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Magnitude and Frequency of Floods for Rural, Unregulated Streams of Tennessee by L-Moments Method

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ABSTRACT

This study presents a regional frequency analysis of Tennessee using the well-known Bulletin-17B method standardly used in the United States and the relatively new and developing L-Moments methods. Flood frequency characteristics were defined for 416 gaging stations located primarily in rural and lightly developed areas of Tennessee. All the gaging stations have 10 or more years of record through 2006. Using the L-Moments method, the generalized extreme value distribution was identified as the most robust distribution for each of four hydrologic areas. Multiple regression equations were also calculated for estimating the flood frequency of ungaged, unregulated, rural streams in each of the four hydrologic areas of Tennessee. Regression equations were computed using the ordinary least squares regression procedure. The standard error of prediction for the regression equations were calculated and used to compare the Bulletin 17B and L-Moments methods. This is the first study to indicate that the L-Moments method is, on average, the better of the two methods tested for predicting flood frequency for unregulated streams and rivers in Tennessee.

This thesis is approved for recommendation
to the Graduate Council.

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CHAPTER 1 INTRODUCTION

Statement of Problem

Floods are one of the most common and widespread natural disasters in the United States (Bin and Kruse, 2006). Each year, floods cause many deaths, displace thousands from their homes and are responsible for billions of dollars in damages (Daviau et al., 2000). From fiscal year 1992 to fiscal year 2001, flooding resulted in approximately $55 billion in damages (U.S.GAO, 2005). Based on reliable estimates of magnitude and frequency of floods, engineers have designed and managed flood plain protection projects, dams such as the Three Gorges Dam on the Yangtze River (Figure 1.1), to minimize the loss of lives and properties (Law and Tasker, 2003).

Fig. 1.1. Three Gorges Dam on Yangtze River

Flood frequency analysis, is a method used to analyze a set of historic flow records to predict the behavior of future flows, and is widely used in the design of hydraulic and flood-plain management projects. It is based on fitting a probability distribution to a series of observations in order to estimate the future probabilities of occurrence of a number of events of interest (Ouarda and El-Adlouni, 2011). Frequency commonly is expressed in terms of exceedance probability (a dimensionless number ranging from 0 to 1.0) or as a recurrence interval (the reciprocal of exceedance probability) in years (Flynn et al., 2006). One of the assumptions of flood frequency analysis is that hydrology is stationary, which means that the probability distribution of hydrologic events is unchanging over time. However, changing hydrologic conditions, driven by the climate system or by human activities within the watershed, as well as concepts of multi-decadal climate variability, present a challenge to the assumption of stationarity (Kiang et al., 2011). It is very difficult, and in some cases impossible, to fit the flood data to a probability distribution identically. Moreover, the risk of rare flood events is extremely difficult to evaluate by using flood frequency analyses (Costa, 1978). Table 1.1 lists several problems in practice by using flood frequency analysis method to predict rare floods. Table 1.2 illustrates the magnitude of the extreme floods used in the dam design, in terms of return periods. Hence, hydrologic frequency analysis should be only used as an aid in estimating rare floods (Haan et al., 1994).

After five decades, the field of flood frequency analysis continues to evolve and remains a very active area of investigation (Rao and Hamed, 2000). Many researchers still continue to examine various distributions, methods of estimation of parameters, and problems related to regionalization (Burning, 1990; Hosking, 1990; Rao and Hamed, 2000; Yang et al., 2010; Waage and Kaatz, 2011).

Table 1.1. Problems in practice of using flood frequency analysis (Wang, 1999)

Location	Extreme flood magnitude
Henan Province, China	Banqiao reservoir was built in Huai River in 1953. The design flood was 4236 m^3/s for T=1000 years. But in1975, the dam was breached by a Q=13000 m^3/s flood. Considering the 1975 flood, the design flood for T=1000 years was 14500 m^3/s.
Virginia, U.S.A.	The reservoir in Bath County was build based on the 1952 to 1982 data records. But in Nov 4, 1985, a Q=581 m^3/s flood occurred. According to the original frequency curve, the return period of this flood was 1 million years.
Dominican Republic	The original design flood (T=10000 years) for Tavera-Bao Dam was 807 m^3/s in 1972. However, after a flood occurred in 1979 due to a hurricane, engineers recalculated the frequency curve and the results indicated that the return period of Q=807 m^3/s flood, was only 170 years.

T: Return period, years
Q: Flood discharge, m^3/s

Table 1.2. The 3rd generation flood control standard of world dam (Berga, 1992)

Dam risk category	Loss of lives (number)	Influence of economic, society, environment, and politics	Check flood	Design flood
High	≥N	Enormous	PMF or T= 5000 - 10000	% PMF or T= 1000 - 5000
Middle	0 - N	Significant	ERA or %PMF or T= 1000 - 5000	ERA or %PMF or T= 500 - 1000
Low	0	Limited	T= 100 - 500	T= 100

PMF: Probable Maximum Flood
ERA: Economic Risk Assessment
T: Return period, years

Purpose of Study

The purpose of this study is to update the previous flood frequency analysis and develop new regional regression models for rural, unregulated streams in Tennessee. Bulletin 17B and L-Moments methods were used to perform the estimation of the magnitude of floods for selected return periods, based on the most recent data available. Magnitudes of flood were regressed against the watershed characteristics. Regression models used in this study include the regional regression models and the Bulletin 17B model. This study also tries to find the better methods between the L-Moments method and Bulletin 17B method.

CHAPTER 2 LITERATURE REVIEW

Overview

A total of six previous studies have been conducted to define the flood frequency for rural streams in Tennessee. These reports were published by Jenkins (1960), Patterson (1964), Speer and Gamble (1964), Randolph and Gamble (1976), Weaver and Gamble (1993), and Law and Tasker (2003). Recent flood frequency studies in other states have introduced some new methods, such as Region-of-Influence (Burns, 1990; Feaster and Tasker, 2002; Law and Tasker, 2003) and L-Moments (Chhibber, 2006) to produce flood frequency estimates at both unregulated and regulated streams.

Previous Studies in Tennessee

Jenkins (1960) used 233 gaging stations in main channels to produce the first flood magnitude and frequency in Tennessee. Two dimensionless frequency curves were graphical fitted on Gumbel probability paper for large and small streams in Tennessee, based on the index-flood method outlined by Dalrymple (1960). The mean annual flood $Q_{2.33}$ was used as the index flood in this study. In order to group the basins which seemed to have similar physical characteristics, and to produce areal relations between mean annual flood and drainage area which were more satisfactory than the general relation, the author had divided the state into six hydrological areas. Each hydrological area had its own unique regression model based on the equation, $Q_{2.33} = CA^{0.77}$.

Patterson (1964) developed methods to calculate the magnitude and frequency of floods in the lower Mississippi River basin, which includes parts of Kansas, Kentucky, Louisiana, Missouri, and Tennessee. Peak flow data from 393 gaging stations in main channels with 5 or more years of record were included in the study. A flood frequency curve at each gaging station was derived by fitting the data on Gumbel probability paper, and the flood magnitudes for the selected return periods were derived. The mean annual flood $Q_{2.33}$ was used as the index flood in this study. The lower Mississippi River basin was divided into seven homogeneous areas on the basis of a homogeneity test (the ratio of the 10-year flood to the mean annual flood). Seven dimensionless frequency curves were developed for the seven homogeneous areas. Mean annual flood was correlated graphically with the drainage area. On the basis of this correlation, a total of 27 hydrologic areas were defined.

Speer and Gamble (1964) conducted a flood frequency analysis of most of the gaging stations in the Cumberland and Tennessee River basins. Peak discharge records of 10 or more years for 216 gaging stations were included in this study. The index-flood and regression methods used in this study were the same methods used by Patterson (1964). The process could be divided into two parts: (1) mean annual flood ($Q_{2.33}$) expressed as a function of size of drainage area and (2) the ratio of flood discharges to the mean flood, related to the return period, in years.

Randolph and Gamble (1976) were the first to calculate the flood frequency by using the log-Pearson Type III distribution and methodology described in U.S. Water Resources Council Bulletin 17 (1976). Flood frequency characteristics were defined for 281 gaging stations in Tennessee and adjoining states having 10 or more years of record not significantly affected by man-made changes. Randolph and Gamble divided the state into four hydrologic areas that were based on the physiographic provinces of Tennessee. They also performed statistical analysis to show that the set of gaging stations for each hydrologic area was statistically different from the single set of all gaging stations in the study area. Regression equations were calculated for each hydrologic area for selected return periods.

Weaver and Gamble (1993) were the first to use the Interagency Advisory Committee on Water Data (IACWD) Bulletin 17B (1982) method to calculated the flood frequency for gaging stations in Tennessee. Flood frequency characteristics were defined for 223 gaging stations in Tennessee having 10 or more years of record through 1986. They continued to use the four hydrologic areas for Tennessee that were previously established by Randolph and Gamble in 1976. They also were the first to use the Generalized Least Squares Regression Method to develop the regression equations for the four hydrologic areas.

Law and Tasker (2003) were the first to use the Region-of-Influence method (Burn 1990) for flood frequency analysis in Tennessee, in conjunction with the Bulletin 17B method. Data up to the year 1999 derived from 453 gaging stations located primarily in rural and lightly developed areas of Tennessee and the adjacent states were used in this study. Four hydrologic areas, previously established by Randolph and Gamble in 1976, were slightly modified for use in this analysis of flood frequency and follow the general physiographic provinces boundaries, as shown in Figure 2.1. Law and Tasker performed the Wilcoxon Signed-Ranks Test to show that each hydrologic area group was significantly different from the other areas. They were also the first to use multiple variables (contributing drainage area, main-channel slope, and climate factor) in the regional regression analysis. Based on the deleted-residual standard error values, the results indicated that the Region-of-Influence Method had less errors than the Bulletin 17B method.

The comparisons of the six previous studies in Tennessee can be seen in Table 2.1.

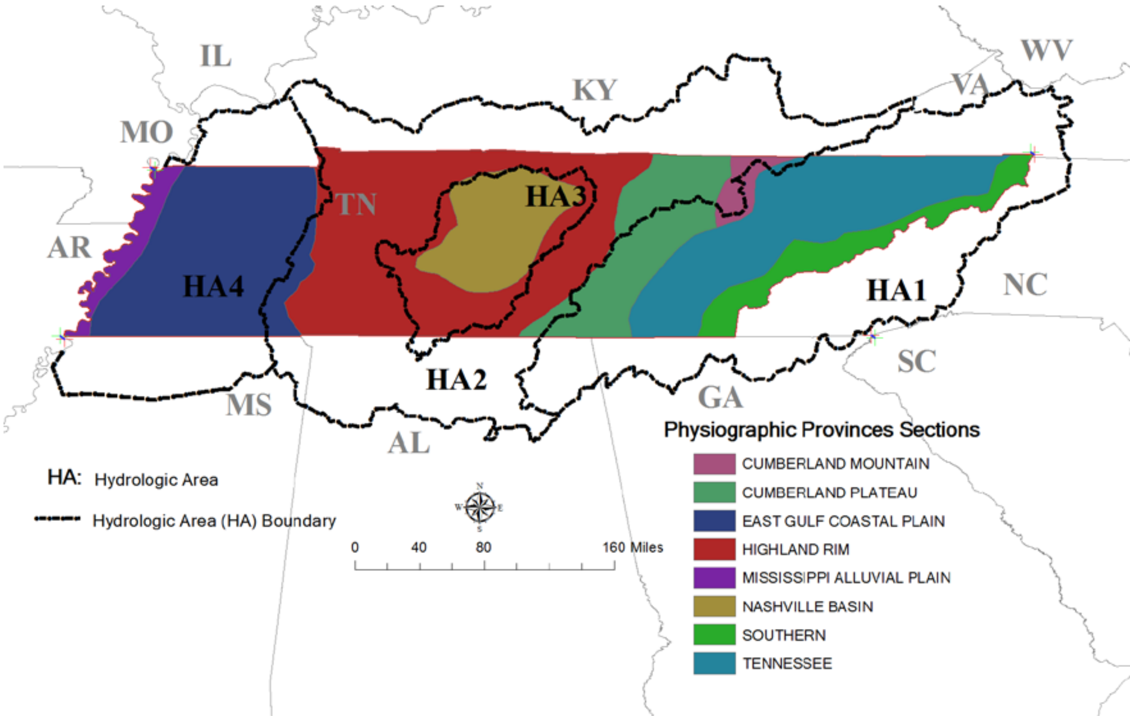

Fig. 2.1. Four hydrologic areas in the study area (Law and Tasker, 2003)

Table. 2.1. Comparisons of the six previous studies in Tennessee

Parameter	**Comparison of six previous studies in Tennessee**					
	1	**2**	**3**	**4**	**5**	**6**
Date	1960	1964	1964	1976	1993	2003
Author	Jenkins	Patterson	Speer and Gamble	Randolph and Gamble	Weaver and Gamble	Law and Tasker
Methods	Index-flood method, Gumbel probability paper	Index-flood method, Gumbel probability paper	Index-flood method, Gumbel probability paper	Bulletin 17	Bulletin 17B	Bulletin 17B, Region-of-Influence
Inputs	Records of 233 gaging stations in main channels up to the year 1958	Records of 393 gaging stations in main channels up to the year 1958	Records of 216 gaging station up to the year 1960	Records of 281 gaging stations up to the year 1975	Records of 223 gaging stations up to the year 1986	Records of 453 gaging stations up to the year 1999
Number of hydrologic areas	6	27	5	4	4	4
Regression method and equation	OLS, $Q_{2.33}=CA^{0.77}$	OLS, $Q_{2.33}=CA^{x}$	OLS, $Q_{2.33}=CA^{0.793}$	OLS, $Q_T=CA^x$	GLS, $Q_T=CA^x$	GLS, $Q_T=CCDA^xCS^yCF^z$
Standard error of estimate or prediction	-	-	-	Avg. $\%SE_e$: 35	Avg. $\%SE_p$: 40	Avg. $\%SE_p$: 38

Flood Frequency Studies in Other States

Asquith (2001) was the first to investigate flood characteristics using L-Moments ratios in his analysis of regulated basins of Texas using three areas. Four regression equations were derived to estimate the L-Moments of annual peak flow data for ungaged sites for each area from data for 367 gaging stations in regulated basins. The results indicated that as potential flood storage in a basin increased, the mean annual peak streamflow decreased nonlinearly.

Feaster and Tasker (2002) used both the regional regression and Region-of-Influence methods to predict the magnitude and frequency of floods in South Carolina at ungaged, rural basins. Peak flow data were utilized from 167 gaging stations in South Carolina and the adjacent states. Feaster and Tasker developed a computer-based application in the Region-of-Influence Method for easy computations and comparison of the predictive errors. The computer application includes the option of using the Region-of-Influence Method, or the generalized least squares regression equations to compute estimated flows and errors of prediction specific to each ungaged site in a study area. Based on the ratio of PRESS values from two methods, the results indicated that the Region-of-Influence method performed better only in the Blue Ridge Province, which had a PRESS values of 0.77.

Walker and Krug (2003) used the regional regression method to predict flood frequency characteristics for 312 gaging stations on Wisconsin streams using the peak flow data collected through water year 2000. The state was divided into five hydrologic areas, and the equations of the relations between flood frequency and drainage basin characteristics were developed by multiple-regression analyses. The average standard error of estimate for five hydrologic areas was 31%.

Chhibber (2006) was the first to use L-Moments method to calculate the magnitude of floods in Arkansas. Data from 415 gaging stations located in Arkansas and adjacent states were used in this study. The state was divided into four hydrologic areas and four regression equations were derived. The results indicated that, instead of log-Pearson Type III distribution, the Generalized Extreme Value (GEV) and Generalized Logistic (GLO) distributions were the most robust distributions for Arkansas.

L-Moments Method

L-Moments method was first proposed by Hosking (1990), and is a system of describing the shapes of probability distributions. Historically L-Moments arose as modifications of the "probability weighted moments" of Greenwood et al. (1979). L-Moments are linear combinations of order statistics which are robust to outliers and unbiased for small samples; these properties make the L-Moments method suitable for flood frequency analysis (Daviau et al., 2000).

For a random variable X with quantile function $x(u)$, the L-Moments of X is defined as follows:

$$\lambda_r = \int_0^1 x(u) P_{r-1}^*(u) du \tag{2.1}$$

where,

$$P_{r-1}^*(u) = \sum_{k=0}^{r-1} p_{r-1,k}^* u^k \tag{2.2}$$

$$p_{r-1,k}^* = \frac{(-1)^{r-1-k}(r-1+k)!}{(k!)^2(r-1-k)!} \tag{2.3}$$

Hosking and Wallis (1997) define polynomials $P_r^*(u), r = 0, 1, 2, \dots,$ as follows

(i) $P_r^*(u)$ is a polynomial of degree r in u.

(ii) $P_r^*(1) = 1$.

(iii) $\int_0^1 P_r^*(u) P_s^*(u) du = 0$ if $r \neq s$.

In terms of probability weighted moments, L-Moments are given by:

$$\lambda_1 = \alpha_0 \qquad = \beta_0 \tag{2.4}$$

$$\lambda_2 = \alpha_0 - 2\alpha_1 \qquad = 2\beta_1 - \beta_0 \tag{2.5}$$

$$\lambda_3 = \alpha_0 - 6\alpha_1 + 6\alpha_2 \qquad = 6\beta_2 - 6\beta_1 + \beta_0 \tag{2.6}$$

$$\lambda_4 = \alpha_0 - 12\alpha_1 + 30\alpha_2 - 20\alpha_3 \qquad = 20\beta_3 - 30\beta_2 + 12\beta_1 - \beta_0 \tag{2.7}$$

$$\lambda_5 = \alpha_0 - 20\alpha_1 + 90\alpha_2 - 140\alpha_3 + 70\alpha_4 = 70\beta_4 - 140\beta_3 + 90\beta_2 - 20\beta_1 + \beta_0 \tag{2.8}$$

where,

$$\alpha_r = \int_0^1 x(u)(1-u)^r du \tag{2.9}$$

$$\beta_r = \int_0^1 x(u) u^r du \tag{2.10}$$

and in general

$$\lambda_{r+1} = (-1)^r \sum_{k=0}^{r} p_{r,k}^* \alpha_k = \sum_{k=0}^{r} p_{r,k}^* \beta_k \tag{2.11}$$

For sample L-Moments, estimation is based on a sample of size n, arranged in ascending order. Let $x_{1:n} \leq x_{2:n} \leq \ldots \leq x_{n:n}$ be the ordered sample. An unbiased estimator of β_r is:

$$b_r = n^{-1} \sum_{j=r+1}^{n} \frac{(j-1)(j-2)\ldots(j-r)}{(n-1)(n-2)\ldots(n-r)} x_{j:n} \tag{2.12}$$

(Landwehr et al., 1979). This may alternatively be written as

$$b_0 = n^{-1}\sum_{j=1}^{n} x_{j:n} \tag{2.13}$$

$$b_1 = n^{-1}\sum_{j=2}^{n} \frac{(j-1)}{(n-1)} x_{j:n} \tag{2.14}$$

$$b_2 = n^{-1}\sum_{j=3}^{n} \frac{(j-1)(j-2)}{(n-1)(n-2)} x_{j:n} \tag{2.15}$$

The sample L-Moments are defined by

$$\ell_1 = b_0 \tag{2.16}$$

$$\ell_2 = 2b_1 - b_0 \tag{2.17}$$

$$\ell_3 = 6b_2 - 6b_1 + b_0 \tag{2.18}$$

$$\ell_4 = 20b_3 - 30b_2 + 12b_1 - b_0 \tag{2.19}$$

$$\ell_5 = 70b_4 - 140b_3 + 90b_2 - 20b_1 + b_0 \tag{2.20}$$

and in general

$$\ell_{r+1} = \sum_{k=0}^{r} p^{*}_{r,k} b_k; \qquad r = 0,1,\ldots,n-1 \tag{2.21}$$

Dimensionless versions of L-Moments are achieved by dividing the higher-order L-Moments by the scale measure λ_2. The L-Moment ratios are defined as follows:

$$\tau_r = \lambda_r / \lambda_2, \qquad r = 3,4,\ldots. \tag{2.22}$$

L-Moment ratios measure the shape of a distribution independently of its scale of measurements.

$L-CV$ is defined as

$$\tau = \lambda_2 / \lambda_1 \tag{2.23}$$

λ_1 is the L-location or mean of the distribution.

λ_2 is the L-scale.

τ is the coefficient of L-variation.

τ_3 is the L-skewness.

τ_4 is the L-kurtosis.

The L-Moments λ_1 and λ_2, the $L-CV$ τ and the L-Moment ratios τ_3 and τ_4 are the most useful quantities for summarizing probability distributions (Hosking, 1989).

Analogously to Equations. (2.22) and (2.23), the sample L-Moment ratios are defined by

$$t_r = \ell_r / \ell_2 \tag{2.24}$$

and the sample $L-CV$ by

$$t = \ell_2 / \ell_1 \tag{2.25}$$

The estimators t_r and t are not unbiased, but their biases are very small in moderate or large samples (Hosking and Wallis, 1997).

Although both moments and L-Moments are measures of the location, scale, and shape of probability distributions, L-Moments are superior to the ordinary moments in several ways:

(1) Both sample L-skewness and sample L-kurtosis are much less biased than the ordinary skewness and kurtosis (Wallis et al., 1974; Hosking and Wallis, 1997; Royston, 1992).

(2) Sample moments are more affected than their L-Moments analogs by extreme observations. Hosking and Wallis (1997) used Corpus Christi windspeed data as an example: If the largest observation is deleted, the sample coefficient of variation $\hat{C}_v$ falls from 0.289 to 0.173 and the sample skewness falls from 3.37 to 1.32, falls of 40% and 61%, respectively. The sample $L-CV$ falls from 0.1229 to 0.0908 and the sample L-skewness t_3 falls from 0.5107 to 0.3721, falls of only 26% and 27%, respectively. Vogel and Fennessey (1993) also showed that, even for

sample sizes in excess of 5000, sample skewness can be severely affected by an outlier, whereas sample L-skewness t_3 is not.

(3) The identification of the distribution from an observed random sample is much more easily achieved, particularly for skew distributions, by using L-Moments rather than conventional moments (Hosking and Wallis, 1997).

Need for This Study

The previous studies show that additional data, improved methods, and the L-Moment method can improve predictions of floods for ungaged rural streams. The most recent study for Tennessee used Bulletin 17B and Region-of-Influence methods with the data to 1999. With additional data and the L-Moments method, the accuracy of prediction of floods should improve and decrease losses and costs due to flooding.

CHAPTER 3 METHODS

Overview

This flood frequency analysis of the unregulated, rural and lightly urbanized streams of Tennessee required eight steps:

- Selection of gaging stations.
    - Rural (urban land use doesn't exceed 10% in a watershed)
    - Unregulated
    - At least 10 years of systematic annual peak flows
    - ½° latitude and longitude outside of Tennessee
- Collection of annual peak flow data for the selected gaging stations.
- Collection of watershed characteristics for the watersheds of the selected gaging stations.
- Screening of data for inconsistencies or discordance.
- Delineation of homogeneous areas using L-Moments Fortran package.
- Estimation of frequency distributions using L-Moments and Bulletin 17B methods.
- Regression analysis of annual peak flow using ordinary least squares method.
- Comparison of the results.

Description of the Study Area

Tennessee has five different physiographic provinces (USGS, 2010) (Figure 3.1). From west to east, the topography ranges from the lowlands of the Mississippi Valley and Coastal Plain; to the Interior Low Plateau; across the Appalachian Plateau; to the Valley and Ridge and the Blue Ridge Province (Law and Tasker, 2003). Elevation ranges from about 300 feet in the west to about 6600 feet in the east (Weaver and Gamble, 1993).

The geology of Tennessee also varies west to east. In the west, the geology primarily consists of sand, silt, clay and gravel. In the middle of Mississippi Plain, geology is dominated by karstic limestone, chert, shale, sandstone, and dolomite. In the east, the Valley and Ridge and Blue Ridge Province are comprised of limestone, dolomite, shale and sandstone. The mountains in the east are underlain by igneous and metamorphic rocks (Tennessee Division of Geology, 2012) (Figure 3.2).

The average precipitation in Tennessee generally increases from west to east. The range of precipitation is about 40-inch in the west to about 80-inch in the east per year (Dickson, 1960).

The streams in Tennessee are divided into three types: perennial, intermittent, and ephemeral stream. Perennial streams are located mostly in the Coastal Plain of Tennessee; intermittent streams are located in the Cumberland Plateau; and ephemeral streams are mostly located in the Central Basin (Weaver and Gamble, 1993). Average annual runoff varies from approximately 18 to 40 inches (USGS, 1986). Evapotranspiration averages about 30 inches per year in Tennessee (Tennessee Department of Conservation and Commerce, 1961).

Catastrophic flooding is unusual in Tennessee, but is more common in winter and spring (December to March), because of the high intense frequent frontal storms and the saturated ground (Law and Tasker, 2003). Extreme floods have occurred in Tennessee in 1793, 1867, 1902, 1929, 1948, 1955, 1973, 1975, and 1984 (Law and Tasker, 2003).

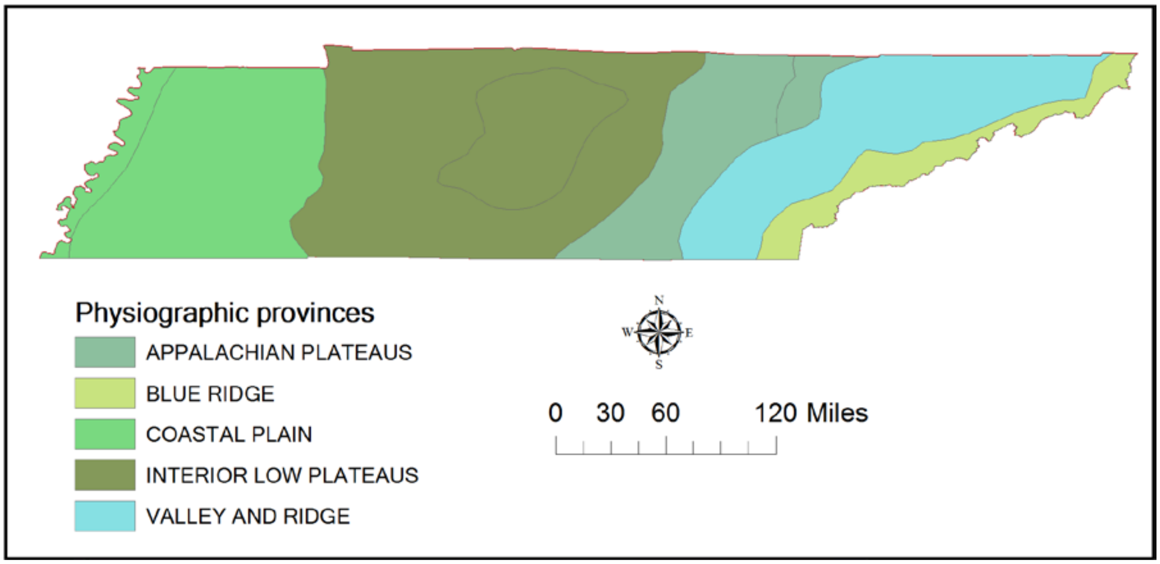

Fig. 3.1. Physiographic provinces in Tennessee (Lawer and Tasker, 2003)

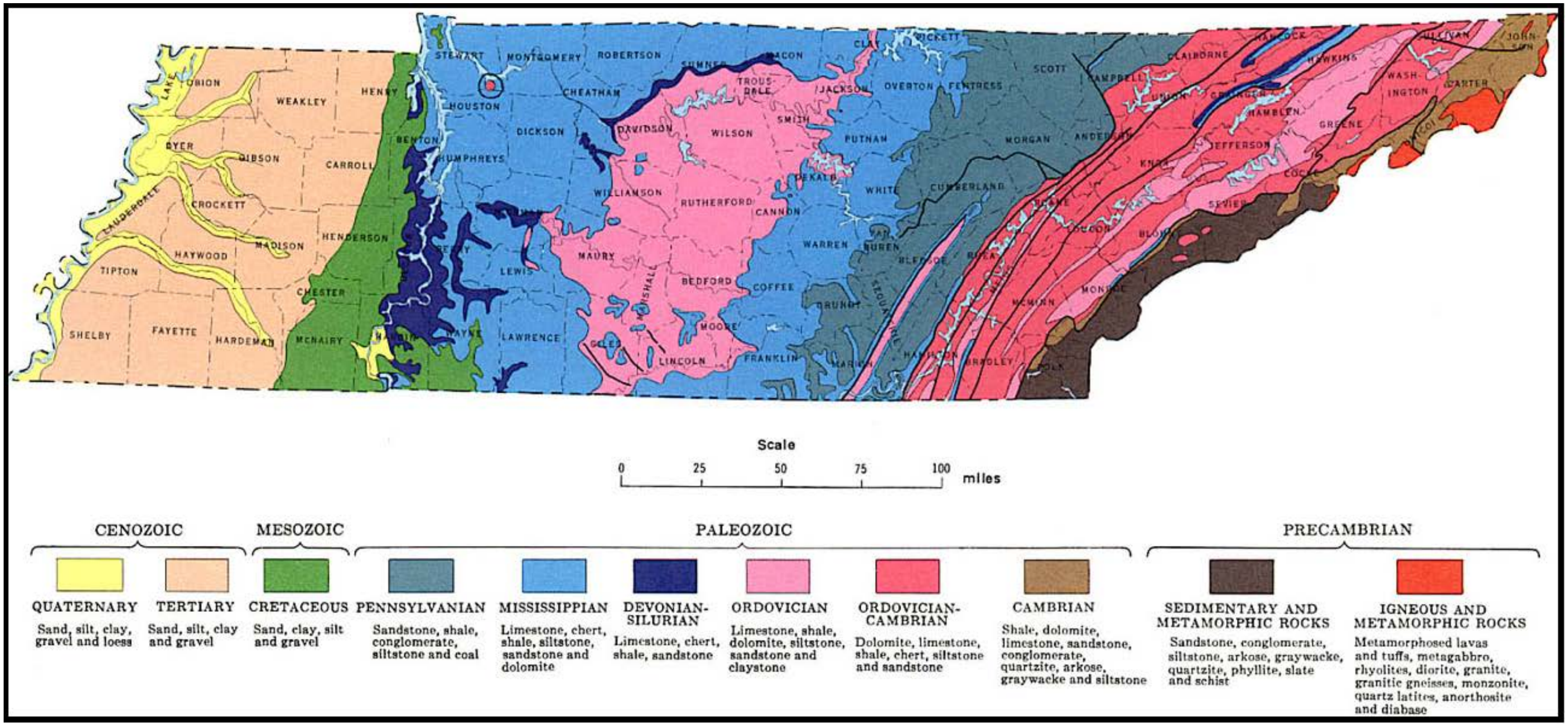

Fig. 3.2. Generalized geologic map of Tennessee (Tennessee Division of Geology, 2012)

Annual Peak Flow Data

The annual peak flow data used in this study were derived from 447 stream gaging stations located in Tennessee and approximately ½° latitude and longitude outside of Tennessee in the adjacent states of Alabama, Georgia, Kentucky, Mississippi, North Carolina, and Virginia. This was done to eliminate discrepancies across state lines (or the “state-line fault”) and to account for data in the immediate bordering areas of a state with similar hydrology (Tortorelli, 1997). Of these stations, 20 are in Alabama, 19 are in Georgia, 35 are in Kentucky, 13 are in Mississippi, 37 are in North Carolina, and 28 are in Virginia. The remaining 295 stations are in Tennessee (Figure 3.3).

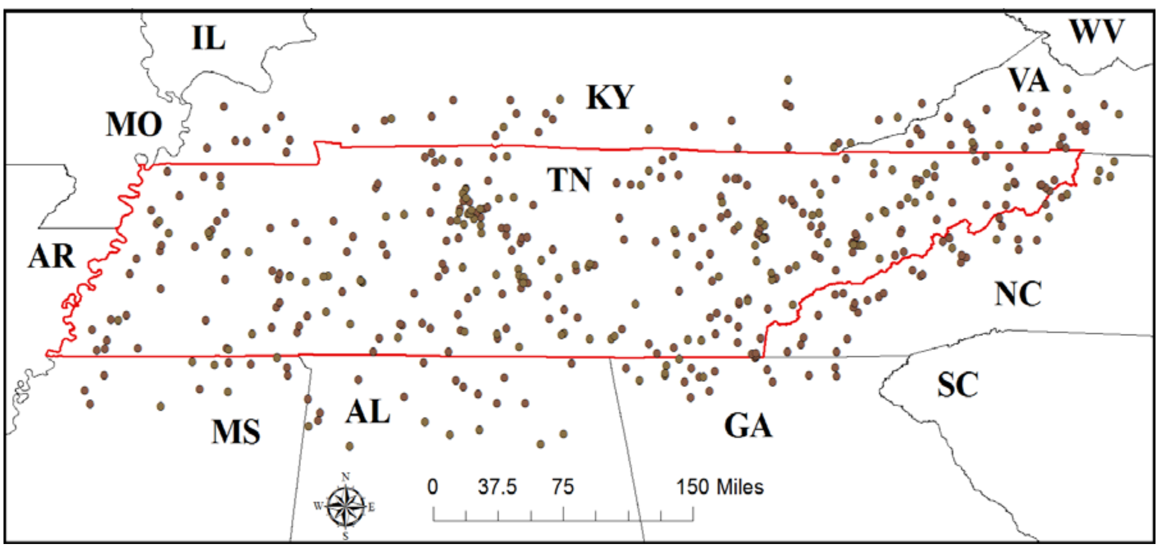

Fig. 3.3. Gaging stations in the study area

Most of the gaging stations are located in rural and lightly developed areas, which means that these stations measure flow in watersheds with up to 10 percent total urban area. However, if the urban area in a watershed was found to exceed 10 percent, the record of a station was discarded and not used in the flood frequency analysis. A number of gaging stations in Davidson County, Tennessee, with more than 10 percent urban land cover, were still used in this study because it has been shown that their T-year floods are not significantly larger than those from rural basins (Wibben, 1976).

Annual peak flow data were collected from U.S. Geological Survey (USGS, 2011b) up through water year 2006. Gaging stations were required to have at least 10 years of systematic annual peak flows as per IACWD (1982). The annual peak flow data used in this study were not significantly affected by manmade changes (such as reservoir regulation). Records from streams that were affected by known or unknown degree of reservoir regulation were only partially used in this study, if the stations had at least 10 years data prior to regulation. A summary of the distribution of data and average length of record for each station is shown in Table 3.1.

Table 3.1. Summary of the distribution of data and average length of record

Contributing drainage area (mi^2)	Number of stations	Average length of records (years)
Less than 2.3	40	22
2.3 to 8.7	53	23
8.7 to 27.9	64	27
27.9 to 85.8	94	34
85.8 to 260.0	89	38
260.0 to 784.1	68	49
784.1 to 2362	31	44
2362 to 7110	6	33
7110 to 21400	2	58

Physical Basin Characteristics

Physical characteristics of a watershed, such as area, elevation, shape, and land use, are the parameters that are used to describe the unique attribute of a watershed. Different physical characteristics can account for differences in the flow magnitude, so these parameters are often used in as the explanatory variables in the regression analysis (Law and Tasker, 2003).

A total of eight basin characteristics were used in this flood frequency analysis. Five basin characteristics (area, slope, length, shape, and elevation) were calculated using the Watershed Modeling System (WMS) software (Environmental Modeling Systems, Inc., 2011), and the other three characteristics (land use, precipitation, and soil) were acquired using the Geographic Information Systems (GIS) by Environmental Systems Research Institute ESRI®. U.S. Geological Survey (USGS, 2011b) also provides data of the contributing drainage area, instead of the total drainage area calculated by WMS. The details of eight basin characteristics in this study are shown in Table 3.2.

Table 3.2. Eight basin characteristics used in this study

Basin characteristics	Calculation method	Description
Contributing drainage area (CDA)	USGS	Contributing drainage area is the total area that contributes runoff upstream of the stream site of interest (Mason et al., 1999). CDA does not account the non-contributing areas.
Basin slope (BS)	WMS	Average basin slope, measured by the "contour-band" method. BS = (total length of all selected elevation contours) * (contour interval) / (contributing drainage area) (Eash, 1994).
Basin length (BL)	WMS	Basin length is the sum of length of a small number of sequential line segments following the geometric centerline of the watershed from the drainage divide to the outlet (Heitmuller et al., 2006).
Basin shape factor (BSF)	WMS	Basin shape factor, ratio of basin length to effective basin width. Effective basin width, ratio of contributing drainage area to basin length (Eash, 1994).
Mean basin elevation (MBE)	WMS	Mean basin elevation is the average group elevation above sea level, measured from topographic maps by transparent grid-sampling (20 to 80 points in basin were samples) (Weaver and Gamble, 1993).
Mean annual precipitation (MAP)	GIS	Mean annual precipitation, computed as a weighted average within the total drainage area. Total drainage area, includes nocontributing areas (Eash, 1994).
Land use and land cover (LULC)	GIS	The distribution of different patterns and use of the land in a watershed.
Hydrologic soil group (HSG)	GIS	Soils are classified into hydrologic soil groups (HSG's) to indicate the minimum rate of infiltration obtained for bare soil after prolonged wetting. Group A soils have low runoff potential and high infiltration rates, while group D soils have high runoff potential and low infiltration rates (SCS, 1986).

Data Sources

The Digital Elevation Model (DEM) data were acquired from the U.S. Geological Survey National Elevation Dataset (NED) (USGS, 2011a). The NED is a seamless dataset and used to determine flow direction and delineate flow. The geographic coordinate used in DEM is the North American Datum of 1983 (NAD 83). The unit of elevation in DEM is meters and referenced to the North American Vertical Datum of 1988 (NAVD 88). There are three type of resolution data for NED: 1 arc-second (about 30 meters), 1/3 arc-second (about 10 meters), and in limited areas at 1/9 arc-second (about 3 meters) (USGS, 2011a). In this study 1 arc-second (about 30 meters) DEM data were used to analyze and derive the basin characteristics.

Land use, hydrologic soil group, and mean annual precipitation data were all obtained from the Natural Resources Conservation Service (NRCS) Geo-spatial Date Gateway (NRCS, 2011).

National Land Cover Data (NLCD) is a 21-class land cover classification scheme applied consistently over the United States, derived from the early to mid-1990s. The resolution of the data is 30 meters and mapped in the Albers Conic Equal Area projection, NAD 83 (USGS, 2012). The newest National Land Cover Data (NLCD 2006) were used in this study to derive the land use and land cover for each watershed.

Soil Survey Spatial and Tabular Data (SSURGO 2.2) is a digital soil survey and generally is the most detailed level of soil geographic data developed by the National Cooperative Soil Survey. This dataset contains information of the physical and chemical soil properties, soil interpretations, and static and dynamic metadata (NRCS, 2012). In this study, hydrologic soil group data for each watershed were acquired from SSURGO 2.2 (NRCS, 2011).

Watershed Modeling System (WMS)

Watershed Modeling System (WMS), developed by the Brigham Young University and U.S. Army Corps of Engineers, is a comprehensive graphical modeling interface for all phases of watershed hydrology and hydraulics. WMS can automatically perform the watershed modeling steps such as watershed delineation, geometric parameter determination, hydrological calculations, Geographical Information System (GIS) overlay operations, and stream cross-section extraction from DEM data (Erturk et al., 2006).

In this study, WMS was used for watershed modeling operations and basin characteristics extraction. WMS imports DEM data and uses them to compute flow direction, extract stream network, and delineate watershed boundaries. The Topographic PArameteriZation program (TOPAZ) is distributed with WMS for this process. Basin outlet was created in WMS based on each gaging station's coordinate (latitude and longitude) which was obtained from the U.S. Geological Survey Surface Water website (USGS, 2011b).

Bulletin 17B Method

A flood frequency relation for a stream where gaging station data are available can be defined by fitting the array of annual peak discharges to a theoretical frequency distribution. The Interagency Advisory Committee on Water Data (IACWD) (1982) has recommended a uniform technique for determining flood flow frequencies by fitting the logarithms of the annual peak discharges to a Pearson Type III distribution and has described these calculations in detail. This technique is now accepted by most Federal and State agencies and is referred to as the log-

Pearson Type III frequency analysis (Weaver and Gamble, 1993). The equation for fitting the log-Pearson Type III distribution to an observed series of annual peak discharges is as follows:

$$\log_{10} Q_T = \bar{X} + KS \tag{3.1}$$

where,

Q_T is the T-year recurrence interval peak discharge,

$\bar{X}$ is the mean of the $\log_{10}$ transformed annual peak discharges,

K is a factor dependent on recurrence interval and the skew coefficient of the $\log_{10}$ transformed annual peak discharges, and

S is the standard deviation of the $\log_{10}$ transformed annual peak discharges.

Values of K can be obtained from Appendix 3 of Bulletin 17B (IACWD, 1982).

The mean, standard deviation, and skew coefficient of station data can be calculated using the following equations:

$$\bar{X} = \frac{\Sigma X}{N} \tag{3.2}$$

$$S = \left[\frac{\Sigma (X - \bar{X})^2}{(N-1)}\right]^{0.5} = \left[\frac{(\Sigma X^2) - (\Sigma X)^2 / N}{(N-1)}\right]^{0.5} \tag{3.3}$$

$$G = \frac{N \Sigma (X - \bar{X})^3}{(N-1)(N-2)S^3} = \frac{N^2 (\Sigma X^3) - 3N(\Sigma X)(\Sigma X^2) + 2(\Sigma X)^3}{N(N-1)(N-2)S^3} \tag{3.4}$$

where,

X is the $\log_{10}$ transformed annual peak discharge,

N is the number of items in dataset,

G is the skew coefficient of the $\log_{10}$ transformed annual peak discharges,

$\bar{X}$ is the mean of the $\log_{10}$ transformed annual peak discharges, and

S is the standard deviation of the $\log_{10}$ transformed annual peak discharges.

Screening the Data

The screening process was used to identify the sites that are grossly discordant with the group as a whole. Discordancy is measured in terms of the L-Moments of the sites' data (Hosking and Wallis, 1997).

Suppose that there are N sites in the group. Let $\mathbf{u}_i = [t^{(i)} \;\; t_3^{(i)} \;\; t_4^{(i)}]^T$ be a vector containing the t, t_3, and t_4 values for site i where the superscript T denotes transposition of a vector or matrix. Let:

$$\bar{\mathbf{u}} = N^{-1}\sum_{i=1}^{N}\mathbf{u}_i \tag{3.5}$$

be the regional average. Define the matrix of sums of squares and cross-products as follows

$$\mathbf{A} = \sum_{i=1}^{N}(\mathbf{u}_i - \bar{\mathbf{u}})(\mathbf{u}_i - \bar{\mathbf{u}})^T \tag{3.6}$$

The discordancy measure for site i is then defined as

$$D_i = \frac{1}{3}N(\mathbf{u}_i - \bar{\mathbf{u}})^T \mathbf{A}^{-1}(\mathbf{u}_i - \bar{\mathbf{u}}) \tag{3.7}$$

If the D_i value is large, it indicates the site i is discordant with other sites. Hosking and Wallis (1997) suggested some critical values for D_i, which are dependent on the number of sites in the study area (Table 3.3).

Table 3.3. Suggested critical values for the discordancy statistic D_i (Hosking and Wallis, 1997)

Number of sites in area	Critical value	Number of sites in area	Critical value
5	1.333	10	2.491
6	1.648	11	2.632
7	1.917	12	2.757
8	2.140	13	2.869
9	2.329	14	2.917
		≥15	3

Identification of Homogeneous Areas

There are two characteristics that could be used to develop homogeneous areas: at-site statistics and site characteristics. At-site statistics are the data calculated from the at-site measurements of floods, while the site characteristics are physical properties of the site (e.g., geographical location, elevation, and area). Hosking and Wallis (1997) strongly prefer to base the formation of areas on site characteristics and to use the at-site statistics only in subsequent testing of the homogeneity of a proposed set of areas.

Clusters are formed from groups of sites with similar site characteristics. Cluster analysis of site characteristics is the most practical method of forming areas from large data sets and has been discussed for many years (Ward, 1963; Gordon, 1981; Everitt, 1993; Kalkstein et al., 1987; Fovell and Fovell, 1993). The L-Moments method performs clustering by using the Ward's clustering algorithm and the K-means algorithm (Hosking and Wallis, 1997).

Ward's algorithm is one of the hierarchical clustering techniques that proceed successively by either merging smaller clusters into larger ones, or by splitting larger cluster to smaller ones (Ward, 1963). Let $\mathbf{X} = \{\mathbf{x}_i / i = 1,...,N\}$ denote a set of N feature vectors in m-dimensional attribute space, each of which characterizes one of the N sites. Further, let $\mathbf{y}_i$ denote the i th rescaled feature vector in the m- dimensional attribute space obtained by rescaling $\mathbf{x}_i$ using the following equation

$$y_{ij} = \frac{w_j}{\sigma_j}[f(x_{ij})] \qquad j = 1,...,m \tag{3.8}$$

In the equation, $f(\cdot)$ represents the transformation function; x_{ij} denotes the value of attribute j in the m- dimensional feature vector $\mathbf{x}_i$, y_{ij} denotes the rescaled value of x_{ij}; w_j is the weight assigned to attribute j; and σ_j is the standard deviation of attribute j.

The objective function, W, of Ward's algorithm (Ward, 1963) minimizes the sum of squares of deviations of the feature vector from the centroid of their respective clusters

$$W = \sum_{k=1}^{K}\sum_{j=1}^{m}\sum_{i=1}^{N_k}(y_{ij}^k - y_{\bullet j}^k)^2 \tag{3.9}$$

In the equation, K denotes the number of clusters; N_k represents the number of feature vectors in cluster k; y_{ij}^k denotes the rescaled value of attribute j in the feature vector i assigned to cluster k; $y_{\bullet j}^k$ is the mean value of feature j for cluster k:

$$y_{\bullet j}^k = \frac{\sum_{i=1}^{N_k} y_{ij}^k}{N_k} \tag{3.10}$$

The K clusters formed in the step "$N - K$" of an agglomerative hierarchical clustering algorithm are used to initialize the K-means algorithm (Hartigan and Wong, 1979). The K-means algorithm is an iterative procedure in which the feature vectors move from one cluster to another to minimize the value of objective function, F, defined in the following equation

$$F = \sum_{k=1}^{K} \sum_{j=1}^{m} \sum_{i=1}^{N_k} d^2 (y_{ij}^k - y_{\bullet j}^k) \tag{3.11}$$

In this study, cluster analysis was first performed using Ward's method. Each site was a cluster by itself, then clusters were merged one by one until all sites belong to a single cluster. Next, the clusters obtained by Ward's method were adjusted using the K-means algorithm, which yield clusters that are a little more compact in the space of cluster variables (Hartigan and Wong, 1979; Hosking and Wallis, 1997).

The homogeneous measure recommended by Hosking and Wallis (1997) is based on L-Moments Ratios. Suppose that the area to be tested for homogeneity has N sites, with site i having record length of peak flows n_i. Let $t^{(i)}$, $t_3^{(i)}$, $t_4^{(i)}$ denote $L-CV$, L-skewness, and L-kurtosis, respectively, at site i. The regional average $L-CV$, L-skewness, and L-kurtosis, represented by t^R, $t_3{}^R$, and $t_4{}^R$, respectively, are computed as:

$$t^R = \sum_{i=1}^{N} n_i t^{(i)} / \sum_{i=1}^{N} n_i \tag{3.12}$$

$$t_3{}^R = \sum_{i=1}^{N} n_i t_3{}^{(i)} / \sum_{i=1}^{N} n_i \tag{3.13}$$

$$t_4{}^R = \sum_{i=1}^{N} n_i t_4{}^{(i)} / \sum_{i=1}^{N} n_i \tag{3.14}$$

; where $n_i / \sum_{i=1}^{N} n_i$ denotes the weight applied to sample L-Moment Ratios at site i, which is proportional to the record length of the site. The regional average mean ℓ_1^R is set to 1.

Heterogeneity measures in L-Moments method are based on three measures of dispersion:

(1) Weighted standard deviation of the at-site sample $L-CVs(V_1)$.

(2) Weighted average distance from the site to the group weighted mean in the two-dimensional space of $L-CV_1$ and L-skewness (V_2).

(3) Weighted average distance from the site to the group weighted mean in the two-dimensional space of L-skewness and L-kurtosis (V_3).

$$V_1 = \left\{ \sum_{i=1}^{N} n_i [t^{(i)} - t^R]^2 / \sum_{i=1}^{N} n_i \right\}^{\frac{1}{2}} \tag{3.15}$$

$$V_2 = \sum_{i=1}^{N} n_i [(t^{(i)} - t^R)^2 + (t_3^{(i)} - t_3^R)^2]^{\frac{1}{2}} / \sum_{i=1}^{N} n_i \tag{3.16}$$

$$V_3 = \sum_{i=1}^{N} n_i [(t_3^{(i)} - t_3^{R})^2 + (t_4^{(i)} - t_4^R)^2]^{\frac{1}{2}} / \sum_{i=1}^{N} n_i \tag{3.17}$$

A large number of realizations (N=500) of the area are simulated from Kappa distribution fitted to regional average L-Moments Ratios: ℓ_1^R=1, t^R, $t_3{}^R$, and $t_4{}^R$. The Kappa distribution is a four-parameter distribution that includes as special cases the generalized logistic, generalized extreme-value, and generalized Pareto distributions (Hosking and Wallis, 1997). The probability density function of Kappa distribution can be found in the Appendix 10 of Hosking and Wallis (1997). For each simulated realization, V_1, V_2, and V_3 are computed.

Let μ_{v1}, μ_{v2}, and μ_{v3} denote the mean and σ_{v1}, σ_{v2}, and σ_{v3} the standard deviation of the N_{sim} values of V_1, V_2, and V_3, respectively. These values are used to estimate the three heterogeneity measures:

$$H_1 = \frac{(V_1 - \mu_{v1})}{\sigma_{v1}} \tag{3.18}$$

$$H_2 = \frac{(V_2 - \mu_{v2})}{\sigma_{v2}} \tag{3.19}$$

$$H_3 = \frac{(V_3 - \mu_{v3})}{\sigma_{v3}} \tag{3.20}$$

A large positive value of H_1 indicates that the observed L-Moments are more dispersed than what is consistent with the hypothesis of homogeneity. H_2 indicates whether the at-site and regional estimated are close to each other; a large value of H_2 indicates that a large deviation between regional and at-site estimates. H_3 indicates whether the at-site estimates and the regional estimate will agree; large values of H_3 indicate a large deviation between at-site estimates and observed data (Atiem and Harmancioglu , 2006; Hosking and Wallis, 1993; Yang et al., 2010).

However, the latter two measures of heterogeneity (H_2 and H_3) lack the power to discriminate between homogeneous and heterogeneous areas. Therefore, it is recommended to use H_1 when testing an area's heterogeneity (Hosking and Wallis, 1997). Hosking and Wallis (1997) suggests that the area be regarded as "acceptable homogeneous" if $H_1 < 1$, "possibly heterogeneous" if $1 \le H_1 < 2$, and "definitely heterogeneous" if $H_1 \ge 2$.

Choice of a Frequency Distribution

Suppose that the area has N sites, with site i having record length n_i and sample L-Moments ratios $t^{(i)}$, $t_3^{(i)}$, and $t_4^{(i)}$. Denote by t^R, t_3^R, and t_4^R the regional average $L-CV$, L-skewness, and L-kurtosis, weighted proportionally to the sites' record length. Fit each candidate distribution (such as Kappa) to the regional average L-Moments 1, t^R, t_3^R, and t_4^R. Next simulate a large number (N_{sim}) of realizations of an area with N sites, each having this Kappa distribution as its frequency distribution. For the m th simulated area, calculate the regional average L-skewness $t_3^{[m]}$ and L-kurtosis $t_4^{[m]}$. The calculations of the bias and the standard deviation of t_4^R are as follows

$$B_4 = N_{sim}^{-1} \sum_{m=1}^{N_{sim}} (t_4^{[m]} - t_4^R) \tag{3.21}$$

$$\sigma_4 = [(N_{sim} - 1)^{-1} \left\{ \sum_{m=1}^{N_{sim}} (t_4^{[m]} - t_4^R)^2 - N_{sim} B_4^2 \right\}]^{\frac{1}{2}} \tag{3.22}$$

for each distribution, the goodness-of-fit is measured by

$$Z^{DIST} = (\tau_4^{DIST} - t_4^R + B_4) / \sigma_4 \tag{3.23}$$

The fit is considered to be adequate if $\left| Z^{DIST} \right|$ is sufficiently close to zero, with a reasonable criterion being $\left| Z^{DIST} \right| \le 1.64$. If more than one candidate distribution is acceptable, for the scientific purposes of the application under consideration, then any of the acceptable distributions is adequate. If none of the candidate distributions is accepted by the Z criterion, a more general distribution like Kappa or Wakeby should be used (Hosking, 1990; Hosking and Wallis, 1993; Yang et al., 2010).

FORTRAN Program for L-Moments

The FORTRAN code available from the IBM® Research page was used in this study to perform the regionalization and L-Moment analysis (IBM, 2011). Sample L-Moments and L-Moments ratios for each gaging station were calculated using the C++ code written for this study, and the code can be seen in Appendix C of this report. Besides the FORTRAN code, the discordancy values for each gaging station were also calculated and checked using the C++ code which can be seen in Appendix D. The FORTRAN code was used to find a goodness of fit among the candidate distribution to the regionalization. The candidate three-parameter distributions include the generalized logistic (GLO), generalized extreme-vale (GEV), generalized Pareto (GPA), lognormal (LN3), and Pearson type III (PE3); the five-parameter distributions are Kappa and Wakeby. The running process of FORTRAN code can be seen in the flowchart as follows:

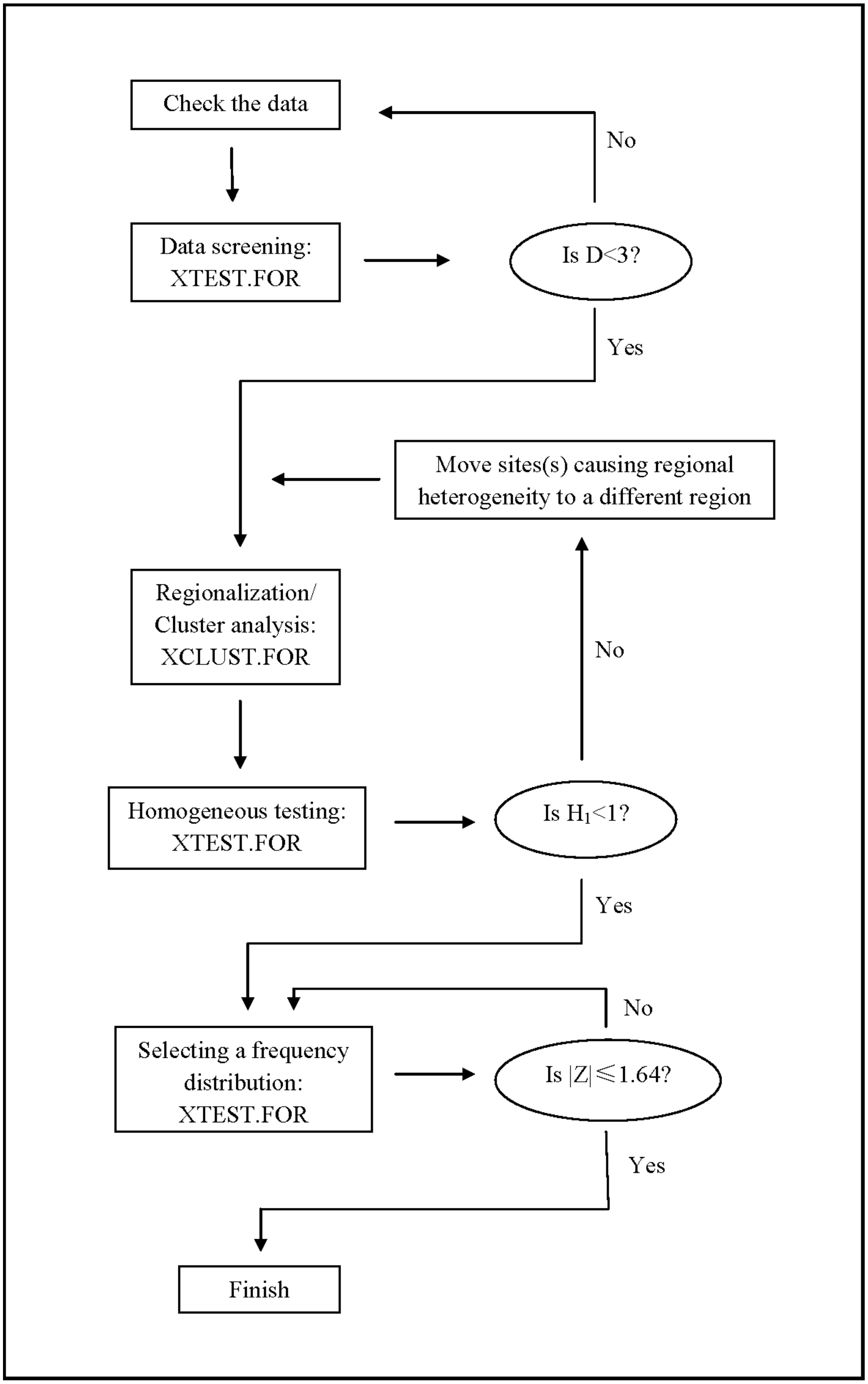

Fig. 3.4. Flowchart showing the running process for the FORTRAN programs

Regression Analysis for Annual Peak Flow

The ordinary least squares (OLS) regression analysis was performed in this study to estimate the relation between the flood discharges and the basin physical characteristics for gaging stations in the study area. All the regression analysis was performed in R software (R Foundation for Statistical Computing, 2012).

The OLS technique is a method of transferring flood-peak characteristics from sites where observed data are available to ungaged locations. The relation is expressed by flood regression equations. The regression equations are used to relate the most significant drainage-basin characteristics (independent variables) to flood-peak characteristics. The multiple-regression model can be expressed in the following form:

$$Q = \alpha A^a B^b C^c \ldots M^m \tag{3.24}$$

where,

Q is flood magnitude;

α is regression constant;

$A, B, C, \ldots M$ are basin physical characteristics; and

$a, b, c, \ldots m$ are regression coefficients (Walker and Krug , 2003).

This form of the multiple-regression model can be achieved by linear regression of the logarithms of the variables:

$$\log_{10} Q = \log_{10} \alpha + a \log_{10} A + b \log_{10} B + c \log_{10} C + \ldots + m \log_{10} M \tag{3.25}$$

Before calculating the regression equation, multicollinearity was checked for each hydrologic area using the VIF value. In this study, if the VIF value exceeded 10, this explanatory variable is considered to be correlated to another explanatory variable, and one of the variables can be dropped from the regression analysis. Based on, a T-test that was performed to find the significant explanatory variables ($\alpha = 0.05$) among the six variables; basin length (BL), basin shape factor (BSF), basin slope (BS), precipitation (P), mean basin elevation (MBE), and contributing drainage area (CDA).

Regression Model Adequacy Checking

Several criteria could be used for evaluating and comparing the different regression models.

1. *Coefficient of Determination*: R^2. R^2 is a measure of the model's capability to fit the present data,

$$R^2 = 1 - \frac{SS_{Error}}{SS_{Total}} \tag{3.26}$$

where,

$SS_{Error} : \sum_{i=1}^{n} (y_i - \hat{y}_i)^2$ sum of squares for error;

$SS_{Total} : \sum_{i=1}^{n} (y_i - \overline{y})^2$ sum of squares for total.

The insertion of any new regressor into a model cannot bring about a decrease in R^2. R^2 is not recommend as a sole criteria for choosing the best prediction model from a set of candidate models (Myers, 1986; Montgomery and Runger, 2006).

2. *Adjusted* R^2. The adjusted R^2 is a statistic in which SS_{Error} and SS_{Total} are replaced by corresponding mean squares,

$$Adjusted\ R^2 = 1 - \frac{SS_{Error} / (n - p)}{SS_{Total} / (n - 1)} \tag{3.27}$$

where,

n : sample size;

p : number of coefficients (Myers, 1986; Montgomery and Runger, 2006).

3. *Root Mean Square Error (RMSE)*. This statistic, the root mean square error, plays an extremely important role in hypothesis testing in multiple regression analysis (Montgomery and Runger, 2006). It can also provide important information in an exercise from which one hopes to select the best model for predication.

4. *Mallows' C_p*. C_p statistic is a measure of the total mean square error for the regression model,

$$C_p = \frac{SS_{Error}(p)}{\hat{\sigma}^2} - n + 2p \tag{3.28}$$

where,

$SS_{Error}(p)$: sum of squares for error with p (full) regressors;

$\hat{\sigma}^2$: residual mean square after regression on the actual k regressors, $k < p$.

A reasonable norm by which to judge the C_p value of a model is $C_p = p$, a value that suggests that the model contains no estimated bias. The "best" regression equation is chosen by either a model with minimum C_p or a model with a slightly larger C_p, that does not contain as much bias (Myers, 1986; Montgomery and Runger, 2006).

5. *Variance Inflation Factor (VIF)*. The VIF is a measure of multicollinearity. The larger the VIF, the more severe the multicollinearity. Some authors have suggested that if any VIF exceeds 10, multicollinearity is a problem (Montgomery and Runger, 2006). Other authors consider this value too liberal and suggest that VIF should not exceed 4 or 5 (Montgomery and Runger, 2006). The VIF is defined as:

$$VIF = \frac{1}{1 - R_i^2} \tag{3.29}$$

R_i^2 is the R^2 for the regression of x_i on the other regressors.

6. *Akaike Information Criterion (AIC).* AIC is a measure of the relative goodness of fit of a statistical model (Akaike, 1974). It is defined as:

$$AIC = 2k - 2\ln(L) \tag{3.30}$$

where,

k is the number of parameters in the regression model, and

L is the maximized value of the likelihood function for the estimated model.

7. *Standard Error of Prediction (* SE_p *).* SE_p is a measure of how well the regression model will perform when applied to ungaged sites and provides a more accurate estimate of the goodness of the model than the other criteria (Weaver and Gamble, 1993).

The standard error of prediction for a site, i, is computed as:

$$S_{p,i} = (\gamma^2 + MSE_{s,i})^{\frac{1}{2}} \tag{3.31}$$

where,

γ^2 is the model error variance that results from the regression equation.

$MSE_{s,i}$ is the sampling error variance which results from estimating equation coefficients from samples of the population.

The average prediction errors can be determined by the following equation:

$$S_{\bar{p}} = [\gamma^2 + \frac{1}{n}\sum_{i=1}^{n} MSE_{s,i}]^{\frac{1}{2}} \tag{3.32}$$

The average prediction error for a regression equation can be transformed from log (base 10) units to percent error by the equation as follows:

$$\%SE_p = 100\{[e^{5.302(S_{\bar{p}}^2)} - 1]^{\frac{1}{2}}\} \qquad (3.33)$$

The standard of error prediction is partitioned into model error and sampling error. Model error is the error associated with assuming an incomplete model form for the prediction equations. Model error cannot be reduced by additional data-collection activities. Sampling error includes both time- and spatial-sampling errors and usually is reduced as more data become available through additional data collection.

More details about the calculation process of standard error of prediction can be found in Moss and Karlinger (1974) and Stedinger and Tasker (1985).

CHAPTER 4 RESULTS AND DISCUSSION

Overview

L-Moments and Bulletin 17B methods were utilized in this study to predict flood frequency characteristics of streams in Tennessee and the adjacent states using the annual peak flow data collected through water year 2006. Out of the 447 gaging stations, a total of 417 gaging stations are located primarily in rural and lightly developed areas (urban<10%) and have 10 or more years of record. After data screening, basin characteristics for the 416 basins were derived using WMS software. Candidate distributions were chosen for each hydrologic area using L-Moments method, and the magnitude of floods for the selected return periods were estimated. Regression equations were computed to predict the magnitude of floods in ungaged streams using hydrologic area physical characteristics.

Basin Characteristics

All of the contributing drainage areas and some of the gaging elevation values for the 447 gaging stations can be derived from the USGS (2011b) website. Four physical characteristics of the basin (basin slope, basin shape factor, mean basin elevation, and basin length) were computed and derived using WMS software. In this process, the drainage area and the gaging station elevation were used as the index characteristics to check the goodness of the model. If the two values calculated from the USGS and WMS had a significant difference, then the model was discarded and rebuilt until the difference is slight. However, we need to notice that the area calculated from the USGS is the contributing drainage area, instead of the total drainage area computed in the WMS. Therefore, it is reasonable to find some significant differences for several gaging stations.

After the processing the input data in WMS, the drainage area shapefile for each gaging station was input into GIS to calculate the mean precipitation, land use, and hydrologic soil group. Land use was divided into four categories in this study: urban, forest and pasture, agriculture, and water bodies. If the land use in a drainage area was found to exceed 10%, the gaging station was discarded and not used in the study.

For the convenience of this study, the 447 gaging stations were classified and ordered in the four hydrologic areas defined by Law and Tasker (2003). The results can be seen in the Appendix B. The station numbers in "red" mean the urban land use exceeds 10% and the station was discarded from future the analysis. The station numbers in "blue" mean that the hydrologic soil group value was affected by the unfinished SSURGO 2.2 maps from the Geo-Spatial Gateway.

L-Moments

The sample L-Moment l_1 and L-Moment ratios t, t_3, t_4, and t_5 were calculated for each of the 417 gaging stations according to the method prescribed by Hosking and Wallis (1997) using a C++ code written for this study and presented in Appendix C.

Data Screening

First treating the entire set of 417 sites as a single area, the discordancy statistic D_i was calculated for each site according to the L-Moments method (Hosking and Wallis, 1997), identified 32 gaging stations as discordant. A careful check was performed on the irregular flows, with any low or high flows were compared with data from the National Climatic Data Center (NCDC, 2012). If the irregular flow data was not supported by NCDC, then this flow value was deleted and the D_i value was recalculated. The irregular flow values of a gaging station were accepted if there would be a good qualitative agreement of the flows between the neighbor sites. The results can be seen in Table 4.1.

Table 4.1. Summary of discordant sites

Station number	Pre D_i	Data treatment	Post D_i	Comments
03162500	3.1	73000 cfs for year 1940 is acceptable	3.5	NCDC has no storm data before 1950 in NC. Neighboring stations (03161000 and 03162110) have similar extreme floods in 1940.
03313500	3.5	7050 cfs for year 1969 is acceptable	3.7	NCDC reports a Thunder Storm Wind on June 24, 1969 in Allen County, KY.
03402020	6.5	Record is acceptable	6.7	Data are similar to neighboring stations (03401500 and 03402000). No irregular flows.
03407908	3.0	Record is acceptable	3.0	Data are similar to neighboring stations (03408500 and 03409500). No irregular flows.
03408000	4.0	70000 cfs for year 1929 is acceptable	4.4	NCDC has no storm data before 1950 in TN. Neighboring stations (03408000 and 03408500) have similar extreme floods in 1929.
03415700	4.5	165 cfs for year 1972 is acceptable	4.6	NCDC reports no extreme events (including drought) on July 29, 1972 in Overton County, TN. Neighboring station (03417700) shows a similar low flow in 1972.

Table 4.1. Summary of discordant sites – Continued

Station number	Pre D_i	Data treatment	Post D_i	Comments
03420600	7.4	7500 cfs for year 1989 is rejectable	3.9	NCDC reports no extreme events on June 22, 1989 in Warren County, TN. Neighboring station (03421000) does not have a similar extreme flood.
03431670	4.8	755 cfs for year 1966 is acceptable	4.9	NCDC reports the Palmer Index (measure of dryness) is -1.84 in May, 1966 in TN, and is the lowest value from 1955 to 1984 in May.
03467993	3.3	Record is acceptable	3.5	Data are similar to a neighboring station (03467998). No irregular flows.
03469130	7.3	Record is acceptable	7.7	Data are similar to neighboring stations (03469160 and 03469200). No irregular flows.
03480000	4.1	50000 cfs for year 1940 is rejectable	0.2	NCDC has no storm data before 1950 in TN. Neighboring station (03482500) does not have a similar extreme flood.
03481000	4.6	27500 cfs for year 1940 is acceptable	5.2	NCDC has no storm data before 1950 in NC. Neighboring stations (03478910 and 03479000) have similar extreme floods in 1940.
03483000	4.4	71500 cfs for year 1940 is rejectable	1.2	NCDC has no storm data before 1950 in TN. Neighboring station (03482500) does not have a similar extreme flood.
03490522	4.7	Gage station deleted	-	Station has 12 years low flow data. Gage height below minimum recordable elevation.
03495500	3.4	Record is acceptable	3.6	Data are similar to a neighboring station (03497000). Other neighboring stations do not have the 1931-1940 period records. No irregular flows.
03514000	3.5	Record is acceptable	3.6	Data are similar to a neighboring station (03516000). No irregular flows.
03528100	5.3	92 cfs for year 1941 is acceptable	5.5	NCDC reports the Palmer Index is -4.04 in July, 1941 in TN, and is the lowest value from 1895 to 2011 in July. Neighboring station (03528000) also has a similar low flow value.

Table 4.1. Summary of discordant sites – Continued

Station number	Pre D_i	Data treatment	Post D_i	Comments
03528300	3.6	Record is acceptable	3.8	Data are similar to neighboring stations (03528400 and 03532000). No irregular flows.
03538215	4.1	10200 cfs for year 1967 is rejectable	0.7	NCDC reports no extreme events on July 11, 1967 in Roane County, TN. Neighboring station (03538200) does not have a similar extreme flood.
03544947	3.6	990 cfs for year 1998 is acceptable	3.7	NCDC reports a flood on January 07, 1998 in Rabun County, GA. Neighboring station (03545000) also shows a similar extreme flood.
03546000	3.6	6820 cfs for year 1949 is acceptable	4.0	NCDC reports no extreme events on June 16, 1949 in Clay County, NC. But neighboring station (03504000) has a similar extreme flood.
03566660	8.1	2620 cfs for year 1973 is acceptable	8.9	NCDC reports a tornado on March 16, 1973 in Chattooga County, GA. Neighboring station (03566700) also has a similar extreme flood.
03566687	4.0	1970 cfs for year 1973 is acceptable	4.6	NCDC reports a tornado on March 16, 1973 in Chattooga County, GA. Neighboring station (03566700) also has a similar extreme flood.
03594300	3.0	382 cfs for year 1975 is acceptable	3.2	NCDC reports a Thunder Storm Wind on March 12, 1975 in Wayne County, TN. Neighboring station (03604000) also has a similar extreme flood.
03594430	3.7	Record is acceptable	3.8	Data are similar to neighboring stations (03594415 and 03594435). No irregular flows.
03597450	5.4	1000 cfs for year 1979 is rejectable	4.6	NCDC reports no extreme events on September 13, 1979 in Bedford County, TN. Neighboring stations (03597000 and 03597500) do not have similar extreme floods. Discharge also is an estimate in 1979 by USGS.
03600088	4.9	Record is acceptable	4.9	No irregular flows. Neighboring stations do not have the 1987-2006 period records.

Table 4.1. Summary of discordant sites – Continued

Station number	Pre D_i	Data treatment	Post D_i	Comments
03604080	6.2	301 cfs for year 1984 is acceptable	6.3	NCDC reports no extreme events on May 08, 1984 in Perry County, TN. But neighboring station (03604070) has a similar extreme flood.
03604090	3.7	Record is acceptable	3.8	Data are similar to neighboring stations (03604070 and 03604080). No irregular flows.
07029412	4.8	Record is acceptable	4.8	No irregular flows.
07030270	3.3	Record is acceptable	3.2	Data are similar to neighboring stations (07030280 and 07031700). No irregular flows.
07276000	3.4	790 cfs for year 1941 is acceptable	3.5	NCDC reports the Palmer Index is -0.69 in January, 1941 in MS. Neighboring station (07277500) also has a similar low flow value.

Formation of Homogeneous Areas

Treating the entire set of 416 sites as a single area, the heterogeneity statistic was calculated as $H_1 = 23.74$. The entire set is therefore considered to be heterogeneous and regionalization is necessary in this study.

Basin characteristics, such as contributing drainage area, gage elevation, gage latitude, gage longitude, and hydrologic soil group, were used in the cluster analysis procedure. Nonlinear transformations were applied to two of the variables: a logarithmic transformation to contributing drainage area and a square root transform of the gage elevation. All basin characteristics were then standardized by dividing by the standard deviation of the values of the 416 sites. These transformation gave a more symmetric distribution of the values of the basin characteristics at the 416 sites, reducing the likelihood that a few sites will have site characteristics so far from the other sites that they will always be assigned to a cluster by themselves, and give a better correspondence between differences in site characteristics and the degree of hydrologic dissimilarity between difference basins (Hosking and Wallis, 1997). The contributing drainage area variable was multiplied by 3 to give it an importance weight in the clustering procedure equal to that of the other variables (elevation, latitude, and longitude) together (Hosking and Wallis, 1997). The results can be seen in the Table 4.2.

According to the heterogeneity measure H_1 criterion ($H_1 < 1$) by Hosking and Wallis (1997), none of the clustered areas were found to be homogenous. From Table 4.2, it is noticed that as the number of clusters increased, more possibly homogenous areas can be found. However, even if the number of clusters was set to 30, only 7 areas (23%) could be considered as possibly homogeneous areas.

Table 4.2. Summary of delineation of homogeneous areas

Site characteristic X	**Cluster variable Y**	**Weight**	**Number of clusters**	**Avg. sites in a cluster**	**Avg. H_1**	**Conditional acceptable homogeneous clusters**
Drainage basin area (mi^2)	$Y=\log(X)/\sigma(\log X)$	3	4	104	11.65	0
Gage elevation (ft)	$Y=X^{0.5}/\sigma(X^{0.5})$	1				
Gage latitude (deg)	$Y=X/\sigma(X)$	1				
Gage longitude (deg)	$Y=X/\sigma(X)$	1				
Drainage basin area (mi^2)	$Y=\log(X)/\sigma(\log X)$	3	10	42	6.90	0
Gage elevation (ft)	$Y=X^{0.5}/\sigma(X^{0.5})$	1				
Gage latitude (deg)	$Y=X/\sigma(X)$	1				
Gage longitude (deg)	$Y=X/\sigma(X)$	1				
Drainage basin area (mi^2)	$Y=\log(X)/\sigma(\log X)$	3	20	21	4.73	4
Gage elevation (ft)	$Y=X^{0.5}/\sigma(X^{0.5})$	1				
Gage latitude (deg)	$Y=X/\sigma(X)$	1				
Gage longitude (deg)	$Y=X/\sigma(X)$	1				
Drainage basin area (mi^2)	$Y=\log(X)/\sigma(\log X)$	3	30	14	3.75	7
Gage elevation (ft)	$Y=X^{0.5}/\sigma(X^{0.5})$	1				
Gage latitude (deg)	$Y=X/\sigma(X)$	1				
Gage longitude (deg)	$Y=X/\sigma(X)$	1				

Another cluster method was utilized in this study. It uses the Euclidian distance between the (1×3) vectors defined by peak runoff characteristics, $Q_2 / Area$, $Q_{10} / Area$, and $Q_{25} / Area$, as a measure of similarity or dissimilarity between stations (Tasker, 1982). The values for Q_2, Q_{10}, and Q_{25} were calculated by Bulletin-17B method (Appendix B). By replacing the basin characteristics, changing the weight, using the Euclidian distance method, none of the four homogeneous could be considered as homogenous areas. The results can be seen in Table 4.3

Four hydrologic areas (see Figure 4.1) were defined and shown to be statistically different based on Wilcoxon Signed-Ranks Test by Law and Tasker (2003) in their analysis of Tennessee. Therefore, these areas were also analyzed for homogeneity. The H_1 values of the four hydrologic areas were also calculated, and the average H_1 value is 11.30. The Analysis of Variance (ANOVA) test was performed between these average H_1 value when the number of cluster was set to 4, and the result indicated there was no significant difference between them ($p > 0.05$).

Although the four hydrologic areas defined by Law and Tasker (2003) were heterogeneous based on the H_1 criterion by Hosking and Wallis (1997), they still had been shown significantly different from each other using the Wilcoxon Signed-Ranks Test. Therefore, they are the better classification ways than the other subjective ways presented above. The four hydrologic areas and 416 gaging stations are shown in the Figure 4.1.

Table 4.3. Summary of delineation of homogeneous areas with different weights and characteristics

Site characteristic X	Cluster variable Y	Weight	Number of clusters	Avg. sites in a cluster	Avg. H_1	Conditional acceptable homogeneous clusters
Drainage basin area (mi^2)	$Y=\log(X)/\sigma(\log X)$	3				
Gage elevation (ft)	$Y=X^{0.5}/\sigma(X^{0.5})$	1	4	104	11.26	0
Soil A (%)	$Y=X/\sigma(X)$	1				
Drainage basin area (mi^2)	$Y=\log(X)/\sigma(\log X)$	1				
Gage elevation (ft)	$Y=X^{0.5}/\sigma(X^{0.5})$	1	4	104	11.65	0
Soil A (%)	$Y=X/\sigma(X)$	1				
Drainage basin area (mi^2)	$Y=\log(X)/\sigma(\log X)$	3	4	104	11.61	0
Gage elevation (ft)	$Y=X^{0.5}/\sigma(X^{0.5})$	1				
Q_2/Area	$Y=X/\sigma(X)$	1				
Q_{10}/Area	$Y=X/\sigma(X)$	1	4	104	11.39	0
Q_{25}/Area	$Y=X/\sigma(X)$	1				

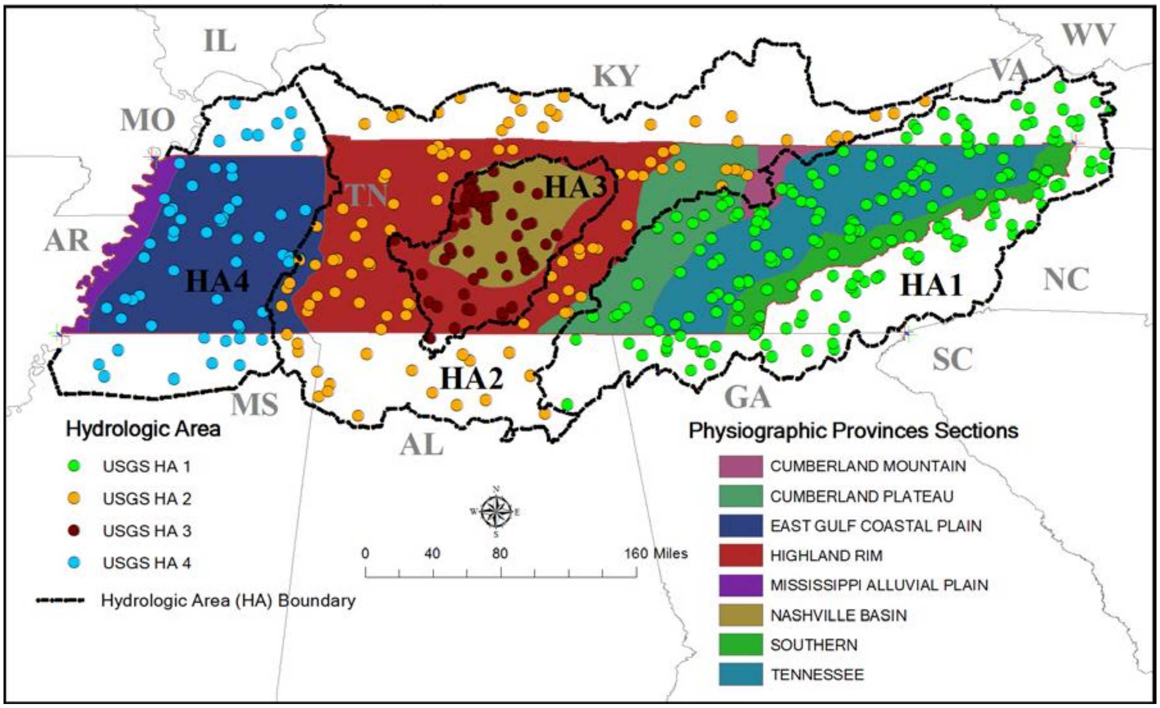

Fig. 4.1. Four hydrologic areas and 416 gaging stations in the study area

Regional frequency analysis is advantageous when the sites forming an area have similar frequency distributions. The term "area" suggests a set of neighboring sites, but geographical closeness is not necessarily an indicator of similarity of the frequency distributions (Hosking and Wallis, 1997). Therefore the principle of regionalization is to cluster a set of areas that have the same probability distribution, not the geographical closeness. Based on this idea, another method of forming homogenous areas was utilized in this study.

There are a total of five candidate three-parameter distributions presented in the L-Moment Fortran code. They are the generalized logistic (GLO), generalized extreme-vale (GEV), generalized Pareto (GPA), lognormal (LN3), and Pearson type III (PE3). First the best-fit frequency distribution among these five distributions was chosen for each gaging station based on the Z value. Then five hydrologic sets were delineated by clustering the gaging stations that have the same distribution, regardless of the geographical location. The results of the best-fit distribution for each gaging station can be found in Appendix B. Figure 4.2 shows the geographical location of each gaging station with its best-fit distribution.

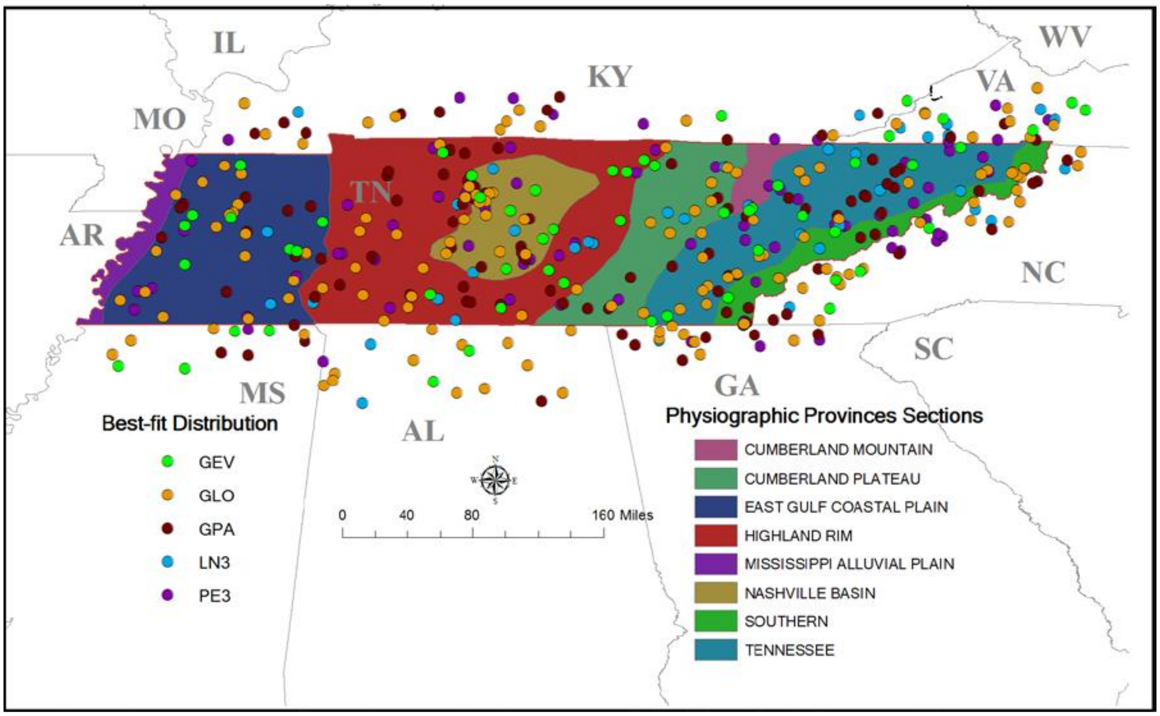

Fig. 4.2. Geographical locations of 416 gaging stations with their best-fit distributions

Choice of Frequency Distribution for the Four Hydrologic Areas

By using the L-Moments Fortran code, a goodness-of-fit test was performed to each hydrologic area and the acceptable distributions were found. Table 4.4 presents the number of gaging stations by hydrologic area and state. Table 4.5 summarizes the Z values and the acceptable frequency distributions. Table 4.6 shows the quantiles of the regional frequency distribution.

Table 4.4. Number of gaging stations by hydrologic area and state

State	Number of stations by hydrologic area				Total stations by state
	1	2	3	4	
Georgia	18	0	0	0	18
Tennessee	108	64	59	40	271
North Carolina	37	0	0	0	37
Kentucky	0	24	0	8	32
Virginia	27	0	0	0	27
Alabama	2	15	1	0	18
Mississippi	0	3	0	10	13
Total stations by hydrologic area	192	106	60	58	416

Table 4.5. Summary of Z value and distribution

Hydrologic area	Acceptable distribution	Z^{DIST}	Selected distribution	Parameters		
				location ξ	scale α	shape k
1	GEV	1.51	GEV	0.738	0.365	-0.127
	LN3	-1.17				
2	GEV	0.74	GEV	0.710	0.398	-0.134
	LN3	-1.24				
3	GEV	-0.19	GEV	0.764	0.386	-0.033
	LN3	-0.91				
4	GEV	-0.51	GEV	0.737	0.402	-0.072
	LN3	-1.54				

Table 4.6. Estimated quantiles for the four hydrologic areas

Hydrologic area	Quantiles, at indicated return periods, T (years)					
	1	2	10	20	100	1000
1	0.231	0.875	1.687	2.053	3.014	4.764
2	0.161	0.860	1.755	2.161	3.241	5.233
3	0.189	0.906	1.667	1.970	2.685	3.766
4	0.156	0.887	1.719	2.068	2.928	4.333

The final magnitude of the flood for selected return period can be calculated using the following equation

$$Q_T = \bar{Q} \times Quantile_T \qquad (4.1)$$

where,

Q_T is the magnitude of flood for the selected return period T

$\bar{Q}$ is the mean annual peak flood for the area

$Quantile_T$ is the quantile value for the selected return period T.

Besides using the quantiles calculated by L-Moments Fortran code, the magnitude of flood also can be calculated directly from the generalized extreme-value (GEV) distribution. The GEV has an explicit analytical quantile function form and this function is expressed as:

$$\frac{Q_T}{\bar{Q}} = \xi + \alpha \frac{1-[-\ln(1-\frac{1}{T})]^k}{k}, \quad k \neq 0 \qquad (4.2)$$

where, ξ, α, and k are three fitting parameters for the GEV.

Choice of Frequency Distribution for the Five Hydrologic Sets

The same goodness-of-fit test was performed on the five hydrologic sets clustered by the gaging stations with the same distribution. The best-fit distributions for the four hydrologic sets (GEV, GPA, LN3, and PE3) were found to be the identical distributions. Namely, the best-fit distribution for the hydrologic set clustered by the gaging stations with the same distribution GEV is GEV. However, based on the Z value, the L-Moments Fortran code could not find any suitable three-parameter distribution for the GLO hydrologic set; although the distribution GLO had the lowest Z value. Therefore, a more common five-parameter distribution (Wakeby) was chosen for the GLO set.

Table 4.7 presents the number of gaging stations by hydrologic set and state. Table 4.8 summarizes the acceptable frequency distributions for the five hydrologic sets. Table 4.9 shows the quantiles of the regional frequency distribution.

Table 4.7. Number of gaging stations by hydrologic set and state

State	Number of stations by hydrologic set					Total stations by state
	GEV	GLO	GPA	LN3	PE3	
Georgia	0	7	7	1	3	18
Tennessee	38	83	72	24	54	271
North Carolina	4	15	8	4	6	37
Kentucky	2	11	10	2	7	32
Virginia	5	9	3	6	4	27
Alabama	2	12	1	2	1	18
Mississippi	4	4	4	0	1	13
Total stations by hydrologic area	55	141	105	39	76	416

Table 4.8. Summary of the acceptable frequency distributions

Hydrologic set	Best fitted distribution	Parameters
GEV	GEV	$\xi = 0.767$, $\alpha = 0.375$, $k = -0.042$
GPA	GPA	$\xi = 0.306$, $\alpha = 0.943$, $k = 0.358$
LN3	LN3	$\xi = 0.856$, $\alpha = 0.468$, $k = -0.569$
PE3	PE3	$\mu = 1.000$, $\delta = 0.583$, $\gamma = 1.488$
GLO	WAKEBY	$\xi = 0.177$, $\alpha = 2.509$, $\beta = 4.994$, $\gamma = 0.283$, $\delta = 0.301$

Table 4.9. Estimated quantiles for the five hydrologic sets

Hydrologic set	Distribution value, at indicated return periods, T (years)					
	1	2	10	20	100	1000
GEV	0.213	0.906	1.652	1.953	2.669	3.770
GPA	0.315	0.885	1.784	2.038	2.432	2.716
LN3	0.252	0.856	1.738	2.129	3.121	4.802
PE3	0.264	0.861	1.777	2.136	2.937	4.041
GLO	0.204	0.881	1.619	2.055	3.498	7.254

Similar to the calculation process above, the final magnitude of the flood for selected return period can be calculated using the Equation 4.1. The LN3 and PE3 distributions have no explicit quantile function forms, so the flood magnitude can only be calculated by the quantile equations. Besides the GEV, the GPA and WAKEBY distributions have the explicit quantile function forms and are expressed as follows

$$\text{GPA:} \frac{Q_T}{\overline{Q}} = \xi + \frac{\partial}{k}[1-(\frac{1}{T})^k], \quad k \neq 0 \tag{4.3}$$

$$\text{WAKEBY:} \frac{Q_T}{\overline{Q}} = \xi + \frac{\partial}{\beta}[1-(\frac{1}{T})^\beta] - \frac{\gamma}{\delta}[1-(\frac{1}{T})^{-\delta}] \tag{4.4}$$

where,

ξ, ∂, and k are three fitting parameters of the GPA

ξ, ∂, β, γ, and δ are five fitting parameters of the WAKEBY.

Bulletin-17B Method

Magnitude of floods for return periods T=2, 5, 10, 25, 50, and 100 years were calculated using the Equation 3.1-4 for the 416 gaging stations, and the results are shown in Appendix B. Log-Pearson Type III distribution was applied to all of the gaging stations. The four hydrologic areas defined by Law and Tasker (2003) were used as the regionalization for the later regression analysis.

Regression Analysis

(1) Mean Annual Flow Regression Analysis for the Four Hydrologic Areas

The final chosen models and some criterion values (such as AIC and standard error of prediction) are provided in the Table 4.10. AIC value was used to choose the final model, and stand error of prediction was used to compare the two studies. The other measurement values (R^2, Adj-R^2, C_p, and RMSE) were used as the aid to choose the final model.

(2) Mean Annual Flow Regression Analysis for the Five Hydrologic Sets

A similar process was performed for the five hydrologic sets. The details are provided in the Table 4.11.

(3) Selected Return Period Flow Regression Analysis for the Four Hydrologic Areas

This regression analysis is one part of the Bulletin-17B method. Instead of the mean annual flow, selected return period flow (T=2, 5, 10, 25, 50, and 100) were regressed in the four hydrologic areas. The process is similar to the former regression analysis, and the results are given in the Table 4.12.

Table 4.10. Regional regression equations and accuracy statistics for mean annual flow in the four hydrologic areas

Hydrologic area	**CDA, mi^2**	**Equation, cfs**	**R^2**	**Adj-R^2**	**C_p**	**AIC**	**RMSE**	**%SE_p**
1	0.33 to 21400	$122BS^{0.22}BSF^{-0.15}MBE^{-0.42}P^{0.97}CDA^{0.76}$	0.9227	0.9207	6.00	-98.48	0.1834	64
2	0.47 to 2557	$251CDA^{0.72}$	0.9555	0.9550	2.00	-120.94	0.1342	46
3	0.17 to 2048	$655BSF^{-0.61}CDA^{0.66}$	0.9528	0.9511	3.00	-66.10	0.1339	45
4	0.95 to 2308	$80306MBE^{-0.84}CDA^{0.52}$	0.9023	0.8987	3.13	-46.20	0.1557	53

BS: basin slope; BSF: basin shape factor; MBE: mean basin elevation; P: mean annual precipitation; CDA: contributing drainage area

Table 4.11. Regional regression equations and accuracy statistics for mean annual flow in the five hydrologic sets

Hydrologic set	**CDA, mi^2**	**Equation, cfs**	**R^2**	**Adj-R^2**	**C_p**	**AIC**	**RMSE**	**%SE_p**
GEV	0.95 to 8934	$P^{1.40}CDA^{0.66}$	0.9975	0.9974	2.0	-22.63	0.1900	46
GLO	0.49 to 21400	$BSF^{-0.30}MBE^{-0.20}P^{1.77}CDA^{0.68}$	0.9976	0.9975	4.0	-72.43	0.1833	44
GPA	0.17 to 4543	$29058BS^{0.30}MBE^{-0.58}CDA^{0.69}$	0.8651	0.8611	4.0	-8.84	0.2255	83
LN3	0.72 to 1784	$203CDA^{0.73}$	0.8964	0.8936	2.0	-17.18	0.1846	64
PE3	0.49 to 1935	$BS^{0.30}BSF^{-0.22}MBE^{-0.41}P^{2.30}CDA^{0.70}$	0.9980	0.9979	5.0	-48.07	0.1686	40

BS: basin slope; BSF: basin shape factor; MBE: mean basin elevation; P: mean annual precipitation; CDA: contributing drainage area

Table 4.12. Summary of ordinary least square regression equations

Return period (years)	Equation, cfs	R^2	Adj-R^2	C_p	AIC	RMSE	%SE_p
Hydrologic area 1 (CDA=0.33 to 21400 mi^2)							
2	$159BS^{0.25}BSF^{-0.14}MBE^{-0.47}P^{0.95}CDA^{0.77}$	0.9251	0.9231	6.0	-98.08	0.1836	64
5	$162BS^{0.23}BSF^{-0.14}MBE^{-0.43}P^{0.98}CDA^{0.76}$	0.9241	0.9221	6.0	-102.65	0.1814	64
10	$152BS^{0.20}BSF^{-0.15}MBE^{-0.40}P^{1.00}CDA^{0.75}$	0.9171	0.9149	6.0	-89.43	0.1878	66
25	$26BSF^{-0.17}MBE^{-0.19}P^{1.05}CDA^{0.73}$	0.8991	0.8969	5.0	-56.60	0.2051	74
50	$P^{1.54}CDA^{0.70}$	0.9969	0.9969	2.0	-24.14	0.2249	56
100	$P^{1.58}CDA^{0.70}$	0.9964	0.9964	2.0	8.26	0.2447	62
Hydrologic area 2 (CDA=0.47 to 2557 mi^2)							
2	$200CDA^{0.73}$	0.9515	0.9510	2.0	-107.49	0.1430	49
5	$357CDA^{0.71}$	0.9544	0.9540	2.0	-120.67	0.1344	46
10	$478CDA^{0.70}$	0.9497	0.9493	2.0	-112.37	0.1398	48
25	$647CDA^{0.70}$	0.9367	0.9361	2.0	-88.95	0.1561	54
50	$785CDA^{0.69}$	0.9222	0.9215	2.0	-66.82	0.1733	61
100	$933CDA^{0.69}$	0.9041	0.9032	2.0	-43.72	0.1932	69
Hydrologic area 3 (CDA=0.17 to 2048 mi^2)							
2	$571BSF^{-0.59}CDA^{0.66}$	0.9497	0.9479	3.0	-61.85	0.1387	46
5	$920BSF^{-0.61}CDA^{0.65}$	0.9515	0.9498	3.0	-66.15	0.1338	45
10	$1162BSF^{-0.63}CDA^{0.64}$	0.9481	0.9463	3.0	-62.28	0.1382	46
25	$1477BSF^{-0.66}CDA^{0.64}$	0.9391	0.9370	3.0	-52.06	0.1505	51
50	$1717BSF^{-0.67}CDA^{0.65}$	0.9293	0.9268	3.0	-42.23	0.1634	56
100	$1961BSF^{-0.69}CDA^{0.65}$	0.9173	0.9143	3.0	-31.64	0.1784	62

Table. 4.12. Summary of ordinary least square regression equations – Continued

Return period (years)	Equation, cfs	R^2	Adj-R^2	C_p	AIC	RMSE	%SE_p
			Hydrologic area 4 (CDA=0.95 to 2308 mi^2)				
2	$99172MBE^{-0.89}CDA^{0.52}$	0.9036	0.9001	3.0	-47.42	0.1541	52
5	$602CDA^{0.54}$	0.8960	0.8941	2.0	-42.47	0.1622	56
10	$727CDA^{0.55}$	0.8847	0.8827	2.0	-34.75	0.1733	60
25	$887CDA^{0.55}$	0.8605	0.858	2.0	-21.30	0.1946	69
50	$1007CDA^{0.55}$	0.8373	0.8343	2.0	-10.47	0.2137	78
100	$1130CDA^{0.55}$	0.8111	0.8077	2.0	0.17	0.2342	87

BS: basin slope; BSF: basin shape factor; MBE: mean basin elevation; P: mean annual precipitation; CDA: contributing drainage area

Comparison of Methods

The prediction errors are a measure of how well the regression model, or estimating equations, will perform when applied to ungaged sites, and therefore are the key criteria to compare the flood frequency analysis methods when they are applied to ungaged sites (Weaver and Gamble, 1993; Feaster and Tasker, 2002; Law and Tasker, 2003). Table 4.21 lists the average standard error of prediction for the three methods.

Table 4.13. Prediction errors for three methods

Hydrologic areas / sets	**Average standard error of prediction for three methods (%)**		
	Bulletin-17B	L-Moments for four hydrologic areas	L-Moments for five hydrologic sets
1	64	64	
2	54	46	
3	51	45	
4	67	53	
GEV			46
GLO			44
GPA			83
LN3			64
PE3			40

From Table 4.13, the L-Moments using the four hydrologic areas regionalization method provides a better prediction of flowrates than the traditional Bulletin-17B method. Although a T-test has shown this difference is not statistically significant ($p > 0.05$), the L-Moments method still decreases the prediction errors and increases accuracy of predictions for hydrologic areas 2, 3, and 4. These results indicate that the L-Moments method is, on average, the better method tested for predicting flood frequency for unregulated streams and rivers in Tennessee. This is not a surprising result because the accuracy of Bulletin-17B method has been doubted for a long time (Hosking and Wallis, 1997). A problem with this approach is that the sample sizes that are typically available are not so large that the frequency distribution can be unequivocally identified. In particular, failure to detect that the frequency distribution is heavy-tailed, with Q_T increasing rapidly as T increase, will result in severe underestimation of extreme quantiles (Hosking and Wallis, 1997). It is therefore recommended to consider a wide range of candidate frequency distributions, instead of only one "textbook" distribution. In fact, Japan and several European countries use GEV instead of Pearson Type III distribution for their flood frequency analysis (Stakhiv, 2011).

For some hydrologic sets, such as GLO and PE3, the five hydrologic sets classification way takes advantage of the four hydrologic areas classification. But the GPA set shows an extreme high prediction errors, and this data set should be checked carefully in the future research. What's more, the five hydrologic sets were clustered regardless of the geographical location, and are therefore not useful for the ungaged sites.

The application of methods in this study can be divided into two parts:

(1) Ungaged sites.

For ungaged sites, it is recommended to use the L-Moments with four hydrologic areas regionalization.

Area1:

$$Q_T = \left[-261 + 351[-\ln(1-\frac{1}{T})]^{-0.127} \right] BS^{0.22} BSF^{-0.15} MBE^{-0.42} P^{0.97} CDA^{0.76} \qquad (4.5)$$

Area 2:

$$Q_T = \left[-567 + 746[-\ln(1-\frac{1}{T})]^{-0.134} \right] CDA^{0.72} \qquad (4.6)$$

Area 3:

$$Q_T = \left[-7164 + 7664[-\ln(1-\frac{1}{T})]^{-0.033} \right] BSF^{-0.61} CDA^{0.66} \quad (4.7)$$

Area 4:

$$Q_T = \left[-389163 + 448348[-\ln(1-\frac{1}{T})]^{-0.072} \right] MBE^{-0.84} CDA^{0.52} \quad (4.8)$$

where,

BS : basin slope,

T : return period,

BSF : basin shape factor,

MBE : mean basin elevation,

P : mean annual precipitation,

CDA: contributing drainage area, and

Q_T : magnitude of flood for the selected return period.

(2) Gaged sites.

For gaged sites, because the five hydrologic sets clusters show some advantages in several sets, it is recommended first to find the geographic location of the selected gaging station. After comparing the prediction errors of the two classification methods, the final equation can be determined. For example, if the gaging station is located in hydrologic area 1 and GEV set, then the magnitude of flood for this station will be calculated using the GEV set regression equation.

Also the limitations should be noticed before using the regression equations. The methods described in this study are suitable only for use on unregulated, rural streams. These methods should not be used where dams, flood-detention structures, or other anthropogenic factors may significantly affect the peak-flow data. Furthermore, the regression models should be used only within the range of the drainage areas used during model development for each hydrologic area or set.

Computation Examples

Example 1:

Assume the discharge is desired for a flood with a return period of 100 years at the gaged site (station number: 03491300), Beech Creek at Kepler (Hawkins County), TN. The contributing drainage area (CDA) at the site is 47 mi^2, and the mean annual precipitation (P) is 45.03 inch.

From the Figure 4.1-2, the site locates in hydrologic area 1 and GEV set.

From the Table 4.13, the prediction errors for hydrologic area 1 and GEV set are 64% and 46%, respectively. So, GEV set regression equation is chosen.

From the Table 4.11, the equation to use is:

$\overline{Q} = P^{1.40} CDA^{0.66} = 45.03^{1.40} \times 47^{0.66} = 2621$ cubic feet per second.

From the Table 4.9, final equation is:

$Q_{T=100} = 2.669 \times 2621 = 6996$ cubic feet per second.

Example 2:

The discharge for a flood with a return period of 100 years is desired for the ungaged site on Piney River upstream from the gaging station at Vernon (station number: 03602500). The site has a drainage area of 160 mi^2 (Weaver and Gamble, 1993).

From the Figure 4.1, the site locates in hydrologic area 2.

From the Equation 4.6, the final equation is:

$$Q_{T=100} = \left[-567 + 746[-\ln(1 - \frac{1}{100})]^{-0.134} \right] \times 160^{0.72} = 31428$$ cubic feet per second.

CHAPTER 5 CONCLUSION

Flood frequency analysis is a method that analyzes historic flow records to predict the behavior of future flows. It has scientific and practical values in the design of hydraulic and flood-plain management projects. The traditional method flood frequency analysis in the United States, the Bulletin-17B method and a more powerful but much less used method of flood frequency analysis, the L-Moments method, were computed and compared in this study.

The annual peak flow data used in this study were derived from 416 stream gaging stations primarily located in rural streams of Tennessee and the adjacent states of Alabama, Georgia, Kentucky, Mississippi, North Carolina, and Virginia. Gaging stations having least 10 years of records free of regulation.

Watershed Modeling System (WMS) software was used to derive the basin characteristics for all 416 gaging stations. L-Moments and L-Moment ratios were computed using C++ code (Appendix C-D). Data was screened using the L-Moment Fortran Package, outliers were dropped if they were not matched with the data from the National Weather Service. Homogeneous areas were tried to delineate using the L-Moment Fortran Package, but none of the classification methods succeed in locating homogeneous areas. The four hydrologic areas defined by USGS were used in this study as the representative of homogeneous areas. Regardless of the geographical location, another classification was evaluated in this study. Five hydrologic sets were delineated by clustering the gaging stations that have the same probability distribution type. Based on the results of the goodness-fit test, the most robust distribution for the four hydrologic areas was the Generalized Extreme Value (GEV) probability distribution.

Multiple regression equations were also calculated for estimating the flood frequency of streams in Tennessee. Regression equations were computed using the ordinary least squares regression procedure. The standard error of prediction for the regression equations were calculated and used to compare the Bulletin 17B and L-Moments methods. This is the first study to indicate that the L-Moments method is, on average, the better of the two methods tested for predicting flood frequency for unregulated streams and rivers in Tennessee.

FURTHER RESEARCH

(1)Recalculation of skewness in Bulletin-17B Method

In this study, skewness was calculated only from the gaging station record. However, the skewness of the station record is sensitive to extreme events and it is difficult to obtain accurate skew estimates from small samples. In Bulletin-17B, it is recommended to weight the station skewness with the generalized skewness. Although Hosking and Wallis (1997) considered the maps of regional skewness used by Bulletin-17B as very unreliable, it is still worth a try to see if the weighted skewness can improve the accuracy of Bulletin-17B Method.

(2) Robust H test

The discordancy measure in terms of the sample L-Moment ratios of the at-site data was used in the data screening process. However, the sample mean and the covariance matrix of the L-Moments ratios, on which the discordancy measure is based, are not robust against outliers in the data, and consequently, this measure can be strongly affected by the discordant sites present in the area (Neykov et al., 2007). So the robust discordant measure is recommended for discordant sites detection in the future research.

(3) Recalculation of mean annual flow using $Q_{2.33}$

The mean annual flow in a gaging station was calculated as the average of all records in this station. Obviously, it is impossible to compute mean annual flow with absolute accuracy, because even the longest streamflow records include data for only a tiny fraction of past floods, and include no data for future floods. Therefore, many studies preferred to use the flood having a return period of 2.33 years, which, according to the theory of extreme values, is the return period of the mean of an infinitely large series of annual peaks (Jenkins, 1960; Patterson, 1964; Speer and Gamble, 1964). So, it is recommended to use this method to calculate the mean annual flow in the future studies.

(4) Generalized least-squares (GLS) regression method.

Ordinary least-squares (OLS) regression procedure was used in this study. However, Stedinger and Tasker (1985) have shown that generalized least-squares regression is superior to ordinary least-squares regression in accounting for the unequal variance of streamflow characteristics and cross-correlated flows for nearby sites. Generalized least-squares procedures use a weighting matrix to ensure that sites in the data set area are weighted proportional to the accuracy of the estimate of the peak discharges and the cross correlation of these event (Weaver and Gamble, 1993). Therefore, it is recommended to use GLS instead of OLS in the future research.

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APPENDIX CONTENT

APPENDIX A: SUMMARY OF SIX PREVIOUS STUDIES IN TENNESSEE

1. "*Floods in Tennessee: Magnitude and frequency*" (Jenkins, 1960).

Table A.1. Values of the coefficient C for six hydrologic areas ($Q_{2.33}=CA^{0.77}$) (Jenkins, 1960).

Hydrologic area	Coefficient C	Equations, in cfs
1	110	$Q_{2.33}=110A^{0.77}$
2	94	$Q_{2.33}=94A^{0.77}$
3	170	$Q_{2.33}=170A^{0.77}$
4	145	$Q_{2.33}=145A^{0.77}$
5	102	$Q_{2.33}=102A^{0.77}$
6	75	$Q_{2.33}=75A^{0.77}$
A: drainage area, mi^2		

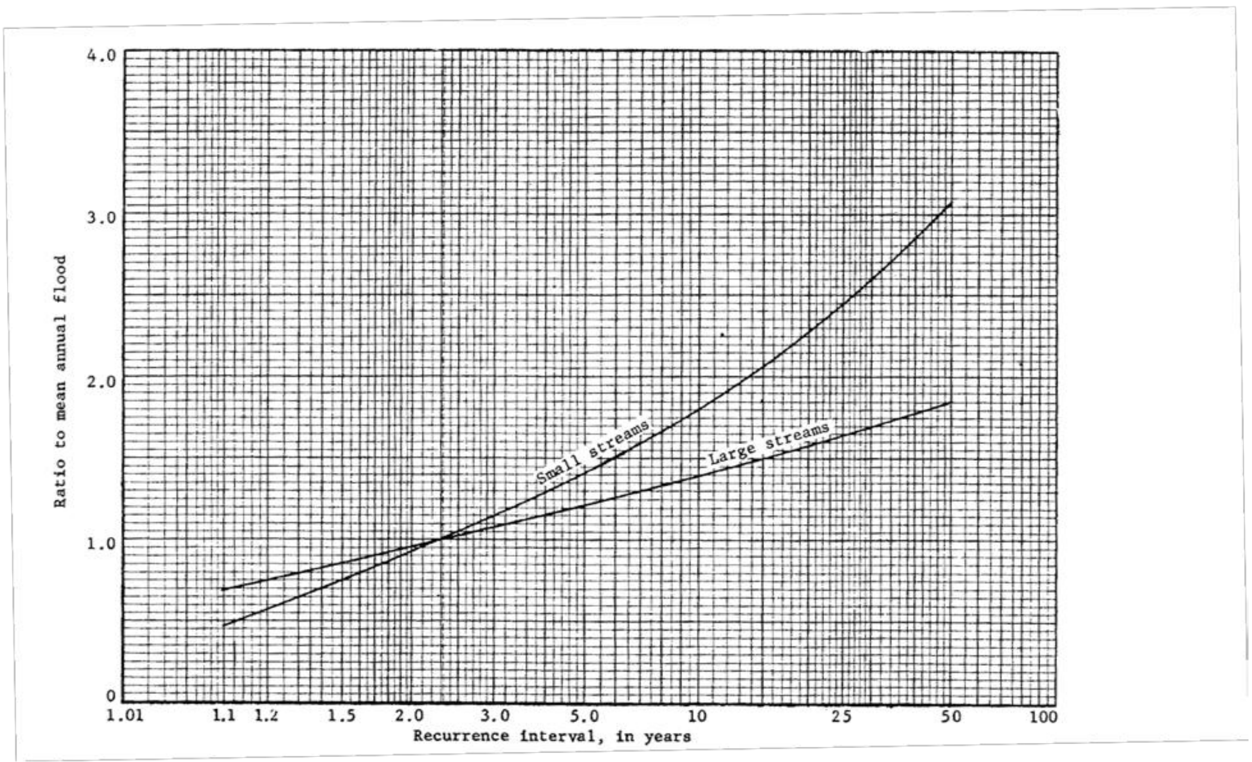

Fig. A.1. Frequency of annual floods on unregulated streams in Tennessee (Jenkins, 1960)

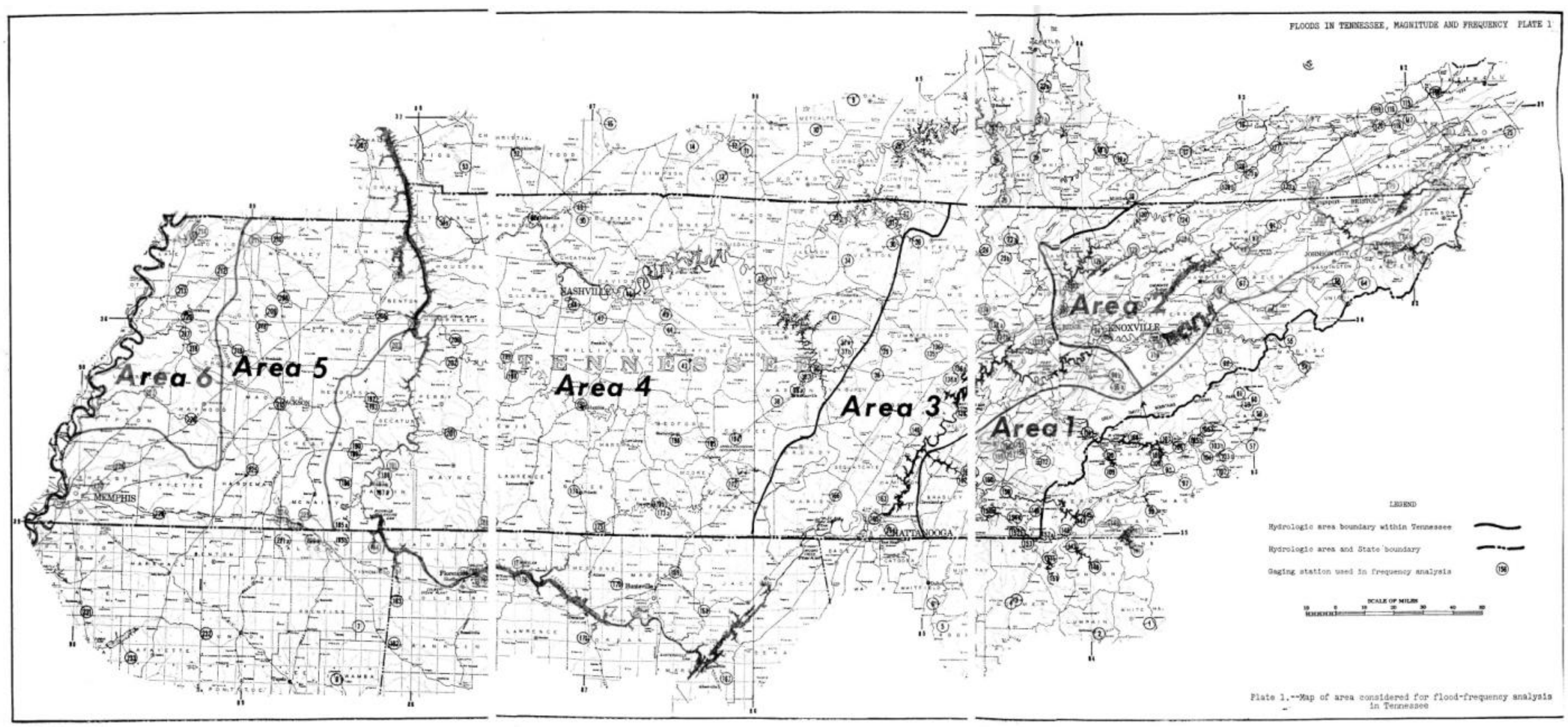

Fig. A.2. Six hydrologic areas and boundaries used in the study (Jenkins, 1960)

2. “*Magnitude and frequency of floods in the United States: Part 7. Lower Mississippi River Basin*” (Patterson, 1964).

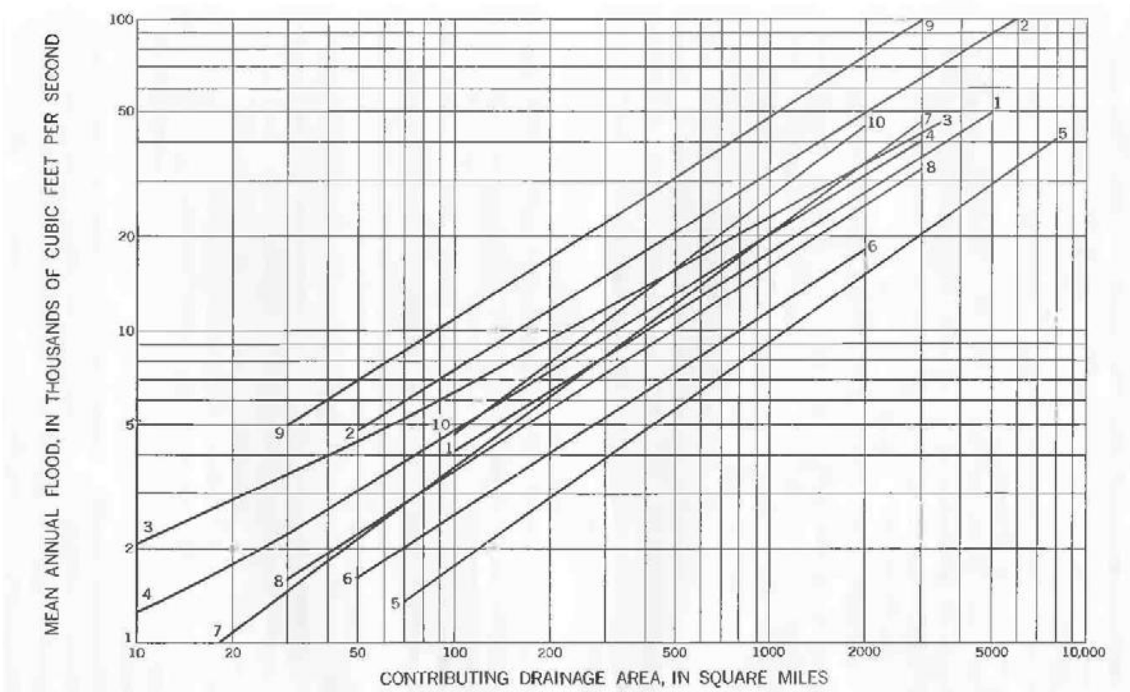

Fig. A.3. Variation of mean annual flood with contributing drainage area in hydrologic areas 1-10 (Patterson, 1964).

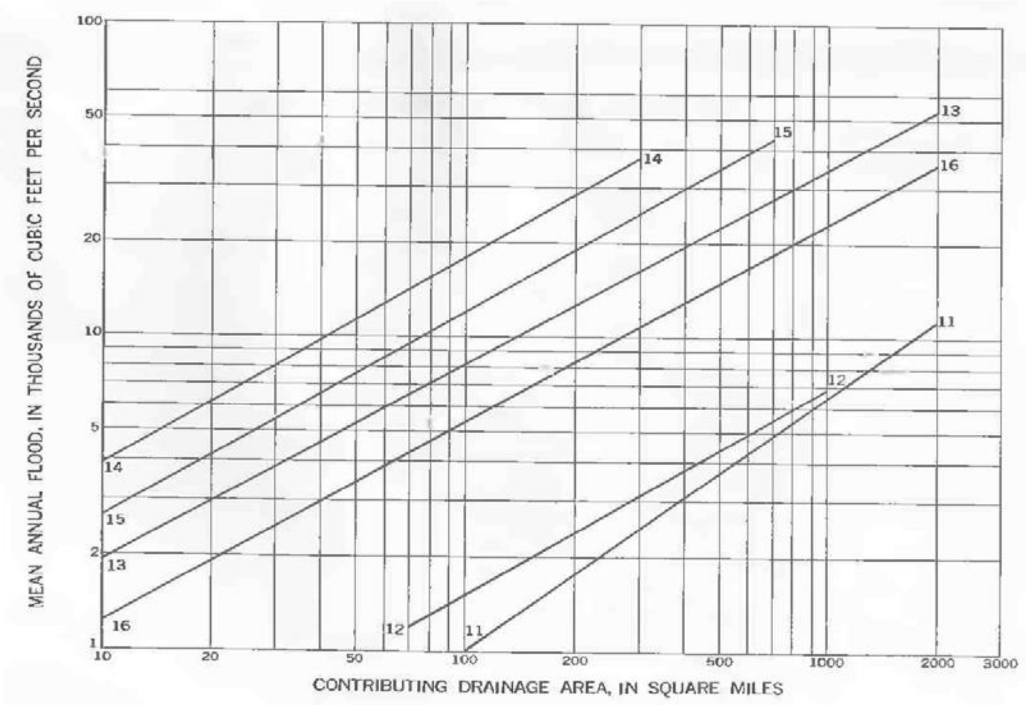

Fig. A.4. Variation of mean annual flood with contributing drainage area in hydrologic areas 11-16 (Patterson, 1964).

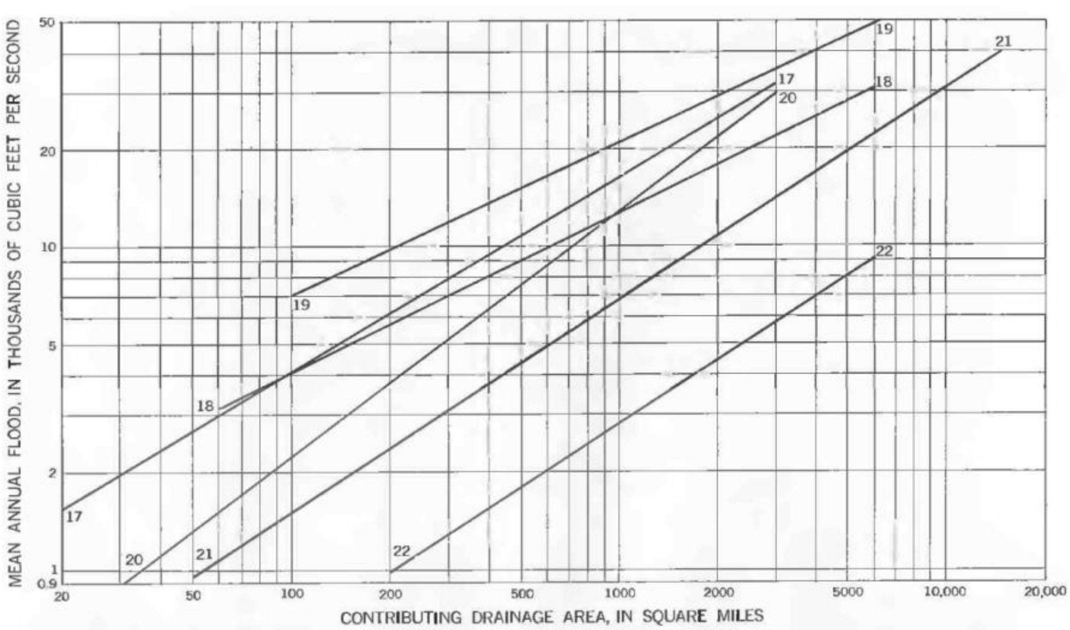

Fig. A.5. Variation of mean annual flood with contributing drainage area in hydrologic areas 17-22 (Patterson, 1964).

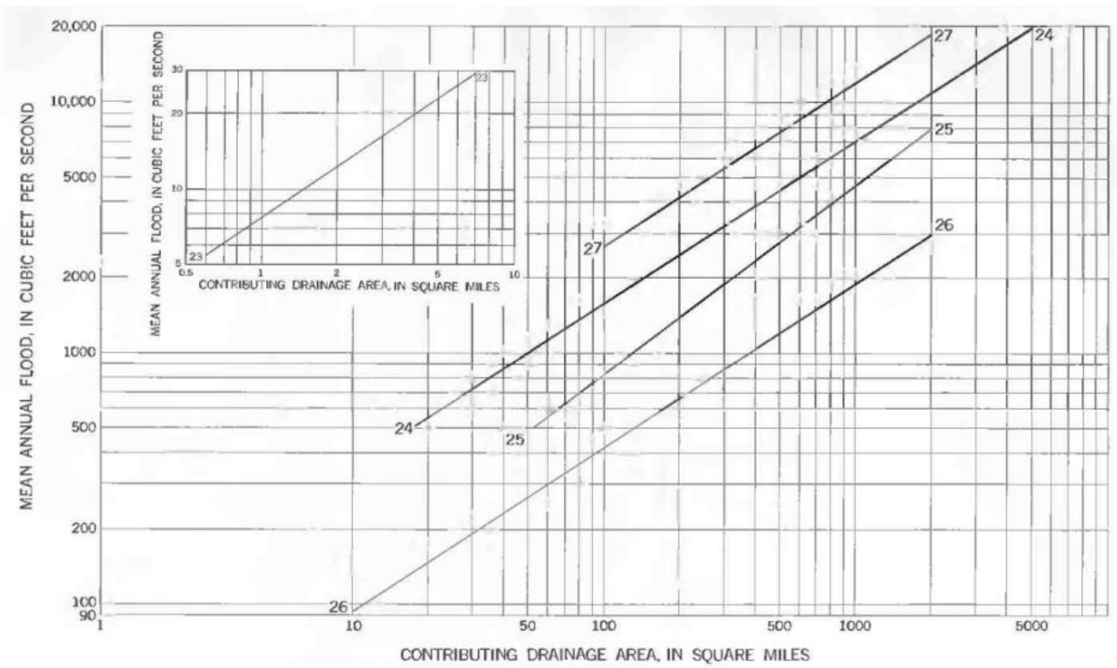

Fig. A.6. Variation of mean annual flood with contributing drainage area in hydrologic areas 23-27 (Patterson, 1964).

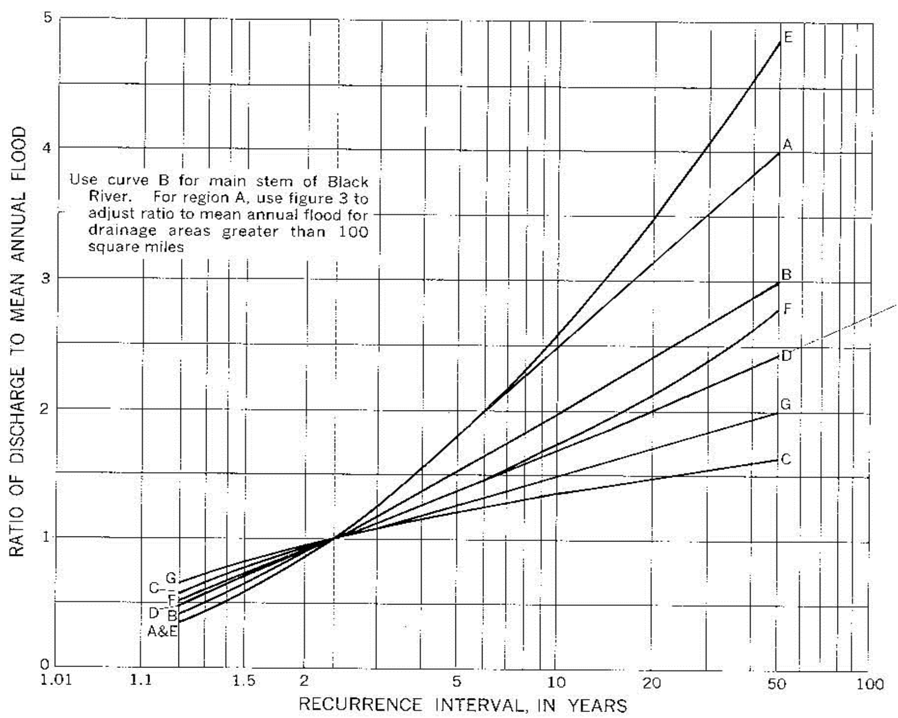

Fig. A.7. Frequency of annual floods (Patterson, 1964).

3. "*Magnitude and frequency of floods in the United States: Part 3-B. Cumberland and Tennessee River Basins*" (Speer and Gamble, 1964).

Table A.2. Values of the coefficient C for five hydrologic areas ($Q_{2.33}=CA^{0.793}$) (Speer and Gamble, 1964).

Hydrologic area	Coefficient C	Equations, in cfs
1	218	$Q_{2.33}=218A^{0.793}$
2	158	$Q_{2.33}=158A^{0.793}$
3	123	$Q_{2.33}=123A^{0.793}$
4	90	$Q_{2.33}=90A^{0.793}$
5	70	$Q_{2.33}=70A^{0.793}$
A: drainage area, mi^2		

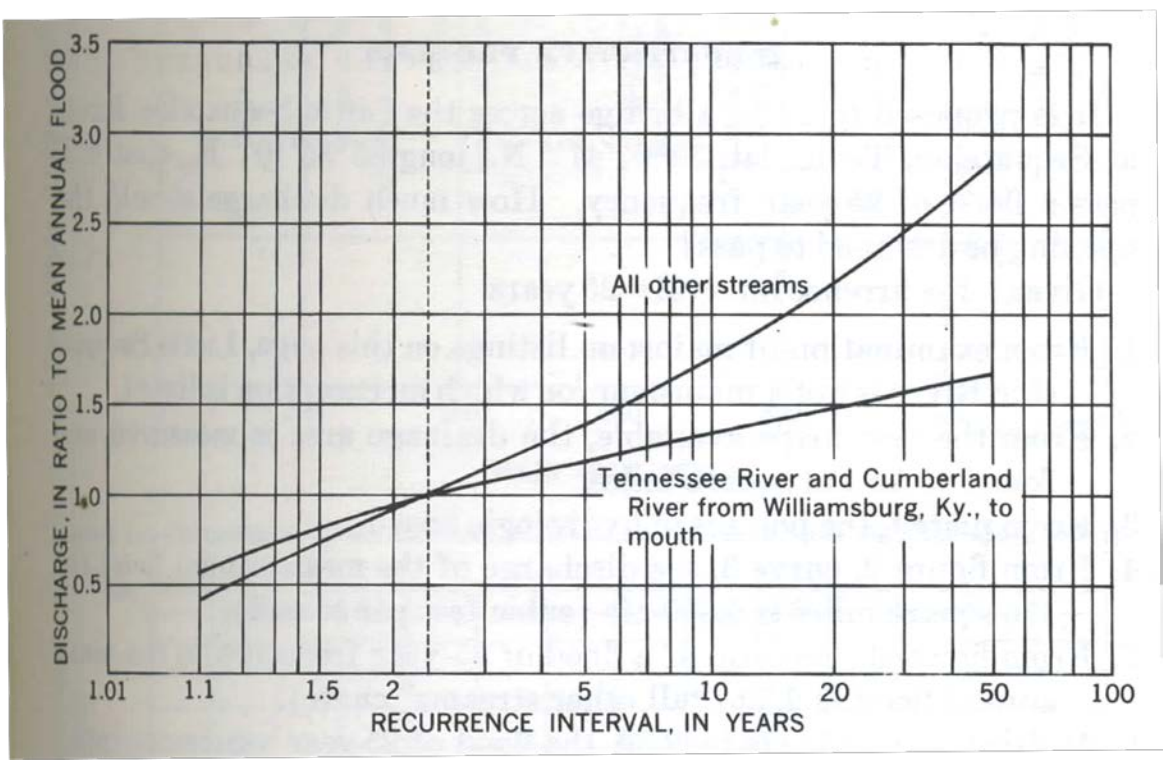

Fig. A.8. Frequency of annual floods (Speer and Gamble, 1964)

4. “*Technique for estimating magnitude and frequency of floods in Tennessee*” (Randolph and Gamble, 1976).

Table A.3. Summary of regression equations (Randolph and Gamble, 1976)

Recurrence interval (years)	Magnitude of floods (cfs)	Standard error of estimate (percent)	Equivalent years of record
	Hydrologic area 1		
2	$Q_2=127A^{0.752}$	45	<2
5	$Q_5=211A^{0.735}$	45	2
10	$Q_{10}=276A^{0.727}$	46	3
25	$Q_{25}=366A^{0.719}$	47	4
50	$Q_{50}=442A^{0.714}$	49	4
100	$Q_{100}=524A^{0.709}$	50	5
	Hydrologic area 2		
2	$Q_2=199A^{0.744}$	29	4
5	$Q_5=352A^{0.729}$	25	8
10	$Q_{10}=465A^{0.723}$	26	10
25	$Q_{25}=614A^{0.722}$	29	11
50	$Q_{50}=738A^{0.719}$	31	11
100	$Q_{100}=867A^{0.718}$	34	11
	Hydrologic area 3		
2	$Q_2=319A^{0.733}$	33	3
5	$Q_5=512A^{0.725}$	30	4
10	$Q_{10}=651A^{0.723}$	30	6
25	$Q_{25}=836A^{0.720}$	31	8
50	$Q_{50}=977A^{0.720}$	32	8
100	$Q_{100}=1125A^{0.719}$	34	9
	Hydrologic area 4		
2	$Q_2=405A^{0.515}$	27	4
5	$Q_5=562A^{0.540}$	29	4
10	$Q_{10}=664A^{0.551}$	32	5
25	$Q_{25}=789A^{0.563}$	34	5
50	$Q_{50}=883A^{0.569}$	36	6
100	$Q_{100}=975A^{0.575}$	38	6

A: drainage area, mi^2

5. “*Flood frequency of streams in rural basins of Tennessee*” (Weaver and Gamble, 1993).

Table A.4. Summary of generalized least-squares regression equations (Weaver and Gamble, 1993)

Recurrence interval (years)	Equation	Standard error of prediction (percent)	Equivalent years of record
	Hydrologic area 1		
2	$Q_2=118A^{0.753}$	44	<2
5	$Q_5=198A^{0.736}$	43	2
10	$Q_{10}=259A^{0.727}$	44	3
25	$Q_{25}=344A^{0.717}$	44	4
50	$Q_{50}=413A^{0.711}$	45	5
100	$Q_{100}=493A^{0.703}$	46	6
500	$Q_{500}=670A^{0.694}$	48	7
	Hydrologic area 2		
2	$Q_2=222A^{0.722}$	35	5
5	$Q_5=382A^{0.708}$	32	9
10	$Q_{10}=502A^{0.703}$	32	12
25	$Q_{25}=668A^{0.697}$	34	13
50	$Q_{50}=800A^{0.694}$	36	13
100	$Q_{100}=938A^{0.690}$	37	13
500	$Q_{500}=1282A^{0.682}$	41	13
	Hydrologic area 3		
2	$Q_2=353A^{0.682}$	41	2
5	$Q_5=562A^{0.678}$	39	3
10	$Q_{10}=716A^{0.676}$	39	5
25	$Q_{25}=924A^{0.673}$	40	6
50	$Q_{50}=1086A^{0.672}$	41	7
100	$Q_{100}=1253A^{0.670}$	42	8
500	$Q_{500}=1656A^{0.666}$	44	8
	Hydrologic area 4		
2	$Q_2=411A^{0.523}$	37	3
5	$Q_5=556A^{0.550}$	36	4
10	$Q_{10}=648A^{0.563}$	38	5
25	$Q_{25}=757A^{0.577}$	40	5
50	$Q_{50}=833A^{0.586}$	42	5
100	$Q_{100}=905A^{0.595}$	44	5
500	$Q_{500}=1063A^{0.612}$	48	5

A: drainage area, mi^2

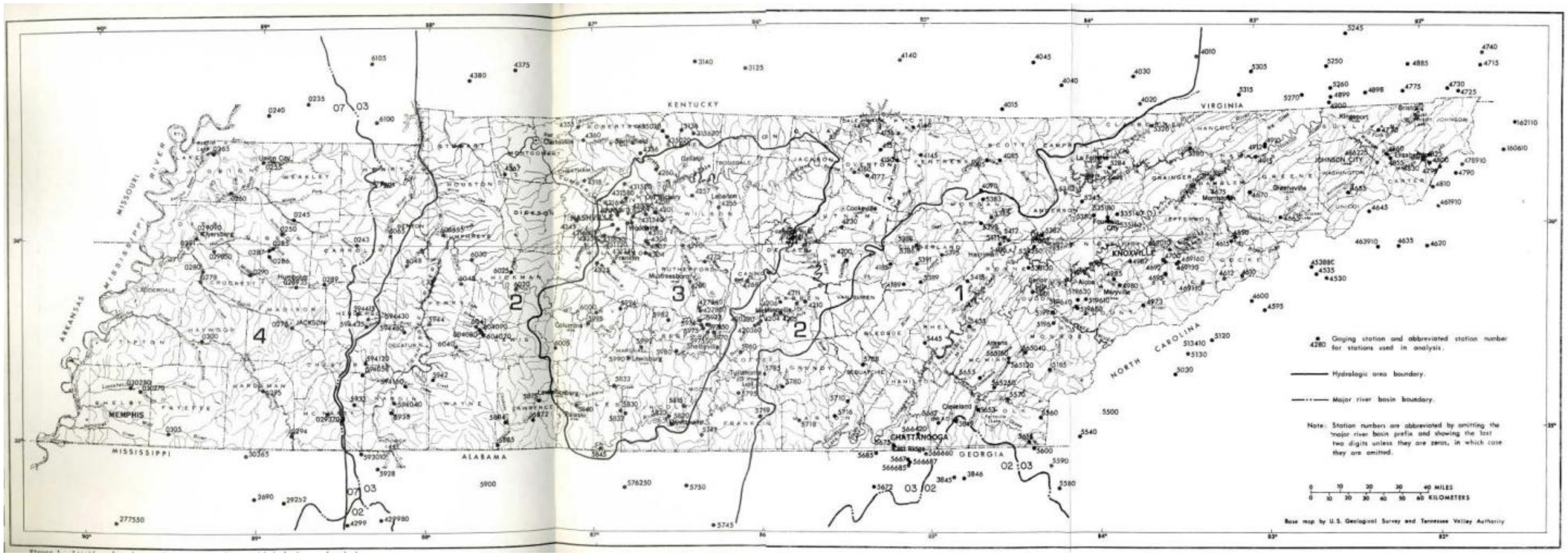

Fig. A.9. Four hydrologic areas and boundaries used in the two studies (Randolph and Gamble, 1976; Weaver and Gamble, 1993)

6. “*Flood-frequency prediction methods for unregulated streams of Tennessee, 2000*” (Law and Tasker, 2003).

Table A.5. Multivariable regional-regression equations and accuracy statistics (Law and Tasker, 2003)

Recurrence interval, in years	Peak-discharge equation, in cfs	Average prediction error, in percent
	Hydrologic area 1 (CDA=0.20 to 9000 mi^2)	
2	$1.72CDA^{0.798}CS^{0.112}CF^{4.581}$	39.2
5	$3.41CDA^{0.783}CS^{0.114}CF^{4.330}$	38.2
10	$5.34CDA^{0.775}CS^{0.116}CF^{4.087}$	40.1
25	$9.00CDA^{0.766}CS^{0.117}CF^{3.778}$	42.7
50	$12.8CDA^{0.760}CS^{0.117}CF^{3.560}$	45.2
100	$17.9CDA^{0.754}CS^{0.117}CF^{3.354}$	47.9
500	$36.1CDA^{0.742}CS^{0.114}CF^{2.904}$	55.2
	Hydrologic area 2 (CDA=0.47 to 2557 mi^2)	
2	$106CDA^{0.787}CS^{0.151}$	30.5
5	$170CDA^{0.779}CS^{0.158}$	28.5
10	$218CDA^{0.776}CS^{0.160}$	29.4
25	$285CDA^{0.772}CS^{0.160}$	31.8
50	$340CDA^{0.769}CS^{0.159}$	34.1
100	$397CDA^{0.766}CS^{0.157}$	36.7
500	$547CDA^{0.761}CS^{0.151}$	43.1
	Hydrologic area 3 (CDA=0.17 to 30.2 mi^2)	
2	$211CDA^{0.815}CS^{0.063}$	35.2
5	$329CDA^{0.798}CS^{0.071}$	34.9
10	$405CDA^{0.793}CS^{0.078}$	35.4
25	$497CDA^{0.789}CS^{0.086}$	36.4
50	$565CDA^{0.786}CS^{0.092}$	37.4
100	$632CDA^{0.785}CS^{0.096}$	38.6
500	$789CDA^{0.781}CS^{0.102}$	40.5
	Hydrologic area 3 (CDA=30.21 to 2048 mi^2)	
2	$409CDA^{0.584}CS^{0.102}$	27.9
5	$767CDA^{0.558}CS^{0.061}$	28.6
10	$980CDA^{0.554}CS^{0.054}$	30.3
25	$1200CDA^{0.557}CS^{0.056}$	33.4
50	$1330CDA^{0.562}CS^{0.061}$	35.9
100	$1430CDA^{0.568}CS^{0.068}$	38.6
500	$1600CDA^{0.587}CS^{0.090}$	45.7

Table A.5. Multivariable regional-regression equations and accuracy statistics – Continued (Law and Tasker, 2003)

Recurrence interval, in years	Peak-discharge equation, in cfs	Average prediction error, in percent
Hydrologic area 4 (CDA=0.76 to 2308 mi^2)		
2	$436CDA^{0.527}$	38.7
5	$618CDA^{0.545}$	37.2
10	$735CDA^{0.554}$	38.0
25	$878CDA^{0.564}$	40.1
50	$981CDA^{0.570}$	42.2
100	$1080CDA^{0.575}$	44.7
500	$1310CDA^{0.586}$	51.1

CDA: contributing drainage area (mi^2); CS: main-channel slope (feet/mile);
CF: 2-year recurrence-interval climate factor

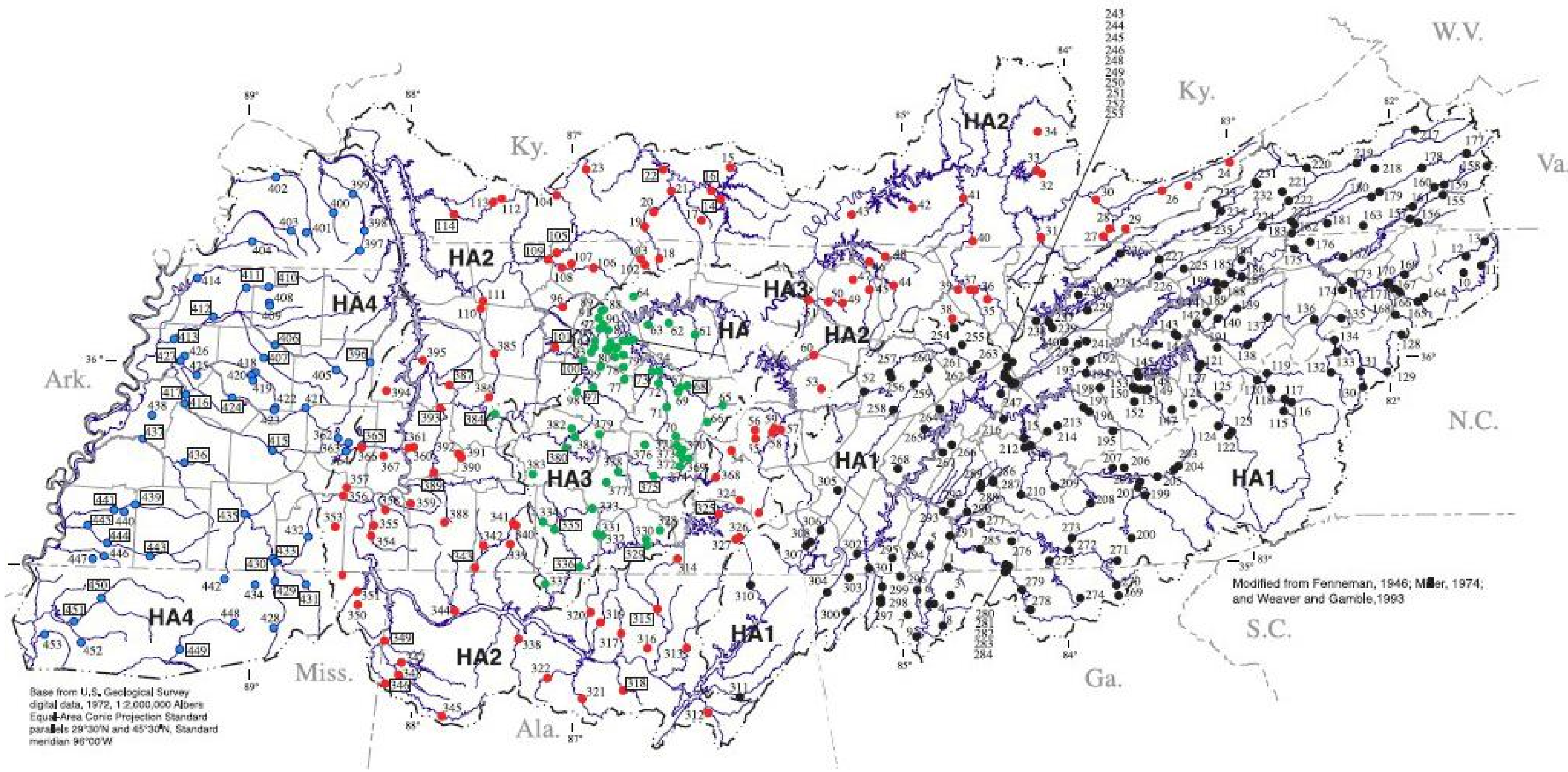

Fig. A.10. Gaging stations and hydrologic areas in the study area (Law and Tasker, 2003)

APPENDIX B: THE SELECTED BASIN CHARACTERISTICS AND FLOOD-FREQUENCY ESTIMATES

Table B.1. Station name and location for 295 gaging stations located in Tennessee

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1				
02384900	COAHULLA CREEK NR CLEVELAND, TN 35.117 84.838	6a - Valley and Ridge province Tennessee section	0.0574	1.98	908.30
03418500	CANEY FORK AT CLIFTY, TN 35.891 85.218	8f - Appalachian Plateaus province Cumberland Plateau section	0.1126	1.15	1844.28
03455000	FRENCH BROAD RIVER NEAR NEWPORT, TN 35.980 83.160	6a - Valley and Ridge province Tennessee section	0.2126	2.42	2617.59
03461000	PIGEON RIVER AT HARTFORD, TN 35.814 83.062	5b - Blue Ridge province Southern section	0.3024	2.71	3569.10
03461200	COSBY CREEK ABOVE COSBY, TN 35.783 83.217	5b - Blue Ridge province Southern section	0.4353	1.72	3383.33
03461500	PIGEON RIVER AT NEWPORT, TN 35.961 83.174	6a - Valley and Ridge province Tennessee section	0.2847	3.53	3266.37
03465000	NORTH INDIAN CREEK NEAR UNICOI, TN 36.176 82.293	5b - Blue Ridge province Southern section	0.3143	1.12	3071.43
03465500	NOLICHUCKY RIVER AT EMBREEVILLE, TN 36.176 82.457	5b - Blue Ridge province Southern section	0.3492	1.51	3225.62
03466228	SINKING CREEK AT AFTON, TN 36.199 82.742	6a - Valley and Ridge province Tennessee section	0.0563	5.01	1687.20
03466500	NOLICHUCKY RIVER BELOW NOLICHUCKY DAM, TN 36.066 82.872	6a - Valley and Ridge province Tennessee section	0.2219	2.63	2752.77

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1 – Continued				
03466890	LICK CREEK NEAR ALBANY, TN 36.248 82.926	6a - Valley and Ridge province Tennessee section	0.0955	2.46	1417.61
03467000	LICK CREEK AT MOHAWK, TN 36.201 83.048	6a - Valley and Ridge province Tennessee section	0.0949	3.54	1379.38
03467480	BENT CREEK AT TAYLOR GAP, TN 36.236 83.111	6a - Valley and Ridge province Tennessee section	0.1147	2.87	1243.17
03467500	NOLICHUCKY RIVER NEAR MORRISTOWN, TN 36.180 83.176	6a - Valley and Ridge province Tennessee section	0.1824	3.14	2335.43
03467993	CEDAR CREEK NEAR VALLEY HOME, TN 36.134 83.313	6a - Valley and Ridge province Tennessee section	0.1783	2.64	1392.24
03467998	SINKING FORK AT WHITE PINE, TN 36.122 83.296	6a - Valley and Ridge province Tennessee section	0.1434	2.83	1343.92
03469000	FRENCH BROAD RIVER BELOW DOUGLAS DAM, TN 35.952 83.551	6a - Valley and Ridge province Tennessee section	0.1654	1.97	2502.10
03469010	MILLICAN CREEK NEAR DOUGLAS DAM, TN 35.929 83.541	6a - Valley and Ridge province Tennessee section	0.1922	2.71	1010.31
03469110	RAMSEY CREEK NEAR PITMAN CENTER, TN 35.759 83.347	5b - Blue Ridge province Southern section	0.3987	4.22	2722.85
03469130	LITTLE PIGEON R NR SEVIERVILLE, TN 35.861 83.504	6a - Valley and Ridge province Tennessee section	0.3872	3.05	2564.31
03469160	EAST FORK LITTLE PIGEON R NR SEVIERVILLE, TN 35.865 83.488	6a - Valley and Ridge province Tennessee section	0.3120	3.97	1577.75
03469175	LITTLE PIGEON RIVER ABOVE SEVIERVILLE, TN 35.865 83.534	6a - Valley and Ridge province Tennessee section	0.3476	2.09	2132.70

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1 – Continued				
03469200	LITTLE PIGEON R AB W PRONG NR SEVIERVILLE, TN 35.870 83.568	6a - Valley and Ridge province Tennessee section	0.3346	2.26	2044.91
03469500	LITTLE PIGEON R NR PIGEON FORGE, TN 35.806 83.574	5b - Blue Ridge province Southern section	0.4023	3.44	2792.76
03470000	LITTLE PIGEON RIVER AT SEVIERVILLE, TN 35.878 83.578	6a - Valley and Ridge province Tennessee section	0.2741	1.43	2088.30
03470215	DUMPLIN CREEK AT MT. HAREB, TN 36.083 83.431	6a - Valley and Ridge province Tennessee section	0.0918	2.56	1323.67
03477000	S F HOLSTON R AT BLUFF CITY, TN 36.477 82.263	6a - Valley and Ridge province Tennessee section	0.1623	4.61	2469.40
03479500	WATAUGA R AT NORTH CAROLINA-TENN STATE LINE, TN 36.290 81.926	5b - Blue Ridge province Southern section	0.2995	1.79	3406.67
03480000	WATAUGA RIVER AT STUMP KNOB, TN 36.310 81.959	5b - Blue Ridge province Southern section	0.3036	2.05	3321.00
03482000	ROAN CREEK NEAR NEVA, TN 36.377 81.890	5b - Blue Ridge province Southern section	0.2962	2.00	2995.29
03482500	ROAN CREEK AT BUTLER, TN 36.342 81.993	5b - Blue Ridge province Southern section	0.3020	2.51	2871.89
03483000	WATAUGA RIVER AT BUTLER, TN 36.333 82.004	5b - Blue Ridge province Southern section	0.3052	1.12	3149.28
03485500	DOE RIVER AT ELIZABETHTON, TN 36.344 82.210	6a - Valley and Ridge province Tennessee section	0.3167	2.49	3121.11
03486000	WATAUGA RIVER AT ELIZABETHTON, TN 36.356 82.224	6a - Valley and Ridge province Tennessee section	0.2642	1.52	3027.70

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1 – Continued				
03486225	POWDER BRANCH NEAR JOHNSON CITY, TN 36.317 82.278	6a - Valley and Ridge province Tennessee section	0.1675	3.68	1796.17
03487500	SOUTH FORK HOLSTON RIVER AT KINGSPORT, TN 36.531 82.558	6a - Valley and Ridge province Tennessee section	0.1739	2.85	2502.31
03487550	REEDY CREEK AT OREBANK, TN 36.562 82.460	6a - Valley and Ridge province Tennessee section	0.1581	3.33	1731.04
03490522	FORGEY CREEK AT ZION HILL, TN 36.487 82.886	6a - Valley and Ridge province Tennessee section	0.0846	1.52	1499.62
03491000	BIG CREEK NEAR ROGERSVILLE, TN 36.426 82.952	6a - Valley and Ridge province Tennessee section	0.1682	3.64	1530.52
03491200	BIG CREEK TRIBUTARY NEAR ROGERSVILLE, TN 36.425 82.955	6a - Valley and Ridge province Tennessee section	0.2163	1.86	1366.21
03491300	BEECH CREEK AT KEPLER, TN 36.402 82.886	6a - Valley and Ridge province Tennessee section	0.2123	2.97	1553.09
03491500	HOLSTON RIVER NEAR ROGERSVILLE, TN 36.370 82.999	6a - Valley and Ridge province Tennessee section	0.1372	3.82	2306.40
03491540	ROBERTSON CREEK NEAR PERSIA, TN 36.340 83.041	6a - Valley and Ridge province Tennessee section	0.1111	2.19	1232.41
03491544	CROCKETT CREEK BELOW ROGERSVILLE, TN 36.380 83.047	6a - Valley and Ridge province Tennessee section	0.1812	3.96	1359.59
03495500	HOLSTON RIVER NEAR KNOXVILLE, TN 36.016 83.832	6a - Valley and Ridge province Tennessee section	0.1267	6.82	2098.85
03496000	FIRST CR AT MINERAL SPRINGS AVE AT KNOXVILLE, TN 36.015 83.922	6a - Valley and Ridge province Tennessee section	0.0924	2.77	1075.46

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1 – Continued				
03497000	TENNESSEE RIVER AT KNOXVILLE, TN 35.955 83.862	6a - Valley and Ridge province Tennessee section	0.1159	3.01	2272.74
03497300	LITTLE RIVER ABOVE TOWNSEND, TN 35.664 83.711	5b - Blue Ridge province Southern section	0.3332	2.01	3215.04
03498000	LITTLE RIVER NEAR WALLAND, TN 35.763 83.850	5b - Blue Ridge province Southern section	0.2836	3.12	2466.11
03498500	LITTLE RIVER NEAR MARYVILLE, TN 35.786 83.884	6a - Valley and Ridge province Tennessee section	0.2295	2.71	2066.42
03498700	NAILS CREEK NEAR KNOXVILLE, TN 35.880 83.780	6a - Valley and Ridge province Tennessee section	0.0850	3.76	1126.69
03518400	NORTH FORK CITICO CREEK NEAR TELLICO PLAINS, TN 35.397 84.074	5b - Blue Ridge province Southern section	0.3387	2.30	3311.24
03518500	TELLICO RIVER AT TELLICO PLAINS, TN 35.362 84.279	5b - Blue Ridge province Southern section	0.2254	2.64	2428.16
03519500	LITTLE TENNESSEE RIVER AT MCGHEE, TN 35.604 84.212	6a - Valley and Ridge province Tennessee section	0.2394	2.42	2776.34
03519600	ISLAND CREEK AT VONORE, TN 35.594 84.249	6a - Valley and Ridge province Tennessee section	0.0494	4.66	943.31
03519610	BAKER CREEK TRIBUTARY NEAR BINFIELD, TN 35.699 84.046	6a - Valley and Ridge province Tennessee section	0.0521	2.24	1048.11
03519640	BAKER CREEK NEAR GREENBACK, TN 35.672 84.108	6a - Valley and Ridge province Tennessee section	0.0425	2.22	977.77
03519700	BAT CREEK NEAR VONORE, TN 35.643 84.253	6a - Valley and Ridge province Tennessee section	0.0672	4.88	972.64

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1 – Continued				
03520100	SWEETWATER CR NR LOUDON, TN 35.738 84.374	6a - Valley and Ridge province Tennessee section	0.0569	4.67	990.14
03527800	BIG WAR CREEK AT LUTHER, TN 36.455 83.241	6a - Valley and Ridge province Tennessee section	0.1951	2.25	1656.90
03528000	CLINCH RIVER ABOVE TAZEWELL, TN 36.425 83.398	6a - Valley and Ridge province Tennessee section	0.1554	10.01	2122.49
03528100	BIG SYCAMORE CREEK NEAR SNEEDVILLE, TN 36.506 83.390	6a - Valley and Ridge province Tennessee section	0.3143	7.13	1890.58
03528300	BIG BARREN CREEK NEAR NEW TAZEWELL, TN 36.382 83.711	6a - Valley and Ridge province Tennessee section	0.1816	2.83	1457.74
03528390	CROOKED CREEK NEAR MAYNARDVILLE, TN 36.266 83.840	6a - Valley and Ridge province Tennessee section	0.1918	1.44	1303.05
03528400	WHITE CREEK NEAR SHARPS CHAPEL, TN 36.345 83.894	6a - Valley and Ridge province Tennessee section	0.2728	1.40	1375.32
03532000	POWELL RIVER NEAR ARTHUR, TN 36.542 83.630	6a - Valley and Ridge province Tennessee section	0.2028	5.80	1847.38
03533000	CLINCH RIVER BELOW NORRIS DAM, TN 36.216 84.082	6a - Valley and Ridge province Tennessee section	0.1671	8.96	1853.97
03534000	COAL CREEK AT LAKE CITY, TN 36.221 84.157	8g - Appalachian Plateaus province Cumberland Mountain section	0.2708	1.91	1710.95
03534500	BUFFALO CREEK AT NORRIS, TN 36.185 84.059	6a - Valley and Ridge province Tennessee section	0.0669	2.42	1065.91
03535000	BULLRUN CREEK NEAR HALLS CROSSROADS, TN 36.114 83.988	6a - Valley and Ridge province Tennessee section	0.2113	6.04	1225.85

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1 – Continued				
03535140	SOUTH FORK BEAVER CREEK AT HARBISON, TN 36.114 83.854	6a - Valley and Ridge province Tennessee section	0.0631	2.18	1142.02
03535180	WILLOW FORK NEAR HALLS CROSSROADS, TN 36.100 83.907	6a - Valley and Ridge province Tennessee section	0.1056	3.75	1210.61
03536450	FIRST CREEK NEAR OAK RIDGE, TN 35.922 84.319	6a - Valley and Ridge province Tennessee section	0.0973	2.12	919.64
03536550	WHITEOAK CR BL MELTON VALLEY DR NR OAK RIDGE, TN 35.919 84.317	6a - Valley and Ridge province Tennessee section	0.0839	2.46	919.53
03537000	WHITEOAK CR BL OAK RIDGE NATL LAB NR OAK RIDGE, TN 35.912 84.316	6a - Valley and Ridge province Tennessee section	0.0823	2.86	911.26
03537100	MELTON BRANCH NR MELTON HILL NR OAK RIDGE, TN 35.916 84.298	6a - Valley and Ridge province Tennessee section	0.0872	1.25	906.97
03538130	CANEY CREEK NEAR KINGSTON, TN 35.865 84.385	6a - Valley and Ridge province Tennessee section	0.0936	1.38	965.09
03538200	POPLAR CREEK NEAR OLIVER SPRINGS, TN 36.022 84.310	8g - Appalachian Plateaus province Cumberland Mountain section	0.1659	2.26	1192.86
03538215	INDIAN CREEK AT OLIVER SPRINGS, TN 36.046 84.347	8g - Appalachian Plateaus province Cumberland Mountain section	0.1917	1.04	1268.36
03538225	POPLAR CREEK NEAR OAK RIDGE, TN 35.999 84.340	6a - Valley and Ridge province Tennessee section	0.1622	2.36	1179.55
03538250	EAST FORK POPLAR CREEK NEAR OAK RIDGE, TN 35.966 84.358	6a - Valley and Ridge province Tennessee section	0.0750	3.40	933.56

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1 – Continued				
03538270	BEAR C AT ST HWY 95 NR OAK RIDGE, TN 35.937 84.339	6a - Valley and Ridge province Tennessee section	0.0935	5.52	972.48
03538275	BEAR CREEK NEAR OAK RIDGE, TN 35.947 84.363	6a - Valley and Ridge province Tennessee section	0.0870	4.17	935.84
03538300	ROCK CR NR SUNBRIGHT, TN 36.198 84.661	8f - Appalachian Plateaus province Cumberland Plateau section	0.2163	1.31	1519.69
03538500	EMORY RIVER NEAR WARTBURG, TN 36.113 84.615	8f - Appalachian Plateaus province Cumberland Plateau section	0.2788	1.28	1608.45
03538600	OBED RIVER AT CROSSVILLE, TN 35.957 85.050	8f - Appalachian Plateaus province Cumberland Plateau section	0.0594	1.85	1841.95
03538800	OBED RIVER TRIBUTARY NEAR CROSSVILLE, TN 35.983 85.059	8f - Appalachian Plateaus province Cumberland Plateau section	0.0467	3.00	1815.53
03538900	SELF CREEK NEAR BIG LICK, TN 35.798 85.042	8f - Appalachian Plateaus province Cumberland Plateau section	0.0664	2.13	1908.08
03539500	DADDYS CREEK NEAR CRAB ORCHARD, TN 35.926 84.913	8f - Appalachian Plateaus province Cumberland Plateau section	0.0891	2.82	1845.41
03539600	DADDYS CREEK NEAR HEBBERTSBURG, TN 35.998 84.823	8f - Appalachian Plateaus province Cumberland Plateau section	0.1000	3.82	1827.45

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1 – Continued				
03539800	OBED RIVER NEAR LANCING, TN 36.081 84.671	8f - Appalachian Plateaus province Cumberland Plateau section	0.0924	2.15	1717.63
03540500	EMORY RIVER AT OAKDALE, TN 35.983 84.558	8f - Appalachian Plateaus province Cumberland Plateau section	0.1246	1.71	1668.01
03541100	BITTER CREEK NEAR CAMP AUSTIN, TN 36.015 84.526	8f - Appalachian Plateaus province Cumberland Plateau section	0.2328	1.44	1340.41
03541500	WHITES CREEK NEAR GLEN ALICE, TN 35.797 84.760	6a - Valley and Ridge province Tennessee section	0.1777	1.24	1658.97
03542500	PINEY RIVER AT SPRING CITY, TN 35.700 84.855	6a - Valley and Ridge province Tennessee section	0.1536	1.74	1765.67
03543200	TEN MILE CR NR DECATUR, TN 35.618 84.692	6a - Valley and Ridge province Tennessee section	0.0633	3.40	887.51
03543500	SEWEE CREEK NEAR DECATUR, TN 35.581 84.748	6a - Valley and Ridge province Tennessee section	0.0673	1.59	903.25
03544500	RICHLAND CREEK NEAR DAYTON, TN 35.505 85.022	6a - Valley and Ridge province Tennessee section	0.1053	2.13	1856.54
03556000	TURTLETOWN CREEK AT TURTLETOWN, TN 35.132 84.344	5b - Blue Ridge province Southern section	0.2005	1.56	1774.22
03557000	HIWASSEE RIVER NEAR RELIANCE, TN 35.222 84.526	5b - Blue Ridge province Southern section	0.1789	2.64	2155.41
03559500	OCOEE RIVER AT COPPERHILL, TN 34.991 84.377	5b - Blue Ridge province Southern section	0.1525	2.72	2243.53

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1 – Continued				
03560500	DAVIS MILL CREEK AT COPPERHILL, TN 34.995 84.382	5b - Blue Ridge province Southern section	0.1351	2.61	1682.49
03561000	NORTH POTATO CREEK NEAR DUCKTOWN, TN 35.015 84.383	5b - Blue Ridge province Southern section	0.1851	2.66	1889.22
03561500	OCOEE RIVER AT MCHARG, TN 35.007 84.363	5b - Blue Ridge province Southern section	0.1485	2.49	2191.35
03563000	OCOEE RIVER AT EMF, TN 35.097 84.535	5b - Blue Ridge province Southern section	0.1551	3.44	2148.70
03565040	CHESTUEE CREEK ABOVE ENGLEWOOD, TN 35.440 84.447	6a - Valley and Ridge province Tennessee section	0.0544	3.81	953.36
03565080	LITTLE CHESTUEE CREEK BELOW WILSON STATION, TN 35.427 84.446	6a - Valley and Ridge province Tennessee section	0.1922	2.31	1033.11
03565120	CHESTUEE CREEK AT ZION HILL, TN 35.401 84.523	6a - Valley and Ridge province Tennessee section	0.1090	4.07	959.83
03565160	MIDDLE CR BELOW HWY 39 NR ENGLEWOOD, TN 35.421 84.521	6a - Valley and Ridge province Tennessee section	0.0937	3.23	956.19
03565250	CHESTUEE CREEK AT DENTVILLE, TN 35.283 84.609	6a - Valley and Ridge province Tennessee section	0.0917	4.11	911.95
03565300	SOUTH CHESTUEE CREEK NEAR BENTON, TN 35.167 84.716	6a - Valley and Ridge province Tennessee section	0.0732	1.67	831.08
03565500	OOSTANAULA CREEK NEAR SANFORD, TN 35.327 84.705	6a - Valley and Ridge province Tennessee section	0.1081	7.10	945.50
03566000	HIWASSEE RIVER AT CHARLESTON, TN 35.288 84.752	6a - Valley and Ridge province Tennessee section	0.1499	2.18	1873.77

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1 – Continued				
03566200	BRYMER CREEK NEAR MCDONALD, TN 35.122 84.950	6a - Valley and Ridge province Tennessee section	0.1014	1.43	887.45
03566420	WOLFTEVER CREEK NEAR OOLTEWAH, TN 35.062 85.066	6a - Valley and Ridge province Tennessee section	0.1099	1.62	903.86
03567500	SOUTH CHICKAMAUGA CREEK NEAR CHICKAMAUGA, TN 35.014 85.207	6a - Valley and Ridge province Tennessee section	0.0897	2.37	923.28
03568000	TENNESSEE RIVER AT CHATTANOOGA, TN 35.087 85.279	8f - Appalachian Plateaus province Cumberland Plateau section	0.0837	3.21	1990.17
03570800	LITTLE BRUSH CREEK NEAR DUNLAP, TN 35.404 85.388	8f - Appalachian Plateaus province Cumberland Plateau section	0.2017	3.08	1916.26
03571000	SEQUATCHIE RIVER NEAR WHITWELL, TN 35.206 85.497	8f - Appalachian Plateaus province Cumberland Plateau section	0.1302	6.84	1384.76
03571500	LITTLE SEQUATCHIE RIVER AT SEQUATCHIE, TN 35.130 85.586	8f - Appalachian Plateaus province Cumberland Plateau section	0.1490	2.39	1702.83
03571600	BROWN SPRING BR NEAR SEQUATCHIE, TN 35.149 85.558	8f - Appalachian Plateaus province Cumberland Plateau section	0.1504	3.70	1021.35
03571800	BATTLE CREEK NEAR MONTEAGLE, TN 35.130 85.771	8f - Appalachian Plateaus province Cumberland Plateau section	0.1827	1.55	1564.91

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi²/mi²)	Mean basin elevation (ft)
	Hydrologic Area 2				
03313600	WEST FK DRAKES CREEK TRIB NR FOUNTAIN HEAD, TN 36.559 86.457	11a - Interior Low Plateaus Highland Rim section	0.0469	2.60	786.71
03407908	NEW RIVER AT CORDELL, TN 36.336 84.452	8f - Appalachian Plateaus province Cumberland Plateau section	0.2907	1.54	2072.10
03408000	NEW RIVER NEAR NEW RIVER, TN 36.384 84.529	8f - Appalachian Plateaus province Cumberland Plateau section	0.2478	1.64	1901.07
03408500	NEW RIVER AT NEW RIVER, TN 36.386 84.555	8f - Appalachian Plateaus province Cumberland Plateau section	0.2373	1.46	1856.41
03409000	WHITE OAK CREEK AT SUNBRIGHT, TN 36.244 84.671	8f - Appalachian Plateaus province Cumberland Plateau section	0.1876	1.74	1567.76
03409500	CLEAR FORK NEAR ROBBINS, TN 36.388 84.630	8f - Appalachian Plateaus province Cumberland Plateau section	0.1017	2.47	1527.09
03414500	EAST FORK OBEY RIVER NEAR JAMESTOWN, TN 36.416 85.026	8f - Appalachian Plateaus province Cumberland Plateau section	0.1699	3.86	1651.07
03415000	WEST FORK OBEY RIVER NEAR ALPINE, TN 36.397 85.174	8f - Appalachian Plateaus province Cumberland Plateau section	0.2298	3.08	1396.77
03415500	OBEY RIVER NEAR BYRDSTOWN, TN 36.536 85.170	11a - Interior Low Plateaus Highland Rim section	0.1686	2.64	1427.60

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 2 - Continued				
03415700	BIG EAGLE CREEK NEAR LIVINGSTON, TN 36.449 85.274	11a - Interior Low Plateaus Highland Rim section	0.1117	3.10	1190.05
03416000	WOLF RIVER NEAR BYRDSTOWN, TN 36.560 85.073	11a - Interior Low Plateaus Highland Rim section	0.1525	2.02	1326.62
03417700	MATHEWS BR TRIBUTARY NEAR LIVINGSTON, TN 36.334 85.340	11a - Interior Low Plateaus Highland Rim section	0.0334	1.31	1002.17
03418000	ROARING RIVER NEAR HILHAM, TN 36.341 85.426	11a - Interior Low Plateaus Highland Rim section	0.0803	1.33	1129.11
03418070	ROARING RIVER ABOVE GAINESBORO, TN 36.351 85.546	11a - Interior Low Plateaus Highland Rim section	0.0762	1.37	1061.69
03420000	CALFKILLER RIVER BELOW SPARTA, TN 35.909 85.479	11a - Interior Low Plateaus Highland Rim section	0.1159	2.48	1391.29
03420360	MUD CREEK TRIBUTARY NO 2 NEAR SUMMITVILLE, TN 35.603 86.026	11a - Interior Low Plateaus Highland Rim section	0.0254	1.29	1096.12
03420500	BARREN FORK NEAR TROUSDALE, TN 35.665 85.883	11a - Interior Low Plateaus Highland Rim section	0.0309	1.47	1092.96
03420600	OWEN BRANCH NEAR CENTERTOWN, TN 35.708 85.885	11a - Interior Low Plateaus Highland Rim section	0.0313	2.51	1064.22
03421000	COLLINS RIVER NEAR MCMINNVILLE, TN 35.709 85.729	11a - Interior Low Plateaus Highland Rim section	0.0692	1.26	1390.29
03421100	SINK TRIBUTARY AT MCMINNVILLE, TN 35.696 85.780	11a - Interior Low Plateaus Highland Rim section	0.0373	2.06	1005.83
03421200	CHARLES CREEK NEAR MCMINNVILLE, TN 35.717 85.768	11a - Interior Low Plateaus Highland Rim section	0.0512	4.87	1059.15

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 2 - Continued				
03423000	FALLING WATER RIVER NEAR COOKEVILLE, TN 36.077 85.521	11a - Interior Low Plateaus Highland Rim section	0.0981	3.52	1215.36
03431800	SYCAMORE CREEK NEAR ASHLAND CITY, TN 36.320 87.051	11a - Interior Low Plateaus Highland Rim section	0.1255	2.69	701.93
03434500	HARPETH RIVER NEAR KINGSTON SPRINGS, TN 36.122 87.099	11a - Interior Low Plateaus Highland Rim section	0.0604	2.67	759.03
03434590	JONES CREEK NEAR BURNS, TN 36.104 87.318	11a - Interior Low Plateaus Highland Rim section	0.0803	1.91	764.18
03435030	RED RIVER NEAR PORTLAND, TN 36.557 86.571	11a - Interior Low Plateaus Highland Rim section	0.0790	2.57	850.66
03435500	RED RIVER NEAR ADAMS, TN 36.589 87.089	11a - Interior Low Plateaus Highland Rim section	0.0237	1.63	652.94
03435770	SULPHUR FORK RED RIVER ABOVE SPRINGFIELD, TN 36.513 86.862	11a - Interior Low Plateaus Highland Rim section	0.0698	2.19	743.61
03435930	SPRING CREEK TRIBUTARY NEAR CEDAR HILL, TN 36.536 86.998	11a - Interior Low Plateaus Highland Rim section	0.0149	1.37	669.43
03436000	SULPHUR FORK RED RIVER NEAR ADAMS, TN 36.515 87.059	11a - Interior Low Plateaus Highland Rim section	0.0695	2.74	690.18
03436100	RED RIVER AT PORT ROYAL, TN 36.555 87.142	11a - Interior Low Plateaus Highland Rim section	0.0270	1.44	656.85
03436690	YELLOW CREEK AT ELLIS MILLS, TN 36.311 87.554	11a - Interior Low Plateaus Highland Rim section	0.1240	2.55	698.65
03436700	YELLOW CREEK NEAR SHILOH, TN 36.349 87.539	11a - Interior Low Plateaus Highland Rim section	0.1255	2.77	683.53

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 2 - Continued				
03574700	BIG HUCKLEBERRY CR NR BELVIDERE, TN 35.067 86.358	11a - Interior Low Plateaus Highland Rim section	0.0097	2.03	965.29
03578000	ELK RIVER NEAR PELHAM, TN 35.297 85.870	11a - Interior Low Plateaus Highland Rim section	0.1187	1.89	1662.52
03578500	BRADLEY CREEK NR PRAIRIE PLAINS, TN 35.356 85.979	11a - Interior Low Plateaus Highland Rim section	0.0415	2.38	1118.99
03579100	ELK RIVER NEAR ESTILL SPRINGS, TN 35.286 86.106	11a - Interior Low Plateaus Highland Rim section	0.0775	1.85	1306.48
03579800	MILLER CR NR COWAN, TN 35.171 85.983	8f - Appalachian Plateaus province Cumberland Plateau section	0.1448	3.09	1349.60
03579900	BOILING FORK CREEK AT COWAN, TN 35.162 86.006	8f - Appalachian Plateaus province Cumberland Plateau section	0.1470	2.12	1370.89
03587200	BLUEWATER CREEK TRIBUTARY NEAR LEOMA, TN 35.141 87.368	11a - Interior Low Plateaus Highland Rim section	0.0218	2.50	922.12
03587500	SHOAL C AB LITTLE SHOAL C, AT LAWRENCEBURG, TN 35.234 87.333	11a - Interior Low Plateaus Highland Rim section	0.0208	1.50	939.48
03588000	SHOAL CREEK AT LAWRENCEBURG, TN 35.244 87.351	11a - Interior Low Plateaus Highland Rim section	0.0208	1.35	944.70
03588400	CHISHOLM CREEK AT WESTPOINT, TN 35.134 87.529	11a - Interior Low Plateaus Highland Rim section	0.0557	3.88	877.97
03588500	SHOAL CREEK AT IRON CITY, TN 35.024 87.579	11a - Interior Low Plateaus Highland Rim section	0.0520	2.31	861.22

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 2 - Continued				
03593300	SNAKE CREEK NEAR ADAMSVILLE, TN 35.220 88.427	3d - Coastal Plain East Gulf Coastal Plain	0.0364	1.66	500.64
03593800	HORSE CREEK NEAR SAVANNAH, TN 35.177 88.209	11a - Interior Low Plateaus Highland Rim section	0.0488	2.81	664.38
03594040	TURKEY CREEK NEAR SAVANNAH, TN 35.229 88.194	11a - Interior Low Plateaus Highland Rim section	0.0532	2.25	565.64
03594058	WHITE OAK CR NEAR MILLEDGEVILLE, TN 35.374 88.382	3d - Coastal Plain East Gulf Coastal Plain	0.0419	1.27	495.30
03594120	MIDDLETON CREEK NEAR MILLEDGEVILLE, TN 35.416 88.361	3d - Coastal Plain East Gulf Coastal Plain	0.0402	1.71	493.37
03594160	INDIAN CREEK NEAR CERRO GORDO, TN 35.307 88.125	11a - Interior Low Plateaus Highland Rim section	0.0687	2.90	734.70
03594200	EAGLE CREEK NEAR CLIFTON JUNCTION, TN 35.339 87.973	11a - Interior Low Plateaus Highland Rim section	0.0758	4.26	710.57
03594300	CYPRESS CREEK TRIBUTARY NEAR POPE, TN 35.619 87.956	11a - Interior Low Plateaus Highland Rim section	0.0705	3.25	589.74
03594400	CYPRESS CREEK AT POPE, TN 35.615 87.990	11a - Interior Low Plateaus Highland Rim section	0.0686	3.36	603.00
03594460	CANE CREEK NEAR CHESTERFIELD, TN 35.614 88.273	3d - Coastal Plain East Gulf Coastal Plain	0.0298	2.64	468.05
03594480	TURKEY CREEK NEAR DECATURVILLE, TN 35.575 88.139	3d - Coastal Plain East Gulf Coastal Plain	0.0375	2.36	461.52
03596000	DUCK RIVER BELOW MANCHESTER, TN 35.471 86.122	11a - Interior Low Plateaus Highland Rim section	0.0256	1.88	1098.48

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 2 - Continued				
03602170	WEST PINEY RIVER AT HWY 70 NEAR DICKSON,TN 36.089 87.470	11a - Interior Low Plateaus Highland Rim section	0.0642	3.45	864.72
03602500	PINEY RIVER AT VERNON, TN 35.871 87.501	11a - Interior Low Plateaus Highland Rim section	0.1248	1.47	746.98
03603000	DUCK RIVER ABOVE HURRICANE MILLS, TN 35.930 87.740	11a - Interior Low Plateaus Highland Rim section	0.0542	4.31	788.33
03603800	CHALK CREEK NEAR WAYNESBORO, TN 35.247 87.767	11a - Interior Low Plateaus Highland Rim section	0.0481	2.74	976.35
03604000	BUFFALO RIVER NEAR FLAT WOODS, TN 35.496 87.833	11a - Interior Low Plateaus Highland Rim section	0.0499	2.72	869.80
03604070	COON CREEK TRIBUTARY NEAR HOHENWALD, TN 35.569 87.667	11a - Interior Low Plateaus Highland Rim section	0.0527	1.31	873.49
03604080	HUGH HOLLOW BRANCH NEAR HOHENWALD, TN 35.583 87.677	11a - Interior Low Plateaus Highland Rim section	0.0692	2.24	834.14
03604090	COON CREEK ABOVE CHOP HOLLOW NEAR HOHENWALD, TN 35.589 87.686	11a - Interior Low Plateaus Highland Rim section	0.0669	1.31	835.25
03604500	BUFFALO RIVER NEAR LOBELVILLE, TN 35.813 87.797	11a - Interior Low Plateaus Highland Rim section	0.0579	2.79	805.48
03604800	BIRDSONG CREEK NEAR HOLLADAY, TN 35.899 88.127	3d - Coastal Plain East Gulf Coastal Plain	0.0885	1.19	497.46
03605555	TRACE CREEK ABOVE DENVER, TN 36.052 87.907	11a - Interior Low Plateaus Highland Rim section	0.1037	9.54	653.75

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 3				
03425500	SPRING CREEK NEAR LEBANON, TN 36.180 86.241	11c - Interior Low Plateaus Nashville Basin	0.0847	2.26	723.91
03425700	SPENCER CREEK NEAR LEBANON, TN 36.239 86.401	11c - Interior Low Plateaus Nashville Basin	0.0797	2.56	663.86
03425800	CEDAR CREEK TRIBUTARY AT GREEN HILL, TN 36.231 86.528	11c - Interior Low Plateaus Nashville Basin	0.0806	1.85	593.73
03426000	DRAKES CREEK ABOVE HENDERSONVILLE, TN 36.371 86.617	11c - Interior Low Plateaus Nashville Basin	0.0763	1.81	729.97
03426800	EAST FORK STONES RIVER AT WOODBURY, TN 35.828 86.077	11c - Interior Low Plateaus Nashville Basin	0.2547	1.41	1018.42
03426874	BRAWLEYS FORK BELOW BRADYVILLE, TN 35.746 86.171	11c - Interior Low Plateaus Nashville Basin	0.2032	2.74	988.43
03427000	BRADLEY CREEK AT LASCASSAS, TN 35.927 86.290	11c - Interior Low Plateaus Nashville Basin	0.0657	1.93	719.40
03427500	EAST FORK STONES RIVER NEAR LASCASSAS, TN 35.918 86.334	11c - Interior Low Plateaus Nashville Basin	0.0865	1.94	830.88
03427690	BUSHMAN CRK AT PITTS LANE FORD NR COMPTON, TN 35.896 86.348	11c - Interior Low Plateaus Nashville Basin	0.0242	2.55	637.21
03427830	SHORT CREEK TRIBUTARY NEAR CHRISTIANA, TN 35.677 86.363	11c - Interior Low Plateaus Nashville Basin	0.0943	3.63	870.76
03428000	WEST FORK STONES RIVER NEAR MURFREESBORO, TN 35.822 86.417	11c - Interior Low Plateaus Nashville Basin	0.0403	2.19	762.14
03428500	WEST FORK STONES RIVER NEAR SMYRNA, TN 35.940 86.465	11c - Interior Low Plateaus Nashville Basin	0.0302	2.54	705.31

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 3 – Continued				
03429000	STONES RIVER NEAR SMYRNA, TN 36.000 86.460	11c - Interior Low Plateaus Nashville Basin	0.0546	1.73	747.08
03429500	STEWART CREEK NEAR SMYRNA, TN 35.998 86.505	11c - Interior Low Plateaus Nashville Basin	0.0576	2.54	652.82
03430100	STONES RIVER BELOW J PERCY PRIEST DAM, TN 36.158 86.620	11c - Interior Low Plateaus Nashville Basin	0.0475	2.21	704.06
03430118	MCCRORY CREEK AT IRONWOOD DRIVE, AT DONELSON, TN 36.152 86.651	11c - Interior Low Plateaus Nashville Basin	0.0813	2.19	551.01
03430400	MILL CREEK AT NOLENSVILLE, TN 35.959 86.675	11c - Interior Low Plateaus Nashville Basin	0.0687	1.36	752.55
03430600	MILL CREEK AT HOBSON PIKE, NEAR ANTIOCH, TN 36.021 86.681	11c - Interior Low Plateaus Nashville Basin	0.0578	1.30	701.98
03431000	MILL CREEK NEAR ANTIOCH, TN 36.082 86.681	11c - Interior Low Plateaus Nashville Basin	0.0914	2.10	674.23
03431040	SEVENMILE CREEK AT BLACKMAN RD NR NASHVILLE, TN 36.072 86.733	11c - Interior Low Plateaus Nashville Basin	0.0940	1.69	657.91
03431060	MILL CREEK AT THOMPSON LANE, NEAR WOODBINE, TN 36.118 86.719	11c - Interior Low Plateaus Nashville Basin	0.0900	2.22	652.81
03431062	MILL CREEK TRIB AT GLENROSE AVE AT WOODBINE, TN 36.117 86.727	11c - Interior Low Plateaus Nashville Basin	0.0550	1.30	537.13
03431080	SIMS BRANCH AT ELM HILL PIKE NEAR DONELSON, TN 36.152 86.684	11c - Interior Low Plateaus Nashville Basin	0.0755	1.65	526.87
03431120	W F BROWNS C AT GEN BATES DR AT NASHVILLE, TN 36.108 86.785	11c - Interior Low Plateaus Nashville Basin	0.0789	2.88	632.87

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 3 – Continued				
03431240	E F BROWNS C AT BAIRD-WARD P CO NASHVILLE, TN 36.109 86.767	11c - Interior Low Plateaus Nashville Basin	0.0532	2.34	590.07
03431340	BROWNS CREEK AT FACTORY STREET AT NASHVILLE, TN 36.141 86.759	11c - Interior Low Plateaus Nashville Basin	0.0674	2.46	585.13
03431490	PAGES BRANCH AT AVONDALE, TN 36.206 86.773	11c - Interior Low Plateaus Nashville Basin	0.0795	1.79	558.36
03431517	CUMMINGS BRANCH AT LICKTON, TN 36.307 86.800	11c - Interior Low Plateaus Nashville Basin	0.1965	2.23	733.46
03431520	CLAYLICK CREEK AT LICKTON, TN 36.301 86.810	11c - Interior Low Plateaus Nashville Basin	0.2485	2.61	728.71
03431550	EARTHMAN FORK AT WHITES CREEK, TN 36.265 86.831	11c - Interior Low Plateaus Nashville Basin	0.2458	3.27	697.57
03431580	EWING CREEK AT KNIGHT ROAD NEAR BORDEAUX, TN 36.232 86.804	11c - Interior Low Plateaus Nashville Basin	0.0959	1.62	586.41
03431600	WHITES CREEK AT TUCKER ROAD NEAR BORDEAUX, TN 36.212 86.825	11c - Interior Low Plateaus Nashville Basin	0.1746	1.54	636.23
03431650	VAUGHNS GAP BR AT PERCY WARNER BELLE MEADE, TN 36.095 86.877	11a - Interior Low Plateaus Highland Rim section	0.1473	1.77	671.53
03431670	RICHLAND C AT FRANSWORTH DR AT BELLE MEADE, TN 36.120 86.857	11a - Interior Low Plateaus Highland Rim section	0.1163	1.34	643.55
03431700	RICHLAND CREEK AT CHARLOTTE AVE AT NASHVILLE, TN 36.151 86.854	11a - Interior Low Plateaus Highland Rim section	0.0941	1.54	603.48
03432350	HARPETH RIVER AT FRANKLIN, TN 35.921 86.866	11c - Interior Low Plateaus Nashville Basin	0.0508	2.86	791.29

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 3 – Continued				
03432500	WEST HARPETH RIVER NEAR LEIPERS FORK, TN 35.899 86.967	11a - Interior Low Plateaus Highland Rim section	0.0607	2.20	799.54
03432925	L HARPETH R AT GRANNY WHITE PIKE AT BRENTWOOD, TN 36.025 86.819	11a - Interior Low Plateaus Highland Rim section	0.0726	2.39	764.85
03433500	HARPETH RIVER AT BELLEVUE, TN 36.054 86.928	11a - Interior Low Plateaus Highland Rim section	0.0571	2.59	775.55
03581500	W FK MULBERRY CR AT MULBERRY, TN 35.209 86.463	11a - Interior Low Plateaus Highland Rim section	0.1703	2.83	926.98
03582000	ELK RIVER ABOVE FAYETTEVILLE, TN 35.134 86.540	11a - Interior Low Plateaus Highland Rim section	0.0611	2.80	1085.85
03582300	NORRIS CR NR FAYETTEVILLE, TN 35.165 86.545	11a - Interior Low Plateaus Highland Rim section	0.1692	2.63	895.76
03583000	BRADSHAW CREEK AT FRANKEWING, TN 35.193 86.845	11a - Interior Low Plateaus Highland Rim section	0.1666	1.73	869.63
03583200	CHICKEN CREEK AT MCBURG, TN 35.184 86.813	11a - Interior Low Plateaus Highland Rim section	0.2113	1.54	858.48
03583300	RICHLAND CREEK NEAR CORNERSVILLE, TN 35.319 86.872	11a - Interior Low Plateaus Highland Rim section	0.1564	1.97	970.85
03583500	WEAKLEY CREEK NEAR BODENHAM, TN 35.252 87.169	11a - Interior Low Plateaus Highland Rim section	0.0630	2.90	936.84
03584000	RICHLAND CREEK NEAR PULASKI, TN 35.214 87.101	11a - Interior Low Plateaus Highland Rim section	0.0764	1.65	899.45

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 3 – Continued				
03584500	ELK RIVER NEAR PROSPECT, TN 35.027 86.948	11a - Interior Low Plateaus Highland Rim section	0.0708	2.93	954.38
03597000	GARRISON FORK AT FAIRFIELD, TN 35.566 86.283	11c - Interior Low Plateaus Nashville Basin	0.1882	1.69	1049.16
03597300	WARTRACE CREEK ABOVE BELL BUCKLE, TN 35.629 86.356	11c - Interior Low Plateaus Nashville Basin	0.1664	2.59	1040.24
03597450	KELLY CREEK TRIBUTARY NEAR BELL BUCKLE, TN 35.609 86.320	11c - Interior Low Plateaus Nashville Basin	0.1725	2.56	1024.09
03597500	WARTRACE CREEK AT BELL BUCKLE, TN 35.588 86.339	11c - Interior Low Plateaus Nashville Basin	0.1406	1.72	1000.97
03597550	MUSE BRANCH NEAR BELL BUCKLE, TN 35.567 86.324	11c - Interior Low Plateaus Nashville Basin	0.0907	2.74	938.13
03597590	WARTRACE CREEK BELOW COUNTY ROAD AT WARTRACE, TN 35.527 86.340	11c - Interior Low Plateaus Nashville Basin	0.1013	2.43	943.46
03598000	DUCK RIVER NEAR SHELBYVILLE, TN 35.480 86.499	11c - Interior Low Plateaus Nashville Basin	0.0518	1.96	997.37
03598200	WEAKLY CREEK NEAR ROVER, TN 35.635 86.551	11c - Interior Low Plateaus Nashville Basin	0.0177	2.95	756.67
03599000	BIG ROCK CREEK AT LEWISBURG, TN 35.449 86.786	11c - Interior Low Plateaus Nashville Basin	0.1060	1.68	880.50
03599200	EAST ROCK CREEK AT FARMINGTON, TN 35.501 86.714	11c - Interior Low Plateaus Nashville Basin	0.0412	2.16	798.64

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 3 – Continued				
03599400	LITTLE FLAT CR TRIB NR RALLY HILL, TN 35.687 86.829	11c - Interior Low Plateaus Nashville Basin	0.0522	3.23	729.57
03599500	DUCK RIVER AT COLUMBIA, TN 35.618 87.032	11c - Interior Low Plateaus Nashville Basin	0.0431	3.11	855.49
03600000	RUTHERFORD CREEK NR CARTERS CREEK, TN 35.673 86.978	11c - Interior Low Plateaus Nashville Basin	0.0726	3.03	769.04
03600088	CARTERS CREEK AT BUTLER ROAD AT CARTERS CREEK, TN 35.717 86.996	11c - Interior Low Plateaus Nashville Basin	0.0956	2.88	763.95
03600500	BIG BIGBY CREEK AT SANDY HOOK, TN 35.489 87.233	11a - Interior Low Plateaus Highland Rim section	0.0697	1.84	933.97
03602000	DUCK RIVER AT CENTERVILLE, TN 35.788 87.466	11a - Interior Low Plateaus Highland Rim section	0.0523	3.73	814.97
	Hydrologic Area 4				
03594415	BEECH RIVER NEAR LEXINGTON , TN 35.659 88.417	3d - Coastal Plain East Gulf Coastal Plain	0.0279	1.80	513.30
03594430	HARMON CREEK NEAR LEXINGTON, TN 35.638 88.354	3d - Coastal Plain East Gulf Coastal Plain	0.0447	3.40	509.44
03594435	PINEY CREEK AT HWY 104 NR LEXINGTON, TN 35.596 88.368	3d - Coastal Plain East Gulf Coastal Plain	0.0430	2.49	501.90
03594445	BEECH RIVER NEAR CHESTERFIELD, TN 35.624 88.273	3d - Coastal Plain East Gulf Coastal Plain	0.0355	1.34	487.28

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 4 - Continued				
03606500	BIG SANDY RIVER AT BRUCETON, TN 36.039 88.228	3d - Coastal Plain East Gulf Coastal Plain	0.0320	3.10	507.90
07024300	BEAVER CREEK AT HUNTINGDON, TN 35.999 88.434	3d - Coastal Plain East Gulf Coastal Plain	0.0270	1.16	446.41
07024500	SOUTH FORK OBION RIVER NEAR GREENFIELD, TN 36.118 88.811	3d - Coastal Plain East Gulf Coastal Plain	0.0267	2.39	433.25
07025000	RUTHERFORD FORK OBION RIVER NEAR BRADFORD, TN 36.053 88.878	3d - Coastal Plain East Gulf Coastal Plain	0.0390	4.61	454.68
07025220	CANE CREEK NEAR MARTIN, TN 36.327 88.851	3d - Coastal Plain East Gulf Coastal Plain	0.0364	2.62	425.24
07025400	NORTH FORK OBION RIVER NEAR MARTIN, TN 36.406 88.856	3d - Coastal Plain East Gulf Coastal Plain	0.0238	2.63	457.02
07025500	NORTH FORK OBION RIVER NEAR UNION CITY, TN 36.400 88.995	3d - Coastal Plain East Gulf Coastal Plain	0.0228	3.51	446.43
07026000	OBION RIVER AT OBION, TN 36.251 89.192	3d - Coastal Plain East Gulf Coastal Plain	0.0218	1.55	413.46
07026300	OBION RIVER NEAR BOGOTA, TN 36.137 89.429	3d - Coastal Plain East Gulf Coastal Plain	0.0214	2.13	405.12

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 4 - Continued				
07026500	REELFOOT CREEK NEAR SAMBURG, TN 36.442 89.296	3e - Coastal Plain Mississippi Alluvial Plain	0.0222	2.65	390.92
07027500	SOUTH FORK FORKED DEER RIVER AT JACKSON, TN 35.594 88.814	3d - Coastal Plain East Gulf Coastal Plain	0.0287	1.42	468.99
07027800	SOUTH FORK FORKED DEER RIVER NEAR GATES, TN 35.817 89.356	3d - Coastal Plain East Gulf Coastal Plain	0.0232	3.76	421.32
07028000	SOUTH FORK FORKED DEER RIVER AT CHESTNUT BLUFF, TN 35.862 89.348	3d - Coastal Plain East Gulf Coastal Plain	0.0229	3.73	414.97
07028500	NORTH FORK FORKED DEER RIVER AT TRENTON, TN 35.980 88.926	3d - Coastal Plain East Gulf Coastal Plain	0.0485	2.66	398.28
07028600	CAIN CREEK TRIBUTARY NEAR TRENTON, TN 35.938 88.941	3d - Coastal Plain East Gulf Coastal Plain	0.0703	1.52	400.78
07028700	CAIN CREEK NEAR TRENTON, TN 35.966 88.954	3d - Coastal Plain East Gulf Coastal Plain	0.0435	2.94	383.73
07028900	MIDDLE FORK FORKED DEER RIVER NR SPRING CREEK, TN 35.810 88.617	3d - Coastal Plain East Gulf Coastal Plain	0.0643	1.66	503.20
07028930	TURKEY CREEK AT MEDINA, TN 35.807 88.802	3d - Coastal Plain East Gulf Coastal Plain	0.0506	1.68	477.94

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 4 - Continued				
07028940	TURKEY CREEK NEAR MEDINA, TN 35.794 88.810	3d - Coastal Plain East Gulf Coastal Plain	0.0466	1.65	467.06
07029000	MIDDLE FORK FORKED DEER RIVER NEAR ALAMO, TN 35.851 89.067	3d - Coastal Plain East Gulf Coastal Plain	0.0346	3.40	433.97
07029050	NASH CREEK NEAR TIGRETT, TN 35.961 89.285	3d - Coastal Plain East Gulf Coastal Plain	0.0393	2.22	325.75
07029090	LEWIS CREEK NEAR DYERSBURG, TN 36.054 89.362	3d - Coastal Plain East Gulf Coastal Plain	0.0563	1.95	371.39
07029100	NORTH FORK FORKED DEER RIVER AT DYERSBURG, TN 36.030 89.387	3d - Coastal Plain East Gulf Coastal Plain	0.0194	3.41	374.63
07029275	HATCHIE RIVER NEAR POCAHONTAS, TN 35.041 88.787	3d - Coastal Plain East Gulf Coastal Plain	0.0501	3.78	525.06
07029370	CYPRESS CREEK AT SELMER, TN 35.168 88.589	3d - Coastal Plain East Gulf Coastal Plain	0.0341	2.42	522.83
07029400	HATCHIE RIVER AT POCAHONTAS, TN 35.057 88.801	3d - Coastal Plain East Gulf Coastal Plain	0.0363	1.48	496.84
07029500	HATCHIE RIVER AT BOLIVAR, TN 35.275 88.977	3d - Coastal Plain East Gulf Coastal Plain	0.0350	1.76	486.40

Table B.1. Station name and location for 295 gaging stations located in Tennessee - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 4 - Continued				
07030000	HATCHIE RIVER NEAR STANTON, TN 35.523 89.349	3d - Coastal Plain East Gulf Coastal Plain	0.0322	2.93	466.60
07030050	HATCHIE RIVER AT RIALTO, TN 35.637 89.604	3d - Coastal Plain East Gulf Coastal Plain	0.0297	3.67	445.42
07030100	CANE CREEK AT RIPLEY, TN 35.756 89.551	3d - Coastal Plain East Gulf Coastal Plain	0.0525	1.22	391.53
07030240	LOOSAHATCHIE RIVER NEAR ARLINGTON, TN 35.310 89.640	3d - Coastal Plain East Gulf Coastal Plain	0.0206	3.15	385.30
07030270	CLEAR CREEK NEAR ARLINGTON, TN 35.272 89.705	3d - Coastal Plain East Gulf Coastal Plain	0.0195	3.38	344.24
07030280	LOOSAHATCHIE RIVER AT BRUNSWICK, TN 35.281 89.766	3d - Coastal Plain East Gulf Coastal Plain	0.0192	2.50	358.94
07030500	WOLF RIVER AT ROSSVILLE, TN 35.054 89.541	3d - Coastal Plain East Gulf Coastal Plain	0.0261	2.27	485.35
07031650	WOLF RIVER AT GERMANTOWN, TN 35.116 89.801	3d - Coastal Plain East Gulf Coastal Plain	0.0239	3.43	447.89
07031700	WOLF RIVER AT RALEIGH, TN 35.202 89.923	3d - Coastal Plain East Gulf Coastal Plain	0.0232	4.25	433.80
07032200	NONCONNAH CREEK NEAR GERMANTOWN, TN 35.050 89.819	3d - Coastal Plain East Gulf Coastal Plain	0.0138	2.92	360.39
07032224	JOHNS CREEK AT RAINES RD AT MEMPHIS, TN 35.035 89.886	3d - Coastal Plain East Gulf Coastal Plain	0.0178	1.29	354.41

Table B.2. Station name and location for 152 gaging stations located in adjacent states

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1				
02384500	CONASAUGA RIVER AT GA 286 NEAR ETON, GA 34.830 84.850	6a - Valley and Ridge province Tennessee section	0.1970	1.93	1374.01
02384540	MILL CREEK NEAR CRANDALL, GA 34.872 84.721	6a - Valley and Ridge province Tennessee section	0.3224	2.76	2173.61
02384600	PINHOOK CREEK NEAR ETON, GA 34.830 84.820	6a - Valley and Ridge province Tennessee section	0.0505	2.92	787.78
02385000	COAHULLA CREEK NEAR VARNELL, GA 34.900 84.920	6a - Valley and Ridge province Tennessee section	0.0716	3.98	860.49
02385500	MILL CREEK AT DALTON, GA 34.780 84.980	6a - Valley and Ridge province Tennessee section	0.1536	1.93	935.36
02385800	HOLLY CREEK NEAR CHATSWORTH, GA 34.720 84.770	6a - Valley and Ridge province Tennessee section	0.2535	2.64	1432.37
02387000	CONASAUGA RIVER AT TILTON, GA 34.670 84.930	6a - Valley and Ridge province Tennessee section	0.0891	1.71	1116.46
03160610	OLD FIELD CREEK NEAR WEST JEFFERSON, NC 36.370 81.530	5b - Blue Ridge province Southern section	0.2371	1.94	3677.71
03161000	SOUTH FORK NEW RIVER NEAR JEFFERSON, NC 36.400 81.420	5b - Blue Ridge province Southern section	0.2430	2.81	3363.17
03162110	BUFFALO CREEK AT WARRENSVILLE, NC 36.450 81.510	5b - Blue Ridge province Southern section	0.3176	1.53	3417.60

Table B.2. Station name and location for 152 gaging stations located in adjacent states - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1 - Continued				
03162500	NORTH FORK NEW RIVER AT CRUMPLER, NC 36.520 81.390	5b - Blue Ridge province Southern section	0.2283	1.65	3440.01
03452000	SANDYMUSH CREEK NEAR ALEXANDER, NC 35.730 82.670	5b - Blue Ridge province Southern section	0.2298	2.08	2653.75
03453000	IVY RIVER NEAR MARSHALL, NC 35.770 82.620	5b - Blue Ridge province Southern section	0.2526	1.64	2836.91
03453500	FRENCH BROAD RIVER AT MARSHALL, NC 35.790 82.660	5b - Blue Ridge province Southern section	0.1935	1.89	2671.11
03453880	BRUSH CREEK AT WALNUT, NC 35.840 82.740	5b - Blue Ridge province Southern section	0.2282	1.66	2298.98
03454000	BIG LAUREL CREEK NEAR STACKHOUSE, NC 35.920 82.760	5b - Blue Ridge province Southern section	0.2946	1.97	2967.71
03454500	FRENCH BROAD RIVER AT HOT SPRINGS, NC 35.890 82.820	5b - Blue Ridge province Southern section	0.2058	2.08	2675.19
03459000	JONATHAN CREEK NEAR COVE CREEK, NC 35.620 83.010	5b - Blue Ridge province Southern section	0.3758	2.67	3772.07
03459500	PIGEON RIVER NEAR HEPCO, NC 35.640 82.990	5b - Blue Ridge province Southern section	0.2867	1.62	3646.13
03460000	CATALOOCHEE CREEK NEAR CATALOOCHEE, NC 35.670 83.070	5b - Blue Ridge province Southern section	0.4234	1.77	3980.55
03461910	NORTH TOE RIVER AT NEWLAND, NC 36.080 81.930	5b - Blue Ridge province Southern section	0.2309	1.81	4037.05
03462000	NORTH TOE RIVER AT ALTAPASS, NC 35.900 82.030	5b - Blue Ridge province Southern section	0.2963	3.10	3643.24

Table B.2. Station name and location for 152 gaging stations located in adjacent states - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1 - Continued				
03463300	SOUTH TOE RIVER NEAR CELO, NC 35.830 82.180	5b - Blue Ridge province Southern section	0.3849	2.42	3905.48
03463500	SOUTH TOE RIVER AT NEWDALE, NC 35.910 82.190	5b - Blue Ridge province Southern section	0.3565	3.70	3659.25
03463910	PHIPPS CREEK NEAR BURNSVILLE, NC 35.910 82.370	5b - Blue Ridge province Southern section	0.2858	5.26	2997.60
03464000	CANE RIVER NEAR SIOUX, NC 36.010 82.330	5b - Blue Ridge province Southern section	0.3805	2.49	3517.28
03464500	NOLICHUCKY RIVER AT POPLAR, NC 36.070 82.340	5b - Blue Ridge province Southern section	0.2960	1.16	3354.05
03471500	S F HOLSTON RIVER AT RIVERSIDE, NEAR CHILHOWIE, VA 36.760 81.630	6a - Valley and Ridge province Tennessee section	0.2033	3.64	2991.11
03472500	BEAVERDAM CREEK AT DAMASCUS, VA 36.630 81.790	5b - Blue Ridge province Southern section	0.3092	3.55	3103.90
03473000	S F HOLSTON RIVER NEAR DAMASCUS, VA 36.650 81.840	6a - Valley and Ridge province Tennessee section	0.2055	2.83	2951.87
03473500	M F HOLSTON RIVER AT GROSECLOSE, VA 36.890 81.350	6a - Valley and Ridge province Tennessee section	0.1033	1.44	2744.04
03474000	M F HOLSTON RIVER AT SEVEN MILE FORD, VA 36.810 81.620	6a - Valley and Ridge province Tennessee section	0.1717	2.77	2604.67

Table B.2. Station name and location for 152 gaging stations located in adjacent states - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1 - Continued				
03474500	M F HOLSTON RIVER AT CHILHOWIE, VA 36.800 81.680	6a - Valley and Ridge province Tennessee section	0.1688	3.29	2554.20
03475000	M F HOLSTON RIVER NEAR MEADOWVIEW, VA 36.710 81.820	6a - Valley and Ridge province Tennessee section	0.1497	4.84	2445.79
03478400	BEAVER CREEK AT BRISTOL, VA 36.630 82.130	6a - Valley and Ridge province Tennessee section	0.1466	2.45	2061.56
03478910	COVE CREEK AT SHERWOOD, NC 36.260 81.780	5b - Blue Ridge province Southern section	0.3173	1.72	3412.17
03479000	WATAUGA RIVER NEAR SUGAR GROVE, NC 36.240 81.820	5b - Blue Ridge province Southern section	0.3010	1.11	3402.16
03481000	ELK RIVER NEAR ELK PARK, NC 36.180 81.960	5b - Blue Ridge province Southern section	0.2987	1.62	3859.06
03487800	LICK CREEK NEAR CHATHAM HILL, VA 36.960 81.470	6a - Valley and Ridge province Tennessee section	0.2496	5.39	2778.95
03488000	N F HOLSTON RIVER NEAR SALTVILLE, VA 36.900 81.750	6a - Valley and Ridge province Tennessee section	0.2157	3.77	2633.39
03488450	BRUMLEY CREEK AT BRUMLEY GAP, VA 36.792 82.019	6a - Valley and Ridge province Tennessee section	0.3173	1.64	3072.25
03488500	N F HOLSTON RIVER AT HOLSTON, VA 36.770 82.070	6a - Valley and Ridge province Tennessee section	0.2153	6.00	2541.06

Table B.2. Station name and location for 152 gaging stations located in adjacent states - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1 - Continued				
03489800	COVE CREEK NEAR SHELLEYS, VA 36.650 82.350	6a - Valley and Ridge province Tennessee section	0.2010	2.39	1836.30
03489900	BIG MOCCASIN CREEK NEAR GATE CITY, VA 36.650 82.550	6a - Valley and Ridge province Tennessee section	0.1906	9.68	2122.16
03490000	N F HOLSTON RIVER NEAR GATE CITY, VA 36.610 82.570	6a - Valley and Ridge province Tennessee section	0.2126	9.20	2284.57
03503000	LITTLE TENNESSEE RIVER AT NEEDMORE, NC 35.340 83.530	5b - Blue Ridge province Southern section	0.2521	2.21	2858.25
03504000	NANTAHALA RIVER NEAR RAINBOW SPRINGS, NC 35.130 83.620	5b - Blue Ridge province Southern section	0.3587	2.56	3977.08
03506500	NANTAHALA RIVER AT ALMOND, NC 35.380 83.570	5b - Blue Ridge province Southern section	0.3927	4.01	3530.17
03507000	LITTLE TENNESSEE RIVER AT JUDSON, NC 35.408 83.557	5b - Blue Ridge province Southern section	0.2664	2.00	3013.67
03511000	OCONALUFTEE RIVER AT CHEROKEE, NC 35.480 83.320	5b - Blue Ridge province Southern section	0.4674	1.78	3946.43
03512000	OCONALUFTEE RIVER AT BIRDTOWN, NC 35.460 83.350	5b - Blue Ridge province Southern section	0.4492	1.68	3764.30
03513000	TUCKASEGEE RIVER AT BRYSON CITY, NC 35.430 83.450	5b - Blue Ridge province Southern section	0.3393	1.71	3451.61
03513500	NOLAND CREEK NEAR BRYSON CITY, NC 35.480 83.504	5b - Blue Ridge province Southern section	0.4578	2.40	4063.71

Table B.2. Station name and location for 152 gaging stations located in adjacent states - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1 - Continued				
03514000	HAZEL CREEK AT PROCTOR, NC 35.480 83.720	5b - Blue Ridge province Southern section	0.4499	2.39	3576.88
03516000	SNOWBIRD CREEK NEAR ROBBINSVILLE, NC 35.310 83.860	5b - Blue Ridge province Southern section	0.3852	2.25	3297.78
03521500	CLINCH RIVER AT RICHLANDS, VA 37.090 81.780	6a - Valley and Ridge province Tennessee section	0.2056	3.19	2632.70
03523000	BIG CEDAR CREEK NEAR LEBANON, VA 36.910 82.040	6a - Valley and Ridge province Tennessee section	0.2664	1.86	2635.42
03524000	CLINCH RIVER AT CLEVELAND, VA 36.940 82.150	6a - Valley and Ridge province Tennessee section	0.2071	3.57	2498.67
03524500	GUEST RIVER AT COEBURN, VA 36.930 82.460	6a - Valley and Ridge province Tennessee section	0.1897	2.67	2516.55
03524900	STONY CREEK AT KA, VA 36.816 82.617	6a - Valley and Ridge province Tennessee section	0.2314	1.34	2868.12
03525000	STONY CREEK AT FORT BLACKMORE, VA 36.770 82.580	6a - Valley and Ridge province Tennessee section	0.2289	1.81	2574.38
03526000	COPPER CREEK NEAR GATE CITY, VA 36.670 82.570	6a - Valley and Ridge province Tennessee section	0.1679	6.27	2031.12

Table B.2. Station name and location for 152 gaging stations located in adjacent states - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1 - Continued				
03527000	CLINCH RIVER AT SPEERS FERRY, VA 36.650 82.750	6a - Valley and Ridge province Tennessee section	0.2068	6.01	2279.39
03529500	POWELL RIVER AT BIG STONE GAP, VA 36.870 82.780	6a - Valley and Ridge province Tennessee section	0.2770	1.34	2417.16
03530000	S F POWELL RIVER AT BIG STONE GAP, VA 36.860 82.770	6a - Valley and Ridge province Tennessee section	0.2283	1.60	2406.83
03530500	N F POWELL RIVER AT PENNINGTON GAP, VA 36.770 83.030	6a - Valley and Ridge province Tennessee section	0.2333	1.99	2129.39
03531000	POWELL RIVER NEAR PENNINGTON GAP, VA 36.734 82.999	6a - Valley and Ridge province Tennessee section	0.2470	2.44	2200.68
03531500	POWELL RIVER NEAR JONESVILLE, VA 36.660 83.090	6a - Valley and Ridge province Tennessee section	0.2390	3.55	2147.71
03544947	BRIER CREEK NEAR HIAWASSEE, GA 34.847 83.709	5b - Blue Ridge province Southern section	0.4393	3.17	2935.54
03545000	HIWASSEE RIVER AT PRESLEY, GA 34.900 83.720	5b - Blue Ridge province Southern section	0.3596	1.40	2804.77
03546000	SHOOTING CREEK NEAR HAYESVILLE, NC 35.020 83.710	5b - Blue Ridge province Southern section	0.3545	1.61	2881.01
03548500	HIWASSEE RIVER ABOVE MURPHY, NC 35.080 84.000	5b - Blue Ridge province Southern section	0.2085	1.77	2461.34
03550000	VALLEY RIVER AT TOMOTLA, NC 35.140 83.980	5b - Blue Ridge province Southern section	0.2690	2.90	2530.16

Table B.2. Station name and location for 152 gaging stations located in adjacent states - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1 - Continued				
03550500	NOTTELY RIVER NEAR BLAIRSVILLE, GA 34.840 83.940	5b - Blue Ridge province Southern section	0.2373	1.28	2486.47
03554000	NOTTELY RIVER NEAR RANGER, NC 35.030 84.120	5b - Blue Ridge province Southern section	0.1421	2.54	2146.76
03558000	TOCCOA RIVER NEAR DIAL, GA 34.790 84.240	5b - Blue Ridge province Southern section	0.1872	1.73	2572.22
03559000	TOCCOA RIVER NEAR BLUE RIDGE, GA 34.890 84.290	5b - Blue Ridge province Southern section	0.1776	2.12	2452.05
03560000	FIGHTINGTOWN CREEK AT MCCAYSVILLE, GA 34.980 84.390	5b - Blue Ridge province Southern section	0.2256	2.43	2079.50
03566660	SUGAR CREEK NEAR RINGGOLD, GA 34.970 85.020	6a - Valley and Ridge province Tennessee section	0.0642	2.35	917.24
03566685	LITTLE CHICKAMAUGA CREEK NEAR RINGGOLD, GA 34.840 85.140	6a - Valley and Ridge province Tennessee section	0.0875	3.09	942.07
03566687	LITTLE CHICKAMAUGA CREEK TRIB NEAR RINGGOLD, GA 34.860 85.140	6a - Valley and Ridge province Tennessee section	0.0896	2.01	925.37
03566700	SOUTH CHICKAMAUGA CREEK AT RINGGOLD, GA 34.920 85.130	6a - Valley and Ridge province Tennessee section	0.1031	1.46	933.44
03567200	WEST CHICKAMAUGA CREEK NEAR KENSINGTON, GA 34.800 85.350	8f - Appalachian Plateaus province Cumberland Plateau section	0.1202	3.19	1162.42

Table B.2. Station name and location for 152 gaging stations located in adjacent states - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 1 - Continued				
03568933	LOOKOUT CREEK NEAR NEW ENGLAND, GA 34.898 85.463	8f - Appalachian Plateaus province Cumberland Plateau section	0.1200	3.88	1241.50
03572110	CROW CREEK AT BASS, AL 34.934 85.918	8f - Appalachian Plateaus province Cumberland Plateau section	0.1625	2.72	1366.17
03572900	TOWN CREEK NEAR GERALDINE, AL 34.378 85.990	8f - Appalachian Plateaus province Cumberland Plateau section	0.0338	7.87	1321.89
	Hydrologic Area 2				
03312500	BARREN RIVER NEAR PAGEVILLE, KY 36.852 86.077	11a - Interior Low Plateaus Highland Rim section	0.0531	1.79	833.23
03312795	LITTLE BEAVER CREEK NEAR GLASGOW, KY 37.010 86.017	11a - Interior Low Plateaus Highland Rim section	0.0262	0.86	732.2
03313000	BARREN RIVER NEAR FINNEY, KY 36.895 86.134	11a - Interior Low Plateaus Highland Rim section	0.0498	1.30	810.71
03313500	WEST BAYS FORK AT SCOTTSVILLE, KY 36.748 86.196	11a - Interior Low Plateaus Highland Rim section	0.0422	2.46	784.89
03313700	WEST FORK DRAKES CREEK NEAR FRANKLIN, KY 36.719 86.546	11a - Interior Low Plateaus Highland Rim section	0.0332	3.05	779.51
03313800	LICK CREEK NEAR FRANKLIN, KY 36.790 86.490	11a - Interior Low Plateaus Highland Rim section	0.0224	2.50	685.07
03314000	DRAKES CREEK NEAR ALVATON, KY 36.895 86.381	11a - Interior Low Plateaus Highland Rim section	0.0399	1.90	728.86

Table B.2. Station name and location for 152 gaging stations located in adjacent states - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 2 - Continued				
03314500	BARREN RIVER AT BOWLING GREEN, KY 37.001 86.431	11a - Interior Low Plateaus Highland Rim section	0.0438	1.51	748.06
03316000	MUD RIVER NEAR LEWISBURG, KY 37.004 86.907	11a - Interior Low Plateaus Highland Rim section	0.0496	2.21	594.16
03400500	POOR FORK AT CUMBERLAND, KY 36.974 82.933	8g - Appalachian Plateaus province Cumberland Mountain section	0.3021	3.77	2386.40
03400700	CLOVER FORK AT EVARTS, KY 36.866 83.194	8g - Appalachian Plateaus province Cumberland Mountain section	0.3951	4.07	2527.72
03401000	CUMBERLAND RIVER NEAR HARLAN, KY 36.847 83.356	8g - Appalachian Plateaus province Cumberland Mountain section	0.3326	4.16	2224.44
03401500	YELLOW CREEK BYPASS AT MIDDLESBORO, KY 36.631 83.729	8g - Appalachian Plateaus province Cumberland Mountain section	0.3144	1.99	2074.39
03402000	YELLOW CREEK NEAR MIDDLESBORO, KY 36.668 83.689	8g - Appalachian Plateaus province Cumberland Mountain section	0.2699	2.19	1842.41
03402020	SHILLALAH CREEK NEAR PAGE, KY 36.665 83.590	8g - Appalachian Plateaus province Cumberland Mountain section	0.2925	1.99	2084.40
03403910	CLEAR FORK AT SAXTON, KY 36.634 84.112	8g - Appalachian Plateaus province Cumberland Mountain section	0.2039	1.19	1641.50

Table B.2. Station name and location for 152 gaging stations located in adjacent states - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 2 - Continued				
03404900	LYNN CAMP CREEK AT CORBIN, KY 36.951 84.094	8f - Appalachian Plateaus province Cumberland Plateau section	0.0869	1.09	1207.79
03405000	LAUREL RIVER AT CORBIN, KY 36.969 84.127	8f - Appalachian Plateaus province Cumberland Plateau section	0.0626	1.41	1199.50
03406000	WOOD CREEK NEAR LONDON, KY 37.161 84.112	8f - Appalachian Plateaus province Cumberland Plateau section	0.0532	1.19	1230.64
03410500	SOUTH FORK CUMBERLAND RIVER NEAR STEARNS, KY 36.627 84.533	8f - Appalachian Plateaus province Cumberland Plateau section	0.1462	1.75	1620.90
03411000	SOUTH FORK CUMBERLAND RIVER AT NEVELSVILLE, KY 36.840 84.583	8f - Appalachian Plateaus province Cumberland Plateau section	0.1461	2.19	1516.01
03413200	BEAVER CREEK NEAR MONTICELLO, KY 36.797 84.896	11a - Interior Low Plateaus Highland Rim section	0.1541	2.58	1205.17
03414102	BEAR CREEK NEAR BURKSVILLE, KY 36.771 85.275	11a - Interior Low Plateaus Highland Rim section	0.1217	1.80	890.12
03435140	WHIPPOORWILL CREEK NEAR CLAYMOUR, KY 36.875 87.089	11a - Interior Low Plateaus Highland Rim section	0.0357	1.41	718.96
03437490	SOUTH FK LITTLE RIVER TR NR HOPINSVILLE, KY 36.858 87.428	11a - Interior Low Plateaus Highland Rim section	0.0412	3.46	618.42
03437500	SOUTH FORK LITTLE RIVER AT HOPKINSVILLE, KY 36.839 87.481	11a - Interior Low Plateaus Highland Rim section	0.0406	2.79	615.41

Table B.2. Station name and location for 152 gaging stations located in adjacent states - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 2 - Continued				
03438000	LITTLE RIVER NEAR CADIZ, KY 36.778 87.722	11a - Interior Low Plateaus Highland Rim section	0.0390	2.66	577.66
03573000	SHORT CREEK NEAR ALBERTVILLE, AL 34.301 86.181	8f - Appalachian Plateaus province Cumberland Plateau section	0.0262	2.07	1061.10
03574500	PAINT ROCK RIVER NEAR WOODVILLE, AL 34.624 86.306	8f - Appalachian Plateaus province Cumberland Plateau section	0.1684	3.95	1231.35
03575000	FLINT RIVER NEAR CHASE, AL 34.819 86.481	11a - Interior Low Plateaus Highland Rim section	0.0324	1.23	868.97
03575700	ALDRIDGE CREEK NEAR FARLEY, AL 34.624 86.541	11a - Interior Low Plateaus Highland Rim section	0.1270	3.01	820.47
03575830	INDIAN CREEK NEAR MADISON, AL 34.697 86.700	11a - Interior Low Plateaus Highland Rim section	0.0478	3.50	788.60
03576148	COTACO CREEK AT FLORETTE, AL 34.414 86.688	8f - Appalachian Plateaus province Cumberland Plateau section	0.1104	1.26	915.59
03576250	LIMESTONE CREEK NEAR ATHENS, AL 34.752 86.823	11a - Interior Low Plateaus Highland Rim section	0.0304	3.31	826.39
03576400	PINEY CREEK NEAR ATHENS, AL 34.803 86.883	11a - Interior Low Plateaus Highland Rim section	0.0262	4.25	813.51
03576500	FLINT CREEK NEAR FALKVILLE, AL 34.373 86.934	8f - Appalachian Plateaus province Cumberland Plateau section	0.1024	1.33	870.50

Table B.2. Station name and location for 152 gaging stations located in adjacent states - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 2 - Continued				
03577000	WEST FLINT CREEK NEAR OAKVILLE, AL 34.476 87.142	11a - Interior Low Plateaus Highland Rim section	0.0399	1.59	704.05
03586500	BIG NANCE CREEK AT COURTLAND, AL 34.670 87.317	11a - Interior Low Plateaus Highland Rim section	0.0277	1.99	659.11
03590000	CYPRESS CREEK NEAR FLORENCE, AL 34.808 87.700	11a - Interior Low Plateaus Highland Rim section	0.0306	2.26	706.34
03591800	BEAR CREEK NEAR HACKLEBURG, AL 34.284 87.774	3d - Coastal Plain East Gulf Coastal Plain	0.0507	2.26	912.30
03592000	BEAR CREEK NEAR RED BAY, AL 34.444 88.115	3d - Coastal Plain East Gulf Coastal Plain	0.0561	4.63	842.49
03592200	CEDAR CREEK NEAR PLEASANT SITE, AL 34.549 88.019	3d - Coastal Plain East Gulf Coastal Plain	0.0636	3.45	759.33
03592300	LITTLE BEAR CREEK NEAR HALLTOWN, AL 34.489 88.035	3d - Coastal Plain East Gulf Coastal Plain	0.0649	5.77	792.63
03592500	BEAR CREEK AT BISHOP, AL 34.656 88.122	3d - Coastal Plain East Gulf Coastal Plain	0.0570	2.70	760.50
03592718	LITTLE YELLOW CREEK EAST NR BURNSVILLE, MS 34.834 88.285	3d - Coastal Plain East Gulf Coastal Plain	0.0360	1.66	532.07
03592800	YELLOW CREEK NR DOSKIE, MS 34.900 88.290	3d - Coastal Plain East Gulf Coastal Plain	0.0407	1.57	529.05
03593010	CHAMBERS CREEK OPPOSITE KENDRICK, MS 34.980 88.380	3d - Coastal Plain East Gulf Coastal Plain	0.0238	2.67	476.94

Table B.2. Station name and location for 152 gaging stations located in adjacent states - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
	Hydrologic Area 3				
03585300	SUGAR CREEK NEAR GOOD SPRINGS, AL 34.944 87.156	11a - Interior Low Plateaus Highland Rim section	0.0481	2.80	837.58
	Hydrologic Area 4				
03610000	CLARKS RIVER AT MURRAY, KY 36.593 88.300	3d - Coastal Plain East Gulf Coastal Plain	0.0178	1.64	554.85
03610200	CLARKS RIVER AT ALMO, KY 36.692 88.274	3d - Coastal Plain East Gulf Coastal Plain	0.0207	2.69	540.84
03610500	CLARKS RIVER NEAR BENTON, KY 36.873 88.347	3d - Coastal Plain East Gulf Coastal Plain	0.0293	4.32	514.47
03610545	WEST FORK CLARKS RIVER NEAR BREWERS, KY 36.780 88.467	3d - Coastal Plain East Gulf Coastal Plain	0.0474	2.46	511.98
07022500	PERRY CREEK NEAR MAYFIELD, KY 36.679 88.632	3d - Coastal Plain East Gulf Coastal Plain	0.0232	2.35	520.79
07023000	MAYFIELD CREEK AT LOVELACEVILLE, KY 36.952 88.825	3d - Coastal Plain East Gulf Coastal Plain	0.0170	5.34	472.36
07023500	OBION CREEK AT PRYORSBURG, KY 36.686 88.726	3d - Coastal Plain East Gulf Coastal Plain	0.0208	3.36	498.74
07024000	BAYOU DE CHIEN NEAR CLINTON, KY 36.629 88.964	3d - Coastal Plain East Gulf Coastal Plain	0.0231	3.41	419.39
07029252	POOL BR NR RIPLEY, MS 34.712 88.788	3d - Coastal Plain East Gulf Coastal Plain	0.0631	2.64	577.18

Table B.2. Station name and location for 152 gaging stations located in adjacent states - Continued

Station number	Station name; latitude and longitude, in decimal degrees (NAD83)	Physiographic regions	Basin slope (ft/ft)	Basin shape factor (mi^2/mi^2)	Mean basin elevation (ft)
		Hydrologic Area 4 - Continued			
07029270	HATCHIE RIVER NR WALNUT, MS 34.944 88.786	3d - Coastal Plain East Gulf Coastal Plain	0.0495	2.76	531.39
07029300	TUSCUMBIA RIVER CANAL NR CORINTH, MS 34.931 88.598	3d - Coastal Plain East Gulf Coastal Plain	0.0241	1.53	484.11
07029412	HURRICANE CREEK NEAR WALNUT, MS 34.925 88.904	3d - Coastal Plain East Gulf Coastal Plain	0.0416	1.96	534.00
07030365	WESLEY BR NR WALNUT, MS 34.950 89.090	3d - Coastal Plain East Gulf Coastal Plain	0.0390	1.65	593.08
07269000	NORTH TIPPAH CREEK NR RIPLEY, MS 34.733 89.025	3d - Coastal Plain East Gulf Coastal Plain	0.0446	1.85	516.13
07269990	TIPPAH CREEK NEAR POTTS CAMP, MS 34.597 89.350	3d - Coastal Plain East Gulf Coastal Plain	0.0407	1.90	465.65
07276000	COLDWATER RIVER NR LEWISBURG, MS 34.841 89.827	3d - Coastal Plain East Gulf Coastal Plain	0.0237	4.05	430.87
07277500	COLDWATER RIVER NR COLDWATER, MS 34.721 89.989	3d - Coastal Plain East Gulf Coastal Plain	0.0228	2.49	391.34
07277730	SENATOBIA CREEK NR SENATOBIA, MS 34.617 89.942	3d - Coastal Plain East Gulf Coastal Plain	0.0198	2.49	350.44

Table B.3. Selected basin characteristics for 295 gaging stations located in Tennessee

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
Hydrologic Area 1												
02384900	16351.84	55.00	31	4.35	4.84	11.26	828.21		17.0	77.1	5.5	0.4
03418500	59784.93	59.57	19	111.00	111.46	0.41		1512.30	1.4	96.8	1.1	0.6
03455000	354452.66	49.38	91	1858.00	1858.79	0.04	1011.12		2.5	96.3	0.6	0.5
03461000	202819.74	51.69	23	547.00	544.67	0.43	1245.28		1.4	97.9	0.4	0.3
03461200	22190.85	54.65	29	10.20	10.27	0.69	1643.70		0.0	100.0	0.0	0.0
03461500	255375.31	51.53	85	666.00	662.84	0.47	1038.26		1.4	97.9	0.3	0.3
03465000	22396.94	50.71	39	15.90	16.21	1.95	2209.34		0.0	99.5	0.4	0.0
03465500	183746.52	48.67	86	805.00	804.17	0.10	1518.83		1.9	97.7	0.2	0.3
03466228	43433.41	45.00	23	13.70	13.50	1.46	1458.94		0.6	96.0	3.3	0.1
03466500	294617.84	48.51	40	1184.00	1183.80	0.02	1173.04		1.4	97.4	0.7	0.3
03466890	108494.01	45.02	22	172.00	171.68	0.19		1101.85	1.5	96.7	1.4	0.2
03467000	147491.18	45.02	30	220.00	220.52	0.24	1060.05		1.7	96.0	1.8	0.4
03467480	13867.81	45.00	21	2.18	2.41	10.55	1079.50		0.1	99.9	0.0	0.0
03467500	383994.42	48.51	61	1679.00	1683.58	0.27	1015.25		1.5	97.0	1.1	0.3
03467993	12167.80	45.68	21	2.01	2.01	0.00	1199.55		0.4	99.5	0.0	0.0
03467998	21859.78	45.68	21	6.38	6.05	5.17	1139.53		5.2	94.4	0.0	0.2
03469000	500011.38	51.65	25	4543.00	4540.96	0.04	865.17		1.9	96.0	0.8	1.1
03469010	17705.58	45.00	17	4.20	4.15	1.19	799.49		0.1	99.5	0.0	0.1
03469110	15468.37	55.03	19	2.18	2.03	6.88		1516.76	0.0	100.0	0.0	0.0
03469130	96133.38	53.84	29	110.00	108.81	1.08	927.75		0.3	99.6	0.0	0.0
03469160	84162.15	53.80	29	64.10	64.03	0.11	928.73		0.2	99.6	0.0	0.2
03469175	103369.57	53.84	18	184.00	183.43	0.31		900.20	0.6	99.3	0.0	0.1
03469200	112557.58	53.84	14	201.00	200.74	0.13	884.52		1.6	98.2	0.1	0.1

Table B.3. Selected basin characteristics for 295 gaging stations located in Tennessee - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
Hydrologic Area 1 – Continued												
03469500	85640.15	53.84	32	76.20	76.53	0.43	964.81		2.6	97.3	0.0	0.0
03470000	117019.72	53.86	63	353.00	343.31	2.75	878.99		2.4	97.3	0.1	0.1
03470215	17670.66	47.00	21	3.65	4.37	19.73	1199.54		0.1	98.2	1.5	0.1
03477000	322562.03	45.69	50	813.00	808.70	0.53	1367.84		1.6	96.5	0.4	1.5
03479500	87108.43	48.68	13	152.00	152.40	0.26	2060.23		0.7	98.8	0.1	0.1
03480000	98957.22	48.68	15	171.00	171.64	0.37	1872.17		0.6	98.8	0.1	0.2
03482000	75304.86	48.69	40	102.00	101.66	0.33	2102.83		0.8	98.5	0.5	0.0
03482500	107641.75	48.69	14	166.00	165.35	0.39	1826.43		0.6	97.8	0.3	1.0
03483000	115267.73	48.70	29	427.00	426.73	0.06	1809.02		0.6	97.9	0.2	1.0
03485500	97569.95	49.56	66	137.00	137.15	0.11	1524.25		1.4	98.1	0.0	0.2
03486000	171311.01	48.55	22	692.00	692.23	0.03	1485.75		0.9	97.3	0.2	1.4
03486225	22743.38	46.55	12	3.48	5.04	44.83		1474.60	1.7	98.0	0.2	0.0
03487500	391403.71	47.01	23	1935.00	1930.26	0.24	1175.35		3.5	94.6	0.3	1.4
03487550	57482.92	45.56	42	36.30	35.63	1.85	1232.18		1.7	97.8	0.3	0.1
03490522	8058.06	47.00	21	1.38	1.53	10.87	1339.46		0.4	98.5	1.0	0.0
03491000	69931.27	46.55	60	47.30	48.26	2.03	1128.39		1.5	97.9	0.4	0.0
03491200	10753.11	45.00	31	2.00	1.86	7.00		1133.16	13.9	85.4	0.0	0.0
03491300	62316.92	45.03	22	47.00	46.93	0.15	1107.34		0.0	99.5	0.4	0.1
03491500	567821.45	47.02	41	3035.00	3028.47	0.22	1054.30		3.0	95.3	0.4	1.2
03491540	29699.26	45.00	21	14.60	14.44	1.10	1099.47		0.1	98.9	0.6	0.4
03491544	22609.79	45.00	16	4.67	4.62	1.07		1103.04	30.8	67.4	0.0	0.0
03495500	843638.50	47.61	10	3747.00	3745.11	0.05	815.39		3.4	93.9	0.4	2.0
03496000	34916.92	52.42	18	11.90	15.81	32.86	940.45		29.5	69.7	0.0	0.7

Table B.3. Selected basin characteristics for 295 gaging stations located in Tennessee - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
						Hydrologic Area 1 – Continued						
03497000	864355.98	49.68	53	8934.00	8895.67	0.43	796.92		2.7	95.1	0.6	1.4
03497300	76903.28	56.04	43	106.00	105.47	0.50	1106.61		0.0	99.9	0.0	0.1
03498000	128544.23	54.73	21	192.00	189.77	1.16	876.96		0.2	99.6	0.0	0.2
03498500	142275.89	54.56	56	269.00	267.85	0.43	849.58		0.5	98.8	0.4	0.3
03498700	6096.92	51.00	31	0.36	0.35	2.78		1037.84	14.7	85.3	0.0	0.0
03518400	21401.36	75.90	10	7.04	7.14	1.42		1788.14	0.0	100.0	0.0	0.0
03518500	92974.96	58.09	62	118.00	117.54	0.39	846.40		0.0	99.9	0.0	0.0
03519500	406189.26	56.33	40	2443.00	2441.88	0.05	759.81		0.5	97.5	0.3	1.7
03519600	39192.68	54.20	23	11.20	11.82	5.54		812.99	5.3	83.8	8.0	2.8
03519610	11663.20	51.00	35	2.10	2.18	3.81		932.03	12.1	87.4	0.4	0.0
03519640	31446.72	52.42	33	16.00	16.00	0.00	844.63		3.4	94.3	1.0	1.2
03519700	63749.39	54.95	23	30.70	29.88	2.67		813.73	3.4	86.5	7.8	2.3
03520100	89275.49	54.96	29	62.20	61.23	1.56	736.70		3.9	82.3	13.1	0.6
03527800	37429.09	49.00	21	22.30	22.37	0.31	1239.53		1.5	98.3	0.0	0.0
03528000	642438.45	46.75	87	1474.00	1478.64	0.31	1060.24		2.9	96.3	0.1	0.2
03528100	33227.61	51.00	10	5.49	5.56	1.28	1346.62		0.3	99.7	0.0	0.0
03528300	40137.80	51.03	10	13.25	20.45	54.34	1038.90		6.7	92.0	0.0	0.0
03528390	11530.27	53.00	21	2.23	3.30	47.98	1099.68		1.8	98.1	0.0	0.0
03528400	10173.82	53.00	36	2.68	2.65	1.12	1081.24		0.1	99.2	0.0	0.7
03532000	332914.03	51.87	88	685.00	685.42	0.06	1043.38		2.6	94.5	0.1	0.2
03533000	853173.87	50.91	34	2913.00	2912.87	0.00	818.69		3.0	93.9	0.1	2.0
03534000	36172.83	55.87	52	24.50	24.58	0.33	842.51		1.3	98.3	0.0	0.2
03534500	25118.35	55.00	31	7.82	9.34	19.44	901.28		5.0	92.6	0.5	1.4

Table B.3. Selected basin characteristics for 295 gaging stations located in Tennessee - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
Hydrologic Area 1 – Continued												
03535000	107445.55	53.56	35	68.50	68.56	0.09	854.50		3.9	95.0	0.0	0.5
03535140	9464.27	52.42	12	1.23	1.48	20.33	1076.06		14.7	84.3	0.0	0.0
03535180	18382.57	53.00	40	3.23	3.23	0.00	1027.46		2.5	97.1	0.0	0.2
03536450	3767.04	55.00	10	0.33	0.24	27.27	772.39		10.7	89.3	0.0	0.0
03536550	14605.15	55.00	12	3.28	3.11	5.18	765.96		19.6	76.1	0.0	1.8
03537000	16533.30	55.00	10	3.62	3.42	5.52	749.98		19.6	76.1	0.2	1.9
03537100	4542.03	55.00	11	0.52	0.59	13.46	783.67		1.8	86.9	0.0	11.3
03538130	16119.07	55.00	24	5.55	6.74	21.44		751.28	3.0	95.4	0.0	1.3
03538200	59429.87	55.87	32	55.90	56.15	0.45	757.76		2.8	95.3	0.1	1.6
03538215	23298.84	55.86	11	18.40	18.70	1.63		778.94	4.1	94.2	0.0	1.5
03538225	73532.88	55.87	29	82.50	82.16	0.41	743.06		3.9	94.0	0.1	1.9
03538250	40695.66	55.00	29	19.50	17.5	10.26	753.74		23.6	73.1	0.0	3.2
03538270	24821.01	55.00	16	4.34	4.00	7.83		836.51	13.1	82.0	0.0	3.9
03538275	29563.24	55.00	18	7.15	7.52	5.17	753.51		9.0	84.2	0.2	6.0
03538300	14263.37	55.76	17	5.54	5.56	0.36		1260.29	1.6	98.3	0.0	0.0
03538500	54433.38	55.88	49	83.20	82.98	0.26	1002.69		0.6	99.1	0.1	0.2
03538600	25326.99	58.94	35	12.00	12.47	3.92		1723.73	16.7	79.2	0.4	3.3
03538800	7794.78	57.00	16	0.72	0.73	1.39		1740.93	1.3	93.3	3.7	0.0
03538900	14932.88	59.53	18	3.80	3.76	1.05		1767.53	1.5	95.5	0.0	2.1
03539500	86082.86	60.15	28	93.50	94.10	0.64	1568.91		4.1	93.5	0.1	1.3
03539600	124079.09	60.15	19	139.00	144.39	3.88	1444.79		4.2	93.3	0.1	1.3
03539800	176287.75	56.28	34	518.00	519.06	0.20	891.54		3.6	94.5	0.3	0.8
03540500	188796.42	56.37	79	764.00	748.33	2.05	761.01		2.8	95.7	0.2	0.7

Table B.3. Selected basin characteristics for 295 gaging stations located in Tennessee - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
						Hydrologic Area 1 – Continued						
03541100	14905.27	57.03	19	5.53	5.53	0.00	876.03		1.8	97.8	0.0	0.3
03541500	65096.57	60.10	48	108.00	122.61	13.53	758.31		1.1	97.4	0.0	0.2
03542500	68325.76	57.58	32	95.90	96.09	0.20	749.36		1.2	97.6	0.6	0.3
03543200	49789.53	55.76	17	26.40	26.18	0.83		757.10	0.4	96.0	2.9	0.5
03543500	71387.41	55.76	60	117.00	114.94	1.76	694.06		0.5	95.3	3.7	0.5
03544500	54564.19	59.93	54	50.20	50.17	0.06	728.35		1.5	93.0	4.7	0.6
03556000	34626.27	61.52	37	26.90	27.51	2.27	1490.47		0.1	99.5	0.0	0.4
03557000	300426.37	60.59	33	1223.00	1225.26	0.18	718.13		0.5	97.0	0.2	2.1
03559500	163260.03	66.10	12	352.00	351.36	0.18	1445.18		0.6	97.8	0.1	1.4
03560500	18838.54	62.68	36	5.16	4.87	5.62	1450.95		0.6	97.5	0.6	1.0
03561000	31268.84	63.09	36	13.00	13.19	1.46	1492.40		1.0	96.6	1.4	0.6
03561500	175946.46	66.56	13	447.00	446.78	0.05	1427.06		0.6	97.9	0.1	1.2
03563000	223700.38	65.71	19	524.00	522.28	0.33	837.76		0.6	98.0	0.1	1.2
03565040	39534.10	55.76	13	14.80	14.71	0.61	835.26		3.0	85.6	10.6	0.3
03565080	22943.72	57.00	10	8.24	8.16	0.97	871.13		0.4	97.9	1.6	0.0
03565120	65667.57	55.76	18	37.80	37.97	0.45	778.24		2.1	91.8	5.7	0.2
03565160	54184.84	57.01	16	32.70	32.64	0.18	775.42		0.9	89.0	9.9	0.2
03565250	114161.80	55.77	18	114.00	113.74	0.23	722.79		1.2	91.7	6.2	0.6
03565300	38398.51	54.99	30	31.80	31.76	0.13	712.01		2.1	95.8	1.2	0.7
03565500	106851.70	57.01	43	57.00	57.72	1.26	716.36		3.5	90.0	6.3	0.2
03566000	374493.47	58.00	25	2298.00	2309.62	0.51	665.43		0.8	96.3	1.0	1.7
03566200	19594.82	55.76	31	9.68	9.61	0.72		776.09	2.4	94.9	1.9	0.7
03566420	29402.55	55.00	45	18.80	19.13	1.76	754.96		5.2	92.9	0.9	0.9

Table B.3. Selected basin characteristics for 295 gaging stations located in Tennessee - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
Hydrologic Area 1 – Continued												
03567500	167797.17	55.21	64	428.00	425.72	0.53	644.06		7.1	90.4	1.5	0.9
03568000	1382466.06	50.93	63	21400.00	21360.07	0.19	620.99		3.7	92.3	0.9	2.6
03570800	36397.64	60.24	28	15.40	15.45	0.32		801.07	1.2	98.3	0.1	0.1
03571000	272245.02	60.55	79	384.00	388.63	1.21	632.61		1.3	95.4	2.6	0.5
03571500	87757.25	60.53	26	116.00	115.38	0.53	619.94		0.4	98.9	0.4	0.3
03571600	7632.32	60.12	24	0.67	0.56	16.42		661.14	2.9	96.1	1.0	0.0
03571800	46631.55	62.21	50	50.40	50.26	0.28	621.52		2.3	95.8	0.5	1.1
Hydrologic Area 2												
03313600	8519.82	53.00	19	0.95	1.00	5.26		693.58	0.0	96.0	4.0	0.0
03407908	92182.58	55.90	10	198.00	197.94	0.03		1164.99	0.2	99.4	0.0	0.2
03408000	119460.86	55.90	12	314.00	312.98	0.32	1095.41		0.5	98.8	0.0	0.4
03408500	124406.84	55.90	71	382.00	380.39	0.42	1091.98		0.7	98.5	0.0	0.5
03409000	24564.22	55.78	22	13.50	12.42	8.00	1293.69		1.5	98.2	0.0	0.0
03409500	136705.94	56.01	72	272.00	271.90	0.04	1081.02		2.1	97.0	0.1	0.2
03414500	147297.20	55.99	64	196.00	202.00	3.06	679.92		1.6	96.6	0.3	0.5
03415000	95745.98	55.99	36	81.00	106.69	31.72	683.97		0.9	93.5	5.2	0.1
03415500	179109.25	55.16	24	445.00	435.98	2.03	576.71		1.4	93.7	3.5	0.9
03415700	21965.13	55.00	24	4.77	5.59	17.19		883.67	2.9	72.9	23.7	0.0
03416000	77439.26	54.95	63	106.00	106.40	0.38	707.14		0.7	97.0	2.0	0.1
03417700	4076.42	55.00	31	0.49	0.45	8.16		927.11	3.3	60.0	36.7	0.0
03418000	52883.01	55.76	43	51.60	75.65	46.61		740.06	5.4	70.6	23.7	0.2

Table B.3. Selected basin characteristics for 295 gaging stations located in Tennessee - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
Hydrologic Area 2 – Continued												
03418070	89932.48	55.96	28	176.00	211.88	20.39	519.99		4.5	74.8	20.1	0.4
03420000	109174.76	57.35	31	111.00	172.45	55.36	811.82		3.6	90.8	5.1	0.3
03420360	8893.52	57.11	26	2.28	2.19	3.95		1048.33	0.3	64.6	29.5	5.6
03420500	71831.72	55.83	51	126.00	125.76	0.19	925.56		0.5	73.1	22.5	3.9
03420600	17593.00	55.76	35	4.60	4.42	3.91		999.49	0.0	83.2	13.5	3.3
03421000	150219.77	56.33	81	640.00	640.42	0.07	825.68		1.4	87.6	9.0	1.8
03421100	5002.21	55.00	22	0.47	0.44	6.38		955.46	74.4	25.6	0.0	0.0
03421200	65197.65	55.76	52	31.10	31.28	0.58		853.78	0.8	85.9	12.0	1.3
03423000	78672.16	57.35	26	45.90	63.15	37.58	893.24		18.8	68.2	12.4	0.2
03431800	84698.74	52.42	44	97.20	95.69	1.55	399.80		0.9	95.9	3.0	0.1
03434500	225441.11	54.20	81	681.00	683.39	0.35	446.96		5.1	91.7	2.9	0.3
03434590	26539.35	55.00	27	13.30	13.23	0.53		596.29	12.4	85.4	0.3	0.3
03435030	32956.23	53.00	20	15.10	15.18	0.53	680.48		0.2	96.3	3.3	0.2
03435500	177489.75	51.73	49	309.00	694.15	124.64	398.10		0.6	47.7	51.5	0.2
03435770	63343.13	51.00	31	56.60	65.60	15.90	538.02		1.4	88.2	10.2	0.1
03435930	6259.69	51.00	20	1.28	1.02	20.31		647.88	0.0	86.0	12.8	1.1
03436000	119356.36	51.00	53	165.00	186.59	13.08	424.10		2.6	88.1	9.0	0.2
03436100	192451.47	51.73	45	935.00	923.41	1.24	375.97		1.0	57.2	41.5	0.2
03436690	85462.07	54.20	23	103.00	102.86	0.14		423.44	0.1	98.2	1.5	0.1
03436700	97628.66	54.20	49	124.00	123.45	0.44	389.99		0.1	97.9	1.8	0.2
03574700	10815.04	57.00	20	2.18	2.07	5.05		938.00	0.5	44.9	49.7	5.0
03578000	58053.24	57.79	42	65.60	63.86	2.65	981.63		0.3	94.7	3.9	1.0
03578500	50253.58	57.55	35	41.30	38.07	7.82	968.15		1.9	71.7	24.2	2.3

Table B.3. Selected basin characteristics for 295 gaging stations located in Tennessee - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
					Hydrologic Area 2 – Continued							
03579100	116126.44	57.85	31	275.00	261.12	5.05	886.49		1.2	77.2	16.7	4.7
03579800	18784.92	57.79	24	4.30	4.10	4.65		970.18	0.0	91.4	8.5	0.1
03579900	30949.54	57.79	24	17.00	16.22	4.59		945.96	0.8	92.3	6.4	0.4
03587200	5070.83	59.00	29	0.49	0.37	24.49		845.91	2.6	97.4	0.0	0.0
03587500	33358.52	59.06	28	27.00	26.61	1.44		802.30	9.8	74.9	14.7	0.5
03588000	45399.37	59.06	24	55.40	54.78	1.12	784.54		8.6	71.0	19.7	0.6
03588400	67410.09	59.16	25	43.00	41.96	2.42	600.31		0.0	97.8	1.5	0.6
03588500	150017.27	59.21	75	348.00	349.24	0.36	534.32		1.7	91.5	5.9	0.8
03593300	48101.90	57.00	20	49.40	50.10	1.42	385.98		0.4	82.2	14.2	3.3
03593800	90934.27	59.00	36	104.00	105.51	1.45	399.96		0.3	94.1	4.1	1.5
03594040	58011.35	57.41	20	53.70	53.71	0.02	377.94		0.3	95.9	2.6	1.3
03594058	41115.97	55.76	19	46.10	47.58	3.21	384.97		0.1	87.2	11.4	1.4
03594120	47120.69	55.76	20	45.50	46.57	2.35	386.96		0.3	85.8	10.8	3.1
03594160	128503.83	57.47	20	201.00	204.18	1.58	390.97		0.3	44.2	0.6	0.2
03594200	46556.41	57.47	29	19.00	18.27	3.84	451.82		0.0	99.3	0.7	0.0
03594300	8202.22	57.00	29	0.75	0.74	1.33		432.73	0.0	91.8	8.0	0.0
03594400	38802.93	57.00	17	16.80	16.09	4.23		388.20	0.1	94.5	4.7	0.2
03594460	40384.94	55.00	14	22.20	22.14	0.27	372.94		0.1	68.5	30.8	0.6
03594480	24517.32	55.00	10	8.40	9.12	8.57	376.77		0.0	72.9	26.5	0.6
03596000	76190.72	57.11	53	107.00	110.86	3.61	878.25		4.8	72.9	14.7	7.6
03602170	14327.13	55.00	23	2.16	2.14	0.93		739.10	0.0	100.0	0.0	0.0
03602500	88952.49	55.00	81	193.00	193.19	0.10	461.74		1.3	97.6	0.9	0.1
03603000	554527.90	56.12	50	2557.00	2557.05	0.00	370.42		1.9	92.7	4.1	1.2

Table B.3. Selected basin characteristics for 295 gaging stations located in Tennessee - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
Hydrologic Area 2 – Continued												
03603800	18064.16	61.00	15	4.88	4.28	12.30		825.18	1.0	97.3	1.7	0.0
03604000	184020.95	57.49	86	447.00	446.30	0.16	513.60		0.5	94.8	3.5	1.1
03604070	4557.57	57.00	28	0.51	0.57	11.76		763.28	0.0	100.0	0.0	0.0
03604080	9790.63	57.00	27	1.52	1.53	0.66		709.98	0.0	100.0	0.0	0.0
03604090	15008.56	57.00	37	6.02	6.18	2.66	247.39		0.0	99.9	0.1	0.0
03604500	234361.10	56.10	65	707.00	706.93	0.01	402.94		0.4	95.6	3.1	0.9
03604800	39271.66	55.00	28	44.90	46.37	3.27	379.92		0.2	88.6	9.9	0.7
03605555	92346.94	55.00	43	31.90	32.05	0.47	376.98		3.0	92.7	3.9	0.3
Hydrologic Area 3												
03425500	47123.53	55.76	35	35.30	35.23	0.20	555.88		0.4	97.7	1.8	0.1
03425700	15350.74	54.20	38	3.32	3.30	0.60		541.27	9.9	89.2	0.8	0.1
03425800	7134.54	53.00	28	0.86	0.99	15.12		498.15	30.1	69.1	0.8	0.0
03426000	31112.26	51.00	31	19.20	19.20	0.00	502.86		0.6	99.0	0.4	0.1
03426800	39230.05	57.00	43	39.10	39.03	0.18	676.14		1.2	97.7	1.0	0.0
03426874	34654.70	57.11	24	15.40	15.70	1.95		700.78	0.3	96.6	3.1	0.0
03427000	44877.45	55.76	20	37.00	37.48	1.30	548.14		0.6	92.8	6.4	0.2
03427500	119223.89	55.83	51	262.00	262.94	0.36	507.80		1.0	95.7	3.0	0.2
03427690	26506.27	55.00	22	9.67	9.87	2.07	569.67		23.4	72.6	1.5	0.1
03427830	4325.28	57.00	10	0.17	0.18	5.88		775.04	0.0	100.0	0.0	0.0
03428000	88293.17	55.76	36	122.00	127.55	4.55	566.23		4.3	90.0	5.0	0.5
03428500	131899.31	55.76	45	194.00	245.66	26.63	499.94		11.5	81.2	6.2	0.8

Table B.3. Selected basin characteristics for 295 gaging stations located in Tennessee - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
Hydrologic Area 3 - Continued												
03429000	167362.93	55.02	41	571.00	580.73	1.70	459.68		7.3	87.5	4.3	0.7
03429500	69739.69	54.20	28	62.10	68.70	10.63	489.93		14.0	84.2	1.3	0.3
03430100	234608.65	54.59	29	892.00	893.81	0.20	379.97		8.2	85.0	3.8	2.7
03430118	20954.56	50.98	28	7.31	7.19	1.64		441.58	28.6	70.4	0.4	0.6
03430400	20908.89	54.20	40	12.00	11.49	4.25	586.16		3.6	95.1	0.9	0.3
03430600	39427.82	53.75	11	43.00	43.05	0.12	515.98		9.6	89.3	0.7	0.2
03431000	61217.36	53.74	53	64.00	64.15	0.23	472.50		14.8	84.2	0.7	0.2
03431040	24238.33	52.42	40	12.20	12.44	1.97	499.00		31.8	68.1	0.0	0.1
03431060	75944.49	53.74	42	93.40	93.30	0.11	432.48		22.4	76.9	0.5	0.2
03431062	8374.78	50.98	28	1.17	1.93	64.96		477.06	59.3	40.7	0.0	0.0
03431080	13486.77	50.98	10	3.92	3.95	0.77	413.20		52.0	47.9	0.0	0.0
03431120	16699.94	52.42	40	3.30	3.47	5.15	499.87		9.4	90.6	0.0	0.0
03431240	11045.22	51.00	34	1.58	1.87	18.35	497.84		73.1	26.9	0.0	0.0
03431340	31018.53	52.42	40	13.20	14.05	6.44	418.85		43.9	56.1	0.0	0.0
03431490	9922.85	51.00	28	2.01	1.97	1.99		435.77	52.9	47.1	0.0	0.0
03431517	12050.95	51.00	15	2.40	2.34	2.5	532.05		0.1	99.9	0.0	0.0
03431520	17415.99	51.00	21	4.13	4.16	0.73		513.40	2.9	96.6	0.5	0.0
03431550	22109.03	51.00	40	6.29	5.36	14.79		467.50	1.0	98.7	0.3	0.0
03431580	24312.98	51.00	18	13.30	13.10	1.50	438.12		27.0	72.0	0.8	0.2
03431600	46953.41	51.00	11	51.60	51.44	0.31	401.52		10.8	88.3	0.7	0.2
03431650	11529.13	53.00	11	2.66	2.70	1.50	515.59		16.1	83.7	0.0	0.2
03431670	21942.54	53.00	11	12.40	12.91	4.11	456.38		8.1	91.8	0.0	0.1
03431700	32814.45	52.42	39	24.30	25.14	3.46	409.50		22.0	78.0	0.0	0.0

Table B.3. Selected basin characteristics for 295 gaging stations located in Tennessee - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
						Hydrologic Area 3 – Continued						
03432350	123945.05	54.20	32	191.00	192.37	0.72	604.46		4.0	90.5	5.2	0.2
03432500	63703.53	55.00	24	66.90	66.20	1.05	634.16		1.5	94.0	4.1	0.2
03432925	38586.75	54.20	28	22.00	22.39	1.77	618.26		21.1	78.2	0.5	0.1
03433500	171574.04	54.20	84	408.00	407.51	0.12	540.99		6.7	88.8	4.0	0.4
03581500	56981.01	57.11	32	41.20	41.14	0.15	687.78		0.1	98.8	1.1	0.0
03582000	254012.09	57.93	18	827.00	827.02	0.00	650.65		1.7	80.6	13.0	4.4
03582300	55558.07	57.00	30	42.60	42.09	1.20	666.33		0.5	97.8	1.5	0.1
03583000	41872.83	57.00	14	36.50	36.40	0.27	656.26		0.2	98.4	1.2	0.1
03583200	18112.59	57.00	35	7.66	7.65	0.13		669.64	1.6	96.3	2.1	0.0
03583300	51182.60	57.00	44	47.50	47.59	0.19	754.35		0.3	96.6	3.0	0.0
03583500	44541.74	59.00	13	24.40	24.51	0.45	688.73		0.1	93.6	6.1	0.2
03584000	129252.35	57.41	41	366.00	364.82	0.32	642.67		0.3	95.0	4.4	0.3
03584500	382186.44	57.78	38	1784.00	1785.62	0.09	563.41		1.4	88.1	8.1	2.3
03597000	55500.56	57.11	31	66.30	65.51	1.19	800.26		0.8	97.2	1.9	0.0
03597300	18637.50	57.00	41	4.99	4.81	3.61		887.03	0.0	95.4	4.5	0.1
03597450	9222.07	57.00	15	0.73	1.19	63.01		880.15	0.0	96.5	3.5	0.0
03597500	27431.48	57.00	30	16.30	15.69	3.74	822.44		0.1	96.3	3.6	0.0
03597550	10619.24	57.00	10	1.86	1.48	20.43		833.91	0.0	100.0	0.0	0.0
03597590	49081.18	57.00	17	35.70	35.51	0.53		787.51	0.4	95.7	3.8	0.1
03598000	161889.68	57.14	41	481.00	479.55	0.30	683.53		3.3	86.8	6.4	3.4
03598200	24449.60	55.76	29	9.46	7.27	23.15		712.09	0.1	75.7	23.2	0.9
03599000	34147.89	57.00	20	24.90	24.84	0.24	705.08		4.1	93.8	1.8	0.3
03599200	51278.07	55.76	36	43.10	43.58	1.11		678.11	0.4	89.5	9.9	0.2

Table B.3. Selected basin characteristics for 295 gaging stations located in Tennessee - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
Hydrologic Area 3 – Continued												
03599400	7964.64	55.00	21	0.63	0.70	11.11		669.59	1.6	97.4	1.0	0.0
03599500	323621.20	55.85	59	1208.00	1208.35	0.03	535.39		2.2	89.8	6.1	1.8
03600000	76601.35	55.76	16	68.80	69.51	1.03		592.88	7.7	86.3	5.5	0.3
03600088	40232.70	55.00	20	20.10	20.16	0.30	606.02		5.6	89.8	4.3	0.3
03600500	30041.47	59.00	35	17.50	17.59	0.51	670.50		1.8	95.9	2.1	0.3
03602000	461299.51	56.12	36	2048.00	2049.05	0.05	450.78		2.1	91.7	4.7	1.4
Hydrologic Area 4												
03594415	28132.94	53.00	11	15.90	15.82	0.50	428.77		1.2	83.2	6.7	8.7
03594430	25621.88	53.00	18	6.87	6.93	0.87	410.64		0.1	95.0	4.8	0.1
03594435	37079.01	54.98	17	19.20	19.82	3.23	401.62		0.2	90.8	2.5	6.4
03594445	68085.38	54.98	19	115.00	124.08	7.90	370.94		1.6	84.1	11.5	2.8
03606500	132771.40	54.98	63	205.00	204.02	0.48	380.49		0.4	81.0	16.5	2.0
07024300	42458.97	55.00	41	55.50	55.95	0.81	364.07		1.5	67.9	25.7	4.9
07024500	159740.27	54.20	73	383.00	382.98	0.01	295.26		0.6	60.8	30.2	8.5
07025000	161754.09	54.20	28	206.00	203.78	1.08	316.42		1.0	63.7	31.8	3.5
07025220	22327.78	53.00	29	6.79	6.82	0.44	350.64		3.1	46.8	46.8	3.3
07025400	165196.44	53.01	39	372.00	372.48	0.13	303.47		0.1	60.2	31.6	8.1
07025500	204870.20	53.01	58	428.00	429.11	0.26	286.87		0.1	56.5	34.5	8.8
07026000	283098.13	52.89	53	1852.00	1850.21	0.10	246.55		0.8	48.1	42.1	9.1
07026300	347978.39	52.89	39	2033.00	2036.69	0.18	248.97		0.8	46.1	43.9	9.2
07026500	87933.83	51.93	22	110.00	104.81	4.72	286.43		0.1	48.0	45.0	6.8

Table B.3. Selected basin characteristics for 295 gaging stations located in Tennessee - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
Hydrologic Area 4 – Continued												
07027500	139759.98	55.74	47	495.00	494.47	0.11	330.65		1.5	73.7	17.2	7.6
07027800	312080.84	54.94	24	932.00	928.93	0.33		270.62	2.4	51.7	36.2	9.8
07028000	323051.97	54.53	28	1003.00	1004.26	0.13	256.97		2.3	49.0	39.2	9.5
07028500	73613.87	54.20	25	73.50	72.95	0.75	311.72		0.6	90.7	7.0	1.7
07028600	6516.40	53.00	30	0.95	1.00	5.26		339.22	4.1	52.2	40.8	2.9
07028700	34537.75	54.20	32	14.40	14.53	0.90		311.31	3.7	29.3	63.2	3.8
07028900	63815.79	54.98	24	88.20	88.10	0.11		399.77	0.6	80.1	17.6	1.8
07028930	14781.62	55.00	12	4.75	4.67	1.68		394.59	3.2	46.1	50.3	0.4
07028940	19038.43	55.00	16	7.87	7.87	0.00		385.85	3.1	42.3	54.0	0.6
07029000	187829.74	54.19	44	369.00	371.71	0.73	288.07		2.7	51.1	41.1	5.0
07029050	21341.11	52.42	24	7.23	7.36	1.80		269.42	1.3	14.4	76.4	7.8
07029090	37272.60	52.42	32	25.50	25.61	0.43	276.71		3.9	50.4	40.3	5.3
07029100	298531.37	53.75	34	939.00	938.72	0.03	245.04		1.9	31.9	56.4	9.8
07029275	180060.93	57.16	12	310.00	308.05	0.63	354.44		0.9	86.3	6.4	6.4
07029370	53959.88	57.00	21	44.10	43.11	2.24	424.52		1.5	81.9	11.8	4.8
07029400	185331.48	57.16	35	837.00	832.29	0.56	348.57		2.1	77.9	10.2	9.8
07029500	268058.31	56.49	76	1480.00	1461.41	1.26	323.52		1.5	79.0	9.0	10.4
07030000	400352.89	55.88	32	1975.00	1960.24	0.75	266.97		1.5	72.6	13.9	12.0
07030050	486085.74	55.88	42	2308.00	2307.02	0.04	239.91		1.6	65.6	20.3	12.5
07030100	33891.61	53.00	34	33.90	33.81	0.27	296.03		3.2	44.4	48.5	3.9
07030240	151771.30	54.20	37	262.00	262.38	0.15	246.46		2.5	54.1	36.2	7.1
07030270	75898.02	54.20	29	60.50	61.14	1.06	245.81		5.5	56.8	32.0	4.8
07030280	187863.12	54.20	37	505.00	505.52	0.10	227.28		3.1	47.5	42.2	7.0

Table B.3. Selected basin characteristics for 295 gaging stations located in Tennessee - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
						Hydrologic Area 4 – Continued						
07030500	178141.81	56.33	47	503.00	502.55	0.09	300.89		0.9	70.3	18.4	10.4
07031650	258312.91	55.80	33	699.00	697.47	0.22	235.85		4.1	66.7	18.7	10.5
07031700	301905.93	55.80	37	771.00	769.08	0.25	217.27		8.4	64.4	17.3	9.9
07032200	74302.71	55.00	41	68.20	67.85	0.51	263.05		20.5	52.5	19.4	7.5
07032224	27102.53	55.00	10	19.40	20.44	5.36		290.83	44.3	44.6	8.6	1.8

Table B.4. Selected basin characteristics for 152 gaging stations located in adjacent states

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
					Hydrologic Area 1 – Continued							
02384500	116492.19	56.15	49	252.00	251.77	0.09	672.63		0.5	96.0	2.9	0.6
02384540	25134.32	62.22	22	7.68	8.21	6.90	889.03		0.0	99.8	0.0	0.2
02384600	17148.25	57.00	47	3.78	3.62	4.23	706.71		1.5	95.1	3.2	0.2
02385000	98977.03	55.66	16	86.70	88.19	1.72	704.93		2.2	93.7	2.3	1.3
02385500	46593.32	55.35	21	38.10	40.25	5.64	695.42		10.7	87.2	0.4	1.7
02385800	68587.40	56.74	46	64.00	63.93	0.11	689.24		2.3	96.8	0.5	0.5
02387000	180870.99	55.49	69	687.00	687.42	0.06	622.30		4.4	92.3	1.9	1.3
03160610	9829.59	55.05	17	1.48	1.79	20.95		3169.33	0.0	99.6	0.0	0.0
03161000	126764.74	51.38	79	205.00	204.95	0.02	2656.67		1.5	97.9	0.1	0.2
03162110	30700.43	49.91	17	21.80	22.17	1.70		2681.21	1.6	98.0	0.1	0.2
03162500	112696.54	47.62	38	277.00	275.30	0.61	2518.43		0.1	99.5	0.1	0.1
03452000	67836.70	48.17	13	79.50	79.47	0.04	1732.20		0.1	99.3	0.6	0.0
03453000	84520.77	48.21	52	158.00	155.80	1.39	1700.07		0.5	99.1	0.3	0.0
03453500	265000.67	49.49	64	1332.00	1333.61	0.12	1646.44		3.5	95.2	0.8	0.5
03453880	19162.72	44.25	17	7.96	7.92	0.50	1729.62		0.4	99.3	0.2	0.0
03454000	83265.09	47.71	40	126.00	126.08	0.06	1595.28		0.1	99.7	0.1	0.0
03454500	301028.48	49.45	15	1567.00	1564.55	0.16	1311.11		3.0	95.6	0.7	0.5
03459000	69991.61	48.82	43	65.30	65.72	0.64	2383.67		1.4	97.7	0.8	0.0
03459500	125469.93	49.33	79	350.00	347.76	0.64	2335.70		2.2	97.1	0.5	0.2
03460000	49298.95	52.75	62	49.20	49.19	0.02	2456.67		0.0	100.0	0.0	0.0
03461910	21716.54	51.32	19	9.24	9.35	1.19		3583.87	3.3	96.3	0.1	0.1
03462000	94862.51	49.94	24	104.00	104.28	0.27	2542.70		0.8	98.9	0.1	0.1
03463300	54231.91	60.93	49	43.30	43.55	0.58	2657.87		0.2	99.7	0.0	0.1

Table B.4. Selected basin characteristics for 152 gaging stations located in adjacent states - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
Hydrologic Area 1 – Continued												
03463500	78602.43	49.86	18	60.80	59.91	1.46	2443.75		0.2	99.7	0.0	0.1
03463910	15704.95	48.27	14	1.61	1.68	4.35		2513.25	0.8	99.2	0.0	0.0
03464000	104420.12	48.35	40	157.00	157.24	0.15	2044.96		0.3	99.3	0.2	0.1
03464500	139873.59	48.48	30	608.00	607.26	0.12	1971.66		0.5	99.1	0.1	0.1
03471500	88078.17	45.90	78	76.60	76.45	0.20	2106.48		0.3	99.3	0.3	0.1
03472500	74127.53	45.74	48	55.60	55.58	0.04	1946.42		0.1	99.3	0.3	0.4
03473000	154548.57	46.57	75	303.00	302.76	0.08	1792.00		0.2	99.5	0.2	0.1
03473500	17119.29	44.71	53	7.40	7.32	1.08	2442.69		0.1	99.3	0.2	0.1
03474000	100443.78	44.72	65	132.00	130.70	0.98	1959.69		3.2	96.5	0.1	0.1
03474500	118305.45	44.72	14	153.00	152.58	0.27	1929.62		3.1	96.5	0.1	0.1
03475000	166587.16	44.72	55	206.00	205.76	0.12	1819.94		3.0	96.5	0.3	0.2
03478400	43128.47	47.01	49	26.90	27.19	1.08	1780.62		6.1	92.6	1.1	0.3
03478910	33166.02	48.68	18	23.10	22.99	0.48		2690.20	0.3	99.6	0.0	0.0
03479000	53140.65	48.69	66	92.10	90.99	1.21	2607.54		0.9	98.8	0.1	0.1
03481000	43757.85	49.93	21	42.00	42.33	0.79	2809.69		1.4	97.8	0.1	0.1
03487800	61993.85	45.57	41	25.80	25.56	0.93	2076.67		0.0	99.7	0.1	0.1
03488000	151857.87	45.61	88	221.00	219.54	0.66	1703.16		0.0	99.4	0.3	0.1
03488450	31271.08	45.58	26	21.40	21.36	0.19	1488.79		0.0	99.2	0.0	0.6
03488500	258419.52	45.62	26	401.00	399.15	0.46	1436.75		0.1	99.2	0.2	0.3
03489800	33815.05	45.57	60	17.20	17.17	0.17	1381.06		0.2	99.7	0.1	0.0
03489900	146605.24	45.76	25	79.60	79.67	0.09	1267.17		0.4	99.5	0.1	0.0
03490000	414909.28	45.73	74	671.00	671.01	0.00	1197.09		0.3	99.1	0.2	0.3
03503000	163954.64	66.92	61	436.00	436.61	0.14	1761.03		0.8	98.6	0.2	0.3

Table B.4. Selected basin characteristics for 152 gaging stations located in adjacent states - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
Hydrologic Area 1 – Continued												
03504000	61941.52	74.84	67	51.90	53.79	3.64	3073.06		0.0	99.8	0.0	0.1
03506500	139719.50	65.88	23	174.00	174.42	0.24	1596.34		0.1	98.4	0.0	1.4
03507000	192732.36	66.67	48	664.00	665.25	0.19	1521.57		0.6	98.3	0.1	0.9
03511000	80695.07	62.99	28	131.00	131.19	0.15	1938.21		0.2	99.8	0.0	0.0
03512000	92886.19	62.03	58	184.00	183.95	0.03	1843.12		0.5	99.4	0.0	0.0
03513000	176839.10	66.63	43	655.00	655.76	0.12	1714.35		0.8	98.5	0.0	0.6
03513500	30307.72	64.97	36	13.80	13.74	0.43	2268.54		0.0	100.0	0.0	0.0
03514000	54214.50	63.62	10	44.40	44.19	0.47	1803.20		0.0	100.0	0.0	0.0
03516000	51027.73	66.35	10	42.00	41.47	1.26	1953.39		0.0	99.9	0.0	0.0
03521500	110403.75	45.67	61	137.00	136.91	0.07	1923.60		6.2	93.4	0.2	0.1
03523000	51653.23	45.58	35	51.60	51.51	0.17	1895.35		0.4	99.1	0.3	0.0
03524000	230338.68	45.71	86	533.00	532.56	0.08	1499.74		3.9	95.5	0.2	0.1
03524500	81170.46	47.95	61	87.20	88.40	1.38	1925.36		10.0	86.6	0.0	0.3
03524900	33587.69	52.61	25	30.80	30.26	1.75	1509.54		0.2	99.8	0.0	0.0
03525000	45392.37	47.94	28	41.50	40.91	1.42	1269.29		0.3	99.6	0.0	0.0
03526000	135881.17	45.76	59	106.00	105.62	0.36	1301.49		0.4	99.3	0.1	0.0
03527000	434033.55	46.13	80	1123.00	1124.33	0.12	1196.04		3.2	95.9	0.1	0.2
03529500	63815.01	50.79	54	112.00	108.68	2.96	1458.64		2.3	84.6	0.0	0.1
03530000	42687.40	55.11	29	39.70	40.93	3.10	1469.56		5.6	93.3	0.4	0.2
03530500	62759.14	52.99	56	71.20	70.84	0.51	1362.58		1.4	96.2	0.0	0.3
03531000	139996.91	52.35	11	289.00	287.93	0.37	1319.52		3.1	90.8	0.1	0.2
03531500	177263.45	52.35	75	319.00	317.72	0.40	1258.63		3.2	91.2	0.1	0.2
03544947	12434.09	71.79	23	1.67	1.75	4.79	2141.52		0.0	100.0	0.0	0.0

Table B.4. Selected basin characteristics for 152 gaging stations located in adjacent states - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
						Hydrologic Area 1 – Continued						
03545000	42178.26	65.34	60	45.50	45.61	0.24	1932.72		0.1	99.8	0.0	0.1
03546000	41177.65	69.17	13	37.60	37.77	0.45	1930.33		0.0	99.8	0.1	0.1
03548500	141435.52	65.63	44	406.00	406.27	0.07	1538.15		0.4	96.7	0.2	2.6
03550000	91311.48	65.96	96	104.00	103.11	0.86	1556.37		1.2	98.0	0.5	0.3
03550500	51760.96	65.14	58	74.80	75.17	0.49	1810.53		0.2	99.3	0.3	0.1
03554000	139035.35	64.25	32	272.00	273.01	0.37	1544.21		0.8	96.7	0.3	1.9
03558000	91846.89	66.72	84	177.00	175.16	1.04	1782.11		0.0	99.8	0.0	0.1
03559000	116673.14	66.72	19	233.00	230.86	0.92	1538.73		0.1	97.7	0.0	2.0
03560000	69203.15	64.73	31	70.90	70.65	0.35	1449.66		0.2	99.5	0.1	0.2
03566660	16909.69	54.99	10	4.44	4.36	1.80	840.02		0.3	97.9	1.4	0.4
03566685	55472.66	55.35	12	35.50	35.74	0.68	775.02		0.8	94.9	3.0	1.1
03566687	13621.50	54.97	10	3.36	3.32	1.19	790.01		2.4	96.8	0.2	0.1
03566700	82886.15	55.13	17	169.00	168.95	0.03	739.49		2.9	94.5	1.7	0.8
03567200	81510.22	55.60	27	73.00	74.62	2.22	759.96		0.4	97.4	1.8	0.3
03568933	127262.27	56.70	27	149.00	149.61	0.41	663.76		2.2	96.1	1.1	0.6
03572110	99489.30	60.22	22	131.00	130.71	0.22	598.83		0.3	97.0	2.3	0.4
03572900	173752.01	57.14	24	141.00	137.59	2.42	1000.08		2.2	87.6	9.4	0.7
						Hydrologic Area 2						
03312500	163156.34	53.07	24	514.00	532.96	3.69	505.05		0.5	92.6	5.9	0.8
03312795	5478.35	53.00	10	0.89	1.26	41.57		658.75	2.9	84.5	12.7	0.0
03313000	184418.45	53.07	11	865.00	939.72	8.64	399.56		0.8	91.6	5.8	1.6

Table B.4. Selected basin characteristics for 152 gaging stations located in adjacent states - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
Hydrologic Area 2 – Continued												
03313500	23016.01	51.00	33	7.47	7.74	3.61	637.23		3.2	94.2	2.5	0.1
03313700	95855.05	52.88	36	91.00	107.90	18.57	573.16		1.6	76.7	21.3	0.4
03313800	40690.75	51.00	25	21.60	23.78	10.09		535.42	0.8	45.0	54.2	0.0
03314000	158270.44	52.88	43	358.00	472.43	31.96	442.65		1.0	82.9	15.9	0.2
03314500	278022.18	52.89	26	1362.00	1840.63	35.14	409.43		1.1	88.5	9.2	1.0
03316000	74780.72	51.00	44	81.50	90.69	11.28	408.65		2.4	88.7	8.4	0.3
03400500	92482.32	50.86	64	82.30	81.36	1.14	1409.81		1.7	95.1	0.0	0.0
03400700	96502.84	51.65	25	82.40	82.15	0.30	1880.44		1.5	96.9	0.0	0.0
03401000	207348.41	50.88	66	374.00	371.05	0.79	1139.60		2.2	96.1	0.0	0.2
03401500	45037.60	53.07	42	35.30	36.58	3.63	1136.62		3.5	92.0	0.0	0.1
03402000	60697.58	53.07	65	60.60	60.26	0.56	1097.50		6.8	90.2	0.0	0.4
03402020	10941.93	53.02	11	2.96	2.15	27.36		1359.06	0.7	98.6	0.0	0.1
03403910	104870.88	53.57	31	331.00	330.72	0.08	921.34		1.5	97.4	0.1	0.3
03404900	40102.63	50.98	49	53.80	53.11	1.28	1048.48		15.1	83.1	0.0	0.2
03405000	89099.31	50.98	33	201.00	201.77	0.38	955.54		12.9	85.7	0.0	0.3
03406000	11257.02	51.00	33	3.89	3.82	1.80	1122.99		27.8	71.3	0.0	0.1
03410500	215339.18	54.94	63	954.00	952.96	0.11	764.34		1.4	97.7	0.0	0.5
03411000	278312.25	53.97	34	1271.00	1269.93	0.08	636.77		1.1	98.0	0.1	0.4
03413200	57148.54	53.08	31	43.40	45.37	4.54	804.28		1.0	92.0	6.9	0.0
03414102	12983.60	53.00	11	3.52	3.36	4.55		642.32	0.3	97.4	2.2	0.0
03435140	28385.67	51.02	19	20.80	20.46	1.63		625.69	0.0	68.6	31.3	0.1
03437490	15357.03	51.00	10	2.62	2.45	6.49		551.64	0.0	77.0	23.0	0.0
03437500	60010.23	51.00	34	46.50	46.36	0.30	499.50		3.7	62.9	33.2	0.1

Table B.4. Selected basin characteristics for 152 gaging stations located in adjacent states - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
Hydrologic Area 2 – Continued												
03438000	134439.98	51.00	67	244.00	243.52	0.20	391.25		3.2	60.2	36.1	0.4
03573000	72188.75	56.98	21	91.60	90.33	1.39	865.93		4.2	86.1	8.7	0.9
03574500	187497.80	57.39	75	320.00	318.95	0.33	571.01		0.3	95.9	3.1	0.7
03575000	108474.62	57.16	65	342.00	342.40	0.12	640.49		2.0	62.8	31.2	4.1
03575700	34381.90	57.00	25	14.10	14.07	0.21	576.04		29.0	70.7	0.3	0.0
03575830	68566.27	57.00	50	49.00	48.14	1.76	601.45		16.0	61.2	20.4	2.3
03576148	69350.19	57.60	15	136.00	136.55	0.40	570.13		2.2	91.7	4.1	1.9
03576250	105690.79	57.45	57	119.00	121.18	1.83	626.45		4.7	76.5	16.6	2.2
03576400	79879.96	57.45	13	55.80	53.83	3.53	655.13		2.5	83.7	11.1	2.6
03576500	56470.63	57.60	28	86.30	86.20	0.12	572.75		2.1	91.4	4.8	1.3
03577000	62191.61	59.00	29	87.60	87.29	0.35	576.69		0.2	70.5	5.4	0.3
03586500	95297.52	59.00	60	166.00	163.32	1.61	573.70		1.8	87.2	4.1	6.6
03590000	114739.46	58.93	19	209.00	209.28	0.13	423.91		3.5	81.2	11.7	3.6
03591800	94587.96	59.33	24	143.00	141.88	0.78	646.67		2.0	92.4	1.6	3.6
03592000	184370.43	59.33	30	263.00	263.22	0.08	506.56		1.6	93.4	1.8	2.9
03592200	133773.20	59.33	20	189.00	186.06	1.56	482.76		2.6	91.2	1.2	4.6
03592300	114097.96	59.33	22	78.20	80.93	3.49	499.42		1.2	94.4	0.6	3.6
03592500	222813.87	59.27	52	667.00	660.23	1.01	419.94		1.9	92.0	2.2	3.7
03592718	35110.32	59.00	36	24.70	26.60	7.69	429.44		2.1	85.9	4.0	8.0
03592800	80768.44	57.22	31	143.00	148.79	4.05	421.05		1.7	85.1	4.6	8.6
03593010	40050.50	57.28	22	21.10	21.52	1.99	402.97		0.5	71.7	15.9	11.9

Table B.4. Selected basin characteristics for 152 gaging stations located in adjacent states - Continued

Station number	Basin length (ft)	Mean annual precip-itation (in)	Years of peak data	Contributing drainage area (mi^2)			Gage elevation (ft) (above NAVD88)		2006 Land use (%)			
				USGS	WMS	Diff (%)	USGS	WMS	Urban	Forest and pasture	Agric-ulture	Water bodies
Hydrologic Area 3												
03585300	108796.16	58.07	12	152.00	151.82	0.12	575.15		0.2	94.7	3.8	1.3
Hydrologic Area 4												
03610000	63985.60	53.02	32	89.70	89.80	0.11	459.73		0.9	39.3	59.7	0.2
03610200	100707.07	53.02	24	134.00	135.09	0.81		420.00	2.8	39.9	57.2	0.1
03610500	166617.15	52.07	45	227.00	230.36	1.48	344.41		2.0	44.9	51.9	1.2
03610545	68372.79	51.59	21	68.70	68.13	0.83	369.98		0.3	60.1	39.1	0.4
07022500	10428.65	51.00	33	1.72	1.66	3.49	478.21		0.0	63.8	35.4	0.8
07023000	177367.62	50.76	40	212.00	211.44	0.26	326.39		1.9	44.4	51.1	2.5
07023500	58752.05	51.57	32	36.80	36.80	0.00	393.59		0.2	61.0	38.5	0.4
07024000	80868.37	52.06	68	68.70	68.81	0.16	307.92		0.3	52.3	41.6	5.8
07029252	8966.48	57.00	11	1.24	1.09	12.10		469.71	1.0	94.4	2.4	2.2
07029270	144159.44	57.22	34	274.00	269.69	1.57	372.87		0.9	86.5	6.7	5.9
07029300	108541.62	57.16	31	277.00	276.09	0.33	380.91		4.1	70.3	14.6	11.0
07029412	33253.42	57.00	17	20.30	20.29	0.05		416.45	1.0	86.6	7.1	5.1
07030365	9661.85	57.00	11	2.17	2.03	6.45		512.18	0.2	87.2	9.0	3.6
07269000	31368.22	57.22	54	19.30	19.10	1.04	386.47		0.7	89.6	5.8	2.9
07269990	137071.68	57.22	20	359.00	354.77	1.18	277.84		1.3	86.6	6.9	5.0
07276000	155535.48	56.60	19	218.00	214.36	1.67	250.63		1.8	72.7	15.0	10.3
07277500	209704.44	56.02	14	617.00	633.41	2.66	208.34		3.4	71.2	16.1	8.9
07277730	66978.00	56.60	16	62.80	64.58	2.83	233.84		1.5	86.7	1.5	0.8

Table B.5. Selected basin characteristics and flood frequency estimates for 295 gaging stations located in Tennessee

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
Hydrologic 1											
02384900	-	-	-	-	-	-	-	-	-	-	-
03418500	0.8	76.4	11.8	11.0	6369	9173	10945	13081	14600	16051	GLO
03455000	16.3	72.3	8.2	3.2	27399	44033	56571	74021	88141	103200	GPA
03461000	28.6	47.9	17.7	5.8	12610	20444	26170	33926	40021	46337	PE3
03461200	4.9	61.6	29.7	3.7	760	1126	1365	1660	1875	2084	GPA
03461500	31.8	57.5	5.7	5.1	15609	25343	32718	43020	51381	60312	PE3
03465000	24.6	53.9	21.4	0.0	475	691	833	1010	1140	1268	GPA
03465500	21.7	71.9	6.0	0.4	19963	32710	43255	59184	73150	89037	LN3
03466228	0.0	72.8	7.4	19.7	331	659	959	1446	1895	2428	PE3
03466500	15.6	69.9	10.4	4.1	21821	34805	45225	60612	73823	88580	PE3
03466890	0.2	26.1	34.2	39.4	3724	5720	6999	8537	9622	10654	GLO
03467000	0.2	23.4	38.2	38.2	5535	8124	9988	12501	14482	16562	GPA
03467480	0.0	35.8	22.1	42.1	1755	2189	2442	2731	2928	3112	GPA
03467500	11.3	57.8	16.8	14.2	23113	35640	45429	59586	71521	84662	LN3
03467993	1.3	38.1	60.5	0.0	121	158	183	217	244	272	GPA
03467998	5.4	36.9	57.2	0.6	892	1263	1515	1841	2089	2339	GPA
03469000	16.3	62.2	12.0	9.5	51209	70534	82051	95289	104305	112660	GPA
03469010	0.1	5.2	24.0	70.7	755	1073	1275	1520	1696	1865	GLO
03469110	2.1	88.2	9.7	0.0	127	238	326	452	555	665	GPA
03469130	3.7	54.8	19.0	22.5	8546	10957	12921	15844	18366	21209	PE3
03469160	0.1	42.7	25.5	31.6	2784	4501	5948	8182	10176	12485	PE3
03469175	2.3	49.3	21.4	27.1	8207	11948	14675	18400	21369	24517	LN3
03469200	2.4	47.8	21.2	28.5	11030	15598	19352	25025	30014	35715	PE3

Table B.5. Selected basin characteristics and flood frequency estimates for 295 gaging stations located in Tennessee - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
Hydrologic 1 - Continued											
03469500	6.5	59.5	18.3	15.7	5796	7852	9092	10542	11547	12490	GEV
03470000	3.2	45.6	22.6	28.6	14701	22673	28325	35823	41621	47563	PE3
03470215	0.1	67.0	30.1	2.8	96	161	204	257	293	328	GPA
03477000	2.5	55.9	19.6	22.0	12390	17124	20080	23630	26153	28570	PE3
03479500	23.3	75.5	0.7	0.5	5178	7597	9603	12670	15389	18520	GLO
03480000	20.9	71.7	7.0	0.4	5808	8929	11302	14652	17401	20378	GLO
03482000	0.0	62.5	36.2	1.3	2745	4325	5550	7306	8768	10366	GLO
03482500	1.1	55.4	38.7	4.8	2705	3699	4110	4441	4597	4703	GLO
03483000	12.9	64.8	20.2	2.1	10208	13124	14870	16911	18330	19672	GLO
03485500	0.8	82.4	16.0	0.8	3185	5099	6602	8778	10605	12615	PE3
03486000	9.4	64.0	23.1	3.5	12682	21118	29204	43241	57179	74849	GLO
03486225	0.0	10.5	89.5	0.0	120	229	329	493	648	834	GLO
03487500	6.1	53.1	27.4	13.5	25197	37228	45600	56565	64982	73572	PE3
03487550	1.1	10.9	77.5	10.4	1121	1774	2308	3111	3812	4608	GEV
03490522	0.0	85.7	8.0	6.3	67	117	173	286	416	601	-
03491000	0.0	45.8	39.7	14.4	2547	3697	4445	5370	6043	6700	PE3
03491200	-	-	-	-	-	-	-	-	-	-	-
03491300	0.0	43.2	19.3	37.5	2105	2812	3153	3476	3657	3800	GEV
03491500	4.8	52.2	30.0	13.0	37390	52703	61923	72561	79827	86577	GPA
03491540	0.3	28.3	34.8	36.6	826	985	1074	1174	1241	1303	GPA
03491544	-	-	-	-	-	-	-	-	-	-	-
03495500	5.2	52.9	29.8	12.1	39109	51828	60373	71321	79578	87972	GPA
03496000	-	-	-	-	-	-	-	-	-	-	-

Table B.5. Selected basin characteristics and flood frequency estimates for 295 gaging stations located in Tennessee - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
					Hydrologic 1 - Continued						
03497000	10.8	57.4	20.0	11.8	98274	136390	158785	184085	201058	216628	GEV
03497300	2.8	54.9	38.3	4.1	6276	10209	13334	17903	21768	26051	LN3
03498000	3.4	43.2	27.7	25.7	9398	13442	15434	17322	18371	19194	GLO
03498500	2.6	44.5	24.4	28.4	12146	18767	23689	30477	35933	41745	LN3
03498700	-	-	-	-	-	-	-	-	-	-	-
03518400	0.0	53.2	46.8	0.0	746	1082	1285	1519	1678	1825	GLO
03518500	3.9	22.3	72.3	1.5	7770	11605	13914	16549	18316	19931	PE3
03519500	21.0	61.7	13.2	4.2	47489	66511	78177	91923	101494	110502	GLO
03519600	3.9	48.4	47.4	0.3	565	988	1465	2425	3521	5086	GLO
03519610	-	-	-	-	-	-	-	-	-	-	-
03519640	1.6	57.7	39.0	1.7	605	1146	1681	2632	3594	4829	PE3
03519700	3.9	70.7	24.3	1.0	1365	2411	3250	4470	5494	6614	GEV
03520100	2.1	87.6	8.6	1.7	1304	2070	2706	3676	4534	5519	PE3
03527800	0.1	33.8	46.7	19.4	1436	2114	2651	3440	4113	4866	GPA
03528000	2.5	47.9	44.5	5.1	23977	35184	43350	54486	63342	72722	GEV
03528100	0.0	84.2	1.9	13.9	350	520	600	671	709	736	LN3
03528300	0.1	94.5	2.5	2.9	286	468	597	767	897	1028	GLO
03528390	3.0	42.9	39.9	14.1	252	436	613	926	1240	1641	GLO
03528400	0.0	96.7	2.0	1.3	118	223	309	434	539	652	GLO
03532000	2.0	58.1	34.8	5.1	15026	21921	26951	33826	39308	45121	LN3
03533000	3.6	52.5	37.5	6.5	41245	59307	70307	83074	91835	100000	GEV
03534000	13.9	29.2	51.0	5.9	3177	4922	6041	7384	8330	9228	PE3
03534500	0.1	44.9	49.3	5.8	693	991	1171	1379	1521	1654	PE3

Table B.5. Selected basin characteristics and flood frequency estimates for 295 gaging stations located in Tennessee - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
					Hydrologic 1 - Continued						
03535000	2.0	41.2	38.4	18.4	3118	6018	8815	13640	18389	24328	GPA
03535140	-	-	-	-	-	-	-	-	-	-	-
03535180	1.6	77.9	7.3	13.3	211	424	622	948	1253	1618	PE3
03536450	-	-	-	-	-	-	-	-	-	-	-
03536550	-	-	-	-	-	-	-	-	-	-	-
03537000	-	-	-	-	-	-	-	-	-	-	-
03537100	100.0	0.0	0.0	0.0	67	114	157	227	293	373	GLO
03538130	0.0	62.0	8.6	29.5	1062	1412	1638	1917	2121	2322	PE3
03538200	4.3	30.4	54.9	10.4	3493	5387	6673	8312	9534	10748	GEV
03538215	6.3	20.0	69.7	4.0	1521	2372	2921	3584	4052	4497	LN3
03538225	4.5	28.1	57.5	9.9	4191	6330	7816	9757	11237	12737	GEV
03538250	-	-	-	-	-	-	-	-	-	-	-
03538270	-	-	-	-	-	-	-	-	-	-	-
03538275	80.0	7.8	11.8	0.4	466	646	773	942	1075	1213	GPA
03538300	0.0	16.4	83.6	0.0	741	1042	1253	1532	1748	1973	PE3
03538500	0.0	18.1	81.9	0.0	6850	10609	13466	17490	20780	24339	GPA
03538600	-	-	-	-	-	-	-	-	-	-	-
03538800	0.0	79.1	3.2	17.6	121	193	262	382	502	654	LN3
03538900	3.3	59.5	5.6	31.6	263	541	818	1308	1799	2424	GLO
03539500	2.3	58.5	13.0	26.1	4900	7264	8647	10187	11196	12099	LN3
03539600	2.3	58.3	14.2	25.1	8014	10409	12031	14134	15742	17383	GLO
03539800	1.1	63.9	19.5	15.5	32717	48428	58583	71018	79985	88638	GLO
03540500	0.8	57.6	30.2	11.4	48953	77887	99177	128231	151315	175498	GEV

Table B.5. Selected basin characteristics and flood frequency estimates for 295 gaging stations located in Tennessee - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
					Hydrologic 1 - Continued						
03541100	0.0	40.1	59.9	0.0	1376	2634	3555	4756	5655	6544	GPA
03541500	0.1	63.4	23.7	12.7	10804	18719	25318	35338	44096	54043	GLO
03542500	0.2	64.6	23.2	12.0	8235	14100	19190	27200	34483	43019	PE3
03543200	0.4	49.4	25.1	25.1	2542	4020	5065	6442	7499	8574	GPA
03543500	0.3	59.8	20.6	19.3	5361	8666	11163	14643	17462	20469	GLO
03544500	0.2	66.3	12.3	21.1	4532	7399	9392	11957	13885	15801	GPA
03556000	3.0	92.7	4.3	0.0	639	892	1034	1190	1291	1380	GPA
03557000	9.6	84.8	4.5	1.1	26777	37879	45547	55552	63222	71091	GEV
03559500	2.4	94.2	3.3	0.1	8630	15803	21713	30496	38000	46323	GLO
03560500	74.3	25.7	0.0	0.0	895	1391	1716	2114	2399	2673	GLO
03561000	59.1	40.9	0.0	0.0	1541	2716	3793	5586	7291	9374	PE3
03561500	5.3	91.2	3.4	0.1	10702	14471	16923	19980	22232	24460	GPA
03563000	6.5	88.8	4.2	0.5	14198	21256	25563	30532	33907	37022	GPA
03565040	1.9	44.2	51.7	2.2	1143	1851	2490	3538	4529	5733	GLO
03565080	2.7	57.1	18.9	21.4	747	937	1049	1181	1273	1360	GPA
03565120	1.5	55.7	30.8	12.0	2110	3019	3599	4308	4817	5310	GLO
03565160	2.5	72.1	17.6	7.8	1427	2302	2962	3883	4629	5426	GPA
03565250	1.6	62.0	20.6	15.8	3260	4612	5428	6370	7015	7614	GPA
03565300	0.4	36.7	36.1	26.8	2080	3581	4824	6697	8323	10162	GLO
03565500	2.2	73.2	13.8	10.8	1382	2759	4067	6279	8412	11025	GLO
03566000	7.0	81.8	7.9	3.3	35634	44595	49249	54068	57056	59632	GLO
03566200	0.7	21.4	57.3	20.7	771	1197	1616	2355	3102	4063	GLO
03566420	1.2	46.5	34.2	18.1	1402	2447	3458	5221	6984	9224	GEV

Table B.5. Selected basin characteristics and flood frequency estimates for 295 gaging stations located in Tennessee - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
Hydrologic 1 - Continued											
03567500	1.3	53.1	28.3	17.4	12346	17713	21196	25504	28639	31703	GEV
03568000	9.8	59.6	21.2	9.4	205906	261503	292953	327982	351247	372426	GLO
03570800	0.0	70.3	27.6	2.0	1890	2559	2952	3397	3698	3975	GPA
03571000	0.2	63.2	27.0	9.6	12266	18443	22655	28069	32139	36219	PE3
03571500	0.2	65.2	4.1	30.5	7770	9305	10058	10802	11246	11618	GPA
03571600	2.9	80.1	4.4	12.5	101	143	168	197	217	235	GLO
03571800	0.8	59.4	2.9	36.9	3945	5378	6462	7999	9269	10653	GPA
Hydrologic 2											
03313600	0.4	60.4	37.3	1.9	205	416	583	818	1006	1201	PE3
03407908	6.8	25.8	67.3	0.1	13124	16830	18806	20887	22198	23341	GLO
03408000	4.4	28.4	67.1	0.0	17306	27337	38153	58771	81207	111979	GLO
03408500	3.7	29.3	67.0	0.0	24768	33988	40202	48162	54171	60260	LN3
03409000	0.0	33.1	66.9	0.0	1964	2929	3600	4477	5148	5830	GLO
03409500	0.2	53.8	32.3	13.7	15021	22058	26665	32388	36568	40656	PE3
03414500	10.8	53.0	24.8	11.4	16575	25319	31369	39232	45196	51216	GPA
03415000	19.9	31.5	35.7	12.9	7442	10630	12582	14865	16443	17919	GEV
03415500	16.7	43.0	27.7	12.6	16879	25943	31506	37932	42281	46281	PE3
03415700	5.6	36.6	55.1	2.7	811	1064	1156	1221	1248	1264	GEV
03416000	28.6	47.9	17.7	5.8	7190	10181	11919	13860	15141	16300	GLO
03417700	6.8	88.1	5.1	0.0	130	231	317	452	572	710	PE3

Table B.5. Selected basin characteristics and flood frequency estimates for 295 gaging stations located in Tennessee - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
Hydrologic 2 - Continued											
03418000	16.7	52.1	26.7	4.5	3408	5428	6790	8502	9757	10984	GEV
03418070	15.8	53.8	26.4	4.0	10560	15397	18261	21497	23651	25610	GEV
03420000	24.7	45.5	14.9	14.9	7573	10343	12120	14310	15902	17459	GEV
03420360	0.0	31.9	62.9	5.1	470	994	1546	2577	3664	5106	PE3
03420500	0.1	33.6	60.0	6.3	9804	16616	21415	27629	32298	36938	LN3
03420600	0.0	42.0	44.9	13.2	335	874	1344	2021	2561	3117	PE3
03421000	0.2	64.4	23.6	11.8	24171	37521	46557	58017	66531	74943	LN3
03421100	-	-	-	-	-	-	-	-	-	-	-
03421200	0.0	52.4	43.9	3.7	3248	5634	7964	12074	16216	21524	LN3
03423000	-	-	-	-	-	-	-	-	-	-	-
03431800	0.9	84.7	13.6	0.9	7226	11506	14730	19217	22850	26731	GPA
03434500	1.7	62.4	24.6	11.3	20976	31284	37948	46099	51961	57607	PE3
03434590	-	-	-	-	-	-	-	-	-	-	-
03435030	0.5	75.0	23.0	1.6	2242	4106	5864	8861	11774	15395	GPA
03435500	0.9	76.6	19.9	2.6	14274	20759	24771	29493	32769	35847	GLO
03435770	1.2	76.8	20.9	1.1	5265	8189	10348	13306	15671	18171	GPA
03435930	0.0	19.5	46.4	34.1	83	116	136	159	175	189	GPA
03436000	2.3	75.4	20.4	1.9	7026	10939	14081	18717	22702	27169	GEV
03436100	1.3	76.2	20.0	2.4	20216	30405	37426	46532	53433	60395	PE3
03436690	0.6	90.5	8.5	0.4	4727	8056	10590	14130	16985	20004	GPA

Table B.5. Selected basin characteristics and flood frequency estimates for 295 gaging stations located in Tennessee - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
Hydrologic 2 - Continued											
03436700	0.6	91.8	7.3	0.4	5483	8853	11460	15171	18233	21565	GPA
03574700	0.0	39.4	51.9	8.7	386	691	938	1300	1606	1942	GLO
03578000	0.3	73.2	21.1	5.4	3948	6346	8263	11087	13504	16193	GLO
03578500	0.3	50.9	40.1	8.7	2619	3958	4732	5575	6117	6593	GEV
03579100	5.6	57.6	29.2	7.7	7164	12519	16412	21578	25551	29565	GPA
03579800	50.7	24.0	13.9	11.5	1662	2597	3156	3782	4194	4561	GPA
03579900	45.4	31.7	9.1	13.8	1986	2903	3642	4744	5698	6777	PE3
03587200	0.0	70.2	27.7	2.1	148	212	257	317	364	413	GLO
03587500	0.3	68.0	23.0	8.6	2862	5076	6977	9942	12607	15686	GLO
03588000	0.2	65.3	26.0	8.5	5111	8293	10758	14274	17179	20342	GPA
03588400	0.7	90.6	6.4	2.4	3213	6312	9150	13795	18125	23291	PE3
03588500	1.4	85.4	9.0	4.3	18403	32305	43267	59002	72033	86112	GLO
03593300	1.9	43.7	43.8	10.6	4352	6413	7816	9621	10980	12345	GLO
03593800	0.4	72.0	23.7	3.9	4863	10405	15859	25336	34666	46254	LN3
03594040	0.1	56.0	38.6	5.3	3063	5862	8186	11647	14592	17836	GPA
03594058	1.7	40.1	49.2	9.0	5418	7780	8876	9847	10354	10729	GLO
03594120	0.2	31.9	61.6	6.3	4042	5642	6399	7093	7468	7754	PE3
03594160	1.8	81.2	12.2	4.8	10900	18905	23999	29897	33859	37450	GLO
03594200	4.0	85.0	10.9	0.0	1482	3296	4868	7231	9243	11431	GPA
03594300	8.9	81.2	9.9	0.0	106	161	210	286	357	442	PE3

Table B.5. Selected basin characteristics and flood frequency estimates for 295 gaging stations located in Tennessee - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
Hydrologic 2 - Continued											
03594400	6.4	83.6	9.8	0.1	1008	2061	2963	4334	5516	6828	PE3
03594460	0.2	13.5	79.3	7.0	1039	1950	2934	4836	6926	9807	GLO
03594480	0.5	11.5	82.5	5.6	978	1625	2105	2765	3288	3834	GPA
03596000	0.4	26.9	60.8	11.9	7141	13444	18691	26538	33266	40733	GEV
03602170	0.4	87.3	9.6	2.7	369	663	898	1239	1524	1834	GPA
03602500	1.4	85.1	13.0	0.5	10159	18458	24204	31381	36546	41504	PE3
03603000	6.3	54.2	31.4	8.0	38573	57738	71655	90520	105459	121196	GLO
03603800	5.1	73.8	21.1	0.0	541	1019	1508	2404	3341	4577	GLO
03604000	3.9	77.9	15.6	2.6	15704	28098	38058	52568	64749	78054	GLO
03604070	7.9	70.1	22.1	0.0	87	153	197	250	286	321	PE3
03604080	0.0	87.0	13.0	0.0	165	526	919	1610	2272	3054	PE3
03604090	3.5	82.5	14.0	0.1	514	1325	2064	3184	4130	5150	GPA
03604500	3.8	80.9	13.6	1.8	16606	29519	39855	54869	67445	81161	GLO
03604800	0.1	29.9	61.3	8.6	5388	7770	8536	8992	9152	9231	GEV
03605555	1.1	62.0	36.7	0.3	3245	5167	6655	8783	10544	12468	PE3
Hydrologic 3											
03425500	2.1	6.6	70.7	20.7	5541	7724	9096	10751	11931	13065	GEV
03425700	0.5	14.4	79.2	6.0	789	1382	1797	2326	2718	3102	PE3
03425800	-	-	-	-	-	-	-	-	-	-	-
03426000	0.3	86.7	12.3	0.7	2597	3895	4697	5631	6273	6871	LN3
03426800	2.0	68.7	28.0	1.3	3999	6222	7886	10195	12059	14052	GEV
03426874	1.5	41.6	35.6	21.2	2373	2655	2794	2933	3018	3091	GEV

Table B.5. Selected basin characteristics and flood frequency estimates for 295 gaging stations located in Tennessee - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
Hydrologic 3 - Continued											
03427000	2.0	10.1	57.7	30.3	7459	10973	13149	15706	17477	19138	GPA
03427500	1.8	29.4	41.8	27.1	16845	22637	26197	30432	33419	36267	GLO
03427690	-	-	-	-	-	-	-	-	-	-	-
03427830	8.3	0.0	56.3	35.4	62	108	133	158	172	183	GPA
03428000	1.0	16.2	50.4	32.3	11999	18660	23954	31700	38306	45658	LN3
03428500	-	-	-	-	-	-	-	-	-	-	-
03429000	1.5	28.7	41.5	28.3	27833	37598	43429	50180	54814	59130	GEV
03429500	-	-	-	-	-	-	-	-	-	-	-
03430100	3.8	23.2	44.8	28.2	30946	42380	49316	57438	63076	68369	GLO
03430118	2.4	52.0	39.9	5.7	1463	2158	2460	2709	2829	2910	GLO
03430400	2.7	14.1	46.0	37.2	5071	7487	8817	10207	11064	11792	GLO
03430600	1.9	29.4	42.3	26.4	4178	6142	7512	9310	10695	12113	PE3
03431000	1.5	35.0	42.1	21.4	6202	9637	12428	16603	20233	24341	GLO
03431040	0.6	71.2	27.9	0.4	1641	2823	4032	6249	8574	11658	GLO
03431060	1.5	44.0	39.0	15.5	8902	12691	15144	18174	20376	22529	LN3
03431062	0.0	76.6	23.4	0.0	370	539	644	769	857	939	GEV
03431080	0.9	86.2	11.5	1.5	694	1323	1841	2608	3256	3965	GPA
03431120	0.0	61.3	38.7	0.0	986	1534	1833	2139	2321	2471	GPA
03431240	0.0	82.2	17.8	0.0	320	472	558	650	708	758	GPA
03431340	0.1	73.8	26.1	0.0	2060	3243	4023	4980	5669	6331	GLO
03431490	1.6	23.4	65.4	9.6	560	1000	1287	1625	1855	2065	GPA
03431517	0.2	90.3	9.5	0.0	339	559	704	880	1004	1122	GEV
03431520	0.0	90.1	9.9	0.0	1000	1759	2343	3163	3827	4531	GPA

Table B.5. Selected basin characteristics and flood frequency estimates for 295 gaging stations located in Tennessee - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
					Hydrologic 3 - Continued						
03431550	0.2	92.0	7.7	0.0	1057	1603	1992	2512	2917	3336	GPA
03431580	0.6	18.2	80.2	1.1	2887	4140	5192	6813	8260	9937	GPA
03431600	0.5	56.0	42.9	0.6	4603	7045	8859	11367	13384	15537	GLO
03431650	0.1	39.6	60.3	0.0	515	788	1006	1327	1601	1908	GPA
03431670	0.1	43.6	55.9	0.5	1806	2394	2717	3063	3284	3478	GLO
03431700	0.1	52.4	47.0	0.6	3276	5053	6211	7630	8646	9622	PE3
03432350	2.5	35.6	38.0	23.8	8746	12250	14361	16801	18470	20023	GLO
03432500	2.3	53.7	32.1	11.9	5440	11800	17847	27911	37377	48752	GPA
03432925	-	-	-	-	-	-	-	-	-	-	-
03433500	2.1	45.7	34.7	17.4	12663	18007	21446	25673	28734	31713	LN3
03581500	0.0	48.3	21.3	30.3	7209	10102	11932	14154	15746	17281	PE3
03582000	9.1	56.6	25.4	8.8	16654	24443	29254	34889	38783	42431	GEV
03582300	0.1	55.0	21.7	23.2	6027	9175	11549	14876	17588	20511	GPA
03583000	6.5	43.0	35.2	15.4	4539	6984	9009	12105	14838	17983	GPA
03583200	0.0	65.2	22.2	12.5	2766	4089	4812	5563	6023	6410	GPA
03583300	0.1	55.0	40.8	4.2	6055	8619	9931	11223	11974	12579	GPA
03583500	0.6	80.3	12.6	6.6	1373	2139	2736	3598	4324	5121	GEV
03584000	3.1	70.3	23.2	3.3	16279	28912	39445	55347	69137	84734	LN3
03584500	6.2	56.5	26.9	10.3	31783	48149	60230	76838	90142	104293	LN3
03597000	0.2	66.5	32.0	1.3	7164	11944	15548	20551	24573	28818	PE3
03597300	0.0	28.5	56.7	14.7	833	1497	2064	2938	3711	4599	GPA
03597450	0.0	33.6	57.3	9.1	401	486	547	629	695	764	GLO
03597500	0.0	24.1	63.4	12.4	4003	5554	6308	7021	7417	7729	PE3

Table B.5. Selected basin characteristics and flood frequency estimates for 295 gaging stations located in Tennessee - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
Hydrologic 3 - Continued											
03597550	0.0	9.7	78.2	12.1	462	699	860	1065	1219	1372	GPA
03597590	0.0	16.2	67.4	16.4	4948	7183	8736	10768	12330	13929	PE3
03598000	1.7	44.9	46.4	7.0	17567	27648	35161	45535	53876	62738	GEV
03598200	0.1	10.2	53.0	36.8	969	1652	2213	3052	3777	4592	GLO
03599000	7.0	41.0	42.0	9.9	4553	7800	10521	14688	18373	22578	LN3
03599200	0.0	8.5	71.1	20.4	4898	8235	10412	13025	14846	16553	GPA
03599400	62.1	2.7	19.2	15.9	170	280	365	483	580	684	PE3
03599500	6.3	30.7	49.8	13.2	25017	34528	41240	50204	57233	64558	GLO
03600000	12.2	46.0	32.4	9.5	4552	7161	9000	11420	13274	15159	GPA
03600088	7.9	46.2	32.9	13.1	2464	2785	2933	3072	3152	3216	GLO
03600500	3.6	83.8	11.8	0.8	2266	3838	4930	6325	7358	8373	GLO
03602000	7.3	46.6	36.2	9.9	33030	46222	55141	66587	75237	83982	GLO
Hydrologic 4											
03594415	8.5	62.7	24.5	4.2	1019	1385	1588	1809	1951	2076	GEV
03594430	1.2	75.0	13.0	10.8	708	898	971	1027	1052	1069	GEV
03594435	6.0	67.5	17.7	8.8	1142	1820	2304	2947	3444	3952	GPA
03594445	2.6	52.0	35.8	9.6	5386	9138	11430	13986	15644	17104	GLO
03606500	0.3	47.2	33.6	18.9	4806	8058	10487	13827	16483	19260	GPA
07024300	0.2	23.6	48.6	27.6	3271	4857	5925	7284	8296	9304	GPA
07024500	0.8	33.5	40.8	24.9	7572	12486	15929	20388	23756	27115	GPA
07025000	1.9	36.5	44.1	17.5	5002	6713	7519	8264	8672	8988	GLO
07025220	0.7	2.9	91.0	5.4	1370	2872	4226	6378	8319	10557	GLO

Table B.5. Selected basin characteristics and flood frequency estimates for 295 gaging stations located in Tennessee - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
					Hydrologic 4 - Continued						
07025400	5.2	22.2	56.5	16.0	8700	14003	18224	24423	29707	35569	GEV
07025500	4.4	20.1	57.2	18.3	9667	16031	20826	27478	32827	38477	GLO
07026000	2.1	21.7	51.6	24.6	27791	41118	46887	51616	53857	55380	GLO
07026300	4.9	21.4	49.7	24.1	22721	31907	35791	38962	40473	41502	GLO
07026500	3.0	47.8	39.6	9.5	5402	9007	12065	16788	21011	25894	PE3
07027500	1.4	50.8	32.5	15.3	8647	14879	20299	28843	36621	45747	GLO
07027800	1.1	41.7	40.5	16.7	10633	18444	24227	32064	38206	44535	PE3
07028000	1.1	40.6	42.3	16.0	14574	24322	30034	36174	40015	43281	GEV
07028500	1.8	27.9	62.4	7.8	3477	5480	7106	9528	11628	13997	GLO
07028600	0.8	44.0	54.4	0.8	504	683	808	973	1101	1233	GEV
07028700	3.7	13.6	80.1	2.6	1406	3034	4670	7565	10467	14129	GLO
07028900	0.4	47.6	38.5	13.6	2939	5813	8667	13741	18857	25403	LN3
07028930	1.2	47.6	48.4	2.8	1622	2237	2634	3126	3484	3836	GPA
07028940	0.9	54.0	42.1	3.0	2789	3994	4834	5935	6784	7658	GLO
07029000	1.4	39.0	46.8	12.9	8116	12316	15118	18636	21230	23779	GLO
07029050	47.3	1.2	22.2	29.3	1062	1418	1618	1835	1977	2103	GEV
07029090	65.1	0.0	24.8	10.1	3223	4948	6043	7346	8257	9118	GPA
07029100	12.4	20.5	50.3	16.8	10861	16023	19429	23686	26812	29884	GPA
07029275	0.6	61.0	31.7	6.7	7275	12557	16036	20226	23148	25884	GLO
07029370	6.7	68.8	20.5	4.0	2003	3064	3927	5226	6358	7645	LN3
07029400	1.4	43.8	45.9	8.8	14802	24226	31558	42035	50708	60163	PE3
07029500	2.4	42.2	43.8	11.7	18723	31331	40844	54049	64659	75852	GPA
07030000	2.4	44.6	42.1	11.0	23832	36146	42934	49989	54304	57922	GEV

Table B.5. Selected basin characteristics and flood frequency estimates for 295 gaging stations located in Tennessee - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
					Hydrologic 4 - Continued						
07030050	2.3	41.5	44.0	12.2	22525	33600	39719	46120	50069	53417	GLO
07030100	1.0	57.5	40.1	1.4	3187	4570	5446	6503	7257	7979	GPA
07030240	8.4	17.4	48.9	25.2	10096	15493	19304	24345	28233	32209	PE3
07030270	6.5	10.6	56.0	26.9	3815	4312	4529	4725	4832	4915	GLO
07030280	5.7	18.5	50.4	25.4	15588	23585	28088	32868	35857	38422	PE3
07030500	6.5	45.7	34.6	13.2	10049	16280	20227	24871	28056	31007	GLO
07031650	6.5	35.8	40.0	17.7	10412	16567	21315	28075	33652	39726	PE3
07031700	6.2	35.2	40.2	18.4	12159	19338	23636	28427	31554	34335	GLO
07032200	-	-	-	-	-	-	-	-	-	-	-
07032224	-	-	-	-	-	-	-	-	-	-	-

Table B.6. Selected basin characteristics and flood frequency estimates for 152 gaging stations located in adjacent states

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
					Hydrologic 1						
02384500	17.1	48.6	23.9	10.5	9216	15160	19756	26283	31658	37480	PE3
02384540	0.0	93.6	6.4	0.0	621	1128	1536	2129	2626	3166	GPA
02384600	0.0	45.6	40.4	14.0	388	601	754	961	1122	1290	GLO
02385000	0.4	51.7	34.1	13.8	3443	5556	7053	9026	10537	12072	GLO
02385500	-	-	-	-	-	-	-	-	-	-	-
02385800	0.0	45.6	23.7	30.7	3584	6209	8396	11715	14615	17907	GLO
02387000	6.3	46.1	29.9	17.7	14073	20374	24508	29667	33448	37168	GPA
03160610	0.0	100.0	0.0	0.0	103	147	180	226	264	305	LN3
03161000	19.8	80.2	0.0	0.0	4487	7886	11388	17856	24680	33774	GLO
03162110	3.0	96.9	0.0	0.1	1119	1655	2027	2513	2886	3266	GPA
03162500	37.4	57.5	4.8	0.3	5469	10198	15898	28126	42969	65317	GLO
03452000	26.5	69.1	2.9	1.5	1960	3008	3907	5323	6611	8128	PE3
03453000	20.9	76.2	2.2	0.7	4156	6999	9410	13123	16435	20258	PE3
03453500	18.5	77.2	3.2	1.2	19072	29412	36381	45195	51729	58175	PE3
03453880	4.0	94.4	1.7	0.0	648	950	1145	1384	1557	1724	GEV
03454000	17.3	62.9	15.0	4.8	3406	5455	7023	9233	11043	13000	PE3
03454500	17.8	76.2	4.4	1.7	22750	36384	47589	64450	79191	95939	GLO
03459000	48.6	49.7	0.0	1.7	1955	2718	3227	3872	4355	4838	GPA
03459500	50.1	48.5	0.0	1.4	10826	16316	20204	25361	29364	33486	PE3
03460000	3.4	86.2	10.3	0.0	1856	2871	3555	4420	5060	5690	PE3
03461910	14.4	85.6	0.0	0.0	372	438	471	505	525	543	GLO
03462000	20.3	79.6	0.0	0.2	2692	4724	6843	10803	15027	20710	GLO
03463300	39.4	56.8	0.3	3.5	5145	9490	13602	20634	27482	36011	GPA

Table B.6. Selected basin characteristics and flood frequency estimates for 152 gaging stations located in adjacent states - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
					Hydrologic 1 - Continued						
03463500	38.8	58.0	0.5	2.7	5541	10241	14839	22936	31067	41445	LN3
03463910	2.8	97.2	0.0	0.0	143	222	285	377	456	544	GLO
03464000	18.3	79.8	1.3	0.6	5003	9365	13572	20877	28098	37200	LN3
03464500	19.4	79.5	0.6	0.5	15358	25306	34081	48209	61291	76927	GLO
03471500	0.9	71.2	17.9	10.0	1993	3171	4062	5305	6315	7398	GLO
03472500	0.0	61.1	33.6	5.3	2110	3140	3865	4825	5568	6333	GPA
03473000	0.4	68.1	23.5	8.0	6607	9714	11968	15026	17450	20007	GLO
03473500	0.1	35.7	19.3	44.9	181	307	401	528	628	731	GEV
03474000	1.9	48.1	17.0	33.0	3411	5776	7633	10299	12514	14925	LN3
03474500	1.8	48.8	19.1	30.2	3810	6224	8258	11389	14180	17402	PE3
03475000	2.0	59.6	15.7	22.7	4205	6596	8254	10404	12030	13666	GEV
03478400	0.3	89.9	0.0	9.8	369	616	818	1122	1386	1683	PE3
03478910	26.8	73.2	0.0	0.0	1051	1899	2571	3537	4336	5197	GPA
03479000	25.6	73.7	0.0	0.7	5601	9776	13243	18471	23001	28126	GPA
03481000	30.2	69.8	0.0	0.0	2077	4084	6633	12388	19722	31244	GLO
03487800	2.9	22.4	32.1	42.6	1325	1885	2197	2531	2742	2926	GEV
03488000	0.7	53.2	37.7	8.4	6113	9301	11588	14652	17052	19544	LN3
03488450	1.3	74.0	11.9	12.8	688	979	1182	1448	1654	1867	GLO
03488500	1.9	59.1	29.9	9.1	10031	15386	19567	25605	30692	36292	GPA
03489800	0.2	58.2	40.3	1.2	857	1186	1363	1546	1659	1756	GLO
03489900	1.1	60.7	36.9	1.3	2404	3395	4085	4989	5685	6403	GPA
03490000	1.7	60.5	30.9	6.9	14542	21172	25768	31775	36383	41089	PE3
03503000	28.3	64.8	4.7	2.2	9738	13581	15969	18818	20832	22749	GLO

Table B.6. Selected basin characteristics and flood frequency estimates for 152 gaging stations located in adjacent states - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
Hydrologic 1 - Continued											
03504000	88.1	10.0	1.8	0.1	2437	3387	4042	4897	5552	6226	GEV
03506500	52.0	35.5	9.3	3.2	5396	8460	10843	14272	17141	20284	GEV
03507000	33.7	58.0	6.0	2.3	13573	21394	27443	36093	43262	51093	GLO
03511000	2.1	91.8	2.9	3.2	5534	7417	8533	9816	10692	11505	GLO
03512000	17.0	78.1	2.3	2.5	8517	11399	13098	15046	16370	17596	GEV
03513000	35.2	59.2	3.8	1.8	17416	27714	35247	45478	53562	61990	GLO
03513500	1.0	98.3	0.7	0.0	945	1292	1529	1839	2076	2320	GLO
03514000	0.8	88.6	2.5	8.1	2303	3635	4666	6141	7365	8702	GPA
03516000	49.7	49.3	1.1	0.0	2747	3986	5090	6875	8541	10543	GLO
03521500	1.6	46.4	26.0	26.0	3567	5110	6005	7002	7657	8247	GLO
03523000	0.8	48.8	50.1	0.3	2259	3148	3668	4254	4645	5003	GLO
03524000	2.0	54.8	41.7	1.5	10495	15834	19550	24410	28123	31892	PE3
03524500	-	-	-	-	-	-	-	-	-	-	-
03524900	0.0	47.3	45.0	7.7	2836	4894	6557	9001	11073	13373	GEV
03525000	0.0	41.8	51.3	6.9	2908	5173	6986	9623	11832	14242	LN3
03526000	0.7	66.2	32.1	1.0	2734	4171	5286	6887	8230	9702	LN3
03527000	3.0	49.4	45.7	1.9	20599	31247	39307	50665	59990	70065	LN3
03529500	5.2	45.5	48.2	1.1	5062	8054	10495	14143	17313	20897	GLO
03530000	5.2	50.7	36.3	7.8	2385	3632	4453	5471	6212	6931	GLO
03530500	0.4	26.3	73.3	0.0	3950	6330	8373	11588	14504	17932	GLO
03531000	3.7	42.7	52.0	1.6	12986	18696	23058	29257	34412	40042	LN3
03531500	3.5	45.0	50.1	1.4	11032	17285	22396	30078	36784	44397	GEV
03544947	0.0	100.0	0.0	0.0	150	365	593	1016	1451	2013	PE3

Table B.6. Selected basin characteristics and flood frequency estimates for 152 gaging stations located in adjacent states - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
Hydrologic 1 - Continued											
03545000	0.2	99.2	0.6	0.0	1899	3022	3851	4986	5891	6841	GPA
03546000	38.9	57.6	2.5	1.0	1256	2174	3230	5389	7896	11532	GLO
03548500	12.9	82.5	3.7	0.9	11612	15872	18465	21510	23632	25630	GPA
03550000	18.8	80.4	0.8	0.0	4037	6180	7748	9884	11582	13372	LN3
03550500	0.6	95.7	3.4	0.3	3399	5089	6269	7819	9008	10222	GLO
03554000	3.4	91.1	5.0	0.5	5969	8959	11149	14144	16532	19063	GPA
03558000	0.3	97.7	2.0	0.1	4570	6839	8340	10215	11592	12942	PE3
03559000	2.4	95.4	2.2	0.1	5856	10217	13565	18260	22054	26068	GPA
03560000	0.3	94.7	5.0	0.0	2386	3472	4309	5505	6506	7603	GPA
03566660	0.5	37.6	53.2	8.6	498	831	1240	2124	3201	4838	GLO
03566685	0.7	70.9	20.0	8.4	1883	3467	4859	7065	9072	11417	LN3
03566687	1.2	89.0	7.7	2.1	318	594	932	1670	2581	3976	GLO
03566700	0.5	55.9	34.5	9.1	9027	12906	15472	18705	21096	23464	GLO
03567200	-	-	-	-	4078	6533	8497	11392	13872	16633	GPA
03568933	0.7	58.5	11.0	29.9	6887	11652	15060	19538	22962	26408	GPA
03572110	41.1	33.8	2.6	22.5	9025	12514	14928	18088	20516	23018	GLO
03572900	0.9	35.9	41.8	21.4	8983	13596	16414	19664	21865	23891	GLO
Hydrologic 2											
03312500	1.1	82.1	16.1	0.7	18688	32909	45218	64519	81975	102291	PE3
03312795	0.6	71.4	28.0	0.0	159	244	311	409	491	583	GPA
03313000	2.4	77.5	19.2	0.8	31378	50423	64590	84083	99691	116145	GPA
03313500	0.4	80.4	19.1	0.0	1382	2018	2598	3554	4462	5572	GLO

Table B.6. Selected basin characteristics and flood frequency estimates for 152 gaging stations located in adjacent states - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
Hydrologic 2 - Continued											
03313700	0.8	78.3	18.9	2.0	5643	9147	11992	16234	19906	24034	GLO
03313800	0.4	96.4	3.1	0.1	2066	3771	5225	7460	9429	11683	GLO
03314000	0.6	76.4	21.9	1.1	15747	27100	37695	55624	73012	94576	GLO
03314500	2.2	73.6	23.1	1.1	29264	46179	60009	80766	98870	119402	PE3
03316000	2.5	33.0	63.9	0.5	5521	7611	8643	9635	10199	10648	PE3
03400500	11.0	73.6	15.5	0.0	3652	5763	7226	9116	10542	11971	GEV
03400700	37.1	60.7	2.2	0.0	5715	9648	12714	17089	20703	24616	GPA
03401000	28.3	62.4	9.3	0.0	16363	25543	32217	41247	48373	55803	LN3
03401500	21.9	42.3	35.8	0.0	3120	4661	5807	7399	8687	10066	PE3
03402000	20.3	41.6	38.1	0.0	4204	6238	7725	9757	11375	13090	GPA
03402020	67.8	18.0	14.2	0.0	544	721	805	883	926	960	GLO
03403910	2.1	26.7	59.3	11.9	11264	16031	19040	22671	25262	27744	PE3
03404900	-	-	-	-	-	-	-	-	-	-	-
03405000	-	-	-	-	-	-	-	-	-	-	-
03406000	-	-	-	-	-	-	-	-	-	-	-
03410500	2.8	43.8	46.7	6.7	44914	61185	71397	83754	92584	101112	GPA
03411000	2.4	52.0	40.3	5.2	50298	72308	87007	105658	119541	133363	GEV
03413200	1.7	56.8	41.3	0.3	2802	4489	5544	6772	7607	8375	GLO
03414102	0.0	38.5	61.5	0.0	614	1157	1375	1523	1580	1611	PE3
03435140	0.3	27.4	66.7	5.7	3199	4920	6275	8244	9912	11759	GPA
03437490	0.0	42.4	53.7	3.9	260	456	575	707	791	864	GPA
03437500	0.7	52.5	46.0	0.8	2773	4450	5780	7727	9381	11213	GLO
03438000	0.9	64.0	33.3	1.9	6325	10281	13639	18860	23548	29002	GLO

Table B.6. Selected basin characteristics and flood frequency estimates for 152 gaging stations located in adjacent states - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
Hydrologic 2 - Continued											
03573000	0.9	55.7	35.1	8.3	6113	9154	11424	14588	17156	19911	GPA
03574500	13.3	23.9	4.0	58.8	17946	27382	34041	42843	49635	56588	GLO
03575000	0.4	54.7	29.2	15.6	16299	31235	43389	61131	75930	91954	GLO
03575700	-	-	-	-	-	-	-	-	-	-	-
03575830	-	-	-	-	-	-	-	-	-	-	-
03576148	0.5	37.7	21.2	40.6	5775	9572	12575	16928	20573	24587	GLO
03576250	0.5	46.6	46.9	6.0	7552	13330	17824	24193	29386	34921	GEV
03576400	0.3	21.5	68.2	10.1	3329	5319	7240	10582	13919	18166	GLO
03576500	0.6	30.0	25.9	43.5	6194	8724	10194	11837	12923	13907	GLO
03577000	0.5	35.2	22.3	42.0	3689	5347	6492	7985	9128	10294	GEV
03586500	1.1	23.4	32.0	43.5	6465	9705	11980	14979	17292	19661	GLO
03590000	0.3	56.4	36.8	6.6	9953	16289	20370	25237	28617	31784	LN3
03591800	9.3	23.9	27.8	39.0	7858	12668	16047	20457	23810	27189	LN3
03592000	12.0	20.7	33.0	34.3	4988	9163	13342	20850	28562	38575	GLO
03592200	27.8	23.7	14.1	34.4	7876	12136	15404	20057	23914	28110	GLO
03592300	32.1	13.5	33.1	21.4	3721	6229	8582	12575	16476	21335	GLO
03592500	19.0	24.5	29.8	26.7	16067	25247	32384	42654	51238	60642	PE3
03592718	0.0	73.1	26.9	0.0	1759	2829	3525	4363	4954	5515	GPA
03592800	1.1	65.5	33.1	0.3	4776	8679	11873	16596	20613	25053	GLO
03593010	0.4	37.0	40.3	22.3	2362	4621	6373	8794	10706	12673	GPA
Hydrologic 3											
03585300	0.7	84.8	11.9	2.6	10083	16895	22368	30411	37228	44809	GLO

Table B.6. Selected basin characteristics and flood frequency estimates for 152 gaging stations located in adjacent states - Continued

Station number	Hydrological soil group (%)				Peak discharge, Q_T (cfs) at indicated recurrence interval, T (years)						Best fitted distribution
	A	B	C	D	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	
					Hydrologic 4						
03610000	0.2	2.8	82.6	14.5	5679	10421	14842	22281	29433	38226	GLO
03610200	0.7	7.7	79.0	12.7	9148	13664	17026	21698	25480	29532	GPA
03610500	0.8	17.2	71.1	10.9	10291	17563	22217	27679	31398	34804	LN3
03610545	1.1	24.3	69.5	5.1	5229	7742	9256	10985	12150	13217	GPA
07022500	1.2	0.0	98.8	0.0	673	1069	1376	1817	2184	2585	GLO
07023000	2.4	14.5	76.5	6.7	6757	9540	11362	13640	15315	16966	GLO
07023500	1.1	12.0	85.5	1.4	3806	4956	5644	6444	6999	7522	GPA
07024000	1.1	15.2	80.4	3.3	3106	4670	5714	7029	8001	8959	PE3
07029252	0.0	81.3	18.7	0.0	343	459	526	603	654	701	GPA
07029270	0.6	61.3	31.0	7.1	7147	11981	15602	20593	24572	28741	PE3
07029300	1.4	28.3	65.0	5.3	8570	14446	18607	24029	28136	32242	GEV
07029412	1.3	46.7	20.8	31.1	1467	1590	1643	1692	1718	1739	GEV
07030365	0.6	79.0	20.3	0.2	231	406	474	521	539	550	GLO
07269000	0.8	41.1	15.3	42.8	2465	4373	5608	7054	8035	8930	GPA
07269990	1.2	48.3	37.8	12.7	11164	15916	18920	22546	25134	27614	GEV
07276000	0.8	49.6	45.9	3.7	11597	17975	20355	21983	22633	22988	GLO
07277500	1.5	43.8	51.1	3.6	17960	35078	49034	69371	86280	104538	GLO
07277730	70.2	11.4	18.1	0.3	14563	17254	18653	20112	21030	21834	GEV

APPENDIX C: THE C++ CODE FOR L-MOMENT RATIO CALCULATION

```
#include <iostream>
#include <vector>
#include <algorithm>
using namespace std;

int main()
{
doubledval;
vector<double>dvec;
while(cin>>dval)
        dvec.push_back(dval);
sort(dvec.begin(), dvec.end());

double sum1=0;
for(vector<double>::iterator ix=dvec.begin(); ix!=dvec.end(); ++ix)
 {
sum1+=*ix;
 }

double l1=sum1/dvec.size();
cout<<"n="<<dvec.size()<<endl;
cout<<"l1="<<l1<<endl;

double sum2=0;
inti=1;
for(vector<double>::iterator iy=dvec.begin()+1; iy!=dvec.end(); ++iy)
 {
  sum2+=(*iy)*i/(dvec.size()-1);
  ++i;
 }

double b1=sum2/dvec.size();
double l2=2*b1-l1;
cout<<"l2="<<l2<<endl;

double sum3=0;
int x=1;
for(vector<double>::iterator iz=dvec.begin()+2; iz!=dvec.end(); ++iz)
 {
  sum3+=(*iz)*x*(x+1)/((dvec.size()-1)*(dvec.size()-2));
  ++x;
 }

double b2=sum3/dvec.size();
```

```
double l3=6*b2-6*b1+l1;
cout<<"t="<<l2/l1<<endl;
cout<<"t3="<<l3/l2<<endl;

double sum4=0;
int y=1;
 for(vector<double>::iterator ia=dvec.begin()+3; ia!=dvec.end(); ++ia)
 {
  sum4+=(*ia)*y*(y+1)*(y+2)/((dvec.size()-1)*(dvec.size()-2)*(dvec.size()-3));
  ++y;
 }

double b3=sum4/dvec.size();
double l4=20*b3-30*b2+12*b1-l1;
cout<<"t4="<<l4/l2<<endl;

double sum5=0;
int z=1;
 for(vector<double>::iterator ib=dvec.begin()+4; ib!=dvec.end(); ++ib)
 {
  sum5+=(*ib)*z*(z+1)*(z+2)*(z+3)/((dvec.size()-1)*(dvec.size()-2)*(dvec.size()-
3)*(dvec.size()-4));
  ++z;
 }

double b4=sum5/dvec.size();
double l5=70*b4-140*b3+90*b2-20*b1+l1;
cout<<"t5="<<l5/l2<<endl;

return 0;
}
```

APPENDIX D: THE C++ CODE FOR DISCORDANCE CALCULATION

```
#include <iostream>
#include <vector>
#include <math.h>
using namespace std;

int main()
{
intconst n=19;//The number of sites. Modified value before building.

double t, t3, t4;

doubleTvec[n][3];

double temp=0;
double temp1=0;
double temp2=0;
for(inti=0; i!=n; ++i)
   {
        cout<<"Please input t, t3, and t4:  ";
cin>>t;
cin>>t3;
cin>>t4;
Tvec[i][0]=t;
        Tvec[i][1]=t3;
        Tvec[i][2]=t4;
        temp+=Tvec[i][0];
         temp1+=Tvec[i][1];
         temp2+=Tvec[i][2];
   }

doubleu_ave[3];

u_ave[0]=temp/n;
u_ave[1]=temp1/n;
u_ave[2]=temp2/n;

double A[3][3]={0};
for(int ix=0; ix!=n; ++ix)
   {
         A[0][0]+=(Tvec[ix][0]-u_ave[0])*(Tvec[ix][0]-u_ave[0]);
         A[0][1]+=(Tvec[ix][0]-u_ave[0])*(Tvec[ix][1]-u_ave[1]);
         A[0][2]+=(Tvec[ix][0]-u_ave[0])*(Tvec[ix][2]-u_ave[2]);
         A[1][0]+=(Tvec[ix][0]-u_ave[0])*(Tvec[ix][1]-u_ave[1]);
         A[1][1]+=(Tvec[ix][1]-u_ave[1])*(Tvec[ix][1]-u_ave[1]);
```

```
            A[1][2]+=(Tvec[ix][1]-u_ave[1])*(Tvec[ix][2]-u_ave[2]);
            A[2][0]+=(Tvec[ix][0]-u_ave[0])*(Tvec[ix][2]-u_ave[2]);
            A[2][1]+=(Tvec[ix][1]-u_ave[1])*(Tvec[ix][2]-u_ave[2]);
            A[2][2]+=(Tvec[ix][2]-u_ave[2])*(Tvec[ix][2]-u_ave[2]);
    }

double M00, M01, M02, M10, M11, M12, M20, M21,M22;
 M00=A[1][1]*A[2][2]-A[1][2]*A[2][1];
 M01=A[1][0]*A[2][2]-A[1][2]*A[2][0];
 M02=A[1][0]*A[2][1]-A[1][1]*A[2][0];
 M10=A[0][1]*A[2][2]-A[2][1]*A[0][2];
 M11=A[0][0]*A[2][2]-A[2][0]*A[0][2];
 M12=A[0][0]*A[2][1]-A[2][0]*A[0][1];
 M20=A[1][2]*A[0][1]-A[0][2]*A[1][1];
 M21=A[1][2]*A[0][0]-A[0][2]*A[1][0];
 M22=A[1][1]*A[0][0]-A[0][1]*A[1][0];

double s;
 s=A[0][0]*M00-A[0][1]*M01+A[0][2]*M02;
 s=abs(s);

double B[3][3];
B[0][0]=M00/s;
B[1][0]=-M01/s;
B[2][0]=M02/s;
B[0][1]=-M10/s;
B[1][1]=M11/s;
B[2][1]=-M12/s;
B[0][2]=M20/s;
B[1][2]=-M21/s;
B[2][2]=M22/s;

for(int j=0; j!=n; ++j)
    {
            double D=0;
     D=((Tvec[j][0]-u_ave[0])*B[0][0]+(Tvec[j][1]-u_ave[1])*B[1][0]+(Tvec[j][2]-
u_ave[2])*B[2][0])*(Tvec[j][0]-u_ave[0])+
                        ((Tvec[j][0]-u_ave[0])*B[0][1]+(Tvec[j][1]-u_ave[1])*B[1][1]+(Tvec[j][2]-
u_ave[2])*B[2][1])*(Tvec[j][1]-u_ave[1])+
                        ((Tvec[j][0]-u_ave[0])*B[0][2]+(Tvec[j][1]-u_ave[1])*B[1][2]+(Tvec[j][2]-
u_ave[2])*B[2][2])*(Tvec[j][2]-u_ave[2]);
            cout<<"the discordancy of site "<<j+1<<" is: "<<D*n/3<<endl;
    }

return 0;
}
```