

# User's Manual for SWSTAT, a Computer Program for Interactive Computation of Surface-Water Statistics

DRAFT - FOR REVIEW PURPOSES ONLY

**U.S. GEOLOGICAL SURVEY**

Water-Resources Investigations Report 94-xxxx

# User's Manual for SWSTAT, a Computer Program for Interactive Computation of Surface-Water Statistics

By ALAN M. LUMB, WILBERT O. THOMAS, JR., and  
KATHLEEN M. FLYNN

United States Geological Survey  
Water-Resources Investigations Report 94-xxx

U.S. DEPARTMENT OF THE INTERIOR  
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY  
Gordon P. Eaton, Director

Any use of trade, product, or firm names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government.

UNITED STATES GOVERNMENT PRINTING OFFICE: 19xx

---

For sale by the  
U.S. Geological Survey  
Earth Science Information Center  
Open-File Reports Section  
Box 25286, MS 517  
Denver Federal Center  
Denver, CO 80225

# CONTENTS

|   |  |
|---|--|
| Abstract .....                                    |  |
| Changes From Previous Version.....                |  |
| Overview--What SWSTAT Can Do .....                |  |
| Introduction.....                                 |  |
| Analyze Data.....                                 |  |
| Plot Data.....                                    |  |
| Acknowledgments.....                              |  |
| How SWSTAT works .....                            |  |
| User Interface.....                               |  |
| Assistance Window.....                            |  |
| Command Line.....                                 |  |
| Data Window .....                                 |  |
| Option Tree .....                                 |  |
| Log Files and Command Files .....                 |  |
| The WDM (Watershed Data Management) File.....     |  |
| File Structure and Maintenance .....              |  |
| Types of Data.....                                |  |
| Time-series Data Sets .....                       |  |
| Time-series Data Compression .....                |  |
| Data-set Attributes .....                         |  |
| Special Time-series Attributes.....               |  |
| Selecting Data Sets .....                         |  |
| Steps to Use SWSTAT on a Project.....             |  |
| Get ANNIE and IOWDM .....                         |  |
| Retrieve Data and Convert Formats if Needed ..... |  |
| Create WDM File.....                              |  |
| Create Data Sets and Add Data.....                |  |
| Verify Data.....                                  |  |
| Correct or Update Data .....                      |  |
| Use Data.....                                     |  |
| Archive the WDM File .....                        |  |
| SWSTAT Options and Examples .....                 |  |
| Organization.....                                 |  |
| Basic.....  |  |

Compare .....  
Duration .....  
Frequency .....  
N-day .....  
Trend .....  
References .....  
Appendix A. Data-set Attributes .....  
Appendix B. User System Specifications File .....  
Appendix C. Glossary of Terms .....

Figures

1. ANNIE and WDM System Interactions and Functions .....  
2. Basic SWSTAT Screen Layout.....  
3. Upper-level Branches of the SWSTAT Option Tree .....

Tables

1. Recommended Values for TGROUPE for Time Series of a Given Time Step and Record Length .....  
B.1. TERM.DAT Parameters .....  
B.2. Example TERM.DAT .....

# User's Manual for SWSTAT, a Computer Program for Interactive Computation of Surface-Water Statistics

By Alan M. Lumb, Wilbert O. Thomas, Jr., and Kathleen M. Flynn

---

## ABSTRACT

---

SWSTAT is an interactive computer program written in Fortran and designed for portability to minicomputers, UNIX workstations, and personal computers with 4 megabytes of memory. SWSTAT helps users interactively perform statistical analyses on time-series data. Procedures in SWSTAT compute flow-duration tables, fit annual series to a frequency distribution, calculate statistics for trend analysis, generate n-day annual series from daily values, and compute various errors and differences between two time series. A binary, direct-access file is used to retrieve and store the data in a logical, well-defined structure and is called a Watershed Data Management (WDM) file. Many other hydrologic and water-quality models and analyses developed by the U.S. Geological Survey and the U.S. Environmental Protection Agency currently use the WDM file. The WDM file provides the user with a common data base for many applications, thus eliminating the need to reformat data from one application to another. Furthermore, the WDM file system offers its users and application programmers an expanding library of subroutines for graphics, user interaction, and data storage and retrieval. This library helps programmers to efficiently create software for highly specialized applications.

This document is the users guide for the October 1993 version of SWSTAT and replaces the statistics portion of the 1990 manual "Users Manual for ANNIE, a Computer Program for Interactive Hydrologic Analyses and Data Management" (Lumb and others, 1990). It describes what SWSTAT can do and how to use SWSTAT and the WDM file. Detailed examples of many SWSTAT options show what the user will see on the screen, the responses to be entered, and the results produced.

---

# CHANGES FROM PREVIOUS VERSION

---

The routines in SWSTAT were previously in the program ANNIE. In addition to removing the routines from ANNIE, the user interface has been replaced by a well-designed, full screen, user interface that uses the function keys and arrow keys to easily move within screens and to the next or previous screen.

All WDM files made with the previous and current version of ANNIE may be used with SWSTAT without modification.

---

## OVERVIEW

## WHAT SWSTAT CAN DO

---

### INTRODUCTION

SWSTAT contains a set of procedures for statistical analysis of time-series data. The relation of SWSTAT to other files and systems is shown in figure 1. GLSNET is a program to perform a generalized least squares analysis from data in a WDM file that was prepared by procedures in SWSTAT.

---

**Figure 1 near here**

---

### ANALYZE DATA

SWSTAT contains the following statistical capabilities to support water-quantity and water-quality modeling:

- Compute basic statistics for a time series.
- Perform flow-duration analysis using values from a time-series data set.
- Compute absolute errors, standard errors, and an error matrix for two time-series data sets.
- Compute an n-day high or low annual time series from a daily time series.
- Perform frequency analysis of any annual time series using the log-Pearson Type III distribution.
- Perform Kendall Tau analysis for trend in annual time series.

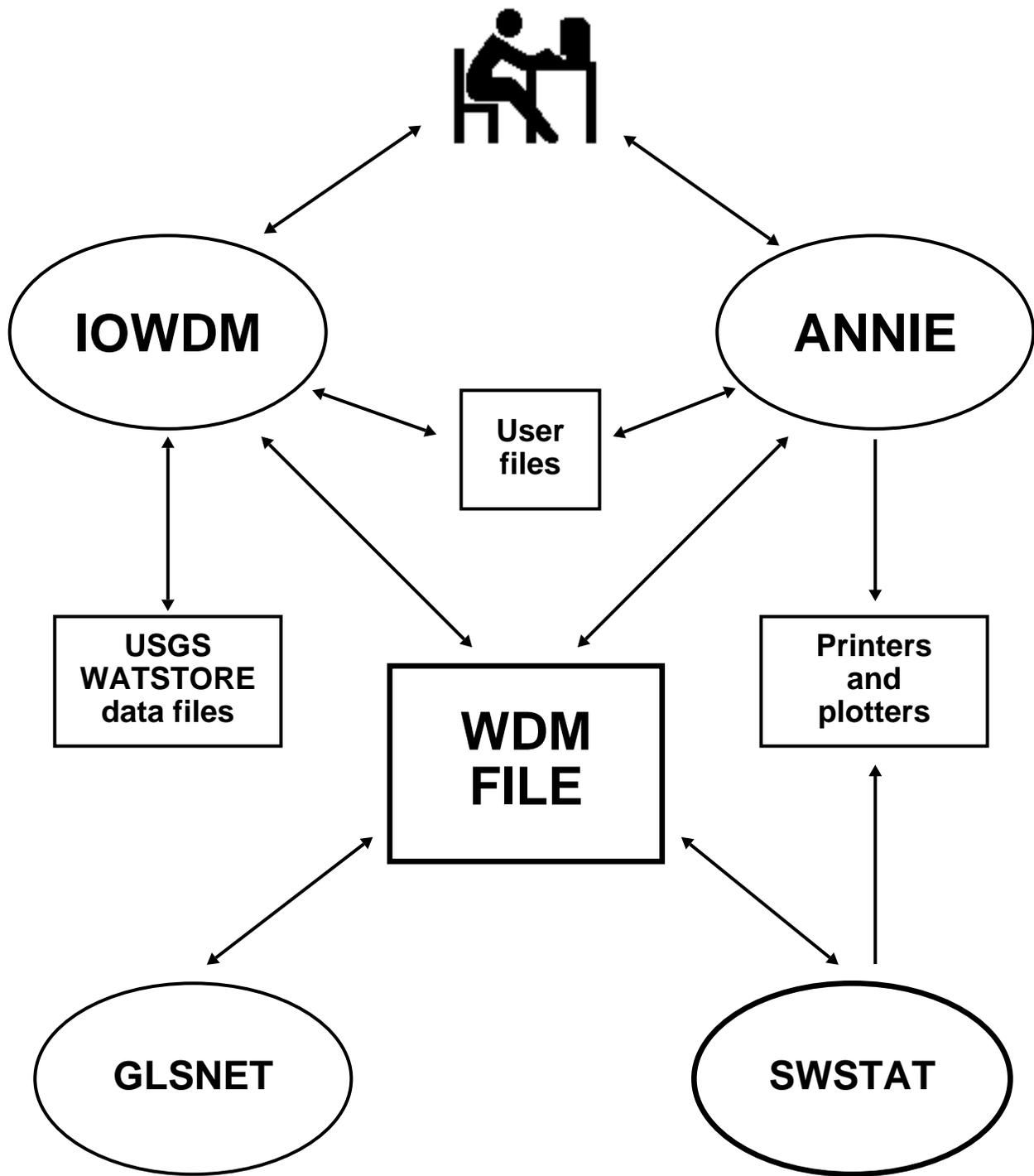


Figure 1. ANNIE and WDM system interactions and functions.

## **PLOT DATA**

Graphics capabilities in SWSTAT include probability plots that meet Geological Survey publication standards. Graphics routines use the American National Standards Institute, Graphical Kernel System (GKS) (ANSI, 1985). Thus, the number and type of output devices depend on only the implementation of GKS on the users system.

---

# **ACKNOWLEDGMENTS**

---

The SWSTAT user interaction and utilities and the file structure WDM have been developed, used, and modified over the past 9 years. During that time many users, agencies, and developers have made significant contributions.

Paul Hummel, Aqua Terra Consultants, is acknowledged for providing several new routines and modifications to many more. John Imhoff, Aqua Terra Consultants, is acknowledged for his efforts to rewrite earlier drafts of this manual into the current format.

The Environmental Protection Agency, Environmental Research Lab, Athens, Georgia, has provided the software libraries for the user interface. Tom Barnwell is acknowledged for his support of that project, and the excellent cooperation between the Environmental Protection Agency and the Geological Survey is attributable to Tom.

The U.S. Soil Conservation Service provided some of the funding for the initial design of the WDM file. Roger Cronshey is acknowledged for his ideas and support.

---

# **HOW SWSTAT WORKS**

---

## **USER INTERFACE**

There are four types of screens that make up SWSTAT: menu, form fill-in, file name, and informational text screens. Commands for displaying help information, moving to previous or following screens, and displaying allowable ranges for input values are available on each screen as applicable.

Each screen consists of at least two boxed-in regions, or windows. These two regions are the data window and the instruction window. A third region, the assistance window, can be displayed or removed from the screen as desired. Beneath the windows, the available

commands appear, with their associated function keys. Figure 2 shows the basic layout of the screens found in SWSTAT.

---

**Figure 2 near here.**

---

All three windows and the line of available commands can be viewed on an 80x24 character screen. Each window has a distinct purpose. User interaction with the program takes place in the data window where menus, input forms, and informational text are displayed. The instruction window contains information on the keystrokes necessary to interact with the program. Error messages related to invalid keystrokes are also displayed in the instruction window. When error messages are displayed, the instruction type in the upper left-hand corner of the window changes from the usual "INSTRUCT" to "ERROR." In the assistance window, help information, valid ranges for input values, and details on program status can be displayed.

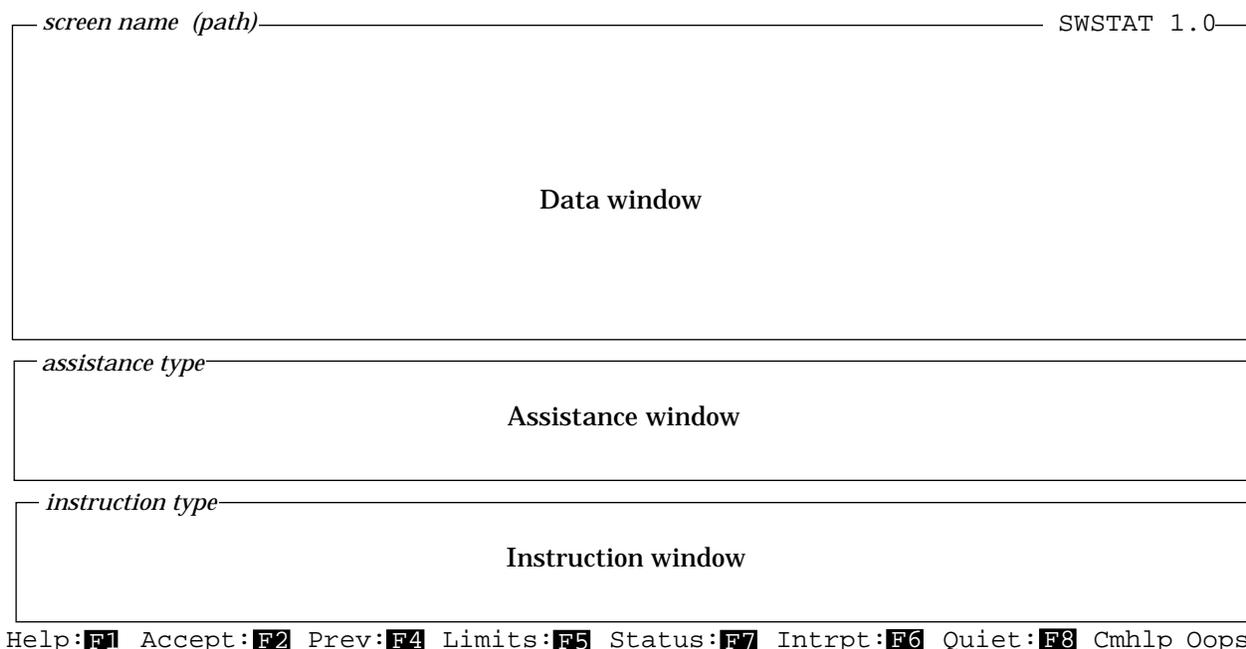
Each screen has a name, which is placed where the words screen name appear in figure 2. The first screen is called the opening screen. All subsequent screens are given a name based on the menu option selected. Screen names are followed by a path--a list of characters that represent the keystrokes made to arrive at the current screen. This list of keystrokes can aid in keeping track of where the current screen falls in the menu hierarchy.

**ASSISTANCE WINDOW**

The assistance window appears when the commands Help, Limits, Status, or Cmhelp are chosen. The name of the command chosen is placed in the upper left-hand corner of the assistance window, where the words assistance type appear in figure 2. The assistance window can be closed by choosing the Quiet command.

**COMMAND LINE**

Figure 2 describes each of the commands available in SWSTAT. Most commands are invoked by pressing a single function key. The Accept command, associated with the F2 function key, is used most frequently in the process of using the program. Those commands not invoked by a single function key are chosen by pressing the F3 function key or the semicolon key (";") followed by the first letter of the command. Pressing either the F3 key or the semicolon key causes the cursor to be placed at the bottom of the screen; any command can then be invoked by typing its first letter. Pressing either of these keys a second time without invoking any command will reactivate the data



| Command | Keys pressed to invoke <sup>1</sup> | Function   |
|---------|-------------------------------------|--|
| Help    | F1<br>or ;h                         | Displays help information in the assistance window. Help information is available for menu options and for input fields on form fill-in and file name screens. Once Help has been chosen, the help information displayed is updated as different screen elements are highlighted and as different screens are displayed. The program automatically closes the assistance window if a screen is reached for which there is no help information. |
| Accept  | F2<br>or ;a                         | Indicates that you have “accepted” the input values, menu option currently highlighted, or text message in the data window. Causes program execution to continue.  |
| Cmhlp   | F3c<br>or ;c                        | Displays brief descriptions of the commands available on the current screen.   |
| Oops    | F3o<br>or ;o                        | Redraws screen. Default values replace any values that have been entered. Available on form fill-in and file name screens.   |
| Prev    | F4<br>or ;p                         | Re-displays the previous screen. Available on most form fill-in screens and file name input screens. The program does not read any input values previously entered if Prev is chosen.  |
| Limits  | F5<br>or ;l                         | Displays valid ranges for numeric input and possible responses for character input on form fill-in and file name screens. As with the Help command, information on input limits is updated as different screen elements are highlighted by using the arrow keys or the Enter key.  |
| Intrpt  | F6<br>or ;i                         | Interrupts current processing loop, returning program to point of execution previous to current process.   |
| Status  | F7<br>or ;s                         | Displays current status information including name of input source, number of stations selected for processing, and hydrograph separation method chosen.   |
| Quiet   | F8<br>or ;q                         | Closes the assistance window. Only available if the assistance window is open.   |

<sup>1</sup>The function keys will work to invoke the commands on most systems. For those systems where this is not the case, the semicolon key (“;”) followed by the first letter of the command can be pressed instead.

**Figure 2.** Basic SWSTAT screen layout.

window. The F3 key and the semicolon key are also used to reactivate the data window when the assistance window becomes the active window on the screen. This occurs when a command has been chosen that opens the assistance window and there is more information to be displayed than can be viewed at one time in the four-line window. The line of commands at the bottom of the screen disappears and directions are given in the instruction window as to how to scroll through the text displayed in the assistance window. Pressing the F3 key or the semicolon key at this point restores the line of commands and reactivates the data window.

## **DATA WINDOW**

Menu selections in the data window can be made by highlighting the desired option through use of the arrow keys and then invoking the Accept command. Alternatively, the first letter of the desired menu option can be typed. If more than one menu option begins with the same letter, enough characters must be typed to uniquely identify the desired option.

Form fill-in screens may require character input, such as a yes/no response or numeric input. There are also option fields that can be toggled on or off by pressing the space bar. Movement of the cursor around these screens is accomplished through use of the arrow keys or the Enter key.

File name screens contain one input field into which a file name is typed. These file names are checked for validity; warnings are issued for invalid file names, and opportunity is given to enter a valid file name.

Informational text screens are displayed to give information on tasks in progress or already completed, as well as to give explanatory information or error messages. When these screens are displayed, use the Accept command to continue.

## **OPTION TREE**

The option tree for the current version of SWSTAT is illustrated in figure 3. Initially, you may find the option tree figure a useful tool for guiding your interactive sessions.

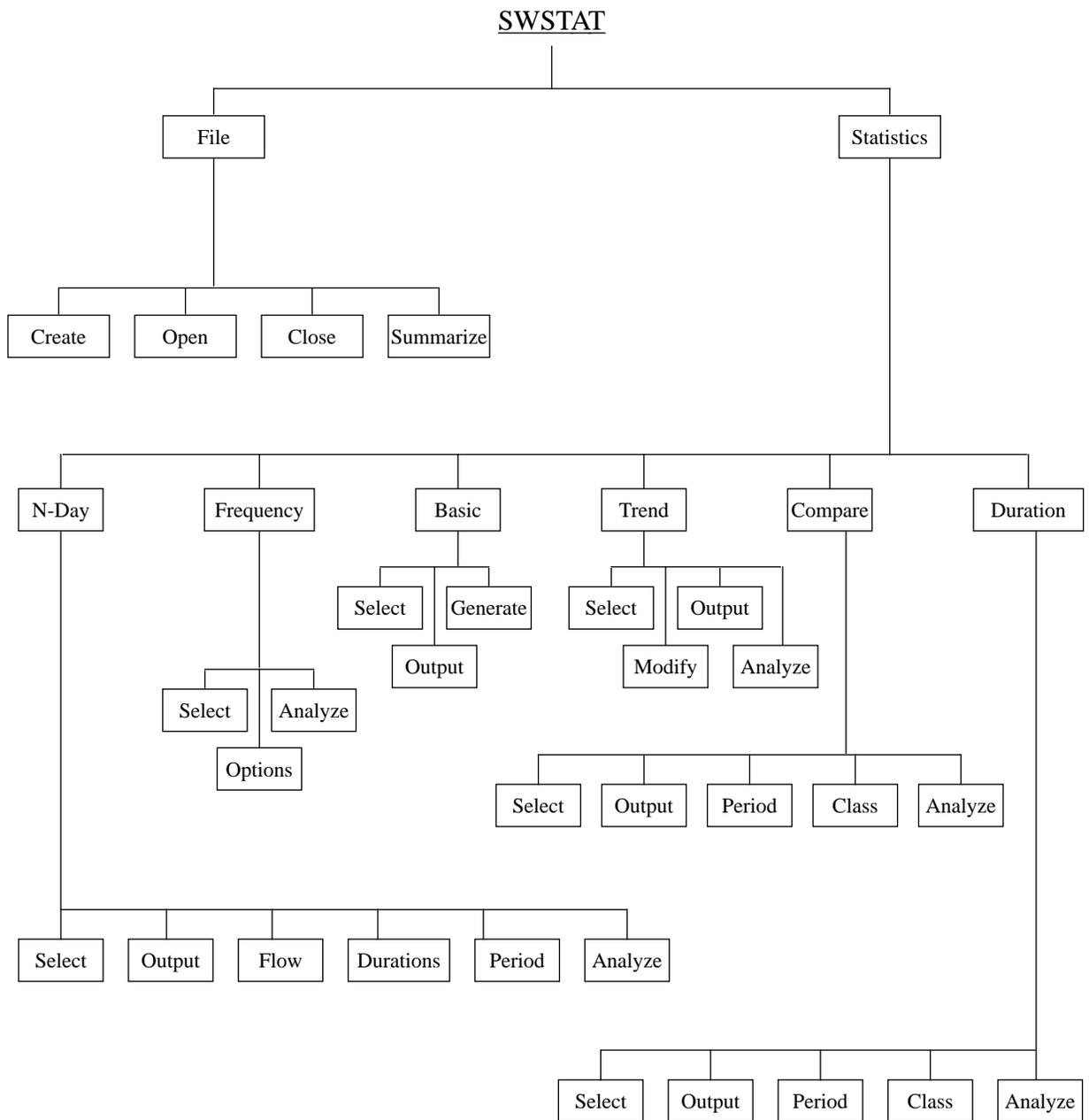
---

**Figure 3 near here.**

---

## **LOG FILES and COMMAND FILES**

A file named APPLIC.LOG is automatically created at the start of each SWSTAT session to store all your responses for the session. Unless you change the name of the file with the operating system, it will be overwritten when you begin the next SWSTAT



**Figure 3.** Upper-level branches of the SWSTAT option tree.

session. Part or all of a renamed log file may be used as a command file of responses for subsequent SWSTAT sessions. Command files are usually created by editing a renamed log file.

To use the command file in an SWSTAT session, enter "@". When a small window appears on the screen, enter the name of the command file. Use of command files offers several advantages. Responses from an incomplete or interrupted session are saved and can be reused, so you are not required to repeat those responses already given to the system. Command files can also be utilized as "templates" for repeating SWSTAT sessions where only one or two responses differ from session to session (for example, annual hydrograph plots where only the data-set number and station number change).

When SWSTAT is instructed to use the contents of a command file, all responses will automatically come from the command file until the end of the command file is reached. At that point you can respond with either an answer or the name of another command file. For the careful and experienced user, a command file may contain the name of another command file.

Occasionally, a command file being read by SWSTAT will get out of sync. When this happens, the session should be terminated and the command file should be edited to correctly order the responses. Most often the cause for a command file out of sync is the opening of an output file. The second time the output file name is read, the output file exists so an additional question is asked "Do you want to write over the file?" This question puts the rest of the responses out of sync.

With the use of the arrow keys and function keys, the log file is a little more difficult to interpret. Appendix D has been provided to assist with the interpretation of the log file. When planning to use a log file for a command file, you will discover it is easier to interpret the file when a menu selection is made with a character response instead of the arrow keys followed by the return (or enter) or F2 key.

---

# THE WDM FILE

---

## **FILE STRUCTURE and MAINTENANCE**

The WDM file is a binary, direct-access file used by SWSTAT that stores hydrologic, hydraulic, meteorologic, water-quality, and physiographic data. The WDM file is organized into data sets. Each data set contains a specific type of data, such as streamflow at a specific site or air temperature at a weather station. Each data set contains attributes that describe the data, such as station identification number, time step of data, latitude, and longitude. The WDM file can contain up to 32,000 data sets. Each data set may be described by either a few attributes or by hundreds of attributes. The WDM file may contain data for all data-collection stations for a basin, for a State, or for any other grouping selected by the user.

Disk space for the WDM file is allocated as needed in 40,960-byte increments (20 2,048-byte records). Data can be added, deleted, and modified without restructuring the data in the file. Space from deleted data sets within a WDM file is reused. Thus, the WDM file requires no special maintenance processing.

## **TYPES OF DATA**

The current release of SWSTAT supports WDM time-series data sets and data-set attributes. Additional data-set types (table, space time, vector, and text) are being used with other programs, but they are not used within SWSTAT.

## **TIME-SERIES DATA SETS**

Time-series data can have time steps from 1 second to 1 year and can be grouped in periods of 1 hour to 1 century. Data are grouped for more rapid access. Data may be tagged with a quality flag to indicate missing records, estimated data, historic flood, and so forth.

## **TIME-SERIES DATA COMPRESSION**

Time-series data are stored in a data set in one of two forms: compressed or uncompressed. The uncompressed form stores a value for every time step. The compressed form stores a value for every time step only when adjacent values are not the same or differ by more than a preset tolerance (see attribute TOLR). For adjacent values that are the same or less than the tolerance, the value and the number of time steps with that value are stored.

## **DATA-SET ATTRIBUTES**

Before data are added to a WDM file, you must assign a unique data-set number (DSN) and values for required attributes that describe how the data are stored. Once data have

been added, the required attributes can no longer be modified. An extensive list of optional attributes is available for further characterization of data contained in a WDM data set. The current list of required and optional data-set attributes is provided in Appendix B of this document. Optional attributes can be added to a data set at any time, but it is good practice to add them when the data set is created. The SWSTAT options **BASIC**, **DURATION**, and **FREQUENCY** add computed statistics as attributes. These attributes are then used by GLSNET.

**SPECIAL  
TIME-SERIES  
ATTRIBUTES**  
**COMPFG**  
**TOLR**  
**VBTIME**  
**TCODE**  
**TSSTEP**  
**TGROUP**  
**TSBYR**  
**TSBMO**

Time-series data may be stored in several different patterns that affect the efficiency of data storage and retrieval. To minimize storage requirements, the attribute COMPFG should be set to 1 for data compression. If only strings of identical values are to be compressed, the attribute TOLR is not needed, otherwise a small, nonzero value for TOLR should be stored.

If the data has a constant time step, the attribute VBTIME should be set to 1 and TSSTEP and TCODE set to the time step and units, respectively. This can reduce data retrieval time by a factor of 3 or more. However, if the time step changes one or more times for a data set, VBTIME must be set to 2.

The attribute TGROUP can be used to minimize retrieval times. TGROUP establishes how the data are grouped in a data set. The SWSTAT software can readily locate the beginning of a group but must read sequentially within a group for the values to be retrieved. An additional consideration is there can be only 100 groups in a data set (although this can be increased with ANNIE when a data set is created). With the above considerations, table 1 has been constructed as a guide to select a value for TGROUP.

**Table 1.** Recommended values for TGROUP for time series of a given time step and record length

| <b>Time step</b>  | <b>Length of record</b> | <b>Recommended TGROUP</b> |
|-------------------|-------------------------|---------------------------|
| daily             | <=100 years             | 6 (years)                 |
| 5 minute - daily  | <=8 years               | 5 (months)                |
| 5 minute - daily  | >8 years                | 6 (years)                 |
| monthly           | <=100 years             | 6 (years)                 |
| monthly           | >100 years              | 7 (centuries)             |
| annual            | <=10,000 years          | 7 (centuries)             |
| 1 second-1 minute | <=100 days              | 4 (days)                  |

For data with daily or shorter time steps and a period of record in excess of 100 years but less than 200 years, it would be better to reset the number of groups than use centuries

## **SELECTING DATA SETS**

for groups. Attributes for the beginning year and month of the data, TSBYR and TSBMO, default to 1900 and 1, respectively. They may need to be defined if the record will contain data before 1900 or months or days is used for the TGROUPE attribute.

SWSTAT uses data-set numbers to identify data sets to be processed. Depending on the process, you may select data sets by number or by using the **SELECT** option to identify data sets with attribute values that meet selected search criteria. Search criteria include: equal to, less than, greater than, not, and, and or. Each time a data set is found that has attributes satisfying the search criteria, the data-set number is added to a buffer. The buffer is simply a list of data-set numbers. As data-set numbers are found, they are continually added to the buffer until the entire buffer is full. Most implementations of SWSTAT set the buffer capacity at 300. During the selection process, you can delete, list, or numerically sort data sets in the buffer.

A new option has been implemented in SWSTAT to scan the available data sets to allow you to select data sets from the lists provided. Several options are available to define the contents of the lists. The lists can be all data sets in the WDM file or data sets currently in the buffer.

Processing options in SWSTAT, such as **DURATION** and **N-DAY**, look in the buffer for data sets to be used. If no data-set numbers are found in the buffer, you are asked to select them. If you know which data-set numbers you wish to use for an analysis, use the **ADD** option to put the numbers in the buffer; if not, you should use the **BROWSE** or the **FIND** option to enter the data-set numbers. Further details on the use of search criteria for selecting data sets based on attribute values are provided in the description of the **SELECT-FIND** and **SELECT-BROWSE** option later in this document.

In conjunction with subsequent instructions, the above discussions should provide the user with sufficient understanding of the WDM file structure and operation. A more detailed discussion is presented in the paper entitled "Data Management for Water-Quality Modeling Development and Use" (Lumb and others, 1988).

---

# STEPS TO USE SWSTAT ON A PROJECT

---

## **STEP 1. Get ANNIE and IOWDM**

When a statistical analysis with SWSTAT is to be used on the project, ANNIE and IOWDM are required to prepare the WDM file for SWSTAT. WDM files have been used for statistical analyses on projects to store over 60 megabytes of data in a single file.

## **STEP 2. Retrieve data and convert formats if needed**

Review the program IOWDM in Appendix A of the ANNIE manual for the available formats. Some user-defined format capabilities are available. If data exist in another WDM file, use ANNIE to EXPORT data sets from other WDM files and IMPORT data sets to your project WDM file. ANNIE can be used to input data from the terminal, but that is the hard way. Hydrologic and meteorologic data retrieved from a CD-ROM can be put in formats that IOWDM can read. Special programs are available to read files from some data loggers.

## **STEP 3. Create WDM file**

The shell of a WDM file must be created before data can be added. WDM files can be created with ANNIE or IOWDM.

## **STEP 4. Create data sets and add data**

Data sets must be created with a unique data-set number before data can be added. The IMPORT option of ANNIE and the input formats for IOWDM create data sets automatically. If they are not created automatically, you must create them with ANNIE. For many statistical analysis projects, it is essential to increase the maximum number of attributes to be allowed for the data set. When creating time-series data sets, it is very important to correctly set the attributes TGROUP, COMPPFG, VBTIME, TSSSTEP, TCODE, and TSBYR (see sections SPECIAL TIME-SERIES ATTRIBUTES, ADD data sets, IOWDM). Data in WATSTORE formats can be added with the program IOWDM. Data from another WDM file can be added with ANNIE using the EXPORT and IMPORT options. Data in a free-field format might be added using the ADD time series option in ANNIE.

## **STEP 5. Verify data**

Listing, tabling, and plotting can be used in ANNIE to view and verify the data added to your project WDM file. The LIST option for time series can be used to find and list time-series values that do not meet selected criteria. Plotting data is always a good way to quickly check for bad values. When plotting, do not pick the option to ignore values off the scale. Numeric attributes of the data, such as drainage area, station elevation,

latitude, and longitude can be plotted one against another for all stations to identify possible erroneous values.

**STEP 6.  
Correct or  
update data**

The MODIFY option in ANNIE for data-set attributes and time series can be used to correct the data. If, however, time-series data are compressed (COMPFG = 1), then you must use the COPY/UPDATE option to correct the compressed portions of the data. The add time series option in SWSTAT should only be used to add data to the end of existing data, because any subsequent data in the data set are deleted.

**STEP 7.  
Use data**

Data in a WDM file can now be used with SWSTAT. Several options in SWSTAT put data on the WDM file. These computed time series can be tabled, listed, plotted, and analyzed with ANNIE as a model postprocessing tool.

**STEP 8.  
Archive the  
WDM file**

The EXPORT option in ANNIE can be used to put all or part of a WDM file on a formatted ASCII file or set of files for archiving. Such files can be read by editors and printed using operating system commands and should be independent of operation systems and computers. These files are often quite long and generally should not be modified.

---

## **SWSTAT OPTIONS AND EXAMPLES**

---

### **ORGANIZATION**

The following section provides a reference guide for using individual SWSTAT analysis options. SWSTAT options are organized in alphabetical order according to the actual menu keywords used in the opening menu: Basic, Compare, Duration, N-day, and Trend. In addition, the select option that is available throughout the program is found following the five options. Within options Compare, Duration, and N-day, a lower level of options are presented in alphabetic order. The guidance provided for each option is contained in two parts, a description of the option and a sample session.

The description contains a discussion of the capabilities of the option, steps to follow, and a discussion of the sample session. All pages for an option contain a header consisting of a large print keyword and a qualifier within a double line box. In the extreme left column of the first part, a "response branch" is provided. This contains the most direct sequence of menu responses that the user can select to progress from the

opening SWSTAT menu to the point in the option tree where the selected option may be performed.

The examples contain a portion of a SWSTAT session beginning after the last keyword in the "response branch." Each sample session illustrates a successful application of an SWSTAT option. It should be noted that SWSTAT offers additional capabilities for some options, which are not illustrated in the sample sessions. When the option includes a table menu, the final table with the modified values are shown. If an option includes output files or graphics, they are included after the interactive session.

**BASIC**

This option computes the mean and standard deviation of a time-series data set and finds the minimum and maximum value. Results are written to the screen and can be written to a file for printing. If the option is selected, the four values can be placed as attributes on the WDM file.

**COMPARE**

This option uses the flow-duration analysis and class intervals to compute absolute error, root mean square error, and bias by class interval for two time series from a WDM file or PLTGEN file. Also, the standard error of estimate for the time series is computed. The analysis is usually performed on an observed variable and a simulated variable, although the analysis can be used to compare two observed time series to screen the data for possible errors. In addition to the two tables showing errors, a third table is an error matrix that provides a count of plus and minus errors by class interval. Each table can provide insight into the distribution of the error. The flow-duration curves for observed and simulated variables can be plotted.

You select two data sets from a WDM file. The time period, class intervals, and output file name are required. When plotting the results on a graphics device, the default line type, color, or symbol should be changed for one of the curves.

- 1 Enter the names of the input and output files.
- 2 Enter the time step for the values to be used.
- 3 If a WDM file is used, enter the data-set number. If a PLTGEN file is used, select two time series. Enter whether the second time series is simulated or measured. The first time series will default to the other.
- 4 Enter the time period for the analysis. For WDM files, the current start and end date is determined from the data set. For PLTGEN files, the end date is unknown.
- 5 Enter the title for the tables and plot.
- 6 Select the standard or user-defined class intervals. For the standard, only the minimum and maximum are entered. The minimum must be greater than zero.
- 7 Select options to print the file on the screen and create a plot as needed.
- 8 For the graphics device, enter type of device, characteristics of each line, scales for the axes, and sizes for the plot.

- 9 Select the error matrix option if needed.

For the example, two measured time series were selected for comparison, data-set numbers 3 and 4 from the file DAVID.WDM. The output file was TEST14.OT2. A 30-year period from October 1, 1950, was selected from a 41-year period that was common to both time series. The standard class intervals were used for values from 1.0 to 100000. All output options and a plot for a graphics device were selected. One time series was a dashed line and the other solid. The probability axis was limited to four standard deviates and the values off the plot were ignored.

# COMPARE

# COMPARE

Listing of output file TEST14.OT2:

Comparison of discharge between Shasta River, CA and Scott River, CA

MEASURED = 115195

SIMULATED = 115175

| Lower class limit | Number of cases | Mean              |         | Root mean square error(2) |         | Bias(3)   |         |
|-------------------|-----------------|-------------------|---------|---------------------------|---------|-----------|---------|
|                   |                 | absolute error(1) |         |                           |         |           |         |
|                   |                 | Average           | Percent | Average                   | Percent | Average   | Percent |
| 0.00              | 0               | 0.000             | 0.0     | 0.000                     | 0.0     | 0.000     | 0.0     |
| 1.00              | 0               | 0.000             | 0.0     | 0.000                     | 0.0     | 0.000     | 0.0     |
| 1.40              | 0               | 0.000             | 0.0     | 0.000                     | 0.0     | 0.000     | 0.0     |
| 2.00              | 0               | 0.000             | 0.0     | 0.000                     | 0.0     | 0.000     | 0.0     |
| 2.80              | 0               | 0.000             | 0.0     | 0.000                     | 0.0     | 0.000     | 0.0     |
| 4.00              | 2               | 57.300            | 1068.6  | 66.223                    | 1214.4  | 57.300    | 1068.6  |
| 5.70              | 49              | 53.204            | 770.5   | 59.853                    | 875.0   | 53.204    | 770.5   |
| 8.10              | 83              | 56.597            | 600.3   | 109.309                   | 1137.2  | 56.311    | 597.3   |
| 11.00             | 309             | 89.846            | 680.5   | 143.538                   | 1094.3  | 89.429    | 677.4   |
| 16.00             | 408             | 95.760            | 522.2   | 154.750                   | 858.7   | 95.068    | 518.6   |
| 23.00             | 436             | 126.222           | 455.2   | 235.359                   | 835.7   | 124.975   | 450.5   |
| 33.00             | 502             | 174.630           | 441.4   | 322.206                   | 804.0   | 173.055   | 437.3   |
| 46.00             | 736             | 277.008           | 504.9   | 453.265                   | 828.0   | 271.378   | 495.2   |
| 66.00             | 871             | 381.727           | 485.3   | 596.411                   | 758.0   | 365.793   | 465.5   |
| 93.00             | 1030            | 510.493           | 465.7   | 771.839                   | 703.6   | 474.522   | 433.4   |
| 130.00            | 2019            | 326.280           | 207.4   | 595.704                   | 385.4   | 238.260   | 153.5   |
| 190.00            | 2451            | 417.574           | 184.0   | 660.836                   | 289.9   | 386.513   | 168.9   |
| 270.00            | 980             | 831.233           | 261.3   | 1004.578                  | 315.7   | 827.718   | 260.2   |
| 380.00            | 573             | 1165.096          | 264.4   | 1394.966                  | 315.1   | 1161.459  | 263.6   |
| 530.00            | 271             | 1612.218          | 261.3   | 1953.788                  | 313.8   | 1605.575  | 260.2   |
| 760.00            | 123             | 2389.658          | 268.5   | 2902.760                  | 320.7   | 2389.235  | 268.4   |
| 1100.00           | 52              | 4047.115          | 325.4   | 4728.623                  | 380.1   | 4047.115  | 325.4   |
| 1500.00           | 40              | 5496.500          | 310.8   | 6454.334                  | 366.4   | 5496.500  | 310.8   |
| 2200.00           | 13              | 6279.230          | 257.5   | 6870.810                  | 285.4   | 6279.230  | 257.5   |
| 3100.00           | 4               | 12535.000         | 321.6   | 13297.467                 | 335.9   | 12535.000 | 321.6   |
| 4300.00           | 4               | 18927.500         | 359.5   | 19908.383                 | 369.8   | 18927.500 | 359.5   |
| 6100.00           | 1               | 21220.000         | 269.3   | 21220.000                 | 269.3   | 21220.000 | 269.3   |
| 8700.00           | 1               | 29100.000         | 279.8   | 29099.996                 | 279.8   | 29100.000 | 279.8   |
| 12000.00          | 0               | 0.000             | 0.0     | 0.000                     | 0.0     | 0.000     | 0.0     |
| 17000.00          | 0               | 0.000             | 0.0     | 0.000                     | 0.0     | 0.000     | 0.0     |
| 25000.00          | 0               | 0.000             | 0.0     | 0.000                     | 0.0     | 0.000     | 0.0     |
| 35000.00          | 0               | 0.000             | 0.0     | 0.000                     | 0.0     | 0.000     | 0.0     |
| 50000.00          | 0               | 0.000             | 0.0     | 0.000                     | 0.0     | 0.000     | 0.0     |
| 71000.00          | 0               | 0.000             | 0.0     | 0.000                     | 0.0     | 0.000     | 0.0     |
| 100000.00         | 0               | 0.000             | 0.0     | 0.000                     | 0.0     | 0.000     | 0.0     |
| -----             |                 | -----             | -----   | -----                     | -----   | -----     | -----   |
|                   | 10958           | 534.998           | 181.9   | 1136.851                  | 3355.9  | 505.972   | 311.4   |

STANDARD ERROR OF ESTIMATE = 1018.09

$$= (n/n-1) * \text{square root}((\text{tot.col.5})^{**2} - (\text{tot.col.7})^{**2})$$

(1) AVERAGE = sum (|S-M|/n)

PERCENT = 100.0 \* (sum(|S-M|/M))/n for all M > 0.0

(2) AVERAGE = square root(sum((S-M)\*\*2)/n)

PERCENT = 100.0 \* square root(sum(((S-M)/M)\*\*2)/n) for all M > 0

(3) AVERAGE = sum (S-M)/n

PERCENT = 100.0 \* (sum ((S-M)/M)/n) for all M > 0.0

S = Simulated value

M = Measured value

sum = Summation

n = Number of pairs of values

| | = Absolute value

note: Percents for the first class interval and the total should not be used if there are measured events that are zero.

# COMPARE

# COMPARE

Comparison of discharge between Shasta River, CA and Scott River, CA

MEASURED = 115195

SIMULATED = 115175

| Lower class limit | Cases equal or exceeding lower limit and less than upper limit |           |          |           | Percent cases equal or exceeding limit |           | Average of cases within class limits |           |
|-------------------|--|-----------|----------|-----------|--|-----------|--------------------------------------|-----------|
|                   | Cases  |           | Percent  |           | Measured                               | Simulated | Measured                             | Simulated |
|                   | Measured   | Simulated | Measured | Simulated |  |           |                                      |           |
| 0.00              | 0  | 0         | 0.00     | 0.00      | 100.00                                 | 100.00    | 0.00                                 | 0.00      |
| 1.00              | 0  | 0         | 0.00     | 0.00      | 100.00                                 | 100.00    | 0.00                                 | 0.00      |
| 1.40              | 0  | 0         | 0.00     | 0.00      | 100.00                                 | 100.00    | 0.00                                 | 0.00      |
| 2.00              | 0  | 0         | 0.00     | 0.00      | 100.00                                 | 100.00    | 0.00                                 | 0.00      |
| 2.80              | 0  | 0         | 0.00     | 0.00      | 100.00                                 | 100.00    | 0.00                                 | 0.00      |
| 4.00              | 2  | 4         | 0.02     | 0.04      | 100.00                                 | 100.00    | 5.20                                 | 5.52      |
| 5.70              | 49   | 22        | 0.45     | 0.20      | 99.98                                  | 99.96     | 7.04                                 | 6.65      |
| 8.10              | 83   | 9         | 0.76     | 0.08      | 99.53                                  | 99.76     | 9.26                                 | 9.11      |
| 11.00             | 309  | 28        | 2.82     | 0.26      | 98.78                                  | 99.68     | 13.28                                | 14.39     |
| 16.00             | 408  | 80        | 3.72     | 0.73      | 95.96                                  | 99.43     | 18.79                                | 19.82     |
| 23.00             | 436  | 198       | 3.98     | 1.81      | 92.23                                  | 98.70     | 27.33                                | 26.57     |
| 33.00             | 502  | 295       | 4.58     | 2.69      | 88.26                                  | 96.89     | 38.90                                | 39.34     |
| 46.00             | 736  | 1006      | 6.72     | 9.18      | 83.67                                  | 94.20     | 55.58                                | 56.50     |
| 66.00             | 871  | 1148      | 7.95     | 10.48     | 76.96                                  | 85.02     | 78.76                                | 78.86     |
| 93.00             | 1030   | 938       | 9.40     | 8.56      | 69.01                                  | 74.54     | 109.65                               | 108.16    |
| 130.00            | 2019   | 639       | 18.42    | 5.83      | 59.61                                  | 65.98     | 164.29                               | 158.45    |
| 190.00            | 2451   | 561       | 22.37    | 5.12      | 41.18                                  | 60.15     | 221.64                               | 226.81    |
| 270.00            | 980  | 657       | 8.94     | 6.00      | 18.82                                  | 55.03     | 316.88                               | 324.50    |
| 380.00            | 573  | 765       | 5.23     | 6.98      | 9.87                                   | 49.03     | 440.84                               | 455.61    |
| 530.00            | 271  | 1166      | 2.47     | 10.64     | 4.65                                   | 42.05     | 617.27                               | 638.59    |
| 760.00            | 123  | 1168      | 1.12     | 10.66     | 2.17                                   | 31.41     | 883.99                               | 916.46    |
| 1100.00           | 52   | 964       | 0.47     | 8.80      | 1.05                                   | 20.75     | 1247.31                              | 1275.26   |
| 1500.00           | 40   | 751       | 0.37     | 6.85      | 0.57                                   | 11.95     | 1776.25                              | 1795.11   |
| 2200.00           | 13   | 312       | 0.12     | 2.85      | 0.21                                   | 5.10      | 2481.54                              | 2569.81   |
| 3100.00           | 4  | 115       | 0.04     | 1.05      | 0.09                                   | 2.25      | 3840.00                              | 3569.65   |
| 4300.00           | 4  | 58        | 0.04     | 0.53      | 0.05                                   | 1.20      | 5147.50                              | 4994.65   |
| 6100.00           | 1  | 36        | 0.01     | 0.33      | 0.02                                   | 0.68      | 7880.00                              | 7049.72   |
| 8700.00           | 1  | 20        | 0.01     | 0.18      | 0.01                                   | 0.35      | 10400.00                             | 10154.00  |
| 12000.00          | 0  | 11        | 0.00     | 0.10      | 0.00                                   | 0.16      | 0.00                                 | 13463.63  |
| 17000.00          | 0  | 3         | 0.00     | 0.03      | 0.00                                   | 0.06      | 0.00                                 | 20100.00  |
| 25000.00          | 0  | 3         | 0.00     | 0.03      | 0.00                                   | 0.04      | 0.00                                 | 30100.00  |
| 35000.00          | 0  | 1         | 0.00     | 0.01      | 0.00                                   | 0.01      | 0.00                                 | 39500.00  |
| 50000.00          | 0  | 0         | 0.00     | 0.00      | 0.00                                   | 0.00      | 0.00                                 | 0.00      |
| 71000.00          | 0  | 0         | 0.00     | 0.00      | 0.00                                   | 0.00      | 0.00                                 | 0.00      |
| 100000.00         | 0  | 0         | 0.00     | 0.00      | 0.00                                   | 0.00      | 0.00                                 | 0.00      |
|                   | 10958  | 10958     | 100.00   | 100.00    |  |           | 201.06                               | 707.04    |

**COMPARE**

**COMPARE**

Comparison of discharge between Shasta River, CA and Scott River, CA

| Lower<br>class<br>limit | Number of deviations between indicated percentages |      |     |     |     |     |      |   |
|-------------------------|--|------|-----|-----|-----|-----|------|---|
|                         | -60  | -30  | -10 | 0   | 10  | 30  | 60   |   |
| 0.00                    | 0  | 0    | 0   | 0   | 0   | 0   | 0    |   |
| 1.00                    | 0  | 0    | 0   | 0   | 0   | 0   | 0    |   |
| 1.40                    | 0  | 0    | 0   | 0   | 0   | 0   | 0    |   |
| 2.00                    | 0  | 0    | 0   | 0   | 0   | 0   | 0    |   |
| 2.80                    | 0  | 0    | 0   | 0   | 0   | 0   | 0    |   |
| 4.00                    | 0  | 0    | 0   | 0   | 0   | 0   | 2    |   |
| 5.70                    | 0  | 0    | 0   | 0   | 0   | 0   | 49   |   |
| 8.10                    | 0  | 2    | 2   | 1   | 0   | 0   | 78   |   |
| 11.00                   | 0  | 8    | 4   | 1   | 0   | 2   | 294  |   |
| 16.00                   | 5  | 7    | 2   | 3   | 11  | 7   | 373  |   |
| 23.00                   | 7  | 6    | 11  | 13  | 4   | 6   | 389  |   |
| 33.00                   | 3  | 8    | 25  | 12  | 18  | 31  | 405  |   |
| 46.00                   | 18   | 34   | 45  | 25  | 16  | 56  | 542  |   |
| 66.00                   | 41   | 91   | 100 | 33  | 23  | 43  | 540  |   |
| 93.00                   | 69   | 209  | 95  | 19  | 2   | 8   | 628  |   |
| 130.00                  | 252  | 752  | 82  | 48  | 52  | 73  | 760  |   |
| 190.00                  | 31   | 298  | 169 | 60  | 41  | 126 | 1726 |   |
| 270.00                  | 2  | 1    | 16  | 11  | 7   | 5   | 938  |   |
| 380.00                  | 1  | 4    | 1   | 0   | 0   | 3   | 564  |   |
| 530.00                  | 1  | 1    | 2   | 1   | 3   | 2   | 261  |   |
| 760.00                  | 0  | 0    | 0   | 1   | 2   | 0   | 120  |   |
| 1100.00                 | 0  | 0    | 0   | 0   | 0   | 1   | 51   |   |
| 1500.00                 | 0  | 0    | 0   | 0   | 0   | 1   | 39   |   |
| 2200.00                 | 0  | 0    | 0   | 0   | 0   | 0   | 13   |   |
| 3100.00                 | 0  | 0    | 0   | 0   | 0   | 0   | 4    |   |
| 4300.00                 | 0  | 0    | 0   | 0   | 0   | 0   | 4    |   |
| 6100.00                 | 0  | 0    | 0   | 0   | 0   | 0   | 1    |   |
| 8700.00                 | 0  | 0    | 0   | 0   | 0   | 0   | 1    |   |
| 12000.00                | 0  | 0    | 0   | 0   | 0   | 0   | 0    |   |
| 17000.00                | 0  | 0    | 0   | 0   | 0   | 0   | 0    |   |
| 25000.00                | 0  | 0    | 0   | 0   | 0   | 0   | 0    |   |
| 35000.00                | 0  | 0    | 0   | 0   | 0   | 0   | 0    |   |
| 50000.00                | 0  | 0    | 0   | 0   | 0   | 0   | 0    |   |
| 71000.00                | 0  | 0    | 0   | 0   | 0   | 0   | 0    |   |
| 100000.00               | 0  | 0    | 0   | 0   | 0   | 0   | 0    |   |
|                         | 430  | 1421 | 554 | 228 | 179 | 364 | 7782 | 0 |

**DURATION**

Duration analysis performs traditional flow-duration analysis by counting occurrences of all time-series values within flow intervals. Output includes a table and a plot using log-normal axes. You can enter the class intervals or have them set by entering a minimum and maximum. Intervals that are computed are uniform in log space. Data must be in a WDM time-series data set and the time step of the data must be 1 day or less.

Default start and end dates are based on the record available in the input file but may be changed to a shorter period. Results are placed in a file that can be viewed on the screen. Note that on the scale of the probability axis, the absolute value of the minimum and maximum should be the same. If not, the absolute value of the larger number will be used for both.

- 1 Enter the names of the input and output files.
- 2 Enter the time step for the values to be used.
- 3 If a WDM file is used, enter the data-set number. If a PLTGEN file is used, select the time series to be used.
- 4 Enter the time period for the analysis. The current start and end date is determined from the data set.
- 5 Enter the title for the table and plot.
- 6 Select the standard or user-defined class intervals. For the standard, only the minimum and maximum are entered. The minimum must be greater than zero.
- 7 Select options to print the file on the screen and create a plot as needed.
- 8 For the graphics device, enter type of device, characteristics of the line, scales for the axes and sizes for the plot.

For the example, data-set number 4 was selected from the file DAVID.WDM. The output table was written to the file TEST14.OT1. A daily time step was used. Although 41 years of record were available, a 30-year period for water years 1951 through 1980

**DURATION****DURATION**

was selected. Standard class intervals from 1.0 to 100000 were used. A plot was made for the graphics terminal using a solid black line. Values greater than three standard deviates were not plotted.

**DURATION****DURATION**

Listing of output file TEST14.OT1

1

Flow duration curve for Scott River near Fort Jones, CA.

| Lower<br>class<br>limit | Cases equal or<br>exceeding lower<br>limit and less<br>than upper limit |         | Cases equal or<br>exceeding lower<br>class limit |         |
|-------------------------|---|---------|--|---------|
|                         | Cases   | Percent | Cases  | Percent |
| 0.00                    | 0   | 0.00    | 10958  | 100.00  |
| 1.00                    | 0   | 0.00    | 10958  | 100.00  |
| 1.40                    | 0   | 0.00    | 10958  | 100.00  |
| 2.00                    | 0   | 0.00    | 10958  | 100.00  |
| 2.80                    | 0   | 0.00    | 10958  | 100.00  |
| 4.00                    | 4   | 0.04    | 10958  | 100.00  |
| 5.70                    | 22  | 0.20    | 10954  | 99.96   |
| 8.10                    | 9   | 0.08    | 10932  | 99.76   |
| 11.00                   | 28  | 0.26    | 10923  | 99.68   |
| 16.00                   | 80  | 0.73    | 10895  | 99.43   |
| 23.00                   | 198   | 1.81    | 10815  | 98.70   |
| 33.00                   | 295   | 2.69    | 10617  | 96.89   |
| 46.00                   | 1006  | 9.18    | 10322  | 94.20   |
| 66.00                   | 1148  | 10.48   | 9316   | 85.02   |
| 93.00                   | 938   | 8.56    | 8168   | 74.54   |
| 130.00                  | 639   | 5.83    | 7230   | 65.98   |
| 190.00                  | 561   | 5.12    | 6591   | 60.15   |
| 270.00                  | 657   | 6.00    | 6030   | 55.03   |
| 380.00                  | 765   | 6.98    | 5373   | 49.03   |
| 530.00                  | 1166  | 10.64   | 4608   | 42.05   |
| 760.00                  | 1168  | 10.66   | 3442   | 31.41   |
| 1100.00                 | 964   | 8.80    | 2274   | 20.75   |
| 1500.00                 | 751   | 6.85    | 1310   | 11.95   |
| 2200.00                 | 312   | 2.85    | 559  | 5.10    |
| 3100.00                 | 115   | 1.05    | 247  | 2.25    |
| 4300.00                 | 58  | 0.53    | 132  | 1.20    |
| 6100.00                 | 36  | 0.33    | 74   | 0.68    |
| 8700.00                 | 20  | 0.18    | 38   | 0.35    |
| 12000.00                | 11  | 0.10    | 18   | 0.16    |
| 17000.00                | 3   | 0.03    | 7  | 0.06    |
| 25000.00                | 3   | 0.03    | 4  | 0.04    |
| 35000.00                | 1   | 0.01    | 1  | 0.01    |
| 50000.00                | 0   | 0.00    | 0  | 0.00    |
| 71000.00                | 0   | 0.00    | 0  | 0.00    |
| 100000.00               | 0   | 0.00    | 0  | 0.00    |

**FREQUENCY**

With this option annual time series on a WDM data set may be analyzed with the log-Pearson Type III distribution, without the extra features of Bulletin 17B. Data may be entered with IOWDM, the ADD time-series option, or may be created with the STATISTICS N-DAY option that computes n-day annual high and low-flow statistics from a daily time series.

The code used in ANNIE is from the cataloged procedure A193 on the U.S. Geological Survey mainframe computer and has been converted to run in ANNIE. Documentation of A193 can be found in the WATSTORE user's manual, volume 4 (Lepkin, 1979). Procedures have been included to handle zero values and periods of missing records. Missing record must have annual values of -1 or less. Besides an output file and plots on the printer or graphics device, this option may add computed flow statistics to the attributes of each data set if requested by the user. These computed statistics may then be used in the generalized least squares (GLS) procedures or placed in a flat file using the TABLE attributes option in ANNIE for further processing by statistical packages or spreadsheet software.

- 1 Enter name of file for output.
- 2 Select annual time-series data sets using the SELECT option as provided.
- 3 Select option for graphics output.
- 4 Enter start and end years for analysis.
- 5 If graphics device selected, enter type of device, scales for axes (probability axis scaled in standard deviates), and sizes for the plot.

The example shows analysis of 7-day low-flow values on data-set number 504 for 44 years on the Shasta River near Yreka, California. Nine attributes were written to the WDM file for data-set number 504. A listing of the output file follows the frequency plot. For a station with zero flows, additional output is provided.

**FREQUENCY****FREQUENCY**

Listing of output file TEST16.OT2:

Log-Pearson Type III Statistics (formerly USGS Program A193, Jan. 1986)

(Note -- Use of log-Pearson Type III distribution is for preliminary computations. User is responsible for assessment and interpretation.)

Station 11517500 Shasta River near Yreka, CA.

Analysis for -- 12 month period  
ending March 31  
1935-1982

Parameter is 7-day low value.

0 zero values in data

44 nonzero values in data

|        |        |        |        |        |
|--------|--------|--------|--------|--------|
| 8.786  | 8.500  | 9.500  | 8.857  | 67.857 |
| 5.471  | 36.286 | 24.286 | 25.571 | 17.000 |
| 20.571 | 11.943 | 9.700  | 13.286 | 31.286 |
| 24.714 | 15.714 | 6.671  | 52.286 | 12.857 |
| 52.000 | 11.143 | 6.414  | 11.357 | 13.000 |
| 36.143 | 12.357 | 38.143 | 10.229 | 19.000 |
| 7.114  | 25.571 | 14.714 | 24.143 | 17.429 |
| 11.743 | 47.286 | 41.143 | 14.571 | 8.814  |
| 31.286 | 13.843 | 17.429 | 5.800  |        |

The following 14 statistics are based on nonzero values.

|                                |         |
|--------------------------------|---------|
| Mean                           | 20.496  |
| Variance                       | 212.884 |
| Standard Deviation             | 14.591  |
| Skewness                       | 1.441   |
| Standard Error of Skewness     | 0.357   |
| Serial Correlation Coefficient | -0.251  |
| Coefficient of Variation       | 0.712   |

|                                       |        |
|---------------------------------------|--------|
| Mean (logs)                           | 1.218  |
| Variance (logs)                       | 0.080  |
| Standard Deviation (logs)             | 0.283  |
| Skewness (logs)                       | 0.331  |
| Standard Error of Skewness (logs)     | 0.357  |
| Serial Correlation Coefficient (logs) | -0.247 |
| Coefficient of Variation (logs)       | 0.232  |

**FREQUENCY****FREQUENCY**

Mean, standard deviation and skew added as attributes (WRCMN,  
 WRCSO, WRCSKW) to users WDM file on data-set 504

| Nonexceedance<br>Probability | Recurrence<br>Interval | Parameter<br>Value |
|------------------------------|------------------------|--------------------|
| -----                        | -----                  | -----              |
| 0.0100                       | 100.00                 | 4.261              |
| 0.0200                       | 50.00                  | 4.881              |
| 0.0500                       | 20.00                  | 6.040              |
| 0.1000                       | 10.00                  | 7.366              |
| 0.2000                       | 5.00                   | 9.481              |
| 0.5000                       | 2.00                   | 15.951             |
| 0.8000                       | 1.25                   | 28.236             |
| 0.9000                       | 1.11                   | 38.859             |
| 0.9600                       | 1.04                   | 55.511             |
| 0.9800                       | 1.02                   | 70.522             |
| 0.9900                       | 1.01                   | 87.996             |

9 statistics added as attributes to users WDM file.  
 MEANND SDND SKWND NUMZRO NONZRO L07020 L07010 L07005 L07002

**N-DAY**

This option computes annual n-day high and low flows for a daily time series. A default set of 1-, 2-, 3-, 7-, 10-, 30-, 60-, 90-, 183-, and 365-day periods can be selected or you may specify the durations in days for the statistics. The start and end time of the observation period is input so the user can specify calendar year (Jan-Dec), water year (Oct-Sept), any other year, or even season. Output is provided in a table and, optionally, the computed annual time-series data sets are added to a WDM file using a year time step. You should put the results on WDM data sets if subsequent frequency analyses are to be performed.

- 1 Select the type of output and enter file name, decimal places, and significant digits if a print file is selected.
- 2 Select option for high flow, low flow, or both.
- 3 Select option for standard or user-defined durations. If user defined, enter up to 10 durations.
- 4 Select data-set numbers for processing.
- 5 Enter a data-set number for output if the WDM output option selected in step 1. The data set does not need to exist.
- 6 Select processing for full period or a common period of record. If a common period, enter the start and ending years.
- 7 Enter season for high flow, low flow, or both depending on the selection in step 2. Usually the season for high flow is a full year beginning in October and ending in September. The season for low flow is usually April through March.

In the example, one data set is selected and the standard durations are used for the full period of record. Output to the WDM file started with data-set number 501 for the first annual time series and ended with 520, 10 data sets for low flow and 10 for high flow. The attributes for the 20 new time series were copied from the source daily values time

series, with the attributes TSSTEP, TCODE, TGROUP, and TSTYPE changed appropriately. The output file follows the example user interaction. The second value in each of the 10 columns is the rank.

# N-DAY

# N-DAY

Listing of output file TEST16.OT1:

STATION NUMBER 11517500  
 LOW MEAN VALUE AND RANKING FOR THE FOLLOWING NUMBER OF CONSECUTIVE DAYS IN YEAR ENDING MARCH  
 DISCHARGE, IN CUBIC FEET PER SECOND

| YEAR | 1-DAY    | 2-DAY    | 3-DAY    | 7-DAY    | 10-DAY   | 30-DAY   | 60-DAY   | 90-DAY    | 183-DAY   | 365-DAY   |
|------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|
| 1935 | 6.50 11  | 7.25 9   | 7.67 9   | 8.79 7   | 9.10 8   | 11.02 5  | 15.74 10 | 18.79 9   | 30.52 1   | 87.28 1   |
| 1936 | 6.00 8   | 6.50 7   | 7.17 8   | 8.50 6   | 9.00 7   | 11.58 6  | 11.94 4  | 14.92 5   | 34.21 2   | 107.06 3  |
| 1937 | 6.50 12  | 8.00 13  | 8.67 11  | 9.50 10  | 9.90 9   | 13.48 11 | 14.43 8  | 16.92 6   | 38.54 5   | 87.82 2   |
| 1938 | 6.00 9   | 6.25 6   | 7.00 7   | 8.86 9   | 8.55 6   | 12.83 10 | 14.30 7  | 19.86 11  | 51.12 12  | 206.65 30 |
| 1939 | 56.00 44 | 58.00 44 | 58.67 44 | 67.86 44 | 75.60 44 | 85.23 44 | 98.12 44 | 103.62 44 | 129.02 42 | 200.42 27 |
| 1940 | 4.10 2   | 4.35 2   | 4.43 2   | 5.47 1   | 5.58 2   | 7.73 1   | 11.66 3  | 13.75 3   | 35.09 3   | 144.51 13 |
| 1941 | 32.00 38 | 33.00 39 | 33.33 38 | 36.29 38 | 40.40 38 | 48.37 38 | 54.95 36 | 59.21 32  | 90.62 30  | 224.90 33 |
| 1946 | 17.00 30 | 17.50 29 | 18.67 29 | 24.29 31 | 25.70 31 | 30.23 30 | 31.10 26 | 34.47 22  | 81.81 27  | 159.92 16 |
| 1947 | 19.00 33 | 20.50 32 | 21.67 33 | 25.57 33 | 27.40 34 | 38.63 33 | 45.23 31 | 50.63 30  | 73.41 22  | 126.98 6  |
| 1948 | 14.00 26 | 15.00 26 | 15.67 27 | 17.00 25 | 17.90 25 | 20.37 22 | 22.68 19 | 29.21 19  | 48.09 11  | 114.35 5  |
| 1949 | 18.00 31 | 19.00 31 | 19.33 30 | 20.57 29 | 21.30 28 | 29.77 29 | 47.62 34 | 59.44 33  | 115.75 36 | 163.03 19 |
| 1950 | 9.00 18  | 9.30 17  | 9.53 14  | 11.94 16 | 13.56 17 | 16.71 17 | 22.49 18 | 26.72 14  | 65.23 16  | 127.18 7  |
| 1951 | 7.70 15  | 8.35 15  | 8.77 12  | 9.70 11  | 10.09 10 | 15.36 14 | 17.21 13 | 26.82 15  | 55.86 14  | 200.91 28 |
| 1952 | 11.00 22 | 12.00 24 | 12.67 24 | 13.29 20 | 14.10 19 | 15.17 12 | 16.15 11 | 21.24 12  | 61.24 15  | 194.81 24 |
| 1953 | 25.00 35 | 26.00 35 | 27.67 35 | 31.29 35 | 32.80 36 | 44.03 36 | 46.33 33 | 60.40 35  | 103.40 33 | 237.07 35 |
| 1954 | 22.00 34 | 22.00 34 | 22.00 34 | 24.71 32 | 27.30 33 | 42.43 35 | 46.25 32 | 56.19 31  | 132.37 43 | 239.18 37 |
| 1955 | 12.00 25 | 14.00 25 | 14.33 25 | 15.71 24 | 16.30 22 | 21.90 25 | 26.82 24 | 41.41 27  | 84.17 29  | 132.28 10 |
| 1956 | 5.90 6   | 5.90 4   | 5.90 4   | 6.67 4   | 7.35 5   | 10.05 4  | 10.78 2  | 12.45 1   | 35.29 4   | 257.04 39 |
| 1957 | 46.00 43 | 48.00 43 | 49.33 43 | 52.29 43 | 54.70 42 | 60.40 42 | 61.52 39 | 71.96 39  | 126.30 39 | 209.76 31 |
| 1958 | 10.00 20 | 11.50 21 | 11.67 21 | 12.86 18 | 15.10 21 | 19.47 21 | 25.67 22 | 37.17 25  | 83.95 28  | 282.12 43 |
| 1959 | 41.00 42 | 47.00 42 | 48.00 42 | 52.00 42 | 55.30 43 | 66.57 43 | 83.98 43 | 101.36 43 | 145.72 44 | 225.27 34 |
| 1960 | 9.50 19  | 9.50 18  | 9.83 15  | 11.14 13 | 12.05 15 | 15.22 13 | 20.84 16 | 33.22 21  | 69.80 20  | 134.26 11 |
| 1961 | 5.50 4   | 5.65 3   | 5.80 3   | 6.41 3   | 7.14 3   | 9.86 3   | 12.83 5  | 14.29 4   | 46.60 9   | 130.89 8  |
| 1962 | 7.00 13  | 8.25 14  | 9.83 16  | 11.36 14 | 11.95 14 | 17.15 18 | 22.96 20 | 28.99 18  | 77.65 24  | 159.22 15 |
| 1963 | 10.00 21 | 10.50 20 | 11.00 19 | 13.00 19 | 13.90 18 | 19.33 20 | 26.07 23 | 28.03 17  | 65.60 17  | 198.63 26 |
| 1964 | 32.00 39 | 32.50 38 | 33.67 39 | 36.14 37 | 38.60 37 | 46.27 37 | 61.15 38 | 75.77 40  | 127.52 41 | 201.64 29 |
| 1965 | 7.50 14  | 7.75 12  | 10.17 18 | 12.36 17 | 12.85 16 | 18.75 19 | 22.16 17 | 30.02 20  | 71.23 21  | 284.68 44 |
| 1966 | 31.00 37 | 32.00 37 | 32.00 37 | 38.14 39 | 41.50 39 | 51.63 39 | 66.10 41 | 76.53 41  | 102.43 32 | 190.59 23 |
| 1967 | 6.40 10  | 7.70 11  | 8.47 10  | 10.23 12 | 10.51 11 | 12.55 8  | 14.11 6  | 17.79 8   | 52.20 13  | 145.30 14 |
| 1968 | 14.00 27 | 15.00 27 | 15.33 26 | 19.00 28 | 21.30 29 | 25.53 27 | 32.13 28 | 43.09 28  | 109.77 34 | 177.37 21 |
| 1969 | 4.90 3   | 6.10 5   | 6.50 5   | 7.11 5   | 7.29 4   | 11.92 7  | 16.34 12 | 27.85 16  | 46.89 10  | 160.35 17 |
| 1970 | 16.00 29 | 18.00 30 | 20.00 31 | 25.57 34 | 25.40 30 | 33.17 31 | 50.87 35 | 60.74 36  | 101.49 31 | 276.33 41 |
| 1971 | 11.00 23 | 11.50 22 | 12.33 23 | 14.71 23 | 17.10 24 | 21.50 23 | 25.53 21 | 37.13 24  | 79.37 25  | 218.50 32 |
| 1972 | 18.00 32 | 20.50 33 | 21.33 32 | 24.14 30 | 26.60 32 | 34.03 32 | 43.03 30 | 59.46 34  | 127.07 40 | 250.25 38 |
| 1973 | 15.00 28 | 15.50 28 | 15.67 28 | 17.43 26 | 18.90 26 | 23.77 26 | 29.62 25 | 35.93 23  | 66.66 18  | 131.45 9  |
| 1974 | 5.70 5   | 7.55 10  | 9.37 13  | 11.74 15 | 11.28 13 | 15.73 15 | 17.61 14 | 19.04 10  | 43.28 6   | 277.89 42 |
| 1975 | 38.00 41 | 38.50 41 | 40.67 41 | 47.29 41 | 49.70 41 | 55.13 41 | 60.68 37 | 67.77 37  | 111.78 35 | 267.64 40 |
| 1976 | 36.00 40 | 37.00 40 | 37.67 40 | 41.14 40 | 42.00 40 | 53.70 40 | 62.52 40 | 68.76 38  | 120.69 38 | 198.15 25 |
| 1977 | 8.00 17  | 10.00 19 | 11.00 20 | 14.57 22 | 16.80 23 | 21.70 24 | 34.52 29 | 45.80 29  | 75.74 23  | 113.92 4  |
| 1978 | 6.00 7   | 6.60 8   | 6.73 6   | 8.81 8   | 11.27 12 | 12.78 9  | 15.12 9  | 17.61 7   | 44.36 7   | 160.36 18 |
| 1979 | 27.00 36 | 28.00 36 | 28.33 36 | 31.29 36 | 32.70 35 | 41.07 34 | 68.33 42 | 81.46 42  | 118.11 37 | 172.15 20 |
| 1980 | 7.90 16  | 8.60 16  | 10.07 17 | 13.84 21 | 14.52 20 | 16.60 16 | 19.57 15 | 26.08 13  | 67.59 19  | 185.00 22 |
| 1981 | 11.00 24 | 11.50 23 | 12.00 22 | 17.43 27 | 19.10 27 | 27.93 28 | 31.82 27 | 39.42 26  | 81.77 26  | 138.56 12 |
| 1982 | 1.50 1   | 2.65 1   | 3.27 1   | 5.80 2   | 5.50 1   | 8.85 2   | 10.64 1  | 12.72 2   | 46.25 8   | 238.67 36 |

# N-DAY

# N-DAY

STATION NUMBER 11517500  
 HIGH MEAN VALUE AND RANKING FOR THE FOLLOWING NUMBER OF CONSECUTIVE DAYS IN YEAR ENDING SEPTEMBER  
 DISCHARGE, IN CUBIC FEET PER SECOND

| YEAR | 1-DAY    | 2-DAY | 3-DAY   | 7-DAY | 10-DAY  | 30-DAY | 60-DAY | 90-DAY | 183-DAY | 365-DAY |        |    |        |    |        |    |        |    |        |    |
|------|----------|-------|---------|-------|---------|--------|--------|--------|---------|---------|--------|----|--------|----|--------|----|--------|----|--------|----|
| 1934 | 164.00   | 1     | 161.50  | 1     | 158.67  | 1      | 152.00 | 1      | 149.00  | 1       | 144.93 | 1  | 140.73 | 1  | 137.80 | 1  | 125.32 | 1  | 77.90  | 1  |
| 1935 | 264.00   | 4     | 258.00  | 5     | 244.33  | 5      | 208.71 | 3      | 201.10  | 3       | 182.87 | 3  | 175.00 | 3  | 165.37 | 2  | 148.54 | 3  | 91.07  | 2  |
| 1936 | 878.00   | 19    | 830.00  | 20    | 728.00  | 20     | 566.86 | 21     | 497.10  | 20      | 311.40 | 16 | 260.13 | 14 | 234.26 | 14 | 179.42 | 8  | 109.25 | 7  |
| 1937 | 442.00   | 11    | 417.00  | 11    | 399.67  | 11     | 310.00 | 10     | 269.60  | 9       | 225.10 | 8  | 197.55 | 7  | 181.01 | 4  | 147.86 | 2  | 97.72  | 4  |
| 1938 | 1470.00  | 26    | 1430.00 | 31    | 1233.3  | 28     | 947.14 | 29     | 836.00  | 29      | 651.73 | 33 | 610.35 | 38 | 590.13 | 39 | 451.08 | 40 | 288.03 | 39 |
| 1939 | 272.00   | 5     | 251.50  | 4     | 236.00  | 4      | 225.43 | 5      | 222.80  | 5       | 202.30 | 5  | 190.02 | 5  | 186.28 | 5  | 176.50 | 7  | 105.99 | 6  |
| 1940 | 1900.00  | 34    | 1560.00 | 33    | 1430.00 | 33     | 1093.4 | 35     | 921.70  | 33      | 548.40 | 28 | 536.50 | 34 | 445.89 | 31 | 318.62 | 29 | 201.25 | 29 |
| 1941 | 1500.00  | 27    | 1295.00 | 26    | 1200.00 | 27     | 1082.4 | 34     | 1051.9  | 35      | 725.10 | 37 | 663.45 | 39 | 588.17 | 38 | 441.10 | 38 | 290.81 | 40 |
| 1946 | 712.00   | 16    | 663.50  | 16    | 615.00  | 16     | 524.29 | 19     | 530.10  | 21      | 380.33 | 22 | 313.82 | 22 | 295.33 | 22 | 242.09 | 21 | 157.70 | 22 |
| 1947 | 347.00   | 7     | 324.50  | 7     | 301.67  | 7      | 260.43 | 6      | 250.00  | 7       | 208.60 | 6  | 192.85 | 6  | 193.73 | 7  | 174.15 | 6  | 111.23 | 8  |
| 1948 | 828.00   | 18    | 774.50  | 19    | 698.00  | 19     | 518.43 | 18     | 438.50  | 17      | 268.67 | 12 | 218.12 | 10 | 204.62 | 9  | 187.07 | 9  | 149.06 | 18 |
| 1949 | 435.00   | 10    | 388.00  | 10    | 362.67  | 10     | 335.43 | 11     | 315.20  | 11      | 252.47 | 11 | 229.70 | 11 | 224.99 | 11 | 208.79 | 15 | 136.96 | 14 |
| 1950 | 568.00   | 14    | 532.50  | 14    | 515.00  | 14     | 464.14 | 16     | 391.30  | 13      | 279.70 | 13 | 242.18 | 13 | 226.52 | 13 | 190.53 | 11 | 123.40 | 11 |
| 1951 | 1510.00  | 28    | 1375.00 | 29    | 1326.7  | 32     | 1054.1 | 33     | 933.40  | 34      | 663.13 | 35 | 524.53 | 32 | 480.70 | 35 | 343.84 | 33 | 202.70 | 30 |
| 1952 | 1610.00  | 31    | 1415.00 | 30    | 1265.3  | 30     | 1011.1 | 30     | 898.20  | 31      | 664.83 | 36 | 517.20 | 31 | 456.27 | 34 | 348.21 | 34 | 226.63 | 33 |
| 1953 | 1830.00  | 33    | 1805.00 | 34    | 1760.00 | 38     | 1397.6 | 39     | 1227.1  | 38      | 758.77 | 38 | 566.15 | 36 | 489.81 | 36 | 376.02 | 35 | 250.59 | 36 |
| 1954 | 1380.00  | 24    | 1180.00 | 23    | 1076.00 | 23     | 846.14 | 26     | 732.60  | 26      | 621.50 | 32 | 531.22 | 33 | 448.06 | 33 | 335.46 | 32 | 211.45 | 31 |
| 1955 | 220.00   | 3     | 216.00  | 3     | 214.67  | 3      | 209.14 | 4      | 206.00  | 4       | 193.47 | 4  | 188.47 | 4  | 188.53 | 6  | 169.44 | 5  | 102.49 | 5  |
| 1956 | 5440.00  | 43    | 4885.00 | 43    | 3950.00 | 43     | 2394.9 | 42     | 1877.3  | 42      | 1092.9 | 42 | 822.07 | 42 | 752.60 | 42 | 511.31 | 42 | 311.72 | 42 |
| 1957 | 1610.00  | 32    | 1228.00 | 25    | 1150.00 | 25     | 836.71 | 25     | 723.80  | 25      | 592.30 | 31 | 440.25 | 28 | 369.74 | 25 | 287.46 | 26 | 182.77 | 25 |
| 1958 | 2720.00  | 40    | 2520.00 | 40    | 2153.3  | 40     | 1541.4 | 41     | 1442.0  | 41      | 1077.5 | 41 | 854.43 | 43 | 762.93 | 43 | 538.79 | 44 | 352.14 | 44 |
| 1959 | 483.00   | 12    | 483.00  | 12    | 473.00  | 12     | 424.71 | 12     | 404.00  | 14      | 313.50 | 17 | 284.78 | 18 | 261.78 | 18 | 222.06 | 17 | 146.04 | 17 |
| 1960 | 1550.00  | 29    | 1310.00 | 27    | 1139.7  | 24     | 685.00 | 22     | 557.00  | 22      | 327.17 | 20 | 273.38 | 17 | 241.53 | 15 | 200.81 | 14 | 125.31 | 12 |
| 1961 | 1020.00  | 21    | 896.50  | 21    | 811.00  | 21     | 495.71 | 17     | 443.80  | 18      | 298.13 | 14 | 265.17 | 16 | 247.31 | 16 | 214.13 | 16 | 145.16 | 16 |
| 1962 | 723.00   | 17    | 699.00  | 17    | 635.00  | 17     | 452.14 | 14     | 391.10  | 12      | 314.20 | 18 | 288.37 | 19 | 282.27 | 21 | 241.36 | 20 | 152.67 | 21 |
| 1963 | 1440.00  | 25    | 1310.00 | 28    | 1286.7  | 31     | 1034.1 | 31     | 872.80  | 30      | 527.50 | 27 | 393.43 | 25 | 383.38 | 28 | 333.75 | 31 | 239.62 | 34 |
| 1964 | 2620.00  | 39    | 1995.00 | 38    | 1583.3  | 34     | 934.86 | 28     | 759.60  | 27      | 443.87 | 24 | 337.78 | 24 | 300.90 | 24 | 257.07 | 23 | 165.09 | 23 |
| 1965 | 10400.00 | 45    | 9140.00 | 45    | 7456.7  | 45     | 4200.0 | 45     | 3209.5  | 45      | 1649.7 | 45 | 1081.0 | 45 | 820.94 | 44 | 531.36 | 43 | 315.05 | 43 |
| 1966 | 1050.00  | 22    | 1010.5  | 22    | 925.33  | 22     | 702.14 | 23     | 597.90  | 23      | 408.57 | 23 | 321.88 | 23 | 296.78 | 23 | 245.40 | 22 | 150.31 | 20 |
| 1967 | 969.00   | 20    | 724.50  | 18    | 646.67  | 18     | 535.43 | 20     | 481.80  | 19      | 348.20 | 21 | 295.18 | 21 | 277.81 | 20 | 260.21 | 24 | 180.36 | 24 |
| 1968 | 645.00   | 15    | 607.50  | 15    | 567.67  | 15     | 462.00 | 15     | 414.60  | 16      | 316.67 | 19 | 294.95 | 20 | 268.46 | 19 | 229.92 | 19 | 138.78 | 15 |
| 1969 | 2090.00  | 36    | 1900.00 | 37    | 1620.00 | 35     | 1041.4 | 32     | 898.30  | 32      | 550.10 | 29 | 428.88 | 27 | 370.80 | 26 | 286.16 | 25 | 191.49 | 26 |
| 1970 | 4010.00  | 42    | 3145.00 | 42    | 2780.00 | 42     | 2585.7 | 43     | 2171.7  | 43      | 1136.3 | 43 | 800.05 | 41 | 681.48 | 41 | 444.19 | 39 | 262.15 | 37 |
| 1971 | 1300.00  | 23    | 1220.00 | 24    | 1160.00 | 26     | 910.86 | 27     | 786.50  | 28      | 506.07 | 26 | 471.35 | 29 | 432.90 | 30 | 400.31 | 37 | 266.33 | 38 |
| 1972 | 2280.00  | 37    | 1870.00 | 36    | 1720.00 | 37     | 1241.3 | 36     | 1066.8  | 36      | 654.77 | 34 | 537.67 | 35 | 446.44 | 32 | 325.05 | 30 | 196.00 | 28 |
| 1973 | 322.00   | 6     | 311.50  | 6     | 300.67  | 6      | 294.14 | 9      | 280.30  | 10      | 241.17 | 10 | 234.78 | 12 | 225.91 | 12 | 195.96 | 13 | 119.73 | 10 |
| 1974 | 5800.00  | 44    | 5410.00 | 44    | 4710.00 | 44     | 3358.6 | 44     | 2790.00 | 44      | 1287.3 | 44 | 870.33 | 44 | 883.42 | 45 | 612.60 | 45 | 364.09 | 45 |
| 1975 | 1900.00  | 35    | 1825.00 | 35    | 1650.00 | 36     | 1321.1 | 37     | 1288.1  | 40      | 782.03 | 39 | 595.08 | 37 | 511.99 | 37 | 377.81 | 36 | 248.66 | 35 |
| 1976 | 511.00   | 13    | 484.00  | 13    | 485.67  | 13     | 443.29 | 13     | 407.10  | 15      | 304.90 | 15 | 261.87 | 15 | 248.80 | 17 | 223.16 | 18 | 149.80 | 19 |
| 1977 | 208.00   | 2     | 199.00  | 2     | 195.33  | 2      | 186.57 | 2      | 183.90  | 2       | 175.63 | 2  | 168.90 | 2  | 166.62 | 3  | 149.41 | 4  | 97.18  | 3  |
| 1978 | 1570.00  | 30    | 1430.00 | 32    | 1235.00 | 29     | 830.86 | 24     | 690.30  | 24      | 456.67 | 25 | 405.12 | 26 | 378.88 | 27 | 314.86 | 28 | 213.78 | 32 |
| 1979 | 364.00   | 8     | 358.00  | 8     | 326.33  | 8      | 268.57 | 7      | 249.00  | 6       | 217.90 | 7  | 210.90 | 9  | 206.92 | 10 | 193.46 | 12 | 131.31 | 13 |
| 1980 | 2410.00  | 38    | 2295.00 | 39    | 1963.3  | 39     | 1350.1 | 38     | 1077.5  | 37      | 584.50 | 30 | 485.23 | 30 | 405.38 | 29 | 308.81 | 27 | 194.86 | 27 |
| 1981 | 395.00   | 9     | 364.50  | 9     | 332.33  | 9      | 286.43 | 8      | 264.60  | 8       | 226.17 | 9  | 209.35 | 8  | 204.57 | 8  | 189.25 | 10 | 117.60 | 9  |
| 1982 | 3620.00  | 41    | 2755.00 | 41    | 2450.00 | 41     | 1483.0 | 40     | 1275.3  | 39      | 890.50 | 40 | 669.08 | 40 | 617.29 | 40 | 469.75 | 41 | 291.39 | 41 |

**TREND**

You use the Kendall Tau statistic to test time series for trends. As implemented in ANNIE, it is used for annual time series as a preprocessing step to frequency analysis. Input can come from either a yearly time-series data set or a peak flow table data set created by IOWDM.

- 1 Enter name of your WDM file.
- 2 Select data set to be processed.
- 3 Enter name of your output file for printing.

For the example, the time-series data set 1003 was processed. The results, Kendall Tau statistic, P-level and median slope, were printed to the screen and written to the file TEST15.OT1.

Listing of output file TEST15.OT1:

|                 |   |  |
|-----------------|---|--|
| Data-set number | = | 1003                                   |
| Station number  | = | 11516530                               |
| Station name    | = | Klamath River below Iron Gate Dam, CA. |
| Data type       | = | L003                                   |
| Starting year   | = | 1962                                   |
| Ending year     | = | 1982                                   |
| Values used     | = | 21                                     |
| Values skipped  | = | 0                                      |
| Kendall Tau     | = | 0.314                                  |
| P-level         | = | 0.049                                  |
| Median slope    | = | 1.658                                  |

## REFERENCES

- Alley, W.M., and Smith, P.E., 1982, Distributed routing rainfall-runoff model--Version II: U.S. Geological Survey Open-File Report 82-344, 201 p.
- American National Standards Institute, 1985, Computer graphics - Graphical Kernel System (GKS) functional description: ANSI X3.124-1985, 268 p.
- Carrigan, P.H., Jr., Dempster, G.R., and Bower, D.E., 1977, User's guide for U.S. Geological Survey rainfall-runoff models--revision of Open-File Report 74-33: U.S. Geological Survey Open-File Report 77-884, section 13, 46 p.
- Hutchinson, N.E., 1975, WATSTORE User's Guide, Volume I: U.S. Geological Survey Open-File Report 75-426.
- Hutchinson, N.E., Stuthmann, N.G., Merk, C.F., and Isherwood, W.L., Jr., 1977, WATSTORE User's Guide, Volume 5: U.S. Geological Survey Open-File Report 77-729-I.
- Interagency Advisory Committee on Water Data, 1982, Guidelines for determining flood-flow frequency: Bulletin 17B of the Hydrology Subcommittee, Office of Water Data Coordination, U.S. Geological Survey, Reston, Va., 183 p.
- Johanson, R.C., Imhoff, J.C., Kittle, J.L., Jr., and Donigian, A.S., 1984, Hydrological Simulation Program - Fortran (HSPF): Users Manual for Release 8.0: U.S. Environmental Protection Agency, EPA/600/3-84-066, 767 p.
- Kittle, J.L., Jr., Hummel, P.R., and Imhoff, J.C., 1989, ANNIE-IDE, A system for developing interactive user interfaces for environmental models (Programmers Guide): U.S. Environmental Protection Agency, EPA/600/3-89/034, 166 p.
- Leavesley, G.H., Lichty, R.W., Troutman, B.M., and Saindon, L.G., 1983, Precipitation-runoff modeling system; user's manual: U.S. Geological Survey Water-Resources Investigations 83-4238, 207 p.
- Lepkin, W.D., DeLapp, M.M., Kirby, W.H., and Wilson, T.A., 1979, WATSTORE User's Guide, Volume 4: U.S. Geological Survey Open-File Report 79-1336-I.
- Lumb, A.M., Carsel, R.F., and Kittle, J.L., Jr., 1988, Data management for water-quality modeling development and use: Proceedings of the International Symposium on Water Quality Modeling of Agricultural Non-Point Sources, 14 p.
- Lumb, A.M., and Kittle, J.L., Jr., 1985, ANNIE - Interactive processing of data bases for hydrologic models: Proceedings of the International Conference on Interactive Information and Processing Systems for Meteorology, Oceanography, and Hydrology.
- Lumb, A.M., Kittle, J.L., Jr., and Flynn, K.M., 1990, Users manual for ANNIE, a computer program for interactive hydrologic analyses and data management: U.S. Geological Survey Water-Resources Investigations Report 89-4080, 236 p.

## APPENDIX A. Data-set Attributes

| Name     | Type | Length | Update | Data-set type |       | Description  |
|----------|------|--------|--------|---------------|-------|--|
|          |      |        |        | Time          | Table |  |
| ACODE    | Int  | 1      | Yes    | Opt           | Opt   | Area units code, user defined.   |
| AGENCY   | Char | 8      | Yes    | Opt           | Opt   | Agency code. See WATSTORE users manual, volume 1, chapter 3.   |
| AQTYPE   | Char | 4      | Yes    | Opt           | Opt   | Aquifer type. See WATSTORE users manual, volume 1, chapter 3.<br>U - unconfined single aquifer<br>N - unconfined multiple aquifers<br>C - confined single aquifer<br>M - confined multiple aquifers<br>X - mixed multiple aquifers |
| AZMUTH   | Real | 1      | Yes    | Opt           | Opt   | Azimuth, in decimal degrees from north of a straight line connecting points 85 and 10 percent of distance from gage to divide.   |
| BASEQ    | Real | 1      | Yes    | Opt           | Opt   | Base discharge, in cubic feet per second. See WATSTORE users manual, volume 1, chapter 3.  |
| BLNGTH   | Real | 1      | Yes    | Opt           | Opt   | Stream length, in miles, from gage to end of defined channel, blue line on topographic map.  |
| BRANCH   | Real | 1      | Yes    | Opt           | Opt   | Integer id number of a channel segment.  |
| BSLOPE   | Real | 1      | Yes    | Opt           | Opt   | Average basin slope, in feet per mile.   |
| CHEAT    | Int  | 1      | Yes    | Opt           | Opt   | Pointer to an associated data set.   |
| COCODE   | Int  | 1      | Yes    | Opt           | Opt   | County or parish code. See WATSTORE users manual, Appendix C.  |
| COMPFG   | Int  | 1      | No     | Opt           | No    | Compression flag<br>1 - yes, data are compressed (default)<br>2 - no, data are not compressed<br>Compressed data will take up less space in the WDM file but may require a COPY operation to update data values.                   |
| CONTDATA | Real | 1      | Yes    | Opt           | Opt   | Drainage area, in square miles, that contributes to surface runoff.  |
| DAREA    | Real | 1      | Yes    | Opt           | Opt   | Total drainage area, in square miles, including noncontributing areas.   |
| DATUM    | Real | 1      | Yes    | Opt           | Opt   | Reference elevation, to mean sea level.  |
| DCODE    | Int  | 1      | Yes    | Opt           | Opt   | Attribute DCODE.   |
| DEPH25   | Real | 1      | Yes    | Opt           | Opt   | Flow depth, in feet. Corresponding to the difference between the 25-percent flow duration gage height and point of zero flow.  |
| DEPTH    | Real | 1      | Yes    | Opt           | Opt   | Sampling depth, in feet, at which observation was made.  |
| DESCRP   | Char | 80     | Yes    | Opt           | Opt   | Data-set description. Might include name and/or location, or some anecdotal information.   |
| DSCODE   | Int  | 1      | Yes    | Opt           | Opt   | State code of the Geological Survey office that operates the station. Usually the same as the state code (STPIPS). See WATSTORE users manual, Appendix B.  |
| EL1085   | Real | 1      | Yes    | Opt           | Opt   | Average of channel elevations, in feet above mean sea level, at points 10 and 85 percent of stream length upstream from gage.  |
| EL5000   | Real | 1      | Yes    | Opt           | Opt   | Percent of basin above elevation 5,000 feet, mean sea level.   |
| EL6000   | Real | 1      | Yes    | Opt           | Opt   | Percent of basin above elevation 6,000 feet, mean sea level.   |
| ELEV     | Real | 1      | Yes    | Opt           | Opt   | Elevation (mean sea level).  |
| FOREST   | Real | 1      | Yes    | Opt           | Opt   | Forested area, in percent of contributing drainage area, measured by the grid sampling methods.  |
| FROST    | Real | 1      | Yes    | Opt           | Opt   | Mean frost depth on February 28, in inches.  |
| GCODE    | Int  | 1      | Yes    | Opt           | Opt   | Angle (slope) code, user defined.  |
| GLACER   | Real | 1      | Yes    | Opt           | Opt   | Area of glaciers, in percent of contributing drainage area.  |
| GUCODE   | Char | 12     | Yes    | Opt           | Opt   | Geologic unit code. See WATSTORE users manual, Appendix F.   |
| H01002   | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 1-day mean discharge, in cubic feet per second for 2-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.   |
| H01005   | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 1-day mean discharge, in cubic feet per second for 5-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.   |

| Name   | Type | Length | Update | Data-set type |       | Description  |
|--------|------|--------|--------|---------------|-------|--|
|        |      |        |        | Time          | Table |  |
| H01010 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 1-day mean discharge, in cubic feet per second for 10-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H01020 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 1-day mean discharge, in cubic feet per second for 20-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H01025 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 1-day mean discharge, in cubic feet per second for 25-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H01050 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 1-day mean discharge, in cubic feet per second for 50-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H01100 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 1-day mean discharge, in cubic feet per second for 100-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969. |
| H03002 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 3-day mean discharge, in cubic feet per second for 2-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.   |
| H03005 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 3-day mean discharge, in cubic feet per second for 5-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.   |
| H03010 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 3-day mean discharge, in cubic feet per second for 10-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H03020 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 3-day mean discharge, in cubic feet per second for 20-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H03025 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 3-day mean discharge, in cubic feet per second for 25-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H03050 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 3-day mean discharge, in cubic feet per second for 50-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H03100 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 3-day mean discharge, in cubic feet per second for 100-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969. |
| H07002 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 7-day mean discharge, in cubic feet per second for 2-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.   |
| H07005 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 7-day mean discharge, in cubic feet per second for 5-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.   |
| H07010 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 7-day mean discharge, in cubic feet per second for 10-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H07020 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 7-day mean discharge, in cubic feet per second for 20-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H07025 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 7-day mean discharge, in cubic feet per second for 25-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H07050 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 7-day mean discharge, in cubic feet per second for 50-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H07100 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 7-day mean discharge, in cubic feet per second for 100-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969. |

| Name   | Type | Length | Update | Data-set type |       | Description   |
|--------|------|--------|--------|---------------|-------|---|
|        |      |        |        | Time          | Table |   |
| H15002 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 15-day mean discharge, in cubic feet per second for 2-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.   |
| H15005 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 15-day mean discharge, in cubic feet per second for 5-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.   |
| H15010 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 15-day mean discharge, in cubic feet per second for 10-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H15020 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 15-day mean discharge, in cubic feet per second for 20-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H15025 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 15-day mean discharge, in cubic feet per second for 25-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H15050 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 15-day mean discharge, in cubic feet per second for 50-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H15100 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 15-day mean discharge, in cubic feet per second for 100-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969. |
| H30002 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 30-day mean discharge, in cubic feet per second for 2-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.   |
| H30005 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 30-day mean discharge, in cubic feet per second for 5-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.   |
| H30010 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 30-day mean discharge, in cubic feet per second for 10-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H30020 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 30-day mean discharge, in cubic feet per second for 20-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H30025 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 30-day mean discharge, in cubic feet per second for 25-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H30050 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 30-day mean discharge, in cubic feet per second for 50-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| H30100 | Real | 1      | Yes    | Opt           | Opt   | Annual maximum 30-day mean discharge, in cubic feet per second for 100-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969. |
| HUCODE | Int  | 1      | Yes    | Opt           | Opt   | Hydrologic unit code (8 digits). These codes are given in the U.S. Geological Survey map series "State Hydrologic Unit Maps," Open-File Report 84-708.                      |
| I24-2. | Real | 1      | Yes    | Opt           | Opt   | Precipitation intensity, 24-hour rainfall, in inches, expected on the average of once each 2 years.   |
| I24010 | Real | 1      | Yes    | Opt           | Opt   | Precipitation intensity, 24-hour rainfall, in inches, expected on the average of once each 10 years.  |
| I24025 | Real | 1      | Yes    | Opt           | Opt   | Precipitation intensity, 24-hour rainfall, in inches, expected on the average of once each 25 years.  |
| I24050 | Real | 1      | Yes    | Opt           | Opt   | Precipitation intensity, 24-hour rainfall, in inches, expected on the average of once each 50 years.  |
| I24100 | Real | 1      | Yes    | Opt           | Opt   | Precipitation intensity, 24-hour rainfall, in inches, expected on the average of once each 100 years.   |
| ISTAID | Int  | 1      | Yes    | Opt           | Opt   | Station identification number, as an integer.   |
| J407BQ | Real | 1      | Yes    | Opt           | Opt   | Base gage discharge, Bulletin 17B frequency analysis.   |

| Name   | Type | Length | Update | Data-set type |       | Description  |
|--------|------|--------|--------|---------------|-------|--|
|        |      |        |        | Time          | Table |  |
| J407BY | Int  | 1      | Yes    | Opt           | Opt   | Year to begin analysis, used to identify subset of available record, Bulletin 17B frequency analysis.  |
| J407EY | Int  | 1      | Yes    | Opt           | Opt   | Year to end analysis, used to identify subset of available record, Bulletin 17B frequency analysis.  |
| J407GS | Real | 1      | Yes    | Opt           | Opt   | Generalized skew, Bulletin 17B frequency analysis.   |
| J407HO | Real | 1      | Yes    | Opt           | Opt   | High outlier discharge criterion, Bulletin 17B frequency analysis.   |
| J407HP | Int  | 1      | Yes    | Opt           | Opt   | Historic peak option (Bulletin 17B frequency analysis):<br>1 - include historic peaks<br>2 - exclude historic peaks  |
| J407LO | Real | 1      | Yes    | Opt           | Opt   | Low outlier discharge criterion (Bulletin 17B frequency analysis).   |
| J407NH | Int  | 1      | Yes    | Opt           | Opt   | Number of historic peaks (Bulletin 17B frequency analysis).  |
| J407SE | Real | 1      | Yes    | Opt           | Opt   | Root mean square error of generalized skew (Bulletin 17B frequency analysis).  |
| J407SO | Int  | 1      | Yes    | Opt           | Opt   | Generalized skew option (Bulletin 17B frequency analysis):<br>-1 - station skew<br>0 - weighted skew<br>1 - generalized skew   |
| J407UR | Int  | 1      | Yes    | Opt           | Opt   | Include urban regulated peaks (Bulletin 17B frequency analysis):<br>1 - no<br>2 - yes  |
| JANAVE | Real | 1      | Yes    | Opt           | Opt   | Mean monthly temperature for January, in degrees Fahrenheit.   |
| JANMIN | Real | 1      | Yes    | Opt           | Opt   | Mean minimum January temperature, in degrees Fahrenheit.   |
| JULAVE | Real | 1      | Yes    | Opt           | Opt   | Mean monthly temperature for July, in degrees Fahrenheit.  |
| JULMAX | Real | 1      | Yes    | Opt           | Opt   | Mean maximum July temperature, in degrees Fahrenheit.  |
| KENPLV | Real | 1      | Yes    | Opt           | Opt   | P-level for Kendall Tau statistic.   |
| KENSLP | Real | 1      | Yes    | Opt           | Opt   | Median slope of time-series trend.   |
| KENTAU | Real | 1      | Yes    | Opt           | Opt   | Kendall Tau statistic for time-series data.  |
| L01002 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 1-day mean discharge, in cubic feet per second, for 2-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| L01010 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 1-day mean discharge, in cubic feet per second, for 10-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969. |
| L01020 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 1-day mean discharge, in cubic feet per second, for 20-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969. |
| L03002 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 3-day mean discharge, in cubic feet per second, for 2-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| L03010 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 3-day mean discharge, in cubic feet per second, for 10-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969. |
| L03020 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 3-day mean discharge, in cubic feet per second, for 20-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969. |
| L07002 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 7-day mean discharge, in cubic feet per second, for 2-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| L07005 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 7-day mean discharge, in cubic feet per second, for 5-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| L07010 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 7-day mean discharge, in cubic feet per second, for 10-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969. |

| Name   | Type | Length | Update | Data-set type |       | Description   |
|--------|------|--------|--------|---------------|-------|---|
|        |      |        |        | Time          | Table |   |
| L07020 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 7-day mean discharge, in cubic feet per second, for 20-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| L14002 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 14-day mean discharge, in cubic feet per second, for 2-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| L14010 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 14-day mean discharge, in cubic feet per second, for 10-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969. |
| L14020 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 14-day mean discharge, in cubic feet per second, for 20-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969. |
| L30002 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 30-day mean discharge, in cubic feet per second, for 2-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| L30010 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 30-day mean discharge, in cubic feet per second, for 10-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969. |
| L30020 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 30-day mean discharge, in cubic feet per second, for 20-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969. |
| L90002 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 90-day mean discharge, in cubic feet per second, for 2-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969.  |
| L90010 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 90-day mean discharge, in cubic feet per second, for 10-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969. |
| L90020 | Real | 1      | Yes    | Opt           | Opt   | Annual minimum 90-day mean discharge, in cubic feet per second, for 20-year recurrence interval, defined by log-Pearson Type III fitting in ANNIE or WATSTORE program A969. |
| LAKE   | Real | 1      | Yes    | Opt           | Opt   | Area of lakes and ponds in percent of contributing drainage area.   |
| LATCTR | Real | 1      | Yes    | Opt           | Opt   | Latitude of center of basin, decimal degrees.   |
| LATDEG | Real | 1      | Yes    | Opt           | Opt   | Latitude in decimal degrees.  |
| LATDMS | Int  | 1      | Yes    | Opt           | Opt   | Latitude in degrees, minutes, seconds (dddmmss).  |
| LCODE  | Int  | 1      | Yes    | Opt           | Opt   | Length units code, user defined.  |
| LENGTH | Real | 1      | Yes    | Opt           | Opt   | Channel length, units user defined.   |
| LKEVAP | Real | 1      | Yes    | Opt           | Opt   | Mean annual lake evaporation, in inches.  |
| LNGCTR | Real | 1      | Yes    | Opt           | Opt   | Longitude of center of basin, decimal degrees.  |
| LNGDEG | Real | 1      | Yes    | Opt           | Opt   | Longitude in decimal degrees.   |
| LNGDMS | Int  | 1      | Yes    | Opt           | Opt   | Longitude in degrees, minutes, seconds (dddmmss).   |
| LOESS  | Real | 1      | Yes    | Opt           | Opt   | Depth of surficial loess, in feet.  |
| MARMAX | Real | 1      | Yes    | Opt           | Opt   | Mean maximum March temperature, in degrees Fahrenheit.  |
| MAXVAL | Real | 1      | Yes    | Opt           | No    | Maximum value in data set, general use.   |
| MEANND | Real | 1      | Yes    | Opt           | Opt   | Mean of the logarithms, base 10, of annual n-day high- or low-flow statistic.   |
| MEANPK | Real | 1      | Yes    | Opt           | Opt   | Mean of the logarithms, base 10, of systematic annual peak discharges from Bulletin 17B frequency analysis or WATSTORE program J407.  |
| MEANVL | Real | 1      | Yes    | Opt           | No    | Mean of values in data set, general use.  |
| MINVAL | Real | 1      | Yes    | Opt           | No    | Minimum value in data set, general use.   |
| NONZRO | Int  | 1      | Yes    | Opt           | No    | Number of nonzero values in the time series.  |
| NUMZRO | Int  | 1      | Yes    | Opt           | No    | Number of zero values in the time series.   |
| P1.25  | Real | 1      | Yes    | Opt           | Opt   | Annual flood peak, in cubic feet per second, 1.25-year recurrence interval.   |
| P10.   | Real | 1      | Yes    | Opt           | Opt   | Annual flood peak, in cubic feet per second, 10-year recurrence interval.   |

| Name   | Type | Length | Update | Data-set type |       | Description  |
|--------|------|--------|--------|---------------|-------|--|
|        |      |        |        | Time          | Table |  |
| P100.  | Real | 1      | Yes    | Opt           | Opt   | Annual flood peak, in cubic feet per second, 100-year recurrence interval.   |
| P2.    | Real | 1      | Yes    | Opt           | Opt   | Annual flood peak, in cubic feet per second, 2-year recurrence interval.   |
| P200.  | Real | 1      | Yes    | Opt           | Opt   | Annual flood peak, in cubic feet per second, 200-year recurrence interval.   |
| P25.   | Real | 1      | Yes    | Opt           | Opt   | Annual flood peak, in cubic feet per second, 25-year recurrence interval.  |
| P5.    | Real | 1      | Yes    | Opt           | Opt   | Annual flood peak, in cubic feet per second, 5-year recurrence interval.   |
| P50.   | Real | 1      | Yes    | Opt           | Opt   | Annual flood peak, in cubic feet per second, 50-year recurrence interval.  |
| P500.  | Real | 1      | Yes    | Opt           | Opt   | Annual flood peak, in cubic feet per second, 500-year recurrence interval.   |
| PARMCD | Int  | 1      | Yes    | Opt           | Opt   | Parameter code, see WATSTORE users manual, Appendix D.   |
| PNEVAP | Real | 1      | Yes    | Opt           | Opt   | Mean annual Class A pan evaporation, in inches.  |
| PRCAPR | Real | 1      | Yes    | Opt           | Opt   | April mean monthly precipitation, in inches.   |
| PRCAUG | Real | 1      | Yes    | Opt           | Opt   | August mean monthly precipitation, in inches.  |
| PRCDEC | Real | 1      | Yes    | Opt           | Opt   | December mean monthly precipitation, in inches.  |
| PRCFEB | Real | 1      | Yes    | Opt           | Opt   | February mean monthly precipitation, in inches.  |
| PRCJAN | Real | 1      | Yes    | Opt           | Opt   | January mean monthly precipitation, in inches.   |
| PRCJUL | Real | 1      | Yes    | Opt           | Opt   | July mean monthly precipitation, in inches.  |
| PRCJUN | Real | 1      | Yes    | Opt           | Opt   | June mean monthly precipitation, in inches.  |
| PRCMAR | Real | 1      | Yes    | Opt           | Opt   | March mean monthly precipitation, in inches.   |
| PRCMAY | Real | 1      | Yes    | Opt           | Opt   | May mean monthly precipitation, in inches.   |
| PRCNOV | Real | 1      | Yes    | Opt           | Opt   | November mean monthly precipitation, in inches.  |
| PRCOCT | Real | 1      | Yes    | Opt           | Opt   | October mean monthly precipitation, in inches.   |
| PRCSEP | Real | 1      | Yes    | Opt           | Opt   | September mean monthly precipitation, in inches.   |
| PRECIP | Real | 1      | Yes    | Opt           | Opt   | Mean annual precipitation, in inches, from U.S. Weather Bureau Series "Climates of States;" grid sampling methods used if isohyetal map is available, otherwise anomaly map constructed (Water-Supply Paper 1580-D). |
| QANN   | Real | 1      | Yes    | Opt           | Opt   | Mean annual discharge, in cubic feet per second, from WATSTORE flow variability program W4422.   |
| QAPR   | Real | 1      | Yes    | Opt           | Opt   | Mean discharge, in cubic feet per second, for April, from WATSTORE flow variability program W4422.   |
| QAUG   | Real | 1      | Yes    | Opt           | Opt   | Mean discharge, in cubic feet per second, for August, from WATSTORE flow variability program W4422.  |
| QDEC   | Real | 1      | Yes    | Opt           | Opt   | Mean discharge, in cubic feet per second, for December, from WATSTORE flow variability program W4422.  |
| QEX10P | Real | 1      | Yes    | Opt           | Opt   | Discharge, in cubic feet per second, exceeded 10 percent of the time, defined by daily flow duration, WATSTORE program A969.   |
| QEX25P | Real | 1      | Yes    | Opt           | Opt   | Discharge, in cubic feet per second, exceeded 25 percent of the time, defined by daily flow duration, WATSTORE program A969.   |
| QEX50P | Real | 1      | Yes    | Opt           | Opt   | Discharge, in cubic feet per second, exceeded 50 percent of the time, defined by daily flow duration, WATSTORE program A969.   |
| QEX70P | Real | 1      | Yes    | Opt           | Opt   | Discharge, in cubic feet per second, exceeded 70 percent of the time, defined by daily flow duration, WATSTORE program A969.   |
| QEX75P | Real | 1      | Yes    | Opt           | Opt   | Discharge, in cubic feet per second, exceeded 75 percent of the time, defined by daily flow duration, WATSTORE program A969.   |
| QEX90P | Real | 1      | Yes    | Opt           | Opt   | Discharge, in cubic feet per second, exceeded 90 percent of the time, defined by daily flow duration, WATSTORE program A969.   |
| QEX95P | Real | 1      | Yes    | Opt           | Opt   | Discharge, in cubic feet per second, exceeded 95 percent of the time, defined by daily flow duration, WATSTORE program A969.   |
| QFEB   | Real | 1      | Yes    | Opt           | Opt   | Mean discharge, in cubic feet per second, for February, from WATSTORE flow variability program W4422.  |
| QJAN   | Real | 1      | Yes    | Opt           | Opt   | Mean discharge, in cubic feet per second, for January, from WATSTORE flow variability program W4422.   |

| Name   | Type | Length | Update | Data-set type |       | Description   |
|--------|------|--------|--------|---------------|-------|---|
|        |      |        |        | Time          | Table |   |
| QJUL   | Real | 1      | Yes    | Opt           | Opt   | Mean discharge, in cubic feet per second, for July, from WATSTORE flow variability program W4422.   |
| QJUN   | Real | 1      | Yes    | Opt           | Opt   | Mean discharge, in cubic feet per second, for June, from WATSTORE flow variability program W4422.   |
| QMAR   | Real | 1      | Yes    | Opt           | Opt   | Mean discharge, in cubic feet per second, for March, from WATSTORE flow variability program W4422.  |
| QMAY   | Real | 1      | Yes    | Opt           | Opt   | Mean discharge, in cubic feet per second, for May, from WATSTORE flow variability program W4422.  |
| QNOV   | Real | 1      | Yes    | Opt           | Opt   | Mean discharge, in cubic feet per second, for November, from WATSTORE flow variability program W4422.   |
| QOCT   | Real | 1      | Yes    | Opt           | Opt   | Mean discharge, in cubic feet per second, for October, from WATSTORE flow variability program W4422.  |
| QSDANN | Real | 1      | Yes    | Opt           | Opt   | Standard deviation of mean annual discharge, in cubic feet per second, from WATSTORE flow variability program W4422.  |
| QSDAPR | Real | 1      | Yes    | Opt           | Opt   | Standard deviation, in cubic feet per second, of mean discharge for April, from WATSTORE flow variability program W4422.  |
| QSDAUG | Real | 1      | Yes    | Opt           | Opt   | Standard deviation, in cubic feet per second, of mean discharge for August, from WATSTORE flow variability program W4422.   |
| QSDDEC | Real | 1      | Yes    | Opt           | Opt   | Standard deviation, in cubic feet per second, of mean discharge for December, from WATSTORE flow variability program W4422.   |
| QSDFEB | Real | 1      | Yes    | Opt           | Opt   | Standard deviation, in cubic feet per second, of mean discharge for February, from WATSTORE flow variability program W4422.   |
| QSDJAN | Real | 1      | Yes    | Opt           | Opt   | Standard deviation, in cubic feet per second, of mean discharge for January, from WATSTORE flow variability program W4422.  |
| QSDJUL | Real | 1      | Yes    | Opt           | Opt   | Standard deviation, in cubic feet per second, of mean discharge for July, from WATSTORE flow variability program W4422.   |
| QSDJUN | Real | 1      | Yes    | Opt           | Opt   | Standard deviation, in cubic feet per second, of mean discharge for June, from WATSTORE flow variability program W4422.   |
| QSDMAR | Real | 1      | Yes    | Opt           | Opt   | Standard deviation, in cubic feet per second, of mean discharge for March, from WATSTORE flow variability program W4422.  |
| QSDMAY | Real | 1      | Yes    | Opt           | Opt   | Standard deviation, in cubic feet per second, of mean discharge for May, from WATSTORE flow variability program W4422.  |
| QSDNOV | Real | 1      | Yes    | Opt           | Opt   | Standard deviation, in cubic feet per second, of mean discharge for November, from WATSTORE flow variability program W4422.   |
| QSDOCT | Real | 1      | Yes    | Opt           | Opt   | Standard deviation, in cubic feet per second, of mean discharge for October, from WATSTORE flow variability program W4422.  |
| QSDSEP | Real | 1      | Yes    | Opt           | Opt   | Standard deviation, in cubic feet per second, of mean discharge for September, from WATSTORE flow variability program W4422.  |
| QSEP   | Real | 1      | Yes    | Opt           | Opt   | Mean discharge, in cubic feet per second, for September, from WATSTORE flow variability program W4422.  |
| RFOOT  | Real | 1      | Yes    | Opt           | Opt   | Distance from mouth of river, in feet.  |
| RMILE  | Real | 1      | Yes    | Opt           | Opt   | Distance from basin outlet, in miles.   |
| RWFLAG | Int  | 1      | Yes    | Opt           | Opt   | Read/Write flag:<br>0 - read and write<br>1 - read only   |
| SDND   | Real | 1      | Yes    | Opt           | Opt   | Standard deviation of logarithms, base 10, of annual n-day high- or low-flow statistic.   |
| SDPK   | Real | 1      | Yes    | Opt           | Opt   | Standard deviation of logarithms, base 10, of systematic annual peak discharges, from Bulletin 17B frequency analysis or WATSTORE program J407.   |
| SEASBG | Int  | 1      | Yes    | Opt           | Opt   | Beginning month of a user-defined season. Will start on first day of the month. Used with attribute SEASND to define a specific time period, usually a year. January is month 1 and December is month 12. |
| SEASND | Int  | 1      | Yes    | Opt           | Opt   | Ending month of a user-defined season. Will end on the last day of the month. Used with attribute SEASBG to define a specific time period, usually a year. January is month 1 and December is month 12.   |

| Name   | Type | Length | Update | Data-set type |       | Description  |
|--------|------|--------|--------|---------------|-------|--|
|        |      |        |        | Time          | Table |  |
| SITECO | Char | 4      | Yes    | Opt           | Opt   | Site code, see WATSTORE users manual, volume 1, chapter 3.<br>SW - stream<br>SP - spring<br>ES - estuary<br>GW - well<br>LK - lake or reservoir<br>ME - meteorological   |
| SKEWCF | Real | 1      | Yes    | Opt           | No    | Skew coefficient of values in data set, general use.   |
| SKWND  | Real | 1      | Yes    | Opt           | Opt   | Skew of logarithm, base 10, of annual n-day high- or low-flow statistic.   |
| SKWPK  | Real | 1      | Yes    | Opt           | Opt   | Skew of logarithms, base 10, of systematic annual peak discharges, from Bulletin 17B frequency analysis or WATSTORE program J407.  |
| SLOPE  | Real | 1      | Yes    | Opt           | Opt   | Slope, units are user defined.   |
| SN002  | Real | 1      | Yes    | Opt           | Opt   | Maximum water equivalent, in inches, of snow cover as of March 15, 2-year recurrence interval.   |
| SN010  | Real | 1      | Yes    | Opt           | Opt   | Maximum water equivalent, in inches, of snow cover as of March 15, 10-year recurrence interval.  |
| SN025  | Real | 1      | Yes    | Opt           | Opt   | Maximum water equivalent, in inches, of snow cover as of March 15, 25-year recurrence interval.  |
| SN100  | Real | 1      | Yes    | Opt           | Opt   | Maximum water equivalent, in inches, of snow cover as of March 15, 100-year recurrence interval.   |
| SNOAPR | Real | 1      | Yes    | Opt           | Opt   | Mean water equivalent, in inches, of snow cover as of April 30.  |
| SNOFAL | Real | 1      | Yes    | Opt           | Opt   | Mean annual snowfall, in inches.   |
| SNOMAR | Real | 1      | Yes    | Opt           | Opt   | Mean water equivalent, in inches, of snow cover as of March 1.   |
| SOILIN | Real | 1      | Yes    | Opt           | Opt   | Soils index, in inches, a relative measure of potential infiltration (soil water storage), from Soil Conservation Service.   |
| STAID  | Char | 16     | Yes    | Opt           | Opt   | Station identification, up to 16 alpha-numeric characters.   |
| STANAM | Char | 48     | Yes    | Opt           | Opt   | Station name or description of the data set.   |
| STATCD | Int  | 1      | Yes    | Opt           | Opt   | Statistics code, see WATSTORE users manual, Appendix E.  |
| STCODE | Char | 4      | Yes    | Opt           | Opt   | Standard 2-character post office state abbreviation, includes<br>DC - District of Columbia<br>PR - Puerto Rico<br>VI - Virgin Islands<br>GU - Guam<br>PI - Pacific Trust Territories<br>Use NON for no state abbreviation.   |
| STDDEV | Real | 1      | Yes    | Opt           | No    | Standard deviation of values in data set, general use.   |
| STFIPS | Int  | 1      | Yes    | Opt           | Opt   | State FIPS code, see WATSTORE users manual, Appendix B.  |
| STORAG | Real | 1      | Yes    | Opt           | Opt   | Area of lakes, ponds, and swamps in percent of contributing drainage area, measured by the grid sampling methods.  |
| SUBHUC | Int  | 1      | Yes    | Opt           | Opt   | Extension to hydrologic unit code (HUCODE). See the U.S. Geological Survey map series "State Hydrologic Unit Maps," Open-File Report 84-708.   |
| TCODE  | Int  | 1      | No     | Reqd          | Opt   | Time units code.<br>1 - seconds                      4 - days<br>2 - minutes                      5 - months<br>3 - hours                         6 - years<br>Used in combination with TSSTEP.  |
| TGROUP | Int  | 1      | No     | Reqd          | No    | Unit for group pointers, depending on the time step of the data, may effect the speed of data retrievals. The default group pointer is 6 (years). See table 1 in users manual for recommended values.<br>3 - hours                         6 - years<br>4 - days                         7 - centuries<br>5 - months |
| TMTOPK | Real | 1      | Yes    | Opt           | Opt   | Time, in hours, measured as time difference between center of mass of total rainfall and peak discharge.   |

| Name    | Type | Length | Update | Data-set type |       | Description   |
|---------|------|--------|--------|---------------|-------|---|
|         |      |        |        | Time          | Table |   |
| TMZONE  | Int  | 1      | Yes    | Opt           | Opt   | Time zone. Each time zone is represented as the number of hours to be added to, or subtracted from, Greenwich time:<br>-4 - Atlantic Standard                    -8 - Pacific Standard<br>-5 - Eastern Standard                    -9 - Yukon Standard<br>-6 - Central Standard                    -10 - Alaska-Hawaii Standard<br>-7 - Mountain Standard |
| TOLR    | Real | 1      | No     | Opt           | No    | Data compression tolerance. Data values within $\pm$ of TOLR will be considered the same value and compressed in the data set. Once data have been compressed, the original values cannot be retrieved.   |
| TSBDY   | Int  | 1      | No     | Opt           | No    | Starting day for time-series data in a data set. Defaults to day 1.   |
| TSBHR   | Int  | 1      | No     | Opt           | No    | Starting hour for time-series data in a data set. Defaults to hour 1.   |
| TSBMO   | Int  | 1      | No     | Opt           | No    | Starting month for time-series data in a data set. Defaults to month 1 (January).   |
| TSBYR   | Int  | 1      | No     | Reqd          | No    | Starting year for time-series data in a data set. Defaults to year 1900.  |
| TSFILL  | Real | 1      | No     | Opt           | Opt   | Time-series filler value. This value will be used for missing values. The default is 0.0.   |
| TSFORM  | Int  | 1      | No     | Reqd          | No    | Form of data:<br>1 - mean over the time step (default)<br>2 - total over the time step<br>3 - instantaneous @ time (end of time step)<br>4 - minimum over the time step<br>5 - maximum over the time step   |
| TSPREC  | Int  | 1      | No     | Opt           | No    | New group, new record flag:<br>0 - start new group at the end of the last group (default)<br>1 - start new group at the beginning of a record   |
| TSPTAD  | Int  | 1      | Yes    | Opt           | No    | Time series put aggregation/disaggregation code.  |
| TSSSTEP | Int  | 1      | No     | Reqd          | Opt   | Time step, in TCODE units (used in combination with TCODE).   |
| TSTYPE  | Char | 4      | Yes    | Opt           | Opt   | User-defined four-character descriptor. Used to describe the contents of the data set, for example:<br>PRCP, RAIN, SNOW - precipitation<br>FLOW, DISC, PEAK - discharge<br>TEMP, TMIN, TMAX - temperature<br>EVAP, PET - evapotranspiration<br>Some models and application programs may require a specific TSTYPE for data sets they use.                 |
| UBC024  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC025  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC026  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC027  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC028  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC029  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC030  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC031  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC038  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC039  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC040  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC066  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC067  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC068  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC069  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC073  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC074  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC166  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC167  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |
| UBC169  | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.   |

| Name   | Type | Length | Update | Data-set type |       | Description  |
|--------|------|--------|--------|---------------|-------|--|
|        |      |        |        | Time          | Table |  |
| UBC170 | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.  |
| UBC182 | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.  |
| UBC183 | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.  |
| UBC184 | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.  |
| UBC185 | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.  |
| UBC186 | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.  |
| UBC187 | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.  |
| UBC188 | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.  |
| UBC189 | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.  |
| UBC190 | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.  |
| UBC191 | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.  |
| UBC192 | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.  |
| UBC193 | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.  |
| UBC194 | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.  |
| UBC195 | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.  |
| UBC200 | Real | 1      | Yes    | Opt           | Opt   | Defined by user or application.  |
| VALLGH | Real | 1      | Yes    | Opt           | Opt   | Valley length, in miles, measured along general path of flood plain from gage to basin divide.   |
| VBTIME | Int  | 1      | No     | Reqd          | No    | Variable time-step option for the data set<br>1 - all data are at the same time step<br>2 - time step may vary (default)   |
| VCODE  | Int  | 1      | Yes    | Opt           | Opt   | Volume units code, user defined.   |
| VLCODE | Int  | 1      | Yes    | Opt           | Opt   | Velocity units code, user defined.   |
| WELLDP | Real | 1      | Yes    | Opt           | Opt   | Depth of well, in feet. The greatest depth at which water can enter the well. See WATSTORE users manual, volume 1, chapter 3.  |
| WEMAR2 | Real | 1      | Yes    | Opt           | Opt   | Water equivalent, in inches, of snow cover as of the first week in March, 2-year recurrence interval.  |
| WRCMN  | Real | 1      | Yes    | Opt           | Opt   | WRC mean of logarithms, base 10, of annual peak discharges after outlier and historic-peak adjustments, from Bulletin 17B frequency analysis or WATSTORE program J407.                               |
| WRCSA  | Real | 1      | Yes    | Opt           | Opt   | WRC standard deviation of logarithms, base 10, of annual peak discharges after outlier and historic-peak adjustments, from Bulletin 17B frequency analysis or WATSTORE program J407.                 |
| WRCSKW | Real | 1      | Yes    | Opt           | Opt   | WRC skew of logarithms, base 10, of annual peak discharge after outlier and historic-peak adjustments and generalized skew weighting, from Bulletin 17B frequency analysis or WATSTORE program J407. |
| XSECLC | Real | 1      | Yes    | Opt           | Opt   | Cross-section locator, distance in feet from left bank (as determined by facing downstream).   |
| YRSDAY | Int  | 1      | Yes    | Opt           | Opt   | Number of years of daily-flow record, from WATSTORE flow variability program W4422.  |
| YRSLOW | Int  | 1      | Yes    | Opt           | Opt   | Number of years of low-flow record.  |
| YRSHPK | Int  | 1      | Yes    | Opt           | Opt   | Number of consecutive years used for historic-peak adjustment to flood-frequency data used in Bulletin 17B frequency analysis or WATSTORE program J407.  |
| YRSPK  | Int  | 1      | Yes    | Opt           | Opt   | Number of years of systematic peak flow record, used in Bulletin 17B frequency analysis or WATSTORE program J407.  |

## APPENDIX B. User System Specifications File

### TERM.DAT

The ANNIE/WDM system contains a number of parameters that define the configuration of the user's computer system and the user's preferences. All of these parameters have default values. Any number of these defaults can be overridden by adding a TERM.DAT file to the directory where ANNIE is being run. The first time ANNIE needs any one of these parameters, they are read from the main message file. Then the user's TERM.DAT file is read, if it exists, and the parameters found replace the defaults from the message file. All of the parameters are saved for the duration of the run. Table B.1 lists the keyword, default value, allowable values, and the definition for each parameter. Table B.2 shows a TERM.DAT file for a Prime with a terminal that emulates Tektronics 4014 and an HP7475 plotter. The keyword must start in column 1 and the value must start in column 7.

It is essential to correctly set the computer type, CMPTYP, and the Fortran unit numbers for terminals, TRMINP and TRMOUT.

Many of the parameters depend on the implementation of GKS and give the user the opportunity to change or correct colors, line types, symbol types, symbol sizes, background color, text fonts, and graphics devices. With most implementations of GKS, text may be modified with the parameters GKPREC, GKSCFT, GKPRFT, GKPLFT, TXTEXF, and TXTCHS. Background color on color monitors can be changed using parameters BCOLOR or BGRED, BGREEN, and BGBLUE. Symbol size can be modified with the parameter SYSSIZ. Eight parameters are available to reset the default code numbers for each of the curve specification, line type, symbol, color, and pattern. All code numbers should be available in the GKS documentation for workstations or device drivers.

**Table B.1.** TERM.DAT Parameters

| Parameter keyword | Default value | Allowable values                 | Definition  |
|-------------------|---------------|----------------------------------|---|
| CMPTYP            | PC            | PC<br>PRIME<br>VAX<br>UNIX<br>DG | Type of computer, use PC for IBM clones.  |
| TRMTYP            | PC            | PC<br>VT100                      | Terminal type.  |
| TRMINP            | 1             | 0 to 5                           | Fortran unit number for reading from the terminal (1 for PRIME, 5 for DEC VAX, 1 for PC, 0 for Data General). |
| TRMOUT            | 1             | 0 to 6                           | Fortran unit number for writing to the terminal (1 for PRIME, 6 for DEC VAX, 1 for PC, 0 for Data General).   |
| GRAPHS            | NO            | NO<br>YES                        | Are GKS library and drivers available?  |
| SCRWID            | 80            | 40 to 256                        | Number of columns on the terminal.  |
| SCRLEN            | 24            | 10 to 100                        | Number of lines shown on the terminal.  |
| FILUNI            | 30            | 7 to 99                          | Starting Fortran unit number used by ANNIE for user's files.  |
| RECTYPE           | WORD          | WORD<br>HWORD<br>BYTE<br>UNKNOWN | Units for specifying record lengths on OPEN statements for unformatted direct access files.                   |

The following 13 items are for MS-DOS PC with color display only.

|        |    |         |  |
|--------|----|---------|--|
| CLRFRM | 15 | 0 to 15 | Color of text for messages related to parameter input. |
| CLRFRT | 11 | 0 to 15 | Color of titles and headers for full screen.           |

**Table B.1.** TERM.DAT Parameters--Continued

| Parameter keyword  | Default value | Allowable values         | Definition  |
|--|---------------|--------------------------|---|
| CLRFRL   | 13            | 0 to 15                  | Color of limits for parameters.   |
| CLRFRE   | 4             | 0 to 15                  | Color for error messages.   |
| CLRFRC   | 14            | 0 to 15                  | Color for user input on command line.   |
| CLRFRR   | 7             | 0 to 15                  | Color for protected data values.  |
| CLRFRR   | 15            | 0 to 15                  | Color for data to be modified.  |
| CLFRFR   | 14            | 0 to 15                  | Color of data to be modified when currently none.                                 |
| CLFRFR   | 7             | 0 to 15                  | Standard color except for full screen.  |
| CLRBKO   | 2             | 0 to 15                  | Color of border.  |
| CLRBKB   | 1             | 0 to 15                  | Color of background for full screen.  |
| CLRBKS   | 0             | 0 to 15                  | Standard background color.  |
| CLRBKD   | 0             | 0 to 15                  | Color of background block for data to be modified.                                |
| WEIBA  | 0             | 0 to 10000               | Weiba plotting position for Bulletin 17B flood-frequency analysis in thousandths. |
| USRLEV   | 0             | 0 to 2                   | User experience level 0-lots, 2=none.   |
| For the following 40 items, see the GKS implementation manual for your system or ask your GKS administrator for a list of supported codes. |               |                          |   |
| GKSDIS   | 4107          | any                      | GKS code number for workstation type for display terminal (not used for PC).      |
| GKSPRT   | 102           | any                      | GKS code number for workstation type for printer device (not used for PC).        |
| GKSPLT   | 9012          | any                      | GKS code number for workstation type for pen plotter (not used for PC).           |
| GKSMET   | 9005          | any                      | GKS code number for metafile (not used for PC).                                   |
| GKSDSP   | 102           | any                      | DISSPLA metafile code number (only useful for DISSPLA implementations of GKS).    |
| GKPREC   | CHAR          | STRING<br>CHAR<br>STROKE | Text precision, see GKS manual for computer system and device type.               |
| GKSCFT   | 1             | -9999 to 9999            | Text font for screen.   |
| GKPRFT   | 1             | -9999 to 9999            | Text font for printer.  |
| GKPLFT   | 1             | -9999 to 9999            | Text font for plotter.  |
| LSOLID   | 1             | -9999 to 9999            | Code for solid line.  |
| LDASH  | 2             | -9999 to 9999            | Code for dashed line.   |
| LDOT   | 3             | -9999 to 9999            | Code for dotted line.   |
| LMIXED   | 4             | -9999 to 9999            | Code for dot dashed line.   |
| 1LUSER   | 1             | -9999 to 9999            | Extra line type code.   |
| 2LUSER   | 1             | -9999 to 9999            | Extra line type code.   |
| 3LUSER   | 1             | -9999 to 9999            | Extra line type code.   |
| 4LUSER   | 1             | -9999 to 9999            | Extra line type code.   |
| CBLACK   | 1             | -9999 to 9999            | Code for black.   |
| CWHITE   | 2             | -9999 to 9999            | Code for white.   |
| CRED   | 3             | -9999 to 9999            | Code for red.   |
| CGREEN   | 4             | -9999 to 9999            | Code for green.   |
| CBLUE  | 5             | -9999 to 9999            | Code for blue.  |
| CCYAN  | 6             | -9999 to 9999            | Code for cyan.  |
| CMAGNT   | 7             | -9999 to 9999            | Code for magenta.   |
| CYELLOW  | 8             | -9999 to 9999            | Code for yellow.  |
| CDOT   | 1             | -9999 to 9999            | Symbol code for dot.  |
| CPLUS  | 2             | -9999 to 9999            | Symbol code for plus.   |
| CSTAR  | 3             | -9999 to 9999            | Symbol code for star.   |
| CZERO  | 4             | -9999 to 9999            | Symbol code for circle.   |
| CX   | 5             | -9999 to 9999            | Symbol code for X.  |
| 1SUSER   | 1             | -9999 to 9999            | Extra symbol code.  |
| 2SUSER   | 1             | -9999 to 9999            | Extra symbol code.  |
| PSOLID   | 2             | -9999 to 9999            | Code for solid fill area.   |
| PHORIZ   | 3             | -9999 to 9999            | Code for horizontal fill area.  |

**Table B.1.** TERM.DAT Parameters--Continued

| <b>Parameter keyword</b> | <b>Default value</b> | <b>Allowable values</b> | <b>Definition</b>                             |
|--------------------------|----------------------|-------------------------|---|
| PVERT                    | 4                    | -9999 to 9999           | Code for vertical fill area.                  |
| PDIAG                    | 5                    | -9999 to 9999           | Code for diagonal fill area.                  |
| 1PUSER                   | 1                    | -9999 to 9999           | Extra fill code.                              |
| 2PUSER                   | 1                    | -9999 to 9999           | Extra fill code.                              |
| 3PUSER                   | 1                    | -9999 to 9999           | Extra fill code.                              |
| 4PUSER                   | 1                    | -9999 to 9999           | Extra fill code.                              |
| SYMSIZ                   | 100                  | 1 to 10000              | Symbol size ratio in hundredths.              |
| TXTEXF                   | 0                    | 0 to 200                | Text expansion factor in hundredths.          |
| TXTCHS                   | 0                    | 0 to 200                | Text character spacing in hundredths.         |
| BCOLOR                   | BLACK                | BLACK<br>WHITE<br>OTHER | Background color.                             |
| BGRED                    | 0                    | 0 to 100                | Percent red for background if BCOLOR=OTHER.   |
| BGREEN                   | 0                    | 0 to 100                | Percent green for background if BCOLOR=OTHER. |
| BGBLUE                   | 0                    | 0 to 100                | Percent blue for background if BCOLOR=OTHER.  |

**Table B.2.** Example TERM.DAT

| <b>File contents</b>                           | <b>Description</b>               |
|--|----------------------------------|
| <b>(Note: description is not part of file)</b> |                                  |
| CMPTYP PRIME                                   | Computer type is Prime.          |
| GRAPHS YES                                     | Graphics library is available.   |
| GKSDIS 9001                                    | Workstation code number.         |
| GKSPLT 9012                                    | GKS code number for pen plotter. |
| GKSMET 1                                       | GKS code number for metafile.    |
| USRLEV 0                                       | User experience is lots.         |
| FILUNI 60                                      | Starting Fortran unit number.    |

---

## APPENDIX C. Glossary of Terms

---

**Attribute.** A variable listed in Appendix A used to characterize and identify a data set.

**Block.** A string of data values in a time-series data set with a header value indicating the date of the first value, number of values in the string, and quality code of the string.

**Buffer.** An array of data-set numbers.

**Command file.** A sequential file of responses to METCMP menus.

**Data compression.** When a sequence of time-series values are the same, the value and the number of those values are stored instead of repeated storage of the same value.

**Data-set number.** A number from 1 to 32,000 assigned to a data set on a WDM file.

**Direct-access file.** A file in which records can be randomly written and read.

**Flat file.** A sequential ASCII file of data.

**GKS** (Graphical Kernal System). An ANSI and FIPS graphics standard implemented by many software vendors with a set of Fortran callable subroutines.

**Log file.** A file created by METCMP to store the sequences of responses to menus.

**Menu.** Text written to the terminal requesting input.

**Message file.** Read only, direct access file that stores all the questions, help information, and valid responses for menus as well as the attribute names, definitions, and characteristics.

**Quality code.** Number from 0 to 30 to tag time-series data and used by some of the data process options in METCMP.

**Screen.** The 24-row (line) by 80-column (character) image on the display monitor or in an X window on the display monitor.

**TERM.DAT file.** User's configuration file providing computer system options to the METCMP software.

**Time series.** Values of a measured or calculated variable over time at regular or irregular intervals.

**WDM** (Watershed Data Management). A binary direct-access file and associated software for storage, retrieval, and management of hydrologic and related data.

**Window.** Part of a screen inside a drawn rectangle 3, 4, 10, or 16 rows by 80 columns.