# AN ANALYSIS OF THE DISTRIBUTION OF DAILY FLOW AND WATER TEMPERATURE FOR THE UPPER POTOMAC ESTUARY

by

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## INTRODUCTION

River flow and water temperature are two principle environmental factors which influence water quality in the upper Potomac estuary. The rates of biochemical reactions increase as temperature increases, and of particular importance are those reactions that produce and consume oxygen such as algal production and respiration and the oxidation of organic matter. In addition, the dissolved oxygen saturation level decreases as water temperature increases which may limit the amount of oxygen available. High water temperature may be detrimental to fish and other higher organisms by directly affecting their physiology as well as by limiting the available oxygen. Some of the important freshwater inflow impacts on water quality are: providing oxygen and nutrients; determining the rate at which upper estuarine waters, and associated point and non point source pollutants, are flushed to the lower estuary; and limiting photosynthesis rates through shading by turbidity. At very low flows the lack of flow generated turbulence limits the rate of exchange of bottom water with the surface which promotes anoxic conditions in bottom waters.

Along with other climatological variables, flow and water temperature define a 'background' physical environment within which there is a certain capacity for various biological processes to take place. This background condition in turn limits the capacity of the Estuary to assimilate point and nonpoint source pollution without violating water quality standards.

Water quality conditions in the upper Potomac Estuary have improved significantly since the early 1970's (Ref 1), mainly as a result of improvements in sewage treatment plant efficiency. However problems remain as indicated by recurring algae blooms such as the Microcyctis algae bloom in 1983. Further pressure on water quality is likely as the population in the metropolitan Washington area increases, causing sewage treatment flows to increase. If one can estimate the frequency with which high temperature and/or low flow conditions occur which are associated with water quality problems such as low DO, algae blooms, fish kills, etc.; then this information can be considered with other data to evaluate the impact of sewage treatment plant operation and alternative wasteload allocations on Potomac water quality.

This study was commissioned by the District of Columbia Department of Environmental Services (since reorganized as the Department of Consumer and Regulatory Affairs) to develop a model which could be used to estimate the frequency of occurrence high water temperature and/or low river flow conditions. The study area is the Potomac Estuary in the District of Columbia, from Chain Bridge to Woodrow Wilson Bridge (Figure F).

The approach taken in this study is to estimate frequency of occurrence of extreme temperature (T) and flow (Q) events by computing the sample likelihood of exceedence for different T and Q values, based on the observed distributions of T and Q. If one assumes that the sample data sets are representative of past conditions, and that future flows and temperatures will be distributed similarly to those in the past, then these sample likelihoods can be used as estimates of the frequency of extreme events in the future.

METHODOLOGY

The river flow data used are the mean daily flow, in cubic feet per second (CFS), from the USGS gage at Little Falls (Ref 2,3), USGS station 01646500, adjusted by adding mean monthly upstream water supply withdrawals to the gaged flow. Treated wastewater in an amount roughly equivalent to water supply withdrawals is returned to the estuary at several treatment plants, principally at Blue Plains. Thus, the sum of Potomac flow at Little Falls plus water supply withdrawals is considered an appropriate flow value for relating water quality conditions to the retention time of water in the upper Potomac Estuary. Although the period of record for this gage begins in 1930, information on withdrawals was available only for the period beginning with the 1963 water year. Thus the flow record used in this study extends from 1 October 1962 to 31 December 1985. Withdrawals are highest in the summer and have gradually increased over the period of record from approximately 350 CFS (monthly average) in the 1962 to approximately 650 CFS in 1986. Because Potomac River flows have a highly skewed distribution and vary several orders of magnitude, flow statistics are computed on the log transform of daily mean flow.

It is a more difficult task to characterize the temperature of the upper Potomac Estuary than to calculate the freshwater flow. There is no single station in the upper Potomac Estuary with a long period of daily temperature measurements comparable to the flow record for Little Falls. The longest record of daily temperature observations at a station comprises only six years. Since the ability to estimate the recurrence interval of extreme events depends on the length of the data record, it was necessary to combine data from different stations and sources to construct a single "pseudo", or composite, record of temperature. An additional complication is that temperature can vary with depth, with location, and diurnally; as well as seasonally.

Sources for temperature data are summarized in Table 1, and in Appendix A. A single composite temperature record was created from these original data sets in a multiple step process beginning with computing a daily average temperature at each station having more than one observation per day. An exception is the PEPCO data set for which the daily minimum temperature was used (see Appendix A).

Temperature bias by station location was evaluated by comparing paired data sets where they overlapped in time. The comparisons, summarized in Table 2, show differences between some but not all stations. The average temperature difference between stations in most paired data sets in Table 2 is less than the standard deviation of the differences for that paired data. The only stations consistently different from the others are the Blue Plains Experimental Plant (BPEP) which is about 1.3$^{o}$ C colder than other stations, and the PEPCO data set which tends to be warmer than other stations. BPEP data may be colder than other data because these temperatures were measured at a depth of 2.5 meters and well away from the shoreline. At most (but not all) other stations temperature tends to be measured at or near the surface, and during the daytime, and so may be biased toward warmer temperatures. Because the BPEP data are consistently cooler than other data, they were adjusted by adding 1.3 to each value. This had the effect of increasing the mean temperature of the composite data sets for each month by approximately 0.1 $^{o}$C. No adjustments were made to the PEPCO data because, while frequently showing warmer temperatures than at other stations, the differences were not consistent.

Some stations reported temperatures less than 0 $^{o}$C. These data were adjusted to 0 before averaging because water temperature, presumably, cannot fall below 0.

After calculating a daily mean temperature for each station, and adjusting the BPEP data, these values were averaged to compute a composite temperature record consisting of a single temperature value for each day. Averaging values at a station before combining with other stations means that a station for which there are many individual observations is not weighted more heavily than a station with only one observation, thereby isolating possible station bias. It should be remembered, however, that some of the values in the composite temperature record represent a single observation while other values are the result of many observations at several stations.

Both flow and temperature vary seasonally in a regular pattern. The effects of season are accounted for by doing separate analyses for each month of the year.

The probability that daily mean temperature will be greater than or equal to some value t is estimated as

$$P\{T>=t\} = m_t/(n+1) \qquad (1)$$

where

$T$ = daily mean water temperature,
$t$ = some specified temperature value,
$m_t$ = rank of temperature t in the data set ordered from highest to lowest value,
$n$ = number of observations in the data set.

The probability that mean daily flow will be less than or equal to some value q is estimated as

$$P\{Q<=q\} = m_q/(n+1) \qquad (2)$$

where

$Q$ = mean daily Potomac flow,

$q$ = some specified critical flow value,

$m_q$ = rank of flow q in the data set ordered from lowest to highest value,

$n$ = number of observations.

The joint probability that Q will be less than or equal to q, <u>and</u> T will be greater than or equal to t, is empirically estimated in a similar manner from the set of days for which there are both T and Q values:

$$P\{Q<=q,T>=t\} = r_{qt}/(n+1) \qquad (3)$$

where

$r_{qt}$ = the number of joint observations with flow less than q and temperature greater than t.

## RESULTS

The composite temperature record was generated from 5608 daily mean temperature values, which after averaging values on same days, yields a record of temperatures for 3104 days fairly evenly distributed throughout the year. This record is continuous from June 1980 through June 1986, and nearly continuous from June 1978 through February 1980. Prior to June 1978, there are scattered values at a frequency of approximately one per month to February 1966. The distribution of temperature measurements over time is such that the results of this study are largely dependent on the climatic conditions of 1978 to mid 1986.

The annual variation of temperature, as represented by the composite temperature record, is illustrated in Figure D, with summary statistics in Table 3. Mean monthly temperatures range from 3.0 $^{o}$C in January to 27.5 $^{o}$C in July. The minimum daily temperature in the composite record is 0.0 $^{o}$C, in January and February. The maximum daily temperature is 33.0 $^{o}$C in July. As might be expected, the standard deviation of daily temperatures is highest in the Spring (3.3 $^{o}$C in April) and Fall (2.9 $^{o}$C in October) and lowest in the Summer (1.7 $^{o}$C in August).

Duration curves for temperature are plotted in Figures A-1 to A-12. These curves were generated by ranking the data for each month, calculating a probability of exceedence for each value using Equation (1), and then plotting probability versus T. The x-axis of the plots is a normal probability scale for which normally distributed data will plot as a straight line. Also plotted (dashed line) is a normal approximation of the data, calculated as

$$y = \bar{y} + z * s_y \qquad (4)$$

where $\bar{y}$ is the mean temperature of that month's data set,
$s_y$ is the standard deviation of that data set,
$z$ is a standard normal deviate,
$y$ is an estimated temperature value.

The normal lines show how well the data may be approximated by a normal distribution estimated from the sample mean and standard deviation. These lines are discussed further in the next section.

Probabilities of exceedence at 1 degree intervals are tabulated in Table 4. The probabilities of exceeding the maximum and minimum temperatures in each month are tabulated in Table 5.

The flow record consists of 8493 daily values covering more than 23 years. Annual variation in flows is illustrated in Figure E, with monthly mean, range, and standard deviation, of log flows. Summary statistics for flow, and log flow, are tabulated in Tables 6a and 6b. The skewed distribution of flows is indicated by the difference between median and mean values for each month, with the median consistently less than the mean flow. The minimum flow in this record is 524 CFS, occurring on 9 September 1966. The actual daily minimum flows of record, after adjustment for water supply withdrawals, recorded by the USGS are 610 CFS and 601 CFS on 9-10 September 1966. The lower flow in this record is the result of adding mean monthly water supply withdrawals, rather than daily withdrawals (which were not available), to daily gaged flows. The maximum flow is 334,487 CFS, on 24 June 1972 (the second highest flow is 293,530 CFS which occurred 7 November 1985). The extreme flood of record for Little Falls is 484,000 CFS on 19 March 1936.

Flow duration curves are plotted in Figures B-1 to B-12. These curves were generated in the same way as the temperature duration curves (Figures A.11-A.12). As before, the dashed line represents a normal approximation to the log flows, calculated using Equation (4).

The empirical probability that mean daily flow will be less than or equal to selected values is tabulated in Table 7. The probabilities of exceeding the maximum, and not exceeding the minimum flows, in each month are tabulated in Table 8.

There are 2923 days with both a temperature and a flow value. Figures C.1 to C.12 are scatter plots of these data for each month. Inspection of these plots suggests that flow and temperature may be correlated. For each month correlation coefficients were calculated for Q and T as well as a t-test for the hypothesis that Q and T are uncorrelated. Results, in Tables 9a and 9b, show that flow and temperature are weakly correlated, but not in a consistent manner. Q and T are uncorrelated in January and March, positively correlated in February and December, and negatively correlated April through November. The highest $r^2$ values are about 0.4 for April, May, and June.

Since flow and temperature appear to be correlated, at least some of the time, Equation (3) was used to estimate joint probabilities. These results were then used to generate Tables 10.1 to 10.12 by interpolating, from the empirical probabilities computed using Equation (3) on each T-Q data pair, the probability of exceedence for the selected flows and temperatures in the Tables, and converting the probability of exceedence to a frequency as (1/Probability). The rightmost column, and the bottom row, in these Tables are the marginal frequencies for Q and T alone.

## DISCUSSION

Figures A and B plot empirical distributions of mean daily water temperature for the Potomac Estuary is the District of Columbia and for mean daily flow at Little Falls. These plots can be sued to estimate the frequency of occurrence of high temperature and low flows by finding the exceedence probability on the x-axis associated, via the plotted data (dotted line), with and temperature (or flow). Note that the x-axis is the percent of time the temperature (flow) is less than or equal to the indicated value. Thus the probability that temperature will be greater than a given value is

$$P = 1 - (\text{Percent} / 100) \qquad (5).$$

For example, from Figure A.8, the empirical likelihood that daily mean temperature in August will exceed 29 $^{o}$C is about 0.15. Over many August days, the frequency of occurrence of days with temperatures exceeding 29 $^{o}$C will be about one in seven.

It should be noted that these plots are <u>descriptive</u> rather than <u>predictive</u>. Because daily temperature (and flow) values are serially correlated the probability of exceeding some critical value on a given day depends on the previous day's value as well as larger seasonal trends. These plots do not consider serial correlation and so should not be used to predict the water temperature (flow) on particular days in the near future. Instead, these plots describe the likely fraction of time that T (Q) will be greater (less) than t (q) for all days in the future.

Figures 10.1 - 10.12 tabulate exceedence probabilities for the joint distribution of flow and temperature. To make the tables easier to read the probabilities have been converted into frequencies of days with $T >= t$ and $Q <= q$, where frequency equals the inverse of the probability. Larger values indicate less frequent occurrences. For example, from Table 10.8, the frequency of occurrence, over many August days, of temperature greater than or equal to 25 $^{o}$C and flow less than or equal to 1000 CFS is about one day in 89.

As explained in the section on Methodology, the approach taken in this study to estimate the frequency of occurrence of extreme temperature and flow events is compute the sample likelihood of exceedence for different values of flow and temperature. This method is nonparametric in that no assumptions are made about the distribution of values. The advantage of the nonparametric approach is that results are dependent entirely on the data and are not "colored" by assumptions about distributional characteristics.

A disadvantage of this method is that results are limited by the available data. In particular, one cannot estimate the exceedence probability for any value that lies outside the range of observed data because there is no information about the shape of the distribution at that value. Instead, using this sample likelihood of exceedence method, all values greater than or equal to the maximum observed are considered together. From equation (1), it can be seen that the probability of having a water temperature greater than or equal to the maximum observed value is $1/(n + 1)$, where n is the sample size. The same results obtain for estimating the likelihood of flows less than or equal to the minimum observed value. Therefore, the ability to estimate the frequency of occurrence of extreme events is dependent on sample size.

An alternative approach is to assume some distributional characteristics for the data. Standard Goodness of Fit tests can be applied to test how well the data fit the assumed distribution. For example, a Normal or Log Normal distribution with parameters mean and variance may be assumed and tested with Chi Square or Kolmorgorov-Smirnov tests. The value in assuming distributional characteristics for a random variable is that the likelihood of events more extreme than have been observed may be estimated by extending the fitted distribution curve.

The danger in assuming a distribution is that, even though an assumed distribution may have "passed" a Goodness of Fit test at an acceptable confidence level, distributional parameters may change across the range of values taken by the variable. The data used in this study exhibit this characteristic. For most of the monthly T and Q data sets, using standard Goodness of Fit tests, a Normal (Log Normal for Q) distribution is acceptable at the 0.05, or 0.01, confidence level. However, inspection of the duration curves in Figures A.1 - A.12 and B.1 - B.12, shows that the fitted distributions (dashed lines), while close to the observed data across most of the range of values, tend to have the greatest error at extreme values, precisely the region one is most interested in having an accurate estimate. It is not necessary to use Normal distributions to approximate these data, but other distributions are likely to have similar errors at extreme values. This is the reason we have chosen to use nonparametric sample likelihoods to estimate exceedence frequencies.

If the data are not a representative sample of the underlying population (of temperature or flow) then results will be biased accordingly. Therefore it is important to note that the results presented here are dependent on the assumptions that the sample data are approximately representative of flow and temperature and that the distributions of temperature and flow in the future will be approximately the same as during the sample period. With 23 years of daily observations, we are reasonably confident that the flow data adequately represent past flow conditions. The temperature data set is much less extensive than the flow data set and, as noted previously, the T distributions developed in the study are dependent on the climate of the past eight years.

While the existing daily flow data may adequately represent the distribution past flows, the distribution of low flows will almost certainly change in the future because of the operation of the Bloomington Reservoir. Two major reservoirs, Savage and Bloomington, affect low flows on the Potomac (there are other smaller ones as well). Savage Reservoir, on the Savage River, has been in operation since 1950, but Bloomington has been in operation only since 1981. These two reservoirs are jointly operated by the U.S. Army Corps of Engineers to maintain the highest possible minimum flow consistent with their various objectives of flood control, water supply, and low flow augmentation. It is too early to know how much of an effect Bloomington will have on low flow frequency, but a comparison of annual minimum flows at gages just above and just below the two reservoirs gives an indication. In Table 11 are listed the annual minimum flows at Kitzmiller MD, and Barnum WV (above and below Bloomington); and Barton MD and Savage MD (above and below Savage). This Table shows that Bloomington is having a significant effect on low flows. The minimum flow achieved each year will vary with water supply conditions but it appears that the likelihood of flows less than about 1500 CFS will be less than what is calculated from the data used in this study, and the likelihood of flows less than 600 CFS will be very much less.

The scatter plots of flow and temperature in Figures C.1 - C.12 suggest that relatively infrequent, but very high flows, may exert a strong influence on correlation between flow and temperature. In addition, low flows rather than high flows are of primary interest for water quality concerns, so correlations were also calculated for T and Q when flow is less than the median for that month. When only these lower flows are considered (Table 9b) the effect is to shift correlation coefficients toward more positive values in all months but February. But this means that data sets that are negatively correlated when the full range of flows are included, become less correlated when only low flows are considered. For example, the July, October, and November, data sets become nearly uncorrelated when only the lower flows are included. The highest $r^2$ is still about 0.4, but for low flows this occurs in December rather than the Spring months. In summary, correlations between flow and temperature appear to be weak enough that only small errors will be introduced by treating them as uncorrelated. In this case the joint probability of ($T >= t$ and $Q <= q$) can be simply estimated as the product of the marginal probabilities for T and Q,

$$P\{Q<=q,\ T>=t\} = P\{Q>=q\} * P\{T>=t\} \qquad (6)$$

## Appendix A: Description of temperature data sources

### 1) PEPCO Potomac River Generating Station at Alexandria, VA

The most extensive temperature record found for this study was made available by the Potomac Electric Power Company (PEPCO, Ref 4) for the Potomac River Generating Station at Alexandria, VA (RM 10.3). The PEPCO power plant uses Potomac water for cooling purposes and influent water temperature is monitored hourly for NPDES permit and for plant operating purposes. At high tide heated discharge water washes into the intake pipe, causing higher temperature readings than for other stations in the study area. To minimize this effect, the minimum daily, instead of the mean daily, temperature was used to construct the PEPCO/Alexandria temperature record which consists of 2195 daily minimum temperatures from 25 June 1980 to 30 June 1986.

### 2) Blue Plains Experimental Plant

The US Army Corps of Engineers, Washington Aqueduct Division, monitored temperature of influent water to the Blue Plains Experimental Water Treatment Plant. The water intake was located 250 meters from the Maryland shore just upstream from Blue Plains (RM 10.2) at a depth of 2.5 meters. Temperature was recorded hourly, and the daily average was made available for this study (Ref 5). The B.P. Exp. Plant temperature record consists of 681 daily mean temperatures from 10 March 1981 to 1 February 1983.

### 3) USGS Chain Bridge Gage Station (Gage # 01646580)

The US Geological Survey monitored temperature at the Chain Bridge gage (R.M. 0.0) daily from 1 June 1978 through September 1981. Recorded data included daily maximum and minimum temperatures, plus occasional instantaneous observations. All observations for each day were averaged (on a few days the reported instantaneous temperature is outside the range of the reported maximum and minimum!). The Chain Bridge Gage record consists of 1029 daily temperatures (Ref 3).

### 4) DC DCRA continuous temperature monitors

The District of Columbia Dept. of Consumer and Regulatory Affairs (DC DCRA) has had, at various times, continuous recording monitors at several stations in the Potomac. Data from the 14th Street Bridge (5.9) and Woodrow Wilson Bridge (12.1) stations for part of 1983 and 1985 were made available by DC DCRA (Ref 6) and by the Metropolitan Washington Council of Governments Department of Environmental Programs (MWCOG, Ref 7). In 1983, the daily maximum and minimum temperatures were supplied, which were averaged to get an approximate daily average. In 1985, hourly temperatures were recorded and were averaged to obtain the daily average. The 14th Street station record includes 113 daily average temperatures from 2 April 1982 to 2 August 1982; and 283 daily average temperatures from 22 January 1985 to 19 November 1985. The Woodrow Wilson Bridge station record includes 139 daily average temperatures from 2 April 1982 to 22 September 1982; and 286 daily average temperatures from 24 January 1985 to 2 December 1985.

5) DC Department of Sanitary Engineering

The DC Department of Sanitary Engineering, a predecessor to the DC DCRA, collected water temperature data at several stations in the District from 1963 through the 1970's on a biweekly (May - Nov), or monthly (Dec - Apr), frequency. Data collected at Geisboro Point (RM 8.2), at various stations in the vicinity of Blue Plains (RM 10.0 10.7), and at Woodrow Wilson Bridge (RM 12.1) were used in this study. This record consists of 614 observations on 123 days from 26 February 1963 to 15 December 1969 (Ref 8).

Temperature data collected by the DC Department of Sanitary Engineering during the 1970's were obtained from the EPA STORET database (Ref 9). This data set consists of 860 observations on 129 days at several stations in the vicinity of Blue Plains (RM 10.0 - 10.7) and at Woodrow Wilson Bridge (RM 12.1). Sampling frequency varied in different years from one per month to one per week, with occasional gaps during winter, with measurements usually collected at various depths.

6) USGS Potomac Estuary Study

The USGS's special Potomac Estuary Study collected data at stations throughout the Estuary (Ref 10 - 12). Data from Chain Bridge (RM 0.0) and Alexandria (RM 12.0) were used here. At Chain Bridge there are a total of 436 observations on 346 days from 20 December 1977 to 24 September 1981. At Alexandria, there are a total of 1608 observations on 173 days from 2 October 1978 to 22 September 1981. The Chain bridge data were combined with the other Chain bridge data set to create a single Chain Bridge data set of 1045 daily average temperatures for the period 11 October 1977 through 30 September 1981.

7) US EPA

This data set, obtained from STORET, consists of 76 measurements collected by the EPA on 69 days at Woodrow Wilson Bridge (Ref 9). Samples were collected weekly from 18 February 1969 to 23 March 1970, mostly at 9 meters depth. Ten samples from March 1967 are also included.

8) Maryland Water Resources Administration

Data collected by the MD WRA at Woodrow Wilson Bridge from 8 July 1974 to 20 October 1978 were obtained via STORET (Ref 9). The data set includes 95 temperature measurements on 38 days. Frequency of samples is one per month. On most days temperature was recorded at the surface and at the bottom.

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Table 1
Summary of Temperature Data by Location.

| Location | Source | R.M. | #Days | Begin | End |
|---|---|---|---|---|---|
| 1) Chain Bridge | 3 | 0.0 | 1029 | 11oct77 | 30sep81 |
| 1) Chain Bridge | 6 | 0.0 | 346 | 20dec77 | 24sep81 |
| 2) 14th St. Bridge | 4 | 5.9 | 396 | 2apr83 | 19nov85 |
| 3) Geisboro Point | 5 | 8.2 | 123 | 26feb63 | 15dec69 |
| 4) Blue Plains Exp. Plant | 2 | 10.2 | 681 | 10mar81 | 1feb83 |
| 5) PEPCO | 1 | 10.3 | 2195 | 25jun80 | 30jun86 |
| 6) Vicinity Blue Plains | 5 | 10.0-10.7 | 28 | 12aug77 | 17nov81 |
| 7) Alexandria | 6 | 12.0 | 173 | 2oct78 | 22sep81 |
| 8) Woodrow Wilson Br. | 4 | 12.1 | 425 | 2apr83 | 2dec85 |
| 8) Woodrow Wilson Br. | 5 | 12.1 | 109 | 7apr70 | 17nov81 |
| 8) Woodrow Wilson Br. | 7 | 12.1 | 69 | 18feb69 | 23mar70 |
| 8) Woodrow Wilson Br. | 8 | 12.1 | 38 | 8jul74 | 2oct78 |

where

- -Location: station name, numbers refer to Figure F.
- -Source refers to sources described in Appendix A.
- -R.M. is River Miles from Chain Bridge.
- -#Days is the number of days on which there are one or more temperature measurements.
- -Begin is the date of the first temperature measurement at this location.
- -End is the date of the last temperature measurement at this location.

Table 2
Comparing Water Temperature at
Different Stations, Same Day

| Data Sets | n | mean | min | max | sd |
|---|---|---|---|---|---|
| PEPCO - BPEP | 681 | 1.3 | -4.9 | 4.6 | 1.10 |
| PEPCO - 14ST82 | 113 | 0.03 | -3.3 | 3.0 | 0.94 |
| PEPCO - 14ST85 | 256 | 1.68 | -2.2 | 6.3 | 1.51 |
| PEPCO - 14ST85s | 175 | 1.05 | -2.2 | 5.3 | 1.05 |
| PEPCO - WW82 | 139 | -0.2 | -5.7 | 1.3 | 0.89 |
| PEPCO - WW85 | 286 | 1.0 | -5.1 | 7.8 | 1.1 |
| PEPCO - WW85s | 181 | 0.95 | -2.3 | 3.9 | 0.73 |
| PEPCO - CBR | 441 | 0.67 | -2.4 | 3.9 | 1.29 |
| PEPCO - ALEX | 89 | 0.0 | -2.1 | 2.6 | 0.86 |
| oppBP - REIS | 123 | 0.36 | -1.5 | 2.8 | 0.68 |
| oppBP - abvBP | 123 | 0.28 | -0.9 | 3.5 | 0.70 |
| oppBP - belBP | 123 | 0.03 | -1.9 | 3.1 | 0.79 |
| oppBP - WW | 122 | 0.25 | -1.5 | 5.9 | 0.94 |
| 14ST82 - WW82 | 80 | -0.30 | -7.2 | 2.4 | 1.21 |
| 14ST82 - WW85 | 246 | -0.68 | -4.9 | 2.3 | 1.43 |
| BPEP - 14ST | 109 | -1.3 | -4.4 | 1.8 | 1.2 |
| BPEP - WW82 | 134 | -1.3 | -6.0 | 0.5 | 0.80 |
| BPEP - CBR | 183 | -1.3 | -5.5 | 1.5 | 1.1 |
| BPEP - ALEX | 35 | -1.3 | -2.5 | 0.7 | 0.71 |
| BPEP - PEPCO | 681 | -1.3 | -4.6 | 4.9 | 1.1 |

where

Data Sets - Pairs of water temperature data sets for which the difference between temperatures measured on the same day are calculated. (See Table 1 and Appendix A for description of station locations)

PEPCO - PEPCO Generating Station
BPEP - Blue Plains Experimental Water Treatment Plant
14ST82- 14th St Bridge continuous monitor 1982 only
14ST85- 14th St Bridge continuous monitor 1985 only
14ST85s-14th St Bridge, summer 1985 only
WW82 - Woodrow Wilson Bridge Continuous monitor, 1982
WW85 - Woodrow Wilson Bridge Continuous monitor, 1985
WW85s - Woodrow Wilson Bridge, summer 1985 only
CBR - Chain Bridge
ALEX - USGS Alexandria station.
GEIS - Geisboro Point
oppBP - DC monitoring stations opposite Blue Plains STP
abvBP - DC monitoring stations above Blue Plains STP
belBP - DC monitoring stations below Blue Plains STP

(continued)

Table 2
(Continued)

where

n = number of days with T (C) measurement at both stations,

mean = average difference in T between stations (first station - second station),

min = minimum of (first station T - second station T),

max = maximum of (first station T - second station T),

sd = standard deviation of the differences.

Table 3
Water Temperature Summary Statistics by Month, for composite temperature record.

| | Jan | Feb | Mar | Apr | May | Jun |
|---|---|---|---|---|---|---|
| nbr obs. | 260 | 236 | 236 | 232 | 258 | 294 |
| minimum | 0.0 | 0.0 | 1.0 | 6.1 | 12.1 | 16.2 |
| maximum | 9.2 | 8.8 | 14.4 | 22.0 | 24.9 | 30.3 |
| mean | 3.03 | 3.64 | 7.36 | 13.27 | 19.74 | 24.54 |
| variance | 3.61 | 5.11 | 5.04 | 10.54 | 6.93 | 5.7 |
| std dev. | 1.90 | 2.26 | 2.24 | 3.25 | 2.63 | 2.39 |

| | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|
| nbr obs. | 268 | 265 | 268 | 266 | 255 | 266 |
| minimum | 20.7 | 23.4 | 16.9 | 10.9 | 4.6 | 0.6 |
| maximum | 33.0 | 31.0 | 29.4 | 22.9 | 20.4 | 13.4 |
| mean | 27.51 | 27.18 | 24.07 | 17.32 | 11.18 | 5.61 |
| variance | 2.70 | 2.71 | 7.10 | 8.59 | 6.41 | 6.75 |
| std dev. | 1.64 | 1.65 | 2.67 | 2.93 | 2.53 | 2.60 |

TABLE 4

Empirical Probability that water temperature (C), on any given day, is greater than or equal to the indicated value.

| Temp | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.0 | .927 | .878 | .996 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | .978 |
| 2.0 | .667 | .751 | .987 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | .921 |
| 3.0 | .429 | .586 | .970 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | .831 |
| 4.0 | .261 | .401 | .937 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | .704 |
| 5.0 | .165 | .262 | .861 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | .994* | .614 |
| 6.0 | .103 | .177 | .722 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | .984 | .472 |
| 7.0 | .040* | .115* | .599 | .988* | ---- | ---- | ---- | ---- | ---- | ---- | .941 | .326 |
| 8.0 | .024* | .042 | .405 | .957 | ---- | ---- | ---- | ---- | ---- | ---- | .883 | .165 |
| 9.0 | .005* | ---- | .228 | .931 | ---- | ---- | ---- | ---- | ---- | ---- | .777 | .079 |
| 10.0 | ---- | ---- | .110 | .841 | ---- | ---- | ---- | ---- | ---- | ---- | .680 | .052 |
| 11.0 | ---- | ---- | .055 | .734 | ---- | ---- | ---- | ---- | ---- | .993 | .591* | .034 |
| 12.0 | ---- | ---- | .024* | .599* | ---- | ---- | ---- | ---- | ---- | .948 | .410 | .019 |
| 13.0 | ---- | ---- | .015* | .515 | .991* | ---- | ---- | ---- | ---- | .906 | .230 | .009* |
| 14.0 | ---- | ---- | .006* | .403 | .989* | ---- | ---- | ---- | ---- | .865 | .125 | ---- |
| 15.0 | ---- | ---- | ---- | .318 | .972* | ---- | ---- | ---- | ---- | .779 | .049* | ---- |
| 16.0 | ---- | ---- | ---- | .215 | .934 | ---- | ---- | ---- | ---- | .667 | .035 | ---- |
| 17.0 | ---- | ---- | ---- | .124 | .846 | .994* | ---- | ---- | .996* | .566 | .012 | ---- |
| 18.0 | ---- | ---- | ---- | .077 | .734 | .992* | ---- | ---- | .989 | .461 | .010* | ---- |
| 19.0 | ---- | ---- | ---- | .054* | .571 | .983 | ---- | ---- | .954* | .345 | .007* | ---- |
| 20.0 | ---- | ---- | ---- | .040* | .459 | .953 | ---- | ---- | .933 | .213 | .005* | ---- |
| 21.0 | ---- | ---- | ---- | .012* | .347 | .922 | .993 | ---- | .866 | .109 | ---- | ---- |
| 22.0 | ---- | ---- | ---- | .004 | .251 | .864 | .990* | ---- | .781 | .037 | ---- | ---- |
| 23.0 | ---- | ---- | ---- | ---- | .147 | .749 | .985 | ---- | .639 | ---- | ---- | ---- |
| 24.0 | ---- | ---- | ---- | ---- | .050 | .620 | .978 | .985 | .569 | ---- | ---- | ---- |
| 25.0 | ---- | ---- | ---- | ---- | ---- | .492 | .948 | .917 | .424 | ---- | ---- | ---- |
| 26.0 | ---- | ---- | ---- | ---- | ---- | .315 | .848 | .748 | .245 | ---- | ---- | ---- |
| 27.0 | ---- | ---- | ---- | ---- | ---- | .149 | .669 | .545 | .138 | ---- | ---- | ---- |
| 28.0 | ---- | ---- | ---- | ---- | ---- | .068 | .405 | .338 | .088* | ---- | ---- | ---- |
| 29.0 | ---- | ---- | ---- | ---- | ---- | .020 | .190 | .150 | .019 | ---- | ---- | ---- |
| 30.0 | ---- | ---- | ---- | ---- | ---- | .007 | .052 | .041 | ---- | ---- | ---- | ---- |
| 31.0 | ---- | ---- | ---- | ---- | ---- | ---- | .011* | .004 | ---- | ---- | ---- | ---- |
| 32.0 | ---- | ---- | ---- | ---- | ---- | ---- | .006* | ---- | ---- | ---- | ---- | ---- |
| 33.0 | ---- | ---- | ---- | ---- | ---- | ---- | .004 | ---- | ---- | ---- | ---- | ---- |
| 34.0 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |

*No adjusted daily mean temperature at exactly this value. Probability was estimated by linearly interpolating from nearest values in record.

'----' indicates temperatures outside the observed range.

Table 5
Empirical Probability Temperature will be greater than or equal to the maximum temperature, or less than or equal to the minimum temperature, on any day.

| Month | MinT | MaxT | Prob. | n+1 |
|---|---|---|---|---|
| Jan | 0.0 | 9.2 | .00383 | 261 |
| Feb | 0.0 | 8.8 | .00422 | 237 |
| Mar | 1.0 | 14.4 | .00422 | 237 |
| Apr | 6.1 | 22.0 | .00429 | 233 |
| May | 12.1 | 24.9 | .00386 | 259 |
| Jun | 16.2 | 30.3 | .00339 | 295 |
| Jul | 20.7 | 33.0 | .00372 | 269 |
| Aug | 23.4 | 31.0 | .00376 | 266 |
| Sep | 16.9 | 29.4 | .00372 | 269 |
| Oct | 10.9 | 22.9 | .00375 | 267 |
| Nov | 4.6 | 20.4 | .00391 | 256 |
| Dec | 0.6 | 13.4 | .00375 | 267 |

MaxT - maximum temperature (C) in the composite data set for each month.

MinT - minimum temperature (C) in the composite data set for each month.

n+1 - sample size plus one.

Prob.- Empirical probability that, on any day the temperature will equal or exceed (or equal or less than) the MaxT (MinT). Computed as 1/(n+1), see Equation (1).

Table 6a
Summary Statistics for Little Falls Flow (CFS) by Month
Adjusted for Diversions, Period of Record: Oct62 - Dec85

| | Jan | Feb | Mar | Apr | May | Jun |
|---|---|---|---|---|---|---|
| nbr obs. | 713 | 650 | 713 | 690 | 713 | 690 |
| minimum | 757 | 1153 | 4100 | 3722 | 2733 | 1401 |
| maximum | 117433 | 209471 | 154428 | 121470 | 114467 | 334487 |
| mean | 13521 | 18295 | 24633 | 20264 | 14785 | 10685 |
| median | 9942 | 12128 | 18059 | 14574 | 10879 | 6886 |

| | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|
| nbr obs. | 713 | 713 | 690 | 744 | 720 | 744 |
| minimum | 804 | 724 | 524 | 1087 | 1148 | 1323 |
| maximum | 50210 | 38277 | 186453 | 194454 | 293530 | 100442 |
| mean | 5385 | 4631 | 4969 | 7391 | 9113 | 12691 |
| median | 4344 | 3451 | 2685 | 2958 | 4726 | 8130 |

Table 6b
Summary Statistics for Log Transform of
Little Falls Flow (Log CFS)

| | Jan | Feb | Mar | Apr | May | Jun |
|---|---|---|---|---|---|---|
| nbr obs. | 713 | 650 | 713 | 690 | 713 | 690 |
| minimum | 2.879 | 3.062 | 3.613 | 3.571 | 3.437 | 3.146 |
| maximum | 5.070 | 5.321 | 5.189 | 5.084 | 5.059 | 5.524 |
| mean | 3.978 | 4.119 | 4.270 | 4.197 | 4.052 | 3.854 |
| variance | 0.134 | 0.112 | 0.100 | 0.089 | 0.093 | 0.111 |
| std dev. | 0.366 | 0.335 | 0.317 | 0.298 | 0.306 | 0.333 |

| | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|
| nbr obs. | 713 | 713 | 690 | 744 | 720 | 744 |
| minimum | 2.905 | 2.860 | 2.719 | 3.036 | 3.060 | 3.122 |
| maximum | 4.701 | 4.583 | 5.271 | 5.289 | 5.468 | 5.002 |
| mean | 3.623 | 3.546 | 3.478 | 3.588 | 3.754 | 3.951 |
| variance | 0.086 | 0.094 | 0.115 | 0.167 | 0.147 | 0.128 |
| std dev. | 0.293 | 0.306 | 0.339 | 0.409 | 0.384 | 0.358 |

TABLE 7

Empirical probability that Little Falls flow (CFS) is less than or equal to the indicated value.

| Flow | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 800 | .002 | ---- | ---- | ---- | ---- | ---- | ---- | .010 | .021 | ---- | ---- | ---- |
| 900 | .003 | ---- | ---- | ---- | ---- | ---- | .011 | .022 | .029 | ---- | ---- | ---- |
| 1000 | .004 | ---- | ---- | ---- | ---- | ---- | .018 | .026 | .037 | ---- | ---- | ---- |
| 1200 | .005 | .002 | ---- | ---- | ---- | ---- | .030 | .049 | .064 | .027 | .003 | ---- |
| 1400 | .011 | .007 | ---- | ---- | ---- | ---- | .057 | .097 | .104 | .047 | .026 | .025 |
| 1500 | .018 | .012 | ---- | ---- | ---- | .008 | .071 | .119 | .129 | .061 | .045 | .035 |
| 1600 | .022 | .013 | ---- | ---- | ---- | .012 | .081 | .155 | .168 | .095 | .058 | .045 |
| 1800 | .026 | .016 | ---- | ---- | ---- | .018 | .107 | .198 | .237 | .180 | .086 | .047 |
| 2000 | .042 | .017 | ---- | ---- | ---- | .024 | .139 | .234 | .305 | .249 | .105 | .048 |
| 2500 | .071 | .020 | ---- | ---- | ---- | .056 | .216 | .316 | .444 | .426 | .201 | .052 |
| 3000 | .088 | .023 | ---- | ---- | .003 | .126 | .304 | .417 | .555 | .524 | .288 | .068 |
| 3500 | .110 | .027 | ---- | ---- | .013 | .190 | .390 | .504 | .664 | .622 | .352 | .103 |
| 4000 | .144 | .038 | ---- | .018 | .032 | .248 | .442 | .585 | .734 | .668 | .416 | .164 |
| 4500 | .198 | .047 | .005 | .019 | .081 | .287 | .509 | .668 | .766 | .704 | .464 | .217 |
| 5000 | .227 | .057 | .021 | .019 | .146 | .339 | .613 | .709 | .811 | .734 | .526 | .262 |
| 6000 | .300 | .136 | .074 | .031 | .224 | .424 | .716 | .801 | .858 | .765 | .577 | .345 |
| 7000 | .357 | .198 | .091 | .097 | .298 | .515 | .807 | .840 | .879 | .781 | .630 | .440 |
| 8000 | .390 | .246 | .126 | .168 | .367 | .576 | .857 | .874 | .900 | .790 | .687 | .523 |
| 9000 | .445 | .322 | .160 | .223 | .410 | .645 | .892 | .900 | .913 | .800 | .720 | .569 |
| 10000 | .490 | .370 | .191 | .276 | .451 | .702 | .909 | .920 | .929 | .815 | .755 | .613 |
| 15000 | .709 | .630 | .374 | .503 | .659 | .847 | .967 | .965 | .962 | .877 | .878 | .738 |
| 20000 | .799 | .746 | .549 | .646 | .775 | .922 | .976 | .984 | .968 | .910 | .919 | .836 |
| 30000 | .904 | .850 | .746 | .807 | .901 | .961 | .989 | .993 | .978 | .944 | .973 | .916 |
| 40000 | .957 | .912 | .832 | .882 | .950 | .974 | .995 | ---- | .987 | .959 | .990 | .954 |
| 50000 | .975 | .953 | .893 | .931 | .974 | .984 | .998 | ---- | .989 | .976 | .996 | .974 |
| 60000 | .985 | .969 | .933 | .966 | .985 | .986 | ---- | ---- | .990 | .985 | ---- | .987 |
| 70000 | .989 | .978 | .953 | .978 | .989 | .989 | ---- | ---- | .992 | .991 | ---- | .990 |
| 80000 | .991 | .984 | .968 | .983 | .993 | .991 | ---- | ---- | .993 | .994 | ---- | .994 |
| 90000 | .993 | .987 | .974 | .993 | .994 | .992 | ---- | ---- | .994 | .995 | ---- | .997 |
| 100000 | .995 | .988 | .981 | .994 | .995 | .993 | ---- | ---- | .995 | .996 | ---- | .998 |

"-----" indicates flows outside the range of observed values.

Table 8
Empirical Probability Flow will be greater than or equal to the maximum Flow, or less than or equal to the minimum Flow, on any day.

| Month | Max Q | Min Q | Prob. | n+1 |
|---|---|---|---|---|
| Jan | 117433 | 757 | .00140 | 714 |
| Feb | 209471 | 1153 | .00154 | 651 |
| Mar | 154428 | 4100 | .00140 | 714 |
| Apr | 121470 | 3722 | .00145 | 691 |
| May | 114467 | 2733 | .00140 | 714 |
| Jun | 334487 | 1401 | .00145 | 691 |
| Jul | 50210 | 804 | .00140 | 714 |
| Aug | 38277 | 724 | .00140 | 714 |
| Sep | 186453 | 524 | .00145 | 691 |
| Oct | 194454 | 1087 | .00134 | 745 |
| Nov | 293530 | 1148 | .00139 | 721 |
| Dec | 100442 | 1323 | .00134 | 745 |

MaxQ - maximum flow, in cfs, in the flow data set for each month.

MinQ - minimum flow, in cfs, in the flow data set for each month.

n+1 - sample size plus one.

Prob.- Empirical probability that, on any day the flow will equal or exceed (or equal or less than) the MaxQ (MinQ). Computed as 1/(n+1), see Equation (1).

Table 9a
Correlation of daily water temperature and log flow.

| Month | r | r sq. | t(n-2) | p | n |
|---|---|---|---|---|---|
| Jan | 0.0598 | 0.0036 | 0.9021 | 0.3680 | 229 |
| Feb | 0.4548 | 0.2069 | 7.3297 | 0.0000 | 208 |
| Mar | 0.0283 | 0.0008 | 0.4038 | 0.6868 | 205 |
| Apr | -0.6343 | 0.4024 | -11.6042 | 0.0000 | 202 |
| May | -0.6057 | 0.3668 | -11.4177 | 0.0000 | 227 |
| Jun | -0.6416 | 0.4116 | -13.5393 | 0.0000 | 264 |
| Jul | -0.3653 | 0.1334 | -6.4002 | 0.0000 | 268 |
| Aug | -0.2361 | 0.0558 | -3.9407 | 0.0001 | 265 |
| Sep | -0.2878 | 0.0828 | -4.9017 | 0.0000 | 268 |
| Oct | -0.4336 | 0.1880 | -7.8190 | 0.0000 | 266 |
| Nov | -0.1117 | 0.0125 | -1.7884 | 0.0749 | 255 |
| Dec | 0.1569 | 0.0246 | 2.5811 | 0.0104 | 266 |

Table 9b
Correlation of daily water temperature and log flow, when flow is less than the median flow.

| Month | r | r sq. | t(n-2) | p | n | median |
|---|---|---|---|---|---|---|
| Jan | 0.1857 | 0.0345 | 2.1801 | 0.031 | 135 | 9942 |
| Feb | 0.0788 | 0.0062 | 0.7904 | 0.431 | 102 | 12128 |
| Mar | 0.0463 | 0.0021 | 0.4685 | 0.640 | 104 | 18059 |
| Apr | -0.5784 | 0.3346 | -6.6894 | 0.000 | 91 | 14575 |
| May | -0.2574 | 0.0663 | -2.4561 | 0.016 | 87 | 10878 |
| Jun | -0.2070 | 0.0429 | -2.0187 | 0.047 | 93 | 6887 |
| Jul | -0.0873 | 0.0076 | -0.8410 | 0.403 | 94 | 4344 |
| Aug | 0.2767 | 0.0766 | 3.0474 | 0.003 | 114 | 3451 |
| Sep | 0.1037 | 0.0108 | 1.1567 | 0.250 | 125 | 2686 |
| Oct | 0.0155 | 0.0002 | 0.1927 | 0.848 | 156 | 2958 |
| Nov | 0.0310 | 0.0010 | 0.3833 | 0.702 | 155 | 4726 |
| Dec | 0.4740 | 0.2247 | 5.6461 | 0.000 | 112 | 8131 |

r = Correlation coefficient of daily water temperature and log mean daily flow.
r-sq = Correlation coefficient squared.
t() = t-test statistic, with n-2 degrees of freedom, for the hypothesis that temperature and flow are independent.
p = significance level of t-test
n = number of joint observations.

Table 10

Tabled values are estimates of the frequency of days, rounded to nearest whole day, with Flows <=, and Temperatures >=, the indicated flows and temperatures. ' - ' indicates lower flows (higher temperatures) than are in the joint flow-temp. data set. Rightmost column (bottom row) is the estimated marginal frequency of lower flows (higher temperatures).

Table 10.1: January Joint Frequency of Occurence of Flows and Temperatures.

Temperature, C

| flow cfs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Q freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 800 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 900 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1200 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1400 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1500 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1600 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1800 | 230 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 230 |
| 2000 | 23 | 230 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 23 |
| 2500 | 9 | 33 | 230 | 230 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 9 |
| 3000 | 7 | 21 | 77 | 230 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 7 |
| 3500 | 7 | 18 | 58 | 230 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 7 |
| 4000 | 5 | 11 | 29 | 58 | 115 | 115 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 5 |
| 4500 | 5 | 9 | 23 | 46 | 77 | 77 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 5 |
| 5000 | 4 | 6 | 13 | 26 | 38 | 38 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 |
| 6000 | 2 | 4 | 8 | 12 | 16 | 19 | 77 | 77 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 7000 | 2 | 3 | 6 | 10 | 14 | 16 | 77 | 77 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 8000 | 2 | 3 | 6 | 10 | 14 | 16 | 77 | 77 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 9000 | 2 | 3 | 6 | 10 | 14 | 16 | 77 | 77 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 10000 | 2 | 3 | 5 | 9 | 12 | 14 | 38 | 46 | 230 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 15000 | 1 | 2 | 4 | 7 | 9 | 11 | 26 | 46 | 230 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 20000 | 1 | 2 | 4 | 6 | 9 | 11 | 26 | 46 | 230 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 30000 | 1 | 2 | 3 | 6 | 8 | 11 | 26 | 46 | 230 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 40000 | 1 | 2 | 3 | 5 | 7 | 9 | 26 | 46 | 230 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 50000 | 1 | 2 | 3 | 5 | 7 | 9 | 26 | 46 | 230 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 60000 | 1 | 2 | 3 | 5 | 7 | 9 | 26 | 46 | 230 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 70000 | 1 | 2 | 3 | 5 | 7 | 9 | 26 | 46 | 230 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 80000 | 1 | 2 | 3 | 5 | 7 | 9 | 26 | 46 | 230 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 90000 | 1 | 2 | 3 | 5 | 7 | 9 | 26 | 46 | 230 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 100000 | 1 | 2 | 3 | 5 | 7 | 9 | 26 | 46 | 230 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| T freq. | 1 | 2 | 3 | 5 | 7 | 9 | 26 | 46 | 230 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |

Table 10.2: February Joint Frequency of Occurence of Flows and Temperatures.

Temperature, C

| flow cfs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Q freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 800 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 900 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1200 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1400 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1500 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1600 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1800 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2500 | 209 | 209 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 209 |
| 3000 | 105 | 105 | 209 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 105 |
| 3500 | 105 | 105 | 209 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 105 |
| 4000 | 105 | 105 | 209 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 105 |
| 4500 | 105 | 105 | 209 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 105 |
| 5000 | 42 | 52 | 105 | 209 | 209 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 42 |
| 6000 | 14 | 19 | 35 | 42 | 70 | 209 | 209 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 14 |
| 7000 | 7 | 8 | 16 | 26 | 42 | 105 | 209 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 7 |
| 8000 | 5 | 6 | 12 | 17 | 23 | 42 | 105 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 5 |
| 9000 | 4 | 6 | 10 | 14 | 19 | 30 | 70 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 |
| 10000 | 4 | 5 | 10 | 14 | 19 | 30 | 70 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 |
| 15000 | 2 | 3 | 4 | 7 | 12 | 21 | 52 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 20000 | 2 | 2 | 4 | 6 | 10 | 16 | 35 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 30000 | 2 | 2 | 3 | 4 | 6 | 10 | 21 | 70 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 40000 | 1 | 2 | 2 | 3 | 4 | 7 | 10 | 26 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 50000 | 1 | 1 | 2 | 3 | 4 | 6 | 9 | 21 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 60000 | 1 | 1 | 2 | 3 | 4 | 6 | 9 | 21 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 70000 | 1 | 1 | 2 | 3 | 4 | 5 | 8 | 21 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 80000 | 1 | 1 | 2 | 3 | 4 | 5 | 8 | 21 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 90000 | 1 | 1 | 2 | 3 | 4 | 5 | 8 | 21 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 100000 | 1 | 1 | 2 | 3 | 4 | 5 | 8 | 21 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| T freq. | 1 | 1 | 2 | 3 | 4 | 5 | 8 | 21 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |

Table 10 (cont.)

Tabled values are estimates of the frequency of days, rounded to nearest whole day, with Flows <=, and Temperatures >=, the indicated flows and temperatures. ' - ' indicates lower flows (higher temperatures) than are in the joint flow-temp. data set. Rightmost column (bottom row) is the estimated marginal frequency of lower flows (higher temperatures).

Table 10.3: March Joint Frequency of Occurence of Flows and Temperatures.

| flow cfs | Temperature, C 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Q freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 800 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 900 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1200 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1400 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1500 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1600 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1800 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2500 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3500 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4500 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5000 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 52 | 52 | 103 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 41 |
| 6000 | 17 | 17 | 17 | 17 | 17 | 21 | 26 | 34 | 41 | 69 | 206 | 206 | 206 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 17 |
| 7000 | 12 | 12 | 12 | 12 | 12 | 17 | 21 | 29 | 41 | 69 | 206 | 206 | 206 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 12 |
| 8000 | 7 | 7 | 7 | 8 | 8 | 10 | 12 | 26 | 34 | 52 | 103 | 206 | 206 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 7 |
| 9000 | 5 | 5 | 5 | 5 | 6 | 8 | 9 | 21 | 29 | 41 | 69 | 103 | 206 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 5 |
| 10000 | 4 | 4 | 4 | 4 | 5 | 6 | 7 | 15 | 26 | 41 | 69 | 103 | 206 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 |
| 15000 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 7 | 10 | 19 | 41 | 103 | 206 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| 20000 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 5 | 8 | 16 | 34 | 103 | 206 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 30000 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 11 | 29 | 103 | 206 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 40000 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 5 | 11 | 29 | 103 | 206 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 50000 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 5 | 11 | 29 | 103 | 206 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 60000 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 5 | 11 | 29 | 103 | 206 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 70000 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 5 | 10 | 26 | 103 | 206 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 80000 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 5 | 10 | 26 | 103 | 206 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 90000 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 5 | 10 | 26 | 103 | 206 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 100000 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 5 | 10 | 26 | 103 | 206 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| T freq. | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 5 | 10 | 26 | 103 | 206 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |

Table 10.4: April Joint Frequency of Occurence of Flows and Temperatures.

| Flow cfs | Temperature, C 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Q freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 800 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 900 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1200 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1400 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1500 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1600 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1800 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2500 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3500 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4000 | 203 | 203 | 203 | 203 | 203 | 203 | 203 | 203 | 203 | 203 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 203 |
| 4500 | 203 | 203 | 203 | 203 | 203 | 203 | 203 | 203 | 203 | 203 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 203 |
| 5000 | 203 | 203 | 203 | 203 | 203 | 203 | 203 | 203 | 203 | 203 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 203 |
| 6000 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 25 | 25 | 25 | 25 | 25 | 51 | 51 | 51 | 51 | 51 | - | - | - | - | - | - | - | - | - | - | - | - | - | 23 |
| 7000 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 10 | 10 | 16 | 17 | 18 | 18 | 23 | 102 | 203 | - | - | - | - | - | - | - | - | - | - | - | 9 |
| 8000 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 8 | 11 | 12 | 16 | 17 | 23 | 102 | 203 | - | - | - | - | - | - | - | - | - | - | - | 6 |
| 9000 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 8 | 10 | 13 | 17 | 23 | 102 | 203 | - | - | - | - | - | - | - | - | - | - | - | 5 |
| 10000 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 8 | 10 | 13 | 17 | 23 | 102 | 203 | - | - | - | - | - | - | - | - | - | - | - | 4 |
| 15000 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 6 | 9 | 12 | 17 | 23 | 102 | 203 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 20000 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 5 | 8 | 12 | 17 | 23 | 102 | 203 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 30000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 5 | 8 | 12 | 17 | 23 | 102 | 203 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 40000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 5 | 8 | 12 | 17 | 23 | 102 | 203 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 50000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 5 | 8 | 12 | 17 | 23 | 102 | 203 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 60000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 5 | 8 | 12 | 17 | 23 | 102 | 203 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 70000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 5 | 8 | 12 | 17 | 23 | 102 | 203 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 80000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 5 | 8 | 12 | 17 | 23 | 102 | 203 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 90000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 5 | 8 | 12 | 17 | 23 | 102 | 203 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 100000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 5 | 8 | 12 | 17 | 23 | 102 | 203 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| T freq. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 5 | 8 | 12 | 17 | 23 | 102 | 203 | - | - | - | - | - | - | - | - | - | - | - | |

Table 10 (cont.)

Tabled values are estimates of the frequency of days, rounded to nearest whole day, with Flows <=, and Temperatures >=, the indicated flows and temperatures. ' - ' indicates lower flows (higher temperatures) than are in the joint flow-temp. data set. Rightmost column (bottom row) is the estimated marginal frequency of lower flows (higher temperatures).

Table 10.5: May Joint Frequency of Occurence of Flows and Temperatures.

| flow cfs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Q freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 800 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 900 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1200 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1400 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1500 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1600 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1800 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2500 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3500 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4000 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 228 | - | - | - | - | - | - | - | - | - | 114 |
| 4500 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 76 | 76 | 76 | 228 | - | - | - | - | - | - | - | - | - | 46 |
| 5000 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 18 | 21 | 33 | 38 | 38 | 57 | - | - | - | - | - | - | - | - | - | 16 |
| 6000 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 12 | 15 | 18 | 21 | 38 | - | - | - | - | - | - | - | - | - | 10 |
| 7000 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 11 | 13 | 18 | 33 | - | - | - | - | - | - | - | - | - | 7 |
| 8000 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 7 | 10 | 15 | 33 | - | - | - | - | - | - | - | - | - | 5 |
| 9000 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 6 | 8 | 13 | 33 | - | - | - | - | - | - | - | - | - | 3 |
| 10000 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 6 | 8 | 12 | 33 | - | - | - | - | - | - | - | - | - | 3 |
| 15000 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 4 | 5 | 8 | 23 | - | - | - | - | - | - | - | - | - | 2 |
| 20000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 5 | 8 | 23 | - | - | - | - | - | - | - | - | - | 1 |
| 30000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 4 | 8 | 23 | - | - | - | - | - | - | - | - | - | 1 |
| 40000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 4 | 8 | 23 | - | - | - | - | - | - | - | - | - | 1 |
| 50000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 4 | 8 | 23 | - | - | - | - | - | - | - | - | - | 1 |
| 60000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 4 | 8 | 23 | - | - | - | - | - | - | - | - | - | 1 |
| 70000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 4 | 8 | 23 | - | - | - | - | - | - | - | - | - | 1 |
| 80000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 4 | 8 | 23 | - | - | - | - | - | - | - | - | - | 1 |
| 90000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 4 | 8 | 23 | - | - | - | - | - | - | - | - | - | 1 |
| 100000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 4 | 8 | 23 | - | - | - | - | - | - | - | - | - | 1 |
| T freq. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 4 | 8 | 23 | - | - | - | - | - | - | - | - | - | |

Table 10.6: June Joint Frequency of Occurence of Flows and Temperatures.

| flow cfs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Q freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 800 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 900 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1200 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1400 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1500 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 265 | 265 | - | - | - | 133 |
| 1600 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 265 | 265 | - | - | - | 133 |
| 1800 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 265 | 265 | - | - | - | 133 |
| 2000 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 265 | 265 | - | - | - | 133 |
| 2500 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 88 | 265 | 265 | - | - | - | 66 |
| 3000 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 29 | 38 | 66 | 88 | 265 | 265 | - | - | - | 27 |
| 3500 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 20 | 29 | 53 | 88 | 265 | 265 | - | - | - | 17 |
| 4000 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 17 | 29 | 53 | 88 | 265 | 265 | - | - | - | 13 |
| 4500 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 12 | 19 | 33 | 66 | 265 | 265 | - | - | - | 9 |
| 5000 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 11 | 20 | 29 | 88 | 133 | - | - | - | 6 |
| 6000 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 7 | 11 | 17 | 53 | 133 | - | - | - | 3 |
| 7000 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 5 | 9 | 17 | 53 | 133 | - | - | - | 3 |
| 8000 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 5 | 8 | 16 | 53 | 133 | - | - | - | 2 |
| 9000 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 4 | 8 | 16 | 53 | 133 | - | - | - | 2 |
| 10000 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 4 | 8 | 16 | 53 | 133 | - | - | - | 2 |
| 15000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 4 | 8 | 15 | 53 | 133 | - | - | - | 1 |
| 20000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 7 | 14 | 44 | 133 | - | - | - | 1 |
| 30000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 7 | 14 | 44 | 133 | - | - | - | 1 |
| 40000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 7 | 14 | 44 | 133 | - | - | - | 1 |
| 50000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 7 | 14 | 44 | 133 | - | - | - | 1 |
| 60000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 7 | 14 | 44 | 133 | - | - | - | 1 |
| 70000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 7 | 14 | 44 | 133 | - | - | - | 1 |
| 80000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 7 | 14 | 44 | 133 | - | - | - | 1 |
| 90000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 7 | 14 | 44 | 133 | - | - | - | 1 |
| 100000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 7 | 14 | 44 | 133 | - | - | - | 1 |
| T freq. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 7 | 14 | 44 | 133 | - | - | - | |

Table 10 (cont.)

Tabled values are estimates of the frequency of days, rounded to nearest whole day, with Flows <=, and Temperatures >=, the indicated flows and temperatures. ' - ' indicates lower flows (higher temperatures) than are in the joint flow-temp. data set. Rightmost column (bottom row) is the estimated marginal frequency of lower flows (higher temperatures).

Table 10.7: July Joint Frequency of Occurence of Flows and Temperatures.

Temperature, C

| flow cfs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Q freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 800 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 900 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | - | - | - | - | - | 269 |
| 1000 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | - | - | - | - | - | 135 |
| 1200 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 90 | 90 | - | - | - | - | - | 67 |
| 1400 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 54 | 54 | 135 | 135 | - | - | - | 45 |
| 1500 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 54 | 54 | 135 | 135 | - | - | - | 45 |
| 1600 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 54 | 54 | 135 | 135 | - | - | - | 45 |
| 1800 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 54 | 54 | 135 | 135 | - | - | - | 45 |
| 2000 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 45 | 45 | 135 | 135 | - | - | - | 38 |
| 2500 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 24 | 30 | 135 | 135 | - | - | - | 22 |
| 3000 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 10 | 14 | 34 | 67 | 269 | 269 | 269 | 7 |
| 3500 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 6 | 8 | 17 | 34 | 135 | 269 | 269 | 4 |
| 4000 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 6 | 13 | 27 | 135 | 269 | 269 | 3 |
| 4500 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 5 | 10 | 24 | 135 | 269 | 269 | 3 |
| 5000 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 4 | 8 | 22 | 135 | 269 | 269 | 2 |
| 6000 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 6 | 19 | 135 | 269 | 269 | 2 |
| 7000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 6 | 19 | 135 | 269 | 269 | 1 |
| 8000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 5 | 19 | 135 | 269 | 269 | 1 |
| 9000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 5 | 19 | 135 | 269 | 269 | 1 |
| 10000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 5 | 19 | 135 | 269 | 269 | 1 |
| 15000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 5 | 19 | 135 | 269 | 269 | 1 |
| 20000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 5 | 19 | 135 | 269 | 269 | 1 |
| 30000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 5 | 19 | 135 | 269 | 269 | 1 |
| 40000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 5 | 19 | 135 | 269 | 269 | 1 |
| 50000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 5 | 19 | 135 | 269 | 269 | 1 |
| 60000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 5 | 19 | 135 | 269 | 269 | 1 |
| 70000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 5 | 19 | 135 | 269 | 269 | 1 |
| 80000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 5 | 19 | 135 | 269 | 269 | 1 |
| 90000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 5 | 19 | 135 | 269 | 269 | 1 |
| 100000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 5 | 19 | 135 | 269 | 269 | 1 |
| T freq. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 5 | 19 | 135 | 269 | 269 | |

Table 10.8: August Joint Frequency of Occurence of Flows and Temperatures.

Temperature, C

| flow cfs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Q freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 800 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 266 | 266 | - | - | - | - | - | 133 |
| 900 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 133 | 266 | - | - | - | - | - | 89 |
| 1000 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 133 | 266 | - | - | - | - | - | 89 |
| 1200 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 89 | 266 | - | - | - | - | - | 67 |
| 1400 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 89 | 266 | - | - | - | - | - | 53 |
| 1500 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 53 | 89 | 266 | - | - | - | - | - | 38 |
| 1600 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 30 | 38 | 89 | 266 | - | - | - | - | - | 24 |
| 1800 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 27 | 33 | 67 | 266 | - | - | - | - | - | 18 |
| 2000 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 22 | 30 | 67 | 266 | - | - | - | - | - | 14 |
| 2500 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 9 | 10 | 13 | 16 | 27 | 266 | - | - | - | 7 |
| 3000 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 5 | 7 | 14 | 67 | 266 | - | - | 3 |
| 3500 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 5 | 9 | 24 | 266 | - | - | 2 |
| 4000 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 5 | 8 | 24 | 266 | - | - | 2 |
| 4500 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 4 | 8 | 24 | 266 | - | - | 2 |
| 5000 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 4 | 7 | 24 | 266 | - | - | 2 |
| 6000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 7 | 24 | 266 | - | - | 1 |
| 7000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 7 | 24 | 266 | - | - | 1 |
| 8000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 7 | 24 | 266 | - | - | 1 |
| 9000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 7 | 24 | 266 | - | - | 1 |
| 10000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 7 | 24 | 266 | - | - | 1 |
| 15000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 7 | 24 | 266 | - | - | 1 |
| 20000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 7 | 24 | 266 | - | - | 1 |
| 30000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 7 | 24 | 266 | - | - | 1 |
| 40000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 7 | 24 | 266 | - | - | 1 |
| 50000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 7 | 24 | 266 | - | - | 1 |
| 60000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 7 | 24 | 266 | - | - | 1 |
| 70000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 7 | 24 | 266 | - | - | 1 |
| 80000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 7 | 24 | 266 | - | - | 1 |
| 90000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 7 | 24 | 266 | - | - | 1 |
| 100000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 7 | 24 | 266 | - | - | 1 |
| T freq. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 7 | 24 | 266 | - | - | |

Table 10 (cont.)

Tabled values are estimates of the frequency of days, rounded to nearest whole day, with Flows <=, and Temperatures >=, the indicated flows and temperatures. ' - ' indicates lower flows (higher temperatures) than are in the joint flow-temp. data set. Rightmost column (bottom row) is the estimated marginal frequency of lower flows (higher temperatures).

Table 10.9: September Joint Frequency of Occurence of Flows and Temperatures.

| flow cfs | Temperature, C 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Q freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 800 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | - | - | - | - | - | - | - | - | - | 269 |
| 900 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | - | - | - | - | - | - | - | - | - | 269 |
| 1000 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | - | - | - | - | - | - | - | - | - | 269 |
| 1200 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | - | - | - | - | - | - | - | - | - | 269 |
| 1400 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 135 | 135 | - | - | - | - | - | - | - | - | - | 90 |
| 1500 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 135 | 135 | - | - | - | - | - | - | - | - | - | 90 |
| 1600 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 135 | 135 | - | - | - | - | - | - | - | - | - | 90 |
| 1800 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 34 | 38 | 90 | 135 | 269 | 269 | - | - | - | - | - | 24 |
| 2000 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 11 | 13 | 21 | 45 | 67 | 67 | 269 | - | - | - | - | 6 |
| 2500 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 6 | 12 | 19 | 21 | 135 | - | - | - | - | 3 |
| 3000 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 7 | 10 | 12 | 54 | - | - | - | - | 2 |
| 3500 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 6 | 10 | 12 | 54 | - | - | - | - | 1 |
| 4000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 12 | 54 | - | - | - | - | 1 |
| 4500 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 12 | 54 | - | - | - | - | 1 |
| 5000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 5 | 9 | 12 | 54 | - | - | - | - | 1 |
| 6000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 5 | 8 | 12 | 54 | - | - | - | - | 1 |
| 7000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 5 | 8 | 12 | 54 | - | - | - | - | 1 |
| 8000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 4 | 8 | 12 | 54 | - | - | - | - | 1 |
| 9000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 4 | 7 | 12 | 54 | - | - | - | - | 1 |
| 10000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 4 | 7 | 12 | 54 | - | - | - | - | 1 |
| 15000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 4 | 7 | 12 | 54 | - | - | - | - | 1 |
| 20000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 4 | 7 | 12 | 54 | - | - | - | - | 1 |
| 30000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 4 | 7 | 12 | 54 | - | - | - | - | 1 |
| 40000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 4 | 7 | 12 | 54 | - | - | - | - | 1 |
| 50000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 4 | 7 | 12 | 54 | - | - | - | - | 1 |
| 60000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 4 | 7 | 12 | 54 | - | - | - | - | 1 |
| 70000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 4 | 7 | 12 | 54 | - | - | - | - | 1 |
| 80000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 4 | 7 | 12 | 54 | - | - | - | - | 1 |
| 90000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 4 | 7 | 12 | 54 | - | - | - | - | 1 |
| 100000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 4 | 7 | 12 | 54 | - | - | - | - | 1 |
| T freq. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 4 | 7 | 12 | 54 | - | - | - | - | |

Table 10.10: October Joint Frequency of Occurence of Flows and Temperatures.

| flow cfs | Temperature, C 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Q freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 800 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 900 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1200 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1400 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1500 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 134 |
| 1600 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 45 | 134 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 30 |
| 1800 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 10 | 12 | 22 | 30 | 67 | 267 | - | - | - | - | - | - | - | - | - | - | - | - | 8 |
| 2000 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 7 | 10 | 15 | 30 | 53 | 267 | - | - | - | - | - | - | - | - | - | - | - | 5 |
| 2500 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 5 | 7 | 14 | 38 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 3000 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 4 | 6 | 11 | 30 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 3500 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 5 | 10 | 30 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 4000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 5 | 10 | 27 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 4500 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 27 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 5000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 27 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 6000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 27 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 7000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 27 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 8000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 27 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 9000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 27 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 10000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 27 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 15000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 27 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 20000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 27 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 30000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 27 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 40000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 27 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 50000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 27 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 60000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 27 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 70000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 27 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 80000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 27 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 90000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 27 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 100000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 27 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| T freq. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 27 | - | - | - | - | - | - | - | - | - | - | - | |

Table 10 (cont.)

Tabled values are estimates of the frequency of days, rounded to nearest whole day, with Flows <=, and Temperatures >=, the indicated flows and temperatures. ' - ' indicates lower flows (higher temperatures) than are in the joint flow-temp. data set. Rightmost column (bottom row) is the estimated marginal frequency of lower flows (higher temperatures).

Table 10.11: November Joint Frequency of Occurence of Flows and Temperatures.

| flow cfs | Temperature, C 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Q freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 800 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 900 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1200 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1400 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1500 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1600 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1800 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 256 |
| 2000 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 256 | 256 | 256 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 85 |
| 2500 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 9 | 10 | 11 | 12 | 20 | 32 | 64 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 8 |
| 3000 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 9 | 16 | 26 | 64 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 |
| 3500 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 7 | 13 | 20 | 51 | 128 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| 4000 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 6 | 10 | 18 | 51 | 128 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 4500 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 4 | 6 | 10 | 26 | 37 | 85 | 128 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 5000 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 6 | 9 | 26 | 37 | 85 | 128 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 6000 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 5 | 9 | 23 | 32 | 85 | 128 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 7000 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 5 | 9 | 23 | 32 | 85 | 128 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 8000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 5 | 9 | 23 | 32 | 85 | 128 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 9000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 5 | 9 | 23 | 32 | 85 | 128 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 10000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 5 | 9 | 23 | 32 | 85 | 128 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 15000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 5 | 9 | 23 | 32 | 85 | 128 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 20000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 5 | 9 | 23 | 32 | 85 | 128 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 30000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 5 | 8 | 21 | 28 | 85 | 128 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 40000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 4 | 8 | 21 | 28 | 85 | 128 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 50000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 4 | 8 | 21 | 28 | 85 | 128 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 60000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 8 | 21 | 28 | 85 | 128 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 70000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 8 | 21 | 28 | 85 | 128 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 80000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 8 | 21 | 28 | 85 | 128 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 90000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 8 | 21 | 28 | 85 | 128 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 100000 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 8 | 21 | 28 | 85 | 128 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| T freq. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 8 | 21 | 28 | 85 | 128 | 256 | 256 | - | - | - | - | - | - | - | - | - | - | - | - | - | |

Table 10.12: December Joint Frequency of Occurence of Flows and Temperatures.

| flow cfs | Temperature, C 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | Q freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 800 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 900 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1000 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1200 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1400 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1500 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1600 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1800 | 267 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 267 |
| 2000 | 267 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 267 |
| 2500 | 134 | 267 | 267 | 267 | 267 | 267 | 267 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 67 |
| 3000 | 27 | 45 | 89 | 89 | 89 | 89 | 89 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 21 |
| 3500 | 16 | 24 | 38 | 53 | 67 | 67 | 89 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 13 |
| 4000 | 9 | 11 | 15 | 22 | 30 | 38 | 67 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 8 |
| 4500 | 6 | 6 | 8 | 10 | 13 | 21 | 38 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 5 |
| 5000 | 5 | 5 | 7 | 8 | 10 | 13 | 22 | 134 | 267 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 |
| 6000 | 3 | 4 | 4 | 5 | 6 | 8 | 12 | 30 | 67 | 134 | 267 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| 7000 | 3 | 3 | 3 | 4 | 5 | 6 | 9 | 19 | 33 | 53 | 134 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| 8000 | 3 | 3 | 3 | 4 | 4 | 6 | 8 | 14 | 21 | 38 | 89 | 267 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 9000 | 2 | 2 | 3 | 3 | 4 | 5 | 6 | 11 | 17 | 30 | 53 | 134 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 10000 | 2 | 2 | 2 | 3 | 3 | 4 | 5 | 10 | 15 | 24 | 38 | 89 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| 15000 | 1 | 2 | 2 | 2 | 2 | 3 | 4 | 8 | 13 | 21 | 33 | 67 | 267 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 20000 | 1 | 1 | 1 | 2 | 2 | 3 | 4 | 7 | 13 | 21 | 33 | 67 | 267 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 30000 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 7 | 13 | 19 | 30 | 53 | 134 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 40000 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 7 | 13 | 19 | 30 | 53 | 134 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 50000 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 6 | 13 | 19 | 30 | 53 | 134 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 60000 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 6 | 13 | 19 | 30 | 53 | 134 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 70000 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 6 | 13 | 19 | 30 | 53 | 134 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 80000 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 6 | 13 | 19 | 30 | 53 | 134 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 90000 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 6 | 13 | 19 | 30 | 53 | 134 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| 100000 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 6 | 13 | 19 | 30 | 53 | 134 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| T freq. | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 6 | 13 | 19 | 30 | 53 | 134 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |

Table 11
Estimate of Low Flow Augmentation by
Bloomington and Savage Reservoirs.

Annual Minimum Flow, CFS

| Year | Kitz. | Barnum | Barton | Savage | Inflow | Outflow | Aug. |
|---|---|---|---|---|---|---|---|
| 1982 | 22 | 38 | 2 | 21 | 26 | 59 | 33 |
| 1983 | 18 | 177 | 2 | 20 | 22 | 197 | 175 |
| 1984 | 19 | 149 | 3.5 | 42 | 26 | 191 | 165 |
| 1985 | 20 | 201 | 1.2 | 48 | 22 | 249 | 227 |

where

Year is Water Year
Barnum is USGS gage 01595800 at Barnum, WV (below Bloom.)
Kitz. is USGS gage 01595500 at Kitzmiller, MD (above Bloom.)
Barton is USGS gage 01596500 at Barton, MD (above Savage)
Savage is USGS gage 01597500 just below Savage R. Dam
Inflow is the sum of the minimum annual flows at Kitzmiller plus twice the flow at Barton (because Barton captures 1/2 the inflow to Savage).
Outflow is the sum of the minimum annual flows at Barnum and Savage.
Aug. is the effective low flow augmentation accomplished by Bloomington and Savage Reservoirs.

Note that 1983 is the first full year of operation for Bloomington Reservoir.

Figure A-1
Temperature Duration Curve for January

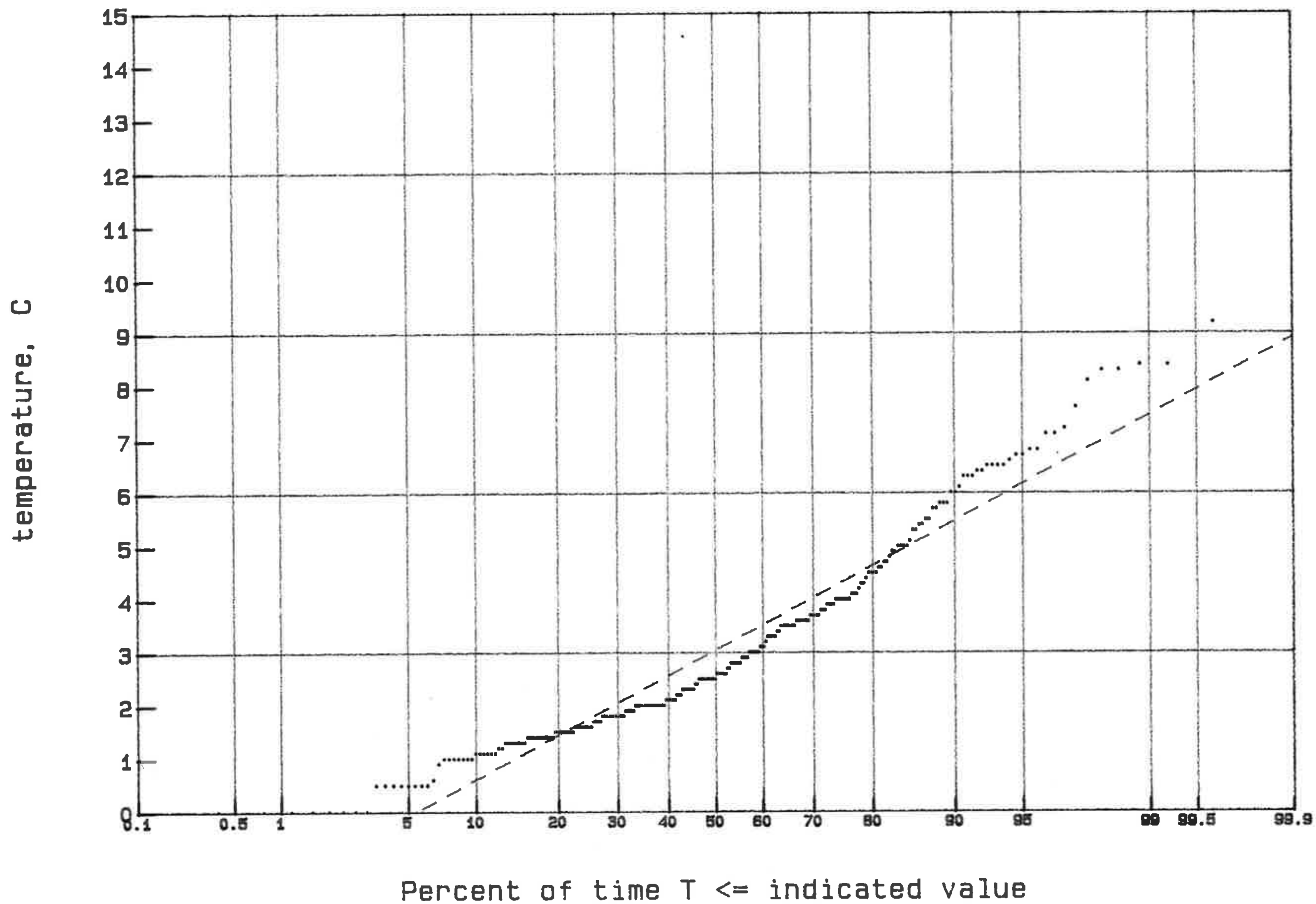


Figure A-2
Temperature Duration Curve for February

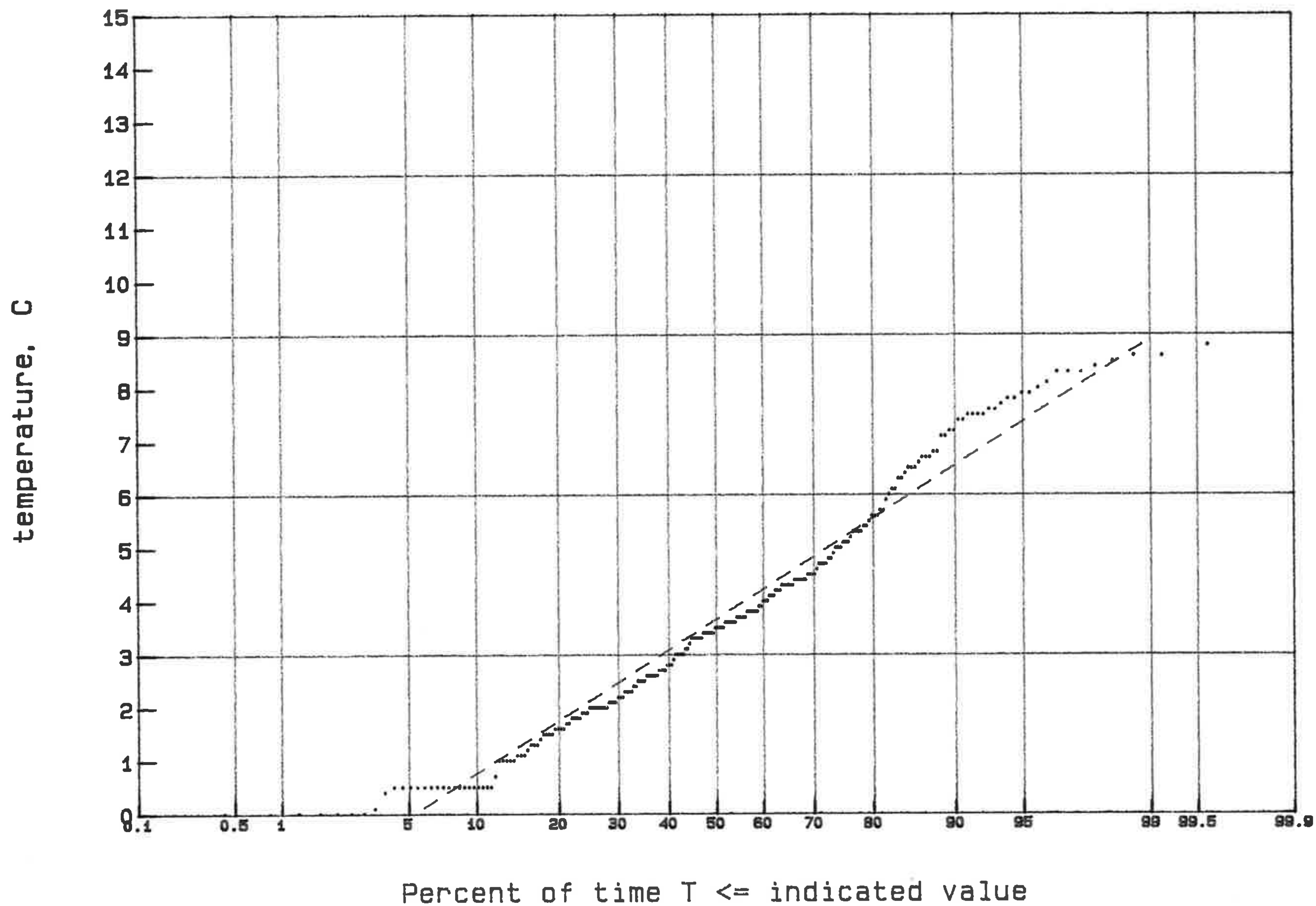


Figure A-3
Temperature Duration Curve for March

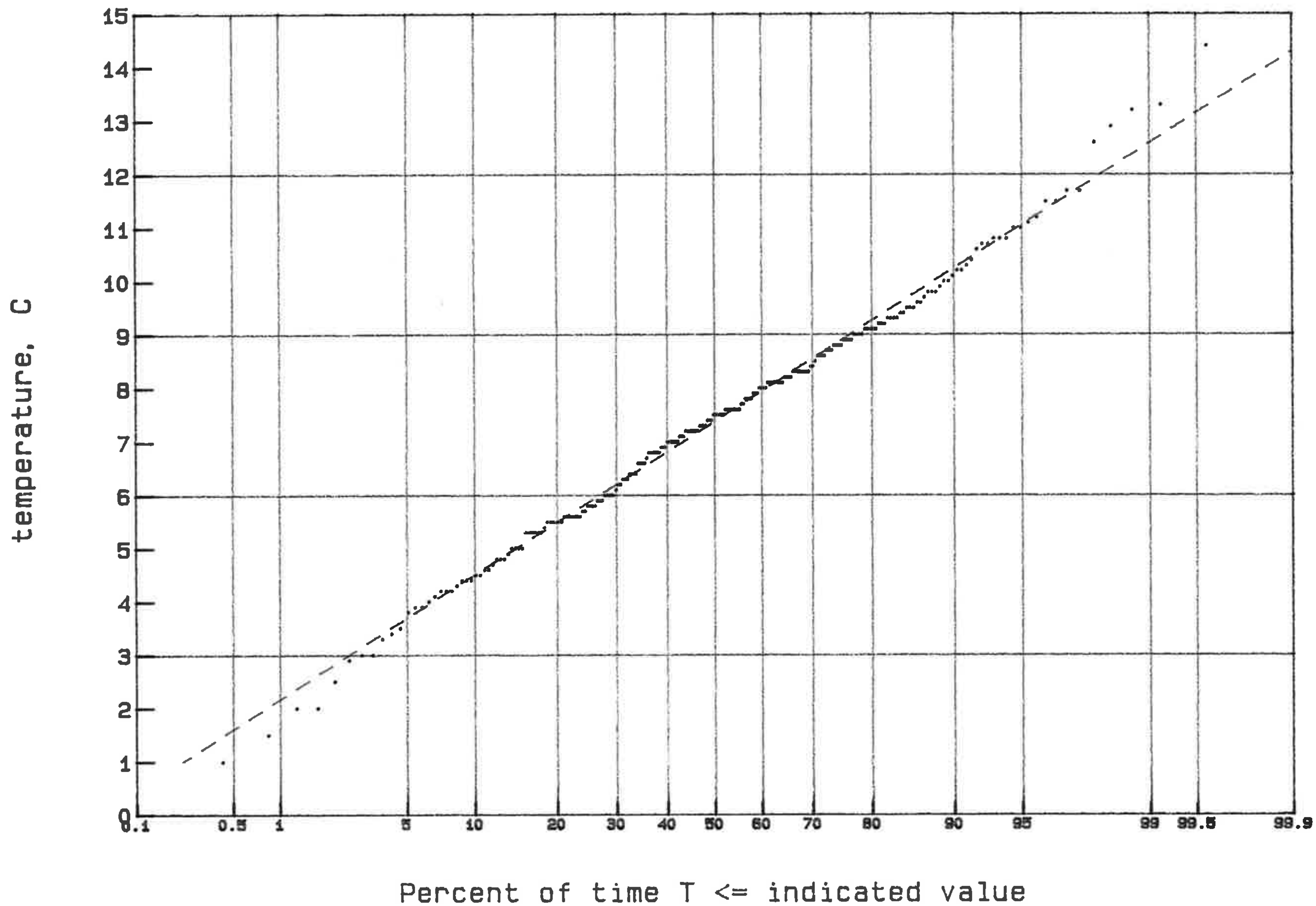


Figure A-4
Temperature Duration Curve for April

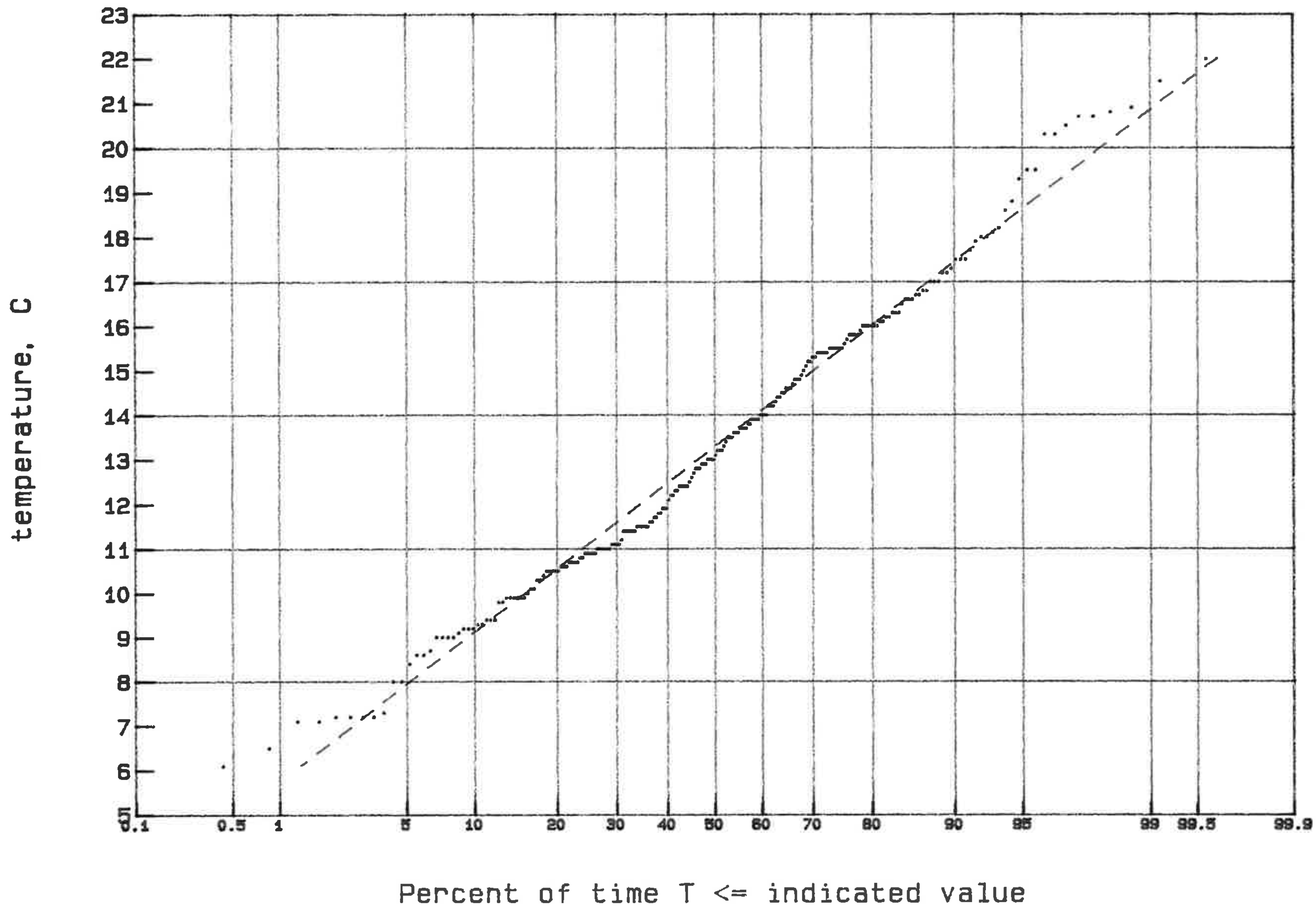


Figure A-5
Temperature Duration Curve for May

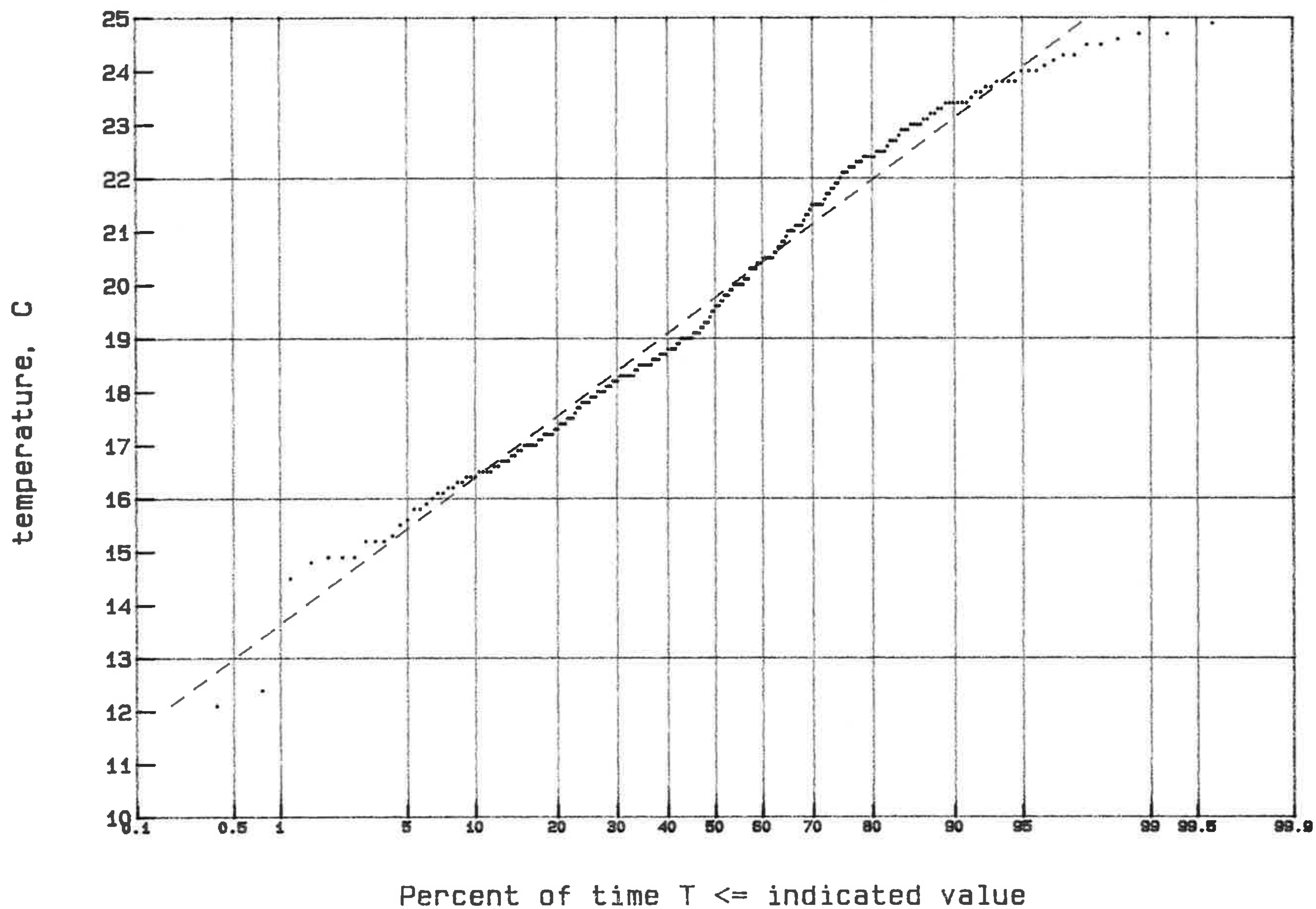


Figure A-6
Temperature Duration Curve for June

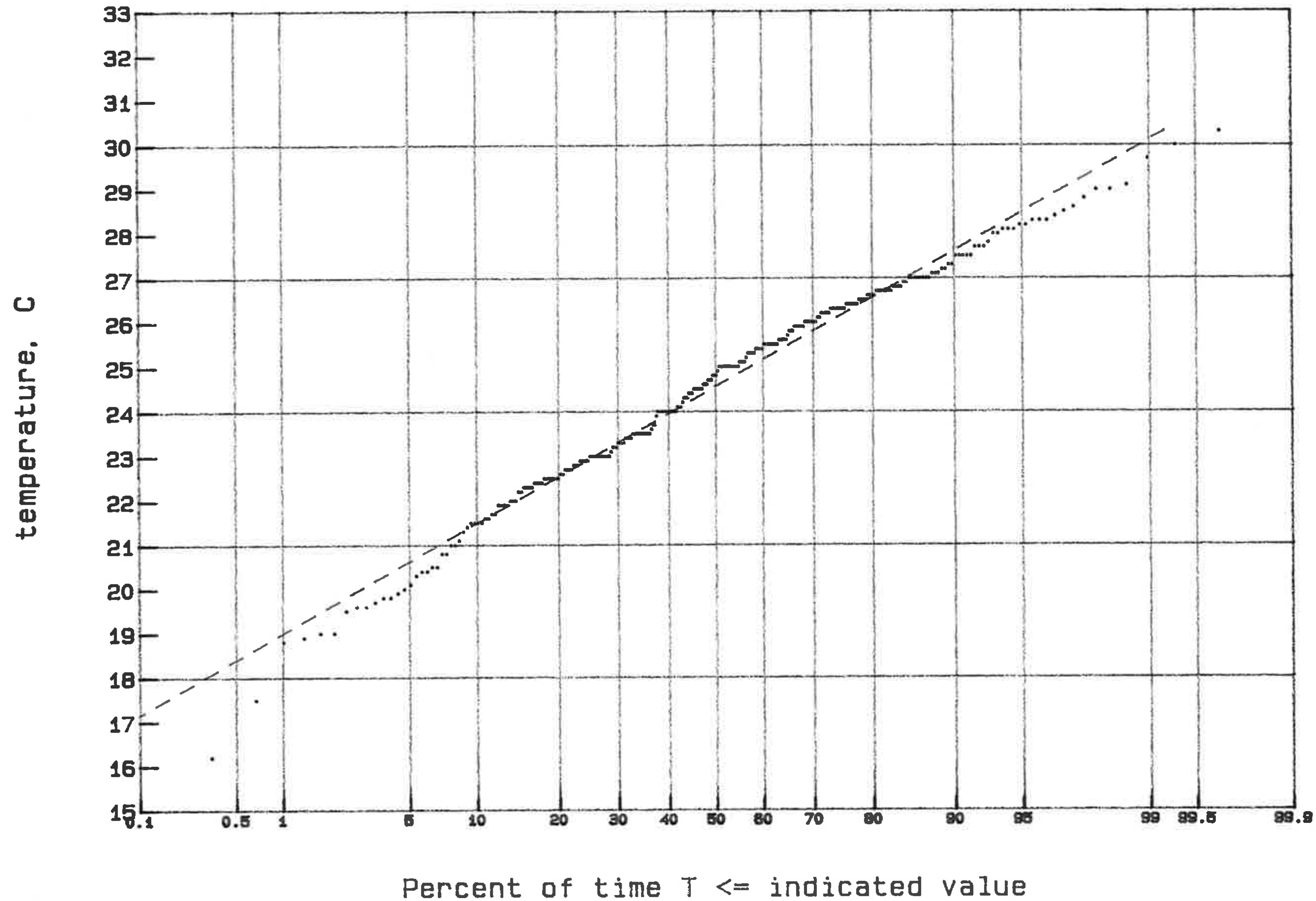


Figure A-7
Temperature Duration Curve for July

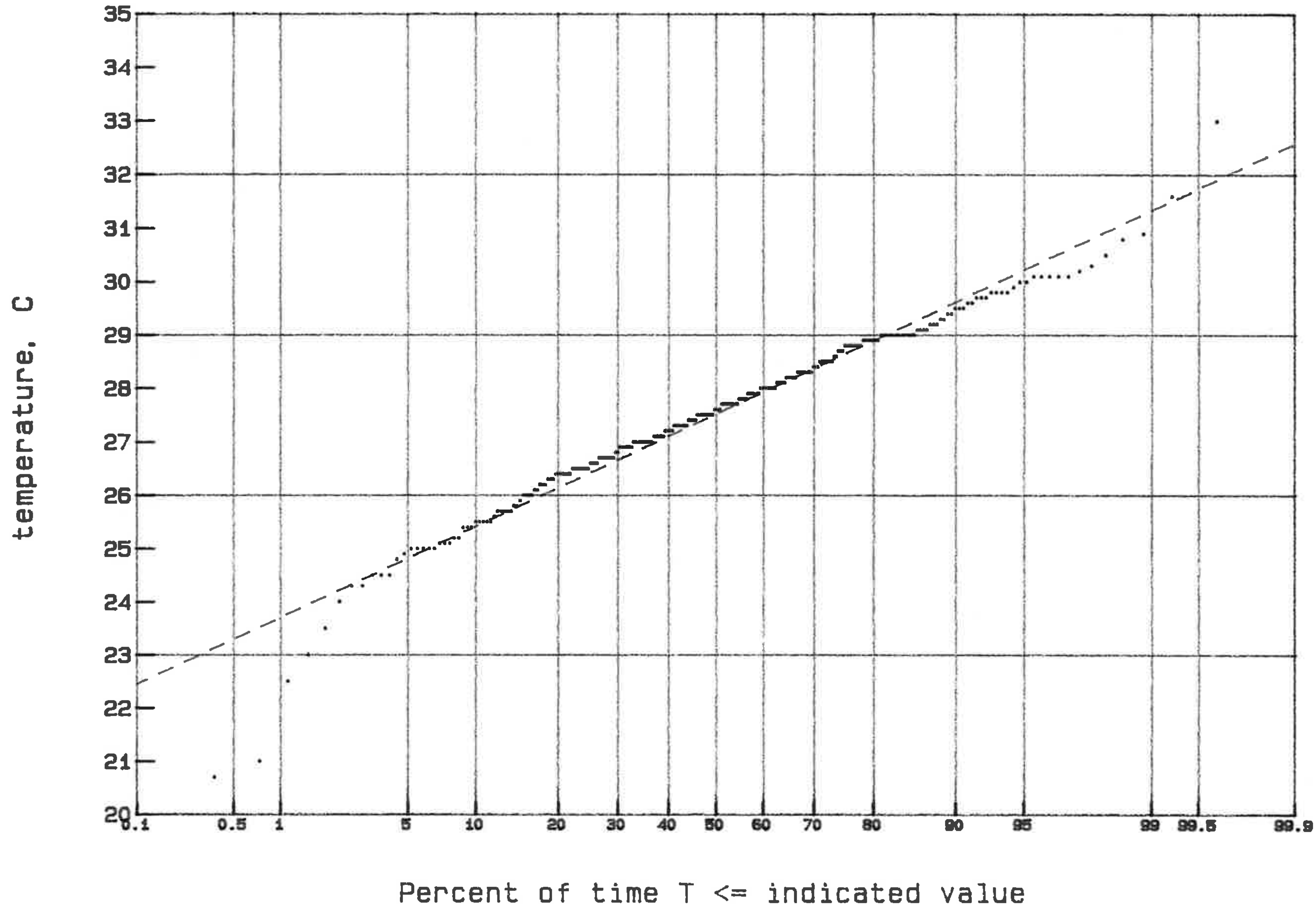


Figure A-8
Temperature Duration Curve for August

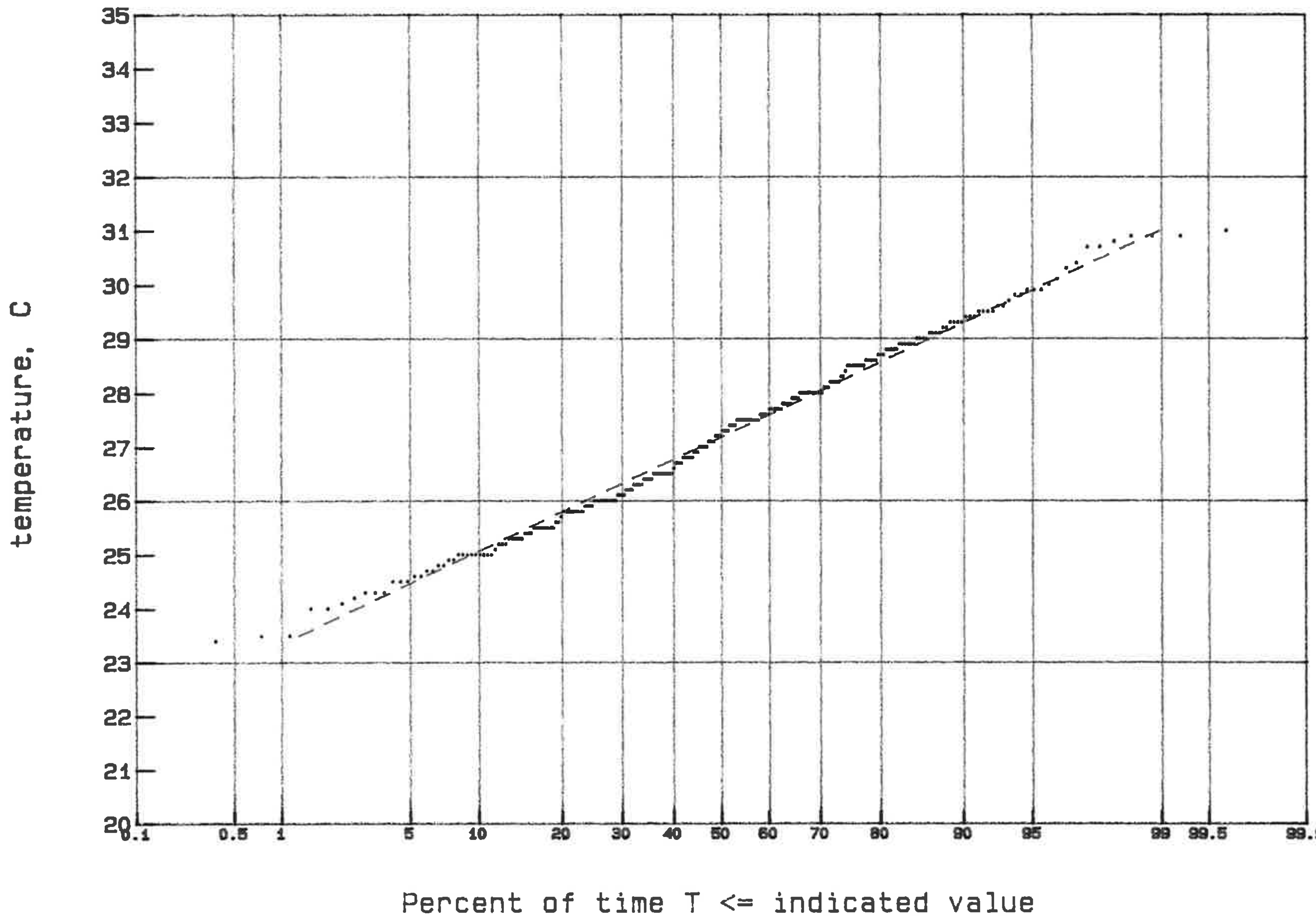


Figure A-9
Temperature Duration Curve for September

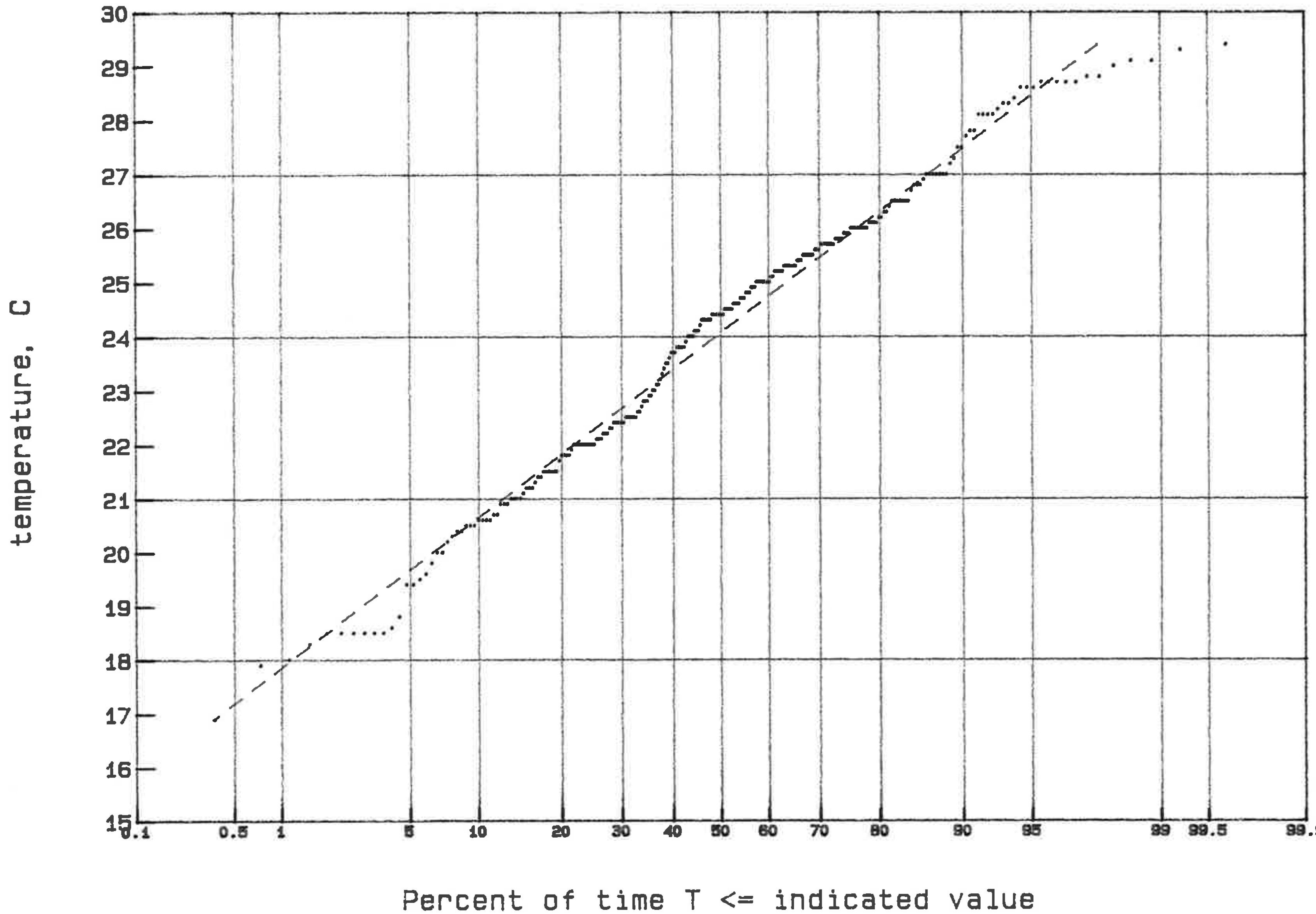


Figure A-10
Temperature Duration Curve for October

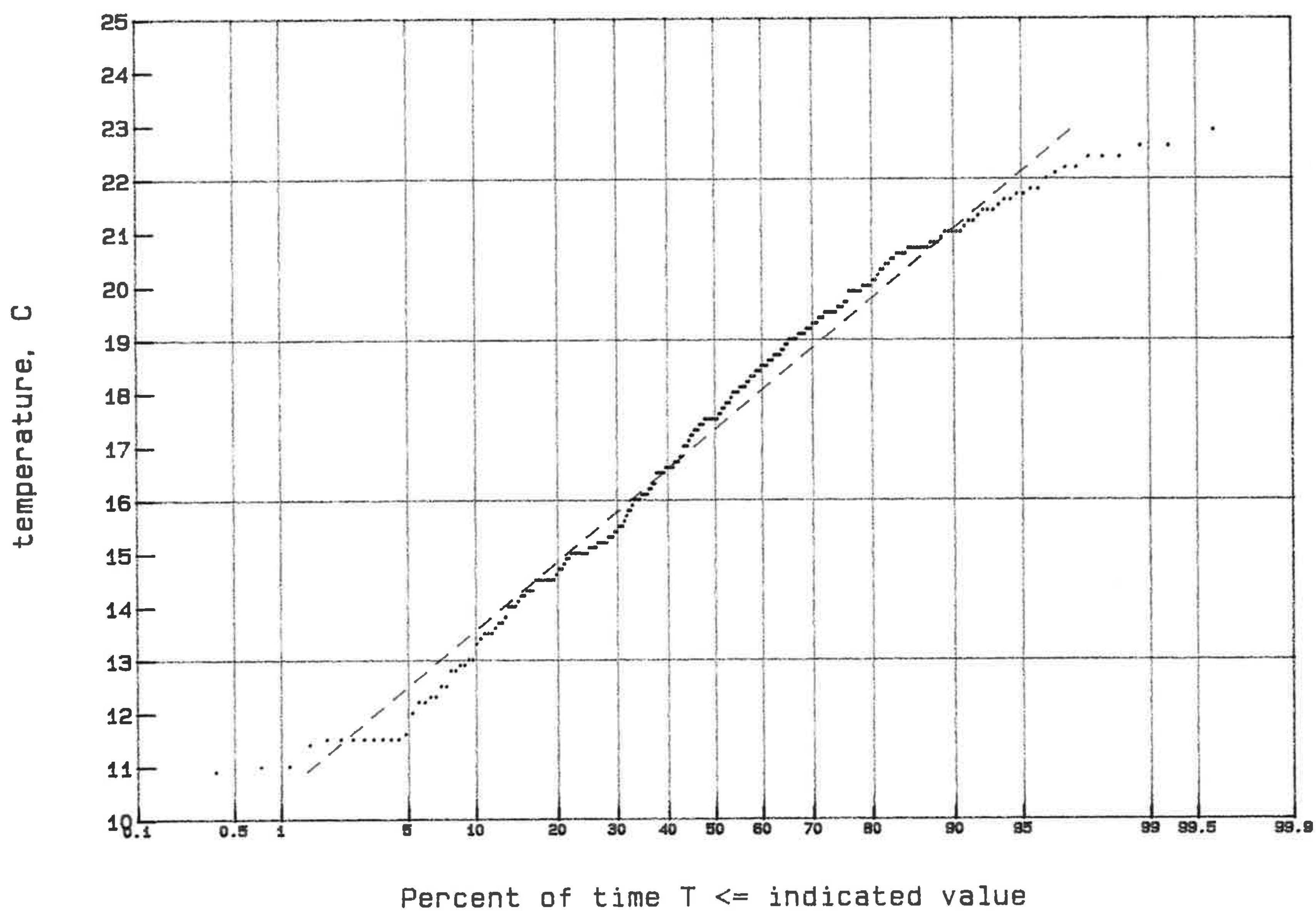


Figure A-11
Temperature Duration Curve for November

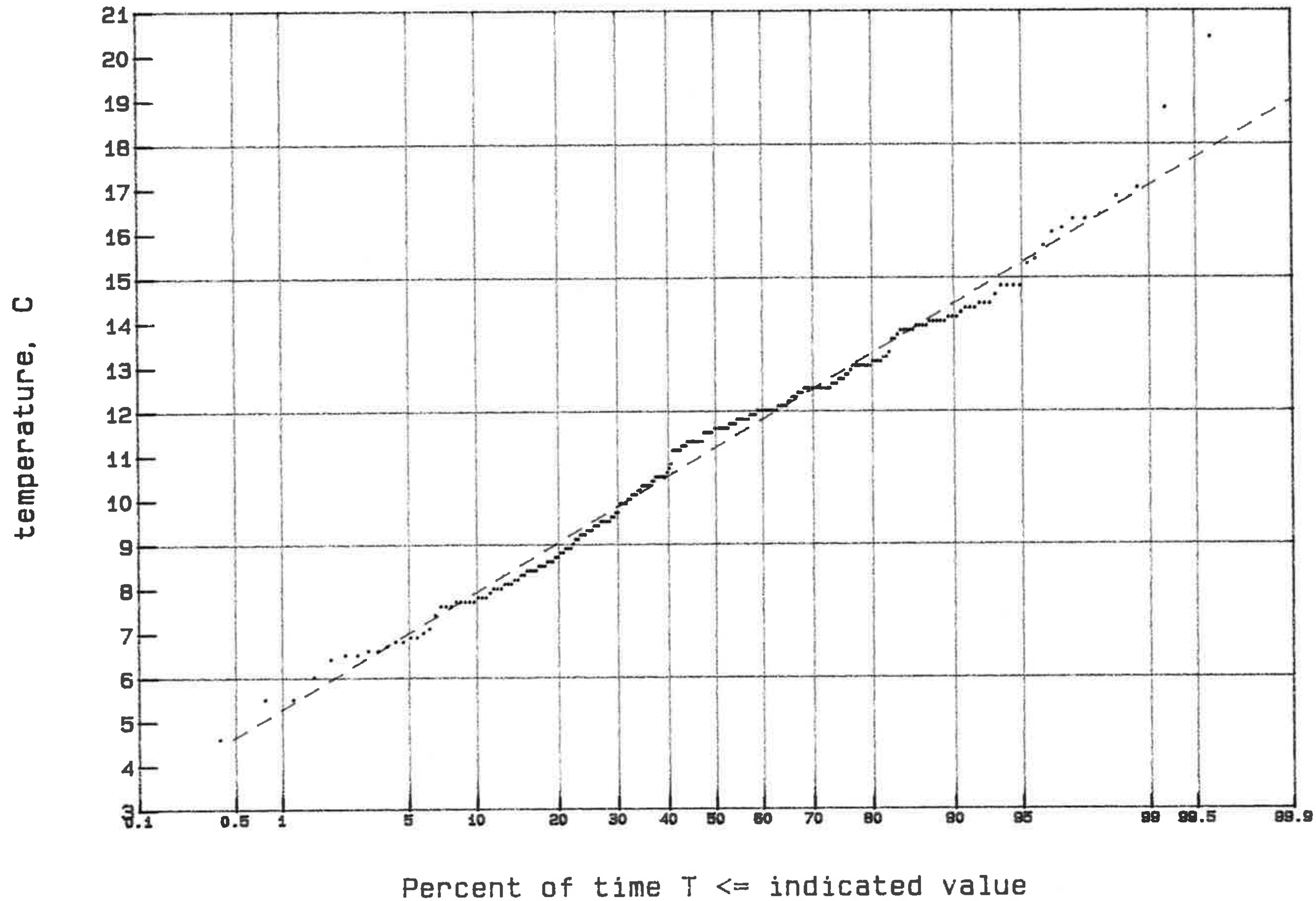


Figure A-12
Temperature Duration Curve for December

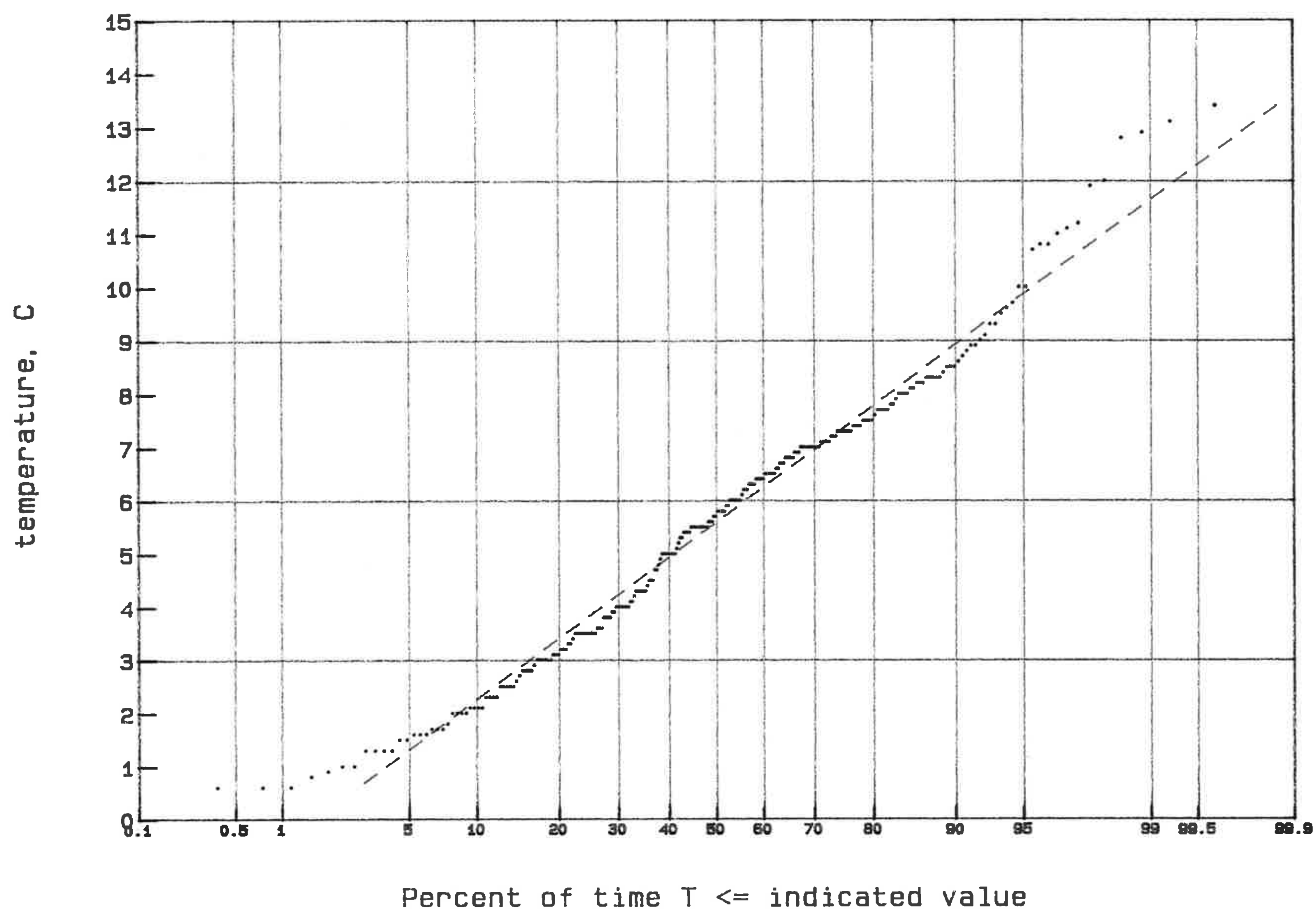


Figure B-1
Flow Duration Curve for January

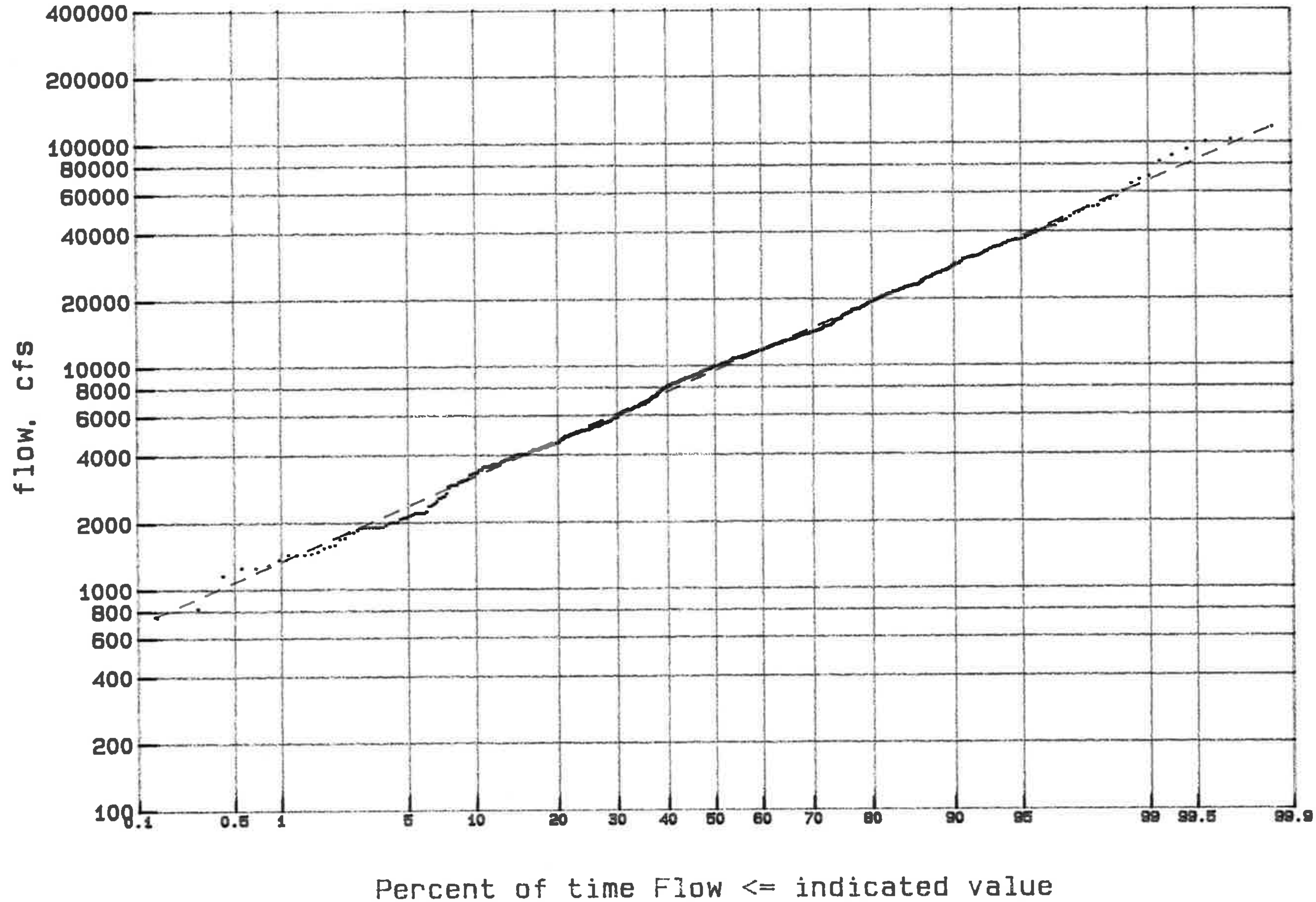


Figure B-2
Flow Duration Curve for February

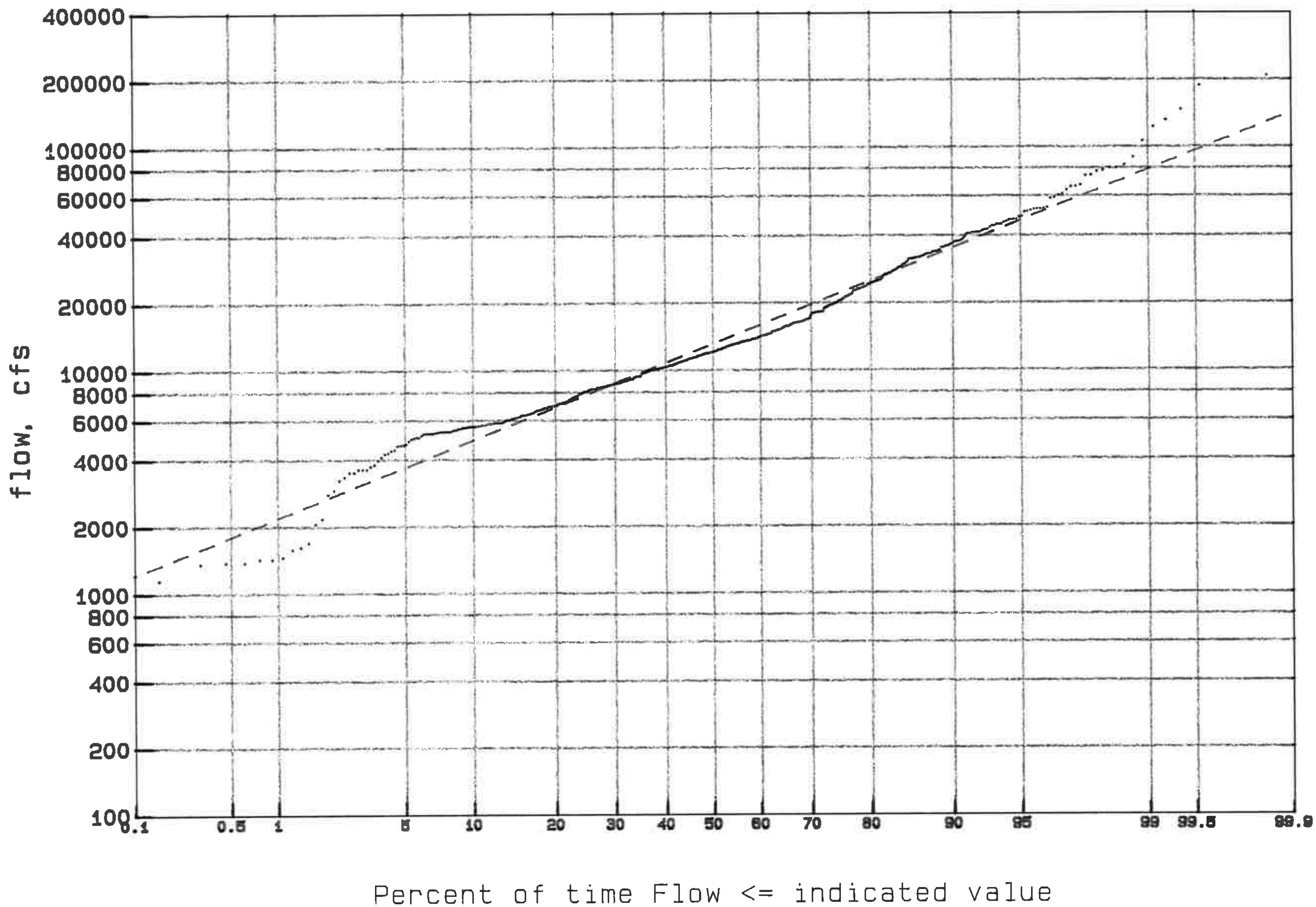


Figure B-3
Flow Duration Curve for March

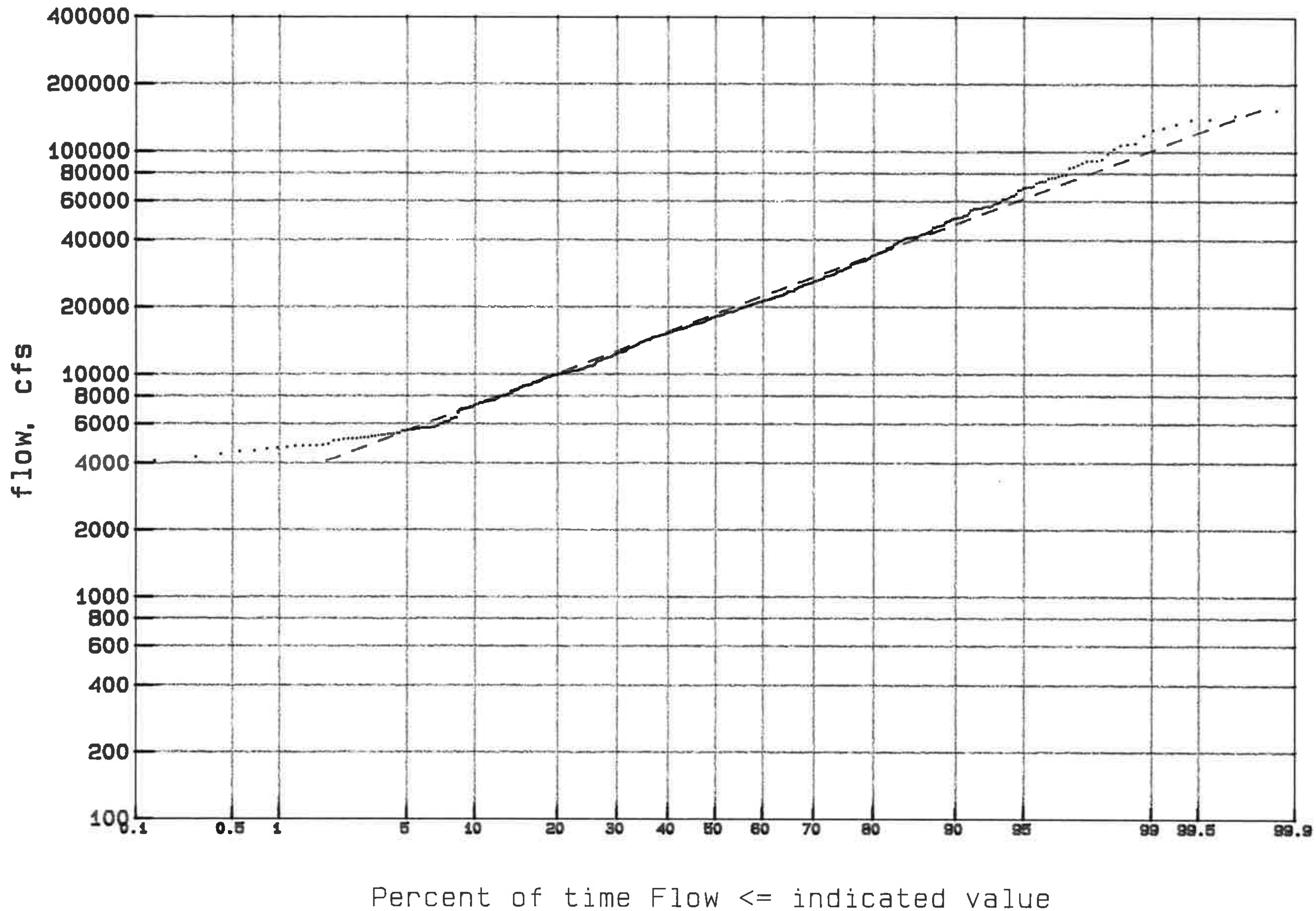


Figure B-4
Flow Duration Curve for April

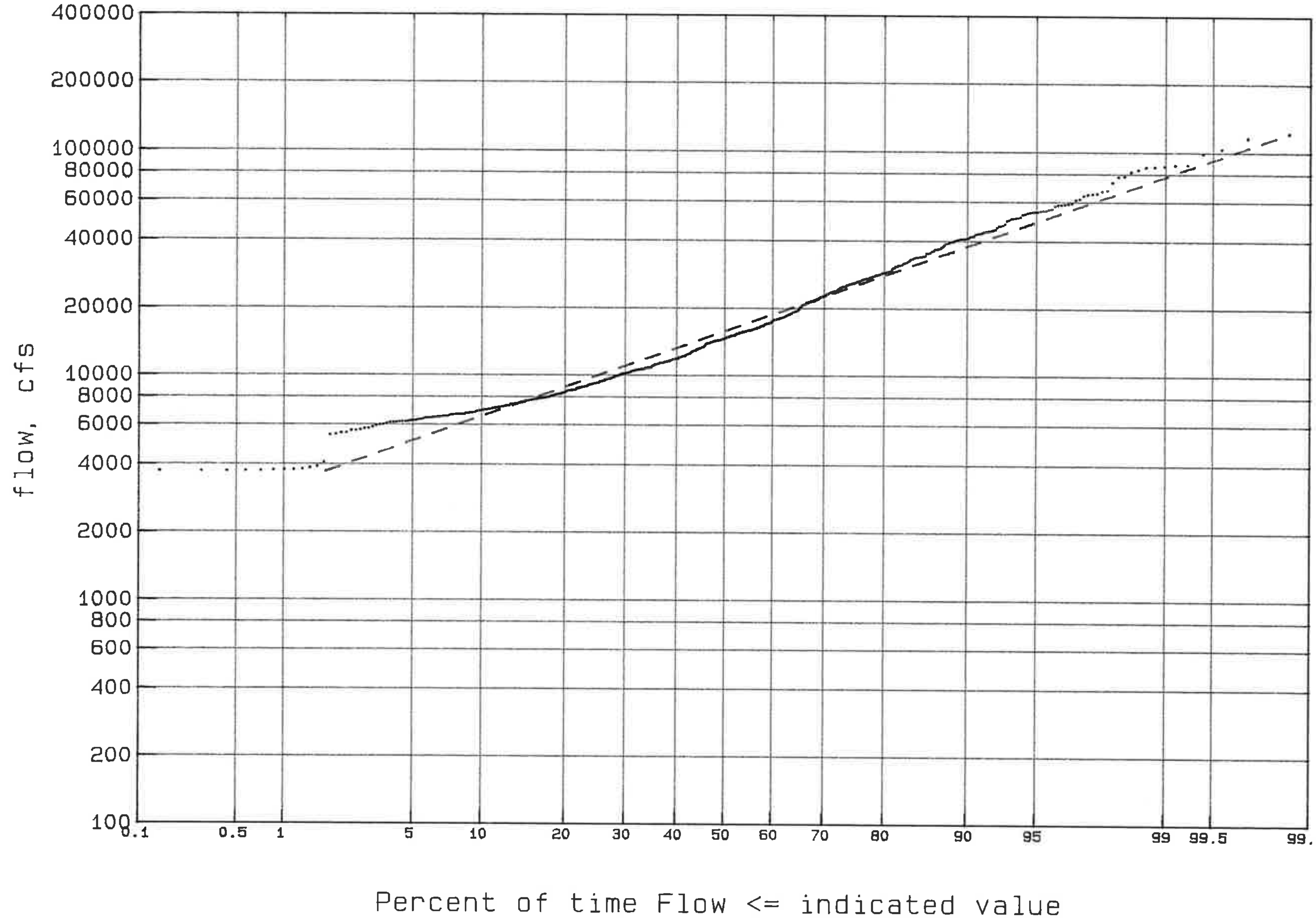


Figure B-5
Flow Duration Curve for May

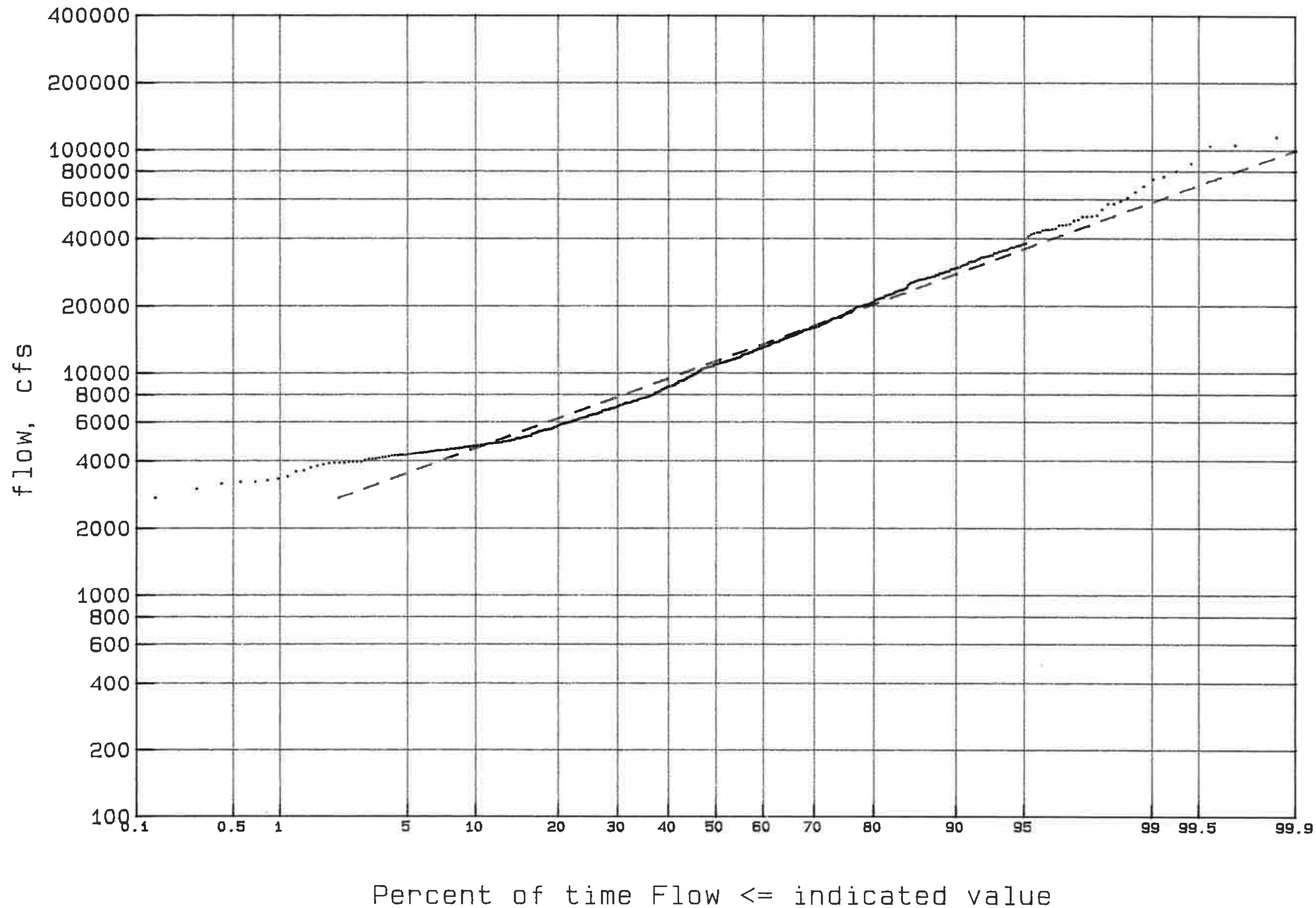


Figure B-6
Flow Duration Curve for June

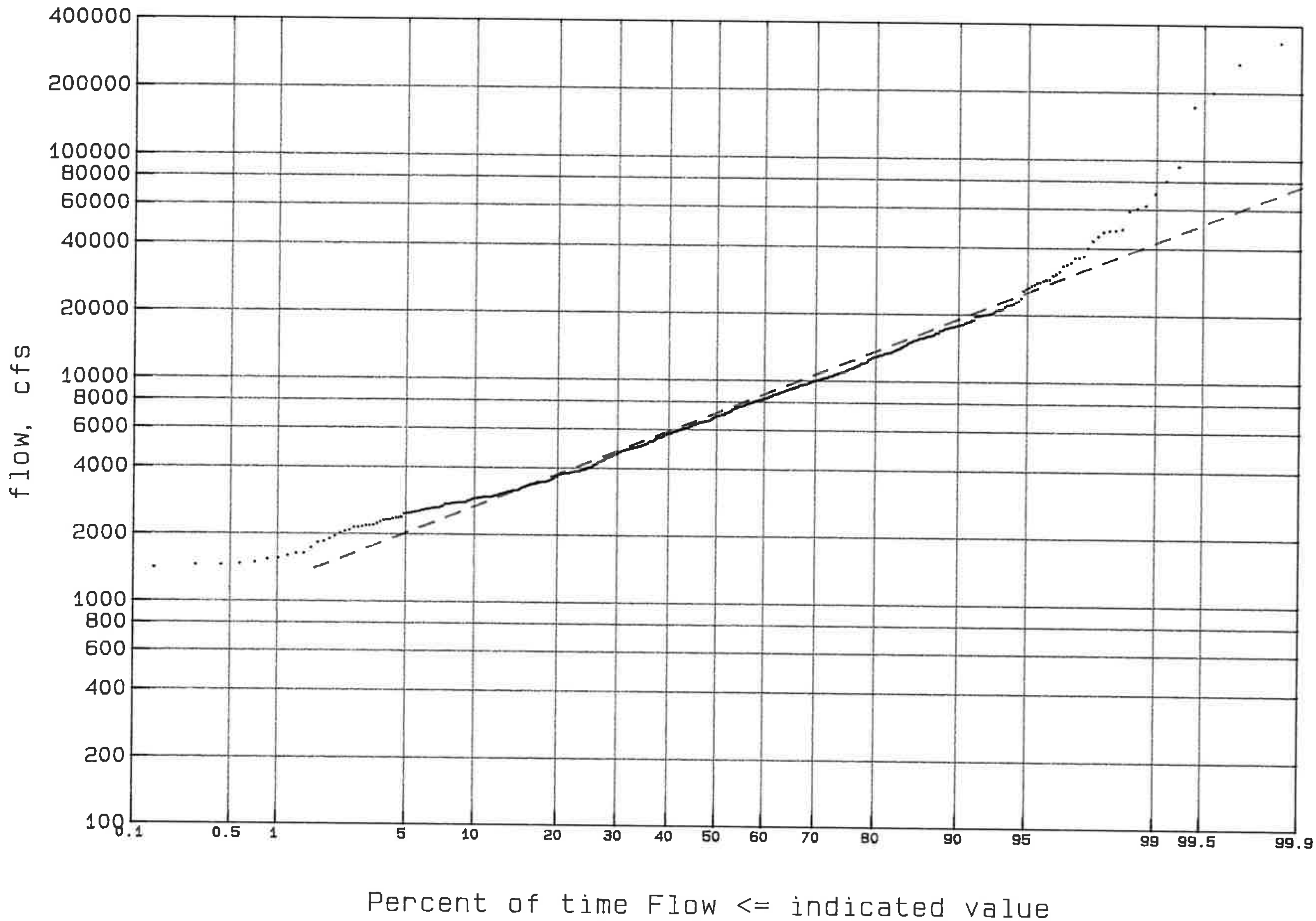


Figure B-7
Flow Duration Curve for July

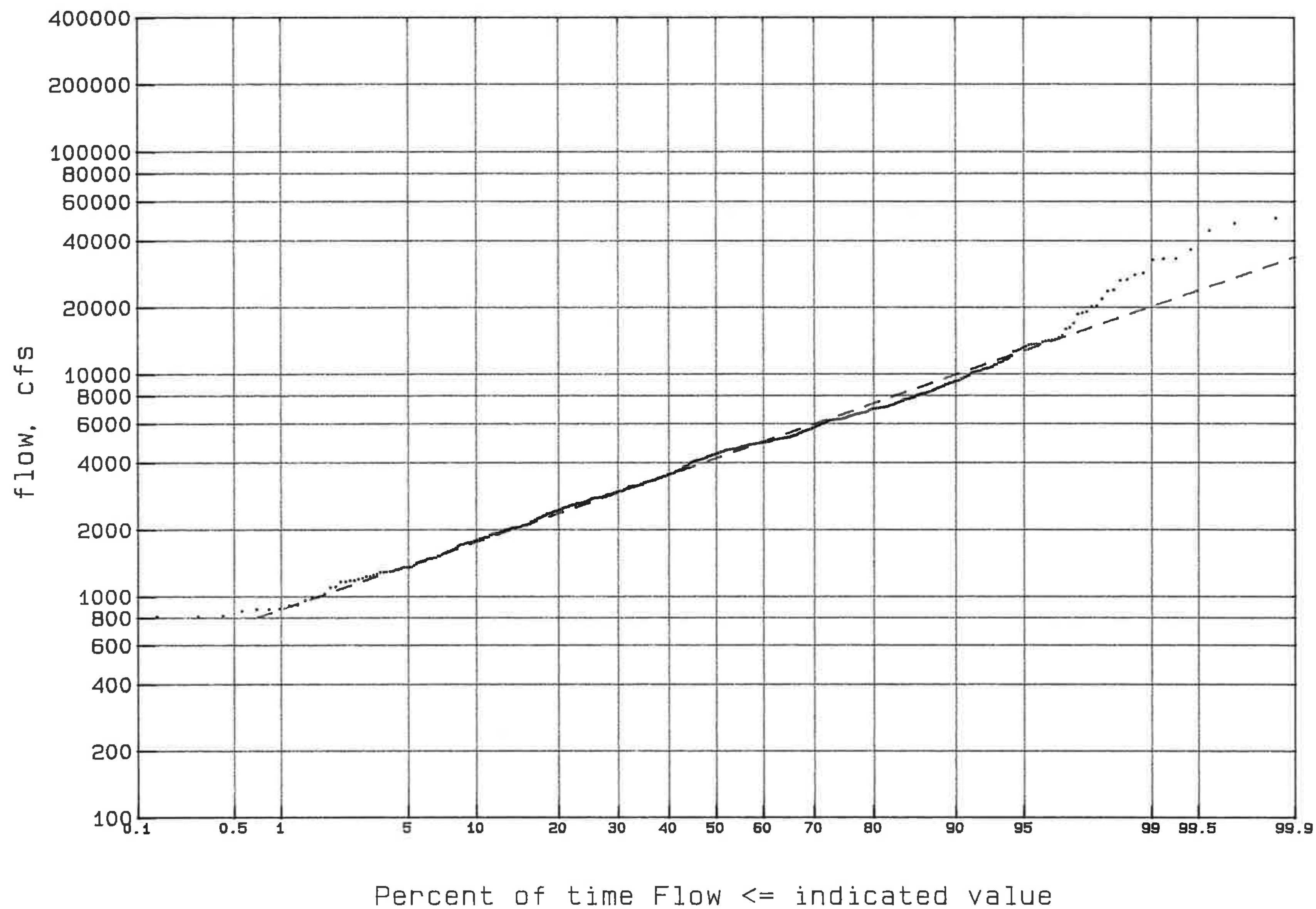


Figure B-8
Flow Duration Curve for August

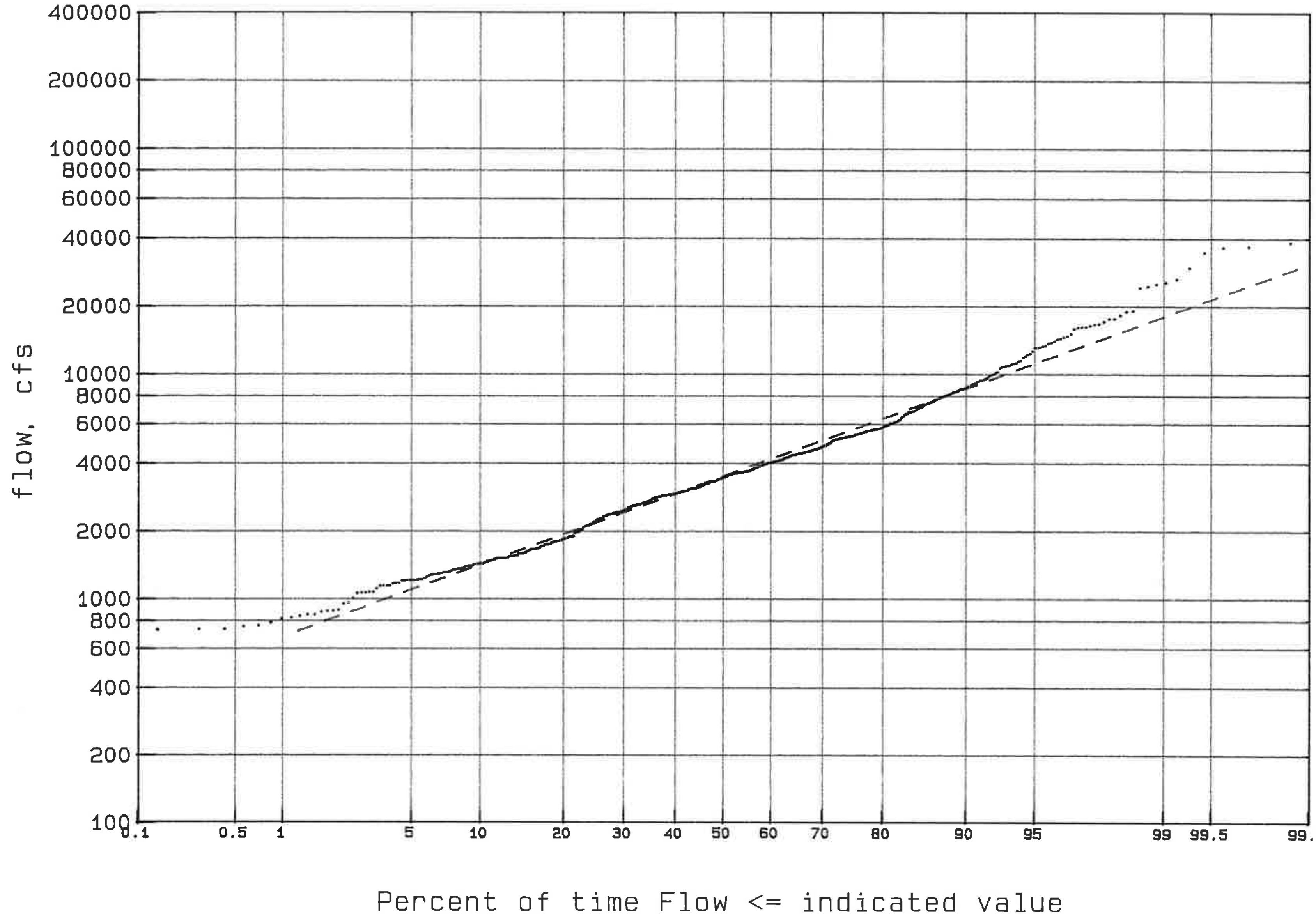


Figure B-9
Flow Duration Curve for September

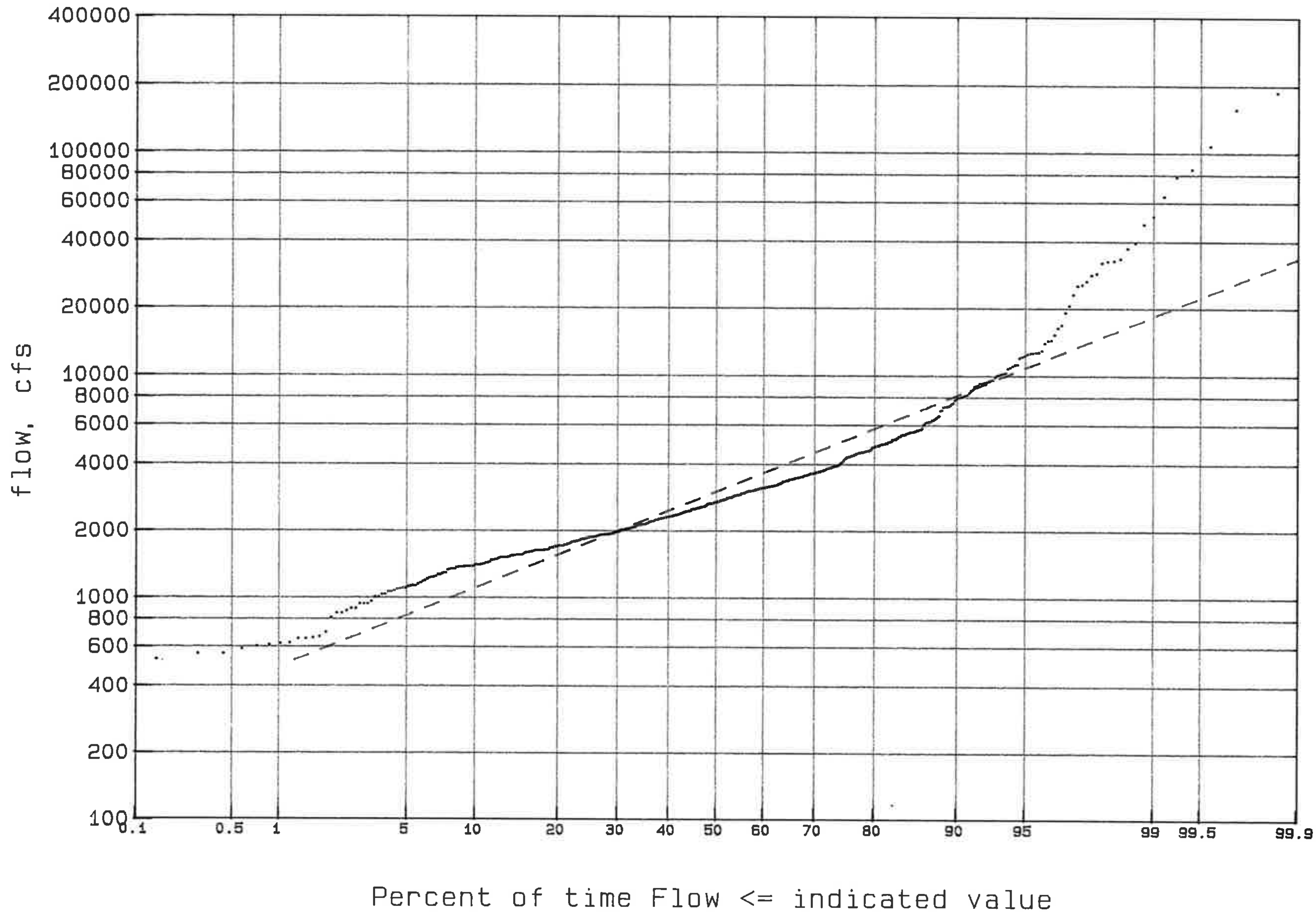


Figure B-10
Flow Duration Curve for October

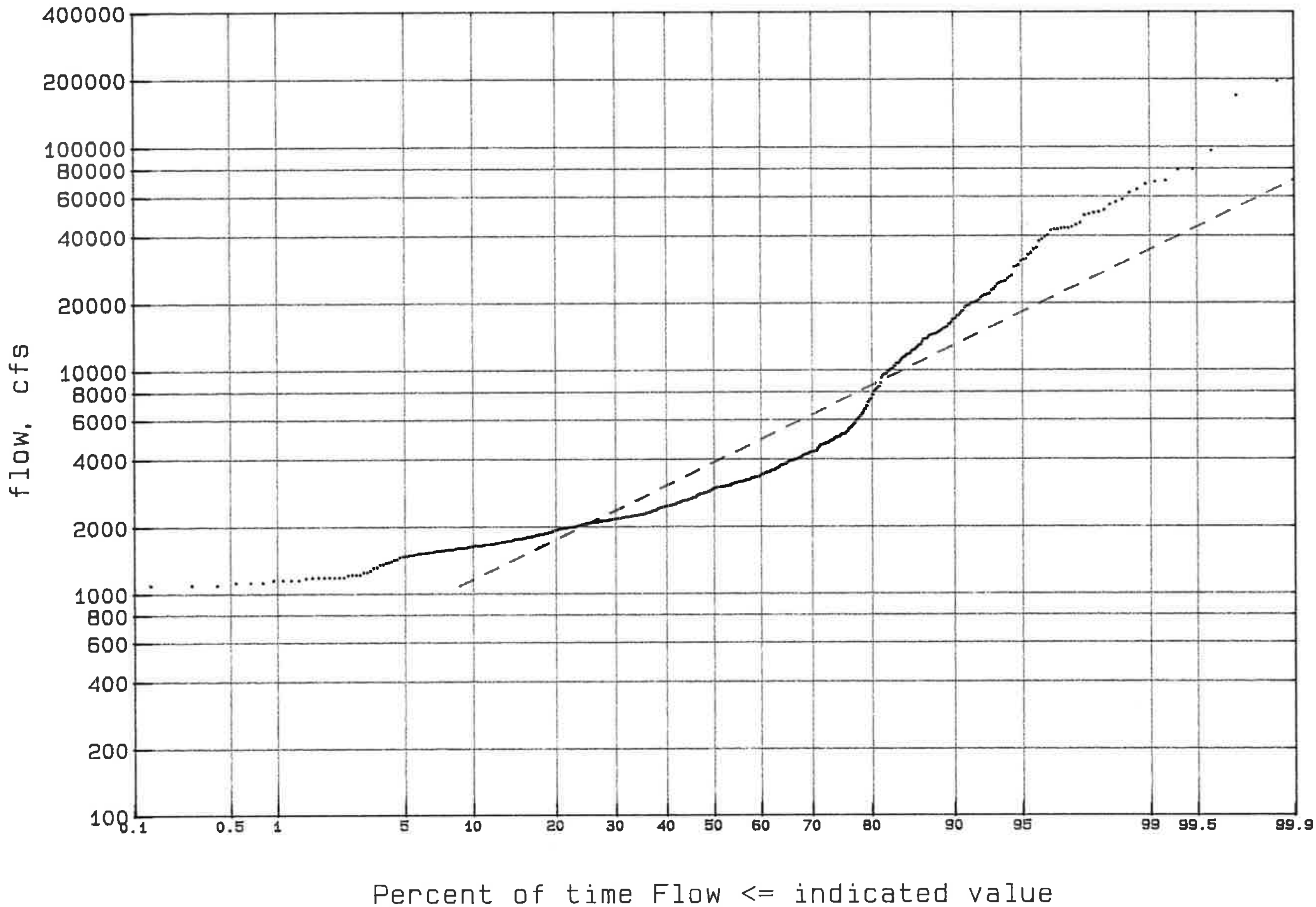


Figure B-11
Flow Duration Curve for November

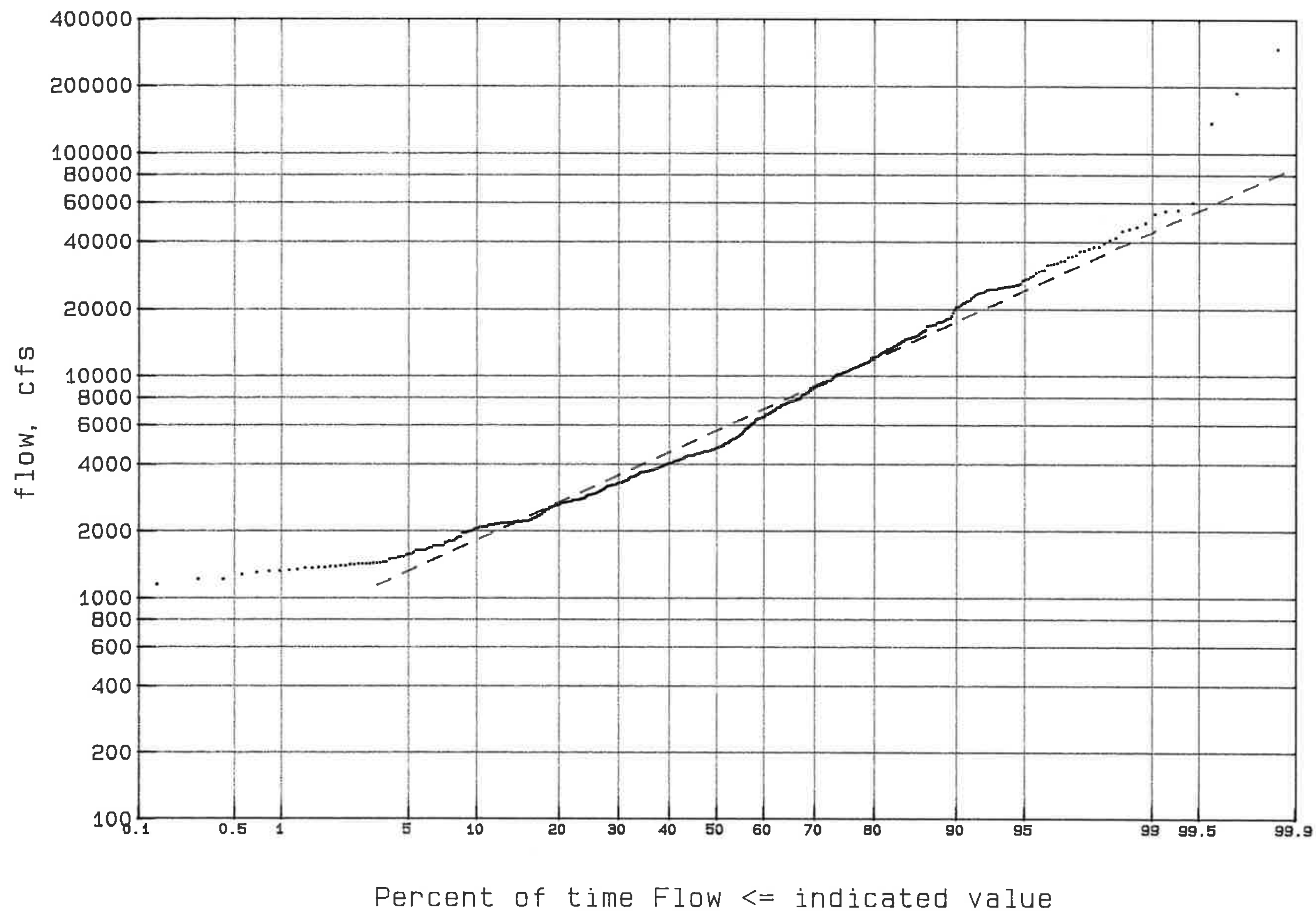


Figure B-12
Flow Duration Curve for December

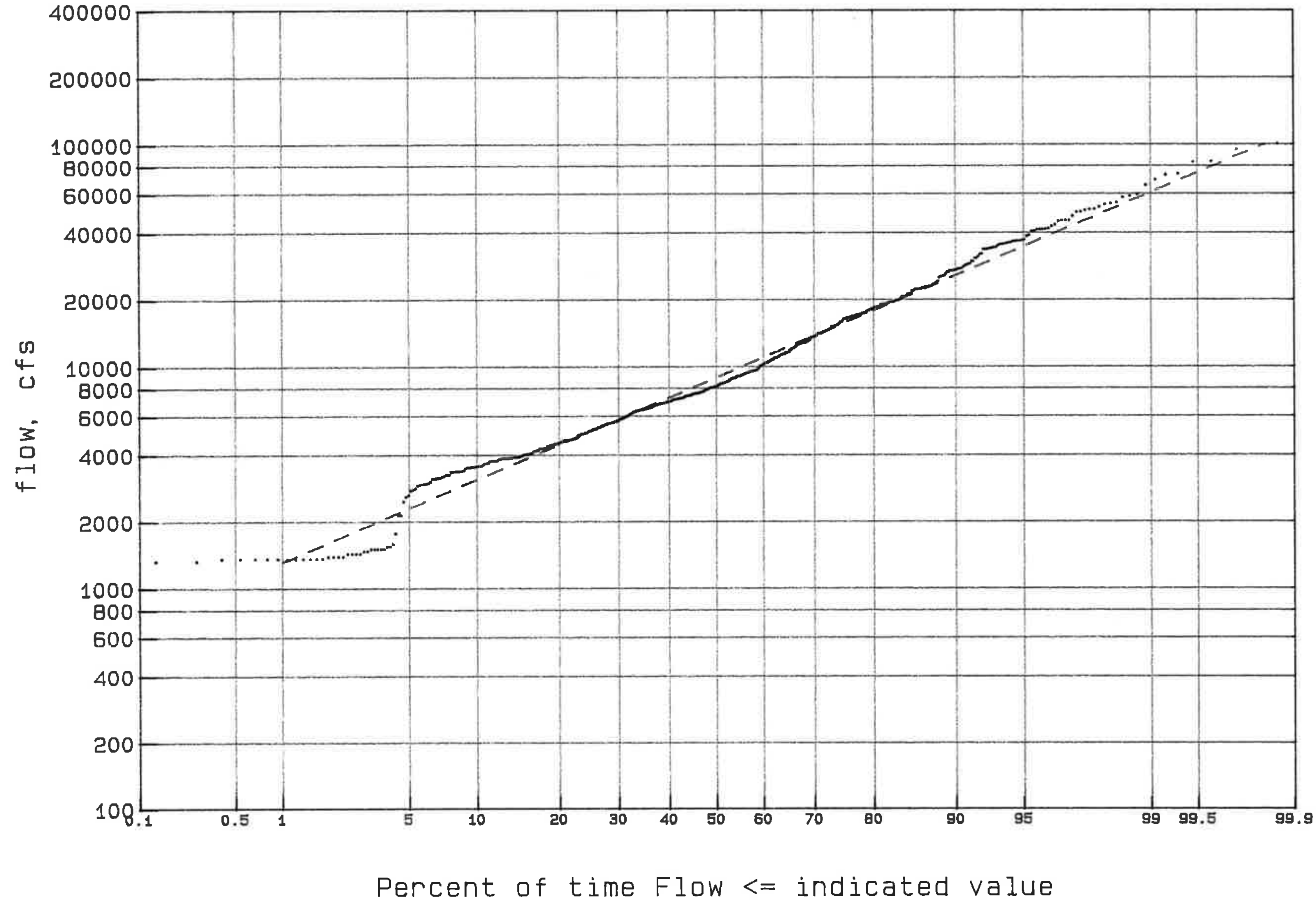


Figure C-1.
Scatter Plot of Flow and Temperature for January.
229 Days

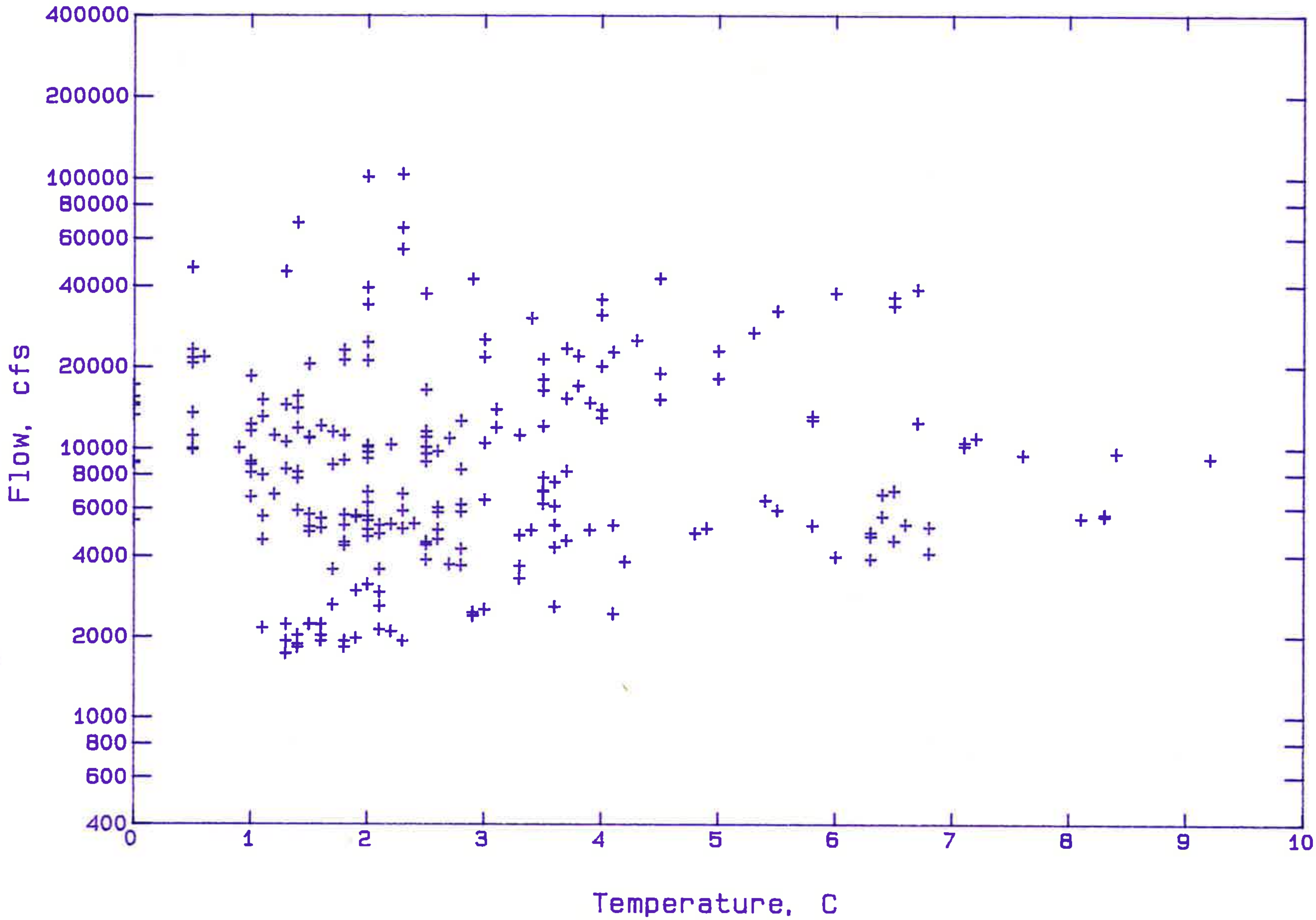


Figure C-2.
Scatter Plot of Flow and Temperature for February.
208 Days

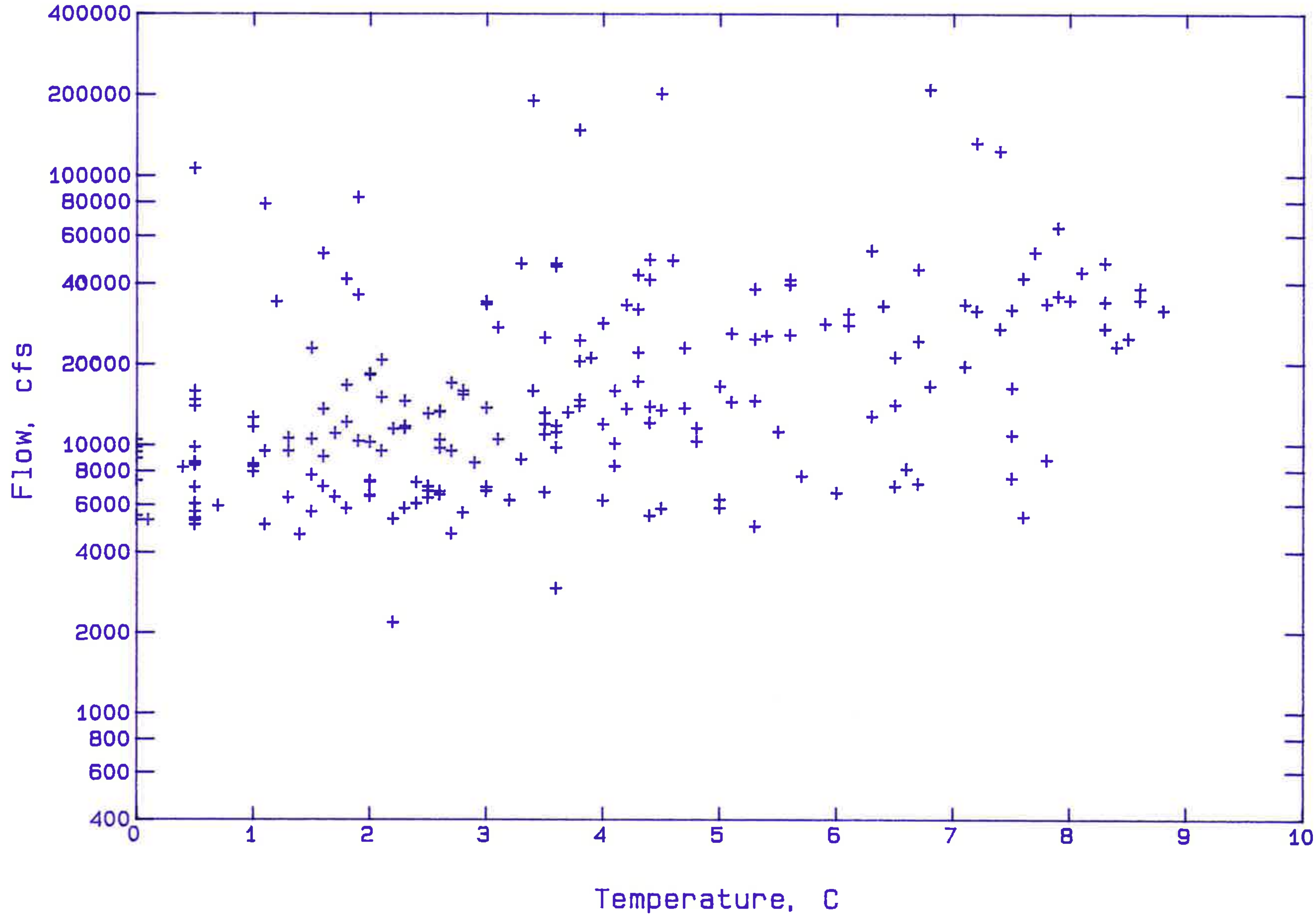


Figure C-3.
Scatter Plot of Flow and Temperature for March.
205 Days

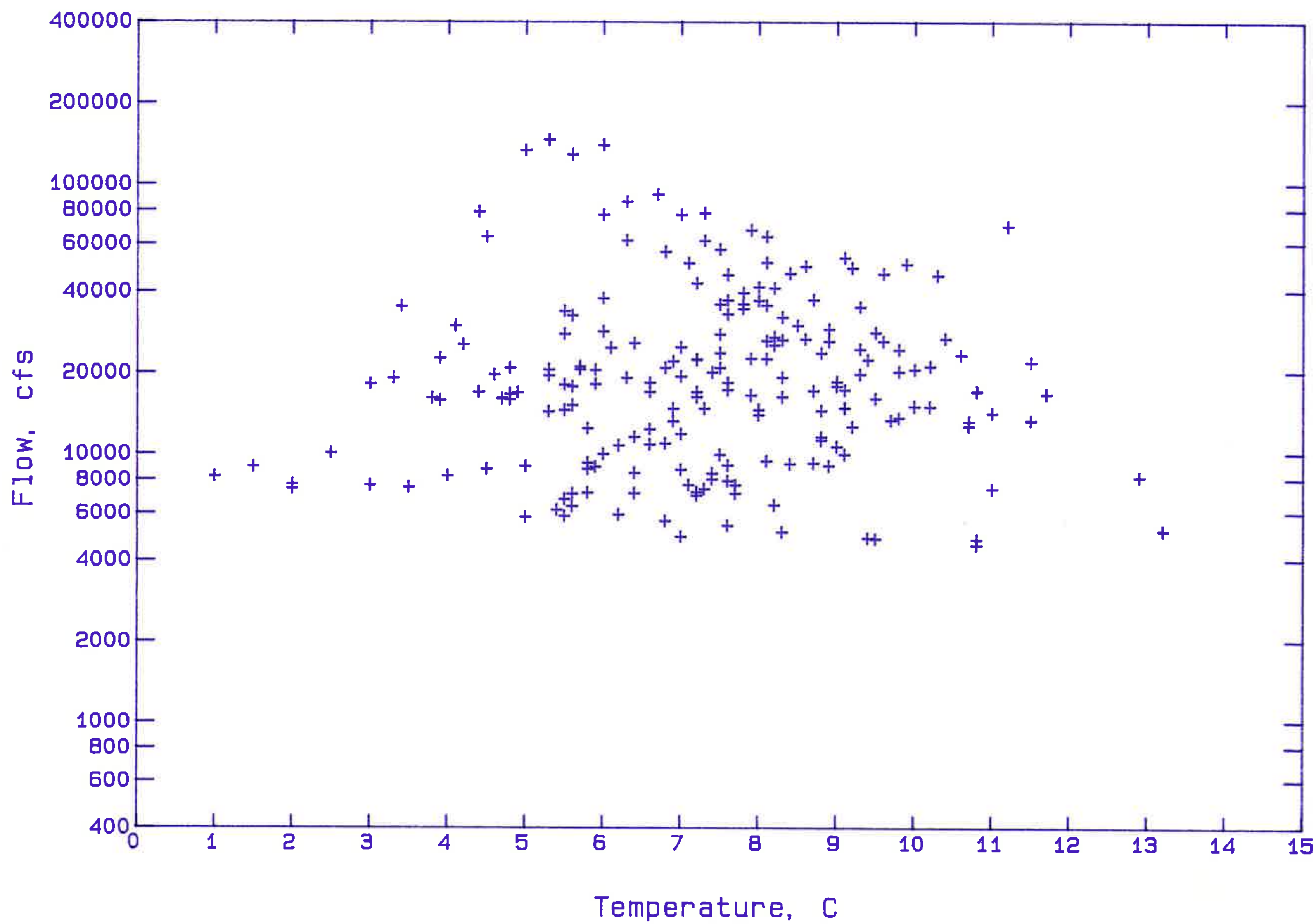


Figure C-4.
Scatter Plot of Flow and Temperature for April.
202 Days

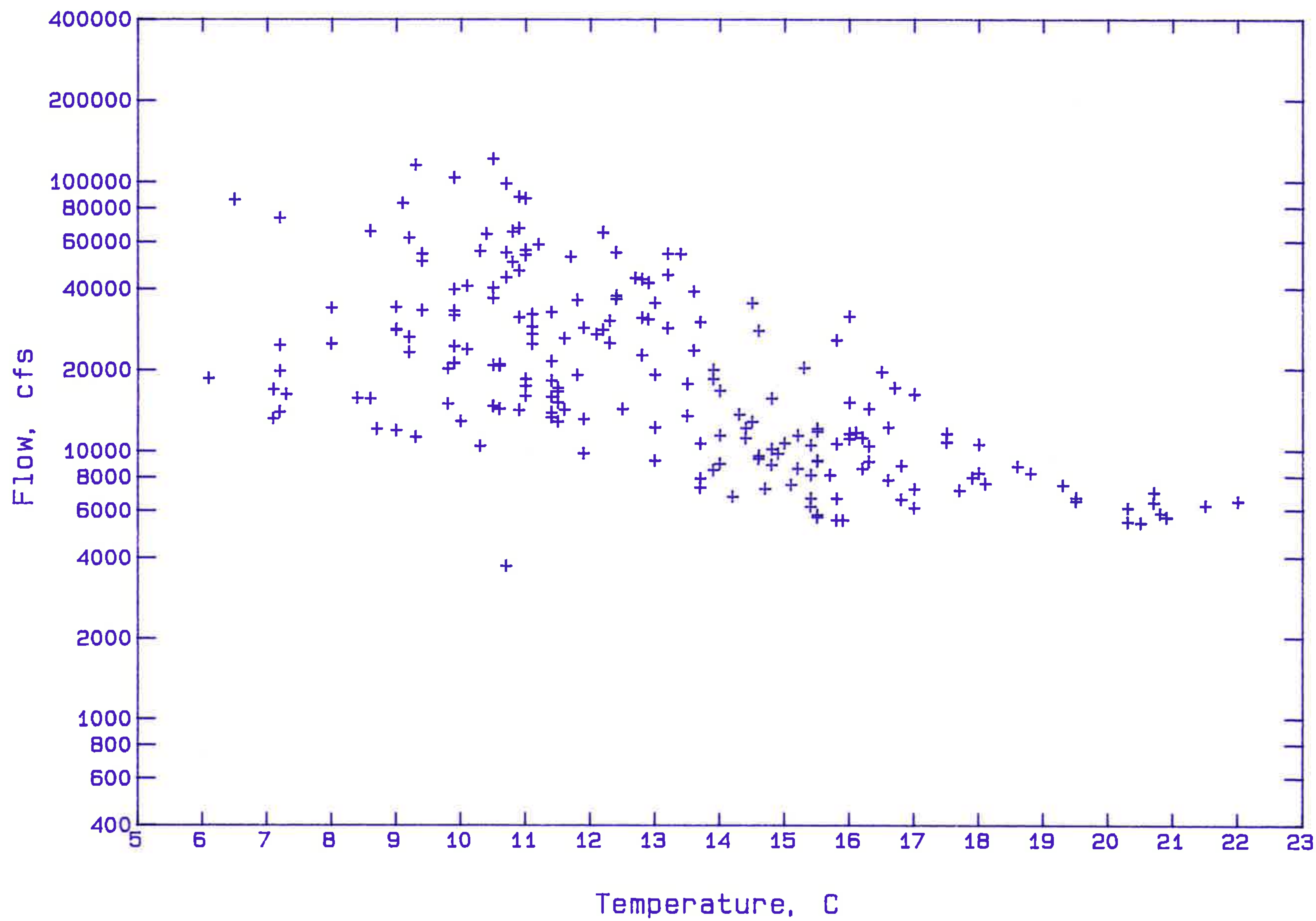


Figure C-5.
Scatter Plot of Flow and Temperature for May.
227 Days

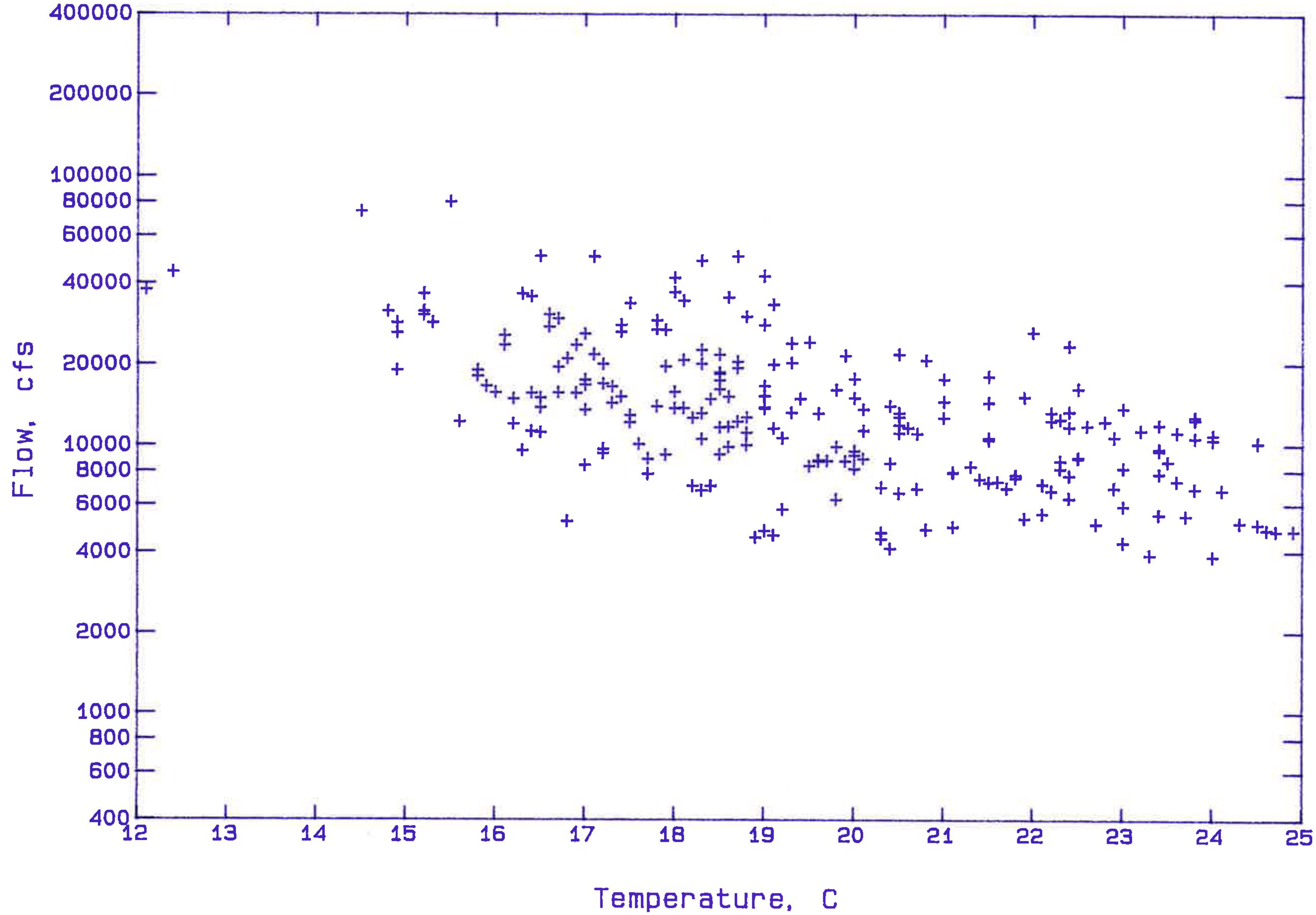


Figure C-6.
Scatter Plot of Flow and Temperature for June.
264 Days

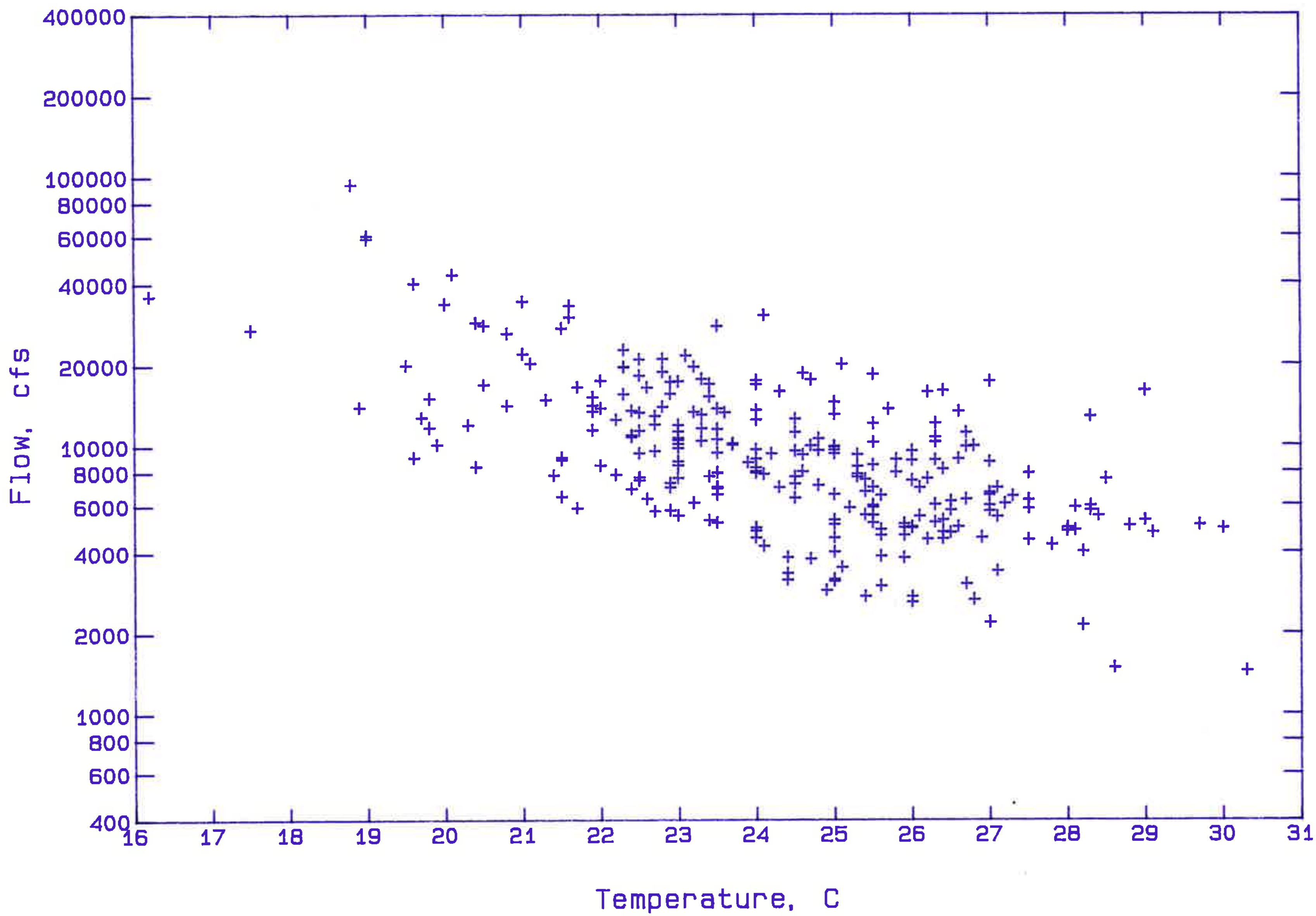


Figure C-7.
Scatter Plot of Flow and Temperature for July.
268 Days

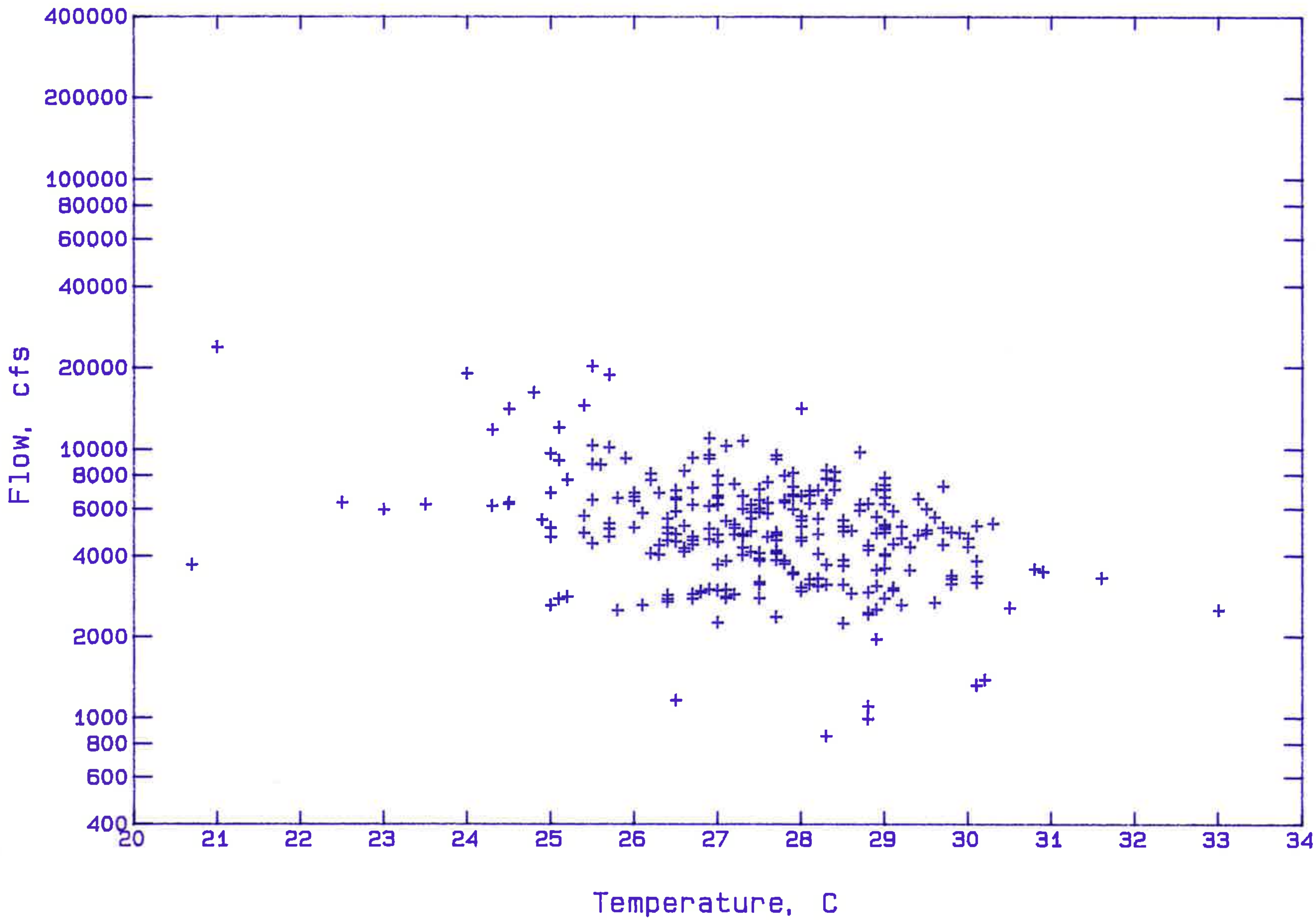


Figure C-8.
Scatter Plot of Flow and Temperature for August.
265 Days

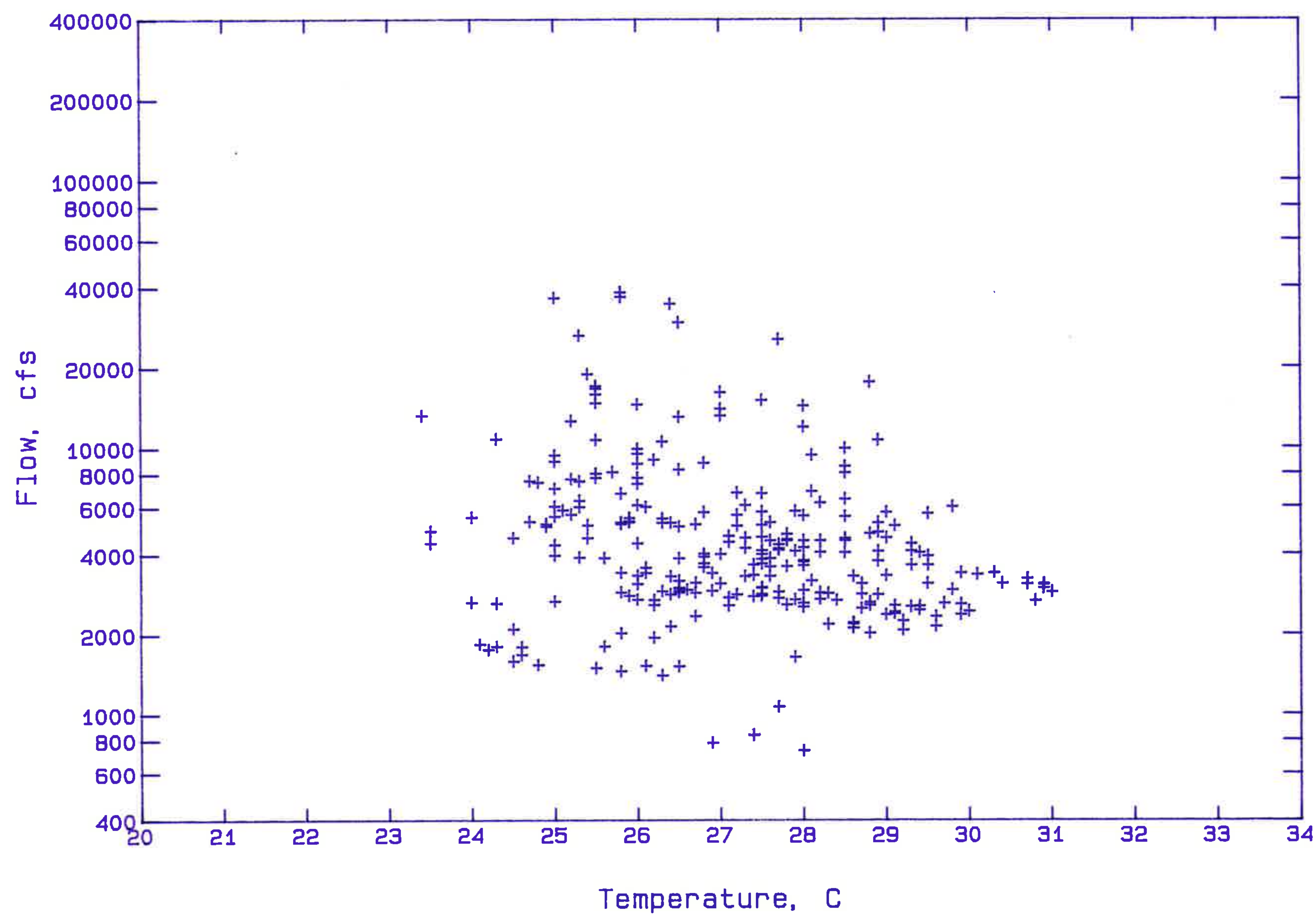


Figure C-9.
Scatter Plot of Flow and Temperature for September.
268 Days

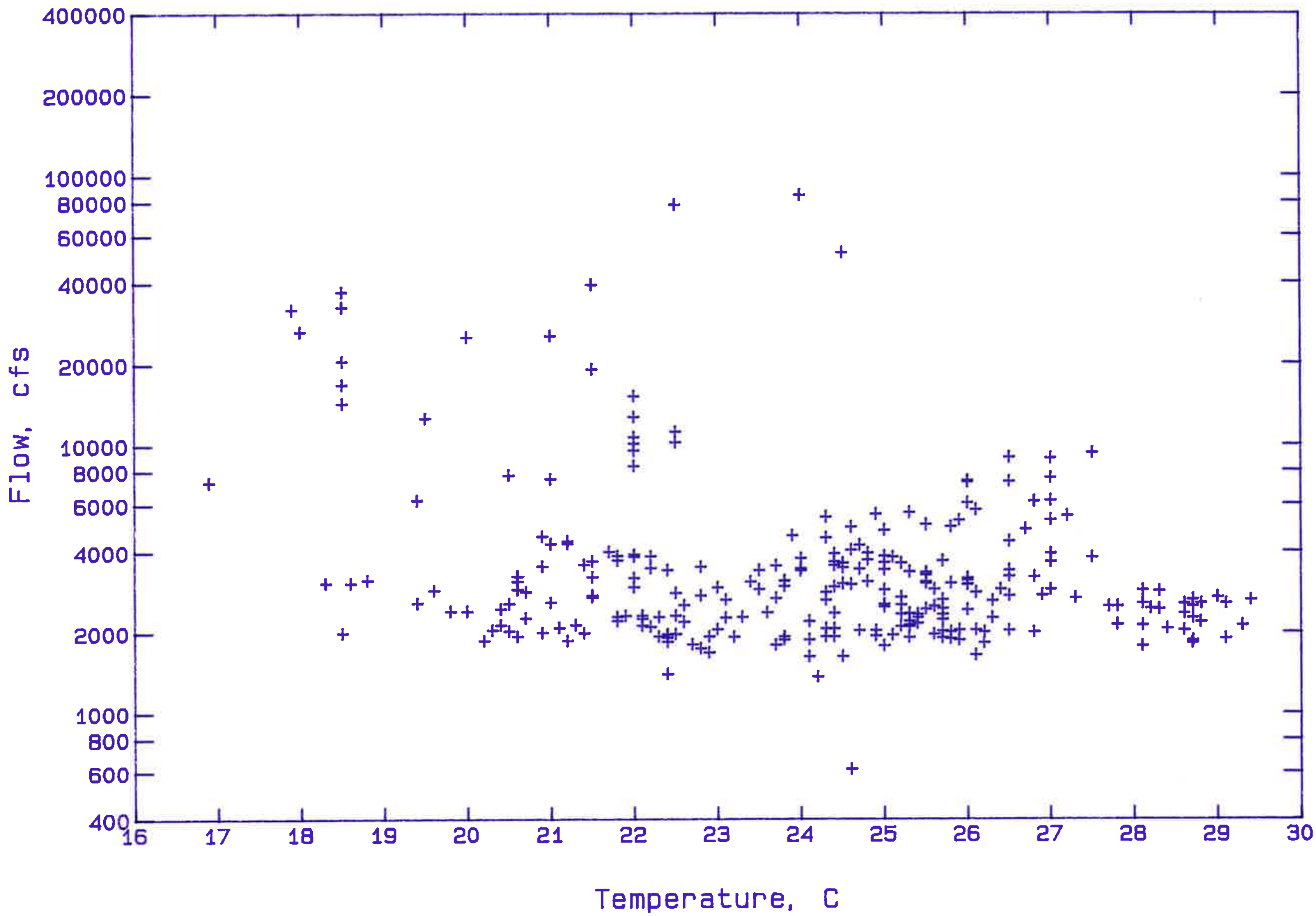


Figure C-10.
Scatter Plot of Flow and Temperature for October.
266 Days

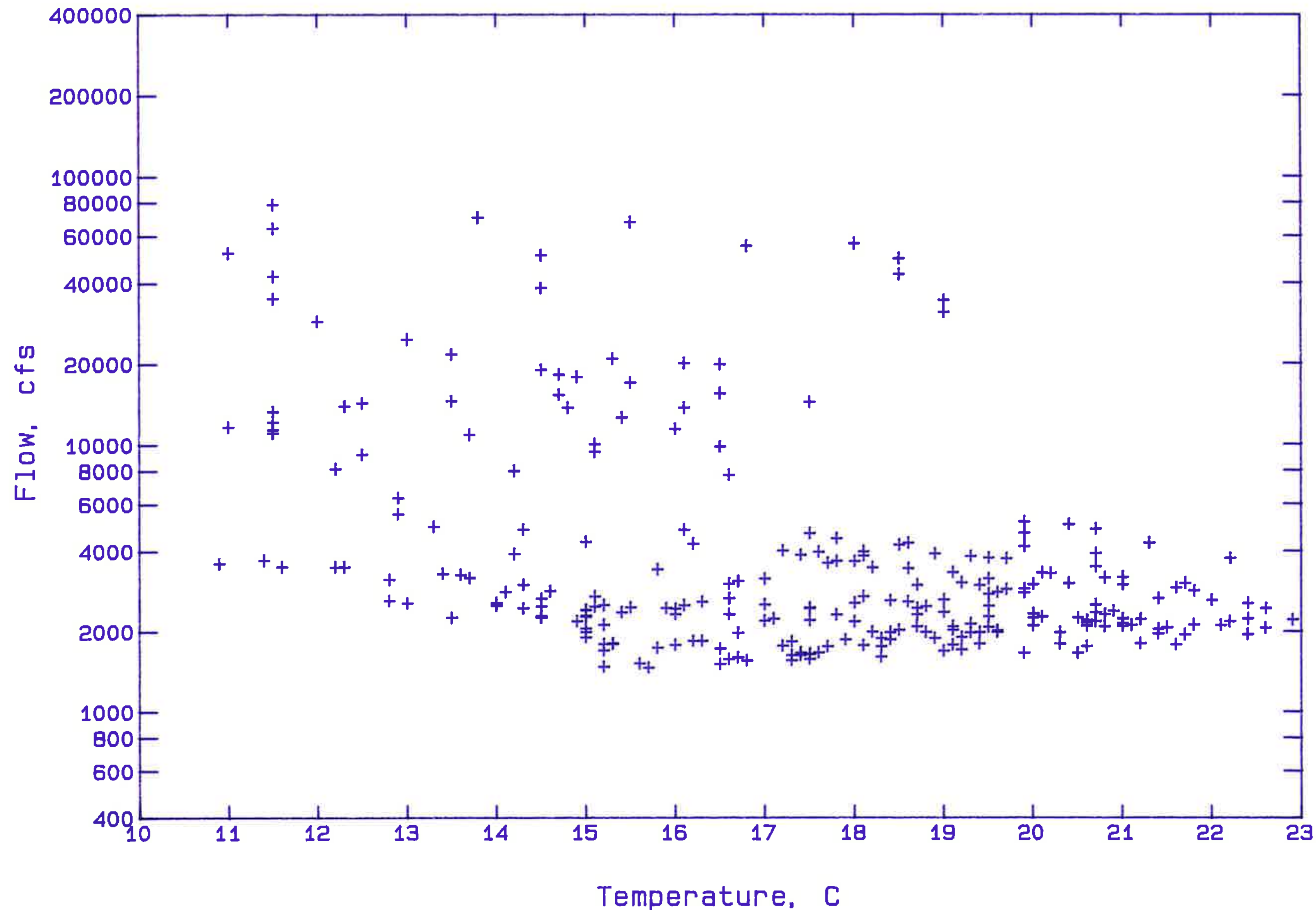


Figure C-11.
Scatter Plot of Flow and Temperature for November.
255 Days

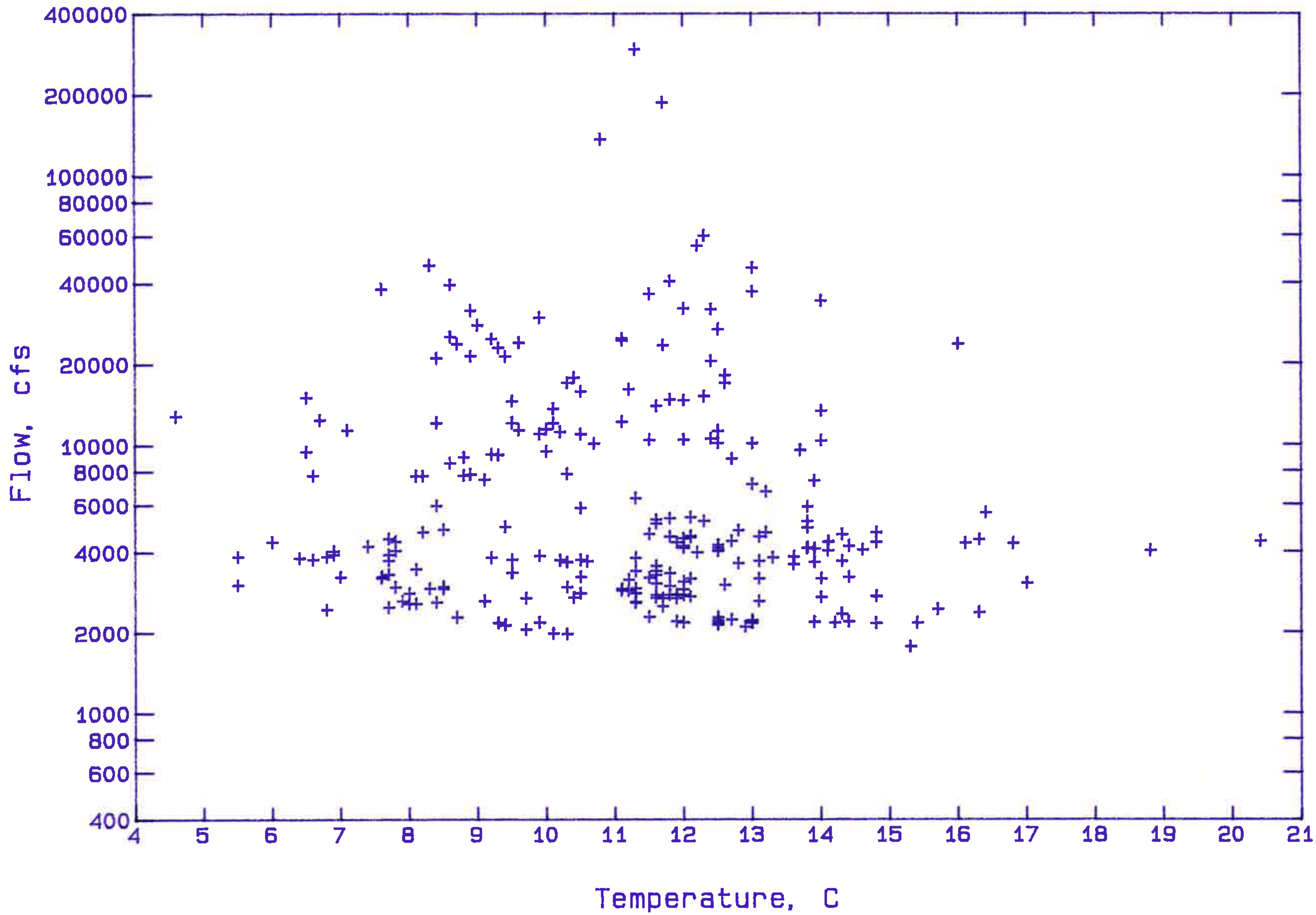


Figure C-12.
Scatter Plot of Flow and Temperature for December.
266 Days

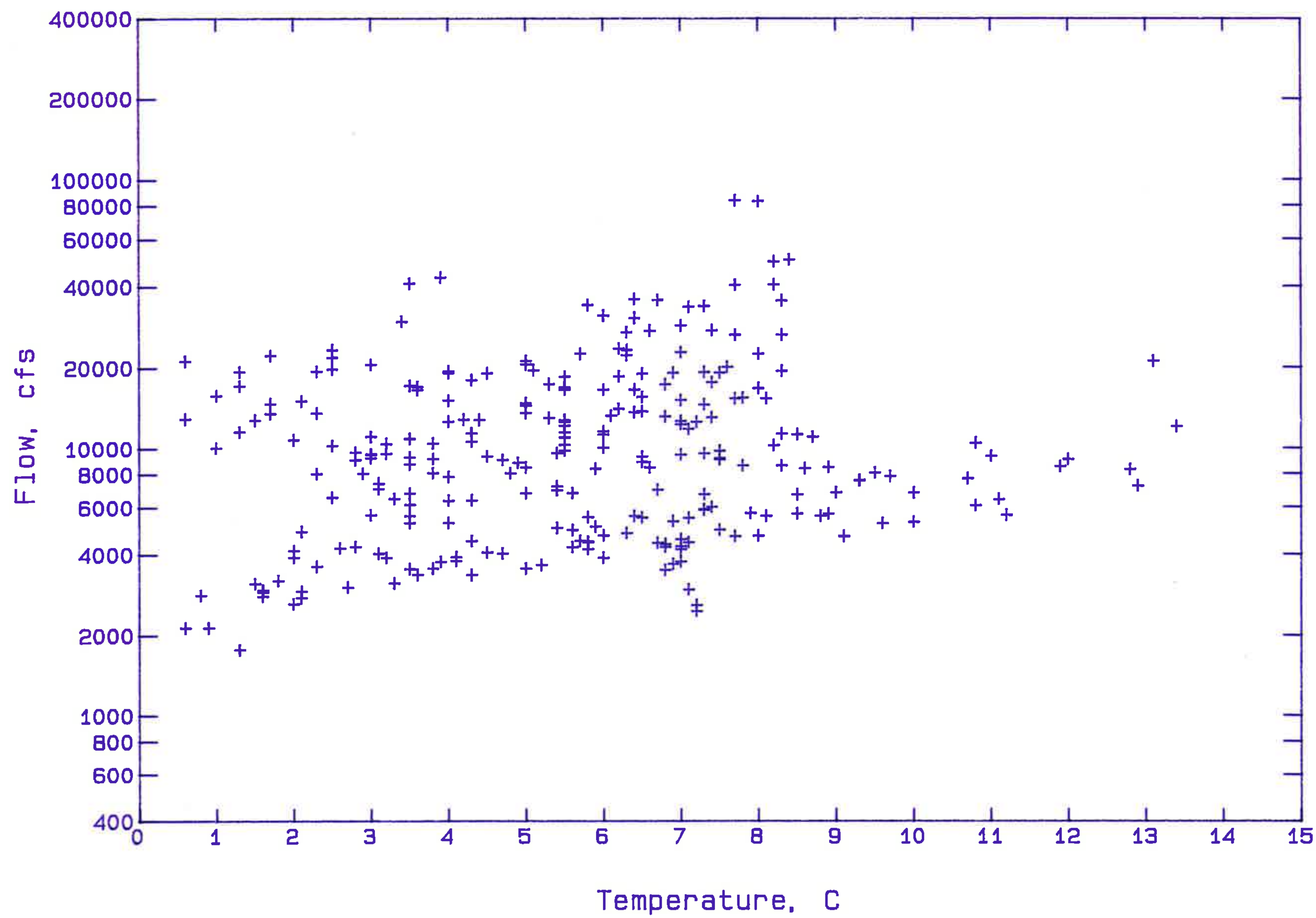


Figure D
Water Temperature by Month
Mean, Standard Deviation, Range, and Number Daily Values

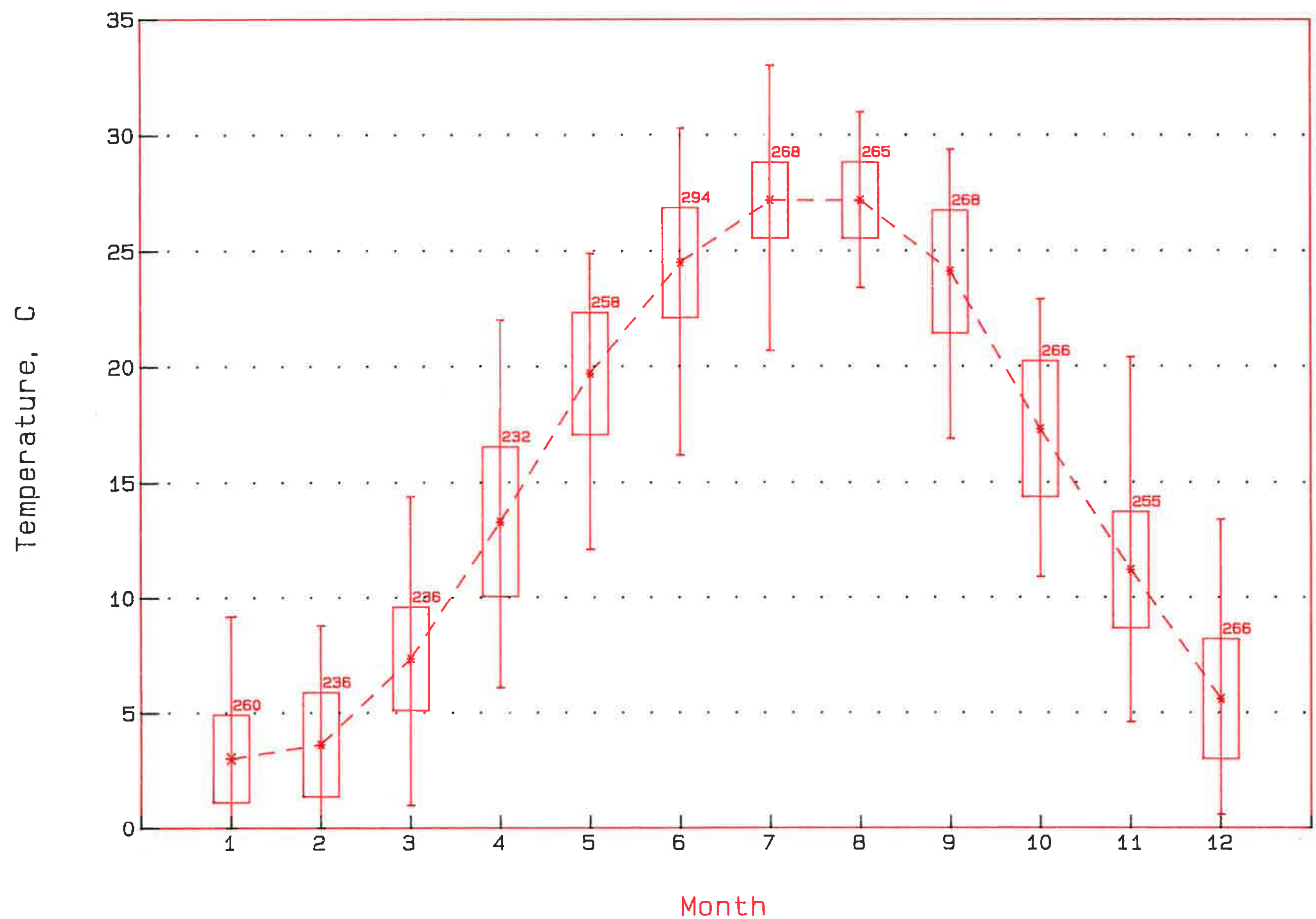
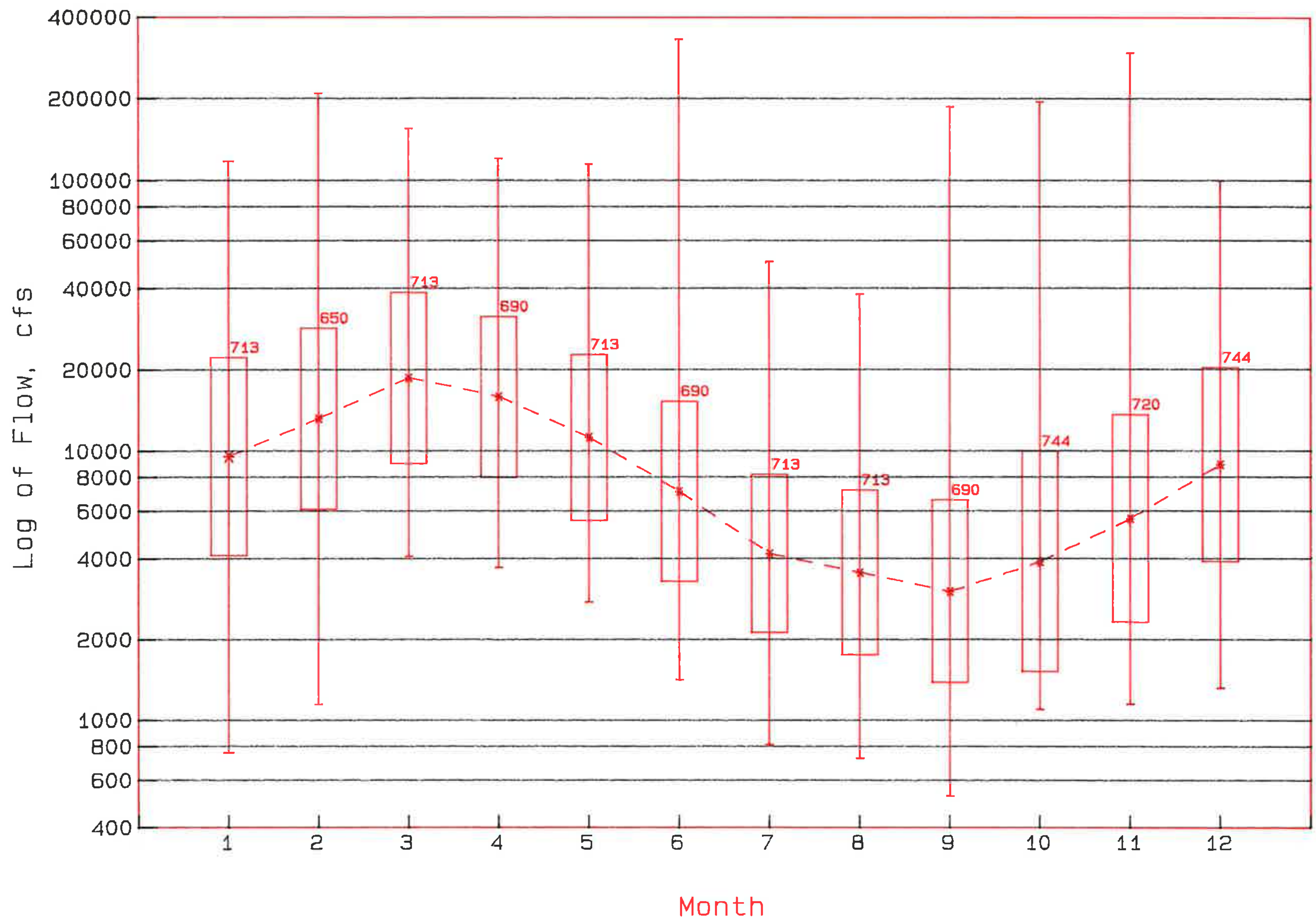


Figure E
Log of Little Falls Flow by Month
Mean, Standard Deviation, Range, and Number Daily Values



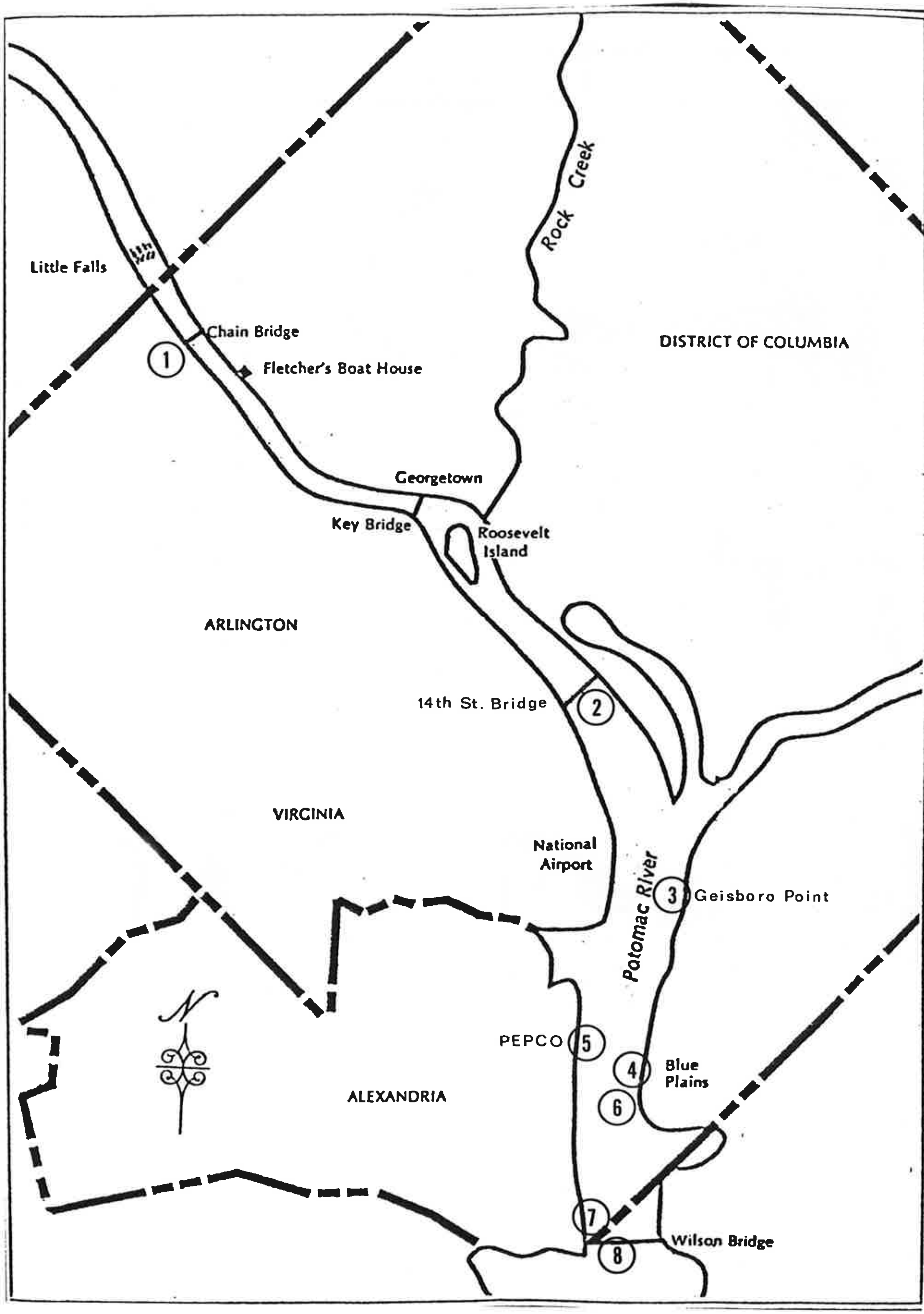



Figure F
Location of Study Area. Flow data are from Little Falls. Temperature data are from stations at 1 - 8.