

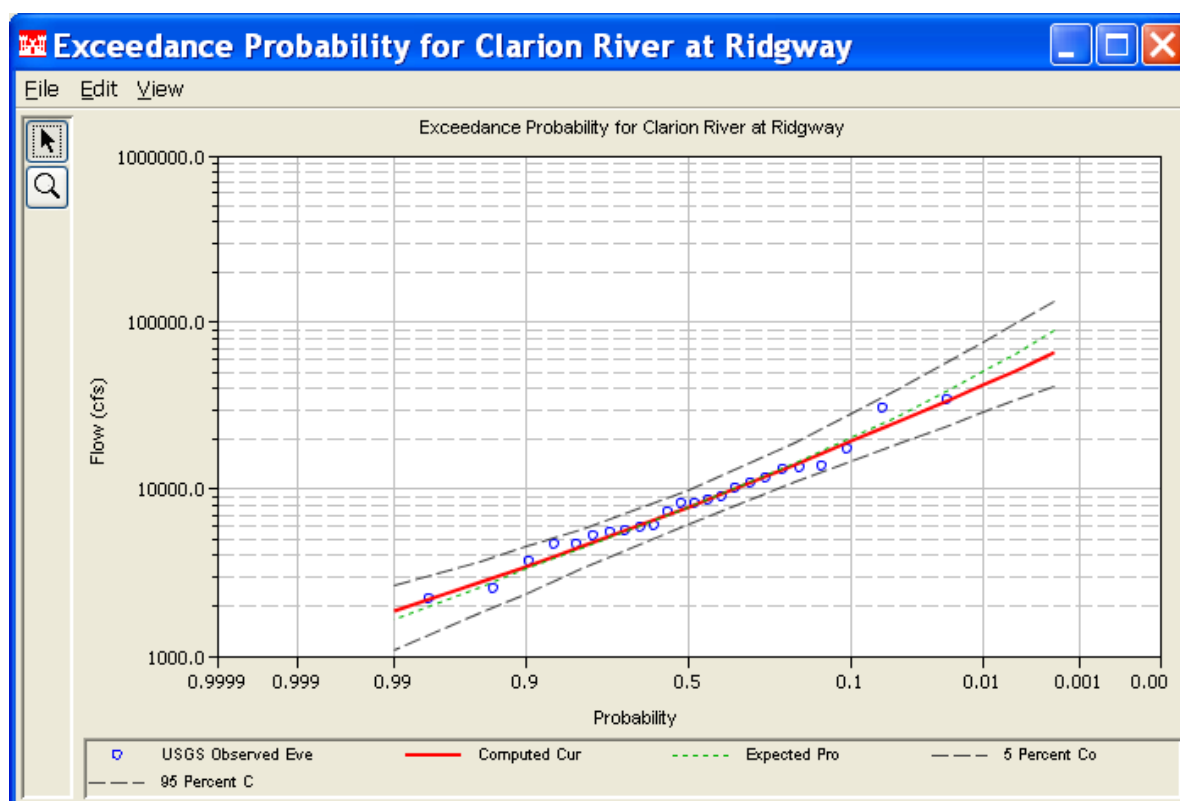


**US Army Corps
of Engineers**

Hydrologic Engineering Center

HEC-SSP

Statistical Software Package



User's Manual

Version 1.0
August 2008

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US Army Corps of Engineers
Institute for Water Resources
Hydrologic Engineering Center
609 Second Street
Davis, CA 95616

(530) 756-1104
(530) 756-8250 FAX
www.hec.usace.army.mil

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Statistical Software Package, HEC-SSP Software Distribution and Availability Statement

The HEC-SSP executable code and documentation are public domain software that were developed by the Hydrologic Engineering Center for the U.S. Army Corps of Engineers. The software was developed with the United States Federal Government resources, and is therefore in the public domain. This software can be downloaded for free from the HEC internet site (www.hec.usace.army.mil). HEC does not provide technical support for this software to non-Corps users. See our software vendor list (on our web page) to locate organizations that provide the program, documentation, and support services for a fee. However, we will respond to all documented instances of program errors. Documented errors are bugs in the software due to programming mistakes not model problems due to user-entered data.

Table of Contents

CHAPTER 1	1-1
Introduction	1-1
Contents	1-1
General Philosophy of the HEC-SSP	1-2
Overview of Program Capabilities	1-2
User Interface	1-2
Statistical Analysis Components	1-3
Data Storage and Management	1-3
Graphical and Tabular Output	1-4
Overview of This Manual	1-4
CHAPTER 2	2-1
Installing HEC-SSP	2-1
Contents	2-1
Hardware and Software Requirements	2-2
Installation Procedure	2-2
To install the software onto your hard disk do the following:	2-2
Uninstall Procedure	2-3
CHAPTER 3	3-1
Working With HEC-SSP - An Overview	3-1
Contents	3-1
Starting HEC-SSP	3-2
To Start HEC-SSP from Windows:	3-2
Overview of the Software Layout	3-2
Steps in Performing a Bulletin 17B Frequency Analysis	3-8
Starting a New Study	3-8
Adding a Background Map	3-9
Importing, Entering, and Editing Data	3-10
Performing the Bulletin 17B Flow Frequency Analysis	3-14
Viewing and Printing Results	3-15
CHAPTER 4	4-1
Using the HEC-SSP Data Editor	4-1
Contents	4-1
Developing a New Data Set	4-2
Importing Data from an HEC-DSS File	4-3
Importing Data from the USGS Website	4-4
Importing Data from an Excel Spreadsheet	4-7
Entering Data Manually	4-9
Metadata	4-10
Plotting and Tabulating the Data	4-11
CHAPTER 5	5-1
Performing a Bulletin 17B Flow Frequency Analysis	5-1
Contents	5-1
Starting a New Analysis	5-2
General Settings, Options, and Computations	5-3
General Settings	5-3
Generalized Skew	5-3
Expected Probability Curve	5-4
Plotting Positions	5-4

Table of Contents

Confidence Limits	5-5
Time Window Modification.....	5-5
Options	5-6
Low Outlier Threshold	5-7
Historic Period Data.....	5-7
User Specified Frequency Ordinates.....	5-8
Compute	5-8
Viewing and Printing Results	5-9
Tabular Output	5-9
Graphical Output	5-10
Viewing the Report File	5-12
CHAPTER 6	6-1
Performing a Generalized Frequency Analysis	6-1
Contents	6-1
Starting a New Analysis	6-2
General Settings and Options.....	6-3
General Settings.....	6-3
Log Transform	6-3
Plotting Positions	6-4
Confidence Limits	6-4
Time Window Modification.....	6-5
Options	6-5
Low Outlier Threshold	6-6
Historic Period Data.....	6-7
User Specified Frequency Ordinates.....	6-8
Output Labeling	6-8
Analytical Frequency Analysis	6-9
Settings.....	6-10
Distribution	6-10
Generalized Skew	6-10
Expected Probability Curve.....	6-11
Compute	6-11
Tabular Results.....	6-11
Plot.....	6-13
Graphical Frequency Analysis	6-14
Viewing and Printing Results	6-15
Tabular Output	6-15
Graphical Output	6-16
Viewing the Report File	6-18
CHAPTER 7	7-1
Performing a Volume-Duration Frequency Analysis	7-1
Contents	7-1
Starting a New Volume-Duration Frequency Analysis.....	7-2
General Settings and Options.....	7-3
General Settings.....	7-3
Log Transform	7-3
Plotting Positions	7-4
Maximum or Minimum Analysis.....	7-5
Year Specification.....	7-5
Time Window Modification.....	7-6
Options	7-7
Flow-Durations.....	7-8
User Specified Frequency Ordinates.....	7-8
Output Labeling	7-9

Duration Table	7-9
Analytical Frequency Analysis.....	7-11
Settings	7-12
Distribution.....	7-12
Expected Probability Curve	7-13
Skew.....	7-13
Compute.....	7-14
Tabular Results.....	7-14
Plot	7-15
Statistics.....	7-16
Graphical Frequency Analysis.....	7-17
Curve Input.....	7-18
Plot	7-18
Viewing and Printing Results – Volume-Duration Frequency Analysis.....	7-19
Tabular Output.....	7-19
Graphical Output.....	7-20
Viewing the Report File	7-21
References.....	1
Example Data Sets	1
Example 1: Fitting the Log-Pearson Type III Distribution.....	3
Example 2: Analysis with High Outliers.....	11
Example 3: Testing and Adjusting for a Low Outlier	19
Example 4: Zero-Flood Years	27
Example 5: Confidence Limits and Low Threshold Discharge	35
Example 6: Use of Historic Data and Median Plotting Position	43
Example 7: Analyzing Stage Data.....	51
Example 8: Using User-Adjusted Statistics.....	60
Example 9: General Frequency – Graphical Analysis	70
Example 10: Volume-Duration Frequency Analysis, Maximum Flows	77
Example 11: Volume-Duration Frequency Analysis, Minimum Flows	88
Customizing Plots	1
Customizing Plots: Overview	2
Using Plot Editors.....	3
Setting Defaults vs. Customizing Individual Plots	4
Accessing Editors	5
Recognizing Plot Editors and Tools	6
Plot Properties Editor.....	6
Individual Plot Property Editors	7
Configure Plot Editor	8
Default Line Style Options Editor.....	9
Default Plot Properties Editor	10
Customizing Plot Titles	11
Customizing Curves	12
Customizing Curves in Individual Plots	12
Specifying Parameter-Based Default Curve Styles.....	13
Name and Parameter.....	14
Type	14
Line Number.....	14
Line/Fill.....	14
Adding New Data Styles.....	14
Specifying Line and Point Styles of Curves.....	15
Customizing Curve Labels.....	17
Customizing Curve Quality Symbols	18
Customizing Viewport Properties	19
Customizing Viewport Borders and Background.....	19

Table of Contents

Customizing Viewport Gridlines	20
Adding and Customizing Marker Lines	22
Adding Markers	22
Deleting Markers	23
Customizing Markers.....	23
Editing Callouts	25
Customizing Axes	26
Changing Axis Type	26
Specifying Axis Scale	26
Modifying Tic Marks	28
Customizing Axis Labels	29
Customizing Legends	31
Customizing Window Panels	32
Customizing the Panel Background Color	33
Customizing the Legend Layout.....	33
Customizing the Horizontal Spacer Size.....	34
Customizing Plot Layout	35
Adding and Removing Viewports	35
Setting Viewport Weights	36
Adding and Removing Axes.....	36
Arranging Viewports and Axes.....	37
Reversing Axes (Invert Data)	38
Exporting and Importing Templates.....	38
Additional Viewing Options for Plots.....	39
Viewing Data in Tabular Form.....	40
Saving Plots	40
Copying Plots to the Clipboard.....	41
Printing Plots.....	42

Foreword

The U.S. Army Corps of Engineers' Statistical Software Package (HEC-SSP) is software that allows you to perform statistical analyses of hydrologic data.

The first official version of HEC-SSP (version 1.0) was released in August of 2008.

The HEC-SSP software was designed by Mr. Gary Brunner, Mr. Jeff Harris, Dr. Beth Faber, and Mr. Matthew Fleming. The HEC-SSP user interface was programmed by Mr. Mark Ackerman, and the computational code was programmed by Mr. Paul Ely. This manual was written by Mr. Gary Brunner and Mr. Matthew Fleming.

C H A P T E R 1

Introduction

Welcome to the U.S. Army Corps of Engineers Statistical Software Package (HEC-SSP) developed by the Hydrologic Engineering Center. This software allows you to perform statistical analyses of hydrologic data. The current version of HEC-SSP can perform flood flow frequency analysis based on Bulletin 17B, "Guidelines for Determining Flood Flow Frequency" (1982), a generalized frequency analysis on not only flow data but other hydrologic data as well, and a volume-duration frequency analysis on high and low flows.

The HEC-SSP software system was developed as a part of the Hydrologic Engineering Center's "Next Generation" (NexGen) development of hydrologic engineering software. The NexGen project encompasses several aspects of hydrologic engineering, including rainfall-runoff analysis, river hydraulics, reservoir system simulation, flood damage analysis, and real-time river forecasting for reservoir operations.

This chapter discusses the general philosophy of HEC-SSP and gives a brief overview of the capabilities of the software system. An overview of this manual is also provided.

Contents

- General Philosophy of the HEC-SSP
- Overview of Program Capabilities
- Overview of This Manual

General Philosophy of the HEC-SSP

HEC-SSP is an integrated system of software, designed for interactive use in a multi-tasking environment. The system is comprised of a graphical user interface (GUI), separate statistical analysis components, data storage and management capabilities, mapping, graphics, and reporting tools.

Over a period of many years, the Hydrologic Engineering Center has supported a variety of statistical packages that perform frequency analysis and other statistical computations. Historically, the programs that received the most use within the Corps of Engineers were HEC-FFA (Flood Frequency Analysis) and STATS (Statistical Analysis of Time Series Data). FFA incorporates Bulletin 17B procedures that have been adopted by the Corps for flow frequency analysis. The STATS software package is used for statistical analysis of time series data. STATS can provide either analytical or graphical frequency analysis, specified by the user. STATS has the capability of computing monthly and annual maximum, minimum, and mean values along with computing a volume-duration analysis. Two other packages that used to receive a lot of use within the Corps of Engineers are REGFRQ (Regional Frequency Computation) and MLRP (Multiple Linear Regression Program). REGFRQ performs regional frequency analysis and MLRP is a multiple linear regression analysis tool.

The goal of HEC-SSP is to ultimately combine all of the statistical analyses capabilities of HEC-FFA, STATS, REGFRQ and MLRP. The current version of HEC-SSP supports performing flood flow frequency analyses based on Bulletin 17B Guidelines, generalized frequency analyses, and volume-duration frequency analyses. New features and additional capabilities will be added in future releases.

Overview of Program Capabilities

HEC-SSP is designed to perform statistical analyses of hydrologic data. The following is a description of the major capabilities of HEC-SSP.

User Interface

The user interacts with HEC-SSP through a graphical user interface (GUI). The main focus in the design of the interface was to make it easy to use the software, while still maintaining a high level of efficiency for the user. The interface provides for the following functions:

- File management
- Data entry, importing, and editing
- Statistical analyses
- Tabulation and graphical displays of results
- Reporting facilities

Statistical Analysis Components

Flow Frequency Analysis (Bulletin 17B) – This component of the software allows the user to perform annual peak flow frequency analyses. The software follows guidelines in Bulletin 17B, "Guidelines for Determining Flood Flow Frequency," by the Interagency Advisory Committee on Water Data.

Generalized Frequency Analysis – This component of the software allows the user to perform annual peak flow frequency analyses by various methods. Additionally the user can perform frequency analysis of variables other than peak flows, such as stage and precipitation data.

Volume-Duration Frequency Analysis – This component of the software allows the user to perform a volume-duration frequency analyses on daily flow data.

Data Storage and Management

Data storage is accomplished through the use of "text" files (ASCII and XML), as well as the HEC Data Storage System (HEC-DSS). User input data are stored in flat files under separate categories of study, analyses, and a data storage list. Gage data are stored in a project HEC-DSS file as time series data. Output data is predominantly stored in HEC-DSS, while a summary of the results is written to an XML file. Additionally, an analysis report file is generated whenever a computation is made. This report file is written to a standard ASCII text file.

Data management is accomplished through the user interface. The modeler is requested to enter a Name and Description for each study being developed. Once the study name is entered, a directory with that name is created, as well as a study file. Additionally a set of subdirectories is created with the following names: Bulletin17bResults, GeneralFrequencyResults, VolumeFrequencyAnalysisResults, Layouts, and Maps. As the user creates new analyses, an analysis file is created in the main project directory. The interface provides for renaming and deletion of files on a study-by-study basis.

Graphical and Tabular Output

Graphics include a map window, plots of the raw data, and frequency curve plots. The map window can be used to display background map layers. Locations of the data being analyzed can be displayed on top of the map layers. Once data are brought into HEC-SSP, they can be plotted for visual inspection. The frequency curve plots shows the results of the analyses, which include the analytically computed curve, the expected probability curve, confidence limits, and the raw data points plotted based on the selected plotting position method. Tabular output consists of tables showing the computed frequency curves, confidence limits, and summary statistics. All graphical and tabular output can be displayed on the screen, sent directly to a printer (or plotter), or passed through the Windows Clipboard to other software, such as a word-processor or spreadsheet.

A report file is available for each analysis. This report file includes the input data, preliminary results, all of the statistical tests (Low and High Outliers, Broken Record, Zero Flows Years, Incomplete Record, Regional Skews, and Historic Information), and final results. This report file is similar to the FFA output file.

Overview of This Manual

This user's manual is the primary documentation on how to use HEC-SSP. The manual is organized as follows:

- Chapters 1-2 provide an introduction and overview of HEC-SSP, as well as instructions on how to install the software.
- Chapter 3 provides an overview on how to use the HEC-SSP software in a step-by-step procedure, including a sample problem that the user can follow.
- Chapter 4 explains in detail how to enter and view data.
- Chapter 5 provides a detailed discussion on how to perform the Bulletin 17B flow frequency analysis. Additionally, this chapter describes all of the output capabilities available for displaying and printing the results.
- Chapter 6 provides a detailed discussion on how to use the generalized frequency analysis editor.
- Chapter 7 provides a detailed discussion on how to use the volume-duration frequency analysis editor.
- Appendix A contains a list of references.
- Appendix B has a series of example analyses that demonstrate the various capabilities of performing a Bulletin 17B flow frequency analysis, performing a general frequency analysis, and performing a volume-duration frequency analysis.

- Appendix C contains a detailed description of how to customize the graphical plots in HEC-SSP.

C H A P T E R 2

Installing HEC-SSP

You install HEC-SSP using the program SETUP.EXE. The Setup program installs the software and the example applications. This chapter discusses the hardware and system requirements needed to use HEC-SSP, how to install the software, and how to uninstall the software.

Contents

- Hardware and Software Requirements
- Installation Procedure
- Uninstall Procedure

Hardware and Software Requirements

Before you install the HEC-SSP software, make sure that your computer has at least the minimum required hardware and software. In order to get the maximum performance from the HEC-SSP software, recommended hardware and software is shown in parentheses. This version of HEC-SSP will run on a microcomputer that has the following:

- Intel Based PC or compatible machine with Pentium processor or higher (a Pentium 4 or higher is recommended).
- A hard disk with at least 100 megabytes of free space
- A CD-Rom drive (or CD-R, CD-RW, DVD), if installing from a CD.
- A minimum of 512 megabytes of RAM (1 Gigabyte or more is recommended).
- A mouse.
- Color Video Display (Recommend running in 1152x864 or higher, and as large a monitor as possible). Recommend at least a 17" monitor.
- MS Windows NT 4.0, 2000, XP, or Vista (or later versions).

Installation Procedure

Installation of the HEC-SSP software is accomplished through the use of the Setup program.

To install the software onto your hard disk do the following:

1. Insert the HEC-SSP CD into your CD drive (or download the software from our web page: www.hec.usace.army.mil).
2. The setup program should run automatically if installing from a CD. When downloading from the web page you will need to save the setup file in a temporary directory and then execute the "HEC-SSP10_Setup.exe" file to run the setup program.
3. If the setup program does not automatically run from the CD, use the windows explorer to start the HEC-SSP10_Setup.exe program on the CD.
4. Follow the setup instructions on the screen.

The setup program automatically creates a program group called HEC. This program group will be listed under the Programs menu, which is under the Start menu. The HEC-SSP program icon will be contained within the HEC program group, within the HEC-SSP subdirectory. The

user can request that a shortcut icon for HEC-SSP be created on the desktop. If installed in the default directory, the HEC-SSP executable can be found in the C:\Program Files\HEC\HEC-SSP\1.0 directory with the name "SSP.EXE".

The HEC-SSP User's Manual and example data sets are also installed with the software. The User's Manual can be viewed by selecting **User's Manual** from the **Help** menu. You must have Adobe Acrobat Reader to view the user's manual. This viewer can be obtained for free from the Adobe web page.

A zip file containing the example data sets described in Appendix B have been installed in the "...**Examples**" folder within the program directory. You can install the example data sets by selecting the **Install Example Data** option from the **Help** menu. After selecting the Install Example Data menu option, a window will open for you to choose a location to install the example data sets. The program will create a subdirectory within your chosen folder called **SSP_Examples**. A project file called "SSP_EXAMPLES.ssp" will be contained in the SSP_Examples folder. You can load the test data sets by using the **Open Study** option from the File menu and then use the file chooser to select this file.

Uninstall Procedure

The HEC-SSP Setup program automatically registers the software with the Windows operating system. To uninstall the software, do the following:

- From the Start Menu select Control Panel.
- Select Add/Remove Programs from within the Control Panel folder.
- From the list of installed software, select the HEC-SSP program and press the Remove button.
- Follow the uninstall directions on the screen and the software will be removed from your hard disk.

CHAPTER 3

Working With HEC-SSP - An Overview

HEC-SSP is an integrated package of statistical analysis modules, in which the user interacts with the system through the use of a Graphical User Interface (GUI). The current version is capable of performing flow frequency analyses based on the Bulletin 17B “Guidelines for Determining Flood Flow Frequency,” dated March 1982, generalized frequency analyses, and volume-duration frequency analyses. This chapter provides an overview of how a Bulletin 17B flow frequency analyses can be performed with the HEC-SSP software. General frequency and volume-duration frequency analyses can be developed in a similar manner as outlined for the Bulletin 17B analysis.

In HEC-SSP terminology, a **Study** is a set of files associated with a particular set of data and statistical analyses being performed. The files for a study are categorized as follows: study information, data list, and analysis data.

Contents

- Starting HEC-SSP
- Overview of the Software Layout
- Steps in Performing a Bulletin 17B Frequency Analysis

Starting HEC-SSP

When you run the HEC-SSP Setup program, a new program group called **HEC** and program icon called **HEC-SSP** are created. They should appear in the start menu under the section called **All Programs**. The user also has the option of creating a shortcut on the desktop. If a shortcut is created, the icon for HEC-SSP will look like the following:



HEC-SSP 1.0

Figure 3-1. The HEC-SSP Icon.

To Start HEC-SSP from Windows:

- Double-click on the HEC-SSP Icon. If you do not have an HEC-SSP shortcut on the desktop, go to the **Start** menu and select **All Programs** → **HEC** → **HEC-SSP** → **HEC-SSP 1.0**.

Overview of the Software Layout

When you first start HEC-SSP, you will see the main window as shown in Figure 3-2, except you will not have any study data on your main window. As shown in Figure 3-2, the main window is laid out with a Menu Bar, a Tool Bar, and four window panes.

The upper right pane (which represents most of the window area) is the **Desktop Area** (Referred to as the “Desktop” from this point in the manual). This area is used for displaying maps, data editors, and analysis windows.

The upper left pane is called the **Study Explorer**. The Study Explorer acts like an explorer tree into the study. The top level of the tree is the study (Clarion River in this example). Below the study is an analyses branch, a data branch, and a map branch. Under the analyses branch, the first level is the types of analysis in the current study. Under each analysis type will be the current user-defined analyses for that type. The data branch lists all of the available data sets that have been brought into the current study. Generally, a data set represents a piece of data at a specific gage location. For example, all of the peak annual flows at a single gage would be stored as a single data set. When an analysis is created, the user selects a data set to be used for that particular analysis. The Map branch of the tree contains any maps the user has put together for the study. By default there is automatically a “Base Map” listed under the maps folder.

The lower left pane, and associated tabs, also belongs to the study explorer. This window is used to show additional information about items selected in the study explorer tree. The tabs are used to switch to different views within the study explorer window. The first tab, labeled Study, shows the explorer view of the study. The second tab, labeled Maps, lists the available maps and map layers associated with each map. The last tab, labeled Files, shows all of the files that make up the current study.

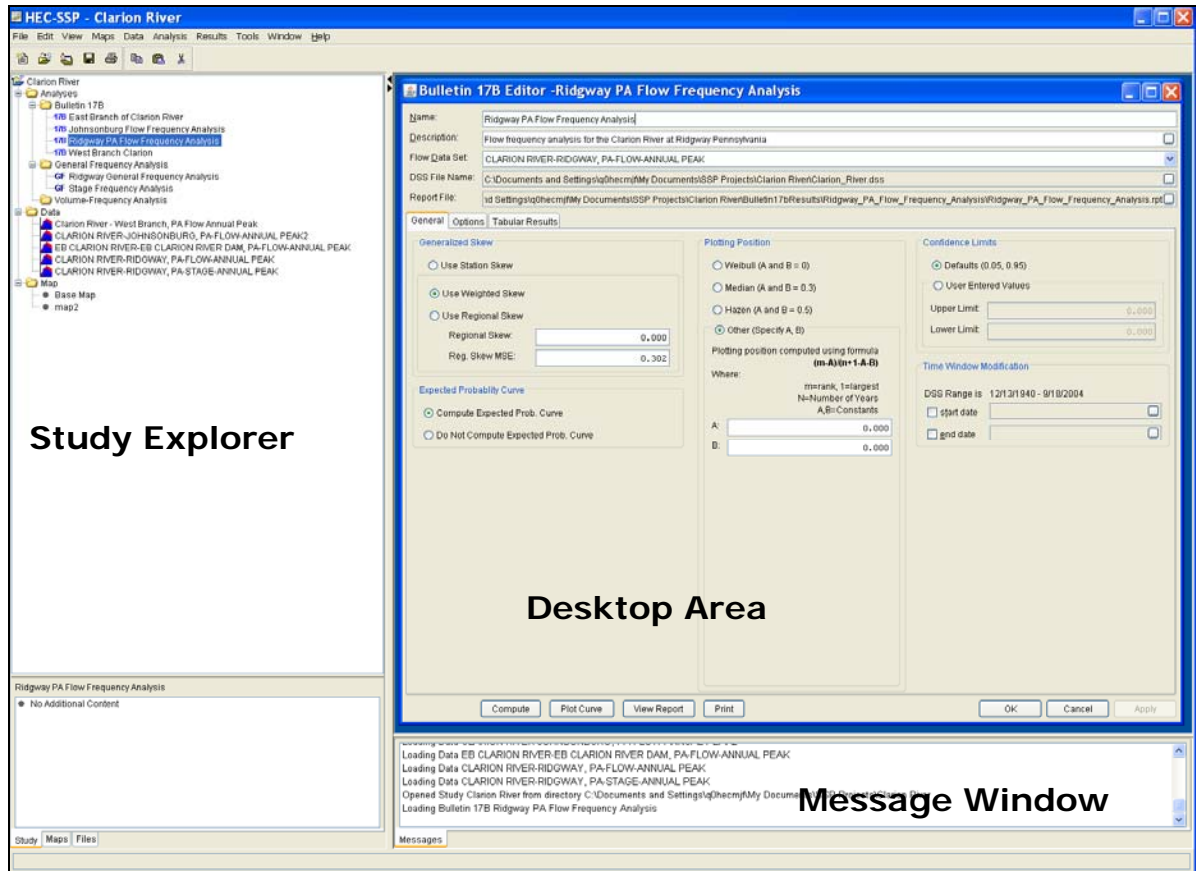
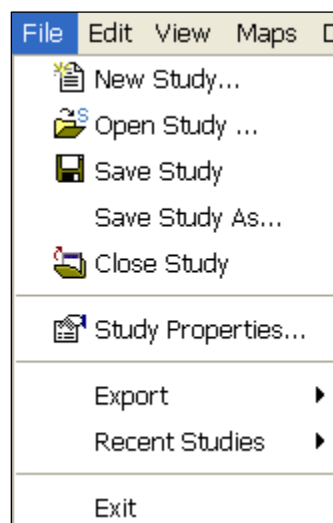


Figure 3-2. The HEC-SSP Main Window.

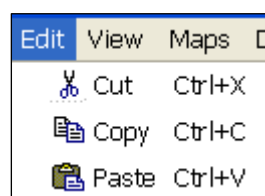
The lower right pane is called the **Message Window**. This window is used to display messages from the software as to what it is doing.

At the top of the HEC-SSP main window is a Menu bar with the following options:

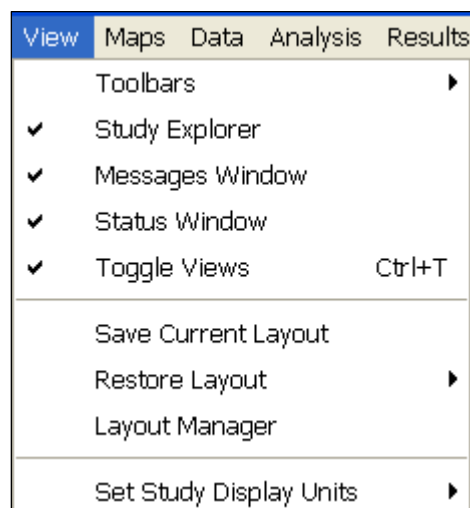
File: This menu is used for file management. Options available under the File menu include New Study, Open Study, Save Study, Save Study As, Close Study, Study Properties, Export, Recent Studies, and Exit. The Study Properties option is used to describe the study and to set the units system. The Export option is used to export HEC-SSP results, stored in the study DSS file, to another DSS file. The Recent Studies option lists the most recently opened studies, which allows the user to quickly open a study that was recently worked on.



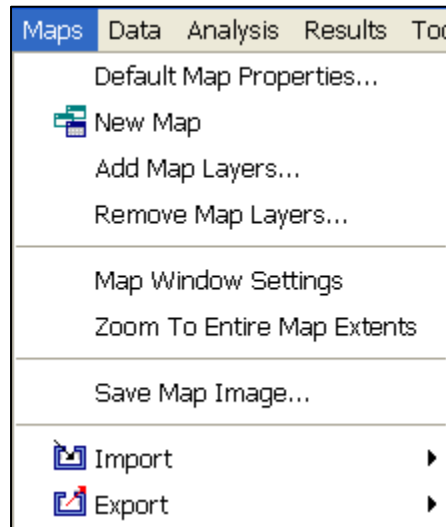
Edit: This menu is used for applying the Cut, Copy, and Paste clipboard features to data in editable fields and tables.



View: The View menu allows the user to control display of the toolbars and the study windows. The user can also toggle between viewing all of the panes or just the Main View Pane. The View menu also has options for saving the current layout (currently opened windows and their sizes and locations) and restoring a previous saved layout. The final option on the View menu is to set the study display units. This option allows the user to switch viewing output between English and metric units.



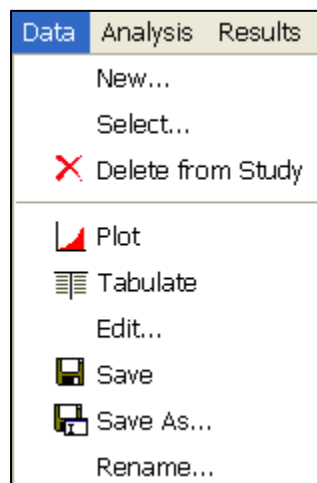
Maps: This menu is used to set the Default Map Properties



(Coordinate system, extents, etc...), define a new map, add map layers to the study, and remove a map. Additionally, this menu has the following options available: Map Window Settings (allows the user to turn map layers on and off), Zoom To Entire Map Extents, Save Map Image, Import, and Export. The Zoom To Entire Map Extents option displays the entire set of map layers within the map window. The Save Map Image option can be used to save the current view of the map to a file. The import and export options currently support importing and exporting a stream alignment to

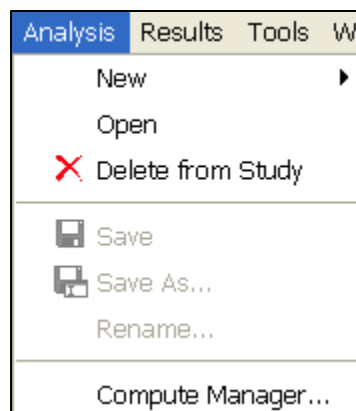
the map window. Later versions of the software will have additional import and export options.

Data: This menu allows the user to define a new data set, open an



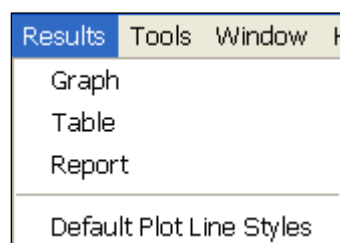
existing data set with the data editor, and delete any existing data sets from the data list. Other options include opening a plot and table of the data.

Analysis: This menu is used to create the various statistical analyses available in the software. Each statistical analysis is saved as a separate file containing the information that is pertinent to that



specific analysis type. The current options under this menu item include New, Open, Delete from Study, Save, Save As, Rename, and Compute Manager. The compute manager allows the user to select one, several, or all of the analyses, and then have them all recomputed.

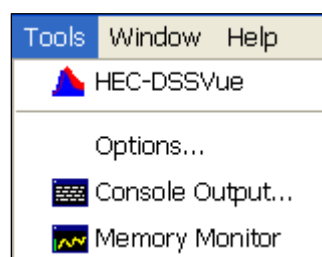
Results: This menu allows the user to graph and tabulate any of the existing analyses that have been computed. Additionally, the user can



request to view the report file from a computed analysis. Users must select at least one analysis in the Study Tree before selecting either Graph, Table, or Report. If more than one analysis of the same type are selected (this is accomplished by holding down the control key while clicking on the various analyses), the Graph option will plot the results from all analyses that are

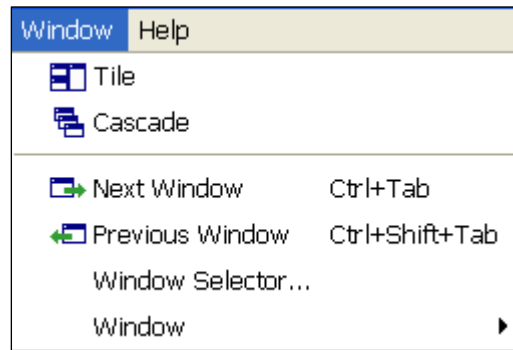
selected in the same plot. However, when multiple analyses are selected, the Table and Report option bring up separate windows for each of the selected analyses. The Default Plot Line Styles menu option lets the user change the default line styles applied to different data types that are plotted in a graph. For example, the user can change the default line style for high outliers so that they are displayed as black triangular data points when a plot is opened.

Tools: This menu includes HEC-DSSVue, Options, Console Output, and Memory Monitor. The Hec-DSSVue option brings up the Hec-



DSSVue program and automatically loads the current study DSS file. Hec-DSSVue is a DSS utility to tabulate, graph, edit, and enter data into DSS. The Options menu item brings up an options window that allows the user to set default HEC-SSP options.

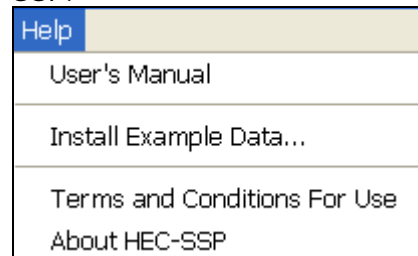
Window: This menu includes Tile, Cascade, Next Window, Previous Window, Window Selector, and Window. All these options are used to control the appearance of the windows in the Desktop area. When



more than one window is open (such as a data editor, and various analysis windows), these menu items will help the user organize the windows, or quickly navigate to a specific window. The Tile option can be used to organize all of the currently opened windows in either a vertical or horizontal tile. The Cascade option puts one window on top of the next

in a cascading fashion. The Next Window option brings the next window in the list of currently opened windows to the top. The Previous Window brings the last window that was on top back to the top. The Window Selector option brings up a pick list of the currently opened windows and allows you to select the one you want. The Window option has a sub menu list of all the opened windows and allows you to select one.

Help: This menu allows the user to open the HEC-SSP User's Manual, install example data sets, read the terms and conditions of use statement, and display the current version information about HEC-SSP.



Also on the HEC-SSP main window is a Tool Bar. The buttons on the tool bar provides quick access to the most frequently used options under the HEC-SSP File and Edit menus.

Steps in Performing a Bulletin 17B Frequency Analysis

There are five main steps in performing a Bulletin 17B flow frequency analysis with HEC-SSP. Similar steps are required when performing a generalized frequency or volume-duration analysis.

- Starting a new study
- Adding a Background Map (Optional)
- Importing, Entering, and Editing Data
- Performing the Bulletin 17B Frequency Analysis
- Viewing and Printing Results

Starting a New Study

The first step in performing a Flow Frequency analysis with HEC-SSP is to establish which directory you wish to work in and to enter a title for the new study. To start a new study, go to the **File** menu and select **New Study**. This will bring up a New Study window as shown below.

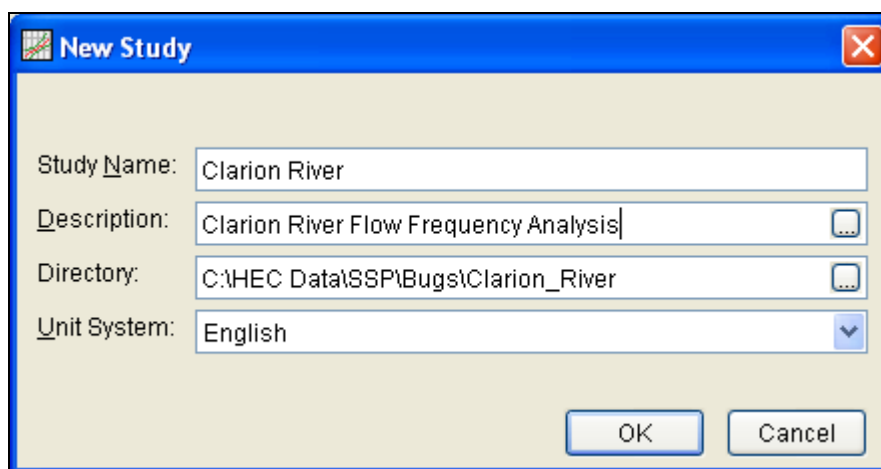


Figure 3-3. New Project Window.

As shown in Figure 3-3, the user is required to enter a name for the study, select a directory to work in (a default location is provided), and select the desired units system. Adding a description of the study is optional. Once you have entered all the information, press the **OK** button to have the information accepted. After the **OK** button is pressed, a subdirectory will be created under the user chosen directory. The subdirectory will be labeled the same name as the user-entered study name. This study directory is where the project file, as well as other study files and directories will be located. Additionally, a default map window will appear in the Main View Pane. However, the map window will be blank when it first opens.

Adding a Background Map

By default, when you start a new project in HEC-SSP a default map window (called Base Map) will open in the Desktop window. Having a background map is optional in HEC-SSP. Not having a map does not prevent the user from importing and entering data, or performing an analysis and viewing results. The map is mostly a visual aid of the study area. Additionally, when you bring in gage data you can enter the map coordinates of the gage and it will show up on the map. Once a gage is located on the map you can right click on it and get a pop-up menu for viewing the data, or graphing and tabulating the results.

To add a map layer to the default map, go to the **Maps** menu and select **Add Map Layers**. When this option is selected a file chooser window will appear, as shown in Figure 3-4, allowing the user to select map layers to bring into the map. The **Create Copy** option on the window will make a copy of the selected map and place it in the Maps subdirectory of the study folder.

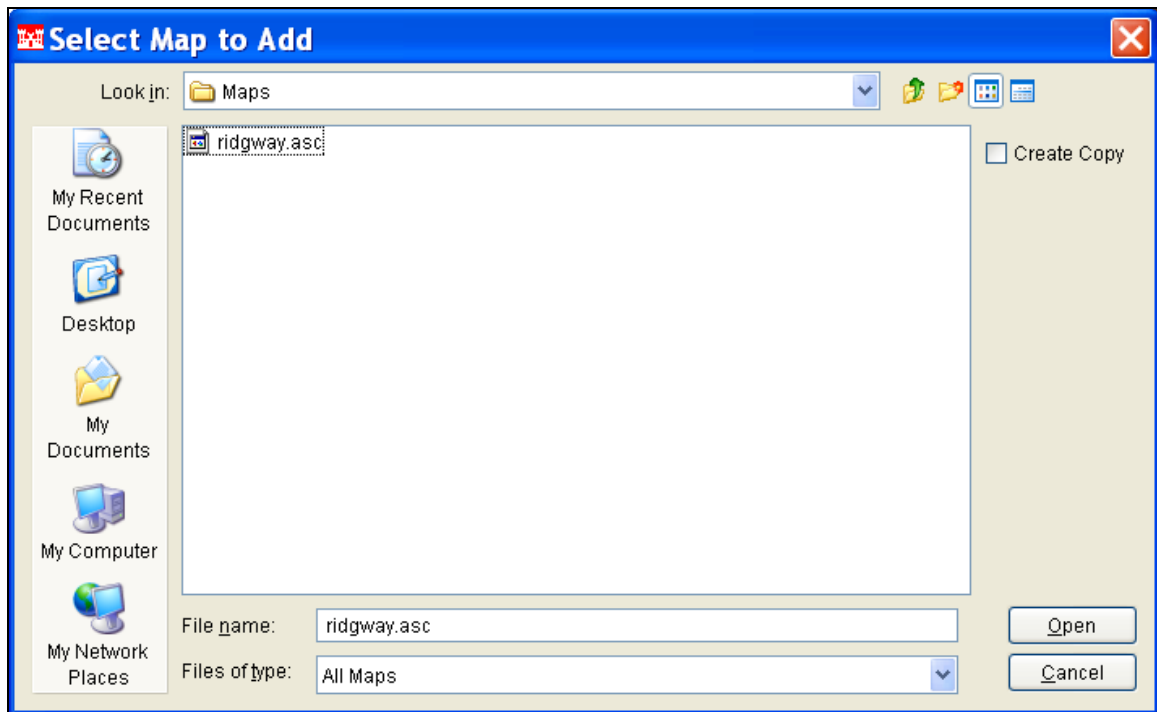


Figure 3-4. Add Map Layers File Chooser.

Currently, the HEC-SSP software can load the following types of map layers: USGS DLG, AutoCAD DXF, shapefile, Raster Image, USGS DEM, Arc Info DEM, ASCII NetTIN, and Mr Sid.

An example map is shown in Figure 3-5. This map is an Arc Info DEM that was exported in the ASCII file format.

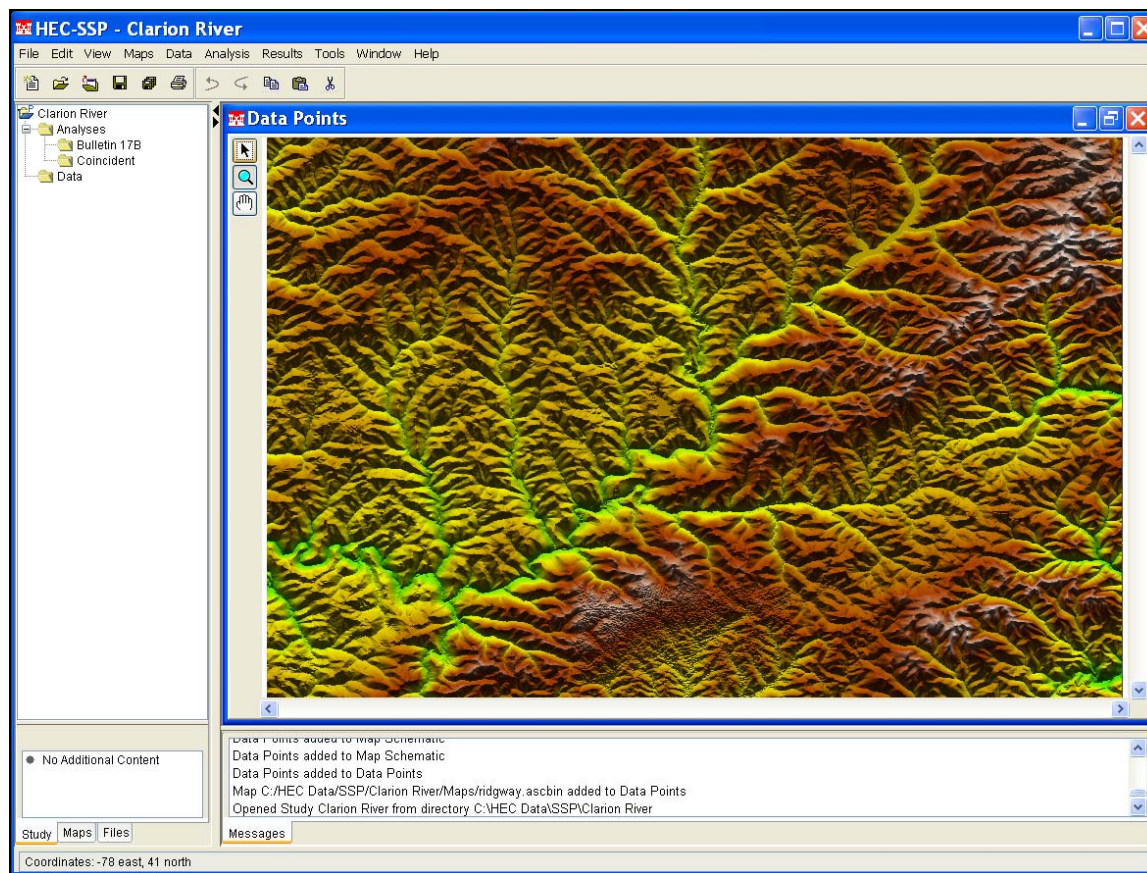


Figure 3-5. Example Background Map.

If more than one map layer is going to be used to make up a map, then it is up to the user to ensure that all map layers are in the same coordinate system. HEC-SSP does not perform coordinate system projections. Also, HEC-SSP can not always determine the coordinate system for all map layers entered. However, under the **Maps** menu is an option called **Default Map Properties**. This menu option can be used to set the default coordinate system for the map layers displayed in HEC-SSP. The user should set the default coordinate system first and then bring in map layers to the study.

Importing, Entering, and Editing Data

Before any analyses can be performed, the user must bring data into the HEC-SSP study. For a peak flow frequency analysis following guidelines in Bulletin 17B, the data must consist of peak annual flow data. To bring data into HEC-SSP go to the **Data** menu and select **New**. This will bring up the data editor as shown in Figure 3-6.

Data Editor -

Name: Short ID:

Description:

Study DSS File: C:\Documents and Settings\lg0hecmj\My Documents\SSP Projects\Clarion River\Clarion_River.dss

Data Source **Details**

Location

☐ HEC-DSS ☒ USGS Website ☐ MS Excel ☐ Manual

USGS Website

Data Type:

Import Data	USGS Station ID's	Basin Name (A Part)	Location (B Part)	Other Qualifier (F Part)
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				

Figure 3-6. HEC-SSP Data Editor.

As shown in Figure 3-6, the Data Editor has fields for the Name, Short Identifier, and the Description of the data at the top of the window. Additionally it lists the study DSS file name that the data will be stored in once it is brought into the study. The study DSS file is always labeled the same name as your study with the .DSS file extension.

The Data Editor contains two tabs, **Data Source** and **Details**. The **Data Source** tab is shown first. This tab is used for selecting and defining a source for bringing data into the HEC-SSP study. Currently, there are four ways to bring data into an HEC-SSP study: import from another HEC-DSS file, import data from the USGS web site, import from a Microsoft Excel spreadsheet, and manually entering the data into a table. All of these methods will import data into the study DSS file.

For this example, only importing data from the USGS website will be shown. For a complete description of the data editor see Chapter 4, Using the Data Editor. To import data from the USGS website, first select the **USGS Website** option from the list of four options available in the Location panel. Next, select **Annual Peak Data** as the data type. The next step is to press the button labeled **Get USGS Station ID's by State**. When this button is pressed a pop-up window will appear (Figure 3-7) allowing the user to select a state from which to get data.

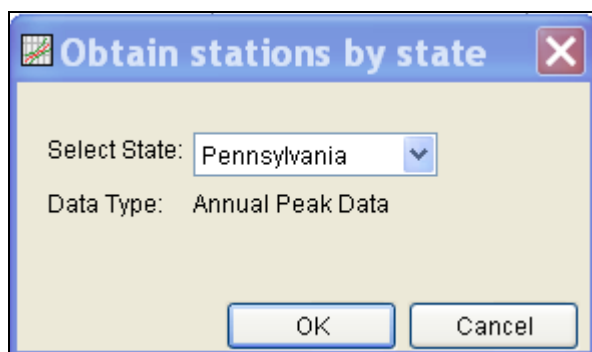


Figure 3-7. Window to Select a State for Downloading Data.

Once a state is selected, press the **OK** button and a list of the available gages from that state will appear in a pick list as shown in Figure 3-8. Check the boxes for all of the gages you would like to import and then press the **Import to Study DSS File** button. Once the import button is pressed, a process will begin in which the data will be downloaded from the USGS website and saved in the study DSS file. HEC-SSP will automatically name the data when importing multiple gages at one time. The USGS import process will download annual peak flow data, annual peak stage data, and the USGS data quality codes. Therefore, for each gage location you request, multiple DSS records will be written to the study DSS file.

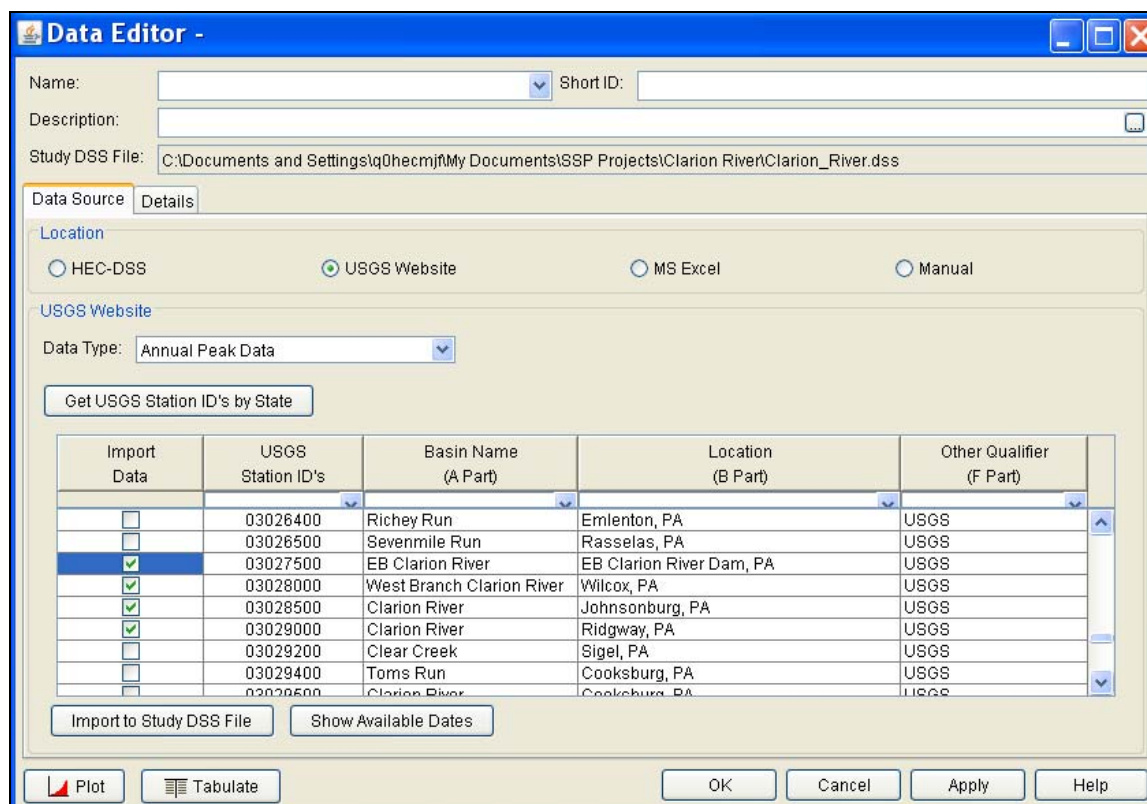


Figure 3-8. Example of Choosing Gages from a USGS State List to Import.

In addition to the data itself, any metadata that is available will be downloaded and stored with the data. The metadata can be viewed from the **Details** Tab on the Data Editor. An example of metadata on the Details tab is shown in Figure 3-9.

The screenshot shows the 'Data Editor - Clarion River at Ridgway, PA' window. The 'Details' tab is selected, displaying the following fields:

- Name:** Clarion River at Ridgway, PA (dropdown menu)
- Short ID:** (empty text field)
- Description:** Downloaded from USGS website. Station 03029000 (text field)
- Study DSS File:** C:\HEC Data\Clarion River\Clarion_River.dss (text field)
- Data Source:** Details (tab)
- State:** Pennsylvania (dropdown menu)
- County:** Elk (dropdown menu)
- Stream:** Clarion River (dropdown menu)
- Location:** Ridgway, PA (text field)
- Drainage Area:** (empty text field)
- DA Units:** (empty text field)
- Gage Operator:** (empty text field)
- USGS No:** (empty text field)
- Gage Datum:** (empty text field)
- HUC:** (empty text field)
- Vertical Datum:** (empty dropdown menu)
- Description:** (empty text field)
- Coordinate Location Data:**
 - Coordinate System:** Lat/Long (dropdown menu)
 - Coordinate ID:** 0 (text field)
 - Horizontal Datum:** NAD83 (dropdown menu)
 - Datum Units:** Decimal Degrees (dropdown menu)
 - Coordinate X Value:** -78.736 (text field)
 - Coordinate Y Value:** 41.421 (text field)

At the bottom, there are buttons for 'Plot', 'Tabulate', 'OK', 'Apply', and 'Cancel'.

Figure 3-9. Example Metadata on the Details Tab.

As shown in Figure 3-9, the metadata consists of the State, County, Stream, Location, Drainage Area, DA Units, Gage Operator, USGS Gage No., Gage Datum, HUC (Hydrologic Unit Code), Vertical Datum, and a description field. Additionally, the coordinate location of the data is shown. The coordinate location consists of Coordinate System, Coordinate ID, Horizontal Datum, Datum Units, Coordinate X Value, and Coordinate Y Value. Most of the USGS data is retrieved with the Latitude/Longitude coordinate system as shown in the example.

If the metadata does not download automatically, the user has the option to enter any of the information by hand. Metadata is not generated automatically for any of the other three data sources. Therefore, entering the metadata is required if the user wants the data to be carried along with the study.

After the data is imported into the study, the user can select any one of the gages from the drop down list located in the **Name** field at the top of the Data Editor. The user has the option to change the name of the data, enter a short identifier, and put in a longer description of the

data. Additionally, at the bottom of the data editor is a Plot and Tabulate button. If you press the **Plot** button you will get a plot of the peak flow data for that gage. If you press the **Tabulate** button you will get a table containing the data.

Once you are satisfied with the data and metadata that have been imported, press the **OK** button to close the Data Editor and save the data. The **Apply** button is used to accept the data for use in the computations, without closing the editor. The **Cancel** button will close the editor and not apply anything that was done while in the data editor.

If the data has coordinate location information, it will then be plotted



on top of the background maps. The software will convert the coordinates of the point data to the default coordinate system of the base map. The user can interact with the plotted points. by right clicking on the gage icon and a pop-up menu will appear as shown to the left. The user has the option to edit the data, plot the data, tabulate it, rename the label, or delete the data.

Performing the Bulletin 17B Flow Frequency Analysis

To perform a Bulletin 17B flow frequency analysis, go to the **Analysis** menu and select **New → Bulletin 17B Flow Frequency**. This will bring up a blank Bulletin 17B Analysis editor. As shown in Figure 3-10, the user must enter a name for the analysis, a description (optional), and select a flow data set (gage data stored in project DSS file). The DSS File Name and Report File are automatically filled in by the program. For now, the DSS File Name will be the study DSS file and the report file will have the same name as the analysis.

The analysis window contains three tabs: General, Options, and Tabular Results. The **General** tab contains settings for Generalized Skew, Expected Probability Curve, Plotting Positions, Confidence limits, and a Time Window Modification. Default settings are already established for each of the options on the General tab; however, the user can change the default settings.

The **Options** tab contains information on Low Outlier Threshold, Historic Period Data, and User-Specified Frequency Ordinates. These options are not required for most analyses but may be necessary depending upon the data.

A detailed description of each of the Bulletin 17B settings and options can be found in Chapter 5, Performing a Bulletin 17B Flow Frequency Analysis. Once all of the settings and options have been selected, the user presses the **Compute** button to have the computations performed. When the computations have finished a message window will pop-up stating **Compute Complete**. Press the **OK** button on the

message window to close the window. Once the computations have finished the user can begin to look at output.

The screenshot shows the 'Bulletin 17B Editor' window. At the top, there are input fields for 'Name:', 'Description:', 'Flow Data Set:', 'DSS File Name:', and 'Report File:'. Below these are three tabs: 'General' (selected), 'Options', and 'Tabular Results'. The 'General' tab contains several sections:

- Generalized Skew:** Three radio buttons: 'Use Station Skew' (selected), 'Use Weighted Skew', and 'Use Regional Skew'. Below 'Use Regional Skew' are input fields for 'Regional Skew:' and 'Reg. Skew MSE:'.
- Expected Probability Curve:** Two radio buttons: 'Compute Expected Prob. Curve' (selected) and 'Do Not Compute Expected Prob. Curve'.
- Plotting Position:** Four radio buttons: 'Weibull (A and B = 0)' (selected), 'Median (A and B = 0.3)', 'Hazen (A and B = 0.5)', and 'Other (Specify A, B)'. Below these is a section titled 'Plotting position computed using formula' with the formula $(m-A)/(n+1-A-B)$ and 'Where: m=rank, 1=largest; N=Number of Years; A,B=Constants'. There are input fields for 'A:' and 'B:'.
- Confidence Limits:** Two radio buttons: 'Defaults (0.05, 0.95)' (selected) and 'User Entered Values'. Below 'User Entered Values' are input fields for 'Upper Limit:' and 'Lower Limit:'.
- Time Window Modification:** A section titled 'DSS Range is' with two checkboxes: 'start date' and 'end date', each followed by an input field.

At the bottom of the window are buttons: 'Compute', 'Plot Curve', 'View Report', 'Print', 'OK', 'Cancel', and 'Apply'.

Figure 3-10. Bulletin 17B Flow Frequency Analysis Editor.

Viewing and Printing Results

Tabular output can be found by selecting the **Tabular Results** tab. When this tab is pressed, a set of tables will appear as shown in Figure 3-11. The primary table on the **Tabular Results** tab consists of percent chance exceedance, computed flow frequency curve, the expected probability adjusted curve, and the 5 and 95 percent confidence limits. The second table (bottom left) contains general statistics about the data, such as the mean, standard deviation, station skew, regional skew, weighted skew, and the adopted skew of the analysis. The third table (bottom right) contains the number of historic events, high outliers, low outliers, zero or missing values, systematic events in the data set, and the number of years in the historic period. The table can be sent to the printer by pressing the **Print** button at the bottom of the analysis window.

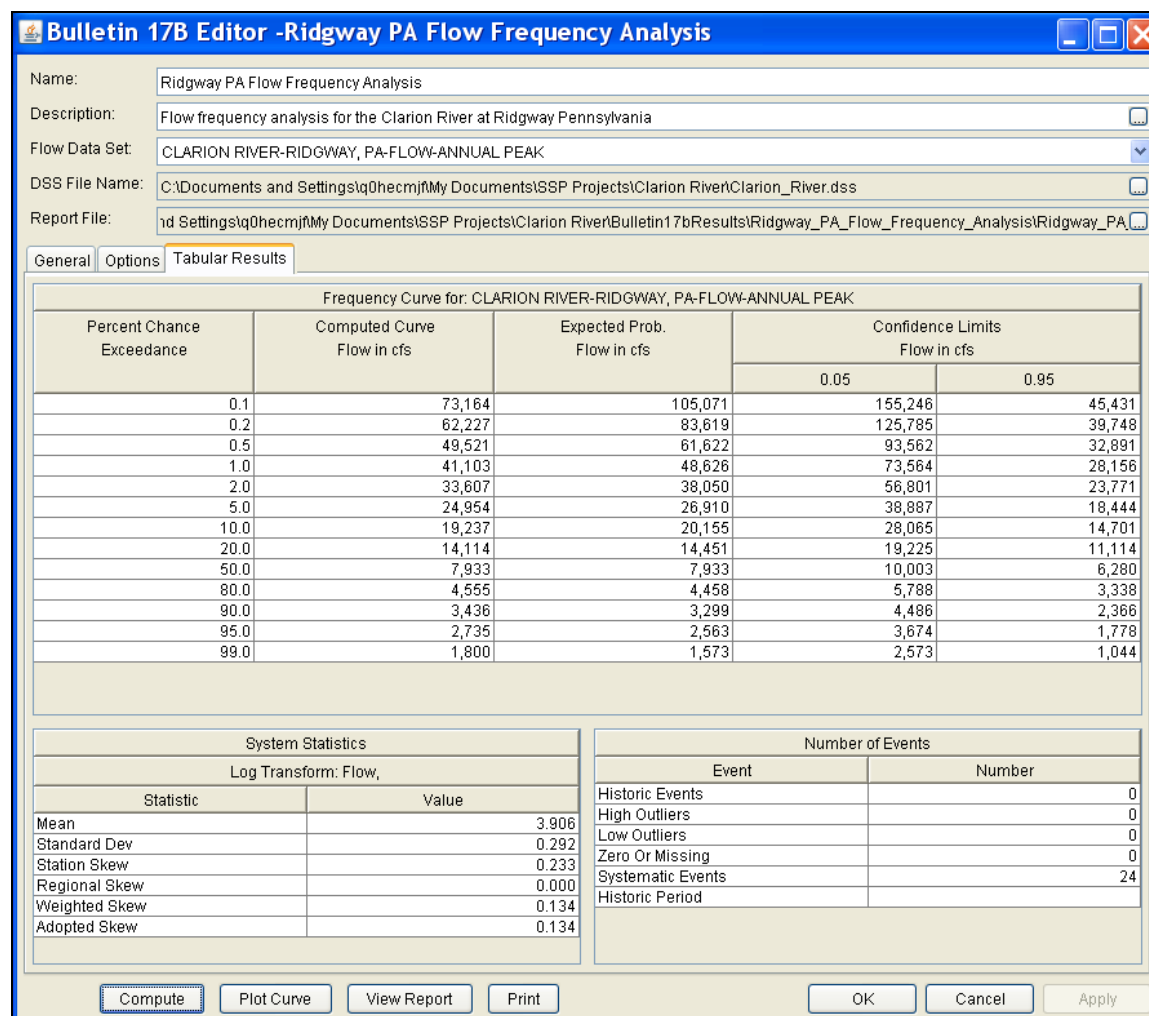


Figure 3-11. Tabular Results of Bulletin 17B Editor.

Graphical output can be obtained by pressing the **Plot Curve** button at the bottom of the analysis editor. When this button is pressed, a plot will appear like the one in Figure 3-12. This plot contains the computed frequency curve, the expected probability adjusted curve, the confidence limits, and the data points plotted by the user-selected plotting position method. Additionally, a plot caption is listed at the top. The plot caption is by default the user-defined name of the analysis. The user can modify the plot properties by selecting the **Edit→Plot Properties** menu option. A plot properties window will open that lets the user change the line style for each data type, change the axis labels, modify the plot title, and edit other plot properties. The user can also edit line styles by placing the mouse on top of the line or data point in the plot or legend and clicking the right mouse button. Then select the **Edit Properties** menu option in the pop-up menu. The plot can be printed or sent to the windows clipboard by using the **Print** and **Copy to Clipboard** options found under the **File** menu.

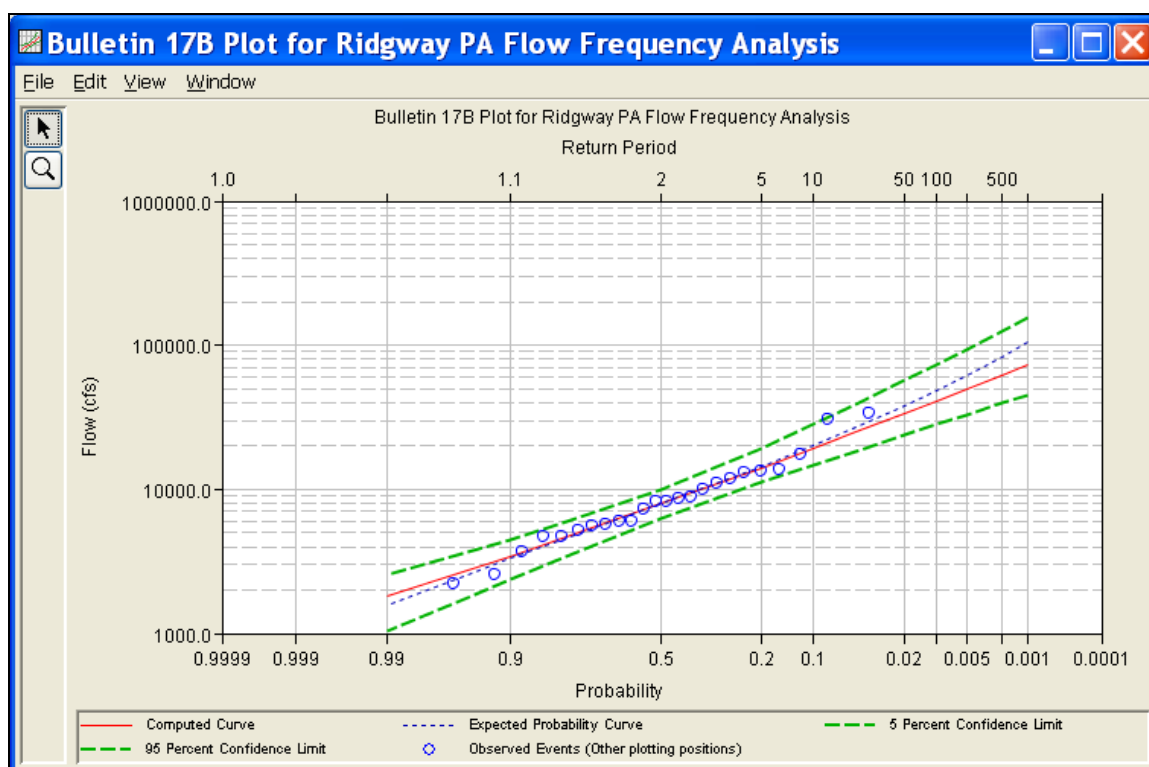


Figure 3-12. Example Flow Frequency Curve Plot.

The final piece of output available from a flow frequency analysis is a text report file. The report file lists all of the input data and user settings, plotting positions of the data points, intermediate results, each of the various statistical tests performed (i.e. high and low outliers, historical data, etc...), and the final results. This file is often useful for understanding how the software arrived at the final frequency curve. Press the **View Report** button at the bottom of the analysis editor to view the report file. When this button is pressed, a window will appear containing the text report as shown in Figure 3-13.

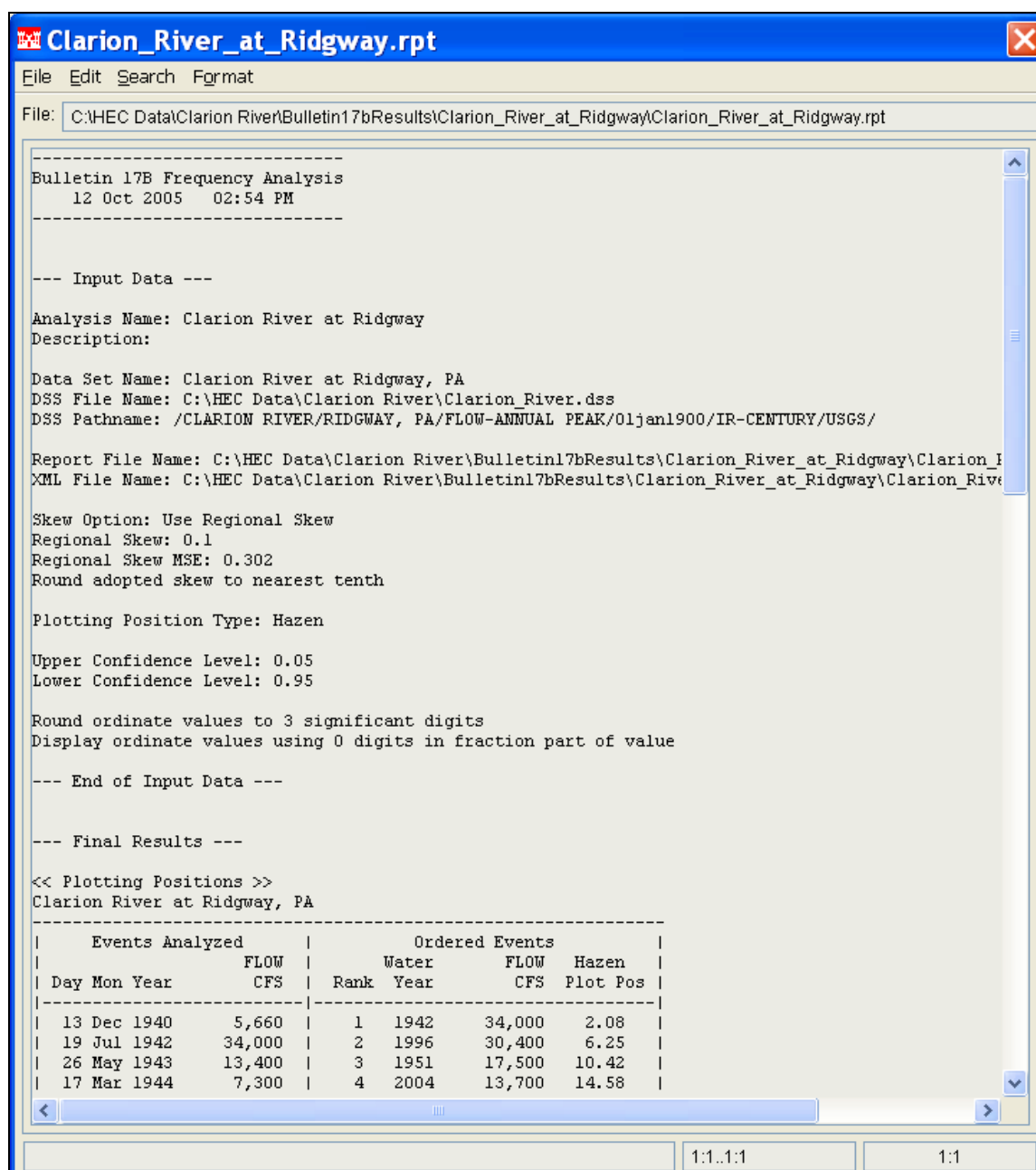


Figure 3-13. Example Report File From Bulletin 17B Frequency Analysis.

CHAPTER 4

Using the HEC-SSP Data Editor

The HEC-SSP Data Editor is used to import, enter, and view data and the corresponding metadata used in an HEC-SSP study. The current version of HEC-SSP can be used to import annual peak data (flow and stage), daily data, hourly data, and real time data. Future versions of HEC-SSP will allow for other data types as other analyses are made available in the software.

Contents

- Developing a New Data Set
- Importing Data from an HEC-DSS File
- Importing Data from the USGS Website
- Importing Data from an Excel Spreadsheet
- Entering Data Manually
- Metadata
- Plotting and Tabulating Data

Developing a New Data Set

Before any analyses can be performed in HEC-SSP, the user must import or enter data into the study. Importing, entering, and viewing data is accomplished in the **Data Editor**. To open the data editor go to the **Data** menu and select **New** from the list of options. This will bring up a data editor as shown in Figure 4-1.

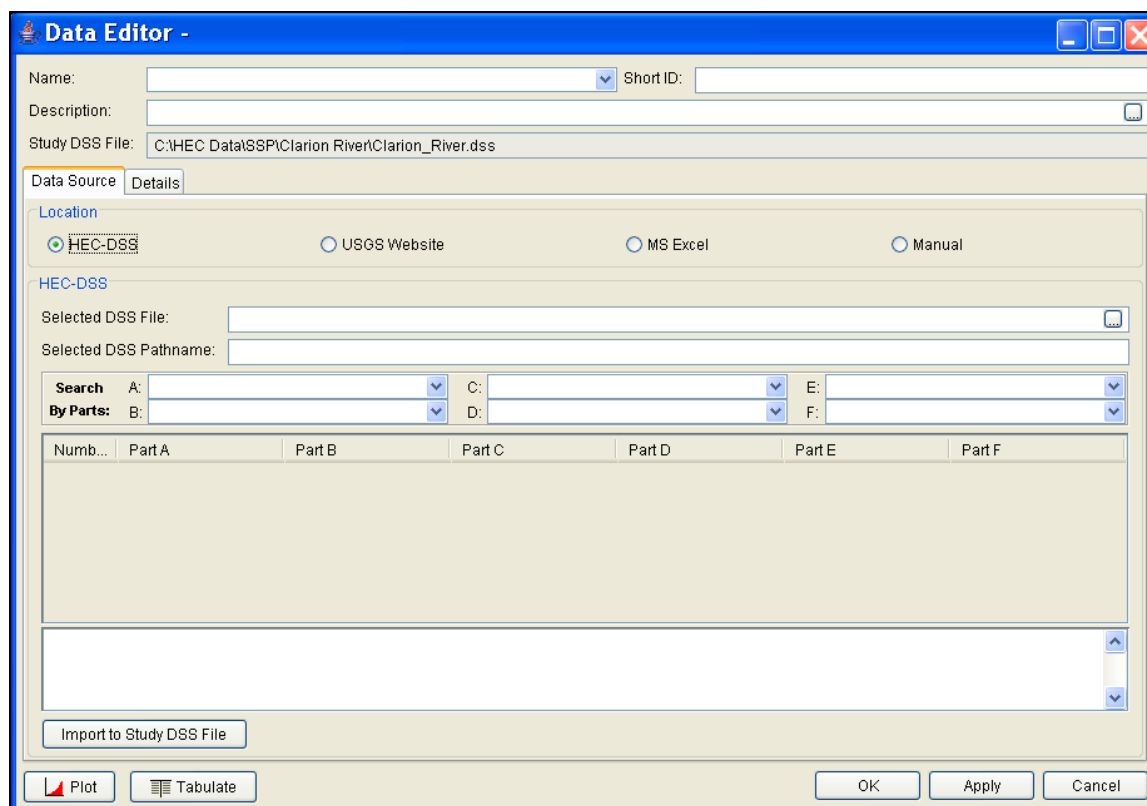


Figure 4-1. HEC-SSP Data Editor.

As shown in Figure 4-1, at the top of the editor, the user can enter a **Name** for the new data set. The user does not have to enter a name when importing a data set from the USGS or an HEC-DSS file. The program will automatically name the data. The user can rename a data set by selecting the data set in the tree and clicking the right mouse button. A pop-up menu should open with a **Rename** menu option. The **Data** menu also contains a **Rename** menu option; however, the data set must be selected in the tree before this option is active. Optionally, the user can also enter a short identifier (limited to 16 characters) and a **Description** of the data set. The study DSS file name is provided. The DSS file is used for storing the data for the study.

The Data Editor contains two main tabs, **Data Source** and **Details**. The **Data Source** tab is used for importing or entering data manually

while the **Details** tab is used to describe the data (i.e. metadata). The **Data Source** tab contains four options for getting data into the study DSS file: Importing from an existing HEC-DSS file, importing from the USGS Website, importing from an Excel spreadsheet, and entering the data manually.

Importing Data from an HEC-DSS File

To import data from an HEC-DSS file into the HEC-SSP study DSS file, first select the **HEC-DSS** radio button on the data editor. Selecting **HEC-DSS** will change the view of the Data Editor to look like Figure 4-2.

Data Editor - CLARION RIVER-JOHNSONBURG, PA-FLOW-ANNUAL PEAK

Name: [] Short ID: []

Description: Downloaded from USGS website. Station 03028500

Study DSS File: C:\HEC Data\SSP\Clarion River\Clarion_River.dss

Data Source | Details

Location

☒ HEC-DSS ☐ USGS Website ☐ MS Excel ☐ Manual

HEC-DSS

Selected DSS File: C:\HEC Data\SSP\Clarion River\Clarion_River.dss

Selected DSS Pathname: []

Search A: [] C: [] E: []

By Parts: B: RIDGWAY, PA D: [] F: []

Numb...	Part A	Part B	Part C	Part D	Part E	Part F
1	CLARION RIVER	RIDGWAY, PA	FLOW-ANNUAL PEAK	01.JAN1900	IR-CENTURY	USGS
2	CLARION RIVER	RIDGWAY, PA	FLOW-ANNUAL PEAK	01.JAN2000	IR-CENTURY	USGS
3	CLARION RIVER	RIDGWAY, PA	FREQ-FLOW-ANNUAL PEAK	MAX EVENTS		USGS
4	CLARION RIVER	RIDGWAY, PA	PEAK CODE	01.JAN1900	IR-CENTURY	USGS
5	CLARION RIVER	RIDGWAY, PA	PEAK CODE	01.JAN2000	IR-CENTURY	USGS
6	CLARION RIVER	RIDGWAY, PA	STAGE-ANNUAL PEAK	01.JAN1900	IR-CENTURY	USGS
7	CLARION RIVER	RIDGWAY, PA	STAGE-ANNUAL PEAK	01.JAN2000	IR-CENTURY	USGS

/CLARION RIVER/RIDGWAY, PA/FLOW-ANNUAL PEAK/01.JAN2000/IR-CENTURY/USGS/

Import to Study DSS File

Plot Tabulate OK Apply Cancel

Figure 4-2. Data Editor with HEC-DSS Import Option.

As shown in Figure 4-2, the user first selects a DSS file to import from by typing the path and name or by choosing the file browser at the end of the input field. Once a DSS file is selected, the table of pathnames will be filled with the records that are contained in that DSS file. The user can reduce the number of listed pathnames by selecting pathname parts to filter in the pathname part selection area just above the table. Any pathname part can be used to filter the list down to a more manageable number of pathnames to select from. The user can then select pathnames to import by double clicking on one or more of the listed pathnames in the table. Each selected

pathname will show up in the list below the table. Once the user has selected all of the pathnames that they want to import, pressing the **Import to Study DSS File** button enacts the import process. An HEC-SSP data set will be developed for each pathname that was selected.

Importing Data from the USGS Website

The second way to import data into HEC-SSP is to use the **USGS Website** option. When this option is selected, the data editor will look like Figure 4-3.

The screenshot shows the 'Data Editor' window with the 'USGS Website' option selected under the 'Location' tab. The 'Data Type' is set to 'Annual Peak Data'. A button labeled 'Get USGS Station ID's by State' is visible. Below it is a table with columns: 'Import Data', 'USGS Station ID's', 'Basin Name (A Part)', 'Location (B Part)', and 'Other Qualifier (F Part)'. The table has three rows, each with a checkbox in the 'Import Data' column. At the bottom of the window are buttons for 'Plot', 'Tabulate', 'OK', 'Cancel', 'Apply', and 'Help'.

Import Data	USGS Station ID's	Basin Name (A Part)	Location (B Part)	Other Qualifier (F Part)
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				

Figure 4-3. HEC-SSP Data Editor with USGS Website Import Option.

The first step in using the USGS import option is to select a data type to import (e.g. Annual Peak Data). Next the user should select the **Get USGS Station ID's by State** button. Selecting this button will bring up a small window that allows the user to select a state in which to acquire data, as shown in Figure 4-4.

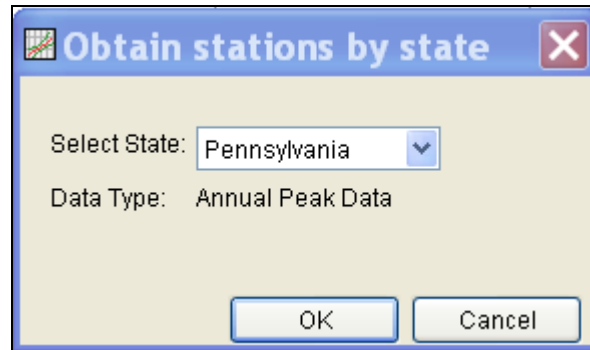


Figure 4-4. Window to Select a State for Importing USGS Data.

Once the user selects a state and presses the **OK** button, a process will begin in which all of the gage locations for that state will be downloaded from the USGS website. A listing of all the gages for that state will then show up in the table at the bottom of the data editor. An example of the data editor with a list of USGS gages is shown in Figure 4-5.

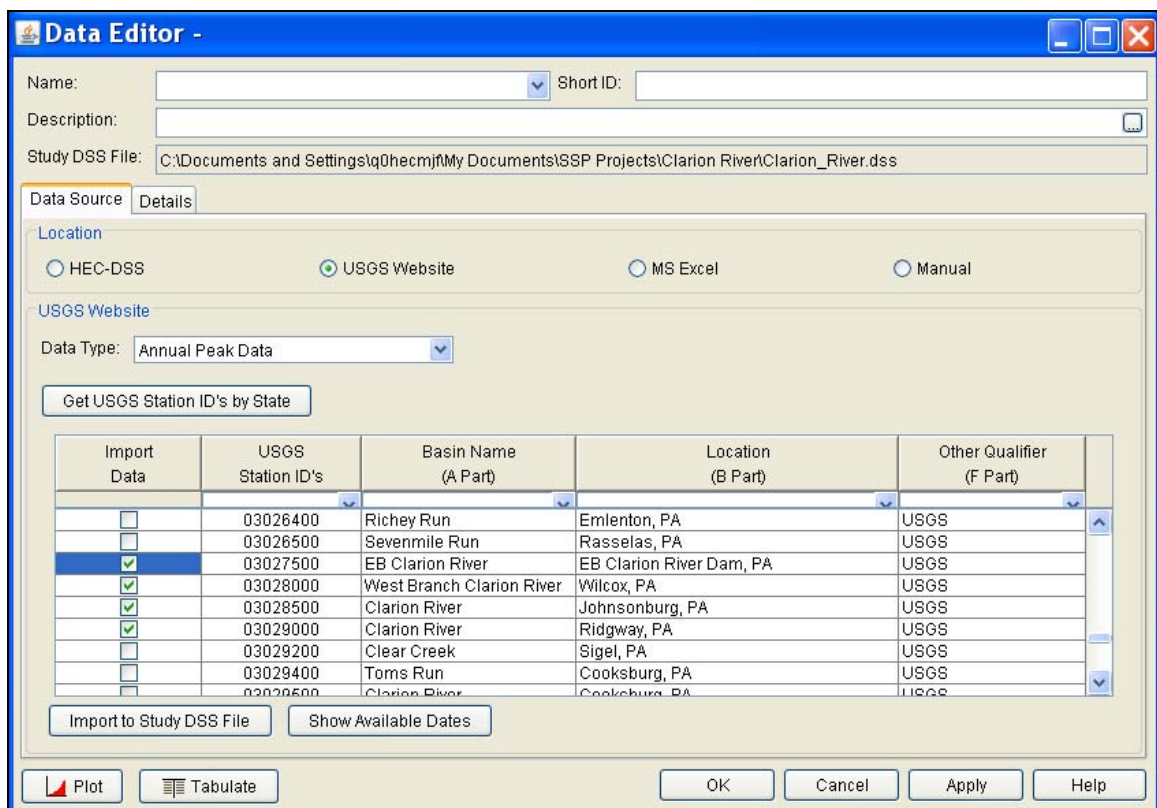


Figure 4-5. Data Editor with USGS Gages Listed in Table.

The next step is to select the desired gages for importing into the HEC-SSP study. The user can filter the list to a smaller number of gages by using the filter drop down boxes at the top of the table. To select a gage for importing, simply check the box in the left hand column for

each gage location that is to be imported. After all of the desired locations are selected, press the **Import to DSS File** button to import the data into the study DSS file. Pressing this button will start a process of downloading data from the USGS website. For each selected location, the software will download whatever data is available. Generally, when "Peak Annual Data" is selected, the software will download Peak Annual Flows, Peak Annual Stages, and Data Quality Codes for each location. Therefore, multiple records will be written to the study HEC-DSS file for each gage location. The data quality codes can be viewed from HEC-DSSVue, which is available from the tools menu. For an explanation of the codes, please visit the USGS website.

Warning: all data download from the USGS website should be reviewed to ensure it is appropriate before any analyses are performed on the data. Some data stored on the USGS website are estimated not measured. The user should check the data on the USGS website and be aware of the quality of all the data before using it. HEC-SSP will import the annual peak flow and stage quality codes to the study HEC-DSS file (the program does not import quality codes for daily, instantaneous, and real time data). The quality code records can be viewed using HEC-DSSVue and will have a pathname C-part of "CODE-PEAK FLOW" or "CODE-PEAK STAGE". A description of the quality codes for annual peak flows is contained in Table 4-1 and a description of the quality codes for annual peak stages is contained in Table 4-2.

Table 4-1. Quality Codes for USGS Annual Peak Flow Data.

Code	Description
1	Discharge is a Maximum Daily Average
2	Discharge is an Estimate
3	Discharge affected by Dam Failure
4	Discharge less than indicated value which is Minimum Recordable Discharge at this site
5	Discharge affected to unknown degree by Regulation or Diversion
6	Discharge affected by Regulation or Diversion
7	Discharge is an Historic Peak
8	Discharge actually greater than indicated value
9	Discharge due to Snowmelt, Hurricane, Ice-Jam or Debris Dam breakup
A	Year of occurrence is unknown or not exact
B	Month or Day of occurrence is unknown or not exact
C	All or part of the record affected by Urbanization, Mining, Agricultural changes, Channelization, or other
D	Base Discharge changed during this year
E	Only Annual Maximum Peak available for this year

Table 4-2. Quality Codes for USGS Annual Peak Stage Data.

Code	Description
1	Gage height affected by backwater
2	Gage height not the maximum for the year
3	Gage height at different site and(or) datum
4	Gage height below minimum recordable elevation
5	Gage height is an estimate
6	Gage datum changed during this year

Importing Data from an Excel Spreadsheet

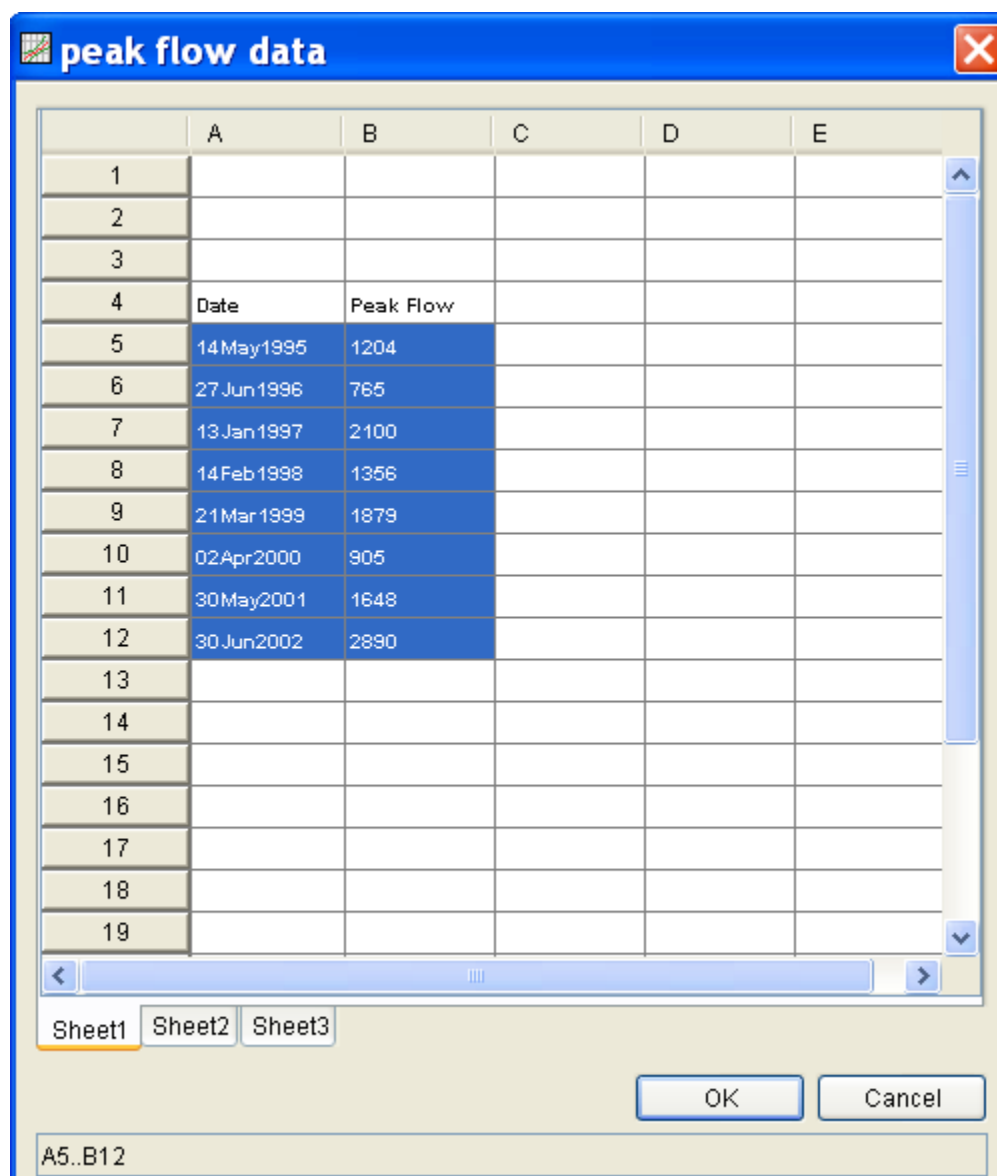
The third option for importing data into HEC-SSP is **MS Excel**. When this option is selected, the data editor will change as shown in Figure 4-6. Currently, only annual peak flows can be imported when using this option. Use the HEC-DSS or USGS options if you need to import data other than annual peak flows.

The screenshot shows the 'Data Editor' window. At the top, there are fields for 'Name:', 'Short ID:', 'Description:', and 'Study DSS File:'. Below these is a tabbed interface with 'Data Source' and 'Details' tabs. Under the 'Data Source' tab, there are four radio buttons: 'HEC-DSS', 'USGS Website', 'MS Excel' (which is selected), and 'Manual'. Below the radio buttons are fields for 'Excel File:', 'Worksheet:', 'Block:', 'Data Type:' (set to 'Annual Peak Flows'), and 'Data Units:'. There is a section for 'DSS Pathname Parts' with fields A, B, C, D, E, and F. Field C is set to 'FLOW' and field E is set to 'IR-CENTURY'. Below this is a 'Pathname:' field containing '///FLOW///IR-CENTURY//'. At the bottom, there is a table with four columns: 'Ordinate', 'Date', 'Time', and 'Value'. The table has two rows, with the first row containing the number '1' under 'Ordinate' and the second row containing the number '2' under 'Ordinate'. Below the table is a button labeled 'Import to Study DSS File'. At the very bottom, there are buttons for 'Plot', 'Tabulate', 'OK', 'Apply', and 'Cancel'.

Figure 4-6. Data Editor with MS Excel Import Option Selected.

The first step in importing data from an Excel spreadsheet is to select browse  at the end of the **Excel File** field. Once an Excel file is

selected, a data view window will pop-up showing the data contained in the selected spreadsheet. An example Excel Data viewer is shown in Figure 4-7.



	A	B	C	D	E
1					
2					
3					
4	Date	Peak Flow			
5	14 May 1995	1204			
6	27 Jun 1996	765			
7	13 Jan 1997	2100			
8	14 Feb 1998	1356			
9	21 Mar 1999	1879			
10	02 Apr 2000	905			
11	30 May 2001	1648			
12	30 Jun 2002	2890			
13					
14					
15					
16					
17					
18					
19					

Sheet1 Sheet2 Sheet3

OK Cancel

A5..B12

Figure 4-7. Example Excel Data Viewer.

The next step is to highlight the date and flow data values for each value to be imported into the study (only highlight the data, not the column headings). The data must be in a format of Date in the first column and Peak Annual Flow in the second column. The date must be in the Day, Month, Year format (ddmmyyyy) as shown in Figure 4-7. Next press the **OK** button and the data will be placed in the table at the bottom of the editor. The last steps before importing the data is to specify the units of the data, and each of the pathname parts for storing the data in the study DSS file. Enter units of **cfs** for data in

cubic feet per second or units of **cms** for data in cubic meters per second. The final step is to press the **Import to Study DSS File** button, and the data will be imported.

Entering Data Manually

The last option for getting data into the study is to enter the data manually. When the **Manual** option is selected, the window will change to what is shown in Figure 4-8. Currently, only annual peak flows can be imported when using this option. Use the HEC-DSS or USGS options if you need to import data other than annual peak flows.

The screenshot shows the 'Data Editor -test1*' window. The 'Name' field is 'Clarion River at Ridgway', 'Short ID' is empty, and 'Description' is empty. The 'Study DSS File' is 'C:\HEC Data\SSP\Clarion River\Clarion_River.dss'. The 'Data Source' tab is selected, and the 'Manual' radio button is chosen. The 'Data Type' is 'Annual Peak Flows', 'Start Date' is '05Jan1962', and 'Start Time' is '0500'. 'Data Units' are 'cfs'. The 'DSS Pathname Parts' section shows: A: 'CLARION RIVER', B: 'RIDGWAY', C: 'FLOW-PEAK ANNUAL', D: (empty), E: 'IR-CENTURY', and F: 'OBSERVED'. The 'Pathname' field contains '/CLARION RIVER/RIDGWAY/FLOW-PEAK ANNUAL/IR-CENTURY/OBSERVED/'. Below this is a table with columns 'Ordinate', 'Date', 'Time', and 'Value'. The table has two rows, with the first row highlighted. At the bottom, there is an 'Import to Study DSS File' button, and a footer with 'Plot', 'Tabulate', 'OK', 'Apply', and 'Cancel' buttons.

Ordinate	Date	Time	Value
1			
2			

Figure 4-8. Data Editor with Manual Data Entry Option Selected.

To enter data manually, the user enters a name for the data set at the top, along with a short identifier and a description (optional). A starting date and time must be entered. The units of the data must also be defined; enter units of **cfs** for data in cubic feet per second or units of **cms** for data in cubic meters per second. The last step before entering the data is to specify the pathname parts for how the data will be stored into the study DSS file. This requires the user to enter a label for the A, B, and F part of the DSS pathname. The C and E part are automatically set by the program. Once all of the data labeling is completed, the data can be entered into the table at the bottom of the editor. The user must enter the **Date**, **Time**, and data **Value** for each

peak flow value to be entered. After a Date, Time, and Value are entered into a row, a new row will be generated in the table when the user leaves the Value field. The date must be in the Day, Month, Year format (ddmmyyyy). Once all of the data are entered into the table, the user presses the **Import to Study DSS File** button and the data will be stored in the study DSS file.

Metadata

When downloading data from the USGS website, in addition to the raw data, the software will also attempt to download any metadata available for each gage location. The metadata will show up on the **Details** tab of the editor. The user can view the metadata by selecting the Details tab, as shown in Figure 4-9.

The screenshot shows the 'Data Editor - Clarion River at Ridgway, PA' window. The 'Details' tab is selected. The form contains the following fields and values:

- Name: Clarion River at Ridgway, PA
- Short ID: (empty)
- Description: Downloaded from USGS website. Station 03029000
- Study DSS File: C:\HEC Data\Clarion River\Clarion_River.dss
- State: Pennsylvania
- County: Elk
- Stream: Clarion River
- Location: Ridgway, PA
- Drainage Area: (empty)
- DA Units: (empty)
- Gage Operator: (empty)
- USGS No.: (empty)
- Gage Datum: (empty)
- HUC: (empty)
- Vertical Datum: (empty)
- Description: (empty)
- Coordinate System: Lat/Long
- Coordinate ID: 0
- Horizontal Datum: NAD83
- Datum Units: Decimal Degrees
- Coordinate X Value: -78.736
- Coordinate Y Value: 41.421

Buttons at the bottom: Plot, Tabulate, OK, Apply, Cancel.

Figure 4-9. Details Tab on the HEC-SSP Data Editor.

As shown in Figure 4-9, the metadata consists of the State, County, Stream, Location, Drainage Area, DA Units, Gage Operator, USGS Gage No., Gage Datum, HUC (Hydrologic Unit Code), Vertical Datum, and a description field. Additionally, the coordinate location of the data is shown. The coordinate location consists of Coordinate System, Coordinate ID, Horizontal Datum, Datum Units, Coordinate X Value, and Coordinate Y Value. Most of the USGS data is in the

Latitude/Longitude coordinate system as shown in the example. If coordinate system data are entered, data icons and text labels will show up on the background map at the specified locations.

If the metadata does not download automatically, the user has the option to enter any of the information by hand. Metadata is not generated automatically for any of the other three data acquisition methods. Therefore, entering the metadata is required if the user wants the data to be carried along with the study.

Plotting and Tabulating the Data

After the data is imported into the study, the user can select any one of the data sets in the study tree. A pop-up menu will open when clicking the right mouse button while a data is selected. The pop-up menu contains options to change the name, plot, and tabulate the data. These options are also available from the Data menu; however, the data must be selected in the tree before these options are available. If you select the **Plot** option, you will get a plot similar to the one shown in Figure 4-10.

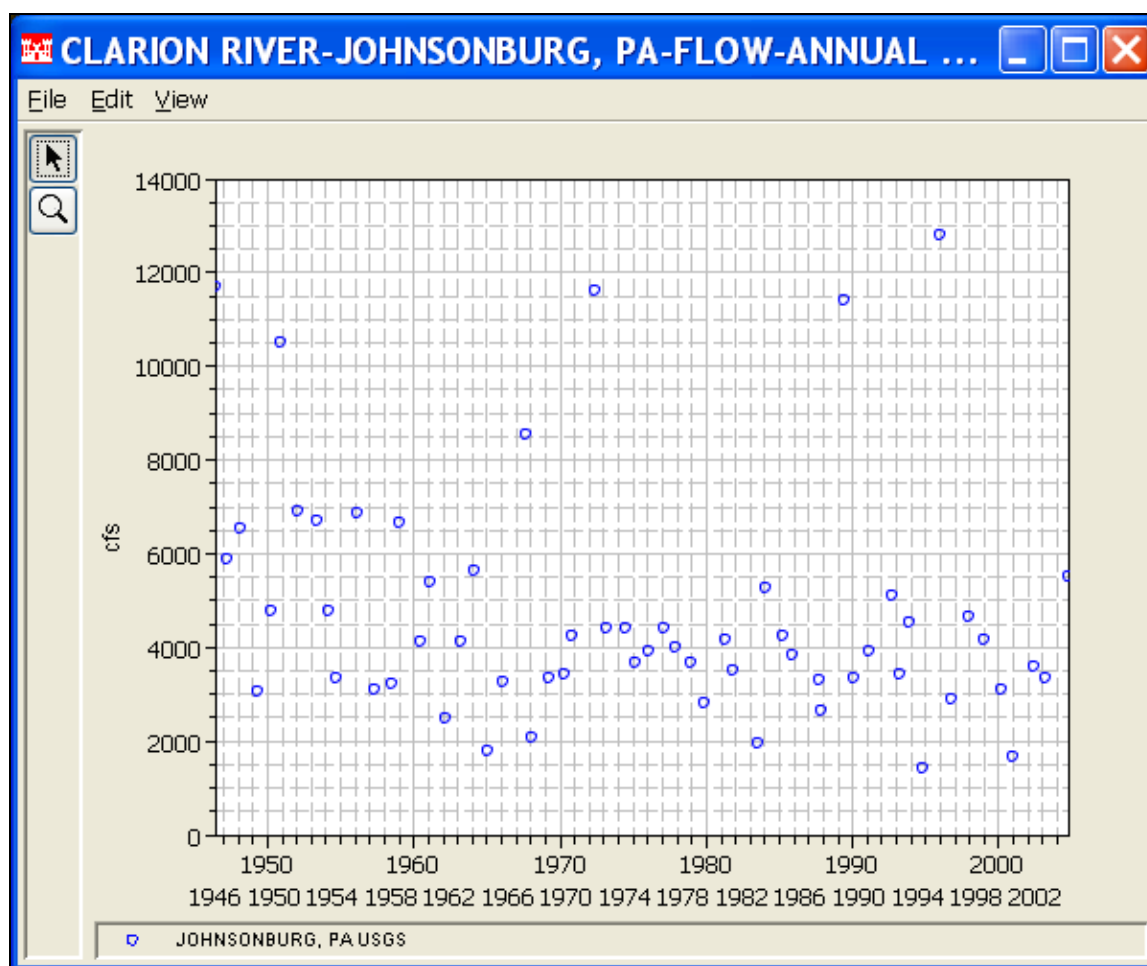



Figure 4-10. Plot of Peak Annual Flow Data Download from USGS Website.

If you select the **Tabulate** option, a table will pop-up with the data listed as shown in Figure 4-11.



Ordinate	Date / Time	RIDGWAY, PA USGS
Units		CFS
Type		INST-VAL
1	13 Dec 40 24:00	5,660
2	19 Jul 42 24:00	34,000
3	26 May 43 24:00	13,400
4	17 Mar 44 24:00	7,300
5	03 Mar 45 24:00	10,000
6	28 May 46 24:00	13,100
7	05 Apr 47 24:00	8,280
8	12 Apr 48 24:00	8,680
9	22 May 49 24:00	3,710
10	29 Mar 50 24:00	8,280
11	25 Nov 50 24:00	17,500
12	18 Jan 52 24:00	10,900
13	23 May 53 24:00	8,900
14	14 Aug 94 24:00	11,700
15	20 Jan 95 24:00	2,530
16	19 Jan 96 24:00	30,400
17	08 Nov 96 24:00	4,630
18	08 Jan 98 24:00	5,510
19	24 Jan 99 24:00	6,030
20	04 Apr 00 24:00	5,220
21	17 Dec 00 24:00	2,190
22	13 May 02 24:00	4,660
23	01 Aug 03 24:00	5,920
24	18 Sep 04 24:00	13,700

Figure 4-11. Table Containing a Listing of Peak Annual Flow Data.

CHAPTER 5

Performing a Bulletin 17B Flow Frequency Analysis

The current version of HEC-SSP allows the user to perform flow frequency analyses based on Bulletin 17B, Guidelines for Determining Flood Flow Frequency (March 1982). This chapter discusses in detail how to perform a Bulletin 17B flow frequency analysis with HEC-SSP.

Contents

- Starting a New Analysis
- General Settings, Options, and Computations
- Viewing and Printing Results

Starting a New Analysis

A flow frequency analysis can be started in two ways within the software, either by right clicking on the Bulletin 17B folder in the study explorer and selecting **New**, or by going to the **Analysis** menu and selecting **New** and then **Bulletin 17B Flow Frequency**. When a new flow frequency analysis is selected, the Bulletin 17B Editor will appear as shown in Figure 5-1.

Figure 5-1. Bulletin 17B Flow Frequency Analysis Editor.

The user is required to enter a **Name** for the analysis, while a **Description** is optional. An annual peak flow data set must be selected from the available data sets stored in the current study DSS file (see chapter 4 for importing data into the study). Once a Name is entered, and a flow data set is selected, the **DSS File Name** and **Report File** will automatically be populated. The DSS filename is by default the study DSS file. The report file is given the same name as the analysis with the extension “.rpt”.

General Settings, Options, and Computations

Once the analysis name and flow data set are selected, the user can begin setting up the analysis. Three tabs are contained on the Bulletin 17B editor. The tabs are labeled **General**, **Options**, and **Results**.

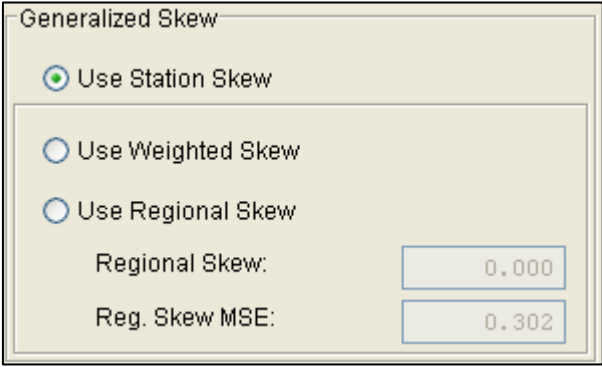
General Settings

The first tab contains general settings for performing the flow frequency analysis (Figure 5-1). These settings include:

- Generalized Skew
- Expected Probability Curve
- Plotting Positions
- Confidence Limits
- Time Window Modification

Generalized Skew

There are three options contained within the generalized skew setting: Use Station Skew, Use Weighted Skew, and Use Regional Skew. The



Generalized Skew

☒ Use Station Skew

☐ Use Weighted Skew

☐ Use Regional Skew

Regional Skew: 0.000

Reg. Skew MSE: 0.302

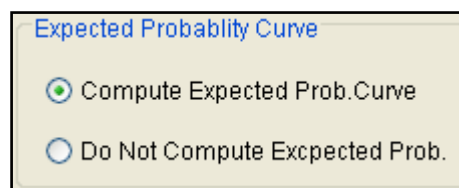
default skew setting is **Use Station Skew**. With this setting, the skew of the computed curve will be based solely on computing a skew from the data points contained in the data set. No weighting will be performed to compute the final skew.

The **Use Weighted Skew** option requires the user to enter a generalized regional skew and a Mean-Square Error (MSE) of the generalized regional skew. This option weights the computed station skew with the generalized regional skew. The equation for performing this weighting can be found in Bulletin 17B (equation 6). If a regional skew is taken from Plate I of Bulletin 17B (the skew map of the United States), the value of $MSE = 0.302$.

The last generalized skew option is **Use Regional Skew**. When this option is selected, the user must enter a generalized regional skew and an MSE for that skew. The program will ignore the computed station skew and use only the generalized regional skew.

Expected Probability Curve

This setting has two options: compute the expected probability curve and do not compute the expected probability curve. The default

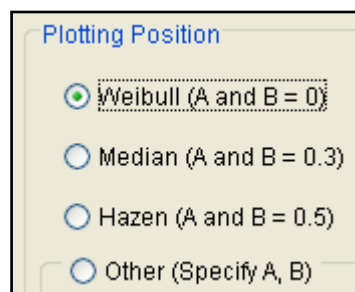


setting is to have the expected probability curve computed. When computed, this curve will be shown in both the result tables and the plots as an additional curve to the computed curve. The expected probability adjustment is an

attempt to correct for a certain bias in the frequency curve computation due to the shortness of the record. Please review the discussion in Bulletin 17B about the expected probability curve adjustment for an explanation of how and why it is computed. The use of the expected probability curve is a policy decision. It is most often used in establishing design flood criteria. The basic flood frequency curve without the expected probability curve adjustment is the curve used in computation of confidence limits, risk, and in obtaining weighted averages of independent estimates of flood frequency discharge (WRC, 1982).

Plotting Positions

Plotting positions are used for plotting the raw data points on the graph. There are four options for plotting position methodologies



within HEC-SSP: Weibull, Median, Hazen, and user entered coefficients. The default method is the Weibull plotting position formula. The generalized plotting position equation is:

$$P = \frac{(m - A)}{(n + 1 - A - B)}$$

Where: m = rank of flood values with the largest equal to 1.

n = number of flood peaks in the data set.

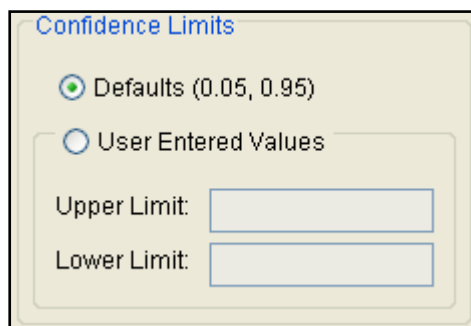
A & B = constants dependent on which equation is used (Weibull A and B=0; Median A and B = 0.3; and Hazen A and B=0.5).

Plotting positions are estimates of the exceedance probability of each data point. Different methods can give very different values for the probabilities of the highest and lowest points in the data set. In the Bulletin 17B methodology, the plotting of data on the graph by a plotting position method is only done as a guide to assist in evaluating

the computed curve. The plotting position method selected does not have any impact on the computed curve.

Confidence Limits

Confidence limits provide a measure of the uncertainty in the

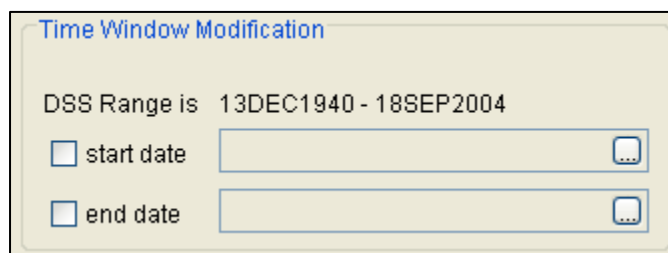
The image shows a dialog box titled "Confidence Limits". It contains two radio buttons: "Defaults (0.05, 0.95)" which is selected, and "User Entered Values". Below the radio buttons are two text input fields labeled "Upper Limit:" and "Lower Limit:". The "User Entered Values" option is currently disabled.

computed discharge for a given exceedance probability. The computation of confidence limits is outlined in Bulletin 17B appendix 9. By default, HEC-SSP calculates the 90 percent confidence interval (i.e. the 5% and 95% confidence limits). The confidence limits must be entered in decimal form (i.e. 95% = 0.95, and 5% = 0.05). The user has the option to

override the default values and enter whatever values they would like for the confidence limits.

Time Window Modification

This option allows the user to narrow the time window used for the analysis. The default is to use all of the annual peak flow data

The image shows a dialog box titled "Time Window Modification". It displays "DSS Range is 13DEC1940 - 18SEP2004". Below this are two checkboxes: "start date" and "end date", each followed by a text input field and a calendar icon. Both checkboxes are currently unchecked.

contained in the selected data set. The user can enter either a start date for the analysis, and end date, or both a start and end date. If a start and/or end date

are used, they must be dates that are encompassed within the data stored in the selected data set. The date range for the selected data set is shown in the editor just above the **Start Date** field.

Options

In addition to the general settings, there are also several options available to the user for modifying the computations of the frequency curves. These options include:

- Low Outlier Threshold
- Historic Period Data
- User-Specified Frequency Ordinates

When the Options tab is selected, the Bulletin 17B Editor will appear as shown in Figure 5-2.

The screenshot shows the 'Bulletin 17B Editor - Ridgway PA Flow Frequency Analysis' window. The 'Options' tab is selected, displaying three main sections: 'Low Outlier Threshold', 'Historic Period Data', and 'User Specified Frequency Ordinates'.

Low Outlier Threshold: A checkbox labeled 'Use Low Outlier Threshold' is unchecked. Below it, a 'Value' field contains '0.000'.

Historic Period Data: A checkbox labeled 'Use Historic Data' is unchecked. Below it, there are input fields for 'Start Year:', 'End Year:', and 'High Threshold:' (containing '0.000'). A table titled 'Historic Events' is also present.

Water Year	Peak

User Specified Frequency Ordinates: A checkbox labeled 'Use Values from Table below' is checked. Below it is a table titled 'Frequency in Percent'.

	0.1
	0.2
	0.5
	1.0
	2.0
	5.0
	10.0
	20.0
	50.0
	80.0
	90.0
	95.0
	99.0

At the bottom of the window, there are buttons for 'Compute', 'Plot Curve', 'View Report', 'Print', 'OK', 'Cancel', and 'Apply'.

Figure 5-2. Bulletin 17B Editor with Options Tab Selected.

Low Outlier Threshold

High and low outlier tests are based on the procedures outlined in Bulletin 17B. The calculated outlier magnitudes, by the Bulletin 17B procedures, are used as default values for the high and low outlier thresholds in HEC-SSP. The user has the option to enter a different value for the low outlier threshold. If a value is entered for the low outlier threshold, then this value will override the computed value from Bulletin 17B procedure. Further discussion of outlier thresholds can be found in Bulletin 17B and the HEC-SSP Statistical Reference Guide. To use the low outlier threshold, simply check the box and enter the value.

Historic Period Data

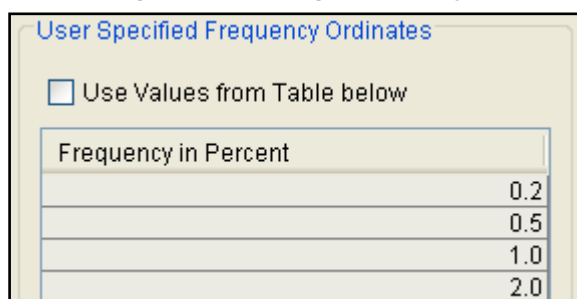
Any historic data that provides reliable estimates of flood peaks outside the systematic record should be used in order to modify and improve the frequency computations. Flood information outside of the systematic record can often be used to extend the record of the largest events to a historic period much longer than that of the systematic record. HEC-SSP uses historic data as recommended in Bulletin 17B. To use historic data in HEC-SSP, check the box labeled **Use Historic Data**. The user can enter a starting year for the historic period, ending year for a historic period, and a high threshold value. If the user enters a high threshold value, then any value in the systematic record greater than that value will also be treated as a historical flood peak. The user can also enter historic flood peaks that are not contained in the systematic record. This is done in the table at the bottom labeled **Historic Flood Peaks**. All years must be entered as water year values (October 1 through September 30). If a start year is not entered, then the assumed start year is the earliest year of the systematic record and any historical values that have been entered. If an end year is not entered, then the assumed end year is the latest year in the systematic record and any entered historic values. Further discussion of the use of historical data can be found in Bulletin 17B and the HEC-SSP Statistical Reference Guide.

Historic Events	
Water Year	Peak

Note: The program treats all data in the data set as systematic data. If historic events are included in the data set, then the user can define the analysis time window (General tab – Time Window Modification) so that it only bounds the systematic record. Then define the historic events in the Historic Events table. Instead of using the Time Window Modification option, another option is to enter a High Threshold value so that the historic data point(s) would be treated as historic data (rather than part of the systematic record). Please see test example 6 in Appendix B for an example of using the historic data adjustment.

User Specified Frequency Ordinates

This option allows the user to change the frequency ordinates used in computing the resulting frequency curves and confidence limits. The



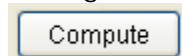
Frequency in Percent
0.2
0.5
1.0
2.0

default values listed in percent chance exceedance are 0.2, 0.5, 1, 2, 5, 10, 20, 50, 80, 90, 95, and 99. Check the box next to **Use Values from Table below** to change or add additional values. Once this box is checked, the user can

add/remove rows and edit the frequency values. To add or remove a row from the table, select the row(s), place the mouse over the highlighted row(s) and click the right mouse button. The pop-up menu contains options to **Insert Row(s)** and **Delete Row(s)**. The program will use the default values, even if they are not contained in the table, when the **Use Values from Table below** option is not checked. Finally, all values in the table must be between 0 and 100.

Compute

Once the new analysis has been defined, and the user has all of the settings and options the way they want them, performing the



computations is simply a matter of pressing the **Compute** button at the bottom of the Bulletin 17B

Editor.

Once the compute button is pressed, the flow frequency computations are performed. If the computations are successful, the user will receive a message that says **Compute Complete**. At this point, the user can begin to review the results of the flow frequency analysis.

Viewing and Printing Results

The user can view output from the flow frequency analysis directly from the Bulletin 17B Editor. The output consists of tabular results, a frequency curve plot, and a report documenting the data and computations performed.

Tabular Output

Once the computations for the flow frequency analysis are completed, the user can view tabular output by opening the **Tabular Results** tab. When this tab is pressed, the results will be displayed as shown in Figure 5-3.

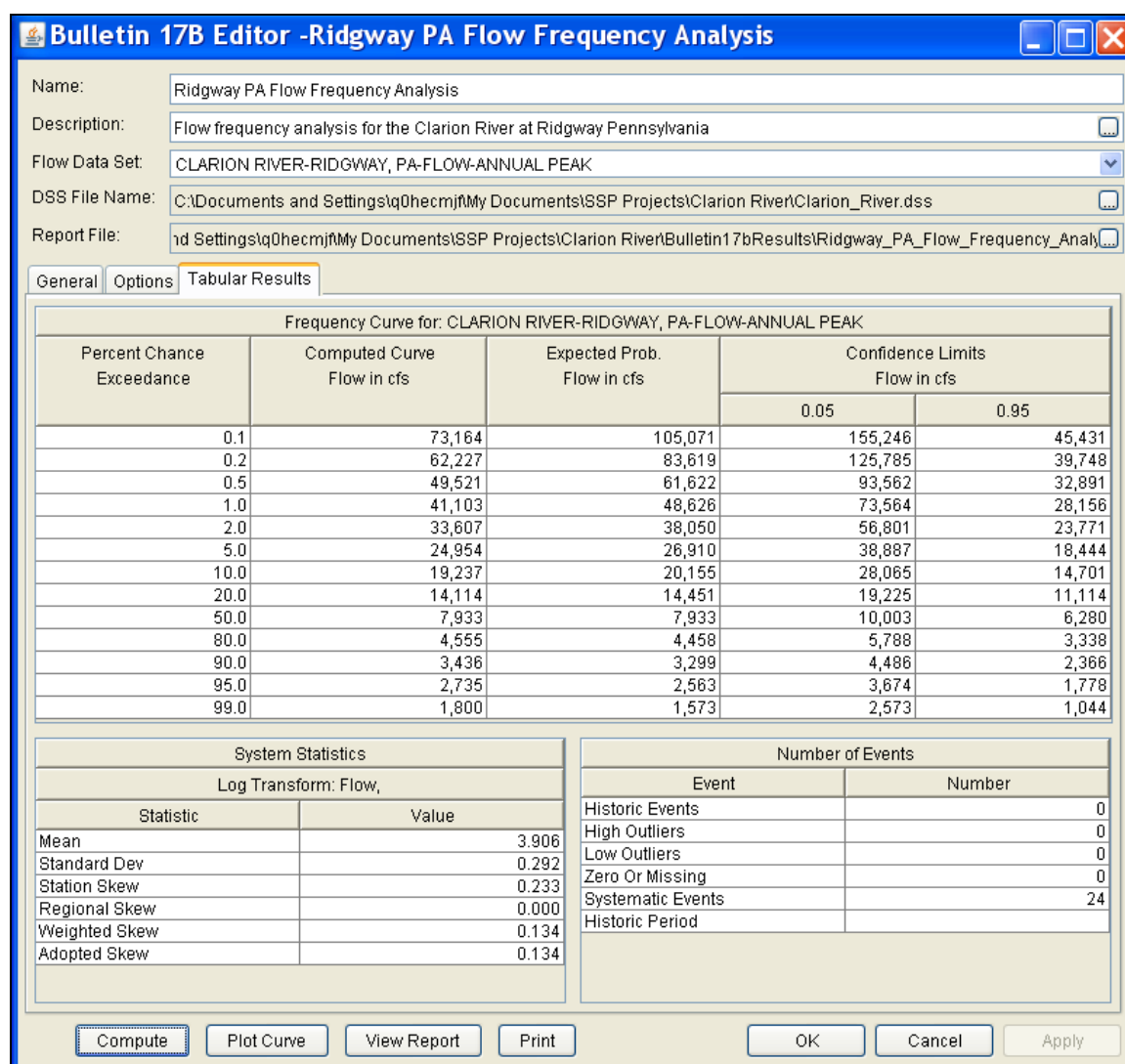


Figure 5-3. Bulletin 17B Editor with Tabular Results Tab Active.

Output on the results tab consists of three tables: Frequency Curves, System Statistics, and Number of Events. The **Frequency Curve** output table contains the percent chance of exceedance ordinates, the computed Log Pearson III frequency curve, the expected probability adjusted frequency curve, the 5% chance of exceedance confidence limit, and the 95% chance of exceedance confidence limit. The **System Statistics** table contains the mean of the data in log space, standard deviation in log space, station skew, user entered regional skew, weighted skew (weighted between station skew and regional skew), and the adopted skew for the analysis. The **Number of Events** table tabulates the number of historic events, high outliers, low outliers, zero or missing values, systematic events, and the number of years in the historic period (this value only comes into play if the user entered historic data).

The tabular results can be printed by using the **Print** button at the bottom of the Bulletin 17B Editor. When the print button is pressed, a window will appear giving the user options for how they would like the table to be printed.

Graphical Output

Graphical output of the frequency curves can be obtained by pressing the **Plot Curve** button. When the Plot Curve button is pressed, a frequency curve plot will appear in a separate window as shown in Figure 5-4. The user can modify the plot properties by selecting the **Edit→Plot Properties** menu option. A plot properties window will open that lets the user change the line style for each data type, change the axis labels, modify the plot title, and edit other plot properties. The user can also edit line styles by placing the mouse on top of the line or data point in the plot or legend and clicking the right mouse button. Then select the **Edit Properties** menu option in the pop-up menu.

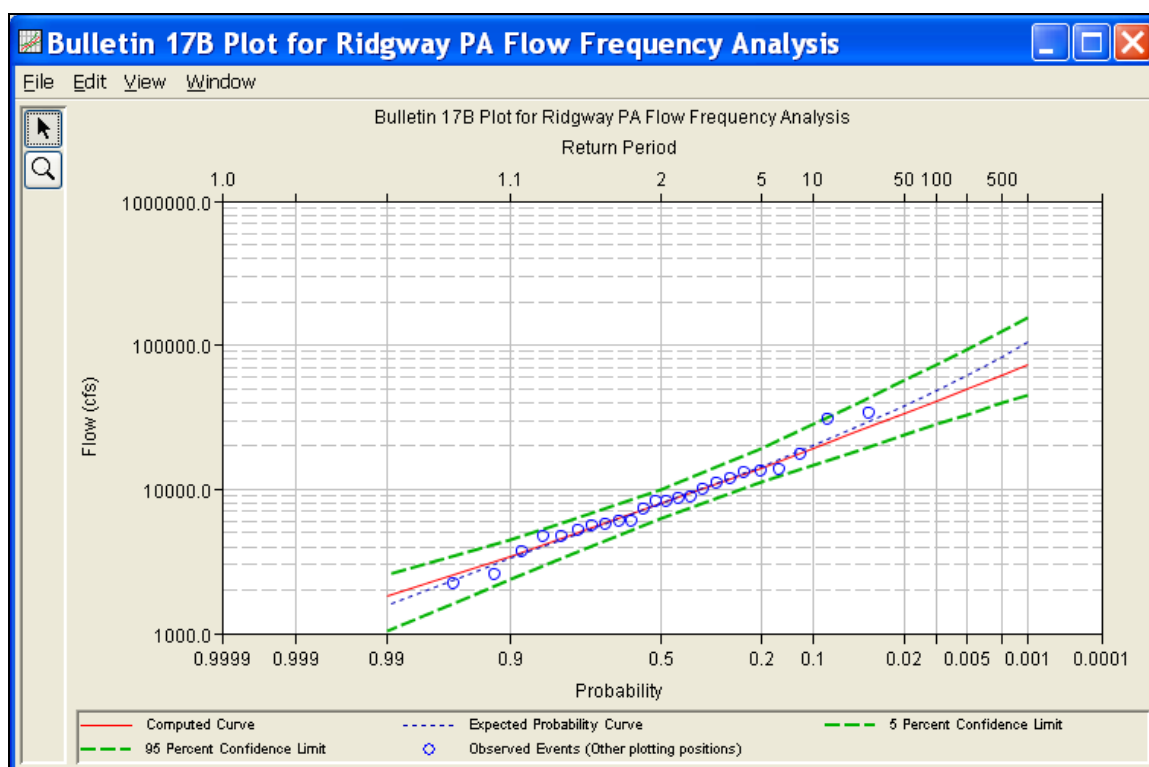


Figure 5-4. Example Frequency Curve Plot.

The frequency curve plot can be sent to the printer by selecting the **Print** option from the **File** menu at the top of the window. Additional printing options available from the File menu are Page Setup, Print Preview, and Print Multiple (used for printing multiple graphs on the same page). The graphic can also be sent to the Windows Clipboard by selecting **Copy to Clipboard** from the File menu. Additionally, the plot can be saved to a file by selecting the **Save As** option from the File menu. When the Save As option is selected, a pop-up window will appear allowing the user to select a directory, enter a filename, and select the format for saving the file. Currently, four file formats are available for saving the graphic to disk, windows metafile, postscript, JPEG, and portable network graphic.

The data contained within the plot can also be tabulated by selecting **Tabulate** from the **File** menu. When this option is selected, a separate window will appear with the data tabulated. Additional options are available from the File menu for saving the graphics options as a template (**Save Template**) and applying previously saved templates to the current graphic (**Apply Template**).

The **Edit** menu on the graphic window contains several options for customizing the graphic. These options include Plot Properties, Configure Plot Layout, Default Line Styles, and Default Plot Properties. Also, a pop-up menu will appear with further customizing options when the user right-clicks on a line on the graph or the legend.

The graphic customizing capabilities within HEC-SSP are very powerful, but are also somewhat complex to use. The code used in developing the plots in HEC-SSP is the same code that was used for developing graphics in HEC-DSSVue and several other HEC software programs. A separate write-up on Customizing Graphics can be found in Appendix C of this manual. Please refer to that appendix for details on using the graphics customizing options.

Viewing the Report File

When the Bulletin 17B computations are performed, the computations module writes a report file of the statistical computations. The report file lists all of the input data and user settings, plotting positions of the data points, intermediate results, each of the various statistical tests performed (i.e. high and low outliers, historical data, etc...), and the final results. This file is often useful for understanding how the software arrived at the final frequency curve.

Press the **View Report** button at the bottom of the Bulletin 17B Analysis window to view the report file. When this button is pressed a window will appear containing the text report as shown in Figure 5-5.

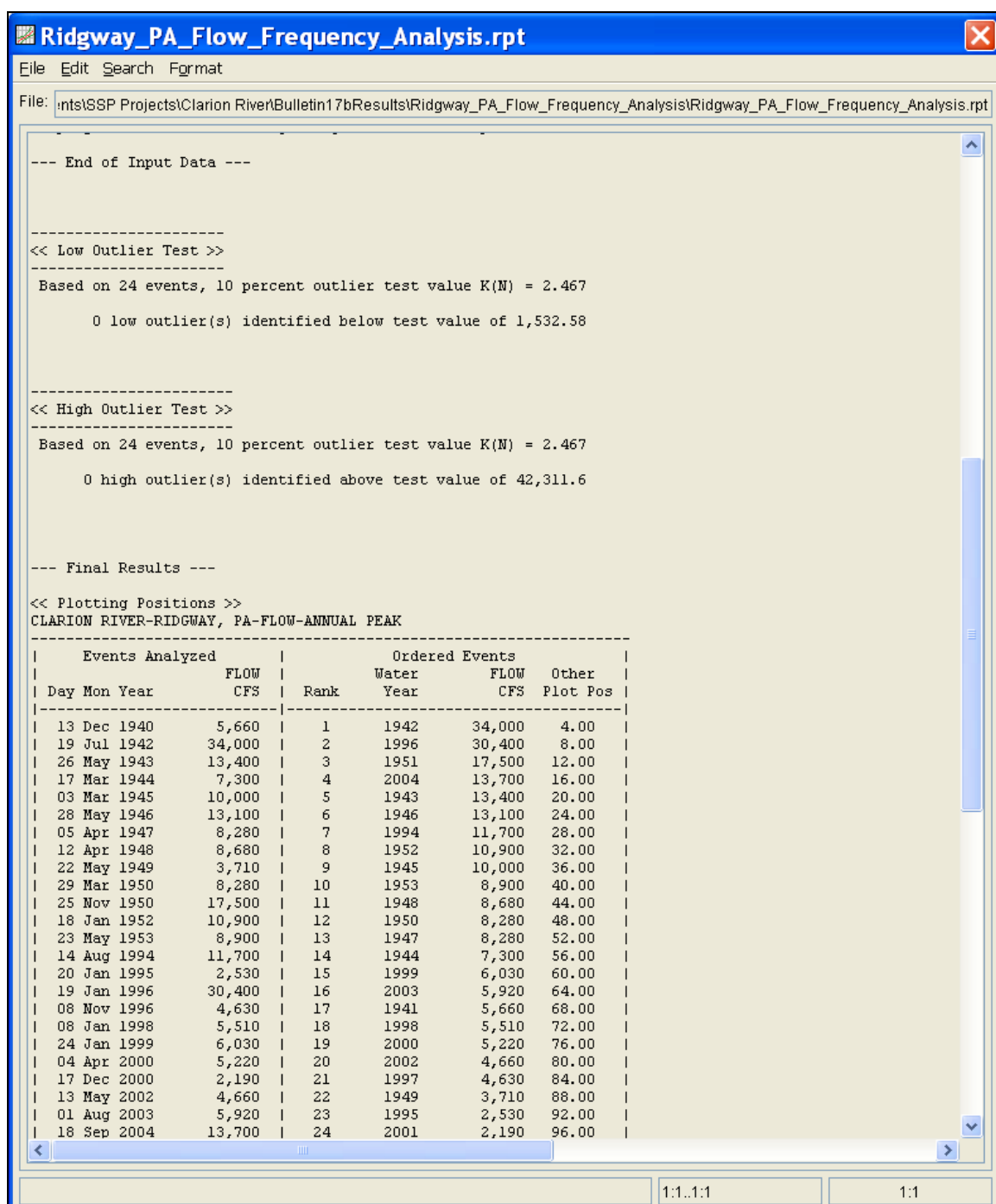


Figure 5-5. Example of the Bulletin 17B Report File.

CHAPTER 6

Performing a Generalized Frequency Analysis

The current version of HEC-SSP allows the user to perform generalized frequency analyses of flow and stage data, as well as other data types. The user can choose between different analytical distributions as well as perform a graphical fit to the data. This chapter discusses in detail how to use the Generalized Frequency analysis editor with HEC-SSP.

Contents

- Starting a New Analysis
- General Settings and Options
- Analytical Frequency Analysis
- Graphical Frequency Analysis
- Viewing and Printing Results

Starting a New Analysis

A generalized frequency analysis can be started in two ways, either by right clicking on the Generalized Frequency Analysis folder in the study tree and selecting **New**, or by going to the **Analysis** menu and selecting **New** and then **Generalized Frequency Analysis**. When a new generalized frequency analysis is selected, the Generalized Frequency editor will appear as shown in Figure 6-1.

General Frequency -

Name:

Description:

Data Set:

DSS File Name:

Report File:

General Options Analytical Graphical

Log Transform

☒ Use Log Transform

☐ Do not use Log Transform

Confidence Limits

☒ Defaults (0.05, 0.95)

☐ User Entered Values

Upper Limit:

Lower Limit:

Time Window Modification

DSS Range is

☐ start date

☐ end date

Plotting Position

☒ Weibull (A and B = 0)

☐ Median (A and B = 0.3)

☐ Hazen (A and B = 0.5)

☐ Other (Specify A, B)

Plotting position computed using formula

$$(m-A)/(n+1-A-B)$$

Where:

m=rank, 1=largest
 N=Number of Years
 A,B=Constants

A:

B:

Compute Plot Analytical Curve Plot Graphical Curve View Report Print OK Cancel Apply

Figure 6-1. Generalized Frequency Analysis Editor.

The user is required to enter a **Name** for the analysis, while a **Description** is optional. A data set (flow, stage, or other) must be selected from the available data sets stored in the current study DSS file (see chapter 4 for importing data into the study). Once a Name is entered and a data set is selected, the **DSS File Name** and **Report**

File will automatically be filled out. The DSS filename is by default the study DSS file. The report file is given the same name as the analysis with the extension “.rpt”.

General Settings and Options

Once the analysis name and data set are selected, the user can begin to perform the computations. Contained on the Generalized Frequency editor are four tabs. The tabs are labeled **General**, **Options**, **Analytical**, and **Graphical**. This section of the manual explains the use of the General and Options tabs.

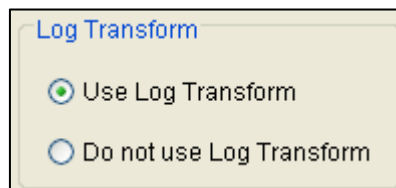
General Settings

The first tab contains general settings for performing the frequency analysis (Figure 6-1). These settings include:

- Log Transforms
- Plotting Positions
- Confidence Limits
- Time Window Modification

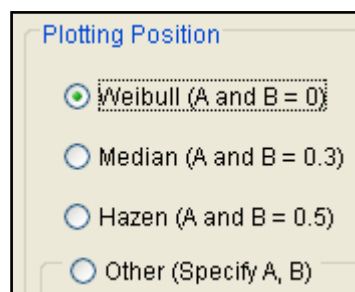
Log Transform

There are two options contained within the Log Transform setting: Use Log Transform and Do not use Log Transform. If the user selects **Use Log Transform** then the logs of the data will be taken first. The frequency analysis will be performed on the logs of the data. If the user selects **Do not use Log Transform**, then the frequency analysis will be performed on the raw data values without taking the logs of the data. The default setting is **Use Log Transform**.



Plotting Positions

Plotting positions are used for plotting the raw data points on the graph. There are four options for plotting position methodologies



The screenshot shows a dialog box titled "Plotting Position" with four radio button options: "Weibull (A and B = 0)", "Median (A and B = 0.3)", "Hazen (A and B = 0.5)", and "Other (Specify A, B)". The "Weibull (A and B = 0)" option is selected.

within HEC-SSP: Weibull, Median, Hazen, and user entered coefficients. The default method is the Weibull plotting position formula. The generalized plotting position equation is:

$$P = \frac{(m - A)}{(n + 1 - A - B)}$$

Where: m = rank of flood values with the largest equal to 1.

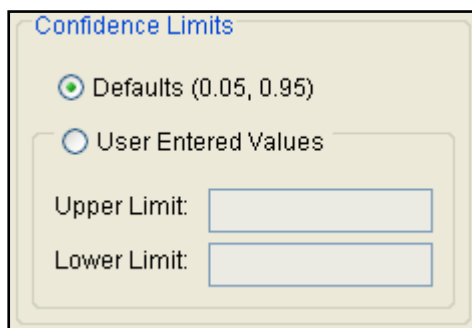
n = number of flood peaks in the data set.

A & B = constants dependent on which equation is used (Weibull A and $B=0$; Median A and $B = 0.3$; and Hazen A and $B=0.5$).

Plotting positions are estimates of the exceedance probability of each data point. Different methods can give very different values for the probabilities of the highest and lowest points in the data set. In the Generalized Frequency methodology, the plotting of data on the graph by a plotting position method is only done as a guide to assist in evaluating the computed curve. The plotting position method selected does not have any impact on the computed curve.

Confidence Limits

Confidence limits provide a measure of the uncertainty in the



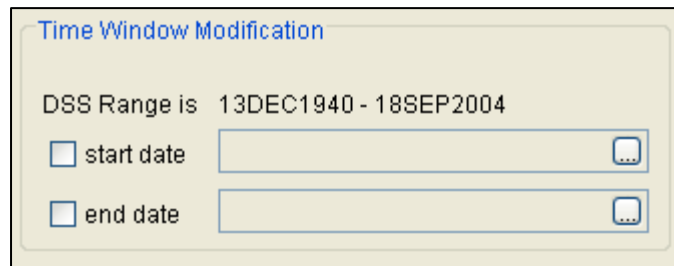
The screenshot shows a dialog box titled "Confidence Limits" with two radio button options: "Defaults (0.05, 0.95)" and "User Entered Values". The "Defaults (0.05, 0.95)" option is selected. Below the "User Entered Values" option, there are two input fields labeled "Upper Limit:" and "Lower Limit:".

computed value for a given exceedance probability. The computation of confidence limits is outlined in Bulletin 17B appendix 9, and is applied in the same manner here in the generalized frequency analysis. By default, HEC-SSP calculates the 90 percent confidence interval (i.e. the 5% and 95% confidence limits). The confidence limits must be entered

in decimal form (i.e. 95% = 0.95, and 5% = 0.05). The user has the option to override the default values.

Time Window Modification

This option allows the user to narrow the time window used for the analysis. The

The screenshot shows a dialog box titled "Time Window Modification" with a light beige background. At the top, it says "DSS Range is 13DEC1940 - 18SEP2004". Below this, there are two rows. The first row has a checkbox labeled "start date" followed by a text input field and a small square button with three dots. The second row has a checkbox labeled "end date" followed by a text input field and a similar button with three dots.

default is to use all of the data contained in the selected data set. The user can enter either a start date and end date or both a start and

end date. If a start and/or end date are used, they must be dates that are encompassed within the data stored in the selected data set. The date range for the selected data set is shown in the editor just above the **Start Date** field.

Options

In addition to the general settings, there are also several options available to the user for modifying the computations of the frequency curves. These options include:

- Low Outlier Threshold
- Historic Period Data
- User-Specified Frequency Ordinates
- Output Labeling

When the Options tab is selected, the Generalized Frequency editor will appear as shown in Figure 6-2.

General Frequency Editor - Ridgway General Frequency Analysis

Name: Ridgway General Frequency Analysis

Description:

Data Set: CLARION RIVER-RIDGWAY, PA-FLOW-ANNUAL PEAK

DSS File Name: I:\Documents and Settings\q0hecmjff\My Documents\SSP Projects\Clarion River\Clarion_River.ds

Report File: uencyResults\Ridgway_General_Frequency_Analysis\Ridgway_General_Frequency_Analysis.r

Options Tab

Low Outlier Threshold

☐ Use Low Outlier Threshold

Value

Output Labeling

Data Name

DSS data name is FLOW-ANNUAL PEAK

☒ change label Flow

Data Unit

DSS Data Unit is CFS

☐ change label CFS

Historic Period Data

☐ Use Historic Data

Historic Period

Start Year: 0

End Year: 0

High Threshold:

Historic Events

Water Year	Peak

User Specified Frequency Ordinates

☒ Use Values from Table below

Frequency in Percent	
0.2	
0.5	
1.0	
2.0	
5.0	
10.0	
20.0	
50.0	
80.0	
90.0	
95.0	

Buttons: Compute, Plot Analytical Curve, Plot Graphical Curve, View Report, Print, OK, Cancel, Apply

Figure 6-2. General Frequency Editor with Options Tab Selected.

Low Outlier Threshold

High and low outlier tests are based on the procedures outlined in Bulletin 17B, and are applied in the same manner in the Generalized Frequency Analysis. The calculated outlier magnitudes, by the Bulletin 17B procedure, are used as default values for the high and low outlier thresholds in HEC-SSP. The user has the option to enter a different value for the low outlier threshold. If a value is entered for the low outlier threshold, then this value will override the computed value from the Bulletin 17B methodology. Further discussion of outlier thresholds can be found in Bulletin 17B and the HEC-SSP Statistical Reference Guide. To use the low outlier threshold, simply check the box and enter the value.

Low Outlier Threshold

☐ Use Low Outlier Threshold

Value 0.000

Historic Period Data

Any historic data that provides reliable estimates outside the systematic record should be used in order to modify and improve the frequency computations. Information outside of the systematic record can often be used to extend the record of the largest events to a historic period much longer than that of the systematic record. HEC-SSP uses historic data as recommended in Bulletin 17B. This

Historic Period Data

☐ Use Historic Data

Historic Period

Start Year:

End Year:

High Threshold:

Historic Events	
Water Year	Peak

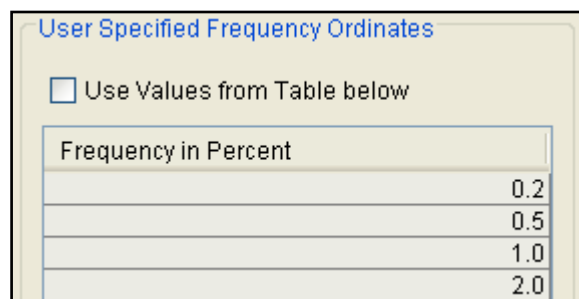
calculation is applied in the same manner in the Generalized Frequency Analysis. To use historic data, check the box labeled **Use Historic Data**. The user can enter a starting year for the historic period, ending year for a historic period, and a High Threshold value. If the user enters a high threshold value, then any data in the systematic record greater than that value will also be treated as a historical annual

maximum. The user can also enter historic data that are not contained in the systematic record. This is done in the table at the bottom labeled **Historic Events**. All years must be entered as water year values (October 1 through September 30). If a start year is not entered, then the assumed start year is the earliest year of the systematic record and any historical values that have been entered. If an end year is not entered, then the assumed end year is the latest year in the systematic record and any entered historic values. Further discussion of the use of historical data can be found in Bulletin 17B and the HEC-SSP Statistical Reference Guide.

Note: The program treats all data in the data set as systematic data. If historic events are included in the data set, then the user can define the analysis time window (General tab – Time Window Modification) so that it only bounds the systematic record. Then define the historic events in the Historic Events table. Instead of using the Time Window Modification option, another option is to enter a High Threshold value so that the historic data point(s) would be treated as historic data (rather than part of the systematic record). Please see test example 6 in Appendix B for an example of using the historic data adjustment.

User Specified Frequency Ordinates

This option allows the user to change the frequency ordinates used in computing the resulting frequency curves and confidence limits. The



The dialog box titled "User Specified Frequency Ordinates" contains a checkbox labeled "Use Values from Table below". Below the checkbox is a table with the heading "Frequency in Percent". The table has four rows with values 0.2, 0.5, 1.0, and 2.0 in the rightmost column.

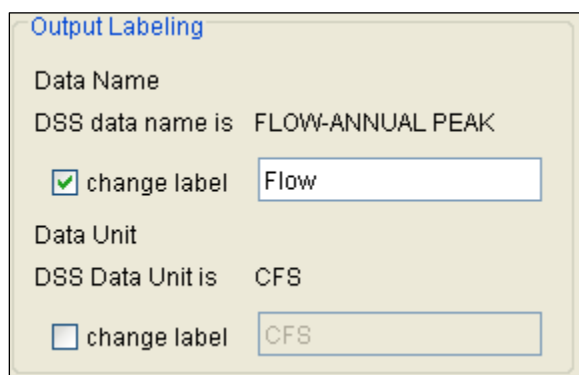
Frequency in Percent
0.2
0.5
1.0
2.0

default values listed in percent chance exceedance are 0.2, 0.5, 1, 2, 5, 10, 20, 50, 80, 90, 95, and 99. Check the box next to **Use Values from Table below** to change or add additional values. Once this box is checked, the user can

add/remove rows and edit the frequency values. To add or remove a row from the table, select the row(s), place the mouse over the highlighted row(s) and click the right mouse button. The pop-up menu contains options to **Insert Row(s)** and **Delete Row(s)**. The program will use the default values, even if they are not contained in the table, when the **Use Values from Table below** option is not checked. Finally, all values in the table must be between 0 and 100.

Output Labeling

This option allows the user to change the default labels for data



The dialog box titled "Output Labeling" contains two sections. The first section is for "Data Name", showing "DSS data name is FLOW-ANNUAL PEAK" and a checkbox labeled "change label" which is checked, with a text box containing "Flow". The second section is for "Data Unit", showing "DSS Data Unit is CFS" and a checkbox labeled "change label" which is unchecked, with a text box containing "CFS".

contained in the output tables and plots. The user can change both the name of the data as well as how the units of the data are labeled.

Analytical Frequency Analysis

Once the new analysis has been defined and the user has all of the general settings and options the way they want them, the user can choose between performing an Analytical Frequency analysis or a Graphical Frequency analysis. This section of the manual describes how to use the Analytical Frequency analysis option.

When the user selects the **Analytical** tab on the Generalized Frequency Analysis editor, the window will appear as shown in Figure 6-3. As shown, three additional tabs will appear on the screen: Settings, Tabular Results, and Plot.

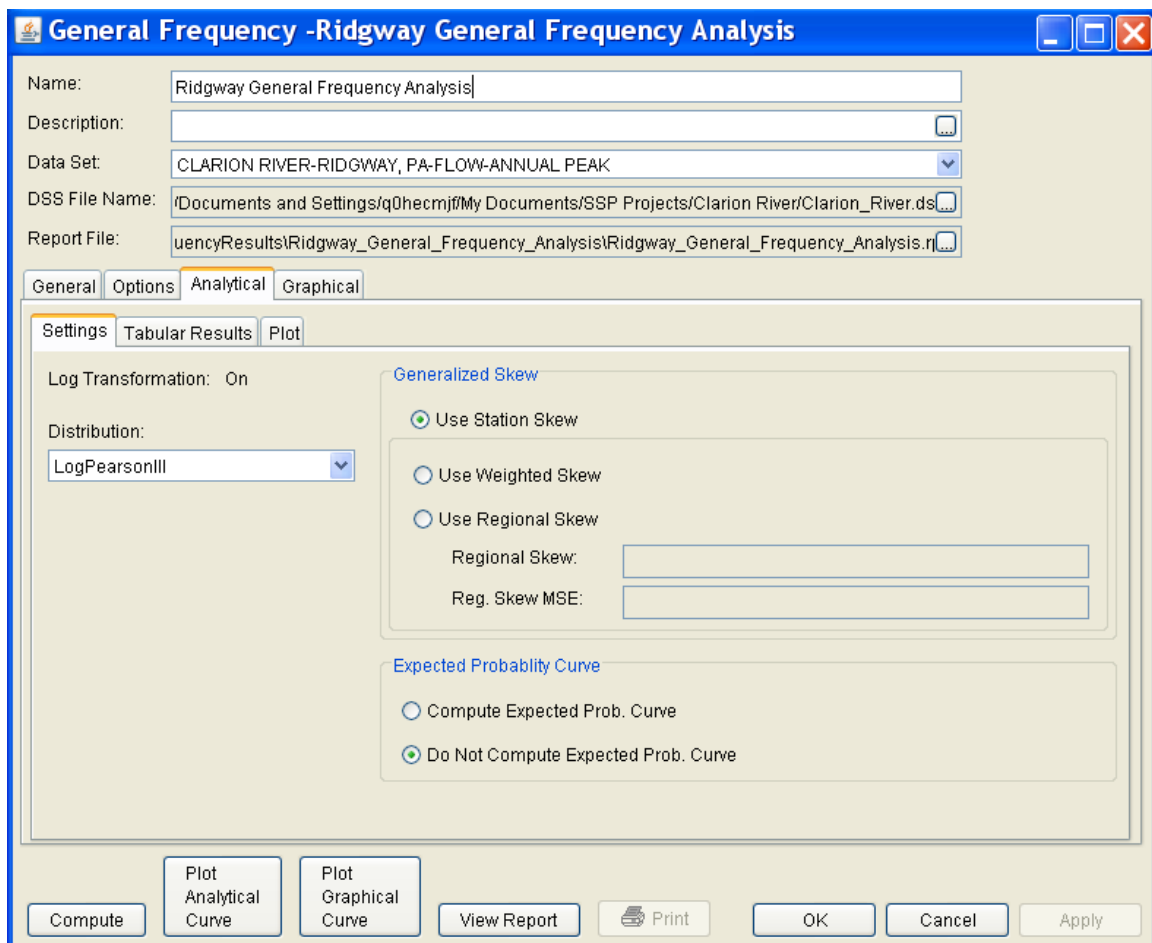


Figure 6-3. Analytical Analysis Tab of the Generalized Frequency Editor.

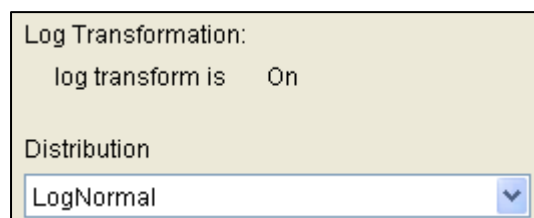
Settings

The **Settings** tab contains additional settings for the analytical frequency analysis. These settings include:

- Distribution
- Generalized Skew
- Expected Probability Curve

Distribution

This option allows the user to select from available analytical distributions to perform the frequency analysis. The current version of HEC-SSP contains five distribution choices: None, Normal, LogNormal, Pearson III, and LogPearson III.



Log Transformation:
log transform is On

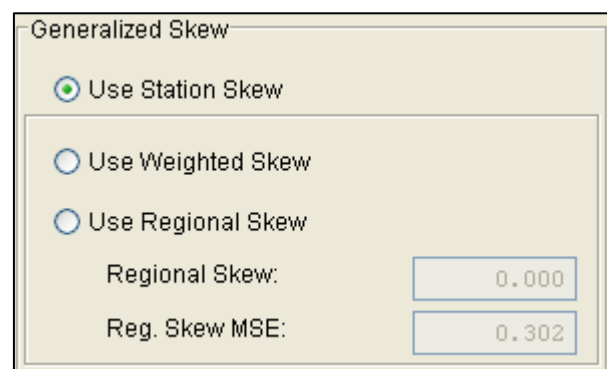
Distribution
LogNormal

If the user has selected to transform the data to log space (General tab), then the only available choices for distribution will be None, LogNormal, and LogPearson III. If the user did not select

the option to transform the data to log space (General tab), then the only available choices for distribution will be None, Normal and Pearson III.

Generalized Skew

There are three options contained within the generalized skew setting: Use Station Skew, Use Weighted Skew, and Use Regional Skew. The



Generalized Skew

☒ Use Station Skew

☐ Use Weighted Skew

☐ Use Regional Skew

Regional Skew: 0.000

Reg. Skew MSE: 0.302

default skew setting is **Use Station Skew**.

With this setting, the skew of the computed curve will be based solely on computing a skew from the data points.

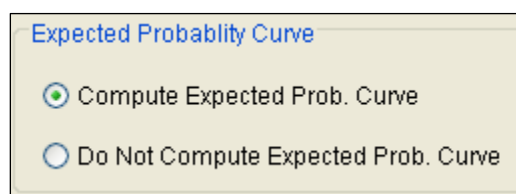
The **Use Weighted Skew** option requires the user to enter a

generalized regional skew and a Mean-Square Error (MSE) of the generalized regional skew. This option weights the computed station skew with the generalized regional skew. The equation for performing this weighting can be found in Bulletin 17B (equation 6). If a regional skew is taken from Plate I of Bulletin 17B (the skew map of the United States), the value of $MSE = 0.302$.

The last generalized skew option is **Use Regional Skew**. When this option is selected, the user must enter a generalized regional skew and an MSE for that skew. The program will ignore the computed station skew and use only the generalized regional skew.

Expected Probability Curve

This setting has two options: Compute the expected probability curve and do not compute the expected probability curve. The default setting is to have the expected probability curve computed. When computed, this curve will be shown in both the tables and the plots as



an additional curve to the computed curve. The expected probability adjustment is an attempt to correct for a certain bias in the frequency curve computation due to the shortness of the

record. Please review the discussion in Bulletin 17B about the expected probability curve adjustment for an explanation of how and why it is computed. The use of the expected probability curve is a policy decision. It is most often used in establishing design flood criteria. The basic flood frequency curve without the expected probability curve adjustment is the curve used in computation of confidence limits, risk, and in obtaining weighted averages of independent estimates of flood frequency discharge (WRC, 1982).

Compute

Once the new analysis has been defined, and the user has all of the General, Options, and Settings information selected the way they want, performing the computations is simply a matter of pressing the **Compute** button at the bottom of the Generalized Frequency editor.



Once the compute button is pressed, the frequency computations are performed. If the computations are successful, the user will receive a message that says "Compute Complete". At this point, the user can begin to review the results of the Analytical Frequency computations.

Tabular Results

The **Tabular Results** tab will bring up a table of results for the Analytical Frequency analysis. An example of the results tab is shown in Figure 6-4.

General Frequency -Ridgway General Frequency Analysis

Name: Ridgway General Frequency Analysis

Description:

Data Set: CLARION RIVER-RIDGWAY, PA-FLOW-ANNUAL PEAK

DSS File Name: /Documents and Settings/q0hecmj/My Documents/SSP Projects/Clarion River/Clarion_River.dss

Report File: uencyResults\Ridgway_General_Frequency_Analysis\Ridgway_General_Frequency_Analysis.rpt

General Options Analytical Graphical

Settings Tabular Results Plot

Percent Chance Exceedance	Curve based on Data			Curve based on User-Adjusted Statistics		
	Computed Curve Flow in CFS	Confidence Limits Flow in CFS		Computed Curve Flow in CFS	Confidence Limits Flow in CFS	
		0.95	0.05		0.95	0.05
0.2	67,541.3	139,913.9	42,532.1	77,405.8	106,783.0	59,741.3
0.5	52,729.6	101,479.7	34,652.2	58,493.5	77,977.5	46,355.9
1.0	43,153.0	78,325.4	29,325.3	46,740.5	60,658.5	37,814.2
2.0	34,803.6	59,405.5	24,483.4	36,839.0	46,499.6	30,441.2
5.0	25,403.3	39,775.4	18,729.5	26,130.1	31,749.5	22,218.2
10.0	19,352.6	28,275.4	14,779.7	19,520.0	23,027.8	16,957.4
20.0	14,055.0	19,129.3	11,071.2	13,943.9	15,984.3	12,350.3
50.0	7,845.2	9,885.9	6,205.5	7,701.6	8,604.5	6,884.8
80.0	4,544.0	5,775.1	3,328.5	4,532.3	5,123.3	3,946.0
90.0	3,465.2	4,519.9	2,390.9	3,519.7	4,036.2	2,999.7
95.0	2,790.7	3,739.2	1,824.4	2,891.5	3,361.2	2,417.7

System Statistics		Number of Events	
Statistic	Value	Event	Number
Mean	3.906	Historic Events	0
Standard Dev	0.292	High Outliers	0
Station Skew	0.233	Low Outliers	0
Regional Skew		Zero Or Missing	0
Weighted Skew		Systematic Events	24
Adopted Skew	0.233	Historic Period	

Log Transformation: On
Distribution: LogPearsonIII

Compute Plot Analytical Curve Plot Graphical Curve View Report Print OK Cancel Apply

Figure 6-4. Tabular Results Tab for Analytical Analysis.

As shown in Figure 6-4, the window contains three tables. The top table contains results of the computed frequency curve. The very left column of the top table is the Percent Chance Exceedance for all the computed values. The next three columns in the top table contain the computed frequency curve and the 95% and 5% confidence limits that correspond to that computed curve. The last three columns of the top table contain a computed frequency curve and confidence limits for an analysis based on user-adjusted statistics for the mean, standard deviation, adopted skew, and equivalent years of record. User entered adjusted statistics are an option that the user can set on the **Plot** tab, which is discussed in detail in the next section of this manual. If the user has not entered adjusted statistics, then these columns will be empty.

Two additional tables are shown at the bottom of the window: System Statistics and Number of Events. The **System Statistics** table consists of the mean, standard deviation, station skew, user entered regional skew, weighted skew (weighted between station skew and regional skew), and the adopted skew for the analysis. The **Number of Events** table contains the number of historic events, high outliers, low outliers, zero or missing values, systematic events, and the number of years in the historic period (this value only comes into play if the user entered historic data).

Additionally, the lower right portion of the table will show if Log Transform is On or Off, and which analytical distribution was selected for the analysis.

Plot

In addition to tabular results, a **Plot** tab is available for viewing a graphical plot of both the computed frequency curve, as well as a computed curve based on any user-adjusted statistics. When the Plot tab is selected the window will change to what is shown in Figure 6-5.

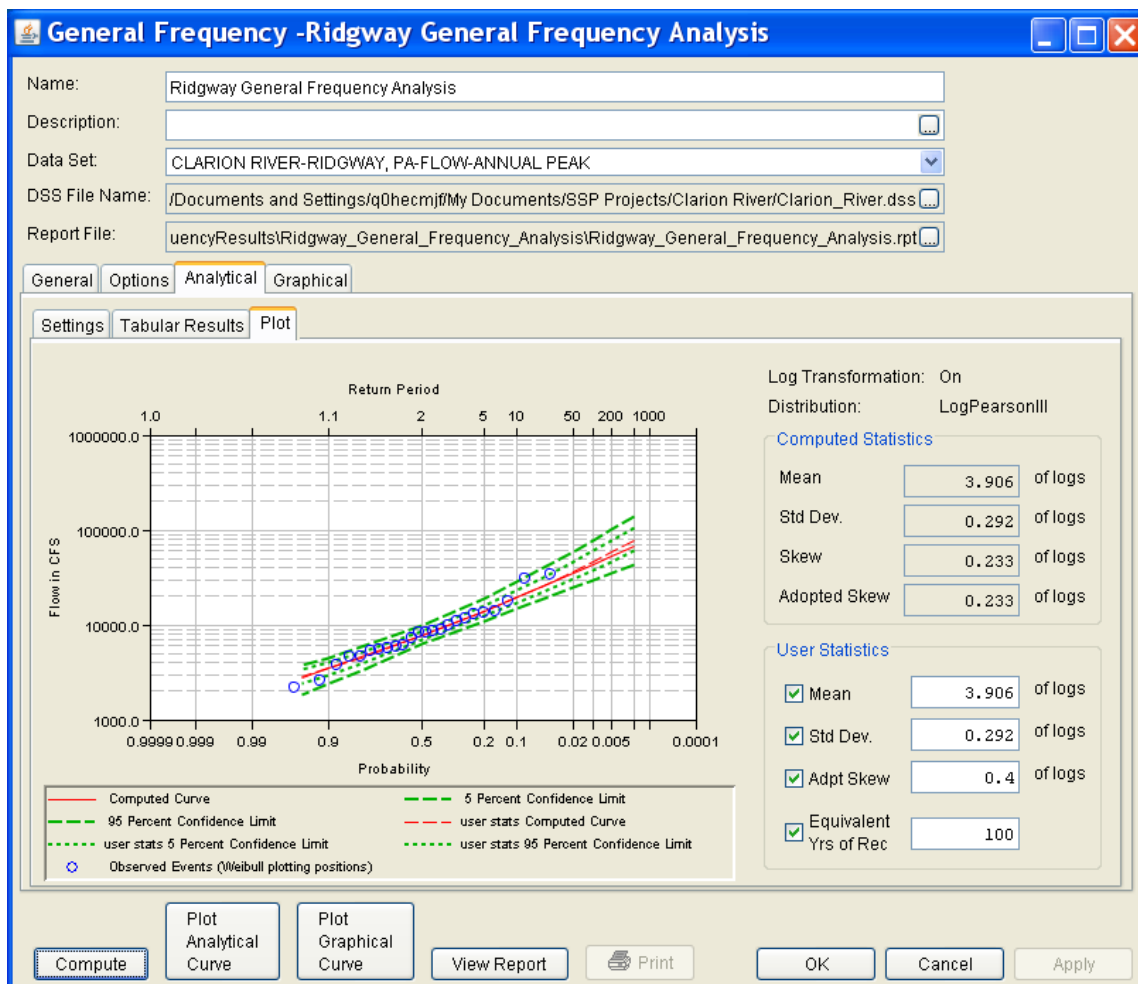


Figure 6-5. Plot Tab of the Generalized Frequency Analytical Analysis.

As shown in Figure 6-5, the plot contains the computed frequency curve, 95 and 5% confidence limits, and raw data points plotted by the user selected plotting position method. The computed statistics for the frequency curve are shown in a table on the right side of the window. Below the computed statistics is a table labeled "User Statistics". There is a check box and a data entry field for the Mean, Standard Deviation, Adopted Skew, and Equivalent Years of Record. The user can enter values into any or all of these fields. Turning on the check box then enacts that field to be used in computing a curve with the user entered statistic overriding the computed value from the raw data. The user statistics option allows the user to see how the curve would change if any or all of the statistics were different. When data is entered into the user statistics fields, and the check boxes are turned on, the user must press the compute button again in order for the computations to be performed with the user entered statistics. After the compute button is pressed, both the plot and the table on the Tabular Results tab will be updated to reflect any user entered statistics.

Graphical Frequency Analysis

In addition to an analytical frequency analysis which uses a statistical distribution fit to the data, the user has the option to graphically fit a curve to the data. A graphical fit can be very useful when the available analytical distributions do not provide a good fit to the data. One example of when a graphical frequency analysis is most appropriate is when plotting a frequency curve for flow data that is downstream of a flood control reservoir. Analytical frequency distributions are often not appropriate for fitting flow data that is significantly regulated by upstream reservoirs. In general, a portion of the flow frequency data for a highly regulated stream will be very flat in the zone in which upstream regulation can control the flows for a range of frequencies. This type of data lends itself to a graphical fit analysis over the use of an analytical equation. Another example of using a graphical fitting technique over an analytical curve is when trying to compute a frequency curve to annual peak stage data at a point on a river. Often the stages will flatten out with decreased frequencies when flows go out into the overbank and floodplain area. Again, this type of data is fitted much better using a graphical fit curve instead of an analytical distribution.

When the **Graphical** tab is selected, the editor will display a plot and table as shown in Figure 6-6. In the plot, the data will be plotted using the user selected plotting position method. The table to the right of the plot allows the user to enter data values for the frequency ordinates defined on the Options tab. When the user enters values in this table, those values will be plotted as a line on the plot after the **Compute** button is pressed. The idea is to enter values in the table that will create a best fit line of the data, based on the user's judgment.

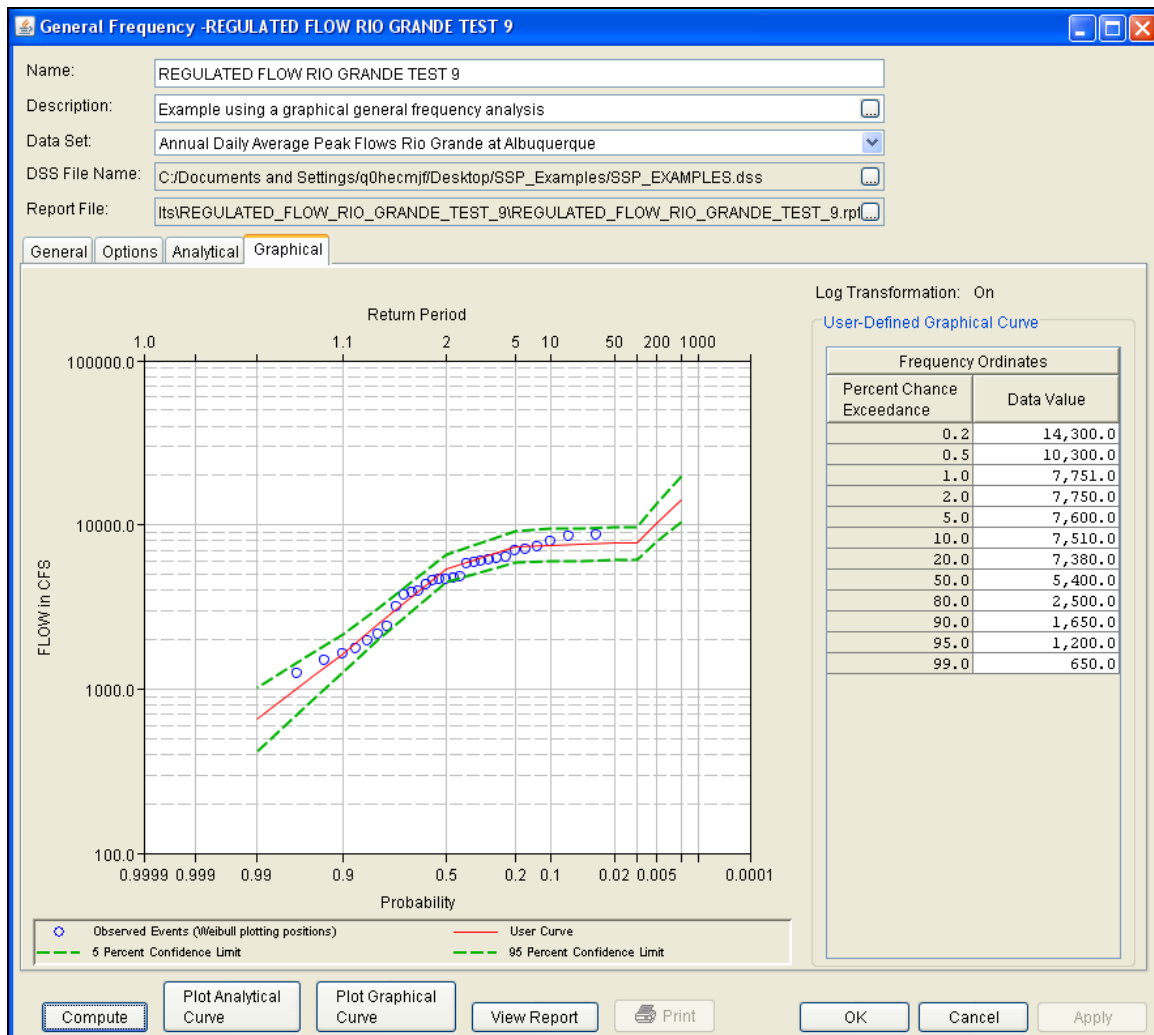


Figure 6-6. Graphical Analysis Tab of the Generalized Frequency Editor.

Viewing and Printing Results

The user can view output for the frequency analysis directly from the Generalized Frequency editor (Tabular and Graphical output) or by using the plot and view buttons at the bottom of the editor. The output consists of tabular results, an analytical frequency curve plot, a graphical frequency curve plot, and a report documenting the data and computations performed.

Tabular Output

Once the computations for the analytical frequency analysis are completed, the user can view tabular output by selecting the **Tabular Results** tab under the **Analytical** analysis tab. The details of this table were discussed under the analytical analysis option above.

The tabular results can be printed by using the **Print** button at the bottom of the Generalized Frequency editor. When the print button is pressed, a window will appear giving the user options for how they would like the table to be printed.

Graphical Output

Graphical output of the analytical frequency curve can be obtained by selecting either the **Plot** tab under the analytical analysis tab, or by pressing the button labeled **Plot Analytical Curve** at the bottom of the general frequency editor. When the Plot Analytical Curve button is pressed, a frequency curve plot will appear in a separate window as shown in Figure 6-7.

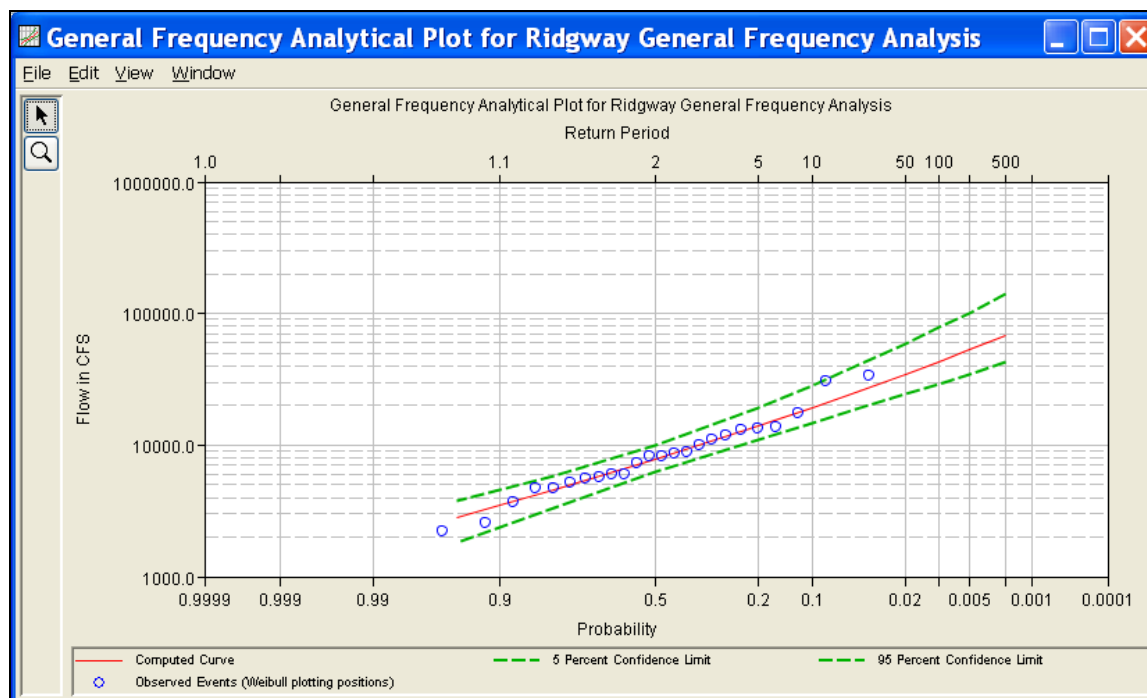


Figure 6-7. Analytical Analysis Frequency Curve Plot.

The analytical frequency curve plot can be sent to the printer by selecting the **Print** option from the **File** menu at the top of the window. Additional printing options available from the File menu are Page Setup, Print Preview, and Print Multiple (used for printing multiple graphs on the same page). The graphic can also be sent to the Windows Clipboard by selecting **Copy to Clipboard** from the File menu. Additionally, the plot can be saved to a file by selecting the **Save As** option from the File menu. When the Save As option is selected, a pop-up window will appear allowing the user to select a directory, enter a filename, and select the format for saving the file. Currently four file formats are available for saving the graphic to disk: windows metafile, postscript, JPEG, and portable network graphic.

The data contained within the plot can also be tabulated by selecting **Tabulate** from the File menu. When this option is selected, a separate window will appear with the data tabulated. Additional options are available from the File menu for saving the plot options as a template (**Save Template**) and applying previously saved templates to the current plot (**Apply Template**).

The **Edit** menu contains several options for customizing the graphic. These options include Plot Properties, Configure Plot Layout, Default Line Styles, and Default Plot Properties. Also, a pop-up menu will appear with further customizing options when the user right-clicks on a line on the graph or the legend. The graphic customizing capabilities within HEC-SSP are very powerful, but are also somewhat complex to use. The code used in developing the plots in HEC-SSP is the same code that was used for developing graphics in HEC-DSSVue and several other HEC software programs. A separate write-up on Customizing Graphics can be found in Appendix C of this manual. Please refer to that appendix for details on using the graphics customizing options.

A plot of the graphical frequency curve can be obtained by pressing either the **Graphical** tab, or by pressing the button labeled **Plot Graphical Curve** at the bottom of the general frequency editor. When the Plot Graphical Curve button is pressed, a frequency curve plot will appear in a separate window as shown in Figure 6-8. All of the same options for tabulating, printing, and sending results to the windows clipboard are available for this plot as they are for the analytical frequency curve plot.

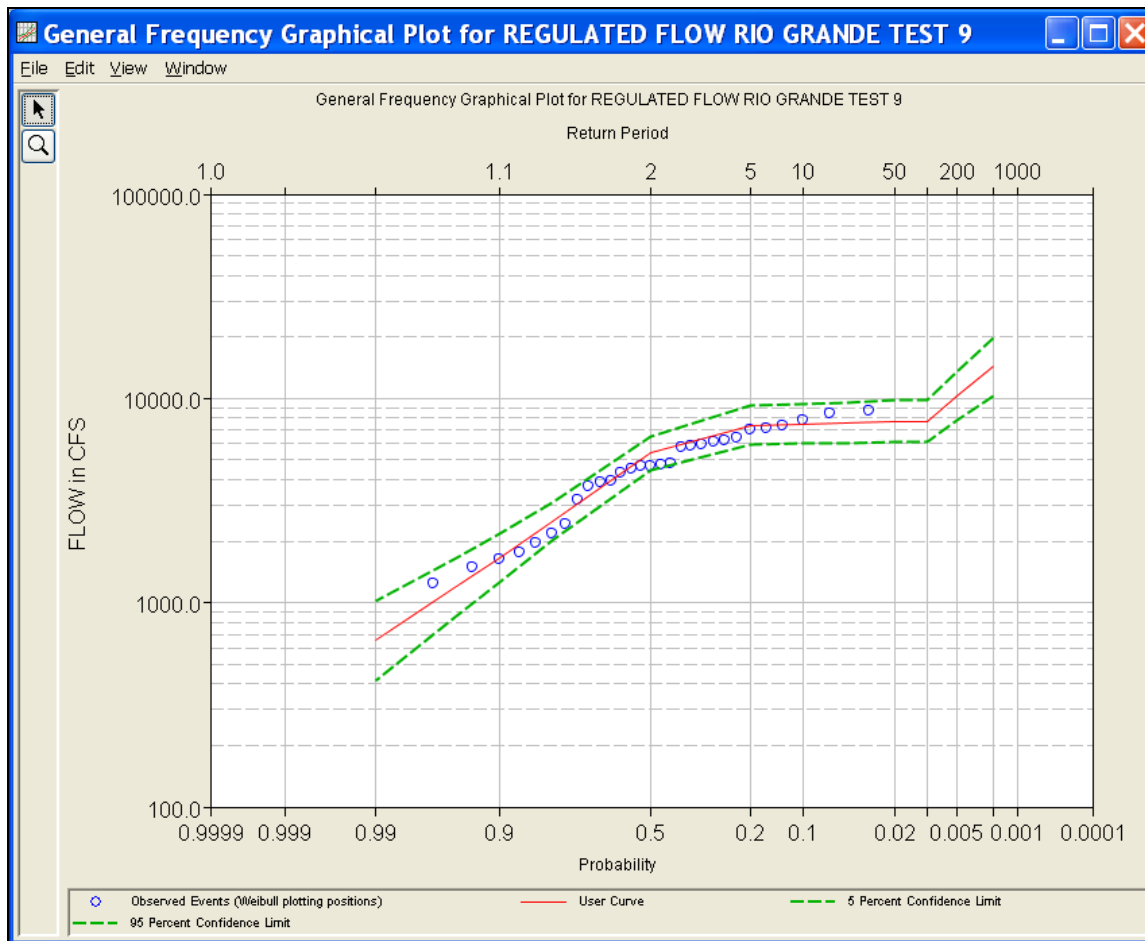


Figure 6-8. Graphical Analysis Frequency Curve Plot.

Viewing the Report File

When the General Frequency analysis computations are performed, the computations module writes a report file. The report file lists all of the input data and user settings, plotting positions of the data points, intermediate results, each of the various statistical tests performed (i.e. high and low outliers, historical data, etc...), and the final results. This file is often useful for understanding how the software arrived at the final frequency curve.

To view the report file press the **View Report** button at the bottom of the General Frequency analysis window. When this button is pressed, a window will appear containing the text report as shown in Figure 6-9.

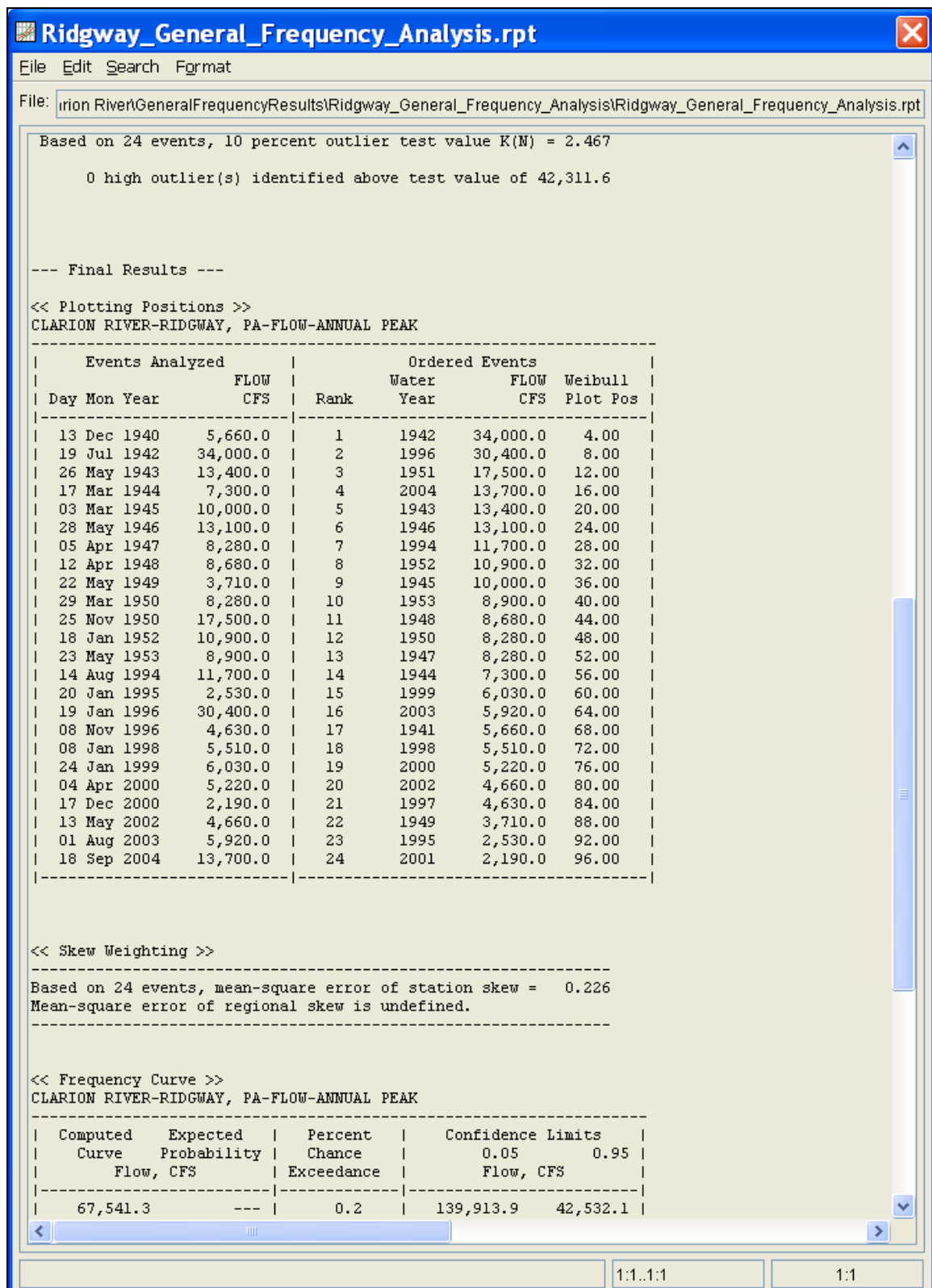


Figure 6-9. General Frequency Analysis Report File

CHAPTER 7

Performing a Volume-Duration Frequency Analysis

The current version of HEC-SSP allows the user to perform a volume-duration frequency analysis of flow data. The user can choose between different analytical distributions as well as perform a graphical fit to the data. This chapter discusses in detail how to use the volume-duration frequency analysis editor with HEC-SSP.

Contents

- Starting a New Volume-Duration Frequency Analysis
- General Settings and Options
- Extracting the Volume-Duration Frequency Data
- Analytical Frequency Analysis
- Graphical Frequency Analysis
- Viewing and Printing Results

Starting a New Volume-Duration Frequency Analysis

A volume-duration frequency analysis can be started in two ways within the software, either by right clicking on the Volume-Frequency Analysis folder in the study explorer and selecting **New**, or by going to the **Analysis** menu and selecting **New** and then **Volume-Frequency Analysis**. When a new volume-frequency analysis is selected, the Volume-Duration Frequency editor will appear as shown in Figure 7-1.

Figure 7-1. Volume-Duration Frequency Analysis Editor.

The user is required to enter a **Name** for the analysis; while a **Description** is optional. A data set (daily average flow) must be selected from the available data sets stored in the current study DSS file (see chapter 4 for importing daily flow data into the study). Once a **Name** is entered and a data set is selected, the **DSS File Name** and **Report File** will automatically be filled out. The DSS filename is by default the same name as the study DSS file. The report file is given the same name as the analysis with the extension ".rpt".

General Settings and Options

Once the analysis name and data set are selected, the user can begin defining the analysis. Five tabs are contained on the Volume-Duration Frequency editor. The tabs are labeled **General**, **Options**, **Duration Table**, **Analytical**, and **Graphical**. This section of the manual explains the use of the General and Options tabs.

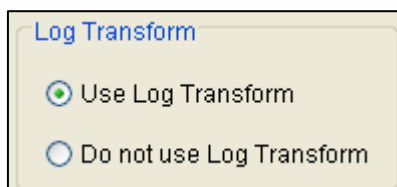
General Settings

The first tab contains general settings for performing the frequency analysis (Figure 7-1). These settings include:

- Log Transforms
- Plotting Positions
- Maximum or Minimum Analysis
- Year Specification
- Time Window Modification

Log Transform

There are two options contained within the Log Transform setting: **Use**



Log Transform and **Do not use Log Transform**. If the user selects **Use Log Transform**, then the logs of the data will be computed first, and the frequency analysis will be performed on the logs of the data. If the user selects **Do not use**

Log Transform, then the frequency analysis will be performed on the raw data values without taking the logs of the data. The default setting is **Use Log Transform**.

Plotting Positions

Plotting positions are used for plotting the raw data points on the graph. There are four options for plotting position within HEC-SSP:

Plotting Position

☒ Weibull (A and B = 0)

☐ Median (A and B = 0.3)

☐ Hazen (A and B = 0.5)

☐ Other (Specify A, B)

Plotting position computed using formula
 $(m-A)/(n+1-A-B)$

Where:

m=rank, 1=largest
 N=Number of Years
 A,B=Constants

A:

B:

Weibull, Median, Hazen, and user entered coefficients. The default method is the Weibull plotting position method.

The generalized plotting position equation is:

$$P = \frac{(m - A)}{(n + 1 - A - B)}$$

Where: m = rank of flood values with the largest equal to 1.

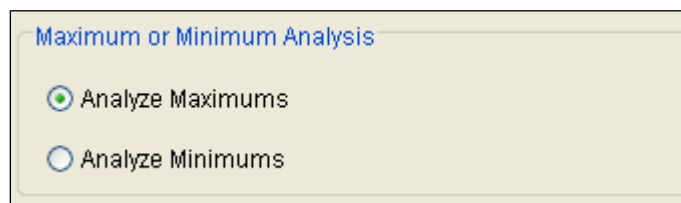
n = number of flood peaks in the data set.

A & B = constants dependent on which equation is used
 (Weibull A and B=0; Median A and B = 0.3; and
 Hazen A and B=0.5).

Plotting positions are estimates of the exceedance probability for each data point. Different methods can give different values for the probabilities of the highest and lowest points in the data set. The plotting of data on the graph by a plotting position method is only done as a guide to assist in evaluating the computed curve. The plotting position method selected does not have any impact on the computed curve.

Maximum or Minimum Analysis

A volume-frequency analysis can be performed using annual maximum or minimum flows. A maximum flow analysis could be used for determining the amount of reservoir storage required for a flood of specific frequency. A minimum flow, or low flow analysis, could be used to determine if a river could supply a given demand. A low flow analysis could also be beneficial for water quality and reservoir storage



Maximum or Minimum Analysis

☒ Analyze Maximums

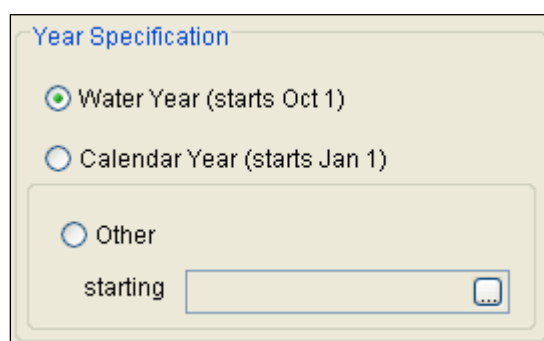
☐ Analyze Minimums

projects. There are two options contained in the Maximum or Minimum Analysis section. If **Analyze Maximums** is

selected, then the program will extract annual maximum volumes for all durations. The program will extract annual minimum volumes for all durations if **Analyze Minimums** is selected.

Year Specification

This option allows the user to define the beginning and ending date for what will be considered as the analysis year for extracting the data. These dates are used for extracting the annual maximum or minimum flows, in order to get one value for each analysis year. It is important to choose a start date that captures all flood events from a certain



Year Specification

☒ Water Year (starts Oct 1)

☐ Calendar Year (starts Jan 1)

☐ Other

starting

hydrologic regime. If high flows generally occur between November and May, then the year should not start between these months. This will minimize the possibility that the same flood event is used for the consecutive years. There are three options contained in the Year Specification section. If **Water Year** is

selected, the program uses a starting date of October 1 and an ending date of September 30. If **Calendar Year** is selected, the program uses a starting date of January 1 and an ending date of December 31. The **Other** option lets the user define the starting date. One way to determine when the year should begin is to plot each year of record on top of one another, as shown in Figure 7-2. This data set is from an area that experiences both snowmelt floods and summer/fall rain floods. Starting the year on January 1 would be more appropriate for this data set because a few large flood events occurred around October 1.

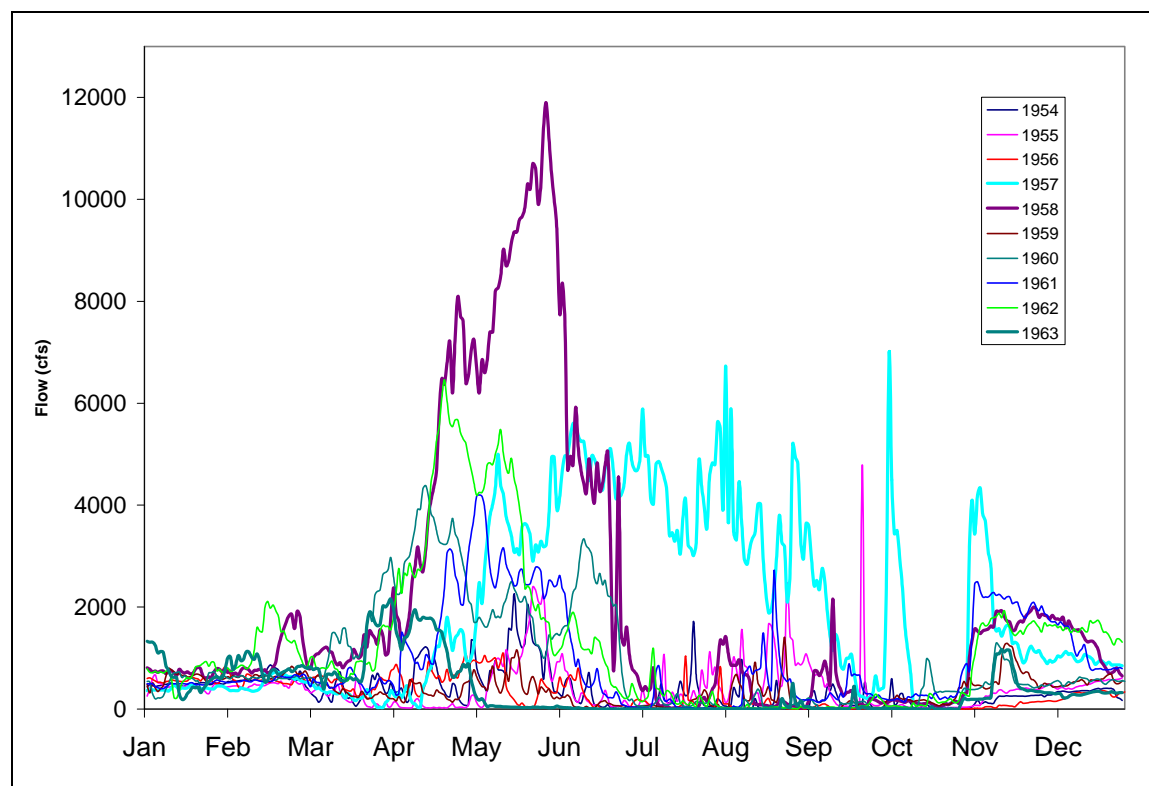


Figure 7-2. Plot Showing when Flood Events Typically Occur.

Time Window Modification

This option allows the user to narrow the time window used for the analysis. When left unchecked, the program will use all of the data contained in the selected data set. The user can enter either a start or end date or both a start and end date. If a start and/or end date are used, they must be dates that are included within the selected data set. The date range for the selected data set is shown in the editor

just above the Start Date field.

Time Window Modification

End Points

DSS Range is

☐ start date

☐ end date

Season

To define a subset of the year

season start: ☐ season end: ☐

NOTE: season must be within a year, as defined in the Year Specification

An additional option at the bottom of the time window modification section allows the user to define a shorter duration, a **Season**, within the year in which the program extracts maximum or minimum flows. This option allows the user to analyze floods that typically occur during a specific season, like snowmelt floods.

When left unchecked, the program will examine all flow records during the year. The season start and end dates must be entered using a two digit day followed by the month, example 15May. The season start and end dates must fall within a year as defined in the Year Specification. The user must enter both start and end dates to define the season subset.

Options

In addition to the general settings, there are also several options available to the user for modifying the computation of the volume-frequency curves. These options include:

- Flow-durations
- User-Specified Frequency Ordinates
- Output Labeling

When the Options tab is selected, the Volume-Duration Frequency editor will appear as shown in Figure 7-3.

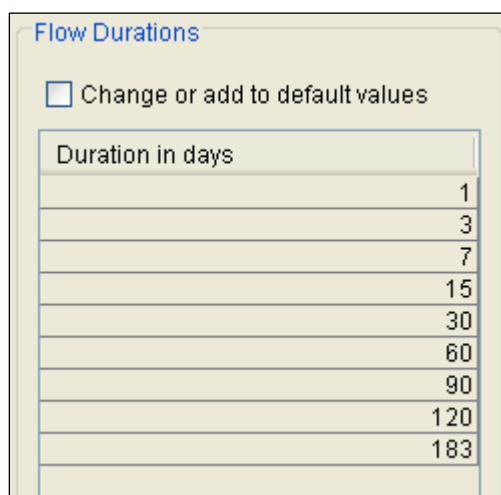
The screenshot shows the 'Options' tab selected in the 'Volume-Duration Frequency Editor'. The interface is divided into three main sections:

- Flow Durations:** Contains a checkbox 'Change or add to default values' and a table with 'Duration in days' and values: 1, 3, 7, 15, 30, 60, 90, 120, 183.
- User Specified Frequency Ordinates:** Contains a checkbox 'Use Values from Table below' and a table with 'Frequency in Percent' and values: 0.2, 0.5, 1.0, 2.0, 5.0, 10.0, 20.0, 50.0, 80.0, 90.0, 95.0, 99.0.
- Output Labeling:** Contains 'Data Name' (DSS data name is FLOW) with a 'change label' button showing 'FLOW', and 'Data Unit' (DSS Data Unit is CFS) with a 'change label' button showing 'CFS'.

Figure 7-3. Volume-Duration Frequency Editor with Options Tab Selected.

Flow-Durations

This option lets the user define which durations are used in the volume-frequency analysis. The program will extract annual maximum



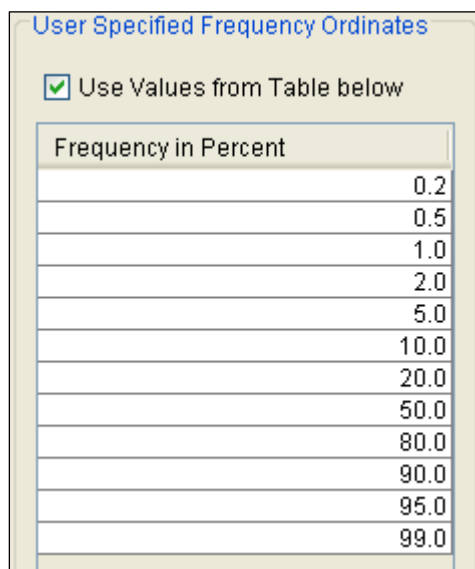
The dialog box titled "Flow Durations" contains a checkbox labeled "Change or add to default values" which is currently unchecked. Below the checkbox is a table with the header "Duration in days". The table contains the following values in its single column: 1, 3, 7, 15, 30, 60, 90, 120, and 183.

Duration in days
1
3
7
15
30
60
90
120
183

or minimum volumes based on the durations defined in this table. The default durations are 1, 3, 7, 15, 30, 60, 120, and 183 days. Check the box next to **Change or add to default values** to change or add additional durations to the analysis. Once this box is checked, the user can add/remove rows and edit the duration values. To add or remove a row from the table, select the row(s), place the mouse over the highlighted row(s) and click the right

mouse button. The pop-up menu contains options to **Insert Row(s)** and **Delete Row(s)**. The program will use the default durations, even if they are not contained in the table, when the **Change or add to default values** option is not checked.

User Specified Frequency Ordinates



The dialog box titled "User Specified Frequency Ordinates" contains a checkbox labeled "Use Values from Table below" which is currently checked. Below the checkbox is a table with the header "Frequency in Percent". The table contains the following values in its single column: 0.2, 0.5, 1.0, 2.0, 5.0, 10.0, 20.0, 50.0, 80.0, 90.0, 95.0, and 99.0.

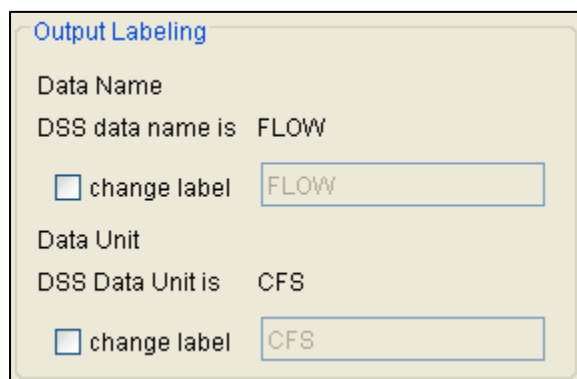
Frequency in Percent
0.2
0.5
1.0
2.0
5.0
10.0
20.0
50.0
80.0
90.0
95.0
99.0

This option allows the user to change the frequency ordinates used for creating result tables and graphs. The default values listed in percent chance exceedance are 0.2, 0.5, 1, 2, 5, 10, 20, 50, 80, 90, 95, and 99. Check the box next to **Use Values from Table below** to change or add additional values. Once this box is checked, the user can add/remove rows and edit the frequency values. To add or remove a row from the table, select the row(s), place the mouse over the highlighted row(s) and click the right mouse button. The pop-up menu

contains options to **Insert Row(s)** and **Delete Row(s)**. The program will use the default values, even if they are not contained in the table, when the **Use Values from Table below** option is not checked. Finally, all values in the table must be between 0 and 100.

Output Labeling

This option allows the user to change the default labels for data contained in the output tables and plots. The user can change both the name of the data and how the units of the data are labeled.



The screenshot shows a dialog box titled "Output Labeling". It contains two sections: "Data Name" and "Data Unit". In the "Data Name" section, it says "DSS data name is FLOW" and there is a checkbox labeled "change label" next to a text box containing "FLOW". In the "Data Unit" section, it says "DSS Data Unit is CFS" and there is a checkbox labeled "change label" next to a text box containing "CFS".

Duration Table

The user can extract the volume-duration data once settings have been defined on the General and Options tabs. When the Duration Table tab is selected, the Volume-Duration Frequency editor will appear as shown in Figure 7-4. The program will compute the annual maximum or minimum average flows for the durations specified on the Options tab when the user presses the **Extract Volume-Duration Data** button at the bottom of the Duration Table.

The program computes the maximum/minimum flows by evaluating the flow record one year at a time. For each duration, the program computes an annual time-series of average flow. The program begins computing the average flow values at a specific number of days after the beginning of the year. The number of days is determined by the duration. For example, for a 15-day duration, the program begins computing the 15-day average flow 15 days after the beginning of the year. If water year is chosen, then the program begins computing the average 15-day flow on October 15. The 15-day flow on October 15 is an average of flow from October 1 through October 15. This approach is an attempt to prevent a scenario in which the same flow event causes maximum/minimum flows in consecutive years; however, it is possible to miss a maximum/minimum value using this approach. The maximum 15-day flow could occur on October 10. If the water year begins on October 1, then the program will not use this value. This is why it is important to choose an appropriate annual starting date.

Chapter 7 Performing a Volume-Duration Frequency Analysis

General
Options
Duration Table
Analytical
Graphical

Year

Volume-Duration Data

Highest Mean Value for Duration, Average Daily FLOW in CFS

1

3

7

15

Date

FLOW

Date

FLOW

Date

FLOW

Date

FLOW

1913	12/24/1912	1500	12/25/1912	1122	12/26/1912	755	01/02/1913	399
1914	09/26/1914	5290	09/27/1914	3187	09/30/1914	1808	09/28/1914	978
1915	04/27/1915	1530	04/28/1915	1059	05/02/1915	674	12/10/1914	435
1916	03/04/1916	2040	03/04/1916	1570	11/10/1915	920	11/16/1915	724
1917	12/18/1916	2860	12/20/1916	2240	12/24/1916	1614	12/30/1916	939
1918	03/11/1918	3930	03/13/1918	3367	03/17/1918	2255	03/18/1918	1372
1919	10/31/1918	322	08/02/1919	179	08/03/1919	127	08/03/1919	96
1920	01/16/1920	6400	01/17/1920	3653	01/21/1920	1698	01/28/1920	849
1921	01/16/1921	13800	01/17/1921	6073	01/20/1921	3981	01/27/1921	2339
1922	09/11/1922	3120	12/24/1921	1910	12/27/1921	1138	01/04/1922	588
1923	03/31/1923	5630	04/01/1923	2283	04/05/1923	1104	01/25/1923	620
1924	04/16/1924	1690	04/17/1924	1453	04/21/1924	891	04/28/1924	506
1925	02/11/1925	2600	10/12/1924	999	10/16/1924	527	10/23/1924	308
1926	06/15/1926	789	06/16/1926	396	06/18/1926	180	11/18/1925	145
1927	05/16/1927	3160	05/18/1927	1910	05/19/1927	1279	05/27/1927	801
1928	12/24/1927	6670	12/25/1927	3040	12/27/1927	1546	12/25/1927	925
1929	07/26/1929	6820	07/28/1929	2571	08/01/1929	1197	08/09/1929	607
1930	01/26/1930	1840	01/26/1930	1109	01/30/1930	673	02/07/1930	384
1931	11/19/1930	1510	11/20/1930	831	10/07/1930	511	11/25/1930	348
1932	02/12/1932	2650	02/07/1932	1846	02/12/1932	1478	02/18/1932	1044
1933	01/02/1933	3900	01/03/1933	1697	03/08/1933	1118	03/08/1933	672
1934	04/26/1934	1130	04/28/1934	552	12/27/1933	276	12/26/1933	160
1935	02/27/1935	2240	02/28/1935	1205	03/03/1935	643	03/12/1935	369
1936	08/25/1936	2660	08/27/1936	1229	08/31/1936	665	09/08/1936	383
1937	03/19/1937	4420	03/20/1937	2533	03/23/1937	1235	05/11/1937	651
1938	11/25/1937	2070	02/04/1938	1004	02/03/1938	784	02/12/1938	521
1939	03/04/1939	1870	03/05/1939	1259	03/07/1939	831	03/13/1939	467
1940	05/13/1940	4860	05/14/1940	1947	05/15/1940	1029	05/23/1940	537
1941	10/02/1940	787	10/04/1940	634	10/07/1940	356	10/15/1940	214

Extract Volume-Duration Data

Compute

Plot Duration Data

Plot Analytical Curve

Plot Graphical Curve

View Report

Print

OK

Cancel

Apply

Figure 7-4. Volume-Duration Table.

The user must **Compute** the analysis before viewing a plot of the volume-duration data. The plot created by pressing the **Plot Duration Data** button, located at the bottom of a Volume-Duration Frequency editor, shows the annual maximum/minimum volumes plotted using the user specified plotting position method, as shown in Figure 7-5.

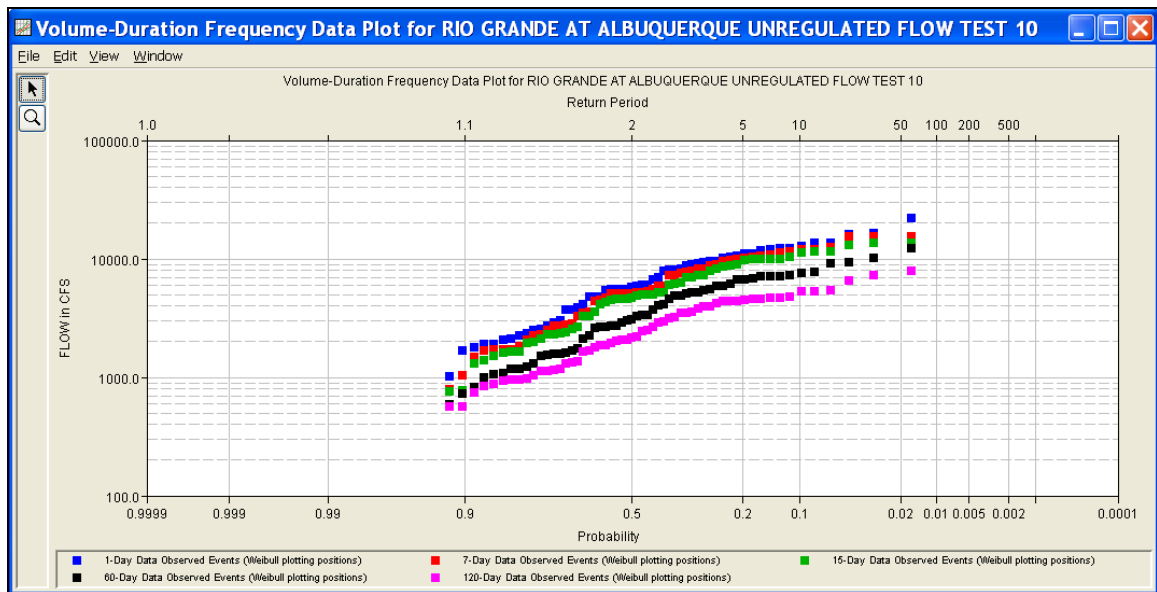


Figure 7-5. Plot of Volume-Duration Data.

Analytical Frequency Analysis

The user can choose between performing an Analytical Frequency Analysis or a Graphical Frequency Analysis once settings have been defined on the General and Options tabs. The Duration Data does not have to be extracted before computing an analysis. The program will automatically extract the duration data when the **Compute** button is pressed. This section of the manual describes how to compute and view results for an Analytical Frequency Analysis.

When the user selects the **Analytical** tab on the Volume-Duration Frequency editor, the window will appear as shown in Figure 7-6. As shown, four additional tabs will appear on the screen: Settings, Tabular Results, Plot, and Statistics.

General Options Duration Table **Analytical** Graphical

Settings Tabular Results Plot Statistics

Log Transformation: On

Distribution:
LogPearsonIII

Expected Probability Curve

☐ Compute Expected Prob.Curve
☒ Do Not Compute Expected Prob.

Skew

☐ Use Station Skew
☒ Use Weighted Skew
☐ Use Regional Skew

Duration	Reg. Skew	R.Skew MSE
1	0.3	0.302
3	0.3	0.302
7	0.3	0.302
15	0.3	0.302
30	0.3	0.302
60	0.3	0.302
90	0.3	0.302
120	0.3	0.302
183	0.3	0.302

Compute Plot Duration Data Plot Analytical Curve Plot Graphical Curve View Report Print OK Cancel Apply

Figure 7-6. Analytical Tab of the Volume-Duration Frequency Editor.

Settings

In addition to settings on the General and Options tabs, there are more options on the Settings tab the user must define in order to perform an Analytical Frequency analysis on the volume-duration data. These settings include:

- Distribution
- Expected Probability Curve
- Skew

Distribution

This option allows the user to select a distribution to perform the frequency analysis. The current version of HEC-SSP contains five distribution choices: None, Normal, LogNormal, Pearson III, and LogPearson III. If the user has selected the **Use Log Transform** option, located on the General tab, then the available choices for distribution are None, LogNormal, and LogPearson III. If the user has selected the **Do not use Log Transform** option, located on the General tab, then the distribution choices are None, Normal, and Pearson III.

Distribution:

LogPearsonIII

None

LogNormal

LogPearsonIII

Expected Probability Curve

This setting has two options, **Compute Expected Prob. Curve** and **Do Not Compute Expected Prob. Curve**. The default setting is to have the expected probability curve computed. When computed, this curve will be shown in both the result table and the plot as an additional curve to the computed curve. The expected probability

adjustment is an attempt to correct for a certain bias in the frequency curve computation due to the shortness of the record. Please review the discussion in Bulletin 17B about the expected probability curve adjustment for an explanation of how and why it is computed. The use of the expected probability curve is a policy decision. It is most often used in establishing design flood criteria. The basic flood frequency curve without the expected probability curve adjustment is the curve used in computation of confidence limits, risk, and in obtaining weighted averages of independent estimates of flood frequency discharge (WRC, 1982).

Skew

The skew option is only available whenever the analytical distribution is set to PearsonIII or LogPearsonIII. There are three options

Skew

☐ Use Station Skew

☒ Use Weighted Skew

☐ Use Regional Skew

Duration	Reg. Skew	R.Skew MSE
1	0.3	0.302
3	0.3	0.302
7	0.3	0.302
15	0.3	0.302
30	0.3	0.302
60	0.3	0.302
90	0.3	0.302
120	0.3	0.302
183	0.3	0.302

contained within the skew setting, **Use Station Skew**, **Use Weighted Skew**, and **Use Regional Skew**. The default skew setting is **Use Station Skew**. With this setting, the skew of the computed curve will be based solely on computing a skew from the data points.

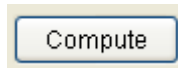
The **Use Weighted Skew** option requires the user to enter a generalized

regional skew and a mean-square error (MSE) of the generalized regional skew. This option weights the computed station skew with the generalized regional skew. The equation for performing this weighting can be found in Bulletin 17B (equation 6). If a regional skew is taken from Plate I of Bulletin 17B (the skew map of the United States), the value of $MSE = 0.302$.

The **Use Regional Skew** option requires the user to enter a generalized regional skew and a mean-square error (MSE) of the generalized regional skew. The program will ignore the computed station skew and use only the generalized regional skew.

Compute

Press the **Compute** button, located at the bottom of the Volume-Duration Frequency editor, once options have been set on the General, Options, and Settings tabs. If the compute is successful, the user will receive a message that says **Compute Complete**. At this point, the user can review results from the analytical analysis by selecting the Tabular Results and Plot tabs.



Note: the volume-duration frequency analysis will identify low and high outliers using guidelines in Bulletin 17B; however, the program will not remove outliers and recompute the statistics.

Tabular Results

The **Tabular Results** tab contains a table of results for the analytical frequency analysis. An example of the results table is shown in Figure 7-7. The top portion of this table contains volumes from the analytical frequency curve for each duration and frequency ordinate defined on the Options tab. The Statistics of the analytical frequency curves are contained below the frequency curve ordinates. The statistics include the mean, standard deviation, station skew, regional skew, weighted skew, adopted skew, number of years of record, and number of years with zero or missing flow.

User-adjusted statistics can be defined by the user on the **Statistics** tab. If the user has not entered statistics on the Statistics tab, then the results table will look similar to Figure 7-7. If the user does enter statistics on the Statistics tab, then the results table will include the adjusted mean, adjusted standard deviation, and adjusted skew. If specified by the user, the program will use the user-adjusted statistics when computing the analytical curves.

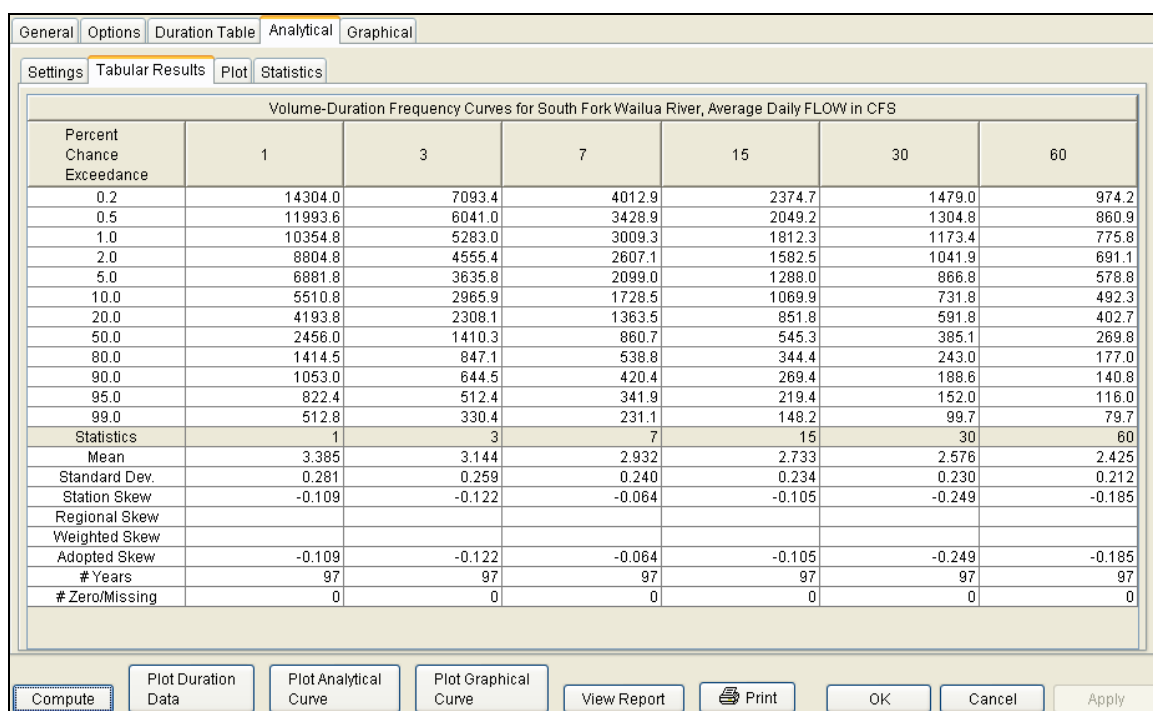


Figure 7-7. Tabular Results for a Volume-Frequency Analysis.

Plot

In addition to tabular results, a **Plot** tab is available for viewing results, as shown in Figure 7-8. The results graph includes the systematic annual maximum/minimum volumes, plotted using the specified plotting position method, and the analytical frequency curves. The analytical frequency curves are based on the computed statistics or user-adjusted statistics if they are defined on the Statistics tab.

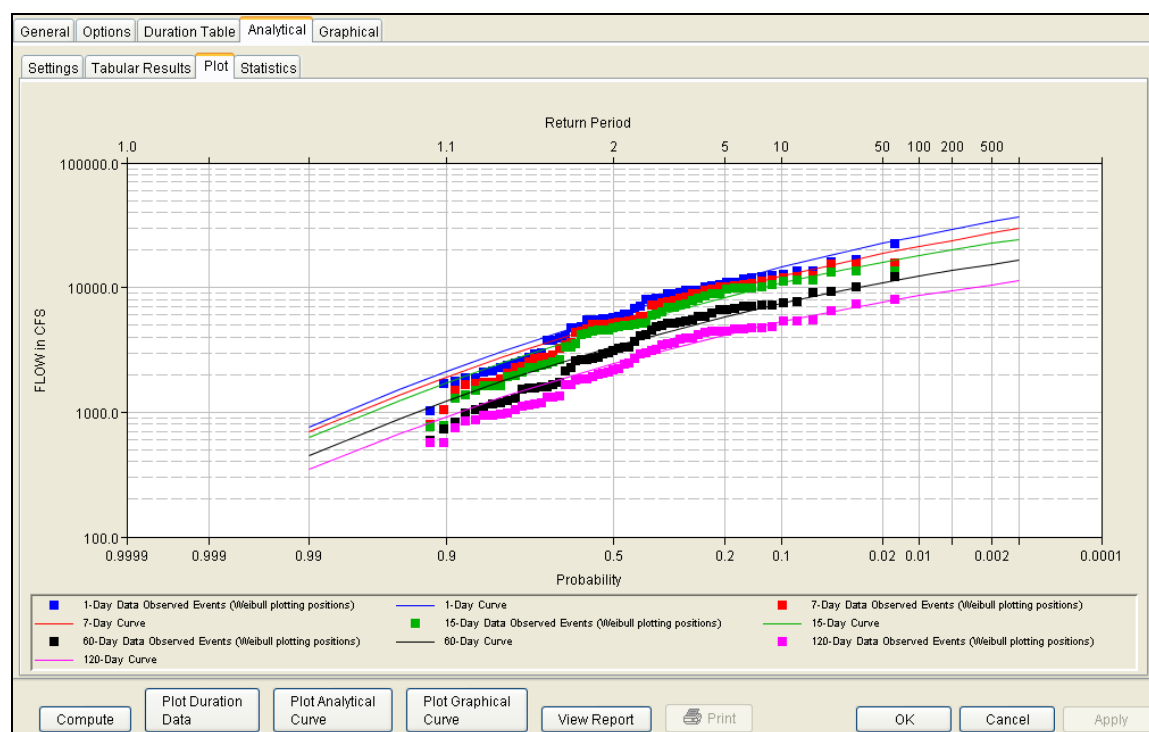


Figure 7-8. Plot of Analytical Results for a Volume-Frequency Analysis.

Statistics

As discussed in EM 1110-2-1415, a necessary step in a volume-frequency analysis is to make sure the analytical frequency curves are consistent across all durations (USACE, 1993). In some situations, frequency curves from different durations might cross one another. The **Statistics** tab contains tools allowing the user to modify the mean, standard deviation, and skew to make sure frequency curves do not cross one another.

When the user selects the **Statistics** tab, the window will appear as shown in Figure 7-9. The upper portion of the Statistics tab contains a plot of the computed and user-adjusted statistics. The user has the option of choosing the parameter to be plotted in the comparison graph. Computed statistics are plotted as black data points and user-adjusted statistics are plotted as blue data points. The first table, **Sample Statistics**, contains the statistics computed from the systematic data. In addition, the adopted skew value in this table can be the station skew, weighted skew, or regional skew. The adopted skew is set by the user on the **Settings** tab. The lower table is where the user enters the adjusted statistics. Before entering adjusted statistics, the user must check the box in column 1. User-adjusted statistics entered in this table are used when the program computes the analytical frequency curve.

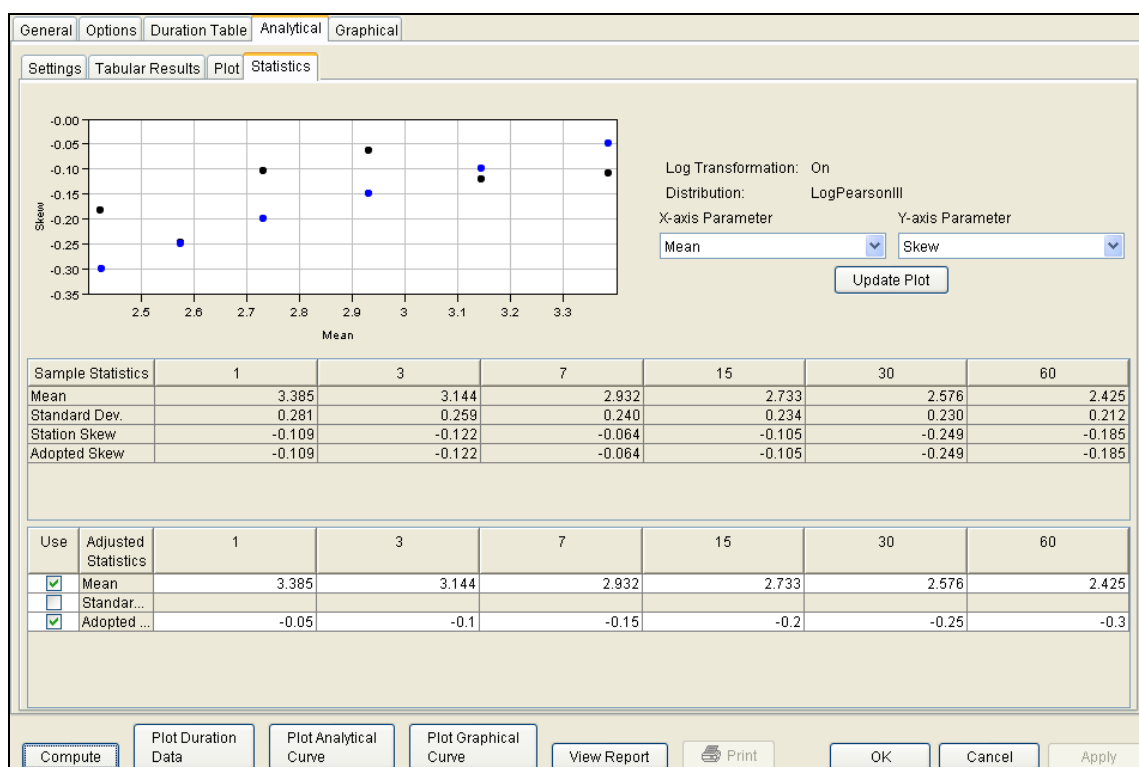


Figure 7-9. Statistics Tab in the Volume-Duration Frequency Editor.

Graphical Frequency Analysis

In addition to an analytical frequency analysis, which uses a statistical distribution to fit the data, the user has the option to graphically fit the data. A graphical fit to data can be very useful when the available analytical distributions do not provide a good fit. One example of when a graphical frequency analysis is more appropriate is when plotting a frequency curve for flow data that is downstream of a flood control reservoir. Analytical frequency distributions are often not appropriate for fitting flow data that is significantly regulated by upstream reservoirs. In general, a portion of the flow frequency data for a highly regulated stream will be very flat in the zone in which upstream regulation can control the flow. This type of data lends itself to a graphical fit.

When the **Graphical** tab is selected on the Volume-Duration Frequency editor, the window will appear as shown in Figure 7-10. As indicated, two additional tabs will appear on the screen, **Curve Input** and **Plot**.

General Options Duration Table Analytical Graphical

Curve Input Plot

User-Defined Graphical Curve Log Transformation: On

Volume-Duration Frequency Curves for CHATTAHOOCHEE RIVER-CORNELIA, GA-FLOW, Average Daily FLOW in CFS					
Percent Chance Exceedance	1	7	30	60	90
0.2					
0.5					
1.0					
2.0					
5.0					
10.0					
20.0					
50.0					
80.0					
90.0					
95.0					
99.0					

Compute Plot Duration Data Plot Analytical Curve Plot Graphical Curve View Report Print OK Cancel Apply

Figure 7-10. Graphical Curve Table for a Volume-Duration Frequency Analysis.

Curve Input

The user manually enters the frequency ordinates for all durations in the table on the **Curve Input** tab. As previously mentioned, the number of frequency ordinates and durations are set on the Options tab. The idea is to enter values in the table that will create a best fit line of the data, based on the user's judgment. Data entered in the graphical curve table will be plotted as a line in the graph on the **Plot** tab after the **Compute** button is pressed.

Plot

The graphical analysis **Plot** tab is available for viewing results, as shown in Figure 7-11. The results graph includes the historic annual maximum/minimum flows, plotted using the specified plotting position method, and the user-defined graphical curve, which was entered in the table on the **Curve Input** tab.

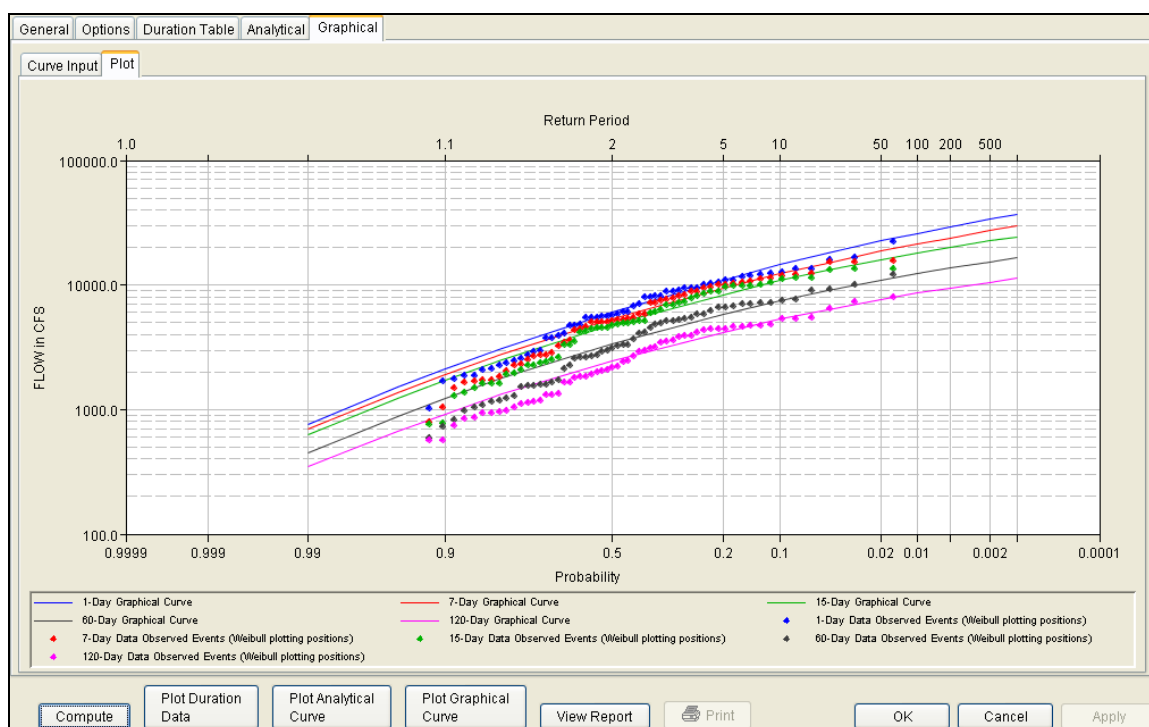


Figure 7-11. Plot Tab for a Graphical Analysis.

Viewing and Printing Results – Volume-Duration Frequency Analysis

The user can view output for the frequency analysis directly from the Volume-Duration Frequency editor (Tabular and Graphical output) or by using the plot and view report buttons at the bottom of the editor. The output consists of tabular results, an analytical frequency curve plot, a graphical frequency curve plot, and a report documenting the data and computations performed.

Tabular Output

Once the computations for the analytical frequency analysis are completed, the user can view tabular output by opening the **Tabular Results** tab under the **Analytical** analysis tab. The details of this table were discussed above. The tabular results can be printed by using the **Print** button at the bottom of the Volume-Duration Frequency editor. When the print button is pressed, a window will appear, giving the user options for how the table is to be printed.

Graphical Output

Graphical output can be opened by selecting one of the plot buttons at the bottom of the Volume-Duration Frequency editor or by selecting the **Plot** tab under the Analytical or Graphical tabs. There are three plot buttons at the bottom of the Volume-Duration Frequency editor, Plot Duration Data, Plot Analytical Curve, and Plot Graphical Curve. Pressing the Plot Duration Data button will open a new window containing a graph showing the systematic data plotted using the user-defined plotting position method. Pressing the Plot Analytical Curve button will open a new window containing a graph with both the systematic data and the computed analytical frequency curves, as shown in Figure 7-12. Pressing the Plot Graphical Curve button will open a new window containing a graph with both the systematic data and the user-defined frequency curves.

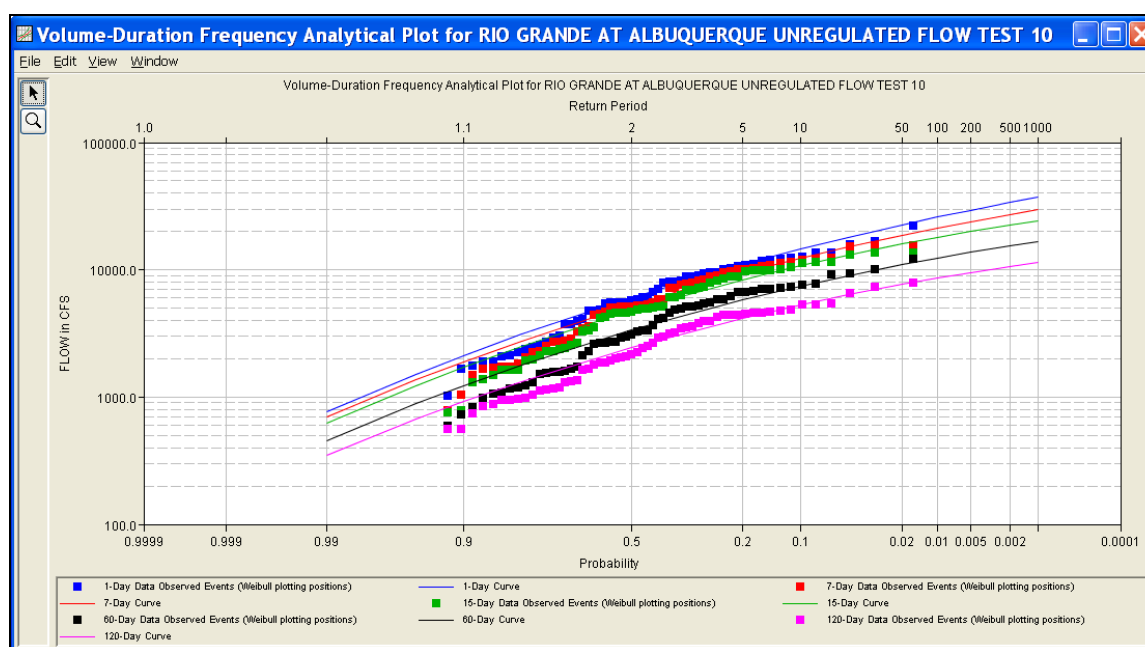


Figure 7-12. Plot of Systematic Data and Analytical Frequency Curves.

All plots opened by selecting one of the plot buttons at the bottom of the Volume-Duration Frequency editor contain menu options for printing, editing, and saving the plots.

Plots can be sent to the printer by selecting the **Print** option located on the **File** menu. Additional printing options available from the File menu are Page Setup, Print Preview, and Print Multiple (used for printing multiple graphs on the same page). The plot can also be sent to the Windows Clipboard by selecting **Copy to Clipboard** from the File menu. Additionally, the plot can be saved to a file by selecting the **Save As** option from the File menu. When the Save As option is selected, a pop-up window will appear allowing the user to select a directory, enter a filename, and select the format for saving the file.

Currently four file formats are available for saving the plot to disk: windows metafile, postscript, JPEG, and portable network graphic. The data contained within the plot can also be tabulated by selecting **Tabulate** from the File menu. When this option is selected, a separate window will appear with the data tabulated. Additional options are available from the File menu for saving the plot properties as a template (**Save Template**) and applying previously saved templates to the current plot (**Apply Template**).

The **Edit** menu contains several options for customizing the plot properties. These options include Plot Properties, Configure Plot Layout, Default Line Styles, and Default Plot Properties. Also, the user can right-click on a line or data point in the plot area or in the legend and a pop-up menu will open with customization options. The graphic customizing capabilities within HEC-SSP are very powerful, but are also somewhat complex to use. The code used in developing the plots in HEC-SSP is the same code that was used for developing graphics in HEC-DSSVue and several other HEC software programs. A separate write-up on Customizing Graphics can be found in Appendix C of this manual. Please refer to that appendix for details on using the graphics customizing options.

Viewing the Report File

Computational results for a volume-duration frequency analysis are written to a report file. The report file lists all of the input data and user settings, plotting positions of the data points, intermediate results, each of the various statistical tests performed (i.e. high and low outliers, historical data, etc...), and the final results. This file is often useful for understanding how the software arrived at the final frequency curves. Press the **View Report** button at the bottom of the Volume-Duration Frequency editor to open the report, as shown in Figure 7-13.

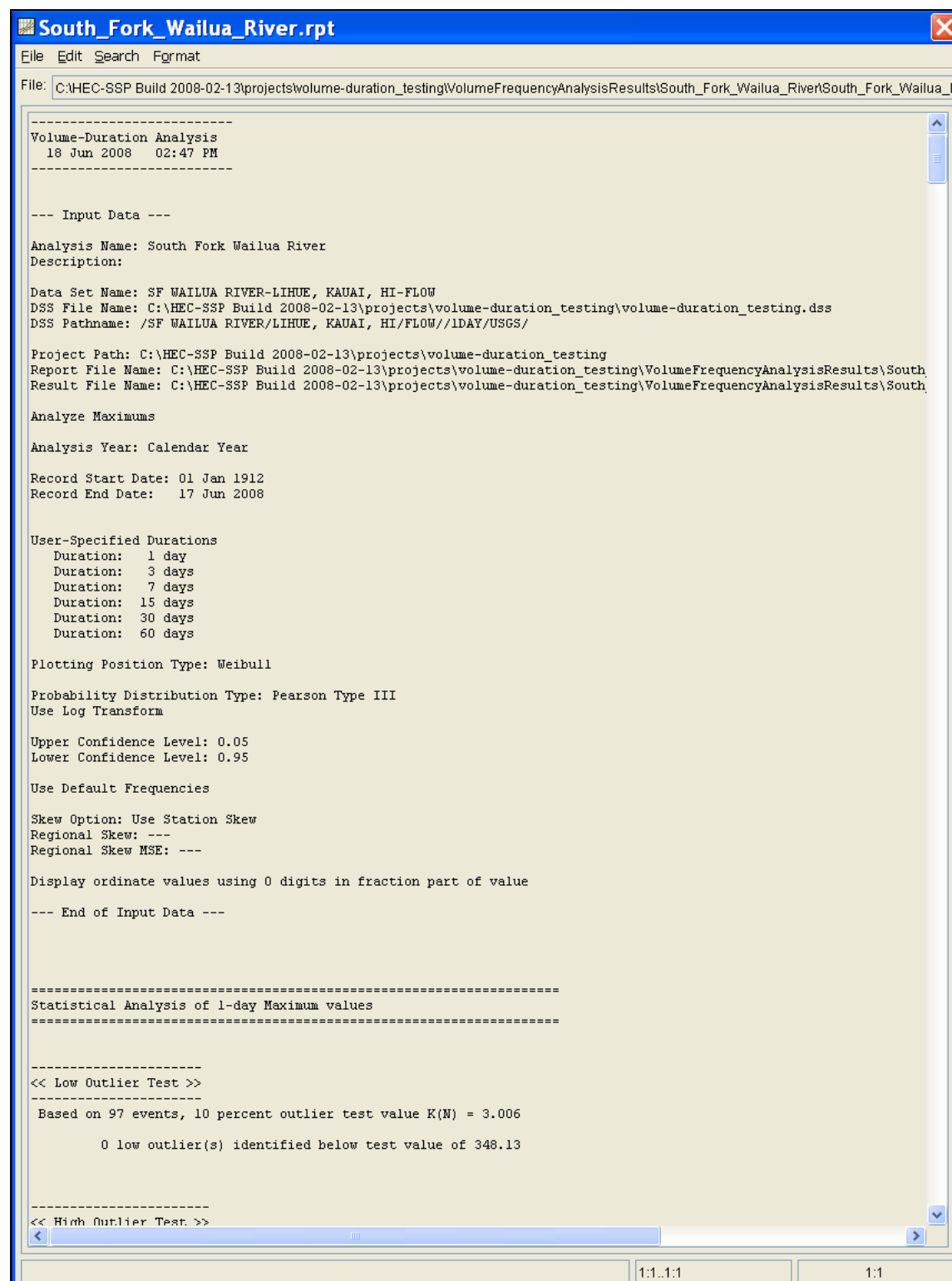


Figure 7-13. Volume-Duration Frequency Report.

A P P E N D I X A

References

Interagency Advisory Committee on Water Data, March 1982. Bulletin 17B, "Guidelines for Determining Flood Flow Frequency", Published by the U.S. Department of the Interior, Geologic Survey.

U.S. Army Corps of Engineers, Hydrologic Engineering Center, May 1992. HEC-FFA, Flood Frequency Analysis, User's Manual.

U.S. Army Corps of Engineers, Hydrologic Frequency Analysis, EM 1110-2-1415. March 1993, Washington, D.C.

A P P E N D I X B

Example Data Sets

The input and output for eleven example data sets are provided to illustrate the use of selected options and to assist in verifying the correct execution of the program.

The first six example data sets are the same examples that were found in the HEC-FFA program documentation. The first six examples were duplicated with a Bulletin 17B and General Frequency analysis. This manual only shows these examples using the Bulletin 17B analysis; however, the example data sets show that results are the same whether a Bulletin 17B or General Frequency analysis was performed. As shown in the example data sets, the HEC-SSP software produces the same results as HEC-FFA for these six data sets. All of these test examples are provided with the software as a single HEC-SSP study labeled "SSP Examples". You can install this study on your computer by selecting the **Help→Install Example Data** menu option. After opening this study for the first time on your computer, you must compute each example before viewing tabular and graphical results.

A brief description of each test example is provided. In most cases the weighted skew option was selected, and a regional skew value was entered from the generalized skew map of the United States provided within Bulletin 17B (Plate 1).

The example problems shown in this section are entitled:

1. Fitting the Log-Pearson Type III Distribution.
2. Analysis with High Outliers.
3. Testing and Adjusting for a Low Outlier.
4. Zero Flood Years.
5. Confidence Limits and Low Threshold Discharge.
6. Use of Historic Data and Median Plotting Positions.
7. Analyzing Stage Data.
8. Using User-Adjusted Statistics.
9. General Frequency - Graphical Analysis.
10. Volume-Duration Frequency Analysis, Maximum Flows.

11. Volume-Duration Frequency Analysis, Minimum Flows.

When the “SSP Examples” study file is open, the screen will appear as shown in Figure B-1.

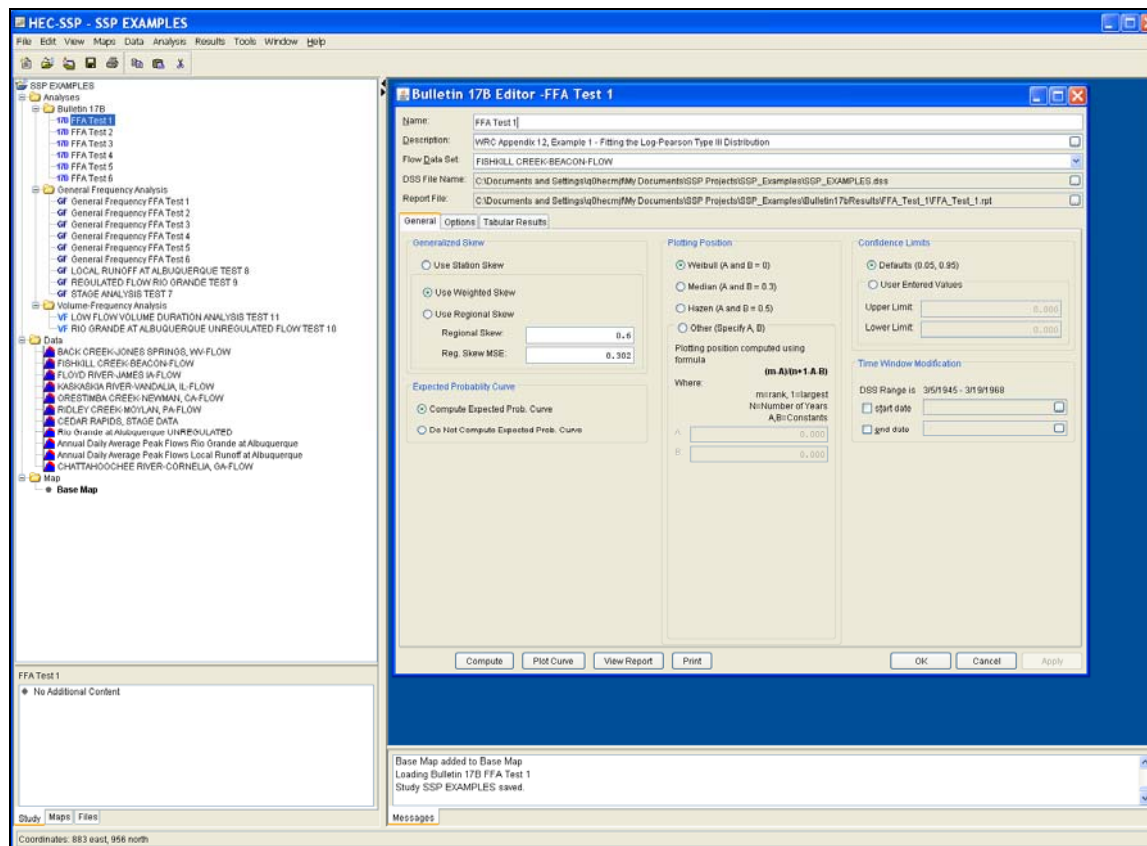


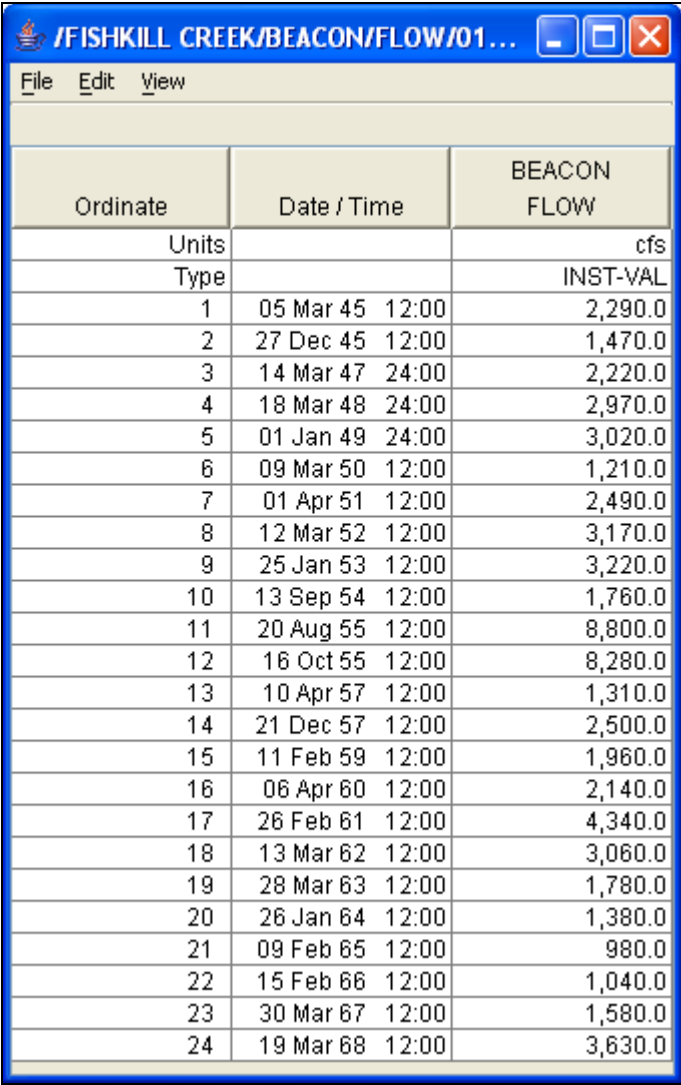
Figure B -1. SSP Examples Study.

As shown in Figure B-1, there are 6 Bulletin 17B analyses, 9 General Frequency analyses, and 2 Volume-Frequency analyses in this study. The following sections document each of the example data sets.

Example 1: Fitting the Log-Pearson Type III Distribution

The input data for the HEC-SSP Example 1 is the same as that for Example 1 in Appendix 12, Guidelines for Determining Flood Flow Frequency, Water Resources Council Bulletin 17B. Example 1 illustrates the routine computation of a frequency curve by the Bulletin 17B methodology.

The data for this example is from Fishkill Creek in Beacon, New York. The period of record used for this example is from 1945 to 1968. To view the data from HEC-SSP, right-click on the data record labeled **"FISHKILL CREEK – BEACON- FLOW"** in the study tree and then select **Tabulate**. The data will appear as shown in Figure B-2.



Ordinate	Date / Time	BEACON FLOW
Units		cfs
Type		INST-VAL
1	05 Mar 45 12:00	2,290.0
2	27 Dec 45 12:00	1,470.0
3	14 Mar 47 24:00	2,220.0
4	18 Mar 48 24:00	2,970.0
5	01 Jan 49 24:00	3,020.0
6	09 Mar 50 12:00	1,210.0
7	01 Apr 51 12:00	2,490.0
8	12 Mar 52 12:00	3,170.0
9	25 Jan 53 12:00	3,220.0
10	13 Sep 54 12:00	1,760.0
11	20 Aug 55 12:00	8,800.0
12	16 Oct 55 12:00	8,280.0
13	10 Apr 57 12:00	1,310.0
14	21 Dec 57 12:00	2,500.0
15	11 Feb 59 12:00	1,960.0
16	06 Apr 60 12:00	2,140.0
17	26 Feb 61 12:00	4,340.0
18	13 Mar 62 12:00	3,060.0
19	28 Mar 63 12:00	1,780.0
20	26 Jan 64 12:00	1,380.0
21	09 Feb 65 12:00	980.0
22	15 Feb 66 12:00	1,040.0
23	30 Mar 67 12:00	1,580.0
24	19 Mar 68 12:00	3,630.0

Figure B-2. Tabulation of the Peak Flow Data for Fishkill Creek.

To plot the data for this example, right-click on the data record again and then select **Plot**. A plot of the data will appear as shown in Figure B-3.

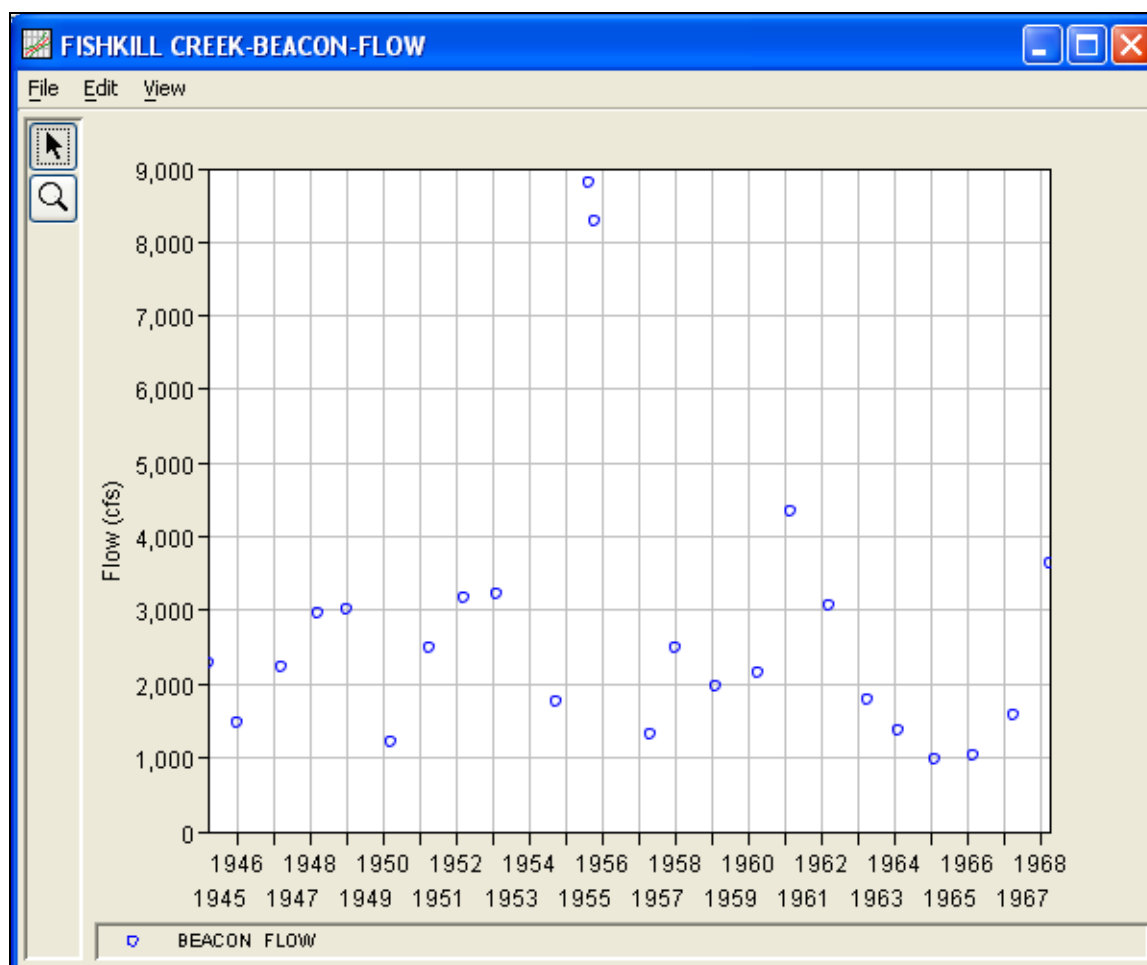


Figure B-3. Plot of the Fishkill Creek Data.

A Bulletin 17B and a General Frequency analysis have been developed for this example. To open the Bulletin 17B analysis editor for test example 1, either double-click on the analysis labeled **FFA Test 1** from the Study Explorer, or from the **Analysis** menu select open, then select **FFA Test 1** from the list of available analyses. When FFA Test 1 is selected, the Bulletin 17B analysis editor will appear as shown in Figure B-4.

Bulletin 17B Editor - FFA Test 1

Name: FFA Test 1

Description: WRC Appendix 12, Example 1 - Fitting the Log-Pearson Type III Distribution

Flow Data Set: FISHKILL CREEK-BEACON-FLOW

DSS File Name: C:\Documents and Settings\q0hecmjft\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: C:\Documents and Settings\q0hecmjft\My Documents\SSP Projects\SSP_Examples\Bulletin17bResults\FFA_Test_1\FFA_Test_1.rpt

General Options Tabular Results

Generalized Skew

☐ Use Station Skew

☒ Use Weighted Skew

☐ Use Regional Skew

Regional Skew: 0.6

Reg. Skew MSE: 0.302

Expected Probability Curve

☒ Compute Expected Prob. Curve

☐ Do Not Compute Expected Prob. Curve

Plotting Position

☒ Weibull (A and B = 0)

☐ Median (A and B = 0.3)

☐ Hazen (A and B = 0.5)

☐ Other (Specify A, B)

Plotting position computed using formula

(m-A)/(n+1-A-B)

Where:

m=rank, 1=largest

N=Number of Years

A,B=Constants

A: 0.000

B: 0.000

Confidence Limits

☒ Defaults (0.05, 0.95)

☐ User Entered Values

Upper Limit: 0.000

Lower Limit: 0.000

Time Window Modification

DSS Range is 3/5/1945 - 3/19/1968

☐ start date

☐ end date

Compute Plot Curve View Report Print OK Cancel Apply

Figure B-4. Bulletin 17B Analysis Editor with Test Example 1 Data Set.

Shown in Figure B-4 are the general settings that were used to perform this frequency analysis. As shown, the **Skew** option was set to use the **Weighted Skew**. To use the weighted skew option, the user must enter a value for the Regional Skew and the Regional Skew Mean Square Error (MSE). This selection requires the user to either look up a value from the generalized skew map of the United States, which is provided with Bulletin 17B, or develop a value from a regional analysis of nearby gages. In this example a value of 0.6 was taken from the generalized skew map of the U.S. from Bulletin 17B. Bulletin 17B suggests using a Regional Skew MSE of 0.302 whenever regional skew values are taken from the map.

Also for this example, the **Expected Probability Curve** option was selected to be computed in addition to the Log Pearson III computed curve. The **Weibull** plotting position method was selected, as well as the default **Confidence Limits** of 0.05 (5 percent chance exceedance) and 0.95 (95% chance exceedance). Shown in Figure B-5 is the Bulletin 17B editor with the **Options Tab** selected.

Bulletin 17B Editor - FFA Test 1

Name: FFA Test 1

Description: WRC Appendix 12, Example 1 - Fitting the Log-Pearson Type III Distribution

Flow Data Set: FISHKILL CREEK-BEACON-FLOW

DSS File Name: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\Bulletin17bResults\FFA_Test_1\FFA_Test_1.rpt

Options

Low Outlier Threshold

☐ Use Low Outlier Threshold

Value: 0.000

Historic Period Data

☐ Use Historic Data

Historic Period

Start Year:

End Year:

High Threshold: 0.000

Historic Events	
Water Year	Peak

User Specified Frequency Ordinates

☐ Use Values from Table below

Frequency in Percent	
	0.2
	0.5
	1.0
	2.0
	5.0
	10.0
	20.0
	50.0
	80.0
	90.0
	95.0
	99.0

Compute Plot Curve View Report Print OK Cancel Apply

Figure B-5. Bulletin 17B Editor with Options Tab Selected for Test Example 1.

As shown in Figure B-5, none of the available options for modifying the frequency analysis were selected for this example. These options include changing the **Low Outlier Threshold** and using **Historic Data**. Additionally, the option to override the default **Frequency Ordinates** was not selected.

Once all of the General and Optional settings are set or selected, the user can press the **Compute** button to perform the analysis. Once the computations have been completed, a message window will pop-up stating **Compute Complete**. Close this window and then select the **Tabular Results** tab. The analysis window should look like Figure B-6.

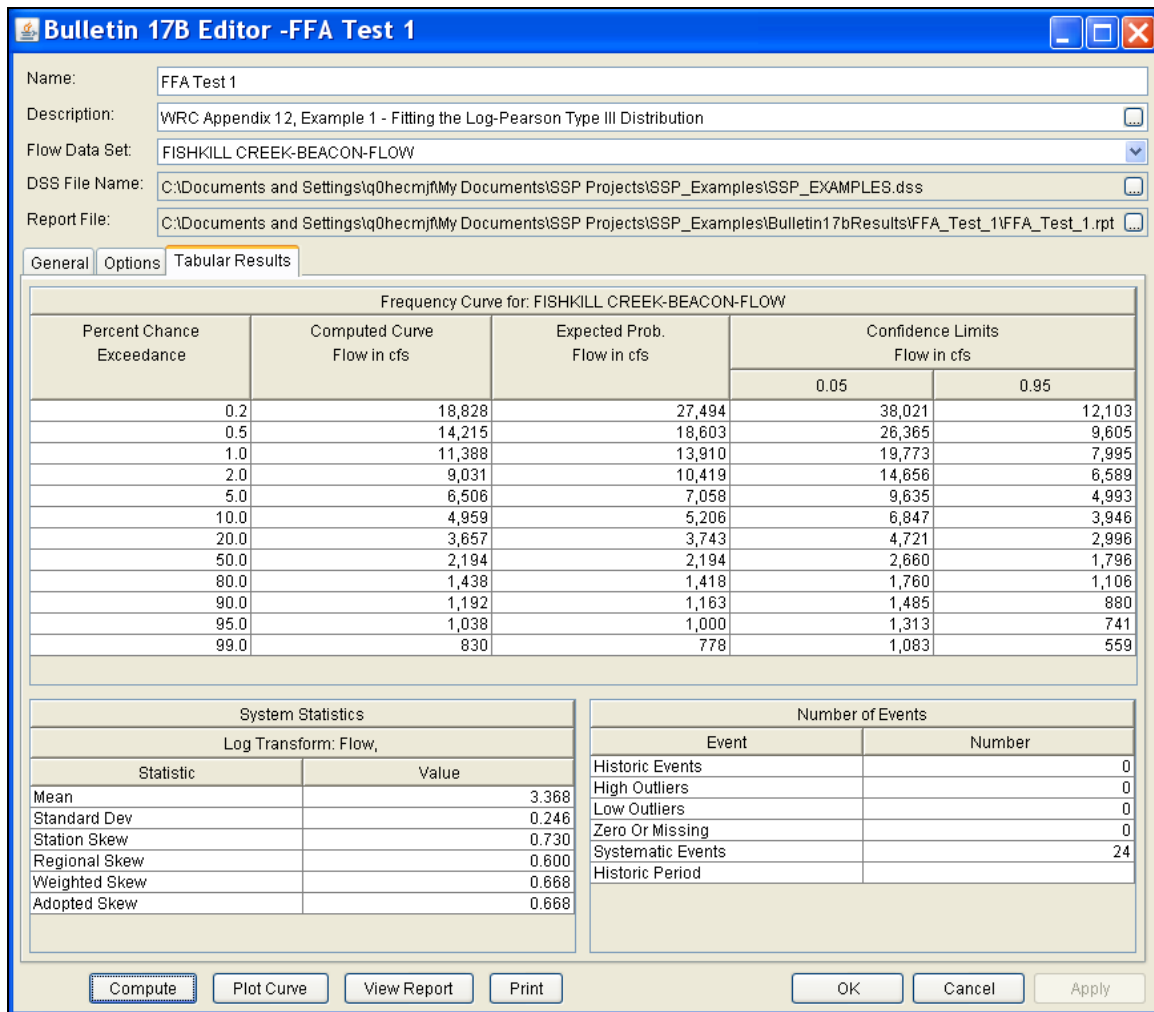


Figure B-6. Bulletin 17B Analysis Window with Results Tab Shown for Test Example 1.

As shown in Figure B-6, the Frequency Curve table contains the following results:

Percent Chance Exceedance

Computed Curve (Log-Pearson III results)

Expected Probability Curve

Confidence Limits (5% and 95% chance exceedance curves)

On the bottom, left side of the results tab is a table of System Statistics for the observed station data (mean, standard deviation, station skew) and regional adjustment (regional skew, weighted skew, and adopted skew). Also on the bottom, right side of the results tab is a Number of Events table showing the number of historic events used in the analysis, number of high outliers found, number of low outliers, number of zero or missing data years, number of systematic events in

the gage record, and the historic record length (if historic data was entered).

In addition to the tabular results, a graphical plot of the computed frequency curves can be obtained by pressing the **Plot Curve** button at the bottom of the analysis window. A plot of the results for this test example is shown in Figure B-7.

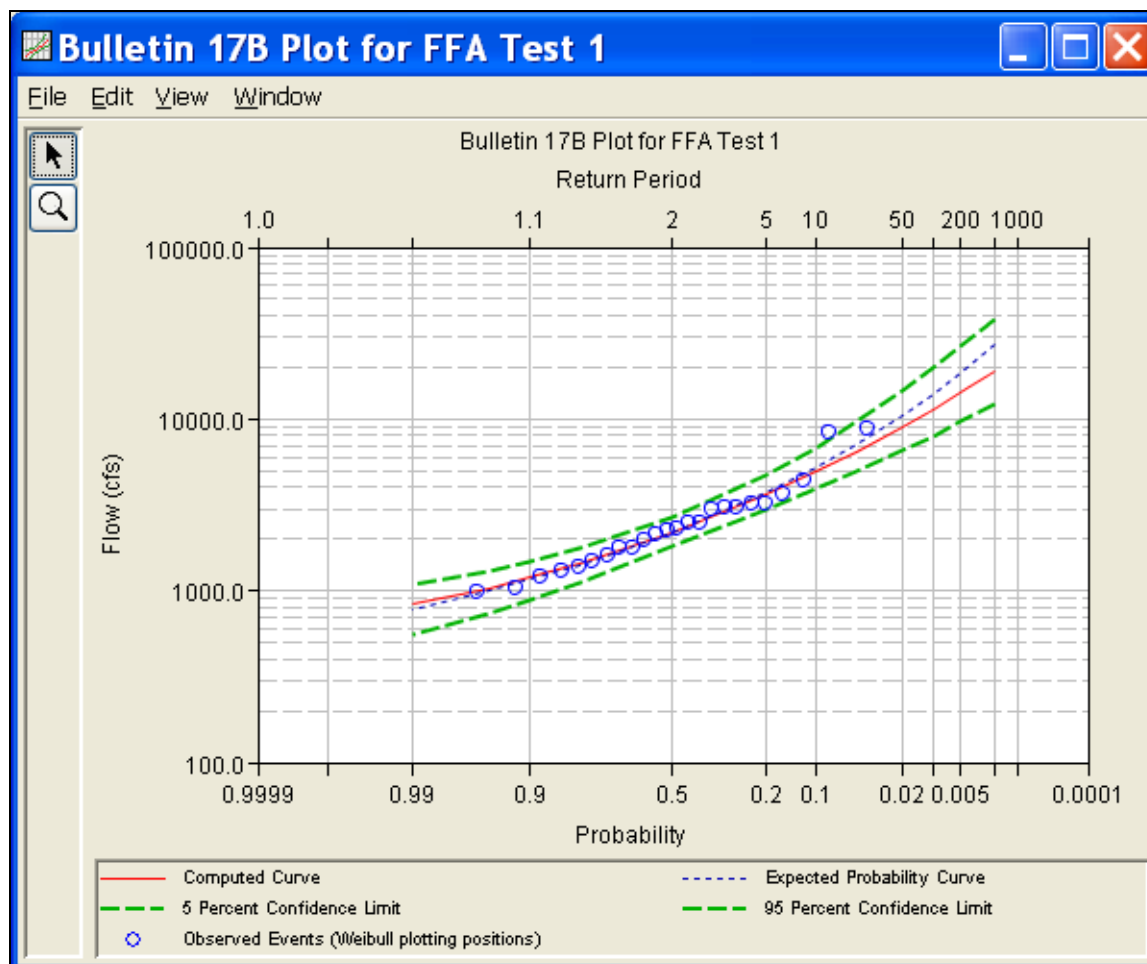


Figure B-7. Plotted Frequency Curves for Test Example 1.

The tabular and graphical results can be sent to the printer or the windows clipboard for transfer into another piece of software. To print the tabular results, select **Print** from the bottom of the analysis window. To send the tabular results to the windows clipboard, highlight the data you want to send to the clipboard and then press the Control-C key sequence. To print the graphical results, first bring up the graphical plot and then select **Print** from the **File** menu. To send the graphic to the windows clipboard, select **Copy to Clipboard** from the **File** menu.

In addition to the tabular and graphical results, there is a report file that shows the order in which the calculations were performed. To review the report file, press the **View Report** button at the bottom of the analysis window. When this button is selected a text viewer will open the report file and display it on the screen. Shown in Figure B-8 is the report file for test example 1.

The report file contains a listing of the input data, preliminary results, outlier and historical data tests, additional calculations needed, and the final frequency curve results. Different types and amounts of information will show up in the report file depending on the data and the options that have been selected for the analysis. The user should review the report file to understand how HEC-SSP performed the Bulletin 17B frequency curve calculations.

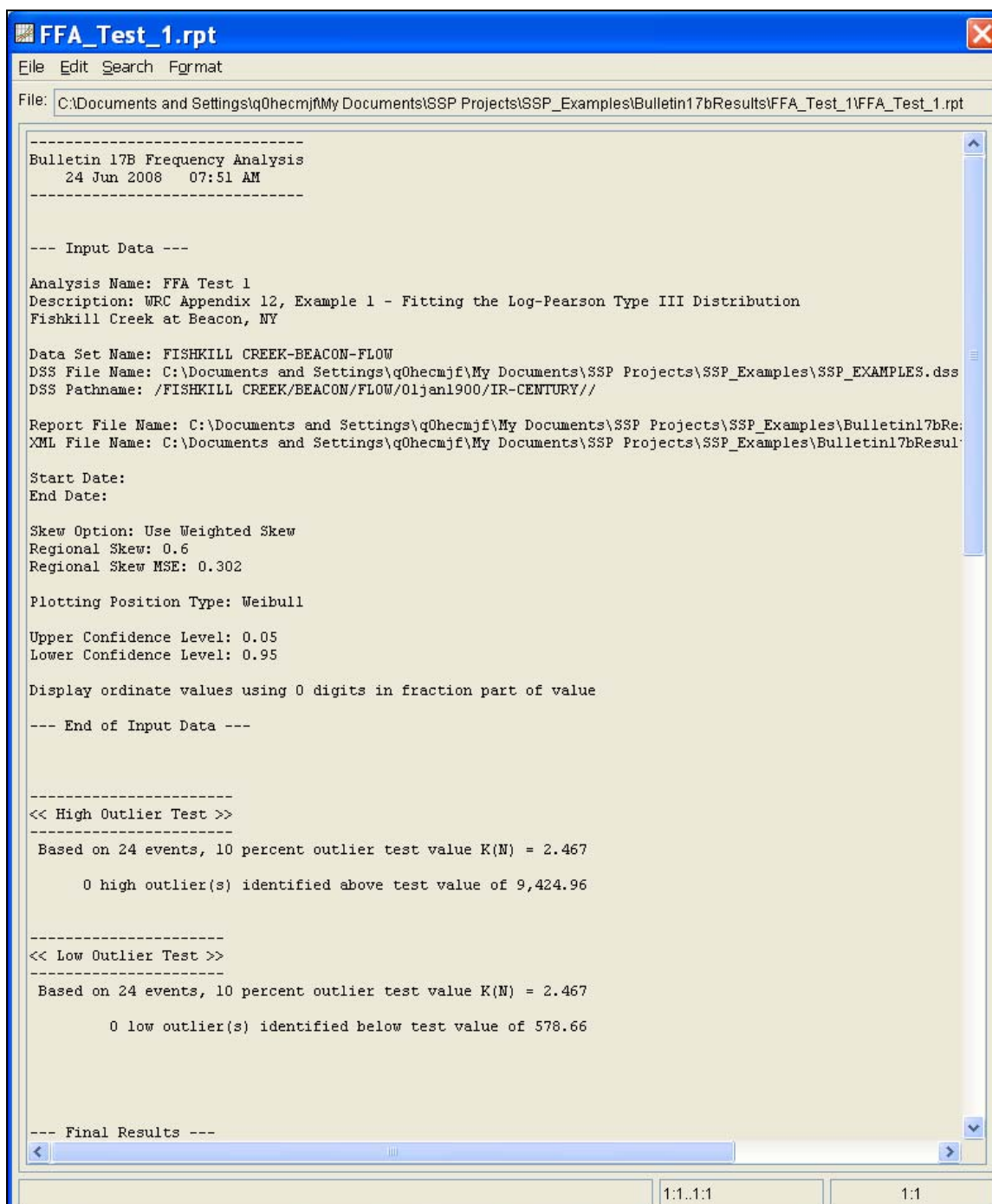
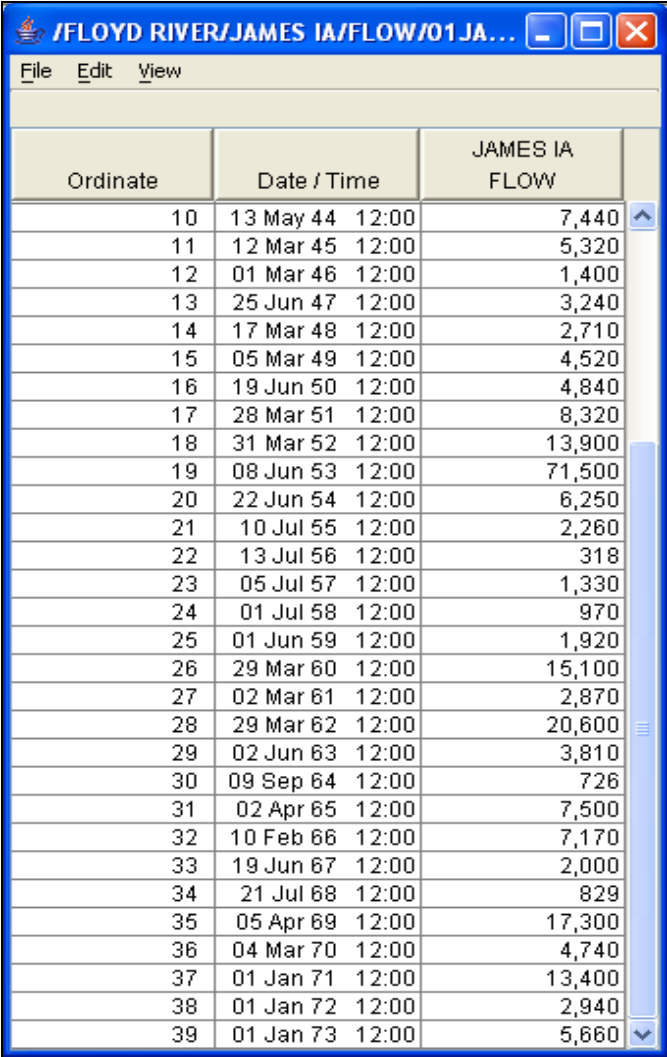


Figure B-8. Test Example 1 Report File.

Example 2: Analysis with High Outliers

The input data for the Example 2 is the same as that for Example 2 in Appendix 12, Guidelines for Determining Flood Flow Frequency, Water Resources Council Bulletin 17B. Example 2 illustrates the application to data with a high outlier.

The data for this example is from Floyd River in James, Iowa. The period of record used is from 1935 to 1973. To view the data from HEC-SSP, right-click on the data record labeled **"FLOYD RIVER-JAMES IA-FLOW"** in the study explorer and then select **Tabulate**. The data will appear as shown in Figure B-9.



Ordinate	Date / Time	JAMES IA FLOW
10	13 May 44 12:00	7,440
11	12 Mar 45 12:00	5,320
12	01 Mar 46 12:00	1,400
13	25 Jun 47 12:00	3,240
14	17 Mar 48 12:00	2,710
15	05 Mar 49 12:00	4,520
16	19 Jun 50 12:00	4,840
17	28 Mar 51 12:00	8,320
18	31 Mar 52 12:00	13,900
19	08 Jun 53 12:00	71,500
20	22 Jun 54 12:00	6,250
21	10 Jul 55 12:00	2,260
22	13 Jul 56 12:00	318
23	05 Jul 57 12:00	1,330
24	01 Jul 58 12:00	970
25	01 Jun 59 12:00	1,920
26	29 Mar 60 12:00	15,100
27	02 Mar 61 12:00	2,870
28	29 Mar 62 12:00	20,600
29	02 Jun 63 12:00	3,810
30	09 Sep 64 12:00	726
31	02 Apr 65 12:00	7,500
32	10 Feb 66 12:00	7,170
33	19 Jun 67 12:00	2,000
34	21 Jul 68 12:00	829
35	05 Apr 69 12:00	17,300
36	04 Mar 70 12:00	4,740
37	01 Jan 71 12:00	13,400
38	01 Jan 72 12:00	2,940
39	01 Jan 73 12:00	5,660

Figure B-9. Tabulation of the Peak Flow Data for the Floyd River.

To plot the data for this example, right-click on the data record and then select **Plot**. A plot of the data will appear as shown in Figure B-10.

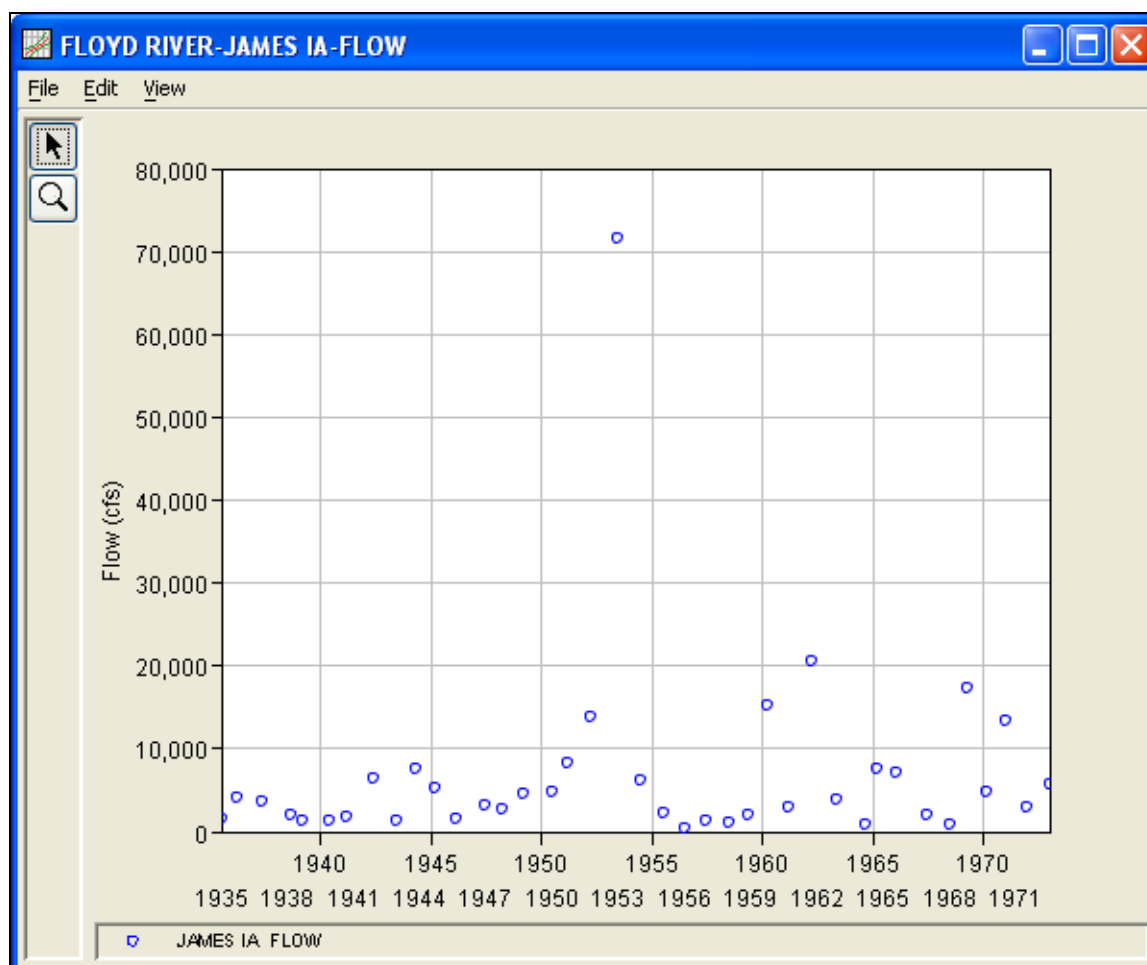


Figure B-10. Plot of Floyd River Data

A Bulletin 17B and General Frequency analysis have been developed for this example. To open the Bulletin 17B analysis editor for test example 2, either double-click on the analysis labeled **FFA Test 2** from the study pane, or from the **Analysis** menu select open and then select **FFA Test 2** from the list of available analyses. When FFA Test 2 is selected, the Bulletin 17B analysis editor will appear as shown in Figure B-11.

Bulletin 17B Editor - FFA Test 2

Name: FFA Test 2

Description: WRC Appendix 12, Example 2 - Adjusting for a high outlier

Flow Data Set: FLOYD RIVER-JAMES IA-FLOW

DSS File Name: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\Bulletin17bResults\FFA_Test_2\FFA_Test_2.rpt

General | Options | Tabular Results

Generalized Skew

☐ Use Station Skew

☒ Use Weighted Skew

☐ Use Regional Skew

Regional Skew: -0.3

Reg. Skew MSE: 0.302

Expected Probability Curve

☒ Compute Expected Prob. Curve

☐ Do Not Compute Expected Prob. Curve

Plotting Position

☒ Weibull (A and B = 0)

☐ Median (A and B = 0.3)

☐ Hazen (A and B = 0.5)

☐ Other (Specify A, B)

Plotting position computed using formula

(m-A)/(n+1-A-B)

Where:

m=rank, 1=largest

N=Number of Years

A,B=Constants

A: 0.000

B: 0.000

Confidence Limits

☒ Defaults (0.05, 0.95)

☐ User Entered Values

Upper Limit: 0.000

Lower Limit: 0.000

Time Window Modification

DSS Range is 6/28/1935 - 1/1/1973

☐ start date

☐ end date

Compute Plot Curve View Report Print OK Cancel Apply

Figure B-11. Bulletin 17B Analysis Editor with Test Example 2 Data Set.

Shown in Figure B-11 are the general settings that were used to perform this frequency analysis. As shown, the **Skew** option was set to use the **Weighted Skew**. To use the weighted skew option, the user must enter a value for the Regional Skew and the Regional Skew Mean Square Error (MSE). This selection requires the user to either look up a value from the generalized skew map of the United States, which is provided with Bulletin 17B, or develop a value from a regional analysis of nearby gages. In this example a value of -0.3 was taken from the generalized skew map of the U.S. from Bulletin 17B. Bulletin 17B suggests using a Regional Skew MSE of 0.302 whenever regional skew values are taken from the map.

Also for this example, the **Expected Probability Curve** option was selected to be computed in addition to the Log Pearson III computed curve. The **Weibull** plotting position method was selected, as well as the default **Confidence Limits** of 0.05 (5 percent chance exceedance) and 0.95 (95% chance exceedance). Shown in Figure B-12 is the Bulletin 17B editor with the **Options Tab** selected.

Bulletin 17B Editor - FFA Test 2

Name: FFA Test 2

Description: WRC Appendix 12, Example 2 - Adjusting for a high outlier

Flow Data Set: FLOYD RIVER-JAMES IA-FLOW

DSS File Name: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\Bulletin17bResults\FFA_Test_2\FFA_Test_2.rpt

General Options Tabular Results

Low Outlier Threshold

☐ Use Low Outlier Threshold

Value: 0.000

Historic Period Data

☒ Use Historic Data

Historic Period

Start Year: 1892

End Year:

High Threshold: 70000

Historic Events	
Water Year	Peak

User Specified Frequency Ordinates

☐ Use Values from Table below

Frequency in Percent	
	0.2
	0.5
	1.0
	2.0
	5.0
	10.0
	20.0
	50.0
	80.0
	90.0
	95.0
	99.0

Compute Plot Curve View Report Print OK Cancel Apply

Figure B-12. Bulletin 17B Editor with Options Tab Selected for Test Example 2.

As shown in Figure B-12, the **Historic Period Data** option has been selected to reflect the fact that the 1953 flood peak of 71,500 cfs is known to be the largest flood since 1892. When the analysis was originally performed on this data set, the 1953 event was found to be a high outlier. (The reader may replicate this result by unchecking the "Use Historic Data" box, hitting the Compute button, and reviewing the Tabular Results tab.) High outliers should not be eliminated from an analysis, as they are valuable pieces of the flow record. However, when a high outlier is found in a data set, it suggests that the event might actually be the largest in a much longer period of record. The analyst should always try to locate and incorporate historic information to define a longer record and improve the quality of the frequency analysis. Since it was known that the 1953 event was the largest value since 1892, the year 1892 is entered as the **Start Year** for the historic period. Additionally, a **High Threshold Value** of 70,000 cfs was entered. By entering the High Threshold Value of 70,000 cfs, the 1953 flood of 71,500 cfs was removed from the systematic record and treated as a historic data value during the historic data adjustment calculations performed by HEC-SSP and outlined in Bulletin 17B, Appendix 6. Since no End Year was entered for the historic period, the last year of the systematic data set will be used as the End Year.

Other features on this tab include the **Low Outlier Threshold** and the option to override the default **Frequency Ordinates**, neither of which are selected in this example.

Once all of the General and Optional settings are set or selected, the user can press the **Compute** button to perform the analysis. Once the computations have been completed, a message window will pop-up stating **Compute Complete**. Close this window and then select the **Tabular Results** tab. The analysis window should look like Figure B-13.

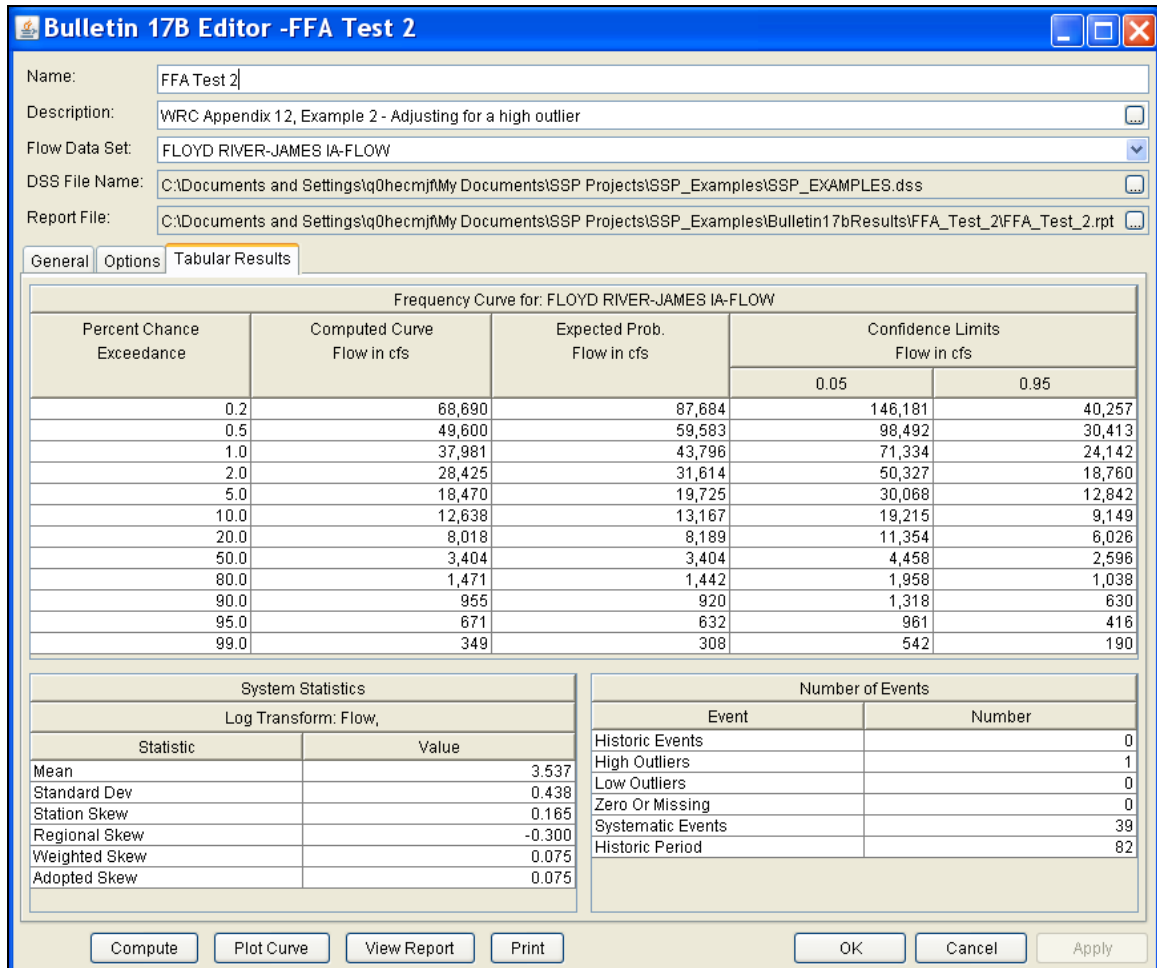


Figure B-13. Bulletin 17B Editor with Results Tab Selected for Test Example 2.

As shown in Figure B-13, the Frequency Curve table contains the following results:

Percent Chance Exceedance

Computed Curve (Log-Pearson III results)

Expected Probability Curve

Confidence Limits (5% and 95% chance exceedance curves)

On the bottom left-hand side of the results tab is the System Statistics table for the observed station data (mean, standard deviation, station skew) and regional adjustment (regional skew, weighted skew, and adopted skew). Also on the bottom right-hand side of the results tab is the Number of Events table showing the number of historic events used in the analysis, number of high outliers found, number of low outliers, number of zero or missing data years, number of systematic events in the gage record, and the historic record length (if historic data was entered).

In addition to the tabular results, a graphical plot of the computed frequency curves can be obtained by pressing the **Plot Curve** button at the bottom of the analysis window. A plot of the results for this test example is shown in Figure B-14.

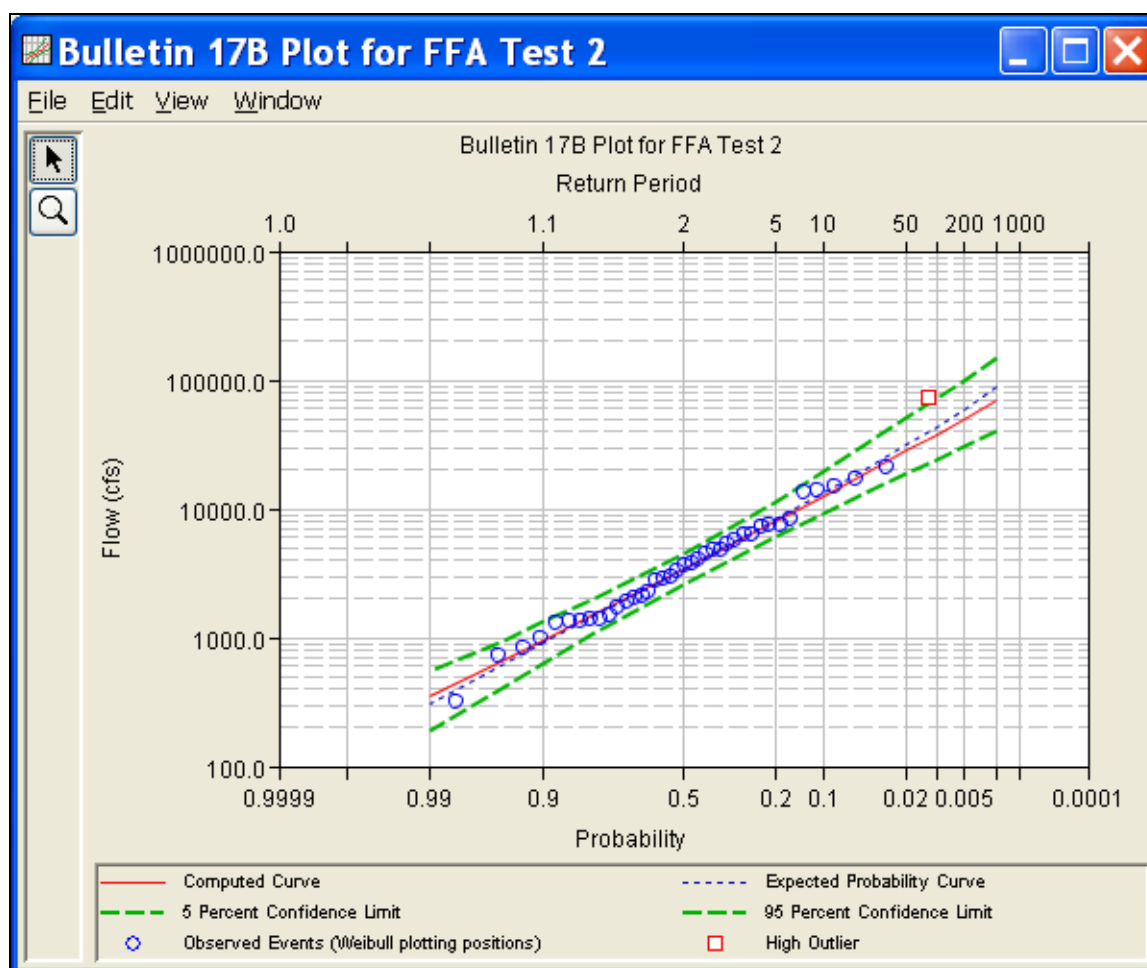


Figure B-14. Plotted Frequency Curves for Test Example 2.

The tabular and graphical results can be sent to the printer or the windows clipboard for transfer into another piece of software. To print

the tabular results, select **Print** from the bottom of the analysis window. To send the tabular results to the windows clipboard, highlight the data you want to send to the clipboard and then press the Control-C key sequence. To print the graphical results, first bring up the graphical plot and then select **Print** from the **File** menu. To send the graphic to the windows clipboard, select **Copy to Clipboard** from the **File** menu.

In addition to the tabular and graphical results, there is a report file that shows the order in which the calculations were performed. To review the report file, press the **View Report** button at the bottom of the analysis window. When this button is selected a text viewer will open the report file and display it on the screen. Shown in Figure B-15 is the report file for test example 2.

The report file contains a listing of the input data, preliminary results, outlier and historical data tests, additional calculations needed, and the final frequency curve results. Different types and amounts of information will show up in the report file depending on the data and the options that have been selected for the analysis. The user should review the report file to understand how HEC-SSP performed the frequency curve calculations.

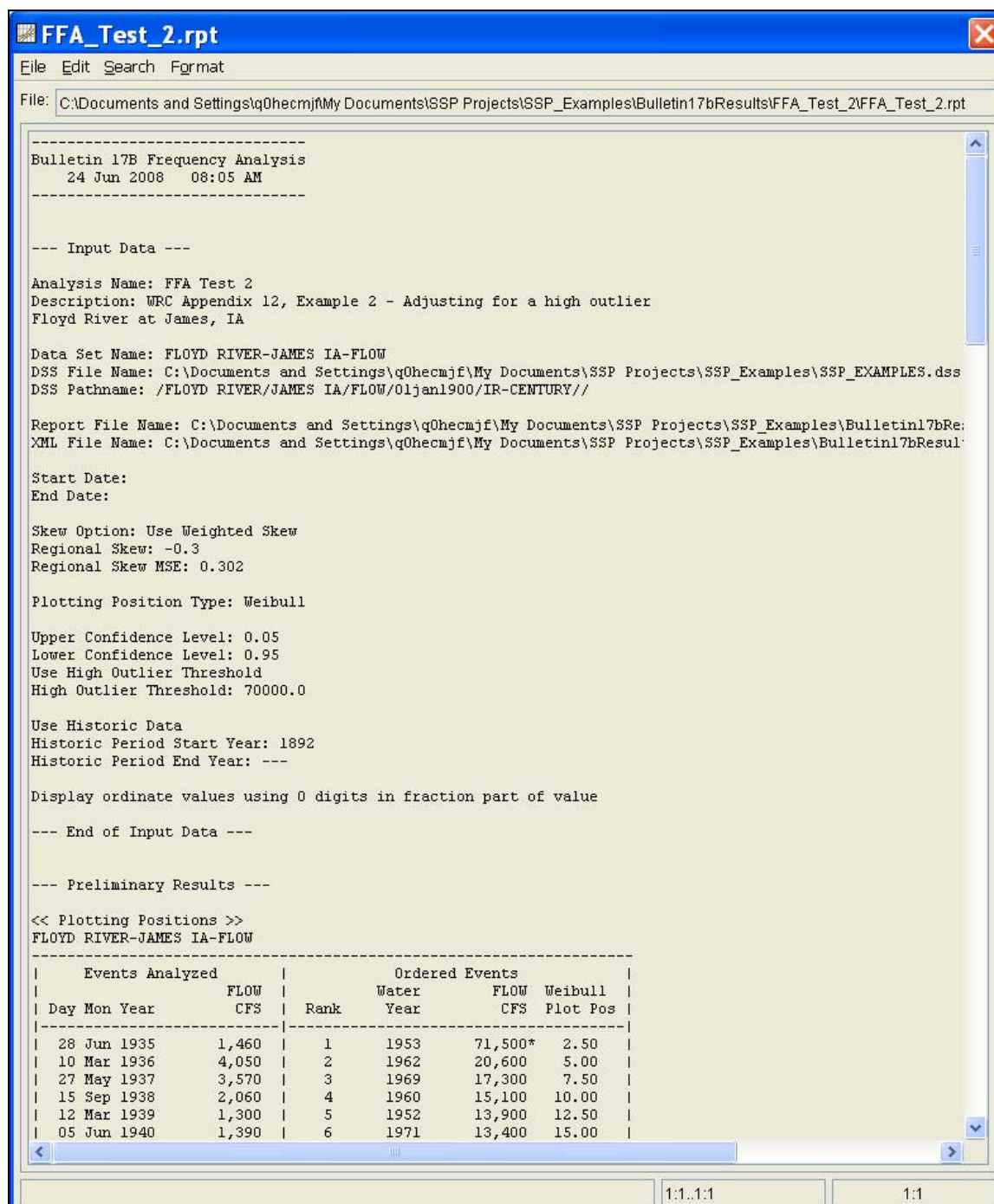
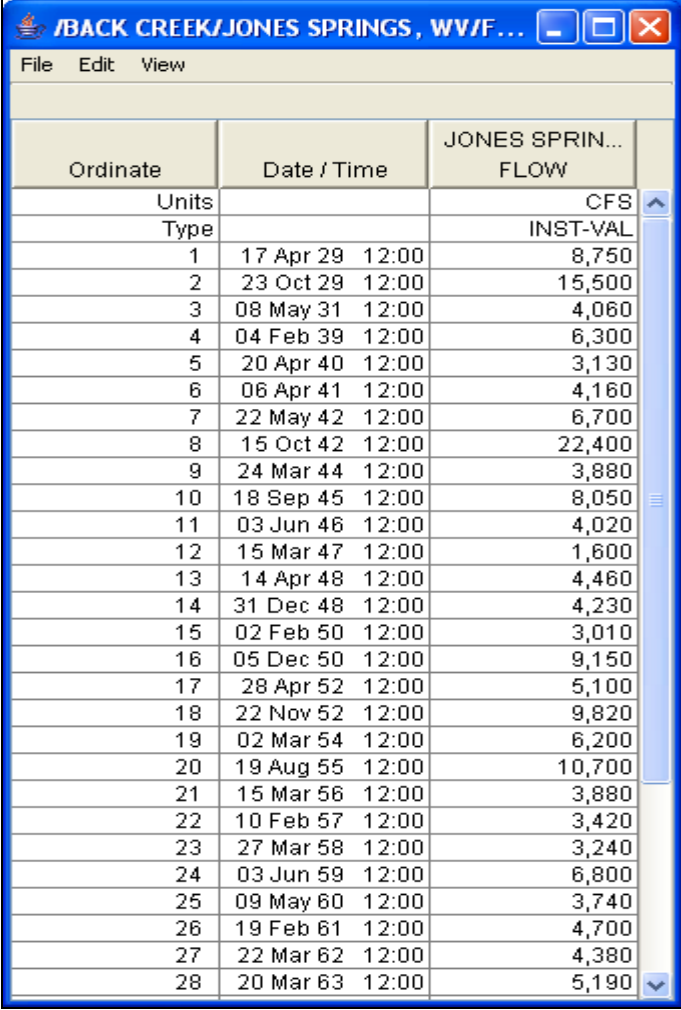


Figure B-15. Test Example 2 Report File.

Example 3: Testing and Adjusting for a Low Outlier

The input data for Test 3 are the same as that for Example 3 in Appendix 12 of the WRC Guidelines. Test 3 illustrates the application to data with a low outlier. Note that the program automatically screens for low outliers and, if low outliers are found, outputs the preliminary results in the report file in order to allow for comparison with the final results.

The data for this example is from Back Creek in Jones Springs, West Virginia. The period of record used for this example is from 1929 to 1973. To view the data, right-click on the data record labeled **"BACK CREEK-JONES SPRINGS, WV-FLOW"** in the study pane and then select **Tabulate**. The data will appear as shown in Figure B-16.



Ordinate	Date / Time	JONES SPRING FLOW
Units		CFS
Type		INST-VAL
1	17 Apr 29 12:00	8,750
2	23 Oct 29 12:00	15,500
3	08 May 31 12:00	4,060
4	04 Feb 39 12:00	6,300
5	20 Apr 40 12:00	3,130
6	06 Apr 41 12:00	4,160
7	22 May 42 12:00	6,700
8	15 Oct 42 12:00	22,400
9	24 Mar 44 12:00	3,880
10	18 Sep 45 12:00	8,050
11	03 Jun 46 12:00	4,020
12	15 Mar 47 12:00	1,600
13	14 Apr 48 12:00	4,460
14	31 Dec 48 12:00	4,230
15	02 Feb 50 12:00	3,010
16	05 Dec 50 12:00	9,150
17	28 Apr 52 12:00	5,100
18	22 Nov 52 12:00	9,820
19	02 Mar 54 12:00	6,200
20	19 Aug 55 12:00	10,700
21	15 Mar 56 12:00	3,880
22	10 Feb 57 12:00	3,420
23	27 Mar 58 12:00	3,240
24	03 Jun 59 12:00	6,800
25	09 May 60 12:00	3,740
26	19 Feb 61 12:00	4,700
27	22 Mar 62 12:00	4,380
28	20 Mar 63 12:00	5,190

Figure B-16. Tabulation of the Peak Flow Data for Back Creek.

To plot the data for this example, right-click on the data record and select **Plot**. A plot of the data will appear as shown in Figure B-17.

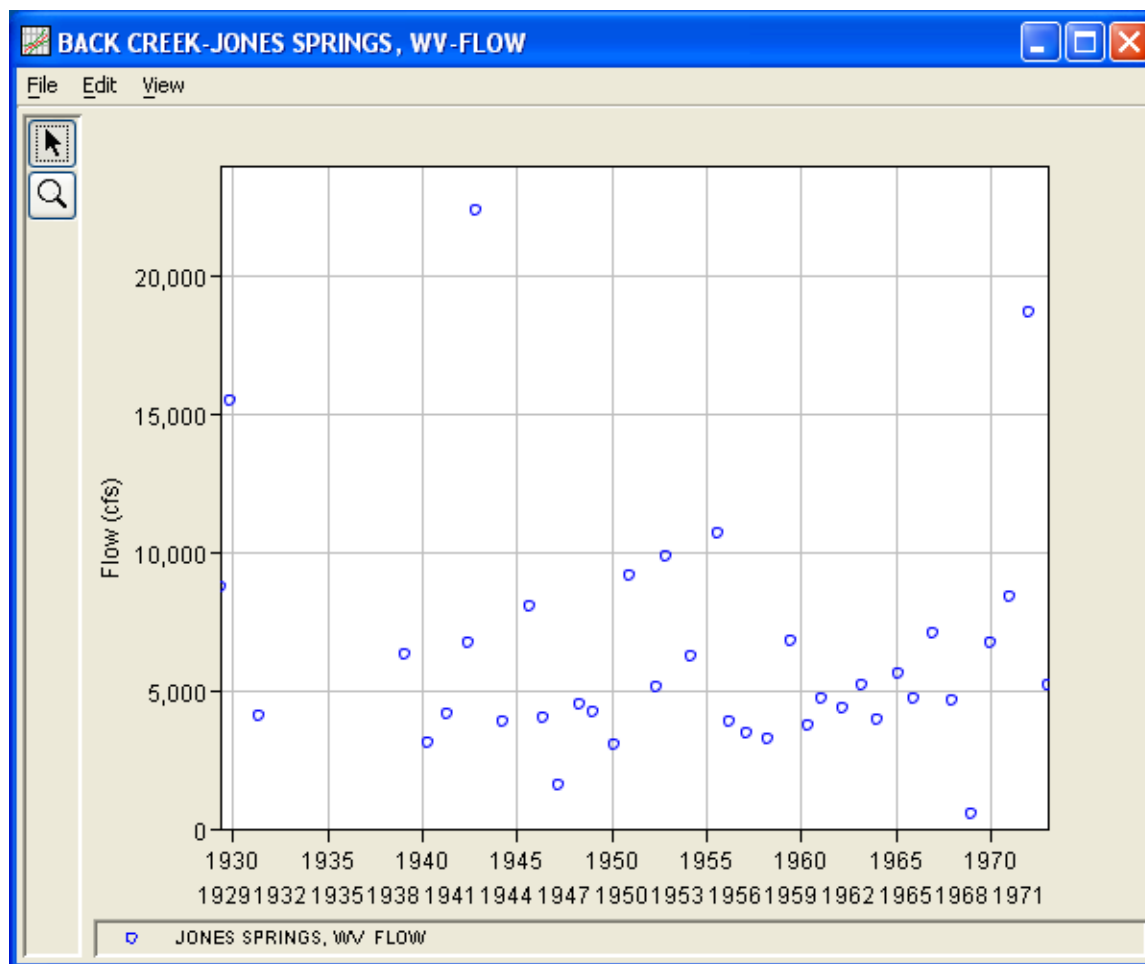


Figure B-17. Plot of Back Creek Data.

A Bulletin 17B and General Frequency analysis have been developed for this example. To open the Bulletin 17B analysis editor for test example 3, either double-click on the analysis labeled **FFA Test 3** from the study explorer, or from the **Analysis** menu select open and then select **FFA Test 3** from the list of available analyses. When FFA Test 3 is selected, the Bulletin 17B analysis editor will appear as shown in Figure B-18.

Bulletin 17B Editor - FFA Test 3

Name: FFA Test 3

Description: WRC Appendix 12, Example 3 - Testing and adjusting for a low outlier

Flow Data Set: BACK CREEK-JONES SPRINGS, WV-FLOW

DSS File Name: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\Bulletin17bResults\FFA_Test_3\FFA_Test_3.rpt

General | Options | Tabular Results

Generalized Skew

☐ Use Station Skew

☒ Use Weighted Skew

☐ Use Regional Skew

Regional Skew: 0.5

Reg. Skew MSE: 0.302

Expected Probability Curve

☒ Compute Expected Prob. Curve

☐ Do Not Compute Expected Prob. Curve

Plotting Position

☒ Weibull (A and B = 0)

☐ Median (A and B = 0.3)

☐ Hazen (A and B = 0.5)

☐ Other (Specify A, B)

Plotting position computed using formula

(m-A)/(n+1-A-B)

Where: m=rank, 1=largest
N=Number of Years
A,B=Constants

A: 0.000

B: 0.000

Confidence Limits

☒ Defaults (0.05, 0.95)

☐ User Entered Values

Upper Limit: 0.000

Lower Limit: 0.000

Time Window Modification

DSS Range is 4/17/1929 - 1/1/1973

☐ start date

☐ end date

Compute Plot Curve View Report Print OK Cancel Apply

Figure B-18. Bulletin 17B Analysis Editor with Test Example 3 Data Set.

Shown in Figure B-18 are the general settings that were used to perform this frequency analysis. As shown, the **Skew** option was set to use the **Weighted Skew**. To use the weighted skew option, the user must enter a value for the Regional Skew and the Regional Skew Mean Square Error (MSE). This selection requires the user to either look up a value from the generalized skew map of the United States, which is provided with Bulletin 17B, or develop a value from a regional analysis of nearby gages. In this example, a value of 0.5 was taken from the generalized skew map of the U.S. from Bulletin 17B. Bulletin 17B suggests using a Regional Skew MSE of 0.302 whenever regional skew values are taken from the map.

Also for this example, the **Expected Probability Curve** option was selected to be computed in addition to the Log Pearson III computed curve. The **Weibull** plotting position method was selected, as well as the default **Confidence Limits** of 0.05 (5 percent chance exceedance) and 0.95 (95% chance exceedance). Shown in Figure B-19 is the Bulletin 17B editor with the **Options Tab** selected.

Bulletin 17B Editor - FFA Test 3

Name: FFA Test 3

Description: WRC Appendix 12, Example 3 - Testing and adjusting for a low outlier

Flow Data Set: BACK CREEK-JONES SPRINGS, WV-FLOW

DSS File Name: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\Bulletin17bResults\FFA_Test_3\FFA_Test_3.rpt

Options

Low Outlier Threshold

☐ Use Low Outlier Threshold

Value: 0.000

Historic Period Data

☐ Use Historic Data

Historic Period

Start Year:

End Year:

High Threshold: 0.000

Historic Events	
Water Year	Peak

User Specified Frequency Ordinates

☐ Use Values from Table below

Frequency in Percent	
	0.2
	0.5
	1.0
	2.0
	5.0
	10.0
	20.0
	50.0
	80.0
	90.0
	95.0
	99.0

Compute Plot Curve View Report Print OK Cancel Apply

Figure B-19. Bulletin 17B Editor with the Options Tab Selected for Test Example 3.

As shown in Figure B-19, none of the available options for modifying the frequency curve were selected for this test example. These options include the **Low Outlier Threshold** and **Historic Period Data**. Additionally, the option to override the default **Frequency Ordinates** was not selected.

Once all of the General and Optional settings are set or selected, the user can press the **Compute** button to perform the analysis. Once the computations have been completed a message window will pop-up stating **Compute Complete**. Close this window and select the **Tabular Results** tab. The analysis window should look like Figure B-20.

Bulletin 17B Editor -FFA Test 3

Name: FFA Test 3

Description: WRC Appendix 12, Example 3 - Testing and adjusting for a low outlier

Flow Data Set: BACK CREEK-JONES SPRINGS, WV-FLOW

DSS File Name: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\Bulletin17bResults\FFA_Test_3\FFA_Test_3.rpt

General Options **Tabular Results**

Frequency Curve for: BACK CREEK-JONES SPRINGS, WV-FLOW

Percent Chance Exceedance	Computed Curve Flow in cfs	Expected Prob. Flow in cfs	Confidence Limits Flow in cfs	
			0.05	0.95
0.2	37,159	45,353	59,928	26,632
0.5	28,934	33,445	44,147	21,506
1.0	23,729	26,457	34,676	18,140
2.0	19,266	20,840	26,933	15,154
5.0	14,322	14,989	18,852	11,699
10.0	11,181	11,493	14,053	9,387
20.0	8,449	8,563	10,157	7,260
50.0	5,238	5,238	6,045	4,521
80.0	3,490	3,460	4,070	2,891
90.0	2,901	2,856	3,434	2,334
95.0	2,524	2,466	3,029	1,982
99.0	2,004	1,924	2,471	1,506

System Statistics		Number of Events	
Log Transform: Flow,		Event	Number
Statistic	Value		
Mean	3.741	Historic Events	0
Standard Dev	0.232	High Outliers	0
Station Skew	0.624	Low Outliers	1
Regional Skew	0.500	Zero Or Missing	0
Weighted Skew	0.577	Systematic Events	38
Adopted Skew	0.577	Historic Period	

Compute Plot Curve View Report Print OK Cancel Apply

Figure B-20. Bulletin 17B Editor with the Results Tab Selected for Test Example 3.

As shown in Figure B-20, the Frequency Curve table contains the following results:

Percent Chance Exceedance

Computed Curve (Log-Pearson III results)

Expected Probability Curve

Confidence Limits (5% and 95% chance exceedance curves)

On the bottom left-hand side of the results tab is a table of System Statistics for the observed station data (mean, standard deviation, station skew) and regional adjustment (regional skew, weighted skew, and adopted skew). Also on the bottom right-hand side of the results tab is a table of Number of Events showing the number of historic events used in the analysis, number of high outliers found, number of low outliers, number of zero or missing data years, number of

systematic events in the gage record, and the historic record length (if historic data was entered).

In this analysis, the software detected 1 low outlier in the systematic record. As recommended in Bulletin 17B, if a low outlier is detected, then that data point will be removed and the Conditional Probability Adjustment will be used to recalculate the frequency curve and then the statistics without that point. Review the report file to see the original statistics, computed curves, the low outlier test, and recomputed curves.

In addition to the tabular results, a graphical plot of the computed frequency curves can be obtained by pressing the **Plot Curve** button at the bottom of the analysis window. A plot of the results for this test example is shown in Figure B-21.

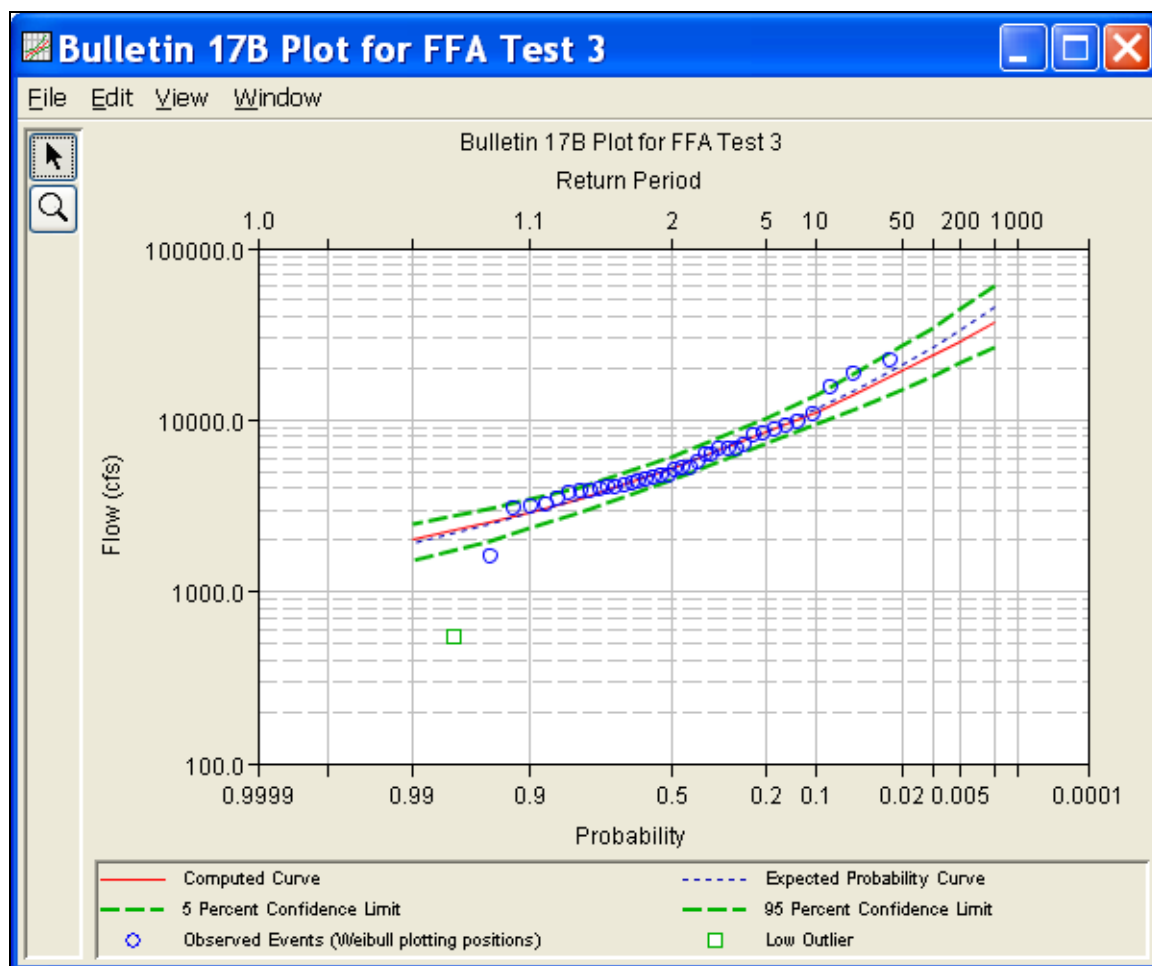


Figure B-21. Plot for Test Example 3.

In addition to the tabular and graphical results, there is a report file that shows the order in which the calculations were performed. To review the report file, press the **View Report** button at the bottom of

the analysis window. When this button is selected a text viewer will open the report file and display it on the screen. Shown in Figure B-22 is the report file for test example 3.

The report file contains a listing of the input data, preliminary results, outlier and historical data tests, additional calculations needed, and the final frequency curve results. Different types and amounts of information will show up in the report file depending on the data and the options that have been selected for the analysis.

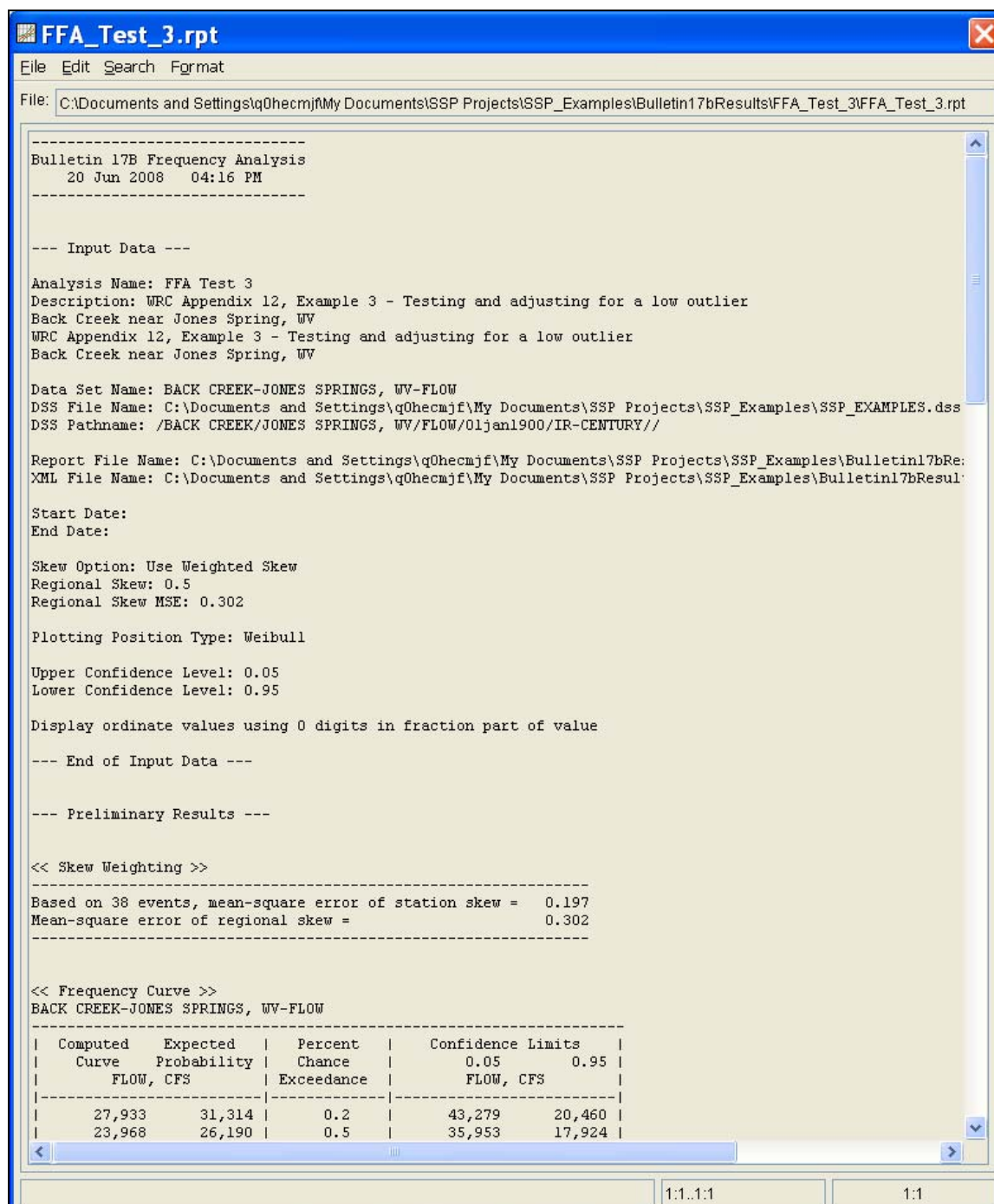
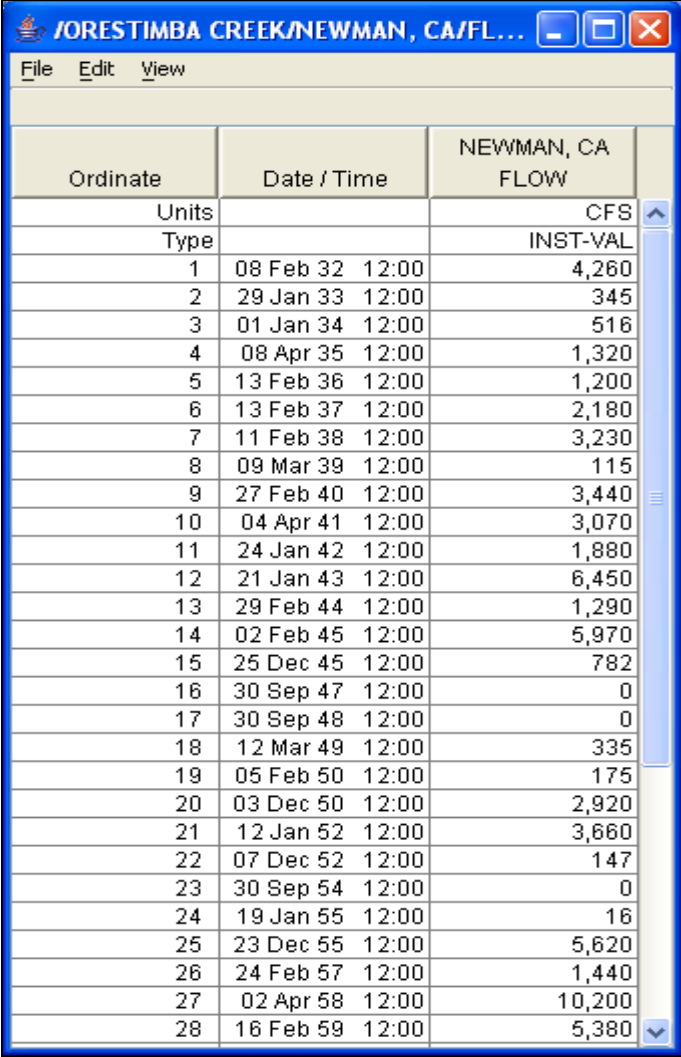


Figure B-22. Report File for Test Example 3.

Example 4: Zero-Flood Years

The input data for Test 4 are the same as that for Example 4 in Appendix 12 of the WRC Guidelines. Test 4 illustrates the application to data that includes several zero flow years.

The data for this example is from Orestimba Creek in Newman, California. The period of record used for this example is from 1932 to 1973. To view the data from HEC-SSP, right-click on the data record labeled "**ORESTIMBA CREEK-NEWMAN, CA-FLOW**" in the study explorer and then select **Tabulate**. The data will appear as shown in Figure B-23.



Ordinate	Date / Time	NEWMAN, CA FLOW
Units		CFS
Type		INST-VAL
1	08 Feb 32 12:00	4,260
2	29 Jan 33 12:00	345
3	01 Jan 34 12:00	516
4	08 Apr 35 12:00	1,320
5	13 Feb 36 12:00	1,200
6	13 Feb 37 12:00	2,180
7	11 Feb 38 12:00	3,230
8	09 Mar 39 12:00	115
9	27 Feb 40 12:00	3,440
10	04 Apr 41 12:00	3,070
11	24 Jan 42 12:00	1,880
12	21 Jan 43 12:00	6,450
13	29 Feb 44 12:00	1,290
14	02 Feb 45 12:00	5,970
15	25 Dec 45 12:00	782
16	30 Sep 47 12:00	0
17	30 Sep 48 12:00	0
18	12 Mar 49 12:00	335
19	05 Feb 50 12:00	175
20	03 Dec 50 12:00	2,920
21	12 Jan 52 12:00	3,660
22	07 Dec 52 12:00	147
23	30 Sep 54 12:00	0
24	19 Jan 55 12:00	16
25	23 Dec 55 12:00	5,620
26	24 Feb 57 12:00	1,440
27	02 Apr 58 12:00	10,200
28	16 Feb 59 12:00	5,380

Figure B-23. Tabulation of the Peak Flow Data for Orestimba Creek.

To plot the data for this example, right-click on the data record and then select **Plot**. A plot of the data will appear as shown in Figure B-24. The years with peak flows measuring zero are visible.

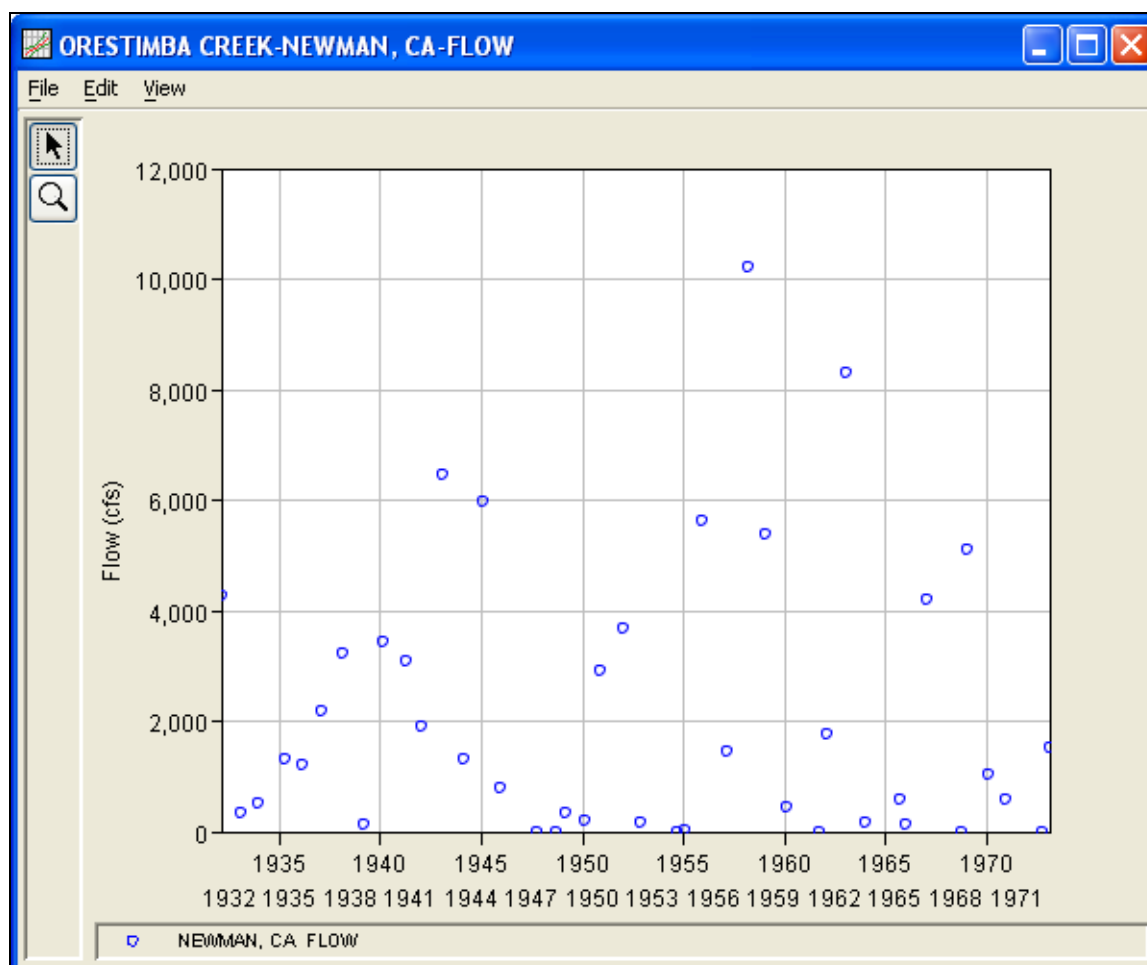


Figure B-24. Plot of Orestimba Creek Data.

A Bulletin 17B and General Frequency analysis have been developed for this example. To open the Bulletin 17B analysis editor for test example 4, either double-click on the analysis labeled **FFA Test 4** from the study explorer, or from the **Analysis** menu select open, then select **FFA Test 4** from the list of available analyses. When FFA Test 4 is selected, the Bulletin 17B analysis editor will appear as shown in Figure B-25.

Bulletin 17B Editor - FFA Test 4*

Name: FFA Test 4

Description: WRC Appendix 12, Example 4 - Zero flood years

Flow Data Set: ORESTIMBA CREEK-NEWMAN, CA-FLOW

DSS File Name: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\Bulletin17bResults\FFA_Test_4\FFA_Test_4.rpt

General | Options | Tabular Results

Generalized Skew

☐ Use Station Skew

☒ Use Weighted Skew

☐ Use Regional Skew

Regional Skew: -0.3

Reg. Skew MSE: 0.302

Expected Probability Curve

☒ Compute Expected Prob. Curve

☐ Do Not Compute Expected Prob. Curve

Plotting Position

☒ Weibull (A and B = 0)

☐ Median (A and B = 0.3)

☐ Hazen (A and B = 0.5)

☐ Other (Specify A, B)

Plotting position computed using formula

(m-A)/(n+1-A-B)

Where: m=rank, 1=largest
N=Number of Years
A,B=Constants

A: 0.000

B: 0.000

Confidence Limits

☒ Defaults (0.05, 0.95)

☐ User Entered Values

Upper Limit: 0.000

Lower Limit: 0.000

Time Window Modification

DSS Range is 2/8/1932 - 2/11/1973

☐ start date

☐ end date

Compute Plot Curve View Report Print OK Cancel Apply

Figure B-25. Bulletin 17B Analysis Editor with Test Example 4 Data Set.

Shown in Figure B-25 are the general settings that were used to perform this frequency analysis. As shown, the **Skew** option was set to use the **Weighted Skew**. To use the weighted skew option, the user must enter a value for the Regional Skew and the Regional Skew Mean Square Error (MSE). This selection requires the user to either look up a value from the generalized skew map of the United States, which is provided with Bulletin 17B, or develop a value from a regional analysis of nearby gages. In this example a value of -0.3 was taken from the generalized skew map of the U.S. from Bulletin 17B. Bulletin 17B suggests using a Regional Skew MSE of 0.302 whenever regional skew values are taken from the map.

Also for this example, the **Expected Probability Curve** option was selected to be computed in addition to the Log Pearson III computed curve. The **Weibull** plotting position method was selected, as well as the default **Confidence Limits** of 0.05 (5 percent chance exceedance) and 0.95 (95% chance exceedance). Shown in Figure B-26 is the Bulletin 17B editor with the **Options Tab** selected.

Bulletin 17B Editor - FFA Test 4*

Name: FFA Test 4

Description: WRC Appendix 12, Example 4 - Zero flood years

Flow Data Set: ORESTIMBA CREEK-NEWMAN, CA-FLOW

DSS File Name: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\Bulletin17bResults\FFA_Test_4\FFA_Test_4.rpt

Options

Low Outlier Threshold

☐ Use Low Outlier Threshold

Value: 0.000

Historic Period Data

☐ Use Historic Data

Historic Period

Start Year:

End Year:

High Threshold: 0.000

Historic Events	
Water Year	Peak

User Specified Frequency Ordinates

☐ Use Values from Table below

Frequency in Percent	
	0.2
	0.5
	1.0
	2.0
	5.0
	10.0
	20.0
	50.0
	80.0
	90.0
	95.0
	99.0

Compute Plot Curve View Report Print OK Cancel Apply

Figure B-26. Bulletin 17B Editor with the Options Tab Selected for Test Example 4.

As shown in Figure B-26, none of the available options for modifying the frequency curve were selected for this test example. These options include the **Low Outlier Threshold** and **Historic Period Data**. Additionally, the option to override the default **Frequency Ordinates** was not selected.

Once all of the General and Optional settings are set or selected, the user can press the **Compute** button to perform the analysis. Once the computations have been completed a message window will pop-up stating **Compute Complete**. Close this window and then select the **Tabular Results** tab. The analysis window should look Figure B-27.

Bulletin 17B Editor -FFA Test 4*

Name: FFA Test 4

Description: WRC Appendix 12, Example 4 - Zero flood years

Flow Data Set: ORESTIMBA CREEK-NEWMAN, CA-FLOW

DSS File Name: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\Bulletin17bResults\FFA_Test_4\FFA_Test_4.rpt

General Options **Tabular Results**

Frequency Curve for: ORESTIMBA CREEK-NEWMAN, CA-FLOW

Percent Chance Exceedance	Computed Curve Flow in cfs	Expected Prob. Flow in cfs	Confidence Limits Flow in cfs	
			0.05	0.95
0.2	32,545	39,023	80,009	16,880
0.5	24,623	28,469	57,347	13,227
1.0	19,296	21,763	42,905	10,678
2.0	14,572	16,030	30,754	8,335
5.0	9,289	9,920	18,093	5,583
10.0	6,041	6,308	10,955	3,787
20.0	3,450	3,534	5,762	2,260
50.0	1,043	1,043	1,559	703
80.0	266	257	404	160
90.0	121	113	196	65
95.0	61	54	106	29
99.0	15	12	32	6

System Statistics	
Log Transform: Flow,	
Statistic	Value
Mean	2.966
Standard Dev	0.668
Station Skew	-0.568
Regional Skew	-0.300
Weighted Skew	-0.473
Adopted Skew	-0.473

Number of Events	
Event	Number
Historic Events	0
High Outliers	0
Low Outliers	1
Zero Or Missing	6
Systematic Events	42
Historic Period	

Compute Plot Curve View Report Print OK Cancel Apply

Figure B-27. Bulletin 17B Editor with the Results Tab Selected for Test Example 4.

As shown in Figure B-27, the Frequency Curve table contains the following results:

Percent Chance Exceedance

Computed Curve (Log-Pearson III results)

Expected Probability Curve

Confidence Limits (5% and 95% chance exceedance curves)

On the bottom left-hand side of the results tab is a table of System Statistics for the observed station data (mean, standard deviation, station skew) and regional adjustment (regional skew, weighted skew, and adopted skew). Also on the bottom right-hand side of the results tab is a table of Number of Events showing the number of historic events used in the analysis, number of high outliers found, number of low outliers, number of zero or missing data years, number of

systematic events in the gage record, and the historic record length (if historic data was entered).

As noted earlier, there were 6 zero values in this record, and also a low outlier. A zero value causes difficulty because the first step in fitting a Log Pearson III distribution is computing the base-10 log of each flow value, which is undefined for zero. Bulletin 17B recommends removing the zero values (and the low outlier) from the systematic record to compute a preliminary frequency curve, and then adjusting that curve with the Conditional Probability Adjustment. The final frequency curve and statistics are shown in the table, and the preliminary calculations can be reviewed in the report file.

In addition to the tabular results, a graphical plot of the computed frequency curves can be obtained by pressing the **Plot Curve** button at the bottom of the analysis window. A plot of the results for this test example is shown in Figure B-28.

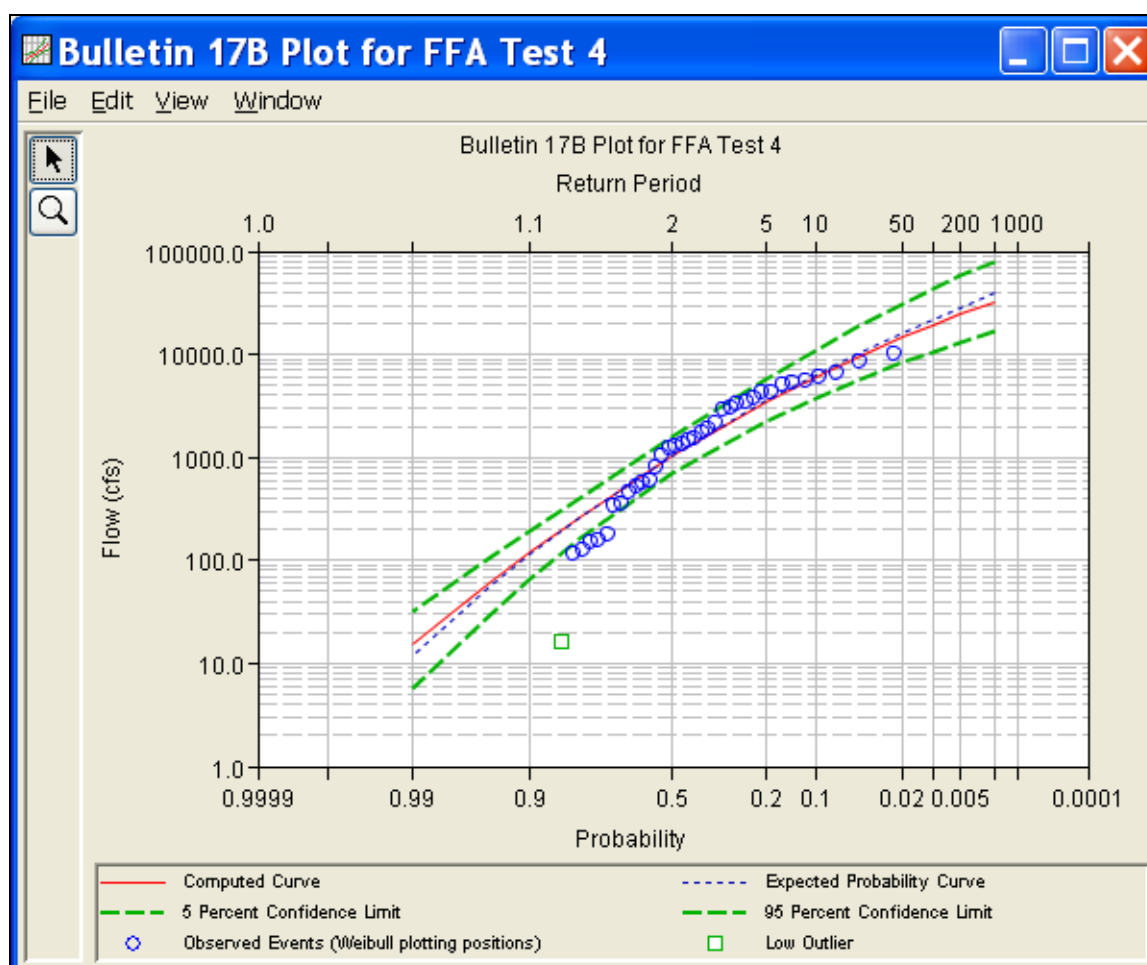


Figure B-28. Plot of Test Example 4 Results.

The tabular and graphical results can be sent to the printer or the windows clipboard for transfer into another piece of software. To print the tabular results, select **Print** from the bottom of the analysis window. To send the tabular results to the windows clipboard, highlight the data you want to send to the clipboard and then press the Control-C key sequence. To print the graphical results, first bring up the graphical plot and then select **Print** from the **File** menu. To send the graphic to the windows clipboard, select **Copy to Clipboard** from the **File** menu.

In addition to the tabular and graphical results, there is a report file that shows the order in which the calculations were performed. To review the report file, press the **View Report** button at the bottom of the analysis window. When this button is selected a text viewer will open the report file and display it on the screen. Shown in Figure B-29 is the report file for test example 4.

The report file contains a listing of the input data, preliminary results, outlier and historical data tests, additional calculations needed, and the final frequency curve results. Different types and amounts of information will show up in the report file depending on the data and the options that have been selected for the analysis.

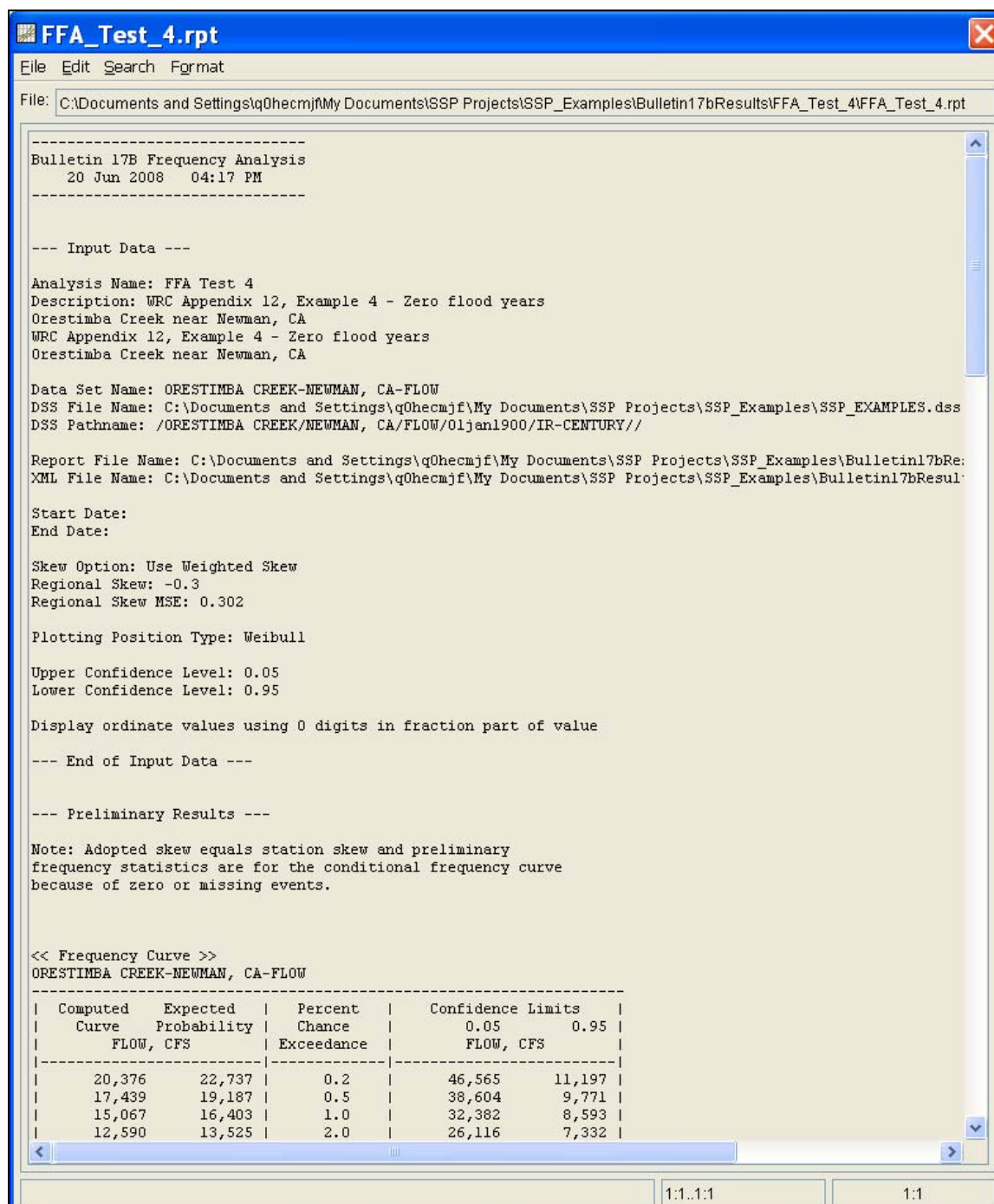
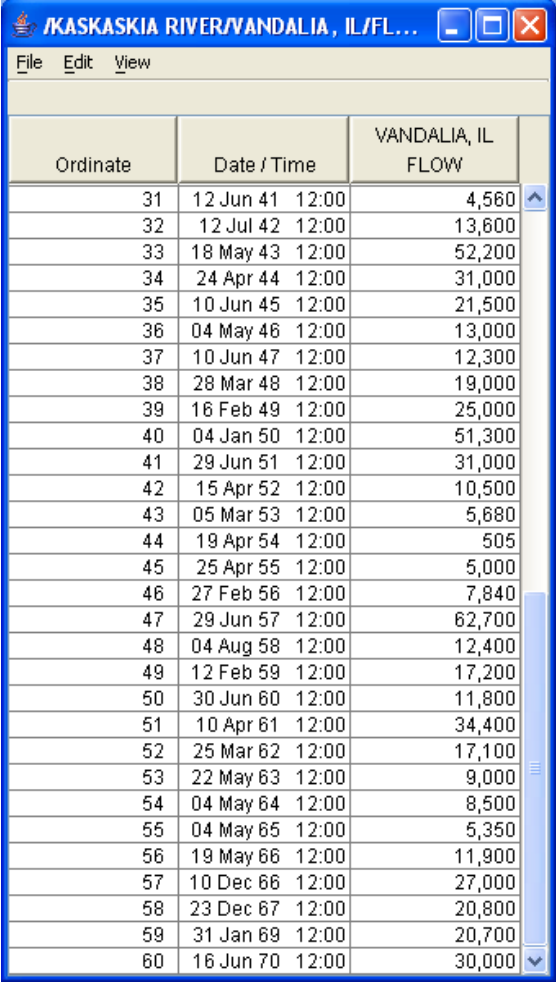


Figure B-29. HEC-SSP Report File for Test Example 4.

Example 5: Confidence Limits and Low Threshold Discharge

This test illustrates the use of user-entered confidence limits. Probabilities of .01 and .99 were entered for the computed confidence limit curves. This data set also includes two very low values, the higher of which is just above the default low outlier threshold. This example therefore also demonstrates the use of a user-entered low outlier threshold set to be higher than both values.

The data for this example is from Kaskaskia River in Vandalia, Illinois. The period of record used for this example is from 1908 to 1970. To view the data from HEC-SSP, right-click on the data record labeled **"KASKASKIA RIVER-VANDALIA, IL-FLOW"** in the study explorer and then select **Tabulate**. The data will appear as shown in Figure B-30.



Ordinate	Date / Time	VANDALIA, IL FLOW
31	12 Jun 41 12:00	4,560
32	12 Jul 42 12:00	13,600
33	18 May 43 12:00	52,200
34	24 Apr 44 12:00	31,000
35	10 Jun 45 12:00	21,500
36	04 May 46 12:00	13,000
37	10 Jun 47 12:00	12,300
38	28 Mar 48 12:00	19,000
39	16 Feb 49 12:00	25,000
40	04 Jan 50 12:00	51,300
41	29 Jun 51 12:00	31,000
42	15 Apr 52 12:00	10,500
43	05 Mar 53 12:00	5,680
44	19 Apr 54 12:00	505
45	25 Apr 55 12:00	5,000
46	27 Feb 56 12:00	7,840
47	29 Jun 57 12:00	62,700
48	04 Aug 58 12:00	12,400
49	12 Feb 59 12:00	17,200
50	30 Jun 60 12:00	11,800
51	10 Apr 61 12:00	34,400
52	25 Mar 62 12:00	17,100
53	22 May 63 12:00	9,000
54	04 May 64 12:00	8,500
55	04 May 65 12:00	5,350
56	19 May 66 12:00	11,900
57	10 Dec 66 12:00	27,000
58	23 Dec 67 12:00	20,800
59	31 Jan 69 12:00	20,700
60	16 Jun 70 12:00	30,000

Figure B-30. Tabulation of the Peak Flow Data for Kaskaskia River.

To plot the data for this example, right-click on the data record and then select **Plot**. A plot of the data will appear as shown in Figure B-31.

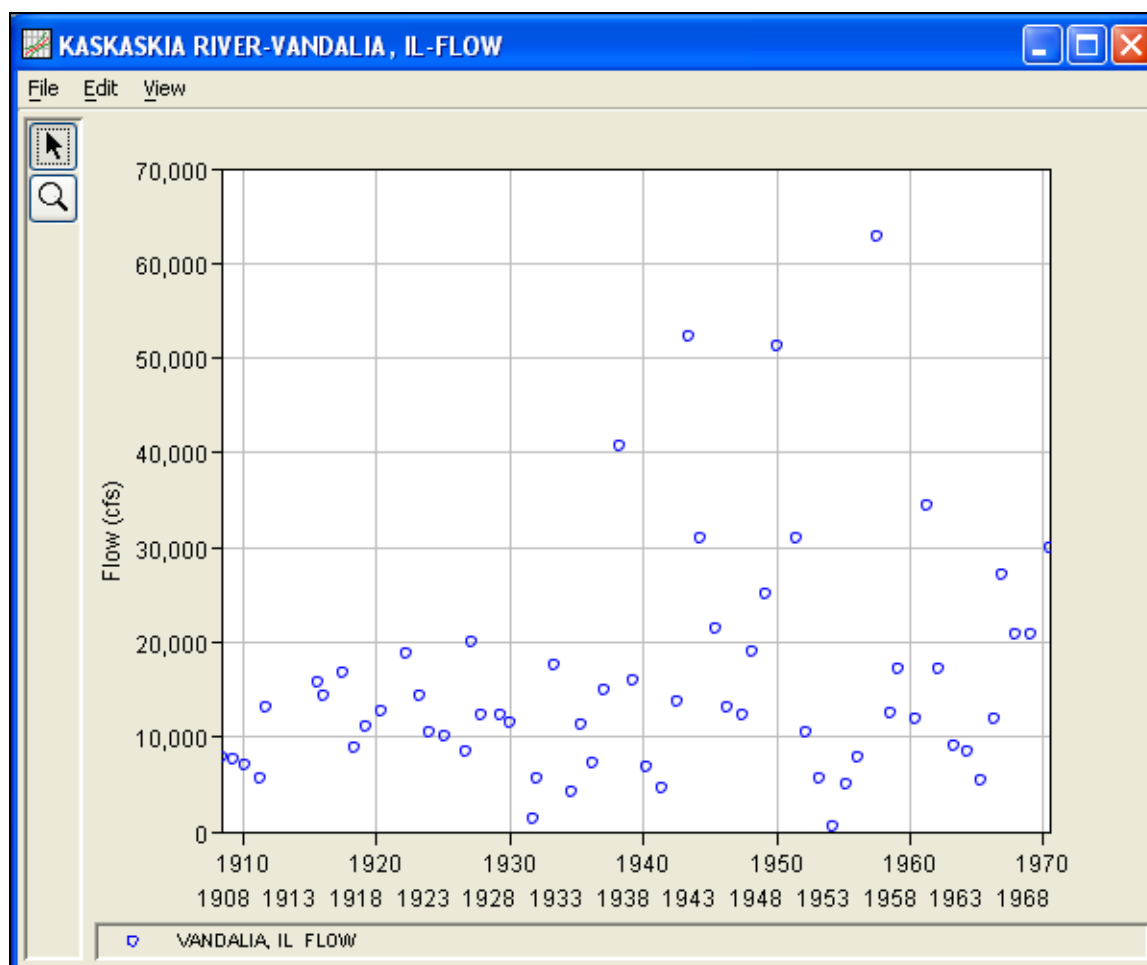


Figure B-31. HEC-SSP Plot of the Kaskaskia River Data.

A Bulletin 17B and General Frequency analysis have been developed for this example. To open the Bulletin 17B analysis editor for test example 5, either double-click on the analysis labeled **FFA Test 5** from the study explorer, or from the **Analysis** menu select **Open** and then select **FFA Test 5** from the list of available analyses. When FFA Test 5 is selected, the Bulletin 17B analysis editor will appear as shown in Figure B-32.

Bulletin 17B Editor - FFA Test 5

Name: FFA Test 5

Description: Example using other confidence limits and a base peak discharge

Flow Data Set: KASKASKIA RIVER-VANDALIA, IL-FLOW

DSS File Name: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\Bulletin17bResults\FFA_Test_5\FFA_Test_5.rpt

General Options Tabular Results

Generalized Skew

☐ Use Station Skew

☒ Use Weighted Skew

☐ Use Regional Skew

Regional Skew: -0.4

Reg. Skew MSE: 0.302

Expected Probability Curve

☒ Compute Expected Prob. Curve

☐ Do Not Compute Expected Prob. Curve

Plotting Position

☒ Weibull (A and B = 0)

☐ Median (A and B = 0.3)

☐ Hazen (A and B = 0.5)

☐ Other (Specify A, B)

Plotting position computed using formula

(m-A)/(n+1-A-B)

Where: m=rank, 1=largest
N=Number of Years
A,B=Constants

A: 0.000

B: 0.000

Confidence Limits

☐ Defaults (0.05, 0.95)

☒ User Entered Values

Upper Limit: 0.01

Lower Limit: 0.99

Time Window Modification

DSS Range is 5/6/1908 - 6/16/1970

☐ start date

☐ end date

Compute Plot Curve View Report Print OK Cancel Apply

Figure B-32. Bulletin 17B Analysis Editor for Test Example 5.

Shown in Figure B-32 are the general settings that were used to perform this frequency analysis. As shown, the **Skew** option was set to use the **Weighted Skew**. To use the weighted skew option, the user must enter a value for the Regional Skew and the Regional Skew Mean Square Error (MSE). This selection requires the user to either look up a value from the generalized skew map of the United States, which is provided with Bulletin 17B, or develop a value from a regional analysis of nearby gages. In this example a value of -0.4 was taken from the generalized skew map of the U.S. from Bulletin 17B. Bulletin 17B suggests using a Regional Skew MSE of 0.302 whenever regional skew values are taken from the map.

Also for this example, the **Expected Probability Curve** option was selected to be computed in addition to the Log Pearson III computed curve. The default method of **Weibull** plotting positions was selected. The default values for confidence limits (.05 and .95) were changed to 0.01 (1 percent chance exceedance) and 0.99 (99% chance exceedance). Shown in Figure B-33 is the Bulletin 17B editor with the **Options Tab** selected.

Bulletin 17B Editor - FFA Test 5

Name: FFA Test 5

Description: Example using other confidence limits and a base peak discharge

Flow Data Set: KASKASKIA RIVER-VANDALIA, IL-FLOW

DSS File Name: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\Bulletin17bResults\FFA_Test_5\FFA_Test_5.rpt

General Options Tabular Results

Low Outlier Threshold

☒ Use Low Outlier Threshold

Value: 2000

Historic Period Data

☐ Use Historic Data

Historic Period

Start Year:

End Year:

High Threshold: 0.000

Historic Events	
Water Year	Peak

User Specified Frequency Ordinates

☐ Use Values from Table below

Frequency in Percent	
	0.2
	0.5
	1.0
	2.0
	5.0
	10.0
	20.0
	50.0
	80.0
	90.0
	95.0
	99.0

Compute Plot Curve View Report Print OK Cancel Apply

Figure B-33. Bulletin 17B Editor with the Options Tab Shown for Test Example 5.

As shown in Figure B-33, a **Low Outlier Threshold** of 2000 was entered. In the initial computation with this data (which the reader can reproduce by Computing without the “Use Low Outlier Threshold” box checked), the default low outlier threshold was 1,253 cfs, just below the second lowest value of 1,270 cfs. A look at the statistics and computed frequency curve from that run shows that the 1,270 cfs value is well below the computed curve and with a station skew of - 0.21 the frequency curve does not fit the upper data well. By choosing to also censor the 1,270 cfs value with a threshold of 2000 cfs, the fit is improved. None of the other available options, such as **Historic Period Data** and the option to override the default **Frequency Ordinates**, were selected for this test example.

Once all of the General and Optional settings are set or selected, the user can press the **Compute** button to perform the analysis. Once the computations have been completed a message window will pop-up stating **Compute Complete**. Close this window and then select the **Tabular Results** tab from the analysis window. The analysis window should look Figure B-34.

Bulletin 17B Editor -FFA Test 5

Name: FFA Test 5

Description: Example using other confidence limits and a base peak discharge

Flow Data Set: KASKASKIA RIVER-VANDALIA, IL-FLOW

DSS File Name: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\Bulletin17bResults\FFA_Test_5\FFA_Test_5.rpt

General Options **Tabular Results**

Frequency Curve for: KASKASKIA RIVER-VANDALIA, IL-FLOW

Percent Chance Exceedance	Computed Curve Flow in cfs	Expected Prob. Flow in cfs	Confidence Limits Flow in cfs	
			0.01	0.99
0.2	92,314	102,679	163,830	62,771
0.5	73,871	79,994	123,959	51,997
1.0	61,633	65,543	98,905	44,582
2.0	50,712	53,082	77,643	37,733
5.0	38,061	39,138	54,542	29,433
10.0	29,659	30,178	40,301	23,617
20.0	22,082	22,277	28,410	18,050
50.0	12,824	12,824	15,554	10,554
80.0	7,652	7,593	9,369	5,937
90.0	5,905	5,820	7,396	4,367
95.0	4,792	4,685	6,147	3,393
99.0	3,283	3,136	4,428	2,131

System Statistics		Number of Events	
Log Transform: Flow,		Event	Number
Statistic	Value		
Mean	4.116	Historic Events	0
Standard Dev	0.274	High Outliers	0
Station Skew	0.399	Low Outliers	2
Regional Skew	-0.400	Zero Or Missing	0
Weighted Skew	0.182	Systematic Events	60
Adopted Skew	0.182	Historic Period	

Compute Plot Curve View Report Print OK Cancel Apply

Figure B-34. Bulletin 17B Editor with the Results Tab Selected for Test Example 5.

As shown in Figure B-34, the Frequency Curve table contains the following results:

Percent Chance Exceedance

Computed Curve (Log-Pearson III results)

Expected Probability Curve

Confidence Limits (1% and 99% chance exceedance curves)

On the bottom left-hand side of the results tab is a table of System Statistics for the observed station data (mean, standard deviation, station skew) and regional adjustment (regional skew, weighted skew, and adopted skew). Also on the bottom right-hand side of the results tab is a table of Number of Events showing the number of historic events used in the analysis, number of high outliers found, number of low outliers, number of zero or missing data years, number of

systematic events in the gage record, and the historic record length (only if historic data was entered).

With the user-defined low-outlier threshold of 2000 cfs, there are 2 low-outliers detected. The analysis report shows the program omitted these values and used the Conditional Probability Adjustment to recompute the resulting frequency curve and statistics. The report file (described below) includes the preliminary computation before removal of outliers and the default and user-defined outlier thresholds, as well as the final frequency curve and statistics.

In addition to the tabular results, a graphical plot of the computed frequency curves can be obtained by pressing the **Plot Curve** button at the bottom of the analysis window. A plot of the results for this test example is shown in Figure B-35.

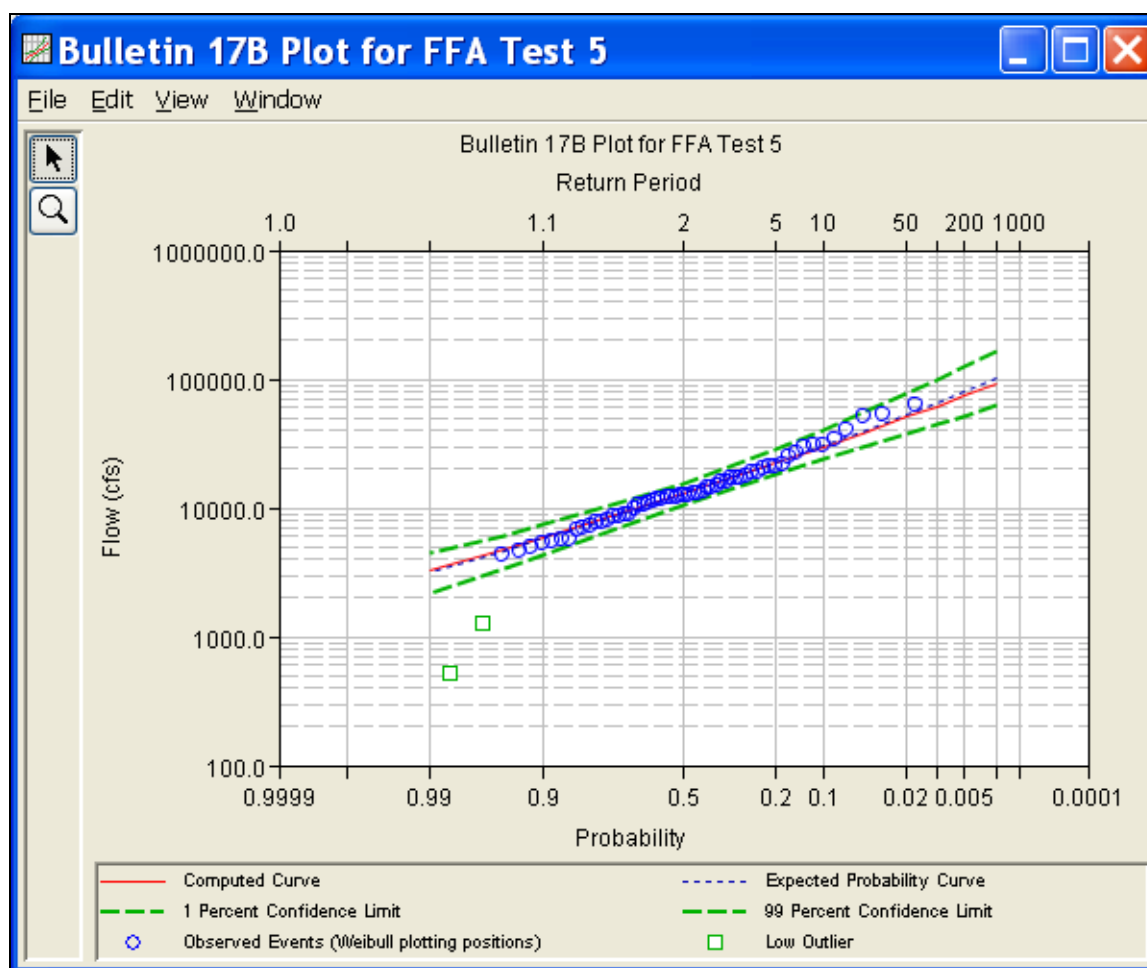


Figure B-35. Plot of the Frequency Curve Results for Test Example 5.

The tabular and graphical results can be sent to the printer or the windows clipboard for transfer into another piece of software. To print the tabular results, select **Print** from the bottom of the analysis

window. To send the tabular results to the windows clipboard, highlight the data you want to send to the clipboard and then press the Control-C key sequence. To print the graphical results, first bring up the graphical plot and then select **Print** from the **File** menu. To send the graphic to the windows clipboard, select **Copy to Clipboard** from the **File** menu.

In addition to the tabular and graphical results, there is a report file that shows the order in which the calculations were performed. To review the report file, press the **View Report** button at the bottom of the analysis window. When this button is selected a text viewer will open the report file and display it on the screen. Shown in Figure B-36 is the report file for test example 5.

The report file contains a listing of the input data, preliminary results, outlier and historical data tests, additional calculations needed, and the final frequency curve results. Different types and amounts of information will show up in the report file depending on the data and the options that have been selected for the analysis.

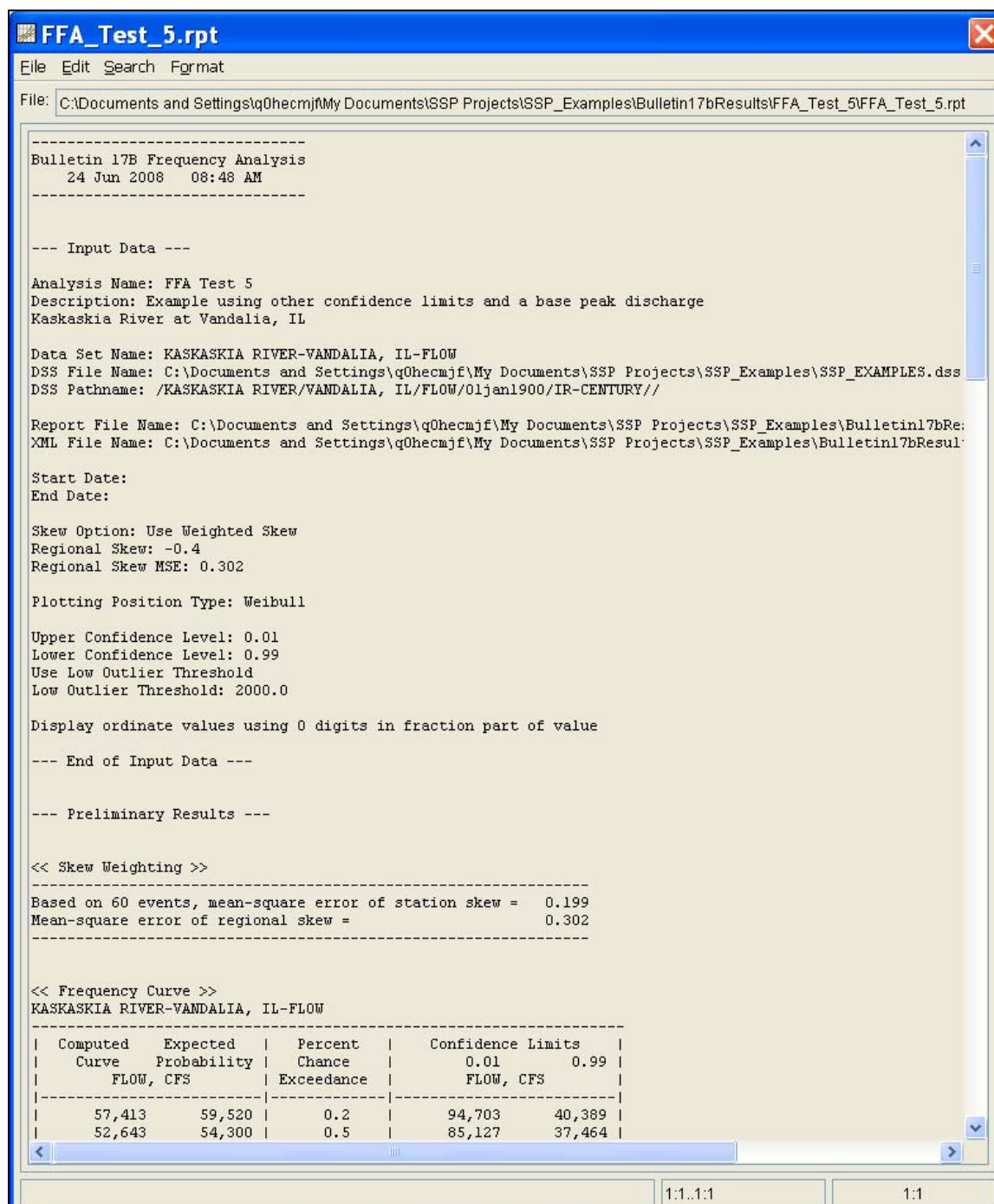



Figure B-36. Report File for Test Example 5.

Example 6: Use of Historic Data and Median Plotting Position

This test demonstrates how to use historic information to improve a flow frequency analysis. A historic flood peak of 15,000 cfs which occurred in 1843 is included in the analysis. This value is the highest known value up to the present time (1974 for this example), even though the systematic record stopped in 1955.

The data for this example is from Ridley Creek in Moylan, Pennsylvania. The period of record used for this example is from 1932 to 1955. To view the data from HEC-SSP, right-click on the data record labeled **"RIDLEY CREEK-MOYLAN, PA-FLOW"** in the study explorer and then select **Tabulate**. The data will appear as shown in Figure B-37.



Ordinate	Date / Time	MOYLAN, PA FLOW
Units		CFS
Type		INST-VAL
1	28 Mar 32 12:00	891.0
2	23 Aug 33 12:00	2,680.0
3	05 Mar 34 12:00	1,080.0
4	09 Jul 35 12:00	3,000.0
5	03 Jan 36 12:00	1,590.0
6	22 Feb 37 12:00	770.0
7	23 Jul 38 12:00	3,320.0
8	03 Feb 39 12:00	978.0
9	15 Mar 40 12:00	1,770.0
10	07 Feb 41 12:00	746.0
11	13 Aug 42 12:00	1,000.0
12	30 Dec 42 12:00	980.0
13	06 Jan 44 12:00	865.0
14	18 Sep 45 12:00	1,040.0
15	26 Dec 45 12:00	1,000.0
16	22 May 47 12:00	483.0
17	05 May 48 12:00	740.0
18	30 Dec 48 12:00	1,040.0
19	03 Aug 50 12:00	1,590.0
20	25 Nov 50 12:00	5,720.0
21	11 Mar 52 12:00	1,490.0
22	22 Nov 52 12:00	918.0
23	14 Dec 53 12:00	670.0
24	18 Aug 55 12:00	4,390.0

Figure B-37. Tabulation of the Peak Flow Data for Ridley Creek.

To plot the data for this example, right-click on the data record and then select **Plot**. A plot of the data will appear as shown in Figure B-38.

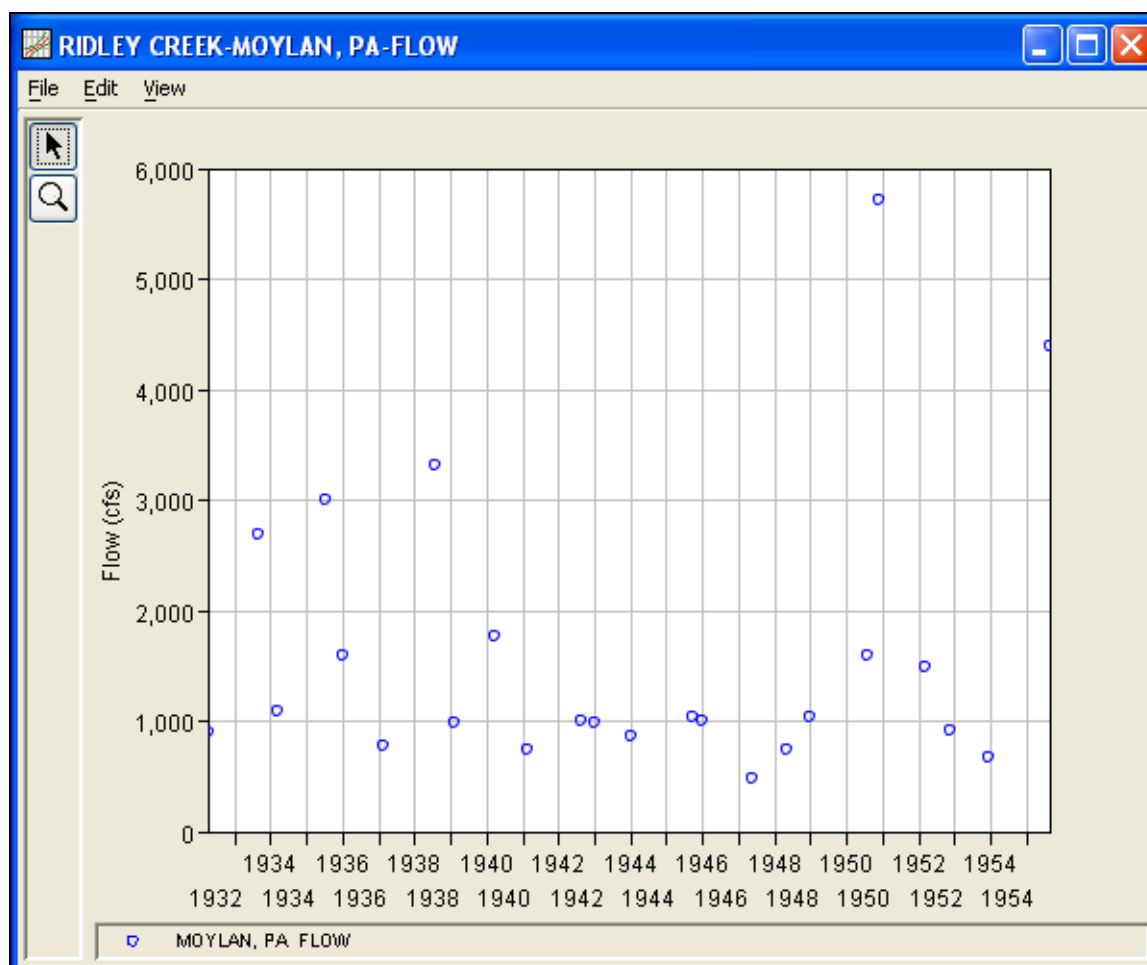


Figure B-38. Plot of the Ridley Creek Data.

A Bulletin 17B and General Frequency analysis have been developed for this example. To open the Bulletin 17B analysis editor for test example 6, either double-click on the analysis labeled **FFA Test 6** from the study explorer, or from the **Analysis** menu select open, then select **FFA Test 6** from the list of available analyses. When FFA Test 6 is selected, the Bulletin 17B analysis editor will appear as shown in Figure B-39.

Bulletin 17B Editor - FFA Test 6

Name: FFA Test 6

Description: Example using Median plot positions, historic data, and period of knowledge beyond last year of data

Flow Data Set: RIDLEY CREEK-MOYLAN, PA-FLOW

DSS File Name: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\Bulletin17bResults\FFA_Test_6\FFA_Test_6.rpt

General Options Tabular Results

Generalized Skew

☐ Use Station Skew

☒ Use Weighted Skew

☐ Use Regional Skew

Regional Skew: 0.4

Reg. Skew MSE: 0.302

Expected Probability Curve

☒ Compute Expected Prob. Curve

☐ Do Not Compute Expected Prob. Curve

Plotting Position

☐ Weibull (A and B = 0)

☒ Median (A and B = 0.3)

☐ Hazen (A and B = 0.5)

☐ Other (Specify A, B)

Plotting position computed using formula

(m-A)/(n+1-A-B)

Where: m=rank, 1=largest
N=Number of Years
A,B=Constants

A: 0.000

B: 0.000

Confidence Limits

☒ Defaults (0.05, 0.95)

☐ User Entered Values

Upper Limit: 0.000

Lower Limit: 0.000

Time Window Modification

DSS Range is 3/28/1932 - 8/18/1955

☐ start date

☐ end date

Compute Plot Curve View Report Print OK Cancel Apply

Figure B-39. Bulletin 17B Analysis Editor for Test Example 6.

Shown in Figure B-39 are the general settings that were used to perform this frequency analysis. As shown, the **Skew** option was set to use the **Weighted Skew**. To use the weighted skew option, the user must enter a value for the Regional Skew and the Regional Skew Mean Square Error (MSE). This selection requires the user to either look up a value from the generalized skew map of the United States, which is provided with Bulletin 17B, or develop a value from a regional analysis of nearby gages. In this example a value of 0.4 was taken from the generalized skew map of the U.S. from Bulletin 17B. Bulletin 17B suggests using a Regional Skew MSE of 0.302 whenever regional skew values are taken from the map.

Also for this example, the **Expected Probability Curve** option was selected to be computed in addition to the Log Pearson III computed curve. The **Median** plotting position method was selected, as well as the default **Confidence Limits** of 0.05 (5 percent chance exceedance) and 0.95 (95% chance exceedance). Shown in Figure B-40 is the Bulletin 17B editor with the **Options Tab** selected.

Bulletin 17B Editor - FFA Test 6

Name: FFA Test 6

Description: Example using Median plot positions, historic data, and period of knowledge beyond last year of data

Flow Data Set: RIDLEY CREEK-MOYLAN, PA-FLOW

DSS File Name: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\Bulletin17bResults\FFA_Test_6\FFA_Test_6.rpt

Options

Low Outlier Threshold

☐ Use Low Outlier Threshold

Value: 0.000

Historic Period Data

☒ Use Historic Data

Historic Period

Start Year:

End Year: 1974

High Threshold:

Historic Events	
Water Year	Peak
1843	15000.0

User Specified Frequency Ordinates

☐ Use Values from Table below

Frequency in Percent	
	0.2
	0.5
	1.0
	2.0
	5.0
	10.0
	20.0
	50.0
	80.0
	90.0
	95.0
	99.0

Buttons: Compute, Plot Curve, View Report, Print, OK, Cancel, Apply

Figure B-40. Bulletin 17B Analysis Editor with Options Tab Shown for Test Example 6.

As shown in Figure B-40, the **Historic Period Data** option has been selected to reflect a historical flood event of 15,000 cfs in 1843 and an analysis period from 1843 to 1974. Historic data is used to account for historic flood events large enough to be relevant to the analysis and not contained in the systematic data record. The additional information provided by historic data can improve the flood frequency analysis, especially when the data collection period for a given area is relatively short. Information for a **Historic Flood Peak** has been entered to account for a peak flow of 15,000 cfs in the 1843 water year. The Historic Period **Start Year** has been left blank. By default this value will be the earliest year found in the historic flood peak data or the systematic record. Therefore for this example, 1843 will automatically be used for the Start Year of the Historic Period. An **End Year** of 1974 has been entered. The systematic record for the gage ended in 1955, however when this analysis was performed in 1974, no other flood peaks of consequence had been observed between 1955 and 1974. Therefore, 1974 is set as the End Year for the historic period analysis.

Other features on this tab include the **Low Outlier Threshold** and the option to override the default **Frequency Ordinates**. Neither option is selected in this example.

Once all of the General and Optional settings are set or selected, the user can press the **Compute** button to perform the analysis. Once the computations have been completed a message window will pop-up stating **Compute Complete**. Close this window and then select the **Tabular Results** tab from the analysis window. The analysis window should look Figure B-41.

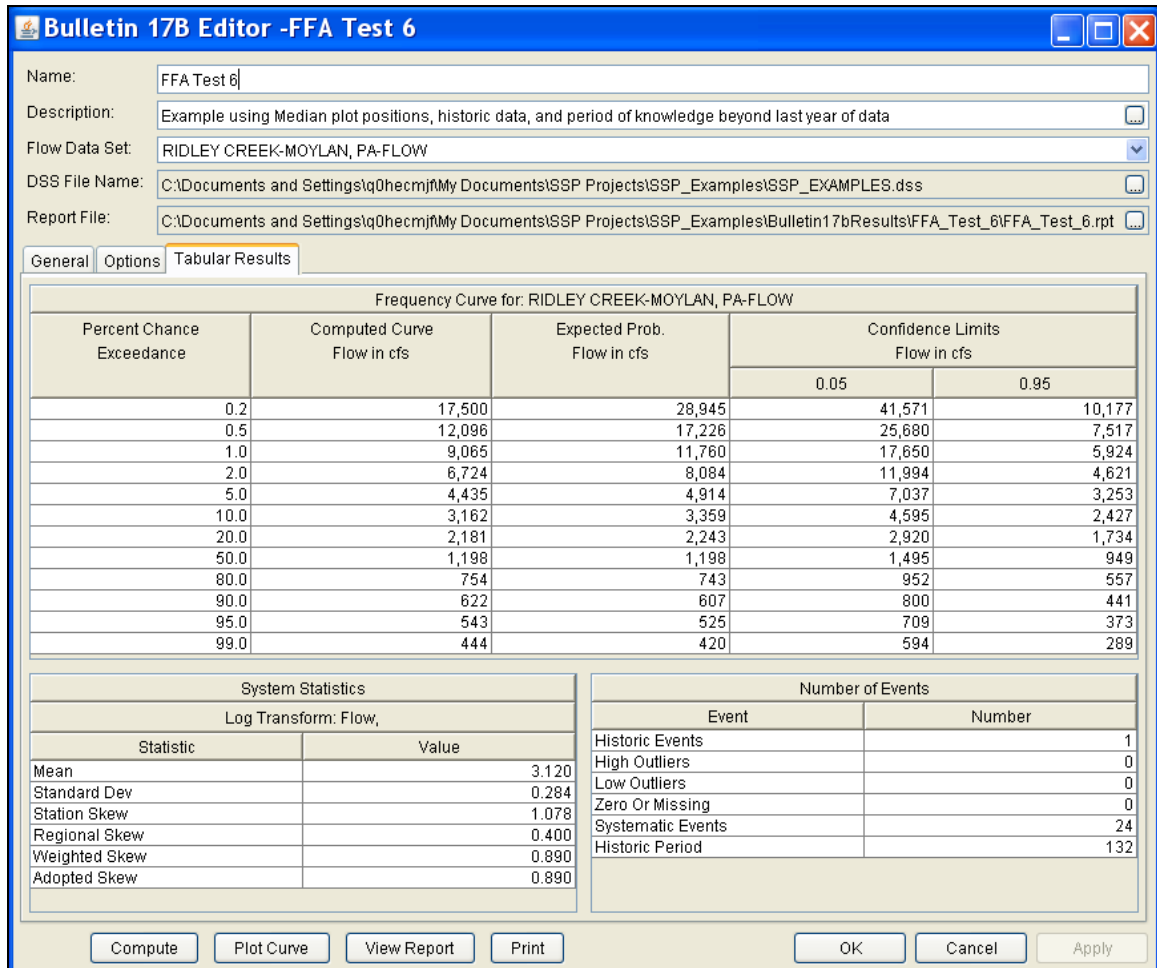


Figure B-41. Bulletin 17B Editor with the Results Tab Selected for Test Example 6.

As shown in Figure B-41, the Frequency Curve table contains the following results:

Percent Chance Exceedance

Computed Curve (Log-Pearson III results)

Expected Probability Curve

Confidence Limits (5% and 95% chance exceedance curves)

On the bottom left-hand side of the results tab is a table of System Statistics for the observed station data (mean, standard deviation, station skew) and regional adjustment (regional skew, weighted skew, and adopted skew). Also on the bottom right-hand side of the results tab is a table of Number of Events showing the number of historic events used in the analysis, number of high outliers found, number of low outliers, number of zero or missing data years, number of systematic events in the gage record, and the historic record length (if historic data was entered).

This example reports one historical flood event, and a historical period of 132 years, between 1843 and 1974. The reported statistics reflect the use of the historical data adjustment outlined in Bulletin 17B Appendix 6. The report file (described below) shows the initial computation of the statistics and frequency curve before the historical data was used, and the resulting statistics and frequency curve after the historical data is taken into account.

In addition to the tabular results, a graphical plot of the computed frequency curves can be obtained by pressing the **Plot Curve** button at the bottom of the analysis window. A plot of the results for this test example is shown in Figure B-42.

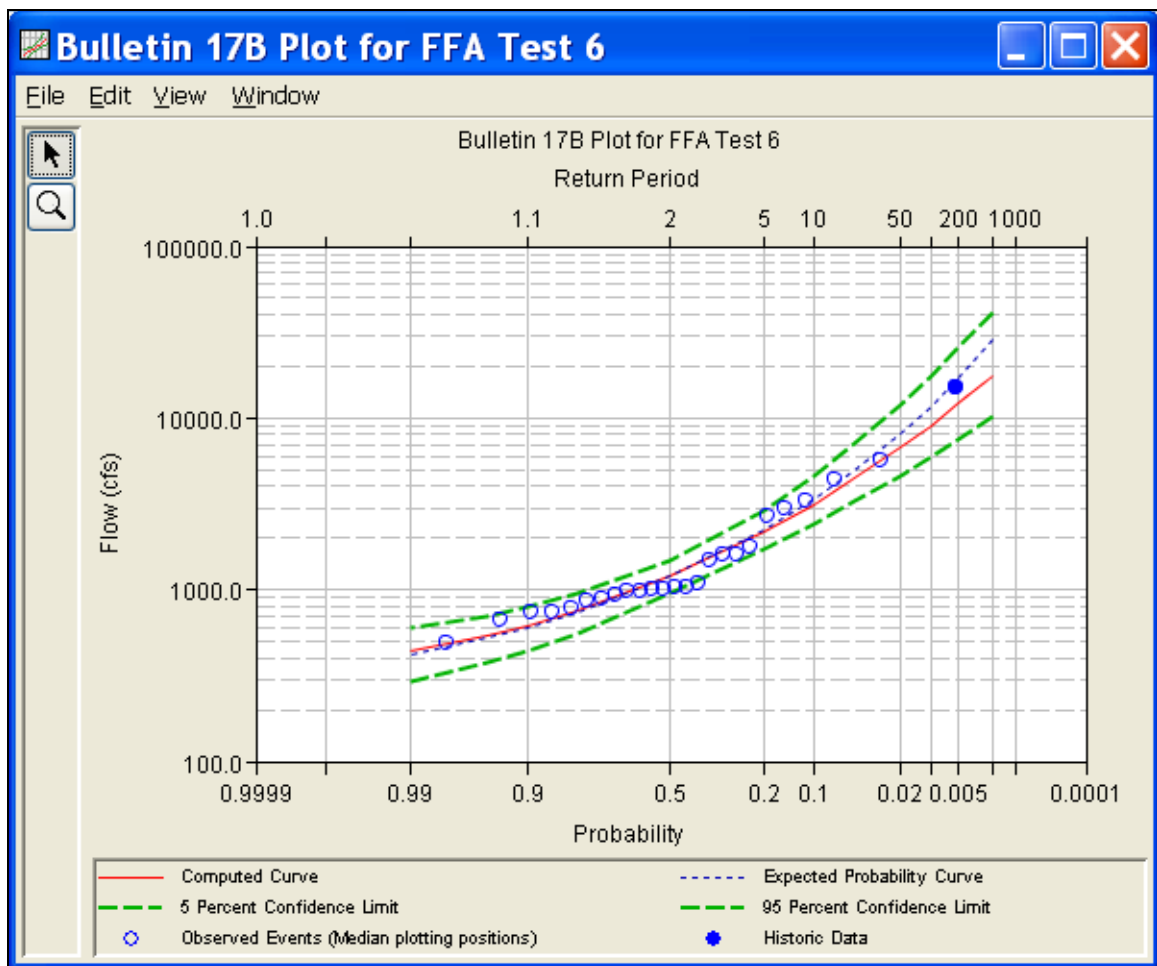


Figure B-42. Plot of the Frequency Curve Results for Test Example 6.

The tabular and graphical results can be sent to the printer or the windows clipboard for transfer into another piece of software. To print the tabular results, select **Print** from the bottom of the analysis window. To send the tabular results to the windows clipboard, highlight the data you want to send to the clipboard and then press the Control-C key sequence. To print the graphical results, first bring up the graphical plot and then select **Print** from the **File** menu. To send the graphic to the windows clipboard, select **Copy to Clipboard** from the **File** menu.

In addition to the tabular and graphical results, there is a report file that shows the order in which the calculations were performed. To review the report file, press the **View Report** button at the bottom of the analysis window. When this button is selected a text viewer will open the report file and display it on the screen. Shown in Figure B-43 is the report file for test example 6.

The report file contains a listing of the input data, preliminary results, outlier and historical data tests, additional calculations needed, and

Appendix B Example Data Sets

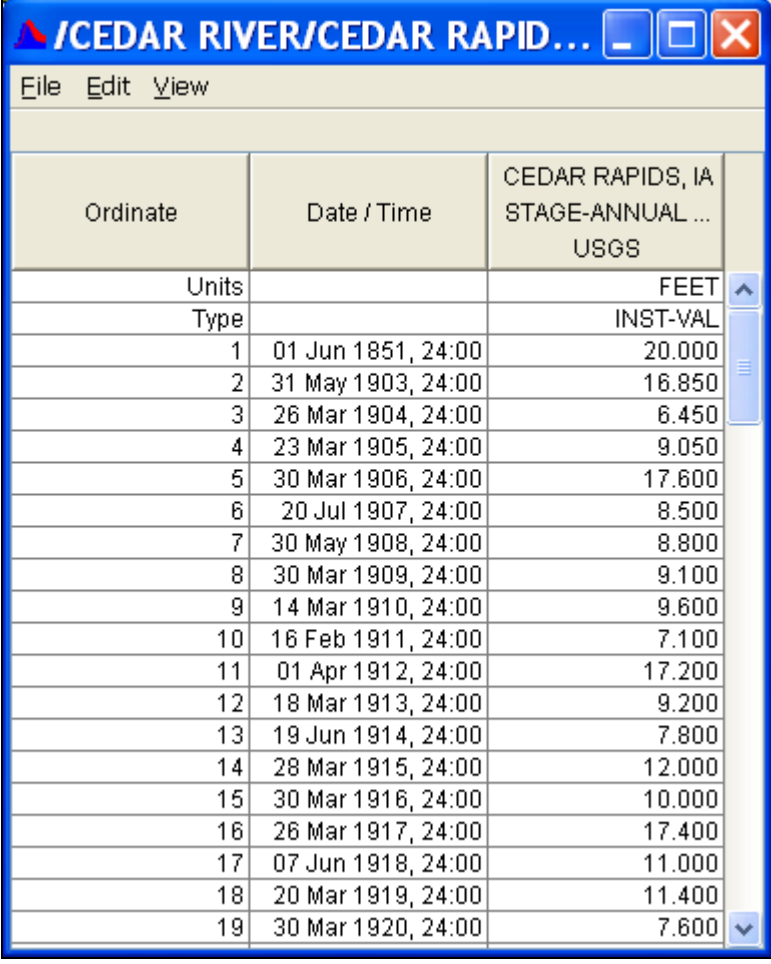
the final frequency curve results. Different types and amounts of information will show up in the report file depending on the data and the options that have been selected for the analysis.



Figure B-43. HEC-SSP Report File for Test Example 6.

Example 7: Analyzing Stage Data

This example demonstrates how to use the General Frequency analysis to analyze stage data. The data for this example is from the Cedar Rapids, Iowa stream gage (gage id 05464500). The period of record used for this example is from 1851 to 2007. In addition to the systematic record, an historic flooding event occurred in June 2008. To view the data, right-click on the data record labeled "**CEDAR RAPIDS, STAGE DATA**" in the study explorer and then select **Tabulate**. The data will appear as shown in Figure B-44.



Ordinate	Date / Time	CEDAR RAPIDS, IA STAGE-ANNUAL ... USGS
Units		FEET
Type		INST-VAL
1	01 Jun 1851, 24:00	20.000
2	31 May 1903, 24:00	16.850
3	26 Mar 1904, 24:00	6.450
4	23 Mar 1905, 24:00	9.050
5	30 Mar 1906, 24:00	17.600
6	20 Jul 1907, 24:00	8.500
7	30 May 1908, 24:00	8.800
8	30 Mar 1909, 24:00	9.100
9	14 Mar 1910, 24:00	9.600
10	16 Feb 1911, 24:00	7.100
11	01 Apr 1912, 24:00	17.200
12	18 Mar 1913, 24:00	9.200
13	19 Jun 1914, 24:00	7.800
14	28 Mar 1915, 24:00	12.000
15	30 Mar 1916, 24:00	10.000
16	26 Mar 1917, 24:00	17.400
17	07 Jun 1918, 24:00	11.000
18	20 Mar 1919, 24:00	11.400
19	30 Mar 1920, 24:00	7.600

Figure B-44. Tabulation of the Peak Stage Data for Cedar Rapids, Iowa.

To plot the data for this example, right-click on the data record and then select **Plot**. A plot of the data will appear as shown in Figure B-45.

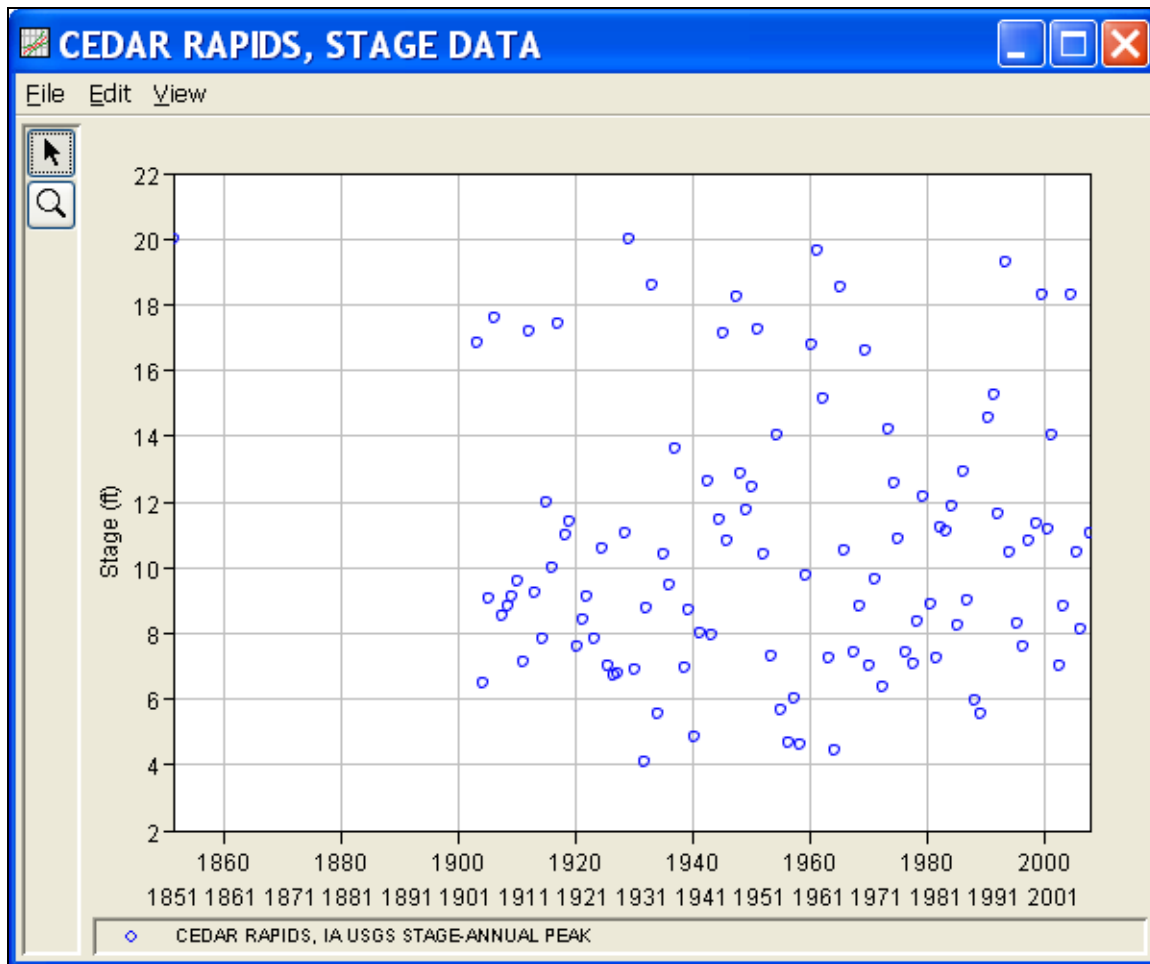


Figure B-45. Plot of the Cedar Rapids Data.

A General Frequency analysis has been developed for this example. To open the General Frequency analysis editor for test example 7, either double-click on the analysis labeled **STAGE ANALYSIS TEST 7** from the study explorer, or from the **Analysis** menu select open, then select **STAGE ANALYSIS TEST 7** from the list of available analyses. When test 7 is opened, the General Frequency analysis editor will appear as shown in Figure B-46. For this analysis, the **Use Log Transform** option was selected, the **Weibull** plotting position method was selected, the default **Confidence Limits** were selected, and no modification was made to the time window.

General Frequency -STAGE ANALYSIS TEST 7

Name: STAGE ANALYSIS TEST 7

Description: Example 7, Stage analysis of Cedar River at Cedar Rapids, Iowa

Data Set: CEDAR RAPIDS, STAGE DATA

DSS File Name: C:\Documents and Settings\q0hecmjff\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLE

Report File: ects\SSP_Examples\GeneralFrequencyResults\STAGE_ANALYSIS_TEST_7\STAGE_ANALYSIS_TE

General Options Analytical Graphical

Log Transform

☒ Use Log Transform

☐ Do not use Log Transform

Confidence Limits

☒ Defaults (0.05, 0.95)

☐ User Entered Values

Upper Limit: 0.05

Lower Limit: 0.95

Time Window Modification

DSS Range is 01JUN1851 - 27AUG2007

☐ start date 1851

☐ end date 2007

Plotting Position

☒ Weibull (A and B = 0)

☐ Median (A and B = 0.3)

☐ Hazen (A and B = 0.5)

☐ Other (Specify A, B)

Plotting position computed using formula

$$(m-A)/(n+1-A-B)$$

Where:
 m=rank, 1=largest
 N=Number of Years
 A,B=Constants

A:

B:

Compute Plot Analytical Curve Plot Graphical Curve View Report Print OK Cancel Apply

Figure B-46. General Frequency Analysis Editor for Test Example 7.

Shown in Figure B-47 is the General Frequency analysis editor with the **Options Tab** selected. The **Historic Period Data** option has been selected to reflect a historical flood event that produced a peak stage of 31.12 feet in June of 2008. The Historic Period **Start Year** has been left empty. By default this value will be the earliest year found in the historic flood peak data or the systematic record. Therefore for this example, 1851 will automatically be used for the Start Year of the Historic Period. This Historic Period **End Year** has also been left empty. By default this value will be the last year found in the historic flood peak data or the systematic record. Therefore for this example, 2008 will automatically be used for the End Year of the Historic Period.

Other features on this tab include the **Low Outlier Threshold**, an option to override the default **Frequency Ordinates**, and **Output Labeling**. The changes made to these options include adding the 0.1 percent frequency ordinate and the data name was changed from STAGE-ANNUAL PEAK to Stage.

Once all of the General and Optional settings are set or selected, the user can choose to perform an Analytical or Graphical analysis. In this example, an analytical analysis was performed on the peak stage data. Shown in Figure B-48 is the **Settings** tab for the analytical analysis. As shown, the distribution selected for this example is LogPearsonIII. The **Skew** option was set to **Use Station Skew** and the **Do Not Compute Excepted Probability** option was selected.

General Frequency -STAGE ANALYSIS TEST 7

Name: STAGE ANALYSIS TEST 7

Description: Example 7, Stage analysis of Cedar River at Cedar Rapids, Iowa

Data Set: CEDAR RAPIDS, STAGE DATA

DSS File Name: C:\Documents and Settings\q0hecmjff\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLE...

Report File: ects\SSP_Examples\GeneralFrequencyResults\STAGE_ANALYSIS_TEST_7\STAGE_ANALYSIS_TE...

General Options Analytical Graphical

Settings Tabular Results Plot

Log Transformation: On

Distribution: LogPearsonIII

Generalized Skew

☒ Use Station Skew

☐ Use Weighted Skew

☐ Use Regional Skew

Regional Skew:

Reg. Skew MSE:

Expected Probability Curve

☐ Compute Expected Prob. Curve

☒ Do Not Compute Expected Prob. Curve

Compute Plot Analytical Curve Plot Graphical Curve View Report Print OK Cancel Apply

Figure B-48. General Frequency Analysis Editor with Settings Tab Shown for Test Example 7.

Press the **Compute** button to perform the analysis. Once the computations have been completed, a message window will pop-up stating **Compute Complete**. Close this window and then select the **Tabular Results** tab within the analytical analysis. The tabular results window should look Figure B-49.

General Frequency -STAGE ANALYSIS TEST 7

Name: STAGE ANALYSIS TEST 7

Description: Example 7, Stage analysis of Cedar River at Cedar Rapids, Iowa

Data Set: CEDAR RAPIDS, STAGE DATA

DSS File Name: Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.ds

Report File: _Examples\GeneralFrequencyResults\STAGE_ANALYSIS_TEST_7\STAGE_ANALYSIS_TEST_7.rpt

General Options Analytical Graphical

Settings Tabular Results Plot

Percent Chance Exceedance	Curve based on Data			Curve based on User-Adjusted Statistics		
	Computed Curve Stage in FEET	Confidence Limits Stage in FEET		Computed Curve Stage in FEET	Confidence Limits Stage in FEET	
		0.95	0.05		0.95	0.05
0.1	35.0	41.6	30.4			
0.2	32.0	37.6	28.0			
0.5	28.2	32.6	25.0			
1.0	25.4	29.1	22.7			
2.0	22.7	25.6	20.5			
5.0	19.2	21.3	17.6			
10.0	16.6	18.1	15.3			
20.0	13.9	15.0	13.0			
50.0	10.0	10.6	9.4			
80.0	7.2	7.7	6.7			
90.0	6.1	6.6	5.6			
95.0	5.4	5.8	4.8			
99.0	4.2	4.7	3.7			

System Statistics		Number of Events	
Statistic	Value	Event	Number
Mean	1.002	Historic Events	1
Standard Dev	0.168	High Outliers	0
Station Skew	0.091	Low Outliers	0
Regional Skew		Zero Or Missing	0
Weighted Skew		Systematic Events	106
Adopted Skew	0.091	Historic Period	158

Log Transformation: On
Distribution: LogPearsonIII

Compute Plot Analytical Curve Plot Graphical Curve View Report Print OK Cancel Apply

Figure B-49. General Frequency Editor with Tabular Results Tab Selected for Test Example 7.

As shown in Figure B-49, the Frequency Curve table contains the following results:

Percent Chance Exceedance

Computed Curve (Log-Pearson III results)

Confidence Limits (5% and 95% chance exceedance curves)

The frequency curve table contains results based on the data, systematic and historic, and results based on user-adjusted statistics. In this example no user-adjusted statistics were defined, therefore these columns are empty. On the bottom left-hand side of the results tab is a table of System Statistics for the observed station data (mean, standard deviation, station skew) and regional adjustment (regional skew, weighted skew, and adopted skew). Also on the bottom right-

hand side of the results tab is a table of Number of Events showing the number of historic events used in the analysis, number of high outliers found, number of low outliers, number of zero or missing data years, number of systematic events in the gage record, and the historic record length (if historic data was entered).

This example reports one historical flood event, and a historical period of 158 years, between 1851 and 2008. The reported statistics reflect the use of the historical data adjustment outlined in Bulletin 17B, Appendix 6. The report file (described below) shows the initial computation of the statistics and frequency curve before the historical data was used, and the resulting statistics and frequency curve after the historical data is taken into account.

In addition to the tabular results, a graphical plot of the computed frequency curves can be obtained by pressing the **Plot Analytical Curve** button at the bottom of the analysis window. A plot of the results for this test example is shown in Figure B-50.

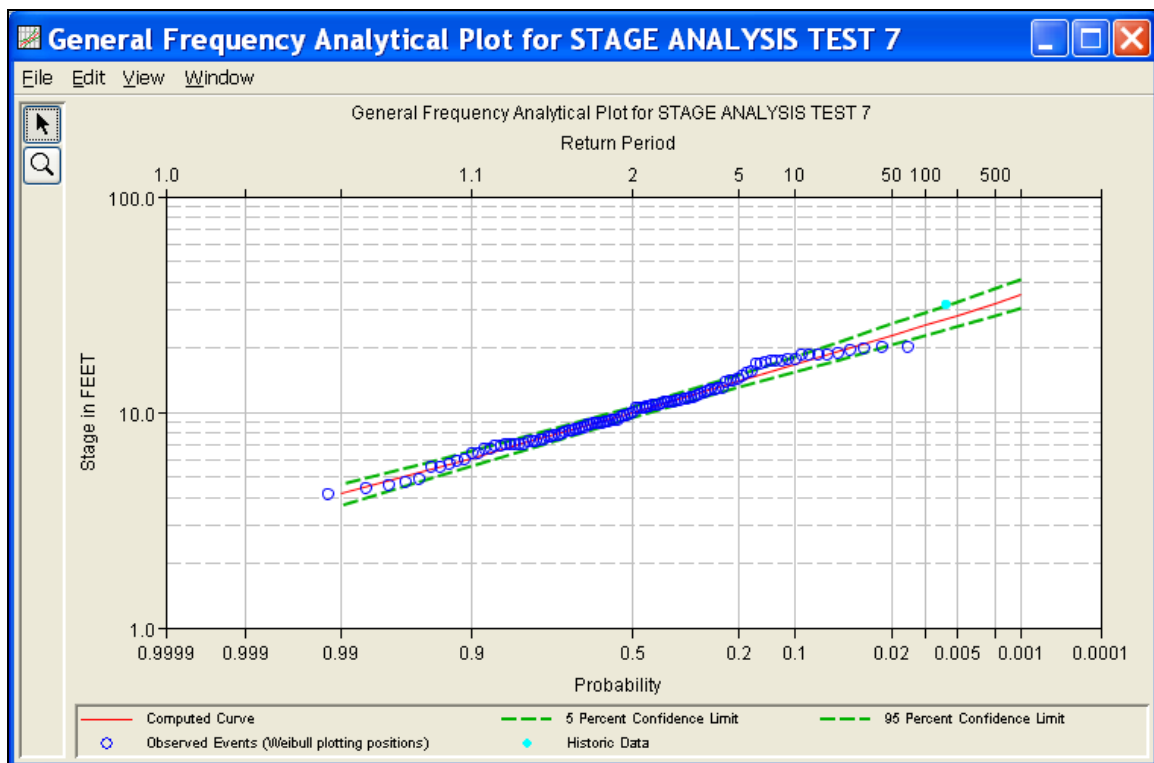


Figure B-50. Plot of the Frequency Curve Results for Test Example 7.

The tabular and graphical results can be sent to the printer or the windows clipboard for transfer into another piece of software. To print the tabular results, select **Print** from the bottom of the analysis window. To send the tabular results to the windows clipboard, highlight the data you want to send to the clipboard and then press the Control-C key sequence. To print the graphical results, first bring up the graphical plot and then select **Print** from the **File** menu. To

send the graphic to the windows clipboard, select **Copy to Clipboard** from the **File** menu.

In addition to the tabular and graphical results, there is a report file that shows the order in which the calculations were performed. To review the report file, press the **View Report** button at the bottom of the analysis window. When this button is selected a text viewer will open the report file and display it on the screen. Shown in Figure B-51 is the report file for test example 7.

The report file contains a listing of the input data, preliminary results, outlier and historical data tests, additional calculations needed, and the final frequency curve results. Different types and amounts of information will show up in the report file depending on the data and the options that have been selected for the analysis.

STAGE_ANALYSIS_TEST_7.rpt

File Edit Search Format

File: ts\SSP Projects\SSP_Examples\General\FrequencyResults\STAGE_ANALYSIS_TEST_7\STAGE_ANALYSIS_TEST_7.rpt

25 Jul 1999	18.3100	98	1988	5.9200	91.59
15 Jul 2000	11.1800	99	1955	5.6700	92.52
17 Apr 2001	14.0400	100	1934	5.5500	93.46
05 Jun 2002	7.0200	101	1989	5.5300	94.39
16 May 2003	8.8200	102	1940	4.8600	95.33
27 May 2004	18.3000	103	1956	4.6900	96.26
03 Jul 2005	10.4300	104	1958	4.5800	97.20
08 Apr 2006	8.1000	105	1964	4.4300	98.13
27 Aug 2007	11.0600	106	1931	4.1000	99.07

<< Skew Weighting >>

Based on 106 events, mean-square error of station skew = 0.052
Mean-square error of regional skew is undefined.

<< Frequency Curve >>
CEDAR RAPIDS, STAGE DATA

Computed Curve	Expected Probability	Percent Chance	Confidence Limits	
Stage, FEET		Exceedance	0.95	0.05
			Stage, FEET	
31.8174	---	0.1	37.4074	27.8953
29.4024	---	0.2	34.2504	25.9637
26.2688	---	0.5	30.2054	23.4306
23.9327	---	1.0	27.2316	21.5198
21.6136	---	2.0	24.3192	19.6010
18.5440	---	5.0	20.5340	17.0205
16.1795	---	10.0	17.6829	14.9924
13.7110	---	20.0	14.7825	12.8235
9.9774	---	50.0	10.6039	9.3882
7.2493	---	80.0	7.7507	6.7241
6.1307	---	90.0	6.6168	5.6088
5.3366	---	95.0	5.8159	4.8176
4.1106	---	99.0	4.5753	3.6087

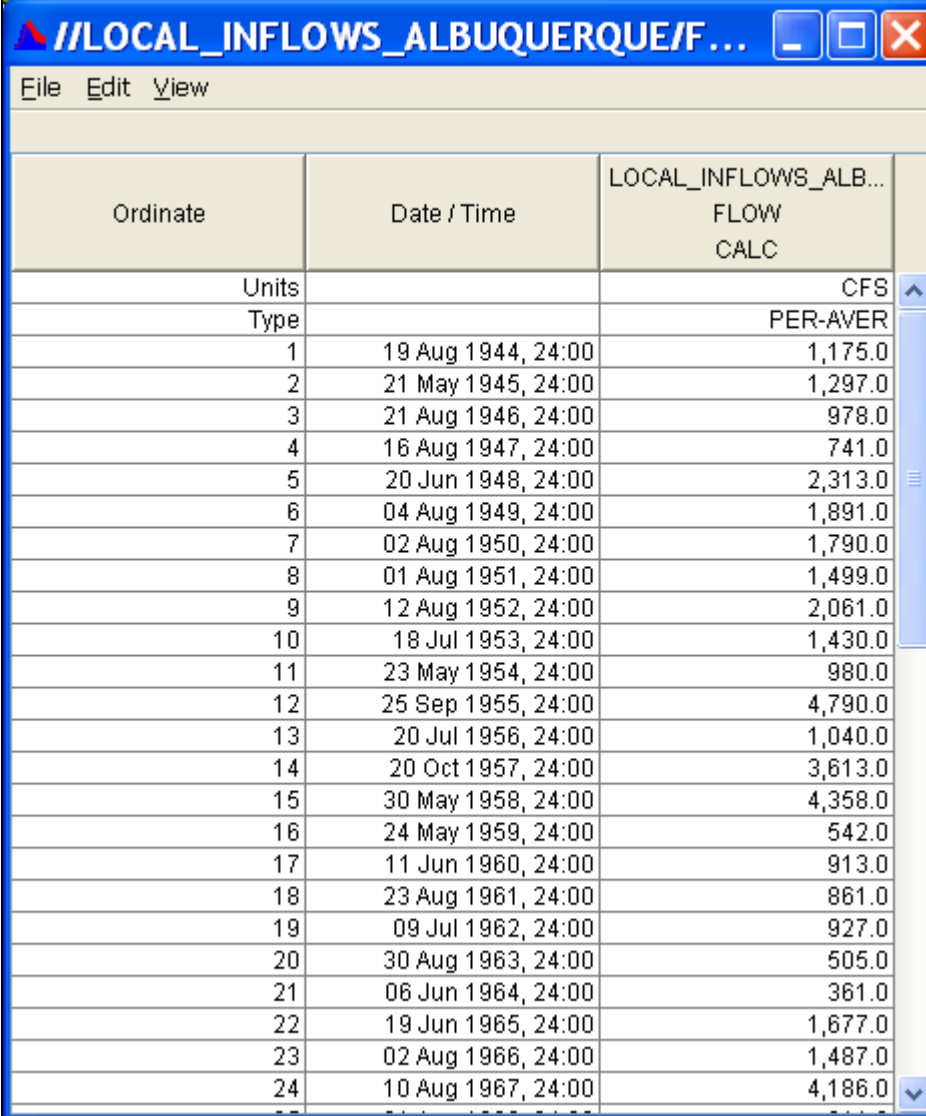
<< Systematic Statistics >>
CEDAR RAPIDS, STAGE DATA

1:1..1:1 1:1

Figure B-51. Report File for Test Example 7.

Example 8: Using User-Adjusted Statistics

This example demonstrates how to use the General Frequency analysis and enter user-adjusted statistics. The data for this example is from an analysis that computed local runoff for the Rio Grande at Albuquerque. The data includes unregulated daily average flows generated by rainfall-runoff from areas downstream of upstream reservoirs. The period of record used for this example is from 1944 to 2000. To view the data, right-click on the data record labeled **"Annual Daily Average Peak Flows Local Runoff at Albuquerque"** in the study explorer and then select **Tabulate**. The data will appear as shown in Figure B-52.



Ordinate	Date / Time	LOCAL_INFLOWS_ALB... FLOW CALC
Units		CFS
Type		PER-AVER
1	19 Aug 1944, 24:00	1,175.0
2	21 May 1945, 24:00	1,297.0
3	21 Aug 1946, 24:00	978.0
4	16 Aug 1947, 24:00	741.0
5	20 Jun 1948, 24:00	2,313.0
6	04 Aug 1949, 24:00	1,891.0
7	02 Aug 1950, 24:00	1,790.0
8	01 Aug 1951, 24:00	1,499.0
9	12 Aug 1952, 24:00	2,061.0
10	18 Jul 1953, 24:00	1,430.0
11	23 May 1954, 24:00	980.0
12	25 Sep 1955, 24:00	4,790.0
13	20 Jul 1956, 24:00	1,040.0
14	20 Oct 1957, 24:00	3,613.0
15	30 May 1958, 24:00	4,358.0
16	24 May 1959, 24:00	542.0
17	11 Jun 1960, 24:00	913.0
18	23 Aug 1961, 24:00	861.0
19	09 Jul 1962, 24:00	927.0
20	30 Aug 1963, 24:00	505.0
21	06 Jun 1964, 24:00	361.0
22	19 Jun 1965, 24:00	1,677.0
23	02 Aug 1966, 24:00	1,487.0
24	10 Aug 1967, 24:00	4,186.0

Figure B-52. Tabulation of the Peak Stage Data for Example 8.

To plot the data for this example, right-click on the data record and then select **Plot**. A plot of the data will appear as shown in Figure B-53.

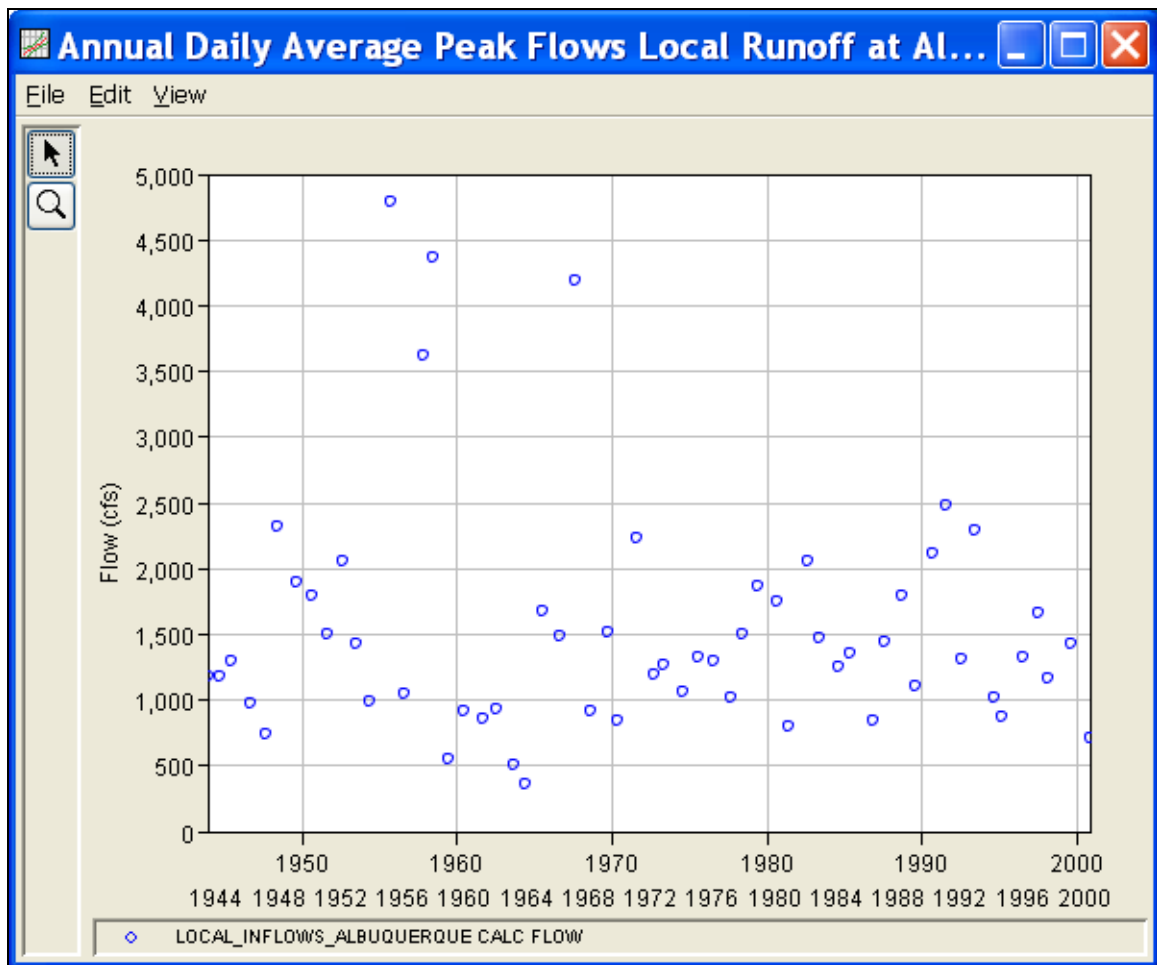


Figure B-53. Plot of Data for Example 8.

A General Frequency analysis has been developed for this example. To open the General Frequency analysis editor for test example 8, either double-click on the analysis labeled **LOCAL RUNOFF AT ALBUQUERQUE TEST 8** from the study explorer, or from the **Analysis** menu select open, then select **LOCAL RUNOFF AT ALBUQUERQUE TEST 8** from the list of available analyses. When test 8 is opened, the General Frequency analysis editor will appear as shown in Figure B-54.

General Frequency -LOCAL RUNOFF AT ALBUQUERQUE TEST 8

Name: LOCAL RUNOFF AT ALBUQUERQUE TEST 8

Description: This examples shows how to enter user adjusted statistics

Data Set: Annual Daily Average Peak Flows Local Runoff at Albuquerque

DSS File Name: C:\Documents and Settings\q0hecmj\Desktop\SSP_Examples\SSP_EXAMPLES.dss

Report File: \CAL_RUNOFF_AT_ALBUQUERQUE_TEST_8\LOCAL_RUNOFF_AT_ALBUQUERQUE_TEST_8.rpt

General Options Analytical Graphical

Log Transform

☒ Use Log Transform

☐ Do not use Log Transform

Confidence Limits

☒ Defaults (0.05, 0.95)

☐ User Entered Values

Upper Limit: 0.05

Lower Limit: 0.95

Time Window Modification

DSS Range is 19AUG1944 - 24OCT2000

☐ start date 1944

☐ end date 2000

Plotting Position

☒ Weibull (A and B = 0)

☐ Median (A and B = 0.3)

☐ Hazen (A and B = 0.5)

☐ Other (Specify A, B)

Plotting position computed using formula

$$(m-A)/(n+1-A-B)$$

Where:
 m=rank, 1=largest
 N=Number of Years
 A,B=Constants

A:

B:

Compute Plot Analytical Curve Plot Graphical Curve View Report Print OK Cancel Apply

Figure B-54. General Frequency Analysis Editor for Test Example 8.

Shown in Figure B-53 are the general settings that were used to perform this frequency analysis. For this analysis, the **Use Log Transform** option was selected, the **Weibull** plotting position method was selected, the default **Confidence Limits** were selected, and no modification was made to the **Time Window**.

Figure B-55. General Frequency Analysis Editor with Options Tab Shown for Test Example 8.

B-63

General Frequency -LOCAL RUNOFF AT ALBUQUERQUE TEST 8*

Name: LOCAL RUNOFF AT ALBUQUERQUE TEST 8

Description: This examples shows how to enter user adjusted statistics

Data Set: Annual Daily Average Peak Flows Local Runoff at Albuquerque

DSS File Name: Documents and Settings/q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.ds

Report File: LOCAL_RUNOFF_AT_ALBUQUERQUE_TEST_8\LOCAL_RUNOFF_AT_ALBUQUERQUE_TEST_8.rpt

General Options Analytical Graphical

Settings Tabular Results Plot

Log Transformation: On

Distribution: LogPearsonIII

Generalized Skew

☒ Use Station Skew

☐ Use Weighted Skew

☐ Use Regional Skew

Regional Skew:

Reg. Skew MSE:

Expected Probability Curve

☐ Compute Expected Prob. Curve

☒ Do Not Compute Expected Prob. Curve

Compute Plot Analytical Curve Plot Graphical Curve View Report Print OK Cancel Apply

Figure B-56. General Frequency Analysis Editor with Settings Tab Shown for Test Example 8.

Press the **Compute** button to perform the analysis. Once the computations have been completed, a message window will pop-up stating **Compute Complete**. Close this window and then select the **Plot** tab within the analytical analysis. The analytical plot window should look Figure B-57.

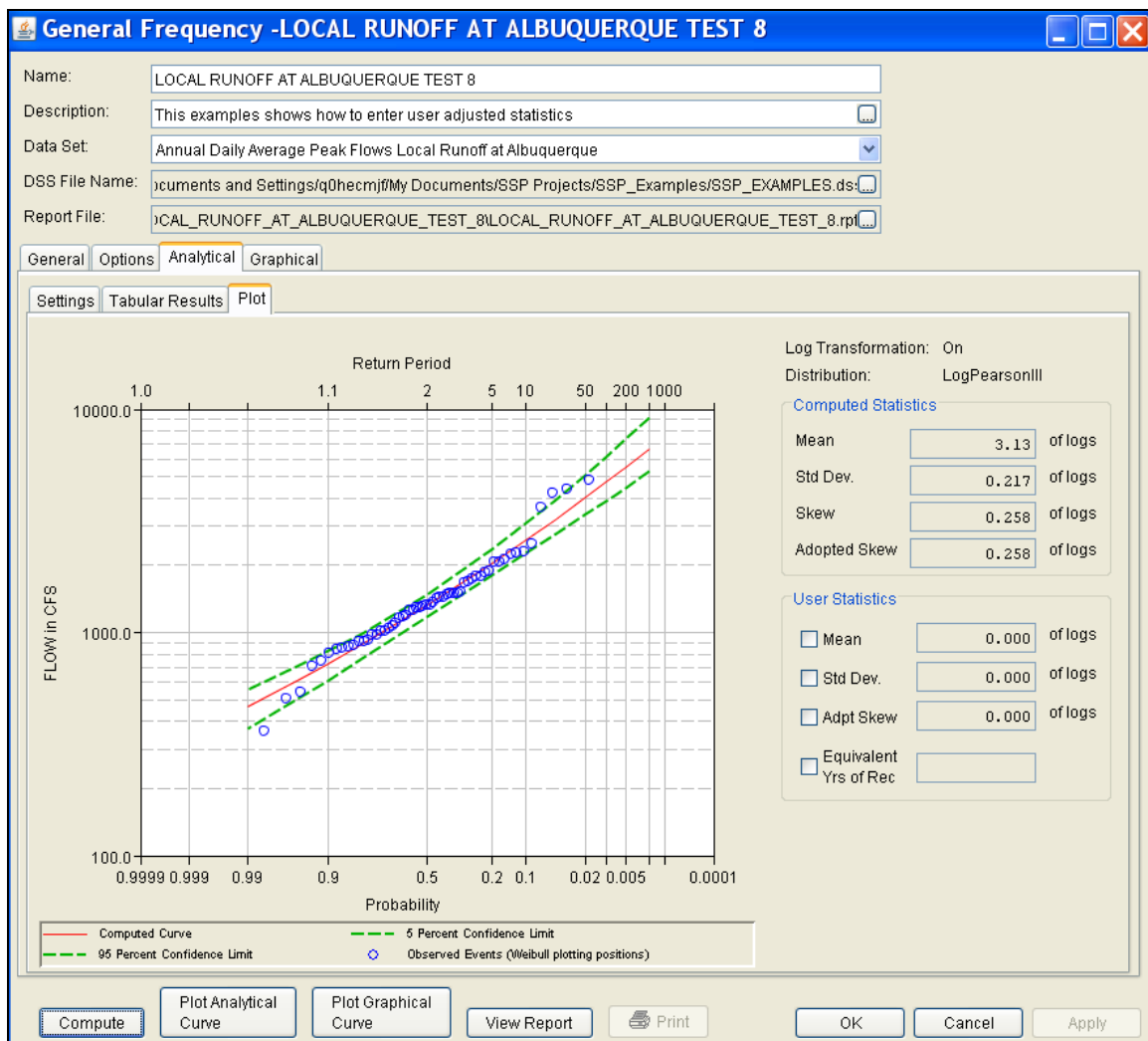


Figure B-57. The Plot Tab for Test Example 8.

As shown in Figure B-57, the **Plot** tab contains a graph of the systematic data, the computed frequency curve, and the confidence limits. The right side of the plot tab contains a table of **Computed Statistics** and **User Statistics**. The user has the option to enter a mean, standard deviation, adopted skew, and equivalent years of record in the User Statistics table. The **Compute** button must be pressed after User Statistics have been entered in order for the program to compute a frequency curve using the user statistics.

As mentioned at the beginning of this example, the annual peak flows were based on daily averaged flows. In order to compute an instantaneous peak flow frequency curve, a relationship between daily averaged flows and the corresponding instantaneous peak flows was developed. This was done by plotting daily averaged flow and the corresponding instantaneous peak flow for selected flood events. Using this relationship, a Mean of 3.731 was computed and entered in the User Statistics table and the analytical analysis was recomputed.

Figure B-58 shows that the frequency curve computed from the user-adjusted statistics is added to the graph. Figure B-58 also shows that the user does not have to enter values for all statistics in order for the program to compute a user-adjusted frequency curve. The program will use statistics computed from the systematic and historic data if the statistics are not defined in the User Statistics table. In this example, the program used the computed statistics for standard deviation, adopted skew, equivalent years of record and the user-defined mean of 3.731 when computing the user-adjusted frequency curve.

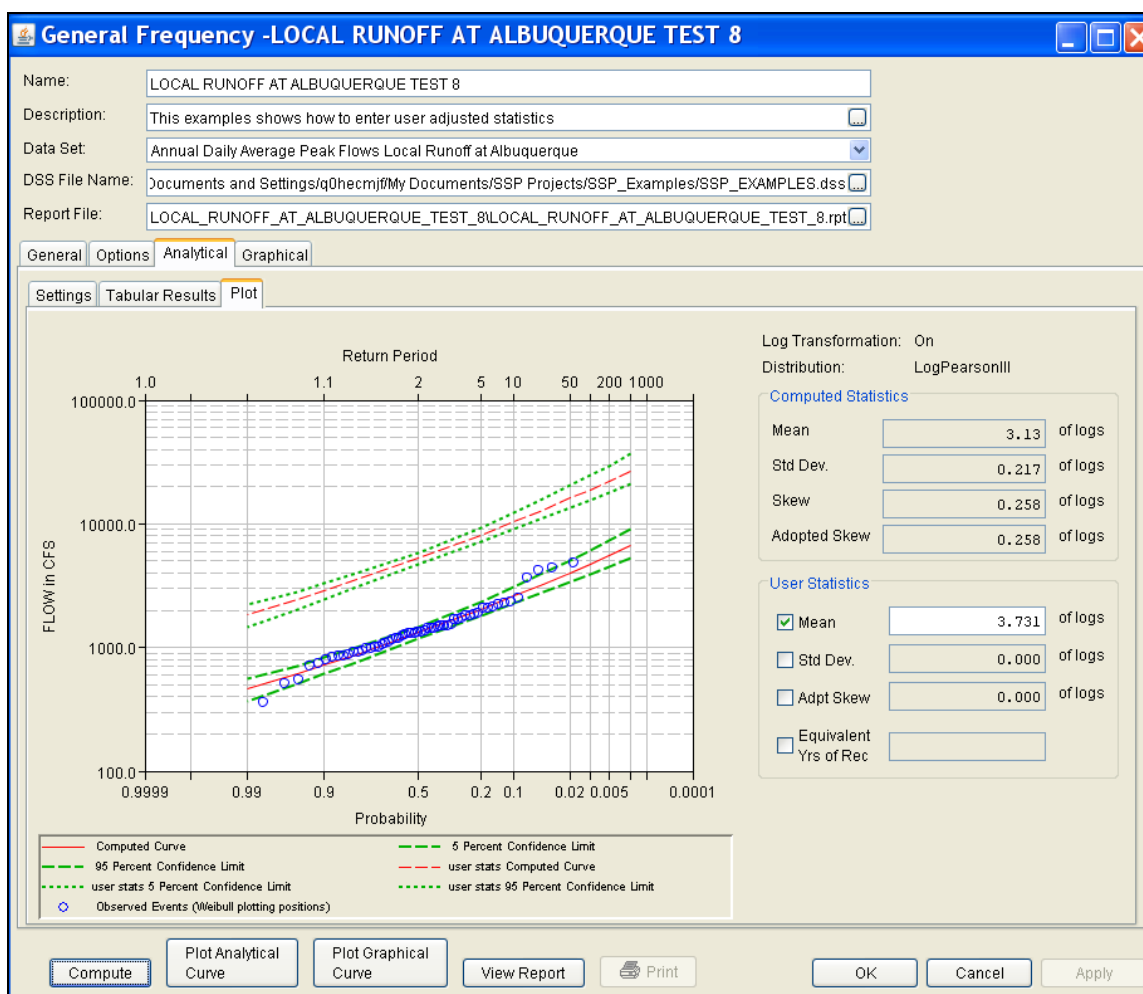


Figure B-58. Plot Tab with User-Adjusted Statistics and Frequency Curves for Test Example 8.

Select the **Tabular Results** tab to see information for both the computed and user-adjusted frequency curves. As shown in Figure B-59, the Frequency Curve table contains the percent chance exceedance, computed curves (Log-Pearson III results), and the Confidence Limits (5% and 95% chance exceedance curves) for both the computed and user-adjusted statistics.

On the bottom left-hand side of the results tab is a table of System Statistics for the observed station data (mean, standard deviation, station skew) and regional adjustment (regional skew, weighted skew, and adopted skew). Also on the bottom right-hand side of the results tab is a table of Number of Events showing the number of historic events used in the analysis, number of high outliers found, number of low outliers, number of zero or missing data years, number of systematic events in the gage record, and the historic record length (if historic data was entered).

General Frequency -LOCAL RUNOFF AT ALBUQUERQUE TEST 8

Name: LOCAL RUNOFF AT ALBUQUERQUE TEST 8

Description: This examples shows how to enter user adjusted statistics

Data Set: Annual Daily Average Peak Flows Local Runoff at Albuquerque

DSS File Name: Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: LOCAL_RUNOFF_AT_ALBUQUERQUE_TEST_8\LOCAL_RUNOFF_AT_ALBUQUERQUE_TEST_8.rpt

General Options Analytical Graphical

Settings Tabular Results Plot

Percent Chance Exceedance	Curve based on Data				Curve based on User-Adjusted Statistics			
	Computed Curve FLOW in CFS	Confidence Limits FLOW in CFS		Computed Curve FLOW in CFS	Confidence Limits FLOW in CFS			
		0.95	0.05		0.95	0.05		
0.2	6,673.4	9,163.0	5,260.5	26,613.6	36,541.9	20,978.9		
0.5	5,530.7	7,356.2	4,459.0	22,056.3	29,336.3	17,782.3		
1.0	4,751.8	6,162.8	3,899.3	18,950.0	24,577.3	15,550.5		
2.0	4,038.7	5,101.9	3,375.4	16,106.4	20,346.5	13,460.9		
5.0	3,184.9	3,878.4	2,728.9	12,701.3	15,467.1	10,883.0		
10.0	2,595.4	3,070.1	2,266.3	10,350.3	12,243.4	9,037.8		
20.0	2,041.7	2,345.8	1,813.8	8,142.2	9,355.0	7,233.3		
50.0	1,321.1	1,474.6	1,182.3	5,268.4	5,880.7	4,714.8		
80.0	881.2	992.6	765.9	3,514.2	3,958.6	3,054.5		
90.0	721.6	824.5	612.2	2,877.6	3,288.0	2,441.6		
95.0	615.5	713.2	510.9	2,454.6	2,844.4	2,037.4		
99.0	463.3	552.8	368.3	1,847.8	2,204.4	1,468.9		

System Statistics		Number of Events	
Statistic	Value	Event	Number
Mean	3.130	Historic Events	0
Standard Dev	0.217	High Outliers	0
Station Skew	0.258	Low Outliers	0
Regional Skew		Zero Or Missing	0
Weighted Skew		Systematic Events	57
Adopted Skew	0.258	Historic Period	

Log Transformation: On
Distribution: LogPearsonIII

Compute Plot Analytical Curve Plot Graphical Curve View Report Print OK Cancel Apply

Figure B-59. General Frequency Editor with Results Tab Selected for Test Example 8.

In addition to the tabular results, a graphical plot of the computed frequency curves can be obtained by pressing the **Plot Analytical Curve** button at the bottom of the analysis window. A plot of the results for this test example is shown in Figure B-60.

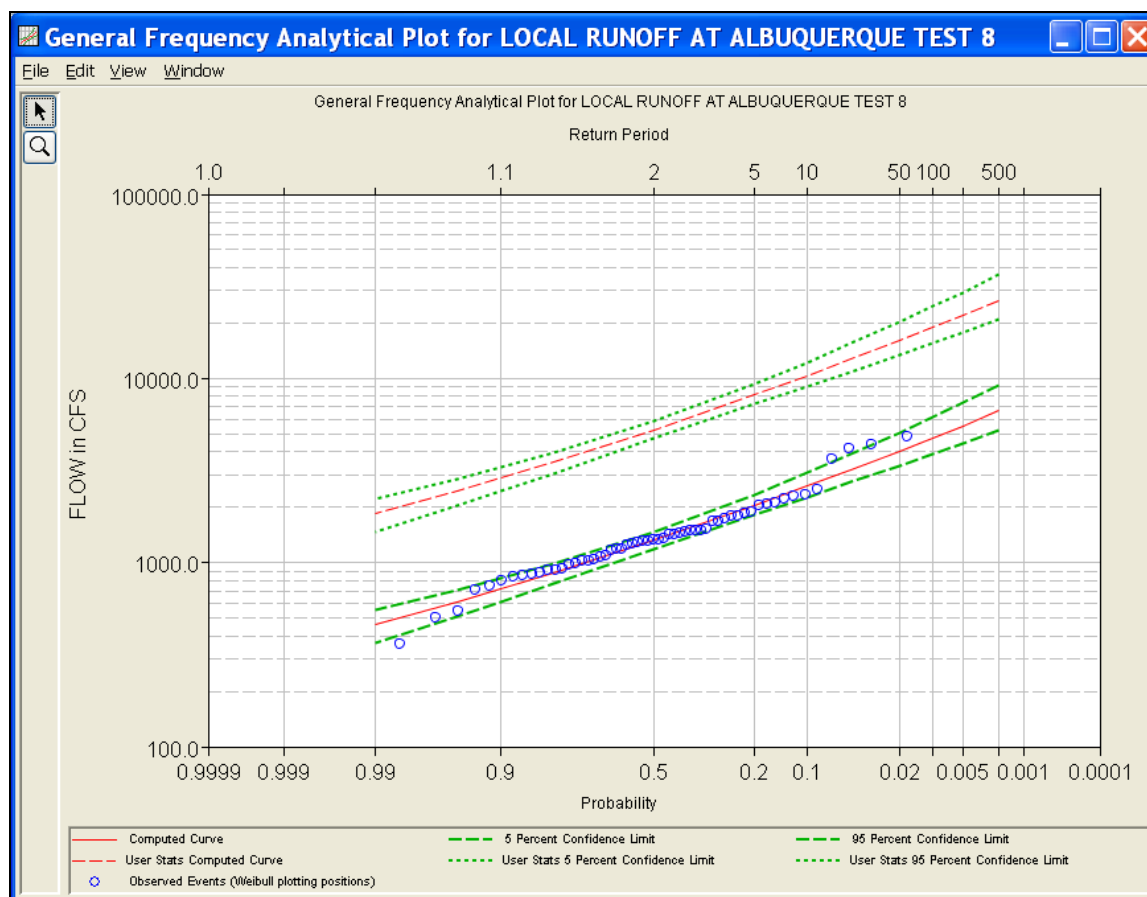


Figure B-60. Plot of the Frequency Curve Results for Test Example 8.

The tabular and graphical results can be sent to the printer or the windows clipboard for transfer into another piece of software. To print the tabular results, select **Print** from the bottom of the analysis window. To send the tabular results to the windows clipboard, highlight the data you want to send to the clipboard and then press the Control-C key sequence. To print the graphical results, first bring up the graphical plot and then select **Print** from the **File** menu. To send the graphic to the windows clipboard, select **Copy to Clipboard** from the **File** menu.

In addition to the tabular and graphical results, there is a report file that shows the order in which the calculations were performed. To review the report file, press the **View Report** button at the bottom of the analysis window. When this button is selected a text viewer will open the report file and display it on the screen. Shown in Figure B-61 is the report file for test example 8.

The report file contains a listing of the input data, preliminary results, outlier and historical data tests, additional calculations needed, and the final frequency curve results. Different types and amounts of information will show up in the report file depending on the data and the options that have been selected for the analysis.

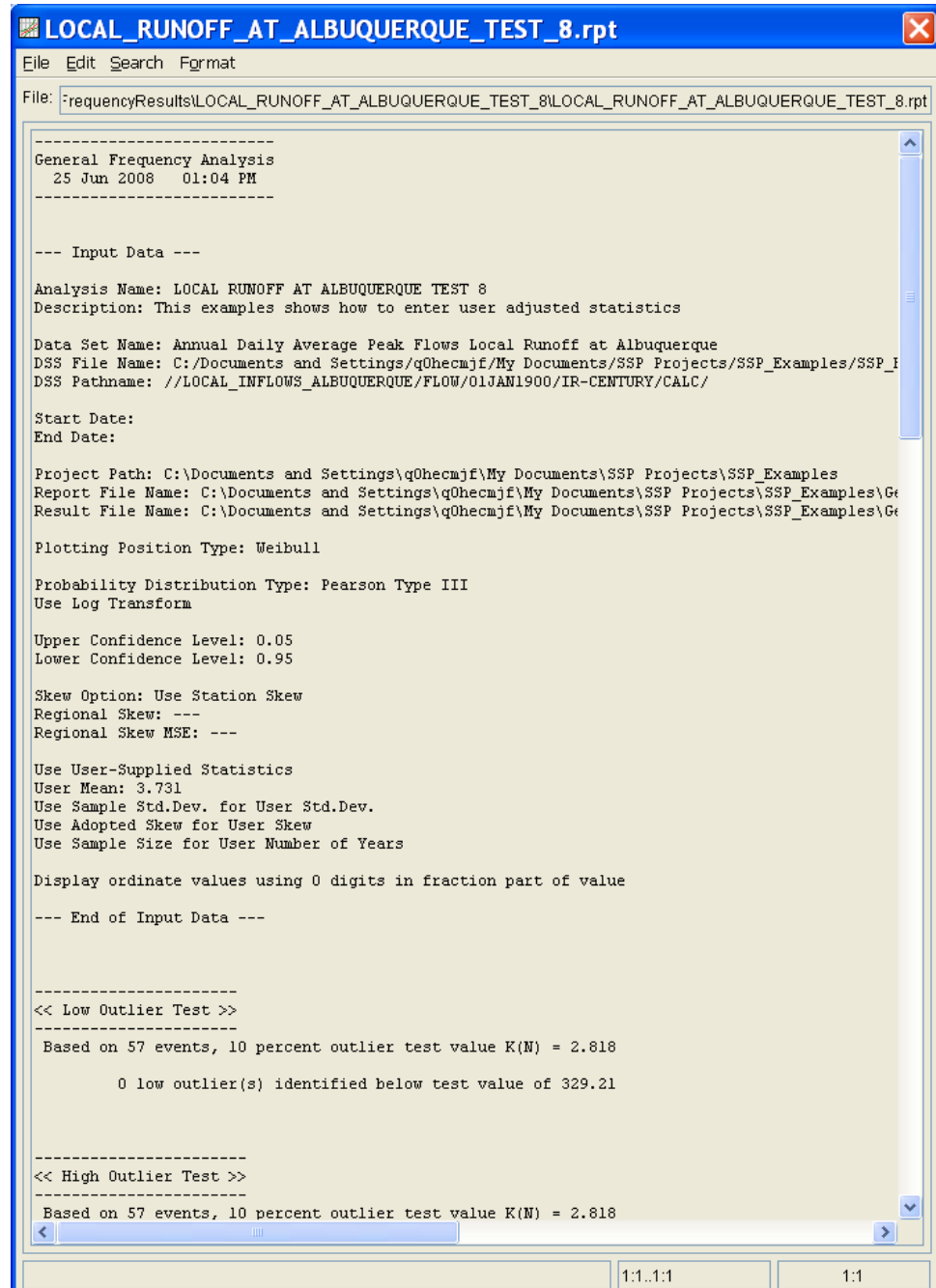
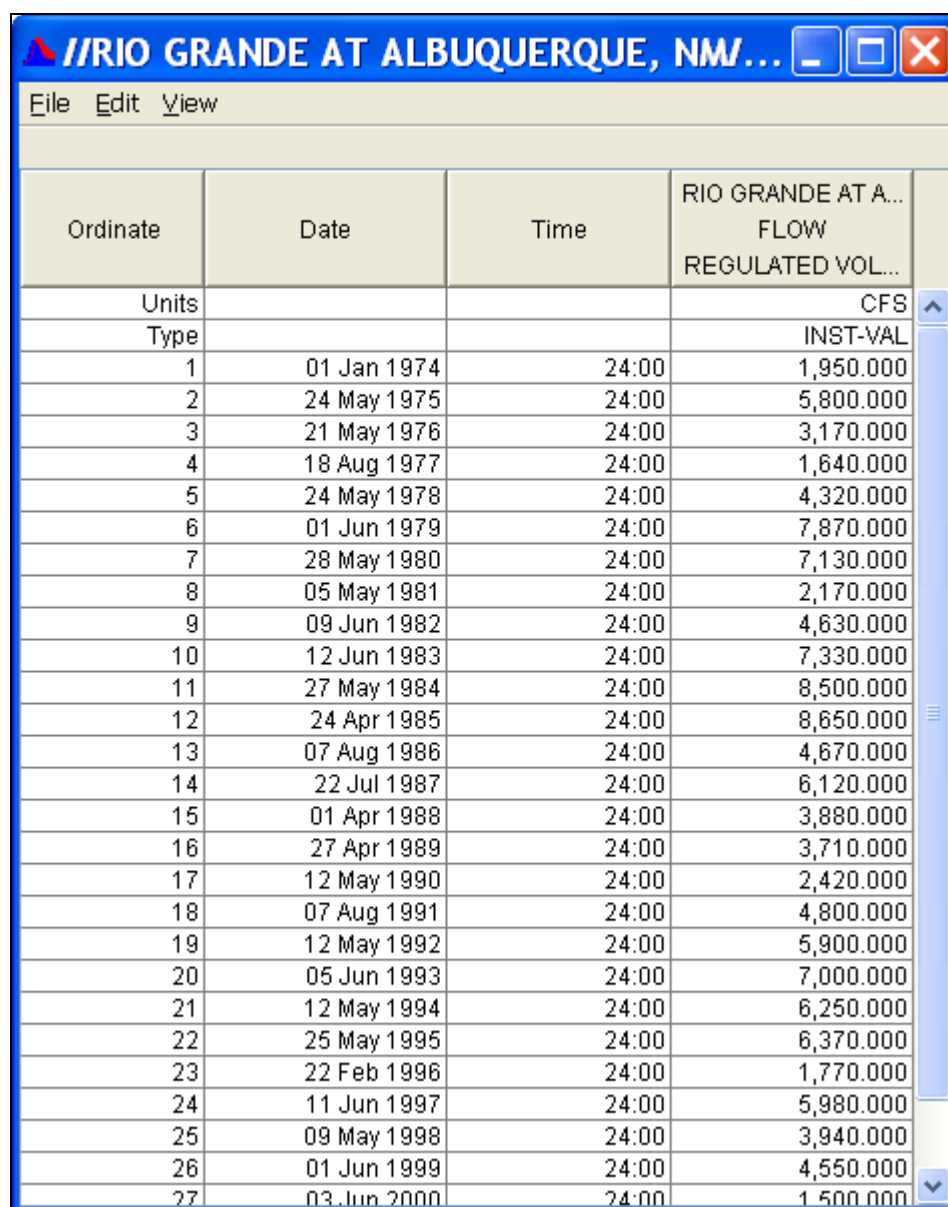


Figure B-61. Report File for Test Example 8.

Example 9: General Frequency – Graphical Analysis

This example demonstrates how to create a Graphical Analysis within a General Frequency analysis. The data for this example is from an analysis that computed regulated flow for the Rio Grande at Albuquerque. The data includes regulated daily average flows from upstream reservoirs routed downstream to Albuquerque. The period of record used for this example is from 1974 to 2002. To view the data, right-click on the data record labeled “**Annual Daily Average Peak Flows Rio Grande at Albuquerque**” in the study explorer and then select **Tabulate**. The data will appear as shown in Figure B-62.



Ordinate	Date	Time	RIO GRANDE AT A... FLOW REGULATED VOL...
Units			CFS
Type			INST-VAL
1	01 Jan 1974	24:00	1,950.000
2	24 May 1975	24:00	5,800.000
3	21 May 1976	24:00	3,170.000
4	18 Aug 1977	24:00	1,640.000
5	24 May 1978	24:00	4,320.000
6	01 Jun 1979	24:00	7,870.000
7	28 May 1980	24:00	7,130.000
8	05 May 1981	24:00	2,170.000
9	09 Jun 1982	24:00	4,630.000
10	12 Jun 1983	24:00	7,330.000
11	27 May 1984	24:00	8,500.000
12	24 Apr 1985	24:00	8,650.000
13	07 Aug 1986	24:00	4,670.000
14	22 Jul 1987	24:00	6,120.000
15	01 Apr 1988	24:00	3,880.000
16	27 Apr 1989	24:00	3,710.000
17	12 May 1990	24:00	2,420.000
18	07 Aug 1991	24:00	4,800.000
19	12 May 1992	24:00	5,900.000
20	05 Jun 1993	24:00	7,000.000
21	12 May 1994	24:00	6,250.000
22	25 May 1995	24:00	6,370.000
23	22 Feb 1996	24:00	1,770.000
24	11 Jun 1997	24:00	5,980.000
25	09 May 1998	24:00	3,940.000
26	01 Jun 1999	24:00	4,550.000
27	03 Jun 2000	24:00	1,500.000

Figure B-62. Tabulation of the Peak Stage Data for Example 9.

To plot the data for this example, right-click on the data record and then select **Plot**. A plot of the data will appear as shown in Figure B-63.

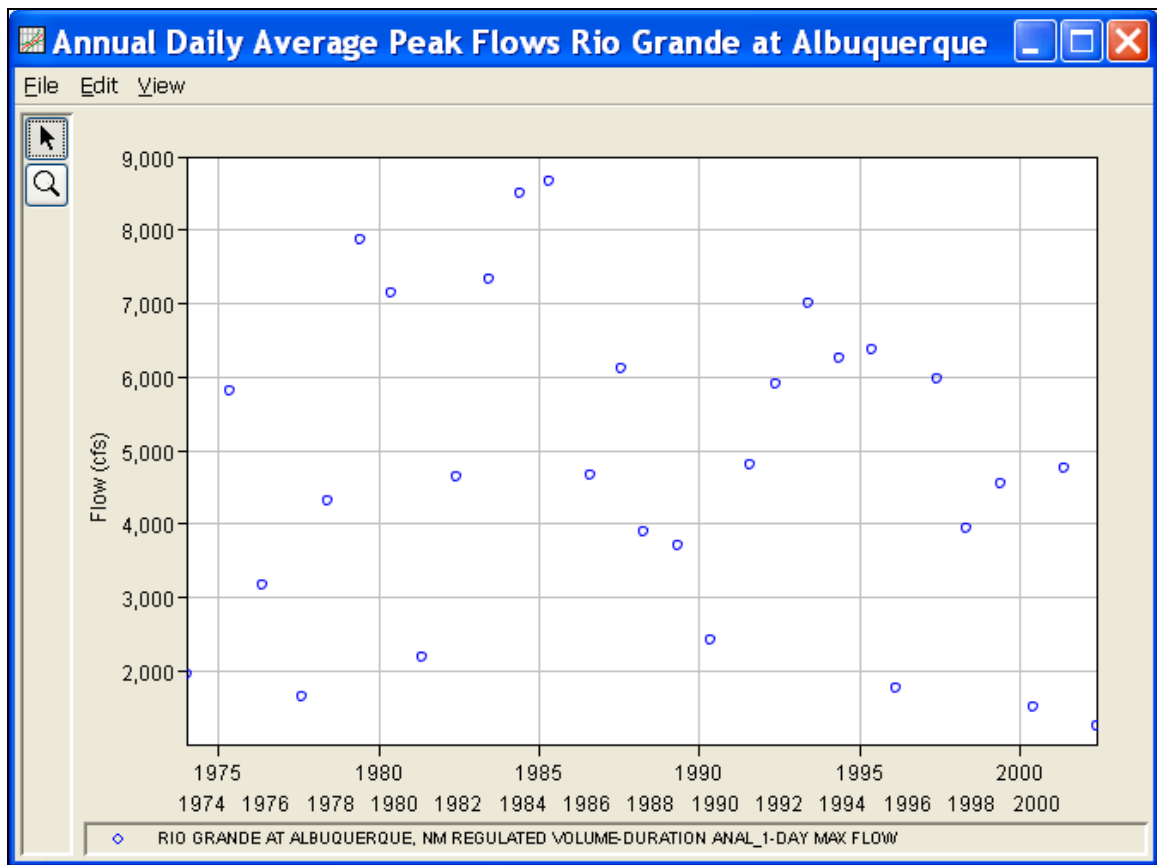


Figure B-63. Plot of Data for Example 9.

A General Frequency analysis has been developed for this example. To open the General Frequency analysis editor for test example 9, either double-click on the analysis labeled **REGULATED FLOW RIO GRANDE TEST 9** from the study explorer, or from the **Analysis** menu select open, then select **REGULATED FLOW RIO GRANDE TEST 9** from the list of available analyses. When test 9 is opened, the General Frequency analysis editor will appear as shown in Figure B-64.

General Frequency -REGULATED FLOW RIO GRANDE TEST 9

Name: REGULATED FLOW RIO GRANDE TEST 9

Description: Example using a graphical general frequency analysis

Data Set: Annual Daily Average Peak Flows Rio Grande at Albuquerque

DSS File Name: C:\Documents and Settings\q0hecmj\Desktop\SSP_Examples\SSP_EXAMPLES.dss

Report File: \\ts\REGULATED_FLOW_RIO_GRANDE_TEST_9\REGULATED_FLOW_RIO_GRANDE_TEST_9.rpt

General Options Analytical Graphical

Log Transform

☒ Use Log Transform

☐ Do not use Log Transform

Confidence Limits

☒ Defaults (0.05, 0.95)

☐ User Entered Values

Upper Limit: 0.05

Lower Limit: 0.95

Time Window Modification

DSS Range is 01JAN1974 - 15MAY2002

☐ start date 1974

☐ end date 2002

Plotting Position

☒ Weibull (A and B = 0)

☐ Median (A and B = 0.3)

☐ Hazen (A and B = 0.5)

☐ Other (Specify A, B)

Plotting position computed using formula

$$(m-A)/(n+1-A-B)$$

Where:
 m=rank, 1=largest
 N=Number of Years
 A,B=Constants

A:

B:

Compute Plot Analytical Curve Plot Graphical Curve View Report Print OK Cancel Apply

Figure B-64. General Frequency Analysis Editor for Test Example 9.

Shown in Figure B-64 are the general settings that were used to perform this frequency analysis. For this analysis, the **Use Log Transform** option was selected, the **Weibull** plotting position method was selected, the default **Confidence Limits** were selected, and no modification was made to the **Time Window**.

Figure B-65. General Frequency Analysis Editor with Options Tab Shown for Test Example 9.

B-73

Appendix B Example Data Sets

network upstream of Albuquerque using current operating criteria. This was done for the 0.2, 0.5, 1.0, 2.0, 10, 20, and 50 percent events. Output from the model was input into the Frequency Ordinates table. For the more frequent events (10 year and below), the graphical curve was fit to the data visually. This example shows how a reservoir network can influence the frequency curve. Notice how the frequency curve is flat for the 20 through the 1 percent chance events. The reservoir network is able to control flooding in this range. This example also shows that as flood events become larger, the reservoir network has less influence on controlling downstream flooding.

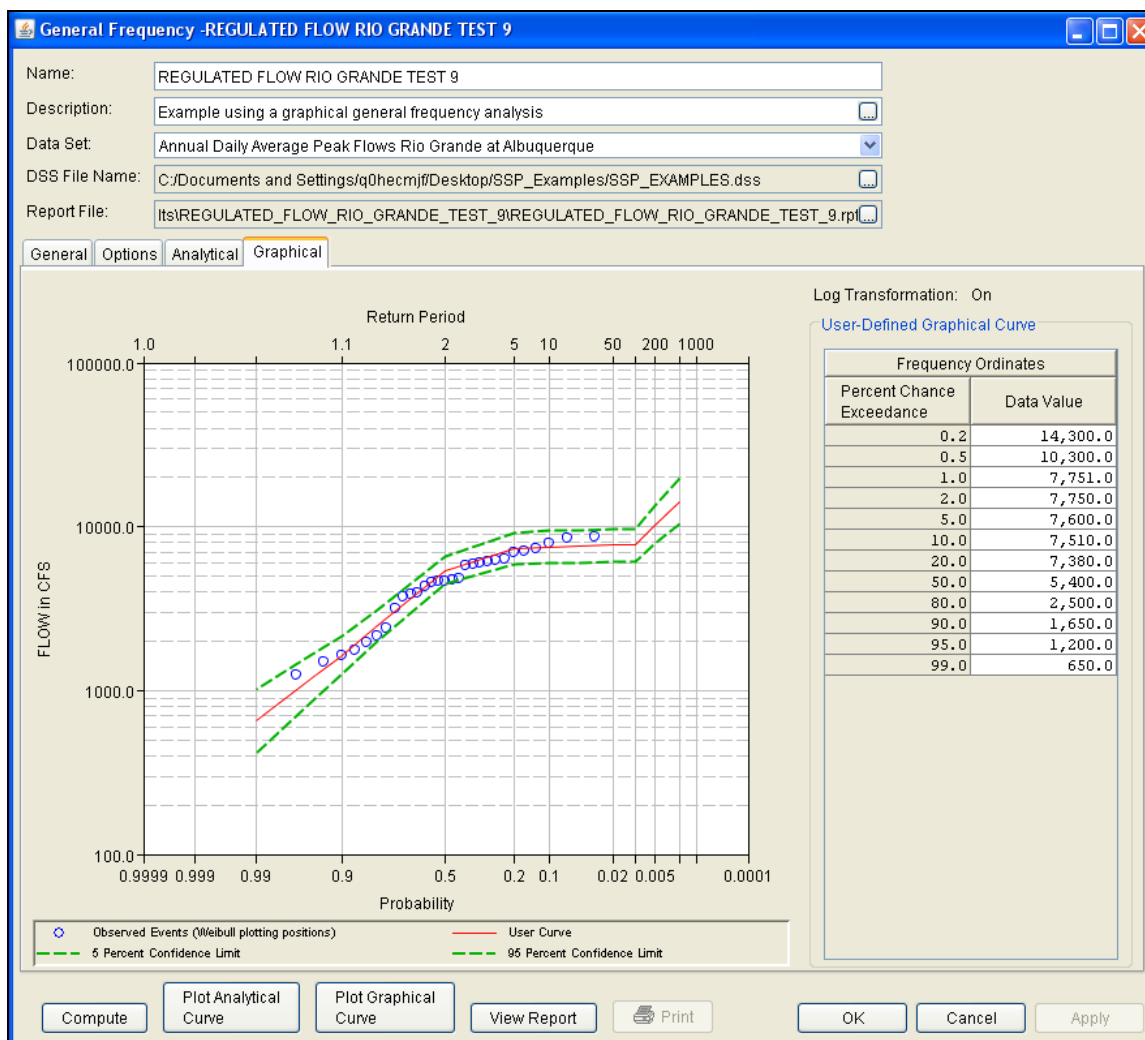


Figure B-66. Graphical Tab Shown for Test Example 9.

A graphical plot of the graphical frequency curve can be obtained by pressing the **Plot Graphical Curve** button at the bottom of the analysis window. A plot of the results for this test example is shown in Figure B-67.

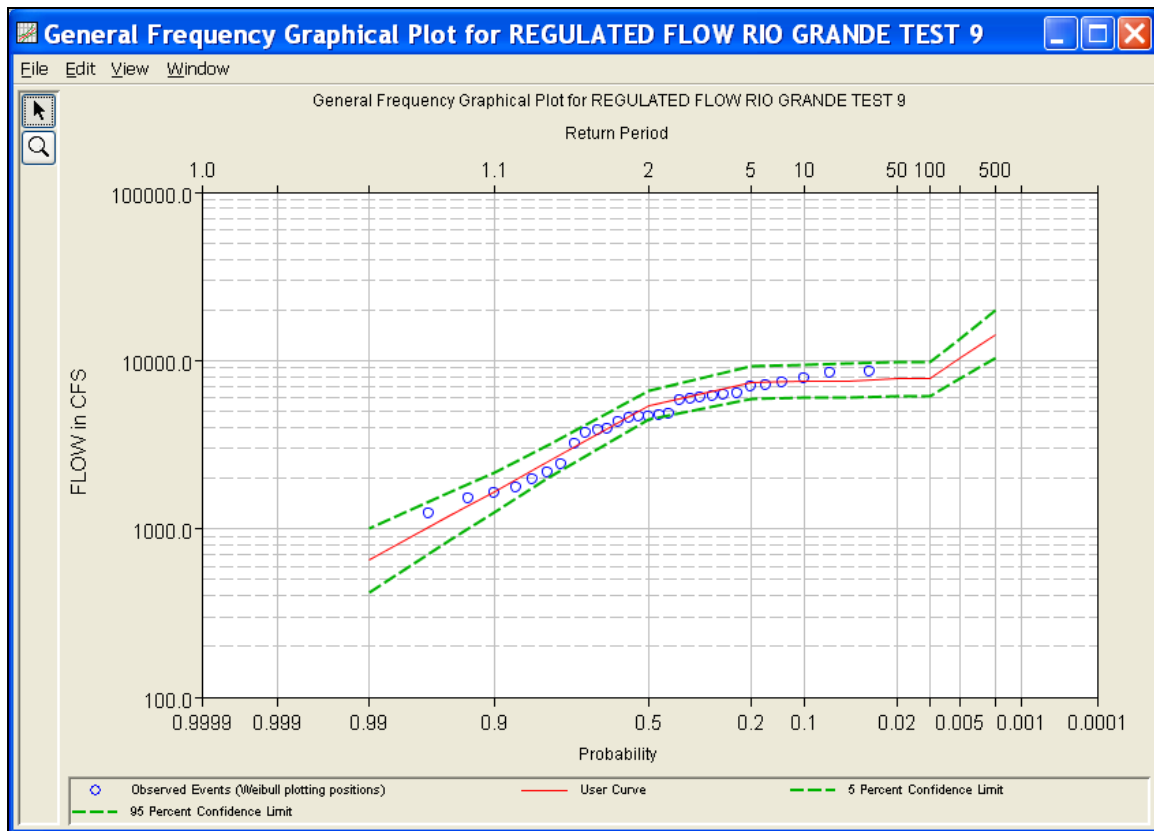


Figure B-67. Plot of the Frequency Curve Results for Test Example 9.

The graphical results can be sent to the printer or the windows clipboard for transfer into another piece of software. To print the graphical results, first bring up the graphical plot and then select **Print** from the **File** menu. To send the graphic to the windows clipboard, select **Copy to Clipboard** from the **File** menu.

In addition to the tabular and graphical results, there is a report file that shows the order in which the calculations were performed. To review the report file, press the **View Report** button at the bottom of the analysis window. When this button is selected a text viewer will open the report file and display it on the screen. Shown in Figure B-68 is the report file for test example 9.

The report file contains a listing of the input data, preliminary results, outlier and historical data tests, and additional calculations needed. Different types and amounts of information will show up in the report file depending on the data and the options that have been selected for the analysis.

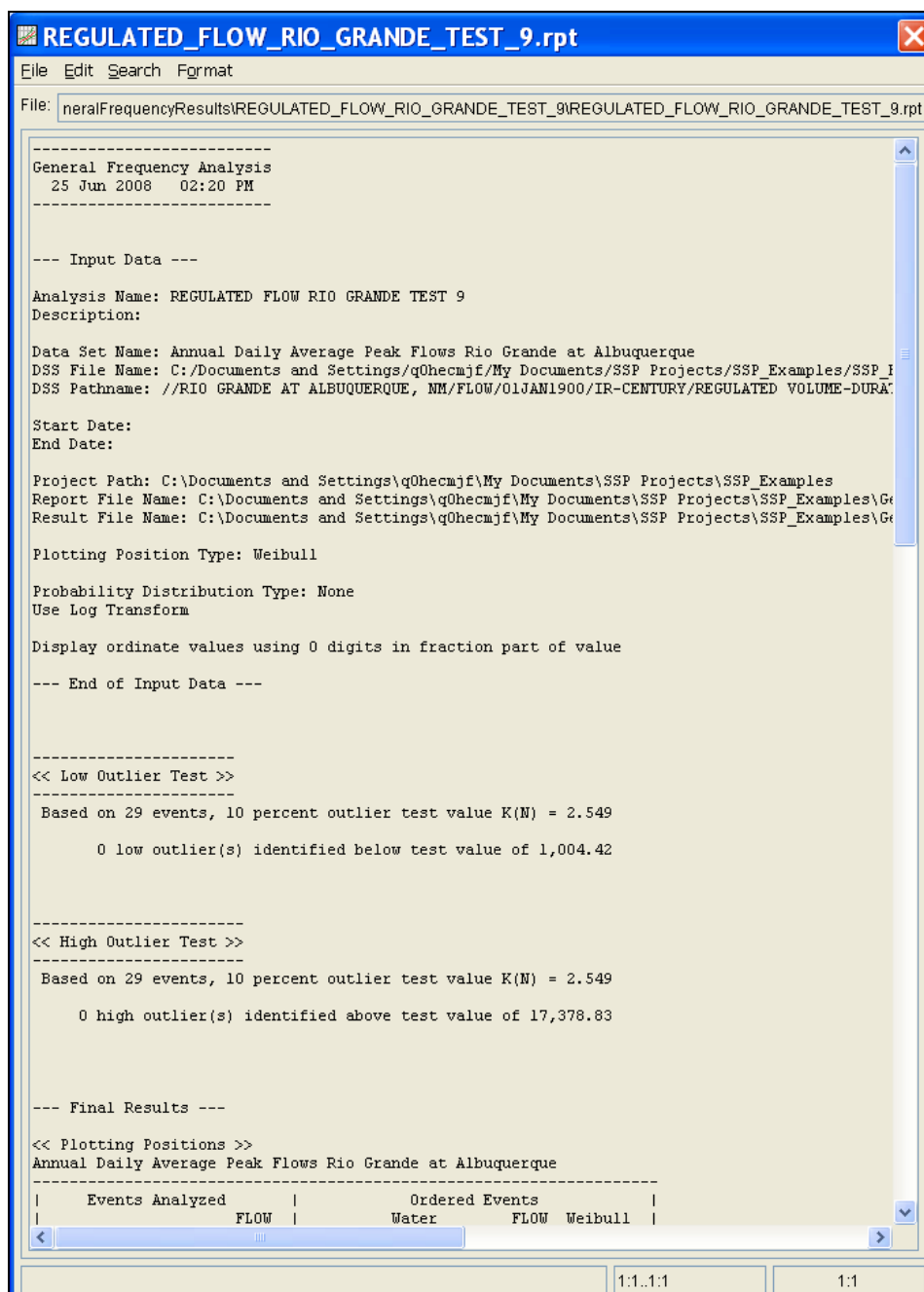


Figure B-68. Report File for Test Example 9.

Example 10: Volume-Duration Frequency Analysis, Maximum Flows

This example demonstrates how to perform a Volume-Duration Frequency analysis for maximum flows. The data for this example was derived from an analysis where a time-series of daily average unregulated flows were computed for the Rio Grande at Albuquerque. The period of record for this example is from 1941 to 2002. To view the data, right-click on the data record labeled **"Rio Grande at Albuquerque UNREGULATED"** in the study explorer and then select **Plot**. The data will appear as shown in Figure B-69.

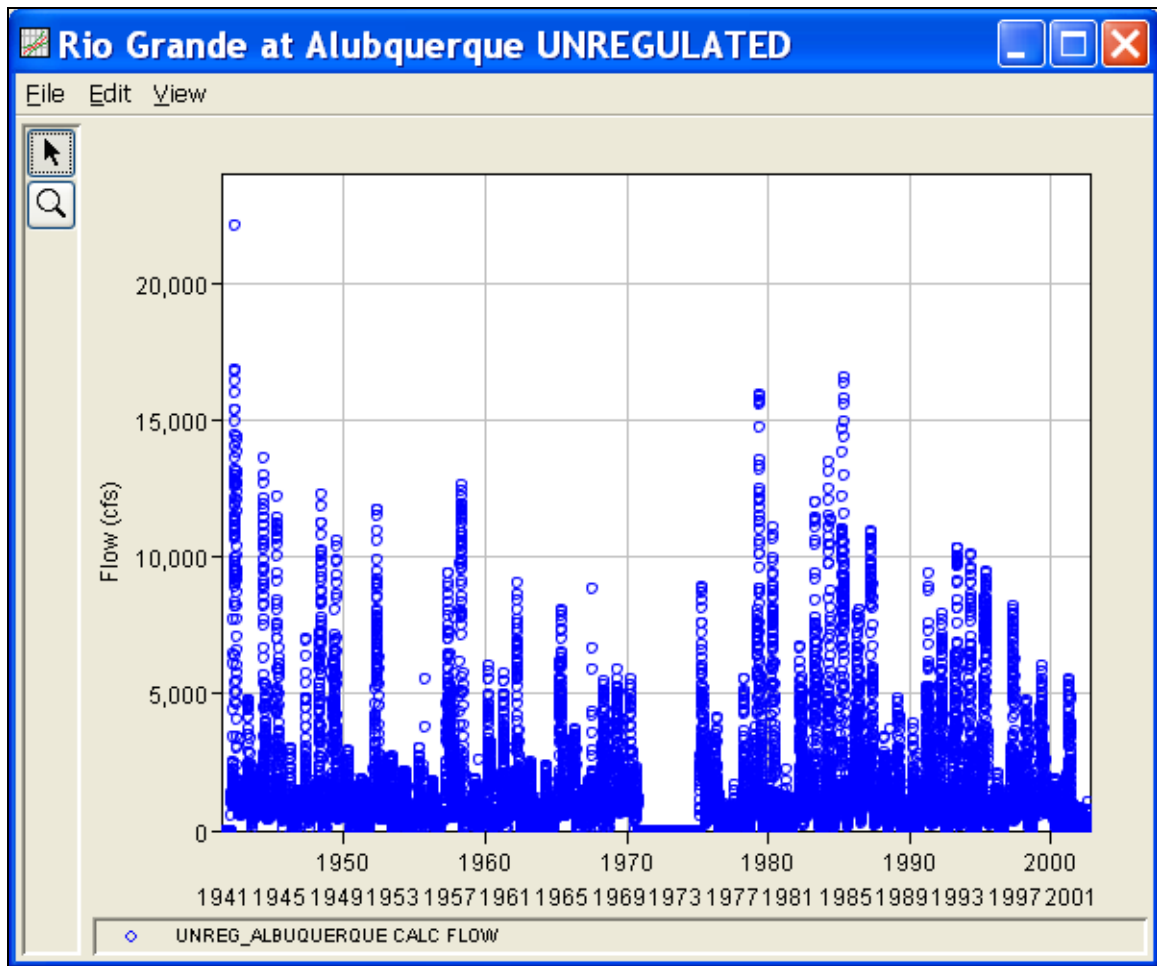


Figure B-69. Plot of Daily Average Flow for Example 10.

A Volume-Duration Frequency analysis has been developed for this example. To open the Volume-Duration Frequency analysis editor for test example 10, either double-click on the analysis labeled **RIO GRANDE AT ALBUQUERQUE UNREGULATED FLOW TEST 10** from the study explorer, or from the **Analysis** menu select open, then select **RIO GRANDE AT ALBUQUERQUE UNREGULATED FLOW**

TEST 10 from the list of available analyses. When test 10 is opened, the Volume-Duration Frequency analysis editor will appear as shown in Figure B-70.

Volume-Duration Frequency -RIO GRANDE AT ALBUQUERQUE UNREGULATED FLOW TEST 10

Name: RIO GRANDE AT ALBUQUERQUE UNREGULATED FLOW TEST 10

Description: Unregulated Volume-Duration Analysis Rio Grande at Albuquerque

Data Set: Rio Grande at Albuquerque UNREGULATED

DSS File Name: \Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: ULATED_FLOW_TEST_10\RIO_GRANDE_AT_ALBUQUERQUE_UNREGULATED_FLOW_TEST_10.rpt

General | Options | Duration Table | Analytical | Graphical

Log Transform

☒ Use Log Transform

☐ Do not use Log Transform

Maximum or Minimum Analysis

☒ Analyze Maximums

☐ Analyze Minimums

Year Specification

☐ Water Year (starts Oct 1)

☒ Calendar Year (starts Jan 1)

☐ Other starting []

Plotting Position

☒ Weibull (A and B = 0)

☐ Median (A and B = 0.3)

☐ Hazen (A and B = 0.5)

☐ Other (Specify A, B)

Plotting position computed using formula

Where: $(m-A)/(n+1-A-B)$

m=rank, 1=largest
N=Number of Years
A,B=Constants

A: []

B: []

Time Window Modification

End Points

DSS Range is 26APR1941 - 30SEP2002

☐ start date []

☐ end date []

Season

To define a subset of the year

season start: [] season end: []

NOTE: season must be within a year, as defined in the Year Specification

Compute Plot Duration Data Plot Analytical Curve Plot Graphical Curve View Report Print OK Cancel Apply

Figure B-70. Volume-Duration Frequency Analysis Editor for Test Example 10.

Shown in Figure B-70 are the general settings that were used to perform this frequency analysis. For this analysis, the **Use Log Transform** option was selected, the **Weibull** plotting position method was selected, **Analyze Maximums** was selected, the **Calendar Year** option was selected, and no modification was made to the **Time Window**.

Shown in Figure B-71 is the Volume-Duration Frequency analysis editor with the **Options** Tab selected. Features on this tab include an option to override the default **Flow-duration** values, an option to override the default **Frequency Ordinates**, and **Output Labeling**. Both the flow-duration and frequency ordinate tables were modified.

Volume-Duration Frequency -RIO GRANDE AT ALBUQUERQUE UNREGULATED FLO...

Name: RIO GRANDE AT ALBUQUERQUE UNREGULATED FLOW TEST 10

Description: Unregulated Volume-Duration Analysis Rio Grande at Albuquerque

Data Set: Rio Grande at Albuquerque UNREGULATED

DSS File Name: I:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLE...

Report File: ULATED_FLOW_TEST_10\RIO_GRANDE_AT_ALBUQUERQUE_UNREGULATED_FLOW_TEST...

General Options **Duration Table** Analytical Graphical

Flow Durations

☒ Change or add to default values

Duration in days
1
7
15
60
120

User Specified Frequency Ordinates

☒ Use Values from Table below

Frequency in Percent
0.1
0.2
0.5
1.0
2.0
5.0
10.0
20.0
50.0
80.0
90.0
95.0
99.0

Output Labeling

Data Name
DSS data name is FLOW
☐ change label FLOW

Data Unit
DSS Data Unit is CFS
☐ change label CFS

Compute Plot Duration Data Plot Analytical Curve Plot Graphical Curve View Report Print OK Cancel Apply

Figure B-71. Options Tab Shown for Test Example 10.

Once all of the General and Optional settings are set or selected, the user can extract the volume-duration data from the time-series of daily flows. Select the **Duration Data** tab and press the **Extract Volume-Duration Data** button at the bottom of the table. The table should then fill with the flow-duration values, as shown in Figure B-72.

Appendix B Example Data Sets

Volume-Duration Frequency -RIO GRANDE AT ALBUQUERQUE UNREGULATED FLOW ...

Name: RIO GRANDE AT ALBUQUERQUE UNREGULATED FLOW TEST 10

Description: Unregulated Volume-Duration Analysis Rio Grande at Albuquerque

Data Set: Rio Grande at Albuquerque UNREGULATED

DSS File Name: \Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES\...

Report File: ULATED_FLOW_TEST_10RIO_GRANDE_AT_ALBUQUERQUE_UNREGULATED_FLOW_TEST_10

General Options **Duration Table** Analytical Graphical

Year	Volume-Duration Data									
	Highest Mean Value for Duration, Average Daily FLOW in CFS									
	1		7		15		60		120	
	Date	FLOW	Date	FLOW	Date	FLOW	Date	FLOW	Date	FLOW
1942	04/24/1942	22076	05/15/1942	15346	06/05/1942	13099	06/14/1942	12137	07/06/1942	7931
1943	04/28/1943	4734	05/02/1943	4638	05/08/1943	4440	06/03/1943	2574	07/02/1943	1850
1944	05/17/1944	13602	05/22/1944	12335	05/28/1944	11502	07/05/1944	7057	07/22/1944	4460
1945	05/08/1945	12141	05/13/1945	11199	05/18/1945	10358	06/19/1945	6137	07/09/1945	3794
1946	04/23/1946	2999	04/27/1946	2734	05/03/1946	2273	05/17/1946	1230	05/31/1946	978
1947	05/12/1947	7004	05/15/1947	5848	05/18/1947	5118	06/15/1947	2709	06/28/1947	1790
1948	05/28/1948	12274	06/11/1948	10224	06/09/1948	9951	06/18/1948	7014	07/10/1948	4567
1949	06/23/1949	10556	06/27/1949	9642	06/30/1949	8133	06/30/1949	5828	07/30/1949	4386
1950	04/24/1950	2901	04/27/1950	2712	04/30/1950	2397	05/04/1950	1549	06/12/1950	1320
1951	05/10/1951	1882	05/14/1951	1718	05/23/1951	1611	06/14/1951	1082	06/05/1951	869
1952	05/08/1952	11669	05/11/1952	10750	05/19/1952	9704	06/22/1952	7147	07/22/1952	4705
1953	05/31/1953	2706	06/04/1953	2497	06/06/1953	2283	06/20/1953	1729	06/28/1953	1299
1954	05/18/1954	2122	04/21/1954	2050	04/28/1954	1929	06/04/1954	1595	06/07/1954	1132
1955	09/25/1955	5497	05/29/1955	2695	05/30/1955	2350	06/21/1955	1559	08/29/1955	1155
1956	05/07/1956	1766	05/11/1956	1722	05/11/1956	1626	06/11/1956	1172	06/14/1956	942
1957	06/09/1957	9404	06/11/1957	8794	06/15/1957	7865	07/06/1957	5358	09/01/1957	4360
1958	05/14/1958	12590	05/17/1958	12047	05/23/1958	11493	06/14/1958	9129	06/22/1958	5434
1959	08/26/1959	2539	05/20/1959	1822	05/20/1959	1625	06/05/1959	1050	06/01/1959	845
1960	04/13/1960	8034	04/16/1960	5336	04/24/1960	4833	05/22/1960	3299	06/27/1960	2483
1961	05/04/1961	5695	05/07/1961	5053	05/07/1961	4518	06/06/1961	3084	06/28/1961	2002
1962	04/22/1962	9023	04/27/1962	8122	05/02/1962	7289	05/28/1962	4879	06/12/1962	3109
1963	04/15/1963	2477	04/16/1963	2289	04/16/1963	2097	05/15/1963	1515	06/04/1963	1115
1964	05/15/1964	2353	05/19/1964	2238	05/25/1964	1964	06/10/1964	1293	06/17/1964	939

Extract Volume-Duration Data

Compute Plot Duration Data Plot Analytical Curve Plot Graphical Curve View Report Print OK Cancel Apply

Figure B-72. Volume-Duration Data Table for Test Example 10.

Once the data has been extracted, the user must choose to perform an Analytical or Graphical analysis. In this example, an analytical analysis was performed. Shown in Figure B-73 is the **Settings** tab for the analytical analysis. As shown, the distribution selected for this example is LogPearsonIII. The **Skew** option was set to **Use Station Skew** and the **Do Not Compute Excepted Probability** option was selected.

Volume-Duration Frequency -RIO GRANDE AT ALBUQUERQUE UNREGULATED FLOW ...

Name: RIO GRANDE AT ALBUQUERQUE UNREGULATED FLOW TEST 10

Description: Unregulated Volume-Duration Analysis Rio Grande at Albuquerque

Data Set: Rio Grande at Alubquerque UNREGULATED

DSS File Name: \Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES\...

Report File: ULATED_FLOW_TEST_10\RIO_GRANDE_AT_ALBUQUERQUE_UNREGULATED_FLOW_TEST_1...

General Options Duration Table Analytical Graphical

Settings Tabular Results Plot Statistics

Log Transformation: On

Distribution: LogPearsonIII

Expected Probability Curve

☐ Compute Expected Prob. Curve

☒ Do Not Compute Expected Prob. Curve

Skew

☒ Use Station Skew

☐ Use Weighted Skew

☐ Use Regional Skew

Duration	Reg. Skew	R.Skew MSE
1		
7		
15		
60		
120		

Compute Plot Duration Data Plot Analytical Curve Plot Graphical Curve View Report Print OK Cancel Apply

Figure B-73. Settings Tab Shown for Test Example 10.

Press the **Compute** button to perform the analysis. Once the computations have been completed, a message window will pop-up stating **Compute Complete**. Close this window and then select the **Tabular Results** tab within the analytical analysis. The results table should look Figure B-74. The top portion of the results table contains the percent chance exceedance for all durations (the report contains confidence limits). The bottom portion of the results table contains the statistics for all duration.

Appendix B Example Data Sets

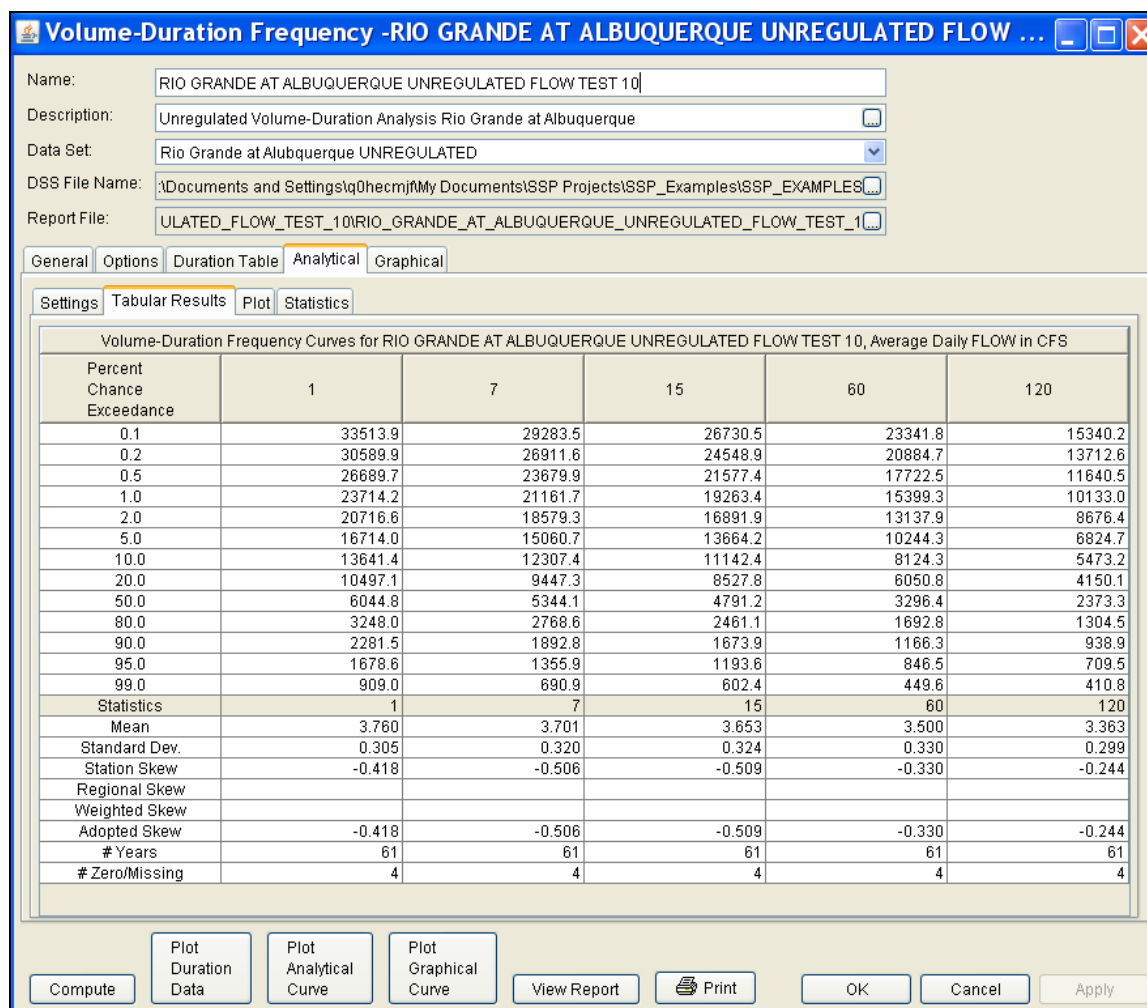


Figure B-74. Tabular Results Tab for Test Example 10.

As shown in Figure B-75, the **Plot** tab contains a graph of the systematic data and the computed frequency curves. Notice how some of the frequency curves look like they might cross if the lines were extended. The **Statistics** tab can be used to modify the computed statistics to ensure that the frequency curves are consistent.

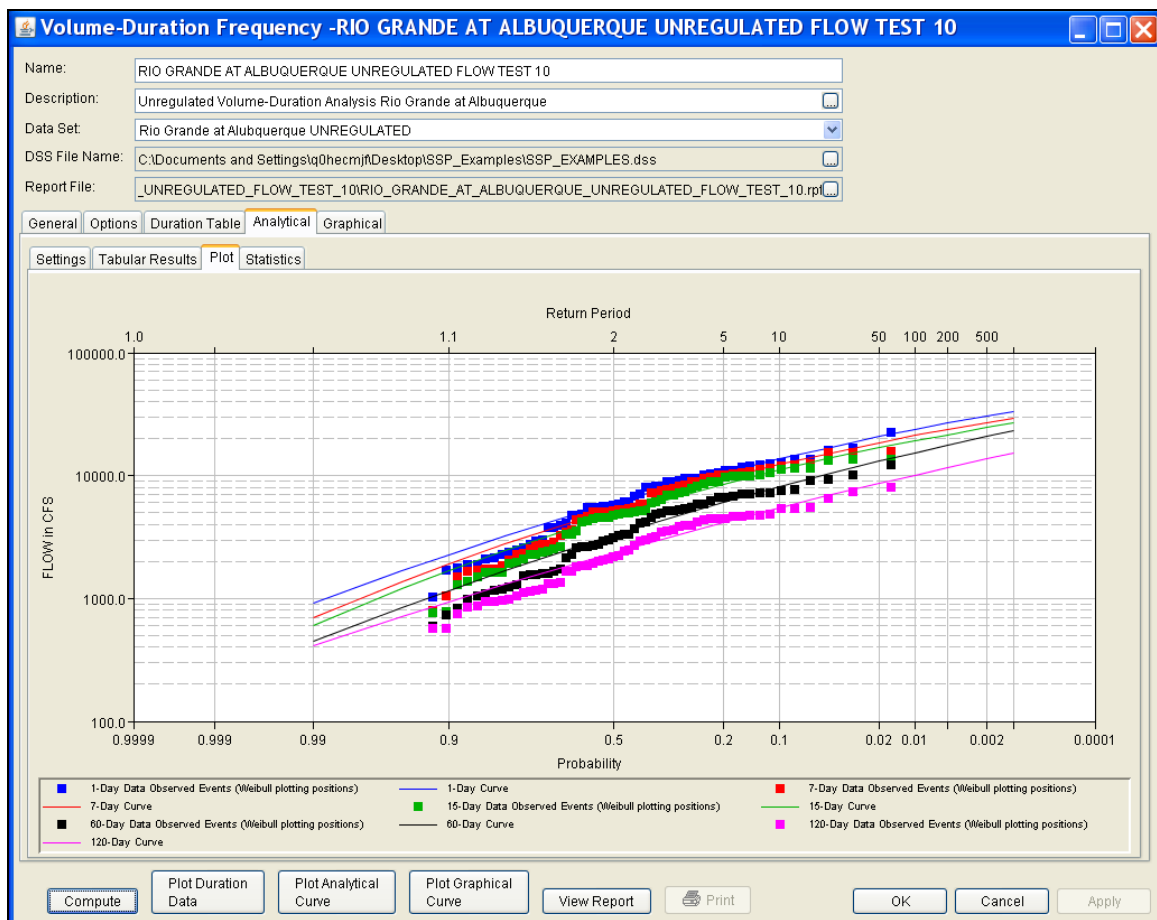


Figure B-75. Plot Tab for Example 10.

For this example, the standard deviation and the adopted skew values were modified to make sure the volume-duration frequency curves were consistent. As shown in Figure B-76, the check boxes next to mean, standard deviation, and adopted skew were checked and then user-adjusted statistics were entered into the table for all durations. The **Compute** button must be pressed after adjusted statistics have been entered in order for the program to recompute the frequency curves using the user-adjusted statistics. Figure B-77 shows the **Plot** tab after the user-adjusted statistics were entered on the **Statistics** tab. Results on the **Tabular Results** tab will also update when user-adjusted statistics are entered on the **Statistics** tab.

Appendix B Example Data Sets

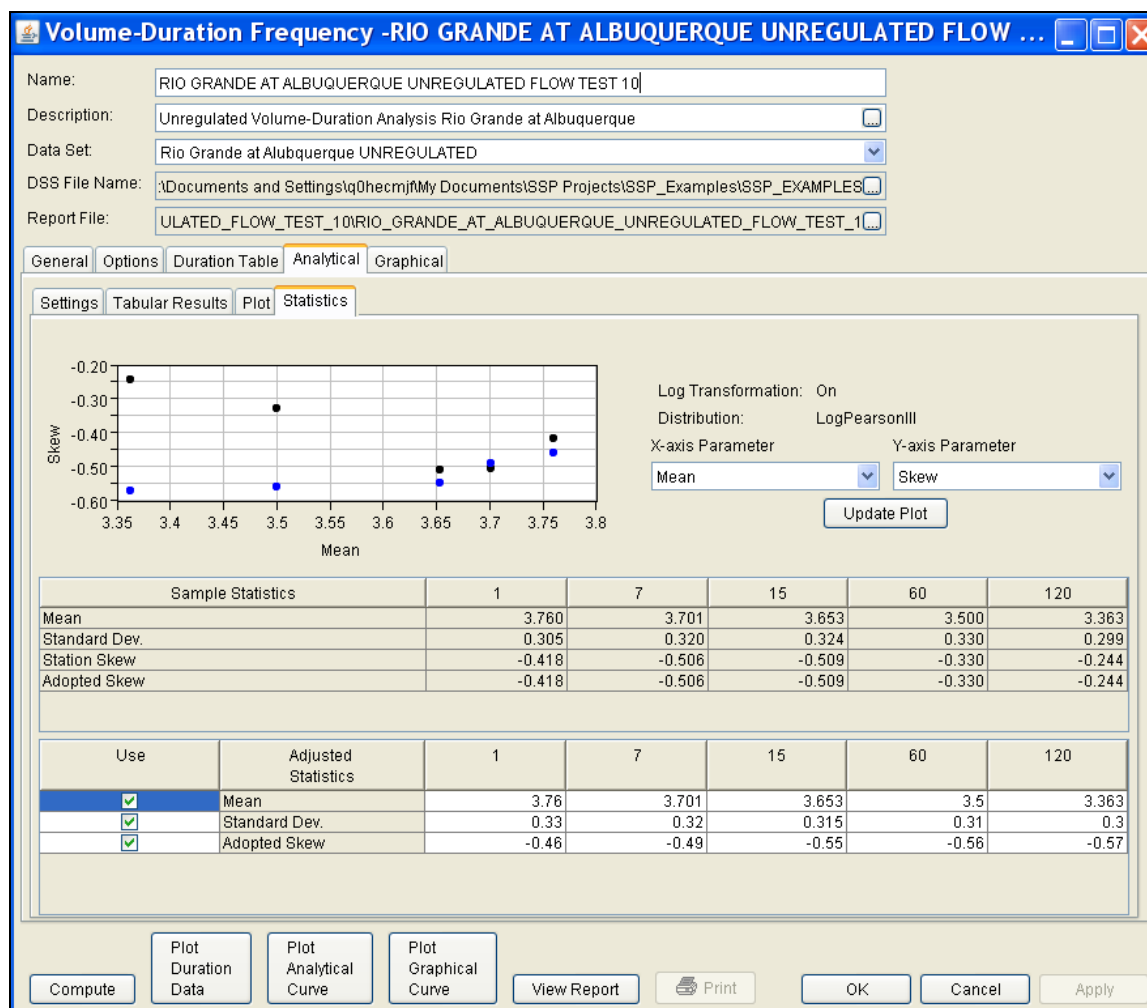


Figure B-76. Statistics Tab for Test Example 10.

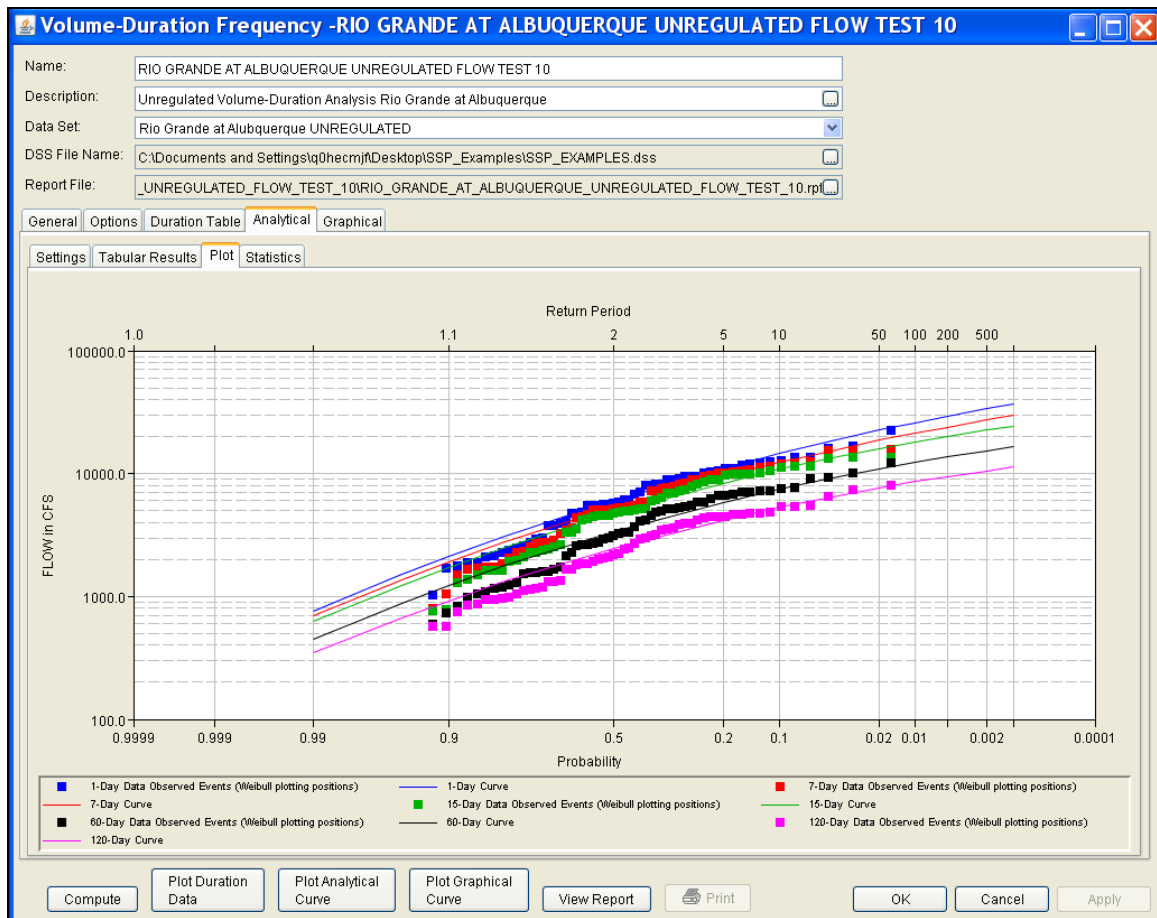


Figure B-77. Plot Tab for Example 10 After the Statistics were Adjusted on the Statistics Tab.

In addition to the Tabular Results and Plot tabs, graphical plots can be opened by selecting the **Plot Duration Data** or **Plot Analytical Curve** buttons at the bottom of the analysis window. A plot of the results for this test example is shown in Figure B-78.

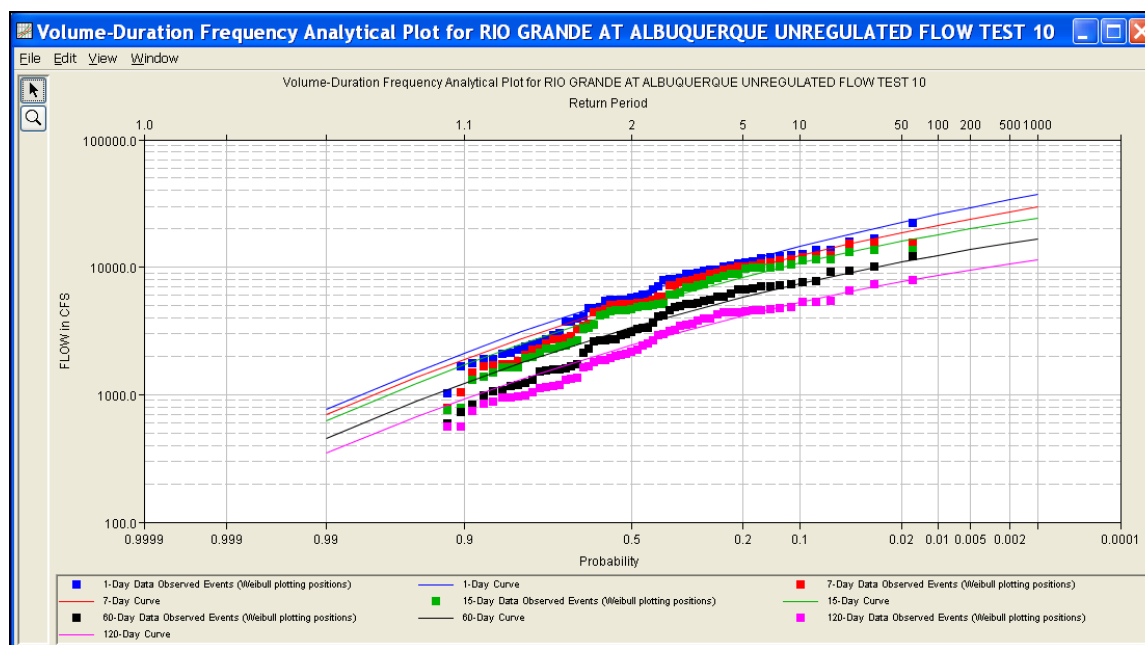


Figure B-78. Plot of the Frequency Curve Results for Test Example 10.

The tabular and graphical results can be sent to the printer or the windows clipboard for transfer into another piece of software. To print the tabular results, select **Print** from the bottom of the analysis window. To send the tabular results to the windows clipboard, highlight the data you want to send to the clipboard and then press the Control-C key sequence. To print the graphical results, first bring up the graphical plot and then select **Print** from the **File** menu. To send the graphic to the windows clipboard, select **Copy to Clipboard** from the **File** menu.

In addition to the tabular and graphical results, there is a report file that shows the order in which the calculations were performed. To review the report file, press the **View Report** button at the bottom of the analysis window. When this button is selected a text viewer will open the report file and display it on the screen. Shown in Figure B-79 is the report file for test example 10.

The report file contains a listing of the input data, preliminary results, outlier and historical data tests, additional calculations needed, and the final frequency curve results. Different types and amounts of information will show up in the report file depending on the data and the options that have been selected for the analysis.



Figure B-79. Report File for Test Example 10.

Example 11: Volume-Duration Frequency Analysis, Minimum Flows

This example demonstrates how to create a low flow Volume-Duration Frequency analysis. The data for this example was downloaded from the USGS. It is comprised of daily average flow for the Chattahoochee River at Cornelia, Georgia. Drought conditions were occurring in the region at the time of this analysis. Among other things, a low flow analysis can be used to determine the severity of a drought. The period of record for this example is from 1957 to 2007. To view the data, right-click on the data record labeled "**CHATTAHOOCHEE RIVER-CORNELIA, GA-FLOW**" in the study explorer and then select **Plot**. The data will appear as shown in Figure B-80.

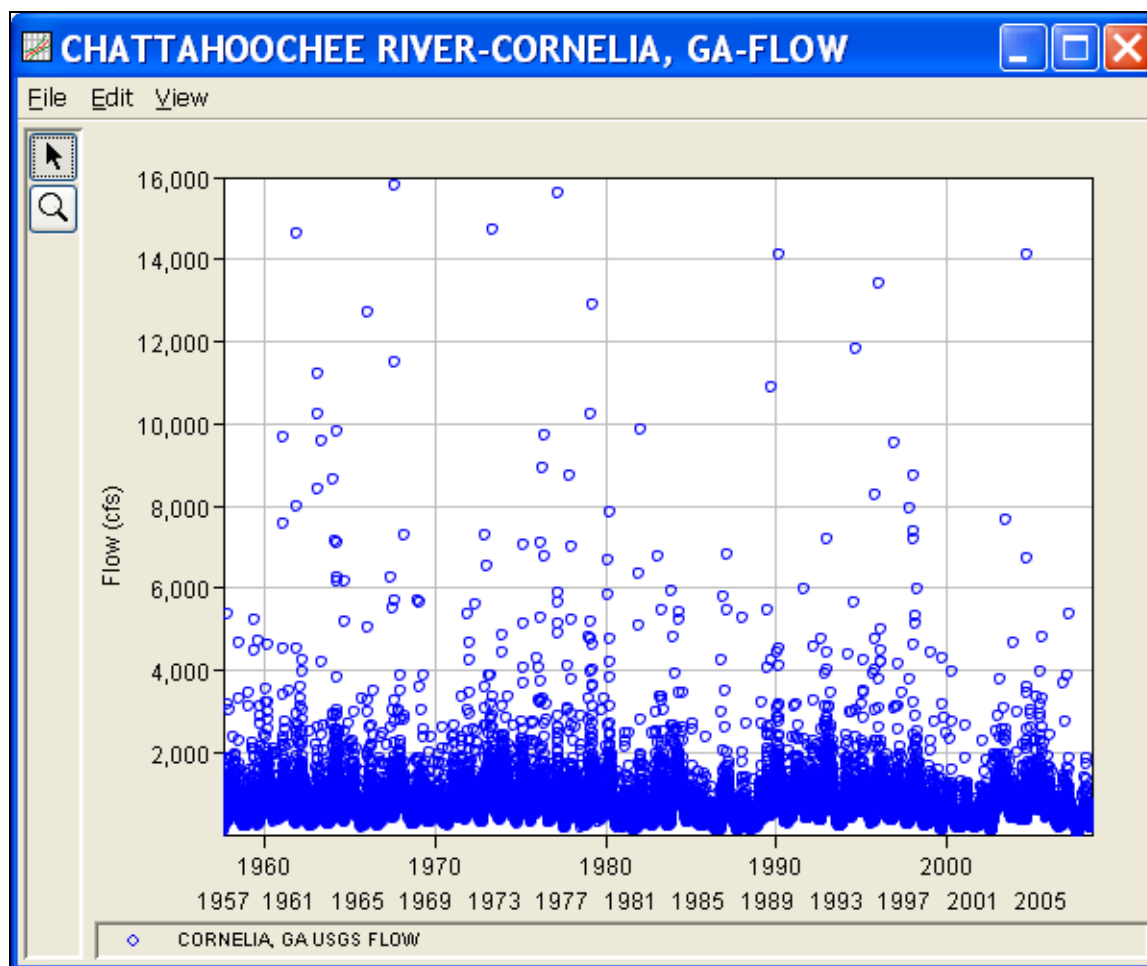


Figure B-80. Plot of Daily Average Flow for Example 11.

A Volume-Duration Frequency analysis has been developed for this example. To open the Volume-Duration Frequency analysis editor for test example 11, either double-click on the analysis labeled **LOW FLOW VOLUME-DURATION ANALYSIS TEST 11** from the study

explorer, or from the **Analysis** menu select open, then select **LOW FLOW VOLUME-DURATION ANALYSIS TEST 11** from the list of available analyses. When test 11 is opened, the Volume-Duration Frequency analysis editor will appear as shown in Figure B-81.

Volume-Duration Frequency -LOW FLOW VOLUME DURATION ANALYSIS TEST 11

Name: LOW FLOW VOLUME DURATION ANALYSIS TEST 11

Description: This example shows how to perform a low flow analysis using HEC-SSP

Data Set: CHATTAHOOCHEE RIVER-CORNELIA, GA-FLOW

DSS File Name: ocuments and Settings\q0hec\mjf\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.ds

Report File: JME_DURATION_ANALYSIS_TEST_11\LOW_FLOW_VOLUME_DURATION_ANALYSIS_TEST_11.rpt

General | Options | Duration Table | Analytical | Graphical

Log Transform

☒ Use Log Transform

☐ Do not use Log Transform

Maximum or Minimum Analysis

☐ Analyze Maximums

☒ Analyze Minimums

Year Specification

☐ Water Year (starts Oct 1)

☒ Calendar Year (starts Jan 1)

☐ Other starting

Plotting Position

☒ Weibull (A and B = 0)

☐ Median (A and B = 0.3)

☐ Hazen (A and B = 0.5)

☐ Other (Specify A, B)

Plotting position computed using formula

$$(m-A)/(n+1-A-B)$$

Where: m=rank, 1=largest
N=Number of Years
A,B=Constants

A:

B:

Time Window Modification

End Points

DSS Range is 31JUL1957 - 22JUN2008

☐ start date

☒ end date 31Dec2007

Season

To define a subset of the year

season start: season end:

NOTE: season must be within a year, as defined in the Year Specification

Compute Plot Duration Data Plot Analytical Curve Plot Graphical Curve View Report Print OK Cancel Apply

Figure B-81. Volume-Duration Frequency Analysis Editor for Test Example 11.

Shown in Figure B-81 are the general settings that were used to perform this frequency analysis. For this analysis, the **Use Log Transform** option was selected, the **Weibull** plotting position method was selected, **Analyze Minimums** was selected, and the **Calendar Year** option was selected. The Calendar Year option was selected because low flows are possible in late September, early November. Starting the year on January 1 minimizes the possibility of using the same low flow event in multiple years. An end date of 31 December 2007 was entered in the **Time Window Modification**. This end date was specified because not all the data for the summer of 2008 was available at the time of the analysis.

Shown in Figure B-82 is the Volume-Duration Frequency analysis editor with the **Options Tab** selected. Features on this tab include an option to override the default **Flow-duration** values, an option to override the default **Frequency Ordinates**, and **Output Labeling**.

The screenshot shows the 'Options' tab of the 'Volume-Duration Frequency -LOW FLOW VOLUME DURATION ANALYSIS TEST 11' dialog. The 'General' tab is also visible with the following settings:

- Name: LOW FLOW VOLUME DURATION ANALYSIS TEST 11
- Description: This example shows how to perform a low flow analysis using HEC-SSP
- Data Set: CHATTAHOOCHEE RIVER-CORNELIA, GA-FLOW
- DSS File Name: C:\Documents and Settings\lg0hecmlj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss
- Report File: \W_FLOW_VOLUME_DURATION_ANALYSIS_TEST_11\LOW_FLOW_VOLUME_DURATION_ANALYSIS_TEST_...

The 'Options' tab has three sub-sections:

- Flow Durations:**
 - ☒ Change or add to default values
 - Table with 2 columns: Duration in days, and a value column.
- User Specified Frequency Ordinates:**
 - ☐ Use Values from Table below
 - Table with 2 columns: Frequency in Percent, and a value column.
- Output Labeling:**
 - Data Name: DSS data name is FLOW
 - ☐ change label FLOW
 - Data Unit: DSS Data Unit is CFS
 - ☐ change label CFS

At the bottom of the dialog, there are buttons for 'Compute', 'Plot Duration Data', 'Plot Analytical Curve', 'Plot Graphical Curve', 'View Report', 'Print', 'OK', 'Cancel', and 'Apply'.

Figure B-82. Options Tab Shown for Test Example 11.

Once all of the General and Optional settings are set or selected, the user can extract the volume-duration data. Select the **Duration Data** tab and press the **Extract Volume-Duration Data** button at the bottom of the table. The table should then fill with the flow-duration values, as shown in Figure B-83.

Volume-Duration Frequency -LOW FLOW VOLUME DURATION ANALYSIS TEST 11

Name: LOW FLOW VOLUME DURATION ANALYSIS TEST 11

Description: This example shows how to perform a low flow analysis using HEC-SSP

Data Set: CHATTAHOOCHEE RIVER-CORNELIA, GA-FLOW

DSS File Name: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: \W_FLOW_VOLUME_DURATION_ANALYSIS_TEST_11\LOW_FLOW_VOLUME_DURATION_ANALYSIS_TEST_11

General Options **Duration Table** Analytical Graphical

Year	Volume-Duration Data									
	Lowest Mean Value for Duration, Average Daily FLOW in CFS									
	1		7		30		60		90	
	Date	FLOW	Date	FLOW	Date	FLOW	Date	FLOW	Date	FLOW
1958	12/13/1958	202	12/26/1958	266	12/21/1958	299	12/26/1958	307	12/26/1958	333
1959	08/30/1959	222	08/30/1959	306	08/30/1959	383	08/30/1959	498	09/06/1959	556
1960	07/17/1960	325	07/19/1960	428	12/10/1960	467	12/31/1960	508	12/31/1960	572
1961	11/12/1961	270	10/29/1961	368	11/12/1961	379	12/09/1961	414	12/09/1961	444
1962	10/28/1962	198	11/08/1962	259	11/08/1962	282	11/17/1962	328	11/17/1962	353
1963	10/20/1963	244	10/21/1963	288	11/04/1963	305	11/28/1963	338	11/22/1963	372
1964	09/27/1964	300	09/28/1964	338	09/29/1964	415	09/28/1964	483	09/28/1964	513
1965	09/26/1965	175	12/24/1965	277	09/29/1965	304	12/29/1965	349	12/31/1965	358
1966	09/11/1966	200	09/12/1966	267	10/17/1966	345	10/17/1966	351	10/17/1966	385
1967	08/19/1967	380	08/19/1967	477	04/23/1967	576	05/30/1967	678	05/31/1967	720
1968	09/15/1968	245	08/30/1968	297	09/15/1968	352	10/15/1968	364	11/07/1968	372
1969	10/19/1969	296	10/30/1969	366	10/31/1969	425	08/15/1969	511	12/25/1969	543
1970	10/04/1970	229	10/08/1970	262	10/18/1970	307	10/19/1970	344	10/28/1970	405
1971	10/31/1971	363	10/13/1971	437	10/21/1971	494	11/01/1971	549	11/23/1971	578
1972	10/15/1972	290	09/16/1972	345	09/29/1972	399	10/22/1972	421	11/02/1972	473
1973	10/27/1973	372	10/27/1973	444	11/18/1973	453	11/20/1973	501	11/20/1973	556
1974	11/08/1974	278	11/11/1974	372	11/16/1974	408	11/18/1974	442	12/07/1974	487

Extract Volume-Duration Data

Compute Plot Duration Data Plot Analytical Curve Plot Graphical Curve View Report Print OK Cancel Apply

Figure B-83. Volume-Duration Data Table for Example 11.

Once the data has been extracted, the user must choose to perform an Analytical or Graphical analysis. In this example, an analytical analysis was performed. Shown in Figure B-84 is the **Settings** tab for the analytical analysis. As shown, the distribution selected for this example is LogPearsonIII. The **Skew** option was set to **Use Station Skew** and the **Do Not Compute Excepted Probability** option was selected.

Volume-Duration Frequency -LOW FLOW VOLUME DURATION ANALYSIS TEST 11

Name: LOW FLOW VOLUME DURATION ANALYSIS TEST 11

Description: This example shows how to perform a low flow analysis using HEC-SSP

Data Set: CHATTAHOOCHEE RIVER-CORNELIA, GA-FLOW

DSS File Name: C:\Documents and Settings\q0hecmj\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss

Report File: \W_FLOW_VOLUME_DURATION_ANALYSIS_TEST_11\LOW_FLOW_VOLUME_DURATION_ANALYSIS_TEST_...

General Options Duration Table **Analytical** Graphical

Settings Tabular Results Plot Statistics

Log Transformation: On

Distribution: LogPearsonIII

Expected Probability Curve

☐ Compute Expected Prob. Curve

☒ Do Not Compute Expected Prob. Curve

Skew

☒ Use Station Skew

☐ Use Weighted Skew

☐ Use Regional Skew

Duration	Reg. Skew	R.Skew MSE
1		
7		
30		
60		
90		

Compute Plot Duration Data Plot Analytical Curve Plot Graphical Curve View Report Print OK Cancel Apply

Figure B-84. Settings Tab Shown for Test Example 11.

Press the **Compute** button to perform the analysis. Once the computations have been completed, a message window will pop-up stating **Compute Complete**. Close this window and then select the **Tabular Results** tab within the analytical analysis. The results table should look Figure B-85. The top portion of the results table contains the percent chance exceedance for all durations (the report contains confidence limits). The bottom portion of the results table contains the statistics for all duration.

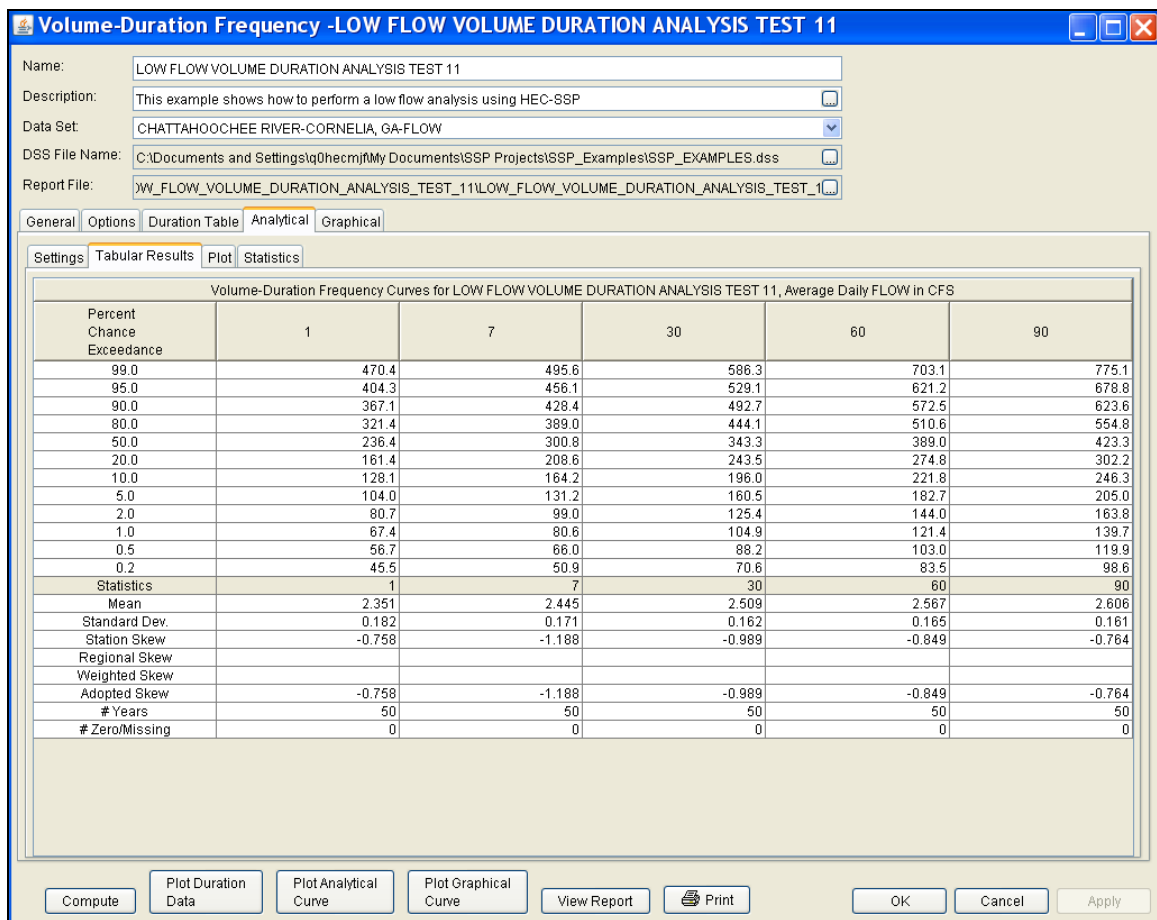


Figure B-85. Tabular Results Tab for Test Example 11.

As shown in Figure B-86, the **Plot** tab contains a graph of the systematic data and the computed frequency curves. Notice how some of the frequency curves look like they might cross if the lines were extended. The **Statistics** tab can be used to modify the computed statistics to ensure that the frequency curves are consistent.

Note: the volume-duration frequency analysis will identify low and high outliers using guidelines in Bulletin 17B; however, the program will not remove outliers and recompute the statistics.

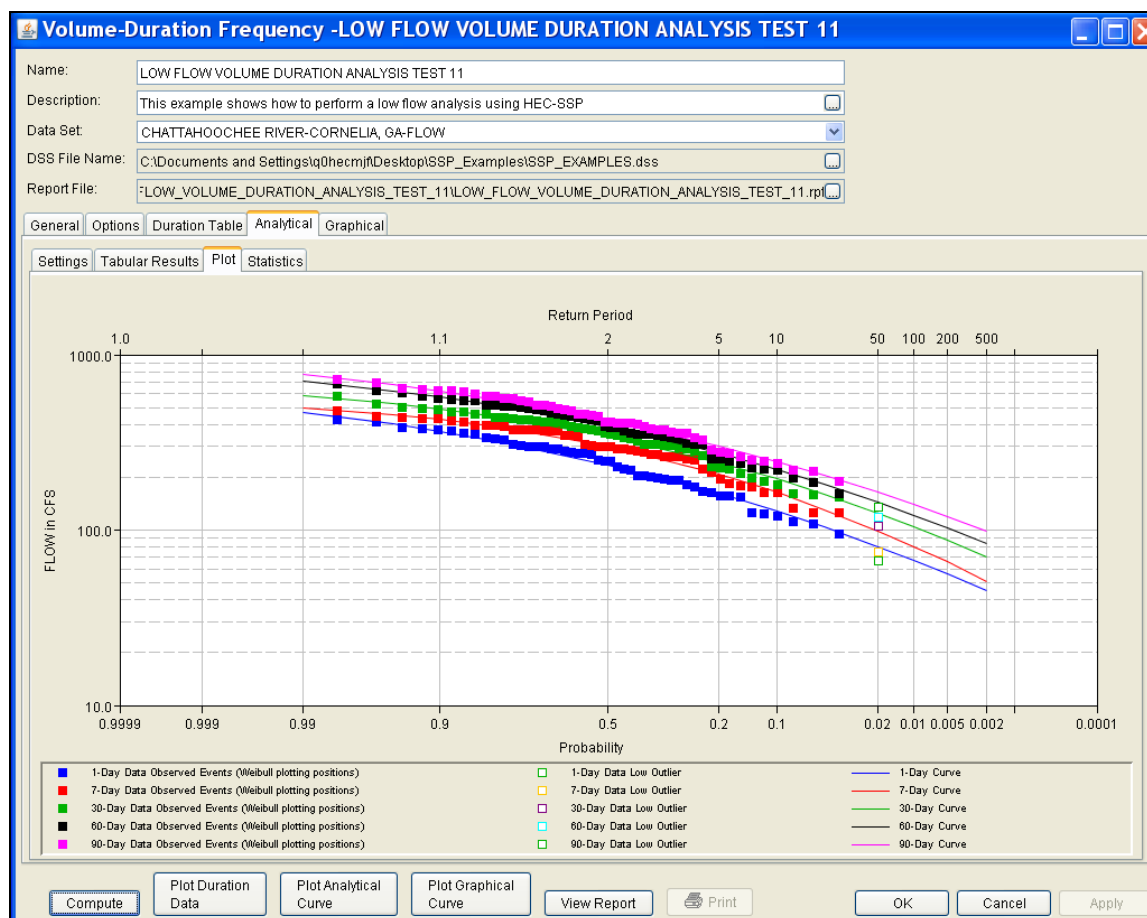


Figure B-86. Plot Tab for Test Example 11.

For this example, the standard deviation and the adopted skew were modified to make sure the volume-duration frequency curves were consistent. As shown in Figure B-87, the check boxes next to mean, standard deviation, and adopted skew were checked and then user-adjusted statistics were entered into the table for all durations. The **Compute** button must be pressed after adjusted statistics have been entered in order for the program to recompute the frequency curves using the user-adjusted statistics. Figure B-88 shows the **Plot** tab after the user-adjusted statistics were entered on the **Statistics** tab. Results in the **Tabular Results** table will also update when user-adjusted statistics are entered on the **Statistics** tab.

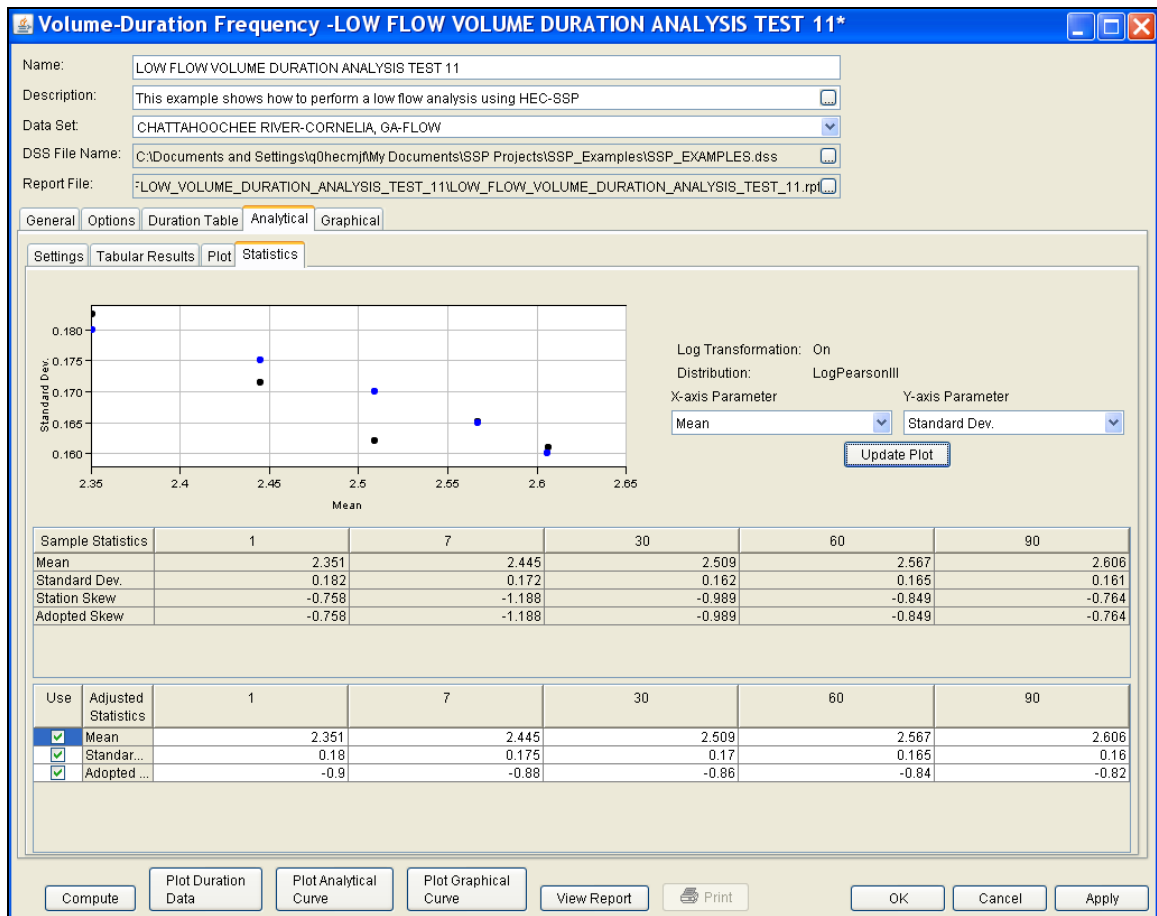


Figure B-87. Statistics Tab for Test Example 11.

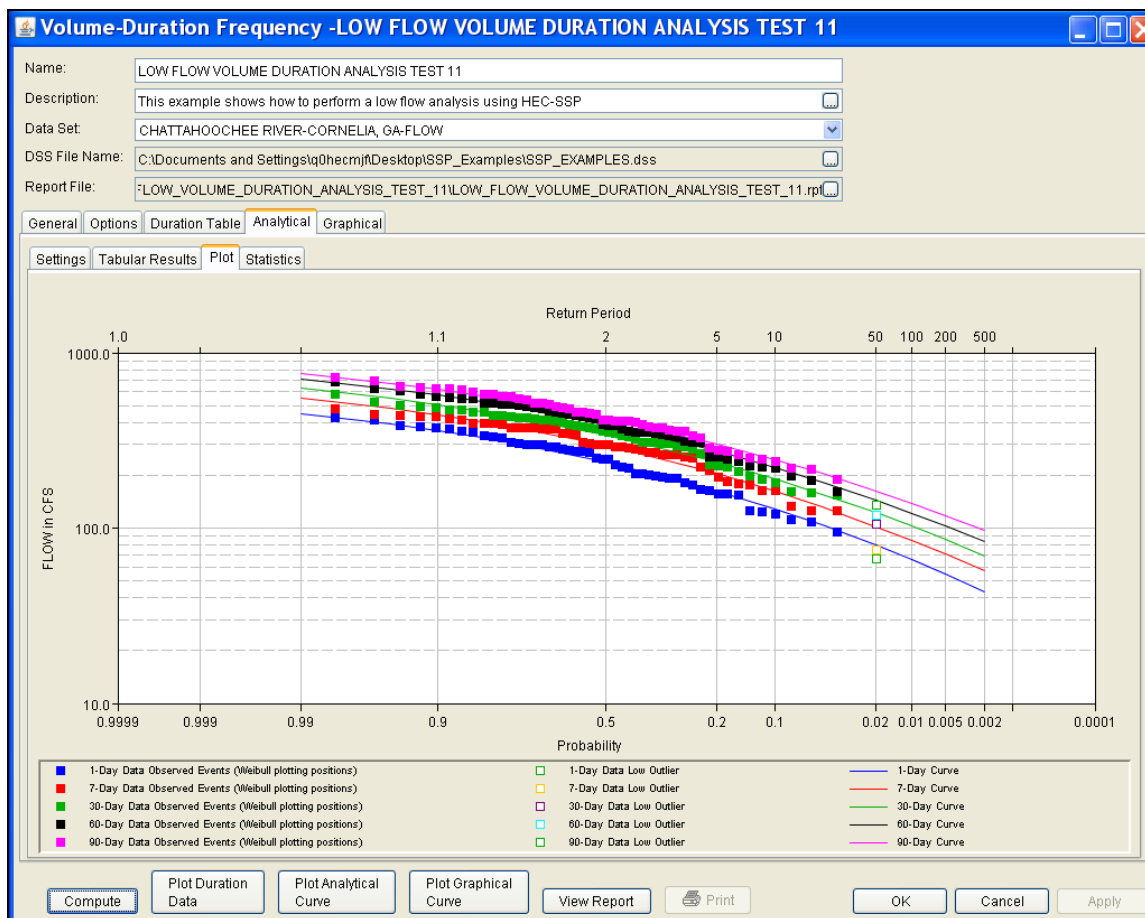


Figure B-88. Plot Tab for Test Example 11.

In addition to the Tabular Results and Plot tabs, graphical plots can be opened by selecting the **Plot Duration Data** or **Plot Analytical Curve** buttons at the bottom of the analysis window. A plot of the results for this test example is shown in Figure B-89.

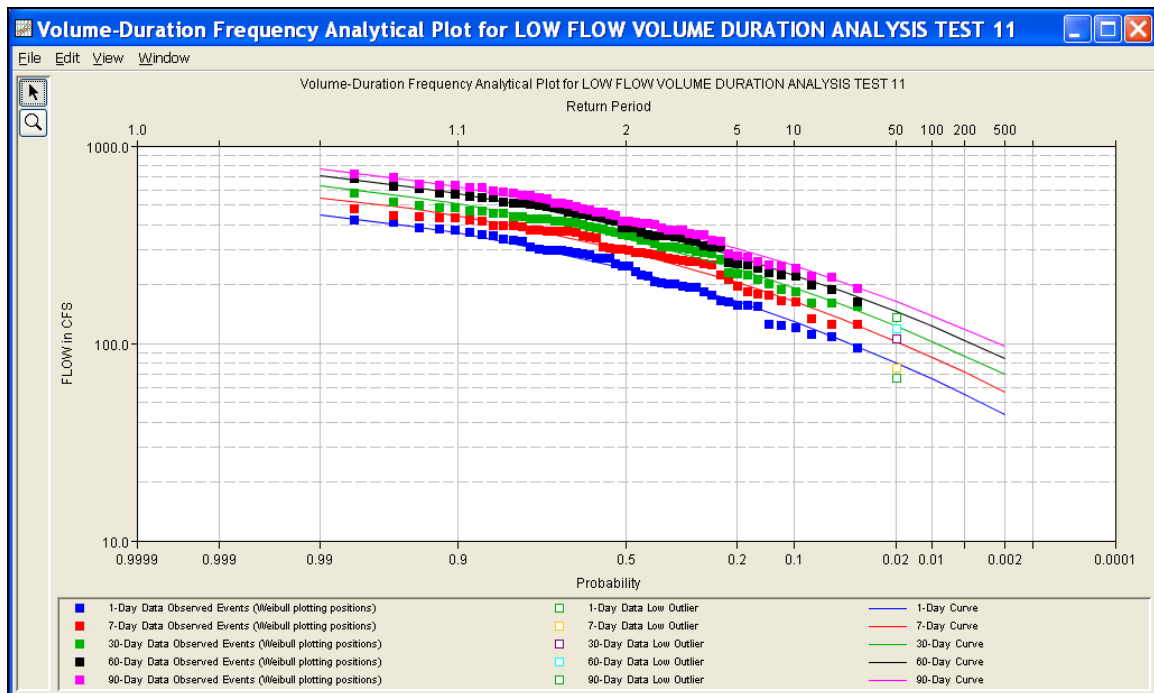


Figure B-89. Plot of the Frequency Curve Results for Test Example 11.

The tabular and graphical results can be sent to the printer or the windows clipboard for transfer into another piece of software. To print the tabular results, select **Print** from the bottom of the analysis window. To send the tabular results to the windows clipboard, highlight the data you want to send to the clipboard and then press the Control-C key sequence. To print the graphical results, first bring up the graphical plot and then select **Print** from the **File** menu. To send the graphic to the windows clipboard, select **Copy to Clipboard** from the **File** menu.

In addition to the tabular and graphical results, there is a report file that shows the order in which the calculations were performed. To review the report file, press the **View Report** button at the bottom of the analysis window. When this button is selected a text viewer will open the report file and display it on the screen. Shown in Figure B-90 is the report file for test example 11.

The report file contains a listing of the input data, preliminary results, outlier and historical data tests, additional calculations needed, and the final frequency curve results. Different types and amounts of information will show up in the report file depending on the data and the options that have been selected for the analysis.

Appendix B Example Data Sets

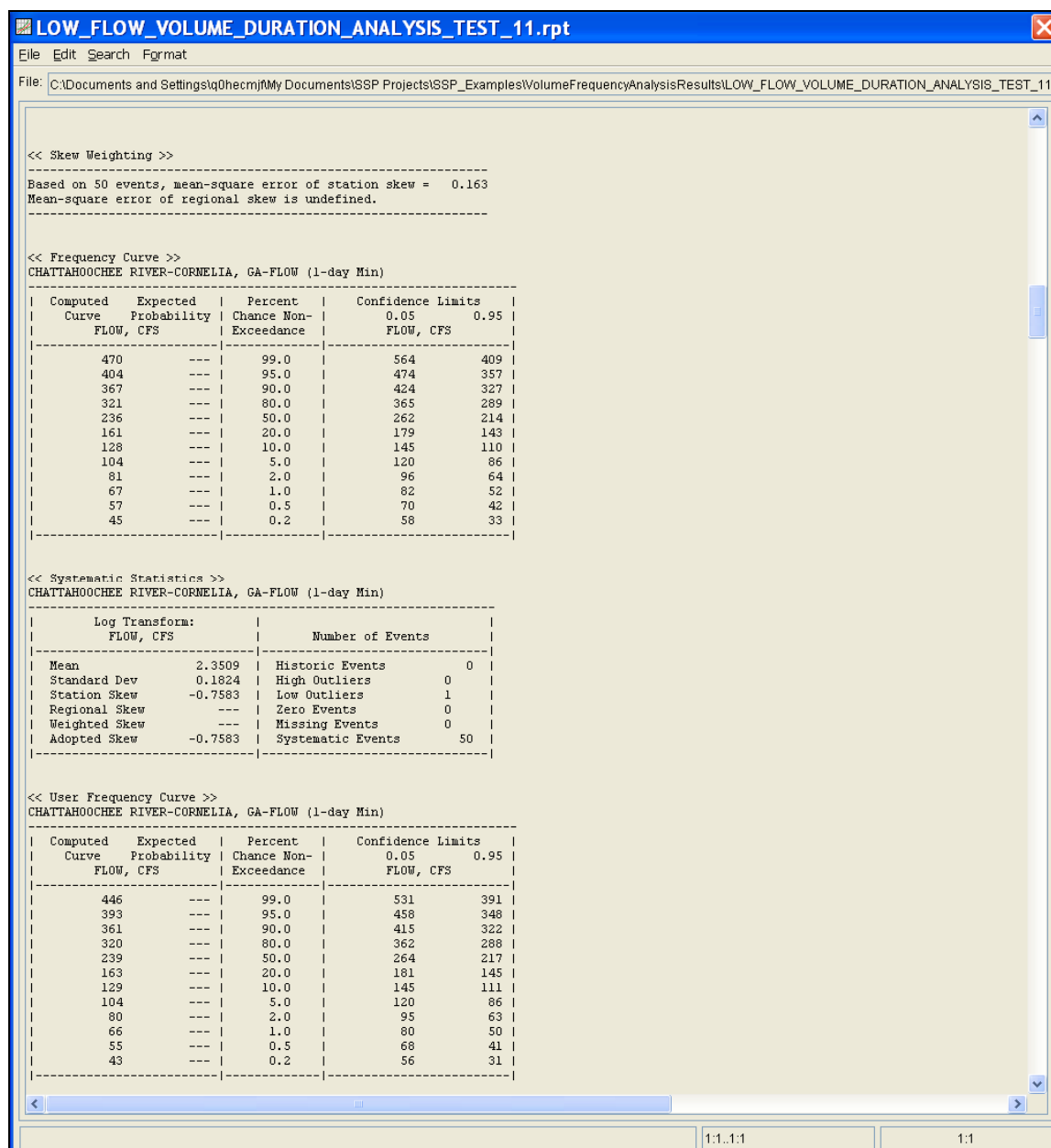


Figure B-90. Report File for Test Example 11.

APPENDIX C

Customizing Plots

The graphic customizing capabilities within HEC-SSP are very powerful, but are also somewhat complex to use. The software used in developing the plots in HEC-SSP is the same code that was used for developing graphics in HEC-DSSVue and several other HEC software programs. This appendix documents how to customize plots in a generic manner. The example plots in this section are from HEC-DSSVue, not HEC-SSP. Figure C-1 shows a sample plot illustrating raw and revised data for stage and flow at a location called Beech Creek Station.

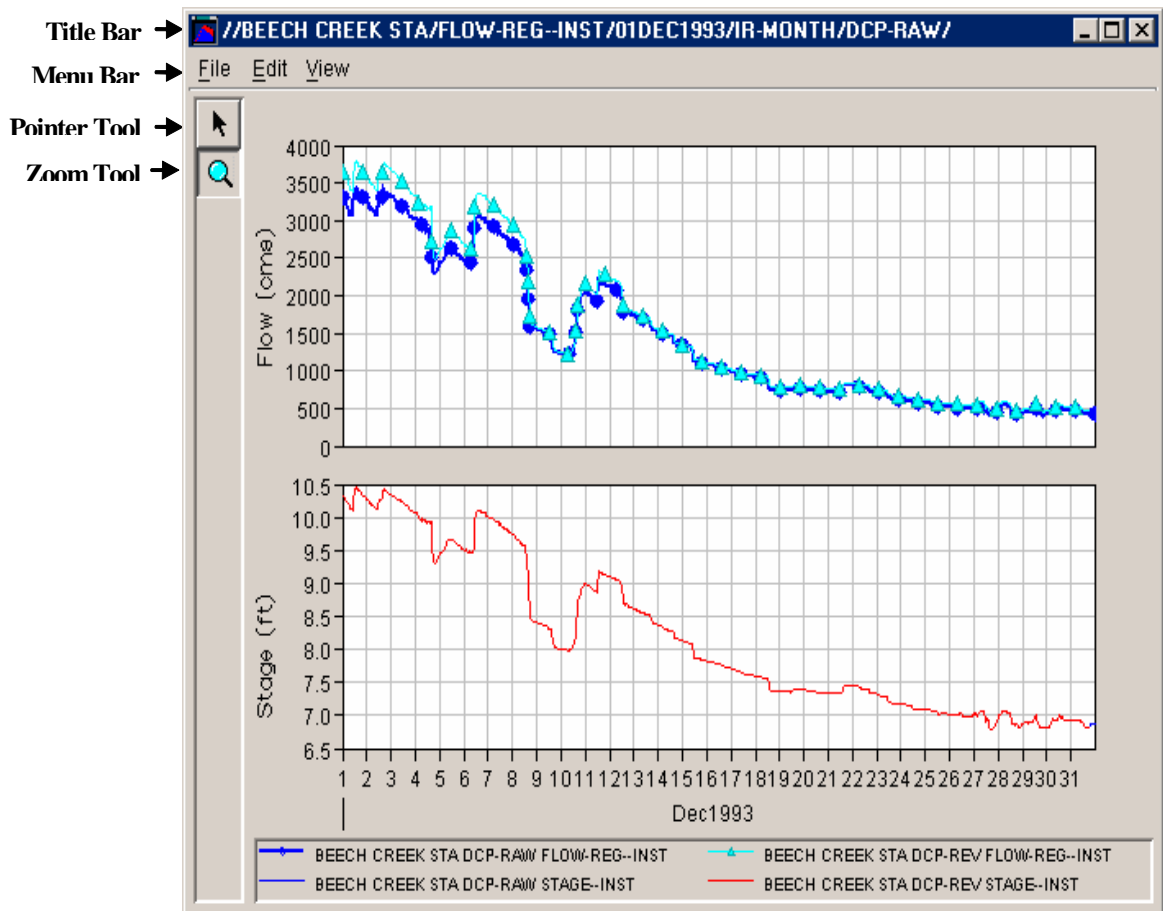




Figure C-1. Plot Window

With the **Pointer Tool** , you can access shortcut menus that allow you to customize features of your plots using the plot window's editing tools. The following sections discuss these tools in detail. The **Zoom Tool**  allows you to view data closely at a specific time. To zoom in, select the Zoom Tool then "draw" a rectangle around the section of the plot you wish to enlarge. To zoom out, right-click anywhere in the display area using the Zoom Tool.

If you wish to keep the plot window on top of your desktop so you can view it while working in other windows, you can select Always on Top from the **View** menu. A check mark indicates this option is active.

Customizing Plots: Overview

Plot properties editors allow you to configure default properties for plots as well as customize individual plots. Figure C-2 shows the features of plots you can configure.

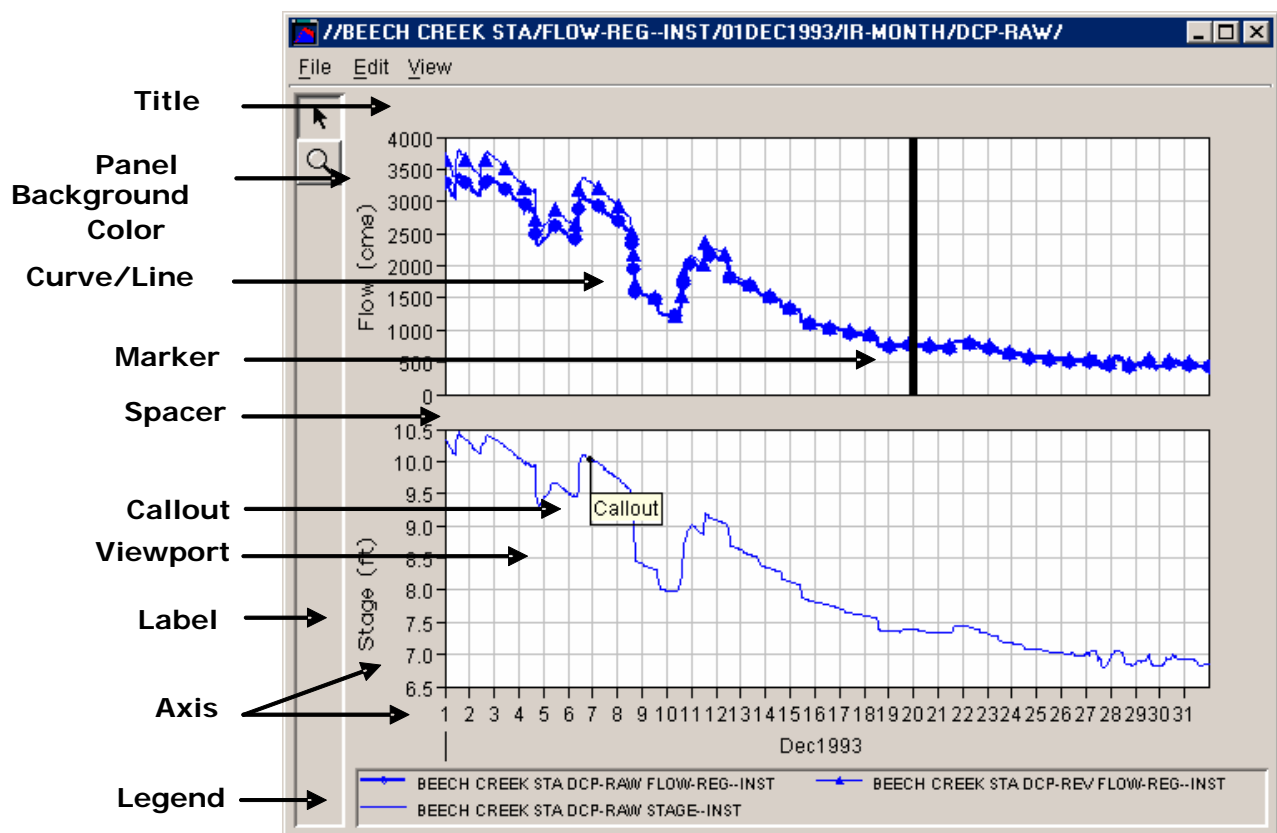


Figure C-2. Configurable Features of Plots

Title: Optionally, you can add a title to the plot display.

Panel Background Color: You can specify the background color of the plot window (light grey is the default).

Curve/Line Properties: You can choose the line and point styles, add labels, and specify symbols to indicate quality.

Marker: You can add markers on the X and Y axes and customize the appearance of these markers.

Spacer: You can specify the distance between viewports, between a viewport and the legend, and the width of side margins.

Callout: You can add descriptive callouts at specific points along a line.

Viewport: You can customize the border around the viewport, the background color and pattern, and the appearance of gridlines. You can also specify the number, size, and content of viewports.

Label: You can add borders and backgrounds to axis and legend labels.

Axis: You can specify either a linear or log axis type, specify the axis scale, and customize tic marks.

Legend: You can add titles to the plot legend and specify whether the legend appears below or to the right of the plot.

Using Plot Editors

Several different editing interfaces allow you to either set defaults for all plots or specify properties of individual plots. Figure C-3 shows three examples: the Default Plot Properties Editor, the Plot Properties Editor, and the Viewport Properties Editor.

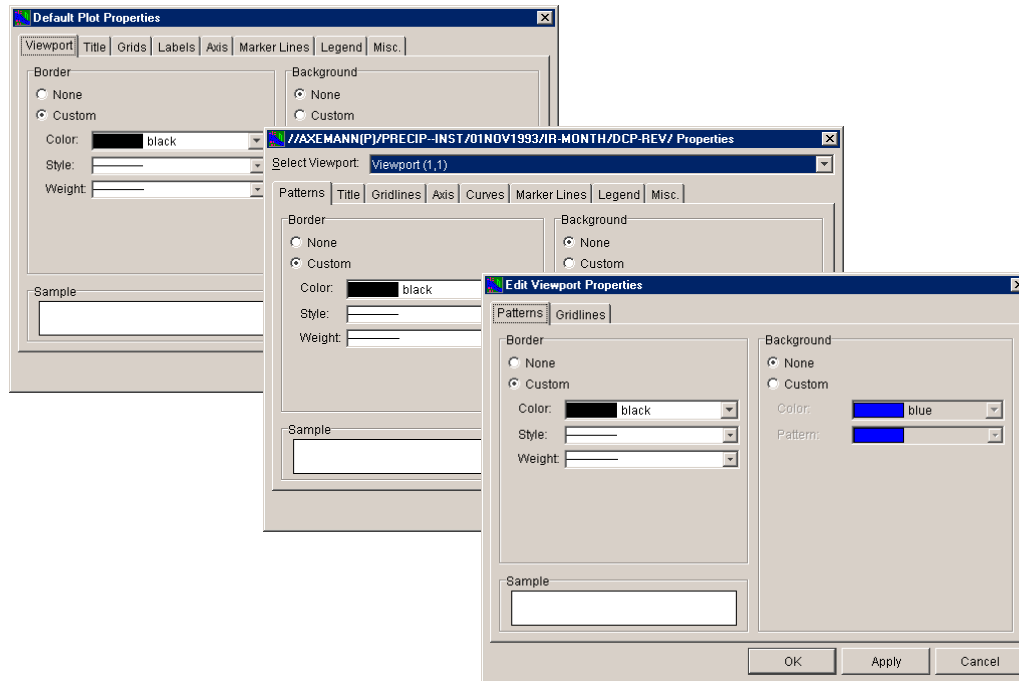


Figure C-3. Examples of Plot Properties Editors

As Figure C-3 illustrates, the editors can look almost identical to each other. Therefore, it is necessary for you to understand what the editors do and how to access the correct editor for your purpose.

Setting Defaults vs. Customizing Individual Plots

Plot editors and tools fall into two categories in terms of function: either they allow you to specify defaults for all plots you create, or they allow you to customize individual plots.

Across these two functional categories, the plot editors and tools either allow you to edit a variety of plot properties, or they can be specialized editors that allow you to edit a single property.

To configure the default appearance of all plots, you need to use the **Default Plot Properties Editor** and **Default Line Style Options Editor**. All settings you specify in these editors will apply to all new plots you open. You can access these editors only from the **Edit** menu of plots.

To customize individual plots, you can use the **Plot Properties Editor** and the **Configure Plot Editor**, both accessed from the **Edit** menu of a plot window. Also, using right-click shortcut menus, you can access specialized editors for individual plot features. The **Viewport Properties Editor** is an example of a specialized editor.

Additionally, once you have customized an individual plot, you can export its settings as a **Template** that you can apply to other plots. To create a template based upon a plot, you will use the **Export Properties** option in the **File** menu of the plot window.

Likewise, you can import Templates to apply previously defined properties to an individual plot. To apply a template to a new plot, you will use the **Import Properties** option in the **File** menu of the new plot window.

Accessing Editors

You can access properties editors from **shortcut menus** (Figure C-4) and from the **Edit** menu in the plot window (Figure C-5).

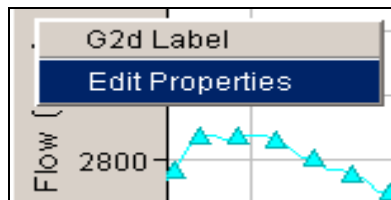


Figure C-4. Shortcut Menu

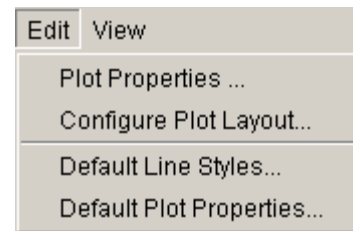


Figure C-5. Edit Menu

You will use these menus according to whether you are defining properties for an individual plot or setting default properties for all plots you create.

Use **shortcut menus** to edit specific components of an individual plot. For example, if you want to edit axis label properties on a plot, right-click on the axis label to access the shortcut menu for the label (Figure C-4), then select the **Edit Properties** command for the label.

Use the **Edit** menu of a plot window to access the **Plot Properties Editor**, **Default Line Style Options Editor**, **Default Plot Properties Editor**, and **Configure Plot Editor**. These editors, discussed below, allow you to edit a variety of plot properties.

Recognizing Plot Editors and Tools

Following is an overview of the editing tools that allow you to customize plots. Later sections provide more detailed instructions on editing specific plot properties using these tools.

Plot Properties Editor

The **Plot Properties Editor** (Figure C-6) is accessed from the **Edit** menu of a plot, and allows you to configure multiple display properties of an individual plot, including the Curves, Axis, the plot Title, Gridlines, border and background Patterns of the viewport, Marker Lines, Legend, and properties of the plot window panel.

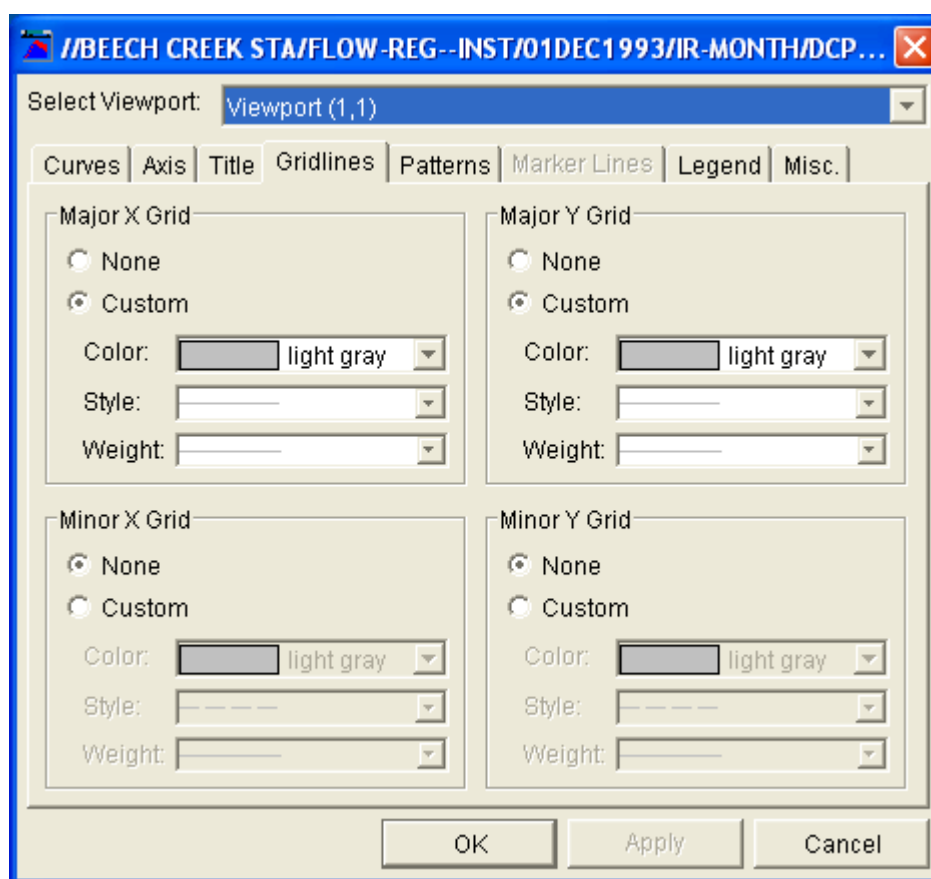


Figure C-6. Plot Properties Editor

When you customize properties of a plot using the Plot Properties Editor, your changes apply only to that individual plot unless you export the plot's properties.

To access the Plot Properties Editor, from the **Edit** menu, choose **Plot Properties**.

Individual Plot Property Editors

When you want to edit a specific property of a plot without launching the Plot Properties Editor, you can use individual plot property editors instead. These individual plot property editors correspond to the tabs of the Plot Properties Editor.

To access an individual plot property editor, right-click on the element you want to edit, and then select **Edit Properties** from the shortcut menu.

For example, if you right-click inside the gridded plot area, called the viewport, you will see the Viewport shortcut menu (Figure C-7). When you choose Edit Properties, the Viewport Properties Editor will open (Figure C-8).

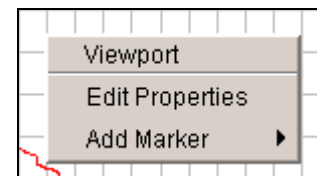


Figure C-7.
Viewport Shortcut Menu

The **Viewport Properties Editor** lets you edit only properties associated with the viewport, using the same Patterns and Gridlines tabs as appear in the Plot Properties Editor.

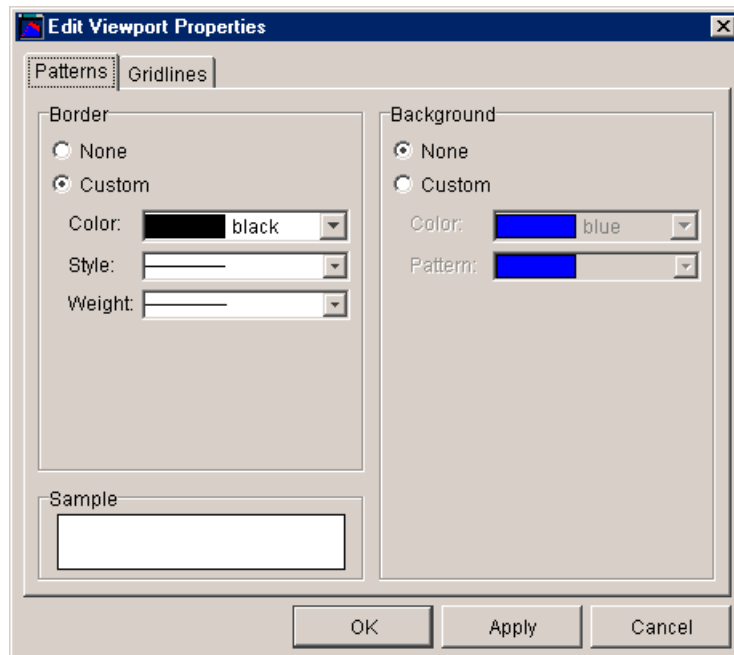


Figure C-8. Viewport Properties Editor

Other individual properties editors are the **Title Properties Editor**, **Axis Properties Editor**, **Curve Properties Editor**, **Label Properties**

Editor, Marker Properties Editor, Legend Properties Editor, and the Spacer Properties Editor.

The only plot property you cannot edit using an individual property editor is the color of the plot window panel.

Configure Plot Editor

The **Configure Plot Editor** (Figure C-9) is accessed from the **Edit** menu of a plot and allows you to customize the layout of an individual plot. You can add and remove axes and add, remove, arrange the order of, and set the weight of viewports in the plot window.

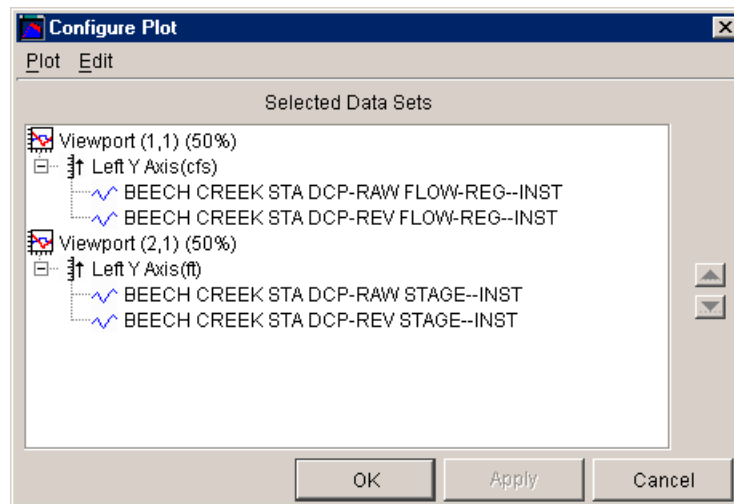


Figure C-9. Configure Plot Editor

When you customize the layout of a plot using the Configure Plot Editor, your changes apply only to that individual plot unless you export the plot's properties.

To access the Configure Plot Editor, from the **Edit** menu click **Configure Plot Layout**.

Default Line Style Options Editor

With the **Default Line Style Options** editor (Figure C-10), you can specify the default line and fill styles, as well as labels, used across all plots for specific parameters.

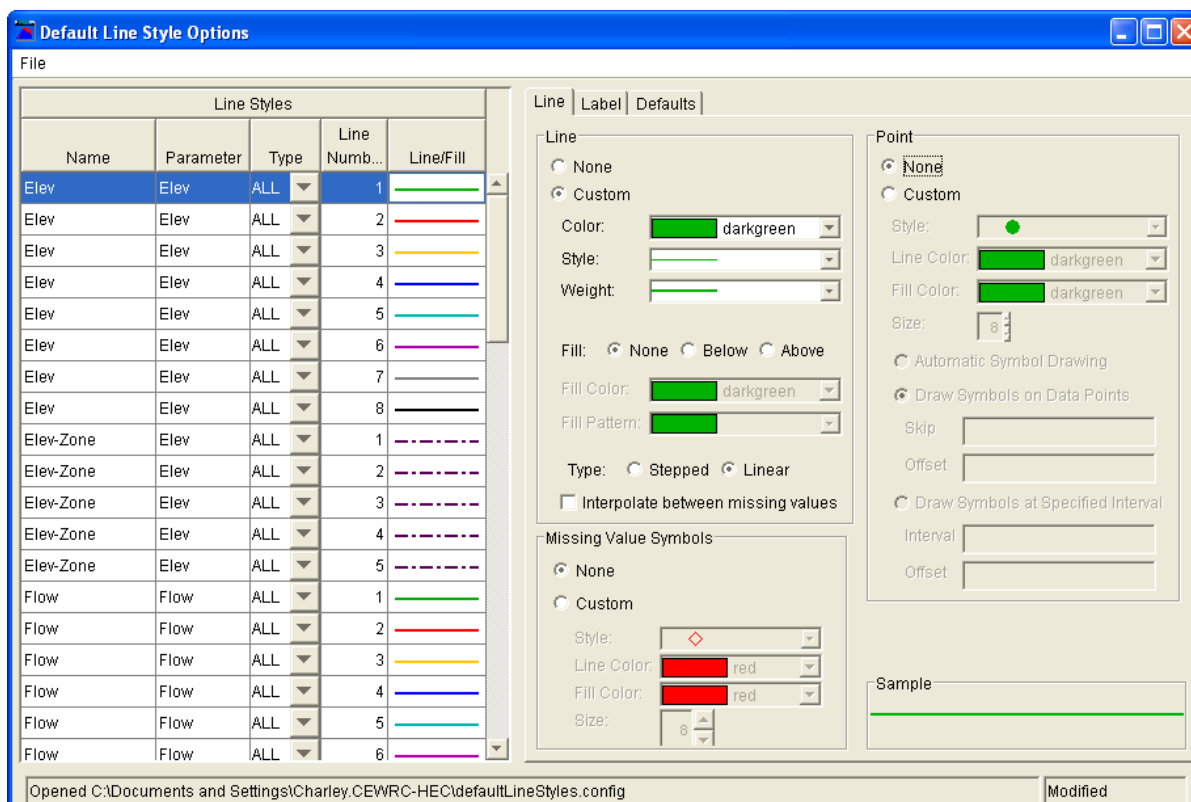


Figure C-10. Default Line Style Options Editor

To access the Default Line Style Options Editor, from the Edit menu, choose Default Line Styles.

Default Plot Properties Editor

The **Default Plot Properties Editor** (Figure C-11) allows you to configure the default display properties of all plots you create. Properties you can configure include the border and background of the Viewport, the Title, Grid lines, Labels, Axis, Marker Lines, Legend, and miscellaneous properties of the plot window panel.

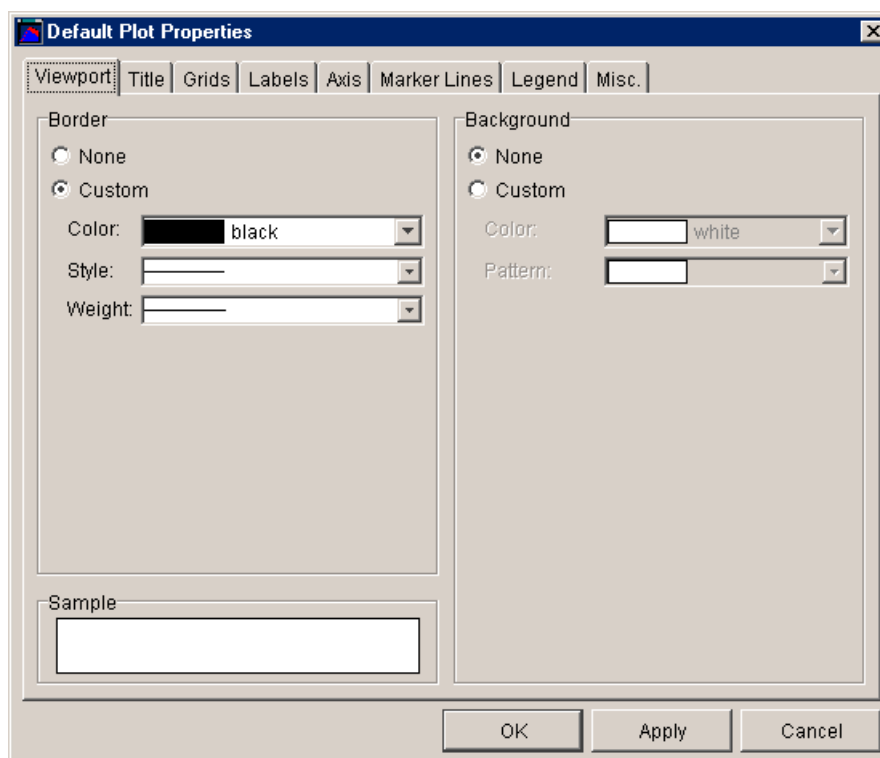


Figure C-11. Default Plot Properties Editor

When you customize plot properties using the Default Plot Properties Editor, your changes apply to all plots you create.

To access the Default Plot Properties Editor, from the **Edit** menu, click **Default Plot Properties**.


Customizing Plot Titles

You can add titles to individual plots and configure default properties for all plot titles.

To add or edit a title on an individual plot, you can either:

- From the **Edit** menu, choose **Plot Properties**. When the Plot Properties Editor opens, select the Title tab.

Or

- Right-click in the blank area above the plot (below the menu bar) with the Pointer Tool , and then select **Edit Properties** from the shortcut menu (Figure C-12). The Title Properties Editor will open.

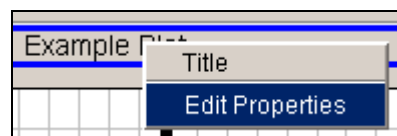


Figure C-12. Shortcut Menu-Edit Properties

To specify the appearance of titles for all of your plots, from the **Edit** menu, click **Default Plot Properties**, then select the Title tab of the Default Plot Properties editor.

Whether you are using the Plot Properties Editor, the specialized Title Properties Editor, or the Default Plot Properties Editor, the worksheet for editing plot title properties is the same.

Figure C-13 shows the Title Properties Editor. This editor contains the same fields as the Title tab of the Plot Properties Editor and the Default Plot Properties Editor.

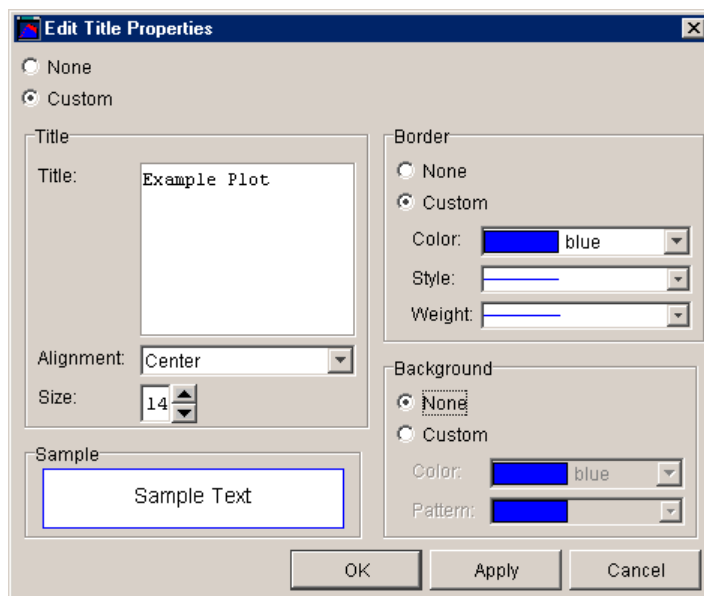


Figure C-13. Edit Title Properties

To specify a title for the plot, select Custom. In the Title panel, type the title you want in the Title box. From the Alignment list, select the alignment for the plot title. Your choices are Center, Left, or Right. From the Size list, select the text size for the title. The Sample box provides a preview of your plot title. The Border group allows you to add a border around the title. You can specify the Color, line Style, and line Weight. The Background group lets you add a background Color and/or Pattern behind your plot title. Click Apply to save your changes and continue adjusting the appearance of the title. Click OK when you are finished.

Customizing Curves


You can customize line and point styles, add labels, and specify symbols to indicate data quality in your plots. Additionally, you can specify the parameter-based default curve styles used across all plots.

There are three different ways to edit plot curves, depending on whether you wish to customize one or more curves in an individual plot or specify defaults for all plots.

Customizing Curves in Individual Plots

To customize all curves in an individual plot, from the **Edit** menu, choose **Plot Properties**. When the Plot Properties Editor opens, select the Curves tab.

To customize a specific curve in an individual plot, right-click on the line or curve you wish to edit

with the Pointer Tool , then select **Edit Properties** from the shortcut menu (Figure C-14). The Edit Curve Properties Editor will open.

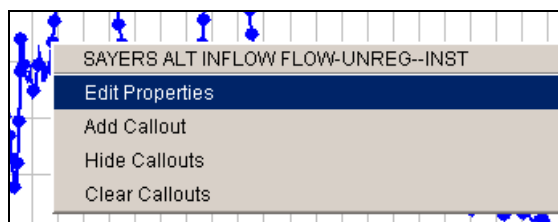


Figure C-14. Shortcut Menu--Curve Properties

The Curves tab of the Plot Properties Editor and the Edit Curve Properties Editor are nearly identical with two exceptions:

First, at the top of the Curves tab of the Plot Properties Editor, there is a list of all curves contained in the plot. In contrast, when you open

the Edit Curve Properties Editor, it deals only with the curve you selected when you launched the editor; therefore, there is no list of curves.

Second, the Curves tab of the Plot Properties Editor has a Remove Line button, whereas the Edit Curve Properties Editor does not.

Despite these differences, both the Edit Curve Properties Editor and the Curves tab of the Plot Properties Editor allow you to edit Style, Label, and Quality Symbols. (You can edit Quality Symbols only if the plot has quality set for its data.)

Specifying Parameter-Based Default Curve Styles

To specify parameter-based default curve styles for all of your plots, from the Edit menu, click Default Line Styles. The Default Line Styles Options Editor gives you a way to edit line styles from the Line Styles box (Figure C-15). You can specify the default, parameter-based curve styles used for all plots.

Line Styles				
Name	Parameter	Type	Line Number	Line/Fill
Elev	Elev	ALL	3	
Elev	Elev	ALL	4	
Elev	Elev	ALL	5	
Elev-Zone	Elev	ALL	1	
Elev-Zone	Elev	ALL	2	
Elev-Zone	Elev	ALL	3	
Elev-Zone	Elev	ALL	4	
Flow	Flow	ALL	1	
Flow	Flow	ALL	2	

Figure C-15. Default Line Style Options Editor: Detail of Line Styles Box

The Line Styles box displays typical data types with default line and fill styles predefined.

You can edit all of these fields, change default line and fill styles for existing types, and add new data types to the list. At this time, there is no delete option.

Name and Parameter

To edit an existing name or parameter, highlight it, and then enter the new name or parameter. The name corresponds to the “C” part of HEC-DSS pathnames. The parameter associates data sets to be plotted in the same viewport. For example, FLOW-IN and FLOW-OUT are different “C” parts, but both are FLOW data sets and are to be plotted in the same viewport.

Type

To change the data type associated with a Name and Parameter, click the down-arrow and select from the list.

Line Number

The Line Number column indicates the number of lines associated with a data type. See Adding New Data Styles below.

Line/Fill

The Line/Fill property determines how curves associated with a particular name/parameter/type combination will appear in all plots. To specify the Line/Fill, select the row, and then customize the Line and Point properties.

Adding New Data Styles

To add a new data type:

From the **File** menu of the **Default Line Style Options Editor**, choose **New**. The New Data Type dialog box will open (Figure C-16).

Select a parameter from the Parameter list.

Enter a name in the Name box.

From the Type list, select the data type.

In the Number of Lines box, enter the number of curves you want to add for this new data type.

If you want to reverse the Y-axis, select Y Axis Reversed.

Click OK to close the dialog box.

The Line Styles box will now display the new data type you have added, repeated as many times as you specified in the Number of Lines box (reflected in the Line Number column). You can customize the new data types as described above.

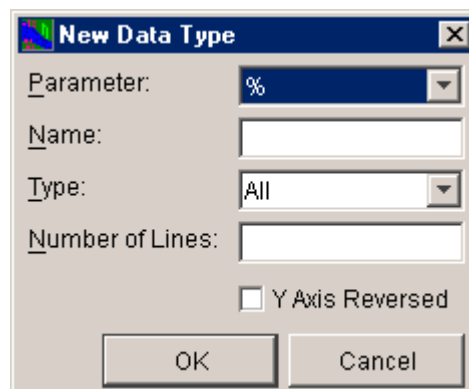


Figure C-16. New Data Type Dialog Box

To save your changes, from the **File** menu, click **Save**. To close the Default Line Styles Options Editor, from the **File** menu, click **Close**.

Specifying Line and Point Styles of Curves

Figure C-17 shows the curve Line and Point Style worksheet. This worksheet is available from the Curves tabs of the Edit Curve Properties Editor, the Plot Properties Editor, and the Default Line Styles Options Editor.

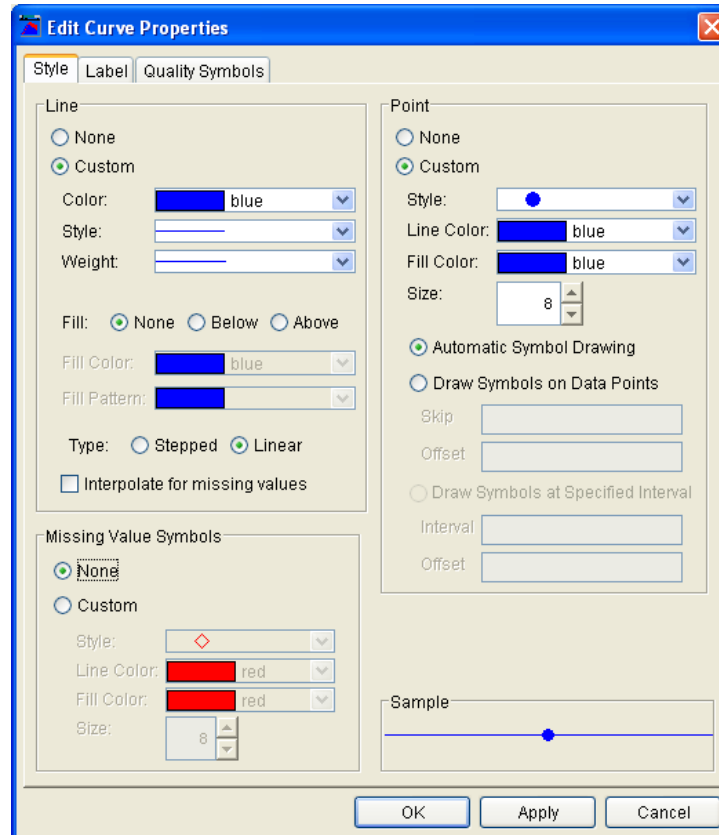


Figure C-17. Curve Line and Point Style Editing Interface

The Style tab has three main groups, Line, Point, and Missing Value Symbols which allow you to customize line and point styles, and a symbol that can be shown for missing values. Beneath the Point group, the Sample box provides a preview of the way your line and point choices will look.

To define line styles for curves:

1. In the Line group, click Custom.
2. Select the color, style, and weight you want for the line.

3. You can display lines with fill above or below, or without fill. Figure C-18 shows a plot with line fill below, whereas Figure C-19 shows the same plot without line fill.
4. Select if you want the curve drawn in a stair-stepped style, or linear with a line drawn directly between each point.
5. Select if you want a line drawn to interpolate where there are missing values.

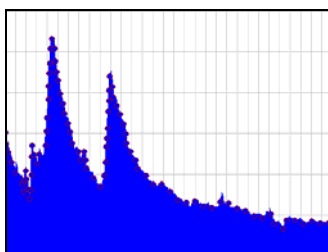


Figure C-18. Plot with Line Fill

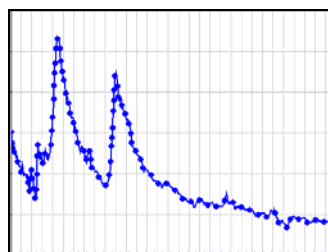


Figure C-19. Plot without Line Fill

To define point styles for curves:

1. In the Point group, click Custom.
2. Choose the Style, Line Color, and Fill Color you want. The Line Color is the "border" around the point symbol, whereas the Fill Color is the color inside the point symbol. Figure C-20 shows an example of a dark line color and a light fill color.
3. In the Size box, specify the size of the point (in pixels) either by selecting a size from the list or by typing in a number from 1-45.
4. Automatic Symbol Drawing allows the plot to compute how to draw the points so they do not overlap. As you zoom in the plot will draw more points because you are increasing the distance between points. This will continue until all points on the curve are drawn.
5. Draw Symbols on Data Points allows you to specify how to draw the points so they don't overlap. If you set the Skip box to one (1), then it will draw one point, skip the next, then draw the third, etc. The Offset box allows you to say how many points on the curve to initially skip before drawing points.

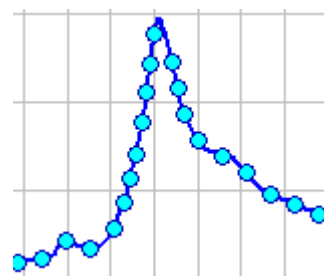


Figure C-20 Example Line and Fill Colors

To define missing value symbols for curves:

1. In the Missing Value Symbol group, click Custom.
2. Choose the Style, Line Color, and Fill Color you want. The Line Color is the “border” around the point symbol, whereas the Fill Color is the color inside the point symbol.
3. In the Size box, specify the size of the point (in pixels) either by selecting a size from the list or by typing in a number from 1-45.
4. This will place the selected symbol on each missing value.

Customizing Curve Labels

Figure C-21 shows the curve Label worksheet, available from the Curves tabs of the Edit Curve Properties Editor, the Plot Properties Editor, and the Default Line Styles Options Editor. This worksheet allows you to customize curve labels.

The image shows a software interface for editing curve labels. It has three tabs at the top: 'Line', 'Label', and 'Defaults'. The 'Label' tab is selected. Inside the 'Label' tab, there is a section titled 'Label' with two radio buttons: 'None' and 'Custom'. The 'Custom' radio button is selected. Below these are three input fields: 'Label Text' (a text box), 'Alignment' (a dropdown menu set to 'Left'), and 'Position' (a dropdown menu set to 'Above'). At the bottom of the dialog is a 'Sample' section with a text box containing the text 'Sample Text'.

Figure C-21. Curve Label Editing Interface

To customize curve labels:

1. Select Custom.
2. Enter the text you want to appear in the curve label in the Label Text box.

3. In the Alignment list, click Left, Center, or Right to select the alignment of the curve label.
4. To set the position of the label, from the Position list, click Above, Center, or Below.

The Sample box provides a preview of the way your labels will look.

Customizing Curve Quality Symbols

Figure C-22 shows the curve Quality Symbols worksheet, available from the Curves tabs of the Edit Curve Properties Editor, the Plot Properties Editor, and the Default Line Styles Options Editor. This worksheet allows you to customize curves for plots that have quality set for their data.

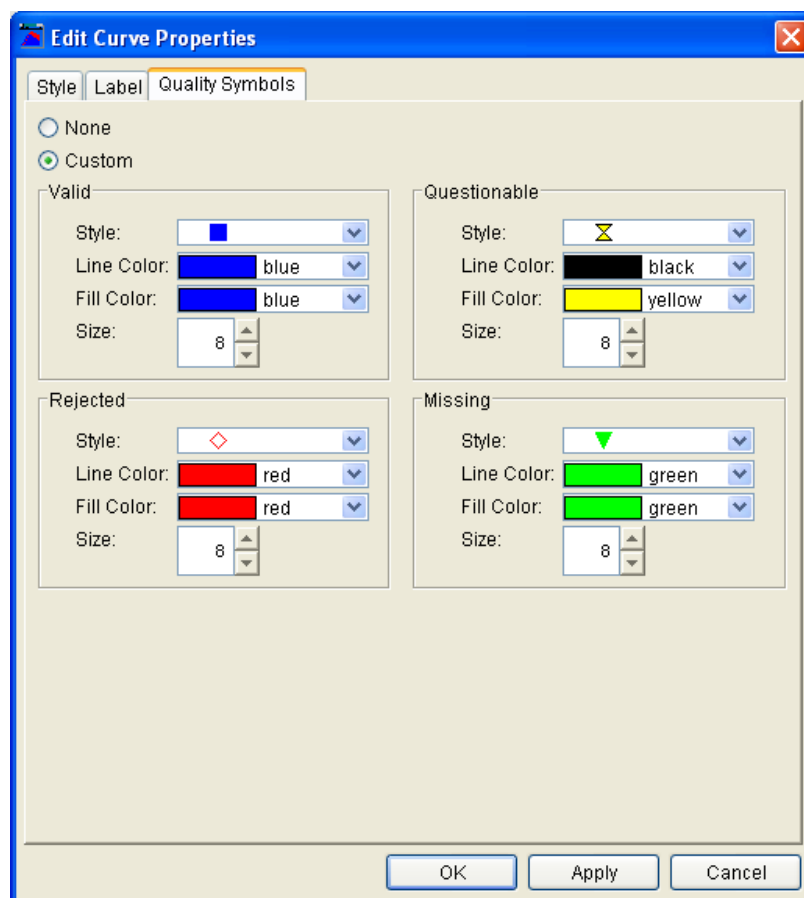


Figure C-22. Curve Quality Symbols Editing Interface

To customize quality symbols:

1. Choose Custom.
2. Select a symbol Style, Line Color, Fill Color, and Size for each quality of data.

Customizing Viewport Properties

Viewports are the gridded areas in the plot window that contain plot curves. You can customize the border around the viewport, the background color and pattern, and the appearance of gridlines.

Customizing Viewport Borders and Background

To customize the borders and backgrounds of viewports in an individual plot, you can either:

From the **Edit** menu, click **Plot Properties**. When the Plot Properties Editor opens, select the Patterns tab.

Or


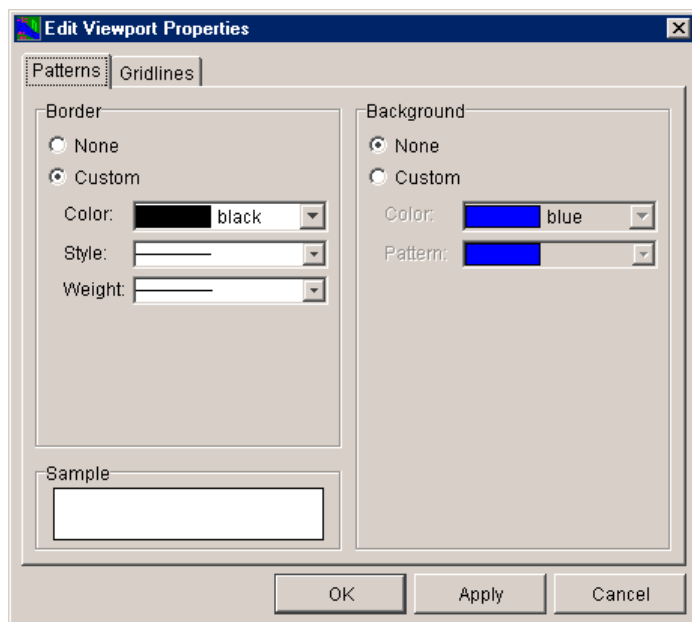
Right-click in a blank area inside the viewport with the Pointer Tool , and then select Edit Properties from the shortcut menu (Figure C-23). When the Viewport Properties Editor opens, select the Patterns tab.



Figure C-23. Shortcut Menu--Viewport Properties

To specify the default border and background of viewports for all of your plots, from the Edit menu, click Default Plot Properties. When the Default Plot Properties Editor opens, choose the Viewport tab.

Figure C-24 shows the Edit Viewport Properties Editor with the Patterns tab selected. This worksheet, accessed from the shortcut menu, contains the same items as the Patterns tab of the Plot Properties Editor and the Viewport tab of the Default Plot Properties Editor.



**Figure C-24. Viewport Properties Editor--
Patterns Tab**

The Patterns (or Viewport) tab has two main groups, Border and Background, which allow you to customize border and background of the viewport, respectively. Beneath the Border group, the Sample box provides a preview of the way the viewport border and background will look.

1. Select Custom in the Border group and choose the Color, Style, and Weight for the border you want to appear around the plot viewport.
2. Select Custom in the Background group and choose the Color and Pattern you want for the background.

Click Apply to save your changes and continue adjusting the appearance of the border and background. Click OK when you are finished.

Customizing Viewport Gridlines

To customize gridlines of viewports in an individual plot, you can either:

From the **Edit** menu, click **Plot Properties**. When the Plot Properties Editor opens, select the Gridlines tab.

Or

Right-click in a blank area inside the viewport with the Pointer Tool



, and then select **Edit Properties** from the shortcut menu (Figure C-25). When the Viewport Properties Editor opens, select the Gridlines tab.

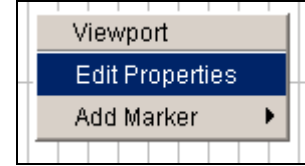


Figure C-25.
Shortcut Menu--
Viewport Properties

To specify viewport gridlines for all of your plots, from the **Edit** menu, select **Default Plot Properties**. When the Default Plot Properties Editor opens, choose the Grids tab.

Figure C-26 shows the Viewport Properties Editor with the Gridlines tab selected. This worksheet, accessed from the shortcut menu, contains the same items as the Gridlines tab of the Plot Properties Editor and the Grids tab of the Default Plot Properties Editor.

By default, the plot viewport displays gridlines only for the Major X Grid and Major Y Grid. The default color is light gray. To change the appearance of Major X and Y gridlines, select Custom and make your selections for Color, Style, and Weight.

By default, the Minor X Grid and Minor Y Grid are set to None and do not display in the plot viewport. If you want to display gridlines for the Minor X Grid and Minor Y Grid, select Custom and make your selections for Color, Style, and Weight.

Click Apply to view your changes without closing the editor. Click OK when you are finished.

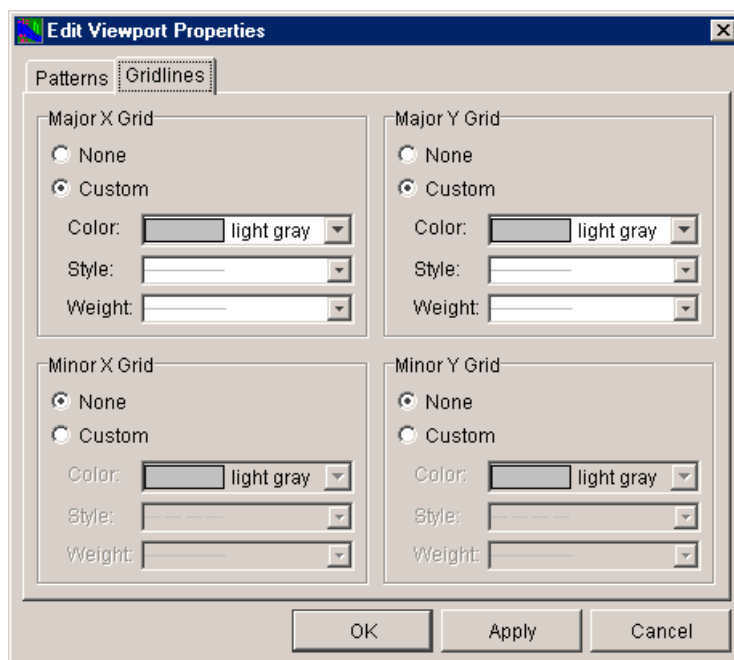


Figure C-26. Viewport Properties Editor--Gridlines Tab

Adding and Customizing Marker Lines

You can add marker lines on your plot's X and Y axes and customize the appearance of these markers.

Adding Markers

To add a marker:

Right-click on the location in the plot where you want the marker to appear.

From the Viewport shortcut menu (Figure C-27), point to Add Marker, and then click either On X-Axis or On Y-Axis.

The marker will now appear in the plot.

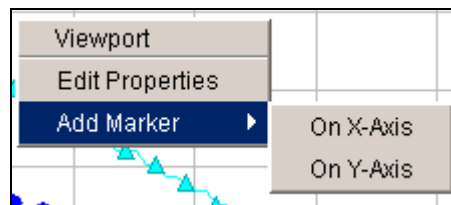



Figure C-27. Shortcut Menu: Add Marker

Deleting Markers

To delete a marker line in a plot, right click on it with the Pointer Tool , and then click Delete from the Marker Line shortcut menu (Figure C-28).

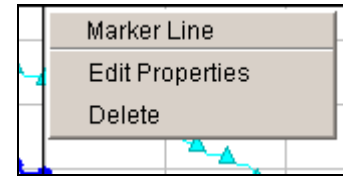



Figure C-28. Shortcut Menu—Marker Line Properties

Customizing Markers

To edit the properties of a marker in an individual plot, you can either:

From the **Edit** menu, click **Plot Properties**. When the Plot Properties Editor opens, select the Marker tab. This worksheet is available only if a marker exists in the plot. Choose the marker you want to edit from the Marker Lines list.

Or

With the Pointer Tool , right-click on the marker you want to edit. From the Marker Line shortcut menu, select Edit Properties (Figure C-28). The Edit Marker Line Properties Editor will open.

To specify the default appearance of markers for all of your plots, from the **Edit** menu, click **Default Plot Properties**. When the Default Plot Properties Editor opens, choose the Marker Lines tab.

The interfaces for the specialized Edit Marker Line Editor and the Default Plot Properties Editor are very similar. However, the Plot Properties Editor interface differs in two ways. First, the Marker worksheet is available only if a marker exists in the current plot. Second, at the top of the editing panel there is a Marker Lines list containing all markers that exist in the current plot.

You can edit the line style and label of a marker using two editing tabs. Figure C-29 shows the Edit Marker Line Properties Editor with the Style worksheet selected, while Figure C-30 shows the Label/Value worksheet. The Marker Line tabs in the Plot Properties Editor and the Default Plot Properties Editor share the same two worksheets.

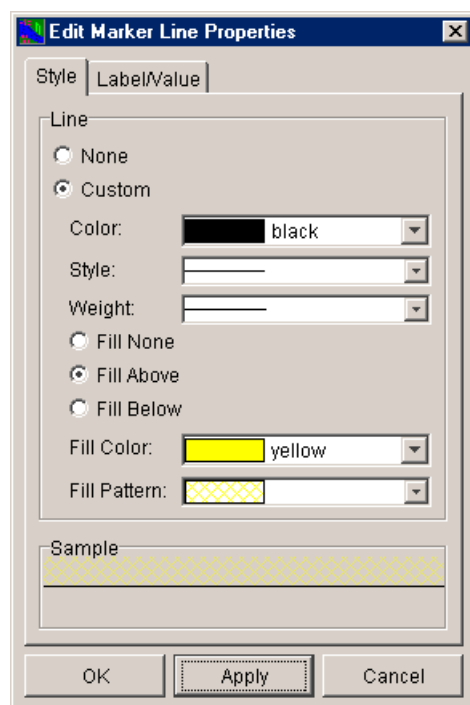


Figure C-29. Marker Line Properties Editor—Style Tab

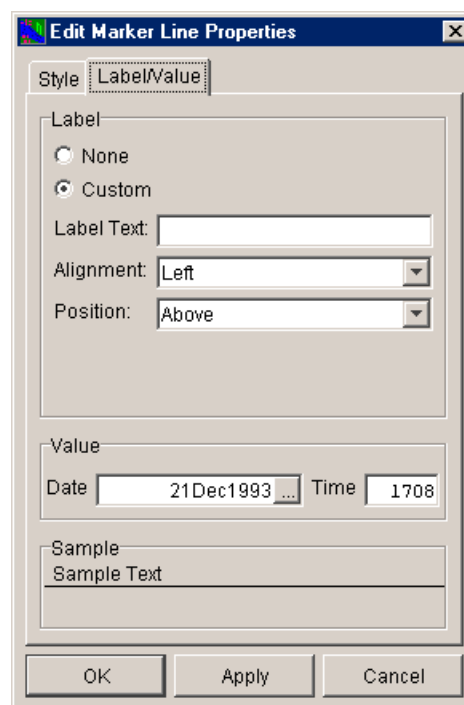


Figure C-30. Marker Line Properties Editor—Label/Value Tab

To edit the line style for markers:

1. Select the Style tab.
2. Choose Custom.
3. Select the Color, Style, and Weight for the marker line.
4. You can display marker lines with fill Above or Below, or without fill. Figure C-31 shows a plot with line Fill Above and a hatched pattern selected.

The Sample box provides a preview of the way the marker line will look.

Click Apply to save your changes without closing the editor.

To add a label to a marker line:

1. Select the Label/Value tab.
2. Choose Custom.

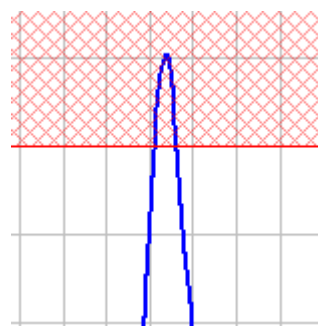



Figure C-31. Marker Line with Fill Above

3. In the Label Text box, enter the text you want to appear in the label.
4. From the Alignment list, select the justification of the label-- Left, Center, or Right.
5. To set the position of the label, from the Position list, select either Above, Center, or Below.
6. For the Date value, enter the date in the format DDMMYYYY (e.g., 21Dec1993). You can also click the  button to access the Calendar Tool (Figure C-32) to select the date.
7. For the Time value, enter the time in 24-hour military format (e.g., for 5:08 pm, enter "1708").

The Sample box provides a preview of the way the marker line will look.

Click Apply to save and view your changes without closing the editor. Click OK when you are finished editing marker line properties.

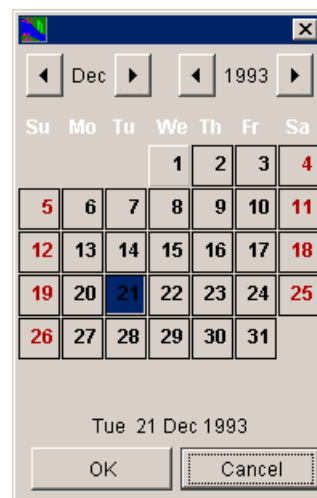


Figure C-32.
Calendar Tool

Editing Callouts

You can add descriptive callouts at specific points along a curve (Figure C-33). To do this:

Right-click on the location on the curve where you want the callout to appear.

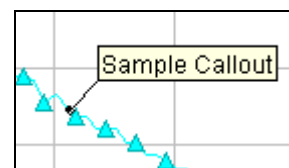


Figure C-33.
Callout

From the shortcut menu (Figure C-34), point to Add Callout.

In the Add Callout dialog box (Figure C-35), enter the text you want to appear in the callout, and then click OK.

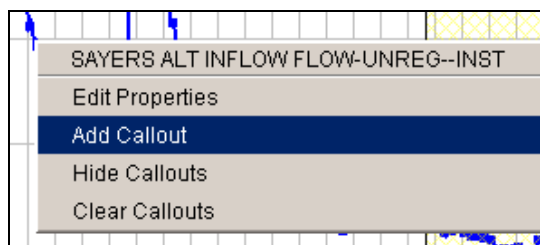


Figure C-34. Shortcut Menu: Add Callout

To hide all callouts in a plot, right-click on a curve in the plot. From the shortcut menu, click Hide Callouts.

Once you have hidden callouts, Hide Callouts in the shortcut menu changes to Show Callouts, allowing you to return callouts to the plot display.

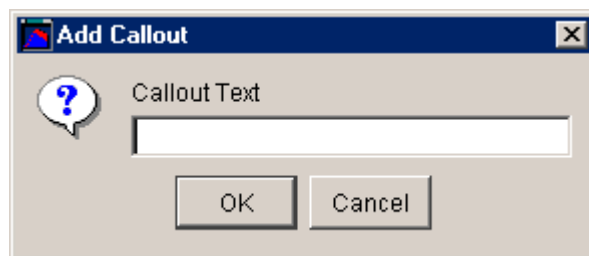


Figure C-35 Add Callout Dialog Box

To permanently remove all callouts from the plot, right-click on a curve in the plot to access the shortcut menu, then click Clear Callouts.

Customizing Axes

You can choose either a linear or log axis type, specify the axis scale, modify tic marks, and customize axis labels. Probability plots are generated for paired data sets with a type of "PROB", and cannot be changed without changing the data type.

Changing Axis Type

By default, plots display using a linear scale (Linear Axis), in which the axis increases and decreases by x . You can also use the log scale, which allows you to view curves that grow exponentially in a near straight line because the axis increases or decreases by the log (x). For example, you might wish to use the log scale when the axis has evenly-spaced major tics with values of 1, 10, 100, 1000, and so on, such as in a performance history plot showing many years of data.

To change the axis type of an individual plot, right-click on an axis. From the Axis Tics shortcut menu, point to Set Axis Type, and then select the axis type from the submenu (Figure C-36).

Depending on the axis type, you can click either Log Axis or Linear Axis.

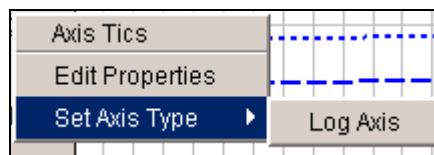


Figure C-36. Shortcut Menu - Set Axis Type

Specifying Axis Scale

You can specify the axis scale and tic interval for individual plots. To do this, you can either:

From the **Edit** menu, click **Plot Properties**. When the Plot Properties Editor opens, select the **Axis** tab. From the Axis worksheet, select the axis you want to edit from the Axis list. Once you have this set, click the Scale tab to access the Scale worksheet.

Or

Right-click on the axis with the Pointer


Tool . From the Axis Tics shortcut menu (Figure C-37), click Edit Properties. When the Edit Axis Properties Editor opens, choose the Scale tab.



Figure C-37. Shortcut Menu—Axis Tics

Figure C-38 shows the Plot Properties Editor with the Axis tab selected and the Scale worksheet open. The Axis worksheets of the Plot Properties Editor and the Default Plot Properties Editor are nearly identical, except for the Axis list on the Plot Properties Editor. The Scale and Tics sub-worksheets are available in all three editors.

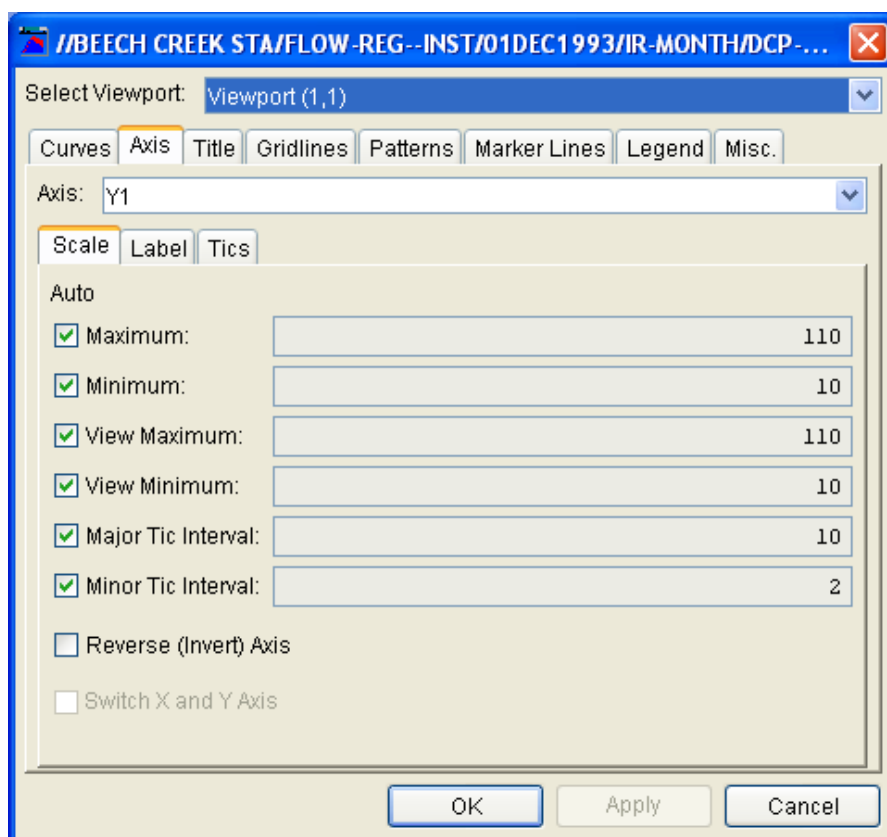


Figure C-38. Plot Properties Editor--Scale Worksheet

With the Scale worksheet, you can specify the range of the scale, the amount of the scale that is visible, and the tic intervals.

If the Auto box is checked, the plot will automatically select the scale. Otherwise, as you zoom in and out of the plot, its view values change while the minimum and maximum scale range values remain fixed:

- **Maximum:** enter the value of the maximum range of the scale.
- **Minimum:** enter the value of the minimum range of the scale.
- **View Maximum:** enter the maximum visible range of the scale.
- **View Minimum:** enter the minimum visible range of the scale.

Tic intervals are the distances between tics on the axis scale:

- **Major Tic Interval:** specify the distance between each major tic.
- **Minor Tic Interval:** specify a value less than or equal to the major tic value.

You can also choose to reverse the axis and invert the data by selecting Reverse (Invert) Axis. If the data set is paired, you can switch the X and Y axis, so what is plotted on the X axis becomes plotted on the Y axis instead.

Click **Apply** to save and view your changes without closing the editor.

Click **OK** to save your changes and close the editor.


Modifying Tic Marks

You can modify the color of tic marks, choose whether or not major and minor tic marks display, and specify whether labels display.

To modify tic marks in an individual plot, you can either:

- From the Edit menu, click Plot Properties. When the Plot Properties Editor opens, select the Axis tab. From the Axis worksheet, select the axis you want to edit from the Axis list. Once you have this set, choose the Tics tab to set tic marks.

Or

- Right-click on the axis with the Pointer Tool . From the Axis Tics shortcut menu (Figure C-37), click Edit Properties. When the Edit Axis Properties Editor opens, choose the Tics tab.

To specify default settings for axis tics in all of your plots, click Default Plot Properties from the plot Edit menu. When the Default Plot Properties Editor opens, choose the Axis tab, then the Tics tab.

Figure C-39 shows the Tics worksheet of the Edit Axis Properties Editor. The Tics worksheet is nearly identical on the Edit Axis Properties Editor, Plot Properties Editor, and Default Plot Properties Editor. However, at the top of the Plot Properties Editor is an Axis list containing all of the axes available for editing in the current plot. In the Plot Properties Editor, you must choose an axis to edit before you can make any changes.

By default, plot axes display major tic marks with labels. To turn off these options, click to clear the Use major tick marks and Use tick mark labels check boxes.

You can also select Use minor tic marks.

To change tic color, select the color you want from the Tic Color list.

Click Apply to save and view changes without closing the editor.

Click OK to save your changes and close the editor.

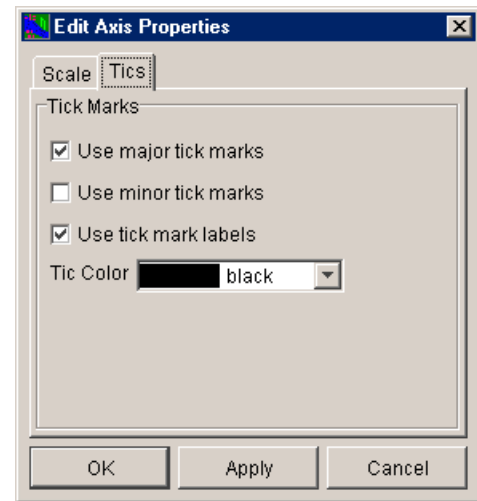


Figure C-39. Axis Properties Editor--Tics Tab


Customizing Axis Labels

You can add borders and backgrounds to axis labels.

To customize axis labels in an individual plot, you can either:

- From the Edit menu, click Plot Properties. When the Plot Properties Editor opens, select the Axis tab. On the Axis worksheet, select the axis you want to edit from the Axis list. Once you have this set, select the Label tab to set axis label properties.

Or

- Right-click on the axis label with the Pointer Tool . From the G2d Label shortcut menu (Figure C-40), click Edit Properties. The Edit Label Properties Editor will open.

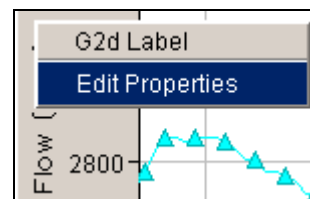


Figure C-40. G2d Label Shortcut Menu

To specify default settings for axis labels in all of your plots, select Default Plot Properties from the plot Edit menu. When the Default Plot Properties Editor opens, choose the Axis tab, then the Label tab.

Figure C-41 shows the Edit Label Properties Editor. The same worksheet is available on the Label tabs of the Plot Properties Editor and Default Plot Properties Editor, with one difference. The Plot Properties Editor has an Axis list containing all of the axes available for editing in the current plot.

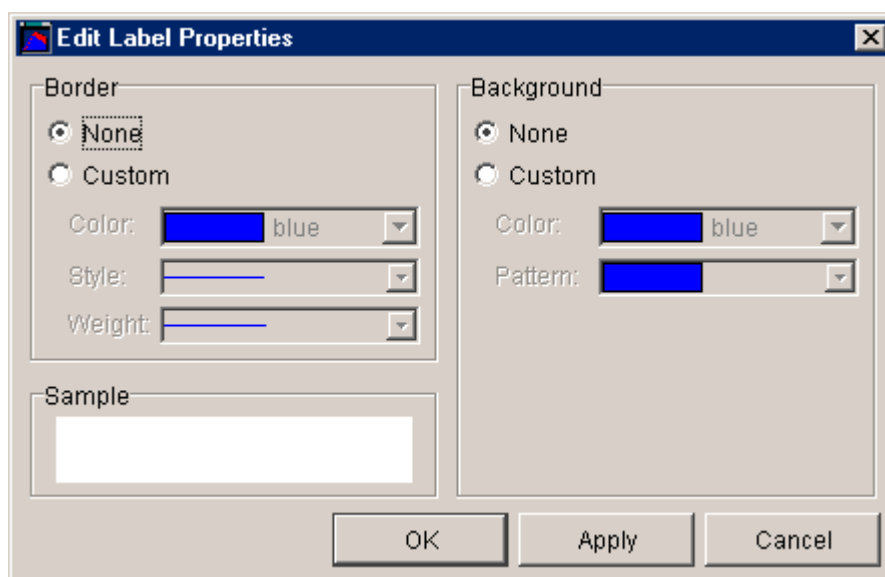


Figure C-41. Label Properties Editor

The Label worksheet has two groups, Border and Background, which allow you to customize border and background of the label, respectively. Beneath the Border group, the Sample box provides a preview of the label.

To add a border around the axis label, choose Custom in the Border group, and then select the Color, Style, and Weight for the borderline.

To add a background to the axis label, choose Custom in the Background group, and then select a Color and Pattern.

Click Apply to save and view your changes without closing the editor. Click OK when you are finished editing axis label properties.

Customizing Legends

As Figure C-42 illustrates, you can add titles to the top of plot legends and add text and graphics to the right and left sides. You can also specify whether the legend appears below or to the right of the plot.

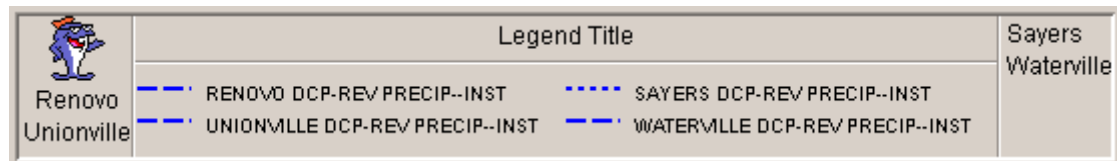



Figure C-42. Customizing Legends

To add legend labels to an individual plot, you can either:

- From the Edit menu, click Plot Properties. When the Plot Properties Editor opens, select the Legend tab.

Or

- Right-click in a blank area inside the legend panel of the plot with the Pointer Tool . From the Legend Panel shortcut menu (Figure C-43), click Edit Properties. The Edit Legend Properties Editor will open.



**Figure C-43.
Shortcut Menu -
Legend Panel**

To specify default settings for all of your plot legends, from the Edit menu, click Default Plot Properties. When the Default Plot Properties Editor opens, choose the Legend tab.

Whether you are using the Plot Properties Editor, Edit Legend Properties Editor, or Default Plot Properties Editor, the worksheet for editing legend titles is the same.

Figure C-44 shows the Legend Properties Editor. This worksheet, accessed from the shortcut menu, contains the same fields as the Legend worksheets of both the Plot Properties Editor and the Default Plot Properties Editor.

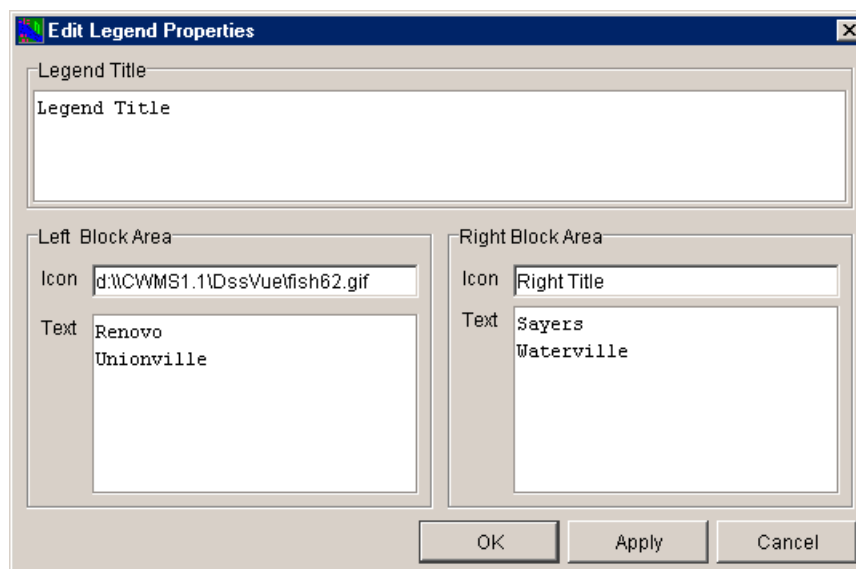


Figure C-44. Legend Properties Editor

In the Legend Title box, enter the title you want to appear along the top of the legend box.

In the Left Block Area and Right Block Area groups, you can specify the Icon and Text you want to appear on either side of the legend block.

If you wish to display icons, type the exact paths and filenames of the icon in the Icon field. (The path is the location on your computer.)

Enter any text you want to display in the Text boxes.

Click Apply to view your changes without closing the editor. Click OK to save your changes and close the editor.

Customizing Window Panels

You can customize the color and spacing of the window "panel" in which plots are displayed; you can also choose whether the plot legend displays horizontally along the bottom of the plot panel or vertically along the right side.

To customize panel properties of an individual plot, from the Edit menu, click Plot Properties. When the Plot Properties Editor opens, select the Misc. tab.

To specify panel properties for all of your plots, from the Edit menu, click Default Plot Properties. When the Default Plot Properties Editor opens, choose the Misc. tab.

Whether you are using the Plot Properties Editor or the Default Plot Properties Editor, the Misc. worksheet is the same. Figure C-45 shows the Misc. worksheet of the Default Plot Properties Editor.

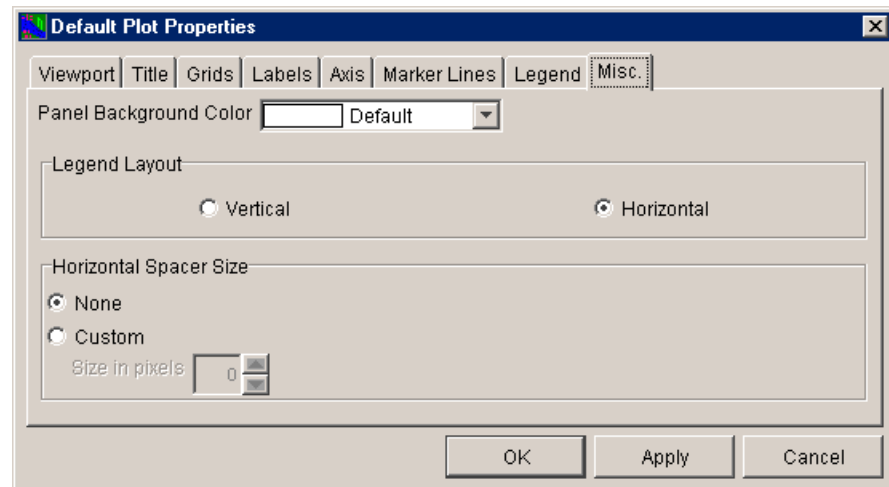


Figure C-45. Default Plot Properties Editor--Misc. Tab

You can also edit the legend layout and spacer size from individual property editors accessed from shortcut menus, as discussed below.

Customizing the Panel Background Color

To customize the panel background color, click the down arrow beside the Panel Background Color field to select the color you want. There is no individual property editor available for customizing the panel background color.

Customizing the Legend Layout

If you want the plot legend to display horizontally along the bottom of the plot panel, in the Legend Layout group, select Horizontal. If you want the plot legend to display vertically along the right side of the plot panel, select Vertical.

Another way to adjust the position of the legend for an individual plot is to use the Legend Panel shortcut menu (Figure C-46).

To access the Legend Panel shortcut menu, with the pointer tool right-click on a blank area inside of the legend panel in the plot window panel. If the legend is currently positioned horizontally, you can click Move To Right, which will cause the legend to display vertically. If the legend is currently positioned vertically, you can click Move to Bottom, which will cause the legend to display horizontally.



Figure C-46 Legend Panel Shortcut Menu

Customizing the Horizontal Spacer Size

In the Plot Properties Editor and Default Plot Properties Editor, horizontal spacer size refers to the space between viewports in plots with multiple viewports. In single-viewport plots, it is the “margin” space between the right side of the viewport and the edge of the window panel.

To specify the horizontal spacer size using the Misc. tab of the Plot Properties Editor or Default Plot Properties Editor, in the Horizontal Spacer Size group, select Custom, then either select the pixel size from the list or enter a value less than 50.

You can also use the Spacer shortcut menu (Figure C-47) to customize both horizontal and vertical spacer size for an individual plot.

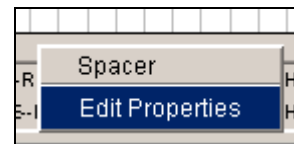


Figure C-47. Spacer Shortcut Menu

To access the Spacer shortcut menu, right-click on a blank space on the plot panel. Click between viewports if you want to adjust vertical spacing between viewports, or to the right of a viewport to adjust horizontal spacing.

From the Spacer shortcut menu, click Edit Properties. The Edit Spacer Properties dialog box will open (Figure C-48).

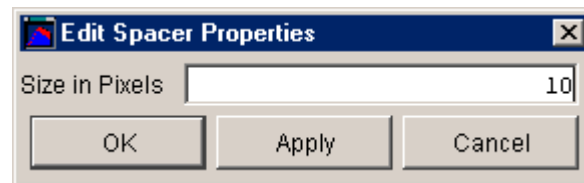


Figure C-48. Edit Spacer Properties Dialog Box

To specify the spacer size, enter a value less than 50.

Customizing Plot Layout

The Configure Plot Editor (Figure C-49) displays plot components in a “tree” structure and allows you to customize the layout of an individual plot. You can add and remove axes as well as add, remove, arrange the order of, and set the weight of viewports in the plot window panel.

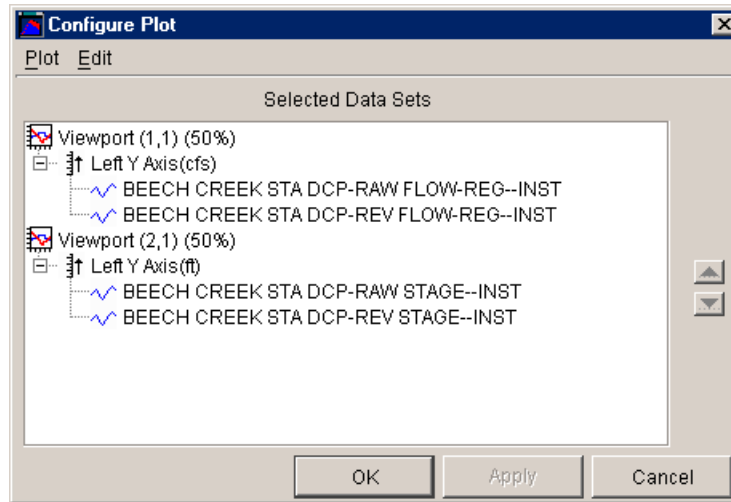


Figure C-49. Configure Plot Editor

When you customize the layout of a plot using the Configure Plot Editor, your changes apply only to that individual plot unless you export the plot's properties.

To access the Configure Plot Editor, from the Edit menu, select Configure Plot Layout.

Adding and Removing Viewports

To add a new viewport to a plot, from the Configure Plot Editor's Edit menu click Add Viewport. The new viewport will appear at the bottom of the “tree” in the Selected Data Sets box.

To remove a viewport, you can either:

- Click on the name of the viewport in the Selected Data Sets “tree.” From the Edit menu, click Remove Viewport.

Or

- Right-click on the viewport's name in the Selected Data Sets "tree." From the shortcut menu (Figure C-50), click Remove.

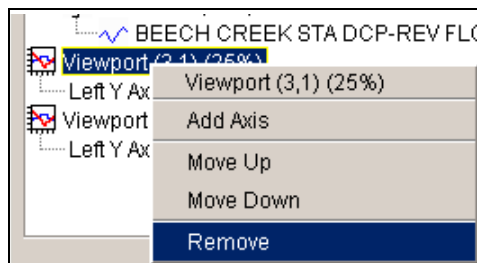


Figure C-50. Shortcut Menu-- Remove Viewport

Setting Viewport Weights

You can customize the relative sizes of viewports in your plots. To do this:

1. From the Edit menu of the Configure Plot Layout Editor, click Set Viewport Weights. The Set Plot Viewport Weights dialog box will open.
2. In the Set Plot Viewport Weights dialog box (Figure C-51), you can specify the relative size of each viewport as a percentage value, with all of the weights adding up to 100%. Figure C-51 shows four viewports of equal weight at 25% each.

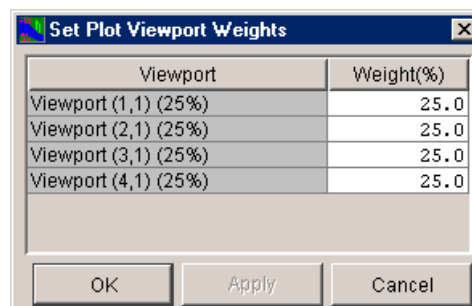


Figure C-51. Set Plot Viewport Weights Dialog Box

Note that the Set Plot Viewport Weights dialog box offers the same right-click shortcut menu commands as are available in all tables. You can cut, copy, and paste data cells; insert, append, and delete rows; and print and export. For more information, refer to the section on tabular data in the Utilities chapter.

Click Apply to save and view your changes without closing the dialog box. Click OK to save your changes and close the dialog box.

Adding and Removing Axes

By default, viewports have a left Y-axis. You can also add a right Y-axis, remove both the left and right Y-axes, and add a new left Y-axis

if you have previously removed it. Viewports can have a maximum of two axes, and you cannot remove an axis when a data set is associated with it.

To add an axis to a viewport, you can either:

- Click on the viewport's name in the tree in the Selected Data Sets box. From the Edit menu, choose Add Axis.

Or

- Right-click on the viewport's name in the tree in the Selected Data Sets. From the shortcut menu (Figure C-52), click Add Axis.

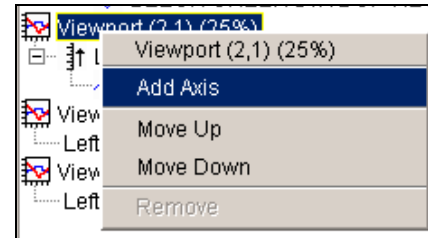


Figure C-52. Shortcut Menu - Add Axis

The tree now displays another axis for the viewport you selected.

To remove an axis that has no data associated with it, you can either:

- Click on the name of the axis you wish to remove in the tree in the Selected Data Sets box. From the Edit menu, click Remove Axis.

Or

- Right-click on the axis you wish to remove in the tree in the Selected Data Sets box. From the shortcut menu, click Remove.

The selected axis will no longer display in the tree.

Arranging Viewports and Axes

You can rearrange the vertical order of viewports in a plot window and move axes (with their associated data sets) to different viewports.

To move a viewport or axis,

1. From the tree in the Selected Data Sets box, right-click on the name of a viewport or axis you want to move.
2. From the shortcut menu, click Move Up or Move Down from the shortcut menu.

3. Either click OK or Apply for the change to take effect in the plot window.

Note that you cannot move individual data sets in the Configure Plot Layout Editor. You can move only the axis with which a data set is associated.

Reversing Axes (Invert Data)

To reverse the direction of an axis so that the data is inverted, right-click on the name of the axis in the tree. From the shortcut menu, click Reverse. Either click OK or Apply for the change to appear in the plot window.

Exporting and Importing Templates

After you have customized a plot, you can save its settings as a template for use in other plots.

Generally, you will use templates when scripting plots. For example, every day you generate a plot of flow, stage, and precipitation via a script, and then apply a template that has all of the correct formatting, such as viewport placement, size, line colors, and fills. For more information about using templates with scripts, refer to the chapter on Scripting.

To create a template from a plot:

1. From the File menu, click Export Properties.
2. From the Export Plot Template dialog box (Figure C-53), specify whether you want the template to be available for All Applications or This Watershed only, and then give the template a Name.
3. Click OK to save the template and close the dialog box.

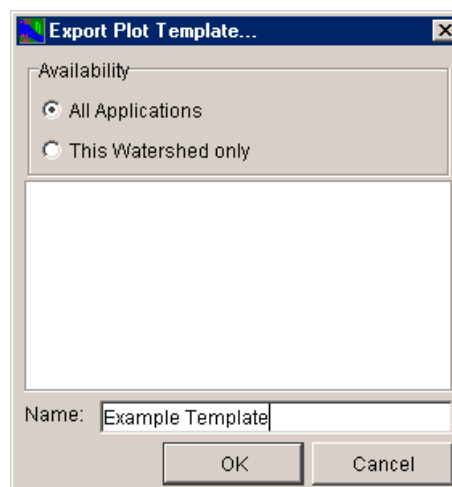


Figure C-53. Export Plot Template Dialog Box

To apply (import) a template you have created to another plot currently open:

1. From the File menu, click Import Properties.

2. In the Import Plot Template dialog box (Figure C-54), specify whether you want to use a template available for All Applications or for This Watershed only.

3. A list of available templates will display. Choose the template you want by clicking on its name.

4. When you select a template, its name will display in the Name field.

5. Click OK to apply the template to the current plot and close the dialog box.

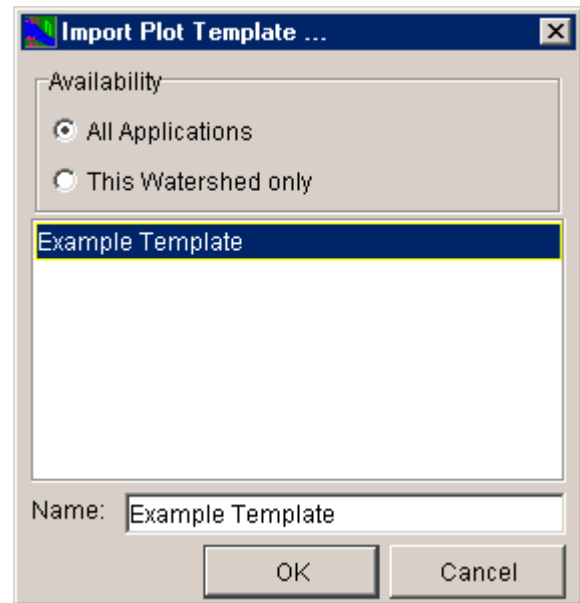


Figure C-54. Import Plot Template Dialog Box

Additional Viewing Options for Plots

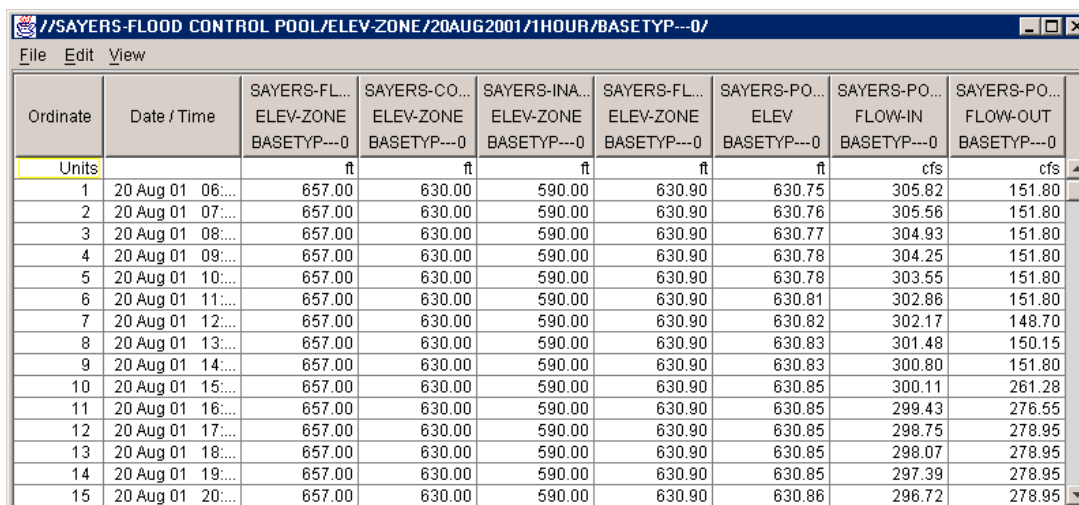
The File menu of plots (Figure C-55) contains several commands that allow you to view plot data in tabular form, save plots, and copy and paste plots into other applications such as Microsoft Word, Excel, and Visio.



Figure C-55. File Menu

Viewing Data in Tabular Form

To view plot data in tabular form, from the File menu, click Tabulate. A dialog box will open displaying the data in tabular form (Figure C-56).



Ordinate	Date / Time	SAYERS-FL... ELEV-ZONE BASETYP---0	SAYERS-CO... ELEV-ZONE BASETYP---0	SAYERS-INA... ELEV-ZONE BASETYP---0	SAYERS-FL... ELEV-ZONE BASETYP---0	SAYERS-PO... ELEV BASETYP---0	SAYERS-PO... FLOW-IN BASETYP---0	SAYERS-PO... FLOW-OUT BASETYP---0
Units		ft	ft	ft	ft	ft	cfs	cfs
1	20 Aug 01 06:...	657.00	630.00	590.00	630.90	630.75	305.82	151.80
2	20 Aug 01 07:...	657.00	630.00	590.00	630.90	630.76	305.56	151.80
3	20 Aug 01 08:...	657.00	630.00	590.00	630.90	630.77	304.93	151.80
4	20 Aug 01 09:...	657.00	630.00	590.00	630.90	630.78	304.25	151.80
5	20 Aug 01 10:...	657.00	630.00	590.00	630.90	630.78	303.55	151.80
6	20 Aug 01 11:...	657.00	630.00	590.00	630.90	630.81	302.86	151.80
7	20 Aug 01 12:...	657.00	630.00	590.00	630.90	630.82	302.17	148.70
8	20 Aug 01 13:...	657.00	630.00	590.00	630.90	630.83	301.48	150.15
9	20 Aug 01 14:...	657.00	630.00	590.00	630.90	630.83	300.80	151.80
10	20 Aug 01 15:...	657.00	630.00	590.00	630.90	630.85	300.11	261.28
11	20 Aug 01 16:...	657.00	630.00	590.00	630.90	630.85	299.43	276.55
12	20 Aug 01 17:...	657.00	630.00	590.00	630.90	630.85	298.75	278.95
13	20 Aug 01 18:...	657.00	630.00	590.00	630.90	630.85	298.07	278.95
14	20 Aug 01 19:...	657.00	630.00	590.00	630.90	630.85	297.39	278.95
15	20 Aug 01 20:...	657.00	630.00	590.00	630.90	630.86	296.72	278.95

Figure C-56. Data in Tabular Form

For more information about tables, refer to the chapter on Utilities.

Saving Plots

You can save a plot as an image (JPEG), a Windows Metafile (*.wmf), as Portable Network Graphics (*.png), or other formats.

To do this, from the File menu, click Save As. From the Save dialog box (Figure C-57), select the location where you want to save the plot, enter a filename in the File name box, and select the file type you want from the Files of type list, then click Save.

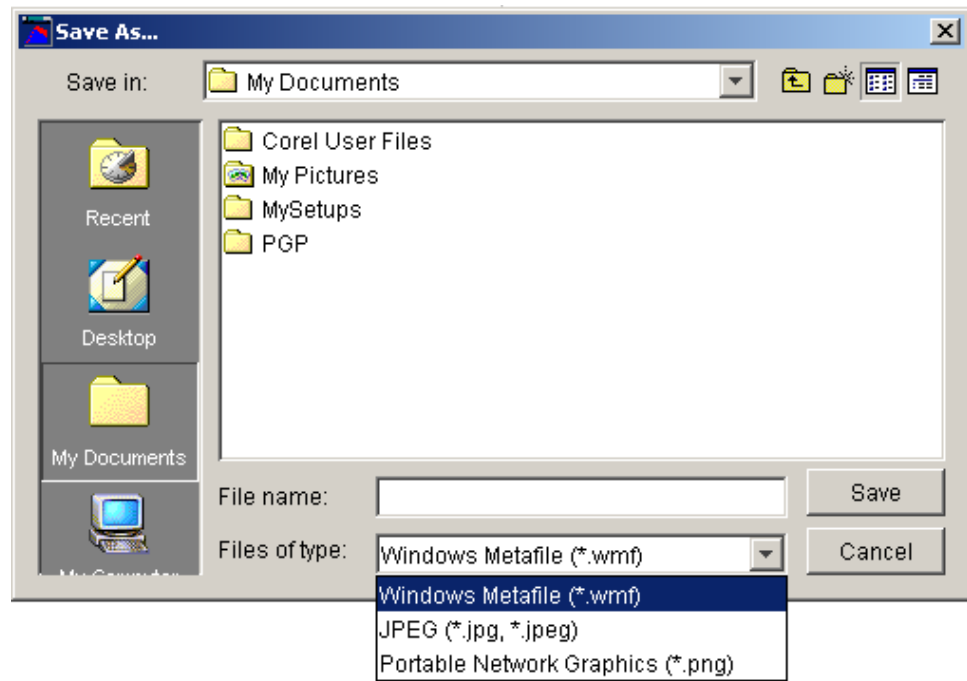


Figure C-57. Save Dialog Box

Copying Plots to the Clipboard

Use Copy to Clipboard from the File menu to copy a plot to the clipboard. You can then paste the plot as an image into another application such as Microsoft Word, Excel, or Visio.

Printing Plots

The Print command, available from the File menu of plots, opens a standard, Windows-style print dialog box.

From the File menu, click Page Setup. The Page Setup dialog box will open (Figure C-58). Here you can set the page Orientation, Page Margins, Page Numbers, and Printer Scale.

Set Margins opens the Printer Margins dialog box (Figure C-59).

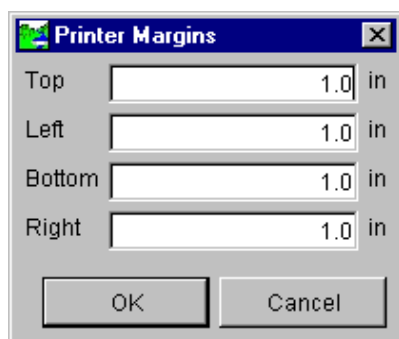


Figure C-59. Printer Margins Dialog Box

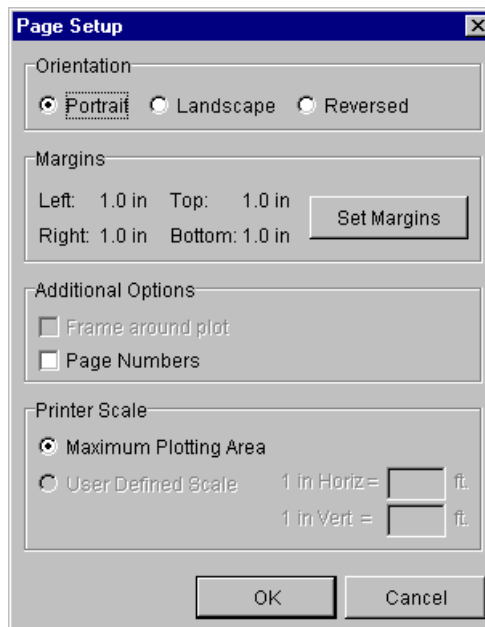


Figure C-58. Page Setup Dialog Box

To view the plot as it will be printed, from the File menu, click Print Preview. Figure C-60 shows an example.

Finally, the Print Multiple command allows you to print several plots on one page. The Print Multiple dialog box (Figure C-61) shows all of the currently open plots in the Available Plots box. To select plots for printing, double-click on the plots in the Available Plots box and the selected plots will move to the Selected Plots box.

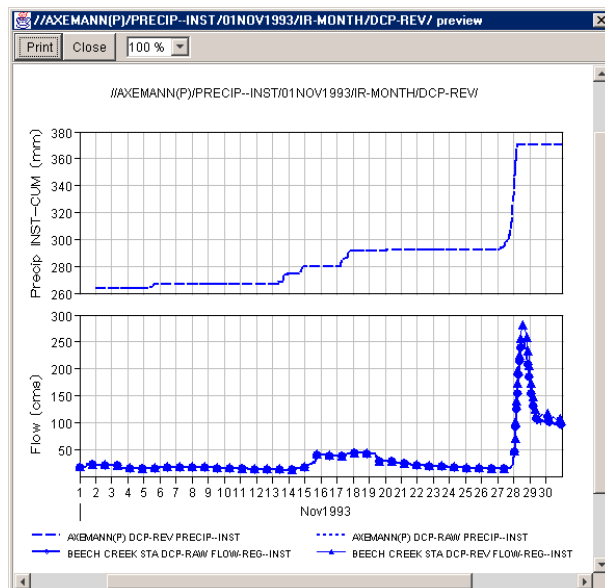


Figure C-60. Example Print Preview of a Plot

Next, use the slider bars to specify the number of plots you wish to appear horizontally and vertically on the page. The grid to the right of the sliders reflects your choices.

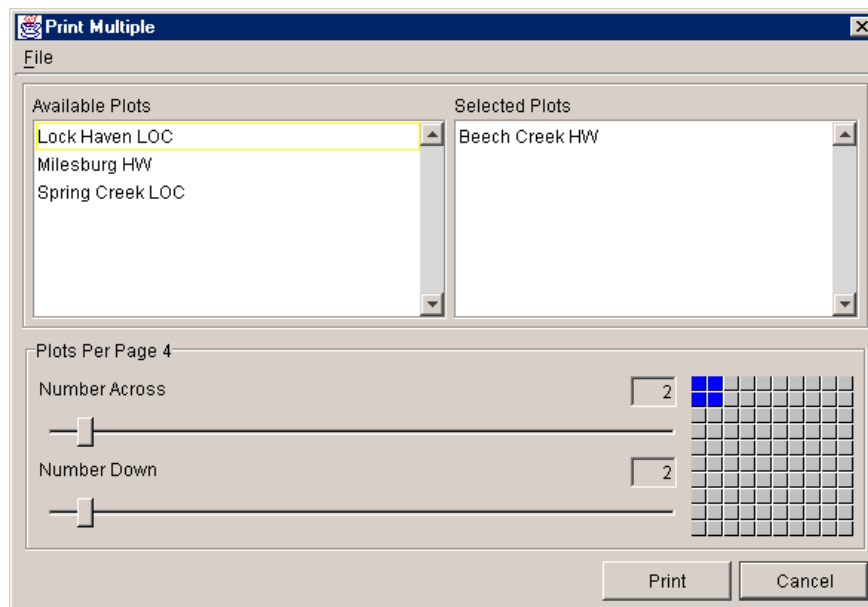


Figure C-61. Print Multiple Dialog Box

Figure C-62 shows a preview of the plots set up above. From the Print Multiple dialog box, you can also use the Page Setup and Print Preview commands. The two commands are available from the File menu of the Print Multiple dialog box.

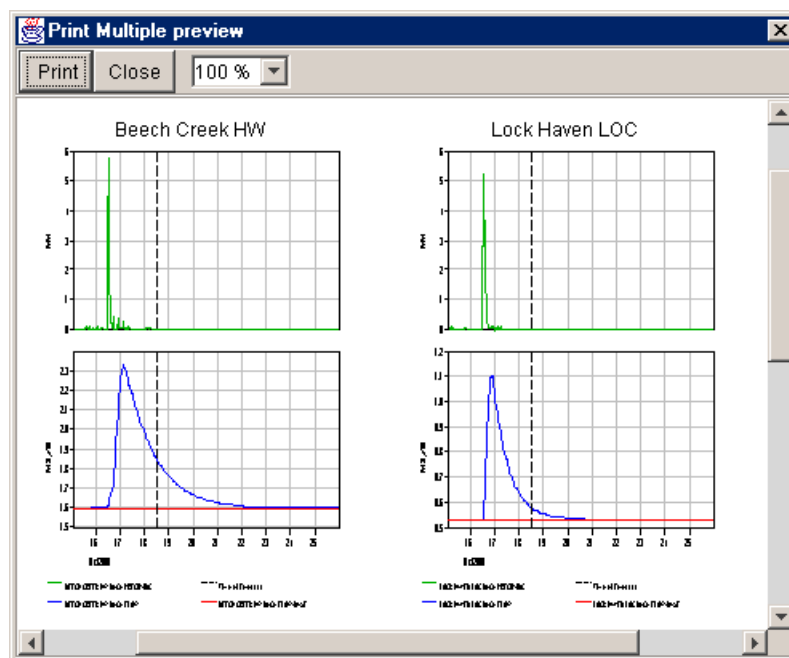


Figure C-62. Print Multiple Preview