ESTIMATING GENERALIZED SKEW OF THE LOG-PEARSON TYPE III DISTRIBUTION FOR ANNUAL PEAK FLOODS IN ILLINOIS

by Kevin A. Oberg and Dean M. Mades

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Dallas L. Peck, Director

For additional information write to:

District Chief
U.S. Geological Survey
Water Resources Division
102 E. Main St., 4th Floor
Urbana, IL 61801

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FACTORS FOR CONVERTING INCH-POUND TO METRIC (SI) UNITS

Multiply inch-pound unit	By	To obtain metric unit
	Length	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
cubic foot (ft^3)	0.02832	cubic meter (m^3)
	Flow	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)

GLOSSARY

Annual peak discharge. The maximum instantaneous peak discharge in a water year.

Confidence limits. Hypothetical frequency curves which will envelop the population frequency curve with a given degree of confidence.

Discharge. The volume of water, in cubic feet per second, that passes a given point within a given period of time.

Flood frequency. The probability that a given flow is equaled or exceeded in a given year. It is equal to 1 divided by the recurrence interval.

Frequency distribution. Function describing the relative frequency with which events of various magnitudes occur.

Gaging station. A particular site on a stream where a systematic record of gage height and discharge is obtained.

Generalized skew. Skew coefficients derived by a procedure that integrates skew coefficients obtained at many locations.

Mean-square error (MSE). Sum of the squared differences between the station skew and generalized skew divided by the number of observations. It can be also be defined as the bias squared plus the variance of the quantity.

Outlier. Data points of extreme events which depart from the trend of other data points.

Skew coefficient. Numerical measure or index of the lack of symmetry in a frequency distribution. It is a function of the third moment of magnitudes about their mean, which is a measure of asymmetry. Also called coefficient of skewness.

Station skew. Skew coefficient of the logarithms of annual peak discharge values available for the period of record at a streamflow gaging station.

Weighted skew. Skew coefficient computed by combining the generalized skew and station skew in inverse proportion to their individual mean-square errors.

ESTIMATING GENERALIZED SKEW OF THE LOG-PEARSON TYPE III

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ABSTRACT

Several techniques for estimating generalized skew of the log-Pearson Type III distribution in Illinois were evaluated. Station skews (skew coefficients computed from gaging-station records) were used to develop these techniques. Peak-flow records at 730 gaging stations having 10 or more annual peaks were selected for computing station skews. These gaging stations were located in Illinois and parts of Indiana, Iowa, Kentucky, Missouri, and Wisconsin. Station skew values ranged from -3.55 to 2.95, with a mean of -0.11.

Four techniques for estimating generalized skew in Illinois were evaluated: (1) A generalized skew map of the United States, (2) an isoline map, (3) a prediction equation, and (4) a regional-mean skew. A generalized skew map of the United States was developed by the U.S. Water Resources Council (WRC) in 1976. Attempts to develop an isoline map of skew coefficients and a prediction equation relating skew coefficients to basin characteristics were unsuccessful. Three variations of a regional-mean skew technique were developed. However, they are only slightly more accurate than the WRC generalized skew map.

Frequency curves computed for 30 gaging stations in Illinois using the variations of the regional-mean skew technique are similar to frequency curves computed with the WRC skew map. Estimates of the 50-, 100-, and 500-year floods computed for 29 of these gaging stations using the regional-mean skew techniques are within the 50-percent confidence limits of frequency curves computed using the WRC skew map.

Although the three variations of the regional-mean skew technique were slightly more accurate than the WRC map, there is no appreciable difference between flood estimates computed using the variations of the regional-mean technique and flood estimates computed using the WRC skew map.

INTRODUCTION

Accurate estimates of the magnitude and frequency of floods are often required in the planning and design of water-resources projects and in flood-plain management. The Interagency Advisory Committee on Water Data (1982) recommends using the log-Pearson Type III probability distribution to define the frequency of occurrence of annual peak discharges. The log-Pearson

Type III distribution is defined by the mean, standard deviation and skew coefficient of the logarithms of discharge. Estimates of the peak discharge for small exceedance probabilities are sensitive to the value of the skew coefficient.

Estimates of the skew coefficient for a single gaging station are biased and subject to large sampling errors, especially when computed from short periods of streamflow records. The accuracy of skew coefficient estimates may be improved by using information from nearby gaging stations to develop a generalized skew. The U.S. Water Resources Council (WRC) has published a map of generalized skew values for the United States (U.S. Water Resources Council, 1976). The map shows isolines of skew coefficient values and the average skew coefficient for each 1-degree quadrangle of latitude and longitude. With the exception of the southern tip of Illinois, the map shows a generalized skew of -0.4 for most of the State. There is, however, wide variation in average skew coefficients in the 1-degree quadrangles from -1.55 to 0.25.

Station skews used to develop the map were calculated using procedures that are in some cases different than those currently recommended. In particular, the low outlier test used was less stringent than the one currently recommended by the Hydrology Subcommittee of the Interagency Advisory Committee on Water Data (1982). In 1981, the WRC updated and revised the guidelines for flood frequency analysis but did not revise the generalized skew map.

Purpose and Scope

This report describes the results of a study to determine an accurate technique for estimating generalized skew in Illinois and to evaluate the appropriateness of the WRC map of generalized skew in Illinois.

Selection of gaging stations used in this study was based on several criteria. Gaging stations having 10 or more annual peak discharges through water year 1983 were used in this study. Gaging stations on streams where annual peak flow is regulated or affected by diversion were excluded from analysis. Gaging stations from adjacent States were used to minimize "State-line" discontinuities in generalized skew.

Station skews were computed using guidelines published in Bulletin 17B (Hydrology Subcommittee of the Interagency Advisory Committee on Water Data, 1982). A bias correction factor suggested by Tasker and Stedinger (1986) was used to compute an unbiased estimate of station skew.

Four techniques for estimating generalized skew were evaluated: (1) The WRC skew map, (2) an isoline map of skew for the study area, (3) a prediction equation relating skew to basin and climatological characteristics, and (4) the mean station skew for selected regions in the study area.

Methods used to select gaging stations, compute station skews, and estimate generalized skew are described first. Results of station-skew computations and a description of the technique selected to estimate generalized skew are presented next. Flood estimates based on the technique selected and the WRC generalized skew map are compared. The main ideas presented in the report and conclusions based on the study are summarized in a final section.

Previous Work

Hardison (1974) first suggested the use of a map of generalized skew for the United States. In 1976, the WRC revised Hardison's map of generalized skew for the United States and published it in Bulletin 17 (U.S. Water Resources Council, 1976). Skews from this map, instead of the station skews, were to be used in flood frequency analysis for gaging stations having less than 25 annual peaks. The generalized skew was to be weighted with the station skew for gaging stations having between 25 and 100 annual peaks. For gaging stations having 100 or more annual peaks, station skew was to be used. The WRC revised its guidelines in 1981 and adopted a weighting scheme suggested by Tasker (1978). In 1982, the WRC ceased to exist; however, the Hydrology Subcommittee continued its work within the IACWD (Interagency Advisory Committee on Water Data).

District offices of the Corps (U.S. Army Corps of Engineers) have developed several procedures to estimate generalized skew. These procedures were developed for use in their respective Districts and are not for use statewide.

Based on a study completed in 1978, the Chicago District adopted skews of 0.1 and -0.2 for three regions in Illinois (C. A. Dovas, Corps, written commun., 1984). The St. Louis District adopted a mean skew of -0.3 for the portion of that District within Illinois (J. T. Lovelace, Corps, written commun., 1984). The Louisville District uses a mean skew of -0.2 (N. M. Whittle, Corps, written commun., 1984) for the Wabash and Ohio River drainage basins in Illinois. The Rock Island District has completed two studies to estimate generalized skew (G. Johnson, Corps, written commun., 1984). The result of the first study was an isoline map for all of the District north of the Illinois River basin, except along the Mississippi River where a mean skew of -0.1 was recommended. In 1981, the Rock Island District completed a study to estimate generalized skew for the Illinois River basin. Mean skews of -0.3 and -0.2 were adopted for the Illinois and Indiana portions of the river basin, respectively.

Acknowledgments

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METHODS OF STUDY

Gaging-Station Selection

Selection of gaging stations used in this study was based on several criteria. Annual peak discharges for gaging stations in Illinois and portions of Indiana, Iowa, Kentucky, Missouri, and Wisconsin were used in this study. Gaging stations in adjacent States were used in order to minimize "State-line" discontinuities in generalized skew. Gaging stations having 10 or more annual peak discharges that were not significantly affected by regulation or diversion were selected. The unregulated annual peak discharges for stations where streamflow has been both unregulated and regulated for certain periods of time were also used.

Computation of Station Skew

The Pearson Type III frequency distribution with a common-logarithmic transformation of the discharges (log-Pearson Type III distribution) is recommended by the Hydrology Subcommittee of the IACWD (1982) for defining the frequency of occurrence of floods in an annual flood series. The log-Pearson Type III distribution is defined by three parameters--the mean, standard deviation, and skew coefficient--which can be calculated by the method of moments. The mean, $\overline{X}$, is computed from the equation:

$$\overline{X} = \frac{\Sigma X}{n} ; \qquad (1)$$

the standard deviation, S, from the equation:

$$S = \left[\frac{\Sigma (X-\overline{X})^2}{(n-1)}\right]^{1/2} ; \qquad (2)$$

and the skew coefficient, G, from the equation:

$$G = \frac{n \; \Sigma (X-\overline{X})^3}{(n-1)(n-2)S^3} ; \qquad (3)$$

where X = common logarithm of annual peak discharge, and
n = number of annual-peak discharges.

The skew coefficient is a measure of the asymmetry of the frequency distribution. The effect of skew coefficient on frequency curves is shown in figure 1. The log-Pearson Type III frequency distribution is equivalent to a log-normal distribution when the skew coefficient is zero. The discharge corresponding to small exceedance probabilities (less than 0.10) will be larger for a positively skewed distribution and smaller for a negatively skewed distribution when compared to a normal distribution.

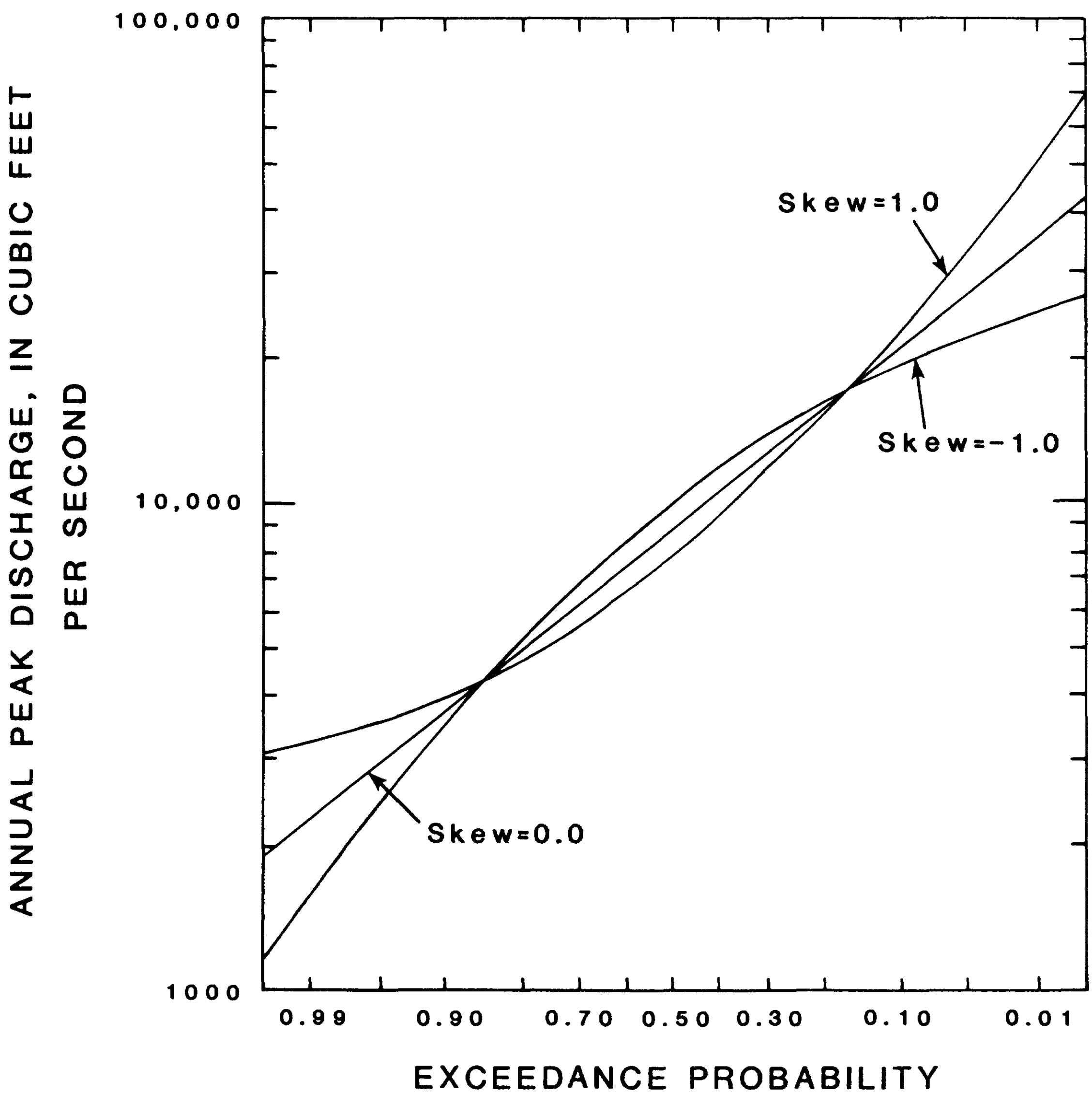

Figure 1.--Effect of skew coefficient on frequency curves computed using the log-Pearson Type III distribution.

Estimates of station skew are sensitive to extremely high and low peak discharges in the annual flood series. Methods used in this study to identify outliers are the same as those described by the Hydrology Subcommittee of the IACWD (1982). High outliers were examined for errors and were compared with peaks at nearby sites. Suspect discharges were eliminated from the annual series and the peak-flow statistics (mean, standard deviation, and skew coefficient) were recalculated. When low outliers were detected, the peak-flow statistics were recomputed without the outlier and a conditional probability adjustment was performed (Hydrology Subcommitte of the IACWD, 1982 p. 18). The peak-flow statistics were also adjusted when historic information indicated that a high outlier or a peak occurring outside the systematic record was the maximum for an extended period of time.

Station skew, G in equation 3, is a biased estimate of the population skew coefficient, g (Wallis and others, 1974, p. 216). A nearly unbiased estimate of the population skew coefficient, G_g, can be obtained by multiplying G times a bias correction factor as shown in equation 4 (Tasker and Stedinger, 1986):

$$G_g = (1 + 6/n) * G . \quad (4)$$

This nearly unbiased estimate of station skew is hereafter referred to as unbiased station skew.

Estimation of Generalized Skew

Use of a generalized skew is desirable because station skew is sensitive to extreme events. Accurate estimates of station skew are also difficult to obtain from gaging stations having short record lengths. Therefore, the Hydrology Subcommittee of the IACWD (1982) recommends using gaging stations having 25 or more annual peak discharges to minimize time-sampling errors. Four techniques for estimating generalized skew in Illinois were evaluated: (1) The WRC skew map, (2) an isoline map of skew for the study area, (3) a prediction equation relating skew to basin and climatological characteristics, and (4) the mean skew of selected regions. The three latter techniques are suggested by the Hydrology Subcommittee of the IACWD (1982, p. 11).

A procedure for performing WLS (weighted least squares) regression was used in conjunction with the three latter techniques for estimating generalized skew. The WLS regression procedure provides better estimates of regression coefficients and a more accurate estimate of the variance of prediction at a site than ordinary least squares regression does (Tasker and Stedinger, 1986). An accurate estimate of the variance of prediction is necessary to properly weight generalized skew and station skew as recommended by the Hydrology Subcommittee of the IACWD (1982). In addition, WLS regression facilitates the use of gaging stations having as few as 10 annual peak discharges, since time-sampling errors for estimates of station skew are accounted for in the regression procedure.

The accuracy of all four techniques was evaluated using a split-sampling approach (Tasker, 1982, p. 967). Split sampling is the reservation of a portion of available data to obtain an independent measure of the accuracy of an estimating technique. It is an effective way to compare different techniques for estimating the same variable. The entire set of gaging stations was split into two sets of approximately equal size, having similar geographic distributions and similar ranges in basin characteristics and station skew values. One set, the estimation set, was used in the application of each technique for estimating generalized skew; the other, the prediction set, was used to compute the MSE (mean-square error) of each technique.

The MSE is a measure of the accuracy of an estimating technique. It is computed by dividing the sum of the squared differences between generalized skew, $\overline{G}$, and station skew, G, by the number of stations in the prediction set, N, as shown in equation 5:

$$MSE = \frac{\Sigma(\overline{G} - G)^2}{N} . \qquad (5)$$

Values for $\overline{G}$ were determined from each of the four techniques for estimating generalized skew.

The most accurate technique--the one with the lowest MSE--was selected for comparison with the WRC skew map. A schematic of the approach used to select the "best" technique is illustrated in figure 2. The methods used to develop each technique for estimating generalized skew are described in the following sections.

The Water Resources Council Skew Map

The map of generalized skew was developed by the WRC (1976) using gaging stations having 25 or more years of nearly homogeneous, unregulated annual peak discharges through water year 1973. Low outliers were identified using equation 5 and figure 14-1 in Bulletin 17 (U.S. Water Resources Council, 1976). Low outliers were not used to compute station skews. No attempt was made to identify high outliers or to use information about historic floods; nor were frequency curves examined in detail.

Average station skews were computed for groups with at least 15 long-term gaging stations in 4 or more 1-degree quadrangles of latitude and longitude. The average station skews were then used to draw the contour lines of generalized skew. Allowance for time-sampling error in the computation of the average station skew was made by drawing contours that were, in some cases, a few tenths different from group averages.

A MSE of 0.302 for the skew map of the United States has been published by the Hydrology Subcommittee of the IACWD (1982, p. 13). However, this MSE is not directly comparable to MSE's of the other techniques used to estimate generalized skew in Illinois. Therefore, a MSE of the WRC skew map was computed for the study area using equation 5.

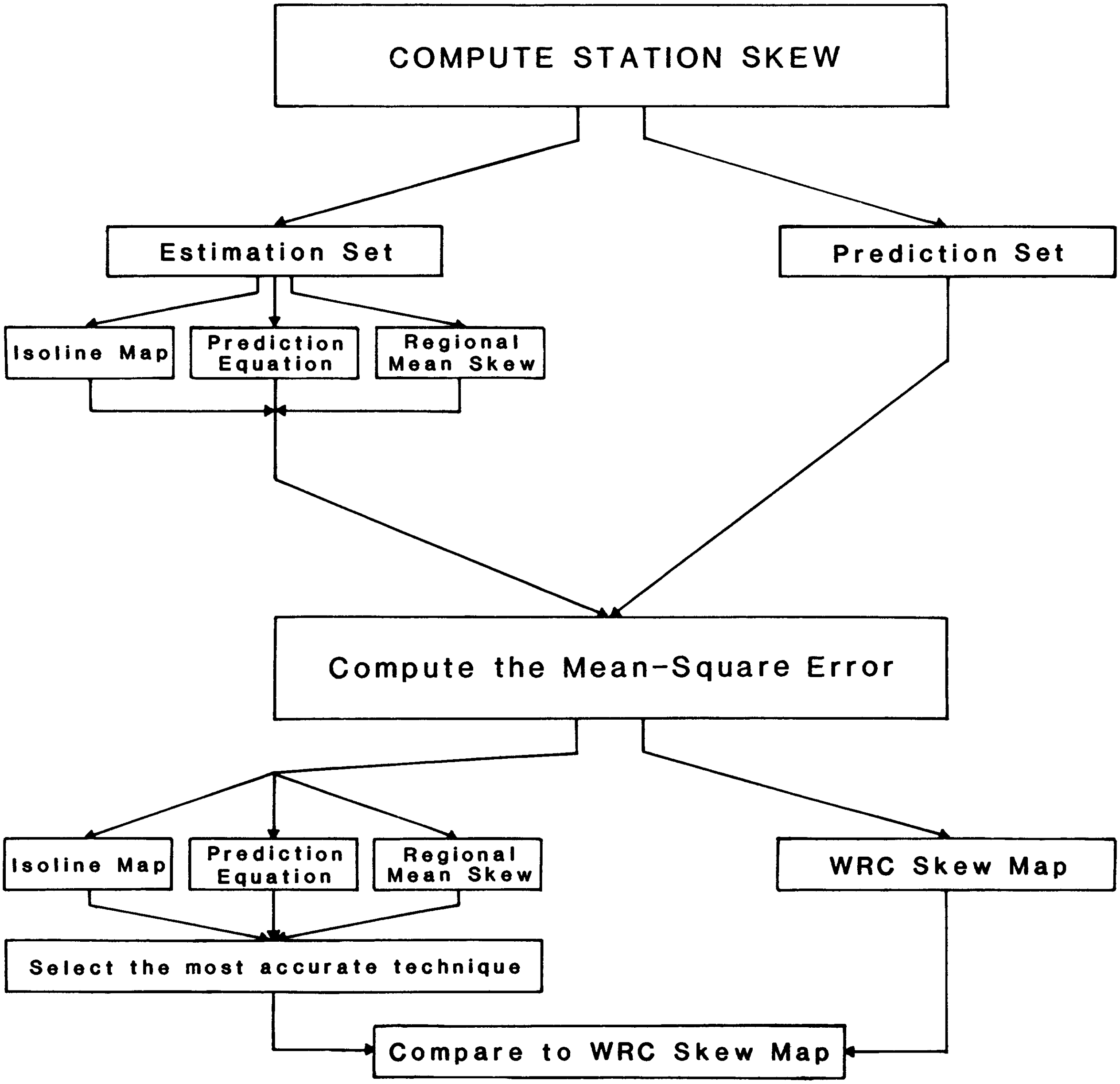

Figure 2.--Approach used to estimate generalized skews and compute mean-square errors. (WRC is U.S. Water Resources Council.)

Isoline Map

The following procedure was used to develop a contour map of generalized skew based on station skews from the estimation set. Station skews were plotted at each gaging station location on a map of the study area. Plotted skew coefficients were examined for areal and topographic trends. Contours of constant skew coefficient values were drawn if a trend was evident. If no trends were evident, the isoline map was not drawn.

Prediction Equation

A prediction equation for estimating generalized skew was developed by performing multiple linear regression analysis to relate station skews to basin and climatological characteristics. The characteristics considered were drainage area, main channel slope, stream length, mean basin elevation, the 2-year 24-hour precipitation intensity, percent of basin having forested cover, and percent of basin in lakes, ponds, and swamps (referred to as percent of basin in storage). Station skew and unbiased station skew were plotted versus each basin and climatological characteristic. Each of the characteristics were also transformed using common logarithms and plotted versus station skew and unbiased station skew. These plots were examined for evidence of correlation between station skew or unbiased station skew and basin or climatological characteristics.

The basin or climatological characteristics most correlated with station skew or unbiased station skew were considered in the regression analysis. Prediction equations relating unbiased station skew to basin and climatological characteristics were developed using WLS regression. The "best" prediction equation selected was the one having (1) the lowest average variance of prediction and (2) regression coefficients not equal to zero at the 0.10 level of significance.

Regional-Mean Skew

A regional-mean skew was determined using the following procedure. The study area was divided into subregions based on hydrologic unit areas (Seaber and others, 1984) and physiography (Fenneman, 1931; Leighton and others, 1948). Subregions were then combined in alternative ways to form larger regions so that the study area was represented by five or fewer regions, each of which was continuous and had at least 20 gaging stations. The mean and the variance of station skews were computed for each region. Weighted-mean skew coefficients were also computed for each region using WLS regression, unbiased station skews, and qualitative variables (Neter and others, 1985, p. 328). The combination of subregions giving the lowest average variance for the study area was selected for comparison with three other techniques for estimating generalized skew.

RESULTS

The results of this study are presented in the following sections. In the first section, the results of gaging-station selection and station-skew computations are presented. In the second section, the split-sampling approach and the results of the four techniques for estimating generalized skew are discussed. In the second section, values of generalized skew and the MSE's associated with each technique are also presented. Frequency curves computed using the WRC map and the regional-mean technique to estimate generalized skew are compared in the third section.

Station Skew

Peak-flow records from gaging stations located in Illinois, western Indiana, southern Wisconsin, eastern Iowa, eastern Missouri, and western Kentucky (plate 1) were evaluated for use in estimating generalized skew. Records of 10 or more annual peak discharges through water year 1983 are available at 898 of these gaging stations. Personnel from U.S. Geological Survey offices in Indiana, Iowa, Kentucky, Missouri, and Wisconsin assisted in examining peak-flow records at each gaging station to determine whether the records were suitable for use in a regional peak-flow study. Peak-flow records at 166 gaging stations were excluded from further analysis because annual peak discharges are significantly affected by regulation or diversion. Records for 730 gaging stations were selected for use in estimating generalized skew. The locations of the gaging stations selected are shown on plate 1. Map index numbers on plate 1 are referenced to U.S. Geological Survey eight-digit downstream-order station-identification numbers given in table 2.

Peak-flow statistics were computed for each gaging station using equations 1, 2, and 3, respectively. Frequency curves defined by these statistics were plotted for each gaging station and examined in detail for any irregularities. Values for each peak-flow statistic are shown in table 2. Station skew values ranged from -3.55 to 2.95, with a mean of -0.11. Unbiased station skews were computed using equation 4; values ranged from -4.47 to 4.22. Table 2 also shows the name, drainage area, and number of annual peaks for each gaging station. The range in the number of annual peaks used to compute station skews was from 10 to 85, with an average of 28.

Techniques for Estimating Generalized Skew

Peak-flow statistics and basin characteristics computed for every gaging station were split into two sets, the estimation and the prediction sets. The estimation set has 364 gaging stations, and the prediction set has 366 gaging stations. One-hundred-sixty-seven gaging stations in the estimation set and 168 gaging stations in the prediction set have 25 or more annual peak discharges.

Data in the estimation set were used to develop three of the four techniques for estimating generalized skew in Illinois. Data in the prediction set were used to determine the accuracies of all four techniques for estimating generalized skew in Illinois (see fig. 2).

Box and whisker plots (Vellman and Hoagland, 1981) in figure 3 show that station skew, unbiased station skew, drainage area, and the number of annual peaks used to compute station skew have similar statistical properties for both sets. The ends of the whiskers represent the range of values, the ends of the boxes represent 25 and 75 percent quartiles and the line in the middle of each box represents the median value. The median value of station skew for each set is almost the same as the median value of unbiased station skew. However, the variance of unbiased station skews is much greater than the variance of station skews. This is shown in figure 3, where the ends of the whiskers and the 25- and 75- percent quartiles are further apart for unbiased station skew than for station skew. The larger variance in unbiased station skew is due to the factor used to correct station skews for bias (see eq. 4).

Four techniques for estimating generalized skew in Illinois were evaluated: (1) The WRC map, (2) an isoline map, (3) a prediction equation, and (4) a regional-mean skew. The map developed by the WRC (U.S. Water Resources Council, 1976) shows isolines of generalized skew for the United States. Generalized skew values for all gaging stations in the estimation set range from -0.40 to -0.22 (fig. 4). The average value of generalized skew for the 367 gaging stations in the estimation set is -0.39. For most of Illinois, the value of generalized skew from the WRC map is a constant -0.4; in the southern one-quarter of the State values of generalized skew begin to increase slightly.

The accuracy of the WRC skew map in the study area was computed using values of station skew (G) and unbiased station skew (C_g). The MSE based on station skews for gaging stations having at least 25 annual peak discharges in the prediction set is 0.24. The MSE based on unbiased station skews (C_g) computed with all gaging stations in the prediction set is 0.63.

The second technique considered was an isoline map. Each station skew value from the estimation set was plotted on a map of the study area at its corresponding gaging station location. Station skew values were then examined for regional trends. No areal or topographic trends in station skew were observed; therefore, no isoline map was drawn. This technique was dropped from further consideration.

The third technique evaluated was a prediction equation relating unbiased station skew to basin and climatological characteristics. Station skews and unbiased station skews are not well correlated with any of the basin and climatological characteristics considered in the study. Plots of station skew and unbiased station skew versus each of the basin and climatological characteristics showed no evidence of a meaningful relation between station skew or unbiased station skew and any of the basin characteristics. Attempts to relate unbiased station skews to basin and climatological characteristics using linear regression analyses were also unsuccessful. This technique was also dropped from further consideration.

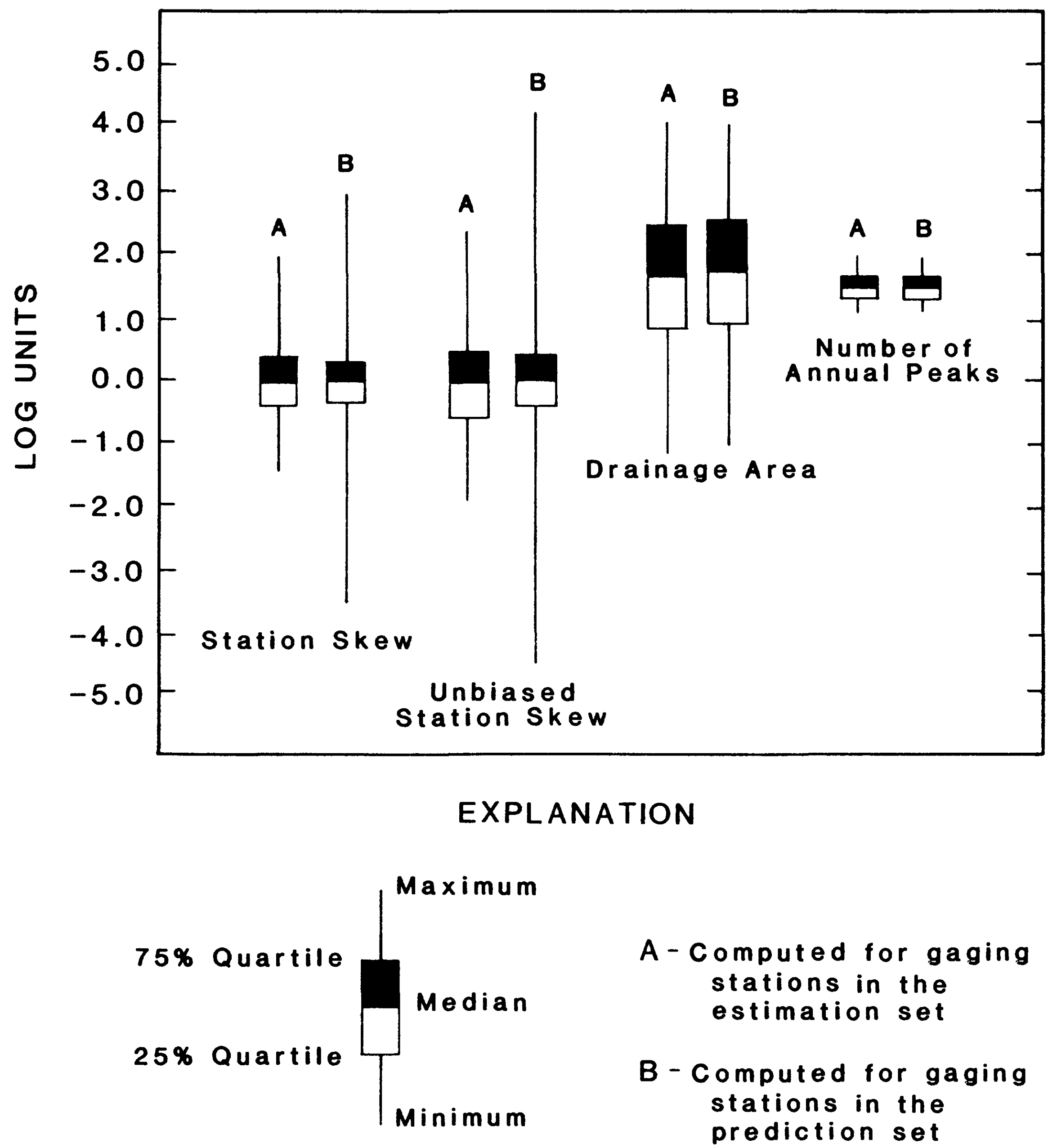

Figure 3.--Schematic plot of selected characteristics in the estimation and prediction sets.

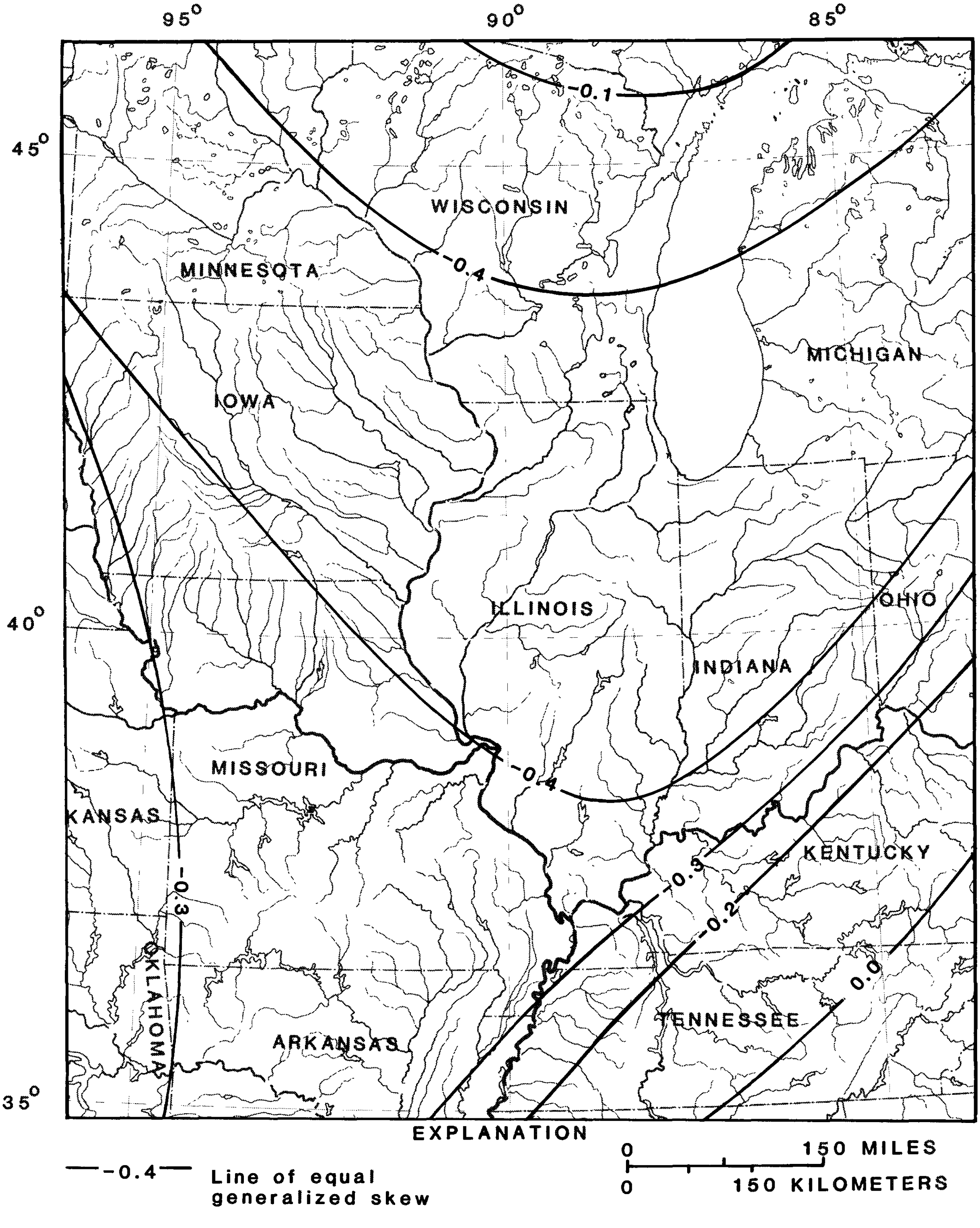

Figure 4.--Water Resources Council isolines of generalized skew. Modified from U.S. Water Resources Council (1976).

The fourth technique considered was the regional-mean skew technique. Three variations of this technique were evaluated by computing generalized skew with the following methods:

1. Mean of unbiased station skews in the estimation set for gaging stations in each of three regions,

2. Mean of unbiased station skews for all stations in the estimation set, and

3. Mean of station skews (not corrected for bias) for all gaging stations having 25 or more annual peaks in the estimation set.

These three variations of the regional-mean skew technique are hereafter referred to as R1, R2, and R3, respectively.

Three regions of generalized skew were defined for R1 (fig. 5) using maps of hydrologic unit areas (Seaber and others, 1984). Region 1 has a value of -0.40 for generalized skew and includes northern Illinois, eastern Iowa, eastern Missouri, southern Wisconsin, and most of the Kaskaskia and Little Wabash River basins in Illinois. Region 2 is composed primarily of the Chicago and Milwaukee metropolitan areas including the Des Plaines River basin. Generalized skew for Region 2 is -0.10. Region 3 has a generalized skew of 0.08. It includes the lower Illinois River basin, most of the Wabash and White River basins in Indiana, western Kentucky, and southern Illinois. Values of generalized skew are weighted means of unbaised station skews in each region. They were computed using the WLS regression procedure with qualitative variables to define the regions. The MSE of generalized skew is 0.60.

The generalized skew and MSE for R2 are based on all unbiased station skews in the estimation and prediction sets, respectively. The generalized skew and MSE for R2 are -0.14 and 0.56, respectively. The value of generalized skew is the mean of unbiased station skews for the entire study area.

The generalized skew and MSE for R3 are based on station skews in the estimation and prediction set, respectively. Generalized skew was computed as the mean of station skews for the entire study area. Only station skews for gaging stations having 25 or more annual peak discharges were used to estimate generalized skew and compute the MSE. The generalized skew for R3 is -0.16; the MSE is 0.20.

Generalized skew and mean-square error values computed for the WRC skew map, R1, R2, and R3 are summarized in table 1. The value of generalized skew for the WRC map shown in table 1 is the mean of WRC map skew values for gaging stations in the estimation set. The MSE's shown for the WRC skew map were computed for comparison purposes only, not for use in flood frequency analysis.

As previously mentioned, unbiased station skews have a greater variance than station skews due to the bias correction factor. The accuracy of techniques developed using unbiased station skews (R1 and R2) is less than the

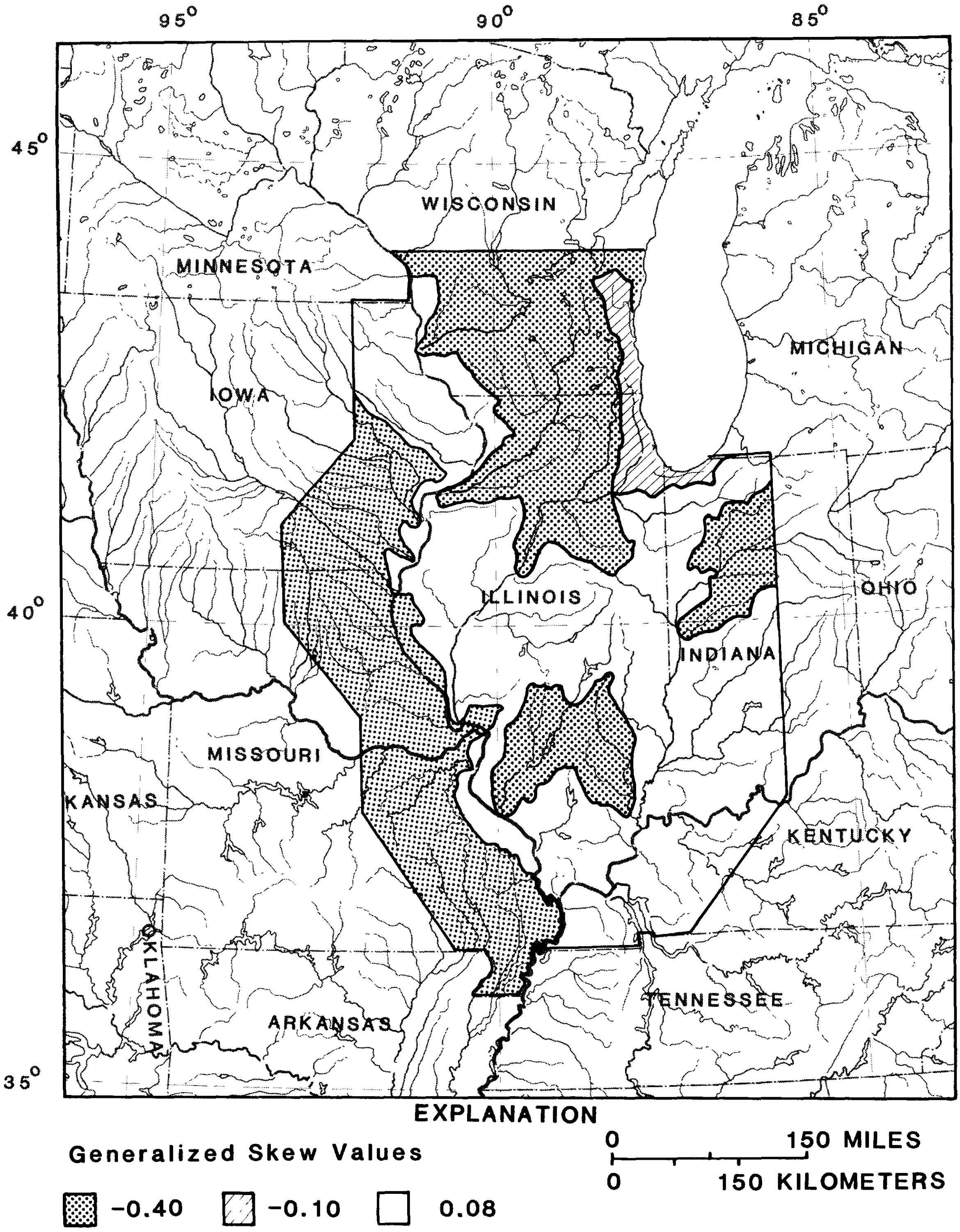

Figure 5.--Regions of generalized skew.

Table 1.--Values of generalized skew and mean-square errors of selected techniques for estimating generalized skew

[Techniques R1, R2, and R3 are described in section "Techniques for Estimating Generalized Skew"]

	Generalized skew(s)	Mean-square error
Techniques based on station skews[1]		
WRC skew map	-0.39	0.24
R3	- .16	.20
Techniques based on unbiased station skews[2]		
WRC skew map	- .39	.63
R2	- .14	.56
R1	- .40 - .10 .08	.60

[1] Values of generalized skew and mean square error based on records from gaging stations with 25 or more annual peak discharges.

[2] Values of generalized skew and mean-square error based on records from gaging stations with 10 or more annual peak discharges.

accuracy of techniques using station skews (WRC skew map and R3). The MSE's computed using unbiased station skew (R1, R2, and WRC skew map) were more than double those computed using station skew (R3 and WRC skew map). This difference in accuracy is also due to the bias correction factor used to compute unbiased station skews. The bias correction factor had little impact on values of generalized skew.

R1, R2, and R3 are only slightly more accurate than estimates of generalized skew obtained from the WRC skew map (table 1). Because differences in accuracy between techniques are small, the best technique for estimating generalized skew is not readily apparent. R3 may, however, be most appropriate for several reasons:

1. Station skews are presently not corrected for bias when doing flood frequency analysis,

2. Gaging stations having 25 or more annual peaks were used to compute the generalized skew, as recommended by the Hydrology Subcommittee of the IACWD (1982, p. 11),

3. R3 is similar to the WRC skew map in that generalized skew from the WRC map is constant for most of the study area, and

4. R3 has the lowest mean square error.

Comparison of Flood Estimates

Based on a comparison of MSE's determined for each generalized skew estimating technique, there is no technique significantly better than the WRC skew map. Flood-frequency curves computed for individual gaging stations using R1, R2, or R3 may, however, be considerably different than flood-frequency curves computed using the WRC skew map. Four flood-frequency curves were computed using (1) the WRC skew map, (2) R1, (3) R2, and (4) R3. In addition, 50-percent confidence limits were computed for the frequency curves determined using the WRC skew map. Procedures for computing confidence limits outlined by the Hydrology Subcommittee of the IACWD (1982, Appendix 9) were followed. The 50-percent confidence limits were computed because they provide a relatively narrow confidence interval for comparing the four frequency curves.

Four frequency curves were computed at each of 30 gaging stations; one frequency curve each for the WRC skew map, R1, R2, and R3. Gaging stations located throughout Illinois, having a range in station skew and drainage area similar to that found in the estimation and prediction sets, were selected. A weighted estimate of skew (Hydrology Subcommittee of the IACWD, 1982, p. 12-13) was used to compute each frequency curve and the 50-percent confidence limits. The weighted skew estimate is computed by weighting station and generalized skew in inverse proportion to their individual mean square errors. Station skews were computed using equation 3. The MSE of station skew was determined using equation 6 in Bulletin 17B (Hydrology Subcommittee of the IACWD, 1982, p. 13). Generalized skew values were determined using the WRC skew map, R1, R2, and R3. The MSE of generalized skew for R1, R2, and R3 was taken from table 1. Generalized skews from the WRC skew map were assigned a MSE of 0.302 (Hydrology Subcommittee of the IACWD, 1982, p. 13).

Peak discharge estimates of the 50-, 100-, and 500-year recurrence interval floods were taken from each frequency curve (table 3). In addition, the 50-percent confidence limits were computed for frequency curves determined using the WRC skew map. The 50-percent confidence limits of the 50-, 100-, and 500-year flood estimates are also shown in table 3.

Peak discharge estimates computed using R1, R2, and R3 to estimate generalized skew are not much different than those computed using the WRC skew map. Only one gaging station (05526500) has peak discharge estimates that are consistently outside the confidence limits for the 50-, 100-, and 500-year peak discharges. The peak discharge estimates that fell outside the 50-percent confidence were computed for gaging station 05526500 using R1. One of the estimates of the 500-year peak discharge for gaging station 05536335 is also outside the 50-percent confidence limits. Frequency curves computed using variations of the regional-mean technique (R1, R2, and R3) are not significantly different from frequency curves computed using the WRC map skews.

SUMMARY AND CONCLUSIONS

Gaging stations having 10 or more annual peak discharges that were not significantly affected by regulation or diversion were considered for use in estimating generalized skew. Gaging stations from adjacent States were used to minimize "State-line" discontinuities in generalized skew. Station skews were computed for each gaging station according to guidelines published by the Hydrology Subcommittee of the Interagency Advisory Committee on Water Data. An unbiased estimate of station skew, referred to as unbiased station skew, was also computed by multiplying station skew by a bias correction factor.

A split-sampling approach was used to evaluate four techniques for estimating generalized skew. All gaging stations were split into two sets of approximately equal size. One set, the estimation set, was used to estimate generalized skew; the other, the prediction set, was used to compute the mean-square error, MSE, of each technique. The most accurate technique--the one with the lowest MSE--was selected for comparison with the WRC (U.S. Water Resources Council) skew map.

The WRC skew map and three other techniques for estimating generalized skew in Illinois were evaluated. The three latter techniques are (1) an isoline map of skew for the study area, (2) a prediction equation relating station skew to basin and climatological characteristics, and (3) the regional-mean skew for selected regions in the study area.

Records for 730 gaging stations were selected for use in estimating generalized skew. Station skew values computed for each gaging station range from -3.55 to 2.95. The mean station skew value is -0.11. Values of unbiased station skew computed using equation 4 range from -4.47 to 4.22. Unbiased station skews have a larger variance than station skews due to the bias correction factor used in computing unbiased station skews.

Skew values and basin characteristics were split into two sets. The estimation set had 364 gaging stations; the prediction set 366 gaging stations. Values of station skew, unbiased station skew, drainage area, and the number of annual peaks have similar statistical properties for both sets.

Four techniques for estimating generalized skew were evaluated; the WRC map and three others. Generalized skews from the WRC map range from -0.40 to -0.22 for gaging stations in the study area. The MSE of the WRC skew map for the study area computed using station skew is 0.24. The MSE based on unbiased station skews is 0.63.

The second and third techniques considered were an isoline map and a prediction equation. No areal trends in station skew were observed; therefore, no isoline map was drawn. Station skews and unbiased station skews are not well correlated with any of the basin characteristics considered in the study. No significant regression models relating skew coefficient values to basin characteristics were found.

The regional-mean skew technique was the fourth technique considered. Three variations of this technique, named R1, R2, and R3, were evaluated. Values of generalized skew and MSE's for the WRC skew map and R1, R2, and R3 were computed. MSE's computed using unbiased station skew were twice as large as those computed using station skew. This difference in accuracy is due to the factor used to correct station skews for bias. R1, R2, and R3 are only slightly more accurate than the WRC skew map. Because of these small differences in accuracy it is not possible to clearly distinguish the "best" technique for estimating generalized skews.

Estimates of the magnitude of the 50-, 100-, and 500-year floods computed using R1, R2, and R3 were compared to flood estimates computed with the WRC skew map. The 50-percent confidence limits for the 50-, 100-, and 500-year floods estimated using the WRC skew map, were also computed. This comparison was made at 30 gaging stations in Illinois to determine if there was any advantage in using R1, R2, or R3 when doing flood frequency analysis. Peak discharges estimated using R2 and R3 are within the 50-percent confidence limits for all gaging stations. Peak discharges estimates using R1 are within the 50-percent confidence limits for 29 of the 30 gaging stations.

As a result of this study the following conclusions are offered:

1. Three variations of the regional-mean technique for estimating generalized skew (R1, R2, and R3) are only slightly more accurate than the WRC skew map.

2. Even though R1, R2, and R3 are more accurate, frequency curves based on R1, R2, and R3 are not significantly different from frequency curves based on the WRC skew map.

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TABLES 2 and 3

Table 2.--Annual peak flow statistics for selected gaging stations in Illinois and adjacent States

Years of record: Number of annual peaks in systematic record. Number in parantheses is the years of historic record used to compute the peak flow statistics.

Peak flow statistics computed with equations 1, 2, and 3:
$\bar{X}$ is the mean of the logarithms of annual peak discharges,
S is the standard deviation of the logarithms of annual peak discharges, and
G is the skew of the logarithms of annual peak discharges.

Map index No.	Station No.	Station name	Drainage area (mi^2)	Years of record	Peak flow statistics $\bar{X}$	S	G
1	03302220	Buck Creek near New Middletown, Ind.	65.2	13	3.67	0.308	-0.334
2	03302500	Indian Creek near Corydon, Ind.	129	40	3.88	.217	.526
3	03302680	West Fork Blue River at Salem, Ind.	19.0	12	3.30	.191	.539
4	03302690	Middle Fork Blue River Tributary near Farabee, Ind.	.07	10	1.23	.290	-.009
5	03302800	Blue River at Fredericksburg, Ind.	283	14	3.94	.106	-.948
6	03303000	Blue River near White Cloud, Ind.	476	58	4.10	.201	-.278
7	03303250	Sigler Creek Tributary at Uniontown, Ind.	.15	11	1.80	.287	.079
8	03303300	Middle Fork Anderson River at Bristow, Ind.	39.8	21(78)	3.22	.286	.804
9	03303400	Crooked Creek at Santa Claus, Ind.	7.86	13	3.02	.319	.694
10	03303440	East Fork Crooked Creek Tributary near Fulda, Ind.	.26	10	1.95	.235	-.975
11	03303900	Little Red Creek Tributary near Heilman, Ind.	.25	10	1.83	.150	.102
12	03317500	North Fork Rough River near Westview, Ky.	42.0	24	3.28	.182	-.431
13	03318000	Rough River near Falls Of Rough, Ky.	454	17	3.91	.198	-1.66
14	03318200	Rock Lick Creek near Glen Dean, Ky.	20.1	22	3.48	.208	.629
15	03318500	Rough River at Falls Of Rough, Ky.	504	10	3.94	.152	-1.34
16	03318800	Caney Creek near Horse Branch, Ky.	124	27	3.73	.168	.207
17	03319000	Rough River near Dundee, Ky.	757	19	3.99	.203	-.828
18	03320000	Green River at Lock 2 at Calhoun, Ky.	7,570	28(60)	4.75	.152	.153
19	03320500	Pond River near Apex, Ky.	194	43	3.84	.258	-.118
20	03321350	South Fork Panther Creek near Whitesville, Ky.	58.2	15	3.42	.114	-.103
21	03322100	Pigeon Creek at Evansville, Ind.	323	22	3.67	.181	.066
22	03327520	Pipe Creek near Bunker Hill, Ind.	159	13	3.32	.153	-.163
23	03327530	Minnow Creek Tributary near Logansport, Ind.	.50	10	1.50	.433	.043
24	03328430	Weesau Creek near Deedsville, Ind.	8.87	13	2.33	.194	.065
25	03328500	Eel River near Logansport, Ind.	789	41	3.88	.147	.450
26	03329400	Rattlesnake Creek near Patton, Ind.	6.83	14	2.25	.266	.143
27	03329700	Deer Creek near Delphi, Ind.	274	40	3.61	.242	.675
28	03329720	Robinson Branch near Delphi, Ind.	5.49	10	2.22	.051	-.656
29	03331500	Tippecanoe River near Ora, Ind.	856	40	3.63	.177	-.193
30	03332300	Little Indian Creek near Royal Center, Ind.	35.0	22	2.49	.124	-.442
31	03332340	Weltzin Ditch Tributary near Francesville, Ind.	.50	11	1.06	.320	1.53
32	03332400	Big Monon Creek near Francesville, Ind.	152	19	3.22	.130	-.608
33	03332780	Big Creek near Wolcott, Ind.	1.35	10	1.96	.316	-.008
34	03333600	Kokomo Creek near Kokomo, Ind.	24.7	23	2.68	.164	.121
35	03333620	Scott Youngman Ditch near Kokomo, Ind.	.86	10	1.68	.312	.127

Table 2.--Annual peak flow statistics for selected gaging stations in Illinois and adjacent States--Continued

Map index No.	Station No.	Station name	Drainage area (mi^2)	Years of record	Peak flow statistics $\bar{X}$	S	G
36	03333700	Wildcat Creek at Kokomo, Ind.	242	27	3.58	0.229	-0.588
37	03334000	Wildcat Creek at Owasco, Ind.	396	38	3.63	.255	-.487
38	03334200	Prairie Creek Tributary near Frankfort, Ind.	2.00	11	2.06	.234	-.903
39	03334500	South Fork Wildcat Creek near Lafayette, Ind.	243	40	3.66	.258	-.227
40	03334900	South Fork Wildcat Creek Tributary near Monitor, Ind.	.10	10	1.42	.373	.268
41	03335000	Wildcat Creek near Lafayette, Ind.	794	28	3.97	.205	-.485
42	03335685	Big Pine Creek Tributary near Pine Village, Ind.	.21	10	1.80	.364	-.169
43	03335690	Mud Pine Creek near Oxford, Ind.	39.4	11	3.17	.213	.290
44	03335700	Big Pine Creek near Williamsport, Ind.	323	26	3.71	.208	-.514
45	03335790	Big Shawnee Creek Tributary near Attica, Ind.	1.00	10	2.02	.184	.797
46	03336100	Big Four Ditch Tributary near Paxton, Ill.	1.05	25	2.04	.255	-.671
47	03336500	Bluegrass Creek at Potomac, Ill.	35.0	33	3.26	.238	-.206
48	03336900	Salt Fork near St. Joseph, Ill.	134	25	3.39	.211	.401
49	03337500	Saline Branch at Urbana, Ill.	68.0	23	3.02	.278	-.337
50	03338000	Salt Fork near Homer, Ill.	340	38	3.57	.230	-.351
51	03338100	Salt Fork Tributary near Catlin, Ill.	2.20	22	2.24	.386	-1.18
52	03338500	Vermilion River near Catlin, Ill.	958	19	3.92	.279	.182
53	03338800	North Fork Vermilion River Tributary near Danville, Ill.	1.31	21	2.46	.319	.297
54	03339108	East Fork Coal Creek near Hillsboro, Ind.	33.4	13	3.20	.126	.172
55	03339230	Woods Ditch near Frankfort, Ind.	1.11	11	1.92	.449	-.624
56	03339500	Sugar Creek at Crawfordsville, Ind.	509	43(69)	3.98	.250	-.364
57	03340000	Sugar Creek near Byron, Ind.	670	31	4.12	.224	-.809
58	03340800	Big Raccoon Creek near Fincastle, Ind.	139	25(107)	3.65	.294	-.143
59	03341000	Big Raccoon Creek at Mansfield, Ind.	248	19	3.84	.296	.717
60	03341200	Little Raccoon Creek near Catlin, Ind.	134	15(97)	3.75	.331	-.023
61	03341700	Big Creek Tributary near Dudley, Ill.	1.08	15	2.26	.242	.673
62	03341900	Raccoon Creek Tributary near Annapolis, Ill.	.04	25	1.24	.307	-.482
63	03342150	West Fork Busseron Creek near Hymera, Ind.	14.4	15	3.06	.150	-.004
64	03342180	Kettle Creek Tributary near Shelburn, Ind.	.48	10	2.15	.320	.087
65	03343400	Embarras River near Camargo, Ill.	186	23	3.45	.250	-1.04
66	03344000	Embarras River near Diona, Ill.	919	19	3.93	.212	.133
67	03344250	Embarras River Tributary near Greenup, Ill.	.08	25	1.36	.262	.042
68	03344425	Muddy Creek Tributary at Woodbury, Ill.	.07	18	1.37	.386	.171
69	03344500	Range Creek near Casey, Ill.	7.61	33	2.95	.313	.231
70	03345500	Embarras River at Ste. Marie, Ill.	1,516	72	4.13	.274	-.109
71	03346000	North Fork Embarras River near Oblong, Ill.	318	43	3.83	.313	-.334
72	03346650	River Deshee Tributary near Frichton, Ind.	.82	10	2.11	.192	-.090
73	03349000	White River at Noblesville Ind.	858	36	4.00	.205	-.023
74	03349700	Little Cicero Creek near Arcadia, Ind.	40.4	26	3.00	.277	-.258
75	03350100	Hinkle Creek near Cicero, Ind.	18.5	26	3.10	.294	-.109

Table 2.--Annual peak flow statistics for selected gaging stations in Illinois and adjacent States--Continued

Map index No.	Station No.	Station name	Drainage area (mi²)	Years of record	Peak flow statistics X̄	S	G
76	03351000	White River near Nora, Ind.	1,219	53(154)	4.09	0.256	-0.500
77	03351310	Crooked Creek at Indianapolis, Ind.	17.9	13	3.06	.303	1.08
78	03352000	Lawrence Creek at Fort Benjamin Harrison, Ind.	2.74	17(57)	2.69	.256	-.067
79	03352200	Mud Creek at Indianapolis, Ind.	42.4	24	2.88	.210	-.219
80	03352400	Blue Creek near Castleton, Ind.	.95	10	1.76	.114	-.193
81	03353000	White River at Indianapolis, Ind.	1,635	74	4.25	.239	-.452
82	03353120	Pleasant Run at Arlington Ave at Indianapolis, Ind.	7.58	23	2.98	.195	.291
83	03353160	Pleasant Run at Brookville Road at Indianapolis, Ind.	10.1	21	3.08	.184	.058
84	03353180	Bean Creek at Indianapolis, Ind.	4.40	12	2.54	.197	.010
85	03353200	Eagle Creek at Zionsville, Ind.	103	25	3.63	.246	-.910
86	03353600	Little Eagle Creek at Speedway, Ind.	23.9	17	3.02	.170	-.375
87	03353620	Lick Creek at Indianapolis, Ind.	15.6	12	2.99	.255	-.008
88	03353668	White Lick Creek Tributary near Brownsburg, Ind.	.31	11	1.71	.254	-.704
89	03353700	West Fork White Lick Creek at Danville, Ind.	28.8	26	3.22	.234	.447
90	03353800	White Lick Creek near Mooresville, Ind.	212	27(40)	3.89	.206	-.119
91	03354500	Beanblossom Creek at Beanblossom, Ind.	14.6	31	3.20	.286	-.021
92	03355000	Bear Creek near Trevlac, Ind.	6.94	26	2.74	.318	-.042
93	03356780	Limestone Creek Tributary near Gosport, Ind.	.72	10	2.08	.215	.193
94	03357350	Plum Creek near Bainbridge, Ind.	3.00	13	2.50	.216	-.049
95	03357500	Big Walnut Creek near Reelsville, Ind.	326	33	3.91	.272	-.319
96	03358000	Mill Creek near Cataract, Ind.	245	32	3.72	.196	-.048
97	03359500	Deer Creek near Putnamville, Ind.	59.0	16	3.74	.191	-.179
98	03360100	Clear Branch at Cory, Ind.	.27	10	1.72	.194	-.113
99	03360400	Doans Creek Tributary near Doans, Ind.	.20	11	1.86	.270	.200
100	03360850	Veales Creek Tributary at Washington, Ind.	.27	10	2.08	.299	.136
101	03361890	Gilmore Creek near Bargersville, Ind.	.71	10	1.96	.255	.596
102	03362000	Youngs Creek near Edinburgh, Ind.	107	40	3.52	.280	-.162
103	03371500	East Fork White River near Bedford, Ind.	3,861	43(136)	4.55	.223	-.507
104	03371600	South Fork Salt Creek at Kurtz, Ind.	38.2	11	3.58	.143	-.011
105	03371650	North Fork Salt Creek at Nashville, Ind.	76.1	20	3.64	.147	-.228
106	03372000	North Fork Salt Creek near Belmont, Ind.	120	26	3.76	.251	-.363
107	03372300	Stephens Creek near Bloomington, Ind.	10.9	12	3.03	.334	1.02
108	03372680	Clear Creek Tributary near Bloomington, Ind.	.38	10	1.82	.348	-.294
109	03372700	Clear Creek near Harrodsburg, Ind.	55.2	12	3.67	.196	.237
110	03373200	Indian Creek near Springville, Ind.	60.7	20	3.56	.191	-.626
111	03373240	Spring Creek Tributary near Springville, Ind.	.54	10	1.80	.456	-.132
112	03373500	East Fork White River at Shoals, Ind.	4,927	78(136)	4.56	.203	-.092
113	03373680	French Lick Creek Tributary near French Lick, Ind.	.30	11	1.98	.324	-.912
114	03373700	Lost River near West Baden Springs, Ind.	287	20	3.66	.234	.353
115	03373850	Slate Creek Tributary near Haysville, Ind.	.14	10	1.79	.204	.554

Table 2.--Annual peak flow statistics for selected gaging stations in Illinois and adjacent States--Continued

Map index No.	Station No.	Station name	Drainage area (mi^2)	Years of record	Peak flow statistics $\overline{X}$	S	G
116	03374455	Patoka River near Hardinsburg, Ind.	12.8	14	3.24	0.224	2.95
117	03375800	Hall Creek near St. Anthony, Ind.	21.8	13(70)	3.35	.195	.486
118	03376230	Shiloh Drain near Jasper, Ind.	.57	10	2.29	.129	.717
119	03376260	Flat Creek near Otwell, Ind.	21.3	18	3.04	.071	1.19
120	03376300	Patoka River at Winslow, Ind.	603	11(14)	3.73	.232	.893
121	03376340	Patoka River Tributary near Glezen, Ind.	.84	11	2.12	.254	.358
122	03376600	Patoka River Tributary near Patoka, Ind.	.40	10	1.95	.276	-.853
123	03378000	Bonpas Creek at Browns, Ill.	228	43	3.46	.168	.244
124	03378550	Big Creek near Wadesville, Ind.	104	17	3.60	.143	.557
125	03378635	Little Wabash River near Effingham, Ill.	240	17	3.71	.163	.261
126	03378650	Second Creek Tributary at Keptown, Ill.	1.62	17	2.36	.269	.338
127	03378900	Little Wabash River at Louisville, Ill.	745	18	4.02	.223	-.180
128	03378980	Little Wabash River Tributary at Clay City, Ill.	.43	22	2.09	.344	-.606
129	03379500	Little Wabash River below Clay City, Ill.	1,131	69	4.09	.296	-.054
130	03379650	Madden Creek near West Salem, Ill.	1.62	21	2.62	.242	.562
131	03380300	Dums Creek Tributary near Iuka, Ill.	.08	25	1.62	.239	-.116
132	03380350	Skillet Fork near Iuka, Ill.	208	18	3.68	.320	-.267
133	03380400	Horse Creek Tributary near Cartter, Ill.	1.13	12	2.34	.263	.228
134	03380450	White Feather Creek near Marlow, Ill.	.43	25	2.12	.228	-.272
135	03380475	Horse Creek near Keenes, Ill.	97.2	23	3.55	.200	-.670
136	03380500	Skillet Fork at Wayne City, Ill.	464	66	3.90	.292	-.093
137	03381500	Little Wabash River at Carmi, Ill.	3,102	44	4.15	.211	.281
138	03381600	Little Wabash River Tributary near New Haven, Ill.	.16	17	1.95	.295	.314
139	03382025	Little Saline Creek Tributary near Goreville, Ill.	.52	22	2.43	.139	.130
140	03382100	South Fork Saline River near Carrier Mills, Ill.	147	18	3.46	.160	-.116
141	03382170	Brushy Creek near Harco, Ill.	13.3	14	3.06	.161	.819
142	03382510	Eagle Creek near Equality, Ill.	8.51	16	2.71	.075	-.644
143	03382520	Black Branch Tributary near Junction, Ill.	1.10	13	2.18	.353	.172
144	03383000	Tradewater River at Olney, Ky.	255	43	3.58	.200	.147
145	03384000	Rose Creek at Nebo, Ky.	2.10	30	2.76	.192	-.500
146	03384450	Lusk Creek near Eddyville, Ill.	42.9	16	3.74	.187	.069
147	03385000	Hayes Creek at Glendale, Ill.	19.1	34	3.34	.241	-.104
148	03385500	Lake Glendale Inlet near Dixon Springs, Ill.	1.05	26	2.75	.261	-.433
149	03437500	South Fork Little River at Hopkinsville, Ky.	46.5	32	3.44	.238	.415
150	03438000	Little River near Cadiz, Ky.	244	44	3.83	.205	.404
151	03438070	Muddy Fork Little River near Cerulean, Ky.	30.5	15	3.56	.126	1.20
152	03610000	Clarks River at Murray, Ky.	89.7	31	3.79	.298	.499
153	03610500	Clarks River near Benton, Ky.	227	44	3.99	.282	-.119
154	03610545	West Fork Clarks River near Brewers, Ky.	68.7	15	3.70	.213	-.693
155	03611260	Massac Creek near Paducah, Ky.	14.6	12	3.28	.219	-.517

Table 2.--Annual peak flow statistics for selected gaging stations in Illinois and adjacent States--Continued

Map index No.	Station No.	Station name	Drainage area (mi^2)	Years of record	Peak flow statistics $\bar{X}$	S	G
156	03612200	Q Ditch Tributary near Choat, Ill.	0.27	21	2.13	0.260	0.182
157	03614000	Hess Bayou Tributary near Mound City, Ill.	1.95	14	2.66	.142	.371
158	04073500	Fox River at Berlin, Wis.	1,340	85	3.53	.172	-.289
159	04083000	West Branch Fond Du Lac River at Fond Du Lac, Wis.	83.1	16	2.85	.239	-1.34
160	04083400	East Branch Fond Du Lac River Tributary near Eden, Wis.	.99	21	1.74	.285	-.460
161	04083500	East Branch Fond Du Lac River at Fond Du Lac, Wis.	78.4	16	2.92	.314	-1.40
162	04085700	Sheboygan River Tributary near Plymouth, Wis.	6.51	21	2.05	.252	.248
163	04086000	Sheboygan River at Sheboygan, Wis.	418	40	3.48	.281	-.945
164	04086150	Milwaukee River at Kewaskum, Wis.	138	14	2.95	.250	.331
165	04086200	East Branch Milwaukee River near New Fane, Wis.	54.1	13	2.32	.264	.162
166	04086340	North Branch Milwaukee River near Fillmore, Wis.	148	13	2.88	.301	-.128
167	04086360	Milwaukee River at Waubeka, Wis.	432	14	3.31	.283	-.410
168	04086400	Milwaukee River Tributary near Fredonia, Wis.	.82	19	1.70	.371	-.820
169	04086500	Cedar Creek near Cedarburg, Wis.	120	48	2.96	.367	-.111
170	04087000	Milwaukee River at Milwaukee, Wis.	696	69	3.67	.212	-.015
171	04087050	Little Menomonee River near Freistadt, Wis.	8.00	25	2.23	.231	-.471
172	04087100	Honey Creek at Milwaukee, Wis.	3.26	24	2.44	.195	.164
173	04087120	Menomonee River at Wauwatosa, Wis.	123	22	3.52	.270	.187
174	04087200	Oak Creek near South Milwaukee, Wis.	13.8	25	2.39	.319	.163
175	04087204	Oak Creek at South Milwaukee, Wis.	25.0	20	2.78	.130	.232
176	04087220	Root River near Franklin, Wis.	49.2	21	3.12	.251	.700
177	04087230	West Branch Root River Canal Tributary near North Cape, Wis.	3.99	21	1.86	.204	-.929
178	04087233	Root River Canal near Franklin, Wis.	57.0	20	2.81	.182	.049
179	04087240	Root River at Racine, Wis.	190	20	3.29	.203	.051
180	04087250	Pike Creek near Kenosha, Wis.	7.25	23	1.87	.282	-.045
181	04087300	Lake Michigan Tributary at Winthrop Harbor, Ill.	1.50	17	1.91	.308	.608
182	04087400	Kellogg Ravine at Zion, Ill.	5.04	15	2.37	.289	.651
183	04093000	Deep River at Lake George Outlet at Hobart, Ind.	124	36	3.15	.243	-.161
184	04093500	Burns Ditch at Gary, Ind.	160	39	3.16	.197	-.139
185	04094000	Little Calumet River at Porter, Ind.	66.2	38	3.02	.236	-.155
186	04094500	Salt Creek near Mccool, Ind.	74.6	38	2.98	.244	-.090
187	04095250	East Branch Trail Creek Tributary near Springville, Ind.	.17	10	1.38	.151	-.808
188	04095300	Trail Creek at Michigan City, Ind.	54.1	13	3.02	.280	-.052
189	04096100	Galena River near Laporte, Ind.	17.2	13	2.43	.239	-.105
190	05382300	Beaver Creek Tributary near Sparta, Wis.	1.72	22	2.10	.175	.402
191	05382500	Little La Crosse River near Leon, Wis.	77.1	47	2.99	.283	-.173
192	05383000	La Crosse River near West Salem, Wis.	398	58	3.39	.230	-.032
193	05386300	Morman Creek near La Crosse, Wis.	25.5	22	2.73	.699	-.451
194	05387100	North Fork Bad Axe River near Genoa, Wis.	80.8	23	3.07	.282	-.627
195	05387500	Upper Iowa River at Decorah, Iowa	511	32(70)	3.79	.290	-.429

Table 2.--Annual peak flow statistics for selected gaging stations in Illinois and adjacent States--Continued

Map index No.	Station No.	Station name	Drainage area (mi^2)	Years of record	Peak flow statistics		
					$\bar{X}$	S	G
196	05388000	Upper Iowa River near Decorah, Iowa	568	30	3.91	0.219	-0.015
197	05388400	Wexford Creek near Harpers Ferry, Iowa	11.9	30	2.85	.535	-.086
198	05388460	Du Charme Creek at Eastman, Wis.	.30	21	1.84	.336	.337
199	05388500	Paint Creek at Waterville, Iowa	42.8	21	3.32	.209	-.457
200	05388600	Paint Creek near Waterville, Iowa	56.0	31	3.34	.304	.665
201	05389000	Yellow River at Ion, Iowa	221	17	3.89	.240	-.035
202	05403500	Lemonweir River at New Lisbon, Wis.	507	39	3.43	.248	-.895
203	05403520	Webster Cre[illegible] at New Lisbon, Wis.	11.8	22	2.22	.320	-1.08
204	05403550	Onemile Creek near Mauston, Wis.	30.2	25	2.71	.348	-.296
205	05403700	Dell Creek near Lake Delton, Wis.	44.9	23	2.55	.292	.136
206	05404200	Narrows Creek at Loganville, Wis.	40.1	25	3.23	.246	-.902
207	05405000	Baraboo River near Baraboo, Wis.	609	50	3.46	.241	-.592
208	05405600	Rowan Creek at Poynette, Wis.	10.4	22	2.40	.436	.139
209	05406500	Black Earth Creek at Black Earth, Wis.	45.6	30	2.66	.274	-.200
210	05406800	Rocky Branch near Richland Center, Wis.	1.68	23	2.16	.416	.471
211	05407100	Richland Creek near Plugtown, Wis.	19.2	25	2.84	.382	.153
212	05407200	Crooked Creek near Boscobel, Wis.	12.9	24	2.68	.369	-.173
213	05407400	Morris Creek Tributary near Norwalk, Wis.	4.59	20	2.54	.351	-.804
214	05408000	Kickapoo River at Lafare, Wis.	266	45	3.46	.270	.310
215	05408500	Knapp Creek near Bloomingdale, Wis.	8.44	15	2.72	.376	.185
216	05409830	North Fork Nederlo Creek near Gays Mills, Wis.	2.21	12	1.79	.388	1.42
217	05409890	Nederlo Creek near Gays Mills, Wis.	9.46	13	2.52	.602	.972
218	05410000	Kickapoo River at Gays Mills, Wis.	617	35	3.48	.275	.012
219	05410500	Kickapoo River at Steuben, Wis.	690	50	3.49	.303	.273
220	05411600	Turkey River at Spillville, Iowa	177	24	3.42	.342	-.747
221	05412000	Turkey River at Elkader, Iowa	891	10	4.06	.212	-.202
222	05412500	Turkey River at Garber, Iowa	1,545	64(93)	4.19	.160	-.374
223	05413400	Pigeon Creek near Lancaster, Wis.	6.93	23	2.68	.406	.271
224	05413500	Grant River at Burton, Wis.	269	49	3.81	.344	-.493
225	05414000	Platte River near Rockville, Wis.	142	48(107)	3.66	.307	-.045
226	05414200	Bear Branch near Platteville, Wis.	2.72	25	2.60	.309	-.269
227	05414350	Little Maquoketa River near Graf, Iowa	39.6	31	3.38	.247	.251
228	05414400	Middle Fork Little Maquoketa River near Rickardsville, Iowa	30.2	28	3.09	.409	1.42
229	05414450	North Fork Little Maquoketa River near Rickardsville, Iowa	21.6	31	3.13	.293	.695
230	05414600	Little Maquoketa River Tributary at Dubuque, Iowa	1.54	28	2.47	.329	.037
231	05414820	Sinsinawa River near Menominee, Ill.	39.6	16	3.52	.320	.294
232	05414900	Pats Creek near Elk Grove, Wis.	8.50	22	2.69	.375	1.51
233	05415000	Galena River at Buncombe, Wis.	125	44	3.70	.242	.812
234	05415500	East Fork Galena River at Council Hill, Ill.	20.1	30	3.30	.382	.342
235	05417000	Maquoketa River near Manchester, Iowa	305	52	3.66	.281	-.188
236	05417700	Bear Creek near Monmouth, Iowa	61.3	19	3.21	.302	-.299
237	05418500	Maquoketa River near Maquoketa, Iowa	1,553	70	4.18	.235	-.235
238	05418750	South Fork Apple River near Nora, Ill.	1.93	20	2.29	.311	-.605
239	05418800	Mill Creek Tributary near Scales Mound, Ill.	.86	20	2.39	.287	-.177
240	05419000	Apple River near Hanover, Ill.	247	49	3.72	.206	.000

Table 2.--Annual peak flow statistics for selected gaging stations in Illinois and adjacent States--Continued

Map index No.	Station No.	Station name	Drainage area (mi^2)	Years of record	Peak flow statistics $\bar{X}$	S	G
241	05420000	Plum River below Carroll Creek near Savanna, Ill.	230	37	3.54	0.275	-0.070
242	05421000	Wapsipinocon River at Independence, Iowa	1,048	50	3.80	.338	-.609
243	05421100	Pine Creek Tributary near Winthrop, Iowa	.33	31	1.91	.376	-.202
244	05421200	Pine Creek near Winthrop, Iowa	28.3	33	3.13	.429	1.46
245	05421300	Pine Creek Tributary No. 2 at Winthrop, Iowa	.70	29	1.83	.644	-.413
246	05421400	Wapsipinicon River at Central City, Iowa	1,263	10	3.98	.177	.438
247	05421500	Wapsipinicon River at Stone City, Iowa	1,324	11	3.88	.142	-.441
248	05421550	Buffalo Creek above Winthrop, Iowa	68.2	29	3.17	.458	.634
249	05421600	Buffalo Creek near Winthrop, Iowa	71.4	19	3.22	.501	.539
250	05422000	Wapsipinicon River near De Witt, Iowa	2,330	49	3.98	.244	-.147
251	05423000	West Branch Rock River near Waupun, Wis.	40.7	33	2.46	.421	-.818
252	05423300	South Branch Rock River Tributary near Waupun, Wis.	12.6	22	2.17	.474	-.645
253	05423500	South Rock River at Waupen, Wis.	63.6	21	2.60	.414	-.710
254	05423800	East Branch Rock River Tributary near Slinger, Wis.	4.42	23	2.17	.170	.473
255	05424000	East Branch Rock River near Mayville, Wis.	181	21	3.00	.324	-.292
256	05424300	Rock River Tributary near Watertown, Wis.	4.58	22	2.00	.335	-1.10
257	05425500	Rock River at Watertown, Wis.	969	45	3.27	.235	-.377
258	05425700	Robbins Creek near Columbus, Wis.	8.01	20	2.09	.337	-1.45
259	05426000	Crawfish River at Milford, Wis.	762	52	3.33	.219	-.544
260	05426100	Scuppernong Creek near Wales, Wis.	8.39	19	1.99	.139	.506
261	05427000	Whitewater Creek at Willis Ray Road near Whitewater, Wis.	22.8	13	2.26	.264	.388
262	05427200	Allen Creek near Fort Atkinson, Wis.	10.2	25	2.04	.219	.407
263	05427800	Token Creek near Madison, Wis.	24.3	21	2.33	.327	-.273
264	05430100	Badfish Creek near Stoughton, Wis.	41.3	10	2.64	.217	-.681
265	05430500	Rock River at Afton, Wis.	3,340	69	3.80	.187	-.388
266	05431500	Turtle Creek near Clinton, Wis.	202	42	3.30	.369	-.187
267	05432300	Rock Branch near Mineral Point, Wis.	4.83	24	2.51	.281	.404
268	05432500	Pecatonica River at Darlington, Wis.	273	44	3.56	.305	.457
269	05433000	East Branch Pecatonica River near Blanchardville, Wis.	221	43	3.40	.335	-.104
270	05433500	Yellowstone River near Blanchardville, Wis.	28.5	27	3.12	.244	-2.14
271	05434200	Skinner Creek Tributary near Monroe, Wis.	.48	22	1.50	.323	-.520
272	05434500	Pecatonica River at Martintown, Wis.	1,034	44	3.74	.241	-.035
273	05435000	Cedar Creek near Winslow, Ill.	1.31	25	1.98	.572	-.470
274	05435500	Pecatonica River at Freeport, Ill.	1,326	70	3.76	.248	.051
275	05435650	Lost Creek Tributary near Shannon, Ill.	1.95	16	2.45	.183	.004
276	05435900	Sugar River Tributary near Pine Bluff, Wis.	7.42	22	2.19	.296	-.169
277	05436000	Mount Vernon Creek near Mount Vernon, Wis.	16.4	16	2.44	.309	.140
278	05436200	Gill Creek near Brooklyn, Wis.	3.33	22	1.99	.205	.007
279	05436500	Sugar River near Brodhead, Wis.	523	69	3.54	.325	-.247
280	05436900	Otter Creek Tributary near Durand, Ill.	.55	20	1.71	.335	.258

Table 2.--Annual peak flow statistics for selected gaging stations in Illinois and adjacent States--Continued

Map index No.	Station No.	Station name	Drainage area (mi^2)	Years of record	Peak flow statistics $\bar{X}$	S	G
281	05437000	Pecatonica River at Shirland, Ill.	2,550	32	3.91	0.208	-0.345
282	05437200	East Fork Raccoon Creek Tributary near Beloit, Wis.	4.64	25	2.10	.445	-.302
283	05437500	Rock River at Rockton, Ill.	6,363	54	4.16	.198	-.363
284	05437600	Rock River Tributary near Rockton, Ill.	2.21	16	2.13	.331	-.859
285	05437950	Kishwaukee River near Huntley, Ill.	14.4	14	2.10	.120	-.612
286	05438250	Coon Creek at Riley, Ill.	85.1	22	3.04	.381	-.974
287	05438300	Lawrence Creek Tributary near Harvard, Ill.	.84	20	1.88	.277	-.178
288	05438390	Piscasaw Creek below Mokeler Creek near Capron, Ill.	88.1	10	3.25	.181	.520
289	05438500	Kishwaukee River at Belvidere, Ill.	538	44	3.55	.314	-.277
290	05438850	Middle Branch of South Branch Kishwaukee River near Malta, Ill.	1.67	25	2.15	.255	-.298
291	05439500	South Branch Kishwaukee River near Fairdale, Ill.	387	44	3.56	.261	-.867
292	05439550	South Branch Kishwaukee River Tributary near Irene, Ill.	1.71	18	1.88	.469	-.279
293	05440000	Kishwaukee River near Perryville, Ill.	1,099	44	3.83	.292	-.562
294	05440500	Killbuck Creek near Monroe Center, Ill.	117	41	3.34	.346	-1.04
295	05440650	Stillman Creek Tributary near Holcomb, Ill.	1.00	18	1.89	.307	-.049
296	05440900	Leaf River Tributary near Forreston, Ill.	.15	23	1.74	.322	.455
297	05441000	Leaf River at Leaf River, Ill.	103	43	3.42	.350	-.587
298	05441500	Rock River at Oregon, Ill.	8,205	10	4.33	.224	.338
299	05442000	Kyte River near Flagg Center, Ill.	116	12	3.10	.170	.321
300	05443500	Rock River at Como, Ill.	8,753	68	4.37	.216	-.677
301	05444000	Elkhorn Creek near Penrose, Ill.	146	44	3.47	.229	-.724
302	05444100	Spring Creek Tributary near Coleta, Ill.	1.42	14	2.42	.309	-.383
303	05446000	Rock Creek at Morrison, Ill.	164	38	3.32	.183	.154
304	05446500	Rock River near Joslin, Ill.	9,549	44	4.34	.212	-.397
305	05446950	Green River Tributary near Amboy, Ill.	.53	16	1.94	.424	.495
306	05447000	Green River at Amboy, Ill.	201	42	3.43	.245	-.916
307	05447050	Green River Tributary No. 2 near Ohio, Ill.	4.95	14	2.16	.246	.328
308	05447200	Normandy Ditch at Normandy, Ill.	5.23	16	1.65	.242	-.510
309	05447350	Mud Creek Tributary near Atkinson, Ill.	1.22	16	2.28	.277	.909
310	05447500	Green River near Geneseo, Ill.	1,003	48	3.75	.197	-.771
311	05448000	Mill Creek at Milan, Ill.	62.4	44	3.42	.336	-.433
312	05448050	Sand Creek near Milan, Ill.	.22	25	1.55	.418	.181
313	05453000	Big Bear Creek at Ladora, Iowa	189	38	3.64	.200	-.753
314	05453100	Iowa River near Marengo, Iowa	2794	27	4.11	.233	-.528
315	05453600	Rapid Creek below Morse, Iowa	8.12	33	2.74	.400	-.146
316	05453700	Rapid Creek Tributary No. 4 near Oasis, Iowa	1.95	24	2.22	.447	-.265
317	05453750	Rapid Creek Southwest Of Morse, Iowa	15.2	32	3.00	.374	-.472
318	05453850	Rapid Creek Tributary No. 3 near Oasis, Iowa	1.62	31	2.53	.308	.158
319	05453900	Rapid Creek Tributary near Oasis, Iowa	.97	33	2.33	.432	-1.26
320	05453950	Rapid Creek Tributary near Iowa City, Iowa	3.43	33	2.63	.385	-.436

Table 2.--Annual peak flow statistics for selected gaging stations in Illinois and adjacent States--Continued

Map index No.	Station No.	Station name	Drainage area (mi^2)	Years of record	Peak flow statistics $\bar{X}$	S	G
321	05454000	Rapid Creek near Iowa City, Iowa	25.3	46	3.17	0.403	-0.705
322	05454300	Clear Creek near Coralville, Iowa	98.1	31	3.27	.363	.040
323	05455000	Ralston Creek at Iowa City, Iowa	3.01	58	2.57	.364	-.338
324	05455100	Old Mans Creek near Iowa City, Iowa	201	33	3.40	.346	.197
325	05455300	South English River near Barnes City, Iowa	11.5	31	2.72	.336	.030
326	05455500	English River at Kalona, Iowa	573	44	3.77	.296	-.213
327	05455550	Bulgers Run near Riverside, Iowa	6.31	18	3.22	.148	-.161
328	05464500	Cedar River at Cedar Rapids, Iowa	6,510	81	4.36	.290	-.566
329	05464640	Prairie Creek at Fairfax, Iowa	178	16	3.48	.267	-.297
330	05465000	Cedar River near Conesville, Iowa	7,785	44	4.40	.286	-.646
331	05465150	North Fork Long Creek at Ainsworth, Iowa	30.2	19	2.90	.244	.760
332	05466000	Edwards River near Orion, Ill.	155	43	3.50	.207	-.928
333	05466500	Edwards River near New Boston, Ill.	445	49	3.59	.249	-.374
334	05467000	Pope Creek near Keithsburg, Ill.	174	49	3.35	.246	-.147
335	05467500	Henderson Creek near Little York, Ill.	151	40	3.36	.256	-.015
336	05468000	North Henderson Creek near Seaton, Ill.	67.1	11	3.03	.149	-.791
337	05468500	Cedar Creek at Little York, Ill.	130	42	3.34	.355	-.189
338	05469000	Henderson Creek near Oquawka, Ill.	432	49	3.69	.267	.454
339	05469500	South Henderson Creek at Biggsville, Ill.	82.9	42	3.26	.297	.813
340	05469750	Ellison Creek Tributary near Roseville, Ill.	.26	25	1.71	.299	-.545
341	05472500	North Skunk River near Sigourney, Iowa	730	39	3.75	.347	-.529
342	05473000	Skunk River at Coppock, Iowa	2,916	37(69)	4.09	.282	-.246
343	05473500	Big Creek near Mount Pleasant, Iowa	106	24	3.28	.358	-.270
344	05474000	Skunk River at Augusta, Iowa	4,303	69	4.30	.222	-.511
345	05491000	Sugar Creek near Keokuk, Iowa	105	23	3.47	.251	-.298
346	05494500	Fox River at Cantril, Iowa	161	11	3.80	.188	.925
347	05495000	Fox River at Wayland, Mo.	400	61	3.79	.289	-.135
348	05495100	Big Branch Tributary near Wayland, Mo.	.70	26	2.08	.443	-.152
349	05495200	Little Creek near Breckenridge, Ill.	1.45	24	2.57	.347	-.377
350	05495500	Bear Creek near Marcelline, Ill.	349	40	3.92	.265	-.479
351	05495600	South Wyaconda River near West Grove, Iowa	4.69	20	2.74	.464	-.270
352	05496000	Wyaconda River above Canton, Mo.	393	57	3.73	.256	.053
353	05496900	Homan Creek Tributary near Quincy, Ill.	.50	21	2.37	.345	-.585
354	05497000	North Fabius River at Monticello, Mo.	452	62	3.89	.212	-.406
355	05497500	Middle Fabius River near Baring, Mo.	185	49	3.64	.275	-.633
356	05497700	Bridge Creek Branch near Baring, Mo.	2.38	25	2.55	.261	-.156
357	05498000	Middle Fabius River near Monticello, Mo.	393	38	3.76	.229	.000
358	05498500	North Fabius River at Taylor, Mo.	930	12	3.99	.320	-.414
359	05500000	South Fabius River near Taylor, Mo.	620	49	3.88	.212	-.135
360	05500500	North River at Bethel, Mo.	58.0	44	3.25	.337	-.261
361	05501000	North River at Palmyra, Mo.	373	49	4.01	.282	.043
362	05501200	Nichols Branch near Palmyra, Mo.	2.54	18	2.63	.327	.450
363	05501500	Burton Creek Tributary near Burton, Ill.	.32	15	2.19	.406	-.238
364	05502020	Hadley Creek near Barry, Ill.	40.9	28	3.65	.224	-.590
365	05502040	Hadley Creek at Kinderhook, Ill.	72.7	44	3.78	.276	-.572

Table 2.--Annual peak flow statistics for selected gaging stations in Illinois and adjacent States--Continued

Map index No.	Station No.	Station name	Drainage area (mi²)	Years of record	Peak flow statistics X	S	G
366	05502120	Kiser Creek Tributary near Barry, Ill.	0.78	25	2.56	0.285	0.105
367	05502500	Salt River near Shelbina, Mo.	481	42	3.80	.238	-.176
368	05502700	Easdale Branch near Shelbyville, Mo.	.71	22	2.52	.251	-.326
369	05503000	Oak Dale Branch near Emden, Mo.	2.64	25	2.82	.199	-.171
370	05503500	Salt River near Hunnewell, Mo.	626	14	3.87	.284	-.658
371	05504700	Bean Creek near Mexico, Mo.	3.02	20	2.80	.333	.363
372	05505000	South Fork Salt River at Santa Fe, Mo.	298	37	3.83	.227	-1.18
373	05506000	Youngs Creek near Mexico, Mo.	67.4	43	3.40	.296	-.550
374	05506800	Elk Fork Salt River near Madison, Mo.	200	14(112)	3.88	.273	-.197
375	05507000	Elk Fork Salt River near Paris, Mo.	262	26(83)	3.85	.225	-.139
376	05507500	Salt River near Monroe City, Mo.	2,230	41	4.44	.247	-.041
377	05508000	Salt River near New London, Mo.	2,480	62	4.44	.220	.142
378	05512500	Bay Creek at Pittsfield, Ill.	39.4	44	3.64	.339	-.695
379	05513000	Bay Creek at Nebo, Ill.	161	44	3.82	.306	-.546
380	05513200	Salt Spring Creek near Gilead, Ill.	1.20	24	2.44	.320	.307
381	05513600	Camp Creek near Elsberry, Mo.	1.50	26	2.57	.353	.219
382	05513650	Hurricane Creek near Elsberry, Mo.	3.06	25	2.88	.382	-.917
383	05513700	Mams Slough Creek near Wellsville, Mo.	5.08	22	2.86	.285	-.558
384	05514200	Reid Branch near Bowling Green, Mo.	.54	23	2.38	.279	-.227
385	05514500	Cuivre River near Troy, Mo.	903	60	4.39	.259	.014
386	05515000	Kankakee River near North Liberty, Ind.	174	33	2.72	.119	-.510
387	05515500	Kankakee River at Davis, Ind.	537	56	3.08	.088	-.376
388	05516000	Yellow River near Bremen, Ind.	135	27	3.07	.127	1.91
389	05516150	Walt Kimble Ditch near Lapaz, Ind.	1.50	10	1.88	.426	.174
390	05516500	Yellow River at Plymouth, Ind.	294	35	3.33	.144	.948
391	05517000	Yellow River at Knox, Ind.	435	40	3.37	.156	-.030
392	05517400	West Arm Payne Ditch near North Judson, Ind.	2.58	10	1.70	.366	.692
393	05517500	Kankakee River at Dunns Bridge, Ind.	1,352	35	3.56	.095	.076
394	05517780	Sievers Creek Tributary near Valparaiso, Ind.	.39	11	1.68	.217	-.523
395	05517890	Cobbs Ditch near Kouts, Ind.	31.7	16	2.66	.212	-.407
396	05518000	Kankakee River at Shelby, Ind.	1,779	61	3.62	.108	-.363
397	05519500	West Creek near Schneider, Ind.	54.7	23	2.97	.201	-.446
398	05520500	Kankakee River at Momence, Ill.	2,294	69	3.80	.157	-.417
399	05521000	Iroquois River at Rosebud, Ind.	35.6	33	2.39	.135	-.150
400	05522000	Iroquois River near North Marion, Ind.	144	35	2.97	.156	-.050
401	05522500	Iroquois River at Rensselaer, Ind.	203	35	3.11	.134	-.488
402	05523000	Bice Ditch near South Marion, Ind.	21.8	34	2.71	.165	-.264
403	05523500	Slough Creek near Collegeville, Ind.	83.7	33	3.07	.198	-.485
404	05524000	Carpenter Creek at Egypt, Ind.	44.8	33	3.01	.233	.242
405	05524300	Yeoman Ditch Tributary near Rensselaer, Ind.	.57	10	1.98	.301	-.366
406	05524500	Iroquois River near Foresman, Ind.	449	35	3.43	.165	-.389
407	05525000	Iroquois River at Iroquois, Ill.	686	39	3.56	.187	.006
408	05525050	Eastburn Hollow near Sheldon, Ill.	10.2	17	2.38	.400	.444
409	05525500	Sugar Creek at Milford, Ill.	446	35	3.79	.275	-.012
410	05526000	Iroquois River near Chebanse, Ill.	2,091	60	4.08	.194	-.266

Table 2.--Annual peak flow statistics for selected gaging stations in Illinois and adjacent States--Continued

Map index No.	Station No.	Station name	Drainage area (mi^2)	Years of record	Peak flow statistics $\bar{X}$	S	G
411	05526150	Kankakee River Tributary near Bourbonnais, Ill.	0.19	25	1.50	0.484	0.067
412	05526500	Terry Creek near Custer Park, Ill.	12.1	26	2.22	.306	1.75
413	05527050	Prairie Creek near Frankfort, Ill.	.80	16	1.90	.213	-.220
414	05527500	Kankakee River near Wilmington, Ill.	5,150	69	4.35	.221	-.134
415	05527800	Des Plaines River at Russell, Ill.	123	23	2.78	.383	-.544
416	05527840	Des Plaines River at Wadsworth, Ill.	145	15	2.86	.371	-1.13
417	05527870	Mill Creek at Wedges Corner, Ill.	18.2	15	1.88	.227	-.508
418	05527900	North Mill Creek at Hickory Corners, Ill.	21.4	16	2.31	.206	.107
419	05527950	Mill Creek at Old Mill Creek, Ill.	60.9	15	2.64	.306	-1.10
420	05528000	Des Plaines River near Gurnee, Ill.	232	37	3.12	.211	-.304
421	05528150	Indian Creek at Diamond Lake, Ill.	10.6	17	2.43	.338	-.440
422	05528200	Hawthorn Drainage Ditch near Mundelein, Ill.	5.88	16	2.32	.216	.409
423	05528230	Indian Creek at Prairie View, Ill.	35.7	14	2.68	.261	-.145
424	05528360	Aptakisic Creek at Aptakisic, Ill.	2.85	16	2.03	.297	.014
425	05528400	Des Plaines River at Wheeling, Ill.	325	11	3.22	.235	-1.08
426	05528440	Buffalo Creek near Lake Zurich, Ill.	1.03	16	1.90	.254	.060
427	05528470	Buffalo Creek at Long Grove, Ill.	7.88	16	2.34	.265	-.626
428	05528500	Buffalo Creek near Wheeling, Ill.	19.6	31	2.53	.275	-.939
429	05529000	Des Plaines River near Des Plaines, Ill.	360	43	3.30	.219	-.804
430	05529300	McDonald Creek near Wheeling, Ill.	4.58	19	2.20	.297	-.533
431	05529500	McDonald Creek near Mount Prospect, Ill.	7.93	31	2.25	.367	-.481
432	05529900	Weller Creek at Mount Prospect, Ill.	9.02	18	2.68	.253	.059
433	05530000	Weller Creek at Des Plaines, Ill.	13.2	33	2.80	.242	-.440
434	05530400	Higgins Creek near Mount Prospect, Ill.	2.24	19	2.13	.313	-.088
435	05530480	Willow Creek at Orchard Place, Ill.	18.1	19	2.74	.331	-.077
436	05530600	Des Plaines River at River Grove, Ill.	451	18	3.40	.155	-.806
437	05530700	Silver Creek at Melrose Park, Ill.	11.2	20	2.64	.121	-.076
438	05530800	Des Plaines River at Forest Park, Ill.	475	23	3.42	.164	-.874
439	05530940	Salt Creek at Palatine, Ill.	6.26	19	2.31	.181	.942
440	05530960	Salt Creek near Palatine, Ill.	16.0	19	2.47	.232	.067
441	05531000	Salt Creek near Arlington Heights, Ill.	32.1	26	2.64	.238	-.321
442	05531050	Salt Creek near Wood Dale, Ill.	53.6	19	2.82	.219	.332
443	05531080	Spring Brook at Bloomingdale, Ill.	5.63	19	2.25	.197	.869
444	05531100	Meacham Creek at Medinah, Ill.	3.94	19	1.79	.227	1.01
445	05531130	Spring Brook at Walnut Avenue at Itasca, Ill.	14.2	18	2.39	.196	.474
446	05531200	Salt Creek at Addison, Ill.	83.7	17	2.92	.164	.723
447	05531300	Salt Creek at Elmhurst, Ill.	91.2	21	2.98	.151	.648
448	05531380	Salt Creek at Oak Brook, Ill.	101	17	2.99	.141	-.160
449	05531500	Salt Creek at Western Springs, Ill.	115	38	3.05	.151	-.390
450	05531800	Addison Creek at Northlake, Ill.	6.79	19	2.48	.105	-.613
451	05532000	Addison Creek at Bellwood, Ill.	17.9	32	2.64	.166	-.554
452	05532500	Des Plaines River at Riverside, Ill.	630	70	3.57	.163	-.499
453	05533000	Flag Creek near Willow Springs, Ill.	16.5	24	2.86	.271	.223
454	05533200	Sawmill Creek Tributary near Tiedtville, Ill.	2.33	18	2.36	.104	-.598
455	05533300	Wards Creek near Woodridge, Ill.	3.21	15	1.89	.193	-.498

Table 2.--Annual peak flow statistics for selected gaging stations in Illinois and adjacent States--Continued

Map index No.	Station No.	Station name	Drainage area (mi^2)	Years of record	Peak flow statistics		
					$\overline{X}$	S	G
456	05533400	Sawmill Creek near Lemont, Ill.	13.0	19	2.73	0.266	-1.10
457	05533500	Des Plaines River at Lemont, Ill.	684	30	3.48	.168	-.662
458	05534300	North Branch Chicago River at Lake Forest, Ill.	10.8	16	2.27	.172	-.555
459	05534400	North Branch Chicago River at Bannockburn, Ill.	15.8	17	2.38	.148	-.785
460	05534500	North Branch Chicago River at Deerfield, Ill.	19.7	31	2.44	.204	-.359
461	05534600	North Branch Chicago River at Northfield, Ill.	23.8	20	2.53	.126	-.488
462	05534900	Skokie River at Lake Bluff, Ill.	8.17	15	2.29	.236	-.440
463	05535000	Skokie River at Lake Forest, Ill.	13.0	32	2.31	.199	-.609
464	05535070	Skokie River near Highland Park, Ill.	21.1	17	2.62	.125	.488
465	05535150	Skokie River at Northfield, Ill.	29.1	19	2.57	.092	.029
466	05535200	North Branch Chicago River at Glenview, Ill.	60.5	18	2.84	.120	.354
467	05535300	West Fork of North Branch Chicago River at Bannockburn, Ill.	2.55	16	2.31	.167	-.158
468	05535400	West Fork of North Branch Chicago River at Deerfield, Ill.	6.50	16	2.56	.118	-.193
469	05535500	West Fork of North Branch Chicago River at Northbrook, Ill.	11.5	31	2.65	.207	-.554
470	05535700	West Fork of North Branch Chicago River at Glenview, Ill.	21.6	18	2.79	.159	-.320
471	05535800	North Branch Chicago River at Morton Grove, Ill.	92.2	20	3.01	.137	.267
472	05536000	North Branch Chicago River at Niles, Ill.	100	33	3.04	.137	-.020
473	05536178	Plum Creek near Dyer, Ind.	34.8	12	3.03	.217	-.957
474	05536190	Hart Ditch at Munster, Ind.	70.7	41	3.11	.181	-.121
475	05536195	Little Calumet River at Munster, Ind.	90.0	24	2.87	.127	.048
476	05536201	Thorn Creek at Park Forest, Ill.	6.28	17	2.49	.321	.471
477	05536207	Thorn Creek Tributary at Chicago Heights, Ill.	3.87	16	2.43	.264	.834
478	05536210	Thorn Creek near Chicago Heights, Ill.	17.2	15	2.99	.191	.271
479	05536215	Thorn Creek at Glenwood, Ill.	24.7	34	3.03	.201	.395
480	05536235	Deer Creek near Chicago Heights, Ill.	23.1	36	2.71	.182	-.453
481	05536238	Butterfield Creek near Lincoln Estates, Ill.	1.77	19	2.14	.338	-.171
482	05536255	Butterfield Creek at Flossmoor, Ill.	23.5	35	2.81	.281	.320
483	05536265	Lansing Ditch near Lansing, Ill.	8.84	36	2.28	.235	-.666
484	05536270	North Creek near Lansing, Ill.	16.8	32	2.54	.198	-.284
485	05536275	Thorn Creek at Thornton, Ill.	104	37	3.30	.204	-.144
486	05536290	Little Calumet River at South Holland, Ill.	208	37	3.39	.163	-.335
487	05536310	Calumet Union Drainage Canal near Markham, Ill.	12.6	16	2.47	.146	-.447
488	05536325	Little Calumet River at Harvey, Ill.	252	17	3.28	.222	-.462
489	05536335	Midlothian Creek near Tinley Park, Ill.	9.13	25	2.35	.143	.873
490	05536340	Midlothian Creek at Oak Forest, Ill.	12.6	33	2.40	.171	.554
491	05536460	Tinley Creek near Oak Forest, Ill.	7.95	19	2.62	.220	-.006
492	05536500	Tinley Creek near Palos Park, Ill.	11.2	32	2.73	.282	.110
493	05536510	Navajo Creek at Palos Heights, Ill.	1.69	19	2.37	.148	.413
494	05536560	Melvina Ditch near Oak Lawn, Ill.	5.58	19	2.13	.277	-.218
495	05536570	Stony Creek (West) at Worth, Ill.	18.0	16	2.60	.292	-.233

Table 2.--Annual peak flow statistics for selected gaging stations in Illinois and adjacent States--Continued

Map index No.	Station No.	Station name	Drainage area (mi^2)	Years of record	Peak flow statistics $\bar{X}$	S	G
496	05536620	Mill Creek near Palos Park, Ill.	6.39	17	2.07	0.230	-0.256
497	05536630	Mill Creek at Palos Park, Ill.	10.8	19	2.29	.330	.200
498	05537500	Long Run near Lemont, Ill.	20.9	33	2.76	.317	.281
499	05538440	Spring Creek near Orland Park, Ill.	1.59	17	1.59	.183	-.482
500	05539000	Hickory Creek at Joliet, Ill.	107	42	3.47	.294	.812
501	05539870	West Branch Du Page River at Ontarioville, Ill.	10.1	19	2.47	.264	-.735
502	05539890	West Branch Du Page River at Wayne, Ill.	23.9	19	2.66	.226	-.101
503	05539900	West Branch Du Page River near West Chicago, Ill.	28.5	23	2.64	.203	-.489
504	05539950	Klein Creek at Carol Stream, Ill.	8.81	19	2.28	.242	1.39
505	05540030	West Branch Du Page River at West Chicago, Ill.	60.2	19	2.84	.185	-.202
506	05540060	Kress Creek at West Chicago, Ill.	18.1	20	2.42	.183	.233
507	05540080	Spring Brook at Wheaton, Ill.	2.10	19	2.19	.186	1.06
508	05540095	West Branch Du Page River near Warrenville, Ill.	90.4	15	3.04	.179	.014
509	05540110	Ferry Creek at Warrenville, Ill.	4.27	19	1.94	.202	.482
510	05540140	East Branch Du Page River near Bloomingdale, Ill.	2.47	19	1.75	.302	-.307
511	05540150	East Branch Du Page River at Glen Ellyn, Ill.	13.6	18	2.37	.270	-.236
512	05540160	East Branch Du Page River near Downers Grove, Ill.	26.6	15	2.74	.235	.087
513	05540190	St. Joseph Creek at Belmont, Ill.	8.80	17	2.52	.224	-.417
514	05540240	Prentiss Creek near Lisle, Ill.	6.48	20	2.28	.234	.710
515	05540500	Du Page River at Shorewood, Ill.	324	43	3.56	.242	.023
516	05541750	Mazon River Tributary near Gardner, Ill.	4.52	22	2.01	.178	-1.03
517	05542000	Mazon River near Coal City, Ill.	455	44	3.88	.277	-1.04
518	05543830	Fox River at Waukesha, Wis.	126	19(32)	2.96	.213	-.077
519	05544300	Mukwonago River Tributary near Mukwonago, Wis.	1.27	21	1.44	.304	-.738
520	05545100	Sugar Creek at Elkhorn, Wis.	6.63	21	2.12	.310	.695
521	05545200	White River Tributary near Burlington, Wis.	2.42	25	1.98	.255	.357
522	05545300	White River near Burlington, Wis.	110	24	2.90	.254	-.057
523	05546500	Fox River at Wilmot, Wis.	868	44	3.42	.203	.105
524	05548150	North Branch Nippersink Creek near Genoa City, Wis.	13.6	21	2.22	.163	-.500
525	05548280	Nippersink Creek near Spring Grove, Ill.	192	18	3.10	.322	-.486
526	05549000	Boone Creek near McHenry, Ill.	15.5	34	2.09	.254	-.599
527	05549700	Mutton Creek at Island Lake, Ill.	10.8	15	1.85	.339	.097
528	05549850	Flint Creek near Fox River Grove, Ill.	37.0	16	2.40	.114	.965
529	05549900	Fox River Tributary near Cary, Ill.	.07	23	1.03	.450	-.415
530	05550000	Fox River at Algonquin, Ill.	1,403	68	3.49	.183	-.287
531	05550300	Tyler Creek at Elgin, Ill.	38.9	17	2.52	.104	-.390
532	05550430	East Branch Poplar Creek near Palatine, Ill.	2.63	17	1.94	.192	.985
533	05550450	Poplar Creek near Ontarioville, Ill.	16.7	17	2.32	.172	.001
534	05550470	Poplar Creek Tributary near Bartlett, Ill.	4.55	19	2.22	.219	.544
535	05550500	Poplar Creek at Elgin, Ill.	35.2	32	2.56	.208	-.024

Table 2.--Annual peak flow statistics for selected gaging stations in Illinois and adjacent States--Continued

Map index No.	Station No.	Station name	Drainage area (mi^2)	Years of record	Peak flow statistics X	S	G
536	05551030	Brewster Creek at Valley View, Ill.	14.0	17	2.35	0.307	-0.306
537	05551050	Norton Creek near Wayne, Ill.	7.35	18	1.95	.334	.586
538	05551060	Norton Creek near St. Charles, Ill.	11.5	18	2.10	.308	1.05
539	05551200	Ferson Creek near St. Charles, Ill.	51.7	23	2.92	.298	-.978
540	05551500	Fox River at Aurora, Ill.	1,705	10	3.74	.176	.186
541	05551520	Indian Creek near North Aurora, Ill.	5.21	19	2.11	.263	-.084
542	05551530	Indian Creek at Aurora, Ill.	16.7	19	2.71	.127	-.645
543	05551620	Blackberry Creek near Kaneville, Ill.	21.6	17	2.63	.115	-.147
544	05551650	Lake Run Tributary near Batavia, Ill.	2.11	16	1.70	.432	.602
545	05551700	Blackberry Creek near Yorkville, Ill.	70.2	23	2.80	.287	-.547
546	05551800	Fox River Tributary No. 2 near Fox, Ill.	.45	19	1.80	.486	-.120
547	05551900	East Branch Big Rock Creek near Big Rock, Ill.	32.6	15	2.80	.210	.174
548	05551930	Welch Creek near Big Rock, Ill.	22.1	16	2.49	.197	-.197
549	05552500	Fox River at Dayton, Ill.	2,642	68	4.07	.229	-.110
550	05554000	North Fork Vermilion River near Charlotte, Ill.	186	41	3.32	.253	-.588
551	05554500	Vermilion River at Pontiac, Ill.	579	41	3.70	.239	-.242
552	05554600	Mud Creek Tributary near Odell, Ill.	.16	18	1.66	.350	-.719
553	05555000	Vermilion River at Streator, Ill.	1,084	15	3.88	.252	-.380
554	05555300	Vermilion River near Leonore, Ill.	1,251	53	4.04	.276	-.347
555	05555400	Vermilion River Tributary at Lowell, Ill.	.14	21	1.41	.505	.498
556	05555775	Vermilion Creek Tributary at Meriden, Ill.	.36	13	1.63	.265	-.360
557	05556500	Big Bureau Creek at Princeton, Ill.	196	47	3.58	.330	-.981
558	05557000	West Bureau Creek at Wyanet, Ill.	86.7	46	3.43	.317	-.041
559	05557100	West Bureau Creek Tributary near Wyanet, Ill.	.33	22	1.90	.354	.036
560	05557500	East Bureau Creek near Bureau, Ill.	99.0	47	3.34	.298	-.395
561	05558000	Big Bureau Creek at Bureau, Ill.	485	11	3.90	.205	-.168
562	05558050	Coffee Creek Tributary near Florid, Ill.	.03	21	1.25	.429	-.254
563	05558075	Coffee Creek Tributary near Hennepin, Ill.	.22	24	1.78	.335	.643
564	05558500	Crow Creek (West) near Henry, Ill.	56.2	32	3.19	.296	.199
565	05559000	Gimlet Creek at Sparland, Ill.	5.66	34	2.91	.251	-.608
566	05559500	Crow Creek near Washburn, Ill.	115	37	3.33	.227	-.076
567	05561000	Ackerman Creek at Farmdale, Ill.	11.2	27	2.80	.405	-.222
568	05563000	Kickapoo Creek near Kickapoo, Ill.	119	38	3.84	.325	.035
569	05563100	Kickapoo Creek Tributary near Kickapoo, Ill.	.07	21	1.44	.440	.017
570	05563500	Kickapoo Creek at Peoria, Ill.	297	41	3.90	.262	.925
571	05564400	Money Creek near Towanda, Ill.	49.0	25	2.94	.237	-.030
572	05564500	Money Creek above Lake Bloomington, Ill.	53.1	25	2.98	.243	.480
573	05565000	Hickory Creek above Lake Bloomington, Ill.	9.81	20	2.68	.373	-.801
574	05566000	East Branch Panther Creek near Gridley, Ill.	6.30	22	2.15	.235	.197
575	05566500	East Branch Panther Creek at El Paso, Ill.	30.5	33	2.77	.324	.989

Table 2.--Annual peak flow statistics for selected gaging stations in Illinois and adjacent States--Continued

Map index No.	Station No.	Station name	Drainage area (mi^2)	Years of record	Peak flow statistics $\bar{X}$	S	G
576	05567000	Panther Creek near El Paso, Ill.	93.9	34	3.32	0.320	0.104
577	05567500	Mackinaw River near Congerville, Ill.	767	39	3.93	.285	.572
578	05567800	Indian Creek Tributary near Hopedale, Ill.	.98	12	2.26	.300	-.300
579	05568000	Mackinaw River near Green Valley, Ill.	1,089	61	3.92	.305	.734
580	05568650	Duck Creek near Canton, Ill.	.49	17	1.82	.224	.270
581	05568800	Indian Creek near Wyoming, Ill.	62.7	24	3.19	.234	.692
582	05568850	Forman Creek Tributary near Victoria, Ill.	1.00	16	2.00	.337	-.112
583	05569500	Spoon River at London Mills, Ill.	1,072	41	4.03	.246	.690
584	05569825	Cedar Creek Tributary at St. Augustine, Ill.	4.06	25	2.59	.237	.661
585	05570000	Spoon River at Seville, Ill.	1,636	67	4.08	.223	-.101
586	05570350	Big Creek at St. David, Ill.	28.0	12	2.98	.165	.944
587	05570370	Big Creek near Bryant, Ill.	41.2	12	2.90	.159	-.500
588	05571000	Sangamon River at Mahomet, Ill.	362	31	3.61	.285	-.073
589	05572000	Sangamon River at Monticello, Ill.	550	74	3.72	.272	-.199
590	05572100	Wildcat Creek Tributary near Monticello, Ill.	.10	21	1.46	.247	-.519
591	05572450	Friends Creek at Argenta, Ill.	111	16	3.22	.269	.678
592	05574000	South Fork Sangamon River near Nokomis, Ill.	11.0	30	2.99	.310	.628
593	05574500	Flat Branch near Taylorville, Ill.	276	33	3.58	.281	-.483
594	05575500	South Fork Sangamon River at Kincaid, Ill.	562	60	3.64	.305	.003
595	05576000	South Fork Sangamon River near Rochester, Ill.	867	34	3.72	.308	-.523
596	05576500	Sangamon River at Riverton, Ill.	2,618	68	4.16	.289	-.865
597	05577500	Spring Creek at Springfield, Ill.	107	36	3.24	.395	-.317
598	05577700	Sangamon River Tributary at Andrew, Ill.	1.50	24	2.32	.318	-.333
599	05578500	Salt Creek near Rowell, Ill.	335	46	3.56	.357	.148
600	05579500	Lake Fork near Cornland, Ill.	214	36	3.31	.302	.192
601	05579750	Kickapoo Creek Tributary at Heyworth, Ill.	3.06	17	2.57	.246	-.243
602	05580000	Kickapoo Creek at Waynesville, Ill.	227	36	3.62	.326	.488
603	05580500	Kickapoo Creek near Lincoln, Ill.	306	39	3.66	.320	.344
604	05580700	Salt Creek Tributary at Middletown, Ill.	.90	15	2.05	.493	-.427
605	05581500	Sugar Creek near Hartsburg, Ill.	333	39	3.75	.338	.701
606	05582000	Salt Creek near Greenview, Ill.	1,804	42	4.10	.283	-.149
607	05582200	Cabiness Creek Tributary near Petersburg, Ill.	.94	21	2.08	.484	.010
608	05582500	Crane Creek near Easton, Ill.	26.5	32	2.32	.330	-.616
609	05583000	Sangamon River near Oakford, Ill.	5,093	66	4.32	.306	-.553
610	05584400	Drowning Fork at Bushnell, Ill.	26.3	23	2.83	.334	-.171
611	05584450	Wigwam Hollow Creek near Macomb, Ill.	.60	16	2.31	.267	-.419
612	05584500	La Moine River at Colmar, Ill.	655	39	3.90	.302	-.316
613	05584950	West Creek at Mount Sterling, Ill.	2.16	12	2.36	.248	.316
614	05585000	La Moine River at Ripley, Ill.	1,293	63	3.94	.224	-.026
615	05585220	Indian Creek Tributary near Sinclair, Ill.	3.58	25	2.57	.342	-.465

Table 2.--Annual peak flow statistics for selected gaging stations in Illinois and adjacent States--Continued

Map index No.	Station No.	Station name	Drainage area (mi^2)	Years of record	Peak flow statistics $\bar{X}$	S	G
616	05585700	Dry Fork Tributary near Mount Sterling, Ill.	0.15	21	1.50	0.247	-0.218
617	05586000	North Fork Mauvaise Terre Creek near Jacksonville, Ill.	29.1	34	2.96	.433	-.893
618	05586350	Little Sandy Creek Tributary near Murrayville, Ill.	1.82	12	2.58	.370	-.606
619	05586500	Hurricane Creek near Roodhouse, Ill.	2.30	33	2.32	.345	.017
620	05586850	Bear Creek Tributary near Reeders, Ill.	.02	25	1.10	.277	.449
621	05587000	Macoupin Creek near Kane, Ill.	868	56	3.96	.333	-.429
622	05587850	Cahokia Creek Tributary No. 2 near Carpenter, Ill.	.45	25	2.17	.357	-.362
623	05587900	Cahokia Creek at Edwardsville, Ill.	212	15	3.64	.212	-1.16
624	05588000	Indian Creek at Wanda, Ill.	36.7	43	3.26	.330	.138
625	05589500	Canteen Creek at Caseyville, Ill.	22.6	45	3.25	.310	-.012
626	05589780	Little Canteen Creek Tributary near Collinsville, Ill.	1.62	14	2.22	.425	-.028
627	05590000	Kaskaskia Ditch at Bondville, Ill.	12.4	39	2.56	.297	.346
628	05590400	Kaskaskia River near Pesotum, Ill.	109	15	3.25	.162	.092
629	05590500	Kaskaskia River at Ficklin, Ill.	126	11	3.28	.272	-.170
630	05590800	Lake Fork at Atwood, Ill.	149	11	3.34	.130	.518
631	05591200	Kaskaskia River at Cooks Mills, Ill.	473	13	3.68	.207	-.417
632	05591500	Asa Creek at Sullivan, Ill.	8.05	32	2.51	.365	-.358
633	05591750	Stringtown Branch Tributary near Lake City, Ill.	.70	20	1.69	.283	-.576
634	05592000	Kaskaskia River at Shelbyville, Ill.	1,054	50	3.95	.301	-.614
635	05592025	Mud Creek Tributary near Tower Hill, Ill.	.20	21	2.05	.354	.131
636	05592300	Wolf Creek near Beecher City, Ill.	47.9	24	3.46	.282	-.377
637	05592700	Hurricane Creek Tributary near Witt, Ill.	.14	25	1.84	.171	-.351
638	05592800	Hurricane Creek near Mulberry Grove, Ill.	152	13	3.86	.250	-.365
639	05593575	Little Crooked Creek near New Minden, Ill.	84.3	16	3.55	.313	-.532
640	05593600	Blue Grass Creek near Raymond, Ill.	17.3	23	2.98	.223	-.608
641	05593700	Blue Grass Creek Tributary near Raymond, Ill.	.34	13	2.16	.196	.161
642	05593900	East Fork Shoal Creek near Coffeen, Ill.	55.5	20	3.32	.248	-.087
643	05594000	Shoal Creek near Breese, Ill.	735	42	3.92	.286	-.493
644	05594090	Sugar Creek at Albers, Ill.	124	10	3.55	.312	-.414
645	05594200	Williams Creek near Cordes, Ill.	1.90	17	2.52	.298	.169
646	05594330	Mud Creek near Marissa, Ill.	72.4	12	3.27	.284	.500
647	05594450	Silver Creek near Troy, Ill.	154	17	3.53	.355	-.830
648	05594800	Silver Creek near Freeburg, Ill.	464	13	3.60	.364	-.923
649	05595000	Kaskaskia River at New Athens, Ill.	5,181	46	4.35	.324	-.181
650	05595200	Richland Creek near Hecker, Ill.	129	14	3.65	.296	-.198
651	05595500	Marys River near Sparta, Ill.	17.8	23	3.16	.355	.344
652	05595510	Lick Branch near Eden, Ill.	1.22	14	2.21	.355	.693
653	05595550	Marys River Tributary at Chester, Ill.	.65	15	2.42	.192	.022
654	05595800	Sevenmile Creek near Mt. Vernon, Ill.	21.1	22	3.00	.223	-.031
655	05596000	Big Muddy River near Benton, Ill.	502	25	3.87	.330	.272

Table 2.--Annual peak flow statistics for selected gaging stations in Illinois and adjacent States--Continued

Map index No.	Station No.	Station name	Drainage area (mi^2)	Years of record	Peak flow statistics $\bar{X}$	S	G
656	05596100	Andy Creek Tributary at Valier, Ill.	1.03	17	2.38	0.320	-0.332
657	05597000	Big Muddy River at Plumfield, Ill.	794	60	3.86	.289	-.606
658	05597450	Crab Orchard Creek Tributary near Pittsburg, Ill.	.65	13	2.36	.129	1.04
659	05597500	Crab Orchard Creek near Marion, Ill.	31.7	32	3.17	.279	-.498
660	05599000	Beaucoup Creek near Matthews, Ill.	292	36	3.67	.335	.070
661	05599500	Big Muddy River at Murphysboro, Ill.	2,169	56	4.08	.268	-.659
662	05599560	Clay Lick Creek near Makanda, Ill.	1.94	17	2.87	.291	.614
663	05599580	Big Muddy River Tributary near Gorham, Ill.	.17	16	1.58	.275	.230
664	05599640	Green Creek Tributary near Jonesboro, Ill.	.43	23	2.40	.246	-.613
665	05599800	Orchard Creek near Fayville, Ill.	.09	12	1.78	.255	.291
666	05600000	Big Creek near Wetaug, Ill.	32.2	42	3.35	.155	.617
667	06902500	Hamilton Branch near New Boston, Mo.	2.51	17	2.76	.253	-.242
668	06902800	Onion Branch at St. Catherine, Mo.	1.04	25	2.36	.359	-.223
669	06903900	Chariton River near Rathbun, Iowa	549	13	3.73	.415	-.010
670	06904300	Shoal Creek near Hartford, Mo.	155	19	3.56	.174	-.763
671	06904700	Strop Branch near Novinger, Mo.	.96	25	2.67	.453	-.599
672	06905000	Chariton River at Elmer, Mo.	1,660	21	4.08	.214	-.204
673	06927000	Maries River at Westphalia, Mo.	257	34	4.06	.224	.279
674	06927100	Doane Branch near Kingdom City, Mo.	.54	20	1.92	.358	.829
675	06927200	Big Hollow near Fulton, Mo.	4.05	16	2.78	.160	-.581
676	06931000	Beaver Creek near Rolla, Mo.	13.7	30	3.33	.313	-.273
677	06931500	Little Beaver Creek near Rolla, Mo.	6.41	32	3.16	.302	.638
678	06931600	Paulsell Branch near Rolla, Mo.	2.33	31	2.95	.374	.413
679	06932000	Little Piney Creek at Newburg, Mo.	200	55	3.76	.382	-.153
680	06933700	Penzer Hollow near Rolla, Mo.	.27	22	1.99	.266	-.127
681	06934000	Gasconade River near Rich Fountain, Mo.	3,180	44	4.44	.276	-.195
682	06934600	Rumbo Branch at Danville, Mo.	1.40	27	2.38	.265	.361
683	06934650	Loutre River at Mineola, Mo.	202	32	3.88	.283	-.914
684	06934750	Little Berger Creek Tributary near Hermann, Mo.	.25	25	1.93	.373	.437
685	06935800	Shotwell Creek at Highway 340 near Ellisville, Mo.	.81	20	2.58	.265	-.466
686	07010350	Meramec River at Cook Station, Mo.	199	15	3.69	.613	-.900
687	07011200	Love Creek near Salem, Mo.	.89	23	2.07	.237	.287
688	07011300	Ragan Branch near Rolla, Mo.	6.58	28	2.80	.478	.382
689	07011500	Green Acre Branch near Rolla Mo.	.62	28	2.39	.363	-.057
690	07012000	Behmke Branch near Rolla, Mo.	1.05	31	2.65	.338	.033
691	07013000	Meramec River near Steelville, Mo.	781	66	4.13	.330	-.654
692	07014500	Meramec River near Sullivan, Mo.	1,475	51	4.26	.344	-.626
693	07015000	Bourbeuse River near St. James, Mo.	21.3	33	3.49	.267	-.702
694	07015500	Lanes Fork near Rolla, Mo.	.22	20	1.81	.238	-.454
695	07015700	Lanes Fork near Vichy, Mo.	24.1	31	3.58	.224	-.335
696	07015720	Bourbeuse River near High Gate, Mo.	135	19	4.07	.320	-.528
697	07015800	Langenberg Branch near Rosebud, Mo.	.64	20	2.03	.320	.311
698	07016000	Bourbeuse River near Spring Bluff, Mo.	608	36	4.16	.223	.357
699	07016500	Bourbeuse River at Union, Mo.	808	69	4.13	.230	.413
700	07017000	Meramec River at Robertsville, Mo.	2,673	12	4.56	.272	-.391

Table 2.--Annual peak flow statistics for selected gaging stations in Illinois and adjacent States--Continued

Map index No.	Station No.	Station name	Drainage area (mi^2)	Years of record	Peak flow statistics $\bar{X}$	S	G
701	07017200	Big River at Irondale, Mo.	175	19	4.15	0.293	-0.585
702	07017500	Dry Branch near Bonne Terre, Mo.	3.35	25	2.76	.242	-.742
703	07017700	Fountain Farm Branch near Potosi, Mo.	2.16	23	2.70	.242	.101
704	07018000	Big River near Desoto, Mo.	718	35	4.22	.236	-.101
705	07018500	Big River at Byrnesville, Mo.	917	61	4.16	.259	-.599
706	07019000	Meramec River near Eureka, Mo.	3,788	66	4.56	.286	-.092
707	07019820	Murphy Branch near Crystal City, Mo.	.44	22	2.20	.290	.685
708	07021000	Castor River at Zalma, Mo.	423	62	4.05	.370	-.026
709	07021200	Sunnbrook Creek near Lutesville, Mo.	.52	19	2.38	.187	-.847
710	07022500	Perry Creek near Mayfield, Ky.	1.72	28	2.84	.239	.214
711	07023000	Mayfield Creek at Lovelaceville, Ky.	212	39	3.83	.169	.368
712	07023500	Obion Creek at Pryorsburg, Ky.	36.8	31	3.58	.157	.144
713	07024000	Bayou De Chien near Clinton, Ky.	68.7	41	3.51	.211	-.293
714	07033000	Wolf Creek near Farmington, Mo.	40.3	23	3.50	.257	.340
715	07035500	Barnes Creek near Fredericktown, Mo.	4.03	26	3.04	.439	-.301
716	07037500	St. Francis River near Patterson, Mo.	956	62	4.51	.250	-.387
717	07037700	Clark Creek near Piedmont, Mo.	4.39	23	2.62	.816	-3.55
718	07038000	Clark Creek at Patterson, Mo.	37.5	21	3.74	.219	-.429
719	07040040	Delaware Creek Tributary near Bloomfield, Mo.	.38	24	2.59	.178	-.376
720	07041000	Little River Ditch 81 near Kennett, Mo.	111	53	3.26	.198	-1.64
721	07042000	Little River Ditch 1 near Kennett, Mo.	235	53	3.64	.176	-1.11
722	07042500	Little River Ditch 251 near Lilbourn, Mo.	235	39	3.46	.153	.329
723	07043500	Little River Ditch No. 1 near Morehouse, Mo.	450	39	3.73	.136	-.736
724	07046000	Little River Ditch 259 near Kennett, Mo.	89.0	53	3.26	.224	-.929
725	07061300	East Fork Black River at Lesterville, Mo.	94.5	15	3.58	.304	-.840
726	07061500	Black River near Annapolis, Mo.	484	45	4.26	.278	-.466
727	07061800	Brawley Hollow near Centerville, Mo.	1.00	19	2.09	.166	.016
728	07063200	Pike Creek Tributary near Poplar Bluff, Mo.	.28	15	2.07	.297	-.514
729	07068200	North Prong Little Black River at Hunter, Mo.	1.23	23	2.23	.374	-.200
730	07068500	Little Black River near Fairdealing, Mo.	187	28	3.83	.419	.282

Table 3.--Comparison of peak discharge estimates for selected recurrence intervals

[Techniques R1, R2, and R3 are described in section "Techniques for Estimating Generalized Skew"]

Station No.	WRC skew map Expected value	Lower limit	Upper limit	R3	R2	R1
	50-year peak discharge, in cubic feet per second					
03343400	7,310	6,500	8,390	7,840	7,320	7,470
03344500	3,890	3,390	4,550	3,970	4,090	4,160
03381500	39,100	36,000	42,900	39,400	40,200	39,800
03382170	2,500	2,230	2,870	2,510	2,630	2,680
05419000	13,300	12,400	14,500	13,500	13,600	13,800
05437500	33,700	31,500	36,200	34,400	34,100	33,800
05439500	9,760	8,940	10,800	10,300	9,760	9,520
05447500	12,000	11,300	12,900	12,500	12,100	11,900
05466500	11,200	10,300	12,400	11,500	11,400	11,600
05501500	896	697	1,220	961	955	961
05502040	18,500	16,800	20,700	19,300	18,700	18,300
05525000	8,510	7,880	9,280	8,620	8,700	8,780
05526500	786	668	952	786	917	961
05527950	1,430	1,200	1,780	1,570	1,440	1,440
05528500	934	839	1,060	996	935	935
05531500	2,110	1,990	2,250	2,150	2,130	2,130
05535070	745	692	814	750	772	774
05536335	460	426	504	461	482	484
05554600	186	153	233	202	190	181
05564400	2,540	2,260	2,920	2,600	2,630	2,680
05570000	33,300	31,000	35,900	33,700	33,800	34,100
05572450	6,040	5,080	7,480	6,140	6,590	6,790
05583000	73,100	66,800	80,700	76,100	74,000	74,900
05587900	9,850	8,790	11,300	10,500	9,840	10,100
05592300	9,520	8,290	11,200	9,970	9,800	10,000
05593600	2,330	2,100	2,630	2,440	2,370	2,310
05594450	13,400	11,100	16,700	14,600	13,500	12,800
05595200	15,400	12,900	19,100	16,100	16,000	15,500
05599500	35,500	32,200	39,500	37,000	35,600	36,200
05600000	4,850	4,540	5,210	4,830	5,000	5,050

Table 3.--Comparison of peak discharge estimates for selected recurrence intervals--Continued

Station No.	WRC skew map Expected value	Lower limit	Upper limit	R3	R2	R1
	100-year peak discharge, in cubic feet per second					
03343400	7,940	7,020	9,180	8,700	7,950	8,170
03344500	4,710	4,060	5,590	4,840	5,040	5,170
03381500	44,800	41,000	49,600	45,300	46,700	46,000
03382170	2,790	2,470	3,260	2,810	3,000	3,090
05419000	15,100	13,900	16,500	15,300	15,500	15,700
05437500	37,000	34,500	40,000	38,000	37,600	37,100
05439500	10,600	9,690	11,800	11,400	10,600	10,300
05447500	12,900	12,100	13,900	13,500	13,000	12,700
05466500	12,600	11,500	14,000	13,100	12,900	13,100
05501500	1,090	833	1,520	1,200	1,190	1,200
05502040	20,700	18,600	23,300	21,900	21,000	20,500
05525000	9,470	8,720	10,400	9,650	9,760	9,890
05526500	997	832	1,240	998	1,240	1,330
05527950	1,590	1,320	2,000	1,800	1,600	1,600
05528500	1,020	912	1,160	1,110	1,020	1,020
05531500	2,260	2,120	2,500	2,320	2,290	2,290
05535070	807	744	890	815	847	852
05536335	512	470	566	514	546	550
05554600	213	173	271	237	219	206
05564400	2,890	2,550	3,360	2,990	3,040	3,100
05570000	37,600	34,900	40,900	38,300	38,500	38,900
05572450	7,230	6,000	9,150	7,400	8,150	8,510
05583000	82,800	75,200	92,000	87,300	84,000	85,400
05587900	10,500	9,340	12,200	11,500	10,500	10,800
05592300	10,800	9,340	12,900	11,500	11,300	11,600
05593600	2,550	2,280	2,900	2,700	2,600	2,520
05594450	15,100	12,500	19,200	17,100	15,300	14,400
05595200	17,700	14,600	22,300	18,800	18,700	17,800
05599500	39,300	35,500	44,100	41,600	39,600	40,400
05600000	5,460	5,080	5,920	5,430	5,690	5,780

Table 3.--Comparison of peak discharge estimates for selected recurrence intervals--Continued

Station No.	WRC skew map Expected value	Lower limit	Upper limit	R3	R2	R1
	500-year peak discharge, in cubic feet per second					
03343400	9,180	8,030	10,800	10,600	9,190	9,580
03344500	6,920	5,810	8,480	7,240	7,750	8,090
03381500	59,200	53,200	66,800	60,200	63,400	61,700
03382170	3,500	3,030	4,220	3,540	3,970	4,170
05419000	19,200	17,500	21,400	19,700	20,200	20,600
05437500	44,200	40,800	48,300	46,200	45,500	44,400
05439500	12,200	11,100	13,800	13,800	12,300	11,800
05447500	14,700	13,600	15,900	15,700	14,800	14,300
05466500	15,800	14,200	17,700	16,700	16,400	16,800
05501500	1,590	1,170	2,330	1,840	1,820	1,850
05502040	25,400	22,600	29,000	27,800	26,100	25,000
05525000	11,700	10,700	13,100	12,100	12,300	12,600
05526500	1,650	1,320	2,140	1,650	2,420	2,740
05527950	1,910	1,560	2,460	2,310	1,940	1,930
05528500	1,190	1,060	1,380	1,360	1,200	1,200
05531500	2,570	2,390	2,780	2,680	2,630	2,640
05535070	950	863	1,070	966	1,030	1,040
05536335	640	578	723	643	715	724
05554600	273	218	358	324	286	260
05564400	3,740	3,230	4,450	3,950	4,040	4,200
05570000	48,000	44,000	52,800	49,400	49,800	50,700
05572450	10,400	8,330	13,800	10,800	12,800	13,800
05583000	104,000	93,600	117,000	113,000	106,000	109,000
05587900	11,900	10,400	13,900	13,500	11,800	12,400
05592300	13,800	11,700	16,800	15,200	14,700	15,400
05593600	3,000	2,660	3,470	3,280	3,100	2,950
05594450	18,900	15,300	24,500	22,700	19,300	17,500
05595200	23,100	18,600	30,200	25,500	25,300	23,400
05599500	47,600	42,500	54,000	51,900	48,000	49,500
05600000	6,990	6,410	7,720	6,940	7,520	7,720