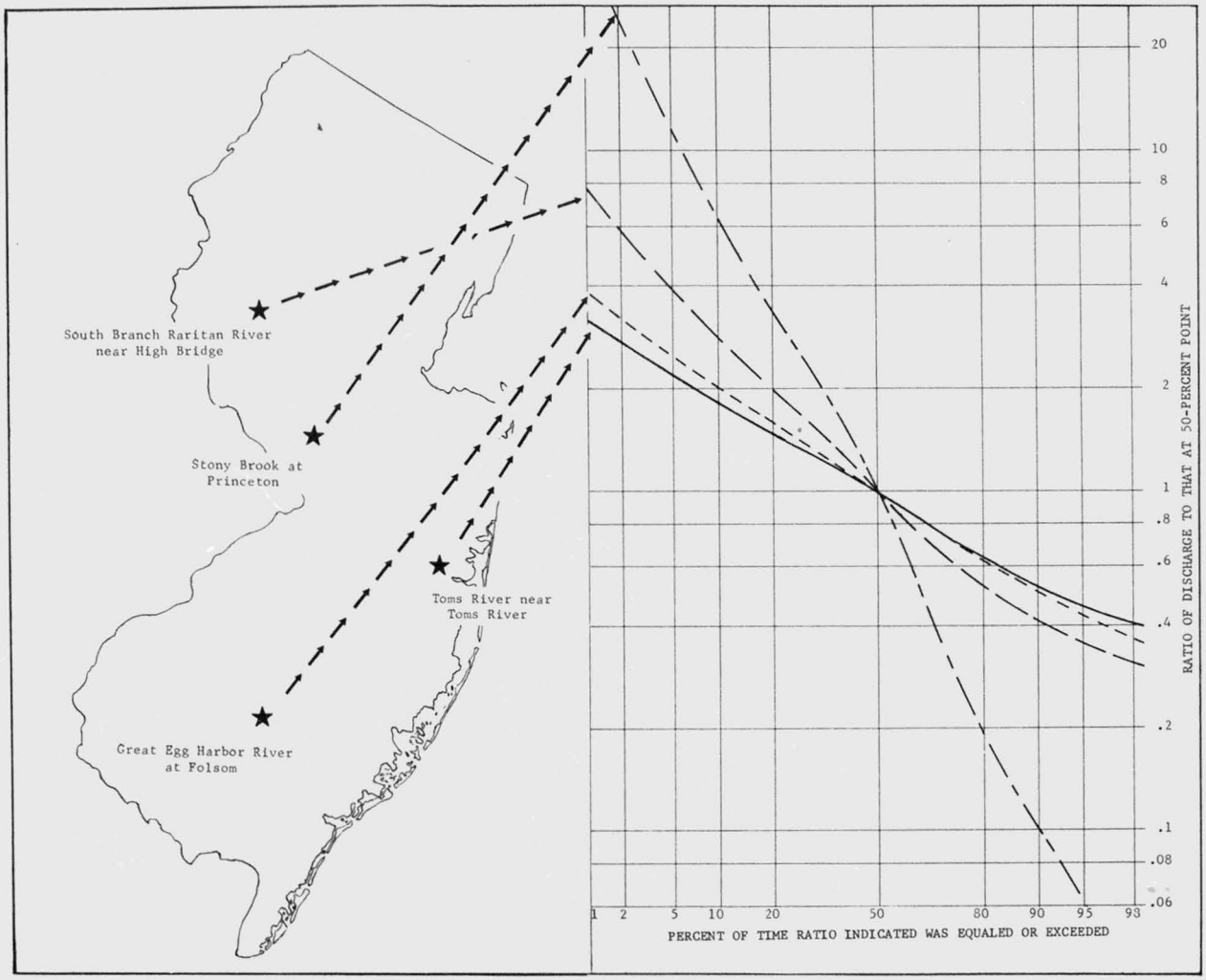
FLOW PROBABILITY OF NEW JERSEY STREAMS

WATER RESOURCES CIRCULAR 15



STATE OF NEW JERSEY

DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT

DIVISION OF WATER POLICY AND SUPPLY

Prepared in cooperation with the United States Department of the Interior Geological Survey

1966

COVER ILLUSTRATION

Flow-duration curves for index stations for northern and southern New Jersey, at High Bridge and Folsom respectively, compared to steepest and flattest curves for stations in the state.

FLOW PROBABILITY OF NEW JERSEY STREAMS

WATER RESOURCES CIRCULAR 15

By

E. G. Miller
Hydraulic Engineer
U.S. Geological Survey

Prepared by the U.S. Geological Survey
in cooperation with the
State of New Jersey
Department of Conservation and Economic Development
Division of Water Policy and Supply

1966

STATE OF NEW JERSEY

Department of Conservation and Economic Development

Robert A. Roe, Commissioner

Division of Water Policy and Supply

George R. Shanklin, Director and Chief Engineer

Water Policy and Supply Council

Lillian M. Schwartz, Chairwoman..... Highland Park
William G. Bank..... Colts Neck
I. Ralph Fox..... Rumson
Herman A. Klenner..... Rahway
Hermia Lechner..... Clinton
J. Duncan Pitney..... Mendham
August C. Schultes..... Woodbury
David I. Stepacoff..... Perth Amboy

Martha H. Brenna, Secretary

CONTENTS

ILLUSTRATIONS

Page

TABLES

FLOW PROBABILITY OF NEW JERSEY STREAMS

By E. G. Miller

INTRODUCTION

This report is one of a series published by the Division of Water Policy and Supply of the New Jersey Department of Conservation and Economic Development to make basic water data available in a form that can be readily used by all interested persons. The objective of the present report is to present flow-duration information based on past records so that estimates of future flows of New Jersey's streams may be made. It is an extension of the flow-duration portions of Water Resources Circular 6 (Miller and McCall, 1961).

The earlier report presented summarized discharge data through September 30, 1958, for New Jersey streams exactly as they were printed by the electronic computer. The present report presents analyzed data in tables that facilitate use of the individual gaging station records, as well as comparisons of water-supply characteristics among the river basins. The data have been extended to include the 1960 records and several recently established gaging stations have been added. Data for all stations listed in this report have been computed and tabulated for the standard reference period 1931-60, agreed upon by the World Meteorological Organization, as well as for the period of actual record.

In general, only those gaging stations have been tabulated that have five or more years of computed record and have a substantial portion of their drainage areas unaffected by regulation or diversion. A few stations with significant regulation, such as Passaic River at Little Falls and the stations on the main stem of the Delaware River, have been included because of the widespread interest in their records. Seventy continuous-record gaging stations are included in the tabulation. The station data give a record of the streamflow experience at the specific locations of the stations and provide a basis for estimating future streamflow at these and nearby locations.

Also tabulated in a summary table are estimated figures of discharge at 4 points on the duration curves for 95 low-flow partial-record stations. These values of discharge were used to help define the geographical distribution in New Jersey of elements of flow-duration curves.

Various aspects of flow-duration curves are discussed to emphasize their usefulness and limitations. Finally, a different but similar concept, called a "flow-volume" curve, is introduced to demonstrate how basic streamflow records may be processed to solve problems dealing with volume of water flowing in a stream as contrasted with the rate of flow in the stream.

The information in this report will be useful to many governmental agencies, engineers, and industries concerned with the availability and variability of streamflow. Water is a necessity of life, industry, and agriculture. Although New Jersey is situated favorably with regard to amount and distribution of precipitation, the quantity of available water is limited and already there are some sections of the State where the demand for water has exceeded the supply immediately available. The future development of New Jersey will depend to a great extent on wise water management. Many water-storage projects will be needed to make flood water, now often lost, available for use during dry periods. Innumerable streams will be considered for potential industrial plant locations or municipal water supplies. All these water developments of the future will require studies of the amount of water available, and the flow-duration data in this report will be of value in such studies of future flow probability.

This report was prepared in the Trenton district office of the United States Geological Survey under the general direction of John E. McCall, district engineer, in cooperation with the New Jersey Department of Conservation and Economic Development, Division of Water Policy and Supply. George R. Shanklin, director and chief engineer of the Division of Water Policy and Supply has guided and coordinated the cooperative program. Most of the data upon which this report is based were obtained under cooperative agreements between these two agencies dating back to 1921.

FLOW-DURATION STUDIES

Records Available

The records of 70 stream-gaging stations are included in the tables. These stations are listed by river basins in downstream order in table 1. The length of record of the individual stations varies from 6 to 63 years as shown by the bar chart in table 1. Thirty-one of the stations have records for the full length of the reference period 1931-60. Locations of the stations are shown on figure 1. Station numbers of the national numbering system of the Geological Survey are used for identification in both table 1 and figure 1.

In addition, measurements at 95 low-flow partial-record stations, more fully described in a later section, were used in the study of the geographical variation of flow duration in New Jersey. These partial-record stations are included in table 2 and located on figure 1.

Graphical Analyses of Streamflow Records

Graphical analyses of streamflow records are commonly presented by either one of two distinctly different methods. The first method preserves the chronological sequence of events by using date or time of occurrence as one element of the plot. Examples of this type of graph are hydrographs and cumulative hydrographs, called mass curves. The second method shows the frequency of occurrence of events, regardless of chronological sequence.

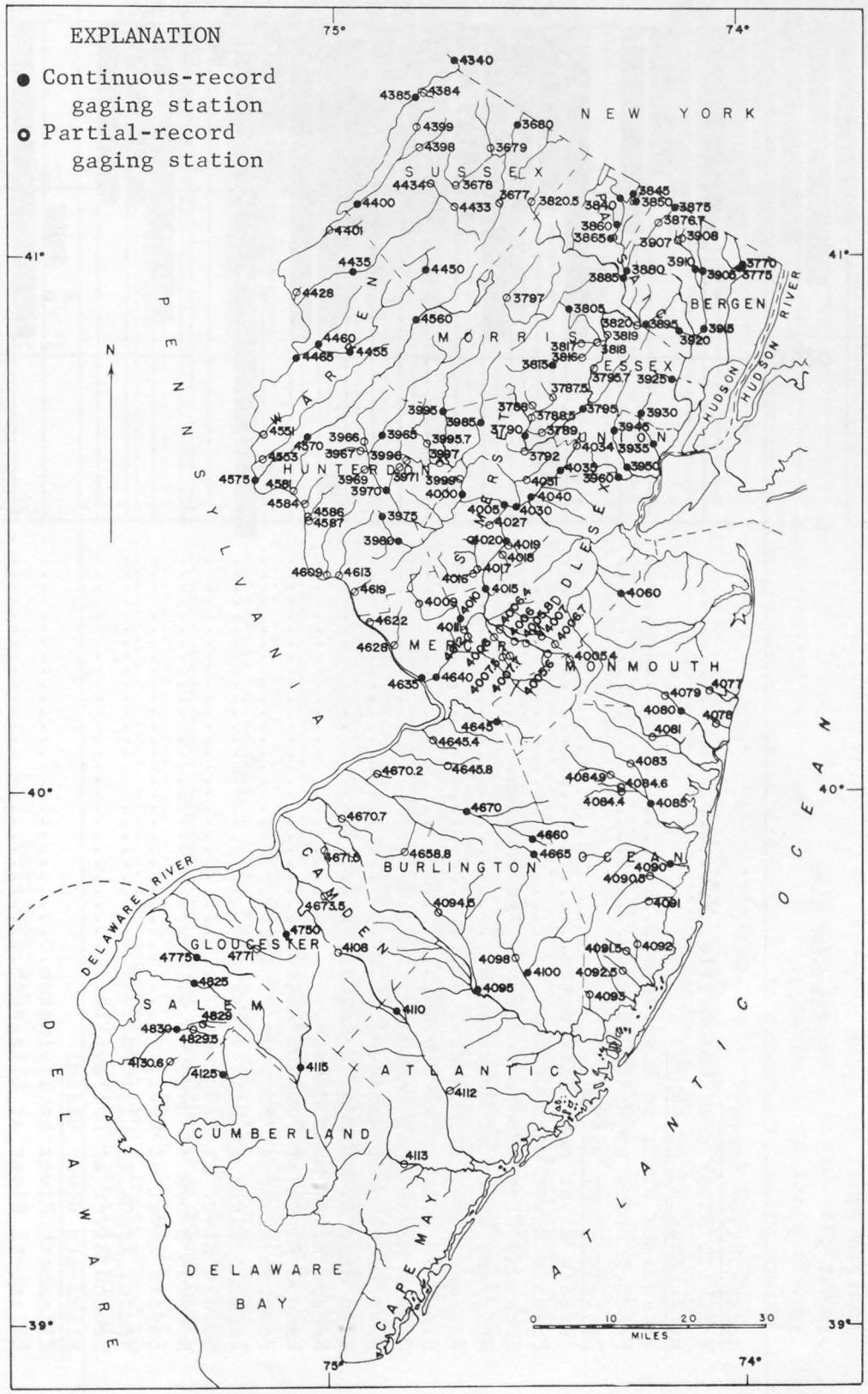


Figure 1.--Map of New Jersey showing locations of gaging stations used in analyses.

Table 1.--Inventory of streamflow records in New Jersey and adjoining areas, 1898-1960, used in this report

Station no.	Station name	Water years of record
	Hudson River basin:	
3680	Wallkill River near Unionville, N.Y.	
	Hackensack River basin:	
3770	Hackensack River at Rivervale	
3775	Pascack Brook at Westwood	
	Passaic River basin:	
3790	Passaic River near Millington	
3795	Passaic River near Chatham	
3805	Rockaway River above reservoir, at Boonton	
3815	Whippany River at Morristown	
3840	Wanaque River at Monks	
3845	Ringwood Creek near Wanaque	
3850	Cupsaw Brook near Wanaque	
3860	West Brook near Wanaque	
3865	Blue Mine Brook near Wanaque	
3875	Ramapo River near Mahwah	
3880	Ramapo River at Pompton Lakes	
3885	Pompton River at Pompton Plains	
3895	Passaic River at Little Falls	
3905	Saddle River at Ridgewood	
3910	Hohokus Brook at Hohokus	
3915	Saddle River at Lodi	
3920	Weasel Brook at Clifton	
3925	Second River at Belleville	
	Elizabeth River basin:	
3930	Elizabeth River at Irvington	
3935	Elizabeth River at Elizabeth	

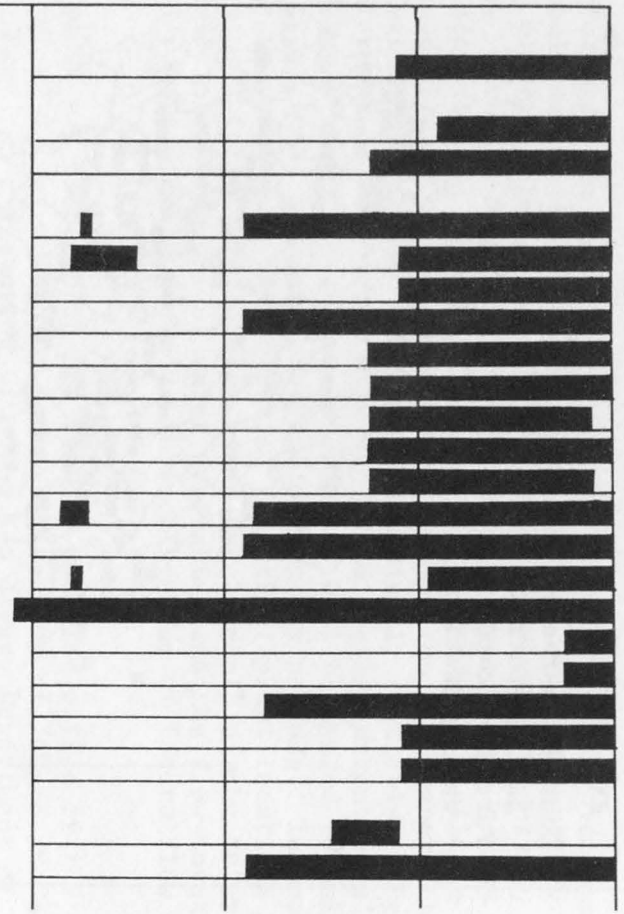


Table 1.--Streamflow records in New Jersey and adjoining areas, 1898-1960, used in this report--Continued

Station no.	Station name	Water years of record
	Rahway River basin:	
3945	Rahway River near Springfield	
3950	Rahway River at Rahway	
3960	Robinsons Branch Rahway River at Rahway	
	Raritan River basin:	
3965	South Branch Raritan River near High Bridge	
3970	South Branch Raritan River at Stanton	
3975	Walnut Brook near Flemington	
3980	Neshanic River at Reaville	
3985	North Branch Raritan River near Far Hills	
3995	Lamington (Black) River near Pottersville	
4000	North Branch Raritan River near Raritan	
4005	Raritan River at Manville	
4010	Stony Brook at Princeton	
4015	Millstone River near Kingston	
4020	Millstone River at Blackwells Mills	
4030	Raritan River at Bound Brook	
4035	Green Brook at Plainfield	
4040	Green Brook at Bound Brook	
4060	Deep Run near Browntown	
	Coastal basins:	
4080	Manasquan River at Squankum	
4085	Toms River near Toms River	
4090	Cedar Creek at Lanoka Harbor	
4095	Batsto River at Batsto	
4100	Oswego River at Harrisville	
4110	Great Egg Harbor River at Folsom	
4115	Maurice River at Norma	
4125	West Branch Cohansey River at Seeley	

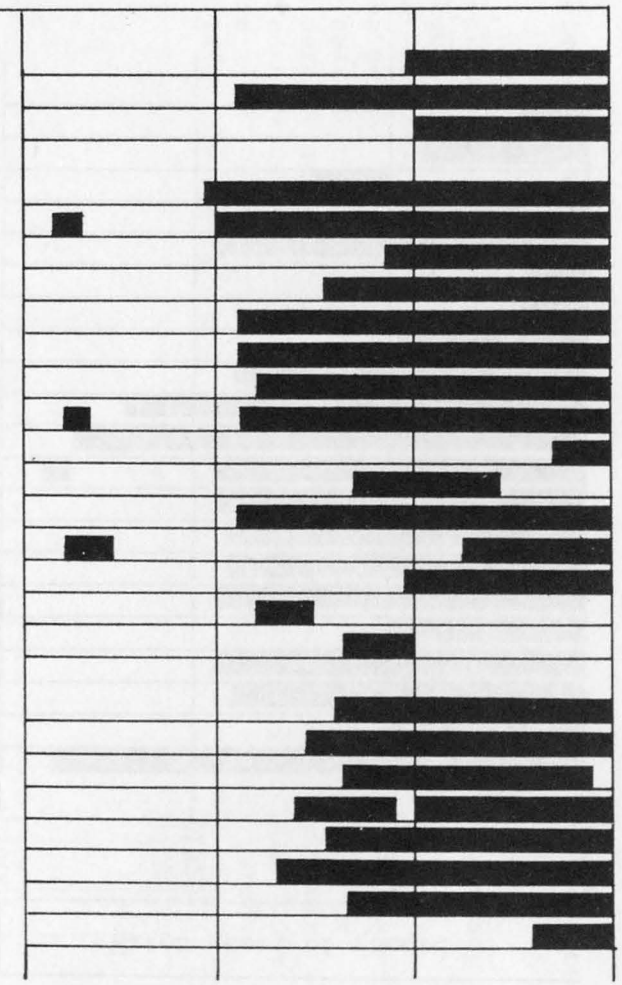
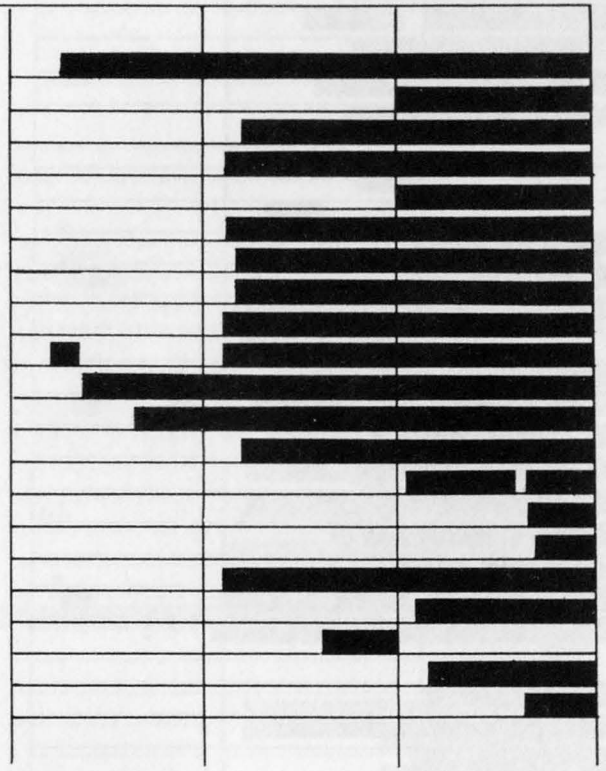


Table 1.--Streamflow records in New Jersey and adjoining areas, 1898-1960, used in this report--Continued

Station no.	Station name	Water years of record
	Delaware River basin:	
4340	Delaware River at Port Jervis, N.Y.	
4385	Delaware River at Montague	
4400	Flat Brook near Flatbrookville	
4435	Paulins Kill at Blairstown	
4450	Pequest River at Huntsville	
4455	Pequest River at Pequest	
4460	Beaver Brook near Belvidere	
4465	Delaware River at Belvidere	
4560	Musconetcong River near Hackettstown	
4570	Musconetcong River near Bloomsbury	
4575	Delaware River at Riegelsville	
4635	Delaware River at Trenton	
4640	Assunpink Creek at Trenton	
4645	Crosswicks Creek at Extonville	
4660	Middle Branch Mt. Misery Brook in Lebanon State Forest	
4665	McDonalds Branch in Lebanon State Forest	
4670	North Branch Rancocas Creek at Pemberton	
4750	Mantua Creek at Pitman	
4775	Oldmans Creek near Woodstown	
4825	Salem River at Woodstown	
4830	Alloway Creek at Alloway	



Examples of this second method are frequency curves and cumulative frequency curves.

This report deals with flow-duration curves -- cumulative frequency curves that show the percent of time during which specified discharges were equaled or exceeded in a given period (Searcy, 1959, p. 1). For example, in the period 1931-60, the daily mean discharge of South Branch Raritan River near High Bridge (fig. 2) was at least 81.0 cubic feet per second for 50 percent of the days. Although all chronological sequence of flow occurrence is lost by the flow-duration method of analysis, flow-duration curves give a considerable amount of information on the general flow characteristics of streams in a condensed form.

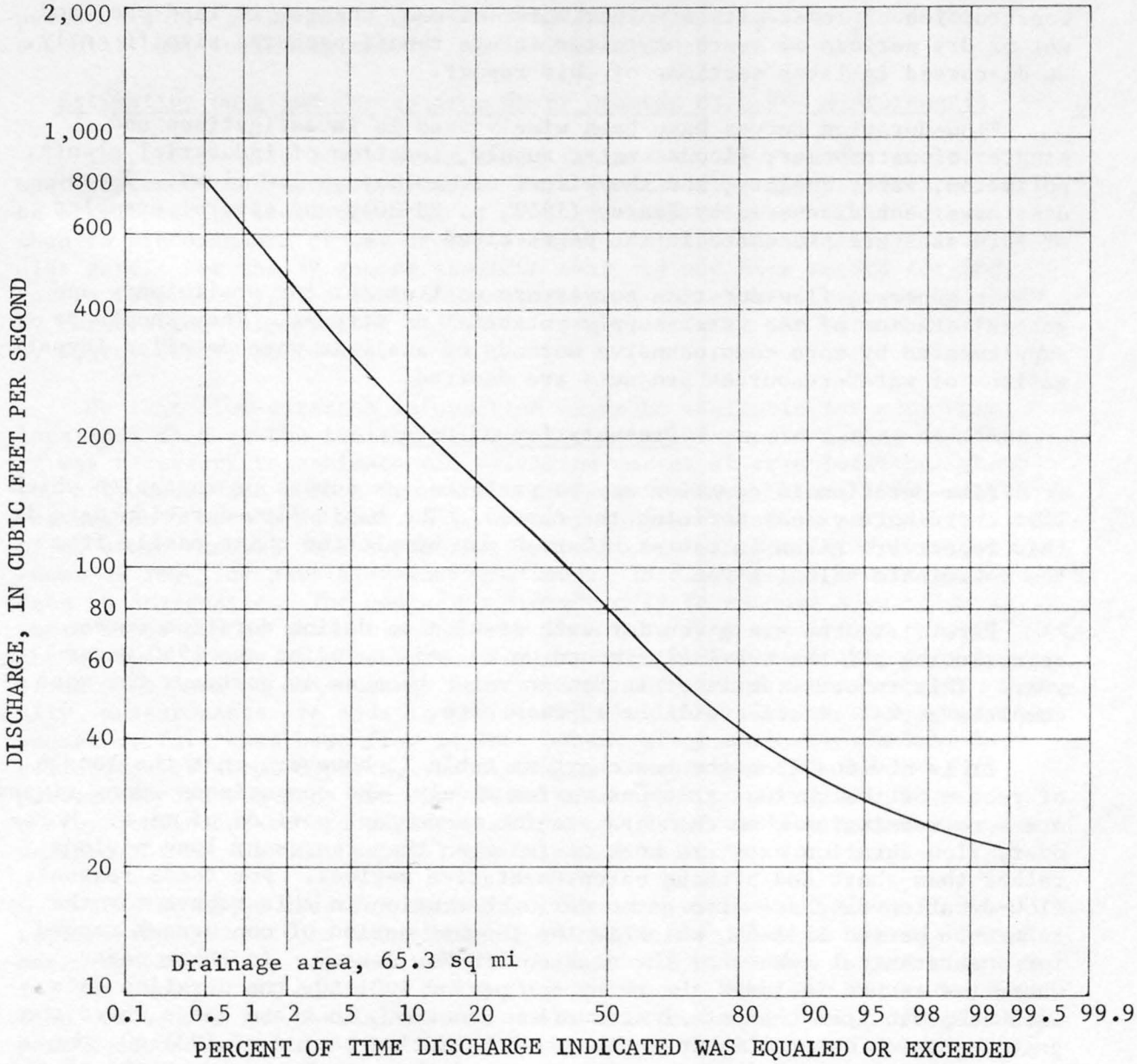


Figure 2.--Duration curve of daily flow, South Branch Raritan River near High Bridge, 1931-60.

Use of Flow-Duration Curves

Flow-duration curves are based on a specific period of past record. They portray the average frequency of occurrence of various magnitudes of streamflow for the period during which the records were collected. If the streamflow for this period is representative of the long-term streamflow, the duration curve may be considered a probability curve and used to estimate the percent of time that various discharges will be equaled or exceeded in the future. Using the example of the preceding section, it would be reasonable to expect that the streamflow of South Branch Raritan River near High Bridge would be at least 81.0 cubic feet per second for 50 percent of the days of some extended period of the future as long as there were no significant changes in regulation, diversion, or land cover. Construction of reservoirs or other works of man, changes in land use, and wet or dry periods of years may alter future runoff patterns significantly, as discussed in later sections of this report.

Flow-duration curves have been widely used in investigations and studies of waterpower, floods, water supply, location of industrial plants, pollution, water quality, and the effect of geology on low flows. These uses have been discussed by Searcy (1959, p. 23-30), and several examples of such uses are presented in the pages cited.

In general, flow-duration curves are most useful for preliminary and general studies of the water-supply potential of streams. They should be supplemented by more comprehensive methods of analysis when detailed investigations of water-resources projects are desired.

Presentation of Data

Flow-duration information may be presented as curves or in tables which list coordinate values defining the curves. The basic flow-duration data in this report are given in tables. Curves may be plotted quite easily from the coordinate values given.

First, figures are given for each station to define duration curves representing all the available record up to and including the 1960 water year. This information is of intrinsic value because it portrays the most complete actual record available at each site.

It is obvious from the bar chart on table 1, however, that the length of record of the various stations varies widely, and comparisons among rivers are more meaningful when the data are for concurrent periods of time. Moreover, flow-duration data are most useful when they represent long periods rather than short and perhaps unrepresentative periods. For these reasons, flow-duration data are also given for each station in this report for the reference period 1931-60, which is the longest period of concurrent record for a substantial number of the stations in New Jersey. In those cases where the record included the reference period 1931-60, the duration data were computed from the actual streamflow records. In those cases where the gaging station was not in operation for the entire period of 1931-60, the duration data were estimated on the basis of the actual record at the station and on records for nearby stations.

The flow-duration data in the main tables are given both as actual discharge and as discharge per square mile. The per-square-mile figures permit comparison of streamflow at locations with drainage areas of different sizes and provide a convenient means for making estimates at points other than gaging stations.

The tabular data for each station are preceded by a brief station description which gives the location, size of drainage area, period of record available, average discharge, extremes, and remarks.

Preceding the main body of tables, there is a summary table, (table 2), which has one line for each station. The data in table 2 are discharge figures in cubic feet per second per square mile for the standard reference period, facilitating the comparison of flow-duration discharge of the various stations, including the 95 low-flow partial-record stations.

Estimating Duration Curves from Short Records or a Few Measurements

To permit valid comparisons among gaging-station records, the records must represent concurrent periods. This insures that any differences may be attributed to local climatic or drainage-basin characteristics rather than to predominance of wet or dry years during the operation of a particular gage. For the 39 gaging stations that did not have record for the entire reference period 1931-60, extension of the shorter records was made by correlation between long and short-term records by the method described by Searcy (1959, p. 12-17).

So that flow-duration information might be available for many more locations than at the limited number of continuous-record gaging stations, it was necessary to estimate flow-duration curves at some locations where the only base data were a few discharge measurements. Since 1958, discharge measurements have been made in New Jersey during base-flow periods (periods of no storm runoff) on a systematic basis at certain specified locations known as low-flow partial-record stations. To date, about 170 sites have been so designated. The operating procedure is to measure streamflow at these sites two or three times a year when base-flow conditions prevail. At these times, three or more days after any significant rainfall, flow in the streams is derived essentially from springs and ground water seepage. Usually, measurements are made in the spring when base flow is high and in the summer or fall when base flow is low. Then, after such records have been collected for about 5 years, the discharge measurements at the low-flow partial-record stations are correlated with the concurrent discharge at a nearby continuous-record gaging station. So far, relation curves have been defined for 95 low-flow partial-record stations in New Jersey.

The technique used for estimating duration curves for these 95 low-flow partial-record stations was simply to plot the magnitude of the discharge measurements at the percents of time indicated by the flow-duration curves for the nearby continuous-record gaging stations. Then the estimated duration curves for the partial-record stations were drawn through the plotted points according to the best fit. These curves for the partial-record stations were particularly useful in the flow-duration analysis because most

of the sites are on small streams where the streamflow is representative of the local geography and geology and is not a composite of several different regions.

Summarized data for the partial-record stations are included in table 2 with a footnote indicating that these estimates are less reliable than the data for continuous-record gaging stations. Individual tables of estimated flow duration for the period of record at partial-record sites are not given in this report because the data cover only a few years, mostly during a drought period.

Variation of Flow Duration with Period of Record

Flow-duration curves, when used as probability curves, apply to an extended period and may not apply to any specific short period. This section is written to demonstrate the possible deviations from an average flow-duration curve for any one year, a series of years, or for the various months of the year.

Figures 3 and 4 show the variations in flow-duration curves for the individual years during the period 1931-60 for South Branch Raritan River near High Bridge and Great Egg Harbor River at Folsom, respectively. The middle curve in each figure is the mean curve based on all the record for the period and is the one usually used in investigations. The top and bottom curves are for the wettest and driest individual years of the period and illustrate how far from the mean curve the flow duration for a single year might be in some future 30-year period. The annual mean discharge for each individual year of the reference period is plotted as a dot at the percent of time that that discharge occurred during the year. To avoid a confusion of lines, duration curves are not drawn through the 28 points between the two extremes, but it is easy to visualize from these points the approximate deviations of the individual flow-duration curves from the mean curve. These two figures serve as a warning that the percentages indicated by a mean flow-duration curve may not be applicable for any one particular year.

It may be seen from these examples that even in a state as small as New Jersey the years of extreme streamflow are not the same ones for all stations in the state. The wettest year during the standard reference period for South Branch Raritan River near High Bridge, long used in hydrologic studies as an index gaging station for north central New Jersey, was 1952; whereas the wettest year for Great Egg Harbor River at Folsom, in the coastal plain in southern New Jersey, was 1939. Obviously, the wettest years in the two regions resulted from different local climatic and hydrologic conditions. The driest years during the standard reference period at the two sample stations occurred during the same long-term drought; 1932 at the northern station, and 1931 at the southern station. The driest years in the entire period of record through 1965 are 1965 at the northern station and 1931 at the southern station.

Figures 3 and 4 also illustrate one example of the use of duration curves to analyze streamflow characteristics. It can be seen that the

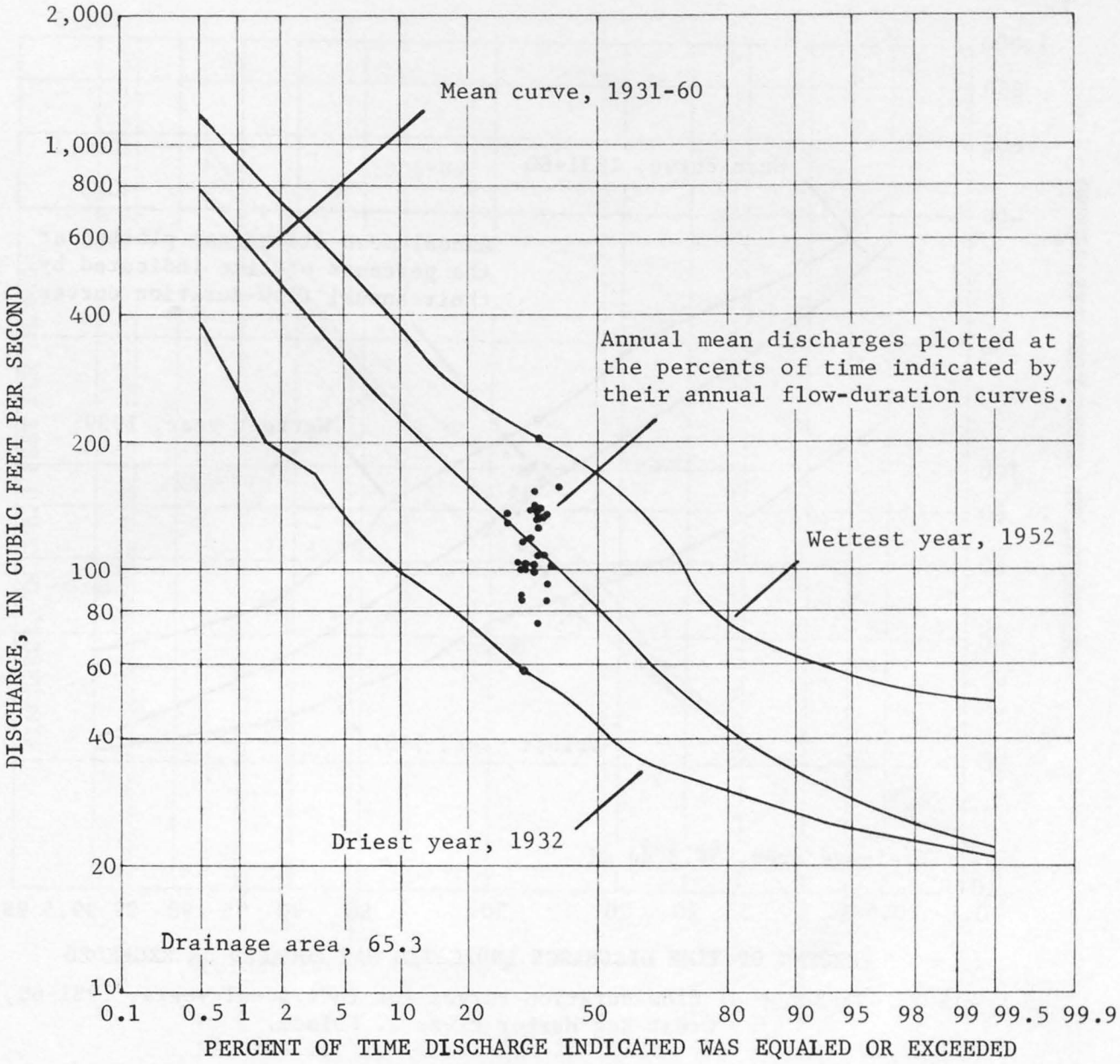


Figure 3.--Range of flow-duration curves for individual years, 1931-60, for South Branch Raritan River near High Bridge.

average of the annual mean discharges for South Branch Raritan River near High Bridge falls on the 34-percent point on the flow-duration curve, whereas the average of the annual mean discharges for Great Egg Harbor River at Folsom falls on the 41-percent point. The higher value for the latter station is typical of the coastal plain in New Jersey and results from the smaller proportional range of discharge during the year. This percentage figure is sometimes used to compare or classify streams.

Figures 5 and 6 show the variation of flow-duration curves by 5-year periods during the reference period 1931-60 for the High Bridge and Folsom stations. The curves demonstrate that 5 years is long enough to average out the extremes to a significant degree and that the deviations of 5-year curves from the duration curves based on the entire reference period are

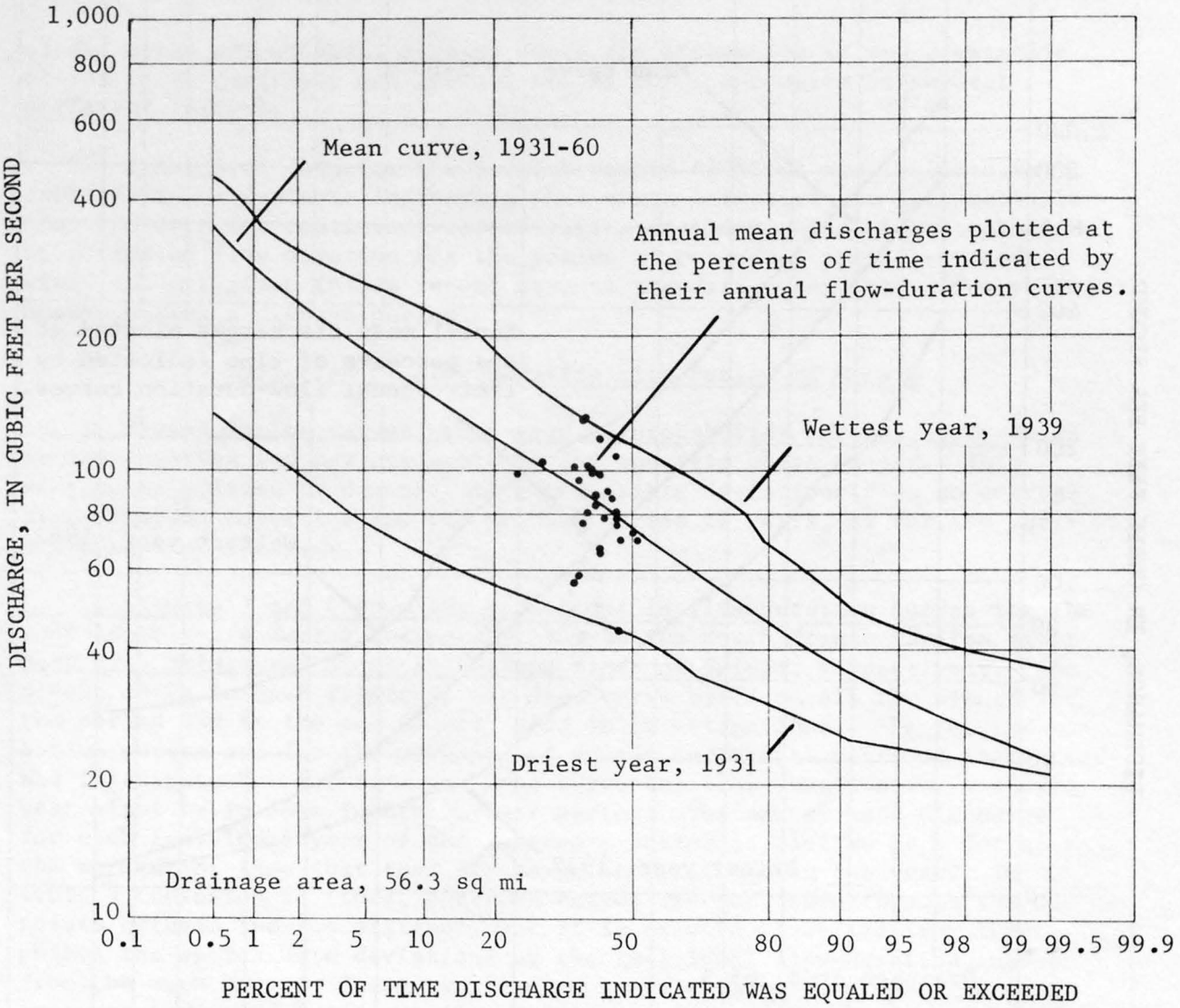


Figure 4.--Range of flow-duration curves for individual years, 1931-60, for Great Egg Harbor River at Folsom.

not nearly as great as the extreme deviations of duration curves for individual years. It should be noted, however, that the values of discharge from a duration curve based on a long period do not apply exactly for any given 5-year period. For most of the range of the flow-duration curves, the wettest 5-year period during 1931-60 was 1951-55 for the High Bridge station and 1936-40 for the Folsom station. The driest 5-year period for most of the range at both stations was 1931-35, although 1941-45 was lower for a small portion of the flow-duration curves at the High Bridge station and almost half of the range of the curves at the Folsom station.

Figures 7 and 8 show individual flow-duration curves for each month of the year for the High Bridge and Folsom stations for the period 1931-60. The curves are quite symmetrical and indicate a systematic advancement from one month to the next. They tend to cross or overlap at the high discharge end, however, reflecting the fact that major floods can occur in any month of the year in New Jersey. The curves demonstrate the point that a flow-

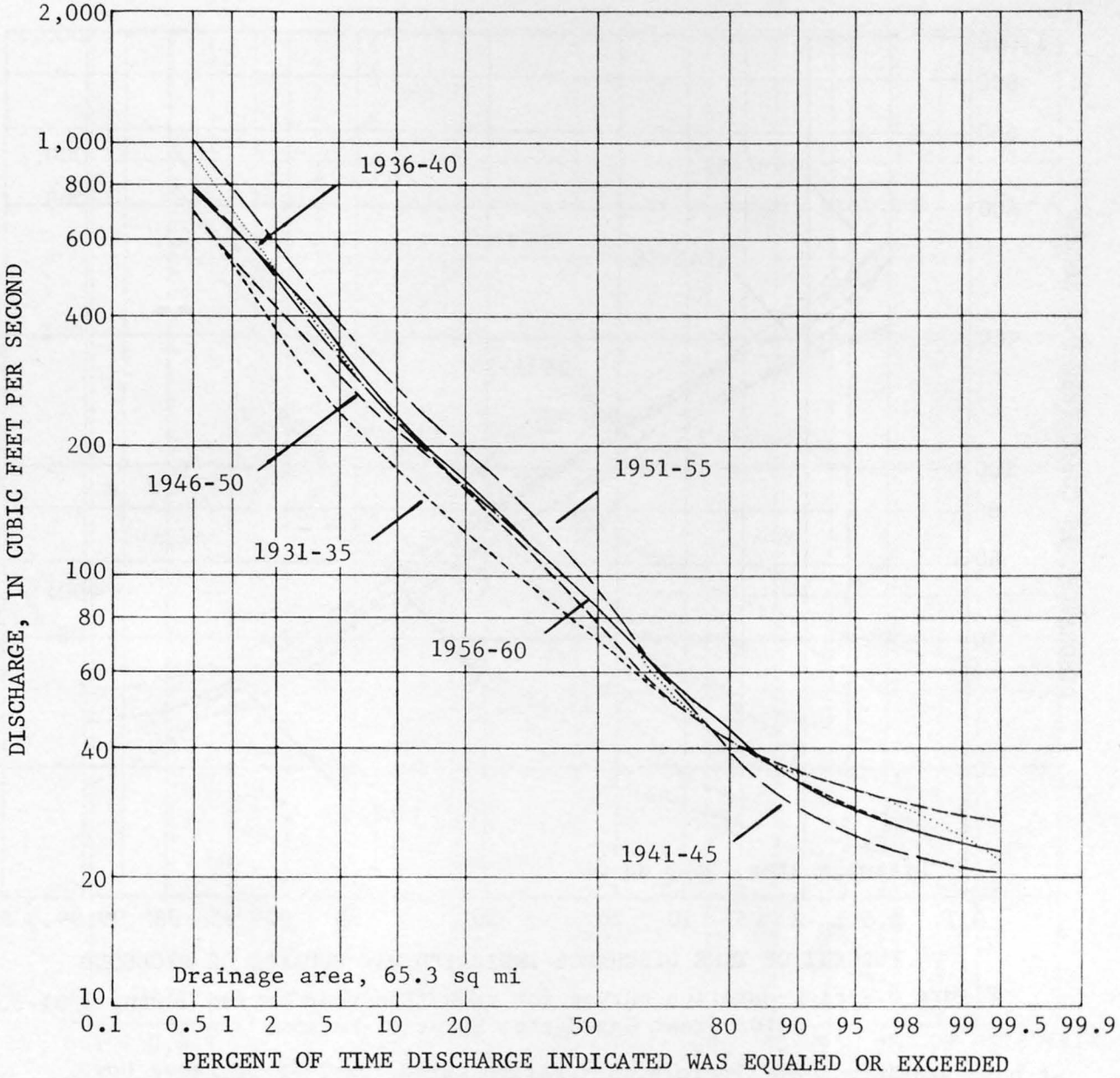


Figure 5.--Flow-duration curves for each five-year period during 1931-60 for South Branch Raritan River near High Bridge.

duration curve based on an extended period of record shows the average distribution of flow to be expected during a long period but does not apply for any specific month.

Figures 9 and 10 were prepared to examine how the duration curves for the standard reference period, 1931-60, compared with the duration curves for the entire period of record for the stations on South Branch Raritan River near High Bridge and Great Egg Harbor River at Folsom. At each station, the curve for the standard reference period is very close to the curve for the period of record. The severity of the drought during 1962-65 is indicated by the marked deviation of the duration curves for that period from the long-term average curves at all duration points

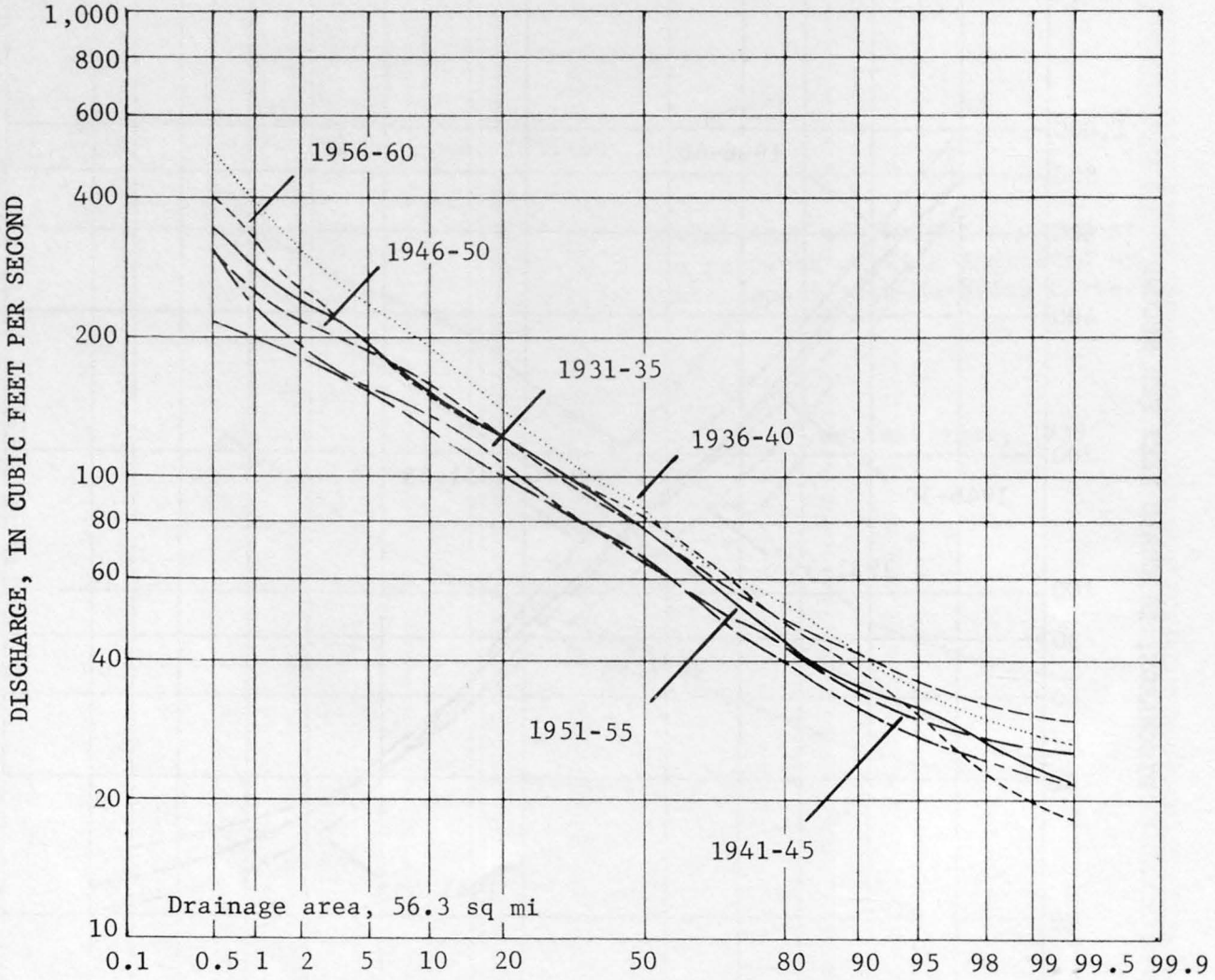


Figure 6.--Flow-duration curves for each five-year period during 1931-60 for Great Egg Harbor River at Folsom.

at both stations. On figure 9, a duration curve for 1919-30 shows how the discharge for those early years at the High Bridge station compares with the discharge for later years.

Flow-duration Curves for Passaic River at Little Falls

Flow-duration curves for Passaic River at Little Falls are presented (fig. 11) for five different periods. Although these curves have limited hydrologic value because of regulation and diversions in the basin, they are presented here because of the widespread interest in the station. Much interest results from the fact that a continuous record is available since September 1897 (from September 1897 to September 1955 at Paterson 3.7 miles downstream from the present site at Little Falls), which is the longest continuous record in the state. Another reason for interest in this particular station is that it is the farthest downstream station on one of the largest rivers in the state.

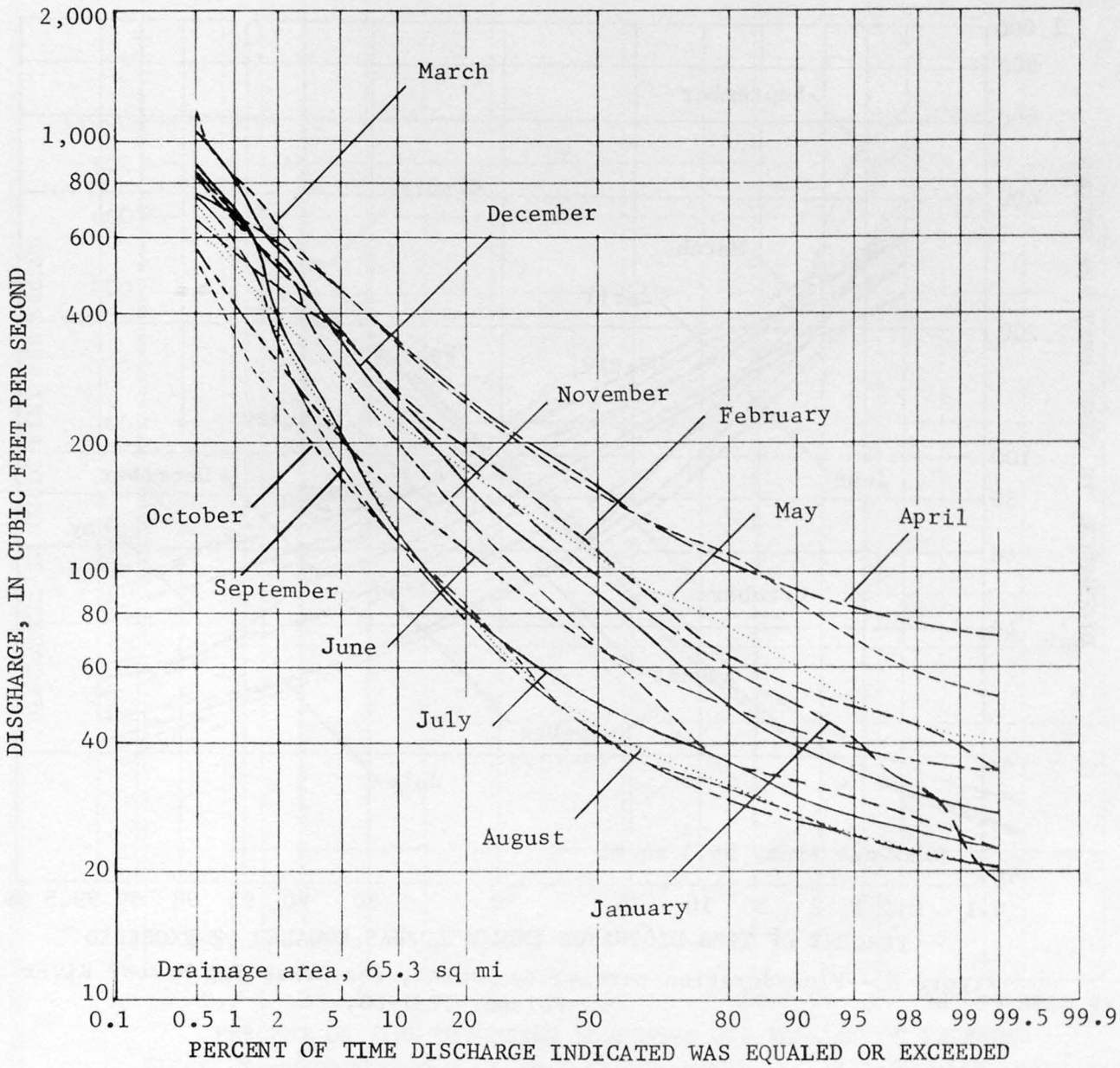


Figure 7.--Flow-duration curves, by months, for South Branch Raritan River near High Bridge, 1931-60.

The flow-duration curves for the standard reference period 1931-60 and for the period of record 1898-1960 are not very different. If those two curves were the only ones plotted in figure 11, the conclusion might be drawn that the pattern of streamflow did not vary much during the period 1898-1960. The curve for 1919-30, however, shows that the streamflow for the lowest 10 percent of the days during this period--that is, flow equaled or exceeded 90 or more percent of the time--was distinctly lower than that indicated by the mean curve. On the contrary, the curve for 1898-1918 shows that the streamflow for the lowest 10 percent of the days during that period was distinctly higher than that indicated by the mean curve. Much of this difference in the magnitude of the flow during the lowest 10 percent of the days may be attributed to the variation in diversion upstream from the gaging station. The average diversion for

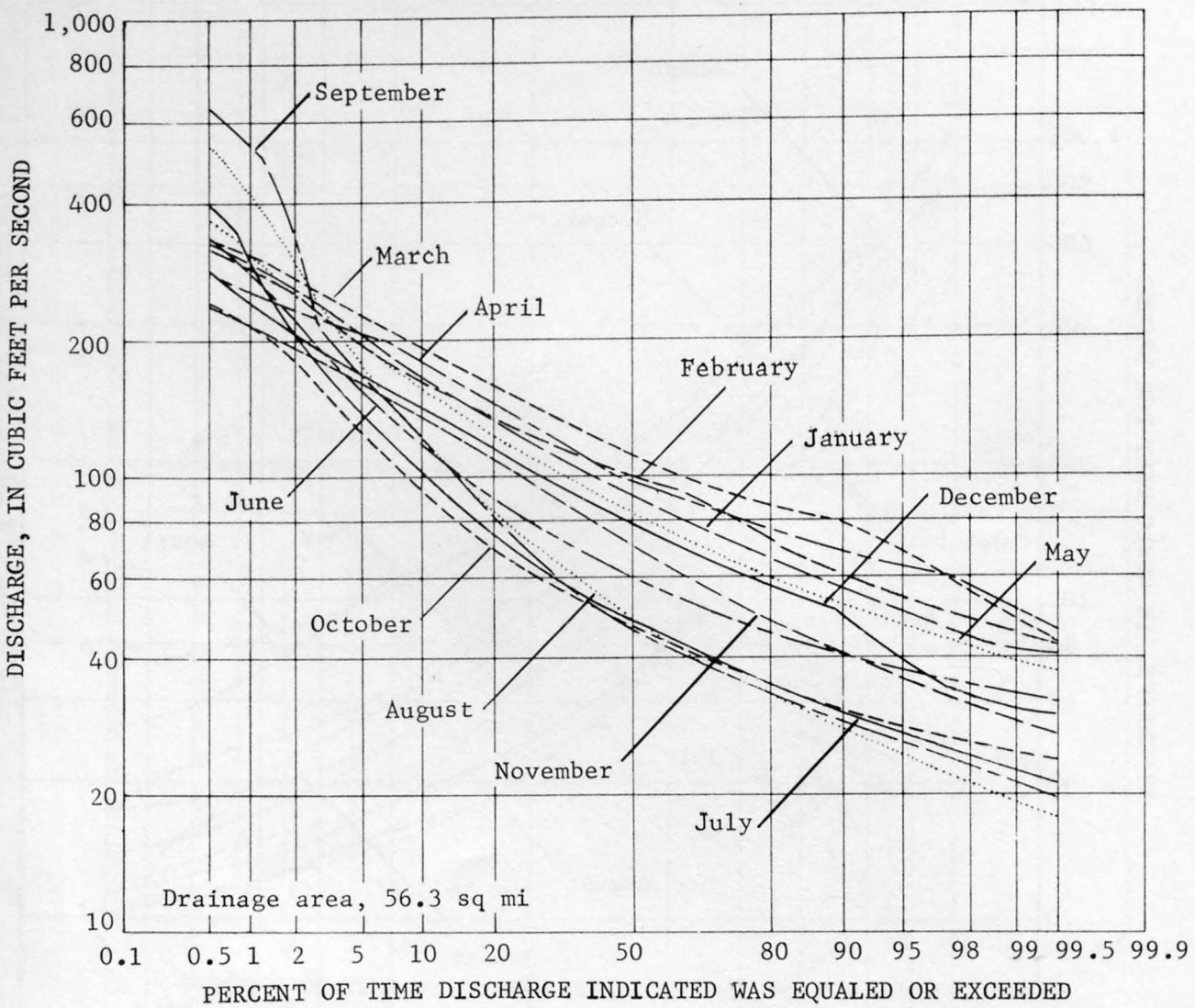


Figure 8.--Flow-duration curves, by months, for Great Egg Harbor River at Folsom, 1931-60.

municipal supply from Passaic River at Little Falls for the two periods was as follows: 1898-1918, 44.2 cfs; and 1919-30, 78.6 cfs. It can be seen that the average diversion during 1919-30 was substantially greater than during the earlier period, and consequently the observed flow for the low-flow periods during 1919-30 would be expected to be lower than during 1898-1918.

The curves of figure 11 emphasize the fact that flow-duration curves must represent areas without regulation and diversions to portray natural hydrologic conditions and the extent of regulation and diversions must be considered when comparisons among river basins are made. In New Jersey it is difficult to find any areas that are completely free of regulation and diversions. This is especially true in the northern metropolitan areas, but even in remote rural areas the practice of pumping water from streams for irrigation of crops is increasing rapidly. The flow-duration curves

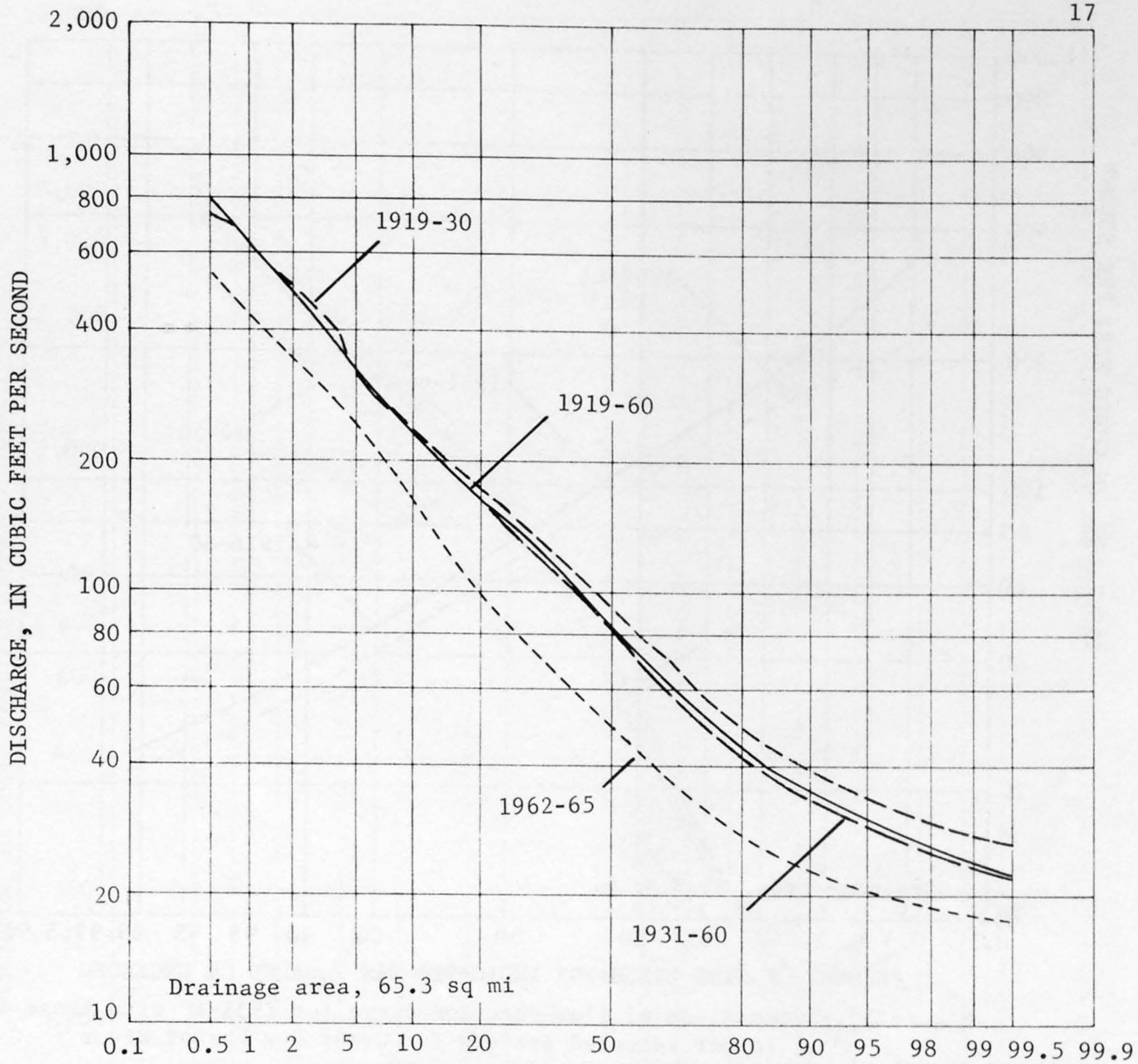


Figure 9.--Comparison of flow-duration curve for 1931-60 with those for other selected periods for South Branch Raritan River near High Bridge.

presented in this report are based on the conditions of regulation and diversions that existed during the period when the records were collected. Whenever these curves are used to predict availability of future streamflow, allowance must be made for changes in regulation and diversion since the period covered by this report.

Special Adjustments for Delaware River at Trenton

Stations significantly affected by regulation and diversions have generally been omitted from this report. The stations on the Delaware River have been included, in spite of the fact that they do not represent natural conditions, because of the great importance of the river and the great

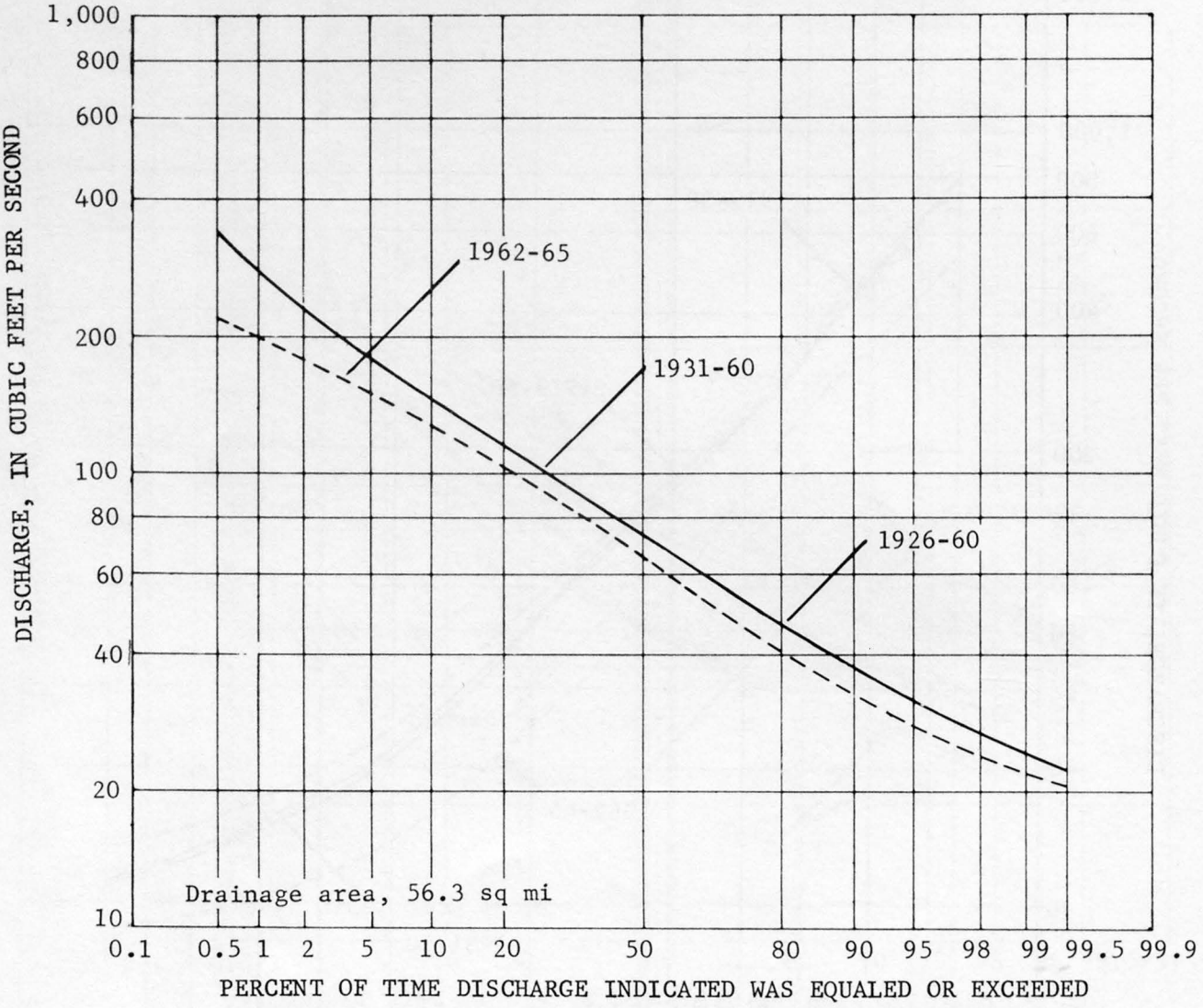


Figure 10.--Comparison of flow-duration curve for 1931-60 with those for other selected periods for Great Egg Harbor River at Folsom.

interest in its records. Some flow-duration curves are presented for Delaware River at Trenton (figs. 12-15) to compare natural streamflow for different periods and to show the effects of regulation and diversions.

In order that the curves for Delaware River at Trenton may be meaningful, allowances must be made for changes in the artificial manipulation of the flow of the river. Adjustments are made to observed streamflow to attempt to compensate for regulation and diversions so that the adjusted records approximate what the streamflow would have been without any interference by works of man. Making such adjustments presents many problems.

In the first place, many adjustments are available only for monthly figures, and duration curves are usually computed on the basis of daily figures. Figure 12 illustrates the difference between a flow-duration

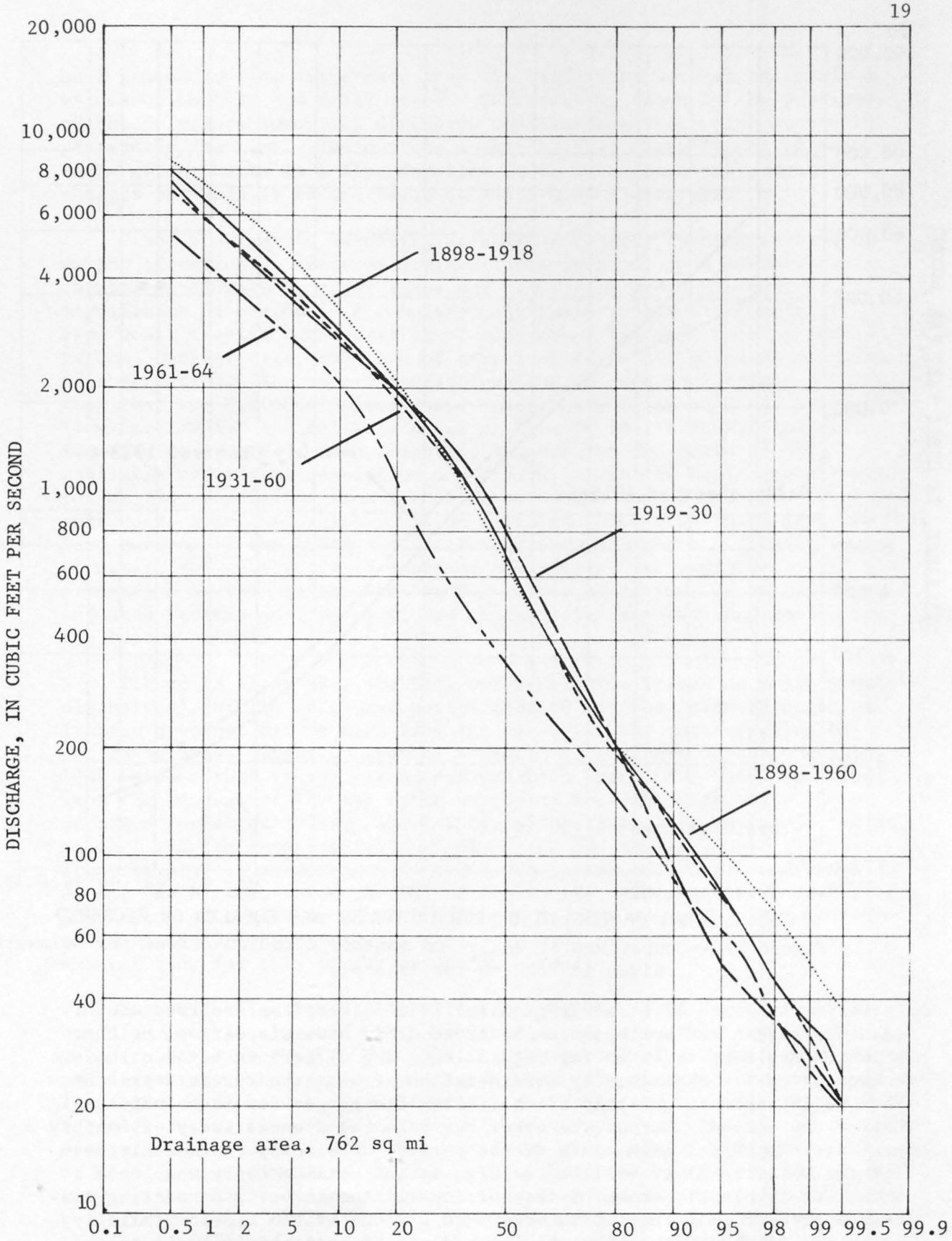


Figure 11.--Comparison of flow-duration curve for 1931-60 with those for other selected periods for Passaic River at Little Falls.

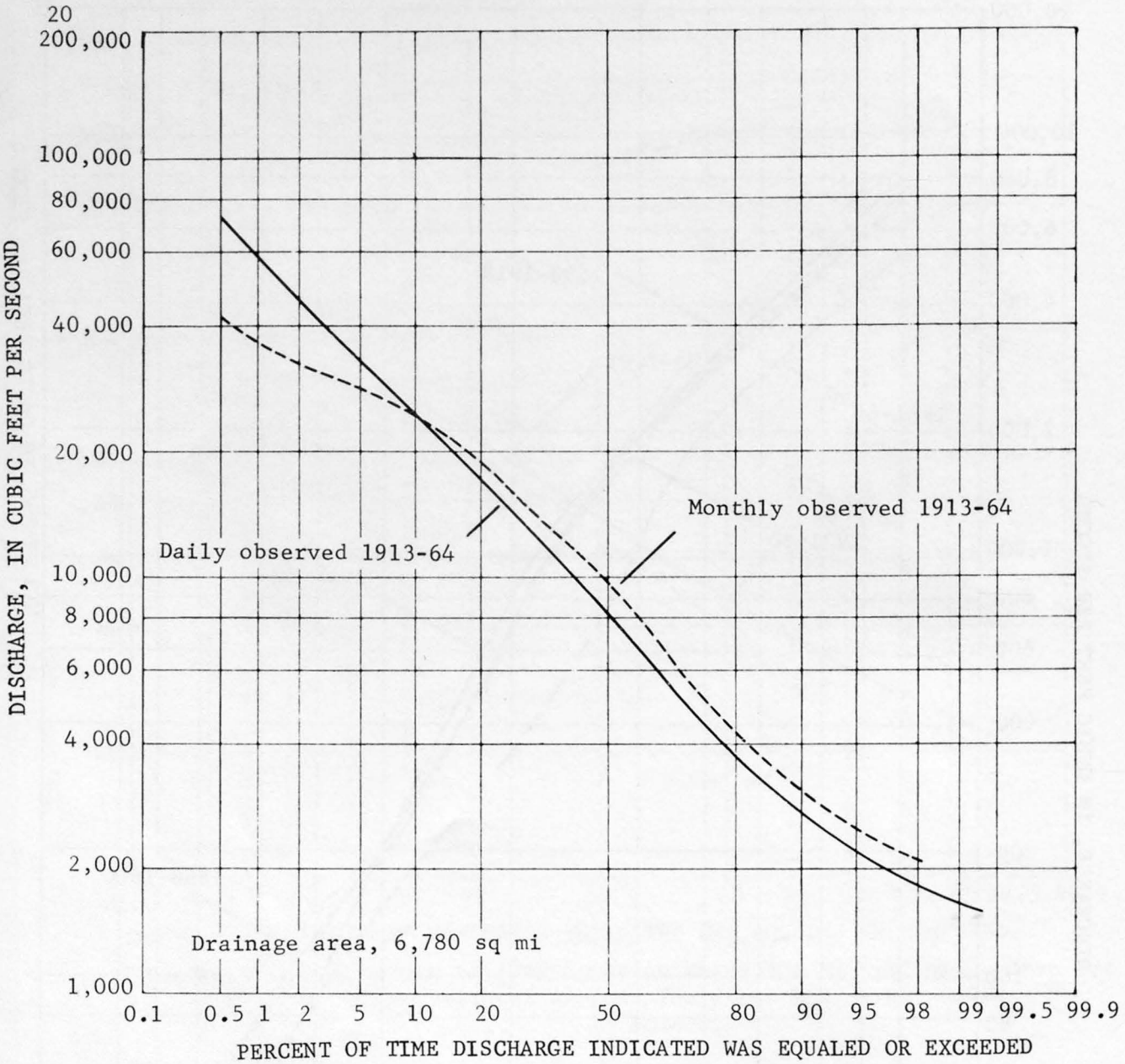


Figure 12.--Comparison of daily and monthly duration curves for Delaware River at Trenton for 1913-64.

curve for Delaware River at Trenton for 1913-64 based on observed monthly mean discharges and one based on observed daily mean discharges, neither of which has been adjusted for regulation. The difference between the two curves is easily explained by consideration of what the curves represent. The one is based on an array of daily mean discharges for each individual day of the period, whereas the other curve is based on an array of monthly mean discharges for each month of the period. Obviously, no monthly mean for the Delaware River will be as large as the maximum daily mean, and this fact is clearly shown by the portions of the curves representing discharge greater than that which occurs 10 percent of the time. Similarly, it is not likely that any monthly mean discharge will be as small as the minimum daily mean, although it is conceivable that these two values could

have a much smaller difference than the difference between the maximum values of monthly and daily means. This fact is shown by the portions of the curves representing discharge smaller than that which occurs 10 percent of the time. The obvious result is that there is not as much range of discharge in a flow-duration curve based on monthly mean discharges as there is in one based on daily mean discharges.

Other problems in adjusting streamflow records involve methods of making adjustments. Records are available to show, on a monthly basis, changes in storage in major lakes and reservoirs and the amount of significant diversions. A complete adjustment to simulated natural flow would require consideration of many other factors, such as evaporation, bank storage, and time of travel of reservoir releases to point of observation. The uncertainties involved in such corrections are such that the U.S. Geological Survey does not publish adjusted streamflow records for the Delaware River at Trenton in its annual reports. Adjusted records have been computed, however, on the basis of all available records of regulation and diversions in the basin and allowance for excess evaporation from the surfaces of the larger man-made lakes and reservoirs over that which would be expected to be evaporated from the land surface if the lakes and reservoirs were not there. Time of travel of water from reservoirs to point of observation was neglected. If streamflow at the Trenton station for different periods is to be compared, adjusted records must be used, and the adjusted records used herein are the best available.

Figure 13 shows that the flow-duration curve (based on monthly mean discharges) for the reference period 1931-60 for the Delaware River at Trenton does not differ much from the curve for the entire period of record 1913-64. There is special interest in the period subsequent to 1954 because that is the period during which there have been diversions from the headwaters for the water supply of New York City. The flow-duration curve for 1954-64 shows that this period, even when adjusted to natural flow to remove effects of diversion and storage, actually had significantly lower discharge for all percentage points of occurrence except the highest three percent of the months. This curve shows that any comparison of the observed flow duration for 1954-64 with other periods would be misleading unless allowance was made for the fact that the natural flow for this period was below normal.

Figure 14 illustrates the difference between flow-duration curves based on monthly observed and monthly adjusted streamflow records for Delaware River at Trenton for 1954-64, the period of greatest regulation and diversion. The curves show clearly that the observed streamflow at times of low flows was significantly higher than the natural streamflow because of the releases from the upstream reservoirs, whereas the observed streamflow at times of high flow was lower than natural streamflow because of flood water going into storage. Throughout the middle portion of the curves, the observed streamflow was less than natural streamflow because of diversions out of the basin. Any increased regulation or diversions in the future will tend to magnify these differences between duration curves based on observed and adjusted streamflow records.

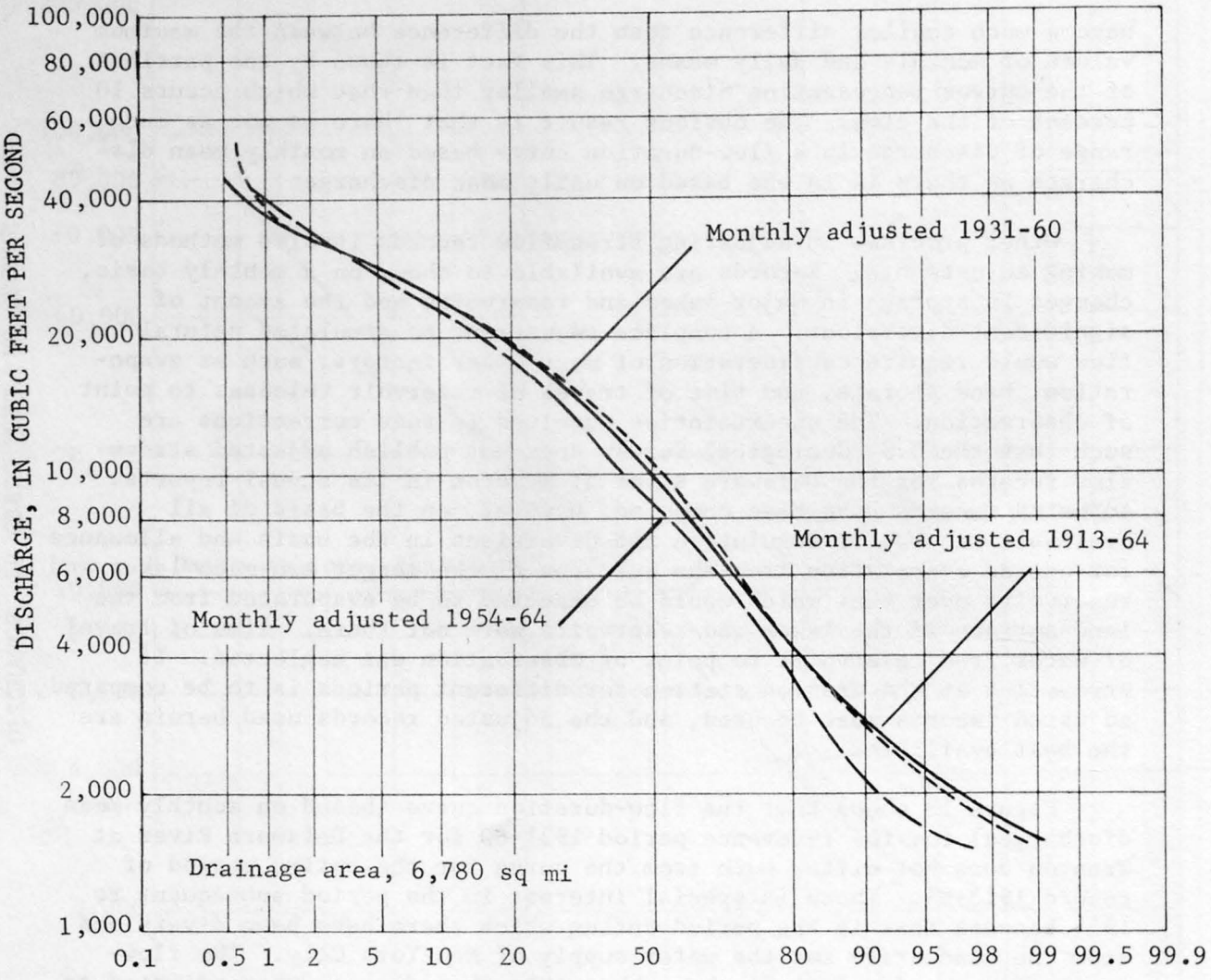


Figure 13.--Comparison of monthly adjusted duration curve for 1931-60 with those for other selected periods for Delaware River at Trenton.

Figure 15 is presented to show some changes in observed streamflow in the Delaware River at Trenton during the period of record. These curves are of interest in comparing recent observed streamflow with the observed streamflow of the past. The monthly observed curve for 1954-64 is lower in discharge throughout all percentages of occurrence than the long-term curves. Some of this difference results from the fact that natural streamflow during this period was lower than normal (see fig. 13), and some results from increased regulation and diversion.

Geographical Variation of Flow Duration in New Jersey

Many similarities and contrasts among flow-duration curves for New Jersey streams may be recognized by inspection. It is necessary, however, to develop some numerical indices to study the regionalization of these curves. On logarithmic-probability paper (see fig. 2), the curves tend to

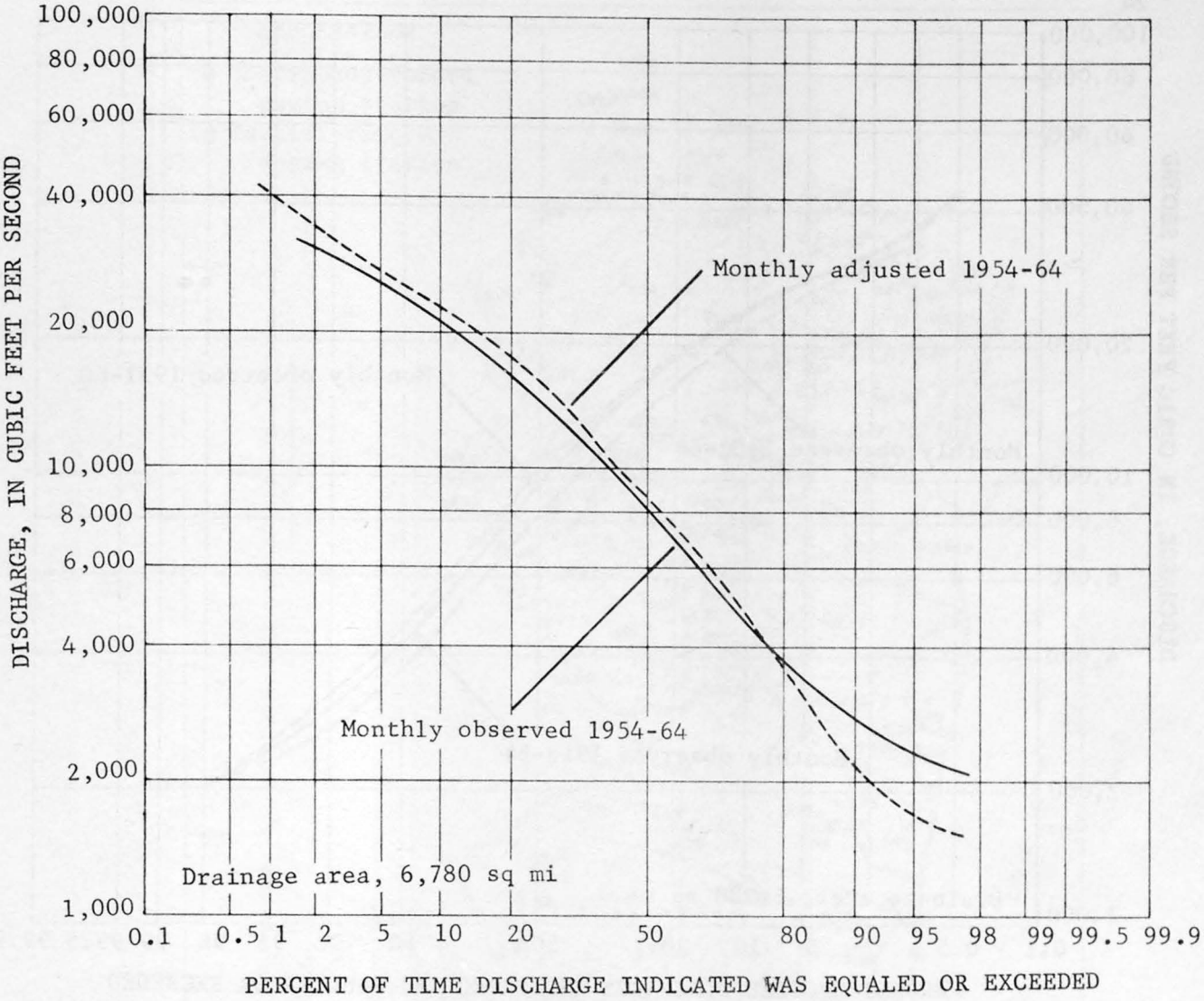


Figure 14.--Comparison of monthly observed and adjusted duration curves for 1954-64 for Delaware River at Trenton.

approach straight lines between the 20- and 80-percent duration points, and in many cases they are nearly straight between the 10- and 90-percent duration points. Beyond these limits, the flow-duration curves may depart appreciably from the straight line and any classification of the curves at their extremities must be in very broad bands. The central portion of the curves, however, permits a mathematical classification, and this has been chosen as the basis for portraying the geographical variation of flow duration in the state.

The most obvious characteristic of a flow-duration curve is its slope. The slope depends upon the variability of streamflow; the more variable the streamflow, the steeper the slope. Lane and Lei (1950) proposed a numerical index to measure streamflow variability. Their index is the standard deviation of the logarithms of the discharge at 10 points of the

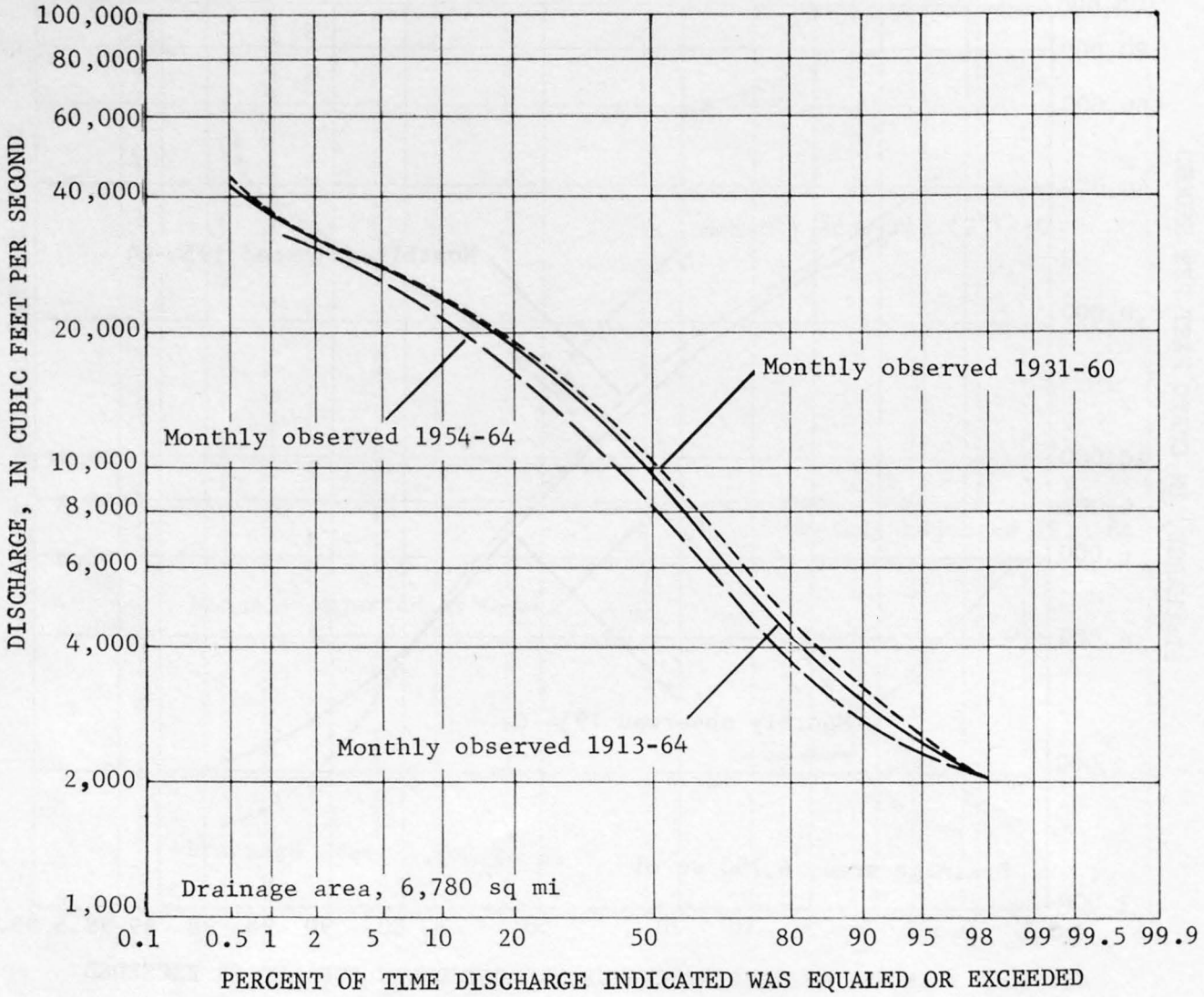


Figure 15.--Comparison of monthly observed duration curve for 1931-60 with those for other selected periods for Delaware River at Trenton.

curve; the discharges which are equaled or exceeded 5%, 15%, 25%, ----95% of the time. Although this method is quite satisfactory as a measure of stream variability, it is apparent that the method is tedious and slow. In this report, a procedure to measure stream variability was used that is not as precise as the Lane and Lei index, but it is simple to use and quite effective in distinguishing the degree of slope for the central portion of the flow-duration curves. The discharge at the 20-percent point on the flow-duration curve was divided by the discharge at the 80-percent point, and the quotient was used as the index of streamflow variability. Obviously, flashy streams have high indices, and streams with comparatively uniform flow have low indices.

Variability indices were plotted on a map or New Jersey for all 70 gaging stations included in this report and for the 95 low-flow partial-record stations for which flow-duration curves have been estimated (fig. 16).

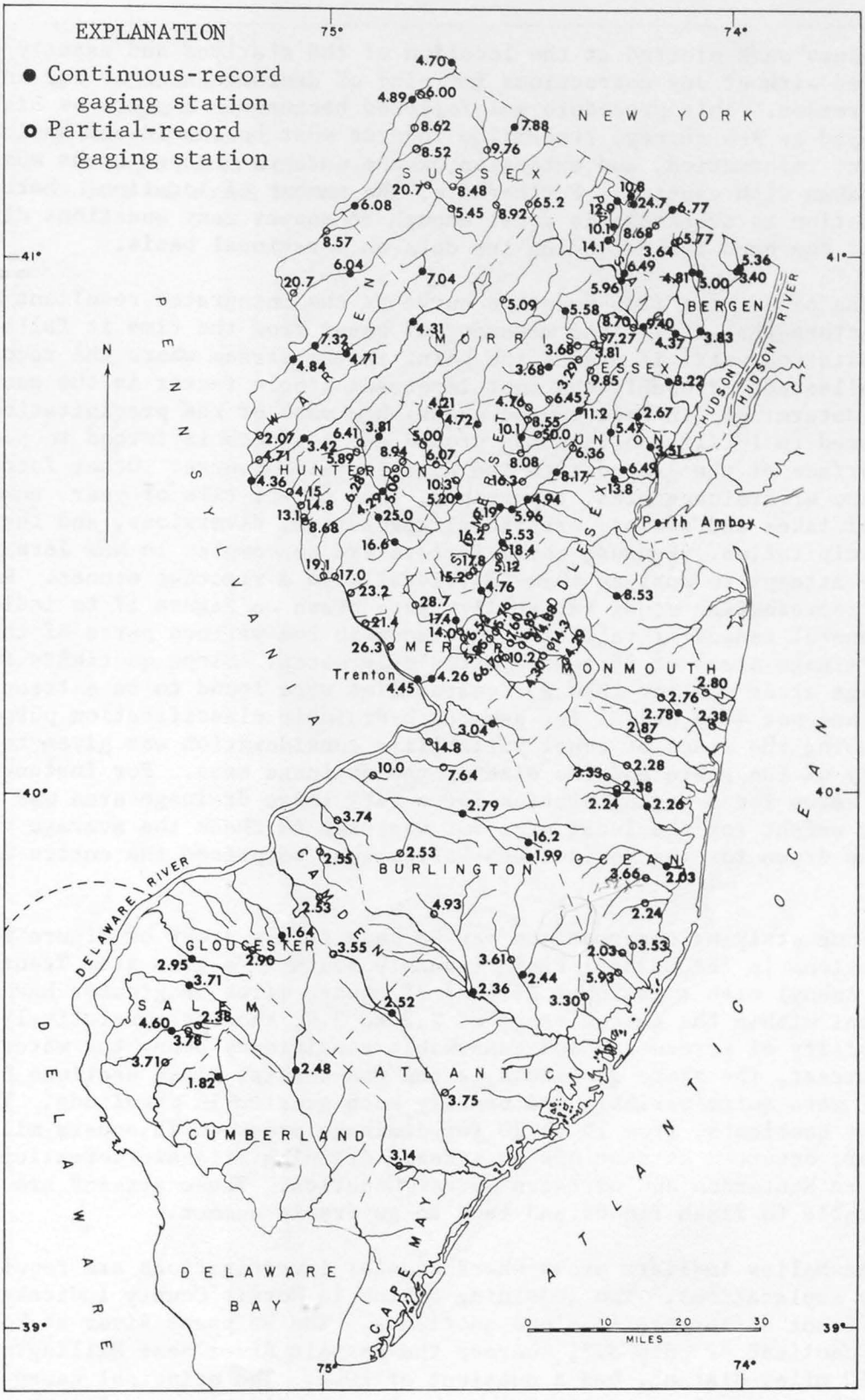


Figure 16.--Ratio of 20-percent point to 80-percent point on flow-duration curves for stations used in analyses.

All values were plotted at the location of the stations and exactly as computed without any corrections for size of drainage area or for any other reason. This procedure was followed because in a state as highly developed as New Jersey, streamflow records must be considered basically as point information, and extension of the data to ungaged areas must be undertaken with caution. Furthermore, the number of locations where information is available is great enough to answer many questions directly without the need for extending the data on a regional basis.

The slope of a flow-duration curve is the integrated resultant of all the factors that affect the movement of water from the time it falls as precipitation until it passes the point in the stream where the records are collected. Probably the most important single factor is the geology, which determines (in undeveloped areas) how much of the precipitation is permitted to infiltrate into the ground and how much is forced to pass over the surface of the ground into the nearest water course. Other factors are the size of drainage area, topography, land cover, time of year, number and size of lakes and swamps, artificial regulation, diversions, and the patterns of precipitation. Because these factors are so complex in New Jersey, there was no attempt to analyze them individually in a rigorous manner. Rather, lines representing equal variability were drawn on figure 17 to indicate the general ranges of values of the index in the various parts of the state for drainage areas of 25 square miles or greater. Slope quotients for drainage areas smaller than 25 square miles were found to be extremely variable and not very useful for general hydrologic classification purposes. In drawing the lines of equal variability consideration was given to the geology of the state and the size of the drainage area. For instance, an index value for a gaging station for a very large drainage area was given little weight for the local area but was used to check the average of the indices drawn for the various sub-basins that comprised the entire drainage area.

Some striking observations may be made from a study of figure 16. All 15 stations in the Coastal Plain (roughly south of a line from Trenton to Perth Amboy) with a drainage area of 25 square miles or greater had a slope quotient within the narrow range of 2.2 to 3.6, showing a relatively small variability of streamflow and remarkable consistency among the watersheds. By contrast, the slope quotients in the non-Coastal Plain sections of New Jersey were quite variable and usually much greater in magnitude. The largest quotients, from 15 to 20 for drainage areas of 25 square miles or greater, occurred at stations on streams draining Triassic formations in southern Hunterdon and northern Mercer Counties. These streams are the most vulnerable to flash floods and tend to go dry in summer.

Anomalies indicate areas where special investigations are required to supply explanations. Two adjoining basins in Morris County indicated a significant difference in slope quotients. The Whippany River at Morristown had a quotient of only 3.7, whereas the Passaic River near Millington, less than 10 miles distant, had a quotient of 10.1. The principal cause of the unusually large slope quotient for the Passaic River near Millington is believed to be the evapotranspiration from Great Swamp which reduces the summer flows. Two adjacent basins of comparable size in Lebanon State

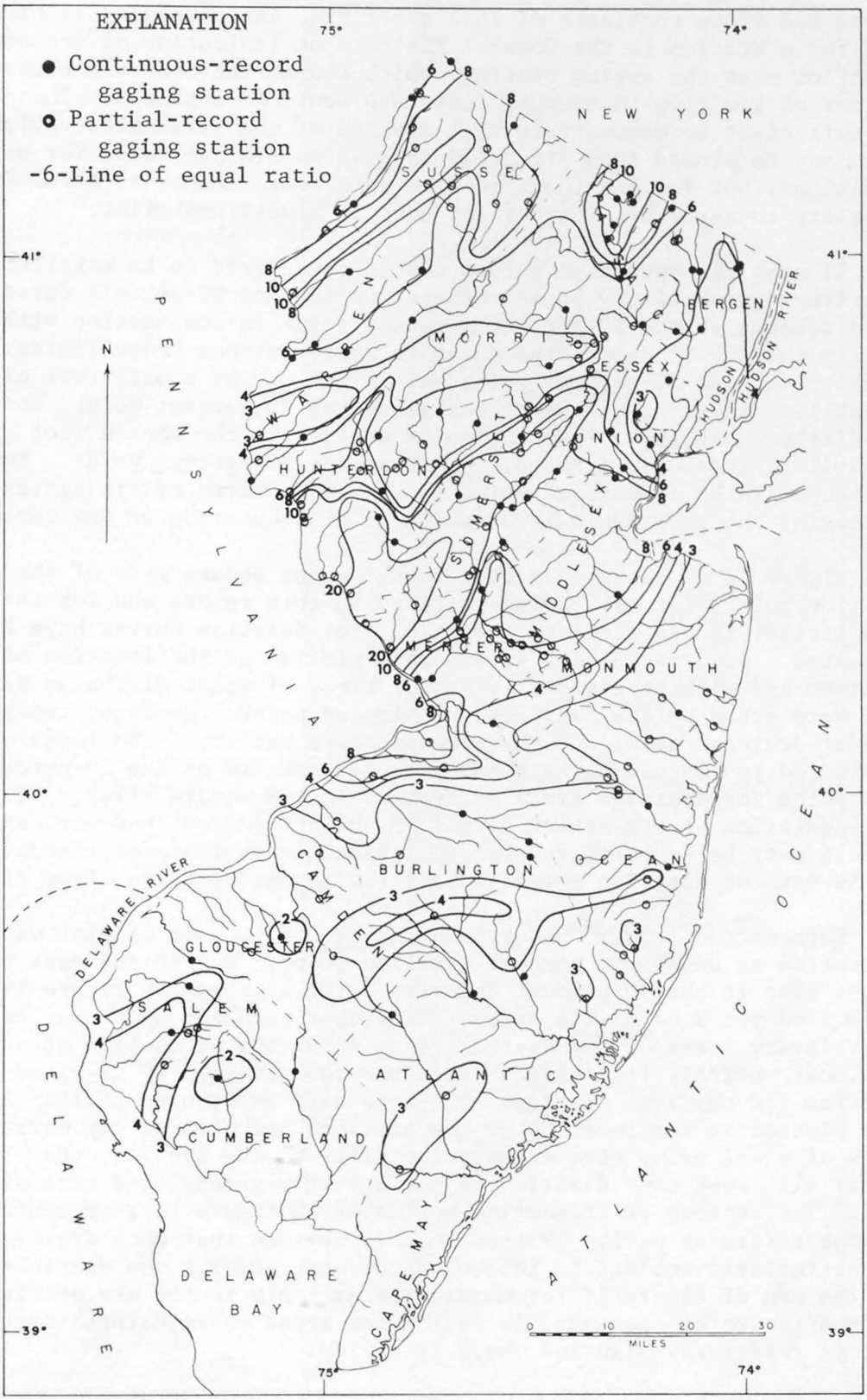


Figure 17.--Ratio of 20-percent point to 80-percent point on flow-duration curve for areas of 25 to 100 square miles.

Forest had slope quotients of 16.2 and 1.99. The unreasonably high value of 16.2 for a station in the Coastal Plain is an indication of ground-water underflow past the gaging station, which causes the observed streamflow in periods of low flow to be much less than would be expected. These examples are sufficient to demonstrate that a value of the streamflow variability index may be picked from figure 17 to give an average value for natural conditions, but for any specific site some measurements of streamflow are necessary to ascertain whether any unusual conditions exist.

If most flow-duration curves may be considered to be straight lines on logarithmic-probability paper between the 20- and 80-percent duration points, the discharge at the 50-percent duration point in conjunction with the variability index will define the duration curve between those limits. The discharge at the 50-percent point multiplied by the square root of the variability index gives the discharge at the 20-percent point, and similarly the discharge at the 50-percent point divided by the square root of the variability index gives the discharge at the 80-percent point. Thus the discharge at the 50-percent point is the second item of classification in portraying the geographical variation of flow duration in New Jersey.

Figure 18 is based upon the discharge per square mile of the 50-percent duration points for all gaging stations in this report and for the 95 low-flow partial-record stations for which flow-duration curves have been estimated. Once again, all values were plotted at the location of the stations and without any corrections. Lines of equal discharge per square mile were drawn on the basis of the plotted points, geology, topography, size of drainage area, and the precipitation pattern. The lines may be considered to represent the general runoff pattern at the 50-percent duration point for drainage areas of from 25 to 100 square miles. Diversions and regulation have a direct effect on the streamflow, however, and those factors must be investigated before a detailed estimate of streamflow at the 50-percent duration point is made for any ungaged area from figure 18.

Information from flow-duration curves may be used to plot maps of streamflow at any given percent duration point. One of the most useful is the plot at the 90-percent duration point as shown in figure 19. The streamflow per square mile at the 90-percent duration point may be used as an arbitrary index of dry-weather flow, since the streamflow at such times is almost entirely from ground-water sources. Figure 19 is based upon this plotting for the same stations that were used in figures 16-18. All values were plotted at the location of the stations and without any corrections. Lines of equal value were drawn principally on the basis of the plotted points with some consideration to geology, topography, and size of drainage area. The pattern of streamflow portrayed on figure 19 represents conditions for the reference period 1931-60. It is obvious that such dry-weather flow is particularly subject to influences of man, and all the cautions mentioned for the use of figure 17 for ungaged areas apply to the use of figure 19. The map is useful, however, in indicating areas where natural dry-weather flow is relatively high and where it is low.

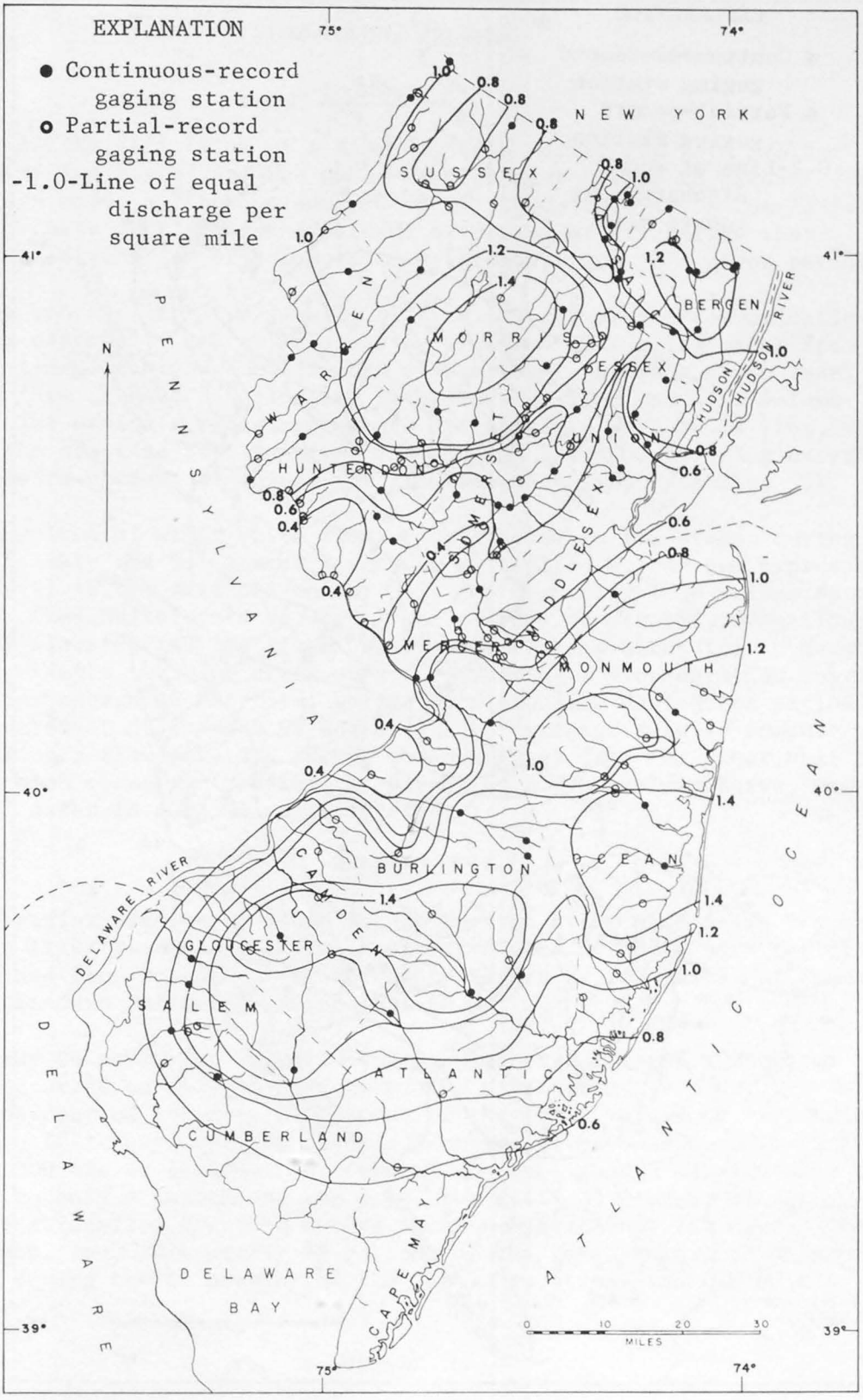


Figure 18.--Discharge, in cubic feet per second per square mile, at 50-percent duration point for areas of 25 to 100 square miles.

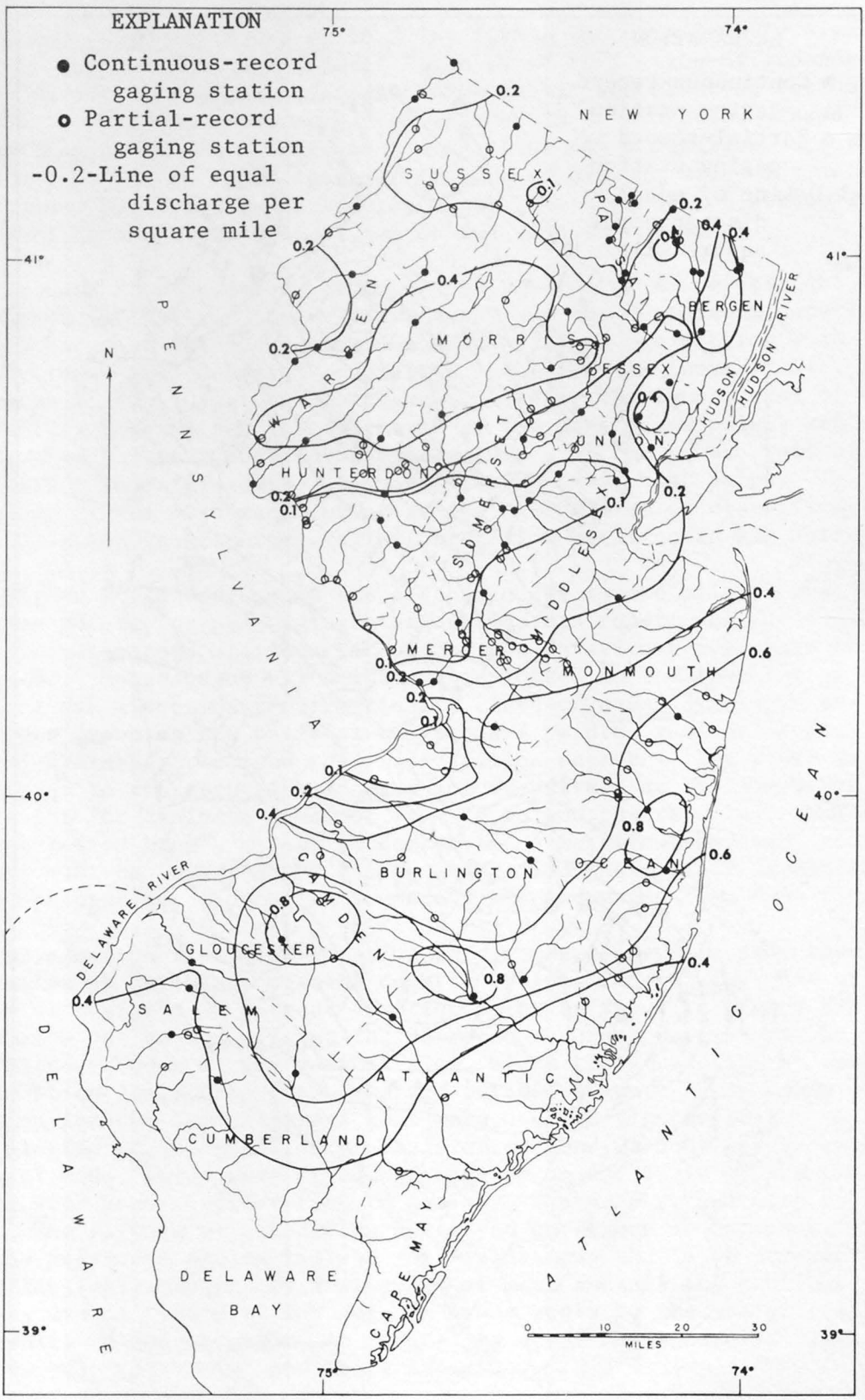


Figure 19.--Discharge, in cubic feet per second per square mile, at 90-percent duration point for areas of 25 to 100 square miles.

FLOW-VOLUME STUDIES

Concept

If, in the definition of a flow-duration curve, the word "volume" is substituted for "time" and the other word changes needed to present this concept are made, a "flow-volume" curve may be defined as "a cumulative frequency curve that shows the percent of volume of streamflow that occurred at discharges of a specified or greater rate in a given period."

This concept, first suggested by R. H. Tice (written communication, 1958), is especially useful in studying problems of pumping water from a river at times of high water or when streamflow is above a given base. The same form is used for plotting both flow-duration and flow-volume curves. The ordinate scale represents discharge in both cases, but, whereas the abscissa represents percent of time for flow-duration curves, it represents percent of volume for flow-volume curves (see fig. 20).

The volume of water which flows past a point in the stream during one day (simply the daily mean discharge multiplied by one and expressed as cfs-days) is the most convenient unit for compiling flow-volume data, although other units could be used. One cfs-day equals 646,300 gallons. The daily flows during the given period are arranged according to magnitude (this is exactly the same array used in preparing a flow-duration curve) and the percentage of the total volume of streamflow during the period that occurred at discharges of a specified or greater rate is computed. In preparing a flow-duration curve, the number of days (or other unit of time) in each class is totaled; in preparing a flow-volume curve, the volume of water in each class is totaled.

Example

The gaging station on South Branch Raritan River at Stanton has been chosen to illustrate a flow-volume curve. Figure 20 shows both the flow-duration and flow-volume curves for South Branch Raritan River at Stanton for the standard reference period 1931-60.

It may be seen, for example, that a discharge rate of 200 cfs or greater occurred on only 40 percent of the days during 1931-60, but during that 40 percent of the days 74 percent of the total volume of streamflow occurred. If it were decided to pump from the river only when the streamflow was 500 cfs or greater, the curves show that such a magnitude of flow occurred on only 9 percent of the days, but still 35 percent of the total volume of streamflow occurred during those comparatively few days. The curves show, too, that nearly 98 percent of the total volume of streamflow occurred during the 87 percent of the days when streamflow was 60 cfs or greater.

SUMMARY

Flow-duration curves, which show the percent of time during which specified discharges were equaled or exceeded in some past period, may be used to estimate the availability of streamflow in the future as long as

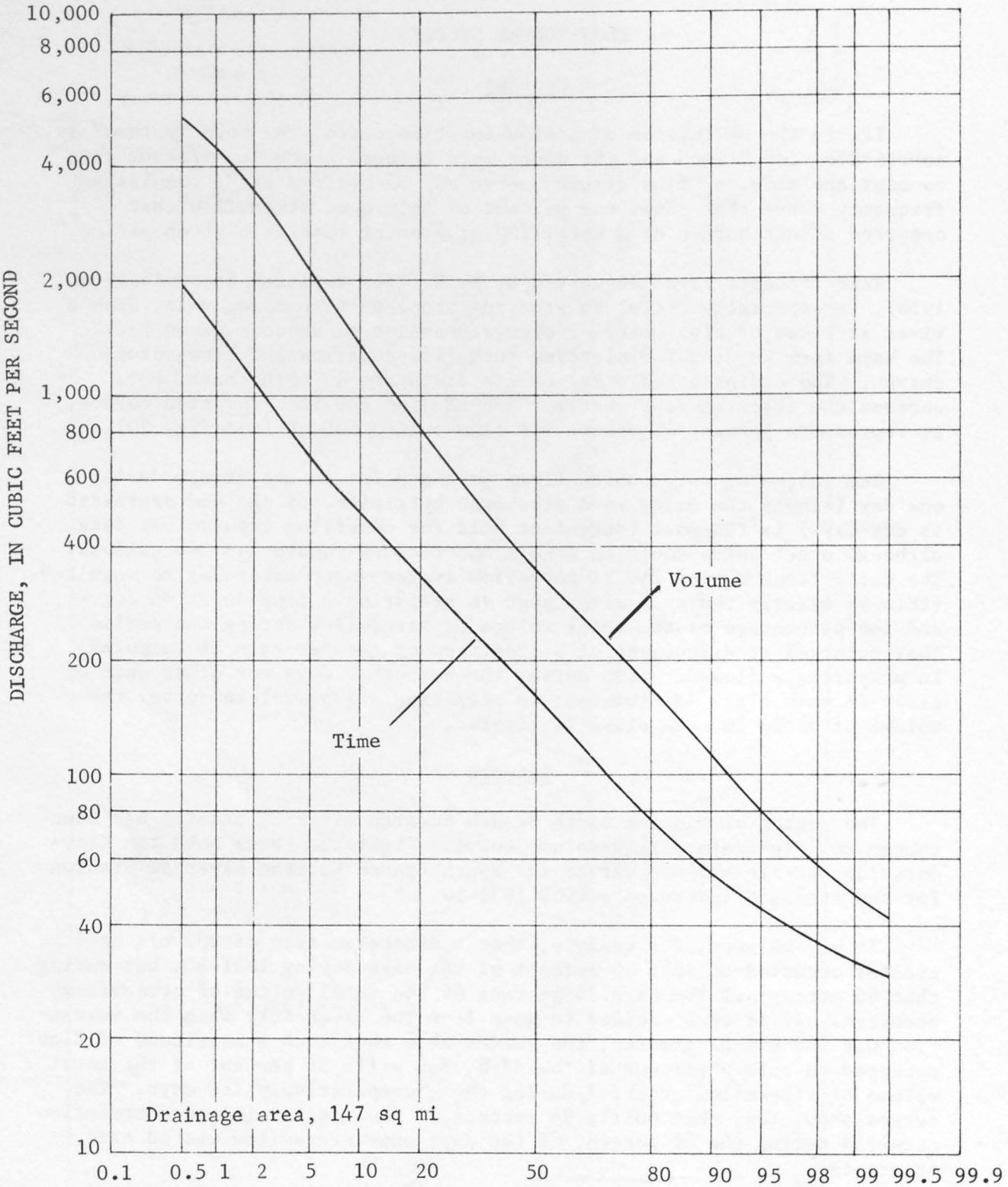


Figure 20.--Comparison of flow-duration and flow-volume curves for South Branch Raritan River at Stanton, 1931-60.

their limitations are understood. The curves show the average distribution of flow which may be expected during an extended period, but they do not apply for any specific year, season, or month, and they must be corrected for changing conditions of regulation or diversion. With these limitations in mind, however, they may be used in investigations of waterpower, floods, water supply, location of industrial plants, pollution, water quality, and the effect of geology on low flows. In general, flow-duration curves are most useful for preliminary and general regional studies. They should be supplemented by more comprehensive methods of analysis when detailed investigations at a given location are required.

This report contains flow-duration data in tabular form for 70 continuous-record gaging stations in New Jersey. Presented for each station are discharge figures for both the period of record and for the reference period 1931-60 in cubic feet per second and also cubic feet per second per square mile. As all data are given for specified points of duration, comparisons among stations may be made easily. Table 2 was designed specifically for this purpose.

Also included in this report are 3 maps of New Jersey, (figs. 17-19), showing respectively for areas from 25 to 100 square miles the geographical variation of the slope of flow-duration curves, the discharge per square mile at the 50-percent duration point, and the discharge per square mile at the 90-percent duration point. These maps are intended for general use only, and it is recommended that no flow-probability curve be synthesized for use at a specific point without some field investigation.

The definition of the lines on figures 17-19 was improved considerably by using information from estimated flow-duration curves at 95 low-flow partial-record stations. Individual flow-duration tables for the partial-record stations are not presented in this report, as the estimates are based on sparse data collected predominantly during drought years. However, summarized data for the partial-record stations, at 4 specified points of duration, adjusted to the 1931-60 reference period, are included in table 2, representing the best such information available at present for many small streams. The program of partial-record stations is operated so that the number of specific points in the state where estimated flow-duration curves may be constructed is constantly increasing. Already some information is available at more than 170 such low-flow partial-record stations and each year the number of these which may be used for constructing estimated flow-duration curves and minimum flow information grows.

The concept of flow-volume curves is introduced. These curves are similar in form to flow-duration curves and are based on the same data. They deal with volume of flow above a given rate, however, instead of frequency of flow above a given rate. No tables of flow-volume curves are presented in this report, but the method of computing such curves is described briefly. The presentation herein of an example of a flow-volume curve may help to determine if there is a demand for computing tables of flow-volume data.

SELECTED REFERENCES

Cross, W. P., 1949, The relation of geology to dry-weather streamflow in Ohio: Am. Geophys. Union Trans., p. 563-566.

Cross, W. P., and Hedges, R. E., 1959, Flow duration of Ohio streams: Ohio Dept. Nat. Resources, Div. Water Bull. 31, 152 p.

Dougherty, D. F., and Lendo, A. C., 1959, Surface-water supply of New Jersey October 1, 1945 to September 30, 1950: New Jersey Dept. Conserv. Econ. Devel. Spec. Rept. 14, 362 p.

Foster, H. A., 1924, Theoretical frequency curves and their application to engineering problems: Am. Soc. Civil Engineers Trans., v. 87, p. 142-203.

_____ 1934, Duration curves: Am. Soc. Civil Engineers Trans., v. 99, p. 1213-1267.

Hartwell, O. W., 1929, Surface-water supply of New Jersey to September 30, 1928: New Jersey Dept. Conserv. Devel. Bull. 33, 301 p.

_____ 1936, Surface-water supply of New Jersey October 1, 1928 to September 30, 1934: New Jersey Water Policy Comm. Spec. Rept. 5, 253 p.

_____ 1944, Surface-water supply of New Jersey October 1, 1934 to September 30, 1940: New Jersey Water Policy Comm. Spec. Rept. 9, 444 p.

Hartwell, O. W., and Lauterhahn, Otto, 1952, Surface-water supply of New Jersey October 1, 1940 to September 30, 1945: New Jersey Dept. Conserv. Econ. Devel. Spec. Rept. 12, 379 p.

Lane, E. W., and Lei, Kai, 1950, Streamflow variability: Am. Soc. Civil Engineers Trans., v. 115, p. 1084-1134.

McCall, J. E., and Lendo, A. C., 1960, Surface-water supply of New Jersey October 1, 1950 to September 30, 1955: New Jersey Dept. Conserv. Econ. Devel. Spec. Rept. 16, 405 p.

_____ 1963, Surface-water supply of New Jersey October 1, 1955 to September 30, 1960: New Jersey Dept. Conserv. Econ. Devel. Spec. Rept. 20, 425 p.

Miller, E. G., and McCall, J. E., 1961, New Jersey streamflow records analyzed with electronic computer: New Jersey Dept. Conserv. Econ. Devel. Water Resources Circ. no. 6, 91 p.

Mitchell, W. D., 1957, Flow duration of Illinois streams: Illinois Dept. Public Works and Bldgs., Div. Waterways, 189 p.

Riggs, H. C., 1961, Frequency of natural events: Jour. Hydraulics Div., Am. Soc. Civil Engineers Proc., v. 87, no. HY1, p. 15-26.

Searcy, J. K., 1959, Flow-duration curves: U.S. Geol. Survey Water-Supply Paper 1542-A, 33 p.

U.S. Geological Survey, issued annually to 1960, Surface-water supply of the United States, pt. 1 or 1-B, North Atlantic slope basins: U.S. Geol. Survey Water-Supply Papers.

FLOW-DURATION DATA

Table 2.--Discharge, in cubic feet per second per square mile, for selected percentages of duration, for New Jersey stream-gaging stations, 1931-60

Station No.	Station Name	Drainage area (sq mi)	Cfsm for percent duration indicated											
			1	2	5	10	20	50	80	90	95	98	99	99.5
*3677	Wallkill River at Franklin	a31					2.39	0.958	0.268	0.168				
*3678	Papakating Creek at Pellettown	a15					1.87	.747	.220	.140				
*3679	Clove Brook at Sussex	19.7					2.08	.812	.213	.134				
3680	Wallkill River near Unionville, N.Y.	144	8.89	7.08	5.14	3.68	2.33	.875	.295	.184	0.137	0.103	0.083	0.074
3770	Hackensack River at Rivervale	58.0	8.96	6.90	4.83	3.45	2.31	1.02	.431	.276	.193	.134	.107	.088
3775	Pascack Brook at Westwood	29.6	9.97	7.30	4.73	3.28	2.30	1.25	.676	.459	.358	.294	.264	.216
*3787.5	Great Brook at Green Village	7.92					2.53	.947	.391	.265				
*3788	Primrose Brook near New Vernon	4.68					2.52	1.22	.530	.352				
*3788.5	Great Brook near Basking Ridge	24.9					2.49	.494	.291	.177				
*3789	Black Brook near Meyersville	10.0					2.40	.680	.048	.014				
3790	Passaic River near Millington	55.4	9.93	8.03	5.69	4.04	2.53	.848	.249	.143	.090	.049	.036	.030
*3792	Dead River near Millington	20.8					2.02	.793	.250	.149				
3795	Passaic River near Chatham	100	9.60	8.10	6.00	4.35	2.60	.820	.232	.136	.092	.058	.046	.039
*3795.7	Passaic River at Hanover	128					2.50	.820	.254	.157				
*3797	Rockaway River at Berkshire Valley	22.4					3.75	1.88	.737	.448				
3805	Rockaway River above reservoir, at Boonton	116	10.3	7.93	5.60	4.18	2.89	1.38	.517	.341	.259	.183	.140	.108
3815	Whippany River at Morristown	29.4	9.69	7.21	4.76	3.33	2.28	1.21	.619	.483	.408	.340	.286	.238
*3816	Whippany River near Whippany	48.5					2.00	1.13	.608	.464				
*3817	Troy Brook at Troy Hills	10.1					2.26	1.19	.614	.480				
*3818	Whippany River near Pine Brook	68.5					2.36	1.23	.620	.465				
*3819	Passaic River at Pine Brook	349					2.66	1.03	.367	.241				
*3820	Passaic River at Two Bridges	361					3.32	1.19	.382	.233				
*3820.5	Pequannock River near Stockholm	5.41					2.77	.447	.043	.017				
3840	Wanaque River at Monks	40.4	12.9	10.1	6.93	5.05	3.12	1.23	.243	.166	.129	.105	.097	.089
3845	Ringwood Creek near Wanaque	19.1	10.5	8.22	5.45	4.03	2.72	1.07	.251	.107	.068	.045	.037	.032
3850	Cupsaw Brook near Wanaque	4.38	13.7	10.3	6.62	4.47	2.88	.845	.116	.062	.037	.023	.018	.016
3860	West Brook near Wanaque	11.8	15.6	11.0	6.78	4.66	3.01	1.07	.297	.173	.117	.081	.069	.062
3865	Blue Mine Brook near Wanaque	1.71	10.9	7.37	4.62	3.04	1.81	.690	.129	.063	.040	.027	.023	.020
3875	Ramapo River near Mahwah	118	12.2	9.15	6.10	4.24	2.75	1.14	.407	.250	.184	.142	.125	.115
*3876.7	Ramapo River near Darlington	129					2.56	.953	.295	.174				
3880	Ramapo River at Pompton Lakes	160	11.1	8.50	5.75	4.06	2.72	1.14	.419	.275	.209	.155	.119	.044
3885	Pompton River at Pompton Plains	355	8.59	6.65	4.51	3.04	1.92	.775	.321	.237	.192	.158	.135	.078
3895	Passaic River at Little Falls	762	7.87	6.43	4.79	3.61	2.47	.906	.262	.163	.102	.060	.041	.027
3905	Saddle River at Ridgewood	21.6	9.54	7.22	4.49	3.19	2.36	1.08	.472	.324	.255	.197	.169	.148
*3907	Hohokus Brook at Wyckoff	5.13					2.34	1.38	.643	.555				
*3908	Valentine Brook at Allendale	2.48					2.42	1.17	.419	.250				
3910	Hohokus Brook at Hohokus	16.4	10.9	7.80	4.82	3.29	2.38	1.21	.494	.317	.280	.244	.223	.207
3915	Saddle River at Lodi	54.6	9.89	7.42	4.95	3.52	2.53	1.30	.659	.476	.377	.295	.256	.225
3920	Weasel Brook at Clifton	4.45	10.8	7.64	4.18	2.61	1.55	.798	.355	.175	.067	.012	.002	.0002
3925	Second River at Belleville	11.6	13.3	9.31	5.17	2.89	1.64	.819	.509	.388	.336	.297	.276	.266
3930	Elizabeth River at Irvington	2.91	21.3	14.9	8.25	4.26	1.92	1.03	.722	.598	.502	.371	.289	.230
3935	Elizabeth River at Elizabeth	18.0	12.2	8.67	4.89	2.78	1.44	.667	.411	.317	.250	.167	.083	.056
3945	Rahway River near Springfield	25.5	11.4	7.69	4.00	2.16	1.14	.447	.208	.145	.112	.085	.075	.068
3950	Rahway River at Rahway	40.9	11.1	7.82	4.30	2.32	1.22	.489	.188	.108	.062	.030	.020	.014
3960	Robinsons Branch Rahway River at Rahway	21.6	14.6	10.4	5.37	2.59	1.11	.361	.081	.037	.012	0	0	0
3965	South Branch Raritan River near High Bridge	65.3	9.49	7.35	4.82	3.49	2.48	1.24	.651	.513	.436	.383	.352	.334
*3966	Spruce Run near Clinton	18.1					2.27	.860	.354	.249				
*3967	Mulhockaway Creek near Clinton	20.5					2.10	.829	.356	.258				
*3969	Cakepoulin Creek at Lansdowne	14.1					1.91	.745	.305	.226				
3970	South Branch Raritan River at Stanton	147	10.1	7.35	4.63	3.27	2.24	1.10	.524	.374	.299	.245	.218	.197
*3971	Prescott Brook at Round Valley	4.61					1.76	.824	.347	.260				
3975	Walnut Brook near Flemington	2.24	16.1	10.4	5.36	3.12	1.81	.518	.072	.026	.007	.001	0	0
3980	Neshanic River at Reaville	25.7	17.2	10.3	4.98	2.84	1.61	.444	.097	.058	.042	.029	.024	.019
3985	North Branch Raritan River near Far Hills	26.2	10.3	7.63	5.11	3.70	2.60	1.26	.550	.378	.286	.198	.147	.103
3995	Lamington (Black) River near Pottersville	32.8	6.65	5.49	4.33	3.41	2.59	1.36	.616	.433	.335	.253	.192	.152
*3995.7	Rockaway Creek at McCrea Mills	17.0					2.59	1.21	.518	.300				
*3996	South Branch Rockaway Creek Tributary at Lebanon	1.02					1.49	.480	.167	.115				
*3997	Rockaway Creek at Whitehouse	37.1					1.99	.889	.329	.226				
*3999	Chambers Brook at North Branch Depot	10.2					1.47	.500	.142	.082				
4000	North Branch Raritan River near Raritan	190	12.1	8.00	4.68	3.11	2.03	.947	.389	.263	.202	.147	.119	.099
4005	Raritan River at Manville	490	11.6	8.16	4.94	3.22	2.02	.867	.327	.214	.165	.114	.097	.083
*4005.4	Millstone River near Manalapan	7.37					2.24	1.07	.522	.350				
*4005.6	Millstone River at Applegarth	15.0					1.55	.733	.360	.257				
*4005.8	Millstone River at Hightstown	19.7					2.28	.838	.335	.168				
*4006	Millstone River at Locust Corner	37.4					2.03	.749	.267	.154				
*4006.4	Millstone River near Grovers Mills	42.6					2.14	.892	.371	.231				
*4006.7	Cranbury Brook at Old Church	3.69					.894	.277	.062	.030				
*4007	Cranbury Brook at Cranbury Station	9.56					1.05	.460	.214	.149				
*4007.5	Big Bear Brook near Hickory Corner	3.46					1.62	.231	.024	.010				
*4007.7	Little Bear Brook at Hickory Corner	1.88					1.36	.415	.133	.075				
*4008	Big Bear Brook near Grovers Mills	9.52					1.16	.473	.197	.156				
*4009	Stony Brook at Glenmoore	17.6					1.53	.392	.053	.024				
4010	Stony Brook at Princeton	44.5	17.8	11.0	5.39	2.88	1.53	.458	.088	.046	.027	.014	.008	.005
*4011	Stony Brook at Clarksville	46.7					1.58	.503	.113	.062				
*4012	Duck Pond Run at Clarksville	5.21					.902	.345	.138	.061				
4015	Millstone River near Kingston	171	10.2	6.78	4.09	2.66	1.75	.842	.368	.225	.145	.078	.055	.039
*4016	Beden Brook near Rocky Hill	27.6					1.59	.507	.105	.062				
*4017	Pike Run near Rocky Hill	22.2					1.49	.441	.083	.048				
*4018	Ten Mile Run near Blackwells Mills	4.36					1.79	.722	.349	.236				
*4019	Six Mile Run at Blackwells Mills	16.1					1.77	.522	.096	.068				
4020	Millstone River at Blackwells Mills	258	10.7	8.14	5.04	3.06	1.82	.760	.329	.229	.169	.107	.074	.058
*4027	Royce Brook at Manville	11.7					1.03	.329	.063	.038				
4030	Raritan River at Bound Brook	779	11.0	8.22	5.07	3.16	1.95	.783	.327	.226	.172	.100	.074	.057
*4031	East Branch Middle Brook at Martinsville	8.45					2.54	.686	.156	.115				
*4034	Green Brook at Seeley Mills	6.28					2.23	.939	.350	.223				

Table 2.--Discharge, in cubic feet per second per square mile, for selected percentages of duration, for New Jersey stations, 1931-60--Continued

Station No.	Station Name	Drainage area (sq mi)	Cfsm for percent duration indicated											
			1	2	5	10	20	50	80	90	95	98	99	99.5
4035	Green Brook at Plainfield	9.75	11.9	8.62	4.87	2.77	1.56	0.636	0.191	0.096	0.059	0.033	0.017	0.011
4040	Green Brook at Bound Brook	49	9.29	5.82	3.80	2.57	1.67	.918	.339	.212	.135	.073	.065	.052
4060	Deep Run near Browntown	8.07	10.8	7.56	4.28	2.83	1.98	1.14	.471	.294	.176	.110	.087	.071
*4077	Shark River at Glendola	a10					2.30	1.40	.820	.660				
*4078	Wreck Pond Brook near Spring Lake	a7					1.97	1.27	.829	.686				
*4079	Manasquan River at West Farms	a30					2.30	1.43	.833	.667				
4080	Manasquan River at Squankum	43.4	8.29	6.34	4.15	2.90	2.05	1.22	.737	.588	.516	.447	.415	.392
*4081	North Branch Metedeconk River at Lakewood	a30					1.37	.800	.477	.380				
*4083	Main Branch Toms River at Whitesville	a45					1.82	1.24	.800	.644				
*4084.4	Union Branch at Lakehurst	a20					2.85	1.95	1.28	1.02				
*4084.6	Manapaqua Brook at Lakehurst	a8					1.25	.838	.525	.425				
*4084.9	Ridgeway Branch near Lakehurst	a25					2.56	.368	.768	.560				
4085	Toms River near Toms River	124	4.84	4.19	3.35	2.78	2.26	1.53	1.00	.806	.702	.613	.581	.556
4090	Cedar Creek at Lanoka Harbor	56.0	5.27	4.39	3.43	3.04	2.43	1.70	1.20	1.00	.830	.580	.455	.386
*4090.5	North Branch Forked River near Forked River	a13					2.31	1.23	.631	.492				
*4091	Oyster Creek near Waretown	a10					5.20	3.50	2.32	1.96				
*4091.5	Mill Creek near Manahawkin	a10					2.70	1.90	1.33	1.15				
*4092	Fourmile Branch Mill Creek near Manahawkin	a5					2.40	1.30	.680	.530				
*4092.5	Cedar Run near Manahawkin	a3					2.67	1.10	.450	.313				
*4093	Mill Branch Tuckerton Creek near Tuckerton	a4					1.65	.938	.500	.388				
*4094.5	Springers Brook near Indian Mills	a10					3.40	1.45	.690	.520				
4095	Batsto River at Batsto	70.5	6.67	5.32	3.97	3.12	2.41	1.53	1.02	.879	.794	.709	.652	.617
*4098	West Branch Wading River near Harrisville	a90					2.89	1.56	.800	.611				
4100	Oswego River at Harrisville	64.0	4.69	3.91	3.00	2.38	1.81	1.17	.742	.617	.547	.461	.398	.356
*4108	Fourmile Branch near Williamstown	a8					.975	.525	.275	.206				
4110	Great Egg Harbor River at Folsom	56.3	5.06	4.19	3.27	2.66	2.06	1.31	.817	.657	.560	.480	.430	.394
*4112	Babcock Creek at Mays Landing	a21					1.71	.857	.457	.333				
*4113	Tuckahoe River at Head of River	a55					1.07	.609	.342	.258				
4115	Maurice River at Norma	113	4.29	3.72	2.92	2.48	2.00	1.29	.805	.637	.522	.416	.350	.305
4125	West Branch Cohansey River at Seeley	2.55	2.63	1.88	1.25	1.04	.871	.651	.478	.416	.376	.341	.322	.290
*4130.6	Canton Drain near Canton	a5					1.26	.680	.340	.232				
4340	Delaware River at Port Jervis, N.Y.	3,076	10.9	8.13	5.46	3.84	2.50	1.12	.533	.377	.286	.215	.182	.158
*4384	Shimers Brook near Montague	6.95					2.24	1.06	.374	.245				
4385	Delaware River at Montague	3,480	10.1	7.90	5.34	3.79	2.50	1.15	.529	.385	.299	.227	.193	.170
*4398	Big Flat Brook near Hainesville	a21					2.48	.976	.290	.176				
*4399	Little Flat Brook at Hainesville	a9					2.22	.878	.258	.158				
4400	Flat Brook near Flatbrookville	65.1	10.9	7.99	5.15	3.63	2.43	1.12	.399	.264	.209	.160	.141	.131
*4401	Vancampens Brook near Millbrook	7.27					2.89	1.17	.337	.213				
*4428	Stony Brook near Columbia	3.51					1.71	.484	.083	.046				
*4433	Paulins Kill at Lafayette	33.6					2.32	.113	.426	.304				
*4434	Culvers Creek at Branchville	a11					2.82	.745	.136	.074				
4435	Paulins Kill at Blairstown	126	9.21	6.98	4.68	3.33	2.30	1.08	.381	.262	.214	.167	.143	.127
4450	Pequest River at Huntsville	31.4	6.75	5.41	4.08	3.18	2.42	1.13	.344	.207	.135	.096	.086	.080
4455	Pequest River at Pequest	108	6.02	5.19	3.98	3.10	2.22	1.09	.472	.338	.273	.224	.198	.181
4460	Beaver Brook near Belvidere	36.2	8.01	6.13	4.36	3.31	2.27	.981	.309	.171	.115	.075	.061	.052
4465	Delaware River at Belvidere	4,535	10.3	7.72	5.25	3.79	2.65	1.21	.547	.379	.300	.238	.212	.192
*4551	Lopatcong Creek at Phillipsburg	14.2					1.34	.915	.648	.570				
*4553	Pohatcong Creek at Carpentersville	57.1					1.30	.630	.275	.194				
4560	Musconetcong River near Hackettstown	70.0	7.14	5.86	4.57	3.71	2.74	1.33	.636	.464	.349	.240	.180	.143
4570	Musconetcong River near Bloomsbury	143	6.22	5.17	3.92	3.08	2.34	1.30	.685	.531	.455	.385	.350	.318
4575	Delaware River at Riegelsville	6,328	9.32	7.19	5.06	3.79	2.65	1.26	.608	.435	.351	.284	.256	.237
*4581	Hakihokake Creek at Milford	17.2					1.72	.814	.413	.320				
*4584	Harihokake Creek near Frenchtown	9.75					1.64	.400	.111	.068				
*4586	Nishisakawick Creek at Frenchtown	11.1					1.53	.414	.117	.074				
*4587	Little Nishisakawick Creek at Frenchtown	3.50					.943	.343	.109	.066				
*4609	Lockatong Creek near Raven Rock	23.3					1.18	.309	.062	.036				
*4613	Wickecheoke Creek at Stockton	26.5					1.47	.396	.087	.052				
*4619	Alexauken Creek near Lambertville	14.9					2.21	.503	.095	.055				
*4622	Moore Creek near Titusville	10.2					1.76	.441	.082	.047				
*4628	Jacobs Creek at Somerset	13.4					1.49	.388	.057	.026				
4635	Delaware River at Trenton	6,780	8.85	6.93	5.01	3.76	2.63	1.25	.590	.428	.339	.277	.248	.227
4640	Assunpink Creek at Trenton	89.4	7.83	6.15	4.08	2.85	1.86	.884	.436	.313	.242	.183	.150	.123
4645	Crosswicks Creek at Extonville	83.6	9.09	6.82	4.31	2.99	1.96	1.09	.646	.496	.419	.359	.311	.268
*4645.4	Crafts Creek at Hedding	a8					2.12	.513	.144	.078				
*4645.8	Assiscunk Creek near Columbus	a7					1.20	.429	.157	.098				
*4658.8	Southwest Branch Rancocas Creek at Medford	a55					1.31	.855	.518	.418				
4660	Middle Branch Mount Misery Brook in Lebanon State Forest	2.73	3.41	2.86	2.09	1.59	1.12	.498	.069	.012	0	0	0	0
4665	McDonalds Branch in Lebanon State Forest	2.31	3.03	2.60	2.10	1.69	1.26	.857	.632	.571	.519	.494	.476	.468
4670	North Branch Rancocas Creek at Pemberton	111	5.41	4.50	3.47	2.75	2.11	1.28	.757	.586	.486	.397	.351	.315
*4670.2	Mill Creek at Willingboro	a8					1.05	.319	.105	.061				
*4670.7	North Branch Pennsauken Creek at Maple Shade	a8					1.96	1.03	.525	.388				
*4671.5	Cooper River at Haddonfield	17.4					1.61	1.06	.632	.517				
*4673.5	North Branch Big Timber Creek Tributary at Laurel Springs	a6					3.83	2.42	1.52	1.22				
4750	Mantua Creek at Pitman	6.75	5.26	4.30	3.20	2.52	2.04	1.54	1.24	1.07	.904	.770	.711	.681
*4771	Raccoon Creek near Mullica Hill	a9					3.00	1.67	1.03	.733				
4775	Oldmans Creek near Woodstown	19.3	5.80	4.56	3.16	2.36	1.71	.974	.580	.482	.399	.326	.269	.220
4825	Salem River at Woodstown	14.6	10.7	7.26	3.97	2.50	1.60	.849	.432	.295	.199	.119	.040	.022
*4829	Cool Run near Alloway	a5					1.74	1.14	.730	.566				
*4829.5	Cedar Brook near Alloway	a4					2.18	1.50	.575	.388				
4830	Alloway Creek at Alloway	21.9	6.94	5.11	3.38	2.37	1.58	.721	.342	.228	.162	.114	.092	.071

* Low-flow partial-record station. Discharge, obtained from estimated duration curve, less reliable than that for continuous-record gaging station.
a Estimated

HUDSON RIVER BASIN

3680. Wallkill River near Unionville, N.Y.

Location.--Lat 41°15'35", long 74°32'55", on right bank at downstream side of highway bridge on the Quarryville-Milton road, 1 mile upstream from small tributary, 2 miles south of the New York-New Jersey State line, and 3 miles south of Unionville, Orange County.
Drainage area.--144 sq mi.
Duration data available.--Water years, 1938-60.
Average discharge.--23 years (1937-60), 224 cfs.
Extremes.--1937-60: Maximum discharge, 6,880 cfs Aug. 19, 1955; minimum, 6.4 cfs Sept. 30, 1941.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1938-60	cfs	1,280	1,020	750	540	350	128	44	27.5	19.8	14.8	12.2	10.6
	cfs/sq mi	8.89	7.08	5.21	3.75	2.43	.889	.306	.191	.137	.103	.085	.074
1931-60	cfs	1,280	1,020	740	530	335	126	42.5	26.5	19.8	14.8	12.0	10.6
	cfs/sq mi	8.89	7.08	5.14	3.68	2.33	.875	.295	.184	.137	.103	.083	.074

HACKENSACK RIVER BASIN

3770. Hackensack River at Rivervale

Location.--Lat 40°59'55", long 73°59'27", on right bank at Westwood Avenue, Rivervale, Bergen County, 1½ miles upstream from Pascack Brook, 4.6 miles upstream from Oradell Dam, and 27.2 miles upstream from mouth.
Drainage area.--58.0 sq mi.
Duration data available.--Water years, 1942-60.
Average discharge.--19 years (1941-60), 97.4 cfs (unadjusted).
Extremes.--1941-60: Maximum discharge, 1,450 cfs Oct. 17, 1955; minimum, 5.5 cfs Aug. 30, Sept. 2, 1953.
Remarks.--Flow regulated by DeForest Lake. Diversion at West Nyack, N.Y., for municipal water supply for city of Nyack, N.Y.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1942-60	cfs	540	420	290	210	140	63	27.0	18.4	13.8	10.0	8.4	7.2
	cfs/sq mi	9.31	7.24	5.00	3.62	2.41	1.09	.465	.317	.238	.172	.145	.124
1931-60	cfs	520	400	280	200	134	59	25.0	16.0	11.2	7.8	6.2	5.1
	cfs/sq mi	8.96	6.90	4.83	3.45	2.31	1.02	.431	.276	.193	.134	.107	.088

3775. Pascack Brook at Westwood

Location.--Lat 40°59'33", long 74°01'19", on right bank 75 ft upstream from Harrington Avenue in Westwood, Bergen County, 500 ft downstream from Musquapsink Brook,and 2.3 miles upstream from mouth.
Drainage area.--29.6 sq mi.
Duration data available.--Water years, 1935-60.
Average Discharge.--26 years (1934-1960), 52.8 cfs (unadjusted).
Extremes.--1934-60: Maximum discharge, 1,610 cfs July 23, 1945; minimum, 5.8 cfs Oct. 21, 1949; minimum daily, 6.1 cfs Oct. 21-25, Nov. 10, 11, 1949.
Remarks.--Flow regulated by Woodcliff Lake 3 miles above station. Water diverted for municipal supply by Spring Valley Water Works and Supply Co. by pumpage from well fields in headwater area of Pascack Brook in vicinity of Spring Valley, N.Y., and by Park Ridge Water Department by pumping from wells above Woodcliff Lake probably reduces flow past this station.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1935-60	cfs	300	218	140	100	70	38.0	20.5	14.0	11.0	9.3	8.5	8.0
	cfs/sq mi	10.1	7.36	4.73	3.34	2.36	1.28	.693	.473	.372	.314	.287	.270
1931-60	cfs	295	216	140	97	68	37.0	20.0	13.6	10.6	8.7	7.8	6.4
	cfs/sq mi	9.97	7.30	4.73	3.28	2.30	1.25	.676	.459	.358	.294	.264	.216

PASSAIC RIVER BASIN

3790. Passaic River near Millington

Location.--Lat 40°40'48", long 74°31'45", on right bank 200 ft downstream from Davis Bridge, in Somerset County, 0.7 mile northwest of Millington, Morris County, and 1.8 miles downstream from Black Brook.
Drainage area.--55.4 sq mi.
Duration data available.--Water years, 1905, 1922-60.
Average discharge.--40 years (1904-5, 1921-60), 88.3 cfs.
Extremes.--1903-6, 1921-60: Maximum discharge, 2,000 cfs Jan. 9, 1905; minimum, 0.9 cfs on several days in August 1932.
Remarks.--Diversion from Osborn Pond by Bernards Water Co. since June 24, 1903.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1905, 1922-60	cfs	570	460	320	224	138	47.5	14.4	8.5	5.9	3.40	2.20	1.78
	cfs/sq mi	10.3	8.30	5.78	4.04	2.49	.857	.260	.153	.106	.061	.040	.032
1931-60	cfs	550	445	315	224	140	47.0	13.8	7.9	5.0	2.70	1.98	1.64
	cfs/sq mi	9.93	8.03	5.69	4.04	2.53	.848	.249	.143	.090	.049	.036	.030

3795. Passaic River near Chatham

Location.--Lat 40°43'31", long 74°23'23", on left bank 150 ft downstream from Stanley Avenue Bridge in Chatham, Morris County, and 3 miles upstream from Canoe Brook.
Drainage area.--100 sq mi.
Duration data available.--Water years, 1904-11, 1938-60.
Average discharge.--31 years (1903-11, 1937-60), 168 cfs.
Extremes.--1903-11, 1937-60: Maximum discharge observed, about 3,000 cfs Jan. 9, 1905; minimum discharge, 2 cfs on many days in May and June, 1903, August and October 1905, September and October 1906, and Sept. 11, 1944.
Remarks.--Diversion from Osborn Pond by Bernards Water Co. since June 24, 1903.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1904-11, 1938-60	cfs	1,080	880	640	455	272	79	22.0	12.6	8.4	5.8	4.75	4.00
	cfs/sq mi	10.8	8.80	6.40	4.55	2.72	.790	.220	.126	.084	.058	.048	.040
1931-60	cfs	960	810	600	435	260	82	23.2	13.6	9.2	5.8	4.60	3.90
	cfs/sq mi	9.60	8.10	6.00	4.35	2.60	.820	.232	.136	.092	.058	.046	.039

3805. Rockaway River above reservoir, at Boonton

Location.--Lat 40°54'06", long 74°24'40", on right bank at Morris Avenue, Boonton, Morris County, 1.8 miles upstream from Boonton Reservoir Dam.
Drainage area.--116 sq mi.
Duration data available.--Water years, 1938-60.
Average discharge.--23 years (1937-60), 215 cfs (unadjusted).
Extremes.--1937-60: Maximum discharge, 3,250 cfs June 2, 1952; minimum, 1.5 cfs Mar. 1, 1938.
Remarks.--Flow regulated by Splitrock Reservoir 14½ miles above station. Town of Boonton diverts water for municipal supply from Taylortown Reservoir on Stony Brook and by pumping from wells in vicinity of Boonton. Most of this diversion is returned to Rockaway River 600 ft below gaging station on Rockaway River below reservoir, at Boonton as sewage effluent.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1938-60	cfs	1,160	920	660	500	350	160	65	42.0	31.0	23.2	19.8	17.6
	cfs/sq mi	10.0	7.93	5.69	4.31	3.02	1.38	.560	.362	.267	.200	.171	.152
1931-60	cfs	1,190	920	650	485	335	160	60	39.5	30.0	21.2	16.2	12.5
	cfs/sq mi	10.3	7.93	5.60	4.18	2.89	1.38	.517	.341	.259	.183	.140	.108

PASSAIC RIVER BASIN

3815. Whippany River at Morristown

Location.--Lat 40°48'21", long 74°27'22", on left bank at Morristown sewage-disposal plant, three-quarters of a mile downstream from Morristown, Morris County, and 9 miles upstream from mouth.
Drainage area.--29.4 sq mi.
Duration data available.--Water years, 1922-60.
Average discharge.--39 years (1921-60), 50.0 cfs.
Extremes.--1921-60: Maximum discharge, 2,000 cfs Aug. 26, 1928; minimum, 2.8 cfs Aug. 27, 1932.
Remarks.--Flow occasionally regulated by operation of gates in Pocahontas Dam, 2.5 miles above station.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1922-60	cfs	290	212	140	99	67	35.0	18.0	14.0	11.6	9.9	8.6	7.5
	cfs/sq mi	9.86	7.21	4.76	3.37	2.28	1.19	.612	.476	.395	.337	.293	.255
1931-60	cfs	285	212	140	98	67	35.5	18.2	14.2	12.0	10.0	8.4	7.0
	cfs/sq mi	9.69	7.21	4.76	3.33	2.28	1.21	.619	.483	.408	.340	.286	.238

3840. Wanaque River at Monks

Location.--Lat 41°07'14", long 74°17'41", on left bank just upstream from Wanaque Reservoir, at Monks, Passaic County.
Drainage area.--40.4 sq mi.
Duration data available.--Water years, 1935-60.
Average discharge.--26 years (1934-60), 82.9 cfs (unadjusted).
Extremes.--1934-60: Maximum discharge, 3,640 cfs Aug. 19, 1955; no flow for part of day in some years just after the waste gate was closed and water was below intake to ports.
Remarks.--Records include flow over spillway, through ports in dam, and down fish ladder in dam. Flow regulated by Greenwood Lake.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1935-60	cfs	520	410	275	194	126	50	10.2	70	5.5	4.45	3.95	3.50
	cfs/sq mi	12.9	10.1	6.81	4.80	3.12	1.24	.259	.173	.136	.110	.098	.087
1931-60	cfs	520	410	280	204	126	49.5	9.8	6.7	5.2	4.25	3.90	3.60
	cfs/sq mi	12.9	10.1	6.93	5.05	3.12	1.23	.243	.166	.129	.105	.097	.089

3845. Ringwood Creek near Wanaque

Location.--Lat 41°07'36", long 74°15'52", on right bank 500 ft upstream from Wanaque Reservoir, 0.7 mile downstream from Ringwood Mill Pond Dam, and 6½ miles north of Wanaque, Passaic County.
Drainage area.--19.1 sq mi.
Duration data available.--Water years, 1935-60.
Average discharge.--26 years (1934-60), 33.4 cfs.
Extremes.--1934-60: Maximum discharge, 1,150 cfs Mar. 30, 1951; no flow for part of day in most years just after waste gate was closed and water was below intake to ports.
Remarks.--Records include flow over spillway and through ports in dam or through waste gate in dam. Flow slightly regulated by Ringwood Mill Pond, Sterling, and Sterling Forest Lakes, and several smaller lakes above station.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1935-60	cfs	202	150	104	76	52	21.4	5.3	2.20	1.46	.97	.74	.60
	cfs/sq mi	10.6	7.85	5.45	3.98	2.72	1.12	.277	.115	.076	.051	.039	.031
1931-60	cfs	200	157	104	77	52	20.4	4.8	2.04	1.30	.86	.71	.62
	cfs/sq mi	10.5	8.22	5.45	4.03	2.72	1.07	.251	.107	.068	.045	.037	.032

PASSAIC RIVER BASIN

3850. Cupsaw Brook near Wanaque

Location.--Lat 41°06'32", long 74°15'16", on left bank just upstream from Wanaque Reservoir, 0.3 mile downstream from Cupsaw Lake and 5 miles north of Wanaque, Passaic County.
Drainage area.--4.38 sq mi.
Duration data available.--Water years, 1935-58.
Average discharge.--23 years (1935-58), 8.01 cfs.
Extremes.--1934-58: Maximum discharge, 536 cfs Mar. 11, 1936; no flow for some days during most years.
Remarks.--Records include flow over spillway and through ports in dam. Flow occasionally regulated by Cupsaw Lake and Sheppard Pond.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1935-58	cfs	59.0	44.5	29.0	19.4	12.6	3.70	.52	.270	.174	.108	.080	.062
	cfs/sq mi	13.5	10.2	6.62	4.43	2.88	.845	.119	.062	.040	.025	.018	.014
1931-60	cfs	60	45.0	29.0	19.6	12.6	3.70	.51	.270	.164	.102	.081	.070
	cfs/sq mi	13.7	10.3	6.62	4.47	2.88	.845	.116	.062	.037	.023	.018	.016

3860. West Brook near Wanaque

Location.--Lat 41°04'16", long 74°18'45", on right bank just upstream from Wanaque Reservoir, 2½ miles northwest of Wanaque, Passaic County.
Drainage area.--11.8 sq mi.
Duration data available.--Water years, 1935-60.
Average discharge.--26 years (1934-60), 24.2 cfs.
Extremes.--1934-60: Maximum discharge, 1,900 cfs Mar. 30, 1951; no flow for part of day in most years just after waste gate was closed and water was below intake to ports.
Remarks.--Records include flow over spillway and through ports in dam or through waste gate in dam. Flow slightly regulated by several lakes above station.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1935-60	cfs	180	130	79	54	35.0	13.6	3.80	2.18	1.52	1.08	.87	.74
	cfs/sq mi	15.3	11.0	6.69	4.58	2.97	1.15	.322	.185	.129	.092	.074	.063
1931-60	cfs	184	130	80	55	35.5	12.6	3.50	2.04	1.38	.96	.82	.73
	cfs/sq mi	15.6	11.0	6.78	4.66	3.01	1.07	.297	.173	.117	.081	.069	.062

3865. Blue Mine Brook near Wanaque

Location.--Lat 41°03'04", long 74°19'10", on left bank 0.2 mile upstream from Wanaque Reservoir and 1.8 miles northwest of Wanaque, Passaic County.
Drainage area.--1.71 sq mi.
Duration data available.--Water years, 1935-58.
Average discharge.--24 years (1934-58), 2.30 cfs.
Extremes.--1934-58: Maximum discharge, 458 cfs Mar. 30, 1951; no flow for many days during most years.
Remarks.--Records include flow over control and through ports.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1935-58	cfs	19.6	13.0	7.8	5.1	3.2	1.16	.230	.112	.072	.047	.037	.032
	cfs/sq mi	11.5	7.68	4.56	2.98	1.87	.678	.135	.065	.042	.027	.022	.019
1931-60	cfs	18.6	12.6	7.9	5.2	3.10	1.18	.220	.108	.069	.047	.039	.034
	cfs/sq mi	10.9	7.37	4.62	3.04	1.81	.690	.129	.063	.040	.027	.023	.020

PASSAIC RIVER BASIN

3875. Ramapo River near Mahwah

Location.--Lat 41°05'51", long 74°09'48", on left bank 350 ft downstream from State Highway 17, 0.6 mile downstream from Mahwah River, and 1.0 mile west of Mahwah, Bergen County.
Drainage area.--118 sq mi.
Duration data available.--Water years, 1903-6, 1923-60.
Average discharge.--42 years (1902-6, 1922-60), 229 cfs.
Extremes.--1902-6, 1922-60: Maximum discharge, about12,400 cfs Oct. 9, 1903; minimum, 7 cfs Dec. 16, 1930, Sept. 12, 1932; minimum daily, 8 cfs Aug. 25, 1929, Sept. 5, 12, 1932.
Remarks.--Diurnal fluctuation occasionally at low flow caused by powerplants above station.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1903-6, 1923-60	cfs	1,440	1,100	730	520	335	140	50	31.5	23.2	17.6	15.0	13.0
	cfs/sq mi	12.2	9.32	6.17	4.41	2.84	1.19	.424	.267	.197	.149	.127	.110
1931-60	cfs	1,440	1,080	720	500	325	134	48.0	29.5	21.8	16.8	14.8	13.6
	cfs/sq mi	12.2	9.15	6.10	4.24	2.75	1.14	.407	.250	.185	.142	.125	.115

3880. Ramapo River at Pompton Lakes

Location.--Lat 40°59'33", long 74°16'44", on right end of dam at pumping station in Pompton Lakes, Passaic County, 2.0 miles upstream from mouth.
Drainage area.--160 sq mi.
Duration data available.--Water years, 1922-60.
Average discharge.--39 years (1921-60), 299 cfs (adjusted for diversion since Dec. 1, 1953).
Extremes.--1921-60: Maximum discharge, 12,300 cfs Mar. 12, 1936; practically no flow for several days in October, November 1922, August, September 1923, July 1927, and on Oct. 20, 1933.
Remarks.--Since December 1953, water diverted by North Jersey District Water Supply Commission to Wanaque Reservoir for municipal supply. Slight regulation by Pompton Lakes (capacity, 300,000,000 gal).

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1922-60	cfs	1,800	1,420	940	660	425	182	70	44.5	32.5	21.0	10.2	3.85
	cfs/sq mi	11.2	8.88	5.88	4.12	2.66	1.14	.438	.278	.203	.131	.064	.024
1931-60	cfs	1,780	1,360	920	650	435	182	67	44	33.5	24.8	19.0	7.0
	cfs/sq mi	11.1	8.50	5.75	4.06	2.72	1.14	.419	.275	.209	.155	.119	.044

3885. Pompton River at Pompton Plains

Location.--Lat 40°58'13", long 74°16'35", at confluence of Pequannock and Ramapo Rivers, 2,000 ft upstream from Jackson Avenue Bridge and three-quarters of a mile east of Pompton Plains, Morris County.
Drainage area.--355 sq mi.
Duration data available.--Water years, 1904, 1941-60.
Average discharge.--21 years (1903-4, 1940-60), 502 cfs (unadjusted).
Extremes.--1903-4, 1940-60: Maximum discharge observed, 28,340 cfs Oct. 10, 1903; no flow Aug. 18-20, 1904.
Remarks.--Water diverted from reservoirs on Pequannock and Wanaque Rivers for municipal supply. Flow regulated by Oak Ridge, Canistear, Clinton, and Echo Lake Reservoirs on Pequannock River and by Greenwood Lake and Wanaque Reservoir on Wanaque River. Some diurnal fluctuations at low flow caused by powerplant on Wanaque River.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1904, 1941-60	cfs	3,100	2,360	1,600	1,100	700	275	122	88	70	57	50	21.6
	cfs/sq mi	8.73	6.65	4.51	3.10	1.97	.775	.344	.248	.197	.161	.141	.061
1931-60	cfs	3,050	2,360	1,600	1,080	680	275	114	84	68	56	48.0	27.7
	cfs/sq mi	8.59	6.65	4.51	3.04	1.92	.775	.321	.237	.192	.158	.135	.078

PASSAIC RIVER BASIN

3895. Passaic River at Little Falls

Location.--Lat 40°53'05", long 74°13'35", on left bank 0.6 mile downstream from Beatties Dam in Little Falls, Passaic County, and 1 mile upstream from Peckman River.
Drainage area.--762 sq mi.
Duration data available.--Water years, 1898-1960.
Average discharge.--63 years (1897-1960), 1,202 cfs (unadjusted).
Extremes.--1897-1960: Maximum daily discharge, 28,000 cfs Oct. 10, 1903; no flow July 3-5, 1904, July 16, 23, 1905.
Remarks.--Diurnal fluctuation at maximum and low flow caused by hydroelectric plant at Beatties Dam. Flow regulated by reservoirs in Rockaway, Pequannock, and Wanaque River basins. Large diversions for municipal supply from Passaic River above Beatties Dam and from Rockaway, Pequannock, and Wanaque Rivers. In addition, the Commonwealth Water Co. diverts small amounts from Canoe Brook near Summit and from Passaic River; that company and the city of East Orange also divert water for municipal supply by pumping from wells.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1898-60	cfs	6,600	5,300	3,850	2,900	1,960	700	202	126	79	45.5	31.5	22.4
	cfs/sq mi	8.66	6.96	5.05	3.81	2.57	.919	.265	.165	.104	.060	.041	.029
1931-60	cfs	6,000	4,900	3,650	2,750	1,880	690	200	124	78	45.5	31.0	20.2
	cfs/sq mi	7.87	6.43	4.79	3.61	2.47	.906	.262	.163	.102	.060	.041	.027

3905. Saddle River at Ridgewood

Location.--Lat 40°59'05", long 74°05'30", on left bank 15 ft upstream from bridge on State Highway 17 at Ridgewood, Bergen County, and 2¾ miles upstream from Hohokus Brook.
Drainage area.--21.6 sq mi.
Duration data available.--Water years, 1955-60.
Average discharge.--6 years (1954-60), 37.4 cfs.
Extremes.--1954-60: Maximum discharge, 1,510 cfs Aug. 19, 1955; minimum daily, 3.3 cfs July 28, 1957.
Remarks.--Diurnal fluctuation at low and medium flows caused by unknown source.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1955-60	cfs	214	158	100	70	52	25.5	13.2	9.7	8.0	6.2	4.80	4.35
	cfs/sq mi	9.91	7.31	4.63	3.24	2.41	1.18	.611	.449	.370	.287	.222	.201
1931-60	cfs	206	156	97	69	51	23.4	10.2	7.0	5.5	4.25	3.65	3.20
	cfs/sq mi	9.54	7.22	4.49	3.19	2.36	1.08	.472	.324	.255	.197	.169	.148

3910. Hohokus Brook at Hohokus

Location.--Lat 40°59'52", long 74°06'48", on left bank 500 ft upstream from Maple Avenue Bridge in Hohokus, Bergen County, and 3.5 miles upstream from mouth.
Drainage area.--16.4 sq mi.
Duration data available.--Water years, 1955-60.
Average discharge.--6 years (1954-60), 30.2 cfs.
Extremes.--1954-60: Maximum discharge, 2,350 cfs Aug. 19, 1955; minimum daily, 3.2 cfs Aug. 6, 1955, Aug. 7, 1957.
Remarks.--Some regulation at low and medium flows caused by unknown source.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1955-60	cfs	182	132	81	56	39.0	22.0	10.8	7.6	6.0	4.80	4.30	3.90
	cfs/sq mi	11.1	8.05	4.94	3.41	2.38	1.34	.659	.463	.366	.293	.262	.238
1931-60	cfs	178	128	79	54	39.0	19.8	8.1	5.2	4.60	4.00	3.65	3.40
	cfs/sq mi	10.9	7.80	4.82	3.29	2.38	1.21	.494	.317	.280	.244	.223	.207

PASSAIC RIVER BASIN

3915. Saddle River at Lodi

Location.--Lat 40°53'25", long 74°04'51", on left bank 560 ft upstream from Outwater Lane Bridge in Lodi, Bergen County, and 3¼ miles upstream in from mouth.
Drainage area.--54.6 sq mi.
Duration data available.--Water years, 1924-60.
Average discharge.--37 years (1923-60), 97.3 cfs.
Extremes.--1923-60: Maximum discharge, 3,500 cfs July 23, 1945; minimum, 1 cfs May 25, 1935; minimum daily, 6 cfs Aug. 4, 1930, Aug. 23, 1934.
Remarks.--Occasional regulation at low flow by mills above station.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1924-60	cfs	520	390	260	188	134	69	35.5	26.2	21.0	16.6	14.4	12.6
	cfs/sq mi	9.52	7.14	4.76	3.44	2.45	1.26	.650	.480	.385	.304	.264	.231
1931-60	cfs	540	405	270	192	138	71	36.0	26.0	20.6	16.1	14.0	12.3
	cfs/sq mi	9.89	7.42	4.95	3.52	2.53	1.30	.659	.476	.377	.295	.256	.225

3920. Weasel Brook at Clifton

Location.--Lat 40°52'12", long 74°08'47", at right end of masonry dam at Jewett Street in Clifton, Passaic County.
Drainage area.--4.45 sq mi.
Duration data available.--Water years, 1938-60.
Average discharge.--23 years (1937-60), 5.86 cfs.
Extremes.--1937-60: Maximum discharge recorded, 496 cfs Sept. 12, 1960; no flow for many days when waste gate was closed and water was below spillway.
Remarks.--Occasional regulation by mill above station.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1938-60	cfs	46.0	33.5	18.8	12.0	7.3	3.55	1.70	.87	.350	.088	.032	.013
	cfs/sq mi	10.3	7.53	4.22	2.70	1.64	.798	.382	.196	.079	.020	.007	.003
1931-60	cfs	48.0	34.0	18.6	11.6	6.9	3.55	1.58	.78	.300	.052	.008	.001
	cfs/sq mi	10.8	7.64	4.18	2.61	1.55	.798	.355	.175	.067	.012	.002	.0002

3925. Second River at Belleville

Location.--Lat 40°47'17", long 74°10'19", on right bank at Belleville, Essex County, 300 ft downstream from Hendricks Brook, 360 ft downstream from Franklin Avenue, 1,100 ft downstream from Hendricks Pond Dam, and 1.4 miles upstream from mouth.
Drainage area.--11.6 sq mi.
Duration data available.--Water years, 1938-60.
Average discharge.--23 years (1937-60), 18.3 cfs.
Extremes.--1937-60: Maximum discharge, 3,300 cfs July 23, 1938; minimum, 0.8 cfs July 29, 1941.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1938-60	cfs	162	118	64	34.5	19.6	10.0	6.8	5.4	4.50	3.85	3.50	3.19
	cfs/sq mi	14.0	10.2	5.52	2.97	1.69	.862	.586	.466	.388	.332	.302	.275
1931-60	cfs	154	108	60	33.5	19.0	9.5	5.9	4.50	3.90	3.45	3.20	3.09
	cfs/sq mi	13.3	9.31	5.17	2.89	1.64	.819	.509	.388	.336	.297	.276	.266

ELIZABETH RIVER BASIN

3930. Elizabeth River at Irvington

Location.--Lat 40°44'10", long 74°13'46", on right bank 135 ft downstream from Valley Avenue Bridge, in Irvington, Essex County.
Drainage area.--2.91 sq mi.
Duration data available.--Water years, 1931-38.
Average discharge.--8 years (1930-38), 5.23 cfs.
Extremes.--1930-38: Maximum discharge, 1,750 cfs July 23, 1938; minimum daily discharge, 0.1 cfs Oct. 8-10, 1935, Jan. 8, 1936.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1931-38	cfs	52	37.0	19.8	9.9	4.50	2.48	1.70	1.32	1.08	.81	.61	.400
	cfs/sq mi	17.9	12.7	6.80	3.40	1.55	.852	.584	.454	.371	.278	.210	.137
1931-60	cfs	62	43.5	24.0	12.4	5.6	3.00	2.10	1.74	1.46	1.08	.84	.67
	cfs/sq mi	21.3	14.9	8.25	4.26	1.92	1.03	.722	.598	.502	.371	.289	.230

3935. Elizabeth River at Elizabeth

Location.--Lat 40°40'03", long 74°13'09", on left bank 85 ft upstream from Westfield Avenue Bridge in Elizabeth, Union County, and 3.3 miles upstream from mouth.
Drainage area.--20.2 sq mi, of which 2.2 sq mi contributes to a storm sewer which bypasses the station.
Duration data available.--Water years, 1922-60.
Average discharge.--39 years (1921-60), 23.6 cfs (unadjusted).
Extremes.--1921-60: Maximum discharge, 2,720 cfs July 23, 1938; no flow many times.
Remarks.--Diversion by pumpage from Hammock well field, in Union, for municipal supply by Elizabethtown Water Co. probably reduces the flow past the station. Elizabethtown Water Co. diverted water for municipal supply from Ursino Lake in Elizabeth prior to 1929. Occasional regulation by Ursino Lake.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1922-60	cfs	218	152	85	48.5	25.0	11.4	6.9	4.70	2.95	1.30	.310	0
	cfs/sq mi	12.1	8.44	4.72	2.69	1.39	.633	.383	.261	.164	.072	.017	0
1931-60	cfs	220	156	88	50	26.0	12.0	7.4	5.7	4.50	3.00	1.50	1.00
	cfs/sq mi	12.2	8.67	4.89	2.78	1.44	.667	.411	.317	.250	.167	.083	.056

RAHWAY RIVER BASIN

3945. Rahway River near Springfield

Location.--Lat 40°41'11", long 74°18'44", on left bank 50 ft downstream from bridge on U.S. Highway 22, 100 ft downstream from Pope Brook, and 1½ miles south of Springfield, Union County.
Drainage area.--25.5 sq mi.
Duration data available.--Water years, 1939-60.
Average discharge.--22 years (1938-60), 26.6 cfs (unadjusted).
Extremes.--1938-60: Maximum discharge, 1,940 cfs July 23, 1938; minimum, 0.9 cfs Sept. 7-9, 11, 12, 1944, Oct. 4, 5, 1957.
Remarks.--Water for municipal supply diverted from river by city of Orange. The flow past this station is affected by diversions by pumpage from wells by Orange, South Orange, Short Hills Water Co., and Springfield station of Elizabethtown Water Co.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1939-60	cfs	305	198	100	56	29.5	10.4	4.6	3.25	2.55	2.04	1.82	1.64
	cfs/sq mi	12.0	7.76	3.92	2.20	1.16	.408	.180	.127	.100	.080	.071	.064
1931-60	cfs	290	196	102	55	29.0	11.4	5.3	3.70	2.85	2.18	1.92	1.74
	cfs/sq mi	11.4	7.69	4.00	2.16	1.14	.447	.208	.145	.112	.085	.075	.068

RAHWAY RIVER BASIN

3950. Rahway River at Rahway

Location.--Lat 40°37'05", long 74°17'00", on left bank 100 ft upstream from St. Georges Avenue Bridge in Rahway, Union County, and 0.9 mile upstream from Robinsons Branch.
Drainage area.--40.9 sq mi.
Duration data available.--Water years, 1922-60.
Average discharge.--39 years (1921-60), 45.4 cfs (unadjusted).
Extremes.--1921-60: Maximum discharge, 3,140 cfs July 24, 1938; minimum daily, 0.1 cfs Aug. 21-24, 1957, July 9, 1959.
Remarks.--Water for municipal supply diverted from river by Rahway and Orange. The flow past this station is affected by diversions by pumpage from wells by Orange, South Orange, Short Hills Water Co., and Springfield station of Elizabethtown Water Co.

		Percent of time discharge indicated was equaled or exceeded										
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1922-60	cfs	450	315	174	96	51	20.6	8.6	5.2	3.20	1.44	.95	.65
	cfs/sq mi	11.0	7.70	4.25	2.35	1.25	.504	.210	.127	.078	.035	.023	.016
1931-60	cfs	455	320	176	95	50	20.0	7.7	4.40	2.55	1.24	.80	.56
	cfs/sq mi	11.1	7.82	4.30	2.32	1.22	.489	.188	.108	.062	.030	.020	.014

3960. Robinsons Branch Rahway River at Rahway

Location.--Lat 40°36'20", long 74°17'57", on right bank of Milton Lake 2,000 ft upstream from Madison Avenue in Rahway, Union County, 3,200 ft downstream from Middlesex Reservoir Dam, and 1.6 miles upstream from mouth.
Drainage area.--21.6 sq mi.
Duration data available.--Water years, 1940-60.
Average discharge.--21 years (1939-60), 24.3 cfs (unadjusted).
Extremes.--1939-60: Maximum discharge, 1,490 cfs Mar. 13, 1953; no flow at times.
Remarks.--Water for municipal supply diverted by Middlesex Water Co. from Middlesex Reservoir 3,200 ft above station. Some regulation by Middlesex Reservoir (capacity, 300,000,000 gal).

		Percent of time discharge indicated was equaled or exceeded										
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1940-60	cfs	325	232	118	57	24.0	6.4	1.28	.57	.100	0	0	0
	cfs/sq mi	15.0	10.7	5.46	2.64	1.11	.296	.059	.026	.005	0	0	0
1931-60	cfs	315	225	116	56	24.0	7.8	1.74	.80	.265	0	0	0
	cfs/sq mi	14.6	10.4	5.37	2.59	1.11	.361	.081	.037	.012	0	0	0

RARITAN RIVER BASIN

3965. South Branch Raritan River near High Bridge

Location.--Lat 40°40'40", long 74°52'45", on left bank 1.0 mile northeast of High Bridge, Hunterdon County, and 4.4 miles upstream from Spruce Run.
Drainage area.--65.3 sq mi.
Duration data available.--Water years, 1919-60.
Average discharge.--42 years (1918-60), 119 cfs.
Extremes.--1918-60: Maximum discharge, 5,160 cfs Mar. 15, 1940; minimum, 6.6 cfs Oct. 11, 1930; minimum daily, 17 cfs Jan. 8, 1940.
Remarks.--Slight diurnal fluctuation caused by small powerplant above station.

		Percent of time discharge indicated was equaled or exceeded										
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1919-60	cfs	620	480	315	228	162	85.0	44.0	35.0	30.0	25.5	23.4	22.0
	cfs/sq mi	9.49	7.35	4.82	3.49	2.48	1.30	.674	.536	.459	.391	.358	.337
1931-60	cfs	620	480	315	228	162	81.0	42.5	33.5	28.5	25.0	23.0	21.8
	cfs/sq mi	9.49	7.35	4.82	3.49	2.48	1.24	.651	.513	.436	.383	.352	.334

RARITAN RIVER BASIN

3970. South Branch Raritan River at Stanton

Location.--Lat 40°34'21", long 74°52'10", on right bank at downstream side of highway bridge at Stanton railroad station, Readington Township, Hunterdon County, 0.4 mile upstream from Prescott Brook.
Drainage area.--147 sq mi.
Duration data available.--Water years, 1904-6, 1920-60.
Average discharge.--44 years (1903-6, 1919-60), 243 cfs.
Extremes.--1903-6, 1919-60: Maximum discharge, 18,000 cfs Aug. 19, 1955; minimum, 9 cfs Nov. 7, 1931; minimum daily, 20 cfs Sept. 22, 1939.
Remarks.--Slight diurnal fluctuation caused by small powerplants above station and occasional regulation at low flow by ponds above station.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1904-6,	cfs	1,420	1,060	680	480	330	170	78	58	47.0	38.5	34.0	30.5
1920-60	cfs/sq mi	9.66	7.21	4.63	3.27	2.24	1.16	.531	.395	.320	.262	.231	.207
1931-60	cfs	1,480	1,080	680	480	330	162	77	55	44.0	36.0	32.0	29.0
	cfs/sq mi	10.1	7.35	4.63	3.27	2.24	1.10	.524	.374	.299	.245	.218	.197

3975. Walnut Brook near Flemington

Location.--Lat 40°30'55", long 74°52'52", on right bank 1.2 miles northwest of Flemington, Hunterdon County, and 2.3 miles upstream from mouth.
Drainage area.--2.24 sq mi.
Duration data available.--Water years, 1937-60.
Average discharge.--24 years (1936-60), 3.20 cfs.
Extremes.--1936-60: Maximum discharge, 645 cfs July 18, 1945; no flow at times.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1937-60	cfs	36.5	24.0	12.8	7.6	4.2	1.20	.168	.065	.0218	0	0	0
	cfs/sq mi	16.3	10.7	5.71	3.39	1.87	.536	.075	.029	.0097	0	0	0
1931-60	cfs	36.0	23.2	12.0	7.0	4.05	1.16	.162	.059	.0158	.0031	0	0
	cfs/sq mi	16.1	10.4	5.36	3.12	1.81	.518	.072	.026	.0071	.001	0	0

3980. Neshanic River at Reaville

Location.--Lat 40°28'18", long 74°49'42", on left bank 50 ft downstream from highway bridge, 0.6 mile southwest of Reaville, Hunterdon County, 1½ miles downstream from Third Neshanic River, and 2.2 miles upstream from Back Brook.
Drainage area.--25.7 sq mi.
Duration data available.--Water years, 1931-60.
Average discharge.--30 years (1930-60), 35.1 cfs.
Extremes.--1930-60: Maximum discharge, 10,300 cfs July 18, 1945; minimum, 0.1 cfs Aug. 16, 17, 1957.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1931-60	cfs	440	265	128	73	41.5	11.4	2.50	1.50	1.08	.75	.61	.490
	cfs/sq mi	17.1	10.3	4.98	2.84	1.61	.444	.097	.058	.042	.029	.024	.019

RARITAN RIVER BASIN

3985. North Branch Raritan River near Far Hills

Location.--Lat 40°42'30", long 74°38'11", on left bank 75 ft upstream from Ravine Lake Dam, 1.6 miles north of Far Hills, Somerset County, and 2.3 miles upstream from Peapack Brook.
Drainage area.--26.2 sq mi.
Duration data available.--Water years, 1922-60.
Average discharge.--39 years (1921-60), 47.5 cfs.
Extremes.--1921-60: Maximum discharge, 3,410 cfs Mar. 15, 1940; no flow at times when Ravine Lake was filling.
Remarks.--Records include occasional diversion of about 2 cfs by small turbine at dam.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1922-60	cfs	270	200	134	97	67	33.0	15.0	10.4	7.9	5.6	4.45	3.20
	cfs/sq mi	10.3	7.63	5.11	3.70	2.56	1.26	.573	.397	.302	.214	.170	.122
1931-60	cfs	270	200	134	97	68	33.0	14.4	9.9	7.5	5.2	3.85	2.70
	cfs/sq mi	10.3	7.63	5.11	3.70	2.60	1.26	.550	.378	.286	.198	.147	.103

3995. Lamington (Black) River near Pottersville

Location.--Lat 40°43'39", long 74°43'50", on right bank 1.1 miles upstream from bridge on State Highway 512, 1.2 miles northwest of Pottersville, Somerset County, and 5.5 miles upstream from Cold Brook.
Drainage area.--32.8 sq mi.
Duration data available.--Water years, 1922-60.
Average discharge.--39 years (1921-60), 56.0 cfs.
Extremes.--1921-60: Maximum discharge, 2,630 cfs Mar. 15, 1940; minimum, 1.3 cfs Oct. 4, 1930.
Remarks.--Flow regulated occasionally by pond above station.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1922-60	cfs	216	180	140	112	85	44.5	20.8	14.4	10.8	7.9	6.1	5.0
	cfs/sq mi	6.59	5.49	4.27	3.41	2.59	1.36	.634	.439	.329	.241	.186	.152
1931-60	cfs	218	180	142	112	85	44.5	20.2	14.2	11.0	8.3	6.3	5.0
	cfs/sq mi	6.65	5.49	4.33	3.41	2.59	1.36	.616	.433	.335	.253	.192	.152

4000. North Branch Raritan River near Raritan

Location.--Lat 40°34'10", long 74°40'45", on right bank 400 ft upstream from U.S. Highway 202, 1.4 miles upstream from confluence with South Branch, and 2 miles west of Raritan, Somerset County.
Drainage area.--190 sq mi.
Duration data available.--Water years, 1924-60.
Average discharge.--37 years (1923-60), 295 cfs.
Extremes.--1923-60: Maximum discharge, 20,700 cfs Aug. 19, 1955; minimum observed, about 3 cfs Nov. 28, 1930, result of freezeup; minimum daily, 8 cfs Nov. 30, 1930.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1924-60	cfs	2,380	1,540	900	600	385	178	76	52	39.5	29.0	23.8	20.0
	cfs/sq mi	12.5	8.12	4.74	3.16	2.03	.937	.400	.274	.208	.153	.125	.105
1931-60	cfs	2,300	1,520	890	590	385	180	74	50	38.5	28.0	22.6	18.8
	cfs/sq mi	12.1	8.00	4.68	3.11	2.03	.947	.389	.263	.203	.147	.119	.099

RARITAN RIVER BASIN

4005. Raritan River at Manville

Location.--Lat 40°33'18", long 74°35'02", on left bank at downstream side of highway bridge at Manville, Somerset County, 1.4 miles upstream from Millstone River.
Drainage area.--490 sq mi.
Duration data available.--Water years, 1904-6, 1922-60.
Average discharge.--42 years (1903-6, 1921-60), 757 cfs (unadjusted).
Extremes.--1903-7, 1921-60: Maximum discharge, 36,100 cfs Sept. 22, 1938; minimum daily discharge, 22 cfs Aug. 20, 1957 (does not include water diverted to Johns-Manville plant).
Remarks.--Records represent flow at gage only. Diversion to Johns-Manville plant, 1,500 ft above station, returned to river 0.6 mile below station. Slight diurnal fluctuation at low flow.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1904-6, 1922-60	cfs	5,900	4,100	2,440	1,560	990	430	170	114	87	63	51	43.0
	cfs/sq mi	12.0	8.37	4.98	3.18	2.02	.878	.347	.233	.178	.129	.104	.088
1931-60	cfs	5,700	4,000	2,420	1,580	990	425	160	105	81	56	47.5	40.5
	cfs/sq mi	11.6	8.16	4.94	3.22	2.02	.867	.327	.214	.165	.114	.097	.083

4010. Stony Brook at Princeton

Location.--Lat 40°19'59", long 74°40'56", on right bank 12 ft downstream from bridge on U.S. Highway 206, 1.6 miles southwest of Princeton, Mercer County, and 4 miles upstream from Lake Carnegie.
Drainage area.--44.5 sq mi.
Duration data available.--Water years, 1954-60.
Average discharge.--7 years (1953-60), 55.7 cfs.
Extremes.--1953-60: Maximum discharge, 5,130 cfs Aug. 13, 1955; minimum, 0.02 cfs Aug. 5, 1955.
Remarks.--Some regulation by several small reservoirs, the first of which was completed in July 1959 (combined capacity, 49,800,000 gal).

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1954-60	cfs	690	455	232	120	63	17.4	3.00	1.30	.62	.230	.154	.112
	cfs/sq mi	15.5	10.2	5.21	2.70	1.42	.391	.067	.029	.014	.0052	.0035	.0025
1931-60	cfs	790	490	240	128	68	20.4	3.90	2.04	1.20	.63	.340	.222
	cfs/sq mi	17.8	11.0	5.39	2.88	1.53	.458	.088	.046	.027	.014	.0076	.0050

4015. Millstone River near Kingston

Location.--Lat 40°23'05", long 74°37'29", on left bank at Princeton sewage disposal plant, 0.8 mile north of Kingston, Middlesex County, 0.8 mile downstream from Heathcote Brook and 1.1 miles downstream from Lake Carnegie Dam.
Drainage area.--171 sq mi.
Duration data available.--Water years, 1934-49.
Average discharge.--16 years (1933-49), 239 cfs.
Extremes.--1933-49: Maximum discharge, 9,820 cfs Sept. 21, 1938; minimum daily, about 2 cfs Aug. 21, 23, Sept. 5, 7, 1944.
Remarks.--Considerable diversion to or inflow from Delaware & Raritan Canal above station. Flow slightly regulated by Lake Carnegie (capacity, 310,000,000 gal) 1.1 miles above station. Some diurnal fluctuation at low flow caused by gristmill above station.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1934-49	cfs	1,740	1,260	740	480	305	146	72	47.5	30.0	15.4	10.2	6.6
	cfs/sq mi	10.2	7.37	4.33	2.81	1.78	.854	.421	.278	.175	.090	.060	.039
1931-60	cfs	1,740	1,160	700	455	300	144	63	38.5	24.8	13.4	9.4	6.6
	cfs/sq mi	10.2	6.78	4.09	2.66	1.75	.842	.368	.225	.145	.078	.055	.039

RARITAN RIVER BASIN

4020. Millstone River at Blackwells Mills

Location.--Lat 40°28'30", long 74°34'34", on left bank 30 ft downstream from highway bridge at Blackwells Mills, Somerset County, and 0.3 mile downstream from Six Mile Run.
Drainage area.--258 sq mi.
Duration data available.--Water years, 1922-60.
Average discharge.--39 years (1921-60), 365 cfs.
Extremes.--1921-60: Maximum discharge, 18,300 cfs Sept. 21, 1938; minimum, about 5 cfs Sept. 16, 1923.
Remarks.--Inflow to and losses from Delaware & Raritan Canal above station. Flow slightly regulated by Lake Carnegie (capacity, 310,000,000 gal) and by several smaller reservoirs, the first of which was completed in July 1959 (combined capacity, 49,800,000 gal).

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1922-60	cfs	2,750	2,060	1,280	800	470	200	92	64	45.5	29.0	21.0	16.2
	cfs/sq mi	10.7	7.98	4.96	3.10	1.82	.775	.357	.248	.176	.112	.081	.063
1931-60	cfs	2,750	2,100	1,300	790	470	196	85	59	43.5	27.5	19.0	15.0
	cfs/sq mi	10.7	8.14	5.04	3.06	1.82	.760	.329	.229	.169	.107	.074	.058

4030. Raritan River at Bound Brook

Location.--Lat 40°33'00", long 74°33'05", on left bank 120 ft upstream from Calco Dam and Cuckold Brook, 1 mile downstream from Millstone River, and 1.3 miles southwest of borough of Bound Brook, Somerset County.
Drainage area.--779 sq mi.
Duration data available.--Water years, 1904-8, 1945-60.
Average discharge.--21 years (1903-8, 1944-60), 1,250 cfs (adjusted for diversion since 1944).
Extremes.--1903-9, 1945-60: Maximum discharge, 32,100 cfs Oct. 10, 1903; minimum daily, 40 cfs Sept. 6, 1957.
Remarks.--Records since 1944 include water diverted 150 ft above dam to Calco plant and returned to river just below dam. Water diverted 1 mile above station by Elizabethtown Water Co. for municipal supply. No diversion prior to 1918. Slight diurnal fluctuation at low flow.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1904-8, 1945-60	cfs	9,300	6,900	4,150	2,600	1,600	720	315	208	150	102	78	64
	cfs/sq mi	11.9	8.86	5.33	3.34	2.05	.924	.404	.267	.193	.131	.100	.082
1931-60	cfs	8,600	6,400	3,950	2,460	1,520	610	255	176	134	78	58	44.5
	cfs/sq mi	11.0	8.22	5.07	3.16	1.95	.783	.327	.226	.172	.100	.074	.057

4035. Green Brook at Plainfield

Location.--Lat 40°36'53", long 74°25'55", on left bank 20 ft downstream from Sycamore Avenue Bridge in Plainfield, Union County, and 1 mile upstream from Stony Brook.
Drainage area.--9.75 sq mi.
Duration data available.--Water years, 1939-60.
Average discharge.--22 years (1938-60), 12.2 cfs (unadjusted).
Extremes.--1938-60: Maximum discharge, 2,890 cfs July 23, 1938 (an additional peak overflow of about 4,400 cfs bypassed gage based on computation of flow over Lower Seeley Dam 4.4 miles upstream by New Jersey Department of Conservation and Economic Development); no flow at times.
Remarks.--Water diverted from Baltusrol well field by Commonwealth Water Co. and from wells in vicinity of Mountainside and Scotch Plains by Plainfield-Union Water Co. for municipal supply and from private and industrial wells in Plainfield and vicinity. Diurnal fluctuation at low flow caused by pumping from wells near river in Plainfield. During extreme high stages considerable overflow above gage from Green Brook basin to adjacent Cedar Brook basin which returns to Green Brook 5.1 miles below gage by way of Bound Brook.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1939-60	cfs	118	85	46.5	27.5	15.6	5.4	1.46	.74	.460	.275	.130	.094
	cfs/sq mi	12.1	8.72	4.77	2.82	1.60	.554	.150	.076	.047	.028	.013	.010
1931-60	cfs	116	84	47.5	27.0	15.2	6.2	1.86	.94	.58	.322	.164	.112
	cfs/sq mi	11.9	8.62	4.87	2.77	1.56	.636	.191	.096	.059	.033	.017	.011

RARITAN RIVER BASIN

4040. Green Brook at Bound Brook

Location.--Lat 40°33'55", long 74°31'30", on left bank 300 ft downstream from State Highway 28 at Bound Brook, Somerset County, 1,300 ft upstream from Ambrose Brook, and 2,400 ft upstream from mouth.
Drainage area.--50.2 sq mi.
Duration data available.--Water years, 1924-30.
Average discharge.--7 years (1923-30), 73.7 cfs.
Extremes.--Unknown.
Remarks.--Diurnal fluctuation caused by powerplants above station. Sewage effluent from Plainfield discharged into brook about 3 miles above station. Diversion by pumpage from well fields by Commonwealth and Elizabethtown Water Co., for municipal supply reduces the flow past the station.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1924-30	cfs	470	315	192	132	91	52	27.5	19.0	15.2	12.4	10.8	9.7
	cfs/sq mi	9.36	6.27	3.82	2.63	1.81	1.04	.548	.378	.303	.247	.215	.193
1931-60	cfs	455	285	186	126	82	45.0	16.6	10.4	6.6	3.60	3.20	2.55
	cfs/sq mi	9.06	5.68	3.71	2.51	1.63	.896	.331	.207	.131	.072	.064	.051

4060. Deep Run near Browntown

Location.--Lat 40°22'30", long 74°18'14", on right bank 5 ft upstream from highway bridge, 0.7 mile downstream from Middlesex-Monmouth county line, and 1.8 miles south of Browntown, Middlesex County.
Drainage area.--8.07 sq mi.
Duration data available.--Water years, 1933-40.
Average discharge.--8 years (1932-40), 14.0 cfs.
Extremes.--1932-40: Maximum discharge, 1,240 cfs Sept. 21, 1938; minimum, 0.1 cfs Feb. 3, 1936 (result of freezeup), and July 23, 1939; minimum daily, 0.6 cfs Aug. 26, 27, 29-31, Sept. 13-15, 1932.
Remarks.--Occasional regulation from unknown source above station.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1933-40	cfs	112	76	41.0	26.5	17.6	9.5	3.95	2.55	1.78	1.22	1.00	.87
	cfs/sq mi	13.9	9.42	5.08	3.28	2.18	1.18	.489	.316	.221	.151	.124	.108
1931-60	cfs	87	61	34.5	22.8	16.0	9.2	3.80	2.37	1.42	.89	.70	.57
	cfs/sq mi	10.8	7.56	4.28	2.83	1.98	1.14	.471	.294	.176	.110	.087	.071

COASTAL BASINS

4080. Manasquan River at Squankum

Location.--Lat 40°09'47", long 74°09'21", on right bank 20 ft downstream from bridge on State Highway 547 (Squankum Park Road) in Squankum, Monmouth County, 0.4 mile downstream from Marshbog Brook.
Drainage area.--43.4 sq mi.
Duration data available.--Water years, 1932-60.
Average discharge.--29 years (1931-60), 72.1 cfs.
Extremes.--1931-60: Maximum discharge, 2,940 cfs Sept. 21, 1938; minimum, 12.9 cfs Sept. 10, 1932.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1932-60	cfs	375	285	182	128	92	54	32.5	26.0	22.4	19.4	18.0	17.0
	cfs/sq mi	8.64	6.57	4.19	2.95	2.12	1.24	.749	.599	.516	.447	.415	.392
1931-60	cfs	360	275	180	126	89	53	32.0	25.5	22.4	19.4	18.0	17.0
	cfs/sq mi	8.29	6.34	4.15	2.90	2.05	1.22	.737	.588	.516	.447	.415	.392

COASTAL BASINS

4085. Toms River near Toms River

Location.--Lat 39°59'10", long 74°13'29", on left bank 1.9 miles downstream from Union Branch and 2.6 miles northwest of Toms River, Ocean County.
Drainage area.--124 sq mi.
Duration data available.--Water years, 1929-60.
Average discharge.--32 years (1928-60), 209 cfs.
Extremes.--1928-60: Maximum discharge, 2,000 cfs Sept. 23, 1938; minimum, 56 cfs July 5, 1944, Sept. 6, 1957.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	80	95	98	99	99.5
1929-60	cfs	600	520	410	340	275	188	124	100	87	77	72	69
	cfs/sq mi	4.84	4.19	3.31	2.74	2.22	1.52	1.00	.806	.702	.621	.581	.556
1931-60	cfs	600	520	415	345	280	190	124	100	87	76	72	69
	cfs/sq mi	4.84	4.19	3.35	2.78	2.26	1.53	1.00	.806	.702	.613	.581	.556

4090. Cedar Creek at Lanoka Harbor

Location.--Lat 39°52'05", long 74°10'06", on right bank 20 ft upstream from bridge on U.S. Highway 9 at Lanoka Harbor, Ocean County.
Drainage area.--56.0 sq mi.
Duration data available.--Water years, 1933-58.
Average discharge.--26 years (1932-58), 108 cfs.
Extremes.--1932-58: Maximum discharge, 1,050 cfs Oct. 28, 1943; minimum, 12 cfs Sept. 4, Oct. 4, 1957.
Remarks.--Flow regulated by cranberry bogs.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1933-58	cfs	295	250	204	174	140	96	68	58	48.5	35.0	25.5	19.8
	cfs/sq mi	5.27	4.46	3.64	3.11	2.50	1.71	1.21	1.04	.866	.625	.455	.354
1931-60	cfs	295	246	192	170	136	95	67	56	46.5	32.5	25.5	21.6
	cfs/sq mi	5.27	4.39	3.43	3.04	2.43	1.70	1.20	1.00	.830	.580	.455	.386

4095. Batsto River at Batsto

Location.--Lat 39°38'33", long 74°39'00", on right bank 30 ft downstream from highway bridge at Batsto, Burlington County, and 1 mile upstream from mouth.
Drainage area.--70.5 sq mi.
Duration data available.--Water years, 1928-38, 1940-60.
Average discharge.--33 years (1927-60), 129 cfs.
Extremes.--1927-60: Maximum daily discharge, 1,310 cfs Aug. 24, 1933; minimum daily, 5.7 cfs Oct. 4, 1959.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1928-38, 1940-60	cfs	455	370	270	212	164	106	71	61	54	49	46	43.5
	cfs/sq mi	6.45	5.25	3.83	3.01	2.33	1.50	1.01	.865	.766	.695	.652	.617
1931-60	cfs	470	375	280	220	170	108	72	62	56	50	46	43.5
	cfs/sq mi	6.67	5.32	3.97	3.12	2.41	1.53	1.02	.879	.794	.709	.652	.617

4100. Oswego River at Harrisville

Location.--Lat 39°39'47", long 74°31'26", on right bank 50 ft downstream from highway bridge at Harrisville, Burlington County, and 0.5 mile upstream from confluence with West Branch Wading River.
Drainage area.--64.0 sq mi.
Duration data available.--Water years, 1931-60.
Average discharge.--30 years (1930-60), 87.8 cfs
Extremes.--1930-60: Maximum discharge, 1,390 cfs Aug. 20, 1939; practically no flow for several hours on Oct. 26, 1932, while pond above station was filling.
Remarks.--Flow regulated occasionally by pond 200 ft above station (capacity, about 30,000,000 gal), and by ponds and cranberry bogs 5 to 10 miles upstream.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1931-60	cfs	300	250	192	152	116	75	47.5	39.5	35.0	29.5	25.5	22.8
	cfs/sq mi	4.69	3.91	3.00	2.38	1.82	1.17	.742	.617	.547	.461	.398	.356

4110. Great Egg Harbor River at Folsom

Location.--Lat 39°35'42", long 74°51'06", on left bank 25 ft upstream from bridge on State Highway 54, 1 mile south of Folsom, Atlantic County, and 2 miles upstream from Pennypot Stream.
Drainage area.--56.3 sq mi.
Duration data available.--Water years, 1926-60.
Average discharge.--35 years (1925-60), 85.1 cfs.
Extremes.--1925-60: Maximum discharge, 1,440 cfs Sept. 3, 1940; minimum, 15 cfs Sept. 6, 1957.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1926-60	cfs	275	226	168	146	114	73.0	46.0	37.0	31.5	27.0	24.6	22.4
	cfs/sq mi	4.88	4.01	2.98	2.59	2.02	1.30	.817	.657	.560	.480	.437	.398
1931-60	cfs	285	236	184	150	116	74.0	46.0	37.0	31.5	27.0	24.2	22.2
	cfs/sq mi	5.06	4.19	3.27	2.66	2.06	1.31	.817	.657	.560	.480	.430	.394

4115. Maurice River at Norma

Location.--Lat 39°29'42", long 75°04'38", on right bank just upstream from Almond Road Bridge at Norma, Salem County, three-quarters of a mile downstream from Blackwater Branch.
Drainage area.--113 sq mi.
Duration data available.--Water years, 1933-60.
Average discharge.--28 years (1932-60), 172 cfs.
Extremes.--1935-60: Maximum discharge, 7,360 cfs Sept. 2, 1940; minimum daily, 27 cfs Sept. 25, 1932.
Remarks.--Occasional regulation from filling and draining of ponds above station.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1933-60	cfs	500	425	340	285	232	152	95	76	62	50	43.0	37.5
	cfs/sq mi	4.42	3.76	3.01	2.52	2.05	1.35	.841	.673	.549	.442	.381	.332
1931-60	cfs	485	420	330	280	226	146	91	72	59	47.0	39.5	34.5
	cfs/sq mi	4.29	3.72	2.92	2.48	2.00	1.29	.805	.637	.522	.416	.350	.305

COASTAL BASINS

4125. West Branch Cohansey River at Seeley

Location.--Lat 39°29'06", long 75°15'33", on right bank 15 ft upstream from County Bridge H-31 at Seeley, Cumberland County, 450 ft upstream from mouth, and 4.1 miles northwest of Bridgeton.
Drainage area.--2.55 sq mi.
Duration data available.--Water years, 1952-60.
Average discharge.--9 years (1951-60), 2.02 cfs.
Extremes.--1951-60: Maximum discharge, 342 cfs Aug. 6, 1952; minimum, 0.01 cfs July 19, 20, 1957.
Remarks.--Diversion for irrigation above station since 1953.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1952-60	cfs	8.9	5.6	3.40	2.70	2.28	1.72	1.26	1.08	.96	.82	.68	.54
	cfs/sq mi	3.49	2.20	1.33	1.06	.894	.675	.494	.424	.376	.322	.267	.212
1931-60	cfs	6.7	4.8	3.20	2.65	2.22	1.66	1.22	1.06	.96	.87	.82	.74
	cfs/sq mi	2.63	1.88	1.25	1.04	.871	.651	.478	.416	.376	.341	.322	.290

DELAWARE RIVER BASIN

4340. Delaware River at Port Jervis, N.Y.

Location.--Lat 41°22'20", long 74°41'50", on right bank 250 ft downstream from bridge on U.S. Highways 6 and 209 at Port Jervis, Orange County, 1½ miles upstream from Neversink River, and 6.5 miles downstream from Mongaup River.
Drainage area.--3,076 sq mi.
Duration data available.--Water years, 1905-60.
Extremes.--1904-60: Maximum discharge, 233,000 cfs Aug. 19, 1955; minimum, 175 cfs Sept. 23, 1908; minimum daily, 175 cfs Sept. 23, 1908.
Remarks.--Large diurnal fluctuations at medium and low flow caused by powerplants on tributary streams. Flow regulated by Lake Wallenpaupack since November 1925, Toronto Reservoir since January 1926, Swinging Bridge Reservoir since January 1930, Cliff Lake since January 1939, and Lebanon Lake since November 1939 (combined capacity, 11,882,770,000 cu ft). Subsequent to September 1954, entire flow from 371 sq mi of drainage area controlled by Pepacton Reservoir. Part of flow diverted for municipal supply of city of New York. Remainder of flow (except for conservation releases and spill) impounded for release during periods of flow flow in the lower Delaware River basin, as directed by the Delaware River Master.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1905-60	cfs	34,500	26,000	17,400	12,000	7,900	3,400	1,500	1,020	750	550	465	405
	cfs/sq mi	11.2	8.45	5.66	3.90	2.57	1.11	.488	.332	.244	.179	.151	.132
1931-60	cfs	33,500	25,000	16,800	11,800	7,700	3,450	1,640	1,160	880	660	560	485
	cfs/sq mi	10.9	8.13	5.46	3.84	2.50	1.12	.533	.377	.286	.215	.182	.158

4385. Delaware River at Montague

Location.--Lat 41°18'30", long 74°47'50", on right bank at downstream side of old bridge pier, 0.4 mile upstream from toll bridge at Montague, Sussex County, and three-quarters of a mile downstream from Saw Kill.
Drainage area.--3,480 sq mi.
Duration data available.--Water years, 1940-60.
Average discharge.--21 years (1939-60), 6,408 cfs (unadjusted).
Extremes.--1939-60: Maximum discharge, 250,000 cfs Aug. 19, 1955; minimum, 382 cfs Aug. 24, 1954; minimum daily, 412 cfs Aug. 23, 1954.
Remarks.--Diurnal fluctuation at medium and low flow caused by powerplants on tributary streams. Flow regulated by Lake Wallenpaupack and by Pepacton, Swinging Bridge, Toronto, Cliff Lake, and Neversink Reservoirs and smaller reservoirs. Diversion from Pepacton and Neversink Reservoirs.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1940-60	cfs	37,000	29,000	19,000	13,400	9,300	4,000	1,880	1,400	1,020	750	640	570
	cfs/sq mi	10.6	8.33	5.46	3.85	2.67	1.15	.540	.402	.293	.216	.184	.164
1931-60	cfs	35,000	27,500	18,600	13,200	9,000	4,000	1,840	1,340	1,040	790	670	590
	cfs/sq mi	10.1	7.90	5.34	3.79	2.59	1.15	.529	.385	.299	.227	.193	.170

DELAWARE RIVER BASIN

4400. Flat Brook near Flatbrookville

Location.--Lat 41°06'24", long 74°57'09", on right bank 1 mile upstream from Flatbrookville, Sussex County, and 1½ miles upstream from mouth.
Drainage area.--65.1 sq mi.
Duration data available.--Water years, 1924-60.
Average discharge.--37 years (1923-60), 111 cfs.
Extremes.--1923-60: Maximum discharge, 9,560 cfs Aug. 19, 1955; minimum,4 cfs Sept. 6, 7, 1923.
Remarks.--Flow occasionally regulated by ponds above station.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1924-60	cfs	700	510	330	234	160	73	27.0	18.0	14.0	11.0	9.6	8.7
	cfs/sq mi	10.8	7.83	5.07	3.59	2.46	1.12	.415	.276	.215	.169	.147	.134
1931-60	cfs	710	520	335	236	158	73	26.0	17.2	13.6	10.4	9.2	8.5
	cfs/sq mi	10.9	7.99	5.15	3.63	2.43	1.12	.399	.264	.209	.160	.141	.131

4435. Paulins Kill at Blairstown

Location.--Lat 40°58'44", long 74°57'15", on right bank 1,200 ft upstream from bridge on State Highway 94 in Blairstown, Warren County, 1,400 ft upstream from Blairs Creek, and 10 miles upstream from mouth.
Drainage area.--126 sq mi.
Duration data available.--Water years 1922-60.
Average discharge.--39 years (1921-60), 194 cfs.
Extremes.--1921-60: Maximum discharge, 8,750 cfs Aug. 19, 1955; minimum, about 2.8 cfs Nov. 1, 1922; minimum daily, 5 cfs Aug. 13, 14, 1930.
Remarks.--Diurnal fluctuation caused by powerplant above station. Flow regulated slightly by Swartswood Lake.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1922-60	cfs	1,100	830	560	410	290	130	50	34.5	27.0	21.6	18.6	16.4
	cfs/sq mi	8.73	6.59	4.44	3.25	2.30	1.03	.397	.274	.214	.171	.148	.130
1931-60	cfs	1,160	880	590	420	290	136	48.0	33.0	27.0	21.0	18.0	16.0
	cfs/sq mi	9.21	6.98	4.68	3.33	2.30	1.08	.381	.262	.214	.167	.143	.127

4450. Pequest River at Huntsville

Location.--Lat 40°58'49", long 74°46'38", on right bank 20 ft upstream from highway bridge in Huntsville, Sussex County, and three-eighths of a mile downstream from East Branch.
Drainage area.--31.4 sq mi.
Duration data available.--Water years, 1940-60.
Average discharge.--21 years (1939-60), 46.7 cfs.
Extremes.--1939-60: Maximum discharge, 560 cfs Aug. 19, 1955; minimum, 1.1 cfs Aug. 2, 1955.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1940-60	cfs	200	166	126	102	77	35.5	10.8	6.4	4.40	2.95	2.60	2.40
	cfs/sq mi	6.37	5.29	4.01	3.25	2.45	1.13	.344	.204	.140	.094	.083	.076
1931-60	cfs	212	170	128	100	76	35.5	10.8	6.5	4.25	3.00	2.70	2.50
	cfs/sq mi	6.75	5.41	4.08	3.18	2.42	1.13	.344	.207	.135	.096	.086	.080

DELAWARE RIVER BASIN

4455. Pequest River at Pequest

Location.--Lat 40°49'43", long 74°58'45", on right bank at Pequest, Warren County, 100 ft upstream from Lehigh and Hudson River Railway bridge and 300 ft downstream from Furnace Brook.
Drainage area.--108 sq mi.
Duration data available.--Water years, 1922-60.
Average discharge.--39 years (1921-60), 154 cfs.
Extremes.--1921-60: Maximum discharge, 1,810 cfs Mar. 14, 1936; minimum, 14 cfs Aug. 4, 5, 1955.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1922-60	cfs	640	550	450	330	234	114	51	37.0	30.0	24.4	21.8	20.0
	cfs/sq mi	5.93	5.09	4.17	3.06	2.17	1.06	.472	.343	.278	.226	.202	.185
1931-60	cfs	650	560	430	335	240	118	51	36.5	29.5	24.2	21.4	19.6
	cfs/sq mi	6.02	5.19	3.98	3.10	2.22	1.09	.472	.338	.273	.224	.198	.181

4460. Beaver Brook near Belvidere

Location.--Lat 40°50'40", long 75°02'48", on right bank 2,000 ft upstream from mouth and 2 miles east of Belvidere, Warren County.
Drainage area.--36.2 sq mi.
Duration data available.--Water years, 1923-60.
Average discharge.-- 38years (1922-60), 52.3 cfs.
Extremes.--1922-60: Maximum discharge, 1,510 cfs Mar. 12, 1936; minimum 1.1 cfs Aug. 3, 4, 1955.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1923-60	cfs	290	220	156	116	81	35.0	11.0	6.3	4.30	2.90	2.32	1.96
	cfs/sq mi	8.01	6.08	4.31	3.20	2.24	.967	.304	.174	.119	.080	.064	.054
1931-60	cfs	290	222	158	120	82	35.5	11.2	6.2	4.15	2.70	2.20	1.88
	cfs/sq mi	8.01	6.13	4.36	3.31	2.27	.981	.309	.171	.115	.075	.061	.052

4465. Delaware River at Belvidere

Location.--Lat 40°49'36", long 75°05'02", on left bank at Belvidere, Warren County, 500 ft downstream from Pequest River.
Drainage area.--4,535 sq mi.
Duration data available.--Water years, 1923-60.
Average discharge.--38 years (1922-60), 8,223 cfs (unadjusted).
Extremes.--1922-60: Maximum discharge, 273,000 cfs Aug. 19, 1955; minimum, 609 cfs Sept. 28, 29, 1943.
Remarks.--Diurnal fluctuation at medium and low flow caused by powerplants on tributary streams. Flow regulated by Lake Wallenpaupack since November 1925, Toronto Reservoir since July 1926, Swinging Bridge Reservoir since January 1930, Cliff Lake since December 1939, and Lebanon Lake since 1940 (combined capacity of reservoirs, 11,833,000,000 cu ft). Subsequent to June 1953, entire flow from 91.8 sq mi of drainage area controlled by Neversink Reservoir; and subsequent to September 1954, entire flow from 371 sq mi of drainage area controlled by Pepacton Reservoir. Part of flow diverted for municipal supply of city of New York. Remainder of flow (except for conservation releases and spill) impounded for release during periods of low flow in the lower Delaware River basin, as directed by the Delaware River Master.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1923-60	cfs	46,000	35,000	23,600	17,400	12,000	5,500	2,440	1,700	1,380	1,120	990	900
	cfs/sq mi	10.1	7.72	5.20	3.84	2.65	1.21	.538	.375	.304	.247	.218	.198
1931-60	cfs	46,500	35,000	23,800	17,200	12,000	5,500	2,480	1,720	1,360	1,080	960	870
	cfs/sq mi	10.3	7.72	5.25	3.79	2.65	1.21	.547	.379	.300	.238	.212	.192

DELAWARE RIVER BASIN

4560. Musconetcong River near Hackettstown

Location.--Lat 40°53'10", long 74°48'00", on right bank 75 ft upstream from Saxton Falls Dam, half a mile upstream from Delaware, Lackawanna and Western Railroad bridge, and 3 miles northeast of Hackettstown, Warren County.
Drainage area.--70.0 sq mi.
Duration data available.--Water years, 1922-60.
Average discharge.--39 years (1921-60), 121 cfs (unadjusted).
Extremes.--1921-60: Maximum discharge, 2,170 cfs Aug. 19, 1955; no flow part of Sept. 6, 1951, Feb. 4, 5, 1957, when water was below spillway, waste gate was closed, and no flow through swimming pool.
Remarks.--Records represent flow over dam and through swimming pool and gate. Flow regulated by Lake Hopatcong and other smaller lakes.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1922-60	cfs	495	405	310	255	188	88	43.0	30.5	23.4	16.8	13.0	10.4
	cfs/sq mi	7.07	5.79	4.43	3.64	2.69	1.26	.614	.436	.334	.240	.186	.149
1931-60	cfs	500	410	320	260	192	93	44.5	32.5	24.4	16.8	12.6	10.0
	cfs/sq mi	7.14	5.86	4.57	3.71	2.74	1.33	.636	.464	.349	.240	.180	.143

4570. Musconetcong River near Bloomsbury

Location.--Lat 40°40'20", long 75°03'40", on right bank just downstream from highway bridge, 1½ miles upstream from Bloomsbury, Hunterdon County, and 9½ miles upstream from mouth.
Drainage area.--143 sq mi.
Duration data available.--Water years, 1904-6, 1922-60.
Average discharge.--42 years (1903-6, 1921-60), 229 cfs (unadjusted).
Extremes.--1903-7, 1921-60: Maximum discharge, 6,960 cfs Oct. 10, 1903; minimum, 8.1 cfs Aug. 2, 1955; minimum daily, 31 cfs July 23, Aug. 3, 1955.
Remarks.--Flow regulated by Lake Hopatcong. Diurnal fluctuation caused by small powerplants above station.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1904-6, 1922-60	cfs	900	740	550	440	330	180	99	79	67	55	49.5	45.0
	cfs/sq mi	6.29	5.17	3.85	3.08	2.31	1.26	.692	.552	.469	.385	.346	.315
1931-60	cfs	890	740	560	440	335	186	98	76	65	55	50	45.5
	cfs/sq mi	6.22	5.17	3.92	3.08	2.34	1.30	.685	.531	.455	.385	.350	.318

4575. Delaware River at Riegelsville

Location.--Lat 40°35'36", long 75°11'17", on left bank 20 ft upstream from suspension bridge at Riegelsville, Warren County, and 600 ft upstream from Musconetcong River. Records since Oct. 1, 1931, include flow of Musconetcong River.
Drainage area.--6,328 sq mi (includes that of Musconetcong River).
Duration data available.--Water years, 1907-60.
Average discharge.--54 years (1906-60), 11,260 cfs, including flow of Musconetcong River after Sept. 30, 1931, and excluding flow of Delaware Division Canal (unadjusted).
Extremes.--1906-60: Maximum discharge, 340,000 cfs Aug. 19, 1955; minimum,not including flow in canal, 870 cfs Sept. 20, 1908.
Remarks.--Diurnal fluctuation at medium and low flow caused by powerplants on tributary streams. Flow regulated by Lake Wallenpaupack since 1925, Toronto Reservoir since July 1926, Swinging Bridge Reservoir since January 1930, Lake Hopatcong since 1931, Cliff Lake since December 1939, Lebanon Lake since January 1940, Neversink Reservoir since June 1953, Pepacton Reservoir since September 1954, and smaller reservoirs. Diversion from Pepacton (since January 1955) and Neversink (since December 1953) Reservoirs and to Delaware Division Canal. Records do not include diversions.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1907-60	cfs	58,000	45,500	32,000	23,800	16,400	7,600	3,550	2,500	1,960	1,600	1,460	1,340
	cfs/sq mi	9.17	7.19	5.06	3.76	2.59	1.20	.561	.395	.310	.253	.231	.212
1931-60	cfs	59,000	45,500	32,000	24,000	16,800	8,000	3,850	2,750	2,220	1,800	1,620	1,500
	cfs/sq mi	9.32	7.19	5.06	3.79	2.65	1.26	.608	.435	.351	.284	.256	.237

DELAWARE RIVER BASIN

4635. Delaware River at Trenton

Location.--Lat 40°13'18", long 74°46'38", on left bank 450 ft upstream from Calhoun Street Bridge at Trenton, Mercer County, and half a mile upstream from Assunpink Creek.
Drainage area.--6,780 sq mi.
Duration data available.--Water years, 1913-60.
Average discharge.--48 years (1912-60), 11,930 cfs (unadjusted).
Extremes.--1912-60: Maximum discharge, 329,000 cfs Aug. 20, 1955; minimum, 1,220 cfs Sept. 18, 19, 1932. Flow in Trenton power race and Delaware & Raritan Canal not included.
Remarks.--Diurnal fluctuation at medium and low flow caused by powerplants on tributary streams. Flow regulated by Lake Hopatcong for period of record, Lake Wallenpaupack since 1925, Toronto Reservoir since July 1926, Swinging Bridge Reservoir since January 1930, Cliff Lake since December 1939, Lebanon Lake since January 1940, Neversink Reservoir since June 1953, Pepacton Reservoir since September 1954, and smaller reservoirs. Diversions above station to Delaware & Raritan Canal for period of record, Delaware Division Canal prior to November 1931, Trenton power race prior to November 1935, from Neversink Reservoir since December 1953, from Pepacton Reservoir since January 1955, and just above station by city of Trenton for municipal supply since August 1955. Records do not include diversions.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1913-60	cfs	60,000	47,500	33,500	25,000	17,400	8,300	3,850	2,750	2,200	1,800	1,640	1,520
	cfs/sq mi	8.85	7.01	4.94	3.69	2.57	1.22	.568	.406	.324	.265	.242	.224
1931-60	cfs	60,000	47,000	34,000	25,500	17,800	8,500	4,000	2,900	2,300	1,880	1,680	1,540
	cfs/sq mi	8.85	6.93	5.01	3.76	2.63	1.25	.590	.428	.339	.277	.248	.227

4640. Assunpink Creek at Trenton

Location.--Lat 40°13'27", long 74°44'58", on left bank at Chambers Street Bridge in Trenton, Mercer County, 1½ miles upstream from mouth.
Drainage area.--89.4 sq mi.
Duration data available.--Water years, 1924-60.
Average discharge.--37 years (1923-60), 119 cfs.
Extremes.--1923-60: Maximum discharge, 3,320 cfs Sept. 22, 1938; minimum, 1.0 cfs Aug. 21, Oct. 22, 1931; minimum daily, 4 cfs July 21, Aug. 8, Sept. 2, 1929.
Remarks.--Some diurnal fluctuation at low flow caused by industrial plants above station. Records include inflow from Ewing-Lawrence Sewerage Authority treatment plant, 2.4 miles above station, since October 1953.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1924-60	cfs	710	560	380	255	166	79	39.5	28.0	21.4	15.6	12.4	9.7
	cfs/sq mi	7.94	6.26	4.25	2.85	1.86	.884	.442	.313	.239	.174	.139	.109
1931-60	cfs	700	550	365	255	166	79	39.0	28.0	21.6	16.4	13.4	11.0
	cfs/sq mi	7.83	6.15	4.08	2.85	1.86	.884	.436	.313	.242	.183	.150	.123

4645. Crosswicks Creek at Extonville

Location.--Lat 40°08'15", long 74°36'02", on right bank upstream from highway bridge at Extonville, Mercer County, half a mile upstream from Pleasant Run and 0.7 mile downstream from Mercer-Monmouth County line.
Drainage area.--83.6 sq mi.
Duration data available.--Water years, 1941-51, 1953-60.
Average discharge.--19 years (1940-51, 1952-60), 125 cfs.
Extremes.--1940-51, 1952-60: Maximum discharge, 3,360 cfs Sept. 1, 1940; minimum, 13.1 cfs Feb. 14, 1942, result of freezeup; minimum daily, 20 cfs Aug. 12, 1949, Aug. 1, 1950, July 23-26, Aug. 4-6, 1955.
Remarks.--Flow regulated occasionally by lakes above station.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1941-51, 1953-60	cfs	690	520	340	232	156	90	54	42.0	35.5	30.5	28.0	25.0
	cfs/sq mi	8.25	6.22	4.07	2.78	1.87	1.08	.646	.502	.425	.365	.335	.299
1931-60	cfs	760	570	360	250	164	91	54	41.5	35.0	30.0	26.0	22.4
	cfs/sq mi	9.09	6.82	4.31	2.99	1.96	1.09	.646	.496	.419	.359	.311	.268

4660. Middle Branch Mount Misery Brook in Lebanon State Forest

Location.--Lat 39°55'00", long 74°30'30", on right bank in Lebanon State Forest, Burlington County, 20 ft upstream from North Branch Road Bridge, 0.3 mile upstream from South Branch Mount Misery Brook, and 5.1 miles southeast of Browns Mills.
Drainage area.--2.73 sq mi.
Duration data available.--Water years, 1953-60.
Average discharge.--8 years (1952-60), 1.99 cfs.
Extremes.--1952-60: Maximum discharge, 45 cfs Aug. 25, 1958; no flow for many days in most years.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1953-60	cfs	9.3	8.0	6.0	4.60	3.25	1.60	.244	.0340	0	0	0	0
	cfs/sq mi	3.41	2.93	2.20	1.68	1.19	.586	.089	.0124	0	0	0	0
1931-60	cfs	9.3	7.8	5.7	4.35	3.05	1.36	.188	.0340	0	0	0	0
	cfs/sq mi	3.41	2.86	2.09	1.59	1.12	.498	.069	.0124	0	0	0	0

4665. McDonalds Branch in Lebanon State Forest

Location.--Lat 39°53'05", long 74°30'20", on right bank in Lebanon State Forest, Burlington County, 25 ft upstream from Butterworth Road Bridge, 3.4 miles upstream from confluence with Cooper Branch, and 7 miles southeast of Browns Mills.
Drainage area.--2.31 sq mi.
Duration data available.--Water years, 1954-60.
Average discharge.--7 years (1953-60), 2.30 cfs.
Extremes.--1953-60: Maximum discharge, 35 cfs Aug. 25, 1958; minimum daily, 1.0 cfs on many days in August to November 1957.
Remarks.--Gage-height record is collected above concrete control and discharge record, which includes leakage around control, is at site 785 ft downstream.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1954-60	cfs	7.0	6.0	4.80	3.80	2.90	2.06	1.46	1.30	1.18	1.10	1.06	1.04
	cfs/sq mi	3.03	2.60	2.08	1.65	1.26	.892	.632	.563	.511	.476	.459	.450
1931-60	cfs	7.0	6.0	4.85	3.90	2.90	1.98	1.46	1.32	1.20	1.14	1.10	1.08
	cfs/sq mi	3.03	2.60	2.10	1.69	1.26	.857	.632	.571	.519	.494	.476	.468

4670. North Branch Rancocas Creek at Pemberton

Location.--Lat 39°58'10", long 74°41'05", on right bank at downstream side of highway bridge at Pemberton, Burlington County, 12 miles upstream from confluence with South Branch.
Drainage area.--111 sq mi.
Duration data available.--Water years, 1922-60.
Average discharge.--39 years (1921-60), 168 cfs.
Extremes.--1921-60: Maximum discharge, 1,730 cfs Aug. 21, 1939; minimum daily, 9 cfs Sept. 29, 1932.
Remarks.--Diurnal fluctuation caused by gristmill just above station prior to 1942. Flow regulated occasionally by operation of gate in dam and by ponds above station thereafter.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1922-60	cfs	590	495	375	300	230	140	82	63	52	42.0	37.5	34.0
	cfs/sq mi	5.32	4.46	3.38	2.70	2.07	1.26	.739	.568	.468	.378	.338	.306
1931-60	cfs	600	500	385	305	234	142	84	65	54	44.0	39.0	35.0
	cfs/sq mi	5.41	4.50	3.47	2.75	2.11	1.28	.757	.586	.486	.396	.351	.315

DELAWARE RIVER BASIN

4750. Mantua Creek at Pitman

Location.--Lat 39°44'14", long 75°06'53", on left abutment of Wadsworth Dam, 0.9 mile east of Pitman, Gloucester County, and 2 miles upstream from Porch Branch.
Drainage area.--6.75 sq mi.
Duration data available.--Water years, 1942-60.
Average discharge.--20 years (1940-60), 11.6 cfs.
Extremes.--1940-60: Maximum discharge, about 4,200 cfs Sept. 1, 1940; minimum, 3.2 cfs July 24, 25, 1944.
Remarks.--Slight regulation by Wadsworth Pond just above station.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1942-60	cfs	33.0	27.0	20.6	16.8	13.8	10.6	8.4	7.2	6.2	5.3	4.80	4.50
	cfs/sq mi	4.89	4.00	3.05	2.49	2.04	1.57	1.24	1.07	.919	.785	.711	.667
1931-60	cfs	35.5	29.0	21.6	17.0	13.8	10.4	8.4	7.2	6.1	5.2	4.80	4.60
	cfs/sq mi	5.26	4.30	3.20	2.52	2.04	1.54	1.24	1.07	.904	.770	.711	.681

4775. Oldmans Creek near Woodstown

Location.--Lat 39°41'27", long 75°19'09", on left bank at upstream side of Woodstown-Swedesboro highway bridge, 2 miles north of Woodstown, Salem County, and 16 miles upstream from mouth.
Drainage area.--19.3 sq mi.
Duration data available.--Water years, 1932-40.
Average discharge.--9 years (1931-40), 29.0 cfs.
Extremes.--1931-40: Maximum discharge, 8,100 cfs Sept. 1, 1940; minimum, 4.2 cfs Jan. 6, 1940, result of freezeup; minimum daily, 4.5 cfs Aug. 8, 1931.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1932-40	cfs	150	106	70	51	37.0	20.2	12.2	9.8	8.4	6.8	6.0	5.6
	cfs/sq mi	7.77	5.49	3.63	2.64	1.92	1.05	.632	.508	.435	.352	.311	.290
1931-60	cfs	112	88	61	45.5	33.0	18.8	11.2	9.3	7.7	6.3	5.2	4.25
	cfs/sq mi	5.80	4.56	3.16	2.36	1.71	.974	.580	.482	.399	.326	.269	.220

4825. Salem River at Woodstown

Location.--Lat 39°38'36", long 75°19'52", on right end of Memorial Lake Dam at Woodstown, Salem County, a quarter of a mile upstream from small brook and 0.3 mile downstream from Pennsylvania-Reading Seashore Lines bridge.
Drainage area.--14.6 sq mi.
Duration data available.--Water years, 1943-60.
Average discharge.--18 years (1942-60), 19.4 cfs.
Extremes.--1940-60: Maximum discharge, 22,000 cfs Sept. 1, 1940; no flow for short periods during many years just after waste gate was closed and water was below spillway.
Remarks.--Records represent flow over dam and through waste gate. Occasional regulation by Memorial Lake.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1943-60	cfs	140	97	56	36.0	23.6	12.8	6.5	4.30	3.00	1.74	.53	.255
	cfs/sq mi	9.59	6.64	3.84	2.47	1.62	.877	.445	.295	.205	.119	.036	.017
1931-60	cfs	156	106	58	36.5	23.4	12.4	6.3	4.30	2.90	1.74	58	.315
	cfs/sq mi	10.7	7.26	3.97	2.50	1.60	.849	.432	.295	.199	.119	.040	.022

DELAWARE RIVER BASIN

4830. Alloway Creek at Alloway

Location.--Lat 39°33'55", long 75°21'35", on right bank at Alloway Lake Dam at Alloway, Salem County, 0.8 mile upstream from Deep Run.
Drainage area.--21.9 sq mi.
Duration data available.--Water years, 1953-60.
Average discharge.--8 years (1952-60), 24.8 cfs.
Extremes.--1952-60: Maximum discharge, 1,860 cfs Sept. 12, 1960; no flow on some days in 1953, 1957, 1958, when waste gate was closed and water was below spillway.
Remarks.--Flow regulated occasionally by operation of waste gate in dam.

		Percent of time discharge indicated was equaled or exceeded											
Period	Discharge	1	2	5	10	20	50	80	90	95	98	99	99.5
1953-60	cfs	152	110	72	51	34.5	17.2	7.5	4.85	3.20	1.92	1.02	.118
	cfs/sq mi	6.94	5.02	3.29	2.33	1.58	.785	.342	.221	.146	.088	.047	.005
1931-60	cfs	152	112	74	52	34.5	15.8	7.5	5.0	3.55	2.50	2.02	1.55
	cfs/sq mi	6.94	5.11	3.38	2.37	1.58	.721	.342	.228	.162	.114	.092	.071