	--	--	331,000[q]	--	--	366,000[q]	--	--	428,000[q]	--	--
2/11	2.3	6.7	27	3,820	1,940	7,520	4,700	2,270	9,770	7,170	2,980	17,200
7/86	*7.3*	*5.3*	*11*	*10,400*	*7,660*	*14,000*	*12,500*	*8,880*	*17,700*	*18,100*	*11,500*	*28,500*
4/72	*9.8*	*3.0*	*7.9*	*21,200*	*17,400*	*25,800*	*23,800*	*18,900*	*29,900*	*29,600*	*21,800*	*40,200*
--/--	--	--	--	68,700[u]	--	--	93,600[u]	--	--	137,000[u]	--	--

Table 1. Peak streamflow data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[mi², square miles; ft³/s, cubic feet per second; AEP, annual exceedance probability; n/a, not applicable; --, data not available; <, less than; >, greater than] [Stations used in the trend analysis are italicized; Stations used in the trend analysis that overlap with trend analyses of Holmes and others (2010) are italicized and bold]

Map site number (fig. 2)	Site number	Station name	Contributing drainage area (mi²)	Flood data: Previous maximum streamflow			Flood data: Floods of 2011			
				Date (month/year)	Stage (ft)	Streamflow (ft³/s)	Rank[c] / annual peaks in record	Date of peak streamflow	Peak stage (ft)	Peak streamflow (ft³/s)
Upper Mississippi River Basin (upstream of the mouth of the Ohio River), excluding the Missouri River Basin—Continued										
123	05488500	Des Moines River near Tracy, Iowa	12,479	06/1947	26.50	155,000	34/93	6/28/2011	13.27	33,500[d]
124	05489500	Des Moines River at Ottumwa, Iowa	13,374	05/1903	19.40	140,000[j]	16/96	6/15/2011	14.90	49,400[d]
125	05490500	Des Moines River at Keosauqua, Iowa	14,038	06/1903	27.85	146,000	13/104	6/15/2011	25.81[e]	69,900[d]
126	***05495000***	***Fox River at Wayland, Missouri***	***400***	***04/1973***	***21.71***	***26,400***	***2/90***	***6/15/2011***	***23.07***	***26,200***
127	05496000	Wyaconda River above Canton, Missouri	393	06/1933	30.00[j]	17,700	6/86	6/16/2011	28.25	13,700
139	05587450	Mississippi River at Grafton, Illinois	171,300	08/1993	38.17	598,000[d]	7/25	5/1/2011	25.93	362,000[d]
140	05592100	Kaskaskia River at Cowden, Illinois	1,330	05/2002	20.36	25,300[d]	3/41	4/26/2011	18.88	17,000[d]
142	05592575	Hickory Creek near Brownstown, Illinois	44.2	11/1993	16.43	6,250	1/23	4/26/2011	16.88	6,880
145	05599490	Big Muddy River at Route 127 at Murphysboro, Illinois	2,159	03/2008	37.24	31,500[d]	5/84	5/2/2011	40.47[e]	42,400[d]
146	07010000	Mississippi River at St. Louis, Missouri	697,000	08/1993	49.58	1,080,000[d]	45/151	4/30/2011	34.93	615,000[d]
148	07020500	Mississippi River at Chester, Illinois	708,600	04/1927	34.40	1,060,000[d,l]	18/87	5/2/2011	39.74	703,000[d]
149	07022000	Mississippi River at Thebes, Illinois	713,200	07/1844	--	1,075,000[d,m]	5/80	5/2/2011	45.52[e]	876,000[d]
Missouri River Basin										
150	06012500	Red Rock River below Lima Reservoir near Monida, Montana	570	05/1933	5.40	2,500[d]	10/87	6/13/2011	4.03	860[d]
151	06015430	Clark Canyon near Dillon, Montana	18.0	05/1984	7.10	415	2/39	6/8/2011	6.10	315
152	*06019500*	*Ruby River above reservoir near Alder, Montana*	*534*	*05/1984*	*6.24*	*3,810*	*5/73*	*6/8/2011*	*6.07*	*1,780*
153	06020600	Ruby River below reservoir near Alder, Montana	596	05/1984	8.52	3,010[d]	3/49	6/9/2011	6.31	1,720[d]
154	06023000	Ruby River near Twin Bridges, Montana	965	06/1947	6.89	1,500	1/27	7/1/2011	5.81	1,630
155	06023100	Beaverhead River at Twin Bridges, Montana	4,779	06/2010	5.52	2,830	2/3	7/1/2011	5.50	2,800
156	06024540	Big Hole River below Mudd Creek near Wisdom, Montana	1,267	06/2010	6.47	5,580	1/14	6/10/2011	6.68	6,660
157	06024580	Big Hole River near Wise River, Montana	1,611	06/2010	6.85	8,100	1/5	6/11/2011	7.14	9,130
158	06026210	Big Hole River near Glen, Montana	2,655	06/2010	7.16	10,400	1/14	6/10/2011	7.63	11,900
159	06031950	Cataract Creek near Basin, Montana	30.6	05/1981	6.88	3,150	3/39	6/7/2011	3.38	820

Rank/ annual peaks used in analysis[ff]	AEP for observed 2011 flood (percent)[b]			Expected peak streamflows for selected AEP (ft³/s)[a]								
				2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	Typical range for 66.7-percent confidence level		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High		Low	High
Upper Mississippi River Basin (upstream of the mouth of the Ohio River), excluding the Missouri River Basin—Continued												
--/--	--	--	--	68,700[u]	--	--	93,600[u]	--	--	137,000[u]	--	--
--/--	--	--	--	77,100[u]	--	--	102,000[u]	--	--	147,000[u]	--	--
--/--	--	--	--	86,000[u]	--	--	113,000[u]	--	--	162,000[u]	--	--
2/90	***1.3***	***.8***	***3.5***	***23,700***	***15,600***	***36,000***	***27,500***	***16,700***	***45,300***	***36,700***	***19,200***	***70,000***
6/86	7.9	4.3	9.4	19,300	13,100	28,300	22,600	14,200	35,800	30,800	16,700	56,700
--/--	--	--	--	446,000[q]	--	--	488,000[q]	--	--	585,000[q]	--	--
3/41	7.6	3.4	11	22,100[s]	17,500	35,700	24,800[s]	18,800	43,700	31,100[s]	20,900	67,200
1/23	4.8	.8	7.5	7,800	6,020	10,100	8,580	6,370	11,600	10,400	7,060	15,400
5/41	1.0	7.2	17	37,800[s]	31,300	48,700	42,500[s]	40,800	44,900	53,600[s]	42,500	74,200
--/--	--	--	--	850,000[q]	--	--	910,000[q]	--	--	1,120,000[q]	--	--
--/--	--	--	--	893,000[q]	--	--	948,000[q]	--	--	1,140,000[q]	--	--
--/--	--	--	--	895,000[q]	--	--	950,000[q]	--	--	1,142,000[q]	--	--
Missouri River Basin												
10/71	4.3	10.0	18	913[s]	851	997	958[s]	889	1,050	1,050[s]	965	1,170
2/39	2.4	1.9	8.1	337[s]	230	570	462[s]	303	837	905[s]	541	1,910
5/73	*7.3*	*4.0*	*9.5*	*2,290*[s]	*2,020*	*2,660*	*2,610*[s]	*2,270*	*3,080*	*3,430*[s]	*2,910*	*4,220*
3/49	8.6	2.9	9.1	2,270[s]	1,950	2,790	2,550[s]	2,160	3,200	3,240[s]	2,660	4,230
1/27	5.3	.7	6.4	1,970[s]	1,540	2,850	2,240[s]	1,710	3,330	2,870[s]	2,110	4,550
--/--	--	--	--	2,210[v]	1,860	2,780	2,450[v]	2,040	3,150	2,610[v]	2,480	4,120
1/14	8.9	1.3	12	8,850[s]	6,410	15,400	9,810[s]	6,970	17,900	11,900[s]	8,150	23,500
--/--	--	--	--	11,900[v]	10,300	14,800	13,200[v]	11,300	16,600	15,800[v]	13,300	20,600
1/14	8.7	1.3	12	16,400[s]	11,600	30,100	18,600[s]	12,800	35,900	23,600[s]	15,500	50,600
3/39	3.6	3.6	11	1,010[s]	795	1,410	1,280[s]	980	1,890	2,170[s]	1,560	3,650

Table 1. Peak streamflow data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[mi^2, square miles; ft^3/s, cubic feet per second; AEP, annual exceedance probability; n/a, not applicable; --, data not available; <, less than; >, greater than] [Stations used in the trend analysis are italicized; Stations used in the trend analysis that overlap with trend analyses of Holmes and others (2010) are italicized and bold]

Map site number (fig. 2)	Site number	Station name	Contri-buting drainage area (mi^2)	Flood data						
				Previous maximum streamflow			Floods of 2011			
				Date (month/year)	Stage (ft)	Streamflow (ft^3/s)	Rank[c] / annual peaks in record	Date of peak stream-flow	Peak stage (ft)	Peak streamflow (ft^3/s)
Missouri River Basin—Continued										
160	06033000	Boulder River near Boulder, Montana	381	05/1981	12.30	7,000[m]	2/72	6/7/2011	10.15	3,520
161	06036650	Jefferson River near Three Forks, Montana	9,532	06/1995	9.00	17,000	1/33	6/12/2011	9.38	17,400
162	06036905	Firehole River near West Yellowstone, Montana	282	05/1996	6.10	2,050	2/22	6/8/2011	5.40	1,570
163	06037500	Madison River near West Yellowstone, Montana	420	05/1996	3.78	2,820	3/85	6/8/2011	3.51	2,520
164	06040800	Madison River above powerplant near McAllister, Montana	2,186	06/2010	9.53	4,220[d]	1/10	6/24/2011	10.80	5,940[d]
166	*06043500*	*Gallatin River near Gallatin Gateway, Montana*	*825*	*06/1997*	*6.71*	*9,160*	*3/83*	*6/30/2011*	*6.51*	*8,410*
167	*06052500*	*Gallatin River at Logan, Montana*	*1,795*	*06/1899*	*--*	*9,840*	*7/92*	*6/30/2011*	*9.57[h,e]*	*7,980*
168	*06054500*	*Missouri River at Toston, Montana*	*14,669*	*06/1997*	*12.22*	*34,000*	*4/79*	*6/15/2011*	*11.53*	*29,500*
169	*06056300*	*Cabin Creek near Townsend, Montana*	*11.8*	*06/1960*	*2.00*	*70*	*1/52*	*5/9/2011*	*3.49*	*120*
170	06061500	Prickly Pear Creek near Clancy, Montana	192	05/1981	8.82	2,300	3/71	6/7/2011	5.37	1,030
171	*06062500*	*Tenmile Creek near Rimini, Montana*	*30.9*	*05/1981*	*6.20*	*3,290*	*4/95*	*6/7/2011*	*4.31*	*742*
172	06071300	Little Prickly Pear Creek at Wolf Creek, Montana	381	05/1975	7.45	4,500[m]	3/26	6/9/2011	7.84	2,460
173	06076690	Smith River near Fort Logan, Montana	846	05/1981	7.80	4,600	3/23	6/10/2011	6.70	2,270
174	06077200	Smith River below Eagle Creek near Fort Logan, Montana	1,088	06/1997	7.00[g]	3,900	1/15	6/9/2011	7.65	4,030
175	06077500	Smith River near Eden, Montana	1,594	06/1953	10.46	12,300	3/27	6/10/2011	8.77	5,710
176	06078200	Missouri River near Ulm, Montana	20,941	06/1953	17.00	35,000[d,w,m]	3/56	6/11/2011	15.48	28,800[d]
177	*06089000*	*Sun River near Vaughn, Montana*	*1,849*	*06/1964*	*23.40*	*53,500*	*4/78*	*6/10/2011*	*8.29*	*14,800*
178	06090300	Missouri River near Great Falls, Montana	23,292	06/1964	--	72,000[d,l]	5/60	6/11/2011	8.10	38,800[d]
179	06090650	Lake Creek near Power, Montana	83.8	03/1993	7.30	300[l]	2/22	6/7/2011	3.53	223
180	*06090800*	*Missouri River at Fort Benton, Montana*	*24,749*	*06/1908*	*18.50[j]*	*140,000[j]*	*10/120*	*6/10/2011*	*11.79[h,e]*	*52,700[d]*
181	06091700	Two Medicine River below South Fork, Near Browning, Montana	250	05/1991	7.78	11,700	4/35	6/7/2011	7.94	6,450
182	*06099500*	*Marias River near Shelby, Montana*	*3,242*	*06/1964*	*23.64*	*241,000[p]*	*10/105*	*6/10/2011*	*12.11*	*18,800*
184	06108800	Teton River at Loma, Montana	2,010	06/2002	5.87	2,000	1/14	6/12/2011	8.52	3,910

Rank/annual peaks used in analysis[ff]	AEP for observed 2011 flood (percent)[b]			Expected peak streamflows for selected AEP (ft^3/s)[a]								
				2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	Typical range for 66.7-percent confidence level		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High		Low	High
Missouri River Basin—Continued												
2/72	2.7	1.0	4.4	3,770[s]	3,140	4,760	4,540[s]	3,710	5,890	6,700[s]	5,260	9,210
1/75	6.5	.2	2.4	21,200[s]	18,400	25,300	23,400[s]	20,100	28,400	28,300[s]	23,900	35,200
2/22	6.9	3.3	14	1,930[s]	1,610	2,560	2,160[s]	1,770	2,960	2,730[s]	2,150	4,030
3/85	2.2	1.7	5.3	2,540[s]	2,330	2,810	2,770[s]	2,520	3,090	3,300[s]	2,950	3,770
1/10	4.1	1.8	16	6,520[s]	5,190	10,300	7,080[s]	5,530	11,700	8,360[s]	6,290	15,300
3/98	5.9	1.4	4.6	9,490[s]	8,760	10,400	10,200[s]	9,350	11,300	11,700[s]	10,600	13,200
7/92	8.6	4.9	10	9,730[s]	8,860	10,900	10,500[s]	9,520	11,900	12,200[s]	10,900	14,100
4/79	8.1	2.7	7.2	35,400[s]	31,900	40,300	38,100[s]	34,100	43,800	43,700[s]	38,700	51,300
1/52	1.0	.4	3.4	89[s]	59	152	120[s]	77	214	215[s]	129	425
3/71	2.0	2.0	6.3	1,030[s]	842	1,330	1,270[s]	1,020	1,680	1,960[s]	1,500	2,770
4/95	3.6	2.3	6.0	884[s]	732	1,110	1,090[s]	882	1,400	1,660[s]	1,300	2,260
3/26	8.6	5.5	17	4,640[s]	2,930	9,170	6,010[s]	3,650	12,700	10,200[s]	5,680	25,000
3/23	9.3	6.2	19	4,450[s]	2,930	8,460	5,840[s]	3,680	12,000	10,400[s]	5,910	25,500
1/15	5.5	1.2	11	5,200[s]	3,520	10,100	6,130[s]	4,030	12,700	8,520[s]	5,240	20,100
3/27	7.0	5.3	16	8,810[s]	6,400	14,100	11,100[s]	7,800	19,000	18,300[s]	11,900	36,200
3/55	8.7	2.6	8.1	37,800[s]	32,100	46,900	41,900[s]	35,200	52,900	51,200[s]	42,000	66,700
4/78	6.7	2.7	7.3	22,800[s]	18,800	29,100	29,400[s]	23,600	38,900	51,800[s]	39,100	74,200
5/59	10	5.0	12	59,300[s]	49,300	75,200	68,900[s]	56,300	89,400	93,400[s]	73,800	127,000
2/22	7.0	3.3	14	335[s]	235	584	415[s]	282	774	651[s]	409	1,400
10/120	5.3	5.9	11	65,900[s]	54,900	83,000	76,600[s]	62,800	98,800	104,000[s]	82,400	141,000
4/35	9.8	6.2	16	12,200[s]	9,160	18,400	15,700[s]	11,400	25,200	27,100[s]	18,200	49,800
10/105	9.9	6.7	12	47,300[s]	37,300	63,100	68,400[s]	52,500	95,700	155,000[s]	111,000	243,000
1/14	3.4	1.3	12	5,040[s]	2,510	17,400	7,080[s]	3,290	28,200	14,300[s]	5,750	78,400

Table 1. Peak streamflow data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[mi², square miles; ft³/s, cubic feet per second; AEP, annual exceedance probability; n/a, not applicable; --, data not available; <, less than; >, greater than] [Stations used in the trend analysis are italicized; Stations used in the trend analysis that overlap with trend analyses of Holmes and others (2010) are italicized and bold]

Map site number (fig. 2)	Site number	Station name	Contributing drainage area (mi²)	Flood data						
				Previous maximum streamflow			Floods of 2011			
				Date (month/year)	Stage (ft)	Streamflow (ft³/s)	Rank[c] / annual peaks in record	Date of peak streamflow	Peak stage (ft)	Peak streamflow (ft³/s)
		Missouri River Basin—Continued								
185	06109500	Missouri River at Virgelle, Montana	34,379	06/1953	--	122,000[j,d]	6/77	6/12/2011	14.07	53,700[d]
186	06112800	Bull Creek Tributary near Hilger, Montana	1.0	06/1991	5.69	415	2/38	5/21/2011	5.16	114
187	06114550	Wolf Creek Tributary near Coffee Creek, Montana	1.7	07/1978	5.55	780	4/38	6/9/2011	6.05	190
188	06114700	Judith River near mouth, Near Winifred, Montana	2,731	03/2003	9.06[g]	7,600	1/11	5/26/2011	10.46	15,300
189	06115200	Missouri River near Landusky, Montana	40,987	06/1953	--	137,000[d]	6/78	6/11/2011	32.35	74,800[d]
190	*06120500*	*Musselshell River at Harlowton, Montana*	*1,125*	*06/1975*	*10.01*	*7,270*	*2/103*	*5/25/2011*	*10.25*	*5,520*
191	06123030	Musselshell River above Mud Creek near Shawmut, Montana	1,513	06/2010	5.76	1,290	1/14	5/26/2011	9.27	8,900
192	06126050	Musselshell River near Lavina, Montana	2,970	06/1997	11.13	6,220[d]	1/20	5/25/2011	13.95	14,500[d]
193	06126500	Musselshell River near Roundup, Montana	4,023	06/1967	12.45	9,610[d]	1/65	5/26/2011	14.78	15,000[d]
194	06127500	Musselshell River at Musselshell, Montana	4,568	06/1967	11.57	9,850[d]	1/66	5/27/2011	13.23	16,200[d]
195	06127520	Home Creek near Sumatra, Montana	2.0	03/1994	5.11	278	2/39	5/10/2011	5.10	164
196	06127570	Butts Coulee near Melstone, Montana	6.7	07/1993	20.18	705	4/49	5/10/2011	14.53	402
197	06127585	Little Wall Creek Tributary near Flatwillow, Montana	9.8	07/2009	6.78	45	1/38	6/7/2011	8.54	326
198	06129000	Box Elder Creek near Winnett, Montana	684	06/1962	15.34	9,910	2/22	5/22/2011	--[y]	9,450[m]
199	*06130500*	*Musselshell River at Mosby, Montana*	*7,846*	*06/1944*	--	*18,000*	*1/80*	*5/23/2011*	*15.98*	*25,100*
200	06130915	Russian Coulee near Jordan, Montana	3.5	08/1993	7.45	840	3/38	5/21/2011	6.05	276
201	06132000	Missouri River below Fort Peck Dam, Montana	57,556	08/1946	--	51,000[d]	1/78	6/15/2011	15.53[e]	65,900[d,l]
202	06142400	Clear Creek near Chinook, Montana	135	09/1986	8.21	571	2/28	6/4/2011	8.44	571
203	06144450	Middle Creek above Lodge Creek near Govenlock, Saskatchewan	276	09/1986	13.84	738	3/25	4/27/2011	9.89	494
204	06154100	Milk River near Harlem, Montana	9,822	1952	--	19,000[j,d,w,m]	6/41	6/11/2011	23.46	6,380[d]
205	06155030	Milk River near Dodson, Montana	11,192	09/1986	29.79	13,200	2/29	5/23/2011	26.25	8,550
206	06164510	Milk River at Juneberg Bridge near Saco, Montana	17,670	04/1978	24.20	12,400[d]	5/34	4/14/2011	22.07	10,300[d]

Rank/ annual peaks used in analysis[ff]	AEP for observed 2011 flood (percent)[b]			Expected peak streamflows for selected AEP (ft^3/s)[a]								
	Estimate	Typical range for 66.7-percent confidence level		2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
				Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High		Low	High
Missouri River Basin—Continued												
6/77	8.0	4.8	11	80,500[s]	66,100	104,000	97,000[s]	78,100	129,000	144,000[s]	111,000	205,000
2/38	6.6	1.9	8.3	250[s]	132	606	381[s]	190	1,010	895[s]	397	2,840
4/38	5.5	5.7	15	494[s]	230	1,450	954[s]	408	3,230	3,910[s]	1,380	18,300
1/11	.9	1.6	15	11,000[s]	6,700	29,300	14,300[s]	8,210	43,900	25,100[s]	12,700	106,000
6/78	5.8	4.8	10	103,000[s]	82,500	136,000	126,000[s]	98,800	172,000	192,000[s]	144,000	282,000
2/103	*1.2*	*.7*	*3.1*	*4,740*[s]	*3,850*	*6,090*	*5,700*[s]	*4,550*	*7,470*	*8,140*[s]	*6,310*	*11,100*
1/14	1.6	1.3	12	7,670[s]	4,300	18,300	10,800[s]	5,750	28,300	21,900[s]	10,400	69,800
1/20	.5	.9	8.6	6,610[s]	4,070	14,400	9,370[s]	5,430	23,100	20,100[s]	10,200	65,600
165	.9	.3	2.7	10,600[s]	7,720	15,800	14,200[s]	10,000	22,200	26,100[s]	17,300	45,100
1/66	.8	.3	2.7	10,400[s]	7,390	15,900	14,000[s]	9,660	22,400	25,800[s]	16,700	45,400
2/39	8.3	1.9	8.1	296[s]	177	593	369[s]	216	774	548[s]	308	1,260
4/49	6.6	4.4	12	644[s]	449	1,040	825[s]	560	1,390	1,350[s]	862	2,490
1/38	.7	.5	4.6	148[s]	81	343	229[s]	117	580	560[s]	254	1,720
2/22	2.2	3.3	14	9,680[s]	5,910	20,800	12,700[s]	7,420	29,700	22,300[s]	11,800	61,900
1/80	*1.7*	*.2*	*2.2*	*23,500*[s]	*17,800*	*33,300*	*30,000*[s]	*22,200*	*43,800*	*48,500*[s]	*34,400*	*75,700*
3/38	6.8	3.7	12	545[s]	325	1,110	781[s]	445	1,710	1,630[s]	840	4,200
1/73	.3	.2	2.4	43,600[s]	37,500	52,900	50,400[s]	42,700	62,300	67,800[s]	55,600	87,400
2/28	3.8	2.6	11	714[s]	405	1,620	873[s]	484	2,090	1,240[s]	661	3,280
3/25	9.6	5.7	17	1,660[s]	650	6,650	2,520[s]	931	11,300	5,650[s]	1,840	31,900
6/41	9.8	9.1	19	15,100[s]	10,200	25,900	21,000[s]	13,600	38,600	42,600[s]	25,000	90,200
2/29	3.9	2.5	11	11,200[s]	6,600	23,900	14,300[s]	8,150	32,400	22,800[s]	12,100	57,800
5/34	8.6	8.7	20	21,000[s]	12,900	41,700	28,000[s]	16,500	59,200	49,600[s]	27,000	120,000

Table 1. Peak streamflow data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[mi², square miles; ft³/s, cubic feet per second; AEP, annual exceedance probability; n/a, not applicable; --, data not available; <, less than; >, greater than] [Stations used in the trend analysis are italicized; Stations used in the trend analysis that overlap with trend analyses of Holmes and others (2010) are italicized and bold]

Map site number (fig. 2)	Site number	Station name	Contributing drainage area (mi²)	Flood data: Previous maximum streamflow			Flood data: Floods of 2011			
				Date (month/year)	Stage (ft)	Streamflow (ft³/s)	Rank[c] / annual peaks in record	Date of peak streamflow	Peak stage (ft)	Peak streamflow (ft³/s)
		Missouri River Basin—Continued								
207	06166000	Beaver Creek below Guston Coulee near Saco, Montana	1,208	09/1986	14.68	23,500	2/29	6/13/2011	12.93[h,e]	3,350
208	06167500	Beaver Creek near Hinsdale, Montana	1,785	06/2007	16.00	2,050	1/7	6/9/2011	19.44	8,210
209	06172310	Milk River at Tampico, Montana	21,078	03/1997	--	11,000[j,l]	1/28	4/15/2011	28.03	19,700
210	06174500	Milk River at Nashua, Montana	22,332	04/1952	31.38	45,300[d]	2/72	6/9/2011	29.52	26,500[d]
211	06177000	Missouri River near Wolf Point, Montana	82,290	03/1939	14.40[h]	66,800[j,d]	1/83	6/14/2011	14.77	93,200[d]
212	*06178500*	*East Poplar River at international boundary, Montana*	*541*	*04/1975*	*12.01*	*4,020*	*12/78*	*4/12/2011*	*11.41*	*1,830[d]*
213	06185500	Missouri River near Culbertson, Montana	91,557	03/1943	15.12[h]	78,200[d]	1/63	6/16/2011	17.50	104,000[d]
214	*06186500*	*Yellowstone River at Yellowstone Lake Outlet, Wyoming*	*991*	*06/1997*	*8.90*	*9,950*	*2/86*	*7/11/2011*	*8.74*	*9,560*
215	06187915	Soda Butte Creek at Park Boundary at Silver Gate, Montana	31.2	06/2010	3.83	1,250	2/13	6/30/2011	3.85	1,230
216	06188000	Lamar River near Tower Ranger Station, Wyoming	660	06/1996	12.15	19,500	4/72	6/24/2011	10.75	15,500
217	*06191500*	*Yellowstone River at Corwin Springs, Montana*	*2,619*	*06/1996*	*10.92*	*32,200*	*5/105*	*6/30/2011*	*10.36*	*30,300*
218	*06192500*	*Yellowstone River near Livingston, Montana*	*3,551*	*06/1997*	*10.72*	*38,000*	*1/87*	*6/30/2011*	*10.15*	*40,600*
219	06195600	Shields River near Livingston, Montana	852	06/1979	6.80	5,600	2/33	5/25/2011	6.36	4,360
220	06200000	Boulder River at Big Timber, Montana	523	06/1997	9.00	9,940	4/64	6/30/2011	8.04	9,370
221	*06205000*	*Stillwater River near Absarokee, Montana*	*935*	*06/1967*	*7.17*	*12,000*	*6/81*	*6/30/2011*	*6.86*	*9,950*
222	*06207500*	*Clarks Fork Yellowstone River near Belfry, Montana*	*1,154*	*06/1981*	*9.97*	*14,800*	*3/90*	*7/5/2011*	*8.68*	*12,500*
223	*06208500*	*Clarks Fork Yellowstone River at Edgar, Montana*	*2,022*	*06/1997*	*9.30*	*11,100*	*5/72*	*7/6/2011*	*9.27*	*10,700*
224	06209500	Rock Creek near Red Lodge, Montana	105	06/1957	4.78	3,110	4/63	6/29/2011	7.78	2,040
225	*06211000*	*Red Lodge Creek above Cooney Reservoir near Boyd, Montana*	*143*	*05/2005*	*7.35*	*3,720*	*1/75*	*5/25/2011*	*7.74*	*4,700*
226	*06211500*	*Willow Creek near Boyd, Montana*	*53.3*	*05/2005*	*8.59*	*2,100*	*1/75*	*5/25/2011*	*8.60*	*2,110*
227	*06214500*	*Yellowstone River at Billings, Montana*	*11,408*	*06/1997*	*15.00*	*82,000*	*3/86*	*7/2/2011*	*14.37*	*70,600*
228	06217300	Twelvemile Creek near Shepherd, Montana	9.1	06/2001	10.25	1,230	2/39	5/24/2011	4.23	395
229	06218500	Wind River near Dubois, Wyoming	232	06/1972	5.48[g]	1,940[d]	1/57	7/1/2011	5.65	2,040[d]

Rank/ annual peaks used in analysis[ff]	AEP for observed 2011 flood (percent)[b]			Expected peak streamflows for selected AEP (ft³/s)[a]								
				2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	Typical range for 66.7-percent confidence level		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High		Low	High
Missouri River Basin—Continued												
2/29	6.0	2.5	11	5,960[s]	3,280	14,200	8,360[s]	4,380	21,600	16,500[s]	7,780	50,700
--/--	--	--	--	7,210[v]	3,960	17,200	10,000[v]	5,260	26,000	19,500[v]	9,210	60,000
1/28	1.1	.7	6.2	17,100[s]	11,600	29,900	19,900[s]	13,200	36,000	26,300[s]	16,700	51,000
2/72	1.8	1.0	4.4	25,800[s]	19,900	35,900	30,200[s]	23,000	43,000	40,300[s]	30,000	60,000
1/75	.2	.2	2.4	54,600[s]	46,900	65,700	65,100[s]	55,000	80,400	95,100[s]	77,300	124,000
12/36	3.6	25	40	3,330[s]	1,030	17,000	6,570[s]	1,850	38,700	25,000[s]	5,850	197,000
1/63	.5	.3	2.8	63,700[s]	53,400	80,200	77,400[s]	63,600	101,000	119,000[s]	92,600	165,000
2/86	1.9	.9	3.7	9,450[s]	8,570	10,600	10,300[s]	9,240	11,700	12,100[s]	10,700	14,100
2/13	7.0	5.7	23	1,490[s]	1,180	2,270	1,650[s]	1,280	2,630	2,030[s]	1,510	3,550
4/72	4.5	3.0	7.9	17,400[s]	15,800	19,600	19,000[s]	17,100	21,700	22,800[s]	20,200	26,800
5/105	2.2	2.8	6.6	30,500[s]	28,400	33,400	32,600[s]	30,100	35,900	36,800[s]	33,700	41,200
1/87	.9	.2	2.0	36,500[s]	33,700	40,100	39,500[s]	36,200	43,800	46,600[s]	42,000	52,700
2/33	5.4	2.2	9.5	5,520[s]	4,380	7,680	6,470[s]	5,020	9,340	9,000[s]	6,660	14,100
4/64	3.1	3.4	8.9	9,820[s]	8,970	11,100	10,600[s]	9,640	12,200	12,500[s]	11,200	14,700
6/81	6.8	4.6	10	11,500[s]	10,600	12,700	12,400[s]	11,300	13,800	14,400[s]	12,900	16,400
3/90	2.9	1.6	5.0	12,900[s]	12,100	14,100	13,900[s]	12,900	15,300	16,100[s]	14,700	18,000
5/98	10	3.0	7.1	12,800[s]	12,000	13,800	13,600[s]	12,700	14,800	15,400[s]	14,200	17,000
4/63	8.5	3.4	9.0	2,630[s]	2,320	3,120	2,930[s]	2,550	3,520	3,620[s]	3,080	4,500
1/75	.9	.2	2.4	3,540[s]	2,710	4,940	4,470[s]	3,350	6,440	7,170[s]	5,120	11,000
1/75	2.0	.2	2.4	2,110[s]	1,580	3,050	2,900[s]	2,100	4,390	5,700[s]	3,860	9,520
3/86	2.9	1.6	5.2	73,700[s]	67,700	81,900	80,100[s]	73,000	89,900	94,600[s]	84,800	109,000
2/39	7.9	1.9	8.1	1,490[s]	468	7,270	2,530[s]	749	13,800	6,640[s]	1,760	44,500
1/57	3.0	.3	3.1	2,120	1,850	2,440	2,280	1,940	2,690	2,640	2,110	3,290

Table 1. Peak streamflow data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[mi², square miles; ft³/s, cubic feet per second; AEP, annual exceedance probability; n/a, not applicable; --, data not available; <, less than; >, greater than] [Stations used in the trend analysis are italicized; Stations used in the trend analysis that overlap with trend analyses of Holmes and others (2010) are italicized and bold]

Map site number (fig. 2)	Site number	Station name	Contributing drainage area (mi²)	Flood data: Previous maximum streamflow: Date (month/year)	Stage (ft)	Streamflow (ft³/s)	Floods of 2011: Rank[c] / annual peaks in record	Date of peak streamflow	Peak stage (ft)	Peak streamflow (ft³/s)
Missouri River Basin—Continued										
230	06224000	Bull Lake Creek above Bull Lake, Wyoming	187	06/1981	7.98	4,470	2/58	7/1/2011	7.22	4,310
231	06225500	Wind River near Crowheart, Wyoming	1,891	06/1991	11.04	14,300[d]	1/67	6/30/2011	10.87	14,700[d]
232	06227600	Wind River near Kinnear, Wyoming	2,194	06/1991	8.03	13,900[d]	1/27	7/2/2011	9.92[j]	16,600[j,d]
233	06228000	Wind River at Riverton, Wyoming	2,309	06/1935	8.15[f]	13,300[d]	5/103	7/2/2011	11.80	11,200[d]
234	06236100	Wind River above Boysen Reservoir near Shoshoni, Wyoming	4,390	06/2010	9.19	19,200[d]	2/21	7/2/2011	9.07	18,700[d]
235	*06278300*	*Shell Creek above Shell Creek Reservoir, Wyoming*	*23.1*	*06/1963*	*7.84[j]*	*1,870*	*2/55*	*6/29/2011*	*7.58*	*1,480*
236	06278500	Shell Creek near Shell, Wyoming	145	06/1945	7.49	3,020[d]	1/70	6/29/2011	7.32	4,850[d]
237	06280300	South Fork Shoshone River near Valley, Wyoming	297	06/1981	9.24	10,000[d]	2/54	6/29/2011	7.93	7,560[d]
238	06281000	South Fork Shoshone River above Buffalo Bill Reservoir, Wyoming	585	06/1981	9.41	9,960[d]	4/48	6/30/2011	9.28	7,530[d]
240	06289820	East Pass Creek near Dayton, Wyoming	21.7	06/2007	7.64[f]	755[d]	2/29	5/21/2011	9.05[e]	732[d]
241	06291000	Owl Creek near Lodge Grass, Montana	163	06/1944	14.18	1,020	1/20	5/25/2011	--[y]	4,810[m]
242	06293300	Long Otter Creek near Lodge Grass, Montana	11.7	05/2008	9.18	360	3/39	5/22/2011	5.96	192
243	*06294000*	*Little Bighorn River near Hardin, Montana*	*1,294*	*05/1978*	*11.20*	*22,600*	*2/59*	*5/23/2011*	*12.32*	*17,300*
244	06294400	Andresen Coulee near Custer, Montana	2.4	06/1991	4.40	255	3/49	3/10/2011	3.32	155
245	06294500	Bighorn River above Tullock Creek near Bighorn, Montana	22,414	06/1991	7.17[g]	16,100[d]	1/47	5/23/2011	10.86	33,200[d]
246	06294930	Sarpy Creek Tributary near Colstrip, Montana	4.4	03/1978	4.84	590	5/40	5/21/2011	6.29	120
247	06294985	East Fork Armells Creek Tributary near Colstrip, Montana	1.9	07/1993	3.71	357	2/39	5/21/2011	3.44	291
248	06295000	Yellowstone River at Forsyth, Montana	39,455	05/1978	14.53	109,800	2/37	5/24/2011	12.24	78,800
249	06295113	Rosebud Creek at Reservation Boundary near Kirby, Montana	123	03/1996	6.30[g]	219	1/32	5/22/2011	10.71	1,720
250	06307616	Tongue River at Birney Day School Bridge near Birney, Montana	2,621	06/2007	7.06	5,340[d]	3/32	6/12/2011	7.30	4,430[d]
251	06307740	Otter Creek at Ashland, Montana	707	03/1978	8.65[h]	425	3/29	5/25/2011	5.51	347
252	06307990	Tongue River above T&Y Diversion Dam near Miles City, Montana	4,508	06/2007	10.40	7,510[d]	2/7	5/22/2011	9.50	6,280[d]

Rank/ annual peaks used in analysis[ff]	AEP for observed 2011 flood (percent)[b]			Expected peak streamflows for selected AEP (ft³/s)[a]								
		Typical range for 66.7-percent confidence level		2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate			Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High		Low	High
				Missouri River Basin—Continued								
2/58	1.6	1.3	5.5	4,180	3,550	4,930	4,540	3,750	5,510	5,350	4,120	6,940
1/66	3.1	.3	2.7	15,600[s]	13,800	18,400	17,300[s]	15,100	20,600	21,200[s]	18,100	26,000
1/27	3.6	.7	6.4	18,900[s]	14,500	27,900	21,800[s]	16,400	33,400	29,100[s]	20,900	48,000
1/61	3.7	.3	2.9	12,300[s]	10,500	15,000	13,500[s]	11,400	16,800	16,200[s]	13,400	20,700
2/21	9.3	3.5	15	28,500[s]	20,400	47,800	33,300[s]	23,200	58,700	45,400[s]	30,000	88,300
255	*1.5*	*1.3*	*5.8*	*1,410*	*1,170*	*1,710*	*1,550*	*1,240*	*1,930*	*1,850*	*1,370*	*2,510*
--/--	--	--	--	--[z]	--	--	--[z]	--	--	--[z]	--	--
2/54	1.9	1.4	5.9	7,510	6,220	9,070	8,190	6,570	10,200	9,730	7,210	13,100
4/48	6.3	4.5	12	9,260[s]	7,980	11,300	10,400[s]	8,860	13,000	13,300[s]	11,000	17,400
2/29	2.8	2.5	11	848[s]	525	1,710	1,190[s]	699	2,620	2,430[s]	1,280	6,440
1/20	< 0.2	.9	8.6	1,580[s]	966	3,470	2,160[s]	1,250	5,290	4,240[s]	2,180	13,200
3/39	8.2	3.6	11	363[s]	210	763	462[s]	261	1,020	715[s]	384	1,740
2/59	*.3*	*1.2*	*5.4*	*8,350*[s]	*6,490*	*11,600*	*10,800*[s]	*8,140*	*15,700*	*18,500*[s]	*13,200*	*29,600*
3/49	2.2	2.9	9.1	165[s]	90	372	273[s]	140	673	776[s]	350	2,330
1/47	3.2	.4	3.7	38,400[s]	29,500	54,600	47,800[s]	35,800	70,800	75,800[s]	53,400	122,000
5/40	7.9	7.3	17	359[s]	200	812	613[s]	319	1,560	1,950[s]	872	6,450
2/39	7.0	1.9	8.1	570[s]	302	1,360	777[s]	397	1,970	1,380[s]	661	3,970
2/37	6.2	2.0	8.5	95,100[s]	82,300	117,000	106,000[s]	90,700	134,000	135,000[s]	111,000	179,000
1/32	.3	.6	5.4	614[s]	372	1,270	880[s]	506	1,980	1,870[s]	961	5,060
3/32	9.9	4.4	14	6,450[s]	4,830	9,660	7,250[s]	5,350	11,200	9,000[s]	6,450	14,500
3/29	6.5	4.9	15	677[s]	362	1,680	974[s]	494	2,640	2,030[s]	918	6,620
--/--	--	--	--	8,080[v]	6,100	12,400	9,320[v]	6,880	14,900	12,400[v]	8,720	21,500

Table 1. Peak streamflow data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[mi², square miles; ft³/s, cubic feet per second; AEP, annual exceedance probability; n/a, not applicable; --, data not available; <, less than; >, greater than] [Stations used in the trend analysis are italicized; Stations used in the trend analysis that overlap with trend analyses of Holmes and others (2010) are italicized and bold]

Map site number (fig. 2)	Site number	Station name	Contributing drainage area (mi²)	Flood data						
				Previous maximum streamflow			Floods of 2011			
				Date (month/year)	Stage (ft)	Streamflow (ft³/s)	Rank[c] / annual peaks in record	Date of peak streamflow	Peak stage (ft)	Peak streamflow (ft³/s)
				Missouri River Basin—Continued						
253	06308340	La Grange Creek near Volborg, Montana	3.7	07/1993	9.65	550	5/38	5/23/2011	8.50	208
254	06308400	Pumpkin Creek near Miles City, Montana	697	05/1975	12.27	2,890	1/20	5/20/2011	14.41	7,900
255	06308500	Tongue River at Miles City, Montana	5,397	06/1962	11.33	13,300[d]	1/70	5/21/2011	13.99	15,300[d]
256	06309000	Yellowstone River at Miles City, Montana	48,253	05/1978	16.50	102,000[d]	3/84	5/24/2011	14.74	85,400[d]
257	*06311000*	*North Fork Powder River near Hazelton, Wyoming*	*24.5*	*06/1953*	*4.34*[f]	*886*	*3/65*	*6/13/2011*	*4.88*	*627*
258	*06326500*	*Powder River near Locate, Montana*	*13,068*	*02/1943*	*11.23*[f]	*31,000*	*5/74*	*5/21/2011*	*11.70*	*24,100*
259	06327500	Yellowstone River at Glendive, Montana	66,739	06/1909	12.70	118,000	1/20	5/23/2011	56.37	125,000
260	*06329500*	*Yellowstone River near Sidney, Montana*	*68,392*	*06/1921*	--	*159,000*	*6/99*	*5/24/2011*	*22.02*[h,e]	*124,000*
261	06331000	Little Muddy River below Cow Creek near Williston, North Dakota	775	04/1979	12.77	9,180[d]	2/57	4/12/2011	12.37	7,470[d]
262	06332523	East Fork Shell Creek near Parshall, North Dakota	360	03/1999	6.39	1,170	1/20	4/11/2011	7.81	3,530
263	06332770	Deepwater Creek at Mouth near Raub, North Dakota	220	03/1997	13.26[h]	1,300[j]	1/20	4/11/2011	16.10	5,180[j]
264	*06334500*	*Little Missouri River at Camp Crook, South Dakota*	*1,974*	*04/2009*	*17.67*	*12,400*	*1/56*	*5/24/2011*	*19.40*	*20,100*
265	06334625	Coal Creek tributary near Mill Iron, Montana	.6	06/1991	6.64	205	4/38	5/10/2011	3.42	48
266	*06335500*	*Little Missouri River at Marmarth, North Dakota*	*4,640*	*03/1947*	*21.70*	*45,000*	*3/73*	*5/23/2011*	*21.11*	*40,300*
267	06336000	Little Missouri River at Medora, North Dakota	6,190	03/1947	20.50	65,000	5/61	5/25/2011	20.39	35,100
268	06336600	Beaver Creek near Trotters, North Dakota	616	03/1978	18.61[g]	2,720	2/34	4/3/2011	18.50	2,560
269	*06337000*	*Little Missouri River near Watford City, North Dakota*	*8,310*	*03/1947*	*24.00*	*110,000*	*5/77*	*5/27/2011*	*16.70*	*34,000*
271	06342500	Missouri River at Bismarck, North Dakota	186,400	04/1952	27.90	500,000	8/83	6/25/2011	19.25[e]	155,000[d]
274	06357800	Grand River at Little Eagle, South Dakota	5,322	03/2009	24.60	32,400[d]	5/53	3/18/2011	21.27[h,e]	16,000[j,d]
275	***06359500***	***Moreau River near Faith, South Dakota***	***2,596***	***04/1944***	***21.90***[f]	***26,000***	***6/68***	***3/17/2011***	***19.92***[h,e]	***17,800***[j]
276	***06360500***	***Moreau River near Whitehorse, South Dakota***	***4,878***	***03/1997***	***26.93***[g]	***29,700***	***1/57***	***3/20/2011***	***26.92***	***34,200***
277	06392900	Beaver Creek at Mallo Camp near Four Corners, Wyoming	10.3	04/1994	2.14	103	1/29	5/21/2011	2.37	154

Rank/ annual peaks used in analysis[ff]	AEP for observed 2011 flood (percent)[b]			Expected peak streamflows for selected AEP (ft³/s)[a]								
				2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	Typical range for 66.7-percent confidence level		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High		Low	High
Missouri River Basin—Continued												
5/38	8.8	7.7	18	495[s]	304	975	708[s]	415	1,500	1,490[s]	786	3,710
1/20	2.3	.9	8.6	8,310[s]	4,150	24,400	11,100[s]	5,310	35,900	19,700[s]	8,500	76,600
1/70	1.8	.3	2.5	14,800[s]	11,800	19,600	17,800[s]	13,900	24,300	25,700[s]	19,400	37,100
2/47	3.8	1.6	6.7	93,400[s]	82,400	110,000	102,000[s]	89,100	122,000	122,000[s]	104,000	152,000
3/65	*3.8*	*2.2*	*6.9*	*703*	*572*	*864*	*790*	*621*	*1,010*	*1,000*	*724*	*1,390*
5/74	*6.2*	*3.9*	*9.4*	*34,400*[s]	*26,700*	*47,100*	*42,000*[s]	*31,900*	*59,000*	*61,900*[s]	*45,200*	*91,800*
1/20	2.5	.9	8.6	128,000[s]	106,000	174,000	141,000[s]	114,000	196,000	168,000[s]	132,000	248,000
6/99	*4.0*	*3.7*	*8.2*	*139,000*[s]	*124,000*	*160,000*	*155,000*[s]	*136,000*	*179,000*	*189,000*[s]	*164,000*	*224,000*
2/57	7.4	1.3	5.6	13,900[s]	8,440	26,200	18,100[s]	10,700	35,500	29,400[s]	16,500	62,300
1/20	1.7	.9	8.6	3,220[s]	1,560	10,100	4,570[s]	2,080	16,000	9,160[s]	3,690	40,500
1/20	1.8	.9	8.6	4,850[s]	2,110	17,900	7,050[s]	2,880	29,300	14,700[s]	5,300	78,000
1/56	*.3*	*.3*	*3.1*	*13,200*[s]	*9,480*	*20,200*	*15,600*[s]	*11,000*	*24,400*	*20,900*[s]	*14,300*	*34,300*
4/38	9.2	5.7	15	158[s]	80	404	249[s]	119	703	633[s]	266	2,180
3/73	*1.6*	*1.9*	*6.1*	*37,400*[s]	*28,600*	*52,200*	*44,600*[s]	*33,500*	*63,700*	*62,000*[s]	*45,100*	*92,600*
5/60	6.1	4.9	11	51,300[s]	38,600	74,000	63,900[s]	47,000	95,300	99,100[s]	69,300	159,000
2/34	9.0	2.2	9.2	4,900[s]	2,790	10,600	6,080[s]	3,370	13,800	8,930[s]	4,710	22,000
5/77	*8.5*	*3.8*	*9.0*	*53,600*[s]	*41,700*	*73,100*	*63,800*[s]	*48,900*	*89,100*	*88,900*[s]	*65,900*	*130,000*
1/57	< 0.2	.3	3.1	75,400[s]	66,500	88,900	85,700[s]	74,500	103,000	113,000[s]	94,750	142,000
5/62	9.8	4.7	11	30,000[s]	22,300	43,900	37,300[s]	27,100	56,500	57,500[s]	39,800	92,900
6/76	***6.8***	***4.9***	***11***	***29,000***[s]	***21,600***	***44,200***	***37,100***[s]	***27,200***	***58,900***	***59,900***[s]	***42,700***	***104,000***
3/83	***3.7***	***.2***	***2.1***	***42,600***[s]	***31,800***	***61,100***	***53,400***[s]	***39,100***	***78,700***	***82,500***[s]	***57,900***	***129,000***
1/29	2.4	.6	6.0	164	102	331	228	135	499	456	241	1,200

Table 1. Peak streamflow data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[mi², square miles; ft³/s, cubic feet per second; AEP, annual exceedance probability; n/a, not applicable; --, data not available; <, less than; >, greater than] [Stations used in the trend analysis are italicized; Stations used in the trend analysis that overlap with trend analyses of Holmes and others (2010) are italicized and bold]

Map site number (fig. 2)	Site number	Station name	Contributing drainage area (mi²)	Flood data: Previous maximum streamflow: Date (month/year)	Previous maximum streamflow: Stage (ft)	Previous maximum streamflow: Streamflow (ft³/s)	Floods of 2011: Rank[c] / annual peaks in record	Floods of 2011: Date of peak streamflow	Floods of 2011: Peak stage (ft)	Floods of 2011: Peak streamflow (ft³/s)
		Missouri River Basin—Continued								
278	06428500	Belle Fourche River at the Wyoming-South Dakota State Line	3,241	05/1995	16.33	6,320[d]	2/65	5/23/2011	16.06	5,840[d]
279	06430800	Annie Creek near Lead, South Dakota	3.7	05/1995	6.12	270	4/23	5/22/2011	5.35	109
280	06430850	Little Spearfish Creek near Lead, South Dakota	27.8	06/1999	5.79	90	2/23	5/22/2011	5.21	67
281	06436000	Belle Fourche River near Fruitdale, South Dakota	4,513	05/1982	14.32	12,700[d]	4/66	5/24/2011	13.84	10,400[d]
282	06436760	Horse Creek above Vale, South Dakota	461	05/1982	24.80	17,700[d]	3/31	5/21/2011	21.05	11,100[d]
283	06437000	Belle Fourche River near Sturgis, South Dakota	5,814	05/1982	19.10	36,400[d]	3/66	5/25/2011	17.39	24,400[d]
284	06438000	Belle Fourche River near Elm Springs, South Dakota	7,022	06/2008	19.73	47,500[d]	6/82	5/25/2011	16.09	35,800[d]
286	*06441500*	*Bad River near Fort Pierre, South Dakota*	*3,147*	*07/1905*	*32.90*	*70,000*[j,w,m]	*6/86*	*6/21/2011*	*27.27*	*23,300*
288	06452320	Platte Creek near Platte, South Dakota	747	05/1995	11.29	2,600	1/23	6/22/2011	12.91[e]	3,570
290	06468170	James River near Grace City, North Dakota	410	04/2009	17.74	7,910	1/43	4/11/2011	17.54	8,140
291	06468250	James River above Arrowwood Lake near Kensal, North Dakota	450	04/2009	14.70[g,h]	8,470	2/26	4/12/2011	14.41	7,800
292	06469400	Pipestem Creek near Pingree, North Dakota	260	04/2009	13.15	9,200	2/38	4/9/2011	12.33[e]	3,680
293	06470000	James River at Jamestown, North Dakota	1,170	05/1950	15.82	6,390	5/77	9/20/2011	13.01	2,470[d]
294	06470500	James River at Lamoure, North Dakota	1,790	04/2009	17.56	12,200[d]	5/62	7/1/2011	14.48[h,e]	4,600[d]
295	06470800	Bear Creek near Oakes, North Dakota	102	04/2009	12.25[g]	1,900	1/35	4/6/2011	12.90	2,570
296	06470878	James River at North Dakota-South Dakota State Line	2,180	04/2009	96.35	11,800[d]	2/10	4/12/2011	95.63[h,e]	8,070[d]
297	06471000	James River at Columbia, South Dakota	4,961	04/2009	19.73[h]	9,620[d]	2/66	7/17/2011	19.79[h,e]	6,200[d]
298	06472000	James River near Stratford, South Dakota	7,647	04/2009	19.98	9,910	2/37	4/29/2011	21.57[h,e]	9,460
299	*06473000*	*James River at Ashton, South Dakota*	*8,326*	*04/2009*	*23.03*[g,h]	*9,500*	*1/66*	*5/2/2011*	*24.40*[h,e]	*9,520*
300	*06475000*	*James River near Redfield, South Dakota*	*11,869*	*04/1997*	*29.92*	*17,000*	*3/62*	*4/27/2011*	*28.09*	*12,700*
301	*06476000*	*James River at Huron, South Dakota*	*13,743*	*04/1997*	*21.28*	*23,400*	*2/72*	*3/26/2011*	*20.07*[h]	*19,900*
302	*06477000*	*James River near Forestburg, South Dakota*	*15,549*	*04/1997*	*20.61*	*25,600*	*1/62*	*3/25/2011*	*20.27*	*28,400*

Rank/ annual peaks used in analysis[ff]	AEP for observed 2011 flood (percent)[b]			Expected peak streamflows for selected AEP (ft³/s)[a]								
	Estimate	Typical range for 66.7-percent confidence level		2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
				Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High		Low	High
Missouri River Basin—Continued												
2/65	2.9	1.1	4.9	6,410[s]	4,920	8,930	7,590[s]	5,740	10,800	10,400[s]	7,630	15,600
--/--	--	--	--	347[x]	--	--	568[x]	--	--	2,800[x]	--	--
--/--	--	--	--	130[x]	--	--	324[x]	--	--	7,790[x]	--	--
4/66	5.5	3.2	8.6	14,800[s]	9,480	25,600	17,900[s]	11,300	31,900	24,800[s]	15,200	46,200
--/--	--	--	--	16,100[x]	--	--	24,000[x]	--	--	68,000[x]	--	--
3/66	4.5	2.1	6.8	35,000[s]	25,200	53,500	46,700[s]	32,600	74,400	84,000[s]	54,900	146,000
6/66	6.6	5.6	12	53,100[s]	35,800	86,700	63,500[s]	42,200	106,000	86,100[s]	55,500	150,000
6/86	*9.0*	*4.3*	*9.4*	*45,800*[s]	*34,500*	*65,100*	*59,600*[s]	*43,800*	*87,500*	*101,000*[s]	*70,700*	*159,000*
1/23	6.2	.8	7.5	7,300	3,250	16,400	11,000	4,360	27,600	24,600	7,670	78,800
1/43	3.2	.4	4.1	9,610[s]	5,410	20,500	12,100[s]	6,640	26,800	18,000[s]	9,420	42,900
2/26	7.9	2.8	12	16,200[s]	7,800	46,900	21,800[s]	10,100	68,300	38,000[s]	16,100	138,000
2/38	7.9	1.9	8.3	7,590[s]	4,300	16,500	10,300[s]	5,630	23,800	18,700[s]	9,420	48,800
3/58	6.2	2.4	7.7	3,670[s]	2,640	5,600	4,570[s]	3,210	7,200	6,960[s]	4,680	11,700
4/58	9.2	3.7	9.8	9,530[s]	6,390	15,900	12,400[s]	8,090	21,600	20,600[s]	12,700	38,800
1/35	3.8	.5	5.0	3,530[s]	1,900	8,280	4,800[s]	2,490	12,000	8,620[s]	4,130	24,500
2/10	9.7	7.4	29	17,600[s]	7,930	85,200	23,200[s]	9,870	132,000	40,600[s]	15,100	320,000
2/66	2.3	1.1	4.8	6,450[s]	4,270	10,800	7,990[s]	5,180	13,800	11,700[s]	7,310	21,300
2/72	1.7	1.0	4.4	8,590[s]	5,930	13,700	12,300[s]	8,170	20,600	25,600[s]	15,800	47,700
1/66	*1.7*	*.3*	*2.7*	*8,490*[s]	*5,850*	*13,700*	*11,800*[s]	*7,850*	*19,900*	*23,200*[s]	*14,300*	*43,300*
3/62	*2.8*	*2.3*	*7.2*	*14,800*[s]	*9,990*	*24,400*	*21,100*[s]	*13,700*	*36,800*	*43,900*[s]	*26,300*	*86,300*
2/72	*1.9*	*1.0*	*4.4*	*19,300*[s]	*13,500*	*30,300*	*27,200*[s]	*18,400*	*44,800*	*55,500*[s]	*34,700*	*102,000*
1/62	*1.9*	*.3*	*2.8*	*27,100*[s]	*17,500*	*47,400*	*37,900*[s]	*23,600*	*69,600*	*73,600*[s]	*42,700*	*150,000*

Table 1. Peak streamflow data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[mi², square miles; ft³/s, cubic feet per second; AEP, annual exceedance probability; n/a, not applicable; --, data not available; <, less than; >, greater than] [Stations used in the trend analysis are italicized; Stations used in the trend analysis that overlap with trend analyses of Holmes and others (2010) are italicized and bold]

Map site number (fig. 2)	Site number	Station name	Contributing drainage area (mi²)	Flood data: Previous maximum streamflow: Date (month/year)	Stage (ft)	Streamflow (ft³/s)	Floods of 2011: Rank[c] / annual peaks in record	Date of peak streamflow	Peak stage (ft)	Peak streamflow (ft³/s)
Missouri River Basin—Continued										
303	*06477500*	*Firesteel Creek near Mount Vernon, South Dakota*	*587*	*07/2010*	*16.04*	*7,420*	*6/56*	*3/17/2011*	*13.86*[e]	*4,720*
304	06478000	James River near Mitchell, South Dakota	17,023	04/1997	23.14[f]	28,000[m]	1/25	3/25/2011	25.20	28,400
305	*06478500*	*James River near Scotland, South Dakota*	*18,601*	*06/1984*	*20.45*	*29,400*	*2/83*	*3/27/2011*	*19.52*	*28,400*
306	06478513	James River near Yankton, South Dakota	18,891	04/1997	22.94	28,800	1/25	3/28/2011	22.24	29,200
307	*06480000*	*Big Sioux River near Brookings, South Dakota*	*2,469*	*04/1969*	*14.77*	*33,900*	*3/58*	*3/24/2011*	*13.33*	*15,400*
308	*06481000*	*Big Sioux River near Dell Rapids, South Dakota*	*3,057*	*04/1969*	*16.47*	*41,300*	*9/63*	*3/24/2011*	*15.63*[h]	*13,600*
309	06482020	Big Sioux River at North Cliff Ave at Sioux Falls, South Dakota	3,778	04/1969	27.45	40,700[d,m]	5/41	3/25/2011	21.53	13,300[d]
311	06486000	Missouri River at Sioux City, Iowa	314,600	04/1952	24.28[f]	441,000	4/76	7/20/2011	35.25[e]	192,000[d]
313	06601200	Missouri River at Decatur, Nebraska	316,200	04/1997	31.99	100,000[d]	1/23	6/28/2011	40.24[e]	191,000[d]
315	06610000	Missouri River at Omaha, Nebraska	322,800	04/1952	30.20[f]	396,000	2/83	7/2/2011	36.29	217,000[d]
316	06614800	Michigan River near Cameron Pass, Colorado	1.5	07/1995	3.69	115	4/38	7/8/2011	3.80	90
317	*06622700*	*North Brush Creek near Saratoga, Wyoming*	*37.4*	*06/2010*	*5.38*	*1,360*	*1/52*	*7/19/2011*	*5.83*	*1,550*
318	06623800	Encampment River above Hog Park Creek near Encampment, Wyoming	72.7	06/2010	6.18	2,280	2/47	6/30/2011	6.06	2,180
319	06630000	North Platte River above Seminoe Reservoir near Sinclair, Wyoming	4,061	06/2010	11.64	16,700[d]	2/72	6/9/2011	11.46	16,200[d]
320	06657000	North Platte River below Whalen Diversion Dam, Wyoming	15,018	06/1955	9.85[f]	22,000[d]	17/96	6/22/2011	10.31	7,210[d]
321	06674500	North Platte River at Wyoming-Nebraska State Line	22,218	06/1929	6.04[f]	17,900[d]	8/83	6/11/2011	6.45	8,050[d]
322	06715000	Clear Creek above West Fork Clear Creek near Empire, Colorado	86.3	06/1995	6.63	1,030	1/17	7/8/2011	6.46	1,060
323	06727500	Fourmile Creek at Orodell, Colorado	24.2	06/1991	4.38[f]	256	1/20	7/13/2011	9.80	770
324	06746110	Joe Wright Creek below Joe Wright Reservoir, Colorado	6.9	08/1991	2.71	284[d]	1/34	6/30/2011	2.83	301[d]
328	06807000	Missouri River at Nebraska City, Nebraska	410,000	04/1952	24.48[f,g]	414,000	2/82	7/7/2011	28.27[e]	229,000[d]
330	06813500	Missouri River at Rulo, Nebraska	414,900	04/1952	25.60	358,000	2/62	6/27/2011	27.26	328,000[d]

Rank/annual peaks used in analysis[ff]	AEP for observed 2011 flood (percent)[b]: Estimate	AEP: Typical range for 66.7-percent confidence level: Low	AEP: Typical range for 66.7-percent confidence level: High	2-percent AEP (50-year recurrence): Estimate	2-percent AEP: 95-percent confidence limit: Low	2-percent AEP: 95-percent confidence limit: High	1-percent AEP (100-year recurrence): Estimate	1-percent AEP: 95-percent confidence limit: Low	1-percent AEP: 95-percent confidence limit: High	0.2-percent AEP (500-year recurrence): Estimate	0.2-percent AEP: 95-percent confidence limit: Low	0.2-percent AEP: 95-percent confidence limit: High
				Expected peak streamflows for selected AEP (ft³/s)[a]								
Missouri River Basin—Continued												
6/56	*9.3*	*6.7*	*14*	*10,300*	*4,270*	*24,800*	*13,900*	*5,050*	*38,400*	*26,100*	*7,500*	*91,200*
1/83	1.9	.2	2.1	27,100[s]	19,100	42,100	39,000[s]	26,500	63,500	82,700[s]	52,000	149,000
2/83	*2.5*	*.9*	*3.8*	*31,000*[s]	*22,000*	*47,600*	*43,800*[s]	*30,000*	*70,200*	*88,700*[s]	*56,700*	*156,000*
1/82	2.1	.2	2.2	29,900[s]	21,300	45,600	41,900[s]	28,900	66,900	84,200[s]	54,100	147,000
3/58	*4.6*	*2.4*	*7.7*	*21,200*[s]	*14,600*	*34,000*	*26,800*[s]	*18,100*	*44,700*	*42,300*[s]	*27,100*	*75,800*
9/63	*8.2*	*9.9*	*18*	*25,200*[s]	*18,200*	*38,400*	*32,800*[s]	*23,000*	*41,800*	*55,300*[s]	*36,600*	*94,800*
9/68	9.4	9.2	17	26,000[s]	19,400	37,700	33,600[s]	24,500	50,500	56,600[s]	38,900	91,800
--/--	--	--	--	114,000[q]	--	--	134,000[q]	--	--	185,000[q]	--	--
--/--	--	--	--	121,000[q]	--	--	142,000[q]	--	--	198,000[q]	--	--
--/--	--	--	--	148,000[q]	--	--	175,000[q]	--	--	248,000[q]	--	--
4/38	5.2	5.7	15	112	82	154	130	91	185	170	111	260
1/52	*1.1*	*.4*	*3.4*	*1,420*	*1,160*	*1,740*	*1,570*	*1,240*	*1,990*	*1,910*	*1,390*	*2,640*
2/47	1.5	1.6	6.7	2,100	1,760	2,510	2,280	1,850	2,800	2,670	2,020	3,540
2/72	1.9	1.0	4.4	16,100[s]	14,100	19,000	17,400[s]	15,100	20,800	20,100[s]	17,200	24,500
5/54	4.2	5.4	13	9,080[s]	7,560	11,600	11,200[s]	9,130	14,900	18,100[s]	13,800	26,000
3/32	5.5	4.4	14	11,100[s]	8,440	16,300	13,800[s]	10,200	21,400	22,000[s]	15,100	38,400
1/17	6.6	1.1	10.0	1,300	922	1,840	1,440	988	2,100	1,760	1,140	2,700
1/20	.6	.9	8.6	425	295	610	561	376	837	987	621	1,570
1/34	3.2	.5	5.1	321[s]	263	541	352[s]	280	662	423[s]	305	1,020
--/--	--	--	--	206,000[q]	--	--	237,000[q]	--	--	276,000[q]	--	--
--/--	--	--	--	217,000[q]	--	--	252,000[q]	--	--	371,000[q]	--	--

Table 1. Peak streamflow data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[mi^2, square miles; ft^3/s, cubic feet per second; AEP, annual exceedance probability; n/a, not applicable; --, data not available; <, less than; >, greater than] [Stations used in the trend analysis are italicized; Stations used in the trend analysis that overlap with trend analyses of Holmes and others (2010) are italicized and bold]

Map site number (fig. 2)	Site number	Station name	Contri-buting drainage area (mi^2)	Flood data						
				Previous maximum streamflow			Floods of 2011			
				Date (month/ year)	Stage (ft)	Streamflow (ft^3/s)	Rank[c] / annual peaks in record	Date of peak stream-flow	Peak stage (ft)	Peak streamflow (ft^3/s)
Missouri River Basin—Continued										
332	*06817000*	*Nodaway River at Clarinda, Iowa*	*762*	*06/2008*	*26.61*	*47,900*	*5/85*	*6/27/2011*	*22.98*	*30,000*
333	06818000	Missouri River at St. Joseph, Missouri	426,500	04/1952	26.82	397,000[d]	5/93	6/28/2011	29.97	277,000[d]
334	06819110	Middle Branch 102 River near Gravity, Iowa	34.5	06/2010	70.29	7,100	1/46	5/11/2011	70.31	7,130
335	*06853800*	*White Rock Creek near Burr Oak, Kansas*	*227*	*09/1973*	*25.06*[f]	*15,800*	*3/55*	*5/25/2011*	*21.30*	*6,660*
336	06856600	Republican River at Clay Center, Kansas	17,042	06/1935	25.74	195,000	11/96	6/2/2011	22.18	29,000[d]
337	06875900	Solomon River near Glen Elder, Kansas	5,340	07/1993	29.57	9,410[d]	4/47	6/2/2011	26.76	6,100[d]
339	*06893000*	*Missouri River at Kansas City, Missouri*	*484,100*	*06/1844*	*48.00*	*625,000*[m]	*15/85*	*6/10/2011*	*32.60*	*245,000*[d]
343	06928000	Gasconade River near Hazel-green, Missouri	1,250	01/1916	30.60	90,000[w,m]	7/67	4/26/2011	29.87	64,300
344	***06933500***	***Gasconade River at Jerome, Missouri***	***2,840***	***12/1982***	***31.34***	***136,000***	***8/93***	***4/27/2011***	***26.58***	***85,100***
345	06934000	Gasconade River near Rich Fountain, Missouri	3,180	12/1982	33.27	134,000[m]	6/72	4/28/2011	28.65	88,000
346	06934500	Missouri River at Hermann, Missouri	522,500	07/1993	36.97	750,000[d]	45/84	5/27/2011	26.60	279,000[d]
Ohio River Basin										
354	*03118000*	*Middle Branch Nimishillen Creek at Canton, Ohio*	*43.1*	*01/1959*	*6.50*	*2,470*	*2/70*	*3/1/2011*	*6.78*	*2,420*
355	*03118500*	*Nimishillen Creek at North Industry, Ohio*	*175*	*07/2003*	*14.18*	*9,310*	*3/90*	*2/28/2011*	*12.92*	*7,920*
357	*03139000*	*Killbuck Creek at Killbuck, Ohio*	*464*	*07/1969*	*26.40*	*47,500*	*5/80*	*3/1/2011*	*18.07*	*10,000*
374	03271000	Wolf Creek at Dayton, Ohio	68.7	01/1959	55.13[f]	12,500[j,m]	4/38	4/19/2011	11.19	8,130
375	03272700	Sevenmile Creek at Camden, Ohio	69.0	05/1989	18.67	20,200	4/41	4/19/2011	14.14	9,060
378	03277200	Ohio River at Markland Dam near Warsaw, Kentucky	83,170	03/1997	60.72	582,000[d]	7/41	4/26/2011	51.97	518,000[d]
382	03291780	Indian-Kentuck Creek near Canaan, Indiana	27.5	05/1990	11.34	7,800	1/42	4/19/2011	11.60	8,300
383	*03294500*	*Ohio River at Louisville, Ken-tucky*	*91,170*	*01/1937*	*85.44*	*1,110,000*	*13/148*	*4/27/2011*	*62.88*	*682,000*[d]
385	03303280	Ohio River at Cannelton Dam at Cannelton, Indiana	97,000	03/1997	52.42	736,000[d]	2/33	4/28/2011	49.30	648,000[d,l]
387	03320000	Green River at Lock 2 at Cal-houn, Kentucky	6,032	01/1937	37.50	208,000	9/81	5/4/2011	34.04[e]	76,900[d]
394	*03373500*	*East Fork White River at Shoals, Indiana*	*4,927*	*03/1913*	*42.20*	*160,000*	*13/109*	*4/26/2011*	*30.67*	*64,000*[d]

Rank/ annual peaks used in analysis[ff]	AEP for observed 2011 flood (percent)[b]			Expected peak streamflows for selected AEP (ft^3/s)[a]								
				2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	Typical range for 66.7-percent confidence level		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High		Low	High
Missouri River Basin—Continued												
5/85	6.0	3.4	8.2	36,100	29,300	44,300	39,700	31,200	50,500	48,000	34,700	66,400
--/--	--	--	--	233,000[q]	--	--	261,000[q]	--	--	324,000[q]	--	--
1/46	1.6	.4	3.8	6,740	4,950	9,190	7,900	5,600	11,100	10,800	7,000	16,800
3/55	7.3	2.6	8.1	12,600	8,350	19,100	17,100	10,700	27,300	32,000	18,100	56,400
5/60	7.5	4.9	11	41,000[s]	31,600	68,500	48,000[s]	35,400	89,600	65,600[s]	42,600	158,000
4/47	7.1	4.6	12	9,100[s]	5,800	16,900	10,900[s]	6,080	22,300	15,300[s]	6,130	40,500
--/--	--	--	--	351,000[q]	--	--	401,000[q]	--	--	530,000[q]	--	--
7/67	8.0	6.8	14	92,000	71,900	118,000	106,000	79,900	142,000	140,000	96,000	203,000
8/92	**7.2**	**5.8**	**11**	**122,000**	**85,300**	**173,000**	**145,000**	**95,300**	**221,000**	**201,000**	**119,000**	**341,000**
6/73	7.0	5.1	11	127,000	86,700	186,000	151,000	96,700	234,000	209,000	121,000	359,000
--/--	--	--	--	604,000[q]	--	--	673,000[q]	--	--	833,000[q]	--	--
Ohio River Basin												
2/70	.8	1.0	4.5	1,940	1,470	2,550	2,250	1,630	3,090	2,970	1,960	4,510
3/90	1.8	1.6	5.0	7,740	6,470	9,270	8,640	7,000	10,700	10,700	8,060	14,200
5/80	6.4	3.6	8.7	15,000	10600	21000	18,600	12,500	27,600	27,400	16,500	45,400
4/38	7.3	5.7	15	10,200	8,070	13,000	11,500	8,730	15,100	14,400	10,100	20,500
4/41	7.9	5.3	14	13,100	9,170	18,800	15,300	10,200	22,900	20,400	12,400	33,600
7/41	> 10	11	22	585,000[s]	544,000	682,000	606,000[s]	558,000	729,000	652,000[s]	578,000	838,000
1/42	2.2	.4	4.2	8,390	6,940	10,200	9,350	7,550	11,600	11,300	8,760	15,500
2/44	2.3	1.7	7.2	687,000[s]	631,000	879,000	723,000[s]	655,000	978,000	803,000[s]	703,000	1,220,000
2/33	5.8	2.2	9.5	704,000[s]	639,000	959,000	742,000[s]	664,000	1,070,000	827,000[s]	713,000	1,370,000
6/52	6.5	7.2	15	95,200[s]	79,100	183,000	108,000[s]	86,800	247,000	145,000[s]	106,000	498,000
3/49	7.5	2.9	9.1	71,600[s]	64,600	86,000	74,100[s]	64,800	93,100	77,700[s]	65,000	131,000

Table 1. Peak streamflow data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[mi², square miles; ft³/s, cubic feet per second; AEP, annual exceedance probability; n/a, not applicable; --, data not available; <, less than; >, greater than] [Stations used in the trend analysis are italicized; Stations used in the trend analysis that overlap with trend analyses of Holmes and others (2010) are italicized and bold]

Map site number (fig. 2)	Site number	Station name	Contributing drainage area (mi²)	Flood data: Previous maximum streamflow: Date (month/year)	Previous maximum streamflow: Stage (ft)	Previous maximum streamflow: Streamflow (ft³/s)	Floods of 2011: Rank[c] / annual peaks in record	Floods of 2011: Date of peak streamflow	Floods of 2011: Peak stage (ft)	Floods of 2011: Peak streamflow (ft³/s)
		Ohioi River Basin—Continued								
395	*03374000*	*White River at Petersburg, Indiana*	*11,125*	*03/1913*	*29.50*[f]	*235,000*[j,m]	*8/89*	*5/3/2011*	*26.88*	*133,000*[d]
396	03375500	Patoka River at Jasper, Indiana	262	03/1913	15.90[f]	16,000[d,w]	16/66	5/3/2011	16.68	4,550[d]
397	03376300	Patoka River at Winslow, Indiana	603	03/1964	28.84[g]	15,500	5/38	4/27/2011	27.32	11,800[d]
398	03376500	Patoka River near Princeton, Indiana	822	01/1937	26.80	18,700	2/77	5/4/2011	24.89	15,700[d]
399	*03377500*	*Wabash River at Mount Carmel, Illinois*	*28,635*	*03/1913*	*31.00*[f,g]	*428,000*	*9/131*	*5/3/2011*	*34.02*	*270,000*[d]
400	03378550	Big Creek near Wadesville, Indiana	104	03/2008	20.55	14,300	5/46	4/24/2011	19.64	9,240
401	*03380500*	*Skillet Fork at Wayne City, Illinois*	*464*	*05/1990*	*25.75*	*59,400*	*8/94*	*4/28/2011*	*22.88*	*22,600*
402	03381500	Little Wabash River at Carmi, Illinois	3,102	05/1961	36.66[g]	46,900[d]	1/72	5/3/2011	36.42[e]	55,300[d]
403	03381700	Ohio River at Old Shawneetown, Illinois	141,000	01/2005	50.57	1,030,000	1/9	5/6/2011	56.37[e]	1,260,000
404	03382100	South Fork Saline River near Carrier Mills, Illinois	147	03/2008	18.41	24,300	2/46	5/3/2011	16.11	7,870
405	*03383000*	*Tradewater River at Olney, Kentucky*	*246*	*01/1937*	*19.27*	*17,000*[w,m]	*4/70*	*4/28/2011*	*17.74*	*9,610*
406	03399800	Ohio River at Smithland Dam, Smithland, Kentucky	144,000	03/1997	51.44	831,000[d,l]	1/18	5/6/2011	54.83	1,170,000[d,l]
415	03605555	Trace Creek above Denver, Tennessee	31.9	05/2010	17.88	14,000[j,w,m,n]	4/49	4/27/2011	12.27	8,930
416	03611500	Ohio River at Metropolis, Illinois	203,000	02/1937	--	1,850,000[d,l]	4/83	5/6/2011	61.65	1,280,000[d,l]
417	03612000	Cache River at Forman, Illinois	244	03/2008	39.01[g]	20,400[d]	2/88	4/27/2011	37.52	11,900[d]
		Lower Mississippi River Basin (downstream from the mouth of the Ohio River)								
418	07022300	Mississippi River near Wickliffe, Kentucky	918,500	02/1937	58.18[e]	2,010,000[aa]	1/1	5/5/2011	--[y]	2,070,000
419	07024500	South Fork Obion River near Greenfield, Tennessee	383	05/2010	23.08[g]	38,000	7/78	5/3/2011	21.76	18,200
420	07026040	Obion River at Highway 51 near Obion, Tennessee	1,875	01/1937	40.40	99,500[m]	2/68	5/6/2011	39.31	63,900[j,l]
421	07030050	Hatchie River at Rialto, Tennessee	2,308	01/1946	22.90[i]	55,700	1/47	5/3/2011	21.79	55,800
422	07030240	Loosahatchie River near Arlington, Tennessee	262	05/2010	25.44	29,600	5/42	4/28/2011	23.87	22,700
423	07030392	Wolf River at La Grange, Tennessee	210	05/2010	15.72	12,200	1/16	4/27/2011	15.88	12,800
424	07030500	Wolf River at Rossville, Tennessee	503	01/1935	13.75	40,000	3/52	4/28/2011	14.46	29,400
425	07031650	Wolf River at Germantown, Tennessee	699	03/1975	27.98	33,400	2/38	4/29/2011	26.91	28,900
426	07032000	Mississippi River at Memphis, Tennessee	932,800	02/1937	50.40[bb,e]	2,020,000[cc]	1/83	5/9/2011	48.03	2,190,000

Rank/ annual peaks used in analysis[ff]	AEP for observed 2011 flood (percent)[b]			Expected peak streamflows for selected AEP (ft³/s)[a]								
				2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	Typical range for 66.7-percent confidence level		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High		Low	High
Ohio River Basin—Continued												
3/50	*5.7*	*2.8*	*8.9*	*152,000*[s]	*129,000*	*199,000*	*165,000*[s]	*133,000*	*224,000*	*192,000*[s]	*138,000*	*290,000*
3/34	9.5	4.2	13	6,780[s]	5,120	16,800	7,920[s]	5,740	23,500	11,000[s]	7,140	50,400
3/25	6.1	5.7	17	14,100[s]	9,720	22,600	15,600[s]	9,720	26,300	18,500[s]	9,720	37,600
1/34	2.7	.5	5.1	16,600[s]	12,600	35,200	19,000[s]	13,900	47,900	25,100[s]	16,300	91,900
1/44	*2.1*	*.4*	*4.0*	*271,000*[s]	*223,000*	*333,000*	*287,000*[s]	*223,000*	*365,000*	*319,000*[s]	*223,000*	*444,000*
5/46	4.8	6.4	15	10,300	8,230	12,800	11,200	8,660	14,500	12,900	9,240	18,000
8/94	*9.3*	*5.7*	*11*	*36,200*	*27,700*	*47,300*	*42,700*	*31,200*	*58,400*	*58,800*	*38,500*	*89,700*
1/72	.7	.3	2.5	43,300[s]	35,700	63,700	49,400[s]	39,400	79,500	64,200[s]	46,800	128,000
--/--	--	--	--	--	--	--	--	--	--	--	--	--
2/46	4.1	1.6	6.9	9,580	6,640	13,800	11,800	7,690	18,000	16,100	9,150	28,200
4/70	*6.9*	*3.1*	*8.2*	*13,900*	*10,400*	*18,600*	*17,100*	*12,100*	*24,000*	*26,400*	*16,700*	*41,500*
1/18	< 0.2	1.0	9.5	851,000[s]	760,000	1,250,000	887,000[s]	780,000	1,370,000	961,000[s]	801,000	1,770,000
3/48	4.1	2.9	9.2	10,600	7,640	14,800	12,400	8,440	18,100	16,700	10,200	27,500
4/83	4.0	2.6	6.9	1,360,000[s]	1,260,000	1,560,000	1,430,000[s]	1,310,000	1,700,000	1,590,000[s]	1,400,000	2,040,000
2/88	2.4	.8	3.6	12,400[s]	9,960	18,500	14,600[s]	11,300	23,900	20,400[s]	14,300	41,600
Lower Mississippi River Basin (downstream from the mouth of the Ohio River)												
--/--	--	--	--	--	--	--	--	--	--	--	--	--
7/78	8.7	5.8	12	26,900	20,800	34,900	31,400	23,200	42,500	42,400	28,200	63,800
2/68	3.5	1.1	4.7	71,400	56,500	90,300	81,400	61,900	107,000	106,000	73,100	153,000
1/47	3.7	.4	3.7	63,600	48,400	83,500	72,900	53,100	100,000	96,400	63,200	147,000
5/42	6.9	7.0	16	29,600	21,900	40,000	33,600	23,800	47,600	43,600	27,600	68,900
1/16	10	1.1	11	20,300	12,400	33,000	23,500	13,700	40,300	31,000	16,000	60,400
3/52	3.3	2.7	8.6	32,400	24,300	43,200	36,900	26,400	51,600	47,300	30,200	74,300
2/38	4.8	1.9	8.3	35,700	25,300	50,500	41,700	28,100	62,000	56,900	34,000	95,300
1/81	.4	.2	2.2	1,880,000[dd]	1,730,000	2,200,000	1,990,000[dd]	1,810,000	2,430,000	2,240,000[dd]	1,960,000	2,990,000

Table 1. Peak streamflow data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[mi², square miles; ft³/s, cubic feet per second; AEP, annual exceedance probability; n/a, not applicable; --, data not available; <, less than; >, greater than] [Stations used in the trend analysis are italicized; Stations used in the trend analysis that overlap with trend analyses of Holmes and others (2010) are italicized and bold]

Map site number (fig. 2)	Site number	Station name	Contributing drainage area (mi²)	Flood data: Previous maximum streamflow			Flood data: Floods of 2011			
				Date (month/year)	Stage (ft)	Streamflow (ft³/s)	Rank[c] / annual peaks in record	Date of peak streamflow	Peak stage (ft)	Peak streamflow (ft³/s)
		Lower Mississippi River Basin (downstream from the mouth of the Ohio River)—Continued								
427	07032200	Nonconnah Creek near Germantown, Tennessee	68.2	10/2002	23.87	14,600	2/42	4/27/2011	23.48	13,800
428	07035000	Little St. Francis River at Fredericktown, Missouri	90.5	11/1993	26.50	25,100	2/23	4/26/2011	22.39	15,000
429	07036100	St. Francis River near Saco, Missouri	664	11/1993	36.10	161,000	4/20	4/26/2011	27.94	63,200
430	*07037500*	*St. Francis River near Patterson, Missouri*	*956*	*12/1982*	*35.77*	*155,000*	*3/90*	*5/2/2011*	*30.92*	*80,000*
431	07039500	St. Francis River at Wappapello, Missouri	1,311	08/1915	--	85,000[w]	2/71	5/3/2011	35.64	28,100[d]
432	07040000	St. Francis River at Fisk, Missouri	1,370	04/2008	23.33	11,400[d]	1/13	5/3/2011	27.10	18,800[d]
433	07040100	St. Francis River at St. Francis, Arkansas	1,770	03/1935	28.20	39,200	2/90	5/3/2011	27.25[e]	27,000[d]
434	07040450	St. Francis River at Lake City, Arkansas	2,370	04/1979	--	42,700[d]	2/87	5/3/2011	14.37	42,600[d]
435	07043500	Little River Ditch 1 near Morehouse, Missouri	341	02/1989	19.50	12,200	3/63	4/28/2011	19.77	10,300
436	07047800	St. Francis River at Parkin, Arkansas	--[k]	01/1930	--	25,300[d]	5/75	5/6/2011	28.02	24,000[d]
437	07047970	Mississippi River at Helena, Arkansas	941,800	04/1912	54.30[bb,e]	2,040,000[w]	1/132	5/11/2011	56.59	2,180,000[d]
438	***07050700***	***James River near Springfield, Missouri***	***246***	***07/1909***	***22.00***	***62,000[w,m]***	***4/57***	***4/26/2011***	***18.85***	***30,600[d]***
439	07052250	James River near Boaz, Missouri	461	03/2008	23.55	41,900[d]	3/18	4/25/2011	20.82	30,500[d]
440	***07052500***	***James River at Galena, Missouri***	***987***	***03/2008***	***35.96***	***85,100***	***3/90***	***4/26/2011***	***30.95[h]***	***64,000***
441	***07057500***	***North Fork River near Tecumseh, Missouri***	***561***	***11/1985***	***28.10***	***133,000***	***3/67***	***4/26/2011***	***24.58***	***81,000***
442	07058000	Bryant Creek near Tecumseh, Missouri	570	12/1982	26.74	71,100	2/57	4/26/2011	23.01	47,600
445	07062500	Black River at Leeper, Missouri	987	03/1904	22.30	125,000[w,m]	24/79	4/24/2011	12.98	11,700[d]
446	07063000	Black River at Poplar Bluff, Missouri	1,245	03/1904	--	100,000[j,w,m]	15/90	4/26/2011	21.41	24,400[d]
447	07064000	Black River near Corning, Arkansas	1,750	06/1945	16.92	48,600	2/95	4/28/2011	18.12	40,700[d]
448	***07068000***	***Current River at Doniphan, Missouri***	***2,038***	***03/1904***	***24.90***	***130,000[w,m]***	***7/95***	***4/26/2011***	***23.76***	***90,100***
449	07069000	Black River at Pocahontas, Arkansas	4,840	04/1927	25.90	80,000[m]	1/76	4/28/2011	28.44	86,600[d]
450	***07071500***	***Eleven Point River near Bardley, Missouri***	***793***	***12/1982***	***21.64***	***49,800***	***5/91***	***4/26/2011***	***17.83***	***33,400***
451	***07072500***	***Black River at Black Rock, Arkansas***	***7,370***	***12/1982***	***31.51[j]***	***190,000[j]***	***2/107***	***4/26/2011***	***30.45***	***172,000***

Rank/ annual peaks used in analysis[ff]	AEP for observed 2011 flood (percent)[b]			Expected peak streamflows for selected AEP (ft³/s)[a]								
				2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	Typical range for 66.7-percent confidence level		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High		Low	High
Lower Mississippi River Basin (downstream from the mouth of the Ohio River)—Continued												
2/42	3.4	1.7	7.5	14,900	11,900	18,600	16,200	12,500	21,100	19,300	13,600	27,400
2/20	5.9	3.7	15	17,800	11,700	27,200	20,000	12,500	31,900	25,100	14,500	43,400
4/20	9.2	11	27	83,100	58,200	119,000	93,100	62,200	139,000	118,000	72,200	194,000
2/89	*5.2*	*.8*	*3.5*	*96,100*	*69,900*	*132,000*	*109,000*	*74,700*	*160,000*	*144,000*	*87,500*	*236,000*
1/70	< 0.2	.3	2.5	17,900[dd]	14,900	31,600	20,600[dd]	16,500	41,400	27,700[dd]	20,300	77,300
1/13	2.7	1.4	13	20,300[dd]	12,700	586,000	25,200[dd]	14,600	1,660,000	41,300[dd]	19,600	15,800,000
2/66	3.3	1.1	4.8	29,500[dd]	24,500	42,800	33,300[dd]	26,900	53,000	42,900[dd]	31,800	84,400
2/64	1.5	1.1	5.0	39,600[dd]	32,300	62,200	45,500[dd]	35,900	80,600	60,600[dd]	43,800	144,000
3/62	6.5	2.3	7.2	11,900	9,320	15,200	12,800	9,440	17,400	14,800	9,510	23,000
5/75	.8	3.9	9.2	20,900[dd]	18,200	27,900	23,000[dd]	19,600	33,200	28,200[dd]	22,600	48,900
1/85	.5	.2	2.1	1,900,000[dd]	1,750,000	2,270,000	2,020,000[dd]	1,840,000	2,540,000	2,300,000[dd]	2,010,000	3,270,000
4/56	***3.4***	***3.8***	***10***	***33,400***[s]	***24,300***	***45,800***	***37,500***[s]	***25,800***	***54,600***	***47,600***[s]	***29,300***	***77,200***
3/18	9.5	7.9	24	44,100	30,100	64,500	50,700	33,100	77,600	67,500	40,500	112,000
3/89	***2.8***	***1.6***	***5.0***	***68,800***	***48,200***	***98,100***	***80,300***	***52,900***	***122,000***	***109,000***	***64,700***	***183,000***
3/67	***.9***	***2.1***	***6.7***	***66,800***	***43,800***	***102,000***	***79,300***	***49,200***	***128,000***	***108,000***	***60,900***	***190,000***
2/57	3.8	1.3	5.6	58,200	38,300	88,200	69,900	43,600	112,000	98,000	55,900	172,000
3/51	8.8	2.8	8.7	21,200[dd]	14,200	85,900	27,800[dd]	17,200	164,000	51,100[dd]	28,100	357,000
3/64	5.4	2.2	7.0	35,900[dd]	24,700	122,000	47,500[dd]	30,300	220,000	88,100[dd]	46,900	865,000
1/63	1.0	.3	2.8	35,500[dd]	28,400	53,500	40,600[dd]	31,300	66,500	52,800[dd]	36,400	105,000
7/95	***5.5***	***4.8***	***9.8***	***120,000***	***82,200***	***175,000***	***143,000***	***92,100***	***222,000***	***200,000***	***116,000***	***343,000***
1/70	1.8	.3	2.5	84,100[dd]	66,700	120,000	96,500[dd]	74,700	149,000	125,000[dd]	89,900	258,000
5/91	***8.9***	***3.2***	***7.6***	***65,700***	***43,200***	***100,000***	***83,000***	***51,500***	***134,000***	***125,000***	***71,000***	***221,000***
2/107	***1.2***	***.7***	***3.0***	***148,000***[dd]	***120,000***	***212,000***	***177,000***[dd]	***139,000***	***274,000***	***254,000***[dd]	***182,000***	***481,000***

Table 1. Peak streamflow data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[mi², square miles; ft³/s, cubic feet per second; AEP, annual exceedance probability; n/a, not applicable; --, data not available; <, less than; >, greater than] [Stations used in the trend analysis are italicized; Stations used in the trend analysis that overlap with trend analyses of Holmes and others (2010) are italicized and bold]

Map site number (fig. 2)	Site number	Station name	Contributing drainage area (mi²)	Flood data: Previous maximum streamflow: Date (month/year)	Stage (ft)	Streamflow (ft³/s)	Floods of 2011: Rank[c] / annual peaks in record	Date of peak streamflow	Peak stage (ft)	Peak streamflow (ft³/s)
Lower Mississippi River Basin (downstream from the mouth of the Ohio River)—Continued										
452	07074420	Black River at Elgin Ferry, Arkansas	8,420	03/2008	32.57[h]	127,000[j]	1/24	4/28/2011	34.77[e]	212,000
453	07074500	White River at Newport, Arkansas	19,900	04/1945	35.19[j,g]	343,000[d]	6/126	5/4/2011	34.17	292,000[d]
454	07074850	White River near Augusta, Arkansas	20,500	03/2008	38.41	252,000[d]	1/74	5/5/2011	40.70	262,000[d]
456	*07077380*	*Cache River at Egypt, Arkansas*	*701*	*01/1966*	*21.88*	*8,940*	*2/62*	*5/4/2011*	*22.15*	*8,500*
457	07083710	Arkansas River below Empire Gulch near Malta, Colorado	238	06/2008	5.41	1,530[d]	1/12	6/17/2011	5.72	1,590[d]
458	07105800	Fountain Creek at Security, Colorado	500	07/1965	11.30	25,000	4/47	9/14/2011	9.48	13,200
459	07105900	Jimmy Camp Creek at Fountain, Colorado	65.4	06/1965	--	124,000[j,m]	4/37	9/15/2011	10.46	4,120
460	07106300	Fountain Creek near Pinon, Colorado	865	04/1999	9.80	19,100[d]	2/39	9/15/2011	9.36	13,600[d]
469	07188653	Big Sugar Creek near Powell, Missouri	141	04/2008	18.11	15,800	1/11	4/25/2011	21.99	24,000
470	07188885	Indian Creek near Lanagan, Missouri	239	03/2008	13.31	14,600	1/12	5/24/2011	14.07	16,100
471	07189100	Buffalo Creek at Tiff City, Missouri	91.6	06/2007	14.31	15,700	1/11	5/24/2011	15.28	26,300
472	07189540	Cave Springs Branch near Southwest City, Missouri	7.9	04/2008	12.45	2,470	2/14	5/23/2011	12.30	2,340
473	07189542	Honey Creek near Southwest City, Missouri	48.2	04/2008	13.89	9,210	2/14	5/24/2011	13.27	7,020
474	*07191000*	*Big Cabin Creek near Big Cabin, Oklahoma*	*450*	*05/1943*	*34.96[f]*	*63,000*	*4/72*	*5/24/2011*	*48.74*	*45,900[d]*
476	07194800	Illinois River at Savoy, Arkansas	167	04/2004	19.63	39,800	1/19	4/25/2011	24.66[j]	86,900
477	07195000	Osage Creek near Elm Springs, Arkansas	130	05/1961	16.66	22,500	1/46	4/25/2011	18.70	38,000
478	07195400	Illinois River at Highway 16 near Siloam Springs, Arkansas	509	03/2008	21.53	61,000	1/12	4/26/2011	26.23	87,100
479	07195430	Illinois River south of Siloam Springs, Arkansas	575	04/2004	20.54	52,000	1/16	4/26/2011	27.71	106,000
480	*07195500*	*Illinois River near Watts, Oklahoma*	*635*	*07/1960*	*25.96*	*68,000*	*1/56*	*4/26/2011*	*28.60*	*97,400[d]*
481	07196090	Illinois River at Chewey, Oklahoma	825	n/a	n/a	n/a	1/1	4/26/2011	29.54	92,200
482	*07196500*	*Illinois River near Tahlequah, Oklahoma*	*959*	*05/1950*	*27.94*	*150,000[j]*	*4/79*	*4/26/2011*	*25.97*	*85,400[d]*
483	***07197000***	***Baron Fork at Eldon, Oklahoma***	***307***	***06/2000***	***26.77***	***54,700***	***1/65***	***4/25/2011***	***28.51***	***63,400[d]***
484	07197360	Caney Creek near Barber, Oklahoma	89.6	06/2000	15.67[f,g]	9,720[j,l]	1/14	4/25/2011	31.42[h,e]	13,100[j]

Rank/ annual peaks used in analysis[ff]	AEP for observed 2011 flood (percent)[b]			Expected peak streamflows for selected AEP (ft³/s)[a]								
				2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	Typical range for 66.7-percent confidence level		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High		Low	High
Lower Mississippi River Basin (downstream from the mouth of the Ohio River)—Continued												
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2/45	2.7	1.6	7.0	317,000[dd]	221,000	1,010,000	399,000[dd]	261,000	1,620,000	649,000[dd]	366,000	4,780,000
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2/62	*2.0*	*1.2*	*5.1*	*8,490*[dd]	*7,450*	*11,000*	*9,290*[dd]	*7,990*	*12,800*	*11,200*[dd]	*9,130*	*18,000*
1/12	8.5	1.5	14	2,010[s]	1,470	5,480	2,210[s]	1,520	7,070	2,640[s]	1,520	12,200
4/47	6.9	4.6	12	18,400	12,700	26,700	21,800	14,100	33,500	30,500	17,300	53,800
4/37	6.1	5.8	15	7,070	3,500	14,300	9,530	4,340	20,900	16,700	6,400	43,800
2/39	3.7	1.9	8.1	17,500[s]	11,300	83,800	22,900[s]	13,700	157,000	41,100[s]	20,100	693,000
1/11	3.6	1.6	15	27,800	16,700	46,300	32,700	19,000	56,300	44,700	24,500	81,300
1/12	9.1	1.5	14	22,700	16,300	31,600	26,200	18,100	37,900	35,500	22,600	55,700
1/11	.6	1.6	15	19,300	11,500	32,500	22,600	13,000	39,200	30,100	16,400	55,100
2/14	9.5	5.3	21	4,370	2,710	7,040	5,430	3,220	9,140	8,170	4,280	15,600
2/14	7.0	5.3	21	18,000	10,300	31,600	22,200	12,200	40,500	33,600	16,100	69,800
1/25	*3.2*	*.7*	*6.9*	*49,200*[s]	*34,900*	*82,300*	*54,500*[s]	*34,900*	*97,000*	*65,700*[s]	*34,900*	*141,000*
1/19	1.2	1.0	9.0	72,700[dd]	41,500	182,000	90,500[dd]	49,100	276,000	139,000[dd]	65,000	692,000
1/46	.9	.4	3.8	28,800[dd]	19,200	56,300	36,600[dd]	22,800	81,400	58,400[dd]	30,300	176,000
1/12	3.6	1.5	14	107,000[dd]	53,900	286,000	134,000[dd]	64,300	441,000	206,000[dd]	85,200	1,170,000
1/16	1.1	1.1	11	92,500[dd]	59,600	296,000	108,000[dd]	66,900	448,000	148,000[dd]	81,000	941,000
1/31	*1.0*	*.6*	*5.6*	*79,500*[s]	*54,700*	*259,000*	*96,400*[s]	*62,800*	*388,000*	*143,000*[s]	*80,900*	*980,000*
--/--	--	--	--	90,200[r]	--	--	104,000[r]	--	--	150,000[r]	--	--
1/25	*2.4*	*.7*	*6.9*	*89,100*[s]	*58,500*	*433,000*	*110,000*[s]	*67,800*	*721,000*	*170,000*[s]	*88,700*	*2,370,000*
1/65	***1.9***	***.3***	***2.7***	***62,500***[s]	***48,200***	***95,400***	***72,600***[s]	***53,800***	***121,000***	***96,200***[s]	***63,700***	***201,000***
1/14	6.7	1.3	12	18,300	12,500	26,900	21,700	14,200	33,200	30,200	17,700	51,700

Table 1. Peak streamflow data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[mi², square miles; ft³/s, cubic feet per second; AEP, annual exceedance probability; n/a, not applicable; --, data not available; <, less than; >, greater than] [Stations used in the trend analysis are italicized; Stations used in the trend analysis that overlap with trend analyses of Holmes and others (2010) are italicized and bold]

Map site number (fig. 2)	Site number	Station name	Contributing drainage area (mi²)	Flood data: Previous maximum streamflow: Date (month/year)	Previous maximum streamflow: Stage (ft)	Previous maximum streamflow: Streamflow (ft³/s)	Floods of 2011: Rank[c] / annual peaks in record	Floods of 2011: Date of peak streamflow	Floods of 2011: Peak stage (ft)	Floods of 2011: Peak streamflow (ft³/s)
Lower Mississippi River Basin (downstream from the mouth of the Ohio River)—Continued										
485	*07198000*	*Illinois River near Gore, Oklahoma*	*1,626*	*05/1950*	*30.20*[f]	*180,000*	*14/73*	*5/24/2011*	*17.57*	*15,900*[d]
487	*07249985*	*Lee Creek near Short, Oklahoma*	420	04/2004	27.77[g]	82,400	3/66	4/26/2011	26.08	70,100
488	07250965	Frog Bayou at Winfrey, Arkansas	54.2	04/2004	11.58	12,900	1/9	4/25/2011	13.88	21,800
489	07265450	Mississippi River at Arkansas City, Arkansas	1,130,600	05/1927	59.20[e]	2,500,000[d,w,ee]	2/88	5/17/2011	53.14	2,400,000[j,d]
490	07289000	Mississippi River at Vicksburg, Mississippi	1,140,500	05/1927	56.20[e]	2,278,000[j]	1/91	5/17/2011	57.17	2,310,000[d,l]
492	07374000	Mississippi River at Baton Rouge, Louisiana	1,125,810	04/1945	45.18	1,473,000	2/36	5/18/2011	45.48	1,440,000[d]
493	07374525	Mississippi River at Belle Chase, Louisiana	1,110,000	02/2010	15.84[g]	1,210,000	1/3	5/17/2011	18.28[e]	1,320,000
494	07381482	Old River Outflow Channel below Hydropower Channel, Louisiana	--[k]	04/2010	35.08[g]	423,000	1/3	5/20/2011	49.82[e]	730,000
495	07381490	Atchafalaya River at Simmesport, Louisiana	--[k]	05/1973	53.40	781,000	3/9	5/24/2011	45.06	697,000
496	07381590	Wax Lake Outlet at Calumet, Louisiana	--[k]	04/1997	--	258,000[l]	1/67	5/27/2011	10.81	323,000
497	07381600	Lower Atchafalaya River at Morgan City, Louisiana	--[k]	04/2008	7.81[g]	366,000	1/34	5/29/2011	10.33[e]	512,000

[a]Unless otherwise noted, expected peak streamflows are based on Water Resources Council Bulletin 17B weighting by variance method.

[b]Where frequency analysis was performed by USGS according to Bulletin 17B methods, the AEP estimate listed here is interpolated from expected peak streamflows (in columns at right). 66.7% confidence limits are computed using non-parametric methods based on the rank and annual peaks used in the USGS frequency analysis. No estimated AEP or confidence limits are computed here for the 2011 peak streamflow if the expected peak streamflows were furnished by other agencies, computed through regional regression equations, or unavailable.

[c]Rank of the maximum instantaneous peak streamflow measured during 2011 event compared to all systematic and historic annual peaks. A rank of 1 indicates that the 2011 peak streamflow was higher than all other recorded annual peaks.

[d]Streamflow was affected by regulation or diversion.

[e]Stage corresponds to maximum stage for the flood, not the stage when the peak streamflow occurred.

[f]Stage was measured at a different site or datum (or both) than the 2011 peak.

[g]Stage is the stage of peak streamflow, not the maximum historic stage.

[h]Stage is affected by backwater.

[i]A previous historic peak stage and unknown streamflow exists that likely exceeds the previous max streamflow.

[j]Estimated.

[k]Major river diversions upstream cause these drainage areas to be indeterminate.

[l]Streamflow is a maximum daily average. Peak streamflow may be higher.

[m]Streamflow is an historic peak.

[n]Streamflow is unknown but greater than the reported value.

[o]All or part of the record is affected by urbanization, mining, agricultural changes, channelization, or other.

[p]Streamflow was affected by dam failure.

[q]Source: U.S. Army Corps of Engineers (2004).

[r]Expected peak streamflow based on regional regression equation estimate only.

Rank/ annual peaks used in analysis[ff]	AEP for observed 2011 flood (percent)[b]			Expected peak streamflows for selected AEP (ft³/s)[a]								
		Typical range for 66.7-percent confidence level		2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
					95-percent confidence limit			95-percent confidence limit			95-percent confidence limit	
	Estimate	Low	High	Estimate	Low	High	Estimate	Low	High	Estimate	Low	High
Lower Mississippi River Basin (downstream from the mouth of the Ohio River)—Continued												
3/61	*7.2*	*2.3*	*7.3*	*19,900*[s]	*16,800*	*38,100*	*22,600*[s]	*18,400*	*52,200*	*29,600*[s]	*22,000*	*110,000*
3/66	2.1	2.1	6.8	70,900[dd]	56,400	95,000	86,100[dd]	67,100	119,000	127,000[dd]	95,000	186,000
1/10	2.0	1.8	16	21,700[dd]	16,000	40,100	24,600[dd]	17,600	48,700	31,700[dd]	21,400	73,100
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1/87	.8	.2	2.0	2,120,000[s]	1,980,000	2,520,000	2,240,000[s]	2,070,000	2,840,000	2,490,000[s]	2,250,000	3,500,000
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[s]Expected peak streamflow based on Water Resources Council Bulletin 17B at-site estimate only.

[t]No USGS streamgage is currently in operation at this site. Streamflow is provided by AmerenUE and computed from operation of turbines in power plant and spillway gates at dam.

[u]Source: U.S. Army Corps of Engineers (2010), Des Moines River Regulated Flow Frequency Study, Rock Island, Illinois., 82p.

[v]Expected peak streamflows determined using drainage area ratio adjustment method as described in WRIR 03-4308 by Parrett and Johnson, 2003, p. 34.

[w]Month or day of occurrence is unknown or not exact.

[x]Source: Sando and others (2008), Peak-flow frequency estimates based on data through water year 2001 for selected streamflow-gaging stations in South Dakota: U.S. Geological Survey Scientific Investigations Report 2008–5104, 367 p

[y]No stage data available. 2011 Streamflow measured directly at site where stage gage is not established or has been discontinued.

[z]No flood frequency analysis available. Peak records furnished by Wyoming State Engineer's Office.

[aa]This value is for Hickman, Kentucky which is 29.6 river miles downstream from Wickliffe, Kentucky and includes the flow through the New Madrid Floodway (Mississippi River Commission, 1955). The 1912 and 1913 maximum streamflows were 2,015,000 ft³/s (Mississippi River Commission, 1955).

[bb]Source: Mississippi River Commission (1954), Annual highest and lowest stages of the Mississippi River and its outlets and tributaries to 1953, Vicksburg, Mississippi, 253 p.

[cc]Source: Mississippi River Commission (1955).

[dd]Source: Westerman and others (2012).

[ee]The amount of flow actually measured was 1,712,000 ft³/s (Mississippi River Commission, 1955) , but 2,500,000 ft³/s was the estimated total flow past Arkansas City factoring in that flow which was bypassing the main channel area through the ruptured levees (written communication, 2012, Charles Shadie, Chief, Water Control, Mississippi Valley Division, U.S. Army Corps of Engineers).

[ff]For statistical reasons, the number of annual peaks used in the analysis may not match the number of annual peaks in the record. Reasons include but are not limited to period extensions from nearby gages and mixed periods of regulation and non-regulation.

[gg]Source: U.S. Army Corps of Engineers (2001).

Table 2. Annual runoff data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.

[Stations used in the trend analysis are italicized. mi², square miles; AEP, annual exceedance probability; <, less than; >, greater than]

Map site number (fig. 2)	Station number	Station name	Contributing drainage area (mi²)	Water year 2011		Period of record				Previous maximum annual runoff based on data through water year 2010[a]	
				Annual runoff (acre-feet)	Rank	Water years with streamflow data	Number of years with streamflow data	Median annual runoff (acre-feet)	Mean annual runoff (acre-feet)	Water year	Annual runoff (acre-feet)
		Red River of the North Basin									
2	*05046000*	*Otter Tail River below Orwell Dam near Fergus Falls, Minnesota*	*1,740*	*1,050,000*	*1*	*1931–2011*	*81*	*255,600*	*295,700*	*2009*	*679,100*
4	*05050000*	*Bois De Sioux River near White Rock, South Dakota*	*1,160*	*607,400*	*1*	*1942–2011*	*70*	*59,000*	*100,300*	*1997*	*388,100*
5	*05051500*	*Red River of the North at Wahpeton, North Dakota*	*4,010*	*2,005,000*	*1*	*1944–2011*	*68*	*453,600*	*531,000*	*2009*	*1,332,000*
9	*05053000*	*Wild Rice River near Abercrombie, North Dakota*	*1,490*	*854,300*	*1*	*1933–2011*	*79*	*41,270*	*106,400*	*2009*	*697,200*
10	*05054000*	*Red River of the North at Fargo, North Dakota*	*6,800*	*3,214,000*	*1*	*1902–2011*	*110*	*417,400*	*580,800*	*2009*	*2,527,000*
12	*05056000*	*Sheyenne River near Warwick, North Dakota*	*760*	*345,300*	*1*	*1950–2011*	*62*	*44,890*	*62,890*	*2009*	*272,900*
22	*05059500*	*Sheyenne River at West Fargo, North Dakota*	*3,090*	*1,267,000*	*1*	*1904–05, 1930–2011*	*84*	*133,900*	*199,300*	*2010*	*752,900*
27	*05062000*	*Buffalo River near Dilworth, Minnesota*	*975*	*460,400*	*2*	*1932–2011*	*80*	*108,200*	*131,900*	*2009*	*526,300*
28	*05064000*	*Wild Rice at Hendrum, Minnesota*	*1,560*	*760,200*	*1*	*1945–84, 1986–2011*	*66*	*228,800*	*268,500*	*2009*	*738,500*
31	*05066500*	*Goose River at Hillsboro, North Dakota*	*1,093*	*485,800*	*1*	*1932, 1935–2011*	*78*	*44,890*	*83,450*	*2009*	*298,300*
32	*05069000*	*Sand Hill River at Climax, Minnesota*	*420*	*186,800*	*1*	*1947–84, 1986–2011*	*64*	*60,810*	*67,650*	*1999*	*180,300*
35	*05079000*	*Red Lake River at Crookston, Minnesota*	*5,270*	*1,911,000*	*4*	*1902–2011*	*110*	*810,900*	*893,000*	*1950*	*2,266,000*
36	*05082500*	*Red River of the North at Grand Forks, North Dakota*	*26,300*	*10,350,000*	*1*	*1905–2011*	*107*	*1,911,000*	*2,405,000*	*2009*	*7,964,000*
38	*05085000*	*Forest River at Minto, North Dakota*	*620*	*96,290*	*7*	*1945–2011*	*67*	*35,470*	*43,230*	*2009*	*198,400*
39	*05087500*	*Middle River at Argyle, Minnesota*	*255*	*113,700*	*3*	*1951–81, 1983–2011*	*60*	*34,030*	*41,270*	*1999*	*143,300*
40	*05090000*	*Park River at Grafton, North Dakota*	695	144,800	4	1932–2011	80	40,900	51,400	2009	259,900
41	*05092000*	*Red River of the North at Drayton, North Dakota*	34,800	11,150,000	1	1950–2011	62	3,334,000	3,570,000	2009	9,846,000
42	05094000	South Branch Two Rivers at Lake Bronson, Minnesota	422	231,700	2	1929–36, 1942–43, 1946–47, 1954–81, 1986–2011	66	54,300	83,420	2009	237,500

Estimated AEP for observed 2011 annual runoff (percent)	Expected annual runoff in acre-feet for selected annual exceedance probabilities (AEP) based on Water Resources Council Bulletin 17B methods								
	2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High
Red River of the North Basin									
< 0.2	720,400	270,700	956,400	758,600	240,000	1,095,000	814,200	311,000	1,485,000
2 to 4	676,500	222,700	1,320,000	845,200	187,300	1,882,000	1,229,000	156,100	4,004,000
< 0.2	1,412,000	1,093,000	1,933,000	1,583,000	1,132,000	2,283,000	1,954,000	1,152,000	3,241,000
1 to 2	715,200	422,400	1,533,000	970,600	504,400	2,374,000	1,729,000	639,800	5,913,000
0.2 to 1	2,147,000	1,545,000	3,014,000	2,514,000	1,626,000	3,755,000	3,335,000	1,701,000	5,890,000
0.2 to 1	266,500	183,300	508,100	331,000	211,100	709,700	503,700	260,900	1,436,000
0.2 to 1	850,900	606,900	1,658,000	1,098,000	740,400	2,532,000	1,853,000	1,081,000	6,450,000
2 to 4	463,000	351,000	731,600	555,600	399,100	958,800	792,900	491,700	1,692,000
2 to 4	800,200	613,500	1,185,000	921,000	660,700	1,457,000	1,201,000	721,800	2,247,000
1 to 2	468,100	302,400	902,800	607,400	354,900	1,315,000	997,700	445,000	2,883,000
2 to 4	212,700	162,500	351,500	251,600	183,300	460,700	350,600	224,100	818,400
4 to 10	2,443,000	1,591,000	3,095,000	2,672,000	1,535,000	3,571,000	3,092,000	1,509,000	4,782,000
0.2 to 1	8,087,000	6,298,000	11,220,000	9,462,000	6,911,000	13,920,000	12,700,000	7,857,000	21,700,000
4 to 10	176,700	125,100	320,200	218,000	144,100	441,700	328,000	179,900	869,200
4 to 10	151,400	66,220	232,600	172,500	56,350	288,800	214,500	49,860	460,900
4 to 10	248,800	134,100	405,600	298,800	128,600	533,900	410,000	117,500	948,000
1 to 2	10,360,000	7,808,000	15,040,000	11,790,000	8,173,000	18,170,000	14,970,000	8,414,000	27,110,000
4 to 10	326,900	189,200	510,900	381,100	179,400	645,400	497,900	160,200	1,059,000

Table 2. Annual runoff data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[Stations used in the trend analysis are italicized. mi², square miles; AEP, annual exceedance probability; <, less than; >, greater than]

Map site number (fig. 2)	Station number	Station name	Contributing drainage area (mi²)	Water year 2011: Annual runoff (acre-feet)	Water year 2011: Rank	Period of record: Water years with streamflow data	Period of record: Number of years with streamflow data	Period of record: Median annual runoff (acre-feet)	Period of record: Mean annual runoff (acre-feet)	Previous maximum annual runoff based on data through water year 2010[a]: Water year	Previous maximum annual runoff based on data through water year 2010[a]: Annual runoff (acre-feet)
		Red River of the North Basin—Continued									
44	*05100000*	*Pembina River at Neche, North Dakota*	*3,410*	*1,050,000*	*1*	*1904–08, 1910–15, 1920–2011*	*103*	*115,100*	*189,700*	*1995*	*810,900*
45	*05102500*	*Red River at Emerson, Manitoba*	*40,200*	*12,810,000*	*1*	*1913–2011*	*99*	*2,324,000*	*3,184,000*	*2009*	*10,930,000*
		Souris River Basin									
46	*05113600*	*Long Creek near Noonan, North Dakota*	*630*	*390,200*	*1*	*1960–2011*	*52*	*15,200*	*35,350*	*1976*	*145,500*
47	*05114000*	*Souris River near Sherwood, North Dakota*	*3,040*	*1,643,000*	*1*	*1931–2011*	*81*	*45,610*	*106,900*	*1976*	*637,100*
49	*05116500*	*Des Lacs River at Foxholm, North Dakota*	*539*	*219,400*	*1*	*1905–06, 1946–2011*	*68*	*10,860*	*22,260*	*1976*	*107,100*
50	*05117500*	*Souris River above Minot, North Dakota*	*3,900*	*1,969,000*	*1*	*1904–2011*	*108*	*60,450*	*127,700*	*1976*	*803,600*
52	*05120500*	*Wintering River near Karlsruhe, North Dakota*	*285*	*91,220*	*1*	*1938–2011*	*74*	*9,050*	*13,000*	*1999*	*59,370*
54	*05123400*	*Willow Creek near Willow City, North Dakota*	*730*	*250,500*	*1*	*1957–2011*	*55*	*15,100*	*42,060*	*1999*	*233,800*
56	*05124000*	*Souris River near Westhope, North Dakota*	*6,600*	*3,403,000*	*1*	*1931–2011*	*81*	*105,000*	*237,000*	*1976*	*1,231,000*
		Upper Mississippi River Basin (upstream from the mouth of the Ohio River), excluding the Missouri River Basin									
57	*05211000*	*Mississippi River at Grand Rapids, Minnesota*	*3,370*	*1,506,000*	*11*	*1886–88, 1901–03, 1905–09, 1912–37, 1939–2011*	*110*	*890,500*	*898,700*	*1906*	*1,759,000*
58	05244000	Crow Wing River at Nimrod, Minnesota	1,030	475,600	4	1940–81, 1992–2011	62	360,500	349,100	1999	548,000
59	*05267000*	*Mississippi River near Royalton, Minnesota*	*11,600*	*5,756,000*	*6*	*1925–2011*	*87*	*3,388,000*	*3,524,000*	*1966*	*6,921,000*
60	05270500	Sauk River near St. Cloud, Minnesota	1,030	752,900	1	1910–12, 1931, 1935–81, 1991–2011	72	233,800	238,300	1972	530,700
62	*05280000*	*Crow River at Rockford, Minnesota*	*2,640*	*2,367,000*	*1*	*1910–11, 1913–17, 1931, 1935–2011*	*85*	*521,300*	*632,900*	*1986*	*1,991,000*
63	*05286000*	*Rum River near St. Francis, Minnesota*	*1,360*	*1,021,000*	*2*	*1931, 1934–2011*	*79*	*461,200*	*471,000*	*1986*	*1,093,000*

Estimated AEP for observed 2011 annual runoff (percent)	Expected annual runoff in acre-feet for selected annual exceedance probabilities (AEP) based on Water Resources Council Bulletin 17B methods								
	2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
		95-percent confidence limit			95-percent confidence limit			95-percent confidence limit	
	Estimate	Low	High	Estimate	Low	High	Estimate	Low	High
Red River of the North Basin—Continued									
1 to 2	*864,200*	*621,800*	*1,393,000*	*1,083,000*	*724,500*	*1,906,000*	*1,668,000*	*918,000*	*3,650,000*
0.2 to 1	*10,420,000*	*8,085,000*	*14,840,000*	*12,250,000*	*8,937,000*	*18,580,000*	*16,630,000*	*10,320,000*	*29,590,000*
Souris River Basin									
< 0.2	*178,200*	*13,440*	*368,300*	*208,900*	*9,836*	*518,600*	*265,400*	*9,729*	*1,131,000*
< 0.2	*607,400*	*371,600*	*1,206,000*	*802,900*	*433,600*	*1,794,000*	*1,357,000*	*528,200*	*4,103,000*
0.2 to 1	*129,100*	*78,290*	*273,600*	*169,700*	*91,160*	*408,500*	*284,900*	*110,700*	*947,400*
< 0.2	*755,700*	*500,000*	*1,412,000*	*1,023,000*	*622,500*	*2,155,000*	*1,840,000*	*894,000*	*5,196,000*
0.2 to 1	*63,330*	*42,730*	*120,300*	*80,830*	*50,310*	*172,900*	*129,600*	*64,690*	*369,700*
0.2 to 1	*201,600*	*5,662*	*500,600*	*221,100*	*3,991*	*744,900*	*247,300*	*16,350*	*2,141,000*
< 0.2	*1,465,000*	*489,400*	*2,795,000*	*1,837,000*	*424,500*	*4,004,000*	*2,679,000*	*370,600*	*8,517,000*
Upper Mississippi River Basin (upstream from the mouth of the Ohio River), excluding the Missouri River Basin									
4 to 10	*1,799,000*	*1,132,000*	*2,116,000*	*1,887,000*	*1,122,000*	*2,316,000*	*2,029,000*	*1,181,000*	*2,790,000*
4 to 10	523,900	472,400	590,100	545,900	475,400	626,900	588,100	472,600	712,600
4 to 10	*7,155,000*	*6,042,000*	*8,568,000*	*7,709,000*	*6,157,000*	*9,527,000*	*8,814,000*	*6,208,000*	*11,870,000*
0.2 to 1	595,600	461,400	779,000	658,300	467,100	901,200	787,600	460,000	1,224,000
1 to 2	*2,079,000*	*1,524,000*	*2,927,000*	*2,392,000*	*1,587,000*	*3,575,000*	*3,084,000*	*1,624,000*	*5,416,000*
0.2 to 1	*943,700*	*541,700*	*1,131,000*	*992,700*	*509,700*	*1,245,000*	*1,073,000*	*546,600*	*1,527,000*

Table 2. Annual runoff data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[Stations used in the trend analysis are italicized. mi², square miles; AEP, annual exceedance probability; <, less than; >, greater than]

Map site number (fig. 2)	Station number	Station name	Contributing drainage area (mi²)	Water year 2011		Period of record				Previous maximum annual runoff based on data through water year 2010[a]	
				Annual runoff (acre-feet)	Rank	Water years with streamflow data	Number of years with streamflow data	Median annual runoff (acre-feet)	Mean annual runoff (acre-feet)	Water year	Annual runoff (acre-feet)
Upper Mississippi River Basin (upstream from the mouth of the Ohio River), excluding the Missouri River Basin—Continued											
65	05288500	*Mississippi River near Anoka, Minnesota*	19,100	11,730,000	2	1932–2011	80	5,998,000	6,064,000	1986	12,810,000
67	05292000	*Minnesota River at Ortonville, Minnesota*	1,160	530,700	1	1939–2011	73	72,400	112,600	2010	453,200
69	05294000	*Pomme De Terre River at Appleton, Minnesota*	905	490,100	1	1936–99, 2004–11	72	78,190	107,900	1997	304,100
70	05300000	*Lac Qui Parle River near Lac Qui Parle, Minnesota*	960	553,100	1	1913, 1932, 1934–99, 2002–11	78	92,670	125,900	1993	452,500
72	05311000	*Minnesota River at Montevideo, Minnesota*	6,180	3,337,000	1	1910–17, 1930–2011	90	530,700	727,400	1997	2,295,000
76	05317000	*Cottonwood River near New Ulm, Minnesota*	1,300	1,187,000	2	1912–13, 1936–37, 1939–2011	77	202,700	298,100	1993	1,303,000
78	05320000	*Blue Earth River near Rapidan, Minnesota*	2,410	2,186,000	2	1940–45, 1950–2011	68	721,800	827,500	1993	3,272,000
81	05320500	*Le Sueur River near Rapidan, Minnesota*	1,110	1,035,000	3	1940–45, 1950–2011	68	413,400	420,600	1993	1,477,000
82	05325000	*Minnesota River at Mankato, Minnesota*	14,900	11,000,000	1	1905, 1911–17, 1930–2011	90	2,237,000	2,801,000	1993	10,790,000
83	05330000	*Minnesota River near Jordan, Minnesota*	16,200	12,740,000	1	1935–2011	77	2,744,000	3,476,000	1993	12,240,000
84	05331000	*Mississippi River at Saint Paul, Minnesota*	36,800	26,500,000	1	1895, 1897, 1901–05, 1907–2011	112	8,579,000	8,845,000	1986	21,430,000
85	05340500	*St. Croix River at St. Croix Falls, Wisconsin*	6,240	4,793,000	5	1911–2011	101	3,178,000	3,175,000	1986	6,204,000
86	05344500	*Mississippi River at Prescott, Wisconsin*	44,800	31,560,000	1	1929–2011	83	13,830,000	13,600,000	1986	27,870,000
88	05355200	Cannon River at Welch, Minnesota	1,340	1,281,000	2	1912–13, 1932–71, 1992–2011	62	431,100	479,600	1993	1,542,000
89	05369500	*Chippewa River at Durand, Wisconsin*	9,010	7,030,000	10	1929–2011	83	5,640,000	5,540,000	1942	8,398,000
90	05378500	*Mississippi River at Winona, Minnesota*	59,200	42,860,000	1	1929–2011	83	21,570,000	21,650,000	1986	41,120,000
91	05382000	*Black River near Galesville, Wisconsin*	2,080	1,832,000	9	1933–2011	79	1,303,000	1,283,000	1993	2,505,000

Estimated AEP for observed 2011 annual runoff (percent)	Expected annual runoff in acre-feet for selected annual exceedance probabilities (AEP) based on Water Resources Council Bulletin 17B methods								
	2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High
Upper Mississippi River Basin (upstream from the mouth of the Ohio River), excluding the Missouri River Basin—Continued									
1 to 2	*11,520,000*	*8,276,000*	*13,500,000*	*12,130,000*	*7,917,000*	*14,730,000*	*13,210,000*	*7,763,000*	*17,690,000*
1 to 2	*478,100*	*247,500*	*758,300*	*561,800*	*228,900*	*972,300*	*740,000*	*203,100*	*1,646,000*
0.2 to 1	*382,900*	*285,600*	*666,100*	*466,800*	*331,300*	*918,000*	*694,100*	*431,000*	*1,825,000*
1 to 2	*520,300*	*366,800*	*844,700*	*629,200*	*403,400*	*1,107,000*	*897,300*	*450,200*	*1,949,000*
< 0.2	*2,142,000*	*679,200*	*3,033,000*	*2,308,000*	*587,800*	*3,607,000*	*2,563,000*	*778,100*	*5,259,000*
2 to 4	*1,202,000*	*871,700*	*2,145,000*	*1,498,000*	*1,027,000*	*3,023,000*	*2,321,000*	*1,367,000*	*6,275,000*
2 to 4	*2,471,000*	*1,644,000*	*3,443,000*	*2,774,000*	*1,584,000*	*4,105,000*	*3,393,000*	*1,462,000*	*5,950,000*
4 to 10	*1,190,000*	*623,200*	*1,614,000*	*1,308,000*	*560,100*	*1,892,000*	*1,528,000*	*531,900*	*2,659,000*
0.2 to 1	*8,759,000*	*6,073,000*	*11,900,000*	*9,905,000*	*6,031,000*	*14,260,000*	*12,260,000*	*5,828,000*	*20,730,000*
0.2 to 1	*10,850,000*	*8,433,000*	*16,170,000*	*12,680,000*	*9,346,000*	*20,320,000*	*17,130,000*	*10,920,000*	*32,810,000*
0.2 to 1	*21,130,000*	*17,890,000*	*26,080,000*	*23,430,000*	*18,970,000*	*30,020,000*	*28,380,000*	*20,530,000*	*40,090,000*
4 to 10	*5,625,000*	*5,078,000*	*6,522,000*	*6,027,000*	*5,318,000*	*7,179,000*	*6,877,000*	*5,707,000*	*8,761,000*
0.2 to 1	*27,130,000*	*22,960,000*	*32,490,000*	*29,180,000*	*23,380,000*	*36,060,000*	*33,270,000*	*23,530,000*	*44,780,000*
1 to 2	1,266,000	1,012,000	1,912,000	1,450,000	1,112,000	2,375,000	1,894,000	1,297,000	3,760,000
> 10	*8,537,000*	*7,730,000*	*9,502,000*	*8,914,000*	*7,812,000*	*10,110,000*	*9,636,000*	*7,841,000*	*11,500,000*
0.2 to 1	*39,320,000*	*34,700,000*	*46,210,000*	*42,020,000*	*35,810,000*	*50,760,000*	*47,530,000*	*37,080,000*	*61,710,000*
4 to 10	*2,228,000*	*1,989,000*	*2,607,000*	*2,372,000*	*2,056,000*	*2,851,000*	*2,669,000*	*2,143,000*	*3,437,000*

Table 2. Annual runoff data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[Stations used in the trend analysis are italicized. mi^2, square miles; AEP, annual exceedance probability; <, less than; >, greater than]

Map site number (fig. 2)	Station number	Station name	Contributing drainage area (mi^2)	Water year 2011		Period of record				Previous maximum annual runoff based on data through water year 2010[a]	
				Annual runoff (acre-feet)	Rank	Water years with streamflow data	Number of years with streamflow data	Median annual runoff (acre-feet)	Mean annual runoff (acre-feet)	Water year	Annual runoff (acre-feet)
Upper Mississippi River Basin (upstream from the mouth of the Ohio River), excluding the Missouri River Basin—Continued											
92	05389500	*Mississippi River at McGregor, Iowa*	67,500	49,950,000	1	1937–2005, 2008–11	73	28,020,000	27,330,000	1993	46,840,000
94	05398000	*Wisconsin River at Rothschild, Wisconsin*	4,020	3,077,000	15	1945–2011	67	2,490,000	2,511,000	1973	4,308,000
95	05407000	*Wisconsin River at Muscoda, Wisconsin*	10,400	8,326,000	8	1914–2011	98	6,277,000	6,293,000	1973	11,580,000
96	05412500	*Turkey River at Garber, Iowa*	1,545	1,057,000	18	1914–16, 1920–27, 1930–2011	91	718,900	754,900	1993	2,107,000
102	05420500	*Mississippi River at Clinton, Iowa*	85,600	65,300,000	3	1874–2011	138	35,730,000	35,720,000	1882	68,560,000
103	05422000	*Wapsipinicon River near De Witt, Iowa*	2,336	1,643,000	21	1935–2011	77	1,158,000	1,267,000	1993	3,953,000
104	05430500	*Rock River at Afton, Wisconsin*	3,340	2,208,000	13	1915–2011	97	1,376,000	1,460,000	2008	3,598,000
105	05437500	*Rock River at Rockton, Illinois*	6,363	4,213,000	16	1904–05, 1915–19, 1940–2011	79	3,026,000	3,254,000	2008	7,124,000
106	05446500	*Rock River near Joslin, Illinois*	9,549	6,581,000	14	1940–2011	72	4,608,000	4,973,000	1993	10,570,000
108	05454500	*Iowa River at Iowa City, Iowa*	3,271	1,911,000	25	1904–2011	108	1,256,000	1,425,000	1993	6,154,000
109	05458500	*Cedar River at Janesville, Iowa*	1,661	1,325,000	8	1905–06, 1915–27, 1933–42, 1946–2011	91	626,200	729,000	1993	2,498,000
110	05464500	*Cedar River at Cedar Rapids, Iowa*	6,510	4,742,000	10	1903–2011	109	2,585,000	2,873,000	1993	10,930,000
112	05465500	*Iowa River at Wapello, Iowa*	12,500	8,326,000	18	1915–2011	97	5,263,000	5,809,000	1993	22,150,000
116	05476000	*Des Moines River at Jackson, Minnesota*	1,250	1,267,000	2	1936–2011	76	216,500	307,600	1993	1,520,000
117	05479000	*East Fork Des Moines River at Dakota City, Iowa*	1,308	955,600	7	1941–2011	71	396,700	481,400	1993	1,984,000
118	05480500	*Des Moines River at Fort Dodge, Iowa*	4,190	3,417,000	5	1914–27, 1947–2011	79	1,173,000	1,374,000	1993	5,705,000
119	05484500	*Raccoon River at Van Meter, Iowa*	3,441	1,622,000	22	1916–2011	96	962,900	1,191,000	1993	4,141,000
120	05485500	*Des Moines River below Raccoon River at Des Moines, Iowa*	9,879	6,277,000	8	1941–2011	71	3,461,000	3,851,000	1993	13,900,000
125	05490500	*Des Moines River at Keosauqua, Iowa*	14,038	9,846,000	7	1904–05, 1912–2011	102	4,130,000	4,971,000	1993	19,470,000
128	05526000	*Iroquois River near Chebanse, Illinois*	2,091	1,332,000	40	1924–2011	88	1,274,000	1,303,000	1993	3,243,000

Estimated AEP for observed 2011 annual runoff (percent)	2-percent AEP (50-year recurrence) Estimate	2-percent AEP 95-percent confidence limit Low	2-percent AEP 95-percent confidence limit High	1-percent AEP (100-year recurrence) Estimate	1-percent AEP 95-percent confidence limit Low	1-percent AEP 95-percent confidence limit High	0.2-percent AEP (500-year recurrence) Estimate	0.2-percent AEP 95-percent confidence limit Low	0.2-percent AEP 95-percent confidence limit High
Upper Mississippi River Basin (upstream from the mouth of the Ohio River), excluding the Missouri River Basin—Continued									
0.2 to 1	46,060,000	41,410,000	54,260,000	49,010,000	43,020,000	59,430,000	55,200,000	45,400,000	71,900,000
> 10	4,050,000	3,657,000	4,717,000	4,279,000	3,768,000	5,113,000	4,748,000	3,912,000	6,058,000
4 to 10	9,566,000	8,835,000	10,560,000	10,010,000	9,036,000	11,240,000	10,870,000	9,284,000	12,780,000
> 10	1,678,000	1,431,000	2,097,000	1,850,000	1,517,000	2,403,000	2,222,000	1,644,000	3,190,000
0.2 to 1	58,070,000	53,560,000	64,230,000	61,300,000	55,360,000	69,060,000	67,800,000	58,020,000	80,080,000
> 10	2,939,000	2,386,000	3,735,000	3,227,000	2,451,000	4,272,000	3,826,000	2,484,000	5,655,000
> 10	2,893,000	2,515,000	3,428,000	3,121,000	2,606,000	3,809,000	3,588,000	2,711,000	4,735,000
> 10	6,344,000	5,552,000	7,845,000	6,903,000	5,877,000	8,878,000	8,126,000	6,416,000	11,500,000
> 10	10,030,000	8,670,000	12,840,000	10,990,000	9,239,000	14,760,000	13,140,000	10,230,000	19,770,000
> 10	3,716,000	3,016,000	4,694,000	4,147,000	3,158,000	5,463,000	5,061,000	3,316,000	7,455,000
4 to 10	1,844,000	1,531,000	2,424,000	2,078,000	1,655,000	2,870,000	2,611,000	1,859,000	4,078,000
> 10	7,120,000	6,006,000	8,992,000	7,978,000	6,461,000	10,510,000	9,894,000	7,198,000	14,500,000
> 10	13,790,000	11,370,000	17,170,000	15,200,000	11,810,000	19,660,000	18,130,000	12,240,000	26,000,000
1 to 2	1,228,000	805,300	1,907,000	1,454,000	825,200	2,435,000	1,967,000	811,300	4,061,000
> 10	1,379,000	781,200	1,872,000	1,524,000	713,400	2,202,000	1,798,000	664,600	3,112,000
4 to 10	4,248,000	3,094,000	5,915,000	4,835,000	3,163,000	7,130,000	6,099,000	3,143,000	10,530,000
> 10	3,446,000	2,734,000	4,609,000	3,924,000	2,919,000	5,522,000	4,993,000	3,159,000	8,023,000
> 10	9,845,000	5,714,000	12,840,000	10,710,000	5,242,000	14,780,000	12,310,000	4,999,000	19,940,000
4 to 10	13,310,000	10,460,000	16,990,000	14,840,000	10,780,000	19,800,000	18,020,000	10,990,000	27,130,000
> 10	2,443,000	1,558,000	2,849,000	2,556,000	1,521,000	3,097,000	2,741,000	1,583,000	3,693,000

Expected annual runoff in acre-feet for selected annual exceedance probabilities (AEP) based on Water Resources Council Bulletin 17B methods

Table 2. Annual runoff data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[Stations used in the trend analysis are italicized. mi^2, square miles; AEP, annual exceedance probability; <, less than; >, greater than]

Map site number (fig. 2)	Station number	Station name	Contributing drainage area (mi^2)	Water year 2011		Period of record				Previous maximum annual runoff based on data through water year 2010[a]	
				Annual runoff (acre-feet)	Rank	Water years with streamflow data	Number of years with streamflow data	Median annual runoff (acre-feet)	Mean annual runoff (acre-feet)	Water year	Annual runoff (acre-feet)
Upper Mississippi River Basin (upstream from the mouth of the Ohio River), excluding the Missouri River Basin—Continued											
129	*05527500*	*Kankakee River near Wilmington, Illinois*	*5,150*	*3,547,000*	*39*	*1916–33, 1936–2011*	*94*	*3,189,000*	*3,316,000*	*1993*	*7,529,000*
130	*05543500*	*Illinois River at Marseilles, Illinois*	*8,259*	*8,108,000*	*35*	*1920–2011*	*92*	*7,674,000*	*7,817,000*	*1993*	*12,960,000*
131	*05552500*	*Fox River at Dayton, Illinois*	*2,642*	*1,897,000*	*13*	*1916–2011*	*96*	*1,372,000*	*1,366,000*	*1993*	*2,852,000*
132	*05555300*	*Vermilion River near Leonore, Illinois*	*1,251*	*691,400*	*32*	*1932–2011*	*80*	*628,100*	*653,300*	*1993*	*1,752,000*
133	*05568500*	*Illinois River at Kingston Mines, Illinois*	*15,818*	*13,470,000*	*20*	*1940–2011*	*72*	*11,440,000*	*11,640,000*	*1993*	*23,310,000*
134	*05570000*	*Spoon River at Seville, Illinois*	*1,636*	*1,187,000*	*16*	*1915–2011*	*97*	*760,200*	*825,500*	*1993*	*2,592,000*
135	05576500	Sangamon River at Riverton, Illinois	2,618	1,962,000	15	1909–12, 1915–56, 1987–2011	71	1,318,000	1,332,000	1927	3,482,000
136	*05582000*	*Salt Creek near Greenview, Illinois*	*1,804*	*1,071,000*	*31*	*1942–2011*	*70*	*984,600*	*1,020,000*	*1993*	*2,433,000*
137	*05583000*	*Sangamon River near Oakford, Illinois*	*5,093*	*3,497,000*	*22*	*1910–11, 1915–18, 1922, 1929–33, 1940–2011*	*84*	*2,563,000*	*2,624,000*	*2010*	*6,545,000*
138	*05586100*	*Illinois River at Valley City, Illinois*	*26,743*	*21,140,000*	*15*	*1939–2011*	*73*	*16,290,000*	*16,970,000*	*1993*	*33,880,000*
141	*05592500*	*Kaskaskia River at Vandalia, Illinois*	*1,940*	*1,759,000*	*13*	*1909–12, 1915–2011*	*101*	*1,108,000*	*1,132,000*	*1927*	*2,614,000*
143	05595000	Kaskaskia River at New Athens, Illinois	5,189	4,887,000	3	1910–12, 1915–21, 1935–71, 2010–11	49	2,795,000	2,728,000	1950	5,893,000
144	*05597000*	*Big Muddy River at Plumfield, Illinois*	*794*	*991,800*	*4*	*1909, 1912, 1915–2011*	*99*	*544,400*	*523,100*	*1950*	*1,325,000*
146	*07010000*	*Mississippi River at St. Louis, Missouri*	*697,000*	*233,800,000*	*5*	*1863–2011*	*149*	*131,800,000*	*135,500,000*	*1993*	*311,300,000*
147	*07019000*	*Meramec River near Eureka, Missouri*	*3,788*	*3,026,000*	*23*	*1904–05, 1922–2011*	*92*	*2,299,000*	*2,379,000*	*1985*	*5,365,000*
148	*07020500*	*Mississippi River at Chester, Illinois*	*708,600*	*244,700,000*	*4*	*1943–2011*	*69*	*145,500,000*	*153,200,000*	*1993*	*320,000,000*
149	*07022000*	*Mississippi River at Thebes, Illinois*	*713,200*	*260,600,000*	*3*	*1934–37, 1940–2011*	*76*	*148,400,000*	*154,100,000*	*1993*	*322,900,000*

Estimated AEP for observed 2011 annual runoff (percent)	Expected annual runoff in acre-feet for selected annual exceedance probabilities (AEP) based on Water Resources Council Bulletin 17B methods								
	2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High
Upper Mississippi River Basin (upstream from the mouth of the Ohio River), excluding the Missouri River Basin—Continued									
> 10	*6,250,000*	*5,438,000*	*7,290,000*	*6,681,000*	*5,564,000*	*8,008,000*	*7,540,000*	*5,668,000*	*9,721,000*
> 10	*12,050,000*	*11,150,000*	*13,610,000*	*12,720,000*	*11,580,000*	*14,700,000*	*14,100,000*	*12,310,000*	*17,240,000*
> 10	*2,671,000*	*2,246,000*	*3,124,000*	*2,853,000*	*2,260,000*	*3,436,000*	*3,204,000*	*2,247,000*	*4,182,000*
> 10	*1,423,000*	*769,100*	*1,746,000*	*1,509,000*	*737,600*	*1,947,000*	*1,655,000*	*779,900*	*2,455,000*
> 10	*19,930,000*	*17,800,000*	*23,500,000*	*21,210,000*	*18,430,000*	*25,720,000*	*23,860,000*	*19,250,000*	*31,080,000*
> 10	*1,925,000*	*1,557,000*	*2,369,000*	*2,105,000*	*1,584,000*	*2,690,000*	*2,467,000*	*1,592,000*	*3,495,000*
> 10	2,969,000	1,267,000	3,794,000	3,123,000	1,141,000	4,275,000	3,358,000	1,318,000	5,585,000
> 10	*2,289,000*	*1,901,000*	*2,957,000*	*2,518,000*	*1,988,000*	*3,394,000*	*3,009,000*	*2,086,000*	*4,533,000*
> 10	*5,788,000*	*4,159,000*	*7,058,000*	*6,212,000*	*3,997,000*	*7,893,000*	*6,993,000*	*3,841,000*	*9,975,000*
> 10	*30,810,000*	*27,150,000*	*36,960,000*	*33,020,000*	*28,190,000*	*40,850,000*	*37,630,000*	*29,540,000*	*50,380,000*
> 10	*1,950,000*	*892,700*	*2,521,000*	*1,974,000*	*1,107,000*	*2,784,000*	*1,997,000*	*1,317,000*	*3,553,000*
4 to 10	5,281,000	1,552,000	7,156,000	5,412,000	1,396,000	8,164,000	5,567,000	2,435,000	11,900,000
2 to 4	*995,700*	*456,000*	*1,262,000*	*1,019,000*	*473,500*	*1,395,000*	*1,046,000*	*611,200*	*1,769,000*
2 to 4	*245,000,000*	*223,500,000*	*279,100,000*	*263,100,000*	*235,300,000*	*307,200,000*	*301,900,000*	*256,200,000*	*374,700,000*
> 10	*5,057,000*	*4,331,000*	*6,168,000*	*5,515,000*	*4,526,000*	*6,962,000*	*6,479,000*	*4,772,000*	*8,948,000*
4 to 10	*275,400,000*	*243,800,000*	*344,200,000*	*297,900,000*	*258,200,000*	*390,000,000*	*348,100,000*	*284,500,000*	*508,300,000*
2 to 4	*268,900,000*	*237,400,000*	*316,100,000*	*286,300,000*	*243,900,000*	*345,900,000*	*321,600,000*	*250,500,000*	*417,500,000*

Table 2. Annual runoff data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[Stations used in the trend analysis are italicized. mi², square miles; AEP, annual exceedance probability; <, less than; >, greater than]

Map site number (fig. 2)	Station number	Station name	Contributing drainage area (mi²)	Water year 2011: Annual runoff (acre-feet)	Water year 2011: Rank	Period of record: Water years with streamflow data	Period of record: Number of years with streamflow data	Period of record: Median annual runoff (acre-feet)	Period of record: Mean annual runoff (acre-feet)	Previous maximum annual runoff based on data through water year 2010[a]: Water year	Previous maximum annual runoff based on data through water year 2010[a]: Annual runoff (acre-feet)
				Missouri River Basin							
161	06036650	Jefferson River near Three Forks, Montana	9,532	2,208,000	4	1895, 1897–1898, 1900–1905, 1939–1969, 1979–2011	72	1,473,000	1,457,000	1984	2,643,000
165	*06041000*	*Madison River below Ennis Lake near McAllister, Montana*	*2,186*	*1,470,000*	*19*	*1939–2011*	*73*	*1,216,000*	*1,271,000*	*1997*	*1,832,000*
167	*06052500*	*Gallatin River at Logan, Montana*	*1,795*	*1,137,000*	*6*	*1894–1905, 1929–2011*	*95*	*760,200*	*770,100*	*1997*	*1,209,000*
168	*06054500*	*Missouri River at Toston, Montana*	*14,669*	*5,010,000*	*7*	*1911–16, 1942–2011*	*76*	*3,660,000*	*3,705,000*	*1997*	*5,604,000*
177	*06089000*	*Sun River near Vaughn, Montana*	*1,849*	*818,100*	*6*	*1935–2011*	*77*	*469,100*	*486,900*	*1943*	*948,400*
180	*06090800*	*Missouri River at Fort Benton, Montana*	*24,749*	*8,833,000*	*1*	*1891–2011*	*121*	*5,459,000*	*5,511,000*	*1894*	*8,615,000*
183	*06101500*	*Marias River near Chester, Montana*	*4,927*	*832,600*	*11*	*1946–47, 1956–2011*	*58*	*540,400*	*579,200*	*1959*	*1,079,000*
189	*06115200*	*Missouri River near Landusky, Montana*	*40,987*	*10,710,000*	*2*	*1935–2011*	*77*	*6,349,000*	*6,510,000*	*1975*	*11,080,000*
199	*06130500*	*Musselshell River at Mosby, Montana*	*7,846*	*1,419,000*	*1*	*1931–32, 1935–2011*	*79*	*129,600*	*199,200*	*1978*	*789,100*
201	*06132000*	*Missouri River below Fort Peck Dam, Montana*	*57,556*	*12,810,000*	*1*	*1935–2000, 2002–2011*	*76*	*6,085,000*	*6,393,000*	*1975*	*10,860,000*
210	*06174500*	*Milk River at Nashua, Montana*	*22,332*	*2,483,000*	*1*	*1940–2011*	*72*	*380,100*	*475,800*	*1952*	*1,716,000*
213	*06185500*	*Missouri River near Culbertson, Montana*	*91,557*	*16,650,000*	*1*	*1942–1951, 1959–2011*	*63*	*6,653,000*	*7,220,000*	*1975*	*12,020,000*
218	*06192500*	*Yellowstone River near Livingston, Montana*	*3,551*	*4,134,000*	*2*	*1898–1905, 1929–1932, 1938–2011*	*86*	*2,632,000*	*2,713,000*	*1997*	*4,431,000*
222	*06207500*	*Clarks Fork Yellowstone River near Belfry, Montana*	*1,154*	*1,014,000*	*4*	*1922–2011*	*90*	*648,300*	*676,200*	*1997*	*1,079,000*
227	*06214500*	*Yellowstone River at Billings, Montana*	*11,408*	*8,181,000*	*2*	*1929–2011*	*83*	*5,090,000*	*5,027,000*	*1997*	*8,760,000*
239	*06289000*	*Little Bighorn River at State line near Wyola, Montana*	*182*	*173,000*	*2*	*1940–2011*	*72*	*103,900*	*108,000*	*1975*	*183,200*

Estimated AEP for observed 2011 annual runoff (percent)	Expected annual runoff in acre-feet for selected annual exceedance probabilities (AEP) based on Water Resources Council Bulletin 17B methods								
	2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High
Missouri River Basin									
4 to 10	3,009,000	2,406,000	5,986,000	3,382,000	2,617,000	7,620,000	4,297,000	3,047,000	13,180,000
> 10	*1,783,000*	*1,669,000*	*2,009,000*	*1,863,000*	*1,723,000*	*2,152,000*	*2,032,000*	*1,821,000*	*2,490,000*
4 to 10	*1,260,000*	*1,154,000*	*1,445,000*	*1,340,000*	*1,205,000*	*1,576,000*	*1,508,000*	*1,292,000*	*1,890,000*
4 to 10	*5,766,000*	*5,284,000*	*6,592,000*	*6,075,000*	*5,458,000*	*7,111,000*	*6,711,000*	*5,718,000*	*8,332,000*
4 to 10	*1,003,000*	*863,000*	*1,254,000*	*1,095,000*	*909,800*	*1,424,000*	*1,295,000*	*978,700*	*1,858,000*
2 to 4	*8,964,000*	*8,284,000*	*10,030,000*	*9,506,000*	*8,635,000*	*10,860,000*	*10,640,000*	*9,235,000*	*12,810,000*
> 10	*980,000*	*501,800*	*1,167,000*	*1,006,000*	*466,100*	*1,263,000*	*1,042,000*	*546,900*	*1,531,000*
2 to 4	*11,000,000*	*9,925,000*	*13,020,000*	*11,750,000*	*10,380,000*	*14,350,000*	*13,340,000*	*11,140,000*	*17,590,000*
< 0.2	*801,400*	*524,200*	*1,244,000*	*951,800*	*538,900*	*1,595,000*	*1,295,000*	*533,200*	*2,679,000*
0.2 to 1	*11,780,000*	*10,430,000*	*14,570,000*	*12,780,000*	*11,060,000*	*16,490,000*	*14,990,000*	*12,200,000*	*21,430,000*
0.2 to 1	*1,848,000*	*1,344,000*	*3,256,000*	*2,274,000*	*1,561,000*	*4,492,000*	*3,422,000*	*2,006,000*	*8,877,000*
0.2 to 1	*13,530,000*	*11,740,000*	*18,600,000*	*14,890,000*	*12,630,000*	*22,270,000*	*18,110,000*	*14,490,000*	*33,300,000*
1 to 2	*4,051,000*	*3,757,000*	*4,747,000*	*4,282,000*	*3,921,000*	*5,221,000*	*4,789,000*	*4,239,000*	*6,427,000*
2 to 4	*1,069,000*	*979,400*	*1,262,000*	*1,143,000*	*1,033,000*	*1,408,000*	*1,313,000*	*1,142,000*	*1,788,000*
1 to 2	*8,104,000*	*7,399,000*	*9,536,000*	*8,647,000*	*7,773,000*	*10,540,000*	*9,847,000*	*8,484,000*	*13,070,000*
2 to 4	*174,300*	*158,400*	*205,500*	*185,200*	*165,300*	*225,500*	*208,700*	*177,000*	*274,100*

Table 2. Annual runoff data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[Stations used in the trend analysis are italicized. mi², square miles; AEP, annual exceedance probability; <, less than; >, greater than]

Map site number (fig. 2)	Station number	Station name	Contributing drainage area (mi²)	Water year 2011		Period of record				Previous maximum annual runoff based on data through water year 2010[a]	
				Annual runoff (acre-feet)	Rank	Water years with streamflow data	Number of years with streamflow data	Median annual runoff (acre-feet)	Mean annual runoff (acre-feet)	Water year	Annual runoff (acre-feet)
Missouri River Basin—Continued											
255	*06308500*	*Tongue River at Miles City, Montana*	*5,397*	*711,700*	*2*	*1939–41, 1947–2011*	*68*	*291,400*	*296,300*	*1978*	*713,800*
256	*06309000*	*Yellowstone River at Miles City, Montana*	*48,253*	*14,330,000*	*1*	*1923, 1929–2011*	*84*	*8,507,000*	*8,177,000*	*1997*	*12,670,000*
258	*06326500*	*Powder River near Locate, Montana*	*13,068*	*948,400*	*3*	*1939–2011*	*73*	*396,000*	*412,900*	*1944*	*1,180,000*
260	*06329500*	*Yellowstone River near Sidney, Montana*	*68,392*	*16,000,000*	*1*	*1911–31, 1934–2011*	*99*	*9,339,000*	*9,027,000*	*1924*	*15,420,000*
269	*06337000*	*Little Missouri River near Watford City, North Dakota*	*8,310*	*1,477,000*	*1*	*1935–2011*	*77*	*329,400*	*400,900*	*1971*	*1,187,000*
270	*06340500*	*Knife River at Hazen, North Dakota*	*2,240*	*345,300*	*2*	*1930–33, 1938–2011*	*78*	*99,180*	*122,100*	*2009*	*373,600*
271	*06342500*	*Missouri River at Bismarck, North Dakota*	*186,400*	*38,520,000*	*1*	*1929–2011*	*83*	*15,350,000*	*16,060,000*	*1975*	*25,770,000*
272	*06349000*	*Heart River at Mandan, North Dakota*	*3,310*	*676,200*	*2*	*1929–32, 1938–2011*	*78*	*140,100*	*195,200*	*2009*	*687,100*
273	*06354000*	*Cannonball River at Breien, North Dakota*	*4,100*	*572,700*	*5*	*1935–2011*	*77*	*124,500*	*181,000*	*2009*	*738,500*
274	*06357800*	*Grand River at Little Eagle, South Dakota*	*5,322*	*573,400*	*3*	*1959–2011*	*53*	*128,100*	*192,900*	*2009*	*818,100*
275	*06359500*	*Moreau River near Faith, South Dakota*	*2,596*	*351,100*	*4*	*1944–2011*	*68*	*68,780*	*107,000*	*2009*	*411,900*
285	06438500	Cheyenne River near Plainview, South Dakota	21,414	1,578,000	3	1951–1981, 1995–2011	48	468,800	573,200	1997	1,752,000
287	*06452000*	*White River near Oacoma, South Dakota*	*9,859*	*1,122,000*	*3*	*1929–2011*	*83*	*372,800*	*425,700*	*1942*	*1,252,000*
289	*06465500*	*Niobrara River near Verdel, Nebraska*	*11,580*	*1,853,000*	*2*	*1939, 1959–2011*	*54*	*1,166,000*	*1,269,000*	*2010*	*1,976,000*
294	*06470500*	*James River at LaMoure, North Dakota*	*1,790*	*1,050,000*	*1*	*1951–2011*	*61*	*78,190*	*151,600*	*2009*	*810,900*
305	*06478500*	*James River near Scotland, South Dakota*	*18,601*	*4,199,000*	*2*	*1929–2011*	*83*	*254,800*	*558,100*	*2010*	*4,214,000*
310	*06485500*	*Big Sioux River at Akron, Iowa*	*6,996*	*4,214,000*	*2*	*1929–2011*	*83*	*760,200*	*995,300*	*1993*	*4,539,000*
311	*06486000*	*Missouri River at Sioux City, Iowa*	*314,600*	*57,270,000*	*1*	*1929–31, 1939–2011*	*76*	*20,600,000*	*21,720,000*	*1997*	*40,470,000*
312	*06600500*	*Floyd River at James, Iowa*	*886*	*607,400*	*5*	*1936–2011*	*76*	*150,900*	*198,300*	*1983*	*693,600*
314	*06607500*	*Little Sioux River near Turin, Iowa*	*3,526*	*2,382,000*	*5*	*1943–57, 1959–2011*	*68*	*894,100*	*961,800*	*1993*	*3,808,000*

Estimated AEP for observed 2011 annual runoff (percent)	Expected annual runoff in acre-feet for selected annual exceedance probabilities (AEP) based on Water Resources Council Bulletin 17B methods								
	2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	95-percent confidence limit Low	95-percent confidence limit High	Estimate	95-percent confidence limit Low	95-percent confidence limit High	Estimate	95-percent confidence limit Low	95-percent confidence limit High
Missouri River Basin—Continued									
< 0.2	600,000	329,000	729,100	632,800	304,500	805,300	687,600	321,300	999,500
0.2 to 1	13,030,000	11,940,000	14,950,000	13,790,000	12,400,000	16,220,000	15,390,000	13,160,000	19,260,000
1 to 2	933,000	687,400	1,165,000	1,009,000	664,200	1,314,000	1,154,000	628,700	1,694,000
1 to 2	15,250,000	13,870,000	17,430,000	16,220,000	14,430,000	18,990,000	18,230,000	15,300,000	22,690,000
0.2 to 1	1,213,000	896,900	1,690,000	1,380,000	923,500	2,034,000	1,741,000	927,600	2,998,000
2 to 4	389,600	298,500	569,300	453,000	324,700	706,300	601,700	361,700	1,108,000
0.2 to 1	28,660,000	25,340,000	37,940,000	31,540,000	27,310,000	45,450,000	38,610,000	31,700,000	69,120,000
2 to 4	808,700	580,000	1,345,000	989,200	658,700	1,801,000	1,454,000	792,200	3,315,000
4 to 10	830,200	579,000	1,537,000	1,053,000	686,500	2,202,000	1,679,000	910,500	4,699,000
4 to 10	896,100	583,300	2,545,000	1,173,000	714,000	4,422,000	2,040,000	1,040,000	15,220,000
4 to 10	517,500	348,600	1,032,000	661,100	413,000	1,505,000	1,067,000	542,000	3,336,000
4 to 10	2,109,000	1,477,000	5,527,000	2,595,000	1,716,000	8,805,000	3,941,000	2,233,000	24,690,000
2 to 4	1,212,000	969,300	1,865,000	1,430,000	1,103,000	2,447,000	2,007,000	1,404,000	4,427,000
2 to 4	1,989,000	1,770,000	2,886,000	2,155,000	1,878,000	3,402,000	2,563,000	2,122,000	4,968,000
1 to 2	958,600	564,400	3,170,000	1,362,000	736,900	6,178,000	2,800,000	1,214,000	27,270,000
1 to 2	3,616,000	2,248,000	8,126,000	5,020,000	2,861,000	13,300,000	9,587,000	4,314,000	37,630,000
1 to 2	4,119,000	2,990,000	7,285,000	5,172,000	3,552,000	10,350,000	8,153,000	4,823,000	21,910,000
< 0.2	40,560,000	35,250,000	57,780,000	45,130,000	38,280,000	72,210,000	56,640,000	45,200,000	113,900,000
2 to 4	687,700	494,300	1,020,000	801,600	520,100	1,270,000	1,061,000	537,900	2,010,000
2 to 4	2,386,000	396,600	7,534,000	2,407,000	632,200	11,950,000	2,420,000	843,300	32,990,000

Table 2. Annual runoff data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[Stations used in the trend analysis are italicized. square miles; AEP, annual exceedance probability; <, less than; >, greater than]

Map site number (fig. 2)	Station number	Station name	Contributing drainage area (mi²)	Water year 2011: Annual runoff (acre-feet)	Water year 2011: Rank	Period of record: Water years with streamflow data	Period of record: Number of years with streamflow data	Period of record: Median annual runoff (acre-feet)	Period of record: Mean annual runoff (acre-feet)	Previous maximum annual runoff based on data through water year 2010[a]: Water year	Previous maximum annual runoff based on data through water year 2010[a]: Annual runoff (acre-feet)
		Missouri River Basin—Continued									
321	*06674500*	*North Platte River at Wyoming-Nebraska State Line*	*22,218*	*2,172,000*	*1*	*1930–2011*	*82*	*444,500*	*568,400*	*1984*	*2,078,000*
325	*06774000*	*Platte River near Ducan, Nebraska*	*54,630*	*3,258,000*	*3*	*1930–2011*	*82*	*991,800*	*1,255,000*	*1984*	*4,822,000*
326	*06793000*	*Loup River near Genoa, Nebraska*	*5,620*	*718,900*	*19*	*1930–31, 1944–2011*	*70*	*494,500*	*583,900*	*1930*	*1,976,000*
327	*06796000*	*Platte River at North Bend, Nebraska*	*57,800*	*4,959,000*	*7*	*1950–2011*	*62*	*3,077,000*	*3,308,000*	*1984*	*7,312,000*
329	*06810000*	*Nishnabotna River above Hamburg, Iowa*	*2,806*	*1,455,000*	*13*	*1923, 1929–2011*	*84*	*810,900*	*965,800*	*1993*	*3,663,000*
330	*06813500*	*Missouri River at Rulo, Nebraska*	*414,900*	*72,400,000*	*1*	*1950–2011*	*62*	*29,320,000*	*31,340,000*	*1997*	*52,050,000*
331	*06815000*	*Big Nemaha River at Falls City, Nebraska*	*1,339*	*207,800*	*47*	*1945–2011*	*67*	*353,300*	*437,600*	*1993*	*1,853,000*
333	*06818000*	*Missouri River at St. Joseph, Missouri*	*426,500*	*75,290,000*	*1*	*1929–2011*	*83*	*29,030,000*	*31,540,000*	*1997*	*55,020,000*
338	*06892350*	*Kansas River at De Soto, Kansas*	*59,756*	*4,047,000*	*55*	*1918–2011*	*94*	*4,554,000*	*5,325,000*	*1993*	*22,150,000*
340	*06902000*	*Grand River near Sumner, Missouri*	*6,880*	*2,773,000*	*46*	*1925–2011*	*87*	*2,795,000*	*3,120,000*	*1993*	*12,600,000*
341	*06905500*	*Chariton River near Prairie Hill, Missouri*	*1,870*	*1,318,000*	*21*	*1930–2011*	*82*	*850,700*	*959,500*	*2010*	*3,301,000*
342	*06926000*	*Osage River near Bagnell, Missouri*	*14,000*	*6,914,000*	*46*	*1926–2011*	*86*	*7,385,000*	*7,653,000*	*1927*	*17,810,000*
346	*06934500*	*Missouri River at Hermann, Missouri*	*522,500*	*100,600,000*	*5*	*1929–2011*	*83*	*57,270,000*	*59,430,000*	*1993*	*131,800,000*
		Ohio River Basin									
347	*03016000*	*Allegheny River at West Hickory, Pennsylvania*	*3,660*	*7,095,000*	*2*	*1942–2005, 2008–2011*	*68*	*4,901,000*	*4,880,000*	*2004*	*7,146,000*
348	*03031500*	*Allegheny River at Parker, Pennsylvania*	*7,671*	*13,830,000*	*3*	*1933–2011*	*79*	*9,991,000*	*10,050,000*	*2004*	*15,490,000*
349	03044000	Connemaugh River at Tunnelton, Pennsylvania	1,358	2,150,000	5	1940–1991, 2010–2011	54	1,658,000	1,730,000	1951	2,519,000
350	*03049500*	*Allegheny River at Natrona, Pennsylvania*	*11,410*	*19,400,000*	*3*	*1939–2011*	*73*	*14,260,000*	*14,340,000*	*2004*	*21,790,000*
351	*03069500*	*Cheat River near Parsons, West Virginia*	*722*	*1,477,000*	*19*	*1914–2011*	*98*	*1,256,000*	*1,261,000*	*1996*	*2,266,000*
352	*03075070*	*Monongahela River at Elizabeth, Pennsylvania*	*5,340*	*7,529,000*	*22*	*1934–2011*	*78*	*6,679,000*	*6,693,000*	*1996*	*10,430,000*
353	*03086000*	*Ohio River at Sewickley, Pennsylvania*	*19,500*	*30,990,000*	*7*	*1934–2011*	*78*	*23,750,000*	*24,390,000*	*2004*	*37,210,000*
356	*03129000*	*Tuscarawas River at Newcomerstown, Ohio*	*2,443*	*2,780,000*	*6*	*1922–2011*	*90*	*1,843,000*	*1,900,000*	*2004*	*3,779,000*

Estimated AEP for observed 2011 annual runoff (percent)	Expected annual runoff in acre-feet for selected annual exceedance probabilities (AEP) based on Water Resources Council Bulletin 17B methods								
	2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High
Missouri River Basin—Continued									
1 to 2	1,780,000	1,309,000	4,782,000	2,288,000	1,579,000	8,001,000	4,010,000	2,358,000	26,950,000
2 to 4	3,379,000	2,708,000	4,563,000	3,821,000	2,889,000	5,433,000	4,810,000	3,127,000	7,814,000
> 10	1,572,000	1,254,000	2,536,000	1,842,000	1,416,000	3,359,000	2,547,000	1,780,000	6,261,000
4 to 10	6,569,000	5,575,000	10,140,000	7,363,000	6,082,000	13,060,000	9,364,000	7,222,000	21,120,000
> 10	2,978,000	2,346,000	4,347,000	3,482,000	2,613,000	5,456,000	4,714,000	3,098,000	8,775,000
0.2 to 1	58,950,000	50,290,000	96,130,000	66,060,000	54,800,000	120,200,000	84,510,000	65,330,000	201,300,000
> 10	1,554,000	1,151,000	2,712,000	1,882,000	1,323,000	3,690,000	2,754,000	1,676,000	7,100,000
0.2 to 1	59,440,000	52,190,000	77,740,000	65,620,000	56,390,000	92,200,000	80,560,000	65,480,000	135,100,000
> 10	15,940,000	12,760,000	25,350,000	18,870,000	14,550,000	33,710,000	26,520,000	18,470,000	62,730,000
> 10	9,304,000	6,826,000	12,520,000	10,500,000	6,919,000	14,910,000	13,000,000	6,837,000	21,400,000
> 10	2,751,000	2,009,000	3,684,000	3,084,000	2,015,000	4,353,000	3,773,000	1,962,000	6,162,000
> 10	18,950,000	13,350,000	23,880,000	20,640,000	12,870,000	27,250,000	23,840,000	12,310,000	35,870,000
4 to 10	118,400,000	103,500,000	147,800,000	129,600,000	110,400,000	168,900,000	154,700,000	122,800,000	223,500,000
Ohio River Basin									
1 to 2	7,094,000	6,575,000	8,139,000	7,441,000	6,803,000	8,776,000	8,176,000	7,197,000	10,290,000
2 to 4	14,460,000	13,500,000	16,160,000	15,120,000	13,910,000	17,250,000	16,470,000	14,580,000	19,760,000
> 10	2,461,000	2,275,000	2,829,000	2,567,000	2,335,000	3,023,000	2,784,000	2,421,000	3,480,000
2 to 4	20,440,000	19,070,000	23,220,000	21,410,000	19,730,000	24,990,000	23,490,000	20,950,000	29,230,000
> 10	1,880,000	1,749,000	2,146,000	1,991,000	1,830,000	2,346,000	2,237,000	1,992,000	2,848,000
> 10	10,150,000	9,358,000	11,730,000	10,720,000	9,749,000	12,780,000	11,960,000	10,470,000	15,330,000
4 to 10	35,130,000	32,740,000	41,170,000	36,920,000	33,990,000	45,050,000	40,780,000	36,370,000	54,860,000
4 to 10	3,066,000	2,771,000	3,447,000	3,223,000	2,823,000	3,697,000	3,529,000	2,869,000	4,274,000

Table 2. Annual runoff data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[Stations used in the trend analysis are italicized. mi², square miles; AEP, annual exceedance probability; <, less than; >, greater than]

Map site number (fig. 2)	Station number	Station name	Contributing drainage area (mi²)	Water year 2011: Annual runoff (acre-feet)	Water year 2011: Rank	Period of record: Water years with streamflow data	Period of record: Number of years with streamflow data	Period of record: Median annual runoff (acre-feet)	Period of record: Mean annual runoff (acre-feet)	Previous maximum annual runoff based on data through water year 2010[a]: Water year	Previous maximum annual runoff based on data through water year 2010[a]: Annual runoff (acre-feet)
					Ohio River Basin—Continued						
358	*03140500*	*Muskingum River near Coshocton, Ohio*	*4,859*	*5,408,000*	*4*	*1937–2011*	*75*	*3,649,000*	*3,739,000*	*2004*	*6,907,000*
359	03150000	Muskingum River at McConnelsville, Ohio	7,422	7,457,000	12	1922–92, 2002–2011	81	5,495,000	5,668,000	2004	9,991,000
360	*03155000*	*Little Kanawha River at Palestine, West Virginia*	*1,516*	*1,549,000*	*35*	*1940–2011*	*72*	*1,524,000*	*1,556,000*	*1994*	*2,628,000*
361	*03159500*	*Hocking River at Athens, Ohio*	*943*	*1,071,000*	*11*	*1916–2011*	*96*	*722,200*	*746,300*	*2004*	*1,318,000*
362	*03176500*	*New River at Glen Lyn, Virginia*	*3,783*	*3,497,000*	*43*	*1928–2011*	*84*	*3,500,000*	*3,599,000*	*2003*	*5,423,000*
363	*03184000*	*Greenbrier River at Hilldale, West Virginia*	*1,619*	*1,578,000*	*39*	*1937–2011*	*75*	*1,651,000*	*1,656,000*	*2003*	*3,157,000*
364	*03192000*	*Gauley River above Belva, West Virginia*	*1,317*	*2,020,000*	*41*	*1930–2011*	*82*	*1,998,000*	*2,006,000*	*2003*	*2,932,000*
365	*03193000*	*Kanawha River at Kanawha Falls, West Virginia*	*8,371*	*8,253,000*	*81*	*1878–2011*	*134*	*8,977,000*	*9,071,000*	*1901*	*15,350,000*
366	*03197000*	*Elk River at Queen Shoals, West Virginia*	*1,145*	*1,542,000*	*37*	*1929–2011*	*83*	*1,499,000*	*1,493,000*	*1994*	*2,237,000*
367	*03198000*	*Kanawha River at Charleston, West Virginia*	*10,448*	*10,640,000*	*42*	*1941–2011*	*71*	*11,080,000*	*11,040,000*	*2004*	*16,510,000*
368	*03212500*	*Levisa Fork at Paintsville, Kentucky*	*2,144*	*2,179,000*	*19*	*1916, 1929–2011*	*84*	*1,774,000*	*1,786,000*	*1994*	*3,062,000*
369	03213700	Tug Fork at Williamson, West Virginia	936	724,000	26	1968–2011	44	818,100	810,200	1979	1,252,000
370	03214500	Tug Fork at Kermit, West Virginia	1,280	1,021,000	18	1916–17, 1930–34, 1986–2011	33	1,057,000	1,054,000	1994	1,651,000
371	*03227500*	*Scioto River at Columbus, Ohio*	*1,629*	*1,824,000*	*2*	*1921–90, 1992–2011*	*90*	*1,137,000*	*1,075,000*	*2008*	*1,875,000*
372	*03234500*	*Scioto River at Higby, Ohio*	*5,131*	*5,531,000*	*4*	*1931–2011*	*81*	*3,490,000*	*3,542,000*	*1996*	*5,937,000*
373	*03253500*	*Licking River at Catawba, Kentucky*	*3,300*	*4,148,000*	*12*	*1916–17, 1929–2011*	*85*	*2,954,000*	*3,015,000*	*1979*	*5,596,000*
376	*03274000*	*Great Miami River at Hamilton, Ohio*	*3,630*	*4,293,000*	*2*	*1928–2011*	*84*	*2,534,000*	*2,546,000*	*2008*	*4,604,000*
377	*03276500*	*Whitewater River at Brookville, Indiana*	*1,224*	*1,491,000*	*9*	*1916–17, 1924–2011*	*90*	*1,014,000*	*991,800*	*1996*	*1,738,000*
379	*03282000*	*Kentucky River at Lock 14 at Heidelberg, Kentucky*	*2,657*	*3,222,000*	*21*	*1926–31, 1939–2011*	*79*	*2,686,000*	*2,692,000*	*1994*	*5,046,000*
380	03284500	Kentucky River at Lock 8 near Camp Nelson, Kentucky	4,414	5,061,000	10	1940–71, 2003–11	41	4,134,000	4,087,000	2004	6,574,000

Estimated AEP for observed 2011 annual runoff (percent)	Expected annual runoff in acre-feet for selected annual exceedance probabilities (AEP) based on Water Resources Council Bulletin 17B methods								
	2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
		95-percent confidence limit			95-percent confidence limit			95-percent confidence limit	
	Estimate	Low	High	Estimate	Low	High	Estimate	Low	High
Ohio River Basin—Continued									
4 to 10	*5,965,000*	*5,420,000*	*6,838,000*	*6,290,000*	*5,578,000*	*7,380,000*	*6,950,000*	*5,781,000*	*8,655,000*
> 10	8,890,000	7,067,000	9,901,000	9,207,000	6,856,000	10,500,000	9,749,000	6,778,000	11,890,000
> 10	*2,610,000*	*2,343,000*	*3,057,000*	*2,770,000*	*2,422,000*	*3,334,000*	*3,102,000*	*2,528,000*	*3,999,000*
4 to 10	*1,214,000*	*1,018,000*	*1,354,000*	*1,265,000*	*1,000,000*	*1,443,000*	*1,354,000*	*983,800*	*1,647,000*
> 10	*5,641,000*	*5,163,000*	*6,352,000*	*5,928,000*	*5,299,000*	*6,813,000*	*6,504,000*	*5,473,000*	*7,882,000*
> 10	*2,653,000*	*2,419,000*	*3,117,000*	*2,820,000*	*2,527,000*	*3,420,000*	*3,178,000*	*2,718,000*	*4,161,000*
> 10	*2,902,000*	*2,700,000*	*3,207,000*	*3,023,000*	*2,763,000*	*3,400,000*	*3,266,000*	*2,845,000*	*3,839,000*
> 10	*14,220,000*	*13,250,000*	*15,840,000*	*15,090,000*	*13,880,000*	*17,180,000*	*16,960,000*	*15,070,000*	*20,390,000*
> 10	*2,276,000*	*2,102,000*	*2,570,000*	*2,393,000*	*2,171,000*	*2,762,000*	*2,634,000*	*2,279,000*	*3,210,000*
> 10	*16,590,000*	*15,250,000*	*18,760,000*	*17,370,000*	*15,640,000*	*20,060,000*	*18,950,000*	*16,140,000*	*23,090,000*
> 10	*2,947,000*	*2,295,000*	*3,315,000*	*3,064,000*	*2,225,000*	*3,538,000*	*3,264,000*	*2,202,000*	*4,058,000*
> 10	1,322,000	912,800	1,541,000	1,376,000	828,500	1,652,000	1,470,000	801,600	1,929,000
> 10	1,686,000	951,400	1,988,000	1,746,000	881,900	2,128,000	1,848,000	746,300	2,499,000
1 to 2	*1,804,000*	*1,206,000*	*2,048,000*	*1,863,000*	*1,147,000*	*2,189,000*	*1,955,000*	*1,241,000*	*2,523,000*
4 to 10	*5,824,000*	*4,097,000*	*6,572,000*	*6,034,000*	*3,995,000*	*7,010,000*	*6,376,000*	*4,107,000*	*8,041,000*
> 10	*4,919,000*	*3,411,000*	*5,551,000*	*5,091,000*	*3,320,000*	*5,920,000*	*5,368,000*	*3,458,000*	*6,790,000*
2 to 4	*4,466,000*	*3,155,000*	*5,113,000*	*4,657,000*	*3,052,000*	*5,505,000*	*4,975,000*	*3,087,000*	*6,432,000*
> 10	*1,744,000*	*1,136,000*	*2,003,000*	*1,810,000*	*1,087,000*	*2,155,000*	*1,915,000*	*1,167,000*	*2,518,000*
> 10	*4,749,000*	*4,139,000*	*5,508,000*	*5,034,000*	*4,192,000*	*5,989,000*	*5,591,000*	*4,198,000*	*7,134,000*
> 10	6,719,000	4,140,000	7,887,000	6,989,000	3,861,000	8,467,000	7,456,000	3,697,000	9,942,000

Table 2. Annual runoff data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[Stations used in the trend analysis are italicized. mi², square miles; AEP, annual exceedance probability; <, less than; >, greater than]

Map site number (fig. 2)	Station number	Station name	Contributing drainage area (mi²)	Water year 2011: Annual runoff (acre-feet)	Water year 2011: Rank	Period of record: Water years with streamflow data	Period of record: Number of years with streamflow data	Period of record: Median annual runoff (acre-feet)	Period of record: Mean annual runoff (acre-feet)	Previous maximum annual runoff based on data through water year 2010[a]: Water year	Previous maximum annual runoff based on data through water year 2010[a]: Annual runoff (acre-feet)
Ohio River Basin—Continued											
381	*03290500*	*Kentucky River at Lock 2 at Lockport, Kentucky*	*5,984*	*7,240,000*	*22*	*1926–30, 1933–37, 1940–2011*	*82*	*5,919,000*	*6,050,000*	*1927*	*10,570,000*
383	*03294500*	*Ohio River at Louisville, Kentucky*	*91,170*	*110,800,000*	*9*	*1929–2011*	*83*	*84,710,000*	*85,500,000*	*2004*	*133,900,000*
384	*03298500*	*Salt River at Shepherdsville, Kentucky*	*1,197*	*1,586,000*	*13*	*1939–2011*	*73*	*1,100,000*	*1,169,000*	*1979*	*2,621,000*
386	*03308500*	*Green River at Munfordville, Kentucky*	*1,493*	*2,389,000*	*24*	*1916–22, 1928–31, 1938–2011*	*85*	*1,984,000*	*1,974,000*	*1979*	*3,830,000*
387	*03320000*	*Green River at Lock 2 at Calhoun, Kentucky*	*6,032*	*10,500,000*	*14*	*1931–2011*	*81*	*8,036,000*	*8,080,000*	*1979*	*16,000,000*
388	*03325000*	*Wabash River at Wabash, Indiana*	*1,768*	*1,651,000*	*11*	*1924–34, 1936–2011*	*87*	*1,187,000*	*1,165,000*	*1950*	*2,165,000*
389	*03329000*	*Wabash River at Logansport, Indiana*	*3,779*	*3,316,000*	*20*	*1924–2011*	*88*	*2,530,000*	*2,564,000*	*1950*	*4,785,000*
390	*03336000*	*Wabash River at Covington, Indiana*	*8,218*	*7,131,000*	*18*	*1940–2011*	*72*	*5,596,000*	*5,729,000*	*1950*	*10,860,000*
391	*03341500*	*Wabash River at Terre Haute, Indiana*	*12,263*	*10,430,000*	*16*	*1928–2011*	*84*	*8,434,000*	*8,311,000*	*1950*	*16,510,000*
392	*03351000*	*White River near Nora, Indiana*	*1,219*	*1,224,000*	*14*	*1930–2011*	*82*	*883,300*	*869,300*	*2007*	*1,491,000*
393	*03360500*	*White River at Newberry, Indiana*	*4,688*	*4,858,000*	*15*	*1929–2011*	*83*	*3,757,000*	*3,688,000*	*2008*	*6,458,000*
394	*03373500*	*East Fork White River at Shoals, Indiana*	*4,927*	*6,154,000*	*9*	*1904–05, 1910–16, 1924–2011*	*97*	*4,358,000*	*4,181,000*	*1950*	*7,529,000*
395	*03374000*	*White River at Petersburg, Indiana*	*11,125*	*13,030,000*	*7*	*1929–2011*	*83*	*9,629,000*	*9,171,000*	*1950*	*16,510,000*
398	*03376500*	*Patoka River near Princeton, Indiana*	*822*	*1,173,000*	*11*	*1935–2011*	*77*	*760,200*	*772,200*	*1950*	*1,506,000*
399	*03377500*	*Wabash River at Mount Carmel, Illinois*	*28,635*	*29,320,000*	*11*	*1928–2011*	*84*	*22,370,000*	*21,240,000*	*1950*	*41,050,000*
402	*03381500*	*Little Wabash River at Carmi, Illinois*	*3,102*	*3,685,000*	*3*	*1940–2011*	*72*	*2,255,000*	*2,081,000*	*1950*	*4,409,000*
407	03404500	Cumberland River at Cumberland Falls, Kentucky	1,977	3,598,000	4	1908–11, 1916–31, 1933–94, 2003–05, 2011	86	2,349,000	2,345,000	1927	3,765,000

Estimated AEP for observed 2011 annual runoff (percent)	Expected annual runoff in acre-feet for selected annual exceedance probabilities (AEP) based on Water Resources Council Bulletin 17B methods								
	2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	95-percent confidence limit Low	95-percent confidence limit High	Estimate	95-percent confidence limit Low	95-percent confidence limit High	Estimate	95-percent confidence limit Low	95-percent confidence limit High
Ohio River Basin—Continued									
> 10	*10,280,000*	*8,786,000*	*11,700,000*	*10,800,000*	*8,719,000*	*12,590,000*	*11,760,000*	*8,541,000*	*14,660,000*
> 10	*126,200,000*	*114,700,000*	*138,600,000*	*131,000,000*	*115,200,000*	*146,300,000*	*140,000,000*	*114,800,000*	*163,700,000*
> 10	*2,037,000*	*1,425,000*	*2,365,000*	*2,131,000*	*1,349,000*	*2,556,000*	*2,292,000*	*1,336,000*	*3,020,000*
> 10	*3,459,000*	*2,976,000*	*3,964,000*	*3,651,000*	*2,980,000*	*4,290,000*	*4,016,000*	*2,944,000*	*5,055,000*
> 10	*14,040,000*	*11,950,000*	*16,100,000*	*14,790,000*	*11,880,000*	*17,390,000*	*16,200,000*	*11,630,000*	*20,430,000*
> 10	*1,924,000*	*1,135,000*	*2,242,000*	*1,967,000*	*1,066,000*	*2,404,000*	*2,022,000*	*1,293,000*	*2,823,000*
> 10	*4,132,000*	*2,670,000*	*4,702,000*	*4,235,000*	*2,529,000*	*5,006,000*	*4,380,000*	*2,851,000*	*5,750,000*
> 10	*9,126,000*	*5,997,000*	*10,330,000*	*9,386,000*	*5,691,000*	*10,990,000*	*9,783,000*	*6,040,000*	*12,600,000*
> 10	*13,820,000*	*9,066,000*	*15,740,000*	*14,260,000*	*8,597,000*	*16,820,000*	*14,930,000*	*9,302,000*	*19,410,000*
> 10	*1,509,000*	*925,200*	*1,749,000*	*1,560,000*	*870,100*	*1,882,000*	*1,635,000*	*959,500*	*2,210,000*
> 10	*6,029,000*	*3,592,000*	*6,996,000*	*6,165,000*	*3,376,000*	*7,489,000*	*6,345,000*	*4,032,000*	*8,768,000*
> 10	*6,862,000*	*3,896,000*	*8,092,000*	*6,990,000*	*3,703,000*	*8,693,000*	*7,148,000*	*4,673,000*	*10,320,000*
> 10	*14,700,000*	*8,457,000*	*17,230,000*	*14,960,000*	*7,946,000*	*18,460,000*	*15,280,000*	*10,090,000*	*21,830,000*
4 to 10	*1,304,000*	*726,100*	*1,538,000*	*1,336,000*	*677,600*	*1,658,000*	*1,378,000*	*823,700*	*1,978,000*
> 10	*33,810,000*	*20,000,000*	*39,330,000*	*34,430,000*	*18,820,000*	*42,040,000*	*35,210,000*	*23,380,000*	*49,280,000*
1 to 2	*3,635,000*	*1,458,000*	*4,749,000*	*3,690,000*	*1,609,000*	*5,303,000*	*3,747,000*	*2,241,000*	*7,186,000*
2 to 4	3,719,000	3,241,000	4,141,000	3,877,000	3,215,000	4,405,000	4,163,000	3,160,000	5,011,000

Table 2. Annual runoff data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[Stations used in the trend analysis are italicized. mi², square miles; AEP, annual exceedance probability; <, less than; >, greater than]

Map site number (fig. 2)	Station number	Station name	Contributing drainage area (mi²)	Water year 2011: Annual runoff (acre-feet)	Water year 2011: Rank	Period of record: Water years with streamflow data	Period of record: Number of years with streamflow data	Period of record: Median annual runoff (acre-feet)	Period of record: Mean annual runoff (acre-feet)	Previous maximum annual runoff based on data through water year 2010[a]: Water year	Previous maximum annual runoff based on data through water year 2010[a]: Annual runoff (acre-feet)
		Ohio River Basin—Continued									
408	03431500	Cumberland River at Nashville, Tennessee	12,856	16,650,000	27	1893–1954, 1993–2011	81	14,330,000	14,700,000	1920	25,340,000
409	*03455000*	*French Broad River near Newport, Tennessee*	*1,858*	*1,940,000*	*55*	*1904–05, 1921–94, 1997–2011*	*91*	*2,114,000*	*2,111,000*	*1973*	*3,359,000*
410	*03528000*	*Clinch River Above Tazewell, Tennessee*	*1,474*	*1,614,000*	*35*	*1920–2011*	*92*	*1,528,000*	*1,479,000*	*1927*	*2,367,000*
411	03532000	Powell River near Arthur, Tennessee	685	905,000	24	1920–1981, 1997–2011	77	818,100	803,600	1974	1,347,000
412	03566000	Hiwassee River at Charleston, Tennessee	2,298	2,317,000	51	1901–02, 1921–39, 1964–76, 1980–81, 1988–2011	61	3,410,000	3,319,000	1990	4,988,000
413	03584600	Elk River at Prospect, Tennessee	1,805	2,056,000	57	1905–07, 1920–94, 1999–2001, 2004–2011	89	2,194,000	2,198,000	1920	3,946,000
414	03603000	Duck River above Hurricane Mills, Tennessee	2,557	2,700,000	44	1926–94, 1999–2001, 2009–11	75	2,860,000	2,966,000	1973	6,313,000
416	*03611500*	*Ohio River at Metropolis, Illinois*	*203,000*	*233,100,000*	*26*	*1929–2011*	*83*	*201,300,000*	*202,100,000*	*1979*	*316,400,000*
		Lower Mississippi River Basin (downstream from the mouth of the Ohio River)									
420	07026040	Obion River at Highway 51 near Obion, Tennessee	1,875	2,201,000	24	1930–58, 1967–95, 2002–11	68	1,940,000	1,995,000	1973	3,873,000
421	07030050	Hatchie River at Rialto, Tennessee	2,308	2,252,000	24	1941–74, 1977–78, 1980–84, 1986–88, 2004–11	52	2,186,000	2,333,000	1973	4,894,000
426	07032000	Mississippi River at Memphis, Tennessee	932,800	515,500,000	4	1934–2011	78	374,100,000	365,800,000	1973	571,100,000
437	07047970	Mississippi River at Helena, Arkansas	941,800	511,100,000	7	1929–2011	83	378,900,000	369,700,000	1973	589,400,000
443	*07060500*	*White River at Calico Rock, Arkansas*	*9,980*	*9,701,000*	*18*	*1940–2011*	*72*	*7,370,000*	*7,430,000*	*1945*	*16,580,000*
444	*07061000*	*White River at Batesville, Arkansas*	*11,070*	*11,290,000*	*10*	*1938–58, 1987–94, 2001–11*	*40*	*9,593,000*	*9,157,000*	*1945*	*19,190,000*

Estimated AEP for observed 2011 annual runoff (percent)	Expected annual runoff in acre-feet for selected annual exceedance probabilities (AEP) based on Water Resources Council Bulletin 17B methods								
	2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High
Ohio River Basin—Continued									
> 10	25,190,000	22,670,000	29,610,000	26,870,000	23,630,000	32,520,000	30,410,000	25,120,000	39,540,000
> 10	*3,334,000*	*3,031,000*	*3,724,000*	*3,496,000*	*3,088,000*	*3,980,000*	*3,812,000*	*3,141,000*	*4,570,000*
> 10	*2,333,000*	*2,076,000*	*2,588,000*	*2,434,000*	*2,080,000*	*2,753,000*	*2,623,000*	*2,066,000*	*3,129,000*
> 10	1,305,000	1,160,000	1,480,000	1,370,000	1,170,000	1,588,000	1,495,000	1,169,000	1,840,000
> 10	5,214,000	4,168,000	5,886,000	5,413,000	3,994,000	6,259,000	5,762,000	3,853,000	7,144,000
> 10	3,713,000	3,051,000	4,187,000	3,880,000	2,985,000	4,488,000	4,177,000	2,922,000	5,182,000
> 10	5,215,000	4,555,000	6,079,000	5,531,000	4,624,000	6,618,000	6,155,000	4,645,000	7,905,000
> 10	*303,100,000*	*265,000,000*	*333,000,000*	*313,800,000*	*261,500,000*	*351,300,000*	*333,000,000*	*256,600,000*	*392,600,000*
Lower Mississippi River Basin (downstream from the mouth of the Ohio River)									
> 10	3,552,000	2,303,000	4,137,000	3,711,000	2,188,000	4,475,000	3,979,000	2,235,000	5,302,000
> 10	4,516,000	3,842,000	5,992,000	4,910,000	4,034,000	6,833,000	5,765,000	4,303,000	9,030,000
4 to 10	541,500,000	489,000,000	598,200,000	562,500,000	490,100,000	632,500,000	601,900,000	486,000,000	710,500,000
4 to 10	546,500,000	486,800,000	600,000,000	566,200,000	483,800,000	632,600,000	602,200,000	476,300,000	706,600,000
> 10	*15,510,000*	*13,280,000*	*19,850,000*	*17,020,000*	*14,090,000*	*22,750,000*	*20,320,000*	*15,350,000*	*30,280,000*
> 10	*17,480,000*	*13,910,000*	*22,380,000*	*18,680,000*	*13,620,000*	*24,830,000*	*21,060,000*	*12,650,000*	*31,170,000*

Table 2. Annual runoff data and results of flood-probability analyses for selected streamgages in the Central United States affected by 2011 flooding.—Continued

[Stations used in the trend analysis are italicized. mi^2, square miles; AEP, annual exceedance probability; <, less than; >, greater than]

Map site number (fig. 2)	Station number	Station name	Contributing drainage area (mi^2)	Water year 2011		Period of record				Previous maximum annual runoff based on data through water year 2010[a]	
				Annual runoff (acre-feet)	Rank	Water years with streamflow data	Number of years with streamflow data	Median annual runoff (acre-feet)	Mean annual runoff (acre-feet)	Water year	Annual runoff (acre-feet)
Lower Mississippi River Basin (downstream from the mouth of the Ohio River)—Continued											
447	*07064000*	*Black River near Corning, Arkansas*	*1,750*	*1,998,000*	*11*	*1939–95, 1999–2011*	*70*	*1,321,000*	*1,368,000*	*1973*	*2,903,000*
448	*07068000*	*Current River at Doniphan, Missouri*	*2,038*	*2,773,000*	*11*	*1922–2011*	*90*	*1,991,000*	*2,035,000*	*1985*	*4,243,000*
451	*07072500*	*Black River at Black Rock, Arkansas*	*7,370*	*8,688,000*	*13*	*1930–31, 1940–2011*	*74*	*5,814,000*	*6,321,000*	*1973*	*12,520,000*
455	07077000	White River at DeValls Bluff, Arkansas	23,400	21,860,000	20	1950–1970, 1989–2011	44	19,870,000	19,460,000	1950	37,140,000
461	*07144300*	*Arkansas River at Wichita, Kansas*	*33,227*	*154,200*	*75*	*1935–2011*	*77*	*631,300*	*754,900*	*1993*	*2,787,000*
462	*07151000*	*Salt Fork Arkansas River at Tonkawa, Oklahoma*	*4,470*	*106,400*	*72*	*1936–2011*	*76*	*568,700*	*650,800*	*1999*	*2,693,000*
463	*07152000*	*Chikaskia River near Blackwell, Oklahoma*	*1,873*	*73,850*	*71*	*1937–2011*	*75*	*362,000*	*449,900*	*1999*	*1,441,000*
464	*07152500*	*Arkansas River at Ralston, Oklahoma*	*46,631*	*810,900*	*84*	*1926–2011*	*86*	*3,584,000*	*3,965,000*	*1999*	*12,160,000*
465	07160000	Cimarron River near Guthrie, Oklahoma	12,932	160,700	66	1938–76, 1984–2011	67	680,500	831,100	1987	2,824,000
466	*07164500*	*Arkansas River at Tulsa, Oklahoma*	*62,811*	*688,500*	*86*	*1926–2011*	*86*	*5,350,000*	*5,610,000*	*1999*	*16,580,000*
467	*07176000*	*Verdigris River near Claremore, Oklahoma*	*6,451*	*883,300*	*62*	*1936–2011*	*76*	*2,827,000*	*3,086,000*	*1999*	*7,891,000*
468	*07183000*	*Neosho River near Iola, Kansas*	*3,723*	*522,700*	*79*	*1896–97, 1899–1903, 1918–2011*	*101*	*1,158,000*	*1,365,000*	*1951*	*4,807,000*
475	07191500	Neosho River near Chouteau, Oklahoma	11,580	4,959,000	42	1938–1950, 1964–2011	61	6,081,000	6,517,000	1993	16,070,000
486	*07245000*	*Canadian River near Whitefield, Oklahoma*	*39,149*	*1,643,000*	*60*	*1939–2011*	*73*	*3,707,000*	*4,317,000*	*1993*	*11,000,000*
490	07289000	Mississippi River at Vicksburg, Mississippi	1,140,500	568,300,000	10	1932–2011	80	448,100,000	443,400,000	1973	720,400,000
491	*07290000*	*Big Black River near Bovina, Mississippi*	*2,812*	*1,419,000*	*68*	*1937–2011*	*75*	*2,592,000*	*2,766,000*	*1983*	*7,891,000*

[a]The U.S. Geological Survey water year begins October 1 of the previous calendar year and ends September 30 of the calendar year.

Estimated AEP for observed 2011 annual runoff (percent)	Expected annual runoff in acre-feet for selected annual exceedance probabilities (AEP) based on Water Resources Council Bulletin 17B methods								
	2-percent AEP (50-year recurrence)			1-percent AEP (100-year recurrence)			0.2-percent AEP (500-year recurrence)		
	Estimate	95-percent confidence limit		Estimate	95-percent confidence limit		Estimate	95-percent confidence limit	
		Low	High		Low	High		Low	High
Lower Mississippi River Basin (downstream from the mouth of the Ohio River)—Continued									
> 10	*2,877,000*	*2,458,000*	*3,836,000*	*3,187,000*	*2,649,000*	*4,512,000*	*3,905,000*	*3,008,000*	*6,368,000*
> 10	*3,754,000*	*3,347,000*	*4,579,000*	*4,084,000*	*3,568,000*	*5,198,000*	*4,831,000*	*3,998,000*	*6,807,000*
> 10	*12,640,000*	*10,970,000*	*16,260,000*	*13,880,000*	*11,740,000*	*18,800,000*	*16,710,000*	*13,180,000*	*25,550,000*
> 10	36,850,000	31,120,000	48,850,000	39,760,000	32,180,000	55,000,000	45,890,000	33,110,000	71,010,000
> 10	*2,428,000*	*1,877,000*	*3,855,000*	*2,895,000*	*2,139,000*	*5,069,000*	*4,107,000*	*2,685,000*	*9,073,000*
> 10	*2,546,000*	*1,858,000*	*4,254,000*	*3,105,000*	*2,126,000*	*5,708,000*	*4,561,000*	*2,621,000*	*10,570,000*
> 10	*1,501,000*	*1,124,000*	*2,234,000*	*1,751,000*	*1,214,000*	*2,787,000*	*2,337,000*	*1,328,000*	*4,427,000*
> 10	*12,130,000*	*9,557,000*	*17,190,000*	*14,050,000*	*10,480,000*	*21,190,000*	*18,590,000*	*11,950,000*	*32,730,000*
> 10	2,853,000	2,134,000	4,886,000	3,434,000	2,441,000	6,578,000	4,960,000	3,067,000	12,370,000
> 10	*16,700,000*	*13,190,000*	*23,250,000*	*19,200,000*	*14,300,000*	*28,310,000*	*24,970,000*	*15,930,000*	*42,650,000*
> 10	*8,705,000*	*3,456,000*	*11,740,000*	*9,449,000*	*3,074,000*	*13,720,000*	*10,730,000*	*3,462,000*	*19,180,000*
> 10	*4,341,000*	*3,087,000*	*5,813,000*	*4,915,000*	*3,106,000*	*6,959,000*	*6,103,000*	*3,061,000*	*10,070,000*
> 10	12,980,000	4,794,000	16,850,000	13,390,000	4,312,000	18,920,000	13,930,000	6,131,000	25,330,000
> 10	*9,638,000*	*3,025,000*	*13,300,000*	*9,984,000*	*2,664,000*	*15,300,000*	*10,420,000*	*4,328,000*	*21,700,000*
> 10	688,000,000	335,700,000	1,351,000,000	701,100,000	51,960,000	1,173,000,000	724,800,000	18,030,000	1,235,000,000
> 10	*5,738,000*	*4,908,000*	*7,191,000*	*6,263,000*	*5,153,000*	*8,156,000*	*7,387,000*	*5,485,000*	*10,620,000*

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