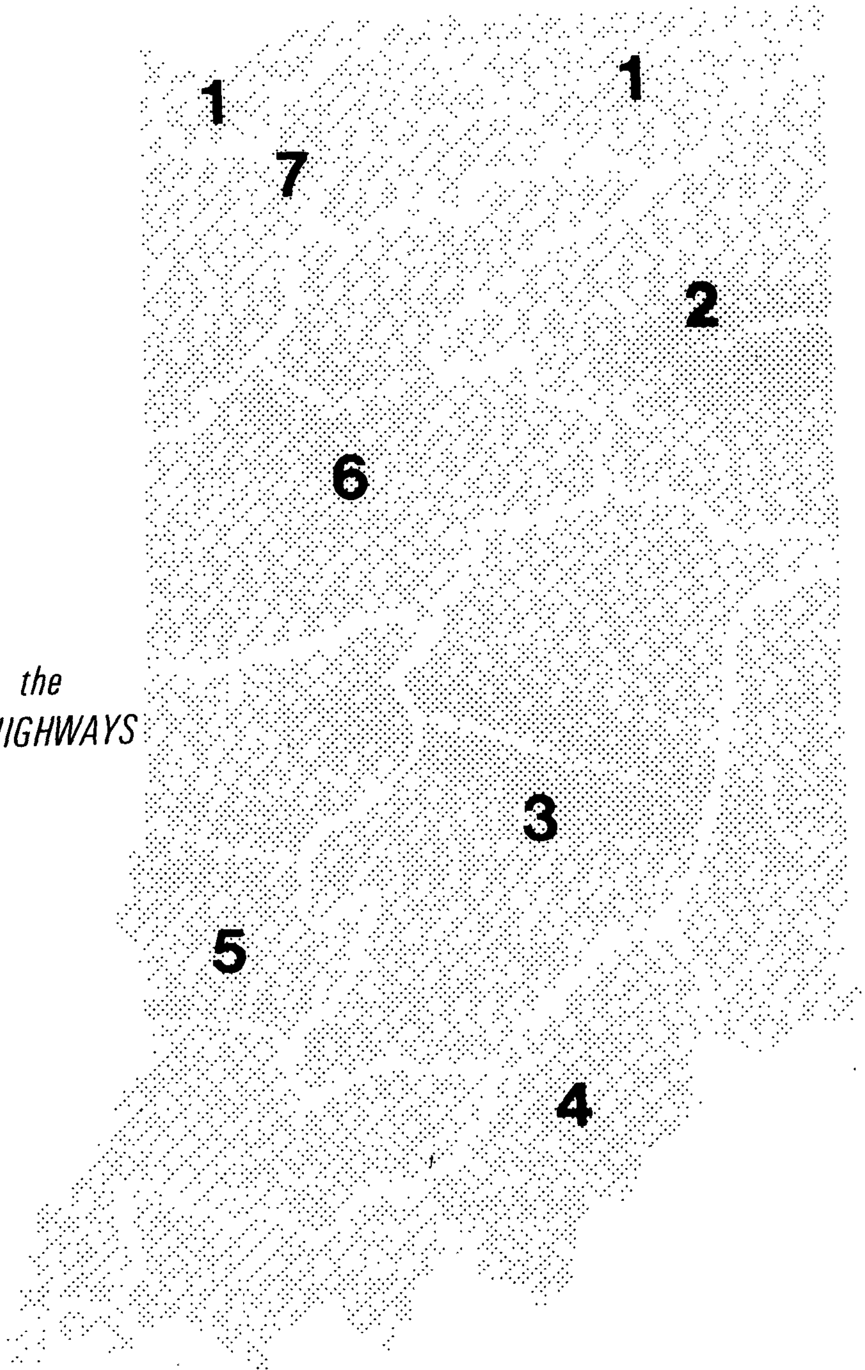
TECHNIQUES FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS ON STREAMS IN INDIANA

U.S. GEOLOGICAL SURVEY
Water-Resources Investigations Report 84-4134



Prepared in cooperation with the
INDIANA DEPARTMENT OF HIGHWAYS
and the FEDERAL HIGHWAY
ADMINISTRATION

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16. Abstract (Limit: 200 words)

Methods for estimating magnitude and frequency of floods on streams are necessary in the design of hydraulic structures and in flood-plain management. Equations for estimating the magnitude and frequency of floods on ungaged streams in Indiana were developed by multiple-regression analysis of basin characteristics and peak-flow statistical data from 242 gaged sites in Indiana, Ohio, and Illinois.

The State of Indiana was divided into seven areas on the basis of regression analysis. A set of equations for estimating peak discharges with recurrence intervals of 2, 10, 25, 50, and 100 years was developed for each area. The equations are valid for unregulated and nonurban streams. Significant basin characteristics in the equations are drainage area, channel length, channel slope, mean annual precipitation, intensity of precipitation, storage, and a runoff coefficient. Standard errors of estimate for the equations range from 24 to 45 percent.

A rainfall-runoff model was used to extend the length of record at 11 gaged sites on small streams. Flood-frequency data from the synthetic peaks and from the observed peaks were combined by weighting techniques.

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CONVERSION TABLE

The inch-pound system of units was used to develop the estimating equations within this report. Inch-pound units can be converted to the International System (SI) of units as follows:

Multiply inch-pound unit	By	To obtain SI unit
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)
square mile (mi^2)	2.590	square kilometer (km^2)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)

TECHNIQUES FOR ESTIMATING MAGNITUDE AND FREQUENCY

OF FLOODS ON STREAMS IN INDIANA

by Dale R. Glatfelter

ABSTRACT

Equations are presented for estimating the magnitude and frequency of floods at ungaged sites on unregulated and nonurban streams in Indiana. The equations were developed by multiple-regression analysis of basin characteristics and peak-flow statistical data from 242 gaged locations in Indiana, Ohio, and Illinois. The State of Indiana was divided into seven areas on the basis of the regression analysis. A set of equations for estimating peak discharges with recurrence intervals of 2, 10, 25, 50, and 100 years was developed for each area. Significant basin characteristics in the equations are drainage area, channel length, channel slope, mean annual precipitation, storage, precipitation intensity, and a runoff coefficient. Standard errors of estimate for the equations range from 24 to 45 percent.

Methods are also presented for estimating flood magnitude and frequency at sites on gaged streams. Flood-frequency data based on observed peaks are given for 270 gaged locations. Twenty of these are on regulated streams, and six are on urban streams. Basin characteristics are also included for 245 of the gaged locations on unregulated and nonurban streams. No techniques are given for estimating flood magnitude and frequency at ungaged sites on regulated or urban streams.

A rainfall-runoff model was used to synthesize long-term peak data at 11 gaged locations on small streams. Flood-frequency curves developed from the long-term synthetic data were combined with curves based on short-term observed data to provide weighted estimates of flood magnitude and frequency at the rainfall-runoff stations.

INTRODUCTION

Purpose and Scope

The purpose of this report is to present techniques for estimating the magnitude and frequency of floods on streams in Indiana. This information is necessary in the design of culverts, bridges, and other hydraulic structures, and in flood-plain management. The contents of this report do not necessarily reflect the official views or policies of the Indiana Department of Highways or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

Background

A study designed primarily to define flood magnitude and frequency on small streams was begun in 1972 by the U.S. Geological Survey in cooperation with the Indiana Department of Highways and the Federal Highway Administration. Davis (1974) presented equations for estimating the magnitude and frequency of floods on any stream in Indiana that drained an area greater than 15 mi^2 and was not affected by regulation or urbanization. Gold (1980) presented equations for estimating the magnitude of floods having 2-year and 10-year recurrence intervals. The equations in Gold's interim report were valid for unregulated, nonurban streams of any size drainage area, but the standard errors of estimate for the equations were greater then those determined by Davis. An additional 10 years of peak data at most stations used in Davis' report, revised techniques for flood-frequency determination (U.S. Water Resources Council, 1981), and 10 years of peak data at gaged sites on small streams were used to update and improve the estimating procedures presented by Davis and Gold.

Methods of Study

Flood-frequency curves were developed from annual peak-discharge data for 242 gaging stations and crest-stage partial-record sites (3 in Ohio, 3 in Illinois, and 236 in Indiana) and guidelines given in U.S. Water Resources Council (1981). The flood-frequency curves from the observed data were then used along with basin characteristics in multiple-regression analysis to develop equations for estimating magnitude and frequency of floods. Basin characteristics and flood-frequency data are presented in tables.

A rainfall-runoff model developed by the U.S. Geological Survey (Dawdy and others, 1972) was used to synthesize peak data at 11 gaging stations on small streams. On the basis of the synthetic data, flood-frequency curves were developed by procedures discussed in Lichty and Liscum (1978). A weighting technique was used to combine the estimates of flood magnitude and frequency obtained from the observed and the synthetic peak data into one flood-frequency curve for the station for use in the regression analysis.

The estimating equations presented in the report were developed by multiple-regression techniques described in Helwig and Council (1979). Basin characteristics for 242 gaged locations were used as the independent variables, and corresponding peak-discharge statistics were used as the dependent variables. On the basis of regression analysis the State was divided into seven areas. A set of equations for estimating peak discharges with recurrence intervals of 2, 10, 25, 50, and 100 years was developed for each area. These equations are applicable only for locations on unregulated, nonurban streams. Examples showing use of the estimating equations are given in the section "Estimating Techniques."

Flood-frequency data are presented in the report for 20 sites on regulated streams and 6 sites on urban streams that were not used in regression analysis. The scope of the report does not include development of techniques for estimating magnitude and frequency of floods at ungaged sites on regulated and urban streams. Rather, the data obtained at sites on regulated and urban streams are presented for use in estimating flood magnitude and frequency at specific locations under current (1983) conditions. A change in regulatory practices or increased urbanization can greatly affect flow characteristics. Peak data should be thoroughly reviewed before a flood-frequency analysis is made.

Peak-discharge data from stations on the Wabash River were analyzed to show the effect of regulation on flood frequency. Results of separate analyses of unregulated peaks and of regulated peaks are presented in the report.

Acknowledgments

The report is the result of a cooperative agreement between the Indiana Department of Highways, the Federal Highway Administration, and the U.S. Geological Survey. Most of the small-stream data used in this report were collected under this cooperative program. The remainder of the streamflow data were collected for many years under various cooperative agreements with State and Federal agencies. Long-term daily precipitation and evaporation data, and rainfall data at 5-minute intervals from individual storms for use in rainfall-runoff modeling were obtained from the National Oceanic and Atmospheric Administration (NOAA) and have been stored in the Geological Survey computer files.

ESTIMATING TECHNIQUES

Sites on Ungaged Streams

Equations were developed to estimate flood magnitude at 2-, 10-, 25-, 50-, and 100-year recurrence intervals from basin characteristics at ungaged sites on unregulated, nonurban streams (table 1). These equations are not intended for use at sites on regulated or urban streams because changes in regulatory practices or increased urbanization can affect peak-flow characteristics. (See sections "Regulated Gaged Streams" and "Urban Gaged Streams.")

Annual peak-flow data from 236 gaging stations and crest-stage partial-record sites in Indiana (fig. 1) plus three stations in Ohio and three stations in Illinois (not on the map) were analyzed by techniques described in U.S. Water Resources Council (1981) to determine peak-flow statistics for each location (table 2, after References). On the basis of the analysis, flood magnitude and frequency were estimated for each of the gáged locations.

Table 1.--Equations for estimating magnitude and frequency of floods on streams in Indiana

Area 1 (16 stations)

Equations	Standard error of estimate		Equivalent years of record
	Log units	Percent	
$Q_2 = 6.72\ DA^{0.714}(STOR + 1)^{-0.289}(PREC - 30)^{0.965}$	0.114	27	3
$Q_{10} = 10.3\ DA^{0.701}(STOR + 1)^{-0.262}(PREC - 30)^{1.060}$	.149	35	3
$Q_{25} = 11.8\ DA^{0.697}(STOR + 1)^{-0.253}(PREC - 30)^{1.093}$	.165	39	3
$Q_{50} = 12.9\ DA^{0.696}(STOR + 1)^{-0.248}(PREC - 30)^{1.114}$	.176	42	4
$Q_{100} = 13.8\ DA^{0.695}(STOR + 1)^{-0.243}(PREC - 30)^{1.132}$	.186	45	5

Statistics of basin characteristics used in area 1 regression analysis

Basin characteristic	Maximum	Minimum	Mean	Median
DA	3,370 mi^2	0.17 mi^2	321 mi^2	79.1 mi^2
STOR	13.3 percent	0.0 percent	3.0 percent	1.3 percent
PREC	46.0 in.	34.0 in.	37.1 in.	35.3 in.

Table 1.--Equations for estimating magnitude and frequency of floods on streams in Indiana--Continued

Area 2 (31 stations)

Equations	Standard error of estimate		Equivalent years of record
	Log units	Percent	
$Q_2 = 26.4\ DA^{0.708}(STOR + 1)^{-0.207}RC^{0.479}(PREC - 30)^{0.653}$	0.104	24	4
$Q_{10} = 61.8\ DA^{0.655}(STOR + 1)^{-0.312}RC^{0.697}(PREC - 30)^{0.696}$	.120	28	4
$Q_{25} = 85.0\ DA^{0.635}(STOR + 1)^{-0.357}RC^{0.782}(PREC - 30)^{0.702}$	.134	31	5
$Q_{50} = 106\ DA^{0.619}(STOR + 1)^{-0.391}RC^{0.859}(PREC - 30)^{0.707}$	.147	35	6
$Q_{100} = 127\ DA^{0.608}(STOR + 1)^{-0.418}RC^{0.902}(PREC - 30)^{0.708}$	.156	37	7

Statistics of basin characteristics used in area 2 regression analysis

Basin characteristic	Maximum	Minimum	Mean	Median
DA	1,967 mi^2	0.17 mi^2	384 mi^2	270 mi^2
STOR	4.1 percent	0 percent	0.8 percent	0.3 percent
RC	0.8	0.5	0.7	0.8
PREC	39.0 in.	34.0 in.	36.7 in.	37.0 in.

Table 1.--Equations for estimating magnitude and frequency of floods on streams in Indiana--Continued

Area 3 (60 stations)

Equations	Standard error of estimate		Equivalent years of record
	Log units	Percent	
$Q_2 = 102\ DA^{0.758} SL^{0.273} (I_{24,2} - 2.5)^{0.948}$	0.150	36	3
$Q_{10} = 141\ DA^{0.772} SL^{0.384} (I_{24,2} - 2.5)^{0.894}$	.144	34	4
$Q_{25} = 158\ DA^{0.776} SL^{0.423} (I_{24,2} - 2.5)^{0.868}$	.150	36	5
$Q_{50} = 170\ DA^{0.777} SL^{0.445} (I_{24,2} - 2.5)^{0.847}$	.156	37	7
$Q_{100} = 181\ DA^{0.779} SL^{0.466} (I_{24,2} - 2.5)^{0.831}$	.163	39	9

Statistics of basin characteristics used in area 3 regression analysis

Basin characteristic	Maximum	Minimum	Mean	Median
DA	4,927 mi^2	0.31 mi^2	488 mi^2	85.1 mi^2
SL	149 ft/mi	2.0 ft/mi	17.2 ft/mi	9.0 ft/mi
$I_{24,2}$	3.15 in.	2.85 in.	2.97 in.	2.95 in.

Table 1.--Equations for estimating magnitude and frequency of floods on streams in Indiana--Continued

Area 4 (46 stations)

Equations	Standard error of estimate		Equivalent years of record
	Log units	Percent	
$Q_2 = 16.8\ DA^{0.435}SL^{0.528}L^{0.860}(I_{24,2} - 2.5)^{0.459}$	0.130	31	3
$Q_{10} = 24.1\ DA^{0.517}SL^{0.628}L^{0.769}(I_{24,2} - 2.5)^{0.445}$	.127	30	6
$Q_{25} = 27.4\ DA^{0.545}SL^{0.664}L^{0.741}(I_{24,2} - 2.5)^{0.448}$	.137	32	7
$Q_{50} = 29.6\ DA^{0.554}SL^{0.687}L^{0.738}(I_{24,2} - 2.5)^{0.458}$	.146	34	9
$Q_{100} = 32.0\ DA^{0.565}SL^{0.705}L^{0.730}(I_{24,2} - 2.5)^{0.464}$	.158	37	11

Statistics of basin characteristics used in area 4 regression analysis

Basin characteristic	Maximum	Minimum	Mean	Median
DA	1,224 mi^2	0.07 mi^2	110 mi^2	10.9 mi^2
SL	267 ft/mi	2.4 ft/mi	51.0 ft/mi	23.6 ft/mi
L	77.1 mi	0.3 mi	18.8 mi	8.6 mi
$I_{24,2}$	3.30 in.	2.80 in.	3.05 in.	3.05 in.

Table 1.--Equations for estimating magnitude and frequency of floods on streams in Indiana--Continued

Area 5 (35 stations)

Equations	Standard error of estimate: Log units	Standard error of estimate: Percent	Equivalent years of record
$Q_2 = 45.5\ DA^{0.760} SL^{0.390}$	0.128	30	3
$Q_{10} = 67.7\ DA^{0.780} SL^{0.469}$	.138	33	5
$Q_{25} = 77.0\ DA^{0.790} SL^{0.499}$	.151	36	5
$Q_{50} = 83.8\ DA^{0.805} SL^{0.516}$	.163	39	7
$Q_{100} = 91.2\ DA^{0.811} SL^{0.529}$	.175	42	8

Statistics of basin characteristics used in area 5 regression analysis

Basin characteristic	Maximum	Minimum	Mean	Median
DA	11,125 mi^2	0.04 mi^2	583 mi^2	21.8 mi^2
SL	236 ft/mi	1.2 ft/mi	35.8 ft/mi	12.6 ft/mi

Table 1.--Equations for estimating magnitude and frequency of floods on streams in Indiana--Continued

Area 6 (32 stations)

Equations	Standard error of estimate		Equivalent years of record
	Log units	Percent	
$Q_2 = 681\ DA^{0.691} RC^{0.856} (I_{24,2} - 2.5)^{1.771}$	0.115	27	5
$Q_{10} = 2{,}177\ DA^{0.622} RC^{0.865} (I_{24,2} - 2.5)^{1.980}$	.125	29	7
$Q_{25} = 3{,}165\ DA^{0.598} RC^{0.852} (I_{24,2} - 2.5)^{2.035}$	.138	32	7
$Q_{50} = 3{,}908\ DA^{0.584} RC^{0.849} (I_{24,2} - 2.5)^{2.049}$	.146	34	10
$Q_{100} = 4{,}734\ DA^{0.570} RC^{0.834} (I_{24,2} - 2.5)^{2.068}$	.157	37	12

Statistics of basin characteristics used in area 6 regression analysis

Basin characteristic	Maximum	Minimum	Mean	Median
DA	856 mi^2	0.10 mi^2	164 mi^2	35.0 mi^2
RC	0.8	0.3	0.6	0.7
$I_{24,2}$	3.00 in.	2.70 in.	2.86 in.	2.85 in.

Table 1.--Equations for estimating magnitude and frequency of floods on streams in Indiana--Continued

Area 7 (22 stations)

Equations	Standard error of estimate		Equivalent years of record
	Log units	Percent	
$Q_{2} = 22.6\ DA^{0.468} SL^{0.414} L^{0.624} RC^{0.846}$	0.109	26	3
$Q_{10} = 45.7\ DA^{0.350} SL^{0.439} L^{0.726} RC^{0.862}$	.122	29	4
$Q_{25} = 56.4\ DA^{0.318} SL^{0.458} L^{0.754} RC^{0.862}$	.137	32	4
$Q_{50} = 63.6\ DA^{0.300} SL^{0.473} L^{0.770} RC^{0.860}$	.149	35	5
$Q_{100} = 70.1\ DA^{0.285} SL^{0.488} L^{0.785} RC^{0.854}$	.160	38	6

Statistics of basin characteristics used in area 7 regression analysis

Basin characteristic	Maximum	Minimum	Mean	Median
DA	1,578 mi^2	0.39 mi^2	241 mi^2	99.8 mi^2
SL	39.7 ft/mi	0.9 ft/mi	7.4 ft/mi	2.7 ft/mi
L	78.6 mi	1.1 mi	23.7 mi	19.8 mi
RC	0.7	0.3	0.4	0.4

Basin characteristics were also determined for each of the 242 gaged locations (table 3, after References). The relation between peak-flow data and basin characteristics were analyzed by multiple-regression techniques. Detailed discussions of flood-frequency determination and multiple-regression analysis are presented later in the report.

On the basis of regression analysis, Indiana has been divided into seven areas (fig. 2). Equations for each area, to be used in estimating flood magnitude having recurrence intervals of 2, 10, 25, 50, and 100 years on unregulated, nonurban streams, are given in table 1. Statistics of the basin characteristics from the stations used in the regression analyses are also shown in the table. The estimating equations are valid at sites where the basin characteristics (particularly drainage area) are within the range listed for the seven areas in the table. Caution should be used when the basin characteristics of the ungaged site are outside the range of those used to develop the equations. The standard error of estimate (in log units and percent) and equivalent years of record for each equation included in table 1 are discussed in the section "Accuracy and Limitations."

Significant basin characteristics required to use the equations are defined as follows:

1. Contributing drainage area (DA), in square miles, is the area contributing directly to surface runoff. This area can be planimetered from topographic maps or can be obtained from the drainage-area report for Indiana (Hoggatt, 1975). Drainage area should be determined to the nearest 0.01 mi^2 in the range from 0.01 to 9.99 mi^2; to the nearest 0.1 mi^2, from 10.0 to 99.9 mi^2; and to the nearest 1 mi^2, for drainage areas greater than 99.9 mi^2.

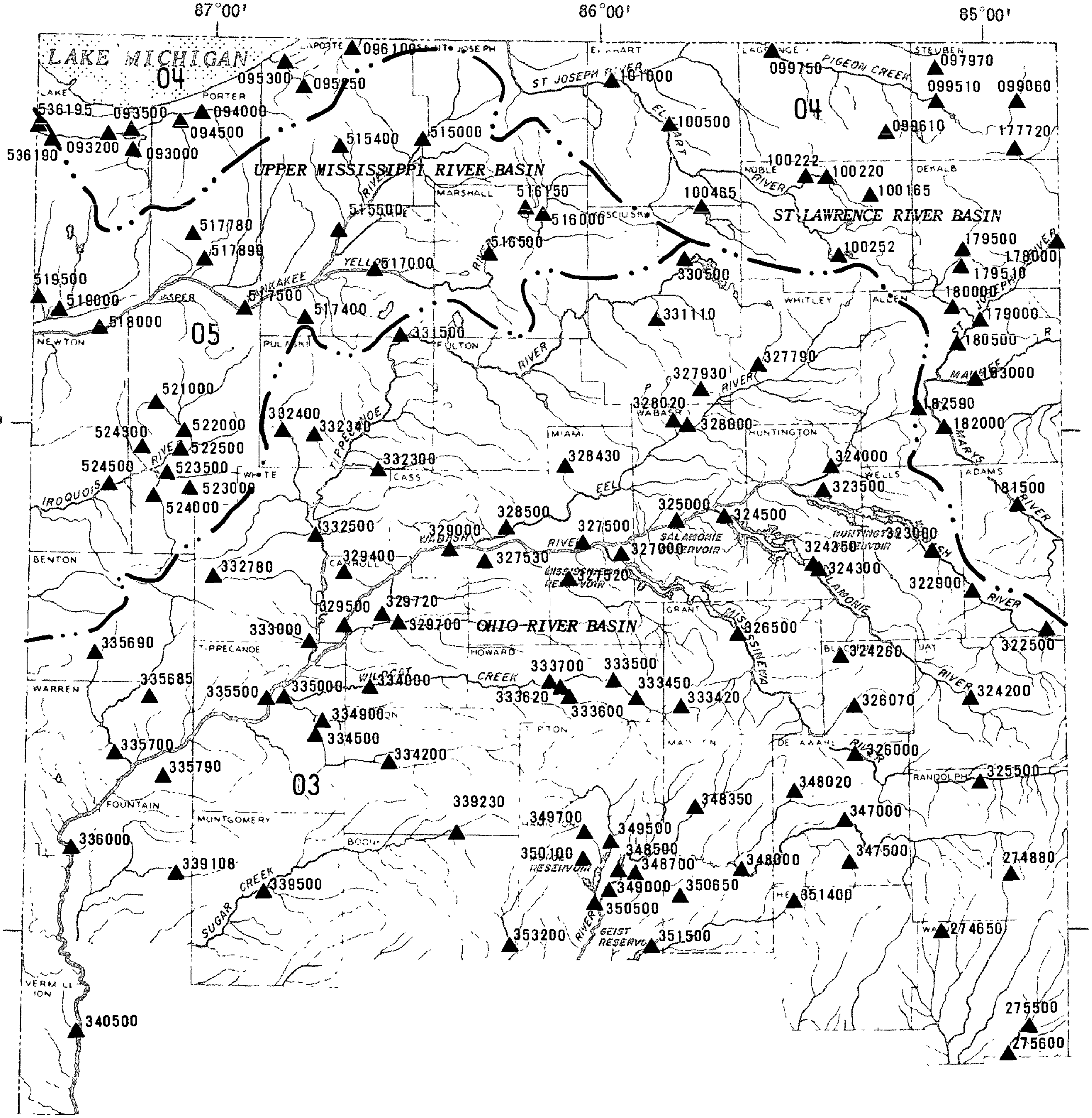
2. Main-channel slope (SL), in feet per mile, the slope of the streambed between points that are 10 and 85 percent of the distance from the location on the stream to the basin divide, is determined from topographic maps. Slope should be determined to the nearest 0.1 ft/mi.

3. Channel length (L), in miles, the distance measured along the main channel from the location on the stream to the basin divide, is determined from topographic maps. Length should be determined to the nearest 0.1 mi.

4. Storage (STOR), the percentage of the contributing drainage area covered by lakes, ponds, and wetlands, is determined from topographic maps. A constant of 1 percent is added to characteristic STOR for use in the estimating equations. Storage should be determined to the nearest 0.1 percent.

5. Mean annual precipitation (PREC), in inches, the 1941-70 average annual precipitation, is determined from figure 3 (Stewart, 1983). A constant of 30 inches is subtracted from the characteristic PREC for use in the estimating equations. The basin centroid should be plotted in figure 3, and mean annual precipitation for that point should be determined to the nearest 0.5 in. by interpolation between lines of equal precipitation.

6. Precipitation intensity ($I_{24,2}$), in inches, the maximum 24-hour precipitation having a recurrence interval of 2 years, is determined from figure 4 (Hershfield, 1961). A constant of 2.5 inches is subtracted from the characteristic $I_{24,2}$ for use in the estimating equations. The basin centroid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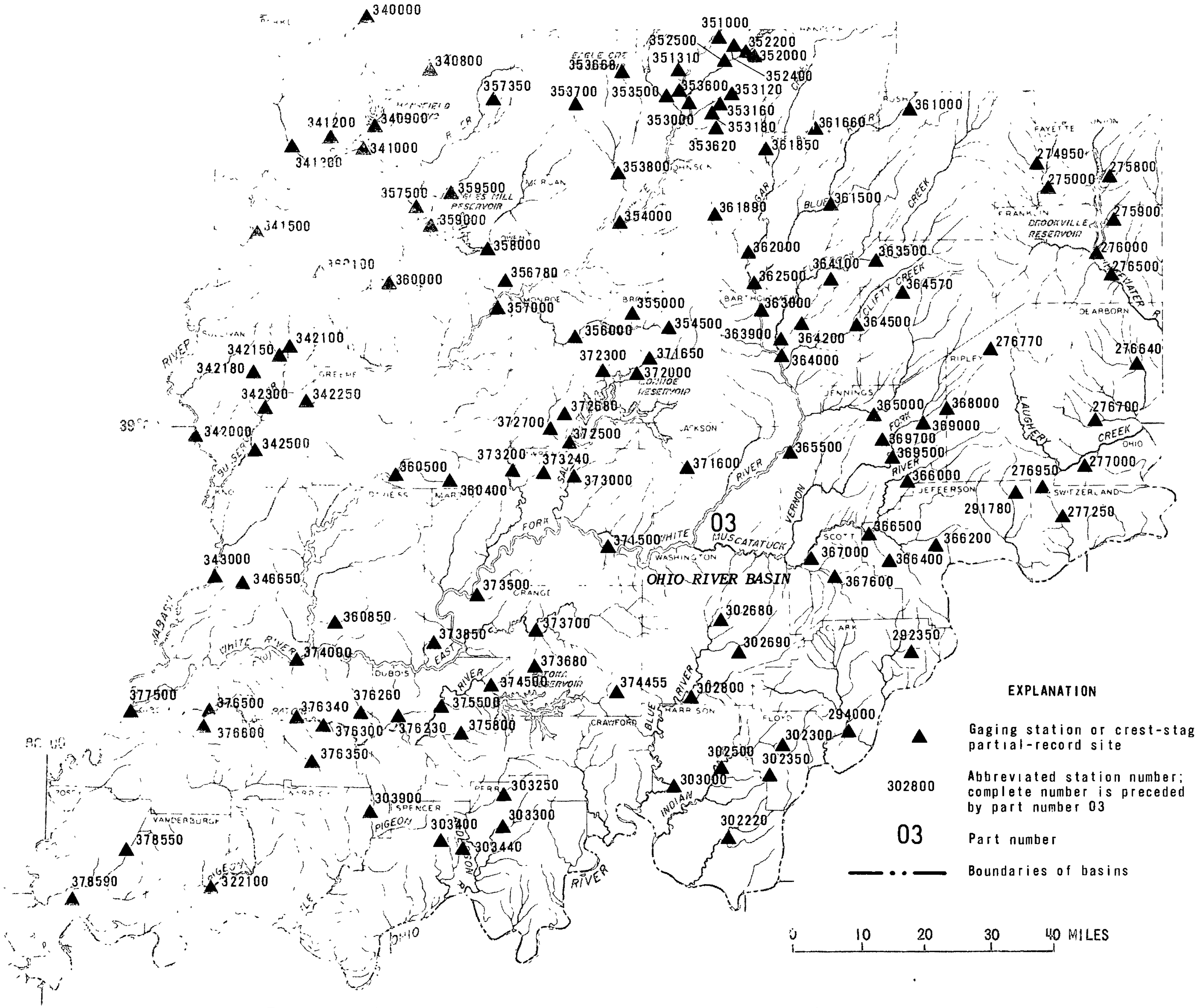

Figure 1.-- Locations of streamflow data-collection sites in Indiana.

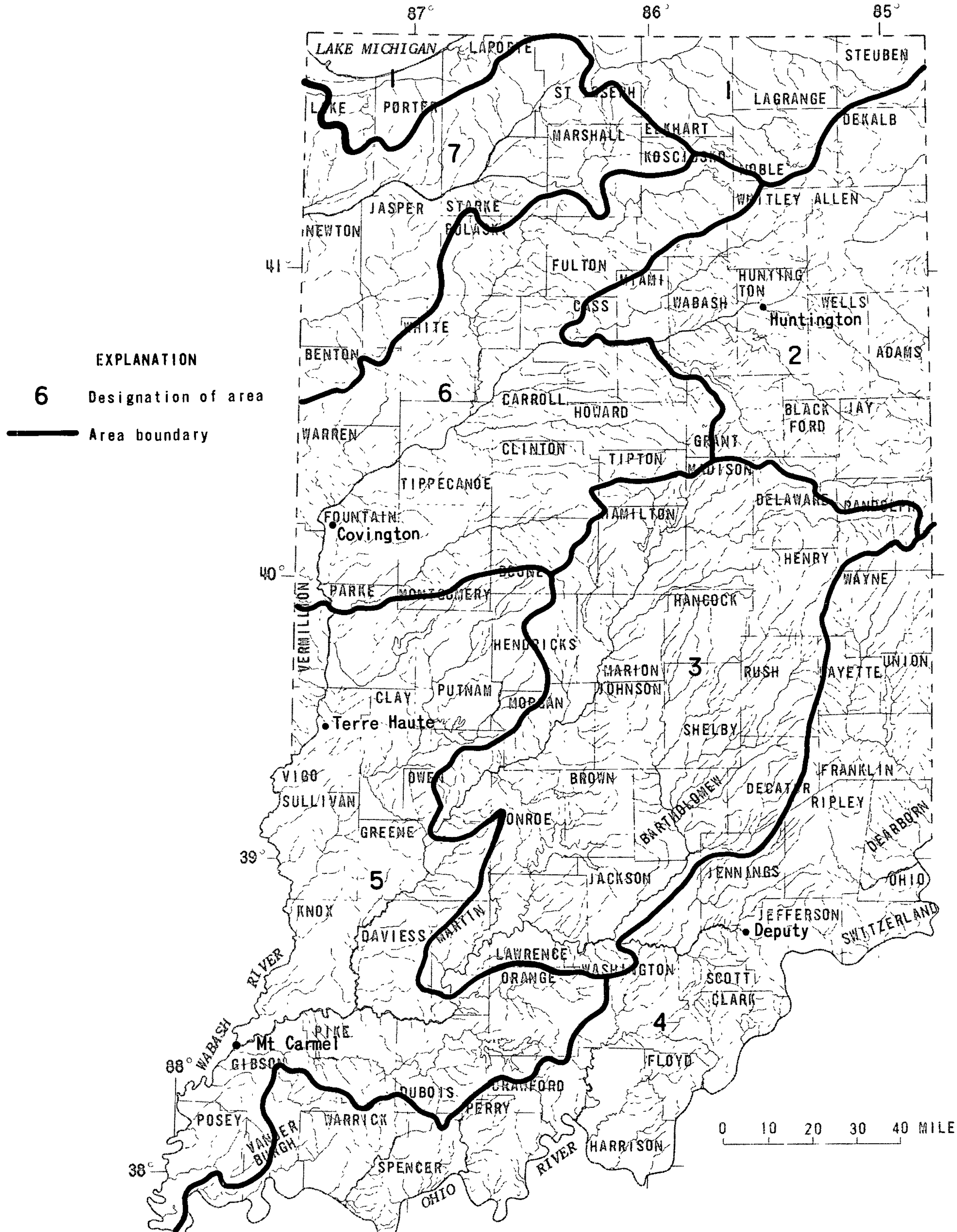

Figure 2.-- Areas for selecting flood-frequency estimating equations.

EXPLANATION

—42— Line of equal precipitation. Interval 2 inches

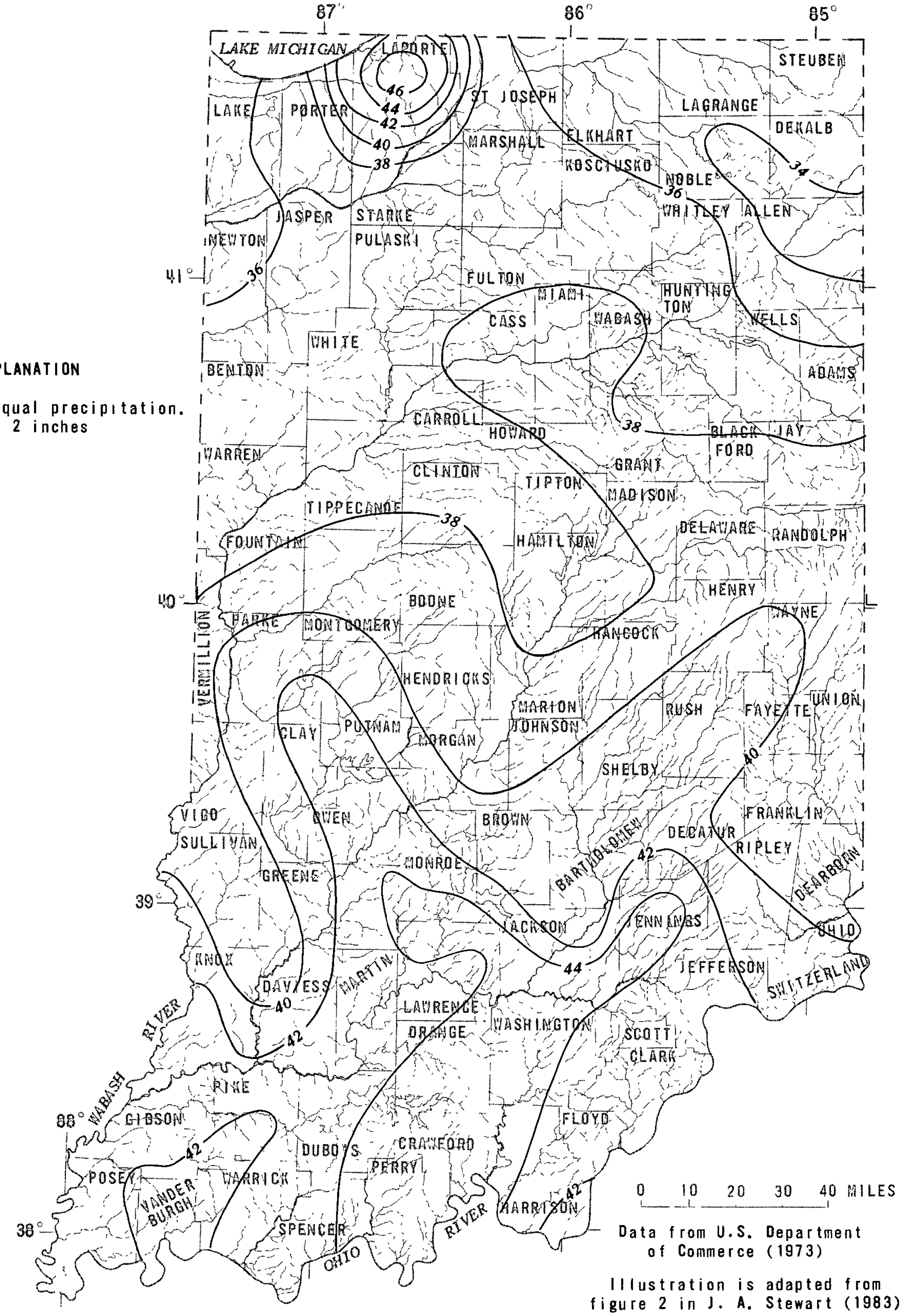

Figure 3.-- Mean annual precipitation, 1941-70.

should be plotted in figure 4, and precipitation intensity for that point should be determined to the nearest 0.05 in. by interpolation between lines of equal precipitation.

7. Runoff coefficient (RC), a coefficient that relates storm runoff to soil permeability by major hydrologic soil groups, is determined from figure 5 (Davis, 1975). Values of the coefficient (fig. 5) range from 0.30, for hydrologic soil-group A, to 1.00, for hydrologic soil-group E. If the drainage area covers more than one hydrologic soil group, the runoff coefficient should be an areally weighted average determined to the nearest 0.05.

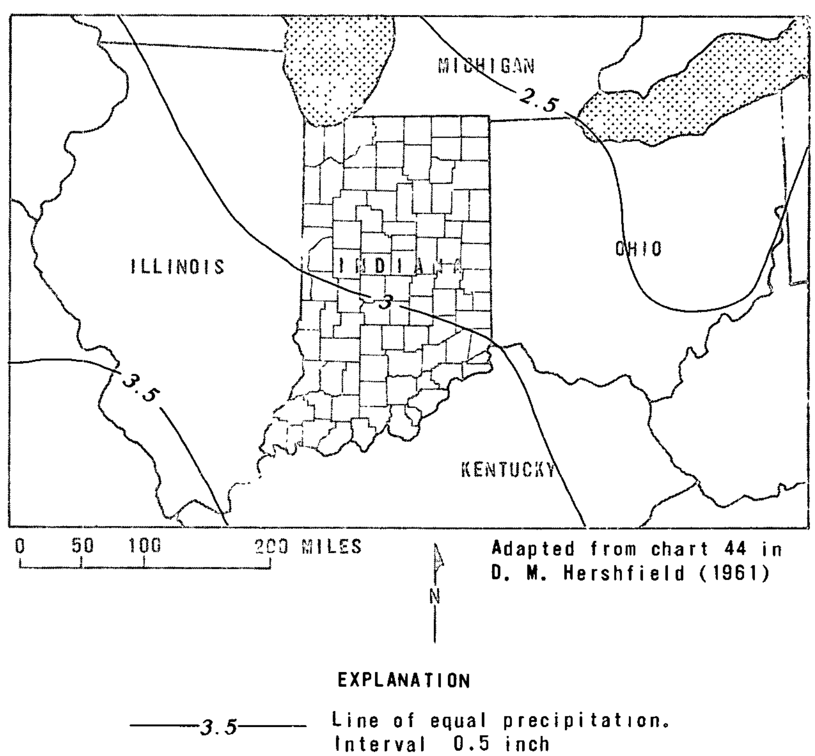

Figure 4.-- Two-year, 24-hour precipitation.

EXPLANATION

HYDROLOGIC SOIL GROUP	SOIL-RUNOFF COEFFICIENT
A	0.30
B	0.50
C	0.70
D	0.80
E	1.00

Hydrologic soil group boundary

(Use a runoff coefficient of 0.30 for streams in group B that are directly below lakes)

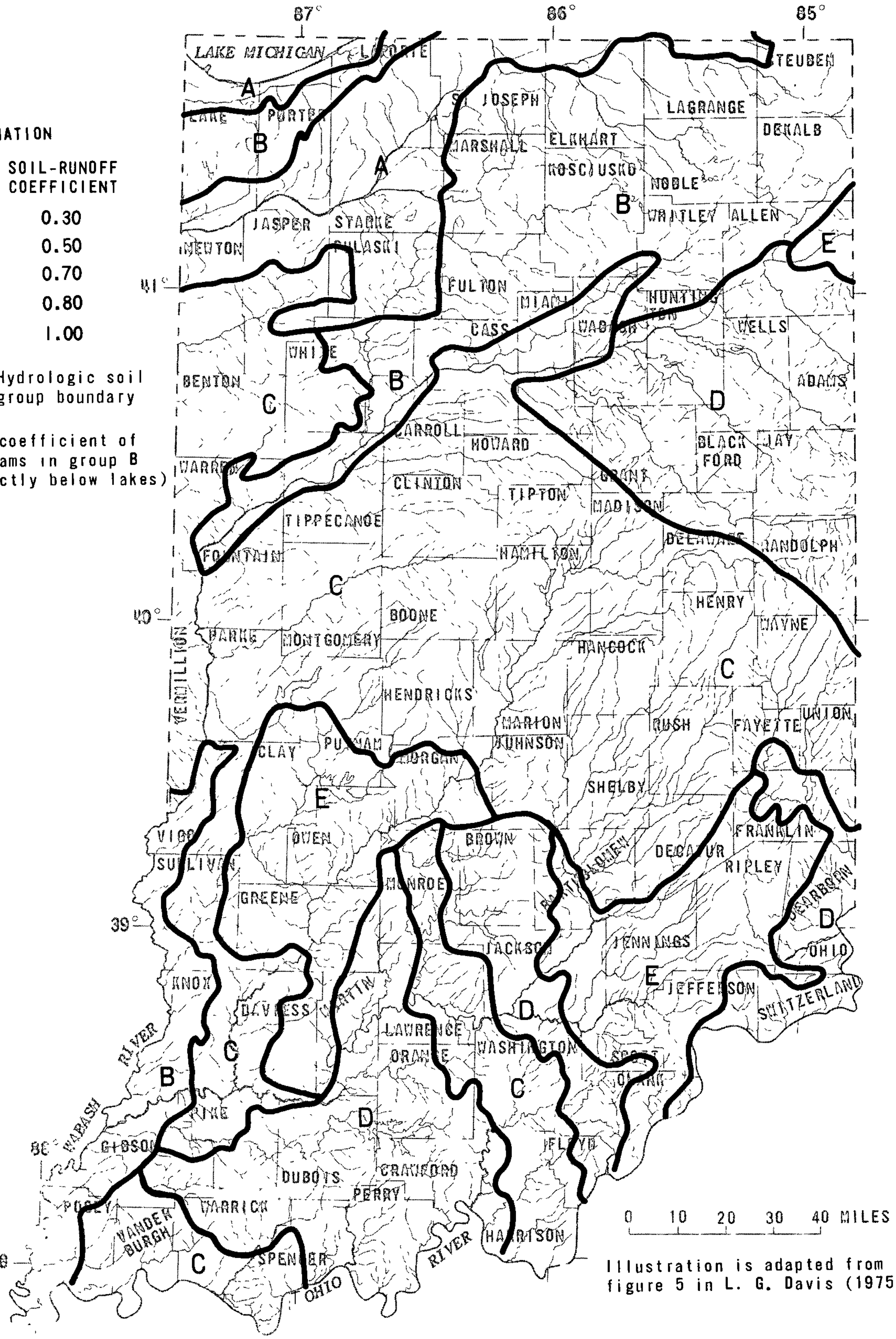

Illustration is adapted from figure 5 in L. G. Davis (1975)

Figure 5.-- Major hydrologic soil groups.

Use of the estimating equations is shown in the following example: A highway engineer is given the task of designing a culvert to pass the 100-year flood on a small stream in Brown County, Ind. From figure 2, the location of the site is found to be in area 3. The equations for estimating flood peaks in area 3 (table 1) require contributing drainage area (DA), channel slope (SL), and 24-hour, 2-year rainfall ($I_{24,2}$) as independent variables. Physical characteristics of the basin determined from a topographic map are as follows:

contributing drainage area, 6.94 mi^2;

channel length, 4.40 mi;

elevation of the channel at a point 10 percent of the length (0.4 mi) upstream, 652 ft;

elevation of the channel at a point 85 percent of the length (3.7 mi) upstream, 824 ft;

distance between points 10 and 85 percent of the length upstream, 3.7 - 0.4 = 3.3 mi;

channel slope, $\frac{824 - 652}{3.3} = 52.1$ ft/mi.

From figure 3, the 24-hour, 2-year precipitation is determined to be 3.05 in.

The equation for estimating the 100-year peak discharge for a site on an unregulated, nonurban stream in area 3 (table 1) is:

$$Q_{100} = 181\ DA^{0.779}\ SL^{0.466}\ (I_{24,2} - 2.5)^{0.831}.$$

Substituting the values of basin characteristics for the ungaged site in the equation yields:

$$Q_{100} = 181 \times 6.94^{0.779} \times 52.1^{0.466} \times (3.05 - 2.5)^{0.831} = 3{,}140\ ft^3/s.$$

Sites on Gaged Streams

Unregulated and Nonurban Gaged Streams

Flood magnitude having a specific recurrence interval can be estimated for a site on an unregulated, nonurban stream by one of the following procedures:

1. If the site is at a gaged location, the weighted estimate of Q_T from table 4 (after References) should be used.

2. If the drainage area of an ungaged site on a gaged stream is less than 50 percent or greater than 150 percent of the drainage area of a gaged site on the same stream, the discharge should be estimated from the appropriate equation in table 1 as if the site were on an ungaged stream. An example showing how to use the estimating equations is shown in the section "Sites on Ungaged Streams."

3. If the drainage area of an ungaged site on a gaged stream is between 50 and 150 percent of the drainage area of a gaged site on the same stream, the discharge should be an estimate calculated from both gaged data (table 4) and estimating equations (table 1). An estimate of the T-year peak discharge at an ungaged site is determined by first computing the ratio:

$$R = \frac{Q_{T_W} \text{ (gaged site)}}{Q_{T_R} \text{ (gaged site)}},$$

where Q_{T_W} (gaged site) is the weighted estimate of the T-year flood at the gaged site and Q_{T_R} (gaged site) is the estimate of the T-year flood at the gaged site determined by a regional estimating equation (table 1). This ratio is the correction needed to adjust the regional value to the weighted value at the gaged site. Values of Q_{T_W} and Q_{T_R} for 245 gaged sites are listed in table 4. The weighting factor (R_W) to be applied to the estimate of Q_T at the ungaged site is computed as:

$$R_W = R - \frac{2\Delta A}{A_G} (R - 1),$$

where R is the ratio defined above, ΔA is the absolute value of the difference between the drainage areas of the gaged and ungaged sites, and A_G is the drainage area of the gaged site. The T-year peak discharge at the ungaged site is then determined by the equation:

$$Q_T = Q_{T_R} \text{ (ungaged site)} \times R_W,$$

where Q_{T_R} (ungaged site) is the estimate of the T-year flood at the ungaged site determined by a regional estimating equation (table 1) and R_W is the weighting factor defined above. The effect of R_W is phased out as ΔA increases to 50 percent of A_G.

Procedures for use in estimating peak discharge at a specific recurrence interval at a gaged site and at an ungaged site on the same stream and near the gaged site are given in the examples that follow.

If an estimate of the 100-year peak discharge is needed for the gaging station on the Muscatatuck River near Deputy, Ind. (03366500), one can be obtained from table 4. The table contains three estimates of Q_{100} for this station: The upper number (40,900 ft^3/s) is from flood-frequency analysis of the observed data, the middle number (44,600 ft^3/s) is from the regression equation for area 4 (table 1), and the lower number (41,200 ft^3/s) is from weighting the two independent estimates. The weighting procedure and analysis of observed peak data are described in the section "Flood-Frequency Analysis." The best estimate of Q_{100} for the gaging station on the Muscatatuck River would be the weighted estimate, 41,200 ft^3/s.

An estimate of Q_{100} is also needed on the Muscatatuck River downstream from the gaging station near Deputy, Ind. (03366500). Q_{100} for the ungaged location is first estimated by the regression equation for area 4 (table 1) which is of the form:

$$Q_{100} = 32.0 \ DA^{0.565} \ SL^{0.705} \ L^{0.730} \ (I_{24,2} - 2.5)^{0.464}.$$

From topographic maps and figure 4, basin characteristics for the ungaged site are determined to be: DA, 359 mi^2; SL, 6.2 ft/mi; L, 68.8 mi; and $I_{24,2}$, 3.00 inches. By substitution:

$$Q_{100} = 32.0 \times 359^{0.565} \times 6.2^{0.705} \times 68.8^{0.730} \times (3.00 - 2.5)^{0.464}$$
$$= 51,200 \ ft^3/s.$$

Because the drainage area at the ungaged site is between 50 and 150 percent of the drainage area at the gaged location this number is then weighted by a factor that reflects how well the estimating equations match values from flood-frequency analysis of observed peaks at the gaged location. In the previous example, the equation for estimating Q_{100} in area 4 produced 44,600 ft^3/s at the gaging station near Deputy, Ind. Flood-frequency analysis of the station record gave 40,900 ft^3/s for Q_{100}. These two estimates were combined by a weighting technique previously mentioned to produce the weighted estimate 41,200 ft^3/s for Q_{100} at the gaging station. The weighting factor to be applied to the estimate of Q_{100} from the regression equation at the ungaged location is calculated as follows:

$$R_W = R - \frac{2\Delta A}{A_G}(R - 1).$$

By substitution:

$$R_W = \frac{41,200}{44,600} - \frac{(2)(359 - 293)}{293}\left(\frac{41,200}{44,600} - 1\right) = 0.958.$$

The best estimate of Q_{100} at the ungaged site on the Muscatatuck River then becomes:

$$Q_T = 51,200 \times 0.958 = 49,000 \ ft^3/s.$$

Regulated Gaged Streams

Flood magnitude and frequency at gaged sites on regulated streams should be estimated on the basis of the best available streamflow data for that site, not on estimating equations. Peak-discharge data are available for many sites on regulated streams in Indiana. Gaging stations on streams affected by regulation are listed in table 5 (after References). The period of record for each station shown in table 5 was split at the time when regulation began. If more than 10 years of unregulated annual-peak data were available, an unregulated flood-frequency curve was determined (table 4). Stations marked with an asterisk (*) in table 4 are currently (1983) regulated, but flood-frequency data from the unregulated period of record at these sites were used in the regression analysis to develop estimating equations. Flood-frequency estimates for current (1983) conditions at each of these stations should be based on peak data from the regulated period and used with caution.

Annual peak discharges affected by regulation were not used in determining flood-frequency curves for use in developing estimating equations. However, if the period of record during regulated flow is of sufficient length, these data can be used to estimate flood magnitude and frequency at a specific site on a regulated stream under current (1983) conditions. Flood-frequency data for eight such sites are shown in table 4. Flow characteristics at sites on regulated streams could be greatly altered by a change in regulatory practices; peak data should be thoroughly reviewed before a flood-frequency analysis is made. Regulated and unregulated peak data should not be combined in determining the flood-frequency curve for a gaged site.

An example of the effect of regulation on flood frequency was obtained by analysis of peak-discharge data from stations on the Wabash River. Streamflow in the Wabash River in the reach downstream from Huntington, Ind., has been regulated since 1968 by flood-control reservoirs operated by the U.S. Army Corps of Engineers. Huntington Reservoir (717 mi^2), Salamonie Reservoir (553 mi^2), and Mississinewa Reservoir (807 mi^2) control more than 25 percent of the drainage area of the Wabash River from Huntington, Ind., to Covington, Ind. Reservoirs on tributaries control a small part of the drainage area of the Wabash River from Terre Haute, Ind., to Mt. Carmel, Ill.

The magnitude and frequency of floods based on analysis of unregulated annual peaks through 1967 at 12 gaging stations on the Wabash River from Huntington to Mt. Carmel are shown in table 6 (after References). Estimates of flood magnitude and frequency for the period of regulated flow (Indiana Department of Natural Resources, 1981) are also given in the table. Regulation has substantially reduced the estimate of flood magnitude for all recurrence intervals at each station.

Urban Gaged Streams

Flood-frequency data from six gaged sites on urban streams are listed in table 4 but were not used in the regression analyses to develop the estimating equations. The data are presented for use in estimating flood magnitude and frequency at specific locations under current (1983) conditions. Peak discharge on an urban stream is dependent on the degree of urbanization within the basin. The imperviousness of the land surface associated with an urban basin is generally greater than that of a nonurban basin, and peak discharge from an urban basin is generally larger than that from a nonurban basin of similar size. Thus, the estimating equations shown in table 1 could underestimate flood magnitude. Conversely, ponding behind a highway embankment, with available storage capacity and with a culvert to allow outflow, could reduce the peak discharge on an urban stream. In this case, flood magnitude in the channel downstream from the embankment could be overestimated by use of the equations shown in table 1. No methodolgy is given in this report for estimating flood magnitude and frequency at ungaged sites on urban streams.

Accuracy and Limitations

The accuracy of the estimating equations in table 1 is expressed as standard error of estimate (log units and percent) and equivalent years of record. The standard error of estimate is a measure of how well the discharges determined by the equations compare with the discharges from the individual station flood-frequency curves that were used to develop the equations. Because of the transformation of the variables to corresponding base 10 logarithmic values before regression analysis, the standard error of estimate was determined in log units and was converted to percent and equivalent years of record by techniques given in Hardison (1971). On the average, two-thirds of the observations of discharge from flood-frequency curves based on observed data lie within one standard error of estimate (expressed in log units) of corresponding values computed by the equations. For example, the standard error of estimate for the Q_{100} equation in area 1 is 0.186 log unit. This means that two-thirds of the time logarithms of the Q_{100} values from flood-frequency analysis of observed peaks will be within 0.186 log unit of the logarithms of the Q_{100} values computed from the equation for area 1. The standard error of 0.186 log unit was converted to 45 percent by the conversion table in Hardison (1971). The standard error of estimate in log units was also converted to equivalent years of record by use of Hardison's equation:

$$N_U = R^2[\overline{I}_V/SE]^2,$$

where N_U is equivalent years of record, R is a function of recurrence interval and mean logarithmic skew, $\overline{I}_V$ is mean logarithmic standard deviation, and SE is the standard error in log units. Using this equation and the statistical analyses of flood frequency for stations in area 1, the author converted the standard error of estimate (0.186 log unit) to an accuracy equivalent of 5 years. Thus, the estimate of a 100-year peak discharge at a site in area 1 computed from the estimating equation has an accuracy similar to that obtained by flood-frequncy analysis of 5 years of peak-discharge data collected at the site.

Split-sampling techniques were used in area 3 to verify the predictive accuracy of the estimating equations. The 60 stations in area 3 were divided into two sets, one set for developing equations and the other for measuring the accuracy of prediction by the equations. The stations were first arranged by size of drainage area and were then alternately assigned to the predicting and estimating sets, beginning with the smallest and ending with the largest. This procedure of data splitting resulted in an estimating set of 30 stations and a predicting set of 30 stations. A regression analysis using data from the 30 stations in the estimating set produced an equation for Q_{100} having a standard error of estimate of 39 percent (0.163 log unit). Independent variables in the equation were the same ones shown to be significant by analysis of data from all 60 stations in area 3. Using this equation, the author computed peak discharges having a 100-year recurrence interval for the 30 stations in the predicting set. The standard error of estimate of the observed values of Q_{100} for stations in the predicting set compared with Q_{100} values for these stations computed by the equation from analysis of data in the estimating set is 46 percent. This approximates the standard error of estimate (39 percent) for Q_{100} where data from all 60 stations in the area were used.

The equations in table 1 are for estimating magnitude and frequency of floods on unregulated, nonurban streams. Statistics of the basin characteristics used in developing the individual area equations are also given in the table. The equations are valid at sites where the basin characteristics fall within the range shown in the table. The equations should not be used for estimating discharge on an urban or a regulated stream; the flood-frequency curve reflecting current conditions at a site should be used in planning and design. No methodology is given for estimating flood magnitude and frequency at ungaged sites on urban or regulated streams.

DATA ANALYSIS

Annual peak-discharge data and basin characteristics from 242 continuous-record and crest-stage partial-record stations having at least 10 years of observed record were used in a multiple-regression analysis to develop equations for estimating magnitude and frequency of floods. Synthetic peak-discharge data generated by a rainfall-runoff model were used to extend the length of record at 11 stations. (See section "Extending Length of Record by a Rainfall-Runoff Model.") Locations of the 236 stations in Indiana used in developing the estimating equations are shown in figure 1. Locations of 26 stations on regulated streams and 6 stations on urban streams not used in developing the estimating equations are also shown in figure 1. Six stations used in the regression analysis (three in Ohio, and three in Illinois) are not shown in figure 1.

Long-term daily and unit-precipitation data for use in the rainfall-runoff model were obtained from the National Oceanic and Atmospheric Administration (NOAA) for Indianapolis, Ind.; Fort Wayne, Ind.; Chicago, Ill.; Peoria, Ill.; Springfield, Ill.; Cairo, Ill.; and Louisville, Ky. Long-term daily-evaporation data for use in the model were obtained for Oaklandon, Ind. (Geist Reservoir).

Peak-discharge frequency data and basin characteristics were determined for each gaged site on naturally flowing streams in Indiana. The State of Indiana was divided into seven areas on the basis of regression analysis. Flood-frequency equations for each of the seven areas were developed by multiple-regression techniques. These equations can be used to estimate the magnitude and frequency of floods on any unregulated, nonurban stream in Indiana.

Flood-Frequency Analysis

Flood-frequency analyses were done for 270 continuous-record stations and crest-stage partial-record sites having at least 10 years of peak-flow data to determine flood-frequency curves for each site. For these analyses, guidelines of the U.S. Water Resources Council (1981) were used to fit the logarithms of the annual peak discharges to a Pearson type-III distribution. Historical peaks and high outliers were given weight, low outliers were omitted, and station skew was weighted with skew values from a generalized skew map in the reference.

The technique for fitting a log-Pearson type-III distribution to observed annual peak discharges is to compute the base 10 logarithm of the discharge (Q) at a selected probability of occurence (P) by the equation:

$$\log Q = \overline{x} + KS,$$

where $\overline{x}$ is the mean of the logarithms of the annual peak discharges, S is the standard deviation of the logarithms of the annual peak discharges, and K is a function of the WRC-weighted skew coefficient (G) and the selected probability of occurrence (P). Values of K can be obtained from U.S. Water Resources Council (1981). A summary of the statistics of the logarithms of the annual peak discharges used in developing flood-frequency curves for the gaged sites is shown in table 2.

Flood-frequency analysis is done to define the relation of flood magnitude (instantaneous maximum discharge) to probability of occurrence or to recurrence interval. Probability of occurrence (P) is the percent chance of a given flood magnitude being exceeded in any 1 year. Recurrence interval (T), which is the reciprocal of the probability of occurrence multiplied by 100, is the average number of years between exceedances of a given flood magnitude. The recurrence interval is an average interval, and the occurrence of floods is random in time; no schedule of regularity is implied. The occurrence of a flood having a 50-year recurrence interval (2-percent probability of occurrence) is no guarantee, therefore, that a flood of equal or greater magnitude will not occur the following year, or even the following week.

Results of flood-frequency analysis of observed annual peaks at 259 individual stations are given in table 4. (Flood-frequency data for 12 stations on the Wabash River downstream from Huntington Reservoir are shown in table 6.) Peak discharges having recurrence intervals of 2, 10, 25, 50, and 100 years estimated by analysis of the observed data are shown in table 4 as the upper number for each station. Because the T-year flood estimated from the log-Pearson type-III distribution of the logarithms of the annual peak discharges and the corresponding estimate from the regression equations (table 1) are considered to be independent, a technique for weighting the two estimates is recommended (Curtis, 1977a, p. 4). The best estimate of flood magnitude at a selected recurrence interval for a gaged location is obtained by the equation:

$$\log Q_T = \frac{(\text{sta yrs rec})(\log \text{sta } Q_T) + (\text{eq yrs rec})(\log \text{reg } Q_T)}{(\text{sta yrs rec}) + (\text{eq yrs rec})}.$$

In the preceding equation, log sta Q_T (log station Q_T) is the upper number for each site in table 4 converted to a logarithm; sta yrs rec (station years of record) is determined from table 2; log reg Q_T (log regression Q_T) is computed as the logarithm of the discharge computed by the estimating equations in table 1 or obtained from table 4 (middle number); and eq yrs rec (equivalent years of record, which is the accuracy of the regression equation) is determined from table 1. The antilog of the calculated log Q_T is the best estimate of flood magnitude at a selected frequency. Weighted estimates of flood magnitude and frequency at each of the stations used in the regression analysis are shown as the lower number in table 4.

Extending Length of Record by a Rainfall-Runoff Model

A long-term record (60-70 years) of synthetic flood peaks was generated for each of 11 stations on small streams by a rainfall-runoff model developed by the U.S. Geological Survey (Dawdy and others, 1971; and Carrigan and others, 1977). The purpose of generating the synthetic data was to increase the effective length of record at the small-stream gaging stations, where short-term concurrent rainfall and discharge data had been collected. Flood hydrographs for each station were generated from daily-rainfall, daily-evaporation, and unit-rainfall data. The model deals with three components of the hydrologic cycle--antecedent soil moisture, storm infiltration, and surface-runoff routing. The two phases involved in using the model are calibration and synthesis.

During calibration of the model, daily rainfall, daily pan evaporation, and concurrent values of unit streamflow and unit rainfall were used to optimize the 10 parameters defined in table 7. Seven of the parameters define the volume of surface runoff, and three control the shape of the flood hydrograph. Several parameters are considered to vary only slightly (Lichty and Liscum, 1978). By holding these parameters constant, the fitting process improves the values of the remaining parameters. The values of DRN and TP/TC were held constant at 1.000 and 0.500 throughout the calibration. Optimum values of the 10 parameters obtained in calibrating the model are shown in table 7 for each of the 11 rainfall-runoff stations.

The optimum values of parameters from calibration of the rainfall-runoff model were used with long-term precipitation and evaporation data provided by the National Oceanic and Atmospheric Administration to generate a long-term series of flood peaks. Long-term evaporation data from Oaklandon, Ind. (Geist Reservoir), was used for each of the 11 gaging stations. However, data from seven long-term-precipitation stations were available for use in synthesis of long-term peak discharge. The choice of which long-term-precipitation record to use was based on techniques in Lichty and Liscum (1978) and Curtis (1977b).

At each of the seven long-term-precipitation stations, synthetic data were generated, and rainfall-runoff model estimates of T-year floods were related to the parameters of the model. Replicate synthesis using the optimum model parameters from each of the 11 gaging stations resulted in 77 synthetic

Table 7.--Results from calibration of the rainfall-runoff model

PSP Product of moisture deficit and suction at the wetted front for soil moisture at field capacity.
KSAT The minimum (saturated) hydraulic conductivity used to determine infiltration rates.
DRN A constant drainage rate for redistribution of soil moisture.
RGF Ratio of the product of moisture deficit and suction at the wetted front for soil moisture at the wilting point to that at field capacity.
BMSM Soil moisture storage volume at field capacity.
EVC Coefficient to convert pan evaporation to potential evapotranspiration.
RR Proportion of daily rainfall that infiltrates the soil.
KSW Time characteristic for linear reservoir routing.
TC Length of the base of the triangular translation hydrograph.
TC/TP Ratio of time to peak to base length of the triangular translation hydrograph.

Station number	PSP	KSAT	DRN	RGF	BMSM	EVC	RR	KSW	TC	TP/TC
03275800	3.998	0.287	1.000	16.664	3.904	0.864	0.855	0.316	10.4	0.500
03276640	1.017	.062	1.000	28.958	2.653	.808	.771	.344	21.7	.500
03324260	3.182	.335	1.000	22.820	7.018	.704	.740	.298	44.6	.500
03329720	2.759	.061	1.000	20.180	2.606	.873	.890	5.721	113.0	.500
03334200	.807	.114	1.000	10.716	1.486	.810	.960	6.989	51.3	.500
03335790	4.003	.145	1.000	11.860	2.625	.967	.730	.397	61.4	.500
03352400	3.374	.042	1.000	23.270	8.337	.778	.911	2.265	97.6	.500
03364100	1.514	.085	1.000	11.880	2.793	.952	.616	2.850	49.1	.500
03366400	1.712	.053	1.000	39.206	3.359	.968	.618	.316	43.2	.500
03373680	4.954	.164	1.000	15.390	2.507	.655	.755	.176	15.4	.500
03378590	1.894	.049	1.000	11.847	1.227	.584	.913	1.063	25.7	.500

annual-flood series (11 gaging stations times 7 precipitation records). A log-Pearson type-III distribution was used to quantify synthetic T-year flood estimates for each of the 77 synthetic peak-data sets.

Regression analyses were used to relate the synthetic estimate of peak discharge at a specified recurrence interval (Q_{T_S}) to a combination of optimum parameters from the rainfall-runoff model (table 7) that define the volume and shape of the hydrograph. The equation for estimating flood magnitude and frequency at a rainfall-runoff station from precipitation data collected at a long-term-precipitation station is as follows:

$$Q_{T_S} = a\ VAR^{b}\ FR^{c}\ DA,$$

where

Q_{T_S} is the synthetic T-year flood estimate, in cubic feet per second, based on precipitation data collected at the respective precipitation station,

a the regression constant,

VAR[1] an index of the dispersion about the mean arrival time (lag), in hours, that describes the hydrograph shape,

FR[2] the infiltration rate, in inches per hour, that describes the hydrograph volume,

b and c the regression coefficients,

and

DA the contributing drainage area, in square miles.

Regression analysis showed the regression coefficient "b" to be constant for all stations and recurrence intervals, and the regression coefficient "c" to be a function of "a", the regression constant. The equation for estimating the synthetic discharge for a specific recurrence interval was transformed to:

$$Q_{T_S} = a_T\ VAR^{-0.310}\ FR^{0.790 \log a_T - 2.266}\ DA.$$

The average standard error of estimate of Q_{T_S} was less than 20 percent. The only variable in this equation is "a_T" because VAR, FR, and DA are known for a given set of model parameters. Site-to-site variability in the magnitude of the regression coeffecient "a_T" is interpreted as reflecting the spatially varying influence of local climatic factors. Values of "a_T" for each of the seven long-term precipitation stations were plotted on a map for recurrence intervals of 2, 10, 25, 50, and 100 years (figs. 6-10). Lines of equal climatic factor drawn on each of the five maps can be used to estimate "a_T" for any location in Indiana. Values of "a_T", DA, VAR, and FR for the 11 rainfall-runoff stations are listed in table 8. Values of Q_{T_S} were calculated from these data.

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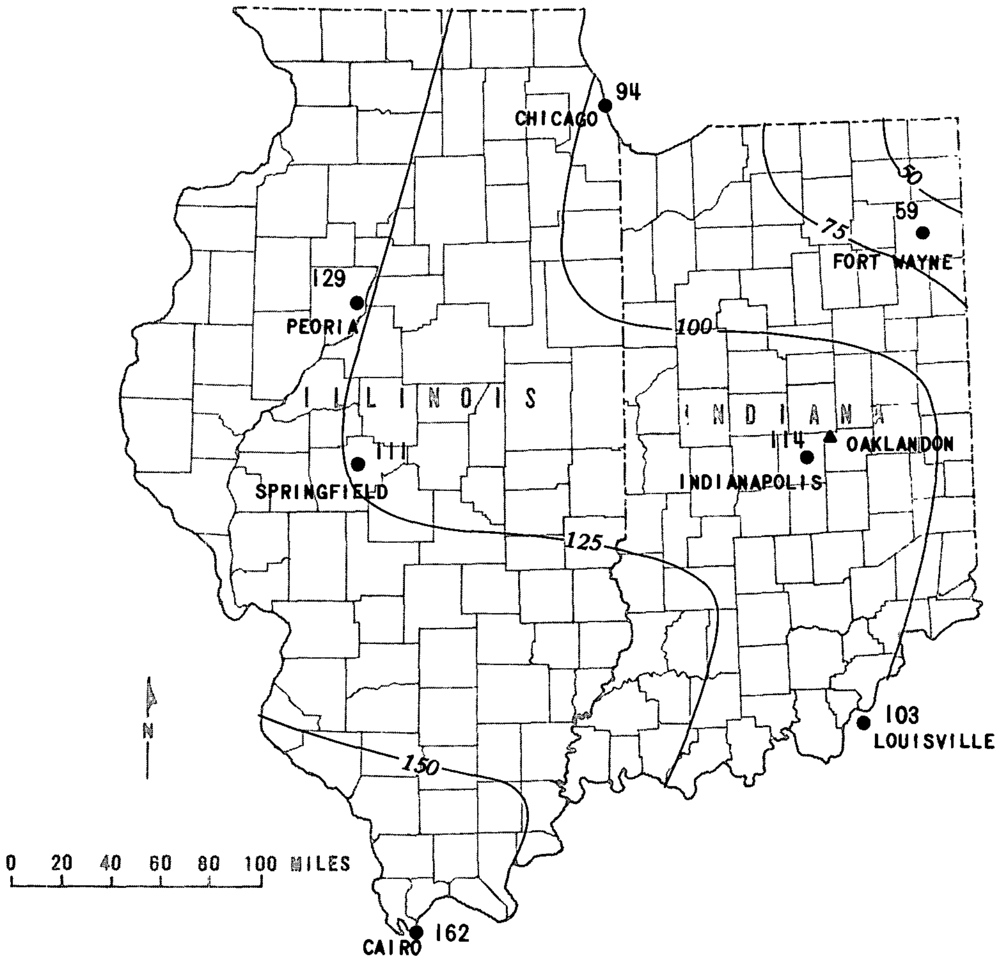
[1]VAR is defined by the equation $VAR = KSW^2 + (TC/60)^2/24$

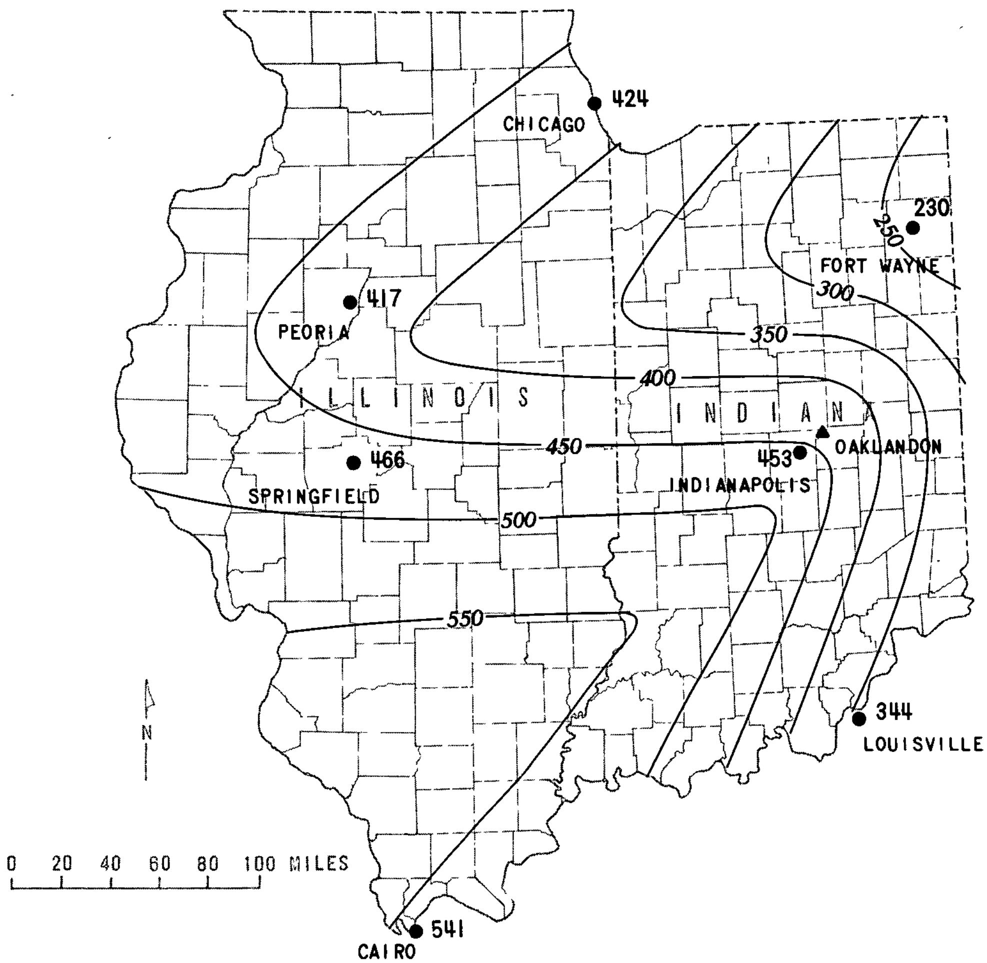
[2]FR is defined by the equation $FR = KSAT\ [1.0 + 0.50\ PSP(0.15\ RGF + 0.85)]$



EXPLANATION

—125—	Line of equal climatic factor a_2
114	Point value of climatic factor a_2
●	Long-term precipitation station
▲	Long-term evaporation station

Figure 6.-- Climatic factor a_2 for estimating synthetic Q_2 at a rainfall-runoff station.



EXPLANATION

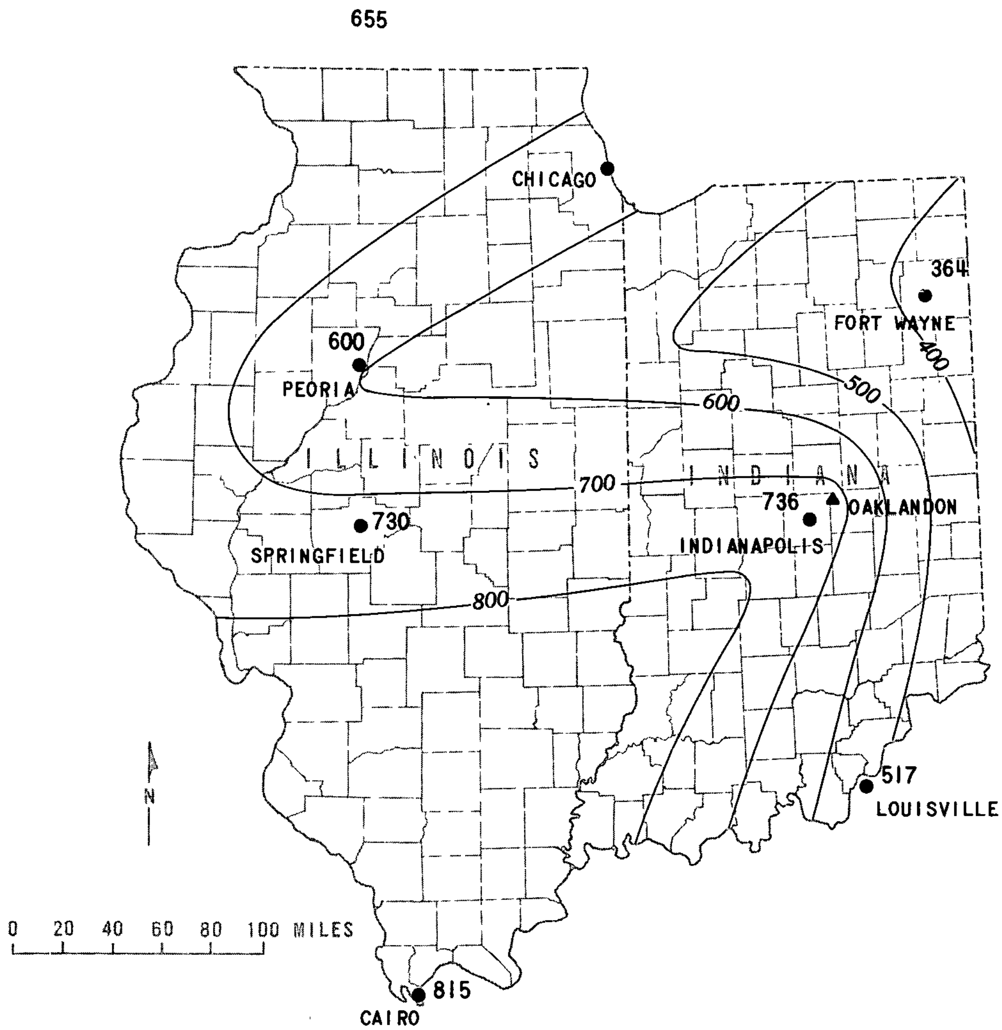
—350— Line of equal climatic factor a_{10}

344 Point value of climatic factor a_{10}

● Long-term precipitation station

▲ Long-term evaporation station

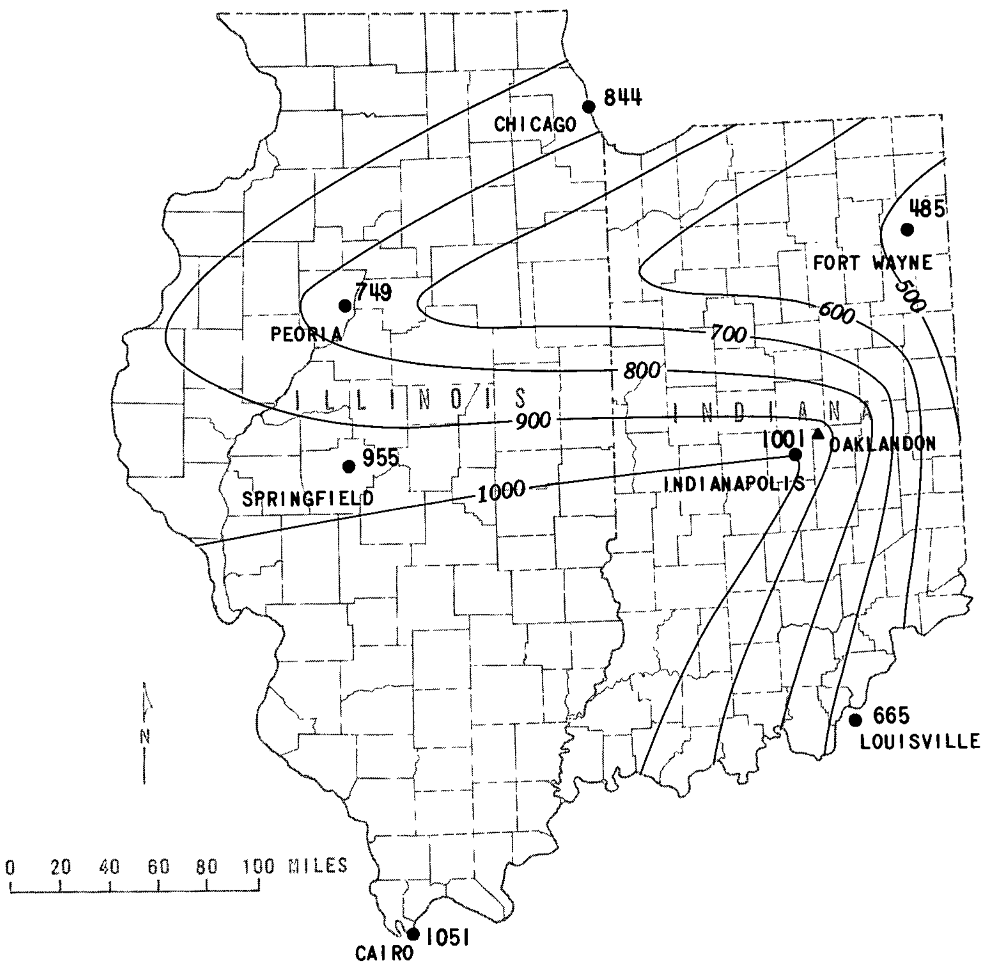
Figure 7.-- Climatic factor a_{10} for estimating synthetic Q_{10} at a rainfall-runoff station.



EXPLANATION

—600—	Line of equal climatic factor a_{25}
517	Point value of climatic factor a_{25}
●	Long-term precipitation station
▲	Long-term evaporation station

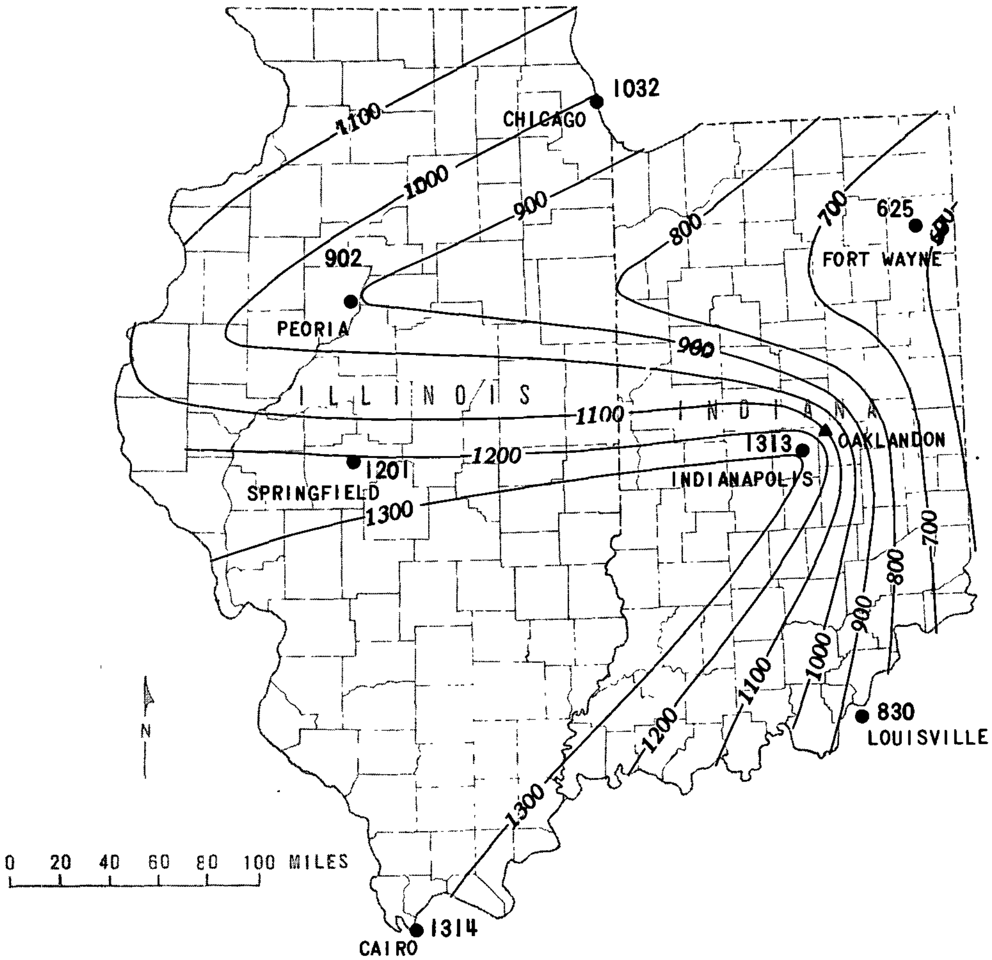
Figure 8.— Climatic factor a_{25} for estimating synthetic Q_{25} at a rainfall-runoff station.



EXPLANATION

—700—	Line of equal climatic factor a_{50}
665	Point value of climatic factor a_{50}
●	Long-term precipitation station
▲	Long-term evaporation station

Figure 9.-- Climatic factor a_{50} for estimating synthetic Q_{50} at a rainfall-runoff station.



EXPLANATION

—900—	Line of equal climatic factor a_{100}
1201	Point value of climatic factor a_{100}
●	Long-term precipitation station
▲	Long-term evaporation station

Figure 10.-- Climatic factor a_{100} for estimating synthetic Q_{100} at a rainfall-runoff station.

The preceding method was used to eliminate the need to select data from a single long-term-precipitation station to estimate synthetic Q_T at each of the 11 stations used in the modeling procedure. Furthermore, synthetic Q_T can also be estimated at any additional rainfall-runoff station whose record is adequate to define VAR and FR; synthesis of annual peak discharges at the various long-term-precipitation stations is not required.

Table 8.--Data used to estimate synthetic Q_T at rainfall-runoff stations

[DA is the drainage area, in square miles. VAR is an index of the dispersion about the mean arrival time (lag), in hours, that describes the hydrograph shape. FR is the infiltration rate, in inches per hour, that describes the hydrograph volume. a_T is the T-year climatic factor (from figs. 6-10)]

Station number	DA	VAR	FR	a_2	a_{10}	a_{25}	a_{50}	a_{100}
03275800	0.26	0.101	2.209	95	340	450	550	650
03276640	.19	.124	.226	90	300	400	500	600
03324260	.86	.112	2.612	95	320	500	600	700
03329720	5.62	32.878	.387	100	340	550	650	800
03334200	2.61	48.877	.227	110	400	650	800	950
03335790	1.22	.201	.908	110	400	650	800	1,000
03352400	.77	5.241	.350	115	450	700	1000	1,250
03364100	1.46	8.150	.254	110	420	650	800	1,000
03366400	.16	.152	.358	100	350	500	650	800
03373680	.29	.034	1.447	120	450	700	900	1,100
03378590	.32	1.138	.171	140	540	800	1,050	1,300

The synthetic flood-frequency curve was combined with the flood-frequency curve based on the 10 years of observed data, and the resultant flood-frequency data at each site was used in the regression analysis to develop estimating equations. A weighting procedure based on an analysis of variance (Lichty and Liscum, 1978, p. 21) and on equivalent years of record (W. O. Thomas, oral commun., 1983) was used to develop the final flood-frequency curve for each of the rainfall-runoff stations. In this procedure, the flood-frequency curves developed from the synthetic and the observed data are assumed to be unbiased and independent.

A value of equivalent years of record for the synthetic estimates of Q_T was determined from statistics of observed data by the equation:

$$N = R^2 \left(\frac{I_V}{SE_p}\right)^2 ,$$

where

N is equivalent years of record;

R a factor based on skew and recurrence interval relating standard error of a T-year flood to I_V and N (from Hardison, 1971, p. C230);

I_V the index of variability, equal to the standard deviation of the logarithms of the annual peaks (from Lichty and Liscum, 1978, p. 21);

and

SE_p the standard error of prediction, equal to the square root of the average variance of the synthetic estimate (from Lichty and Liscum, 1978, p. 29).

The weighting factor applied to the observed estimates of peak discharge (Q_T) was determined as the ratio of years of observed data to total years of record (observed and synthetic). The weighting factor applied to the synthetic estimate of peak discharge (Q_{T_S}) was equal to one minus the observed weighting factor. All information needed to determine the combined (weighted) flood-frequency curve at a rainfall-runoff station is given in table 9. Constant values of I_V (equal to S) and G were taken from Lichty and Liscum (1978, p. 21); R values were taken from Hardison (1971, p. C230); and SE_p values were determined by the equation $SE_p = \sqrt{VMM}$ and data in Lichty and Liscum (1978, p. 29). Data from the combined flood-frequency curves at the 11 rainfall-runoff stations were included in regression analysis to develop the estimating equations and are shown as the upper number in table 4.

Sample calculations to determine factors for weighting synthetic and observed estimates of a 25-year flood follow: Given: $I_V = S = 0.298$, $G = -0.109$, R (for $T = 25$ and $G = -0.109$) $= 1.512$, and $SE_p = \sqrt{VMM}$ (for $T = 25$) $= \sqrt{0.0110} = 0.105$. Substituting these values into the equation to calculate equivalent years of record gives:

$$N = R^2 \left(\frac{I_V}{SE_p}\right)^2 = (1.512)^2 \left(\frac{0.298}{0.105}\right)^2 = 18.4 \text{ years.}$$

The synthetic estimate of Q_{25} has an equivalency equal to 18.4 years compared to the 10 years of observed data. The weighting factor applied to the observed estimate of Q_{25} is:

$$\frac{N_{obs}}{N_{obs} + N_{syn}} = \frac{10}{10 + 18.4} = 0.35.$$

The weighting factor applied to the synthetic estimate of Q_{25} is:

$$1.00 - 0.35 = 0.65.$$

Therefore, the weighted estimate of Q_{25} from combining the observed and the synthetic frequency curves is calculated by the equation:

$$Q_{25_{weighted}} = (0.35)(Q_{25_{observed}}) + (0.65)(Q_{25_{synthetic}}).$$

Table 9.--Equations used to combine observed and synthetic estimates of Q_T at rainfall-runoff stations

[I_V and G are constant for all recurrence intervals. I_V, which is S in Lichty and Liscum (1978, p. 21), is 0.298. G, from Lichty and Liscum (1978, p. 21), is -0.109. T is the recurrence interval. R, from Hardison (1971, p. C230), is a function of T and G. SE_p is the square root of VMM, from Lichty and Liscum (1978, p. 29). N_{obs} is the number of observed peaks. N_{syn} is the equivalent years of record for the synthetic estimate of Q_T. $Q_{T_{obs}}$ is the estimate of Q_T from observed data. $Q_{T_{syn}}$ is the estimate of Q_T from synthetic data. $Q_{T_{wt}}$ is the weighted estimate of Q_T from combining $Q_{T_{obs}}$ and $Q_{T_{syn}}$.]

For T = 2 years, R = 0.999, SE_p = 0.140, N_{obs} = 10, and N_{syn} = 4.5

$$Q_{2_{wt}} = (0.70)(Q_{2_{obs}}) + (0.30)(Q_{2_{syn}})$$

For T = 10 years, R = 1.298, SE_p = 0.102, N_{obs} = 10, and N_{syn} = 14.4

$$Q_{10_{wt}} = (0.40)(Q_{10_{obs}}) + (0.60)(Q_{10_{syn}})$$

For T = 25 years, R = 1.512, SE_p = 0.105, N_{obs} = 10, and N_{syn} = 18.4

$$Q_{25_{wt}} = (0.35)(Q_{25_{obs}}) + (0.65)(Q_{25_{syn}})$$

For T = 50 years, R = 1.841, SE_p = 0.112, N_{obs} = 10, and N_{syn} = 24.0

$$Q_{50_{wt}} = (0.30)(Q_{50_{obs}}) + (0.70)(Q_{50_{syn}})$$

For T = 100 years, R = 2.192, SE_p = 0.118, N_{obs} = 10, and N_{syn} = 30.7

$$Q_{100_{wt}} = (0.25)(Q_{100_{obs}}) + (0.75)(Q_{100_{syn}})$$

Regression Analysis

Multiple-regression analysis was used to develop the relation between flood magnitudes having 2-, 10-, 25-, 50-, and 100-year recurrence intervals (table 4, upper number) and basin characteristics (table 3) for 242 gaged locations in Indiana, Ohio, and Illinois. Independent variables (basin characteristics) and dependent variables (peak-flow statistics) were transformed to base 10 logarithms before analysis by multiple-regression techniques, and the equations were developed in log-linear form. Equations for estimating flood frequency are presented so that information from sites where peak data are available can be transferred to ungaged locations. These equations, which relate the most significant basin characteristics to peak discharge at specific recurrence intervals, are of the form:

$$\log Q_T = \log a + b \log A + c \log B + d \log C + \ldots n \log N$$

or

$$Q_T = a\, A^b\, B^c\, C^d \ldots N^n,$$

where Q_T is the flood magnitude, in cubic feet per second, having a recurrence interval of T years;

a the regression constant;

A, B, C...N the basin characteristics;

and b, c, d...n the regression coefficients.

Forward selection, backward elimination, and maximum R^2 improvement regression analyses described in Helwig and Council (1979) were done on data from throughout the State and on data from the seven areas used to define flood-frequency relations. For each area, the equations with the lowest standard error of estimate, independent variables significant at the 90-percent confidence level, and logical regression coefficients were chosen to estimate flood magnitude at recurrence intervals of 2, 10, 25, 50, and 100 years.

The State of Indiana was divided into seven areas (fig. 2) on the basis of regression analysis. Initially, basin characteristics and flood-frequency data from all 242 gaged sites were analyzed as a single area. Standard errors of estimate ranged from 38 percent for the 2-year flood to 50 percent for the 100-year flood. Grouping the stations by physiographic region and rerunning the regression analysis did not produce standard errors of estimate lower than those determined from analysis of a single area. Residuals (observed value minus the value computed from the estimating equation) from the single-area analysis were plotted on a State map. Stations were grouped by major river basins into areas having similar residuals and regression analysis was done on data from the stations in each area. The residuals from these analyses were plotted on a map. Stations were reassigned from one area to another on the basis of the residuals and regression analyses rerun. If the standard errors of estimate for both areas decreased, and regression coefficients were logical, the stations were kept in the new area; if not, the stations were kept in the old area. Some large areas were split into smaller subareas, and analyses were run on data from each of them. Conversely, several areas were combined into one large area for analysis. The regrouping of stations continued until no further improvement resulted from the reassignment of stations from one area to another. The groupings then consisted of seven geographical areas. Except for the White River and East Fork White River, basins drained by unregulated streams were not divided; all stations within a basin were reassigned from one area to another. Residuals from the final estimating equations were plotted against independent and dependent variables, and no trends were detected in the plots.

Equations for each of the seven areas, their accuracy, and statistical information about the independent variables used in the regression are shown in table 1. Standard errors of the equations are shown in log units and in percent. Accuracy of the equations is also shown as the number of years of record needed at an ungaged location in the area to produce an estimate as good as that produced by the equation (equivalent years of record).

Basin characteristics used as independent variables in the regression analyses included contributing drainage area, channel length, channel slope, average elevation, storage, forested area, mean annual precipitation (Stewart, 1983), precipitation intensity of a 24-hour, 2-year storm (Hershfield, 1961), precipitation index (Davis, 1974); and a soil runoff coefficient (Davis, 1975). Of these, average elevation, forested area, and precipitation index were insignificant in the estimating equations. Various combinations of the remaining variables were used in the final estimating equations. The equations for the individual areas are valid for all unregulated, nonurban streams in the area.

Additional analyses were done to determine whether equations for estimating flood magnitude and frequency could be developed on the basis of drainage-area size as was done by Davis (1974). Davis presented one equation for all locations draining 15 to 100 mi^2 and another for all locations draining more than 200 mi^2 (except the Wabash and White Rivers). He used a weighting procedure on streams draining 100 to 200 mi^2. Separating the 242 stations into groups based on drainage-area size did not produce equations with lower standard errors of estimate than those based on location (dividing the State into seven areas). The results of the analyses are shown in table 10. Comparison of the standard errors of estimate for the two sets of equations shows that equations based on location are better for estimating peak discharge on all sizes of streams and that the standard error of estimate for streams draining less than 100 mi^2 is virtually constant.

Split-sampling techniques were used to analyze the data from area 3 and to verify that the standard errors of estimate shown in table 1 are representative of the predictive accuracy of the estimating equations. Split sampling is discussed in the section "Accuracy and Limitations."

Table 10.--Standard errors of estimate of Q_{100} for area equations and equations developed by grouping stations according to size of drainage basin

Drainage area (square miles)	Number of stations	Standard error of estimate of Q100	
		area equations	basin size equations
<10	77	41 percent	56 percent
<15	84	41 percent	56 percent
<20	90	42 percent	54 percent
<50	117	43 percent	61 percent
<100	133	42 percent	58 percent
>100	109	32 percent	33 percent
>0.1	242	37 percent	50 percent

SUMMARY

Methods for estimating the magnitude and frequency of floods on any unregulated, nonurban stream in Indiana are given in this report. The State was divided into seven areas, and a set of equations for estimating peak discharges with recurrence intervals of 2, 10, 25, 50, and 100 years was developed for each area. Peak-discharge and basin-characteristics data from 242 gaging stations and crest-stage partial-record stations in Indiana and nearby Ohio and Illinois were used in multiple-regression analysis to develop the equations. A log-Pearson type-III frequency distribution based on guidelines of the U.S. Water Resources Council (1981) was used to develop flood-frequency curves for the individual stations. Basin characteristics shown to be significant in estimating flood magnitude included drainage area, channel length, channel slope, mean annual precipitation, precipitation intensity, storage, and a runoff coefficient. Standard errors of estimate ranged from 24 to 45 percent.

Peak-flow data synthesized by a rainfall-runoff model was used to extend the length of record at 11 small-stream gaging stations. The synthetic data were used to develop a flood-frequency curve for each station. These curves and flood-frequency curves developed from observed data were then combined into one curve for each station for use in regression analysis.

Flood-frequency data from stations on regulated and urban streams are presented for use in estimating flood magnitude and frequency at specific locations under current (1983) conditions. No methodology is given in the report for estimating magnitude and frequency of floods at ungaged sites on regulated or urban streams.

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TABLES 2-6

Table 2.--Statistics of logarithms of annual peaks

Station number	Station name	Length of record (years)	Mean	Standard deviation	WRC-weighted skew
03242100	Wayne Creek at Waynesville, Ohio	16	2.408	0.291	-0.055
03262750	Millers ditch at Tipp City, Ohio	[h]39	1.992	.280	-.005
03272900	Collins Creek at Collinsville, Ohio	16	2.352	.212	-.385
03274650	Whitewater River near Economy, Ind.	11	2.753	.173	-.240
03274880	Green Fork tributary near Lynn, Ind.	10	1.972	.296	-.260
03274950	Little Williams Creek at Connersville, Ind.	13	2.903	.283	.138
03275000	Whitewater River near Alpine, Ind.	53	4.073	.293	-.348
03275500	East Fork Whitewater River at Richmond, Ind.	29	3.707	.289	-.261
03275600	East Fork Whitewater River at Abington, Ind.	16	3.819	.172	-.459
[m]03275800	West Run near Liberty, Ind.	41	1.795	.320	-.300
03275900	Templeton Creek near Fairfield, Ind.	10	2.593	.364	-.005
[*]03276000	East Fork Whitewater River at Brookville, Ind.	20	4.009	.271	.124
[*]03276500	Whitewater River at Brookville, Ind.	55	4.454	.222	-.239
[m]03276640	Tanners Creek tributary near Lawrenceburg, Ind.	41	1.985	.289	-.700
03276700	South Hogan Creek near Dillsboro, Ind.	[h]85	3.679	.250	.226
03276770	Laughery Creek tributary near Napoleon, Ind.	10	1.482	.166	-.056

Table 2.--Statistics of logarithms of annual peaks--Continued

Station number	Station name	Length of record (years)	Mean	Standard deviation	WRC-weighted skew
03276950	Uhlman Creek tributary near Avonburg, Ind.	10	1.536	0.325	-0.381
03277000	Laughery Creek near Farmers Retreat, Ind.	[h]85	4.038	.215	.081
03277250	Indian Creek tributary near Bloomington, Ind.	10	1.548	.194	-.163
03291780	Indian-Kentuck Creek near Canaan, Ind.	12	3.438	.251	-.152
03292350	Flag Run tributary near New Washington, Ind.	10	1.293	.212	-.091
03294000	Silver Creek near Sellersburg, Ind.	27	3.796	.236	.148
03302220	Buck Creek near New Middletown, Ind.	12	3.661	.321	-.263
03302300	Little Indian Creek near Galen, Ind.	13	3.443	.235	-.504
03302350	Georgetown Creek tributary near Georgetown, Ind.	10	2.123	.371	.192
03302500	Indian Creek near Corydon, Ind.	38	3.876	.220	.275
03302680	West Fork Blue River at Salem, Ind.	11	3.287	.190	.106
03302690	Middle Fork Blue River tributary near Farabee, Ind.	10	1.228	.290	-.194
03302800	Blue River at Fredericksburg, Ind.	13	3.932	.102	-.602
03303000	Blue River near White Cloud, Ind.	56	4.084	.195	-.302
03303250	Sigler Creek tributary at Uniontown, Ind.	10	1.771	.282	-.075

Table 2.--Statistics of logarithms of annual peaks--Continued

Station number	Station name	Length of record (years)	Mean	Standard deviation	WRC-weighted skew
03303300	Middle Fork Anderson River at Bristow, Ind.	[h]77	3.224	0.291	0.444
03303400	Crooked Creek near Santa Claus, Ind.	12	2.979	.291	.148
03303440	Crooked Creek tributary near Fulda, Ind.	10	1.949	.235	-.537
03303900	Little Red Creek tributary near Heilman, Ind.	10	1.832	.149	-.168
03322100	Pigeon Creek at Evansville, Ind.	21	3.666	.184	-.077
03322500	Wabash River near New Corydon, Ind.	30	3.607	.170	-.712
03322900	Wabash River at Linn Grove, Ind.	18	3.724	.130	-.553
03323000	Wabash River at Bluffton, Ind.	[h]144	3.737	.210	-.359
*03323500	Wabash River at Huntington, Ind.	18	3.839	.216	-.652
03324000	Little River near Huntington, Ind.	39	3.523	.121	-.112
03324200	Salamonie River at Portland, Ind.	22	3.383	.110	-.584
[m]03324260	Salamonie River tributary near Montpelier, Ind.	41	1.931	.367	.600
03324300	Salamonie River near Warren, Ind.	24	3.829	.153	-.396
03324350	Brook Creek tributary near Warren, Ind.	11	1.564	.390	-.437

Table 2.--Statistics of logarithms of annual peaks--Continued

Station number	Station name	Length of record (years)	Mean	Standard deviation	WRC-weighted skew
*03324500	Salamonie River at Dora, Ind.	44	3.857	0.193	-0.428
03325500	Mississinewa River near Ridgeville, Ind.	35	3.559	.240	-.183
03326000	Mississinewa River near Eaton, Ind.	20	3.786	.264	-.241
03326070	Big Lick Creek near Hartford City, Ind.	10	2.894	.166	.094
03326500	Mississinewa River at Marion, Ind.	58	4.019	.223	-.685
*03327000	Mississinewa River at Peoria, Ind.	16	3.989	.292	-.470
03327520	Pipe Creek near Bunker Hill, Ind.	13	3.320	.153	-.295
03327530	Minnow Creek tributary near Logansport, Ind.	10	1.496	.433	-.227
03327790	Eel River tributary near Columbia City, Ind.	10	1.264	.316	-.162
03327930	Koontz ditch near Sidney, Ind.	10	2.161	.294	-.222
03328000	Eel River at North Manchester, Ind.	59	3.596	.181	-.578
03328020	Otter Creek tributary near North Manchester, Ind.	10	1.989	.214	-.157
03328430	Weesau Creek near Deedsville, Ind.	12	2.304	.184	-.151
03328500	Eel River near Logansport, Ind.	40	3.875	.148	.175

Table 2.--Statistics of logarithms of annual peaks--Continued

Station number	Station name	Length of record (years)	Mean	Standard deviation	WRC-weighted skew
03329400	Rattlesnake Creek near Patton, Ind.	13	2.230	0.261	-0.086
03329700	Deer Creek near Delphi, Ind.	39	3.611	.245	.247
[m]03329720	Robinson Branch near Delphi, Ind.	41	2.320	.378	-.400
03330500	Tippecanoe River at Oswego, Ind.	[h]39	2.584	.172	.235
03331110	Walnut Creek near Warsaw, Ind.	13	2.192	.260	.127
03331500	Tippecanoe River near Ora, Ind.	39	3.628	.180	-.242
03332300	Little Indian Creek near Royal Center, Ind.	22	2.487	.124	-.422
03332340	Weltzin ditch tributary near Francesville, Ind.	10	1.064	.336	.097
03332400	Big Monon Creek near Francesville, Ind.	19	3.217	.130	-.502
03332780	Big Creek near Wolcott, Ind.	10	1.962	.316	-.246
03333420	Grassy Fork tributary at Point Isabel, Ind.	10	1.788	.290	-.411
03333450	Wildcat Creek near Jerome, Ind.	20	3.404	.190	-.344
03333500	Wildcat Creek at Greentown, Ind.	[h]19	3.412	.236	-.064
03333600	Kokomo Creek near Kokomo, Ind.	22	2.671	.163	-.051
03333620	Scott-Youngman ditch near Kokomo, Ind.	10	1.684	.312	-.196

Table 2.--Statistics of logarithms of annual peaks--Continued

Station number	Station name	Length of record (years)	Mean	Standard deviation	WRC-weighted skew
03333700	Wildcat Creek at Kokomo, Ind.	26	3.559	0.254	-0.586
03334000	Wildcat Creek at Owasco, Ind.	38	3.631	.255	-.455
[m]03334200	Prairie Creek tributary near Frankfort, Ind.	41	2.162	.308	-.400
03334500	South Fork Wildcat Creek near Lafayette, Ind.	39	3.656	.262	-.291
03334900	South Fork Wildcat Creek tributary near Monitor, Ind.	10	1.418	.373	-.146
03335000	Wildcat Creek near Lafayette, Ind.	27	3.966	.209	-.446
03335685	Big Pine tributary near Pine Village, Ind.	10	1.795	.364	-.311
03335690	Mud Pine Creek near Oxford, Ind.	11	3.174	.213	-.124
03335700	Big Pine Creek near Williamsport, Ind.	26	3.710	.208	-.464
[m]03335790	Big Shawnee Creek tributary near Attica, Ind.	41	2.118	.482	-.400
03336500	Bluegrass Creek at Potomac, Ill.	32	3.252	.241	-.251
03338100	Salt Fork tributary near Catlin, Ill.	17	2.244	.391	-.400
03338800	North Fork Vermilion River tributary near Danville, Ill.	20	2.462	.298	-.400
03339108	East Fork Coal Creek near Hillsboro, Ind.	13	3.200	.126	-.147
03339230	Woods ditch near Frankfort, Ind.	11	1.925	.449	-.486

Table 2.--Statistics of logarithms of annual peaks--Continued

Station number	Station name	Length of record (years)	Mean	Standard deviation	WRC-weighted skew
03339500	Sugar Creek at Crawfordsville, Ind.	[h]69	3.913	0.259	-0.124
03340000	Sugar Creek near Byron, Ind.	31	4.117	.224	-.629
03340800	Big Raccoon Creek near Fincastle, Ind.	[h]107	3.654	.294	-.183
03341000	Big Raccoon Creek at Mansfield, Ind.	19	3.838	.296	.135
03341200	Little Raccoon Creek near Catlin, Ind.	[h]97	3.754	.331	-.082
03341700	Big Creek tributary near Dudley, Ill.	15	2.263	.242	.070
03341900	Raccoon Creek tributary near Annapolis, Ill.	25	1.238	.307	-.446
[r]03342100	Busseron Creek near Hymera, Ind.	15	3.105	.128	-.484
03342150	West Fork Busseron Creek near Hymera, Ind.	15	3.056	.150	-.208
03342180	Kettle Creek near Shelburn, Ind.	10	2.151	.320	-.210
[r]03342250	Mud Creek near Dugger, Ind.	15	2.836	.159	-.285
[r]03342300	Busseron Creek near Sullivan, Ind.	15	3.451	.196	-.232
[p]03342500	Busseron Creek near Carlisle, Ind.	38	3.528	.184	.083
03346650	River Deshee tributary near Frichton, Ind.	10	2.107	.192	-.269
03347000	White River at Muncie, Ind.	[h]154	3.454	.284	.282
03347500	Buck Creek at Muncie, Ind.	27	2.911	.182	-.147

Table 2.--Statistics of logarithms of annual peaks--Continued

Station number	Station name	Length of record (years)	Mean	Standard deviation	WRC-weighted skew
03348000	White River at Anderson, Ind.	[h]154	3.804	0.269	-0.387
03348020	Kill Buck Creek near Gaston, Ind.	14	2.556	.168	.090
03348350	Pipe Creek at Frankton, Ind.	13	3.262	.152	.131
03348500	White River near Noblesville, Ind.	61	4.012	.243	-.424
03348700	White River tributary near Strawtown, Ind.	10	1.612	.240	-.437
03349000	White River at Noblesville, Ind.	35	4.003	.208	-.167
03349500	Cicero Creek near Arcadia, Ind.	[h]69	3.259	.170	.204
03349700	Little Cicero Creek near Arcadia, Ind.	26	3.004	.277	-.316
03350100	Hinkle Creek near Cicero, Ind.	26	3.098	.294	-.225
03350650	Stoney Creek tributary near Lapel, Ind.	10	1.926	.222	-.129
03351000	White River near Nora, Ind.	[h]154	4.018	.234	-.473
03351310	Crooked Creek at Indianapolis, Ind.	12	3.086	.301	.114
03351400	Sugar Creek near Middletown, Ind.	13	2.682	.234	-.384
03351500	Fall Creek near Fortville, Ind.	40	3.442	.222	-.075
[u]03352000	Lawrence Creek at Fort Benjamin Harrison, Indianapolis, Ind.	[h]57	2.691	.256	-.146

Table 2.--Statistics of logarithms of annual peaks--Continued

Station number	Station name	Length of record (years)	Mean	Standard deviation	WRC-weighted skew
03352200	Mud Creek at Indianapolis, Ind.	24	2.879	0.210	-0.295
[m]03352400	Blue Creek near Castleton, Ind.	41	1.840	.295	.400
*03352500	Fall Creek at Millersville, Ind.	[h]116	3.282	.386	-.480
03353000	White River at Indianapolis, Ind.	73	4.248	.251	-.567
[u]03353120	Pleasant Run at Arlington Avenue, Indianapolis, Ind.	22	2.986	.193	-.051
[u]03353160	Pleasant Run at Brookville Road, Indianapolis, Ind.	21	3.084	.184	-.141
03353180	Bean Creek at Indianapolis, Ind.	11	2.555	.203	-.296
03353200	Eagle Creek at Zionsville, Ind.	24	3.638	.252	-.676
*03353500	Eagle Creek at Indianapolis, Ind.	[h]142	3.688	.292	-.401
[u]03353600	Little Eagle Creek at Speedway, Ind.	22	3.043	.240	-.097
03353620	Lick Creek at Indianapolis, Ind.	11	3.004	.264	-.296
03353668	White Lick Creek tributary near Brownsburg, Ind.	10	1.705	.268	-.483
03353700	West Fork White Lick Creek at Danville, Ind.	25	3.230	.229	.075
03353800	White Lick Creek near Mooresville, Ind.	[h]39	3.898	.197	-.291

Table 2.--Statistics of logarithms of annual peaks--Continued

Station number	Station name	Length of record (years)	Mean	Standard deviation	WRC-weighted skew
[p]03354000	White River near Centerton, Ind.	[h]154	4.362	0.206	-0.576
03354500	Beanblossom Creek at Beanblossom, Ind.	30	3.204	.290	-.187
03355000	Bear Creek near Trevlac, Ind.	26	2.746	.318	-.177
03356780	Limestone Creek tributary near Gosport, Ind.	10	2.078	.215	-.168
[p]03357000	White River at Spencer, Ind.	[h]144	4.442	.239	-.594
03357350	Plum Creek near Bainbridge, Ind.	12	2.506	.226	-.250
03357500	Big Walnut Creek near Reelsville, Ind.	32	3.918	.275	-.387
03358000	Mill Creek near Cataract, Ind.	32	3.721	.196	-.169
*03359000	Mill Creek near Manhattan, Ind.	13	3.655	.136	.011
03359500	Deer Creek near Putnamville, Ind.	16	3.745	.191	-.292
*03360000	Eel River at Bowling Green, Ind.	23	4.171	.206	.170
03360100	Clear Branch at Cory, Ind.	10	1.725	.194	-.289
03360400	Doans Creek tributary near Doans, Ind.	10	1.882	.277	-.233
[p]03360500	White River at Newberry, Ind.	[h]106	4.540	.205	-.309
03360850	Veales Creek near Washington, Ind.	10	2.079	.299	-.176
03361000	Big Blue River at Carthage, Ind.	[h]45	3.560	.218	-.262

Table 2.--Statistics of logarithms of annual peaks--Continued

Station number	Station name	Length of record (years)	Mean	Standard deviation	WRC-weighted skew
03361500	Big Blue River at Shelbyville, Ind.	[h]45	3.841	0.212	-0.312
03361660	Little Sugar Creek tributary at Carrollton, Ind.	10	1.816	.192	-.258
03361850	Buck Creek at Acton, Ind.	14	3.376	.184	.174
03361890	Gilmore Creek near Bargersville, Ind.	10	1.965	.255	-.027
03362000	Youngs Creek near Edinburgh, Ind.	39	3.525	.283	-.225
03362500	Sugar Creek near Edinburgh, Ind.	39	3.902	.248	-.220
03363000	Driftwood River near Edinburgh, Ind.	40	4.167	.240	-.164
03363500	Flatrock River at St. Paul, Ind.	51	3.783	.284	-.373
03363900	Flatrock River at Columbus, Ind.	14	3.394	.177	.006
03364000	East Fork White River at Columbus, Ind.	[h]69	4.340	.258	-.157
[m]03364100	Tough Creek near Norristown, Ind.	41	2.200	.282	-.300
03364200	Haw Creek near Clifford, Ind.	14	3.309	.066	-.256
03364500	Clifty Creek at Hartsville, Ind.	[h]85	3.561	.257	.124
03364570	Fall Fork Clifty Creek near Horace, Ind.	10	2.063	.358	-.429
03365000	Sand Creek near Brewersville, Ind.	34	3.864	.204	-.097
03365500	East Fork White River at Seymour, Ind.	[h]135	4.448	.267	-.558

Table 2.--Statistics of logarithms of annual peaks--Continued

Station number	Station name	Length of record (years)	Mean	Standard deviation	WRC-weighted skew
03366000	Graham Creek near Vernon, Ind.	20	3.792	0.229	0.218
03366200	Harberts Creek near Madison, Ind.	13	3.023	.138	-.552
[m]03366400	Lewis Creek tributary near Kent, Ind.	41	1.868	.161	.600
03366500	Muscatatuck River near Deputy, Ind.	[h]116	4.159	.182	.208
03367000	Muscatatuck River near Austin, Ind.	39	4.123	.249	-.139
03367600	Flat Creek tributary at New Frankfort, Ind.	10	1.879	.259	-.011
03368000	Brush Creek near Nebraska, Ind.	26	3.305	.185	.370
03369000	Vernon Fork Muscatatuck River near Butlerville, Ind.	[h]116	3.821	.202	-.076
03369500	Vernon Fork Muscatatuck River at Vernon, Ind.	42	4.128	.255	-.043
03369700	Sixmile Creek tributary near North Vernon, Ind.	10	1.583	.312	-.374
03371500	East Fork White River near Bedford, Ind.	[h]135	4.548	.226	-.463
03371600	South Fork Salt Creek at Kurtz, Ind.	11	3.578	.143	-.223
03371650	North Fork Salt Creek at Nashville, Ind.	20	3.642	.147	-.300
03372000	North Fork Salt Creek near Belmont, Ind.	26	3.765	.251	-.371

Table 2.--Statistics of logarithms of annual peaks--Continued

Station number	Station name	Length of record (years)	Mean	Standard deviation	WRC-weighted skew
03372300	Stephens Creek near Bloomington, Ind.	11	3.308	0.349	0.087
03372680	Clear Creek tributary near Bloomington, Ind.	10	1.820	.348	-.352
03372700	Clear Creek near Harrodsburg, Ind.	12	3.667	.196	-.125
*03373000	Salt Creek near Peerless, Ind.	22	4.003	.234	-.330
03373200	Indian Creek near Springville, Ind.	20	3.557	.191	-.505
03373240	Spring Creek tributary near Springville, Ind.	10	1.802	.456	-.285
03373500	East Fork White River at Shoals, Ind.	[h]135	4.559	.205	-.101
[m]03373680	French Lick Creek tributary near French Lick, Ind.	41	1.973	.397	.000
03373700	Lost River near West Baden Springs, Ind.	20	3.662	.232	.009
03373850	Slate Creek tributary near Hayesville, Ind.	10	1.787	.204	-.023
[p]03374000	White River at Petersburg, Ind.	[h]154	4.824	.216	-.379
03374455	Patoka River near Hardinsburg, Ind.	13	3.235	.233	.112
*03374500	Patoka River near Ellsworth, Ind.	[h]66	3.443	.236	.407
*03375500	Patoka River at Jasper, Ind.	[h]69	3.562	.262	.108

Table 2.--Statistics of logarithms of annual peaks--Continued

Station number	Station name	Length of record (years)	Mean	Standard deviation	WRC-weighted skew
03375800	Hall Creek near St. Anthony, Ind.	[h]69	3.321	0.198	0.465
03376230	Shiloh Drain near Jasper, Ind.	10	2.292	.129	.035
03376260	Flat Creek near Otwell, Ind.	17	3.044	.073	.229
03376300	Patoka River at Winslow, Ind.	[h]14	3.727	.232	.155
03376340	Patoka River tributary near Glezen, Ind.	10	2.085	.243	.003
[p]03376350	South Fork Patoka River near Spurgeon, Ind.	17	3.374	.168	.019
[p]03376500	Patoka River near Princeton, Ind.	47	3.741	.233	.079
03376600	Patoka River tributary near Patoka, Ind.	10	1.953	.276	-.544
03378550	Big Creek near Wadesville, Ind.	16	3.581	.127	.035
[m]03378590	Olive Creek tributary near Solitude, Ind.	41	1.981	.246	-.400
04093000	Deep River at Lake George outlet at Hobart, Ind.	35	3.139	.242	-.207
[u]04093200	Little Calumet River at Gary, Ind.	12	2.033	.245	-.377
04093500	Burns ditch at Gary, Ind.	38	3.149	.195	-.204
04094000	Little Calumet River at Porter, Ind.	37	3.013	.234	-.205
04094500	Salt Creek near McCool, Ind.	37	2.973	.247	-.166

Table 2.--Statistics of logarithms of annual peaks--Continued

Station number	Station name	Length of record (years)	Mean	Standard deviation	WRC-weighted skew
04095250	East Branch Trail Creek tributary near Springville, Ind.	10	1.376	0.151	-0.546
04095300	Trail Creek at Michigan City, Ind.	12	3.014	.290	-.204
04096100	Galena River near Laporte, Ind.	12	2.407	.229	-.227
[r]04097970	Lime Lake outlet at Panama, Ind.	13	1.409	.129	-.030
04099060	Pigeon Creek tributary near Ellis, Ind.	10	1.653	.274	-.193
04099510	Pigeon Creek near Angola, Ind.	37	2.542	.172	-.302
04099610	Pretty Lake inlet near Stroh, Ind.	17	.993	.306	-.353
04099750	Pigeon River near Scott, Ind.	14	3.078	.166	-.180
04100165	Wible Lake inlet near Kendallville, Ind.	10	1.466	.158	-.196
04100220	North Branch Elkhart River near Cosperville, Ind.	24	2.615	.162	-.381
04100222	North Branch Elkhart River at Cosperville, Ind.	11	2.678	.147	-.018
[r]04100252	Forker Creek near Burr Oak, Ind.	13	2.183	.195	.027
[r]04100465	Turkey Creek at Syracuse, Ind.	13	2.086	.098	-.188
04100500	Elkhart River at Goshen, Ind.	55	3.434	.186	-.438
04101000	St. Joseph River at Elkhart, Ind.	61	3.986	.152	-.008

Table 2.--Statistics of logarithms of annual peaks--Continued

Station number	Station name	Length of record (years)	Mean	Standard deviation	WRC-weighted skew
04177720	Fish Creek at Hamilton, Ind.	13	2.478	0.170	-0.183
04178000	St. Joseph River near Newville, Ind.	36	3.608	.202	-.250
[r]04179000	St. Joseph River at Cedarville, Ind.	27	3.684	.194	-.011
04179500	Cedar Creek at Auburn, Ind.	39	2.944	.146	-.121
04179510	Cecil Metcalf ditch near Auburn, Ind.	10	1.682	.293	-.271
04180000	Cedar Creek near Cedarville, Ind.	36	3.458	.154	-.424
04180500	St. Joseph River near Fort Wayne, Ind.	[h]43	3.894	.124	-.009
04181500	St. Marys River at Decatur, Ind.	51	3.734	.208	-.497
04182000	St. Marys River near Fort Wayne, Ind.	52	3.800	.195	-.554
04182590	Harber ditch at Fort Wayne, Ind.	18	2.810	.112	-.409
04183000	Maumee River at New Haven, Ind.	36	4.116	.126	.115
05515000	Kankakee River near North Liberty, Ind.	32	2.712	.118	-.455
[r]05515400	Kingsbury Creek near Laporte, Ind.	12	1.579	.138	.053
05515500	Kankakee River at Davis, Ind.	55	3.082	.081	-.234
05516000	Yellow River near Bremen, Ind.	27	3.072	.127	.330
05516150	Walt Kimble ditch near Lapaz, Ind.	10	1.883	.426	-.179

Table 2.--Statistics of logarithms of annual peaks--Continued

Station number	Station name	Length of record (years)	Mean	Standard deviation	WRC-weighted skew
05516500	Yellow River at Plymouth, Ind.	34	3.324	0.142	0.310
05517000	Yellow River at Knox, Ind.	39	3.371	.158	-.139
05517400	Payne ditch tributary near North Judson, Ind.	10	1.701	.366	-.004
05517500	Kankakee River at Dunns Bridge, Ind.	34	3.555	.095	-.046
05517780	Cobb ditch near Valparaiso, Ind.	10	1.654	.213	-.399
05517890	Cobb ditch near Kouts, Ind.	15	2.641	.210	-.356
05518000	Kankakee River at Shelby, Ind.	60	3.618	.109	-.351
05519000	Singleton ditch at Schneider, Ind.	34	3.014	.183	.003
05519500	West Creek near Shneider, Ind.	23	2.967	.201	-.425
05521000	Iroquois River at Rosebud, Ind.	33	2.394	.135	-.238
05522000	Iroquois River near North Marion, Ind.	33	2.956	.152	-.134
05522500	Iroquois River at Rensselaer, Ind.	33	3.101	.134	-.428
05523000	Bice ditch near South Marion, Ind.	33	2.703	.166	-.276
05523500	Slough ditch near Collegeville, Ind.	32	3.072	.200	-.478
05524000	Carpenter Creek at Egypt, Ind.	32	3.016	.237	-.015

Table 2.--Statistics of logarithms of annual peaks--Continued

Station number	Station name	Length of record (years)	Mean	Standard deviation	WRC-weighted skew
05524300	Yoeman ditch tributary near Rensselaer, Ind.	10	1.986	0.301	-0.387
05524500	Iroquois River near Foresman, Ind.	33	3.420	.164	-.361
05536190	Hart ditch at Munster, Ind.	39	3.106	.183	-.145
u05536195	Little Calumet River at Munster, Ind.	23	2.864	.128	-.096

h Historic flood information used to extend length of record.

m Statistics from the combination of observed peaks and synthetic peaks from the rainfall-runoff model.

* Statistics of peaks from the unregulated period of record at a station on a stream that is currently regulated.

r Statistics of peaks from the entire period of record at a station on a stream that is totally regulated.

p Statistics of peaks from the entire period of record at a station on a stream that is partially regulated.

u Statistics of peaks from the entire period of record at a station on an urban stream.

Table 3.--Selected basin characteristics of gaging stations and partial-record sites

DA is the drainage area, in square miles, that contributes directly to surface runoff.
SL is the main channel slope, in feet per mile.
L is the main channel length, in miles.
ELEV is the average basin elevation, in feet (National Geodetic Vertical Datum of 1929).
STOR is the percentage of the contributing drainage area covered by lakes, ponds, or wetlands.
FOR is the percentage of the drainage area covered by forest.
PREC is the mean annual precipitation, in inches.
$I_{24,2}$ is the 24-hour rainfall having a recurrence interval of 2 years, in inches.
RC is the soil runoff coefficient.

Station number	DA	SL	L	ELEV	STOR	FOR	PREC	$I_{24,2}$	RC
03242100	1.01	98.0	1.81	854.0	0.000	10.000	39.0	2.90	0.70
03262750	0.83	60.0	1.91	878.0	0.000	10.000	38.5	2.80	0.80
03272900	0.94	120.0	1.62	783.0	0.000	24.000	39.0	2.90	0.70
03274650	10.40	11.8	7.00	1,112.0	11.000	7.600	40.0	2.80	0.70
03274880	0.78	48.7	1.50	1,190.0	0.130	3.800	39.0	2.80	0.80
03274950	9.16	28.8	6.10	932.0	0.469	35.370	40.0	2.95	0.70
03275000	529.00	8.7	47.40	940.0	0.080	11.100	40.0	2.90	0.70
03275500	121.00	12.8	19.50	980.0	0.600	8.760	39.0	2.85	0.75
03275600	200.00	12.1	29.00	1,076.0	0.400	11.000	39.0	2.85	0.75
03275800	0.26	100.0	0.64	974.0	0.000	11.530	40.0	2.90	0.70
03275900	5.39	23.6	5.80	969.0	0.630	13.350	39.0	2.95	0.70
03276000	380.00	9.2	52.10	1,050.0	0.320	16.100	39.0	2.90	0.75
03276500	1,224.00	7.3	72.90	840.0	0.150	19.200	39.5	2.95	0.75
03276640	0.19	253.0	0.76	597.5	0.000	1.050	40.0	3.00	0.80
03276700	38.10	22.2	18.20	798.0	0.560	24.900	40.0	3.00	0.90

Table 3.--Selected basin characteristics of gaging stations and partial-record sites--Continued

Station number	DA	SL	L	ELEV	STOR	FOR	PREC	$I_{24,2}$	RC
03276770	0.11	45.3	0.53	979.0	0.000	9.090	40.0	3.00	1.00
03276950	0.16	94.6	0.57	940.0	1.250	1.250	41.0	3.05	0.80
03277000	248.00	6.6	63.80	877.0	0.520	30.500	40.5	3.05	0.95
03277250	0.16	92.2	0.57	890.5	0.625	25.000	41.0	3.05	0.80
03291780	27.50	30.3	13.30	780.0	0.425	31.600	41.5	3.05	0.90
03292350	0.16	43.0	0.68	722.0	0.000	6.250	43.0	3.05	1.00
03294000	189.00	5.5	25.10	602.0	0.340	39.900	43.0	3.10	0.85
03302220	37.10	18.6	14.40	625.0	0.458	29.470	42.0	3.20	0.70
03302300	16.10	19.0	10.20	792.0	2.360	25.470	43.0	3.15	0.80
03302350	0.56	140.0	0.95	820.0	0.178	1.790	43.0	3.15	0.70
03302500	118.00	6.3	33.20	769.0	0.330	32.700	43.0	3.15	0.75
03302680	19.00	36.8	9.10	853.0	1.180	10.060	44.0	3.10	0.70
03302690	0.07	222.0	0.30	855.0	0.000	42.860	44.0	3.20	0.70
03302800	206.00	6.5	37.70	694.0	0.439	23.700	44.0	3.15	0.75
03303000	284.00	3.8	77.10	739.0	0.480	35.100	44.0	3.20	0.75
03303250	0.15	267.0	0.80	530.0	0.000	20.000	44.0	3.20	0.80
03303300	39.80	15.4	14.00	551.0	0.000	68.800	44.0	3.20	0.80
03303400	7.86	23.7	4.35	447.5	0.648	59.620	44.0	3.25	0.80
03303440	0.26	104.5	0.76	480.0	0.384	15.380	44.0	3.30	0.80
03303900	0.25	82.0	0.57	477.5	0.000	16.000	43.0	3.30	0.80
03322100	323.00	2.4	42.00	448.0	0.500	10.000	42.0	3.30	0.75
03322500	262.00	3.2	63.10	933.0	4.100	7.900	37.0	2.70	0.80
03322900	453.00	2.4	84.40	869.0	3.000	9.000	37.0	2.70	0.80
03323000	532.00	2.0	93.30	897.0	2.200	9.900	37.0	2.70	0.80
03323500	721.00	2.0	117.00	878.0	1.700	9.600	37.0	2.70	0.80

Table 3.--Selected basin characteristics of gaging stations and partial-record sites--Continued

Station number	DA	SL	L	ELEV	STOR	FOR	PREC	$I_{24,2}$	RC
03324000	263.00	4.4	28.00	808.0	0.160	10.800	36.0	2.70	0.70
03324200	85.60	5.8	17.40	948.0	0.100	11.000	38.0	2.80	0.80
03324260	0.86	14.6	1.60	879.5	0.000	12.790	38.0	2.80	0.80
03324300	425.00	2.4	58.10	897.0	0.100	9.900	38.0	2.80	0.80
03324350	0.52	27.7	1.10	850.5	0.000	5.770	37.0	2.75	0.80
03324500	557.00	2.7	85.00	873.0	0.120	10.700	38.0	2.80	0.80
03325500	133.00	4.6	20.10	1,008.0	0.180	7.800	39.0	2.80	0.80
03326000	310.00	3.0	48.00	976.0	0.130	9.300	38.5	2.80	0.80
03326070	29.20	4.2	13.00	899.5	0.320	13.360	38.0	2.80	0.80
03326500	682.00	2.9	83.80	944.0	0.180	8.500	38.5	2.80	0.80
03327000	808.00	3.3	113.00	922.0	0.170	9.600	38.5	2.80	0.80
03327520	159.00	3.3	34.20	798.0	0.050	3.360	38.0	2.80	0.80
03327530	0.50	27.0	1.50	705.5	0.000	8.000	38.0	2.85	0.70
03327790	0.17	43.7	0.61	830.0	0.000	52.940	36.0	2.70	0.50
03327930	2.50	32.5	1.70	900.0	0.080	3.200	37.0	2.70	0.50
03328000	417.00	2.1	41.90	850.0	0.520	11.000	36.5	2.70	0.55
03328020	0.92	32.6	2.46	795.0	0.100	15.220	38.0	2.75	0.70
03328430	8.87	9.3	7.00	823.5	0.110	7.940	38.0	2.80	0.50
03328500	789.00	2.4	87.10	786.0	0.440	12.600	37.0	2.70	0.55
03329400	6.83	8.8	4.50	665.0	0.000	4.000	38.0	2.85	0.50
03329700	274.00	5.6	50.30	756.0	0.100	6.200	38.0	2.85	0.70
03329720	5.62	14.0	5.10	662.5	0.179	17.320	38.0	2.90	0.60
03330500	113.00	3.6	22.70	900.0	6.330	13.200	36.0	2.70	0.30
03331110	19.60	5.5	9.50	852.0	3.000	7.500	37.0	2.70	0.50
03331500	856.00	1.6	105.00	827.0	2.130	11.300	37.0	2.75	0.45

Table 3.--Selected basin characteristics of gaging stations and partial-record sites--Continued

Station number	DA	SL	L	ELEV	STOR	FOR	PREC	$I_{24,2}$	RC
03332300	35.00	7.1	11.10	733.0	0.000	5.300	38.0	2.80	0.40
03332340	0.50	4.1	1.70	687.5	0.000	28.000	37.0	2.80	0.30
03332400	152.00	2.4	19.10	792.0	0.060	13.400	38.0	2.80	0.40
03332780	1.35	21.9	1.70	735.0	0.070	0.000	37.0	2.85	0.70
03333420	0.67	28.9	1.30	883.0	0.000	7.460	38.0	2.75	0.80
03333450	146.00	3.3	24.10	873.0	0.030	5.000	38.0	2.80	0.75
03333500	168.00	3.3	29.60	864.0	0.050	4.900	38.0	2.80	0.75
03333600	24.70	4.5	13.70	847.0	0.090	7.800	38.0	2.85	0.70
03333620	0.86	14.5	1.10	864.0	0.000	0.000	38.0	2.85	0.70
03333700	242.00	2.7	44.10	854.0	0.420	6.600	38.0	2.85	0.70
03334000	396.00	3.3	83.50	790.0	0.320	9.100	38.0	2.85	0.70
03334200	2.61	7.8	3.00	869.0	0.000	1.890	38.0	2.90	0.70
03334500	243.00	7.1	48.80	842.0	0.160	8.300	38.0	2.90	0.70
03334900	0.10	21.6	0.49	756.0	0.000	0.000	38.0	2.90	0.50
03335000	794.00	3.5	102.00	811.0	0.220	9.300	38.0	2.90	0.70
03335685	0.21	37.8	0.64	741.0	0.000	9.520	38.0	2.95	0.70
03335690	39.40	9.0	9.60	757.0	0.000	0.100	37.0	2.90	0.70
03335700	323,00	4.4	48.50	948.0	0.080	3.200	37.5	2.90	0.65
03335790	1.22	21.0	1.90	697.5	0.410	2.460	38.0	2.95	0.70
03336500	35.00	6.9	12.80	731.0	0.000	1.560	38.0	3.00	0.70
03338100	2.20	15.8	3.40	663.0	0.000	0.000	38.0	3.00	0.70
03338800	1.31	33.2	2.21	667.0	0.000	1.610	37.5	3.00	0.70
03339108	33.40	11.6	11.50	716.0	0.100	4.000	39.0	2.95	0.70
03339230	1.11	15.7	2.10	906.5	0.000	0.000	38.0	2.90	0.70
03339500	509.00	5.3	51.20	862.0	0.120	6.000	39.5	2.95	0.70

Table 3.--Selected basin characteristics of gaging stations and partial-record sites--Continued

Station number	DA	SL	L	ELEV	STOR	FOR	PREC	$I_{24,2}$	RC
03340000	670.00	5.4	72.00	845.0	0.100	7.500	39.0	2.95	0.70
03340800	139.00	7.2	35.90	864.0	0.000	7.000	39.5	2.95	0.70
03341000	248.00	6.7	54.10	825.0	0.710	14.600	40.5	3.00	0.75
03341200	133.00	11.4	29.10	713.0	0.000	23.800	41.0	3.00	0.70
03341700	1.08	44.4	1.69	732.0	0.000	32.000	39.4	3.10	0.70
03341900	0.04	52.8	0.30	508.0	0.000	0.000	40.1	3.20	0.50
03342150	14.40	12.9	10.30	536.0	0.500	15.000	40.0	3.15	0.70
03342180	0.48	21.6	1.30	551.5	0.000	0.000	39.0	3.20	0.70
03342500	228.00	2.9	30.60	531.0	0.940	22.200	39.5	3.15	0.80
03346650	0.82	36.1	1.30	522.5	0.000	2.490	40.0	3.25	0.50
03347000	241.00	4.7	49.40	1,104.0	0.640	9.300	39.5	2.85	0.75
03347500	35.50	10.2	12.50	974.0	0.220	9.300	39.0	2.85	0.70
03348000	406.00	4.4	72.00	1,042.0	0.480	9.700	39.5	2.90	0.75
03348020	25.50	3.6	13.30	908.0	0.129	6.000	38.5	2.85	0.80
03348350	113.00	4.5	20.40	855.0	0.820	5.780	38.0	2.85	0.75
03348500	828.00	4.1	93.40	952.0	0.280	8.900	39.0	2.90	0.75
03348700	0.42	13.0	1.50	802.5	0.238	4.048	38.0	2.90	0.70
03349000	858.00	3.9	102.00	796.0	0.270	9.100	39.0	2.90	0.75
03349500	131.00	4.0	27.10	893.0	0.120	7.800	38.0	2.90	0.70
03349700	40.40	6.2	15.00	892.0	0.180	3.900	38.0	2.90	0.70
03350100	18.50	18.7	6.40	893.0	0.000	12.200	38.0	2.90	0.70
03350650	0.46	26.5	1.10	859.0	0.000	6.520	38.0	2.85	0.70
03351000	1,219.00	3.7	117.00	811.0	0.430	8.500	38.0	2.90	0.70
03351310	17.90	14.8	11.60	798.5	0.179	9.350	38.0	2.95	0.70
03351400	5.80	18.7	6.20	1,006.5	0.103	4.086	39.0	2.90	0.70

Table 3.--Selected basin characteristics of gaging stations and partial-record sites--Continued

Station number	DA	SL	L	ELEV	STOR	FOR	PREC	$I_{24,2}$	RC
03351500	169.00	7.2	31.80	910.0	0.160	9.000	38.0	2.90	0.70
03352200	42.40	6.7	19.30	895.0	0.000	6.500	38.0	2.90	0.70
03352400	0.77	18.4	1.40	828.0	0.700	3.100	38.0	2.95	0.70
03352500	298.00	5.3	48.80	879.0	1.150	10.300	38.0	2.90	0.70
03353000	1,635.00	3.5	135.00	794.0	0.590	9.000	38.0	2.90	0.70
03353180	4.40	10.8	7.80	818.5	0.000	45.910	39.0	2.95	0.70
03353200	103.00	15.2	17.40	924.0	0.220	9.100	38.0	2.90	0.70
03353500	174.00	6.8	35.10	891.0	0.470	11.900	38.0	2.90	0.70
03353620	15.60	11.5	10.40	809.5	0.480	8.650	39.0	2.95	0.70
03353668	0.31	28.0	0.95	910.0	0.645	9.680	38.5	3.00	0.70
03353700	28.80	10.6	11.50	933.0	0.000	10.300	39.0	3.00	0.70
03353800	212.00	9.0	35.10	866.0	0.210	10.200	39.0	3.00	0.70
03354000	2,444.00	3.1	166.00	727.0	0.560	10.700	38.5	2.95	0.70
03354500	14.60	19.8	7.60	807.0	1.100	61.600	40.5	3.10	0.80
03355000	6.94	52.1	4.40	825.0	1.140	87.400	40.5	3.05	0.80
03356780	0.72	113.0	1.30	625.0	0.280	9.720	43.0	3.10	1.00
03357000	2,988.00	2.8	203.00	705.0	0.620	18.400	39.0	2.95	0.75
03357350	3.00	24.2	4.46	883.0	0.100	5.000	40.0	3.00	0.70
03357500	326.00	6.6	58.80	827.0	0.120	24.300	40.5	3.00	0.80
03358000	245.00	5.8	29.50	782.0	0.030	14.200	40.5	3.00	0.85
03359000	294.00	5.1	45.00	776.0	0.810	20.900	41.0	3.05	0.85
03359500	59.00	12.6	18.30	786.0	0.470	55.700	41.0	3.00	0.75
03360000	830.00	5.8	75.70	790.0	0.430	26.200	41.0	3.00	0.85
03360100	0.27	28.0	0.95	628.0	0.000	0.000	41.0	3.10	1.00
03360400	0.20	174.0	0.61	670.0	0.500	28.000	42.0	3.15	1.00

Table 3.--Selected basin characteristics of gaging stations and partial-record sites--Continued

Station number	DA	SL	L	ELEV	STOR	FOR	PREC	$I_{24,2}$	RC
03360500	4,688.00	2.4	253.00	704.0	0.630	23.000	40.0	3.10	0.80
03360850	0.27	64.0	0.83	480.0	0.000	3.700	40.0	3.20	0.70
03361000	184.00	5.8	30.80	1,017.0	0.040	6.100	40.0	2.90	0.70
03361500	421.00	4.8	57.60	953.0	0.060	7.800	40.5	2.90	0.70
03361660	0.70	23.6	1.40	842.5	0.000	0.000	39.0	2.95	0.70
03361850	78.80	14.8	8.33	812.0	1.110	6.500	39.0	2.95	0.70
03361890	0.71	23.9	1.20	814.5	0.000	0.000	39.0	3.00	0.70
03362000	107.00	4.3	30.10	778.0	0.110	44.700	40.0	3.00	0.70
03362500	474.00	4.5	81.10	827.0	0.060	7.600	40.0	3.00	0.70
03363000	1,060.00	5.9	67.30	872.0	0.040	8.050	40.0	2.95	0.70
03363500	303.00	5.7	60.60	993.0	0.040	9.200	40.5	2.95	0.70
03363900	534.00	5.0	92.40	686.0	0.040	8.000	41.0	2.95	0.70
03364000	1,707.00	3.8	117.00	784.0	0.040	7.600	40.5	3.00	0.70
03364100	1.46	22.1	1.40	729.5	0.068	6.164	41.0	3.00	0.70
03364200	47.50	8.9	11.40	698.0	0.029	1.140	41.5	3.05	0.70
03364500	91.40	10.3	33.70	938.0	0.040	4.600	41.0	3.00	0.70
03364570	0.83	28.5	1.70	857.5	0.480	22.890	41.0	3.00	0.70
03365000	155.00	8.9	42.30	906.0	1.130	67.900	41.0	3.05	0.85
03365500	2,341.00	2.8	146.00	906.0	1.150	11.600	41.0	3.00	0.70
03366000	77.20	9.4	32.60	887.0	0.150	30.300	42.0	3.05	1.00
03366200	9.31	18.3	8.90	813.5	0.880	24.650	42.0	3.05	1.00
03366400	0.16	71.0	0.98	726.0	1.250	12.500	42.0	3.05	1.00
03366500	293.00	7.6	54.70	771.0	0.260	33.900	43.0	3.00	1.00
03367000	359.00	6.2	68.80	731.0	0.240	50.500	43.0	3.00	1.00
03367600	0.34	62.7	1.10	634.0	1.470	14.700	44.0	3.10	1.00

Table 3.--Selected basin characteristics of gaging stations and partial-record sites--Continued

Station number	DA	SL	L	ELEV	STOR	FOR	PREC	$I_{24,2}$	RC
03368000	11.40	28.1	8.30	845.0	0.000	32.100	42.0	3.05	1.00
03369000	85.90	12.2	29.10	869.0	0.370	31.400	41.0	3.05	1.00
03369500	198.00	9.2	43.20	856.0	0.200	33.800	41.0	3.05	1.00
03369700	0.39	40.0	0.95	734.0	0.510	10.250	44.0	3.05	1.00
03371500	3,861.00	2.5	207.00	685.0	0.140	17.800	43.0	3.05	0.80
03371600	38.20	13.0	10.60	732.0	0.460	54.200	44.0	3.10	0.80
03371650	76.10	13.5	18.80	731.0	0.410	69.600	41.0	3.10	0.80
03372000	120.00	9.0	34.70	720.0	1.100	88.400	41.5	3.10	0.80
03372300	10.90	44.6	5.50	657.5	0.300	85.320	41.0	3.10	0.80
03372680	0.38	119.0	1.30	742.5	0.790	86.840	44.0	3.10	0.70
03372700	47.80	19.1	13.70	633.0	0.490	31.100	44.0	3.10	0.70
03373000	573.00	2.0	58.20	700.0	3.500	66.900	42.0	3.10	0.80
03373200	60.70	12.5	17.20	744.0	0.260	38.500	44.0	3.10	0.80
03373240	0.54	149.0	1.40	641.0	0.000	0.000	44.0	3.15	0.80
03373500	4,927.00	2.0	255.00	625.0	0.530	23.800	43.0	3.05	0.80
03373680	0.29	236.0	0.91	600.0	0.340	62.070	44.0	3.15	0.80
03373700	287.00	6.1	53.10	702.0	0.400	38.500	44.0	3.15	0.75
03373850	0.14	182.0	0.57	520.0	0.000	21.400	43.0	3.20	0.90
03374000	11,125.00	1.9	315.00	609.0	0.300	15.000	42.0	3.00	0.80
03374455	12.80	23.6	5.70	666.0	0.078	76,640	44.0	3.15	0.80
03374500	171.00	3.2	48.10	636.0	0.050	45,800	44.0	3.20	0.80
03375500	262.00	2.4	72.60	654.0	0.080	47.600	44.0	3.20	0.80
03375800	21.80	18.2	8.82	528.0	0.000	24.000	44.0	3.20	0.80
03376230	0.57	48.2	1.10	480.0	0.017	1.400	44.0	3.20	0.80
03376260	21.30	6.4	8.30	484.0	1.500	10.000	42.0	3.20	0.80

Table 3.--Selected basin characteristics of gaging stations and partial-record sites--Continued

Station number	DA	SL	L	ELEV	STOR	FOR	PREC	$I_{24,2}$	RC
03376300	603.00	1.3	122.90	578.0	0.320	39.100	43.0	3.20	0.80
03376340	0.84	39.1	1.50	442.5	0.360	25.000	42.0	3.25	0.70
03376350	42.80	9.9	9.80	495.0	3.700	30.900	42.0	3.25	0.80
03376500	822.00	1.2	143.00	552.0	0.510	33.600	43.0	3.20	0.80
03376600	0.40	72.0	1.10	465.0	0.750	8.500	42.0	3.30	0.70
03378550	104.00	3.8	18.60	445.0	0.610	11.400	42.0	3.30	0.70
03378590	0.32	79.5	1.10	412.0	0.000	3.125	42.0	3.35	0.50
04093000	124.00	3.6	29.80	690.0	0.600	5.900	36.1	2.80	0.45
04093500	160.00	3.2	36.00	645.0	0.090	6.040	36.0	2.80	0.40
04094000	66.20	6.2	14.80	694.0	0.900	18.100	41.0	2.80	0.40
04094500	74.60	4.7	22.50	712.0	0.410	12.600	37.5	2.80	0.40
04095250	0.17	147.0	0.64	715.0	0.000	41.170	42.0	2.75	0.50
04095300	54.10	6.4	12.50	630.0	1.700	20.100	46.0	2.70	0.35
04096100	14.90	20.1	8.30	697.5	11.340	24.680	45.0	2.70	0.50
04099060	1.22	14.0	2.00	1,018.5	0.250	18.030	35.0	2.60	0.50
04099510	83.50	6.0	10.60	980.0	0.800	2.800	34.0	2.60	0.50
04099610	0.60	5.6	1.70	981.0	13.300	20.000	34.0	2.60	0.50
04099750	307.00	3.5	63.20	990.0	2.600	6.800	34.0	2.60	0.45
04100165	2.47	18.2	3.60	995.0	0.160	35.000	34.0	2.65	0.50
04100220	134.00	3.9	26.60	956.0	4.660	14.700	34.0	2.70	0.50
04100222	142.00	3.9	29.70	956.0	8.000	3.600	34.0	2.70	0.50
04100500	594.00	2.8	65.90	881.0	2.100	9.400	35.2	2.70	0.50
04101000	3,370.00	2.2	135.00	833.0	3.200	14.200	35.3	2.70	0.40
04177720	37.50	16.0	6.40	778.0	4.000	6.000	34.0	2.60	0.40
04178000	610.00	6.2	74.40	901.0	0.270	6.300	34.8	2.60	0.50

Table 3.--Selected basin characteristics of gaging stations and partial-record sites--Continued

Station number	DA	SL	L	ELEV	STOR	FOR	PREC	$I_{24,2}$	RC
04179500	87.30	8.0	20.10	916.0	0.460	10.000	34.5	2.60	0.50
04179510	0.78	9.4	1.40	875.0	0.000	3.970	34.0	2.65	0.50
04180000	270.00	6.0	35.80	871.0	0.400	14.100	34.3	2.70	0.50
04180500	1,060.00	2.3	98.20	826.0	0.370	9.800	34.6	2.70	0.50
04181500	621.00	2.1	79.40	816.0	1.010	5.100	36.0	2.70	0.80
04182000	762.00	1.7	98.20	810.0	1.010	5.100	36.0	2.70	0.80
04182590	21.90	3.9	12.30	794.0	1.475	4.635	35.0	2.70	0.80
04183000	1,967.00	2.9	124.00	817.0	0.610	8.100	35.0	2.70	0.65
05515000	116.00	1.2	23.20	750.0	1.550	10.200	38.5	2.70	0.30
05515500	400.00	1.3	49.60	756.0	1.100	9.400	41.0	2.70	0.30
05516000	131.00	5.0	12.90	830.0	0.210	11.200	36.0	2.70	0.50
05516150	1.50	11.0	2.70	823.5	0.000	3.330	37.0	2.70	0.50
05516500	272.00	2.2	26.60	823.0	0.380	10.800	36.5	2.70	0.50
05517000	384.00	2.3	54.40	774.0	0.650	12.900	37.0	2.75	0.40
05517400	2.58	15.8	2.90	692.5	0.039	55.039	38.0	2.80	0.30
05517500	1,160.00	0.9	69.60	697.0	0.920	11.400	38.0	2.75	0.35
05517780	0.39	36.1	1.10	774.0	0.000	38.500	37.0	2.75	0.50
05517890	30.30	8.6	12.80	702.0	3.040	6.340	37.0	2.75	0.30
05518000	1,578.00	0.9	78.60	702.0	0.740	11.300	39.0	2.75	0.35
05519000	123.00	3.2	22.20	696.0	1.610	7.900	36.0	2.80	0.40
05519500	54.70	2.3	21.10	710.0	0.220	10.200	36.0	2.80	0.50
05521000	35.60	2.5	8.90	693.0	0.130	15.400	36.5	2.85	0.40
05522000	144.00	2.9	15.70	682.0	0.450	10.300	36.5	2.85	0.40
05522500	203.00	2.5	18.60	681.0	0.330	8.100	36.5	2.85	0.40
05523000	21.80	6.4	10.40	700.0	0.000	5.300	37.0	2.85	0.70

Table 3.--Selected basin characteristics of gaging stations and partial-record sites--Continued.

Station number	DA	SL	L	ELEV	STOR	FOR	PREC	$I_{24,2}$	RC
05523500	83.70	2.2	13.20	723.0	0.000	7.900	37.0	2.85	0.70
05524000	44.80	6.4	21.40	727.0	0.000	0.140	37.0	2.90	0.70
05524300	0.57	39.7	1.70	690.0	0.000	0.250	36.5	2.85	0.70
05524500	449.00	2.0	30.70	683.0	0.190	6.900	36.5	2.85	0.60
05536190	70.70	7.4	22.60	663.0	0.000	5.900	36.0	2.80	0.30

Table 4.--T-year peak discharges at gaging stations and partial-record sites

[The upper numbers (in the sets of three) are values of Q_T from flood-frequency analysis of observed station data. The middle numbers are values of Q_T estimated by regression equations (table 1). The lower numbers are values of Q_T obtained by weighting the station and regional estimates. Data are in cubic feet per second]

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03242100	Wayne Creek at Waynesville, Ohio	258	602	817	994	1,190
		208	453	595	706	823
		249	557	742	879	1,020
03262750	Millers ditch at Tipp City, Ohio	98	225	304	369	440
		135	276	354	413	475
		100	231	311	377	447
03272900	Collins Creek at Collinsville, Ohio	232	411	494	553	609
		204	456	604	720	842
		227	423	525	608	695
03274650	Whitewater River near Economy, Ind.	576	933	1,100	1,220	1,330
		526	996	1,250	1,430	1,620
		565	955	1,150	1,310	1,470
03274880	Green Fork tributary near Lynn, Ind.	97	220	290	345	401
		96	194	249	289	331
		96	210	272	317	363
03274950	Little Williams Creek at Connersville, Ind.	788	1,860	2,580	3,200	3,900
		854	1,760	2,280	2,670	3,090
		800	1,830	2,470	2,970	3,510
03275000	Whitewater River near Alpine, Ind.	12,300	27,300	35,400	41,600	47,700
		14,600	31,000	40,700	47,900	55,600
		12,400	27,700	36,000	42,500	49,000

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03275500	East Fork Whitewater River at Richmond, Ind.	5,240	11,700	15,400	18,200	21,100
		4,130	8,780	11,500	13,500	15,600
		5,120	11,100	14,500	17,000	19,400
03275600	East Fork Whitewater River at Abington, Ind.	6,800	10,700	12,300	13,500	14,500
		7,020	14,900	19,500	22,900	26,600
		6,830	11,700	14,200	16,300	18,600
03275800	West Run near Liberty, Ind.	65	156	214	267	312
		48	102	133	157	182
		64	148	200	243	278
03275900	Templeton Creek near Fairfield, Ind.	392	1,150	1,700	2,180	2,740
		583	1,140	1,440	1,680	1,920
		430	1,150	1,590	1,930	2,270
*03276000	East Fork Whitewater River at Brookville, Ind.	10,100	22,900	31,200	38,300	46,100
		14,100	29,100	37,800	44,400	51,400
		10,500	24,200	32,800	40,100	47,900
*03276500	Whitewater River at Brookville, Ind.	29,000	54,000	66,700	76,100	85,400
		29,500	62,900	82,700	97,900	114,000
		29,000	54,800	68,300	78,900	89,500
03276640	Tanners Creek tributary near Lawrenceburg, Ind.	106	213	261	295	322
		87	196	262	313	368
		105	211	261	298	331
03276700	South Hogan Creek near Dillsboro, Ind.	4,680	10,100	13,700	16,700	20,100
		3,720	7,590	9,810	11,600	13,400
		4,640	9,910	13,400	16,100	19,200

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03276770	Laughery Creek tributary near Napoleon, Ind.	31	49	59	66	73
		20	38	47	54	62
		28	45	54	60	67
03276950	Uhlman Creek tributary near Avonburg, Ind.	36	87	115	137	159
		39	81	104	122	141
		37	84	110	130	150
03277000	Laughery Creek near Farmers Retreat, Ind.	10,800	20,700	26,300	30,800	35,600
		13,600	25,500	32,100	37,500	43,000
		10,900	21,000	26,700	31,400	36,400
03277250	Indian Creek tributary near Bloomington, Ind.	36	62	75	85	95
		39	80	103	120	139
		36	68	86	100	116
03291780	Indian-Kentuck Creek near Canaan, Ind.	2,780	5,690	7,300	8,550	9,840
		3,040	6,390	8,350	9,920	11,600
		2,830	5,910	7,670	9,110	10,600
03292350	Flag Run tributary near New Washington, Ind.	20	37	45	52	59
		30	57	70	81	92
		22	43	54	64	75
03294000	Silver Creek near Sellersburg, Ind.	6,160	12,600	16,600	19,900	23,400
		5,130	10,000	12,800	14,900	17,100
		6,050	12,100	15,700	18,500	21,400
03302220	Buck Creek near New Middletown, Ind.	4,730	11,500	15,600	18,800	22,200
		3,200	6,500	8,400	9,920	11,500
		4,380	9,510	12,400	14,300	16,200

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03302300	Little Indian Creek near Galena, Ind.	2,900	5,350	6,460	7,230	7,960
		1,620	3,170	4,050	4,750	5,480
		2,600	4,540	5,490	6,090	6,710
03302350	Georgetown Creek tributary near Georgetown, Ind.	129	403	625	835	1,090
		139	316	422	505	594
		131	368	532	658	793
03302500	Indian Creek near Corydon, Ind.	7,340	14,600	19,100	22,900	27,100
		5,900	11,000	13,800	16,000	18,300
		7,220	14,000	18,200	21,400	24,800
03302680	West Fork Blue River at Salem, Ind.	1,920	3,400	4,230	4,870	5,530
		2,150	4,630	6,100	7,260	8,500
		1,970	3,790	4,880	5,830	6,860
03302690	Middle Fork Blue River tributary near Farabee, Ind.	17	39	52	62	73
		28	61	81	97	113
		19	46	62	76	92
03302800	Blue River at Fredericksburg, Ind.	12,300	21,200	25,400	28,400	31,400
		8,560	16,500	21,000	24,500	28,200
		11,500	19,600	23,800	26,700	29,900
03303000	Blue River near White Cloud, Ind.	12,400	21,200	25,400	28,300	31,200
		14,200	24,900	30,700	35,500	40,400
		12,500	21,500	25,900	29,200	32,500
03303250	Sigler Creek tributary at Uniontown, Ind.	60	135	181	218	258
		99	217	288	345	406
		67	161	219	271	327

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03303300	Middle Fork Anderson River at Bristow, Ind.	1,600	4,060	5,970	7,760	9,900
		2,910	5,860	7,540	8,870	10,300
		1,640	4,170	6,090	7,870	9,950
03303400	Crooked Creek near Santa Claus, Ind.	936	2,270	3,190	3,980	4,870
		682	1,390	1,800	2,120	2,450
		878	1,930	2,580	3,040	3,510
03303440	Crooked Creek tributary near Fulda, Ind.	93	171	206	230	252
		78	163	213	252	293
		89	168	209	240	273
03303900	Little Red Creek tributary near Heilman, Ind.	69	105	121	133	145
		52	110	143	169	196
		64	107	130	149	170
03322100	Pigeon Creek at Evansville, Ind.	4,660	7,930	9,600	10,800	12,100
		7,430	13,300	16,500	18,900	21,400
		4,940	8,890	11,100	12,800	14,700
03322500	Wabash River near New Corydon, Ind.	4,230	6,420	7,230	7,730	8,170
		3,120	4,730	5,370	5,780	6,160
		4,080	6,190	6,930	7,360	7,750
03322900	Wabash River at Linn Grove, Ind.	5,440	7,600	8,410	8,920	9,380
		4,830	7,300	8,280	8,920	9,520
		5,320	7,540	8,380	8,920	9,420
03323000	Wabash River at Bluffton, Ind.	5,610	9,930	12,000	13,400	14,800
		5,670	8,690	9,930	10,800	11,500
		5,610	9,890	11,900	13,300	14,600

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
*03323500	Wabash River at Huntington, Ind.	7,290	12,500	14,600	16,000	17,300
		7,280	11,200	12,800	13,900	14,900
		7,290	12,200	14,200	15,400	16,600
03324000	Little River near Huntington, Ind.	3,350	4,740	5,360	5,800	6,220
		3,590	6,160	7,380	8,230	9,110
		3,370	4,860	5,560	6,080	6,590
03324200	Salamonie River at Portland, Ind.	2,480	3,280	3,560	3,740	3,900
		2,110	4,030	5,010	5,760	6,510
		2,420	3,390	3,790	4,100	4,410
03324260	Salamonie River tributary near Montpelier, Ind.	84	299	536	714	921
		83	204	279	348	414
		84	289	499	651	820
03324300	Salamonie River near Warren, Ind.	6,910	10,400	11,900	12,900	13,800
		6,560	12,300	13,900	15,500	17,200
		6,860	10,700	12,200	13,400	14,500
03324350	Brook Creek tributary near Warren, Ind.	39	110	153	187	222
		53	134	185	232	277
		42	116	162	202	242
*03324500	Salamonie River at Dora, Ind.	7,420	12,400	14,600	16,100	17,600
		7,920	13,700	16,400	18,200	20,200
		7,460	12,500	14,800	16,300	17,900
03325500	Mississinewa River near Ridgeville, Ind.	3,690	7,280	9,210	10,700	12,200
		3,080	5,700	7,020	8,050	8,990
		3,620	7,100	8,900	10,300	11,600

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03326000	Mississinewa River near Eaton, Ind.	6,270	13,100	16,800	19,700	22,500
		5,440	9,660	11,700	13,300	14,700
		6,120	12,500	15,600	18,000	20,200
03326070	Big Lick Creek near	778	1,280	1,550	1,750	1,960
	Hartford City, Ind.	952	1,880	2,370	2,770	3,140
		824	1,430	1,790	2,080	2,380
03326500	Mississinewa River at Marion, Ind.	11,100	19,200	22,500	24,700	26,600
		9,410	16,000	19,000	21,100	23,300
		11,000	19,000	22,200	24,300	26,200
*03327000	Mississinewa River at Peoria, Ind.	10,300	22,100	28,100	32,500	36,700
		10,600	17,900	21,300	23,600	25,900
		10,400	21,200	26,300	29,800	33,000
03327520	Pipe Creek near Bunker Hill, Ind.	2,130	3,240	3,730	4,070	4,390
		2,220	3,890	4,690	5,300	5,870
		2,150	3,450	4,040	4,560	5,050
03327530	Minnow Creek tributary near	33	109	166	215	269
	Logansport, Ind.	48	130	182	224	270
		37	117	172	220	270
03327790	Eel River tributary near	19	46	63	77	91
	Columbia City, Ind.	17	42	56	70	82
		18	45	61	74	88
03327930	Koontz ditch near Sidney, Ind.	149	339	449	536	626
		127	263	337	396	456
		142	315	408	478	549

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03328000	Eel River at North Manchester, Ind.	4,110	6,510	7,480	8,110	8,690
		4,420	6,840	7,870	8,470	9,170
		4,130	6,530	7,510	8,140	8,740
03328020	Otter Creek tributary near North Manchester, Ind.	99	182	225	258	290
		80	188	254	312	367
		93	184	234	277	320
03328430	Weesau Creek near Deedsville, Ind.	203	344	413	464	514
		339	655	819	948	1,070
		231	404	505	589	674
03328500	Eel River near Logansport, Ind.	7,430	11,700	13,900	15,600	17,300
		7,370	11,100	12,700	13,500	14,600
		7,420	11,600	13,800	15,300	16,900
03329400	Rattlesnake Creek near Patton, Ind.	171	365	478	568	662
		221	495	654	776	906
		184	406	533	650	770
03329700	Deer Creek near Delphi, Ind.	3,990	8,520	11,500	14,000	16,800
		3,780	6,570	7,910	8,910	9,830
		3,970	8,190	10,900	12,800	14,800
03329720	Robinson Branch near Delphi, Ind.	226	576	817	964	1,160
		285	666	889	1,060	1,240
		232	588	827	982	1,180
03330500	Tippecanoe River at Oswego, Ind.	378	644	793	911	1,030
		369	603	726	823	921
		377	638	782	892	1,010

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03331110	Walnut Creek near Warsaw, Ind.	154	339	457	556	665
		170	315	394	456	519
		158	330	434	510	591
03331500	Tippecanoe River near Ora, Ind.	4,310	7,120	8,440	9,390	10,300
		3,140	4,680	5,410	5,980	6,490
		4,160	6,680	7,890	8,560	9,240
03332300	Little Indian Creek near Royal Center, Ind.	313	436	485	517	546
		430	829	1,050	1,210	1,390
		332	509	584	674	759
03332340	Weltzin ditch tributary near Francesville, Ind.	12	32	46	59	74
		18	46	65	80	97
		13	37	53	69	86
03332400	Big Monon Creek near Francesville, Ind.	1,690	2,370	2,630	2,810	2,960
		1,190	2,070	2,520	2,860	3,200
		1,570	2,290	2,600	2,830	3,050
03332780	Big Creek near Wolcott, Ind.	94	227	307	369	435
		96	241	330	400	476
		95	233	316	384	457
03333420	Grassy Fork tributary at Point Isabel, Ind.	64	140	179	208	237
		37	90	123	150	178
		53	117	153	176	203
03333450	Wildcat Creek near Jerome, Ind.	2,600	4,360	5,170	5,740	6,280
		1,980	3,470	4,210	4,770	5,290
		2,460	4,110	4,900	5,400	5,890

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03333500	Wildcat Creek at Greentown, Ind.	2,600	5,160	6,600	7,730	8,910
		2,180	3,790	4,580	5,180	5,730
		2,510	4,750	5,980	6,730	7,510
03333600	Kokomo Creek near Kokomo, Ind.	470	758	900	1,010	1,110
		717	1,470	1,880	2,190	2,490
		508	889	1,080	1,290	1,480
03333620	Scott-Youngman ditch near	49	119	162	196	232
	Kokomo, Ind.	70	182	252	308	368
		55	142	194	246	298
03333700	Wildcat Creek at Kokomo, Ind.	3,840	7,330	8,900	9,980	11,000
		3,480	6,100	7,370	8,290	9,180
		3,780	7,050	8,550	9,480	10,400
03334000	Wildcat Creek at Owasco, Ind.	4,470	8,760	10,800	12,300	13,700
		4,880	8,260	9,860	11,000	12,100
		4,520	8,680	10,600	12,000	13,300
03334200	Prairie Creek tributary near	154	349	451	514	576
	Frankfort, Ind.	194	478	648	781	921
		158	365	475	558	641
03334500	South Fork Wildcat Creek near	4,660	9,600	12,200	14,200	16,200
	Lafayette, Ind.	4,420	7,970	9,690	10,900	12,100
		4,630	9,330	11,800	13,500	15,100
03334900	South Fork Wildcat Creek tributary	27	78	112	142	176
	near Monitor, Ind.	15	46	68	87	107
		22	63	92	111	134

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03335000	Wildcat Creek near Lafayette, Ind.	9,590	16,700	19,900	22,100	24,200
		9,990	16,600	19,600	21,800	23,800
		9,650	16,700	19,800	22,000	24,100
03335685	Big Pine Creek tributary near Pine Village, Ind.	65	177	247	303	362
		42	124	181	226	277
		56	153	217	262	313
03335690	Mud Pine Creek near Oxford, Ind.	1,510	2,780	3,450	3,960	4,470
		1,260	2,570	3,260	3,780	4,300
		1,430	2,700	3,380	3,870	4,380
03335700	Big Pine Creek near Williamsport, Ind.	5,320	9,220	11,000	12,100	13,300
		5,040	8,890	10,800	12,100	13,400
		5,270	9,150	11,000	12,100	13,300
03335790	Big Shawnee Creek tributary near Attica, Ind.	143	563	928	1,200	1,560
		140	372	518	632	755
		143	530	832	1,060	1,320
03336500	Bluegrass Creek at Potomac, Ill.	1,830	3,580	4,490	5,170	5,860
		1,720	3,710	4,790	5,560	6,370
		1,810	3,600	4,540	5,260	5,990
03338100	Salt Fork tributary near Catlin, Ill.	186	531	745	915	1,090
		254	662	913	1,110	1,310
		200	566	791	981	1,180
03338800	North Fork Vermilion River tributary near Danville, Ill.	303	674	872	1,020	1,170
		177	479	670	817	978
		272	617	814	947	1,090

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03339108	East Fork Coal Creek near Hillsboro, Ind.	1,600	2,290	2,590	2,810	3,010
		1,380	2,920	3,750	4,360	4,980
		1,540	2,490	2,950	3,400	3,830
03339230	Woods ditch near Frankfort, Ind.	91	296	427	532	641
		106	278	385	470	561
		96	289	410	501	598
03339500	Sugar Creek at Crawfordsville, Ind.	8,280	17,400	22,600	26,700	31,000
		9,070	16,000	19,200	21,400	23,600
		8,330	17,300	22,300	26,000	29,800
03340000	Sugar Creek near Byron, Ind.	13,800	24,300	28,700	31,600	34,200
		10,900	18,800	22,500	25,100	27,500
		13,400	23,200	27,400	29,900	32,200
03340800	Big Raccoon Creek near Fincastle, Ind.	4,600	10,600	14,100	16,900	19,800
		4,190	8,020	10,200	11,800	13,500
		4,590	10,500	13,900	16,500	19,300
03341000	Big Raccoon Creek at Mansfield, Ind.	6,770	16,600	23,400	29,300	36,000
		6,320	12,200	15,500	18,000	20,700
		6,710	15,600	21,500	25,700	30,600
03341200	Little Raccoon Creek near Catlin, Ind.	5,740	15,000	21,100	26,300	32,000
		4,840	9,610	12,300	14,500	16,700
		5,710	14,700	20,600	25,300	30,400
03341700	Big Creek tributary near Dudley, Ill.	182	376	493	588	690
		212	425	543	635	728
		187	388	505	602	703

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03341900	Raccoon Creek tributary near Annapolis, Ill.	18	41	53	62	71
		18	35	44	50	57
		18	40	52	59	67
r03342100	Busseron Creek near Hymera, Ind.	1,310	1,820	2,020	2,160	2,270
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03342150	West Fork Busseron Creek near Hymera, Ind.	1,150	1,760	2,030	2,230	2,420
		938	1,800	2,270	2,630	3,000
		1,110	1,770	2,090	2,350	2,610
03342180	Kettle Creek near Shelburn, Ind.	145	357	487	591	700
		86	161	200	229	259
		129	274	362	400	450
r03342250	Mud Creek near Dugger, Ind.	698	1,080	1,250	1,370	1,490
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r03342300	Busseron Creek near Sullivan, Ind.	2,870	4,970	5,990	6,730	7,450
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03342500	Busseron Creek near Carlisle, Ind.	3,350	5,810	7,150	8,180	9,240
		4,280	7,710	9,530	10,900	12,400
		3,410	6,000	7,390	8,560	9,730
03346650	River Deshee tributary near Frichton, Ind.	130	222	266	297	328
		158	312	394	458	523
		136	248	303	355	404

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03347000	White River at Muncie, Ind.	2,760	6,700	9,500	12,000	14,900
		3,670	6,920	8,610	9,870	11,100
		2,780	6,710	9,470	11,900	14,700
03347500	Buck Creek at Muncie, Ind.	824	1,380	1,660	1,860	2,060
		1,060	2,130	2,700	3,150	3,590
		845	1,460	1,790	2,070	2,370
03348000	White River at Anderson, Ind.	6,630	13,700	17,300	19,900	22,600
		6,070	11,400	14,100	16,100	18,100
		6,620	13,600	17,200	19,700	22,300
03348020	Kill Buck Creek near Gaston, Ind.	358	594	718	813	909
		621	1,100	1,350	1,530	1,710
		394	682	847	1,000	1,160
03348350	Pipe Creek at Frankton, Ind.	1,810	2,870	3,420	3,840	4,260
		2,040	3,800	4,700	5,390	6,060
		1,850	3,070	3,740	4,320	4,920
03348500	White River near Noblesville, Ind.	10,700	20,400	25,100	28,400	31,600
		10,200	19,200	23,800	27,100	30,500
		10,700	20,300	25,000	28,300	31,500
03348700	White River tributary near Strawtown, Ind.	43	81	99	112	124
		44	86	108	125	142
		43	82	102	117	132
03349000	White River at Noblesville, Ind.	10,200	18,400	22,600	25,800	28,900
		10,400	19,400	23,900	27,300	30,700
		10,200	18,500	22,800	26,000	29,200

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03349500	Cicero Creek near Arcadia, Ind.	1,790	3,030	3,710	4,240	4,790
		2,510	4,580	5,630	6,410	7,180
		1,820	3,100	3,820	4,400	5,020
03349700	Little Cicero Creek near Arcadia, Ind.	1,040	2,230	2,860	3,340	3,830
		1,160	2,190	2,720	3,120	3,520
		1,050	2,220	2,840	3,290	3,750
03350100	Hinkle Creek near Cicero, Ind.	1,290	2,930	3,890	4,630	5,410
		866	1,830	2,360	2,780	3,200
		1,240	2,750	3,590	4,160	4,730
03350650	Stoney Creek tributary near Lapel, Ind.	85	161	202	233	264
		51	107	139	164	190
		76	143	178	202	226
03351000	White River near Nora, Ind.	10,900	20,200	24,400	27,500	30,300
		13,300	24,900	30,700	35,000	39,300
		10,900	20,300	24,600	27,800	30,700
03351310	Crooked Creek at Indianapolis, Ind.	1,200	2,990	4,210	5,270	6,470
		886	1,810	2,310	2,700	3,090
		1,130	2,640	3,530	4,120	4,710
03351400	Sugar Creek near Middletown, Ind.	498	933	1,140	1,300	1,440
		359	747	962	1,130	1,300
		468	885	1,090	1,240	1,380
03351500	Fall Creek near Fortville, Ind.	2,790	5,300	6,680	7,740	8,830
		3,570	6,990	8,790	10,100	11,500
		2,840	5,430	6,890	8,060	9,270

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
[u]03352000	Lawrence Creek at Fort Benjamin Harrison, Indianapolis, Ind.	498	1,030	1,330	1,570	1,810
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03352200	Mud Creek at Indianapolis, Ind.	776	1,380	1,680	1,890	2,090
		1,230	2,340	2,920	3,350	3,790
		817	1,490	1,850	2,150	2,460
03352400	Blue Creek near Castleton, Ind.	72	180	245	317	382
		86	174	221	258	295
		73	179	242	308	365
*03352500	Fall Creek at Millersville, Ind.	2,050	5,660	7,770	9,390	11,000
		5,050	9,620	12,000	13,800	15,500
		2,100	5,760	7,910	9,600	11,300
03353000	White River at Indianapolis, Ind.	18,700	35,500	43,200	48,400	53,300
		16,400	30,500	37,700	42,900	48,200
		18,600	35,200	42,800	47,900	52,700
[u]03353120	Pleasant Run at Arlington Avenue, Indianapolis, Ind.	973	1,710	2,100	2,390	2,680
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[u]03353160	Pleasant Run at Brookville Road, Indianapolis, Ind.	1,220	2,070	2,490	2,800	3,110
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03353180	Bean Creek at Indianapolis, Ind.	367	642	774	868	960
		281	543	682	788	894
		346	614	744	836	930

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03353200	Eagle Creek at Zionsville, Ind.	4,630	8,640	10,300	11,500	12,500
		3,010	6,350	8,210	9,630	11,100
		4,410	8,270	9,900	11,000	12,100
[*]03353500	Eagle Creek at Indianapolis, Ind.	5,100	11,100	14,300	16,700	19,000
		3,600	6,990	8,770	10,100	11,500
		5,060	11,000	14,100	16,300	18,400
[u]03353600	Little Eagle Creek at Speedway, Ind.	1,110	2,220	2,840	3,330	3,830
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03353620	Lick Creek at Indianapolis, Ind.	1,040	2,150	2,740	3,190	3,630
		745	1,480	1,870	2,170	2,470
		968	1,950	2,430	2,740	3,050
03353668	White Lick Creek tributary near Brownsburg, Ind.	53	107	134	152	170
		54	111	143	167	193
		53	108	137	158	180
03353700	West Fork White Lick Creek at Danville, Ind.	1,690	3,350	4,340	5,130	5,970
		1,280	2,530	3,180	3,680	4,180
		1,640	3,220	4,120	4,770	4,430
03353800	White Lick Creek near Mooresville, Ind.	8,080	13,900	16,700	18,600	20,600
		5,590	11,000	14,000	16,100	18,400
		7,870	13,600	16,400	18,200	20,200
03354000	White River near Centerton, Ind.	24,100	40,700	47,700	52,400	56,600
		24,100	44,000	54,300	61,400	68,800
		24,100	40,800	47,900	52,800	57,200

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03354500	Beanblossom Creek at	1,630	3,700	4,920	5,880	6,880
	Beanblossom, Ind.	1,080	2,240	2,870	3,340	3,830
		1,570	3,490	4,550	5,280	6,010
03355000	Bear Creek near Trevlac, Ind.	569	1,400	1,920	2,340	2,790
		736	1,690	2,240	2,680	3,140
		584	1,440	1,970	2,410	2,870
03356780	Limestone Creek tributary near	121	224	276	316	356
	Gosport, Ind.	177	428	579	700	828
		132	269	353	439	531
03357000	White River at Spencer, Ind.	29,200	53,700	64,300	71,500	78,200
		27,300	49,400	60,800	68,600	76,800
		29,200	53,600	64,200	71,400	78,100
03357350	Plum Creek near Bainbridge, Ind.	327	615	761	869	976
		364	710	900	1,050	1,200
		334	642	799	930	1,060
03357500	Big Walnut Creek near	8,620	18,100	23,000	26,600	30,100
	Reelsville, Ind.	7,740	15,000	19,100	22,300	25,600
		8,540	17,600	22,400	25,800	29,100
03358000	Mill Creek near Cataract, Ind.	5,330	9,290	11,300	12,700	14,200
		5,920	11,300	14,300	16,600	19,000
		5,380	9,540	11,700	13,300	15,000
*03359000	Mill Creek near Manhattan, Ind.	4,520	6,760	7,840	8,630	9,400
		6,470	12,200	15,400	18,000	20,500
		4,830	7,970	9,470	11,100	12,700

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03359500	Deer Creek near Putnamville, Ind.	5,680	9,620	11,500	12,800	14,100
		2,710	5,340	6,830	7,980	9,170
		5,060	8,360	10,200	11,100	12,200
*03360000	Eel River at Bowling Green, Ind.	14,600	27,400	34,900	41,000	47,400
		15,000	29,200	37,400	43,800	50,400
		14,600	27,700	35,300	41,600	48,200
03360100	Clear Branch at Cory, Ind.	54	93	111	124	136
		62	116	144	166	188
		56	100	121	140	157
03360400	Doans Creek tributary near Doans, Ind.	78	170	221	261	302
		100	217	284	337	390
		83	184	240	290	338
03360500	White River at Newberry, Ind.	35,600	62,400	75,300	84,500	93,400
		39,600	74,600	94,400	110,000	126,000
		35,700	62,900	76,100	85,900	95,400
03360850	Veales Creek near Washington, Ind.	122	286	383	461	544
		85	171	218	255	291
		112	241	318	361	412
03361000	Big Blue River at Carthage, Ind.	3,710	6,790	8,330	9,460	10,600
		3,600	6,840	8,580	9,840	11,100
		3,700	6,790	8,350	9,510	10,700
03361500	Big Blue River at Shelbyville, Ind.	7,110	12,700	15,400	17,300	19,200
		6,410	12,100	15,100	17,200	19,400
		7,060	12,600	15,400	17,300	19,200

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03361660	Little Sugar Creek tributary at Carrollton, Ind.	67	114	136	153	168
		86	177	228	267	307
		71	129	162	192	224
03361850	Buck Creek at Acton, Ind.	2,350	4,120	5,110	5,890	6,710
		2,730	5,660	7,320	8,530	9,820
		2,410	4,420	5,620	6,660	7,790
03361890	Gilmore Creek near Bargersville, Ind.	92	196	257	306	358
		97	197	254	297	342
		93	196	256	302	350
03362000	Youngs Creek near Edinburgh, Ind.	3,430	7,590	9,960	11,800	13,700
		2,710	4,920	6,020	6,830	7,630
		3,370	7,390	9,410	10,900	12,300
03362500	Sugar Creek near Edinburgh, Ind.	8,140	16,300	20,800	24,100	27,500
		8,490	15,800	19,500	22,200	24,800
		8,160	16,300	20,600	23,800	27,000
03363000	Driftwood River near Edinburgh, Ind.	14,900	29,500	37,500	43,500	49,700
		15,300	29,600	37,300	42,700	48,500
		14,900	29,500	37,500	43,400	49,500
03363500	Flatrock River at St. Paul, Ind.	6,310	13,600	17,500	20,300	23,200
		5,850	11,100	13,900	15,900	18,000
		6,280	13,400	17,100	19,700	22,300
03363900	Flatrock River at Columbus, Ind.	8,590	14,500	17,500	19,800	22,200
		8,670	16,300	20,400	23,300	26,300
		8,600	14,900	18,200	20,900	23,700

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03364000	East Fork White River at	22,200	46,300	59,800	70,400	81,200
	Columbus, Ind.	21,400	39,800	49,000	55,600	62,300
		22,200	45,900	59,000	68,900	78,800
03364100	Tough Creek near Norristown, Ind.	162	349	449	516	594
		163	335	430	503	577
		162	348	447	514	591
03364200	Haw Creek near Clifford, Ind.	2,050	2,460	2,620	2,720	2,820
		1,960	3,780	4,730	5,440	6,160
		2,030	2,710	3,060	3,430	3,830
03364500	Clifty Creek at Hartsville, Ind.	3,600	7,820	10,500	12,700	15,200
		3,060	6,070	7,720	8,910	10,200
		3,580	7,730	10,300	12,400	14,600
03364570	Fall Fork Clifty Creek near	123	317	430	516	604
	Horace, Ind.	114	239	309	363	418
		121	292	385	446	508
03365000	Sand Creek near Brewersville, Ind.	7,380	13,300	16,400	18,700	21,100
		4,810	9,390	11,900	13,600	15,500
		7,130	12,800	15,700	17,700	19,800
03365500	East Fork White River at	29,700	58,900	72,500	81,900	90,800
	Seymour, Ind.	25,100	45,000	55,100	64,100	69,300
		29,600	58,400	71,800	80,900	89,300
03366000	Graham Creek near Vernon, Ind.	6,080	12,300	16,200	19,500	23,000
		5,550	10,400	13,100	15,300	17,500
		6,010	11,800	15,300	18,100	20,900

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03366200	Harberts Creek near Madison, Ind.	1,090	1,550	1,720	1,840	1,940
		1,030	1,950	2,460	2,860	3,280
		1,080	1,670	1,950	2,200	2,470
03366400	Lewis Creek tributary near Kent, Ind.	71	125	153	179	205
		54	103	129	150	171
		70	122	149	173	197
03366500	Muscatatuck River near Deputy, Ind.	14,200	24,900	31,000	35,800	40,900
		13,200	25,900	33,000	38,700	44,600
		14,200	24,900	31,100	36,000	41,200
03367000	Muscatatuck River near Austin, Ind.	13,500	27,500	35,300	41,300	47,600
		15,800	30,200	38,200	44,600	51,200
		13,700	27,800	35,700	41,900	48,400
03367600	Flat Creek tributary at New Frankfort, Ind.	76	162	214	257	301
		80	159	203	237	272
		77	161	209	247	286
03368000	Brush Creek near Nebraska, Ind.	1,960	3,530	4,480	5,260	6,100
		1,330	2,690	3,470	4,080	4,730
		1,880	3,350	4,240	4,930	5,650
03369000	Vernon Fork Muscatatuck River near Butlerville, Ind.	6,660	12,000	14,800	16,900	19,100
		6,030	11,900	15,200	17,800	20,500
		6,640	12,000	14,800	17,000	19,200
03369500	Vernon Fork Muscatatuck River at Vernon, Ind.	13,500	28,400	37,300	44,300	51,800
		10,500	20,700	26,500	31,200	36,000
		13,300	27,300	35,500	41,600	48,000

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03369700	Sixmile Creek tributary near North Vernon, Ind.	40	93	122	144	166
		57	111	140	162	185
		43	99	129	152	176
03371500	East Fork White River near Bedford, Ind.	36,800	66,700	80,400	90,000	99,100
		38,900	69,000	84,100	94,300	105,000
		36,800	66,800	80,500	90,200	99,500
03371600	South Fork Salt Creek at Kurtz, Ind.	3,830	5,710	6,550	7,140	7,690
		2,000	4,000	5,060	5,860	6,660
		3,330	5,190	6,040	6,610	7,210
03371650	North Fork Salt Creek at Nashville, Ind.	4,460	6,680	7,640	8,300	8,930
		3,400	6,910	8,770	10,200	11,600
		4,300	6,720	7,850	8,750	9,690
03372000	North Fork Salt Creek near Belmont, Ind.	6,030	11,900	14,800	16,900	19,000
		4,300	8,400	10,500	12,100	13,700
		5,820	11,400	14,000	15,700	17,500
03372300	Stephens Creek near Bloomington, Ind.	1,080	3,080	4,570	5,910	7,460
		1,080	2,440	3,220	3,830	4,460
		1,080	2,890	4,100	4,990	5,920
03372680	Clear Creek tributary near Bloomington, Ind.	69	178	243	294	346
		111	267	361	436	516
		77	200	277	346	418
03372700	Clear Creek near Harrodsburg, Ind.	4,690	8,220	10,000	11,400	12,700
		2,630	5,510	7,080	8,270	9,490
		4,180	7,440	9,040	10,100	11,200

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
*03373000	Salt Creek near Peerless, Ind.	10,400	19,600	24,200	27,600	30,900
		9,340	15,800	18,700	20,900	23,000
		10,300	19,000	23,100	25,800	28,300
03373200	Indian Creek near Springville, Ind.	3,740	6,160	7,190	7,880	8,520
		2,810	5,630	7,130	8,250	9,390
		3,600	6,070	7,180	7,970	8,780
03373240	Spring Creek tributary near	67	235	358	465	585
	Springville, Ind.	166	409	558	678	804
		82	275	415	543	680
03373500	East Fork White River at Shoals, Ind.	36,500	65,900	81,400	93,000	105,000
		44,000	76,400	92,500	103,000	114,000
		36,600	66,200	81,800	93,500	106,000
03373680	French Lick Creek tributary near	92	302	479	640	819
	French Lick, Ind.	150	334	443	530	617
		95	305	475	623	782
03373700	Lost River near West Baden	4,590	9,110	11,700	13,800	16,000
	Springs, Ind.	6,800	13,100	16,600	19,300	22,200
		4,830	9,800	12,500	15,100	17,600
03373850	Slate Creek tributary near	61	112	139	160	181
	Hayesville, Ind.	78	167	219	259	300
		65	128	162	195	227
03374000	White River at Petersburg, Ind.	68,900	123,000	149,000	167,000	184,000
		69,700	131,000	166,000	194,000	223,000
		68,900	123,000	150,000	168,000	186,000

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03374455	Patoka River near Hardinsburg, Ind.	1,700	3,440	4,490	5,350	6,260
		1,080	2,180	2,790	3,280	3,770
		1,560	3,030	3,940	4,510	5,160
*03374500	Patoka River near Ellsworth, Ind.	2,670	5,670	7,700	9,470	11,500
		3,570	6,450	7,980	9,160	10,400
		2,700	5,720	7,720	9,440	11,400
*03375500	Patoka River at Jasper, Ind.	3,610	7,960	10,700	13,000	15,600
		4,420	7,860	9,680	11,100	12,500
		3,640	7,950	10,600	12,800	15,200
03375800	Hall Creek near St. Anthony, Ind.	2,020	3,820	4,980	5,950	7,040
		1,470	2,920	3,740	4,370	5,020
		1,990	3,750	4,880	5,780	6,800
03376230	Shiloh Drain near Jasper, Ind.	195	286	330	362	393
		135	269	342	399	456
		179	280	334	377	420
03376260	Flat Creek near Otwell, Ind.	1,110	1,380	1,500	1,590	1,680
		960	1,760	2,180	2,500	2,830
		1,080	1,460	1,630	1,810	1,980
03376300	Patoka River at Winslow, Ind.	5,260	10,700	14,000	16,700	19,700
		6,550	11,300	13,800	15,700	17,600
		5,470	10,900	13,900	16,300	18,900
03376340	Patoka River tributary near Glezen, Ind.	122	249	324	384	447
		167	330	418	487	556
		131	273	353	423	493

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
03376350	South Fork Patoka River near	2,360	3,890	4,680	5,270	5,870
	Spurgeon, Ind.	1,940	3,720	4,700	5,460	6,240
		2,290	3,850	4,680	5,320	5,990
03376500	Patoka River near Princeton, Ind.	5,470	11,000	14,300	17,000	19,800
		8,040	13,900	16,900	19,200	21,700
		5,600	11,200	14,500	17,300	20,100
03376600	Patoka River tributary near	95	194	241	274	305
	Patoka, Ind.	120	246	316	370	425
		100	210	264	310	353
03378550	Big Creek near Wadesville, Ind.	3,800	5,550	6,380	6,980	7,580
		2,620	4,740	5,870	6,740	7,640
		3,580	5,350	6,260	6,910	7,600
03378590	Olive Creek tributary near	98	192	232	262	289
	Solitude, Ind.	106	216	278	326	375
		99	194	237	270	302
04093000	Deep River at Lake George outlet at	1,400	2,770	3,500	4,060	4,620
	Hobart, Ind.	1,050	1,810	2,180	2,450	2,720
		1,370	2,680	3,370	3,860	4,320
[u]04093200	Little Calumet River at Gary, Ind.	112	216	268	306	342
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04093500	Burns ditch at Gary, Ind.	1,430	2,480	2,990	3,370	3,740
		1,390	2,350	2,820	3,160	3,500
		1,430	2,470	2,980	3,350	3,710

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
04094000	Little Calumet River at Porter, Ind.	1,050	2,030	2,540	2,930	3,320
		1,130	2,090	2,560	2,940	3,280
		1,060	2,030	2,540	2,930	3,320
04094500	Salt Creek near McCool, Ind.	955	1,930	2,460	2,870	3,290
		925	1,630	1,980	2,240	2,490
		953	1,910	2,420	2,800	3,180
04095250	East Branch Trail Creek tributary near Springville, Ind.	24	36	41	44	46
		21	41	52	60	67
		24	37	43	48	53
04095300	Trail Creek at Michigan City, Ind.	1,060	2,390	3,170	3,780	4,410
		1,270	2,450	3,070	3,540	4,010
		1,100	2,400	3,150	3,720	4,290
04096100	Galena River near Laporte, Ind.	260	495	616	707	797
		317	644	819	952	1,080
		270	522	652	762	872
[r]04097970	Lime Lake outlet at Panama, Ind.	26	38	43	47	51
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04099060	Pigeon Creek tributary near Ellis, Ind.	46	100	130	154	178
		34	61	74	84	93
		43	89	114	129	143
04099510	Pigeon Creek near Angola, Ind.	355	569	666	735	800
		509	851	1,010	1,130	1,240
		365	586	687	767	843

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
04099610	Pretty Lake inlet near Stroh, Ind.	10	24	31	36	42
		8	16	19	22	24
		10	22	29	33	37
04099750	Pigeon River near Scott, Ind.	1,210	1,940	2,280	2,530	2,770
		1,060	1,770	2,100	2,370	2,600
		1,180	1,910	2,250	2,490	2,720
04100165	Wible Lake inlet near Kendallville, Ind.	30	46	53	59	65
		47	81	97	109	120
		33	53	62	71	79
04100220	North Branch Elkhart River near Cosperville, Ind.	422	654	754	822	885
		513	878	1,050	1,180	1,310
		431	676	783	866	947
04100222	North Branch Elkhart River at Cosperville, Ind.	477	735	860	952	1,040
		467	812	974	1,100	1,220
		475	751	883	989	1,090
[r]04100252	Forker Creek near Burr Oak, Ind.	152	272	336	386	438
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[r]04100465	Turkey Creek at Syracuse, Ind.	123	162	178	189	199
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04100500	Elkhart River at Goshen, Ind.	2,800	4,590	5,370	5,900	6,390
		2,280	3,860	4,620	5,180	5,740
		2,770	4,550	5,330	5,850	6,330

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
04101000	St. Joseph River at Elkhart, Ind.	9,690	15,200	17,800	19,800	21,800
		7,340	12,300	14,700	16,400	18,200
		9,560	15,000	17,600	19,600	21,500
04177720	Fish Creek at Hamilton, Ind.	304	493	582	647	709
		393	557	618	646	685
		323	507	592	647	701
04178000	St. Joseph River near Newville, Ind.	4,140	7,270	8,800	9,910	11,000
		4,720	7,030	8,000	8,600	9,230
		4,190	7,240	8,700	9,710	10,700
[r]04179000	St. Joseph River at Cedarville, Ind.	4,840	8,570	10,600	12,100	13,600
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04179500	Cedar Creek at Auburn, Ind.	885	1,350	1,560	1,710	1,860
		1,110	1,800	2,120	2,330	2,550
		904	1,390	1,620	1,780	1,950
04179510	Cecil Metcalf ditch near Auburn, Ind.	50	112	147	174	202
		40	85	112	134	156
		46	104	134	158	182
04180000	Cedar Creek near Cedarville, Ind.	2,940	4,430	5,050	5,470	5,850
		2,420	3,700	4,260	4,620	5,000
		2,880	4,350	4,950	5,340	5,700
04180500	St. Joseph River near Fort Wayne, Ind.	7,840	11,300	12,900	14,100	15,200
		6,680	9,570	10,700	11,400	12,100
		7,730	11,100	12,700	13,700	14,700

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
04181500	St. Marys River at Decatur, Ind.	5,640	9,710	11,500	12,700	13,800
		6,300	9,990	11,600	12,700	13,800
		5,690	9,730	11,500	12,700	13,800
04182000	St. Marys River near Fort Wayne, Ind.	6,570	10,800	12,600	13,800	14,900
		7,260	11,400	13,200	14,400	15,600
		6,620	10,800	12,700	13,900	15,000
04182590	Harber ditch at Fort Wayne, Ind.	658	886	975	1,030	1,090
		501	923	1,130	1,300	1,450
		626	893	1,010	1,090	1,180
04183000	Maumee River at New Haven, Ind.	13,000	19,000	22,000	24,200	26,300
		12,000	17,400	19,600	20,700	22,200
		12,900	18,800	21,700	23,700	25,600
05515000	Kankakee River near North Liberty, Ind.	526	718	792	840	883
		578	908	1,050	1,150	1,250
		530	737	818	877	933
[r]05515400	Kingsbury Creek near Laporte, Ind.	38	57	67	73	80
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05515500	Kankakee River at Davis, Ind.	1,220	1,530	1,650	1,730	1,810
		1,710	2,520	2,870	3,120	3,360
		1,240	1,580	1,710	1,820	1,920
05516000	Yellow River near Bremen, Ind.	1,160	1,730	2,030	2,260	2,490
		1,180	1,800	2,100	2,320	2,540
		1,160	1,740	2,040	2,270	2,500

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
05516150	Walt Kimble ditch near Lapaz, Ind.	79	263	400	520	657
		76	171	224	264	306
		78	233	339	415	493
05516500	Yellow River at Plymouth, Ind.	2,070	3,230	3,860	4,350	4,850
		1,860	2,740	3,140	3,420	3,690
		2,050	3,170	3,780	4,220	4,660
05517000	Yellow River at Knox, Ind.	2,370	3,730	4,380	4,840	5,290
		2,880	4,370	5,060	5,550	6,040
		2,400	3,790	4,440	4,920	5,380
05517400	Payne ditch tributary near	50	148	219	282	355
	North Judson, Ind.	77	164	214	252	291
		55	152	217	271	330
05517500	Kankakee River at Dunns	3,590	4,740	5,230	5,580	5,910
	Bridge, Ind.	3,420	4,540	5,020	5,340	5,670
		3,580	4,720	5,210	5,550	5,870
05517780	Cobb ditch near Valparaiso, Ind.	47	83	99	111	122
		38	94	128	155	184
		44	86	107	124	142
05517890	Cobb ditch near Kouts, Ind.	450	796	958	1,070	1,190
		481	876	1,080	1,240	1,400
		455	812	983	1,110	1,250
05518000	Kankakee River at Shelby, Ind.	4,210	5,660	6,230	6,610	6,960
		4,260	5,520	6,070	6,440	6,810
		4,210	5,650	6,220	6,600	6,950

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
05519000	Singleton ditch at Schneider, Ind.	1,030	1,770	2,160	2,460	2,760
		1,110	1,770	2,090	2,310	2,540
		1,040	1,770	2,150	2,440	2,730
05519500	West Creek near Schneider, Ind.	957	1,630	1,940	2,150	2,350
		774	1,350	1,620	1,810	2,000
		934	1,590	1,890	2,080	2,270
05521000	Iroquois River at Rosebud, Ind.	251	366	416	451	484
		316	530	630	702	771
		256	381	435	478	520
05522000	Iroquois River near North Marion, Ind.	910	1,400	1,640	1,800	1,960
		921	1,390	1,610	1,770	1,930
		911	1,400	1,640	1,800	1,950
05522500	Iroquois River at Rensselaer, Ind.	1,290	1,840	2,060	2,210	2,340
		1,130	1,660	1,910	2,090	2,260
		1,280	1,820	2,040	2,190	2,330
05523000	Bice ditch near South Marion, Ind.	513	813	948	1,040	1,130
		656	1,220	1,510	1,720	1,930
		524	850	997	1,110	1,230
05523500	Slough ditch near Collegeville, Ind.	1,220	2,070	2,440	2,690	2,930
		918	1,460	1,700	1,870	2,030
		1,190	1,990	2,340	2,560	2,770
05524000	Carpenter Creek at Egypt, Ind.	1,040	2,090	2,690	3,170	3,670
		1,440	2,660	3,280	3,730	4,180
		1,070	2,150	2,750	3,240	3,750

Table 4.--T-year peak discharges at gaging stations and partial-record sites--Continued

Station number	Station name	Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}
05524300	Yoeman ditch tributary near Rensselaer, Ind.	101	227	295	346	397
		82	205	280	340	403
		96	220	290	344	399
05524500	Iroquois River near Foresman, Ind.	2,690	4,190	4,850	5,300	5,720
		2,890	4,060	4,600	4,960	5,330
		2,710	4,180	4,820	5,250	5,660
05536190	Hart ditch at Munster, Ind.	1,290	2,170	2,610	2,930	3,250
		958	1,670	2,030	2,310	2,590
		1,260	2,120	2,550	2,850	3,150
u05536195	Little Calumet River at Munster, Ind.	734	1,060	1,210	1,320	1,420
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* Station on stream that is currently regulated. Only peak-discharge data form the period of unregulated streamflow was used to determine the station flood-frequency curve shown in the table. The weighted values of Q_T should not be used for current conditions at this station.

u Station on stream affected by urbanization. Only the individual station flood-frequency curve is shown in the table for this station.

r Station on stream affected by regulation. Only the individual station flood-frequency curve based on regulated annual peaks is shown in the table for this station.

Table 5.--Gaging stations on regulated streams

Station number	Station name	Period of record	Remarks
*03276000	East Fork Whitewater River at Brookville, Ind.	1954-81	Regulated since 1974 by Brookville Lake.
*03276500	Whitewater River at Brookville, Ind.	1916-20 1924-81	Regulated since 1974 by Brookville Lake.
*03323500	Wabash River at Huntington, Ind.	1951-81	Regulated since 1969 by Huntington Lake.
*03324500	Salamonie River at Dora, Ind.	1924-81	Regulated since 1967 by Salamonie Lake.
03325000	Wabash River at Wabash, Ind.	1924-81	Regulated since 1969 by Huntington Lake and since 1967 by Salamonie Lake.
*03327000	Mississinewa River at Peoria, Ind.	1953-81	Regulated since 1968 by Mississinewa Lake.
03327500	Wabash River at Peru, Ind.	1943-81	Regulated since 1969 by Huntington Lake, since 1967 by Salamonie Lake, and since 1968 by Mississinewa Lake.
03329000	Wabash River at Logansport, Ind.	1904-06 1911-16 1924-81	Regulated since 1969 by Huntington Lake, since 1967 by Salamonie Lake, and since 1968 by Mississinewa Lake.
03329500	Wabash River at Delphi, Ind.	1940-71	Regulated since 1969 by Huntington Lake, since 1967 by Salamonie Lake, and since 1968 by Mississinewa Lake.
03332500	Tippecanoe River near Monticello, Ind.	1932-81	Regulated by Lake Shafer.
03333000	Tippecanoe River near Delphi, Ind.	1905-06 1940-81	Regulated by Lake Shafer and Lake Freeman.

Table 5.--Gaging stations on regulated streams--Continued

Station number	Station name	Period of record	Remarks
03335500	Wabash River at Lafayette, Ind.	1901-02 1904 1907-81	Regulated since 1969 by Huntington Lake, since 1967 by Salamonie Lake, and since 1968 by Mississinewa Lake.
03336000	Wabash River at Covington, Ind.	1927-81	Regulated since 1969 by Huntington Lake, since 1967 by Salamonie Lake, and since 1968 by Mississinewa Lake.
03340500	Wabash River at Montezuma, Ind.	1913 1925-81	Regulated since 1969 by Huntington Lake, since 1967 by Salamonie Lake, and since 1968 by Mississinewa Lake.
03340900	Big Raccoon Creek near Ferndale, Ind.	1957-81	Regulated since 1960 by Cecil M. Harden Lake.
03341300	Big Raccoon Creek at Coxville, Ind.	1957-81	Regulated since 1960 by Cecil M. Harden Lake.
03341500	Wabash River at Terre Haute, Ind.	1828-83 1892-97 1902-81	Regulated since 1969 by Huntington Lake, since 1967 by Salamonie Lake, since 1968 by Mississinewa Lake, and since 1960 by Cecil M. Harden Lake.
03342000	Wabash River at Riverton, Ind.	1912-14 1939-81	Regulated since 1969 by Huntington Lake, since 1967 by Salamonie Lake, since 1968 by Mississinewa Lake, and since 1960 by Cecil M. Harden Lake.
03342100	Busseron Creek near Hymera, Ind.	1967-81	Affected by U.S. Soil Conservation Service floodwater-retarding structures.
03342250	Mud Creek near Dugger, Ind.	1967-81	Affected by surface mining operations.
03342300	Busseron Creek near Sullivan, Ind.	1967-81	Affected by U.S. Soil Conservation Service floodwater-retarding structures and surface mining operations.

Table 5.--Gaging stations on regulated streams

Station number	Station name	Period of record	Remarks
[P]03342500	Busseron Creek near Carlisle, Ind.	1944-81	Affected by U.S Soil Conservation Service floodwater-retarding structures and surface mining operations.
03343000	Wabash River at Vincennes, Ind.	1913-81	Regulated since 1969 by Huntington Lake, since 1967 by Salamonie Lake, since 1968 by Mississinewa Lake, and since 1960 by Cecil M. Harden Lake.
03350500	Cicero Creek at Noblesville, Ind.	1951-80	Regulated since 1955 by Morse Reservoir.
*03352500	Fall Creek at Millersville, Ind.	1930-81	Regulated since 1943 by Geist Reservoir.
*03353500	Eagle Creek at Indianapolis, Ind.	1939-81	Regulated since 1969 by Eagle Creek Reservoir.
[P]03354000	White River near Centerton, Ind.	1931-32 1947-81	Partially regulated by upstream reservoirs.
03356000	Beanblossom Creek at Dolan, Ind.	1946-78	Regulated since 1953 by Lake Lemon.
[P]03357000	White River at Spencer, Ind.	1926-71	Partially regulated by upstream reservoirs.
*03359000	Mill Creek near Manhattan, Ind.	1940-81	Regulated since 1953 by Cagles Mill Lake.
*03360000	Eel River at Bowling Green, Ind.	1913 1931-81	Regulated since 1953 by Cagles Mill Lake.
[P]03360500	White River at Newberry, Ind.	1908-81	Partially regulated by upstream reservoirs.
03372500	Salt Creek near Harrodsburg, Ind.	1956-81	Regulated since 1966 by Monroe Lake.
*03373000	Salt Creek near Peerless, Ind.	1939-71	Regulated since 1966 by Monroe Lake.
[P]03374000	White River at Petersburg, Ind.	1925-81	Partially regulated by upstream reservoirs.
*03374500	Patoka River near Ellsworth, Ind.	1962-81	Regulated since 1978 by Patoka Lake.

Table 5.--Gaging stations on regulated streams--Continued

Station number	Station name	Period of record	Remarks
*03375500	Patoka River at Jasper, Ind.	1948-81	Regulated since 1955 by Beaver Creek Reservoir and since 1978 by Patoka Lake.
p03376350	South Fork Patoka River near Spurgeon, Ind.	1965-81	Partially regulated by surface mining operations.
p03376500	Patoka River near Princeton, Ind.	1935-81	Partially regulated by upstream reservoirs and surface mining operations.
03377500	Wabash River at Mount Carmel, Ill.	1875-78 1885-99 1900-81	Partially regulated by upstream reservoirs.
04097970	Lime Lake Outlet at Panama, Ind.	1970-82	Regulated by Lime Lake.
04100252	Forker Creek near Burr Oak, Ind.	1970-82	Regulated by Miller Lake.
04100465	Turkey Creek at Syracuse, Ind.	1970-82	Regulated by Syracuse Lake.
04179000	St. Joseph River at Cedarville, Ind.	1956-82	Regulated by Cedarville Reservoir.
05515400	Kingsbury Creek near Laporte, Ind.	1971-82	High flow regulated by upstream culvert.

* Station is on a stream that is currently regulated, but has sufficient unregulated peak data to define an unregulated flood-frequency curve. Only annual peaks not affected by regulation were used to determine the flood-frequency curve for this station shown in table 4.

p Station is on a stream that is only partially regulated. Annual peaks from the entire period of record were used to determine the flood-frequency curve for this station shown in table 4.

Table 6.--Flood magnitude and frequency on the Wabash River, natural and regulated flow

[The upper values of Q_T are from flood-frequency analysis of unregulated peaks. Values of Q_T for regulated flow are from Indiana Department of Natural Resources (1981). DA is drainage area, in square miles. RM is river mile, measured upstream from the mouth. Q_T is discharge, in cubic feet per second]

03323500	Wabash River at Huntington, Ind. DA = 721 square miles RM = 409.0				
	Unregulated (1951-68)	Q_{10} = 12,500	Q_{25} = 14,600	Q_{50} = 16,000	Q_{100} = 17,300
	Regulated	Q_{10} = 7,000	Q_{25} = 7,000	Q_{50} = 9,000	Q_{100} = 11,000
03325000	Wabash River at Wabash, Ind. DA = 1,768 square miles RM = 387.2				
	Unregulated (1924-67)	Q_{10} = 37,400	Q_{25} = 45,400	Q_{50} = 51,000	Q_{100} = 56,400
	Regulated	Q_{10} = 18,000	Q_{25} = 23,000	Q_{50} = 26,500	Q_{100} = 30,000
03327500	Wabash River at Peru, Ind. DA = 2,686 square miles RM = 370.5				
	Unregulated (1913-67)	Q_{10} = 49,100	Q_{25} = 59,500	Q_{50} = 67,000	Q_{100} = 74,300
	Regulated	Q_{10} = 19,500	Q_{25} = 24,000	Q_{50} = 27,000	Q_{100} = 31,000

Table 6.--Flood magnitude and frequency on the Wabash River, natural and regulated flow--Continued

03329000 Wabash River at Logansport, Ind. DA = 3,779 square miles RM = 353.7					
	Unregulated (1883-1967)	Q_{10} = 62,600	Q_{25} = 75,100	Q_{50} = 84,000	Q_{100} = 92,600
	Regulated	Q_{10} = 41,500	Q_{25} = 50,000	Q_{50} = 57,000	Q_{100} = 65,000
03329500 Wabash River at Delphi, Ind. DA = 4,072 square miles RM = 330.8					
	Unregulated (1913-67)	Q_{10} = 63,300	Q_{25} = 76,700	Q_{50} = 86,400	Q_{100} = 95,800
	Regulated	Q_{10} = 45,000	Q_{25} = 55,000	Q_{50} = 63,000	Q_{100} = 71,000
03335500 Wabash River at Lafayette, Ind. DA = 7,267 square miles RM = 311.9					
	Unregulated (1901-67)	Q_{10} = 88,100	Q_{25} = 106,000	Q_{50} = 118,000	Q_{100} = 130,000
	Regulated	Q_{10} = 63,000	Q_{25} = 67,000	Q_{50} = 87,000	Q_{100} = 95,000
03336000 Wabash River at Covington, Ind. DA = 8,218 square miles RM = 271.1					
	Unregulated (1913-67)	Q_{10} = 99,000	Q_{25} = 123,000	Q_{50} = 139,000	Q_{100} = 155,000
	Regulated	Q_{10} = 71,000	Q_{25} = 87,000	Q_{50} = 98,000	Q_{100} = 109,000

Table 6.--Flood magnitude and frequency on the Wabash River, natural and regulated flow--Continued

03340500 Wabash River at Montezuma, Ind. DA = 11,118 square miles RM = 240.0				
Unregulated (1913-67)	Q_{10} = 124,000	Q_{25} = 154,000	Q_{50} = 175,000	Q_{100} = 195,000
Regulated	Q_{10} = 92,000	Q_{25} = 111,000	Q_{50} = 128,000	Q_{100} = 140,000
03341500 Wabash River at Terre Haute, Ind. DA = 12,265 square miles RM = 214.4				
Unregulated (1828-1967)	Q_{10} = 128,000	Q_{25} = 159,000	Q_{50} = 181,000	Q_{100} = 202,000
Regulated	Q_{10} = 99,000	Q_{25} = 120,000	Q_{50} = 138,000	Q_{100} = 152,000
03342000 Wabash River at Riverton, Ind. DA = 13,161 square miles RM = 162.0				
Unregulated (1912-67)	Q_{10} = 132,000	Q_{25} = 174,000	Q_{50} = 208,000	Q_{100} = 243,000
Regulated	Q_{10} = 105,000	Q_{25} = 127,000	Q_{50} = 144,000	Q_{100} = 160,000
03343000 Wabash River at Vincennes, Ind. DA = 13,706 square miles RM = 129.8				
Unregulated (1913-67)	Q_{10} = 102,000	Q_{25} = 125,000	Q_{50} = 143,000	Q_{100} = 160,000
Regulated	Q_{10} = 93,000	Q_{25} = 118,000	Q_{50} = 134,000	Q_{100} = 149,000
03377500 Wabash River at Mt. Carmel, Ill. DA = 28,635 square miles RM = 94.4				
Unregulated (1875-1967)	Q_{10} = 236,000	Q_{25} = 284,000	Q_{50} = 318,000	Q_{100} = 350,000
Regulated	Q_{10} = 207,000	Q_{25} = 250,000	Q_{50} = 285,000	Q_{100} = 315,000