In cooperation with the
West Virginia Department of Transportation
Division of Highways

Estimating Magnitude and Frequency of Peak Discharges for Rural, Unregulated, Streams in West Virginia

Water-Resources Investigation Report 00-4080

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

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By Jeffrey B. Wiley, John T. Atkins, Jr., and Gary D. Tasker

U.S. Department of the Interior
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WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

Charleston, West Virginia

2000

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PLATE

1. Map showing flood-frequency regions in West Virginia and locations of streamflow-gaging stations ..... IN POCKET

CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
Length		
inch (in.)	2.54	centimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
Area		
square mile (mi^2)	2.590	square kilometer
Flow rate		
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
cubic foot per second per square mile [$(ft^3/s)/mi^2$]	0.01093	cubic meter per second per square kilometer

Temperature in degrees Fahrenheit (^oF) may be converted to degrees Celsius (^oF) as follows:

$$^oC = (^oF - 32) / 1.8$$

Sea level: In this report, “sea level” refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)—a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

ESTIMATING MAGNITUDE AND FREQUENCY OF PEAK DISCHARGES FOR RURAL, UNREGULATED, STREAMS IN WEST VIRGINIA

by Jeffrey B. Wiley, John T. Atkins, Jr., and Gary D. Tasker

Abstract

Multiple and simple least-squares regression models for the $\log_{10}$-transformed 100-year discharge with independent variables describing the basin characteristics ($\log_{10}$-transformed and untransformed) for 267 streamflow-gaging stations were evaluated, and the regression residuals were plotted as areal distributions that defined three regions of the State, designated East, North, and South. Exploratory data analysis procedures identified 31 gaging stations at which discharges are different than would be expected for West Virginia. Regional equations for the 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year peak discharges were determined by generalized least-squares regression using data from 236 gaging stations. Log_{10}-transformed drainage area was the most significant independent variable for all regions.

Equations developed in this study are applicable only to rural, unregulated, streams within the boundaries of West Virginia. The accuracy of estimating equations is quantified by measuring the average prediction error (from 27.7 to 44.7 percent) and equivalent years of record (from 1.6 to 20.0 years).

Introduction

Many engineering projects are built within or adjacent to flood-prone areas. Information on past flooding and estimates of the magnitude and frequency of potential future floods are critical to the safe and economical design of hydraulic structures such as bridges, culverts, dams, and flood dikes and levees. To provide such information and estimates needed for the design of structures that will meet existing or proposed safety standards, yet not incur excessive costs because of overdesign, the U.S. Geological Survey (USGS), in cooperation with the West Virginia Department of Transportation, Division of Highways, revised previously developed equations for estimating the magnitude and frequency of peak discharges on rural, unregulated streams in West Virginia. The results of this study supercede those published by Runner (1980b).

The report presents newly revised equations for estimating the peak discharges of the 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year recurrence interval floods on rural, unregulated, streams in West Virginia. The report documents the information used to estimate the magnitude and frequency of flooding. The documentation includes the history of regional flooding in West Virginia, the climatic conditions affecting flooding in the State, the results of previous studies, the quality of peak discharge data, and the quality and extent of basin characteristics data. The statistical methods used in the analyses here are described to support the reliability of the application of the resulting equations to West Virginia streams. The accuracies of the equations are discussed to provide project designers with estimates of the uncertainty of peak discharges calculated by the use of the equations.

The equations should not be applied to urban areas having paved surfaces, concrete channels, or culverts. The equations should not be applied to streams regulated by dams, or large lakes and ponds. Equations are not applicable to heavily mined areas if excessive runoff is diverted into or outside the basin, retained along strip benches, or retained underground. Equations are not applicable to karst areas if excessive runoff is diverted into, outside, or within the basin through solution channels or other cavities in carbonate (limestone and dolomite) rocks.

Description of Study Area

West Virginia is in the mid-Atlantic region of the eastern United States (fig. 1), and can be differentiated by three physiographic provinces and two climatic regions. The three physiographic provinces are the Appalachian Plateaus, Valley and Ridge, and Blue Ridge. Airmasses move across the State such that two climatic regions can be identified by a line defined in this report as the Climatic Divide.

Physiographic Provinces. Generally, the part of the State west of the Climatic Divide is in the Appalachian Plateaus Province, where altitudes decrease northwestward from about 3,000-4,860 ft (Spruce Knob) along the Climatic Divide to about 500-700 ft along the Ohio River. The part of West Virginia east of the Climatic Divide is in the Valley and Ridge Province, except for the extreme eastern tip of the State, which is in the Blue Ridge Province. Altitudes decrease from the Climatic Divide to about 250 ft (at Harpers Ferry) in the eastern panhandle (U.S. Geological Survey, 1990).

The Appalachian Plateaus Province consists of consolidated, mostly noncarbonate sedimentary rocks that have a gentle slope from southeast to northwest near the Climatic Divide and are nearly flat-lying along the Ohio River. The one exception is the northeastern area of the Province (west of the Climatic Divide), where the rocks are gently folded and some carbonate rock crops out (Fenneman, 1938). The rocks in the Appalachian Plateaus Province have been eroded by streams to form steep hills and deeply incised valleys in dendritic patterns.

The Valley and Ridge Province in West Virginia consists of consolidated carbonate and noncarbonate sedimentary rocks that are folded sharply and extensively faulted (Fenneman, 1938). Northeast-trending valleys and ridges parallel the Climatic Divide in a trellis pattern.

The Blue Ridge Province consists of metamorphic rocks. The Province has high relief between mountains and wide valleys that parallel the Climatic Divide. Within West Virginia, the rocks are predominantly metamorphosed sandstone and shale (Fenneman, 1938).

Climate. The climate of West Virginia is primarily continental, with mild summers and cold winters. Major weather systems generally approach from the west and southwest, although polar continental airmasses of cold, dry air that approach from the north and northwest are not unusual throughout the State. Airmasses from the Atlantic Ocean sometimes affect the area east of the Climatic Divide. Generally, tropical continental masses of hot, dry air from the southwest affect the climate west of the Climatic Divide. Tropical maritime masses of warm, moist air from the Gulf of Mexico affect the climate east of the Climatic Divide. Land-recycled moisture through evaporation from local and upwind land surfaces, lakes, and reservoirs also affects the climate of the state (U.S. Geological Survey, 1991).

Precipitation.--Annual precipitation averages 42 in. statewide with about 60 percent received from March through August. July is the wettest month, and September through November are the driest. Annual precipitation in the State generally decreases northwestward from about 50-60 in. along the Climatic Divide to about 40 in. along the Ohio River, and is about 40 in. east of the Climatic Divide. Greater precipitation along and west of the Climatic Divide is a consequence of the higher elevations along the Divide and the general movement of weather systems approaching from the west and southwest. Annual snowfall follows the general pattern of annual precipitation, decreasing northwestward from about 36-100 in. along the Climatic Divide to about 20-30 in. along the Ohio River. Annual snowfall is about 24-36 in. east of the Climatic Divide. (U.S. Geological Survey, 1991; U.S. Department of Commerce, 1960, 1968)

Flooding.--Flooding across large drainage areas results from regional climatic events like frontal systems in winter and early spring, rainfall on snowpack in early spring, and tropical cyclones (hurricanes and tropical storms) in late summer or early fall. Generally, the most severe flooding across small drainage areas results from local intense thunderstorms in late spring through summer (Doll and others, 1963).

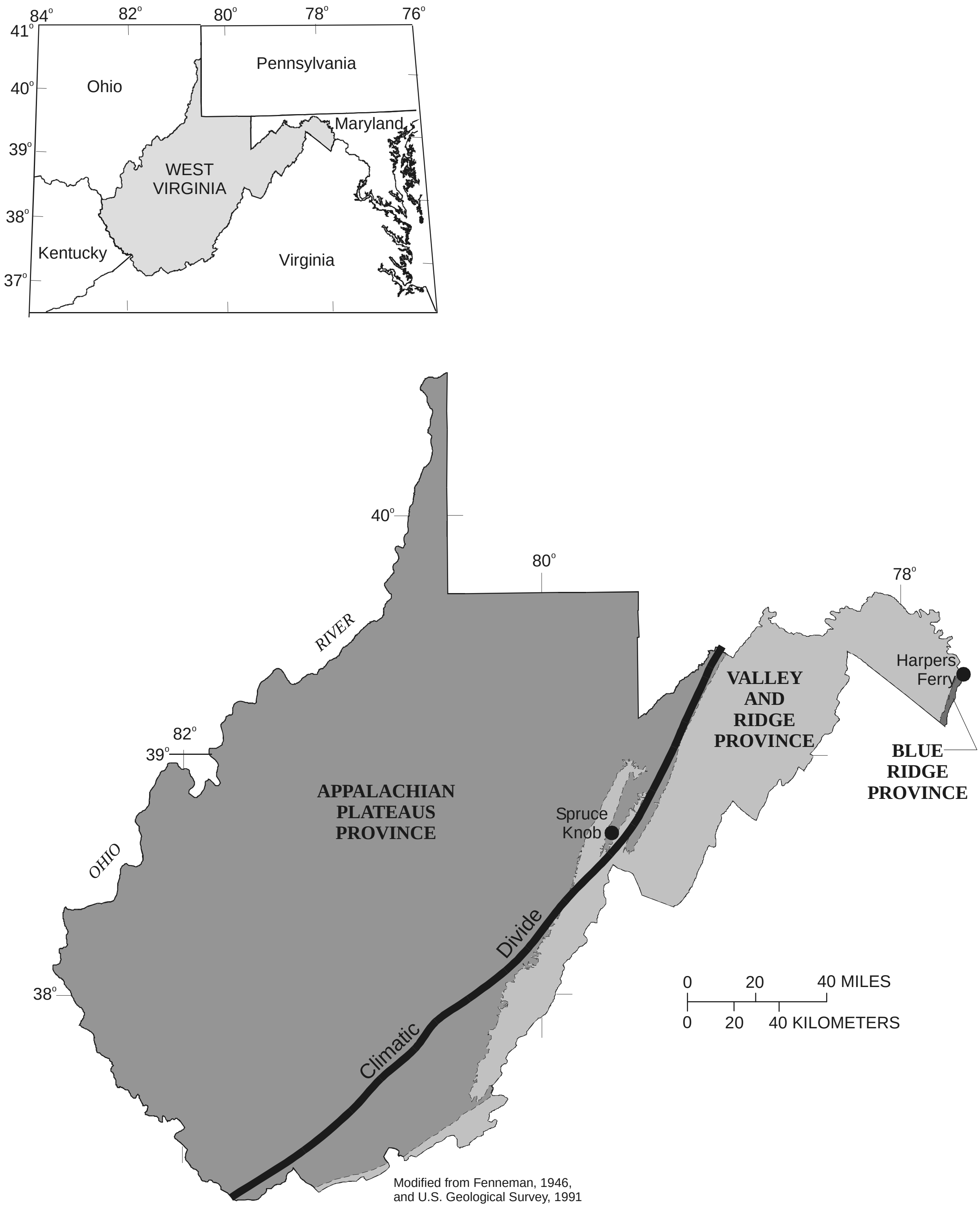

Figure 1. Physiographic provinces and Climatic Divide in West Virginia.

Regional Historical Floods

Before 1930, neither floods nor streamflow in West Virginia were systematically documented. Since 1930, data on regional flooding has been collected as part of the operation of a Statewide stream-gaging network supported by State and Federal funding. Local floods on small, ungaged watersheds remain only sparsely quantified. Major regional floods affecting West Virginia occurred in 1844, 1877, 1878, 1888, 1889, 1912, 1918, 1932, 1936, 1949, 1963, 1967, 1977, 1984, 1985, and 1996. For floods prior to 1930, the regional extent is not defined, but may have affected other rivers in the region. Locations of selected West Virginia streams are shown in Figure 2, supplementing information presented in Figure 1 to assist with discussions of historical floods.

July 1844.--Flooding was recorded by Speer and Gamble (1965, p. 148) on the Cheat River. This flood is about equal in magnitude to that in July 1888 and May 1996.

November 1877.--Flooding was recorded by Tice (1968, pp. 488, 490) on the South Branch Potomac River. This flood was about equal in magnitude to that in March 1936 and September 1996.

September 1878.--Flooding was recorded by Speer and Gamble (1965, pp. 284-288) on the New River.

July 1888.--Flooding was recorded by Speer and Gamble (1965, pp. 121, 138, 146-149) on the Monongahela River. This flood was about equal in magnitude to that in July 1844 on the Cheat River, and May 1996 on the Cheat and upper Monongahela River.

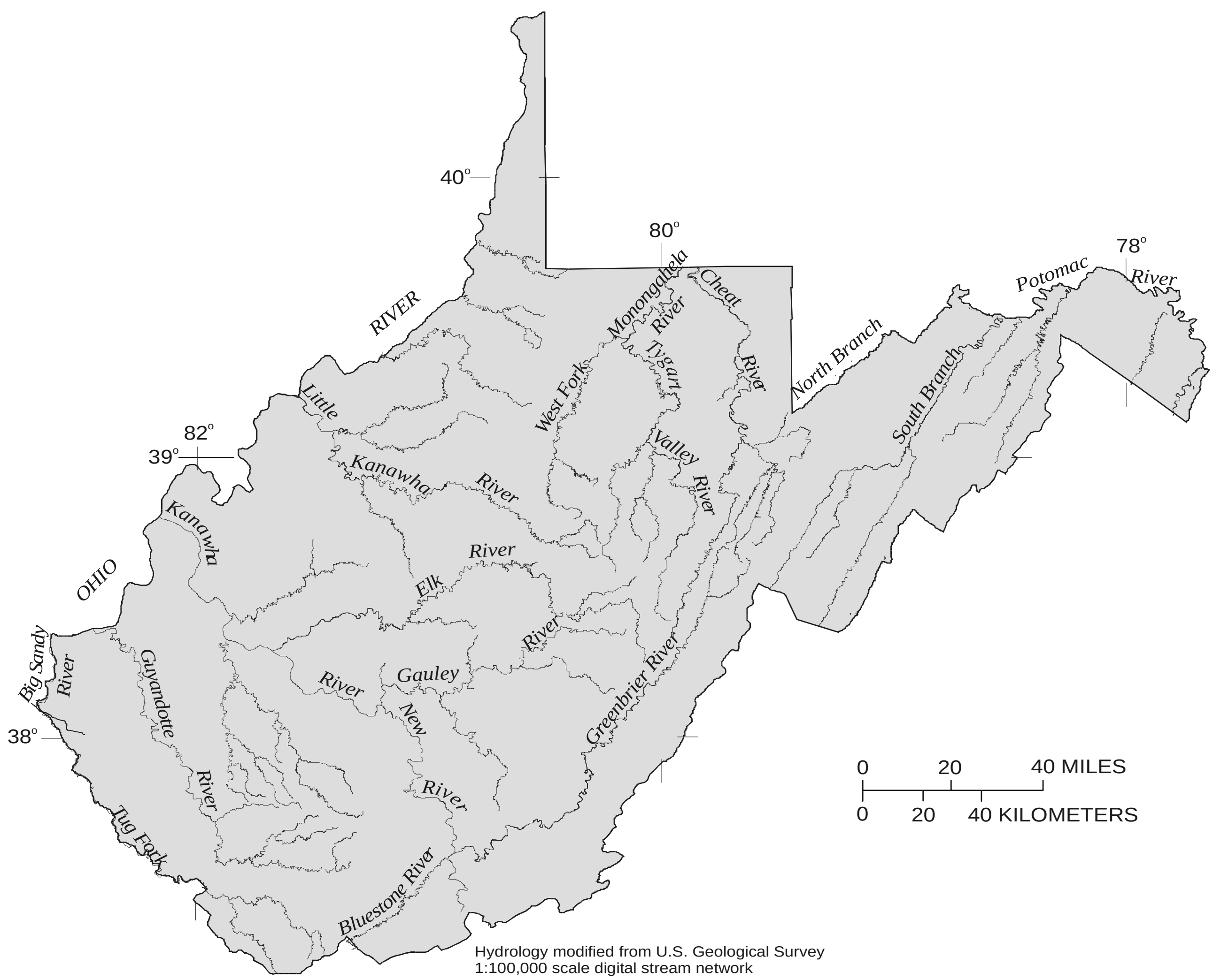

Figure 2. Selected streams in West Virginia.

July 1888.--Flooding was recorded by Speer and Gamble (1965, pp. 121, 138, 146-149) on the Monongahela River. This flood was about equal in magnitude to that in July 1844 on the Cheat River, and May 1996 on the Cheat and upper Monongahela River.

May-June 1889.--Flooding was recorded by Tice (1968, pp. 480, 490, 494, 497) on the North Branch Potomac River. This flood was about equal in magnitude to that in March 1936 and September 1996.

July 1912.--Flooding was recorded by Speer and Gamble (1965, pp. 118, 121, 127-128) on the Tygart Valley River.

March 1918.--Flooding was recorded by Speer and Gamble (1965, pp. 298, 310) on the Greenbrier and Gauley Rivers.

February 1932.--Flooding was recorded by Speer and Gamble (1965, pp. 119, 121, 129, 295, 298, 304, 307, 310) on the Tygart, Greenbrier, and Gauley Rivers.

March 1936.--Flooding was recorded on the Potomac and Cheat Rivers. This flood, which is documented by Grover (1937) as having a regional extent including the upper Ohio, Potomac, and James Rivers (the James River in Virginia), was caused by four separate cyclonic storms passing over the northeastern United States, resulting in multiple peak discharges and superposition of later peak discharges on earlier peak discharges. This flood was about equal in magnitude to that in September 1877, May-June 1889, and September 1996 on the Potomac River.

June 1949.--Flooding was recorded by Tice (1968, pp. 483-488) on the South Branch Potomac River.

March 1963.--Flooding was recorded on the Big Sandy (including the Tug Fork in West Virginia), Guyandotte, Little Kanawha, Cheat, and Greenbrier Rivers. This flood, which is documented by Barnes (1964) as having affected the western slopes of the Appalachian Mountains from Alabama to West Virginia, was caused by three separate frontal storms in which rain fell on a snowpack, followed by two additional storms.

March 1967.--Flooding was recorded on the Kanawha and Monongahela Rivers. This flood was caused by 4-5 in. of rainfall over three days augmented by runoff from melting snow (U.S. Geological Survey, 1991).

April 1977.--Flooding was recorded on the Tug Fork and Guyandotte Rivers. This flood is documented by Runner (1979), and Runner and Chin (1980) as having affected northeastern Tennessee, southwestern Virginia, eastern Kentucky, and southern West Virginia. This flood resulted from a frontal storm that moved southeastward through the region, became stationary, then moved slowly northwestward with heavy rainfall. The highest peak discharges ever recorded on the Tug Fork and Guyandotte Rivers resulted from this storm.

May 1984.--Flooding was recorded on the Tug Fork and Guyandotte Rivers (U.S. Geological Survey, 1991).

November 1985.--Flooding was recorded on the Monongahela, Potomac, upper Little Kanawha, upper Elk, and upper Greenbrier Rivers. This flood is documented by Lescinsky (1987) and Carpenter (1990) as having affected eastern West Virginia, western and northern Virginia, southwestern Pennsylvania, and western Maryland. This flood resulted from a complex sequence of meteorological events. Hurricane Juan moved from the Gulf of Mexico through southern Mississippi, ultimately causing precipitation as far north as Michigan and generating less than 2 in. of rainfall in West Virginia. This rainfall was caused by a second low pressure system developing from the hurricane remnants. The low pressure developed near the Tennessee-North Carolina border and traveled rapidly eastward to the Atlantic Ocean. A third low pressure system moved from the Gulf of Mexico into the Florida panhandle and moved slowly up the east coast of the United States, resulting in additional rainfall of up to 9 in. in West Virginia. The highest peak discharges ever recorded on the upper Monongahela and Potomac Rivers resulted from this flood.

January 1996.-- About 2 in. of rain fell on a 3-4 ft snowpack resulting in flooding in the upper Potomac, upper Cheat, upper Elk, and Greenbrier Rivers.

May 1996.--A frontal storm caused flooding on the Cheat and upper Monongahela River about equal in magnitude to that on the Cheat River in July 1844 and July 1888.

September 1996.--Tropical storm Fran caused regional flooding on the upper Potomac River. This flood was about equal in magnitude to that in November 1877 on the South Branch Potomac River, in May-June 1889 on the North Branch Potomac River, and March 1936.

Previous Studies

Studies completed in 1969, 1970, 1971, and 1980 for flooding in West Virginia lacked data for peak discharges on stations having drainage areas less than 50 mi^2. These studies compensated for the lack of data for small drainage areas by recommending not using flood-estimating methods for small drainage areas; limiting the frequency estimates to small recurrence intervals; increasing record lengths for small drainages by use of a rainfall-runoff model; or, using a composite analysis of long-term data (primarily stations with a minimum of 40 years of record) with an analysis of long-term data combined with short-term, small drainage-area data.

Frye and Runner, 1969.--This study estimated flood magnitude and frequency for rural, unregulated, streams in West Virginia by using relations presented in U.S. Geological Survey Water Supply Papers 1672 (Tice, 1968) and 1675 (Speer and Gamble, 1965). The country-wide flood-frequency relations in these publications were developed for regional or major river basins. The relations were recommended for use only on drainage areas greater than 50 mi^2 in the Ohio River Basin and greater than 30 mi^2 in the Potomac River Basin.

Frye and Runner, 1970.--This study presented a method for estimating peak discharges using an analytical technique similar to that proposed by Benson (1962). Peak-discharge data for rural, unregulated, streams in West Virginia with a minimum of ten years of record were analyzed. The analytical techniques were recommended for application only to drainage areas greater than 50 mi^2 because there were not adequate data available from drainage areas less than 50 mi^2.

Frye and Runner, 1971.--This study presented a method for estimating the 2-, 5-, and 10-year peak discharges for rural, unregulated, streams in the Ohio River Basin of West Virginia. Data from a small-stream network with an average record length of 6 years were correlated with long-term gaging-station data to correct for time bias. The relations were applicable only to streams with drainage areas between 1 and 50 mi^2.

Runner, 1980b.--This study presented equations for estimating the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year peak discharges for rural, unregulated, streams in West Virginia. The flood-estimating equations were recommended for use for drainage areas between 0.3 and 2,000 mi^2. The frequency analyses in this study were made using methods recommended by the U.S. Water Resources Council (1976), including adjustments to station-frequency determinations by applying weighted regional and station skews. The peak-discharge data from 170 gaging stations included data from Maryland and Virginia. Records of peak discharges for 15 stations with small drainage areas (ranging from 1.8 to 12.2 mi^2) were synthesized to greater than 40 years of record (Runner, 1980a) by application of a rainfall-runoff model developed by Dawdy, Lichty, and Bergmann (1972). On the basis of regression analyses using 12 basin characteristics as independent variables, regional flood-frequency relations were developed separately for stations with more than 40 years of record (including 15 small-drainage-area stations for which at least a 40-year record was synthesized) and for all 170 stations. Three regions were delineated using an analysis of the regression residuals, and drainage area was determined as the only statistically significant independent variable. A composite of the relations for stations having greater than 40 years of record and all 170 gaging stations was determined.

Development of Estimating Equations

Annual peak discharge data and basin characteristics data for streamflow-gaging stations in West Virginia were quality assured and analyzed to determine the magnitude and frequency of peak discharges. The flood-frequency relations for the 100-year recurrence interval flood were regionalized by plotting the areal distribution of residuals from application of multiple and simple least-squares regression models. Independent variables described basin characteristics for each station location. Magnitude and frequency data for 100-year recurrence interval floods in surrounding states were incorporated into the modeling and regionalization procedure. Areal distributions of residual plots from a regional regression of the 100-year peak discharges were used to help select data from surrounding states. These data were included with West Virginia data to produce the regional relations most applicable to West Virginia. The flood-estimating equations for all recurrence intervals were computed from a generalized least-squares regression model using the regions and independent variables determined from the analysis of the multiple and simple least-squares regression models of the 100-year recurrence interval data.

Peak Discharge Data

Peak discharges for 160 rural, unregulated, West Virginia streamflow-gaging stations having a minimum of 10 years of record through the 1997 water year (the period beginning October 1 of the previous year through September 30 of the indicated year) were available for this study. The peak-discharge values were quality assured by comparison with published values and by plotting the peaks to evaluate the stage-discharge relations. Some peak discharges were estimated using data from nearby stations or were based on some on-site data to lengthen systematic and historical records.

Annual-peak discharge data are maintained in the U.S. Geological Survey's "Peak File" data base available on the World Wide Web from the USGS United States NWIS-W Data Retrieval at http://waterdata.usgs.gov/. Through the 1960 water year, multiple years of peak data are published in the "USGS Water-Supply Paper" series of reports. Since the 1961 water year, peak data have been published annually in the "U.S. Geological Survey Water Resources Data - West Virginia" series of reports (series title has changed several times since 1961).

Peak discharges were not available for the gaging station Shavers Fork at Cheat Bridge (03067500) for the minimum 10 years of record required for this study. The most recent period of record, 1992 through 1997, does not have a stage-discharge relation developed. The current period along with previous periods would exceed the minimum 10 years of record, but a rating could not be developed prior to this study.

Peak discharges for the gaging station Cheat River at Rowlesburg (03070000) are a combination of records that either include or exclude flow from the tributary stream Saltlick Creek. Before the flood of November 5, 1985, peak-discharge data were collected at locations that include flow from Saltlick Creek, with a drainage area of 974 mi^2. From November 6, 1985 through September 30, 1996, peak-discharge data were collected at a location that excluded flow from Saltlick Creek, with a drainage area of 939 mi^2. No data were collected at either of these locations during the 1997 water year. The station ratings were difficult to define accurately after November 5, 1985 because they were affected by scour throughout the range of stage. Peak discharges were not adjusted for the 4 percent difference in drainage area (typically necessary to combine the records) because the rating definition difficulties resulted in peak discharges with much greater than 4 percent uncertainties. For this study, peak-discharge data for the two locations were combined without correction, using a drainage area of 974 mi^2.

Peak discharges for the 1979-1982 water years at the gaging station Right Fork Holly River at Guardian (03195100), and peak discharges for the 1979-1982 and 1987-1997 water years at the gaging station Left Fork Holly River near Replete (03195250) were provided by the U.S. Army Corp of Engineers, Huntington District (Phillip E. Anderson, oral and written commun., 1997 and 1998). These peak discharges are included in the Peak File maintained by the U.S. Geological Survey and are published in the 1998 annual water-data report for West Virginia (Ward and others, 1999).

Peak discharges for the gaging station Moody Moore Hollow near Huntersville (03181900) were previously incorrectly identified. The station is located at an unnamed tributary identified by local residents as Mack Butterball Hollow. The station name, latitude and longitude, and drainage area were revised to Mack Butterball Hollow near Huntersville; 38^o 14' 09" and 79^o 58' 27"; and 0.10 square miles, respectively. The station number (03181900) remained the same, and all basin characteristics data were revised to apply to the correct location.

Quality assurance.--The Peak File for West Virginia gaging stations was compared with published values, and all discrepancies were corrected to published values. Stage-discharge relations were plotted for all entries in the Peak File (including partial peaks at and above base discharges where available) to study high-discharge ratings. This historical perspective of rating analysis indicated publication errors, rating analysis errors, and needs for improved rating definition. All identified errors were corrected, and rating definition needs were met through streamflow-model applications and slope-conveyance rating extension techniques (Rantz, and others, 1982). Revised peak discharges are published in the 1997 and 1998 annual data reports (Ward and others, 1998; Ward and others, 1999). For this study, the quality-assurance procedures were not applied to data from stations outside of West Virginia.

Peak discharge estimates.--Peak discharges at nearby stations on the same stream (having less than 10 percent difference in drainage area) and operating during different time periods were combined into a single time-series record using drainage-area weighting techniques at one or both stations. Peak discharges for major flood events at discontinued stations where gaging stations were operating upstream and downstream from the discontinued station were estimated based on comparison of unit-peak discharges [in $(ft^3/s)/mi^2$] for each flood event. Peak discharges for historical floods were estimated for stations having some at-site data (stage or reference notes by USGS hydrographer comparing magnitude of different floods) with sufficient peak discharges of other floods to develop flood-specific regional trends in unit-peak discharges. Unit-peak discharge trends were used to estimate unit-peak discharges at stations for regional historical floods prior to 1930. Peak discharges were estimated by multiplying the estimated unit-peak discharge by the station drainage area. Estimated peak discharges are published in the 1997 and 1998 annual data reports (Ward and others, 1998; Ward and others, 1999).

Basin Characteristics Data

Eleven basin characteristics for 160 rural, unregulated, West Virginia streamflow-gaging stations having a minimum of 10 years of record through the 1997 water year were available for this study (locations of gaging stations are shown on pl. 1). Information for stations in surrounding states were acquired to augment West Virginia data. Various methods were used to check basin characteristics data. Basin characteristics for gaging stations in West Virginia were compared with published values and interpolated from maps, and some-

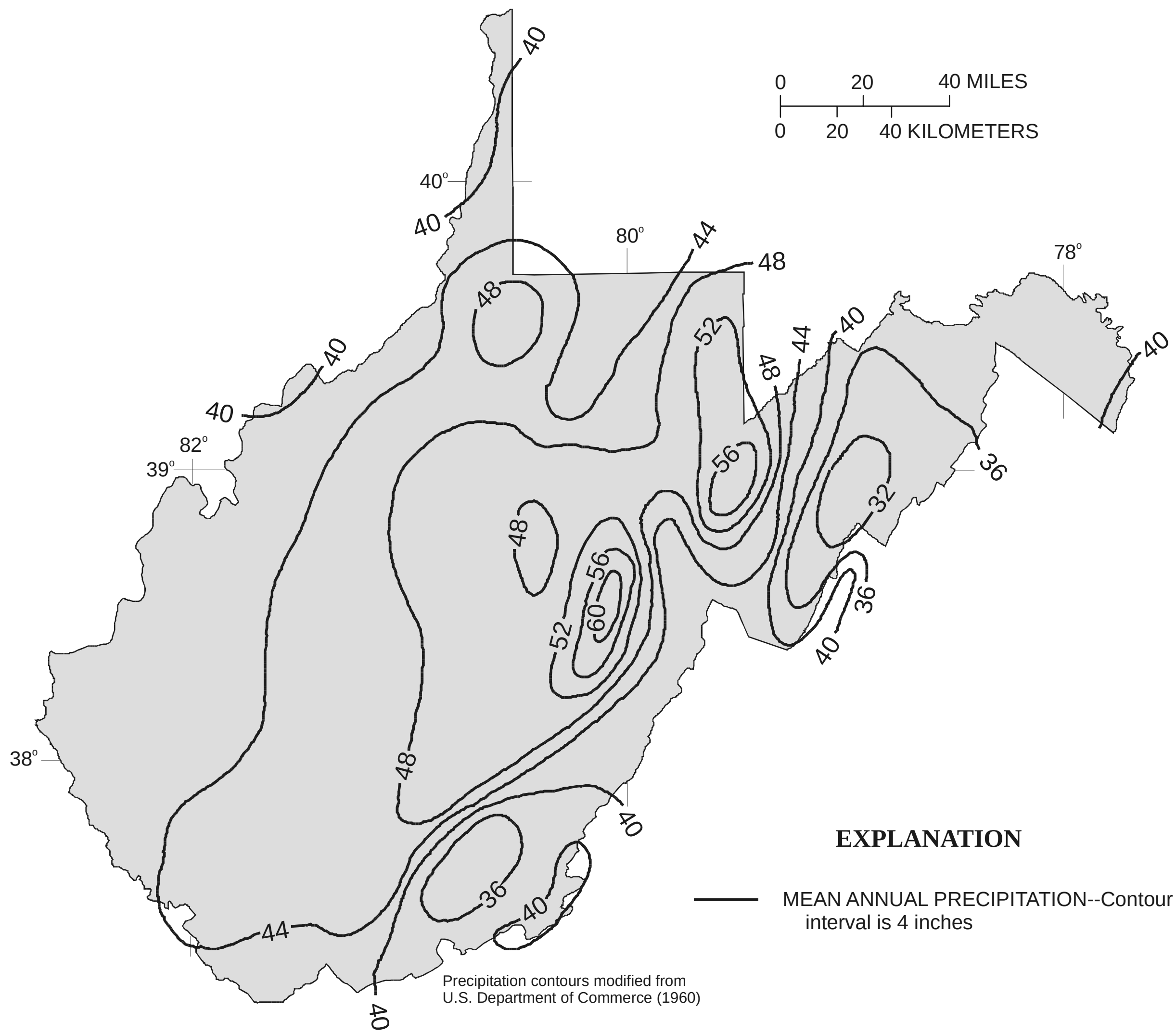

Figure 3. Mean annual precipitation in West Virginia (1931-55).

values were checked through reevaluation of characteristics.

The U.S. Geological Survey "Streamflow/Basin Characteristics" data base generally contains variables that (1) quantify statistical summaries of daily-mean discharges and peak discharges, and (2) describe the basin at and upstream from a gaging station by quantifying topographic map features and interpreting climatological iso-maps. These are variables that intuitively can be assumed to affect streamflow (Thomas and Benson, 1969). This data base is not maintained on an annual basis and is not available on the World Wide Web. Contents from this data base for 160 gaging stations in West Virginia and 113 gaging stations selected from surrounding states are presented in tables 1, 2, and 3 located near the end of this report.

Basin characteristics found to be significant independent variables in recent regression analyses of data from West Virginia gaging stations were drainage area (Runner, 1980b; Wiley, 1987; and, Friel and others, 1989), mean basin elevation (Wiley, 1987), and streamflow variability index (Friel and others, 1989). Eleven basin characteristics were used to describe the basins at and upstream from West Virginia gaging stations. These basin characteristics are listed in table 1 and were considered for the correlation and regression analyses.

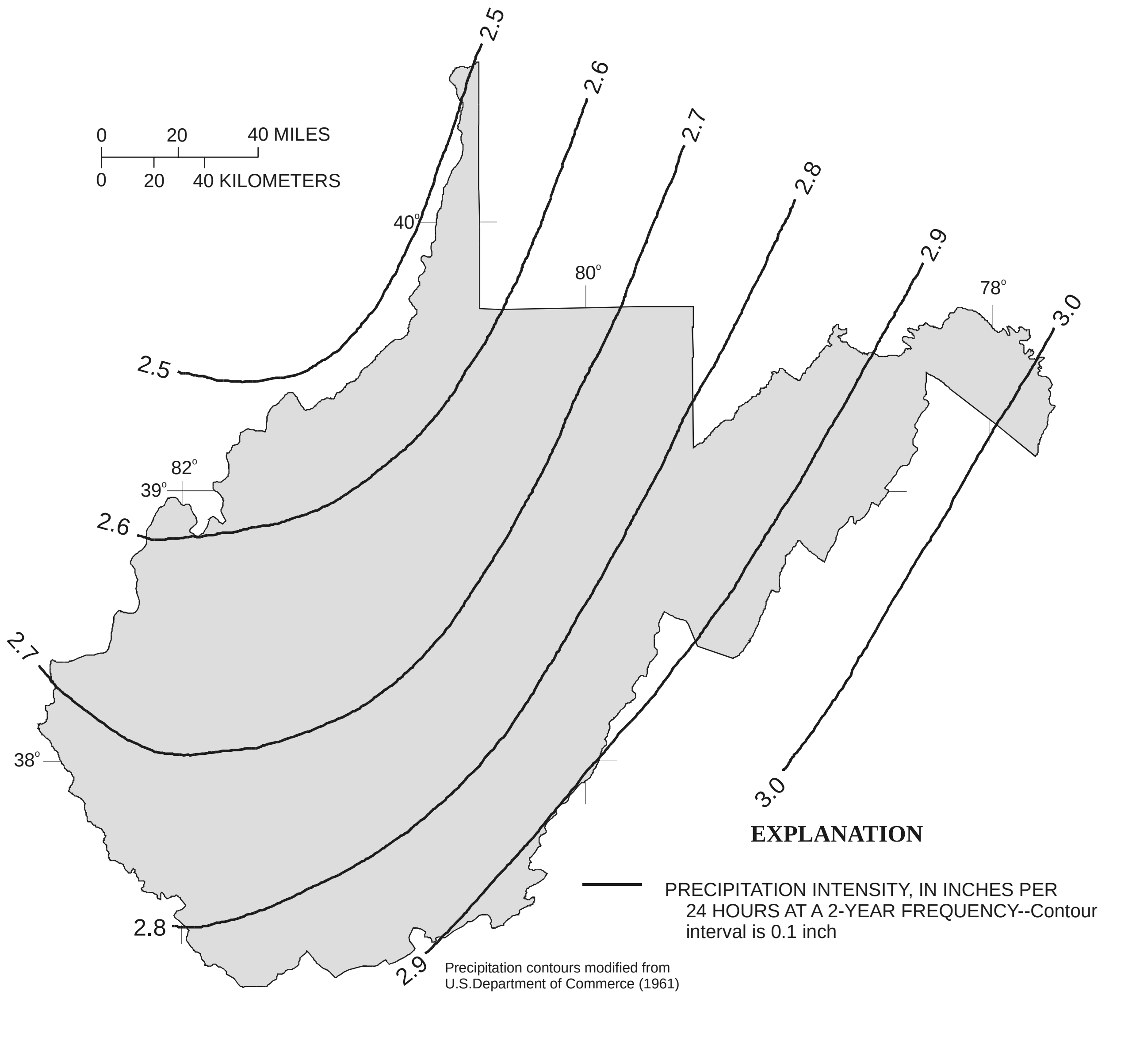

Figure 4. Precipitation intensity in West Virginia.

1. **Drainage area**, in square miles (mi^2), determined by tracing basin boundaries on a U.S. Geological Survey 1:24,000-scale topographic map and measuring the enclosed area, or by reading from a report of tabulated drainage areas (Mathes, 1977; Wilson, 1979; Mathes and others, 1982; Preston and Mathes, 1984; Stewart and Mathes, 1995; Wiley and Hunt, 1995; Wiley, 1997);

2. **Main-channel slope**, in feet per mile (ft/mi), determined from a U.S. Geological Survey 1:24,000- or 1:62,500-scale topographic map as the slope between points along the main stream channel located10 and 85 percent of the distance from the gaging station to the basin divide;

3. **Stream length**, in miles (mi), determined from a U.S. Geological Survey 1:24,000- or 1:62,500-scale topographic map as the length of the main stream channel from the gaging station to the basin divide;

4. **Mean basin elevation**, in feet above mean sea level, determined by averaging elevations read from a U.S. Geological Survey 1:24,000- or 1:62,500-scale topographic map at 20-80 grid crossings selected from the placement of a square grid over a delineated basin;

5. **Forested area**, in percent, determined by dividing the number of grid crossings at forests (area shaded with green) shown on a U.S. Geological Survey 1:24,000- or 1:62,500-scale topographic map by the total 20-80 grid crossings selected from the place-

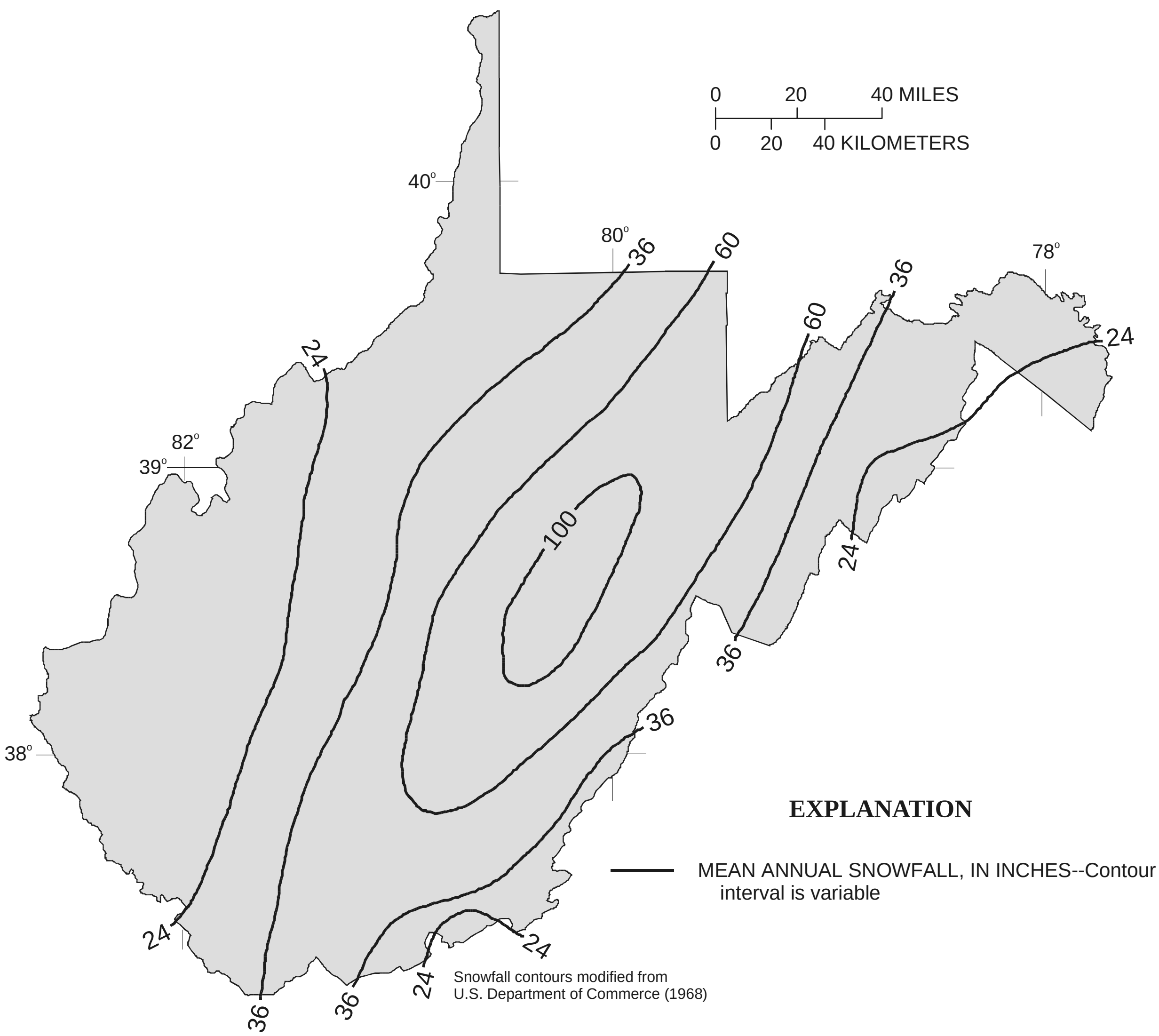

Figure 5. Mean annual snowfall in West Virginia through 1960.

ment of a square grid over a delineated basin, then multiplying by 100;

6. **Mean annual precipitation**, in inches, determined by visually integrating an isohyetal map (fig. 3) published by the U.S. Department of Commerce (1960) over the area of a delineated basin;

7. **Precipitation intensity**, in inches per 24 hours occurring on an average of once every two years, determined by visually intergrating an isohyetal map (fig. 4) modified from that published by the U.S. Department of Commerce (1961) over the area of a delineated basin. (This isohyetal map was modified by interpreting isograms for 2.6, 2.7, 2.8, and 2.9 in.);

8. **Mean annual snowfall**, in inches, determined by visually integrating an isohyetal map (fig. 5) published by the U.S. Department of Commerce (1968) over the area of a delineated basin;

9. **Mean minimum January temperature**, in degrees Fahrenheit (^{o}F), determined by visually integrating an isothermal map (fig. 6) published by the U.S. Department of Commerce (1960) over the area of a delineated basin;

10. **Local station slope**, in feet per mile (ft/mi), determined by measuring the distance between topographic contour-line crossings along the main channel upstream and downstream from a gaging station

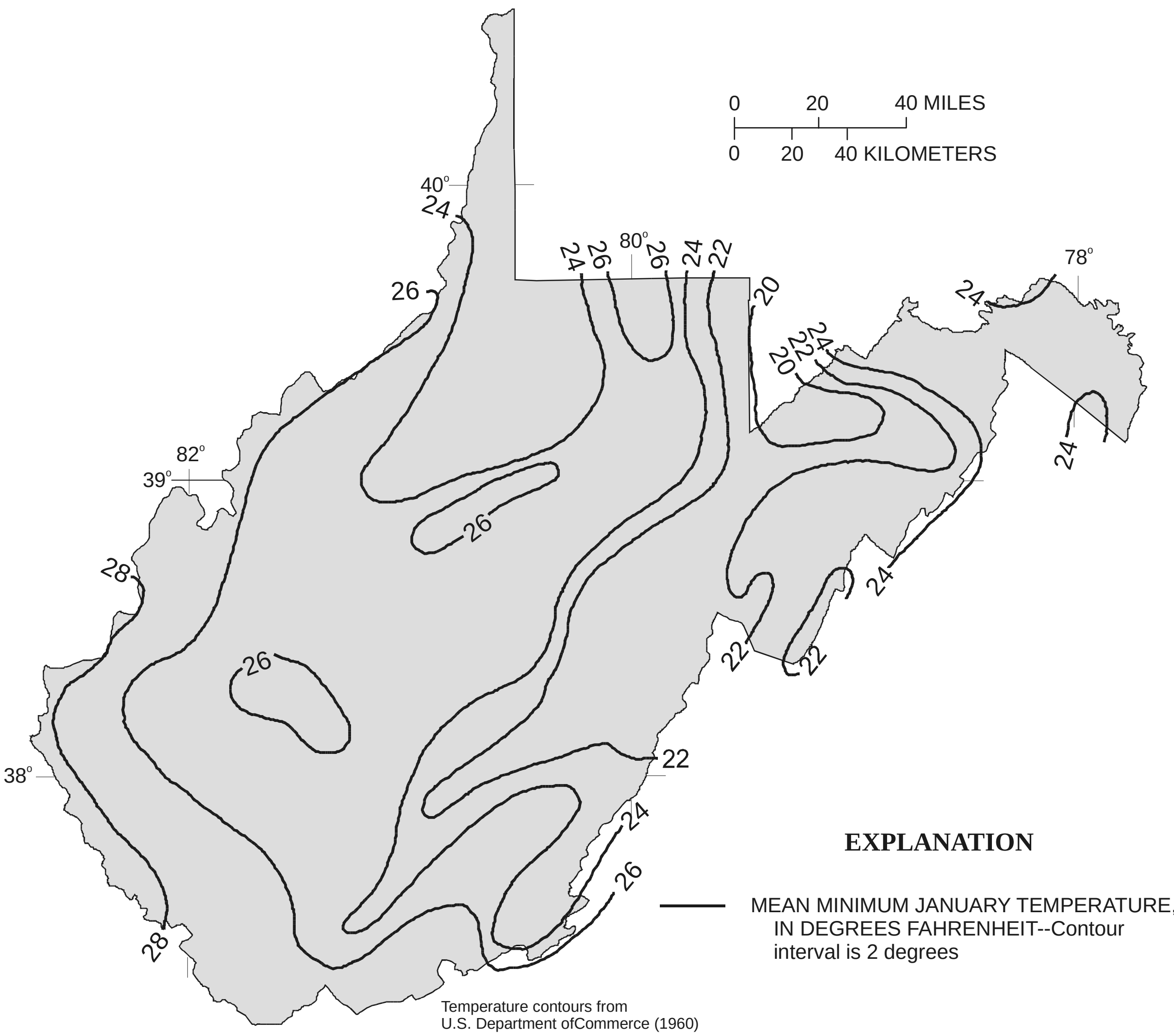

Figure 6. Mean minimum January temperature in West Virginia (1931-52).

located on U.S. Geological Survey 1:24,000-scale topographic map, and dividing the difference in elevations between the contour lines by that distance; and,

11. **Streamflow variability index**, determined either (1) as the standard deviation of the $\log_{10}$ transformations of the 5-, 15-, 25-, 35-, 45-, 55-, 65-, 75-, 85-, and 95-percent flow durations for gaging stations having daily mean discharges computed, or (2) by visually integrating a variability index boundary map published by Friel and others (1989) over the area of adelineated basin for gaging stations not having daily mean discharges computed.

Basin characteristics data for surrounding states (table 1) were obtained from the most recent U.S. Geological Survey flood-frequency studies in these states (Bisese, 1995; Choquette, 1988; Dillow, 1996; Flippo, 1982; and, Koltun and Roberts, 1990), from the USGS "Streamflow/Basin Characteristics" data base, and from correspondence with USGS colleagues K.J. Ruhl (Kentucky, 1997) and J.A. Dillow (Maryland, 1997). Not all selected basin characteristics data were readily available for surrounding states, and these data were not determined for the correlation and regression analyses.

Quality assurance.--The USGS "Streamflow/Basin Characteristics" data base for West Virginia gaging stations was quality assured for the 11 basin characteristics listed in table 1 and for the peak-flow statistics determined by the magnitude and frequency analysis listed in tables 2 and 3. All drainage areas were compared to those published in the most recent reports (Mathes, 1977; Wilson, 1979; Mathes and others, 1982; Preston and Mathes, 1984; Stewart and Mathes, 1995; Wiley and Hunt, 1995; Wiley, 1997). About 5 percent of the values for main-channel slope, stream length, mean basin elevation, and percent forested area were checked. The values for percent forested area were corrected for two small-drainage stations, and the quality-assurance process for percent forested area was expanded to include about 25 percent of the small-drainage stations, with only one additional error found. All values for mean annual precipitation, precipitation intensity, annual snowfall, and mean minimum January temperature were checked with re-interpolations of maps or corrected to that value. Many of the basin characteristics interpolated from the maps required modification because different maps were used or visual integration over the basin had not been done (the value from the map for the location of the gaging station may have been entered instead of a basin average). All values for peak-flow statistics determined by the magnitude and frequency analysis were checked against those in the data base or corrected to that value. All streamflow variability indexes published by Friel and others (1989) were checked against those in the data base or corrected to that value. These quality-assurance procedures were not applied to data from stations outside of West Virginia.

Magnitude and Frequency Analysis

The magnitudes and frequencies of peak discharges at 160 streamflow-gaging stations on rural, unregulated, streams in West Virginia, for which a minimum of 10 years of record through 1997 was available (pl. 1 in pocket), were determined following the guidelines (Bulletin 17B) established by the Interagency Advisory Committee on Water Data, Water Resources Council (1982). The systematic streamflow records for those stations were analyzed, both visually and statistically, for trends. Data from gaging stations in surrounding states were used to augment the West Virginia data.

The Pearson Type III probability curve is assumed to fit to the $\log_{10}$ transformed systematic annual-peak series for a given gaging station. Regional general skew was obtained from the national skew map provided in Bulletin 17B. Regional general skew is weighted with station skew to adjust the probability curve. Additionally, high-outlier, low-outlier, and historical peak assessments are made to adjust the annual-peak series. Mixed populations, such as floods from snowmelt and those from tropical storms or hurricanes, were not separately analyzed. Selected statistics from the magnitude and frequency analyses for the 160 gaging stations in West Virginia and 113 gaging stations selected from surrounding states are listed in table 2 (at the end of this report). The 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year peak discharges for the 160 gaging stations in West Virginia and 113 gaging stations in surrounding states are listed in table 3 (also at the end of this report).

Typically, the magnitude of a flood frequency increases with increasing drainage area. For floods with recurrence intervals greater than 10 years, however, the frequencies calculated for the station Tygart Valley River near Dailey (03050000) are greater than those for the station Tygart Valley River near Elkins (03050500), although the drainage area for Tygart Valley River near Dailey (185 mi^2) is less than the drainage area for Tygart Valley River near Elkins (271 mi^2) (tables 1 and 3). This inconsistency may be due to the wide floodplain along the river between Daily and Elkins, which contrasts with the more mountainous and narrower floodplains upstream from Daily, and therefore increases the stream storage and attenuates the flood peak. The inconsistency may occur also because the frequency analysis for each station is based on different time periods, thus creating a time-sampling error.

All systematic annual peak-series data for West Virginia were plotted against time and visually inspected to detect trends, outliers, and nonhomogeneity. Visual inspection of data for the gaging station Poplar Fork at Teays (03201410) indicated nonhomogeneity. The data for 1967-1978 had higher annual peaks than the data for 1992-1997. This nonhomogeneity was caused by a rating error for the period 1967-1978. The annual peaks for the period 1967-1978 were revised, but this data still had higher annual peaks than data for 1992-1997. It is not clear if this difference is due to nonhomogeneity or due to a time-sampling error. The entire period of record for this station was used in this study, but collection of additional years of record at this location is needed to ensure that homogeneity exists in this annual-peak series.

Some regulation has occurred upstream from the gaging station on Deckers Creek at Morgantown (03062500) since about the 1991 water year. The extent to which regulation affects the peak discharges was investigated by plotting peak discharges at Deckers Creek at Morgantown against peak discharges at Cobun Creek at Morgantown (03062400) before and after the 1991 water year. The plot showed the same relationship before and after the 1991 water year, indicating that the effects to peak discharges are insignificant at Deckers Creek at Morgantown (there are no known regulation effects to peak discharges at Cobun Creek at Morgantown).

The randomness of the systematic annual-peak series (excluding historical peaks) was statistically tested to detect a trend using Kendall's test for correlation (Kendall, 1975; Hirsch and others, 1982). The computer program SWSTAT (Surface Water STATistics), version 3.2, dated April 3, 1998 (Lumb and others, 1990; written commun. from USGS colleagues A.M. Lumb, W.O. Thomas, Jr., and K.M. Flynn, titled "Users manual for SWSTAT, a computer program for interactive computation of surface-water statistics," June 15, 1995) was used to calculate Kendall's tau and the level of significance (the probability or "p-value"). For the Kendall's test for correlation, the hypothesis that there is no trend is tested. If the hypothesis fails to attain a particular level of significance, the hypothesis of no trend is rejected. For this study, the particular level of significance was selected as 0.05, so a trend is determined for an annual-peak series if the level of significance is less than 0.05. Kendall's tau and the level of significance were determined for the annual-peak series of 160 gaging stations in West Virginia (table 2). The peak series for 10 gaging stations (6.25 percent of the 160 stations) indicated a trend. By chance, 8 stations would be expected to indicate a trend (5 percent of the 160 stations), so there is little difference between the number of stations analyzed as having a trend and the number of stations expected to show a trend by chance. No significance could be determined for the trend indicated at the 10 gages, and all 10 gages were retained for consideration in the data correlation and regional regression analysis.

Virginia.--The magnitude and frequency of peak discharges (table 3) for Virginia gaging stations were determined by Bisese (1995). Peak-discharge statistics for Virginia stations (table 2) are limited because the published frequency discharges were not equivalent to those stored in the USGS "Streamflow/Basin Characteristics" data base; the data base contains statistical information for the magnitude and frequency analysis used to determine the frequency discharges. The authors of this report used the published discharges, but were unable to recreate the statistics without reanalyzing the peak-discharge data, which was beyond the scope of this study. Data for the following gaging stations were not used for determining the final regional equations applicable to Virginia, but were considered for regional analysis in this study: 02009500, 02011400, and 02011460. Data for 46 gaging stations in Virginia (pl. 1) were considered for the data correlation and regional regression analysis.

Kentucky.--The magnitude and frequency of peak discharges (table 3) for Kentucky gaging stations were determined by Choquette (1988). The following gaging stations used in the Kentucky study were initially selected for consideration in this study, but were eliminated from consideration because the stations had less than 10 years of systematic record: 03207965, 03209300, 03210160, 03212515, 03216505, and 03216564 (station 03216564 had 9 years of record that was lengthened to 60 years using synthetic data generated by application of a rainfall-runoff model). The

200-year and 500-year peak discharges were not published in Choquette (1988), but were obtained from the USGS “Streamflow/Basin Characteristics” data base. Revisions and additions to basin characteristics data were provided by K.J. Ruhl, U.S.Geological Survey, oral and written commun., 1997. Data for 10 gaging stations in Kentucky (pl. 1) were considered for the data correlation and regional regression analysis.

Maryland.--The magnitude and frequency of peak discharges (table 3) for Maryland gaging stations were determined by Dillow (1996). The following gaging stations were not used for the regional analysis in Maryland, but were considered for regional analysis in this study: 01595000, 01595500, 01596000, 01600000, 01603000, 01613000, 01618000, and 01638500. Station 01610105 was initially selected for consideration in this study, but was eliminated from consideration because the station had only 7 years of record available. The following gaging stations used in the Maryland study were selected for consideration in this study even though they are in carbonate areas: 01617800, 01619475, and 01619500. These three gaging stations in carbonate-rock areas were considered because they do not exhibit short time lags between rainfall and runoff (J.A. Dillow, U.S. Geological Survey, written commun., 1997), that is typical of streams in karst areas of West Virginia. The 200-year peak discharges were not published by Dillow (1996), but were obtained from the USGS “Streamflow/Basin Characteristics” data base. Revised magnitude and frequency data from that published by Dillow (1996) were determined for the following gaging stations (J.A. Dillow, written commun., 1997): 01596000, 01600000, 01603000, 01613000, 01618000, and 01638500. Data for 31 gaging stations in Maryland (pl. 1) were considered for the data correlation and regional regression analysis.

Pennsylvania.--The magnitude and frequency of peak discharges (table 3) for Pennsylvania gaging stations were determined by Flippo (1982). No frequency discharges were published, but were obtained from the USGS “Streamflow/Basin Characteristics” data base. Data for 4 gaging stations in Pennsylvania (pl. 1) were considered for the data correlation and regional regression analysis.

Ohio.--The magnitude and frequency of peak discharges (table 3) for Ohio gaging stations were determined by Koltun and Roberts (1990). The 200-year and 500-year peak discharges were not published, but were obtained from the USGS “Streamflow/Basin Characteristics” data base. Data for 22 gaging stations in Ohio (pl. 1) were considered for the data correlation and regional regression analysis.

Data Correlation

The 160 rural, unregulated, West Virginia streamflow-gaging stations having a minimum of 10 years of record through the 1997 water year were reduced to 154 for correlation and regional regression analysis. Correlation procedures were used to identify independent variables with unique differences. Available data for 113 gaging stations in surrounding states augmented West Virginia data for correlation and regional regression analysis.

Data from the following six gaging stations were not used for correlation and regional regression analysis: Elk River at Centralia (03195000) because the peak record for this station was used to lengthen the record for Elk River below Webster Springs (03194700); Twelvepole Creek at Wayne (03207000) because the peak record here was used to lengthen the record for Twelvepole Creek below Wayne (03207020); Tug Fork near Kermit (03214000) because the peak record here was used to lengthen the record for Tug Fork at Kermit (03214500); New River at Caperton (03185500) because the peak record here was used to lengthen the record for New River at Fayette (03186000); Cheat River near Morgantown (03071500) because the peak record for this station was used to lengthen the record for Cheat River near Pisgah (03071000); and Tuscarora Creek above Martinsburg (01617000) because the station is located in a karst area of the State.

The 11 basin characteristics describing the basin at and upstream from a gaging station (see Basin Characteristics Data section of this report) were $\log_{10}$ transformed. Transformed and untransformed data were evaluated for collinearity using a Pearson Coefficient correlation matrix. Additionally, a shape factor, defined as the drainage area divided by the squared basin length, was $\log_{10}$ transformed, and transformed and untransformed values were evaluated for collinearity. High correlations (absolute value of Pearson correlation coefficient greater than 0.80) were detected among $\log_{10}$ transformed drainage area, main-channel slope, and stream length. High correlations were also detected among $\log_{10}$ transformed main-channel slope, stream length, and local station slope. Additionally, high correlations were detected between the untransformed values of drainage area and main-channel slope, and main-channel slope and local station slope. No high correlations were determined between any $\log_{10}$ transformed and any untransformed value. In the regional regression analysis, should a pair of highly correlated values become part of a regression equation, consideration will be given to eliminate one of the values from the equation. (No pair of highly correlated values become part of a regression equation.)

Regional Regression Analysis

Multiple and simple least-squares regression models for the $\log_{10}$-transformed 100-year discharge with independent variables describing the basin characteristics (both $\log_{10}$ transformed and untransformed values) for each gaging station were evaluated, and residuals were plotted as areal distributions to determine regional boundaries. The final regional regression equations for the 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year peak discharges (table 4) were determined by executing a generalized least-squares regression model (Stedinger and Tasker, 1985; Tasker and Stedinger, 1989) (version 2.5) using the independent variables determined from application of the multiple least-squares regression model.

Regional regression procedures for the 100-year discharge were completed for the entire data set and three regions (fig. 7) were delineated. A multiple least-squares regression model for the $\log_{10}$-transformed 100-year discharge using basin characteristics (both $\log_{10}$ transformed and untransformed values) as the independent variables was evaluated. The most significant independent variable was determined as drainage area. A simple least-squares regression model was evaluated for the $\log_{10}$-transformed 100-year discharge with $\log_{10}$-transformed drainage area as the only independent variable. Residuals from the simple least-squares regression analysis were plotted by latitude and longitude of the gaging station. Additionally, plots of drainage area against the 100-year discharges for individual basins were developed. The residual plots indicated areas of West Virginia with similar magnitudes of residuals. The plots of individual basins were grouped for the areas with similar magnitudes of residuals. The plots of individual basins not included in these groups were overlaid with each group to determine similarities (magnitudes and slopes of the plots). The groups were expanded to include all basins by choosing the group most similar with each basin plot, and a regional boundary was constructed along the basin boundary between groups. The multiple and simple regression procedures were repeated for each group ($\log_{10}$-transformed drainage area was the most significant independent variable in all cases), and plots were analyzed, until no additional regional boundaries could be identified. On the basis of these analyses, three regions were delineated-- East, North, and South.

<u>East Region.</u>-Regional regression procedures for the $\log_{10}$-transformed 100-year discharge were completed for the East Region. The number of gaging stations included in the analysis of the East Region was reduced from 87 to 74 by the exclusion of 13 West Virginia, Virginia, and Maryland stations. Stations 01637000, 01637500, 01638480, 01638500, 01643700, 01644000, 01644100, and 01619475 were excluded because stations were located east of the eastern panhandle, and plots of drainage area against the 100-year discharge and high regression residuals indicated the stations in this geographic area were not representative of frequency discharges expected in West Virginia. Station 01617800 was not used because it is located in 100 percent carbonate rock (Dillow, 1996, p. 30), and high regression residuals indicated the station was not representative of frequency discharges expected in West Virginia (the equations developed for West Virginia are not applicable in karst areas if excessive runoff is diverted into, outside, or within the basin through solution channels). Stations 01610000, 01630000, 01618000, and 01636500 were excluded because these large drainage area stations (greater than 2,000 mi^2) leveraged the regression analysis, resulting in underestimating frequency discharges for smaller drainage areas. Log_{10}-transformed drainage area was determined as the most significant independent variable. An areal plot of residuals did not indicate additional subregions. A generalized least-squares regression model was executed with $\log_{10}$-transformed drainage area as the independent variable to determine frequency-discharge equations for the East Region (table 4).

<u>North Region.</u>-Regional regression procedures for the $\log_{10}$-transformed 100-year discharge were completed for the North Region. The number of gaging stations included in the analysis of the North Region was reduced from 70 to 62 by the exclusion of 8 Ohio stations.These stations, 03110980, 03111450, 03111455, 03111470, 03111490, 03111540, 03115710, and 03115600 were excluded because high regression residuals for stations located in the geographic area northwest of the Ohio River, away from the border with West Virginia, indicated they were not

Table 4. Estimating equations and regression statistics determined from the regional regression analysis

[Q(n) is the discharge in cubic feet per second for the (n)-year recurrence interval; A is the drainage area in square miles.]

Regression equation	Standard error of the model, in percent	Average standard error of sampling, in percent	Average perdiction error, in percent	Equivalent years of record	Number of streamflow stations	Range of drainage area, in square miles
East Region						
$Q(2)=62.6A^{0.842}$	37.7	8.3	38.8	2.3	74	0.22-1,486
$Q(5)=102A^{0.849}$	32.4	8.9	33.7	5.2		
$Q(10)=133A^{0.855}$	30.7	9.5	32.3	8.3		
$Q(25)=174A^{0.863}$	30.3	10.6	32.3	12.6		
$Q(50)=206A^{0.869}$	31.0	11.3	33.2	33.2		
$Q(100)=240A^{0.875}$	32.2	12.0	34.6	17.4		
$Q(200)=276A^{0.881}$	34.0	12.9	36.6	18.8		
$Q(500)=326A^{0.889}$	36.8	14.1	39.8	20.0		
North Region						
$Q(2)=138A^{0.724}$	27.0	6.9	28.0	3.3	62	0.13-1,516
$Q(5)=249A^{0.678}$	26.6	7.3	27.7	4.7		
$Q(10)=341A^{0.653}$	26.7	8.0	28.0	6.3		
$Q(25)=478A^{0.626}$	27.6	8.6	29.0	8.3		
$Q(50)=594A^{0.609}$	28.5	8.9	29.9	9.5		
$Q(100)=722A^{0.594}$	29.7	9.5	31.3	10.5		
$Q(200)=862A^{0.580}$	31.1	10.3	32.9	11.2		
$Q(500)=1069A^{0.563}$	33.2	11.1	35.2	11.8		
South Region						
$Q(2)=95.4A^{0.785}$	38.4	7.3	39.2	1.6	100	0.10-8,371
$Q(5)=153A^{0.772}$	35.8	7.3	36.6	2.7		
$Q(10)=197A^{0.766}$	35.3	8.0	36.3	3.8		
$Q(25)=257A^{0.759}$	35.9	8.6	37.0	5.3		
$Q(50)=305A^{0.755}$	37.0	8.9	38.2	6.2		
$Q(100)=355A^{0.751}$	38.5	9.5	39.9	6.9		
$Q(200)=408A^{0.748}$	40.3	10.0	41.7	7.4		
$Q(500)=481A^{0.744}$	43.1	10.8	44.7	7.9		

Figure 7. Regional boundaries for the estimating equations.

representative of frequency discharges expected in West Virginia. Log_{10}-transformed drainage area was determined as the most significant independent variable. An areal plot of residuals did not indicate additional subregions. A generalized least-squares regression model was executed with $\log_{10}$-transformed drainage area as the independent variable to determine frequency-discharge equations for the North Region (table 4).

South Region.-Regional regression procedures for the $\log_{10}$-transformed 100-year discharge were completed for the South Region. The number of gaging stations included in the analysis of the South Region was reduced from 110 to 100 by the exclusion of 10 Virginia stations. Stations 03207400, 03207500, 03207800, 03208500, 03208950, and 03209000 were not used because high regression residuals for these headwater streams of the Levisa Fork, which tend to be more rocky than the sandy streams common in the South Region, indicated that stations in this geographic area were not representative of frequency discharges expected in West Virginia. Stations 02009500, 02011400, and 02011460 were excluded because a high regression residual resulted for station 02009500, and Bisese (1995, p. 45) had omitted all three of these stations from the regional regression analysis for Virginia. Station 02012950 was excluded because it is located in carbonate rock (D.C. Hayes, U.S. Geological Survey, oral commun., 1999) (the equations developed for West Virginia are not applicable in karst areas if excessive runoff is diverted into, outside, or within the basin through solution channels), and a high regression residual indicated the station was not representative of frequency discharges expected in West Virginia. Log_{10}-transformed drainage area was determined as the most significant independent variable. An areal plot of residuals did not indicate additional subregions. A generalized least-squares regression model was executed with $\log_{10}$-transformed drainage area as the independent variable to determine frequency discharges for the South Region (table 4).

Estimating Procedure

How frequency-discharge estimates are obtained depends on whether the stream location of interest is at a streamflow-gaging station, on an ungaged stream, or on the same stream as a nearby gaging station. The estimating procedure is not applicable on urbanized and regulated streams, and caution should be used if the stream is heavily affected by mining or located in a karst area.

If the location is at a gaging station, table 3 is used to read the frequency discharges directly (the appropriate equation and weighting factors have been applied). No weighted value is presented in table 3 for one of the two stations on the same stream that were combined into a single time-series record. For this case, the station location without a weighted value presented should be analyzed as "on the same stream as a nearby gaging station." No weighted value is presented in table 3 for Tuscarora Creek above Martinsburg (01617000). Because the station is located in a karst area of the State, the frequency of the systematic record (S) should be used directly. If the location is on an ungaged stream, the desired regional regression equation is evaluated for the appropriate region. If the location is on the same stream as a nearby gaging station, discharges are determined at the ungaged location from the desired regional regression equation and then adjusted by a factor that related differences between the ungaged and gaged locations.

<u>At a streamflow-gaging station.</u>--A frequency discharge at a gaging station is determined by reading the weighted (W) value directly from table 3. For example, the weighted 100-year discharge at the gaging station Greenbrier River at Alderson (03183500) is given as 82,100 ft^3/s. This discharge was calculated by weighting (1) the discharge determined from the systematic and historical record (S), using the guidelines established by the Interagency Advisory Committee on Water Data, Water Resources Council (table 3), and (2) the discharge determined by the appropriate regional (R) regression equation (table 3). The weighting technique considered (1) the number of years of peak-discharge record (summation of the number of years of systematic record, the number of historical peaks, and the number of high-outlier peaks from table 2 located at the end of this report), and (2) the number of equivalent years of record (an estimate given in table 4 of the number of systematic years of record collected at a gaging location necessary to calculate frequency discharges with an accuracy equal to that of the regional regression equation). The following equation was used:

$$Q_w = (Q_s N + Q_r E) / (N + E),$$

where

Q_w is the weighted discharge in cubic feet per second;
Q_s is the frequency discharge in cubic feet per second determined from the systematic and historical record using the guidelines established by the Water Resources Council;
Q_r is the frequency discharge in cubic feet per second determined by the regional regression equation;
N is the number of years of peak-discharge record; and
E is the equivalent years of record.

<u>On an ungaged stream.</u>--A frequency discharge on an ungaged stream is determined by applying the desired regional regression equation for the appropriate region (table 4). For example, the 10-year discharge of Fishing Creek just downstream from the confluence of North and South Forks of Fishing Creek in Wetzel County (Pine Grove $7^1/_2$-minute U.S. Geological Survey topographic map) can be calculated as follows:

1. The stream is located in the North Region as determined from figure 7;
2. The 10-year regression equation for the North Region is selected from table 4 as:

$$Q(10)=341A^{0.653},$$

where

Q(10) is the 10-year frequency discharge in cubic feet per second, and

A is the drainage area in square miles.

3. The drainage area is determined by measuring the area on a topographic map or by reading from the U.S. Geological Survey drainage-area report (Wiley, 1997, page 30) as 113.92 mi^2; and

4. The 10-year regression equation for the North Region is evaluated as 7,510 ft^3/s.

<u>On the same stream and near a gaging station.</u>--A frequency discharge on the same stream and near a gaging station (where near is between 50 and 150 percent of the drainage area at the gaged location) is determined by adjusting the frequency discharge determined from the regional equation by a factor relating (1) drainage areas, and (2) weighted and regional regression discharges (Hannum, 1976; Glatfelter, 1984). For example, the 50-year discharge of Coal River just downstream from the confluence of the Little Coal and Big Coal Rivers in Kanawha County (Alum Creek $7^1/_2$-minute U.S. Geological Survey topographic map) can be calculated as follows:

1. The drainage area is determined by measuring the area on a topographic map or by reading from the U.S. Geological Survey drainage-area report (Mathes and others, 1982, page 196) as 830.02 mi^2, which is 96 percent (between 50 and 150 percent) of the drainage area given in table 1 (862 mi^2) for the gaging station Coal River at Tornado (03200500);

2. The weighted 50-year discharge for Coal River at Tornado (03200500) is read directly from table 3 as 43,700 ft^3/s (see discussion above for calculations at a gaging station), and the regional 50-year discharge is read directly from table 3 as 50,000 ft^3/s;

3. The 50-year discharge for the Coal River just downstream from the confluence of the Little Coal and Big Coal Rivers is determined from the equation given in table 4 as 48,800 ft^3/s (South Region, drainage area of 830.02 mi^2: see discussion above for an ungaged stream);

4. The correction factor for the gaged location is determined as 0.874 from the following equation:

$$C_g = Q_w / Q_r ,$$

where

C_g is the correction factor for the gaging station location;

Q_w is the weighted frequency discharge in cubic feet per second read from table 3; and

Q_r is the regional regression discharge in cubic feet per second read from table 3;

5. The correction factor for the ungaged location is determined as 0.883 from the following equation:

$$C_u = C_g - [(2 |A_g - A_u|) / A_g] (C_g - 1),$$

where

C_u is the correction factor for the ungaged location;

C_g is the correction factor for the gaging station location (see previous equation);

A_g is the drainage area in square miles at the gaging station location read from table 1;

A_u is the drainage area in square miles at the ungaged location; and

$|A_g - A_u|$ is the absolute value of the difference between the drainage area in square miles (mi^2) at the gaging station location and the drainage area in square miles (mi^2) at the ungaged location; and

6. The adjusted 50-year discharge for the Coal River just downstream from the confluence of the Little Coal and Big Coal Rivers is determined as 43,100 ft^3/s from the following equation:

$$Q_a = C_u Q_u ,$$

where

Q_a is the adjusted frequency discharge in cubic feet per second;

C_u is the correction factor for the ungaged location (see previous equation); and

Q_u is the regional regression discharge at the ungaged location in cubic feet per second.

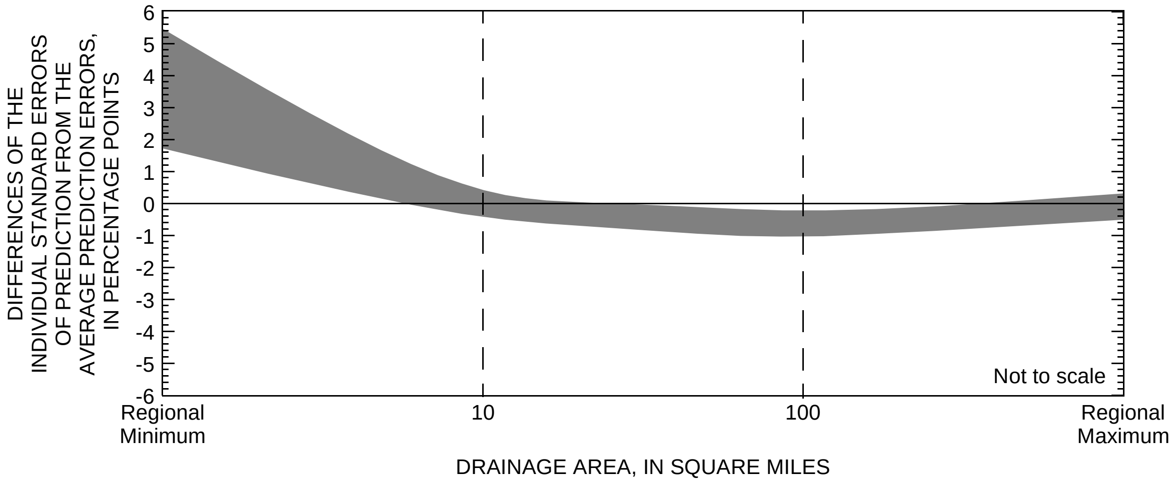

Figure 8. Range of differences for the indicated drainage areas (shaded) of the individual standard errors of prediction from the average prediction errors; graph represents all regional regression equations.

Accuracy of Flood-Estimating Equations

Accuracy of estimating equations are quantified by measuring the average prediction error and equivalent years of record (Hardison, 1969, 1971). The average prediction error ranged from 27.7 to 44.7 percent, and the equivalent years of record ranged from 1.6 to 20.0. These accuracy measurements are included with the regression statistics summarized in table 4.

Average prediction error.-- Average prediction error is the square root of the sum of the squared standard error of the model (the portion of the total error due to an imperfect model) and average squared standard error of sampling (the portion of the total error due to estimating model parameters from a sample) in log units. The calculations involved in estimating the average prediction error are explained in Tasker and Stedinger (1989) and in Appendix 1 of this report. The average prediction error is within 3.0 percentage points of the standard error of the model for all regression equations presented in table 4, indicating that addition of the average standard error of sampling to the standard error of the model accounts for very little additional unexplained variance of the frequency discharge estimate.

The average prediction error is the square root of the average of individual squared standard errors of prediction. Individual standard errors of prediction for the regression equations can be determined as described in Appendix 1(Koltun and Roberts, 1990, Appendix A; and Hodge and Tasker, 1995, p. 37-42). This method was applied to each regression equation shown in table 4 to investigate the variation of the individual standard errors of prediction and compare the individual standard errors of prediction to the average prediction error. For the regression equations developed in this study, it is not worthwhile to compute individual standard errors of prediction, because the difference between the individual standard errors of prediction and average prediction error is insignificant.

The variation of the individual standard errors of prediction over the range of drainage areas for the regression equations was compared to the average prediction error (fig. 8). The individual standard errors of prediction increase for drainage areas less than and greater than about 100 mi^2 (where the individual standard errors are less than 1.1 percentage points less than average prediction error) for all regression equations. The maximum individual standard errors of prediction for the maximum drainage areas are within 0.5 percentage points of the average standard error of prediction for all regression equations. The maximum individual standard errors of prediction for the minimum drainage areas are less than 5.4 percentage points greater than the average prediction error for all regression equations. The individual standard errors of prediction are about equal (within 0.4 percentage points) to the average prediction error at 10 mi^2 for all regression equations. In summary, the individual standard errors of prediction are within 1.1 percentage points of the average prediction error for drainage areas greater than 10 mi^2, and the individual standard errors of prediction increase to a maximum of 5.4 percentage points greater than the average standard error of prediction at the minimum drainage areas.

Equivalent years of record.-- Equivalent years of record (table 4) is an estimate of the number of systematic years of record that must be collected at a gaging location to calculate frequency discharges with an accuracy equal to that of the regional equation. Equivalent years of record is a weighting factor that is applied when determining frequency discharges at gaging stations (see Estimating Procedure section of this report).

Limitations of Flood-Estimating Equations

Equations developed in this study are only applicable to rural, unregulated, streams located within the boundaries of West Virginia. The equations should not be applied to urban areas having paved surfaces, concrete channels, or culverts. The equations should not be applied to streams regulated by dams, or large lakes and ponds. Equations are not applicable to heavily mined areas if excessive runoff is diverted into or outside the basin, retained along strip benches, or retained underground. Equations are not applicable to karst areas if excessive runoff is diverted into, outside, or within the basin through solution channels or other cavities in carbonate (limestone and dolomite) rocks. Jones (1997) describes the locations of karst areas in eastern counties of West Virginia including Monongalia, Preston, Barbour, Tucker, Grant, Mineral, Hardy, Hampshire, Morgan, Berkeley, Jefferson, Randolph, Pendleton, Pocahontas, Greenbrier, Summers, Monroe, and Mercer (counties are presented in fig. 7).

These equations should not be applied to streams where variables fall outside the range of values used to develop the equations (table 4). The Potomac River, downstream from the confluence of the North Branch and South Branch, and the Shenandoah River, have drainage areas outside the range of values used to develop the East Region equations. These equations should not be applied to these stream locations, but gaging-station frequency discharges (table 3) may assist in making frequency discharge estimates on these rivers.

Summary

The magnitude and frequency of peak discharge were determined for 160 rural, unregulated, West Virginia streamflow-gaging stations having a minimum of 10 years of record through the 1997 water year. All systematic annual-peak series data for West Virginia were plotted and visually inspected to detect trends, outliers, and nonhomogeneity. The randomness of the systematic annual-peak series was statistically tested to detect monotonic trends, using Kendall's tau.

The 160 rural, unregulated, West Virginia gaging stations were reduced to 154 for correlation and regional regression analysis; five gaging stations were excluded from the analysis because peak data were used to lengthen records for other nearby gaging stations, and one gaging station was excluded because it was located in a karst area.

Eleven basin characteristics, a shape factor, and flood frequencies from 154 West Virginia gaging stations were considered for regression analysis. West Virginia data were augmented with available basin characteristics and flood frequency data from the following surrounding states: 46 stations in Virginia, 10 stations in Kentucky, 31 stations in Maryland, 4 stations in Pennsylvania, and 22 stations in Ohio.

Multiple and simple least-squares regression models for the $\log_{10}$-transformed 100-year discharge with independent variables describing the basin characteristics ($\log_{10}$-transformed and untransformed values) for 267 gaging stations were evaluated. Residuals were plotted as areal distributions to delineate boundaries of three regions in West Virginia-- East, North, and South. Regression procedures identified 31 gaging stations not representative of discharges expected in West Virginia. Regional equations for the 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year peak discharges were determined by executing a generalized least-squares regression model using data from 236 gaging stations. Log_{10}-transformed drainage area was the most significant independent variable for all Regions.

Examples of application of the regional regression equations were presented for three situations: at a gaging station; on an ungaged stream; and, on the same stream and near a gaging station.

Accuracy of estimating equations were quantified by measuring the average standard error of pre-

diction and equivalent years of record. The average standard error of prediction ranged from 27.7 to 44.7 percent, and the equivalent years of record ranged from 1.6 to 20.0 years. Equations developed in this study are only applicable to rural, unregulated, streams located within the boundaries of West Virginia. Caution should be used if equations are applied to heavily mined or karst areas.

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Table 1. Basin characteristics data used in the regression analysis to develop flood-estimating equations

[--, information not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania]

				Basin Characteristics										
Station number	**State**	**Latitude, in decimal degrees**	**Longitude, in decimal degrees**	**Drainage area, in square miles**	**Main channel slope, in feet per mile**	**Stream length, in miles**	**Mean basin elevation, in feet above sea level**	**Forested area, in percent**	**Mean annual precipitation intensity, in inches**	**Two-year 24-hour precipitation intensity, in inches**	**Mean annual snowfall, in inches**	**Mean minimum January temperature, in degrees Fahrenheit**	**Local station slope, in feet per mile**	**Stream-flow variability index**
01595000	MD	39.260	79.390	73.1	30.5	17.5	2,450	78	48	2.75	77	18.5	- -	- -
01595300	WV	39.367	79.179	42.6	70.6	16.8	2,670	75	41	2.9	60	20	84.5	0.560
01599500	WV	39.410	79.001	46.5	62.4	14.5	1,830	75	37	2.9	50	21	29.3	.574
01595500	MD	39.390	79.180	225	48.7	26.9	2,820	73	46	2.75	70	20	- -	- -
01596000	MD	39.480	79.070	287	47.6	43.1	2,670	77	45.5	2.75	60	22	- -	- -
01596500	MD	39.570	79.100	49.1	65.1	19.1	2,510	81	44	2.75	57	20.5	- -	- -
01597000	MD	39.500	79.160	16.7	137	9.3	2,510	79	46	2.75	60	21	- -	- -
01598000	MD	39.480	79.070	115	69.8	24.8	2,407	83	44.5	2.75	56.7	21	- -	- -
01599000	MD	39.490	79.040	72.4	62.7	17.0	2,166	92	41.5	2.75	49.8	24	- -	- -
01600000	MD	39.570	78.840	596	36.3	65.6	2,265	74	43	2.75	55	22	- -	- -
01601500	MD	39.670	78.790	247	55.0	34.7	1,875	70	36	2.75	44.4	23	- -	- -
01603000	MD	39.620	78.770	877	39.1	82.1	2,155	73	42	2.75	52.5	21	- -	- -
01604500	WV	39.443	78.822	211	17.0	34.5	1,280	74	36	2.9	35	22	6.72	.565
01605500	WV	38.636	79.338	179	46.9	25.7	2,940	80	40	2.9	40	22	26.7	.379
01605700	WV	38.696	79.388	.45	1,070	1.0	3,700	90	36	2.9	35	22	502	.550
01606000	WV	38.985	79.236	335	39.1	47.7	3,120	80	44	2.9	50	22	29.3	.536

Table 1. Basin characteristics data used in the regression analysis to develop flood-estimating equations —Continued

[--, information not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania]

				Basin Characteristics										
Station number	State	Latitude, in decimal degrees	Longitude, in decimal degrees	Drainage area, in square miles	Main channel slope, in feet per mile	Stream length, in miles	Mean basin elevation, in feet above sea level	Forested area, in percent	Mean annual precipitation intensity, in inches	Two-year 24-hour precipitation intensity, in inches	Mean annual snowfall, in inches	Mean minimum January temperature, in degrees Fahrenheit	Local station slope, in feet per mile	Stream-flow variability index
01606500	WV	38.991	79.176	676	27.2	62.8	2,910	80	40	2.9	50	22	16.2	0.433
01606800	WV	38.806	79.214	1.43	280	2.5	2,040	75	32	2.9	40	22	132	.450
01607500	WV	38.631	79.244	103	30.1	23.5	2,470	80	38	2.9	32	22	16.1	.522
01608000	WV	39.012	78.956	277	20.5	61.2	2,180	80	33	2.9	32	22	14.7	.477
01608100	WV	39.089	78.899	.24	780	.6	1,770	99	32	2.9	30	22	235	.450
01608500	WV	39.447	78.654	1,486	14.4	122.0	2,250	75	35	2.9	35	23	4.83	.453
01609000	MD	39.550	78.560	148	13.5	40.3	1,310	79	36	2.85	- -	23.5	- -	- -
01609500	MD	39.550	78.560	5.08	61.2	5.4	818	90	36.5	2.85	29	23	- -	- -
01609800	WV	39.499	78.489	108	35.4	27.0	1,220	70	34	2.9	30	23	14.1	.797
01610000	MD	39.540	78.460	3,129	10.5	158	1,920	76	38	2.6	40	23	- -	- -
01610150	MD	39.700	78.320	10.4	46.3	8.8	1,060	62.4	37	2.9	30	23	- -	- -
01610155	MD	39.650	78.340	102	17.5	34.3	1,120	73.4	38	2.85	- -	24	- -	- -
01610500	WV	39.182	78.507	306	18.8	49.7	2,040	75	35	2.9	24	23	6.68	.436
01611500	WV	39.582	78.310	675	10.4	105.1	1,700	75	36	2.9	26	24	6.43	.463
01612500	MD	39.710	78.230	16.9	93.6	5.8	851	74	37.5	2.9	23	21	- -	- -
01613000	MD	39.700	78.180	4,090	7.93	196	1,803	77	35.5	2.85	36.9	22	- -	- -
01613150	MD	39.692	78.132	4.80	47.5	6.5	720	27.8	37.5	2.9	35	24	- -	- -

Table 1. Basin characteristics data used in the regression analysis to develop flood-estimating equations —Continued

[--, information not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania]

				Basin Characteristics										
Station number	**State**	**Latitude, in decimal degrees**	**Longitude, in decimal degrees**	**Drainage area, in square miles**	**Main channel slope, in feet per mile**	**Stream length, in miles**	**Mean basin elevation, in feet above sea level**	**Forested area, in percent**	**Mean annual precipitation intensity, in inches**	**Two-year 24-hour precipitation intensity, in inches**	**Mean annual snowfall, in inches**	**Mean minimum January temperature, in degrees Fahrenheit**	**Local station slope, in feet per mile**	**Stream-flow variability index**
01613160	MD	39.691	78.127	1.20	132	2.8	683	40	37.5	2.9	26	24	--	--
01613900	VA	39.210	78.290	15.0	167	7.9	1,200	70	37.0	2.80	23.4	24.2	--	--
01614000	WV	39.512	78.038	235	9.20	41.9	890	70	39	3.0	26	24	3.88	0.570
01615000	VA	39.180	78.070	57.4	17.4	20.2	760	38	38.4	3.04	22.5	24.8	--	--
01616000	VA	39.180	78.090	16.5	37.8	9.9	800	42	38.3	2.93	22.9	25.1	--	--
01616500	WV	39.424	77.939	273	5.90	50.9	630	30	40	3.0	24	24	3.39	.320
01617000	WV	39.469	77.972	11.3	34.5	7.8	740	30	38	3.0	26	24	17.8	.380
01617800	MD	39.510	77.780	18.9	23.8	9.6	509	11.7	39.5	3.1	--	26	--	--
01618000	MD	39.430	77.800	5,936	5.98	248.5	1,524	68	37	2.59	36.1	23	--	--
01619475	MD	39.470	77.660	.10	401	.54	512	26	39.5	3.15	25	26	--	--
01619500	MD	39.450	77.730	281	10.8	51.8	781	29.8	40	3.1	30.6	26	--	--
01620500	VA	38.340	79.240	17.2	148	9.6	3,330	98	42.1	3.65	24.7	22.0	--	--
01621000	VA	38.500	79.050	72.6	107	15.0	2,870	100	39.1	2.80	24.5	21.5	--	--
01621200	VA	38.470	78.990	9.45	88.2	4.6	1,830	74	35.5	2.80	25.2	22.2	--	--
01621400	VA	38.430	78.880	5.52	37.9	4.4	1,350	2	38.5	3.00	28.0	22.8	--	--
01621450	VA	38.390	78.920	.72	176	1.4	1,290	8	37.4	2.83	27.1	23.4	--	--

Table 1. Basin characteristics data used in the regression analysis to develop flood-estimating equations —Continued

[--, information not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania]

				Basin Characteristics										
Station number	State	Latitude, in decimal degrees	Longitude, in decimal degrees	Drainage area, in square miles	Main channel slope, in feet per mile	Stream length, in miles	Mean basin elevation, in feet above sea level	Forested area, in percent	Mean annual precipitation intensity, in inches	Two-year 24-hour precipitation intensity, in inches	Mean annual snowfall, in inches	Mean minimum January temperature, in degrees Fahrenheit	Local station slope, in feet per mile	Stream-flow variability index
01622000	VA	38.340	78.910	379	43.2	38.9	2,040	52	39.0	3.09	25.4	22.2	- -	- -
01622100	VA	38.330	78.940	1.55	100	2.9	1,250	25	39.0	3.24	27.0	24.0	- -	- -
01622300	VA	38.160	79.270	.55	973	1.5	2,000	95	39.5	2.95	24.3	24.7	- -	- -
01622400	VA	38.200	79.220	.49	950	1.0	1,800	63	37.8	2.88	24.6	25.0	- -	- -
01632000	VA	38.640	78.850	210	44.3	25.8	2,020	89	35.8	3.09	24.0	21.0	- -	- -
01632300	VA	38.580	78.760	8.15	48.8	5.4	1,260	15	37.4	2.90	24.5	24.2	- -	- -
01632900	VA	38.690	78.640	93.2	20.5	25.1	1,400	50	38.0	3.58	23.8	24.2	- -	- -
01632950	VA	38.800	78.720	.31	500	1.0	1,450	98	35.2	2.87	23.3	23.8	- -	- -
01632970	VA	38.760	78.690	6.49	61.8	4.5	1,200	45	35.2	2.78	23.3	23.8	- -	- -
01633000	VA	38.750	78.640	506	24.3	45.9	1,670	53	37.0	3.14	24.6	22.4	- -	- -
01633500	VA	38.870	78.630	79.4	28.6	20.4	2,030	86	34.0	2.80	23.2	23.4	- -	- -
01633650	VA	38.930	78.550	3.66	292.1	2.5	1,510	60	35.2	2.52	22.5	23.9	- -	- -
01634000	VA	38.980	78.340	768	9.86	103	1,430	50	36.5	3.03	23.9	23.0	- -	- -
01634500	VA	39.080	78.330	103	33	23.4	1,350	86	34.6	2.87	22.6	23.8	- -	- -
01636500	WV	39.282	77.789	3,022	6.70	183.8	1,540	50	42	3.0	24	25	5.70	0.334
01637000	MD	39.480	77.540	8.83	210	5.1	1,010	48	42	3.2	34	24	- -	- -
01637500	MD	39.430	77.560	66.9	47.5	23.9	1,110	37	42.5	3.15	35	23.5	- -	- -

Table 1. Basin characteristics data used in the regression analysis to develop flood-estimating equations —Continued

[--, information not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennyslvania]

Station number	State	Latitude, in decimal degrees	Longitude, in decimal degrees	Basin Characteristics: Drainage area, in square miles	Main channel slope, in feet per mile	Stream length, in miles	Mean basin elevation, in feet above sea level	Forested area, in percent	Mean annual precipitation intensity, in inches	Two-year 24-hour precipitation intensity, in inches	Mean annual snowfall, in inches	Mean minimum January temperature, in degrees Fahrenheit	Local station slope, in feet per mile	Stream-flow variability index
01638480	VA	39.250	77.580	89.6	14.1	27.5	600	30	41.3	3.19	20.2	23.5	- -	- -
01638500	MD	39.270	77.540	9,651	5.56	270.9	1,356	59	39.5	3.05	30.6	23	- -	- -
01643700	VA	38.990	77.800	123	16.8	22.9	700	40	39.8	3.18	20.3	24.3	- -	- -
01644000	VA	39.020	77.580	332	8.25	40.6	660	35	40.0	3.18	20.4	23.8	- -	- -
01644100	VA	39.070	77.610	2.05	71.7	3.1	560	17	39.9	3.00	20.5	24.4	- -	- -
02009500	VA	38.270	79.670	.74	800	2.0	2,380	70	40.8	2.80	24.2	20.7	- -	- -
02011400	VA	38.042	79.882	158	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
02011460	VA	38.245	79.769	60.1	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
02011480	VA	38.135	79.866	85.8	27.0	5.3	- -	- -	- -	- -	- -	- -	- -	- -
02011500	VA	38.070	79.900	134	44.4	33.4	2,890	90	40.9	2.86	24.0	20.8	- -	- -
02012500	VA	37.880	79.980	411	25.3	57.6	2,480	80	40.8	2.74	23.4	21.2	- -	- -
02012950	VA	37.660	80.240	.66	592	1.7	2,330	68	37.8	2.55	19.6	24.0	- -	- -
02013000	VA	37.800	80.050	164	40.5	27.3	2,230	87	38.5	2.56	20.8	23.4	- -	- -
02014000	VA	37.730	80.040	153	27.3	39.8	2,320	85	38.6	2.62	19.6	24.4	- -	- -
03050000	WV	38.809	79.882	185	24.5	37.6	3,110	80	56	2.8	90	21	9.44	0.582
03050500	WV	38.924	79.879	271	13.8	55.0	2,940	80	50	2.8	90	21	1.65	.577

Table 1. Basin characteristics data used in the regression analysis to develop flood-estimating equations —Continued

[--, information not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania]

				Basin Characteristics										
Station number	**State**	**Latitude, in decimal degrees**	**Longitude, in decimal degrees**	**Drainage area, in square miles**	**Main channel slope, in feet per mile**	**Stream length, in miles**	**Mean basin elevation, in feet above sea level**	**Forested area, in percent**	**Mean annual precipitation intensity, in inches**	**Two-year 24-hour precipitation intensity, in inches**	**Mean annual snowfall, in inches**	**Mean minimum January temperature, in degrees Fahrenheit**	**Local station slope, in feet per mile**	**Stream-flow variability index**
03050650	WV	38.976	79.838	0.38	110	1.3	2,025	80	48	2.8	80	23	101	0.650
03051000	WV	39.029	79.936	406	11.2	71.8	2,690	80	48	2.8	90	22	4.46	.596
03051500	WV	38.939	80.090	122	43.0	26.6	2,600	80	54	2.8	100	24	4.29	.567
03052000	WV	39.039	80.068	148	25.7	37.9	2,480	80	53	2.8	100	24	47.4	.607
03052340	WV	39.005	80.256	2.33	38.6	2.9	1,550	60	48	2.7	80	25	6.99	.550
03052500	WV	38.964	80.153	14.3	54.0	12.6	1,870	60	48	2.7	90	25	46.5	.642
03053500	WV	39.051	80.115	277	22.5	54.0	2,110	60	52	2.7	90	25	13.0	.558
03054500	WV	39.150	80.039	914	11.2	88.4	2,410	75	50	2.7	90	24	8.29	.559
03055020	WV	39.125	79.997	.60	265	.8	1,790	20	47	2.7	70	25	40.6	.750
03055040	WV	39.153	79.979	3.15	42.3	3.5	1,780	35	47	2.7	70	25	50.3	.750
03056250	WV	39.336	79.994	96.8	28.3	23.0	1,680	60	46	2.7	60	25	9.96	.631
03056500	WV	39.350	80.042	1,304	12.0	114.8	2,220	75	49	2.7	70	24	2.52	.564
03056600	WV	39.379	79.963	2.33	107	2.0	1,470	30	46	2.6	40	25	96.0	.650
03057300	WV	38.869	80.458	28.8	51.0	11.9	1,380	50	48	2.7	80	25	3.94	.943
03057500	WV	38.975	80.444	25.7	19.7	9.5	1,350	50	48	2.7	60	25	5.56	.927
03058000	WV	39.003	80.474	101	13.2	30.4	1,340	55	47	2.7	70	26	2.69	.718
03058500	WV	39.091	80.468	181	5.40	39.4	1,340	55	48	2.7	70	25	2.48	.694

Table 1. Basin characteristics data used in the regression analysis to develop flood-estimating equations —Continued

[--, information not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania]

Station number	State	Latitude, in decimal degrees	Longitude, in decimal degrees	Basin Characteristics										
				Drainage area, in square miles	Main channel slope, in feet per mile	Stream length, in miles	Mean basin elevation, in feet above sea level	Forested area, in percent	Mean annual precipitation intensity, in inches	Two-year 24-hour precipitation intensity, in inches	Mean annual snowfall, in inches	Mean minimum January temperature, in degrees Fahrenheit	Local station slope, in feet per mile	Stream-flow variability index
03059000	WV	39.271	80.356	384	3.60	71.4	1,250	30	48	2.7	55	25	2.31	0.758
03059500	WV	39.228	80.297	84.6	8.90	16.4	1,350	30	48	2.7	55	24	6.03	.618
03060500	WV	39.286	80.543	8.32	42.3	3.5	1,220	40	48	2.7	40	24	10.6	.988
03061000	WV	39.422	80.276	759	2.50	89.3	1,260	50	46	2.7	50	25	2.18	.577
03061500	WV	39.504	80.172	116	7.40	23.5	1,300	65	46	2.7	30	24	6.62	.660
03062400	WV	39.608	79.955	11.0	132	8.4	1,420	75	44	2.7	40	26	26.0	.732
03062500	WV	39.629	79.953	63.2	46.0	23.4	1,770	65	44	2.7	50	26	28.6	.605
03063950	WV	38.882	79.596	1.08	265	1.3	3,100	60	57	2.8	70	22	192	.370
03065000	WV	39.072	79.623	349	41.8	37.6	3,310	80	52	2.8	80	22	11.8	.500
03066000	WV	39.127	79.469	85.9	8.10	21.4	3,250	50	52	2.8	70	21	11.6	.430
03068610	WV	38.907	79.697	5.06	451	3.1	3,250	90	52	2.8	80	22	126	.430
03069000	WV	39.096	79.677	213	29.5	84.7	3,300	90	46	2.8	80	22	8.59	.440
03069500	WV	39.123	79.681	722	29.3	87.7	3,250	85	49	2.8	70	22	21.3	.469
03069850	WV	39.259	79.722	.95	305	1.1	2,105	60	50	2.9	80	23	282	.650
03069880	WV	39.289	79.704	12.2	105	8.1	2,290	60	52	2.7	70	24	48.2	.560
03070000	WV	39.346	79.666	974	24.0	118.4	2,950	80	51	2.8	70	23	10.3	.481

Table 1. Basin characteristics data used in the regression analysis to develop flood-estimating equations —Continued

[--, information not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania]

				Basin Characteristics										
Station number	State	Latitude, in decimal degrees	Longitude, in decimal degrees	Drainage area, in square miles	Main channel slope, in feet per mile	Stream length, in miles	Mean basin elevation, in feet above sea level	Forested area, in percent	Mean annual precipitation intensity, in inches	Two-year 24-hour precipitation intensity, in inches	Mean annual snowfall, in inches	Mean minimum January temperature, in degrees Fahrenheit	Local station slope, in feet per mile	Stream-flow variability index
03070500	WV	39.616	79.705	200	10.4	24.4	2,070	10	49	2.7	55	22	49.8	0.593
03071000	WV	39.607	79.778	1,354	21.5	145.0	2,700	80	50	2.8	70	22	12.8	.502
03071500	WV	39.667	79.862	1,380	21.4	151.7	2690	80	50	2.8	70	22	12.8	.490
03072000	PA	39.760	79.970	229	3.94	42.94	1100	44	41.6	2.3	45	24	- -	- -
03072590	PA	39.800	79.800	16.3	135	6.61	1340	45	41.9	2.45	- -	26	- -	- -
03075450	MD	39.410	79.350	.57	99.4	1.1	2,520	79	47.5	2.75	- -	20	- -	- -
03075500	MD	39.420	79.430	134	6.09	20.0	2,610	64	50	2.7	74	18	- -	- -
03075600	MD	39.490	79.420	.53	204	1.1	2,470	63	49.5	2.7	- -	20	- -	- -
03076505	MD	39.660	79.430	.22	415	.76	1,930	45	48	2.65	- -	20	- -	- -
03076600	MD	39.640	79.320	48.9	65.6	15.9	2,460	44	48	2.7	- -	20	- -	- -
03108000	PA	40.630	80.340	178	8.36	42.61	1100	38	38.0	2.3	47	22	- -	- -
03109000	OH	40.780	80.760	6.19	55.6	5.23	1,188	15	39	2.5	34	20	- -	- -
03109500	OH	40.680	80.540	496	8.29	52.0	1,112	15	37.5	2.5	32	22	- -	- -
03110000	OH	40.540	80.730	147	9.81	28.9	1,089	44	40	2.5	36	22	- -	- -
03110980	OH	40.332	80.812	.04	500	.27	1,250	11	39	2.5	- -	22	- -	- -
03111150	PA	40.200	80.410	10.3	34.4	6.36	1190	12	39.2	2.4	- -	22	- -	- -
03111450	OH	40.207	80.923	1.31	95.2	2.24	1,110	8.2	39.5	2.5	- -	21	- -	- -

Table 1. Basin characteristics data used in the regression analysis to develop flood-estimating equations —Continued

[--, information not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennyslvania]

				Basin Characteristics										
Station number	**State**	**Latitude, in decimal degrees**	**Longitude, in decimal degrees**	**Drainage area, in square miles**	**Main channel slope, in feet per mile**	**Stream length, in miles**	**Mean basin elevation, in feet above sea level**	**Forested area, in percent**	**Mean annual precipitation intensity, in inches**	**Two-year 24-hour precipitation intensity, in inches**	**Mean annual snowfall, in inches**	**Mean minimum January temperature, in degrees Fahrenheit**	**Local station slope, in feet per mile**	**Stream-flow variability index**
03111455	OH	40.208	80.920	10.9	37.9	5.98	1,150	11	39.5	2.5	- -	21.5	- -	- -
03111470	OH	40.302	80.849	1.57	78.8	2.20	1,220	11.5	39	2.5	- -	22.5	- -	- -
03111490	OH	40.272	80.847	.44	130	1.63	1,130	14.8	39	2.5	- -	22.5	- -	- -
03111500	OH	40.190	80.730	123	14.4	25.8	1,106	15	39	2.5	38	23	- -	- -
03111540	OH	40.152	80.883	.34	254	.87	1,160	20.6	39.5	2.5	- -	22	- -	- -
03112000	WV	40.044	80.661	281	11.1	34.8	1,230	50	40	2.5	30	24	10.1	0.698
03113700	WV	39.961	80.701	4.95	140	2.8	1,200	60	42	2.5	30	24	59.8	.584
03114000	OH	39.910	80.920	134	16.0	26.2	1,142	8.3	41	2.5	35	23	- -	- -
03114240	OH	39.782	81.056	.53	246	1.63	1,120	36.8	41.5	2.5	- -	24	- -	- -
03114500	WV	39.475	80.997	458	3.90	72.0	1,060	60	46	2.6	32	24	2.33	.748
03114550	WV	39.506	81.028	.88	120	1.4	920	90	43	2.5	28	24	75.4	.650
03114600	WV	39.503	81.016	1.22	110	1.8	960	70	43	2.5	28	24	44.0	.650
03114650	WV	39.487	81.007	4.19	62.7	1.6	900	40	43	2.5	28	24	30.3	.671
03115280	OH	39.625	81.048	5.45	90.3	3.03	985	61.1	42	2.5	- -	25	- -	- -
03115400	OH	39.563	81.204	210	7.0	42.345	974	50	41.5	2.5	- -	25	- -	- -
03115410	OH	39.543	81.209	.13	289	.61	805	52.6	41.5	2.5	- -	25	- -	- -

Table 1. Basin characteristics data used in the regression analysis to develop flood-estimating equations —Continued

[--, information not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania]

				Basin Characteristics										
Station number	State	Latitude, in decimal degrees	Longitude, in decimal degrees	Drainage area, in square miles	Main channel slope, in feet per mile	Stream length, in miles	Mean basin elevation, in feet above sea level	Forested area, in percent	Mean annual precipitation intensity, in inches	Two-year 24-hour precipitation intensity, in inches	Mean annual snowfall, in inches	Mean minimum January temperature, in degrees Fahrenheit	Local station slope, in feet per mile	Stream-flow variability index
03115510	OH	39.473	81.314	1.52	114	1.97	865	53.3	40.5	2.5	- -	26	- -	- -
03115600	OH	39.770	81.370	3.46	75.5	3.64	1,030	25.2	40	2.5	32	23	- -	- -
03115710	OH	39.661	81.449	.19	366	.95	960	47.9	40	2.5	- -	23.5	- -	- -
03150600	OH	39.473	81.466	.99	58.0	1.913	721	29	40	2.5	- -	25	- -	- -
03151400	WV	38.743	80.526	112	42.1	30.6	1,770	70	48	2.7	90	25	9.38	0.562
03151500	WV	38.824	80.593	155	33.6	39.3	1,600	70	48	2.7	70	25	1.56	.675
03152000	WV	38.934	80.839	387	17.4	62.8	1,280	65	48	2.7	60	25	1.11	.676
03152200	WV	39.124	80.691	2.91	133	2.5	1,090	50	48	2.6	40	24	43.7	.740
03152500	WV	38.962	80.867	144	6.70	27.8	1,050	55	48	2.6	40	24	3.27	.699
03153000	WV	38.862	81.035	162	10.2	28.7	1,110	75	48	2.6	40	25	3.26	.810
03153500	WV	38.922	81.098	913	11.1	86.2	1,170	65	48	2.7	45	25	1.33	.698
03154000	WV	38.844	81.223	205	5.50	29.1	1,030	50	47	2.6	32	25	5.27	.808
03154250	WV	38.803	81.366	2.82	61.9	2.8	880	40	45	2.6	26	24	32.9	.742
03154500	WV	38.961	81.390	79.4	6.50	22.6	910	45	44	2.6	24	25	4.46	.853
03155000	WV	39.059	81.390	1,516	3.10	138.3	1,090	60	48	2.6	35	25	.914	.651
03155200	WV	39.078	81.190	210	5.60	43.1	1,020	45	46	2.6	34	24	28.2	.713
03155450	WV	39.083	81.261	3.52	89.0	2.6	890	80	43	2.6	24	25	55.6	.850

Table 1. Basin characteristics data used in the regression analysis to develop flood-estimating equations —Continued

[--, information not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennyslvania]

				Basin Characteristics										
Station number	**State**	**Latitude, in decimal degrees**	**Longitude, in decimal degrees**	**Drainage area, in square miles**	**Main channel slope, in feet per mile**	**Stream length, in miles**	**Mean basin elevation, in feet above sea level**	**Forested area, in percent**	**Mean annual precipitation intensity, in inches**	**Two-year 24-hour precipitation intensity, in inches**	**Mean annual snowfall, in inches**	**Mean minimum January temperature, in degrees Fahrenheit**	**Local station slope, in feet per mile**	**Stream-flow variability index**
03155500	WV	39.119	81.278	453	4.30	53.2	990	55	45	2.6	30	24	3.53	0.752
03159540	OH	39.064	81.882	1.56	4.00	29.8	749	42	40.5	2.6	- -	26	- -	- -
03159700	WV	38.765	81.678	.70	80.0	1.3	885	30	42	2.6	23	25	48.0	.850
03171500	VA	37.290	80.620	2,941	8.03	199	2,740	51	43.5	2.88	18.8	24.7	- -	- -
03173000	VA	37.270	80.710	305	20.1	53.7	2,590	64	37.4	2.56	17.9	25.8	- -	- -
03175500	VA	37.310	80.850	223	35.9	45.0	2,810	71	40.6	2.57	26.2	25.4	- -	- -
03176500	VA	37.370	80.860	3,768	6.72	225	2,700	53	42.3	2.80	19.5	24.8	- -	- -
03177000	WV	37.400	80.806	50.6	37.9	12.3	2,400	50	38	2.9	24	26	41.7	.490
03177500	WV	37.532	80.819	189	15.3	40.0	2,310	60	38	2.9	30	26	15.8	.532
03177700	VA	37.260	81.280	39.8	31.6	15.2	2,800	90	43.2	2.50	31.1	25.0	- -	- -
03178500	WV	37.504	81.128	32.0	87.3	9.5	2,710	90	44	2.8	40	25	84.1	.772
03179000	WV	37.544	81.011	395	5.90	100.0	2,570	60	40	2.8	40	26	12.2	.522
03179500	WV	37.585	80.965	438	8.00	103.0	2,560	60	40	2.8	40	26	16.6	.568
03180000	WV	37.645	80.884	4,602	5.40	262.3	2,690	60	40	2.9	24	25	11.7	.287
03180350	WV	38.558	79.831	1.13	740	1.8	3,535	95	42	2.8	80	20	264	.550
03180500	WV	38.544	79.833	133	23.8	19.1	3,620	80	42	2.8	70	21	15.4	.535

Table 1. Basin characteristics data used in the regression analysis to develop flood-estimating equations —Continued

[--, information not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania]

				Basin Characteristics										
Station number	State	Latitude, in decimal degrees	Longitude, in decimal degrees	Drainage area, in square miles	Main channel slope, in feet per mile	Stream length, in miles	Mean basin elevation, in feet above sea level	Forested area, in percent	Mean annual precipitation intensity, in inches	Two-year 24-hour precipitation intensity, in inches	Mean annual snowfall, in inches	Mean minimum January temperature, in degrees Fahrenheit	Local station slope, in feet per mile	Stream-flow variability index
03180530	WV	38.508	79.784	1.28	109	3.1	3,120	70	42	2.8	70	21	48.0	0.550
03180680	WV	38.409	79.812	1.52	488	3.2	3,350	90	42	2.8	60	21	48.0	.550
03181900	WV	38.236	79.974	.10	528	.6	2,620	99	40	2.9	45	22	111	.550
03182000	WV	38.211	80.075	108	28.3	25.4	2,910	80	40	2.9	40	22	11.1	.514
03182500	WV	38.186	80.131	540	16.1	66.1	3,180	80	42	2.8	55	21	6.93	.549
03182700	WV	37.908	80.291	144	19.9	27.5	2,480	95	40	2.9	40	23	18.3	.535
03183000	WV	37.685	80.457	80.8	37.5	19.2	2,630	70	38	2.9	35	24	20.2	.524
03183500	WV	37.724	80.642	1,364	9.20	140.8	2,840	80	41	2.8	50	22	5.78	.527
03183550	WV	37.738	80.710	3.84	544	3.5	2,705	95	36	2.9	45	25	192	.650
03183570	WV	37.684	80.717	2.71	280	2.5	1,950	60	36	2.9	45	25	35.2	.650
03184000	WV	37.640	80.805	1,619	9.00	164.0	2,770	75	40	2.8	50	23	4.91	.538
03184500	WV	37.670	80.893	6,256	7.80	264.0	2,670	60	40	2.9	30	24	11.7	.308
03185000	WV	37.761	81.162	52.7	12.3	20.6	2,570	80	44	2.8	45	24	36.8	.550
03185020	WV	37.725	81.101	.62	350	1.0	2,680	60	43	2.8	50	24	46.9	.650
03185500	WV	38.022	81.029	6,826	6.60	309.9	2,700	65	40	2.9	35	24	16.8	.350
03186000	WV	38.065	81.078	6,850	6.60	314.9	2,700	65	40	2.9	35	24	17.2	.329
03186500	WV	38.379	80.484	128	41.9	31.4	3,410	99	52	2.8	100	21	13.5	.542

Table 1. Basin characteristics data used in the regression analysis to develop flood-estimating equations —Continued

[--, information not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania]

				Basin Characteristics										
Station number	**State**	**Latitude, in decimal degrees**	**Longitude, in decimal degrees**	**Drainage area, in square miles**	**Main channel slope, in feet per mile**	**Stream length, in miles**	**Mean basin elevation, in feet above sea level**	**Forested area, in percent**	**Mean annual precipitation intensity, in inches**	**Two-year 24-hour precipitation intensity, in inches**	**Mean annual snowfall, in inches**	**Mean minimum January temperature, in degrees Fahrenheit**	**Local station slope, in feet per mile**	**Stream-flow variability index**
03187000	WV	38.366	80.601	236	27.7	37.0	3,180	95	50	2.8	100	22	8.33	0.541
03187300	WV	38.258	80.324	9.78	126	6.5	3,950	99	53	2.8	80	21	93.3	.408
03187500	WV	38.295	80.527	80.4	52.5	27.2	3,270	99	49	2.8	90	22	45.8	.486
03189000	WV	38.229	80.583	150	76.6	20.6	3,320	95	49	2.8	80	22	37.7	.624
03189100	WV	38.291	80.641	529	21.9	46.6	3,050	92	49	2.8	80	23	23.8	.485
03189500	WV	38.271	80.819	680	18.0	62.8	2,960	90	49	2.8	80	24	19.3	.557
03189650	WV	38.176	80.869	2.78	143	2.8	2,080	95	49	2.7	70	23	31.0	.707
03190000	WV	38.112	80.876	287	15.1	44.9	2,880	75	48	2.8	70	22	17.4	.629
03190400	WV	38.190	80.947	365	17.3	55.7	2,700	80	48	2.8	70	23	49.2	.513
03190500	WV	38.225	80.932	4.22	35.0	3.8	1,750	25	48	2.7	60	24	18.3	.650
03191400	WV	38.258	80.990	4.28	110	3.5	1,500	60	48	2.7	60	24	111	.650
03191500	WV	38.262	81.023	40.2	53.1	13.1	1,700	80	48	2.7	55	25	18.7	.607
03192000	WV	38.233	81.181	1,317	19.2	99.9	2,690	85	48	2.8	70	24	4.41	.599
03192500	WV	38.225	81.192	1,402	19.2	100.9	2,690	85	48	2.8	70	24	4.41	.507
03193000	WV	38.138	81.214	8,371	6.30	329.0	2,690	65	42	2.8	35	24	4.41	.361
03193725	WV	37.981	81.274	.42	533	1.0	1,800	65	44	2.7	40	25	151	.450

Table 1. Basin characteristics data used in the regression analysis to develop flood-estimating equations —Continued

[--, information not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania]

				Basin Characteristics										
Station number	State	Latitude, in decimal degrees	Longitude, in decimal degrees	Drainage area, in square miles	Main channel slope, in feet per mile	Stream length, in miles	Mean basin elevation, in feet above sea level	Forested area, in percent	Mean annual precipitation intensity, in inches	Two-year 24-hour precipitation intensity, in inches	Mean annual snowfall, in inches	Mean minimum January temperature, in degrees Fahrenheit	Local station slope, in feet per mile	Stream-flow variability index
03194700	WV	38.597	80.491	266	45.0	54.1	3,000	88	54	2.8	100	22	11.4	0.476
03195000	WV	38.617	80.556	281	34.8	65.4	2,900	90	52	2.8	100	22	11.4	.540
03195100	WV	38.635	80.466	51.9	67.5	16.8	2,090	89	50	2.7	100	24	23.2	.557
03195250	WV	38.689	80.432	46.5	125	15.2	2,240	81	50	2.7	100	24	55.3	.550
03195500	WV	38.663	80.710	542	29.2	81.6	2,430	90	50	2.8	90	24	3.30	.571
03195600	WV	38.677	80.713	6.98	71.0	4.7	1,180	50	48	2.7	60	25	22.9	.629
03197000	WV	38.471	81.284	1,145	12.6	155.9	1,840	85	47	2.7	60	25	2.26	.600
03197150	WV	38.626	81.234	2.01	100	2.0	1,010	60	44	2.7	30	26	48.0	.950
03197900	WV	38.354	81.523	.49	242	1.1	1,015	70	44	2.7	24	26	88.0	.850
03198450	WV	38.125	81.692	7.75	49.0	4.8	1,230	50	43	2.7	24	26	28.1	.947
03198500	WV	38.180	81.712	391	28.1	63.0	1,750	95	43	2.7	28	26	3.21	.600
03198780	WV	38.006	81.815	1.97	330	2.5	1,410	95	44	2.7	24	26	117	.650
03198800	WV	38.028	81.834	1.28	167	2.0	1,130	90	44	2.7	24	26	132	.650
03199000	WV	38.080	81.836	269	19.7	32.3	1,630	95	44	2.7	26	26	5.13	.609
03199400	WV	38.155	81.852	318	15.5	40.4	1,540	95	44	2.7	24	26	3.25	.485
03200500	WV	38.339	81.842	862	10.5	106.9	1,450	90	44	2.7	24	26	1.72	.493
03200600	WV	38.451	81.854	.87	180	1.5	835	50	42	2.7	23	26	70.4	.850

Table 1. Basin characteristics data used in the regression analysis to develop flood-estimating equations —Continued

[--, information not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania]

Station number	State	Latitude, in decimal degrees	Longitude, in decimal degrees	Basin Characteristics: Drainage area, in square miles	Main channel slope, in feet per mile	Stream length, in miles	Mean basin elevation, in feet above sea level	Forested area, in percent	Mean annual precipitation intensity, in inches	Two-year 24-hour precipitation intensity, in inches	Mean annual snowfall, in inches	Mean minimum January temperature, in degrees Fahrenheit	Local station slope, in feet per mile	Stream-flow variability index
03201000	WV	38.526	81.631	238	3.90	44.5	940	45	45	2.6	24	25	2.19	0.875
03201410	WV	38.450	81.932	8.47	25.0	5.9	820	25	42	2.7	22	26	16.4	.602
03201420	WV	38.479	81.930	2.05	93.0	2.0	820	50	42	2.7	22	26	40.6	.850
03201440	WV	38.644	82.048	1.04	108	1.6	810	60	42	2.6	22	28	42.2	.850
03201480	WV	38.838	82.095	.70	128	1.3	710	90	40	2.6	22	27	52.8	.850
03202000	OH	38.870	82.360	585	2.81	71.6	829	21.9	40	2.6	21	26	- -	- -
03202400	WV	37.604	81.645	306	35.2	37.5	2,080	91	46	2.8	35	25	4.60	.398
03202480	WV	37.563	81.652	7.34	94.3	4.9	1,710	85	45	2.8	32	27	40.8	.592
03202750	WV	37.623	81.707	126	32.0	25.8	1,150	80	46	2.8	32	26	8.40	.512
03203000	WV	37.740	81.877	758	12.9	86.9	1,950	90	45	2.8	34	26	5.44	.586
03203600	WV	37.842	81.976	833	10.4	99.2	1,900	90	45	2.8	30	26	5.83	.480
03204000	WV	38.221	82.203	1,224	7.70	144.7	1,790	90	44	2.8	26	26	1.17	.566
03204500	WV	38.388	82.113	256	4.10	48.5	950	80	43	2.7	23	26	1.55	.819
03205995	OH	38.418	82.510	.73	124	1.52	740	84.9	42.5	2.7	- -	28	- -	- -
03206600	WV	38.017	82.296	38.5	21.7	17.2	1,080	92	43	2.7	22	27	8.84	.694
03206800	WV	38.154	82.385	139	8.14	39.3	1,040	85	43	2.7	22	27	4.04	1.029

Table 1. Basin characteristics data used in the regression analysis to develop flood-estimating equations —Continued

[--, information not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania]

				Basin Characteristics										
Station number	State	Latitude, in decimal degrees	Longitude, in decimal degrees	Drainage area, in square miles	Main channel slope, in feet per mile	Stream length, in miles	Mean basin elevation, in feet above sea level	Forested area, in percent	Mean annual precipitation intensity, in inches	Two-year 24-hour precipitation intensity, in inches	Mean annual snowfall, in inches	Mean minimum January temperature, in degrees Fahrenheit	Local station slope, in feet per mile	Stream-flow variability index
03207000	WV	38.217	82.449	291	6.57	48.3	1,020	80	43	2.7	22	27	2.51	0.806
03207020	WV	38.249	82.434	300	5.70	52.3	1,020	80	43	2.7	22	27	2.51	.873
03207400	VA	37.220	82.100	19.8	119	6.3	1,700	95	40.5	2.78	20.5	29.2	- -	- -
03207500	VA	37.300	82.130	235	36.6	23.5	2,040	92	41.6	2.71	21.8	27.6	- -	- -
03207800	VA	37.350	82.200	297	26.5	31.8	2,000	90	43.5	2.60	22.2	26.6	- -	- -
03207962	KY	37.449	82.338	.82	510	1.46	- -	82	44	2.8	22	28	- -	- -
03208000	KY	37.416	82.421	392	16.9	52.7	1,900	- -	44	2.8	22	28	- -	- -
03208500	VA	37.210	82.300	286	19.3	23.5	2,120	97	42.6	2.82	19.2	28.7	- -	- -
03208950	VA	37.120	82.440	66.5	42.5	17.0	2,090	95	46.0	2.84	19.6	28.0	- -	- -
03209000	VA	37.230	82.340	221	10.2	41.3	2,000	92	46.9	2.82	19.3	27.6	- -	- -
03209575	KY	37.311	82.816	3.17	181	2.59	- -	- -	42	2.8	22	28	- -	- -
03210000	KY	37.567	82.458	56.3	24.3	21.5	1,400	82	44	2.8	22	28	- -	- -
03211500	KY	37.744	82.724	206	6.4	55.1	1,200	82	44	2.8	22	28	- -	- -
03212000	KY	37.835	82.871	103	8.3	21.0	1,000	79	45	2.8	20	28	- -	- -
03212750	WV	37.441	81.600	174	24.5	23.9	2,120	75	43	2.8	40	26	9.78	.349
03212980	WV	37.395	81.803	209	24.1	39.3	2,070	85	43	2.8	35	27	25.1	.439

Table 1. Basin characteristics data used in the regression analysis to develop flood-estimating equations —Continued

[--, information not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania]

				Basin Characteristics										
Station number	**State**	**Latitude, in decimal degrees**	**Longitude, in decimal degrees**	**Drainage area, in square miles**	**Main channel slope, in feet per mile**	**Stream length, in miles**	**Mean basin elevation, in feet above sea level**	**Forested area, in percent**	**Mean annual precipitation intensity, in inches**	**Two-year 24-hour precipitation intensity, in inches**	**Mean annual snowfall, in inches**	**Mean minimum January temperature, in degrees Fahrenheit**	**Local station slope, in feet per mile**	**Stream-flow variability index**
03213000	WV	37.486	81.844	504	16.8	49.2	2,030	90	43	2.8	32	27	4.98	0.470
03213500	WV	37.445	81.871	31.0	61.4	11.7	1,830	90	44	2.8	26	27	32.2	.652
03213700	WV	37.673	82.280	936	10.2	99.6	1,800	90	43	2.8	28	27	2.37	.436
03214000	WV	37.818	82.389	1,188	8.50	117.1	1,700	90	43	2.8	26	28	1.60	.512
03214500	WV	37.837	82.409	1,280	8.00	125.6	1,660	90	43	2.8	26	28	1.60	.531
03214900	WV	38.006	82.515	1,507	6.50	144.6	1,550	90	43	2.8	24	28	1.32	.432
03215500	KY	38.144	82.685	217	3.5	40.1	800	75	44	2.7	20	28	- -	- -
03216500	KY	38.330	82.939	400	3.7	47.2	900	68	44	2.8	20	28	- -	- -
03216540	KY	38.234	82.709	12.2	18.3	8.73	- -	- -	41	2.7	20	29	- -	- -
03216563	KY	38.364	82.796	.94	85.0	1.57	- -	- -	42	- -	20	- -	- -	- -

Table 2. Peak-discharge statistics from the frequency analysis of the gaging station systematic and historical record

[--, information is not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania.]

			Number of years of record		Number of peaks			Skew			Trend analysis	
Station number	State	Water years bounding systematic peaks	Systematic	Historical	Historical	High outlier	Low outlier	Gener-alized	Systematic	Weighted	Kendall's tau	Signifi-cance level
01595000	MD	1955-1990	36	0	0	- -	- -	- -	0.400	0.377	- -	- -
01595300	WV	1955-1982	27	73	1	1	0	0.348	.355	1.090	-0.239	0.083
01595500	MD	1950-1990	41	0	0	- -	- -	- -	1.633	.877	- -	- -
01596000	MD	1924-1950	25	32	1	- -	- -	- -	.378	.434	- -	- -
01596500	MD	1949-1990	42	0	0	- -	- -	- -	.610	.511	- -	- -
01597000	MD	1949-1981	33	0	0	- -	- -	- -	.925	.659	- -	- -
01598000	MD	1925-1950	24	0	0	- -	- -	- -	.723	.545	- -	- -
01599000	MD	1931-1990	60	0	0	- -	- -	- -	.492	.453	- -	- -
01599500	WV	1948-1969	21	0	0	0	0	.371	-.463	-.064	-.100	.546
01600000	MD	1936-1950	15	27	1	- -	- -	- -	.472	.433	- -	- -
01601500	MD	1930-1990	61	0	0	- -	- -	- -	.983	.756	- -	- -
01603000	MD	1930-1981	52	102	2	- -	- -	- -	.823	.756	- -	- -
01604500	WV	1939-1997	59	0	0	0	0	.383	-.264	-.098	-.196	.028
01605500	WV	1936-1997	51	120	0	1	0	.419	.604	.436	.129	.185
01605700	WV	1965-1977	13	0	0	0	0	.404	.360	.385	.461	.033
01606000	WV	1940-1980	41	120	2	1	0	.389	.466	.777	.163	.135

Table 2. Peak-discharge statistics from the frequency analysis of the gaging station systematic and historical record —Continued

[--, information is not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania.]

			Number of years of record		Number of peaks			Skew			Trend analysis	
Station number	**State**	**Water years bounding systematic peaks**	**Systematic**	**Historical**	**Historical**	**High outlier**	**Low outlier**	**Gener-alized**	**Systematic**	**Weighted**	**Kendall's tau**	**Signifi-cance level**
01606500	WV	1924-1997	70	120	1	3	0	0.396	0.961	0.703	0.063	0.447
01606800	WV	1965-1977	13	0	0	0	0	.415	.305	.367	.308	.161
01607500	WV	1944-1997	54	120	2	2	0	.433	.777	.678	-.117	.213
01608000	WV	1924-1997	68	120	0	1	0	.423	.898	.640	-.054	.512
01608100	WV	1965-1977	13	0	0	0	0	.419	-.358	.084	.153	.017
01608500	WV	1900-1997	74	120	1	3	0	.398	.667	.533	.091	.253
01609000	MD	1928-1981	22	0	0	- -	- -	- -	.165	.265	- -	- -
01609500	MD	1948-1976	25	0	0	- -	- -	- -	-.760	.583	- -	- -
01609800	WV	1967-1977	11	0	0	0	0	.406	.328	.375	.309	.213
01610000	MD	1936-1981	43	101	1	- -	- -	- -	-.413	.010	- -	- -
01610150	MD	1965-1983	18	0	0	- -	- -	- -	-.091	.141	- -	- -
01610155	MD	1968-1977	10	0	0	- -	- -	- -	.101	.283	- -	- -
01610500	WV	1936-1951	14	67	0	[a]1	0	.446	.049	.115	-.142	.511
01611500	WV	1923-1997	74	109	1	1	0	.411	-.074	-.019	.041	.604
01612500	MD	1948-1964	17	0	0	- -	- -	- -	.196	.298	- -	- -
01613000	MD	1929-1994	63	0	0	- -	- -	- -	.502	.475	- -	- -
01613150	MD	1965-1986	22	0	0	- -	- -	- -	.244	.319	- -	- -

Table 2. Peak-discharge statistics from the frequency analysis of the gaging station systematic and historical record —Continued

[--, information is not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania.]

			Number of years of record		Number of peaks			Skew			Trend analysis	
Station number	State	Water years bounding systematic peaks	Systematic	Historical	Historical	High outlier	Low outlier	Gener-alized	Systematic	Weighted	Kendall’s tau	Signifi-cance level
01613160	MD	1965-1976	12	0	0	- -	- -	- -	0.643	0.504	- -	- -
01613900	VA	1961-1991	31	0	0	- -	- -	- -	- -	- -	- -	- -
01614000	WV	1929-1997	46	0	0	0	1	0.445	-.531	.467	0.043	0.683
01615000	VA	1944-1991	48	0	0	- -	- -	- -	- -	- -	- -	- -
01616000	VA	1950-1991	24	0	0	- -	- -	- -	- -	- -	- -	- -
01616500	WV	1948-1997	50	62	1	1	0	.470	.176	.244	.300	.002
01617000	WV	1949-1977	24	0	0	0	1	.459	-1.046	.334	.197	.175
01617800	MD	1964-1990	27	0	0	- -	- -	- -	.584	.538	- -	- -
01618000	MD	1929-1990	62	0	0	- -	- -	- -	.288	.349	- -	- -
01619475	MD	1966-1976	11	0	0	- -	- -	- -	.628	.553	- -	- -
01619500	MD	1928-1990	63	0	0	- -	- -	- -	.323	.367	- -	- -
01620500	VA	1947-1991	45	0	0	- -	- -	- -	- -	- -	- -	- -
01621000	VA	- -	- -	55	- -	- -	- -	- -	- -	- -	- -	- -
01621200	VA	1949-1976	27	0	0	- -	- -	- -	- -	- -	- -	- -
01621400	VA	- -	- -	40	- -	- -	- -	- -	- -	- -	- -	- -
01621450	VA	- -	- -	25	- -	- -	- -	- -	- -	- -	- -	- -

Table 2. Peak-discharge statistics from the frequency analysis of the gaging station systematic and historical record —Continued

[--, information is not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania.]

Station number	State	Water years bounding systematic peaks	Number of years of record		Number of peaks			Skew			Trend analysis	
			Systematic	Historical	Historical	High outlier	Low outlier	Gener-alized	Systematic	Weighted	Kendall's tau	Signifi-cance level
01622000	VA	- -	- -	130	- -	- -	- -	- -	- -	- -	- -	- -
01622100	VA	1966-1975	10	0	0	- -	- -	- -	- -	- -	- -	- -
01622300	VA	1967-1976	10	0	0	- -	- -	- -	- -	- -	- -	- -
01622400	VA	1967-1991	21	0	0	- -	- -	- -	- -	- -	- -	- -
01632000	VA	- -	- -	155	- -	- -	- -	- -	- -	- -	- -	- -
01632300	VA	1950-1977	24	0	0	- -	- -	- -	- -	- -	- -	- -
01632900	VA	1961-1991	30	0	0	- -	- -	- -	- -	- -	- -	- -
01632950	VA	1966-1975	10	0	0	- -	- -	- -	- -	- -	- -	- -
01632970	VA	1972-1991	19	0	0	- -	- -	- -	- -	- -	- -	- -
01633000	VA	- -	- -	155	- -	- -	- -	- -	- -	- -	- -	- -
01633500	VA	- -	- -	63	- -	- -	- -	- -	- -	- -	- -	- -
01633650	VA	1971-1991	21	0	0	- -	- -	- -	- -	- -	- -	- -
01634000	VA	- -	- -	120	- -	- -	- -	- -	- -	- -	- -	- -
01634500	VA	1936-1991	55	0	0	- -	- -	- -	- -	- -	- -	- -
01636500	WV	1896-1997	80	128	2	4	0	0.515	0.146	0.134	0.033	0.662
01637000	MD	1948-1977	30	0	0	- -	- -	- -	.355	.422	- -	- -
01637500	MD	1948-1990	43	0	0	- -	- -	- -	.664	.615	- -	- -

Table 2. Peak-discharge statistics from the frequency analysis of the gaging station systematic and historical record —Continued

[--, information is not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania.]

			Number of years of record		Number of peaks			Skew			Trend analysis	
Station number	State	Water years bounding systematic peaks	Systematic	Historical	Historical	High outlier	Low outlier	Gener-alized	Systematic	Weighted	Kendall's tau	Signifi-cance level
01638480	VA	- -	- -	40	- -	- -	- -	- -	- -	- -	- -	- -
01638500	MD	1895-1990	96	102	1	- -	- -	- -	0.187	0.326	- -	- -
01643700	VA	- -	- -	100	- -	- -	- -	- -	- -	- -	- -	- -
01644000	VA	1889-1991	65	0	0	- -	- -	- -	- -	- -	- -	- -
01644100	VA	- -	- -	25	- -	- -	- -	- -	- -	- -	- -	- -
02009500	VA	1966-1975	10	0	0	- -	- -	- -	- -	- -	- -	- -
02011400	VA	- -	- -	75	- -	- -	- -	- -	- -	- -	- -	- -
02011460	VA	- -	- -	75	- -	- -	- -	- -	- -	- -	- -	- -
02011480	VA	1974-1984	11	0	0	- -	- -	- -	- -	- -	- -	- -
02011500	VA	- -	- -	75	- -	- -	- -	- -	- -	- -	- -	- -
02012500	VA	- -	- -	75	- -	- -	- -	- -	- -	- -	- -	- -
02012950	VA	- -	- -	25	- -	- -	- -	- -	- -	- -	- -	- -
02013000	VA	- -	- -	75	- -	- -	- -	- -	- -	- -	- -	- -
02014000	VA	- -	- -	122	- -	- -	- -	- -	- -	- -	- -	- -
03050000	WV	1916-1997	70	110	1	0	0	0.320	.334	.436	0.130	0.113
03050500	WV	1945-1997	53	110	0	1	0	.306	.715	.469	.104	.275

Table 2. Peak-discharge statistics from the frequency analysis of the gaging station systematic and historical record —Continued

[--, information is not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania.]

Station number	State	Water years bounding systematic peaks	Number of years of record		Number of peaks			Skew			Trend analysis	
			Systematic	Historical	Historical	High outlier	Low outlier	Gener-alized	Systematic	Weighted	Kendall's tau	Signifi-cance level
03050650	WV	1964-1977	14	0	0	0	0	0.306	-0.094	0.120	-0.274	0.189
03051000	WV	1908-1997	90	110	1	2	0	.284	.289	.269	.027	.709
03051500	WV	1916-1942	27	110	2	0	0	.276	.176	.251	.157	.260
03052000	WV	1943-1997	46	110	1	0	0	.265	.227	.276	.166	.105
03052340	WV	1966-1975	10	0	0	1	0	.246	.788	.440	-.222	.418
03052500	WV	1947-1997	51	0	0	0	0	.265	.402	.361	.121	.211
03053500	WV	1908-1997	83	0	0	0	0	.257	-.349	-.219	-.002	.978
03054500	WV	1941-1997	57	110	0	[b]1	0	.251	.352	.261	.143	.118
03055020	WV	1966-1997	12	0	0	0	0	.260	-.516	-.054	-.091	.730
03055040	WV	1964-1977	14	0	0	0	0	.259	.334	.292	-.121	.584
03056250	WV	1985-1997	13	0	0	0	0	.227	.313	.265	-.051	.855
03056500	WV	1908-1938	31	0	0	0	0	.219	.251	.239	-.026	.852
03056600	WV	1965-1977	13	0	0	0	0	.225	-.280	.005	.077	.760
03057300	WV	1985-1997	13	0	0	0	0	.238	-.013	.125	.205	.360
03057500	WV	1946-1985	40	0	0	0	0	.226	-.295	-.123	-.072	.521
03058000	WV	1947-1989	43	102	0	1	0	.218	.337	.162	-.128	.229
03058500	WV	1916-1989	74	102	0	[c]1	0	.205	-.085	-.074	-.123	.124

Table 2. Peak-discharge statistics from the frequency analysis of the gaging station systematic and historical record —Continued

[--, information is not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania.]

			Number of years of record		Number of peaks			Skew			Trend analysis	
Station number	State	Water years bounding systematic peaks	Systematic	Historical	Historical	High outlier	Low outlier	Gener-alized	Systematic	Weighted	Kendall's tau	Signifi-cance level
03059000	WV	1924-1983	60	102	1	0	0	0.191	-0.488	-0.286	-0.016	0.858
03059500	WV	1944-1970	27	0	0	0	0	.206	-.062	.041	-.078	.588
03060500	WV	1952-1969	18	0	0	0	0	.165	-.347	-.091	.013	.970
03061000	WV	1908-1989	65	102	0	[d]1	0	.178	-.183	-.140	-.002	.986
03061500	WV	1916-1997	73	90	1	0	0	.178	-.178	-.041	-.024	.768
03062400	WV	1966-1997	32	0	0	1	0	.190	.854	.562	-.123	.330
03062500	WV	1947-1997	30	51	1	0	0	.187	.324	.368	-.172	.187
03063950	WV	1965-1977	12	0	0	1	0	.351	1.487	.674	.030	.945
03065000	WV	1941-1997	57	110	0	1	0	.322	1.310	.859	.167	.068
03066000	WV	1922-1997	76	110	0	1	0	.337	.746	.596	.181	.021
03068610	WV	1974-1997	15	0	0	0	0	.334	-.032	.157	.162	.428
03069000	WV	1911-1996	72	110	2	1	0	.311	.992	.721	.064	.428
03069500	WV	1914-1997	84	154	2	4	0	.307	1.144	.791	.134	.071
03069850	WV	1966-1977	12	0	0	1	0	.280	.609	.412	-.030	.945
03069880	WV	1968-1997	14	30	1	0	0	.279	-.464	.642	-.253	.227
03070000	WV	1921-1996	74	154	2	2	0	.276	.796	.527	.178	.024

Table 2. Peak-discharge statistics from the frequency analysis of the gaging station systematic and historical record —Continued

[--, information is not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania.]

			Number of years of record		Number of peaks			Skew			Trend analysis	
Station number	State	Water years bounding systematic peaks	Systematic	Historical	Historical	High outlier	Low outlier	Gener-alized	Systematic	Weighted	Kendall's tau	Signifi-cance level
03070500	WV	1910-1997	83	110	1	0	0	0.230	0.692	0.711	-0.066	0.376
03071000	WV	1903-1958	47	142	1	0	0	.291	.130	.210	-.004	.978
03071500	WV	1903-1926	16	142	1	0	0	.196	-.284	-.091	.017	.964
03072000	PA	1941-1975	35	0	0	- -	- -	- -	-.277	.093	- -	- -
03072590	PA	1964-1978	15	0	0	- -	- -	- -	.132	.161	- -	- -
03075450	MD	1965-1976	12	0	0	- -	- -	- -	-1.024	-.164	- -	- -
03075500	MD	1942-1990	49	0	0	- -	- -	- -	.095	.151	- -	- -
03075600	MD	1965-1986	22	0	0	- -	- -	- -	.599	.452	- -	- -
03076505	MD	1965-1976	12	0	0	- -	- -	- -	-.475	-.034	- -	- -
03076600	MD	1965-1990	26	0	0	- -	- -	- -	.214	.239	- -	- -
03108000	PA	1916-1975	50	0	0	- -	- -	- -	-.216	-.072	- -	- -
03109000	OH	1947-1981	35	0	0	- -	- -	- -	.441	.256	- -	- -
03109500	OH	1916-1987	72	0	0	- -	- -	- -	.214	.162	- -	- -
03110000	OH	1941-1987	47	0	0	- -	- -	- -	.296	.200	- -	- -
03110980	OH	1978-1987	10	0	0	- -	- -	- -	-.105	-.048	- -	- -
03111150	PA	1961-1975	15	0	0	- -	- -	- -	-.135	.050	- -	- -
03111450	OH	1978-1987	10	0	0	- -	- -	- -	-.031	-.019	- -	- -

Table 2. Peak-discharge statistics from the frequency analysis of the gaging station systematic and historical record —Continued

[--, information is not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania.]

Station number	State	Water years bounding systematic peaks	Number of years of record		Number of peaks			Skew			Trend analysis	
			Systematic	Historical	Historical	High outlier	Low outlier	Gener-alized	Systematic	Weighted	Kendall's tau	Signifi-cance level
03111455	OH	1978-1987	10	0	0	- -	- -	- -	-0.769	-0.284	- -	- -
03111470	OH	1978-1987	10	0	0	- -	- -	- -	.400	.142	- -	- -
03111490	OH	1978-1987	10	0	0	- -	- -	- -	1.568	.324	- -	- -
03111500	OH	1942-1987	46	0	0	--	--	--	-.735	-.261	--	--
03111540	OH	1978-1987	10	0	0	--	--	--	-.118	-.047	--	--
03112000	WV	1941-1986	46	0	0	0	0	0.036	-.031	-.013	-0.014	0.902
03113700	WV	1970-1996	12	0	0	0	0	.042	-.143	-.037	-.182	.451
03114000	OH	1927-1987	38	0	0	- -	- -	- -	.061	.049	- -	- -
03114240	OH	1978-1987	10	0	0	- -	- -	- -	-.254	-.080	- -	- -
03114500	WV	1916-1997	78	123	1	0	0	.079	.157	.199	.095	.219
03114550	WV	1966-1977	12	0	0	0	0	.071	-.547	-.179	.212	.373
03114600	WV	1967-1977	11	0	0	0	0	.073	-.362	-.100	-.018	1.000
03114650	WV	1969-1997	13	0	0	0	0	.076	.005	.044	.256	.246
03115280	OH	1978-1987	10	0	0	- -	- -	- -	1.257	.404	- -	- -
03115400	OH	1959-1981	23	75	0	1	- -	- -	.188	-.204	- -	- -
03115410	OH	1978-1987	10	0	0	- -	- -	- -	-.667	-.216	- -	- -

Table 2. Peak-discharge statistics from the frequency analysis of the gaging station systematic and historical record —Continued

[--, information is not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania.]

			Number of years of record		Number of peaks			Skew			Trend analysis	
Station number	**State**	**Water years bounding systematic peaks**	**Systematic**	**Historical**	**Historical**	**High outlier**	**Low outlier**	**Gener-alized**	**Systematic**	**Weighted**	**Kendall's tau**	**Signifi-cance level**
03115510	OH	1978-1987	10	0	0	- -	- -	- -	0.937	0.348	- -	- -
03115600	OH	1947-1979	33	0	0	- -	- -	- -	.121	.076	- -	- -
03115710	OH	1978-1987	10	0	0	- -	- -	- -	1.180	.361	- -	- -
03150600	OH	1966-1980	15	0	0	- -	- -	- -	.567	.264	- -	- -
03151400	WV	1975-1997	21	80	0	[e]1	0	0.247	.521	.273	0.247	0.124
03151500	WV	1939-1973	35	79	1	0	0	.227	-.427	-.224	.045	.712
03152000	WV	1929-1978	50	0	0	0	0	.181	-.008	.040	-.050	.616
03152200	WV	1970-1997	12	0	0	0	0	.171	-.153	.033	.151	.537
03152500	WV	1938-1951	14	0	0	0	0	.173	-.597	-.158	.461	.025
03153000	WV	1939-1975	37	0	0	0	1	.166	-.878	-.207	.087	.456
03153500	WV	1929-1978	50	0	0	0	0	.147	-.354	-.205	.038	.707
03154000	WV	1929-1997	63	0	0	0	0	.141	-.200	-.119	-.124	.151
03154250	WV	1970-1997	12	0	0	0	0	.127	.044	.091	.182	.451
03154500	WV	1952-1978	27	0	0	0	0	.098	-.596	-.290	.168	.227
03155000	WV	1939-1978	40	0	0	0	1	.084	-.738	-.134	.024	.834
03155200	WV	1938-1951	14	0	0	0	0	.111	-.548	-.175	.330	.111
03155450	WV	1965-1997	16	0	0	0	0	.099	-.331	-.106	.117	.558

Table 2. Peak-discharge statistics from the frequency analysis of the gaging station systematic and historical record —Continued

[--, information is not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania.]

			Number of years of record		Number of peaks			Skew			Trend analysis	
Station number	State	Water years bounding systematic peaks	Systematic	Historical	Historical	High outlier	Low outlier	Gener-alized	Systematic	Weighted	Kendall's tau	Signifi-cance level
03155500	WV	1930-1997	59	0	0	0	0	0.092	-0.092	-0.049	-0.043	0.638
03159540	OH	1966-1987	22	0	0	- -	- -	- -	.982	.463	- -	- -
03159700	WV	1965-1977	13	0	0	1	0	.088	1.189	.465	-.141	.541
03171500	VA	- -	- -	150	- -	- -	- -	- -	- -	- -	- -	- -
03173000	VA	- -	- -	115	- -	- -	- -	- -	- -	- -	- -	- -
03175500	VA	1909-1991	62	0	0	- -	- -	- -	- -	- -	- -	- -
03176500	VA	- -	- -	150	- -	- -	- -	- -	- -	- -	- -	- -
03177000	WV	1942-1951	10	0	0	0	0	.381	-.408	.085	.156	.588
03177500	WV	1942-1951	10	0	0	0	1	.366	-1.599	-.081	.178	.530
03177700	VA	1966-1980	15	0	0	--	--	--	--	--	--	--
03178500	WV	1947-1997	28	51	0	f1	0	.335	-.122	-.058	-.020	.895
03179000	WV	1951-1997	47	0	0	0	2	.344	-1.000	.035	.092	.369
03179500	WV	1909-1948	27	0	0	0	0	.345	-.191	.022	.217	.118
03180000	WV	1924-1948	25	71	1	1	0	.347	1.218	.800	.100	.498
03180350	WV	1966-1977	12	0	0	0	0	.357	.391	.371	.167	.492
03180500	WV	1944-1997	54	102	0	2	0	.359	1.624	.972	.188	.046

Table 2. Peak-discharge statistics from the frequency analysis of the gaging station systematic and historical record —Continued

[--, information is not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania.]

			Number of years of record		Number of peaks			Skew			Trend analysis	
Station number	State	Water years bounding systematic peaks	Systematic	Historical	Historical	High outlier	Low outlier	Gener-alized	Systematic	Weighted	Kendall's tau	Signifi-cance level
03180530	WV	1966-1977	11	0	0	0	0	0.370	-0.155	0.157	0.236	0.350
03180680	WV	1965-1977	13	0	0	0	0	.378	-.134	.151	.205	.360
03181900	WV	1965-1977	13	0	0	0	1	.376	-.768	.086	-.167	.459
03182000	WV	1946-1997	18	80	1	1	0	.367	1.499	.901	.124	.495
03182500	WV	1930-1997	68	102	0	1	0	.364	.609	.473	.144	.084
03182700	WV	1972-1982	11	80	1	0	0	.381	.775	.654	-.309	.213
03183000	WV	1946-1997	29	0	0	0	0	.388	.107	.212	.121	.367
03183500	WV	1896-1997	102	0	0	0	0	.364	-.223	-.122	-.014	.842
03183550	WV	1966-1977	12	0	0	0	1	.356	-1.136	-.089	.136	.582
03183570	WV	1966-1977	12	0	0	0	0	.361	.436	.392	.076	.783
03184000	WV	1936-1997	62	0	0	0	0	.356	.139	.190	.103	.241
03184500	WV	1937-1948	12	41	0	1	0	.344	.602	.041	0.000	1.000
03185000	WV	1952-1982	31	0	0	0	0	.305	.340	.326	-.075	.563
03185020	WV	1966-1977	12	0	0	0	0	.316	-.703	-.086	.167	.492
03185500	WV	1929-1948	20	0	0	0	0	.293	-.167	.045	-.032	.871
03186000	WV	1896-1948	35	71	1	0	0	.281	-.434	-.128	-.040	.744
03186500	WV	1930-1997	68	0	0	0	0	.301	.522	.463	.058	.485

Table 2. Peak-discharge statistics from the frequency analysis of the gaging station systematic and historical record —Continued

[--, information is not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania.]

			Number of years of record		Number of peaks			Skew			Trend analysis	
Station number	State	Water years bounding systematic peaks	Systematic	Historical	Historical	High outlier	Low outlier	Gener-alized	Systematic	Weighted	Kendall's tau	Signifi-cance level
03187000	WV	1930-1997	66	0	0	0	0	0.289	0.227	0.241	-0.008	0.925
03187300	WV	1969-1997	18	0	0	0	0	.334	.637	.478	.241	.173
03187500	WV	1945-1997	39	66	1	0	0	.307	.436	.411	.096	.397
03189000	WV	1930-1982	43	71	0	1	0	.310	1.077	.769	.171	.109
03189100	WV	1965-1997	31	66	2	1	0	.295	-.035	.047	-.019	.892
03189500	WV	1929-1965	37	0	0	1	0	.279	.912	.641	-.117	.314
03189650	WV	1966-1977	12	0	0	0	0	.287	-.519	-.039	0.000	1.000
03190000	WV	1909-1971	51	0	0	0	0	.296	.029	.097	.073	.455
03190400	WV	1967-1997	29	0	0	0	0	.277	-.028	.083	.113	.398
03190500	WV	1966-1976	11	0	0	0	0	.273	-.731	-.106	.291	.241
03191400	WV	1966-1997	16	52	0	[g]1	0	.262	.384	.109	.283	.137
03191500	WV	1946-1997	31	52	0	[h]1	0	.258	.400	.287	-.071	.586
03192000	WV	1929-1964	36	55	1	0	0	.242	.444	.451	-.081	.496
03192500	WV	1909-1930	14	56	2	1	0	.242	.410	.030	.341	.098
03193000	WV	1878-1948	71	0	0	0	0	.253	-.075	-.008	-.108	.183
03193725	WV	1966-1977	12	0	0	0	1	.269	-.478	.350	.242	.301

Table 2. Peak-discharge statistics from the frequency analysis of the gaging station systematic and historical record —Continued

[--, information is not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania.]

			Number of years of record		Number of peaks			Skew			Trend analysis	
Station number	State	Water years bounding systematic peaks	Systematic	Historical	Historical	High outlier	Low outlier	Gener-alized	Systematic	Weighted	Kendall's tau	Signifi-cance level
03194700	WV	1930-1997	66	102	0	1	0	0.270	0.769	0.615	0.107	0.205
03195000	WV	1935-1963	29	0	0	0	0	.260	-.043	.068	.121	.367
03195100	WV	1975-1987	10	0	0	1	0	.268	1.062	.526	.022	1.000
03195250	WV	1975-1997	20	0	0	0	0	.265	.560	.413	.337	.041
03195500	WV	1939-1960	22	0	0	0	0	.235	-.127	.031	.056	.735
03195600	WV	1966-1997	16	0	0	0	0	.233	.271	.251	.200	.300
03197000	WV	1929-1960	32	43	0	1	0	.191	.654	.451	-.181	.149
03197150	WV	1966-1977	12	0	0	0	1	.174	-1.608	.044	-.152	.537
03197900	WV	1964-1975	12	0	0	0	0	.179	.326	.240	.030	.945
03198450	WV	1965-1997	17	0	0	0	0	.196	.949	.519	.147	.434
03198500	WV	1909-1997	75	0	0	0	0	.184	.124	.136	.059	.453
03198780	WV	1966-1977	12	0	0	0	0	.201	-.087	.077	-.152	.537
03198800	WV	1963-1977	14	0	0	0	0	.195	-.408	-.072	-.022	.956
03199000	WV	1931-1984	54	0	0	0	0	.186	-.028	.024	-.020	.835
03199400	WV	1975-1984	10	0	0	0	0	.171	.728	.372	.067	.858
03200500	WV	1909-1997	42	0	0	0	0	.140	-.471	-.262	-.082	.448
03200600	WV	1966-1977	12	0	0	0	1	.118	-.541	.173	.258	.271

Table 2. Peak-discharge statistics from the frequency analysis of the gaging station systematic and historical record —Continued

[--, information is not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania.]

Station number	State	Water years bounding systematic peaks	Number of years of record		Number of peaks			Skew			Trend analysis	
			Systematic	Historical	Historical	High outlier	Low outlier	Gener-alized	Systematic	Weighted	Kendall's tau	Signifi-cance level
03201000	WV	1909-1997	52	0	0	0	0	0.135	-0.223	-0.125	-0.038	0.693
03201410	WV	1967-1997	18	0	0	0	0	.108	-.060	.020	-.203	.256
03201420	WV	1965-1977	13	0	0	0	1	.103	-1.307	-.270	-.346	.112
03201440	WV	1965-1977	13	0	0	0	0	.058	.995	.402	-.026	.951
03201480	WV	1965-1977	13	0	0	0	0	.019	-.768	-.300	-.436	.044
03202000	OH	1916-1985	68	0	0	- -	- -	- -	.314	.235	- -	- -
03202400	WV	1969-1997	29	0	0	0	0	.265	-.156	.003	-.150	.260
03202480	WV	1970-1997	12	0	0	0	0	.268	.086	.190	-.061	.837
03202750	WV	1975-1997	23	0	0	0	1	.255	-1.111	.206	-.107	.492
03203000	WV	1929-1979	51	0	0	0	0	.223	-.413	-.222	.064	.516
03203600	WV	1961-1979	19	0	0	0	0	.200	-.641	-.208	.094	.600
03204000	WV	1916-1979	58	73	1	1	0	.107	-.637	-.430	.065	.477
03204500	WV	1938-1980	43	70	1	2	0	.093	.462	.345	.078	.470
03205995	OH	1978-1987	10	0	0	- -	- -	- -	.745	.288	- -	- -
03206600	WV	1965-1997	33	0	0	0	1	.124	-.156	.282	.182	.141
03206800	WV	1962-1971	10	59	1	1	0	.088	.734	.248	-.156	.591

Table 2. Peak-discharge statistics from the frequency analysis of the gaging station systematic and historical record —Continued

[--, information is not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania.]

			Number of years of record		Number of peaks			Skew			Trend analysis	
Station number	State	Water years bounding systematic peaks	Systematic	Historical	Historical	High outlier	Low outlier	Generalized	Systematic	Weighted	Kendall's tau	Significance level
03207000	WV	1916-1966	31	59	1	0	0	0.068	-0.138	0.012	-0.138	0.284
03207020	WV	1916-1971	36	59	1	0	0	.066	-.185	-.010	-.108	.361
03207400	VA	- -	- -	40	- -	- -	- -	- -	- -	- -	- -	- -
03207500	VA	1929-1991	42	0	0	- -	- -	- -	- -	- -	- -	- -
03207800	VA	- -	- -	63	- -	- -	- -	- -	- -	- -	- -	- -
03207962	KY	1975-1984	10	0	0	- -	- -	- -	-.442	-.048	- -	- -
03208000	KY	1938-1968	30	107	0	[i]1	--	--	-.134	-.177	--	--
03208500	VA	1927-1991	65	0	0	--	--	--	--	--	--	--
03208950	VA	--	65	--	--	--	--	--	--	--	--	--
03209000	VA	- -	- -	75	- -	- -	- -	- -	- -	- -	- -	- -
03209575	KY	1976-1985	10	0	0	- -	- -	- -	1.460	.478	- -	- -
03210000	KY	1938-1985	46	0	0	- -	- -	- -	-.541	-.308	- -	- -
03211500	KY	1938-1949	12	32	2	- -	- -	- -	-1.027	-.130	- -	- -
03212000	KY	1950-1981	32	0	0	- -	- -	- -	-.615	-.343	- -	- -
03212750	WV	1986-1997	12	0	0	0	1	.287	-.727	.122	.182	.451
03212980	WV	1986-1997	12	0	0	0	1	.269	-2.111	-.135	.273	.244

Table 2. Peak-discharge statistics from the frequency analysis of the gaging station systematic and historical record —Continued

[--, information is not available; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania.]

			Number of years of record		Number of peaks			Skew			Trend analysis	
Station number	State	Water years bounding systematic peaks	Systematic	Historical	Historical	High outlier	Low outlier	Gener-alized	Systematic	Weighted	Kendall's tau	Signifi-cance level
03213000	WV	1931-1986	56	0	0	0	0	0.255	-0.276	-0.134	0.062	0.506
03213500	WV	1947-1985	39	0	0	0	0	.256	-.353	-.145	.162	.150
03213700	WV	1968-1997	30	0	0	0	1	.169	-.328	.247	-.060	.656
03214000	WV	1935-1985	51	0	0	0	0	.133	.006	.038	.123	.205
03214500	WV	1916-1997	71	0	0	0	1	.127	-.145	.126	-.012	.889
03214900	WV	1977-1995	12	0	0	0	0	.087	.204	.136	-.182	.451
03215500	KY	1916-1984	52	0	0	- -	- -	- -	.140	.113	- -	- -
03216500	KY	1937-1967	30	84	0	[j]1	- -	- -	-.523	.065	- -	- -
03216540	KY	1973-1985	13	0	0	- -	- -	- -	.726	.310	- -	- -
03216563	KY	1976-1985	10	0	0	- -	- -	- -	-1.144	.181	- -	- -

[a] High-outlier threshold was set to 36,000 cubic feet per second.
[b] High-outlier threshold was set to 60,000 cubic feet per second.
[c] High-outlier threshold was set to 17,000 cubic feet per second.
[d] High-outlier threshold was set to 41,000 cubic feet per second.
[e] High-outlier threshold was set to 19,000 cubic feet per second.
[f] High-outlier threshold was set to 5,600 cubic feet per second.
[g] High-outlier threshold was set to 1,900 cubic feet per second.
[h] High-outlier threshold was set to 11,000 cubic feet per second.
[i] High-outlier threshold was set to 32,000 cubic feet per second.
[j] High-outlier threshold was set to 24,000 cubic feet per second.

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second							
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
01595000	MD	East	North Branch Potomac River at Steyer	S	3,320	5,360	7,020	9,520	11,700	14,100	16,900	21,100
01595300	WV	East	Abram Creek at Oakmont	S	1,240	1,900	2,490	3,470	4,410	5,540	6,930	9,240
				R	1,470	2,470	3,280	4,430	5,370	6,400	7,520	9,170
				W	1,260	1,970	2,640	3,720	4,700	5,830	7,140	9,220
01595500	MD	East	North Br. Potomac River at Kitzmiller	S	7,470	12,100	16,400	23,500	30,200	38,500	48,600	65,400
01596000	MD	East	North Br. Potomac River at Bloomington	S	8,400	14,800	20,500	29,600	38,000	47,900	59,600	78,400
01596500	MD	East	Savage River near Barton	S	1,460	2,300	2,990	4,040	4,960	6,000	7,200	9,050
01597000	MD	East	Crabtree Creek near Swanton	S	484	843	1,170	1,720	2,250	2,890	3,680	4,990
01598000	MD	East	Savage River at Bloomington	S	3,450	5,880	8,030	11,500	14,600	18,400	22,900	30,100
01599000	MD	East	Georges Creek at Franklin	S	1,860	2,980	3,900	5,290	6,500	7,890	9,470	11,900
01599500	WV	East	New Creek near Keyser	S	1,040	1,850	2,500	3,430	4,200	5,030	5,930	7,220
				R	1,590	2,660	3,530	4,770	5,800	6,910	8,120	9,910
				W	1,080	1,990	2,760	3,880	4,800	5,800	6,870	8,420
01600000	MD	East	North Branch Potomac River at Pinto	S	15,900	27,100	36,700	51,600	65,100	80,900	99,200	128,000
01601500	MD	East	Wills Creek near Cumberland	S	5,930	9,660	13,000	18,300	23,300	29,400	36,600	48,500
01603000	MD	East	N. Br. Potomac River near Cumberland	S	17,700	28,000	37,000	51,200	64,300	79,800	98,200	128,000

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

					Recurrence-interval peak-disharge, in cubic feet per second							
Station number	State	Region	Station name	Esti-mate type	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
01604500	WV	East	Patterson Creek near Headsville	S	3,950	7,070	9,520	13,000	15,900	19,000	22,300	27,000
				R	5,670	9,620	12,900	17,600	21,600	25,900	30,800	38,100
				W	4,010	7,260	9,900	13,800	17,000	20,500	24,200	29,600
01605500	WV	East	South Branch Potomac River at Franklin	S	4,480	8,300	11,900	17,800	23,400	30,100	38,300	51,700
				R	4,930	8,370	11,200	15,300	18,700	22,500	26,600	32,900
				W	4,500	8,350	11,800	17,200	22,100	27,800	34,500	45,200
01605700	WV	East	Reeds Creek Tributary near Franklin	S	20.3	32.3	42.0	56.4	68.9	82.9	98.6	123
				R	31.9	51.9	67.0	87.4	103	119	136	160
				W	21.5	36.3	49.2	68.2	83.6	99.9	117	142
01606000	WV	East	N. Fk. S. Br. Potomac River at Cabins	S	8,340	14,200	19,500	28,500	37,100	47,600	60,700	82,500
				R	8,360	14,300	19,100	26,200	32,200	38,900	46,300	57,400
				W	8,340	14,200	19,400	28,000	35,800	45,100	56,200	74,200
01606500	WV	East	S. Br. Potomac River near Petersburg	S	12,900	23,000	32,400	48,500	64,200	83,800	108,000	149,000
				R	15,100	25,900	34,800	48,000	59,300	71,800	85,900	107,000
				W	13,000	23,200	32,700	48,500	63,300	81,200	103,000	138,000
01606800	WV	East	Brushy Run near Petersburg	S	39.7	85.3	131	213	295	398	529	754
				R	84.5	139	180	237	282	328	378	448
				W	43.9	96.7	147	223	288	359	439	561

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second 2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
01607500	WV	East	S. Fk. S. Br. Potomac R. at Brandywine	S	5,550	7,130	10,800	17,500	24,500	33,700	45,700	67,100
				R	3,100	5,230	6,970	9,480	11,600	13,800	16,400	20,100
				W	3,530	6,960	10,300	15,800	21,100	27,700	35,900	49,900
01608000	WV	East	S. Fk. S. Br. Potomac R. near Moorefield	S	6,200	11,700	17,100	26,500	35,900	47,800	62,800	88,600
				R	7,130	12,100	16,200	22,200	27,300	32,900	39,100	48,500
				W	6,230	11,800	17,000	25,800	34,000	44,000	56,200	76,600
01608100	WV	East	Williams Hollow near Moorefield	S	46.4	61.4	71.2	83.6	92.8	102	111	124
				R	18.8	30.4	39.2	50.8	59.7	68.9	78.4	91.6
				W	41.6	52.0	58.5	67.8	75.5	83.9	92.9	106
01608500	WV	East	S. Br. Potomac River near Springfield	S	23,100	42,700	60,900	91,600	121,000	157,000	202,000	276,000
				R	29,300	50,500	68,300	94,700	118,000	143,000	172,000	216,000
				W	23,300	43,200	61,700	92,000	120,000	154,000	195,000	261,000
01609000	MD	East	Town Creek near Oldtown	S	3,800	6,160	8,030	10,800	13,100	15,700	18,600	23,000
01609500	MD	East	Sawpit Run near Oldtown	S	266	398	504	662	798	951	1,120	1,390
01609800	WV	East	Little Cacapon River near Levels	S	3,800	5,970	7,700	10,200	12,400	14,900	17,600	21,700
				R	3,220	5,450	7,260	9,870	12,100	14,400	17,100	21,000
				W	3,690	5,790	7,500	10,000	12,200	14,600	17,300	21,200
01610000	MD	[1]East	Potomac River at Paw Paw	S	44,800	67,100	83,000	104,000	120,000	137,000	155,000	179,000
01610150	MD	East	Bear Creek at Forest Park	S	378	668	907	1,270	1,580	1,920	2,310	2,900

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second 2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
01610155	MD	East	Sideling Hill Creek at Bellegrove	S	4,450	7,620	10,300	14,300	17,800	21,900	26,500	33,500
01610500	WV	East	Cacapon River at Yellow Spring	S	7,390	15,000	22,000	33,300	43,700	55,900	70,200	92,800
				R	7,750	13,200	17,700	24,200	29,800	35,900	42,700	53,000
				W	7,440	14,500	20,200	28,500	35,500	43,300	52,200	66,000
01611500	WV	East	Cacapon River near Great Cacapon	S	13,600	25,100	34,700	48,800	60,800	74,100	88,800	110,000
				R	15,100	25,800	34,800	48,000	59,200	71,700	85,800	107,000
				W	13,600	25,200	34,700	48,700	60,500	73,600	88,100	110,000
01612500	MD	East	Little Tonoloway Creek near Hancock	S	520	898	1,220	1,700	2,130	2,630	3,190	4,060
01613000	MD	[1]East	Potomac River at Hancock	S	55,500	90,200	119,000	164,000	203,000	249,000	301,000	383,000
01613150	MD	East	Ditch Run near Hancock	S	237	377	489	653	792	948	1,120	1,380
01613160	MD	East	Potomac River Tributary near Hancock	S	105	149	183	230	270	313	361	431
01613900	VA	East	Hogue Creek near Hayfield	S	837	1,540	2,080	2,840	3,450	4,100	4,770	5,720
01614000	WV	East	Back Creek near Jones Springs	S	5,570	9,310	12,500	17,500	22,000	27,200	33,300	42,900
				R	6,200	10,500	14,100	19,300	23,700	28,500	33,900	41,900
				W	5,600	9,440	12,800	17,900	22,400	27,600	33,500	42,500
01615000	VA	East	Opequon Creek near Berryville	S	2,160	4,030	5,640	8,120	10,300	12,800	15,700	20,000
01616000	VA	East	Abrams Creek near Winchester	S	483	813	1,080	1,460	1,780	2,130	2,520	3,100

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second							
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
01616500	WV	East	Opequon Creek near Martinsburg	S	4,650	8,740	12,400	18,100	23,400	29,600	36,800	48,100
				R	7,040	12,000	16,000	22,000	27,000	32,500	38,600	47,900
				W	4,740	9,020	12,900	18,900	24,200	30,300	37,300	48,000
01617000	WV	[1]East	Tuscarora Creek above Martinsburg	S	168	286	385	536	670	824	1,000	1,270
01617800	MD	[1]East	Marsh Run at Grimes	S	93.6	186	277	438	599	804	1,060	1,510
01618000	MD	[1]East	Potomac River at Shepherdstown	S	72,200	112,000	143,000	188,000	226,000	268,000	315,000	384,000
01619475	MD	[1]East	Dog Creek Tributary near Locust Grove	S	20.9	43.9	67.7	111	156	215	292	428
01619500	MD	East	Antietam Creek near Sharpsburg	S	2,560	4,490	6,150	8,760	11,100	13,900	17,100	22,100
01620500	VA	East	North River near Stokesville	S	668	1,500	2,430	4,270	6,330	9,200	13,200	20,700
01621000	VA	East	Dry River at Rawley Springs	S	2,260	3,990	5,680	8,660	11,700	15,500	20,500	29,100
01621200	VA	East	War Branch near Hinton	S	548	960	1,320	1,890	2,420	3,030	3,760	4,920
01621400	VA	East	Blacks Run at Harrisonburg	S	469	690	867	1,130	1,350	1,610	1,890	2,330
01621450	VA	East	Blacks Run Tributary near Harrisonburg	S	41	69	96	141	185	239	306	419
01622000	VA	East	North River near Burketown	S	7,150	13,400	19,600	30,600	41,800	56,200	74,700	107,000
01622100	VA	East	North River Tributary at Mount Crawford	S	58	102	138	194	242	298	361	457
01622300	VA	East	Buffalo Branch Trib. near Agusta Springs	S	53	74	89	110	128	146	166	194
01622400	VA	East	Buffalo Branch Tributary near Christian	S	50	84	114	163	207	261	324	426
01632000	VA	East	N. Fk. Shenandoah R. at Cootes Store	S	8,110	14,500	19,600	26,900	32,900	39,300	46,300	56,300
01632300	VA	East	Long Meadow near Broadway	S	128	296	477	816	1,170	1,650	2,260	3,370

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second							
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
01632900	VA	East	Smith Creek near New Market	S	2,030	3,830	5,430	7,970	10,300	13,000	16,100	21,100
01632950	VA	East	Crooked Run Tributary near Conicville	S	23	34	42	53	62	71	81	95
01632970	VA	East	Crooked Run near Mount Jackson	S	701	1,270	1,740	2,470	3,100	3,820	4,630	5,870
01633000	VA	East	N. Fk. Shenandoah R. at Mount Jackson	S	10,300	17,400	22,800	30,400	36,600	43,300	50,400	60,700
01633500	VA	East	Stony Creek at Columbia Furnace	S	1,930	3,590	5,060	7,390	9,510	12,000	14,900	19,500
01633650	VA	East	Pughs Run near Woodstock	S	114	229	340	528	712	940	1,220	1,690
01634000	VA	East	N. Fk. Shenandoah River near Strasburg	S	11,100	20,200	28,200	40,800	52,200	65,600	81,100	106,000
01634500	VA	East	Cedar Creek near Winchester	S	3,110	6,320	9,540	14,800	20,100	26,700	34,900	48,700
01636500	WV	[1]East	Shenandoah River at Millville	S	33,600	60,900	83,800	119,000	149,000	183,000	222,000	281,000
01637000	MD	[1]East	Little Catoctin Creek at Harmony	S	547	1,250	2,000	3,390	4,860	6,790	9,320	13,800
01637500	MD	[1]East	Catoctin Creek near Middletown	S	2,280	4,030	5,650	8,330	10,900	14,000	17,900	24,200
01638480	VA	[1]East	Catoctin Creek at Taylorstown	S	3,880	7,470	10,700	15,900	20,600	26,300	32,800	43,300
01638500	MD	[1]East	Potomac River at Point Of Rocks	S	104,000	164,000	210,000	278,000	334,000	396,000	464,000	564,000
01643700	VA	[1]East	Goose Creek near Middleburg	S	3,480	6,020	8,040	11,000	13,400	16,100	19,000	23,200
01644000	VA	[1]East	Goose Creek near Leesburg	S	6,990	14,100	21,000	33,400	45,700	61,300	81,100	115,000
01644100	VA	[1]East	South Fork Sycolin Creek near Leesburg	S	348	573	757	1,030	1,270	1,540	1,850	2,310
02009500	VA	[1]South	Cattail Run near Bolar	S	32	39	44	51	56	61	66	73
02011400	VA	[1]South	Jackson River near Bacova	S	3,640	5,550	7,140	9,590	11,800	14,300	17,200	21,700

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

					Recurrence-interval peak-disharge, in cubic feet per second							
Station number	State	Region	Station name	Esti-mate type	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
02011460	VA	[1]South	Back Creek near Sunrise	S	2,430	3,680	4,750	6,430	7,960	9,750	11,900	15,300
02011480	VA	South	Back Cr. at Rt. 600 near Mountain Grove	S	4,370	6,180	7,430	9,060	10,300	11,600	12,900	14,700
02011500	VA	South	Back Creek near Mountain Grove	S	5,830	8,620	10,500	12,900	14,700	16,500	18,300	20,800
02012500	VA	South	Jackson River at Falling Spring	S	10,200	15,800	19,700	24,600	28,200	31,900	35,500	40,400
02012950	VA	[1]South	Sweet Spgs. Cr. Trib. at Sweet Chaylbeate	S	40	124	226	428	647	941	1,330	2,010
02013000	VA	South	Dunlap Creek near Covington	S	5,010	8,070	10,400	13,600	16,200	19,000	22,000	26,200
02014000	VA	South	Potts Creek near Covington	S	3,710	5,670	7,080	8,970	10,400	12,000	13,600	15,800
03050000	WV	North	Tygart Valley River near Dailey	S	6,640	9,400	11,500	14,300	16,700	19,200	22,000	26,000
				R	6,040	8,570	10,300	12,600	14,300	16,000	17,800	20,200
				W	6,630	9,370	11,400	14,200	16,500	18,900	21,600	25,400
03050500	WV	North	Tygart Valley River near Elkins	S	7,240	9,690	11,500	13,900	15,800	17,800	19,900	23,000
				R	7,960	11,100	13,200	16,000	18,000	20,100	22,200	25,000
				W	7,270	9,760	11,600	14,000	16,000	18,000	20,200	23,200
03050650	WV	North	Leading Creek Tributary near Gilman	S	45.6	102	157	251	342	452	586	804
				R	68.4	129	181	261	330	406	492	620
				W	52.0	112	168	256	335	424	527	684

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

					Recurrence-interval peak-disharge, in cubic feet per second							
Station number	State	Region	Station name	Esti-mate type	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03051000	WV	North	Tygart Valley River at Belington	S	10,200	13,500	15,800	18,700	21,000	23,300	25,800	29,100
				R	10,700	14,600	17,200	20,500	23,000	25,500	28,000	31,400
				W	10,200	13,500	15,800	18,800	21,100	23,500	25,900	29,300
03051500	WV	North	Middle Fork River at Midvale	S	4,870	7,250	9,040	11,500	13,500	15,700	18,000	21,400
				R	4,470	6,46	7,850	9,680	11,100	12,500	14,000	16,000
				W	4,840	7,190	8,910	11,300	13,100	15,100	17,300	20,300
03052000	WV	North	Middle Fork River at Audra	S	5,950	8,590	10,500	13,200	15,300	17,600	20,000	23,500
				R	5,140	7,370	8,910	10,900	12,500	14,000	15,600	17,800
				W	5,910	8,510	10,400	12,900	15,000	17,100	19,400	22,600
03052340	WV	North	Mud Lick Run near Buckhannon	S	154	188	210	239	261	283	305	336
				R	254	442	593	812	994	1,190	1,410	1,720
				W	182	269	350	473	575	684	798	957
03052500	WV	North	Sand Run near Buckhannon	S	772	1,250	1,650	2,230	2,740	3,310	3,960	4,950
				R	946	1,510	1,940	2,530	3,000	3,500	4,030	4,780
				W	783	1,280	1,680	2,270	2,780	3,350	3,980	4,920
03053500	WV	North	Buckhannon River near Hall	S	7,490	9,800	11,200	12,800	14,000	15,100	16,200	17,500
				R	8,090	11,300	13,400	16,200	18,200	20,300	22,500	25,400
				W	7,500	9,840	11,300	13,000	14,300	15,500	16,600	18,100

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second							
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03054500	WV	North	Tygart Valley River at Phillipi	S	21,900	29,900	35,500	43,000	48,800	54,800	61,100	70,000
				R	19,200	25,300	29,200	34,100	37,800	41,300	44,900	49,700
				W	21,800	29,700	35,200	42,400	47,900	53,600	59,600	67,900
03055020	WV	North	Bonica Run on U.S. 250 near Phillipi	S	67.6	112	146	192	229	268	310	369
				R	95.2	176	244	347	435	533	641	802
				W	76.1	136	188	268	335	409	490	607
03055040	WV	North	Bonica Run on Route 38 near Phillipi	S	209	360	488	683	855	1,050	1,280	1,620
				R	316	542	722	980	1,190	1,430	1,680	2,040
				W	232	412	570	807	1,010	1,230	1,480	1,840
03056250	WV	North	Three Fork Creek near Grafton	S	4,660	7,000	8,760	11,200	13,300	15,400	17,800	21,200
				R	3,780	5,520	6,750	8,370	9,620	10,900	12,200	14,000
				W	4,500	6,640	8,150	10,200	11,800	13,500	15,300	17,800
03056500	WV	North	Tygart Valley River at Fetterman	S	31,000	42,300	50,100	60,400	68,400	76,700	85,300	97,300
				R	24,800	32,200	36,900	42,700	46,900	51,000	55,200	60,700
				W	30,800	41,600	48,900	58,300	65,400	72,700	80,400	90,900
03056600	WV	North	Rt. Fk. Wickwire Run near Grafton	S	204	319	403	517	607	702	802	942
				R	254	442	593	812	994	1,190	1,410	1,720
				W	217	358	475	645	787	939	1,100	1,330

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second 2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03057300	WV	North	West Fork River at Walkersville	S	1,590	2,410	3,020	3,850	4,520	5,220	5,980	7,050
				R	1,570	2,430	3,060	3,920	4,600	5,310	6,050	7,090
				W	1,580	2,420	3,030	3,880	4,550	5,260	6,010	7,070
03057500	WV	North	Skin Creek near Brownsville	S	1,290	1,650	1,870	2,140	2,320	2,500	2,680	2,900
				R	1,450	2,250	2,840	3,650	4,290	4,960	5,660	6,650
				W	1,300	1,710	1,980	2,350	2,620	2,890	3,170	3,520
03058000	WV	North	West Fork River at Brownsville	S	3,180	4,470	5,380	6,570	7,500	8,460	9,470	10,900
				R	3,900	5,690	6,940	8,600	9,870	11,200	12,500	14,400
				W	3,220	4,550	5,510	6,800	7,800	8,840	9,910	11,400
03058500	WV	North	West Fork River at Butcherville	S	6,050	8,540	10,200	12,300	13,900	15,400	17,000	19,100
				R	5,940	8,440	10,200	12,400	14,100	15,800	17,600	20,000
				W	6,050	8,540	10,200	12,300	13,900	15,500	17,100	19,200
03059000	WV	North	West Fork River at Clarksburg	S	10,000	13,100	15,000	17,200	18,700	20,100	21,500	23,200
				R	10,200	14,100	16,600	19,800	22,300	24,700	27,200	30,500
				W	10,000	13,200	15,100	17,400	19,000	20,500	21,900	23,800
03059500	WV	North	Elk Creek at Quiet Dell	S	2,640	4,390	5,750	7,670	9,250	11,000	12,800	15,500
				R	3,430	5,040	6,180	7,690	8,860	10,100	11,300	13,000
				W	2,700	4,470	5,820	7,680	9,160	10,700	12,400	14,800

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second							
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03060500	WV	North	Salem Fork at Salem	S	817	1,450	1,950	2,660	3,240	3,860	4,530	5,490
				R	639	1,050	1,360	1,800	2,160	2,540	2,940	3,520
				W	781	1,340	1,750	2,310	2,760	3,240	3,760	4,500
03061000	WV	North	West Fork River at Enterprise	S	17,600	24,600	29,200	34,800	39,000	43,100	47,200	52,500
				R	16,800	22,300	25,900	30,400	33,700	37,000	40,300	44,700
				W	17,600	24,500	29,000	34,600	38,600	42,600	46,600	51,800
03061500	WV	North	Buffalo Creek at Barrackville	S	5,220	6,930	8,030	9,380	10,400	11,300	12,300	13,600
				R	4,310	6,250	7,600	9,380	10,700	12,100	13,600	15,500
				W	5,190	6,900	8,000	9,380	10,400	11,400	12,400	13,800
03062400	WV	North	Cobun Creek at Morgantown	S	496	856	1,180	1,700	2,180	2,760	3,450	4,580
				R	782	1,260	1,630	2,140	2,560	3,000	3,460	4,120
				W	521	907	1,250	1,790	2,270	2,820	3,460	4,440
03062500	WV	North	Deckers Creek at Morgantown	S	1,590	2,720	3,680	5,160	6,490	8,020	9,800	12,600
				R	2,770	4,140	5,110	6,410	7,420	8,460	9,540	11,000
				W	1,650	2,840	3,850	5,360	6,660	8,120	9,740	12,200
03063950	WV	East	Job Run near Wymer	S	63.1	122	182	287	395	534	711	1,020
				R	66.7	109	142	186	221	257	295	349
				W	63.6	119	166	234	292	358	432	548

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second							
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03065000	WV	East	Dry Fork at Hendricks	S	12,700	19,900	26,200	36,400	45,900	57,200	70,700	92,900
				R	8,660	14,800	19,800	27,200	33,400	40,300	48,000	59,500
				W	12,500	19,400	25,200	34,400	42,700	52,400	63,800	82,100
03066000	WV	East	Blackwater River at Davis	S	2,500	3,760	4,780	6,310	7,640	9,140	10,800	13,500
				R	2,660	4,490	5,970	8,100	9,880	11,800	13,900	17,100
				W	2,500	3,810	4,890	6,550	7,990	9,610	11,400	14,200
03068610	WV	East	Taylor Run at Bowden	S	237	359	450	574	674	781	894	1,060
				R	245	405	531	705	844	992	1,150	1,380
				W	238	370	476	628	752	884	1,020	1,220
03069000	WV	East	Shavers Fork at Parsons	S	8,790	12,400	15,200	19,300	22,900	26,800	31,200	37,900
				R	5,710	9,700	13,000	17,700	21,700	26,100	31,000	38,400
				W	8,680	12,200	15,000	19,100	22,700	26,700	31,200	38,000
03069500	WV	East	Cheat River near Parsons	S	24,400	36,300	46,200	61,400	74,900	90,500	109,000	137,000
				R	16,000	27,400	36,800	50,800	62,800	76,100	91,000	114,000
				W	24,100	35,700	45,200	59,900	72,900	87,900	105,000	132,000
03069850	WV	East	Long Run near Parsons	S	78.2	114	141	180	212	246	284	340
				R	59.9	97.9	127	167	197	230	263	311
				W	75.3	109	136	173	204	237	272	323

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second 2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03069880	WV	East	Buffalo Creek near Rowlesburg	S	1,310	2,120	2,820	3,940	4,960	6,160	7,570	9,840
				R	514	855	1,130	1,510	1,810	2,140	2,500	3,020
				W	1,180	1,740	2,120	2,670	3,140	3,690	4,330	5,320
03070000	WV	East	Cheat River at Rowlesburg	S	33,500	49,600	62,200	80,700	96,400	114,000	134,000	163,000
				R	20,500	35,300	47,600	65,800	81,400	98,900	119,000	148,000
				W	33,100	48,500	60,600	78,400	93,800	111,000	130,000	160,000
03070500	WV	East	Big Sandy Creek near Rockville	S	7,130	10,300	12,900	16,700	20,000	23,700	27,900	34,300
				R	5,420	9,200	12,300	16,800	20,600	24,700	29,400	36,300
				W	7,070	10,200	12,800	16,700	20,100	23,900	28,200	34,700
03071000	WV	East	Cheat River near Pisgah	S	43,300	64,500	80,100	102,000	119,000	138,000	158,000	186,000
				R	27,100	46,700	63,100	87,400	108,000	132,000	158,000	199,000
				W	42,400	62,400	77,300	98,600	116,000	136,000	158,000	190,000
03071500	WV	[1]East	Cheat River near Morgantown	S	46,600	67,000	80,700	98,100	111,000	124,000	138,000	155,000
03072000	PA	North	Dunkard Creek at Shannopin	S	6,850	9,870	12,000	14,800	17,000	19,200	21,500	24,800
03072590	PA	East	Georges Creek at Smithfield	S	662	978	1,210	1,520	1,770	2,030	2,310	2,700
03075450	MD	East	Little Youghiogheny R. Trib. at Deer Park	S	23.7	35.0	42.5	52.1	59.2	66.4	73.5	83.0
03075500	MD	East	Youghiogheny River near Oakland	S	4,200	6,330	7,900	10,000	11,800	13,600	15,600	18,300
03075600	MD	East	Toliver Run Tributary near Hoyes Run	S	30.2	54.1	75.6	111	143	182	228	303
03076505	MD	East	Youghiogheny R. Trib. near Friendsville	S	11.8	15.6	18.1	21.2	23.5	25.7	27.9	30.8

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second							
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03076600	MD	East	Bear Creek at Friendsville	S	1,570	2,170	2,590	3,160	3,600	4,060	4,530	5,210
03108000	PA	North	Raccoon Creek at Moffatts Mill	S	3,890	5,940	7,380	9,290	10,800	12,300	13,800	16,000
03109000	OH	North	Lisbon Creek at Lisbon	S	382	614	797	1,060	1,290	1,540	1,820	2,230
03109500	OH	North	Little Beaver Creek near East Liverpool	S	9,310	13,700	16,800	21,100	24,600	28,200	32,000	37,400
03110000	OH	North	Yellow Creek near Hammondsville	S	3,190	4,530	5,490	6,770	7,780	8,840	9,950	11,500
03110980	OH	[1]North	Consol Run at Bloomingdale	S	6	12	17	24	30	37	44	55
03111150	PA	North	Brush Run near Buffalo	S	503	861	1,140	1,550	1,890	2,260	2,660	3,250
03111450	OH	[1]North	Branson Run at Georgetown	S	52	84	109	143	170	199	230	274
03111455	OH	[1]North	South Fork Short Creek at Georgetown	S	199	308	382	475	544	612	680	769
03111470	OH	[1]North	Little Piney Fork at Parlett	S	62	129	191	291	385	497	629	839
03111490	OH	[1]North	Piney Fork Tributary near Piney Fork	S	12	24	35	53	71	92	118	160
03111500	OH	North	Short Creek near Dillonvale	S	2,940	4,160	4,940	5,880	6,560	7,210	7,850	8,680
03111540	OH	[1]North	Sloan Run Tributary near Harrisville	S	49	133	224	388	552	756	1,010	1,430
03112000	WV	North	Wheeling Creek at Elm Grove	S	9,120	13,600	16,800	21,100	24,300	27,700	31,200	36,000
				R	8,170	11,400	13,500	16,300	18,400	20,500	22,700	25,600
				W	9,080	13,500	16,600	20,500	23,600	26,700	29,900	34,300
03113700	WV	North	Little Grave Creek near Glendale	S	495	940	1,310	1,870	2,340	2,870	3,460	4,320
				R	439	736	969	1,300	1,570	1,870	2,180	2,630
				W	479	864	1,160	1,570	1,910	2,270	2,670	3,260

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second							
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03114000	OH	North	Captina Creek at Armstrongs Mills	S	6,300	9,740	12,200	15,700	18,400	21,300	24,300	28,600
03114240	OH	North	Wood Run near Woodsfield	S	64	133	192	284	365	456	559	713
03114500	WV	North	Middle Island Creek at Little	S	13,500	17,600	20,400	23,900	26,600	29,300	32,100	35,900
				R	11,600	15,800	18,600	22,200	24,800	27,400	30,100	33,700
				W	13,400	17,600	20,300	23,800	26,500	29,200	31,900	35,700
03114550	WV	North	Buffalo Run near Friendly	S	207	369	493	665	804	950	1,100	1,320
				R	126	228	314	441	550	669	801	995
				W	175	302	396	531	644	769	905	1,110
03114600	WV	North	Little Buffalo Run near Friendly	S	254	416	535	697	826	959	1,100	1,290
				R	159	285	388	541	670	812	968	1,200
				W	217	355	457	605	730	866	1,010	1,230
03114650	WV	North	Buffalo Run near Little	S	831	1,510	2,070	2,900	3,620	4,410	5,290	6,600
				R	389	658	869	1,170	1,420	1,690	1,980	2,400
				W	681	1,140	1,460	1,900	2,260	2,660	3,100	3,760
03115280	OH	North	Trail Run near Antioch	S	629	980	1,260	1,670	2,020	2,420	2,860	3,530
03115400	OH	North	Little Muskingum River at Bloomfield	S	7,110	9,590	11,100	13,000	14,300	15,600	16,900	18,500
03115410	OH	North	Graham Run near Bloomfield	S	20	41	59	86	109	134	162	202
03115510	OH	North	Moss Run near Wingott	S	220	371	497	690	860	1,050	1,280	1,620
03115600	OH	North	Barns Run near Summerfield	S	540	1,090	1,580	2,350	3,060	3,870	4,820	6,290

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

					Recurrence-interval peak-disharge, in cubic feet per second							
Station number	State	Region	Station name	Esti-mate type	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03115710	OH	[1]North	Buffalo Run Tributary near Dexter City	S	44	52	58	65	70	75	80	87
03150600	OH	[1]North	Tupper Creek at Devola	S	139	224	292	391	475	569	673	828
03151400	WV	North	Little Kanawha River near Wildcat	S	4,940	7,590	9,630	12,500	14,900	17,500	20,400	24,600
				R	4,200	6,100	7,430	9,170	10,500	11,900	13,300	15,200
				W	4,860	7,360	9,170	11,600	13,600	15,700	18,000	21,300
03151500	WV	North	Little Kanawha River near Burnsville	S	5,250	6,790	7,710	8,790	9,540	10,200	10,900	11,800
				R	5,310	7,600	9,180	11,200	12,800	14,400	16,000	18,300
				W	5,250	6,850	7,850	9,070	9,960	10,800	11,700	12,800
03152000	WV	North	Little Kanawha River at Glenville	S	9,640	12,900	15,100	17,800	19,800	21,800	23,900	26,600
				R	10,300	14,100	16,700	19,900	22,400	24,800	27,300	30,600
				W	9,660	13,000	15,200	17,900	20,000	22,100	24,200	27,000
03152200	WV	North	Buck Run near Leopold	S	328	427	490	570	630	680	740	815
				R	299	514	685	933	1,140	1,360	1,600	1,950
				W	319	457	568	730	864	1,010	1,150	1,360
03152500	WV	North	Leading Creek near Glenville	S	6,140	8,860	10,700	13,000	14,600	16,300	18,000	20,200
				R	5,040	7,230	8,750	10,700	12,300	13,800	15,400	17,500
				W	5,960	8,520	10,200	12,200	13,800	15,400	17,000	19,100

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second							
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03153000	WV	North	Steer Creek near Grantsville	S	6,980	9,780	11,600	13,800	15,400	16,900	18,400	20,400
				R	5,480	7,830	9,450	11,600	13,200	14,800	16,500	18,700
				W	6,880	9,610	11,300	13,400	15,000	16,500	18,100	20,100
03153500	WV	North	Little Kanawha River at Grantsville	S	20,000	25,100	28,000	31,400	33,800	36,000	38,100	40,800
				R	19,200	25,300	29,200	34,100	37,700	41,300	44,900	49,600
				W	20,000	25,100	28,100	31,600	34,000	36,400	38,600	41,400
03154000	WV	North	W. Fk. Little Kanawha River at Rocksdale	S	7,800	10,900	13,000	15,600	17,400	19,300	21,200	23,700
				R	6,500	9,190	11,000	13,400	15,200	17,000	18,900	21,400
				W	7,760	10,900	12,900	15,400	17,200	19,100	20,900	23,400
03154250	WV	North	Tanner Run at Spencer	S	655	994	1,240	1,580	1,850	2,130	2,430	2,850
				R	292	503	671	915	1,120	1,340	1,570	1,920
				W	518	773	949	1,200	1,410	1,640	1,890	2,260
03154500	WV	North	Reedy Creek near Reedy	S	3,640	4,690	5,310	6,020	6,510	6,970	7,410	7,950
				R	3,270	4,830	5,930	7,400	8,530	9,690	10,900	12,600
				W	3,610	4,710	5,410	6,280	6,920	7,550	8,180	8,980
03155000	WV	North	Little Kanawha River at Palestine	S	29,200	38,100	43,600	50,200	54,900	59,500	63,900	69,600
				R	27,700	35,700	40,700	46,900	51,400	55,800	60,200	66,000
				W	29,100	38,000	43,400	49,900	54,600	59,100	63,500	69,200

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second							
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03155200	WV	North	South Fork Hughes River at Macfarlan	S	8,220	10,300	11,500	12,900	13,900	14,800	15,800	16,900
				R	6,620	9,340	11,200	13,600	15,400	17,300	19,100	21,700
				W	7,980	10,100	11,400	13,100	14,400	15,600	16,900	18,500
03155450	WV	North	Big Island Run near Elizabeth	S	706	1,110	1,410	1,800	2,100	2,410	2,730	3,180
				R	343	584	776	1,050	1,280	1,520	1,790	2,170
				W	599	920	1,140	1,430	1,670	1,930	2,210	2,620
03155500	WV	North	Hughes River at Cisco	S	14,300	19,500	22,900	27,100	30,200	33,300	36,400	40,500
				R	11,500	15,700	18,500	22,000	24,600	27,200	29,900	33,500
				W	14,200	19,300	22,600	26,700	29,700	32,700	35,700	39,700
03159540	OH	North	Shade River near Chester	S	3,490	4,630	5,440	6,530	7,390	8,300	9,270	10,600
03159700	WV	North	Grasslick Run near Ripley	S	149	243	321	442	549	672	814	1,030
				R	106	196	270	382	478	584	701	875
				W	133	222	296	409	507	618	743	933
03171500	VA	South	New River at Eggleston	S	32,200	54,700	76,200	114,000	151,000	198,000	257,000	360,000
03173000	VA	South	Walker Creek at Bane	S	6,620	9,870	12,300	15,600	18,300	21,200	24,300	28,700
03175500	VA	South	Wolf Creek near Narrows	S	5,400	7,680	9,090	10,700	11,900	13,000	14,000	15,300
03176500	VA	South	New River at Glen Lyn	S	36,800	62,300	86,100	127,000	166,000	215,000	276,000	380,000

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second							
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03177000	WV	South	Rich Creek near Peterstown	S	1,440	1,920	2,240	2,650	2,950	3,250	3,560	3,970
				R	2,070	3,160	3,970	5,050	5,890	6,760	7,660	8,910
				W	1,520	2,140	2,640	3,320	3,860	4,410	4,960	5,710
03177500	WV	South	Indian Creek at Indian Mills	S	3,930	4,600	5,000	5,450	5,750	6,040	6,320	6,670
				R	5,830	8,750	10,900	13,700	15,900	18,200	20,500	23,800
				W	4,140	5,260	6,170	7,450	8,440	9,410	10,400	11,600
03177700	VA	South	Bluestone River at Bluefield	S	703	940	1,100	1,310	1,460	1,620	1,780	2,000
03178500	WV	South	Camp Creek near Camp Creek	S	1,410	2,370	3,090	4,100	4,920	5,780	6,700	8,010
				R	1,450	2,220	2,790	3,560	4,170	4,790	5,440	6,340
				W	1,410	2,350	3,050	4,010	4,770	5,570	6,410	7,600
03179000	WV	South	Bluestone River near Pipestem	S	8,180	11,600	13,900	16,900	19,200	21,600	24,000	27,200
				R	10,400	15,500	19,100	24,000	27,800	31,600	35,600	41,100
				W	8,240	11,800	14,200	17,500	20,000	22,600	25,200	28,800
03179500	WV	South	Bluestone River at Lilly	S	8,770	11,800	13,800	16,200	18,100	19,900	21,700	24,200
				R	11,300	16,700	20,700	26,000	30,000	34,200	38,500	44,400
				W	8,890	12,100	14,400	17,400	19,800	22,100	24,500	27,600
03180000	WV	South	New River at Bluestone Dam	S	45,600	69,000	88,900	120,000	148,000	180,000	218,000	279,000
				R	71,400	103,000	125,000	155,000	177,000	200,000	223,000	256,000
				W	46,400	70,900	91,700	124,000	151,000	183,000	219,000	275,000

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second 2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03180350	WV	South	W. Fk. Greenbrier River Trib. at Durbin	S	53.7	79.0	98.3	126	148	173	199	239
				R	105	168	216	282	334	389	447	526
				W	58.7	92.4	121	165	200	238	278	335
03180500	WV	South	Greenbrier River at Durbin	S	4,540	7,160	9,540	13,500	17,200	21,800	27,300	36,600
				R	4,430	6,670	8,310	10,500	12,200	14,000	15,800	18,300
				W	4,540	7,140	9,460	13,200	16,600	20,700	25,600	33,500
03180530	WV	South	Brush Run near Bartow	S	71.3	137	195	286	369	464	575	748
				R	116	185	238	310	367	427	490	577
				W	76.5	146	206	294	368	449	537	666
T03180680	WV	South	Cooper Run near Green Bank	S	96.7	164	217	296	362	436	518	639
				R	132	211	271	353	418	486	557	656
				W	101	172	230	313	381	454	533	646
03181900	WV	South	Mack Butterball Hollow near Huntersville	S	10.4	14.0	16.4	19.5	21.8	24.2	26.6	29.8
				R	15.7	25.8	33.7	44.8	53.7	63.0	72.8	86.6
				W	11.0	15.9	19.8	25.5	30.1	34.8	39.7	46.2
03182000	WV	South	Knapp Creek at Marlinton	S	4,870	7,130	9,040	12,000	14,600	17,700	21,300	27,000
				R	3,760	5,680	7,090	8,970	10,400	11,900	13,500	15,700
				W	4,800	6,980	8,750	11,400	13,700	16,300	19,200	23,700

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second							
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03182500	WV	South	Greenbrier River at Buckeye	S	18,000	26,300	32,800	42,000	49,800	58,300	67,800	81,800
				R	13,300	19,700	24,300	30,400	35,200	40,000	45,000	51,900
				W	17,900	26,100	32,300	41,100	48,500	56,500	65,300	78,200
03182700	WV	South	Anthony Creek near Anthony	S	9,180	13,000	15,900	20,200	23,800	27,900	32,400	39,100
				R	4,710	7,090	8,830	11,200	13,000	14,800	16,800	19,400
				W	8,720	12,000	14,400	17,800	20,600	23,600	26,900	31,800
03183000	WV	South	Second Creek near Second Creek	S	2,480	3,950	5,090	6,730	8,100	9,600	11,200	13,700
				R	2,990	4,540	5,680	7,200	8,380	9,610	10,900	12,600
				W	2,500	4,000	5,160	6,800	8,150	9,600	11,200	13,400
03183500	WV	South	Greenbrier River at Alderson	S	34,100	47,400	56,000	66,700	74,500	82,200	89,900	100,000
				R	27,500	40,300	49,400	61,500	70,700	80,200	90,000	103,000
				W	34,000	47,200	55,700	66,400	74,300	82,100	89,900	100,000
03183550	WV	South	Griffith Creek near Alderson	S	278	356	404	462	504	544	582	633
				R	274	432	551	713	842	975	1,110	1,310
				W	277	370	439	533	607	682	759	860
03183570	WV	South	Buggar Lick at Pence Springs	S	126	229	322	472	611	777	974	1,290
				R	209	330	422	548	647	751	859	1,010
				W	134	247	346	496	624	767	925	1,160

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second							
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03184000	WV	South	Greenbrier River at Hilldale	S	37,000	49,900	58,700	70,200	79,000	88,000	97,300	110,000
				R	31,500	46,000	56,300	70,000	80,500	91,300	102,000	117,000
				W	36,800	49,700	58,600	70,200	79,100	88,300	97,700	111,000
03184500	WV	South	New River at Hinton	S	73,300	102,000	121,000	145,000	164,000	182,000	201,000	227,000
				R	90,900	131,000	159,000	195,000	223,000	252,000	281,000	321,000
				W	73,600	102,000	122,000	148,000	167,000	187,000	207,000	235,000
03185000	WV	South	Piney Creek at Raleigh	S	1,150	1,830	2,380	3,180	3,870	4,640	5,490	6,780
				R	2,140	3,260	4,090	5,200	6,070	6,970	7,900	9,180
				W	1,180	1,920	2,530	3,420	4,180	5,000	5,900	7,220
03185020	WV	South	Little Beaver Cr. Trib. near Shady Springs	S	30.0	56.1	77.4	109	135	164	195	241
				R	65.5	106	136	179	213	248	285	337
				W	33.4	64.1	90.3	128	160	193	228	278
03185500	WV	[1]South	New River at Caperton	S	90,200	130,000	158,000	195,000	223,000	252,000	282,000	323,000
03186000	WV	South	New River at Fayette	S	95,200	142,000	173,000	214,000	244,000	275,000	307,000	349,000
				R	97,600	140,000	170,000	209,000	239,000	270,000	301,000	344,000
				W	95,300	142,000	173,000	213,000	244,000	275,000	306,000	348,000
03186500	WV	South	Williams River at Dyer	S	7,700	11,300	14,100	18,100	21,500	25,200	29,300	35,400
				R	4,300	6,480	8,070	10,200	11,900	13,600	15,300	17,800
				W	7,600	11,100	13,700	17,400	20,500	23,800	27,500	32,900

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second							
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03187000	WV	South	Gauley River at Camden on Gauley	S	11,500	17,200	21,400	27,300	32,000	37,100	42,600	50,600
				R	6,940	10,400	12,900	16,200	18,800	21,500	24,200	28,000
				W	11,400	16,900	20,800	26,300	30,700	35,300	40,300	47,500
03187300	WV	South	North Fk. Cranberry River near Hillsboro	S	758	1,220	1,600	2,190	2,700	3,300	3,980	5,030
				R	571	889	1,130	1,450	1,700	1,970	2,240	2,620
				W	739	1,170	1,500	1,980	2,390	2,830	3,330	4,080
03187500	WV	South	Cranberry River near Richwood	S	4,650	6,840	8,510	10,900	12,900	15,000	17,400	20,900
				R	2,980	4,520	5,650	7,170	8,350	9,570	10,800	12,600
				W	4,580	6,670	8,230	10,400	12,200	14,100	16,200	19,300
03189000	WV	South	Cherry River at Fenwick	S	8,280	12,700	16,400	22,300	27,500	33,700	40,900	52,400
				R	4,860	7,320	9,110	11,500	13,400	15,300	17,300	20,000
				W	8,130	12,300	15,700	20,700	25,200	30,200	36,100	45,200
03189100	WV	South	Gauley River near Craigsville	S	25,400	37,300	45,700	56,900	65,500	74,500	83,800	96,700
				R	13,100	19,400	23,900	30,000	34,600	39,400	44,300	51,100
				W	24,800	35,900	43,300	52,900	60,400	68,100	76,100	87,300
03189500	WV	South	Gauley River near Summersville	S	25,700	36,200	44,400	56,200	66,200	77,300	89,500	108,000
				R	15,900	23,500	29,000	36,200	41,800	47,600	53,500	61,600
				W	25,200	35,300	42,800	53,500	62,300	72,000	82,600	98,400

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

					Recurrence-interval peak-disharge, in cubic feet per second							
Station number	State	Region	Station name	Esti-mate type	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03189650	WV	South	Collison Creek near Nallen	S	172	268	338	431	504	581	660	771
				R	213	337	430	558	660	765	875	1,030
				W	177	281	360	469	556	647	741	871
03190000	WV	South	Meadow River at Nallen	S	5,980	8,020	9,370	11,100	12,400	13,700	15,000	16,800
				R	8,090	12,100	15,000	18,800	21,800	24,900	28,100	32,400
				W	6,030	8,180	9,670	11,600	13,100	14,700	16,200	18,300
03190400	WV	South	Meadow River near Mount Lookout	S	9,080	12,700	15,200	18,400	20,900	23,500	26,100	29,700
				R	9,780	14,500	18,000	22,600	26,200	29,800	33,600	38,800
				W	9,110	12,800	15,500	19,000	21,700	24,500	27,400	31,300
03190500	WV	South	Meadow Creek near Summersville	S	323	434	505	592	654	716	777	856
				R	295	465	592	766	904	1,050	1,200	1,400
				W	319	441	528	647	741	837	934	1,070
03191400	WV	South	Laurel Creek near Summersville	S	224	436	624	919	1,190	1,490	1,850	2,400
				R	298	470	599	775	913	1,060	1,210	1,420
				W	230	441	618	878	1,100	1,340	1,600	1,990
03191500	WV	South	Peters Creek near Lockwood	S	2,470	4,020	5,280	7,140	8,730	10,500	12,500	15,500
				R	1,730	2,650	3,330	4,240	4,950	5,690	6,450	7,510
				W	2,420	3,890	5,010	6,600	7,920	9,370	11,000	13,300

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Estimate type	Recurrence-interval peak-disharge, in cubic feet per second 2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03192000	WV	South	Gauley River above Belva	S	41,600	58,500	71,000	88,500	103,000	118,000	135,000	159,000
				R	26,800	39,200	48,100	59,800	68,900	78,100	87,700	101,000
				W	41,300	57,700	69,700	86,300	99,700	114,000	130,000	152,000
03192500	WV	South	Gauley River at Belva	S	36,500	51,000	60,900	73,600	83,200	93,000	103,000	116,000
				R	28,100	41,100	50,400	62,800	72,200	81,900	91,900	106,000
				W	35,900	50,000	59,500	71,700	81,100	90,600	100,000	114,000
03193000	WV	South	Kanawha River at Kanawha Falls	S	123,000	174,000	208,000	252,000	285,000	318,000	353,000	399,000
				R	114,000	163,000	198,000	243,000	278,000	313,000	349,000	399,000
				W	123,000	173,000	207,000	251,000	285,000	318,000	352,000	399,000
03193725	WV	South	Little Fork at Mossy	S	18.0	27.1	34.2	44.2	52.6	61.8	71.9	86.7
				R	48.3	78.2	101	133	158	185	213	252
				W	20.6	33.9	45.9	64.1	79.3	95.5	113	137
03194700	WV	South	Elk River below Webster Springs	S	11,100	16,000	19,800	25,300	29,900	35,100	40,900	49,600
				R	7,630	11,400	14,100	17,800	20,600	23,500	26,500	30,600
				W	11,000	15,800	19,400	24,600	29,000	33,900	39,200	47,200
03195000	WV	[1]South	Elk River at Centralia	S	11,200	13,600	15,100	16,900	18,200	19,500	20,700	22,300
03195100	WV	South	Right Fork Holly River at Guardian	S	2,390	3,510	4,390	5,660	6,740	7,930	9,260	11,300
				R	2,120	3,230	4,040	5,140	6,000	6,890	7,810	9,080
				W	2,350	3,450	4,290	5,470	6,440	7,480	8,600	10,200

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

					Recurrence-interval peak-disharge, in cubic feet per second							
Station number	**State**	**Region**	**Station name**	**Esti-mate type**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**
03195250	WV	South	Left Fork Holly River near Replete	S	2,510	3,830	4,870	6,390	7,670	9,100	10,700	13,100
				R	1,940	2,960	3,720	4,730	5,530	6,350	7,190	8,370
				W	2,460	3,710	4,660	5,990	7,090	8,270	9,570	11,500
03195500	WV	South	Elk River at Sutton	S	19,200	25,400	29,400	34,400	38,100	41,700	45,400	50,300
				R	13,300	19,700	24,400	30,500	35,300	40,100	45,100	52,000
				W	19,100	25,200	29,100	34,100	37,800	41,600	45,400	50,500
03195600	WV	South	Granny Creek at Sutton	S	882	1,180	1,390	1,660	1,870	2,080	2,310	2,620
				R	438	685	870	1,120	1,320	1,530	1,740	2,040
				W	823	1,090	1,260	1,500	1,690	1,890	2,100	2,400
03197000	WV	South	Elk River at Queen Shoals	S	27,000	36,600	43,600	53,200	60,900	69,000	77,700	90,100
				R	24,000	35,200	43,200	53,800	62,000	70,400	78,900	90,800
				W	26,900	36,600	43,600	53,200	60,900	69,100	77,800	90,200
03197150	WV	South	Ashleycamp Run near Left Hand	S	201	254	286	327	356	384	412	450
				R	165	262	336	437	516	600	687	808
				W	196	255	299	360	408	458	508	577
03197900	WV	South	Elk Twomile Creek Trib. near Charleston	S	67.6	112	147	200	244	294	350	433
				R	54.5	88.1	114	150	178	208	239	283
				W	65.7	106	137	181	217	256	299	360

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

					Recurrence-interval peak-disharge, in cubic feet per second							
Station number	State	Region	Station name	Esti-mate type	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03198450	WV	South	Drawdy Creek near Peytona	S	346	619	867	1,270	1,660	2,120	2,680	3,590
				R	476	743	943	1,220	1,430	1,650	1,880	2,210
				W	357	636	881	1,260	1,590	1,960	2,390	3,050
03198500	WV	South	Big Coal River at Ashford	S	10,500	16,400	20,800	27,000	32,000	37,500	43,300	51,700
				R	10,300	15,300	19,000	23,800	27,600	31,400	35,400	40,800
				W	10,500	16,300	20,700	26,800	31,700	36,900	42,500	50,600
03198780	WV	South	Hunters Branch near Madison	S	120	198	258	344	416	493	576	698
				R	162	258	330	430	509	591	677	796
				W	125	209	276	371	448	529	615	738
03198800	WV	South	Low Gap Creek near Madison	S	74.0	171	263	413	553	716	906	1,200
				R	116	185	238	310	367	427	490	577
				W	78.0	173	256	379	482	595	720	904
03199000	WV	South	Little Coal River at Danville	S	9,200	15,600	20,700	27,800	33,800	40,200	47,100	57,200
				R	7,690	11,500	14,300	17,900	20,800	23,700	26,700	30,900
				W	9,160	15,400	20,200	26,800	32,200	37,900	44,100	53,000
03199400	WV	South	Little Coal River at Julian	S	9,790	16,000	21,000	28,700	35,300	42,800	51400	64,500
				R	8,770	13,100	16,200	20,400	23,600	26,900	30,300	35,000
				W	9,650	15,300	19,600	25,600	30,400	35,600	41,300	49,500

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second							
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03200500	WV	South	Coal River at Tornado	S	20,600	28,300	33,100	38,900	43,000	46,900	50,700	55,600
				R	19,200	28,300	34,800	43,400	50,000	56,800	63,800	73,500
				W	20,500	28,300	33,200	39,300	43,700	48,100	52,300	57,900
03200600	WV	South	Little Scary Creek near Nitro	S	83.1	131	167	218	261	307	356	428
				R	85.5	137	177	231	275	320	367	433
				W	83.4	132	170	223	266	312	361	431
03201000	WV	South	Pocatalico River at Sissonville	S	6,730	9,540	11,400	13,700	15,400	17,100	18,800	21,100
				R	6,990	10,500	13,000	16,300	18,900	21,600	24,400	28,200
				W	6,730	9,580	11,500	13,900	15,800	17,600	19,400	21,900
03201410	WV	South	Poplar Fork at Teays	S	1,030	1,410	1,670	1,990	2,230	2,470	2,720	3,050
				R	510	796	1,010	1,300	1,530	1,770	2,010	2,360
				W	970	1,300	1,520	1,800	2,010	2,240	2,480	2,800
03201420	WV	South	Long Branch near Teays	S	259	345	397	459	502	543	582	632
				R	168	266	341	443	524	609	697	820
				W	245	328	382	454	510	567	625	702
03201440	WV	South	Sixteenmile Creek near Pliny	S	298	474	618	831	1,020	1,220	1,460	1,820
				R	98.4	158	203	265	314	366	420	495
				W	259	383	465	578	673	777	894	1,070

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second							
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03201480	WV	South	Threemile Creek Trib. near Point Pleasant	S	134	243	326	438	526	617	711	839
				R	72.1	116	150	196	233	272	312	369
				W	124	210	267	339	395	453	514	599
03202000	OH	South	Raccoon Creek at Adamsville	S	6,030	9,820	11,100	14,000	16,400	19,000	21,700	25,600
03202400	WV	South	Guyandotte River near Baileysville	S	7,990	14,600	20,000	28,000	34,800	42,300	50,600	62,800
				R	8,510	12,700	15,700	19,800	22,900	26,100	29,400	34,000
				W	8,020	14,400	19,500	26,600	32,400	38,700	45,500	55,300
03202480	WV	South	Brier Creek at Fanrock	S	439	734	970	1,320	1,610	1,940	2,300	2,850
				R	456	712	905	1,170	1,370	1,590	1,810	2,120
				W	441	729	952	1,270	1,520	1,790	2,090	2,510
03202750	WV	South	Clear Fork at Clear Fork	S	4,350	6,160	7,450	9,180	10,500	12,000	13,400	15,600
				R	4,240	6,400	7,970	10,100	11,700	13,400	15,200	17,600
				W	4,340	6,180	7,520	9,340	10,800	12,300	13,900	16,000
03203000	WV	South	Guyandotte River at Man	S	20,000	30,100	36,800	45,300	51,600	57,900	64,100	72,400
				R	17,300	25,600	31,500	39,400	45,400	51,600	58,000	66,800
				W	20,000	29,900	36,500	44,900	51,100	57,300	63,600	71,800
03203600	WV	South	Guyandotte River at Logan	S	24,500	39,200	49,700	63,400	73,900	84,500	95,400	110,000
				R	18,700	27,500	33,900	42,300	48,800	55,400	62,200	71,600
				W	24,200	38,400	48,100	60,600	70,000	79,500	89,300	103,000

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

					Recurrence-interval peak-disharge, in cubic feet per second							
Station number	State	Region	Station name	Esti-mate type	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03204000	WV	South	Guyandotte River at Branchland	S	23,000	33,200	39,400	46,700	51,800	56,500	61,000	66,700
				R	25,300	37,000	45,500	56,600	65,200	74,000	83,000	95,400
				W	23,100	33,300	39,600	47,200	52,600	57,700	62,600	68,800
03204500	WV	South	Mud River near Milton	S	6,210	9,780	12,600	16,800	20,300	24,200	28,600	35,200
				R	7,400	11,100	13,700	17,300	20,000	22,800	25,800	29,800
				W	6,240	9,840	12,700	16,800	20,300	24,100	28,200	34,400
03205995	OH	South	Sandusky Creek near Burlington	S	100	143	175	219	254	291	331	388
03206600	WV	South	East Fork Twelvepole Creek near Dunlow	S	1,780	2,510	3,030	3,740	4,300	4,890	5,510	6,400
				R	1,670	2,560	3,220	4,100	4,790	5,510	6,250	7,270
				W	1,780	2,510	3,050	3,790	4,370	4,990	5,650	6,570
03206800	WV	South	E. Fk. Twelvepole Creek near East Lynn	S	3,380	4,860	5,950	7,430	8,610	9,870	11,200	13,100
				R	4,580	6,900	8,600	10,900	12,600	14,400	16,300	18,900
				W	3,460	5,100	6,360	8,120	9,530	11,000	12,500	14,700
03207000	WV	[1]South	Twelvepole Creek at Wayne	S	6,460	10,100	12,700	16,300	19,100	22,100	25,200	29,600
03207020	WV	South	Twelvepole Creek below Wayne	S	6,460	9,980	12,500	15,900	18,600	21,400	24,300	28,400
				R	8,380	12,500	15,500	19,500	22,600	25,700	29,000	33,500
				W	6,510	10,100	12,700	16,200	19,000	21,800	24,800	29,000
03207400	VA	[1]South	Prater Creek at Vasant	S	832	1,900	2,890	4,470	5,880	7,510	9,350	12,200
03207500	VA	[1]South	Levisa Fork near Grundy	S	10,300	18,200	24,200	32,300	38,600	45,200	52,100	61,500

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second							
					2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03207800	VA	[1]South	Levisa Fork at Big Rock	S	8,220	16,000	22,600	32,400	40,700	49,900	60,000	75,000
03207962	KY	South	Dicks Fork at Phyllis	S	54.2	120	184	289	387	502	636	847
03208000	KY	South	Levisa Fork below Fishtrap Dam	S	12,100	17,600	12,200	25,800	29,100	32,400	35,700	40,100
03208500	VA	[1]South	Russel Fork at Haysi	S	13,200	23,000	30,200	40,100	47,800	55,800	64,000	75,300
03208950	VA	[1]South	Cranes Nest River near Clintwood	S	2,250	4,160	5,790	8,310	10,500	13,100	16,000	20,500
03209000	VA	[1]South	Pond R. blw. Flannagan Dam near Haysi	S	9,520	14,800	18,500	23,400	27,100	30,900	34,800	40,100
03209575	KY	South	Bill D. Branch near Kite	S	287	441	566	750	909	1,090	1,290	1,600
03210000	KY	South	Johns Creek near Meta	S	2,710	4,300	5,390	6,770	7,800	8,820	9,830	11,200
03211500	KY	South	Johns Creek near Van Lear	S	3,910	5,800	7,090	8,740	9,980	11,200	12,500	14,200
03212000	KY	South	Paint Creek at Staffordsville	S	5,280	9,200	12,000	15,800	18,600	21,500	24,400	28,300
03212750	WV	South	Tug Fork at Welch	S	2,820	4,450	5,670	7,390	8,790	10,300	11,900	14,200
				R	5,470	8,210	10,200	12,900	15,000	17,100	19,300	22,300
				W	3,050	4,970	6,520	8,730	10,500	12,400	14,300	17,000
03212980	WV	South	Dry Fork at Beartown	S	5,040	6,920	8,120	9,610	10,700	11,800	12,800	14,200
				R	6,310	9,460	11,700	14,800	17,200	19,600	22,100	25,600
				W	5,170	7,310	8,860	10,900	12,500	14,100	15,700	17,900
03213000	WV	South	Tug Fork at Litwar	S	12,200	20,000	25,700	33,400	39,500	45,800	52,300	61,400
				R	12,600	18,700	23,000	28,900	33,400	38,000	42,700	49,300
				W	12,200	20,000	25,600	33,100	38,900	44,900	51,200	59,800

Table 3. Magnitude and frequency discharges for gaging stations in West Virginia and surrounding states —Continued

[Recurrence-interval peak-discharges are presented in the following order: first line (S), from the systematic and historical record using the guidelines established by the Water Resources Council; second line (R), from the regionalized regression equation; and, third line (W), from weighting (1) the systematic and historical record using the guidelines established by the Water Resources Council, and (2) the regional regression equation, using the number of years of peak discharge and equivalent years of record.]

Station number	State	Region	Station name	Esti-mate type	Recurrence-interval peak-disharge, in cubic feet per second: 2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
03213500	WV	South	Panther Creek near Panther	S	1,610	2,990	4,100	5,680	6,980	8,390	9,900	12,100
				R	1,410	2,170	2,730	3,480	4,070	4,680	5,310	6,190
				W	1,600	2,930	3,940	5,340	6,470	7,660	8,930	10,700
03213700	WV	South	Tug Fork at Williamson	S	17,400	29,300	39,000	53,600	66,200	80,300	96,200	120,000
				R	20,500	30,100	37,000	46,200	53,200	60,500	67,900	78,100
				W	17,500	29,400	38,800	52,500	63,900	76,500	90,300	111,000
03214000	WV	[1]South	Tug Fork near Kermit	S	23,900	41,300	55,100	75,000	91,700	110,000	130,000	159,000
03214500	WV	South	Tug Fork at Kermit	S	24,300	40,000	52,400	70,200	85,000	101,000	119,000	145,000
				R	26,200	38,300	47,000	58,600	67,400	76,500	85,800	98,600
				W	24,300	40,000	52,100	69,400	83,600	98,900	116,000	140,000
03214900	WV	South	Tug Fork at Glenhayes	S	18,600	29,900	38,600	50,900	61,100	72,100	84,100	102,000
				R	29,700	43,500	53,300	66,300	76,300	86,500	97,000	111,000
				W	19,500	31,800	41,400	54,800	65,400	76,600	88,400	105,000
03215500	KY	South	Blaine Creek at Yatesville	S	5,910	9,020	11,300	14,500	17,000	19,700	22,500	26,600
03216500	KY	South	Little Sandy River at Grayson	S	9,910	13,800	16,400	19,800	22,400	25,100	27,800	31,400
03216540	KY	South	E. Fk. Little Sandy River near Fallsburg	S	815	1,050	1,210	1,410	1,570	1,730	1,890	2,120
03216563	KY	South	Mile Branch near Rush	S	199	277	329	395	445	495	546	613

[1] The station is located in the indicated region, but was not used in the regional frequency analysis.

APPENDIX

Appendix 1. Accuracy of Estimating Equations

The uncertainty or error in a prediction at an ungaged site may be estimated by partitioning the mean square error into the part due to having an imperfect model, γ^2, and the part due to sampling error, MSE_s (Tasker and Stedinger, 1989). The values for the standard error of the model, γ, are calculated in log (base 10) units. The standard error of the model can be transformed from log (base 10) units to percent by the formula:

$$SE_{model}\text{(in percent)} = 00\left[e^{(5.3019\gamma^2)} - 1\right]^{0.5}.$$

The values for SE_{model} (in percent) for each regional equation are shown in table 4. The sampling mean square error, MSE_s, is the mean square error for a site due to estimating the true model parameters from observed flows at gaging stations in a region. The value of MSE_s at a specific site can be estimated as follows: Denote the column vector of n logarithms of observed peak-discharge characteristics at n sites in a region by **Y**. For example,

$$\mathbf{Y}=\begin{bmatrix} \log Q_{50,\,1} \\ \log Q_{50,\,2} \\ \ldots \\ \ldots \\ \log Q_{50,\,n} \end{bmatrix}$$

in which, $Q_{50,i}$ represents the observed 50-year peak at the *i*th gaging station in the region. Further, let **X** represent a (n by p) matrix of p-1 basin characteristics augmented by a column of ones at n gaging stations in a region, and let **B** represent a column vector of p regression coefficients. For example, in the North Region where drainage area, A, was the significant explanatory variable,

$$\mathbf{X}=\begin{bmatrix} 1 & \log(A_1) \\ 1 & \log(A_2) \\ \ldots & \ldots \\ \ldots & \ldots \\ 1 & \log(A_n) \end{bmatrix}$$

$$\text{and } \mathbf{B}=\begin{bmatrix} a \\ b \end{bmatrix}.$$

The linear model can be written in matrix notation as

$$\mathbf{Y}=\mathbf{XB}.$$

The mean square sampling error, MSE_s, for an ungaged site with basin characteristics given by the row vector $x_0 = [1 \log(A_0)]$, for example, is calculated as

$$MSE_s=\mathbf{x}_0\{\mathbf{X}^T\Lambda^{-1}\mathbf{X}\}^{-1}\mathbf{x}_0^T$$

in which Λ is the (n by n) covariance matrix associated with **Y**. The diagonal elements of Λ are model error variance, γ^2, plus the time sampling error for each site i, (i=1,2,3,...n), which is estimated as a function of a regional estimate of the standard deviation of annual peaks at site i, the recurrence interval of the dependent variable, and the number of years of record at site i. The off-diagonal elements of Λ are the sample covariance of the estimated T-year peaks at sites i and j. These off-diagonal elements are estimated as a function of a regional estimate of the standard deviation of annual peaks at sites i and j, the recurrence interval of the dependent variable, and the number of concurrent years of record at sites i and j (Tasker and Stedinger, 1989). The (p by p) matrix $\{\mathbf{X}^T\Lambda^{-1}\mathbf{X}\}^{-1}$ along with values of γ^2 for each equation in table 4 is shown in table A1. The mean square error of a prediction, in square log (base 10) units, at a specific ungaged site can be estimated as

$$MSE_p = \gamma^2 + MSE_s.$$

To estimate the average prediction error for a region, we compute MSE_p for each gage site as if it were an ungaged site: we use its appropriate basin characteristic for $\mathbf{x_0}$ and compute an average for all the gaged sites then take the square root. This result,

APE_{logs}, is in log (base 10) units. The average prediction error, APE, in percent, can be calculated as

$$APE_{percent} = 100\left[e^{(5.3019\overline{MSE_p})} - 1\right]^{0.5}$$

where $\overline{MSE}_p$ is $(ASE_{logs})^2$. The values for $APE_{percent}$ for each equation in each region is shown in Table 4.

Consider the process of estimating error for a particular application of one of the regional equations in Table 4. Taking the example of the 2-year recurrence interval matrix for the North region in table A1,

MSEs =

$$\begin{bmatrix} 1 & \log A_0 \end{bmatrix} \begin{bmatrix} 0.0020084 & -0.00075628 \\ -0.00075628 & 0.00036696 \end{bmatrix} \begin{bmatrix} 1 \\ \log A_0 \end{bmatrix},$$

the resulting estimate of mean square error of prediction is the following scalar function of $\log A_0$:

$$\begin{aligned} MSE_p = {} & 0.013303 + 0.0020084 + \\ & 2(-0.00075628 \log A_0) + \\ & 0.00036696 (\log A_0)^2. \end{aligned}$$

A value of the independent variable, $A_0 = 0.13$ square miles, gives:

$$MSE_p = 0.0169395,$$

which in turn gives,

$$APE_{percent} = 30.7,$$

which differs from the average prediction error of 28.0 percent (from Table 4) by 2.7 percent. This (and every) result falls within the shaded area of Figure 8.

Table A1. Matrix $[\chi^T\Lambda^{-1}\chi]^{-1}$ and values of γ^2 for each flood-estimating equation by region and recurrence interval.

[These matrices and γ^2 can be used to compute the standard error of a prediction, MSE_p, as explained in the text of this appendix. Numbers are given in scientific notation-- for example, 0.20007E-02 = 0.0020007. γ^2 is the model error variance.]

North Region

2-year recurrence interval, γ^2=0.13303E-01

0.20084E-02	-0.75628E-03
-0.75628E-03	0.36696E-03

5-year recurrence interval, γ^2=0.12949E-01

0.22822E-02	-0.84774E-03
-0.84774E-03	0.39985E-03

10-year recurrence interval, γ^2=0.13044E-01

0.26152E-02	-0.96287E-03
-0.96287E-03	0.44526E-03

25-year recurrence interval, γ^2=0.13754E-01

0.31330E-02	-0.11444E-02
-0.11444E-02	0.51998E-03

50-year recurrence interval, γ^2=0.14684E-01

0.35698E-02	-0.12994E-02
-0.12994E-02	0.58562E-03

100-year recurrence interval, γ^2=0.15916E-01

0.40406E-02	-0.14679E-02
-0.14679E-02	0.65835E-03

200-year recurrence interval, γ^2=0.17405E-01

0.45409E-02	-0.16485E-02
-0.16485E-02	0.73731E-03

500-year recurrence interval, γ^2=0.19717E-01

0.52417E-02	-0.19032E-02
-0.19032E-02	0.85011E-03

Table A1. Matrix $[\chi^{T}\Lambda^{-1}\chi]^{-1}$ and values of γ^{2} for each flood-estimating equation by region and recurrence interval - Continued.

[These matrices and γ^{2} can be used to compute the standard error of a prediction, MSE_{p}, as explained in the text of this appendix. Numbers are given in scientific notation-- for example, 0.20007E-02 = 0.0020007. γ^{2} is the model error variance.]

East Region

2-year recurrence interval, γ^{2}=0.25063E-01

0.21930E-02	-0.75555E-03
-0.75555E-03	0.42133E-03

5-year recurrence interval, γ^{2}=0.18821E-01

0.23395E-02	-0.71568E-03
-0.71568E-03	0.38529E-03

10-year recurrence interval, γ^{2}=0.17030E-01

0.26231E-02	-0.75347E-03
-0.75347E-03	0.40120E-03

25-year recurrence interval, γ^{2}=0.16603E-01

0.31091E-02	-0.85245E-03
-0.85245E-03	0.45213E-03

50-year recurrence interval, γ^{2}=0.17269E-01

0.35485E-02	-0.95732E-03
-0.95732E-03	0.50805E-03

100-year recurrence interval, γ^{2}=0.18625E-01

0.40483E-02	-0.10854E-02
-0.10854E-02	0.57726E-03

200-year recurrence interval, γ^{2}=0.20579E-01

0.46052E-02	-0.12345E-02
-0.12345E-02	0.65858E-03

500-year recurrence interval, γ^{2}=0.23954E-01

0.54203E-02	-0.14597E-02
-0.14597E-02	0.78256E-03

Table A1. Matrix $[\chi^{T}\Lambda^{-1}\chi]^{-1}$ and values of γ^{2} for each flood-estimating equation by region and recurrence interval - Continued.

[These matrices and γ^{2} can be used to compute the standard error of a prediction, MSE_{p}, as explained in the text of this appendix. Numbers are given in scientific notation-- for example, 0.20007E-02 = 0.0020007. γ^{2} is the model error variance.]

South Region

2-year recurrence interval, γ^{2}=0.22800E-01

0.20219E-02	-0.66676E-03
-0.66676E-03	0.29941E-03

5-year recurrence interval, γ^{2}=0.19504E-01

0.21813E-02	-0.69687E-03
-0.69687E-03	0.30203E-03

10-year recurrence interval, γ^{2}=0.18839E-01

0.24508E-02	-0.76973E-03
-0.76973E-03	0.32700E-03

25-year recurrence interval, γ^{2}=0.19356E-01

0.28978E-02	-0.89799E-03
-0.89799E-03	0.37538E-03

50-year recurrence interval, γ^{2}=0.20525E-01

0.32851E-02	-0.10126E-02
-0.10126E-02	0.42042E-03

100-year recurrence interval, γ^{2}=0.22225E-01

0.37070E-02	-0.11395E-02
-0.11395E-02	0.47132E-03

200-year recurrence interval, γ^{2}=0.24371E-01

0.41598E-02	-0.12774E-02
-0.12774E-02	0.52740E-03

500-year recurrence interval, γ^{2}=0.27829E-01

0.48005E-02	-0.14747E-02
-0.14747E-02	0.60864E-03