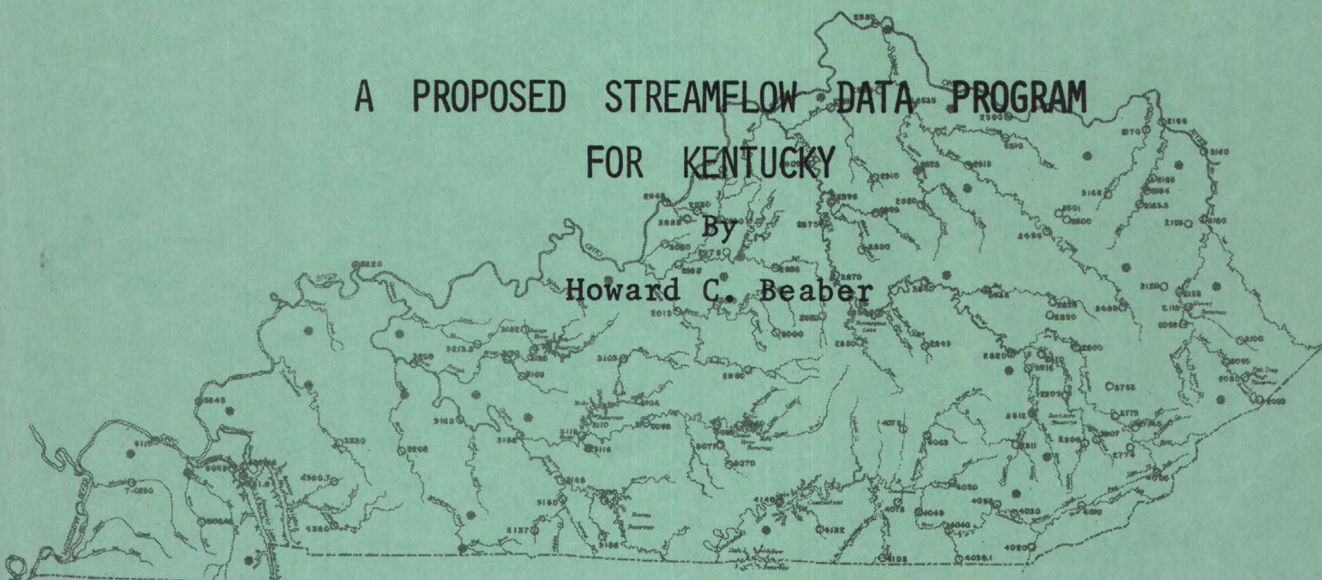
UNITED STATES

DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

WATER RESOURCES DIVISION



A PROPOSED STREAMFLOW DATA PROGRAM FOR KENTUCKY

By

Howard C. Beaber

Open-file report

Louisville, Kentucky

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ABSTRACT

An evaluation of the streamflow data available in Kentucky was made to provide guidelines for planning future programs. The basic steps in the evaluation procedure were (1) definition of the long-term goals of the streamflow data program in quantitative form, (2) examination and analysis of all available data to determine which goals have already been met, and (3) consideration of alternate programs and techniques to meet the remaining objectives. It was found that many of the goals could be met by generalization of the data for gaged basins by regression analysis. This fact indicates that significant changes could be made in the present data program that would allow emphasis to be placed on attaining the goals that have not been met. A streamflow data program based on the guidelines developed in this study is proposed for the future.

INTRODUCTION

Historically, surface-water data programs have developed in the U.S. Geological Survey in response to local economic and hydrologic stimuli. Federal, State, county, and municipal organizations have for many years contributed substantial funds to the Geological Survey to obtain data for specific purposes and general inventory of water resources. Accordingly, over the years, a wealth of streamflow data has been accumulated.

The accelerated need for water resources information, coupled with advances in water science, indicates the need for an improved approach to evaluating and planning a surface-water data program. The purpose of this study is to set forth the results of a study of the present streamflow data program and recommend ways in which it may be improved or modified.

Stream gaging in Kentucky to provide daily flow records was first started in 1907 when the U.S. Geological Survey established two stations on the Cumberland River at Cumberland Falls and the Kentucky River near Winchester. Several earlier stations established in 1905 were inadequate to compute daily discharge.

In 1912 the Kentucky legislature passed an act creating a State Geological Survey and authorized it to co-operate with federal agencies. Subsequently in 1915 a co-operative program was arranged between the U.S. Geological Survey and the State Geologist for the collection of streamflow data, with expenditure of State money limited to the payment of gage observer's salaries for a few stations. This limited State co-operative program was continued through 1932.

The Rivers and Harbors Bill signed on March 4, 1915, directed the Army Engineers to make surveys in the Ohio River basin and shortly after this time the Engineers co-operated in the establishment of a few gaging stations in Kentucky.

About 15 stations were operated during the period 1915 to 1927 in co-operation with the State Geologist and Army Engineers. This number was increased to about 30 in 1931. The succeeding years of the depression (1932-37) reduced funds to such an extent that only a few stations were operated during the depression years.

The destructive effect of the severe floods of 1936 in the northeastern states and the outstanding floods of 1937 in the Ohio River basin strongly emphasized the need for streamflow data. The Kentucky Department of Highways, realizing the need for this type of data, entered into a co-operative agreement with the U.S. Geological Survey in 1938. Thus, based on increased support provided by the Army Engineers and the Department of Highways, a District office was established by the U.S. Geological Survey in Louisville on April 18, 1938. Supplementary Federal support was also provided for several years through allotments from the Works Progress Administration (WPA) for the repair, maintenance, and construction of stream-gaging stations.

Through the increased co-operative support, additional stream-gaging stations were established or re-established in 1938 and 1939 such that 32 stations were in operation by June 30, 1938, and 50 stations in operation by June 30, 1939. In the meantime, 12 stations located in Kentucky, but operated by the U.S. Geological Survey offices in the contiguous states of Indiana, Missouri and Tennessee, were transferred to the Kentucky District. During the subsequent period of about 10 years the number of gaging stations was gradually increased to about 90 stations.

In 1949, through the efforts of the newly created Agricultural and Industrial Development Board of Kentucky, the State co-operative stream-gaging program was reorganized and enlarged on a state-wide basis to include investigations of surface and ground waters, and quality of these waters. The Department of Highways co-operation on surface water was transferred and included in the overall state-wide program in co-operation with the Agriculture and Industrial Development Board. Thus, the present state-wide program in co-operation with the Kentucky Geological Survey represents a continuation of the overall program established in 1949. Indirectly this overall program was supported by other State agencies, including substantial support by the Department of Highways.

During the period 1949 to 1954 a number of gaging stations were established and a few stations were discontinued for various reasons. The new stations were mostly on small streams, some of which were established in co-operation with the Soil Conservation Service for the program of small watershed studies, and others for specific agency needs such as the Department of Highways need for data on small streams at selected locations.

In the period from 1955 through 1969, a total of 35 gaging stations were added to the state wide network including 21 stations established in co-operation with the Corps of Engineers in connection with flood-control projects. The other 14 stations were established for various projects or programs in co-operation with other Federal and State agencies, including a few stations at selected locations, to improve the hydrologic network under the State co-operative program and the needs of the State agencies. Thus, on June 30, 1970, there were 139 continuous streamflow stations in operation in Kentucky.

During the severe drought of 1953 about one-hundred low-flow sites were selected on ungaged tributary streams or at intermediate points on gaged streams to provide low-flow coverage of the State. Discharge measurements were made at these sites for this drought and measurements made at most of the sites in succeeding years during low-flow or drought periods. Sixty-six of these sites were incorporated into a low-flow partial record network in 1968.

A crest-stage partial-record network was begun in 1957 with 36 crest-stage gages being operated at the present time.

HYDROLOGY OF KENTUCKY

The climate of Kentucky is moderate and temperate, but has rather wide extremes of temperature and precipitation. The State lies within the path of frequent moisture-laden pressure systems moving northeastward from the Gulf of Mexico, producing precipitation in the form of rain, snow, sleet and hail. These pressure systems are accompanied by corresponding changes in temperature.

Kentucky has a mean annual precipitation of 46 inches ranging from about 40 inches in the extreme north part of the State to about 52 inches in the south central part. Rainfall during severe storms can amount to as much as 8 inches in a 24-hour period. These heavy flood-producing rains are most apt to occur during the months from December through March. Drought conditions are most likely to occur from July to October.

Snow in Kentucky usually falls from November through March with the mean annual snowfall ranging from 6 to 10 inches in the southwest to 15 to 20 inches in the eastern mountains.

The mean annual temperature in Kentucky ranges from about 54°F in the northern part of the State to about 59°F in the southwestern part. Minimum temperatures in the winter are caused by cold waves moving southward from Canada, with maximum temperatures in summer caused by high pressure areas over the southeastern States.

Data on evapotranspiration in Kentucky is rather scarce, however, observations by the Tennessee Valley Authority at the Murray, Kentucky-Paris, Tennessee evaporation station indicate that about 75% of the annual evaporation occurs from April through October. Monthly mean evaporation at this station ranges from about 1.1 inches in December and January to about 6.5 inches in July (for the period 1943-64).

Physiographically speaking, Kentucky consists of seven areas shown in figure 1. The Bluegrass area consists of rolling land with deeply eroded river channels, and shallow stream beds. Cavernous limestone typically underlies the inner Bluegrass area. The Knobs area extends in an irregular strip around the Bluegrass area from the Kinniconnick Creek basin to the mouth of the Salt River and is characterized by knob-like topography, steep slopes, deeply eroded stream channels and thin eroded soils.

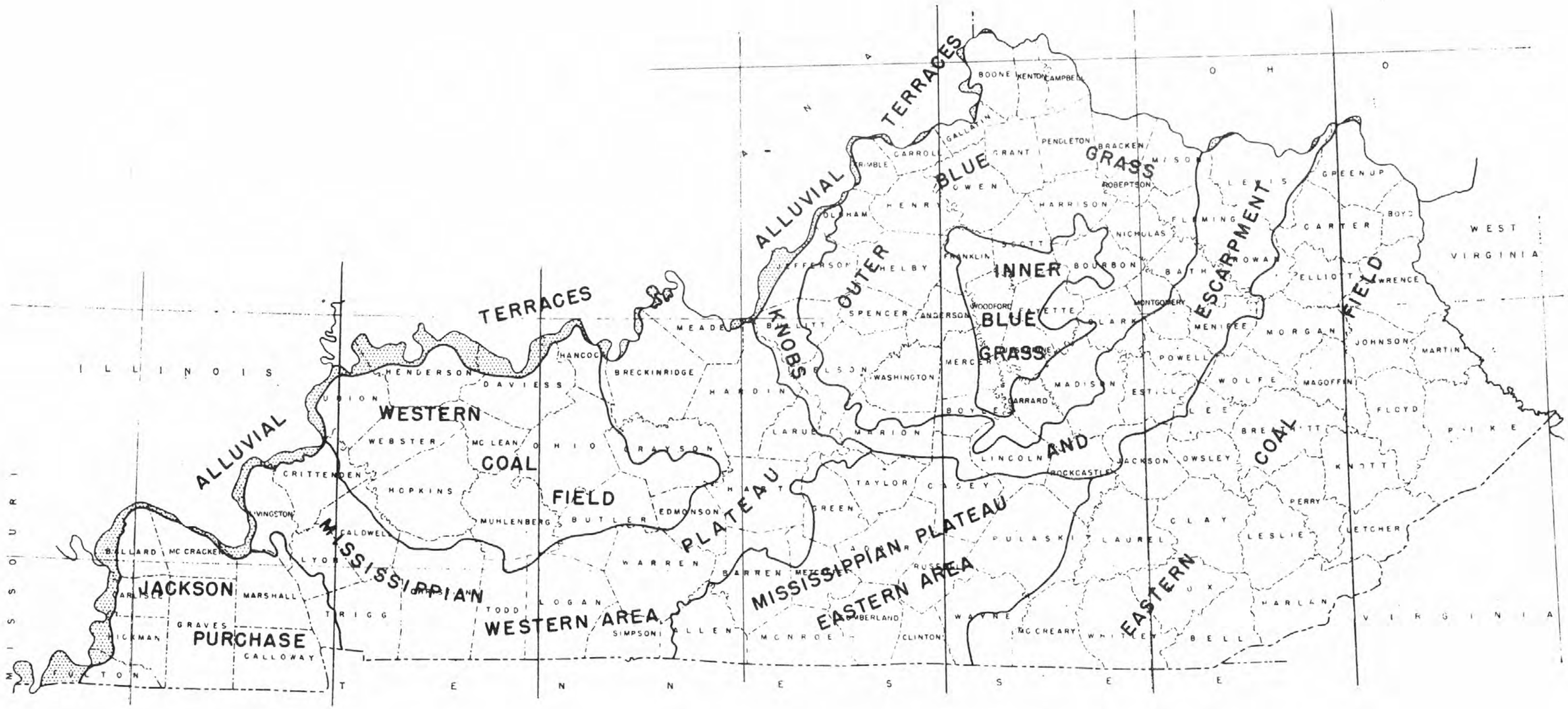

FIGURE 1.- PHYSIOGRAPHIC AREAS OF KENTUCKY

East of the Knobs area, beginning in the Tygarts Creek basin and extending southwest to the Cumberland River at the Kentucky-Tennessee State line, is the Cumberland Plateau or Eastern Coal Field region, consisting of steep ridges, deeply eroded stream beds, and numerous outcroppings of limestone and sandstone. The highest mountain in the State is in this area; Big Black Mountain, elevation, 4,145 feet.

West of the Cumberland Plateau and south of the Knobs area and extending westward to the mouth of the Cumberland River is the Mississippian Plateau characterized by rolling country side, marked by deep stream beds, short streams, and numerous outcroppings of sandstone and limestone. Much of this area is underlain by cavernous limestone, the most well-known caverns being those at Mammoth Cave. In this area drainage is dominantly subsurface. North and west of the Mississippian Plateau area is the Western Coal Field region extending from the Blackford Creek basin to the mouth of the Tradewater River and eastward to the mouth of the Barren River. Most of the region is a rolling upland underlain by shale and sandstone and marked by gently sloping valley walls and wide valley bottoms. Between the Tennessee and Mississippi Rivers is the Jackson Purchase area, an area of low relief underlain by soils varying from the thin red soils of the hilly area to the thick alluvial soils of the Mississippi River bottoms. The seventh region is a thin irregular shelf bordering the Ohio River from the mouth of the Big Sandy River to the mouth of the Cumberland River, characterized by alluvial sand and gravel.

There are about 3,000 miles of navigable streams in Kentucky, of which the Ohio River is the largest and most important. Two of the largest man-made lakes in the world are partially in Kentucky; Kentucky Lake on the Tennessee River and Lake Barkley on the Cumberland River.

CONCEPTS AND PROCEDURES USED IN THIS STUDY

The principal concept of this study is that streamflow information may be needed at any point on any stream in Kentucky, and that the program must be designed to accommodate this need. This information can be provided by a combination of data collection and hydrologic studies that generalize the information obtained at gaging sites.

Another important concept is that the goals of the program, including accuracy goals, should be identified in quantitative form. This permits evaluation of existing data to determine which goals have been attained and how the program should be modified.

The procedures used in this study are presented with reference to the general framework shown by table 1. Streamflow data are classified into four types; (1) data for current use, (2) data for planning and design, (3) data to define long-term trends (4) data on the stream environment. For the second type of data, streams are classified as natural or regulated, and each of these classifications is further subdivided into principal or minor, with the separation of the two occurring at a drainage area of about 500 square miles.

Table 1.—*Framework for design of data collection program*

Type of data	Current use	Planning and Design				Long-term trends	Stream environment
		Natural Flow		Regulated Flow			
		Minor streams	Principal streams	Minor streams	Principal streams		
Goals	To provide current data on streamflow needed for day-by-day decisions on water management as required.	To provide information on statistical characteristics of flow at any site on any stream to the specified accuracy.				To provide a long-term data base of homogeneous records on natural-flow streams.	To describe the hydrologic environment of stream channels and drainage basins.
Drainage area limits	Full range	Less than 500* sq mi.	Greater than 500* sq mi.	Less than 500* sq mi.	Greater than 500* sq mi.	Full range	Full range
Accuracy goal	As required	Equivalent to 10 years of record.	Equivalent to 25 years of record.	Equivalent to 10 years of record.	Equivalent to 25 years of record.	Highest obtainable	As required
Approach	Operate gaging stations as required to provide specific information needed.	Relate flow characteristics to drainage basin characteristics using data for gaged basins.	Operate gaging stations to obtain 25 years of record (or the equivalent by correlation) at a network of points on principal streams; interpolate between points.	Develop generalized relations that account for the effect of storage, diversion or regulation on natural flow characteristics.	Utilize analytical model of stream system with observed data as input to compute homogeneous records for both natural flow conditions and present conditions of development.	Operate a number of carefully selected gaging stations indefinitely.	Observe and publish information on stream environment.
Evaluate available data	Identify stations where data is used currently and code the specific use of data.	Develop relationship for each flow characteristic and compare standard error with accuracy goal. Evaluate sample.	Lay out network of points on principal streams and compare data available at these points with goal.	Appraise type of regulation, data available, and areas where relationships are needed.	Identify stream systems that should be studied using model approach and determine data requirements.	Select two stations in each WRC subregion to operate indefinitely for this purpose.	Evaluate information available in relation to goals.
Design future program		Identify goals that have not been attained. Consider alternate means of attaining goals. Identify elements of future program.					

*May be varied with terrain and hydrologic conditions.

In the initial phase of the study, program goals were established for each type of data. All available data were then examined and analyzed. This led to a comparison of the information now available with the goals that had been set and to consideration of the elements that should be included in the future program.

Data for Current Use

Current information on streamflow is needed at many sites for day-by-day decisions for water management, for accounting of current water availability, for the management of water quality, for the forecasts of flow, and for the surveillance necessary to comply with legal requirements. Sites at which the needed data are collected are termed "current purpose" streamflow stations.

Data for current use are obtained by operating gaging stations to obtain the data specifically required for water-management systems. Current-purpose data stations are identified separately in this study because (1) justification can be related to specific needs; (2) the data may have little or no transfer value in a hydrologic sense; and (3) the locations of the stations, the accuracy requirements, and the period of operation are specified by the user of the data, who usually provides the financing.

This part of the program is not subject to design, but changes in response to the needs for data in water management.

Data for Planning and Design

Streamflow records form the principal basis for the planning and design of water-related facilities. Past hydrologic experience, however, is never precisely duplicated in the future; the exact sequence of wet and dry years probably will not occur again. For this reason, designers and planners commonly utilize statistical characteristics of streamflow rather than the records of flow at specific times. It is assumed that the probability of occurrence of a flow of a given magnitude or other statistical parameter in the future can be approximated from the frequency of such occurrence in the past. Typical statistical characteristics are the mean flow, the flood of 50-year recurrence interval, and the standard deviation of annual mean flows.

A long record of streamflow at the specific site is desirable for defining statistical characteristics of streamflow at that site. Although it is not feasible to collect a long continuous streamflow record at every site where it may be needed, a number of such stations are required to provide information that can be transferred to ungaged sites or to sites where little streamflow information is available.

Natural-Flow Streams

The transfer of information on natural-flow streams is done by relating flow characteristics to basin characteristics, such as drainage area, topography, and climate; by relating a short record to a longer one; or by interpolating between gaged points on a stream channel.

To evaluate the statistical characteristics of streamflow, the streams in Kentucky were identified as having either natural or regulated-flow conditions. For the purpose of this study, streams were also defined under each of the above categories as being minor streams (drainage area less than 500 sq mi), or principal streams (drainage area greater than 500 sq mi). The intent is to use size of drainage area as an index, as more costly water developments can be expected on larger streams, justifying a higher accuracy goal for principal streams than for minor streams. The point of division of 500 square miles was modified in some instances in the mountainous and knob areas of eastern Kentucky where a division point of about 400 square miles was used. The principal-stream network was further defined by first identifying sites with drainage areas of about 500 square miles on the upstream segment of all streams, and then identifying the next and following sites on each stream from the upstream station to the mouth at points where the drainage area has doubled, or more than doubled, due to large tributaries.

Regulated-Flow Streams

The natural flow regimen of many streams is altered by the construction of storage reservoirs and the diversion of water for consumptive use. These alterations increase the scope of both the data collection and the analysis that is required to provide information on the flow characteristics.

To be useful in statistical prediction, streamflow data must be homogeneous in time. Frequently, it is not possible to obtain a long record under one condition of development before additional changes occur.

Definition of the flow characteristics at any point on any stream is also much more difficult under conditions of regulation. The procedures used for natural streams--regression, correlation, interpolation, etc.--cannot be applied.

For regulated streams, a systems approach seems to be the most efficient way of providing meaningful information on the statistical characteristics of flow. This approach requires some type of analytical model of the stream system. Such models are simple in concept and generally consist of water-budget equations and flow-storage equations. However, in many instances the use of the digital computer is required for complex equations, or to handle large volumes of data. A computer program tailored to the individual system can be prepared.

Development of such a model requires information on stage-capacity curves of reservoirs, stage-discharge curves at the outlets, operating-rule curves for the release of water, losses due to evaporation and seepage, the geometry of the stream channel, and records of diversions and return flow. Information on streamflow at some point or points is also needed as input to the model and to verify the output. Frequently aquifer characteristics and ground-water pumpage should be considered.

The model and the associated data can be used to derive homogeneous data for both the natural and the regulated conditions. All historical streamflow records for both natural and regulated flows could be used as input to the model. Furthermore, data could also be derived for ungaged sites in the stream system.

Accuracy Goals

In using past hydrologic experience to appraise the probability of future occurrences, some error must be tolerated. Natural streamflow, like other events related to climate, is generally random in occurrence and varies greatly in time and space. Statistical techniques used in the analysis of random events, therefore, are considered applicable. Measures of the variability with time of annual mean flow and other streamflow characteristics are determined from the historical streamflow data, and the probable errors involved in defining streamflow characteristics can be appraised. The principal measure of the accuracy with which a particular streamflow characteristic can be determined is the statistical measure of error, "standard error of estimate," and is expressed in this report as a percentage of the average value of the characteristic. The standard error is the estimated limit above and below the average within which about 67 percent of future values of the characteristics are expected to fall. Conversely, there is only one chance in three that future values will differ from the average by more than one standard error.

In general, the longer the record, the more reliable are the estimates of probable future occurrences. However, even with a long record, say 50-100 years or more, it is not possible to determine with great precision the probability of certain flow characteristics such as floods of a given magnitude, for example. The standard error of various streamflow parameters decreases with the years of available record, but at a decreasing rate; typical examples are shown in figure 2. The incremental economic value of the additional years of record beyond a reasonable limit in the planning and design of projects is under continuing study, but no usable guidelines are available now.

Accuracy goals for streamflow characteristics are expressed as the accuracy equivalent of an arbitrary number of years of record. These goals are the same for natural and regulated flows; that is, accuracy equivalent to that which would be obtained from 10 years of record at the site for minor streams (drainage area, less than about 500 sq mi), and accuracy equivalent to that which would be obtained from 25 years of record for principal streams (drainage area, more than about 500 sq mi).

At sites on natural-flow streams where streamflow records are not available, the desired streamflow characteristics may be defined by means of the relation between the streamflow parameter and the characteristics of the drainage basin. This definition is accomplished by multiple regression analysis, a statistical method of handling sample data that can relate a streamflow characteristic to the topographic and climatic characteristics that affect streamflow. This analysis produces a regression equation that can be used to compute the flow characteristics at any

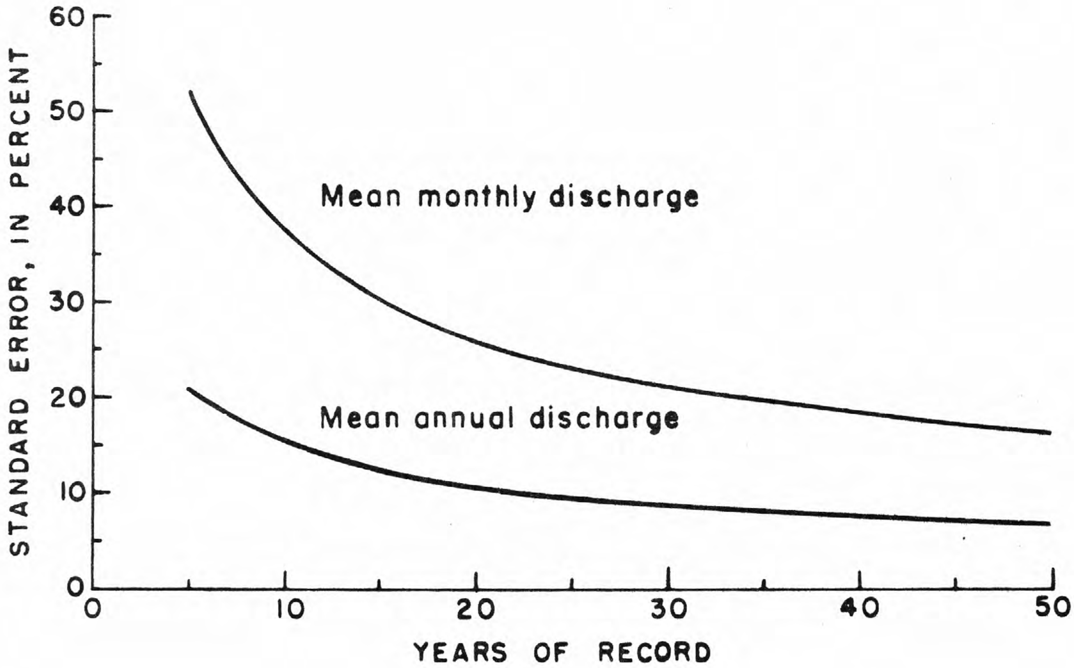

FIGURE 2.-CURVE SHOWING RELATION OF STANDARD ERROR TO YEARS OF RECORD

point on natural streams in Kentucky. The standard error of a regression equation provides a measure of the accuracy of an estimate made from it at an ungaged site. That error may be compared with the error associated with the same characteristic defined from a given number of years of record in order to determine whether the accuracy objective has been met.

Data to Define Long-Term Trends

Characteristics of streamflow defined from gaging-station records are used to estimate future-flow characteristics, on the assumption that the observed record is a representative sample of the long-term flows of the stream. To affirm this assumption, or to better define the ways in which the characteristics of flows change with time, selected gaging stations on natural streams should be operated indefinitely. The accuracy of gaging at these sites should be the highest that the state of the art permits.

Data on Stream Environment

Environmental data describe the physical environment in which the water exists, especially those features that relate to the use of water for recreation, waste disposal, conjunctive surface water-ground water supply, and the preservation of the esthetic character of water features. The types of data required for this purpose are suggested by the following:

1. The geologic and hydraulic properties of the stream-aquifer systems.
2. Time of travel of solutes in stream channels.

3. Definition of flood profiles along stream channels.
4. Identification of flood plains of streams for floods of different frequencies.
5. Definition of stream and stream-channel properties, such as velocities, depths, bank vegetation, bed material, water temperature, water quality, and accessibility.
6. Data needed to define the effects of manmade changes in the environment on the quantity and quality of streamflow.
7. Character of the drainage basin, including area, vegetal cover, land and channel slopes, geology, and topography.
8. Climatic factors influencing the water supply.

GOALS OF THE KENTUCKY STREAMFLOW DATA PROGRAM

The objective of the Kentucky streamflow data program is to provide information on flow at any point on any stream. Within this general objective, specific goals are set for each of the four types of data that represent the particular information that is needed.

Data for Current Use

The program goal for this type of data is to provide the particular information needed at specific sites for current use. Accuracy goals at a given site, as specified by the data user, can be met by intensive observation, or by more sophisticated instrumentation as needed.

Data for Planning and Design

The goal for this type of data is to define, within the given accuracy, the statistical flow characteristics listed in table 2. This definition applies not only to all streams with natural flow, but also to those streams that are affected by regulation and diversion. The accuracy goals shown for each flow characteristic are equivalent to 10 years of record for minor streams and 25 years of record for principal streams. The standard errors were calculated from a theoretical relation of standard error to index of variability (for Kentucky streams) and number of years of record.

Table 2.--Accuracy goals

Streamflow characteristic	Standard error (percent)	
	10 years	25 years
Mean annual discharge	11	7
Mean monthly discharge (average)	35	22
Standard deviation of annual discharge	22	14
Standard deviation of monthly discharges (average)	22	14
50-year flood	29	18
7-day 2-year low flow	29	18
7-day 20-year low flow	45	28
7-day 50-year high flow	27	17

Data to Define Long-Term Trends

The goal for this type of data is to operate indefinitely a small network of gaging stations on streams that are expected to be relatively free from manmade changes. One or two stations should be located in each major drainage area in the State, and stations should be located on streams that differ in physical characteristics.

Data on Stream Environment

Environmental data describe the flow and the stream channel in terms that will be valuable in planning the use of the stream for any purpose such as recreation, waste disposal, conjunctive surface water-ground water supply, and in guarding against water hazards. The long-range goals for this type of data in Kentucky are given below:

1. Hydrometric surveys of stream-aquifer systems.
2. Surveys of time of travel of solutes in stream channels.
3. Definition of flood profiles along stream channels.
4. Identification of flood plains of streams for floods of different frequencies.
5. Reconnaissance surveys of streamflow and stream channel parameters that are related to the use of the stream for recreation, such as velocities, depths, bank vegetation, bed material, water temperature, water quality, and accessibility.

6. Research studies of the effect of manmade changes in the environment on streamflow.
7. Basin characteristics such as area, slopes, and soils.

EVALUATION OF EXISTING DATA IN KENTUCKY

In this evaluation all available data are considered and analyzed in relation to program objectives. A separate evaluation is made for each of the four types of data.

Data for Current Use

Kentucky has 100 stations in the stream gaging network to provide data for current use. The need for this type of data is presently being met but will change from year to year as the requirements change. The need for this type of data has increased rapidly over the past 11 years due mainly to construction of flood control reservoirs. Many more reservoirs are either in the construction or planning stage. The current purpose stations operated in Kentucky are shown in table A-1 of the appendix. The summary below shows a breakdown of the current purpose stations as to data use. Any one gaging station may have multiple data uses.

Data use	Number of stations
1. Accounting of current surface water availability.	14
2. Current data on a day-by-day basis for water management.	62
3. Forecasts of flow.	35

Data use	Number of stations
4. Discharge for computation of sediment loads.	6
5. Legal requirements.	1
6. Research or special studies.	28

Data for Planning and Design

The statistical characteristics of streamflow can be defined by sample gaging, analytical methods of regionalization, systems studies, or any combination of the three. The following discussion of the evaluation of this type of data follows the framework shown in table 1.

Evaluation of the Natural-Flow Systems

The purpose of the evaluation is to determine how accurately the statistical characteristics that are listed as goals can be defined by regionalization of the data now available.

The most effective way now known for defining statistical streamflow characteristics on a broad scale is to relate the streamflow characteristics to basin characteristics in equations developed by use of multiple-regression techniques applied to past data.

Once the equation and its constants are defined, streamflow characteristics for a specific site in a given basin can be computed by substituting the appropriate values of the hydrologic basin characteristics variables in the formulas.

The results of the multiple-regression equations were based on the records for 129 gaging stations in Kentucky and contiguous States, representing unregulated flow and having 10 or more years of record. The records include both minor and principal streams and were not adjusted to any particular base period. Records for Tennessee River near Paducah, Cumberland River near Grand Rivers, or mainstem stations on the Ohio River were not used because of the magnitude of the drainage areas.

A second regression analysis was made as described above except this analysis included only those stations of about 500 square miles or less in drainage area. The results of this analysis indicate little or no change in standard errors of estimate for flow predictions and are not included in this report.

Drainage-basin characteristics.--Drainage-basin characteristics defined for this study are:

a. Drainage area, in square miles, as shown in the latest Geological Survey streamflow reports, measured on 1:24,000 U.S. Geological maps.

b. Main-channel slope, in feet per mile, determined from elevations at points 10 percent and 85 percent of the distance along the channel from the gaging station to the divide. This index was described and used by Benson (1962, 1964).

c. Main-channel length, in miles, from the gaging station to the basin divide, as measured with a template graduated in 0.1-mile units, or as taken from river profiles furnished by the U.S. Army Corps of Engineers.

d. Area of lakes and ponds, expressed as percentage of the total drainage area, determined from 1:24,000 U.S. Geological Survey maps. The parameter used for regression analysis was percent area of lakes and ponds plus 1.0.

e. Mean basin elevation, in thousands of feet above mean sea level, measured on 1:24,000 U.S. Geological Survey maps by laying a grid over the map, determining the elevation at grid intersections, and averaging those elevations. The grid spacing was selected to give at least 25 intersections within the basin boundary.

f. Forest cover, expressed as a percentage of the total drainage area, is the area covered by forests as shown on 1:24,000 and 1:250,000 U.S. Geological Survey maps, determined by the grid method. The parameter used for regression analysis was percent forest cover plus 1.0.

g. Mean annual precipitation, in inches, determined from an isohyetal map prepared by the U.S. Weather Bureau. The parameter used for regression analysis was mean annual precipitation minus 20.

h. The maximum 24-hour rainfall having a recurrence interval of 2 years (24-hour 2-year rainfall), expressed in inches. These values were determined from U.S. Weather Bureau publication (1961).

i. Non-contributing drainage area, expressed as a percentage of the total drainage area, is the area which does not contribute directly to surface runoff, determined from 1:24,000 U.S. Geological Survey maps. The parameter used for regression analysis was percent non-contributing area plus 1.0.

j. Soils infiltration index, in inches, a measure of soils infiltration capacity furnished by the Soil Conservation Service.

Values of the above basin characteristics for 114 gaging stations in Kentucky used in the analysis are listed in table A-2.

Streamflow characteristics.--The following streamflow characteristics defined at gaging stations include the full range of flow and represent those required for planning and design:

a. Flood-peak characteristics are represented by discharges from the annual flood-frequency curve at recurrence intervals of 1.25, 2, 5, 10, 25, and 50 years. In this report, these peak-flow rates are denoted as $P_{1.25}$, P_2, etc. The frequency curves were prepared as described by the Water Resources Council (1967). The symbol P_a refers to the average of the annual peak discharges.

b. Mean-flow characteristics are described by the mean of the annual means, Q_a, and by the means of record for each calendar months, Q_n, where the subscript refers to the numerical order of the month beginning with January as 1.

c. Flow-variability characteristics are represented by the standard deviations of the annual and monthly means. The symbols used are, respectively, SD_a and SD_n, where the subscript n refers to the numerical order of months with January as 1. The symbol SD_p refers to the standard deviation of the annual peak discharges.

d. Low-flow characteristics are the annual minimum 7-day mean flows at 2-year and 20-year recurrence intervals ($M_{7,2}$ and $M_{7,20}$). These were determined from graphical low-flow frequency curves.

e. Flood-volume characteristics represent the annual highest average flow for 3-day, 7-day, 15-day, and 30-day periods at recurrence intervals of 2, 5, 10, 25, and 50 years. These characteristics are noted symbolically in this report as $V_{3,2}$, $V_{3,5}$, $V_{3,10}$, $V_{3,25}$, $V_{3,50}$ $V_{7,2}$, etc. They were determined from frequency curves prepared as described by the Water Resources Council (1967).

f. Skewness, or measures of dispersion are represented by the symbols SK_a, SK_{V7}, and SK_p, where the subscripts a, V7, and p, refer to annual discharge, 7-day high average flow discharge and average of the annual peaks, respectively.

Values for most of the flow characteristics for 114 gaging stations in Kentucky are shown in table A-3.

Regression analysis.--The next step was to relate each of the streamflow characteristics to basin and climatic characteristics in equations developed by using multiple regression techniques. The equation has the form $Y=aA^{b1}S^{b2}L^{b3}$ -----, where Y is a statistical streamflow characteristic; A, S, and L are topographic or climatic characteristics; a is the regression constant; and b_1, b_2, and b_3 are coefficients obtained by regression. This method was described by Benson (1962). In this study, drainage area, main-channel slope, main-channel length, area of lakes and ponds, basin elevation, forest cover, annual precipitation, rainfall intensity, non-contributing area, and soils index, were used initially in each regression. The computer calculated the regression equation, the standard error of estimate, and the significance of each basin parameter. Automatically, then, the computer repeated the calculations, omitting the least significant basin parameter in each calculation until only the most significant parameter remained. After relations for a given streamflow characteristic had all been computed, the entire computation process was repeated using another streamflow characteristic along with the same set of basin characteristics.

Table 3 illustrates the output of the regression analyses of mean annual flow. On the basis of the regression analyses, the equation for determining mean annual discharge at ungaged sites in Kentucky, which includes all statistically significant variables, is

$$Q_a=0.270A^{1.01}St^{-0.14}E^{0.23}I^{1.36},$$

where Q_a is mean annual discharge, in cubic feet per second; A is drainage area, in square miles; St is area of lakes and ponds in percent of drainage area (plus 1); E is the mean elevation of the basin, in thousands of feet above mean sea level; and I is the maximum 24-hour 2-year rainfall intensity, in inches. By eliminating area of lakes and ponds from the equation, the standard error is increased by only 0.2 percent. In this instance, the equation using only drainage area, elevation and rainfall intensity would be the most useful, as the use of this equation will eliminate the necessity of computing the area of lakes and ponds.

Table A-4 shows, for each of 59 streamflow characteristics, the regression constant, the regression coefficient (exponent) for all statistically significant basin parameters, and the standard error.

The standard errors shown in table A-4 should be compared with the corresponding values of table 2 to determine whether the accuracy goals have been met. A detailed discussion of this comparison will be deferred to a later section of this report.

Principal streams.--The object of this study consisted of identification of sites on principal streams and the corresponding length of record at each site. Techniques of regionalization, in general, cannot be used

Table 3.--Summary of regression analyses of mean annual flow

Dependent variable	Regression constant	Regression coefficients for independent variables										Standard error of estimate	
		Area	Slope	Length	Lakes and ponds	Elevation	Forest cover	Precipitation	Intensity	Non-contributing area	Soils	Percent	Percent change[a]
Mean annual flow.	0.172	[b]0.98	-0.006	0.037	-0.11	[b]0.19	0.006	0.29	[c]0.81	0.003	0.093	12.1	-------
	.168	[b].98	------	.043	-.11	[b].18	.006	.29	[c].80	.003	.094	12.1	0
	.165	[b].98	------	.044	-.11	[b].18	.005	.30	[c].79	-----	.11	12.1	0
	.161	[b].99	------	.042	[c]-.11	[b].18	-----	.32	[c].76	-----	.11	12.1	0
	.162	[b]1.01	------	-----	-.11	[b].18	-----	.34	[c].72	-----	.10	12.1	0
	.144	[b]1.01	------	-----	[c]-.12	[b].17	-----	[c].38	[c].80	-----	-----	12.1	0
	.270	[b]1.01	------	-----	[c]-.14	[b].23	-----	----	[b]1.36	-----	-----	12.1	0
	.29	[b]1.01	------	-----	-----	[b].25	-----	----	[b]1.27	-----	-----	12.3	+.2
	1.22	[b]1.01	------	-----	-----	[b].10	-----	----	-----	-----	-----	14.4	+2.1
	1.19	[b]1.02	------	-----	-----	-----	-----	----	-----	-----	-----	14.8	+0.4

a Percent change when least significant variables are dropped, as indicated by dashed line in column.

b Significant at 1-percent level.

c Significant at 5-percent level.

for principal streams because of higher accuracy requirements, therefore, the goals for this category must be met by actual operation of gaging stations.

There are at present 15 stations in Kentucky in the unregulated principal stream system and all 15 of these sites have met the goal of over 25 years of record.

Three stations in the Licking River basin and two stations in the North Fork Kentucky River basin, although falling in the unregulated principal stream category, were not classified as such. At the present time a flood control dam is under construction in both basins and these five stations are identified in the regulated principal stream system.

Evaluation of the Regulated-Flow Systems

The goals for regulated streams are more difficult to attain because the technique of regionalization does not apply, the characteristics are not necessarily stationary in time, and a meaningful correlation seldom exists between flows at two sites if at least one of the flows is regulated. A systems approach may be used to define the characteristics of regulated streamflow under different patterns of regulation, or under the condition of natural flow. Systems studies for all of the regulated-stream systems in Kentucky will require a major effort. Therefore, the present evaluation is limited to (1) identifying the regulated streams, and (2) describing briefly the approach that will be used.

Streams in Kentucky which are materially regulated are as follows:

STREAM	REACH OF STREAM
Levisa Fork	Below Fishtrap Reservoir
Russell Fork	In Kentucky
Johns Creek	Below Dewey Reservoir
Big Sandy River	Below Tug Fork
Little Sandy River	Below Grayson Reservoir
Middle Fork Kentucky River	Below Buckhorn Reservoir
North Fork Kentucky River	Below Middle Fork Kentucky River
Kentucky River	Below South Fork Kentucky River
Dix River	Below Herrington Lake
Green River	Below Green River Reservoir
Nolin River	Below Nolin River Reservoir
Barren River	Below Barren River Reservoir
Rough River	Below Rough River Reservoir
Cumberland River	Below Lake Cumberland
Tennessee River	In Kentucky
Ohio River	In Kentucky

Not included in the above list are Licking River below Cave Run Reservoir, Carr Fork below Carr Fork Reservoir, North Fork Kentucky River below Carr Fork, and Laurel River below Laurel River Reservoir, which are subject to regulation in the near future due to flood control dams currently under construction. Also not included are a few streams that may be regulated seasonally by diversions for water supply and by recreational lakes and conservation district dams.

Streamflow data obtained before and after reservoir construction, and records of reservoir contents, will be useful in systems studies. Available streamflow records for regulated Kentucky streams are shown in table 4. Records of daily contents are available for all major reservoirs in these systems.

Data to Define Long-Term Trends

At the present time there are no stations in Kentucky designated as long-term stations for indefinite operation. No stations on regulated streams are now so designated.

Data on Stream Environment

In connection with the present study, many environmental factors were determined for sites in Kentucky. Basin characteristics of stream slopes and lengths were determined at 127 locations with other basin characteristics such as drainage area, forest cover, area of lakes and ponds, rainfall intensity, annual precipitation, land elevations, soils indices, and non-contributing-areas determined at 145 sites.

Flood plains have been outlined on 98 topographic quadrangle maps, and the Corps of Engineers and Tennessee Valley Authority have defined flood profiles for major streams and many of their tributaries. Detailed channel surveys have been made at two gaging stations and cross sections surveyed at 22 stations. Channel surveys have been made at many sites in connection with indirect determinations of peak flows for unusual floods.

Table 4.--Gaging stations on regulated stream systems

(Purpose of reservoir: FC, flood control; LF, low flow augmentation; N, navigation; PG, power generation; R, recreation).

Station number	Station name	Length of record (in years)		Date regulation began	Reservoir	
		Before regulation	After regulation		Name	Purpose
3-2080	Levisa Fork below Fishtrap Dam, near Millard---	30	2	Oct. 1968	Fishtrap	FC, LF, R
3-2093	Russell Fork at Elkhorn City-------------------	4	6	Mar. 1965	John W. Flannagan	FC, LF, R
3-2095	Levisa Fork at Pikeville-----------------------	31	2	do	Flannagan, Fishtrap	------------
3-2098	Levisa Fork at Prestonsburg--------------------	5	2	do	do	------------
3-2115	Johns Creek near Van Lear----------------------	10	21	May 1950	Dewey	FC, R
3-2125	Levisa Fork at Paintsville---------------------	22	21	do	Flannagan, Fishtrap, Dewey	------------
3-2150	Big Sandy River at Louisa----------------------	11	21	do	do	------------
3-2163.5	Little Sandy River below Grayson Dam, near Leon	2	2	July 1968	Grayson	FC, LF, R
3-2164	Little Sandy River at Leon---------------------	7	2	do	do	------------
3-2165	Little Sandy River at Grayson------------------	30	2	do	do	------------
3-2809	Middle Fork Kentucky River at Buckhorn---------	4	10	Dec. 1960	Buckhorn	FC, LF, R
3-2810	Middle Fork Kentucky River at Tallega----------	22	10	do	do	------------
3-2820	Kentucky River at lock 14, at Heidelberg-------	28	10	do	do	------------
3-2840	Kentucky River at lock 10, near Winchester-----	53	10	do	do	------------
3-2845	Kentucky River at lock 8, near Camp Nelson-----	21	10	do	do	------------
3-2862	Dix River at Dix Dam (stage only)--------------	----------	----------	Nov. 1925	Herrington Lake	PG, R
3-2870	Kentucky River at lock 6, near Salvisa---------	----------	45	do	Buckhorn, Herrington Lake	------------
3-2875	Kentucky River at lock 4, at Frankfort---------	----------	45	do	do	------------
3-2905	Kentucky River at lock 2, at Lockport----------	----------	45	do	do	------------
3-3060	Green River near Campbellsville----------------	6	2	Feb. 1969	Green River	FC, LF, R
3-3065	Green River at Greensburg----------------------	29	2	do	do	------------
3-3085	Green River at Munfordville--------------------	42	2	do	do	------------
3-3110	Nolin River at Kyrock--------------------------	14	8	Mar. 1963	Nolin River	FC, LF, R
3-3115	Green River at lock 6, at Brownsville----------	31	8	do	Nolin River, Green River	------------
3-3130	Barren River near Finney-----------------------	12	7	Mar. 1964	Barren River	FC, LF, R
3-3145	Barren River at Bowling Green------------------	25	7	do	do	------------
3-3155	Green River at lock 4, at Woodbury-------------	25	8	do	Barren R., Green R., Nolin R.	------------
3-3165	Green River at Paradise------------------------	13	8	do	do	------------
3-3185	Rough River at Falls of Rough------------------	11	11	Oct. 1959	Rough River	FC, LF, R
3-3190	Rough River near Dundee------------------------	20	11	do	do	------------
3-3200	Green River at lock 2, at Calhoun--------------	29	11	do	Barren, Green, Nolin, Rough	------------
3-4140	Cumberland River near Rowena-------------------	10	21	Mar. 1950	Lake Cumberland	FC, N, PG, R

DISCUSSION OF THE EVALUATION

Of the four data categories used in this study, only one, data for planning and designing of water projects, is clearly subject to design. The requirements for other types of data are established in response to specific needs, or are defined by hydrologic judgment.

The evaluation of available streamflow data by regression analysis was based on data from 129 continuous-record gaging stations. Records for both minor and principal natural-flow streams were included. The conclusions and implications drawn from the results, based on standard errors shown in tables 2 and A-4, are:

1. For natural flows, application of the regression equations will provide estimates of mean annual discharge, standard deviation of annual discharge, mean monthly discharge, and 50-year 7-day high flow at ungaged sites on minor streams within the accuracy objectives, but not on principal streams (those with drainage areas greater than about 500 sq mi). Therefore, no additional data are required to define these characteristics on minor streams.
2. Low-flow characteristics at ungaged sites on natural-flow streams, minor and principal, cannot be estimated accurately by regression. Thus, accurate estimates of low-flow characteristics at a site will require measurements of low flow correlated with con-current flows at a suitable continuous-record index station where similar hydrologic conditions prevail.

3. Flood-peak characteristics on ungaged minor and principal streams cannot be estimated accurately by use of regression equations. Estimates of flood-peak discharges will require a network of continuous or crest-stage partial-record gaging stations at selected sites, along with further research in improvement of analytical methods for flood frequency prediction.

4. Regression equations are not satisfactory for any of the streamflow characteristics for drainage areas of less than about 75 square miles.

5. The objectives established for identifying the principal-streams network included sites with drainage areas of about 500 square miles on the most upstream segment of the stream and, proceeding downstream, sites where the drainage area is approximately double that of the previous site. The accuracy objective of 25 years of record, or equivalent, has been attained at 15 of the 21 stations on natural-flow principal streams identified solely in this category. To meet the objective of sampling progressively doubled increments of drainage areas on principal streams, six additional stations are needed.

THE PROPOSED PROGRAM

The study as outlined in the previous sections of this paper has designated the goals of the streamflow data program and evaluated the available data in relation to the accuracy goals. There now remains the selection of alternate ways of meeting the remaining objectives and proposing plans that will eventually attain as many of the goals as are economically feasible.

Data Collection

Data for Current Use

The 100 current purpose gaging stations operated in Kentucky are fulfilling the needs for current uses and their operation should be continued. The need for more stations of this type will increase in the future, due mainly, to construction of flood control reservoirs.

An assessment of the needs of this current purpose data should be made annually to determine the possibility of converting currently operated continuous stations to low-flow crest-stage partial-record stations which would substantially reduce costs.

Refer to figure 3 (inside back cover) for the location of current purpose stations listed in table A-1.

Data for Planning and Design

Some of the objectives for a planning and design network have been met, however, this study indicates a need for an increased number of continuous record gaging stations and partial-record stations, particularly on sites for small drainage area basins. The study also shows that a number of the existing continuous stations should be converted to partial-record stations.

Natural-flow, minor streams.--Regression equations are not satisfactory for any streamflow characteristics for drainage areas of less than about 75 square miles and data for these characteristics can only be obtained by actual operation of gaging stations or utilizing other forms of regression equations. The regression equation used in this report assumed a linear relation between the flow characteristic and the logarithm of the basin characteristic. Other forms or transforms may give better results. An effort should be made to define new basin characteristics that may have an effect on the regression analysis. These new variables might include geologic parameters, regional ground water patterns, channel geometry, land uses, soil infiltration and other precipitation data. Studies in connection with development of a better regression equation and uses of new basin characteristics should be made a part of the future streamflow program.

Studies for this report indicate the need to sample additional flow characteristics for small drainage areas ranging from one to 20 square miles in size. Consequently it is recommended that 26 new gaging stations be installed at sites geographically located to sample flows which have not previously been sampled. These 26 small stream stations are recommended for inclusion in the minor stream network and are identified in capitol letters in table A-5 and their locations shown in figure 3.

The following four stations in the minor-stream network (90 to 227 square miles) have been operated for periods ranging from 19 to 31 years and are not recommended for inclusion in the future program:

3-3160	Mud River near Lewisburg
3-6100	Clarks River at Murray
3-6105	Clarks River near Benton
7-0240	Bayou de Chien near Clinton

There are 16 stations in the minor-stream category with drainage areas under 50 square miles and periods of record ranging from 15 to 29 years in length. Thirteen of these stations have at least 18 years of record and are not recommended for inclusion in the program. The remaining three stations with 15 and 16 years of record are recommended for discontinuance in two or three years. These three stations are Bear Branch near Noble (3-2780), North Fork Rough River near Westview (3-3175), and Perry Creek near Mayfield (7-0225).

All of the above minor-stream stations which have not been recommended for inclusion in the program should be converted to crest-stage low-flow partial-record stations upon discontinuance. Low-flow data for these stations would consist of discharge measurements during years of extreme low flow. The locations of these crest-stage low-flow partial-record stations, after discontinuance as continuous record stations, are shown in figure 4 (inside back cover).

Regression equations will not give accurate results for low-flow characteristics for any minor streams and these characteristics will have to be generalized by making annual discharge measurements during periods of low flow. The low-flow network was defined by identifying sites with drainage areas of 50 square miles on the upstream segment of all streams, and then identifying the next and following sites on each stream from the upstream site to the mouth at points where the drainage area has doubled. For the minor-stream network this entailed choosing sites at drainage areas of 50, 100, 200, and 400 square miles which have not been previously gaged.

To complete the above network it is recommended that 61 low-flow partial-record stations be established at sites covering the range of 100, 200, and 400 square miles and 160 low-flow partial-record stations be established on streams of 50 square miles.

The approximate locations of the recommended sites for drainage areas over 100 square miles are shown in figure 4.

To compliment the above proposed network, it is further recommended that low-flow discharge measurements be made as "the needs arise" at sites draining less than 50 square miles. Numerous measurements should be made on small selected streams during periods of extreme drought.

Information is needed on the flood characteristics of small streams for drainage areas ranging from one to 20 square miles. This type of network is necessary as regression analysis is not satisfactory for flood-flow predictions for areas of this size. It is recommended that approximately 50 crest-stage gages be established throughout Kentucky on these small areas and operated for 10 to 15 years. No attempt has been made in this study to define the locations of these sites, except that they should vary in size of drainage area from one to 20 square miles and be distributed geographically to fill gaps in the present crest-stage network. At this time it is not known if this network of 50 sites is sufficient for definition. Future studies may indicate the need for additional sites in this category. If possible, the crest-stage gages should be installed at all low-flow partial-record sites, however, in many cases this will not be possible due to non-existing conditions for high-water definition.

Natural-flow, principal streams.--The accuracy objective of 25 years of record on natural-flow principal streams has been obtained at 15 of the 21 selected sites. These 15 stations are not required in the network, however, they must be retained in the program for current purpose uses. To fulfill the requirements of this network it is recommended that six new gaging stations be installed at the approximate locations as noted below:

South Fork Kentucky River at Oneida (Kentucky River basin)

Salt River above or below Brashears Creek (Salt River basin)

Pond River near mouth (Green River basin)

Tradewater River near mouth (Tradewater River basin)

Red River above or below Whippoorwill Creek
(Cumberland River basin)

Clarks River near mouth (Tennessee River basin)

Feasibility studies for Booneville Reservoir on the South Fork Kentucky River may indicate the deletion of the Oneida site from the program due to future inundation. Gaging stations on the Pond, Clarks, and Tradewater Rivers will be extremely difficult to operate due to backwater from the Green and/or Ohio Rivers at most stages. Stream slopes may be so flat during periods of low water that special equipment, such as deflection vanes or meters, will be necessary.

Low-flow and peak-discharge characteristics for natural-flow principal streams cannot be defined by regression and will need to be obtained by gaging station operation. The network of 21 principal stream gaging stations described above will satisfy the objectives for low flow and peak discharge data.

Regulated-flow, minor streams.--For purposes of this study, consideration of this category of data was limited only to identifying the regulated-streams systems. These streams are: Johns Creek, Little Sandy River, Carr Fork, and Laurel River. The gaging stations on Johns Creek and the Little Sandy River are classified as current purpose and must be continued. Carr Fork and Laurel River dams are under construction at the present time, therefore, these streams are classified as regulated for the purpose of this report.

The proposed programs should include provisions to continue the collection of records of inflow, outflow, reservoir contents, diversions, operation schedules, and other pertinent hydrologic data at the major reservoirs in the regulated-streams systems described above.

Regulated-flow principal streams.--The regulated streams in this category are: Levisa Fork below Fishtrap Dam, Russell Fork below Elkhorn City, Big Sandy River below Tug Fork, Little Sandy River below Grayson Dam, Licking River below Cave Run Dam (under construction), North Fork Kentucky River below Hazard, Middle Fork Kentucky River below Buckhorn Dam, Kentucky River below Middle Fork Kentucky River, Dix River below Dix Dam, Green River below Green River Dam, Nolin River below Nolin River Dam, Barren River below Barren River Dam, Rough River below Rough River Dam, Cumberland River below Wolf Creek Dam, and Tennessee River below Kentucky Dam. There are no gaging stations on the above streams having 25 years of record, therefore, all stations on streams in this category must be continued.

The proposed program should include the same provisions for collection of data as regulated-flow, minor streams mentioned previously.

Streamflow data obtained before and after reservoir construction are useful in systems studies of regulated streams. Table 4 lists the years of record available before and after reservoir construction for gaging stations on presently regulated streams in Kentucky and provides basic information on each major reservoir. Not included in table 4 are the gaging stations on the Ohio River and on the Cumberland and Tennessee Rivers downstream from Lake Barkley and Kentucky Lake respectively. At the latter two sites flow is controlled by a complex system of reservoirs. Also not included are several gaging stations on streams which may show seasonal regulation due to diversions for water supply or from recreational lakes and soil conservation district dams. Although not included in this report the latter will be considered in the systems approach.

Pending development of applicable systems-approach methods, it is assumed that the stations listed in table 4 are needed and that they will be adequate for the systems studies. Reservoir gages to determine the contents of all major reservoirs are presently in operation and patterns of reservoir operation are available. Inflow can be determined by existing or future gaging stations or can be calculated from the change in reservoir content and outflow.

Data to Define Long-Term Trends in Streamflow

This part of the study involves the identification of gaging stations that will be operated indefinitely to detect trends in streamflow. These stations have been selected to provide a long term sample reflecting areal coverage of the State, a range of drainage-area size, and a variety of climatic and physiographic characteristics. The 19 stations identified in this category and proposed for operation idefinitely are listed below, and the drainage area and period of record are shown for each station.

Station number	Station name	Years of record	Drainage area (sq mi)
3-2100	Johns Creek near Meta	28	56.3
3-2168	Tygarts Creek at Olive Hill	12	59.6
3-2510	North Fork Licking River near Lewisburg	23	119
3-2520	Stoner Creek at Paris	16	239
3-2785	Troublesome Creek at Noble	19	177
3-2825	Red River near Hazel Green	15	65.8
3-2895	Elkhorn Creek near Frankfort	32	473
3-2924.6	Harrods Creek near La Grange	1	24.1
3-2945	Ohio River at Louisville	41	91,170
3-2980	Floyds Fork near Fisherville	25	138
3-2990	Rolling Fork near Lebanon	31	239
3-3070	Russell Creek near Columbia	30	188
3-3137	West Fork Drakes Creek near Franklin	1	110
3-3188	Caney Creek near Horse Branch	13	124
3-3830	Tradewater River at Olney	29	255
3-4045	Cumberland River at Cumberland Falls	59	1,977
3-4075	Buck Creek near Shopville	17	165
3-6115	Ohio River at Metropolis, Ill.	41	203,000
7-0230	Mayfield Creek at Lovelaceville	31	212

Summary

Table A-5 summarizes the data-collection phase of the proposed program. The table includes all streamflow stations now in operation and those to be established for the proposed program. Each station is identified as to type of data and recommendations are made as to whether the station should be included in the proposed network or whether it has met the objective for which it was operated and could be discontinued. The locations of existing and proposed gaging stations included in the program are shown in figure 3.

Data Analysis

The streamflow-data network operated through the years supplies a base for analyses and reports thereon which should be started as soon as the proposed streamflow data program can be implemented. Some aspects of data analyses are of a continuing nature, with the data collection effort continuing, reoriented as necessary to fill gaps or eliminate deficiencies, and provide data for continuing future analyses.

The basic information assembled for use in this report, along with the corresponding statistical approaches, have provided much data for which data analyses and appropriate studies can be made. It is recommended that the following reports be forthcoming during the next few years:

1. Low-flow characteristics of Kentucky streams. This report would provide quantitative information on the magnitude and frequency of low-flow.

2. Techniques for estimating probable frequency of stream flooding which would update an earlier report entitled, "Floods in Kentucky-Magnitude and Frequency."

3. Rainfall-runoff relationships for small streams, using data collected on peak discharges, flood hydrographs, and concurrent records of rainfall and runoff.

4. Flow-duration report to portray the variations of discharge at a particular site.

5. Publishing of statistics on mean annual and mean monthly flows for flow variability purposes.

The constantly increasing demand for other information on water resources in Kentucky has indicated the need for numerous hydrologic studies which should be initiated in the near future. A few of these studies are: Time of travel, base-flow, high-flow (flood) volume, evaporation, transpiration, flood profile, flood zoning, regulated-streams systems, streamflow data program, draft-storage studies, etc.

These are only a few of the data analyses and hydrologic studies that could be made in Kentucky. Changing needs for streamflow information and changes in technology in water-related fields must be continuously evaluated in light of the data analyses that should be generated under the streamflow data program for Kentucky.

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APPENDIX A

Table A-1.--Current-purpose gaging stations

Station number	Station name	Purpose						
		Account-ing	Opera-tion	Forecast-ing	Dispos-al	Water quality	Compact or legal	Research or special studies
3-2080	Levisa Fork below Fishtrap Dam, near Millard---	--------	X	--------	--------	--------	--------	--------
3-2093	Russell Fork at Elkhorn City	--------	X	--------	--------	--------	--------	--------
3-2095	Levisa Fork at Pikeville	--------	X	X	--------	--------	--------	--------
3-2098	Levisa Fork at Prestonsburg	--------	X	X	--------	--------	--------	--------
3-2100	Johns Creek near Meta	--------	X	--------	--------	--------	--------	--------
3-2115	Johns Creek near Van Lear	--------	X	--------	--------	--------	--------	--------
3-2120	Paint Creek at Staffordsville	--------	--------	--------	--------	--------	--------	X
3-2125	Levisa Fork at Paintsville	--------	X	X	--------	X	--------	--------
3-2150	Big Sandy River at Louisa	X	--------	X	--------	--------	--------	--------
3-2155	Blaine Creek at Yatesville	--------	--------	--------	--------	--------	--------	X
3-2160	Ohio River at Ashland	--------	--------	X	--------	--------	--------	--------
3-2163.5	Little Sandy River below Grayson Dam, near Leon	--------	X	--------	--------	--------	--------	--------
3-2164	Little Sandy River at Leon	--------	X	--------	--------	--------	--------	--------
3-2165	Little Sandy River at Grayson	--------	X	X	--------	--------	--------	--------
3-2166	Ohio River at Greenup Dam	--------	X	--------	--------	--------	--------	--------
3-2170	Tygarts Creek near Greenup	--------	--------	--------	--------	X	--------	--------
3-2380	Ohio River at Maysville	--------	--------	X	--------	--------	--------	--------
3-2485	Licking River near Salyersville	--------	X	--------	--------	--------	--------	--------
3-2495	Licking River at Farmers	--------	X	X	--------	--------	--------	--------
3-2500	Triplett Creek at Morehead	--------	X	--------	--------	--------	--------	--------
3-2501	North Fork Triplett Creek near Morehead	--------	X	--------	--------	--------	--------	--------
3-2515	Licking River at McKinneysburg	X	X	--------	--------	X	--------	--------
3-2525	South Fork Licking River at Cynthiana	--------	X	X	--------	--------	--------	--------
3-2535	Licking River at Catawba	X	X	X	--------	--------	--------	--------
3-2550	Ohio River at Cincinnati, Ohio	X	--------	X	--------	--------	--------	--------
3-2774	Leatherwood Creek at Daisy	--------	--------	--------	--------	--------	--------	X
3-2774.5	Carr Fork near Sassafras	--------	X	--------	--------	--------	--------	--------
3-2775	North Fork Kentucky River at Hazard	--------	X	X	--------	--------	--------	--------
3-2800	North Fork Kentucky River at Jackson	--------	X	X	--------	--------	--------	--------
3-2806	Middle Fork Kentucky River near Hyden	--------	X	--------	--------	--------	--------	--------
3-2807	Cutshin Creek at Wooton	--------	X	--------	--------	--------	--------	--------
3-2809	Middle Fork Kentucky River at Buckhorn	--------	X	--------	--------	--------	--------	--------
3-2810	Middle Fork Kentucky River at Tallega	--------	X	--------	--------	--------	--------	--------
3-2811	Goose Creek at Manchester	--------	--------	--------	--------	--------	--------	X

Table A-1.--Current-purpose gaging stations--Continued

Station number	Station name	Purpose						
		Accounting	Operation	Forecasting	Disposal	Water quality	Compact or legal	Research or special studies
3-2815	South Fork Kentucky River at Booneville	-------	-------	-------	-------	-------	-------	X
3-2820	Kentucky River at lock 14, at Heidelberg	-------	X	X	-------	-------	-------	-------
3-2825	Red River near Hazel Green	-------	-------	-------	-------	-------	-------	X
3-2830	Stillwater Creek at Stillwater	-------	-------	-------	-------	-------	-------	X
3-2835	Red River at Clay City	-------	-------	X	-------	-------	-------	X
3-2840	Kentucky River at lock 10, near Winchester	-------	X	X	-------	-------	-------	-------
3-2845	Kentucky River at lock 8, near Camp Nelson	-------	X	-------	-------	-------	-------	-------
3-2850	Dix River near Danville	-------	X	-------	-------	-------	-------	-------
3-2870	Kentucky River at lock 6, near Salvisa	-------	-------	-------	-------	-------	X	-------
3-2875	Kentucky River at lock 4, at Frankfort	-------	X	X	-------	X	-------	-------
3-2880	North Elkhorn Creek near Georgetown	-------	-------	-------	-------	-------	-------	X
3-2890	South Elkhorn Creek at Fort Spring	-------	-------	-------	-------	-------	-------	X
3-2905	Kentucky River at lock 2, at Lockport	X	X	X	-------	-------	-------	-------
3-2910	Eagle Creek at Sadieville	-------	-------	-------	-------	-------	-------	X
3-2915	Eagle Creek at Glencoe	-------	-------	-------	-------	-------	-------	X
3-2925	South Fork Beargrass Creek at Louisville	-------	-------	-------	-------	-------	-------	X
3-2930	Middle Fork Beargrass Creek at Cannons Lane, at Louisville.	-------	-------	-------	-------	-------	-------	X
3-2945	Ohio River at Louisville	X	X	X	-------	-------	-------	-------
3-2950	Salt River near Harrodsburg	-------	-------	-------	-------	-------	-------	X
3-2955	Salt River near Van Buren	-------	-------	-------	-------	-------	-------	X
3-2975	Plum Creek at Waterford	-------	-------	-------	-------	-------	-------	X
3-2985	Salt River at Shepherdsville	X	-------	X	-------	-------	-------	-------
3-3000	Beech Fork near Springfield	-------	-------	-------	-------	-------	-------	X
3-3010	Beech Fork at Bardstown	-------	-------	-------	-------	-------	-------	X
3-3015	Rolling Fork near Boston	X	-------	X	-------	-------	-------	-------
3-3020	Pond Creek near Louisville	-------	-------	-------	-------	-------	-------	X
3-3060	Green River near Campbellsville	-------	X	-------	-------	-------	-------	-------
3-3065	Green River at Greensburg	-------	X	X	-------	-------	-------	-------
3-3070	Russell Creek near Columbia	-------	X	-------	-------	-------	-------	-------
3-3071	Russell Creek near Gresham	-------	X	-------	-------	-------	-------	-------
3-3085	Green River at Munfordville	X	X	X	-------	X	-------	-------
3-3103	Nolin River at White Mills	-------	X	-------	-------	-------	-------	-------
3-3104	Bacon Creek near Priceville	-------	X	-------	-------	-------	-------	-------

Table A-1.--Current-purpose gaging stations--Continued

Station number	Station name	Purpose						
		Accounting	Operation	Forecasting	Disposal	Water quality	Compact or legal	Research or special studies
3-3110	Nolin River at Kyrock	--------	X	--------	--------	--------	--------	--------
3-3115	Green River at lock 6, at Brownsville	--------	X	X	--------	--------	--------	--------
3-3130	Barren River near Finney	--------	X	--------	--------	--------	--------	--------
3-3135	West Bays Fork at Scottsville	--------	--------	--------	--------	--------	--------	X
3-3140	Drakes Creek near Alvaton	--------	X	--------	--------	--------	--------	--------
3-3145	Barren River at Bowling Green	--------	X	X	--------	--------	--------	--------
3-3155	Green River at lock 4, at Woodbury	--------	X	X	--------	--------	--------	--------
3-3165	Green River at Paradise	--------	X	--------	--------	--------	--------	--------
3-3182	Rock Lick Creek near Glen Dean	--------	X	--------	--------	--------	--------	--------
3-3185	Rough River at Falls of Rough	--------	X	--------	--------	--------	--------	--------
3-3188	Caney Creek near Horse Branch	--------	X	--------	--------	--------	--------	--------
3-3190	Rough River near Dundee	--------	X	--------	--------	--------	--------	--------
3-3200	Green River at lock 2, at Calhoun	X	X	X	--------	--------	--------	--------
3-3205	East Fork Pond River near Apex	--------	--------	--------	--------	--------	--------	X
3-3220	Ohio River at Evansville, Ind.	X	X	X	--------	--------	--------	--------
3-3830	Tradewater River at Olney	--------	--------	--------	--------	X	--------	--------
3-3845	Ohio River at Golconda, Ill	--------	X	X	--------	--------	--------	--------
3-4005	Poor Fork at Cumberland	--------	--------	X	--------	--------	--------	X
3-4010	Cumberland River near Harlan	--------	--------	X	--------	--------	--------	X
3-4020	Yellow Creek near Middlesboro	--------	--------	--------	--------	--------	--------	X
3-4030	Cumberland River near Pineville	--------	--------	X	--------	--------	--------	X
3-4035	Cumberland River at Barbourville	--------	--------	X	--------	--------	--------	X
3-4040	Cumberland River at Williamsburg	--------	X	X	--------	--------	--------	--------
3-4050	Laurel River at Corbin	--------	X	--------	--------	--------	--------	--------
3-4065	Rockcastle River at Billows	--------	X	--------	--------	--------	--------	--------
3-4073	Helton Branch at Greenwood	--------	--------	--------	--------	--------	--------	X
3-4105	South Fork Cumberland River near Stearns	--------	X	--------	--------	--------	--------	--------
3-4140	Cumberland River near Rowena	--------	X	--------	--------	--------	--------	--------
3-4380	Little River near Cadiz	--------	X	--------	--------	--------	--------	--------
3-4381.9	Barkley-Kentucky Canal near Grand Rivers	--------	X	--------	--------	--------	--------	--------
3-4382.2	Cumberland River near Grand Rivers	X	X	--------	--------	--------	--------	--------
3-6095	Tennessee River near Paducah	X	X	--------	--------	--------	--------	--------
3-6115	Ohio River at Metropolis, Ill	X	--------	X	--------	--------	--------	--------

TABLE A-2.--BASIN CHARACTERISTICS AT GAGING STATIONS

STATION NUMBER	STATION NAME	DRAINAGE AREA (SQUARE MILES)	SLOPE (FEET PER MILE)	MAIN CHANNEL LENGTH (MILES)	AREA OF LAKES, PONDS (PERCENT)	ELEVATION (THOUSANDS OF FEET)	FOREST COVER (PERCENT)	ANNUAL PRECIPITATION (INCHES)	2-YEAR 24-HOUR RAINFALL (INCHES)	NON-CONTRIBUTING AREA (PERCENT)	SOILS INDEX (INCHES)
03208000	LEVISA F BELOW FISHTRAP DAM	386.00	16.90	52.70	0.00	1.90	85.00	44.00	2.80	0.00	2.80
03209500	LEVISA F AT PIKEVILLE	1237.00	11.50	70.40	0.01	1.80	84.00	44.00	2.80	0.00	2.80
03210000	JOHNS C NR META	56.30	24.30	21.50	0.00	1.40	82.00	44.00	2.80	0.00	2.80
03211500	JOHNS C NR VAN LEAR	206.00	6.40	55.10	0.00	1.20	82.00	44.00	2.80	0.00	2.80
03212000	PAINT C AT STAFFORDSVILLE	103.00	8.50	21.00	0.00	1.00	79.00	45.00	2.80	0.00	2.80
03212500	LEVISA F AT PAINTSVILLE	2143.00	5.30	120.30	0.01	1.50	81.00	44.00	2.80	0.00	2.80
03215000	BIG SANDY R AT LOUISA	3892.00	4.50	137.60	0.01	1.50	84.00	44.00	2.80	0.00	2.80
03215500	BLAINE C AT YATESVILLE	217.00	3.50	40.10	0.00	0.80	75.00	44.00	2.80	0.00	2.80
03216500	LITTLE SANDY R AT GRAYSON	402.00	3.70	47.20	0.00	0.90	68.00	44.00	2.80	0.00	2.80
03216800	TYGARTS C AT OLIVE HILL	59.60	18.80	12.00	0.02	1.00	56.00	44.00	2.80	0.00	2.80
03217000	TYGARTS C NR GREENUP	242.00	4.60	61.20	0.02	0.95	64.00	44.00	2.80	4.00	2.80
03248500	LICKING R NR SALYERSVILLE	140.00	4.70	36.40	0.01	1.10	83.00	46.00	2.90	0.00	2.70
03249500	LICKING R AT FARMERS	831.00	2.10	133.50	0.02	1.00	75.00	46.00	2.90	0.00	2.70
03250000	TRIPLETT C AT MOREHEAD	47.90	29.40	9.70	0.06	1.00	73.00	45.00	2.90	0.00	2.70
03250500	LICKING R AT BLUE LICK SPRINGS	1785.00	1.70	205.40	0.06	0.95	58.00	46.00	2.90	0.00	2.70
03251000	NF LICKING R NR LEWISBURG	119.00	2.60	32.20	0.18	0.90	16.00	44.00	2.90	0.00	2.70
03251500	LICKING R AT MCKINNEYSBURG	2326.00	1.60	238.90	0.09	0.90	48.00	45.00	2.90	0.00	2.70
03252000	STONER C AT PARIS	239.00	2.40	56.20	0.75	0.95	1.00	44.00	3.00	0.00	3.00
03252500	SF LICKING R AT CYNTHIANA	621.00	2.40	85.90	0.60	0.90	2.00	44.00	3.00	1.00	3.00
03253500	LICKING R AT CATAWBA	3300.00	1.50	255.20	0.19	0.90	35.00	44.00	3.00	0.00	2.80
03277500	NF KENTUCKY R AT HAZARD	466.00	7.40	61.60	0.00	1.60	82.00	48.00	2.90	0.00	2.80
03278000	BEAR BRANCH NR NOBLE	2.21	116.00	2.60	0.00	1.20	97.00	47.00	2.90	0.00	2.80
03278500	TROUBLESOME C AT NOBLE	177.00	8.80	35.70	0.00	1.30	89.00	47.00	2.90	0.00	2.80
03280000	NF KENTUCKY R AT JACKSON	1101.00	4.60	118.00	0.01	1.40	86.00	48.00	2.90	0.00	2.80
03280600	MF KENTUCKY R NR HYDEN	202.00	29.40	27.20	0.01	1.70	94.00	48.00	3.00	0.00	2.80
03280700	CUTSHIN C AT WOOTON	61.30	44.60	18.40	0.02	1.50	93.00	48.00	2.90	0.00	2.80
03281000	MF KENTUCKY R AT TALLEGA	537.00	4.70	95.00	0.00	1.40	91.00	48.00	3.00	0.00	2.80
03281500	SF KENTUCKY R AT BOONEVILLE	722.00	5.10	77.00	0.01	1.20	82.00	48.00	3.00	0.00	2.80
03282000	KENTUCKY R LOCK 14, HEIDELBERG	2657.00	3.20	173.40	0.01	1.30	85.00	48.00	3.00	0.00	2.70
03282500	RED R NR HAZEL GREEN	65.80	8.20	20.20	0.03	1.10	70.00	46.00	2.90	0.00	2.70
03283000	STILLWATER C AT STILLWATER	24.00	23.60	7.40	0.00	1.10	67.00	46.00	2.90	0.00	2.70
03283500	RED R AT CLAY CITY	362.00	6.00	68.90	0.03	1.00	77.00	46.00	2.90	1.00	2.70
03284000	KENTUCKY R LOCK 10, WINCHESTER	3955.00	2.20	246.20	0.03	1.20	79.00	47.00	3.00	0.00	2.70
03284500	KENTUCKY R LOCK 8, CAMP NELSON	4414.00	1.90	282.70	0.05	1.20	73.00	47.00	3.00	1.00	2.70
03285000	DIX R NR DANVILLE	318.00	4.10	50.50	0.10	1.00	30.00	47.00	3.10	0.00	2.70
03287000	KENTUCKY R LOCK 6 NR SALVISA	5102.00	1.60	326.40	0.15	1.10	65.00	46.00	3.00	2.00	2.70
03287500	KENTUCKY R LOCK 4 AT FRANKFORT	5412.00	1.50	356.70	0.16	1.10	63.00	46.00	3.00	2.00	2.70
03288000	NORTH ELKHORN C NR GEORGETOWN	119.00	3.80	31.40	0.53	0.95	1.00	43.00	3.00	7.00	2.70
03288500	CAVE C NR FORT SPRING	2.53	37.40	2.70	0.00	0.95	1.00	44.00	3.10	24.00	2.70
03289000	SOUTH ELKHORN C AT FORT SPRING	24.00	16.50	9.60	0.17	0.95	1.00	44.00	3.10	12.00	2.70
03289500	ELKHORN C NR FRANKFORT	473.00	3.60	78.20	0.54	0.90	2.00	44.00	3.10	15.00	2.70
03290000	FLAT C NR FRANKFORT	5.63	39.80	3.40	0.18	0.80	54.00	45.00	3.10	0.00	2.70
03290500	KENTUCKY R LOCK 2 AT LOCKPORT	6180.00	1.40	391.60	0.20	1.10	57.00	46.00	3.10	3.00	2.70
03291000	EAGLE C AT SADIEVILLE	42.90	9.00	16.00	0.21	0.90	35.00	42.00	3.00	0.00	2.70
03291500	EAGLE C AT GLENCOE	437.00	3.50	80.80	0.16	0.85	17.00	42.00	3.00	0.00	2.70
03292500	SF BEARGRASS C AT LOUISVILLE	17.20	19.40	8.90	0.12	0.55	3.00	43.00	3.10	1.00	2.70
03293000	MF BEARGRASS C AT LOUISVILLE	18.90	18.50	9.60	0.00	0.60	3.00	43.00	3.10	3.00	2.70
03295000	SALT R NR HARRODSBURG	41.40	8.50	18.70	0.22	0.95	5.00	47.00	3.10	4.00	2.70
03295500	SALT R NR VAN BUREN	196.00	3.80	78.20	0.21	0.85	14.00	47.00	3.10	2.00	2.70
03297500	PLUM C AT WATERFORD	31.80	16.50	14.40	0.79	0.70	11.00	46.00	3.10	0.00	2.70
03298000	FLOYDS F AT FISHERVILLE	138.00	5.50	34.70	0.83	0.75	4.00	45.00	3.10	0.00	2.70
03298500	SALT R AT SHEPHERDSVILLE	1197.00	4.00	132.60	0.61	0.70	12.00	45.00	3.10	0.00	2.70
03299000	ROLLING F NR LEBANON	239.00	10.30	38.60	0.02	0.95	71.00	50.00	3.20	0.00	2.40
03300000	BEECH F NR SPRINGFIELD	85.90	5.80	26.20	0.18	0.85	15.00	49.00	3.20	0.00	2.40
03301000	BEECH F AT BARDSTOWN	669.00	3.90	90.60	0.17	0.80	20.00	48.00	3.20	0.00	2.40
03301500	ROLLING F NR BOSTON	1299.00	3.50	112.30	0.12	0.80	43.00	48.00	3.20	0.00	2.40
03302000	POND C NR LOUISVILLE	64.00	11.70	15.20	0.59	0.55	12.00	43.00	3.20	0.00	2.70

TABLE A-2.--BASIN CHARACTERISTICS AT GAGING STATIONS--CONTINUED

STATION NUMBER	STATION NAME	DRAINAGE AREA (SQUARE MILES)	SLOPE (FEET PER MILE)	MAIN CHANNEL LENGTH (MILES)	AREA OF LAKES, PONDS (PERCENT)	ELEVATION (THOUSANDS OF FEET)	FOREST COVER (PERCENT)	ANNUAL PRECIPITATION (INCHES)	2-YEAR 24-HOUR RAINFALL (INCHES)	NON-CONTRIBUTING AREA (PERCENT)	SOILS INDEX (INCHES)
03304500	MCGILLS C NR MCKINNEY	2.14	150.00	2.10	0.00	1.20	75.00	47.00	3.20	0.00	3.70
03305000	GREEN R NR MCKINNEY	22.40	31.80	8.30	0.00	1.20	81.00	47.00	3.20	0.00	3.70
03306500	GREEN R AT GREENSBURG	736.00	3.50	102.50	0.02	0.95	62.00	49.00	3.20	1.00	3.70
03307000	RUSSELL C NR COLUMBIA	188.00	7.00	40.30	0.04	0.90	30.00	52.00	3.30	8.00	3.70
03307500	SF LITTLE BARREN R AT EDMONTON	18.30	15.40	9.00	0.11	0.90	62.00	51.00	3.30	0.00	3.70
03308500	GREEN R AT MUNFORDVILLE	1673.00	2.80	156.40	0.07	0.85	47.00	50.00	3.20	11.00	3.70
03309000	GREEN R AT MAMMOTH CAVE	1983.00	2.50	184.90	0.09	0.85	44.00	50.00	3.20	22.00	3.70
03309500	MCDOUGAL C NR HODGENVILLE	5.34	24.00	4.90	0.00	0.85	20.00	49.00	3.20	0.00	3.70
03310000	NF NOLIN R AT HODGENVILLE	36.40	20.00	7.30	0.06	0.85	17.00	49.00	3.20	2.00	3.70
03310500	NOLIN R AT WAX	600.00	2.60	91.40	0.22	0.75	23.00	50.00	3.20	37.00	3.70
03311000	NOLIN R AT KYROCK	672.00	2.60	100.10	0.21	0.75	25.00	50.00	3.20	33.00	3.70
03311500	GREEN R LOCK 6 AT BROWNSVILLE	2762.00	2.30	200.50	0.12	0.80	41.00	50.00	3.20	25.00	3.70
03312000	BEAR C NR LEITCHFIELD	30.80	26.80	7.70	0.13	0.65	36.00	49.00	3.30	0.00	3.70
03312500	BARREN R NR PAGEVILLE	531.00	4.30	65.80	0.09	0.85	30.00	50.00	3.30	4.00	3.70
03313000	BARREN R NR FINNEY	940.00	3.70	79.10	0.14	0.80	23.00	51.00	3.30	8.00	3.70
03313500	WEST BAYS F AT SCOTTSVILLE	7.47	50.40	4.80	0.13	0.80	20.00	51.00	3.30	0.00	3.70
03314000	DRAKES C NR ALVATON	478.00	6.60	41.70	0.42	0.75	14.00	50.00	3.40	25.00	3.70
03314500	BARREN R AT BOWLING GREEN	1848.00	2.60	120.20	0.30	0.75	20.00	50.00	3.40	26.00	3.70
03315500	GREEN R LOCK 4 AT WOODBURY	5403.00	2.00	233.10	0.21	0.75	32.00	50.00	3.30	25.00	3.70
03316000	MUD R NR LEWISBURG	90.50	7.10	24.40	0.20	0.60	20.00	48.00	3.40	10.00	3.70
03316500	GREEN R AT PARADISE	6182.00	1.70	282.10	0.22	0.75	33.00	50.00	3.40	22.00	3.70
03317000	ROUGH R NR MADRID	225.00	4.90	39.80	0.09	0.70	31.00	47.00	3.20	30.00	3.70
03317500	NF ROUGH R NR WESTVIEW	42.00	16.20	11.30	0.17	0.70	43.00	47.00	3.20	45.00	3.70
03318000	ROUGH R NR FALLS OF ROUGH	454.00	3.30	66.00	0.09	0.70	33.00	47.00	3.20	24.00	3.70
03318200	ROCK LICK C NR GLEN DEAN	20.10	31.30	6.30	0.15	0.65	32.00	47.00	3.30	0.00	3.70
03318500	ROUGH R AT FALLS OF ROUGH	504.00	2.90	73.30	0.10	0.70	33.00	47.00	3.30	22.00	3.70
03318800	CANEY C NR HORSE BRANCH	124.00	3.00	29.60	0.15	0.60	31.00	48.00	3.30	0.00	3.70
03319000	ROUGH R NR DUNDEE	757.00	2.30	93.50	0.11	0.65	33.00	47.00	3.30	16.00	3.70
03320000	GREEN R LOCK 2 AT CALHOUN	7564.00	1.50	319.00	0.24	0.70	33.00	48.00	3.30	20.00	3.70
03320500	EAST F POND R NR APEX	194.00	2.70	40.30	0.08	0.60	41.00	47.00	3.40	1.00	3.20
03383000	TRADEWATER R AT OLNEY	255.00	2.00	53.30	0.61	0.55	78.00	45.00	3.40	4.00	3.70
03384000	ROSE C AT NEBO	2.10	28.80	2.20	0.48	0.40	5.00	45.00	3.40	0.00	3.70
03400500	POOR F AT CUMBERLAND	82.30	28.10	25.80	0.00	2.50	90.00	48.00	2.90	0.00	3.10
03401000	CUMBERLAND R NR HARLAN	374.00	13.60	51.30	0.01	2.30	89.00	48.00	2.90	0.00	3.10
03402000	YELLOW C NR MIDDLESBORO	58.20	74.40	12.70	0.53	2.00	80.00	48.00	3.10	0.00	3.10
03403000	CUMBERLAND R NR PINEVILLE	809.00	8.20	94.90	0.05	2.00	85.00	48.00	3.00	0.00	3.10
03403500	CUMBERLAND R AT BARBOURVILLE	960.00	7.40	106.90	0.04	1.90	85.00	48.00	3.00	0.00	3.10
03404000	CUMBERLAND R AT WILLIAMSBURG	1607.00	4.80	151.90	0.06	1.70	80.00	48.00	3.00	0.00	3.10
03404500	CUMBERLAND R CUMBERLAND FALLS	1977.00	3.80	179.70	0.06	1.60	81.00	48.00	3.10	0.00	3.10
03405000	LAUREL R AT CORBIN	201.00	5.80	28.40	0.06	1.20	25.00	48.00	3.10	0.00	3.10
03406000	WOOD C NR LONDON	3.89	48.90	2.60	0.26	1.20	64.00	48.00	3.10	0.00	3.10
03406500	ROCKCASTLE R AT BILLOWS	604.00	3.60	57.30	0.02	1.20	60.00	48.00	3.10	0.00	3.10
03407300	HELTON B AT GREENWOOD	0.85	130.00	1.55	0.00	1.20	94.00	49.00	3.20	0.00	3.10
03407500	BUCK C NR SHOPVILLE	165.00	10.10	30.00	0.05	1.10	31.00	49.00	3.10	0.00	3.10
03410500	SF CUMBERLAND R NR STEARNS	954.00	9.00	74.90	0.00	1.60	98.00	48.00	3.30	0.00	3.10
03411000	SF CUMBERLAND R AT NEVELSVILLE	1271.00	8.00	100.00	0.01	1.50	95.00	48.00	3.30	0.00	3.10
03411500	CUMBERLAND R AT BURNSIDE	4865.00	3.90	226.10	0.04	1.40	77.00	49.00	3.10	0.00	3.10
03412500	PITMAN C AT SOMERSET	31.30	19.00	12.20	0.13	1.10	19.00	50.00	3.10	0.00	3.10
03414000	CUMBERLAND R NR ROWENA	5790.00	3.10	282.70	0.04	1.40	72.00	50.00	3.20	0.00	3.10
03437500	SF LITTLE R AT HOPKINSVILLE	46.50	7.10	17.40	0.52	0.60	11.00	47.00	3.40	24.00	3.90
03438000	LITTLE R NR CADIZ	244.00	3.60	48.00	0.92	0.55	9.00	47.00	3.40	38.00	3.90
03610000	CLARKS R AT MURRAY	89.70	9.90	13.20	0.16	0.55	11.00	48.00	3.50	0.00	3.50
03610500	CLARKS R NR BENTON	227.00	6.20	37.50	0.14	0.50	13.00	48.00	3.50	0.00	3.50
07022500	PERRY C NR MAYFIELD	1.72	28.10	2.10	1.18	0.50	1.00	49.00	3.60	0.00	3.00
07023000	MAYFIELD C AT LOVELACEVILLE	212.00	5.30	41.80	0.50	0.50	9.00	48.00	3.60	0.00	3.00
07023500	OBION C AT PRYORSBURG	36.80	10.20	11.10	1.36	0.50	8.00	49.00	3.60	0.00	3.00
07024000	BAYOU DE CHIEN NR CLINTON	68.70	8.00	18.20	0.63	0.40	16.00	49.00	3.60	0.00	3.00

TABLE A-3.--FLOW CHARACTERISTICS AT GAGING STATIONS

STATION NUMBER	STATION NAME	2-YEAR PEAK DISCHARGE (CFS)	5-YEAR PEAK DISCHARGE (CFS)	10-YEAR PEAK DISCHARGE (CFS)	25-YEAR PEAK DISCHARGE (CFS)	50-YEAR PEAK DISCHARGE (CFS)	MEAN ANNUAL DISCHARGE (CFS)	MEAN OCTOBER DISCHARGE (CFS)
03208000	LEVISA F BELOW FISHTRAP DAM	12000.	18000.	23000.	28000.	32000.	452.90	65.50
03209500	LEVISA F AT PIKEVILLE	30000.	45000.	55000.	68000.	77000.	1377.00	221.80
03210000	JOHNS C NR META	2700.	4200.	5100.	6200.	7000.	66.48	9.61
03211500	JOHNS C NR VAN LEAR	4700.	7100.	8400.	9300.		180.60	16.49
03212000	PAINT C AT STAFFORDSVILLE	6000.	11000.	14000.	18000.		122.00	14.22
03212500	LEVISA F AT PAINTSVILLE	35000.	50000.	59000.	69000.	77000.	2265.00	455.30
03215000	BIG SANDY R AT LOUISA	51000.	73000.	86000.	100000.		3618.00	476.40
03215500	BLAINE C AT YATESVILLE	6700.	10000.	12000.	17000.	20000.	249.20	35.18
03216500	LITTLE SANDY R AT GRAYSON	10000.	15000.	18000.	22000.	24000.	472.40	40.31
03216800	TYGARTS C AT OLIVE HILL	5600.	7800.	9000.			85.34	8.49
03217000	TYGARTS C NR GREENUP	7100.	10000.	12000.	15000.	17000.	299.20	22.77
03248500	LICKING R NR SALYERSVILLE	4200.	7000.	8900.	13000.	17000.	161.20	14.82
03249500	LICKING R AT FARMERS	12000.	17000.	19000.	24000.	28000.	1029.00	92.29
03250000	TRIPLETT C AT MOREHEAD	6000.	11000.	15000.	23000.	31000.	74.20	4.83
03250500	LICKING R AT BLUE LICK SPRINGS	22000.	26000.	30000.	33000.	36000.	2269.00	131.80
03251000	NF LICKING R NR LEWISBURG	6200.	8500.	9500.	12000.	14000.	151.50	15.71
03251500	LICKING R AT MCKINNEYSBURG	33000.	42000.	45000.	55000.	62000.	2956.00	265.00
03252000	STONER C AT PARIS	8000.	12000.	14000.	18000.		254.50	16.76
03252500	SF LICKING R AT CYNTHIANA	19000.	25000.	27000.	31000.	35000.	738.50	38.80
03253500	LICKING R AT CATAWBA	47000.	63000.	75000.	85000.	95000.	4069.00	367.30
03277500	NF KENTUCKY R AT HAZARD	19000.	28000.	35000.	45000.	52000.	542.50	93.89
03278000	BEAR BRANCH NR NOBLE	230.	350.	430.	520.	590.	2.84	0.21
03278500	TROUBLESOME C AT NOBLE	8200.	14000.	17000.	22000.		228.00	32.30
03280000	NF KENTUCKY R AT JACKSON	25000.	37000.	45000.	55000.	62000.	1283.00	176.20
03280600	MF KENTUCKY R NR HYDEN	14000.	27000.	39000.	61000.		284.00	71.33
03280700	CUTSHIN C AT WOOTON	3600.	8500.	13000.	19000.		85.29	22.18
03281000	MF KENTUCKY R AT TALLEGA	14000.	23000.	30000.	45000.	60000.	691.30	49.92
03281500	SF KENTUCKY R AT BOONEVILLE	23000.	37000.	48000.	62000.	74000.	1014.00	115.60
03282000	KENTUCKY R LOCK 14, HEIDELBERG	55000.	80000.	97000.	120000.	135000.	3522.00	395.70
03282500	RED R NR HAZEL GREEN	2200.	3600.	4900.	7200.		85.62	6.50
03283000	STILLWATER C AT STILLWATER	2600.	4300.	5600.	7500.		35.21	3.21
03283500	RED R AT CLAY CITY	8800.	14000.	18000.	22000.	26000.	468.00	45.43
03284000	KENTUCKY R LOCK 10, WINCHESTER	58000.	74000.	82000.	89000.	94000.	5177.00	824.80
03284500	KENTUCKY R LOCK 8, CAMP NELSON	54000.	78000.	88000.	96000.	100000.	5783.00	743.50
03285000	DIX R NR DANVILLE	12000.	16000.	19000.	21000.	23000.	429.60	22.48
03287000	KENTUCKY R LOCK 6 NR SALVISA	66000.	86000.	97000.	109000.	118000.	6584.00	856.50
03287500	KENTUCKY R LOCK 4 AT FRANKFORT	64000.	81000.	89000.	96000.	100000.	7061.00	970.50
03288000	NORTH ELKHORN C NR GEORGETOWN	4300.	5700.	7000.	8500.		145.50	7.65
03288500	CAVE C NR FORT SPRING	95.	180.	260.	380.		2.73	0.17
03289000	SOUTH ELKHORN C AT FORT SPRING	860.	1400.	1800.	2400.		29.46	2.32
03289500	ELKHORN C NR FRANKFORT	13000.	19000.	22000.	26000.	28000.	587.40	67.72
03290000	FLAT C NR FRANKFORT	2300.	3200.	5000.	7500.		6.48	0.87
03290500	KENTUCKY R LOCK 2 AT LOCKPORT	68000.	85000.	93000.	100000.	104000.	8344.00	1106.00
03291000	EAGLE C AT SADIEVILLE	4400.	6100.	7400.	9200.	11000.	57.65	9.83
03291500	EAGLE C AT GLENCOE	23000.	31000.	38000.	48000.	55000.	528.70	71.61
03292500	SF BEARGRASS C AT LOUISVILLE	910.	1700.	2200.	3200.	4000.	20.70	2.25
03293000	MF BEARGRASS C AT LOUISVILLE	1200.	1800.	2700.	4000.	5000.	23.38	4.09
03295000	SALT R NR HARRODSBURG	3200.	4000.	4300.	4600.		46.81	6.14
03295500	SALT R NR VAN BUREN	9600.	13000.	15000.	17000.	19000.	237.50	24.89
03297500	PLUM C AT WATERFORD	6000.	8500.	10000.	12000.		38.74	4.92
03298000	FLOYDS F AT FISHERVILLE	8500.	11000.	15000.	20000.	25000.	164.00	12.61
03298500	SALT R AT SHEPHERDSVILLE	28000.	38000.	49000.	72000.	89000.	1488.00	124.50
03299000	ROLLING F NR LEBANON	13000.	18000.	22000.	27000.	30000.	313.50	21.58
03300000	BEECH F NR SPRINGFIELD	5700.	7600.	8800.	10000.		98.45	17.95
03301000	BEECH F AT BARDSTOWN	20000.	26000.	29000.	32000.	33000.	883.00	117.50
03301500	ROLLING F NR BOSTON	28000.	37000.	40000.	42000.	43000.	1666.00	167.90
03302000	POND C NR LOUISVILLE	2200.	3400.	4400.	5700.	7500.	80.16	11.84

TABLE A-3.--FLOW CHARACTERISTICS AT GAGING STATIONS--CONTINUED

STATION NUMBER	STATION NAME	2-YEAR PEAK DISCHARGE (CFS)	5-YEAR PEAK DISCHARGE (CFS)	10-YEAR PEAK DISCHARGE (CFS)	25-YEAR PEAK DISCHARGE (CFS)	50-YEAR PEAK DISCHARGE (CFS)	MEAN ANNUAL DISCHARGE (CFS)	MEAN OCTOBER DISCHARGE (CFS)
03304500	MCGILLS C NR MCKINNEY	380.	690.	890.	1100.		2.71	0.19
03305000	GREEN R NR MCKINNEY	2900.	5600.	7700.	11000.		29.82	1.38
03306500	GREEN R AT GREENSBURG	18000.	27000.	35000.	50000.	65000.	1077.00	95.24
03307000	RUSSELL C NR COLUMBIA	7200.	10000.	12000.	17000.	21000.	270.10	37.63
03307500	SF LITTLE BARREN R AT EDMONTON	1500.	1700.	1900.	2100.	2200.	26.33	2.24
03308500	GREEN R AT MUNFORDVILLE	28000.	40000.	50000.	65000.	77000	2578.00	485.90
03309000	GREEN R AT MAMMOTH CAVE	29000.	45000.	57000.	74000.		2882.00	279.30
03309500	MCDOUGAL C NR HODGENVILLE	870.	1600.	2200.	3200.		7.12	1.22
03310000	NF NOLIN R AT HODGENVILLE	4200.	6500.	7800.	9100.	9900.	46.28	6.27
03310500	NOLIN R AT WAX	9300.	13000.	16000.	20000.	24000.	793.10	129.70
03311000	NOLIN R AT KYROCK	9700.	14000.	17000.	20000.		869.70	107.10
03311500	GREEN R LOCK 6 AT BROWNSVILLE	36000.	52000.	64000.	90000.	110000.	4137.00	812.10
03312000	BEAR C NR LEITCHFIELD	4500.	5900.	6800.	7800.		43.58	3.78
03312500	BARREN R NR PAGEVILLE	19000.	33000.	45000.	65000.	82000.	844.10	143.20
03313000	BARREN R NR FINNEY	30000.	50000.	60000.	80000.		1460.00	210.40
03313500	WEST BAYS F AT SCOTTSVILLE	1500.	1700.	1800.	1900.		10.30	1.28
03314000	DRAKES C NR ALVATON	16000.	25000.	32000.	41000.	49000.	676.00	82.62
03314500	BARREN R AT BOWLING GREEN	30000.	47000.	61000.	82000.	99000.	2424.00	325.60
03315500	GREEN R LOCK 4 AT WOODBURY	59000.	87000.	110000.	130000.	160000.	7798.00	991.30
03316000	MUD R NR LEWISBURG	5100.	7400.	9000.	11000.	13000.	148.70	10.34
03316500	GREEN R AT PARADISE	55000.	76000.	90000.	120000.		8822.00	853.60
03317000	ROUGH R NR MADRID	9600.	12000.	13000.	14000.	15000.	318.10	32.33
03317500	NF ROUGH R NR WESTVIEW	1900.	2800.	3400.	4200.		36.32	5.57
03318000	ROUGH R NR FALLS OF ROUGH	9100.	12000.	13000.	14000.		627.40	44.48
03318200	ROCK LICK C NR GLEN DEAN	2900.	5000.	6800.	9700.		24.86	1.48
03318500	ROUGH R AT FALLS OF ROUGH	9100.	12000.	13000.	14000.		792.90	54.89
03318800	CANEY C NR HORSE BRANCH	5600.	7800.	9300.	11000.		151.00	12.51
03319000	ROUGH R NR DUNDEE	11000.	15000.	17000.	19000.		973.30	66.47
03320000	GREEN R LOCK 2 AT CALHOUN	54000.	78000.	96000.	120000.	150000.	10740.00	1245.00
03320500	EAST F POND R NR APEX	7400.	12000.	15000.	19000.	23000.	261.80	11.25
03383000	TRADEWATER R AT OLNEY	4000.	6500.	8700.	12000.	15000.	314.60	15.77
03384000	ROSE C AT NEBO	570.	780.	1000.	1200.		1.75	0.24
03400500	POOR F AT CUMBERLAND	4000.	6100.	7500.	10000.	13000.	140.50	31.20
03401000	CUMBERLAND R NR HARLAN	18000.	26000.	32000.	39000.	44000.	664.70	122.90
03402000	YELLOW C NR MIDDLESBORO	3400.	5100.	6600.	10000.	13000.	105.20	18.13
03403000	CUMBERLAND R NR PINEVILLE	29000.	39000.	47000.	56000.	63000.	1337.00	212.60
03403500	CUMBERLAND R AT BARBOURVILLE	27000.	35000.	42000.	50000.	56000.	1693.00	288.80
03404000	CUMBERLAND R AT WILLIAMSBURG	27000.	35000.	41000.	49000.		2640.00	418.90
03404500	CUMBERLAND R CUMBERLAND FALLS	33000.	43000.	50000.	58000.	64000.	3124.00	541.90
03405000	LAUREL R AT CORBIN	6800.	11000.	15000.	19000.	23000.	330.60	21.26
03406000	WOOD C NR LONDON	290.	440.	530.	620.		5.37	0.77
03406500	ROCKCASTLE R AT BILLOWS	21000.	30000.	36000.	46000.	52000.	889.00	64.89
03407300	HELTON B AT GREENWOOD	57.	110.	150.	220.		1.09	0.23
03407500	BUCK C NR SHOPVILLE	8200.	13000.	16000.	20000.		233.50	12.59
03410500	SF CUMBERLAND R NR STEARNS	46000.	58000.	65000.	72000.	78000.	1716.00	230.20
03411000	SF CUMBERLAND R AT NEVELSVILLE	50000.	72000.	87000.	110000.	130000.	2198.00	462.60
03411500	CUMBERLAND R AT BURNSIDE	110000.	140000.	160000.	180000.	200000.	7630.00	1504.00
03412500	PITMAN C AT SOMERSET	2000.	2700.	3100.	3400.		43.86	4.33
03414000	CUMBERLAND R NR ROWENA	97000.	136000.	161000.	193000.		7702.00	844.20
03437500	SF LITTLE R AT HOPKINSVILLE	2400.	4000.	6000.	10000.		64.37	4.44
03438000	LITTLE R NR CADIZ	6300.	9300.	12000.	14000.	17000.	325.60	40.97
03610000	CLARKS R AT MURRAY	6600.	13000.	20000.	40000.		89.36	3.01
03610500	CLARKS R NR BENTON	9700.	17000.	24000.	33000.	41000.	270.80	24.58
07022500	PERRY C NR MAYFIELD	650.	1000.	1200.	1500.		1.71	0.13
07023000	MAYFIELD C AT LOVELACEVILLE	6600.	9700.	13000.	17000.	21000.	232.60	38.56
07023500	OBION C AT PRYORSBURG	3300.	4500.	5400.	6200.		36.49	2.13
07024000	BAYOU DE CHIEN NR CLINTON	3200.	5000.	6500.	8500.	10000.	88.17	24.95

TABLE A-3.--FLOW CHARACTERISTICS AT GAGING STATIONS--CONTINUED

STATION NUMBER	MEAN NOVEMBER DISCHARGE (CFS)	MEAN DECEMBER DISCHARGE (CFS)	MEAN JANUARY DISCHARGE (CFS)	MEAN FEBRUARY DISCHARGE (CFS)	MEAN MARCH DISCHARGE (CFS)	MEAN APRIL DISCHARGE (CFS)	MEAN MAY DISCHARGE (CFS)	MEAN JUNE DISCHARGE (CFS)	MEAN JULY DISCHARGE (CFS)	MEAN AUGUST DISCHARGE (CFS)
03208000	179.10	475.70	682.70	930.10	1197.00	759.20	483.60	220.00	204.90	182.40
03209500	547.60	1328.00	2084.00	3074.00	3572.00	2276.00	1399.00	683.70	688.10	560.00
03210000	25.04	66.79	103.80	151.80	187.20	116.40	57.95	25.35	26.34	18.77
03211500	65.53	166.10	283.50	357.70	496.70	386.70	145.80	89.75	77.84	72.15
03212000	53.60	136.20	177.30	285.80	322.10	207.80	137.40	40.13	63.19	25.44
03212500	977.00	1986.00	3844.00	4584.00	5921.00	3923.00	2030.00	1070.00	1124.00	1081.00
03215000	1228.00	3440.00	6079.00	7477.00	9322.00	5975.00	3252.00	2038.00	2026.00	1735.00
03215500	93.04	266.80	400.90	564.60	611.70	404.10	255.80	144.60	109.20	72.19
03216500	165.60	477.10	709.10	1070.00	1190.00	846.20	487.10	258.20	233.00	110.00
03216800	32.77	89.03	95.61	156.60	229.40	182.00	96.82	36.64	62.83	25.30
03217000	117.60	323.50	464.60	626.90	752.30	507.70	359.70	167.90	126.50	70.62
03248500	57.58	164.30	264.90	388.70	415.70	283.20	155.20	73.87	66.02	38.01
03249500	400.10	995.90	1598.00	2664.00	2629.00	1818.00	1107.00	546.10	511.10	292.30
03250000	28.40	80.81	114.70	154.80	190.30	130.40	79.27	36.66	40.48	17.25
03250500	871.20	2264.00	3935.00	5481.00	5328.00	3833.00	2089.00	1433.00	1122.00	513.60
03251000	73.81	182.90	322.40	331.90	352.60	209.80	119.80	60.96	65.32	33.65
03251500	1128.00	3007.00	4817.00	6609.00	7796.00	4873.00	2970.00	1756.00	1401.00	655.40
03252000	90.81	293.30	368.50	615.70	748.30	368.20	238.30	108.90	132.00	69.29
03252500	287.70	809.30	1381.00	1750.00	1998.00	1111.00	581.30	431.30	307.30	142.20
03253500	1625.00	4067.00	7855.00	8109.00	10350.00	6605.00	3965.00	2339.00	1914.00	1022.00
03277500	256.30	577.70	883.40	1168.00	1398.00	886.30	501.30	252.60	242.90	204.80
03278000	0.75	2.25	4.53	6.88	7.58	6.67	2.62	0.72	1.21	0.67
03278500	97.07	250.20	361.10	530.90	611.70	416.20	219.90	84.15	75.54	49.54
03280000	613.50	1273.00	2056.00	2924.00	3325.00	2180.00	1204.00	553.00	564.90	426.50
03280600	160.20	354.60	417.70	507.90	740.00	519.50	292.30	146.70	99.50	78.29
03280700	48.09	102.40	120.00	150.10	214.70	155.70	81.79	51.13	36.92	30.84
03281000	268.60	729.00	1211.00	1602.00	1621.00	1183.00	595.20	339.70	344.90	222.80
03281500	536.20	1179.00	1750.00	2190.00	2464.00	1611.00	931.10	568.50	484.00	282.30
03282000	1905.00	3844.00	5786.00	8128.00	8053.00	5911.00	3384.00	1830.00	1699.00	1118.00
03282500	28.15	98.05	110.20	205.40	232.00	173.90	87.36	28.63	37.55	20.98
03283000	13.75	43.51	46.12	87.78	86.97	66.13	35.52	12.23	19.08	7.95
03283500	198.80	475.10	733.40	1018.00	1143.00	814.50	440.70	258.30	273.80	153.00
03284000	2338.00	5399.00	9915.00	10770.00	11909.99	8393.00	5119.00	2884.00	2513.00	1518.00
03284500	2921.00	6431.00	10009.99	13430.00	12989.99	9380.00	5035.00	3114.00	2899.00	1968.00
03285000	218.50	527.20	812.10	1030.00	1067.00	595.70	351.80	236.50	206.00	74.39
03287000	2984.00	6558.00	11990.00	14080.00	15120.00	10810.00	6006.00	3916.00	3816.00	2190.00
03287500	3369.00	6929.00	13030.00	14919.99	16170.00	11439.99	6496.00	4304.00	4042.00	2286.00
03288000	62.79	189.40	258.70	338.70	429.00	193.00	133.50	56.64	48.74	24.12
03288500	0.78	2.86	3.87	6.38	8.10	4.01	3.48	1.37	1.22	0.54
03289000	14.74	38.26	48.53	65.82	81.70	37.00	31.34	14.60	12.85	5.55
03289500	274.20	711.20	1160.00	1282.00	1489.00	803.10	510.50	334.30	239.80	131.50
03290000	4.23	8.29	8.66	12.68	17.67	8.73	7.18	3.61	3.85	0.89
03290500	3799.00	8378.00	16270.00	16890.00	19140.00	13419.99	8073.00	5120.00	4416.00	2487.00
03291000	39.15	66.68	97.28	116.00	144.70	84.71	54.84	44.15	21.18	9.68
03291500	308.20	571.90	920.00	1092.00	1307.00	821.80	542.10	354.90	215.60	68.07
03292500	8.26	17.21	38.07	48.78	49.60	30.29	24.47	17.36	7.84	3.72
03293000	10.41	20.33	38.42	49.21	58.80	33.42	26.51	17.91	10.79	6.10
03295000	21.48	65.62	77.45	114.30	114.00	58.13	46.30	25.27	26.96	5.97
03295500	136.50	283.40	446.60	566.60	562.10	321.60	189.40	127.60	109.40	65.11
03297500	18.24	36.48	50.56	92.95	105.60	51.94	41.57	26.34	24.75	6.85
03298000	63.73	170.80	305.00	401.70	435.70	224.40	180.10	96.55	45.95	21.94
03298500	689.90	1532.00	2707.00	3370.00	3988.00	2232.00	1369.00	905.20	533.80	298.10
03299000	139.70	350.90	565.70	724.50	775.50	499.20	279.10	171.00	170.10	59.01
03300000	54.42	108.50	159.80	222.30	237.00	119.10	98.96	52.36	79.04	26.87
03301000	521.90	1020.00	1649.00	1915.00	2129.00	1080.00	831.80	546.80	533.40	181.60
03301500	865.30	1782.00	2970.00	3792.00	4079.00	2464.00	1524.00	905.40	962.90	392.80
03302000	33.25	69.74	144.50	175.00	212.90	112.70	90.69	59.01	26.67	14.16

TABLE A-3.--FLOW CHARACTERISTICS AT GAGING STATIONS--CONTINUED

STATION NUMBER	MEAN NOVEMBER DISCHARGE (CFS)	MEAN DECEMBER DISCHARGE (CFS)	MEAN JANUARY DISCHARGE (CFS)	MEAN FEBRUARY DISCHARGE (CFS)	MEAN MARCH DISCHARGE (CFS)	MEAN APRIL DISCHARGE (CFS)	MEAN MAY DISCHARGE (CFS)	MEAN JUNE DISCHARGE (CFS)	MEAN JULY DISCHARGE (CFS)	MEAN AUGUST DISCHARGE (CFS)
03304500	1.48	2.91	3.87	5.93	7.62	4.71	2.77	1.62	1.12	0.30
03305000	15.46	33.96	43.52	64.00	83.85	49.09	31.46	17.22	14.60	3.47
03306500	554.10	1238.00	1943.00	2403.00	2644.00	1622.00	950.10	638.30	542.60	234.70
03307000	156.80	321.30	484.20	603.10	616.90	386.20	212.40	173.60	140.80	79.20
03307500	14.83	35.37	51.97	60.98	60.83	39.13	21.77	11.70	11.11	3.86
03308500	1570.00	2779.00	4643.00	5340.00	6073.00	3748.00	2386.00	1565.00	1228.00	787.30
03309000	861.70	2412.00	5860.00	7128.00	6345.00	4818.00	2283.00	1958.00	1396.00	844.00
03309500	4.13	6.60	9.56	15.29	18.27	10.25	6.70	3.31	6.04	3.34
03310000	29.37	49.95	78.09	98.62	113.50	58.83	44.29	18.14	34.17	17.33
03310500	438.00	761.60	1516.00	1687.00	1698.00	1187.00	721.30	455.90	430.40	337.10
03311000	300.20	740.60	1487.00	1749.00	1897.00	1462.00	816.70	460.90	423.40	384.10
03311500	2420.00	4554.00	7351.00	9014.00	8921.00	6312.00	3791.00	2802.00	1860.00	1230.00
03312000	32.71	60.67	86.36	86.98	100.30	53.29	41.76	22.87	17.44	6.99
03312500	446.00	948.00	1596.00	1858.00	1881.00	1254.00	710.80	521.60	352.90	245.00
03313000	530.10	1544.00	3011.00	3294.00	3282.00	1926.00	1138.00	1057.00	669.00	489.90
03313500	5.42	12.86	16.88	23.99	27.83	14.58	9.08	5.32	3.57	1.57
03314000	319.70	771.60	1222.00	1603.00	1603.00	982.70	652.00	360.60	248.00	162.00
03314500	1126.00	2544.00	4507.00	5943.00	5626.00	3654.00	2025.00	1448.00	923.30	597.30
03315500	3950.00	8052.00	13940.00	18310.00	18159.99	12280.00	6524.00	4530.00	3182.00	2418.00
03316000	86.95	174.50	270.70	349.60	383.10	218.10	135.30	76.22	35.41	21.49
03316500	2773.00	8040.00	17439.99	18790.00	21699.99	15510.00	7646.00	5909.00	3575.00	2462.00
03317000	202.00	333.90	566.50	698.60	679.90	508.20	309.90	218.40	142.60	89.44
03317500	16.09	34.49	46.55	84.49	96.24	54.66	61.13	15.34	12.98	4.34
03318000	323.30	618.00	1332.00	1393.00	1327.00	1053.00	543.80	395.80	227.60	179.70
03318200	12.92	29.72	33.78	44.03	70.59	36.73	47.74	10.53	5.18	3.45
03318500	678.90	1099.00	1764.00	1748.00	1457.00	875.10	768.60	473.40	291.50	167.00
03318800	78.31	191.10	235.30	287.90	420.50	223.10	220.30	50.90	72.90	13.48
03319000	621.10	1093.00	1913.00	2143.00	2136.00	1434.00	1044.00	541.60	330.80	218.70
03320000	4495.00	9918.00	20749.99	24889.99	23489.99	19220.00	10079.99	5805.00	4029.00	3282.00
03320500	160.70	297.60	496.10	576.70	703.20	389.20	290.30	103.00	50.34	32.66
03383000	190.20	333.40	574.10	660.70	868.00	522.80	379.90	106.40	68.51	31.35
03384000	1.00	1.40	2.13	4.43	4.71	2.95	2.42	0.51	0.75	0.50
03400500	81.04	163.50	231.20	279.30	316.90	208.90	137.80	72.91	83.74	58.33
03401000	349.70	798.00	1170.00	1391.00	1562.00	969.70	618.70	322.30	377.00	225.80
03402000	53.07	131.40	196.00	228.30	245.70	154.60	79.90	49.01	64.38	32.77
03403000	628.70	1593.00	2307.00	2947.00	3249.00	2068.00	1134.00	664.60	746.40	406.50
03403500	1068.00	2258.00	2883.00	3534.00	3881.00	2519.00	1832.00	867.40	679.80	369.60
03404000	1384.00	3417.00	4306.00	5649.00	7045.00	4318.00	2313.00	1121.00	1088.00	501.20
03404500	1588.00	3447.00	5835.00	6464.00	7386.00	4984.00	3048.00	1573.00	1455.00	890.50
03405000	179.30	460.80	670.20	766.50	768.50	445.00	281.70	175.60	130.30	48.38
03406000	2.06	5.98	7.38	11.80	13.52	9.07	5.27	3.39	3.07	1.44
03406500	428.70	1025.00	1678.00	2015.00	2133.00	1338.00	753.80	533.00	454.30	208.40
03407300	0.58	1.35	1.71	2.06	2.83	1.87	0.92	0.65	0.53	0.21
03407500	82.25	272.20	361.00	577.90	610.60	370.00	204.30	142.80	130.50	35.89
03410500	981.60	2450.00	3401.00	3996.00	3895.00	2482.00	1454.00	707.60	590.20	258.00
03411000	1357.00	2656.00	4643.00	4328.00	4808.00	3235.00	1981.00	1147.00	771.20	686.20
03411500	4060.00	8966.00	16350.00	15450.00	16539.99	11049.99	6999.00	4250.00	3317.00	2226.00
03412500	14.99	53.54	68.11	111.80	114.60	72.29	34.54	21.51	20.41	7.33
03414000	3141.00	7706.00	15520.00	16800.00	18809.99	12710.00	5637.00	3629.00	4671.00	2431.00
03437500	38.89	73.25	117.50	135.00	164.40	83.19	76.32	31.39	22.46	15.34
03438000	169.40	332.50	534.10	674.60	804.70	488.40	371.40	186.90	143.60	92.78
03610000	59.88	102.10	130.10	219.80	276.60	111.20	99.13	32.97	28.92	6.87
03610500	163.80	293.30	510.60	668.00	684.40	383.00	263.90	93.06	78.38	50.70
07022500	1.16	1.62	2.33	3.93	5.35	1.99	1.89	0.60	0.69	0.41
07023000	141.60	223.70	428.50	512.10	573.70	345.00	257.90	113.50	63.93	56.36
07023500	20.96	41.88	56.86	79.70	107.20	47.48	40.78	15.00	14.94	5.97
07024000	64.93	88.42	146.80	166.80	203.80	123.90	96.09	54.24	35.11	28.65

TABLE A-3.--FLOW CHARACTERISTICS AT GAGING STATIONS--CONTINUED

STATION NUMBER	MEAN SEPTEMBER DISCHARGE (CFS)	STANDARD DEVIATION ANNUAL DISCHARGE (CFS)	STANDARD DEVIATION OCTOBER DISCHARGE (CFS)	STANDARD DEVIATION NOVEMBER DISCHARGE (CFS)	STANDARD DEVIATION DECEMBER DISCHARGE (CFS)	STANDARD DEVIATION JANUARY DISCHARGE (CFS)	STANDARD DEVIATION FEBRUARY DISCHARGE (CFS)	STANDARD DEVIATION MARCH DISCHARGE (CFS)	STANDARD DEVIATION APRIL DISCHARGE (CFS)	STANDARD DEVIATION MAY DISCHARGE (CFS)
03208000	78.39	142.20	86.22	171.90	423.00	499.20	539.90	686.80	389.90	415.50
03209500	177.60	416.70	356.60	568.90	1128.00	1527.00	1760.00	2137.00	1181.00	1335.00
03210000	13.37	20.14	16.25	25.91	61.22	76.66	83.75	106.60	80.77	50.59
03211500	17.85	71.03	26.57	104.10	220.00	247.30	234.90	251.10	322.80	103.60
03212000	9.89	48.30	19.63	74.75	123.40	133.00	204.60	168.90	129.30	122.10
03212500	283.20	733.00	609.30	1293.00	2048.00	3073.00	2822.00	2967.00	2226.00	1843.00
03215000	574.20	1274.00	605.10	1496.00	3641.00	4330.00	5769.00	4381.00	2910.00	2278.00
03215500	50.64	97.32	70.03	141.90	270.00	298.80	380.10	334.80	256.30	194.20
03216500	118.90	188.80	57.94	235.50	512.90	573.60	760.50	658.00	524.00	386.00
03216800	12.55	24.48	11.64	31.15	68.02	48.29	69.22	140.90	102.40	95.68
03217000	68.18	112.10	35.79	147.20	299.20	368.00	402.70	412.20	303.80	270.00
03248500	25.51	60.10	20.02	76.81	154.50	206.20	255.30	238.50	187.30	125.00
03249500	169.80	379.40	118.50	565.60	934.60	1138.00	1524.00	1453.00	1078.00	871.10
03250000	16.64	24.98	6.53	39.07	75.94	96.13	99.79	111.90	64.86	60.81
03250500	420.40	883.80	224.70	1316.00	2303.00	2940.00	3888.00	2991.00	2455.00	1564.00
03251000	57.77	52.72	35.68	88.36	140.40	267.90	216.50	209.40	171.40	120.80
03251500	505.40	1043.00	380.40	1536.00	2755.00	3528.00	4534.00	4256.00	3224.00	2360.00
03252000	20.43	82.47	22.08	120.90	267.80	197.70	416.40	498.10	271.20	269.60
03252500	79.63	276.80	68.14	444.00	825.00	1214.00	1151.00	1220.00	950.40	615.50
03253500	807.20	1438.00	511.10	2042.00	3703.00	6796.00	5475.00	5858.00	4277.00	3627.00
03277500	76.42	163.50	165.70	275.70	503.10	642.00	668.50	876.20	481.90	488.80
03278000	0.28	0.85	0.35	0.85	2.00	4.08	3.88	3.97	3.74	2.64
03278500	25.09	71.96	58.61	116.00	206.10	244.60	320.40	344.20	239.60	166.10
03280000	188.70	421.20	246.30	646.50	1111.00	1516.00	1864.00	2045.00	1243.00	1022.00
03280600	31.46	78.12	129.30	158.20	276.10	194.50	189.80	424.00	254.90	231.20
03280700	13.15	25.79	35.49	48.27	78.37	60.64	64.19	137.20	80.48	67.63
03281000	81.37	219.50	54.15	287.10	671.50	969.10	1083.00	973.20	621.00	521.20
03281500	120.80	330.60	149.70	524.00	1117.00	1319.00	1372.00	1363.00	963.80	714.20
03282000	490.70	1202.00	485.00	1800.00	3994.00	4080.00	5012.00	4701.00	3495.00	2672.00
03282500	5.39	22.37	10.53	33.34	84.60	73.38	115.60	126.80	93.11	85.03
03283000	3.32	10.02	4.88	18.49	37.41	29.27	52.69	44.43	39.82	44.14
03283500	71.04	169.00	46.82	268.10	455.00	565.40	673.70	595.00	446.30	311.00
03284000	832.00	1540.00	1124.00	2620.00	4948.00	6261.00	6173.00	6424.00	4663.00	3541.00
03284500	918.30	1959.00	1334.00	3353.00	6271.00	6501.00	8216.00	7775.00	5432.00	3535.00
03285000	46.54	140.50	28.29	310.50	494.90	633.90	691.90	563.30	410.80	298.70
03287000	1085.00	2294.00	1219.00	3248.00	6494.00	8995.00	9540.00	8607.00	5889.00	4727.00
03287500	1213.00	2338.00	1416.00	3461.00	6614.00	9583.00	9938.00	8980.00	6441.00	5089.00
03288000	11.71	48.59	9.31	76.55	205.10	189.70	220.50	257.60	146.40	157.20
03288500	0.19	0.96	0.22	1.09	3.29	2.23	3.75	5.02	3.04	3.64
03289000	2.45	10.07	3.10	18.56	40.21	37.39	39.41	46.44	25.85	35.25
03289500	77.73	222.60	99.44	356.40	712.60	933.00	809.30	1010.00	657.90	502.50
03290000	1.35	2.57	1.77	6.56	7.28	4.94	10.25	17.32	6.79	8.82
03290500	1432.00	2797.00	1765.00	3996.00	7834.00	11970.00	11040.00	10860.00	7687.00	6430.00
03291000	6.81	18.68	18.63	40.85	53.54	92.18	80.34	112.80	69.89	51.51
03291500	104.20	179.40	121.30	357.90	516.60	738.50	767.20	1040.00	616.10	580.80
03292500	2.20	7.30	2.33	9.90	18.12	33.19	28.45	32.44	22.23	25.64
03293000	6.04	7.81	3.74	12.09	20.91	35.27	32.00	43.77	24.76	26.09
03295000	3.33	18.18	20.20	36.93	67.19	56.99	96.92	70.96	53.54	51.89
03295500	35.04	81.90	61.65	197.40	284.30	382.00	388.30	333.90	215.30	216.90
03297500	7.83	12.16	7.49	36.22	33.32	37.68	64.68	95.44	44.82	54.72
03298000	22.43	60.24	26.59	102.70	181.80	291.80	271.00	342.40	197.40	222.10
03298500	208.00	566.90	231.50	1043.00	1639.00	2584.00	2328.00	2818.00	1527.00	1398.00
03299000	28.18	118.20	51.59	220.90	383.90	496.70	499.20	397.10	273.20	276.20
03300000	10.73	33.29	50.34	89.46	97.45	98.42	166.60	135.50	81.51	95.57
03301000	119.90	332.20	375.10	724.80	1010.00	1492.00	1418.00	1390.00	663.90	925.90
03301500	198.00	632.50	467.50	1302.00	1941.00	2690.00	2784.00	2369.00	1435.00	1555.00
03302000	16.56	29.22	11.59	50.05	73.49	141.20	123.70	168.80	98.11	98.38

TABLE A-3.--FLOW CHARACTERISTICS AT GAGING STATIONS--CONTINUED

STATION NUMBER	MEAN SEPTEMBER DISCHARGE (CFS)	STANDARD DEVIATION ANNUAL DISCHARGE (CFS)	STANDARD DEVIATION OCTOBER DISCHARGE (CFS)	STANDARD DEVIATION NOVEMBER DISCHARGE (CFS)	STANDARD DEVIATION DECEMBER DISCHARGE (CFS)	STANDARD DEVIATION JANUARY DISCHARGE (CFS)	STANDARD DEVIATION FEBRUARY DISCHARGE (CFS)	STANDARD DEVIATION MARCH DISCHARGE (CFS)	STANDARD DEVIATION APRIL DISCHARGE (CFS)	STANDARD DEVIATION MAY DISCHARGE (CFS)
03304500	0.17	0.99	0.27	2.48	3.17	2.12	4.83	4.42	2.75	2.15
03305000	1.64	12.18	2.21	25.35	36.60	23.90	48.29	47.25	29.52	28.27
03306500	127.40	423.10	134.90	864.80	1249.00	1446.00	1583.00	1436.00	826.00	813.80
03307000	47.91	100.50	50.96	232.70	300.50	371.10	380.60	316.10	188.10	160.10
03307500	4.08	8.46	3.87	19.65	32.31	40.34	32.81	26.76	19.25	18.00
03308500	479.30	953.70	584.20	2055.00	2714.00	3291.00	3623.00	3357.00	1885.00	1886.00
03309000	675.30	1266.00	216.60	770.40	2452.00	5256.00	4959.00	3524.00	2342.00	1416.00
03309500	1.15	2.52	1.26	7.17	6.46	5.76	10.19	12.50	7.04	6.41
03310000	9.27	18.58	8.98	45.61	53.09	84.85	64.65	66.37	34.91	38.87
03310500	206.10	316.20	62.72	717.40	905.30	1680.00	1074.00	954.00	639.50	516.30
03311000	251.70	401.00	52.57	425.30	810.90	1749.00	1218.00	1095.00	607.40	666.00
03311500	871.20	1617.00	1330.00	3207.00	4810.00	5642.00	6071.00	5162.00	3080.00	2724.00
03312000	11.82	19.71	6.56	57.85	72.70	94.18	67.84	61.31	39.10	42.32
03312500	229.90	296.40	100.90	497.20	906.30	1227.00	1077.00	977.90	589.30	454.40
03313000	473.40	479.50	194.40	362.40	1264.00	2388.00	1774.00	1224.00	1204.00	653.30
03313500	2.06	3.57	1.21	7.58	15.74	13.13	16.51	16.32	7.39	7.85
03314000	157.10	272.10	84.23	465.60	865.90	1071.00	1038.00	805.80	468.30	450.30
03314500	588.80	906.40	299.40	1453.00	2761.00	3583.00	3713.00	2892.00	1743.00	1296.00
03315500	1885.00	2869.00	712.40	5885.00	8869.00	10920.00	11769.99	9674.00	5445.00	4335.00
03316000	34.97	67.84	17.26	169.30	217.80	250.00	246.60	218.00	110.70	129.90
03316500	2681.00	4000.00	763.60	3167.00	8042.00	15700.00	13260.00	12000.00	6616.00	5093.00
03317000	59.63	140.60	17.89	327.00	405.50	537.20	500.20	388.60	284.00	238.10
03317500	6.25	9.32	13.01	31.40	33.46	29.66	69.83	63.35	29.44	56.55
03318000	141.20	327.60	30.74	475.40	656.90	1450.00	954.30	703.60	491.60	428.30
03318200	2.81	4.89	2.59	24.07	30.45	25.15	26.76	63.35	23.09	45.76
03318500	189.50	380.90	35.29	887.30	1129.00	1616.00	1276.00	870.20	496.30	577.40
03318800	10.18	40.71	33.43	172.10	183.20	141.40	174.50	289.90	168.80	213.90
03319000	206.70	469.40	41.80	969.20	1327.00	1848.00	1694.00	1329.00	783.20	814.20
03320000	2580.00	4363.00	786.50	6477.00	12010.00	17689.99	17250.00	12559.99	9274.00	6931.00
03320500	48.44	106.80	13.92	340.00	328.30	461.40	407.50	376.50	202.10	279.20
03383000	42.73	137.60	31.42	449.70	416.20	548.80	495.40	508.30	303.00	362.10
03384000	0.14	0.73	0.64	3.39	2.09	2.14	4.81	3.84	2.61	2.79
03400500	27.09	33.90	37.33	73.41	116.00	138.60	143.40	151.80	95.96	86.32
03401000	101.60	158.60	171.00	318.30	600.80	717.40	703.70	797.20	457.80	420.20
03402000	14.71	26.55	21.03	56.80	105.30	126.50	125.40	116.90	78.87	54.78
03403000	168.00	325.00	332.10	612.60	1284.00	1493.00	1639.00	1647.00	931.80	810.30
03403500	237.40	471.20	421.30	1089.00	1914.00	1467.00	1872.00	2310.00	1231.00	1228.00
03404000	267.70	661.90	666.30	1491.00	2586.00	1999.00	3427.00	3543.00	2074.00	1830.00
03404500	450.70	823.60	761.60	1706.00	3155.00	3385.00	3407.00	3932.00	2199.00	1998.00
03405000	41.44	96.39	35.19	216.00	330.50	435.70	408.20	349.30	265.40	233.60
03406000	0.98	1.74	0.53	2.11	4.86	5.60	7.71	6.49	5.45	4.29
03406500	95.42	266.10	75.01	537.30	915.60	1296.00	1271.00	1033.00	729.40	500.60
03407300	0.22	0.37	0.08	0.58	0.98	1.56	1.19	1.51	1.21	0.75
03407500	21.36	84.59	29.91	162.00	274.80	217.40	408.10	323.70	227.10	198.10
03410500	257.30	381.00	219.50	1047.00	1931.00	2227.00	2022.00	1486.00	1290.00	914.80
03411000	404.20	646.90	719.70	1437.00	2466.00	3135.00	2299.00	2497.00	1485.00	1333.00
03411500	1225.00	2050.00	2028.00	4329.00	7952.00	10020.00	7975.00	8960.00	4780.00	4279.00
03412500	6.77	15.20	8.69	25.74	47.82	45.13	73.74	56.99	42.40	34.40
03414000	925.60	2085.00	1148.00	2894.00	8147.00	12589.99	9679.00	7409.00	5443.00	3003.00
03437500	13.82	28.10	5.82	85.19	80.52	115.70	97.17	92.76	44.77	70.66
03438000	88.30	152.90	30.56	357.00	410.20	520.90	512.70	413.50	225.70	301.40
03610000	8.78	41.60	4.65	176.40	151.50	105.80	191.50	217.50	76.68	113.10
03610500	59.02	135.90	43.87	414.50	390.50	528.40	484.10	421.80	249.20	294.80
07022500	0.52	0.73	0.19	3.71	2.04	2.03	2.98	3.94	1.51	2.03
07023000	53.30	111.00	55.89	324.00	288.80	459.50	400.10	405.20	263.70	245.10
07023500	7.07	14.86	3.01	63.70	53.87	57.57	67.05	83.38	37.25	38.63
07024000	28.65	37.67	28.35	106.10	89.28	148.30	112.50	130.20	80.66	80.88

TABLE A-3.--FLOW CHARACTERISTICS AT GAGING STATIONS--CONTINUED

STATION NUMBER	STANDARD DEVIATION JUNE DISCHARGE (CFS)	STANDARD DEVIATION JULY DISCHARGE (CFS)	STANDARD DEVIATION AUGUST DISCHARGE (CFS)	STANDARD DEVIATION SEPTEMBER DISCHARGE (CFS)	7-DAY 2-YEAR LOW FLOW DISCHARGE (CFS)	7-DAY 20-YEAR LOW FLOW DISCHARGE (CFS)	7-DAY 2-YEAR HIGH FLOW DISCHARGE (CFS)	7-DAY 10-YEAR HIGH FLOW DISCHARGE (CFS)	7-DAY 50-YEAR HIGH FLOW DISCHARGE (CFS)
03208000	184.50	196.10	247.90	123.60	8.20	0.40	3400.	6100.	8770.
03209500	517.10	640.60	623.20	167.50	25.00	3.00	10200.	19100.	27800.
03210000	27.09	39.38	33.88	35.64	0.13	0.00	548.	961.	1280.
03211500	105.00	122.90	158.40	23.33	1.60	0.19	1620.	2680.	
03212000	45.74	108.00	32.85	7.96	1.50	0.00	1150.	1900.	
03212500	1040.00	1147.00	1153.00	187.60	43.00	12.00	16900.	26500.	32800.
03215000	1659.00	1812.00	1864.00	410.60	165.00	74.00	24500.	39100.	
03215500	205.10	131.30	155.70	128.10	2.60	0.17	2120.	3600.	4530.
03216500	421.20	288.70	178.00	403.20	7.20	2.20	4270.	7010.	8460.
03216800	71.54	71.39	38.93	12.34	0.76	0.00	834.	1080.	
03217000	245.40	171.70	84.05	196.10	1.70	0.00	2660.	3700.	3960.
03248500	96.47	80.79	61.78	53.83	1.10	0.00	1420.	2310.	2710.
03249500	671.10	588.00	397.40	416.30	17.00	2.40	7760.	12700.	15500.
03250000	63.53	57.05	26.78	59.62	0.39	0.00	650.	1050.	1350.
03250500	1871.00	1263.00	634.70	1062.00	23.00	4.30	15900.	25000.	29700.
03251000	105.30	83.48	44.31	156.90	0.00	0.00	1540.	2300.	3700.
03251500	2183.00	1448.00	726.70	1221.00	30.00	6.40	22700.	33400.	45000.
03252000	100.40	141.10	98.25	31.65	1.20	0.29	2500.	4500.	
03252500	589.00	402.60	209.60	205.90	2.70	0.60	7340.	11300.	18000.
03253500	2808.00	2100.00	1200.00	1511.00	45.00	7.30	31800.	49500.	75000.
03277500	226.60	283.70	258.70	82.66	7.00	1.20	4520.	7750.	11000.
03278000	0.78	2.24	0.97	0.46	0.00	0.00	26.	41.	55.
03278500	77.55	98.77	79.24	46.11	0.90	0.00	1900.	3230.	
03280000	473.40	616.30	564.00	252.90	17.00	1.00	10300.	17000.	23000.
03280600	139.20	108.00	67.57	39.46			2250.	3580.	
03280700	45.43	43.46	38.39	18.67			667.	1130.	
03281000	292.70	376.70	320.70	93.60	5.30	0.20	5050.	9200.	13600.
03281500	659.40	567.70	390.00	165.50	7.90	0.10	8210.	14600.	19800.
03282000	1705.00	1711.00	1500.00	602.40	49.00	8.60	24900.	44000.	61400.
03282500	26.89	34.03	32.15	7.08	0.10	0.00	750.	1160.	
03283000	12.78	17.10	11.05	4.42	0.10	0.00	314.	530.	
03283500	296.40	345.70	194.20	91.44	9.80	2.30	3380.	6000.	8050.
03284000	2787.00	2693.00	1799.00	958.30	98.00	24.00	36700.	56700.	69900.
03284500	2796.00	2949.00	2633.00	1152.00	114.00	35.00	40600.	66200.	83900.
03285000	263.50	260.30	111.20	84.98	0.23	0.00	3640.	5750.	7270.
03287000	4011.00	3691.00	2503.00	1166.00	266.00	85.00	44700.	75000.	97200.
03287500	4250.00	4085.00	2705.00	1255.00	297.00	128.00	47500.	76600.	95100.
03288000	68.26	68.52	38.27	24.85	0.80	0.00	1470.	2030.	
03288500	2.12	2.34	0.93	0.18	0.05	0.00	24.	35.	
03289000	20.66	23.02	9.22	3.20	0.20	0.00	260.	360.	
03289500	350.10	312.30	170.60	113.00	14.00	3.80	4890.	8500.	14000.
03290000	4.91	6.97	1.40	3.91	0.00	0.00	66.	140.	
03290500	5175.00	4732.00	2977.00	1475.00	348.00	138.00	58000.	82900.	110000.
03291000	57.85	33.88	14.33	16.81	0.00	0.00	550.	1090.	2100.
03291500	381.40	278.60	100.50	258.60	0.10	0.00	4940.	9090.	15000.
03292500	22.13	7.27	4.02	2.84	0.17	0.00	180.	317.	
03293000	21.73	10.40	6.85	8.83	1.00	0.00	188.	357.	680.
03295000	36.55	39.62	10.67	6.09	0.01	0.00	488.	798.	
03295500	142.10	148.90	112.60	58.81	0.01	0.00	2210.	3560.	4450.
03297500	48.11	30.62	12.79	18.52	0.00	0.00	464.	1000.	
03298000	143.40	61.78	33.13	51.36	0.01	0.00	1580.	3500.	7000.
03298500	1169.00	697.00	415.10	342.60	1.00	0.01	13600.	22800.	38000.
03299000	200.20	232.70	77.73	47.83	0.22	0.00	2640.	4460.	5890.
03300000	55.68	111.70	34.58	9.68	0.01	0.00	940.	1590.	
03301000	605.60	648.10	210.50	192.80	1.40	0.10	8290.	13500.	20000.
03301500	921.00	1202.00	459.60	317.10	9.00	0.80	13900.	22400.	27400.
03302000	83.35	24.18	13.52	27.05	2.80	0.15	819.	1440.	2600.

TABLE A-3.--FLOW CHARACTERISTICS AT GAGING STATIONS--CONTINUED

STATION NUMBER	STANDARD DEVIATION JUNE DISCHARGE (CFS)	STANDARD DEVIATION JULY DISCHARGE (CFS)	STANDARD DEVIATION AUGUST DISCHARGE (CFS)	STANDARD DEVIATION SEPTEMBER DISCHARGE (CFS)	7-DAY 2-YEAR LOW FLOW DISCHARGE (CFS)	7-DAY 20-YEAR LOW FLOW DISCHARGE (CFS)	7-DAY 2-YEAR HIGH FLOW DISCHARGE (CFS)	7-DAY 10-YEAR HIGH FLOW DISCHARGE (CFS)	7-DAY 50-YEAR HIGH FLOW DISCHARGE (CFS)
03304500	2.07	1.36	0.49	0.27	0.00	0.00	25.	43.	
03305000	24.23	20.53	5.88	2.46	0.00	0.00	276.	484.	
03306500	716.70	703.20	297.10	201.10	10.00	1.00	8060.	14400.	20600.
03307000	171.60	149.30	99.73	69.25	5.00	1.00	2010.	3290.	4320.
03307500	13.33	20.52	5.92	7.74	0.00	0.00	221.	334.	420.
03308500	1724.00	1407.00	820.80	574.50	111.00	64.00	17400.	30100.	41500.
03309000	1955.00	1091.00	513.10	1041.00	139.00	99.00	19300.	36400.	
03309500	2.00	7.70	6.28	1.40	0.17	0.00	69.	120.	
03310000	14.66	42.54	24.30	16.08	0.30	0.00	406.	659.	786.
03310500	257.50	357.60	313.10	197.10	72.00	42.00	5540.	10200.	18000.
03311000	263.40	269.70	282.60	298.60	74.00	47.00	5630.	9890.	
03311500	2978.00	1705.00	1198.00	1041.00	246.00	141.00	26900.	45900.	59900.
03312000	33.02	19.06	10.03	20.67	0.35	0.00	425.	743.	
03312500	498.20	289.10	204.90	350.40	54.00	26.00	6170.	11300.	16100.
03313000	1049.00	562.20	341.50	736.30	79.00	54.00	10900.	18800.	
03313500	5.51	5.08	1.70	3.61	0.30	0.01	89.	156.	
03314000	317.30	190.00	144.80	329.80	29.00	14.00	5200.	9110.	13500.
03314500	1280.00	737.10	443.00	980.40	105.00	55.00	17100.	29500.	39100.
03315500	3434.00	2148.00	2295.00	2646.00	411.00	234.00	49700.	80000.	120000.
03316000	102.30	53.55	23.55	129.80	0.90	0.00	1440.	2330.	3500.
03316500	5354.00	2454.00	1631.00	4813.00	421.00	294.00	51400.	85000.	
03317000	191.70	121.90	67.84	92.61	14.00	8.90	2660.	3940.	4800.
03317500	15.19	18.06	4.35	12.01	0.16	0.05	362.	731.	
03318000	365.50	128.30	134.30	277.40	15.00	9.50	4870.	7190.	
03318200	9.23	4.85	4.96	3.17	0.05	0.00	299.	584.	
03318500	446.50	245.10	192.70	339.10	17.00	8.50	6310.	7830.	
03318800	51.51	126.80	18.34	17.30	0.01	0.00	1710.	2950.	
03319000	516.90	240.00	217.20	498.40	19.00	13.00	7770.	11100.	
03320000	5566.00	2951.00	3034.00	4141.00	496.00	299.00	52700.	90200.	124000.
03320500	146.80	61.88	40.38	154.80	0.05	0.00	2600.	4380.	6030.
03383000	133.30	113.50	54.99	152.10	0.10	0.00	2880.	5080.	8500.
03384000	0.85	0.95	1.75	0.25	0.00	0.00	24.	62.	
03400500	50.31	83.53	62.30	19.53	8.50	3.10	908.	1490.	2900.
03401000	225.70	381.70	245.90	77.33	23.00	7.70	4580.	7350.	10100.
03402000	36.75	80.96	40.47	13.03	3.80	1.70	823.	1300.	1690.
03403000	531.80	741.90	453.50	134.20	36.00	8.40	9870.	15900.	21600.
03403500	738.70	637.10	302.10	239.20	40.00	7.00	12000.	20500.	29200.
03404000	837.60	1296.00	434.90	235.90	50.00	9.00	19100.	30300.	
03404500	1345.00	1477.00	862.70	532.20	63.00	12.00	21000.	33900.	45900.
03405000	198.10	154.90	55.56	87.78	1.70	0.30	2480.	4110.	6400.
03406000	4.36	2.67	1.08	0.66	0.36	0.22	40.	67.	
03406500	696.30	453.60	255.50	124.70	8.90	1.80	6970.	12200.	17000.
03407300	0.56	0.70	0.06	0.06	0.12	0.06	9.	17.	
03407500	199.00	167.20	59.19	41.51	0.05	0.00	2040.	3370.	
03410500	547.30	778.30	193.70	434.90	38.00	15.00	14100.	21200.	26300.
03411000	1509.00	892.00	939.70	513.20	56.00	18.00	16600.	25000.	31400.
03411500	3783.00	3177.00	2092.00	1204.00	184.00	69.00	53600.	84700.	109000.
03412500	27.17	26.36	7.93	11.50	0.25	0.04	359.	563.	
03414000	2518.00	4783.00	2391.00	785.80	468.00	54.00	57300.	96900.	
03437500	29.10	28.58	19.23	34.06	0.76	0.25	611.	1060.	
03438000	120.80	113.40	82.61	172.90	18.00	8.70	2380.	4260.	5740.
03610000	56.25	49.49	9.45	16.32	0.00	0.00	1210.	2480.	
03610500	106.90	119.90	100.90	173.60	3.40	2.20	3100.	5280.	9000.
07022500	1.18	0.71	0.50	0.96	0.00	0.00	22.	55.	
07023000	155.00	61.99	66.66	72.80	12.00	6.80	2610.	4420.	7500.
07023500	33.32	29.57	7.35	12.28	0.00	0.00	431.	976.	
07024000	78.94	35.12	26.53	30.36	9.50	5.80	828.	1590.	3000.

Table A-4.--Summary of regression analysis

[Model is $Y=aA^{b1}S^{b2}L^{b3}St^{b4}E^{b5}F^{b6}P^{b7}I^{b8}Ak^{b9}Si^{b10}$]

Flow characteristic, Y	Regression constant, a	Exponent of basin characteristic										Standard error of estimate (percent)
		Drainage area, A	Main channel slope, S	Main channel length, L	Percent area lakes and ponds plus 1, St	Mean basin elevation ÷1,000, E	Percent forest cover plus 1, F	Mean annual precipitation minus 20, P	2-year 24-hour rainfall, I	Percent non-contributing area plus 1, Ak	Soils index, Si	
Q_a	0.270	1.01	--------	--------	-0.143	0.230	--------	--------	1.36	--------	--------	12
Q_1	.142	1.05	--------	--------	-.190	.252	--------	--------	2.22	--------	--------	18
Q_2	.124	1.01	--------	--------	--------	.0742	--------	0.938	--------	--------	--------	14
Q_3	1.16	.991	--------	--------	--------	.219	--------	--------	.995	--------	--------	11
Q_4	1.21	1.01	--------	--------	-.151	.138	0.0566	--------	--------	--------	0.269	14
Q_5	.874	.988	--------	--------	--------	--------	.0312	--------	--------	--------	.292	15
Q_6	.0792	.945	0.133	0.265	--------	--------	--------	--------	1.04	--------	--------	26
Q_7	.0135	1.00	--------	--------	--------	--------	--------	2.02	-2.59	--------	--------	24
Q_8	.0192	1.11	.124	--------	--------	--------	--------	1.57	-2.91	0.0661	--------	32
Q_9	.0493	1.11	.158	--------	--------	-.455	.116	--------	--------	.100	--------	40
Q_{10}	.0273	1.19	.326	--------	--------	--------	--------	--------	--------	--------	--------	43
Q_{11}	.0202	1.01	--------	--------	--------	.307	--------	--------	2.99	--------	--------	24
Q_{12}	.149	.964	-.0842	--------	-.224	.486	--------	--------	2.35	--------	--------	19
Mean of standard errors of regression equations of mean monthly discharges--------												23
SD_a	.0578	1.02	--------	--------	--------	-.210	--------	.479	--------	--------	.292	16
SD_1	.0970	1.06	--------	--------	--------	--------	--------	--------	2.23	--------	--------	26
SD_2	.215	.977	-.0686	--------	--------	--------	--------	.466	.770	--------	--------	16
SD_3	4.44	.981	--------	--------	--------	--------	--------	-.596	1.08	-.0394	--------	15
SD_4	1.24	.864	--------	.196	--------	--------	--------	--------	--------	-.0413	--------	14

Table A-4.--Summary of regression analysis--Continued

Flow characteristic, Y	Regression constant, a	Exponent of basin characteristic										Standard error of estimate (percent)
		Drainage area, A	Main channel slope, S	Main channel length, L	Percent area lakes and ponds plus 1, St	Mean basin elevation ÷1,000, E	Percent forest cover plus 1, F	Mean annual precipitation minus 20, P	2-year 24-hour rainfall, I	Percent non-contributing area plus 1, Ak	Soils index, Si	
SD_5	13.3	0.953	--------	--------	--------	--------	--------	-1.07	1.10	--------	--------	19
SD_6	.181	1.01	--------	--------	--------	--------	--------	--------	2.09	--------	-0.934	36
SD_7	.0197	.884	-0.132	--------	--------	0.390	--------	1.72	--------	--------	-1.12	30
SD_8	4.20	1.04	--------	--------	--------	--------	--------	--------	-2.30	--------	--------	39
SD_9	.143	1.06	--------	--------	--------	-.924	0.123	--------	--------	--------	--------	60
SD_{10}	.0652	1.14	.223	--------	--------	--------	--------	--------	--------	-0.129	--------	52
SD_{11}	.0116	.936	-.122	--------	--------	--------	--------	--------	3.82	-.102	.562	28
SD_{12}	.0826	1.01	--------	--------	--------	.157	--------	--------	2.42	--------	--------	18
Mean of standard errors of regression equations of standard deviations of mean monthly discharges--------												29
$P_{1.25}$	7.31	1.02	--------	-0.488	0.639	--------	--------	.891	--------	.161	--------	41
P_2	8.58	1.07	--------	-.571	--------	--------	-.112	1.14	--------	-.173	--------	37
P_5	19.4	1.12	--------	-.696	--------	--------	-.0893	1.04	--------	-.163	--------	35
P_{10}	17.2	1.14	.210	-.587	--------	-.262	-.0810	.850	--------	-.160	--------	35
P_{25}	251	1.16	.255	-.635	--------	-.387	--------	--------	--------	-.129	--------	40
P_{50}	117	.760	.273	--------	--------	--------	-.143	--------	--------	-.146	1.08	33
$M_{7,2}$	No meaningful equation derived.											
$M_{7,20}$	No meaningful equation derived.											
$V_{3,2}$	4.56	.948	--------	--------	--------	--------	--------	--------	1.46	-.0795	--------	19
$V_{3,5}$	6.64	.932	--------	--------	--------	--------	--------	--------	1.53	-.0845	--------	18
$V_{3,10}$	1.32	1.01	--------	-.149	--------	--------	--------	--------	1.51	-.0847	--------	19
$V_{3,25}$	8.27	.906	--------	--------	--------	--------	--------	--------	1.82	-.101	--------	23

Table A-4.--Summary of regression analysis--Continued

Flow characteristic, Y	Regression constant, a	Exponent of basin characteristic										Standard error of estimate (percent)
		Drainage area, A	Main channel slope, S	Main channel length, L	Percent area lakes and ponds plus 1, St	Mean basin elevation ÷1,000, E	Percent forest cover plus 1, F	Mean annual precipitation minus 20, P	2-year 24-hour rainfall, I	Percent non-contributing area plus 1, Ak	Soils index, Si	
$V_{3,50}$	24.2	1.05	--------	-0.259	--------	--------	-0.0973	--------	1.51	-0.0925	------	22
$V_{7,2}$	2.94	.977	--------	--------	--------	--------	--------	--------	1.29	-.0480	------	13
$V_{7,5}$	3.44	.969	--------	--------	--------	--------	--------	--------	1.51	-.0559	------	12
$V_{7,10}$	3.44	.961	--------	--------	--------	--------	--------	--------	1.72	-.0675	------	13
$V_{7,25}$	4.41	.949	--------	--------	0.229	--------	--------	--------	1.72	-.0795	------	17
$V_{7,50}$	8.73	.939	--------	--------	--------	--------	-.100	--------	1.65	-.0839	------	17
$V_{15,2}$	1.83	.961	-0.0529	--------	--------	0.162	--------	--------	1.54	-.0328	------	13
$V_{15,5}$	3.06	.983	--------	--------	--------	--------	--------	--------	1.19	-.0345	------	11
$V_{15,10}$	3.77	.982	--------	--------	--------	--------	--------	--------	1.16	-.0340	------	12
$V_{15,25}$	5.25	.978	--------	--------	--------	--------	--------	--------	1.05	-.0328	------	14
$V_{15,50}$	10.3	.970	--------	--------	--------	--------	-.0545	--------	.774	-.0347	------	15
$V_{30,2}$	1.55	.994	--------	--------	--------	.115	--------	--------	1.11	--------	------	13
$V_{30,5}$	2.51	1.00	--------	--------	--------	--------	--------	--------	.973	-.0189	------	11
$V_{30,10}$	3.71	.997	--------	--------	--------	--------	--------	--------	.774	--------	------	12
$V_{30,25}$	2.14	1.02	.0491	--------	--------	-.118	--------	0.421	--------	--------	------	13
$V_{30,50}$	5.48	.986	--------	--------	--------	--------	--------	--------	.725	--------	------	13
SK_a	.133	.131	.165	--------	--------	-.928	--------	--------	--------	--------	0.840	35
SK_{V7}	2.89	--------	--------	--------	--------	--------	-.135	--------	--------	-.0827	------	46
P_a	2.50	1.06	.220	-.366	--------	-.309	-.110	1.16	--------	-.186	------	34
SD_p	3.65	--------	--------	-.0419	-.230	--------	--------	-.262	--------	--------	.219	11
SK_p	No meaningful equation derived.											

Table A-5.--Streamflow stations now in operation and those needed for proposed network

Station number	Station name	Recommendations		Types of data			
					Planning and design		
		Include in network	Not recommended for inclusion	Current purpose	Minor streams	Principal streams	Long-term trend
3-2080	Levisa Fork below Fishtrap Dam, near Millard	X	----------	X	-------	X	-----
3-2093	Russell Fork at Elkhorn City	X	----------	X	-------	X	-----
	SMALL STREAM IN SOUTHERN PIKE COUNTY	X	----------	-------	X	---------	-----
3-2095	Levisa Fork at Pikeville	X	----------	X	-------	X	-----
3-2098	Levisa Fork at Prestonsburg	X	----------	X	-------	---------	-----
3-2100	Johns Creek near Meta	X	----------	X	-------	---------	X
3-2115	Johns Creek near Van Lear	X	----------	X	-------	---------	-----
3-2120	Paint Creek at Staffordsville	X	----------	X	-------	---------	-----
3-2125	Levisa Fork at Paintsville	X	----------	X	-------	X	-----
	SMALL STREAM IN MARTIN COUNTY	X	----------	-------	X	---------	-----
3-2150	Big Sandy River at Louisa	X	----------	X	-------	X	-----
3-2155	Blaine Creek at Yatesville	X	----------	X	-------	---------	-----
3-2160	Ohio River at Ashland	X	----------	X	-------	---------	-----
3-2163.5	Little Sandy River below Grayson Dam, near Leon	X	----------	X	X	---------	-----
3-2164	Little Sandy River at Leon	X	----------	X	X	---------	-----
3-2165	Little Sandy River at Grayson	X	----------	X	-------	X	-----
	SMALL STREAM IN OR NEAR BOYD COUNTY	X	----------	-------	X	---------	-----
3-2166	Ohio River at Greenup Dam	X	----------	X	-------	---------	-----
3-2168	Tygarts Creek at Olive Hill	X	----------	-------	-------	---------	X
3-2170	Tygarts Creek near Greenup	X	----------	X	-------	---------	-----
	SMALL STREAM IN LEWIS COUNTY	X	----------	-------	X	---------	-----
3-2380	Ohio River at Maysville	X	----------	X	-------	---------	-----
	SMALL STREAM IN BRACKEN COUNTY	X	----------	-------	X	---------	-----
3-2485	Licking River near Salyersville	X	----------	X	-------	---------	-----
	SMALL STREAM IN EASTERN MORGAN COUNTY	X	----------	-------	X	---------	-----
3-2495	Licking River at Farmers	X	----------	X	-------	X	-----
3-2500	Triplett Creek at Morehead	X	----------	X	-------	---------	-----
3-2501	North Fork Triplett Creek near Morehead	X	----------	X	-------	---------	-----
	SMALL STREAM IN OR NEAR NICHOLAS COUNTY	X	----------	-------	X	---------	-----
3-2510	North Fork Licking River near Lewisburg	X	----------	-------	-------	---------	X
3-2515	Licking River at McKinneysburg	X	----------	X	-------	X	-----
3-2520	Stoner Creek at Paris	X	----------	-------	-------	---------	X
3-2525	South Fork Licking River at Cynthiana	X	----------	X	-------	---------	-----
3-2535	Licking River at Catawba	X	----------	X	-------	X	-----
3-2544	North Fork Grassy Creek near Piner	X	----------	-------	X	---------	-----
	SMALL STREAM IN OR NEAR COVINGTON	X	----------	-------	X	---------	-----
3-2550	Ohio River at Cincinnati, Ohio	X	----------	X	-------	---------	-----
	SMALL STREAM IN GALLATIN COUNTY	X	----------	-------	X	---------	-----
3-2774	Leatherwood Creek at Daisy	X	----------	X	-------	---------	-----

Table A-5.--Streamflow stations now in operation and those needed for proposed network--Continued

Station name	Station name	Recommendations: Include in network	Recommendations: Not recommended for inclusion	Types of data: Current purpose	Planning and design: Minor streams	Planning and design: Principal streams	Long-term trend
3-2774.5	Carr Fork near Sassafras----------------------------	X	----------	X	X	---------	-----
3-2775	North Fork Kentucky River at Hazard-----------------	X	----------	X	-------	X	-----
3-2780	Bear Branch near Noble------------------------------	-------	X	-------	-------	---------	-----
3-2785	Troublesome Creek at Noble--------------------------	X	----------	-------	-------	---------	X
3-2800	North Fork Kentucky River at Jackson----------------	X	----------	X	-------	X	-----
3-2806	Middle Fork Kentucky River near Hyden---------------	X	----------	X	-------	---------	-----
3-2807	Cutshin Creek at Wooton-----------------------------	X	----------	X	-------	---------	-----
3-2809	Middle Fork Kentucky River at Buckhorn--------------	X	----------	X	-------	X	-----
3-2810	Middle Fork Kentucky River at Tallega---------------	X	----------	X	-------	---------	-----
	SMALL STREAM IN LESLIE OR CLAY COUNTY---------------	X	----------	-------	X	---------	-----
3-2811	Goose Creek at Manchester---------------------------	X	----------	X	-------	---------	-----
3-2812	SOUTH FORK KENTUCKY RIVER AT ONEIDA-----------------	X	----------	-------	-------	X	-----
3-2815	South Fork Kentucky River at Booneville-------------	X	----------	X	-------	---------	-----
	SMALL STREAM IN LEE OR OWSLEY COUNTY----------------	X	----------	-------	X	---------	-----
3-2820	Kentucky River at lock 14, at Heidelberg------------	X	----------	X	-------	X	-----
3-2825	Red River near Hazel Green--------------------------	X	----------	X	-------	---------	X
3-2830	Stillwater Creek at Stillwater----------------------	X	----------	X	-------	---------	-----
3-2835	Red River at Clay City------------------------------	X	----------	X	-------	---------	-----
	SMALL STREAM IN CLARK COUNTY------------------------	X	----------	-------	X	---------	-----
3-2840	Kentucky River at lock 10, near Winchester----------	X	----------	X	-------	---------	-----
3-2843	Silver Creek near Kingston--------------------------	X	----------	-------	X	---------	-----
3-2845	Kentucky River at lock 8, near Camp Nelson----------	X	----------	X	-------	X	-----
3-2850	Dix River near Danville-----------------------------	X	----------	X	-------	---------	-----
3-2870	Kentucky River at lock 6, near Salvisa--------------	X	----------	X	-------	---------	-----
3-2875	Kentucky River at lock 4, at Frankfort--------------	X	----------	X	-------	---------	-----
3-2880	North Elkhorn Creek near Georgetown-----------------	X	----------	X	-------	---------	-----
3-2885	Cave Creek near Fort Spring-------------------------	-------	X	-------	-------	---------	-----
3-2890	South Elkhorn Creek at Fort Spring------------------	X	----------	X	-------	---------	-----
3-2895	Elkhorn Creek near Frankfort------------------------	X	----------	-------	-------	---------	X
3-2900	Flat Creek near Frankfort---------------------------	-------	X	-------	-------	---------	-----
3-2905	Kentucky River at lock 2, at Lockport---------------	X	----------	X	-------	X	-----
3-2910	Eagle Creek at Sadieville---------------------------	X	----------	X	-------	---------	-----
3-2915	Eagle Creek at Glencoe------------------------------	X	----------	X	-------	---------	-----
3-2924.6	Harrods Creek near La Grange------------------------	X	----------	-------	-------	---------	X
3-2925	South Fork Beargrass Creek at Louisville------------	X	----------	X	-------	---------	-----
3-2930	Middle Fork Beargrass Creek at Cannons Lane, at Louisville.	X	----------	X	-------	---------	-----
3-2945	Ohio River at Louisville----------------------------	X	----------	X	-------	X	X
3-2950	Salt River near Harrodsburg-------------------------	X	----------	X	-------	---------	-----
3-2955	Salt River near Van Buren---------------------------	X	----------	X	-------	---------	-----

Table A-5.--Streamflow stations now in operation and those needed for proposed network--Continued

Station name	Station name	Recommendations: Include in network	Recommendations: Not recommended for inclusion	Types of data: Current purpose	Planning and design: Minor streams	Planning and design: Principal streams	Long-term trend
	SALT RIVER ABOVE OR BELOW BRASHEARS CREEK	X	----------	-------	-------	X	-----
3-2975	Plum Creek at Waterford	X	----------	X	-------	---------	-----
	SMALL STREAM IN NELSON COUNTY	X	----------	-------	X	---------	-----
3-2980	Floyds Fork at Fisherville	X	----------	-------	-------	---------	X
3-2985	Salt River at Shepherdsville	X	----------	X	-------	---------	-----
3-2990	Rolling Fork near Lebanon	X	----------	-------	-------	---------	X
3-3000	Beech Fork near Springfield	X	----------	X	-------	---------	-----
3-3010	Beech Fork at Bardstown	X	----------	X	-------	---------	-----
3-3015	Rolling Fork near Boston	X	----------	X	-------	---------	-----
3-3020	Pond Creek near Louisville	X	----------	X	-------	---------	-----
	SMALL STREAM IN MEADE COUNTY	X	----------	-------	X	---------	-----
3-3045	McGills Creek near McKinney	-------	X	-------	-------	---------	-----
3-3050	Green River near McKinney	-------	X	-------	-------	---------	-----
3-3060	Green River near Campbellsville	X	----------	X	-------	X	-----
3-3065	Green River at Greensburg	X	----------	X	-------	---------	-----
3-3070	Russell Creek near Columbia	X	----------	X	-------	---------	X
3-3071	Russell Creek near Gresham	X	----------	X	-------	---------	-----
	SMALL STREAM IN TAYLOR COUNTY	X	----------	-------	X	---------	-----
3-3075	South Fork Little Barren River at Edmonton	-------	X	-------	-------	---------	-----
3-3085	Green River at Munfordville	X	----------	X	-------	X	-----
3-3095	McDougal Creek near Hodgenville	-------	X	-------	-------	---------	-----
3-3100	North Fork Nolin River at Hodgenville	-------	X	-------	-------	---------	-----
3-3103	Nolin River at White Mills	X	---------	X	-------	---------	-----
3-3104	Bacon Creek near Priceville	X	---------	X	-------	---------	-----
3-3110	Nolin River at Kyrock	X	---------	X	-------	X	-----
3-3115	Green River at lock 6, at Brownsville	X	---------	X	-------	X	-----
	SMALL STREAM IN EDMONSON COUNTY (BEAVERDAM CREEK)	X	---------	-------	X	---------	-----
3-3120	Bear Creek near Leitchfield	-------	X	-------	-------	---------	-----
3-3130	Barren River near Finney	X	---------	X	-------	X	-----
3-3135	West Bays Fork at Scottsville	X	---------	X	-------	---------	-----
3-3137	West Fork Drakes Creek at Franklin	X	---------	-------	-------	---------	X
3-3140	Drakes Creek near Alvaton	X	---------	X	-------	---------	-----
3-3145	Barren River at Bowling Green	X	---------	X	-------	X	-----
3-3155	Green River at lock 4, at Woodbury	X	---------	X	-------	X	-----
	SMALL STREAM IN BUTLER COUNTY	X	---------	-------	X	---------	-----
3-3160	Mud River near Lewisburg	-------	X	-------	-------	---------	-----
3-3165	Green River at Paradise	X	---------	X	-------	---------	-----
	SMALL STREAM IN OHIO COUNTY	X	---------	-------	X	---------	-----
3-3175	North Fork Rough River near Westview	-------	X	-------	-------	---------	-----

Table A-5.--Streamflow stations now in operation and those needed for proposed network--Continued

Station name	Station name	Recommendations		Types of data			
		Include in network	Not recommended for inclusion	Current purpose	Planning and design		Long-term trend
					Minor streams	Principal streams	
3-3182	Rock Lick Creek near Glen Dean	X	---------	X	-------	---------	-----
3-3185	Rough River at Falls of Rough	X	---------	X	-------	X	-----
3-3188	Caney Creek near Horse Branch	X	---------	X	-------	---------	X
3-3190	Rough River near Dundee	X	---------	X	-------	X	-----
3-3200	Green River at lock 2, at Calhoun	X	---------	X	-------	X	-----
3-3205	East Fork Pond River near Apex	X	---------	X	-------	---------	-----
	POND RIVER NEAR MOUTH	X	---------	-------	-------	X	-----
	SMALL STREAM IN DAVIS OR MCCLEAN COUNTY	X	---------	-------	X	---------	-----
3-3213.5	South Fork Panther Creek near Whitesville	X	---------	-------	X	---------	-----
3-3220	Ohio River at Evansville, Ind	X	---------	X	-------	---------	-----
	SMALL STREAM IN HENDERSON OR UNION COUNTY	X	---------	-------	X	---------	-----
3-3830	Tradewater River at Olney	X	---------	X	-------	---------	X
3-3840	Rose Creek at Nebo	-------	X	-------	-------	---------	-----
	TRADEWATER RIVER NEAR MOUTH	X	---------	-------	-------	X	-----
3-3845	Ohio River at Golconda, Ill	X	---------	X	-------	---------	-----
3-4005	Poor Fork at Cumberland	X	---------	X	-------	---------	-----
3-4010	Cumberland River near Harlan	X	---------	X	-------	---------	-----
3-4020	Yellow Creek near Middlesboro	X	---------	X	-------	---------	-----
3-4030	Cumberland River near Pineville	X	---------	X	-------	---------	-----
	SMALL STREAM IN KNOX COUNTY	X	---------	-------	X	---------	-----
3-4035	Cumberland River at Barbourville	X	---------	X	-------	---------	-----
3-4039.1	Clear Fork at Saxton	X	---------	-------	X	---------	-----
3-4040	Cumberland River at Williamsburg	X	---------	X	-------	---------	-----
3-4045	Cumberland River at Cumberland Falls	X	---------	-------	-------	---------	X
3-4050	Laurel River at Corbin	X	---------	X	-------	---------	-----
3-4060	Wood Creek near London	-------	X	-------	-------	---------	-----
3-4065	Rockcastle River at Billows	X	---------	X	-------	---------	-----
3-4073	Helton Branch at Greenwood	-------	---------	X	-------	---------	-----
3-4075	Buck Creek near Shopville	X	---------	-------	-------	---------	X
3-4105	South Fork Cumberland River near Stearns	X	---------	X	-------	---------	-----
3-4125	Pitman Creek at Somerset	-------	X	-------	-------	---------	-----
3-4132	Beaver Creek near Monticello	X	---------	-------	X	---------	-----
3-4140	Cumberland River near Rowena	X	---------	X	-------	X	-----
	SMALL STREAM IN CUMBERLAND OR CLINTON COUNTY	X	---------	-------	X	---------	-----
	SMALL STREAM IN SOUTHERN LOGAN COUNTY	X	---------	-------	X	---------	-----
	RED RIVER ABOVE OR BELOW WHIPPOORWILL CREEK	X	---------	-------	-------	X	-----
3-4375	South Fork Little River at Hopkinsville	-------	X	-------	-------	---------	-----
3-4380	Little River near Cadiz	X	---------	X	-------	---------	-----
3-4380.7	Muddy Fork Little River near Cerulean	X	---------	-------	X	---------	-----

Table A-5.--Streamflow stations now in operation and those needed for proposed network--Continued

Station name	Station name	Recommendations		Types of data			
		Include in network	Not recom-mended for inclusion	Current purpose	Planning and design		Long-term trend
					Minor streams	Principal streams	
3-4381.9	Barkley-Kentucky Canal near Grand Rivers-------------	X	----------	X	-------	---------	-----
3-4382.2	Cumberland River near Grand Rivers------------------	X	----------	X	-------	X	-----
	SMALL STREAM LIVINGSTON CREEK BASIN------------------	X	----------	-------	X	---------	-----
	SMALL STREAM EASTERN CALLOWAY COUNTY-----------------	X	----------	-------	X	---------	-----
3-6095	Tennessee River near Paducah------------------------	X	----------	X	-------	X	-----
3-6100	Clarks River at Murray------------------------------	-------	X	-------	-------	---------	-----
3-6105	Clarks River near Benton----------------------------	-------	X	-------	-------	---------	-----
3-6105.45	West Fork Clarks River near Brewers-----------------	X	----------	-------	X	---------	-----
	CLARKS RIVER NEAR MOUTH-----------------------------	X	----------	-------	-------	X	-----
3-6115	Ohio River at Metropolis, Ill-----------------------	X	----------	X	-------	X	X
	SMALL STREAM IN BALLARD OR MCCRACKEN COUNTY----------	X	----------	-------	X	---------	-----
07-0225	Perry Creek near Mayfield---------------------------	-------	X	-------	-------	---------	-----
07-0230	Mayfield Creek at Lovelaceville---------------------	X	----------	-------	-------	---------	X
07-0235	Obion Creek at Pryorsburg---------------------------	-------	X	-------	-------	---------	-----
07-0240	Bayou de Chien near Clinton-------------------------	-------	X	-------	-------	---------	-----

EXPLANATION

2080 ○ Existing gaging station

● Proposed gaging station

(Numbers are those permanently assigned in Geological Survey numbering system and shown in table A-5)

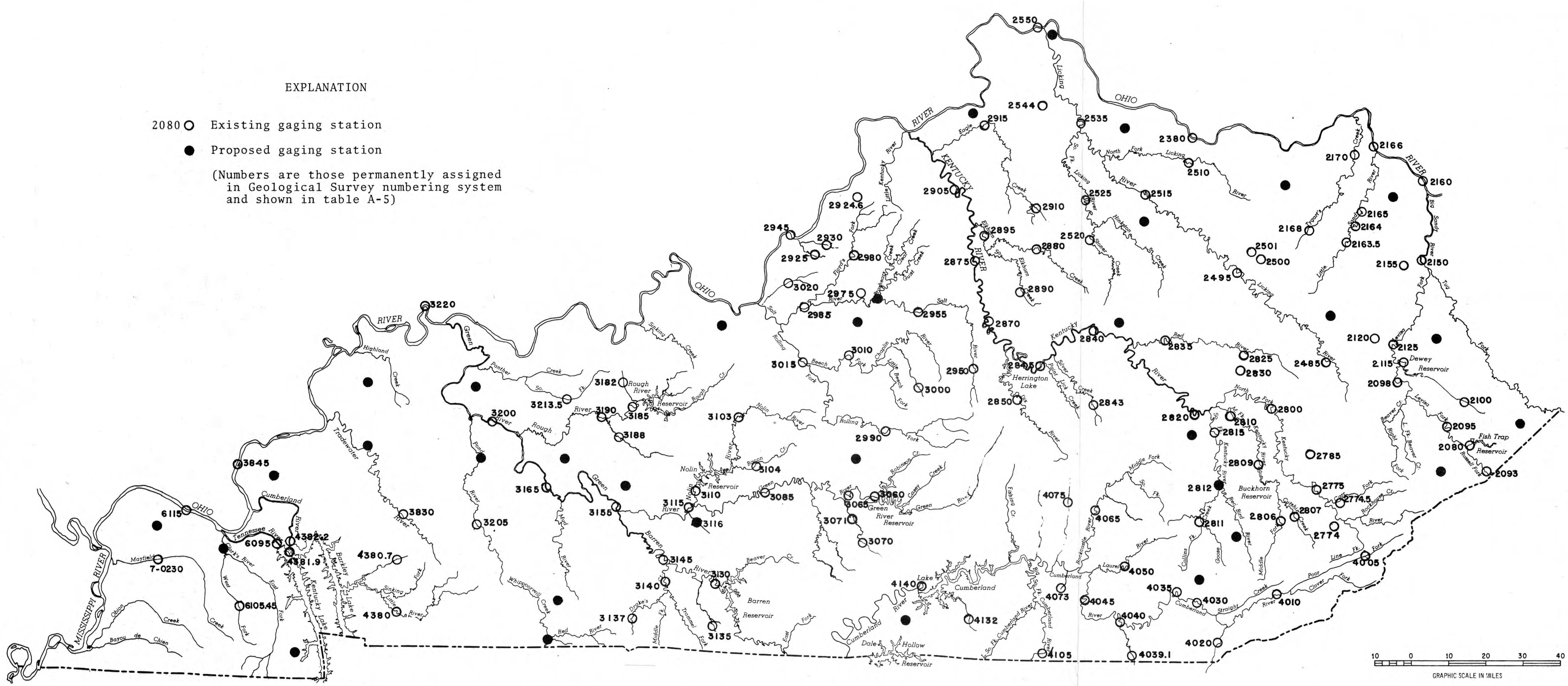

FIGURE 3.- PROPOSED NETWORK OF GAGING STATIONS IN KENTUCKY

EXPLANATION

2094 ▽ Existing low-flow partial-record station

4049 △ Existing crest-stage partial-record station

2773 Existing low-flow crest-stage partial-record station

▼ Proposed low-flow partial-record station

◆ Proposed low-flow crest-stage partial-record station

Note.--This map does not show the location of 50 recommended crest-stage partial-record stations and 160 recommended low-flow partial-record stations at sites on small streams.

(Numbers are those permanently assigned in Geological Survey numbering system)

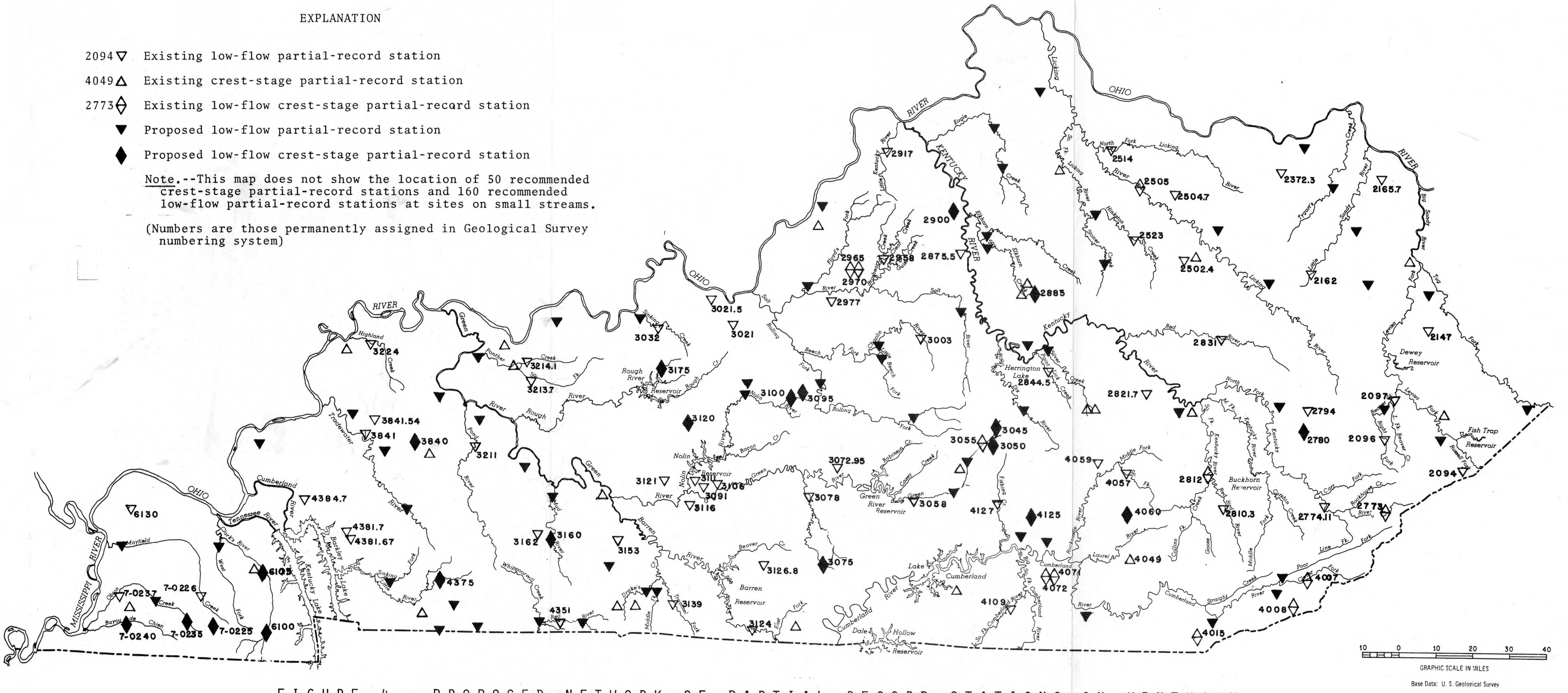

FIGURE 4.- PROPOSED NETWORK OF PARTIAL-RECORD STATIONS IN KENTUCKY