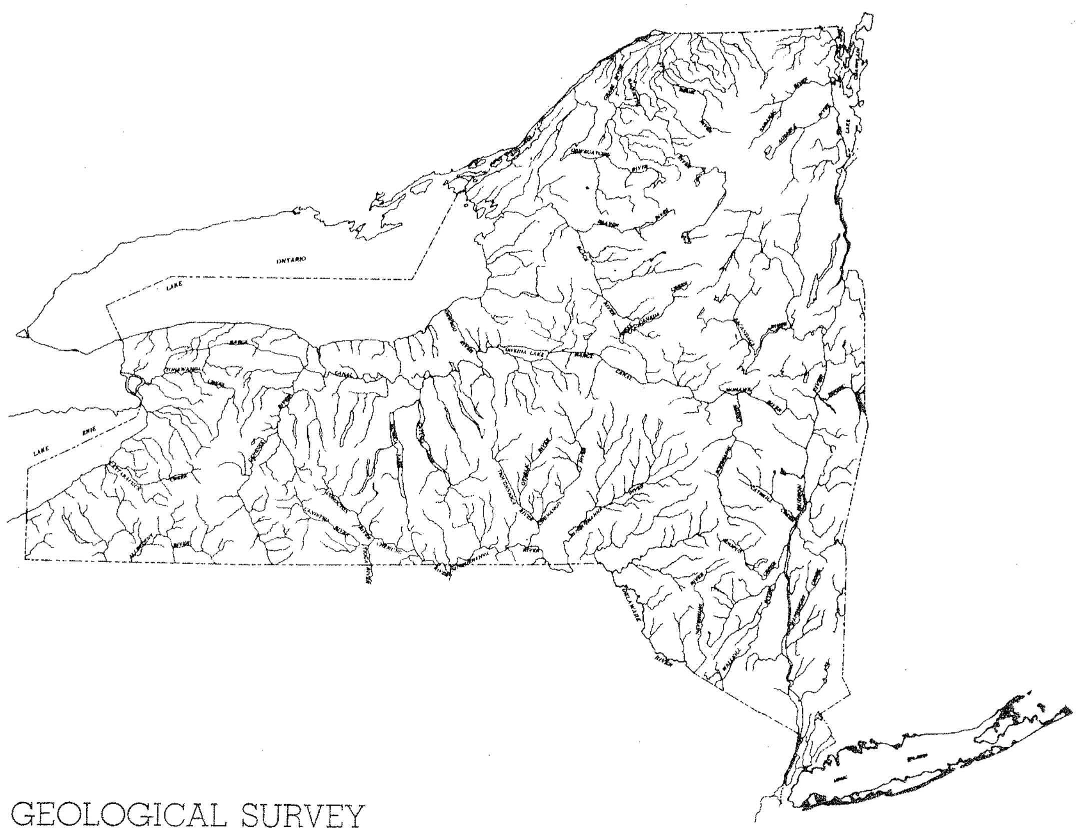
Techniques for Estimating Magnitude and Frequency of Floods on Rural Unregulated Streams in New York State Excluding Long Island



U.S. GEOLOGICAL SURVEY

Water-Resources Investigations 79-83

Prepared in cooperation with

New York State Department of Transportation
New York State Department of Environmental Conservation

BIBLIOGRAPHIC DATA SHEET	1. Report No.	2.	3. Recipient's Accession No.
4. Title and Subtitle Techniques for estimating magnitude and frequency of floods on rural unregulated streams in New York State excluding Long Island			5. Report Date July 1979 6.
7. Author(s) Thomas J. Zembrzuski, Jr., and Bernard Dunn			8. Performing Organization Rept. No. USGS/WRI 79-83
9. Performing Organization Name and Address U.S. Geological Survey, Water Resources Division 343 U.S. Post Office & Courthouse Albany, N.Y. 12201			10. Project/Task/Work Unit No. 11. Contract/Grant No.
12. Sponsoring Organization Name and Address U.S. Geological Survey, Water Resources Division 343 U.S. Post Office & Courthouse Albany, N.Y. 12201			13. Type of Report & Period Covered Final 14.

15. Supplementary Notes

16. Abstracts Techniques are presented for estimating the magnitude and frequency of floods at ungaged sites on unregulated rural streams in New York, excluding Long Island. Discharge-frequency data and basin characteristics of 220 gaging stations in New York and adjacent states were used in multiple linear regression analyses to develop equations for floods that range in recurrence interval from 2 to 100 years. Separate equations were developed for northern, southeastern, and western regions of New York. Drainage area is the independent variable needed in all equations; other variables needed, depending on region, are main-channel slope, storage index, and mean annual precipitation. A method is given for obtaining improved discharge-frequency relationships at gage sites by weighting log-Pearson Type III and regression estimates according to their variances. Basin characteristics, log-Pearson Type III statistics, and regression and weighted estimates of the discharge-frequency relationship are tabulated for the New York gaging stations used in the regression analyses.

17. Key Words and Document Analysis. 17a. Descriptors

*Estimating equations, *Flood frequency, *Frequency analysis, *Natural flow, *New York, *Peak discharge, *Regional analysis, *Regression analysis, Rivers

17b. Identifiers/Open-Ended Terms

Basin characteristics, Flow characteristics

17c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
No restriction on distribution.	UNCLASSIFIED	66
	20. Security Class (This Page) UNCLASSIFIED	22. Price

TECHNIQUES FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS ON RURAL UNREGULATED STREAMS IN NEW YORK STATE EXCLUDING LONG ISLAND

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Albany, New York

1979

UNITED STATES DEPARTMENT OF THE INTERIOR

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Albany, New York 12201

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INTERNATIONAL SYSTEM (SI) UNITS

Multiply Inch-pound units	*By*	*To obtain SI units*
inch (in)	2.54×10^{1}	millimeter (mm)
	2.54×10^{0}	centimeter (cm)
	2.54×10^{-2}	meter (m)
foot (ft)	3.048×10^{-1}	meter (m)
mile (mi)	1.609×10^{0}	kilometer (km)
square mile (mi^2)	2.590×10^{0}	square kilometer (km^2)
foot per mile (ft/mi)	1.894×10^{-1}	meter per kilometer (m/km)
cubic foot per second (ft^3/s)	2.832×10^{1}	liter per second (L/s)
	2.832×10^{-2}	cubic meter per second (m^3/s)

TECHNIQUES FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS ON RURAL UNREGULATED STREAMS IN NEW YORK STATE, EXCLUDING LONG ISLAND

By

Thomas J. Zembrzuski, Jr. and Bernard Dunn

ABSTRACT

Techniques are presented for estimating the magnitude and frequency of floods at ungaged sites on unregulated rural streams in New York, excluding Long Island. The discharge-frequency data and basin characteristics of 220 stream-gaging stations in New York and adjacent States were used in developing multiple linear regression equations for floods ranging in recurrence interval from 2 to 100 years. Separate equations were developed for northern, southeastern, and western New York. Standard errors of estimate of the 100-year flood range from 32.9 percent in the southeastern region to 42.8 percent in the western region. Drainage area is the independent variable needed in all equations; other variables needed, depending on region, are main-channel slope, storage index, and mean annual precipitation.

A method is given for obtaining improved discharge-frequency relationships at gaged sites by weighting log-Pearson Type III and regression estimates according to their variances.

Basin characteristics, log-Pearson Type III statistics, and regression and weighted estimates of the frequency-discharge relationship, are tabulated for the gaging stations used in the regression analyses.

INTRODUCTION

The effective management of flood-prone areas and the design of structures along rivers and streams require knowledge of the magnitude and frequency of floods. This report provides methods for estimating the magnitude and frequency of floods in New York, excluding Long Island, at ungaged sites on unregulated and rural streams. Methods are also outlined for (1) obtaining improved estimates of the discharge-frequency relationship at gaged sites, and (2) using the improved estimates to refine those determined at ungaged sites on gaged streams.

Flood-discharge records for gaged sites at which a minimum of 10 consecutive flood peaks have been observed, throughout New York and in nearby areas of adjacent States, were used in log-Pearson Type III analyses to define the flood-frequency curve for each site. A multiple-regression technique was used in which discharge estimates for floods of selected frequencies were related to drainage-basin characteristics. These analyses indicated that the most significant variables for estimating flood discharges of unregulated streams in New York were drainage area, slope of main channel, storage (percentage of drainage area in lakes and swamps), and mean annual precipitation. For gaged sites, improved flood-frequency estimates were obtained by weighting regression and log-Pearson Type III estimates according to their variances.

Regression equations were developed for three regions in New York State. The northern region consists of the upper Hudson River basin (upstream from the Federal Dam at Troy), Mohawk River basin, streams draining into the St. Lawrence River and Lake Champlain, and the Black River basin. The southeastern region consists of the Lower Hudson, Housatonic, Hackensack, Passaic, and Delaware River basins. The western region includes the Susquehanna, Allegany, and Niagara River basins and streams draining into Lakes Erie and Ontario.

Information in this report is presented in three sections. The first, "Application of techniques," gives (1) preferred regression formulas and instructions for their use, (2) guidelines for obtaining discharge-frequency information at gaged sites, ungaged sites, and ungaged sites on gaged streams, and (3) examples illustrating use of the methods. The second section, "Analytical techniques," provides documentation of methods used in the analyses. The third section, appendices 1-3, presents streamflow and basin characteristics, discharge-frequency tables, and alternative regression equations.

The development of techniques for estimating flood magnitude and frequency on regulated streams, urbanized basins, and streams on Long Island is beyond the scope of this study. For regulated streams, regional methods are generally inappropriate, and discharge profiles are usually defined on a stream-by-stream basis with the aid of flood-hydrograph-routing techniques.

Regional methods have successfully been used in other States to develop flood-frequency relationships on streams draining urbanized basins (Stankowski, 1974; Sauer, 1974). Streams of this type respond to precipitation differently from those in rural areas because much of an urbanized basin is covered by impervious material and(or) is drained by storm sewers. Floodflow data for these basins in New York are too few to quantify the effect of urbanization on flood-frequency relationships.

Likewise, flood data on Long Island streams are insufficient to define the unique relationships between floodflow and basin characteristics here. Flooding on many parts of Long Island is affected by urbanization, and flooding in nonurbanized areas is affected by high infiltration and storage capacities of the soils.

Previous Studies

This report should be used in preference to previous U.S. Geological Survey reports that provide techniques for estimation of flood magnitude and frequency in New York. Robison (1961) used the index-flood method as outlined by Dalrymple (1960). Later analyses by the same method are given in U.S. Geological Survey Water-Supply Papers by Speer and Gamble (1965), Tice (1968), and Wiitala (1965). Darmer (1970) used a multiple regression technique with the frequency curves prepared as described by the U.S. Water Resources Council (1967).

The addition of 7 years of data and new guidelines, as outlined in U.S. Water Resources Council Bulletin 17A (1977) for computing station flood-frequency curves, warrants this update of methods given in previous reports.

Acknowledgments

Data collection and report preparation were made possible by a cooperative program with the New York State Department of Transportation. Additional support for data-collection programs was provided by the New York State Department of Environmental Conservation, U.S. Army Corps of Engineers, the U.S. Soil Conservation Service, and several municipal and county governments. Data on basin storage and forest cover were obtained from the New York State Economic Development Board Land Use and Natural Resources Inventory (LUNR).

APPLICATION OF TECHNIQUES

The following methods are suggested for determining discharge-frequency relationships for sites on unregulated, rural streams in New York. Locations of gaging stations and boundaries of corresponding flood-frequency regions are given in figure 1; areal distribution of mean annual precipitation is given in figure 2.

Gaged Sites

If the gaged site is given in figure 1, obtain its identification number and refer to its discharge-frequency relationship in appendix 1. It is suggested that the weighted discharges be used as the best estimate.

Caution should be exercised when using the information from some of the gaging stations listed in appendix 1. Several gaging stations used in this regression analysis are on currently regulated streams. All data entries for these streams reflect preregulation conditions and are not generally applicable to present conditions.

The procedure for computing weighted discharge estimates is described in section "Improved flood-frequency estimates at gaged sites." In the future, acquisition of new historic flood information, or the occurrence of a rare flood at a gaged site, may warrant recomputation of log-Pearson estimates. The procedure could then be used to refine the weighted discharge estimates given in appendix 1. In addition, the methods could be applied to recently established gaged sites that have accrued the recommended minimum of 10 years of annual peak-discharge record for log-Pearson Type III analyses.

Ungaged Sites

For sites on ungaged streams, determine from figure 1 the region in which the stream is located and apply the appropriate regional regression equation given in tables 1-3. (Standard errors of the estimating equations are also given in tables 1-3.) Formal definitions, abbreviations, and units of the basin characteristics required for application of the estimating equations given throughout this report are as follows:

Drainage area (A), in square miles.--The area of a basin (watershed) upstream from the site of interest is delineated on 7.5- or 15-minute U.S. Geological Survey topographic maps and then determined by planimetering the basin outline.

Mean annual precipitation (P), in inches.--The basin of interest is located on the rainfall map in figure 2 (Hunt, 1969), and the value of mean annual precipitation is interpolated from the lines of equal precipitation.

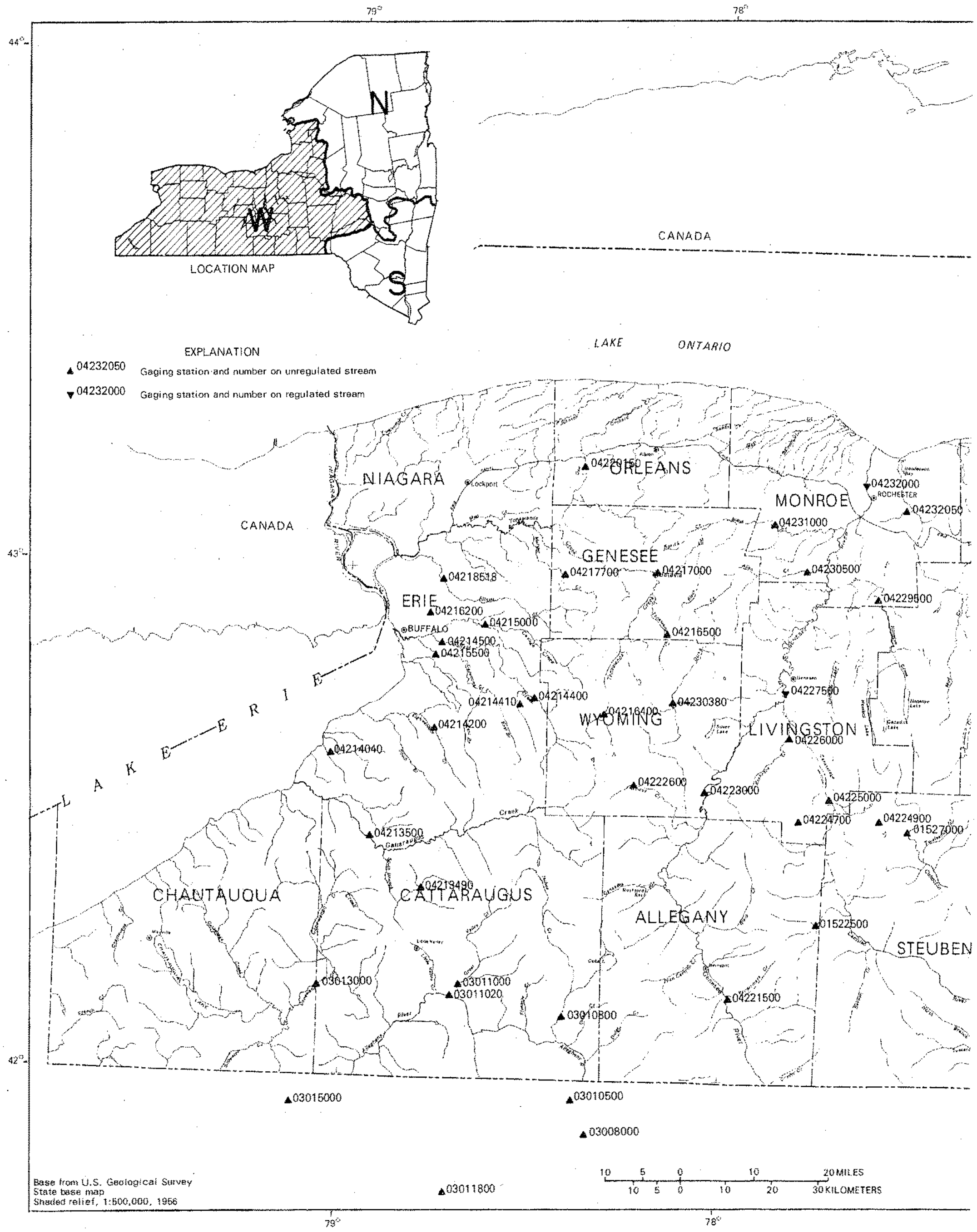
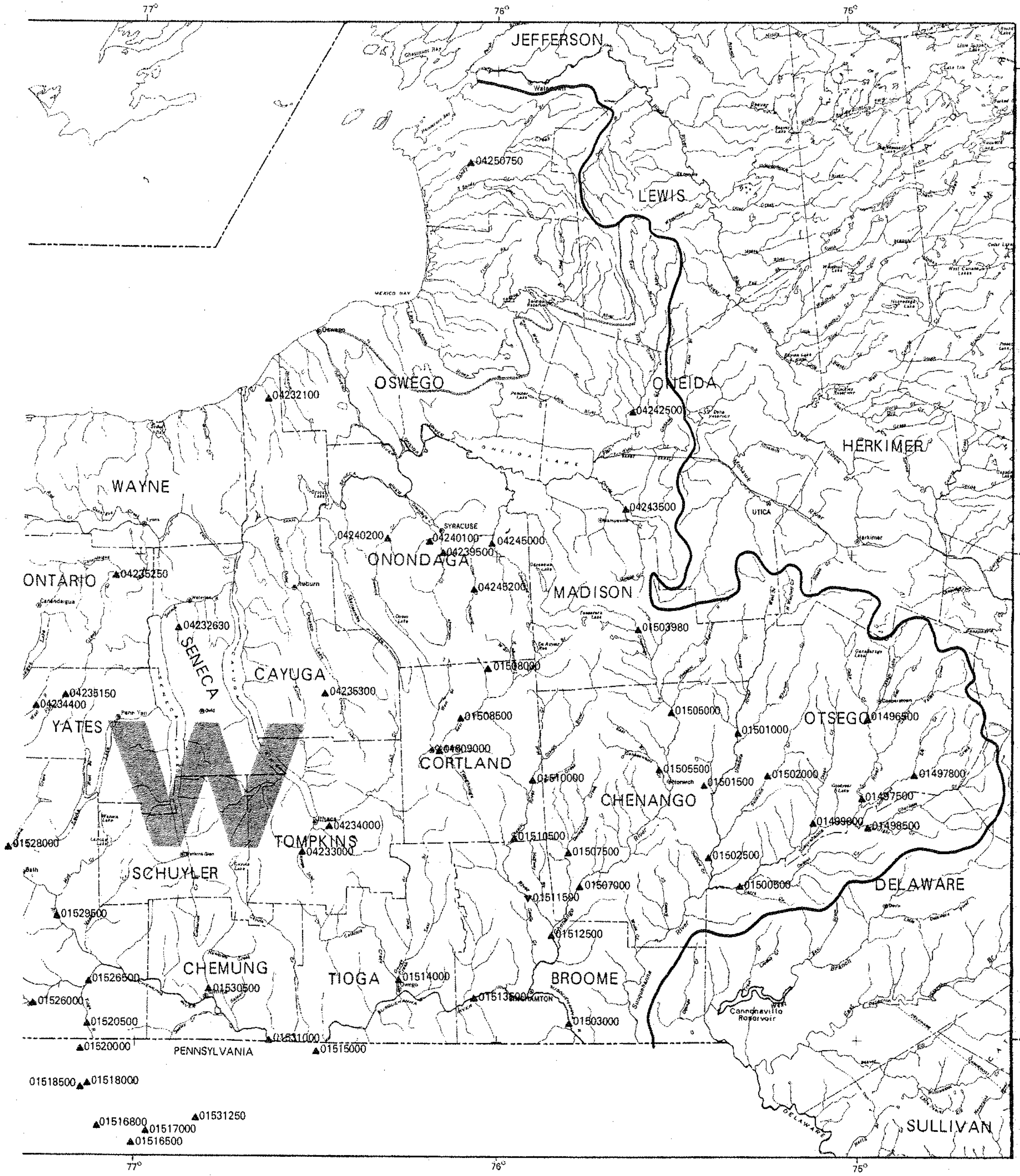


Figure 1.--Locations of gaging stations and boundaries of flood-frequency regions, New York (excluding Long Island).



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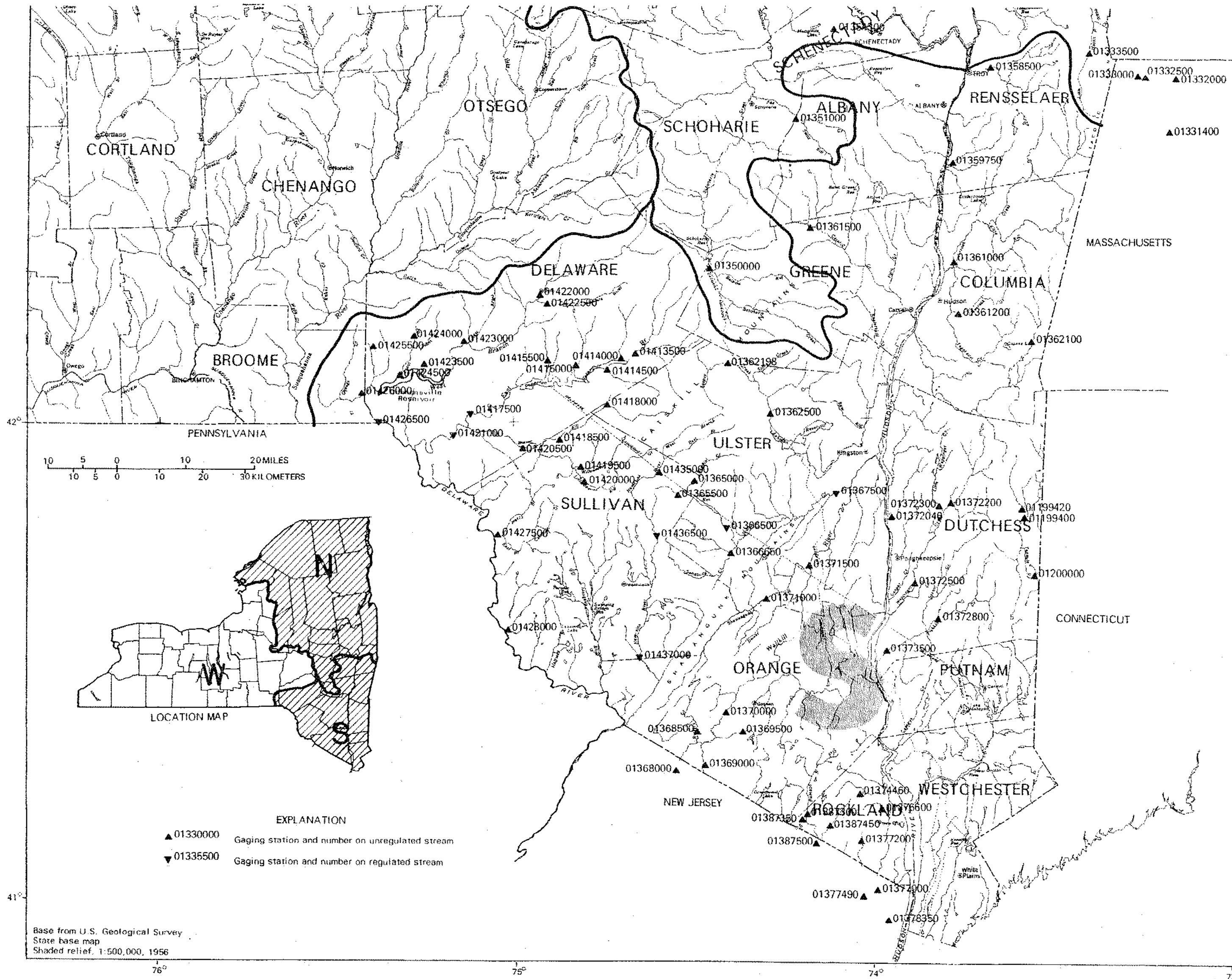


Figure 1.--Continued.

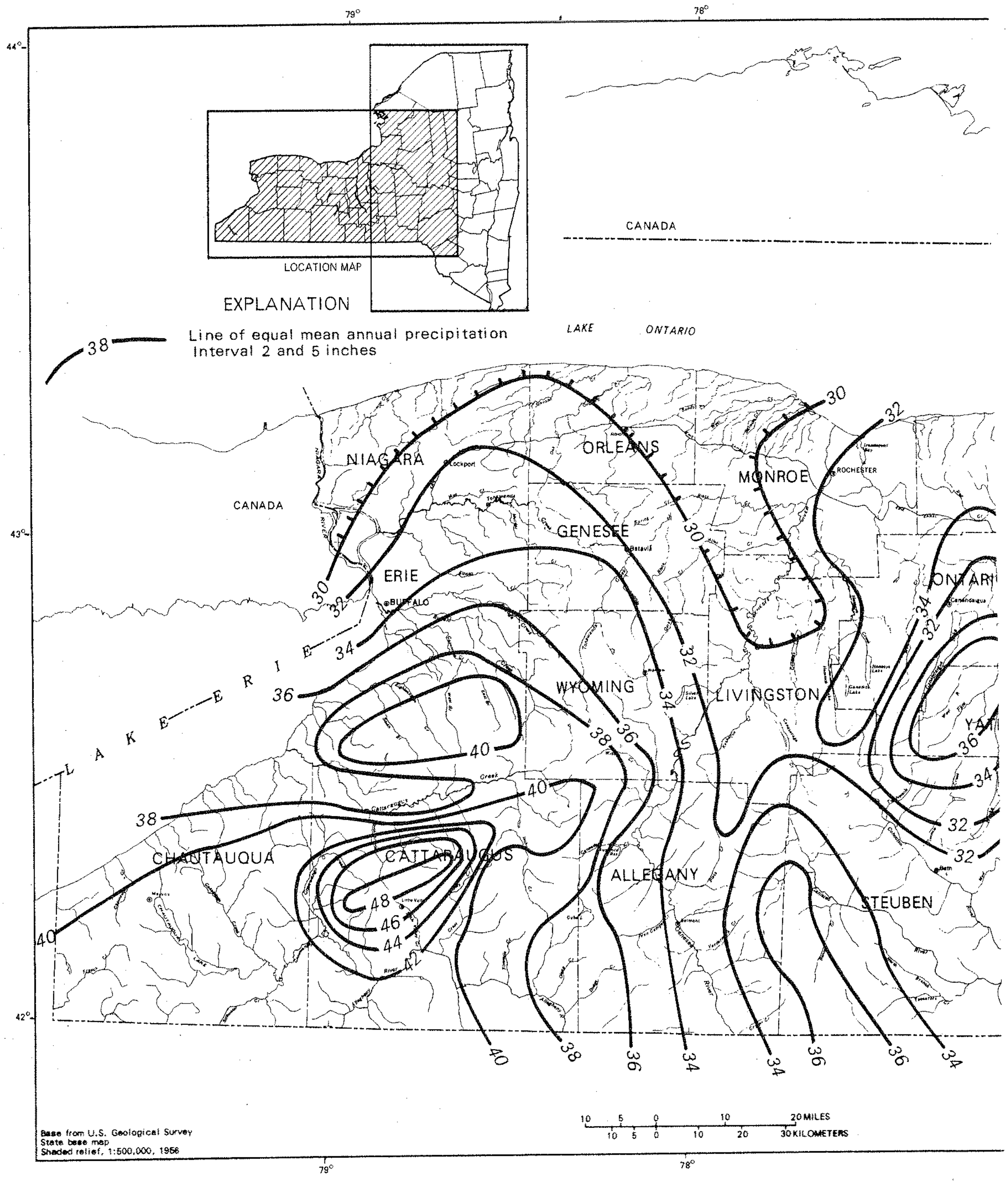
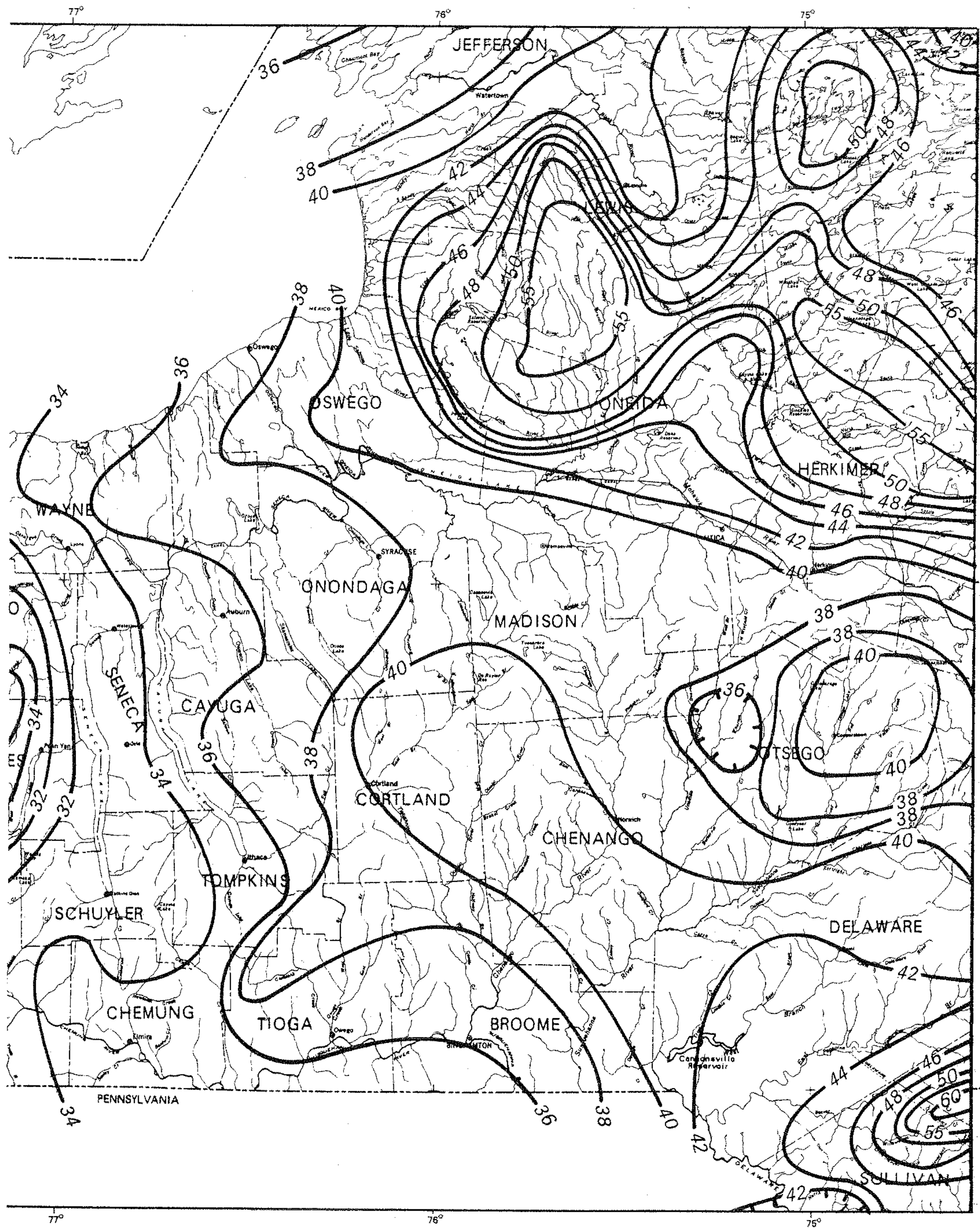


Figure 2.--Distribution of mean annual precipitation in New York (excluding Long Island) during 1931-60.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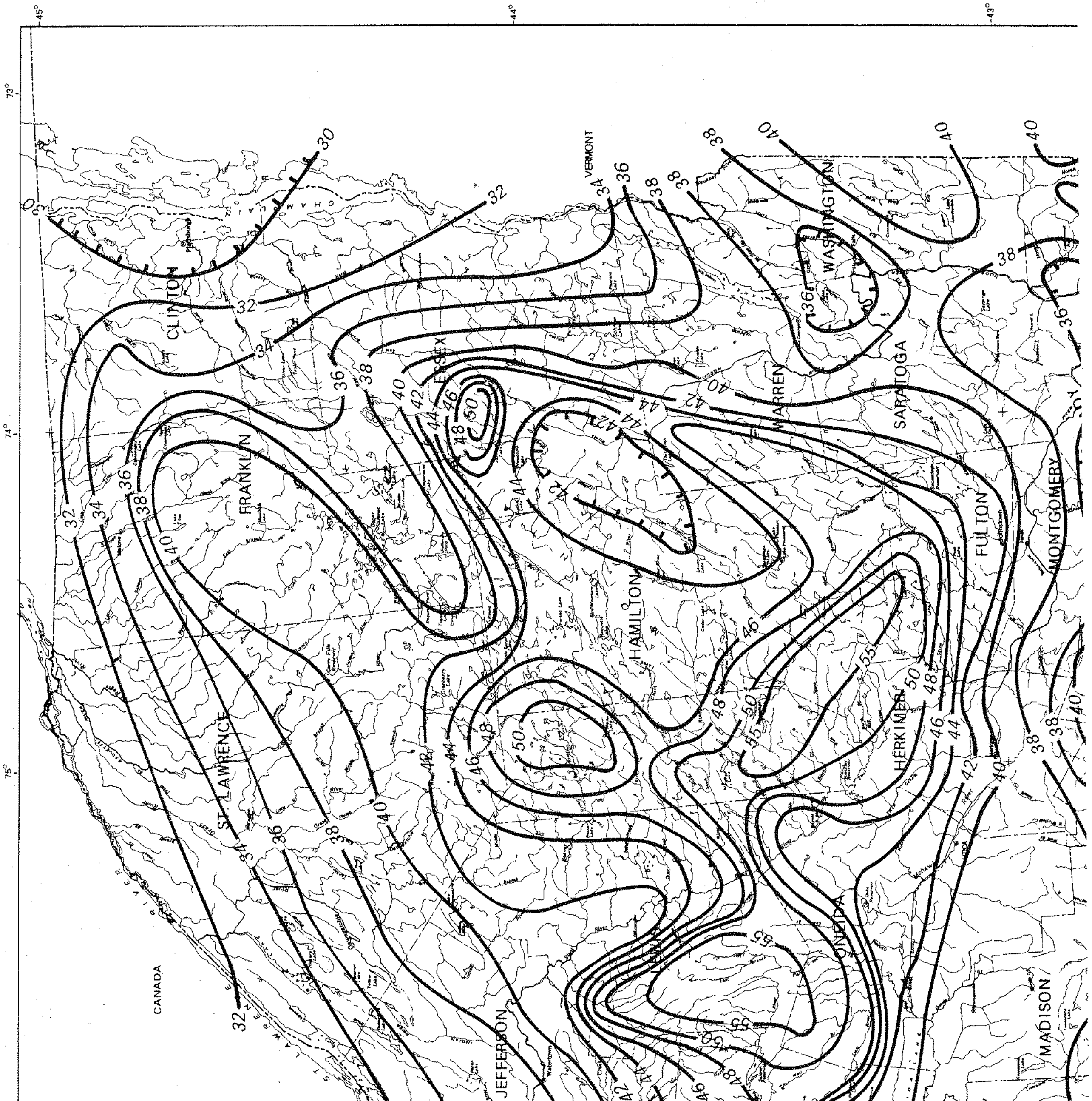

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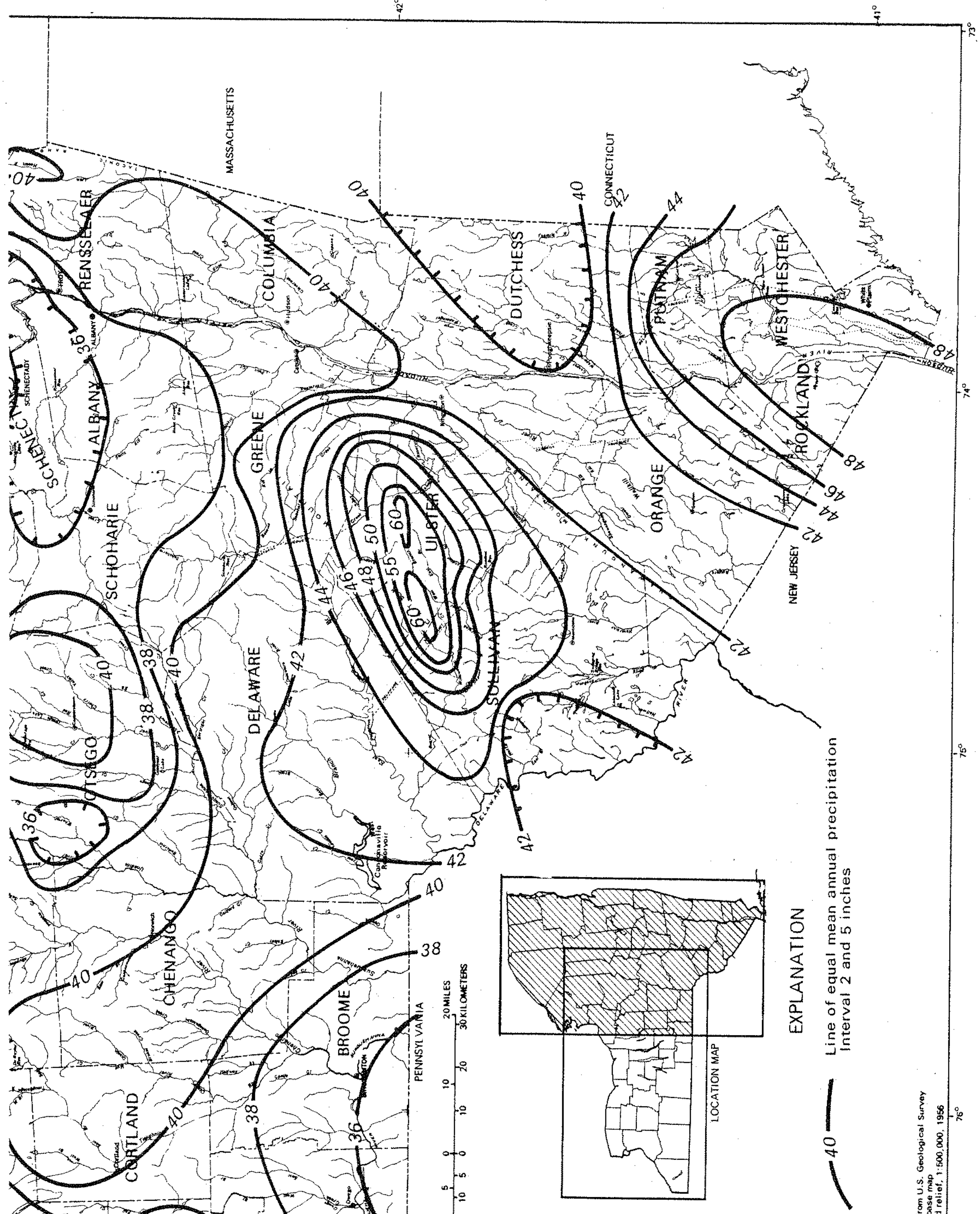

Figure 2.--Continued.

Main-channel slope (S), in feet per mile.--The difference in elevation (ft) between points 10 percent and 85 percent of the distance up the channel from the site of interest to the basin divide, divided by the distance (mi) between the two points. It is determined from 7.5- or 15-minute maps.

Storage (S_t), in percent.--The percentage of total drainage area shown as lakes, ponds, and swamps is determined from (1) 7.5- or 15-minute topographic maps by grid sampling or planimetering, or (2) the New York State Land Use and Natural Resources (LUNR) Inventory. Information regarding use and applications of the LUNR inventory can be obtained from:

LUNR User Service
Resources Information Laboratory
Box 22 - Roberts Hall
Cornell University
Ithaca, N.Y. 14853

or

New York State Economic Development Board
17th Floor
Alfred E. Smith Building
Albany, N.Y. 12225

Sometimes estimates of floods are needed for recurrence intervals other than those for which equations are provided in this report. These estimates can be obtained from a frequency curve drawn from values computed from the equations. Values of at least the 2-, 10-, and 100-year floods should be computed to define the shape of the curve. An example of a flood-frequency curve is provided in the section "Discharge-frequency relationship."

Alternative regression equations for each of the three flood-frequency regions are given in appendix 3. These equations contain only the most significant basin characteristic (drainage area) and are intended to provide rough estimates. The more reliable flood-frequency estimates are obtained from equations in tables 1, 2, or 3.

Ungaged Sites on Gaged Streams

If the ungaged site for which flood-frequency estimates are needed is on a gaged stream and if the site has a drainage area within one-half to twice the drainage area of the stream at the gage, the following procedure (Hannum, 1976) is suggested:

(1) For the ungaged site, compute the flood magnitude (Q_R) from the appropriate regression equations in table 1, 2, or 3.

(2) From the values given in appendix 1 for the gaging station, compute the ratio (K_G) of the weighted discharge to the regression discharge.

(3) Compute the weighted ratio for the ungaged site as follows:

a. for a site downstream from the gaging station:

$$K_S = (K_G - 1)\ \frac{(2A_G - A_S)}{A_G} + 1$$

b. for a site upstream from the gaging station:

$$K_S = (K_G - 1)\ \frac{(2A_S - A_G)}{A_G} + 1$$

where:

K_S is the ratio of the weighted discharge to the regression discharge at the ungaged site.

A_S is the drainage area at the ungaged site.

A_G is the drainage area at the gage.

(4) From Q_R obtained in step 1 and K_S obtained in step 3, compute the weighted discharge (Q_W) at the ungaged site, by:

$$Q_W = K_S \times Q_R$$

Table 1.--Regression equations and standard errors of estimate for northern flood-frequency region, New York

Recurrence interval (years)	Estimating equation	Standard error of estimate (percent)
2	$59.7\ A^{.795}(S_t+10)^{-.770}(P-20)^{.707}$	32.4
5	$151\ A^{.781}(S_t+10)^{-.909}(P-20)^{.664}$	33.7
10	$250\ A^{.773}(S_t+10)^{-1.00}(P-20)^{.655}$	35.0
25	$433\ A^{.767}(S_t+10)^{-1.11}(P-20)^{.654}$	37.0
50	$620\ A^{.763}(S_t+10)^{-1.19}(P-20)^{.661}$	38.6
100	$864\ A^{.759}(S_t+10)^{-1.27}(P-20)^{.670}$	40.2

Table 2.--Regression equations and standard errors of estimate for southeastern flood-frequency region, New York

Recurrence interval (years)	Estimating equation	Standard error of estimate (percent)
2	$0.104\ A^{1.00} S^{.324} (P-20)^{1.43}$	30.3
5	$.107\ A^{1.02} S^{.370} (P-20)^{1.49}$	27.6
10	$.111\ A^{1.03} S^{.393} (P-20)^{1.52}$	27.6
25	$.120\ A^{1.04} S^{.418} (P-20)^{1.55}$	28.9
50	$.129\ A^{1.05} S^{.433} (P-20)^{1.56}$	30.6
100	$.138\ A^{1.06} S^{.447} (P-20)^{1.57}$	32.9

Table 3.--Regression equations and standard errors of estimate for the western flood-frequency region, New York

Recurrence interval (years)	Estimating equation	Standard error of estimate (percent)
2	$2{,}120\ A^{.809} (S_t+10)^{-1.39}$	39.5
5	$6{,}100\ A^{.780} (S_t+10)^{-1.59}$	37.2
10	$10{,}900\ A^{.765} (S_t+10)^{-1.70}$	37.4
25	$21{,}200\ A^{.750} (S_t+10)^{-1.84}$	39.0
50	$33{,}000\ A^{.741} (S_t+10)^{-1.94}$	40.8
100	$49{,}900\ A^{.733} (S_t+10)^{-2.03}$	42.8

Limitations of Procedure

The estimating equations given in this report should be used only for unregulated, rural streams. In addition, caution should be exercised when applying the equations to sites downstream from natural lakes or swampy areas. On small streams, field reconnaissance may be helpful in identifying temporary impoundment areas such as behind roadway embankments with small culverts that could store floodwaters.

These equations were developed for streams in New York State. If flood-frequency estimates are required for sites near or on the other side of the State border, estimating techniques applicable in the adjacent State should also be considered. Generally, a discharge estimate for each site should be computed by both techniques, and the result should be weighted according to their variances (U.S. Water Resources Council, 1977). Flood-frequency reports for adjacent states are listed in the references.

The relationship between floodflow and basin characteristics (actually, between the logarithms of these variables) given by a multiple linear-regression equation is assumed to be linear only within the range of characteristics that define that relationship. The ranges in values of drainage area, percent storage, mean annual precipitation, and slope are given by region in table 4. (Although the final estimating equations for the three regions did not include all four variables, the variables were all statistically significant at the 95-percent confidence level for the experimental statewide equations discussed in the section "Regional regression analyses.") The suitability of the regional equations is undefined for streams having values beyond the ranges given in table 4.

Table 4 lists additional sample statistics for each region, including the number of gaging stations, and the average periods of systematic and historic record of the gaging stations, used in the analysis. Also given are the mean and limits of one standard deviation of the mean of sample values of drainage area, percent storage, mean annual precipitation, and slope. These statistics, computed from logarithmically transformed values, are presented in natural units. They are provided to give an indication of the statistical nature of each sample. For a particular region and variable, the indicated limits of one standard deviation include approximately two-thirds of the sample.

Separate regional analyses of the relationships between residuals (difference between observed and computed flood discharge values) and percent storage, mean annual precipitation, and slope indicate a random distribution of errors throughout the ranges of each of these variables. Plots of residuals versus drainage area for the western and southeastern regions indicate the same. However, these plots suggest that the regression relations developed for the northern region are not as well defined for streams draining areas of less than 10 mi^2 as for larger streams.

Table 4.--Statistical properties of three flood-frequency regions of New York

Region	Number of gaging stations	Average period of systematic record (years)	Average period of historic record (years)		Properties of sample basin characteristics: Area (A) (mi^2)	Storage (St) (percent)	Precipitation (P) (inches)	Slope (S) (ft/mi)
Northern	59	24	27	Mean	118	4.60	40.8	33.8
				Standard deviation	28.8 - 486	1.58 - 12.2	34.8 - 47.0	14.5 - 78.6
				Range	3.7 - 4500	0.0 - 21.7	31.8 - 55.1	3.2 - 250
South-eastern	65	23	24	Mean	57.4	2.38	43.8	33.4
				Standard deviation	14.7 - 223	0.58 - 6.22	40.1 - 48.2	13.4 - 83.0
				Range	1.51- 783	0.0 - 10.3	38.2 - 55.1	3.9 - 326
Western	96	23	25	Mean	101	1.90	36.9	21.3
				Standard deviation	18.2 - 556	0.46 - 4.78	33.8 - 40.8	7.50- 60.6
				Range	0.70- 4773	0.0 - 12.8	30.3 - 49.6	2.10- 318

The poorer definition for small streams results from the small number of sites in this drainage-area size category available for analysis. Accordingly, flood-frequency estimates computed for streams with drainage areas of less than 10 mi^2 in the northern region should be carefully examined and modified with any other pertinent hydrologic information.

Examples of Computations

1. Determine the magnitude of the 25-year flood on Cayadutta Creek at the mouth, near Fonda, Montgomery County.

   a. Cayadutta Creek drains into the Mohawk River, in the northern region. The required basin characteristics (from table 1) are drainage area, percent storage, and mean annual precipitation.

   b. The drainage area, as planimetered from U.S. Geological Survey topographic sheets, is 63.3 mi^2. The storage, obtained from the LUNR inventory, is 3.39 percent. The average mean annual precipitation over the basin, as determined from figure 2, is 42.0 inches.

   c. The equation for the 25-year flood in the northern region (table 1) is

$$Q25 = 433 \times A^{.767} (S_t+10)^{-1.11} (P-20)^{.654}$$

$$= 433 \times 63.3^{.767} \times 13.39^{-1.11} \times 22^{.654}$$

$$= 4,420 \text{ ft}^3/\text{s}$$

2. Determine the magnitude of the 100-year flood on the Beaver Kill, Sullivan County, upstream from its junction with Willowemoc Creek. The site is in the southeastern region, 5 miles downstream from the gaging station on Beaver Kill at Craigie Clair (station 01418500). The drainage area at the site is 98.3 mi^2, less than twice the drainage area at the gaging station (82.0 mi^2). Therefore, procedures for determining discharge-frequency estimates for ungaged sites on gaged streams will be used.

a. The variables needed in the estimating equations for the southeastern region are drainage area, slope, and mean annual precipitation.

Drainage area = 98.3 mi^2; slope = 36.8 ft/mi; and mean annual precipitation = 49.0 inches.

From table 2:

$$Q_{R100} = .138\ A^{1.06} S^{.447} (P-20)^{1.57}$$

$$= .138 \times 98.3^{1.06} \times 36.8^{.447} \times 29^{1.57}$$

$$= 17{,}700\ ft^3/s$$

b. From appendix 1, the regression discharge for station 01418500 is 17,300 ft^3/s, the weighted discharge is 15,700 ft^3/s, and

$$K_G = \frac{15{,}700}{17{,}300}$$

$$= .908$$

c. For a site downstream from a gaging station,

$$K_S = (K_G - 1)\ \frac{(2A_G - A_S)}{A_G} + 1$$

$$= (.908 - 1)\ \frac{([2 \times 82.0] - 98.3)}{82.0} + 1$$

$$= .926$$

d. The final, adjusted estimate of Q_{100} for the site is

$$Q_{W100} = K_s \times Q_{R100}$$

$$= .926 \times 17{,}700$$

$$= 16{,}400\ ft^3/s$$

ANALYTICAL TECHNIQUES

Annual Peak-Discharge Data

The flood-frequency analyses in this report are based on annual peak-discharge data collected through September 1975 from 220 continuous-record and partial-record gaging stations. Of these sites, 198 are in New York and are shown in figure 1. Also included are 22 gaging stations on streams flowing directly into or out of New York; of these, 11 are in Pennsylvania, 4 in New Jersey, 4 in Massachusetts, 2 in Vermont, and 1 in Connecticut.

Annual peaks from gaging stations having at least 10 consecutive years of unregulated, nonurbanized record were selected for the analysis. Generally, if more than 25 percent of the drainage area at a gaging station was upstream from a controlled reservoir (or within a densely populated area), the stream was considered regulated (or urbanized). However, these criteria were not adhered to in all cases. For example, if a reservoir was judged to not significantly affect the flood peaks at a particular gaging station, that station's annual peak record was included for analysis. Conversely, gaging stations close to natural lake outlets were not included if their records showed that the lakes had attenuated flood peaks to a significant degree.

The drainage areas of the gaging stations selected for the analysis ranged from 0.70 mi^2 to 4,773 mi^2. A histogram showing the distribution of sites, by drainage-area size, is given in figure 3. Approximately 70 percent have drainage areas within the 20- to 500-mi^2 range, and their distribution within this range is fairly even (fig. 3).

The distribution of gaging stations, by length of period of operating (systematic) record, is shown in figure 4. The time intervals are given in 5-year increments.

Discharge-Frequency Relationships

The discharge-frequency relationship of a streamflow-measurement site is usually expressed in terms of exceedance probability, or recurrence interval. Exceedance probability is the probability that a flood of specified magnitude will be equaled or exceeded in any 1 year. Recurrence interval, the reciprocal of exceedance probability, is the average time interval between actual occurrences of a flood of equal or greater magnitude. The representation of a discharge-frequency relationship on a graph is known as a flood-frequency curve. An example is depicted in figure 5.

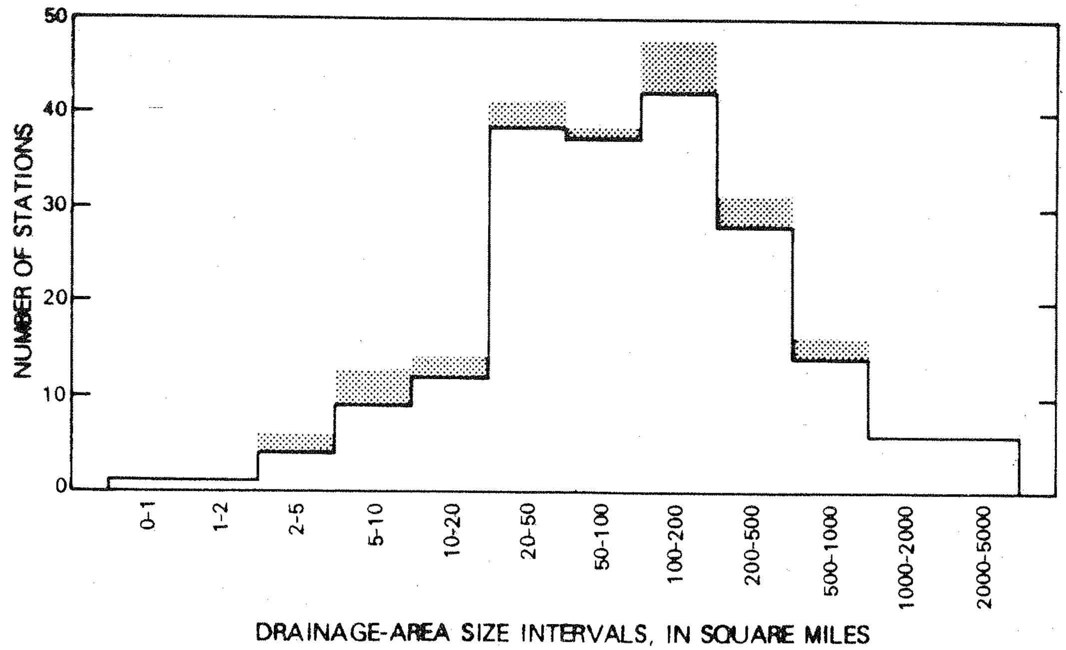

Figure 3.--Distribution of sites, by drainage-area size intervals. (Shaded portions of graph represent stations on nearby streams in adjacent states.)

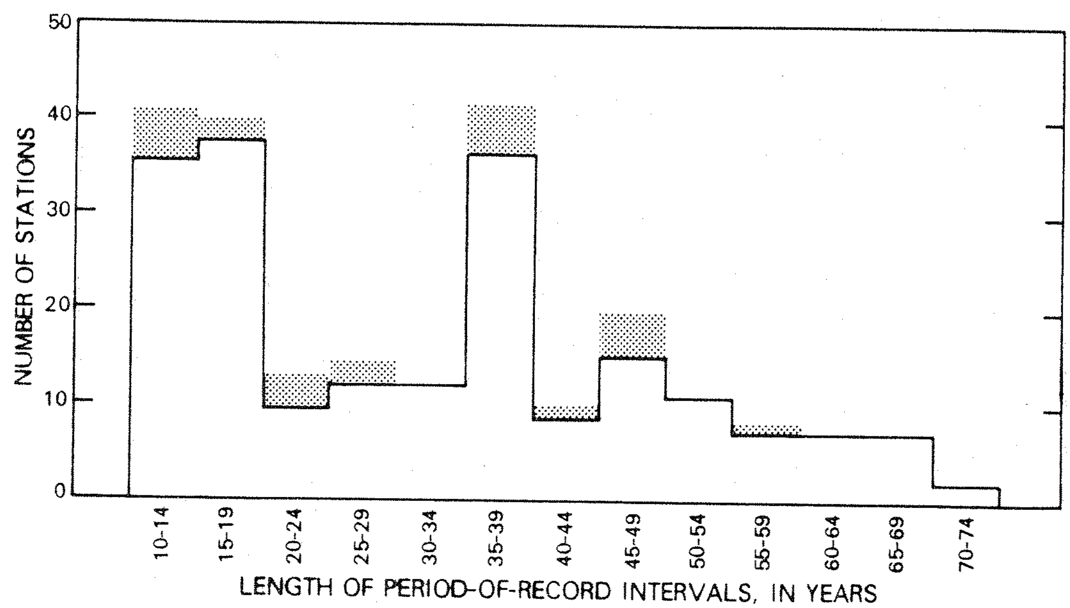

Figure 4.--Distribution of sites, by length of period of record, in 5-year intervals. (Shaded portions of graph represent stations on nearby streams in adjacent states.)

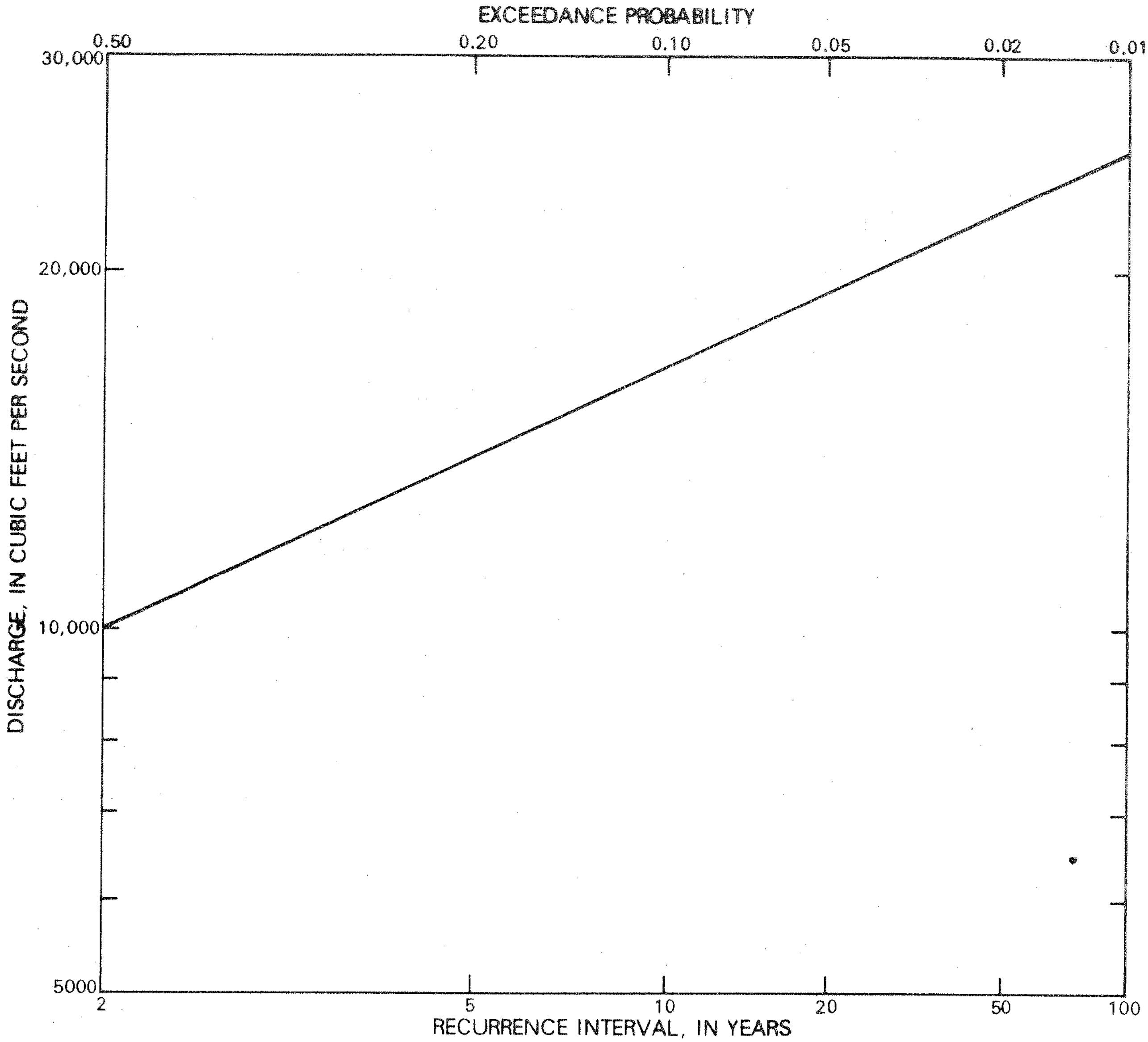

Figure 5.--Flood-frequency curve for Ausable River near Ausable Forks, N.Y. (station 04275500).

The terminology used in this context does not imply that floods of a given frequency will recur at regular intervals. On the contrary, an uncommonly large flood may recur during a short time period--even within the same year. The relationship of recurrence interval to probability of exceedance during time periods greater than 1 year is given in table 5 and by the following equation:

$$P = 1 - (1 - 1/t)^n$$

where

P is probability of at least one exceedance within the specified time interval.

n is the time period, in years.

t is the recurrence interval, in years.

(Multiply P by 100 to obtain percent chance of exceedance.)

For example, the 100-year flood has a 1-percent chance of occurring in any 1-year period, a 10-percent chance of occurring in any 10-year period, and a 39-percent chance of occurring during any 50-year period. (See table 5.)

Annual peak-discharge data at each gaging station were fitted to a log-Pearson Type III distribution according to guidelines given in U.S. Water Resources Council Bulletin 17A (1977). Specifically, generalized skew values were obtained from the map given therein (plate 1-WRC), and adjustments to frequency curves were made for historical information and low outliers. Discharge-frequency relationships for the stations used in this analysis are tabulated in appendix 1; log-Pearson Type III statistics are given in appendix 2.

Table 5.--Probability that a flood of given recurrence interval will be exceeded during indicated time period.[1/]

Recurrence interval (years)	Time periods, in years				
	5	10	25	50	100
5	0.67	0.89	*	*	*
10	.41	.65	.93	*	*
25	.18	.34	.64	.87	.98
50	.10	.18	.40	.64	.87
100	.05	.10	.22	.39	.63

1/ To obtain percent chance of exceedence, multiply probability values by 100

* Probability greater than .99 but less than 1.00

Regional Regression Analysis

The direct transfer of flood-frequency information from a gaged site to an ungaged site, even on a nearby stream, is generally of unknown reliability. However, the floodflow characteristics of a stream are related to the physical and climatic characteristics of its drainage basin. Multiple regression techniques can be used to formulate mathematical relationships between the observed floodflow characteristics and easily measured basin characteristics of a sample of gaged sites. By analogy, the relationships are assumed to be statistically valid for ungaged sites on streams whose basin characteristics are similar to those in the gaged-site sample.

The multiple regression analyses done for this study assumed a linear relationship between the logarithms of the floodflow and basin characteristics. The equation is expressed in the form:

$$\log Q_t = \log c + a \log A + b \log B + \ldots + n \log N,$$

or transformed:

$$Q_t = c\ A^a B^b \ldots N^n$$

where

Q_t is the flood discharge of a given (t-year) recurrence interval.

c is the regression constant.

A, B,...N are values for the physical and climatic characteristics of the basin.

a, b,... n are the regression coefficients.

The standard error of estimate, usually expressed in percent, is one measure of how well the sample data fit the relationship derived by a regression analysis. Approximately 2 out of 3 sample values of Q_t fall within the limits of one standard error of estimate, and about 19 out of 20 fall within twice these limits.

Equations were developed for floods of 2-, 5-, 10-, 25-, 50-, and 100-year recurrence intervals. Basin characteristics that were tested for significance in explaining the stream-to-stream variation in floodflow characteristics were drainage area, main-channel slope, main-channel length, mean basin elevation, storage in lakes and swamps, forest cover, mean annual precipitation, 2-year 24-hour precipitation intensity, mean minimum January temperature, and average water equivalent of snow on March 2. Selected basin characteristics are given in appendix 2 by individual station.

A statewide equation, and several equations derived from samples of various combinations of gaging stations, were investigated. The sample combinations were based on either areal consideration or drainage-area-size categories. Only equations for Q_{10} and Q_{100} were developed for evaluating the different combinations. The suitability of each equation was assessed according to (1) any exhibited bias (either areal or within a certain range of basin characteristics), (2) its standard error of estimate, (3) whether it was hydrologically reasonable, and (4) its ease of application. Only those basin characteristics that were significant at the 95-percent confidence limit were retained for possible use in an equation. The least significant of the remaining variables were also removed if their elimination did not interject any new bias into the relationship or appreciably worsen the standard error of estimate. The minimum sample of gaging stations used in an analysis was 25.

Residuals were plotted on a State map to detect any areal bias in a regression equation. Plots of residuals versus drainage area, slope, storage, etc. were also made to identify biases associated with these variables.

No substantial areal biases were detected with the statewide regression relationships, but the computed (regression) values for streams draining more than 700 mi^2 tended to be higher than the observed (log-Pearson type III) values. In addition, the statewide equations were not well defined for small streams (those having drainage areas less than 10 mi^2). For small streams, about half of the computed values of Q_{10} and Q_{100} fell outside the standard error of estimate for those equations.

The samples of sites in both size categories mentioned above were too small to permit development of their own separate regression equations. Attempts to divide the statewide sample into other drainage-area-size categories were not uniformly successful. For example, one set of equations developed for all streams in the State having drainage areas over 25 mi^2 had an unwieldy number of significant basin characteristics but showed no areal or other biases. However, although the set of equations for drainage basins less than 25 mi^2 had a sample size of 48 stations, and had relatively low standard errors of estimate, it left northern New York largely unrepresented and the central part of the state only sparsely represented.

A regional division of the statewide sample showed the most promise in removing the biases associated with large streams and in yielding manageable regression equations at minimum expense to the standard error of estimate. The closeness of fit for small streams in the western and southeastern regions was also acceptable. As mentioned in a previous section, the lack of data for small streams in the northern region precludes good definition of estimates of Q_t for streams of this size in this part of the state.

For ease of application, and to eliminate intrabasin discrepancies in flood-frequency estimations, the regional boundaries were drawn along major drainage-basin divides. The estimating equations and their standard errors of estimate are given in tables 1-3.

Improved Flood-Frequency Estimates At Gaged Sites

The regional regression models can be used to improve gaging-station estimates by various averaging techniques. U.S. Water Resources Council Bulletin 17A (1977) suggests "if two independent estimates are weighted inversely proportional to their variance, the variance of the weighted average...is less than the variance of either estimate." (Variance is a measure of the amount of dispersion of a set of values around their mean, and is equivalent to the square of the standard deviation.)

The variance-weighting technique was applied to the flood-frequency relationships of gaging stations in this report. It has the form:

$$\log Q_W = \frac{\log Q_G (V_R) + \log Q_R(V_G)}{(V_R + V_G)}$$

where

Q_W is the weighted flood-discharge estimate for the station

Q_G is the log-Pearson Type III estimate for the station

Q_R is the regional regression estimate for the station

V_G is the variance of the log Pearson Type III estimate, in log units

V_R is the variance of the regression estimate, in log units

The variances of the estimating equations (V_R) are given for each region in table 6; the figures are in log units.

Table 6.--Variances of flood-flow-estimating equations for New York, by region.

Recurrence interval (years)	Variance (V_R), in log units		
	Northern region	Southeastern region	Western region
2	0.0191	0.0168	0.0280
5	.0206	.0141	.0250
10	.0223	.0140	.0253
25	.0247	.0153	.0274
50	.0268	.0172	.0298
100	.0289	.0197	.0327

The variance of log-Pearson Type III estimates (V_G) is computed according to a formula given by Hardison (1971):

$$V_G = \frac{(RI_V)^2}{N}$$

where

R is skew dependent, and is interpolated from values given in table 7 (Hardison, 1971).1/

I_V is the standard deviation, in log units, of the sample of annual peaks recorded at a gaging station

N is the number of years of record at the gaging station.

If historical adjustments were made to the gaging-station log-Pearson Type III relationship, historically adjusted values of skew, I_V, and N should be used in the variance (V_G) calculations.

Weighted discharge estimates are given in appendix 1 for all gaged sites in New York used in the regional regression analyses. These values are considered to be more accurate than either the log-Pearson Type III estimates or the regression estimates.

An example of the variance-weighting computations is given for the 50-year flood at the gaging station on Oatka Creek at Warsaw, Wyoming County (station 04235150).

a. From appendix 1, the log Pearson estimate of the 50-year flood, (Q_G) is 3,050 ft^3/s, and the regression estimate (Q_R) is 5,250 ft^3/s.

b. From table 6, the variance (V_R) of the western region equation for the 50-year flood is 0.0298.

c. From appendix 2, values of I_V, N, and skew are:

$I_V = 0.181$

N = 16 years (historic record)

skew = -0.02

1/ Since the "true" skewness (population skew) of the logarithms of the annual peak discharges is not known, adjustments should be made to the R values given in this table for the 50- and 100-year floods. For 50-year floods, increase the R value by 10 percent; for 100-year floods, by 20 percent.

From table 7, the 50-year flood R value for an array of annual peaks having a skew of -0.02 is interpolated as 1.75. Since this is not the population skew, 10 percent is added to this value to give 1.93. The variance (V_G) of the 50-year log Pearson estimate is:

$$V_G = \frac{(RI_V)^2}{N}$$

$$= \frac{(1.93 \times .181)^2}{16}$$

$$= .0076$$

d. The weighted 50-year flood estimate (Q_W) is computed as

$$\log Q_W = \frac{\log Q_G(V_R) + \log Q_R(V_G)}{V_R + V_G}$$

$$= \frac{\log(3050) \times (0.0298) + \log(5250) \times (.0076)}{(.0298 + .0076)}$$

$$= 3.5322$$

$$Q_W = 3410 \text{ ft}^3/\text{s}$$

This is the weighted estimate that appears in appendix 1.

Table 7.--Values of (R) for appraising accuracy of a T-year flood discharge estimated from observed annual peaks from a log-Pearson Type III population of known skew[1]

[Data from Hardison, 1971]

Flood-recurrence interval (years)	R for indicated logarithmic skew coefficient of population of annual peaks								
	-1.5	-1.0	-0.5	-0.2	0	+0.2	+0.5	1.0	1.5
2	.845	.933	.983	.997	1.000	.997	.983	.933	.845
5	.819	.916	1.020	1.020	1.164	1.229	1.328	1.486	1.638
10	.926	1.029	1.148	1.258	1.350	1.454	1.629	1.956	2.325
25	1.026	1.163	1.316	1.500	1.591	1.747	2.013	2.560	3.228
50	1.075	1.246	1.433	1.608	1.763	1.950	2.288	3.006	3.903
100	1.107	1.313	1.538	1.742	1.925	2.146	2.554	3.438	4.574

[1] For a 50-year peak computed from sample skew, indicated value of R should be increased 10 percent; for a 100-year peak, 20 percent.

SUMMARY AND SUGGESTIONS FOR FUTURE STUDY

Techniques presented in this report provide a means for estimating flood-frequency relationships on rural, unregulated streams in New York, exluding Long Island. Regression methods were used to relate floodflow characteristics to basin and climatic characteristics. As a result, the State was divided into three hydrologic regions. Estimating equations were developed for floods ranging from 2-year to 100-year recurrence intervals in each region. Drainage area is an independent variable needed in all equations. Other variables required are: northern region, storage index and mean annual precipitation; southeastern region, slope and mean annual precipitation; and western region, storage index.

The regional relationships can also be used to improve flood-frequency estimates at gaged sites by weighting regression and log-Pearson Type III estimates according to their variances. Weighted frequency-discharge estimates are given for all gaging stations used in the regression. The method for computing such estimates is also presented.

The equations are uniformly defined throughout the range of applicable basin characteristics in the southeastern and western regions. However, the definition for small streams (those draining less than about 10 mi^2) in the northern region is inadequate. Peak-flow data from additional small-stream gaging stations in this region are still needed to develop improved estimating equations for streams in this size category.

General flood-frequency relationships for streams draining urbanized areas in New York have not been developed. However, studies made in other States show promise in identifying and quantifying urban basin characteristics that have an effect on the magnitude and frequency of floods.

Regional methods are generally inappropriate in defining peak-flow-frequency relationships on regulated streams. Sophisticated flow models that route flood hydrographs can be used to define discharge profiles along the length of a stream. Some of the streamflow characteristics required by these models could be estimated by regression techniques.

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Appendix 1.--T-year peak discharges at gaging stations

Discharge-frequency relationships for each gaging station are presented in the following sequence: top line is derived from log-Pearson Type III analysis; middle line is computed from regression equations; bottom line shows weighted, or best estimates of, T-year floods.
Gaging stations listed below are in New York State, unless otherwise noted.
For gaging stations in adjacent states, only log-Pearson Type III and regression estimates are given. Additional flood-frequency information for these sites is available in reports from adjacent states. These reports are listed in the references.
Stations marked with an asterisk (*) are on currently regulated streams. The discharge-frequency relationships shown reflect preregulation conditions and are not generally applicable to present conditions.
Discharge values are given in units of cubic feet per second.

STATION	STATION NAME	RECURRENCE INTERVAL, IN YEARS					
NUMBER		2	5	10	25	50	100
	NORTHERN REGION						
01312000	HUDSON RIVER NEAR NEWCOMB	3530	4620	5350	6280	6970	7680
		4020	5440	6430	7730	8740	9790
		3540	4630	5370	6330	7040	7790
01313500	CEDAR RIVER BELOW CHAIN OF LAKES NEAR INDIAN LAKE	3710	5080	6020	7250	8200	9170
		3430	4760	5690	6940	7920	8940
		3700	5070	6000	7230	8180	9140
01314000	HUDSON RIVER AT GOOLEY NEAR INDIAN LAKE	8150	10500	11900	13700	15000	16300
		7030	9560	11300	13600	15400	17300
		8130	10500	11900	13700	15000	16300
01315500	HUDSON RIVER AT NORTH CREEK	12800	17100	19900	23600	26400	29200
		13000	17400	20500	24600	27800	31100
		12800	17100	19900	23600	26500	29300
01318500	HUDSON RIVER AT HADLEY	19300	25400	29500	34700	38600	42500
		19600	26600	31400	37900	42900	48000
		19300	25400	29500	34800	38800	42800
01319000	EAST BRANCH SACANDAGA RIVER AT GRIFFIN	4030	5730	6940	8570	9860	11200
		3240	4590	5580	6940	8040	9210
		4010	5680	6870	8470	9700	11000

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	NORTHERN REGION, CONTINUED						
01319800	WEST BRANCH SACANDAGA RIVER AT ARIETTA	983	1500	1890	2440	2900	3400
		1250	1740	2110	2610	3010	3450
		1020	1550	1940	2490	2940	3420
01319950	SAND LAKE OUTLET NEAR PISECO	186	241	277	324	360	396
		303	420	501	608	691	777
		192	252	294	352	404	461
01321000	SACANDAGA RIVER NEAR HOPE	12700	17200	20400	24700	28100	31700
		9140	12300	14600	17600	19900	22400
		12600	17000	20200	24300	27400	30700
01328000	BOND CREEK AT DUNHAM BASIN	698	938	1110	1330	1510	1690
		607	950	1220	1600	1910	2260
		694	939	1120	1350	1560	1770
01329000	BATTEN KILL AT ARLINGTON, VERMONT	3250	4610	5630	7050	8220	9480
		5550	8080	10000	12800	15200	17800
		--	--	--	--	--	--
01329500	BATTEN KILL AT BATTENVILLE	6000	8820	11100	14500	17400	20600
		8570	12300	15000	18800	21900	25300
		6050	8940	11300	14800	17900	21300
01330000	GLOWEGEE CREEK AT WEST MILTON	683	973	1190	1480	1720	1980
		720	1030	1250	1530	1760	1990
		685	978	1200	1490	1730	1980
01330500	KAYDEROSSERAS CREEK NEAR WEST MILTON	1590	2220	2690	3340	3870	4430
		2070	2940	3560	4400	5050	5740
		1600	2250	2730	3410	3980	4590
01331400	DRY BROOK NEAR ADAMS, MASSACHUSETTS	505	664	778	930	1050	1180
		472	712	898	1160	1380	1630
		--	--	--	--	--	--

APPENDIX 1.--T-YEAR PEAK DISCHARGES AT GAGING STATIONS, CONTINUED

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS: 2	5	10	25	50	100
	NORTHERN REGION, CONTINUED						
01332000	NORTH BRANCH HOOSIC RIVER AT NORTH ADAMS,	2250	3710	4960	6900	8650	10700
	MASSACHUSETTS	2280	3410	4280	5570	6670	7900
		--	--	--	--	--	--
01332500	HOOSIC RIVER NEAR WILLIAMSTOWN,	3700	5610	7140	9390	11300	13500
	MASSACHUSETTS	4910	7130	8830	11300	13300	15500
		--	--	--	--	--	--
01333000	GREEN RIVER AT WILLIAMSTOWN, MASSACHUSETTS	1300	2070	2700	3660	4490	5450
		1860	2770	3480	4480	5330	6250
		--	--	--	--	--	--
01333500	LITTLE HOOSIC RIVER AT PETERSBURG	1910	3060	4020	5460	6740	8190
		2060	3110	3920	5090	6060	7130
		1920	3070	4000	5370	6520	7770
01334000	WALLOOMSAC RIVER NEAR NORTH BENNINGTON,	3090	4740	6020	7880	9450	11200
	VERMONT	3920	5760	7170	9190	10900	12700
		--	--	--	--	--	--
01334500	HOOSIC RIVER NEAR EAGLE BRIDGE	10300	15600	20200	27700	34600	42900
		11200	16200	20000	25300	29600	34400
		10300	15600	20200	27400	33800	40900
*01335500	HUDSON RIVER AT MECHANICVILLE	40100	51700	60200	71700	81000	90900
		43600	59600	70700	85800	97500	110000
		40100	51800	60400	72100	81700	92000
01342800	WEST CANADA CREEK AT NOBLEBORO	8160	10000	11100	12400	13400	14200
		5760	7880	9430	11600	13300	15100
		8130	9980	11100	12400	13400	14200

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS					
		2	5	10	25	50	100
	NORTHERN REGION, CONTINUED						
01348000	EAST CANADA CREEK AT EAST CREEK	8110	10500	12200	14400	16100	18000
		6220	8450	10000	12100	13800	15500
		8090	10500	12100	14300	16000	17800
01349000	OTSQUAGO CREEK AT FORT PLAIN	4510	6720	8400	10800	12700	14800
		2040	3100	3930	5110	6090	7170
		4260	6200	7600	9480	10700	12100
01350000	SCHOHARIE CREEK AT PRATTSVILLE	13100	23600	32600	46700	59200	73800
		6900	10100	12600	16100	19100	22300
		12600	22000	29600	40500	48300	56200
01351000	FOX CREEK AT WEST BERNE	2670	3700	4460	5490	6330	7210
		1730	2540	3120	3920	4560	5230
		2600	3570	4270	5200	5900	6610
01354300	PLOTTER KILL AT RYNEX CORNERS	265	385	475	602	705	817
		151	225	278	349	405	464
		250	356	430	526	592	657
04252500	BLACK RIVER NEAR BOONVILLE	5490	7140	8280	9790	11000	12200
		6510	8720	10300	12300	14000	15700
		5500	7170	8320	9870	11100	12400
04254500	MOOSE RIVER AT MCKEEVER	7230	9510	11100	13200	14900	16600
		6480	8530	9920	11700	13100	14500
		7220	9490	11100	13100	14800	16500
04256000	INDEPENDENCE RIVER AT DONNATSBURG	1990	2700	3190	3820	4310	4810
		2020	2670	3110	3670	4100	4530
		1990	2700	3190	3810	4290	4780
04258500	DEER RIVER AT COPENHAGEN	4610	6580	7990	9880	11400	12900
		2200	2920	3410	4040	4540	5030
		4490	6310	7590	9210	10300	11300

APPENDIX 1.--T-YEAR PEAK DISCHARGES AT GAGING STATIONS, CONTINUED

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	NORTHERN REGION, CONTINUED						
04262500	WEST BRANCH OSWEGATCHIE RIVER NEAR HARRISVILLE	3910	4860	5450	6160	6680	7180
		4420	5830	6770	7970	8890	9810
		3910	4870	5470	6200	6730	7270
04263000	OSWEGATCHIE RIVER NEAR HEUVELTON	9140	11800	13500	15700	17300	18900
		11300	14800	17100	20000	22200	24400
		9170	11800	13600	15800	17500	19200
04263500	OSWEGATCHIE RIVER NEAR OGDENSBURG	12600	15500	17200	19300	20800	22200
		11500	15200	17600	20600	22700	24800
		12500	15500	17200	19400	21000	22500
04264700	NORTH BRANCH GRASS RIVER NEAR CLARE	496	723	882	1090	1250	1420
		993	1380	1640	1970	2230	2490
		551	817	1010	1280	1510	1770
04265000	GRASS RIVER AT PYRITES	4500	5750	6540	7490	8170	8840
		5070	6830	8010	9540	10700	11900
		4510	5770	6570	7550	8260	8990
04265100	ELM CREEK NEAR HERMON	565	781	925	1110	1250	1380
		796	1130	1370	1680	1920	2160
		581	810	968	1180	1350	1530
04265200	TANNER CREEK AT STELLAVILLE	780	1130	1370	1690	1930	2170
		689	956	1140	1360	1540	1710
		766	1100	1320	1600	1790	1980
04265300	LITTLE RIVER NEAR CANTON	1130	1800	2290	2980	3530	4120
		1060	1540	1900	2370	2740	3130
		1120	1750	2200	2810	3250	3700

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	NORTHERN REGION, CONTINUED						
04267700	PARKHURST BROOK NEAR POTSDAM	346	506	617	761	872	985
		581	885	1110	1430	1680	1950
		366	593	674	857	1020	1200
04267800	TROUT BROOK AT ALLEN CORNERS	1000	1620	2080	2710	3220	3750
		718	983	1150	1350	1500	1640
		948	1470	1830	2250	2500	2700
04268800	WEST BRANCH ST. REGIS RIVER NEAR	2300	3060	3560	4190	4660	5130
	PARISHVILLE	1930	2470	2790	3170	3430	3680
		2270	3010	3480	4050	4440	4800
04269000	ST. REGIS RIVER AT BRASHER CENTER	7430	10100	11900	14300	16100	18000
		6690	8670	9930	11500	12600	13700
		7410	10100	11800	14200	15900	17600
04269050	ALLEN BROOK NEAR BRASHER FALLS	416	602	730	896	1020	1150
		470	700	867	1090	1270	1460
		423	616	752	934	1080	1240
04269500	DEER RIVER AT BRASHER IRON WORKS	2630	3770	4540	5550	6310	7090
		3020	4200	5000	6050	6850	7660
		2670	3830	4610	5650	6440	7260
04270000	SALMON RIVER AT CHASM FALLS	1550	2060	2390	2790	3070	3360
		1560	2090	2430	2860	3160	3500
04270200	LITTLE SALMON RIVER AT BOMBAY	1610	2220	2620	3140	3520	3910
		1710	2530	3110	3900	4520	5170
		1620	2250	2670	3240	3690	4170
04270700	TROUT RIVER AT TROUT RIVER	2660	4630	6190	8430	10300	12300
		2460	3670	4560	5790	6780	7850
		2620	4370	5660	7400	8650	9890

APPENDIX 1.--T-YEAR PEAK DISCHARGES AT GAGING STATIONS, CONTINUED

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	NORTHERN REGION, CONTINUED						
04270800	ENGLISH RIVER NEAR MOOERS FORKS	965	1490	1880	2400	2810	3250
		774	1130	1380	1710	1970	2230
		936	1420	1770	2210	2510	2820
04271500	GREAT CHAZY RIVER AT PERRY MILLS	3370	4560	5330	6290	7000	7710
		3710	5300	6400	7870	9000	10200
		3380	4580	5370	6370	7130	7920
04273500	SARANAC RIVER AT PLATTSBURG	5070	6860	8050	9560	10700	11800
		6380	8490	9840	11600	12800	14000
		5100	6910	8120	9650	10800	12000
04273700	SALMON RIVER AT SOUTH PLATTSBURG	716	1160	1490	1970	2360	2780
		1180	1810	2270	2900	3400	3930
		779	1280	1660	2220	2710	3240
04274000	WEST BRANCH AUSABLE RIVER NEAR LAKE PLACID	3210	4510	5440	6680	7660	8680
		2460	3490	4220	5190	5960	6760
		3190	4470	5380	6590	7520	8470
04275000	EAST BRANCH AUSABLE RIVER AT AU SABLE FORKS	5870	8470	10300	12900	14900	17000
		5200	7670	9530	12200	14300	16700
		5850	8440	10300	12900	14800	17000
04275500	AUSABLE RIVER NEAR AU SABLE FORKS	9810	13700	16300	19700	22400	25100
		8250	11800	14300	17800	20600	23500
		9770	13600	16200	19600	22300	25000
04276200	BOUQUET RIVER AT NEW RUSSIA	1450	2080	2540	3160	3650	4170
		1140	1750	2210	2870	3400	3980
		1430	2050	2500	3120	3600	4130

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS					
		2	5	10	25	50	100
	NORTHERN REGION, CONTINUED						
04276500	BOUQUET RIVER AT WILLSBORO	4300 4650 4310	6220 6760 6240	7510 8270 7540	9140 10300 9210	10400 12000 10500	11600 13700 11800
04278300	NORTHWEST BAY BROOK NEAR BOLTON LANDING	945 759 917	1350 1130 1300	1650 1400 1590	2050 1760 1960	2380 2060 2260	2720 2380 2560
	SOUTHEASTERN REGION						
01199400	WEBATUCK CREEK NEAR SOUTH AMENIA	1360 1630 1390	1920 2470 2020	2350 3160 2560	2970 4180 3360	3490 5060 4110	4050 6060 4970
01199420	TENMILE RIVER NEAR WASSAIC	2220 2400 2240	3240 3680 3330	4030 4710 4220	5180 6250 5570	6150 7590 6780	7230 9110 8170
01200000	TENMILE RIVER NEAR GAYLORDSVILLE, CONNECTICUT	2840 3870 --	5060 5920 --	7120 7580 --	10500 10000 --	13800 12200 --	17800 14600 --
01358500	POESTEN KILL NEAR TROY	2150 2910 2190	3520 4770 3670	4760 6310 5040	6800 8670 7270	8740 10700 9410	11100 13200 11900
01359750	MOORDENER KILL AT CASTLETON-ON-HUDSON	714 649 710	980 983 981	1170 1250 1190	1440 1650 1490	1660 2000 1760	1880 2390 2060
01361000	KINDERHOOK CREEK AT ROSSMAN	5400 6970 5450	8910 11000 9090	12100 14400 12400	17500 19500 17900	22500 23900 22900	28800 29000 28800

APPENDIX 1.--T-YEAR PEAK DISCHARGES AT GAGING STATIONS, CONTINUED

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	SOUTHEASTERN REGION, CONTINUED						
01361200	CLAVERACK CREEK AT CLAVERACK	1500	2500	3350	4680	5870	7250
		1350	2070	2660	3540	4300	5160
		1470	2350	3030	4050	4880	5800
01361500	CATSKILL CREEK AT OAK HILL	4010	6360	8250	11000	13400	16100
		2120	3350	4350	5860	7190	8700
		3910	6070	7700	10100	12000	14100
01362100	ROELIFF JANSEN KILL NEAR HILLSDALE	767	1300	1760	2480	3140	3910
		739	1150	1490	1990	2430	2930
		761	1240	1630	2200	2670	3200
01362198	ESOPUS CREEK AT SHANDAKEN	2750	5270	7640	11600	15500	20200
		3400	5620	7480	10300	12800	15700
		2950	5440	7560	10700	13500	16600
01362500	ESOPUS CREEK AT COLDBROOK	12400	23300	33300	49500	64500	82400
		9790	16200	21700	29900	37200	45700
		12200	22500	31300	45300	56900	70100
01365000	RONDOUT CREEK NEAR LOWES CORNERS	2300	3930	5290	7390	9240	11400
		2280	3750	4970	6830	8480	10400
		2300	3900	5220	7250	8990	11000
01365500	CHESTNUT CREEK AT GRAHAMSVILLE	1140	2200	3200	4870	6480	8450
		1260	2080	2760	3820	4750	5830
		1160	2170	3050	4410	5570	6890
*01366500	RONDOUT CREEK NEAR LACKAWACK	4610	8090	11200	16300	21000	26700
		4500	7360	9750	13400	16600	20300
		4600	7970	10900	15400	19400	23900

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	SOUTHEASTERN REGION, CONTINUED						
01366650	SANDBURG CREEK AT ELLENVILLE	1760	2990	4060	5760	7300	9120
		2120	3400	4460	6070	7480	9100
		1820	3110	4220	5910	7400	9110
*01367500	RONDOUT CREEK AT ROSENDALE	11400	15900	19200	23900	27800	32000
		11700	18900	24800	33700	41600	50600
		11400	16000	19600	24900	29600	34900
01368000	WALLKILL RIVER NEAR UNIONVILLE	1720	2490	3110	4020	4810	5690
		2850	4350	5560	7370	8930	10700
		1760	2630	3390	4530	5660	6970
01368500	RUTGERS CREEK AT GARDNERVILLE	1620	2660	3540	4930	6170	7630
		1580	2460	3180	4260	5200	6260
		1620	2610	3420	4660	5690	6860
01369000	POCHUCK CREEK NEAR PINE ISLAND	1190	1730	2150	2760	3280	3860
		1700	2510	3150	4100	4910	5820
		1210	1800	2270	2980	3640	4390
01369500	QUAKER CREEK AT FLORIDA	370	565	721	952	1150	1370
		286	434	553	731	884	1060
		365	547	689	897	1070	1250
01370000	WALLKILL RIVER AT PELLETS ISLAND MOUNTAIN	3970	5580	6810	8580	10100	11700
		5890	8810	11200	14600	17600	21000
		4010	5730	7120	9170	11100	13200
01371000	SHAWANGUNK KILL AT PINE BUSH	3270	5560	7550	10700	13600	17000
		2350	3630	4670	6220	7570	9100
		3130	5000	6420	8540	10200	12000
01371500	WALLKILL RIVER AT GARDINER	10100	14300	17700	22500	26600	31100
		10200	15300	19400	25500	30800	36700
		10100	14400	17900	22900	27300	32300

APPENDIX 1.--T-YEAR PEAK DISCHARGES AT GAGING STATIONS, CONTINUED

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	SOUTHEASTERN REGION, CONTINUED						
01372040	CRUM ELBOW CREEK AT HYDE PARK	227	358	466	629	773	937
		351	514	644	834	998	1180
		242	397	525	715	886	1080
01372200	WAPPINGER CREEK NEAR CLINTON CORNERS	1550	2650	3610	5140	6550	8220
		2270	3550	4610	6190	7570	9150
		1650	2890	3970	5620	7100	8790
01372300	LITTLE WAPPINGER CREEK AT SALT POINT	502	841	1130	1590	2010	2500
		580	850	1060	1380	1650	1950
		514	843	1100	1490	1810	2150
01372500	WAPPINGER CREEK NEAR WAPPINGERS FALLS	2780	5200	7520	11500	15400	20300
		3150	4790	6100	8050	9750	11700
		2820	5110	7080	10100	12600	15300
01372800	FISHKILL CREEK AT HOPEWELL JUNCTION	879	1480	2010	2860	3640	4570
		1350	2050	2610	3440	4160	4980
		939	1630	2230	3120	3930	4820
01373500	FISHKILL CREEK AT BEACON	2240	3850	5350	7880	10300	13400
		3710	5630	7180	9480	11500	13700
		2290	3980	5580	8170	10600	13500
01374460	SOUTH BRANCH MINISCEONGO CREEK AT LETCHWORTH VILLAGE	136	218	289	397	496	612
		201	299	376	490	588	698
		145	240	321	440	548	666
01376600	HACKENSACK RIVER AT BROOKSIDE PARK	890	1110	1260	1470	1630	1800
		717	1150	1510	2060	2530	3080
		882	1110	1290	1570	1830	2130

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	SOUTHEASTERN REGION, CONTINUED						
01377000	HACKENSACK RIVER AT RIVERVALE, NEW JERSEY	820 944 --	1080 1360 --	1270 1680 --	1530 2156 --	1750 2560 --	1980 3010 --
01377200	PASCACK BROOK TRIBUTARY AT SPRING VALLEY	196 208 198	295 319 301	376 408 387	499 542 517	607 658 633	730 788 764
01377490	MUSQUAPSINK BROOK AT WESTWOOD, NEW JERSEY	211 189 --	259 281 --	293 353 --	338 460 --	374 553 --	411 656 --
01387300	STONY BROOK AT SLOATSBURG	609 874 668	1020 1410 1180	1380 1860 1630	1970 2540 2320	2510 3130 2950	3160 3820 3660
01378350	TENAKILL BROOK AT CRESSKILL, NEW JERSEY	168 58 --	202 80 --	226 98 --	258 123 --	282 145 --	307 168
01387350	NAKOMA BROOK AT SLOATSBURG	142 239 160	256 371 297	362 477 417	541 637 597	714 776 755	925 933 931
01387450	MAHWAH RIVER NEAR SUFFERN	457 436 453	831 662 760	1180 843 997	1770 1110 1350	2330 1350 1620	3030 1610 1920
01387500	RAMAPO RIVER NEAR MAHWAH, NEW JERSEY	2650 2950 --	4540 4550 --	6230 5850 --	8980 7780 --	11600 9460 --	14700 11400 --
01413500	EAST BRANCH DELAWARE RIVER AT MARGARETVILLE	5550 3780 5400	8790 5830 8330	11400 7480 10600	15100 9950 13700	18300 12100 16200	21900 14500 19000

APPENDIX 1.--T-YEAR PEAK DISCHARGES AT GAGING STATIONS, CONTINUED

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS					
		2	5	10	25	50	100
	SOUTHEASTERN REGION, CONTINUED						
01414000	PLATTE KILL AT DUNRAVEN	1470	2160	2690	3450	4080	4770
		1370	2210	2910	3970	4910	5980
		1460	2170	2740	3600	4370	5250
01414500	MILL BROOK NEAR DUNRAVEN	1440	2320	3040	4110	5030	6070
		1320	2170	2880	3950	4900	6000
		1430	2300	3010	4070	4990	6040
01415000	TREMPER KILL NEAR ANDES	1280	2060	2690	3610	4400	5290
		1160	1840	2400	3240	3980	4820
		1270	2030	2630	3520	4270	5120
01415500	TERRY CLOVE KILL NEAR PEPACTON	728	1210	1610	2220	2770	3390
		611	980	1280	1750	2150	2620
		713	1150	1510	2040	2480	2980
*01417500	EAST BRANCH DELAWARE RIVER AT HARVARD	13900	21500	27600	36500	44200	52900
		9320	14400	18500	24600	29900	36000
		13200	19700	24500	31600	37200	43500
01418000	BEAVER KILL NEAR TURNWOOD	3130	4830	6180	8170	9870	11800
		2360	3840	5080	6950	8600	10500
		2960	4470	5680	7530	9100	10900
01418500	BEAVER KILL AT CRAIGIE CLAIR	3930	6120	7850	10400	12500	14900
		3890	6330	8360	11400	14100	17300
		3930	6140	7940	10600	13000	15700
01419500	WILLOWEMOC CREEK NEAR LIVINGSTON MANOR	3210	5270	7000	9660	12000	14800
		3910	6440	8550	11800	14600	17900
		3270	5450	7330	10200	12900	16000

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS					
		2	5	10	25	50	100
	SOUTHEASTERN REGION, CONTINUED						
01420000	LITTLE BEAVER KILL NEAR LIVINGSTON MANOR	1200	1910	2480	3310	4030	4820
		1290	2100	2770	3790	4690	5710
		1210	1930	2520	3400	4180	5060
01420500	BEAVER KILL AT COOKS FALLS	9530	15000	19300	25400	30600	36300
		10400	17000	22500	30800	38200	46600
		9570	15200	19600	26100	31900	38500
*01421000	EAST BRANCH DELAWARE RIVER AT FISHS EDDY	24000	35200	43500	55000	64300	74200
		17900	28100	36400	48800	59600	71800
		23700	34600	42700	54100	63500	73700
01422000	WEST BRANCH DELAWARE RIVER AT DELHI	3690	5200	6290	7770	8950	10200
		3130	4860	6260	8360	10200	12300
		3660	5170	6290	7850	9170	10600
01422500	LITTLE DELAWARE RIVER NEAR DELHI	2040	2700	3160	3770	4230	4720
		1590	2540	3310	4480	5510	6680
		2030	2690	3170	3840	4390	5000
01423000	WEST BRANCH DELAWARE RIVER AT WALTON	8640	12800	16100	20700	24500	28700
		6620	10200	13200	17600	21400	25700
		8450	12400	15400	19800	23400	27500
01423500	DRYDEN CREEK NEAR GRANTON	314	476	602	785	938	1110
		401	645	845	1150	1420	1730
		325	512	670	909	1140	1400
01424000	TROUT CREEK NEAR ROCK ROYAL	869	1270	1580	2000	2350	2740
		843	1360	1790	2450	3020	3680
		866	1290	1640	2140	2610	3150
01424500	TROUT CREEK AT CANNONSVILLE	2070	2860	3420	4200	4810	5470
		1550	2460	3200	4320	5300	6420
		2030	2810	3380	4220	4930	5750

APPENDIX 1.--T-YEAR PEAK DISCHARGES AT GAGING STATIONS, CONTINUED

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	SOUTHEASTERN REGION, CONTINUED						
01425500	COLD SPRING BROOK AT CHINA	78	125	162	217	264	317
		80	128	168	228	281	342
		79	126	164	220	270	327
01426000	OQUAGA CREEK AT DEPOSIT	2590	3680	4480	5600	6520	7500
		1690	2650	3440	4620	5650	6830
		2530	3570	4320	5410	6310	7310
*01426500	WEST BRANCH DELAWARE RIVER AT HALE EDDY	15200	21300	25500	31000	35200	39600
		10500	16200	20900	27800	33800	40500
		15000	21000	25200	30700	35000	39700
01427500	CALLICOON CREEK AT CALLICOON	4270	6200	7670	9780	11500	13400
		3550	5660	7390	10000	12300	15000
		4230	6140	7630	9820	11700	13800
01428000	TENMILE RIVER AT TUSTEN	1050	1810	2490	3580	4580	5770
		1160	1790	2290	3050	3710	4450
		1060	1800	2420	3350	4130	5000
01435000	NEVERSINK RIVER NEAR CLARYVILLE	5070	8200	10800	14700	18100	22000
		4790	7960	10600	14700	18300	22500
		5050	8160	10800	14700	18200	22200
*01436500	NEVERSINK RIVER AT WOODBURNE	7060	10900	14100	18700	22800	27300
		5880	9500	12500	17000	21000	25600
		6880	10500	13500	18000	21900	26300
*01437000	NEVERSINK RIVER AT OAKLAND VALLEY	8610	13600	17600	23700	29000	35000
		8340	13400	17600	24000	29600	36000
		8580	13600	17600	23800	29200	35500

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	WESTERN REGION						
01496500	OAKS CREEK AT INDEX	1350	1820	2130	2520	2800	3090
		1400	1920	2280	2720	3050	3380
		1350	1820	2140	2530	2820	3110
01497500	SUSQUEHANNA RIVER AT COLLIERSVILLE	4310	5710	6660	7860	8780	9710
		4630	6330	7480	8950	10100	11200
		4310	5720	6680	7900	8840	9810
01497800	SCHENEVUS CREEK AT SCHENEVUS	797	1260	1630	2180	2650	3170
		1920	3040	3890	5100	6090	7160
		888	1510	2060	2900	3760	4720
01498500	CHARLOTTE CREEK AT WEST DAVENPORT	3900	5910	7440	9600	11400	13300
		4010	5990	7440	9420	11000	12700
		3900	5910	7440	9580	11300	13200
01499000	OTEGO CREEK NEAR ONEONTA	2550	3610	4370	5380	6180	7020
		2770	4190	5220	6650	7780	8990
		2560	3640	4420	5480	6350	7290
01500500	SUSQUEHANNA RIVER AT UNADILLA	3100	17200	20100	23900	26800	29900
		14800	20500	24500	29800	34000	38200
		13100	17300	20300	24200	27300	30700
01501000	UNADILLA RIVER NEAR NEW BERLIN	3600	4830	5650	6690	7470	8260
		4220	6190	7620	9540	11100	12700
		3610	4860	5700	6790	7640	8510
01501500	SAGE BROOK NEAR SOUTH NEW BERLIN	33	62	89	131	171	218
		65	119	164	233	293	360
		35	69	100	152	203	265
01502000	BUTTERNUT CREEK AT MORRIS	1910	2540	2970	3530	3960	4410
		1780	2750	3470	4470	5280	6140
		1910	2550	2990	3580	4050	4560

APPENDIX 1.--T-YEAR PEAK DISCHARGES AT GAGING STATIONS, CONTINUED

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	WESTERN REGION, CONTINUED						
01502500	UNADILLA RIVER AT ROCKDALE	8570	11500	13500	16100	18100	20100
		9640	13800	16800	20800	24000	27300
		8590	11600	13600	16300	18500	20700
01503000	SUSQUEHANNA RIVER AT CONKLIN	31200	40600	46500	53700	58800	63900
		32200	44500	53100	64600	73500	82900
		31200	40600	46600	53800	59000	64300
01503980	CHENANGO RIVER AT EATON	800	1300	1690	2270	2760	3300
		580	869	1080	1350	1570	1790
		763	1180	1480	1880	2150	2420
01505000	CHENANGO RIVER AT SHERBURNE	4330	6050	7240	8800	10000	11200
		4400	6240	7520	9200	10500	11800
		4330	6060	7250	8830	10000	11300
01505500	CANASAWACTA CREEK NEAR SOUTH PLYMOTH	2520	3920	4970	6450	7650	8940
		1770	2740	3470	4480	5300	6180
		2480	3820	4810	6180	7220	8330
01507000	CHENANGO RIVER AT GREENE	8950	12000	14100	16700	18800	20800
		9960	14100	17000	20900	23900	27000
		8970	12100	14200	16900	19100	21300
01507500	GENEGANTSLET CREEK AT SMITHVILLE FLATS	2630	3570	4220	5070	5730	6410
		2010	3020	3750	4740	5530	6360
		2610	3550	4200	5050	5710	6400
01508000	SHACKHAM BROOK NEAR TRUXTON	169	271	350	463	556	656
		206	363	490	679	841	1020
		171	278	364	490	602	728

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	WESTERN REGION, CONTINUED						
01508500	ALBRIGHT CREEK AT EAST HOMER	398	689	929	1290	1600	1960
		410	704	940	1290	1580	1910
		399	691	931	1290	1600	1950
01509000	TIOUGHNIOGA RIVER AT CORTLAND	5760	8350	10200	12600	14400	16300
		6070	8870	10900	13600	15800	18100
		5770	8370	10200	12700	14500	16500
01510000	OTSELIC RIVER AT CINCINNATUS	4470	5700	6510	7530	8300	9070
		4130	6320	7940	10200	12000	14000
		4460	5710	6550	7620	8470	9350
01510500	OTSELIC RIVER NEAR UPPER LISLE	6040	8280	9810	11800	13300	14800
		5450	8180	10200	13000	15200	17600
		6030	8280	9820	11800	13400	15000
*01511500	TIOUGHNIOGA RIVER AT ITASKA	14000	19700	24200	30900	36600	43100
		13400	19300	23400	29000	33500	38200
		14000	19700	24200	30800	36300	42400
01512500	CHENANGO RIVER NEAR CHENANGO FORKS	22100	30100	36100	44700	51800	59500
		22400	31200	37300	45500	51900	58500
		22100	30100	36100	44700	51800	59400
01513500	SUSQUEHANNA RIVER AT JOHNSON CITY	51600	65900	75100	86600	95000	103000
		51100	69300	82000	98900	112000	126000
		51600	65900	75200	86800	95300	103000
01514000	OWEGO CREEK NEAR OWEGO	5830	8770	11100	14400	17200	20300
		5080	7720	9680	12400	14600	17000
		5810	8730	11000	14300	16900	19900
01515000	SUSQUEHANNA RIVER NEAR WAVERLY	64500	85300	99200	117000	130000	144000
		59300	79900	94300	113000	128000	143000
		64500	85200	99100	117000	130000	144000

APPENDIX 1.--T-YEAR PEAK DISCHARGES AT GAGING STATIONS, CONTINUED

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS: 2	5	10	25	50	100
	WESTERN REGION, CONTINUED						
01516500	COREY CREEK NEAR MAINESBURG, PENNSYLVANIA	759	1430	2040	3020	3940	5040
		656	1110	1460	1990	2430	2920
		--	--	--	--	--	--
01516800	MANNS CREEK NEAR MANSFIELD, PENNSYLVANIA	324	470	577	723	840	965
		212	373	503	698	864	1050
		--	--	--	--	--	--
01517000	ELK RUN NEAR MAINESBURG, PENNSYLVANIA	625	1080	1460	2050	2560	3140
		569	965	1280	1740	2140	2570
		--	--	--	--	--	--
01518000	TIOGA CREEK AT TIOGA, PENNSYLVANIA	10400	18100	24700	35100	44600	55600
		8350	12800	16200	21000	24900	29200
		--	--	--	--	--	--
01518500	CROOKED CREEK AT TIOGA, PENNSYLVANIA	3910	6380	8320	11100	13500	16100
		4240	6690	8560	11200	13400	15800
		--	--	--	--	--	--
01520000	COWANESQUE RIVER NEAR LAWRENCEVILLE, PENNSYLVANIA	10600	18200	24300	33500	41500	50300
		8750	13400	16900	21900	26000	30500
		--	--	--	--	--	--
01520500	TIOGA RIVER AT LINDLEY	21000	35500	47600	66100	82500	101000
		18600	27700	34500	44000	51700	59900
		20900	35100	46600	63700	77900	93000
01522500	KARR VALLEY CREEK AT ALMOND	2630	4410	5770	7680	9230	10900
		1230	2020	2630	3520	4270	5080
		2520	4130	5280	6890	8050	9230

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	WESTERN REGION, CONTINUED						
01526000	TUSCARORA CREEK NEAR SOUTH ADDISON	5610	9890	13300	18300	22400	27000
		3670	5720	7270	9470	11300	13200
		5450	9360	12300	16400	19400	22500
01526500	TIOGA RIVER NEAR ERWINS	31500	49500	63700	84400	102000	121000
		29800	43600	53800	67900	79400	91600
		31500	49300	63100	83200	99600	117000
01527000	COHOCTON RIVER AT COHOCTON	408	633	806	1050	1260	1480
		1250	1870	2320	2920	3390	3890
		428	681	890	1190	1480	1800
01528000	FIVEMILE CREEK NEAR KANONA	1510	2210	2730	3440	4010	4610
		1900	2900	3650	4680	5510	6390
		1520	2240	2790	3540	4170	4850
01529500	COHOCTON RIVER NEAR CAMPBELL	7380	12300	16300	22200	27200	32900
		8840	12700	15500	19200	22200	25200
		7430	12300	16200	21800	26300	31200
01530500	NEWTOWN CREEK AT ELMIRA	2300	2910	3310	3790	4150	4510
		2380	3680	4650	6020	7130	8310
		2300	2920	3340	3850	4260	4680
01531000	CHEMUNG RIVER AT CHEMUNG	46600	69800	86700	110000	128000	147000
		40200	56300	67900	83400	95700	109000
		46500	69400	85900	109000	126000	143000
01531250	NORTH BRANCH SUGAR CREEK TRIBUTARY NEAR COLUMBIA CROSSROADS, PENNSYLVANIA	675	1280	1810	2660	3450	4370
		507	862	1150	1570	1920	2310
		--	--	--	--	--	--
03008000	NEWELL CREEK NEAR PORT ALLEGANY, PENNSYLVANIA	399	765	1080	1580	2020	2520
		458	782	1040	1420	1750	2110
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APPENDIX 1.--T-YEAR PEAK DISCHARGES AT GAGING STATIONS, CONTINUED

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	WESTERN REGION, CONTINUED						
03010500	ALLEGHENY RIVER NEAR ELDRED, PENNSYLVANIA	7310	12700	17600	25900	33800	43500
		14400	21600	27100	34800	41000	47700
		--	--	--	--	--	--
03010800	OLEAN CREEK NEAR OLEAN	4100	8390	12100	18000	23100	28900
		5160	7790	9740	12400	14600	16900
		4320	8210	11200	15400	18400	21500
03011000	GREAT VALLEY CREEK AT SALAMANCA	5510	8910	11500	15000	17800	20800
		4120	6350	8040	10400	12300	14400
		5340	8450	10700	13700	15900	18200
03011020	ALLEGHENY RIVER AT SALAMANCA	24000	32700	38700	46400	52400	58600
		31100	44700	54700	68400	79300	91000
		24100	32900	39100	47000	53400	60200
03011800	KINZUA CREEK NEAR GUFFEY, PENNSYLVANIA	1240	2430	3460	5060	6470	8090
		1820	2920	3780	4990	6000	7100
		--	--	--	--	--	--
03013000	CONEWANGO CREEK AT WATERBORO	3690	5060	5980	7160	8040	8930
		5530	7980	9730	12100	13900	15800
		3730	5150	6130	7410	8430	9500
03015000	CONEWANGO CREEK NEAR RUSSELL, PENNSYLVANIA	8540	11600	13700	16200	18000	19900
		14300	20300	24500	30300	34800	39500
		--	--	--	--	--	--
04213490	SOUTH BRANCH CATTARAUGUS CREEK NEAR OTTO	1580	2250	2710	3290	3740	4180
		858	1350	1720	2230	2650	3100
		1500	2110	2530	3050	3440	3830

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	WESTERN REGION, CONTINUED						
04213500	CATTARAUGUS CREEK AT GOWANDA	15300	21500	25600	30900	34900	38900
		8960	13100	16100	20100	23300	26700
		15200	21200	25200	30300	34100	37900
04214040	DELAWARE CREEK NEAR ANGOLA	280	410	498	612	697	784
		386	639	836	1120	1350	1610
		289	436	544	694	829	982
04214200	EIGHTEENMILE CREEK AT NORTH BOSTON	2960	3870	4430	5120	5620	6100
		1430	2290	2950	3880	4660	5500
		2850	3730	4260	4960	5460	5980
04214400	BUFFALO CREEK NEAR WALES HOLLOW	3910	5890	7270	9100	10500	11900
		2050	3090	3850	4890	5720	6590
		3620	5280	6370	7780	8690	9560
04214410	HUNTER CREEK AT COLEGRAVE	890	1180	1360	1590	1760	1920
		707	1180	1550	2100	2560	3060
		878	1180	1380	1650	1880	2120
04214500	BUFFALO CREEK AT GARDENVILLE	7570	10100	11600	13500	14800	16100
		3800	5750	7190	9190	10800	12500
		7510	10000	11500	13400	14600	15900
04215000	CAYUGA CREEK NEAR LANCASTER	5280	7220	8520	10200	11400	12700
		3120	4870	6200	8080	9620	11300
		5240	7160	8450	10100	11300	12600
04215500	CAZENOVIA CREEK AT EBENEZER	7140	9490	11000	12900	14300	15700
		4200	6520	8270	10700	12800	15000
		7060	9390	10900	12800	14200	15600
04216200	SCAJAQUADA CREEK AT BUFFALO	953	1300	1530	1820	2040	2260
		738	1230	1610	2160	2620	3130
		947	1300	1530	1840	2090	2340

APPENDIX 1.--T-YEAR PEAK DISCHARGES AT GAGING STATIONS, CONTINUED

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	WESTERN REGION, CONTINUED						
04216400	TONAWANDA CREEK NEAR JOHNSONBURG	860	1160	1360	1600	1780	1960
		804	1260	1600	2070	2460	2860
		857	1170	1380	1660	1880	2130
04216500	LITTLE TONAWANDA CREEK AT LINDEN	1020	1570	1960	2450	2830	3210
		858	1380	1780	2340	2800	3300
		1010	1560	1950	2440	2830	3220
04217000	TONAWANDA CREEK AT BATAVIA	3860	5270	6140	7170	7900	8600
		3020	4310	5210	6400	7320	8260
		3850	5250	6120	7150	7880	8580
04217700	MURDER CREEK AT PEMBROKE	834	1340	1700	2200	2590	2990
		802	1160	1400	1720	1960	2200
		830	1300	1630	2050	2360	2650
04218518	ELLICOTT CREEK BELOW WILLIAMSVILLE	1790	2700	3340	4180	4840	5510
		1860	2810	3500	4450	5200	5990
		1790	2700	3350	4200	4870	5560
04220150	OAK ORCHARD CREEK AT MEDINA	892	1240	1480	1770	1980	2190
		1780	2390	2790	3280	3640	3990
		937	1320	1600	1950	2240	2530
04221500	GENESEE RIVER AT SCIO	7310	11800	15400	20700	25400	30500
		7630	11400	14200	18100	21200	24500
		7320	11800	15300	20500	24900	29500
04222600	WISCOY CREEK AT BLISS	821	1130	1340	1590	1790	1980
		599	916	1150	1460	1710	1970
		805	1110	1320	1570	1770	1980

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	WESTERN REGION, CONTINUED						
04223000	GENESEE RIVER AT PORTAGEVILLE	22100	31900	39100	49000	57000	65600
		19800	28700	35200	44100	51300	58900
		22100	31800	38900	48700	56600	64900
04224700	SUGAR CREEK NEAR OSSIAN	735	1010	1190	1430	1600	1780
		552	937	1250	1700	2080	2500
		720	1000	1200	1470	1700	1950
04224900	MILL CREEK AT PATCHENVILLE	218	557	915	1560	2210	3020
		299	514	686	938	1150	1390
		250	534	767	1110	1370	1640
04225000	CANASERAGA CREEK NEAR DANSVILLE	3850	5850	7270	9140	10600	12100
		4560	7020	8870	11500	13600	15900
		3870	5890	7350	9270	10800	12500
04226000	KESHEQUA CREEK AT CRAIG COLONY NEAR SONYEA	2740	4130	5120	6450	7480	8550
		2500	3980	5100	6710	8040	9480
		2720	4110	5120	6510	7630	8840
*04227500	GENESEE RIVER AT JONES BRIDGE NEAR MOUNT MORRIS	20700	28700	34400	42000	48100	54400
		24700	35000	42400	52400	60400	68700
		20700	28800	34600	42300	48700	55200
04229500	HONEOYE CREEK AT HONEOYE FALLS	1720	2710	3440	4450	5260	6130
		3100	4360	5230	6350	7220	8100
		1790	2830	3620	4700	5600	6560
04230380	OATKA CREEK AT WARSAW	1300	1850	2220	2690	3050	3410
		1610	2570	3320	4380	5250	6200
		1320	1910	2340	2900	3410	3950

APPENDIX 1.--T-YEAR PEAK DISCHARGES AT GAGING STATIONS, CONTINUED

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	WESTERN REGION, CONTINUED						
04230500	OATKA CREEK AT GARBUTT	2520	3850	4790	6040	7020	8030
		3470	4920	5940	7270	8300	9350
		2560	3920	4900	6180	7220	8280
04231000	BLACK CREEK AT CHURCHVILLE	1520	2270	2810	3520	4070	4640
		1730	2400	2850	3410	3840	4260
		1530	2280	2810	3510	4030	4570
*04232000	GENESEE RIVER AT ROCHESTER	21700	26500	30100	35100	39100	43400
		32900	44900	53300	64300	72900	81800
		21900	26600	30200	35300	39500	44100
04232050	ALLEN CREEK NEAR ROCHESTER	837	1330	1700	2210	2610	3040
		990	1570	2010	2620	3130	3660
		854	1370	1760	2300	2760	3250
04232100	STERLING CREEK AT STERLING	826	1040	1180	1350	1470	1590
		731	1040	1250	1510	1710	1910
		824	1040	1180	1360	1490	1630
04232630	KENDIG CREEK NEAR MACDOUGALL	424	777	1080	1530	1920	2360
		673	1120	1470	1980	2400	2860
		473	878	1220	1720	2170	2660
04233000	CAYUGA INLET NEAR ITHACA	1240	2140	2860	3930	4830	5840
		1140	1780	2260	2930	3480	4060
		1230	2100	2780	3750	4510	5320
04234000	FALL CREEK NEAR ITHACA	3090	4520	5590	7080	8290	9580
		2930	4360	5400	6800	7920	9090
		3090	4510	5580	7060	8260	9530

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS 2	5	10	25	50	100
	WESTERN REGION, CONTINUED						
04234400	WEST RIVER NEAR MIDDLESEX	654	1480	2280	3620	4900	6450
		1110	1770	2270	2990	3580	4210
		790	1610	2280	3220	3960	4720
04235150	FLINT CREEK AT POTTER	572	1180	1740	2640	3470	4450
		1090	1730	2220	2900	3450	4050
		665	1340	1920	2760	3460	4200
04235250	FLINT CREEK AT PHELPS	1210	1950	2510	3290	3930	4610
		2270	3360	4140	5190	6020	6890
		1300	2140	2800	3720	4530	5400
04235300	OWASCO INLET AT MORAVIA	3490	6070	8210	11400	14200	17300
		2760	4170	5210	6630	7770	8980
		3320	5380	6840	8870	10200	11600
04239500	ONONDAGA CREEK AT SYRACUSE	1810	2850	3650	4770	5700	6700
		1820	2630	3190	3930	4500	5080
		1810	2790	3500	4440	5130	5820
04240100	HARBOR BROOK AT SYRACUSE	248	426	572	784	967	1170
		425	697	908	1210	1460	1720
		268	474	649	906	1140	1400
04240200	NINEMILE CREEK AT CAMILLUS	1370	2260	2950	3960	4800	5720
		1500	2150	2600	3180	3630	4090
		1380	2240	2870	3720	4350	4980
04242500	EAST BRANCH FISH CREEK AT TABERG	6750	8910	10400	12200	13600	15000
		1910	2520	2920	3390	3740	4070
		6630	8650	10000	11600	12700	13700

APPENDIX 1.--T-YEAR PEAK DISCHARGES AT GAGING STATIONS, CONTINUED

STATION NUMBER	STATION NAME	RECURRENCE INTERVAL, IN YEARS					
		2	5	10	25	50	100
	WESTERN REGION, CONTINUED						
04243500	ONEIDA CREEK AT ONEIDA	3360	4950	6090	7610	8810	10000
		2820	4240	5280	6700	7830	9030
		3350	4930	6060	7560	8750	9920
04245000	LIMESTONE CREEK AT FAYETTEVILLE	2670	4270	5490	7200	8600	10100
		2130	3200	3990	5050	5900	6790
		2640	4170	5300	6850	8030	9240
04245200	BUTTERNUT CREEK NEAR JAMESVILLE	936	1370	1680	2110	2450	2810
		1170	1870	2390	3140	3750	4410
		951	1420	1770	2280	2720	3220
04250750	SANDY CREEK NEAR ADAMS	4740	6440	7560	8990	10100	11100
		2380	3420	4160	5120	5870	6640
		4590	6160	7150	8420	9290	10100

Appendix 2.--Selected basin characteristics of gaged streams and statistical properties of annual peak discharge samples

A is drainage area, in square miles, contributing directly to runoff; S is main channel slope, in feet per mile, between points 10 percent and 85 percent of distance along stream from gaging station to basin divide; St is percentage of drainage area in lakes and swamps; P is basin average of mean annual precipitation, in inches.
Years of systematic record are the number of years, through 1975, of systematic peak-flow data collection; years of historic record are the number of years, through 1975, for which information is available indicating that a flood that occurred before, during, or after the systematic record is the maximum within an extended period.
Log-Pearson Type III statistics are given in logarithmic units.
The three flood frequency regions are symbolized by SE, for southeastern; N for northern; and W for western.
Stations marked with an asterisk (*) are on currently regulated streams. The storage data and log-Pearson Type III statistics reflect preregulation conditions.

STATION NUMBER	BASIN CHARACTERISTICS				YEARS OF RECORD		LOG-PEARSON TYPE III STATISTICS			FLOOD FREQUENCY REGION
	A	S	ST	P	SYSTEMATIC	HISTORIC	MEAN	STANDARD DEVIATION	SKEW	
					HOUSATONIC RIVER BASIN					
01199400	81.0	19.5	6.7	40.0	14	--	3.148	0.169	0.550	SE
01199420	120	19.2	7.0	40.0	15	--	3.364	0.182	0.550	SE
01200000	203	13.4	5.4	41.0	44	--	3.481	0.280	0.598	SE
					HUDSON RIVER BASIN					
01312000	192	63.5	8.8	45.4	50	63	3.552	0.136	0.177	N
01313500	160	29.2	6.8	42.0	34	45	3.574	0.158	0.177	N
01314000	419	13.8	7.7	41.8	52	63	3.911	0.129	0.002	N
01315500	792	24.8	7.5	45.0	68	--	4.112	0.144	0.172	N
01318500	1664	16.4	6.3	38.0	54	63	4.289	0.140	0.148	N
01319000	114	38.8	4.3	45.0	42	63	3.612	0.177	0.209	N
01319800	28.9	93.2	6.3	55.0	13	--	3.004	0.208	0.300	N
01319950	7.20	22.7	11.2	50.0	14	--	2.278	0.128	0.260	N
01321000	491	33.3	7.4	46.0	64	--	4.112	0.151	0.354	N
01328000	14.7	25.5	0.1	36.0	28	--	2.853	0.146	0.329	N
01329000	152	62.7	1.0	49.0	48	--	3.524	0.171	0.440	N
01329500	394	9.2	2.4	41.0	46	72	3.798	0.186	0.637	N
01330000	26.0	42.3	7.2	39.2	15	27	2.846	0.174	0.360	N
01330500	90.0	26.0	5.6	39.0	49	--	3.212	0.166	0.408	N
01331400	7.53	188	1.7	48.0	14	--	2.714	0.134	0.470	N
01332000	39.0	77.4	0.2	55.3	45	--	3.372	0.244	0.509	N
01332500	132	19.2	1.3	49.6	36	--	3.585	0.203	0.493	N
01333000	42.6	33.0	1.0	45.9	27	--	3.130	0.228	0.452	N
01333500	56.1	118	0.3	40.5	24	27	3.298	0.231	0.462	N
01334000	111	125	1.0	45.4	45	--	3.503	0.211	0.364	N

Appendix 2.--Selected basin characteristics of gaged streams and statistical properties of annual peak discharge samples, continued

STATION NUMBER	BASIN CHARACTERISTICS				YEARS OF RECORD		LOG-PEARSON TYPE III STATISTICS			FLOOD FREQUENCY REGION
	A	S	ST	P	SYSTEMATIC	HISTORIC	MEAN	STANDARD DEVIATION	SKEW	
					HUDSON RIVER BASIN, CONTINUED					
01334500	510	15.0	1.3	40.8	64	79	4.044	0.195	0.979	N
*01335500	4500	13.7	4.6	36.2	42	80	4.617	0.122	0.666	N
01342800	192	37.6	5.8	55.1	18	74	3.911	0.106	-0.048	N
01348000	291	42.7	7.4	47.2	65	78	3.919	0.126	0.460	N
01349000	59.2	75.4	0.1	38.5	26	--	3.664	0.199	0.313	N
01350000	236	30.3	0.6	43.2	66	72	4.130	0.294	0.261	N
01351000	73.0	46.0	3.6	36.1	20	--	3.437	0.161	0.400	N
01354300	3.70	156	6.2	37.8	15	--	2.437	0.183	0.380	N
01358500	89.4	89.2	7.7	39.9	45	52	3.365	0.234	0.827	SE
01359750	32.6	29.1	8.0	38.2	18	--	2.866	0.155	0.440	SE
01361000	329	25.7	4.1	39.5	41	77	3.765	0.239	0.825	SE
01361200	60.6	28.6	5.4	39.7	15	--	3.196	0.249	0.470	SE
01361500	98.0	45.7	1.3	37.4	65	75	3.617	0.228	0.362	SE
01362100	27.5	54.0	2.3	39.5	14	--	2.905	0.257	0.490	SE
01362198	59.5	82.0	0.1	50.0	12	--	3.462	0.319	0.440	SE
01362500	192	50.4	1.2	50.9	44	102	4.109	0.315	0.322	SE
01365000	38.5	85.3	0.2	50.5	39	48	3.375	0.266	0.320	SE
01365500	20.9	153	1.0	47.0	37	--	3.081	0.321	0.422	SE
*01366500	100	57.6	2.5	47.5	20	55	3.687	0.274	0.523	SE
01366650	56.7	59.3	3.9	44.0	19	--	3.266	0.259	0.490	SE
*01367500	386	24.2	3.2	45.4	20	55	4.072	0.160	0.533	SE
01368000	140	14.8	5.3	41.5	38	40	3.255	0.178	0.682	SE
01368500	59.7	33.5	1.8	41.5	25	--	3.232	0.239	0.550	SE
01369000	98.0	8.1	7.7	42.0	38	--	3.093	0.180	0.579	SE
01369500	9.74	42.0	6.4	42.0	38	--	2.587	0.205	0.495	SE
01370000	385	6.1	5.5	41.5	49	56	3.616	0.164	0.607	SE
01371000	102	21.8	3.2	41.5	25	--	3.537	0.257	0.513	SE
01371500	711	5.0	4.9	41.5	51	56	4.022	0.169	0.639	SE
01372040	18.6	16.3	6.5	40.0	16	--	2.377	0.221	0.520	SE
01372200	92.4	34.7	4.8	40.2	19	20	3.214	0.259	0.530	SE
01372300	32.9	12.6	7.6	40.2	19	20	2.723	0.250	0.520	SE
01372500	181	12.6	5.7	40.0	47	--	3.474	0.303	0.597	SE
01372800	57.3	17.4	6.3	43.0	12	20	2.969	0.251	0.590	SE
01373500	186	10.7	7.9	42.8	24	94	3.383	0.259	0.779	SE
01374460	5.83	23.9	10.3	48.0	16	--	2.162	0.224	0.650	SE

STATION NUMBER	BASIN CHARACTERISTICS				YEARS OF RECORD		LOG-PEARSON TYPE III STATISTICS			FLOOD FREQUENCY REGION
	A	S	ST	P	SYSTEMATIC	HISTORIC	MEAN	STANDARD DEVIATION	SKEW	
					HACKENSACK RIVER BASIN					
01376600	13.2	95.8	5.6	48.0	14	--	2.961	0.106	0.650	SE
01370000	58.0	5.0	4.1	43.0	35	--	2.929	0.130	0.550	SE
01377200	4.58	55.5	3.3	48.0	16	--	2.315	0.197	0.650	SE
01377490	6.53	27.3	5.5	44.0	10	--	2.335	0.099	0.700	SE
01378350	3.01	9.4	0.0	43.0	11	--	2.235	0.089	0.700	SE
					PASSAIC RIVER BASIN					
01387300	18.2	108	6.1	45.0	10	--	2.812	0.247	0.640	SE
01387350	5.35	70.8	8.4	46.2	16	--	2.184	0.283	0.620	SE
01387450	12.3	30.1	5.5	47.0	17	--	2.688	0.289	0.580	SE
01387500	118	17.2	5.6	44.0	55	--	3.450	0.260	0.609	SE
					DELAWARE RIVER BASIN					
01413500	163	15.2	0.4	43.4	39	--	3.757	0.228	0.320	SE
01414000	34.7	91.5	0.0	42.6	21	--	3.180	0.190	0.410	SE
01414500	25.0	120	0.2	46.1	39	--	3.170	0.238	0.343	SE
01415000	33.0	60.7	1.0	42.9	39	--	3.121	0.235	0.324	SE
01415500	14.1	114	0.1	43.0	26	--	2.879	0.248	0.406	SE
*01417500	457	9.8	0.3	43.6	20	--	4.157	0.215	0.430	SE
01418000	40.8	65.9	0.9	51.8	11	--	3.511	0.213	0.430	SE
01418500	82.0	52.7	0.7	49.1	38	--	3.608	0.218	0.368	SE
01419500	63.0	64.1	1.7	53.6	37	--	3.525	0.242	0.461	SE
01420000	19.8	83.8	3.8	52.8	51	--	3.091	0.232	0.320	SE
01420500	241	33.4	2.0	50.2	62	--	3.990	0.225	0.284	SE
*01421000	783	9.3	0.9	45.9	42	51	4.388	0.192	0.259	SE
01422000	142	21.5	0.4	40.9	38	--	3.576	0.170	0.296	SE
01422500	49.8	57.6	0.4	41.7	37	--	3.317	0.140	0.312	SE
01423000	331	13.1	0.4	41.8	25	--	3.949	0.195	0.390	SE
01423500	8.85	148	0.7	42.4	16	--	2.511	0.205	0.380	SE
01424000	20.4	117	0.3	42.1	16	--	2.951	0.187	0.370	SE
01424500	49.5	50.9	0.2	42.0	23	--	3.326	0.159	0.370	SE
01425500	1.51	326	0.0	41.0	34	--	1.908	0.232	0.325	SE
01426000	66.4	40.8	0.6	40.0	33	--	3.424	0.173	0.392	SE

Appendix 2.--Selected basin characteristics of gaged streams and statistical properties of annual peak discharge samples, continued

STATION NUMBER	BASIN CHARACTERISTICS A	S	ST	P	YEARS OF RECORD SYSTEMATIC	HISTORIC	LOG-PEARSON TYPE III STATISTICS MEAN	STANDARD DEVIATION	SKEW	FLOOD FREQUENCY REGION
					DELAWARE RIVER BASIN, CONTINUED					
*01426500	593	9.3	0.5	41.7	51	60	4.186	0.170	0.136	SE
01427500	111	37.9	2.6	43.8	36	--	3.644	0.183	0.455	SE
01428000	45.0	29.0	5.9	41.8	28	--	3.042	0.268	0.497	SE
01435000	65.6	70.6	0.4	56.8	38	--	3.722	0.235	0.427	SE
*01436500	113	31.0	1.3	55.0	16	--	3.865	0.214	0.470	SE
*01437000	222	27.2	4.9	48.7	26	--	3.953	0.222	0.478	SE
					SUSQUEHANNA RIVER BASIN					
01496500	102	12.3	10.1	39.0	42	--	3.129	0.155	-0.008	W
01497500	351	3.0	7.4	39.7	48	52	3.638	0.143	0.161	W
01497800	54.2	43.2	1.0	40.0	13	--	2.916	0.226	0.360	W
01498500	167	28.3	2.5	39.4	38	--	3.602	0.206	0.288	W
01499000	108	18.7	2.6	38.8	35	--	3.414	0.174	0.229	W
01500500	984	3.4	3.8	39.7	38	--	4.123	0.137	0.327	W
01501000	196	7.5	3.2	39.0	49	52	3.559	0.149	0.104	W
01501500	0.70	318	0.0	39.6	36	--	1.550	0.304	0.372	W
01502000	59.7	27.8	2.3	38.7	38	--	3.287	0.142	0.265	W
01502500	520	4.8	2.9	39.1	43	--	3.937	0.149	0.171	W
01503000	2232	3.6	2.6	39.4	63	111	4.494	0.136	-0.045	W
01503980	24.3	30.1	6.4	39.7	12	--	2.913	0.242	0.240	W
01505000	263	14.6	5.2	39.6	38	40	3.639	0.171	0.114	W
01505500	57.9	65.4	2.2	40.0	31	40	3.408	0.223	0.156	W
01507000	593	5.7	3.6	40.0	39	41	3.957	0.147	0.182	W
01507500	82.3	40.6	3.6	40.5	34	41	3.426	0.153	0.229	W
01508000	2.95	193	0.1	40.5	36	--	2.235	0.239	0.149	W
01508500	6.81	108	0.0	40.5	37	--	2.610	0.275	0.206	W
01509000	292	6.3	2.8	40.0	37	41	3.763	0.189	0.074	W
01510000	147	16.2	1.4	40.7	33	41	3.654	0.122	0.217	W
01510500	217	15.0	1.7	40.6	33	74	3.784	0.160	0.116	W
*01511500	730	6.6	2.4	40.0	12	74	4.168	0.162	0.796	W
01512500	1483	4.7	2.9	39.8	63	111	4.360	0.149	0.651	W
01513500	3960	3.2	2.7	39.5	39	111	4.715	0.125	0.100	W
01514000	186	14.3	1.2	38.2	46	74	3.780	0.200	0.427	W
01515000	4773	3.4	2.7	39.2	39	111	4.813	0.142	0.147	W
01516500	12.2	50.4	0.0	34.7	22	--	2.897	0.314	0.330	W
01516800	3.01	154	0.0	34.0	16	--	2.519	0.186	0.250	W
01517000	10.2	89.5	0.0	35.0	22	--	2.807	0.275	0.250	W
01518000	282	44.0	0.0	34.7	38	--	4.034	0.273	0.385	W

STATION NUMBER	BASIN CHARACTERISTICS A	S	ST	P	YEARS OF RECORD SYSTEMATIC	HISTORIC	LOG-PEARSON TYPE III STATISTICS MEAN	STANDARD DEVIATION	SKEW	FLOOD FREQUENCY REGION
					SUSQUEHANNA RIVER BASIN, CONTINUED					
01518500	122	27.8	0.0	34.0	23	--	3.601	0.246	0.200	W
01520000	298	20.1	0.0	34.3	25	--	4.036	0.270	0.200	W
01520500	771	24.4	0.1	36.0	46	87	4.338	0.258	0.358	W
01522500	27.4	72.2	0.2	35.0	32	41	3.419	0.267	-0.021	W
01526000	114	35.8	0.7	34.0	35	41	3.750	0.292	0.010	W
01526500	1377	17.1	0.1	35.8	57	87	4.511	0.224	0.330	W
01527000	52.2	29.9	4.7	33.0	25	41	2.620	0.220	0.239	W
01528000	66.8	12.6	2.6	33.6	39	41	3.185	0.193	0.210	W
01529500	470	10.2	2.9	33.4	57	--	3.879	0.254	0.256	W
01530500	77.5	45.2	1.7	34.6	38	41	3.365	0.119	0.129	W
01531000	2506	7.2	1.5	34.2	72	87	4.672	0.206	0.107	W
01531250	8.83	46.6	0.0	35.0	14	--	2.843	0.318	0.250	W
					ALLEGHANY RIVER BASIN					
03008000	7.79	87.6	0.0	39.0	16	--	2.606	0.332	0.100	W
03010500	550	11.2	0.0	40.5	37	--	3.894	0.264	0.687	W
03010800	198	5.6	1.5	38.5	17	--	3.609	0.372	-0.054	W
03011000	137	17.4	0.9	40.9	18	--	3.741	0.248	0.000	W
03011020	1608	5.5	0.7	41.1	72	--	4.386	0.155	0.189	W
03011800	46.4	35.4	0.5	45.0	11	--	3.097	0.343	0.050	W
03013000	290	4.2	3.7	43.6	37	--	3.568	0.163	0.039	W
03015000	816	2.1	2.7	43.3	37	--	3.930	0.161	-0.053	W
					STREAMS TRIBUTARY TO LAKE ERIE					
04213490	25.6	48.9	2.7	46.8	13	--	3.196	0.186	-0.050	W
04213500	432	22.3	2.2	41.4	36	65	4.183	0.177	-0.026	W
04214040	8.15	32.9	1.6	37.0	13	--	2.445	0.199	-0.090	W
04214200	37.2	35.1	1.0	39.0	13	--	3.470	0.139	-0.070	W
04214400	80.1	29.0	3.2	37.5	12	--	3.590	0.213	-0.050	W
04214410	14.0	38.3	0.3	38.0	12	--	2.949	0.146	-0.040	W
04214500	144	18.4	1.9	39.4	37	72	3.875	0.150	-0.160	W
04215000	94.9	29.3	0.8	37.9	35	72	3.724	0.160	0.065	W
04215500	134	28.4	0.6	39.9	35	39	3.854	0.147	0.003	W

Appendix 2.--Selected basin characteristics of gaged streams and statistical properties of annual peak discharge samples, continued

STATION NUMBER	BASIN CHARACTERISTICS				YEARS OF RECORD		LOG-PEARSON TYPE III STATISTICS			FLOOD FREQUENCY REGION
	A	S	ST	P	SYSTEMATIC	HISTORIC	MEAN	STANDARD DEVIATION	SKEW	
					NIAGARA RIVER BASIN					
04216200	15.3	9.0	0.5	33.0	18	34	2.980	0.160	0.025	W
04216400	24.6	89.4	3.0	35.8	14	--	2.934	0.156	-0.040	W
04216500	22.1	28.8	1.7	34.3	57	--	2.999	0.232	-0.197	W
04217000	171	16.1	5.6	35.6	31	72	3.579	0.167	-0.274	W
04217700	43.9	20.9	8.3	34.0	14	--	2.919	0.245	-0.070	W
04218518	72.4	7.7	3.4	33.0	20	57	3.252	0.213	-0.039	W
					STREAMS TRIBUTARY TO LAKE ONTARIO					
04220150	157	4.1	11.6	31.2	14	--	2.949	0.173	-0.080	W
04221500	309	22.6	1.3	35.1	56	74	3.878	0.236	0.346	W
04222600	21.8	14.0	5.0	36.0	14	--	2.914	0.165	-0.020	W
04223000	982	8.8	1.1	35.4	67	74	4.354	0.181	0.312	W
04224700	9.83	89.3	0.0	34.0	12	--	2.868	0.162	0.050	W
04224900	5.00	194	0.5	32.0	11	--	2.346	0.479	0.060	W
04225000	153	33.5	0.8	32.6	60	--	3.583	0.218	-0.058	W
04226000	68.8	39.9	0.5	30.8	15	--	3.438	0.211	0.010	W
*04227500	1419	13.3	1.8	34.3	45	83	4.324	0.162	0.293	W
04229500	195	4.0	6.5	32.0	29	--	3.237	0.232	0.052	W
04230380	41.9	58.0	0.8	34.8	12	16	3.114	0.181	-0.020	W
04230500	204	34.4	5.6	32.0	30	--	3.401	0.218	-0.021	W
04231000	123	18.0	9.2	30.3	30	--	3.182	0.208	-0.006	W
*04232000	2457	8.1	3.2	33.3	47	188	4.350	0.096	0.942	W
04232050	28.0	33.7	2.1	32.6	16	--	2.924	0.239	-0.020	W
04232100	44.4	11.3	9.7	37.0	18	--	2.919	0.119	0.050	W
04232630	13.8	21.2	0.6	33.0	11	--	2.633	0.309	0.100	W
04233000	35.2	77.2	2.5	36.3	39	41	3.101	0.275	0.129	W
04234000	126	15.9	3.3	38.0	50	71	3.499	0.190	0.294	W
04234400	29.3	27.8	1.5	36.0	11	--	2.821	0.416	0.070	W
04235150	31.0	66.7	1.9	36.0	11	16	2.764	0.369	0.100	W
04235250	102	12.5	4.1	32.0	16	--	3.085	0.243	0.070	W
04235300	106	21.7	2.6	37.0	10	--	3.552	0.279	0.190	W
04239500	98.2	11.8	6.2	37.7	10	--	3.263	0.231	0.160	W
04240100	9.60	113	1.9	38.0	16	--	2.404	0.272	0.160	W
04240200	84.3	21.3	7.0	37.0	17	--	3.143	0.252	0.150	W
04242500	188	37.0	12.8	49.6	52	--	3.833	0.140	0.173	W
04243500	113	46.8	2.8	39.2	26	85	3.529	0.198	0.085	W
04245000	85.5	37.6	3.4	39.6	36	--	3.431	0.238	0.112	W
04245200	32.2	48.0	1.6	38.5	17	--	2.978	0.191	0.190	W

STATION NUMBER	BASIN CHARACTERISTICS A	S	ST	P	YEARS OF RECORD SYSTEMATIC	HISTORIC	LOG-PEARSON TYPE III STATISTICS MEAN	STANDARD DEVIATION	SKEW	FLOOD FREQUENCY REGION
					STREAMS TRIBUTARY TO LAKE ONTARIO, CONTINUED					
04250750	128	25.8	5.6	42.0	18	--	3.676	0.158	0.030	W
04252500	295	28.1	8.4	50.3	65	--	3.748	0.130	0.387	N
04254500	365	8.9	11.1	47.5	66	74	3.868	0.135	0.393	N
04256000	91.7	38.9	13.2	47.6	48	--	3.304	0.154	0.188	N
04258500	88.7	25.5	12.3	51.1	46	--	3.670	0.179	0.194	N
					ST. LAWRENCE RIVER BASIN					
04262500	258	26.7	12.2	45.0	59	--	3.594	0.111	0.053	N
04263000	973	13.2	11.6	40.6	59	--	3.964	0.129	0.147	N
04263500	1580	12.7	11.7	32.2	13	--	4.100	0.106	0.010	N
04264700	46.3	27.4	10.2	38.8	11	--	2.697	0.194	0.030	N
04265000	335	25.4	9.9	40.1	51	--	3.652	0.128	-0.029	N
04265100	33.0	8.5	7.6	37.4	17	--	2.753	0.167	0.000	N
04265200	32.3	17.0	11.2	37.8	11	--	2.892	0.192	-0.010	N
04265300	42.4	40.1	4.6	36.0	17	--	3.052	0.240	0.020	N
04267700	17.8	47.2	2.2	35.0	17	--	2.539	0.197	-0.020	N
04267800	56.2	8.7	14.8	32.0	17	--	3.001	0.248	-0.030	N
04268800	172	15.2	21.7	38.0	17	--	3.362	0.147	0.050	N
04269000	616	25.6	14.9	39.1	63	--	3.877	0.152	0.232	N
04269050	16.0	56.5	4.4	35.0	14	--	2.620	0.191	-0.010	N
04269500	189	30.9	7.9	36.4	14	--	3.421	0.185	0.000	N
04270000	132	16.5	9.5	40.2	50	--	3.190	0.148	-0.070	N
04270200	93.6	45.8	3.6	32.0	17	--	3.206	0.166	0.000	N
04270700	107	62.4	2.0	35.0	16	--	3.424	0.286	0.000	N
04270800	40.8	52.0	6.0	31.8	16	--	2.986	0.224	0.030	N
04271500	247	3.2	5.3	33.7	40	--	3.527	0.157	-0.035	N
04273500	608	19.2	11.9	35.8	32	48	3.706	0.155	0.057	N
04273700	61.9	54.6	1.7	29.5	15	--	2.860	0.243	0.100	N
04274000	116	75.7	5.7	38.3	49	63	3.513	0.171	0.225	N
04275000	198	53.5	1.0	39.8	51	63	3.775	0.184	0.206	N
04275500	448	56.2	3.2	38.5	58	65	3.995	0.168	0.107	N
04276200	37.6	173	0.7	34.5	27	--	3.167	0.182	0.224	N
04276500	275	42.20	3.1	34.1	45	52	3.629	0.194	-0.116	N
04278300	23.4	250	3.6	38.0	10	--	2.985	0.176	0.310	N

Appendix 3.--Alternative Regional Flood-Frequency Equations

The following regional flood-frequency equations are provided for obtaining rough estimates. The more reliable and accurate relationships are given in tables 1, 2, and 3 on pages 9 and 10.

Flood-frequency region	T-year flood	Estimating equation	Standard error of estimate (percent)
Northern	Q_2 =	$70\ 7A^{.761}$	44.4
	Q_5 =	$110\ A^{.740}$	46.8
	Q_{10} =	$141\ A^{.728}$	49.2
	Q_{25} =	$184\ A^{.717}$	52.7
	Q_{50} =	$219\ A^{.709}$	55.4
	Q_{100} =	$258\ A^{.702}$	58.2
Southeastern	Q_2 =	$53.8\ A^{.861}$	51.2
	Q_5 =	$83.2\ A^{.864}$	53.0
	Q_{10} =	$107\ A^{.865}$	54.7
	Q_{25} =	$143\ A^{.866}$	57.3
	Q_{50} =	$174\ A^{.867}$	59.5
	Q_{100} =	$209\ A^{.868}$	61.9
Western	Q_2 =	$75.0\ A^{.776}$	47.9
	Q_5 =	$133\ A^{.742}$	48.5
	Q_{10} =	$181\ A^{.724}$	50.2
	Q_{50} =	$311\ A^{.694}$	56.1
	Q_{100} =	$377\ A^{.684}$	59.0